HYUNDAI

TRAJET

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.

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Body (Interior & Exterior)

GENERAL

ESHA0010

SPECIFICATIONS

Hood	
Type	Rear hinged, front opening 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
Tailgate	
Type	Inner hinged, gas lifter type
Glass thickness mm (in)	
Windshield glass	5 (0.20)
Front door glass	3.2 (0.13)
Rear door glass	3.2 (0.13)
Tailgate glass	3.2 (0.13)
Seat belt	E.L.R

E.L.R. : Emergency Locking Retractor

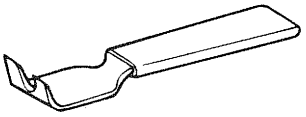
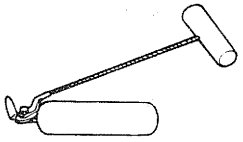
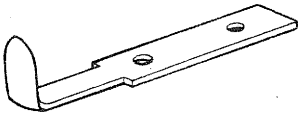
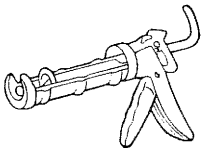
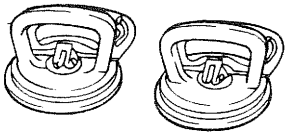
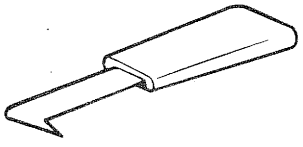
TIGHTENING TORQUE

ESHA0050

	Nm	kgf·cm	lb·ft
Front and rear doors			
Door hinge to body	34-42	340-420	24.6-30.4
Door hinge to door	13-26	130-260	9.4-18.8
Tailgate			
Tailgate lid hinge to body	7-9	70-90	5.1-6.5
Tailgate lid hinge to tailgate	7-9	70-90	5.1-6.5
Gas lifter to body	7-9	70-90	5.1-6.5
Gas lifter to tailgate	7-9	70-90	5.1-6.5
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	5.1-8.0
Seat belt			
Front seat belt upper anchor	40-55	400-550	28.9-39.8
Front seat belt retractor	40-55	400-550	28.9-39.8
Height adjuster	40-55	400-550	28.9-39.8
Second and third seat belt upper anchor	40-55	400-550	28.9-39.8
Second and third seat belt lower anchor	40-55	400-550	28.9-39.8
Second and third seat belt retractor anchor	40-55	400-550	28.9-39.8
Seat			
Front seat mounting bolts and nuts	35-55	350-550	25.4-40

SPECIAL TOOLS

ESHA0100

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 Headlining clip remover	 ESA9010H	Removal of the headlining clip
09861-31100 Sealant cut-out tool	 ESA9010I	Cutting the sealant for the windshield glass (use with 09861-31200)
09861-31200 Sealant cutting blade	 ESA9010J	Cutting the sealant for the windshield glass (use with 09861-31100)
09861-31300 Sealant gun	 ESA9010K	Application of the sealant to the windshield glass
09681-31400 Glass holder	 ESA9010L	Removal and installation of the windshield glass
09681-31000 Windshield glass moulding remover	 ESA9010M	Removal of the windshield glass moulding

TROUBLESHOOTING

ESHA0150

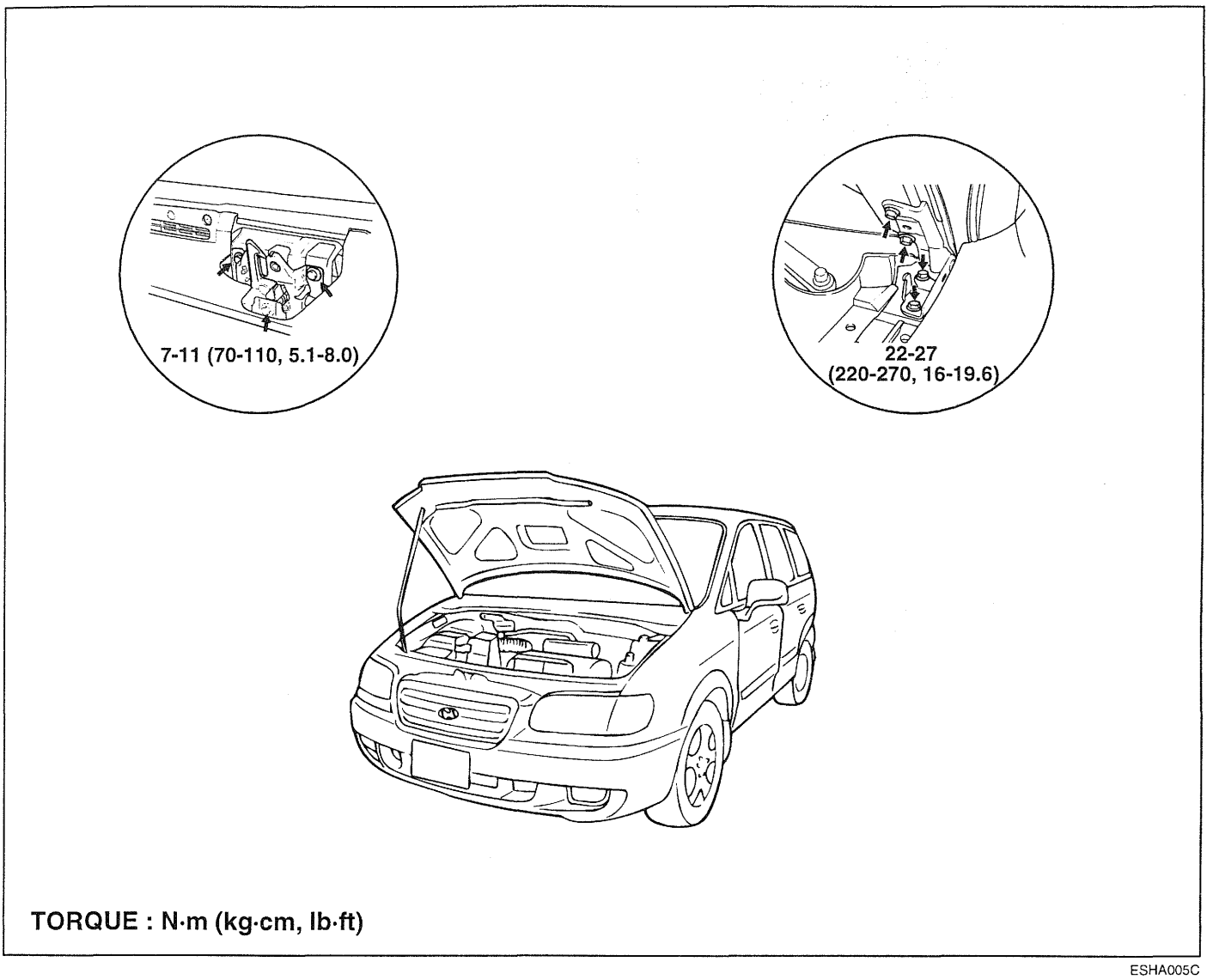
Trouble symptom	Probable cause	Remedy
Water leaks from sunroof	Dirt accumulated in drain pipe	Clear dirt inside of drain pipe
	Clogged drain pipe	Blow air into drain pipe to remove dirt
	Broken or dislocated drain pipe, defective or cracked clip	Check pipe installation and flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and improperly fitted weatherstrip	Adjust
Wind noise	Loose or deformed deflector	Retighten or replace
Roof lid makes a noise when moved	Foreign particles lodged in guide rail	Check drive cable and guide rails for foreign particles
	Loosed guide rails and lid	Retighten
Motor runs but lid does not move or moves only halfway	Foreign particles lodged in guide rail	Check drive cable and guide rails for foreign particles
	Incorrect engagement of motor pinion with drive cable	Check for loose motor installation and damaged pinion
	Decrease in clutch slipping force of motor	Adjust
	Increased lid sliding resistance or interference of lid with drive cables, weatherstrip, etc. due to maladjustment of lid	Adjust or replace
Noise in motor (Clutch slipping noise from motor when lid is fully opened or closed is not an unusual noise.)	Incorrect engagement of motor pinion with drive cable	Check pinion installation and retighten motor
	Worn out or damaged motor pinion bearing	Replace motor assembly
	Worn out or deformed drive cable	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	Correct or replace
	Door hinge required 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

Trouble symptom	Probable cause	Remedy
Wind noise around door	Weatherstrip not holding firmly	Adjust fit of door
	Improperly installed weatherstrip or setting of weatherstrip setting of 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

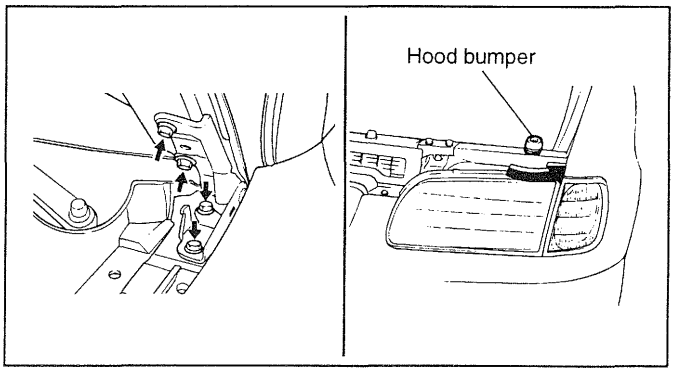
COMPONENTS ESHA0200



ESHA005C

HOOD ALIGNMENT ADJUSTMENT ESHA0250

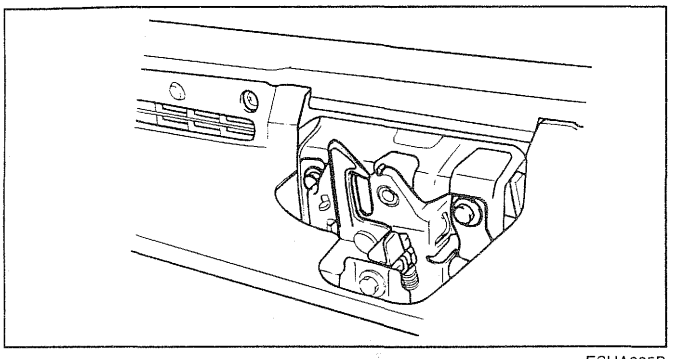
1. Adjust the longitudinal and lateral positions of the hood by utilizing the holes in the hinge.
2. Turn the hood bumpers either clockwise or counter-clockwise to adjust the height of the hood.



ESHA005A

3. Loosen the bolts holding the hood latch.

4. Adjust the alignment of the hood striker and the hood latch by adjusting the horizontal and vertical position of the latch and the height of the hood.

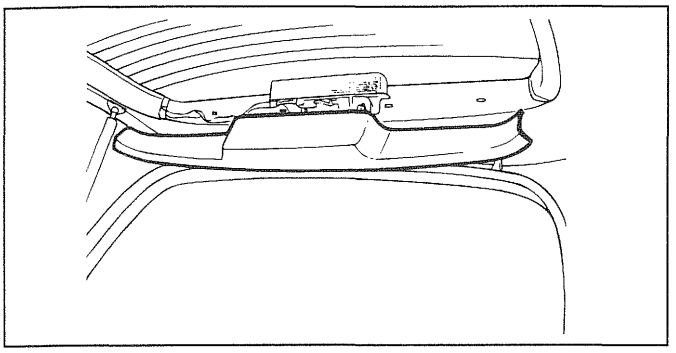


ESHA005B

TAILGATE

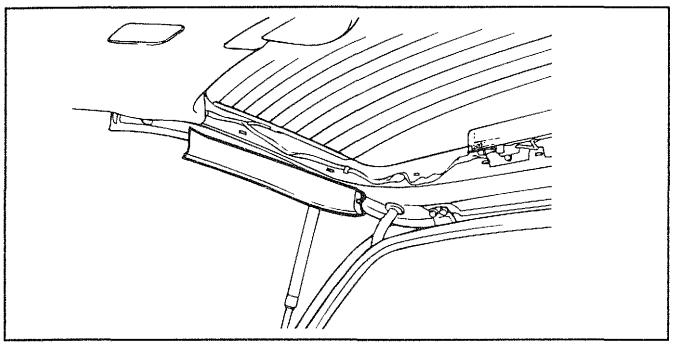
REMOVAL AND INSTALLATION ESHA0300

1. Remove the upper trim from the tailgate frame.



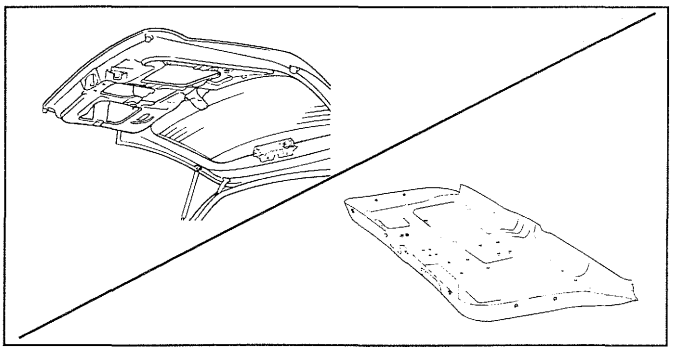
ESHA010A

2. Remove the side trim from the tailgate frame.



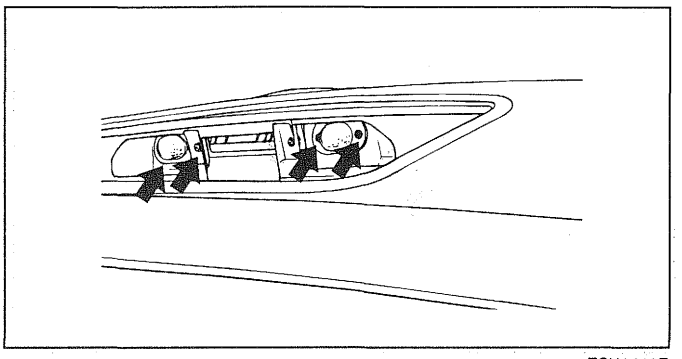
ESHA010B

3. Remove the tapping screw and the trim grip and then the tailgate trim panel.



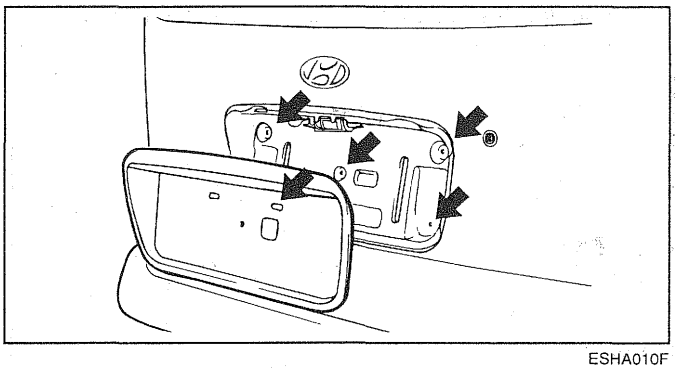
ESHA010C

4. Remove the license lamp



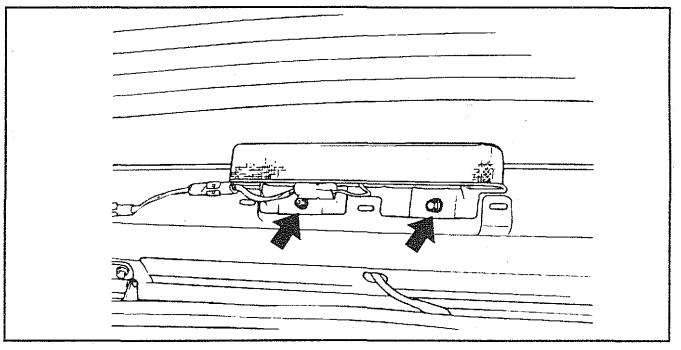
ESHA010E

5. Remove the back panel molding.



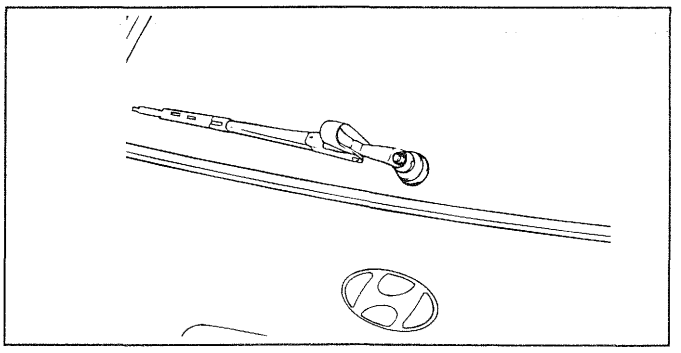
ESHA010F

6. Remove the high mounted stop lamp.

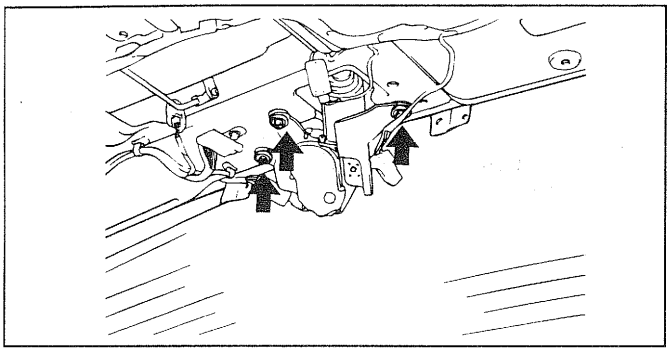


ESHA010H

7. Remove the rear wiper motor.

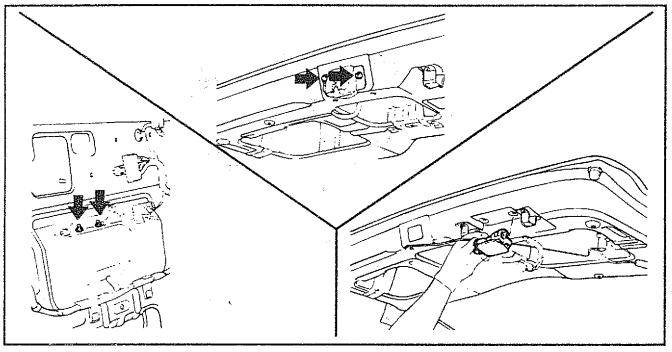


ESHA010I

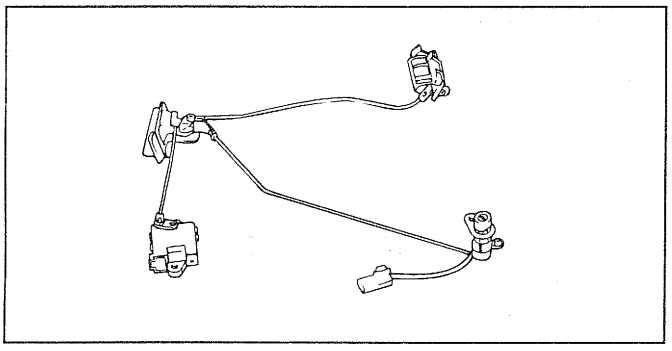


ESHA010J

8. Remove the tailgate outside handle, the tailgate actuator, the tailgate latch, and the key cylinder.



ESHA010G



ESHA010M

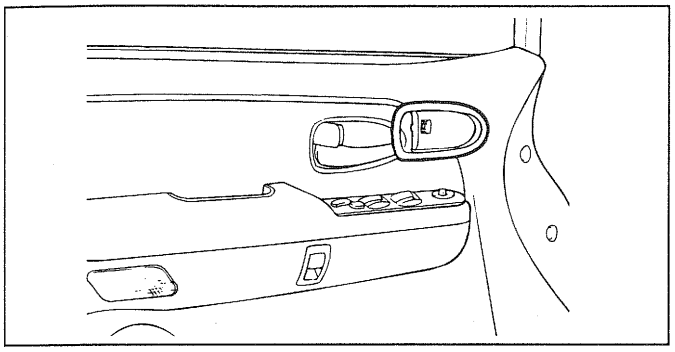
9. Remove the tailgate lifter.

10. Installation is the reverse of the removal process.

FRONT DOOR

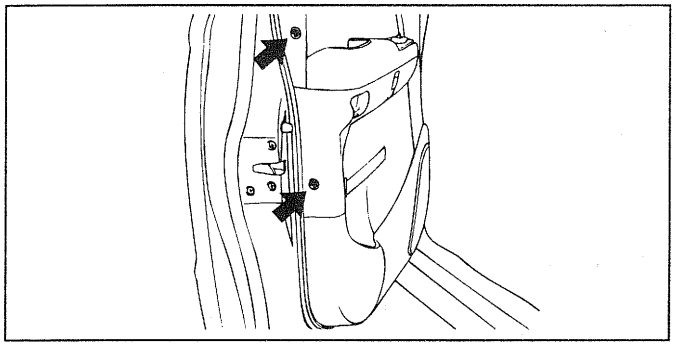
REMOVAL AND INSTALLATION ESHA0350

1. Loosen the screw holding the handle inside door.



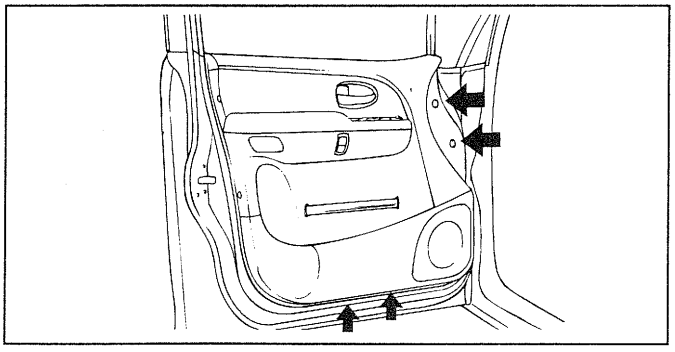
ESHA015A

2. Remove the tapping screw cap and loosen the tapping screws.



ESHA015B

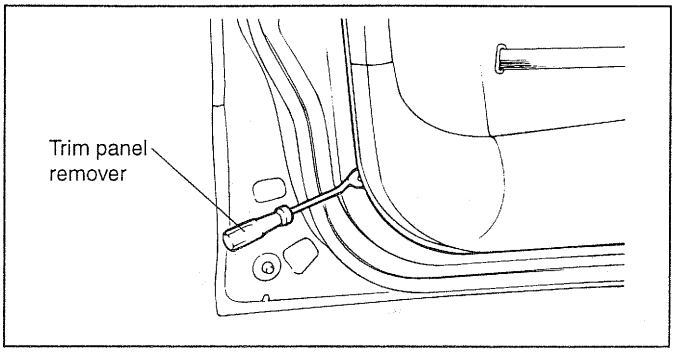
3. Loosen the screws holding the door trim panel.



ESHA015C

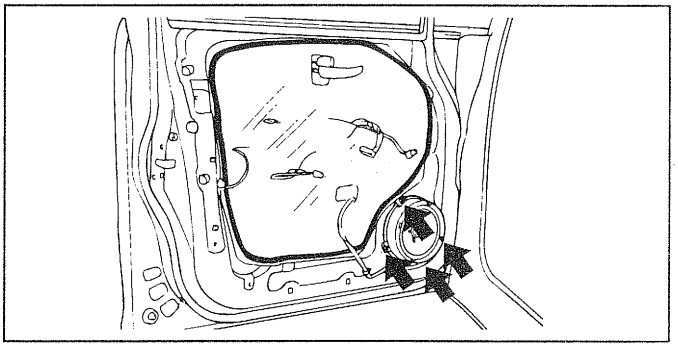
4. Insert a trim panel remover between the trim fasteners and the door trim panel to pry off.

   Disconnect the wire connectors from the front door.



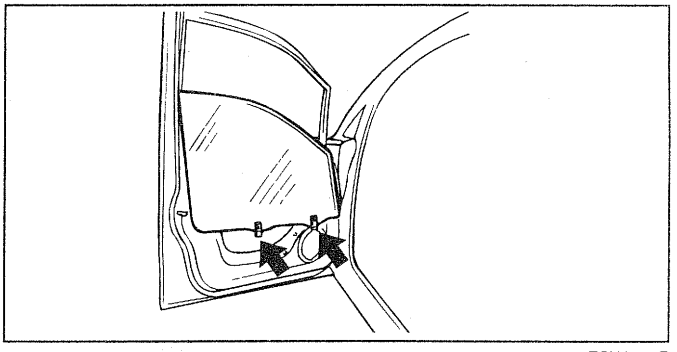
ESHA015D

5. Remove the front speaker and the door trim seal.



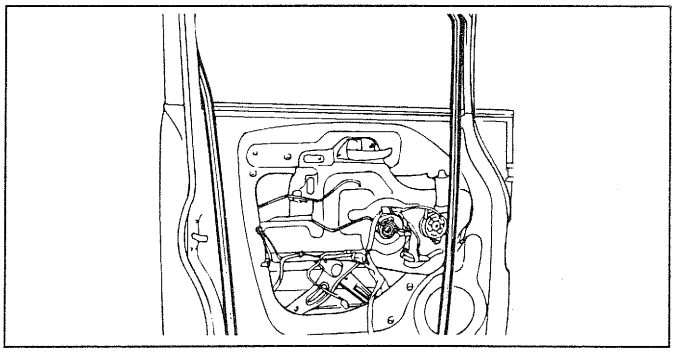
ESHA015E

6. Remove the front door glass from the front door module.



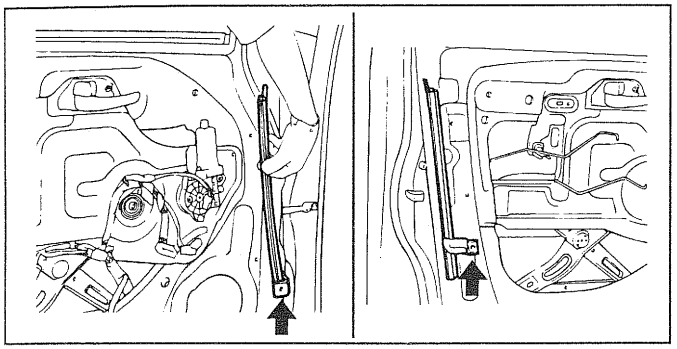
ESHA015F

7. Remove the front door window glass run.



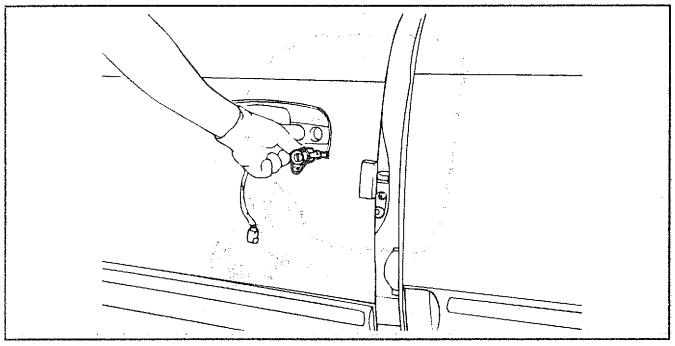
ESHA015G

8. Remove the front channel and the rear channel from the front door.



ESHA015H

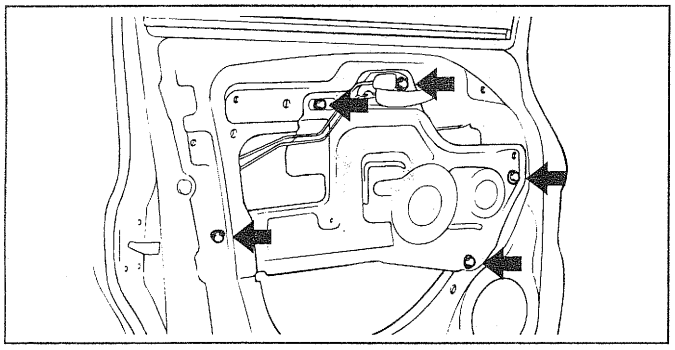
9. Remove the door key cylinder.



ESHA015J

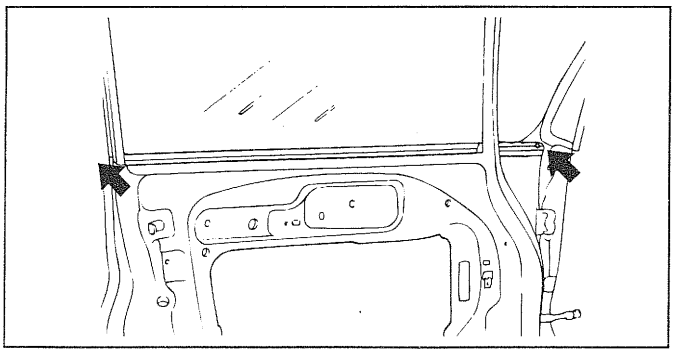
10. Loosen the bolts holding the handle outside front door, the latch, and the door lock actuator.

    Remove the wire harness and the front door module.



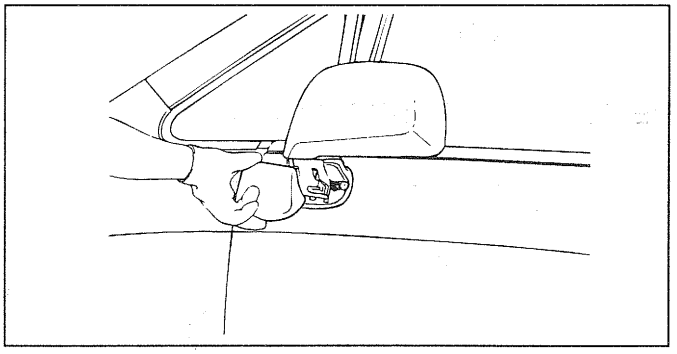
ESHA015K

11. Remove the weather strip outside door belt.



ESHA015L

12. Remove the outside rear view mirror.



ESHA015M

13. Installation is the reverse of the removal process.

    When installing the door trim seal, butyl tape should not be placed over the area when installing the door trim fastener.

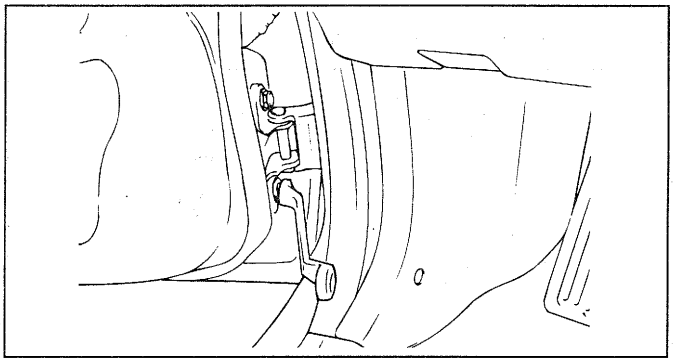
ADJUSTMENT ESHA0400

DOOR POSITION

Check for a flush fit with the body, then check for an equal gap between the front and rear, top and bottom door edges and the body. The door and body edges should also be parallel.

CAUTION

Attach protective tape to the fender edges where the hinge is installed.



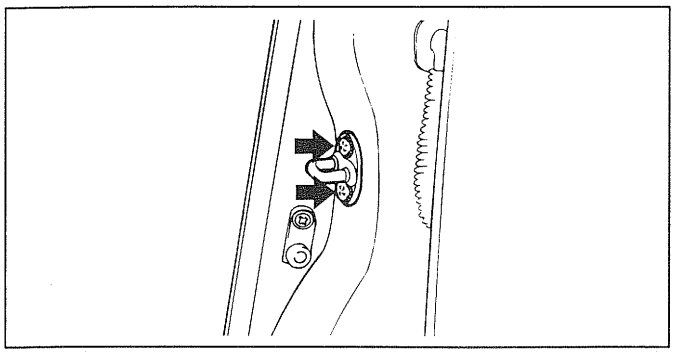
ESA9095A

DOOR STRIKER

Make sure the door is not loose, and that it latches securely without slamming. If necessary, adjust the door as follows :

1. Draw a line around the striker plate for reference.

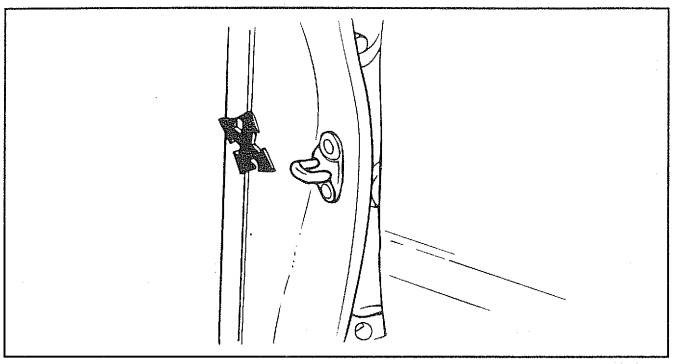
2. Loosen the striker screws, and move the striker IN and OUT to make the latch fit tighter or looser. Move the striker UP and DOWN to align it with the latch opening. Then lightly tighten the screws and recheck.



ESHA015N

NOTE

Hold the outside handle outward and push the door against the body to ensure the striker has a tight fit.

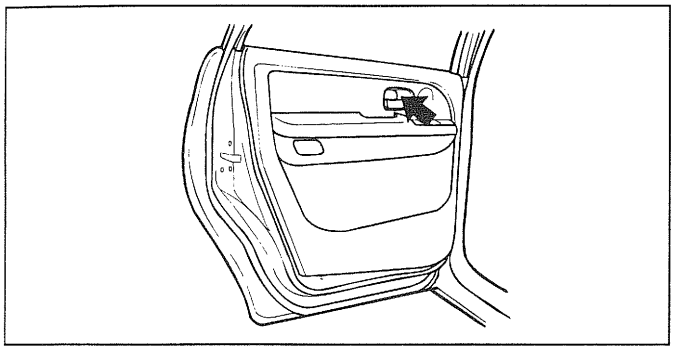


ESA9095B

REAR DOOR

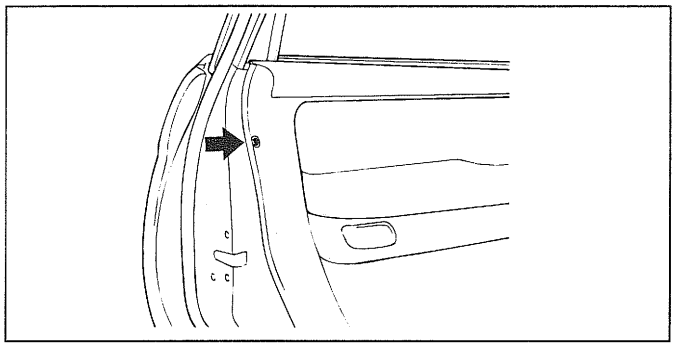
REMOVAL AND INSTALLATION ESHA0450

1. Loosen the screw holding the handle inside the door.



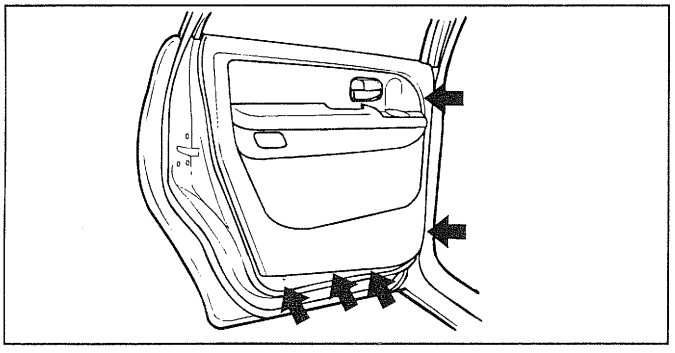
ESHA020A

2. Remove the tapping screw cap and then loosen the tapping screws.



ESHA020B

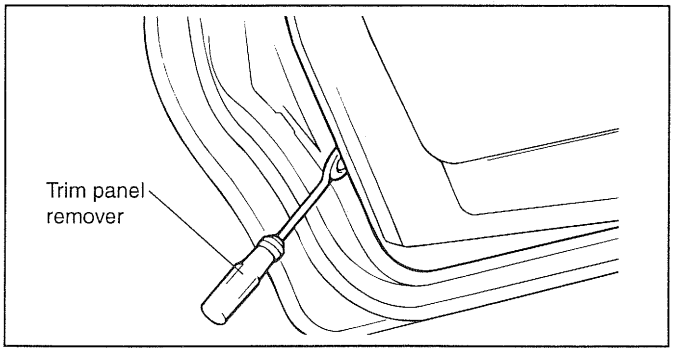
3. Remove the screws holding the door trim panel.



ESHA020C

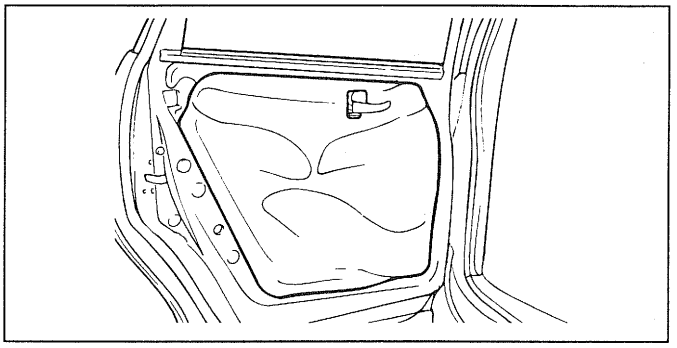
4. Insert a trim panel remover between the trim fasteners and the door trim panel to pry off.

   Disconnect the wire connectors from the rear door.



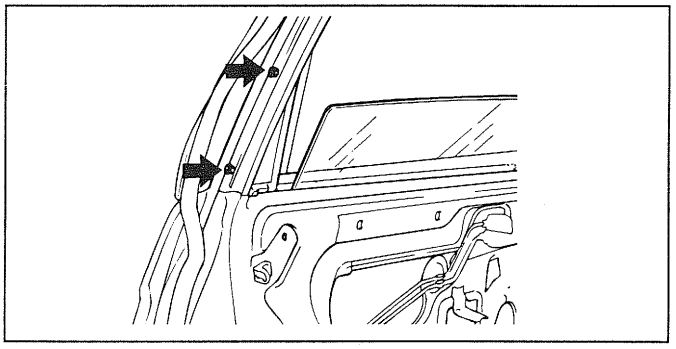
ESHA020D

5. Remove the door trim seal.



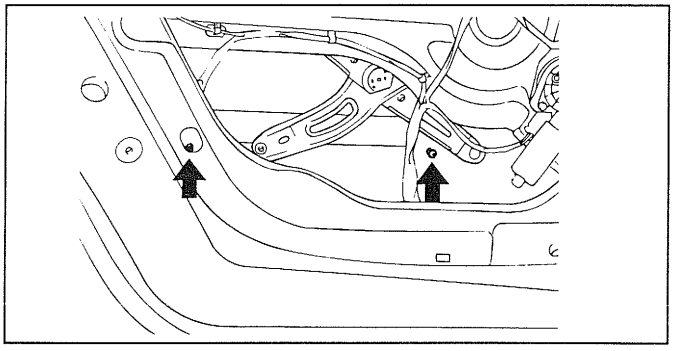
ESHA020E

6. Remove the delta cover from the rear door.



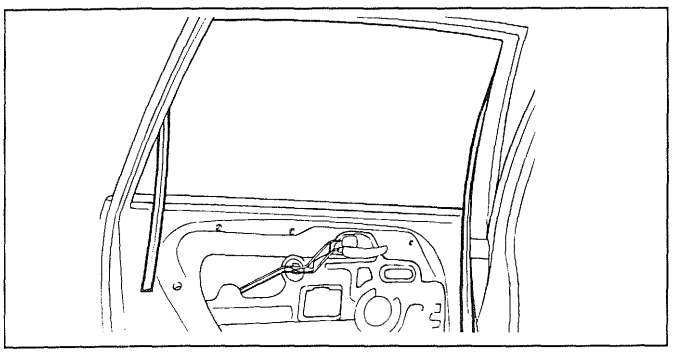
ESHA020F

7. Remove the rear door glass from the rear door module.



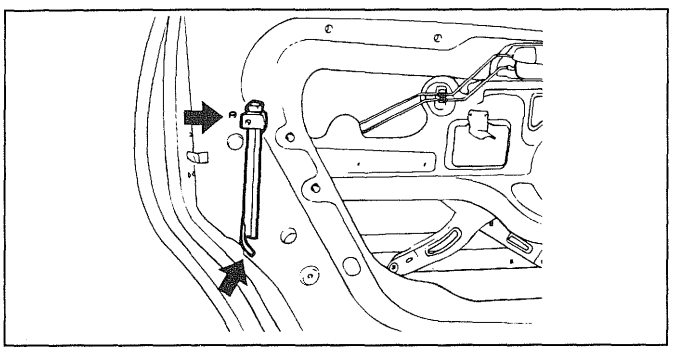
ESHA020G

8. Remove the rear door glass run.



ESHA020H

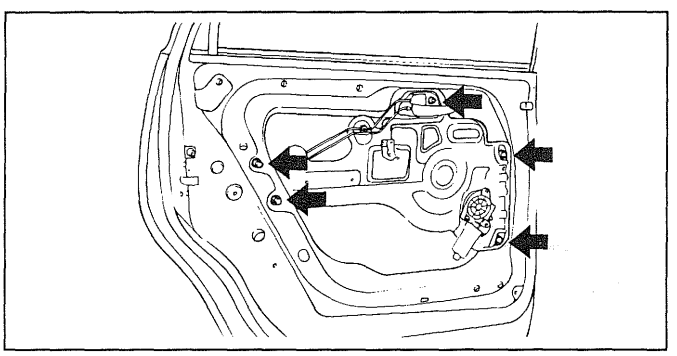
9. Remove the rear panel from the rear door.



ESHA020I

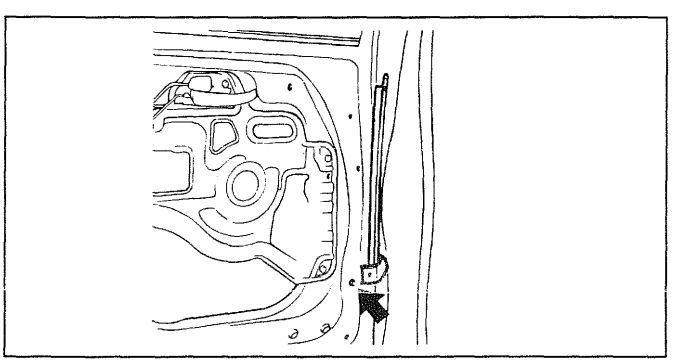
10. Disconnect the rod from the outside handle.

    Remove the latch and the wire harness and the rear door module.



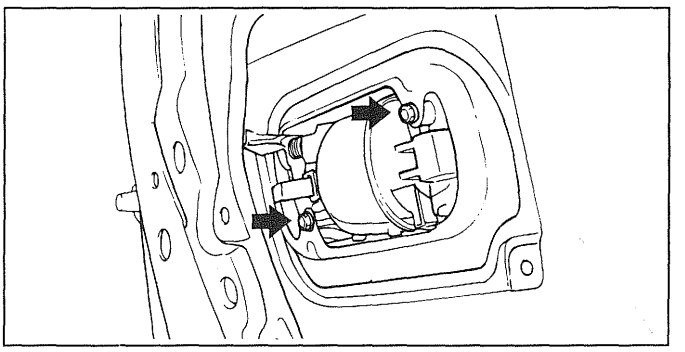
ESHA020K

11. Remove the rear door front panel.



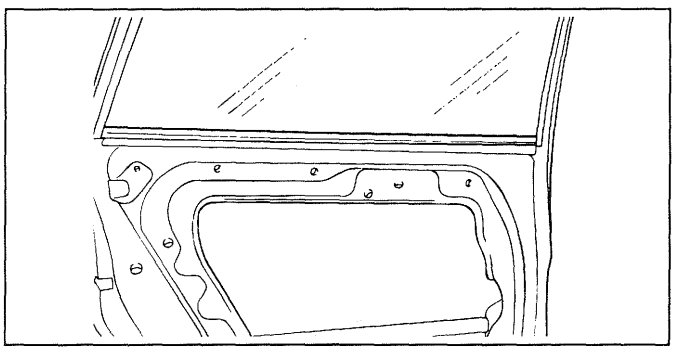
ESHA020L

12. Remove the rear door outside handle.



ESHA020J

13. Remove the weather strip outside rear door belt.



ESHA020M

14. Installation is the reverse of the removal process.

    When installing the door trim seal, butyl tape should not be placed over the area installing the door trim fastener.

ADJUSTMENT ESHA0500

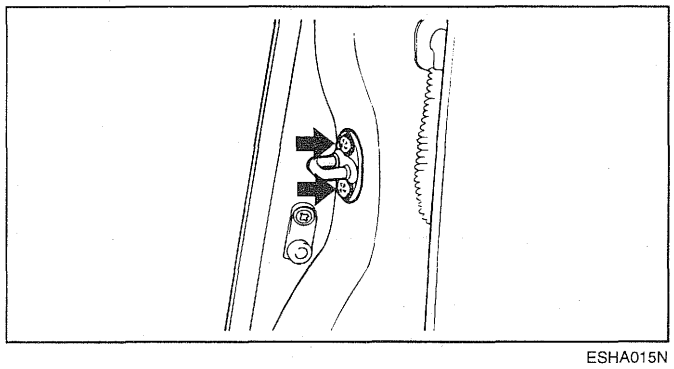
DOOR POSITION

Check for a tight fit with the body, then check for an equal gap between the front and rear, top and bottom door edges and the body. The door and body edges should also be parallel.

DOOR STRIKER

Make sure the door is not loose, and that it latches securely without slamming. If necessary, adjust the door as follows :

1. Draw a line around the striker plate for reference.
2. Loosen the striker screws, and move the striker IN and OUT to make the latch fit tighter or looser. Move the striker UP and DOWN to align it with the latch opening. Then lightly tighten the screws and recheck.



ESHA015N

BODY SIDE MOLDINGS

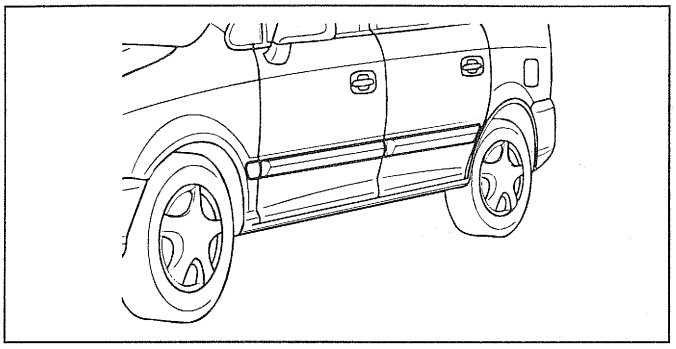
REMOVAL AND INSTALLATION ESHA0550

WAISTLINE MOLDING

Beginning from either end, remove the waistline molding using the special tool (09800–21000) from the front and rear doors.

CAUTION

Take care not to scratch or bend the door moldings.



ESHA025C

ROOF SIDE GARNISH ESHA0600

1. Remove the roof side garnish by using a flat bladed screwdriver.

CAUTION

When prying with a flat bladed screwdriver, wrap it with protective tape to prevent damage.

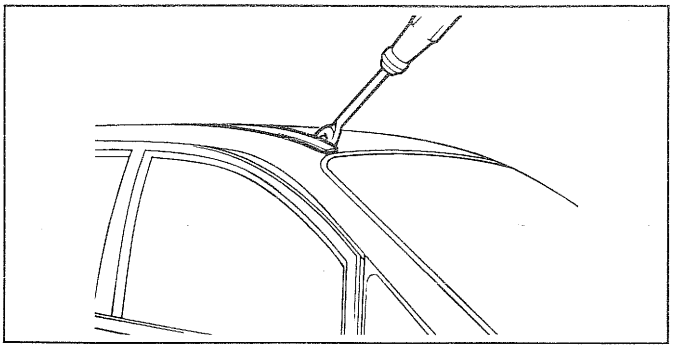
In order not to scratch the body and roof side garnish, use protective tape on the body.

2. Pull the roof side garnish up, then remove the roof side garnish.

3. Installation is the reverse of the removal process.

NOTE

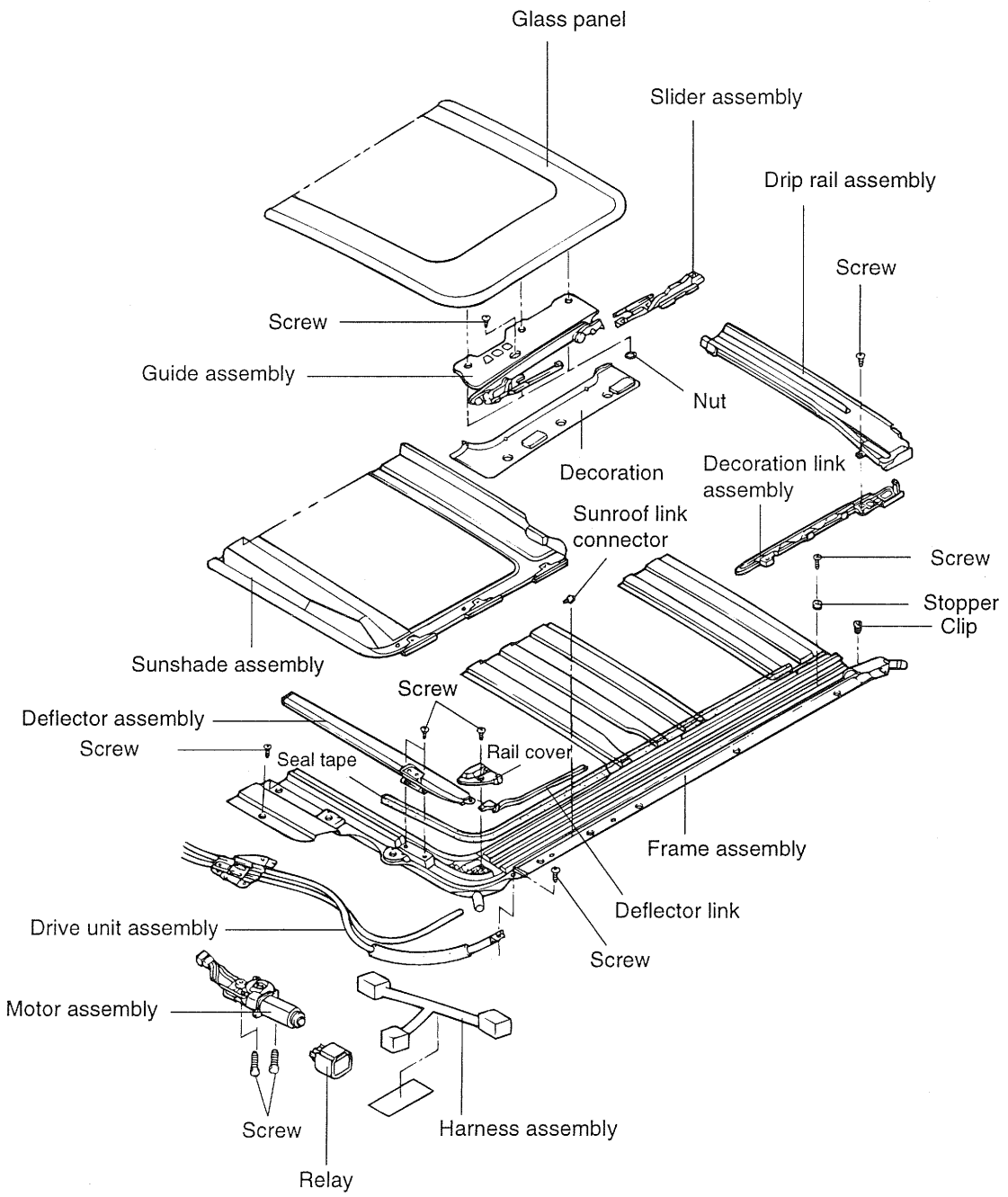
If necessary, replace any damaged clips.



ESHA025B

SUN ROOF

COMPONENTS ESHA0650



ESHA065A

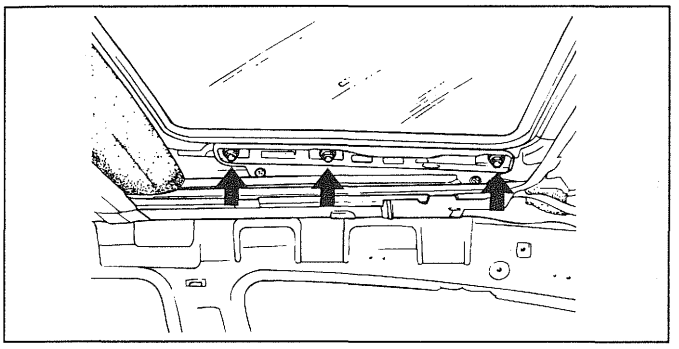
REMOVAL ESHA0700

1. To remove the sunroof, first remove the following parts :
   1) Overhead console lamp.
   2) Sunvisor and grip handle.
   3) Pillar trims.
2. Remove the decoration cover and the glass panel.

Tightening torque

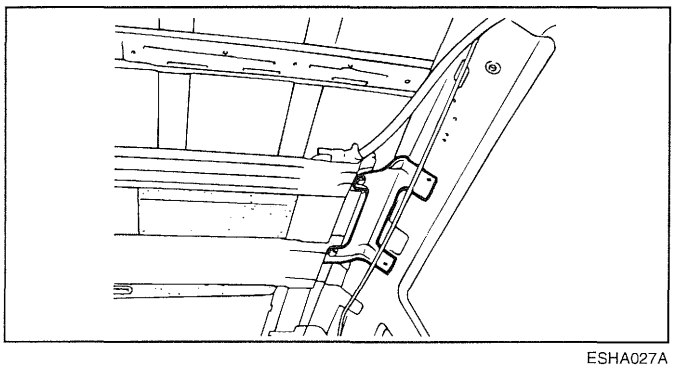
Glass panel mounting nuts :

4-6 Nm (40-60 kg·cm, 2.9-4.4 lb·ft)



ESA9011K

3. Disconnect the drain hose.



ESHA027A

4. Loosen the bolts and nuts holding the sunroof and then remove the sunroof assembly.

Tightening torque

Sunroof mounting bolts:

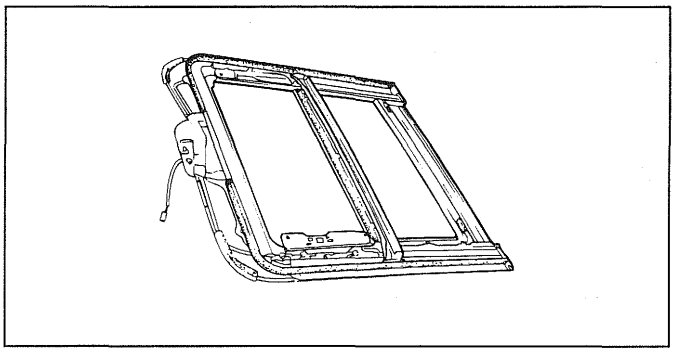
7-11 Nm (70-110 kg·cm, 5.1-8.0 lb·ft)

Sunroof mounting nuts:

4-6 Nm (40-60 kg·cm, 2.9-4.4 lb·ft)

NOTE

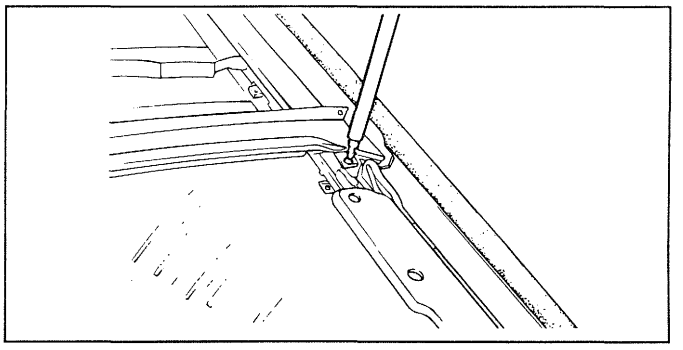
When removing the sunroof assembly, carefully pull out the sunroof assembly to avoid damage to the other parts.



ESA9011B

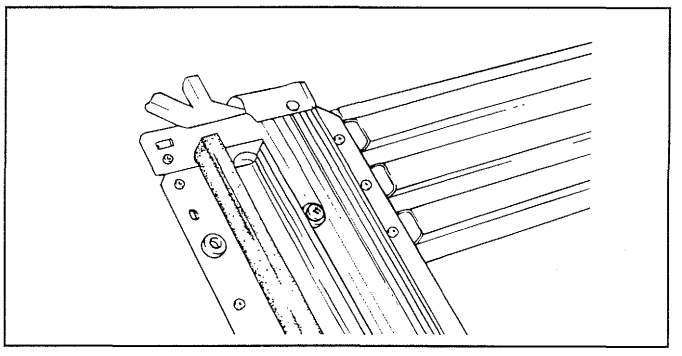
DISASSEMBLY ESHA0750

1. Remove the drip rail.



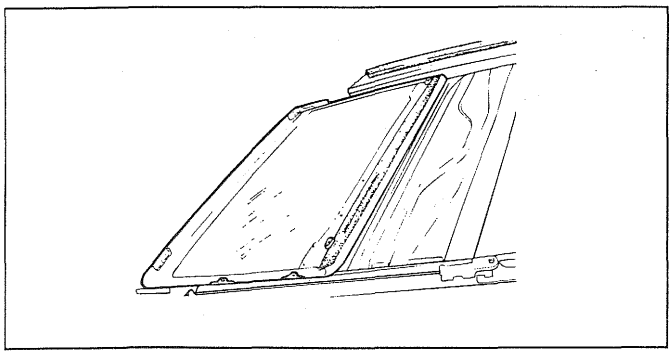
ESA9011C

2. Remove the stopper.



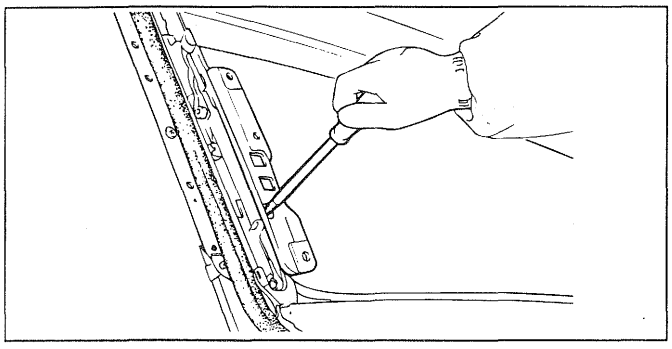
ESA9011D

3. Remove the sun shade.



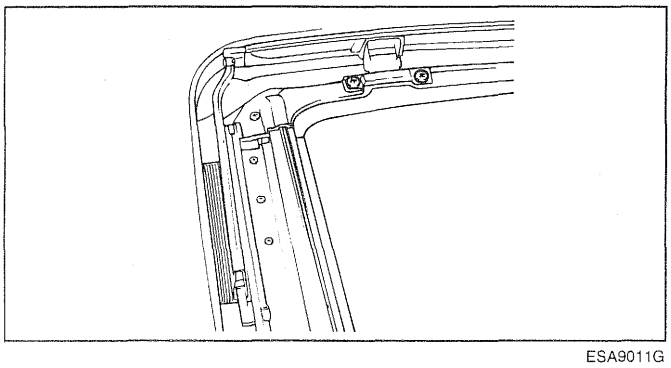
ESA9011E

4. Remove the guide assembly.



ESA9011F

5. Remove the deflector.

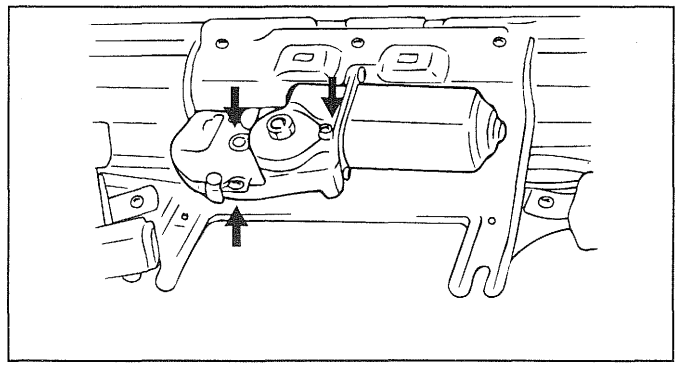


ESA9011G

6. Remove the motor assembly.

CAUTION

When removing the motor, the slider assembly should always be in a fully closed position. If there is discrepancy between the glass position and the motor ring in a fully closed position, the sunroof will not operate correctly.



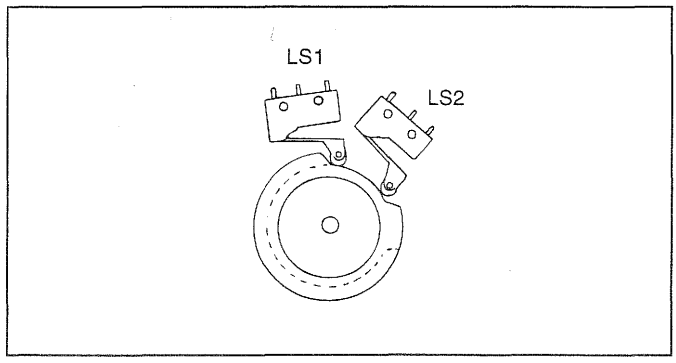
ESA9060N

INSTALLATION ESHA0850

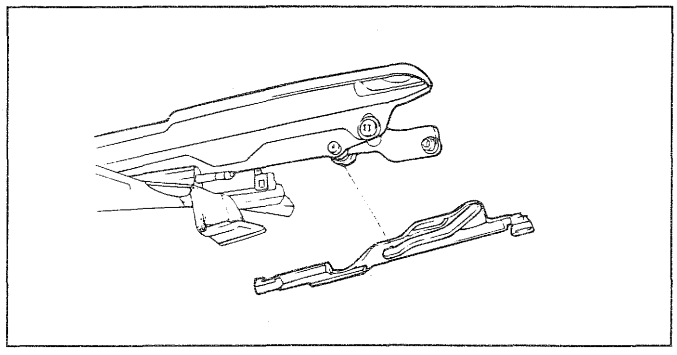
Installation is the reverse of the removal process.

NOTE

Check that the limit switches (LS1 and LS2) of the motor are the fully closed. Align the guide roller center and slider mating mark in the fully closed position.



ESA9070D



ESA9011H

CHECK OPERATING CONDITION AFTER INSTALLATION ESHA0900

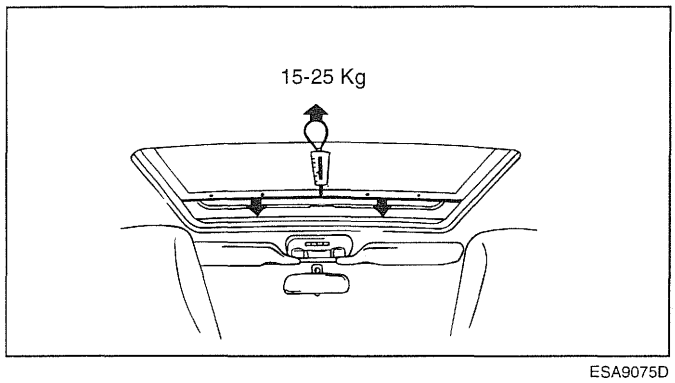
If the glass panel movement is difficult, check and adjust.

1. Make sure the battery voltage is normal.
2. Make sure that the sunroof sliding unit is free of abrasive materials.
3. Make sure that, when the glass panel opens, the rear position of the panel does not interfere with the roof panel. If interference occurs, fully open the glass panel and move the stopper forward.

NOTE

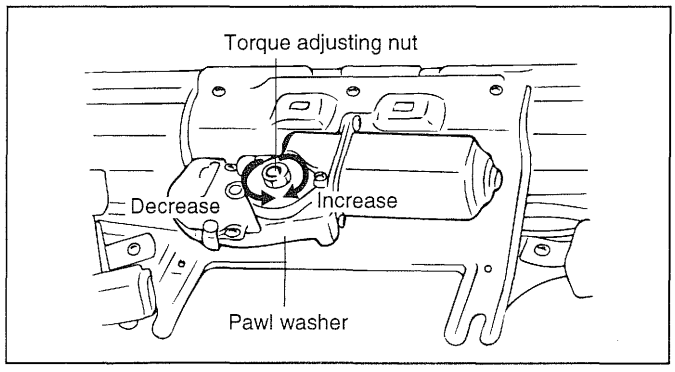
If the stopper is moved forward too far, it may cause malfunction or leaks. Make sure the gap between the glass panel and roof panel is not more than 0.3 mm.

4. Measure the driving force of the motor, and adjust it to 15-25 kg (33.1-55.7 lb) with the torque adjustment nut on the motor.



ESA9075D

5. After adjustment, be sure to lock the nut with the pawl washer.



ESA9075E

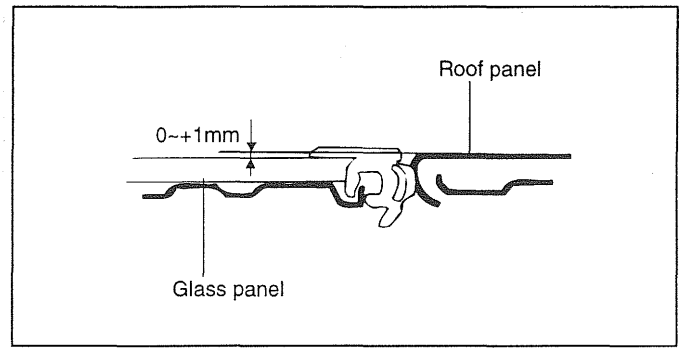
ADJUSTMENT ESHA0950

Adjust the difference between the height of the glass panel and the roof panel.

Front side : 0 (+0, –1.0) mm

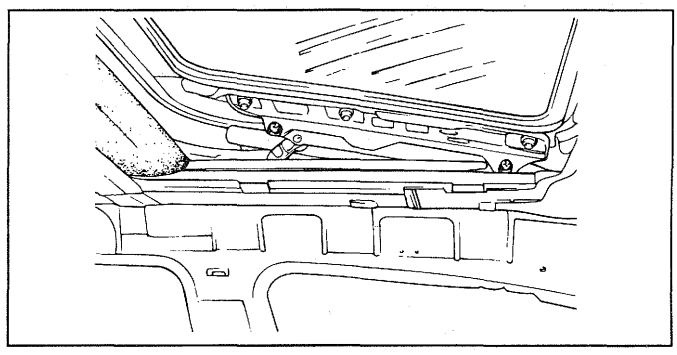
Rear side : 0 (+1, +0) mm

If the difference is not as specific, adjust the following procedure.



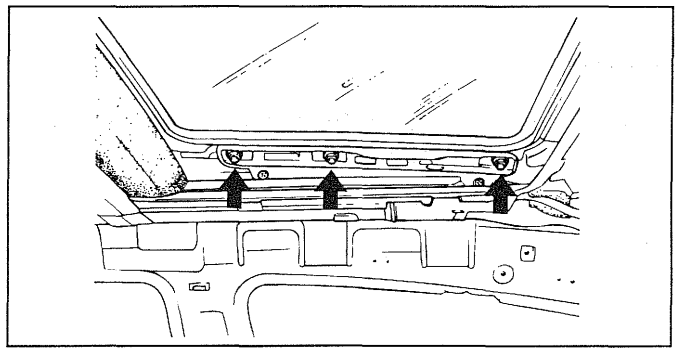
ESA9011J

1. Loosen the front screw and rear screw. Adjust the height between the glass panel and roof panel.



ESA9011I

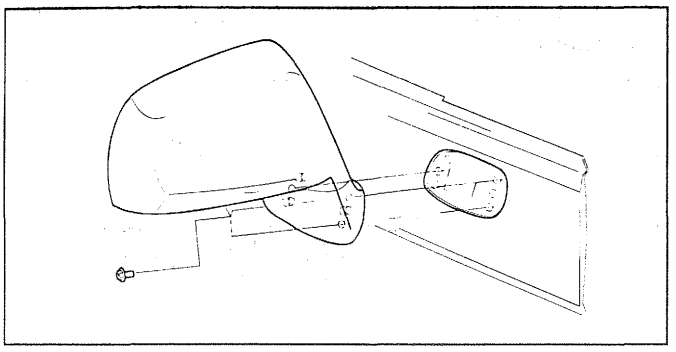
2. Loosen the nuts holding the glass panel and adjust the gap between the glass panel and roof panel.



ESA9011K

OUTSIDE REAR VIEW MIRROR

COMPONENTS ESHA1000



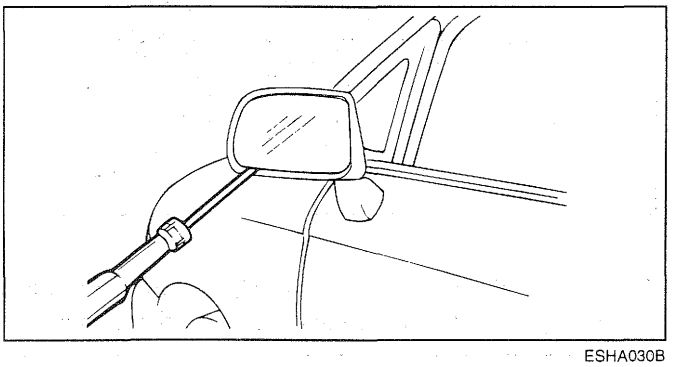
ESHA030A

REMOVAL AND INSTALLATION ESHA1050

CAUTION

Wear gloves to remove and install the mirror holder.

1. Insert flat bladed screwdriver between the outside rearview mirror holder and mirror assembly.

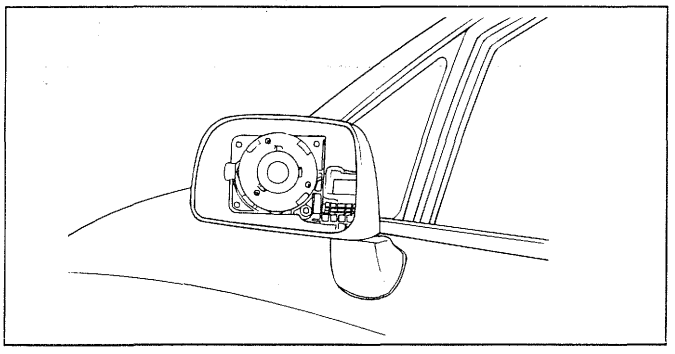


ESHA030B

CAUTION

When prying with a flat bladed screwdriver, wrap it with a shop towel to prevent damage.

2. Remove the outside rearview mirror actuator from outside rearview mirror housing.



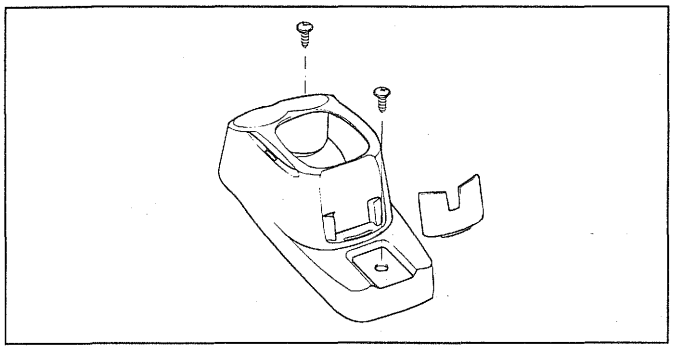
ESHA030C

3. Installation is the reverse of the removal process.

INTERIOR

CONSOLE

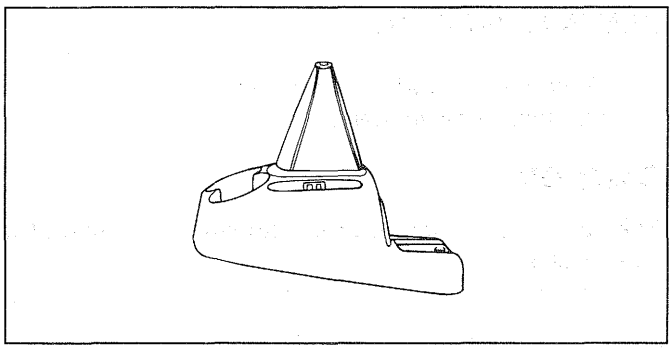
COMPONENTS ESHA1100



ESHA035A

REMOVAL AND INSTALLATION ESHA1150

1. After removal of knob, loosen the screws holding the floor console and then pull out the floor console.
2. Installation is the reverse of the removal process.



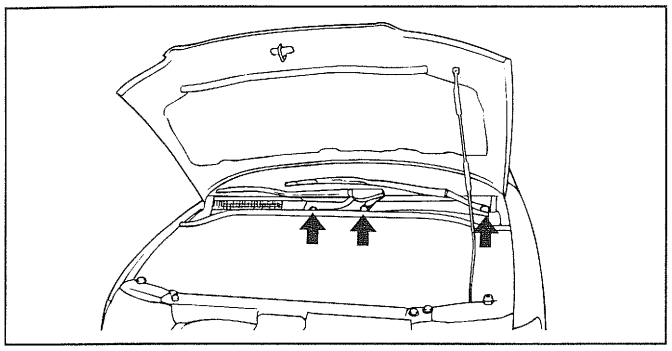
ESHA035B

CRASH PAD

REMOVAL AND INSTALLATION ESHA1200

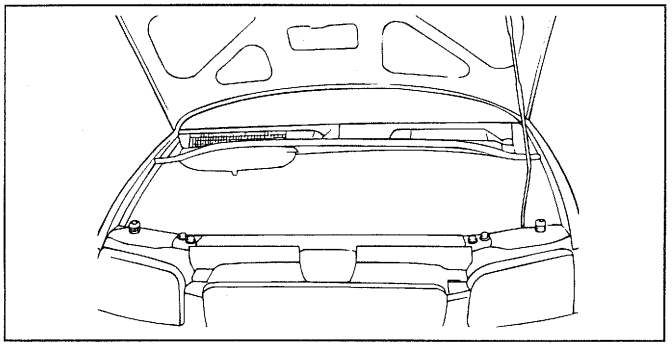
REMOVAL OUTDOORS

1. Separate the battery cable from the negative (-) battery terminal.
2. Remove the windshield wiper arm and blade.



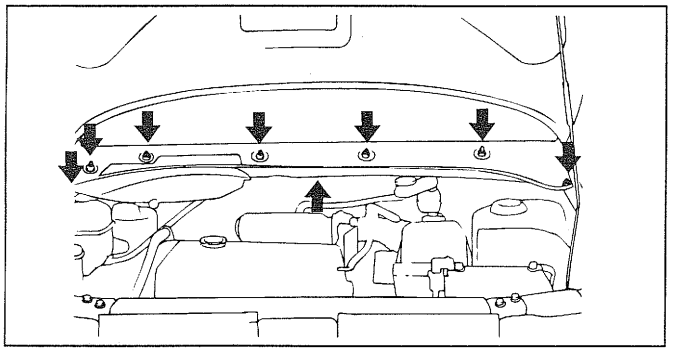
ESHA040A

3. Remove the weather strip and the cowl top cover.



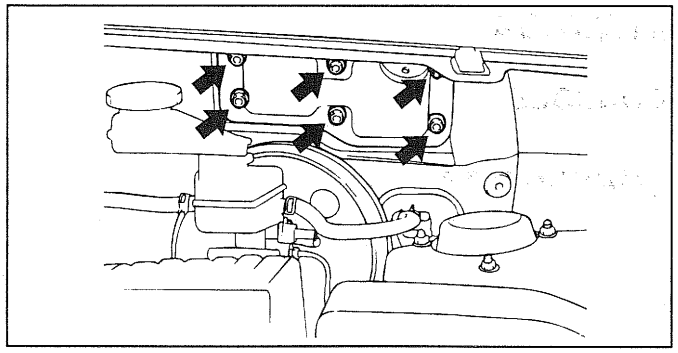
ESHA040B

4. Remove the cowl top outer front panel by installing the windshield wiper linkage.



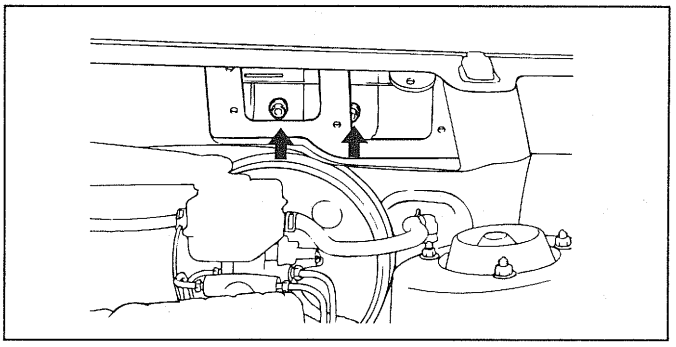
ESHA040C

5. Remove the cover.



ESHA040D

6. Remove the bolts holding the cowl cross bar.



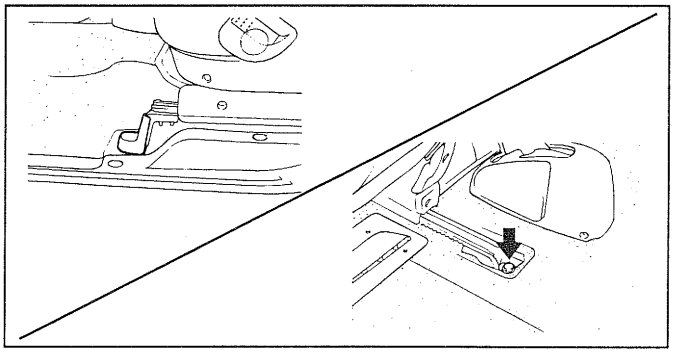
ESHA040E

REMOVAL INDOORS

1. Disconnect the wire connectors from the front seats and then remove them.

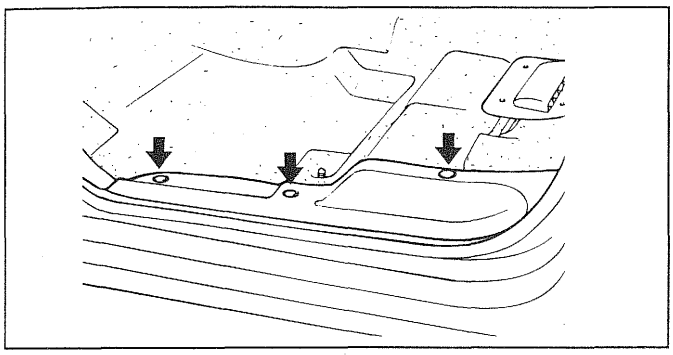
CAUTION

Take care not to scratch the trim when removing the front seats.



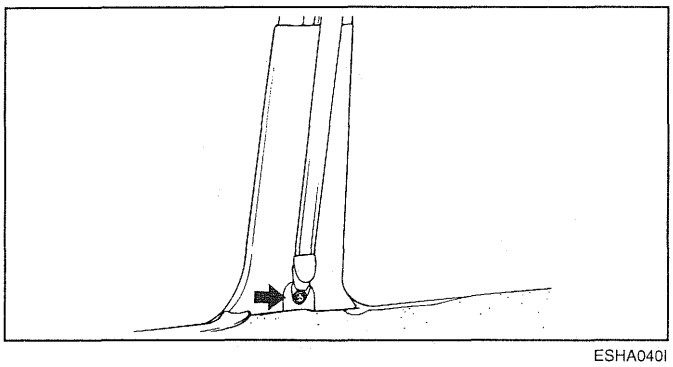
ESHA040F

2. Remove the front door scuff trims.



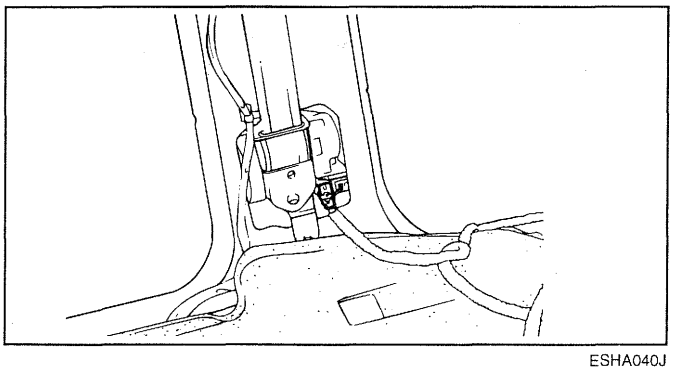
ESHA040H

3. Loosen the seat belt lower anchor bolt and remove the center pillar lower trim.



ESHA040I

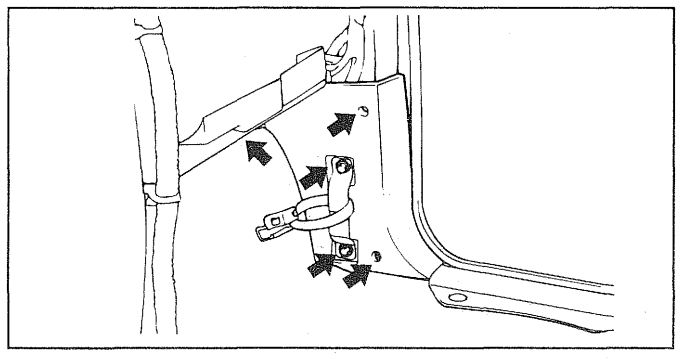
4. Remove the pretensioner connector and the load limiter connector (For vehicles equipped with pretensioner).



ESHA040J

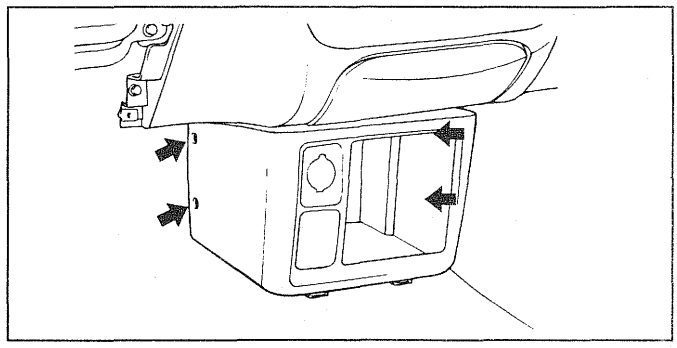
5. Remove the band holding the extinguisher and then remove the cowl side trim.

   Remove the console.



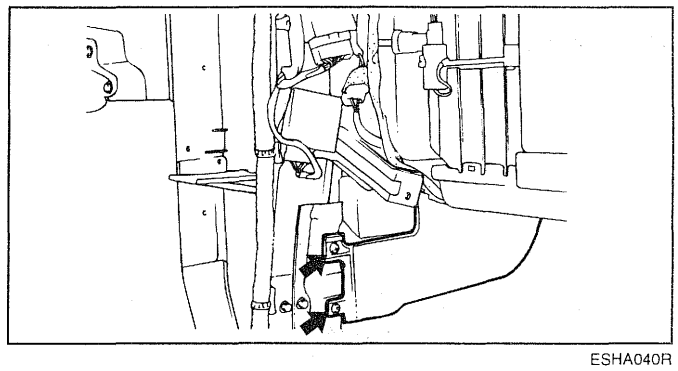
ESHA040K

6. Remove the multi box and disconnect the connectors.



ESHA040L

7. Remove the center lower side cover.

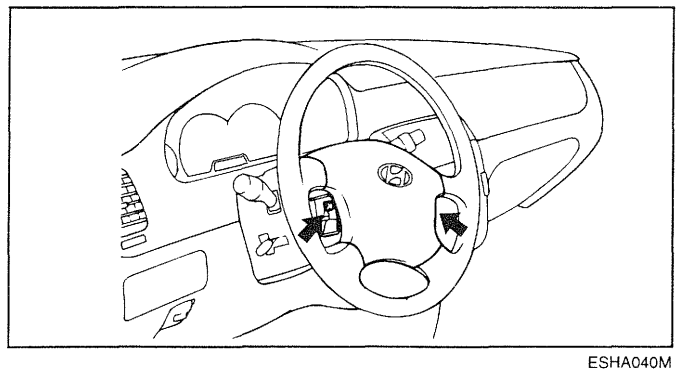


ESHA040R

8. Remove the air bag module.

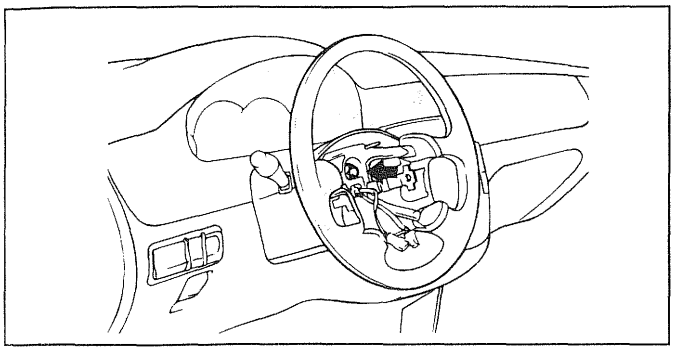
CAUTION

Before removal of the air bag module and clock spring, refer to the RT Group.



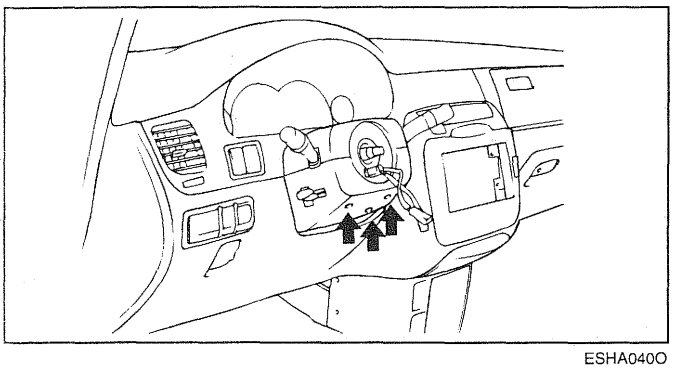
ESHA040M

9. Remove the steering wheel.



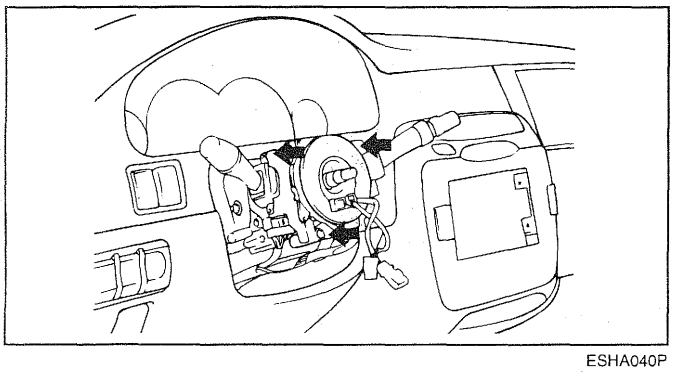
ESHA040N

10. Loosen the screws holding the steering column lower shroud and then remove the steering column lower and upper shroud.



ESHA040O

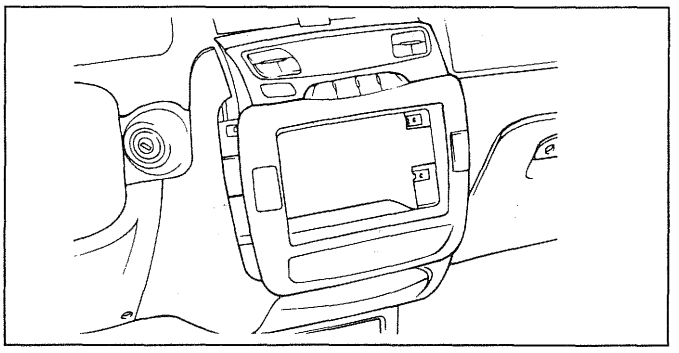
11. Remove the multifunction switch after disconnection of connectors.



ESHA040P

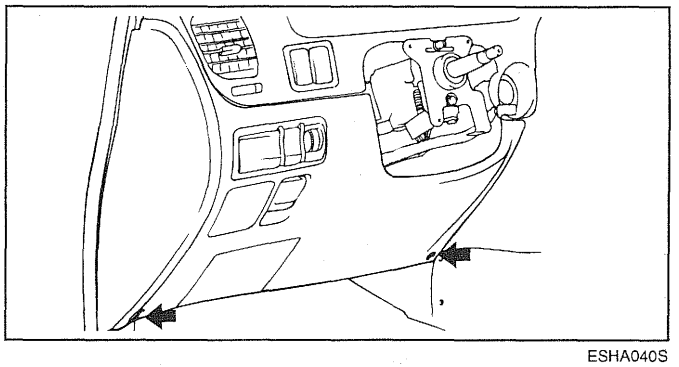
12. Remove the center facia panel and disconnect the connectors.

13. Remove the audio.



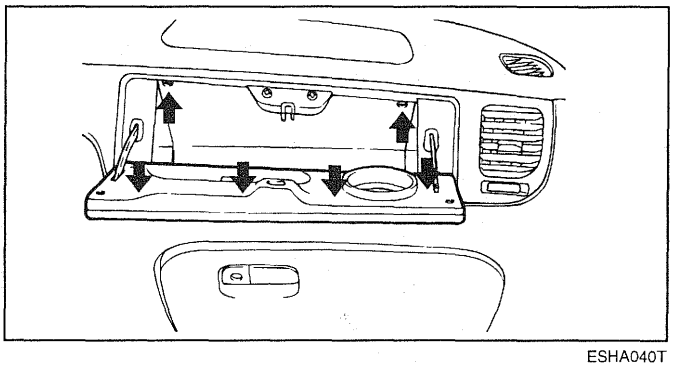
ESHA040Q

14. Remove the driver side lower crash pad panel and hood release cable.



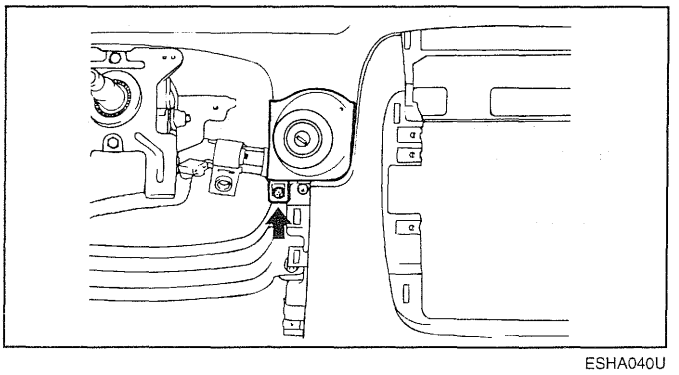
ESHA040S

15. Remove the crash pad upper tray housing.



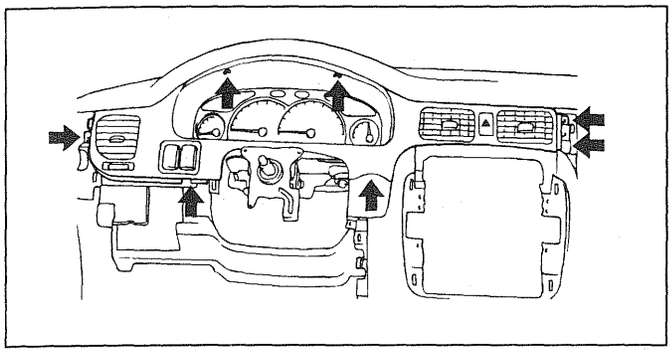
ESHA040T

16. Remove the ignition key bezel.



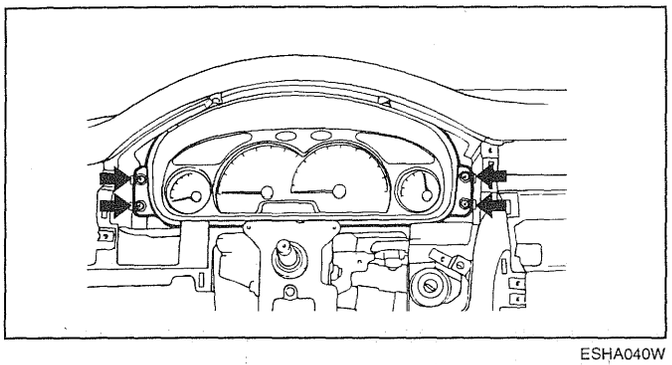
ESHA040U

17. Remove the cluster facia panel.



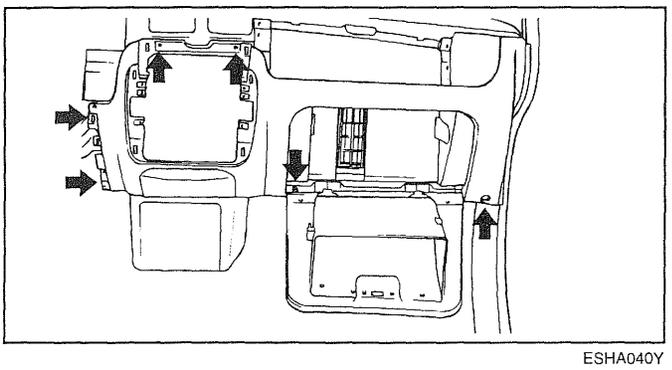
ESHA040V

18. Remove the cluster.



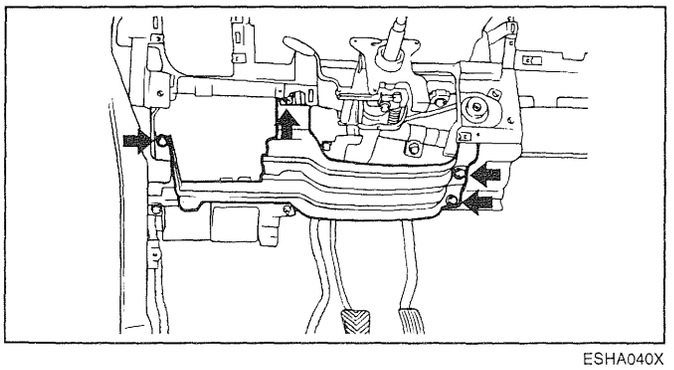
ESHA040W

19. Remove the lower main crash pad.



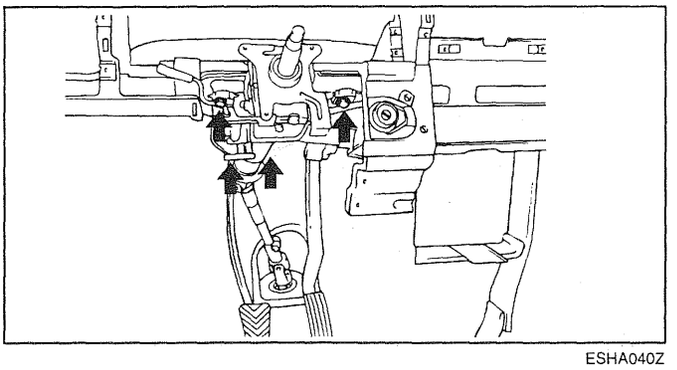
ESHA040Y

20. Remove the driver side support panel.



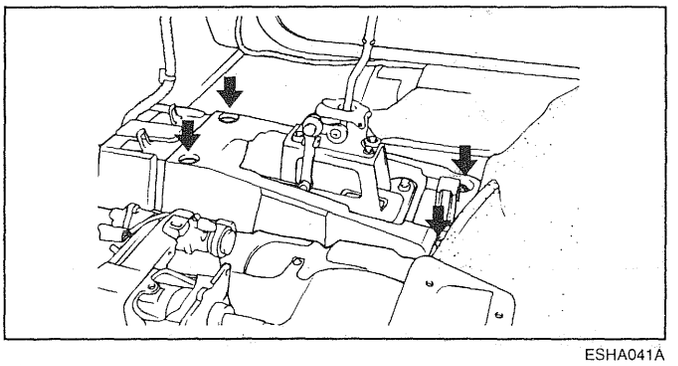
ESHA040X

21. Loosen the bolts holding the steering column and pull down the steering column.



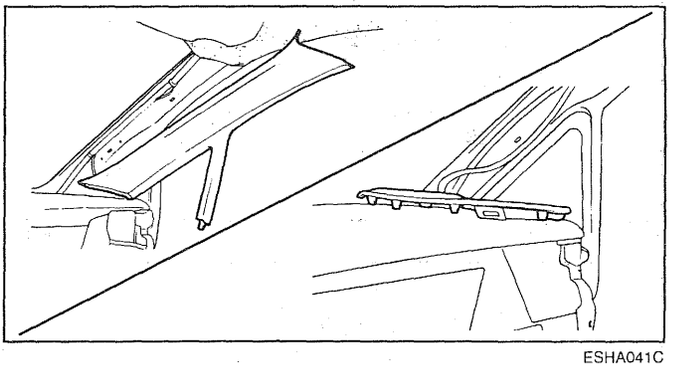
ESHA040Z

22. Remove the bracket holding console.



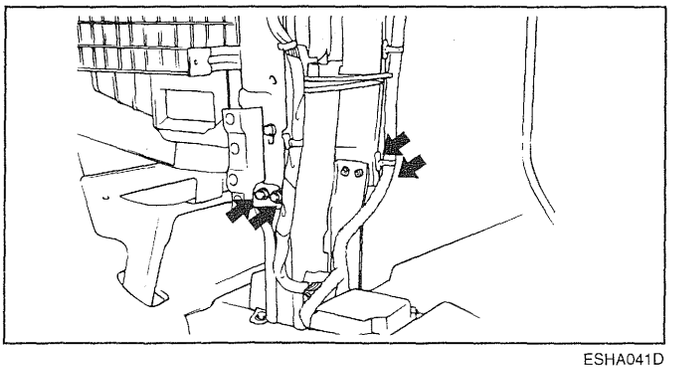
ESHA041A

23. Remove the front pillar trim and the crash pad upper side cover.

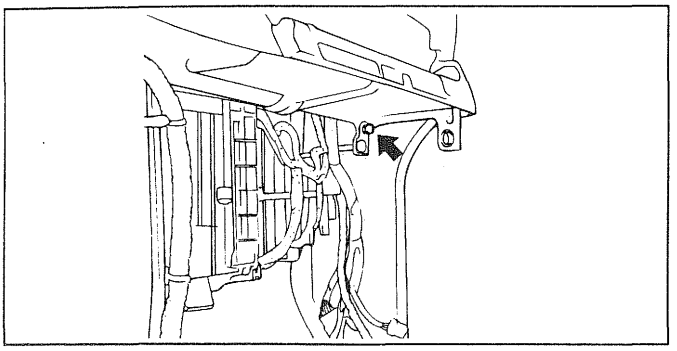


ESHA041C

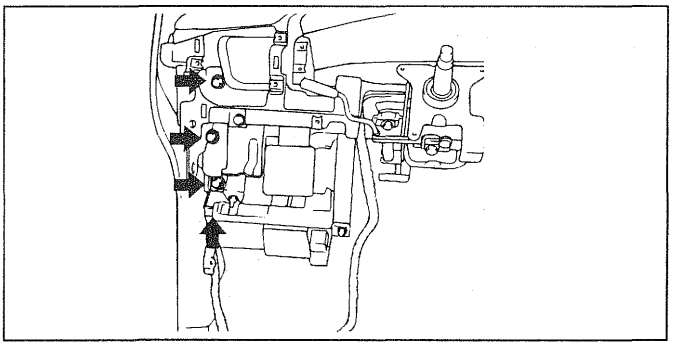
24. Loosen the bolts holding the main crash pad.



ESHA041D

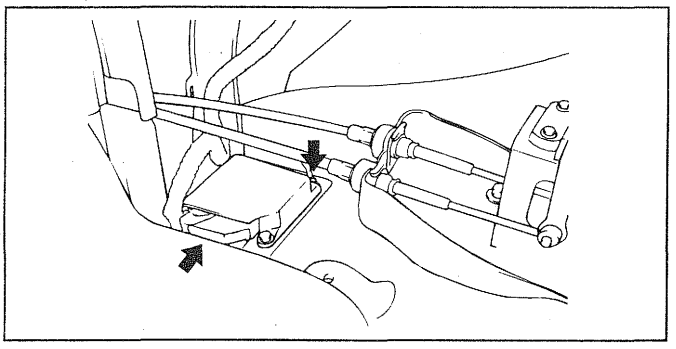


ESHA041E

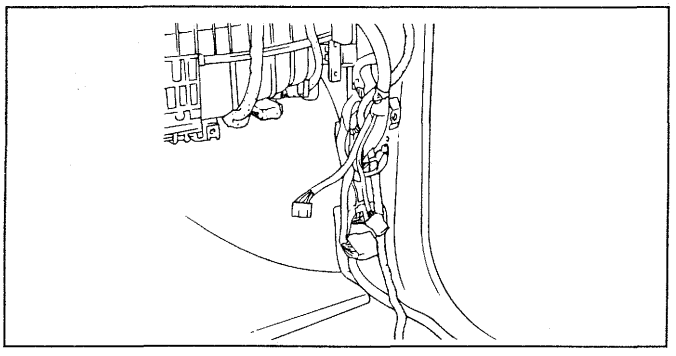


ESHA041F

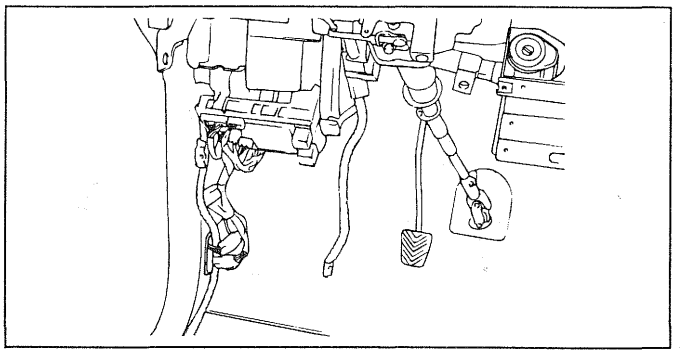
25. Disconnect the ground and connectors.



ESHA041G

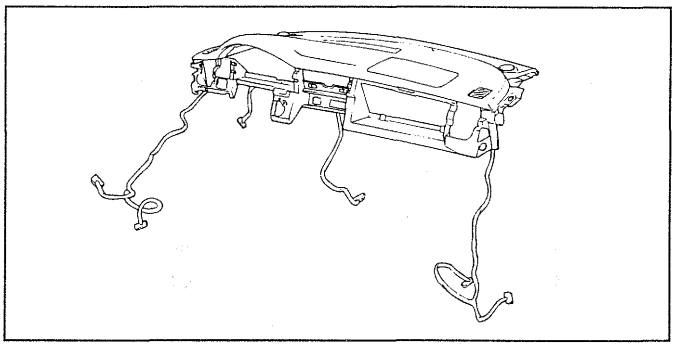


ESHA041H



ESHA041I

26. Remove the main crash pad.



ESHA041J

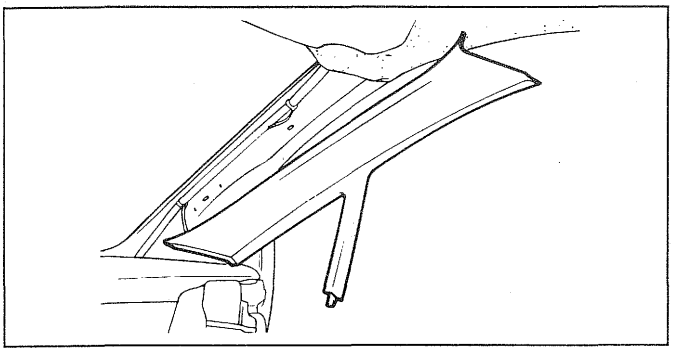
27. Installation is the reverse of the removal process. Connect all connectors securely.

INTERIOR TRIM

REMOVAL ESHA1250

FRONT PILLAR TRIM

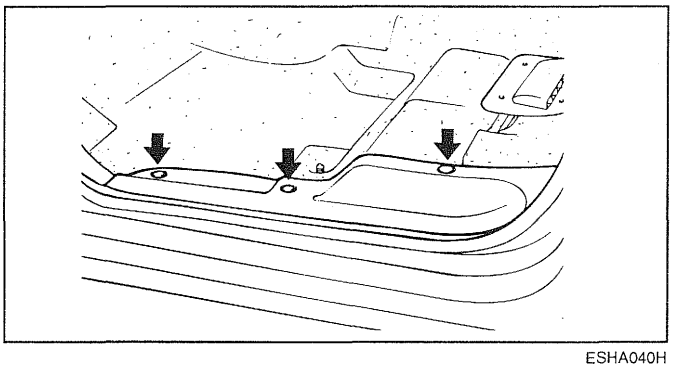
Remove the front pillar trim with a screwdriver.



ESHA041B

FRONT DOOR SCUFF TRIM

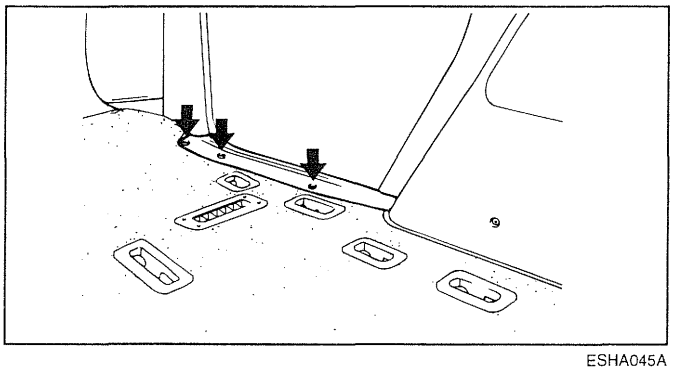
1. Remove the plugs from the front door scuff trim.
2. Remove the front door scuff trim.



ESHA040H

REAR DOOR SCUFF TRIM

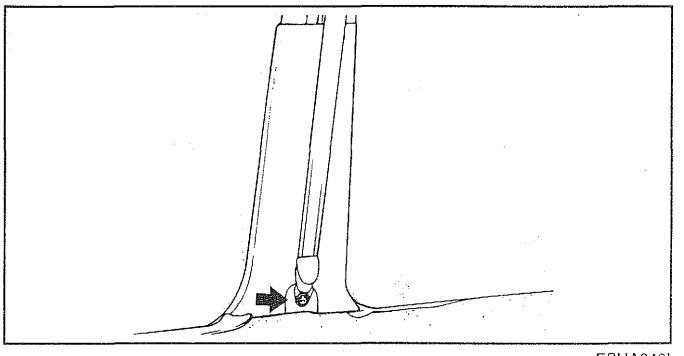
1. Remove the plugs from the rear door scuff trim.
2. Remove the rear door scuff trim.



ESHA045A

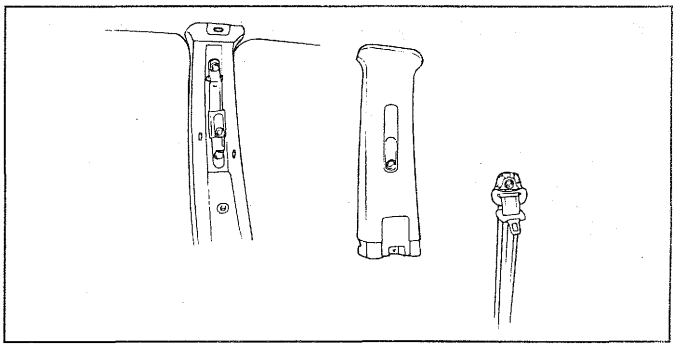
CENTER PILLAR TRIM

1. Loosen the bolt holding the seat belt lower anchor and remove the center pillar lower trim.



ESHA040I

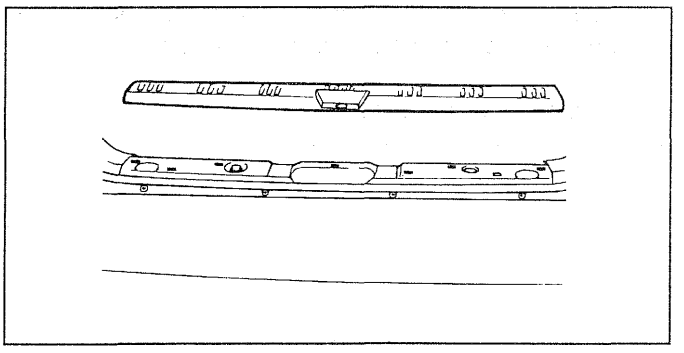
2. Loosen the bolt holding the seat belt upper anchor and remove the center pillar upper trim.



ESHA045B

REAR TRANSVERSE

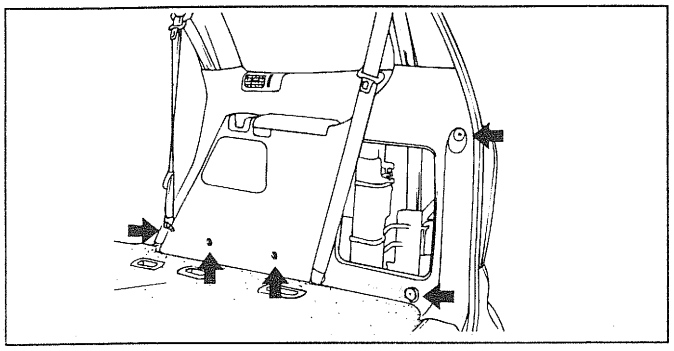
Remove the rear transverse trim with a flat bladed screwdriver.



ESHA045C

QUARTER TRIM

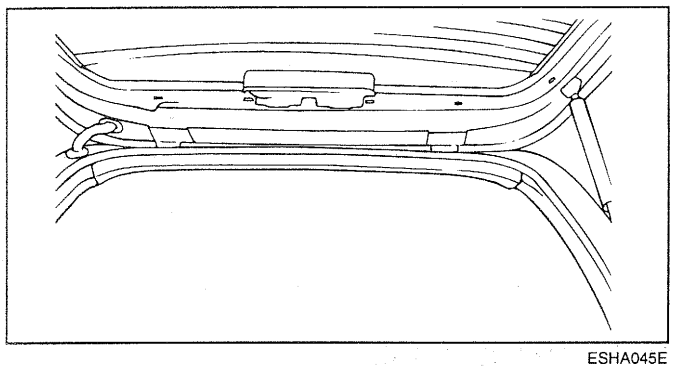
Loosen the bolts holding the center seat belt lower anchor and remove the quarter trim.



ESHA045D

HEADLINING REAR COVER

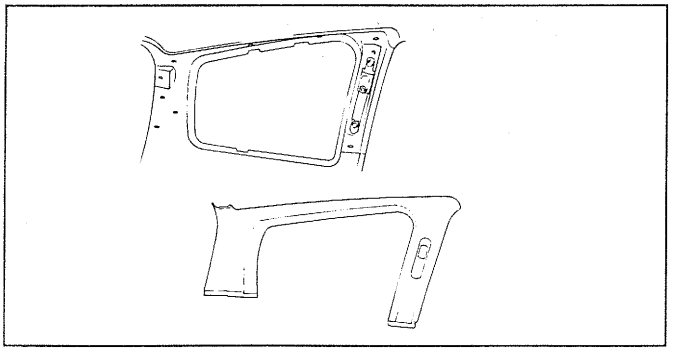
Remove the headlining rear cover with a screwdriver.



ESHA045E

REAR PILLAR TRIM

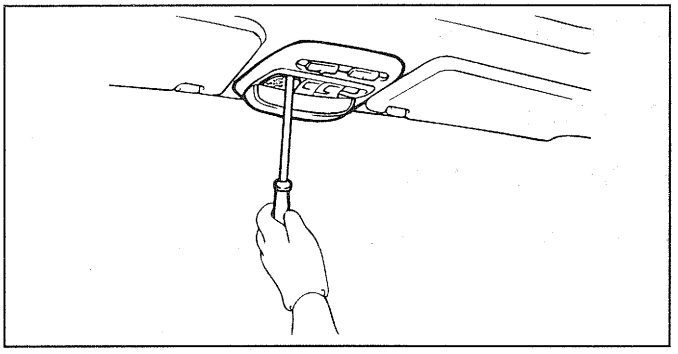
1. Loosen the bolts holding center seat belt upper anchor and rear seat belt upper anchor.
2. Remove the rear pillar trim.



ESHA045F

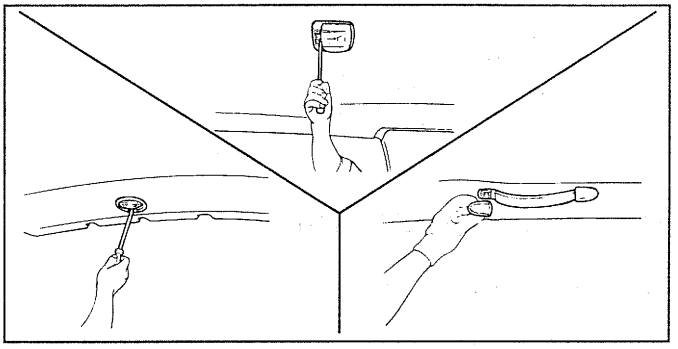
HEADLINING

1. To remove the headlining, first remove the following parts :
   - Overhead console lamp and sunvisor.



ESHA045G

   - Room lamp and assist grip.

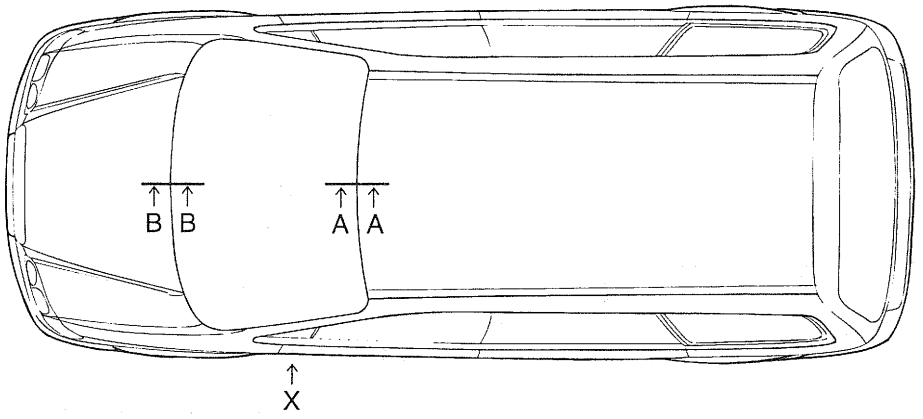


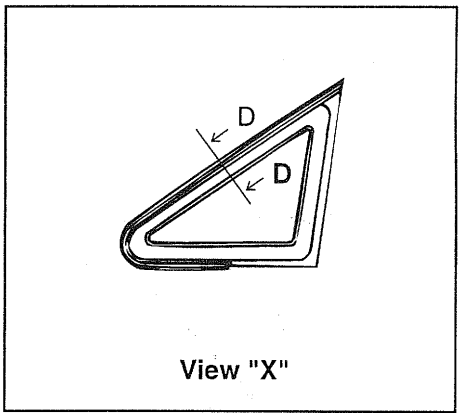
ESHA045H

2. Installation is the reverse of the removal process.

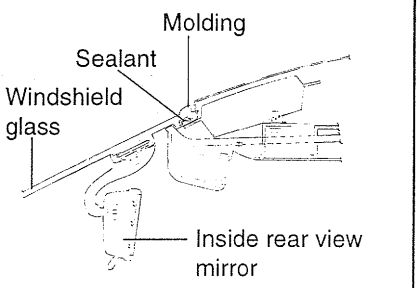
WINDSHIELD GLASS

COMPONENTS ESHA1300

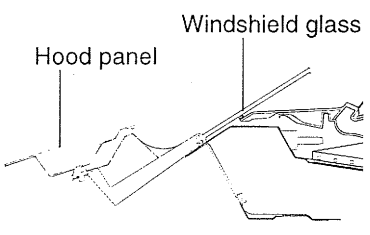




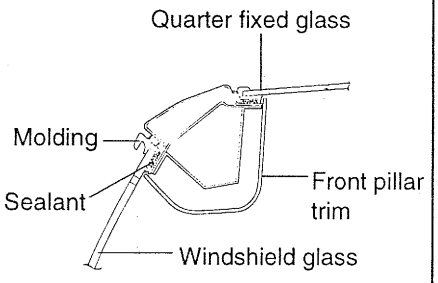
View "X"



SECT. A-A



SECT. B-B

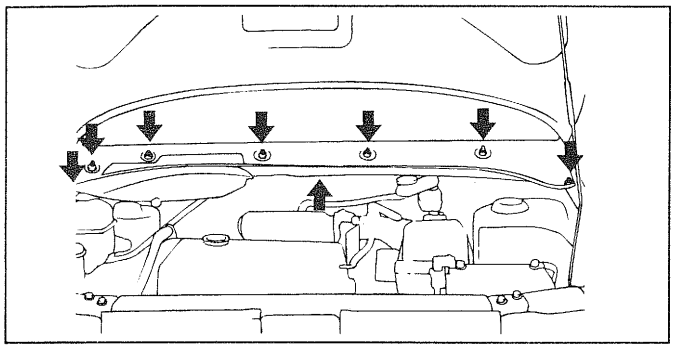


SECT. D-D

ESHA050A

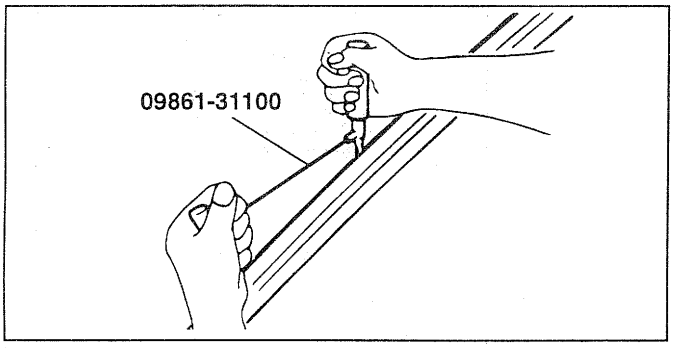
REMOVAL ESHA1350

1. To remove the windshield, first remove the following parts :
   1) Front pillar trims
   2) Inside rear view mirror
   3) Wiper arms
   4) Cowl top cover
   5) Windshield glass molding



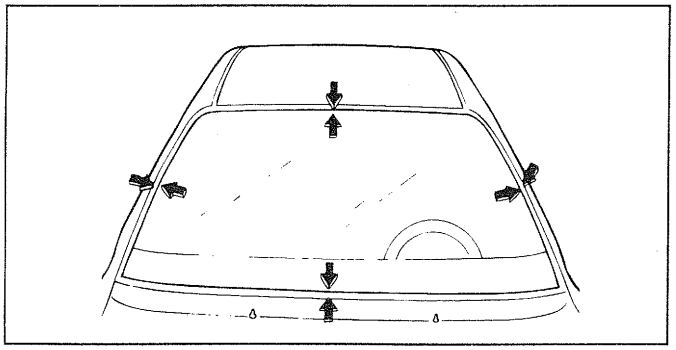
ESHA040C

2. Use the special tool (09861–31100) to cut through the sealant.



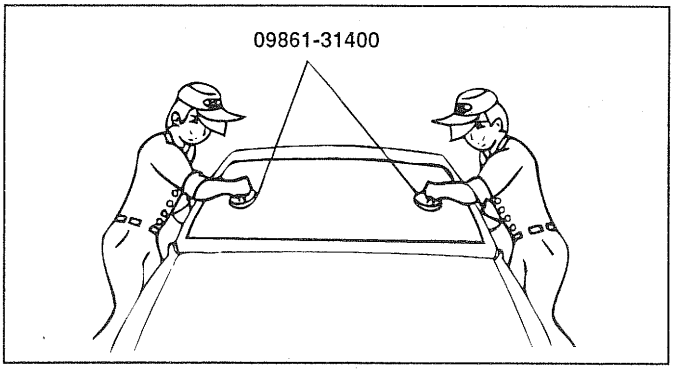
ESDA230B

3. Make mating marks on the glass and body if the glass is to be reinstalled.



X60-026A

4. Take out the windshield glass with the special tool using the Glass Holder.



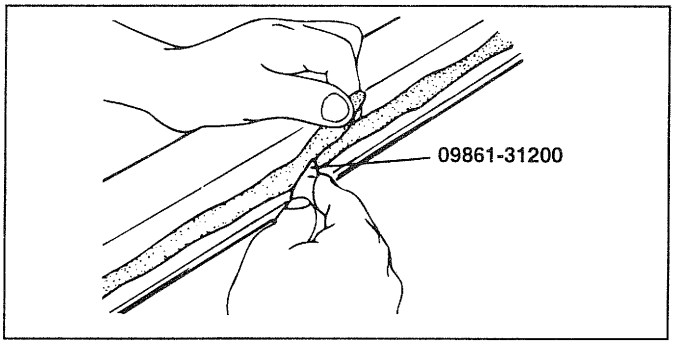
ESDA230D

INSTALLATION ESHA1400

1. Using a cutter knife or the special tool, 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

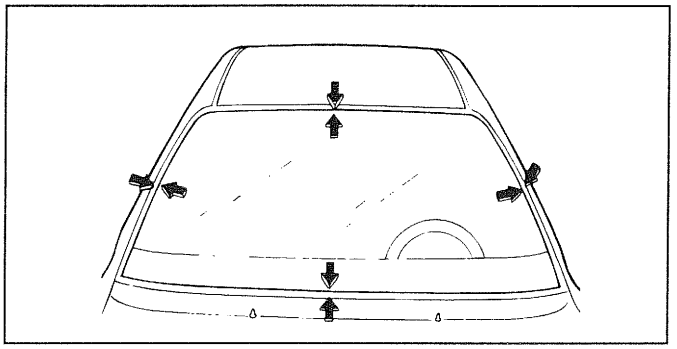
Be careful not to remove more adhesive than necessary, and also not to damage the paintwork on the body surface with the knife. If the paintwork is damaged, repair the damaged area with touch-up paint.



ESDA235B

2. Clean the body bonding surface with a sponge dampened in alcohol or wax and grease remover.

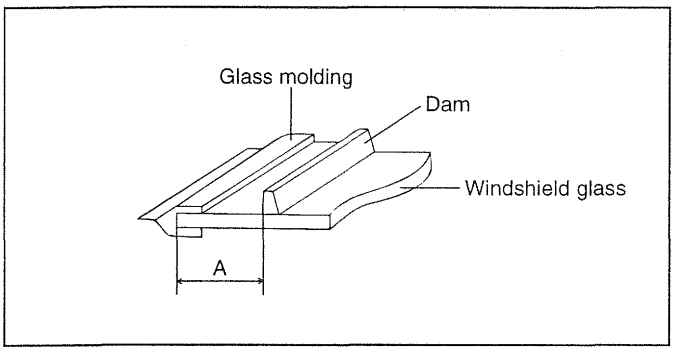
3. Center a new windshield glass in the opening. Mark the location by marking lines across the glass and body with a grease pencil at the four points as shown.



X60-026A

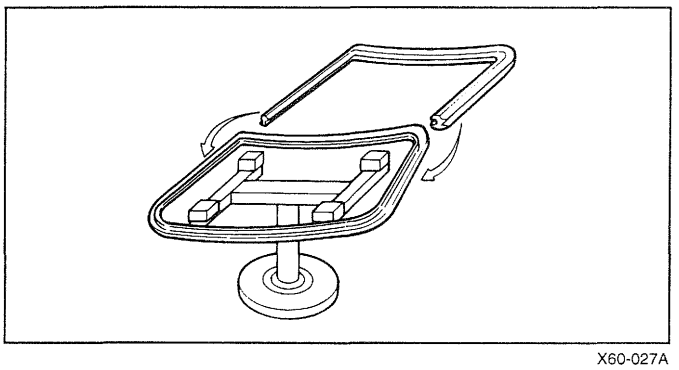
4. Glue the rubber dam to the inside surface of the windshield glass around the entire edge as shown, to contain the sealant during installation.

Part	"A"	Remarks
Upper	12.5mm constant	Glass molding sub
Side		



ESHA050E

5. Install the windshield glass molding without any gaps.

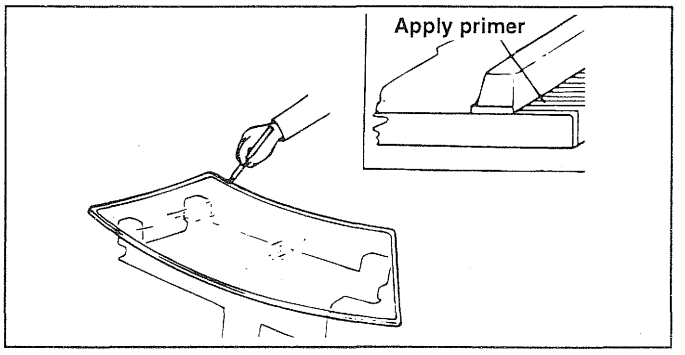


X60-027A

6. Apply a light coat of glass primer to the outside of the dam.

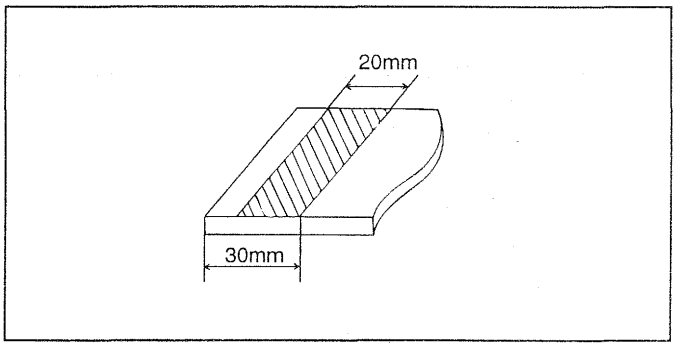
NOTE

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.**



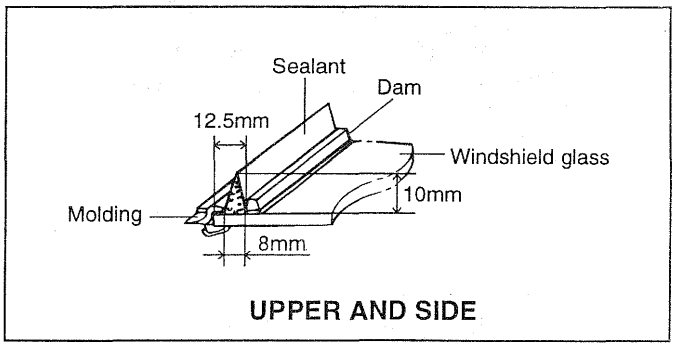
ESDA235E

7. Apply a primer to the lower glass as shown.

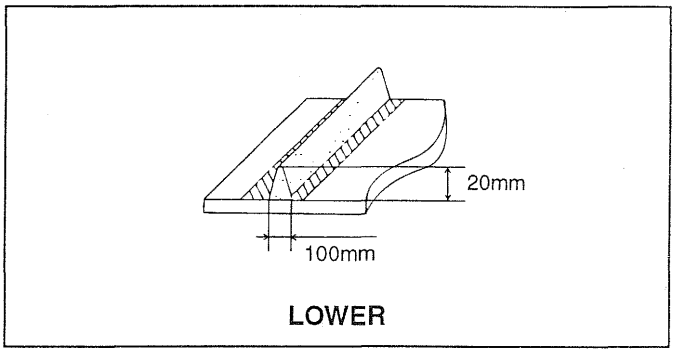


ESHA050F

8. Apply a sealant around the edge of the glass.



ESDA235A



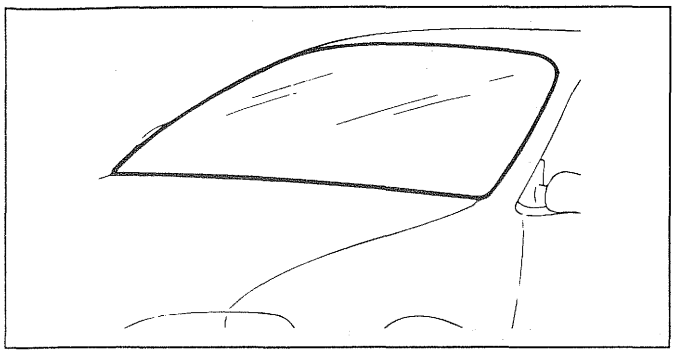
ESHA050G

NOTE

Apply the adhesive within 5 minutes after applying the primer to the glass.

9. Apply a light coat of body primer to the original sealant remaining around the window opening

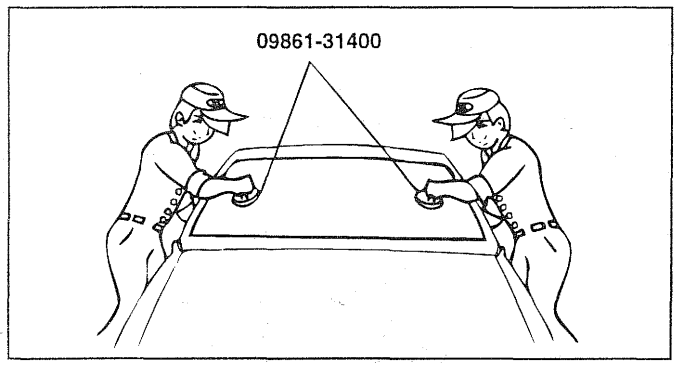
flange. The glass should be installed within 10 minutes after you apply the primer.



ESDA235F

10. Using suction cups or the special tool, lower the glass over the opening, align it with the marks made in step 3 and set it down on the sealant.

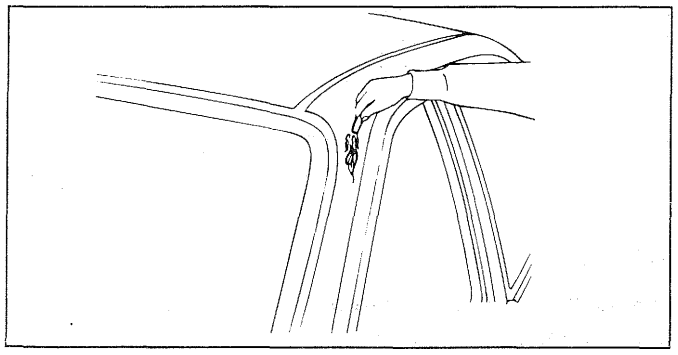
11. Scrape or wipe excess adhesive off with a putty knife or gauze. Fill all cavities around the windshield glass.



ESDA230D

12. 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.

13. If there are leaks, dry the affected area, then apply sealant.



ESDA235G

14. Install the removed parts.

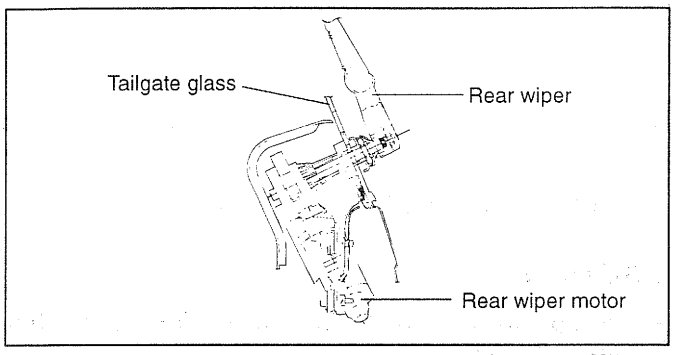
CAUTION

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

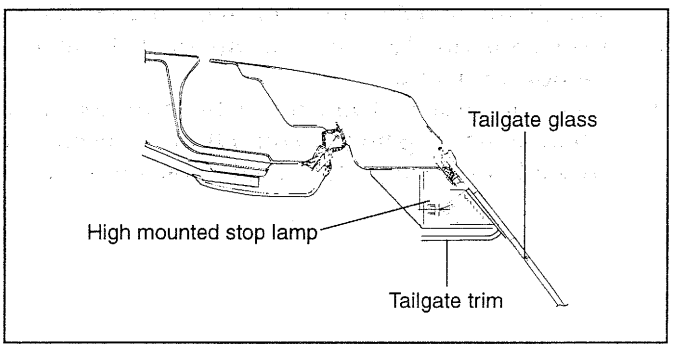
REMOVAL ESHA1450

1. To remove the tailgate glass, first remove the following parts :
   1) Rear window defogger wire connector.
   2) Tailgate trims.
   3) Rear wiper and wiper motor.



ESHA055A

   4) High mounted stop lamp.



ESHA055B

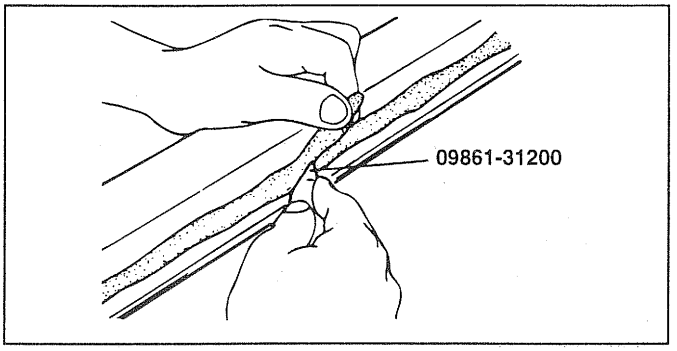
2. Remove the tailgate glass in the same manner as the windshield glass.

INSTALLATION ESHA1500

1. Using a cutter knife or the special tool, scrape the old sealant smoothly to a thickness of about 2 mm (0.08 in.) on the bonding surface around the entire tailgate glass.

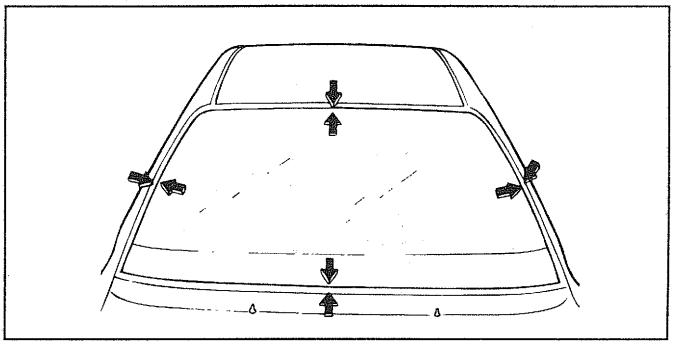
CAUTION

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.

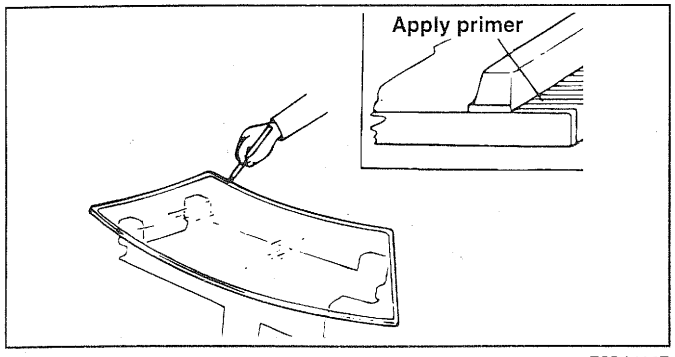


ESHA150B

4. Glue the rubber dam to the inside surface of the tailgate glass around the entire edge as shown, to contain the sealant during installation.
5. Install the tailgate glass molding without any gaps.
6. Apply a light coat of glass primer to the outside of the dam.

NOTE

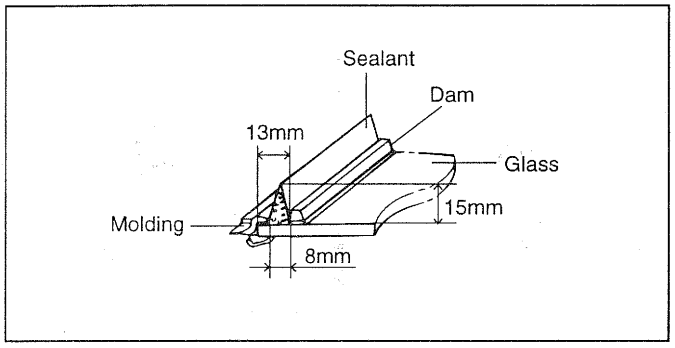
1. **Never touch the surface applied primer with your hands.**
   If you do, the adhesive may not bond to the glass properly, causing a leak after the tailgate glass has been installed.
2. **Do not apply body primer to the glass.**
3. **Keep water, dust, and abrasive materials away from the surface applied primer.**



ESDA235E

7. Apply a light coat of body primer to the original sealant remaining around the window opening flange. The glass should be installed within 10 minutes after you apply the primer.

8. Apply a sealant around the edge of the glass.



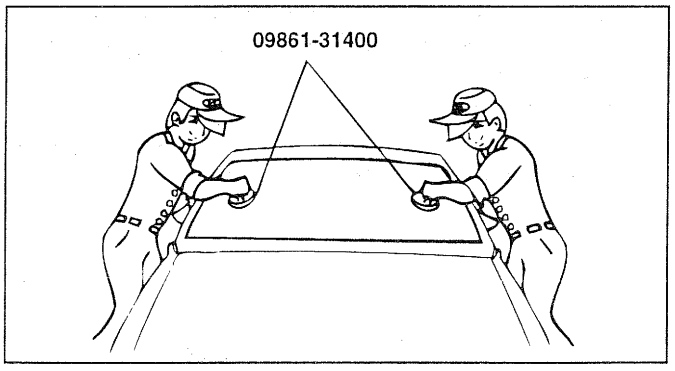
ESHA150A

NOTE

Apply the adhesive within 5 minutes after applying the primer to the glass.

9. Use suction cups or the special tool, lower the glass over the opening, align it with the marks made in step 3 and set it down on the sealant.

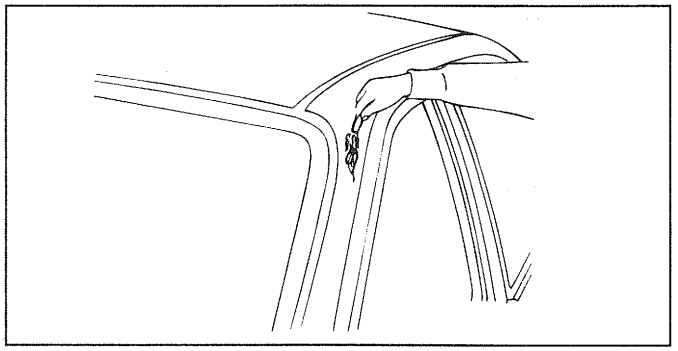
10. Scrape or wipe excess adhesive off with putty knife or gauze. Fill all cavities around the tailgate glass.



ESDA230D

11. 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.

12. If there are leaks, dry the affected area, then apply sealant.



ESDA235G

13. Install the removed parts.

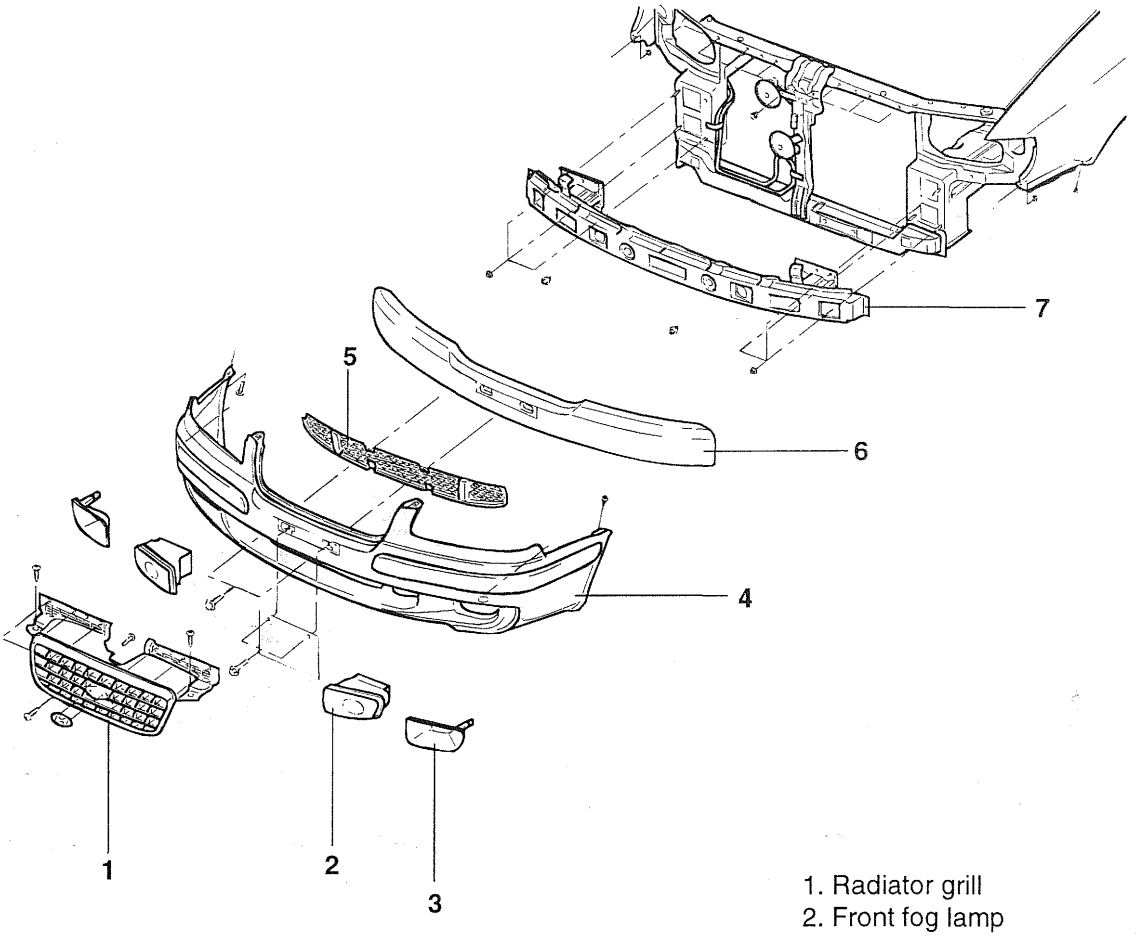
CAUTION

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).**

BUMPER

FRONT BUMPER

COMPONENTS ESHA1550

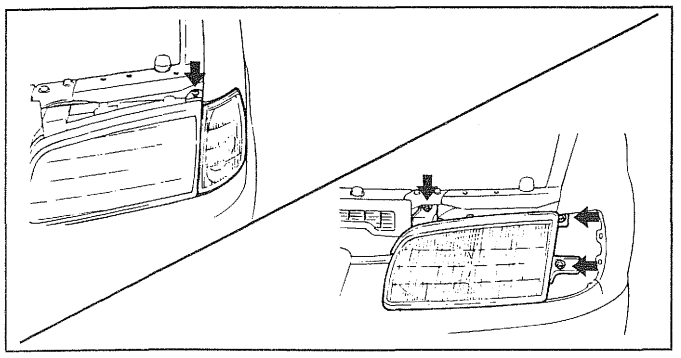


1. Radiator grill
2. Front fog lamp
3. Blanking cover
4. Bumper cover
5. Bumper cover mesh
6. Energy absorber
7. Bumper rail

ESHA155A

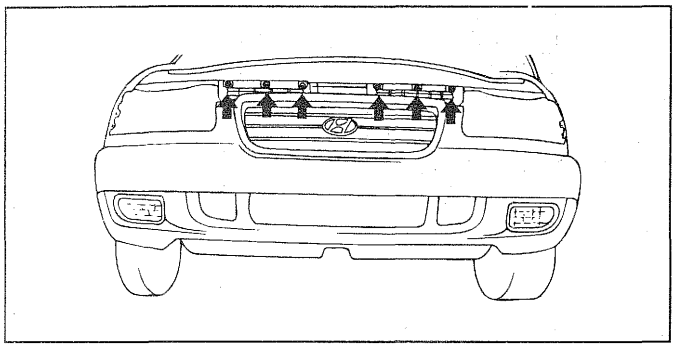
REMOVAL AND INSTALLATION ESHA1600

1. Remove the turn signal lamps and head lamps.



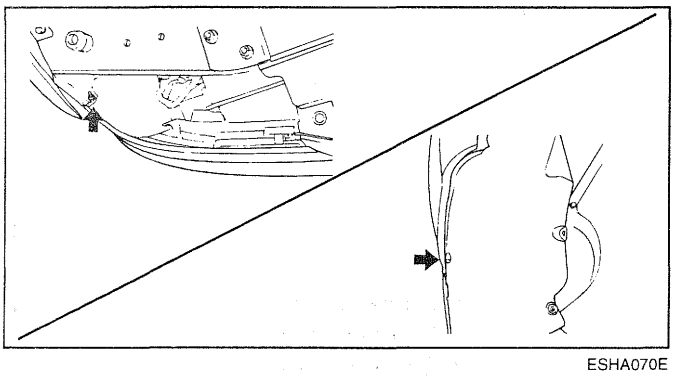
ESHA070B

2. Loosen the screws holding the radiator grill upper cover.



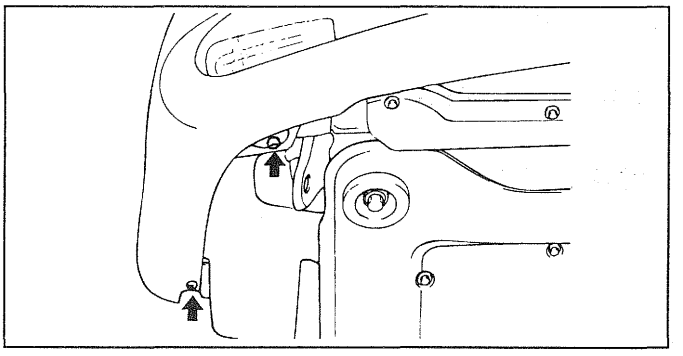
ESHA070D

3. Loosen the nuts and screws holding the front bumper cover.



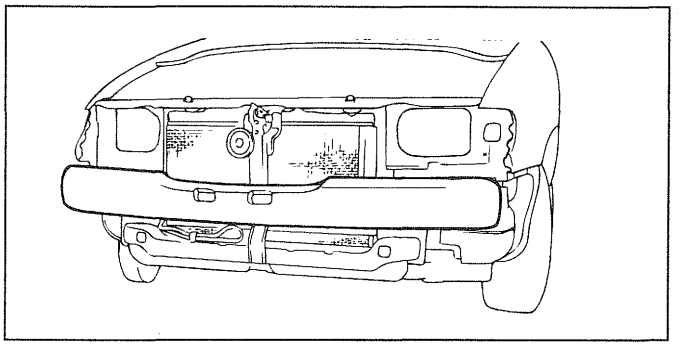
ESHA070E

4. Raise the vehicle then remove the front bumper and the screws holding the front wheel guard.



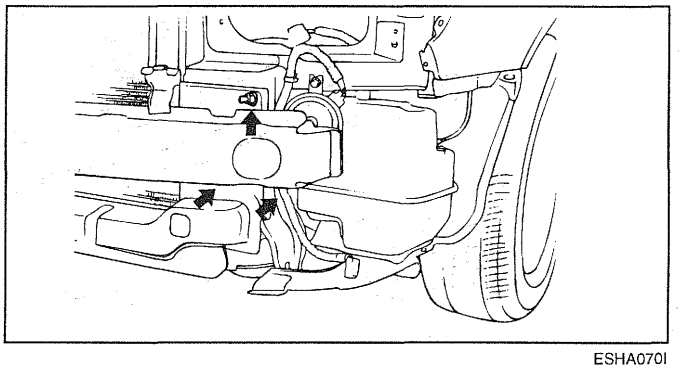
ESHA070G

5. Remove the front bumper cover and the bumper energy absorber.



ESHA070H

6. Remove the front bumper rail.

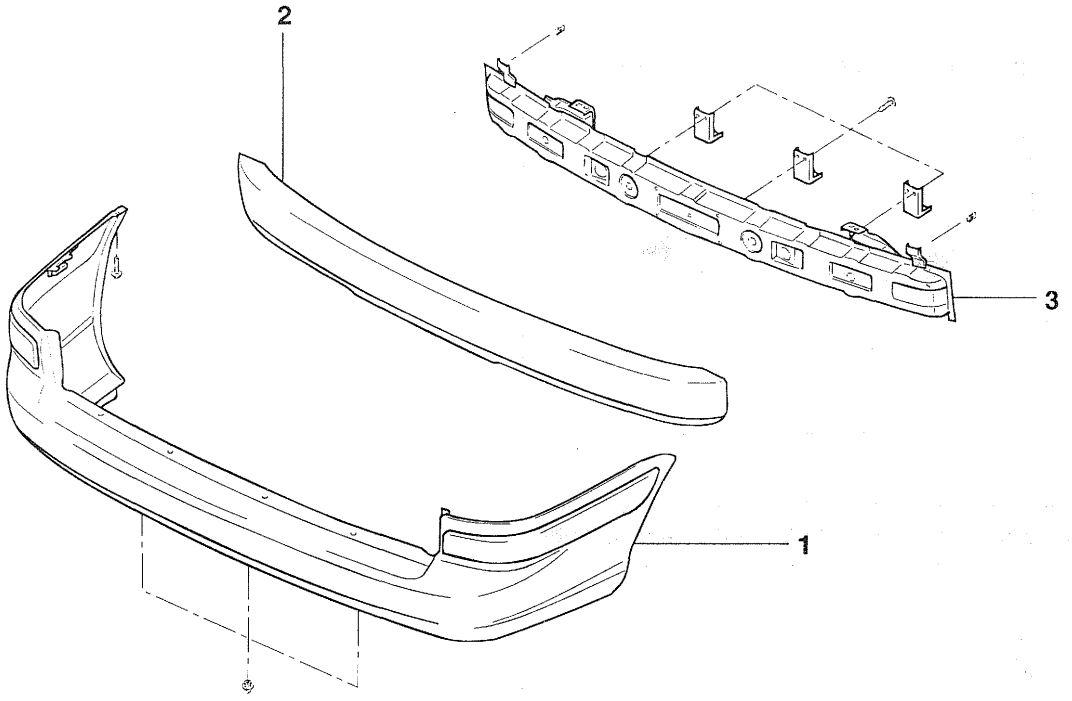


ESHA070I

7. Installation is the reverse of the removal process.

REAR BUMPER

COMPONENTS ESHA1650

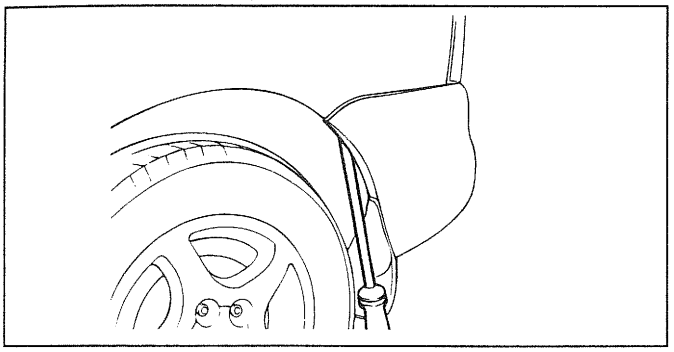


1. Bumper cover
2. Energy absorber
3. Bumper rail

ESHA165A

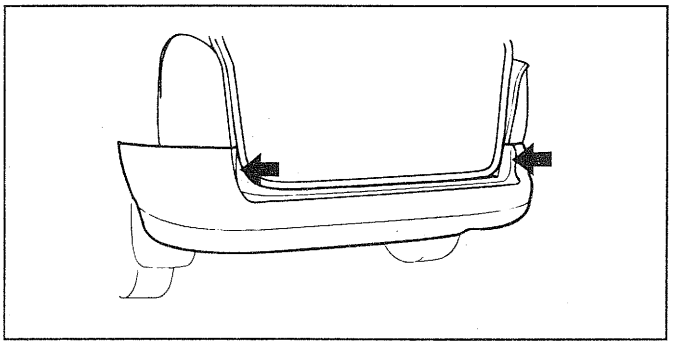
REMOVAL AND INSTALLATION ESHA1700

1. Remove the screws holding the rear mud guard and the screws holding the rear wheel house.



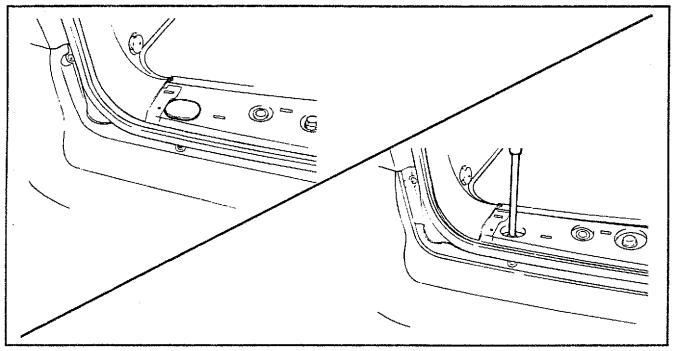
ESHA075B

2. Remove the screws holding the rear bumper cover.



ESHA075C

3. Remove the rear transverse trim and then remove the plugs and the screws holding the rear bumper.



ESHA075D

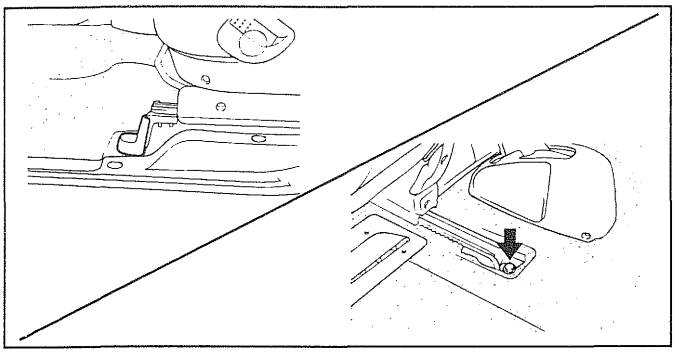
4. Installation is the reverse of the removal process.

SEAT

FRONT SEAT

REMOVAL AND INSTALLATION ESHA1750

1. Pull out the front seat mounting cover.
2. Loosen the bolts and nuts holding the front seat and remove the front seat.

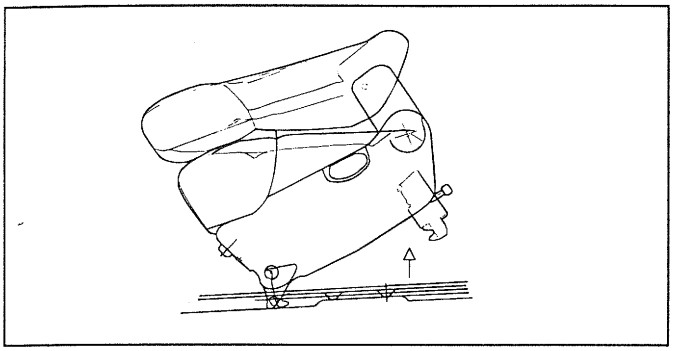


ESHA040F

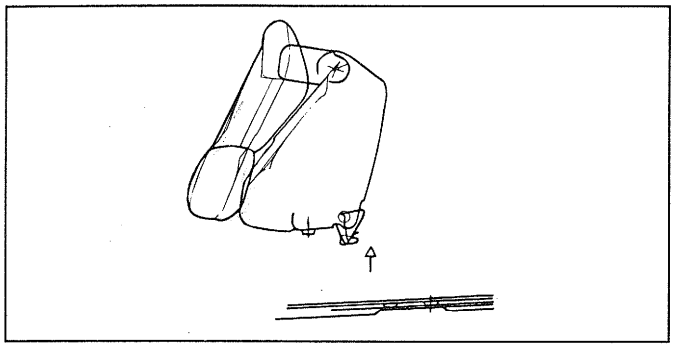
REAR SEAT

REMOVAL AND INSTALLATION ESHA1800

Remove the second seat and the third seat as shown.



ESHA080A

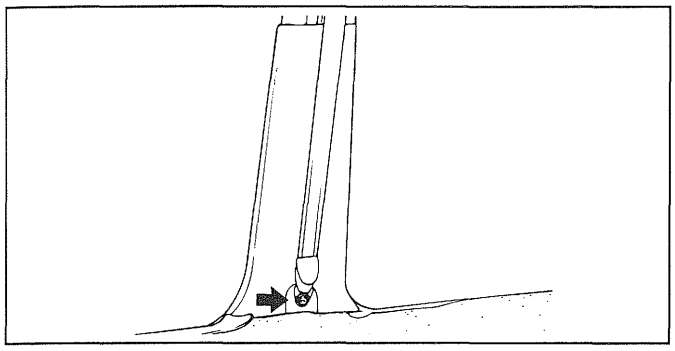


ESHA080B

FRONT SEAT BELT

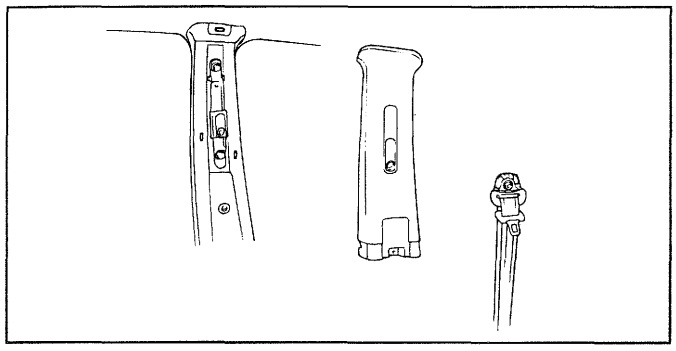
REMOVAL AND INSTALLATION ESHA1850

1. Loosen the seat belt lower anchor bolt and remove the center pillar lower trim.



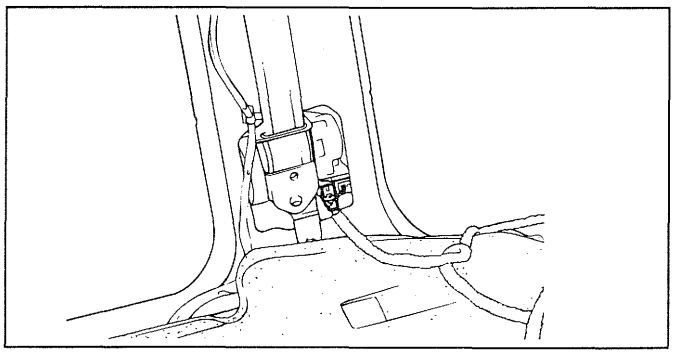
ESHA040I

2. Loosen the seat belt upper anchor bolt.



ESHA045B

3. In case of vehicles equipped with pretensioner seat belt, disconnect the negative (-) battery terminal and disconnect the connector from the gas generator and then remove the retractor.



ESHA040J

4. Installation is the reverse of the removal process.

CAUTION

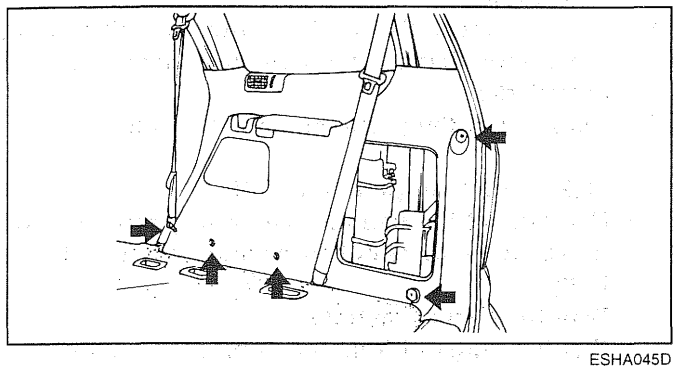
1. **A pretensioner functions one time only. Be sure to replace the pretensioner seat belt after it is deployed.**
2. **Do not attempt to disassemble or repair the seat belt pre-tensioner. When it malfunctions, replace with a new pre-tensioner seat belt.**
3. **Be cautious in handling a pre-tensioner seat belt, and do not drop it in water, or oil. If crushed, damaged, or deformed, replace it with a new one.**
4. **Only connect the battery after installation of the pretensioner seat belt has been correctly completed.**
5. **Removal of the pretensioner seat belt :**

   - **Make sure that ignition is "Off".**
   - **Disconnect the negative (-) battery terminal and make sure it does not come into contact with the body.**
   - **Wait for about 1 minute.**
   - **Pull the plug out from the appropriate connector at the gas generator.**
   - **Loosen the bolt and remove the belt from the vehicle body.**

REAR SEAT BELT

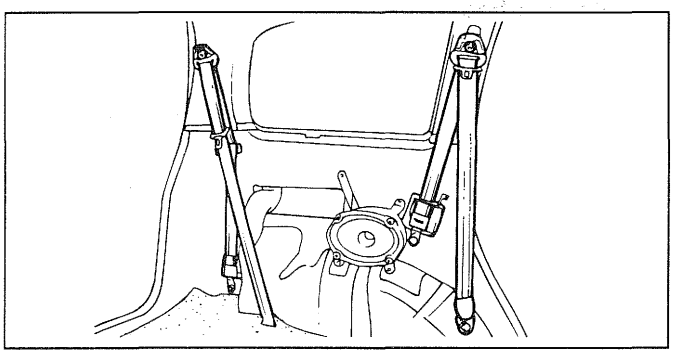
REMOVAL AND INSTALLATION ESHA1900

1. Loosen the seat belt lower anchor bolt and remove the quarter trim.



ESHA045D

2. Remove the rear seat belt retractor.



ESHA085B

3. Installation is the reverse of the removal process.

Body Electrical System

GENERAL

INSTRUMENTS AND WARNING SYSTEM ETHA0010

SPECIFICATIONS

Warning lamps		Bulb wattage (W)	Color
Illumination		3.4	Beige
High Beam		3.0	Blue
Low fuel		3.0	Amber
Turn signal (LH, RH)		1.4	Green
Battery (Charge)		1.4	Red
Oil pressure		1.4	Red
Air bag		1.4	Red
Parking brake		1.4	Red
Seat belt		1.4	Red
Check engine		1.4	Amber
ABS		1.4	Amber
Door ajar		1.4	Red
Tailgate open		1.4	Amber
Cruise		1.4	Green
Fog lamp		1.4	Green
Immobilizer		1.4	Amber
A/T	**P**	1.4	Green
	R	1.4	Amber
	N	1.4	Green
	D	1.4	Green
	3	1.4	Green
	2	1.4	Green
	L	1.4	Green

SERVICE SPECIFICATIONS ETHA0050

<table>
<tr><th>Items</th><th>Specifications</th></tr>
<tr><td>Speedometer
Type
Input spec.
Indication

Standard values</td><td>o Cross coil type.
o Hall IC type : 4 pulses/rev.
o Km : At 637 rpm x 4 pulses/rev. indicate 60 Km/h
o MILE : At 1026 rpm x 4 pulses/rev. indicate 60 MPH

<table>
<tr><td>Velocity (Km/ h)</td><td>20</td><td>40</td><td>60</td><td>80</td><td>100</td><td>120</td></tr>
<tr><td>Tolerance (Km/ h)</td><td>20-24.1</td><td>40-43</td><td>60-64.1</td><td>80-85.2</td><td>100-105.2</td><td>120.5-126.3</td></tr>
<tr><td>Tolerance (Km/ h)</td><td>20.8-25.4</td><td>40-44</td><td>60.8-65.4</td><td>81.4-86.8</td><td>102.6-108.2</td><td>123.5-129.6</td></tr>
<tr><td>Velocity (Km/ h)</td><td>140</td><td>160</td><td>180</td><td>200</td><td colspan="2">Remarks</td></tr>
<tr><td>Tolerance (Km/ h)</td><td>140.5-146.7</td><td>160.5-167.5</td><td>181-188.4</td><td>201-209.1</td><td colspan="2">EXCEPT, EEC & GENERAL</td></tr>
<tr><td>Tolerance (Km/ h)</td><td>144.4-151</td><td>165.4-172.4</td><td>186.3-193.8</td><td>207.2-215.2</td><td colspan="2">EEC, GENERAL</td></tr>
</table>

<table>
<tr><td>Velocity (MPH)</td><td>10</td><td>20</td><td>40</td><td>60</td><td>80</td><td>100</td></tr>
<tr><td>Tolerance (MPH)</td><td>10-12.5</td><td>20-22</td><td>40-42.6</td><td>60-63.4</td><td>80.3-84.1</td><td>100.3-104.7</td></tr>
<tr><td>Tolerance (MPH)</td><td>8.5-11.5</td><td>18.5-21.5</td><td>38.5-41.5</td><td>58.3-61.7</td><td>78-82</td><td>97.7-102.3</td></tr>
<tr><td>Velocity (MPH)</td><td>120</td><td colspan="5">Remarks</td></tr>
<tr><td>Tolerance (MPH)</td><td>120.3-125.3</td><td colspan="5">EXCEPT USA</td></tr>
<tr><td>Tolerance (MPH)</td><td>117.5-122.5</td><td colspan="5">USA</td></tr>
</table>

o Must tap the speedometer with hand to prevent hysterisis effects when inspected.</td></tr>
<tr><td>Tachometer
Type
Standard values</td><td>o Cross coil type. (4 cyl: 2pulses/ rev, 6 cyl: 3pulses/ rev)

<table>
<tr><td>Revolution(RPM)</td><td>1000</td><td>2,000</td><td>3,000</td><td>4,000</td><td>5,000</td><td>6,000</td><td>7,000</td></tr>
<tr><td>Tolerance(RPM)</td><td>±100</td><td>±125</td><td>±150</td><td>±200</td><td>±250</td><td>±300</td><td>±350</td></tr>
</table>

o Must tap the tachometer with hand to prevent hysterisis effects when inspected.</td></tr>
<tr><td>Fuel gauge
Type

Standard values</td><td>o Cross coil type (Fixed point type : Pointer should not fall into the "E" point but indicate remaining fuel level when IG. off).

<table>
<tr><th rowspan="2">Level</th><th>Gauge</th><th rowspan="2">Tolerance assembled with fuel sender (°)</th></tr>
<tr><th>Resistance (Ω)</th></tr>
<tr><td>E (Empty)</td><td>95</td><td>- 40 $^{+2.4}_{-2.2}$</td></tr>
<tr><td>1/2</td><td>32.5</td><td>0 ±5.3</td></tr>
<tr><td>F (Full)</td><td>7</td><td>40 ±3.5</td></tr>
</table>

o Inspection order : E→ F→ E
The indications must be read at least 7 minutes after the input of the datum resistance value to each measuring point.
o Point stabilty tolerance : Within 9°
Apply the power for 10 minutes. Then turn off the power source for 30 minutes and read the position of the pointer.</td></tr>
</table>

ETHA005A

<table>
<tr><th>Items</th><th>Specifications</th></tr>
<tr><td>Temperature gauge
Type
Indication standard

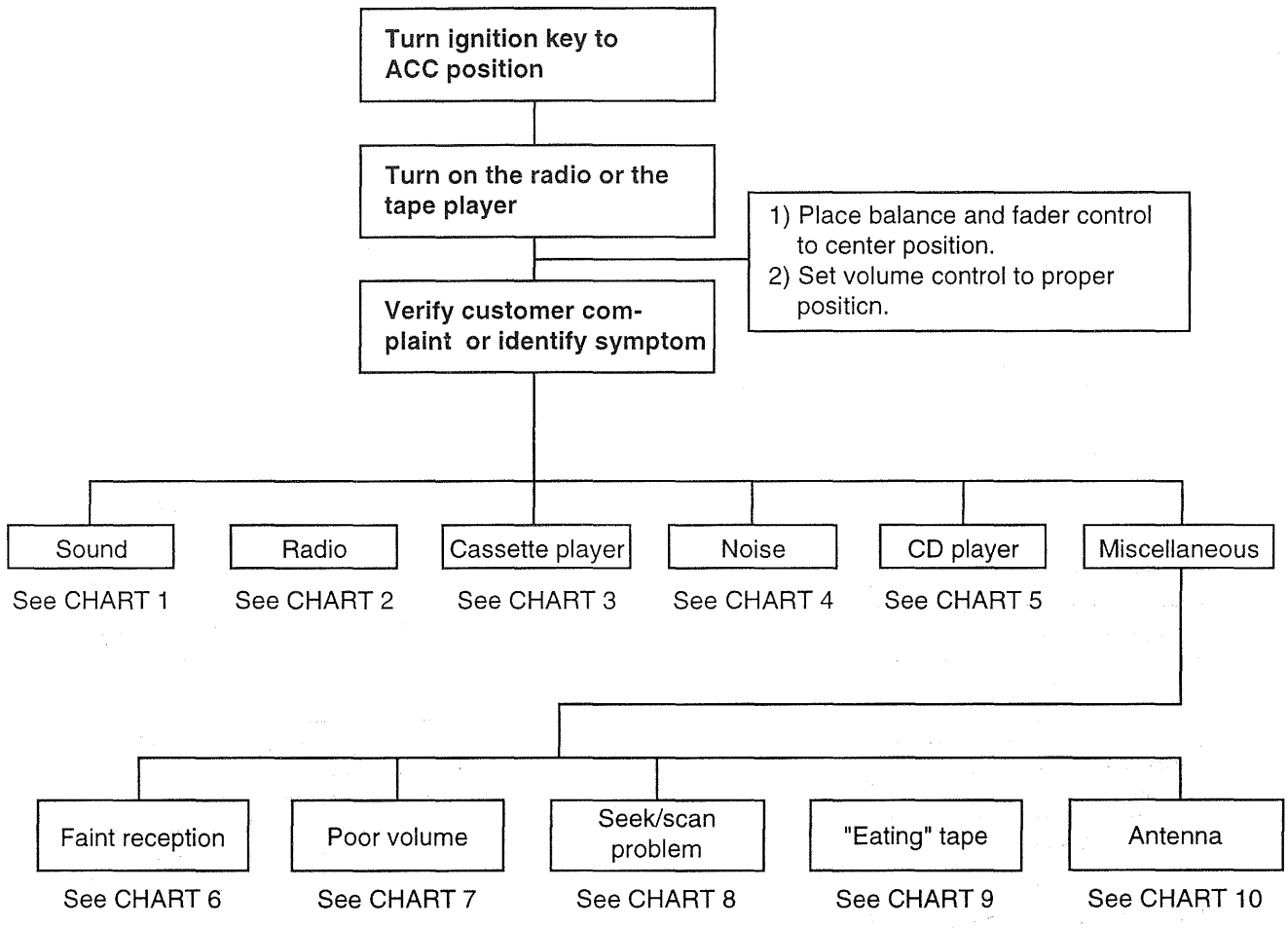
Resistance of temperature sender</td><td>
o Cross coil type (Intermedia stability type).
<table>
<tr><th>Temperature</th><th>Angle (°)</th><th>Assembled tolerance (°C)</th></tr>
<tr><td>55°C</td><td>-40</td><td>-</td></tr>
<tr><td>85°C~110°C</td><td>-7^{+2}_{-3}</td><td>-7^{+3}_{-2}</td></tr>
<tr><td>Red zone (over 125°C)</td><td>over 35±5</td><td>35^{+7}_{-4}</td></tr>
</table>
o Inspection order : OFF→C→H
<table>
<tr><td>Temperature (°C)</td><td>55</td><td>85</td><td>110</td><td>125</td></tr>
<tr><td>Resistance (Ω)</td><td>157</td><td>48.4</td><td>24</td><td>15.2</td></tr>
</table>
</td></tr>
</table>

ETHA005B

TROUBLESHOOTING ETHA0100

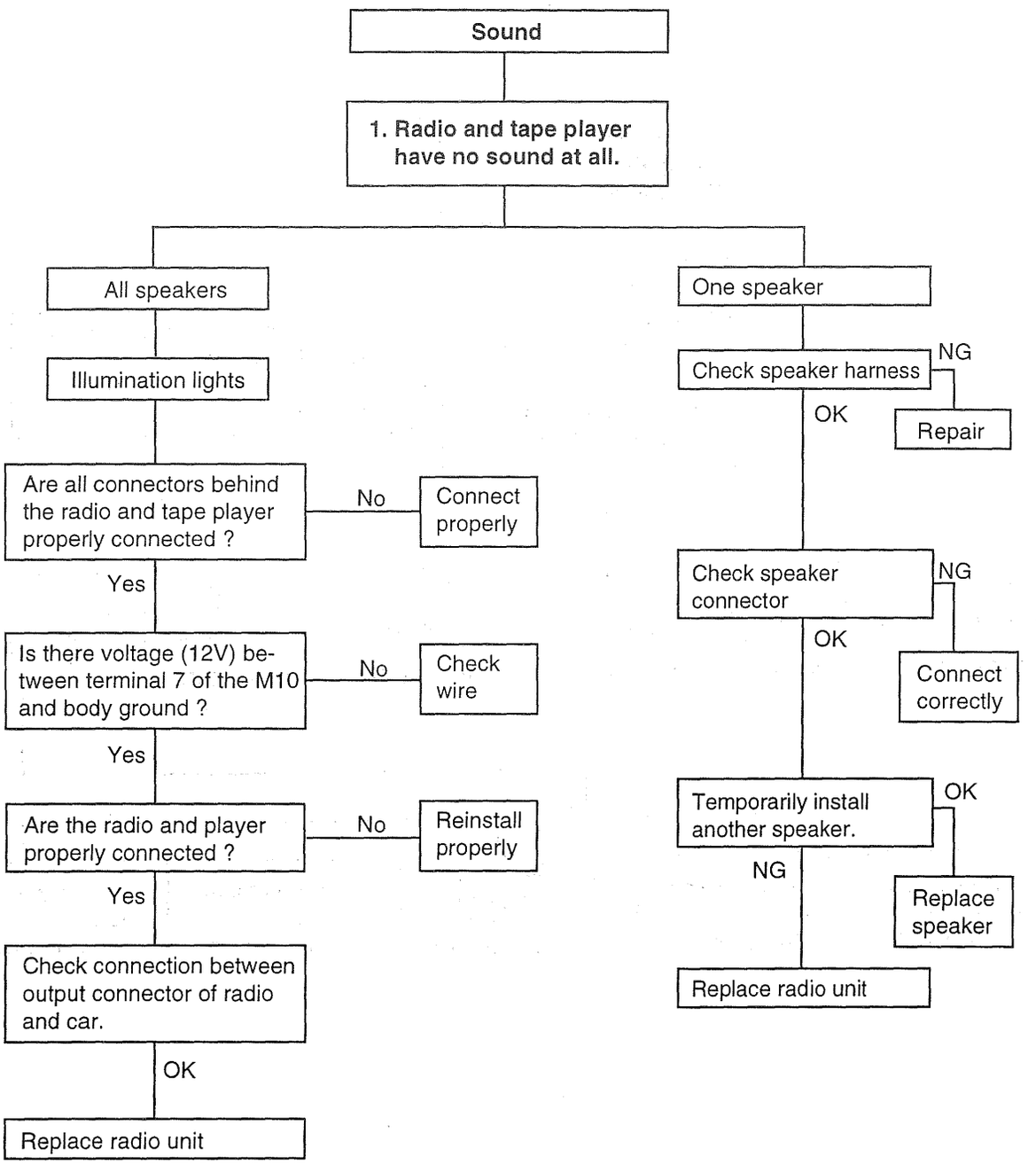
AUDIO

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.

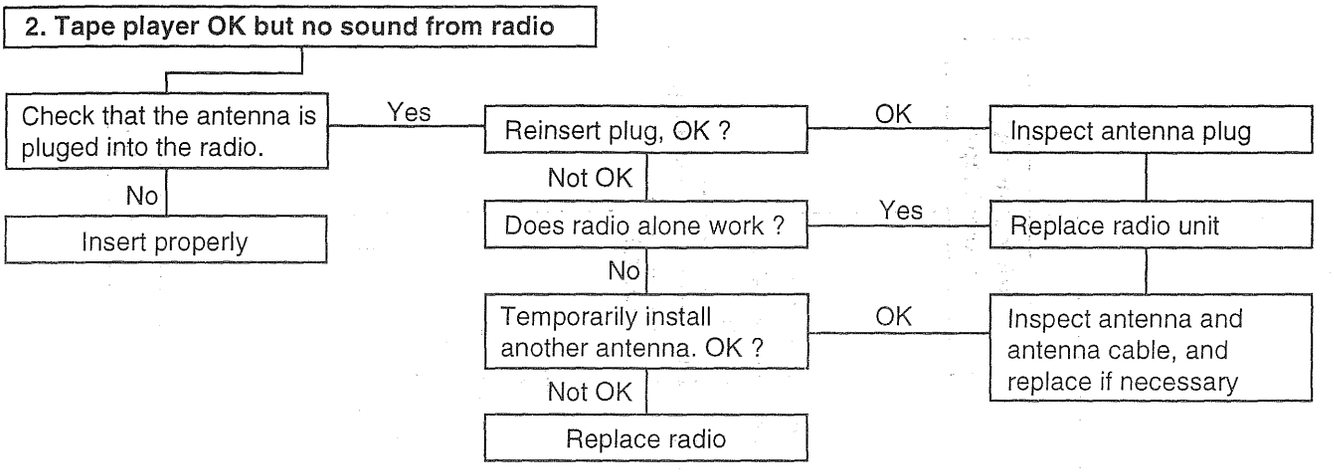


ETHA010A

CHART 1 ETAA0110

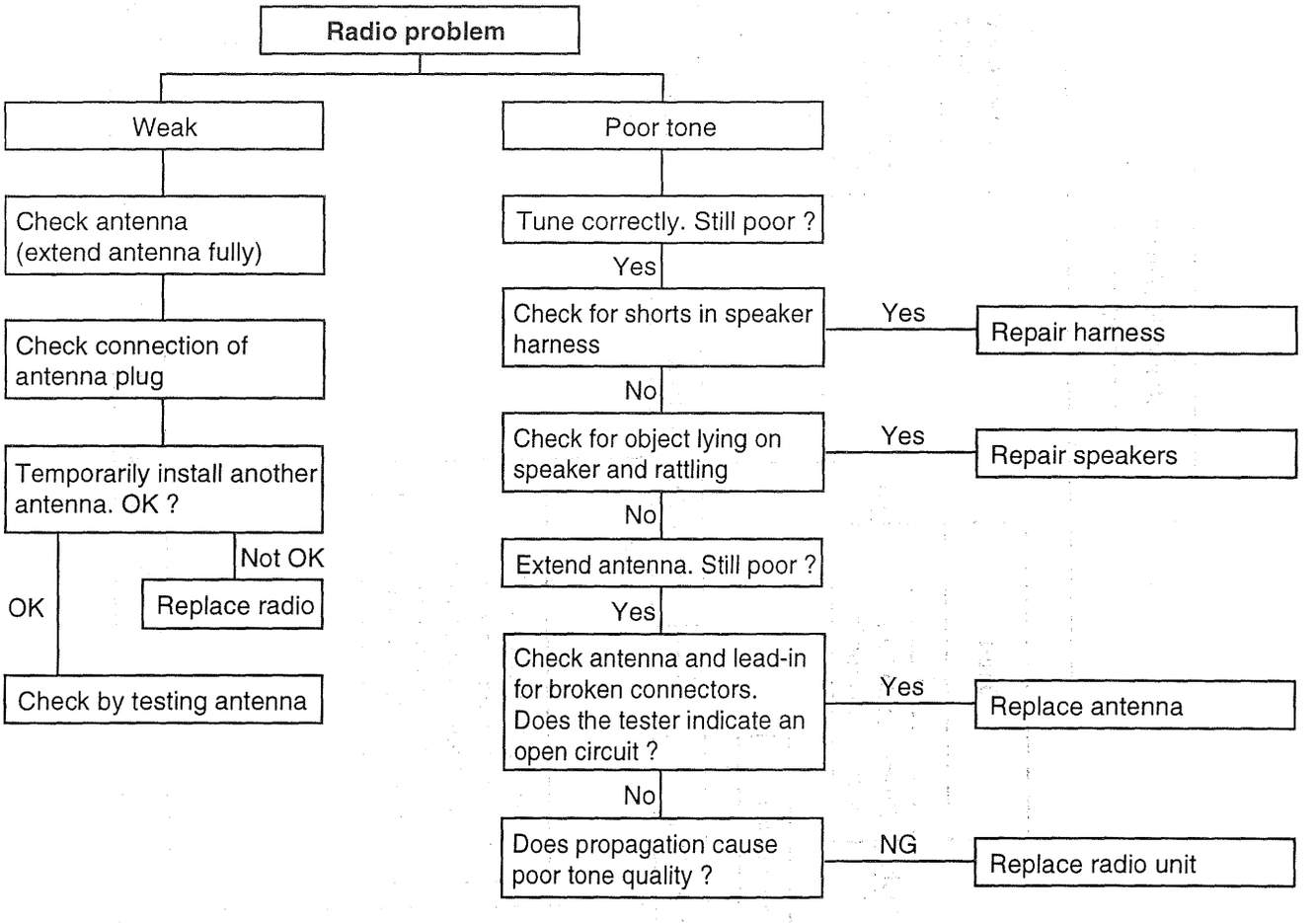


ETAA010B



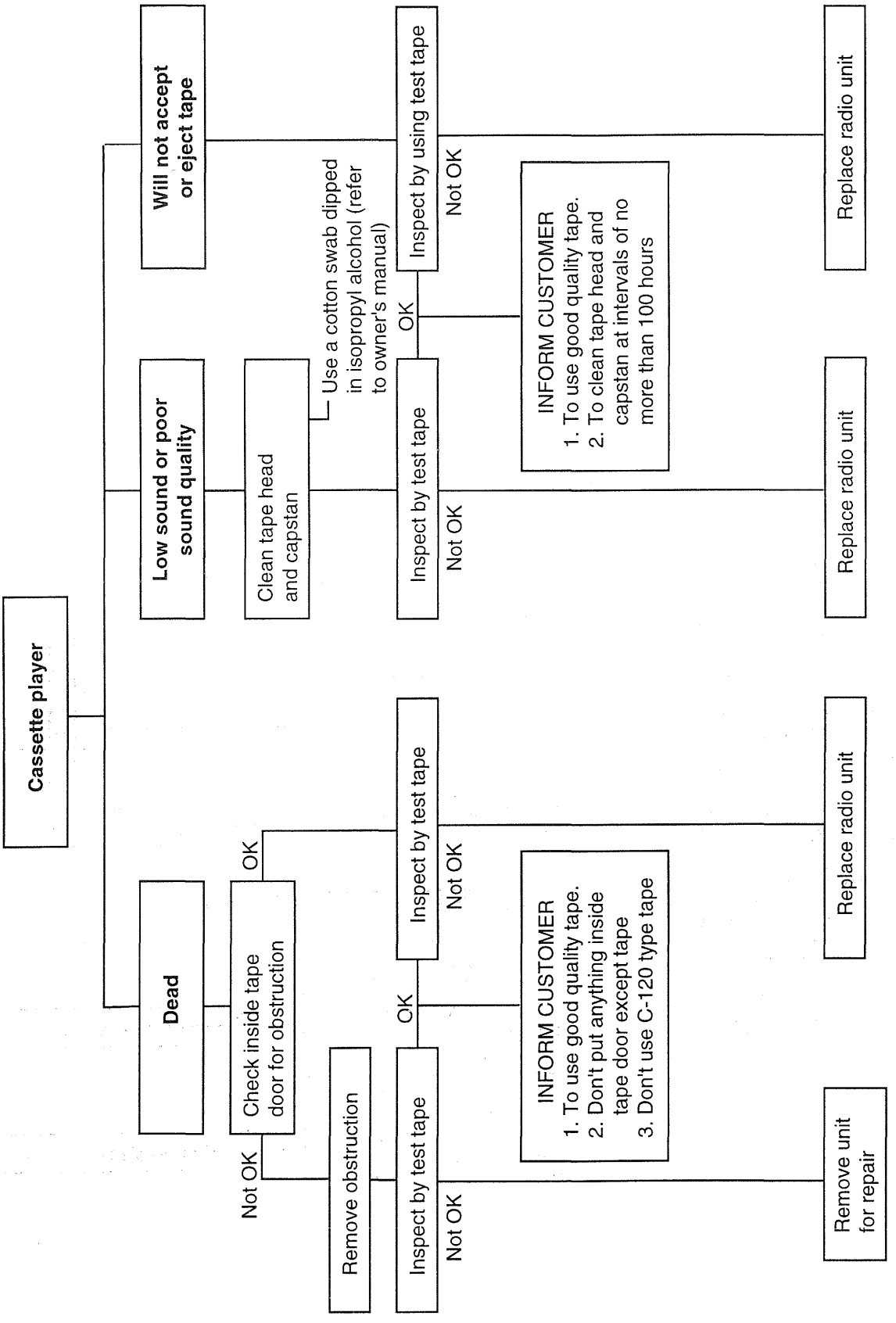
ETA9010C

CHART 2 ETA90130



ETA9010D

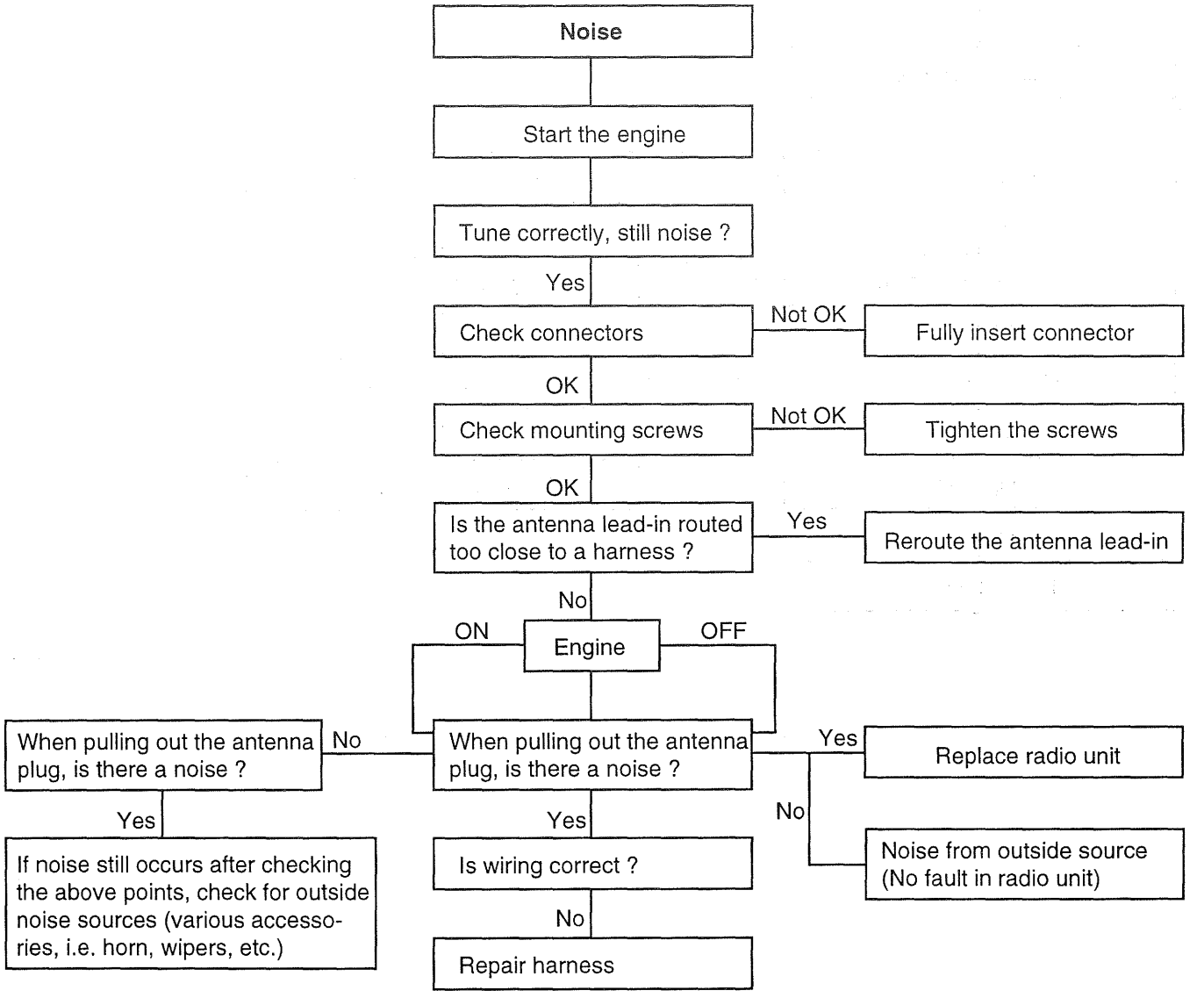
CHART 3 ETA90140



ETA9010E

CHART 4 ETA90150

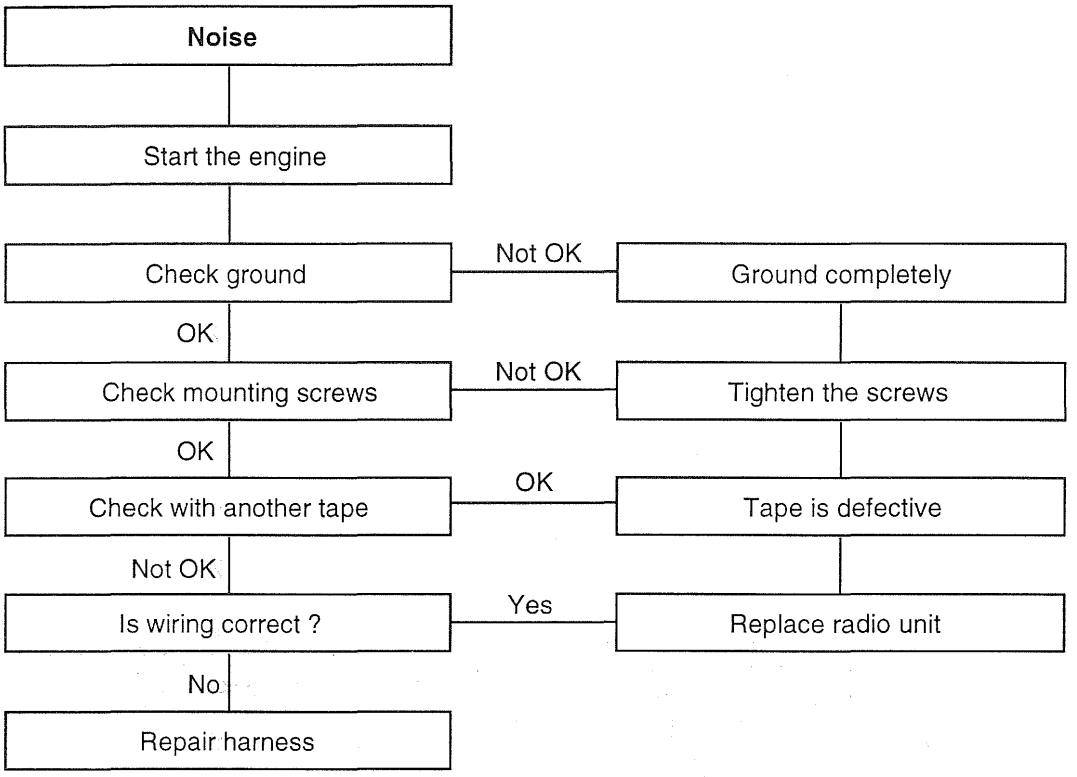
1. RADIO



ETA9010F

CHART 4 (CONTINUED) ETA90160

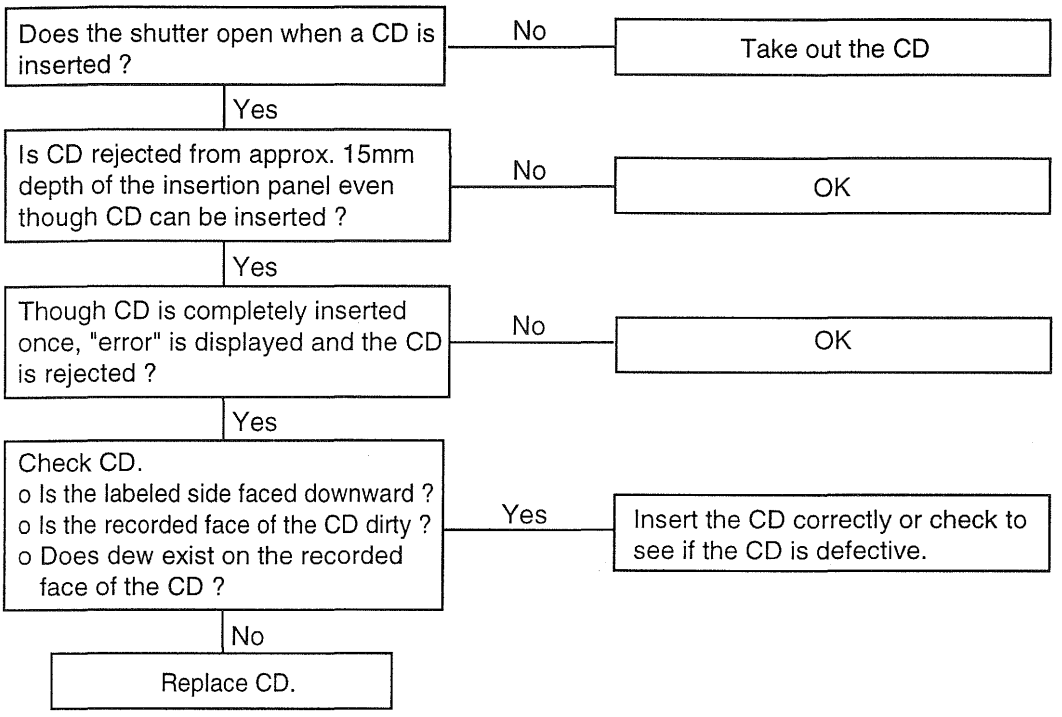
2. TAPE



ETA9010G

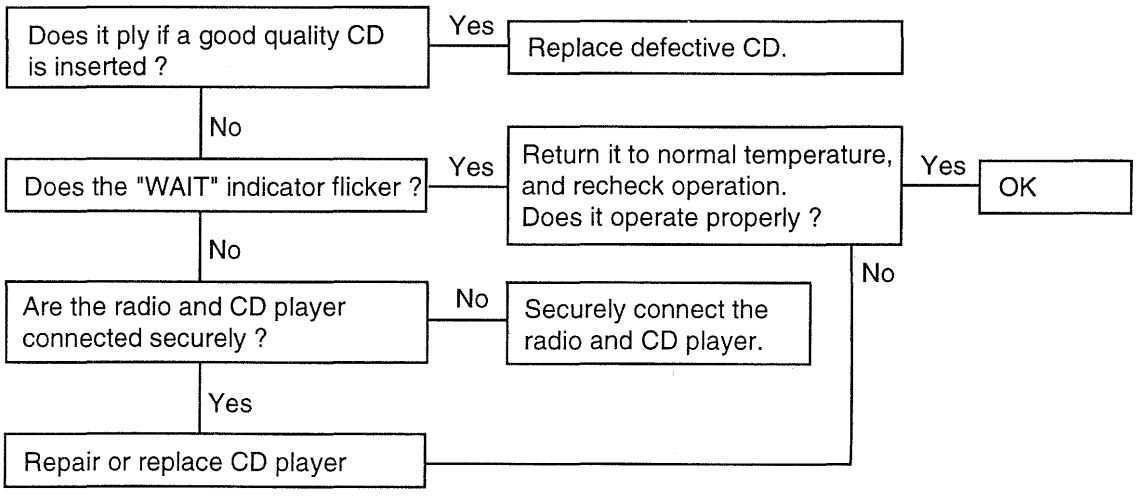
CHART 5 ETA90170

1. CD WILL NOT BE ACCEPTED



ETA9010H

2. NO SOUND

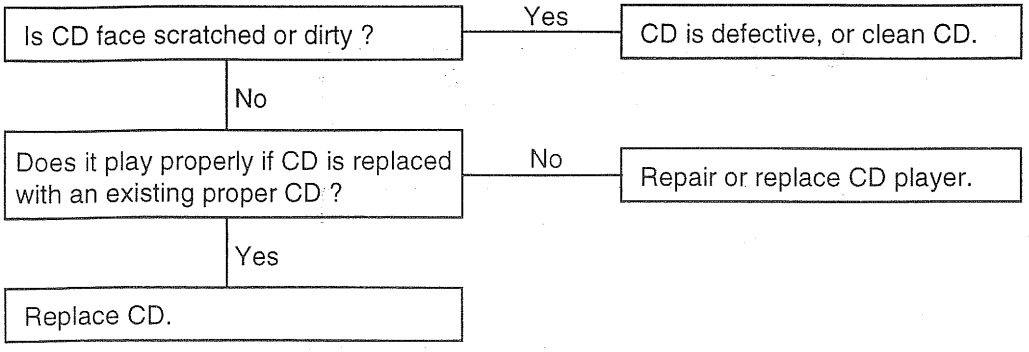


(The combined radio cassette must operate properly.)

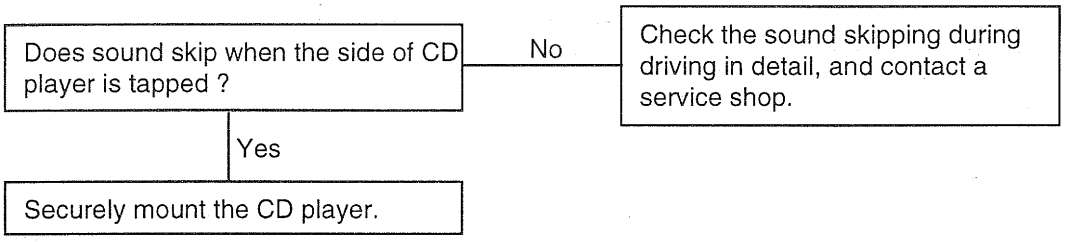
ETA9010O

3. CD SOUND SKIPS

1. Sound sometimes skips during parking.

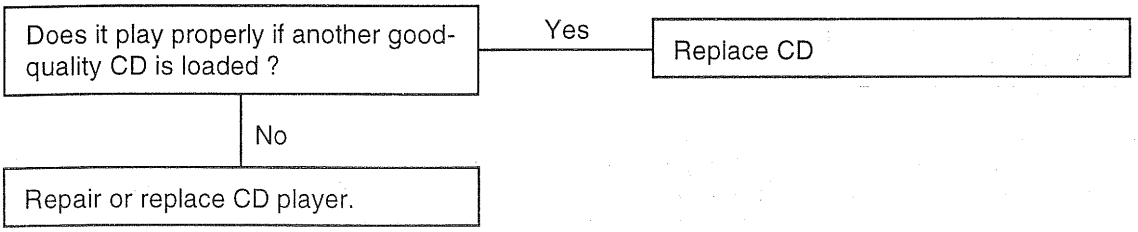


2. Sound sometimes skipes during driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other abnormalities.)

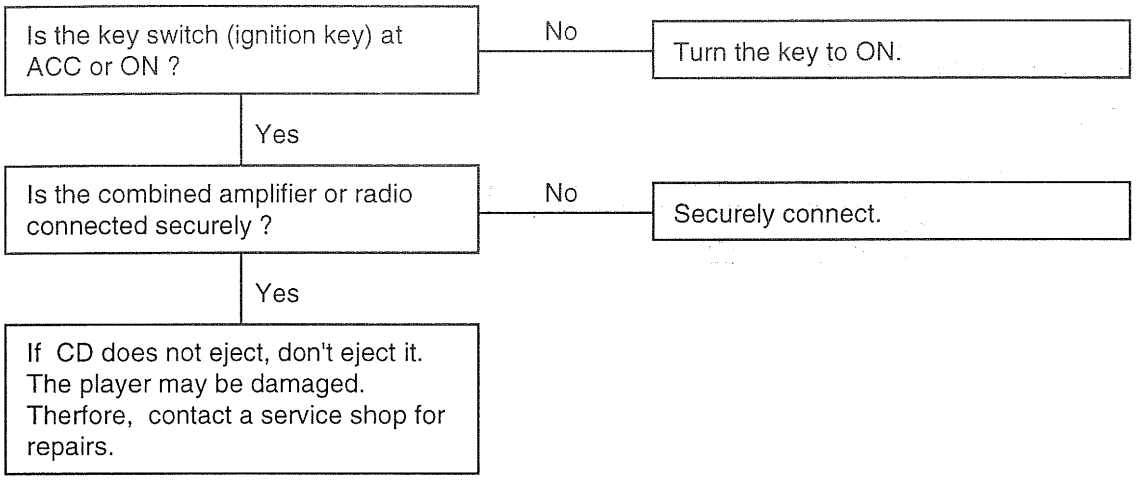


ETA9010I

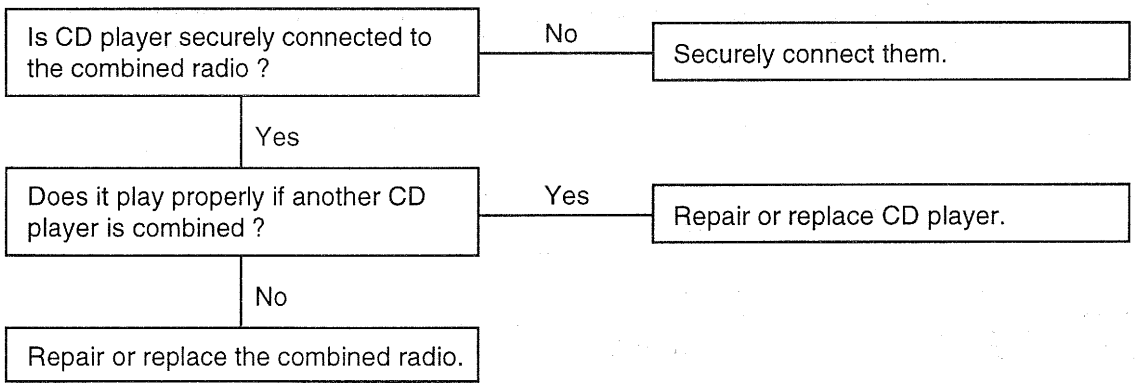
4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT

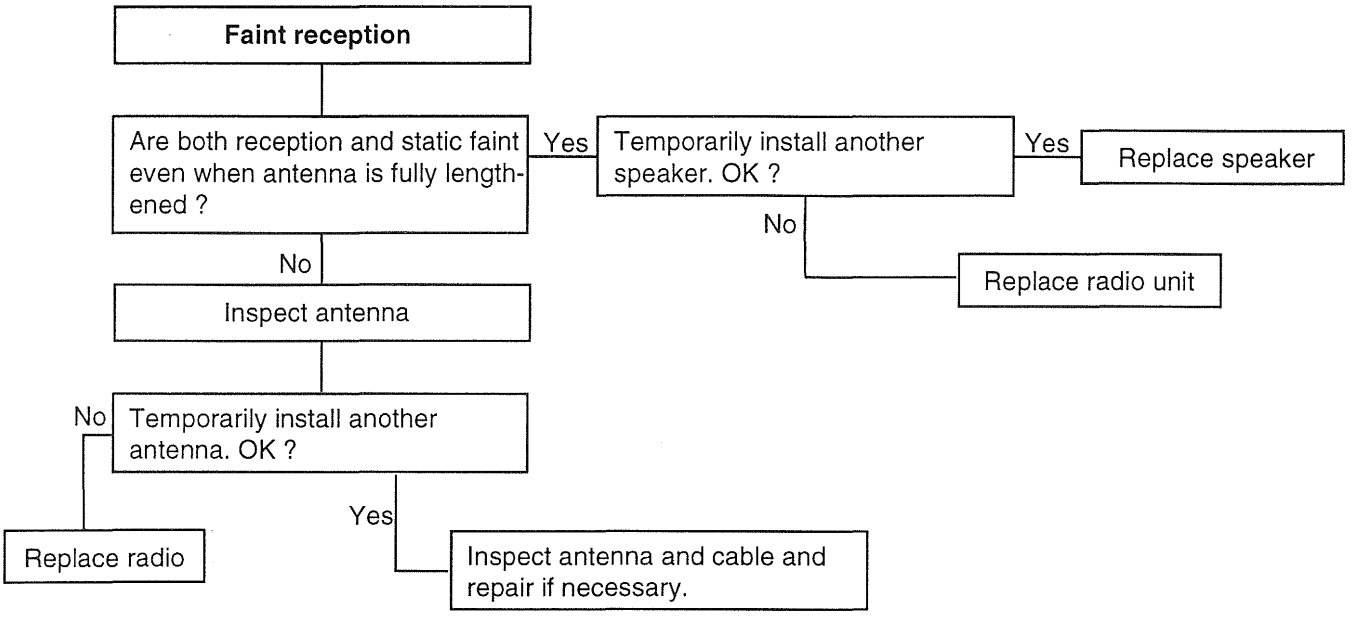


6. NO SOUND FROM ONE SPEAKER



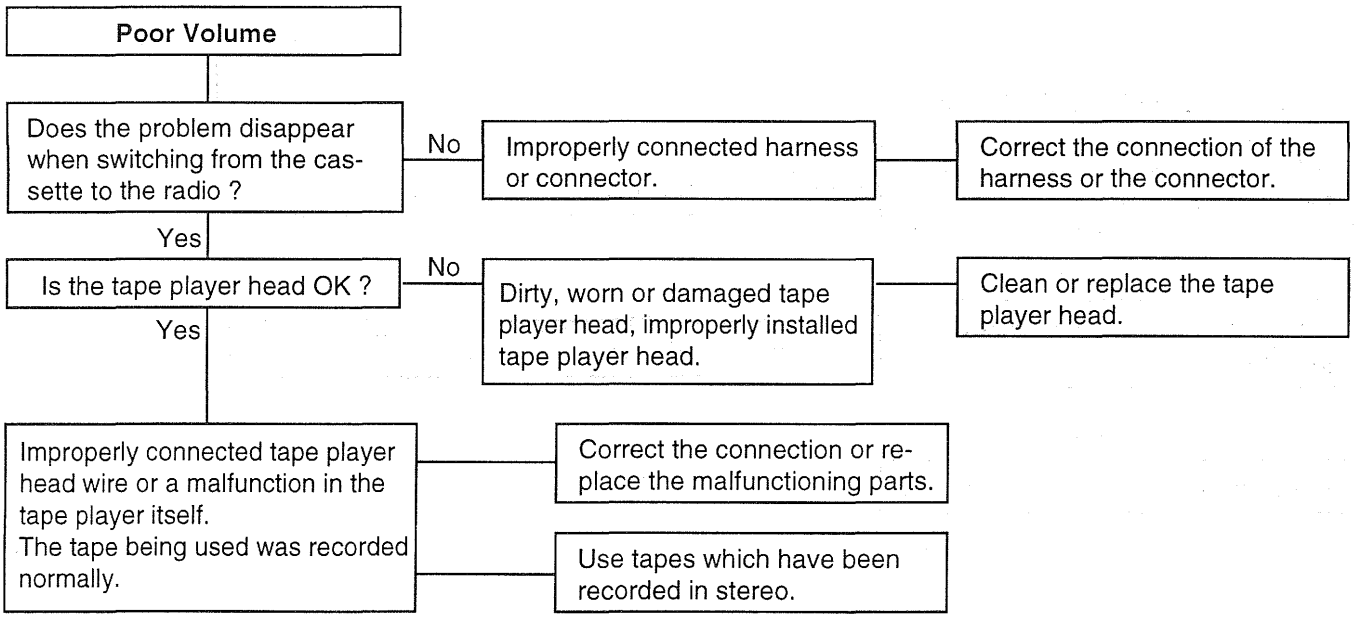
ETA9010

CHART 6 ETA90200



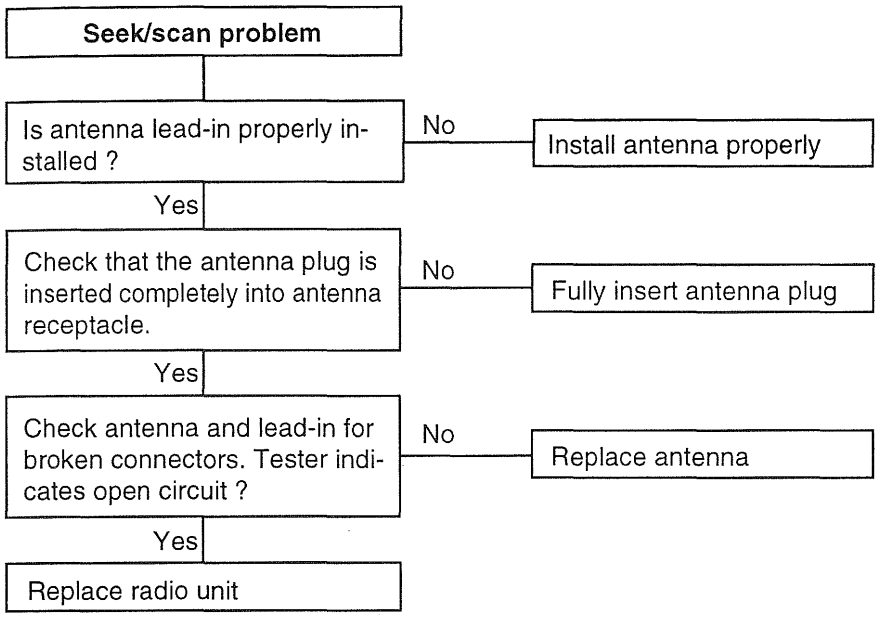
ETA9010K

CHART 7 ETA90210



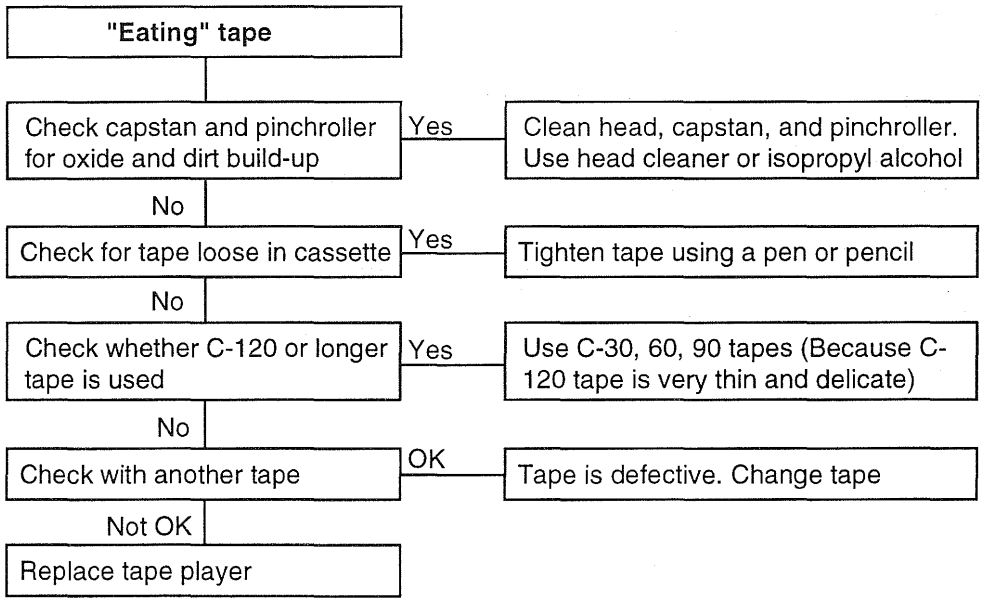
ETA9010L

CHART 8 ETA90220



ETA9010M

CHART 9 ETA90230

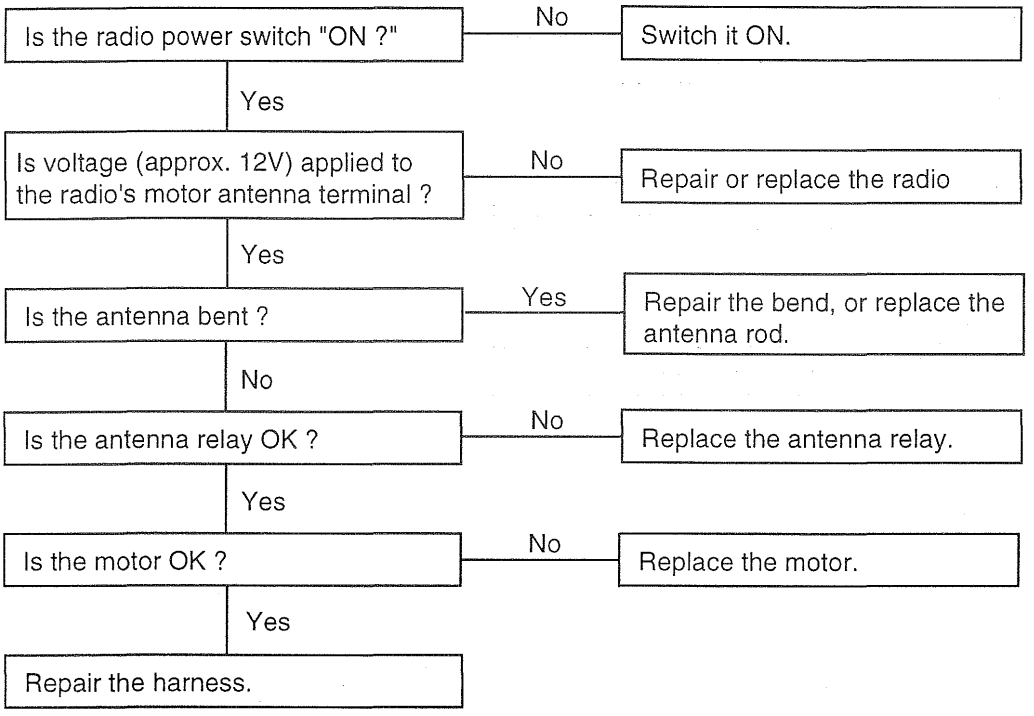


ETA9010N

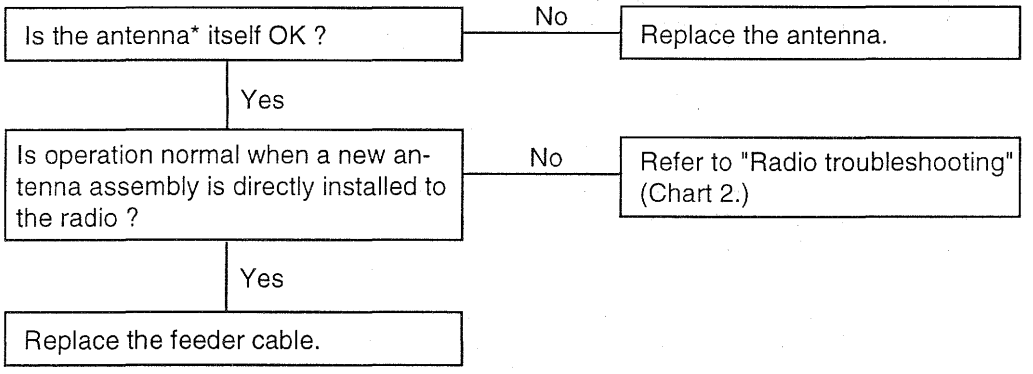
CHART 10 ETAA0240

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

TROUBLESHOOTING ETHA0700

Trouble symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary

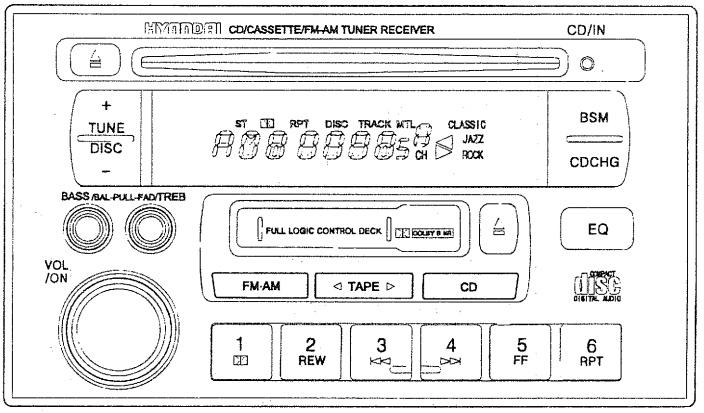
Trouble symptom	Possible cause	Remedy
Headlamps do not light	Bulb burned out	Replace bulb
	Fuse 28 (10A) blown	Replace fuse and check for short
	Headlamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail and license lamp do not light	Tail lamp fuse blown (10A)	Replace fuse and check for short
	Fusible link blown	Replace fusible link
	Taillamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Fuse 24 (15A) blown	Replace fuse and check for short
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
	Stop lamp relay faulty	Replace relay
Stop lamps stay on	Stop lamp switch faulty	Adjust or replace switch
	Stop lamp relay faulty	Replace relay
Instrument lamps do not light (taillamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not operate	Fuse 3 (10A) blown	Replace fuse and check for short
	Flasher faulty	Check flasher
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not operate	Fuse 23 (10A) blown	Replace fuse and check for short
	Flasher faulty	Check flasher
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattage are smaller or larger than is specified for use	Replace lamps
	Defective flahser	Replace flasher
Back up lamps do not light up	Fuse 11 (10A) blown	Replace fuse and check for short
	Back up lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Overhead console lamp do not light up	Fuse 16 blown	Replace fuse and check for short
	Wiring or ground faulty	Repair if necessary

AUDIO SYSTEM

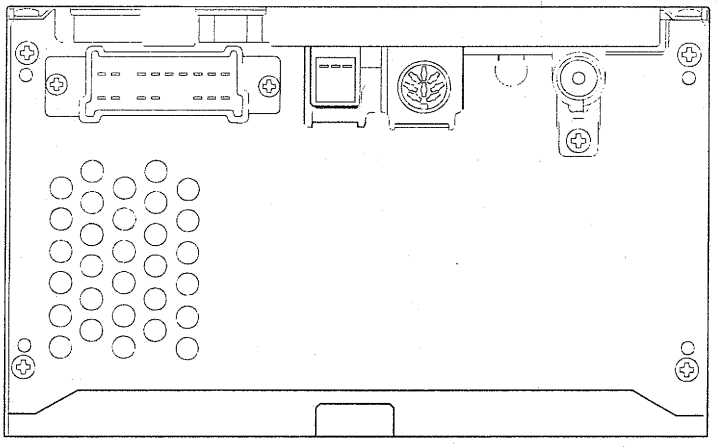
AUDIO UNIT

COMPONENTS ETHA0850

<H940A>



ETHA005C



ETHA005D

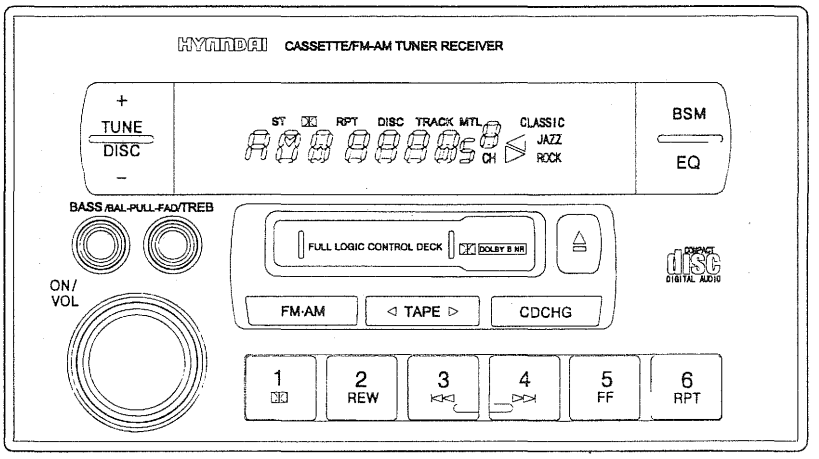
16P CONNECTOR	NO.	NOTE
[M36] ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ETHA005E	1	ANT B+
	2	EXT-AMP RR LH(-) INPUT
	3	EXT-AMP FRT LH(-) INPUT
	4	EXT-AMP FRT RH(-) INPUT
	5	EXT-AMP RR RH(-) INPUT
	6	ILL(-)
	7	ACC(+)
	8	GROUND
	9	EXT-AMP RR LH(+) INPUT
	10	EXT-AMP FRT LH(+) INPUT
	11	N.C
	12	AMP REMOTE
	13	EXT-AMP FRT RH(+) INPUT
	14	EXT-AMP RR RH(+) INPUT
	15	ILL(+)
	16	BACK UP(+)

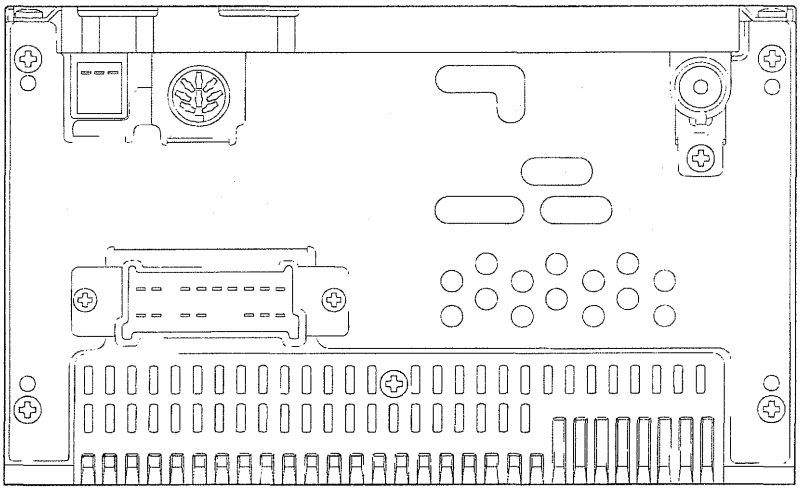
3P CONNECTOR	NO.	NOTE
① ② ③ ETHA005F	1	GROUND
	2	SIGNAL
	3	REAR SIGNAL

8P CONNECTOR	NO.	NOTE
(CD CHANGER) ③ ④ ⑤ ② ⑧ ⑥ ① ⑦ ETHA005G	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M.GROUND
	6	NC
	7	L
	8	A.GROUND

ETHA085A

<H940B>





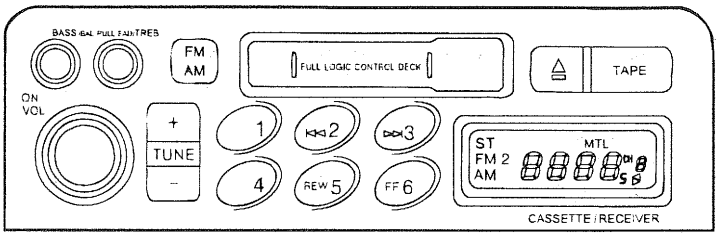
16P CONNECTOR	NO.	NOTE
[M36] ETHA005E	1	ANT B+
	2	EXT-AMP RR LH(-) INPUT
	3	EXT-AMP FRT LH(-) INPUT
	4	EXT-AMP FRT RH(-) INPUT
	5	EXT-AMP RR RH(-) INPUT
	6	ILL(-)
	7	ACC(+)
	8	GROUND
	9	EXT-AMP RR LH(+) INPUT
	10	EXT-AMP FRT LH(+) INPUT
	11	N.C
	12	AMP REMOTE
	13	EXT-AMP FRT RH(+) INPUT
	14	EXT-AMP RR RH(+) INPUT
	15	ILL(+)
	16	BACK UP(+)

3P CONNECTOR	NO.	NOTE
ETHA005F	1	GROUND
	2	SIGNAL
	3	REAR SIGNAL

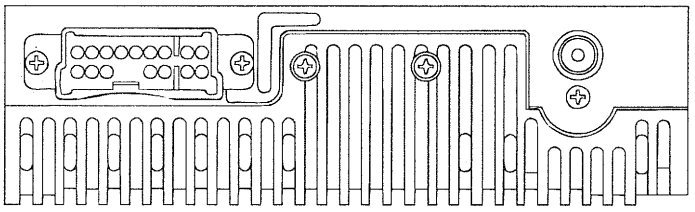
8P CONNECTOR	NO.	NOTE
(CD CHANGER) ETHA005G	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M.GROUND
	6	NC
	7	L
	8	A.GROUND

ETHA085B

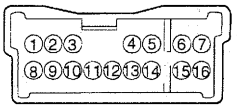
<H910C>



ETHA005Q



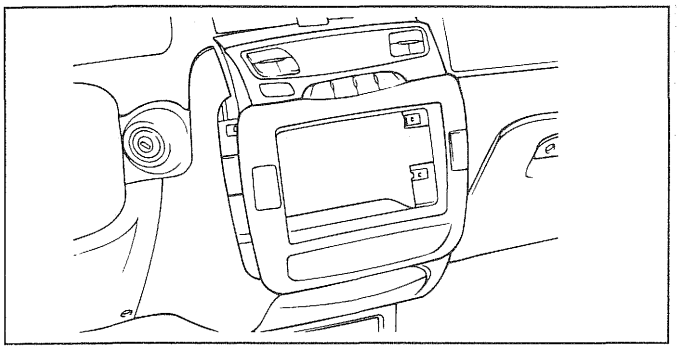
ETHA005R

16P CONNECTOR	NO.	NOTE
 ETHA005S	1	AUTO ANTENNA
	2	SPKR RR LH(-)
	3	SPKR FRT LH(-)
	4	SPKR FRT RH(-)
	5	SPKR RR RH(-)
	6	ILL(-)
	7	ACC(+)
	8	GROUND
	9	SPKR RR LH(+)
	10	SPKR FRT LH(+)
	11	N.C
	12	N.C
	13	SPKR FRT RH(+)
	14	SPKR RR RH(+)
	15	ILL(+)
	16	BACK UP(+)

ETHA085C

REMOVAL AND INSTALLATION ETHA0900

1. Disconnect negative (-) battery terminal.
2. Remove the center facia panel and disconnect air temperature switch connector.



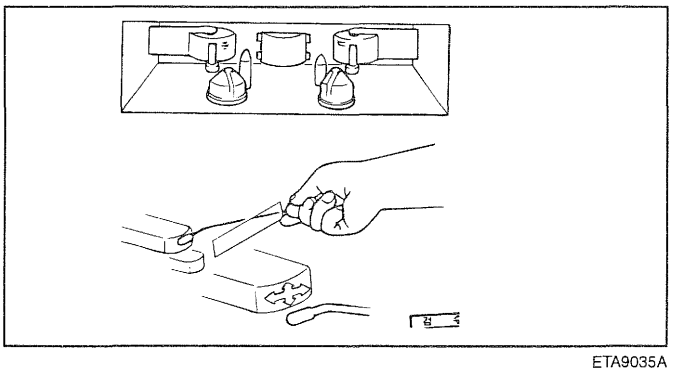
ESHA040Q

3. Loosen the screws holding the audio and remove the audio assembly from the mounting bracket.
4. Installation is the reverse of the removal process.

SERVICE INSTRUCTIONS ETHA0750

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 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.



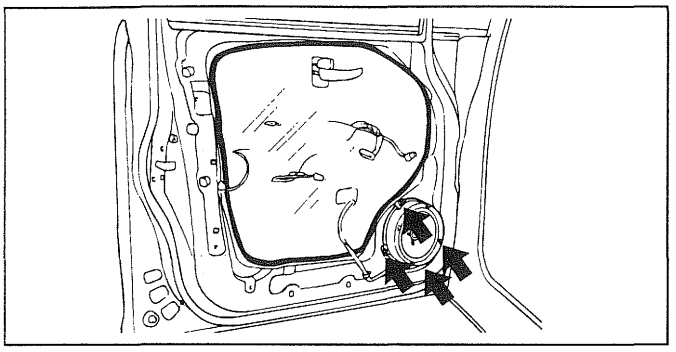
ETA9035A

SPEAKERS

REMOVAL AND INSTALLATION ETHA0950

FRONT SPEAKER

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

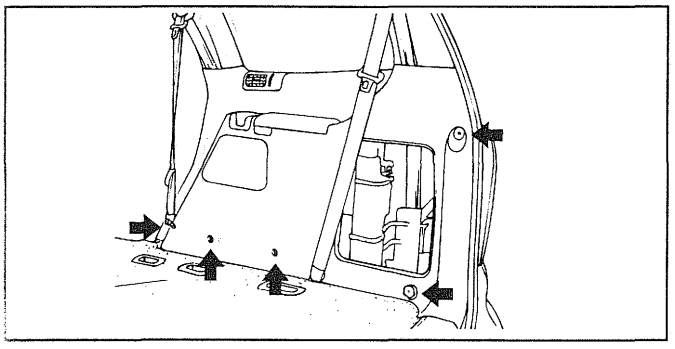


ESHA015E

2. Installation is the reverse of the removal process.

REAR SPEAKER

1. Remove the rear quarter trim (Refer to the BD group).



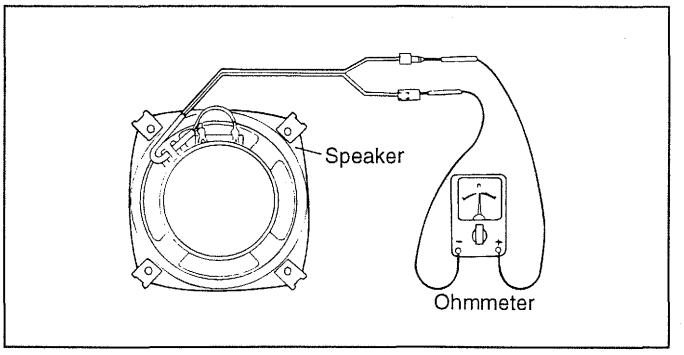
ESHA045D

2. Remove the rear speaker.

SPEAKER CHECKING ETA90400

1. Check the speaker by using an ohmmeter. If an ohmmeter indicates the impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is ok.

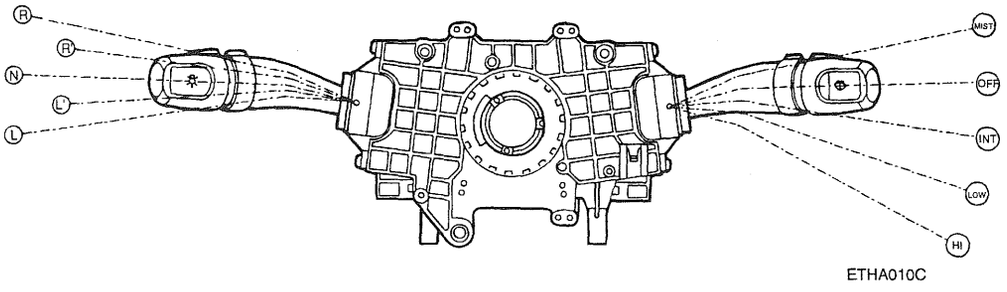
2. If a clicking sound is emitted from the speaker when the ohmmeter plugs, touch the speaker terminals, the speaker is ok.



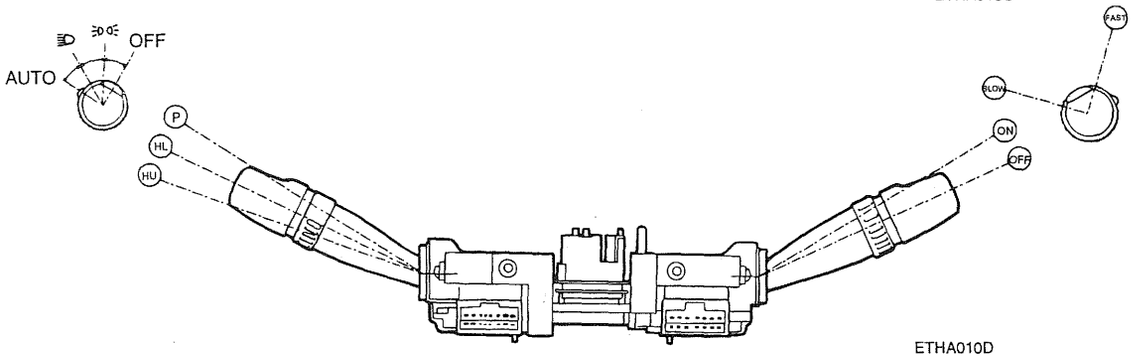
ETA9040A

MULTI FUNCTION SWITCH

COMPONENTS(WITHOUT AIR BAG) ETHA1000



ETHA010C



ETHA010D

M26-2

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

M26-1

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

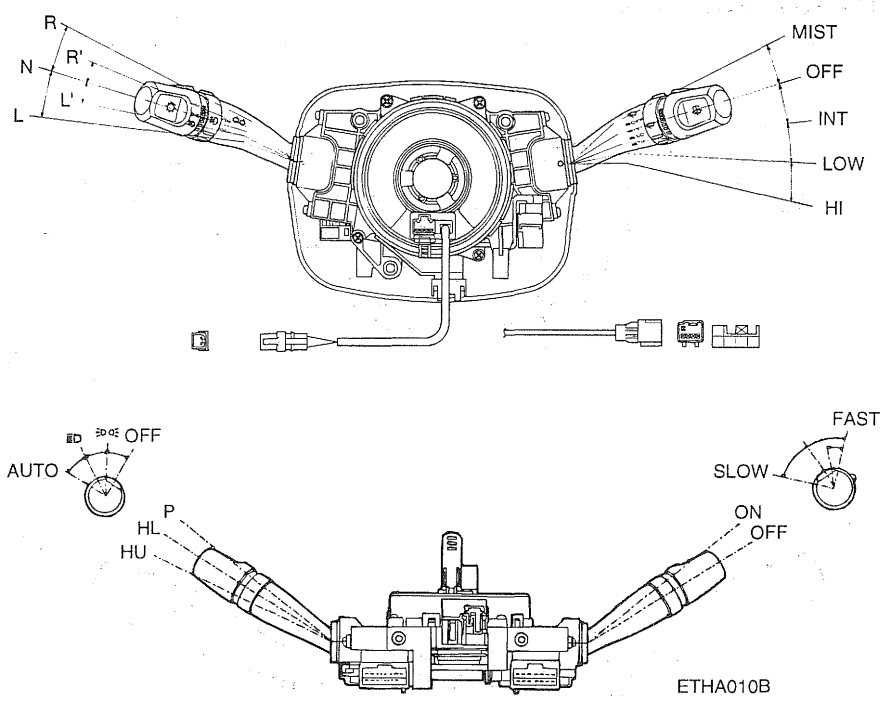
Circuit connection

Connector No.	Terminal No.	Description
M26-1	1	Head lamp passing switch
	2	Head lamp high beam power
	3	-
	4	-
	5	-
	6	-
	7	Turn signal RH lamp switch
	8	Flasher unit power
	9	Turn signal LH lamp switch
	10	Head lamp low beam power
	11	Dimmer & passing ground
	12	Front fog lamp switch
	13	Front fog lamp switch ground
	14	Tail lamp switch
	15	Head lamp switch
	16	Auto light/Rear fog lamp switch
	17	Lighting switch ground
	18	-

Connector No.	Terminal No.	Description
M26-2	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
	14	Intermittent wiper ground

ETHA100A

COMPONENTS(WITH AIR BAG)



M26-2

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

M26-1

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

M26-3

1	2	3	4

Circuit connection

Connector No.	Terminal No.	Description
M26-1	1	Head lamp passing switch
	2	Head lamp high beam power
	3	-
	4	-
	5	-
	6	-
	7	Turn signal RH lamp switch
	8	Flasher unit power
	9	Turn signal LH lamp switch
	10	Head lamp low beam power
	11	Dimmer & passing ground
	12	Front fog lamp switch
	13	Front fog lamp switch ground
	14	Tail lamp switch
	15	Head lamp switch
	16	Auto light/Rear fog lamp switch
	17	Lighting switch ground
	18	-

Connector No.	Terminal No.	Description
M26-2	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
	13	Intermittent wiper
	14	Intermittent wiper ground
M26-3	1	-
	2	Horn relay
	3	-
	4	-

KTDA030Y

ETHA100B

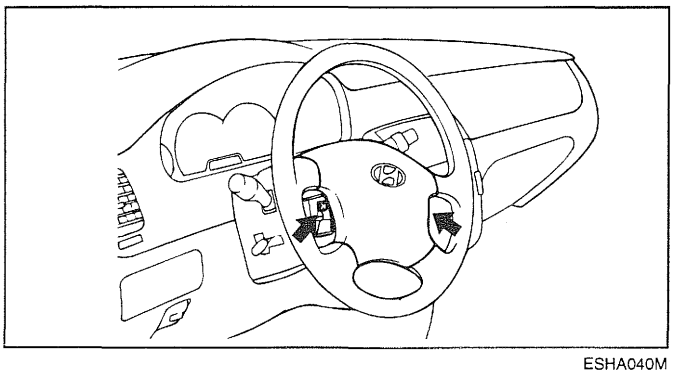
REMOVAL AND INSTALLATION ETHA1050

Prior to removing of the multifunction switch assembly in vehicles equipped with air bags, be careful to follow the following:

CAUTION

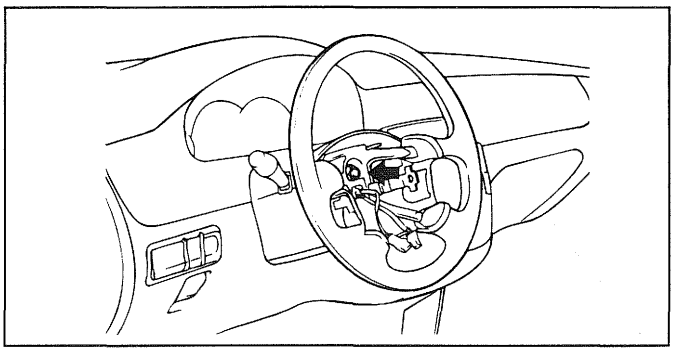
- **Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.**
- **Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace if a dent, crack, deformation or rust are detected.**
- **The air bag module should be stored 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 handing 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.**
- **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. Remove the air bag module.



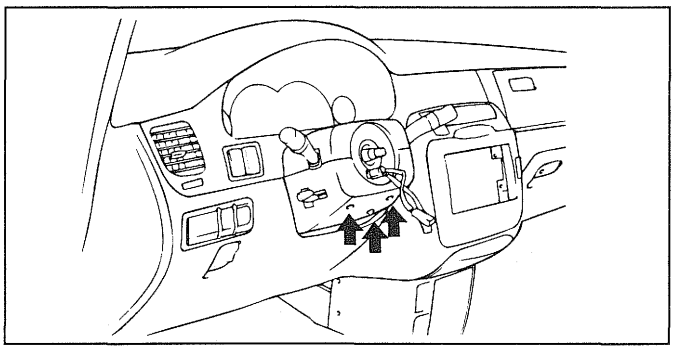
ESHA040M

2. Remove the steering wheel.



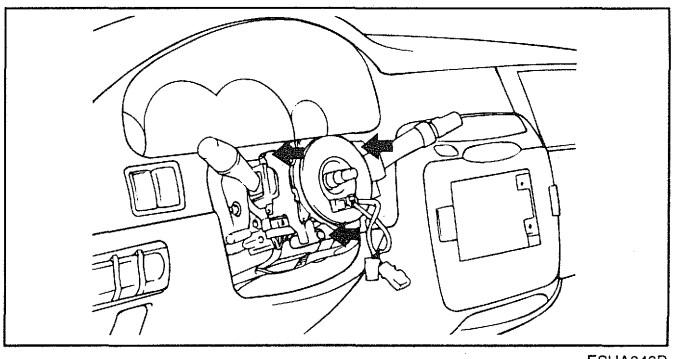
ESHA040N

3. Remove the steering column upper shroud and steering column lower shroud.



ESHA040O

4. Loosen the multifunction switch mounting screws and disconnect the connector. Remove the multi function switch assembly.



ESHA040P

5. Installation is the reverse of the removal process.

INSPECTION ETHA1100

Check the continuity between the terminals while operating the switch.

LIGHTING SWITCH [M26-1]

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

KTDA040A

FRONT FOG LAMP SWITCH [M26-1]

Position \ Terminal	12	13
OFF		
INT	○	○

KTDA040F

DIMMER AND PASSING SWITCH [M26-1]

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

HU : Head lamp high beam

HL : Head lamp low beam

P : Head lamp passing switch

KTDA040B

TURN SIGNAL AND LANE CHANGE SWITCH [M26-1]

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

KTDA040C

WIPER AND INTERMITTENT VOLUME SWITCH [M26-2]

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

KTDA040D

WASHER SWITCH [M26-2]

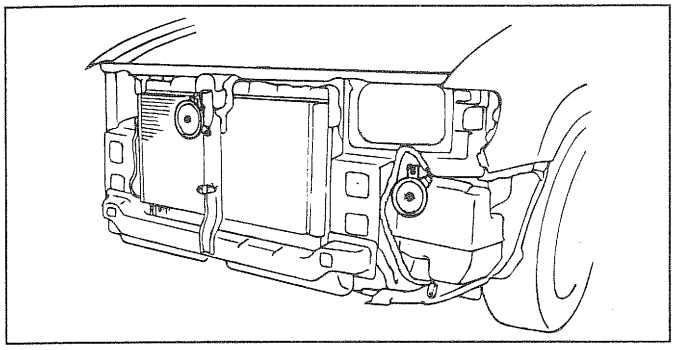
Position \ Terminal	7	8
OFF		
ON	○	○

KTDA040E

HORNS

REMOVAL AND INSTALLATION ETHA1150

1. Remove the bolts holding horn and remove the horn assembly.



ETHA015A

2. Installation is the reverse of the removal process.

INSPECTION ETHA1200

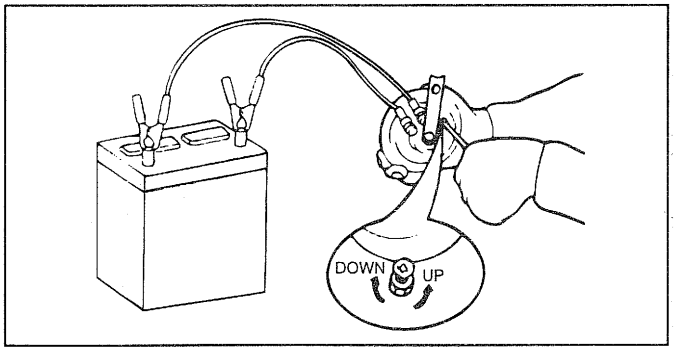
1. Test the horn by connecting battery voltage to the 1 and 2 terminals.
2. The horn should make a sound. If the horn fails to make a sound, replace it.

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 keep it from loosening.



ETDA050A

ETACS (ELECTRONIC TIME AND ALARM CONTROL SYSTEM)

ELECTRONIC TIME AND ALARM CONTROL MODULE OPERATION CHECK OF COMPONENTS ETHA1250

While operating the components, check whether the operations are normal with timing chart.

ETACS FUNCTION

1. **Vehicle speed sensing intermittent wiper**

   Time specification

   T1 : Max. 0.6 sec.

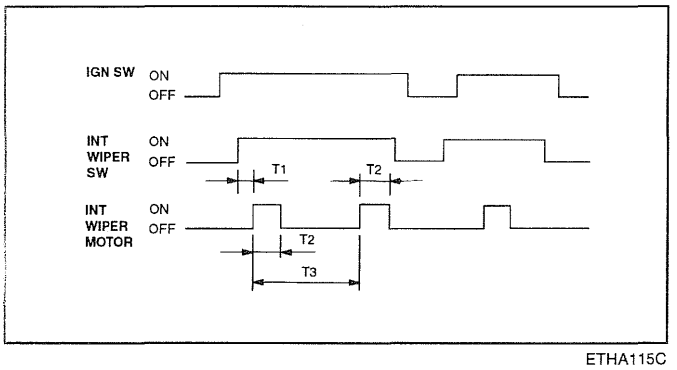
   T2 : 0.6~0.7 sec. (Time of wiper motor 1 rotation)

   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.

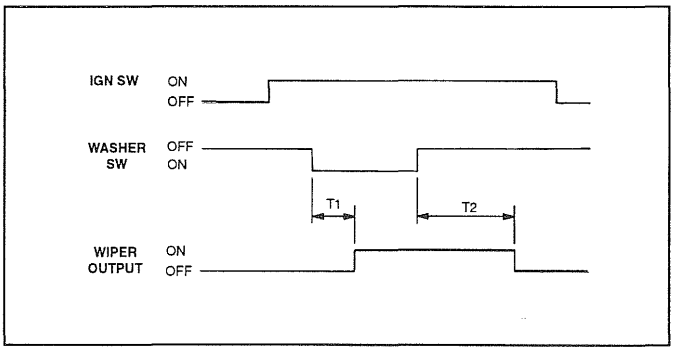
   1.0±0.2sec (VR=0kΩ)~10.0±1sec (VR=50KΩ)



ETHA115C

2. **Washer**

   a. Time specification
      T1 : 0.6 sec. or more
      T2 : 2.5 - 3.8 sec.
      T1 : 0.2 - 0.6 sec. (Mist)
   b. This function should be operated preferentially even though the variable intermittent wiper is operating.

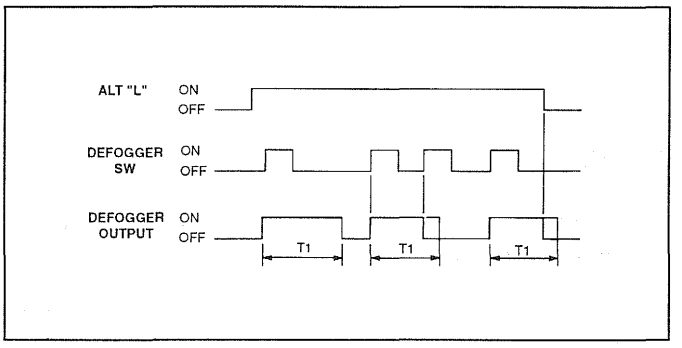


ETHA115D

3. **Rear window defogger**

   Time specification

   T1 : 20±1min.



ETHA115E

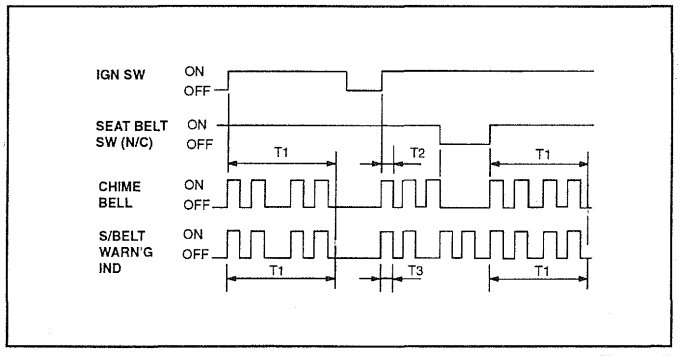
4. **Seat belt warning**

   Time specification

   T1 : 6 ± 1 sec.

   T2 : 0.45±0.1 sec.

   T3 : 0.3 ± 0.1 sec.



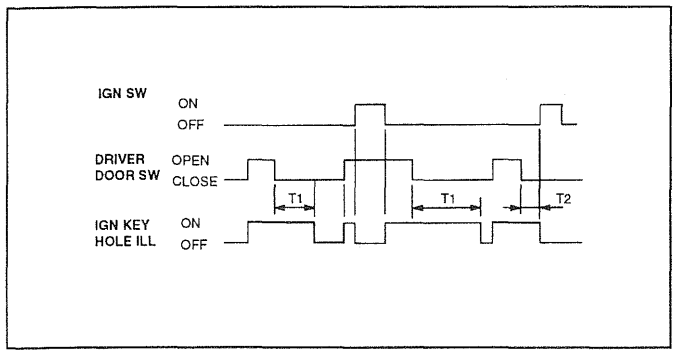
ETHA115F

5. **Ignition key hole illumination**

   Time specification

   T1 : 10 ± 1 sec.

   T2 : 0 - 10 sec.

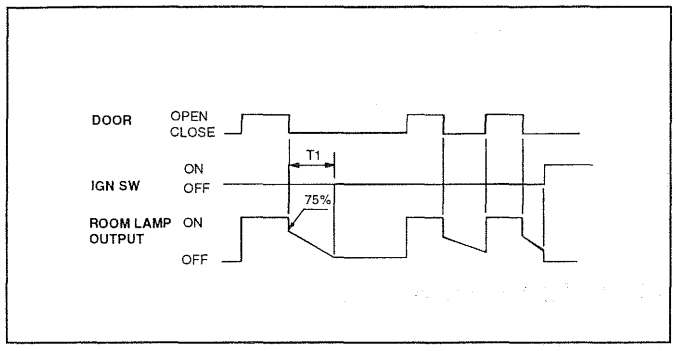


ETHA115J

6. **Delayed out room lamp**

Time specification

T1 : 5.5±0.5 sec.

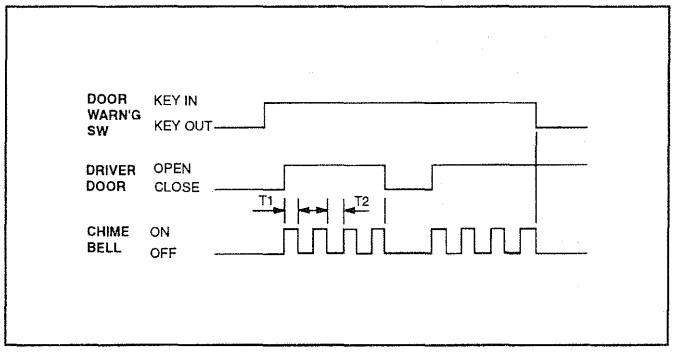


ETHA115G

7. **Door warning**

Time specification

T1, T2 : 0.45±0.1 sec.

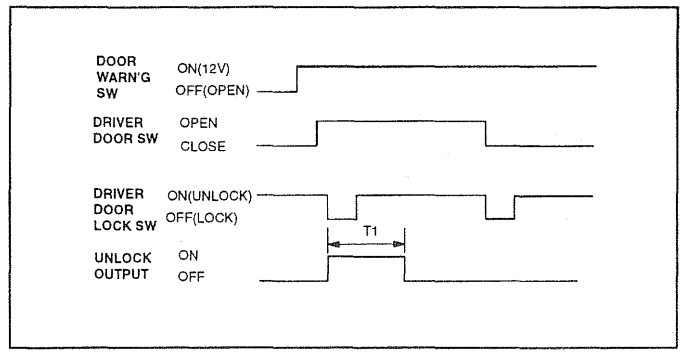


ETHA115L

8. **Ignition key reminder**

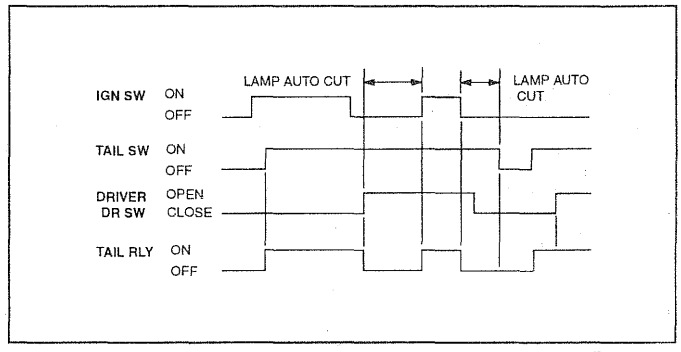
Time specification

T1 : 5±0.5 sec.



ETHA115I

9. **Tail lamp auto cut**

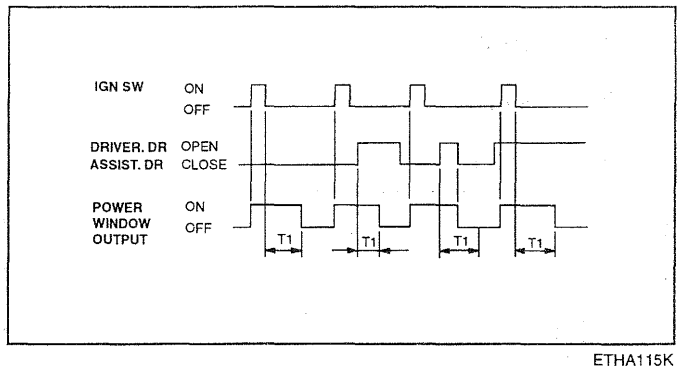


ETHA115M

10. **Power window timer**

Time specification

T1 : 30±3 sec.

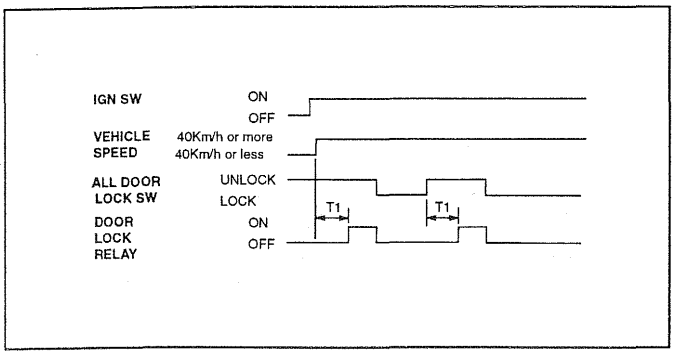


ETHA115K

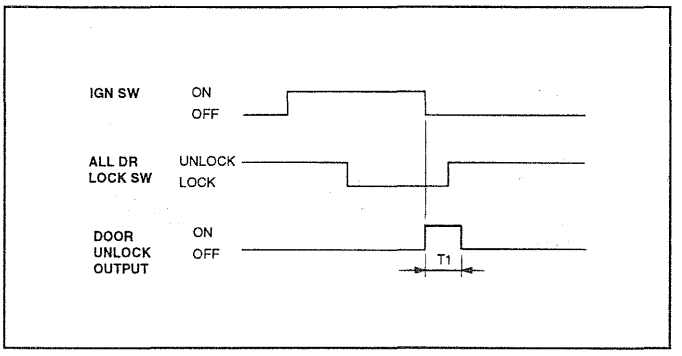
11. **Auto door lock**

Time specification

T1 : 2.5±0.5 sec.



ETHA115N

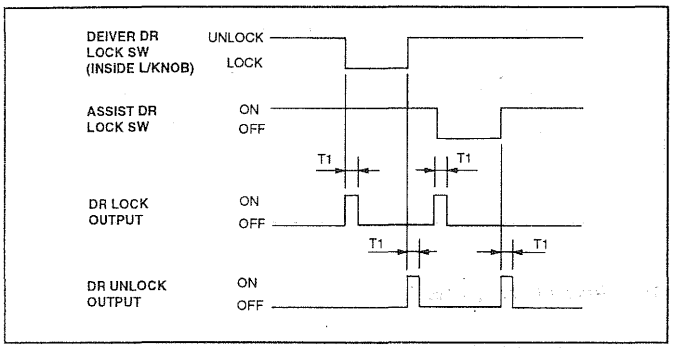


ETHA115P

12. **Central door lock/unlock**

Time specification

T1 : 0.5±0.1 sec.



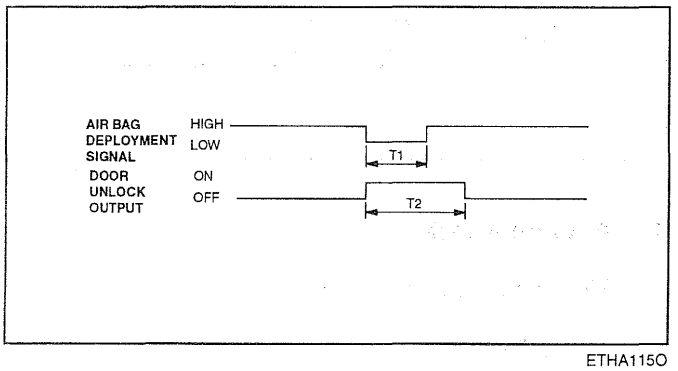
ETHA115H

13. **Auto door unlock**

Time specification

T1 : 200ms

T2 : 1±0.2 sec.



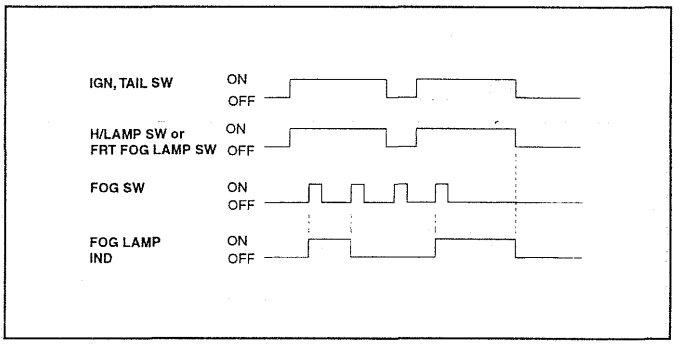
ETHA115O

14. **Ignition key off unlock.**

Time specification

T1 : 0.5±0.5 sec

15. **Rear fog lamp control**



ETHA120E

ANTI-THEFT FUNCTION

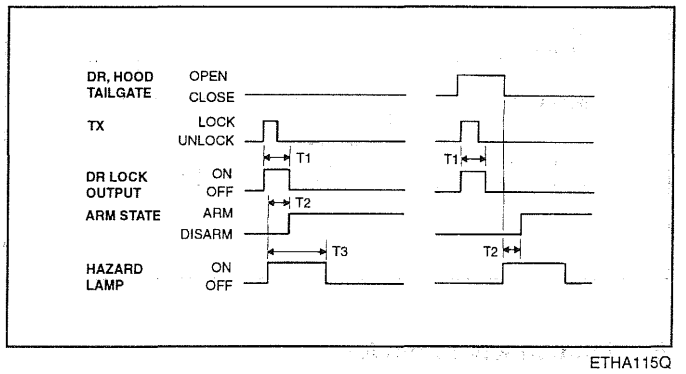
1. **Arm function**

Time specification

T1 : 0.5sec.

T2 : Max 2sec.

T3 : 1.0±0.2sec.

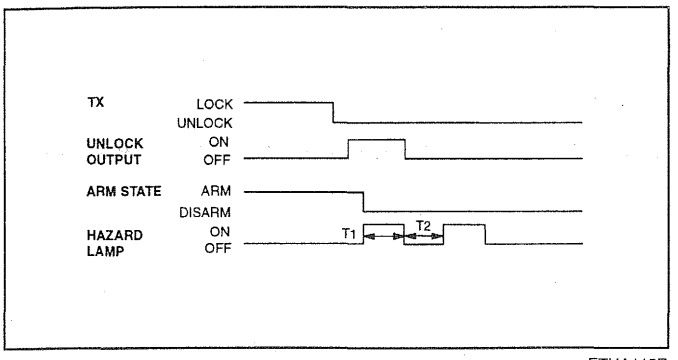


ETHA115Q

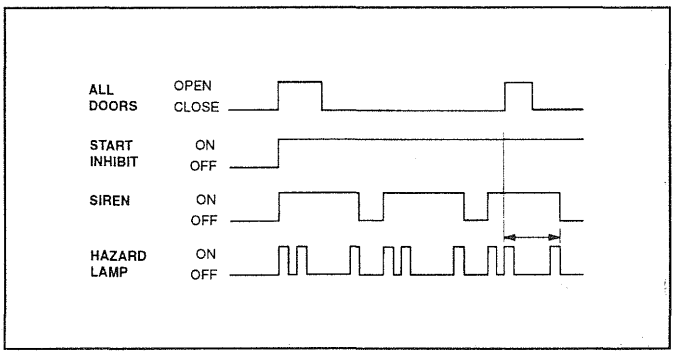
2. **Disarm function**

Time specification

T1, T2 : 0.5±0.1sec.



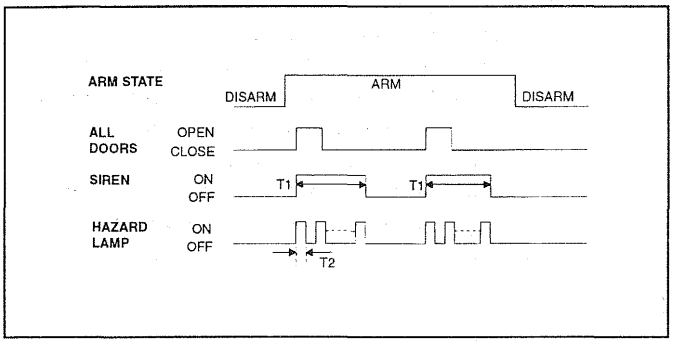
ETHA115R



ETHA115T

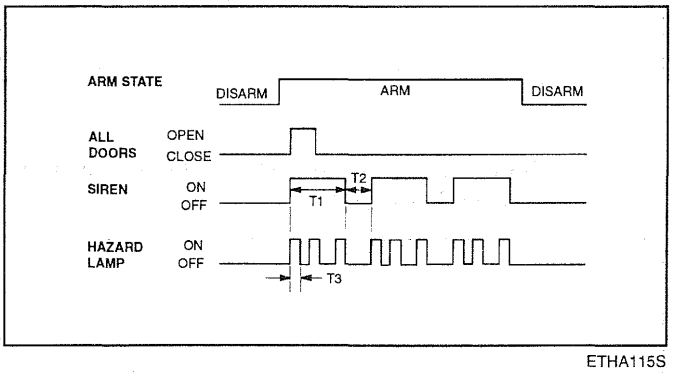
3. Alarm function

a. Only EC Area
Time specification
T1 : 27±2sec.
T2 : 0.5±0.1sec.



ETHA120F

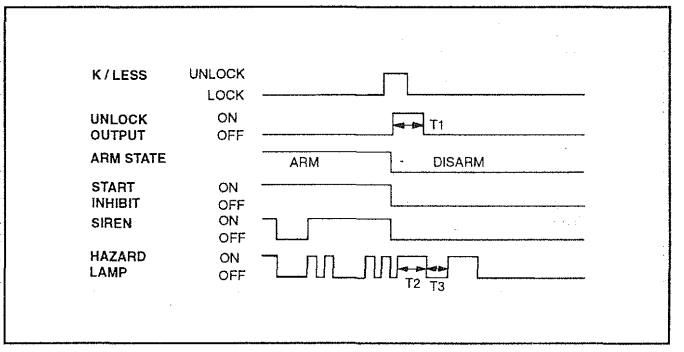
b. Except EC Area
Time specification
T1 : 27±2sec.
T2 : 10±1sec.



ETHA115S

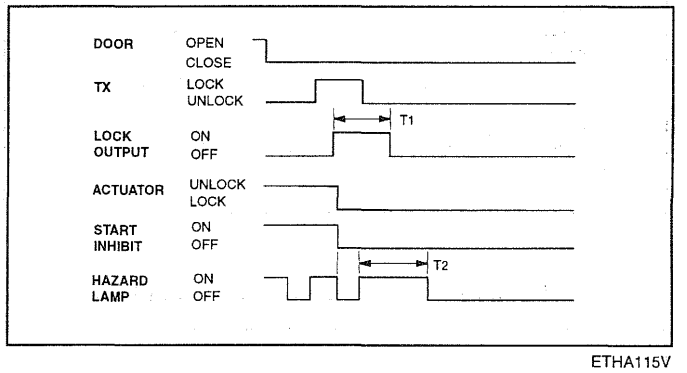
c. New alarm occurs during the alarm state.

d. Disarmed with TX (Transmitter) during the alarm state.
Time specification
T1, T2, T3 : 0.5±0.1sec.



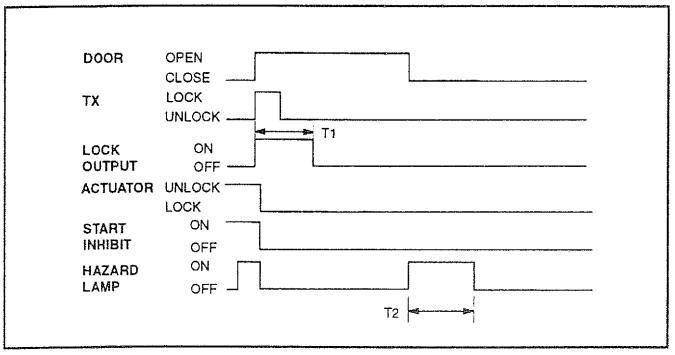
ETHA115U

e. TX lock button pressed when the door closed during the alarm state.
Time specification
T1 : 0.5sec.
T2 : 1.0±0.2sec.



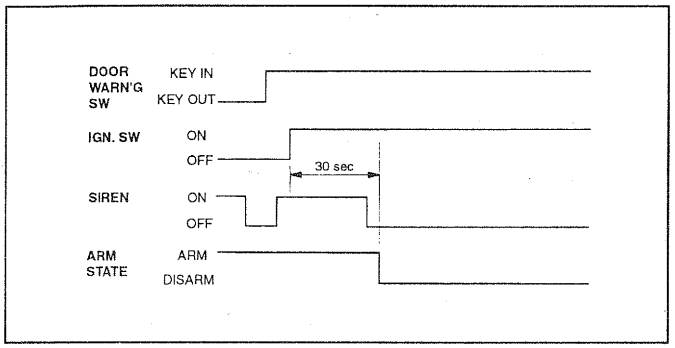
ETHA115V

f. TX lock button pressed when the door opened during the alarm state.
Time specification
T1 : 0.5sec.
T2 : 1.0±0.2sec.



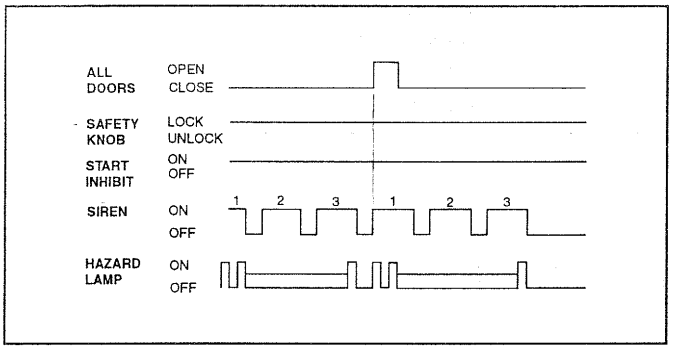
ETHA115W

g. Disarmed after 30 sec when the ignition switch turned on during the alarm state.



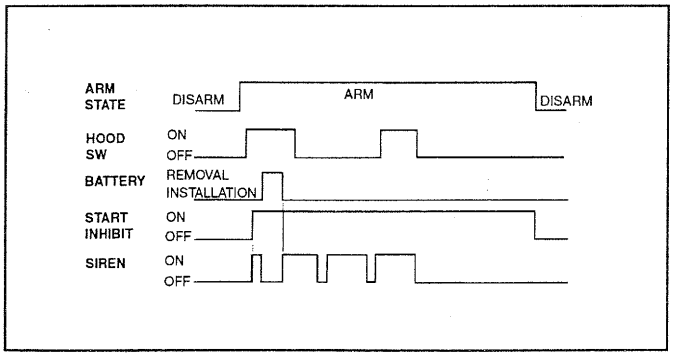
ETHA115X

h. Start inhibit is "ON" regardless of safety knob lock state.



ETHA115Y

i. Battery is separated during the alarm state.



ETHA115Z

4. **Code saving method.**

a. Remove the lower crash panel.

NOTE

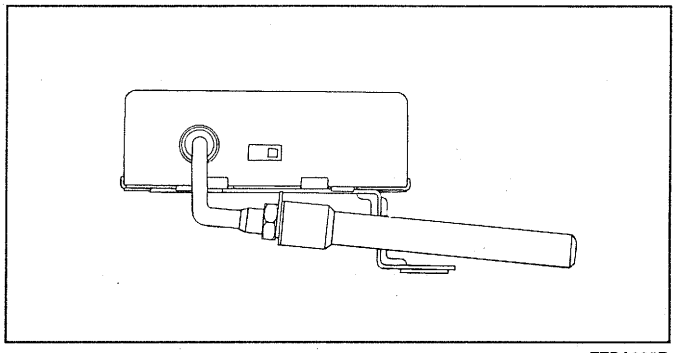
Don't disconnect the negative (-) battery terminal.

b. Code saving :

- Activating the keyless entry-receiver unit and change code saving switch of the receiver unit from "OFF" to "SET".
- The secret codes from the transmitter are stored into the receiver unit when the door lock button or unlock button pressed.

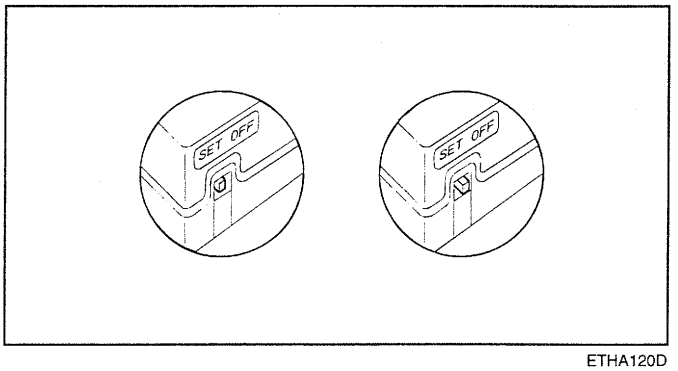
c. Code saving :

- Change code saving switch of the receiver unit from "OFF" to "SET".
- The same secret code from transmitter are stored into the receiver unit when the door lock or unlock button from the changing transmitter are pressed.
- The code saving of 2nd transmitter unit will be achieved in the same method.



ETDA085R

d. Change code saving switch of the receiver unit from "SET" to "OFF".

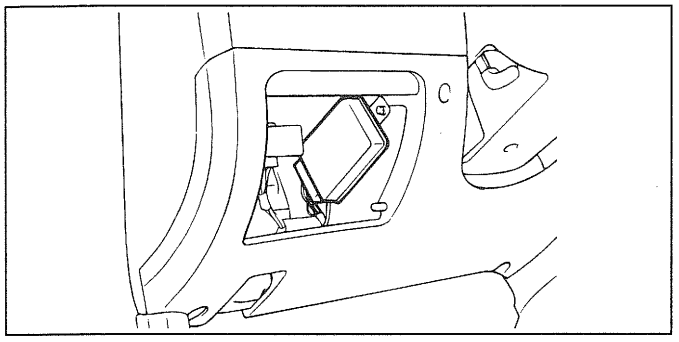


ETHA120D

e. Install the lower crash panel.

REMOVAL AND INSTALLATION ETHA1300

1. Disconnect the negative (-) battery terminal
2. Remove the lower crash panel.
3. Remove the ETACM from the junction block and disconnect the connectors.



ETDA080A

4. Installation is the reverse of the removal process.

FUSES AND RELAYS

RELAY BOX (ENGINE COMPARTMENT)

FUSIBLE LINK ETHA1350

SPECIFICATIONS

Circuit	Rated Capacity	Circuit	Rated Capacity
Ignition switch 1	30A	ABS 1	30A
Ignition switch 2	50A	ABS 2	30A
Power window	30A	Radiator	30A
Condenser	20A		

INSPECTION

1. Check for a burnt fusible link with an ohmmeter.
2. If a fusible link burns out, there is a short or some other problem in the circuit. Carefully determine the cause and correct it before replacing the fusible link.

CAUTION

The fusible link will burn out within 15 seconds if a higher than specified current flows through the circuit.

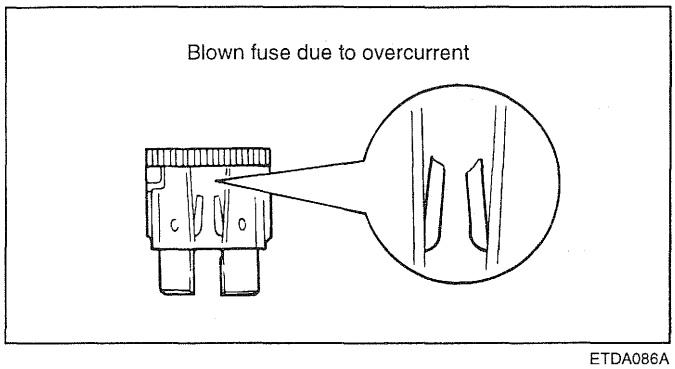
FUSES

INSPECTION ETDA0860

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

1. **Fuse blown due to over-current.**

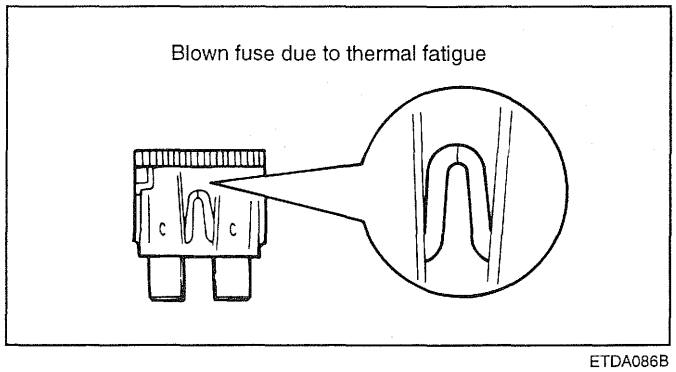
   Prior to replacing the fuse with a new one, check the circuit for a short and the related parts for abnormal condition. Only after the correction of a short or replacement of abnormal parts, should a fuse with the same ampere rating be installed.



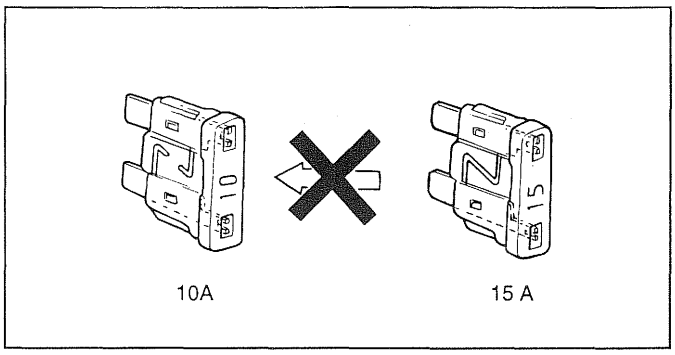
ETDA086A

2. **Fuse blown due to repeated current on-off.**

   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.



ETDA086B



ETDA086C

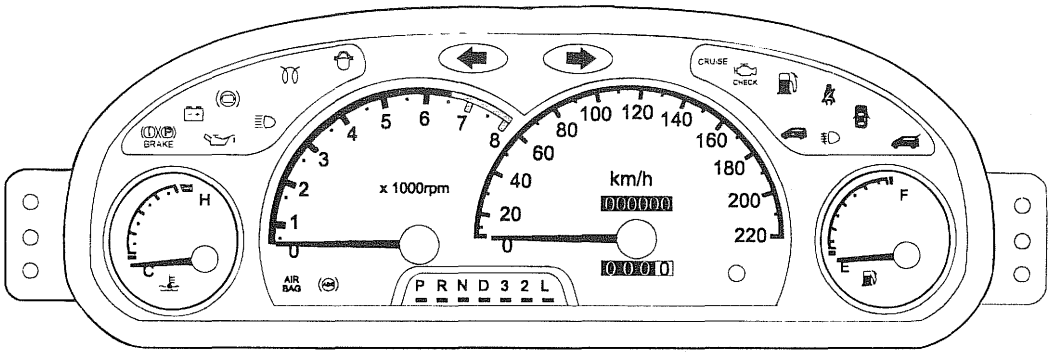
CAUTION

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, please use the fuse puller in the fuse box.

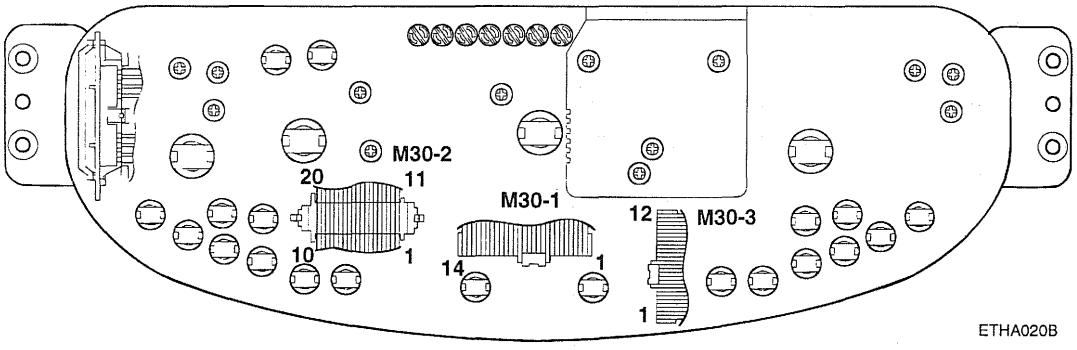
INDICATORS AND GAUGES

INSTRUMENT CLUSTER

COMPONENTS ETHA1450



ETHA020D



ETHA020B

[M30-1]

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

[M30-3]

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

[M30-2]

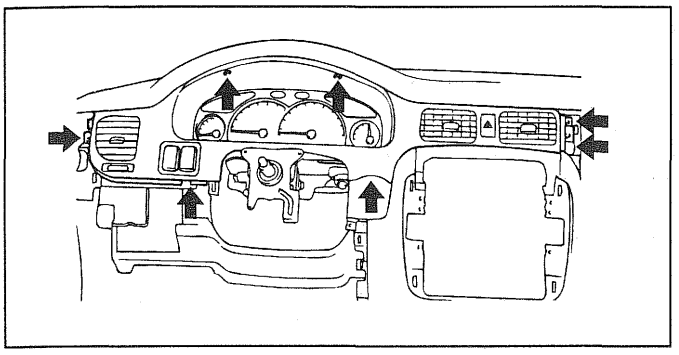
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

KTDA095C

ETHA145A

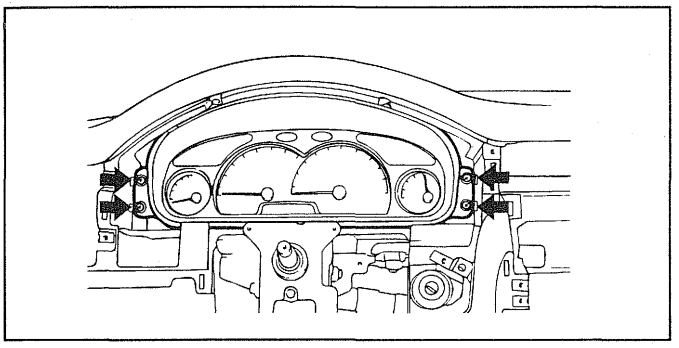
REMOVAL AND INSTALLATION ETHA1500

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



ESHA040V

3. Loosen the screws holding the cluster and remove the instrument cluster

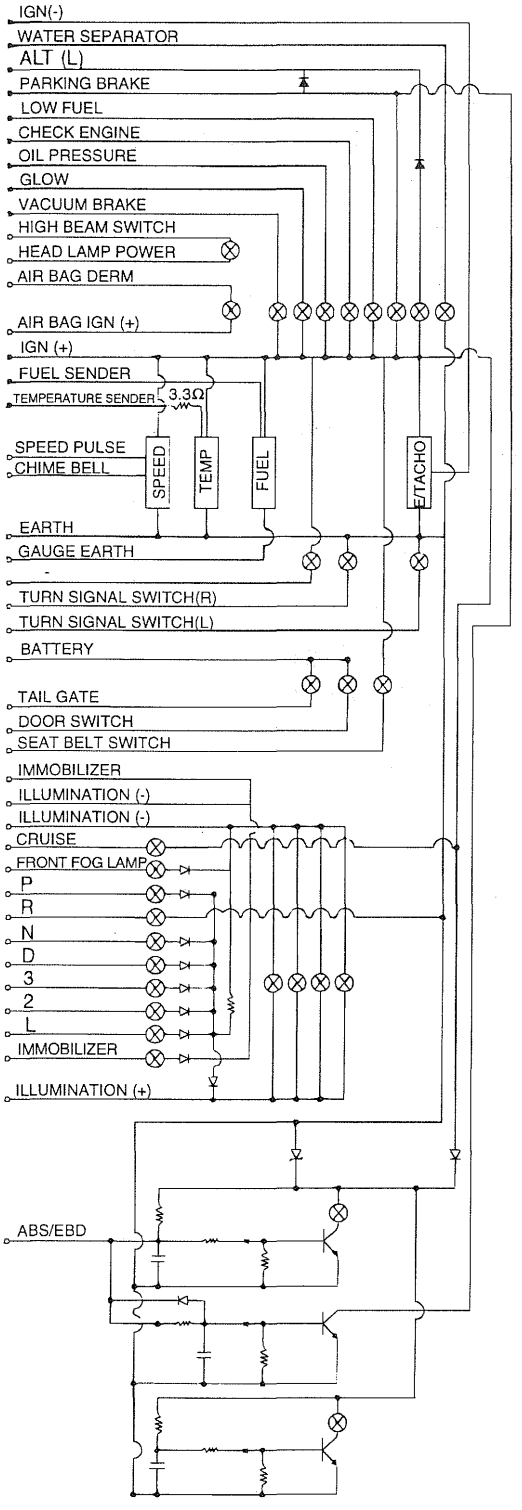


ESHA040W

4. Installation is the reverse of the removal process.

CIRCUIT DIAGRAM ETHA1550

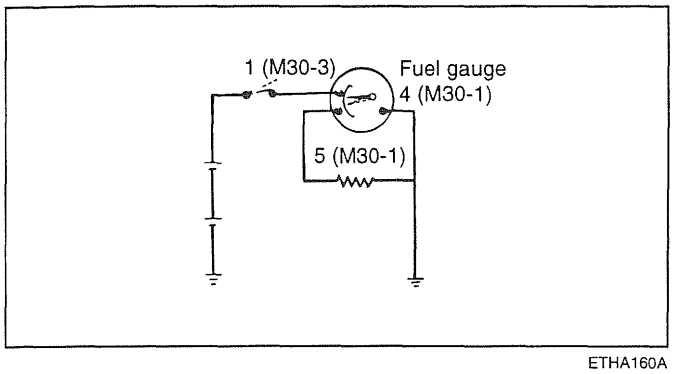
M30-1	M30-2	M30-3
	12	
	5	
	1	
	19	
		4
		3
	20	
	4	
	3	
	10	
	9	
	13	
	14	
	7,15	1
5		
	16	
6		
3		
2	6	
4		
	8	
1		
14		
		8
		9
		10
		5
		11
		12
	17	
		2
		6
13		
12		
11		
10		
9		
8		
7		
		7
	11	
	13	



ETHA020C

FUEL GAUGE

INSPECTION ETHA1600



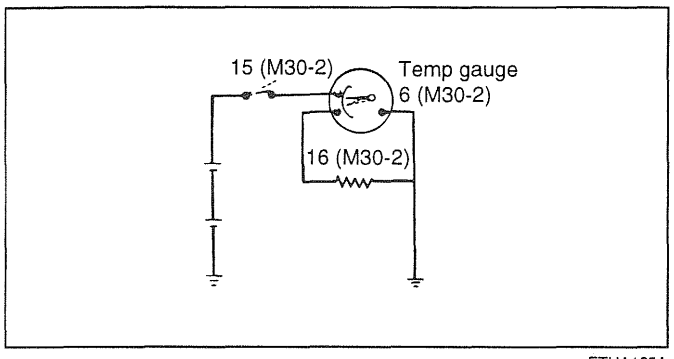
ETHA160A

1. Connect the positive (+) lead from battery to terminal 1 (M30–3) and negative (-) lead to terminal 4 (M30–1).
2. Connect the variable resistance to terminal 5 (M30–1) and terminal 4 (M30–1).
3. Vary the variable resistance.
4. Check that the fuel gauge pointer moves. If the operation is not as specified, replace the gauge.

Resistance (Ω)	Gauge level
95	E
32.5	1/2
7	F

ENGINE COOLANT TEMPERATURE GAUGE

INSPECTION ETHA1650



ETHA165A

1. Connect the positive (+) lead from battery to terminal 15 (M30–2) and negative (-) lead to terminal 6 (M30–2).
2. Connect the variable resistance to terminal 16 (M30–2) and terminal 6 (M30–2).
3. Vary the variable resistance.
4. Check that the temperature gauge pointer moves. If the operation is not as specified, replace the gauge.

Resistance (Ω)	Gauge level
157	-40°
48.4-24	-7°
15.2	+30°

TACHOMETER

INSPECTION ETHA1700

1. Connect the tune-up test tachometer and start the engine.
2. Compare the tester and tachometer indications. If the difference is excessive, replace the tachometer.

CAUTION

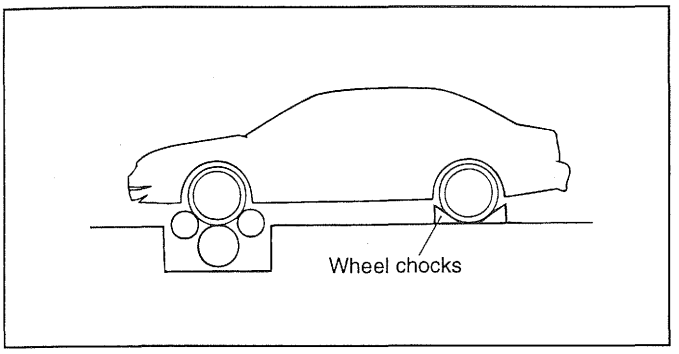
1. **Reversing the connections of the tachometer will damage the transistor and diodes inside.**
2. **When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.**

Revolution (rpm)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	Remark
Tolerance (rpm)	±100	±125	±150	±200	±250	±300	±350	

SPEEDOMETER

COMPONENT CHECK ETHA1750

SPEEDOMETER



ETA9100A

1. Adjust the pressure of the tires to the specified level.
2. Set the vehicle onto a speedometer tester and use wheel chocks to hold the front wheels.
3. Check if the speedometer indicator range is within the standard values.

CAUTION

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

NOTE

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

Pointer vibration can be caused by a loose or dry speedometer cable.

Velocity (Km/ h)	20	40	60	80	100	120	140	160	180	200	Remark
Toler-ance (Km/ h)	20-24.1	40-43	60-64.1	80-85.2	100-105.2	120.5-126.3	140.5-146.7	160.5-167.5	181-188.4	201-209.1	Except EEC& GEN-ERAL
	20.8-25.4	40-44	60.8-65.4	81.4-86.8	102.6-108.2	123.5-129.6	144.4-151	165.4-172.4	186.3-193.8	207.2-215.2	EEC, GEN-ERAL

Velocity (MPH)	10	20	40	60	80	100	120	Remark
Toler-ance (MPH)	10-12.5	20-22	40-42.6	60-63.4	80.3-84.1	100.3-104.7	120.3-125.3	EXCEPT U.S.A
	8.5-11.5	18.5-21.5	38.5-41.5	58.3-61.7	78-82	97.7-102.3	117.5-122.5	U.S.A

POWER DOOR MIRRORS

POWER DOOR MIRROR SWITCH

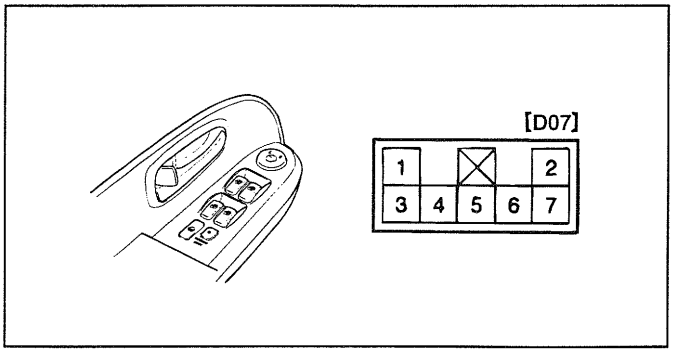
INSPECTION ETHA1800

1. Remove the power window main switch from the door trim panel.
2. Disconnect the outside rear view mirror connector from the harness.
3. Operate the switch and check for continuity between the terminals. If continuity is not as specified, replace the mirror switch.

[D07]

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

ETHA025B



ETHA180A

POWER DOOR MIRROR ACTUATOR

INSPECTION ETHA1850

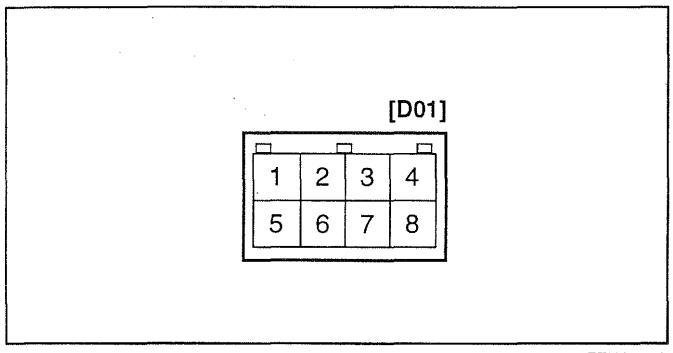
1. Disconnect the outside rear view mirror connector from the harness.

2. Apply battery voltage to each terminal as shown in the table and confirm that the mirror operates properly.

[D01]

Position \ Terminal	6	7	8
UP	⊖	⊕	⊕
DOWN	⊕	⊖	⊖
LEFT	⊖	⊕	⊖
RIGHT	⊕	⊖	⊕

ETHA030B



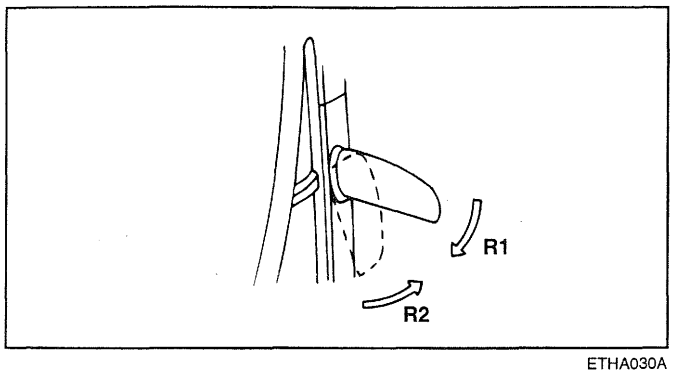
ETHA185A

MIRROR FOLDING

[D01]

Direction \ Terminal	3	4
R1	⊖	⊕
R2	⊕	⊖

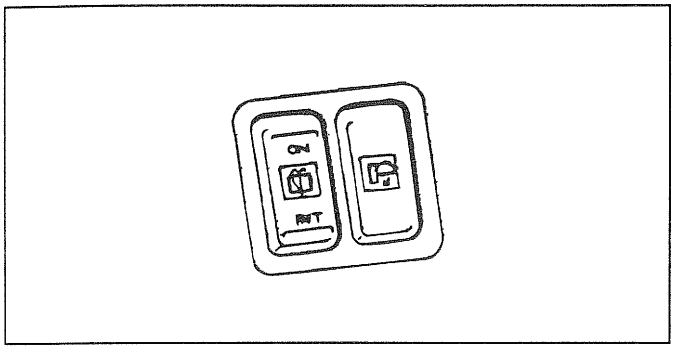
ETHA030D



ETHA030A

OUTSIDE MIRROR FOLDING SWITCH

ETHA2000



ETHA040A

INSPECTION ETHA2050

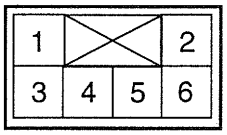
1. Remove the cluster facia panel.
2. Disconnect the outside mirror folding switch and check for continuity between the terminals.

[M24]

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

ETHA040B

[M24]



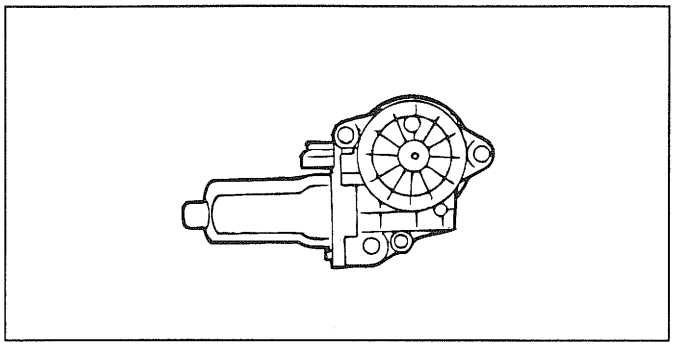
ETHA205A

POWER WINDOWS

POWER WINDOW MOTOR

INSPECTION ETHA1900

Connect the motor terminals directly to the battery 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.



ETHA035A

POWER WINDOW SWITCH

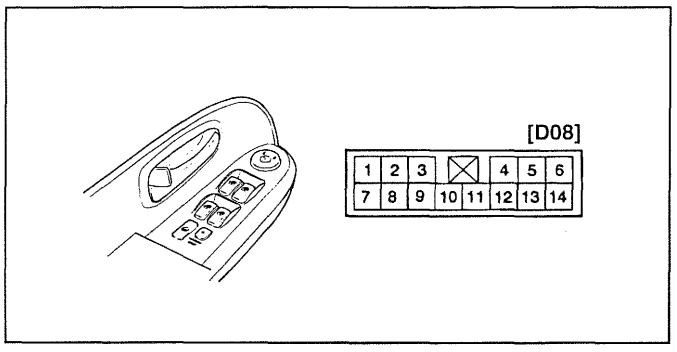
INSPECTION ETHA1950

1. Remove the power window main switch from the door trim panel.
2. Operate the switch, and check for continuity between the terminals.
3. If continuity is not as specified, replace the switch.

[D08]

Position \ Terminal	FRONT LEFT				FRONT RIGHT				REAR LEFT				REAR RIGHT			
	5	6	10	11	2	4	10	11	9	10	11	12	7	8	10	11
UP	○		○	○	○		○	○	○	○	○		○		○	
OFF	○	○	○		○	○	○		○	○		○	○	○	○	
DOWN		○	○	○		○	○	○	○		○	○		○	○	○

ETDA035C



ETHA195A

DOOR LOCK SWITCH [D08]

Position \ Terminal	10	13	14
LOCK	○		○
OFF			
UNLOCK	○	○	

ETHA035D

WINDOW LOCK SWITCH [D08]

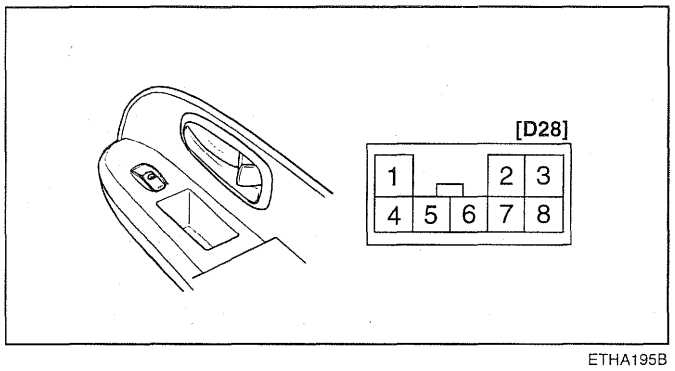
Position \ Terminal	1	11
NORMAL	○	○
LOCK		

ETHA035E

POWER WINDOW SUB SWITCH [D28]

Terminal / Position	1	2	3	5	7
UP	○	○	○		○
OFF	○	○	○	○	
DOWN	○		○	○	○

ETHA035F



ETHA195B

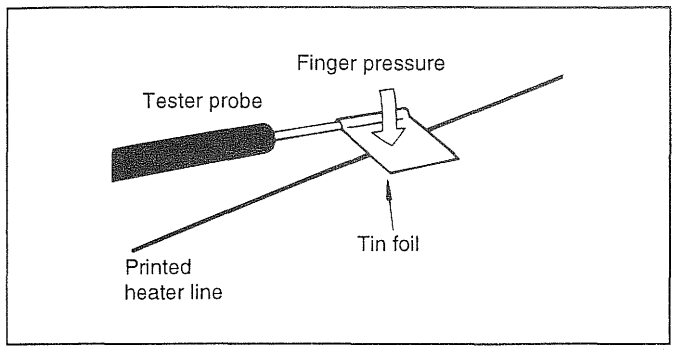
REAR WINDOW DEFOGGER

REAR WINDOW DEFOGGER PRINTED HEATER

INSPECTION ETA91650

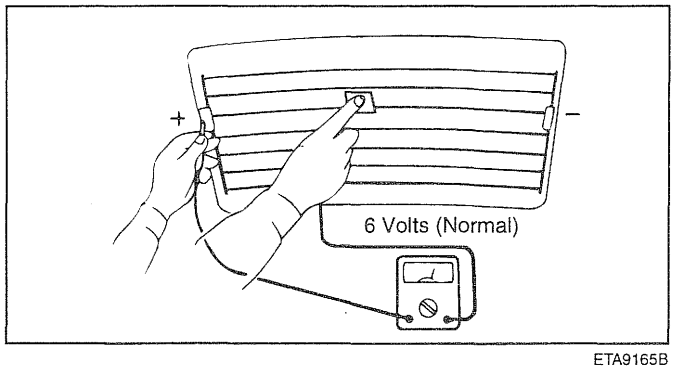
CAUTION

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.



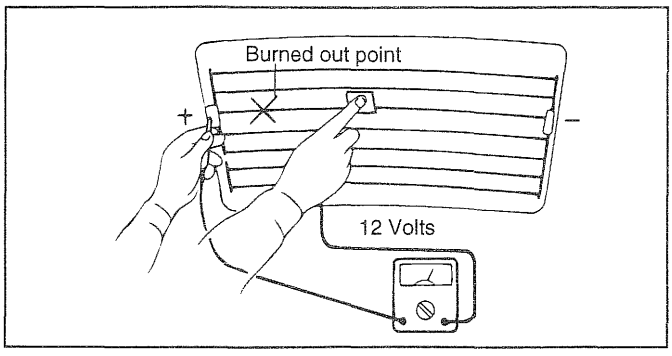
ETA9165A

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.



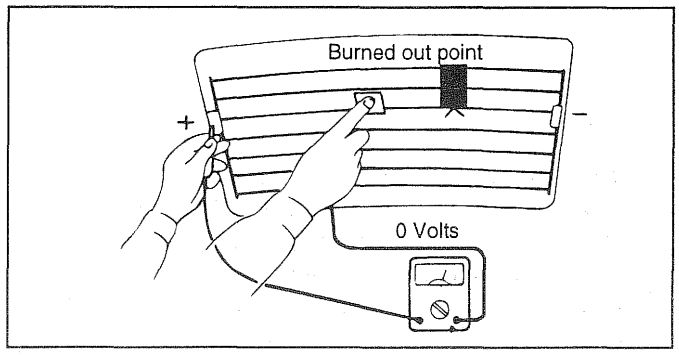
ETA9165B

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



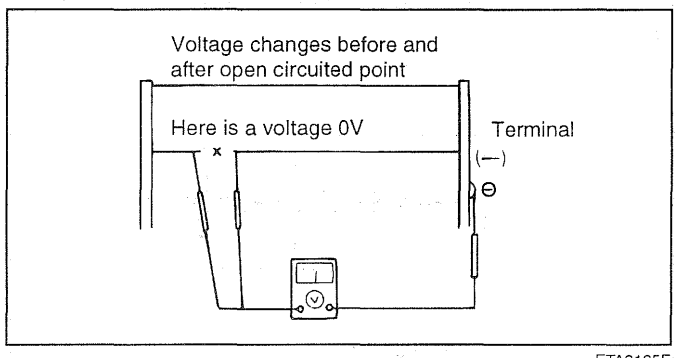
ETA9165C

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



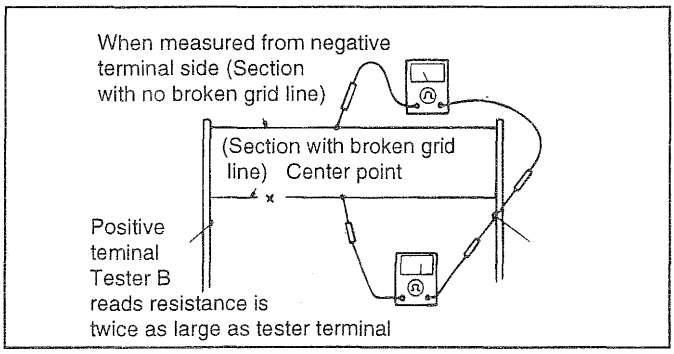
ETA9165D

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-circuited 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 after another. The section involving a broken heater line indicates resistance twice as that in other section. In the affected section, move the test lead to a position where resistance sharply changes.



ETA9165F

REPAIR OF BROKEN HEATER LINE

Prepare the following items:

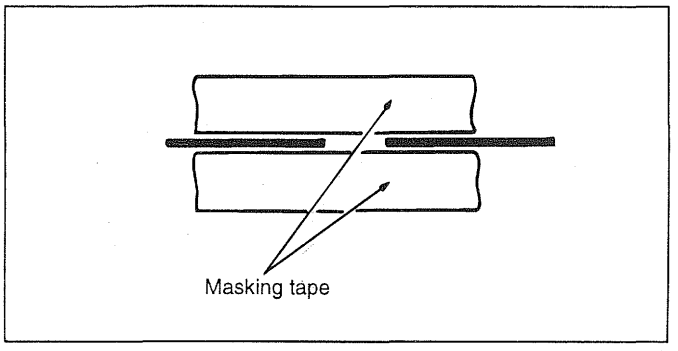
1. Conductive paint.

2. Paint thinner.
3. Masking taps.
4. Silicone remover.
5. 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 completely dried. (allow 24 hours).

CAUTION

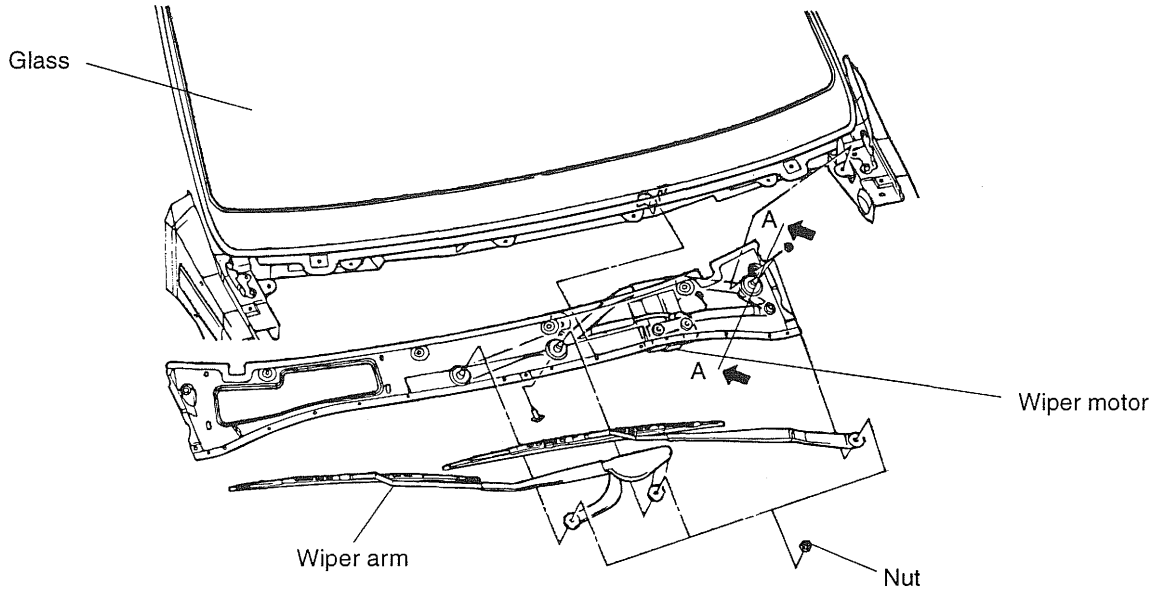
After repairing, clean the glass with a soft dry cloth or wipe along the grid line with a slightly moistened cloth.



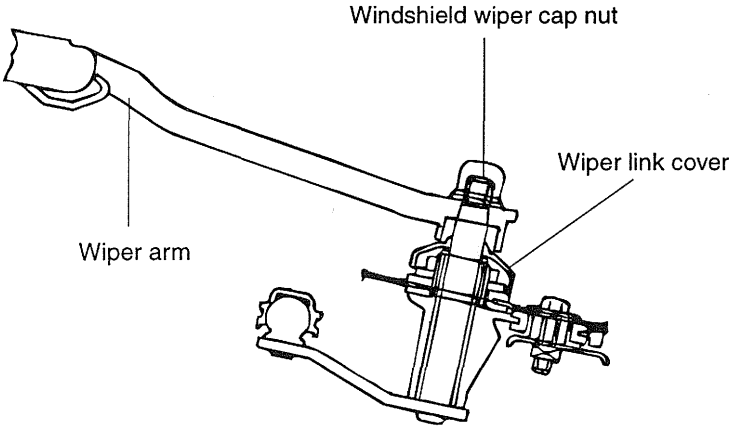
ETA9165G

WINDSHIELD WIPER/WASHER

COMPONENTS ETHA2300



ETHA065A



ETHA065B

SECT. A-A

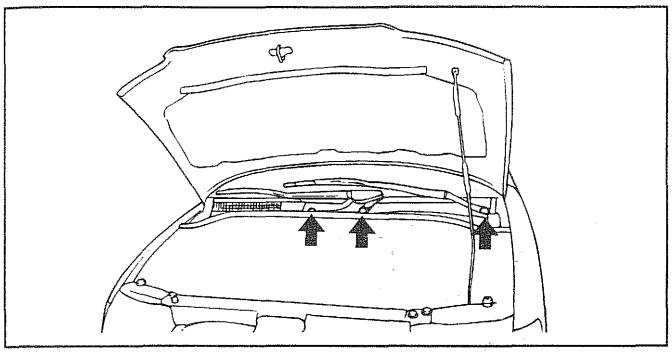
ETHA230A

REMOVAL ETHA2350

1. Remove the windshield wiper arm and blade.

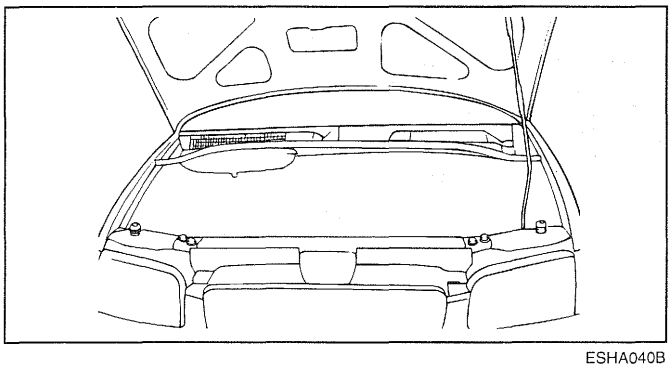
NOTE

Care must be taken not to scratch the engine hood.



ESHA040A

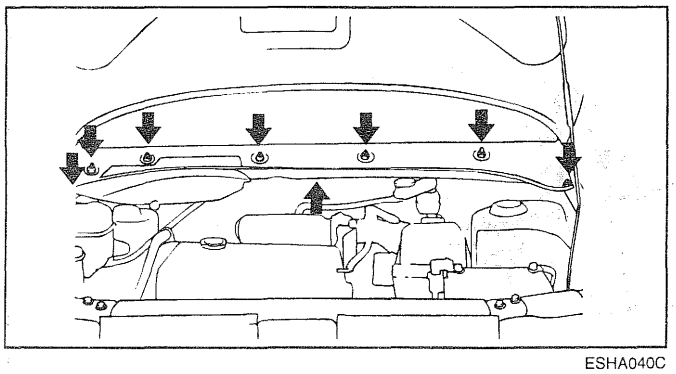
2. Remove the cowl top cover.



ESHA040B

3. Disconnect the windshield wiper motor connector and remove the windshield wiper motor and the link.

Tightening torque : 7-11Nm (70-110kg.cm, 5.1-8.0lb.ft)



ESHA040C

RAINSENSING WINDSHIELD WIPER SYSTEM ETHA3000

DESCRIPTION

The Rainsensing windshield wiper system is a wiper system that, in addition to providing normal wiper functions off, mist, manual low speed, manual high speed, and wash, provides automatic control of automatic int, automatic low, and automatic high speeds.

When the ignition key is in the ON position, the rainsensor will be activated.

OPERATING MODES

MULTIFUNCTION SWITCH POSITION	RAINSENSOR OPERATING MODE	SENSOR ACTION
MIST	MIST	Mist is controlled by the column switch. The sensor has no affect on this function.
OFF	OFF	If not already parked, wiper motor moves with low speed until blades are in the depressed park position.
AUTOMATIC Automatic mode has 5 sensitivity settings	AUTOMATIC	Automatic INT/speed control The sensitivity to raindrop accumulation on the windshield is set by the multifunction switch sensitivity adjustment.
LOW SPEED	MANUAL	Wiper motor runs continuously in low speed, for example 45 wipes/minute. The sensor has no affect on this function.
HI SPEED	MANUAL	Wiper motor moves continuously with high speed, for example 60 wipes/minute. The sensor has no affect on this function.
WASH When washer switch is turned on during 0.6 sec or more	WASH	If washer switch is turned on during 0.6 sec or more, the wiper operate during 2.5~3.8 sec
WASH When washer switch is turned on during 0.6 sec or less	WASH	If washer switch is turned on during 0.6 sec or less, the wiper operate only one time

1. **OFF MODE**

   With the wiper switch "OFF" and the ignition switch "ON", the rainsensor is considered to be in the "OFF" mode. In this mode, the sensor commands the wiper motor to be "OFF".

2. **AUTOMATIC MODE**

   When the multifunction switch is moved to auto position and the ignition switch is in the run or accessory positions, the rainsensor is considered to be in "automatic" mode. Once a single "instant wipe" has occurred, the wipers remain at "innerwipe/park" until the rainsensor determines that the dwell time at that position is appropriate for the amount of precipitation on the windshield, rainsensor provides input to the wiper motor to activate the wipers to clear the precipitation from the windshield.

3. **AUTOMATIC INT**

   For all automatic int. operations the rainsensor commands the wipers to operate in low speed for one wipe, followed by a variable dwell period in the inner wipe position.

4. **AUTOMATIC LOW**

   Automatic low speed operation is utilized when the amount of precipitation impinging on the windshield exceeds the automatic int to automatic low threshold. This threshold includes sufficient hysterisis to prevent cycling between automatic int and automatic low speed operation with a steady amount of precipitation accumulation on the windshield.

5. **AUTOMATIC HIGH**

Automatic high speed operation utilized when the amount of precipitation impinging on the windshield exceeds the automatic low to automatic high threshold. This threshold includes sufficient hysterisis to prevent cycling between automatic low and automatic high speed operation with a steady amount of precipitation accumulation on the windshield.

6. **WASH MODE**

The rainsensor monitors the multifunction switch to determine if the wash function is selected. Rainsensor enables the wiper motor to run in low speed during the wash mode and performs wipes from 2.5 to 3.8 sec.

7. **MANUAL MODE**

The rainsensor determines when a manual mode such as manual low, mist, off or manual high is selected. The column switch performs these modes and the rain sensor has no affect.

REPLACEMENT

The rainsensor module is mounted to the optocoupler using two snap fit stainless steel clips.

This allows the rainsensor module to be easily removed and replaced in the event of a rainsensor module failure.

If the windshield requires replacement, the existing rainsensor module may be unsnapped from the original windshield and reinstalled onto the new windshield. It is snap-fit to the new optocoupler, an integral portion of the replacement windshield as delivered by the replacement windshield manufacturer.

TROUBLESHOOTING

The rainsensor has two levels of fault detection as described below:

1. **FAULT A**

Fault A is indicated when the sensor has detected that the sensor servo operating point is above the expected limits. This is an indication of damage to the windscreen in the area of the coupler or the sensor has been removed from the coupler.

2. **FAULT B**

Fault B is indicated when the sensor has detected that it no longer is responding to rain signals.

This is an indication of damage to the windscreen in the area of the coupler or, more likely, that the sensor has detected an electrical failure within the sensor.

3. **ATTACHMENT GRADE VALUE**

Attachment grade is used to determine when a fault in A is detected. The attachment grade value is set at 140. This allows the product to operate in all conditions other than the most severe damage the windscreen.

4. **USE SENSITIVITY ADJUSTMENT TO INDICATE FAULT**

A method to indicate detected faults is available to a service garage technician by using the sensitivity input and the wipers as an indicator. The service method is described as follows:

- With ignition "ON", move the sensitivity adjustment to the high sensitivity setting.
- Decrease the sensitivity by one setting.
- If a wipe occurs, then Fault A has been detected and the service technician should assure that the coupler area on the windscreen is not damaged and the sensor is secured to the coupler.
- Decrease the sensitivity one more setting.
- If a wipe occurs, then Fault B has been detected and the sensor should be removed and replaced with a known good sensor.

CAUTION

When the ignition key is "ON" and the multifunction switch is in the auto position the wiper could operate in the following conditions.

- **Be careful not to touch the upper sensor front window glass.**
- **Be careful not to scrub the upper sensor front window glass with a cloth.**
- **Be careful not to vibrate the front window glass.**

WINDSHIELD WIPER/WASHER SWITCH ETHA2400

INSPECTION

Check the switch for continuity between the terminals.

WIPER AND INTERMITTENT VOLUME SWITCH [M26-2]

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

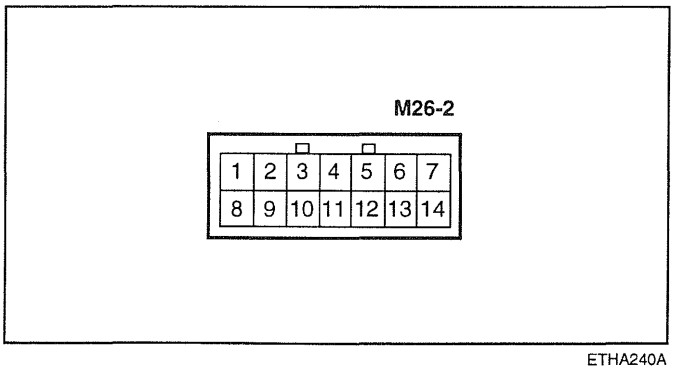
KTDA040D

WASHER SWITCH [M26-2]

Position \ Terminal	7	8
OFF		
ON	○	○

KTDA040E

If continuity is not as specified, replace the wiper and washer switch.

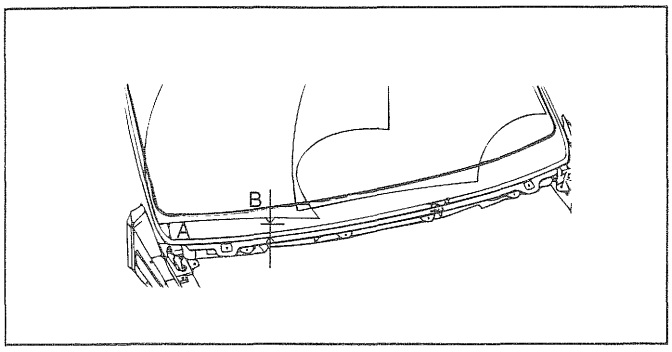


ETHA240A

INSTALLATION ETHA2550

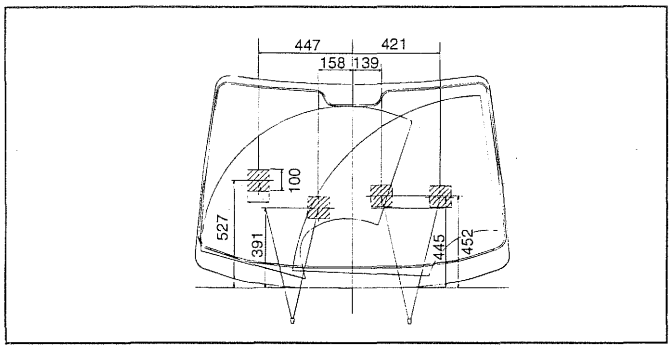
1. Install the wiper arm to the specified position.

Specified position	A	B
Distance (mm)	50	45



ETHA065C

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



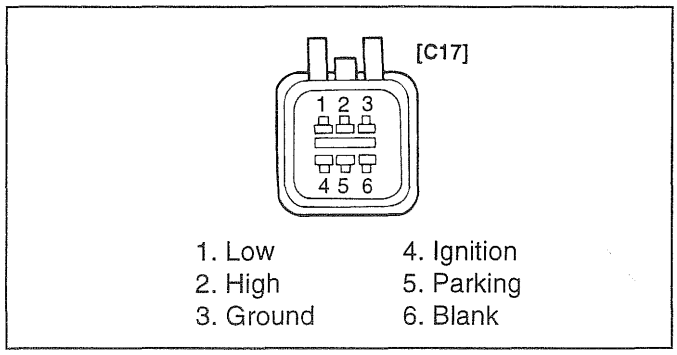
ETHA065D

FRONT WIPER MOTOR

INSPECTION ETHA2450

SPEED OPERATION CHECK

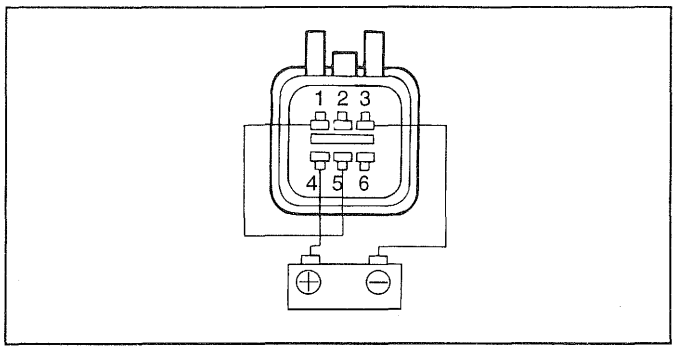
1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminals 4 and the negative (-) lead to terminal 1.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 2.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



ETHA245A

AUTOMATIC STOP OPERATION CHECK

1. Operate the motor at low speed.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 1.
3. Connect terminals 5 and 1.
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.



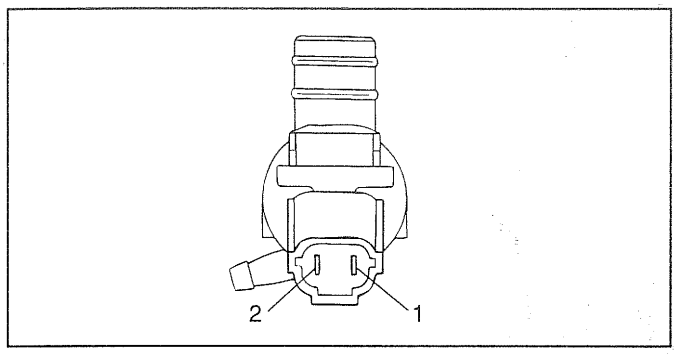
ETDA155B

FRONT WASHER MOTOR

INSPECTION ETA91800

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

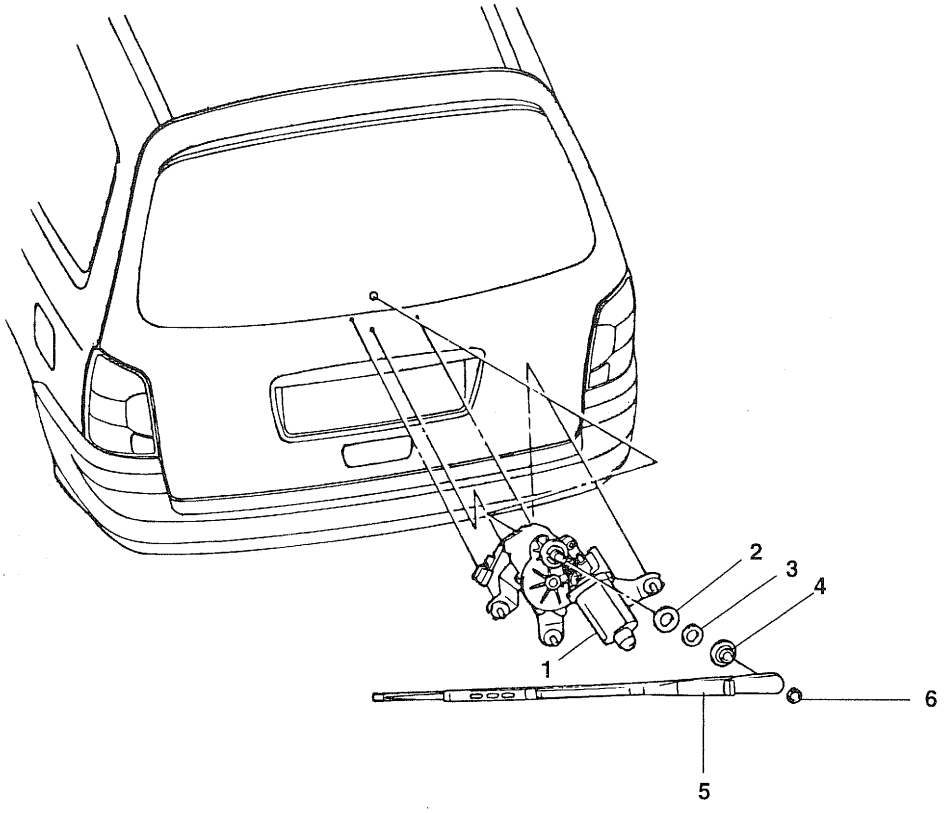
2. Connect positive (+) and negative (-) battery cables to terminals 2 and 1 respectively to see that the washer motor runs and water is pumped.

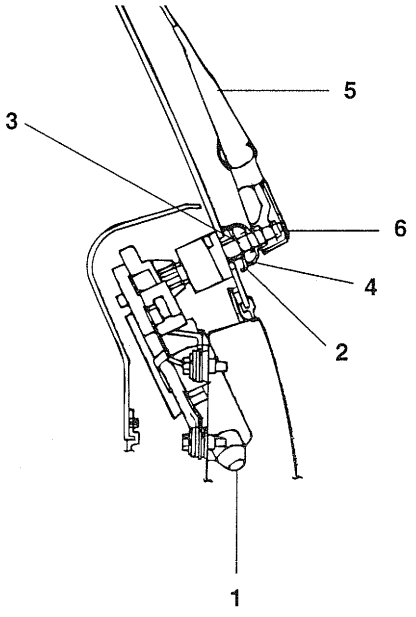


ETA9180A

REAR WIPER/WASHER

COMPONENTS ETHA2600





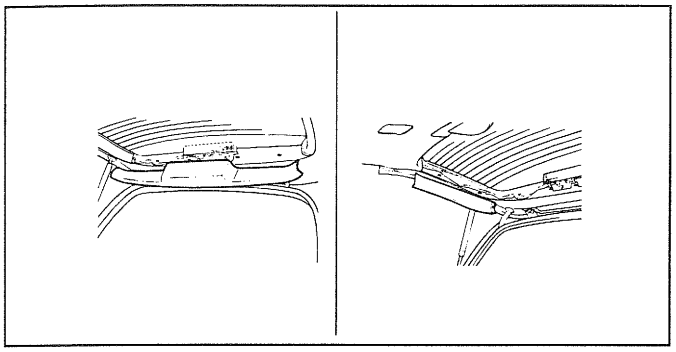
1. Rear wiper motor and link
2. Cap
3. Nut
4. Cover
5. Rear wiper arm and blade
6. Nut

ETHA260A

REAR WIPER MOTOR

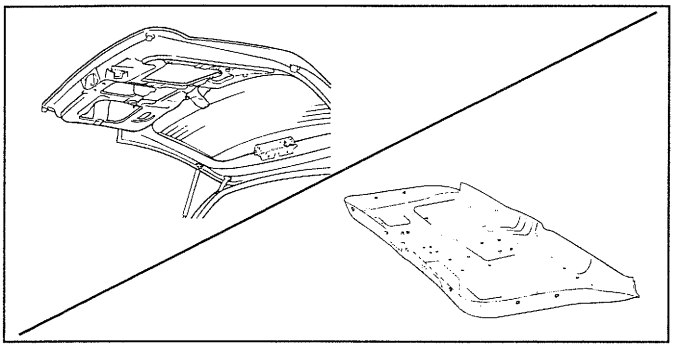
REMOVAL ETHA2650

1. Remove the tailgate frame upper and side trim.



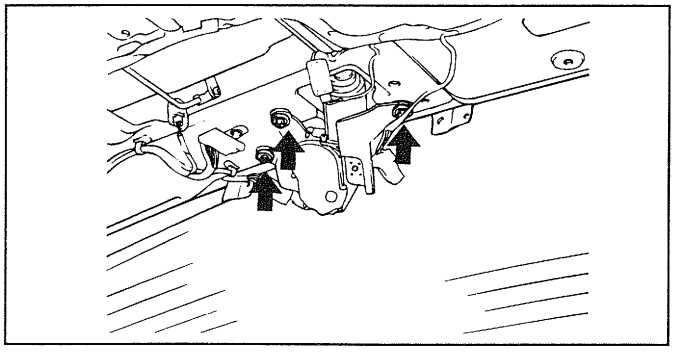
ETHA265A

2. Remove the tailgate trim panel.



ESHA010C

3. Remove the rear wiper motor.

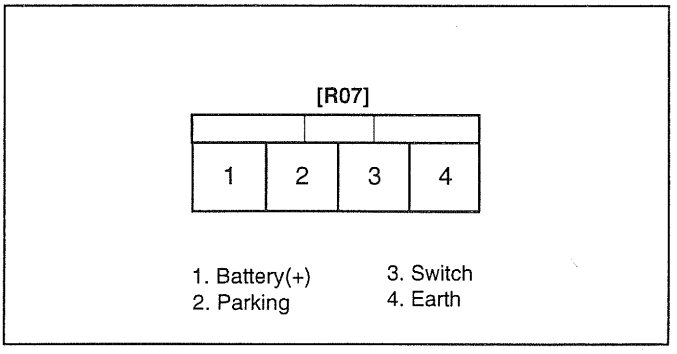


ESHA010J

4. Installation is the reverse of the removal process.

INSPECTION ETHA2700

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

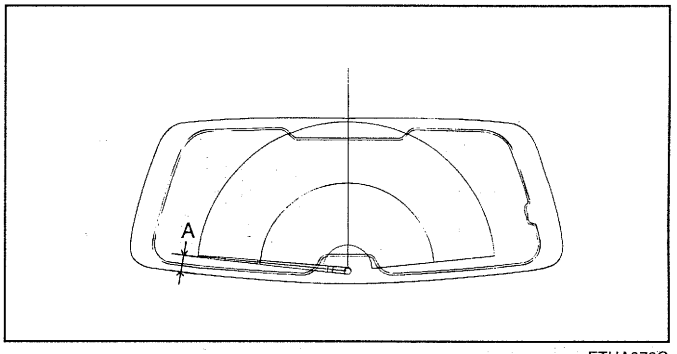


KTDA170A

INSTALLATION ETHA2800

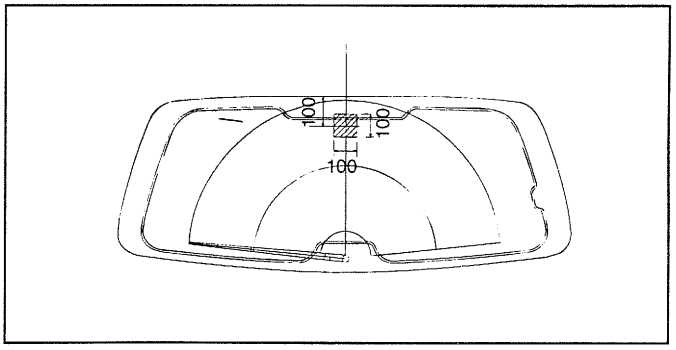
1. Install the rear wiper arm to the specified stop position.

Specified position	A
Distance	60mm



ETHA070C

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



ETHA070D

REAR WASHER SWITCH

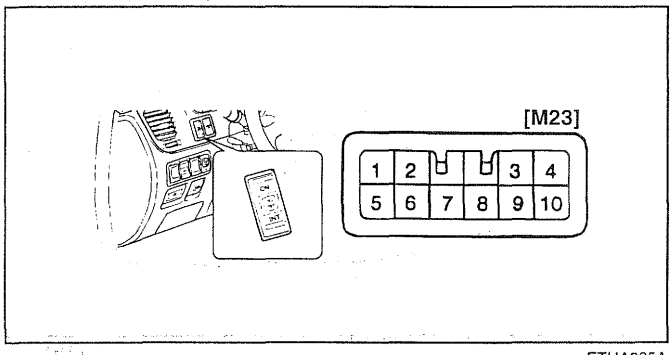
INSPECTION ETHA2850

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

[M23]

Mode		Terminal 1	2	3	4	6	9	10
Wiper switch	ON				○		○	
	OFF			○			○	
	INT				○	○		
Washer switch	ON				○			○
Illumination	Tail	○	○	○				

KTDA171C



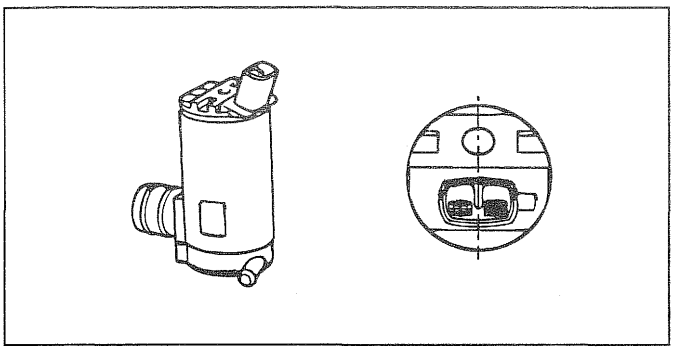
ETHA285A

REAR WASHER MOTOR

INSPECTION ETHA2750

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

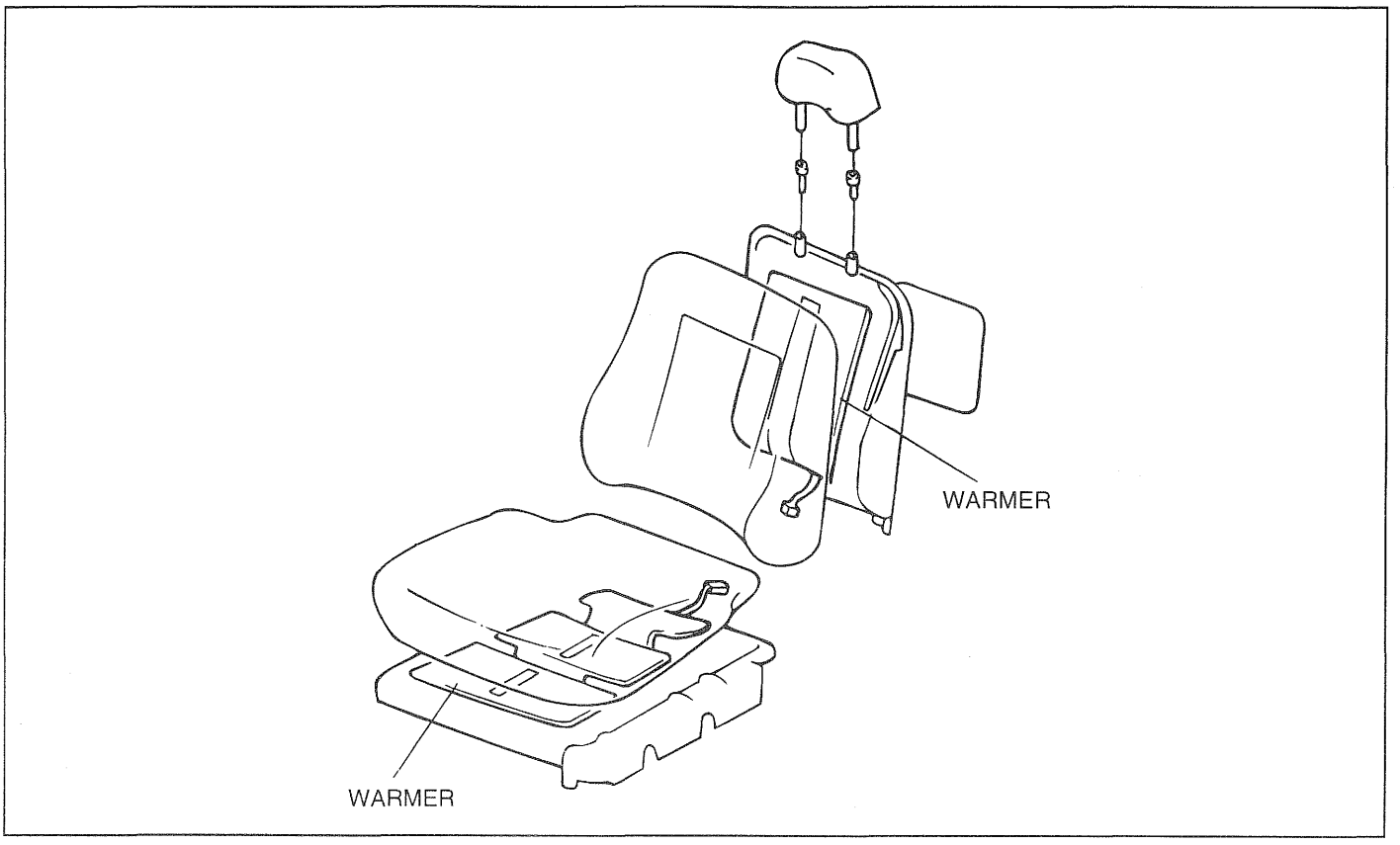
2. Connect positive(+) and negative(-) battery cables to terminals 1 and 2 respectively to see that the washer motor runs and water is pumped.



ETHA275A

SEAT WARMER

SEAT WARMER SYSTEM ETA92050



ETA9205A

SEAT WARMER SWITCH

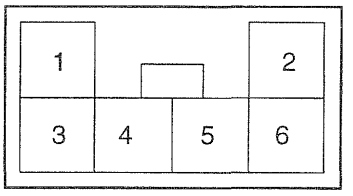
INSPECTION ETHA3250

Inspect the switch continuity between terminals as below.

Terminal / Switch position	1	2	3	4	5	6
ON	○		○		○	
OFF	○		○			

ETHA325A

Connector No : M145, M146



(Component Side)

ETHA325B

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

SUNROOF

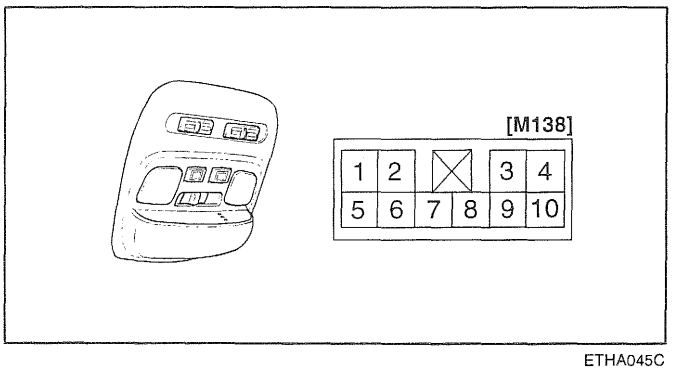
SUN ROOF SWITCH

INSPECTION ETHA3300

1. Using an ohmmeter, check for continuity between the terminals.
2. If the continuity is not as specified, replace the switch.

Condition		Terminal 1	2	3	4	5	6	7	8	9	10
Slide switch	Open		○	○							
	Close			○			○				
Tilt switch	Up			○		○					
	Down	○		○							

ETHA330A



ETHA045C

SUN ROOF RELAY

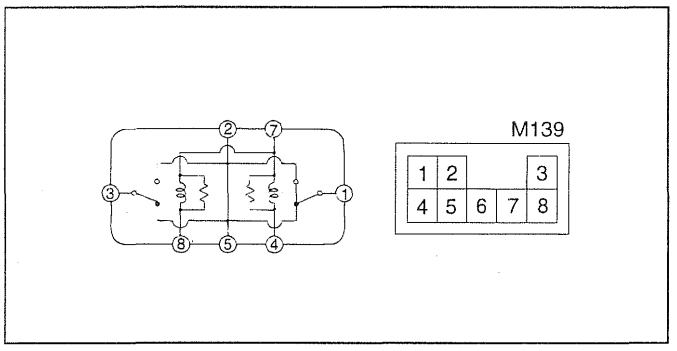
INSPECTION ETHA3350

Check for continuity between the terminals.

Terminal / Position	1	2	3	4	5	6	7	8
Battery voltage not supplied (coils not energized)	○		○	○	○		○	○
Battery voltage supplied (coils energized)	○	○		⊖			⊕	
		○	○				⊕	⊖

⊕---⊖ **Indicates battery connection**

ETHA335A

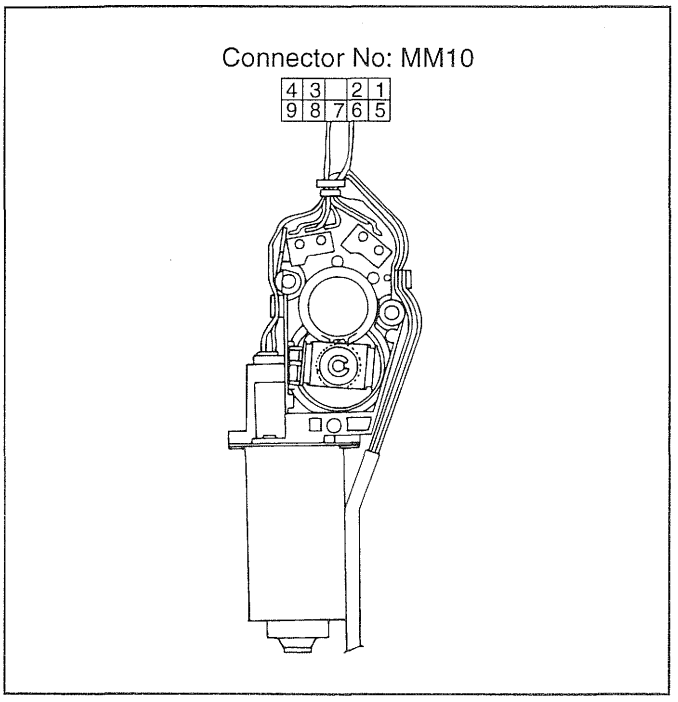


ETHA130A

SUN ROOF MOTOR

INSPECTION ETHA3400

1. Remove the overhead console lamp.
2. Disconnect the motor connector from sun roof harness.
3. After applying DC 12V to the terminal 8, apply the terminal 3 to the ground.
4. Check that the motor turns in the direction of the sunroof when tilted down and is open.
5. Reverse the connections and check that the motor turns in the direction when the sunroof is closed and tilted up.



ETAA215B

HEAD LAMPS

LIGHTING SYSTEM ETHA2900

PRE-AIMING INSTRUCTIONS

The headlamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacture's instructions.

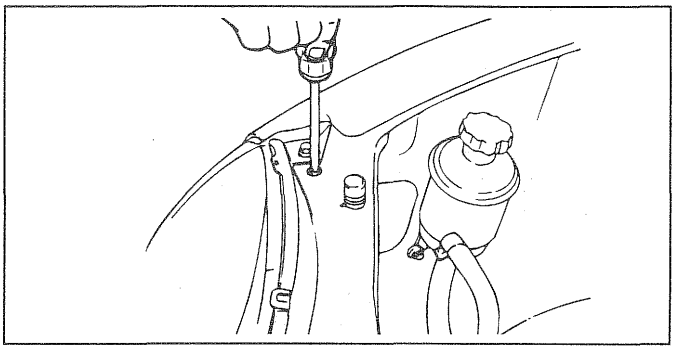
NOTE

If there are any regulations pertinent to the aiming of headlamps in the area where the vehicle is to be used, adjust to as to meet those requirements.

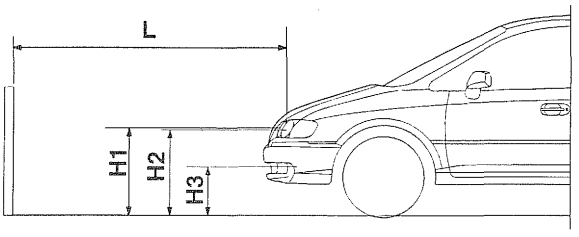
Alternately turn the adjusting bolts to adjust the headlamp aiming. If beam-setting equipment is not available, proceed as follows:

1. Inflate the tires to the specified pressure and remove the load from the vehicle except a driver, spare tire, and tool.
2. The vehicle should be placed on the flat floor.
3. Draw vertical lines (Vertical lines passing through respective headlamp centers) and a horizontal line (Horizontal line passing through center of headlamps) on the screen.
4. With the headlamp and battery in normal condition, aim the headlamps.

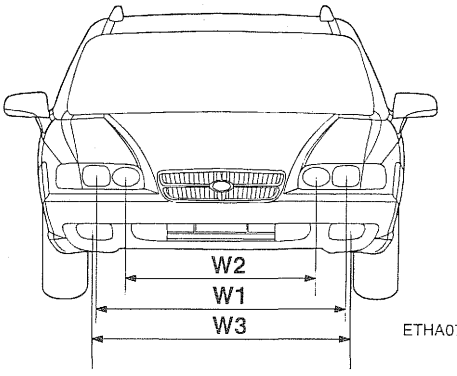
   Make the vertical and horizontal adjustment of the lower beam to the standard values by using the adjusting knobs.



ETA9230A



ETHA075B



ETHA075A

H1 : Height between the head lamp bulb center and ground (low beam)
H2 : Height between the head lamp bulb center and ground (high beam)
H3 : Height between the fog lamp bulb center and ground

W1 : Distance between the head lamp bulb center (low beam)
W2 : Distance between the head lamp bulb center (high beam)
W3 : Distance between the fog lamp bulb center

ETHA290A

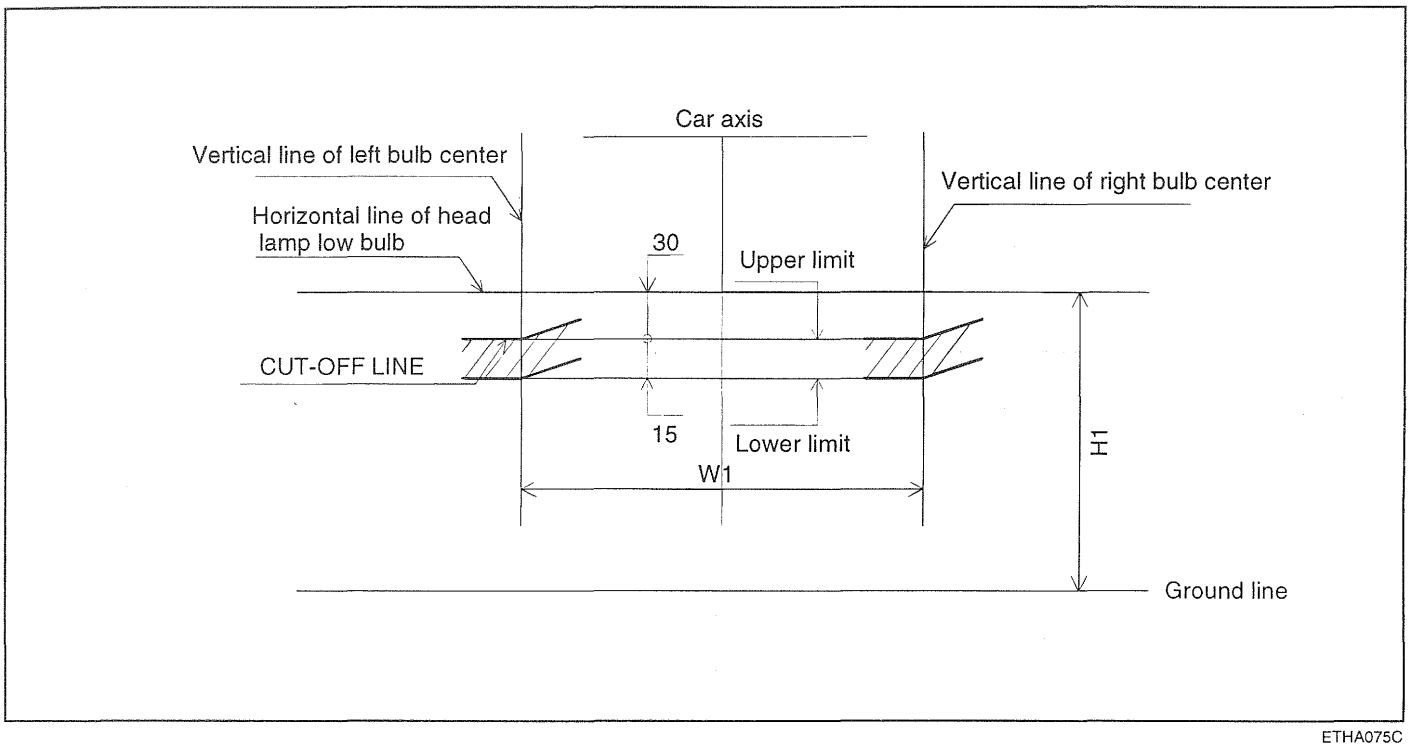
HEAD LAMP AND FOG LAMP AIMING POINT

Unit : mm

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	700	694	365	1,254	978	1,270	3,000
With driver	685	679	350				

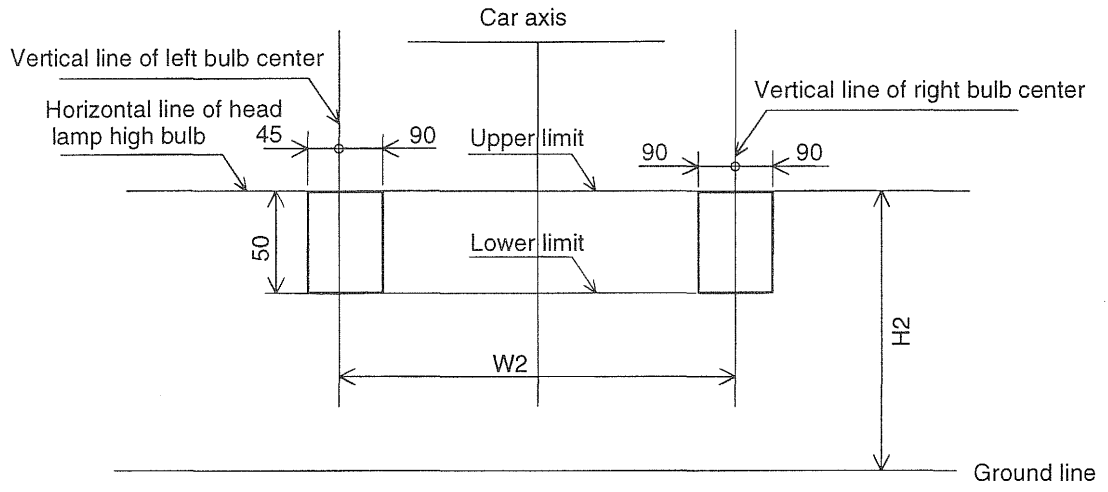
ETHA290B

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



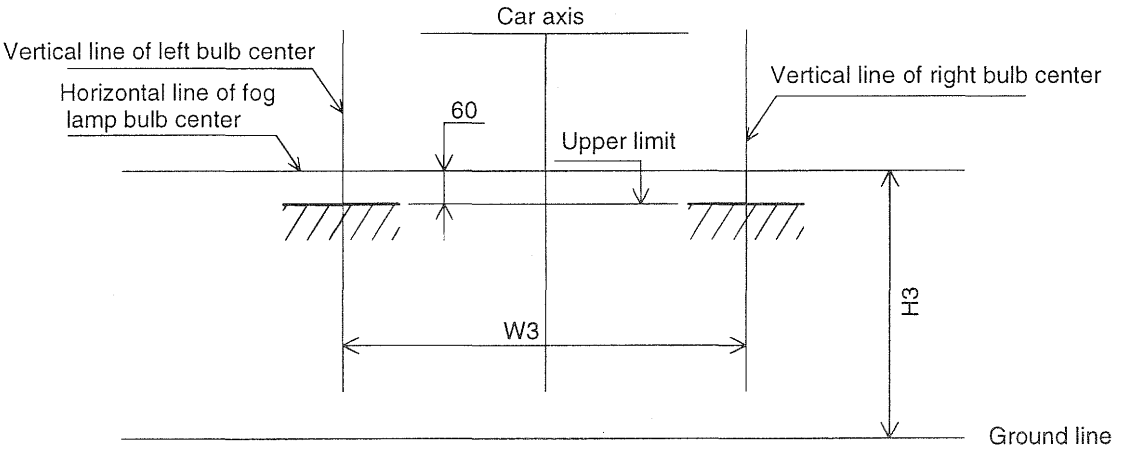
ETHA075C

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



ETHA075D

- Turn the front fog lamp on without driver. The cut-off line is projected in the allowable range.



ETHA075E

HEAD LAMP RELAY ETHA3050

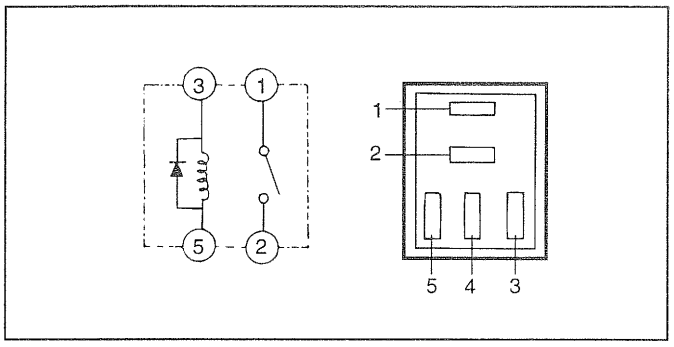
INSPECTION

1. Pull out the headlamp relay from the relay box in the engine compartment.
2. Check for continuity between terminals.

Terminal / Position	1	2	3	5
When de-energized			○—○	
When energized	○—○		⊕	⊖

NOTE:
1. ○—○: Indicates that there is continuity between the terminals.
2. ⊖—⊕: Indicates that power is supplied.

ETHA305A



ETDA211B

AUTO LIGHT CONTROL MODULE ETHA2950

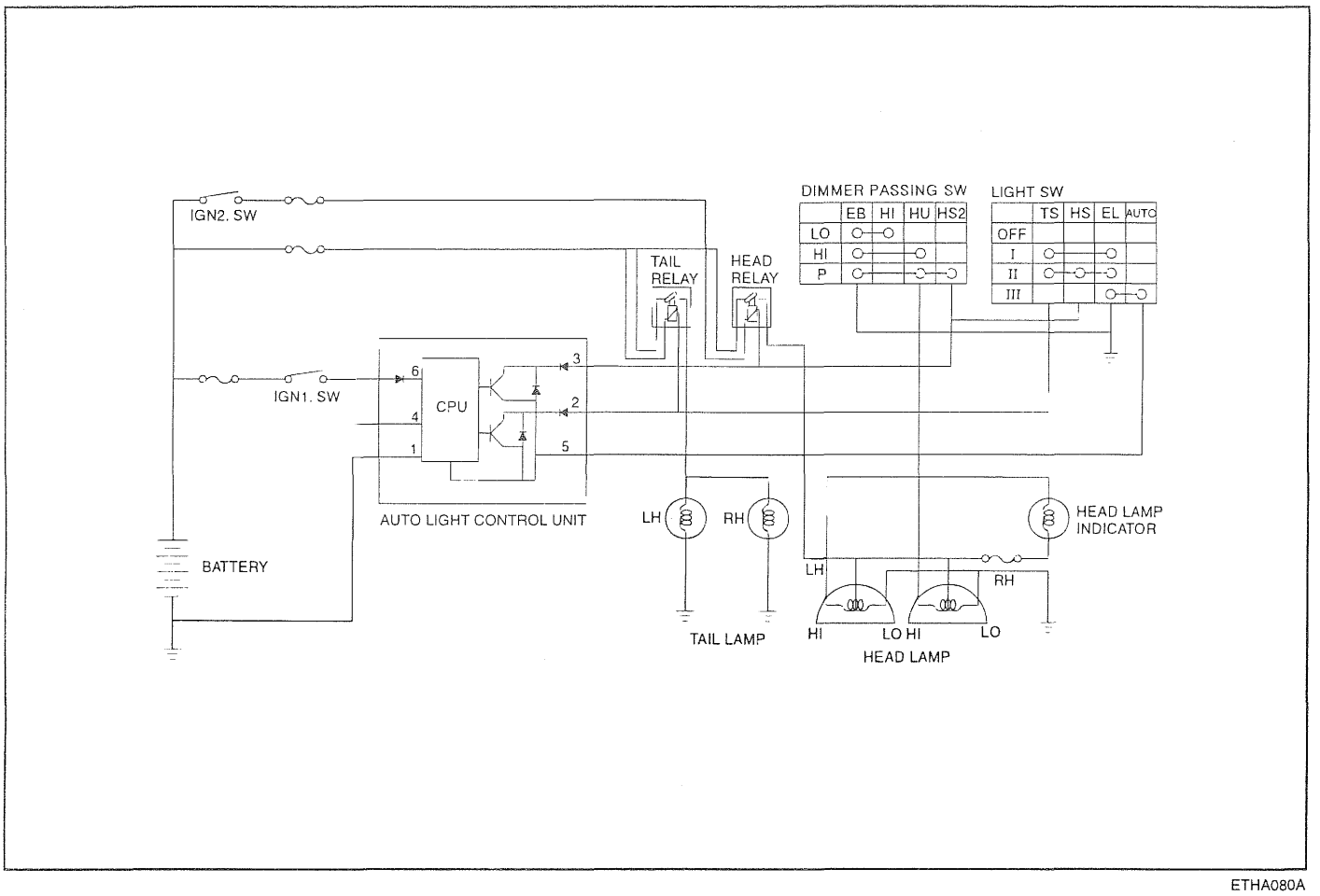
DESCRIPTION

The auto light control system operates by using the auto light switch, and turns the head lamp and tail lamp on or off automatically in accordance with the detection illumination.

SPECIFICATIONS

Items	Specifications
Rated voltage	DC 12V
Operating voltage	DC 9V~16V
Load	Max. 200mA (Relay)
Operating temperature range	-30°C~+80°C

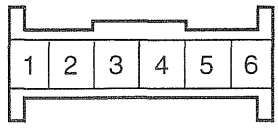
CIRCUIT DIAGRAM



ETHA080A

PIN CONNECTION

[M65]



1. Ground
2. Tail lamp relay
3. Head lamp relay
4. Detection illumination input
5. Auto light switch
6. IGN. switch

Terminal	Voltage
1	Earth
2	5V(Normal), 0V(Tail lamp relay)
3	12V(Ignition ON)
5	5V(Normal), 0V(Switch ON)
6	12V(Ignition ON)

ETHA295A

DETECTION ILLUMINATION

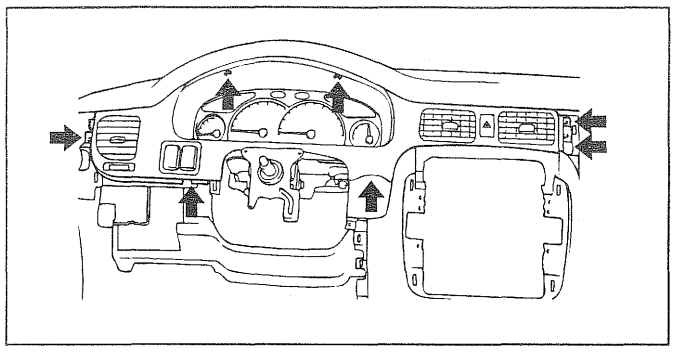
TYPE	CONDITION	TAIL LAMP	HEAD LAMP
Non solar glass	ON	50.8±3(LUX)	13.6±1.4(LUX)
	OFF	99.4±6(LUX)	25.9±3(LUX)
Solar glass	ON	23.8±3(LUX)	5.7±1.4(LUX)
	OFF	46.7±3(LUX)	12.2±1.4(LUX)

TURN/HAZARD LAMPS

TURN/HAZARD SWITCH

INSPECTION ETHA3100

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel.
3. Disconnect the connector from the hazard lamp switch.



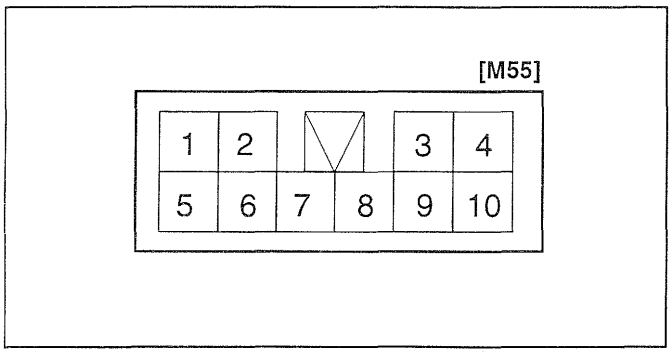
ESHA040V

4. Operate the switch and check for continuity between terminals by using an ohmmeter.

[M55]

Position \ Terminal	1	2	3	5	6	7	8	9	10
OFF		●	●	●			●		
ON					●	●	●	●	●

KTDA213C

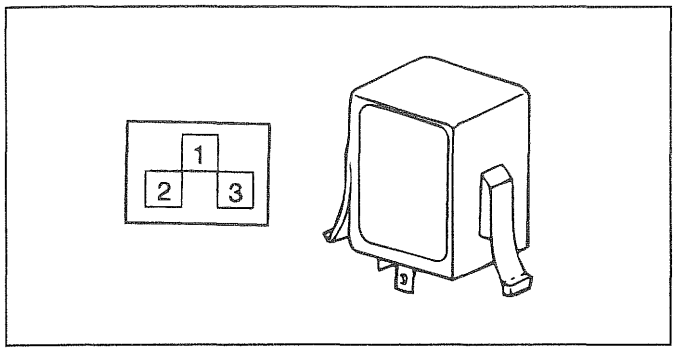


KTDA213B

FLASHER UNIT

INSPECTION ETHA3150

1. Remove the flasher unit from the relay box.
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 parallel to each other to terminals 2 and 3. 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.

COURTESY AND TRUNK LAMPS

OVERHEAD CONSOLE LAMP

INSPECTION ETHA2100

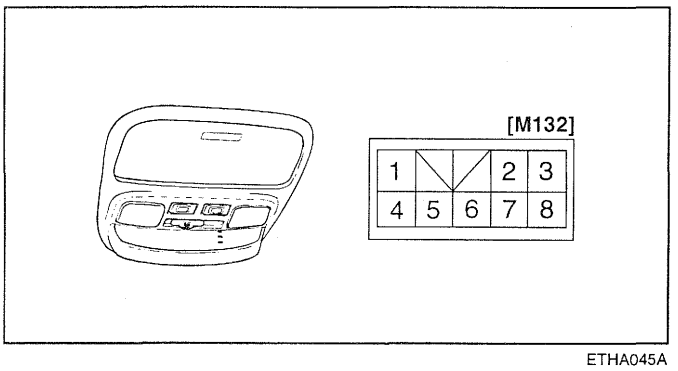
Remove the overhead console lamp and check for continuity between the terminals.

- VEHICLES WITHOUT SUNROOF

[M132]

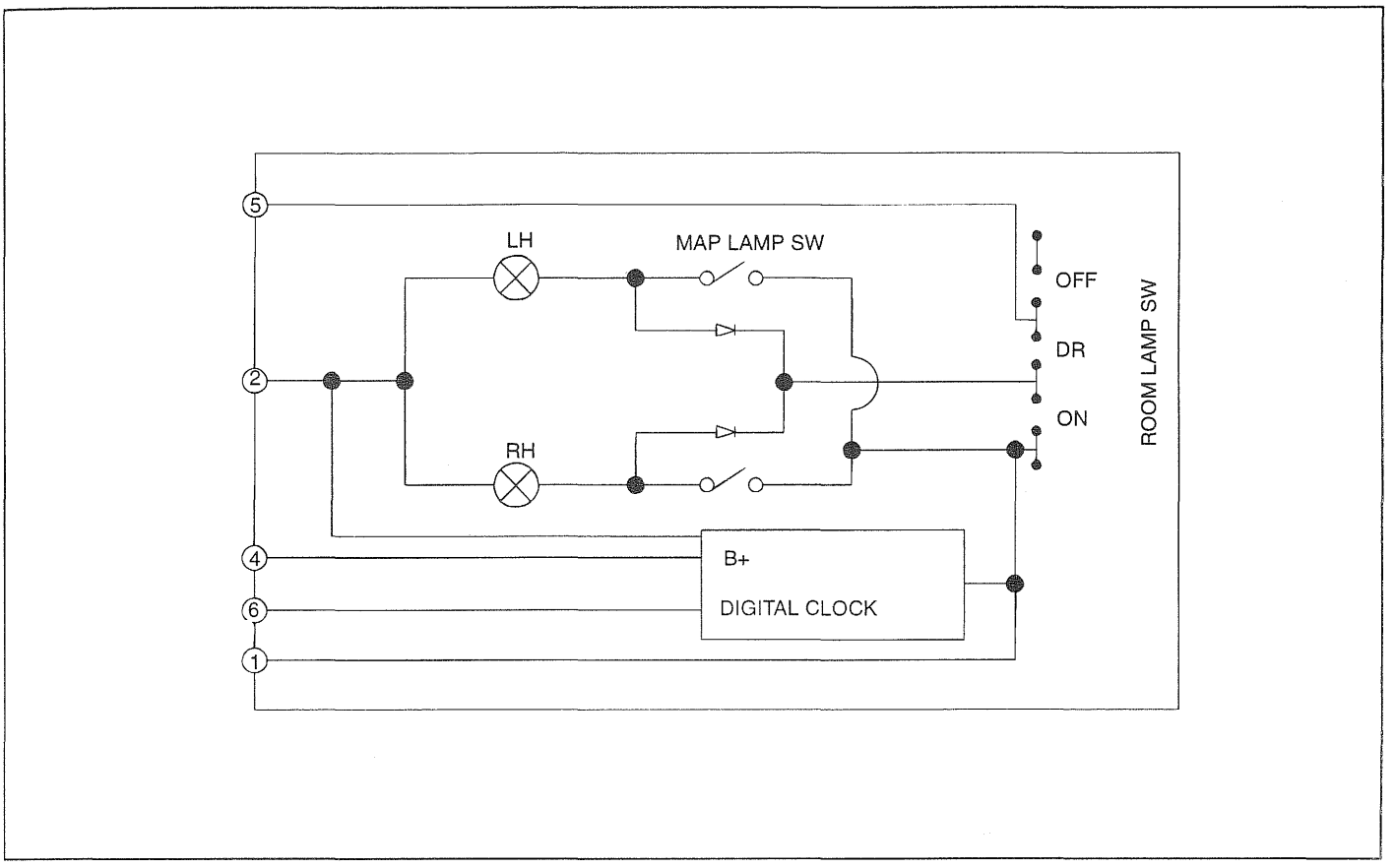
Sort / Position / Terminal	ROOM LAMP SWITCH			MAP LAMP SWITCH			
				LH		RH	
	ON	DR	OFF	ON	OFF	ON	OFF
1	○			○		○	
2	○	○					
5		○		○		○	

ETHA045E



ETHA045A

CIRCUIT DIAGRAM ETHA2150



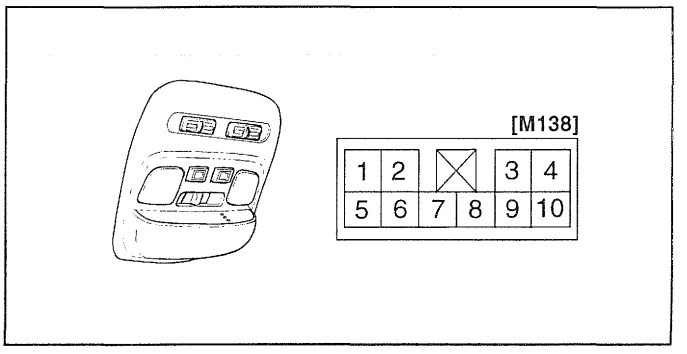
ETHA045B

- VEHICLES WITH SUNROOF

[M138]

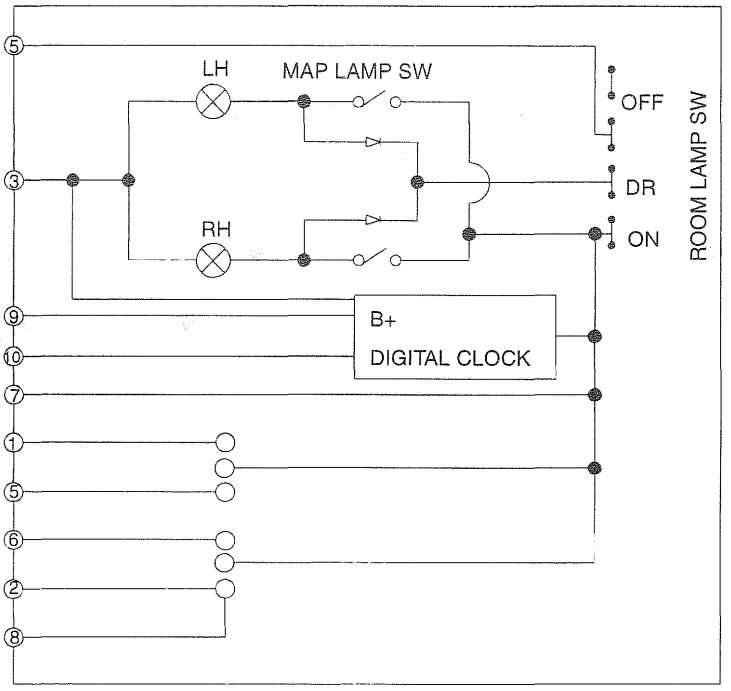
Sort / Position / Terminal	ROOM LAMP SWITCH			MAP LAMP SWITCH			
	ON	DR	OFF	LH		RH	
				ON	OFF	ON	OFF
3	○	○		○		○	
4		○					
7	○			○		○	

ETHA045F



ETHA045C

CIRCUIT DIAGRAM ETHA2200



ETHA045D

IMMOBILIZER CONTROL SYSTEM

IMMOBILIZER SYSTEM ETHA3450

DESCRIPTIONThe immobilizer system is an anti-theft device which enables starting to be possible only when the mechanical and wireless secret codes are aligned simultaneously.

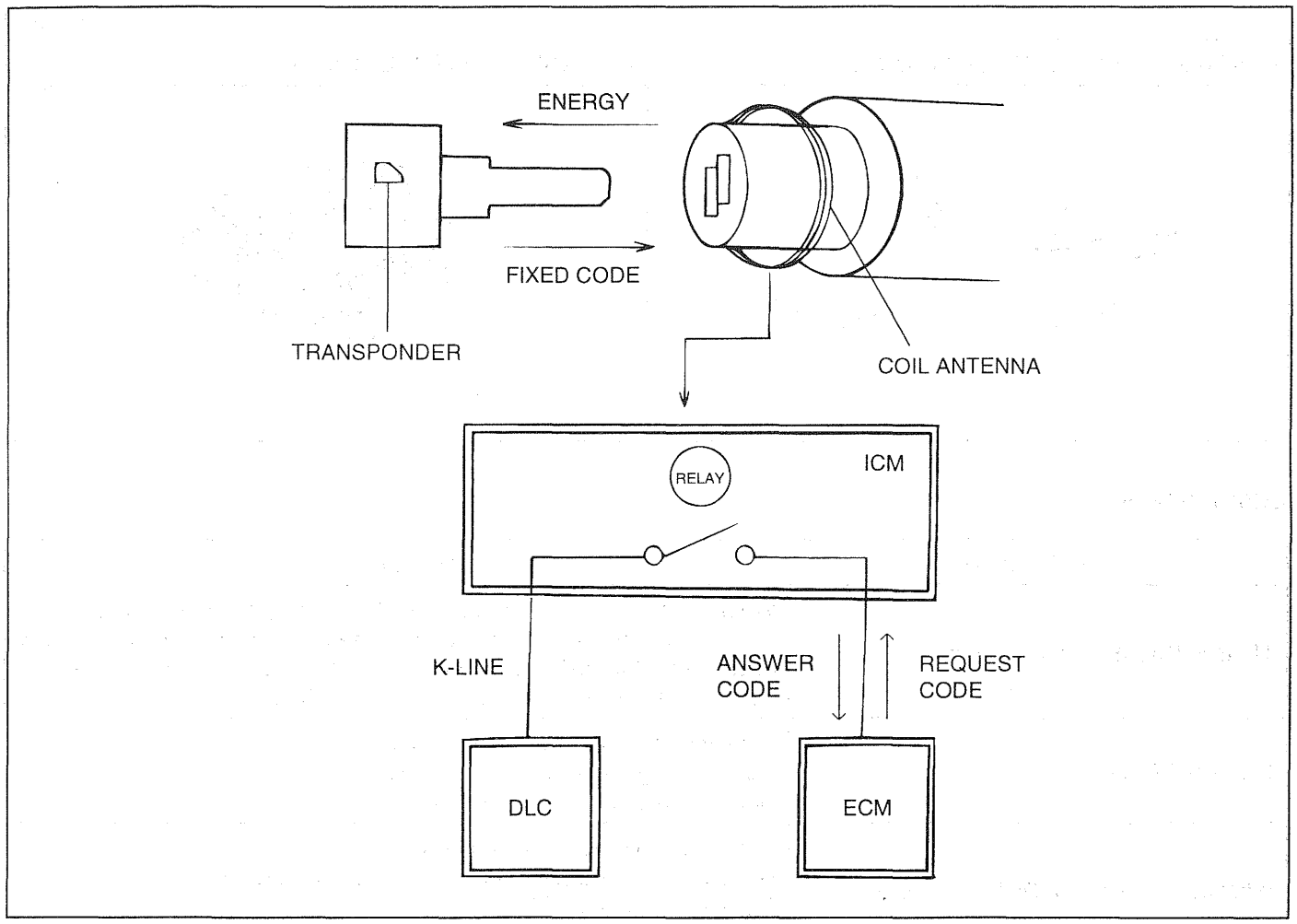
The transponder built in the ignition key signals its unique frequency code and at this time the ICM compares it with the memorized code.

When the codes are aligned, the ICM sends signals to the ECM so that starting is possible.

ICM : Immobilizer Control Module

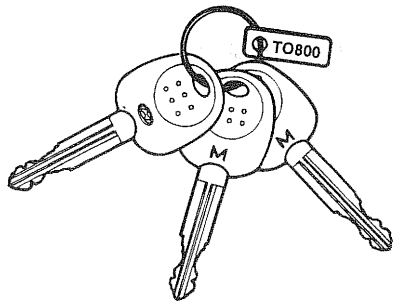
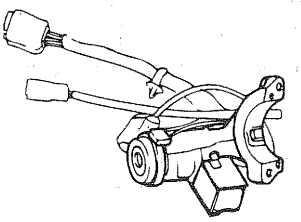
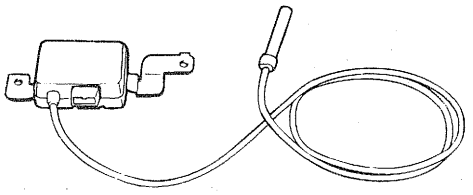
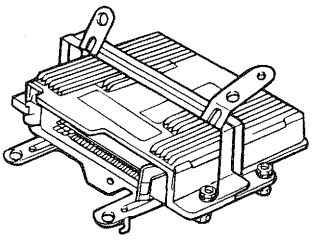
ECM : Engine Control Module

SYSTEM BLOCK DIAGRAM



B6BE705A

COMPONENT

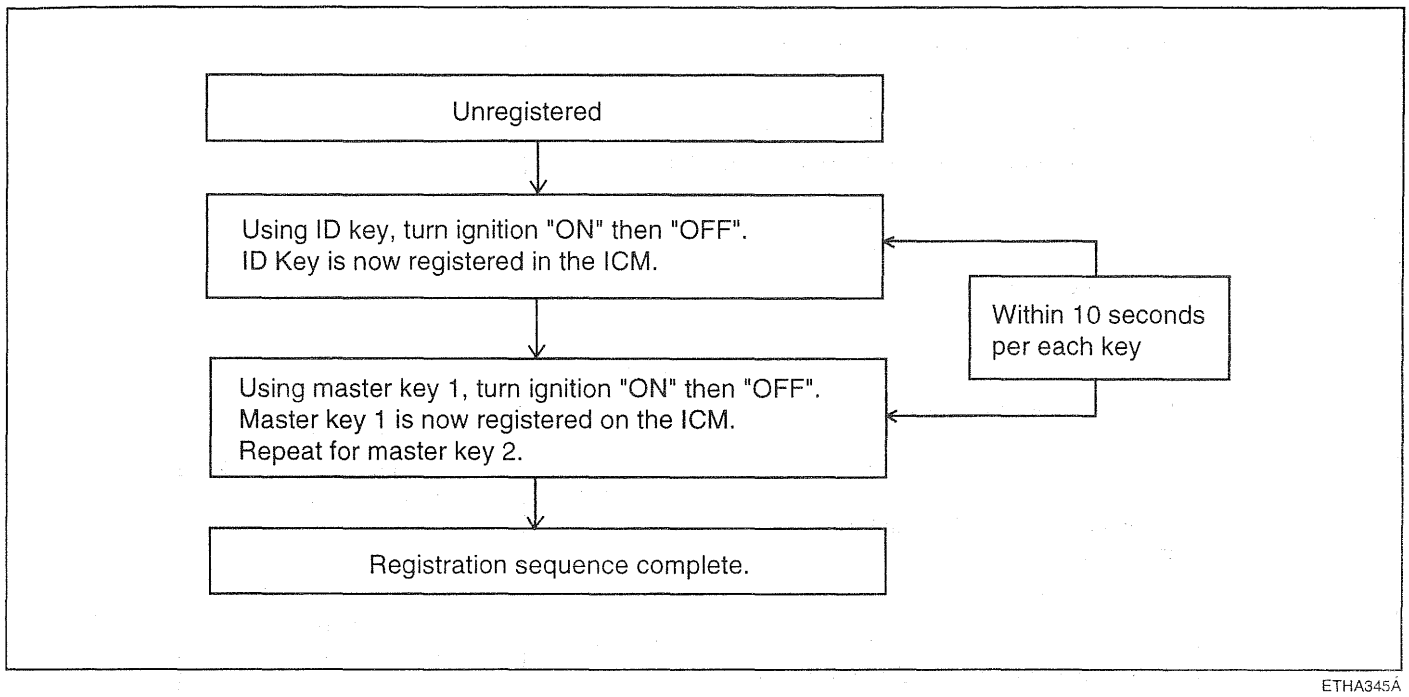
A. TRANSPONDER KEY	B. COIL ANTENNA
 B880B01A	 B6BE225C
C. IMMOBILIZER CONTROL MODULE	D. ENGINE CONTROL MODUEL
 B6BE710D	 B6BE710E

DESCRIPTION

COMPONENT		DESCRIPTION
TRANSPONDER (built-in keys)		When ignition is "ON", the coil supplies energy to the transponder, which in turn accumulates energy in the condenser. Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE.
COIL ANTENNA		Supplies energy to the transponder. Receives signal from the transponder. Sends transponder signal to the ICM.
IMMOBILIZER CONTROL MODULE		Supplies power to the coil antenna. Receives and analyzes signal from the coil antenna. Transmits signal to ICM Stores VIN which composes of the ID CODE and password.
ENGINE CONTROL MODULE		With the ignition "ON", the ECM receives information from the ICM and permits injection to take place.
KEYS	ID KEY	Must be used first to register the unique ID CODE in the ICM. This ID CODE is then recorded into the master keys.
	MASTER	Once the ID CODE is recorded into the MASTER KEY, this key is for general use.
DATA LINK CONNECTOR		By connecting the voltmeter or HI-SCAN, control module diagnostic code can be read.

KEY REGISTRATION

1. **ID Code registration sequence**

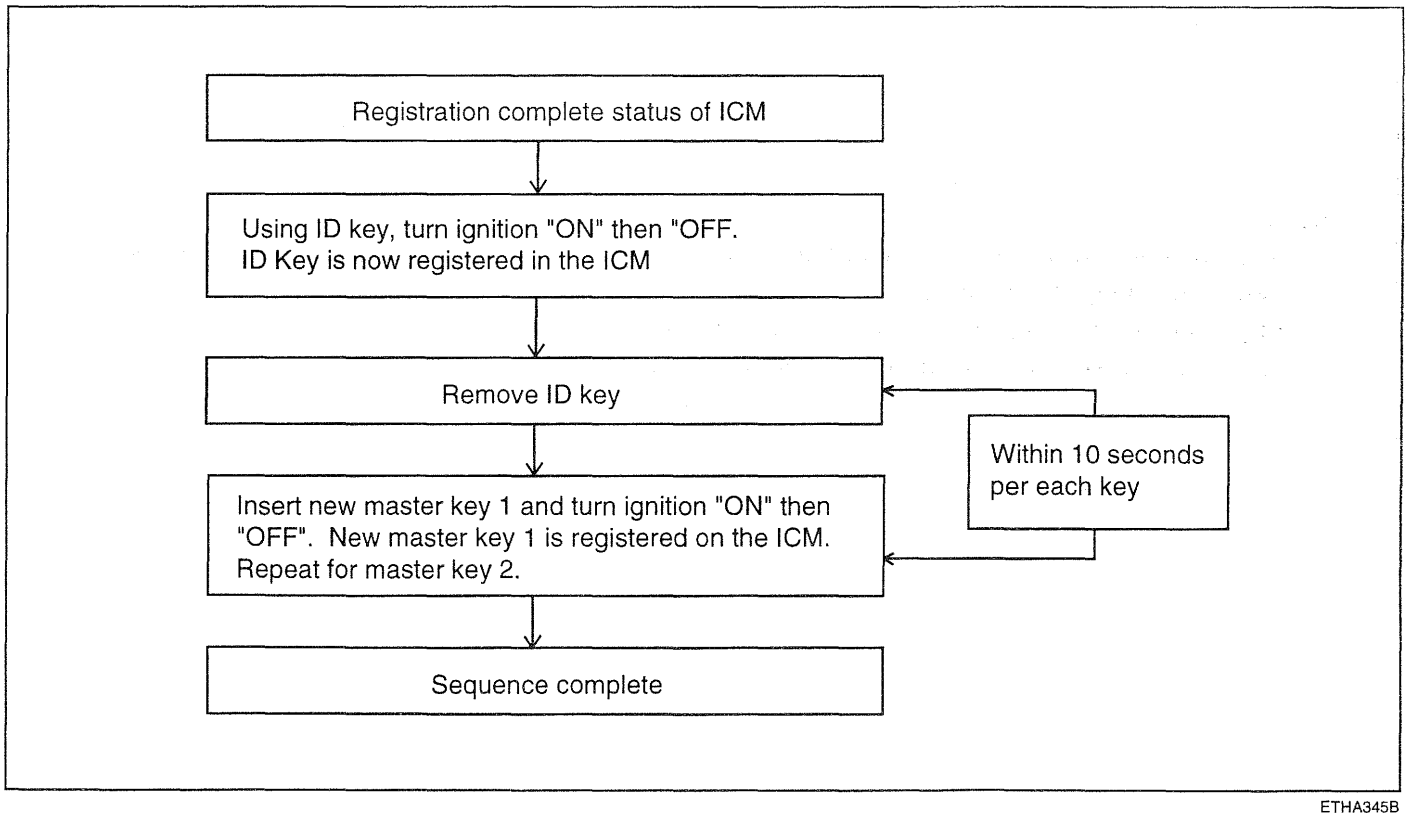


ETHA345A

2. **Master key correction**

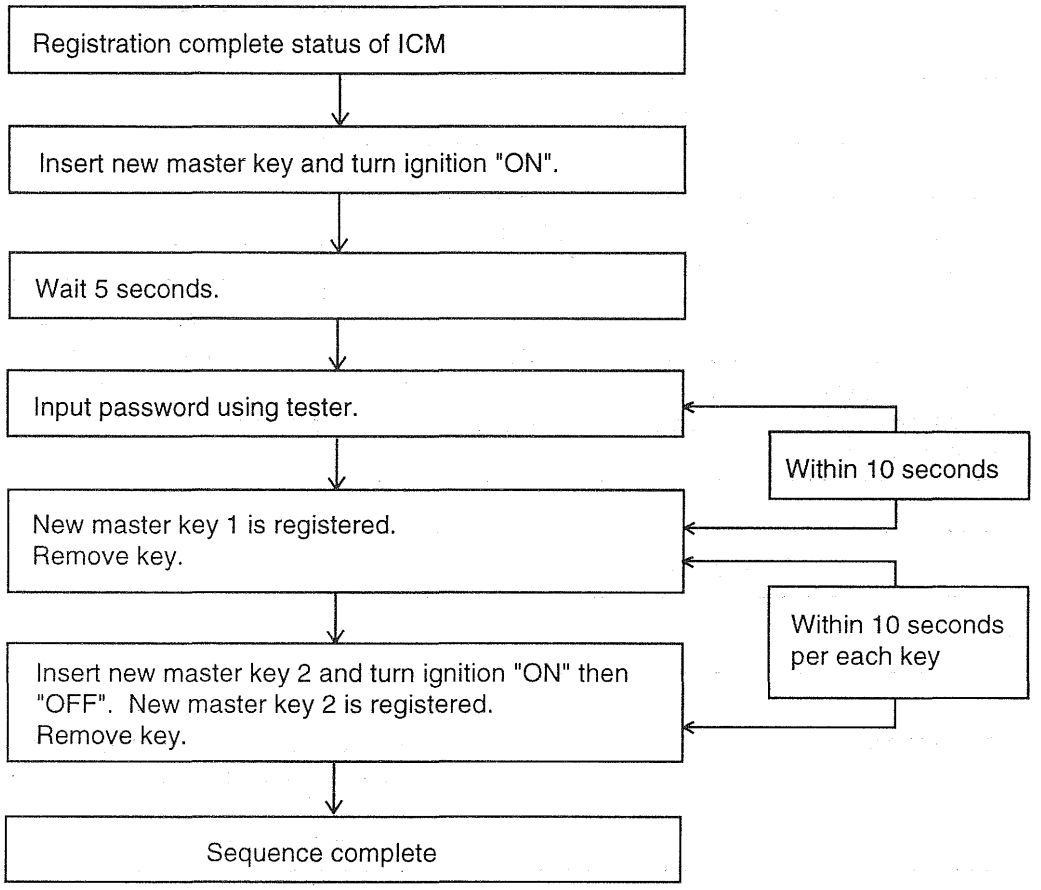
If a new set of master keys needs to be produced, it can be done by two methods:

a. Using ID key



ETHA345B

b. Using password



NOTE

- **Once the password is mis-registered, it is impossible to register new password during 10 seconds regardless of ignition ON/OFF.**
- **When the master 3 keys have been registered, the codes for existing master keys are all cleared.**
- **The password should consist of 4 numbers among ten (0~9) numbers.**

ETHA345C

Body Electrical System

GENERAL

INSTRUMENTS AND WARNING SYSTEM ETHA0010

SPECIFICATIONS

Warning lamps		Bulb wattage (W)	Color
Illumination		3.4	Beige
High Beam		3.0	Blue
Low fuel		3.0	Amber
Turn signal (LH, RH)		1.4	Green
Battery (Charge)		1.4	Red
Oil pressure		1.4	Red
Air bag		1.4	Red
Parking brake		1.4	Red
Seat belt		1.4	Red
Check engine		1.4	Amber
ABS		1.4	Amber
Door ajar		1.4	Red
Tailgate open		1.4	Amber
Cruise		1.4	Green
Fog lamp		1.4	Green
Immobilizer		1.4	Amber
A/T	P	1.4	Green
	R	1.4	Amber
	N	1.4	Green
	D	1.4	Green
	3	1.4	Green
	2	1.4	Green
	L	1.4	Green

SERVICE SPECIFICATIONS ETHA0050

Speedometer

Type

o Cross coil type.

Input spec.

o Hall IC type : 4 pulses/rev.

Indication

o Km : At 637 rpm x 4 pulses/rev. indicate 60 Km/h

o MILE : At 1026 rpm x 4 pulses/rev. indicate 60 MPH

Standard values

Velocity (Km/ h)	20	40	60	80	100	120
Tolerance (Km/ h)	20-24.1	40-43	60-64.1	80-85.2	100-105.2	120.5-126.3
Tolerance (Km/ h)	20.8-25.4	40-44	60.8-65.4	81.4-86.8	102.6-108.2	123.5-129.6

Velocity (Km/ h)	140	160	180	200	Remarks
Tolerance (Km/ h)	140.5-146.7	160.5-167.5	181-188.4	201-209.1	EXCEPT, EEC & GENERAL
Tolerance (Km/ h)	144.4-151	165.4-172.4	186.3-193.8	207.2-215.2	EEC, GENERAL

Velocity (MPH)	10	20	40	60	80	100
Tolerance (MPH)	10-12.5	20-22	40-42.6	60-63.4	80.3-84.1	100.3-104.7
Tolerance (MPH)	8.5-11.5	18.5-21.5	38.5-41.5	58.3-61.7	78-82	97.7-102.3

Velocity (MPH)	120	Remarks
Tolerance (MPH)	120.3-125.3	EXCEPT USA
Tolerance (MPH)	117.5-122.5	USA

o Must tap the speedometer with hand to prevent hysterisis effects when inspected.

Tachometer

Type

o Cross coil type. (4 cyl: 2pulses/ rev, 6 cyl: 3pulses/ rev)

Standard values

Revolution(RPM)	1000	2,000	3,000	4,000	5,000	6,000	7,000
Tolerance(RPM)	±100	±125	±150	±200	±250	±300	±350

o Must tap the tachometer with hand to prevent hysterisis effects when inspected.

Fuel gauge

Type

o Cross coil type (Fixed point type : Pointer should not fall into the "E" point but indicate remaining fuel level when IG. off).

Standard values

Level	Gauge Resistance (Ω)	Tolerance assembled with fuel sender (°)
E (Empty)	95	$-40^{+2.4}_{-2.2}$
1/2	32.5	0±5.3
F (Full)	7	40±3.5

o Inspection order : E→ F→ E
The indications must be read at least 7 minutes after the input of the datum resistance value to each measuring point.

o Point stabilty tolerance : Within 9°
Apply the power for 10 minutes. Then turn off the power source for 30 minutes and read the position of the pointer.

ETHA005A

<table>
<tr><th>Items</th><th>Specifications</th></tr>
<tr><td>Temperature gauge
Type
Indication standard

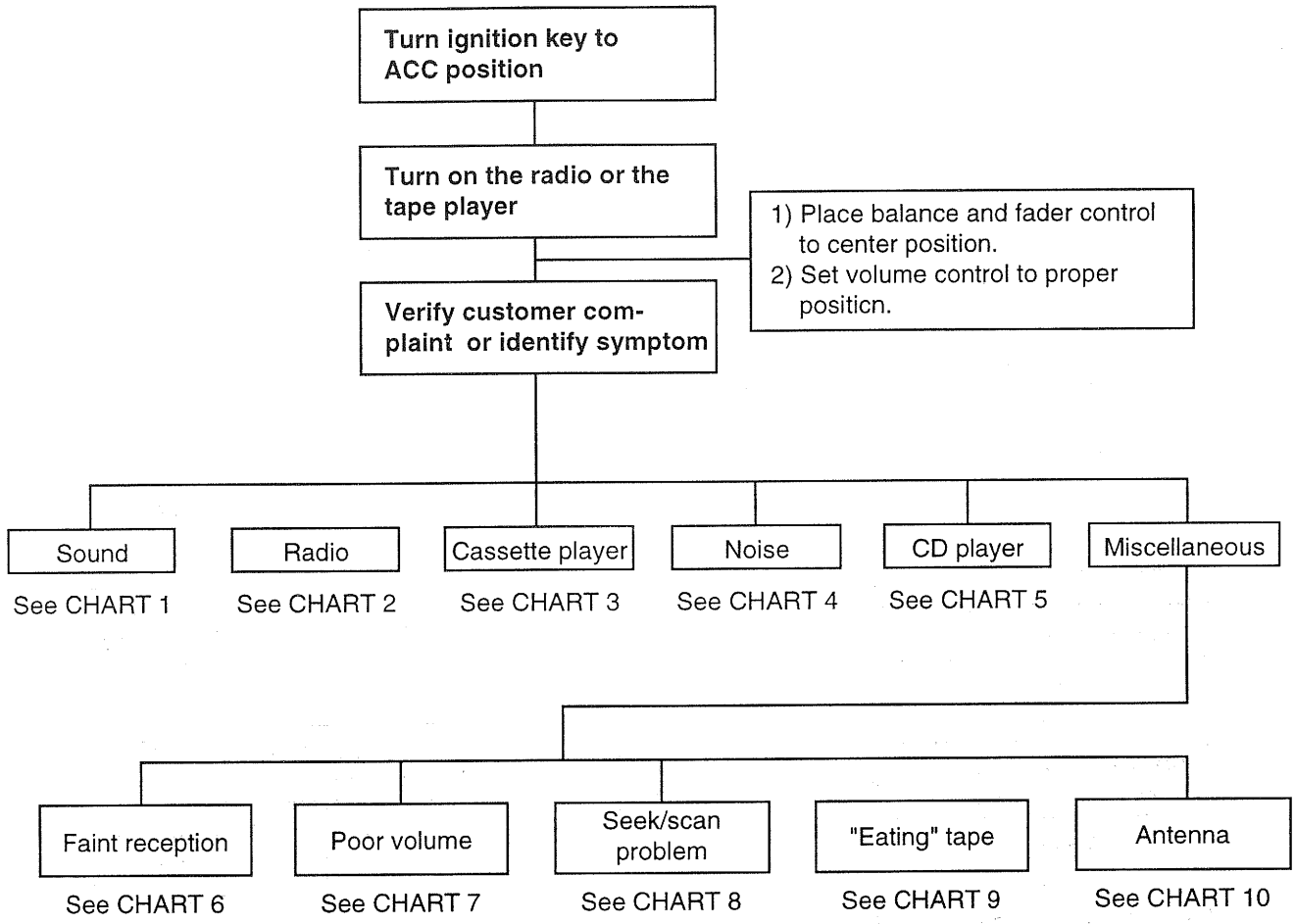
Resistance of temperature sender</td><td>
o Cross coil type (Intermedia stability type).
<table>
<tr><th>Temperature</th><th>Angle (°)</th><th>Assembled tolerance (°C)</th></tr>
<tr><td>55°C</td><td>-40</td><td>-</td></tr>
<tr><td>85°C~110°C</td><td>-7^{+2}_{-3}</td><td>-7^{+3}_{-2}</td></tr>
<tr><td>Red zone (over 125°C)</td><td>over 35±5</td><td>35^{+7}_{-4}</td></tr>
</table>
o Inspection order : OFF→C→H
<table>
<tr><td>Temperature (°C)</td><td>55</td><td>85</td><td>110</td><td>125</td></tr>
<tr><td>Resistance (Ω)</td><td>157</td><td>48.4</td><td>24</td><td>15.2</td></tr>
</table>
</td></tr>
</table>

ETHA005B

TROUBLESHOOTING ETHA0100

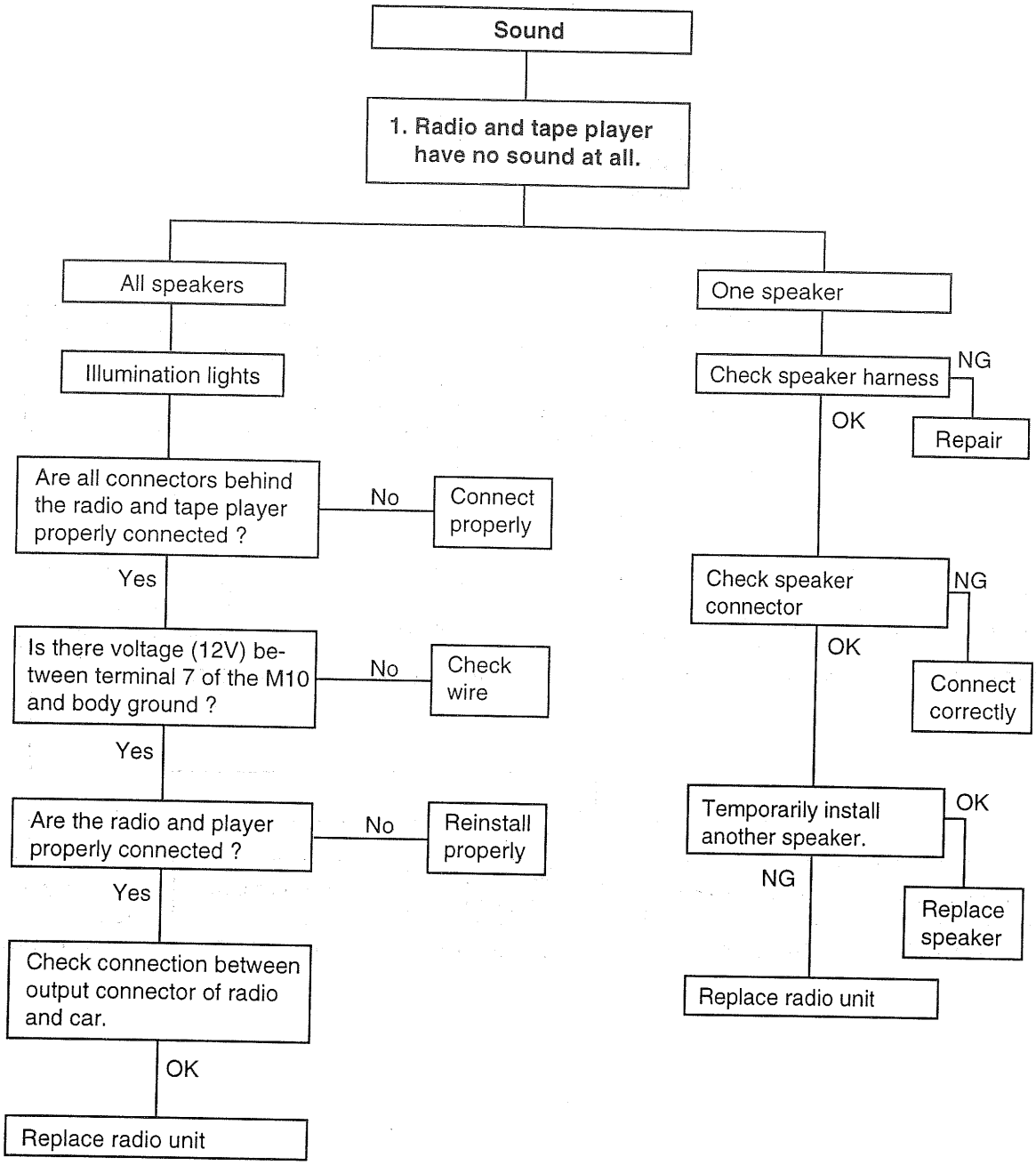
AUDIO

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.

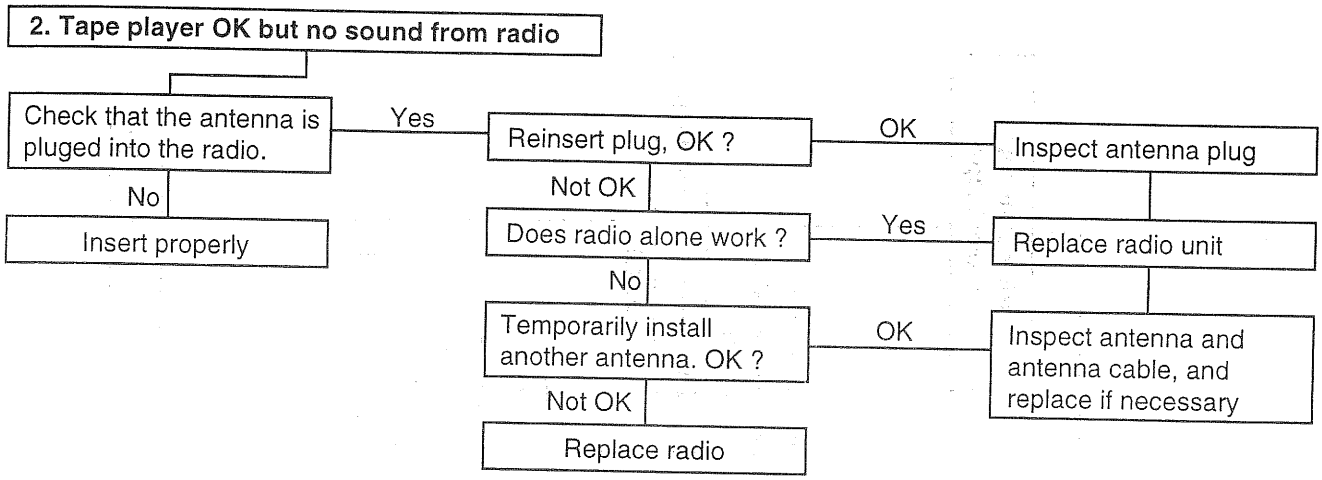


ETHA010A

CHART 1 ETAA0110

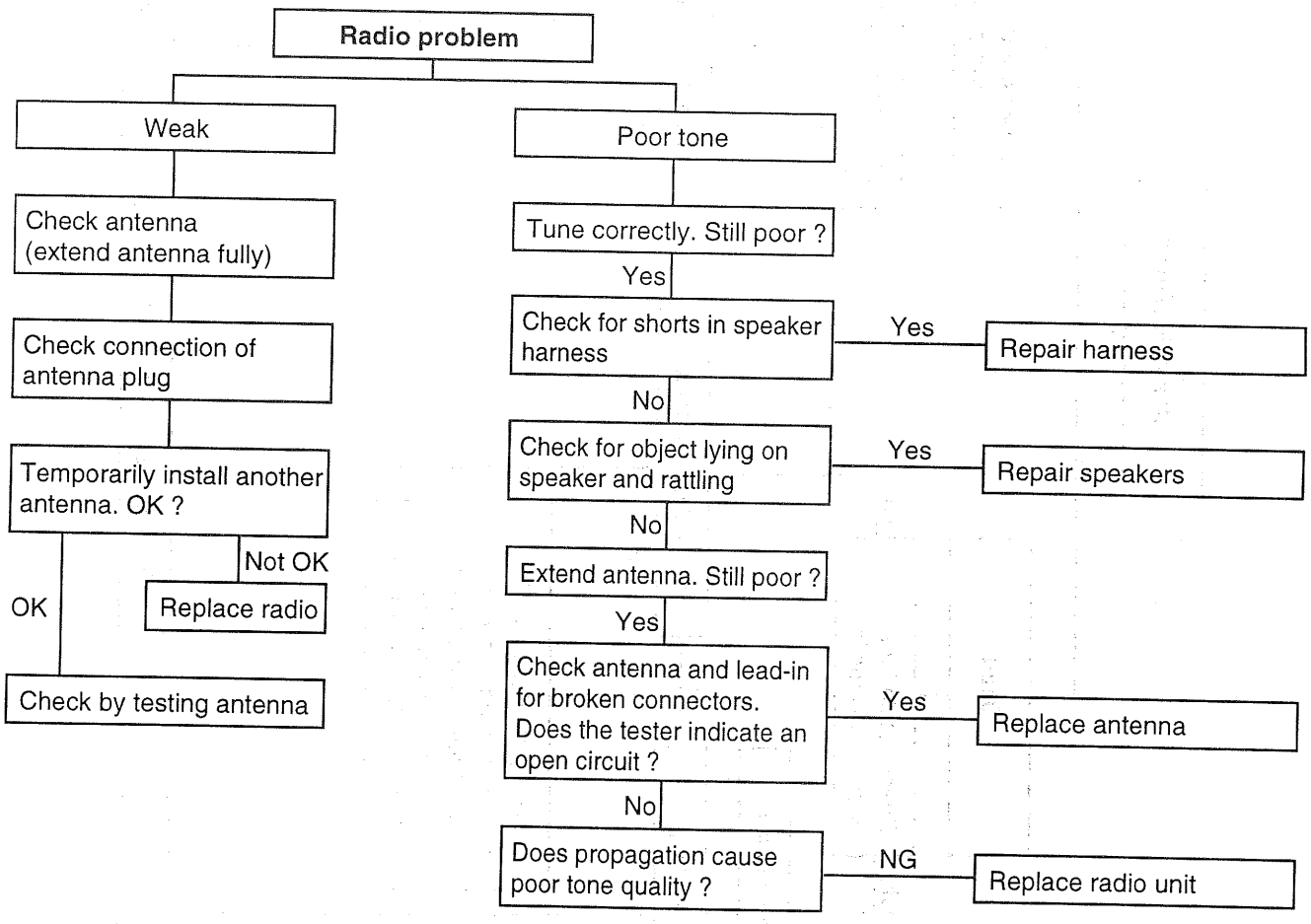


ETAA010B



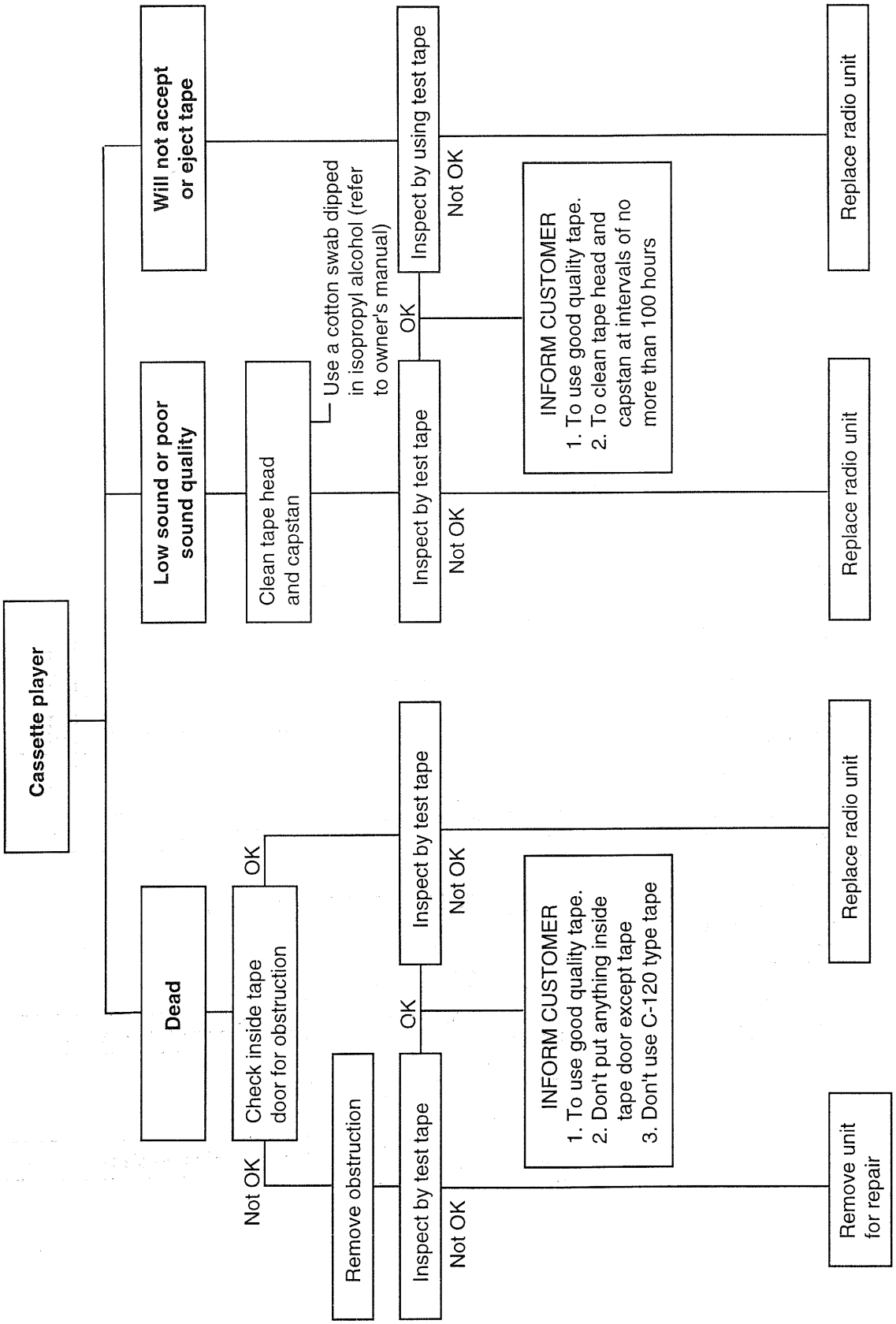
ETA9010C

CHART 2 ETA90130



ETA9010D

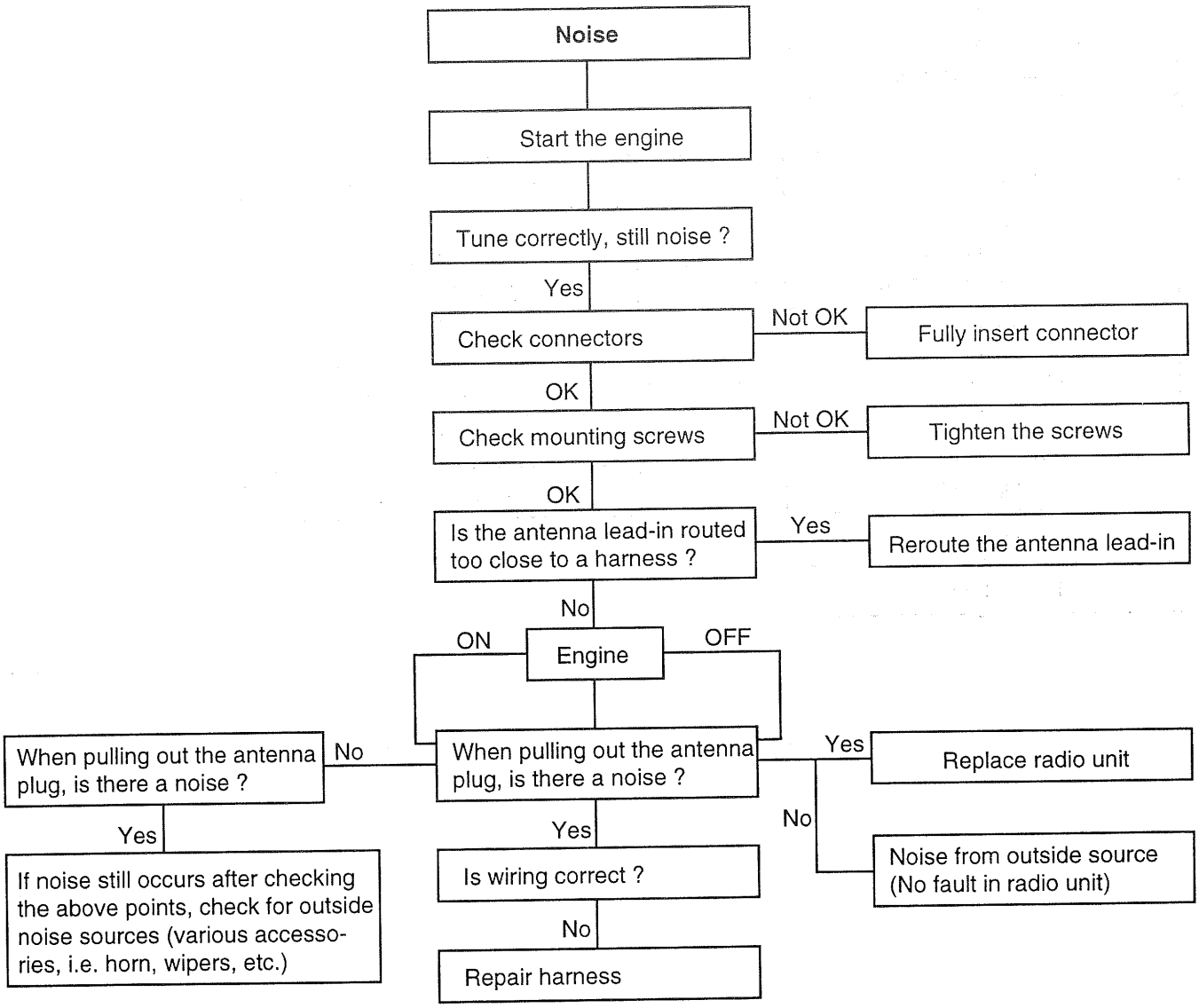
CHART 3 ETA90140



ETA9010E

CHART 4 ETA90150

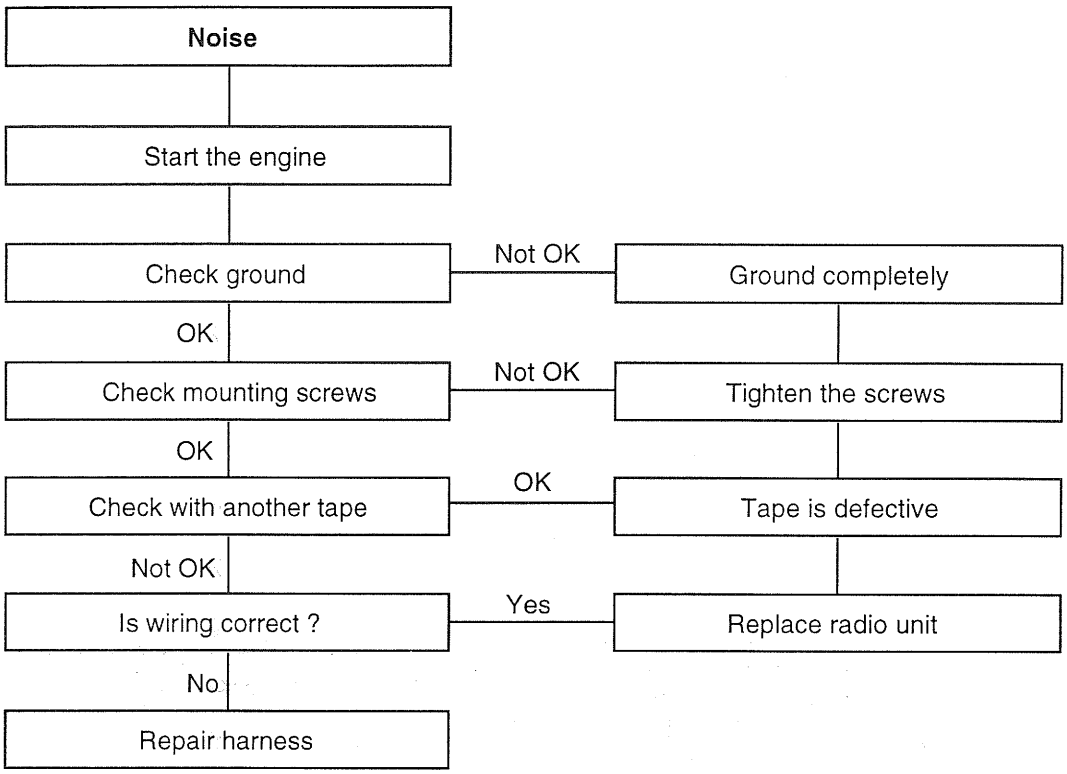
1. RADIO



ETA9010F

CHART 4 (CONTINUED) ETA90160

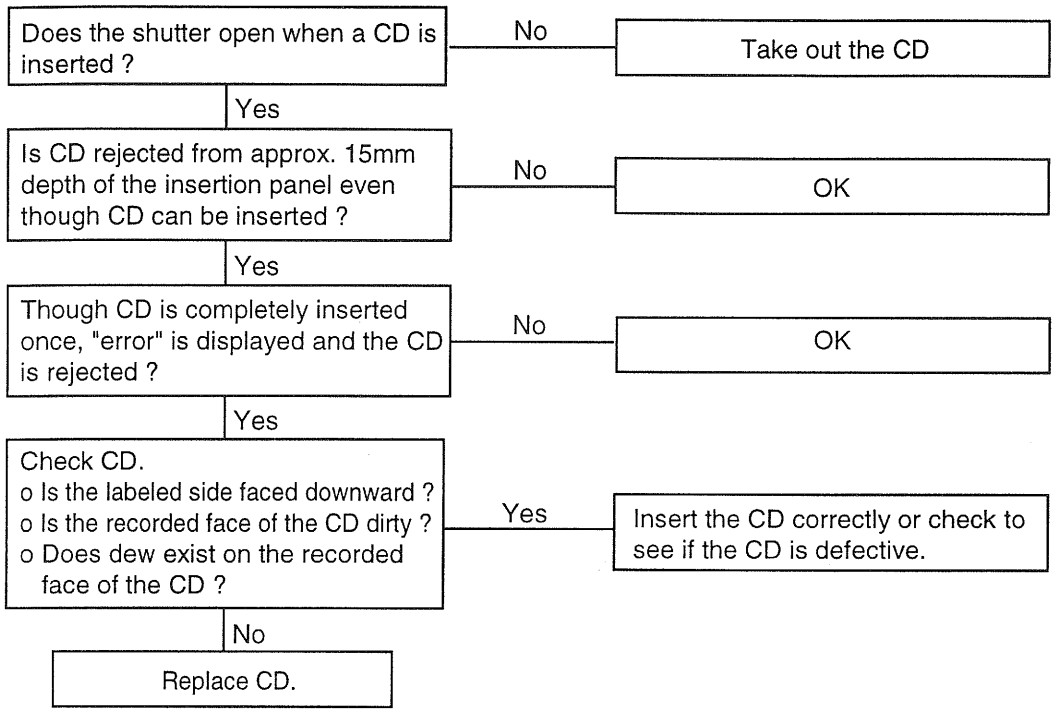
2. TAPE



ETA9010G

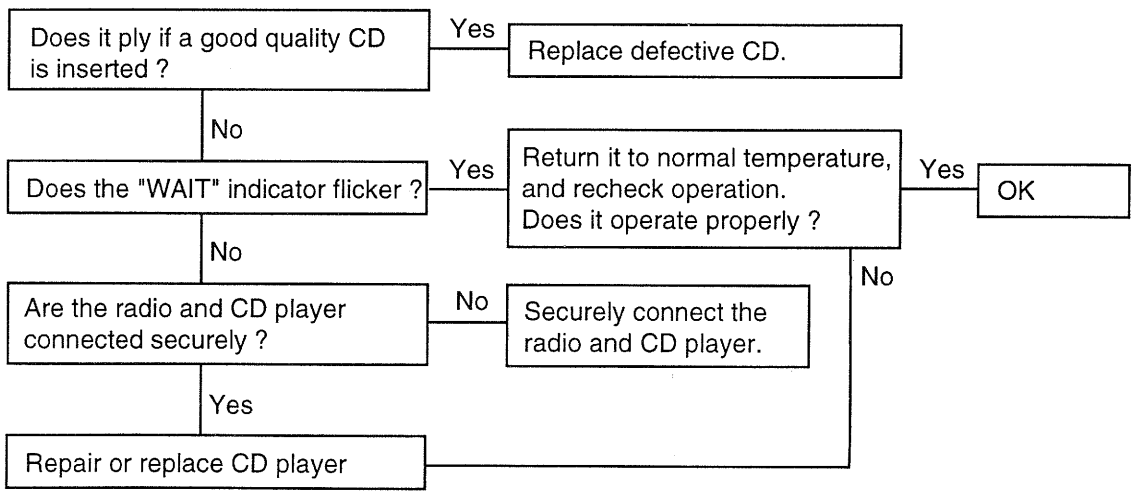
CHART 5 ETA90170

1. CD WILL NOT BE ACCEPTED



ETA9010H

2. NO SOUND

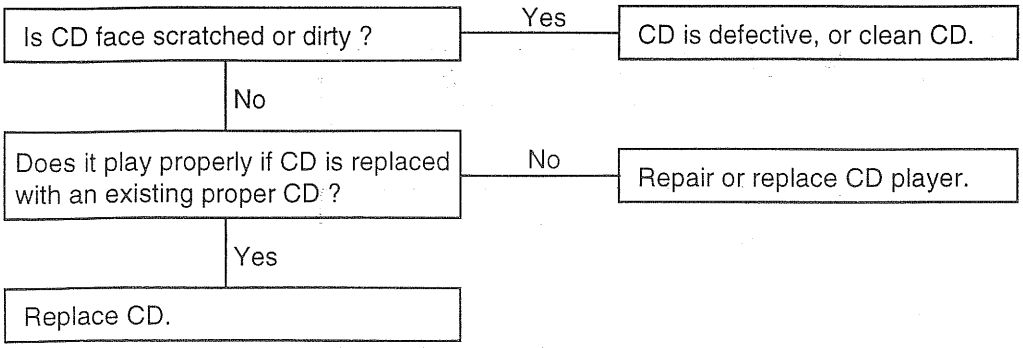


(The combined radio cassette must operate properly.)

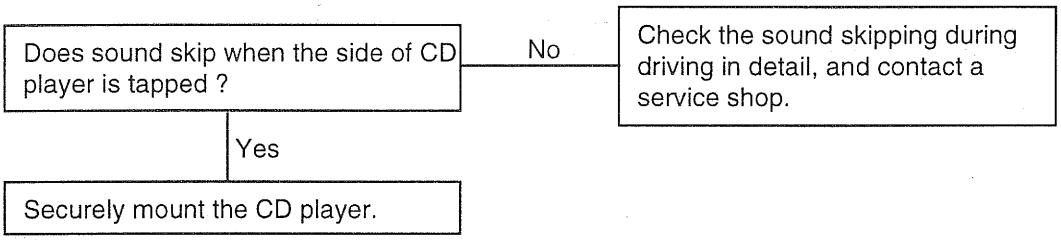
ETA9010O

3. CD SOUND SKIPS

1. Sound sometimes skips during parking.

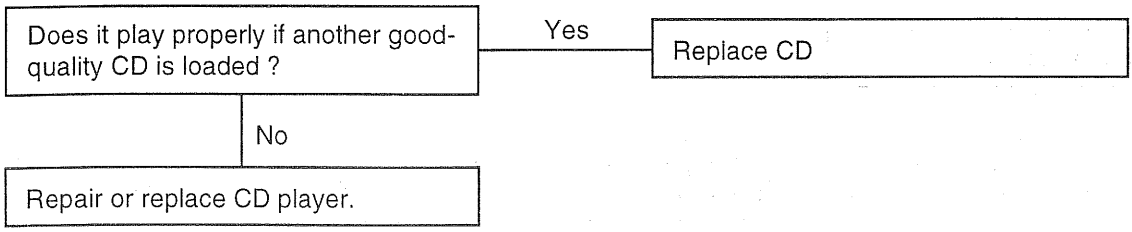


2. Sound sometimes skipes during driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other abnormalities.)

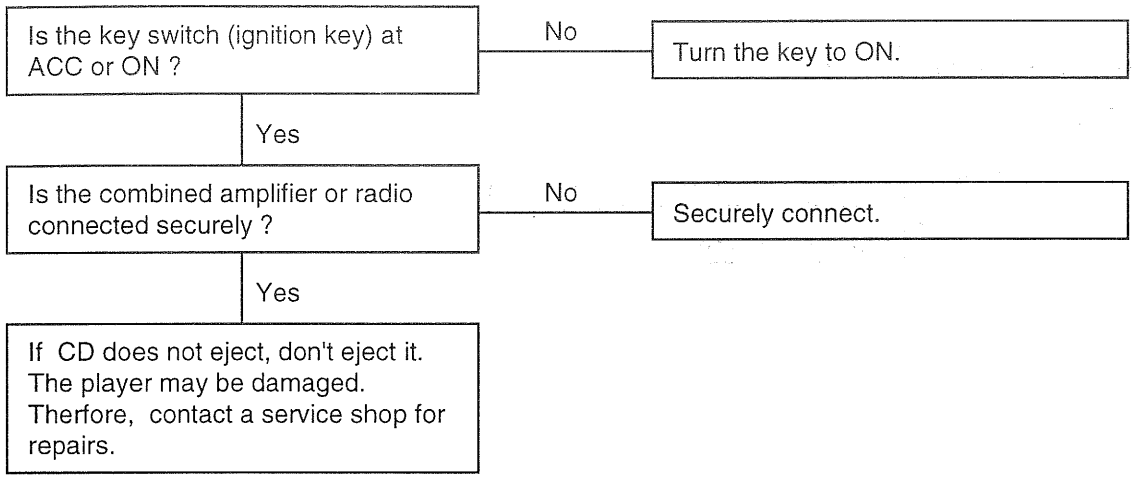


ETA9010I

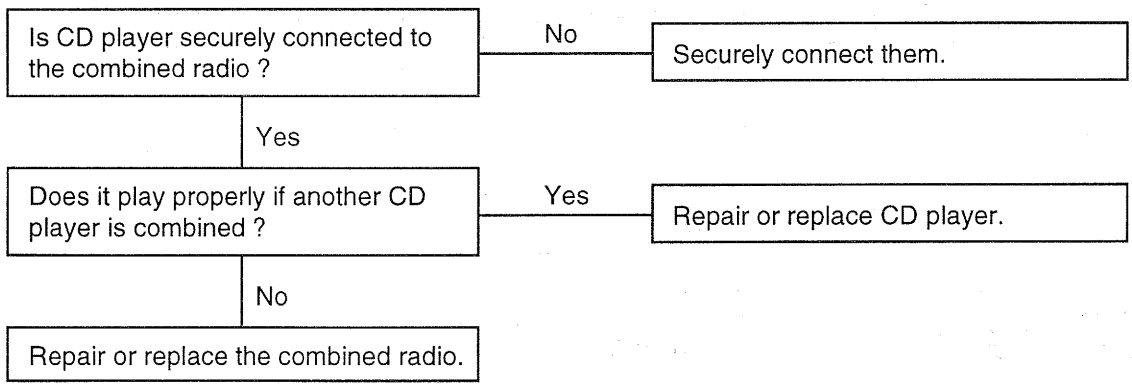
4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT

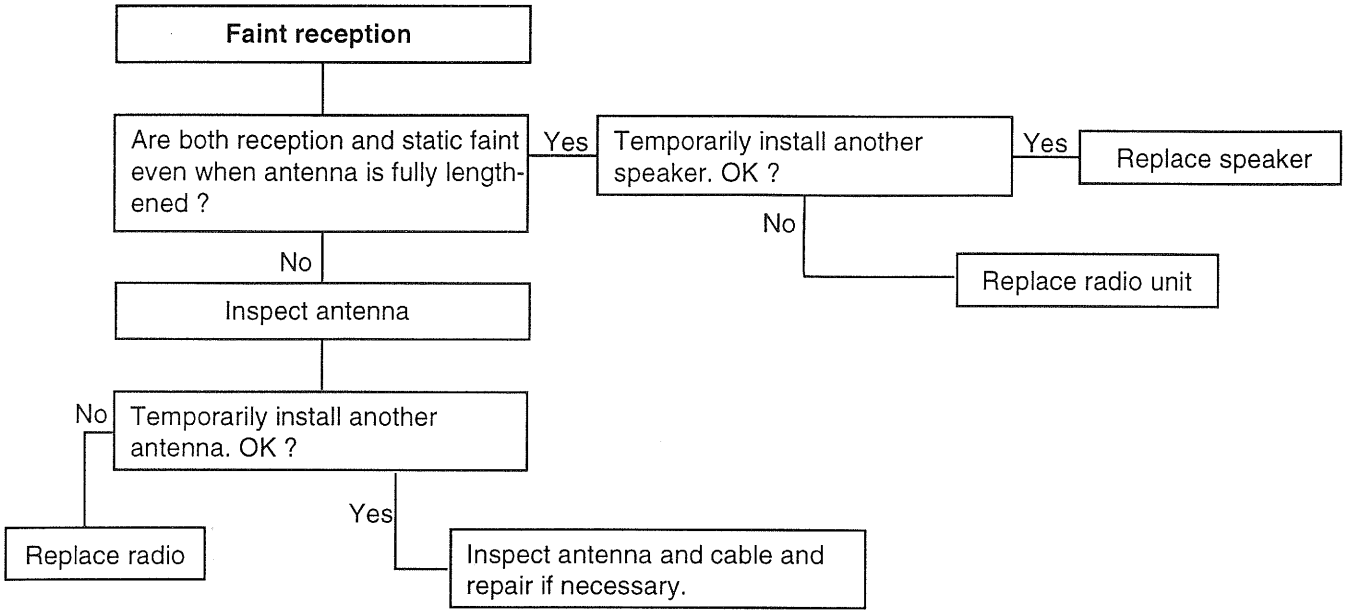


6. NO SOUND FROM ONE SPEAKER



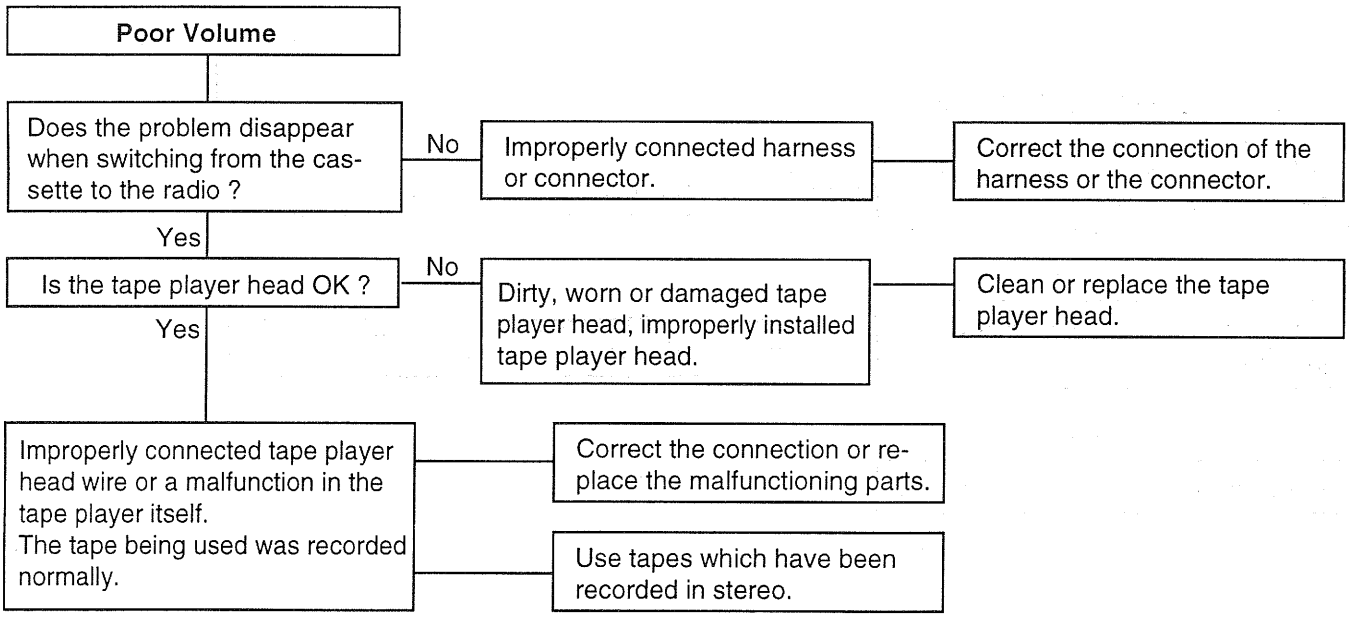
ETA9010

CHART 6 ETA90200



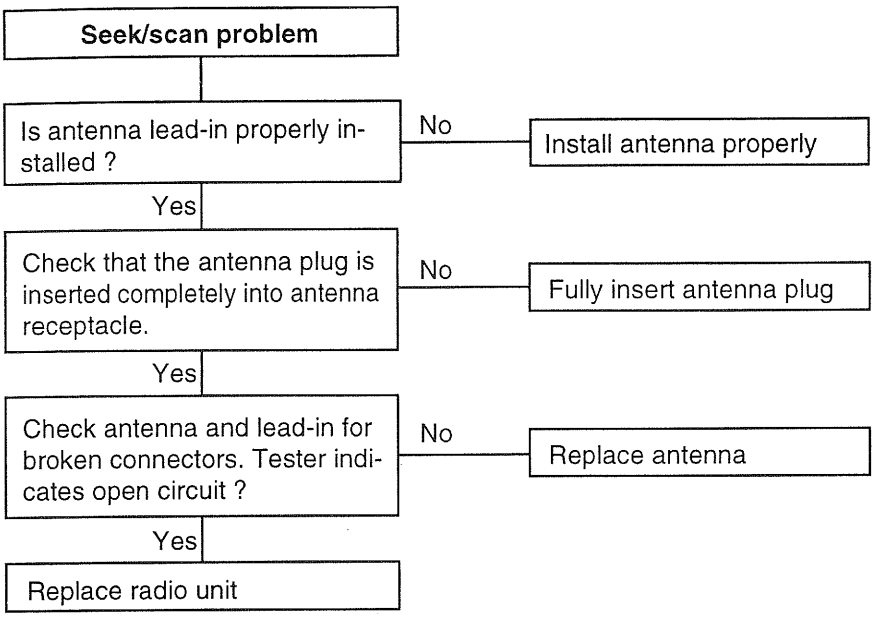
ETA9010K

CHART 7 ETA90210



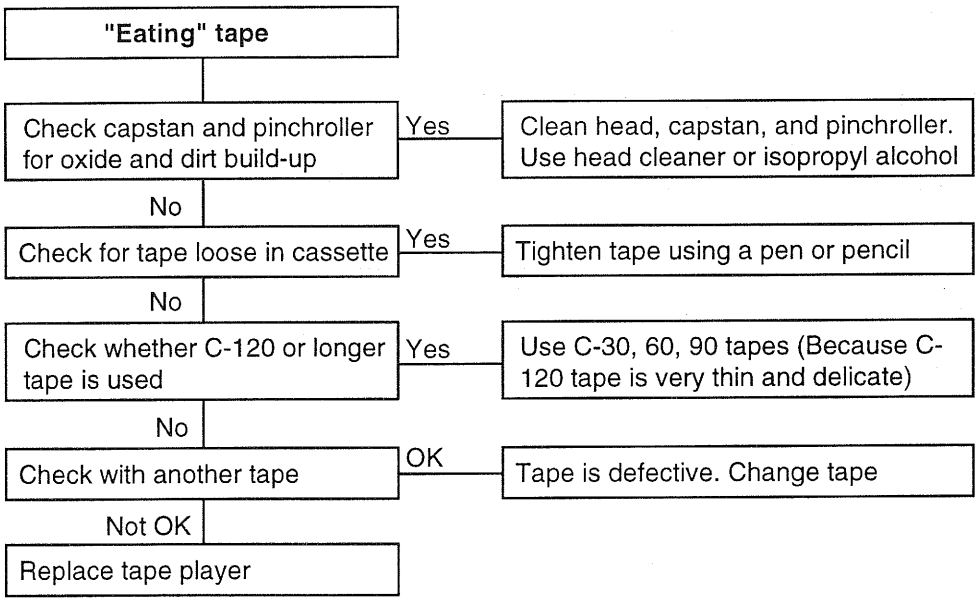
ETA9010L

CHART 8 ETA90220



ETA9010M

CHART 9 ETA90230

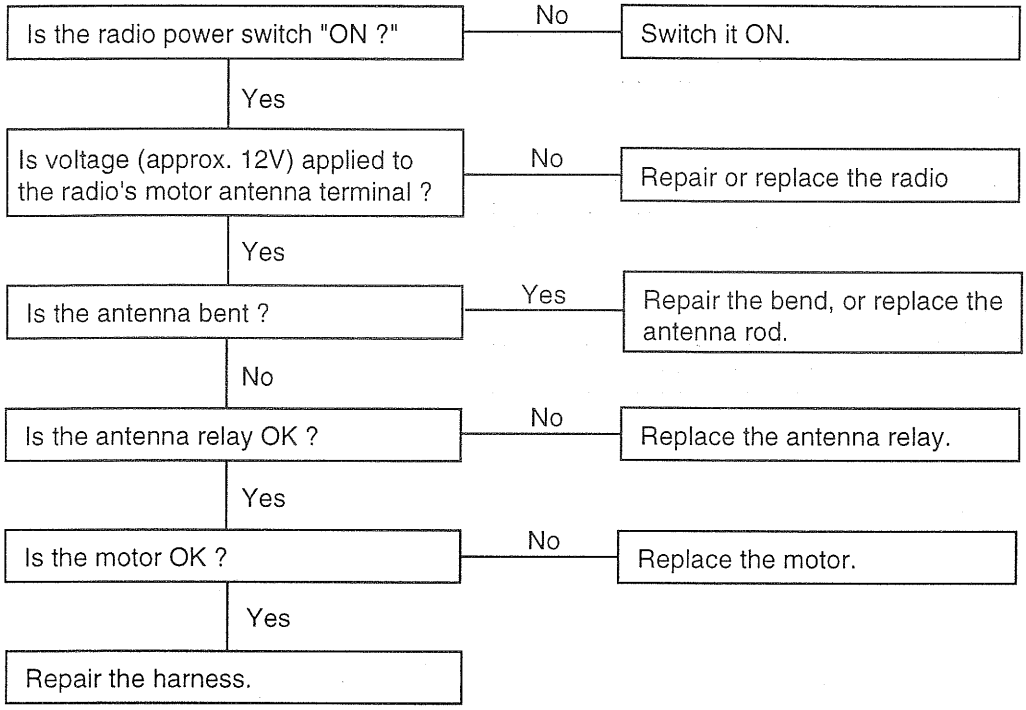


ETA9010N

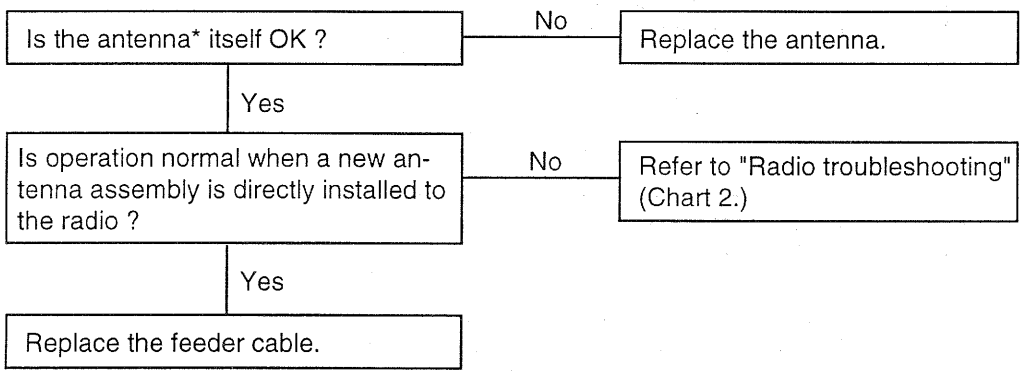
CHART 10 ETAA0240

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

TROUBLESHOOTING ETHA0700

Trouble symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary

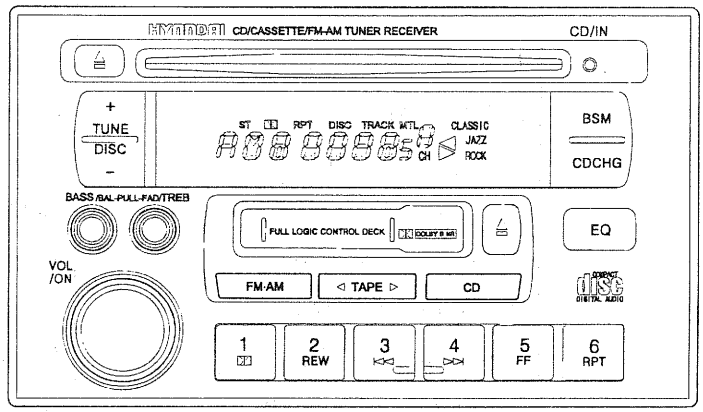
Trouble symptom	Possible cause	Remedy
Headlamps do not light	Bulb burned out	Replace bulb
	Fuse 28 (10A) blown	Replace fuse and check for short
	Headlamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail and license lamp do not light	Tail lamp fuse blown (10A)	Replace fuse and check for short
	Fusible link blown	Replace fusible link
	Taillamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Fuse 24 (15A) blown	Replace fuse and check for short
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
	Stop lamp relay faulty	Replace relay
Stop lamps stay on	Stop lamp switch faulty	Adjust or replace switch
	Stop lamp relay faulty	Replace relay
Instrument lamps do not light (taillamps light)	Rheostat faulty	Check rheostat
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not flash on one side	Bulb burned out	Replace bulb
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Turn signal lamp does not operate	Fuse 3 (10A) blown	Replace fuse and check for short
	Flasher faulty	Check flasher
	Turn signal switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not operate	Fuse 23 (10A) blown	Replace fuse and check for short
	Flasher faulty	Check flasher
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher rate too slow or too fast	Lamps' wattage are smaller or larger than is specified for use	Replace lamps
	Defective flahser	Replace flasher
Back up lamps do not light up	Fuse 11 (10A) blown	Replace fuse and check for short
	Back up lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Overhead console lamp do not light up	Fuse 16 blown	Replace fuse and check for short
	Wiring or ground faulty	Repair if necessary

AUDIO SYSTEM

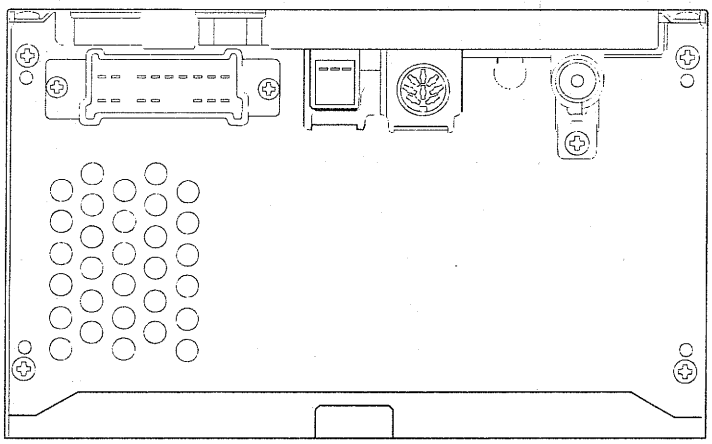
AUDIO UNIT

COMPONENTS ETHA0850

<H940A>



ETHA005C



ETHA005D

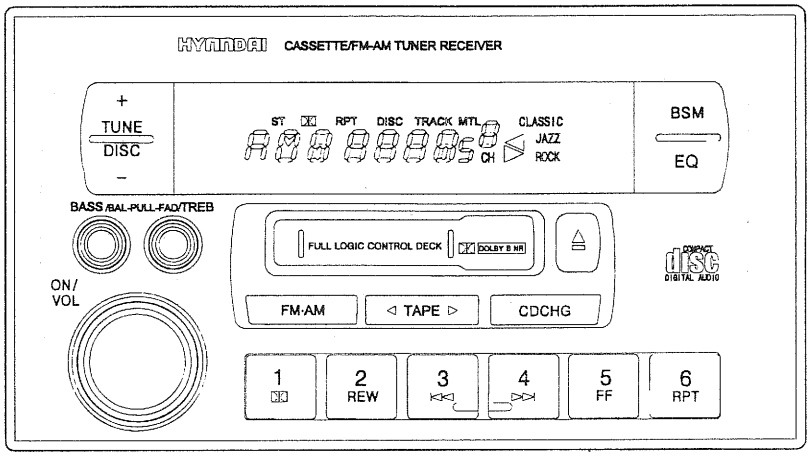
16P CONNECTOR	NO.	NOTE
[M36] ①②③ ④⑤ ⑥⑦ ⑧⑨⑩⑪⑫⑬⑭ ⑮⑯ ETHA005E	1	ANT B+
	2	EXT-AMP RR LH(-) INPUT
	3	EXT-AMP FRT LH(-) INPUT
	4	EXT-AMP FRT RH(-) INPUT
	5	EXT-AMP RR RH(-) INPUT
	6	ILL(-)
	7	ACC(+)
	8	GROUND
	9	EXT-AMP RR LH(+) INPUT
	10	EXT-AMP FRT LH(+) INPUT
	11	N.C
	12	AMP REMOTE
	13	EXT-AMP FRT RH(+) INPUT
	14	EXT-AMP RR RH(+) INPUT
	15	ILL(+)
	16	BACK UP(+)

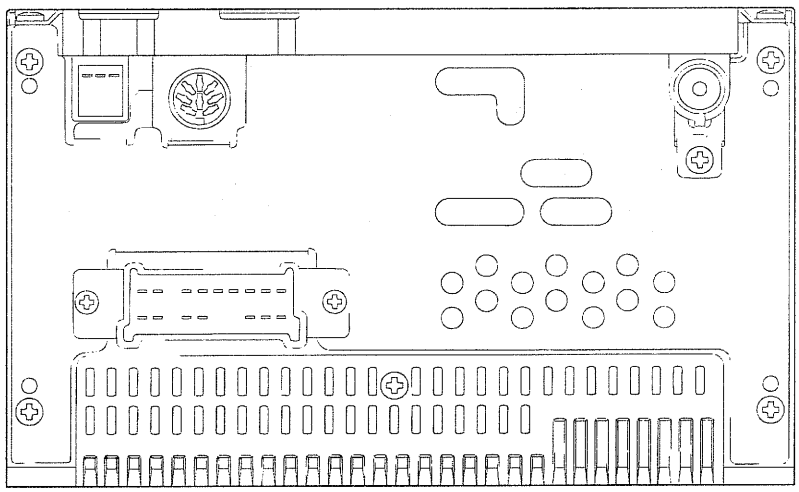
3P CONNECTOR	NO.	NOTE
① ② ③ ETHA005F	1	GROUND
	2	SIGNAL
	3	REAR SIGNAL

8P CONNECTOR	NO.	NOTE
(CD CHANGER) ③④⑤ ②⑧⑥ ①⑦ ETHA005G	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M.GROUND
	6	NC
	7	L
	8	A.GROUND

ETHA085A

<H940B>





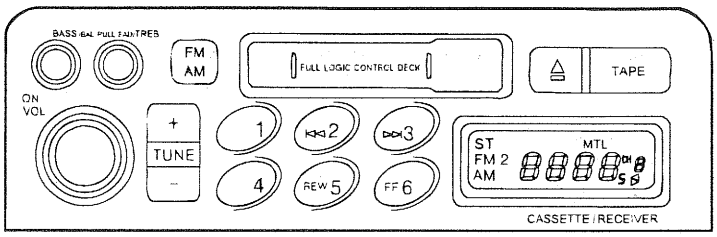
16P CONNECTOR	NO.	NOTE
[M36] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 ETHA005E	1	ANT B+
	2	EXT-AMP RR LH(-) INPUT
	3	EXT-AMP FRT LH(-) INPUT
	4	EXT-AMP FRT RH(-) INPUT
	5	EXT-AMP RR RH(-) INPUT
	6	ILL(-)
	7	ACC(+)
	8	GROUND
	9	EXT-AMP RR LH(+) INPUT
	10	EXT-AMP FRT LH(+) INPUT
	11	N.C
	12	AMP REMOTE
	13	EXT-AMP FRT RH(+) INPUT
	14	EXT-AMP RR RH(+) INPUT
	15	ILL(+)
	16	BACK UP(+)

3P CONNECTOR	NO.	NOTE
1 2 3 ETHA005F	1	GROUND
	2	SIGNAL
	3	REAR SIGNAL

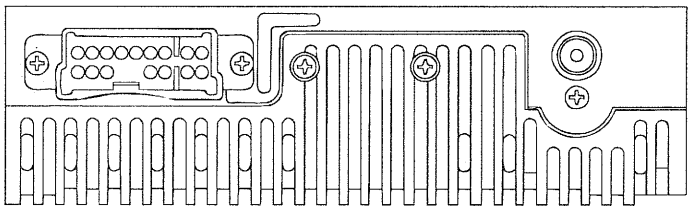
8P CONNECTOR	NO.	NOTE
(CD CHANGER) 3 4 5 2 8 6 1 7 ETHA005G	1	R
	2	CD ON
	3	BUS
	4	B+
	5	M.GROUND
	6	NC
	7	L
	8	A.GROUND

ETHA085B

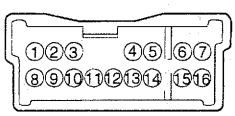
<H910C>



ETHA005Q



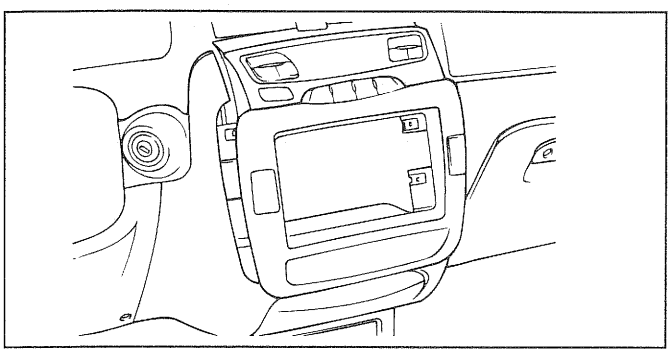
ETHA005R

16P CONNECTOR	NO.	NOTE
 ETHA005S	1	AUTO ANTENNA
	2	SPKR RR LH(-)
	3	SPKR FRT LH(-)
	4	SPKR FRT RH(-)
	5	SPKR RR RH(-)
	6	ILL(-)
	7	ACC(+)
	8	GROUND
	9	SPKR RR LH(+)
	10	SPKR FRT LH(+)
	11	N.C
	12	N.C
	13	SPKR FRT RH(+)
	14	SPKR RR RH(+)
	15	ILL(+)
	16	BACK UP(+)

ETHA085C

REMOVAL AND INSTALLATION ETHA0900

1. Disconnect negative (-) battery terminal.
2. Remove the center facia panel and disconnect air temperature switch connector.



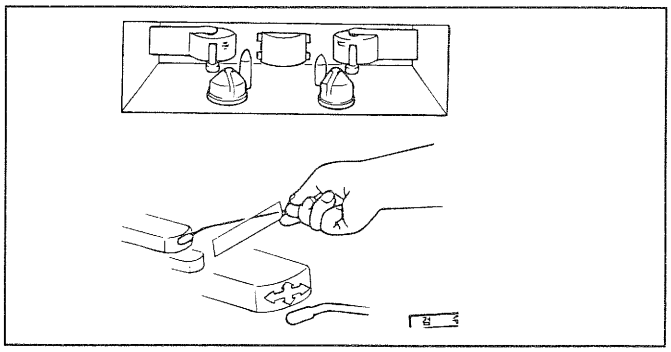
ESHA040Q

3. Loosen the screws holding the audio and remove the audio assembly from the mounting bracket.
4. Installation is the reverse of the removal process.

SERVICE INSTRUCTIONS ETHA0750

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 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.



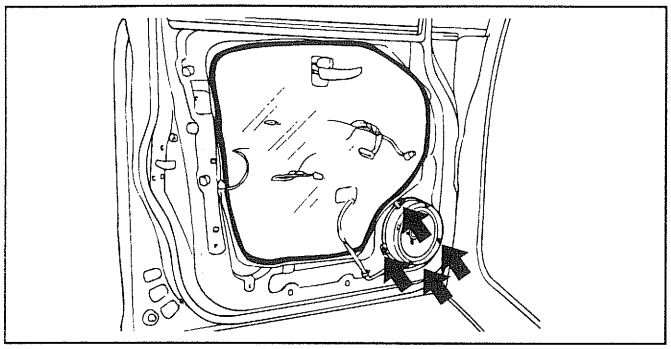
ETA9035A

SPEAKERS

REMOVAL AND INSTALLATION ETHA0950

FRONT SPEAKER

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

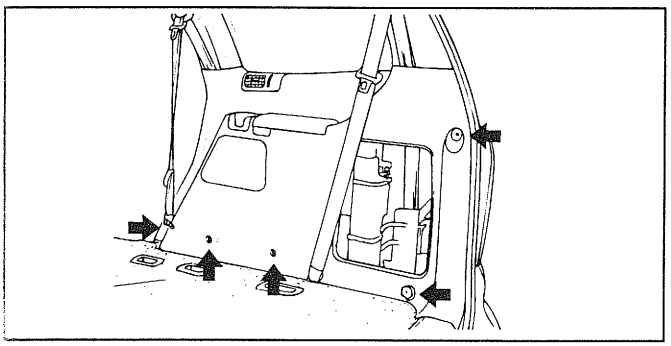


ESHA015E

2. Installation is the reverse of the removal process.

REAR SPEAKER

1. Remove the rear quarter trim (Refer to the BD group).



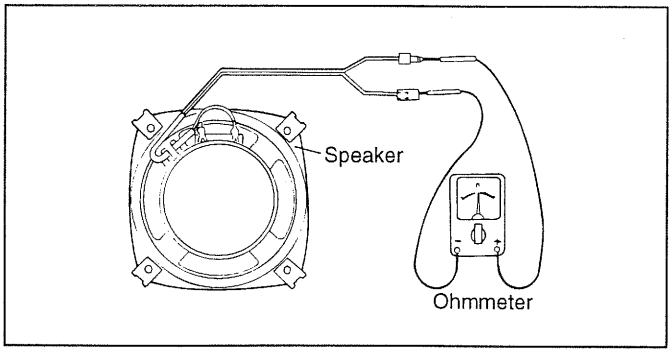
ESHA045D

2. Remove the rear speaker.

SPEAKER CHECKING ETA90400

1. Check the speaker by using an ohmmeter. If an ohmmeter indicates the impedance of the speaker when checking between the speaker (+) and speaker (-) of the same channel, the speaker is ok.

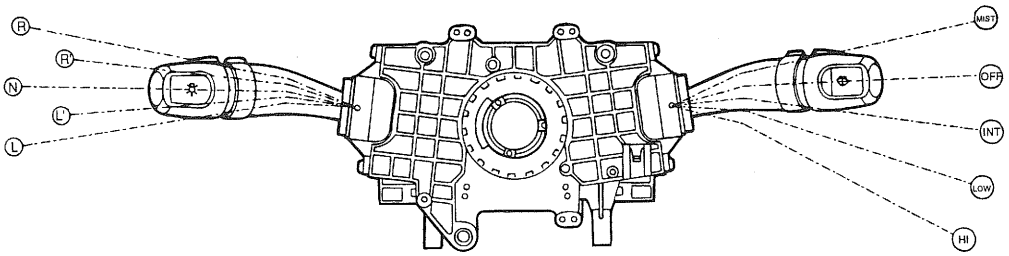
2. If a clicking sound is emitted from the speaker when the ohmmeter plugs, touch the speaker terminals, the speaker is ok.



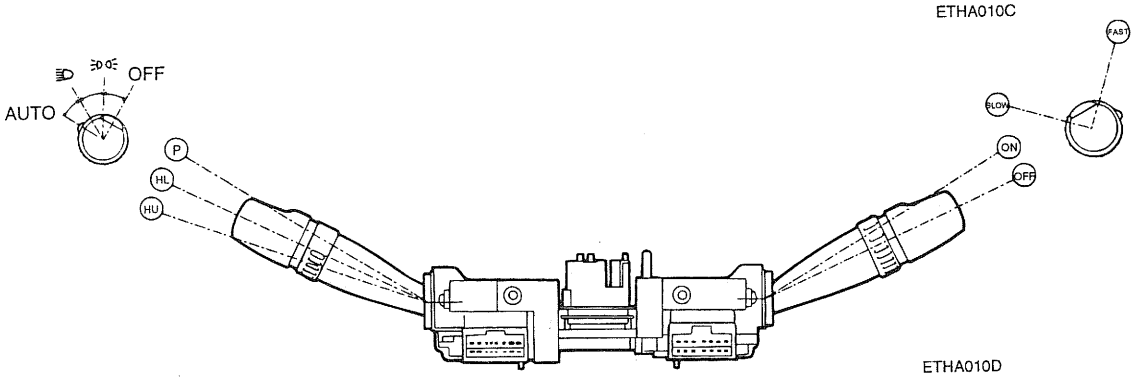
ETA9040A

MULTI FUNCTION SWITCH

COMPONENTS(WITHOUT AIR BAG) ETHA1000



ETHA010C



ETHA010D

M26-2

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

M26-1

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

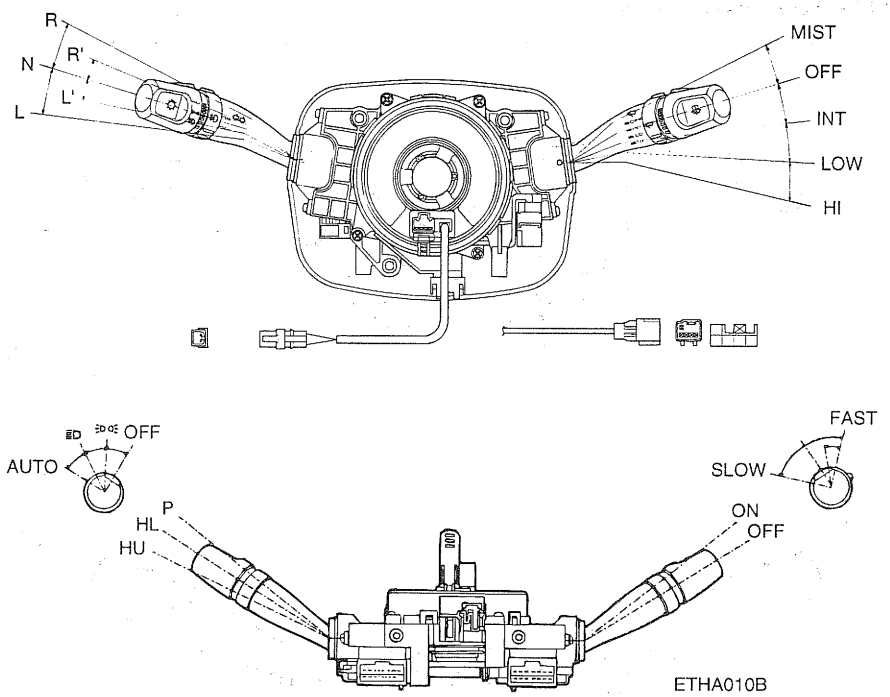
Circuit connection

Connector No.	Terminal No.	Description
M26-1	1	Head lamp passing switch
	2	Head lamp high beam power
	3	-
	4	-
	5	-
	6	-
	7	Turn signal RH lamp switch
	8	Flasher unit power
	9	Turn signal LH lamp switch
	10	Head lamp low beam power
	11	Dimmer & passing ground
	12	Front fog lamp switch
	13	Front fog lamp switch ground
	14	Tail lamp switch
	15	Head lamp switch
	16	Auto light/Rear fog lamp switch
	17	Lighting switch ground
	18	-

Connector No.	Terminal No.	Description
M26-2	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
	14	Intermittent wiper ground

ETHA100A

COMPONENTS(WITH AIR BAG)



M26-2

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

M26-1

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

M26-3

1	2	3	4

Circuit connection

Connector No.	Terminal No.	Description
M26-1	1	Head lamp passing switch
	2	Head lamp high beam power
	3	-
	4	-
	5	-
	6	-
	7	Turn signal RH lamp switch
	8	Flasher unit power
	9	Turn signal LH lamp switch
	10	Head lamp low beam power
	11	Dimmer & passing ground
	12	Front fog lamp switch
	13	Front fog lamp switch ground
	14	Tail lamp switch
	15	Head lamp switch
	16	Auto light/Rear fog lamp switch
	17	Lighting switch ground
	18	-

Connector No.	Terminal No.	Description
M26-2	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
	13	Intermittent wiper
	14	Intermittent wiper ground
M26-3	1	-
	2	Horn relay
	3	-
	4	-

KTDA030Y

ETHA100B

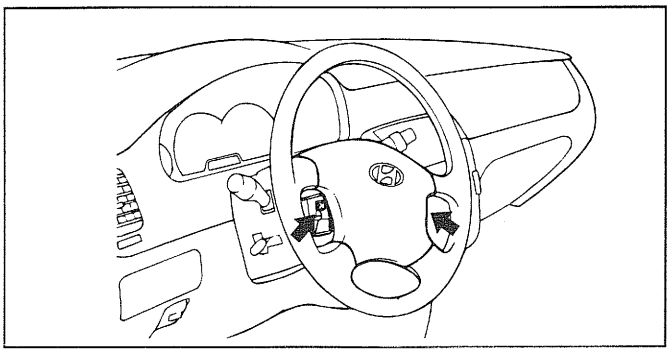
REMOVAL AND INSTALLATION ETHA1050

Prior to removing of the multifunction switch assembly in vehicles equipped with air bags, be careful to follow the following:

CAUTION

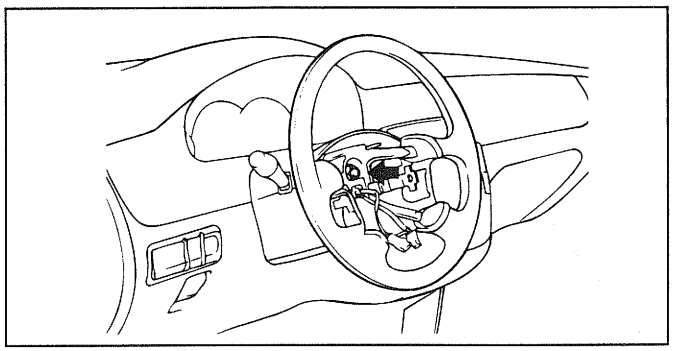
- **Never attempt to disassemble or repair the air bag module or clock spring. If faulty, replace it.**
- **Do not drop the air bag module or clock spring or allow contact with water, grease or oil. Replace if a dent, crack, deformation or rust are detected.**
- **The air bag module should be stored 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 handing 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.**
- **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. Remove the air bag module.



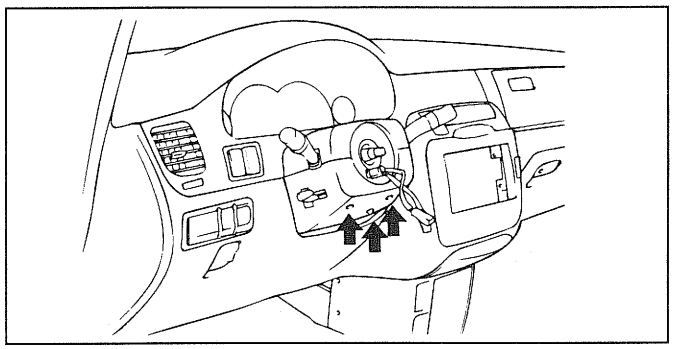
ESHA040M

2. Remove the steering wheel.



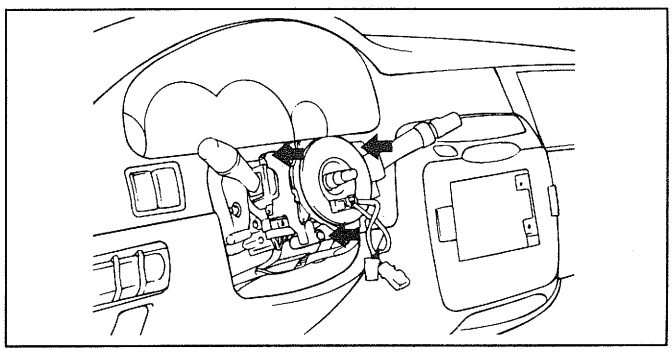
ESHA040N

3. Remove the steering column upper shroud and steering column lower shroud.



ESHA040O

4. Loosen the multifunction switch mounting screws and disconnect the connector. Remove the multi function switch assembly.



ESHA040P

5. Installation is the reverse of the removal process.

INSPECTION ETHA1100

Check the continuity between the terminals while operating the switch.

LIGHTING SWITCH [M26-1]

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

KTDA040A

FRONT FOG LAMP SWITCH [M26–1]

Position \ Terminal	12	13
OFF		
INT	○	○

KTDA040F

DIMMER AND PASSING SWITCH [M26-1]

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

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

KTDA040B

TURN SIGNAL AND LANE CHANGE SWITCH [M26-1]

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

KTDA040C

WIPER AND INTERMITTENT VOLUME SWITCH [M26-2]

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

KTDA040D

WASHER SWITCH [M26-2]

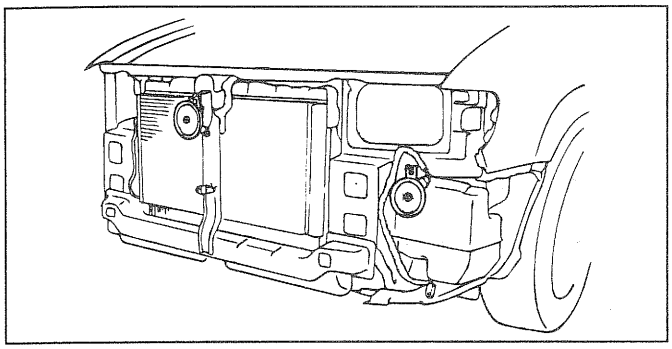
Position \ Terminal	7	8
OFF		
ON	○	○

KTDA040E

HORNS

REMOVAL AND INSTALLATION ETHA1150

1. Remove the bolts holding horn and remove the horn assembly.



ETHA015A

2. Installation is the reverse of the removal process.

INSPECTION ETHA1200

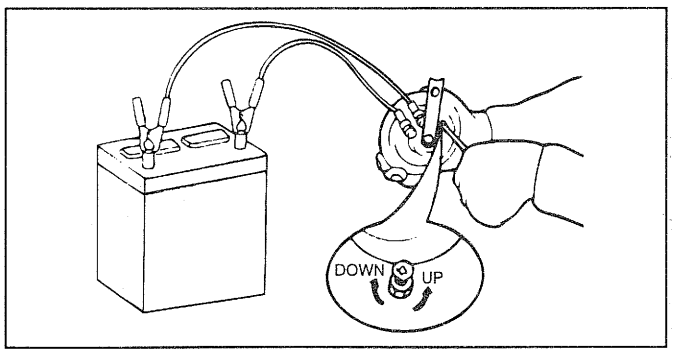
1. Test the horn by connecting battery voltage to the 1 and 2 terminals.
2. The horn should make a sound. If the horn fails to make a sound, replace it.

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 keep it from loosening.



ETDA050A

ETACS (ELECTRONIC TIME AND ALARM CONTROL SYSTEM)

ELECTRONIC TIME AND ALARM CONTROL MODULE OPERATION CHECK OF COMPONENTS ETHA1250

While operating the components, check whether the operations are normal with timing chart.

ETACS FUNCTION

1. **Vehicle speed sensing intermittent wiper**

   Time specification

   T1 : Max. 0.6 sec.

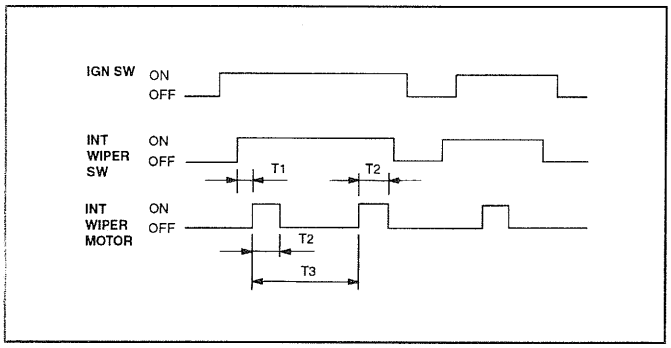
   T2 : 0.6~0.7 sec. (Time of wiper motor 1 rotation)

   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.

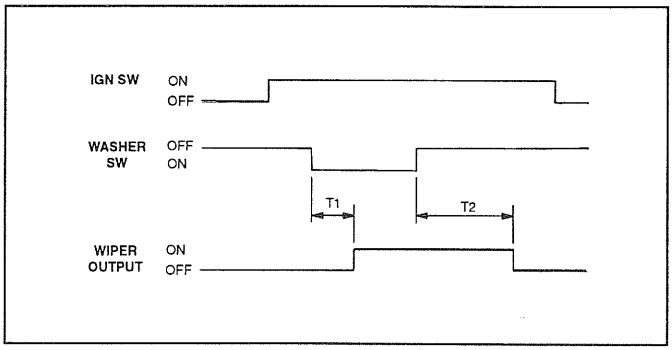
   1.0±0.2sec (VR=0kΩ)~10.0±1sec (VR=50KΩ)



ETHA115C

2. **Washer**

   a. Time specification
      T1 : 0.6 sec. or more
      T2 : 2.5 - 3.8 sec.
      T1 : 0.2 - 0.6 sec. (Mist)
   b. This function should be operated preferentially even though the variable intermittent wiper is operating.

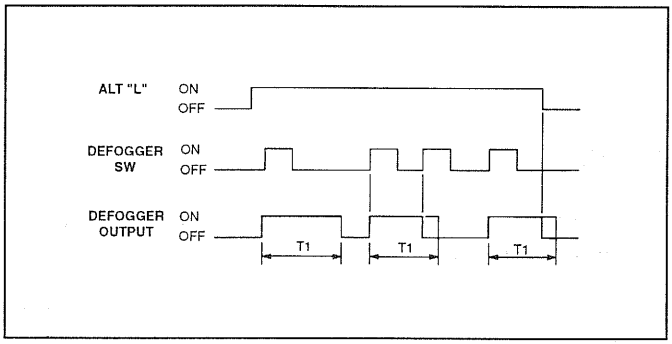


ETHA115D

3. **Rear window defogger**

   Time specification

   T1 : 20±1min.



ETHA115E

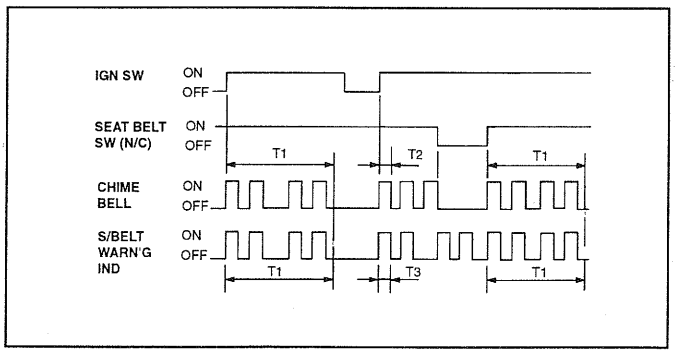
4. **Seat belt warning**

   Time specification

   T1 : 6 ± 1 sec.

   T2 : 0.45±0.1 sec.

   T3 : 0.3 ± 0.1 sec.



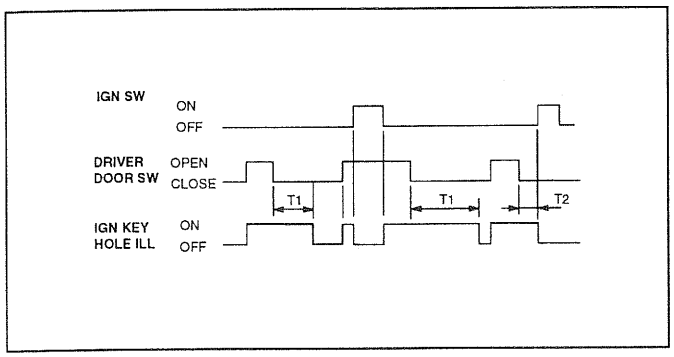
ETHA115F

5. **Ignition key hole illumination**

   Time specification

   T1 : 10 ± 1 sec.

   T2 : 0 - 10 sec.

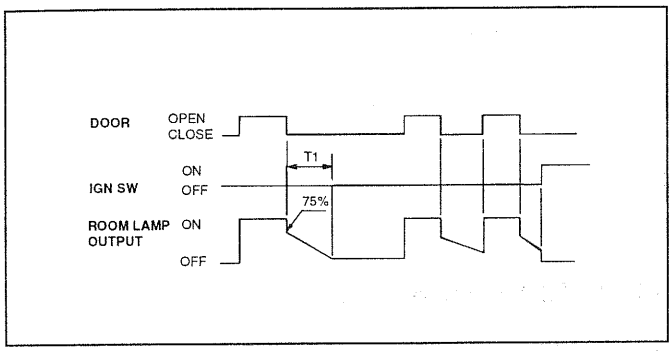


ETHA115J

6. **Delayed out room lamp**

Time specification

T1 : 5.5±0.5 sec.

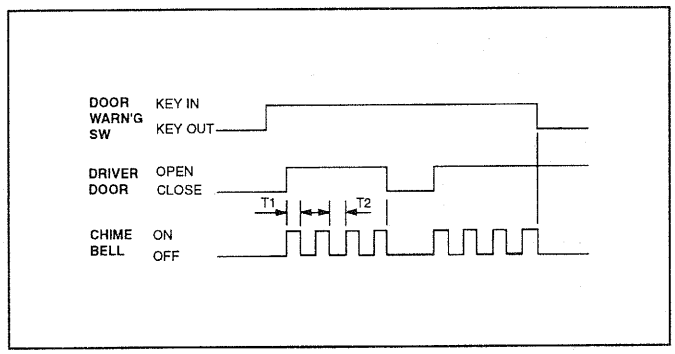


ETHA115G

7. **Door warning**

Time specification

T1, T2 : 0.45±0.1 sec.

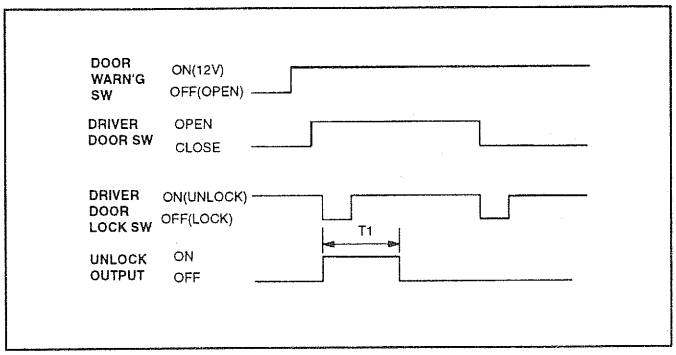


ETHA115L

8. **Ignition key reminder**

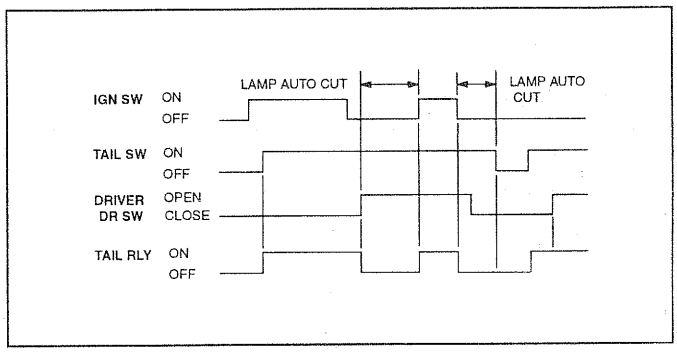
Time specification

T1 : 5±0.5 sec.



ETHA115I

9. **Tail lamp auto cut**

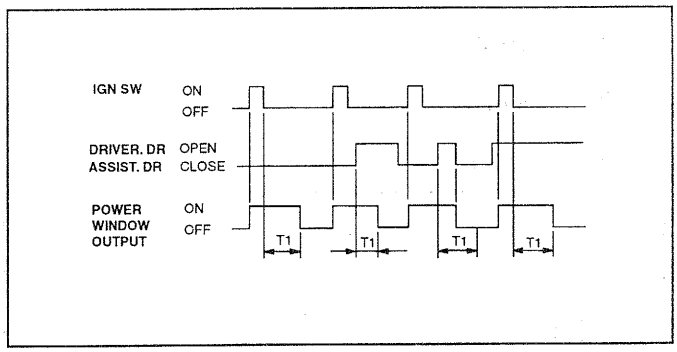


ETHA115M

10. **Power window timer**

Time specification

T1 : 30±3 sec.

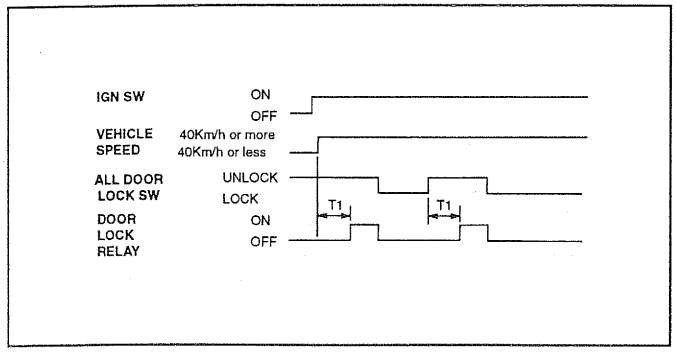


ETHA115K

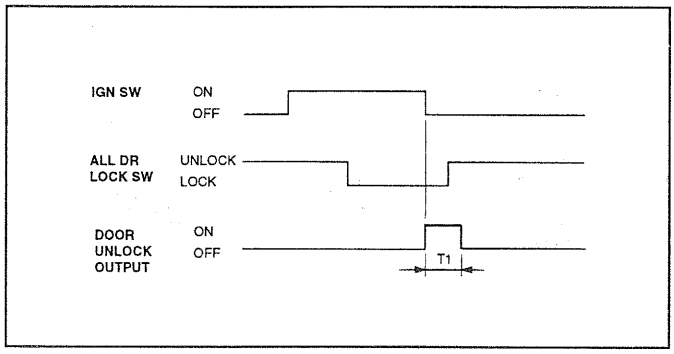
11. **Auto door lock**

Time specification

T1 : 2.5±0.5 sec.



ETHA115N

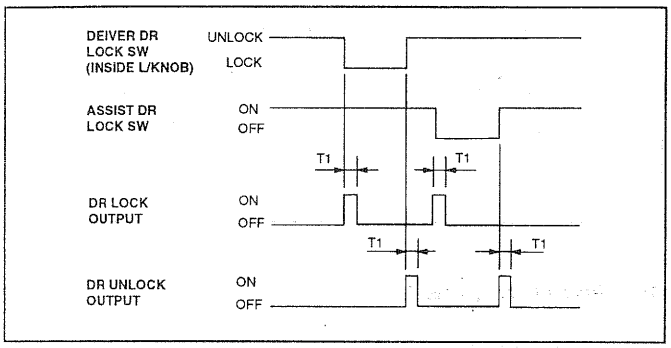


ETHA115P

12. **Central door lock/unlock**

Time specification

T1 : 0.5±0.1 sec.



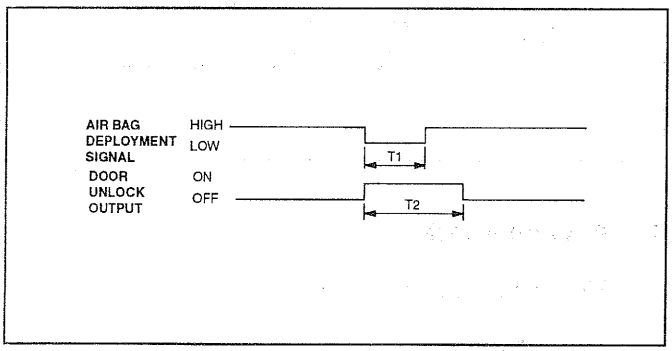
ETHA115H

13. **Auto door unlock**

Time specification

T1 : 200ms

T2 : 1±0.2 sec.



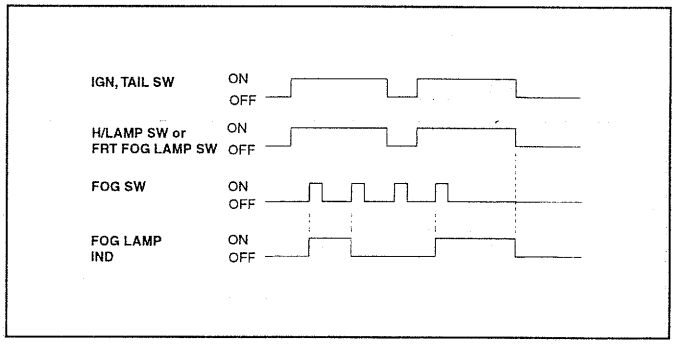
ETHA115O

14. **Ignition key off unlock.**

Time specification

T1 : 0.5±0.5 sec

15. **Rear fog lamp control**



ETHA120E

ANTI-THEFT FUNCTION

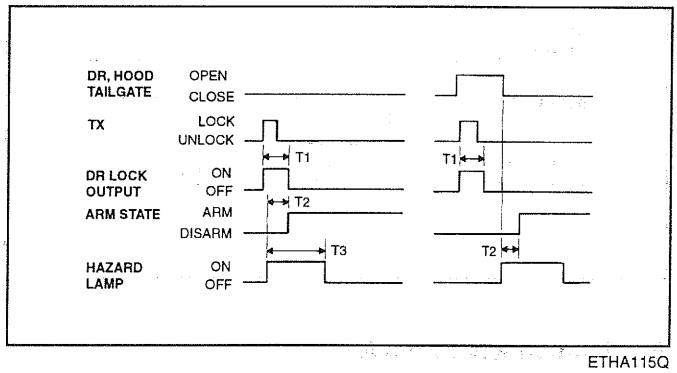
1. **Arm function**

Time specification

T1 : 0.5sec.

T2 : Max 2sec.

T3 : 1.0±0.2sec.

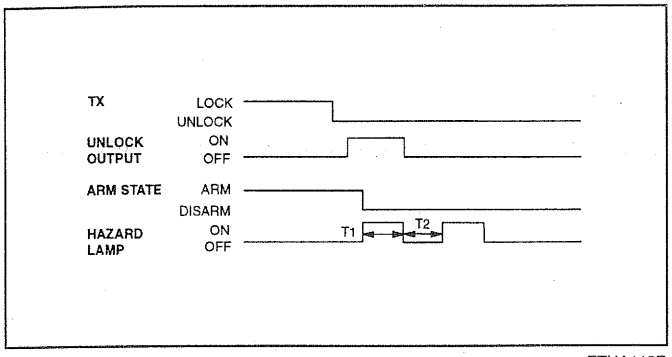


ETHA115Q

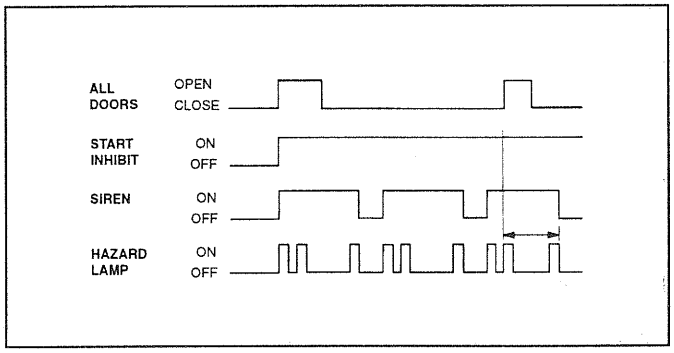
2. **Disarm function**

Time specification

T1, T2 : 0.5±0.1sec.



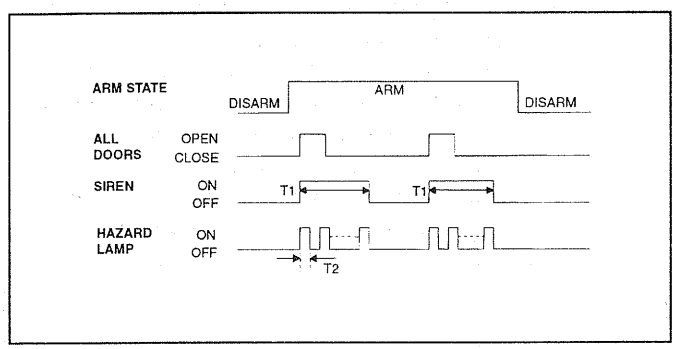
ETHA115R



ETHA115T

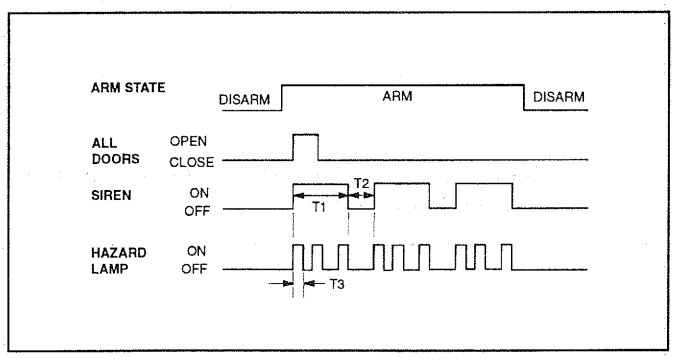
3. Alarm function

a. Only EC Area
Time specification
T1 : 27±2sec.
T2 : 0.5±0.1sec.



ETHA120F

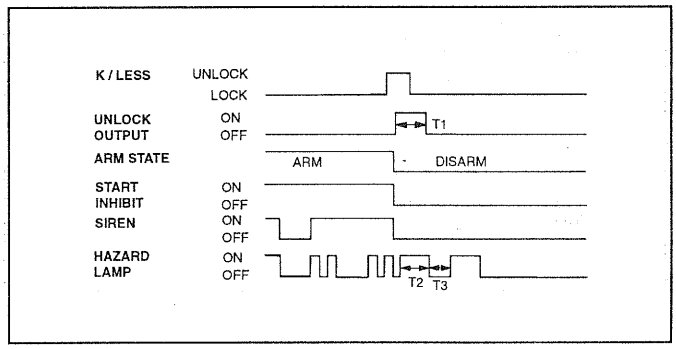
b. Except EC Area
Time specification
T1 : 27±2sec.
T2 : 10±1sec.



ETHA115S

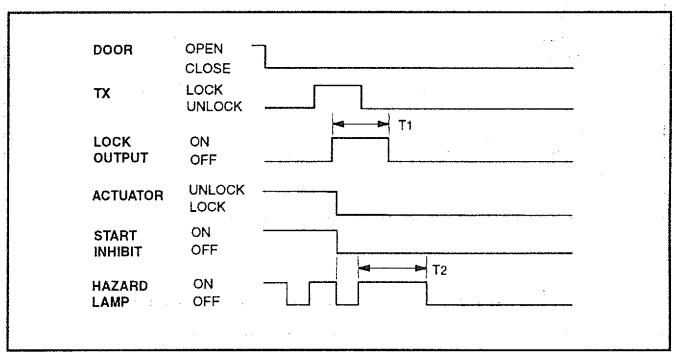
c. New alarm occurs during the alarm state.

d. Disarmed with TX (Transmitter) during the alarm state.
Time specification
T1, T2, T3 : 0.5±0.1sec.



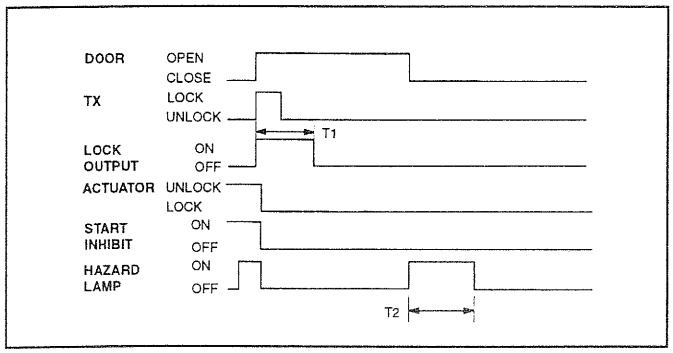
ETHA115U

e. TX lock button pressed when the door closed during the alarm state.
Time specification
T1 : 0.5sec.
T2 : 1.0±0.2sec.



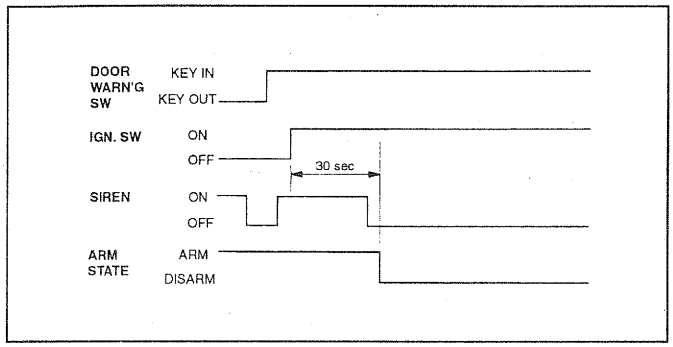
ETHA115V

f. TX lock button pressed when the door opened during the alarm state.
Time specification
T1 : 0.5sec.
T2 : 1.0±0.2sec.



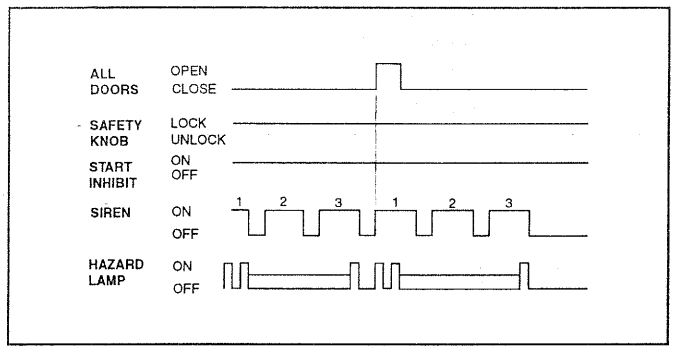
ETHA115W

g. Disarmed after 30 sec when the ignition switch turned on during the alarm state.



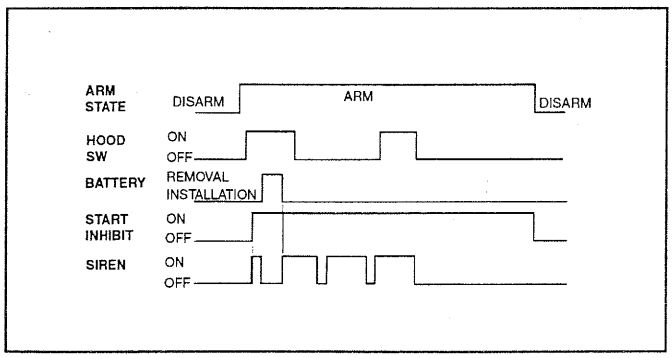
ETHA115X

h. Start inhibit is "ON" regardless of safety knob lock state.



ETHA115Y

i. Battery is separated during the alarm state.



ETHA115Z

4. **Code saving method.**

a. Remove the lower crash panel.

NOTE

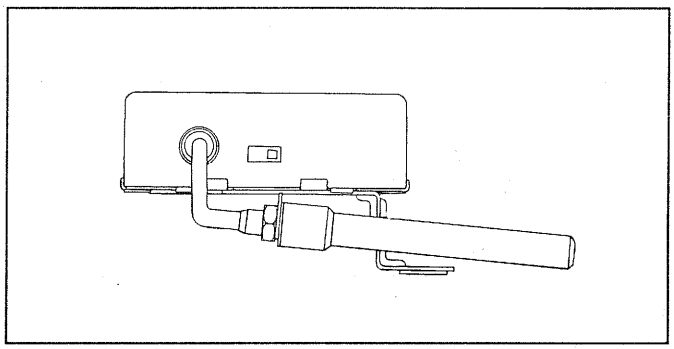
Don't disconnect the negative (-) battery terminal.

b. Code saving :

- Activating the keyless entry-receiver unit and change code saving switch of the receiver unit from "OFF" to "SET".
- The secret codes from the transmitter are stored into the receiver unit when the door lock button or unlock button pressed.

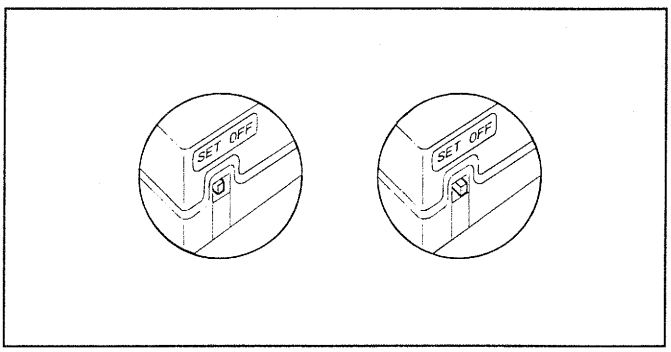
c. Code saving :

- Change code saving switch of the receiver unit from "OFF" to "SET".
- The same secret code from transmitter are stored into the receiver unit when the door lock or unlock button from the changing transmitter are pressed.
- The code saving of 2nd transmitter unit will be achieved in the same method.



ETDA085R

d. Change code saving switch of the receiver unit from "SET" to "OFF".

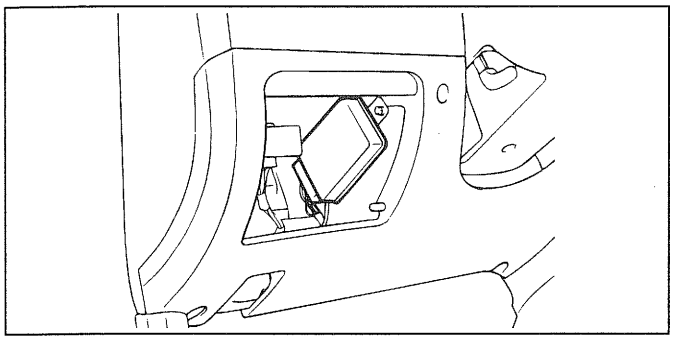


ETHA120D

e. Install the lower crash panel.

REMOVAL AND INSTALLATION ETHA1300

1. Disconnect the negative (-) battery terminal
2. Remove the lower crash panel.
3. Remove the ETACM from the junction block and disconnect the connectors.



ETDA080A

4. Installation is the reverse of the removal process.

FUSES AND RELAYS

RELAY BOX (ENGINE COMPARTMENT)

FUSIBLE LINK ETHA1350

SPECIFICATIONS

Circuit	Rated Capacity	Circuit	Rated Capacity
Ignition switch 1	30A	ABS 1	30A
Ignition switch 2	50A	ABS 2	30A
Power window	30A	Radiator	30A
Condenser	20A		

INSPECTION

1. Check for a burnt fusible link with an ohmmeter.
2. If a fusible link burns out, there is a short or some other problem in the circuit. Carefully determine the cause and correct it before replacing the fusible link.

CAUTION

The fusible link will burn out within 15 seconds if a higher than specified current flows through the circuit.

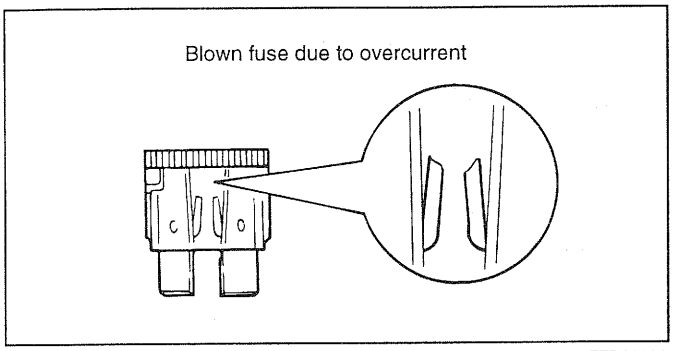
FUSES

INSPECTION ETDA0860

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

1. **Fuse blown due to over-current.**

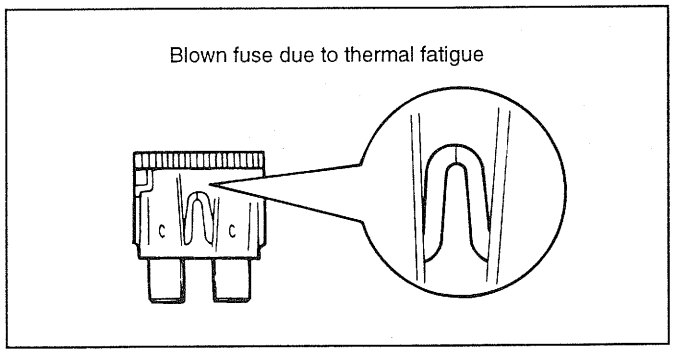
   Prior to replacing the fuse with a new one, check the circuit for a short and the related parts for abnormal condition. Only after the correction of a short or replacement of abnormal parts, should a fuse with the same ampere rating be installed.



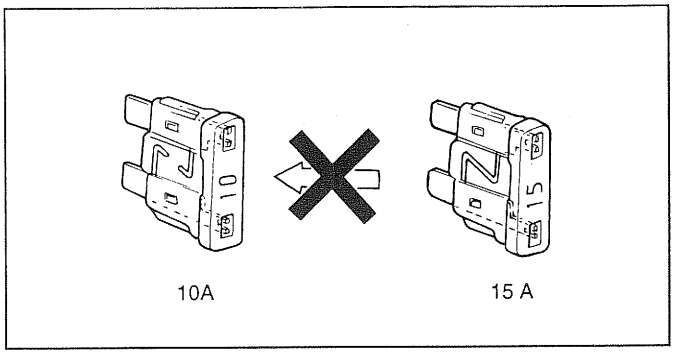
ETDA086A

2. **Fuse blown due to repeated current on-off.**

   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.



ETDA086B



ETDA086C

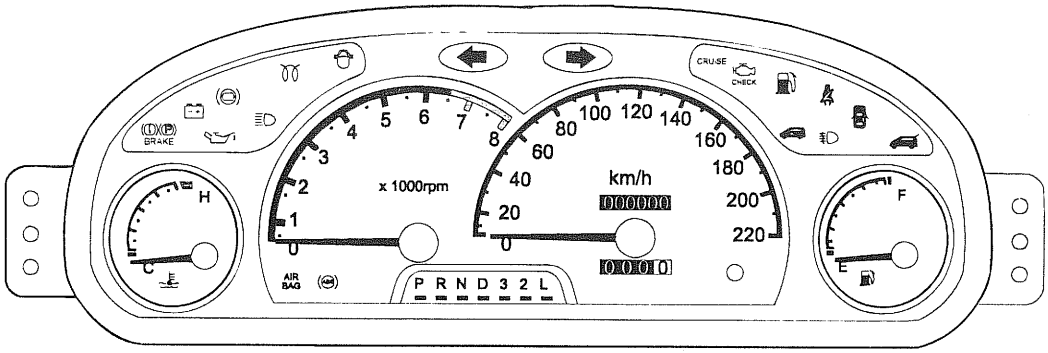
CAUTION

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, please use the fuse puller in the fuse box.

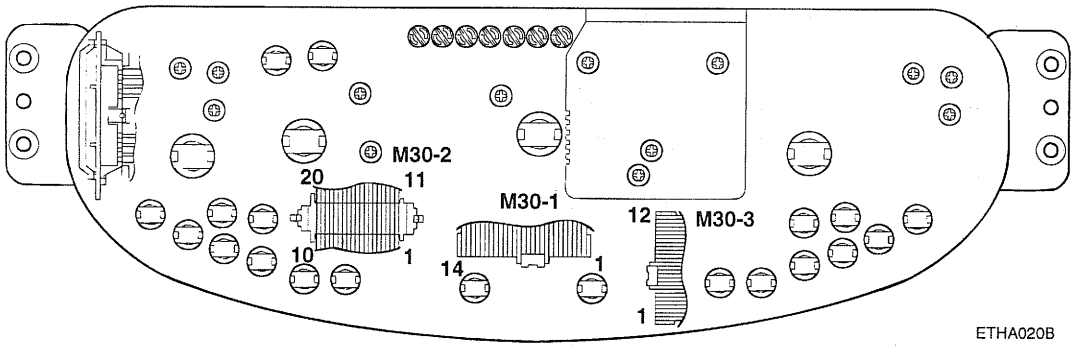
INDICATORS AND GAUGES

INSTRUMENT CLUSTER

COMPONENTS ETHA1450



ETHA020D



ETHA020B

[M30-1]

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

[M30-3]

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

[M30-2]

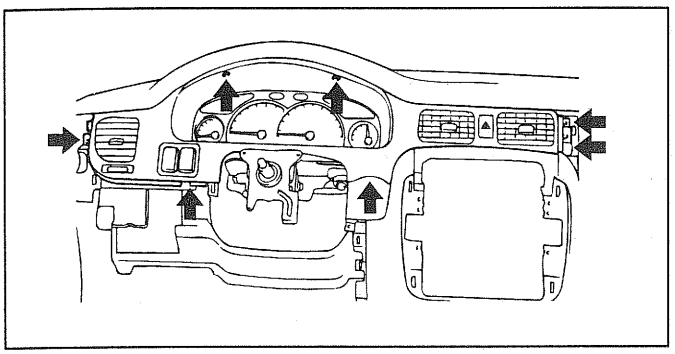
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

KTDA095C

ETHA145A

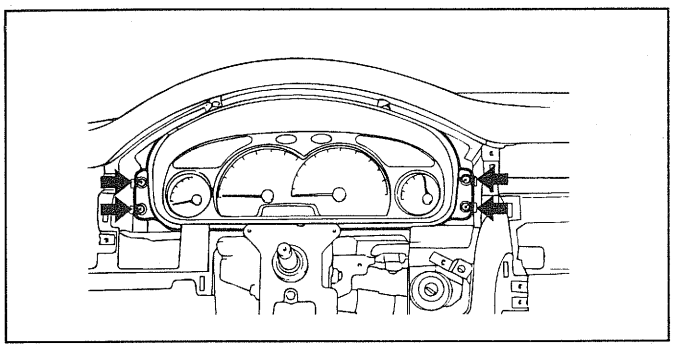
REMOVAL AND INSTALLATION ETHA1500

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



ESHA040V

3. Loosen the screws holding the cluster and remove the instrument cluster

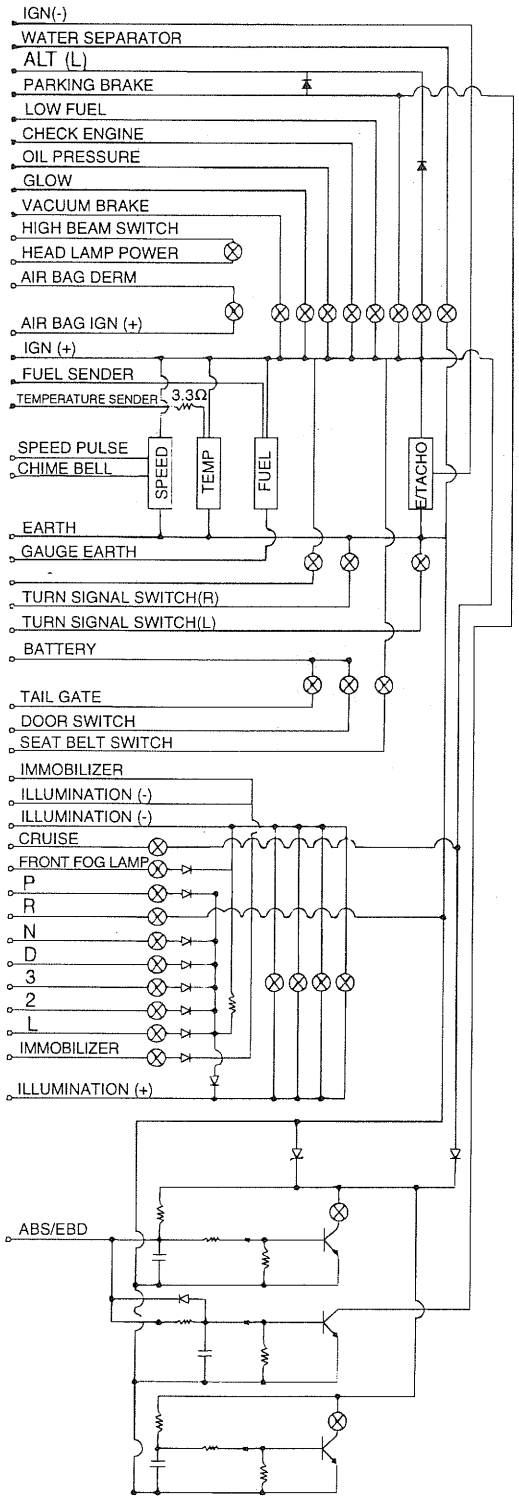


ESHA040W

4. Installation is the reverse of the removal process.

CIRCUIT DIAGRAM ETHA1550

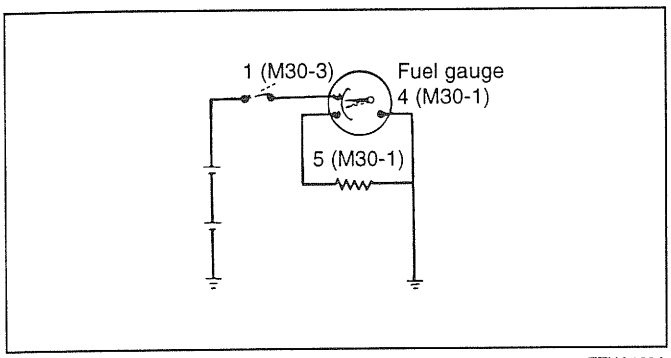
M30-1	M30-2	M30-3
	12	
	5	
	1	
	19	
		4
		3
	20	
	4	
	3	
	10	
	9	
	13	
	14	
	7,15	1
5		
	16	
6		
3		
2	6	
4		
	8	
1		
14		
		8
		9
		10
		5
		11
		12
	17	
		2
		6
13		
12		
11		
10		
9		
8		
7		
		7
	11	
	13	



ETHA020C

FUEL GAUGE

INSPECTION ETHA1600



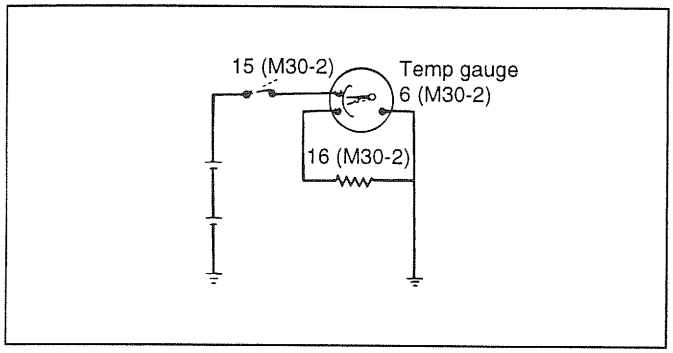
ETHA160A

1. Connect the positive (+) lead from battery to terminal 1 (M30–3) and negative (-) lead to terminal 4 (M30–1).
2. Connect the variable resistance to terminal 5 (M30–1) and terminal 4 (M30–1).
3. Vary the variable resistance.
4. Check that the fuel gauge pointer moves. If the operation is not as specified, replace the gauge.

Resistance (Ω)	Gauge level
95	E
32.5	1/2
7	F

ENGINE COOLANT TEMPERATURE GAUGE

INSPECTION ETHA1650



ETHA165A

1. Connect the positive (+) lead from battery to terminal 15 (M30–2) and negative (-) lead to terminal 6 (M30–2).
2. Connect the variable resistance to terminal 16 (M30–2) and terminal 6 (M30–2).
3. Vary the variable resistance.
4. Check that the temperature gauge pointer moves. If the operation is not as specified, replace the gauge.

Resistance (Ω)	Gauge level
157	-40°
48.4-24	-7°
15.2	+30°

TACHOMETER

INSPECTION ETHA1700

1. Connect the tune-up test tachometer and start the engine.
2. Compare the tester and tachometer indications. If the difference is excessive, replace the tachometer.

CAUTION

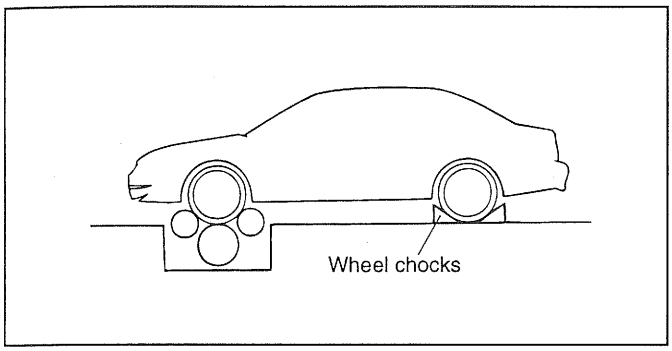
1. **Reversing the connections of the tachometer will damage the transistor and diodes inside.**
2. **When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.**

Revolution (rpm)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	Remark
Tolerance (rpm)	±100	±125	±150	±200	±250	±300	±350	

SPEEDOMETER

COMPONENT CHECK ETHA1750

SPEEDOMETER



ETA9100A

1. Adjust the pressure of the tires to the specified level.
2. Set the vehicle onto a speedometer tester and use wheel chocks to hold the front wheels.
3. Check if the speedometer indicator range is within the standard values.

CAUTION

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

NOTE

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

Pointer vibration can be caused by a loose or dry speedometer cable.

Velocity (Km/ h)	20	40	60	80	100	120	140	160	180	200	Remark
Tolerance (Km/ h)	20-24.1	40-43	60-64.1	80-85.2	100-105.2	120.5-126.3	140.5-146.7	160.5-167.5	181-188.4	201-209.1	Except EEC& GENERAL
	20.8-25.4	40-44	60.8-65.4	81.4-86.8	102.6-108.2	123.5-129.6	144.4-151	165.4-172.4	186.3-193.8	207.2-215.2	EEC, GENERAL

Velocity (MPH)	10	20	40	60	80	100	120	Remark
Tolerance (MPH)	10-12.5	20-22	40-42.6	60-63.4	80.3-84.1	100.3-104.7	120.3-125.3	EXCEPT U.S.A
	8.5-11.5	18.5-21.5	38.5-41.5	58.3-61.7	78-82	97.7-102.3	117.5-122.5	U.S.A

POWER DOOR MIRRORS

POWER DOOR MIRROR SWITCH

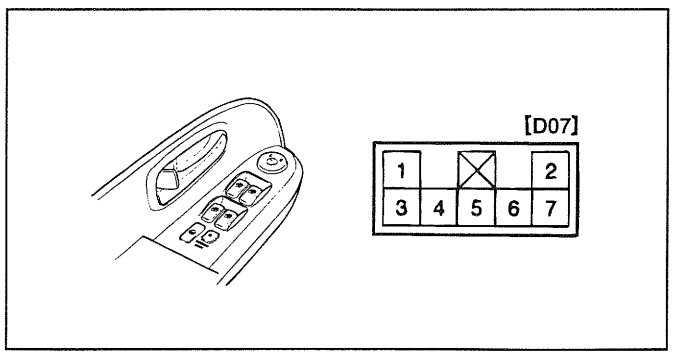
INSPECTION ETHA1800

1. Remove the power window main switch from the door trim panel.
2. Disconnect the outside rear view mirror connector from the harness.
3. Operate the switch and check for continuity between the terminals. If continuity is not as specified, replace the mirror switch.

[D07]

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

ETHA025B



ETHA180A

POWER DOOR MIRROR ACTUATOR

INSPECTION ETHA1850

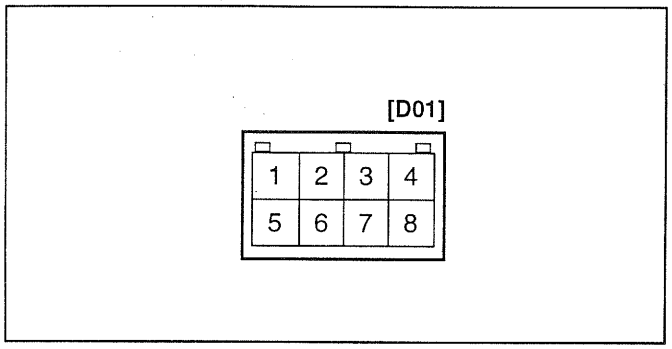
1. Disconnect the outside rear view mirror connector from the harness.

2. Apply battery voltage to each terminal as shown in the table and confirm that the mirror operates properly.

[D01]

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

ETHA030B



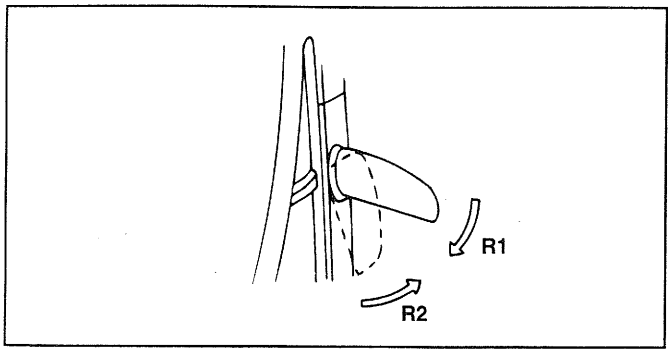
ETHA185A

MIRROR FOLDING

[D01]

Terminal / Direction	3	4
R1	⊖	⊕
R2	⊕	⊖

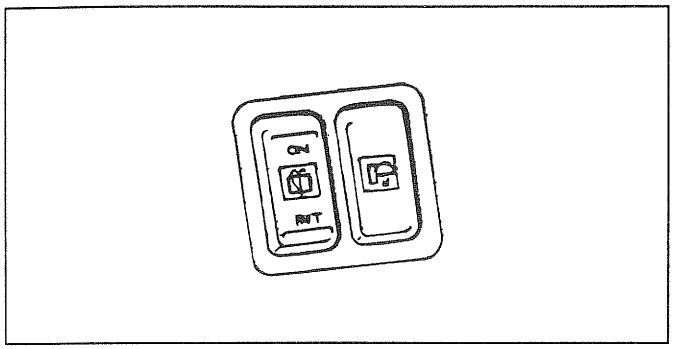
ETHA030D



ETHA030A

OUTSIDE MIRROR FOLDING SWITCH

ETHA2000



ETHA040A

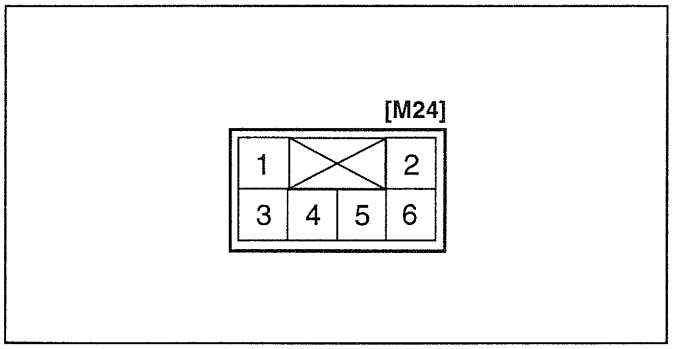
INSPECTION ETHA2050

1. Remove the cluster facia panel.
2. Disconnect the outside mirror folding switch and check for continuity between the terminals.

[M24]

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

ETHA040B



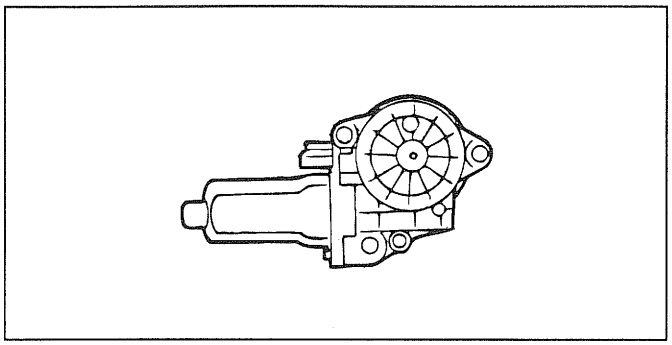
ETHA205A

POWER WINDOWS

POWER WINDOW MOTOR

INSPECTION ETHA1900

Connect the motor terminals directly to the battery 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.



ETHA035A

POWER WINDOW SWITCH

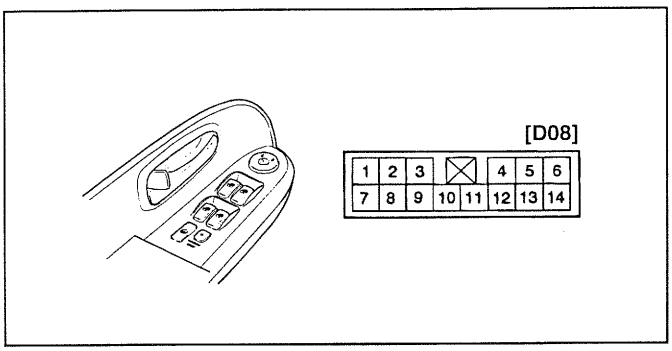
INSPECTION ETHA1950

1. Remove the power window main switch from the door trim panel.
2. Operate the switch, and check for continuity between the terminals.
3. If continuity is not as specified, replace the switch.

[D08]

Terminal / Position	FRONT LEFT				FRONT RIGHT				REAR LEFT				REAR RIGHT			
	5	6	10	11	2	4	10	11	9	10	11	12	7	8	10	11
UP	○			○	○			○	○		○		○			○
		○	○			○	○			○		○		○	○	
OFF	○	○	○		○	○	○		○	○		○	○	○	○	
DOWN		○		○		○		○			○	○		○		○
	○		○		○		○		○	○			○		○	

ETDA035C



ETHA195A

DOOR LOCK SWITCH [D08]

Terminal / Position	10	13	14
LOCK	○		○
OFF			
UNLOCK	○	○	

ETHA035D

WINDOW LOCK SWITCH [D08]

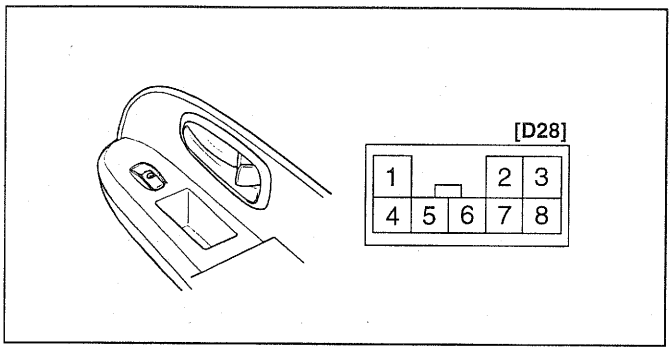
Terminal / Position	1	11
NORMAL	○	○
LOCK		

ETHA035E

POWER WINDOW SUB SWITCH [D28]

Terminal / Position	1	2	3	5	7
UP	○	○	○		○
OFF	○	○	○	○	
DOWN	○		○	○	○

ETHA035F



ETHA195B

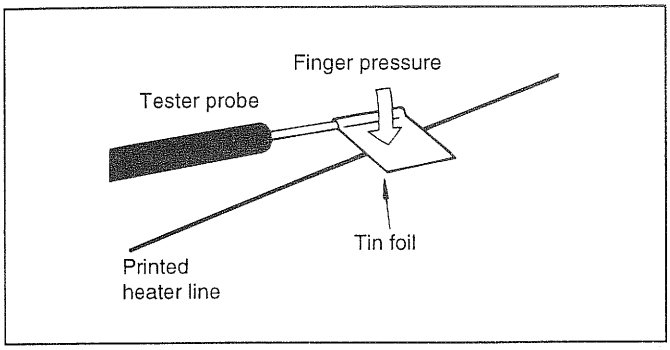
REAR WINDOW DEFOGGER

REAR WINDOW DEFOGGER PRINTED HEATER

INSPECTION ETA91650

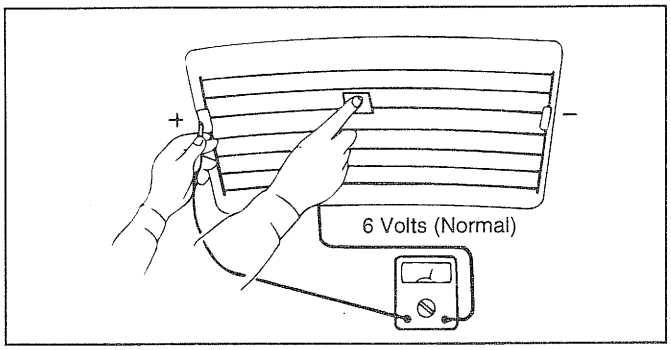
CAUTION

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.



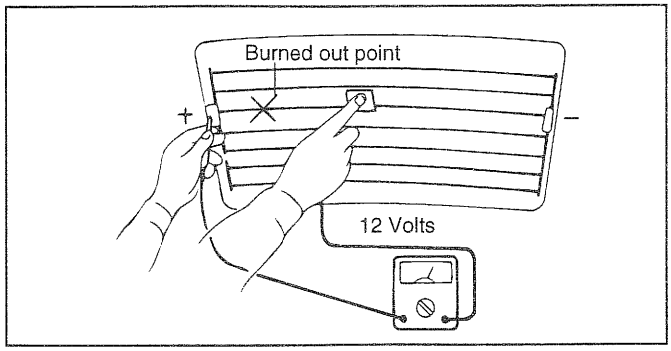
ETA9165A

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.



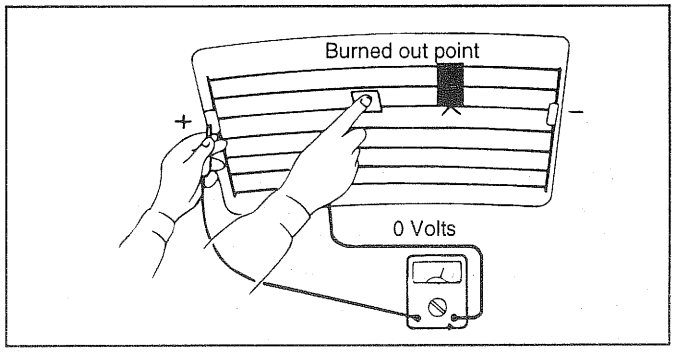
ETA9165B

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



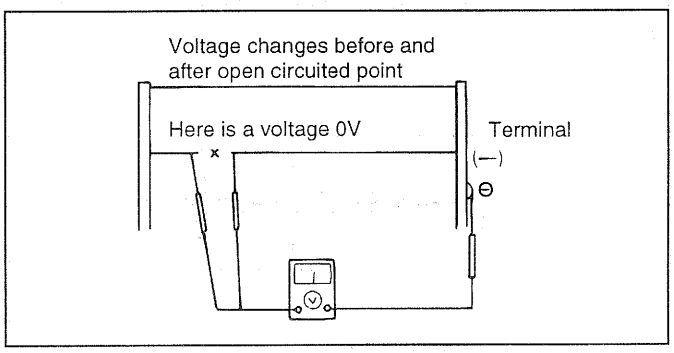
ETA9165C

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



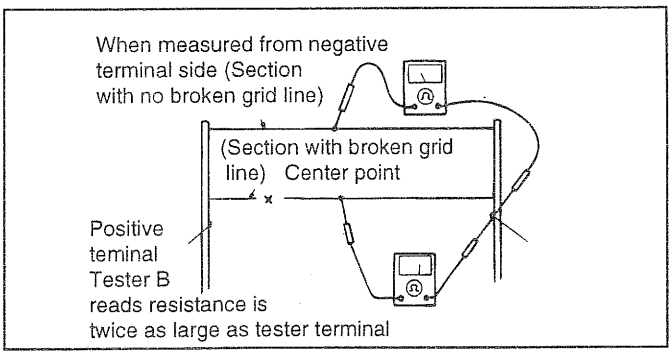
ETA9165D

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-circuited 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 after another. The section involving a broken heater line indicates resistance twice as that in other section. In the affected section, move the test lead to a position where resistance sharply changes.



ETA9165F

REPAIR OF BROKEN HEATER LINE

Prepare the following items:

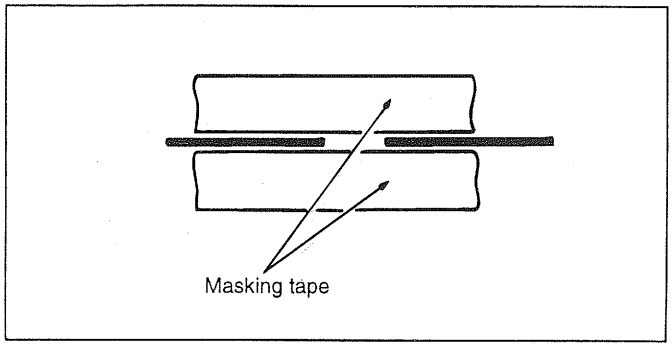
1. Conductive paint.

2. Paint thinner.
3. Masking taps.
4. Silicone remover.
5. 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 completely dried. (allow 24 hours).

CAUTION

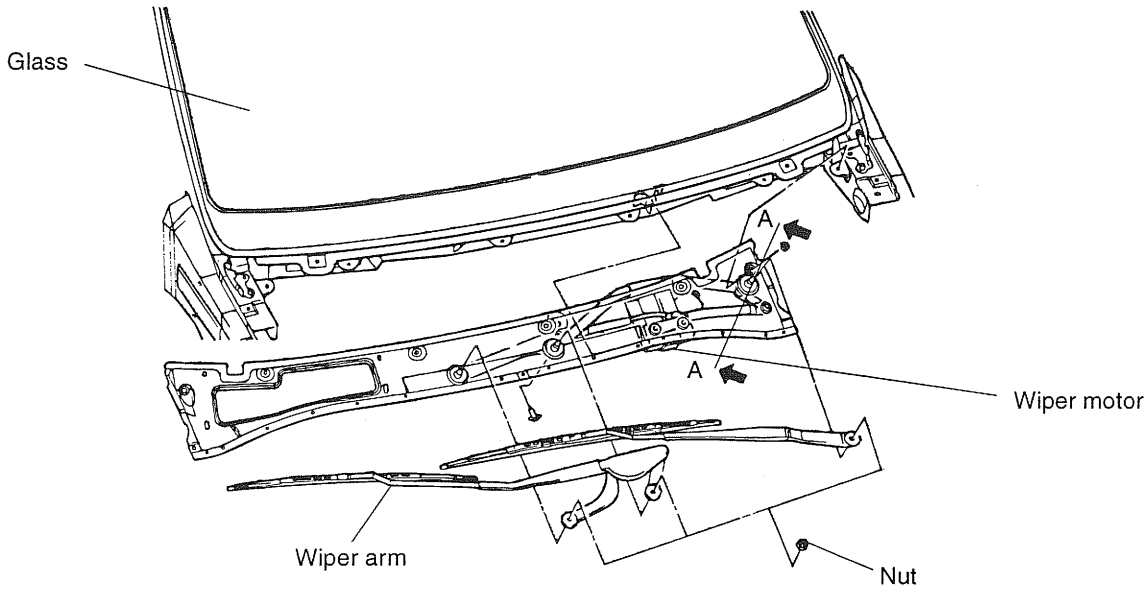
After repairing, clean the glass with a soft dry cloth or wipe along the grid line with a slightly moistened cloth.



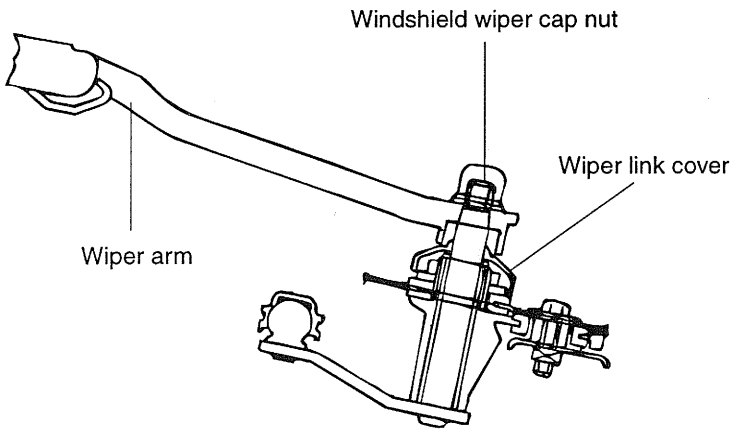
ETA9165G

WINDSHIELD WIPER/WASHER

COMPONENTS ETHA2300



ETHA065A



ETHA065B

SECT. A-A

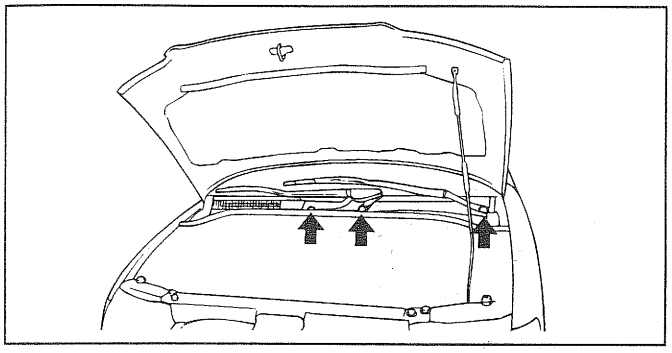
ETHA230A

REMOVAL ETHA2350

1. Remove the windshield wiper arm and blade.

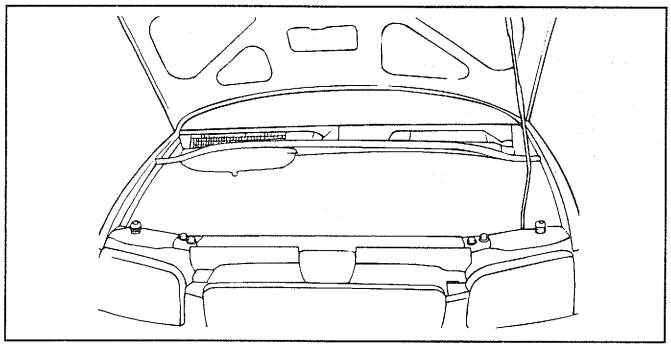
NOTE

Care must be taken not to scratch the engine hood.



ESHA040A

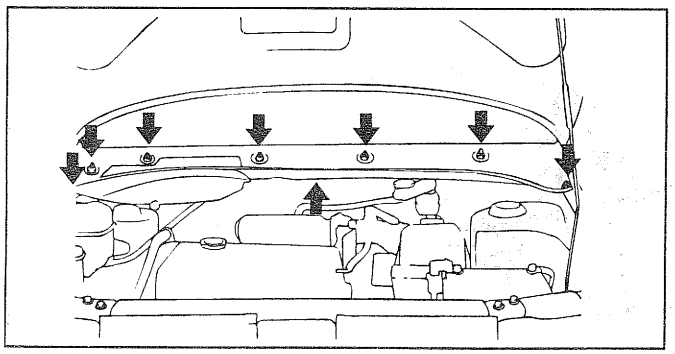
2. Remove the cowl top cover.



ESHA040B

3. Disconnect the windshield wiper motor connector and remove the windshield wiper motor and the link.

Tightening torque : 7-11Nm (70-110kg.cm, 5.1-8.0lb.ft)



ESHA040C

RAINSENSING WINDSHIELD WIPER SYSTEM ETHA3000

DESCRIPTION

The Rainsensing windshield wiper system is a wiper system that, in addition to providing normal wiper functions off, mist, manual low speed, manual high speed, and wash, provides automatic control of automatic int, automatic low, and automatic high speeds.

When the ignition key is in the ON position, the rainsensor will be activated.

OPERATING MODES

MULTIFUNCTION SWITCH POSITION	RAINSENSOR OPERATING MODE	SENSOR ACTION
MIST	MIST	Mist is controlled by the column switch. The sensor has no affect on this function.
OFF	OFF	If not already parked, wiper motor moves with low speed until blades are in the depressed park position.
AUTOMATIC Automatic mode has 5 sensitivity settings	AUTOMATIC	Automatic INT/speed control The sensitivity to raindrop accumulation on the windshield is set by the multifunction switch sensitivity adjustment.
LOW SPEED	MANUAL	Wiper motor runs continuously in low speed, for example 45 wipes/minute. The sensor has no affect on this function.
HI SPEED	MANUAL	Wiper motor moves continuously with high speed, for example 60 wipes/minute. The sensor has no affect on this function.
WASH When washer switch is turned on during 0.6 sec or more	WASH	If washer switch is turned on during 0.6 sec or more, the wiper operate during 2.5~3.8 sec
WASH When washer switch is turned on during 0.6 sec or less	WASH	If washer switch is turned on during 0.6 sec or less, the wiper operate only one time

1. **OFF MODE**

   With the wiper switch "OFF" and the ignition switch "ON", the rainsensor is considered to be in the "OFF" mode. In this mode, the sensor commands the wiper motor to be "OFF".

2. **AUTOMATIC MODE**

   When the multifunction switch is moved to auto position and the ignition switch is in the run or accessory positions, the rainsensor is considered to be in "automatic" mode. Once a single "instant wipe" has occurred, the wipers remain at "innerwipe/park" until the rainsensor determines that the dwell time at that position is appropriate for the amount of precipitation on the windshield, rainsensor provides input to the wiper motor to activate the wipers to clear the precipitation from the windshield.

3. **AUTOMATIC INT**

   For all automatic int. operations the rainsensor commands the wipers to operate in low speed for one wipe, followed by a variable dwell period in the inner wipe position.

4. **AUTOMATIC LOW**

   Automatic low speed operation is utilized when the amount of precipitation impinging on the windshield exceeds the automatic int to automatic low threshold. This threshold includes sufficient hysterisis to prevent cycling between automatic int and automatic low speed operation with a steady amount of precipitation accumulation on the windshield.

5. **AUTOMATIC HIGH**

Automatic high speed operation utilized when the amount of precipitation impinging on the windshield exceeds the automatic low to automatic high threshold. This threshold includes sufficient hysterisis to prevent cycling between automatic low and automatic high speed operation with a steady amount of precipitation accumulation on the windshield.

6. **WASH MODE**

The rainsensor monitors the multifunction switch to determine if the wash function is selected. Rainsensor enables the wiper motor to run in low speed during the wash mode and performs wipes from 2.5 to 3.8 sec.

7. **MANUAL MODE**

The rainsensor determines when a manual mode such as manual low, mist, off or manual high is selected. The column switch performs these modes and the rain sensor has no affect.

REPLACEMENT

The rainsensor module is mounted to the optocoupler using two snap fit stainless steel clips.

This allows the rainsensor module to be easily removed and replaced in the event of a rainsensor module failure.

If the windshield requires replacement, the existing rainsensor module may be unsnapped from the original windshield and reinstalled onto the new windshield. It is snap-fit to the new optocoupler, an integral portion of the replacement windshield as delivered by the replacement windshield manufacturer.

TROUBLESHOOTING

The rainsensor has two levels of fault detection as described below:

1. **FAULT A**

Fault A is indicated when the sensor has detected that the sensor servo operating point is above the expected limits. This is an indication of damage to the windscreen in the area of the coupler or the sensor has been removed from the coupler.

2. **FAULT B**

Fault B is indicated when the sensor has detected that it no longer is responding to rain signals.

This is an indication of damage to the windscreen in the area of the coupler or, more likely, that the sensor has detected an electrical failure within the sensor.

3. **ATTACHMENT GRADE VALUE**

Attachment grade is used to determine when a fault in A is detected. The attachment grade value is set at 140. This allows the product to operate in all conditions other than the most severe damage the windscreen.

4. **USE SENSITIVITY ADJUSTMENT TO INDICATE FAULT**

A method to indicate detected faults is available to a service garage technician by using the sensitivity input and the wipers as an indicator. The service method is described as follows:

- With ignition "ON", move the sensitivity adjustment to the high sensitivity setting.
- Decrease the sensitivity by one setting.
- If a wipe occurs, then Fault A has been detected and the service technician should assure that the coupler area on the windscreen is not damaged and the sensor is secured to the coupler.
- Decrease the sensitivity one more setting.
- If a wipe occurs, then Fault B has been detected and the sensor should be removed and replaced with a known good sensor.

CAUTION

When the ignition key is "ON" and the multifunction switch is in the auto position the wiper could operate in the following conditions.

- **Be careful not to touch the upper sensor front window glass.**
- **Be careful not to scrub the upper sensor front window glass with a cloth.**
- **Be careful not to vibrate the front window glass.**

WINDSHIELD WIPER/WASHER SWITCH ETHA2400

INSPECTION

Check the switch for continuity between the terminals.

WIPER AND INTERMITTENT VOLUME SWITCH [M26-2]

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

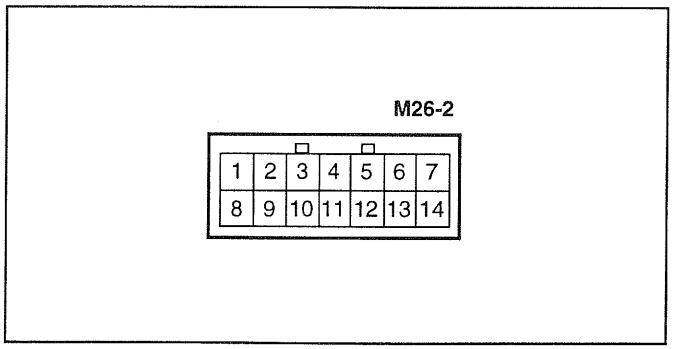
KTDA040D

WASHER SWITCH [M26-2]

Position \ Terminal	7	8
OFF		
ON	○	○

KTDA040E

If continuity is not as specified, replace the wiper and washer switch.

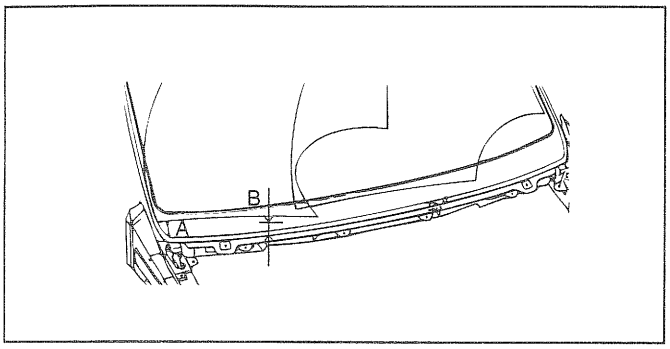


ETHA240A

INSTALLATION ETHA2550

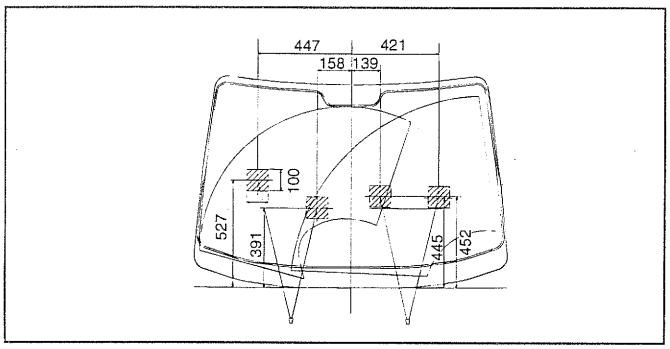
1. Install the wiper arm to the specified position.

Specified position	A	B
Distance (mm)	50	45



ETHA065C

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



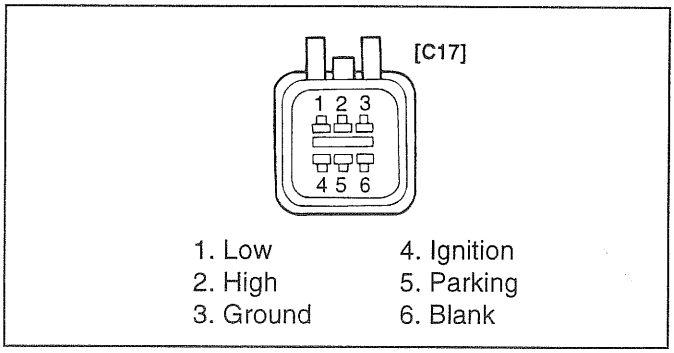
ETHA065D

FRONT WIPER MOTOR

INSPECTION ETHA2450

SPEED OPERATION CHECK

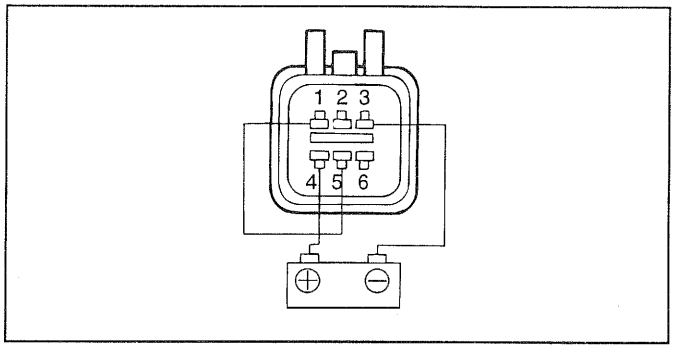
1. Remove the connector from the wiper motor.
2. Attach the positive (+) lead from the battery to terminals 4 and the negative (-) lead to terminal 1.
3. Check that the motor operates at low speed.
4. Connect the positive (+) lead from the battery to terminal 4 and the negative (-) lead to terminal 2.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



ETHA245A

AUTOMATIC STOP OPERATION CHECK

1. Operate the motor at low speed.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 1.
3. Connect terminals 5 and 1.
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.



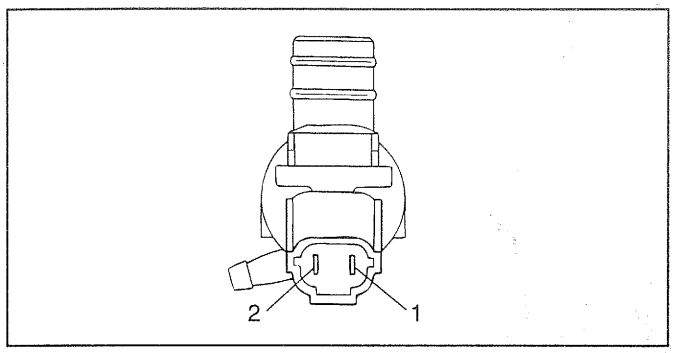
ETDA155B

FRONT WASHER MOTOR

INSPECTION ETA91800

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

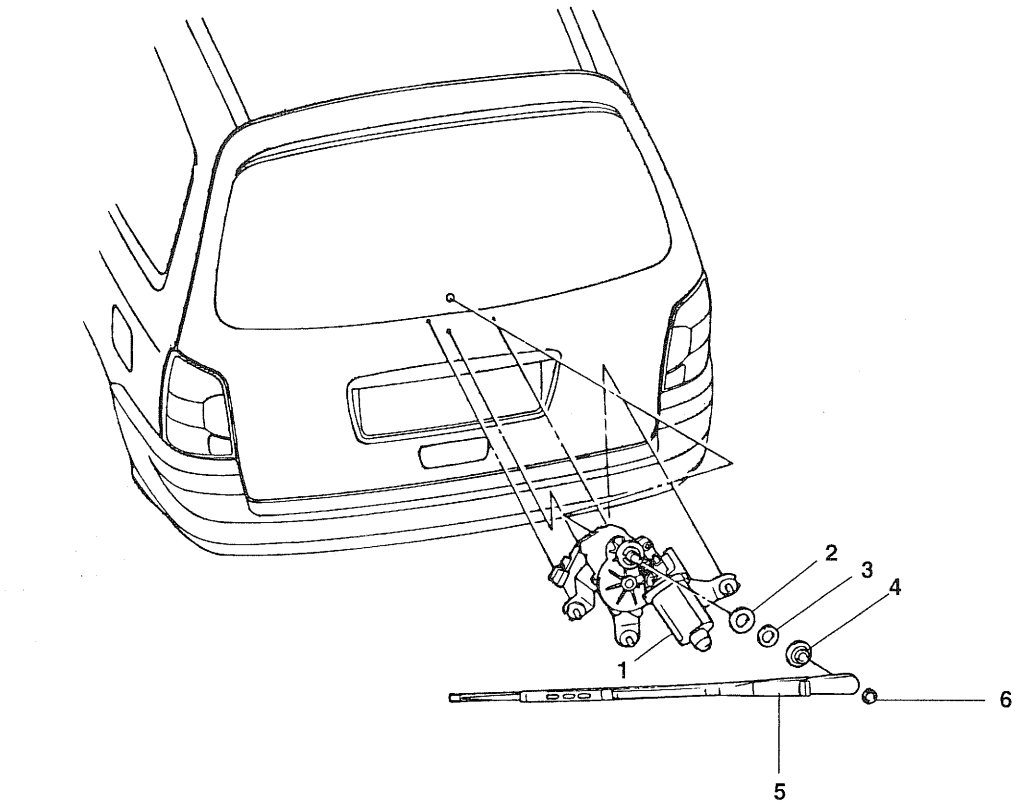
2. Connect positive (+) and negative (-) battery cables to terminals 2 and 1 respectively to see that the washer motor runs and water is pumped.

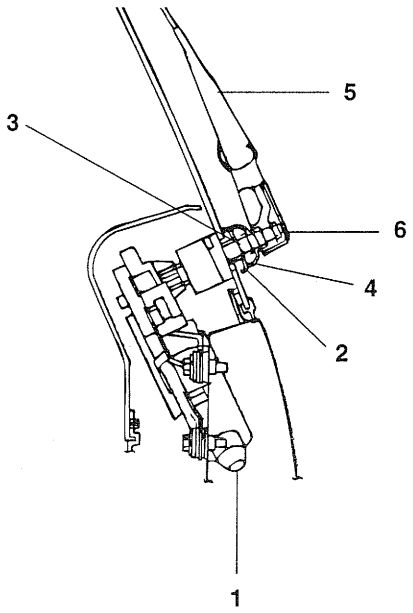


ETA9180A

REAR WIPER/WASHER

COMPONENTS ETHA2600





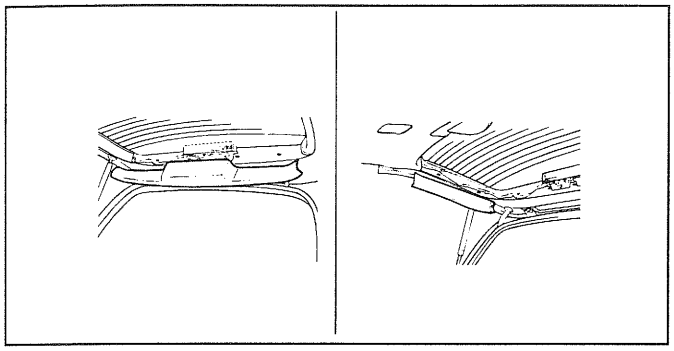
1. Rear wiper motor and link
2. Cap
3. Nut
4. Cover
5. Rear wiper arm and blade
6. Nut

ETHA260A

REAR WIPER MOTOR

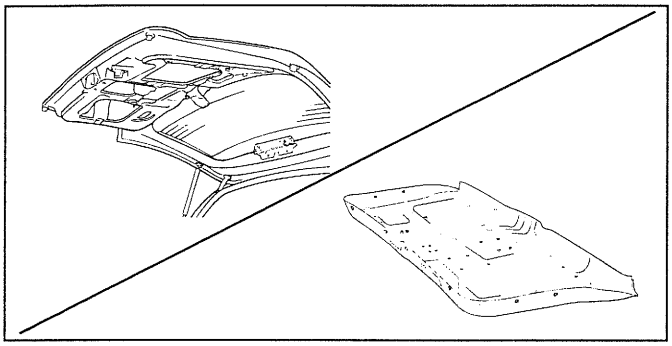
REMOVAL ETHA2650

1. Remove the tailgate frame upper and side trim.



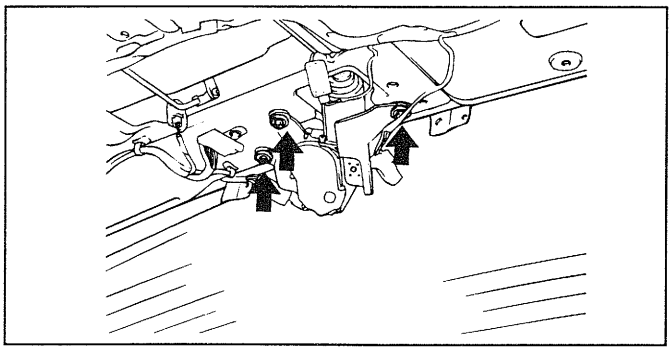
ETHA265A

2. Remove the tailgate trim panel.



ESHA010C

3. Remove the rear wiper motor.

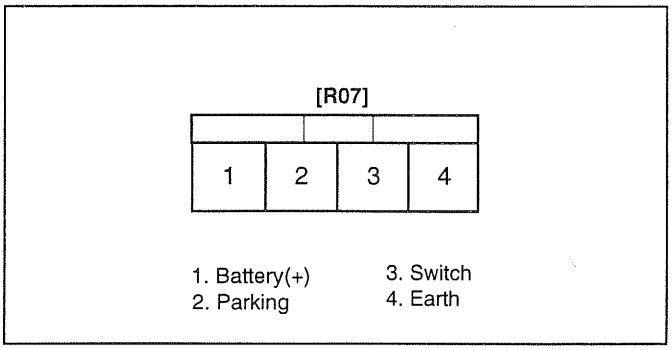


ESHA010J

4. Installation is the reverse of the removal process.

INSPECTION ETHA2700

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

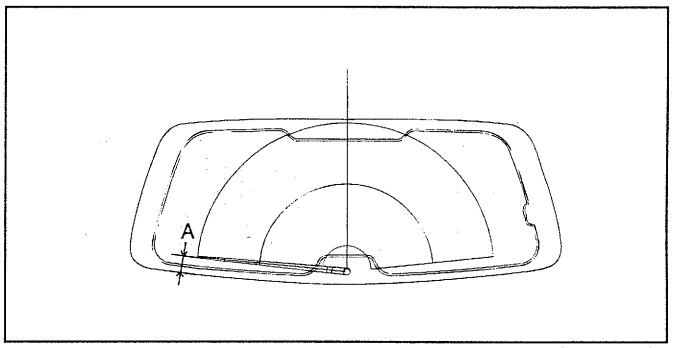


KTDA170A

INSTALLATION ETHA2800

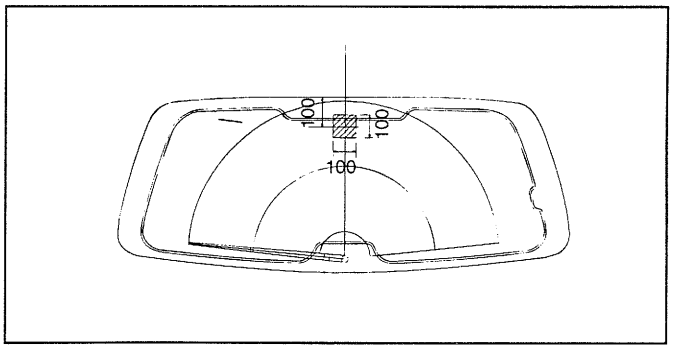
1. Install the rear wiper arm to the specified stop position.

Specified position	A
Distance	60mm



ETHA070C

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



ETHA070D

REAR WASHER SWITCH

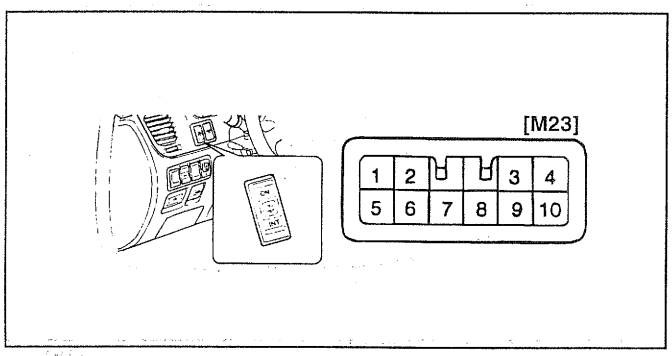
INSPECTION ETHA2850

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

[M23]

Mode		Terminal 1	2	3	4	6	9	10
Wiper switch	ON				○		○	
	OFF			○			○	
	INT				○	○		
Washer switch	ON				○			○
Illumination	Tail	○	○	○				

KTDA171C



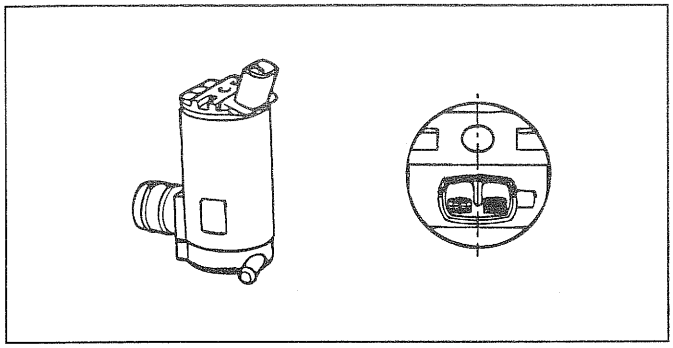
ETHA285A

REAR WASHER MOTOR

INSPECTION ETHA2750

1. With the washer motor connected to the reservoir tank, fill the reservoir tank with water.

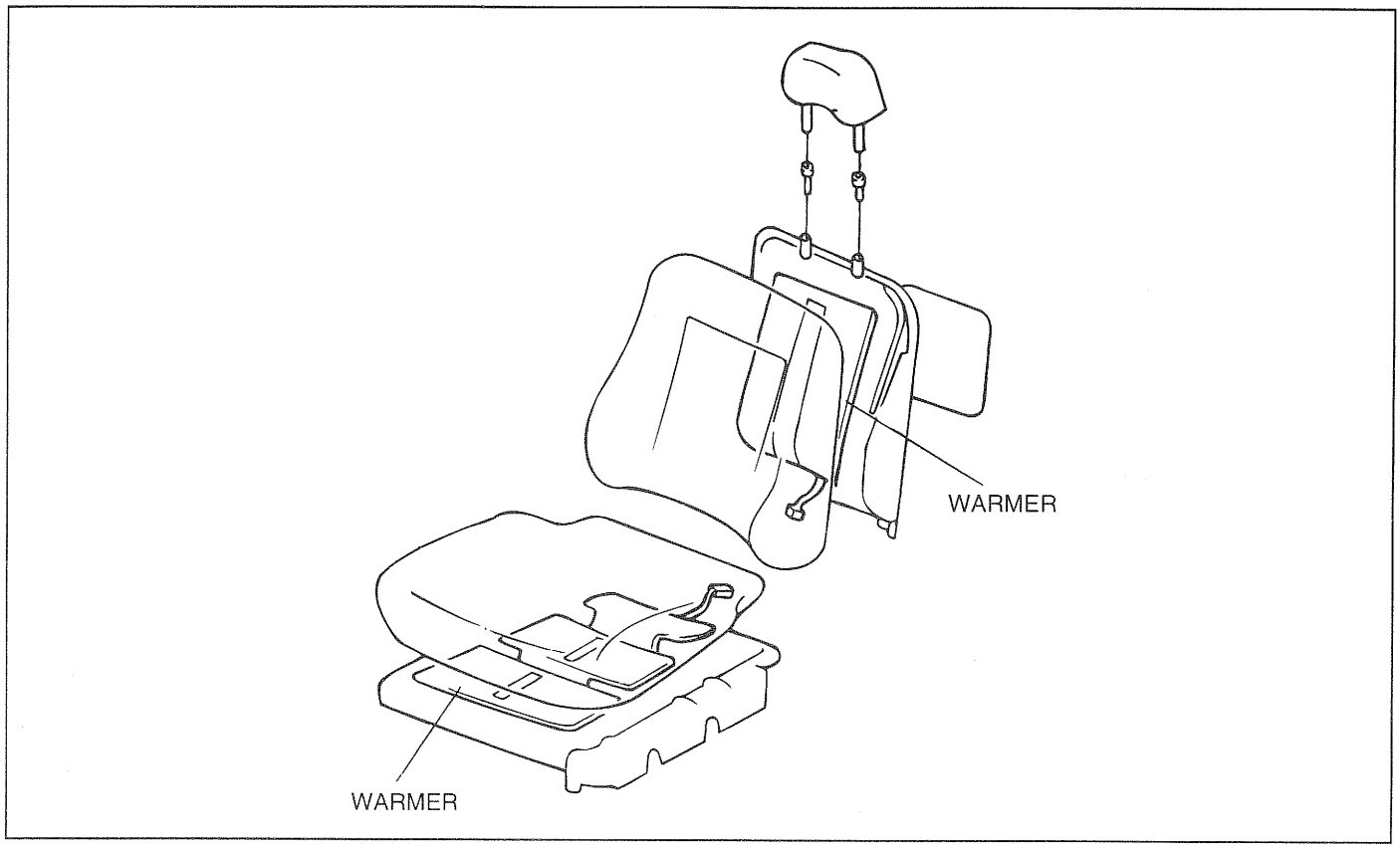
2. Connect positive(+) and negative(-) battery cables to terminals 1 and 2 respectively to see that the washer motor runs and water is pumped.



ETHA275A

SEAT WARMER

SEAT WARMER SYSTEM ETA92050



ETA9205A

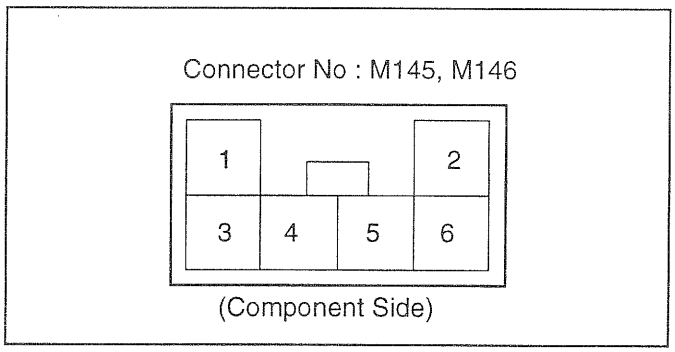
SEAT WARMER SWITCH

INSPECTION ETHA3250

Inspect the switch continuity between terminals as below.

Terminal / Switch position	1	2	3	4	5	6
ON	○		○		○	
OFF	○		○			

ETHA325A



ETHA325B

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

SUNROOF

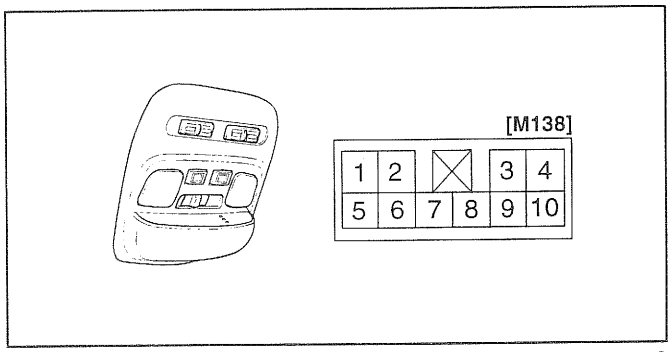
SUN ROOF SWITCH

INSPECTION ETHA3300

1. Using an ohmmeter, check for continuity between the terminals.
2. If the continuity is not as specified, replace the switch.

Condition		Terminal 1	2	3	4	5	6	7	8	9	10
Slide switch	Open		○	○							
	Close			○			○				
Tilt switch	Up			○		○					
	Down	○		○							

ETHA330A



ETHA045C

SUN ROOF RELAY

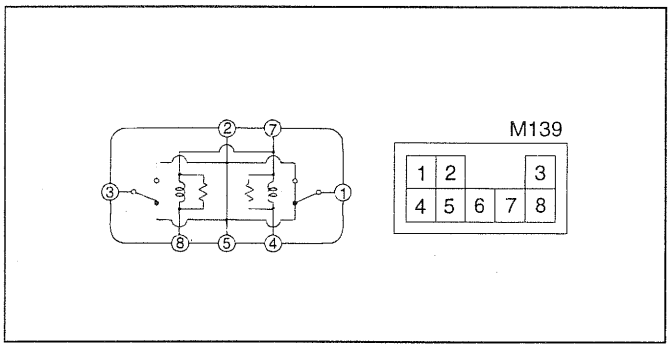
INSPECTION ETHA3350

Check for continuity between the terminals.

Terminal / Position	1	2	3	4	5	6	7	8
Battery voltage not supplied (coils not energized)	○		○		○			
Battery voltage supplied (coils energized)	○	○		⊖			⊕	
		○	○				⊕	⊖

⊕- - -⊖ **Indicates battery connection**

ETHA335A

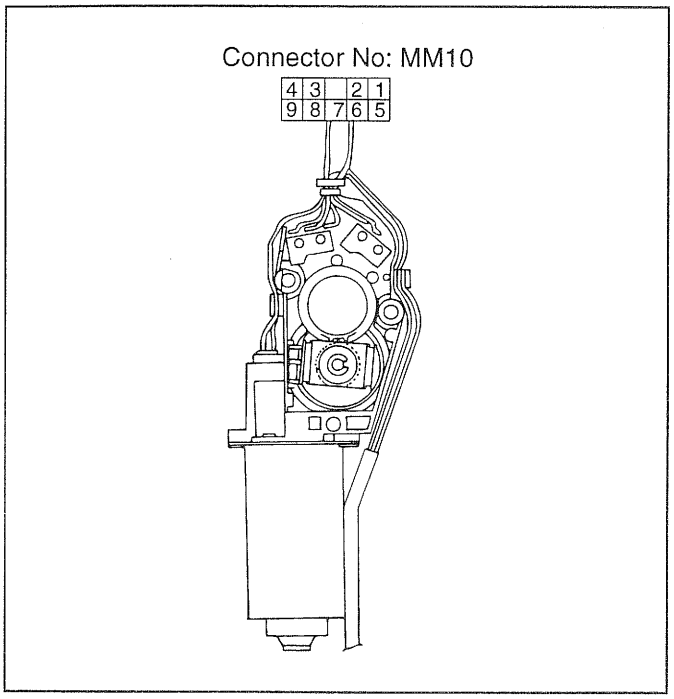


ETHA130A

SUN ROOF MOTOR

INSPECTION ETHA3400

1. Remove the overhead console lamp.
2. Disconnect the motor connector from sun roof harness.
3. After applying DC 12V to the terminal 8, apply the terminal 3 to the ground.
4. Check that the motor turns in the direction of the sunroof when tilted down and is open.
5. Reverse the connections and check that the motor turns in the direction when the sunroof is closed and tilted up.



ETAA215B

HEAD LAMPS

LIGHTING SYSTEM ETHA2900

PRE-AIMING INSTRUCTIONS

The headlamps should be aimed with the proper beam-setting equipment, and in accordance with the equipment manufacture's instructions.

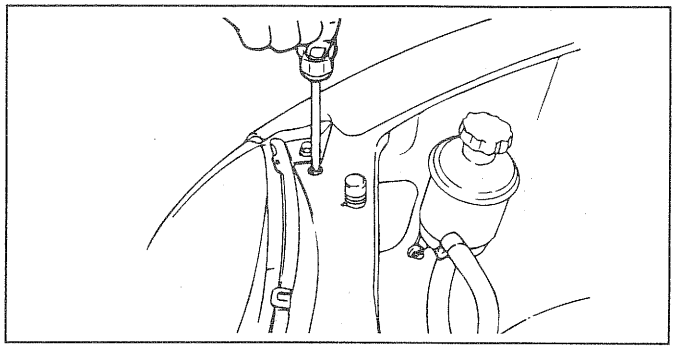
NOTE

If there are any regulations pertinent to the aiming of headlamps in the area where the vehicle is to be used, adjust to as to meet those requirements.

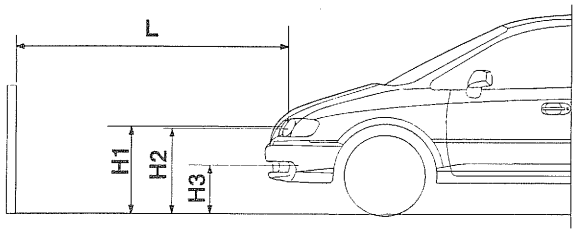
Alternately turn the adjusting bolts to adjust the headlamp aiming. If beam-setting equipment is not available, proceed as follows:

1. Inflate the tires to the specified pressure and remove the load from the vehicle except a driver, spare tire, and tool.
2. The vehicle should be placed on the flat floor.
3. Draw vertical lines (Vertical lines passing through respective headlamp centers) and a horizontal line (Horizontal line passing through center of headlamps) on the screen.
4. With the headlamp and battery in normal condition, aim the headlamps.

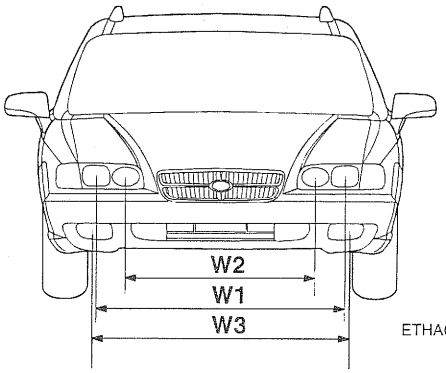
   Make the vertical and horizontal adjustment of the lower beam to the standard values by using the adjusting knobs.



ETA9230A



ETHA075B



ETHA075A

H1 : Height between the head lamp bulb center and ground (low beam)
H2 : Height between the head lamp bulb center and ground (high beam)
H3 : Height between the fog lamp bulb center and ground

W1 : Distance between the head lamp bulb center (low beam)
W2 : Distance between the head lamp bulb center (high beam)
W3 : Distance between the fog lamp bulb center

ETHA290A

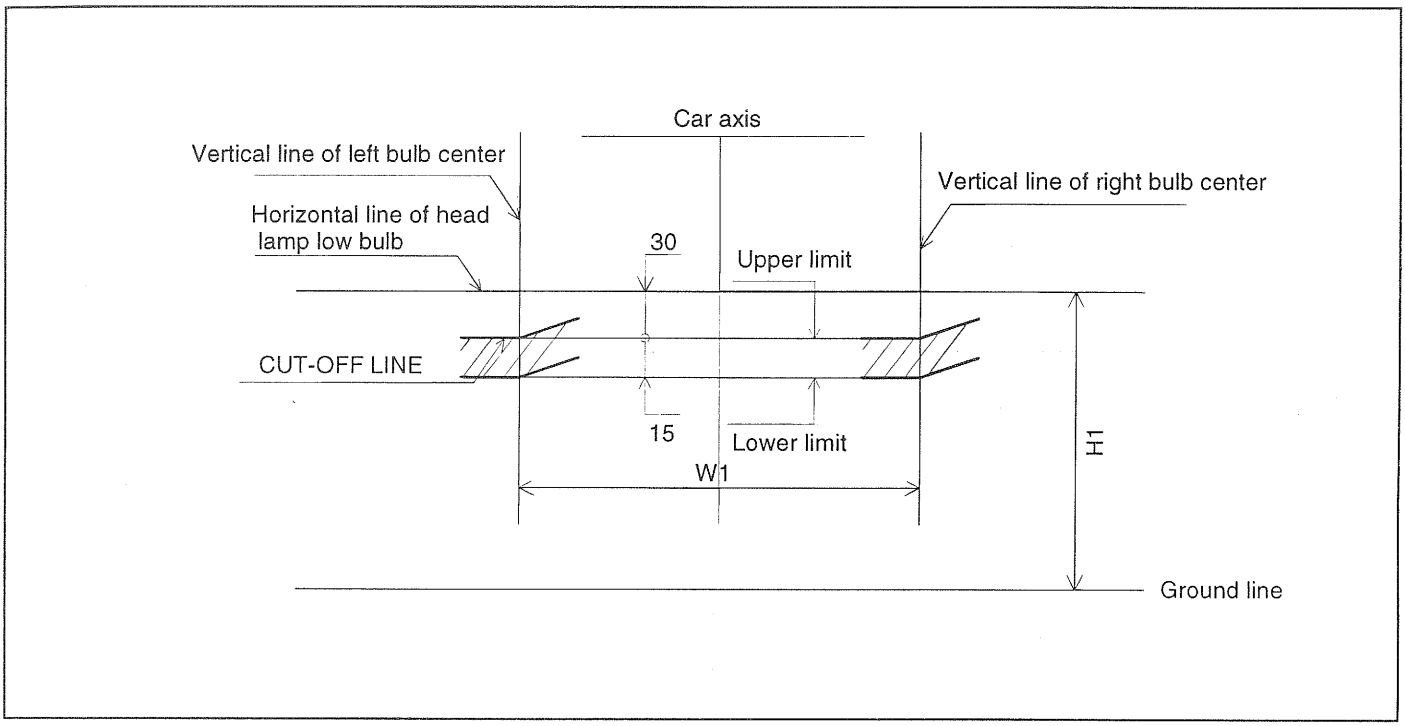
HEAD LAMP AND FOG LAMP AIMING POINT

Unit : mm

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	700	694	365	1,254	978	1,270	3,000
With driver	685	679	350				

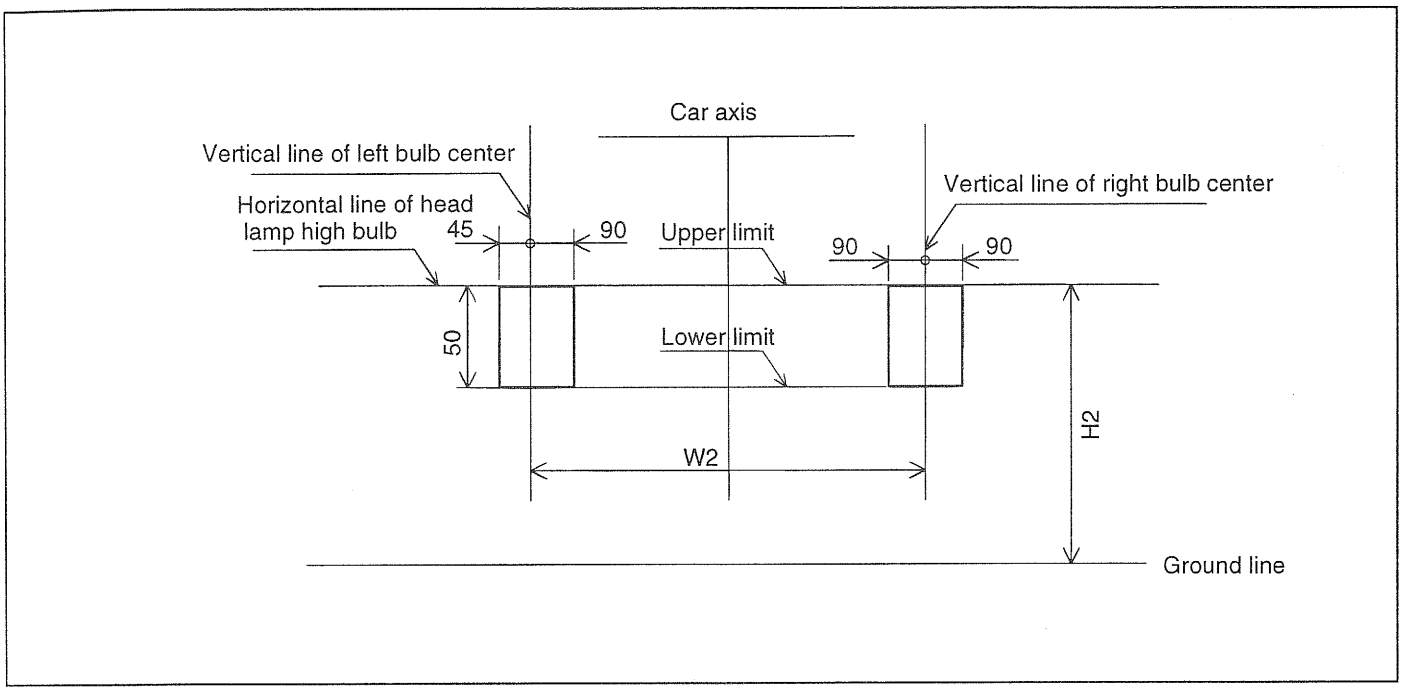
ETHA290B

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



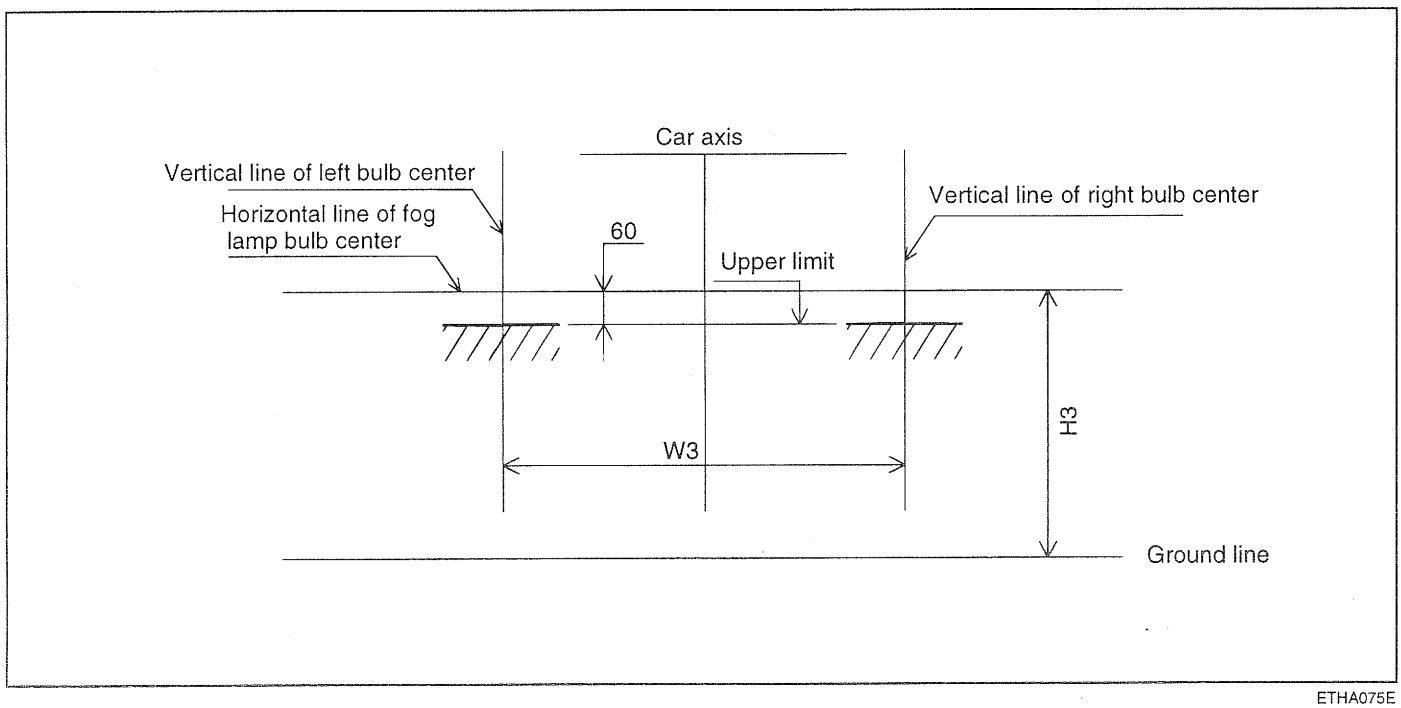
ETHA075C

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



ETHA075D

- Turn the front fog lamp on without driver. The cut-off line is projected in the allowable range.



ETHA075E

HEAD LAMP RELAY ETHA3050

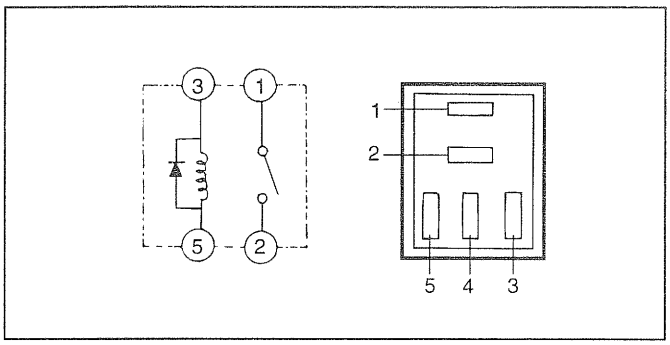
INSPECTION

1. Pull out the headlamp relay from the relay box in the engine compartment.
2. Check for continuity between terminals.

Terminal / Position	1	2	3	5
When de-energized			○—○	
When energized	○—○		⊕—⊖	

NOTE:
1. ○—○: Indicates that there is continuity between the terminals.
2. ⊖—⊕: Indicates that power is supplied.

ETHA305A



ETDA211B

AUTO LIGHT CONTROL MODULE ETHA2950

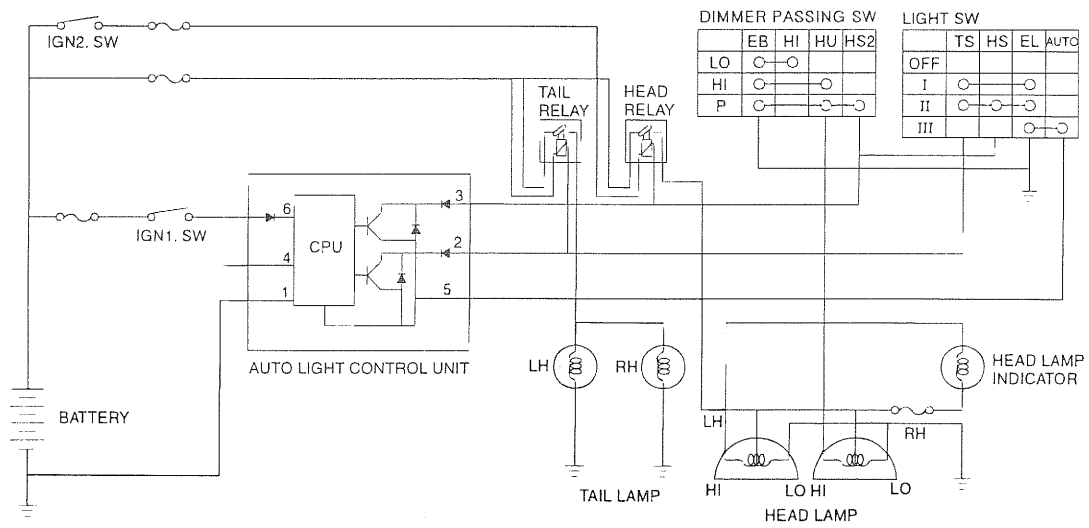
DESCRIPTION

The auto light control system operates by using the auto light switch, and turns the head lamp and tail lamp on or off automatically in accordance with the detection illumination.

SPECIFICATIONS

Items	Specifications
Rated voltage	DC 12V
Operating voltage	DC 9V~16V
Load	Max. 200mA (Relay)
Operating temperature range	-30°C~+80°C

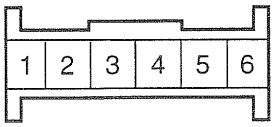
CIRCUIT DIAGRAM



ETHA080A

PIN CONNECTION

[M65]



1. Ground
2. Tail lamp relay
3. Head lamp relay
4. Detection illumination input
5. Auto light switch
6. IGN. switch

Terminal	Voltage
1	Earth
2	5V(Normal), 0V(Tail lamp relay)
3	12V(Ignition ON)
5	5V(Normal), 0V(Switch ON)
6	12V(Ignition ON)

ETHA295A

DETECTION ILLUMINATION

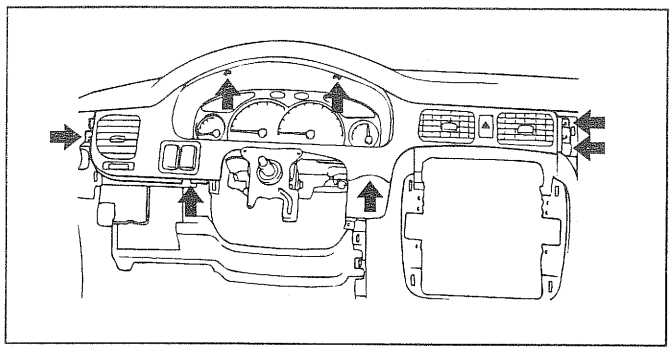
TYPE	CONDITION	TAIL LAMP	HEAD LAMP
Non solar glass	ON	50.8±3(LUX)	13.6±1.4(LUX)
	OFF	99.4±6(LUX)	25.9±3(LUX)
Solar glass	ON	23.8±3(LUX)	5.7±1.4(LUX)
	OFF	46.7±3(LUX)	12.2±1.4(LUX)

TURN/HAZARD LAMPS

TURN/HAZARD SWITCH

INSPECTION ETHA3100

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel.
3. Disconnect the connector from the hazard lamp switch.



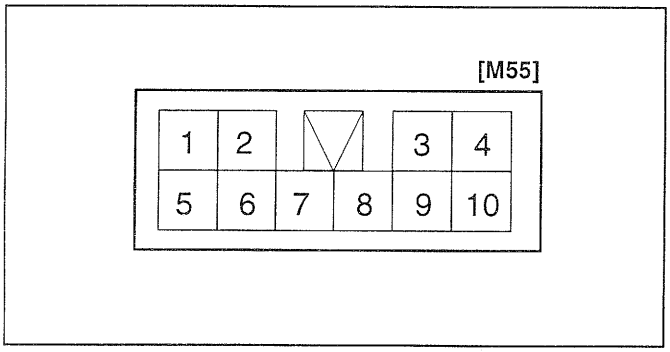
ESHA040V

4. Operate the switch and check for continuity between terminals by using an ohmmeter.

[M55]

Position \ Terminal	1	2	3	5	6	7	8	9	10
OFF		●		●			●		
ON					●	●	●	●	●

KTDA213C

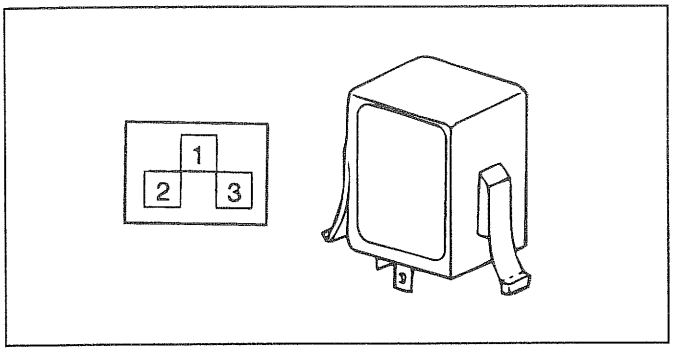


KTDA213B

FLASHER UNIT

INSPECTION ETHA3150

1. Remove the flasher unit from the relay box.
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 parallel to each other to terminals 2 and 3. 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.

COURTESY AND TRUNK LAMPS

OVERHEAD CONSOLE LAMP

INSPECTION ETHA2100

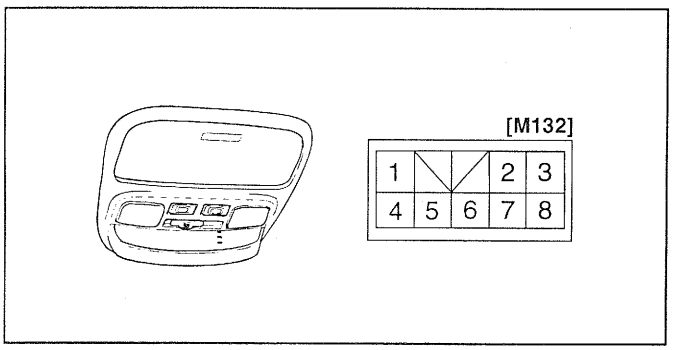
Remove the overhead console lamp and check for continuity between the terminals.

- VEHICLES WITHOUT SUNROOF

[M132]

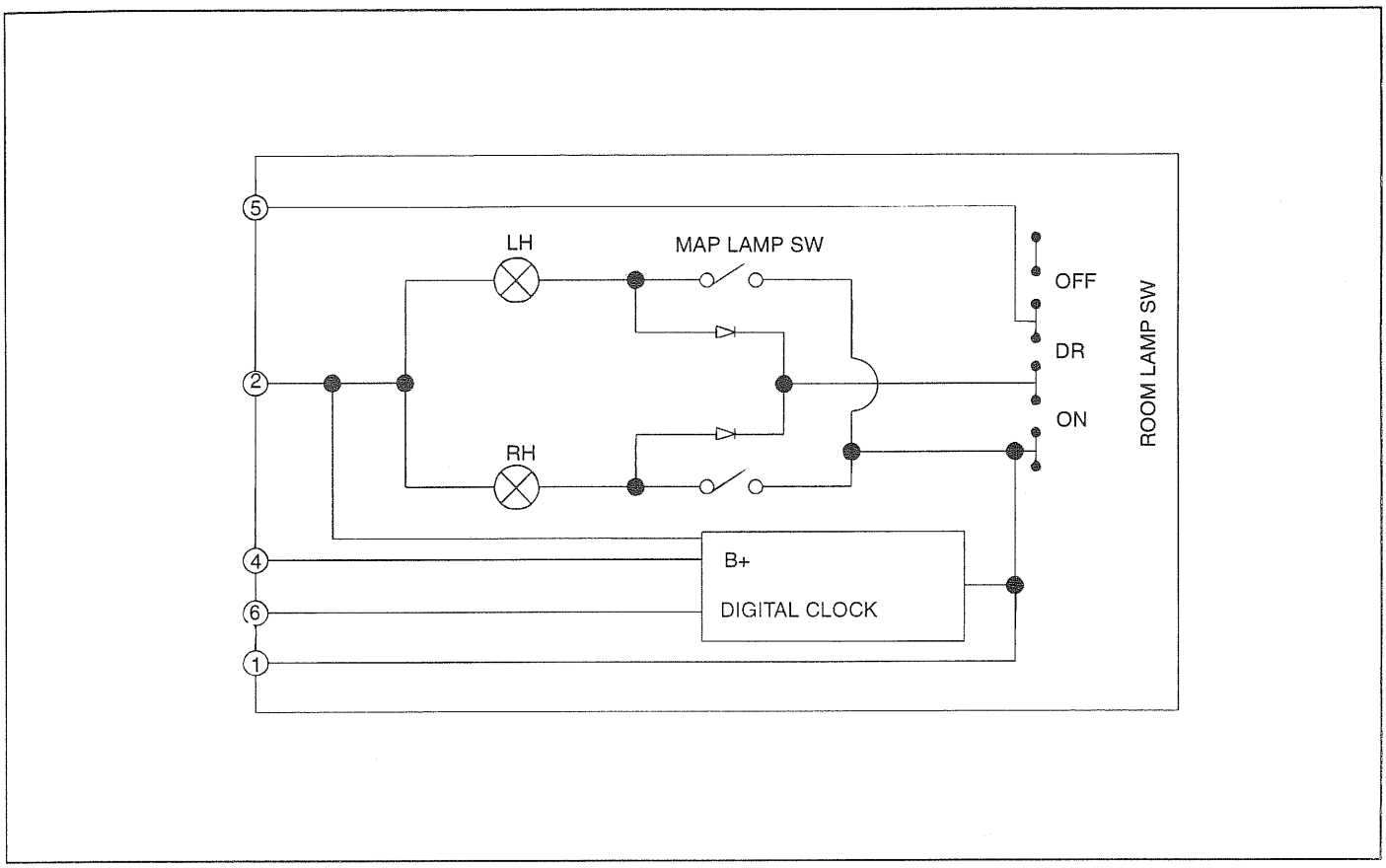
Sort / Position / Terminal	ROOM LAMP SWITCH			MAP LAMP SWITCH			
				LH		RH	
	ON	DR	OFF	ON	OFF	ON	OFF
1	○			○		○	
2	○	○					
5		○		○		○	

ETHA045E



ETHA045A

CIRCUIT DIAGRAM ETHA2150



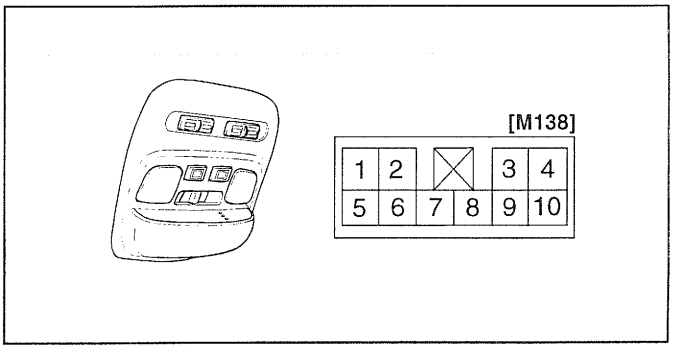
ETHA045B

- VEHICLES WITH SUNROOF

[M138]

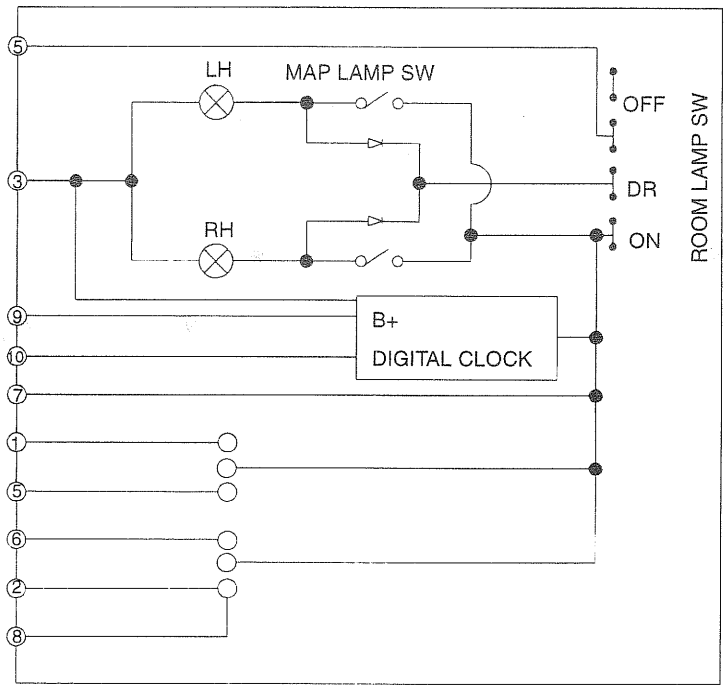
Sort / Position / Terminal	ROOM LAMP SWITCH			MAP LAMP SWITCH			
				LH		RH	
	ON	DR	OFF	ON	OFF	ON	OFF
3	○	○		○		○	
4		○					
7	○			○		○	

ETHA045F



ETHA045C

CIRCUIT DIAGRAM ETHA2200



ETHA045D

IMMOBILIZER CONTROL SYSTEM

IMMOBILIZER SYSTEM ETHA3450

DESCRIPTIONThe immobilizer system is an anti-theft device which enables starting to be possible only when the mechanical and wireless secret codes are aligned simultaneously.

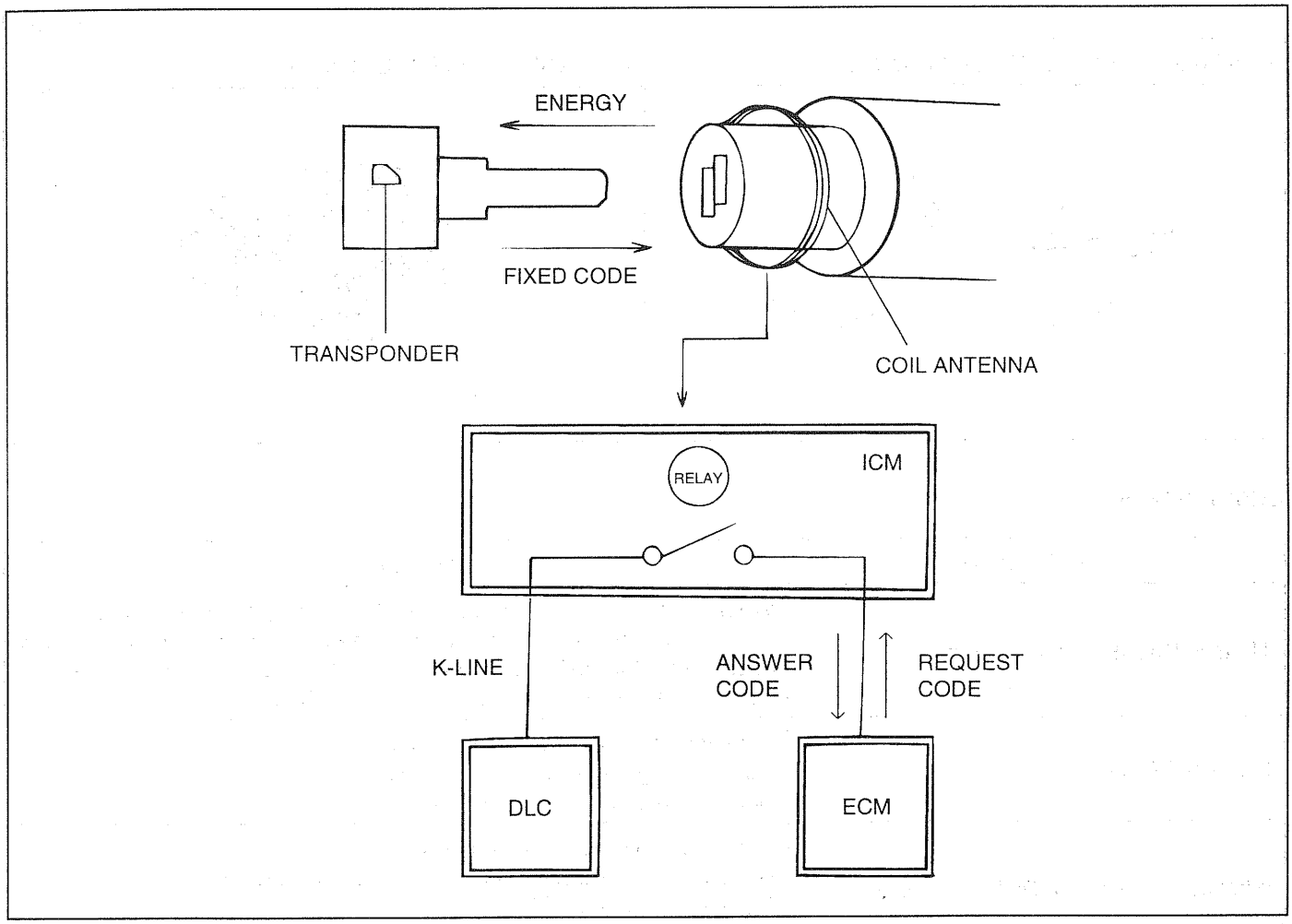
The transponder built in the ignition key signals its unique frequency code and at this time the ICM compares it with the memorized code.

When the codes are aligned, the ICM sends signals to the ECM so that starting is possible.

ICM : Immobilizer Control Module

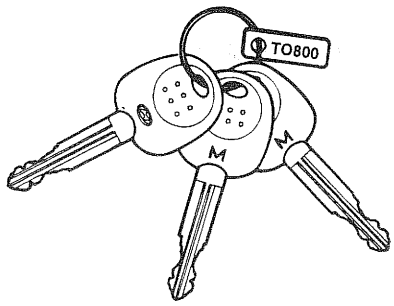
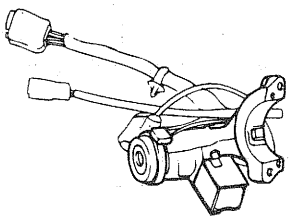
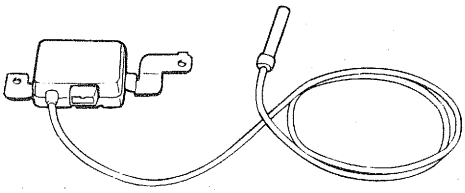
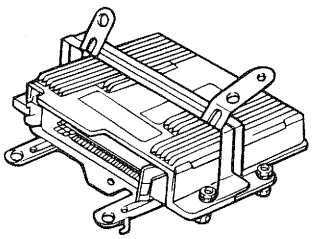
ECM : Engine Control Module

SYSTEM BLOCK DIAGRAM



B6BE705A

COMPONENT

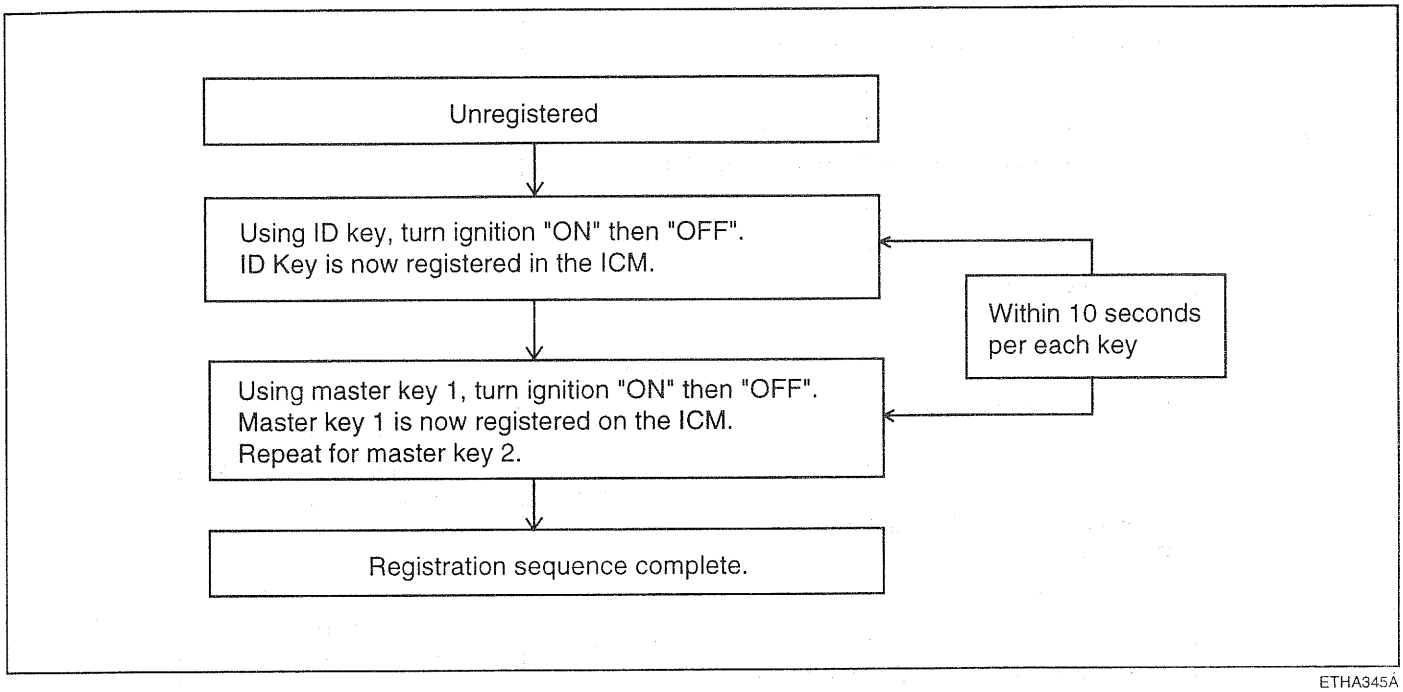
A. TRANSPONDER KEY	B. COIL ANTENNA
 B880B01A	 B6BE225C
C. IMMOBILIZER CONTROL MODULE	D. ENGINE CONTROL MODUEL
 B6BE710D	 B6BE710E

DESCRIPTION

COMPONENT		DESCRIPTION
TRANSPONDER (built-in keys)		When ignition is "ON", the coil supplies energy to the transponder, which in turn accumulates energy in the condenser. Once the energy supply from the coil has stopped, using the stored energy in the condenser, the transponder transmits the ID CODE.
COIL ANTENNA		Supplies energy to the transponder. Receives signal from the transponder. Sends transponder signal to the ICM.
IMMOBILIZER CONTROL MODULE		Supplies power to the coil antenna. Receives and analyzes signal from the coil antenna. Transmits signal to ICM Stores VIN which composes of the ID CODE and password.
ENGINE CONTROL MODULE		With the ignition "ON", the ECM receives information from the ICM and permits injection to take place.
KEYS	ID KEY	Must be used first to register the unique ID CODE in the ICM. This ID CODE is then recorded into the master keys.
	MASTER	Once the ID CODE is recorded into the MASTER KEY, this key is for general use.
DATA LINK CONNECTOR		By connecting the voltmeter or HI-SCAN, control module diagnostic code can be read.

KEY REGISTRATION

1. ID Code registration sequence

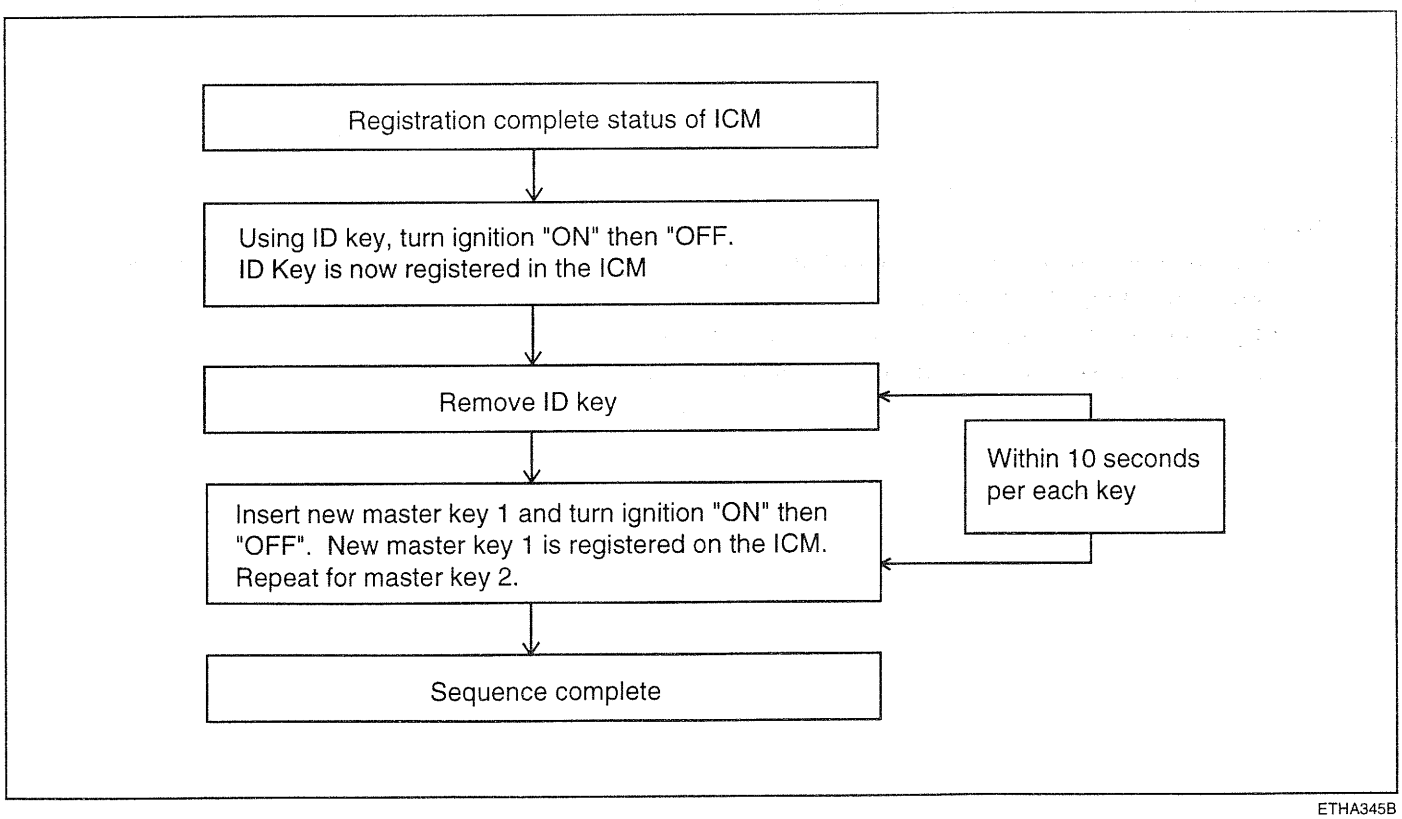


ETHA345A

2. Master key correction

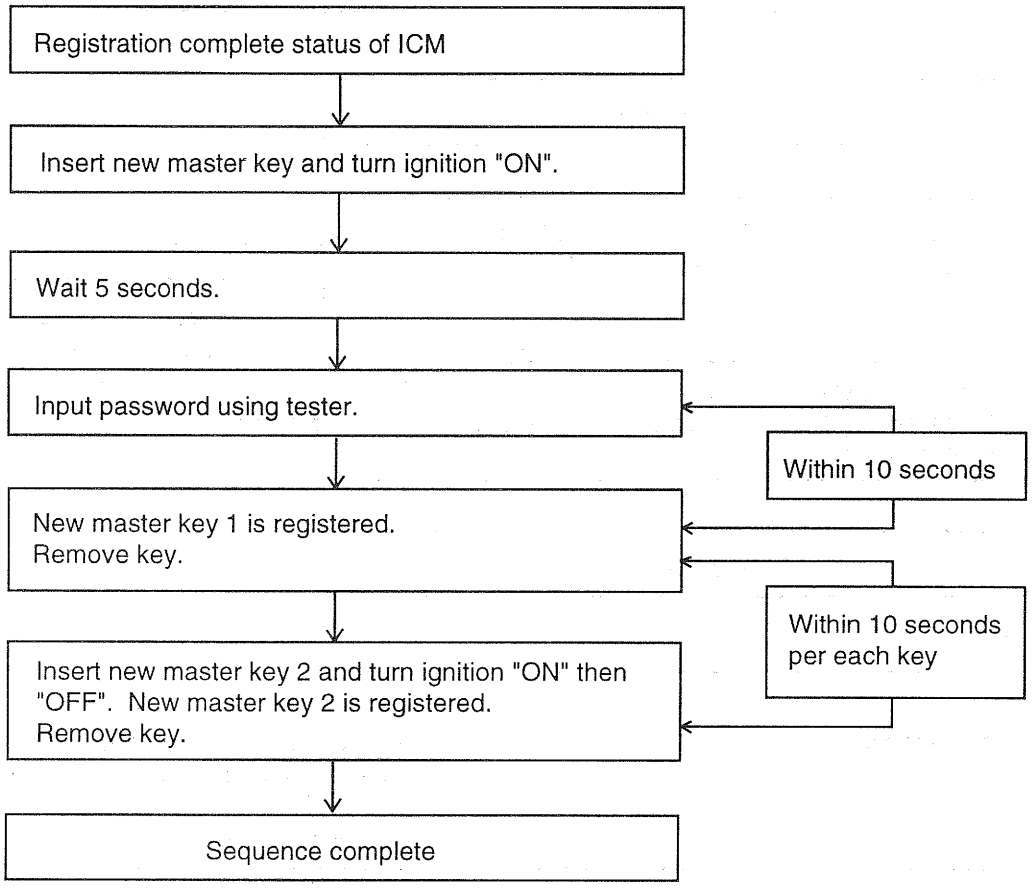
If a new set of master keys needs to be produced, it can be done by two methods:

a. Using ID key



ETHA345B

b. Using password



NOTE

- **Once the password is mis-registered, it is impossible to register new password during 10 seconds regardless of ignition ON/OFF.**
- **When the master 3 keys have been registered, the codes for existing master keys are all cleared.**
- **The password should consist of 4 numbers among ten (0~9) numbers.**

ETHA345C

Brake System

GENERAL

EJHA0010

SPECIFICATIONS

Master cylinder	
Type	Tandem type
I.D.	25.4 mm (1.0 in.)
Fluid level sensor	Provided
Brake booster	
Type	Vacuum type with tandem booster
Effective dia.	8 + 9 in.
Boosting ratio	7.0 : 1
Front brake	
Type	Floating type with ventilated disc
Disc O.D.	276 mm (10.87in.)
Disc thickness	26 mm (1.02 in.)
Pad thickness	16.5 mm (0.65 in.)
Cylinder I.D.	42.9 mm (1.689 in.) (X2)
Rear disk brake	
Type	Floating type with solid disc
Disc O.D.	284 mm (11.18 in.)
Disc thickness	10 mm (0.39 in.)
Pad thickness	15 mm (0.59 in.)
Cylinder I.D.	38.2 mm (1.50 in.)
Parking brake	
Type	Mechanical brake acting on rear wheels
Braking type	Foot type
Cable arrangement	V type
Rear drum brake	
Type	Leading-trailing drum
Drum I.D.	254 mm (10 in.)
Cylinder I.D.	20.64 mm (0.81 in.)
Clearance adjustment	Automatic
Lining thickness	5.0 mm (0.20 in.)

O.D. = Outer diameter

I.D. = Inner diameter

SERVICE STANDARD

EJHA0050

Standard value	
Brake pedal height	176±0.3mm
Stop lamp switch outer case to pedal stopper clearance	0.5-1.0 mm (0.020-0.040 in.)
Brake pedal free play	3-8 mm (0.117-0.312 in.)
Booster push rod to master cylinder piston clearance	0 (at 500 mmHg vacuum)
Brake pedal to floor board clearance	44 mm (1.73 in.)
Service limit	
Front disc brake pad thickness	2.0 mm (0.079 in.)
Front disc thickness (minimum)	24.4 mm (0.96 in.)
Front disc runout	0.05 mm (0.0020 in.)
Front disc thickness variation	0.01 mm (0.0004 in.)
Wheel cylinder to piston clearance	0.15 mm (0.006 in.)
Rear disc brake pad thickness	2.0 mm (0.079 in.)
Rear drum I.D.	256 mm (10.08 in.)
Rear disc thciness	8.4 mm (0.33 in.)

TIGHTENING TORQUE

EJHA0100

	Nm	Kg·cm	lb·ft
Master cylinder to booster mounting nut	8-12	80-120	5.9-8.8
Brake booster mounting nut	13-16	130-160	9.4-11.6
Brake booster vacuum hose fitting to surge tank	15-18	150-180	11-13
Bleeder screw	7-9	70-90	5-6.6
Brake tube flare nut, brake hose	13-17	130-170	9-12
Caliper guide rod bolt	22-32	220-320	16-24
Caliper assembly to knuckle			
Front	8-10	80-100	5.8-7.3
Rear	5-6	50-60	3.6-4.3
Brake hose to front caliper	17-20	170-200	12.3-14.5
Wheel cylinder mounting bolt	12-18	120-180	8.8-13

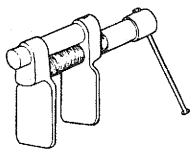
LUBRICANT

EJHA0150

	Recommended lubricant	Quantity
Brake fluid	DOT 3 or equivalent	As required
Brake pedal bushing and brake pedal bolt	Chassis grease SAE J310, NLGI No.0	As required
Clevis pin	Wheel bearing grease SAE J310, NLGI No.2	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease, NLGI No.0-1	As required

SPECIAL TOOLS

EJHA0200

Tool (Number and Name)	Illustration	Use
09581 - 11000 Piston expander	 EJDA043A	Pushing back of the front disc and rear disc brake piston

TROUBLESHOOTING

EJHA0250

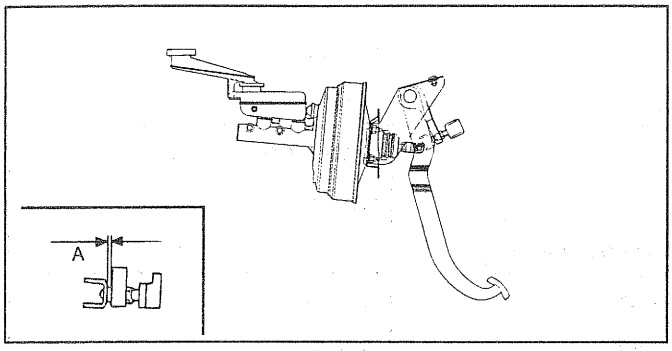
Trouble symptom	Probable cause	Remedy
Noise or vibration when brakes are applied	Caliper improperly mounted	Correct
	Loose caliper mounting bolts	Retighten
	Unevenly worn or cracked brake drum or brake disc	Replace
	Foreign material in brake drum	Clean
	Seized pad or lining contact surface	Replace
	Excessive 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 in 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

Trouble symptom	Probable cause	Remedy
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	Correct
	Proportioning valve malfunction	Replace
Increased pedal stroke required (Reduced pedal to floor-board clearance)	Air in the brake system	Bleed the system
	Brake fluid leaks	Correct
	Excessive push rod to master cylinder clearance	Adjust
Brake drag	Incomplete release of parking brake	Correct
	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	Correct
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	Correct
	Excessive parking brake lever stroke	Adjust the parking brake lever stroke or check the parking brake cable routing
	No air bleeding after lining replacement	Air bleeding

SERVICE BRAKE PEDAL INSPECTION AND ADJUSTMENT EJHA0300

1. Turn the stop lamp switch until the clearance between the outer case of the stop lamp switch and pedal arm reaches the standard value, and then secure the stop lamp switch with the lock nut.

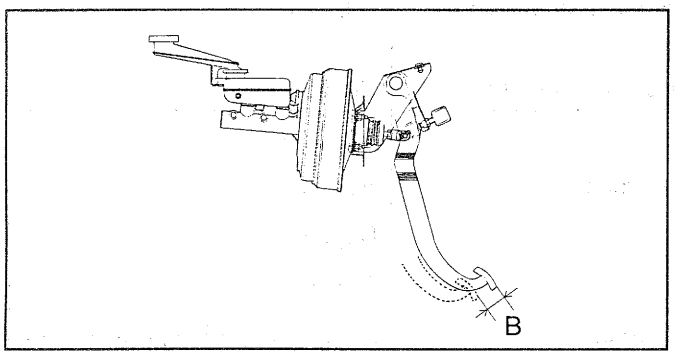
Clearance between pedal and stop lamp switch "A" :
0.5-1.0 mm (0.02-0.039 in.)



EJHA001A

2. Free play of brake pedal.

Brake pedal free play "B" :
3-8 mm (0.12-0.32 in.)



EJHA230A

BRAKE BOOSTER OPERATION TEST WITHOUT A TESTER

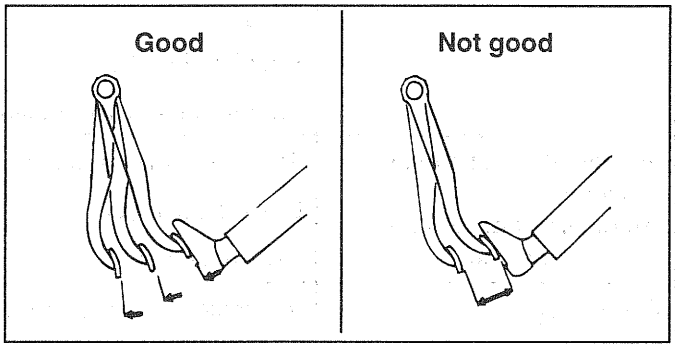
For a simple check of brake booster operation, perform the following tests.

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 the first time, but gradually rises after the second or third time, the brake booster is functioning properly. Go to step 2.

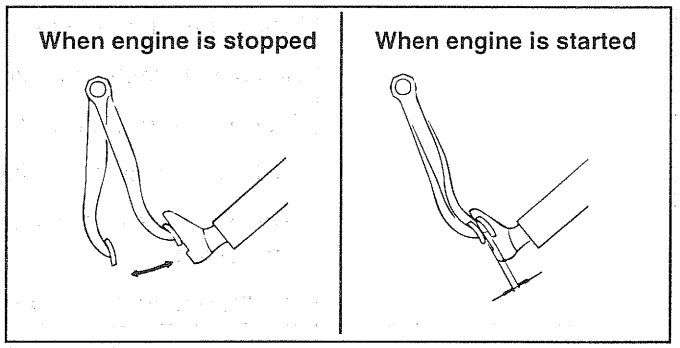
2. With the engine stopped, depress the brake pedal several times. Depress the brake pedal and start the engine. If the pedal goes down slightly, the booster is in good condition. Go to step 3.

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 one of the above three tests is not OK, check the vacuum hoses, the check valve and the brake booster. Make any necessary corrections. If all tests are OK, the unit is in good condition.



EJA9002A



EJA9002B

BLEEDING OF THE BRAKE SYSTEM EJHA2350

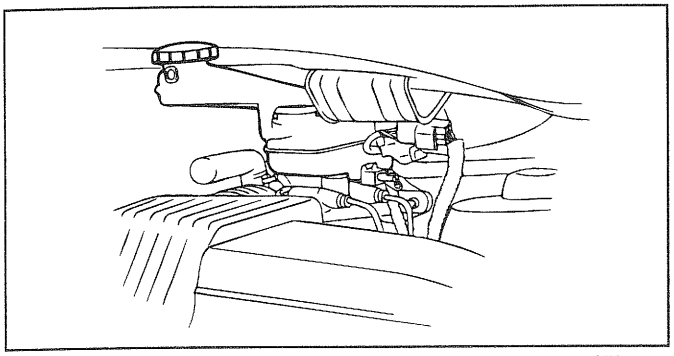
1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

CAUTION

Do not allow brake fluid to remain on a painted surface. Wash it off immediately.

NOTE

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

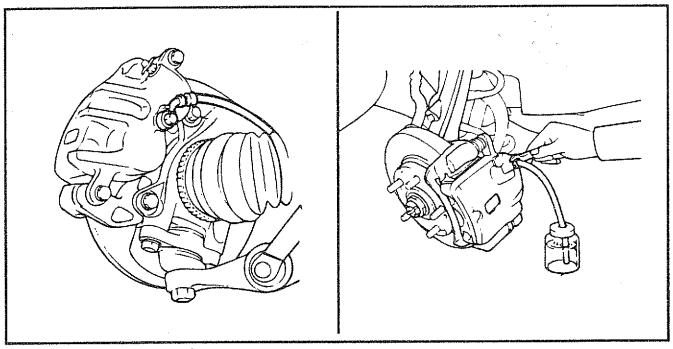


EJHA002A

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

3. Slowly pump the brake pedal several times.

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



KFW8006A

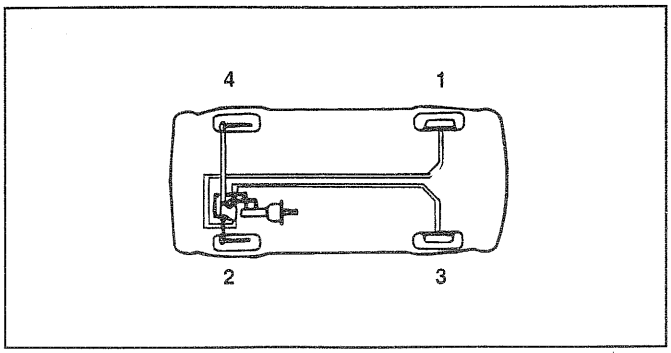
5. Repeat steps 3 and 4 until there are no more bubbles in the fluid.

6. Tighten the bleeder plug screw.

Bleeder screw tightening torque :

7-9 Nm (70-90 kg·cm, 5-6.6 lb·ft)

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

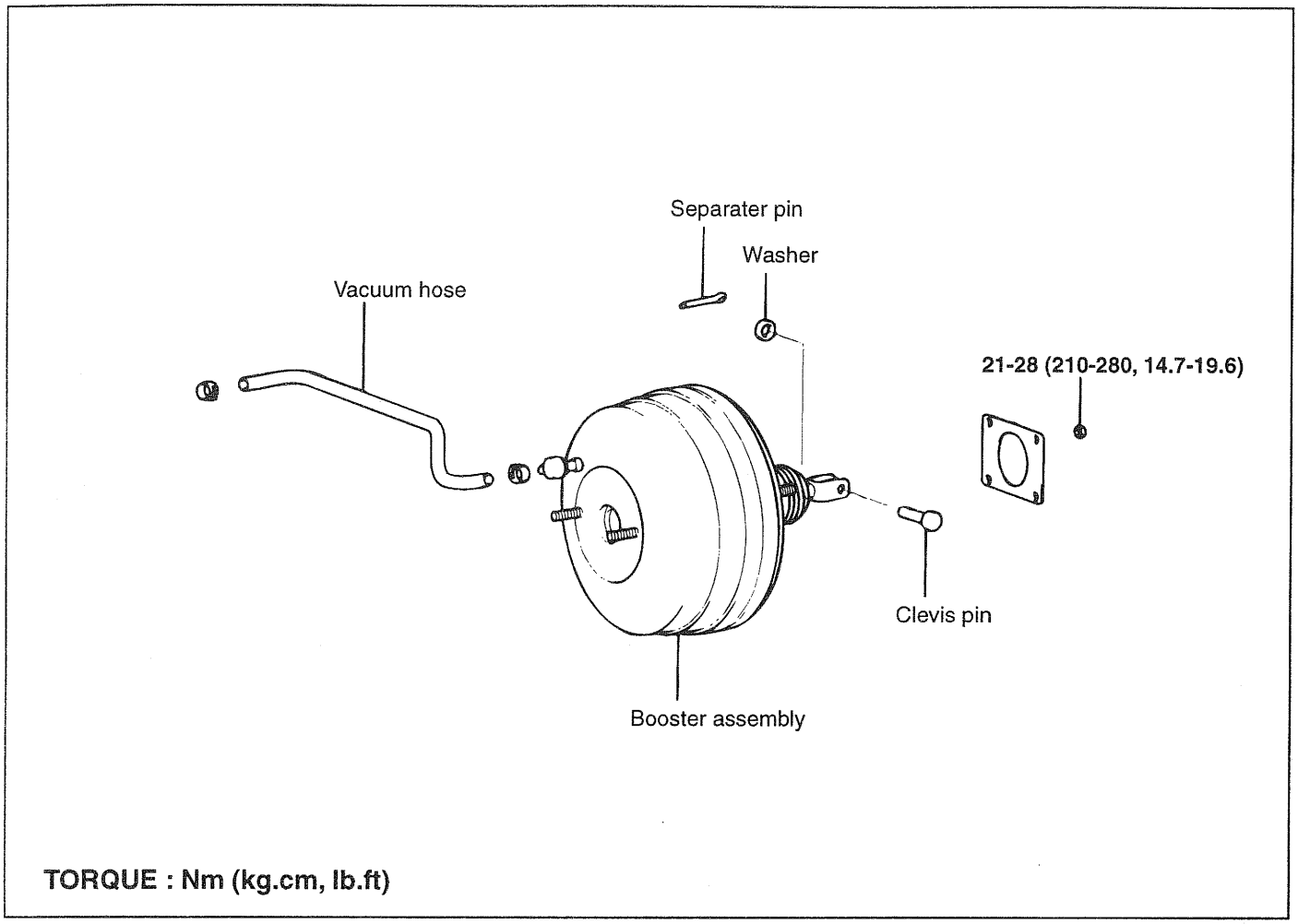


EJA9004A

BRAKE SYSTEM

BRAKE BOOSTER

COMPONENTS EJHA0850



KFW8019A

CHECK VALVE OPERATING TEST EJHA0900

Remove the vacuum hose from the booster

↓

Start the engine

↓

Plug the vacuum hose hole with a finger

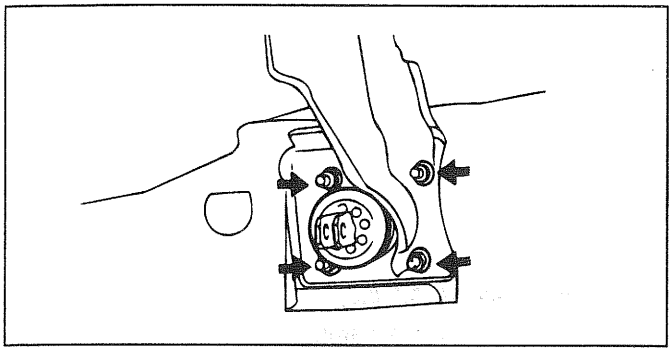
↓

Check that a vacuum is present and is maintained

EJHA285A

REMOVAL EJHA0950

1. Remove the master cylinder.
2. Remove the vacuum hose.
3. Remove the operating rod from the brake pedal.
4. Loosen the booster mounting nuts to remove the booster assembly.



EJA9011B

INSTALLATION EJHA1000

1. Install the master cylinder.
2. Attach the booster and master cylinder to the dash panel.
3. Reinstall the vacuum hose securely to prevent vacuum leaks.
4. Couple the operating rod with the brake pedal.
5. Bleed the system.

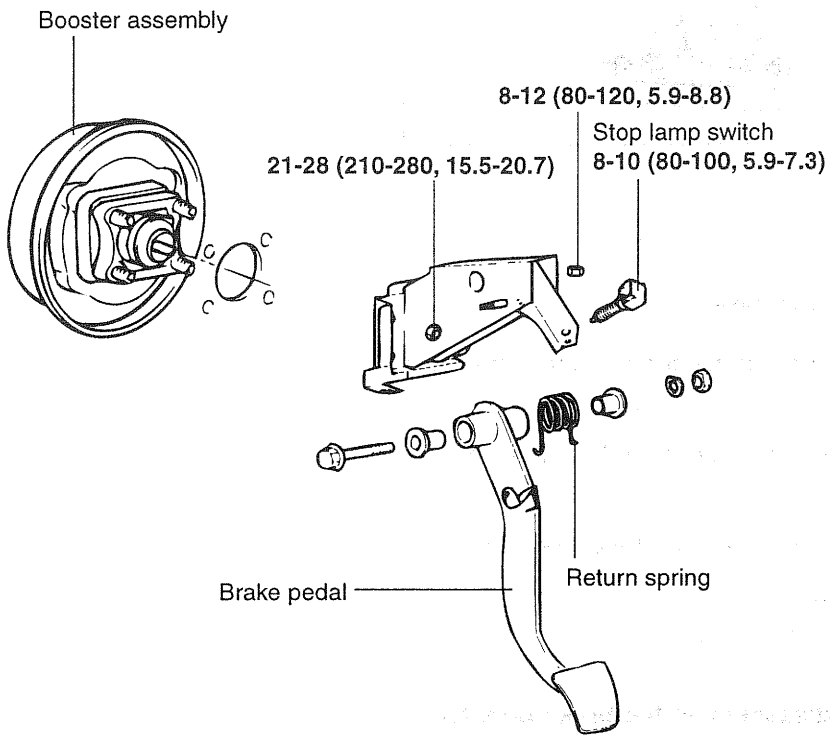
NOTE

Do not attempt to disassemble the brake booster.

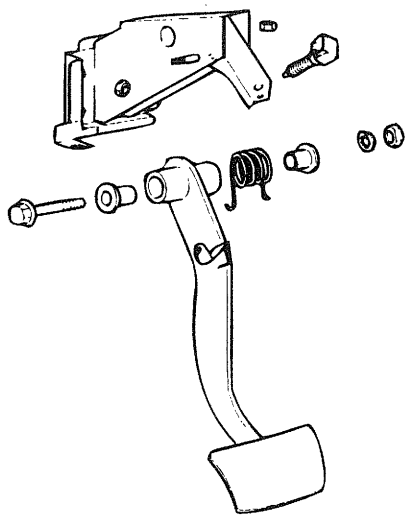
BRAKE PEDAL

COMPONENTS EJHA0350

[M/T]



[A/T]

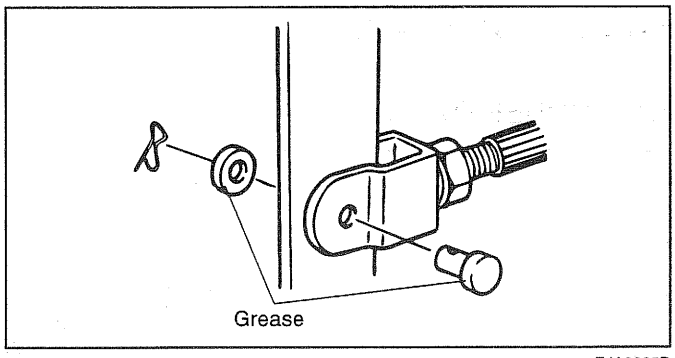


TORQUE : Nm (kg.cm, lb.ft)

KFW8010A

REMOVAL EJHA0400

1. Remove the lower crash pad assembly (Refer to Body Group).
2. Remove the stop lamp switch and disconnect the shift lock cable (Vehicle with automatic speed control system only).
3. Remove the cotter pin and clevis pin.
4. Remove the brake pedal member assembly mounting nut.
5. Remove the brake pedal assembly.



EJA9005B

INSPECTION EJHA0450

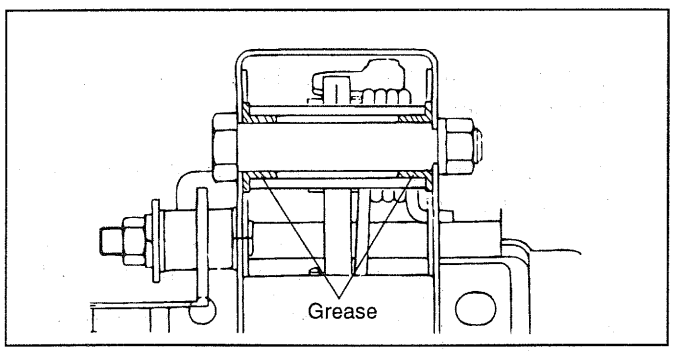
1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.

INSTALLATION EJHA0500

Installation is the reverse of the removal procedure.

NOTE

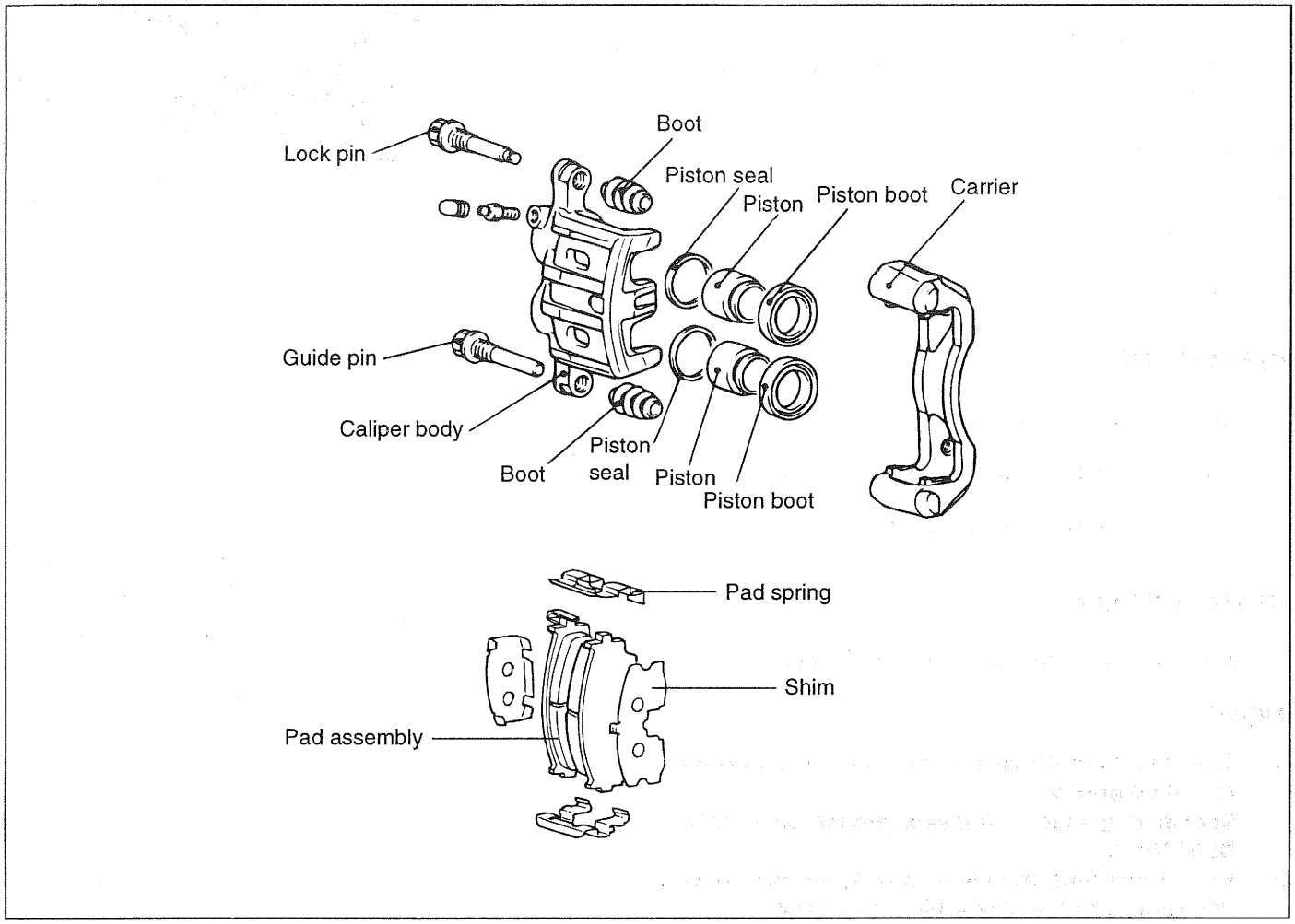
1. **Coat the inner surface of the bushings with the specified grease.**
   Specified grease : Chassis grease SAE J310, NLGI No. 0
2. **Before inserting the clevis pin, apply the specified grease to the clevis pin and washer.**



EJB9003A

FRONT DISC BRAKE

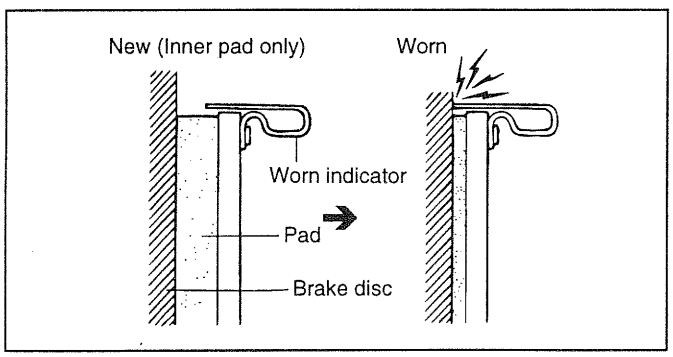
COMPONENTS EJHA1050



EJHA300A

REPLACEMENT OF BRAKE PADS EJHA1100

If a squeaking noise occurs from the front brake while driving and braking, inspect the brake pads.



EJA9015E

2. Check the pad thickness through the cylinder inspection hole.

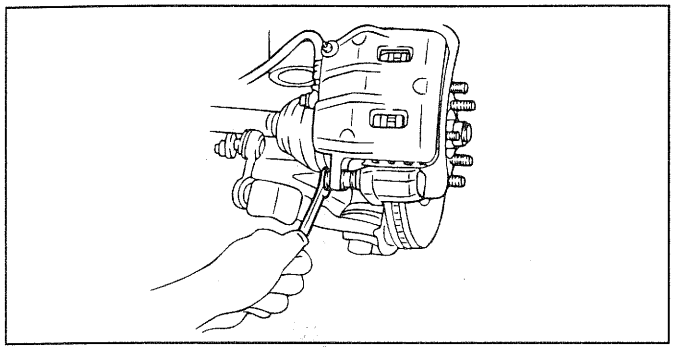
   If the pad lining thickness is out of specification, replace the pads.

	Standard value	Service limit
Pad lining thickness mm (in.)	10.5 (0.413)	2.0 (0.079)

3. Remove two bolts from the carrier and remove the brake cylinder.

REMOVAL EJHA1110

1. Remove the wheel and tire.

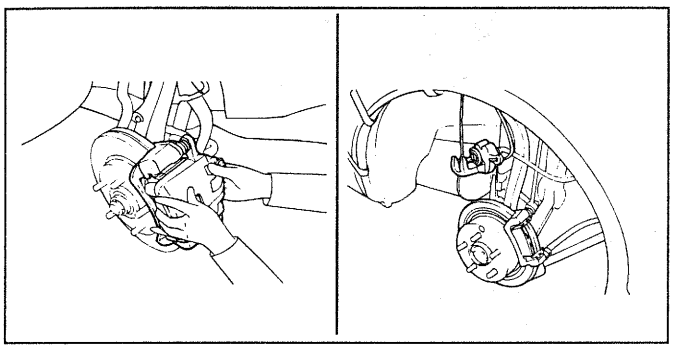


EJHA007B

4. Remove the brake cylinder and suspend it with wire.

NOTE

Do not disconnect the brake hose.

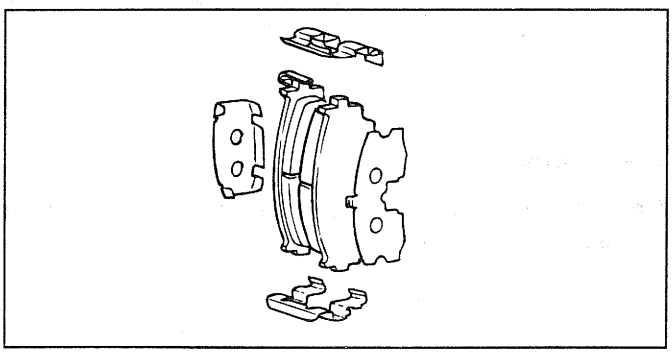


KFW8024A

5. Remove the pads.

NOTE

Be careful not to depress the brake pedal while disassembling the pads.



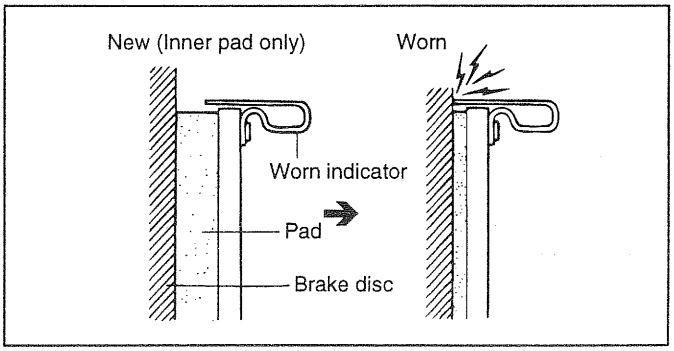
EJA9015D

INSPECTION EJHA1150

1. Check the pads for wear or oil contamination.

   Replace or correct if necessary.

2. Check the shims for damage or deformation.



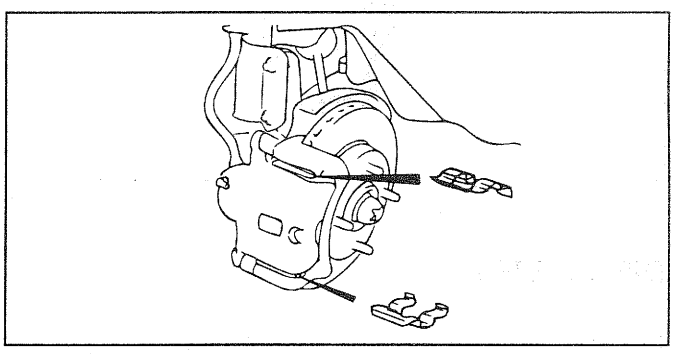
EJA9015E

INSTALLATION EJHA1200

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

NOTE

a. **All four pads must be replaced as a complete set.**
b. **Position the pad with its pad wear sensor to the piston side and to the upward.**
c. **Remove rust before positioning the pad clip or replace with a new one if it is damaged.**



EJA9015F

3. Press in piston with a hammer handle or equivalent.
4. Lower and insert the brake cylinder carefully so as not to damage the boot.
5. Install the two guide rod bolts and tighten.

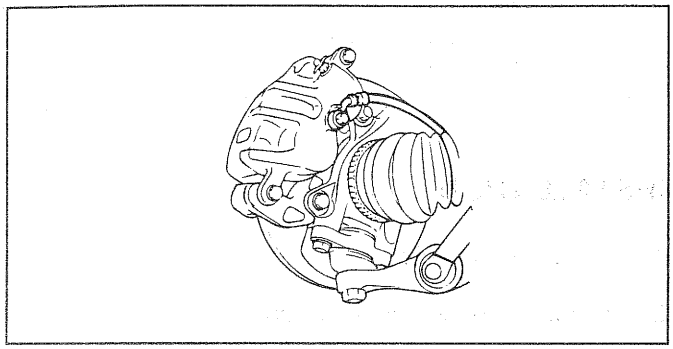
   Tighten the connections to the specified torque.

Guide rod bolt :	
	22-32 Nm (220-320 kg·cm, 16-24 lb·ft)

CALIPER ASSEMBLY EJHA1250

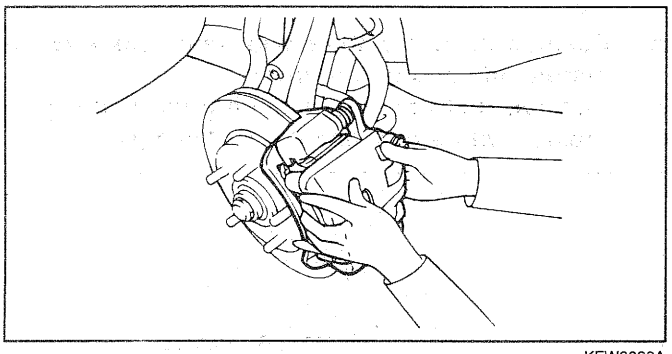
REMOVAL

1. Remove the wheel and tire.
2. Remove the brake hose from the caliper.



KFW8005A

3. Remove the caliper assembly.



KFW8023A

DISASSEMBLY EJHA1300

Front disc brakes should be disassembled with right and left sets separately.

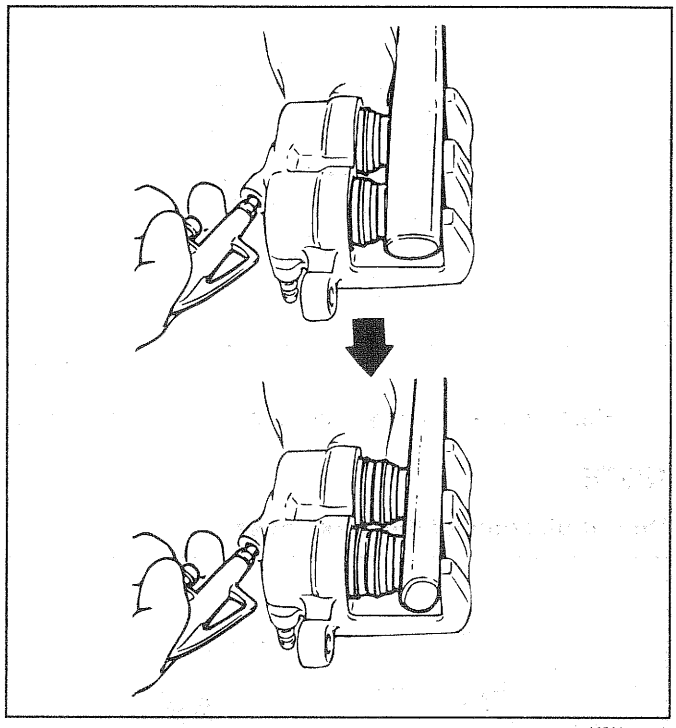
1. Remove the piston boot/piston.

   Blow compressed air into the brake hose seating hose. Remove the piston and the piston boot.

CAUTION

Remove the piston using a plastic hammer handle. Blow air slowly adjusting heights of the two pistons to ensure even push-out.

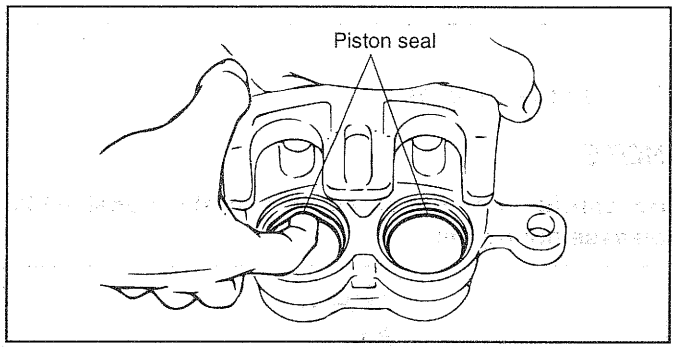
Secondary piston shall not be removed before primary piston is removed completely. Otherwise the secondary piston will be not be removable.



KGX8039A

2. Remove the piston seal.

   1) Remove the piston seal with finger.



KGX8040A

CAUTION

Do not use a screwdriver or another tool. It may damage the cylinder inside.

   2) Clean the piston surface and cylinder inside using the trichloro ethylene, alcohol or specified brake oil.

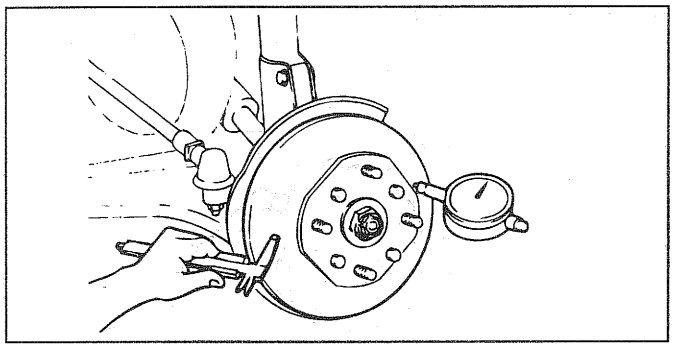
Brake oil : DOT 3 or equivalent

3. Clean the outer surface of the piston and the inner surface of the cylinder with the specified brake fluid.

INSPECTION EJHA1350

1. Check the caliper body cylinder inner surface for wear, damage and/or corrosion.
2. Check the piston for wear, damage and/or corrosion.
3. Check the caliper body and sleeve for wear.
4. Check pads for deformation, metal backing for damage, and for oil on the pads.
5. Check the carrier for damage, rust, wear and cracks.
6. Inspect the brake disc using a dial indicator and micrometer. Machine or replace as necessary.

	Standard value	Standard limit
Thickness of disc mm (in.)	26 (1.02)	24.4 (0.96)
Runout of disc mm (in.)	-	0.05 (0.0020)



EJA9015N

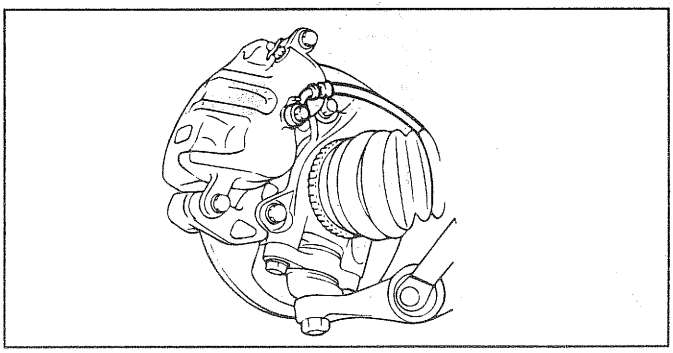
7. If necessary, replace the brake disc.
   1) Jack the vehicle up and support it with jack stands.
   2) Remove the wheel and tire.
   3) Remove the front wheel brake assembly from the knuckle and suspend it with a wire.
   4) Remove the front disc from the hub.

HOW TO CHECK FRONT DISC RUNOUT AND THICKNESS EJHA1400

FRONT BRAKE DISC RUN-OUT CHECK

1. Remove the caliper support bolts, then raise the caliper assembly upward and secure by using wire.
2. Inspect the disc surface for groove, cracks, and rust.

   Clean the disc thoroughly and remove all rust.



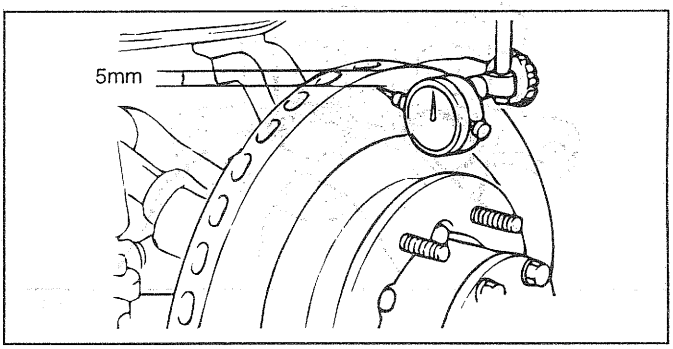
KFW8025A

3. Place a dial gauge approximately 5 mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

   Limit : 0.05 mm (0.0020 in.)

NOTE

Tighten the nuts in order to secure the disc to the hub.



HE58-16

FRONT BRAKE DISC THICKNESS CHECK

1. Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm (0.39 in.) from the outer edge of the disc.

   Brake disc thicknes

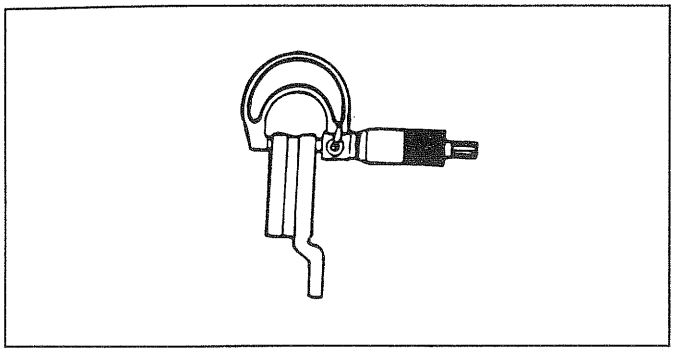
   Standard value : 26 mm (1.02 in.)

   Limit : 24.4 mm (0.96 in.)

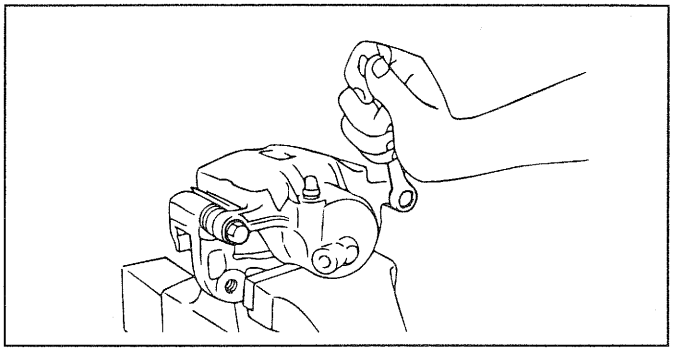
   Thickness variation (at least 8 positions)

   The difference between any thickness measurements should not be more than 0.005 mm.

2. If the disc is exceeds the limits for thickness, remove it and install a new one.



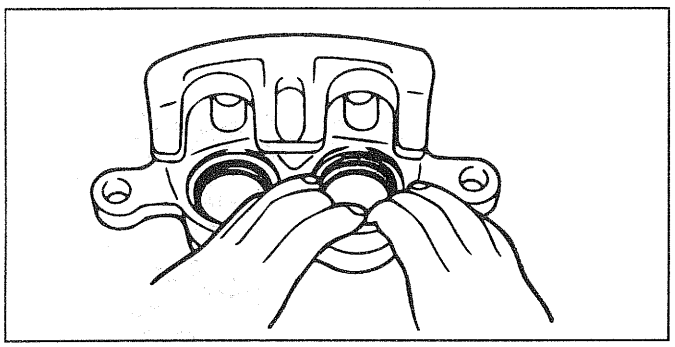
EJA9015S



EJA9015J

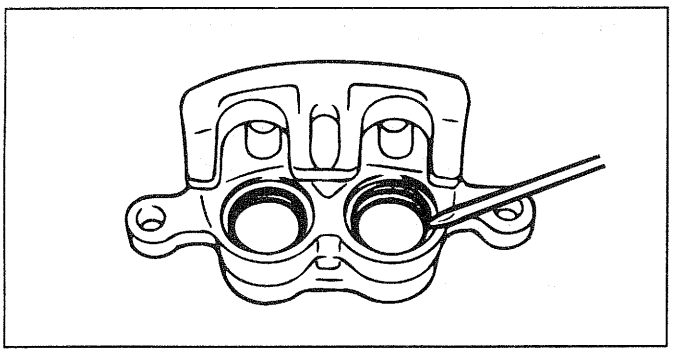
ASSEMBLY EJHA1450

1. Clean the components with isopropyl alcohol except for the pad and shim.
2. Install the piston seal.
3. After applying the specified brake fluid to the piston outer surface, install the piston into the cylinder.



EJHA345A

4. Install the piston boot and boot ring.



EJHA345B

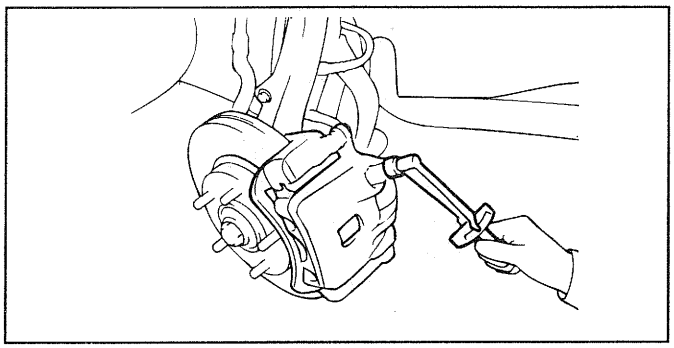
5. Install the guide pin boots and guide pin.

INSTALLATION EJHA1500

1. Install the pads and brake cylinder.
2. Install the brake hose to the caliper.

Bleeder screw tightening torque :
7-9 Nm (70-90 kg·cm, 5-6.6 lb·ft)

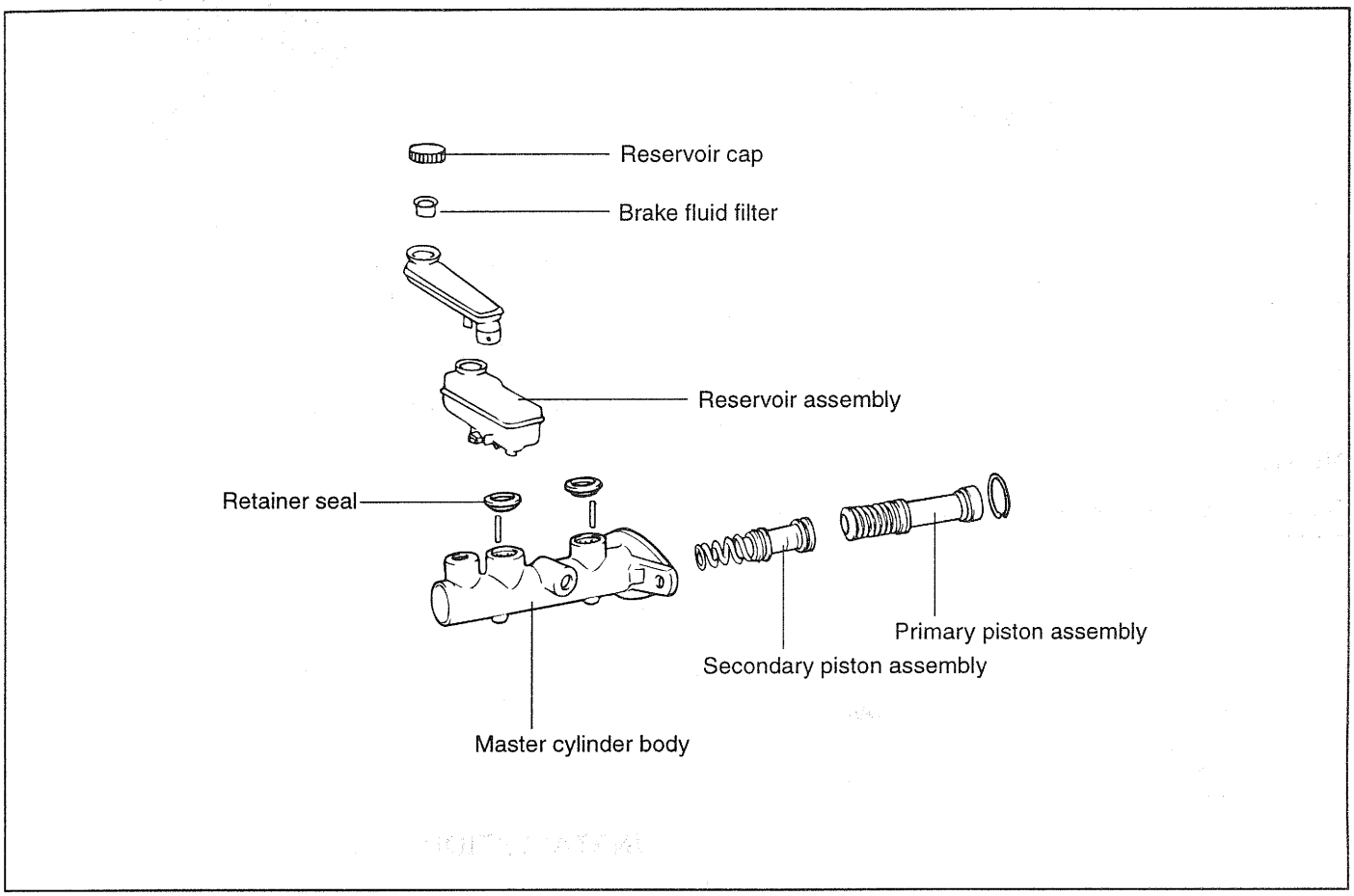
3. Fill the brake reservoir with brake fluid.
4. Bleed the system.



KFW8026A

MASTER CYLINDER

COMPONENTS EJHA0550



EJHA003A

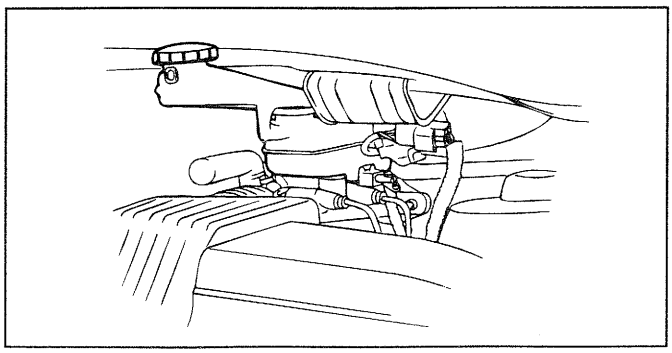
REMOVAL EJHA0600

1. Detach the brake tubes from the master cylinder, and then install the plug.

CAUTION

Do not allow brake fluid to remain on a painted surface. Wash it off immediately.

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



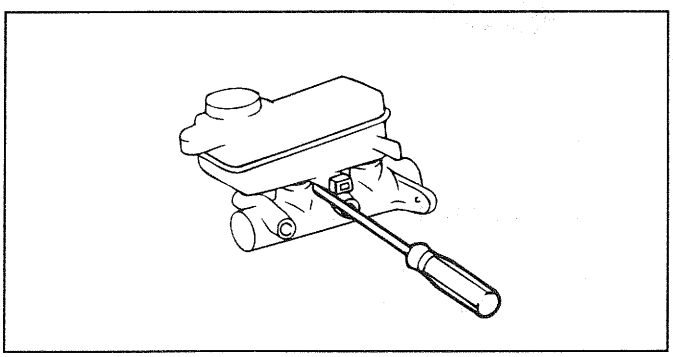
EJHA002A

DISASSEMBLY EJHA0650

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove reservoir from the master cylinder.

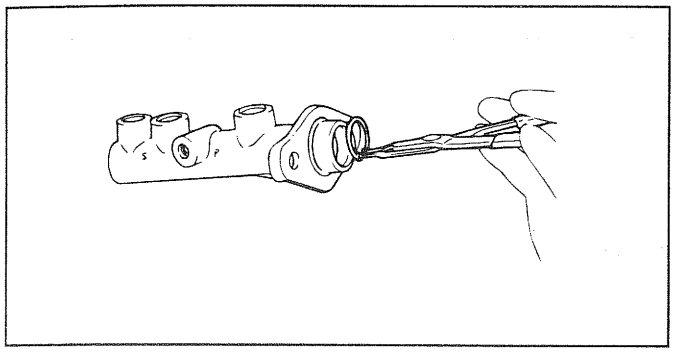
NOTE

When bleeding by pressurized fluid, do not press the brake pedal.



EJHA004A

3. Using snap ring pliers, remove the retaining ring.
4. Remove the primary piston assembly.

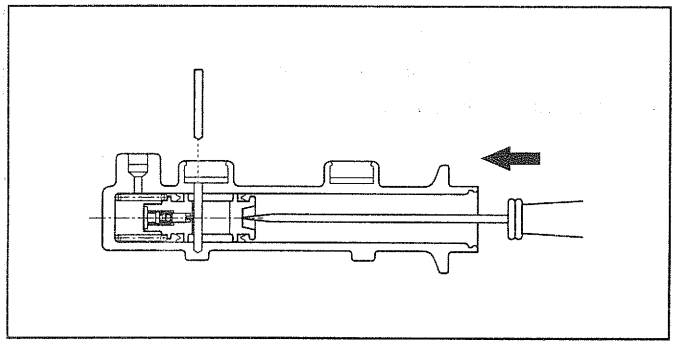


EJA9009C

5. Using a screwdriver, push the secondary piston and remove.

NOTE

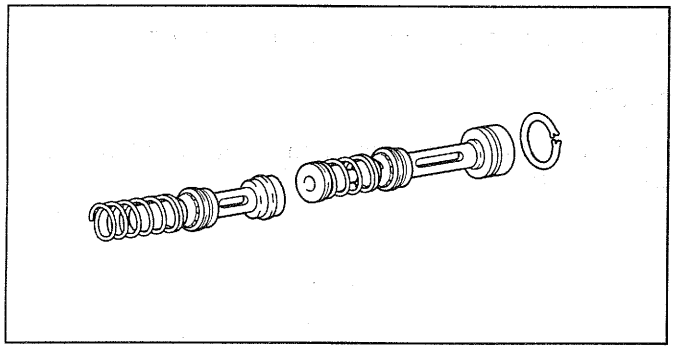
Do not disassemble the primary and secondary piston assembly.



KFW8014A

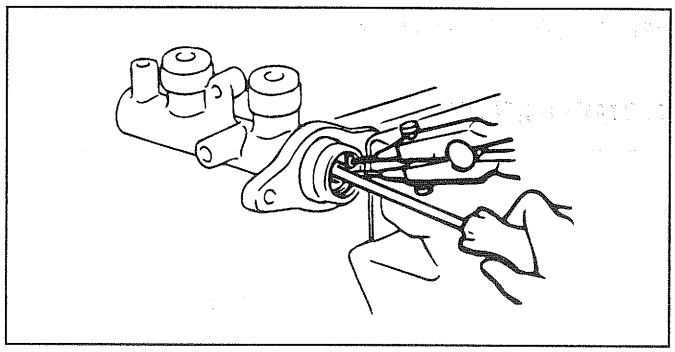
ASSEMBLY EJHA0750

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



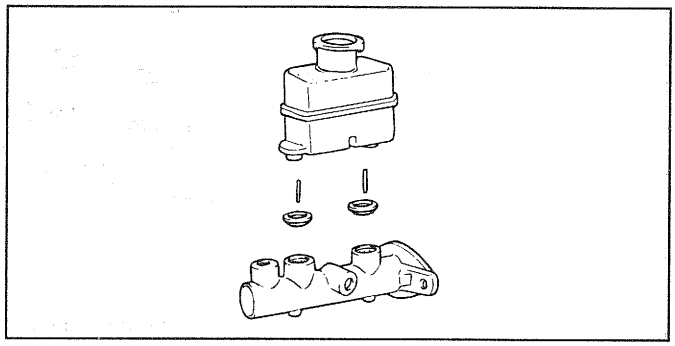
KFW8016A

2. Carefully insert the springs and pistons straight in.
3. Push the pistons in with a screwdriver and install the retaining ring.



HE58-11

4. Using a screwdriver, push the piston all the way and install the piston pin.
5. Mount the two grommets.
6. Install the reservoir in the cylinder.



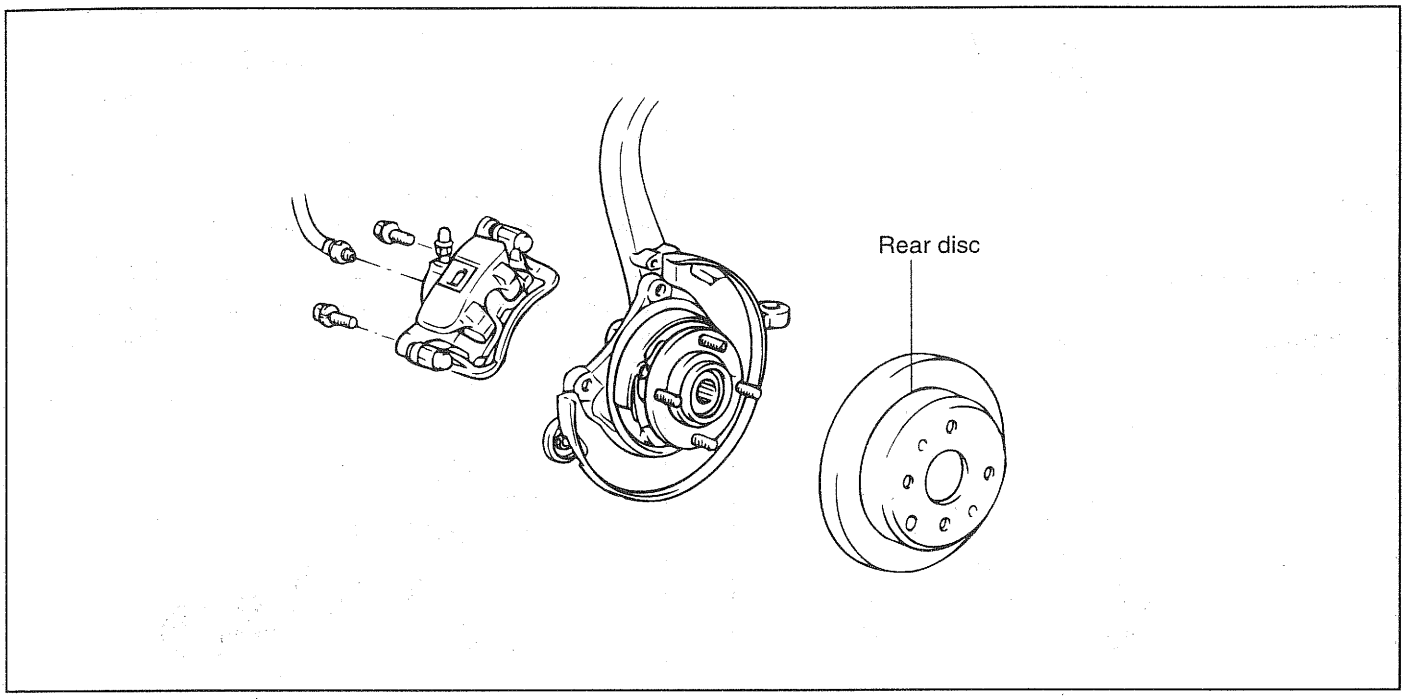
KFW8017A

INSTALLATION EJHA0800

1. Install the master cylinder on the brake booster.
2. Connect the brake tubes to the master cylinder.
3. Fill brake reservoir with brake fluid and bleed the system.

REAR DISC BRAKE

COMPONENTS EJHA1550



EJA9019A

REMOVAL EJHA1600

The procedure is the same with front disc brake pad.

INSPECTION EJHA1650

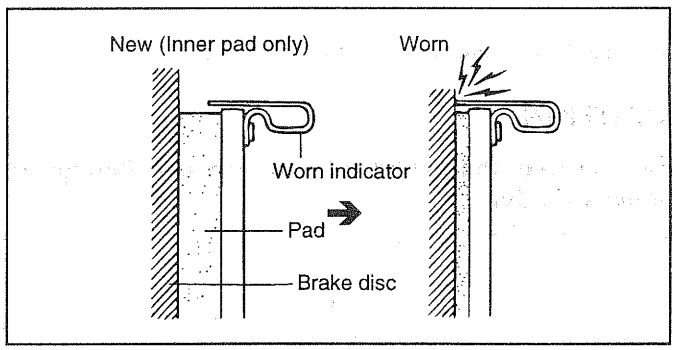
1. Check the pads for wear or oil contamination and replace if necessary.

NOTE

The pads for the right and left wheels should be replaced at the same time.

Pad thickness wear limit : 2.0mm

2. Check for worn or damaged dust boots. If dust or mud has entered the caliper assembly through this seal, the caliper assembly must be replaced or rebuilt.



EJA9015E

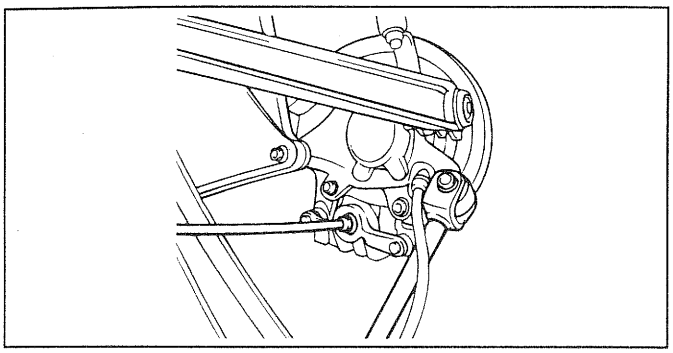
INSPECTION EJHA1700

Before replacing the brake pads, remove the brake fluid from the master cylinder reservoir until it is half full.

CALIPER

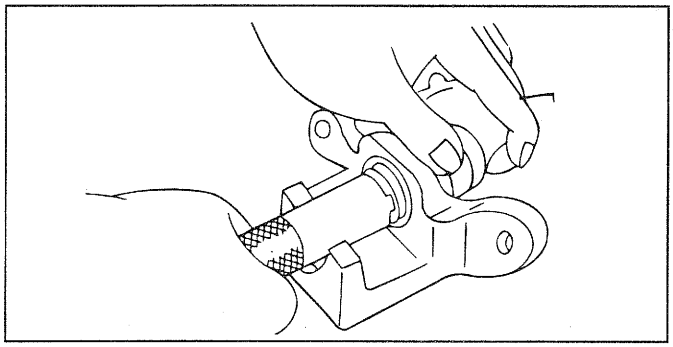
DISASSEMBLY

1. Remove the caliper mounting bolts and the caliper assy.
2. Remove the carrier bolt and the carrier with brake pad.



KFW8027A

3. Remove the piston boot.
4. Remove the piston assy.

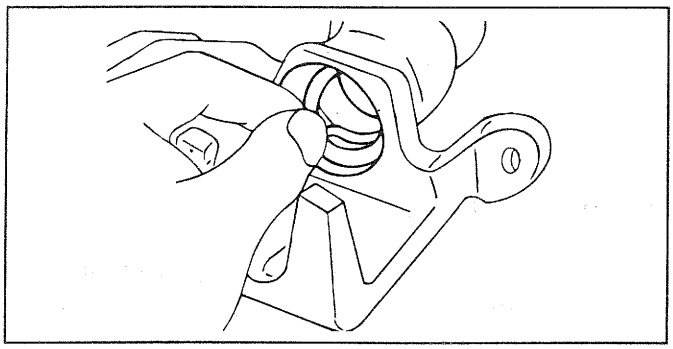


EJA9020C

5. Remove piston seal with finger tip.

CAUTION

Do not use sharpened tools to prevent damage to inner cylinder.



EJA9020D

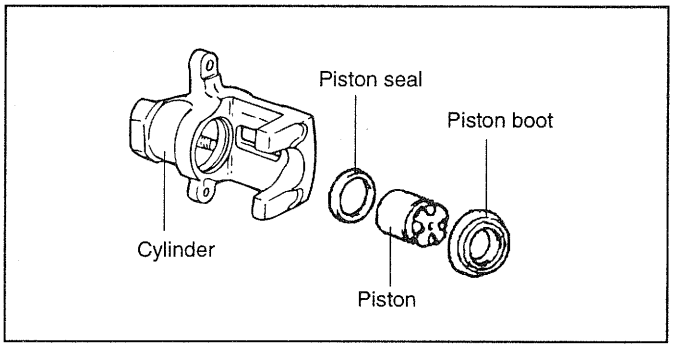
ASSEMBLY

1. Check for worn, damaged, or rusted piston bore and piston.

   Replace the damaged parts if necessary.

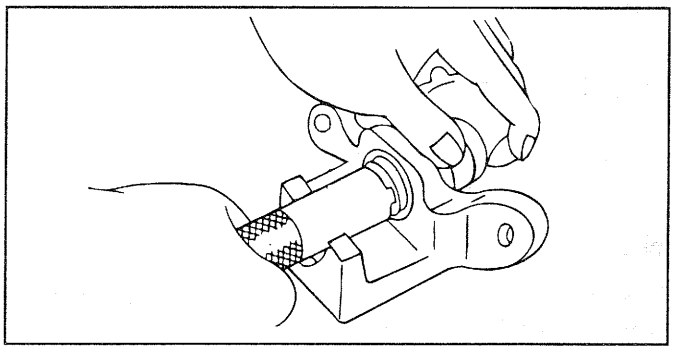
2. Check for damaged piston seal, boot, and pin insulators.
3. Apply a recommended lubricant to the following parts.

Parts	Recommended lubricant	Quantity
Piston seal	Brake fluid (Dot 3)	As required
Cylinder inner side	Brake fluid (Dot 3)	As required
Piston boot	Brake fluid (Dot 3)	As required
Piston outer surface	Brake fluid (Dot 3)	As required
Guide-rod insulators	Rubber grease	As required



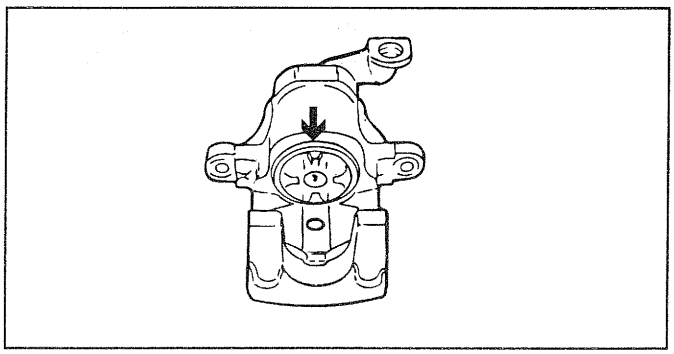
EJA9020F

4. Push the piston into the caliper.



EJA9020G

5. Align the piston mating mark upward as shown in illustration.

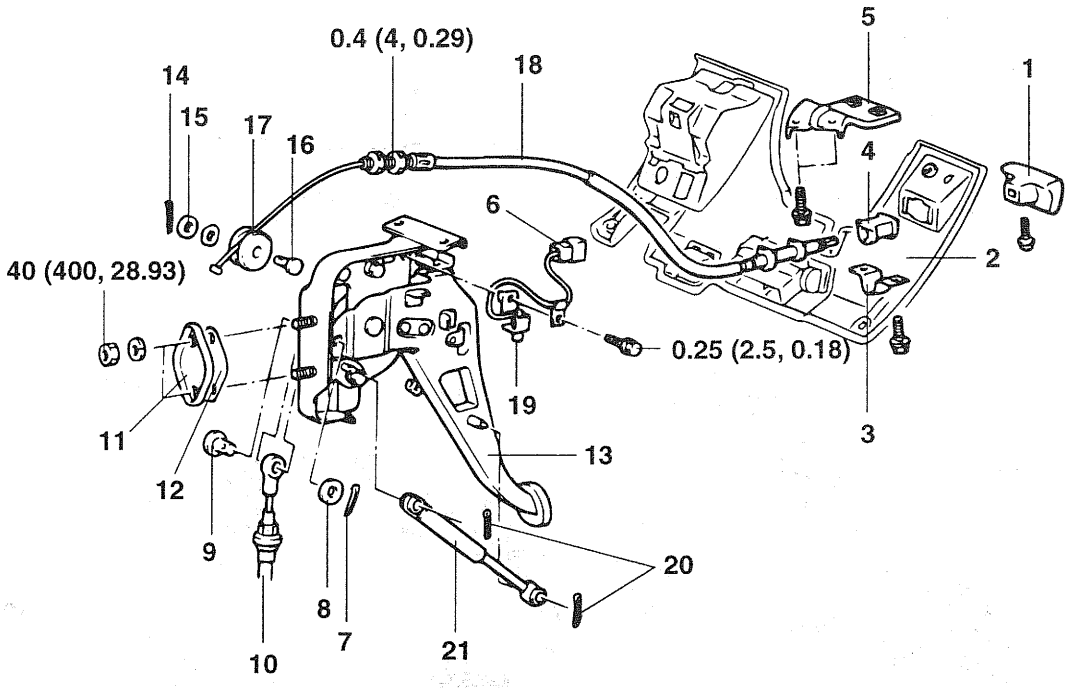


EJA9020H

PARKING BRAKE SYSTEM

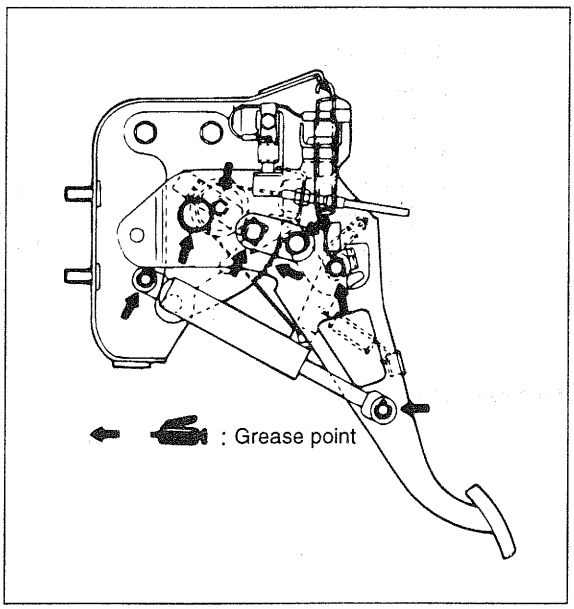
PARKING BRAKE

COMPONENTS EJHA1750



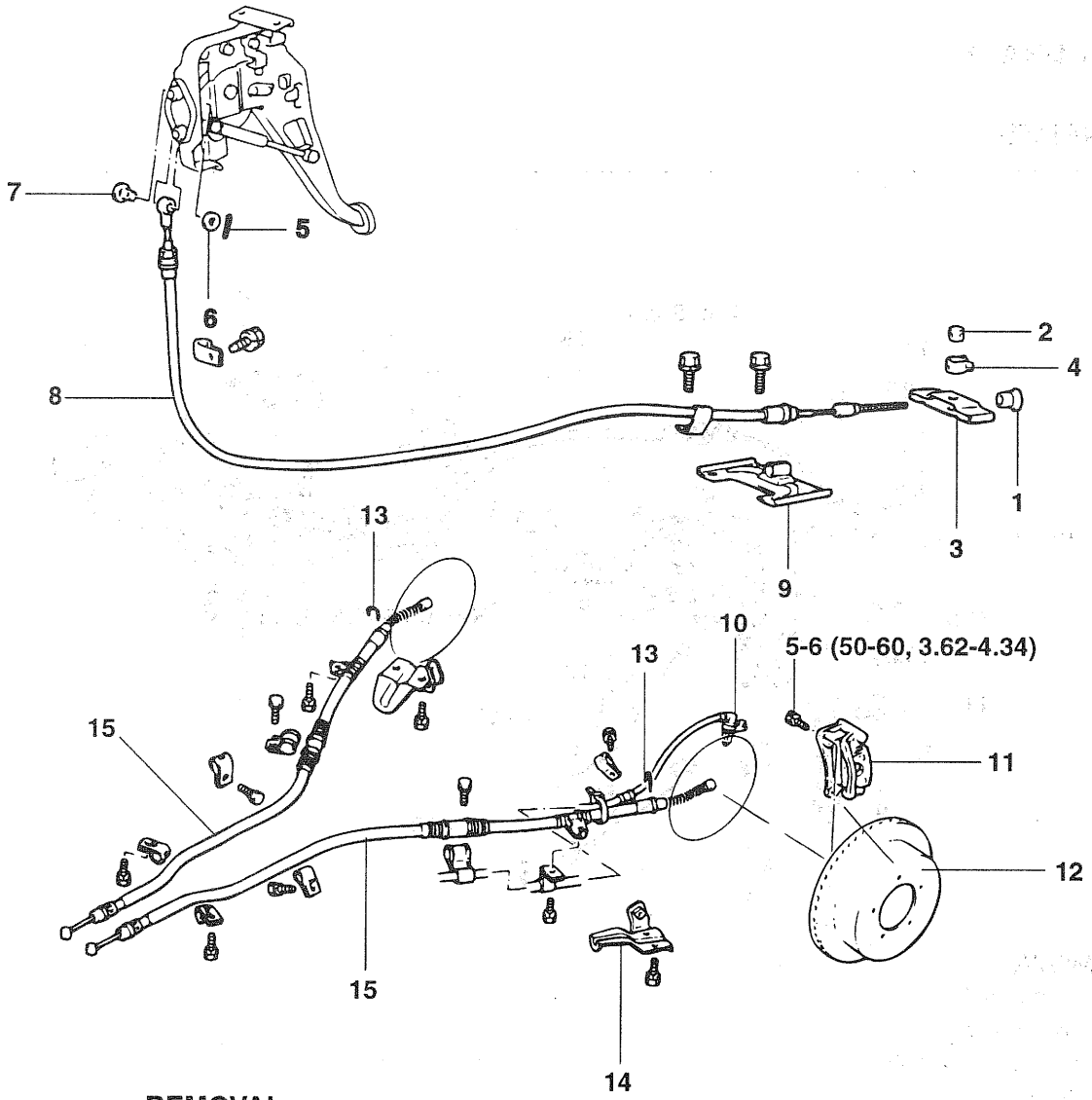
REMOVAL

1. Release nob
2. Lower panel
3. Parking brake plate
4. Bushing
5. Release cable bracket
6. Wiring connector
7. Split pin
8. Washer
9. Clevis pin
10. Front parking brake
11. Plate
12. Sealer
13. Parking brake pedal
14. Split pin
15. Washer
16. Clevis pin
17. Roller
18. Release cable
19. Parking brake switch
20. Split pin
21. Pedal damper



TORQUE : Nm (kg.cm, lb.ft)

EJHA011A



REMOVAL

1. Adjusting nut
2. Pin
3. Equalizer
4. Nut holder
5. Split pin
6. Washer
7. Clevis pin
8. Front parking brake cable
9. Rear cable bracket
10. Rear speed sensor
11. Rear brake assembly
12. Rear brake disc
13. Clip
14. Parking brake protector
15. Parking brake cable

TORQUE : Nm (kg.cm, lb.ft)

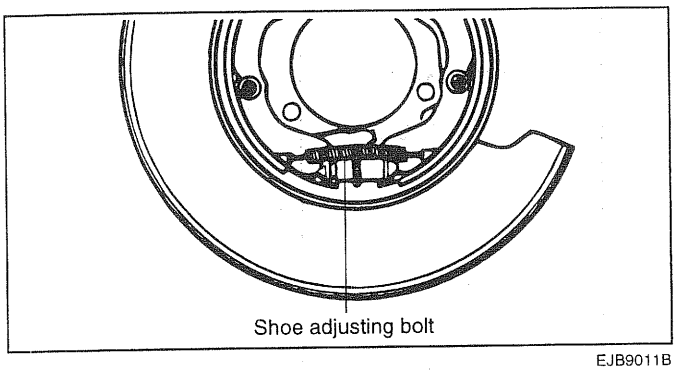
EJHA011B

REMOVAL EJHA1800

Remove the components as shown in illustrations.

INSTALLATION EJHA1850

1. Installation is the reverse of the removal procedure.
2. Set the adjuster lever all the way back when installing the shoe-to-shoe spring.



EJB9011B

3. Apply a coating of the specified grease to each sliding part of the ratchet plate or the ratchet pawl.

Specified grase :

SAE J310, NLGI No.2

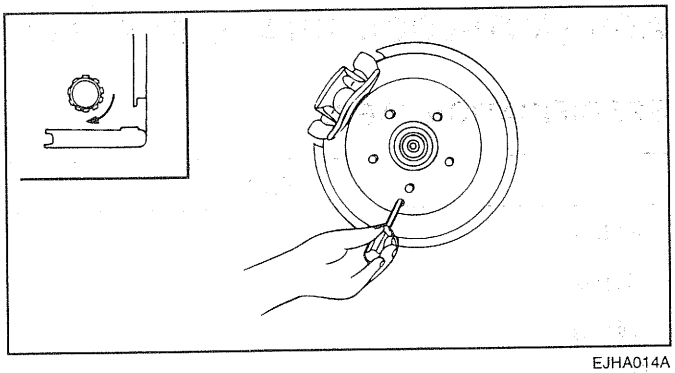
SERVICE ADJUSTMENT EJHA1900

1. Pull the parking brake lever 4–5 times with pull stroke.
2. Adjust parking brake stroke to be 88–98mm (3.47–3.90 in.) by turing the adjusting nut while applying 20kgf to the brake pedal.

CAUTION

Parking brake adjustment must be carried out after adjusting rear shoe clearance.

3. Remove the adjusting hole plug and then turn the adjustor to the direction of the arrow so as not to rotate the disc using a screw driver (flat tip (-)).
4. Rotate the adjustor as much as 5 notches to the opposite direction of the arrow.



EJHA014A

5. After replacing brake lining (Bed-in procedure),
   1) Operate parking brake pedal for 10 kgf effort when the vehicle speed is 60 kPh and then drive the vehicle 500mm.
   2) Repeat the above procedure twice.
6. After adjusting parking brake, it must be free from clearance between adjusting nut and pin.

   Check that the brake does not drag.
7. After assembling, check that all parts move smoothly.

ABS (ANTI-LOCK BRAKE SYSTEM) EJHA2000

SPECIFICATION (ABS)

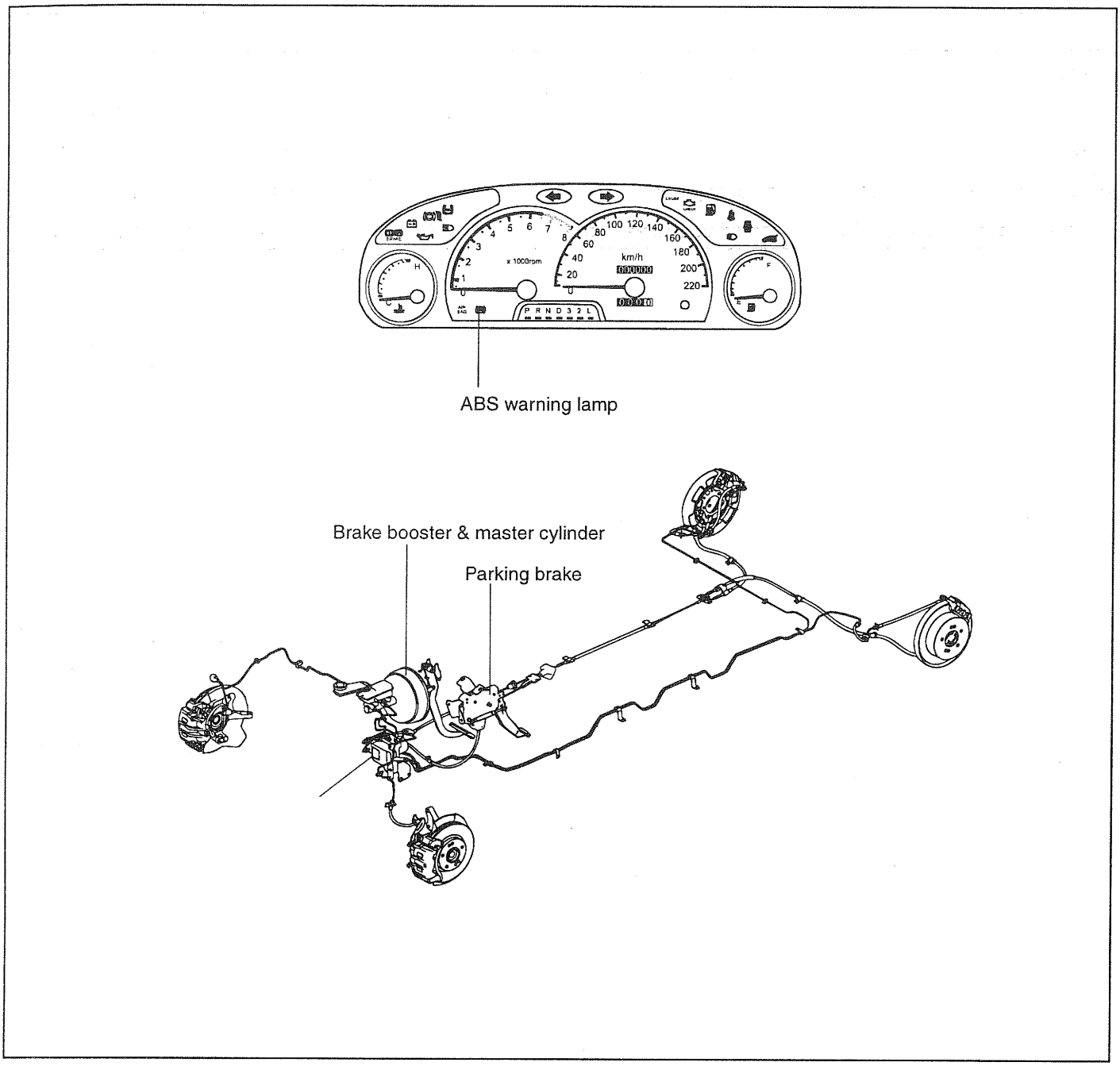
Part	Standard value	Remark
System		
Type	Solenoid/Solenoid	
Mode	ABS + EBD	
ECU		
Operating voltage	10V - 16V	
Operating temperature	-40°C - 110°C	
Warning lamp		
ABS		
Operating current	12V	
EBD		
Consumption current	80mA	
Wheel speed sensor		Min. P/P voltage 130mV
Internal resistance		
Front	1100Ω ± 50%	
Rear	1100Ω ± 50%	
Insulation resistance	Min. 1000kΩ	
Air gap		
Front	0.3-1.2 mm	
Rear	0.2-0.7 mm	
Tone wheel	47T	
HECU (Hydraulic and Electronic Control Unit)		o LPA : Low Pressure, Accumulator o HPA : High Pressure, Accumulator o NO : Normal Open o NC : Normal Close
Pump capacity	2.45 cc/sec	
Accumulator amount		
LPA	3.0cc	
HPA	6.0cc	
NO Solenoid vlave		
Front	Ø0.70mm	
Rear	Ø0.40mm	
NC Solenoid valve		
Front	Ø0.56mm	
Rear	Ø0.40mm	
Pump orifice	Ø0.5mm	

TIGHTENING TORQUE (ABS)

EJHA2050

	Nm	kg.cm	lb.ft
Sensor mounting bolt on the brake plate			
Front	0.4-0.6	4-6	0.29-0.43
Rear	0.4-0.6	4-6	0.29-0.43
Hydraulic & electronic control unit mounting bolt	0.8-1.0	8-10	0.58-0.72
Hydraulic & electronic control unit mounting bracket bolt	1.7-2.6	17-26	1.23-1.88

SYSTEM COMPONENT EJHA2100



EJHA020B

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 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 integrated control unit (HECU) recieves signals about the vehicle's speed, direction and road conditions from sensors at the wheels and the steering column.

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

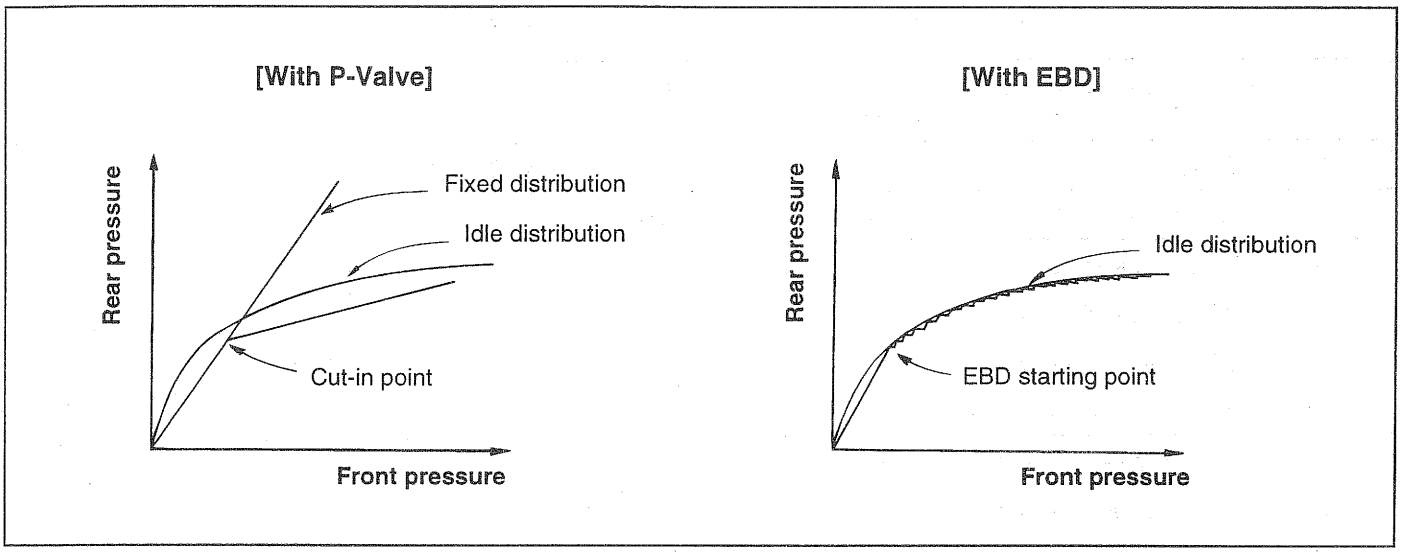
EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION) EJHA2150

EBD is additionally applied, instead of the proportioning valve, to deliver ideal distribution of fluid pressure to the front and rear brakes. This prevents the brakes from skidding in the event of rear wheel lock up and provides higher brake efficiency within the range of brake application.

ADVANTAGES

- Functional improvement of base-brake system
- Compensation of different friction coefficients
- Elimination of proportioning valve
- Failure recognition by warning lamp

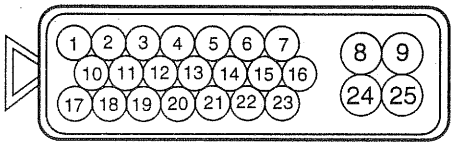
COMPARISON BETWEEN PROPORTIONING VALVE AND EBD



EJA0032A

INSPECTION AT HECU TERMINALS EJHA2200

TERMINAL VOLTAGE CHART

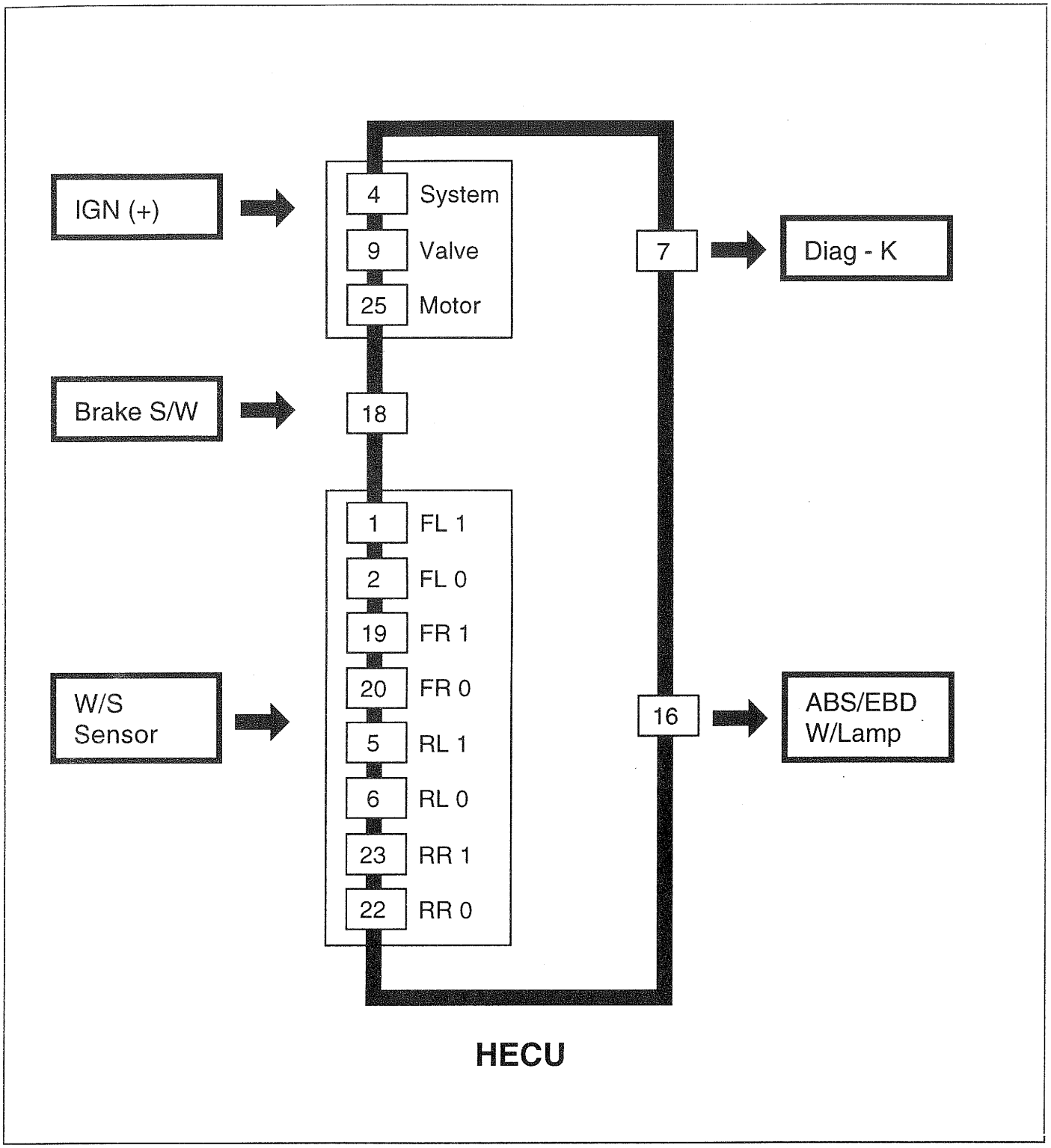


EJHA025A

Terminal No.	Description	Condition	Output
9	• Battery power source 1 • Solenoid valve power source	Always	System voltage
8	Ground	Always - In ABS control	
7	Diagnosis interface terminal (K-Line)	Connect the Hi-Scan	
5 1 19 22	Wheel speed sensor (Left rear) Wheel speed sensor (Left front) Wheel speed sensor (Right front) Wheel speed sensor (Right rear)		Resistance R=1.1kΩ ± 50% Min. detectable voltage V 130mVpp/50Hz (Vpp:Peak to Peak voltage)
6 2 20 23	Wheel speed sensor (Left rear) Wheel speed sensor (Left front) Wheel speed sensor (Right front) Wheel speed sensor (Right rear)		
4	Power input via ignition 2 switch	Ignition 2 condition	Over voltage detection : 16.5±0.5V < V < 20V Suspend voltage detection : 7.0±0.5V < V < 9.5±0.5 V System off : V < 5.5±0.5V
3	Not used		
25	• Battery power source 2 • Motor power source	Always	• System voltage • Max. current 1 < 100A (t < 100mesc.) • Rated current I < 30A (t > 100msec.)
24	Ground	G05	
16	ABS warning lamp	Energize the ABS relay	Max. current I < 200mA Max. voltage 40V
10, 11, 12, 13, 14, 15	Not used		

Terminal No.	Description	Condition	Output
18	Brake lamp switch input terminal		Input voltage threshold 1.00 < V2 < 2.75V 5.00 < VH < 16.00V
17, 21	Not used		

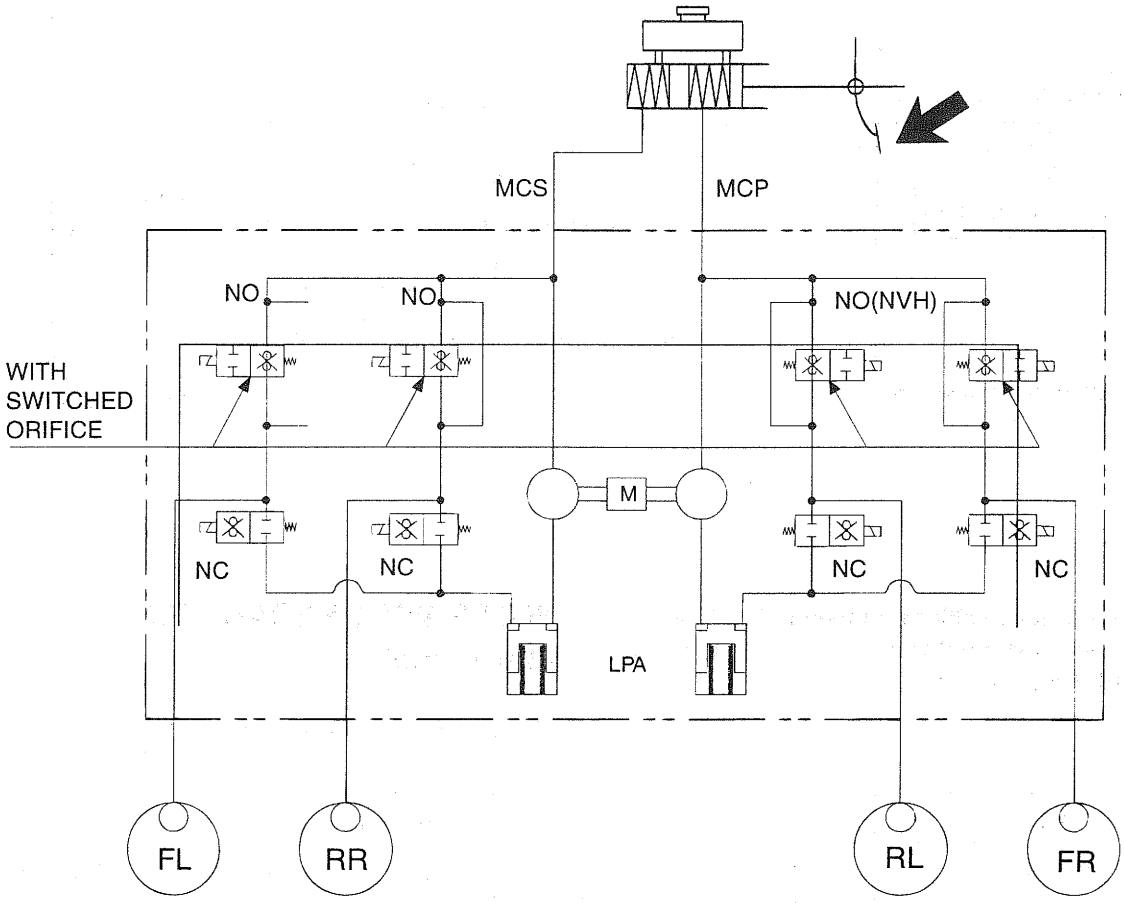
DIAGRAM OF INPUT/OUTPUT FOR HECU EJHA2250



EJHA030B

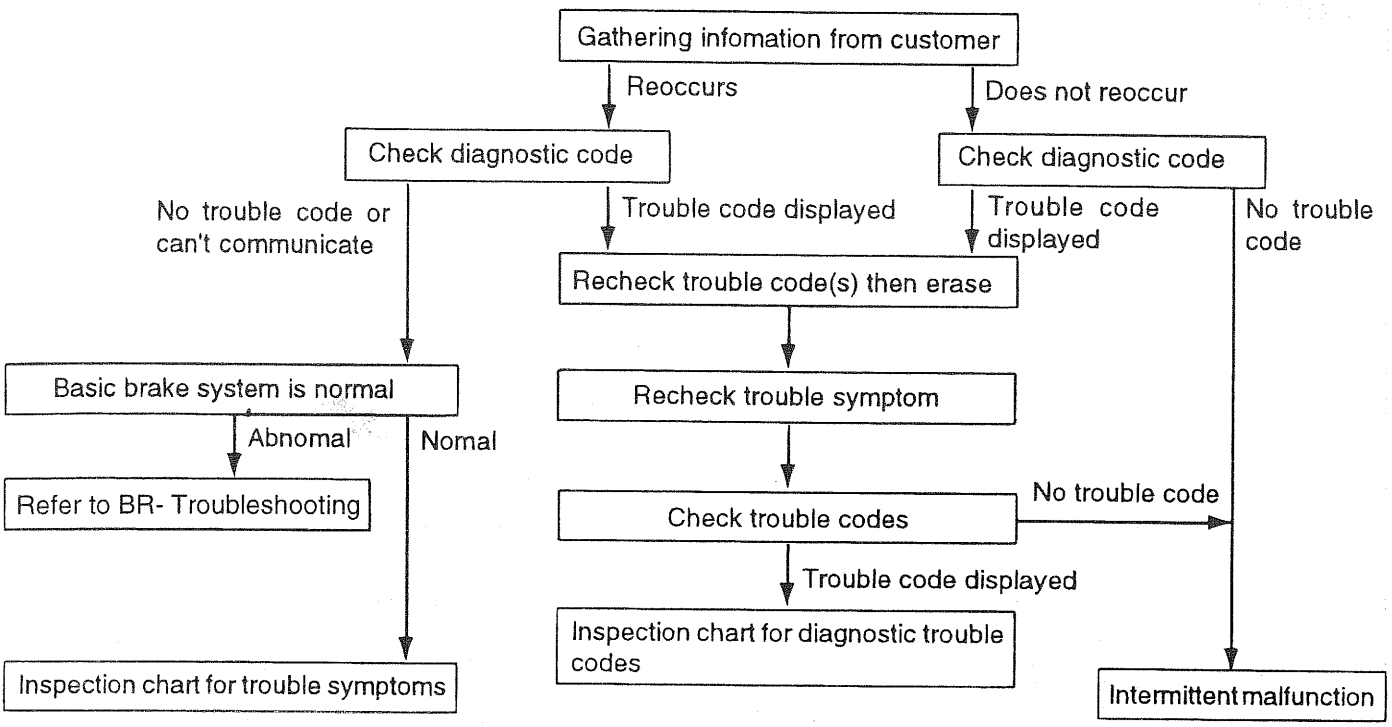
SYSTEM DIAGRAM EJHA2300

[ABS]



EJHA015A

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING EJHA2400



EJDA015A

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

NOTES WITH REGARD TO DIAGNOSIS EJHA2450

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, and is not abnormal.
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 and by not being too overconfident.
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 EJHA2500

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)

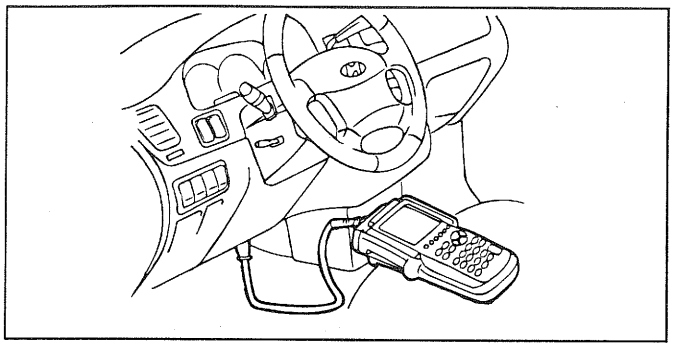
Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON ☐ Does not light up

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

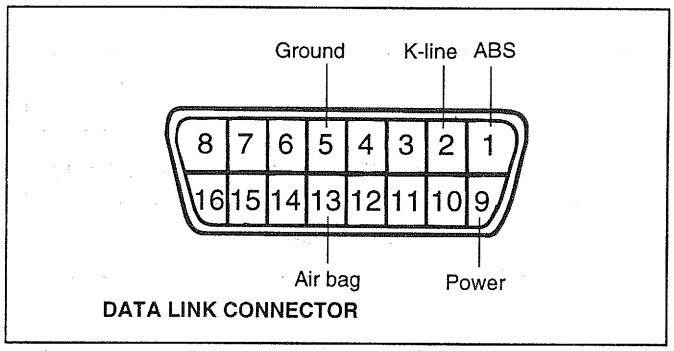
EJDA017A

HI-SCAN CHECK EJHA2550

1. Turn the ignition "OFF".
2. Connect the Hi-scan to the data link connector located underneath low crash pad panel.
3. Turn the ignition "ON".
4. Use the Hi-scan to check the self-diagnosis codes.
5. After completion of the repair or correction of the problems, turn the ignition switch; then erase the stored faults codes using the clear key.
6. Disconnect the Hi-scan.



ERHA006A



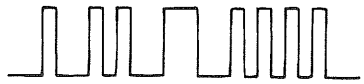
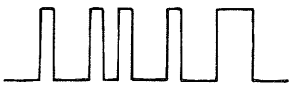
DATA LINK CONNECTOR

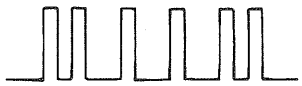
EJHA100A

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES EJHA2600

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

DTC on Hi-Scan Flash pattern of SRI	Description
C1101  H7BR005A	Battery voltage over volt (18V < V)
C1102  H7BR006A	Battery voltage low volt (< 9V)
C1200  H7BR007A	FL wheel sensor : open or short to GND
C1201  H7BR008A	-Range / Performance : exciter or speed jump error
C1202  H7BR009A	- No signal : air-gab error
C1203  H7BR010A	FR wheel sensor : open or short to GND

DTC on Hi-Scan Flash pattern of SRI	Description
C1204  H7BR011A	- Range / Performace : exciter or speed jump error
C1205  H7BR012A	- No signal : air-gab error
C1206  H7BR013A	RL wheel sensor : open or short to GND
C1207  H7BR014A	- Range / Performanace : exciter or speed jump error
C1208  H7BR015A	Battery voltage over volt (18V < V)
C1209  H7BR016A	RR whel sensor : open or short to GND
C1210  H7BR017A	- Range / Performance : exciter or speed jump error

DTC on Hi-Scan Flash pattern of SRI	Description
C1211  H7BR018A	Battery voltage over volt (18V < V)
C1604  H7BR022A	Harware (including valve failures)
C2112  H7BR023A	Valve relay (including fuse failure)
C2402  H7BR024A	Electrical (Pump-Motor)

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)	

FAILSAFE SPECIFICATION

Detect timing A : Initial check mode B : Out of control C : ABS control mode D : EBD control mode E : Diagnostic mode

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
1	C1101	Power supply	Over voltage of VIGN	When VIGN>18V continue 224ms, ECU detect the failure.	All wheel inhibit	All wheel inhibit	All wheel inhibit	VIGN < 17V	O	O	O	O	O	O	
	C1102		Voltage drop of VIGN	When VIGN<9V or VREF<9V continue 224ms, ECU detect the failure.	ABS inhibit (permit EBD control)	Continue EBD control	ABS inhibit	VIGN>10V and VREF>10V continue 224ms. But in case of ABS control mode, all wheels inhibit until end of ABS control.	O	-	O	O	O	O	
			Voltage drop of VIGN (EBD inhibit)	When VIGN<7.5V or VREF<7.5V continue 70ms, ECU detect the failure.	All wheel inhibit	All wheel inhibit	All wheel inhibit	VIGN>9V and VREF>9V continue 70ms	O	O					
2	C1604	Actuator	Interruptions or short circuit of actuator	Master CPU always sends test pulse (about 200s) to valves, and feedback signal returns into master and slave CPU. When feedback signal is not equal to test signal, CPU recognizes the actuator failure. Monitoring time is 56ms. But while CPU detected voltagedrop or overvoltage, failure of actuator is not detected.	System down	System down	System down	Restart	O	O	O *1	O	O	O	
	C2112 VREF< 6V	Main relay	Interruptions or short circuit of main relay								O *1	O	O	O	

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management: Out of control	Management: EBD control mode	Management: ABS control mode	Conditions for Restoration	ABS W/L	EBD W/L	Detect timing: A	B	C	D	E
3	C1604	Main relay	Interruptions or short circuit of Inhibit	While initial check, main CPU checks the functions of sub CPU inhibit signal and custom IC inhibit circuit.	System down	-	-	Restart	O	O	O				
			Interruptions or short circuit of main relay	1) IG-SW ECU checks VREF just after IGN-SW ON, and detects the failure. OFF: 2.5V>VREF, 4.2V<VREF (short or leak) — 105ms ON: VREF<6V (open) — 105ms: While ECU detected un-usual VIGN, failure isn't detected	System down	-	-	Restart	O	O	O				
	C112			When VREF<6V continue 224ms, ECU detects the failure. But while ECU detects voltagedrop or overvoltage, the failure is not detected.	System down	System down	System down	Restart	O	O	O *1	O	O	O	
4	FL : C1200 FR : C1203 RL : C1206 RR : C1209	Wheel speed sensor	Interruptions or short circuit of wheel speed sensor	Main CPU detects the failure by checking voltage of wheel speed sensor mounted the wheel that velocity is 0km/h. Sensor voltage<0.4V or >2.7V Monitoring time=196ms	Manage-ment A	Manage-ment B	Manage-ment C	Restart	O	O *a	O	O	O	O	

EJHA105B

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
4	FL : C1201 FR : C1204 RL : C1207 RR : C1210	Wheel speed sensor	Intermittently interruptions or short circuit of sensor. Defect of air gap or sensor wheels or clearance of bearing	After wheel velocity change over 30km/h per 7ms (over 120G), in case that there is the difference between calibrated wheel velocity and monitoring velocity continuously beyond the constant, ECU detects the failure.	Management B	Management B	Management C	To meet EC regulation, all wheel inhibit and light ABS WL until vehicle velocity > 20km/h after restart.	O	O *a		O	O	O	O
	FL : C1202 FR : C1205 RL : C1208 RR : C1211		Missing sensor signal Too large air gap Sensor wheel is not installed	When starting the vehicle, ECU detects the failure by the following conditions. 1. $V_{MAX} \geq$ 40km/h and $V_{ref} \leq 0.6 \times V_{MAX}$ Monitoring time 120s.	Management B	Management B	Management C	To meet EC regulation, all wheel inhibit and light ABS WL until vehicle velocity > 20km/h after restart.	O	O *a		O	O	O	
				2. Monitoring V_{ref} from $V_{MAX} > 7$km/h to $V_{MAX} \geq$ 20km/h, in case that V_{ref} is continuously V_{ref} < 6km/h, ECU recognizes the failure of wheels of V_W < 6km/h.	Management B	-	-					O			
				3. During monitoring mode b) (V_{MAX} < 20km/h), 120sec. after over spinning wheel is detected, in case that V_{MAX} < 20km/h and V_{ref} < 6km/h continue for 120sec., ECU recognizes the failure of wheels of V_W < 6km/h.	Management B	-	-					O			
			Too large air gap Long term EMI	In ABS control, when pressure decrease mode and hold mode continue 14sec., ECU detects the failure.	-	-	Management C	To meet EC regulation, all wheel inhibit and light ABS WL until vehicle velocity > 20km/h after restart.	O	O *a			O		
	C1604		Defect of clearance of bearing EMI/IGN noise	When there are over 32 pulses from wheel sensor within 7ms, ECU detects the failure.	System down	System down	System down	Restart	O	O	O	O	O	O	

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management: Out of control	Management: EBD control mode	Management: ABS control mode	Conditions for Restoration	ABS W/L	EBD W/L	Detect timing: A	B	C	D	E
5	C2402	Motor Motor relay	Interruption or short circuit of motor/motor relay	Monitoring VMS, ECU detects the failure. > 6.5V: 1785ms < 6.5V: 196ms When VIGN is unusual, ECU does not detect the failure.	ABS inhibit (permit EBD control	Continue EBD control	ABS inhibit	If ECU detects the failure of motor relay output ON or motor lock(see 7-(2)), after checking main relay failure at initial check, ECU unconditionally checks motor and motor relay with motor ON for 560ms. If ECU detects motor lock, ECU repeats the same check. After that, in case of unusual condition, ECU recognizes the failure. This step meets the EC regulation.	O	-	O *2	O *2	O	O	
			Interruption of motor Motor lock	1. Monitoring decrease of VMS, ECU detects the failure. Monitoring VMS every 7ms since motor relay output change from ON to OFF, It is recognized as normal condition in case that ECU detects VMS>5V over 6 times. If it is abnormal, ECU does the same check again with motor ON for 560ms. If it is abnormal again, ECU repeats the same process with motor ON for 553ms. After that, the state is abnormal again, ECU recognizes the failure. After initial check, in case that more than predetermined acceleration continues for a fixed period, ECU checks in the same way as the above with motor ON for 560ms. If that is abnormal, motor ON for 553ms and ECU repeats the same process. After that, in case of abnormal condition, ECU recognizes the failure. If VIGN is abnormal, ECU does not detect the failure.						O *3	O *3	O	O	O *3
			Failure of motor relay circuit / motor relay over current	Compare the information of voltage of motor relay monitor and DIAG signal outputted from custom IC, ECU detects the failure. But ECU does not check the failure for 1000ms from motor is turned off.				Restart		O	O	O		

EJHA105D

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
6	C1604	ECU	CPU failure	1.When ECU starts, main and sub CPU execute the following checks : a) ECU checks the value of the result of fixed multiplication whether it becomes the value decided in advance or not. b) ECU executes read/write for RAM. c) ECU executes sum check of ROM.	System down	System down	System down	Restart	O	O	O				O
				2. IGN After IGN ON, main and sub CPU communicate each other for synchronization. When one or the other CPU can't synchronize within 1sec., main CPU shifts system down and sub CPU stops running.	System down	System down	System down	Restart	O	O	O				O
				3.Main and sub CPU always execute the following checks. ECU checks whether program is finished or not	System down	System down	System down	Restart	O	O	O	O	O	O	O

EJHA105E

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
6	C1604	ECU	CPU failure	4. In every program cycle, main CPU and sub CPU communicate with each other for synchronization. When one or the other CPU can't synchronize within 300μ sec, main CPU shifts system down and sub CPU stops running.	System down	System down	System down	Restart	O	O	O	O	O	O	O
				5. Sub CPU checks the following : a) Sub CPU always compares the result of AD sent by main CPU with the result of AD calculated by sub CPU, in case that there is a difference above 7 bits for 112ms, ECU recognizes the failure. b) In case that wheel velocity of FL calculated by main CPU is different from that calculated by sub CPU above 10km/h for 504ms, ECU recognizes the failure. c) Sub CPU calculates the slip from Vref calculated by main CPU and wheel velocity of FL calculated by sub CPU. ECU recognizes the failure when main CPU judges ABS phase as pressure decrease phase for 1sec. with no slip calculated by sub CPU.d). When main CPU does not judge ABS phase as pressure decrease phase, in case that main CPU sets the valves as pressure decrease state for 1 sec., ECU recognizes the failure.). When main CPU judges ABS phase as out of ABS control, in which case the valve driven information from main CPU is pressure hold state for 1 sec., ECU recognizes the failure.	System down	System down	System down	Restart	O	O	O	O	O	O	

*1 In case of main relay ON only
*2 In case of motor initial check only, ECU detects the failure of motor relay output ON.
*3 In case of motor initial check only
*a In case of over two wheels failure

Management A

Conditions	Management
Vmax > 5km/h	Management B
Vmax < 5km/h	One front wheel failure defects wheel inhibit
	One rear wheel or over two wheels failure All wheels inhibit

Management B

Conditions	Management
Failure of one wheel	ABS inhibit (permit EBD control)
Failure of over two wheels	System down

Management C

Conditions Management	Management
Failure of one front wheel	ECU discontinues ABS control of defected wheel and continues ABS control of normal wheels. ABS inhibit after end of ABS control.
Failure of two front wheel	ECU discontinues ABS control of defected wheel and continues ABS control of normal wheels. System down after end of ABS control.
Failure of one rear wheel	ECU continues ABS control of rear wheels using information of normal rear wheel and front wheels. System down after end of ABS control.
Failure of two rear wheel	System down
Failure of one front wheel and one rear wheel	ECU discontinues ABS control of defected front wheel, and continues rear wheels using in-formation of normal rear wheel. System down after end of ABS control.
Failure of over three wheels	System down

ADDITIONAL EXPLANATION OF FAILSAFE

1. WL initial lighting time
   1) Immediately after IG-SW ON, WL is lights up for 3 sec. . This term is called 'WL initial lighting time'.
   2) Within this term, in case that ECU detects the failure, WL is lighted continuously.

NOTE

1. System down
   It is the condition that changes to normal brake with WL ON after detecting the failure by software.
   ECU restart is caused by IG-SW OFF → ON once.
   After the failure is corrected, in case of restarting ECU, it returns to a normal mode with WL OFF.
2. All wheel inhibit
   ECU discontinues ABS control of all wheels. (Equivalent to normal brake)
   When the failure is corrected, it returns to normal mode with WL OFF. (But during ABS control, it does not return to a normal mode.)

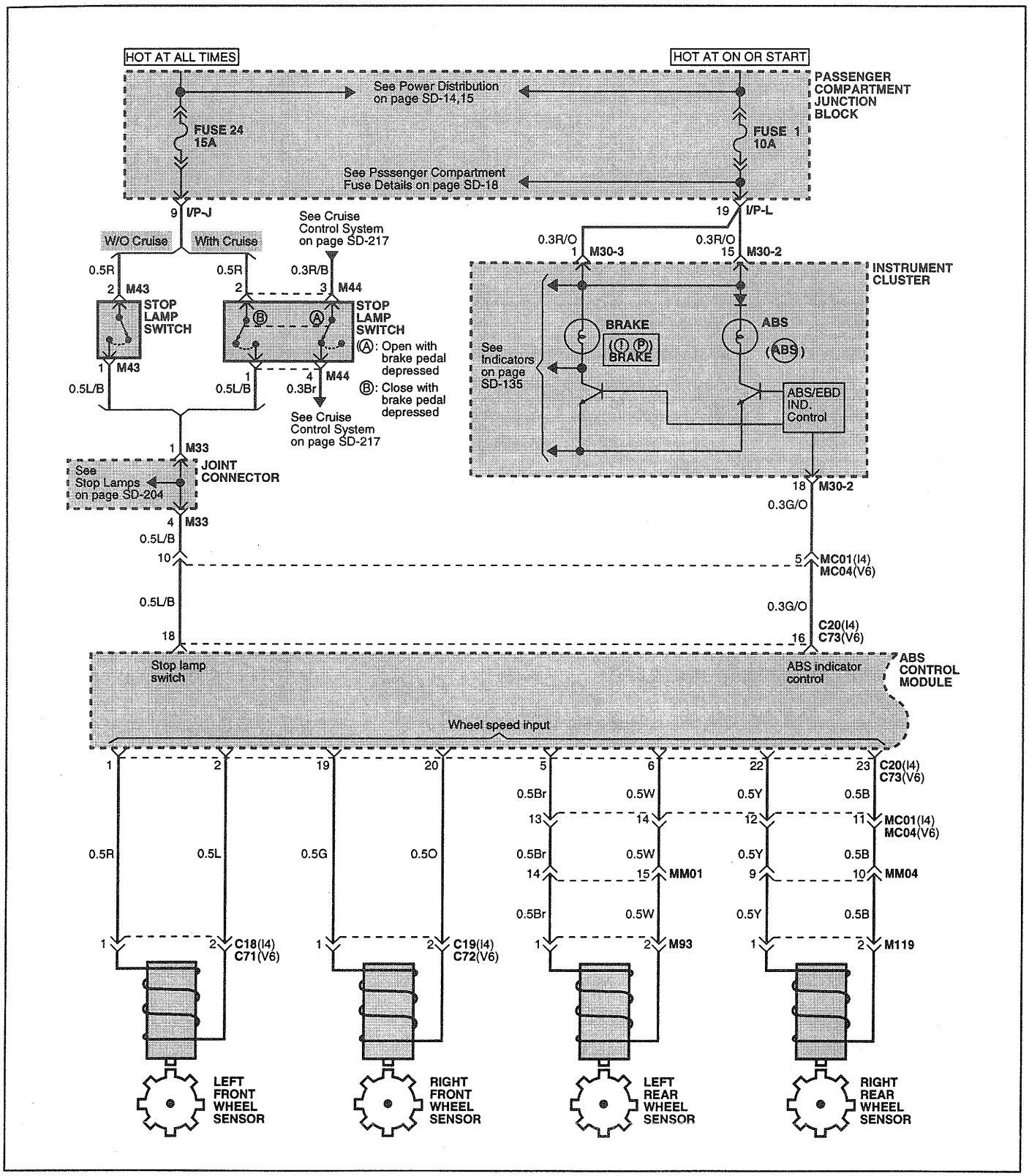
TERM COMMENTARY

VIGN : Terminal voltage of IGN, VREF : Terminal voltage of REF
VMAX : Maximum wheel velocity, Vref : estimated vehicle velocity

EJHA105G

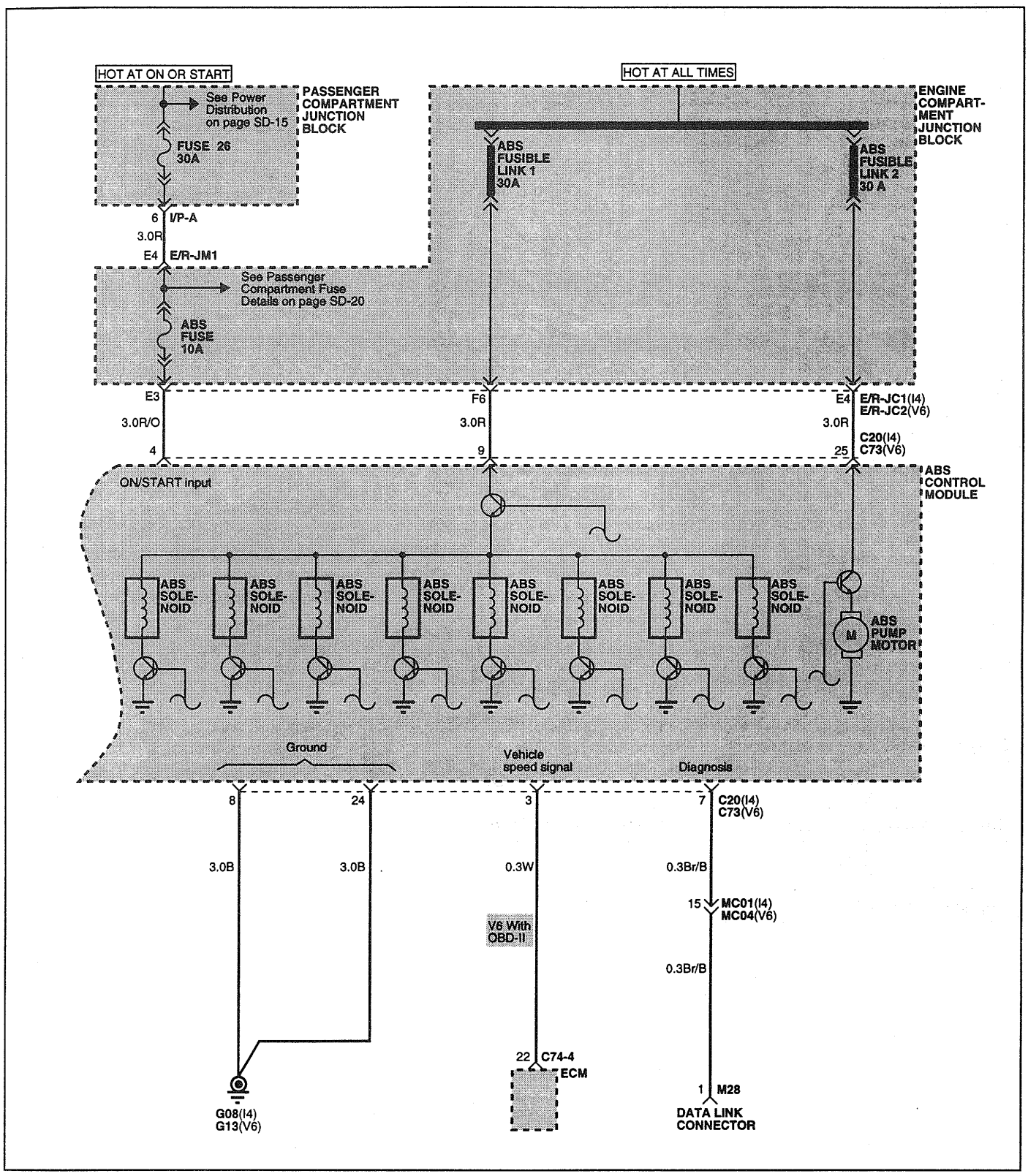
SCHEMATIC DIAGRAM EJHA2650

ABS CIRCUIT (1)



EJHA020C

ABS CIRCUIT (2)

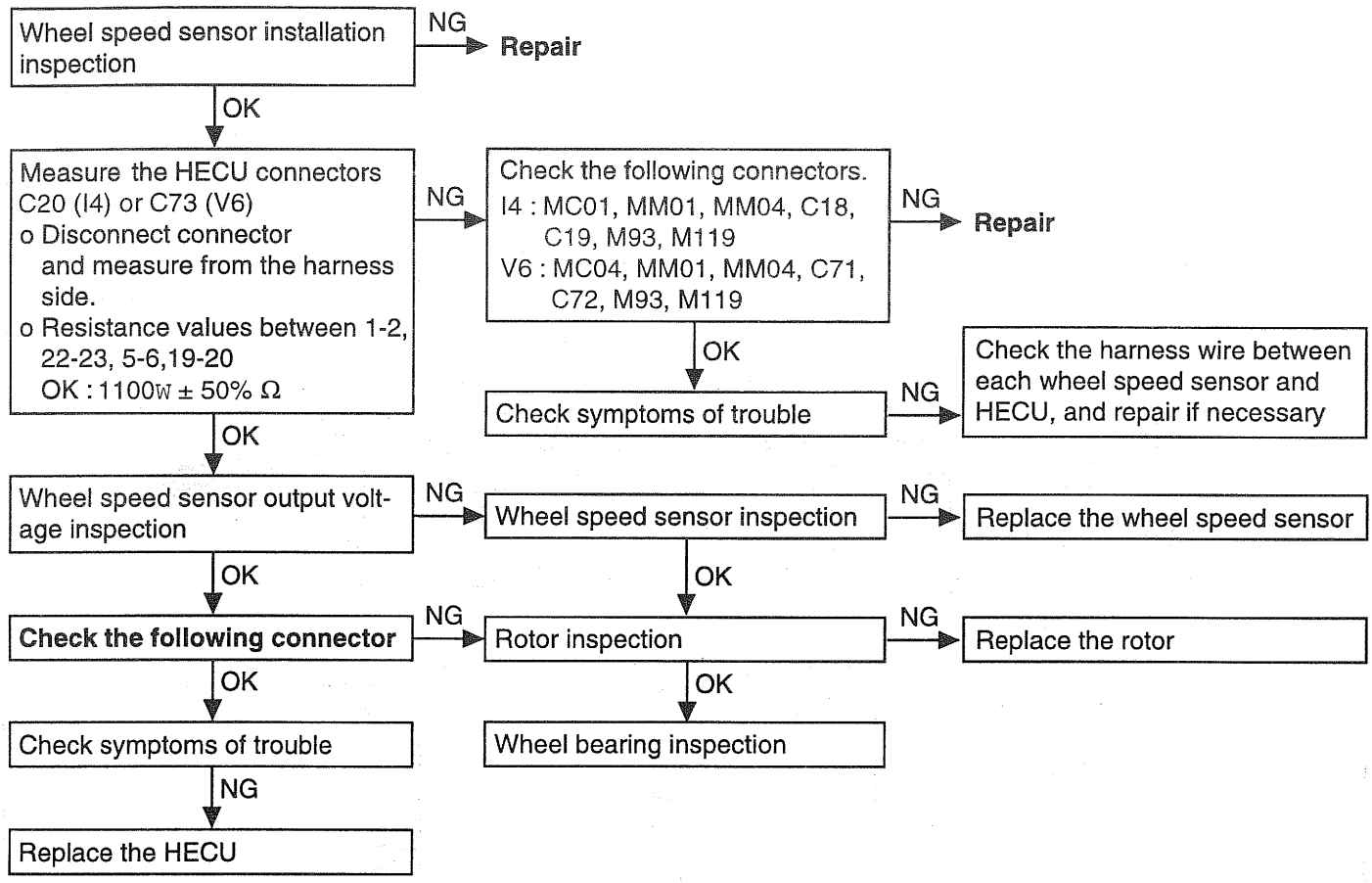


EJHA020D

INSPECTION PROCEDURE FOR DIAGNOSTIC TROUBLE CODES

EJHA2700

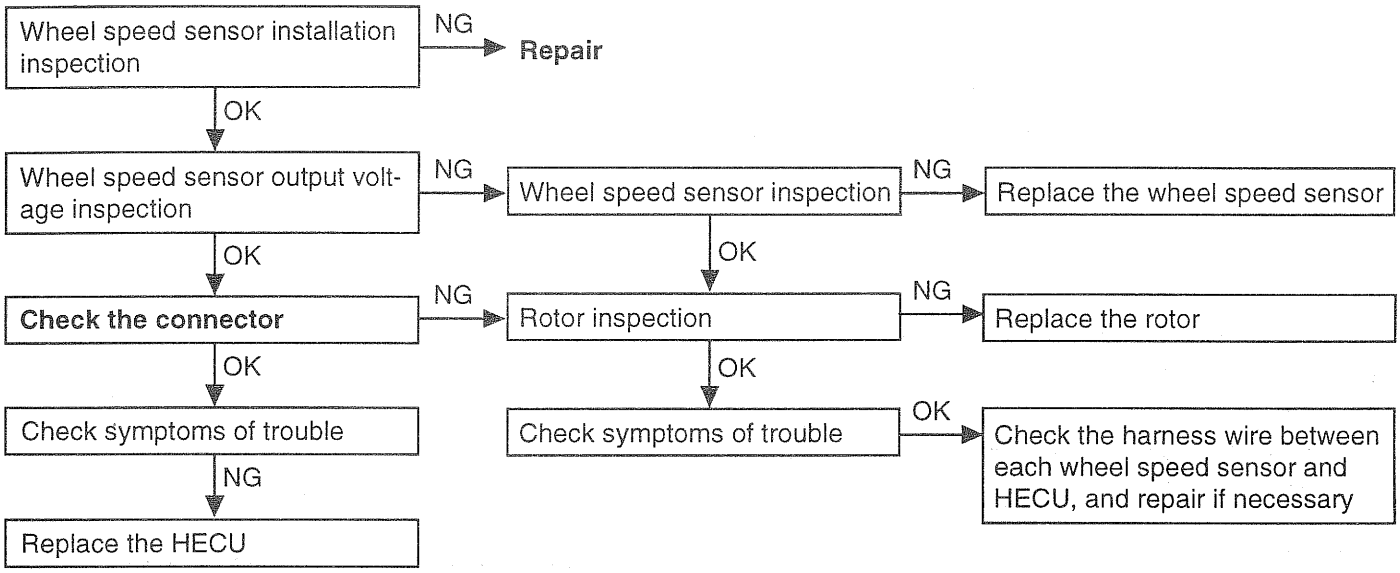
DTC No. C1200, C1203, C1206, C1209 Wheel speed sensor open or short to GND circuit	Probable cause
The HECU determines that an open or short circuit has occured in more than one line of the wheel speed sensors	• Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction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



EJHA110A

EJHA2750

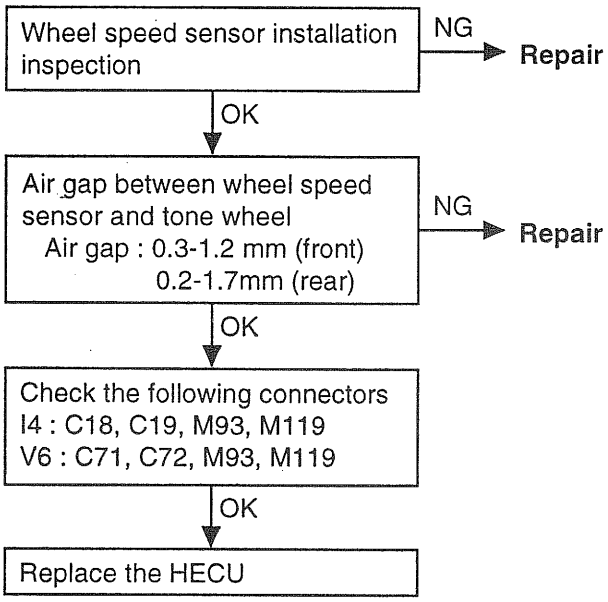
DTC No. C1201, C1204, C1207, C1210 (Speed jump or wrong exciter)	Probable cause
A wheel speed sensor outputs an abnormal signal (other than an open short-circuit).	• Improper installation of wheel speed sensor • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of HECU



EJHA115A

EHJA2800

DTC No. C1202, C1205, C1208, C1211 (Large air gap)	Probable cause
A wheel speed sensor outputs no 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



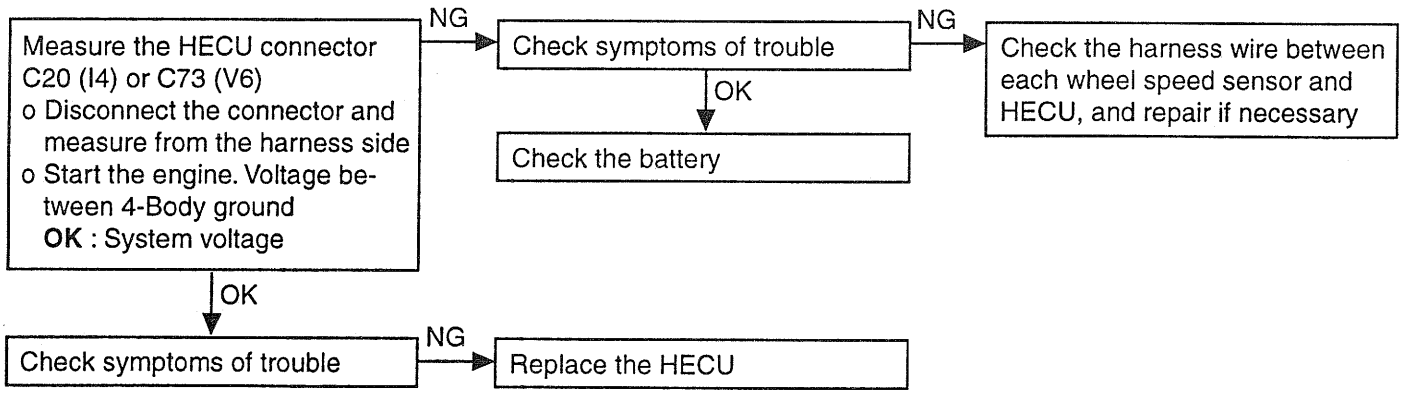
EJHA120A

EJHA2850

DTC No. C1101, C1102 Voltage out of range (Low and over 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.

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.



EJHA125A

EJHA2900

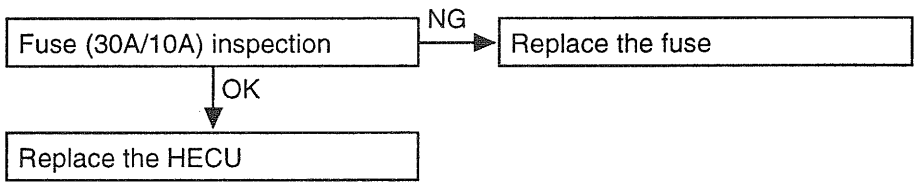
DTC No. C1604 ECU Hardware (EEPROM and ECU failure)	Probable cause
The HECU always monitors the solenoid valve drive circuit. It determines that there is an open or short-circuit in the solenoid coil or in a harness. Even if no current flows in the solenoid even though the HECU is turned on and vice versa.	• Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of HECU

EJHA2950

DTC No. C2112 Valve relay (Including fuse failure)	Probable cause
When the ignition switch is turned ON, the HECU switches the valve relay off and on during the initial check. In that way, the HECU compares the signals sent to the valve relay with the voltage in the valve power monitor line. That is how to check if the valve relay is operating normally. The HECU always checks if current flows in the valve power monitor line. It determines that there is an open circuit when no current flows. If no current flows in the valve power monitor line, this diagnosis code is output.	• Malfunction of wiring harness or connector • Malfunction of HECU

NOTE

Whenever reading the diagnosis codes using the ABS warning lamp, this diagnosis code will be output.



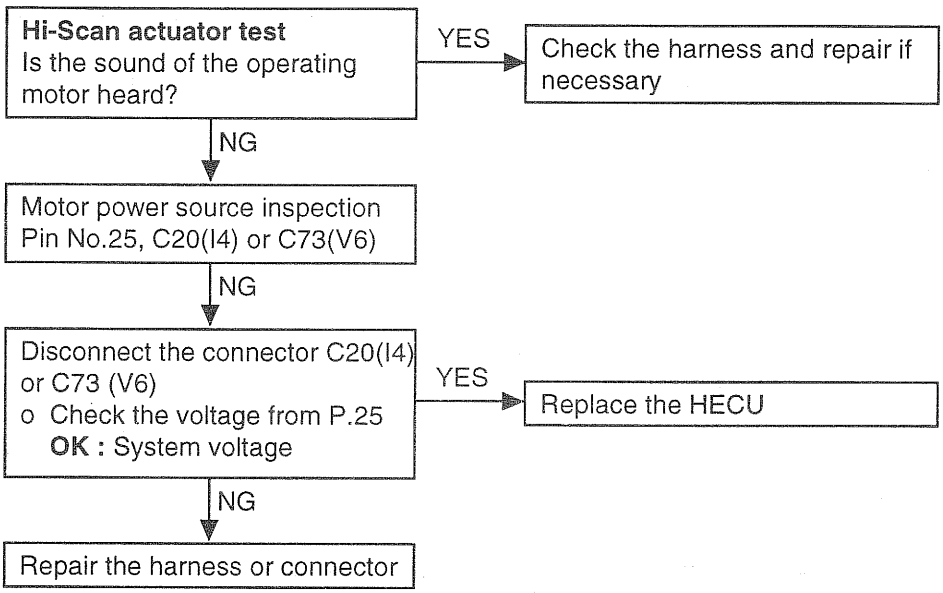
EJFA029B

EJHA3000

DTC No. C2402 Electrical (Motor relay, motor)	Probable cause
When the motor power line is normal but no signal is input to the motor monitor line, it is abnormal.	• Malfunction of hydraulic unit • Malfunction of HECU

CAUTION

Because force-driving of the motor by means of the actuator test will discharge the battery, the engine should be run for a while after testing is completed.

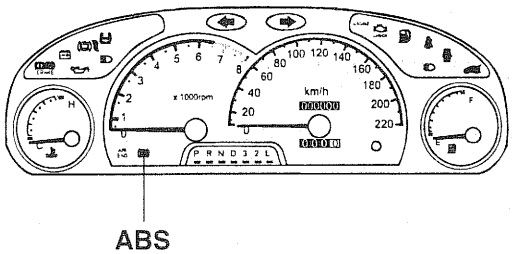


EJHA140A

ABS WARNING LAMP INSPECTION EJHA3050

Check that the ABS warning lamp illuminates as follows.

When the ignition key is turned "ON", the ABS warning lamp comes on for approximately 2 seconds and then goes out.



ERHA003A

INSPECTION CHART FOR TROUBLE SYMPTOMS EJHA3100

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

Trouble system		Inspection procedure No.
Communication with Hi-Scan is not possible	Communication with all system is not possible.	1
	Communication with ABS only is not possible.	2
When the ignition key is turned "ON" (engine stopped), the ABS warning lamp does not illuminate.		3
After the engine start, 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 (Caution 2.)	-

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.

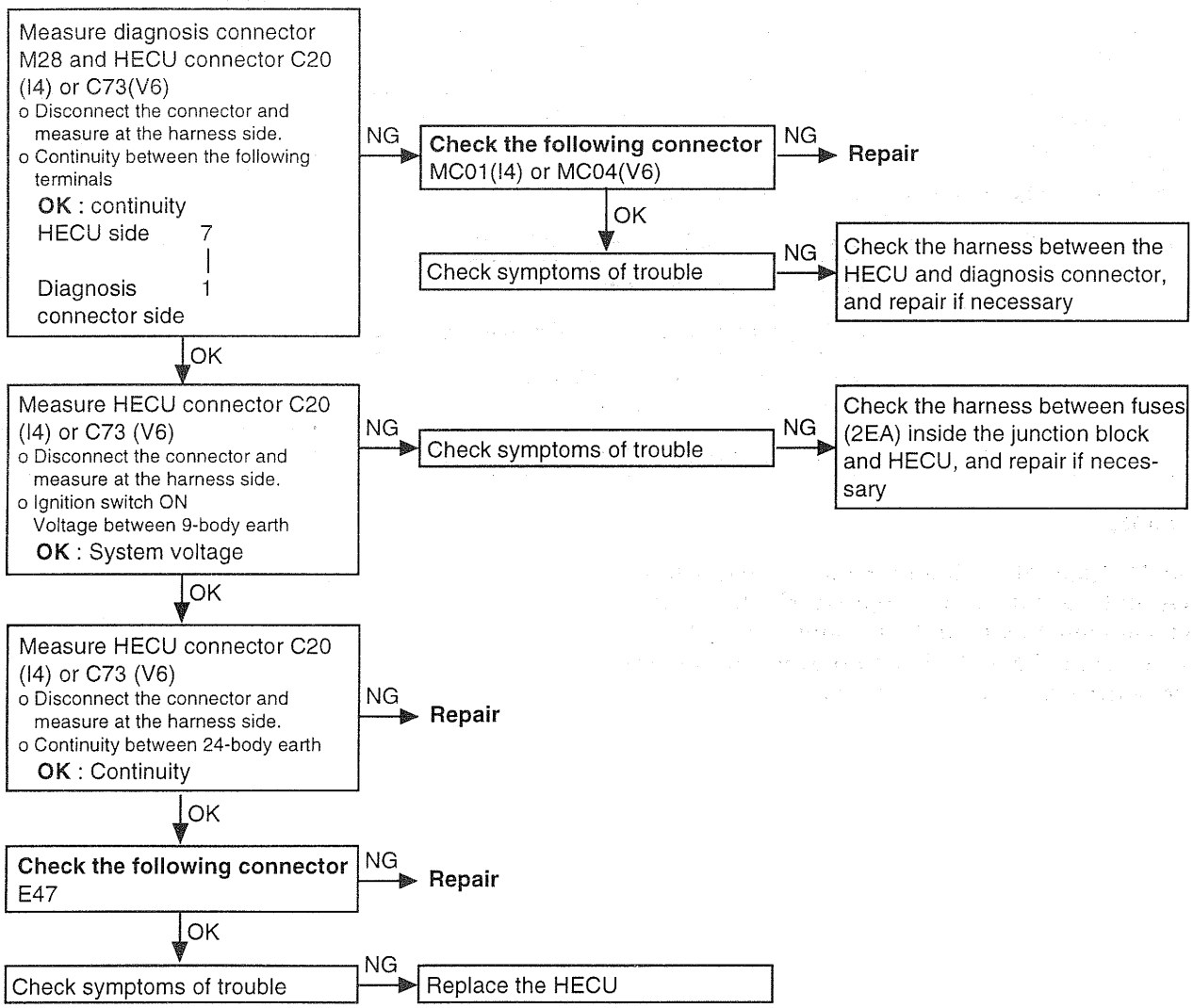
INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS EJHA3150

INSPECTION PROCEDURE 1

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

INSPECTION PROCEDURE 2

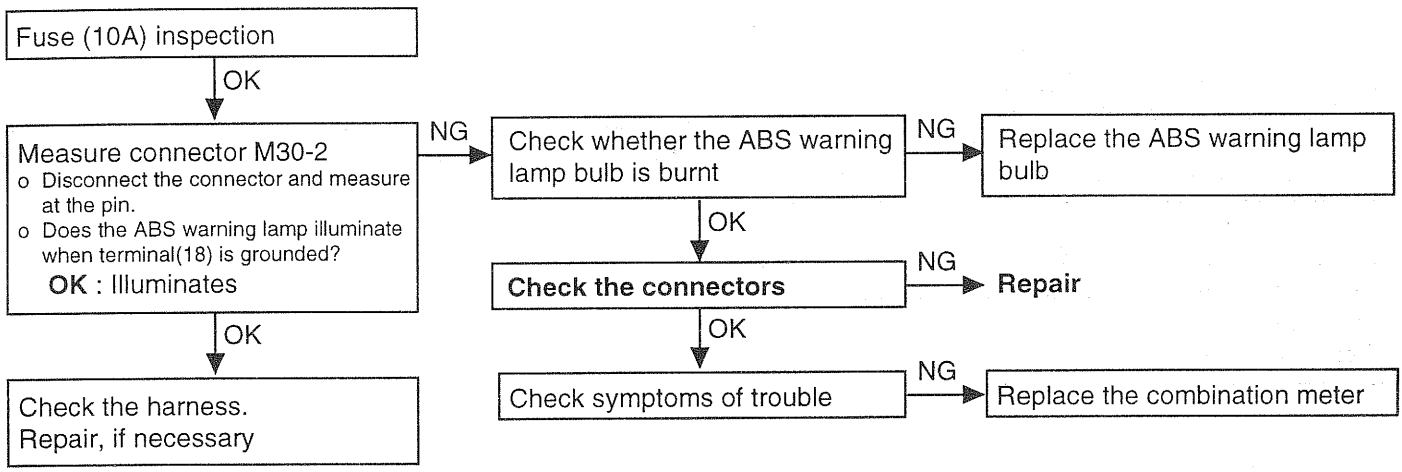
Communication with Hi-Scan is not possible. (Communication with ABS only is not possible.)	Probable cause
When communication with Hi-Scan is not possible, the cause is probably an open circuit in the HECU power circuit or an open circuit in the diagnosis output circuit.	• Blown fuse • Malfunction of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



EJHA155A

INSPECTION PROCEDURE 3

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

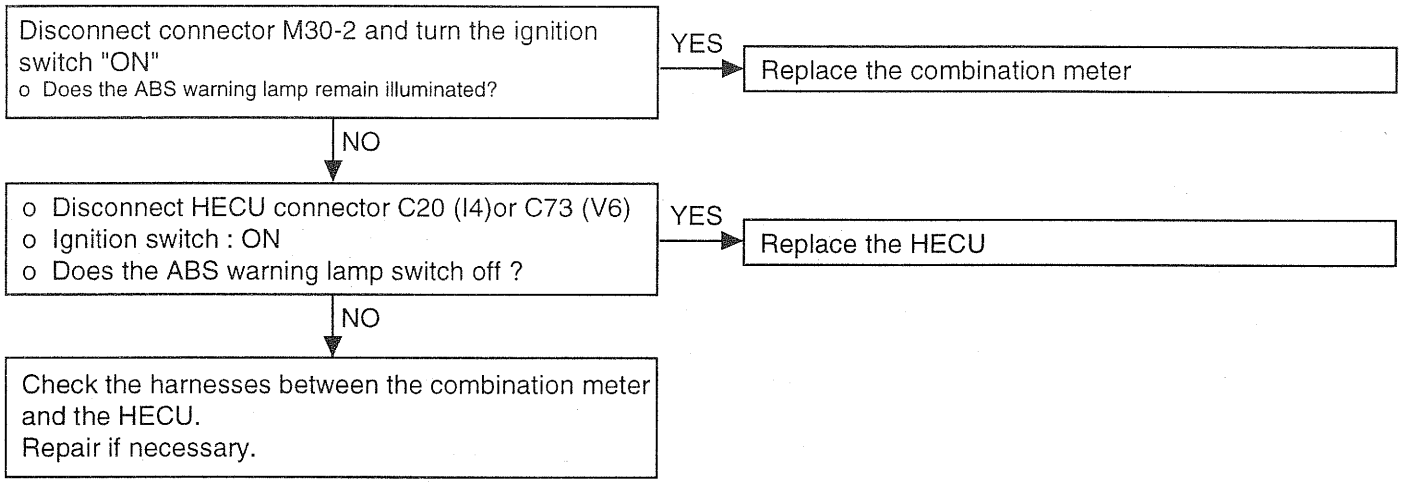


EJHA155B

INSPECTION PROCEDURE 4

Even after the engine is started, the ABS warning lamp remains illuminated	Probable cause
The cause is probably a short-circuit in the ABS warning lamp illumination circuit	• Malfunction of combination meter • Malfunction of HECU • Malfunction of wiring harness

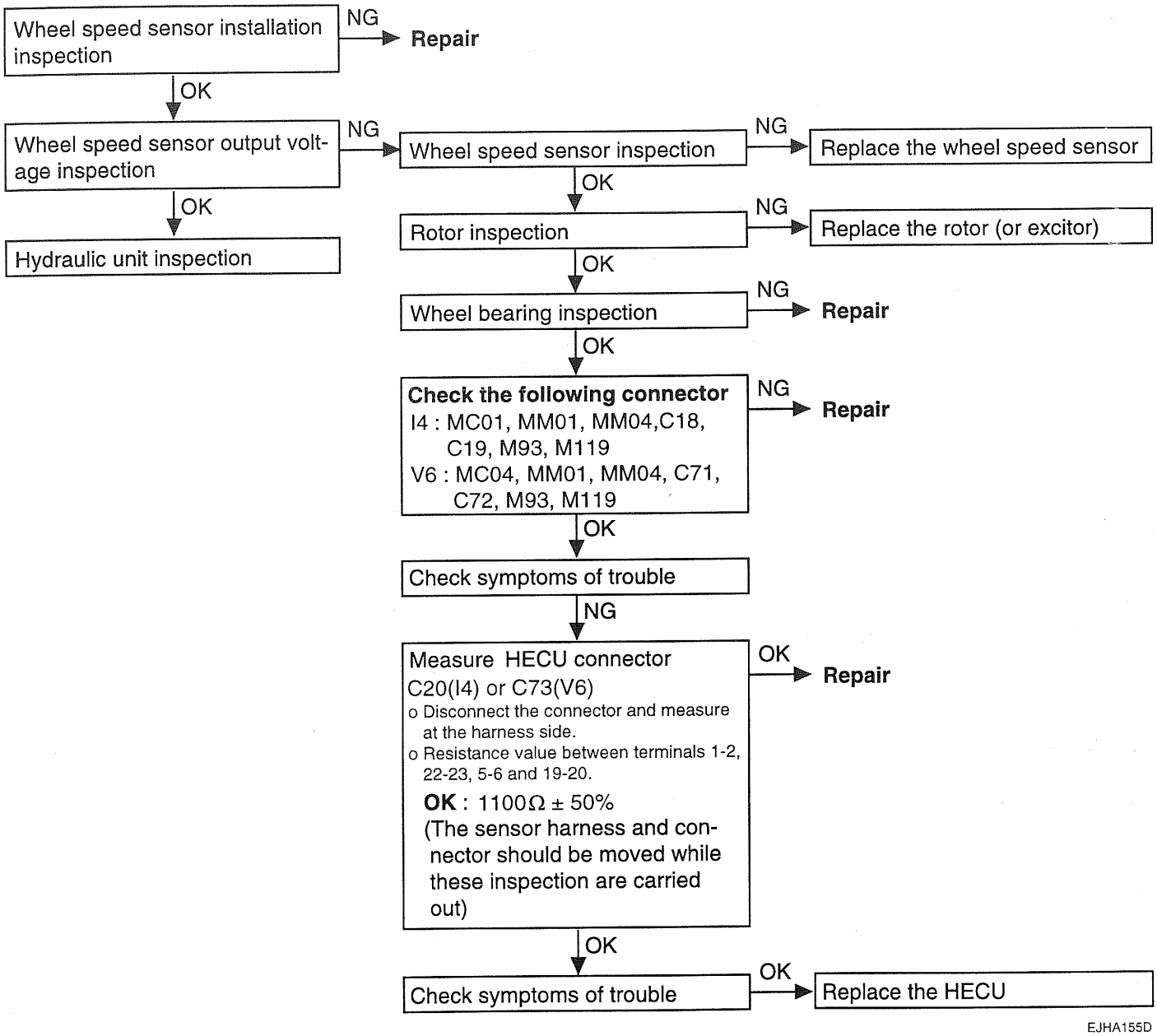
This trouble symptom is limited to cases where communication with the Hi-Scan is possible (HECU power supply is normal) and the diagnosis code is normal.



EJHA155C

INSPECTION PROCEDURE 5

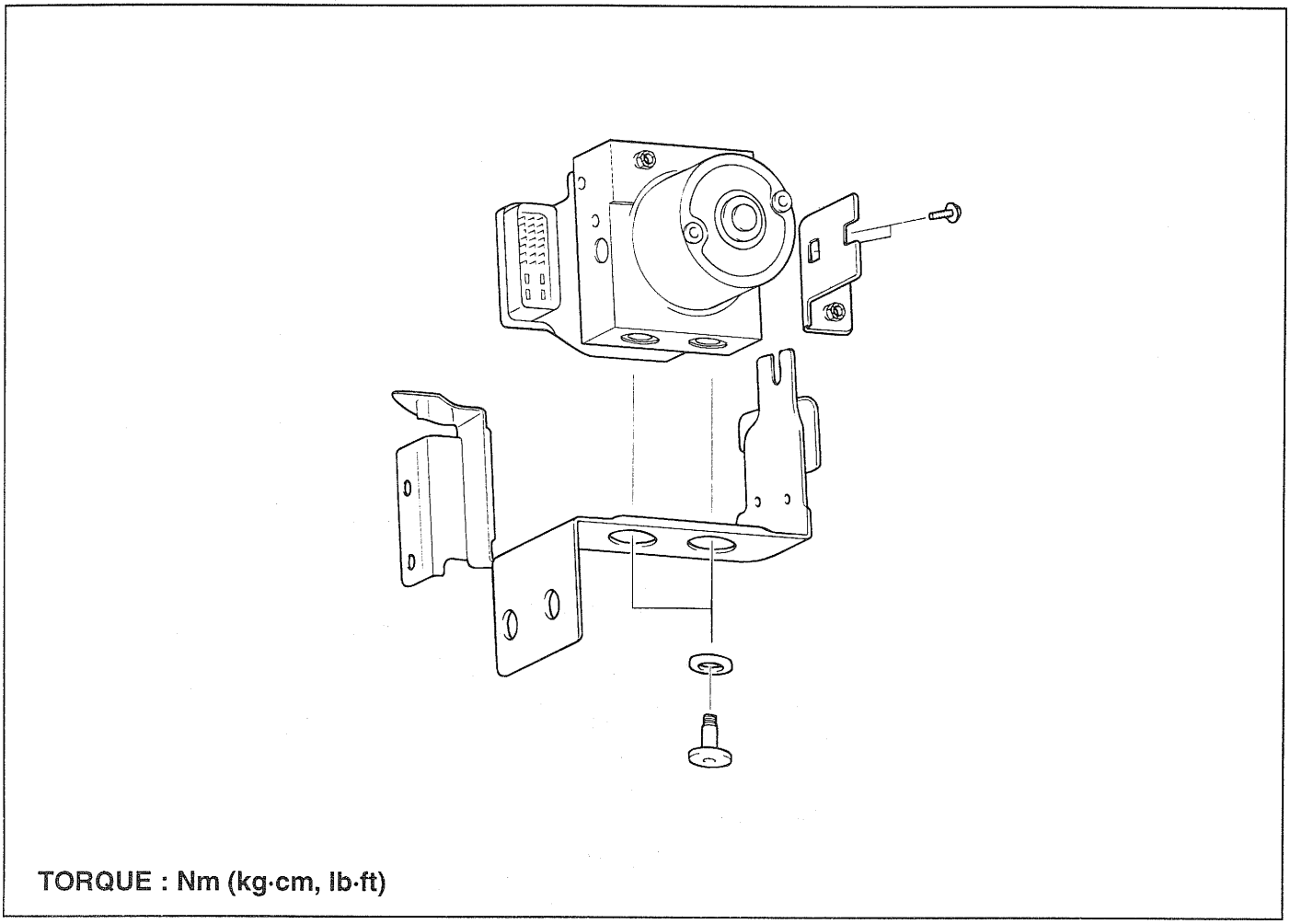
Brake operation is abnormal	Probable cause
This varies depending on driving conditions and road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	• Improper installation of wheel speed sensor • Incorrect sensor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



EJHA155D

ANTI-LOCK BRAKING SYSTEM CONTROL MODULE

COMPONENTS EJHA3200

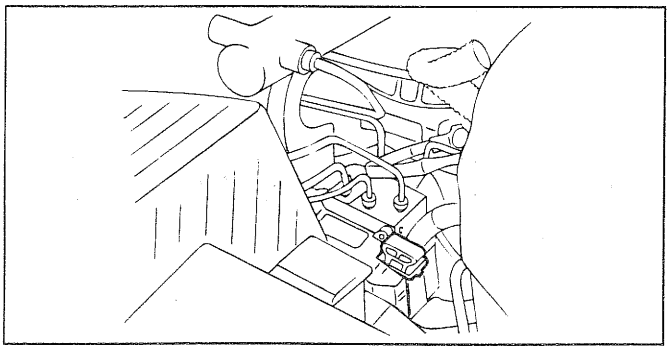


TORQUE : Nm (kg·cm, lb·ft)

EJHA040A

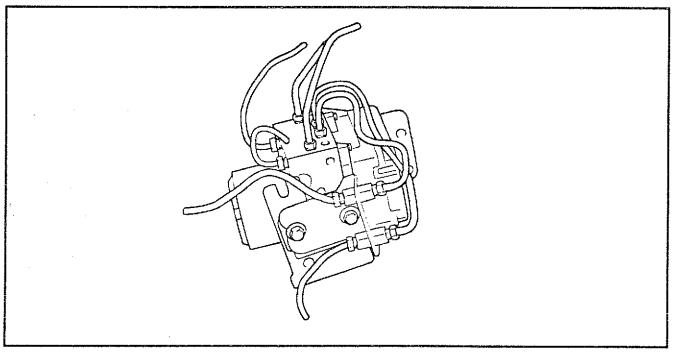
REMOVAL EJHA3250

1. Disconnect the HECU (Hydraulic and electronic Control Unit) and motor connector.



EJHA022A

2. Disconnect the brake tubes from the HECU.



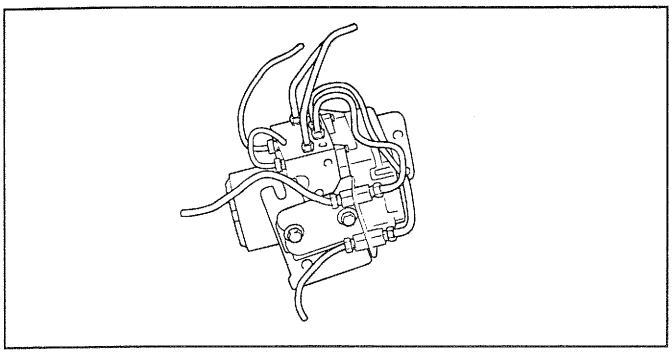
EJHA045A

3. Remove the HECU bracket mounting bolt and the HECU.

CAUTION

1. **Never attempt to disassemble the HECU.**

2. **The HECU must be transported and stored in the upright position and with sealed ports. The HECU must not be drained.**



EJHA045A

INSTALLATION EJHA3300

1. Follow the reverse order of the removal.
2. Tighten the modulator mounting bolts and brake tube nuts to the specified torque.

Tightening toque

HECU mounting bolt :

8-10 Nm (80-100 kg·cm, 5.6-6.9 lb·ft)

Brake tube nut :

13-17 Nm (130-170 kg·cm, 9-12 lb·ft)

ANTI-LOCK BRAKING SYSTEM MODULATOR

HYDRAULIC MODULE INSPECTION EJHA3600

CAUTION

Turn the ignition switch off before connecting or disconnecting the Hi-Scan.

1. Jack the vehicle up and support the vehicle with rigid racks with specified jack-up points or replace the wheels which are checked on the rollers of the braking force tester.

CAUTION

1. **The roller of the braking force tester and the tire should be dry during testing.**
2. **When testing the front brakes, apply the parking brake, and when testing the rear brakes, stop the front wheels by chocking them.**

2. Release the parking brake and feel the drag force (drag torque) on each road wheel.

   When using the braking force tester, take a reading of the brake drag force.

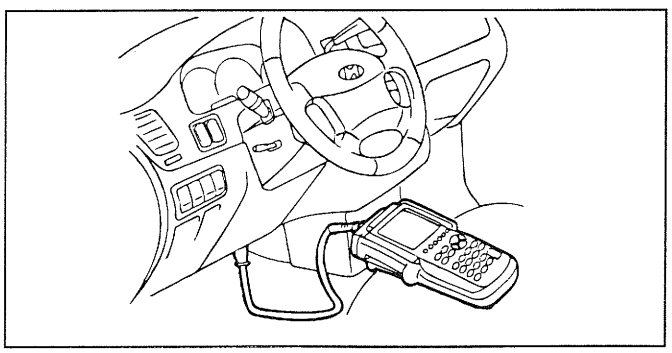
3. Turn the ignition key "OFF" and set the Hi-Scan as shown in the diagram.

4. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.

NOTE

When the ABS has been interrupted by the fail-safe function, the Hi-Scan actuator testing cannot be used.

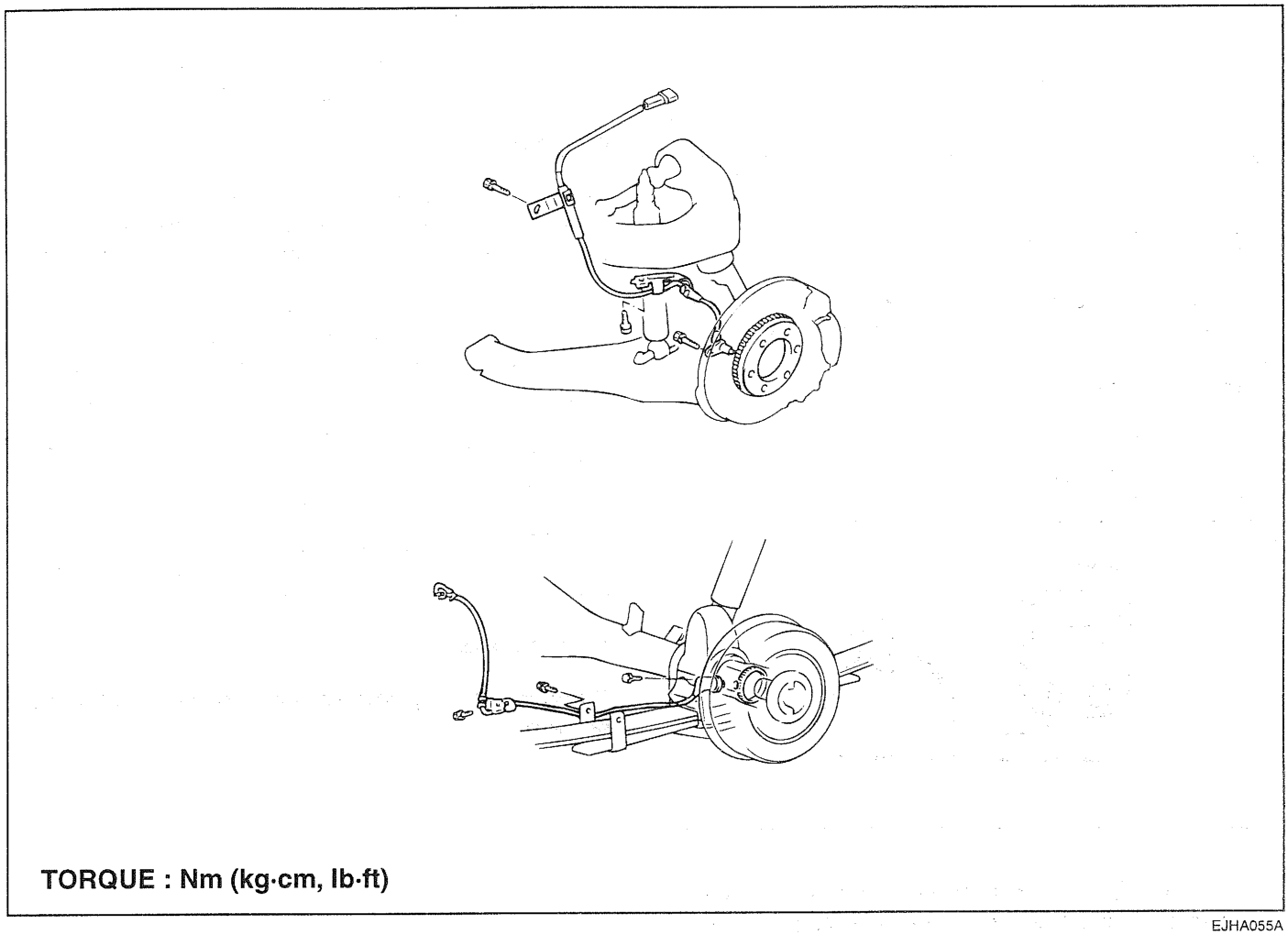
5. Use the Hi-Scan to force-drive the actuator.



ERHA006A

ANTI-LOCK BRAKING SYSTEM WHEEL SPEED SENSOR

COMPONENTS EJHA3350

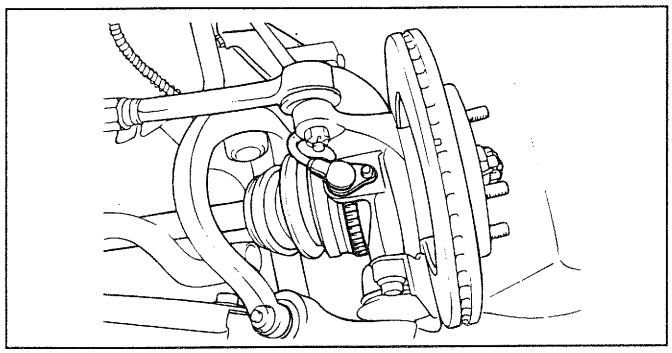


EJHA055A

REMOVAL EJHA3400

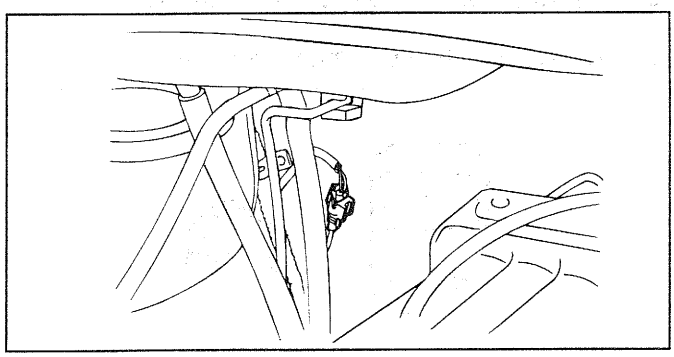
FRONT WHEEL SPEED SENSOR

1. Remove the front wheel speed sensor mounting bolt.



KFW8059A

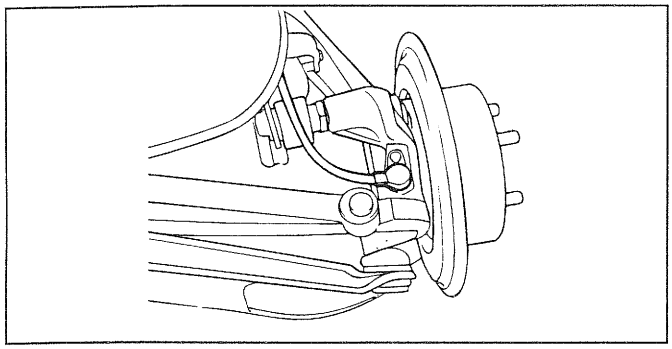
2. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector.



EJHA023B

REAR WHEEL SPEED SENSOR

Remove the rear wheel speed sensor after disconnection the wheel speed sensor connector.



KFW8060A

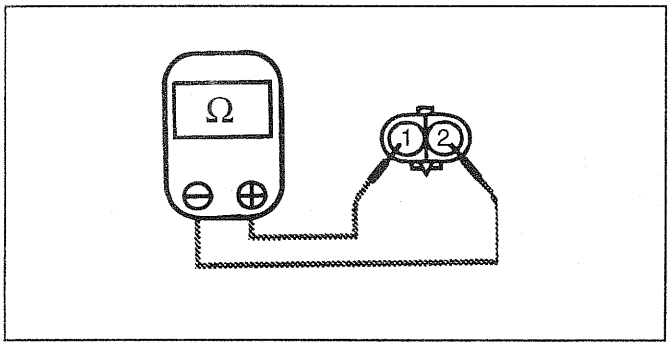
INSPECTION EJHA3450

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

Service standard

Front : 1100Ω ± 50%

Rear : 1100Ω ± 50%



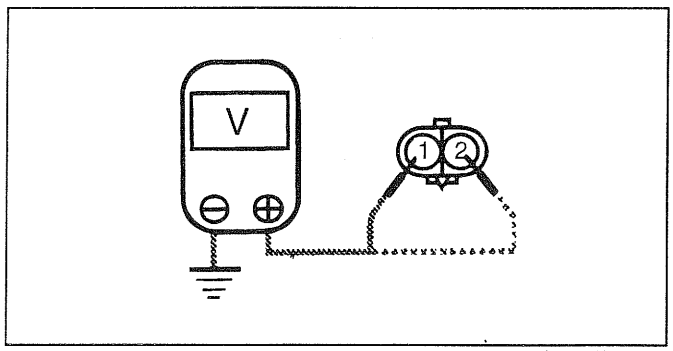
EJA9031E

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.



EJA9031F

ABS OPERATION CHECK EJHA3550

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift the vehicle up and release the parking brake.
2. Disconnect the HECU harness connector and measure from the harness side connector.

CAUTION

Be sure to remove the connector double lock and insert the probe into the harness side. Inserting it into the terminal side will result in a bad connection.

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

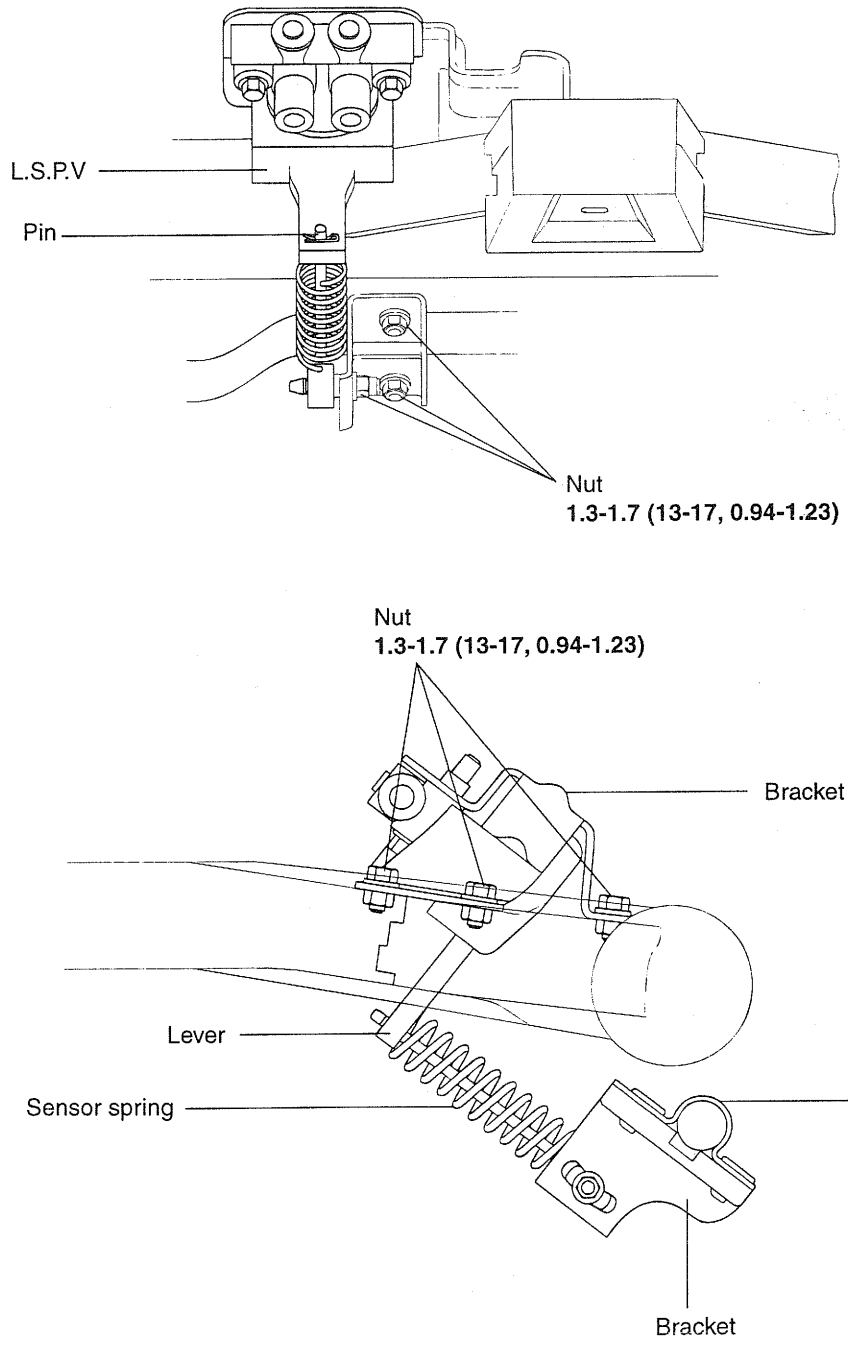
Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	1	19	5	22
	2	20	6	23

Output voltage

When measuring with an oscilloscope : 130 mV p-p or more

LSPV (LOAD SENSING PROPORTIONING VALVE)

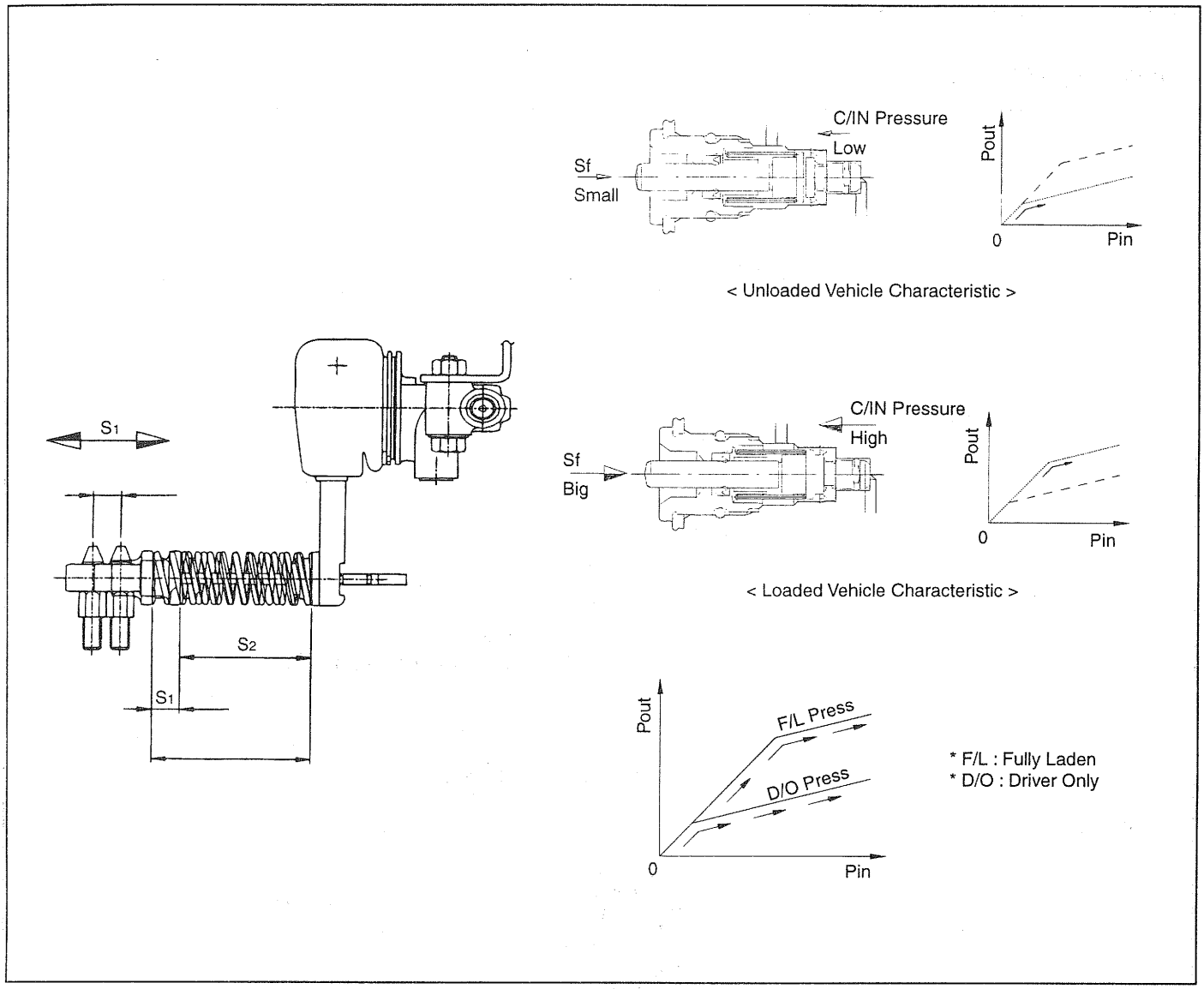
COMPONENTS EJHA3950



TORQUE : Nm (kg.cm, lb.ft)

EJHA395A

SUMMARY EJHA4000



EJHA030A

L.S.P.V (Load Sensing Proportioning Valve) is a control device for applying the ideal hydraulic line pressure to the rear brake of a vehicle according to the loading of the rear axle. It is a necessary component for stability when braking.

Load sensing is to perceive change of distance between the body and the trailing arm, resulted from change of load according to loadage.

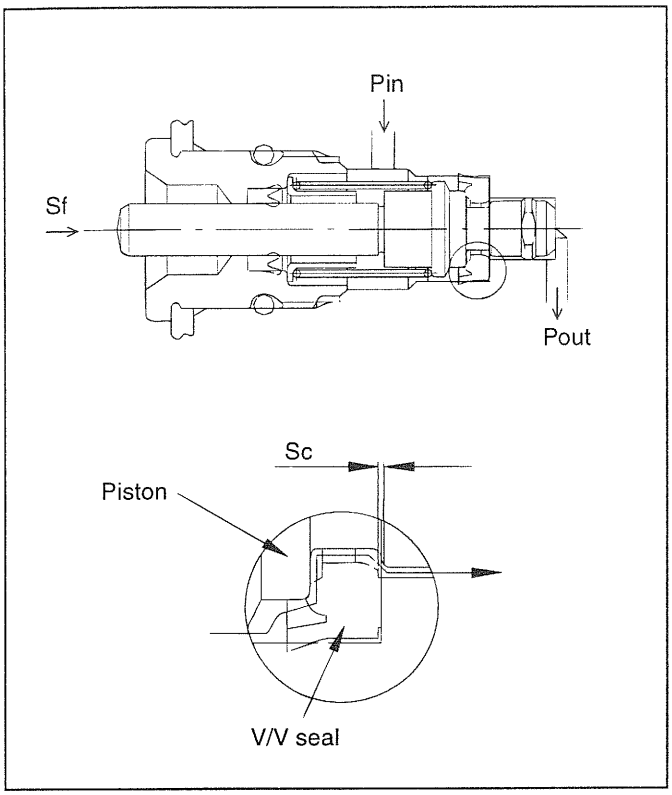
If the vehicle load amount increases, the distance between the chassis frame and trailing arm is reduced, the reduction of the distance causes the length of sensing spring to decrease by S1.

Spring force (Sf) increased by S1 is transmitted to the piston through the lever, resulting in the force applied to the piston increasing in proportion to the cut/in pressure.

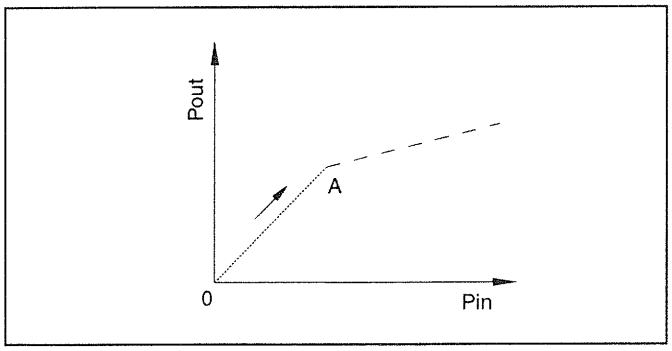
PRINCIPLE OF OPERATION EJHA4050

NON OPERATION (0–A)

Input pressure from master cylinder is lower than Sf applied to the piston, input pressure(Pin) is sent to the rear side without a change in pressure.



EJHA405A



EJHA405B

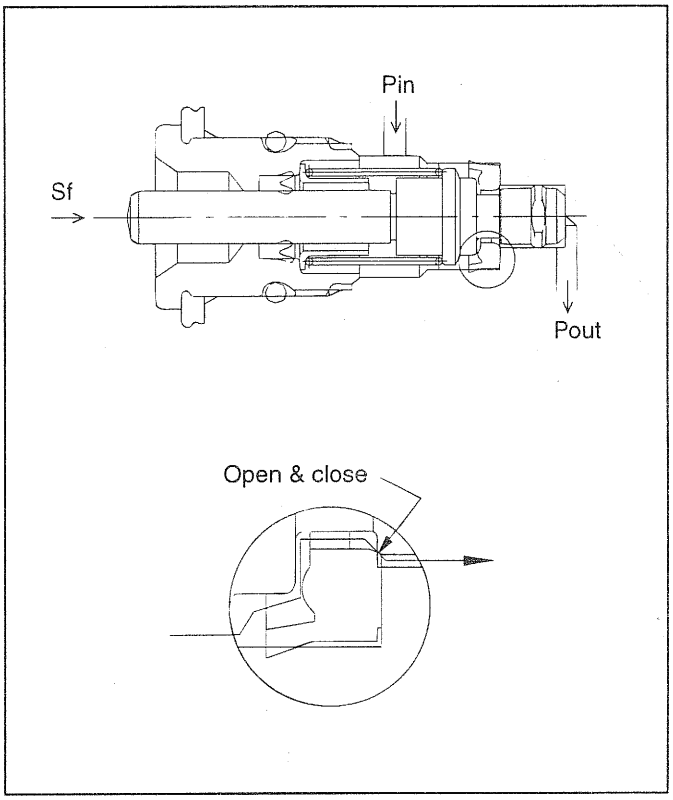
OPERATION

When the Pin increases, the pressure exerted at point A becomes greater than Sf, the piston moves toward the left and the pressure decreases by touching the valve seal.

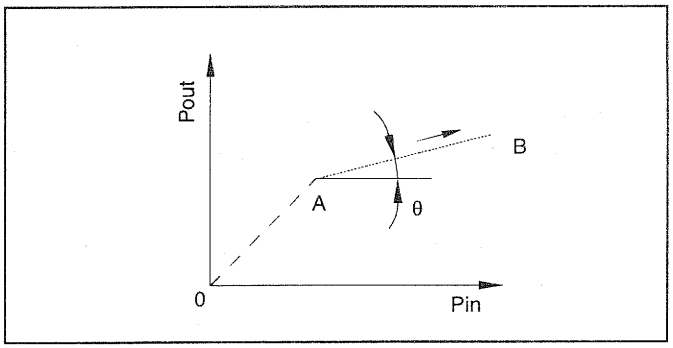
If the Pin increases further, the piston moves to the right again and opens the valve.

At this time, the input pressure and output pressure (Pin and Pout) balances with Sf by repeatedly opening and closing the valve.

As a result, Pout shows decompression characteristics that has a declination of tan θ.



EJHA405C



EJHA405D

REMOVAL EJHA4100

Remove the components refering to the illustration.

INSTALLATION EJHA4150

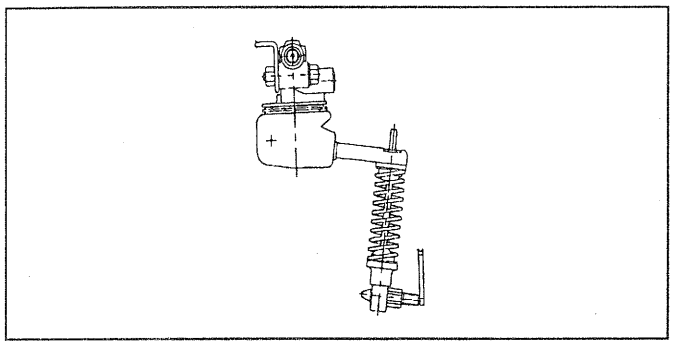
CAUTION

When setting the valve, the vehicle's normal load must be applied to all wheels.

New LSPV is fitted with the setting pin. This pin must be maintained in assembly condition until setting is complete.

1. Fit the valve body to the bracket.

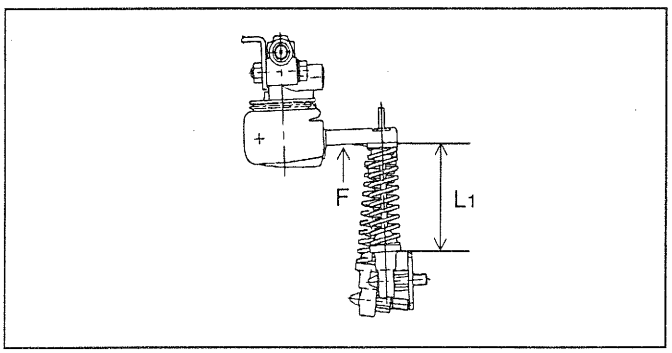
   TORQUE : 11–14 N.m (110–140 kg.cm)



EJHA033A

2. When of pushing the lever to the highest position, tighten the nut after inserting the stud bolt into the slot hole.

   At this time, the sensing spring length L1 should not change while tightening.

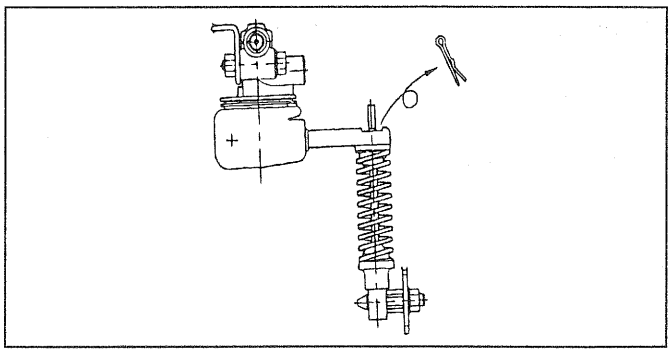


EJHA033B

3. Finish setting after removing the setting pin.

4. Be sure to remove the setting pin after setting is finished.

   If the setting pin is not removed, it can cause malfunction or damage to the components during driving.



EJHA033C

Clutch System

GENERAL

EOHA0010

SPECIFICATIONS

Clutch operating method	Hydraulic type
Clutch disc	
Type	Single dry with diaphragm.
Facing diameter (Outside x Inside)mm (in.)	225 x 150 (8.9 x 5.9)
Clutch cover assembly	
Type	Diaphragm spring strap
Setting load N (lb)	4500-4900 (1009-1097)
Clutch release cylinder	
I.D.mm (in.)	19.05 (0.747)
Clutch mester cylinder	
I.D.mm (in.)	15.87(0.62)

SERVICE STANDARD

EOHA0020

Standard value	
Clutch disc thickness [When free]	8.3-8.9 mm (0.326-0.350 in.)
Clutch pedal height	185.4 mm
Clutch pedal free play	6-13 mm (0.24-0.51 in.)
Clutch pedal stroke	150 mm (5.90 in.)
Limit	
Clutch disc rivet sink	0.3 mm (0.012 in.)
Diaphragm spring end height difference	0.5 mm (0.02 in.)
Clutch release cylinder clearance to piston	0.15 mm (0.006 in.)
Clutch master cylinder clearance to piston	0.15 mm (0.006 in.)

TIGHTENING TORQUE

EOA90030

Item	Nm	kg.cm	lb.ft
Clutch pedal to pedal support member (clutch pedal bracket)	25-35	250-350	18-25
Clutch master cylinder mounting bolt	8-12	80-120	6-9
Clutch tube flare nut	12-16	120-160	9-12
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 lock nut	10-15	80-100	7-11
Clutch master cylinder reservoir	8-10	80-100	6-7
Ignition lock switch	8-10	80-100	6-7
Clutch member	8-12	80-120	6-9

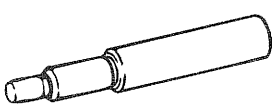
LUBRICANTS

EOA90040

Items	Specified lubricants	Quantity
Contact surface of release bearing and fulcrum of clutch release fork	CASMOLY L 9508	As required
Inner surface of clutch release bearing	CASMOLY L 9508	As required
Inner surface of clutch release cylinder and outer circumference of piston and cup	Brake fluid DOT3	As required
Inner surface of clutch disc spline	CASMOLY L 9508	As required
Inner surface of clutch master cylinder and outer circumference of piston assembly	Brake fluid DOT 3	As required
Clutch master cylinder push rod, clevis pin and washer	Wheel bearing grease SAE J310, NLGI No.2	As required
Clutch pedal shaft and bushings	Chassis grease SAE J310, NLGI No.1	As required
Contact portion of release fork to release cylinder push rod	CASMOLY L9508	As required
Input shaft spline	CASMOLY L 9508	As required

SPECIAL TOOLS

EOHA0050

Tool (Number and name)	Illustration	Use
09411-11000 Clutch disc guide	 EOA9005A	Installation of the clutch disc

TROUBLESHOOTING

EOA90060

Trouble symptom		Probable cause	Remedy
Clutch slipping • Car will not respond to engine speed during acceleration • Insufficient car speed • Lack of power during uphill driving		Insufficient pedal free play	Adjust
		Clogged hydraulic system	Correct or replace parts
		Excessive wear of clutch disc facing	Replace
		Hardened clutch disc facing, or oil on surface	Replace
		Damaged pressure plate or flywheel	Replace
		Weak or broken pressure spring	Replace
Difficult gear shifting (gear noise during shifting)		Excessive pedal free play	Adjust
		Hydraulic system fluid leaks, air trapping or clogging	Repair or replace parts
		Unusual wear or corrosion of clutch disc spling	Replace
		Excessive vibration (distortion) of clutch disc	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 suddenly jump starts with clutch partially engaged	Damaged pilot bushing	Replace
Hard pedal effort		Insufficient lubrication of clutch pedal	Repair
		Insufficient lubrication of spline part of clutch disc	Repair
		Insufficient lubrication of clutch release lever shaft	Repair
		Insufficient lubication of front bearing retainer	Repair
Hard to shift or will not shift		Clutch pedal free play excessive	Adjust pedal free play
		Clutch release cylinder faulty	Repair release cylinder
		Clutch disc out of place, runout is excessive or lining broken	Inspect clutch disc
		Spline on input shaft or clutch disc dirty	Repair as necessary
		Clutch pressure plate faulty	Replace clutch cover
Clutch slips		Clutch pedal free play insufficient	Adjust pedal free play
		Clogged hydraulic system	Repair or replace parts
		Clutch disc lining oily or worn out	Inspect clutch disc
		Pressure plate faulty	Replace clutch cover
		Release fork binding	Inspect release fork

Trouble symptom	Probable cause	Remedy
Clutch grabs/chatters	Clutch disc lining oily or worn out	Inspect clutch disc
	Pressure plate faulty	Replace clutch cover
	Clutch diaphragm spring bent	Replace clutch cover
	Worn or broken torsion spring	Replace clutch disc
	Engine mounts loose	Repair as necessary
Clutch noisy	Damaged clutch pedal bushing	Replace clutch pedal bushing
	Loose part inside housing	Repair as necessary
	Release bearing worn or dirty	Replace release bearing
	Release fork or linkage sticks	Repair as necessary

CLUTCH SYSTEM

SERVICE ADJUSTMENT PROCEDURE EOHA0070

CLUTCH PEDAL INSPECTION AND ADJUSTMENT

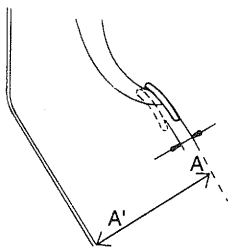
1. Measure the clutch pedal height (From the face of the pedal pad to the floorboard) and the clutch pedal clevis pin play (measured at the face of the pedal pad).

Standard value :

(A) 1-3 mm (0.04-0.11 in.)

(A') 185.4 mm

Clutch pedal clevis pin play (A) and Pedal height (A')



EOA9007A

2. If the clutch pedal clevis pin free-play is not within the standard value range, adjust as follows :

   a. Turn and adjust the bolt, then secure by tightening the lock nut.

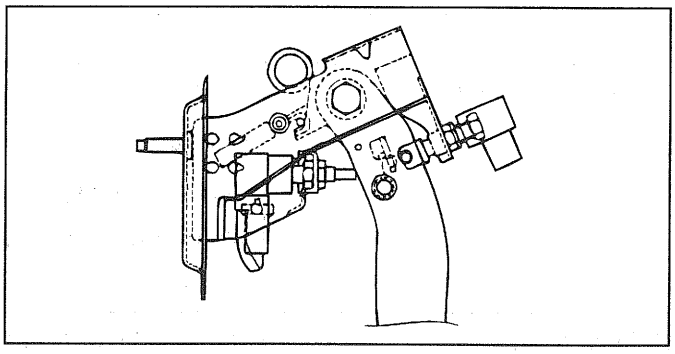
NOTE

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

   b. Turn the push rod to coincide with the standard value and then secure the push rod with the lock nut.

CAUTION

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



EOA9030A

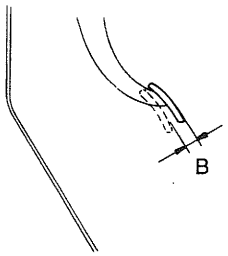
3. After completing the adjustments, check that the clutch pedal free play (measured at the face of the pedal pad) within the standard value ranges.

Standard value :

.....6-13 mm (0.2-0.5 in.)

4. If the clutch pedal free play and the distance between the clutch pedal and the floor board when the clutch is disengaged do not meet with the standard values, it may be the result of either air in the hydraulic system or a faulty master cylinder clutch. Take the air out or disassemble and inspect the master cylinder or clutch.

Clutch pedal free play



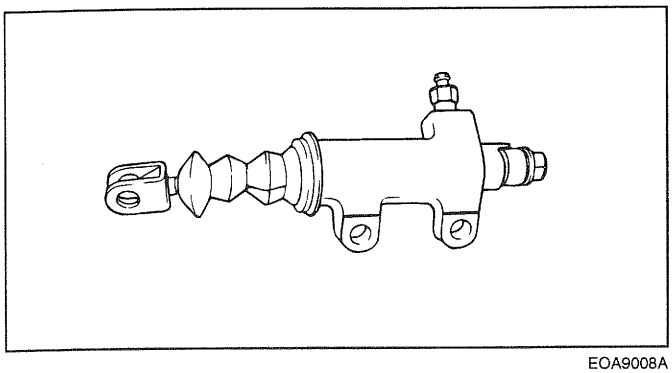
EOA9007C

BLEEDING EOA90080

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 (DOT3).

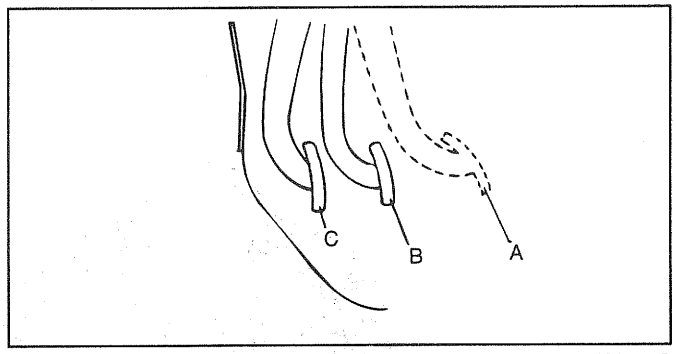


EOA9008A

1. Loosen the bleeder screw on 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

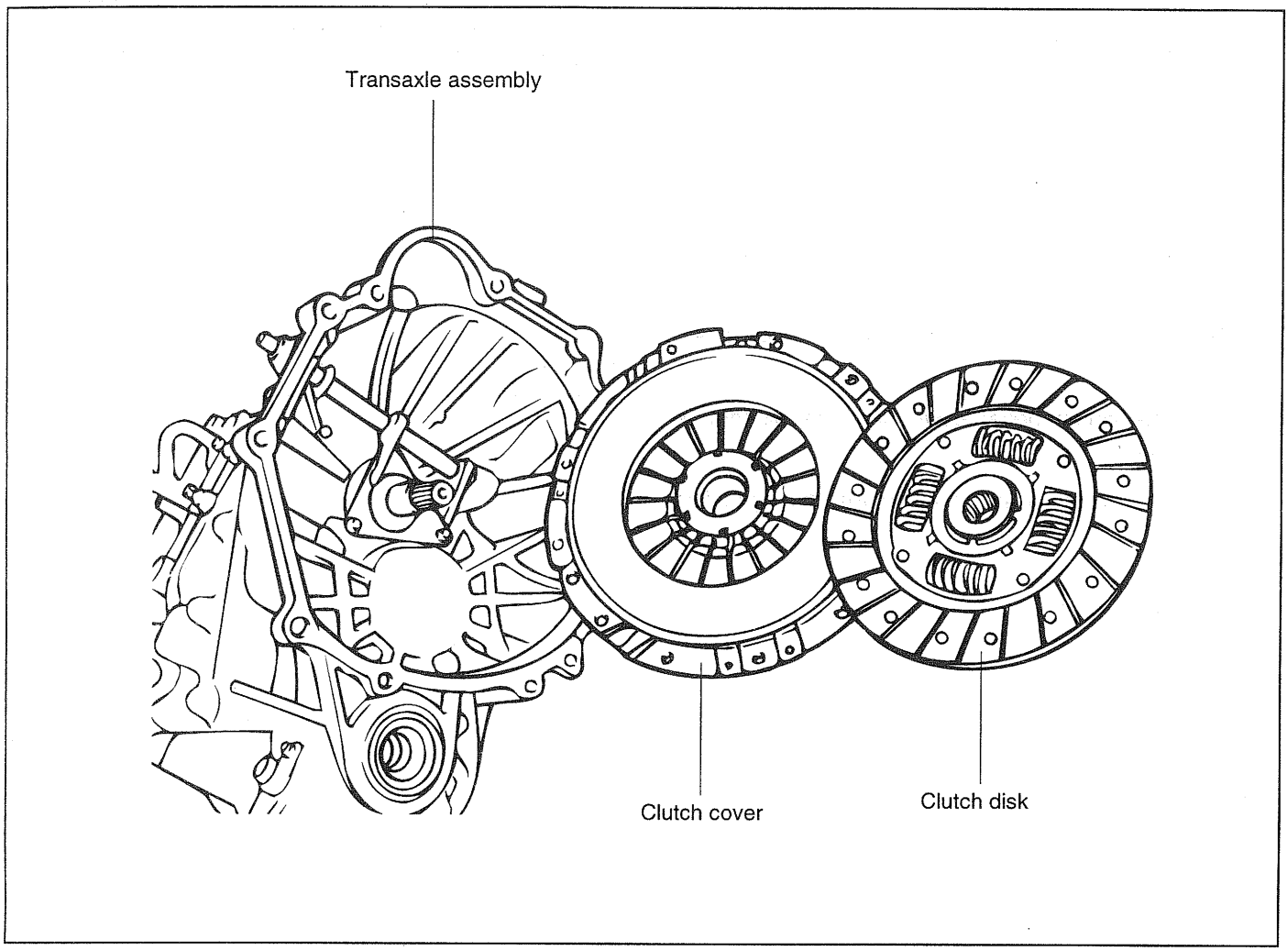
The rapidly-repeated operation of the clutch pedal in B-C range may cause the release cylinder's position to be forced out from the release cylinder body during the air bleeding, repress the clutch pedal after it returns to the "A" point completely.



EOA9008B

CLUTCH COVER AND DISC

COMPONENTS EOA90270



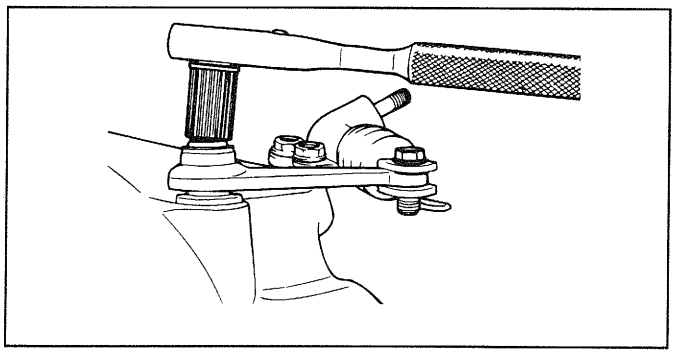
EOA9027A

REMOVAL EOA90280

1. To remove the transaxle assembly first remove the air cleaner joint, then the mounting bracket, and wiring etc.
2. Remove the release lever.
   1. Loosen the release lever nut and washer.
   2. Remove the clevis pin and snap ring from the release cylinder.
   3. Remove the release lever.

NOTE

It is impossible to remove transaxle assembly without doing this step. Because, clutch cover, release bearing and release fork are combined together.

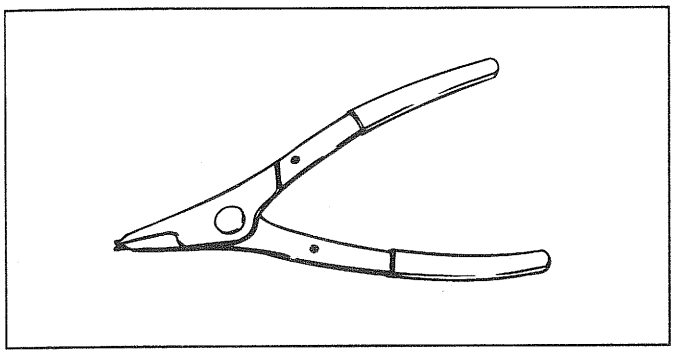


EOA9028B

3. Loosen the bolts attached to the release cylinder and remove the release cylinder.

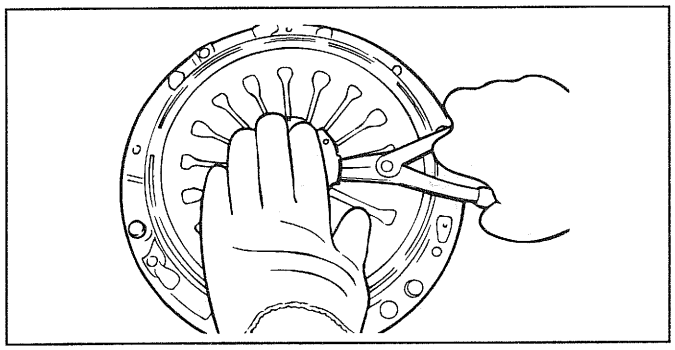
4. Remove the transaxle assembly, after removing each bolt which connect the transaxle assembly and engine.

5. If the clutch cover is attached to the flywheel, remove the release bearing using appropriate tool as shown.



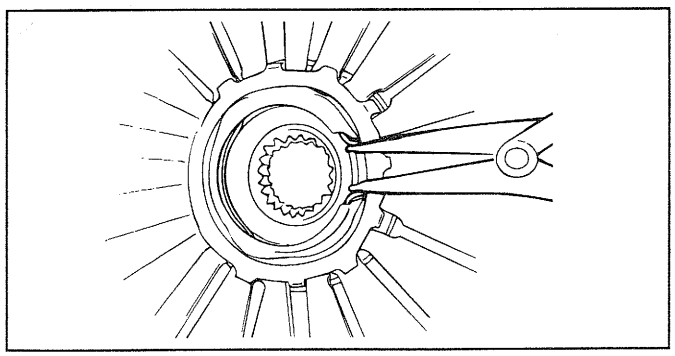
EMA9025B

1. Rotate the release bearing in an easy direction in order to examine the snap ring.
2. Insert the tool under the wave washer as shown in the illustration and place in the center of snap ring.
3. Widen the space of snap ring by pushing the bearing as shown in the illustration.



EOA9028C

4. The snap ring-widen state is as shown in the figure.



EOA9028D

5. In the snap ring-widen state, pull out the release bearing and remove it.

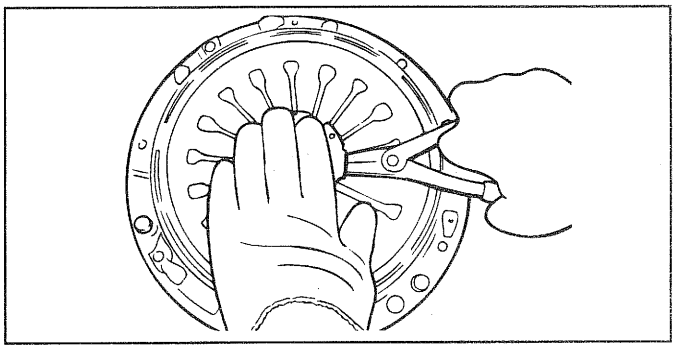
6. Insert the special tool (09411-11000) in the clutch disc to prevent the disc from falling.

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

NOTE

Do not clean the clutch disc or release bearing with cleaning solvent.

8. Remove the release fork shaft and bushing.



EOA9028E

INSPECTION EOA90290

CLUTCH COVER ASSEMBLY

1. Clean the dust on the clutch housing using the vacuum brush or dry floor cloth and do not use the compressed air. Check the oil leakage in engine rear bearing oil seal and transaxle front oil seal. If leaky, repair them.

2. The friction surface of pressure plate must be equalized to entire disc surface. If any part is excessive wear at the point of contact, the pressure plate is installed badly.

3. Check the friction surface of flywheel for color change, partial damage, small crack, and wear.

4. Don't touch the clutch disc with the contaminated hands or gloves. Replace the clutch disc, if the facing is stained with oil or grease. Measure the rivet sink and replace the clutch disc, if it is less than 3 mm.

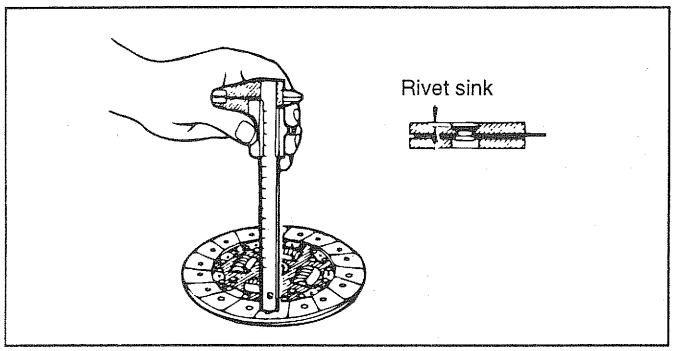
Limit	0.3 mm (0.012 in.)

5. Check the hub spline and torsion spring of clutch disc for excessive wear.

6. Clean the friction surface of pressure plate with cleaning solvent.

7. Measure the flat of pressure plate with a square. If it exceeds 0.5 mm, replace it. Check the pressure plate surface of wear, cracks, and color change.

8. Check that the three-dowel on the flywheel is installed completely.



EOA9029B

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 contaction points for wear.

2. Replace the bearing if the release fork contacting points are worn out abnormally.

CLUTCH RELEASE FORK

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

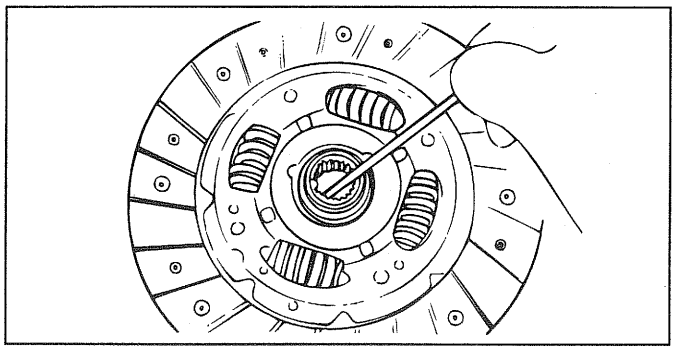
INSTALLATION EOA90300

1. Apply multipurpose grease to the spline of disc.

   Grease : CASMOLY L 9508

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.



EOA9030F

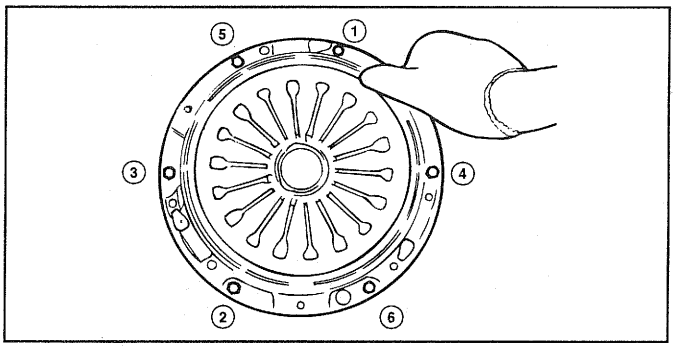
2. Install the clutch disc assembly to the flywheel using the special tool (09411-11000).

3. Install the clutch cover assembly to the flywheel and temporarily tighten the bolts one or two steps at a time in a star pattern.

Tightening torque

Clutch cover bolt .....

15-22 Nm (150-220 kg·cm, 11-16 lb·ft)

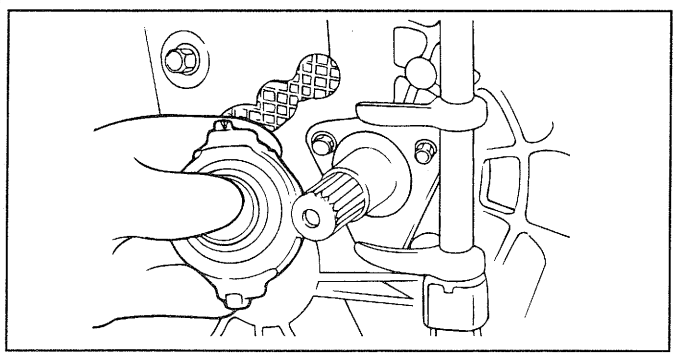


EOA9030B

4. Align the bearing to the release fork and then install it to the sleeve of housing.

CAUTION

Apply multipurpose grease (CASMOLY L9508) to the grease home of bearing sleeve and contact point of release fork.

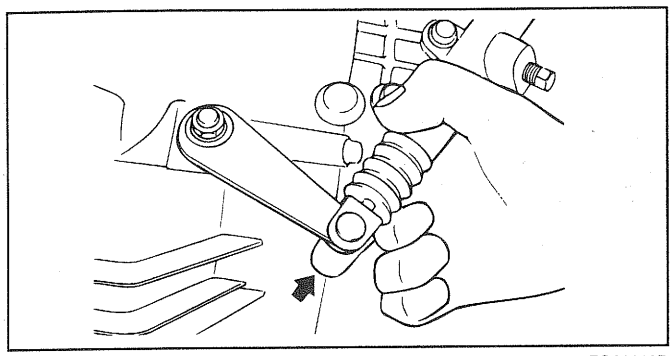


EOA9030C

5. Install the release lever to the release fork.

CAUTION

If the transaxle assembly is installed to engine without performing this step, release bearing can be separated as the release fork rotates freely.

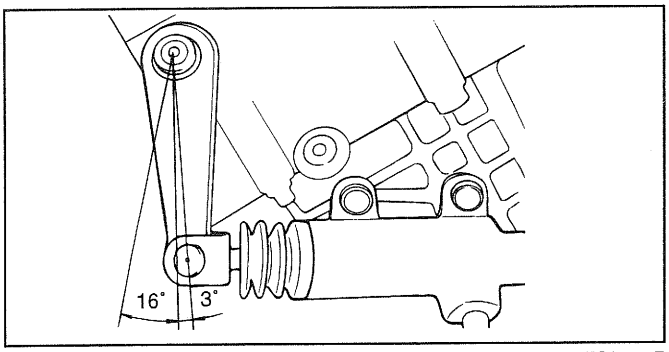


EOA9030D

6. Install the transaxle assembly to the engine.

7. After finishing step 6, push the release lever to the arrow mark. If there is a click sound, the release bearing and clutch cover are aligned correctly.

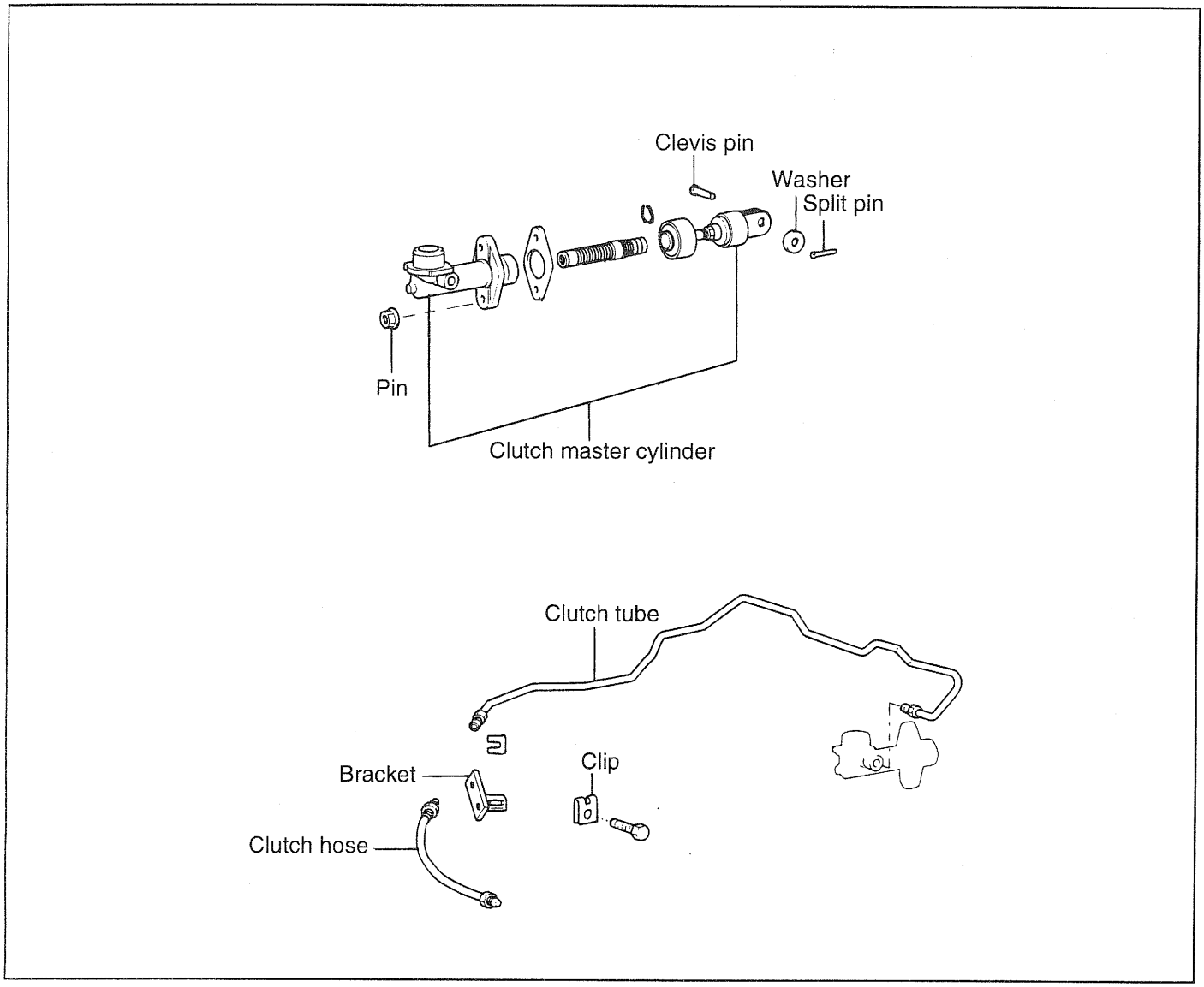
   Release lever operating range : 3° or less. If the range is over 3° it is a symptom that the release bearing and clutch cover are not aligned correctly. Push the release lever to the arrow mark one more time.



EOA9030E

CLUTCH MASTER CYLINDER

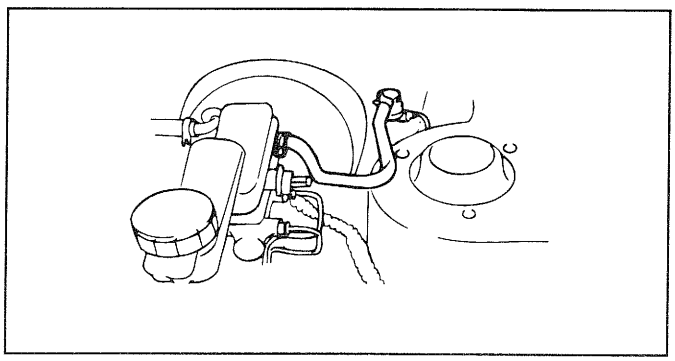
COMPONENTS EOA90140



EOA9028A

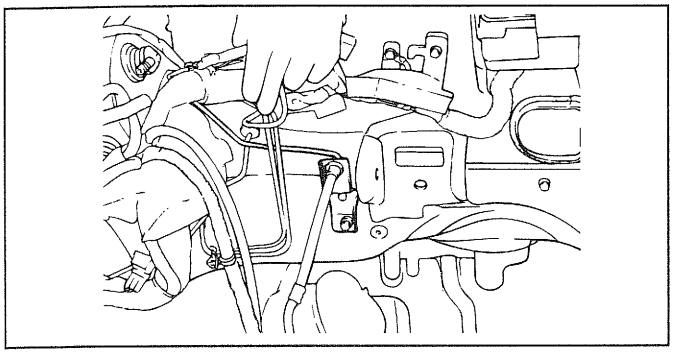
DISASSEMBLY EOHA0150

1. Drain the clutch fluid through the bleed plug.
2. Remove clevis pin, split pin (cotter pin), and washer.
3. Disconnect the clutch tube (master cylinder side).
4. Remove the master cylinder mounting bolt.



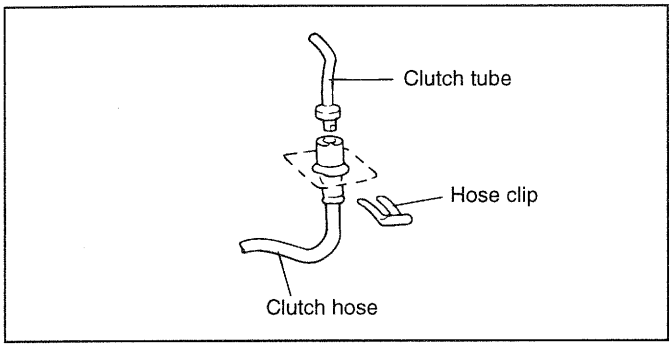
EOHA010A

5. Remove the clutch line clips.
6. Hold the nut on the clutch hose and loosen the flare nut on the clutch tube.



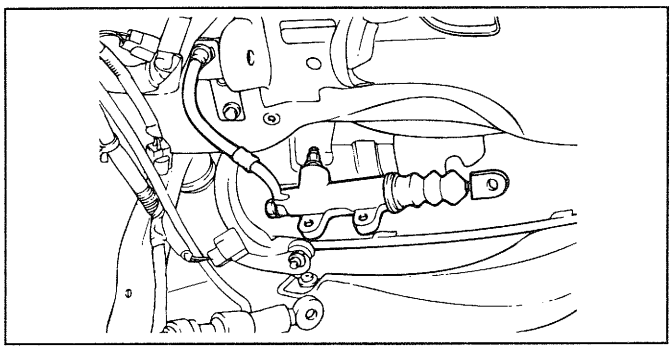
EOA9014B

7. Remove the clip from the clutch hose to remove clutch hose from bracket.
8. Remove the clutch tube.



EOA9014C

9. Disconnect the clutch tube (release cylinder side).



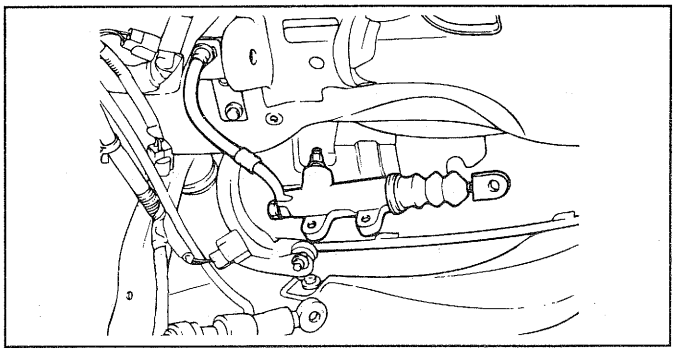
EOA9014D

INSPECTION EOA90160

Check the clutch hose or tube for cracks or clogging.

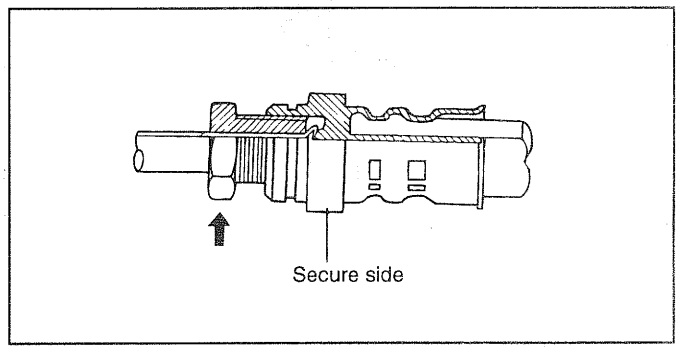
REASSEMBLY EOHA0170

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



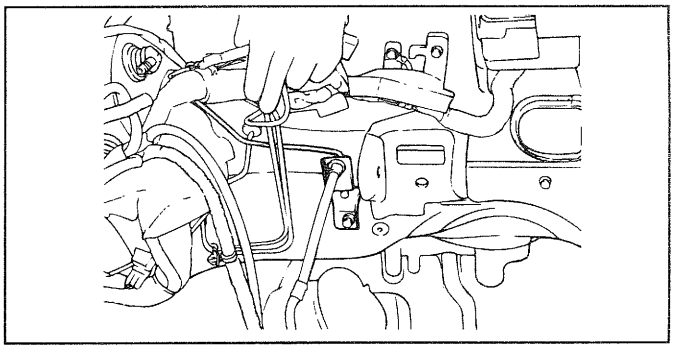
EOA9014D

2. Temporarily tighten the flare nut by hand, then tighten it to the specified torque, being careful that the clutch hose does not become twisted.



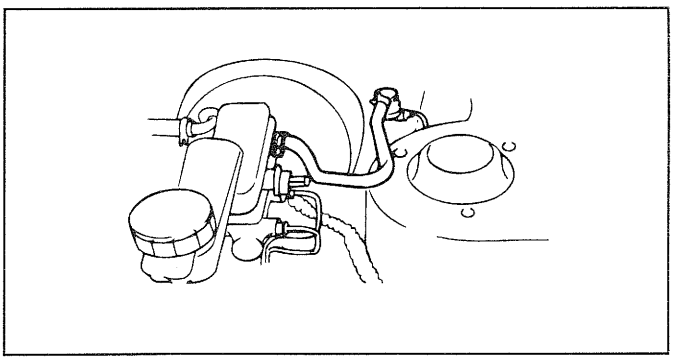
EOA9017A

3. Install the clutch tube and clips.



EOA9014B

4. Install the master cylinder.

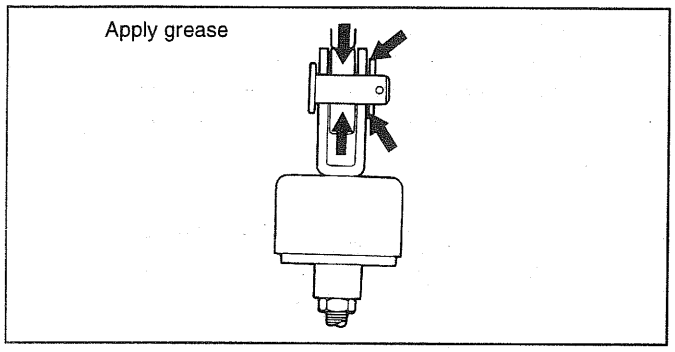


EOHA010A

5. Apply the specified grease to the clevis pin and washer.

Wheel bearing grease	
.....	SAE J310a, NLGI NO.2

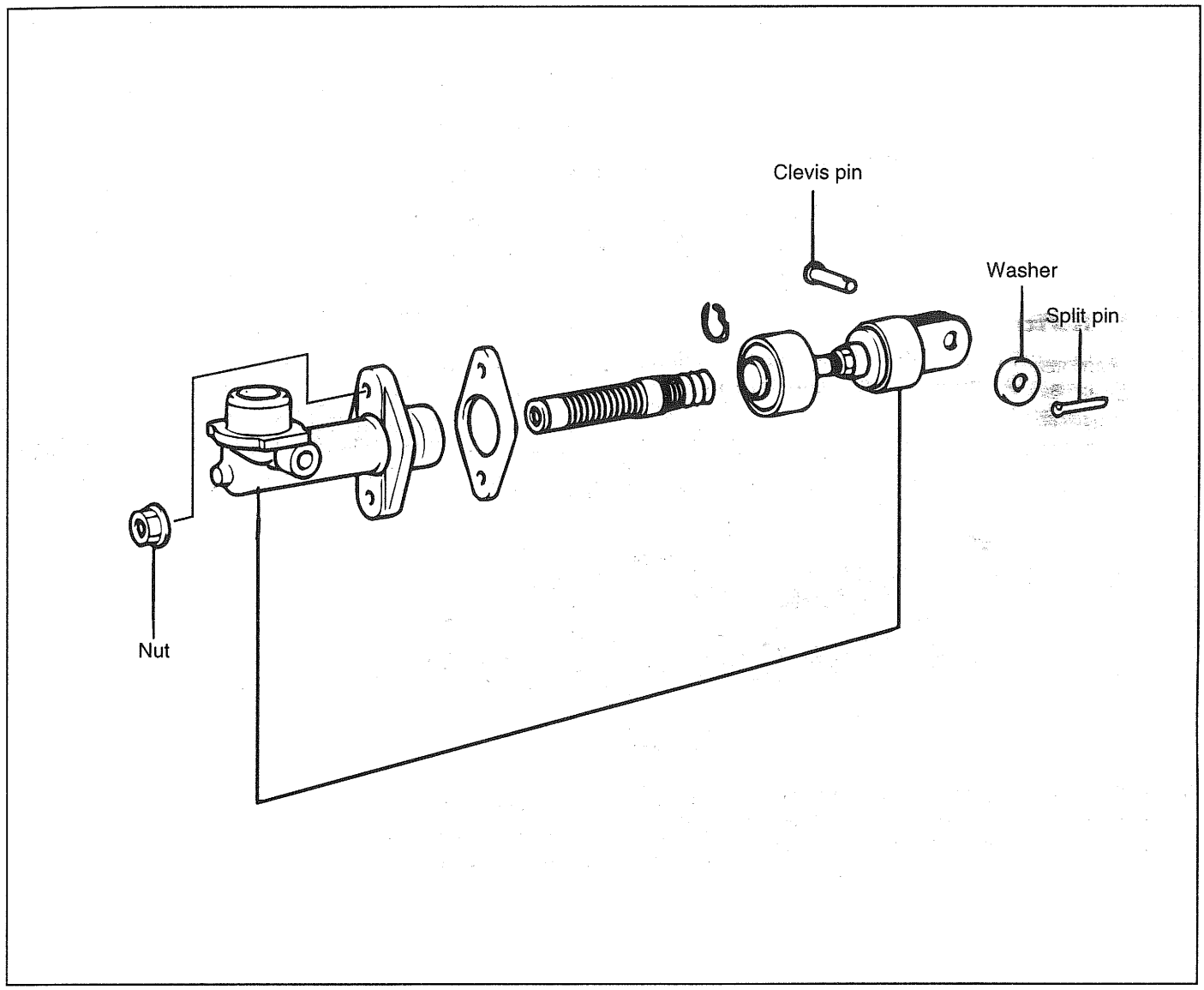
6. Install the push rod to the clutch pedal.
7. Pour the clutch fluid into the clutch master cylinder.
8. Bleed the clutch system.



EOA9013B

CLUTCH MASTER CYLINDER EOHA0180

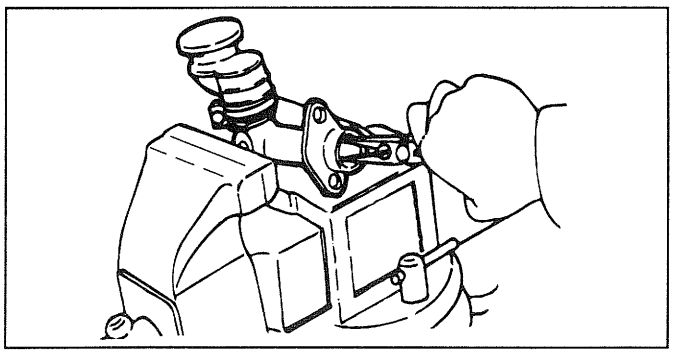
COMPONENTS



EOHA018A

DISASSEMBLY EOA90190

1. Remove the piston stop ring.
2. Pull out the push rod and piston assembly.
3. Remove the reservoir band, reservoir cap, and reservoir.



EOA9019A

NOTE

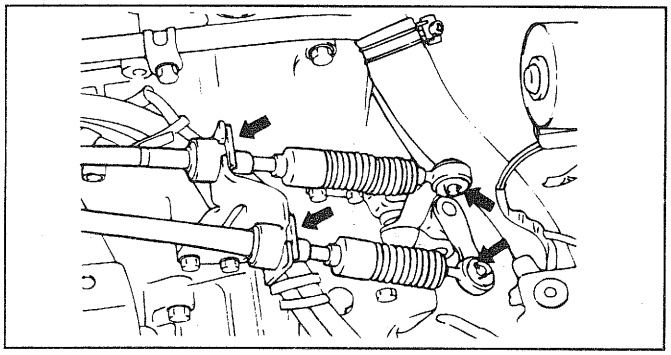
1. **Use care not to damage the master cylinder body and piston assembly.**
2. **Do not disassemble the piston assembly.**

INSPECTION EOHA0200

1. Check inside of 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 clogged.
5. Measure the master cylinder inside diameter and the piston outside diameter with a cylinder gauge micrometer.

NOTE

Measure the inside diameter of the master cylinder at three places (bottom, middle, and top) in a perpendicular direction.



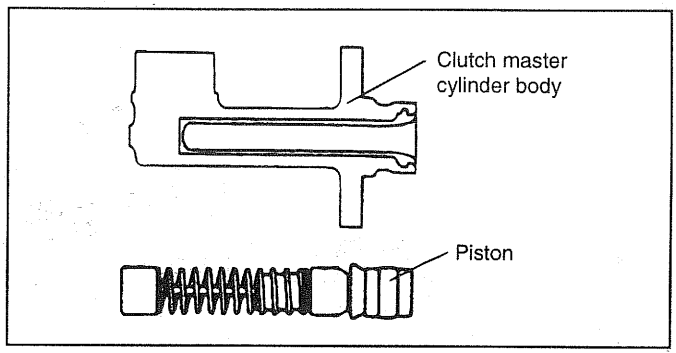
EOA9019B

6. If the master cylinder-to-piston clearance exceeds the limit, replace the master cylinder and/or piston assembly. Limit : 0.15 mm (0.006 in.)

REASSEMBLY EOA90210

1. Apply the specified fluid to the inner surface of the master cylinder body and to the entire periphery of the piston assembly.
2. Install the piston assembly.

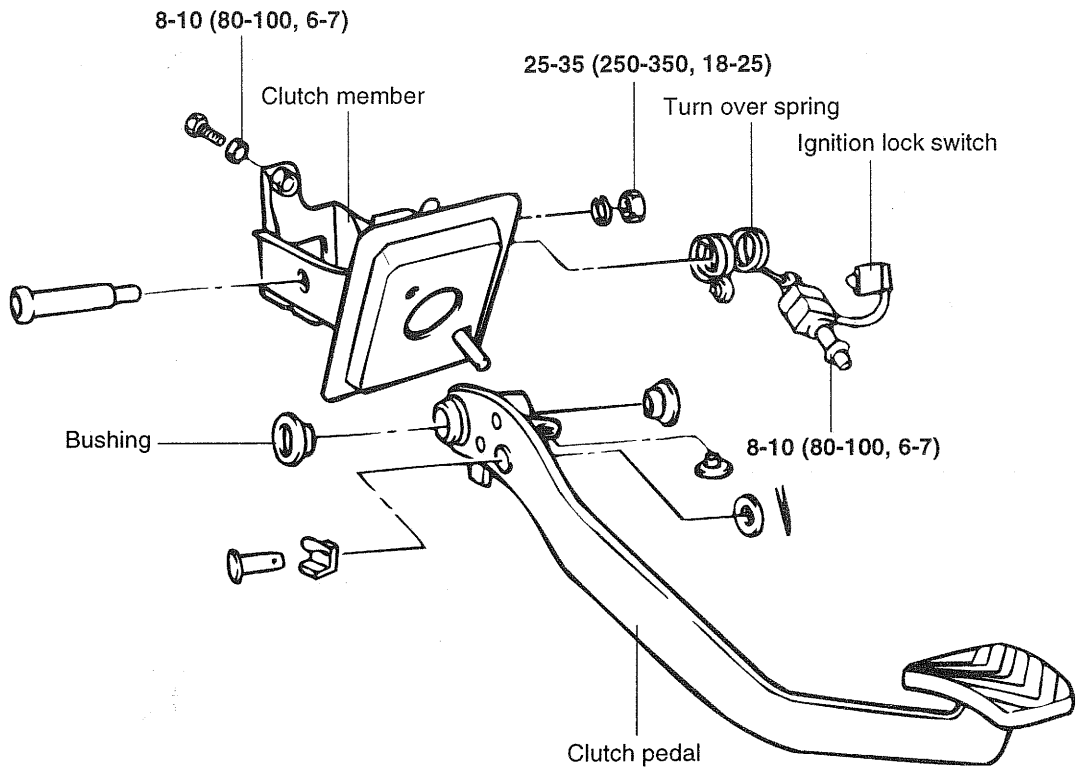
Specified fluid ..... Brake fluid DOT 3



EOA9019C

CLUTCH PEDAL

COMPONENTS EOA90090

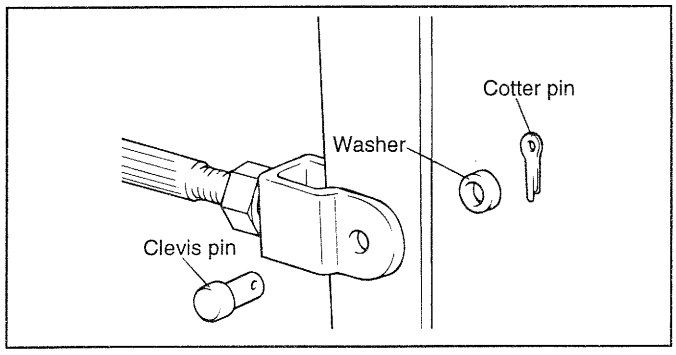


TORQUE : N.m (kg.cm, lb.ft)

EOA9009A

DISASSEMBLY EOA90100

1. Disassemble the cotter pin, washer, and clevis pin.
2. Disassemble the clutch pedal mounting bolt.



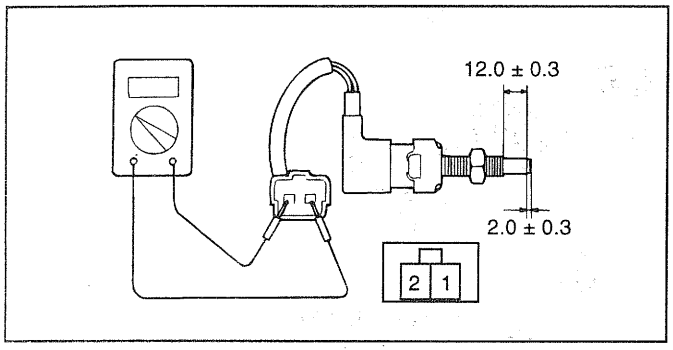
EOA9010A

INSPECTION EOA90110

1. Check the pedal shaft and bushing for wear.
2. Check the clutch pedal for bending or torsion.
3. Check the return spring for damage or deterioration.
4. Check the pedal pad for damage or wear.

IGNITION LOCK SWICH INSPECTION

Remove the ignition lock switch and check continuity between the terminals. If the continuity is not as specified, replace the switch.



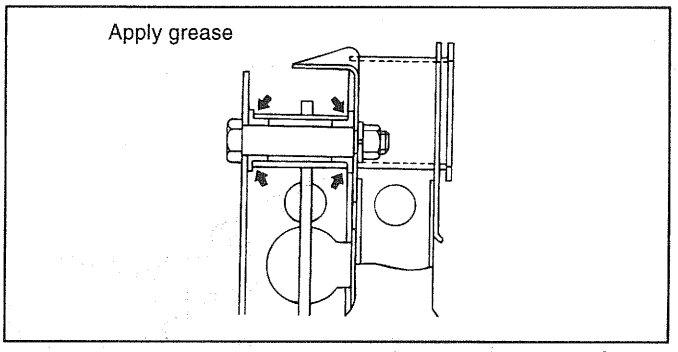
EOA9012A

REASSEMBLY EOA90130

1. Apply the specified grease to the clutch pedal and bushings.

Chassis grease .....SAE J310a, NLGI No.1

2. Install the clutch pedal mounting bolt.

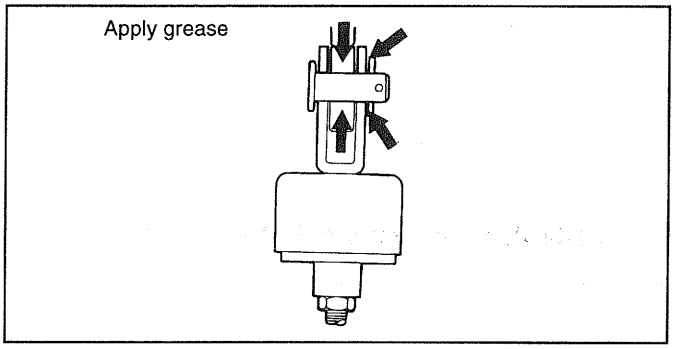


EOA9013A

3. Apply the specified grease to the clevis pin and washer.

Wheel bearing grease .....SAE J310, NLGI No.2

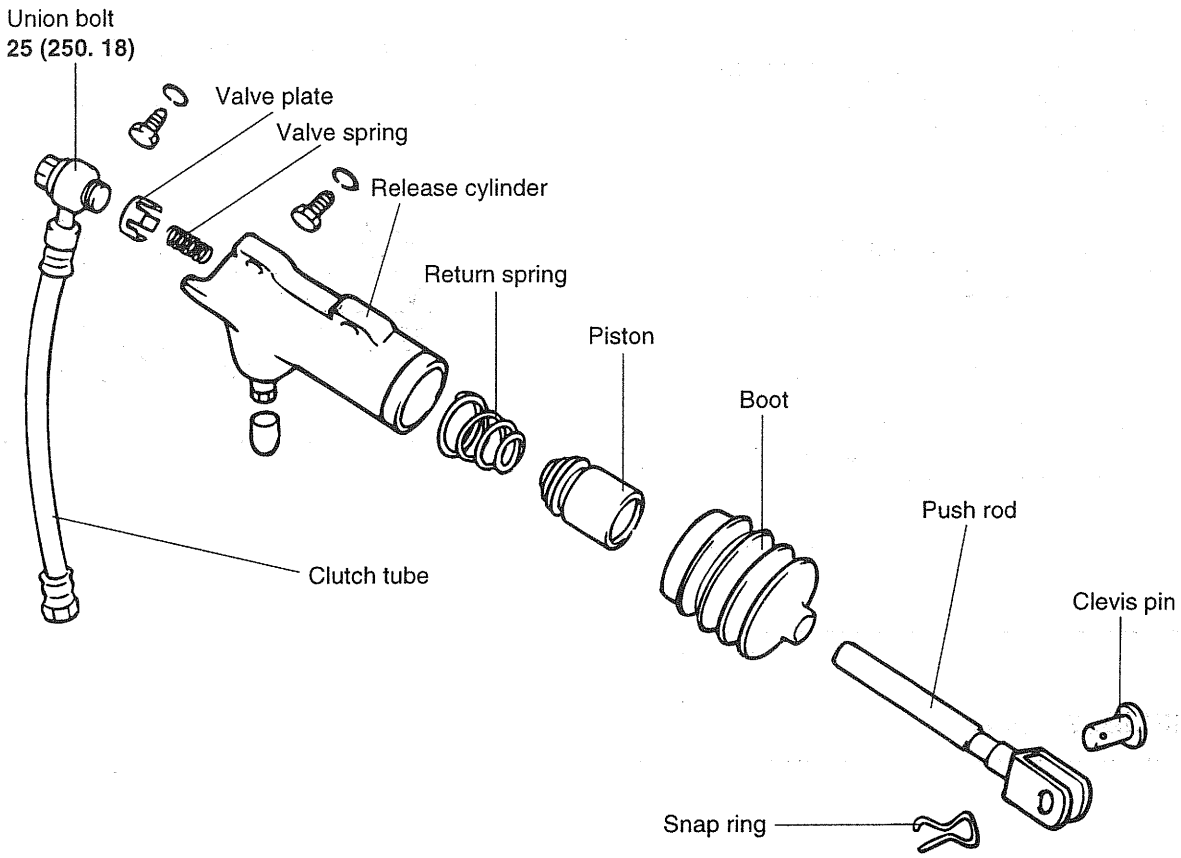
4. Install the push rod to the clutch pedal.
5. Adjust the clutch pedal clevis pin play.



EOA9013B

CLUTCH RELEASE CYLINDER

COMPONENTS EOA90220



TORQUE : N.m (kg.cm, lb.ft)

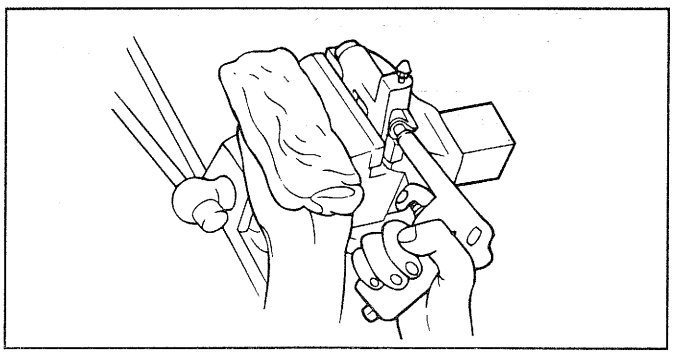
EOA9022A

REMOVAL EOA90230

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 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.**



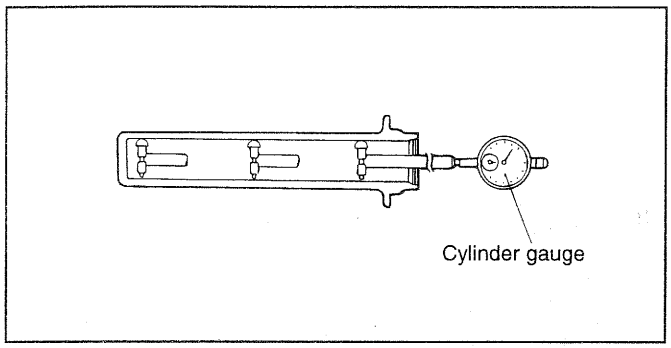
EOA9023A

INSPECTION EOA90240

1. Check the clutch release cylinder for fluid leakage.
2. Check the clutch release cylinder boots for damage.
3. Check the release cylinder bore for rust and damage.
4. 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.

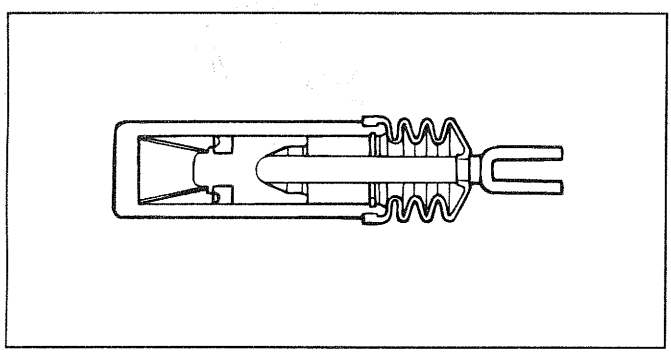
Limit :

Clearance to pistion .. 0.15 mm (0.006 in.)



EOA9024A

REASSEMBLY EOA90250



EOA9025A

1. Apply specified brake fluid to the release cylinder bore and the outer surface of the piston and piston cup. Push the piston cup assembly in to the cylinder.

Use the specified fluid ..... Brake fluid DOT 3

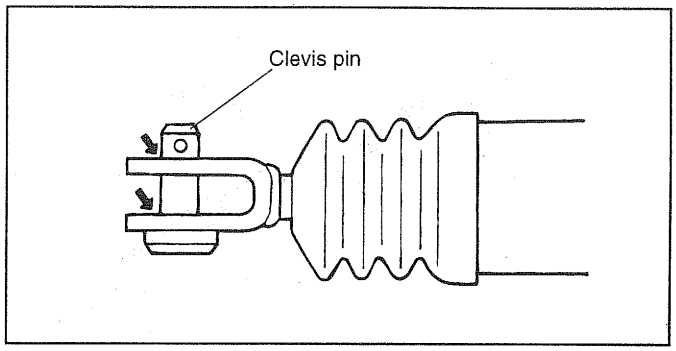
2. Install the clutch hose, valve plate, spring, push rod, and boot.

INSTALLATION EOA90260

1. Coat the clevis pin with the specified grease. Align the hose at the end of the release cylinder push rod with that of the clutch release fork shaft, and insert the clevis pin into the holes.

   Specified grease : CASMOLY L9508

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



EOA9026A

Driveshaft and Axle

GENERAL

EIHA1000

SPECIFICATIONS

Driveshaft		
Joint type	2.0 L	2.7L
Outer	B.J.	A.C.
Inner	T.J.	A.A.R.
Maximum permissible angle		
Outer	46.5°	46.5°
Inner	23°	23°
Center bearing (V6 ENG.)		
Type	Radial ball bearing	
Dimensions (O.D. x I.D.) mm (in.)	62 x 30 (2.44 x 1.18)	
Inner shaft (V6 ENG.)		
Length mm (in.)	412±0.5(16.22±0.02)	
Wheel bearing		
Type	Double row angular contact ball bearing	
Dimensions (O.D. x I.D.) mm (in.)	87 x 45 (3.423 x 1.77)	

B.J. : Birfield joint
T.J. : Tripod joint
A.C. : Angular contact (GKN)
A.A.R. : Angular adjusted roller (GKN)

SERVICE STANDARD

EIHA1100

Limit		
Hub end play	mm (in.)	0.008 (0.0003) or less
Front wheel bearing starting torque	Nm (kg.cm, lb.in.)	1.8 (18, 16) or less
Rear wheel bearing starting torque	Nm (kg·cm, lb·in.)	1.8 (18, 16) or less

TIGHTENING TORQUE

EIHA1200

	Nm	Kg·cm	lb·ft
Driveshaft nut	240-280	2400-2800	177-207
Brake caliper to knuckle	65-75	650-750	48-55
Knuckle to lower arm ball joint	90-110	900-1100	66-81
Wheel nut	90-110	900-1100	66-81
Strut lower mounting bolt	110-130	1100-1300	81-96
Stabilizer bar link mounting nut	100-120	1000-1200	74-89
Tie rod end to knuckle	24-34	240-340	18-25
Center bearing bracket	40-50	400-500	30-37
Front axle assembly dust cover	7-11	70-110	52-81
Rear wheel bearing flange nut	200-260	2000-2600	148-192
Rear brake caliper mounting	50-60	500-600	37-44
Rear brake hose and tube plate nut	13-17	130-170	10-13

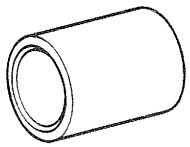
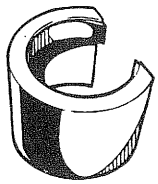
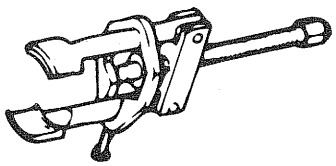
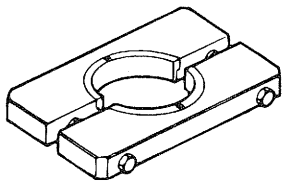
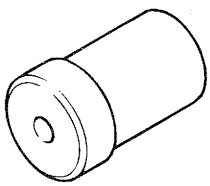
LUBRICANTS

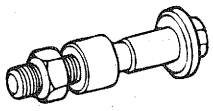
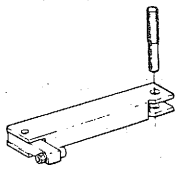
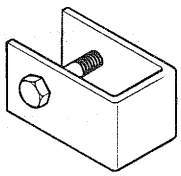
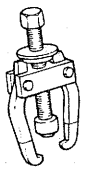
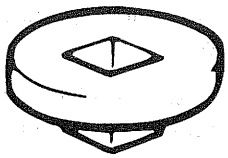
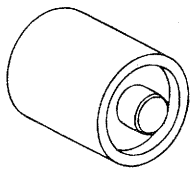
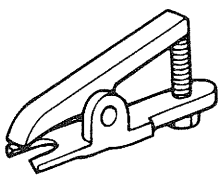
EIHA1300

	Recommended Lubricants	Capacities
B.J.-T.J. Type driveshaft (2.0L)		
B.J. boot grease	Centoplex 278M/136K or Sunlight SW-2	115±6gr.
T.J. boot grease	Oneluber MK	145±6gr.
A.C.-A.A.R. Type driveshaft (2.7L A/T)		
A.C. boot grease	Century	115±5gr.
A.A.R. boot grease	Oneluber GKN	105±10gr.

SPECIAL TOOLS

EIHA1400

Tool (Number and Name)	Illustration	Use
09216-21100 Mount bushing remover and installer	 EIHA140A	• Removal of center bearing (use with 09495-33100, 09216-21600) • Removal of rear hub tone wheel (use with 09457–34000)
09216-22100 Mount bushing remover and installer base	 EIHA140B	Installation of rear hub tone wheel
09432-33300 Bearing installer	 EIHA140C	Installation of inner shaft into center bearing
09455-21000 Bearing and gear puller	 HFR49-7	Removal of inner race from front hub (use with 09545-34100)
09457-34000 Removing plate	 EIHA140D	Removal of rear hub tone wheel (use with 09216-21100)
09495-33100 Center bearing remover and installer	 EIHA140E	• Removal and installation of center bearing • Installation of center bearing dust seal • Removal of front wheel bearing outer race (use with 09216-21100)

Tool (Number and Name)	Illustration	Use
09517-21500 Front hub remover and installer	 HFR49-3	Removal and installation of front hub
09517-29000 Knuckle arm bridge	 EIHA140F	Removal of front hub (use with 09517-3A000 and 09517-21500)
09517-3A000 Knuckle arm bridge adapter	 EIHA140G	Removal of front hub (use with 09517-21500 and 09517-29000)
09517-43001 Bearing puller	 EIHA140H	Removal of center bearing bracket
09532-11600 Preload socket	 HFR49-10	Measurement of front wheel bearing starting torque (use with torque wrench)
09545-34100 Lower arm bushing remover and installer	 EIHA140I	Removal of hub from knuckle
09568-34000 Ball joint remover	 HFR49-1	Removal of front lower arm and tie rod end ball joint

TROUBLESHOOTING

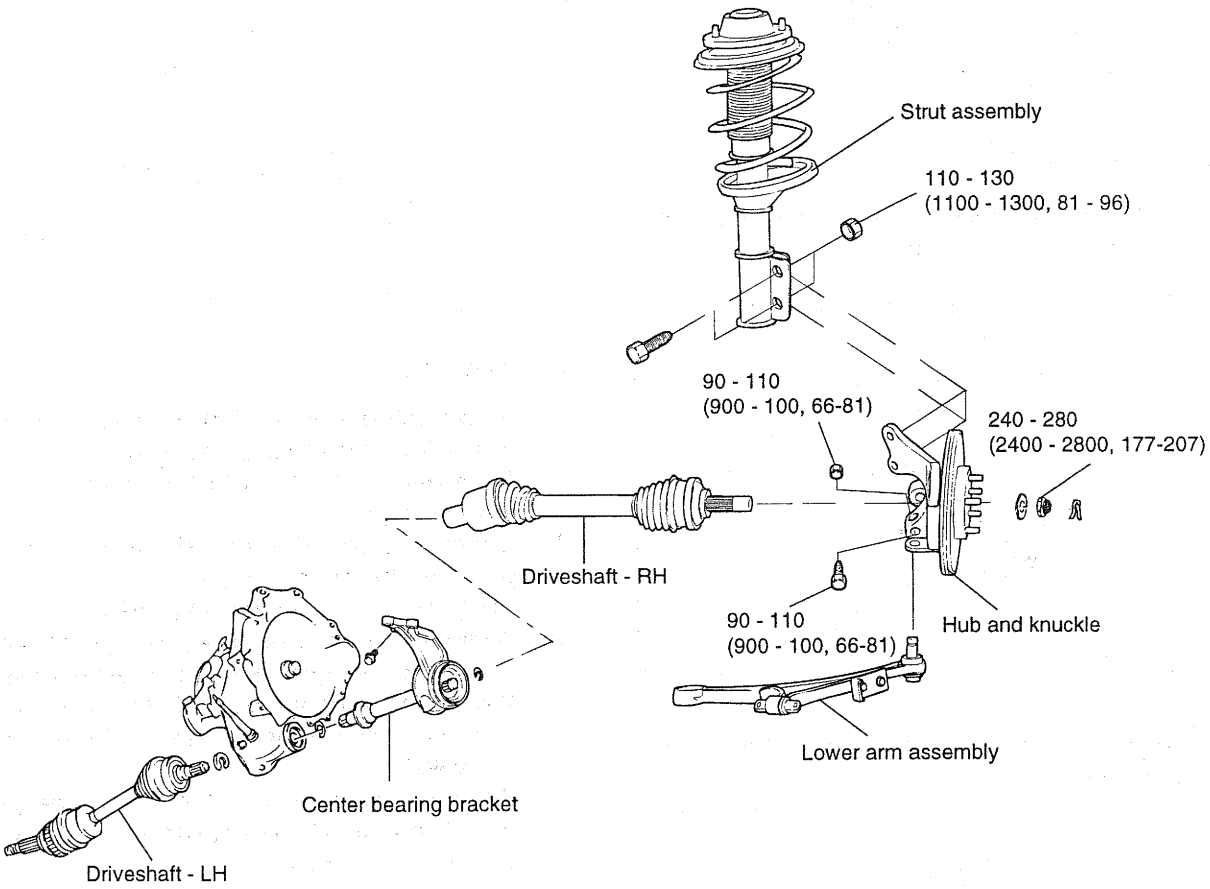
EIHA1500

Trouble Symptom	Probable cause	Remedy
Vehicle pulls to one side	Scoring of drive shaft ball joint Wear, rattle or scoring of wheel bearing Defective from suspension and steering	Replace Replace Adjust or replace
Vibration	Wear, damage or bending of drive shaft Drive shaft rattle and hub serration Wear, rattle or sintering of wheel bearing	Replace Replace Replace
Shimmy	Defective wheel balance Defective front suspension and steering	Adjust or replace Adjust or replace
Excessive noise	Wear, damage or bending of drive shaft Rattle of drive shaft and hub serration Rattle of drive shaft and side gear serration Wear, rattle or scoring of wheel bearing Loose hub nut Defective front suspension and steering	Replace Replace Replace Replace Adjust or replace Adjust or replace
Bent cage	Cage damage due to improper handling or tool usage	Replace bearing
Galling	Metal smears on roller end due to overheating, lubricant problem or overloading	Replace bearing Check seals, check for proper lubrication
Cracked inner race	Race cracked due to improper fit, cocking or poor bearing seats	Replace bearing
Etching	Bearing surfaces appear gray or grayish black in color with related etching away of material usually at roller spacing	Replace bearing Check seals, check for proper lubrication
Brinelling	Surface indentations, on race surface caused by rollers either under impact loading or vibration while the bearing is not rotating	Replace bearing
Heat discoloration	Heat discoloration is dark blue resulting from overload or no lubricant (Yellow or brown color is normal)	Replace bearing Check seals and other parts
Fatigue spalling	Flaking of surface metal resulting from fatigue	Replace bearing Clean all related parts

DRIVESHAFT

FRONT DRIVESHAFT ASSEMBLY

COMPONENTS EIHA2000

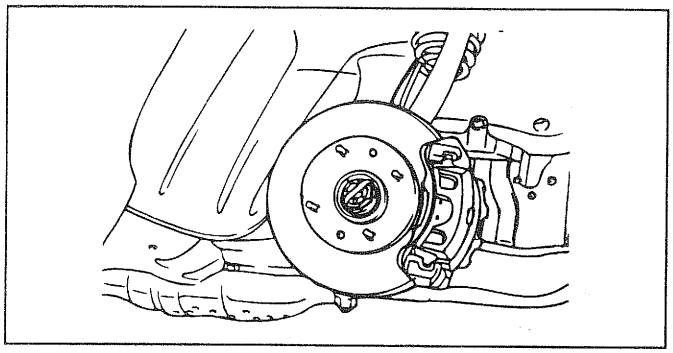


TORQUE : Nm (kg·cm, lb·ft)

EIHA001A

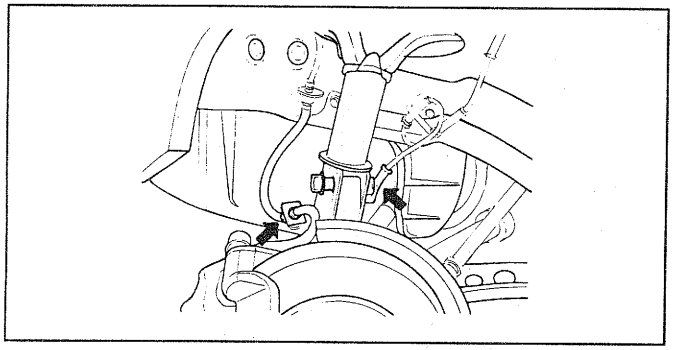
REMOVAL EIHA2100

1. Remove the aluminum wheel cover using a flat-blade screwdriver.
2. Raise the vehicle and remove the wheel.
3. Remove the split pin and drive shaft nut.



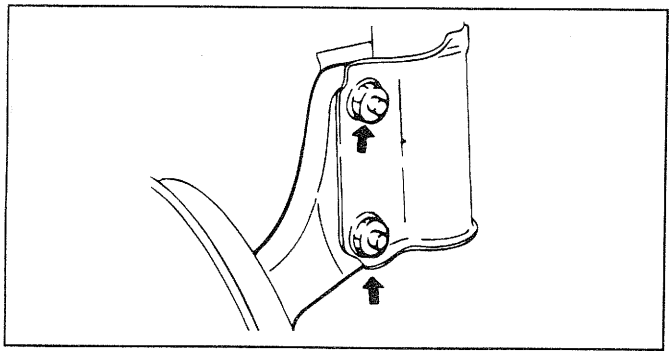
EIHA210A

4. Drain transaxle oil.
5. Detach the wheel speed sensor cable from the bracket (for a vehicle equipped with ABS)
6. Detach the brake hose cable from the bracket.



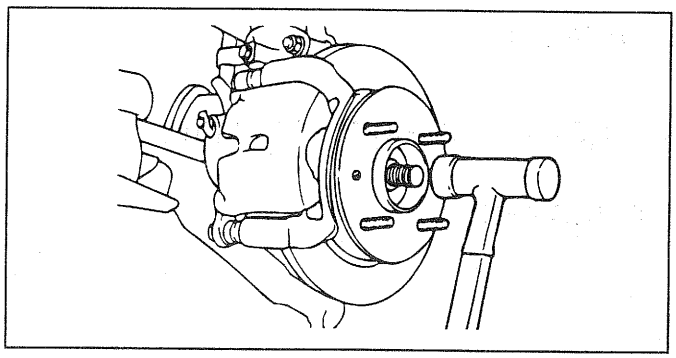
EIHA002A

7. Remove two flange bolts and detach the knuckle from the strut.



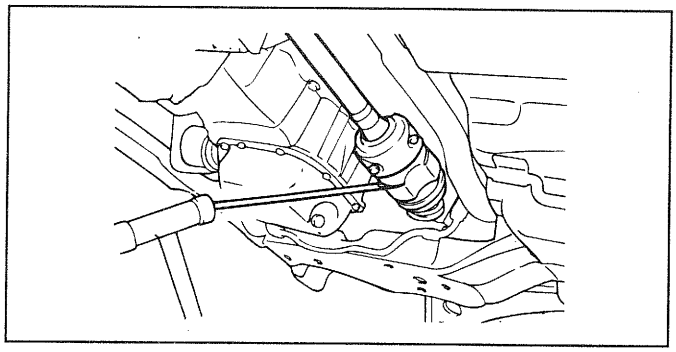
S5SS012B

8. Separate the drive shaft from the axle hub by tapping it lightly with a plastic hammer.



EIHA210B

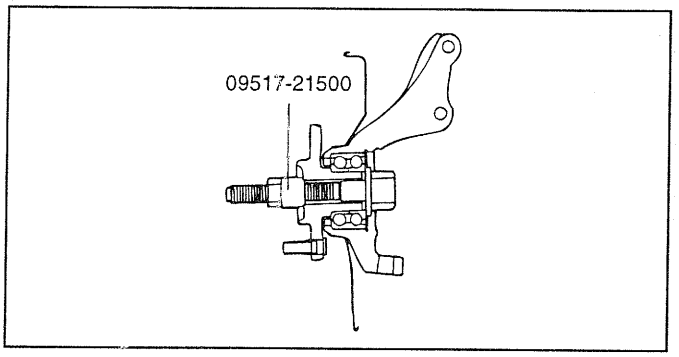
9. Remove the drive shaft from the differential gear or inner shaft using a hammer and brass bar.



EIHA003A

CAUTION

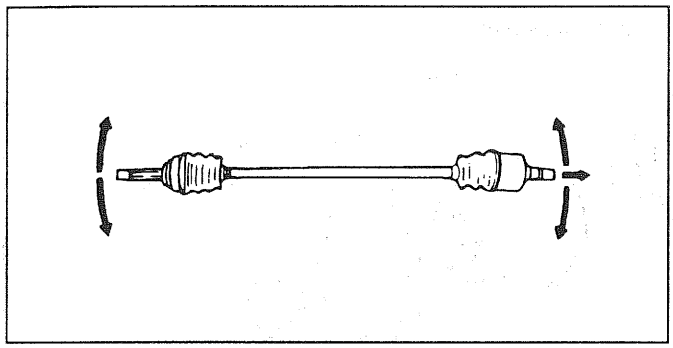
1. **If you pull the drive shaft by force, components in the joint kit break away from it.**
   As a result, the boot is torn and bearing balls are damaged.
2. **Cover a hole of transaxle with a oil cap to prevent contamination**
3. **Support the drive shaft properly.**
4. **Whenever removing the drive shaft from the transaxle case, replace the retainer ring.**
5. **While loosening the nuts of the drive shaft, make sure the wheel bearing does not get the load of the vehicle.**
   If the vehicle moves and then the wheel bearing gets the load of the vehicle, hold it for a while using a special tool.



S5DS007F

INSPECTION EIHA2200

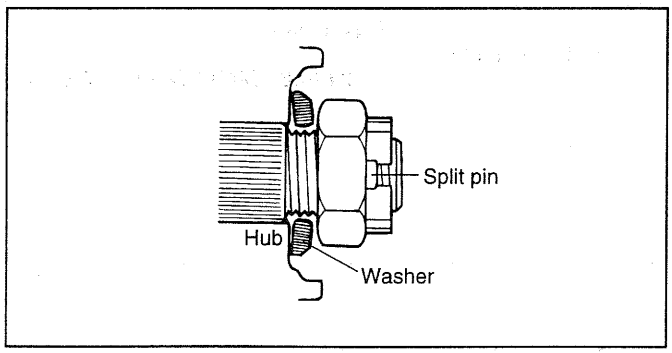
1. Check the driveshaft boots for damage and deterioration.
2. Check the splines for wear and damage.
3. Check the ball joints for wear and operation condition.
4. Check the dynamic damper for damage and deterioration



EIA9211A

INSTALLATION EIHA2300

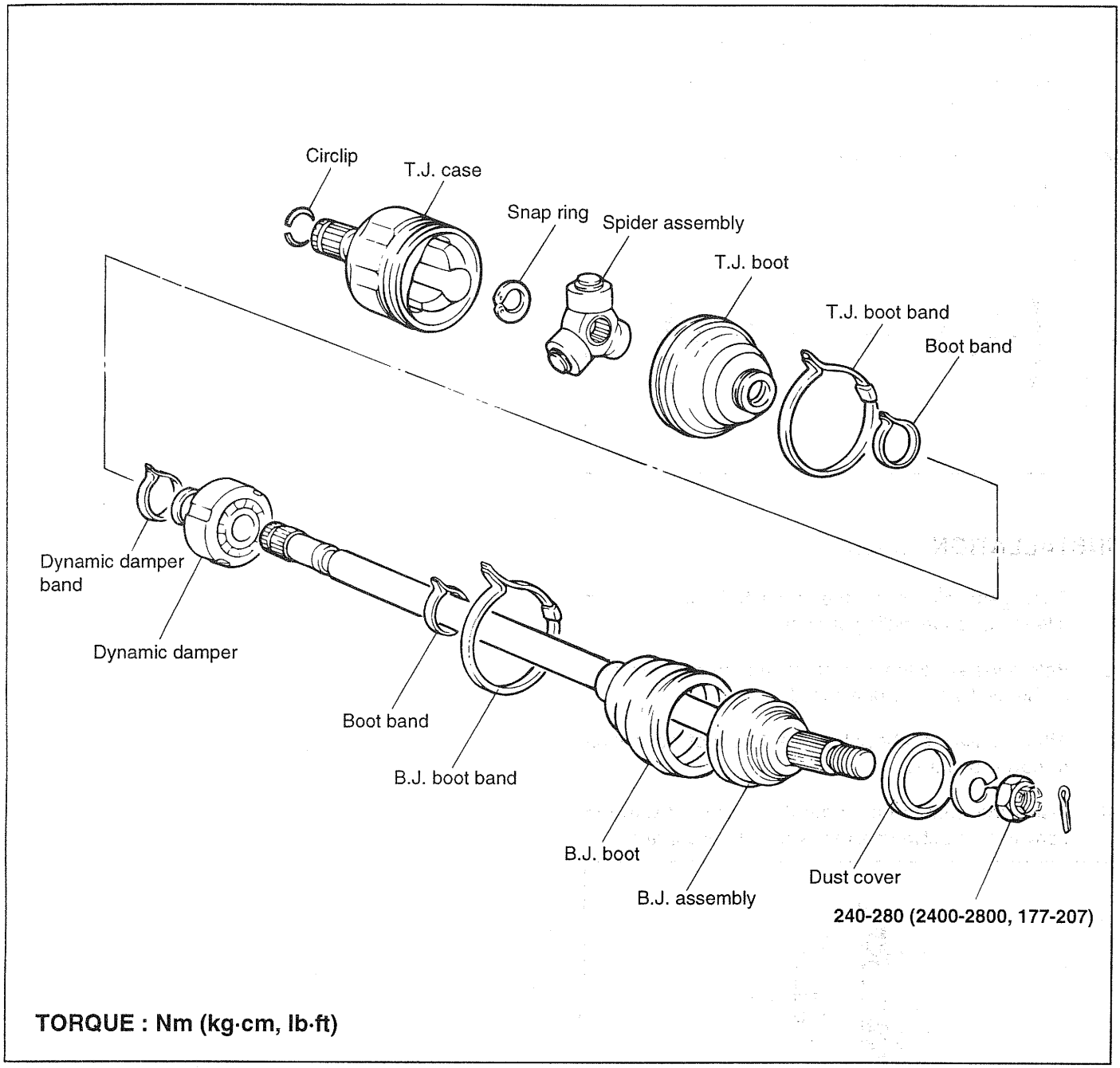
1. Coat gear oil on to the driveshaft splines and differential case sliding surface.
2. Before installing the driveshaft, set the opening side of the circlip facing downward.
3. After installation, check that the driveshaft cannot be removed by hand.
4. Install the washer under the driveshaft nut with the convex side outward as shown in the illustration.



EIA9212A

FRONT DRIVESHAFT (T.J-BJ TYPE)

COMPONENTS EIDA3000



EIDA300A

DISASSEMBLY EIDA3010

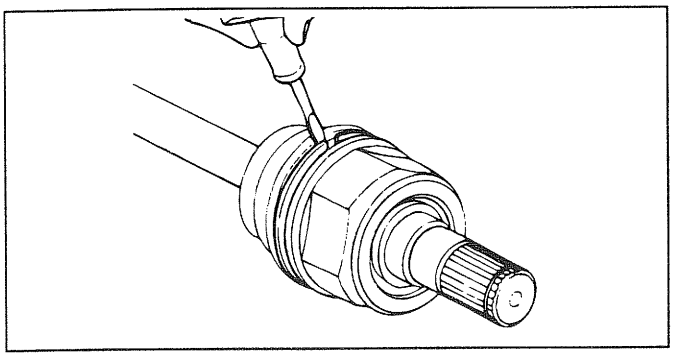
NOTE

1. **Do not disassemble the B.J. assembly.**
2. **The drive shaft joint uses special grease. Do not substitute with another type of grease.**
3. **The boot band should be replaced with a new one.**

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

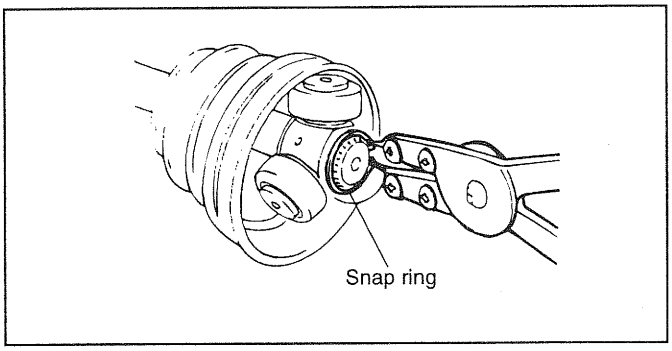
NOTE

Be careful not to damage the boot.



EIDA301A

2. Remove the snap ring and spider assembly from the driveshaft.



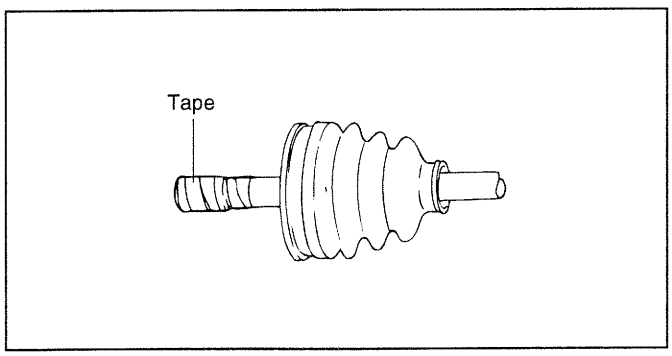
EIDA301B

3. Clean the spider assembly.

4. Remove the B.J. boot bands and pull out the T.J. boot and B.J. boot.

NOTE

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



EIDA251D

INSPECTION EIDA3020

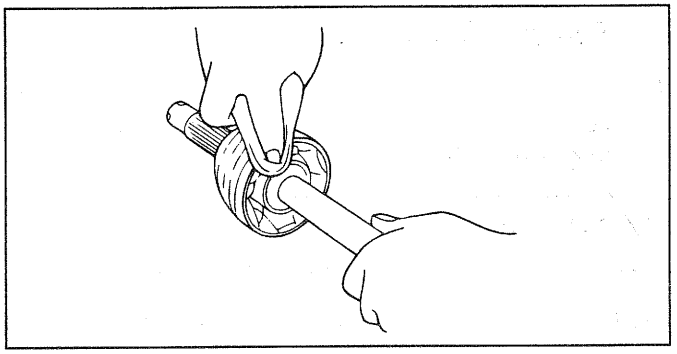
1. Check the driveshaft spline part for wear or damage.

2. Check for entry of water and/or foreign material into B.J.

3. Check the spider assembly for roller rotation, wear or corrosion.

4. Check the groove inside the T.J. case for wear or corrosion.

5. Check the dynamic damper for damage or cracking.



EIDA252A

REASSEMBLY EIHA3120

1. Wrap tape around the drive shaft splines (T.J. side) to prevent damage to the boots.

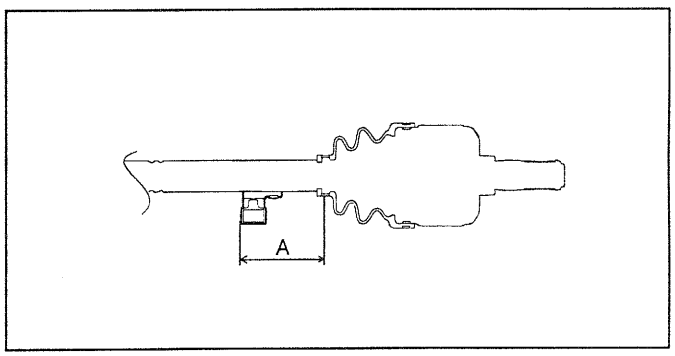
2. Apply grease to the drive shaft and install the boots.

Recommended lubricant

B.J. Boot grease : Centoplex 278M/136K
T.J. Boot grease : Oneluber MK

3. To install the dynamic damper, keep the B.J. and shaft in a straight line and secure the dynamic damper in the direction illustrated, and then install the small boot band.

Standard value (A) : 160mm (6.3 in)



EIHA005A

4. Apply the specified grease into the T.J. boot and install the boot.

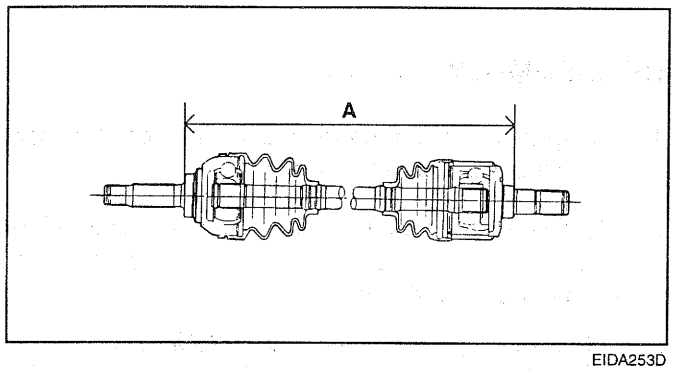
T.J. boot grease gr.

Total : 145±6gr.
In the joint : 100±3gr.
In the boot : 45±3gr.

5. Tighten the T.J. boot bands.

6. Add specified grease to the B.J. as much as was wiped away at the time of inspection.
7. Install the boots.
8. Tighten the B.J. boot bands.
9. To control the air in the T.J. boot, maintain the specified distance between the boot bands when they are tightened.

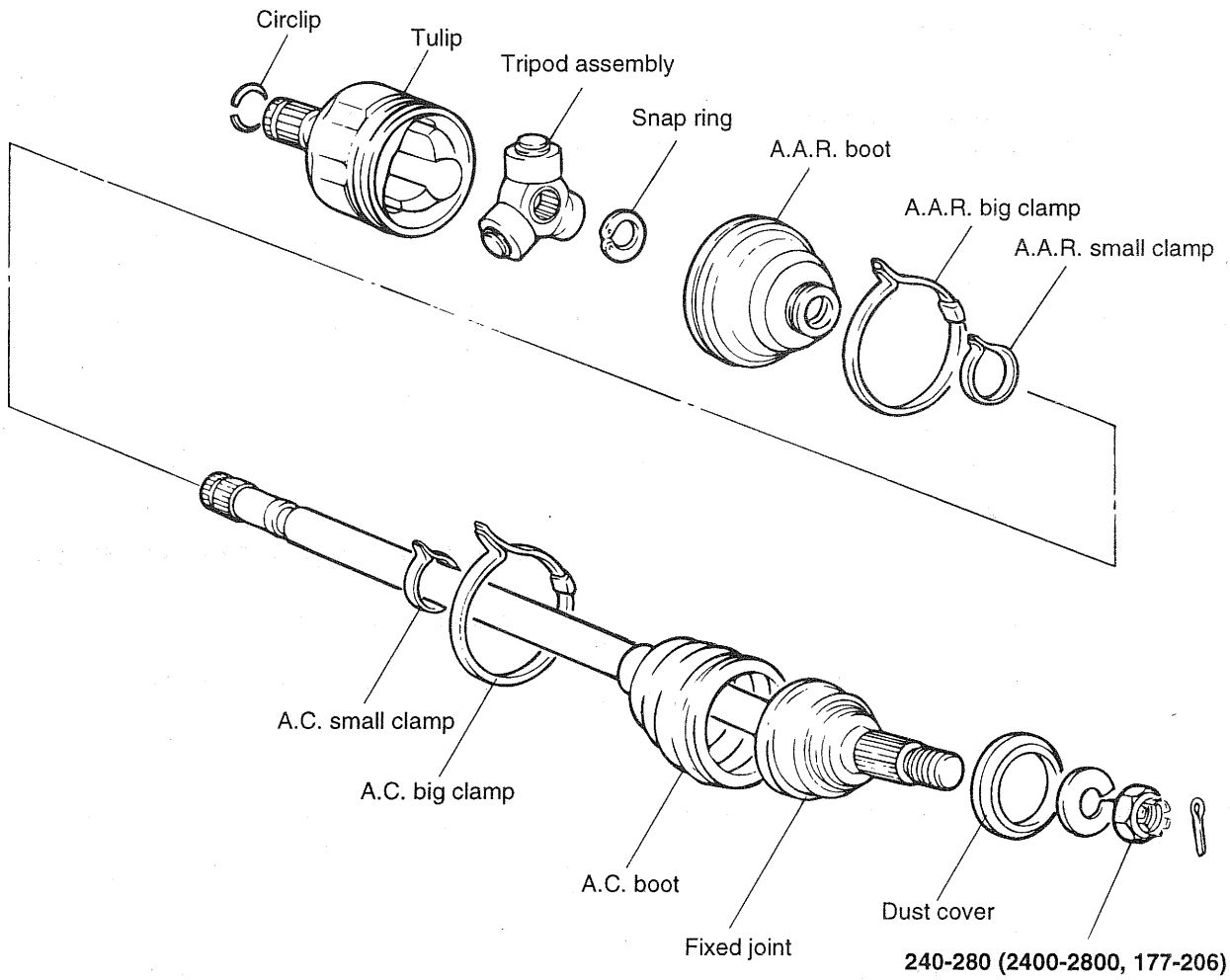
Standard value (A)	mm (in.)
LH	539±2 (21.2±0.08)
RH	841±2 (33.1±0.08)



EIDA253D

FRONT DRIVESHAFT (AAR-AC TYPE)

COMPONENTS EIHA3300



TORQUE : Nm (kg·cm, lb·ft)

EIHA330A

DISASSEMBLY EIHA3310

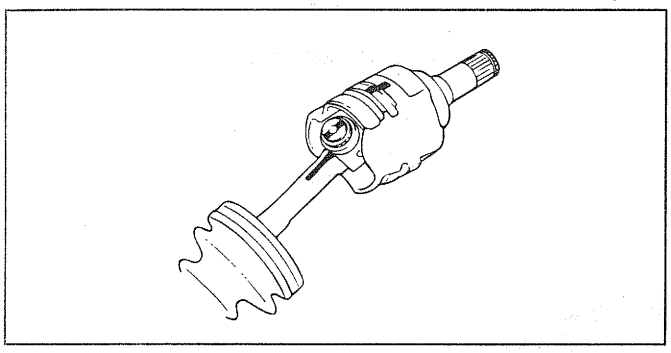
CAUTION

- **Do not disassemble the tripod assembly.**
- **The driveshaft joint uses special grease. Do not substitute it with another type of grease.**
- **The boot clamp should be replaced with a new one.**
- **The boot should be replaced with a new one.**

1. Using a side cutter, cut the big clamps of the A.A.R. and A.C.
2. Using a brass bar and hammer, remove the small clamps of the A.A.R. and A.C.
3. Place a matchmark on the tripod and tulip.

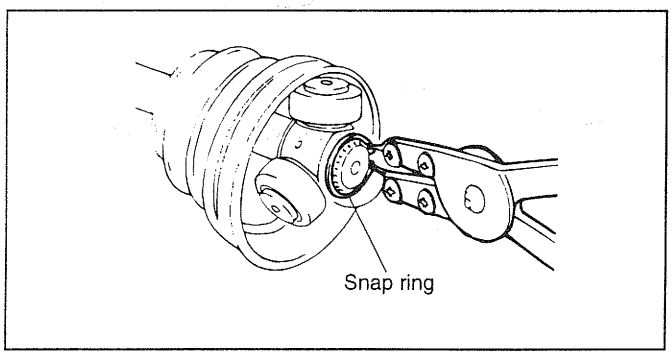
NOTE

Do not punch the mark.



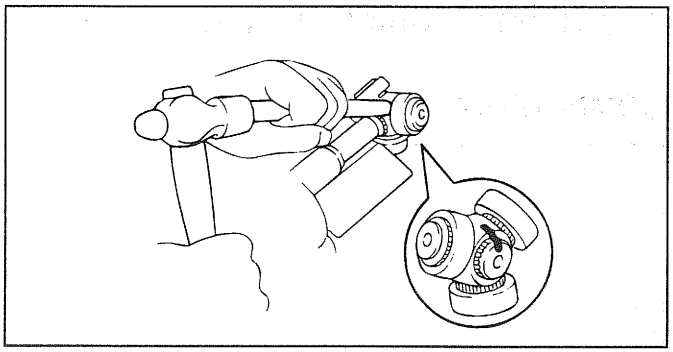
EIB9002A

4. Remove the tulip assembly from the driveshaft.
5. Using a snap ring expander, remove the snap ring.



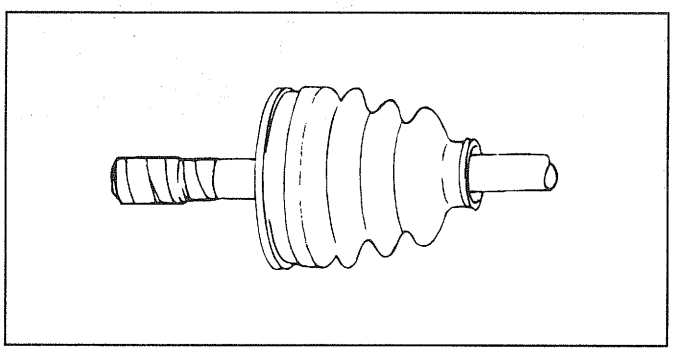
EIDA301B

6. Align matchmark on the tripod and joint shaft.
7. Using a brass bar and hammer, remove the tripod from the joint shaft.



EIB9003A

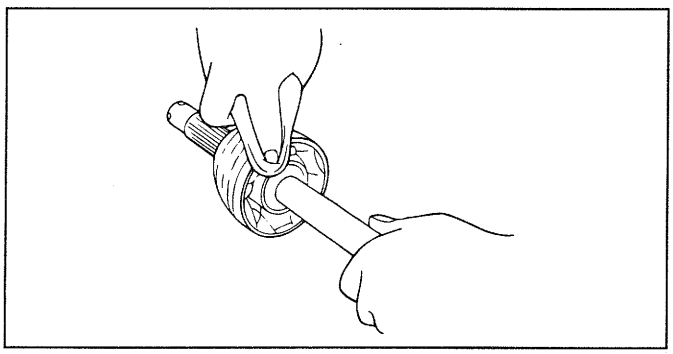
8. Remove the A.C. boot clamps. Pull out the A.A.R. boot and A.C. boot.



J49-015C

INSPECTION AFTER DISASSEMBLY EIHA3320

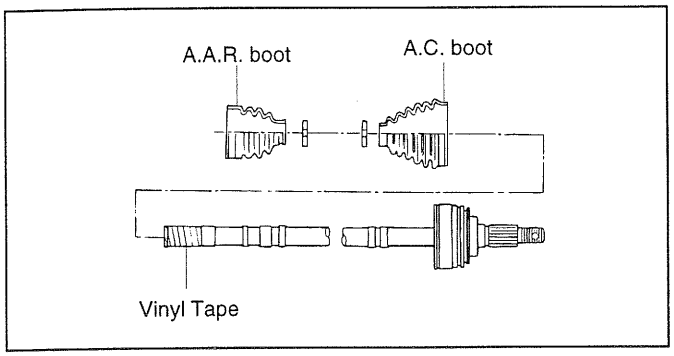
1. Check the driveshaft spline part for wear or damage.
2. Check for entry of water and/or contamination in boot.
3. Check the tripod assembly for roller rotation, wear or corrosion.
4. Check the grooves inside tulip for wear or corrosion.



EIDA252A

REASSEMBLY EIHA3330

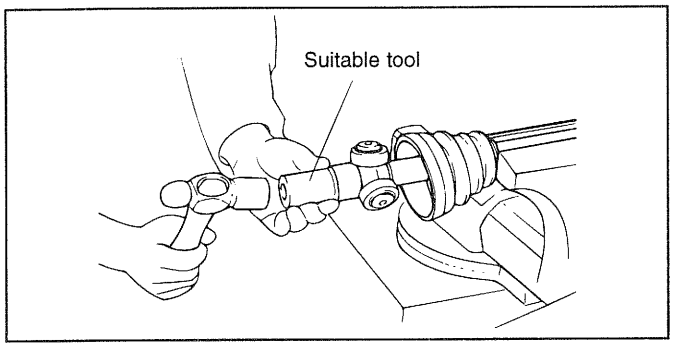
1. Wrap tape around the drive shaft splines (A.A.R. side) to prevent damage to the boots.
2. Before installing the boots, place new clamps to the small boot ends and install them to the drive shaft.



EIHA333A

3. After aligning the matchmark, place the beveled side of the tripod axial spline toward the A.C. joint.

4. Using suitable tool and hammer, tap in the tripod to the drive shaft.

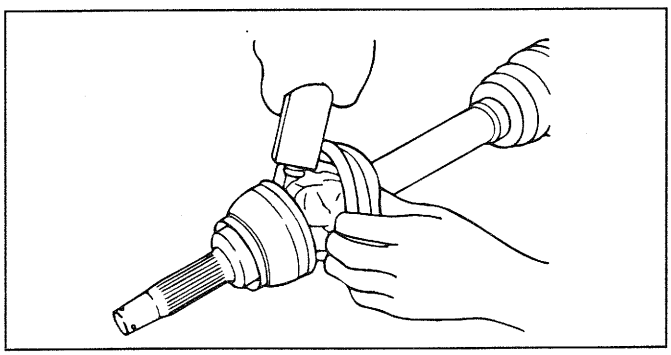


EIB9001A

5. Install a new snap ring.

6. Add specified grease to the A.C. joint and boot as much as wiped away at the time of inspection.

7. Apply specified grease to the A.A.R. joint and boot.



S5DS012B

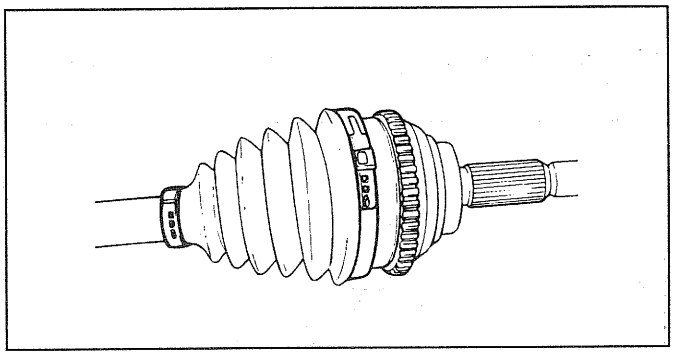
8. Align the matchmarks and install the A.A.R. joint to the shaft.

9. Install the boots.

NOTE

- **Make sure that the 2 boots are on the shaft groove.**
- **Make sure that the 2 boots are not stretched.**

10. Position the holes of the clamps free end to the closing hooks.



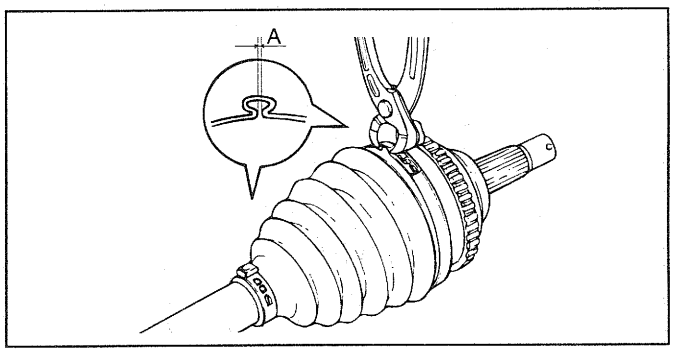
EIB9006A

11. Using a plier, secure the clamps.

Clearance (A)

A.C. big clamp : 2.0mm (0.079 in) or less

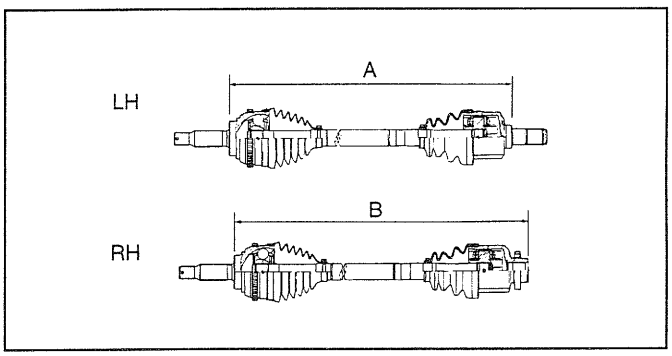
A.C. small clamp : 1.8mm (0.071 in) or less



EIB9007A

12. To control air in the A.A.R. boot, keep the specified distance between the boot clamps when they are tightened.

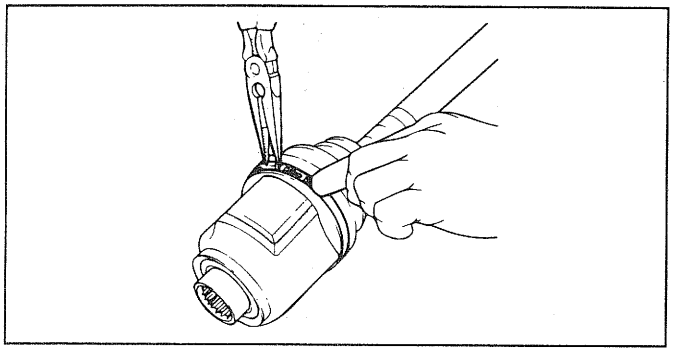
Standard value (A/B)	mm (in.)
LH(A)	523.1±2 (20.59±0.08)
RH(B)	542.7±3 (21.37±0.12)



EIA9253A

13. Holding the A.A.R. big clamp near the closing hook, using the long noise plier, position the hole of the clamps free end over the closing hook.

14. Secure the clamp by drawing the closing hooks together.

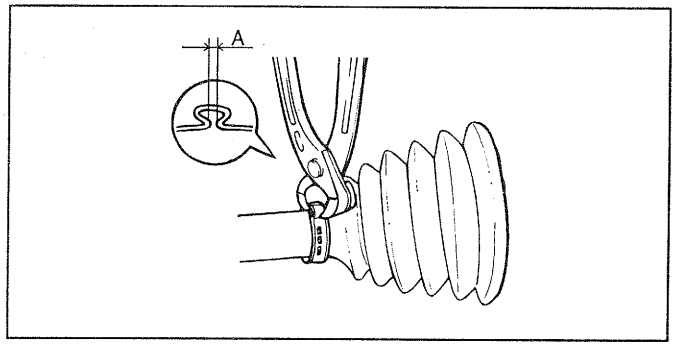


EIB9008A

15. Using a plier, secure the small clamp of the A.A.R..

Clearance (A)

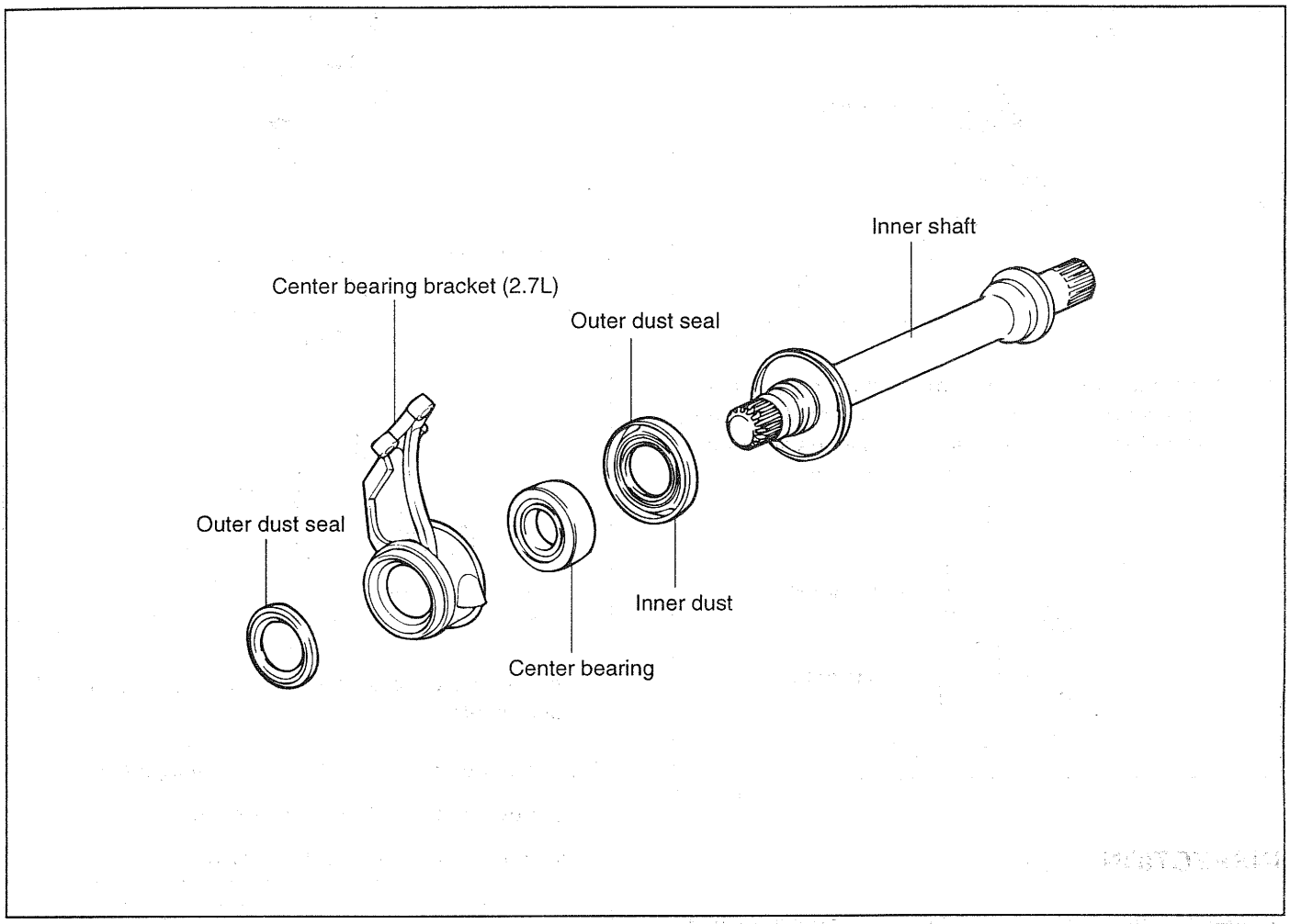
A.A.R. small clamp : 1.6mm (0.063 in) or less



EIB9010A

CENTER BEARING AND INNER SHAFT

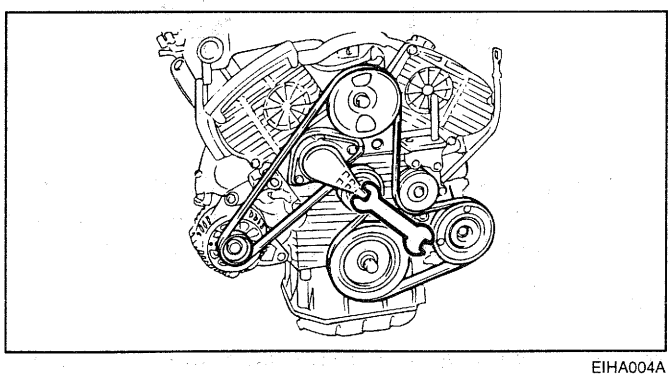
COMPONENTS EIHA3500



EIHA007A

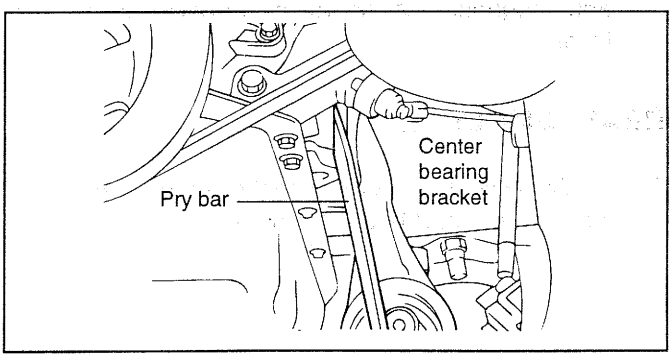
REMOVAL EIHA3505

1. After releasing the auto tensioner, remove the drive belt.



EIHA004A

2. Remove the alternator assembly.
3. Remove the center bearing bracket mounting bolts. Insert the pry bar between the center bearing bracket and the cylinder block to disconnect the bracket from the cylinder block.

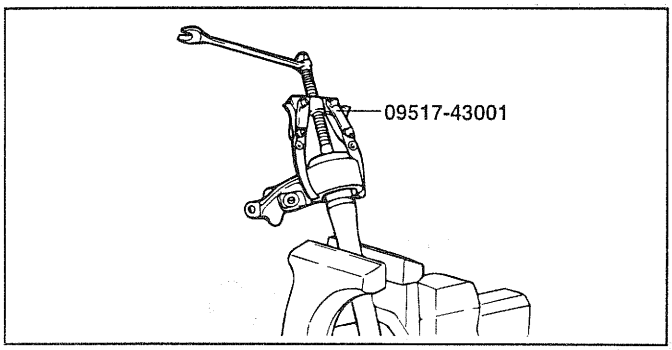


EIA9210H

4. Remove the center bearing and inner shaft.

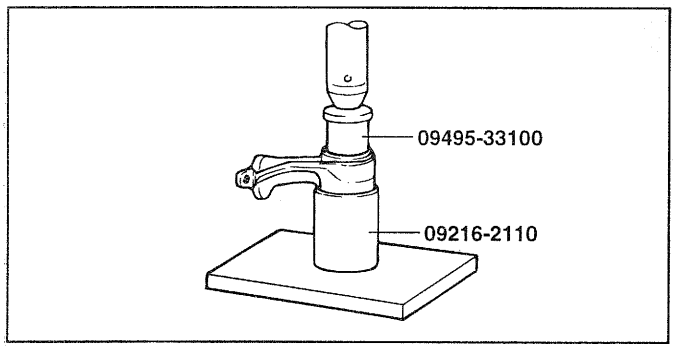
DISASSEMBLY EIHA3510

1. Using the special tool, disassemble the center bearing bracket from the inner shaft.



EIA9351A

2. Using the special tool, remove the center bearing by pressing it from the outside of the center bearing bracket to the inside of it as shown in the illustration.



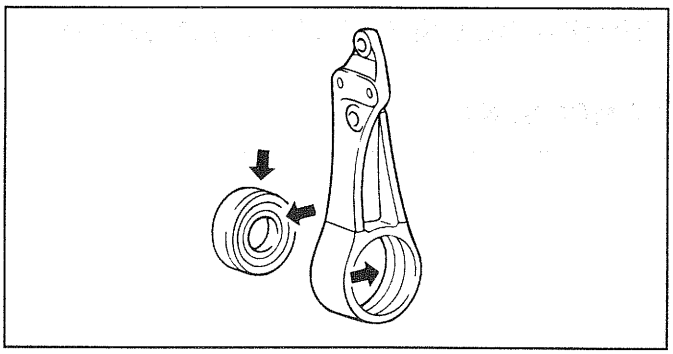
EIHA351A

INSPECTION EIHA3520

1. Check the inner shaft for damage, bending or rust.
2. Check the inner shaft splines for wear or damage.
3. Check the center bearing for scoring, discoloration, and roughness of the roller journal's moving surfaces.

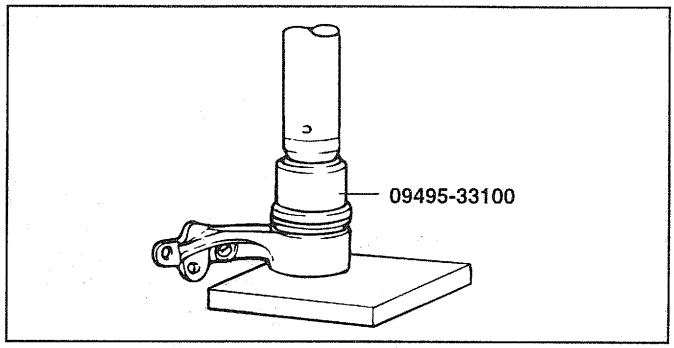
REASSEMBLY EIHA3530

1. Apply multipurpose grease to the center bearing and inside the center bearing bracket.



EIA9353E

2. Using the special tools, press the center bearing into the center bearing bracket.



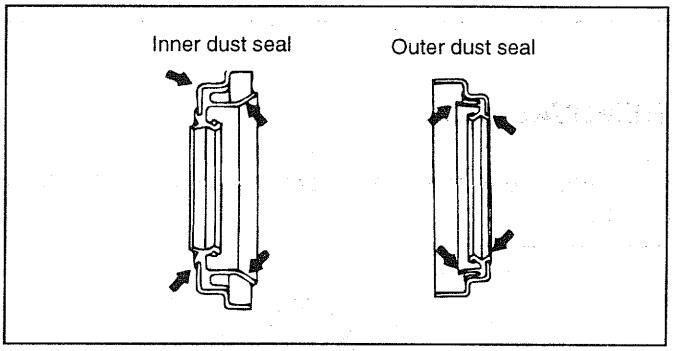
EIA9353B

3. Apply multipurpose grease to the rear surface of all dust seals.

Recommended grease : LIG-2 or Sunlight No.2

Inner dust seal : 7-10 g (0.25-0.35 oz)

Outer dust seal : 4-6 g (0.14-0.21 oz)

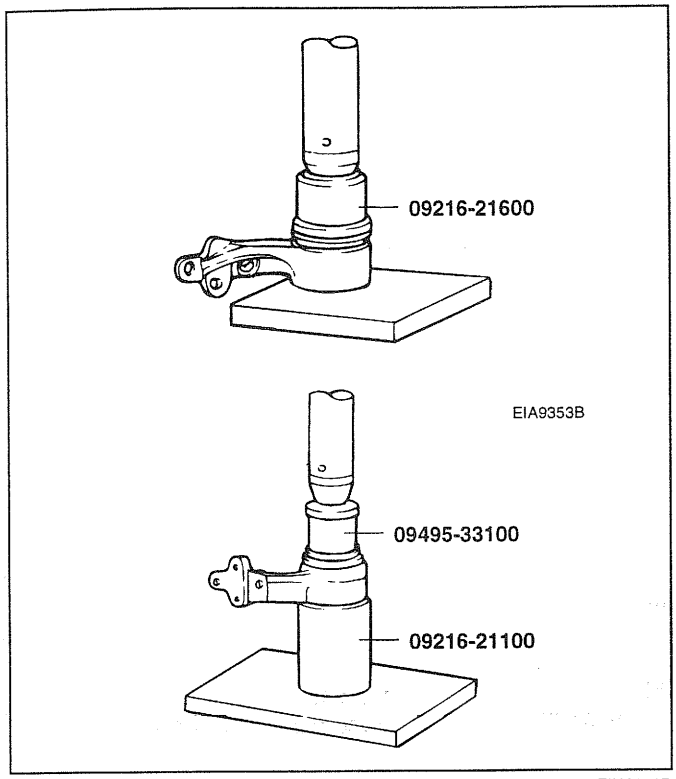


EIHA353A

4. Using the special tool, tap the outer dust seal and inner dust seal in that order until they are flushed with the edge of the center bearing bracket.

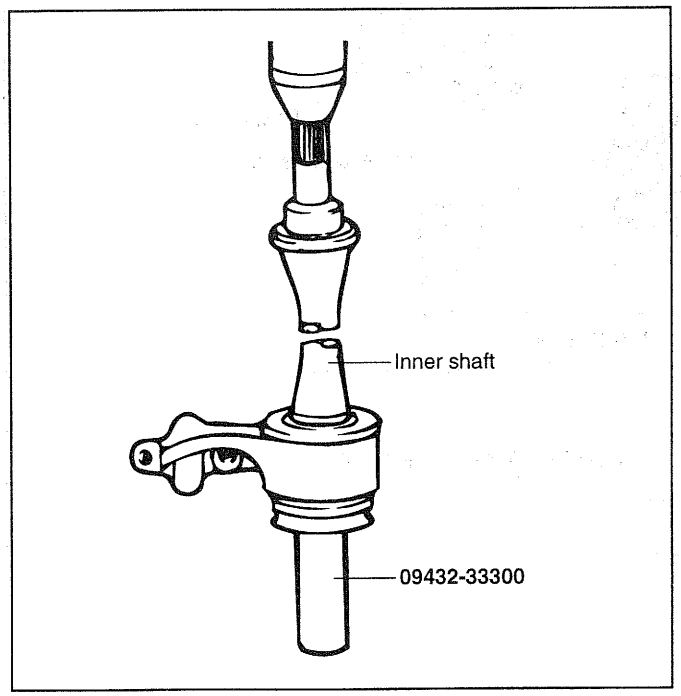
NOTE

When applying grease, make sure that it does not adhere to the outside of the lip.



EIHA353B

5. Using the special tool, support the center bearing as shown in the figure, then press in the inner shaft.

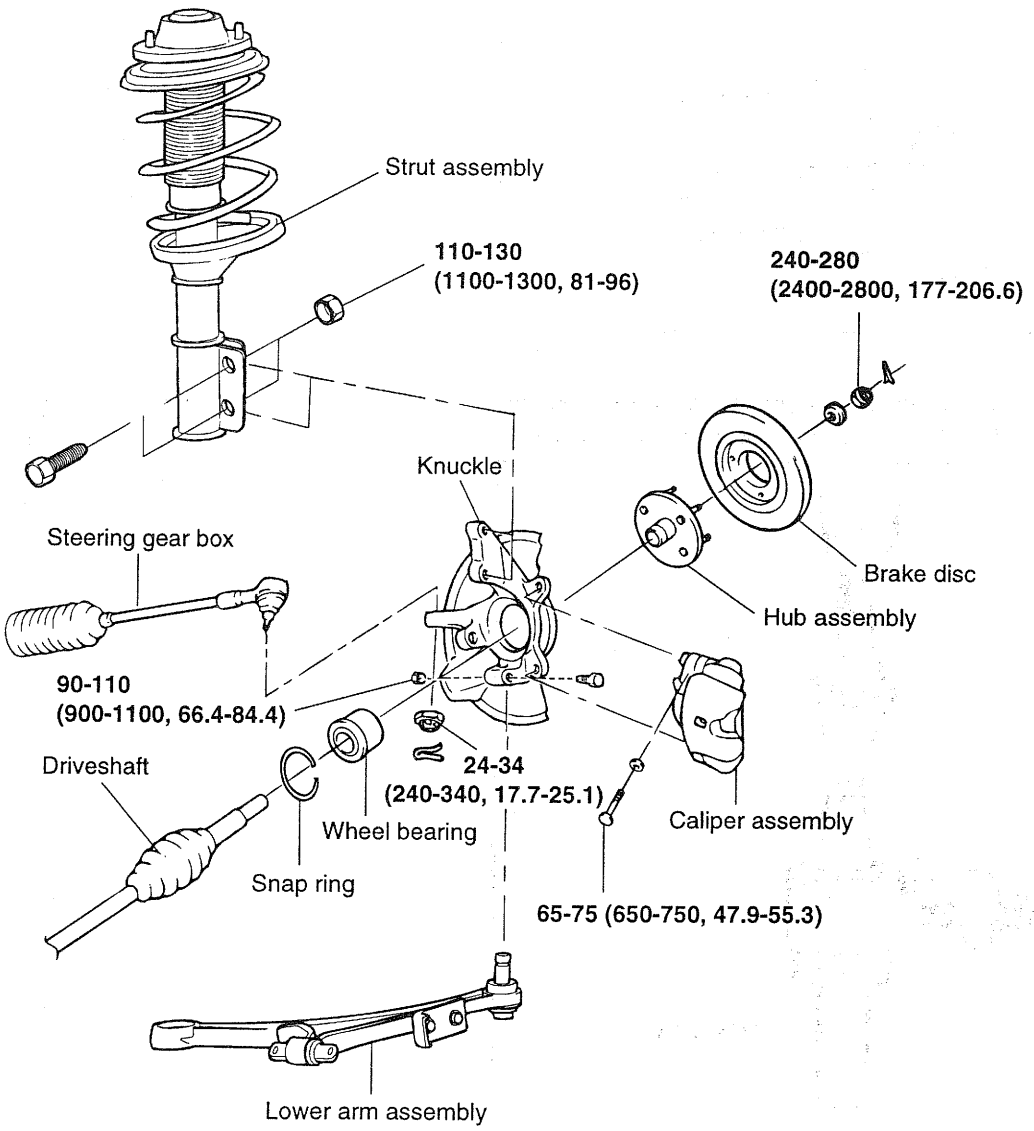


EIA9353C

FRONT AXLE

FRONT HUB/KNUCKLE

COMPONENTS EIHA4000

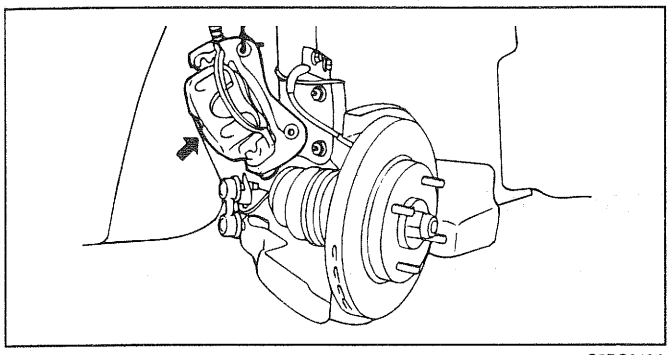


TORQUE : Nm (kg·cm, lb·ft)

EIHA008A

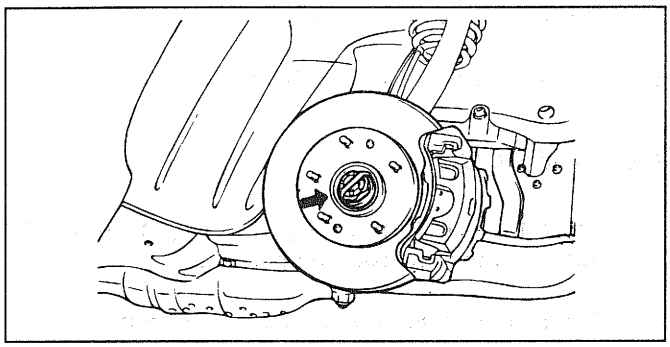
REMOVAL EIHA4100

1. Raise the vehicle and remove the front wheel.
2. Remove the vehicle speed sensor from the knuckle.
3. Remove the caliper and suspend it with a wire.



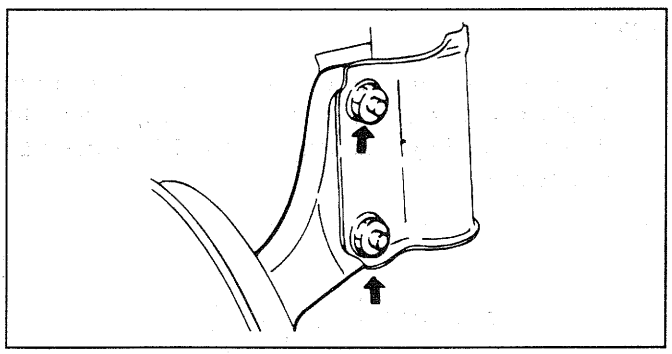
S5DS018A

4. Remove the split pin and driveshaft nut from the front hub.



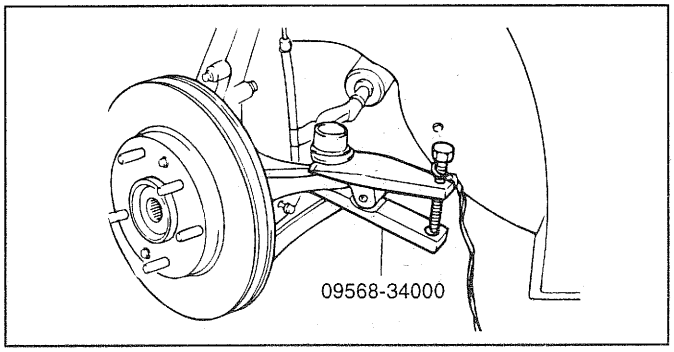
EIHA017A

5. Remove the 2 bolts and the knuckle from the strut assembly.



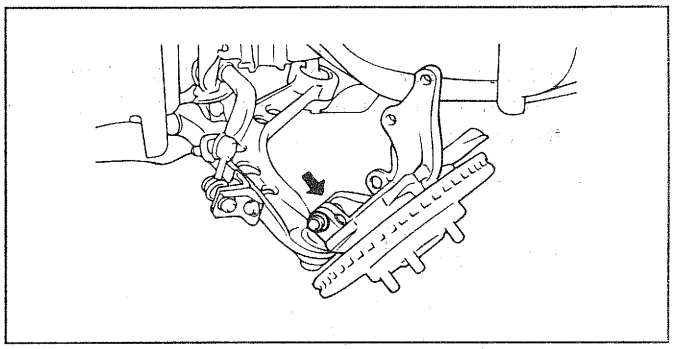
S5SS012B

6. Disconnect the tie rod end ball joint from the knuckle using the special tool.



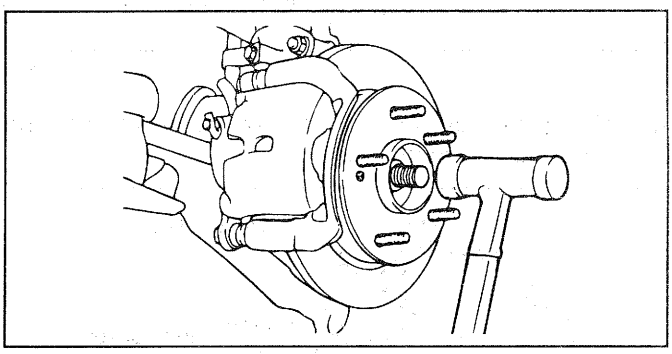
EIHA018A

7. Remove the lower arm ball joint mounting bolt.



EIHA009A

8. Using a plastic hammer, disconnect the driveshaft from the axle hub.

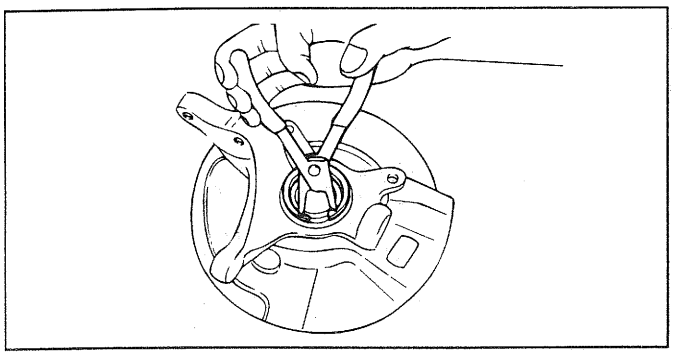


EIHA010A

9. Remove the front axle assembly.

DISASSEMBLY EIHA4110

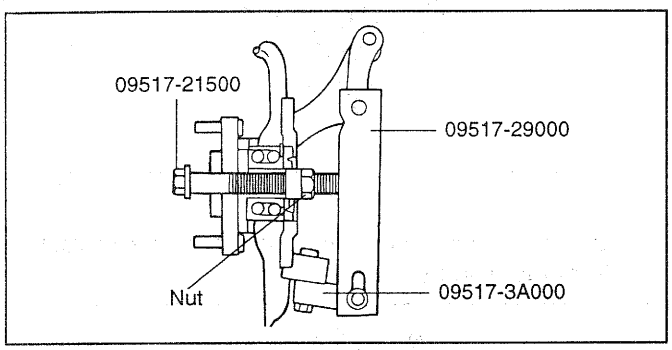
1. Remove the brake disc from the hub.
2. Remove the snap ring.



V5DS016A

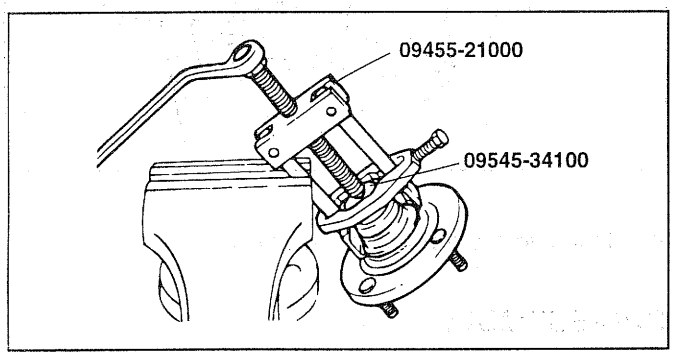
3. Remove the hub from the knuckle using a special tool.

   - Install the special tool to the hub and knuckle.
   - Tighten the nut of the special tool to disconnect the hub from the knuckle.



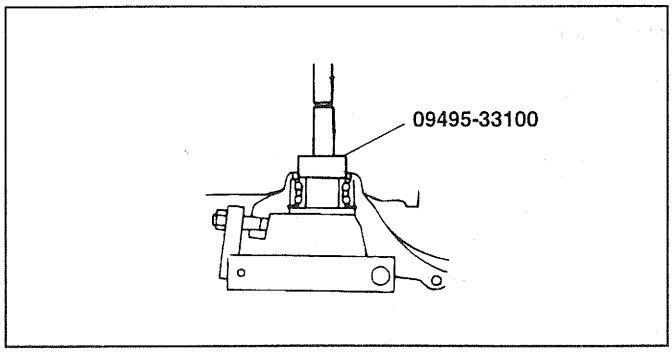
S5DS020A

4. Using the special tool, remove the wheel bearing inner race from the hub.



S5DS020C

5. Using the special tool, remove the wheel bearing outer race from the knuckle.



EIHA011A

INSPECTION EIHA4120

1. Check the hub for cracks and check the splines for wear.
2. Check the hub bolts for cracks and damage.
3. Check the brake disc for scoring and damage.
4. Check the knuckle for cracks.
5. Check the bearings for defects.

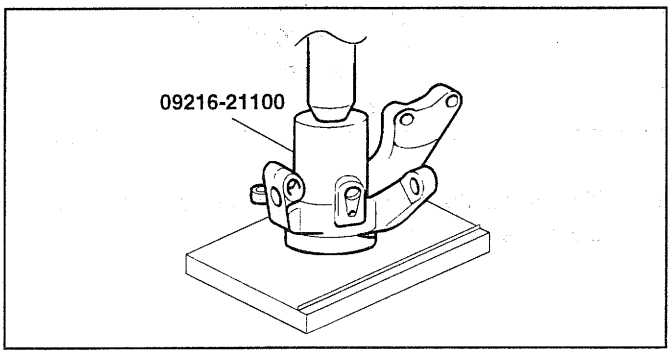
REASSEMBLY EIHA4130

1. Apply thin coat of multi-purpose grease to the surface of the knuckle and bearing.
2. Using the special tool, press in the bearing to the knuckle.

Press in load [kg(f), (lb(f))] : 4500-5000 (9921-11023)

NOTE

- **Do not press the inner race of wheel bearing. That will cause damage to the bearing assembly.**
- **When installing a bearing assembly, always use a new one.**



EIHA012A

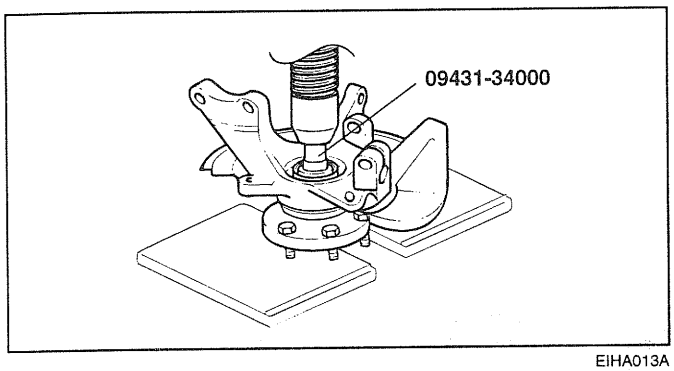
3. Install the snap ring into the groove of knuckle.
4. Install the backing plate to knuckle.

5. Press in the hub to the knuckle using a special tool.

Press in load [kg(f), (lb(f))] : 2000-2500(4409-5512)

NOTE

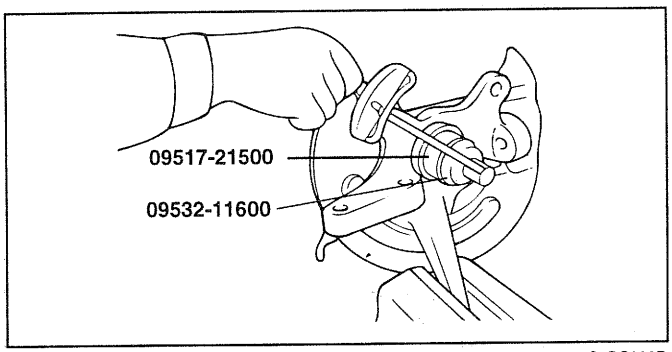
Do not press the outer race of the wheel bearing. This will cause damage to the bearing assembly.



EIHA013A

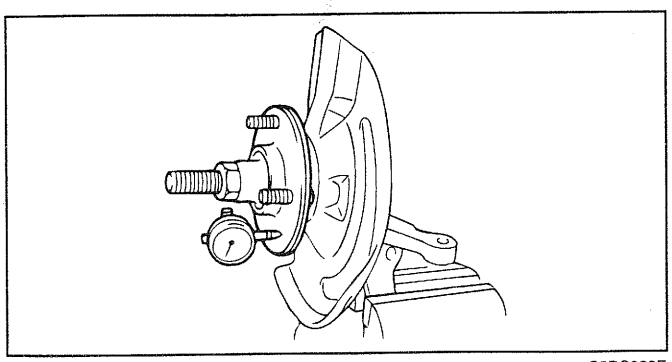
6. Rotate the hub several times to seat the bearing.
7. Measure the wheel bearing starting torque.

Wheel bearing starting torque [Limit]: 1.88 Nm (18.8kg.cm, 16.64lb.in) or less



S5DS022D

8. Measure end play of the hub by installing a dial gauge and check that it is within specifications.
9. Remove the dial gauge.
10. Install the hub to the disc.



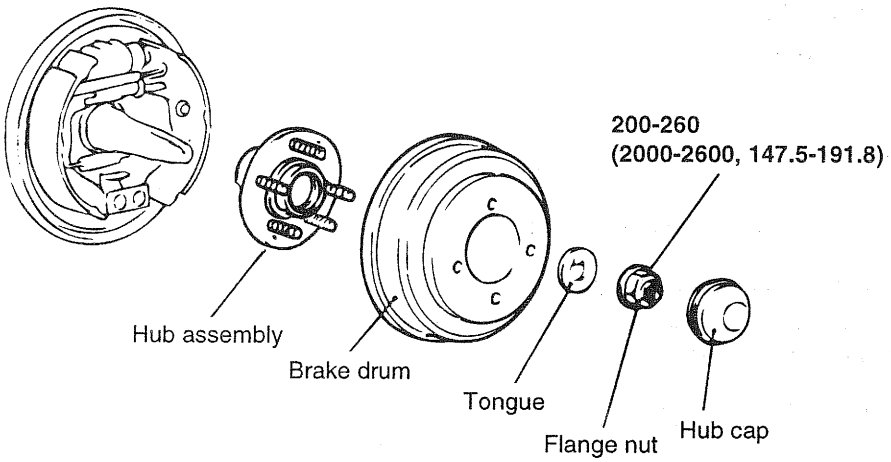
S5DS022E

REAR AXLE

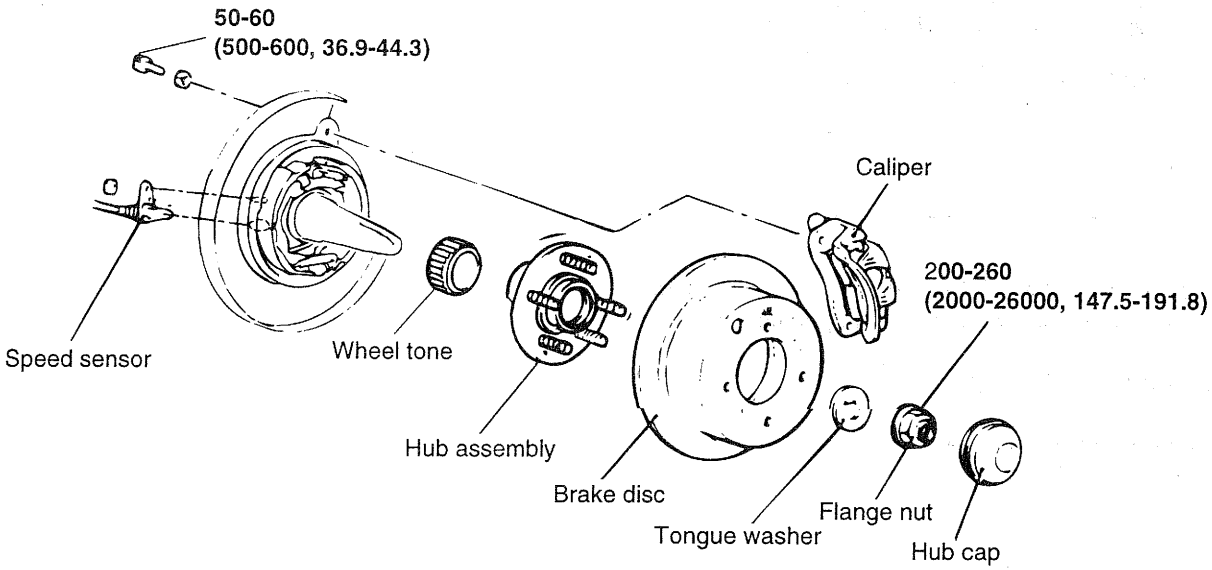
REAR AXLE/HUB

COMPONENTS EIHA800

<DRUM BRAKE>



<DISC BRAKE>



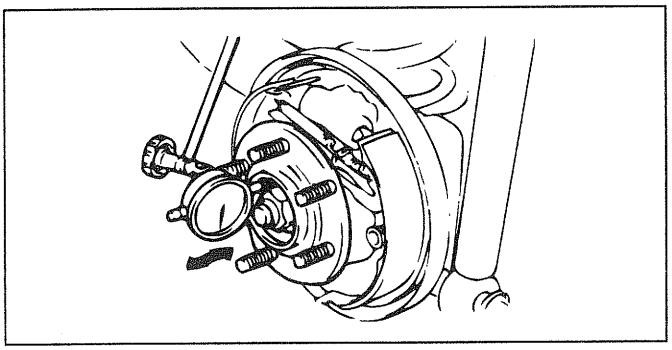
TORQUE : Nm (kg·cm, lb·ft)

EIHA014A

INSPECTION OF WHEEL BEARING END PLAY EIHA8100

1. Release the parking brake.
2. Remove the brake drum from the hub.
3. Remove the caliper assembly and brake disc (for disc brake).
4. Measure end play of the wheel bearing.
   - Install a dial gauge to the surface of the hub as shown in the illustration.
   - Check the scale of a dial gauge by moving the hub in the axial direction.

Limit value : 0.05mm or less



EIHA019A

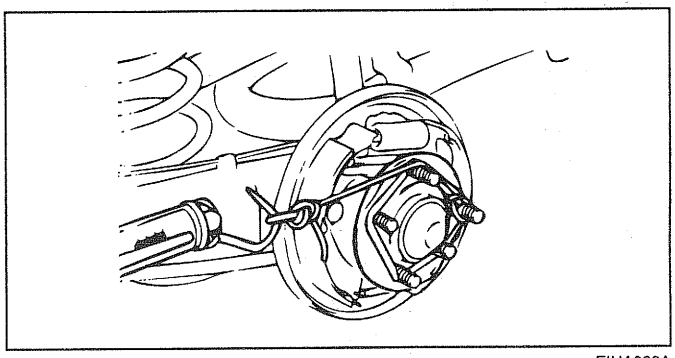
5. If the end play is over the limit value, loosen the flange nut and tighten it again to the specified torque. Then measure it again.
6. If the end play is beyond limit value, replace rear hub assembly.

CHECKING STARTING TORQUE OF REAR HUB ROTATION EIHA8110

1. Release the parking brake.
2. Remove the brake drum.
3. Remove the caliper assembly and brake disc (for a vehicle equipped with ABS).
4. Measure starting torque of the hub rotation.
   - Rotate the hub several times to seat the bearing.
   - After suspending the spring balance to the hub bolt, check the scale for spring balance, pulling it at a 90° angle.

Starting torque of rear hub rotation :

27N (6.1 lbs) or less

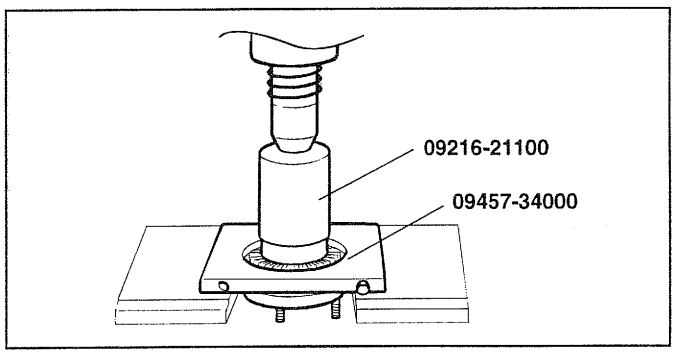


EIHA020A

5. If the starting torque is over the limit value, loosen the flange nut and tighten it again to the specified torque. Then measure it again.
6. If the starting torque is beyond the limit value, replace the rear hub assembly.

REMOVAL EIHA8120

1. Jack the vehicle up and remove the wheel.
2. After stretching the caulking part of the wheel nut, remove the nut and tongue washer.
3. Disconnect the caliper from the rear arm and suspend it to the frame.
4. Remove the brake disc.
5. Remove the rear hub.
6. Using a special tool, remove the tone wheel.



EIHA015A

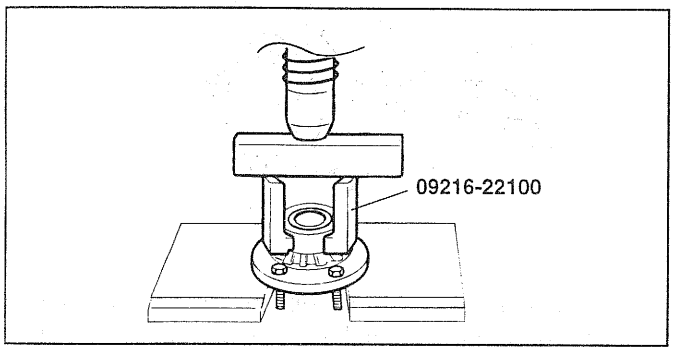
INSPECTION EIHA8130

1. Check that the bearing of the rear hub is not worn out or damaged.
2. Check that the tone wheel is not broken or damaged.

3. Check that there is no scratch on the inside surface of the hub.

DISASSEMBLY EIHA8140

1. Using a special tool, press in the tone wheel to the rear hub.



EIHA016A

2. Installation is the reverse order of removal.

Emissions Control System

GENERAL

EEHA0010

SPECIFICATIONS

Components	Function	Remarks
Crankcase Emission System Positive crankcase ventilation (PCV) valve	HC reduction	Variable flow rate type
Evaporative Emission System EVAP Canister EVAP Canister Purge Solenoid Valve	HC reduction	Duty control solenoid valve
Exhaust Emission System MFI system (air-fuel mixture control device) Three-way catalytic converter	CO, HC, NOx reduction CO, HC, NOx reduction	Heated oxygen sensor feedback type Monolithic type

EVAP : Evaporative Emission

SERVICE STANDARD

EVAP Canister Purge Solenoid Valve Coil current	0.45A or below (at 12V)

TIGHTENING TORQUE

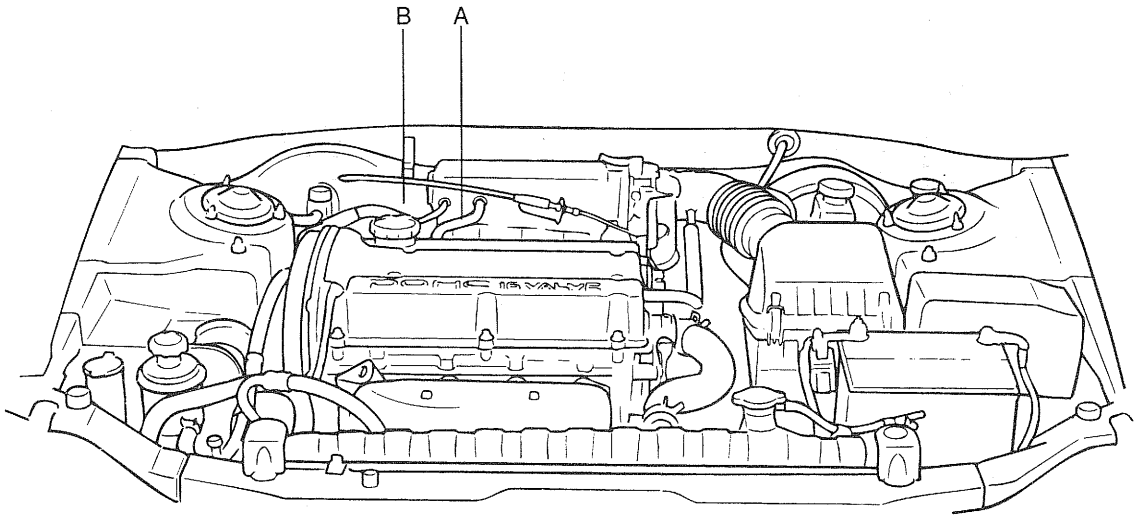
Item	Nm	kg·cm	lb·ft
Positive crankcase ventilation valve	8-12	80-120	6-9

TROUBLESHOOTING

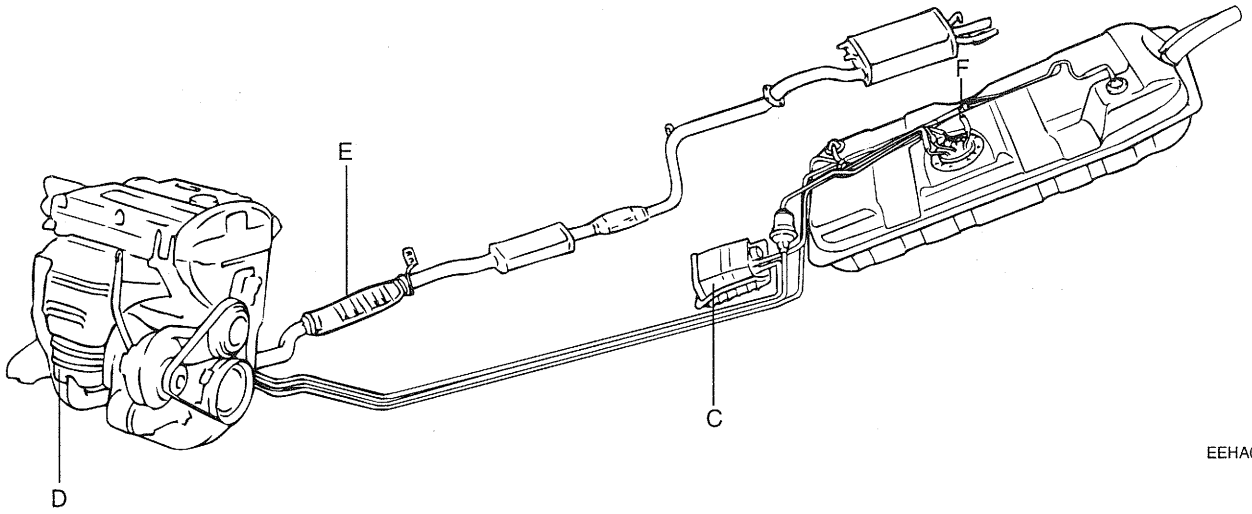
Symptom	Probable cause	Remedy
Engine will not start or hard to start	Vacuum hose disconnected or damaged EGR valve is not closed Malfunction of the EVAP Canister Purge Solenoid Valve	Repair or replace Repair or replace Repair or replace
Rough idle or engine stalls	Vacuum hose disconnected or damaged EGR valve is not closed Malfunction of the PCV valve Malfunction of the EVAP Canister Purge System	Repair or replace Repair or replace Replace Check the system; if there is a problem, check its component parts
Excessive oil consumption	Positive crankcase ventilation line clogged	Check positive crankcase ventilation system
Poor fuel mileage	Malfunction of the exhaust gas recirculation	Check the system; if there is a problem, check its component parts

EMISSION CONTROLS LOCATION EEHA0050

[2.0 I4]



EEA9005A

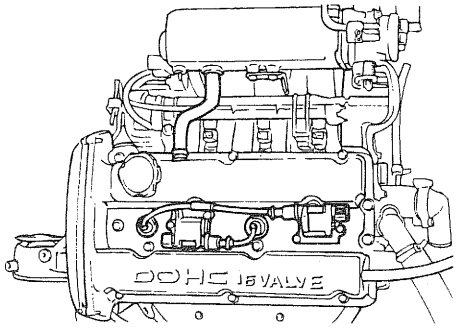


EEHA005B

A. PCV Valve
B. EVAP Canister Purge Solenoid Valve
C. EVAP Canister
D. Catalytic converter (MCC) ..... OBD-II area.
E. Catalytic converter (UCC) ..... OBD-II and General area.
F. Two-way valve

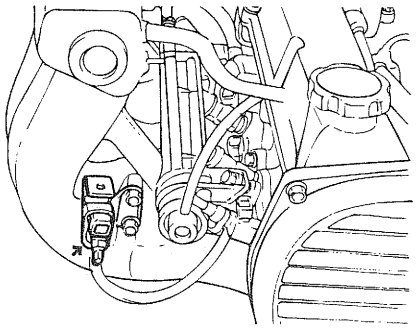
EEHA005A

A. PCV valve



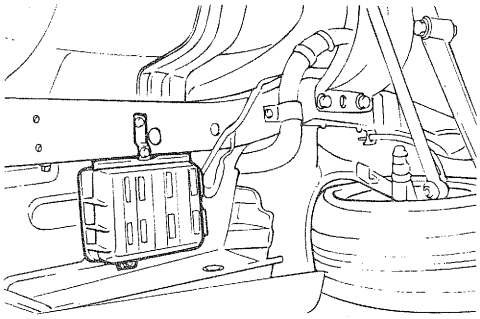
EEA9005C

B. EVAP Canister Purge Solenoid Valve



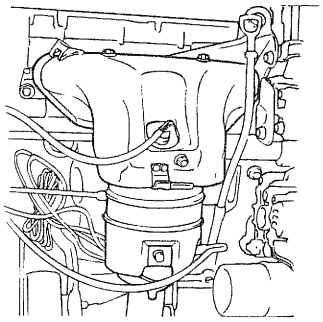
EEA9005D

C. EVAP. Canister



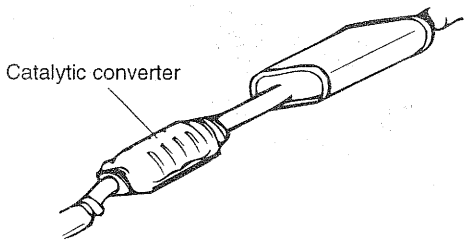
EEA9005E

D. Catalytic Converter (MCC)



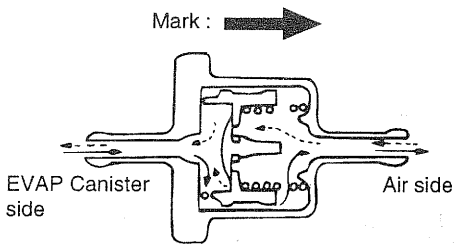
EEA9005G

E. Catalytic Converter (UCC)



EEA9005F

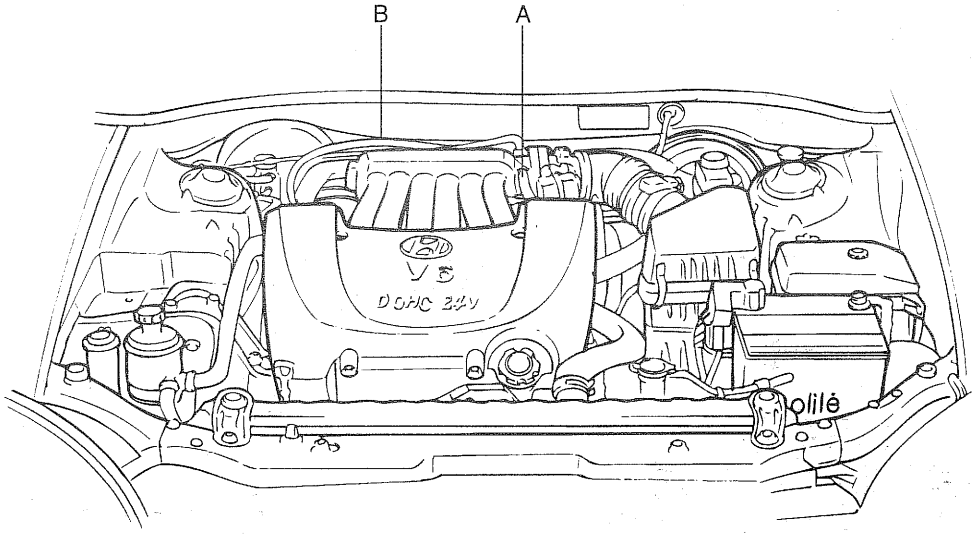
F. Two-way Valve



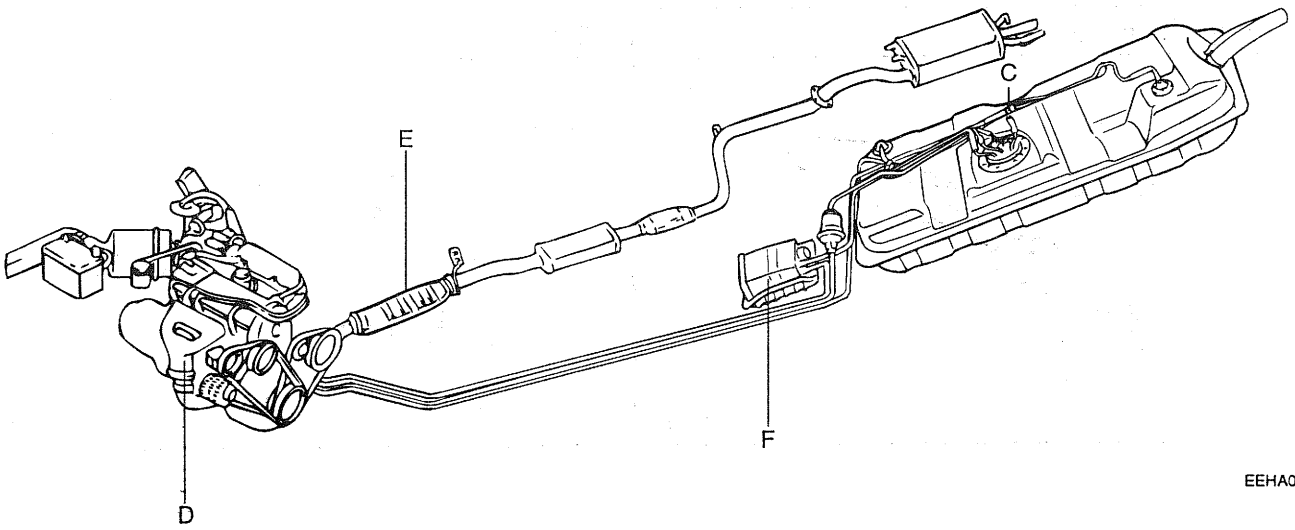
V5EC201D

EMISSION CONTROLS LOCATION EEHA0060

[2.7 V6]



EEA9006A

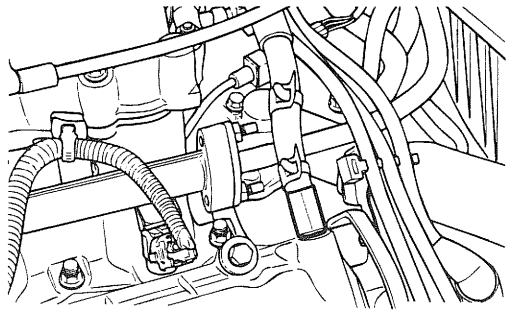


EEHA006A

A. PCV Valve
B. EVAP Canister Purge Solenoid Valve
C. Two-way valve
D. Catalytic converter (MCC) ..... OBD-II area.
E. Catalytic converter (UCC) ..... OBD-II and General area.
F. EVAP Canister

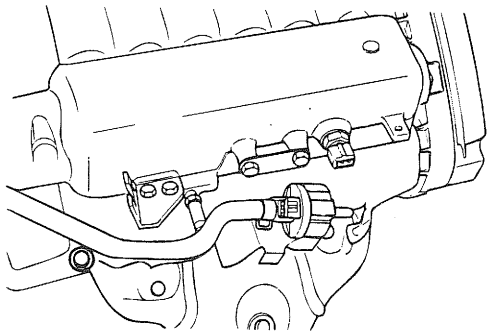
EEHA006A

A. PCV valve



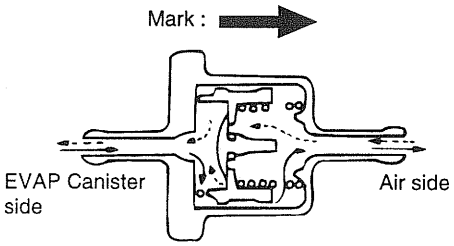
KFW4002A

B. EVAP Canister Purge Solenoid Valve



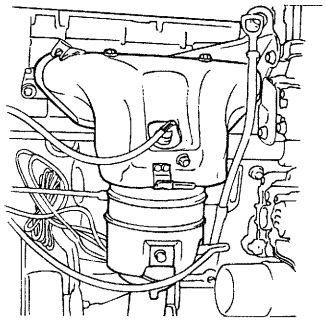
KFW5011A

C. Two-way Valve



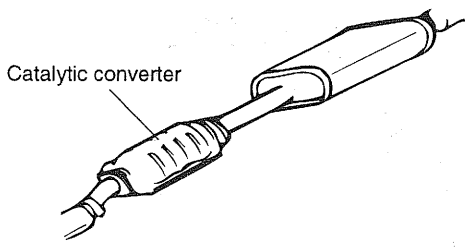
V5EC201D

D. Catalytic Converter (MCC)



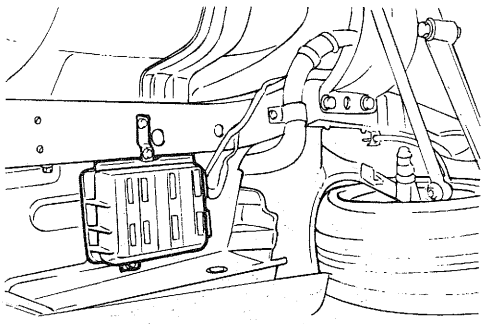
EEA9005G

E. Catalytic Converter (UCC)



EEA9005F

F. Evap. Canister

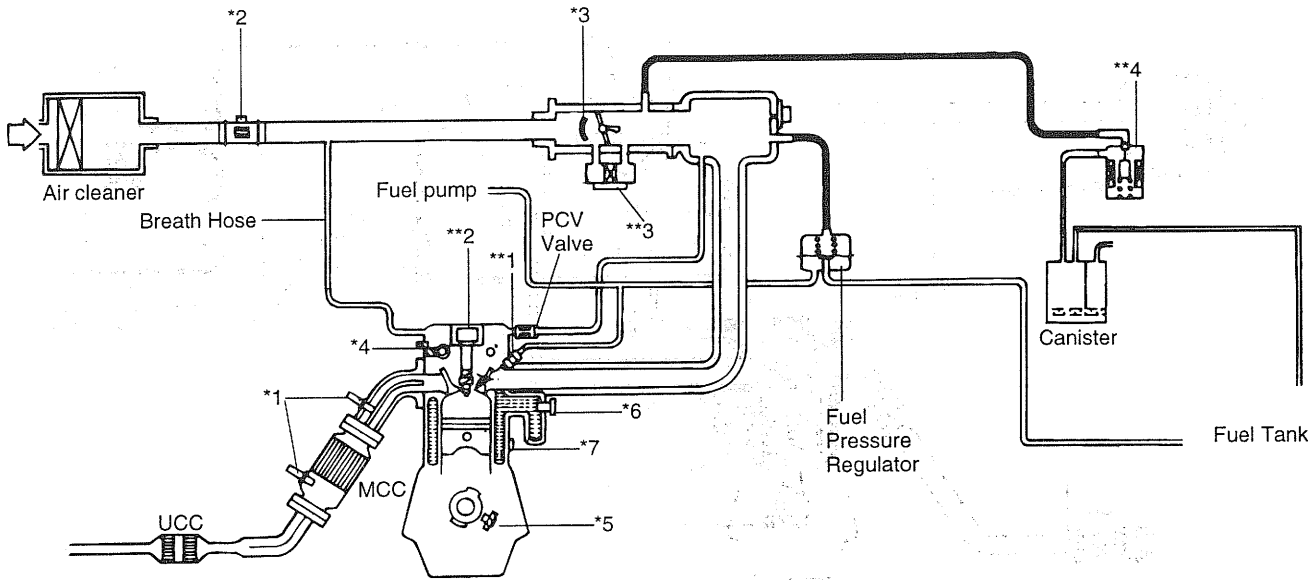


EEA9005E

SCHEMATIC DRAWING (2.0 I4, OBD-II) EEHA0071

[UNLEADED, OBD-II]

*1. HEATER OXYGEN SENSOR (HO2S) *2. HOT FILM SENSOR *3. THROTTLE POSITION SENSOR (With Idle Switch) *4. CAMSHAFT POSITION SENSOR (CMP SENSOR) *5. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *6. ENGINE COOLANT TEMP. SENSOR (ECT Sensor) *7. KNOCK SENSOR	o IGNITION SWITCH o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o POWER STEERING SWITCH o IGNITION DETECT SIGNAL o BATTERY VOLTAGE	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



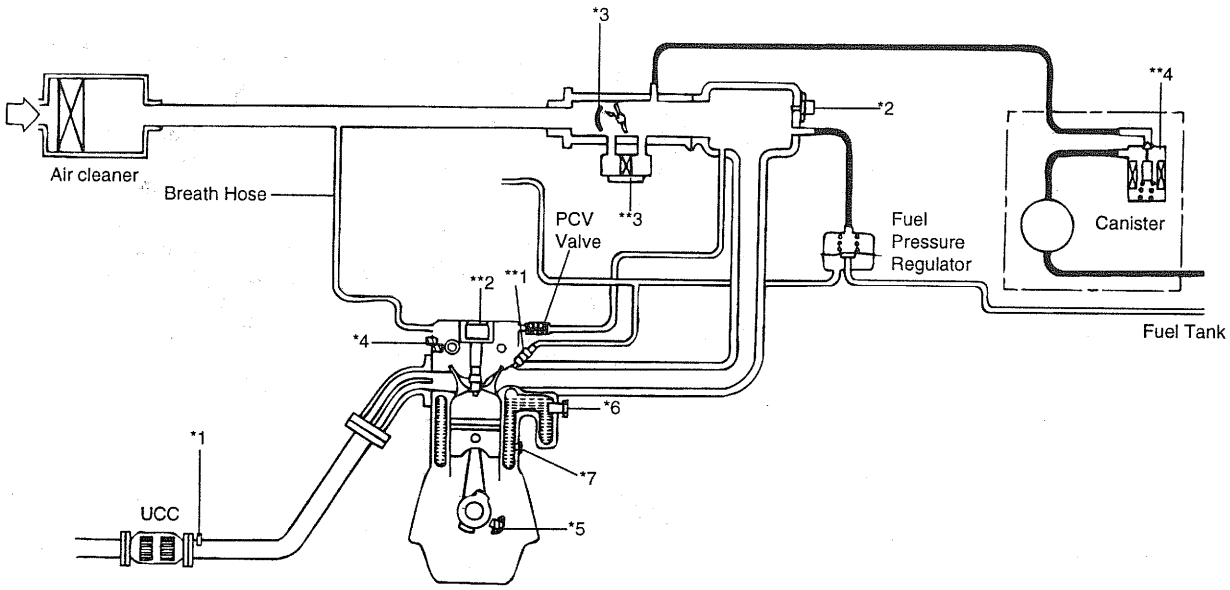
ECM : Engine Control Module
EVAP : Evaporative Emission
MCC : Manifold Catalytic Converter
UCC : Under floor Catalytic Converter

EEHA007A

SCHEMATIC DRAWING (2.0 I4) EEHA0070

[UNLEADED]

*1. HEATER OXYGEN SENSOR (HO2S) *2. MAP & IAT SENSOR *3. THROTTLE POSITION SENSOR (With Idle Switch) *4. CAMSHAFT POSITION SENSOR (CMP SENSOR) *5. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *6. ENGINE COOLANT TEMP. SENSOR (ECT Sensor) *7. KNOCK SENSOR	o IGNITION SWITCH o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o POWER STEERING SWITCH o IGNITION DETECT SIGNAL o BATTERY VOLTAGE	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



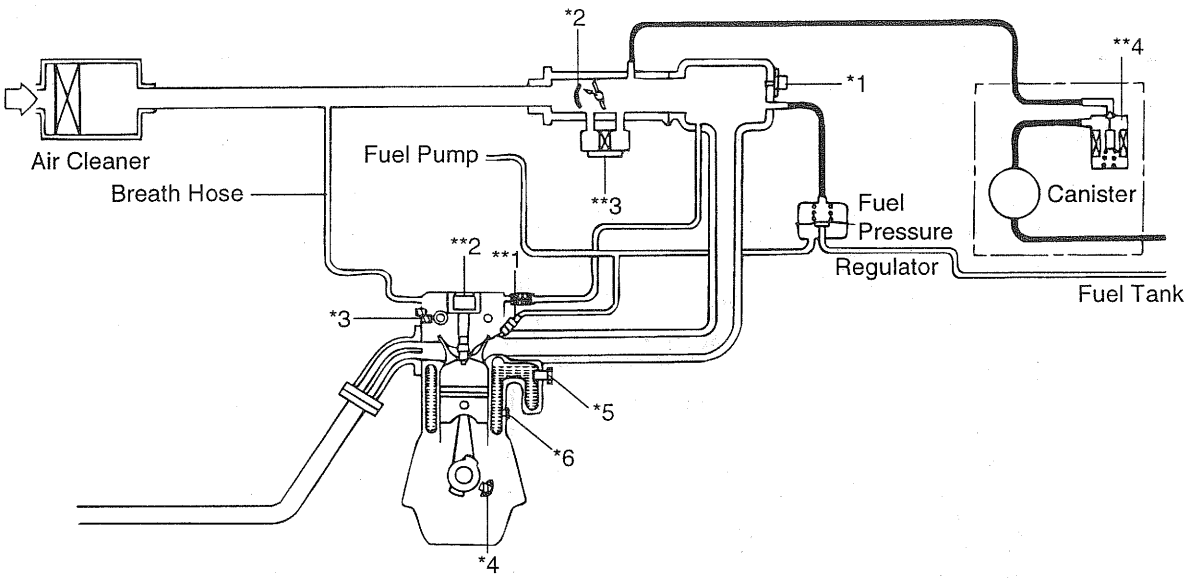
ECM : Engine Control Module
EVAP : Evaporative Emission
UCC : Under floor Catalytic Converter

EEHA007B

SCHEMATIC DRAWING (2.0 I4) EEHA0080

[LEADED]

*1. MAP & IAT SENSOR *2. THROTTLE POSITION SENSOR (With Idle Switch) *3. CAMSHAFT POSITION SENSOR (CMP SENSOR) *4. CAMSHAFT POSITION SENSOR (CKP SENSOR) *5. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *6. KNOCK SENSOR	o IGNITION SWITCH o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o POWER STEERING SWITCH o IGNITION DETECT SIGNAL o BATTERY VOLTAGE o VARIABLE REGISTER	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



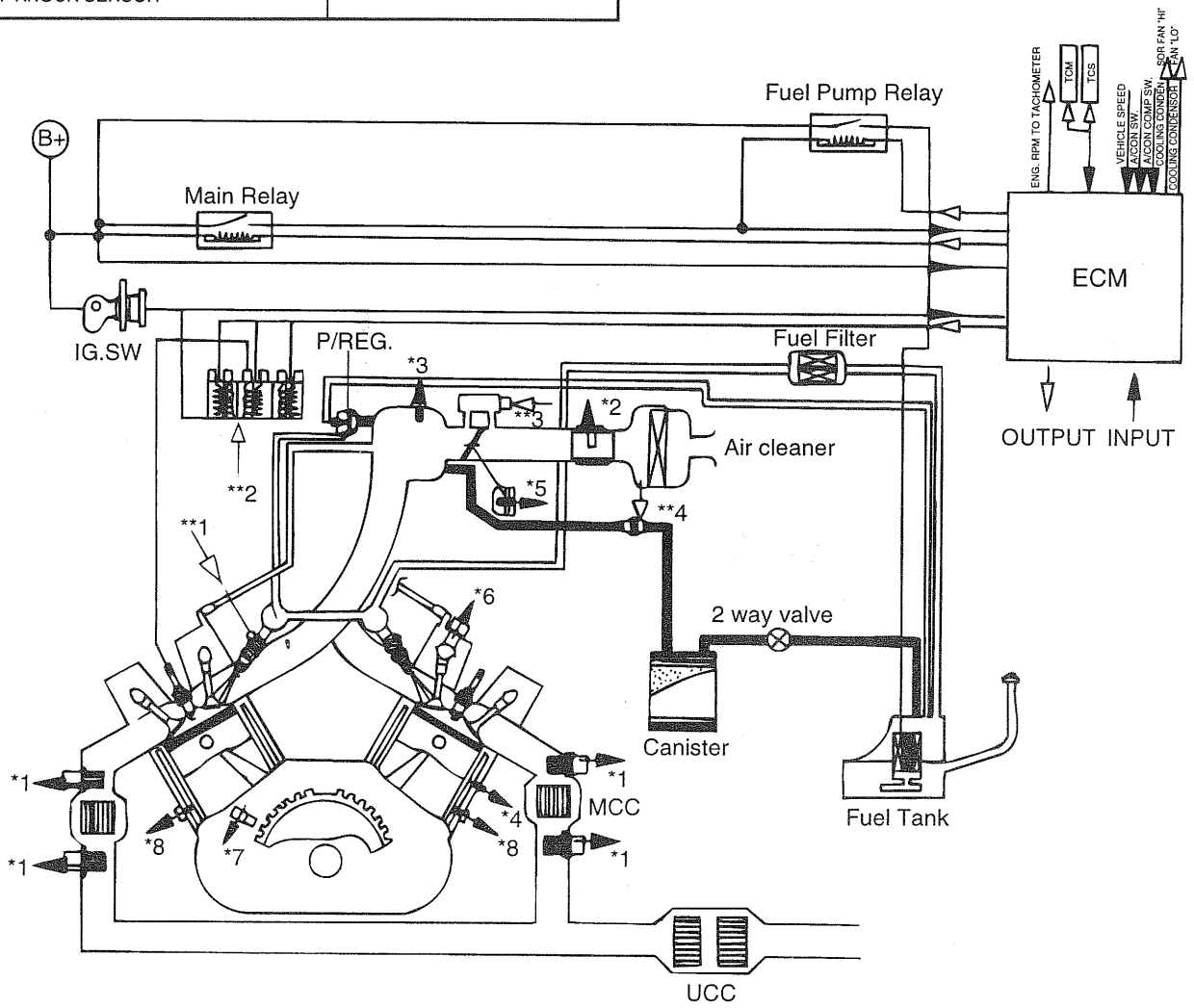
ECM : Engine Control Module
EVAP : Evaporative Emission

EEA9008A

SCHEMATIC DRAWING (2.7 V6, OBD-II) EEHA0091

[UNLEADED, OBD-II]

*1. HEATED OXYGEN SENSOR (H02S) *2. HOT FILM SENSOR *3. INTAKE AIR TEMP. SENSOR (IAT SENSOR) *4. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *5. THROTTLE POSITION SENSOR (TP SENSOR) *6. CAMSHAFT POSITION SENSOR (CMP SENSOR) *7. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *8. KNOCK SENSOR	o IGNITION SWITCH o BATTERY VOLTAGE o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o FUEL PUMP RELAY SIGNAL	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



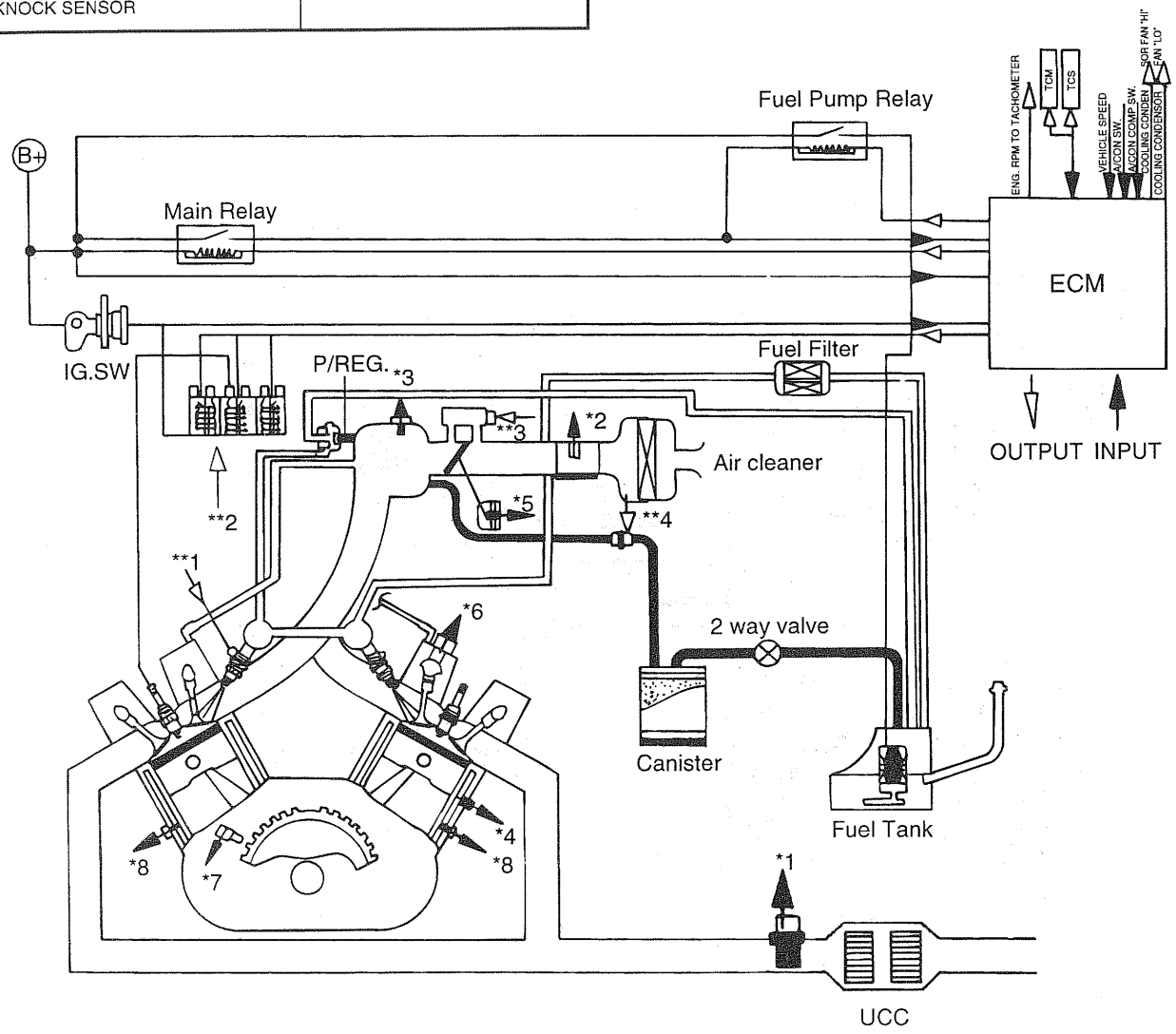
ECM : Engine Control Module
EVAP : Evaporative Emission
UCC : Under floor Catalytic Converter
MCC : Manifold Catalytic Converter

EEHA009A

SCHEMATIC DRAWING (2.7 V6) EEHA0090

[UNLEADED]

*1. HEATED OXYGEN SENSOR (H02S) *2. HOT FILM SENSOR *3. INTAKE AIR TEMP. SENSOR (IAT SENSOR) *4. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *5. THROTTLE POSITION SENSOR (TP SENSOR) *6. CAMSHAFT POSITION SENSOR (CMP SENSOR) *7. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *8. KNOCK SENSOR	o IGNITION SWITCH o BATTERY VOLTAGE o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o FUEL PUMP RELAY SIGNAL	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS



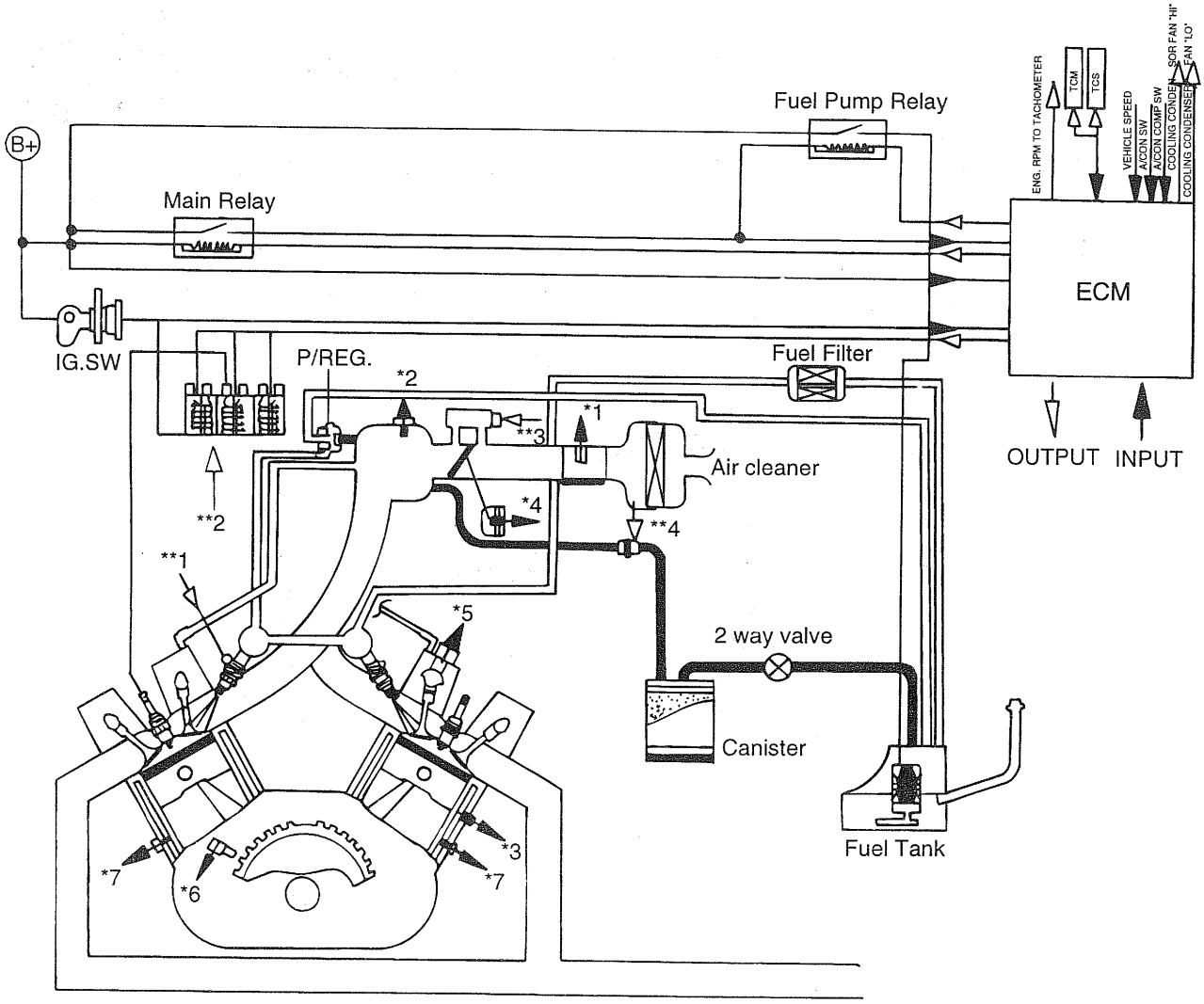
ECM : Engine Control Module
EVAP : Evaporative Emission
UCC : Under floor catalytic converter

EEHA009B

SCHEMATIC DRAWING (2.7 V6) EEHA0100

[LEADED]

*1. HOT FILM SENSOR *2. INTAKE AIR TEMP. SENSOR (IAT SENSOR) *3. ENGINE COOLANT TEMP. SENSOR (ECT SENSOR) *4. THROTTLE POSITION SENSOR (TP SENSOR) *5. CAMSHAFT POSITION SENSOR (CMP SENSOR) *6. CRANKSHAFT POSITION SENSOR (CKP SENSOR) *7. KNOCK SENSOR	o IGNITION SWITCH o BATTERY VOLTAGE o VEHICLE SPEED SENSOR o COOLER LOAD SIGNAL o "PNP" SWITCH (A/T ONLY) o FUEL PUMP RELAY SIGNAL o VARIABLE REGISTER	INPUT → ECM → OUTPUT	**1. FUEL INJECTOR **2. IGNITION COIL **3. ISC MOTOR (Linear Solenoid Type) **4. EVAP Canister Purge Solenoid Valve o FUEL PUMP CONTROL o MFI CONTROL RELAY o COOLER RELAY o IGNITION TIMING CONTROL o DIAGNOSIS

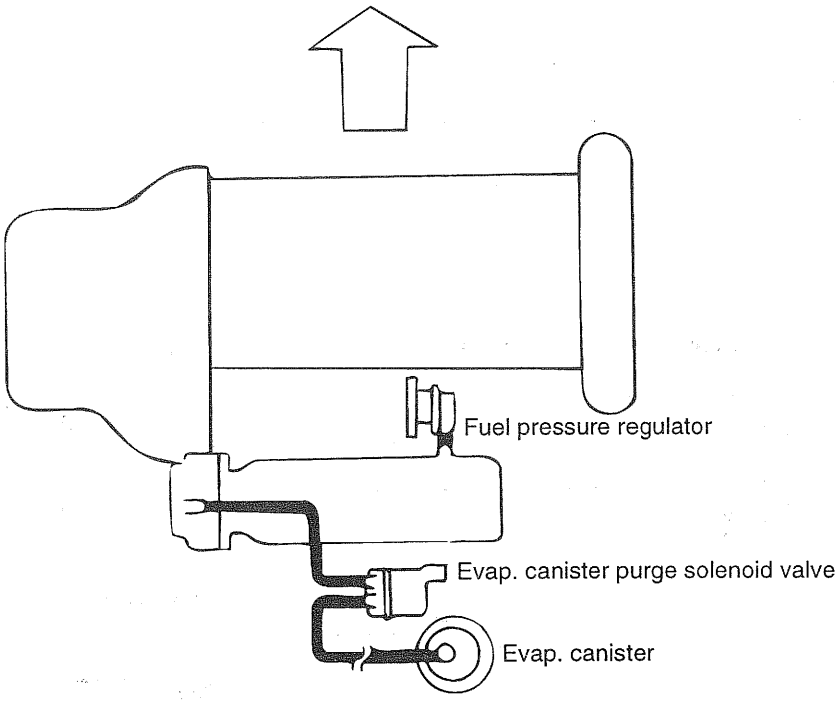


ECM : Engine Control Module
EVAP : Evaporative Emission

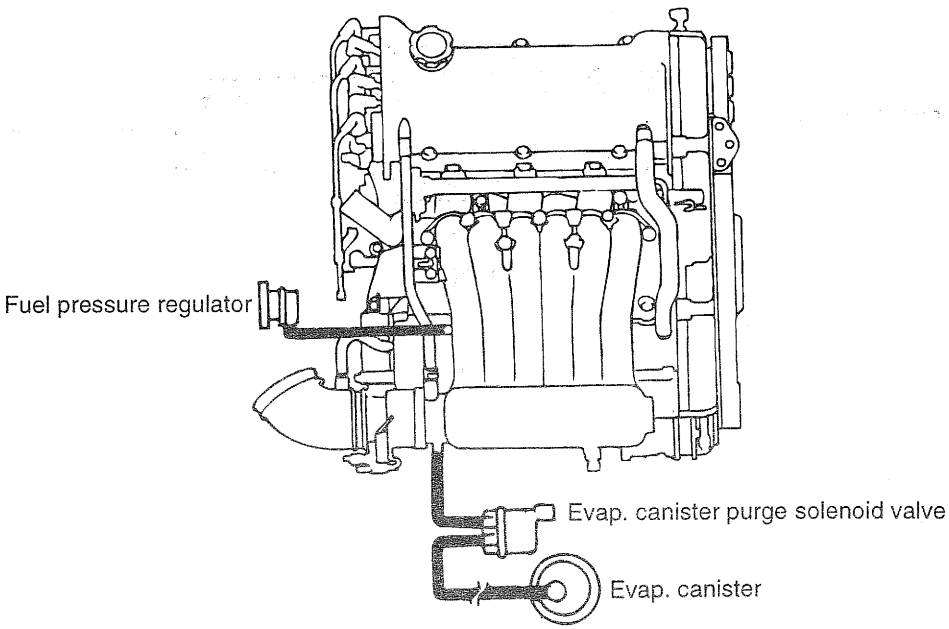
EEA9009B

VACUUM HOSES LAYOUT EEHA0110

[2.0 I4]



[2.7 V6]

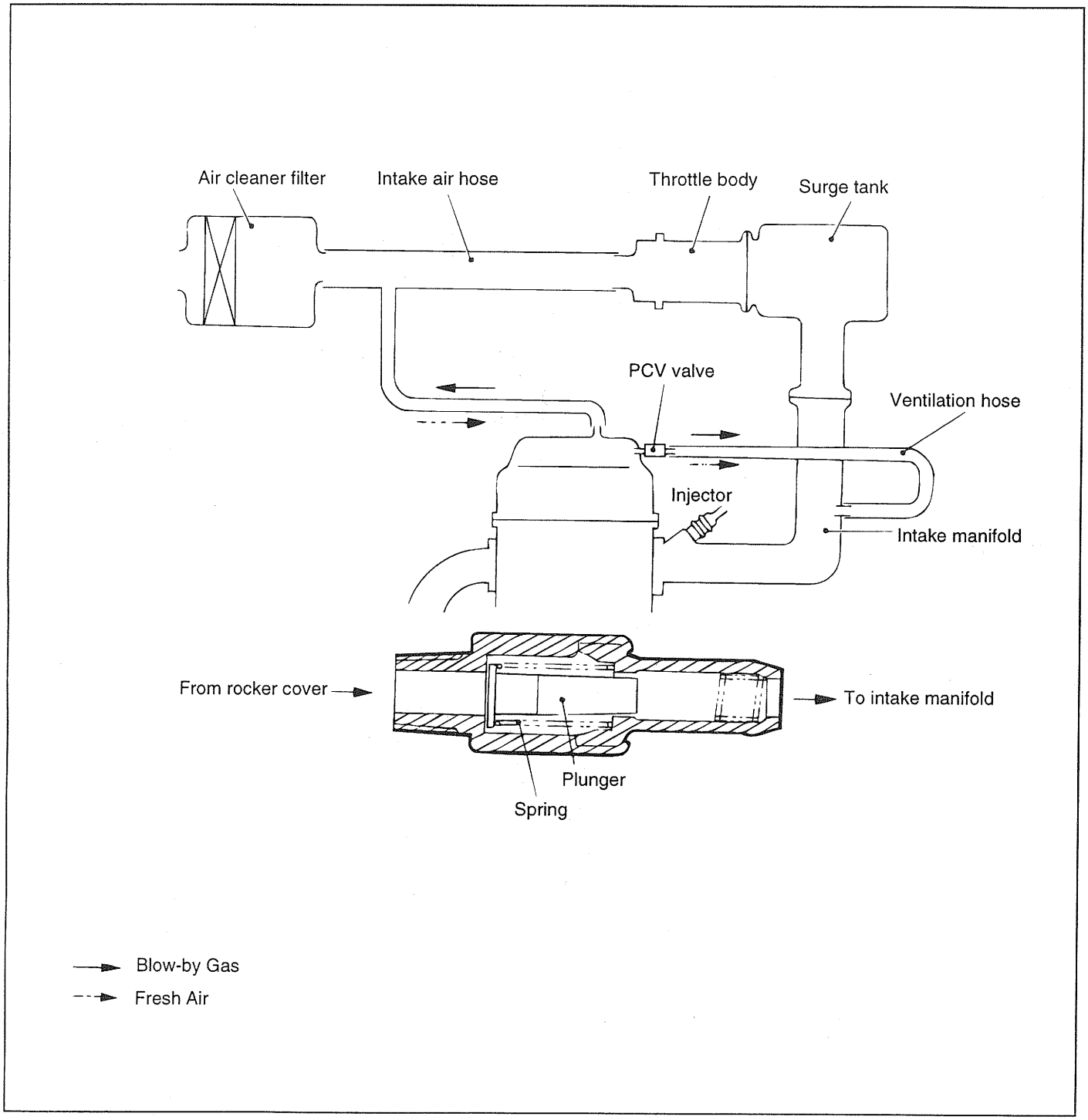


EEHA011A

CRANKCASE EMISSION CONTROL SYSTEM

POSITIVE CRANKCASE VENTILATION (PCV) VALVE EEA90120

COMPONENTS

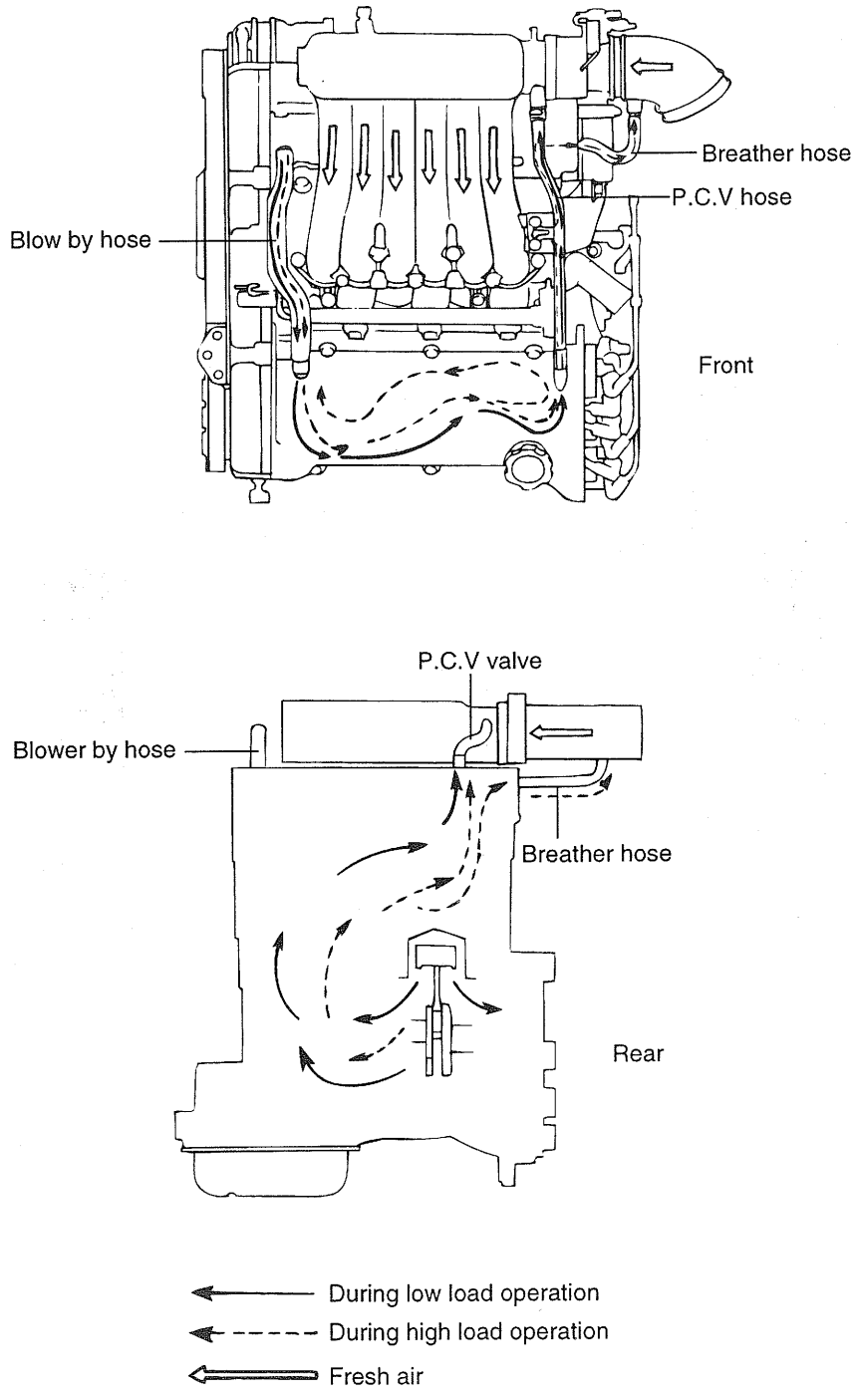


EEA9012A

POSITIVE CRANKCASE VENTILATION (PCV) VALVE EEHA0130

COMPONENTS

[2.7 V6]

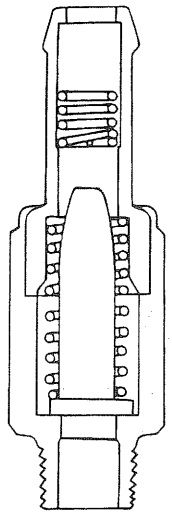


EEHA013A

PCV VALVE OPERATING

EEA90140

Intake manifold side (No vacuum)

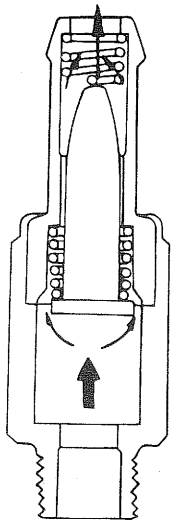


EEA9014A

Rocker cover side

Engine condition	Not running
PCV valve	Not operating
Vacuum passage	Restricted

Intake manifold side (High vacuum)

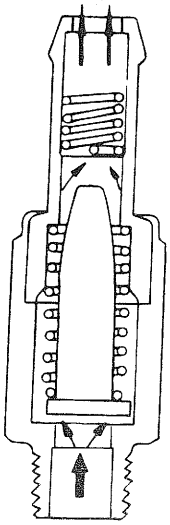


EEA9014B

Rocker cover side

Engine condition	Idling or decelerating
PCV valve	Fully operating
Vacuum passage	Small

Intake manifold side (Moderate vacuum)

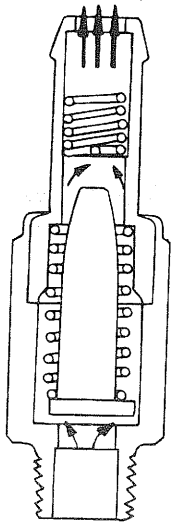


EEA9014C

Rocker cover side

Engine condition	Normal operation
PCV valve	Properly operating
Vacuum passage	Large

Intake manifold side (Low vacuum)



EEA9014D

Rocker cover side

Engine condition	Accelerating and high load
PCV valve	Slightly operating
Vacuum passage	Much large

DISASSEMBLY EEA90150

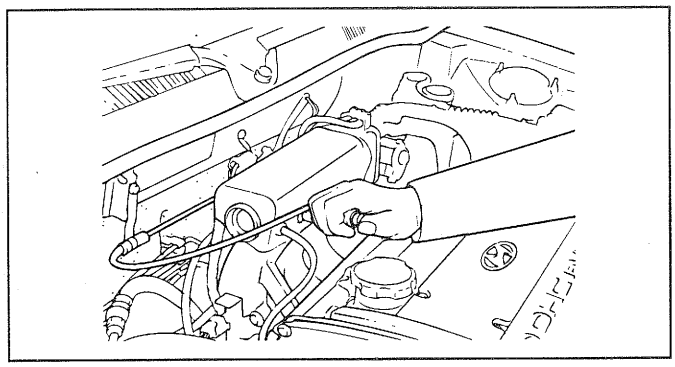
1. Disconnect the ventilation hose from the positive crankcase ventilation (PCV) valve. Remove the PCV valve from the rocker cover and reconnect it to the ventilation hose.

2. Run the engine at idle and put a finger on the open end of the PCV valve and make sure that intake manifold vacuum is felt.

NOTE

The plunger inside the PCV valve will move back and forth.

3. If vacuum is not felt, clean the PCV valve and ventilation hose in cleaning solvent, or replace if necessary.



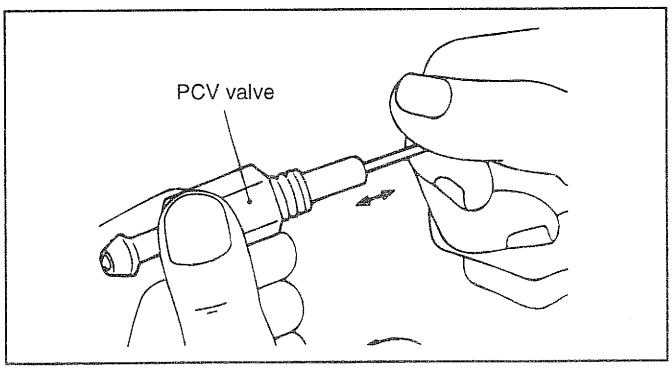
EEA9015A

INSPECTION

1. Remove the positive crankcase ventilation valve.

2. Insert a thin stick into the positive crankcase ventilation valve from the threaded side to check that the plunger moves.

3. If the plunger does not move, the positive crankcase ventilation valve is clogged. Clean or replace it.



EEA9015B

INSTALLATION

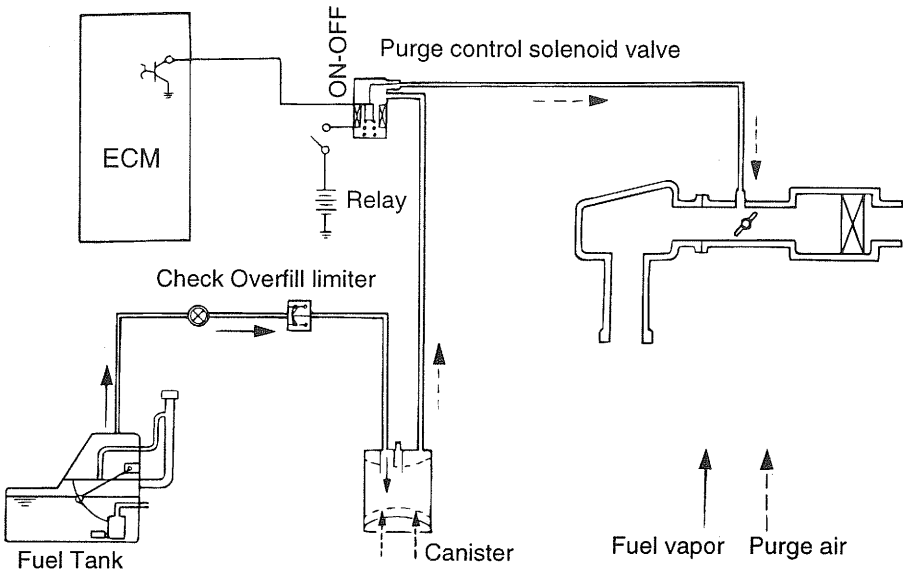
Install the positive crankcase ventilation valve and tighten to the specified torque.

Tightening torque PCV valve : 8-12 Nm(80-120 kg.cm, 6-8 lb.ft)

EVAPORATIVE EMISSION CONTROL SYSTEM

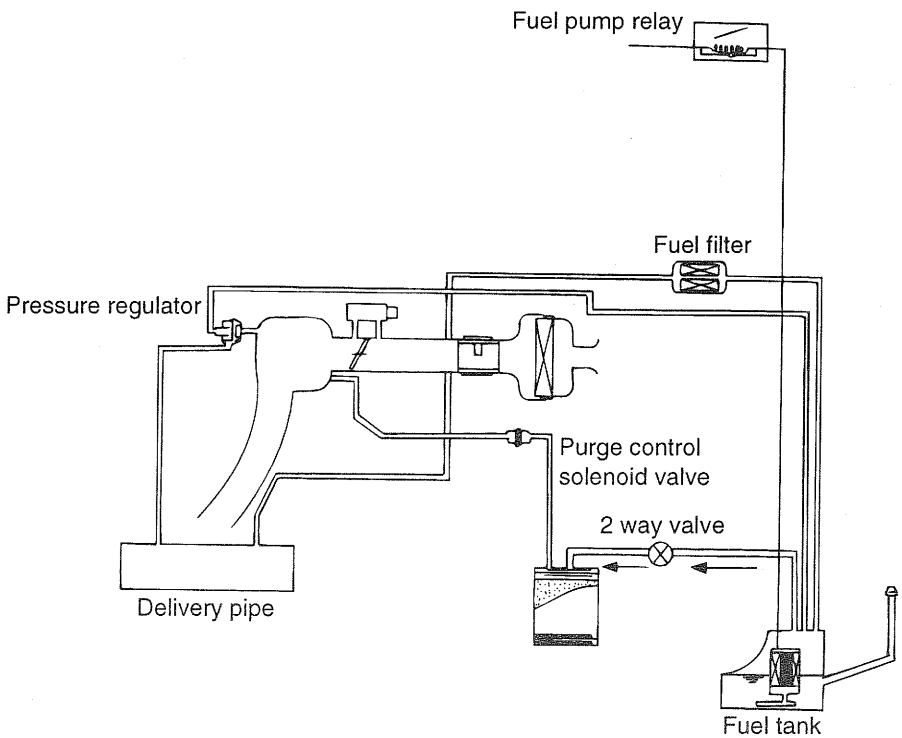
COMPONENTS EEHA0180

[2.0 I4]



EEA9016A

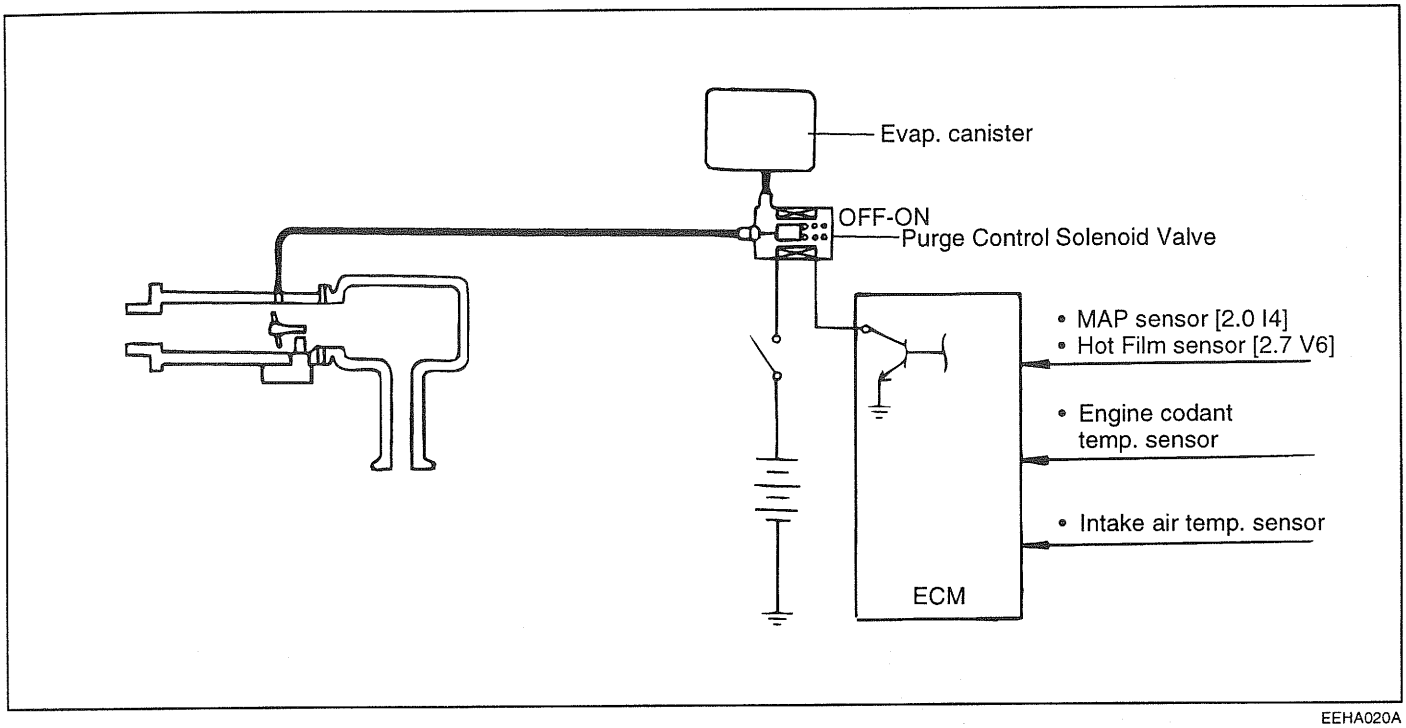
[2.7 V6]



EEA9016B

EEHA018A

EVAPORATIVE (EVAP) CANISTER PURGE SOLENOID VALVE EEHA0200

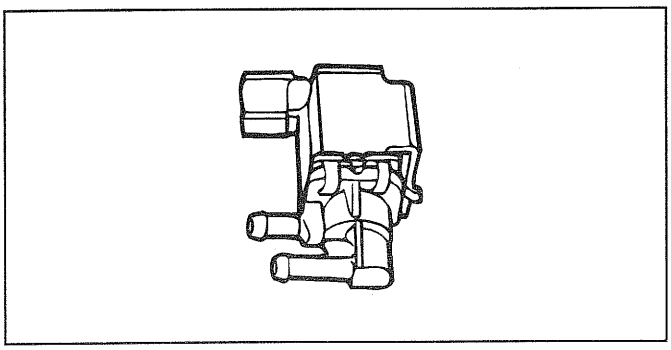


EEHA020A

EVAP CANISTER PURGE SOLENOID VALVE

NOTE

The EVAP Canister Purge Solenoid Valve is controlled by the ECM; when the engine coolant temperature is low, and also during idling, the valve closes so that evaporated fuel is not drawn into the surge tank. After the warm-up of the engine during ordinary driving, valve opens to let the stored vapors flow into the surge tank.

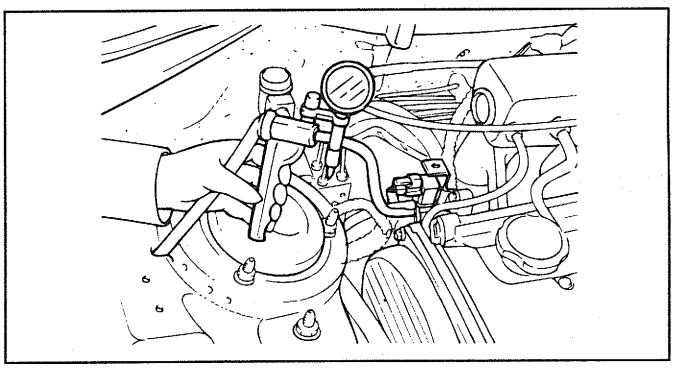


EEAA024A

INSPECTION

NOTE

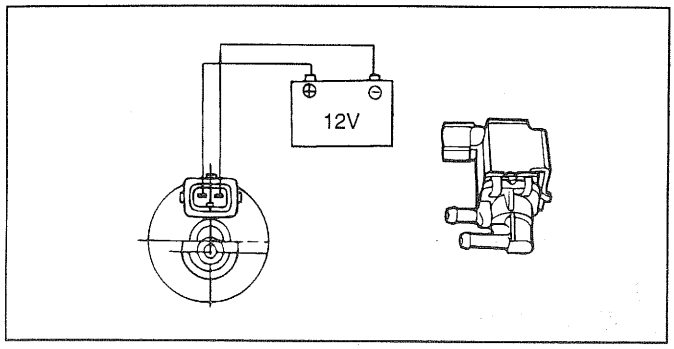
When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.



EEA9020B

1. Disconnect the vacuum hose (black with red stripe) 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 EVAP Canister Purge Solenoid Valve and when the voltage is discontinued.

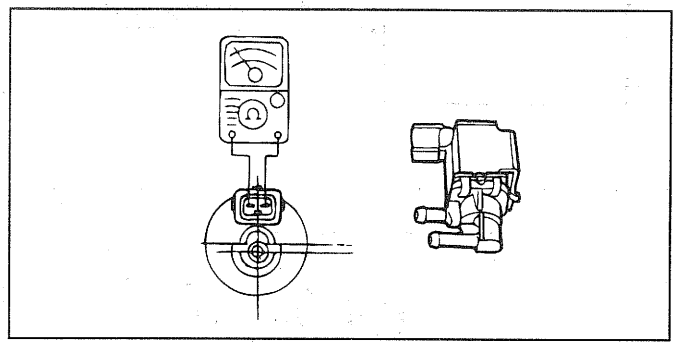
Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained



EEAA020C

5. Measure the current between the terminals of the solenoid valve.

EVAP Canister Purge Solenoid Valve:
Coil at 20°C (68°F) : 0.45A or below (at 12V)
Coil resistance : 26Ω [at 20°C (68°F)]

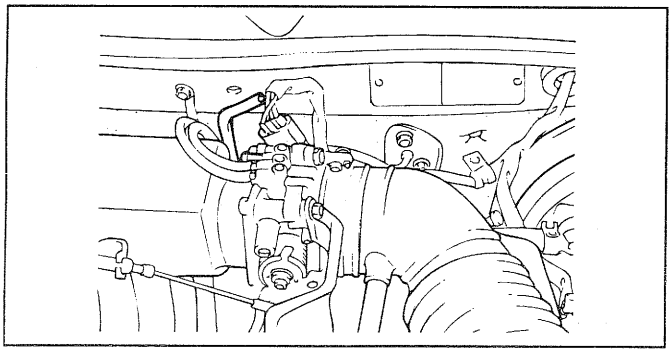


EEAA020D

VACUUM HOSE

Engine coolant temperature : 80-95°C (176-205°F)

1. Disconnect the vacuum hose from the intake manifold purge hose nipple and connect a hand vacuum pump to the nipple.

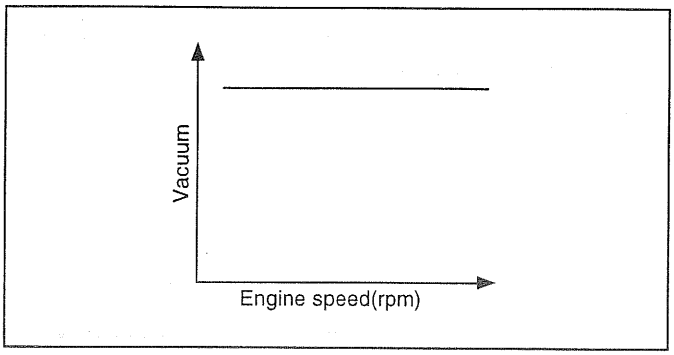


EEA9023A

2. Start the engine and check that, after raising the engine speed by racing the engine, vacuum remains fairly constant.

NOTE

If there is no vacuum created, the intake manifold port may be clogged and require cleaning.



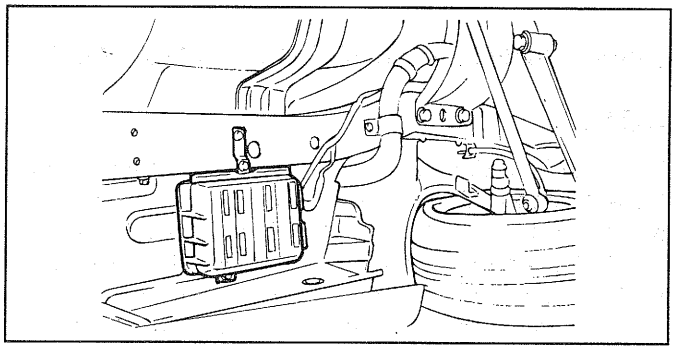
EEA9023B

EVAPORATIVE (EVAP) CANISTER EEHA0240

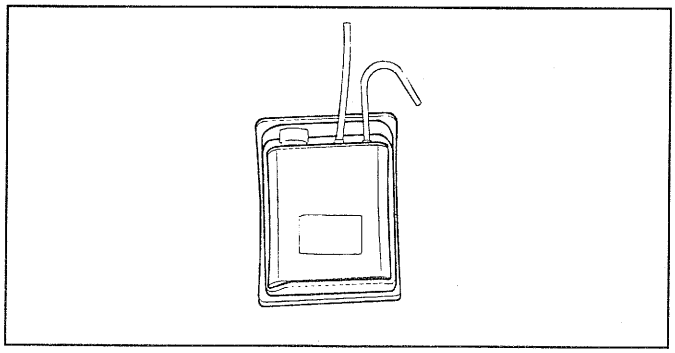
CANISTER

For monitoring, a CCV and an air filter exists as in the illustration.

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.



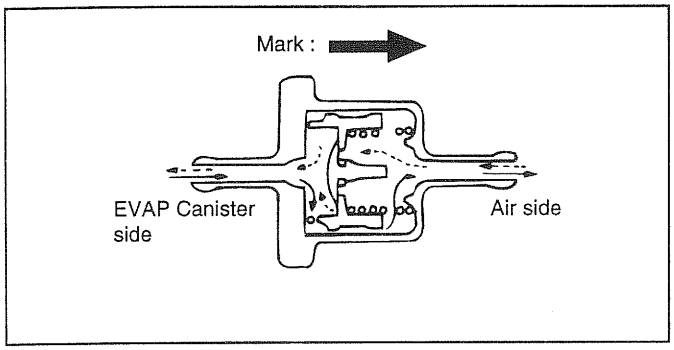
EEA9005E



EEHA005E

TWO-WAY VALVE

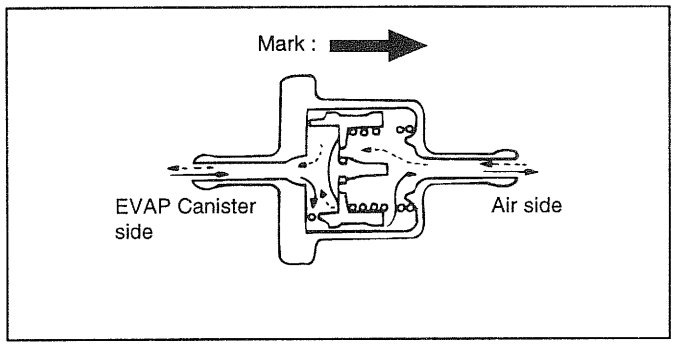
1. Inspect that air flows as shown.
2. Check to connect correctly such as the arrow mark on the valve.



V5EC201D

OVERFILL LIMITER (TWO WAY VALVE) EEAA0250

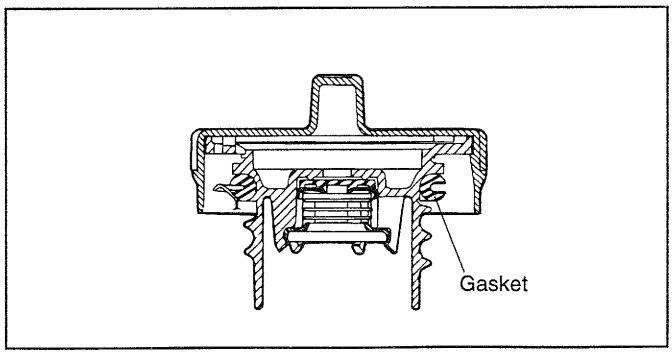
To inspect the overfill limiter (two-way valve), refer to Fuel tank.



V5EC201D

FUEL FILER CAP EEAA0260

Check the gasket of the fuel filler cap, and the filler cap itself, for damage or deformation. Replace the cap if necessary.



V5EC205A

EXHAUST EMISSION CONTROL SYSTEM

VEHICLES WITH CATALYTIC CONVERTER EEA90270

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. Additional control devices include a catalytic converter.

These systems have been integrated into a highly effective system which controls exhaust emissions while maintaining good driveability and fuel economy.

AIR/FUEL MIXTURE RATIO CONTROL SYSTEM [MULTIPORT FUEL INJECTION (MFI) SYSTEM] EEA90280

The MFI system employs the signals from the heated oxygen sensor to activate and control the injector installed in the manifold for each cylinder, precisely regulating the air/ fuel mixture ratio and reducing emissions.

This 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. The two operating modes in the MFI system are as follows:

1. Open loop-air/fuel ratio is controlled by information programmed into the ECM during the manufacturing process.
2. Closed loop-air/fuel ratio varies by the ECM based on information supplied by the heated oxygen sensor.

Engine Electrical System

GENERAL

SPECIFICATIONS EBHA0010

IGNITION

	2.0 I4 Liter Engine	2.7 V6 Liter Engine
Type	Mold coil	
Primary coil resistance	0.86 ± 0.09 (Ω)	0.74 ± 10% (Ω)
Secondary coil resistance	12.1 ± 1.8 (KΩ)	13.3 ± 15% (KΩ)

SPARK PLUG

	2.0 I4	2.7 V6
Type	RN9YC4 BPR6ES-11	RFR5N-11 RFR6N-11 RC10PYP4
Plug gap	1.0-1.1 mm (0.039-0.043 in.)	

STARTER MOTOR

	All Engines
Type	Reduction drive (with planetary gear)
Voltage	12V
Output	1.2 KW
No-load characteristics	
Terminal voltage	11V
Amperage	90A or below
Speed	2,800 RPM MIN
Number of pinion teeth	8
Pinion gap	0.5-2.0 mm (0.0197-0.079 in.)

GENERATOR

	All Engines
Type	Battery voltage sensing
Rated output	13.5V / 95A
Voltage regulator type	Electronic built-in type
Regulator setting voltage	14.4 ± 0.3 V
Temperature compensated	-10 ± 3 mV/°C

BATTERY

	2.0 I4 Liter Engine	2.7 V6 Liter Engine
Type	MF60AH	MF 68 AH
Ampere hours		
5HR	48 AH or more	55 AH or more
Cold cranking [at -17.8°C (0°F)]	550 A or more	540 AH or more
Reverse capacity	92 min.	122 min.
Specific gravity [at 25°C (77°F)]	1.280 ± 0.01	1.280 ± 0.01

NOTE

COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 or greater at a specified temperature. REVERSE CAPACITY RATING is the amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5 at 26.7°C (80°F).

CRUISE CONTROL SYSTEM

Speed control module	
Operating voltage range	DC 10 - 16V
Operating temperature	-30 - +75°C (-22 - +167°F)
Voltage drop between unit and actuator	0.4V
Operating speed range	Low speed limit : 40 ± 3 km/h (25 ± 2 mph)
	High speed limit : 145 ± 5 km/h (90 ± 3 mph)
Actuator	
Rated voltage	DC 12V
Operating temperature	-30 - +90°C (-22 - +194°F)
Operating consumption	3A or less (at 12V 20°C)
Insulating resistance	1MΩ or less (at 500V megger)
Cruise main switch	
Rated voltage	DC 12V
Operating force	0.3 - 1.0 kg
Voltage drop	0.15 V or less
Stop lamp switch	
Rated voltage	DC 12V
Rated load	
Stop lamp	27 x 5W (lamp load)
Cruise control	0.1 - 0.5A (relay load)
Insulating resistance	Min 3 MΩ (by 500V megger)

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

TROUBLESHOOTING EBA90030

IGNITION SYSTEM

Trouble condition	Probable cause	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch faulty	Replace ignition lock switch
	Ignition coil faulty	Inspect ignition coil
	Power transistor faulty	Inspect power transistor
	Spark plugs faulty	Replace plugs
	Ignition wiring disconnected or broken	Inspect wiring
	Spark plugs faulty	Replace plugs
Rough idle or stalls	Ignition wiring faulty	Inspect wiring
	Ignition coil faulty	Inspect ignition coil
	Spark plug cable faulty	Inspect spark plug cable
Engine hesitates/poor acceleration	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Inspect ignition coil
Poor mileage	Spark plugs faulty	Replace plugs

CHARGING SYSTEM

Trouble condition	Probable cause	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connections
	Electronic voltage regulator faulty	Replace voltage regulator
Charging warning indicator does not go out with engine running (Battery requires frequent recharging)	Drive belt loose or worn	Adjust tension or replace drive belt
	Battery cables loose, corroded or worn	Repair or replace cables
	Fuse blown	Check fuses
	Fusible link blown	Replace fusible link
	Electronic voltage regulator or generator faulty	Test generator
	Wiring faulty	Repair wiring

Trouble condition	Probable cause	Remedy
Engine hesitates/poor acceleration Overcharge	Drive belt loose or worn	Adjust tension or replace drive belt
	Wiring connection loose or open circuit	Tighten loose connection or repair wiring
	Fusible link blown	Replace fusible link
	Poor grounding	Repair
	Electronic voltage regulator or generator faulty	Test generator
	Worn battery	Replace battery
	Electronic voltage regulator faulty	Replace voltage regulator
	Voltage sensing wire faulty	Repair wire

STARTING SYSTEM

Trouble condition	Probable cause	Remedy
Engine will not crank	Battery charge low	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 charge low	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

CRUISE CONTROL SYSTEM PRE-TROUBLESHOOTING

PRE-TROUBLESHOOTING

Before starting troubleshooting, inspect each of the following sections, and if there is an abnormality, carry out a repair.

1. Check if the installation and connection routes of the cables and vacuum hoses of the cruise vacuum pump assembly, actuator and pulley assembly are all normal.
2. Check if the pulley assembly and the movement of all cables are all working smoothly.
3. Check if there is no excessive play or tension in each cable.

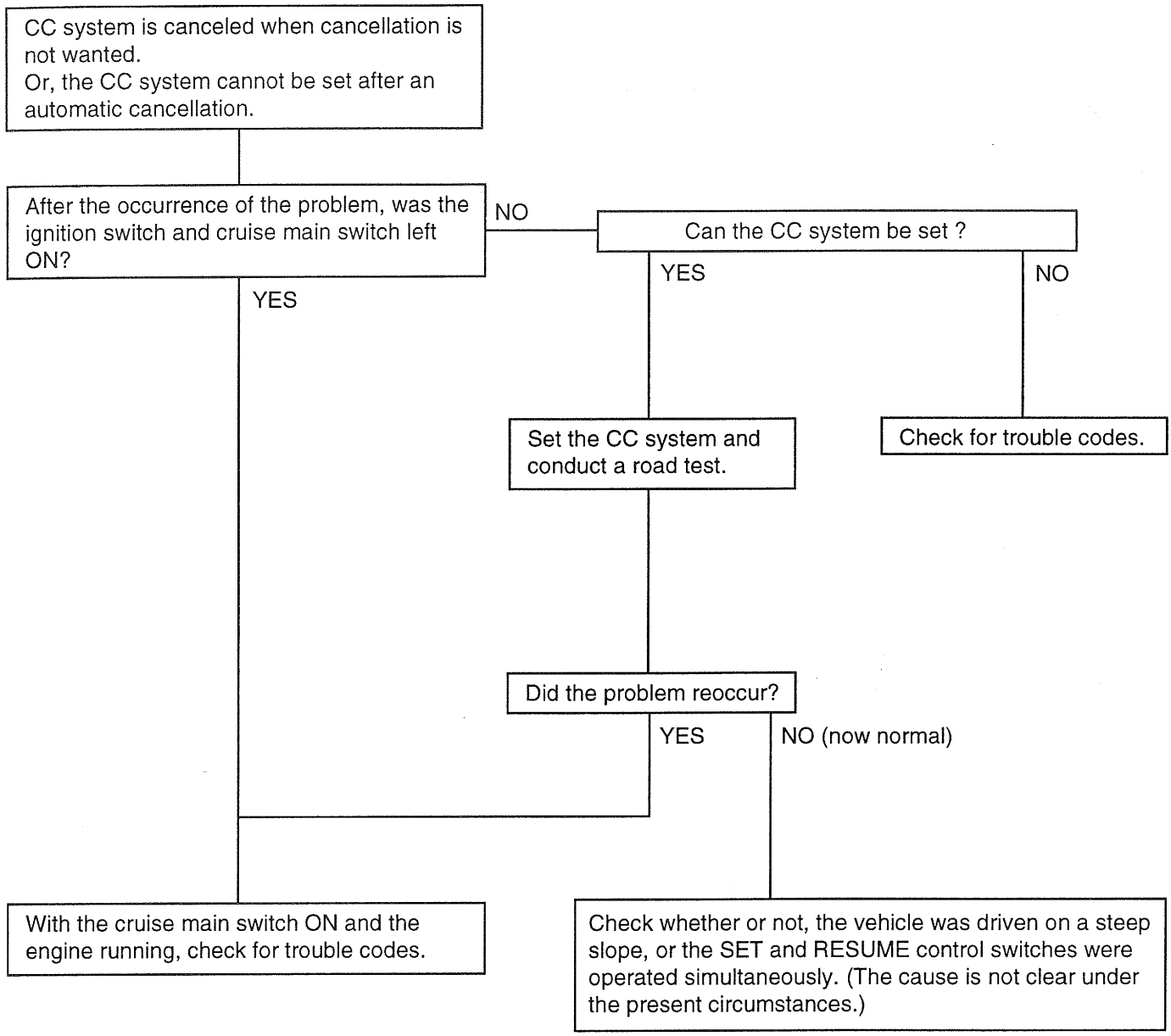
TROUBLESHOOTING PROCEDURES

First, select the applicable malfunction symptom from the Trouble Symptom charts. Determine the condition of all function circuits.

1. Make the following preliminary inspections.
   - Check that the installation of the actuator, accelerator cable are correct, and that the cables and links are securely connected.
   - Check that the accelerator pedal moves smoothly.
   - Adjust the cable so there is not excessive tension or excessive play on the accelerator cable.
   - Check that the actuator and unit assembly, cruise main, control switch and the connector of each cancel switch are connected securely.
2. Check in the sequence indicated in the "Trouble Symptom" chart.
3. If a normal condition is indicated, replace the cruise control module.

TROUBLE SYMPTOM CHARTS

TROUBLE SYMPTOM 1



CC : Cruise Control

EBA9003A

TROUBLE SYMPTOM 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the speedometer cable or speedometer drive gear	
	Cruise vacuum pump circuit poor contact	Repair the actuator system, or replace the part
	Malfunction of the acutator and unit	Replace the actuator and unit

TROUBLE SYMPTOM 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the stop lamp switch	Repair the harness or replace the stop lamp switch
	Cruise vacuum pump drive circuit short-circuit	Repair the harness or replace the vacuum pump
	Malfunction of the actuator and unit	Replace the actuator and unit

TROUBLE SYMPTOM 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace the inhibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the actuator and unit	Replace the actuator and unit

TROUBLE SYMPTOM 5

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	Repair the harness or replace the SET switch
	Actuator circuit poor contact	Repair the harness or replace the actuator
	Malfunction of the actuator	
	Malfunction of the actuator and unit	Replace the actuator and unit

TROUBLE SYMPTOM 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or replace the RESUME switch
	Actuator circuit poor contact	Repair the harness or replace the actuator
	Malfunction of the actuator	
	Malfunction of the actuator and unit	Replace the actuator and unit

TROUBLE SYMPTOM 7

Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the speedometer cable or the speedometer drive gear	
	Malfunction of the actuator and unit	Replace the actuator and unit

TROUBLE SYMPTOM 8

Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

TROUBLE SYMPTOM 9

Trouble symptom	Probable cause	Remedy
Malfunction of control function by ON/OFF switching of idle switch	Malfunction of circuit related to idle switch function	Repair the harness or replace the part
	Malfunction of the actuator and unit	

TROUBLE SYMPTOM 10

Trouble symptom	Probable cause	Remedy
Overdrive is not canceled during fixed speed driving	Malfunction of circuit related to overdrive cancelation, or malfunction of actuator and unit	Repair the harness or replace the part
No shift to overdrive during manual driving		

IGNITION SYSTEM

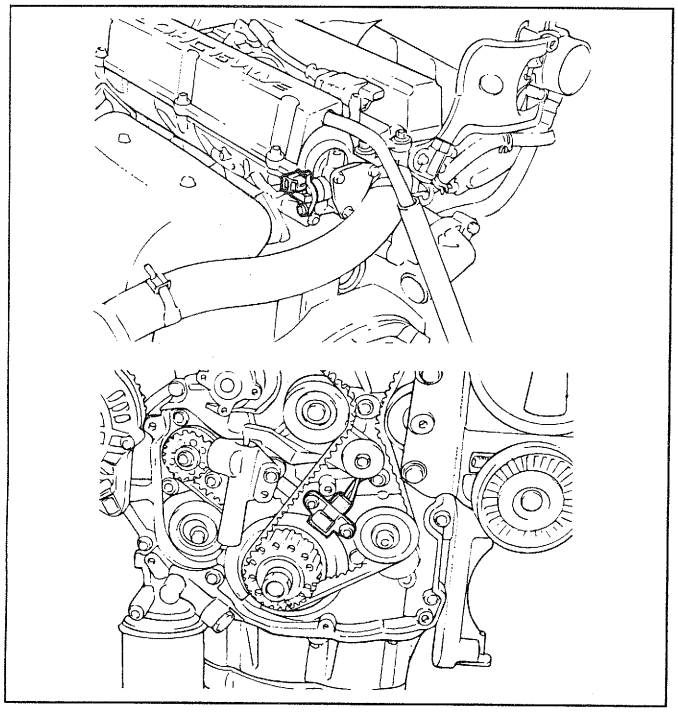
GENERAL INFORMATION EBA90040

Ignition timing is controlled by the electric control ignition timing system. The ignition timing data for the engine operating conditions are programmed in the memory of the engine control module (ECM).

The engine conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based upon these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the power transistor. The ignition coil is activated and timing is controlled at the optimum point.

*CKP : Crankshaft Position

*CMP : Camshaft Position



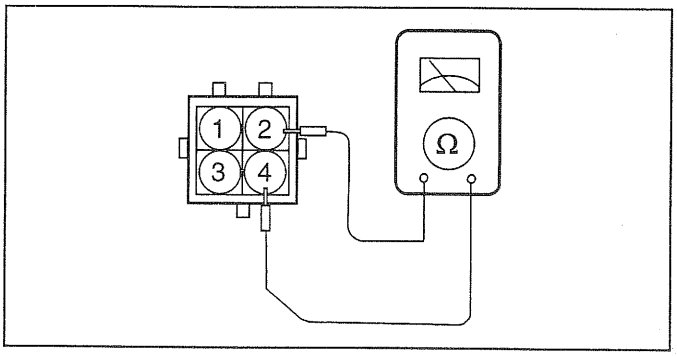
EBA9004A

IGNITION COIL (2.7L V6 ENGINE) EBHA0060

1. **Measurement of the primary coil resistance**

   Measure the resistance between connector terminals 1 and 2 (the coils at the No. 3 and No. 6 cylinder sides) of the ignition coil, and between terminals 2 and 4 (the coils at the No. 1 and No. 4 cylinder sides), and between terminals 2 and 3 (the coils at the No.2 and No.5 cylinder sides).

   Standard value : 0.74 ± 10% (Ω)



EBHA006A

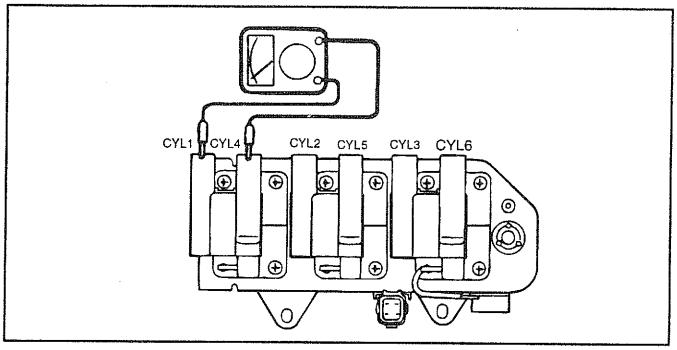
2. **Measurement of the secondary coil resistance**

   Measure the resistance between the high-voltage terminal for the No. 3 and No. 6 cylinders, between the high-voltage terminals for the No. 1 and No. 4 cylinders and between the high-voltage terminals for the No.2 and No.5 cylinders.

   Standard value : 13.3 ± 15% (KΩ)

CAUTION

When measuring the resistance of the secondary coil, be sure to disconnect the connector of the ignition coil.



EBA9009B

IGNITION SYSTEM (DOHC)

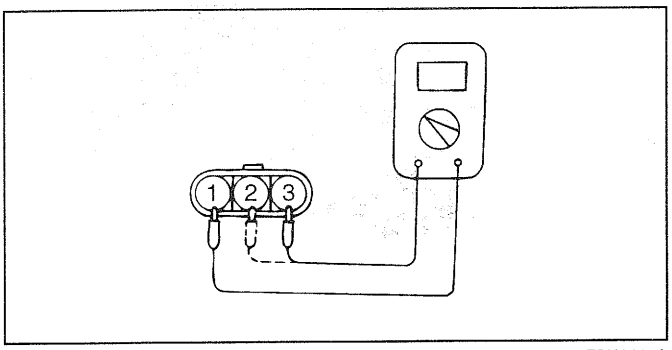
IGNITION COIL (2.0 I4 ENGINE : POWER TRANSISTOR BULILT-IN) EBHA0070

1. **Measurement of the primary coil resistance**

   Connect the negative (-) terminal of a 3V power supply to terminal 2 of the power transistor; then check whether there is continuity between terminal 3 and terminal 2 when terminal 1 and the positive (+) terminal are connected and disconnected.

Terminal 3 and (+) terminal	Terminal 1 and (+) terminal 2
Connected	Continuity (Approximately 0.86Ω)
Disconnected	Non continuity

Replace the power transistor if there is malfunction.

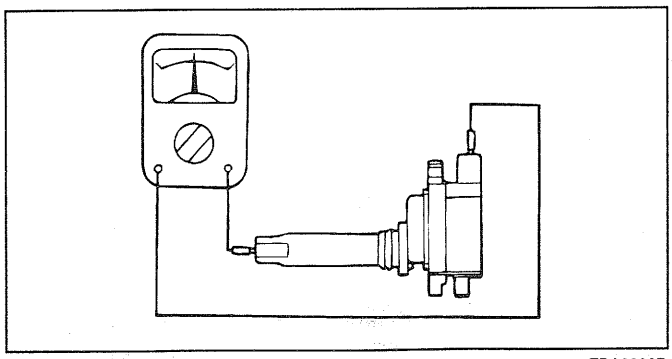


EBHA007A

2. **Measurement of the secondary coil resistance**

   Measure the resistance between the high-voltage terminals of the ignition coil.

   Standard value: Approximately 12 kΩ



EBA9009D

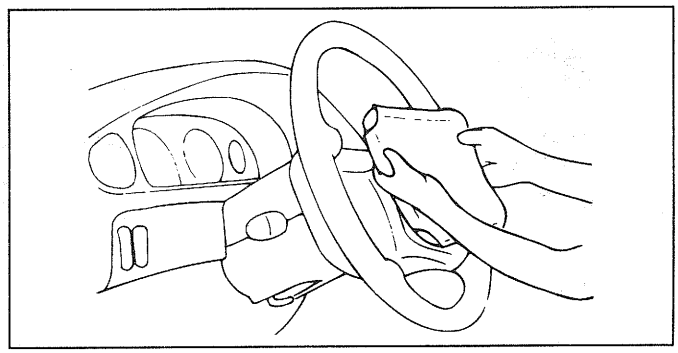
REMOVAL AND INSTALLATION EBA90070

1. Disconnect the negative battery terminal.
2. Remove the air bag module.

CAUTION

The SRS system is designed to retain enough power to deploy air bag for about 30 seconds even after battery has been disconnected, so serious injury may result from unintended air bag deployment if service is done on the SRS system immediately after battery cable is disconnected.

3. Loosen the tapping screw and lift up horn pad and remove it.
4. Remove the lock nut and the washer.
5. Pulling the dynamic damper forward, lift it up and remove it.

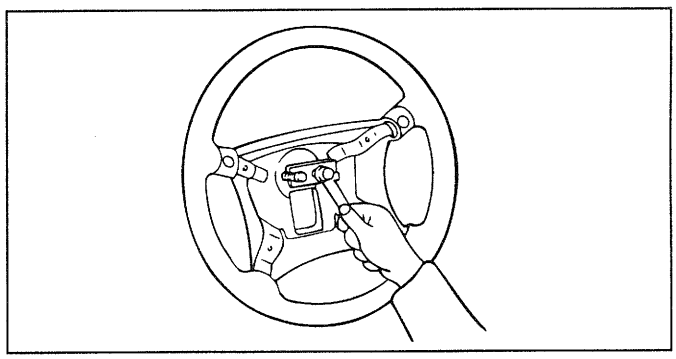


EBA9010A

6. Install the special tool (09561–11001) and remove the steering wheel.

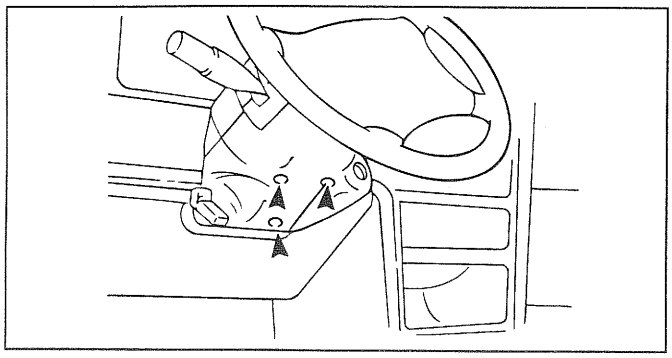
CAUTION

Do not hammer on the steering wheel to remove it.



EBA9010B

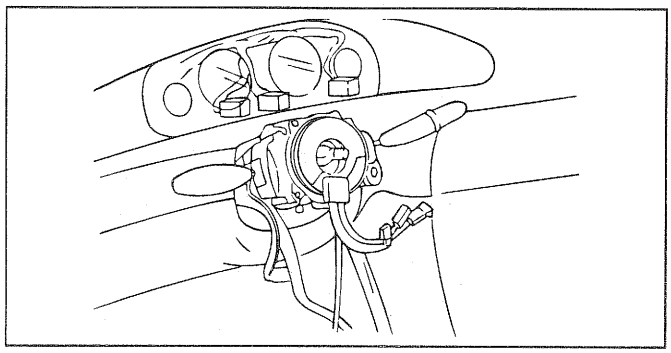
7. Remove the steering column lower and upper shrouds.
8. Remove the lower cover.



EBA9010C

9. Disconnect the connectors and remove the multi-function switch.

10. Remove the mounting bolts and separate ignition switch from steering column.



EBA9010D

INSPECTION EBHA0080

1. Separate the connector located under the steering column.

2. Inspect the switch continuity between the terminals.

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

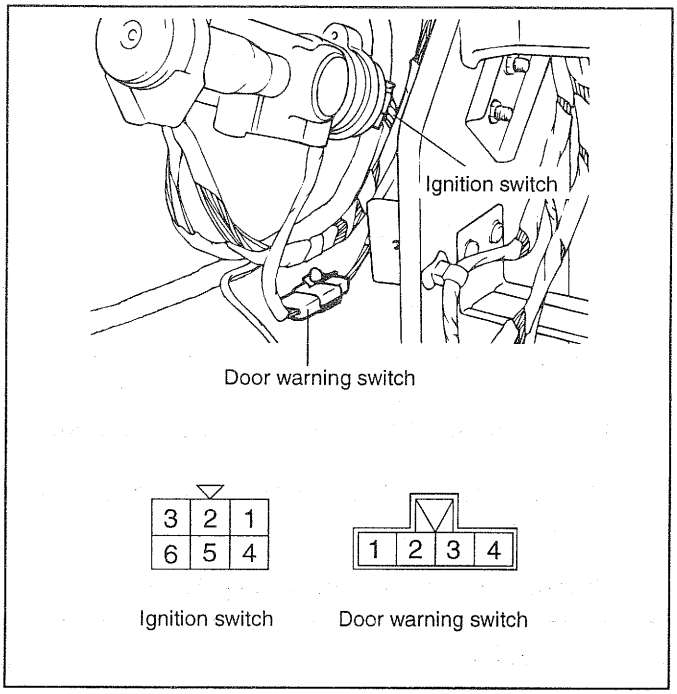
Position \ Terminal	Key	Ignition switch 6	5	4	3	2	1	Door warning switch and key illumination 4	3	2	1	Lock RO	RE
LOCK	Removed									○—○		L	L
LOCK	Inserted											L	F
ACC	Inserted			○	—	—	○					F	F
ON1	Inserted		○	—	○	—	○					F	F
START	Inserted				○	—	○					F	F
ON2	Inserted		○	—	—	—	○					F	F

NOTE

○—○ indicates that there is continuity between the terminal.

RO : Round the locking bar
RE : Return the locking bar
L : Lock
F : Free

EBHA080A



EBHA080B

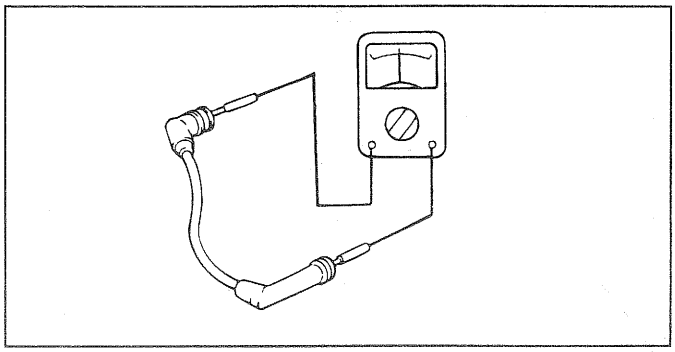
HINTS

If engine will not crank, determine whether the condition exists with the transaxle range switch in the "PARK" or in the "NEUTRAL" position.

If the "NO-CRANK" condition occurs in one shift lever position but not the other, a more probable cause is the transaxle range switch.

SPARK PLUG TEST EBHA0090

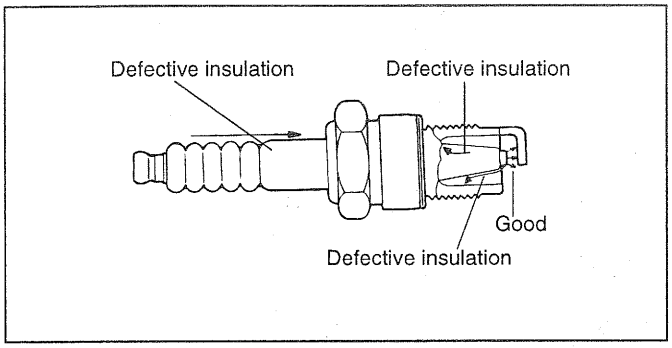
1. Remove the spark plug and connect to the spark plug cable.
2. Ground the spark plug outer electrode and crank the engine.
3. Check to be sure that there is an electrical discharge between the electrodes at this time.



EBA9009G

CAUTION

When replacing the spark plug, use the genuine parts which have resistance.



EBA9009F

SPARK PLUG CABLES TEST

1. Disconnect one at a time each of the spark plug cables while the engine is idling to check whether the engine's running performance changes or not.

CAUTION

Wear rubber gloves while operating.

2. If the engine performance does not change, check theyresistance of the spark plug, and check the spark plug itself.
3. Check the cap and outer shell for cracks.
4. Measure the resistance.

FOR 2.7 LITER ENGINE

Spark plug cable (KΩ)					
No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
4.39 ~6.59	2.28 ~ 3.43	3.49 ~5.24	1.9 ~2.86	3.25 ~ 4.87	1.3 ~ 1.95

NOTE

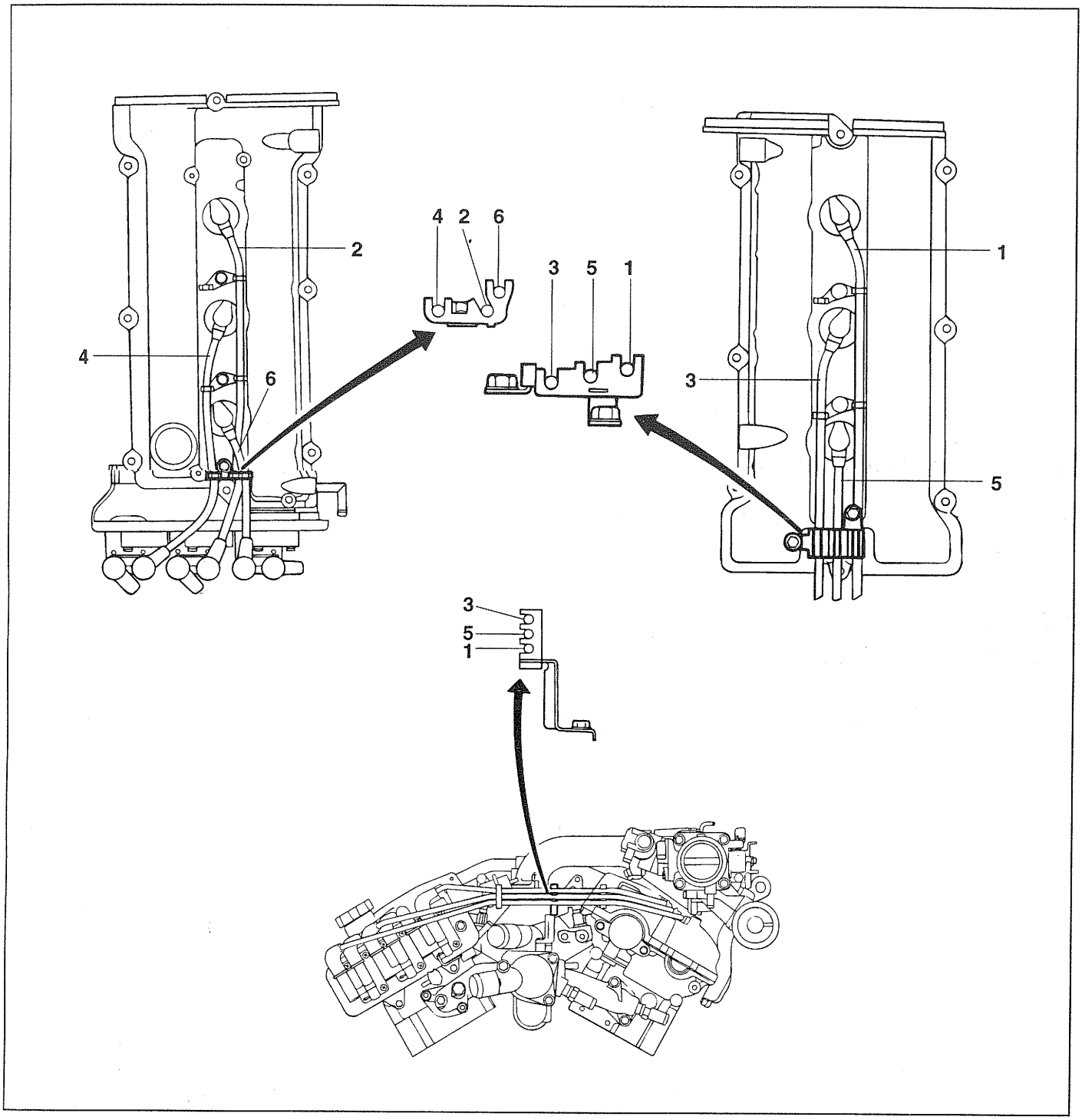
Resistance should not be higher than 10,000Ω-per foot of cable. If resistance is higher, replace the cable.

IGNITION SYSTEM (V6)

INSTALLATION OF SPARK PLUG CABLE (V6 2.7 LITER ENGINE) EBHA0100

Improper arrangement of spark plug cables will induce voltage 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.



EBA9010E

INSPECTION AND CLEANING EBHA0110

1. Disconnect the spark plug cable from the spark plug.

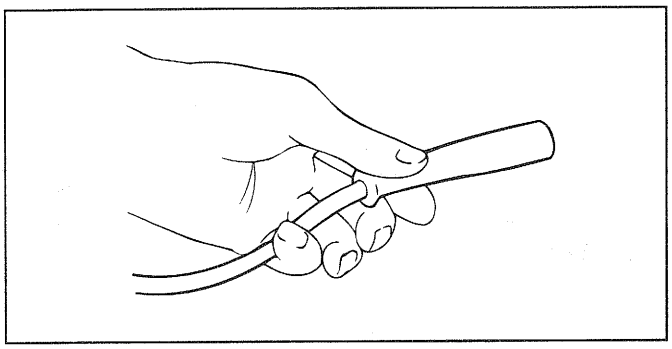
NOTE

Pull on the spark plug cable boot when removing the spark plug cable, not the cable, as it may be damaged.

2. Using the spark plug wrench, remove all of the spark plugs from the cylinder head.

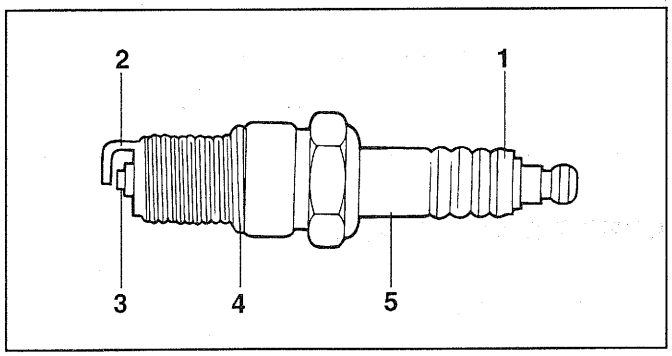
NOTE

Take care not to allow contaminants to enter through the spark plug holes.



EBA9015A

3. Check spark plugs for the following:
   1) Broken insulator
   2) Worn electrode
   3) Carbon deposits
   4) Damaged or broken gasket
   5) Condition of the porcelain insulator at the tip of the spark plug

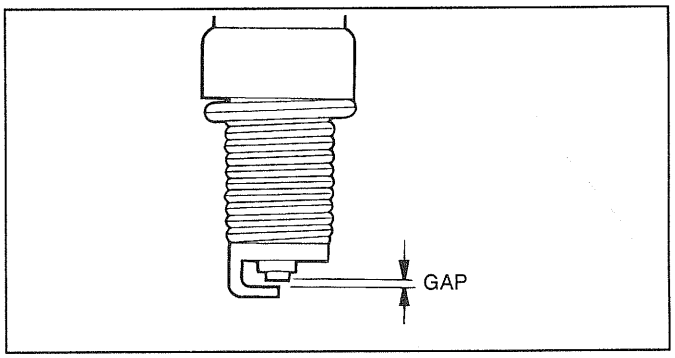


EBA9015B

4. Check the spark plug gap using a wire gap gauge, and adjust if necessary.

Standard value

Spark plug gap : 1.0-1.1 mm (0.039-0.043 in.)



EBA9015C

5. Re-insert the spark plug and tighten to the specified torque. If it is overtorqued, damage to the threaded portion of cylinder head may result.

Tightening torque

Spark plug : 20-30Nm (200-300kg·cm, 15-22 lb·ft)

NOTE

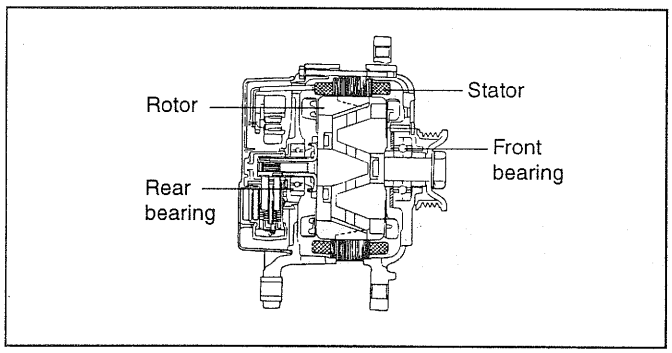
When replacing the spark plug, use the genuine parts which have resistance.

CHARGING SYSTEM

GENERAL INFORMATION EBA90120

The charging system included a battery, an 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 AC current to DC current. Therefore, DC current appears at generator "B" terminal.

In addition, the charging voltage of this generator is regulated by the battery voltage detection system. 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 V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.



EBA9130A

INSPECTION EBHA0130

VOLTAGE DROP TEST OF GENERATOR OUTPUT WIRE

This test determines whether or not the wiring between the generator "B" terminal and the battery (+) terminal is good by the voltage drop method.

PREPARATION

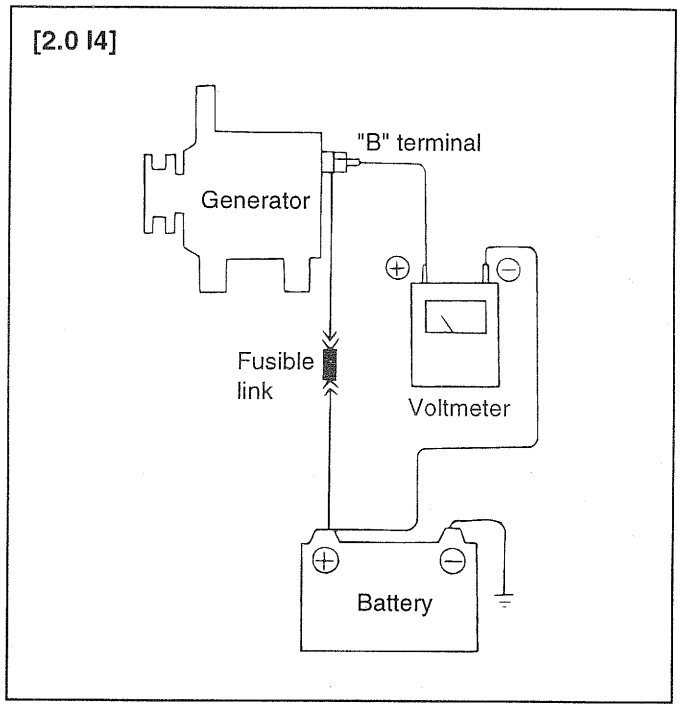
1. Turn the ignition switch to "OFF".

NOTE

To find abnormal conditions of the connection, actions should not be taken on the two terminals and each connection during the test.

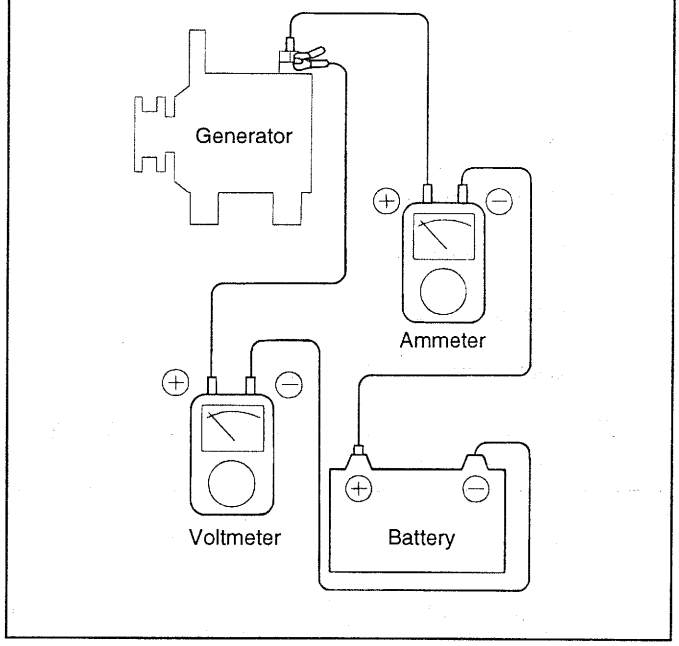
2. Connect a digital voltmeter between the generator "B" terminal and battery (+) lead wire to the battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.

[2.0 I4]



EBHA013A

[2.7 V6]



EBHA013B

CONDITIONS FOR THE TEST

1. Start the engine.
2. Switch on the headlamps, blower motor and so on. And then, read the voltmeter under this condition.

RESULT

1. The voltmeter may indicate the standard value.

   Standard value : 0.2V max.

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the generator "B" terminal to the fusible link to the battery (+) terminal. Check for loose connections, color change due to an overheated harness, etc. Correct them before testing again.

3. Upon completion of the test, set the engine speed at idle. Turn off the head lamps, blower motor and the ignition switch.

OUTPUT CURRENT TEST

This test determines whether or not 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.

    1) Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking method is de scribed in "BATTERY".

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.

    2) Check the tension of the generator drive belt. The belt tension check method is described in the section "COOLING".

2. Turn off the ignition switch.

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

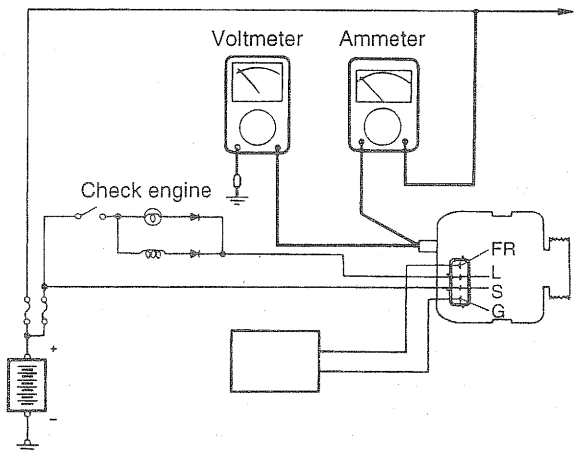
Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

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.

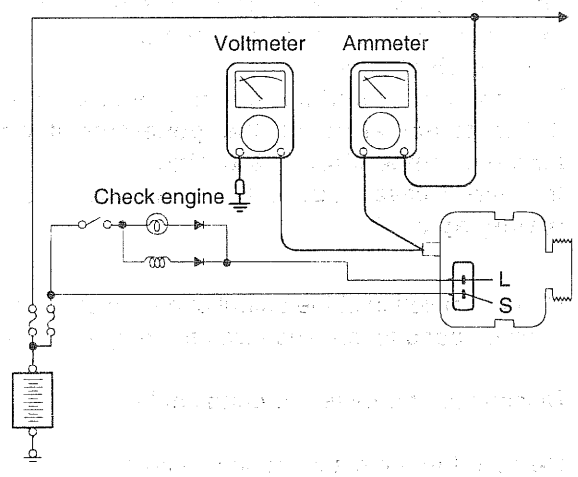
8. Leave the engine hood open.

[2.0 I4]



HE27-007

[2.7 V6]



EBHA203B

TEST

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between the generator "B" terminal and battery (-) terminal, a blown fusible link or poor grounding is suspected.

2. Start the engine and turn on the headlights.

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 up, 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 (95A generator) : 63A min.

NOTE

- **The nominal output current value is shown on the nameplate affixed to the generator body.**
- **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. If such is the case, keep the headlights on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.**
  The nominal output current may not be obtained if the temperature of the generator itself or ambient temperature is too high.
  In such a case, reduce the temperature before testing again.

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.

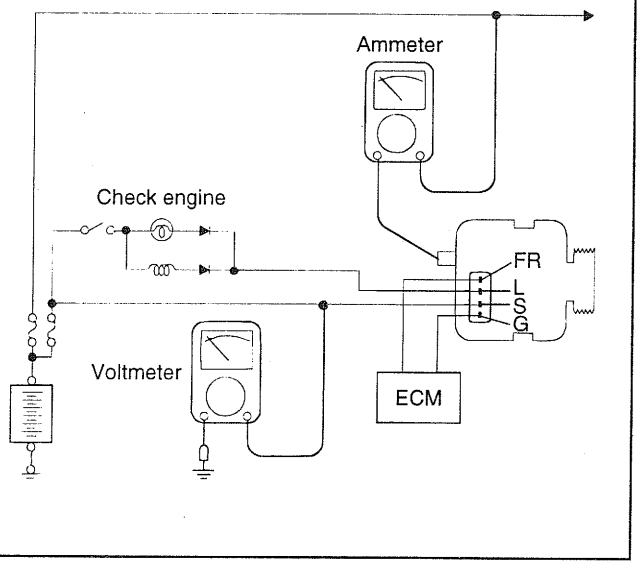
REGULATED VOLTAGE TEST

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

PREPARATION

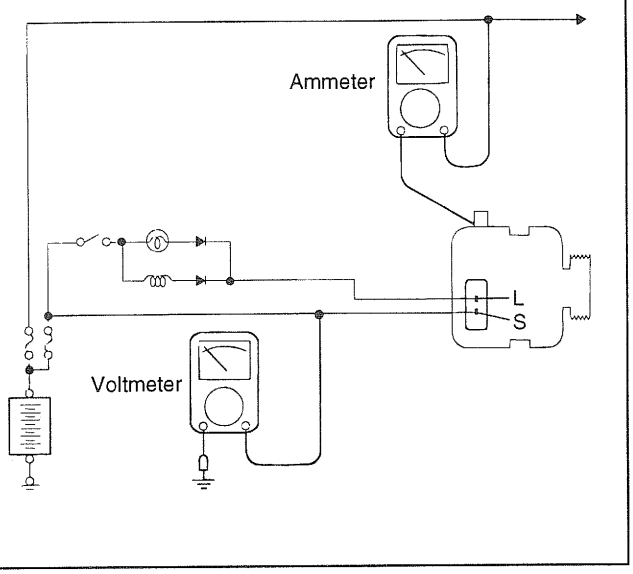
1. Prior to the test, check the following items and correct if necessary.
   1) Check that the battery installed on the vehicle is fully charged. For battery checking method, see "BATTERY."
   2) Check the generator drive belt tension. For belt tension check, see "COOLING" section.
2. Turn ignition switch 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 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.

[2.0 I4]



EBHA204A

[2.7 V6]



EBHA204B

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

Voltage regulator ambient temperature °C(°F)	Regulating voltage (V)
-20 (-4)	14.2-15.4
20 (68)	13.9-14.9
60 (140)	13.4-14.6
80 (176)	13.1-14.5

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 and ammeter and the engine tachometer.
5. Connect the generator output wire to the generator "B" terminal.
6. Connect the battery ground cable.

GENERATOR OUTPUT LINE VOLTAGE DROP TEST EBA90140

This test determines the condition of the wiring from the generator "B" terminal to the battery (+) terminal (including the fusible link).

1. Be sure to check the following before testing:
   - Generator installation and wiring connections
   - Generator drive belt tension
   - Fusible link
   - Abnormal noise from the generator while the engine is running.
2. Turn the ignition switch to the OFF position.
3. Disconnect the negative battery cable.
4. Disconnect the generator output wire from the generator "B" terminal. Connect a DC test ammeter with a range of 0-100A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal. Connect the (-) lead of the ammeter to the disconnected output wire.)

NOTE

An inductive-type ammeter which enables measurements to be taken without disconnecting the generator output wire is recommended. Using this equipment will lessen the possibility of a voltage drop caused by a loose "B" terminal connection.

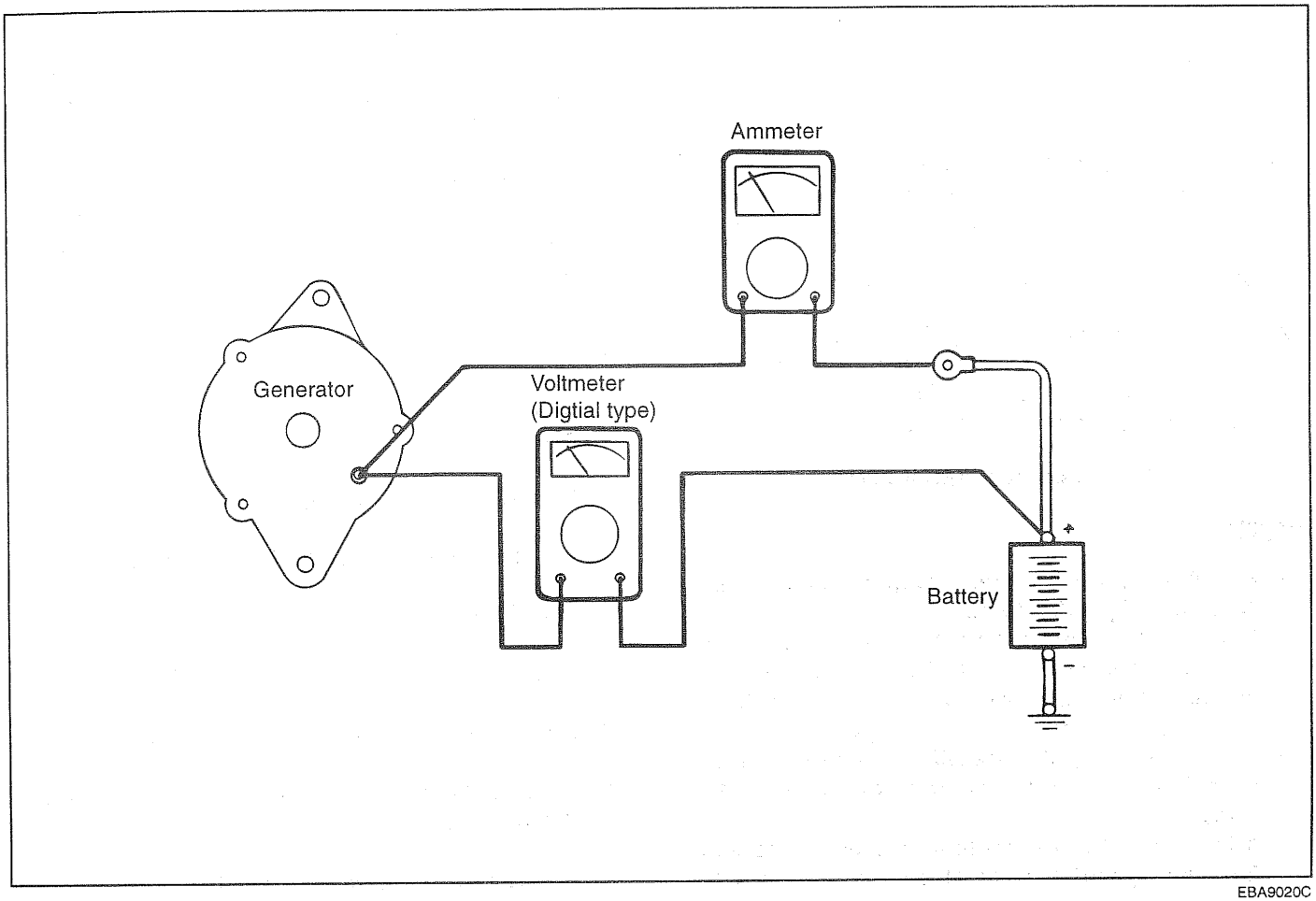
5. Connect a digital-type voltmeter between the generator "B" terminal and the battery (+) terminal. (Connect the (+) lead of the voltmeter to the "B" terminal. Connect the (-) lead of the voltmeter to the battery (+) cable.)
6. Reconnect the negative battery cable.
7. Connect a tachometer or the scan tool.
8. Leave the hood open and connect a tachometer.
9. Start the engine.
10. With the engine running at approx. 2500 r/min, turn the headlights and other lights on and off to adjust the generator load on the ammeter slightly above 30A.

    Limit: max. 0.3V

NOTE

When the generator output is high and the value displayed on the ammeter does not decrease to 30A, set the value to 40A. Read the value displayed on the voltmeter. In this case the limit becomes max. 0.4V.

11. If the value displayed on the voltmeter is still above the limit, a malfunction in the generator output wire may exist. Check the wiring between the generator "B" terminal and the battery (+) terminal (including fusible link). If a terminal is not sufficiently tight or if the harness has become discolored due to overheating, repair, the test again.
12. After the test, run the engine at idle.
13. Turn off all lights and turn the ignition switch to the OFF position.
14. Disconnect the tachometer or the scan tool.
15. Disconnect the negative battery cable.
16. Disconnect the ammeter and voltmeter.
17. Connect the generator output wire to the generator "B" terminal.
18. Connect the negative battery cable.



EBA9020C

OUTPUT CURRENT TEST

This test determines if the generator output current is normal.

1. Before testing, be sure to check the following:
   - Generator installation and wiring connections
   - Battery

NOTE

The battery used should be slightly discharged. The load needed by a fully-charged battery is insufficient for an accurate test.

   - Generator drive belt tension.
   - Fusible link
   - Abnormal noise from the generator while the engine is running.

2. Turn the ignition switch to the OFF position.
3. Disconnect the negative battery cable.
4. Disconnect the generator output wire from the generator "B" terminal. Connect a DC test ammeter with a range of 0-100 A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal. Connect the (-) lead of the ammeter to the disconnected output wire.)

CAUTION

Never use clips but tighten bolts and nuts to connect the line. Otherwise loose connections (e.g. using clips) will lead to a serious accident because of high current.

NOTE

An inductive-type ammeter which enables measurements to be taken without disconnecting the generator output wire is recommended.

5. Connect a voltmeter with a range of 0-20V between the generator "B" terminal and the ground. (Connect the (+) lead of the voltmeter to the "B" terminal, and then connect the (-) lead of the voltmeter to the ground.)
6. Connect the negative battery cable.
7. Connect a tachometer or the scan tool.
8. Leave the hood open.

9. Check that the reading on the voltmeter is equal to battery voltage.

NOTE

If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the generator "B" terminal and the battery (+) terminal.

10. Start the engine, and turn the headlights on.

11. Switch the headlights to high beam, turn the heater blower switch to High, increase the engine speed to approx. 2,500 r/min, and read the maximum current output displayed on the ammeter.

    Limit : 70% of nominal output current

NOTE

- **For the nominal current output, refer to the Generator Specifications.**
- **Because the current from the battery will soon drop after the engine is started, Step #10 should be carried out as quickly as possible in order to obtain the maximum current output value.**
- **The current output value will depend on the electrical load and the temperature of the generator body.**
- **If insufficient electrical load is used while testing, the specified level of current may not be output even though the generator is normal. In such a case, increase the electrical load by leaving the headlights on with the engine off to discharge the battery before testing.**
- **The specified level of current also may not be output if the temperature of the generator body and/or ambient temperature is too high. In such a case, allow the generator to cool before testing.**

12. The reading on the ammeter should be above the limit value. If the reading is below the limit value and the generator output wire is normal, remove the generator from the engine and check the generator.

13. Run the engine at idle speed after the test.

14. Turn the ignition switch to the OFF position.

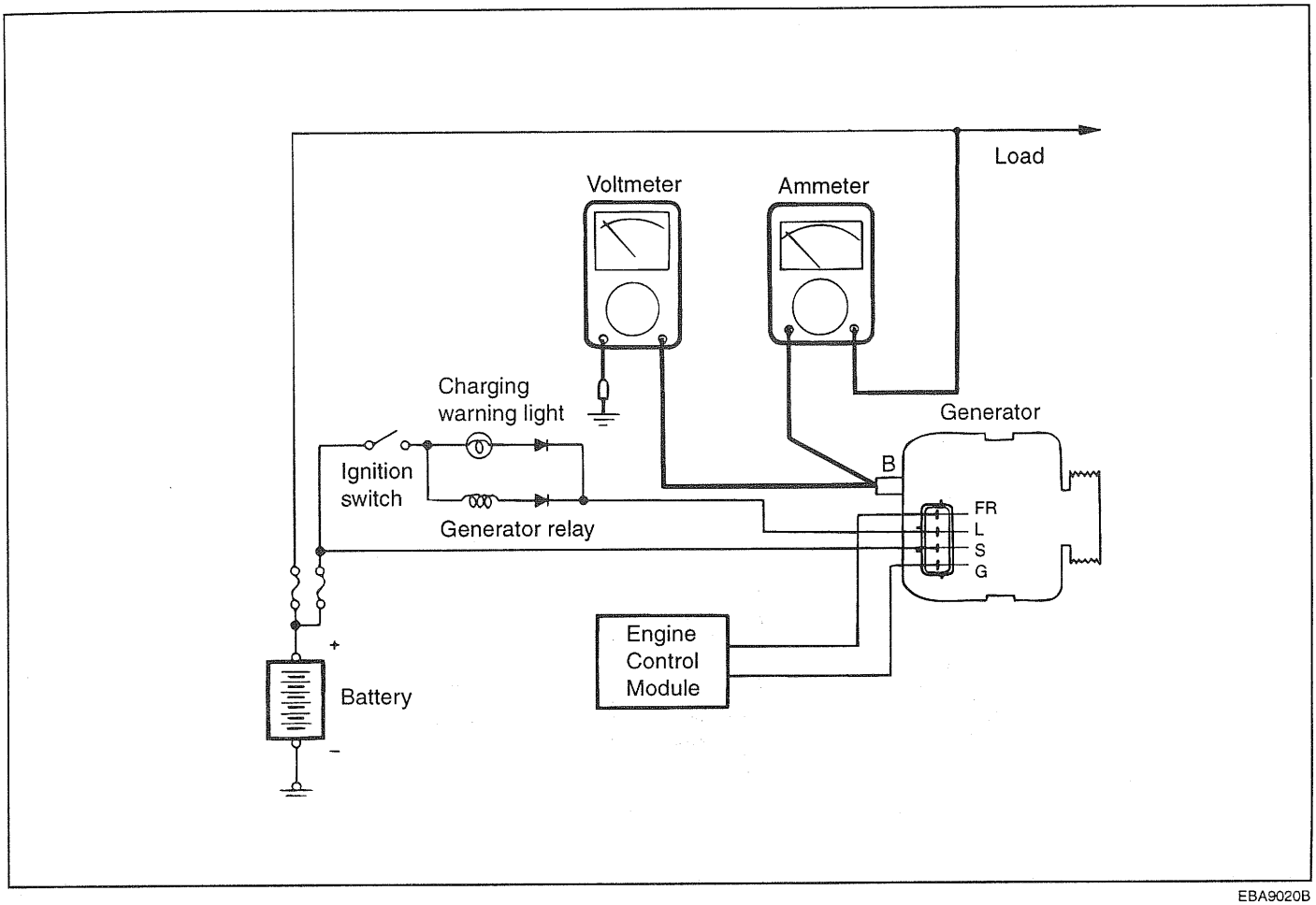
15. Disconnect the tachometer or the scan tool.

16. Disconnect the negative battery cable.

17. Disconnect the ammeter and voltmeter.

18. Connect the generator output wire to the generator "B" terminal.

19. Connect the negative battery cable.



EBA9020B

REGULATED VOLTAGE TEST

This test determines if the voltage regulator is correctly controlling the generator output voltage.

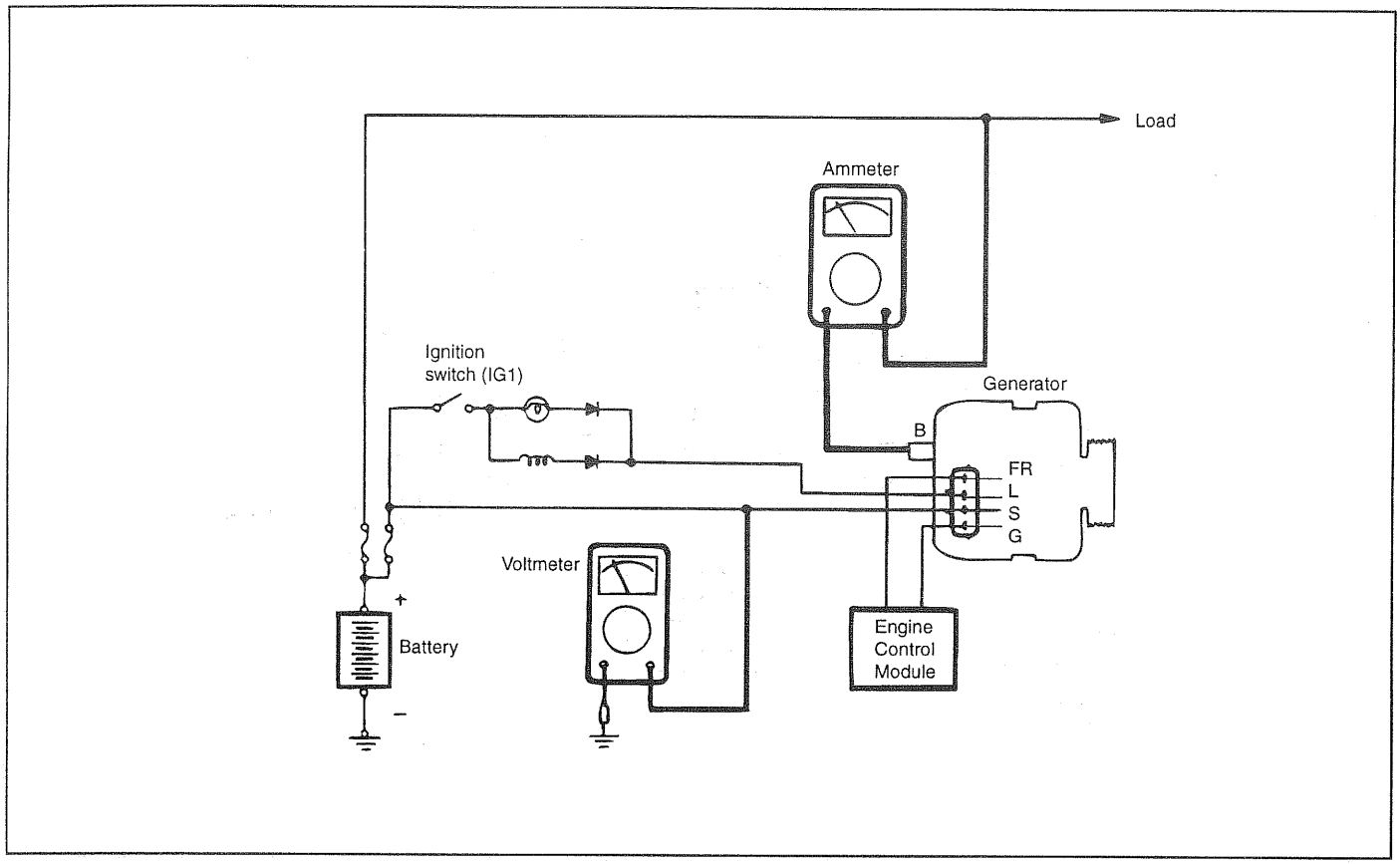
1. Be sure to check the following:
   - Generator installation and wiring connections.
   - Battery fully charged.
   - Generator drive belt tension.
   - Fusible link.
   - Abnormal noise from the generator while the engine is running.
2. Turn the ignition switch to the OFF position.
3. Disconnect the negative battery cable.
4. Connect a digital-type voltmeter between the generator "S" terminal and the ground. (Connect he (+) lead of the voltmeter to the "S" terminal. Connect the (-) lead of the voltmeter to a secure ground or to the battery (-) terminal.)
5. Disconnect the generator output wire from the generator "B" terminal.
6. Connect a DC test ammeter with a range of 0-100A in series between the "B" terminal and the disconnected output wire. (Connect the (+) lead of the ammeter to the "B" terminal. Connect the (-) lead of the ammeter to the disconnected output wire.)
7. Reconnect the negative battery cable.
8. Connect a tachometer or the scan tool. Check that the reading on the voltmeter is equal to the battery voltage.

NOTE

If the voltage is 0 V, the cause is probably an open circuit in the wire or fusible link between the generator "S" terminal and the battery (+) terminal.

9. Make sure all lights and accessories are off.
10. Start the engine.
11. Increase the engine speed to approx. 2,500 r./min.
12. Read the voltmeter when the current output by the generator becomes 10 A or less.
13. If the voltage reading conforms to the value in the voltage regulation table, the voltage regulator is operating normally. If the voltage is not within

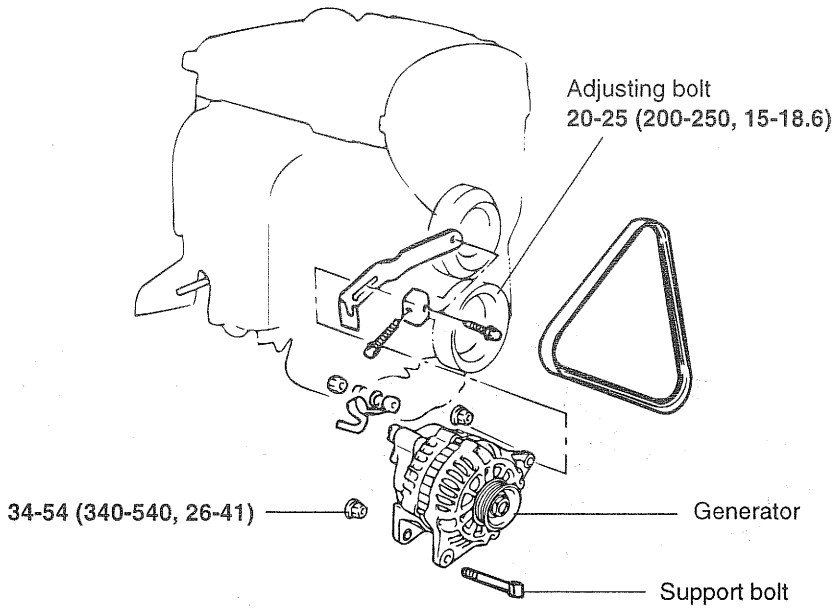
the standard value, a malfunction of the voltage regulator or of the generator exists.



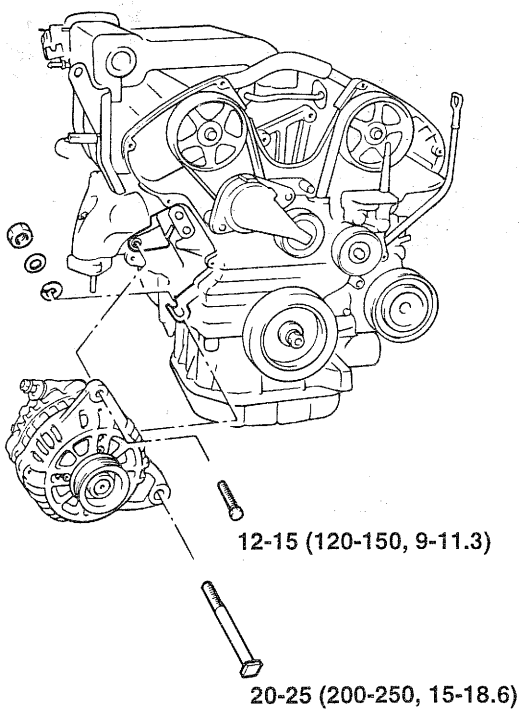
EBA9020A

REMOVAL AND INSTALLATION EBHA0150

2.0 I4



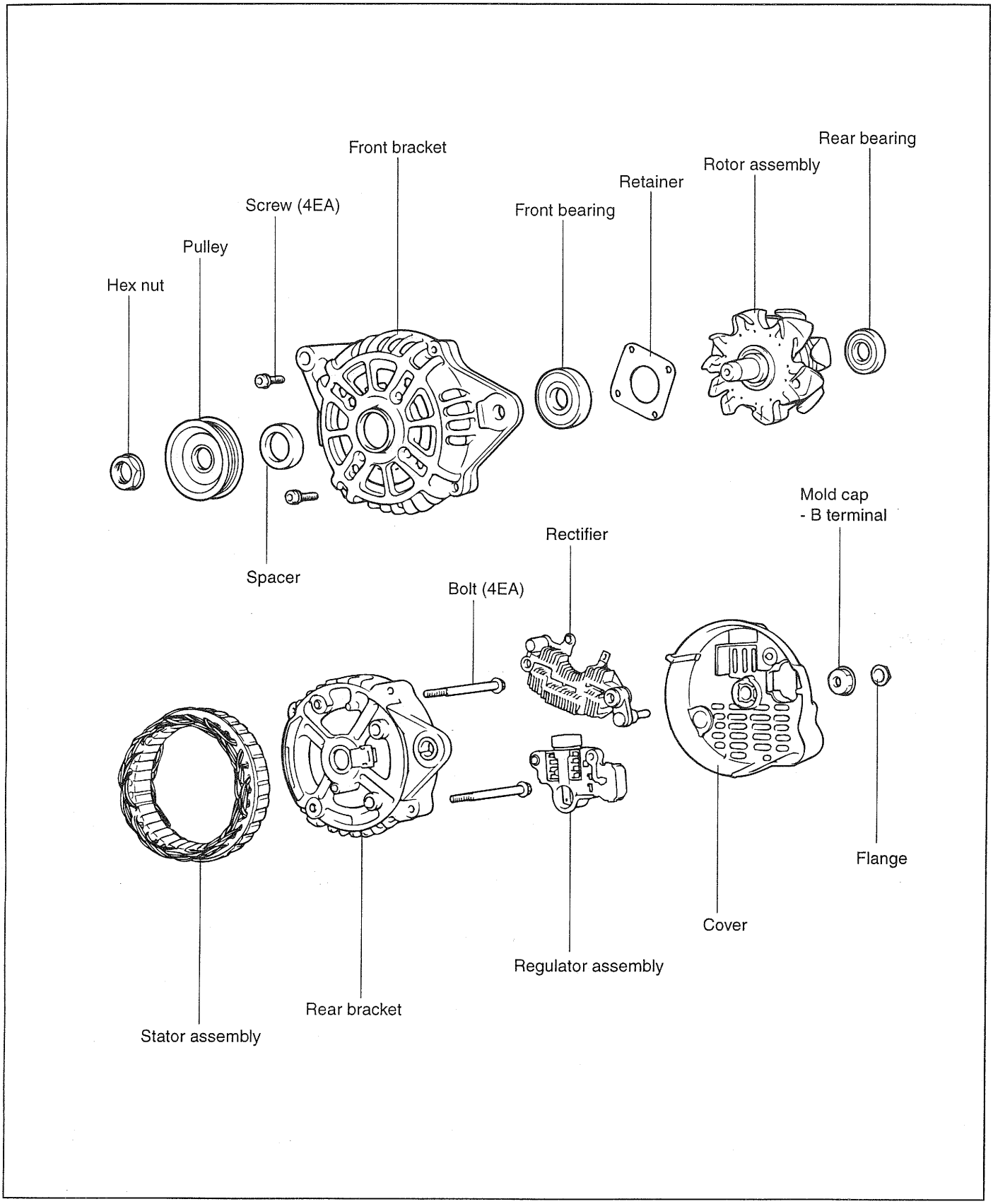
2.7 V6



TORQUE : Nm (kg·cm, lb·ft)

EBHA015A

DISASSEMBLY AND REASSEMBLY EBHA0160



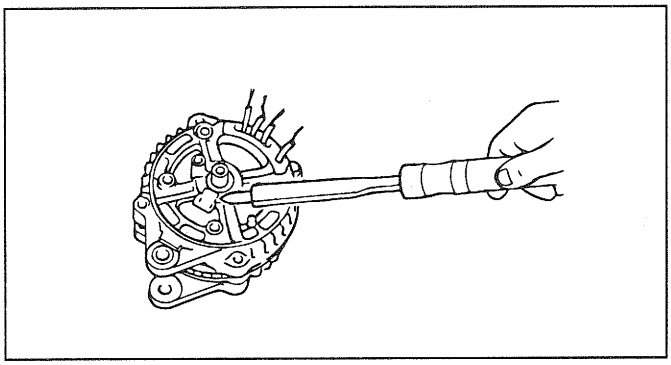
EBA9030A

DISASSEMBLY [2.0 I4]

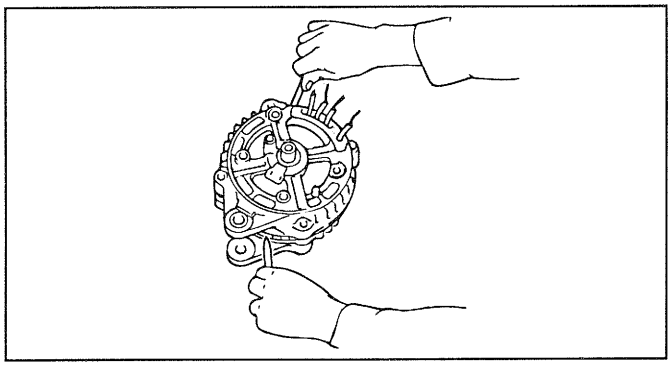
1. Remove the four through bolts.
2. Insert a flat screwdriver between the front bracket and stator core, and pry downward.

CAUTION

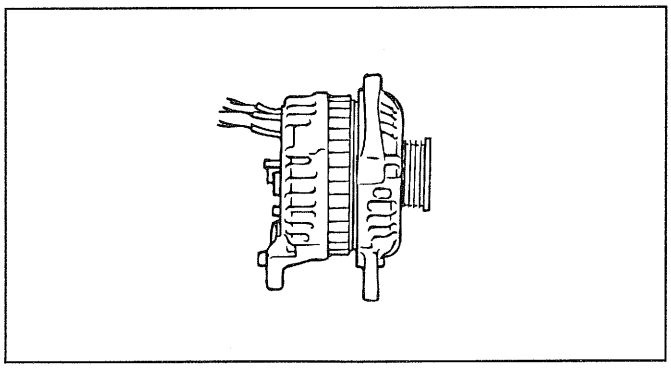
1. **Do not insert the screwdriver too deeply, as there is a danger of damaging the stator coil.**
2. **The rear cover may be hard to remove because a ring is used to lock the outer race of the rear bearing. To facilitate removal of rear cover, heat just the bearing box section with a 200-watt soldering iron. Do not use a heat gun as it may damage the diode assembly.**



EBHA206A

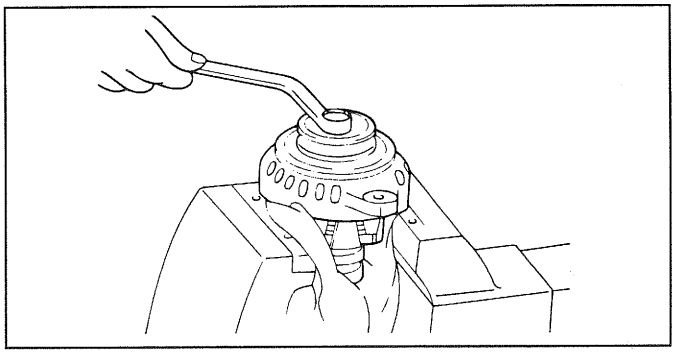


EBHA206B



EBHA206C

3. Secure the rotor in a vise with the pulley side up.



EBA9016D

CAUTION

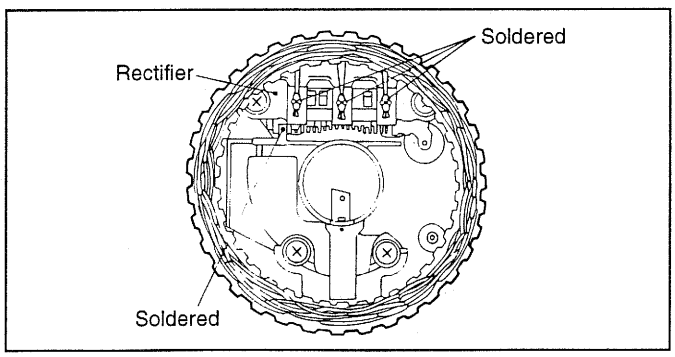
Be careful that the vise jaws do not damage the rotor.

4. Remove the pulley nut, spring washer, pulley, and spacer.
5. Remove the front bracket and two seals.
6. Remove the rotor from the vise.
7. Remove the brush holder screws, rectifier screws, and nut from the "B" terminal.
8. Remove the stator assembly from the rear bracket.
9. Detach the slinger from the brush holder.
10. When the stator is to be removed, unsolder the three stator leads to the main diodes on the rectifier.

CAUTION

1. **When soldering or unsoldering, make sure that heat from soldering iron is not transmitted to the diodes for a long period.**
2. **Do not exert excessive force on the leads of the diodes.**

11. When separating the rectifier from the brush holder, unsolder the two plates soldered to the rectifier.



EBA9016E

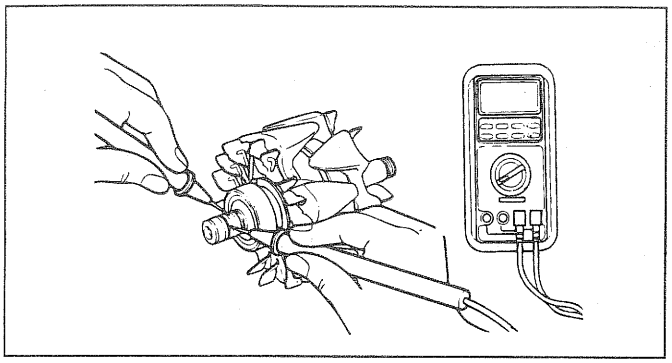
INSPECTION

ROTOR

1. Check the rotor coil for continuity. Make sure there is continuity between the slip rings.

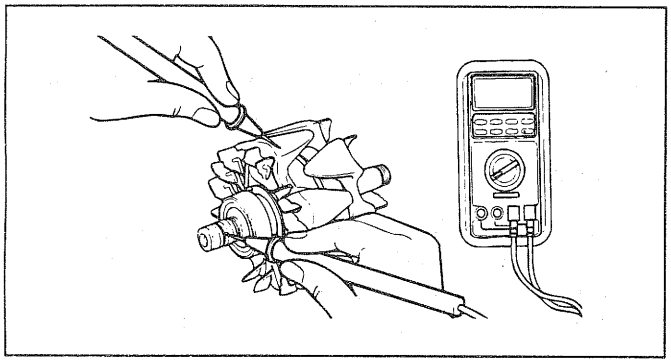
   If resistance is extremely low, there is a short. If there is no continuity or if there is a short circuit, replace the rotor assembly.

   Resistance value : Approx. 3.1Ω



KFW2021A

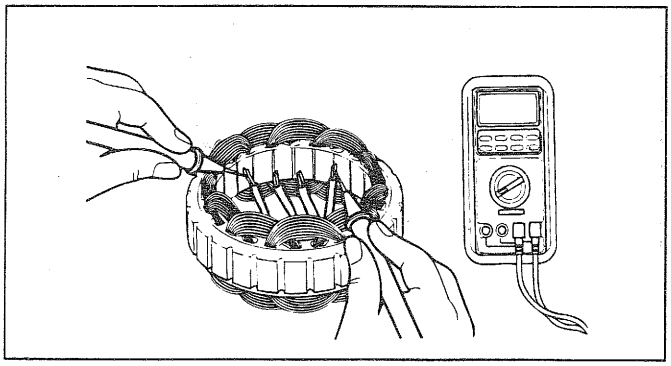
2. Check the rotor coil for a ground. Check that there is no continuity between slip the ring and the core. If there is continuity, replace rotor assembly.



KFW2022A

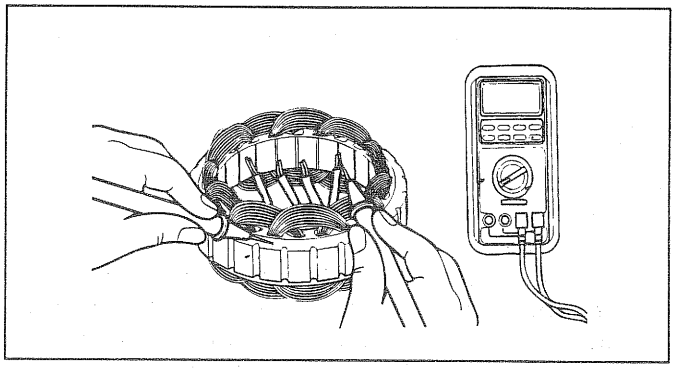
STATOR

1. Make a continuity check on the stator coil. Check that there is continuity between the coil leads. If there is no continuity, replace the stator assembly.



KFW2023A

2. Check the coil for grounding. Check that there is no continuity between the coil and the core. If there is continuity, replace the stator assembly.



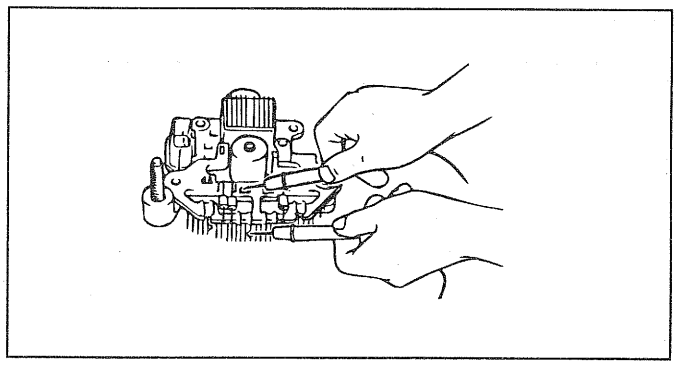
KFW2024A

RECTIFIERS

Positive rectifier test

Check for continuity between the positive rectifier and stator coil lead connection terminal with an ohmmeter. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted.

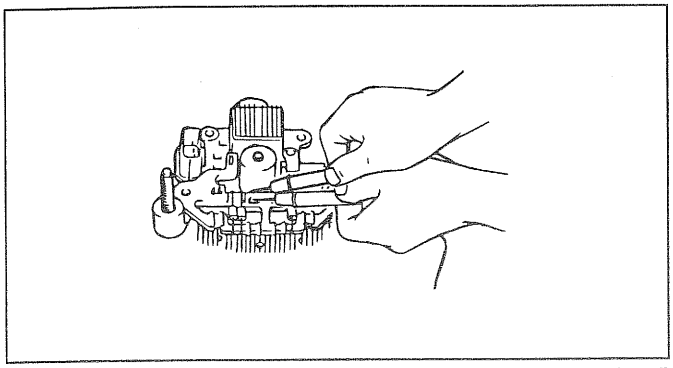
Replace the rectifier assembly.



EBHA206E

Negative rectifier test

Check for continuity between the negative rectifier and the stator coil lead connection terminal. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, the diode is shorted, and the rectifier assembly must be replaced.

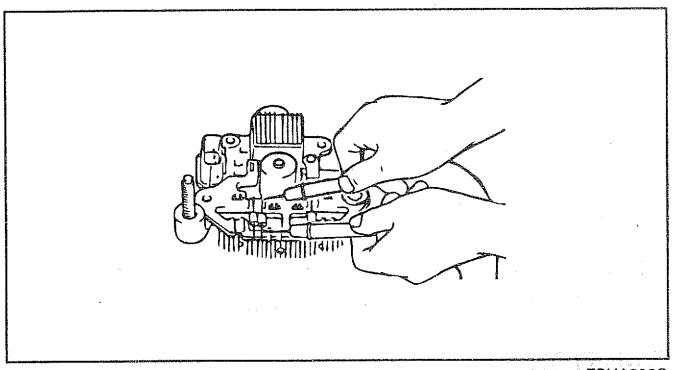


EBHA206F

Diode trio test

Check the three diodes for continuity by connecting an ohmmeter to both ends of each diode. Each diode should have continuity in only one direction.

If continuity is present in both directions, the diode is defective and the heatsink assembly must be replaced.

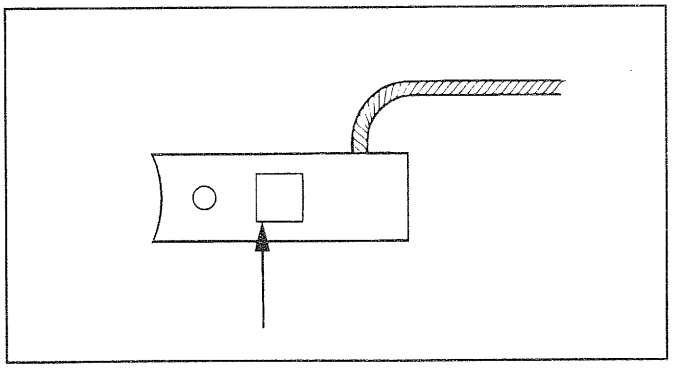


EBHA206G

BRUSH REPLACEMENT

1. Measure the length of the brush protrusion shown in the illustration, and replace the brush if the measured value is below the limit value.

Limit : 2mm (0.8 in.) or less



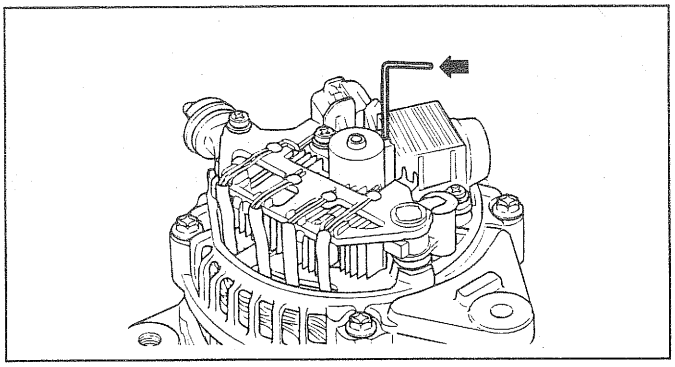
KFW2028A

2. The brush can be removed if the solder of the brush lead wire is removed.
3. When installing a new brush, insert the brush into the holder, and then solder the lead wire.

REASSEMBLY

Perform reassembly in the reverse procedure of disassembly. Pay attention to the following:

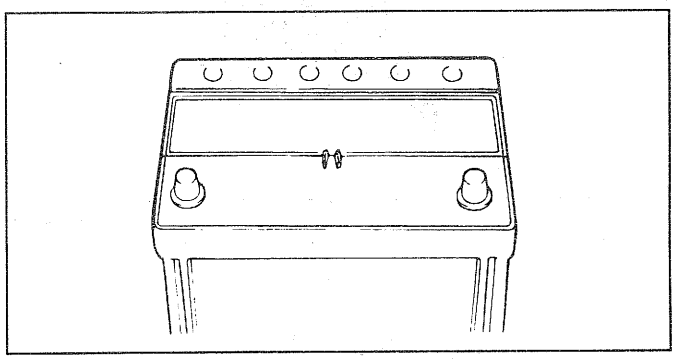
Before the rotor is attached to the rear bracket, insert a wire through the small hole in the rear bracket to lock the brush. After the rotor has been installed, the wire can be removed.



KFW2029A

DESCRIPTION EBA90170

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.



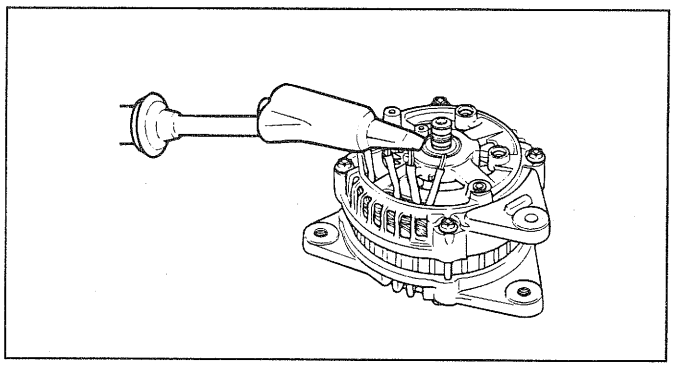
EBA9017D

DISASSEMBLY [2.7 V6] EBA90180

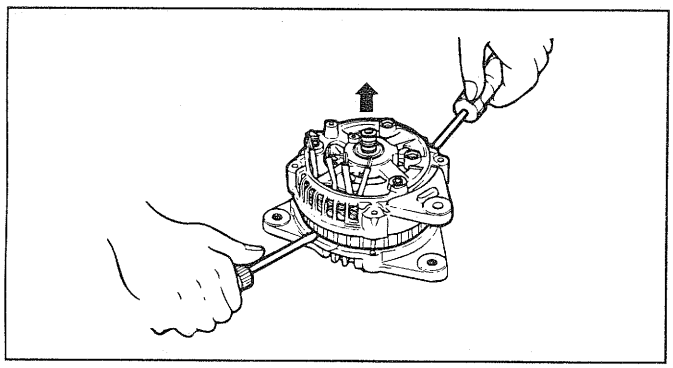
1. Remove the four through bolts.
2. Insert a flat screwdriver between the front bracket and stator core, and pry downward.

CAUTION

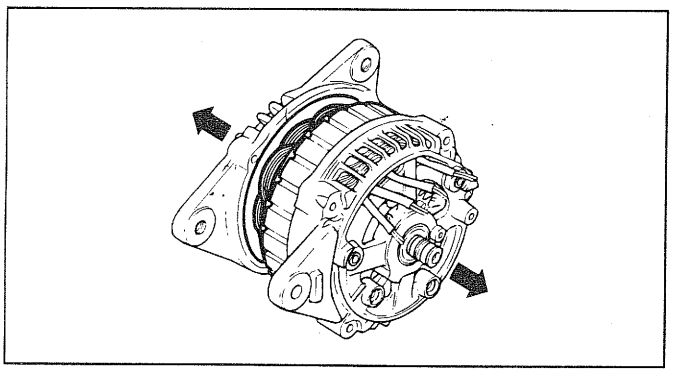
1. **Do not insert the screwdriver too deeply, as there is a danger of damaging the stator coil.**
2. **The rear cover may be hard to remove because a ring is used to lock the outer race of the rear bearing. To facilitate removal of rear cover, heat just the bearing box section with a 200-watt soldering iron. Do not use a heat gun as it may damage the diode assembly.**



KFW2018A



KFW2017A

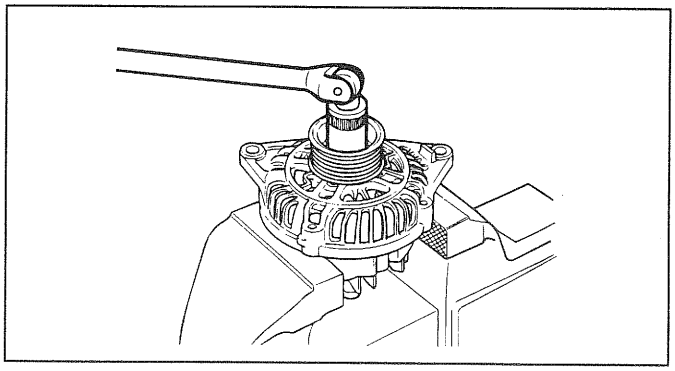


KFW2019A

3. Secure the rotor in a vise with the pulley side up.

CAUTION

Be careful that the vise jaws do not damage the rotor.



KFW2020A

4. Remove the pulley nut, spring washer, pulley, and spacer.
5. Remove the front bracket and two seals.
6. Remove the rotor from the vise.
7. Remove the brush holder screws, rectifier screws, and nut from the "B" terminal.
8. Remove the stator assembly from the rear bracket.
9. Detach the slinger from the brush holder.
10. When the stator is to be removed, unsolder the three stator leads to the main diodes on the rectifier.

CAUTION

1. **When soldering or unsoldering, make sure that heat from soldering iron is not transmitted to the diodes for a long period.**
2. **Do not exert excessive force on the leads of the diodes.**

11. When separating the rectifier from the brush holder, unsolder the two plates soldered to the rectifier.

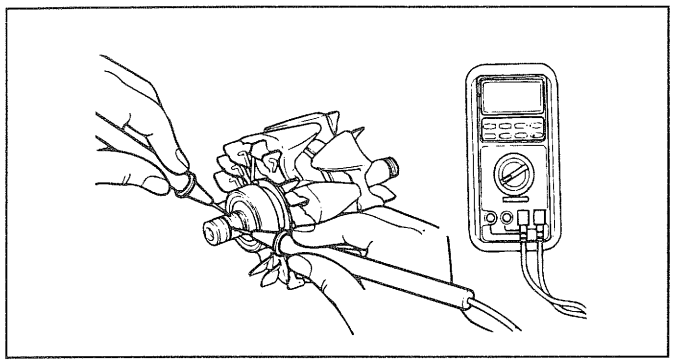
INSPECTION

ROTOR

1. Check the rotor coil for continuity. Make sure there is continuity between the slip rings.

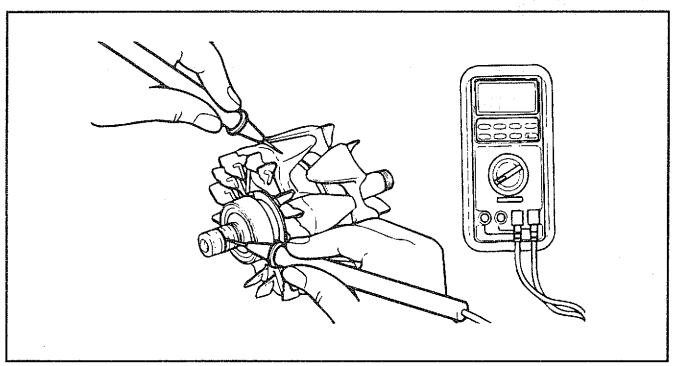
   If resistance is extremely low, there is a short. If there is no continuity or if there is a short circuit, replace the rotor assembly.

   Resistance value : Approx. 3.1Ω



KFW2021A

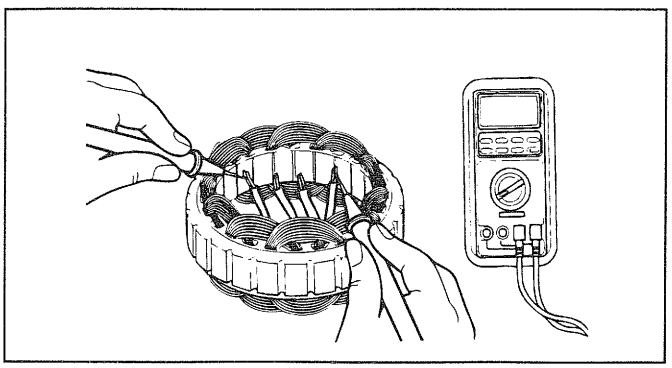
2. Check the rotor coil for a ground. Check that there is no continuity between slip the ring and the core. If there is continuity, replace rotor assembly.



KFW2022A

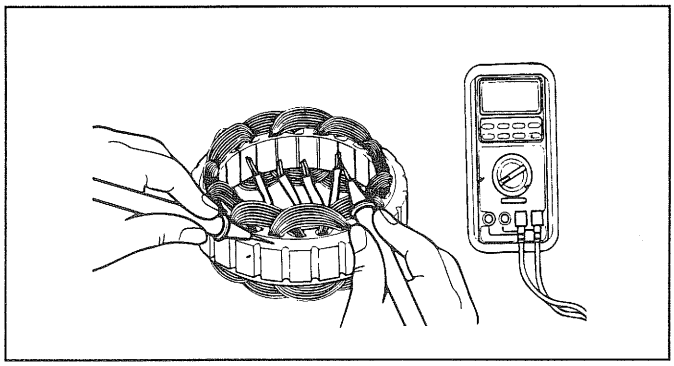
STATOR

1. Make a continuity check on the stator coil. Check that there is continuity between the coil leads. If there is no continuity, replace stator assembly.



KFW2023A

2. Check the coil for grounding. Check that there is no continuity between the coil and the core. If there is continuity, replace the stator assembly.



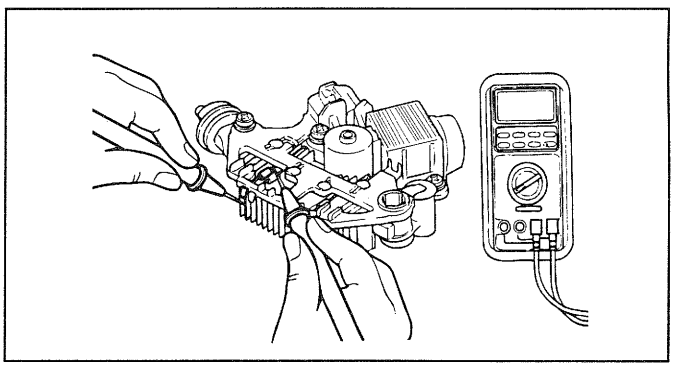
KFW2024A

RECTIFIERS

Positive rectifier test

Check for continuity between the positive rectifier and stator coil lead connection terminal with an ohmmeter. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted.

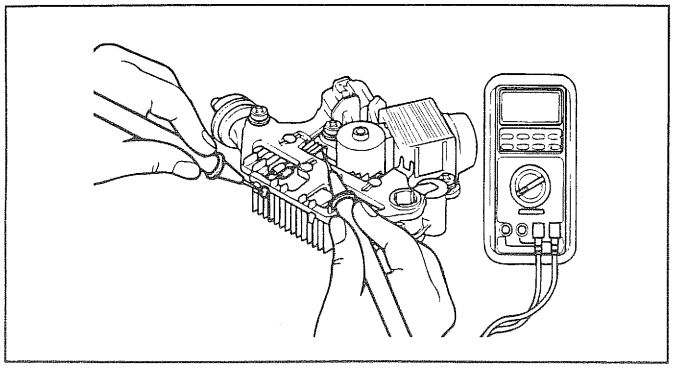
Replace the rectifier assembly.



KFW2025A

Negative rectifier test

Check for continuity between the negative rectifier and the stator coil lead connection terminal. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, the diode is shorted, and the rectifier assembly must be replaced.

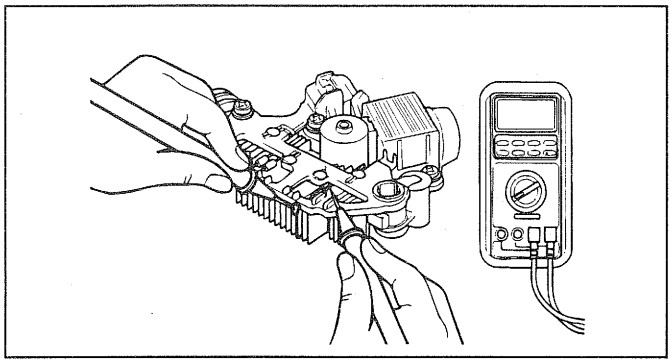


KFW2026A

Diode trio test

Check the three diodes for continuity by connecting an ohmmeter to both ends of each diode. Each diode should have continuity in only one direction.

If continuity is present in both directions, the diode is defective and the heatsink assembly must be replaced.

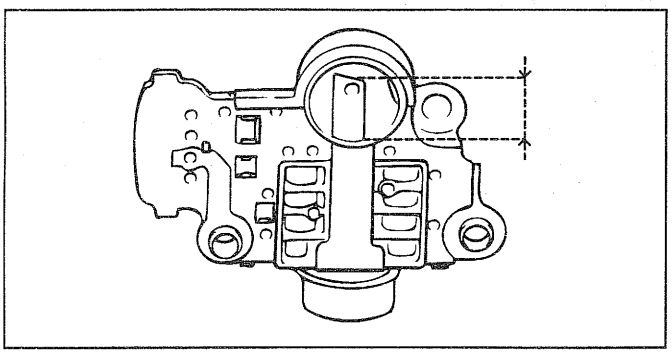


KFW2027A

BRUSH REPLACEMENT

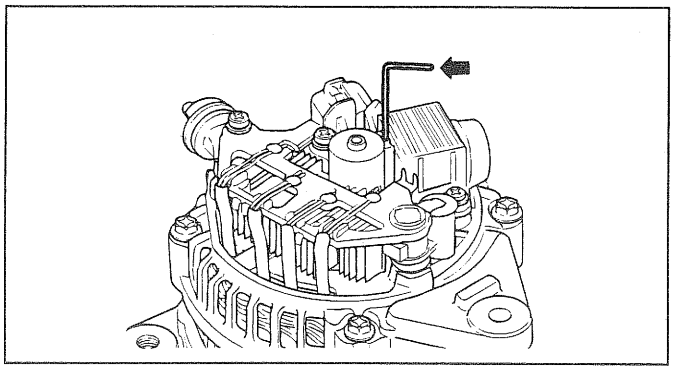
1. Measure the length of the brush protrusion shown in the illustration, and replace the brush if the measured value is below the limit value.

Limit : 2mm (0.8 in.) or less



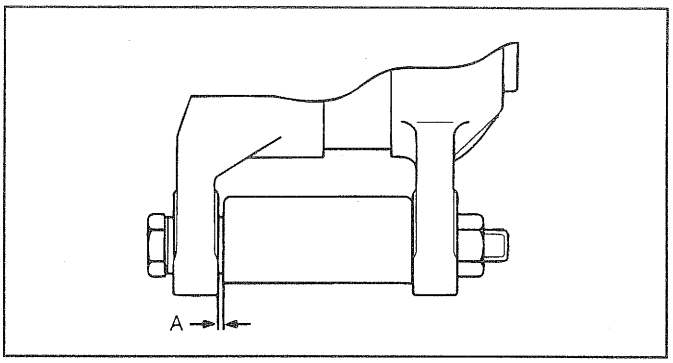
EBA9030E

2. The brush can be removed if the solder of the brush lead wire is removed.



KFW2029A

3. When installing a new brush, insert the brush into the holder, and then solder the lead wire.



KFW2009A

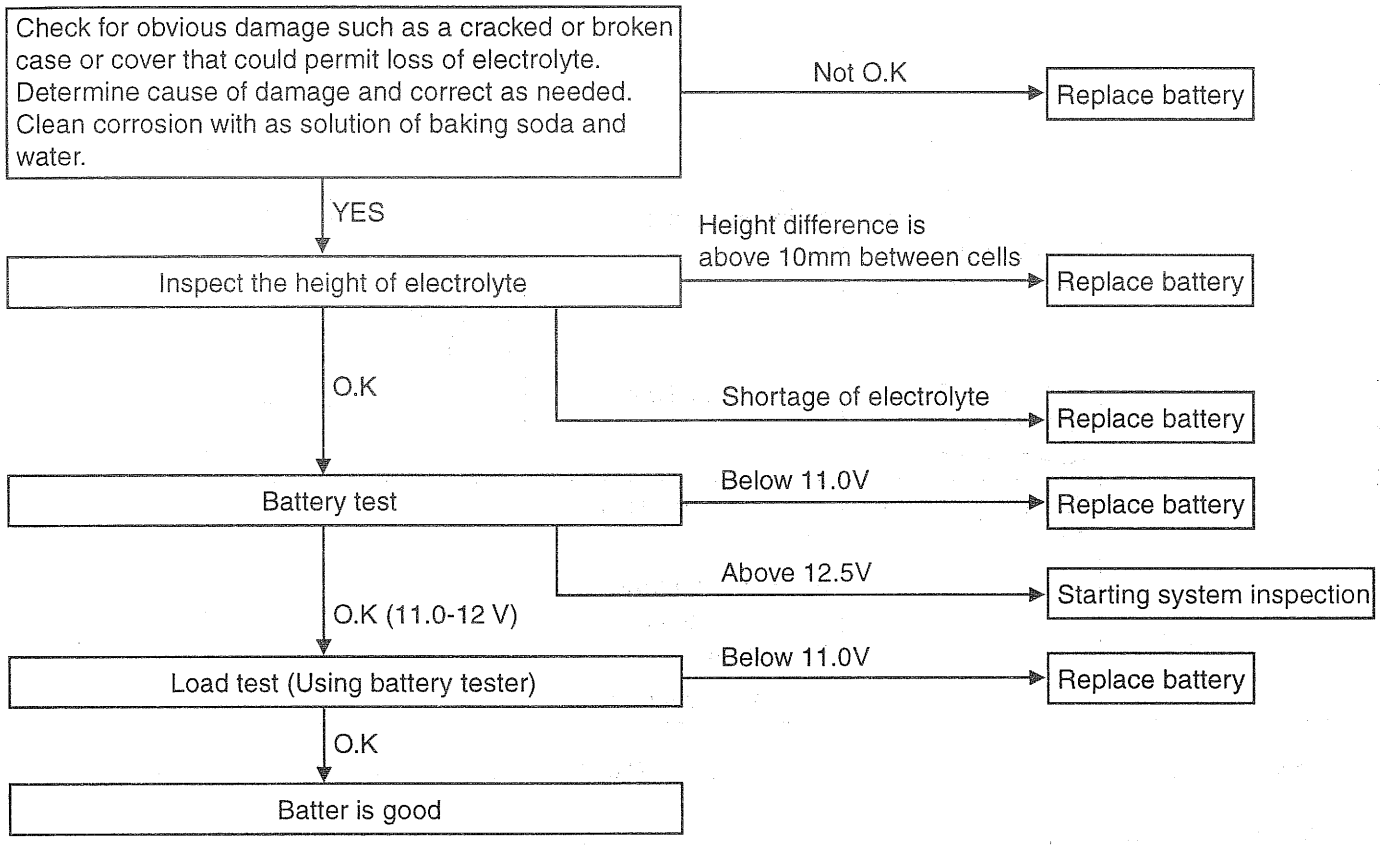
REASSEMBLY

Perform reassembly in the reverse procedure of disassembly. Pay attention to the following:

Before the rotor is attached to the rear bracket, insert a wire through the small hole in the rear bracket to lock the brush. After the rotor has been installed, the wire can be removed.

BATTERY VISUAL INSPECTION (1)

1. CHECKING FLOW



EBA9018B

2. CHECKING SHEET

Item	Trouble	Cause	Remedy	Decision of and battery	
				User	Manufacture
1. Visual inspection	* Battery terminal damage	* Dealing carelessness * Bad tightening condition between battery cable and terminal	Replace	O	
	Cover Breakage	* Dealing carelessness	Replace	O	
	* Electrolyte leakage				
	- Cover breakage	* Dealing carelessness	Replace	O	
	- Cover sealing part leakage	* Bad cover sealing	Replace		O
2. Electrolyte height inspection	* Electrolyte height between cells is over 10mm	* Cell short * Vaporization caused by outer temperature	Replace Replace	O	O
	* Shortage of electrolyte	* Electrolyte loss caused by over-charge	Replace	O	

Item	Trouble	Cause	Remedy	Decision of and battery	
				User	Manufacture
3. Voltage inspection	1. Battery voltage <13.2V	1. Over charge	Replace * Check the electric system	O	
	2. 12.5V < Battery voltage < 12.9	2. Normal			
	3. 12.0V < Battery voltage < 12.4V (Simple discharge)	1. Insufficient charge	* Battery Load Test (Refer to Load Test shee)	O	
	4. 11.0 V <Battery voltage <12.0 (Over discharge	2. Internal failure		O	
	5. Battery voltage : 11.0V	1. Charge condition failure	Replace	O	
		2. Let the battery alone on discharge condition for long period		O	
		3. Internal circuit open			O

3. LOAD TEST

1. When discharging the battery during 15 seconds at half currency of C.C.P, the voltage of battery should be over the voltage as shown below

REGULATING VOLTAGE TABLE

Ambient Temperature	Voltage
above 20°C	9.6V
~ 18°C	9.5V
~ 10°C	9.4V
~ 4°C	9.3V
~ -1°C	9.1V
~ -7°C	8.9V
~ -12°C	8.7V

2. When the voltage is not within specification, test 2nd load test again, and if not, do the re-charge.

3. If the battery voltage (left alone within 2 hours after re-charging) is over 12.5V and the voltage after load test is over the standard value, this battery can be used.

BATTERY VISUAL INSPECTION (2)

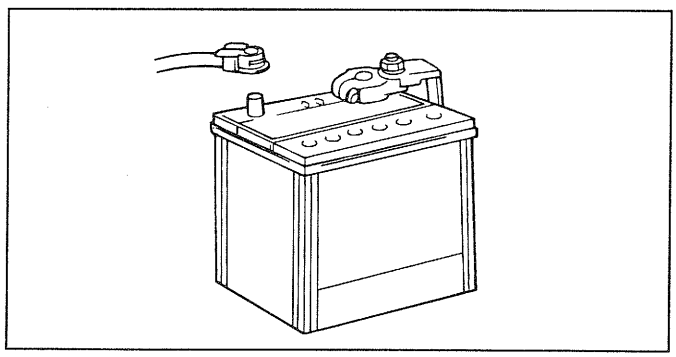
1. Make sure ignition switch and all accessories are in the Off position.

2. Disconnect the battery cables (negative first).

3. Remove the battery from the vehicle.

CAUTION

Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte. Rubber gloves (not household type) should be worn when removing the battery.



EBA9018C

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.

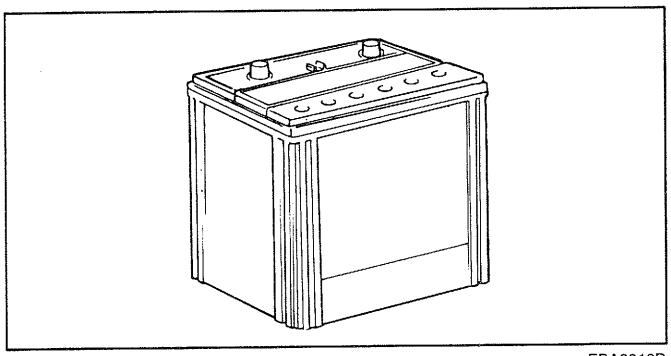
10. Connect the cable terminals to the battery post, making sure the top of the terminal are flush with the top of the post.

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 open flames away from the battery.



EBA9018D

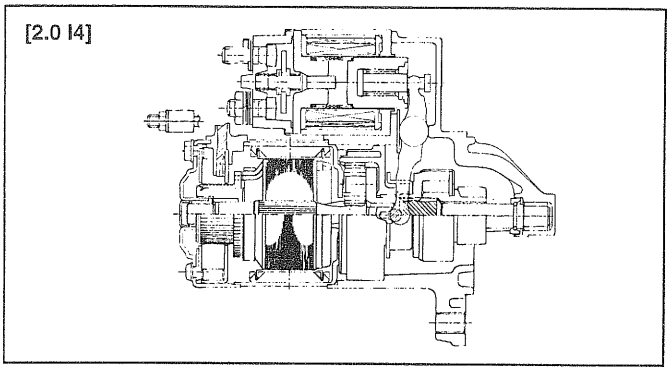
STARTING SYSTEM

GENERAL INFORMATION EBHA0190

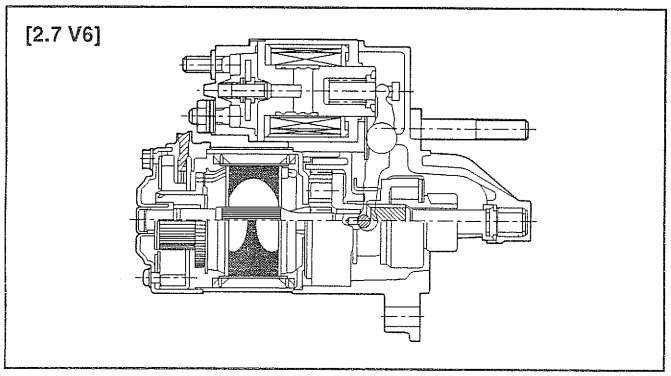
The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch (A/T only), connection wires and the battery cables.

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.



EBHA301A

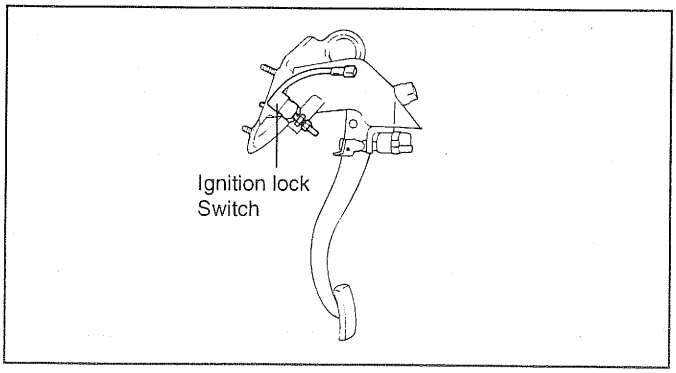


KFW2010A

EBHA0200

CHECK CLUTCH PEDAL

Check that pedal height, pedal freeplay and clutch pedal clevis pin play are correct. (Refer to clutch group)



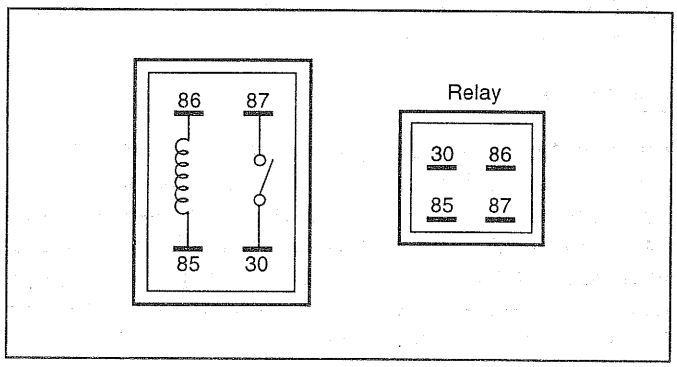
EBA9020D

CHECK STARTER RELAY

Remove the starter relay and check continuity between the terminals. If the continuity is not as specified, replace the relay.

Condition \ Terminal No.	85	86	87	30
When de-energized	○	○		
When energized	○	○	○	○

EBA9020E



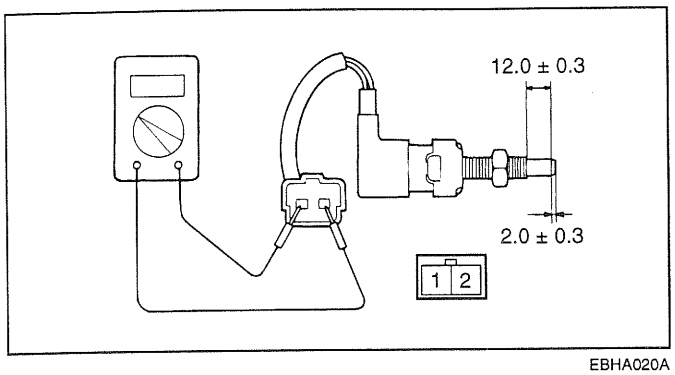
EBA9020F

CHECK IGNITION LOCK SWITCH

Remove the ignition lock switch and check continuity between the terminals. If the continuity is not as specified, replace the switch.

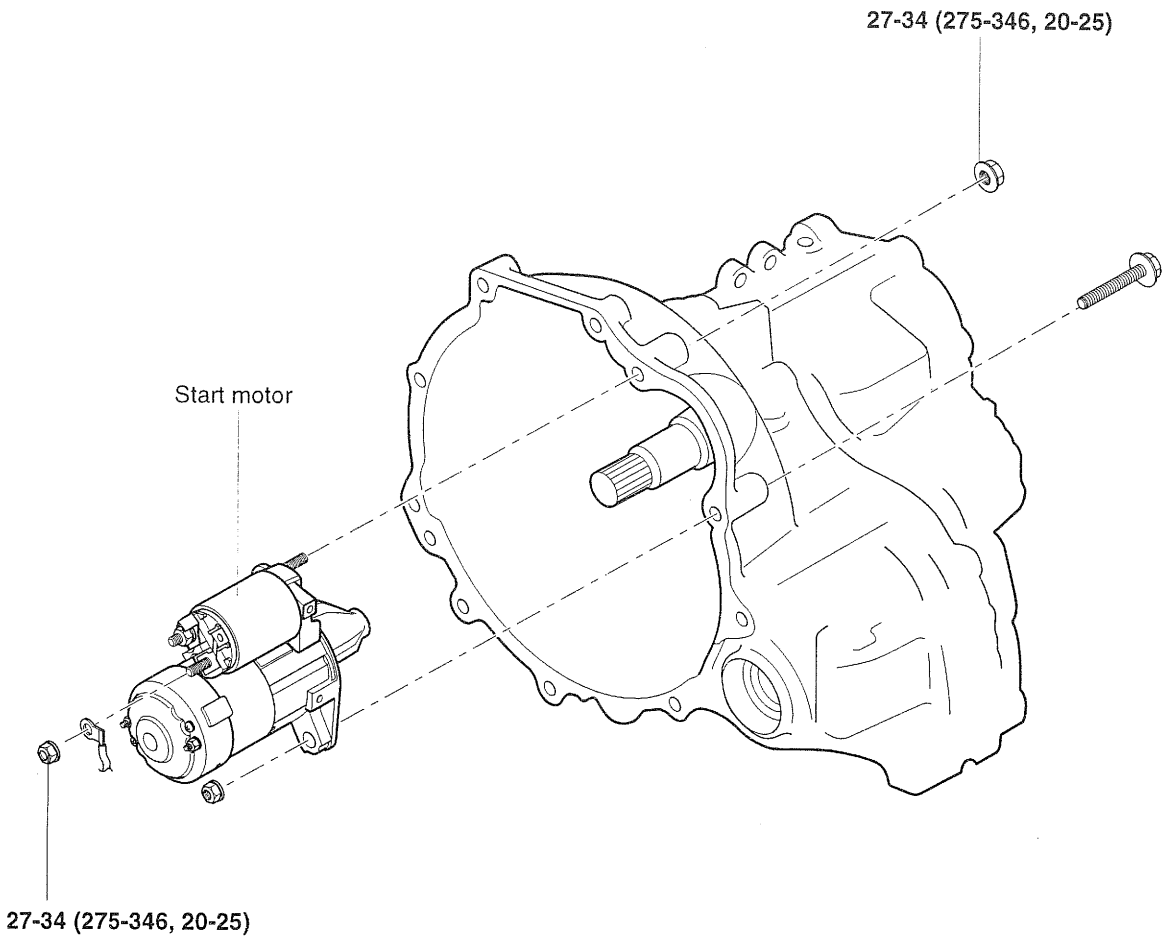
Condition \ Terminal	1	2
Pushed	○	○
Free		

EBA9020G



EBHA020A

REMOVAL AND INSTALLATION EBHA0210

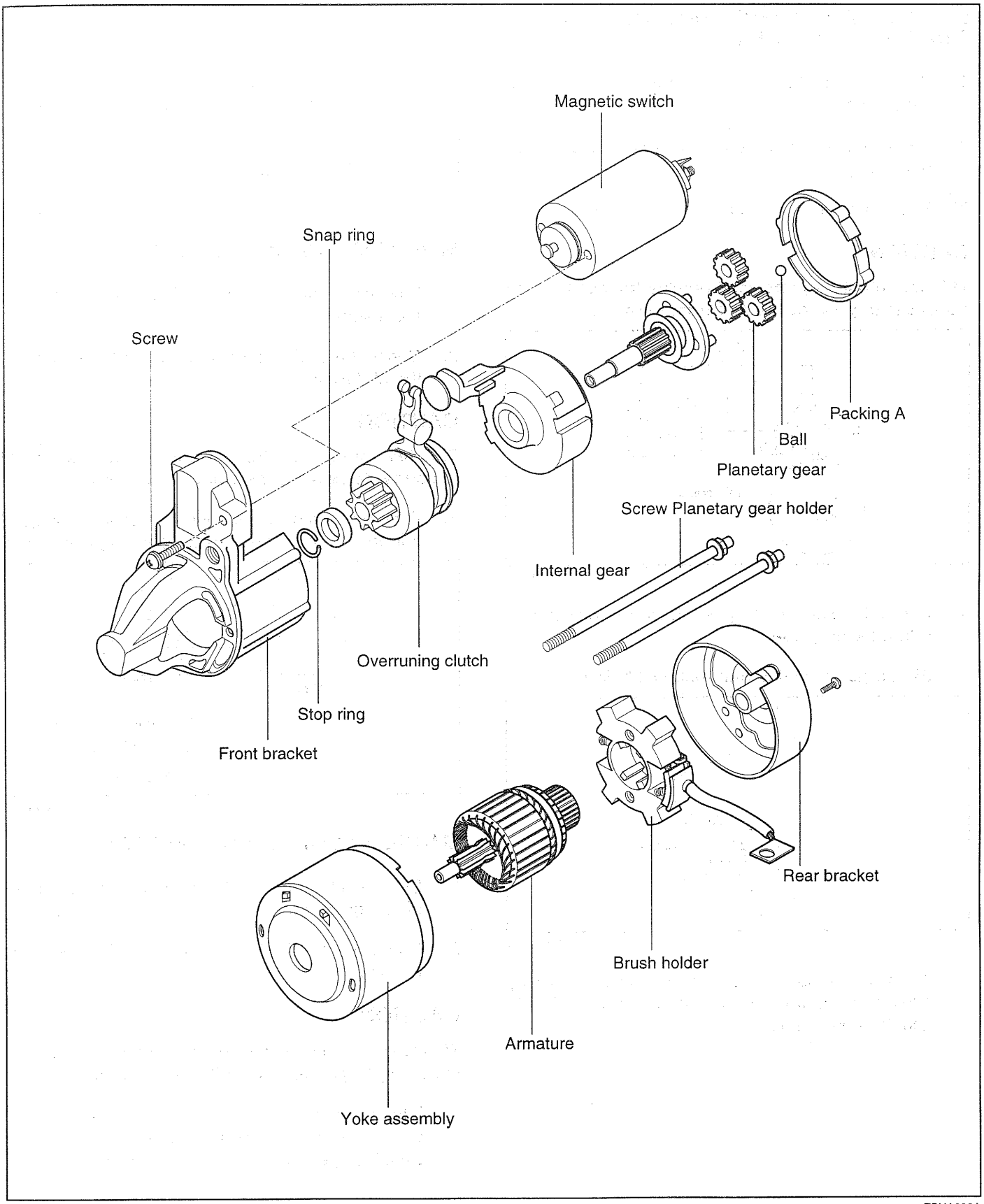


TORQUE : Nm (kg.cm, lb.ft)

KFW2011A

1. Disconnect the battery ground cable.
2. Remove the speed meter 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 the removal procedure.

COMPONENTS EBHA0220



EBHA306A

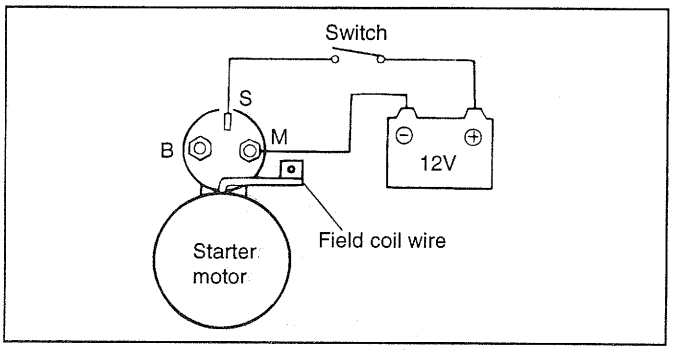
CHECKING FOR OPERATION EBHA0230

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

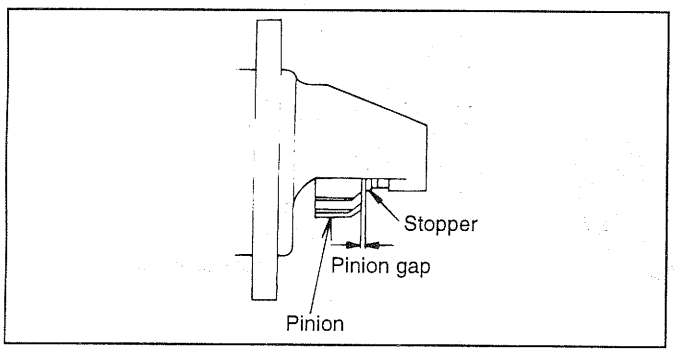
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



EBA9023A

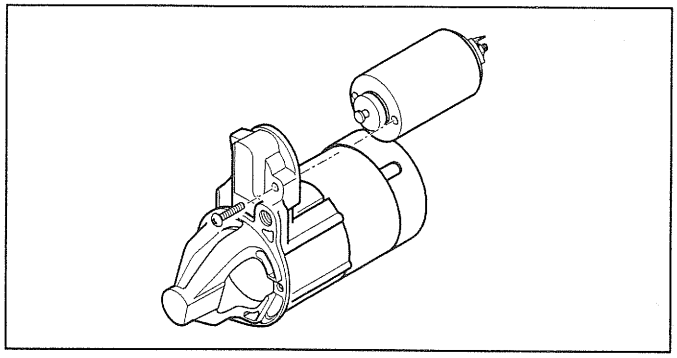
4. Check the pinion for stopper clearance (pinion gap) with a feeler gauge.

   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

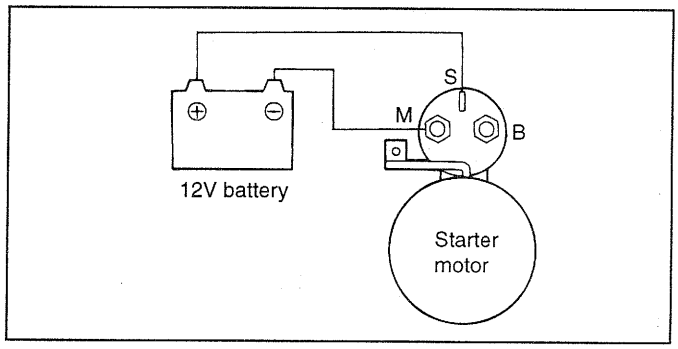
MAGNETIC SWITCH PULL-IN TEST

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

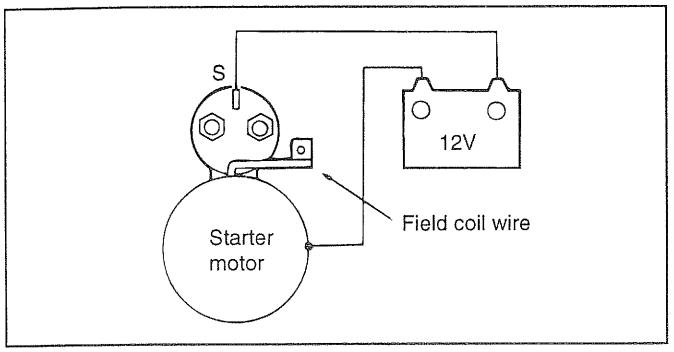
MAGNETIC SWITCH HOLD-IN TEST

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.



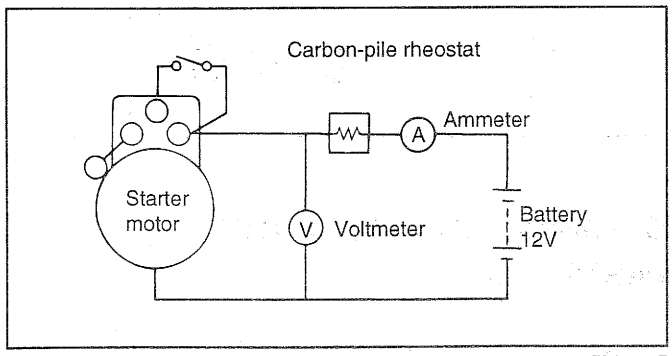
EBA9023E

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 the starter motor turns smoothly and freely:

   Current : Max. 90 Amps

   Speed : Min. 3,000 rpm



EBA9023F

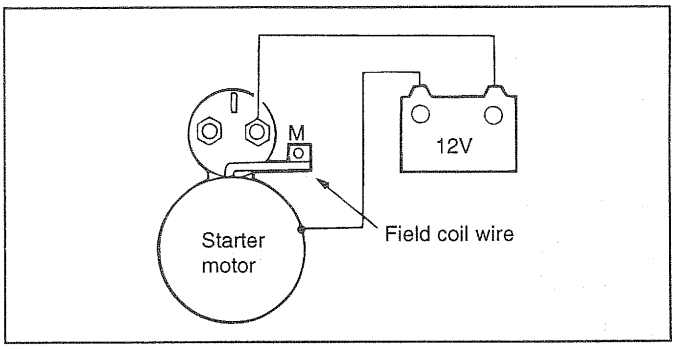
MAGNETIC SWITCH RETURN TEST

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

INSPECTION EBHA0240

CHECKING THE COMMUTATOR

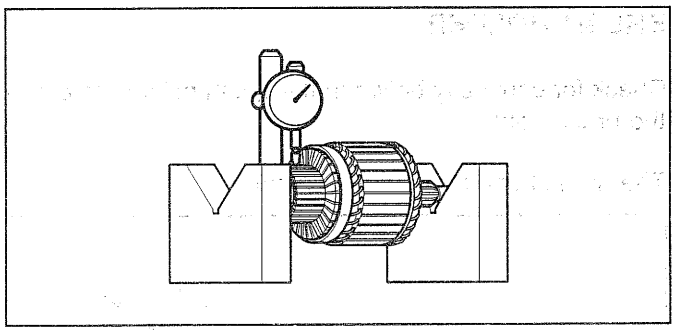
1. Place the armature on a pair of V-blocks, and check the deflection by using a dial gauge.

Standard value

Armature deflection : 0.05 mm (0.002 in.)

Limit

Armature deflection : 0.1 mm (0.0039 in.)



KFW2033A

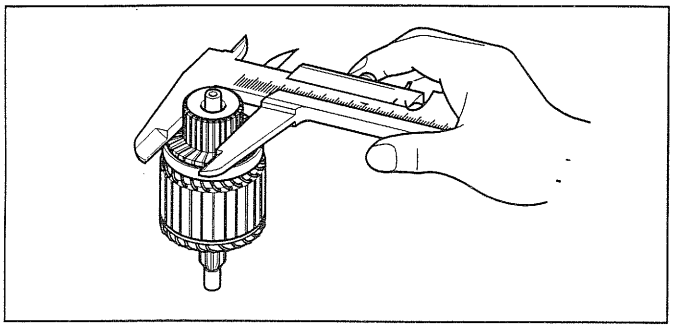
2. Check the outer diameter of the commutator.

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

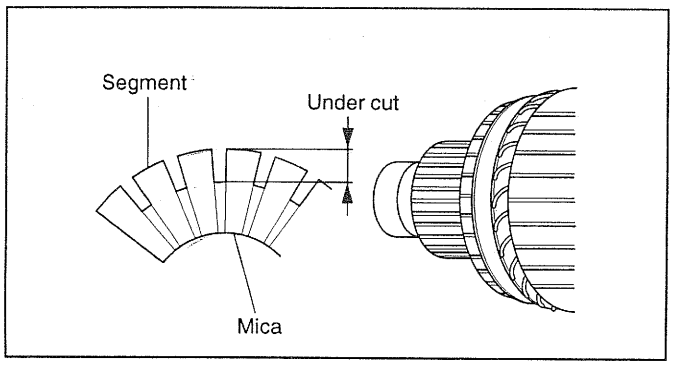
3. Check the depth of the undercut between segments.

Standard value

Depth of the undercut between segment : 0.5mm (0.020 in.)

Limit

Depth of the undercut between segment : 0.2mm (0.079 in.)

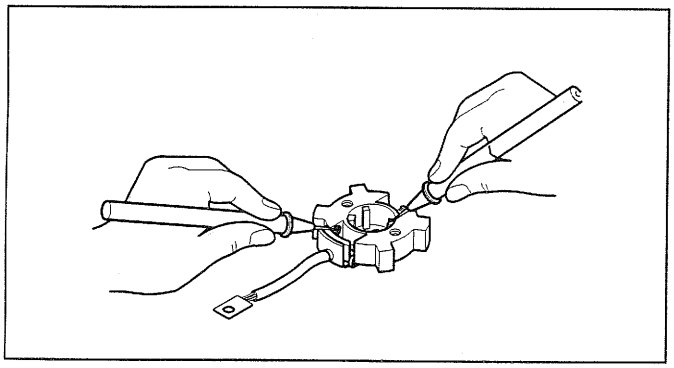


KFW2035A

BRUSH HOLDER

Check for continuity between the brush holder plate and the brush holder.

The normal condition is no continuity.

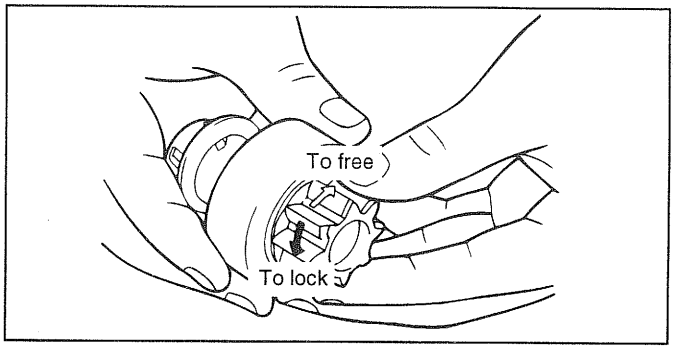


KFW2036A

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.



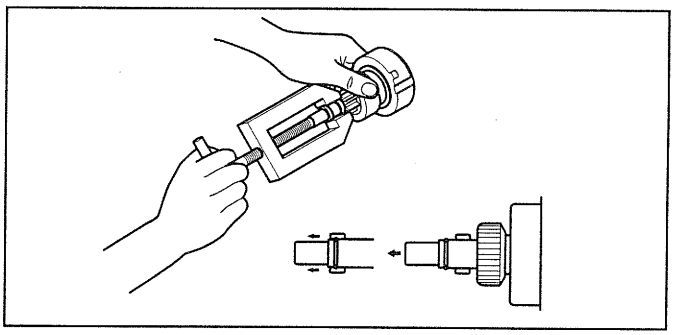
EBA9024E

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 OF THE STOP RING AND SNAP RING EBHA0250

Using a suitable pulling tool, pull overrunning clutch stop ring over snap ring.



KFW2043A

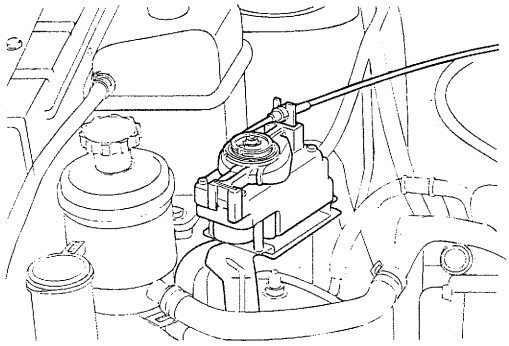
CLEANING STARTER MOTOR PARTS EBA90260

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.

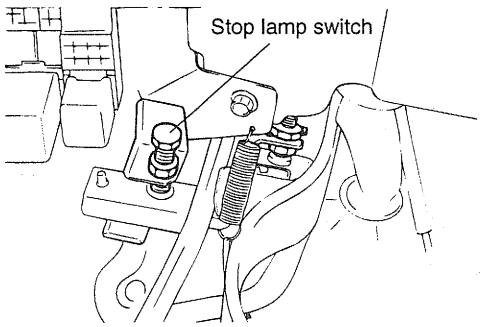
2. Do not immerse drive unit in cleaning solvent. Overrunning clutch is pre-lubricated at the factory and solvent will wash lubrication from clutch.

COMPONENTS LOCATION

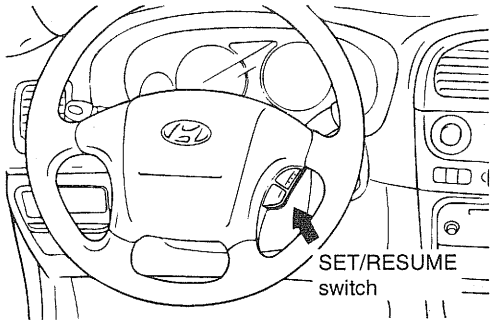
EBHA0300



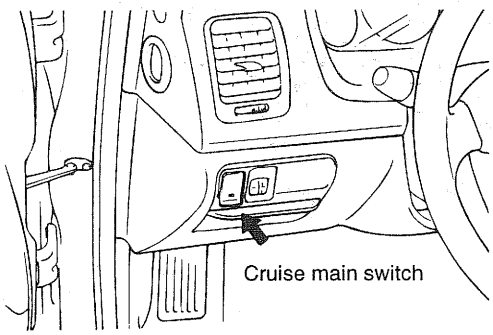
EBHA031C



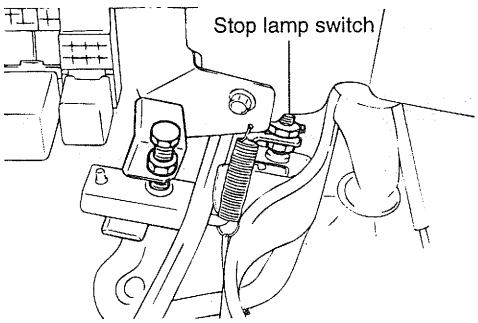
EBA9030G



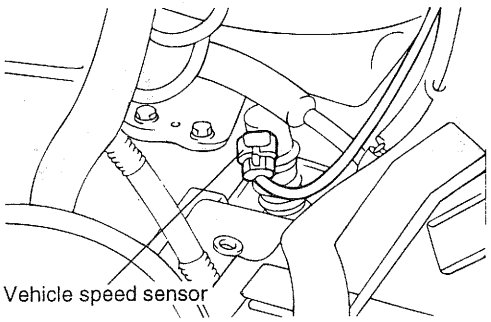
EBAA030B



EBAA030C

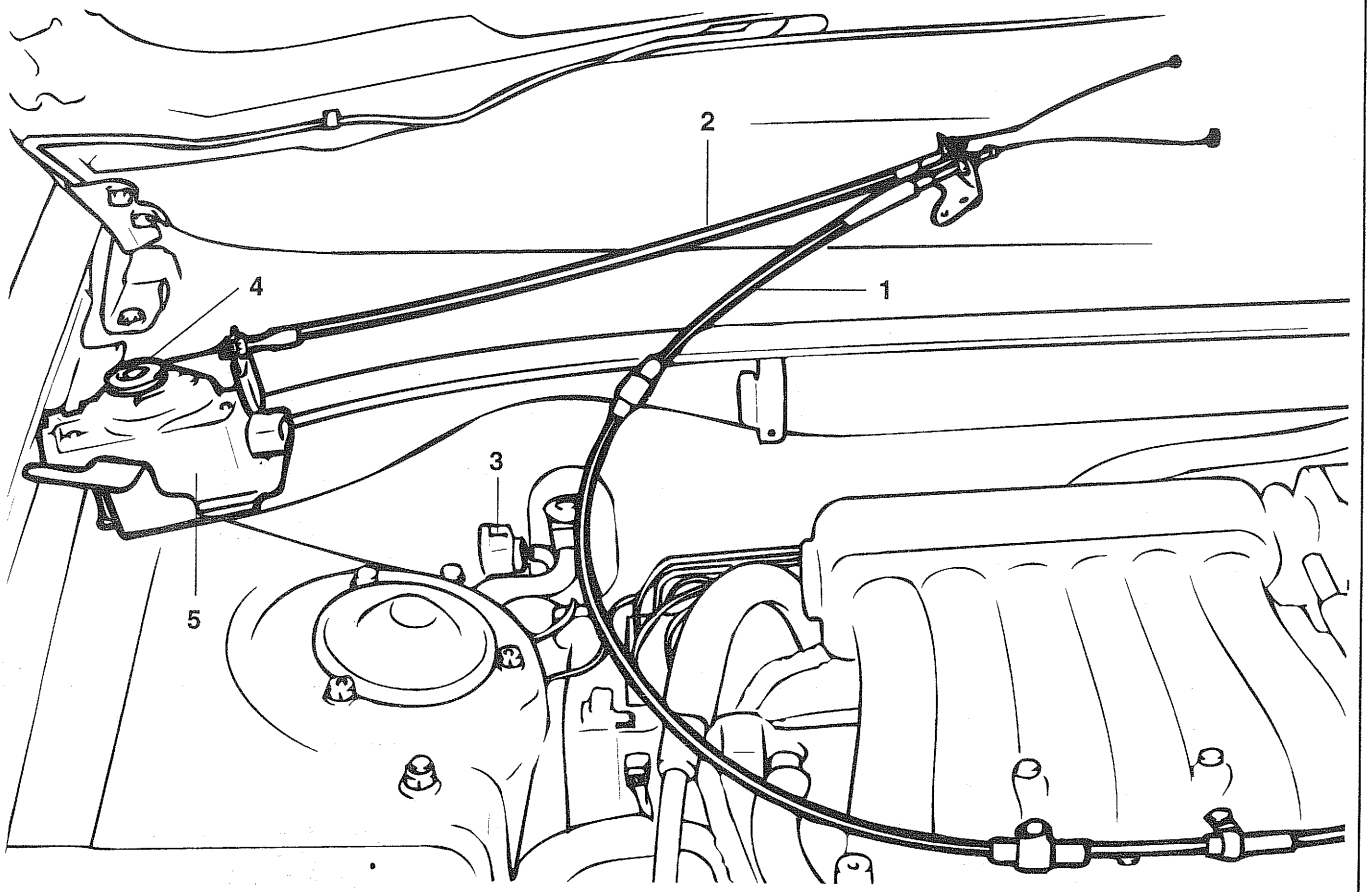


EBA9030L



EBA9030N

COMPONENTS EBHA0310

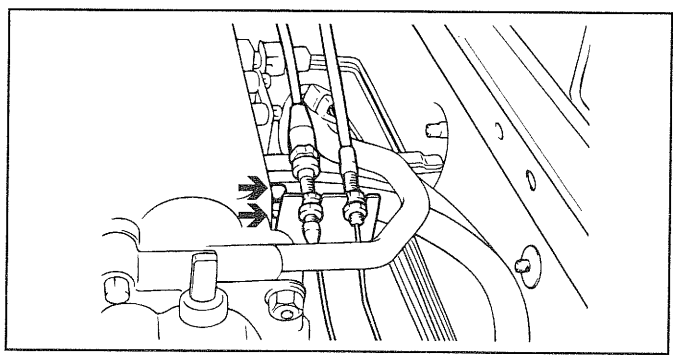


1. Accelerator cable and throttle assembly connection
2. Cruise control cable and pulley assembly connection
3. Actuator & unit assembly connector
4. Pulley assembly
5. Actuator & unit assembly

EBAA031A

REMOVAL AND INSTALLATION

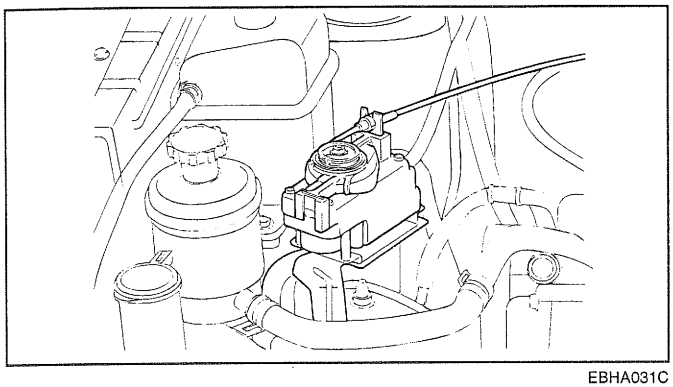
1. Remove the battery negative terminal.
2. Disconnect the accelerator cable and cruise control cable from throttle assembly by turing throttle lever to full open position.
3. Disconnect the accelerator cable from accelerator pedal connection.
4. Remove the accelerator cable mounting bolts.



EBAA031B

5. Remove the actuator and unit assembly mounting bolt.

6. Installation is the reverse order of removal.



EBHA031C

PARTS INSPECTION EBA90320

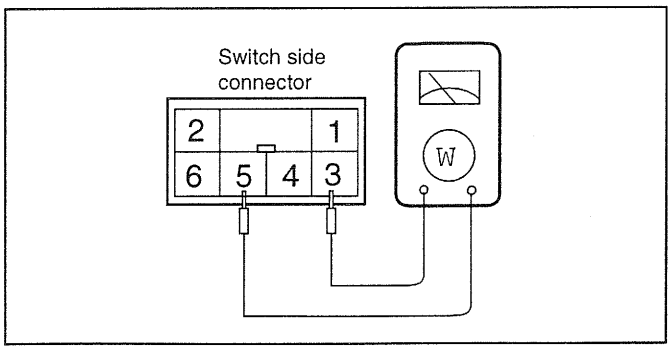
CRUISE CONTROL MAIN SWITCH

1. Operate the switch and check for the continuity between the terminals.

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

Terminal / Position	1	2	3	4	5	6
ON			○		○	
	○			○		
OFF	○			○		

EBAA032A



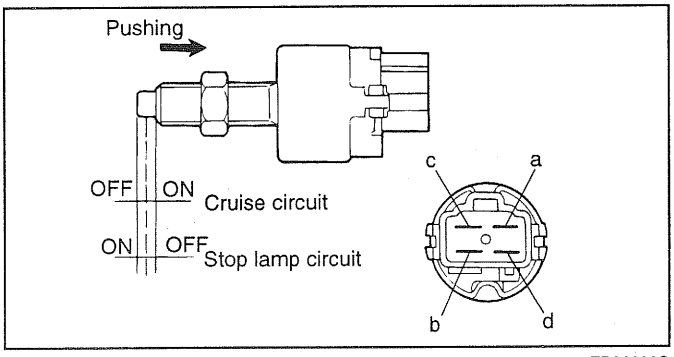
EBAA032B

STOP LAMP SWITCH

After operating the stop lamp switch, check for continuity between the terminals.

Terminal / Position	1	2	3	4
Not pushing			○	○
Pushing	○	○		

EBAA032C



EBA9032C

INSPECTION EBAA0330

CONDITION

- Turn A/C and all lights OFF. Inspect and adjust at no load.
- Warm engine until stabilized at idle. Confirm idle speed is at specified RPM.
- Then, ignition switch OFF.

1. Confirm there are no sharp bends in cables.

2. Depress the accelerator pedal and check if the throttle lever moves smoothly from fully closed to fully open.

3. Check inner cables for correct slack.

4. If there is too much slack or no slack, adjust play by the following procedures.

SERVICE HINT

1. If the cable is very loose, the loss of speed going uphill will be large.

2. If the cable is too tight, the idle RPM will become high.

CABLE ADJUSTMENT

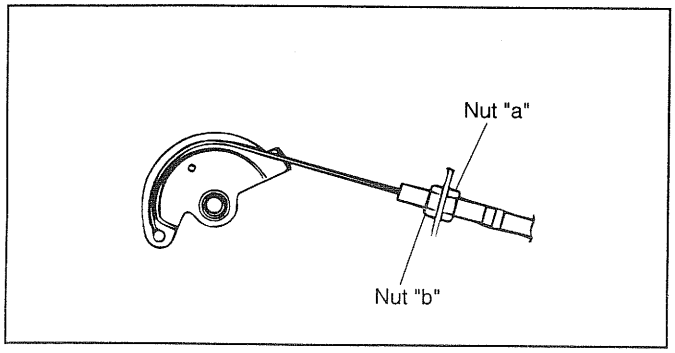
1. Assemble the cable to actuator and unit assembly.

2. Tighten nut “b” after pulling cable tightly.

3. Back nut “b” off one turn.

4. Tighten nut “a”.

5. Cable should have approximately 1mm of slack with actuator and unit against stop.



EBAA033A

Engine Mechanical System

GENERAL

GENERAL ECHA0100

SPECIFICATIONS

Description	Specification	Limit
General		
Type	In-line, Double Overhead Camshaft	
Number of cylinders	4	
Bore	86.5 mm (3.41 in.)	
Stroke	100 mm (3.94 in.)	
Total displacement	2351 cc (143.5 cu.in.)	
Compression ratio	10:1	
Firing order	1-3-4-2	
Idle R.P.M	725 ± 100 rpm	
Ignition timing at idling speed	BTDC 12° ± 8°	
Valve timing		
Intake valve		
Opens (BTDC)	18°	
Closes (ABDC)	54°	
Exhaust valve		
Opens (BBDC)	56°	
Closes (ATDC)	8°	
Cylinder head		
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.2 mm (0.008 in.)
Flatness of manifold mounting surface	0.15 mm (0.0059 in.)	0.3 mm (0.012 in.)
Dimensions for reworking oversize valve seat hole		
Intake		
0.3 mm (0.012 in.) O.S	35.3-35.325 mm (1.39-1.3907 in.)	
0.6mm (0.024 in.) O.S	35.6-35.625 mm (1.40-1.4026 in.)	
Exhaust		
0.3mm (0.012 in.) O.S.	33.3-33.325 mm (1.31-1.3120 in)	
0.6mm (0.024 in.) O.S.	33.6-33.625 mm (1.32-1.3238 in.)	
Dimensions for reworking oversize valve guide hole (both intake and exhaust)		

Description	Specification	Limit
0.05mm (0.002in.) O.S.	12.05-12.068 mm (0.4751 in.)	
0.25mm (0.010in.) O.S.	12.25-12.268 mm (0.4830 in.)	
0.50mm (0.020in.) O.S.	12.50-12.518 mm (0.4928 in.)	
Camshaft		
Cam height		
Intake	35.493 mm (1.3974 in.)	34.993 mm (1.3776 in.)
Exhaust		
M/T	35.204 mm (1.3860 in.)	34.704 mm (1.3663 in.)
A/T	35.204 mm (1.3860 in.)	34.704 mm (1.3663 in.)
Journal O.D.	26 mm (1.02 in.)	
Bearing oil clearance	0.040-0.076 mm (0.0020-0.0030 in.)	
End play	0.1-0.15 mm (0.004-0.006 in.)	
Valve		
Valve length		
Intake	109.5 mm (4.311 in.)	
Exhaust	109.7 mm (4.319 in.)	
Stem O.D.		
Intake	6.565-6.580 mm (0.2585-0.2591 in.)	
Exhaust	6.530-6.550 mm (0.2571-0.2579 in.)	
Face angle	45°~45°5'	
Thickness of valve head (margin)		
Intake	1.0 mm (0.039 in.)	0.7 mm (0.028 in.)
Exhaust	1.5 mm (0.059 in.)	1.0 mm (0.039 in.)
Valve stem to valve guide clearance		
Intake	0.020-0.047 mm (0.0008-0.0019 in.)	0.1 mm (0.0039 in.)
Exhaust	0.050-0.085 mm (0.0020-0.0033 in.)	0.15 mm (0.0059 in.)
Valve guide		

Description	Specification	Limit
Length		
Intake	45.5 mm (1.791 in.)	
Exhaust	50.5 mm (1.988 in.)	
Service over size	0.05, 0.25, 0.50 mm (0.002, 0.010, 0.020 in.)	
Valve seat		
Width of seat contact	0.9-1.3mm (0.035-0.051 in.)	
Seat angle	-44° 5'	
Service size	0.3 mm (0.012 in.), 0.6 mm (0.024 in.) oversize	
Valve spring		
Free length	45.82 mm (1.804 in.)	44.82 mm (1.7646 in.)
Load	25.3kg/40mm (55.8 lb/1.57 in.) at installed height	
Out of squareness	Less than 1.5°	4°
Cylinder block		
Cylinder bore	86.5+0.03 mm (3.406+0.0012 in.)	
Out-of-roundness and taper of cylinder bore	Less than 0.01 mm (0.0004 in.)	
Flatness of gasket surface	Less than 0.05 mm (0.0020 in.)	0.1 mm (0.0039 in.)
Piston		
O.D.	85-0.03 mm (3.346-0.0012 in.)	
Piston-to-cylinder clearance	0.02-0.04 mm (0.0008-0.0016 in.)	
Ring groove width		
No. 1	1.22-1.24 mm (0.048-0.049 in.)	
No. 2	1.51-1.53 mm (0.059-0.060 in.)	
Oil	2.81-2.83 mm (0.111-0.1114 in.)	
Service size	0.5 mm (0.020 in.) oversize	
Piston ring		
Side clearance		
No. 1	0.03-0.07 mm (0.0012-0.0028 in.)	

Description	Specification	Limit
No. 2	0.02-0.06 mm (0.0008-0.0024 in.)	0.1 mm (0.0039 in.)
Oil ring	0.06-0.15 mm (0.0024-0.0059 in.)	
End gap		
No. 1	0.25-0.35 mm (0.0098-0.0138 in.)	0.8 mm (0.031 in.)
No. 2	0.40-0.55 mm (0.0157-0.0216 in.)	0.8 mm (0.031 in.)
Oil ring side rail	0.10-0.40 mm (0.0039-0.0157 in.)	1.0 mm (0.039 in.)
Connecting rod		
Bend	0.05 mm (0.0020 in.)	
Twist	0. 1 mm (0.004 in.)	
Connecting rod big end to crankshaft side clearance	0.10-0.25 mm (0.0040-0.0098 in.)	0.4 mm (0.0157in.)
Piston pin press-in load	1250±500 kg (2756±1100 lb.f)	
Connecting load pin O.D	48-48.015 mm (1.890-1.8903 in.)	
Connecting rod bearing oil clearance	0.015-0.048 mm (0.0008-0.0020 in.)	0.1 mm (0.0039 in.)
Crankshaft main bearing oil clearance		
No. 1,2,4,5 journal	0.018-0.036 mm (0.0007-0.0014 in.)	0.1 mm (0.0039 in.)
No. 3 journal	0.024-0.042 mm (0.0009-0.0016 in.)	
Crankshaft		
Journal O.D.	56.982-57.000 mm (2.2434-2.2441 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 (0.0002 in.)	
End play	0.05-0.25 mm (0.0020-0.0098 in.)	0.25 mm (0.0098 in.)
Flywheel		
Runout		0.13 mm(0.0051in.)
Oil pressure at curb idle speed	80 kPa (11.6 psi)	
[Oil temperature is 75-90°C (167-194°F)]		
Oil pump		

Description	Specification	Limit
Tip clearance		
Drive gear	0.16-0.21 mm (0.0063-0.0083 in.)	0.25 mm(0.0098in.)
Driven gear	0.18-0.21 mm (0.0071-0.0083 in.)	0.25 mm(0.0098in.)
Side clearance		
Drive gear	0.08-0.14 mm (0.0031-0.0055 in.)	0.25 mm(0.0098in.)
Driven gear	0.06-0.12 mm (0.0024-0.0047 in.)	0.25 mm(0.0098in.)
Relief spring		
Free length	46.6 mm (1.835 in.)	
Load [61 N (13.5 lb)]	40.1 mm (1.579in.)	
Right silent shaft		
Front journal diameter	18.467-18.480 mm (0.7270-0.7276 in.)	
Rear journal diameter	40.951-40.967mm (1.6516-1.6129in.)	
Oil clearance		
Front	0.020-0.061 mm (0.0008-0.0024 in.)	
Rear	0.050-0.091 mm (0.0020-0.0036 in.)	
Left silent shaft		
Front journal diameter	18.467-18.480mm (0.7270-0.7276in.)	
Rear journal diameter	40.951-40.967 mm (1.6122-1.6130 in.)	
Oil clearance		
Front	0.020-0.054 mm (0.0008-0.0021 in.)	
Rear	0.042-0.083 mm (0.0017-0.0033 in.)	
Cooling method	Engine coolant cooling, forced circulation with electric fan	
Cooling system quantity	7.0 lit (7.4 U.S.qts., 6.1 Imp.qts.) [For DOHC]	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	82°C(180°F)	

Description	Specification	Limit
Opening temperature range	80°C-84°C (176°F-183°F)	
Wide open temperature	95°C (203°F)	
Radiator cap		
Main valve opening pressure	107.9±14.7 kPa (1.1±0.15 kg/cm^2 , 15.64±2.13 psi)	
Main valve closing pressure	83.4 kPa (0.85 kg/ cm^2, 12.1 psi)	
Vacuum valve opening pressure	-6.86 kPa (-0.07 kg/ cm^2, -1.00 psi)	
Air cleaner		
Type	Dry type	
Element	Unwoven cloth type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	
Coolant temperature sensor		
Type	Thermister type	
Resistance		
20°C (68°F)	2.45±0.14 kΩ	
80°C (176°F)	0.3222 kΩ	

SERVICE STANDARD

Standard value	
Coolant concentration	
Tropical area	40%
Other area	50%

LUBRICANT

Engine coolant	Ethylene glycol base for aluminum radiator

SELANT

Engine coolant temperature sensor	LOCTITE 262, three bond No. 1324 or equivalent
Oil pressure switch	3M ATD No. 8660 or Three bond No. 1141E

NOTE

O.D.= Outer Diameter

I.D.= Inner Diameter

O.S.= Oversize Diameter

U.S. = Undersize Diameter

TIGHTENING TORQUE

ECHA0200

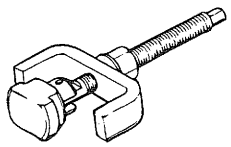
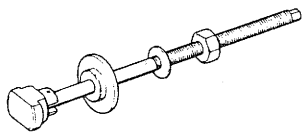
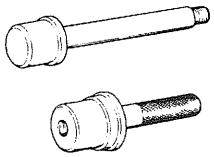
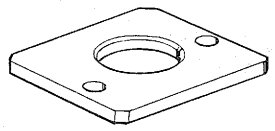
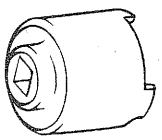
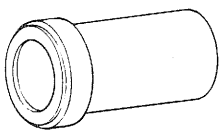
Item	Nm	kg.cm	Lb.ft
Engine mount insulator bolt	90-110	900-1100	65-80
Engine mounting bracket nuts	60-80	600-800	43-58
Engine mounting bracket bolts	60-80	600-800	43-58
Engine Support bracket bolt and nut	55-65	550-650	40-47
Front roll stopper bracket to cross member bolts	40-55	400-550	29-40
Front roll 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
Air conditioner compressor to bracket	23-27	230-270	17-20
Power steering oil pump to bracket	35-45	350-450	25-33
Front exhaust pipe to exhaust manifold	30-40	300-400	22-29
Rocker cover bolt	8-10	80-100	6-7
Center cover bolt	4-5	40-50	3-3.6
Camshaft sprocket bolt	80-100	800-1000	58-72
Camshaft bearing cap bolt	19-21	190-210	14-15
Crankshaft position sensor	10-13	100-130	7-9
Throttle body stay	15-22	150-220	11-16
Air cleaner body installation bolt	8-10	80-100	6-7
Crankshaft sprocket bolt	110-130	1100-1300	80-94
Damper pulley to crankshaft sprocket	20-30	200-300	14-22
Cylinder head bolt (cold engine)			
With change parts	63+Release all bolts +20+90°+90°	630+Release all bolts +200+90°+90°	46+Release all bolts +14+90°+90°
Without change parts.	20+90°+90°	200+90°+90°	14+90°+90°
Intake manifold stay	18-25	180-250	13-18
Tension pulley bracket bolt	23-27	230-270	17-20
Auto tensioner bolt	20-27	200-270	14-20
Tensioner pulley bolt	43-55	430-550	31-40
Idler pulley bolt	30-42	300-420	22-30
Front exhaust pipe clamp bolt	20-30	200-300	14-22
Oil pan (lower and upper)	10-12	100-120	7-9

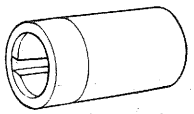
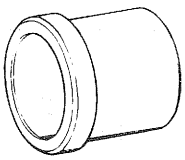
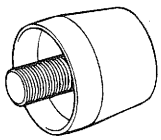
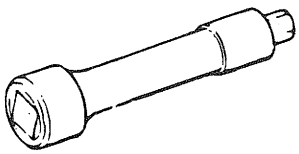
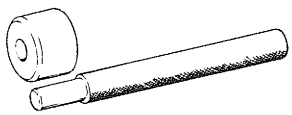
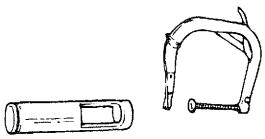
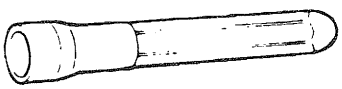
Item	Nm	kg.cm	Lb.ft
Oil pan drain plug	35-45	350-450	25-33
Oil screen	15-22	150-220	11-16
Oil pump sprocket nut	50-60	500-600	36-43
Oil pressure switch	8-12	80-120	6-9
Oil filter bracket bolt	20–27	200-270	14-20
Oil pump cover bolt	15-18	150-180	11-13
Oil seal case bolt	10-12	100-120	7-9
Plug cap	20-27	200-270	14-20
Front case bolt (M6)	20-27	200-270	14-20
Driven gear bolt	34-40	340-400	25-29
Engine coolant pump pulley bolt	8-10	80-100	6-7
Timing belt upper cover	8-10	80-100	6-7
Timing belt lower cover	8-10	80-100	6-7
Relief plug	40-50	400-500	29-36
Flywheel	130-140	1300-1400	94-101
Drive plate	130-140	1300-1400	94-101
Timing belt rear right cover	10-12	100-120	7-9
Timing belt rear left cover (upper)	10-12	100-120	7-9
Connecting rod cap bolt	20+90°	200+90°	14+90°
Crankshaft bearing cap bolt	25+90°	250+90°	18+90°
Engine hanger			
M8	25-30	250-300	18-22
M10	35-55	350-550	25-40
Alternator support bolt	20-25	200-250	14-18
Alternator brace bolt			
M8x90	8-12	80-120	6-9
M8x40	20-25	200-250	14-18
Engine coolant pump to cylinder block bolt	20-27	200-270	14-20
Engine coolant temperature sensor	20-40	200-400	14-29
Engine coolant inlet fiting attaching bolt	10-15	100-150	7-11
Air cleaner mounting bolts	8-10	80-100	6-7
Resonator mounting bolt (Nut)	8-10	80-100	6-7
Throttle body to intake manifold	15-22	150-220	11-16
Intake manifold mounting bolt (M8)	15-20	150-200	11-14
Intake manifold mounting nut	30-42	300-420	22-30
Tension rod bracket bolt to tension rod	35-55	350-550	25-40

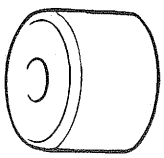
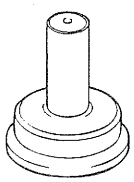
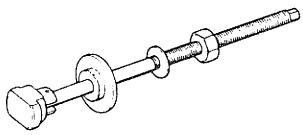
Item	Nm	kg.cm	Lb.ft
Ignition coil bolts	8-12	80-120	6-9
Power transistor bolts	10-12	100-120	7-9
Front exhaust manifold bolt to cylinder block	20-30	200-300	14-22
Center exhaust pipe nuts to catalytic converter	30-40	300-400	22-29
Center exhaust pipe bolts to main muffler	30-40	300-400	22-29
Center exhaust pipe bolt to bracket	10-15	100-150	7-11
Hanger bolt to body	10-15	100-150	7-11
Hanger bolt to main muffler	10-15	100-150	7-11
Exhaust manifold nuts to engine nut(8)	25-30	250-300	18-22
Exhaust manifold nuts to engine nut(10)	35-55	350-550	25-40
Oxygen sensor	40-50	400-500	29-36
Heat protector bolt to exhaust manifold	12-15	120-150	9-11
Air cleaner bracket bolt	10-13	100-130	7-9
Exhaust manifold cover to exhaust manifold bolt	12-15	120-150	9-11
Oxygen sensor to exhaust manifold	40-50	400-500	29-36
Front exhaust pipe bracket bolt	20-30	200-300	14-22
Main muffler hanger support bracket bolt	10-20	100-200	7-14
Oil level gauge	12-15	120-150	9-11
Stud bolt	30-40	300-400	22-29
Tensioner arm assembly	17-26	170-260	12-19
Balance shaft bolt	34-40	340-400	25-29
Starter bolt to cylinder block	27-35	270-350	20-25
Radiator fan motor bolt	8-10	80-100	6-7
Delivery pipe to cylinder block	10-13	100-130	7-9

SPECIAL TOOLS

ECHA0300

Tool (Number and name)	Illustration	Use
Counter balance shaft bearing puller (09212-32000)	 ECA9930K	Removal of front bearing of counter balance shaft
Counter balance shaft bearing puller (09212-32100)	 ECA9930L	Removal of rear bearing of counter balance shaft (use with 09212-32300)
Counter balance shaft bearing installer (09212-32200)	 ECA9930M	Installation of counter balance shaft front and rear bearing (use with 09212-32300)
Guide plate (09212-32300)	 ECA9930N	Removal and installation of counter balance shaft rear bearing (use with 09212-32100, 09212-32200)
Plug cap wrench (09213-33000)	 ECA9930O	Removal and installation of front case cap plug
Crankshaft front oil seal installer (09214-32000)	 ECA9930A	Installation of the crankshaft front oil seal (use with 09214-32100)

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal guide (09214-32100)	 ECA9930B	Installation of the crankshaft front oil seal (use with 09214-32000)
Camshaft oil seal installer (09221-21000)	 ECA9930C	Installation of the camshaft oil seal (use with 09221-21100)
Camshaft oil seal guide (09221-21100)	 E2121100	1. Used as a guide when pressing in the camshaft oil seal (use with 09221-21000)
Cylinder head bolt socket (09221-32001)	 ECHA001E	Removal and installation of the cylinder head bolt
Valve guide installer (09222-21200A, 09222-21200B)	 ECA9930G	Removal and installation of the valve guide
Valve spring compressor (09222-28000) Valve spring compressor holder (09222-28100)	 ECA9930E	Removal and installation of the inlet or exhaust valve
Valve stem oil seal install (09222-28200)	 ECHA001G	Installation of the valve stem oil seal

Tool (Number and name)	Illustration	Use
Valve guide installer adapter (09222-28400)	 ECHA001I	Installation of the valve guide
Crankshaft rear oil seal installer (09231-21000)	 ECA9930H	1. Installation of the engine rear oil seal 2. Installation of the crankshaft real oil seal
Piston pin remover and installer kit (09234-33001)	 ECA9930L	Removal and installation of the piston pin
insert (09234-33002)	 ECA9930J	Removal and installation of the piston pin (use with 09234-33001)

TROUBLESHOOTING

ECHA0400

Symptom	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 valve 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
	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 rolling and 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 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 beaing 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 (alternator 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 radiator	Foreign material in coolant	Replace

Symptom	Probable cause	Remedy
Abnormally high coolant temperature	Faulty thermostat	Replace
	Faulty radiator cap	Replace
	Restriction of flow in cooling system	Replace
	Loose or missing drive belt	Adjust or replace
	Faulty engine coolant pump	Replace
	Faulty temperature 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 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	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

CHECKING ENGINE OIL ECHA0500

1. Position a vehicle on a level surface.
2. Stop the engine.

NOTE

In the case of a vehicle that has been out of service for a prolonged period, run the engine for several minutes.

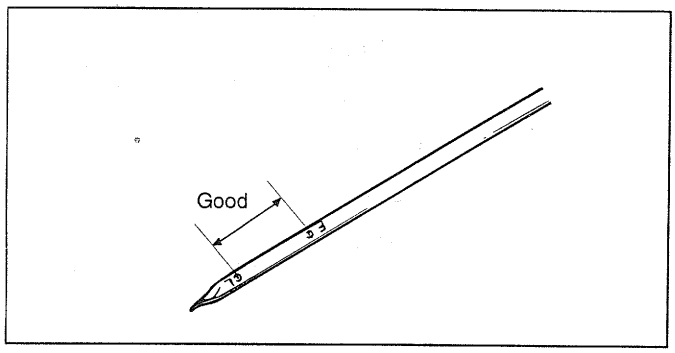
Stop the engine and wait for 5 minutes at least, and then check the oil level..

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 same type of engine oil as the used one.

4. Check that the oil is not dirty or mixed with coolant or gasoline and it has the proper viscosity.

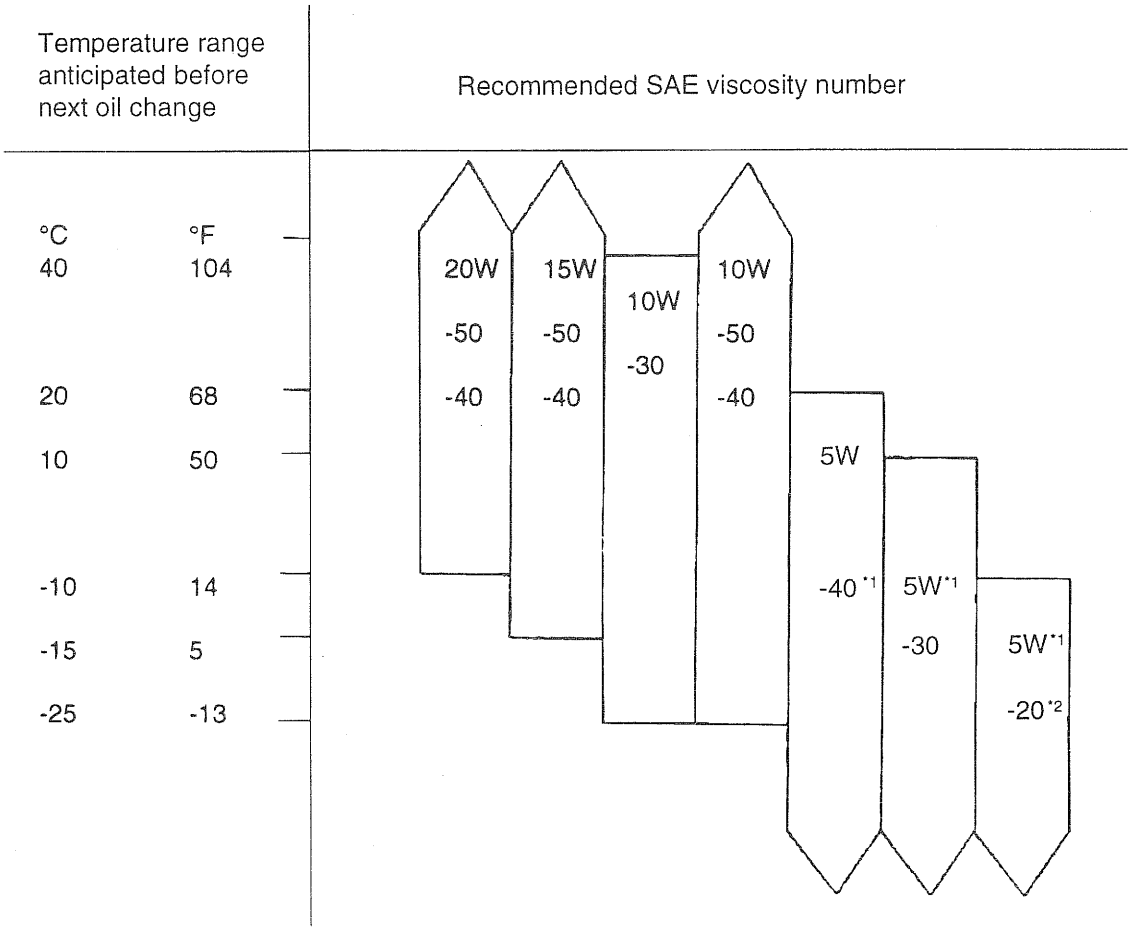


EDA9000A

SELECTION OF ENGINE OIL ECHA0600

Recommended API classification: SD OR ABOVE SE OR ABOVE [For EC.]

Recommended SAE viscosity grades:



***1 Restricted by driving and climate condition.**
***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 which do not have both a SAE grade number and an API service classification on the container should not be used.

CHANGING ENGINE OIL ECHA0700

1. Run the engine until it reaches normal operating temperature.
2. Stop the engine.
3. Remove the oil filler cap and the 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)

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 : 4.0 lit (4.23 U.S.qts., 3.51 Imp.qts.)

NOTE

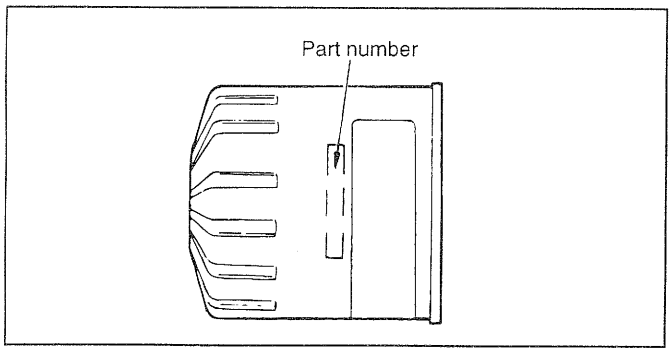
Do not overfill. This will cause oil aeration and loss of oil pressure.

6. Install the oil filler cap.
7. Start and run the engine.
8. Stop the engine and then check the oil level. Add oil if necessary.

REPLACING THE OIL FILTER ECHA0800

All Hundai Moter Campany engines are equipped with a high quality, throw-away oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters is various considerably.

High quality replacement 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 a new filter.



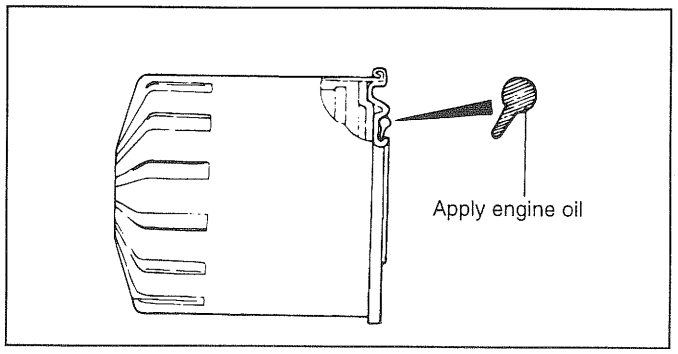
ECA9970A

PROCEDURE FOR REPLACING THE 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.

Oil filter : 12-16 Nm (120-160 kg.cm, 9-12 lb.ft)

4. Start and run the engine and check for engine oil leak.
5. After stopping the engine, check the oil level and add oil as necessary.



ECA9970B

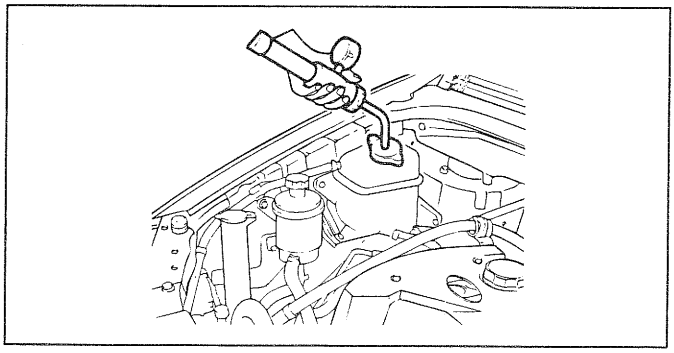
CHECKING COOLANT LEAK ECHA0900

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/cm^2) 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 spray 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.



ECHA054A

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 :

107.9kPa±14.7kPa (1.1±0.15 kg/cm^2, 15.64±2.13)

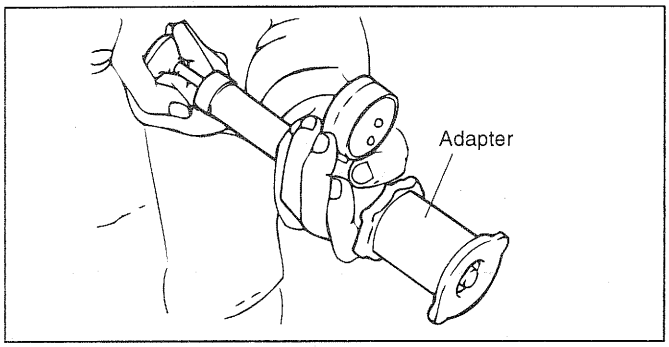
Main valve closing pressure :

83.4 kPa (0.85 kg/cm^2, 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

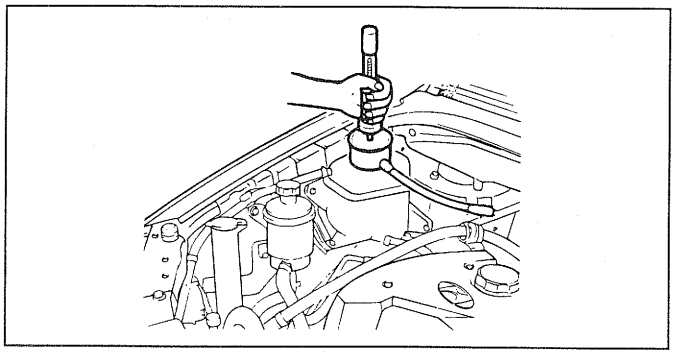
Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect indication.



ECA9090A

SPECIFIC GRAVITY TEST ECHA1000

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.



ECHA054B

RELATION BETWEEN 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%, the anti-corrosion property 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 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 ECHA1100

1. Before checking compression pressure, 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 engine coolant temperature reaches 80-95°C (176-205°F).
3. Stop the engine and disconnect the spark plug cables.
4. Remove the spark plugs.
5. Crank the engine to remove any foreign material in the cylinders.
6. Insert the compression gauge into the spark plug hole.

7. Depress the accelerator pedal to open the throttle fully.

8. Crank the engine and read the gauge.

Standard value : 1200kpa (12.2Kg/cm^2, 170 psi)

Limit : 12.0 kg/cm^2 (1.18 MPa, 171 psi)

9. Repeat steps from 6 to 8 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/cm^2 ,14 psi) between cylinders

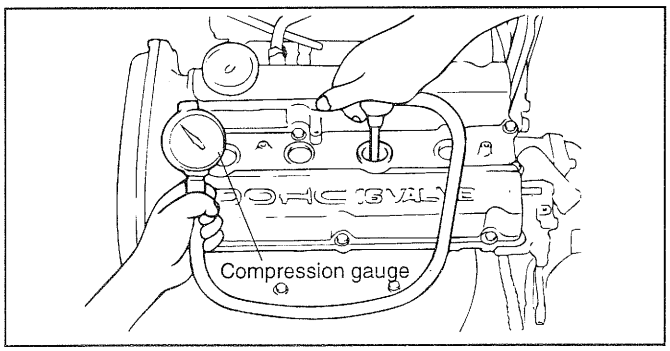
10. If a cylinder's compression or pressure differential is below specification, add a small amount of oil through the spark plug hole, and repeat steps from 6 to 9.

    1) If the addition of oil makes the compression to rise, it is possible 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)



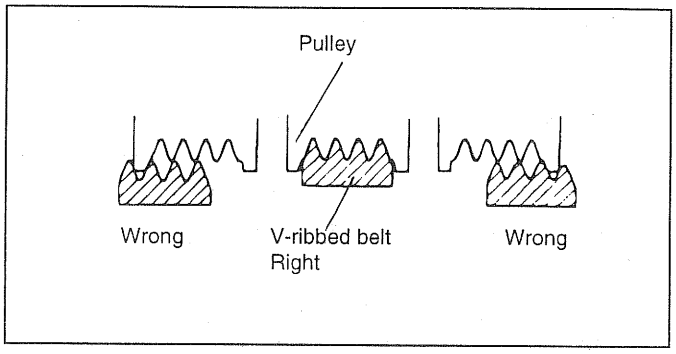
ECA9001A

ADJUSTING DRIVE BELT TENSION ECHA1200

1. Check that the belts are not damaged and are properly fit for the pulley grooves.

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 degree that the belt is deflected.**



ECA9980A

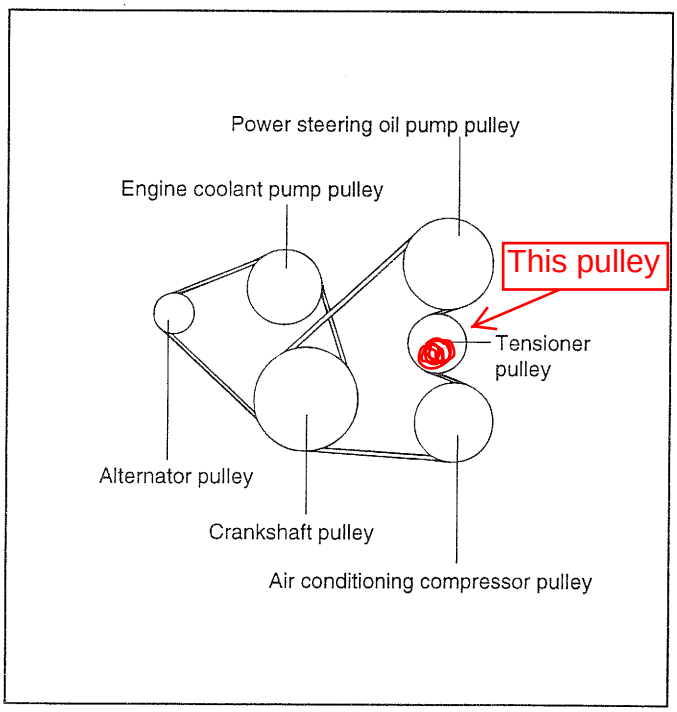
2. Apply 100 N (22 lbs.) force to the back and midway portion of the belt between the pulleys as shown in the illustration, measure the amount of deflection with a tension gauge.

STANDARD VALUE:

Items		Inspection	Adjustment	
			New	Used
For alternator	Deflection mm (in.)	9.0-10.4 (0.35-0.41)	7.5-9.0 (0.30-0.35)	10 (0.40)
	Tension N (lb)	350-500 (79-112)	600-700 (135-157)	400 (90)
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

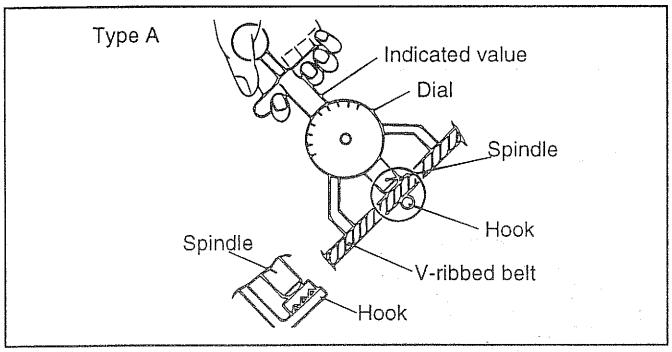
1. **The belt tension must be measured between the specified pulleys.**
2. **When a new belt is installed, adjust the tension to the central value of the standard range indicated under "New" in the above table. And then let the engine idle for 5 minutes or more, and check the standard value indicated under "Inspection."**
3. **When adjusting a belt which has been used or a belt installed newly 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.**



ECA9002A

A TYPE OF TENSION GAUGE

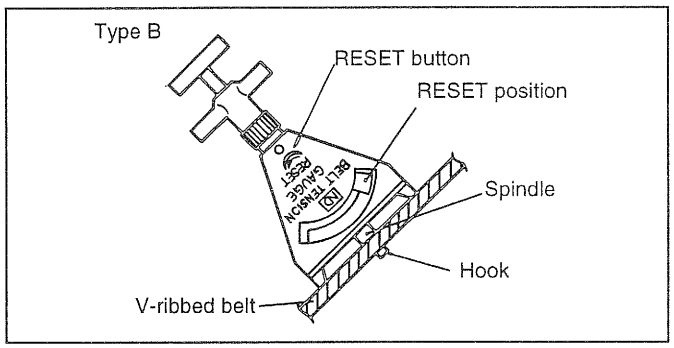
Do not let the dial section of the tension gauge contact other objects during measurement.



ECA9980C

B TYPE OF 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 will 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 nut A :

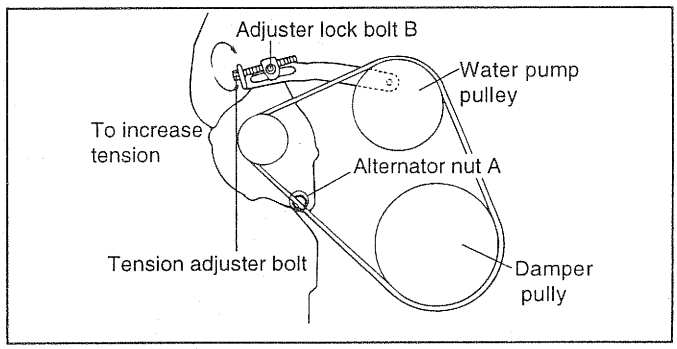
35-55 Nm (350-550 kg.cm, 25-40 lb.ft)

Adjuster lock bolt B :

20-25 Nm (200-250 kg.cm, 14-18 lb.ft)

Tension adjuster bolt :

8-12 Nm (80-120 kg.cm, 6-9 lb.ft)



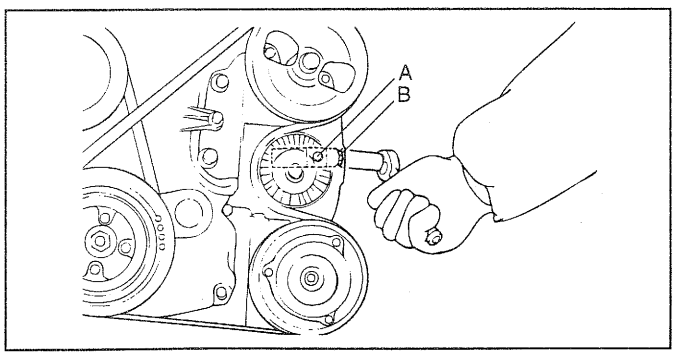
ECA9003A

ADJUSTING THE BELT OF POWER STEERING AND AIR CONDITIONER

1. Loosen the tension pulley adjustment bolt A.
2. Adjust the belt deflection with the adjustment bolt B.
3. Tighten the fixing bolt A.
4. Recheck the belt deflection and readjust, if necessary.

NOTE

Before rechecking, crank the engine one more revoltions.

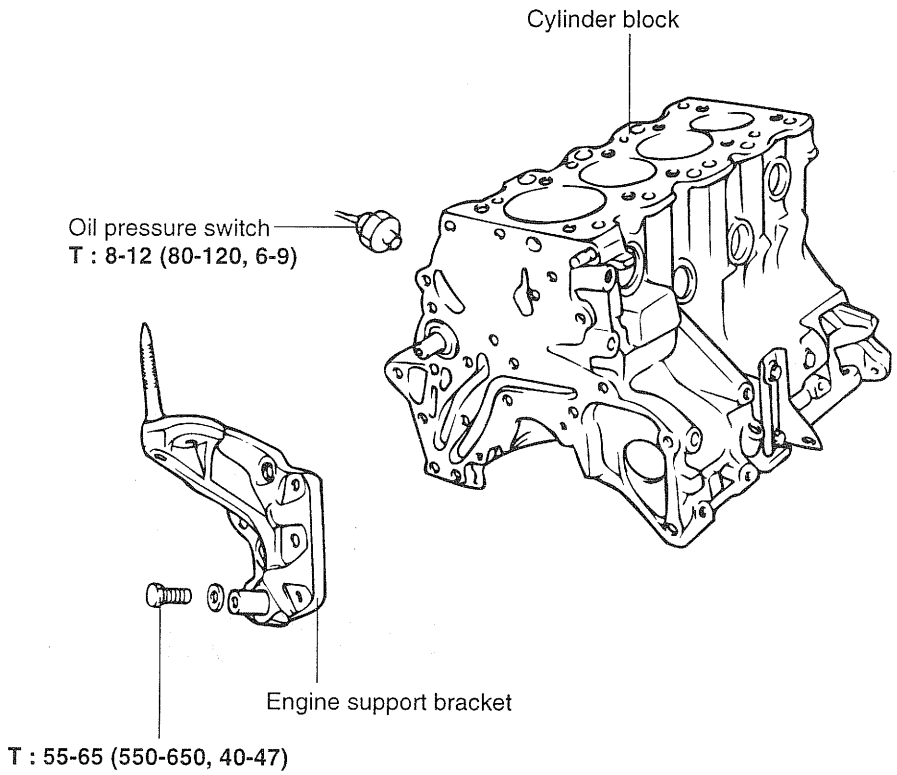


ECA9004A

ENGINE BLOCK

ENGINE BLOCK

CYLINDER BLOCK ECHA1500



TORQUE : Nm (kg·cm, lb·ft)

ECHA150A

DISASSEMBLY ECHA1600

Remove the cylinder head, timing belt train, front case, flywheel, piston and crankshaft.

For further details, refer to the appropriate section.

INSPECTION ECHA1700

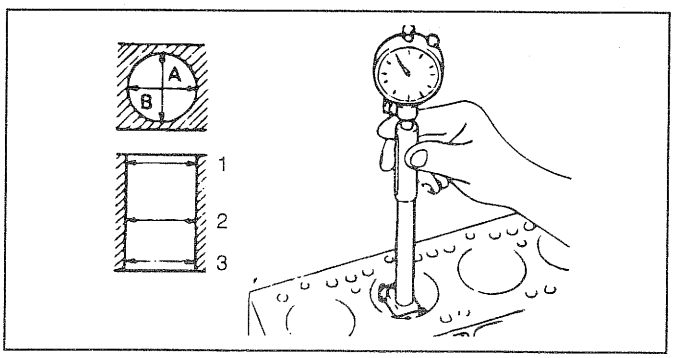
CYLINDER BLOCK

1. Visually check the cylinder block for scores, rust and corrosion. Also check for cracks or any other defects. Repair or replace the block if defective.
2. Measure the cylinder bore with a cylinder gauge at the three levels indicated 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 : 86.5+0.03 mm (3.41+0.0012 in.)

Out-of -round and taper of cylinder bore :

Max. 0.01mm(0.0004 in.)

4. If a ridge exists at the top of the cylinder, cut it away with a ridge reamer.

5.

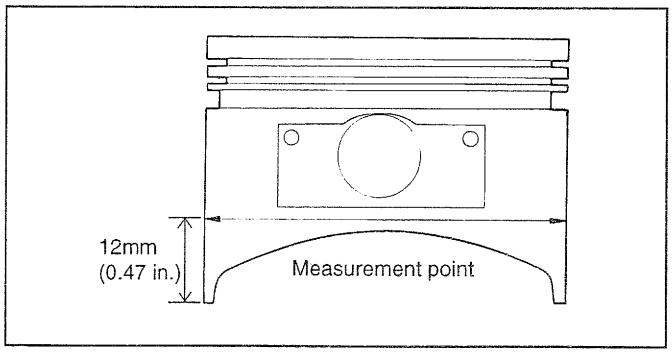
PISTON SERVICE SIZE AND MARK MM (IN.)

Identification Mark	Size
0.50	0.50 (0.020) O.S

6. To rebore 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 2 mm (0.08 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder wall clearance :

0.02-0.04mm(0.0008-0.0016 in.)



ECA9451A

7. Check for damage and cracks.

8. Check the top surface of the cylinder block for flatness. If the top surface exceeds limits, grind to minimum limit or replace.

Standard value

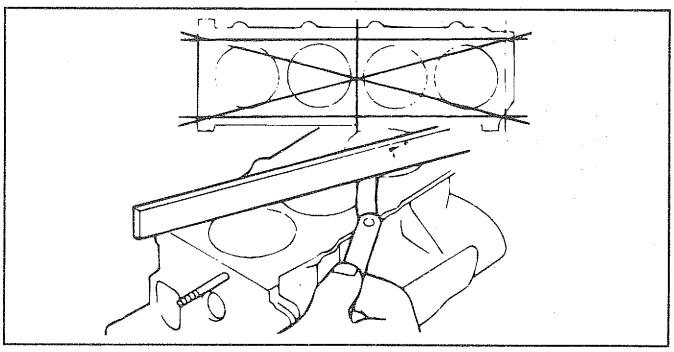
Flatness of cylinder block : Max. 0.05mm(0.0020 in.)

Service limit

Flatness of cylinder block : 0.1mm(0.0039 in.)

NOTE

When the cylinder head is assembled, grinding less than 0.2 mm (0.008 in.) is permissible.



ECA9450B

BORING CYLINDER

1. Oversize pistons used should be determined basis of the largest bore cylinder.

Identification Mark	Size
0.50	0.50 mm (0.020 in.) O.S.

NOTE

Size mark is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.

3. On the basis of measured O.D., calculate the boring dimension.

   Boring dimension = Piston O.D + 0.02 to 0.04 mm (0.0008 to 0.0016 in.) (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. Check 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.

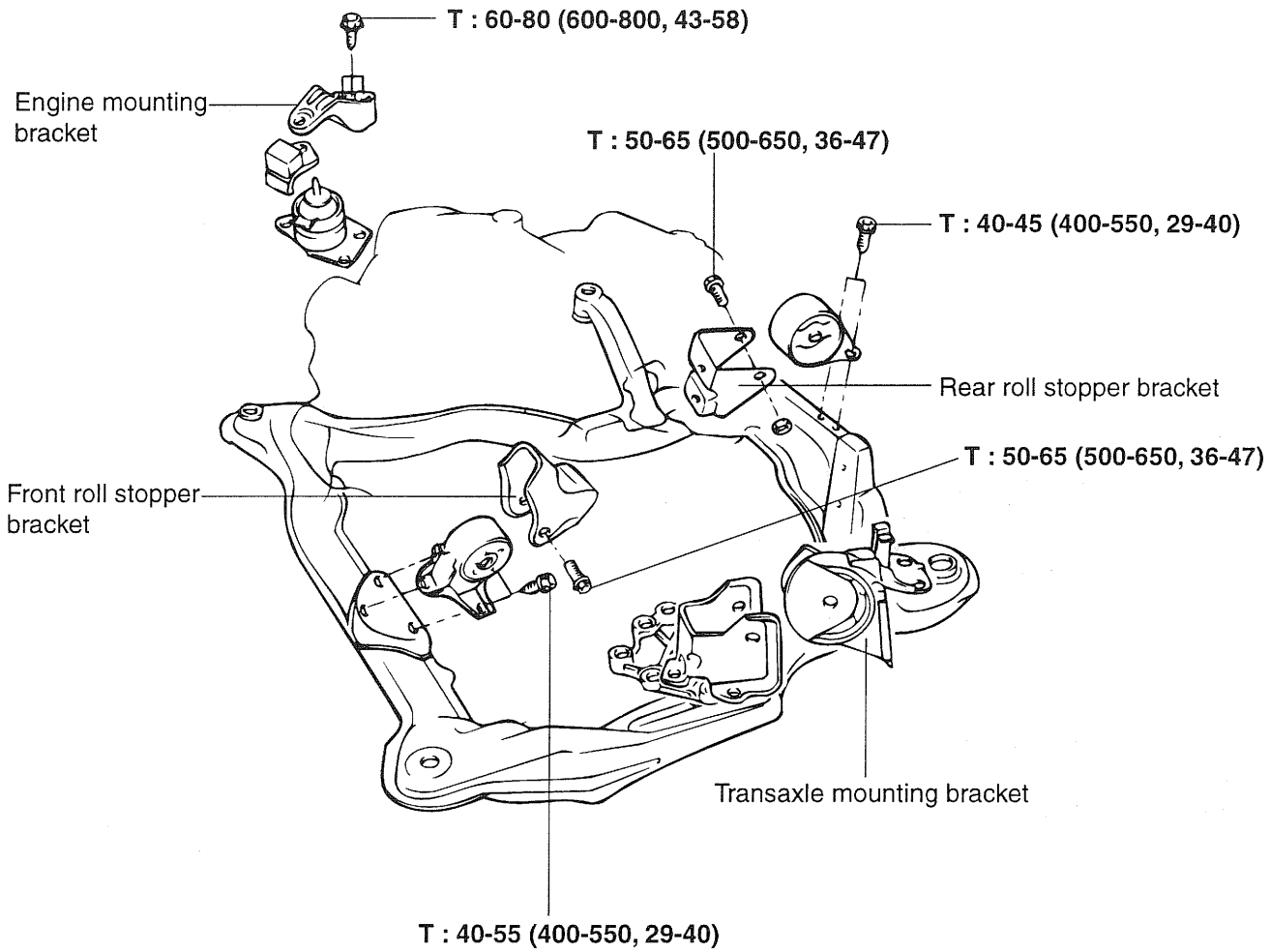
REASSEMBLY ECHA1800

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

ENGINE MOUNTING ECHA2000

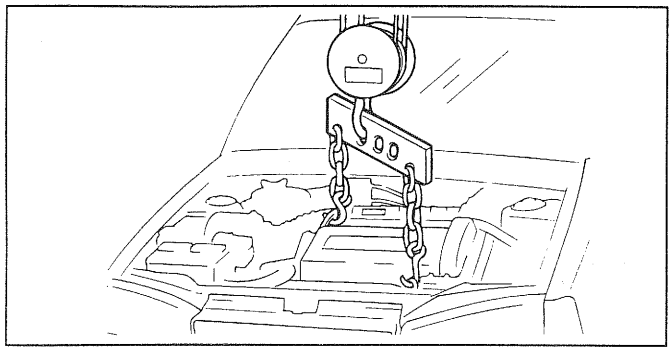


TORQUE : Nm (kg·cm, lb·ft)

ECHA003A

REMOVAL ECHA2100

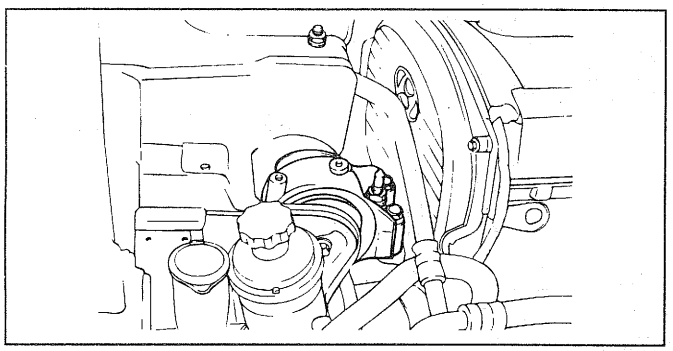
Hang a chain or cable to the engine hooks and lift enough so that there may be no pressure on the insulators.



ECA9120A

ENGINE MOUNTING

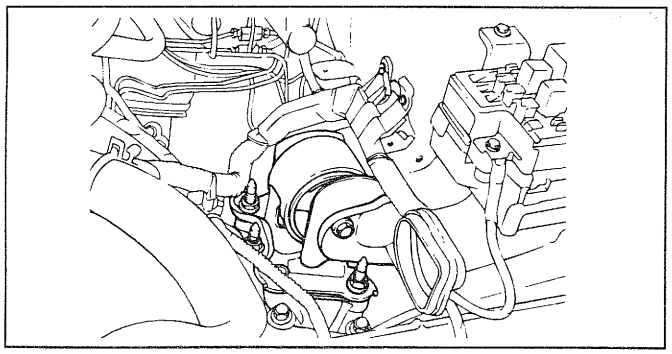
1. Remove the engine mounting insulator bolts.
2. Remove the engine mounting bracket from the engine.



ECA9006A

TRANSAXLE MOUNTING

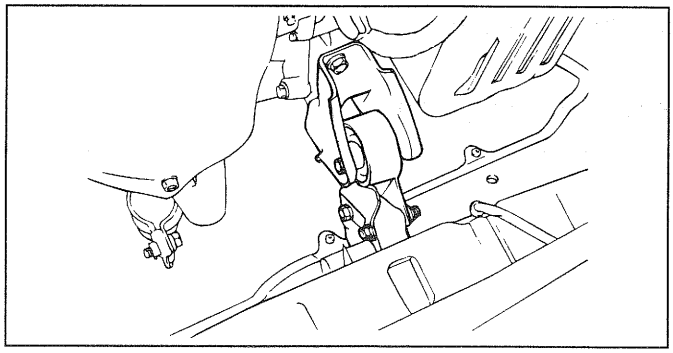
1. Remove the transaxle mounting insulator bolts.
2. Remove the tranaxle mounting bracket from the transaxle.



ECA9007A

FRONT ROLL STOPPER

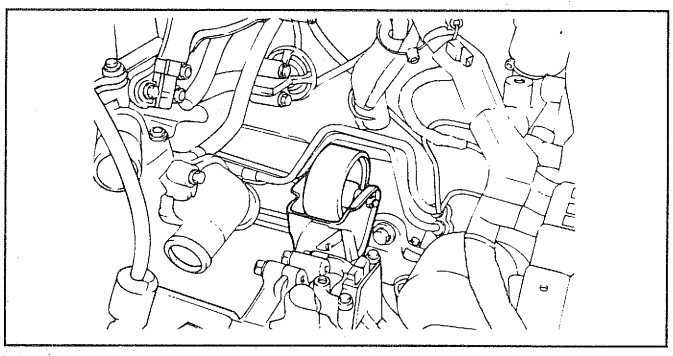
Remove the front roll stopper bracket from the sub-frame.



ECA9008A

REAR ROLL STOPPER

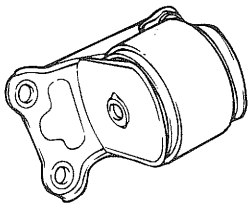
1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the subframe.



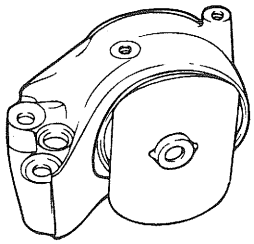
ECA9009A

INSPECTION ITEMS ECHA2200

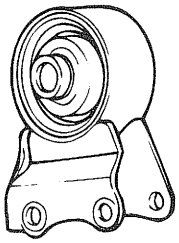
Transaxle mounting



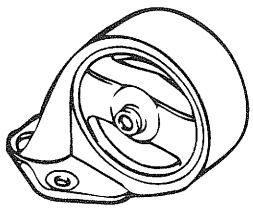
Engine mounting



Front roll stopper assembly



Rear roll stopper assembly

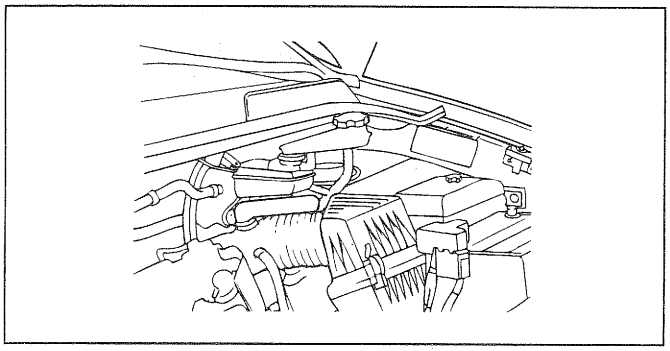


ECA9010A

ENGINE AND TRANSAXLE ASSEMBLY ECHA2300

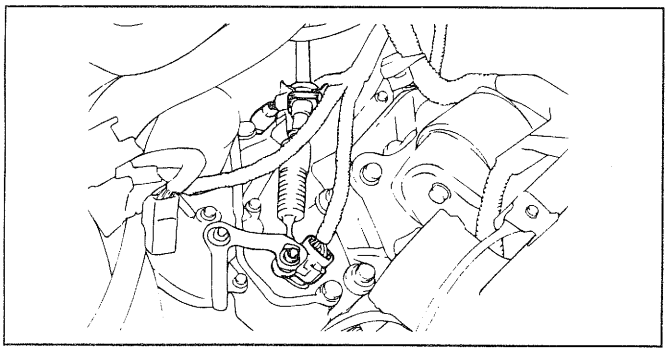
REMOVAL

1. Remove the battery.
2. Detach the air cleaner.

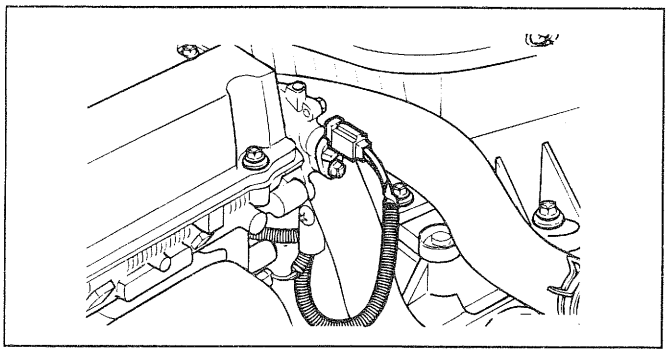


ECHA004A

3. Disconnect the engine harness connectors.
   1. Engine wiring connectors (alternator, starter, etc.)
   2. TPS connector
   3. Power steering switch connector, oil pressure gauge connector.
   4. Back up lamp switch connector.
   5. A/T solenoid, inhibit switch connector.
   6. Coolant temperature sensor.
   7. Ignition coil, power TR connector.
   8. Idle speed control valve (ISCV) connector.
   9. MAP and ATS connector.
   10. Oxygen sensor connector.



ECA9014A



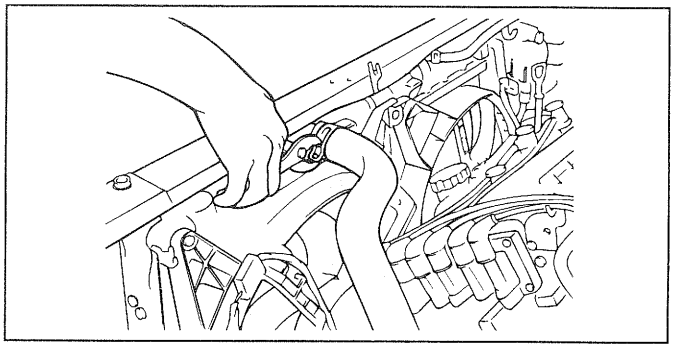
ECHA004C

4. Drain the engine coolant.
5. For a vehicle with automatic transaxles, disconnect the transaxle oil cooler hoses.

NOTE

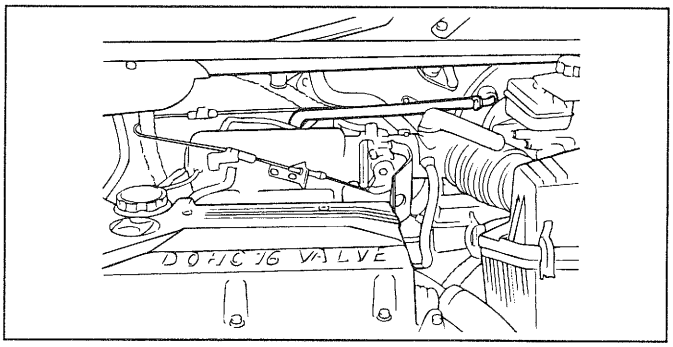
- **When disconnecting the hoses, make identification marks to avoid making any mistake when installing them again.**
- **Be careful not to spill any of oil or fluid out of the hoses. Plug the openings to prevent the entry of foreign material.**

6. Disconnect the radiator upper and lower hoses on the engine side then remove the radiator assembly.



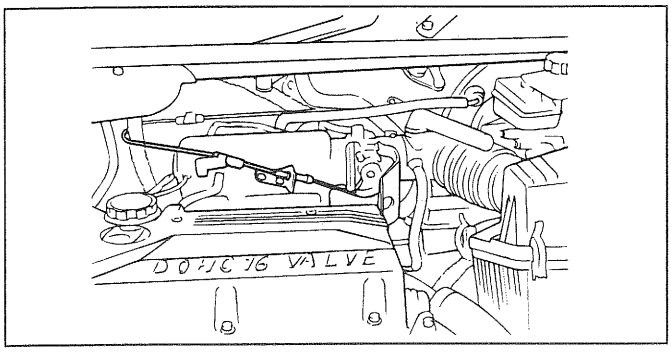
EDHA004D

7. Disconnect the engine ground.
8. Disconnect the brake booster vacuum hose.



EDHA006B

9. Disconnect the heater hoses (inlet and outlet) on the engine side.
10. Disconnect the accelerator cable at the engine side.

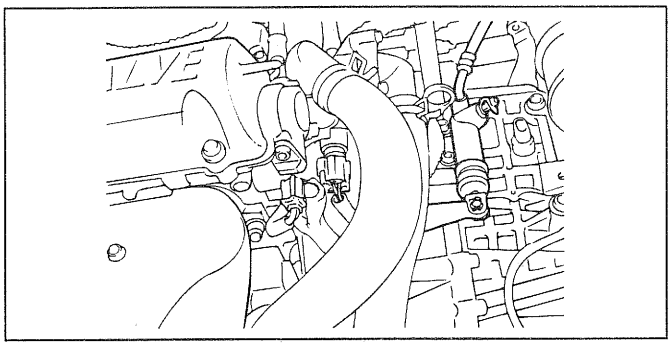


EDHA006E

11. Using a special tool, remove the main fuel line connected to delivery pipe (supply/return).

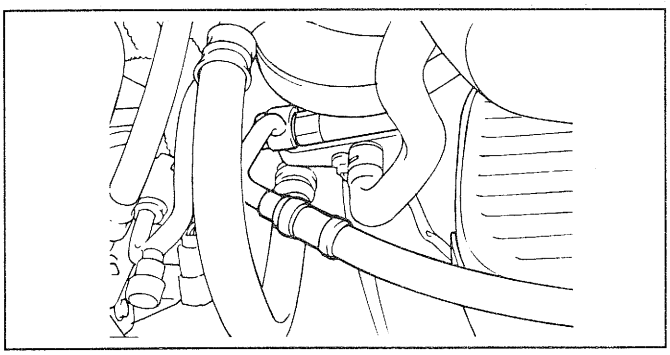
12. Disconnect the speedometer cable from the transaxle.

13. Disconnect the clutch cable or control cable from the transaxle.



ECHA004N

14. Disconnect the power steering suction hose and return hose from pump.

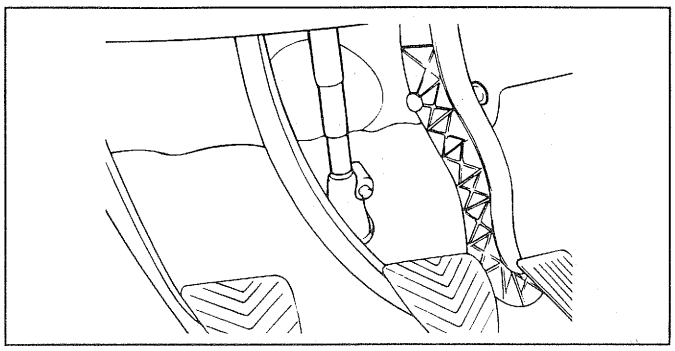


ECHA004H

15. Detach the steering dust cover in the room and then disassemble the gear box by loosening the universal joint bolt.

NOTE

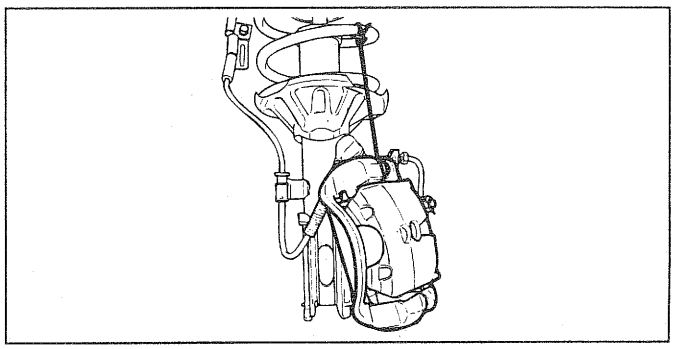
Make sure that make identification marks between the universal joint and the gear box for the assembly.



ECHA004I

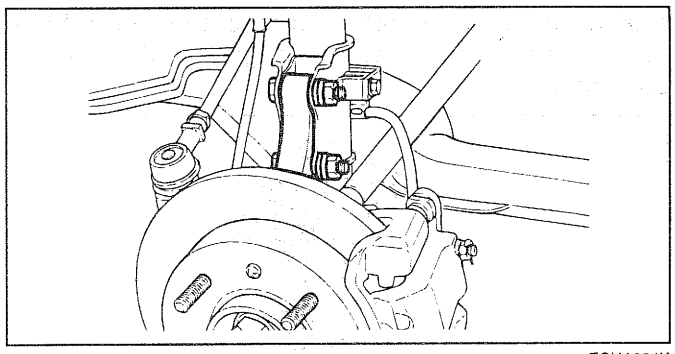
16. Raise the vehicle and then remove the front tire.

17. Remove the calliper assembly from knuckle and then tie it upside.



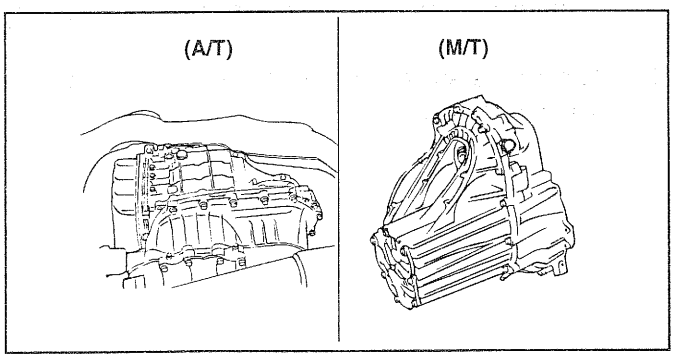
ECHA004J

18. Loosen the strut lower bolt and then remove it.



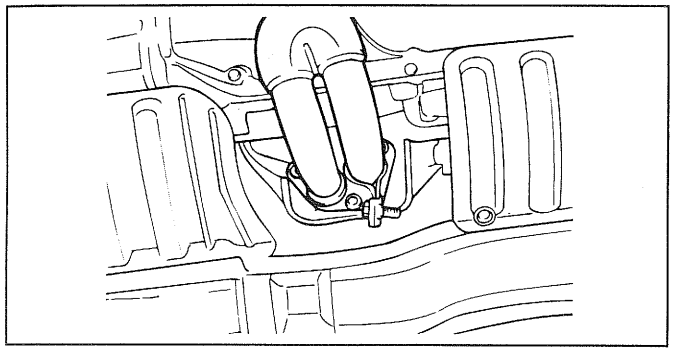
ECHA004K

19. Drain the transaxle oil.



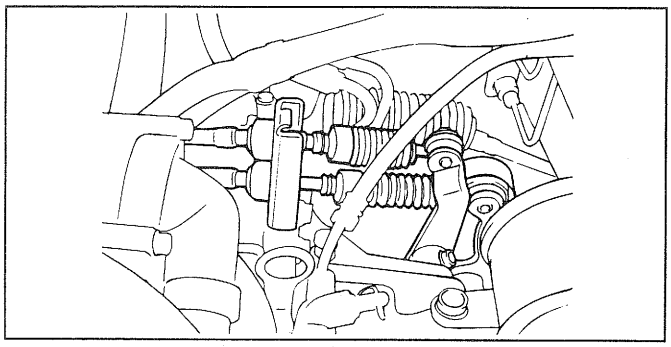
EDHA004Z

20. Remove the front muffler.



ECHA004M

21. Remove the transaxle control rod and extension rod (M/T only).

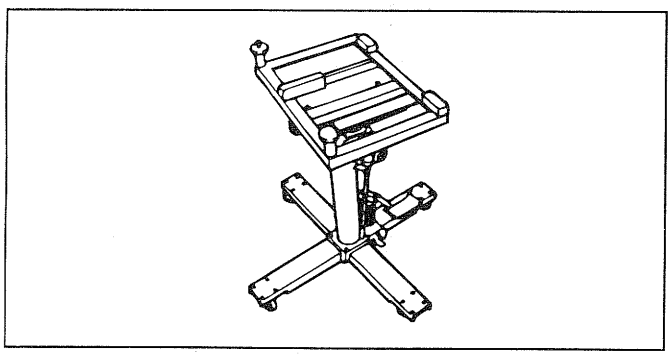


EDHA006F

22. Put the special die on the T/M jack and then adjust it to sub-frame.

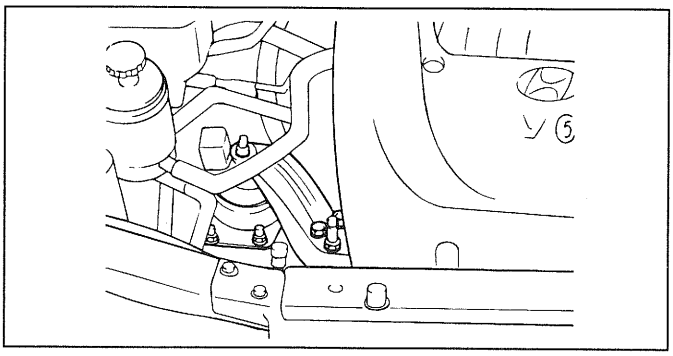
NOTE

Check that all the cables, harness connector, hose are disconnected from the engine and transaxle assembly.

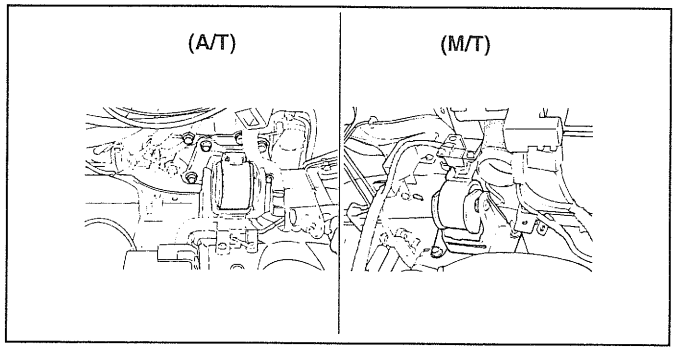


ECHA004O

23. Remove the engine mounting bracket and transaxle mounting bracket.

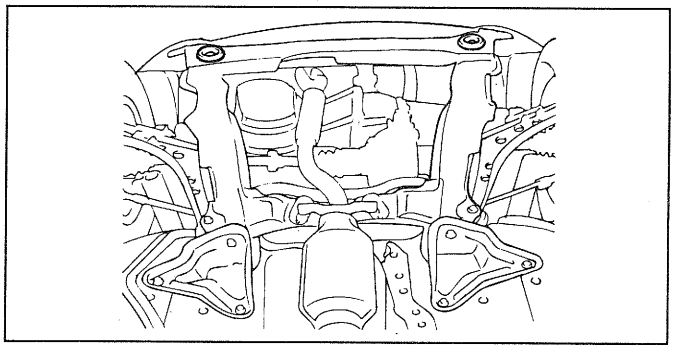


EDHA004A

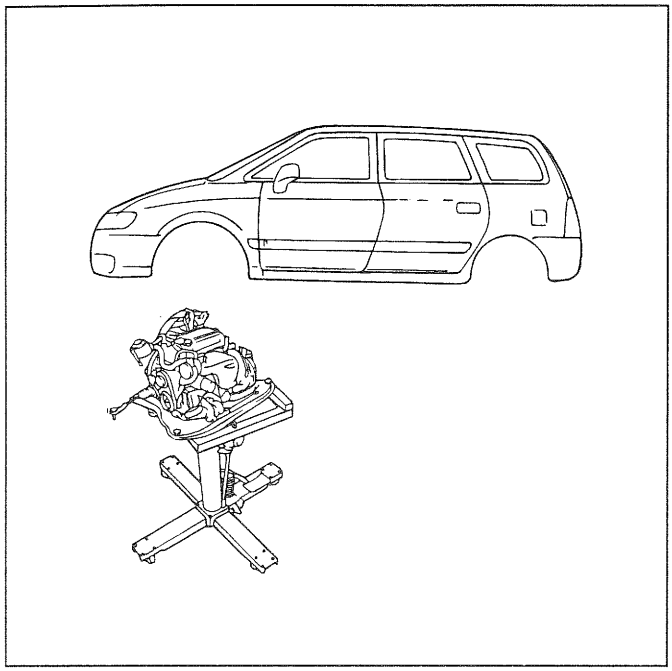


EDHA004C

24. Remove the sub-frame installation bolts.

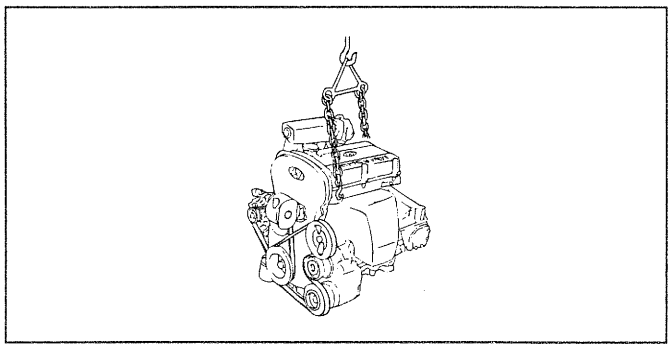


ECHA052A



EDHA006I

25. After remoring the drive shaft and hang the engine and transaxle assembly on the hoist and then remove the front roll stopper and the rear roll stopper.



ECA9021A

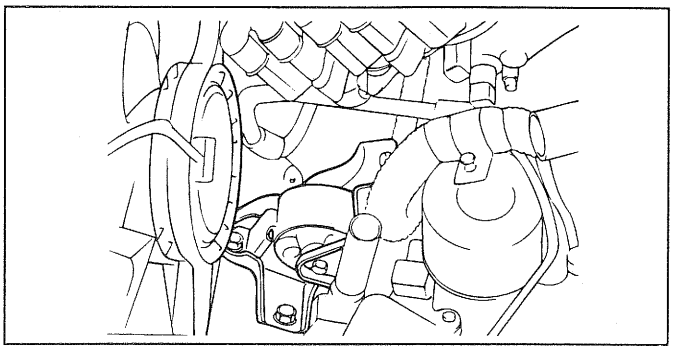
INSTALLATION ECHA2400

1. While checking the connections of harnesses, pipes, hoses, etc., make sure that none of them is being caught, damaged, etc.

2. Install the front roll stopper to the bracket roughly.

Tightening torque

Service standard : 50-65 Nm (500-650kg.cm, 36-47 lb.ft)

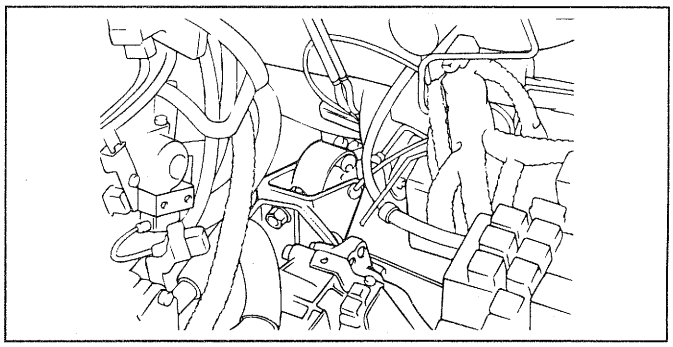


ECHA005A

3. Install the rear roll stopper to the bracket.

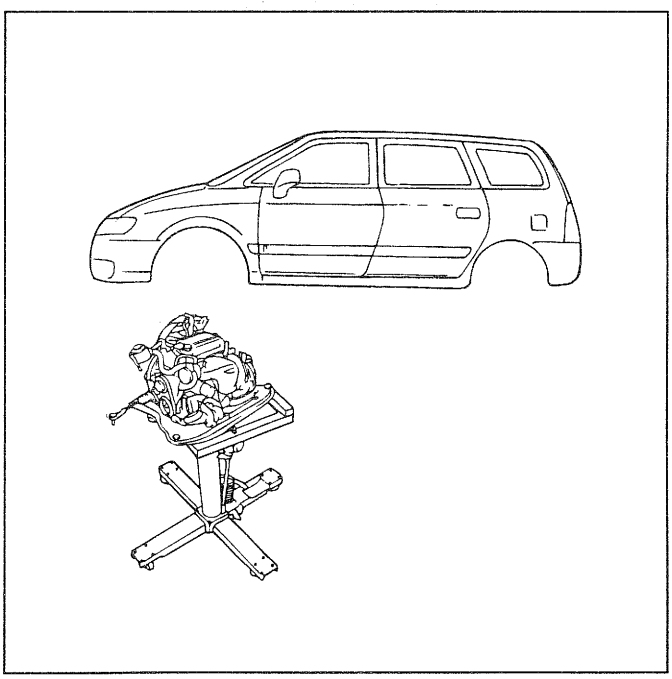
Tightening torque

Service standard : 50-65Nm(500-650kg.cm, 36-47 lb.ft)



ECHA005B

4. Put on the engine, transaxle sub-frame assembly by using the T/M jack and then adjust it to the vehicle body slowly.

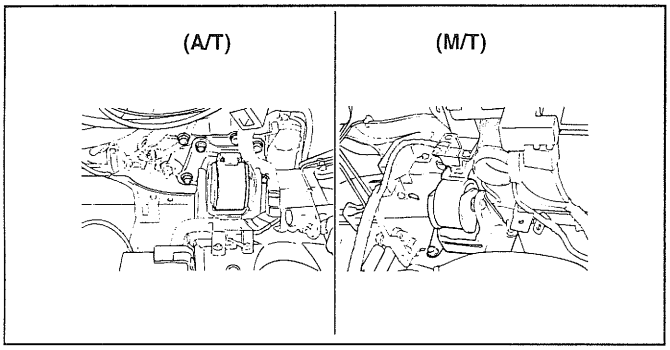


EDHA006I

5. Install the transaxle mounting bracket.

Tightening torque

Service standard : 90-110Nm(900-1100kg.cm, 65-80 lb.ft)



EDHA004C

6. Install the engine bracket (right side).

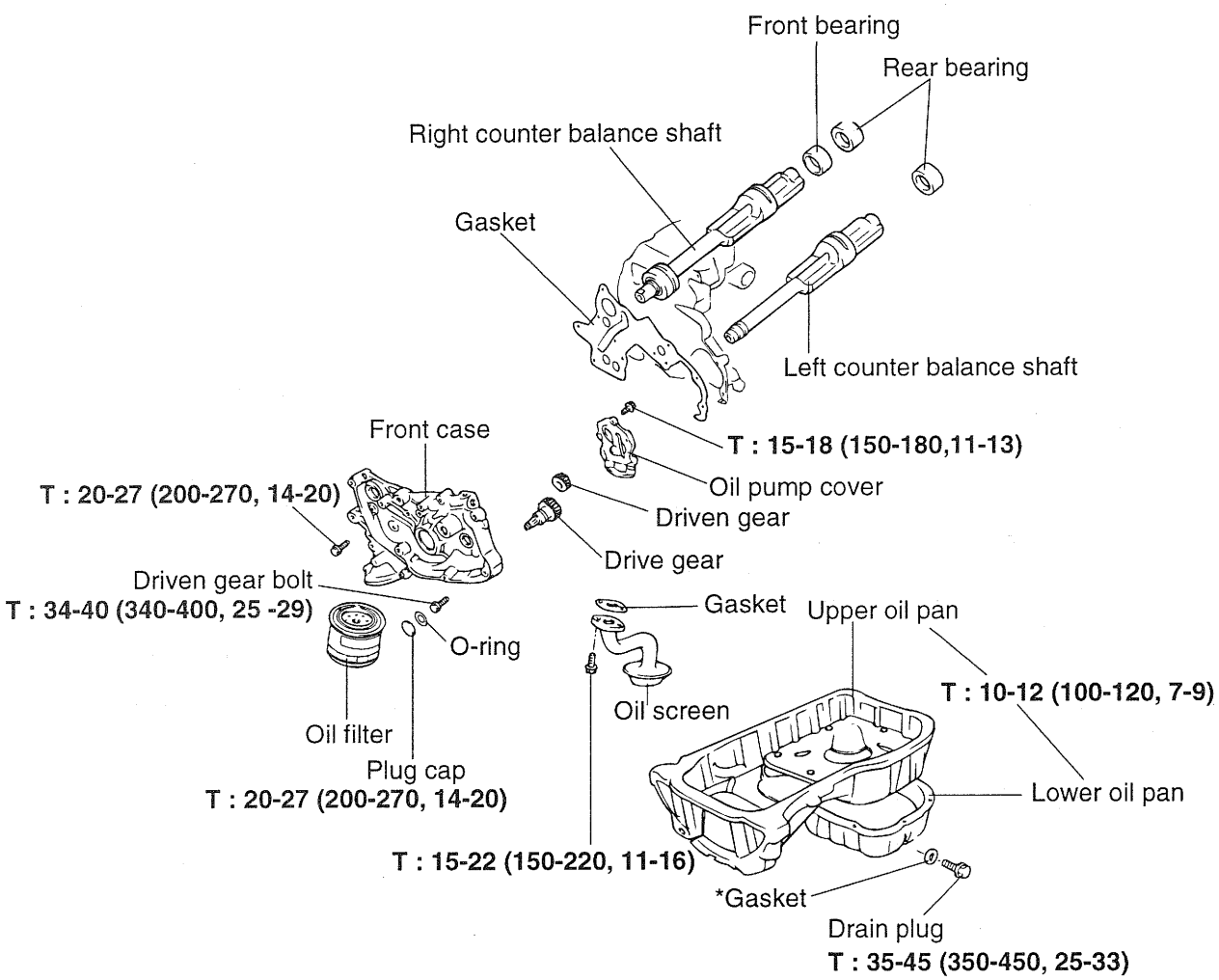
Tightening torque

Service standard : 60-80Nm(600-800kg.cm, 43-58 lb.ft)

7. To install all of parts follow the removal procedures in the reverse order.
8. Refill the coolant and then check for leak.
9. Refill the transaxle oil and check for leak, test it's operation.
10. Check for the operation of the transaxle control cable and accelerator cable.
11. Check for proper operation of each gauge.

FRONT CASE

OIL PUMP CASE, OIL PUMP AND COUNTER BALANCE SHAFT ECHA2500



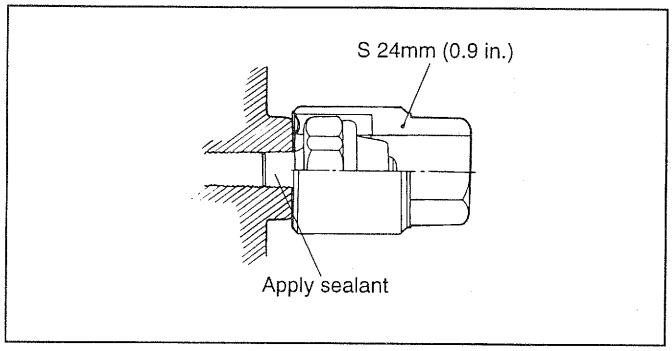
TORQUE : Nm (kg.cm, lb.ft)

*Drain plug gasket should not be used again.

ECHA250A

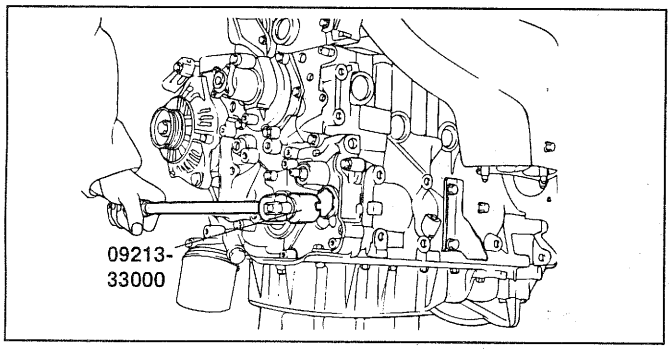
DISASSEMBLY ECHA2600

1. Remove the timing belt. Refer to "Timing Belt."
2. Remove all the oil pan bolts.
3. Tap the oil pan by rubber hammer and remove the cylinder block and oil pan.
4. Remove the oil screen and gasket.
5. Remove the front case assembly.
6. Remove the oil pressure switch.



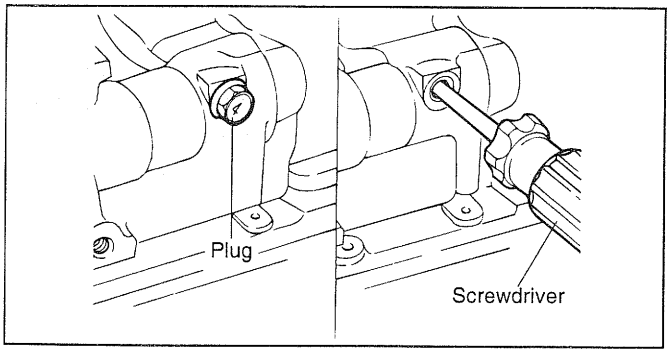
ECHA260A

7. Remove the oil filter bracket and gasket.
8. Using the special tool (09213-33000) remove the plug cap from the oil pump portion of the front case.



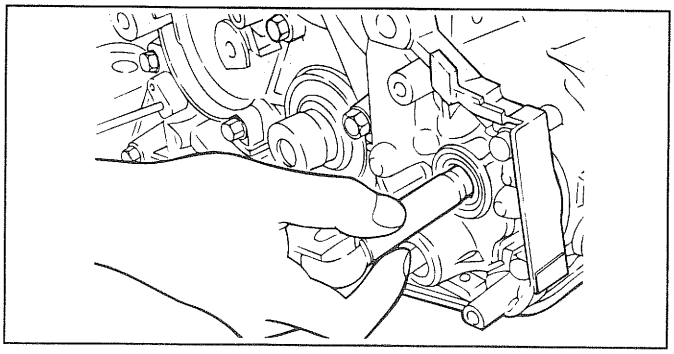
ECA9040A

9. Remove the left side of cylinder block plug and insert a screw driver with an 8 mm (0.32 in.) diameter into plug hole. The screwdriver must be inserted more than 60 mm (2.4 in.)



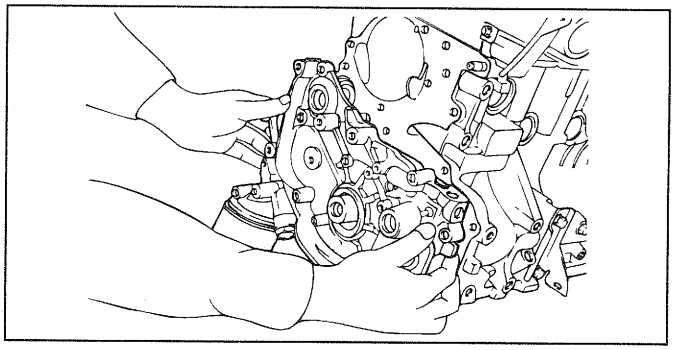
ECA9310C

10. Remove the oil pump driven gear and the left counter balance shaft retaining bolt.



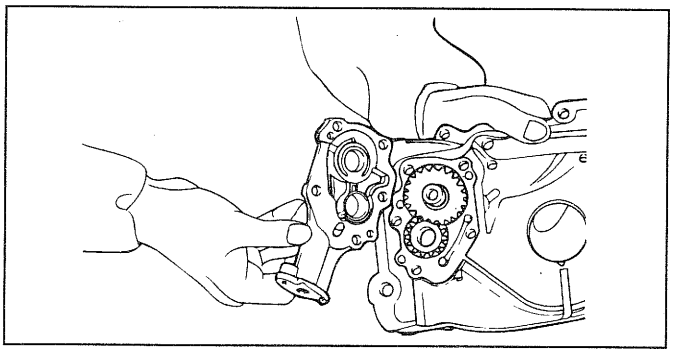
ECA9310D

11. Remove the front case mounting bolts and remove the front case assembly and gasket and then remove the two counter balance shafts from the cylinder block.



ECA9041A

12. Remove the oil pump cover from the front case.
13. Remove the oil pump gears from the front case.



ECA9042A

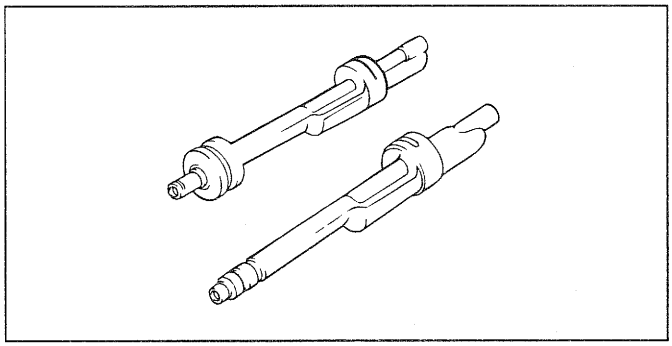
INSPECTION ECHA2700

FRONT CASE

1. Check oil holes for clogging. Clean holes if necessary.
2. Check the counter balance shaft front bearing section for wear, damage and seizure. If there is anything wrong with the section, replace the front case.
3. Check the front case for crack and other damage.
4. Replace the cracked or damaged front case.

COUNTER BALANCE SHAFT

1. Check journals for wear or seizure.
2. If excessive wear or seizure is evident, check the bearing carefully.
3. If necessary, replace the counter balance shaft bearing or both.



ECA9043A

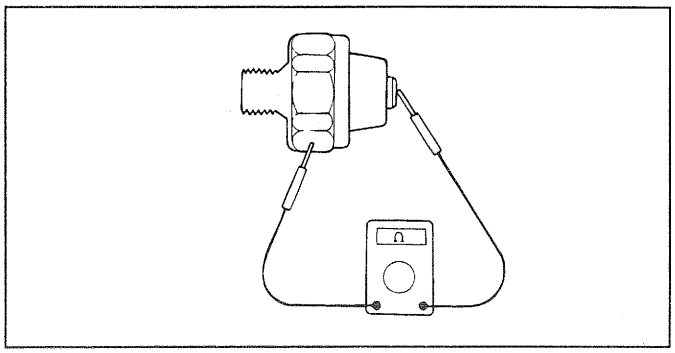
OIL SEAL

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.

OIL PRESSURE SWITCH

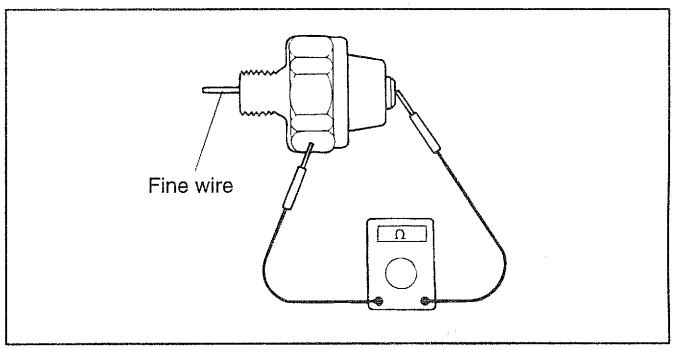
1. Check the continuity between the terminal and the body with an ohmmeter.

   If there is nonconitnuity, replace the oil pressure switch.



ECA9320D

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 it.
3. If there is noncontinuity when a 50 kPa (7 psi) vacuum is applied through the oil hole, the switch is operating properly. Check the leakage of air. If air leaks, the diaphragm is broken. Replace the switch.



ECA9320E

OIL PUMP

1. Assemble the oil pump gear to the front case and rotate it to ensure smooth rotation with no looseness.
2. Make sure that there is no ridge wear on the contact surface between the front case and gear surface of the oil pump cover.
3. Install the drive and driven gears to the front case, measure the tip clearance of the gears.

[Standard value]

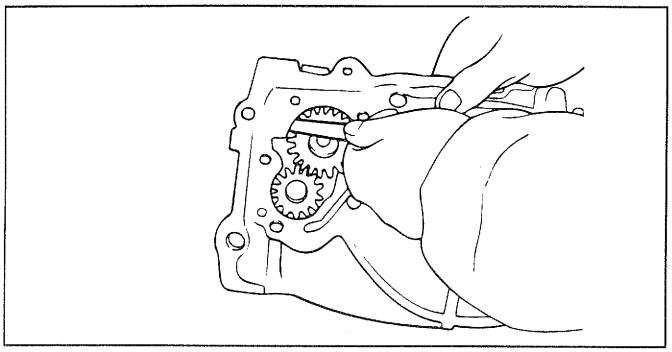
Drive gear : 0.16-0.21mm(0.0063-0.0083 in.)

Driven gear : 0.18-0.21mm(0.0071-0.0083 in.)

[Limit]

Drive gear : 0.25mm(0.0098 in)

Driven gear : 0.25mm(0.0098 in.)



ECA9044A

4. Check the side clearance.

[Standard value]

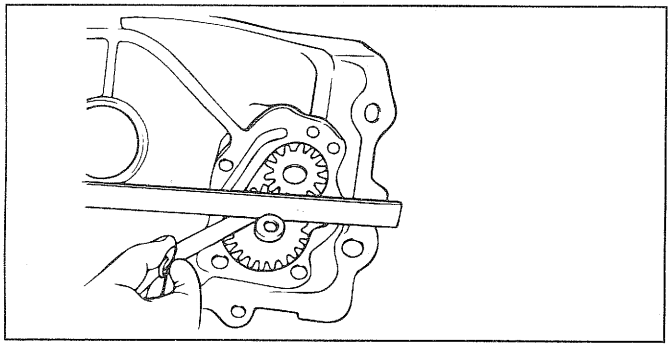
Drive gear : 0.08-0.14mm(0.0031-0.0055in.)

Driven gear : 0.06-0.12mm(0.0024-0.0047in.)

[Limit]

Drive gear : 0.25mm(0.0098 in)

Driven gear : 0.25mm(0.0098 in.)



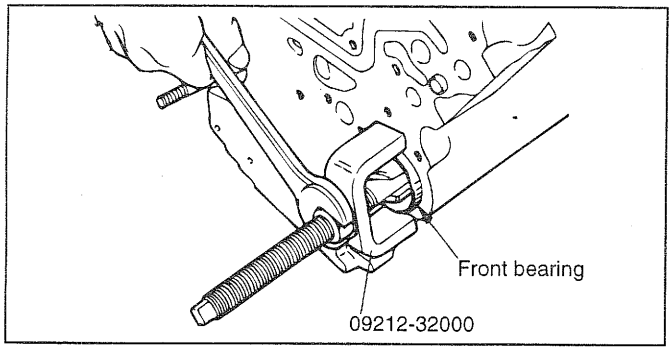
ECA9045A

COUNTER BALANCE SHAFT BEARING

ECHA2800

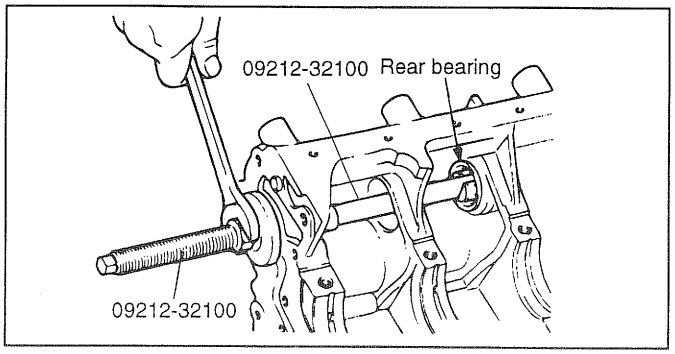
REPLACEMENT

1. Using a special tool, remove the front bearing of the right counter balance shaft from the cylinder block.



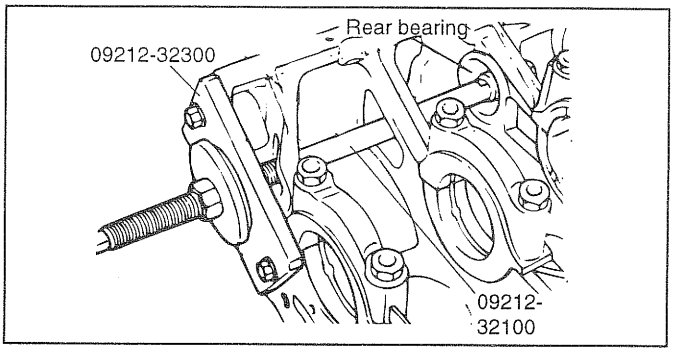
ECA9330A

2. Using a special tool, remove the rear bearing of the right counter balance shaft from the cylinder block.



ECHA280A

3. Using a special tool, remove the rear bearing of the left counter balance shaft from the cylinder block. At this time, install a special tool on the front surface of cylinder block to hold the bearing puller.

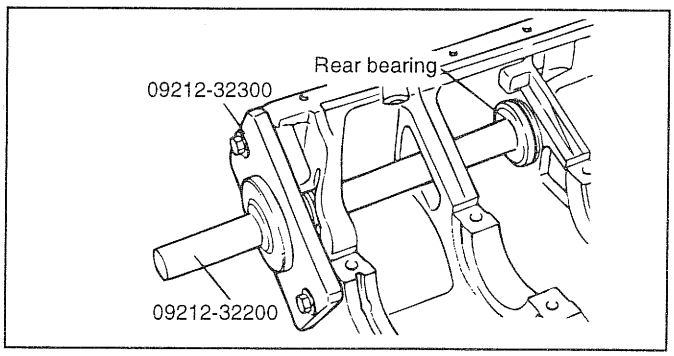


ECHA280B

4. Using a special tool, install the rear bearing of the left counter balance shaft to the cylinder block.

NOTE

1. **Apply engine oil to the outside of rear bearing and bearing hole in cylinder block.**
2. **The left rear bearing has no oil holes.**



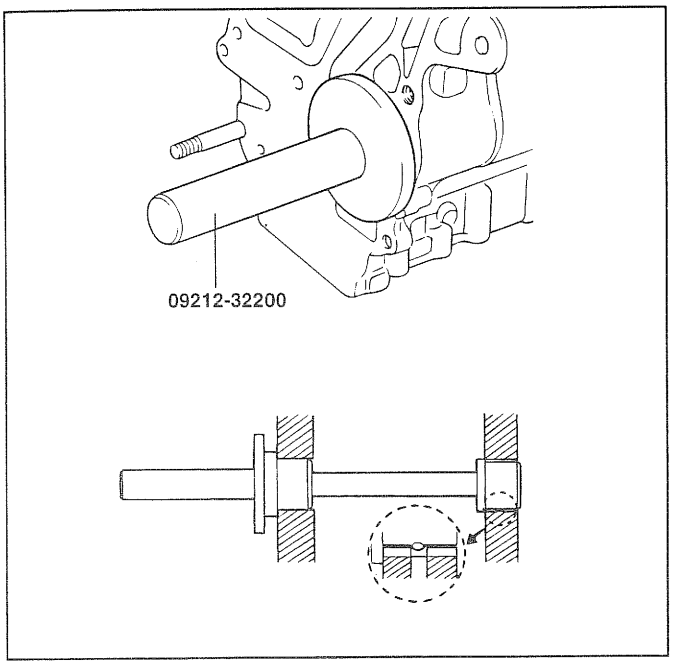
ECA9330D

5. Using a special tool, install the rear bearing of the right counter balance shaft to the cylinder block.

NOTE

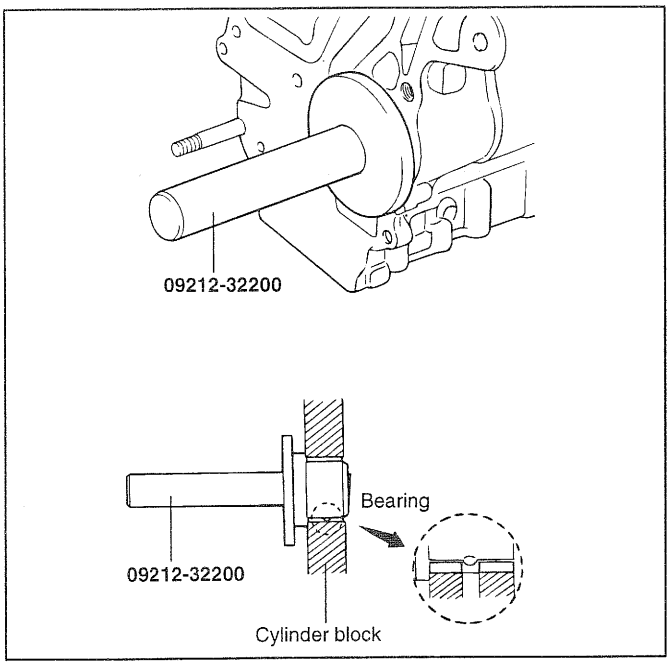
1. **Apply engine oil to the outside surface of bearing.**

2. **Make sure that the bearing oil hole is aligned with the oil hole of cylinder block.**



ECA9330E

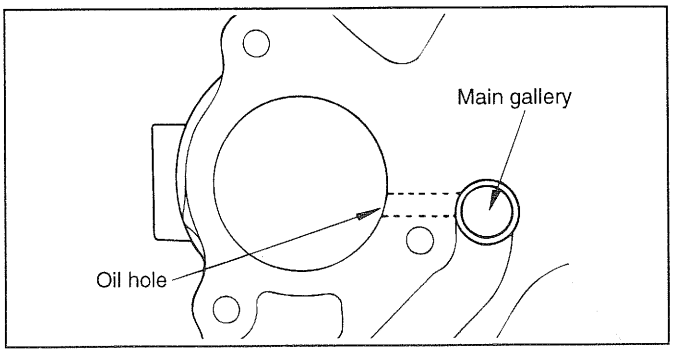
6. Using a special tool, install the front bearing of the right counter balance shaft to the cylinder block.



ECA9330F

NOTE

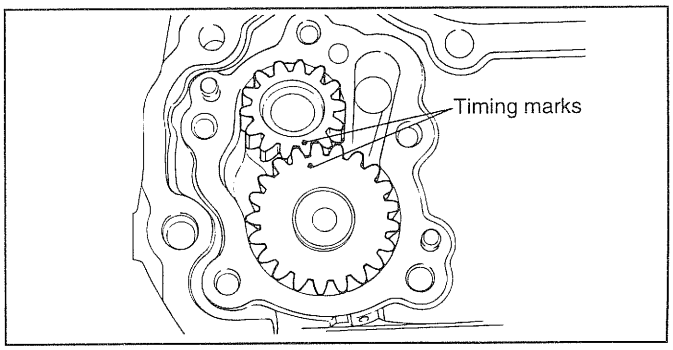
Make sure that the bearing oil hole is aligned with the oil hole cylinder block.



ECA9330G

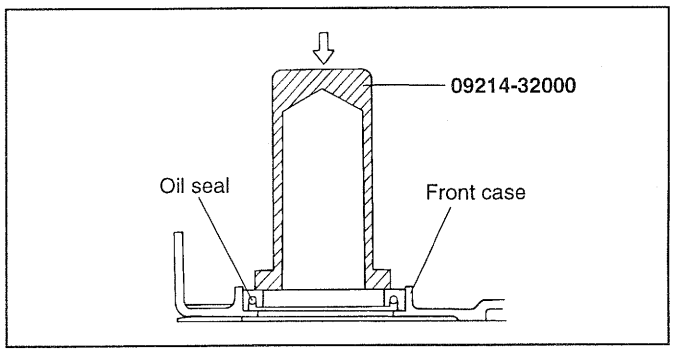
REASSEMBLY ECHA2900

1. Apply engine oil to the gear and align the two timing marks.



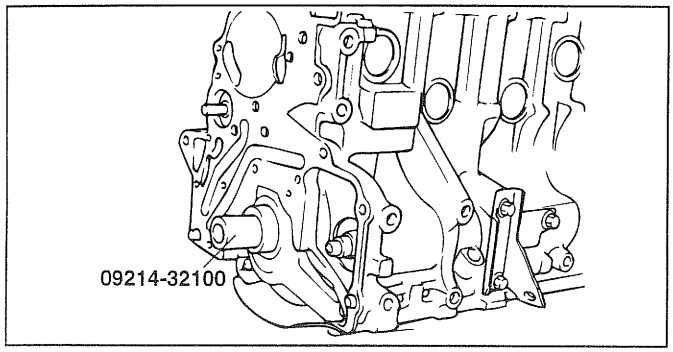
ECA9340A

2. Using the special tool, crankshaft front oil seal installer (09214-32000), install the crankshaft front oil seal into the front case.



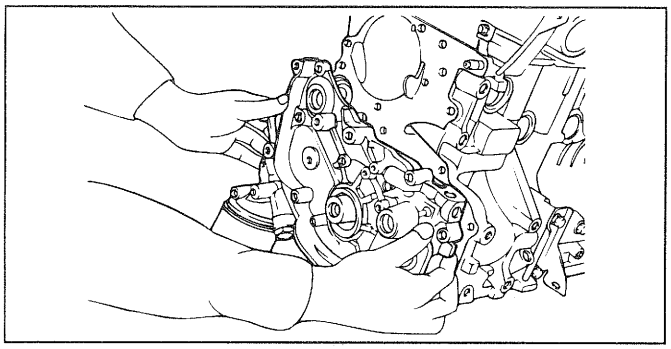
ECA9340B

3. Set the special tool (09214-32100) on the front end of crankshaft and apply a thin coat of engine oil to the outer circumference of the special tool to install the front case.



ECA9046A

4. Install a new front case gasket to the front case assembly and tighten the flange bolts temporarily.



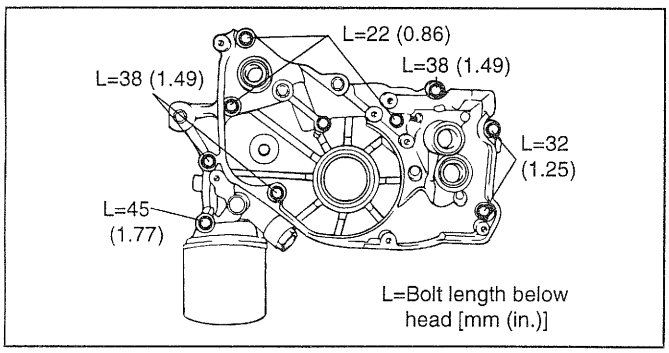
ECA9041A

5. Install the front case assembly with a new gasket. Tighten bolts to the specified torque.

Front case assembly

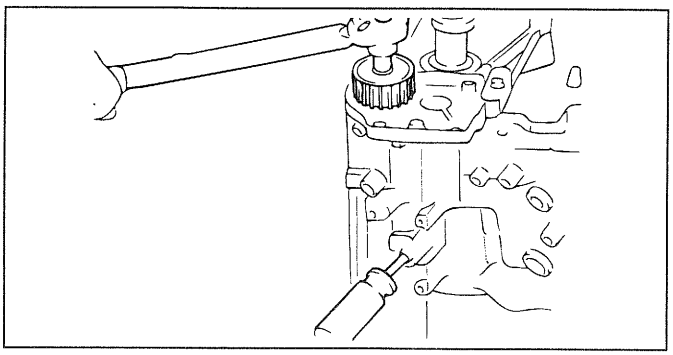
Tightening torque :

20-27Nm(200-270kg.cm, 14-20 lb.ft)



ECJA290B

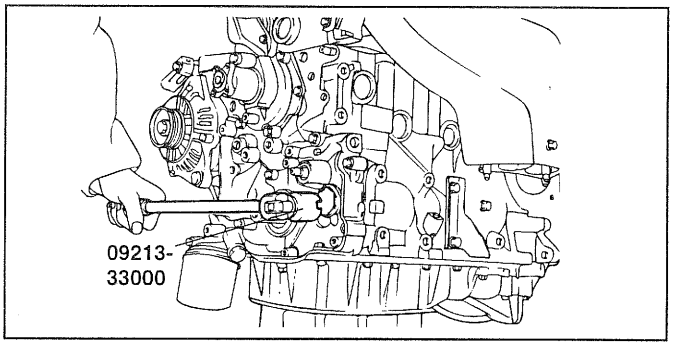
6. Insert a screwdriver into the plug hole in left side of cylinder block. After checking that the shaft is in a proper position, tighten.



ECA9340F

7. Install a new O-ring to the groove of the front case.

8. Using a special tool, install the plug case and tighten to the specified torque.



ECA9040A

Plug cap

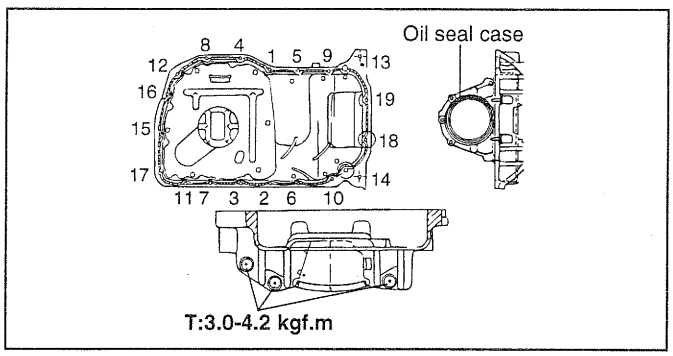
Tightening torque :

20-27 N.m (200-270 kg.cm, 14-20 lb.ft)

9. Apply sealant to the groove of the pan flange as shown.

NOTE

1. **Apply sealant approximately 4 mm (0.16 in.) in thickness.**
2. **After application of sealant, install oil pan within 15 minutes before installing the oil pan.**



ECJA290A

10. Note the difference in bolt lengths at the location shown.

Install the oil pan and tighten the bolts to the specified torque.

Tightening torque

Oil pan bolt : 10-12Nm(100-120kg.cm, 7-9 lb.ft)

11. Using 24 mm deep socket, install the oil pressure switch after applying sealant to the threaded area.

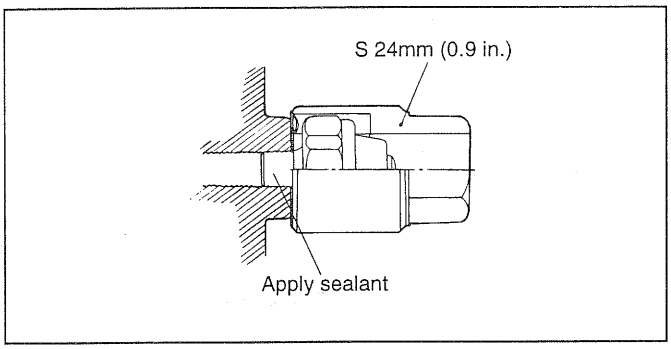
Sealant : Threebond 1104 or equivalent

NOTE

Do not torque the oil pressure switch excessively.

Tightening torque

Oil pressure switch : 8-12Nm(80-120kg.cm, 6-9 lb.ft)

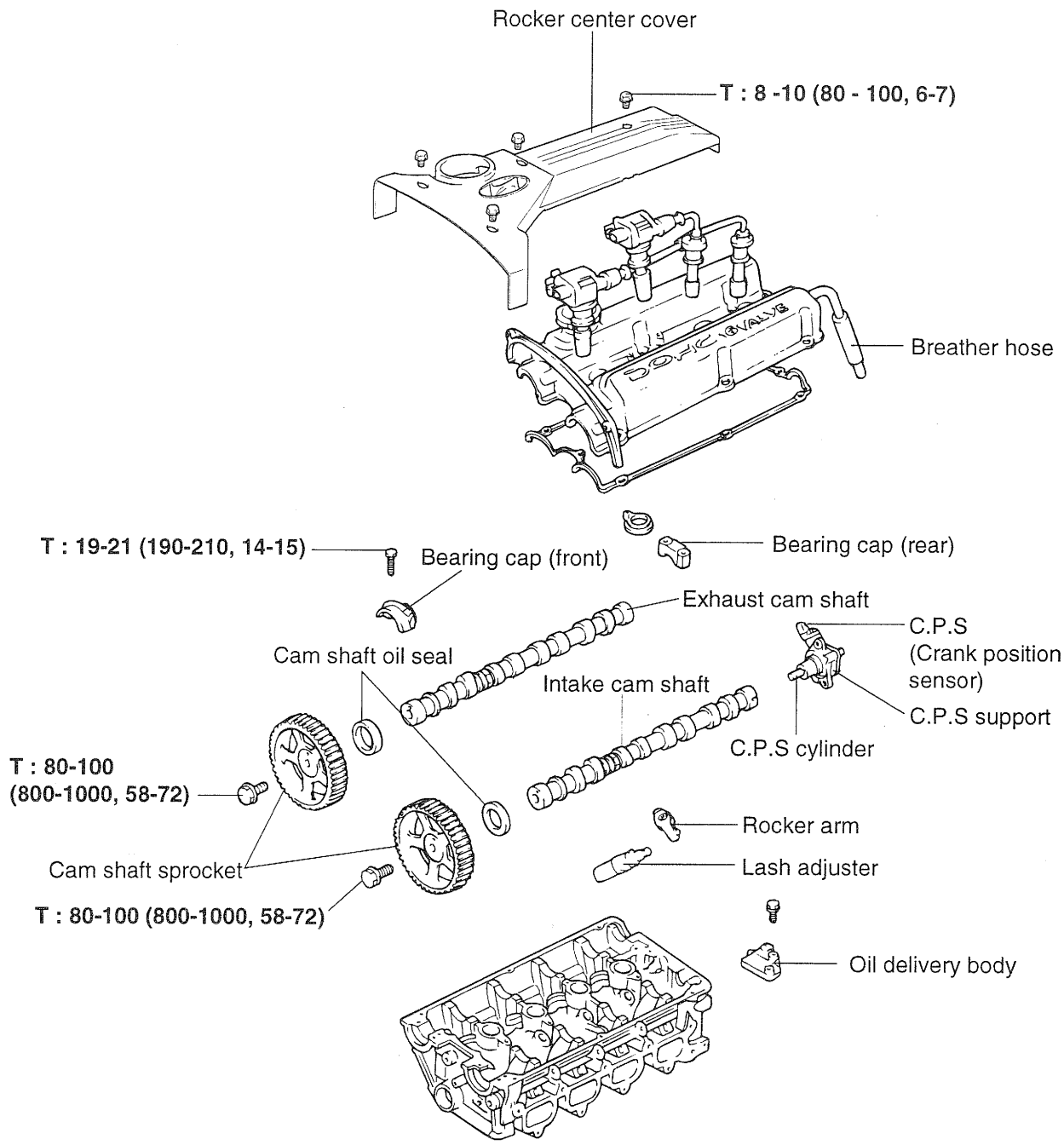


ECHA260A

MAIN MOVING SYSTEM

CAM SHAFT

CAMSHAFTS AND ROCKER ARMS ECHA3000

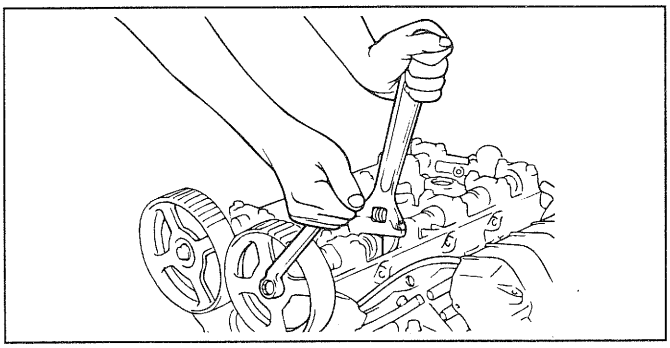


TORQUE : Nm (kg.cm, lb.ft)

ECHA053A

DISASSEMBLY ECHA3100

1. Disconnect the negative terminal from the battery.
2. Drain the engine coolant.
3. Remove the breather hose between the air cleaner and the rocker cover.
4. Remove the air cleaner.
5. Remove the timing belt cover.
6. Remove the rocker cover, crank position sensor.
7. Loosen the camshaft sprocket bolts then remove the camshaft sprockets.
8. Loosen the bearing cap bolts and remove the bearing caps, camshafts, rocker arms and lash adjusters.

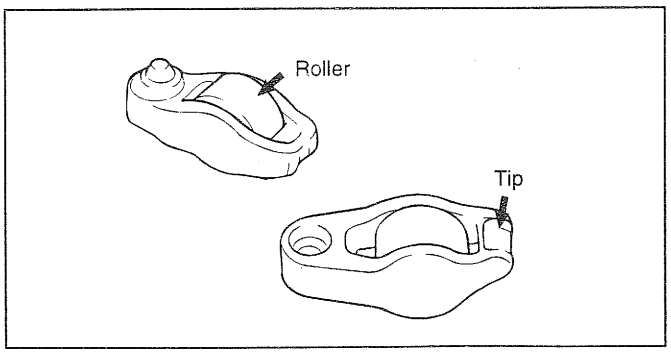


ECA9170C

INSPECTION ECHA3200

ROCKER ARMS

1. Check rotation of the roller. If it does not rotate smoothly or loose, replace it.
2. Check the roller surface. Replace if there are any dent, damage or seizure.
3. Check the valve contact surface for possible damage or seizure. Replace if necessary.



ECA9240A

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 : 35.493 mm (1.3974 in.)

Exhaust :

M/T : 35.204 mm (1.3860 in.)

A/T : 35.204 mm (1.3866 in.)

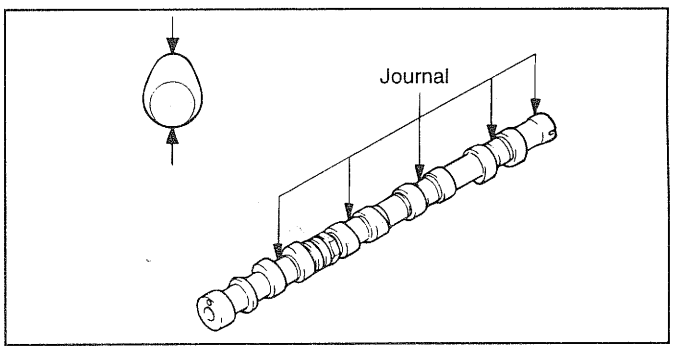
[Limit]

Intake : 35.993 mm (1.4170 in.)

Exhaust :

M/T : 34.704 mm (1.3663 in.)

34.704 mm (1.3663 in.)



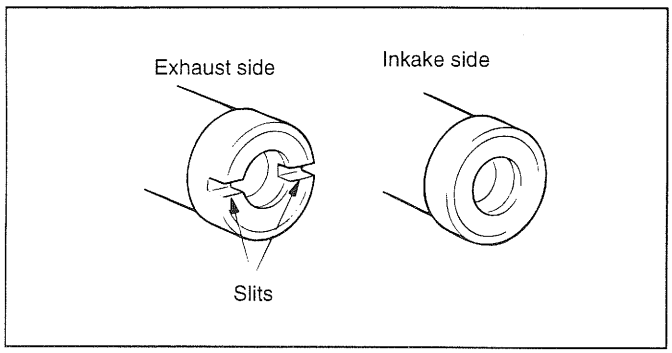
ECA9240B

REASSEMBLY ECHA3300

1. Install the camshafts on the cylinder head.

NOTE

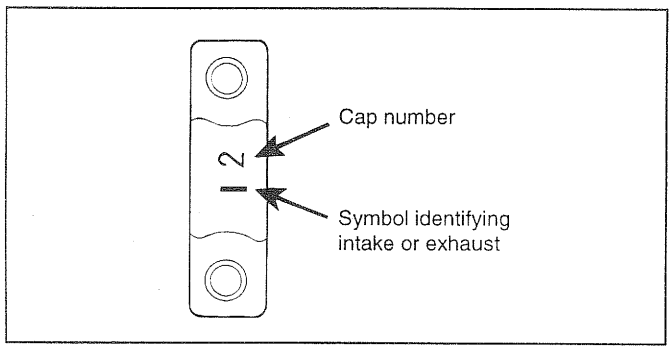
1. **Apply engine oil to journals and cams of the camshafts.**
2. **The exhaust camshaft has a slit on its rear end for driving the crankshaft position sensor.**



ECA9250A

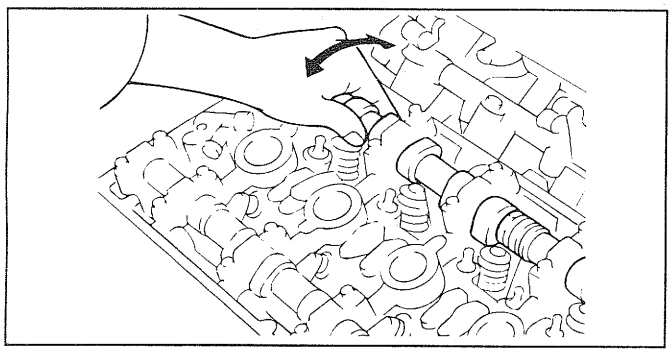
2. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.

I : Intake camshaft. E : Exhaust camshaft



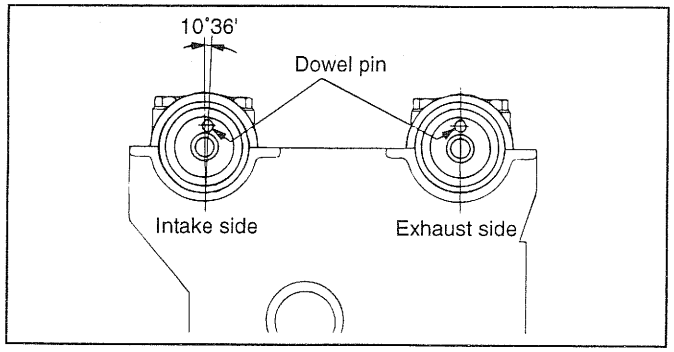
ECA9250B

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.



ECA9250C

4. Make sure that the dowel pins on the camshaft sprocket end are located on the top.



ECHA330A

5. Tighten the bearing caps to the specified torque in two or three steps as shown.

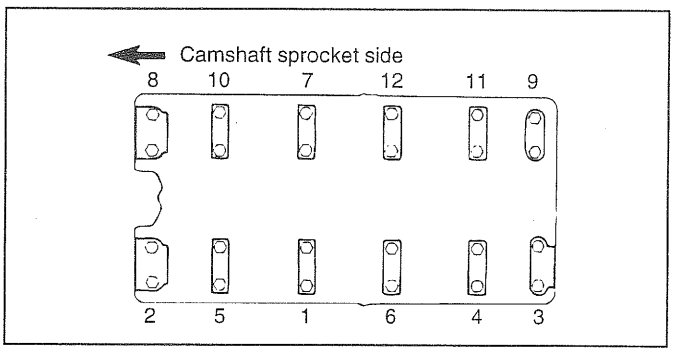
NOTE

Tighten the rocker arms uniformly.

Tightening torque

Bearing cap bolts:

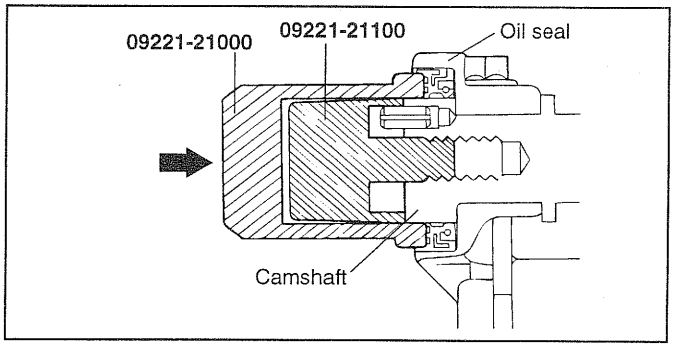
19-21 Nm (190-210 kg.cm, 14-15 lb.ft)



ECHA330B

6. Using a special tools, camshaft oil seal Installer and guide (09221-21000, 09221-21100), press and fit the camshaft oil seal. 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.



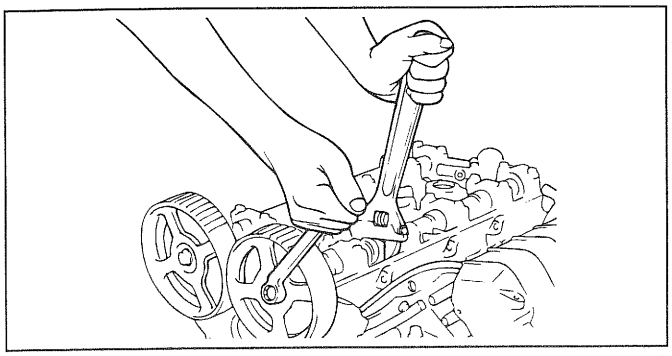
ECHA330C

7. Install the camshaft sprockets to the specified torque.

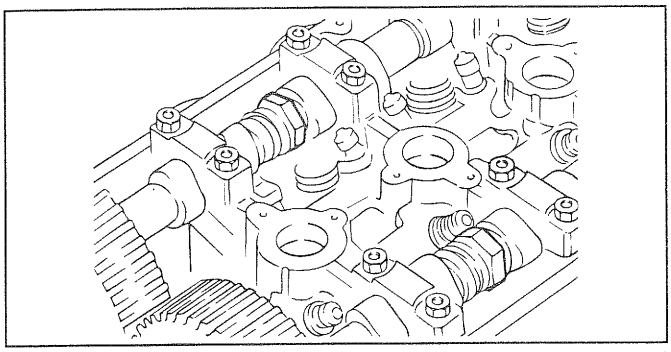
Tightening torque

Camshaft sprocket bolts :

80-100 Nm (800-1000 kg.cm, 58-72lb.ft)



ECA9170C



ECA9210J

8. Install the rocker cover. Apply sealant as shown.

Tightening torque

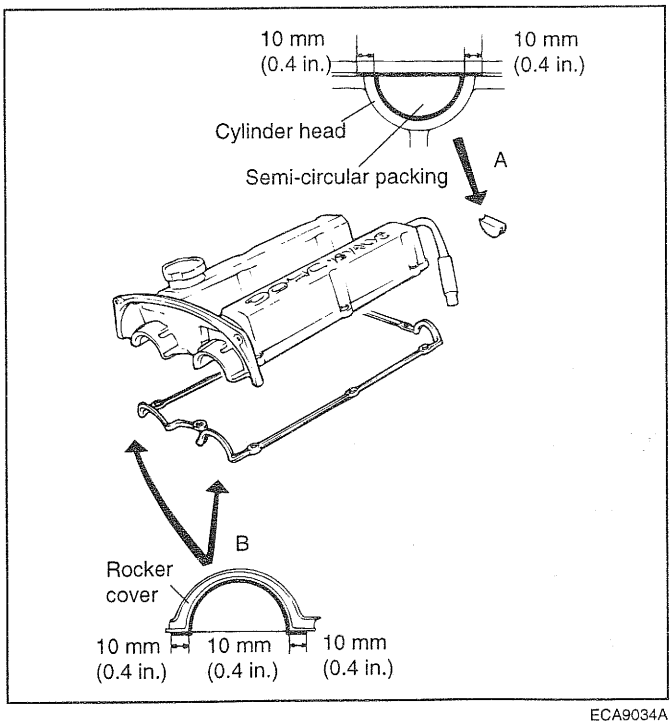
Rocker cover bolts : 8-10 Nm (80-100 kg.cm, 6-7 lb.ft)

Center cover bolts : 4-5 Nm (40-50 kg.cm, 3-4 lb.ft)

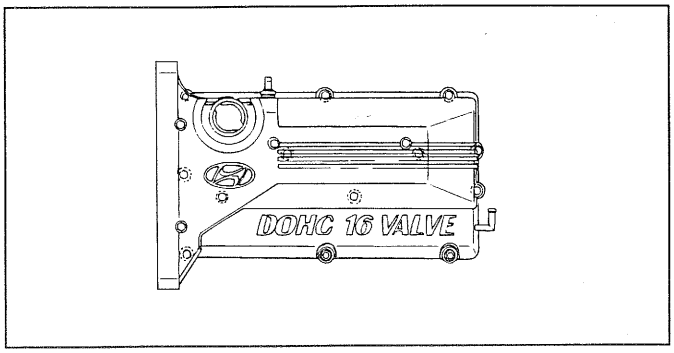
Sealant

A Portion : Threebond No. 10 or equivalent

B Portion : Threebond No. 1212D or equivalent

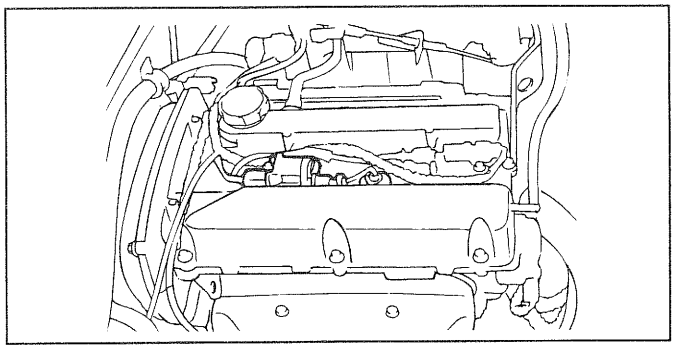


ECA9034A



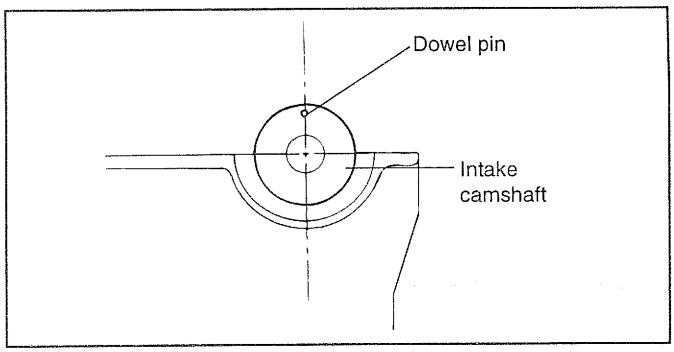
ECA9035A

9. Install the spark plugs, ignition coil and connect the connector and then install the center cover.



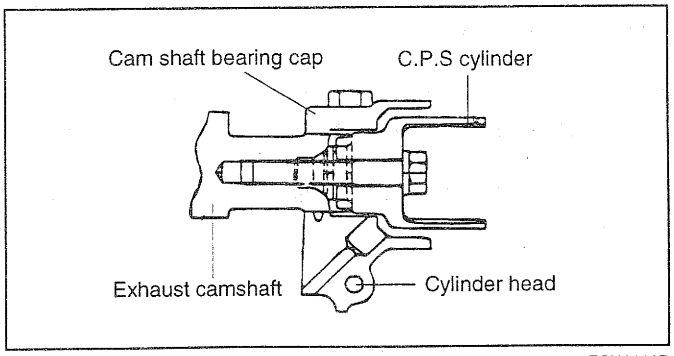
ECHA008A

10. Install the dowel pin on the sprocket side of the intake cam shaft.



ECA9250L

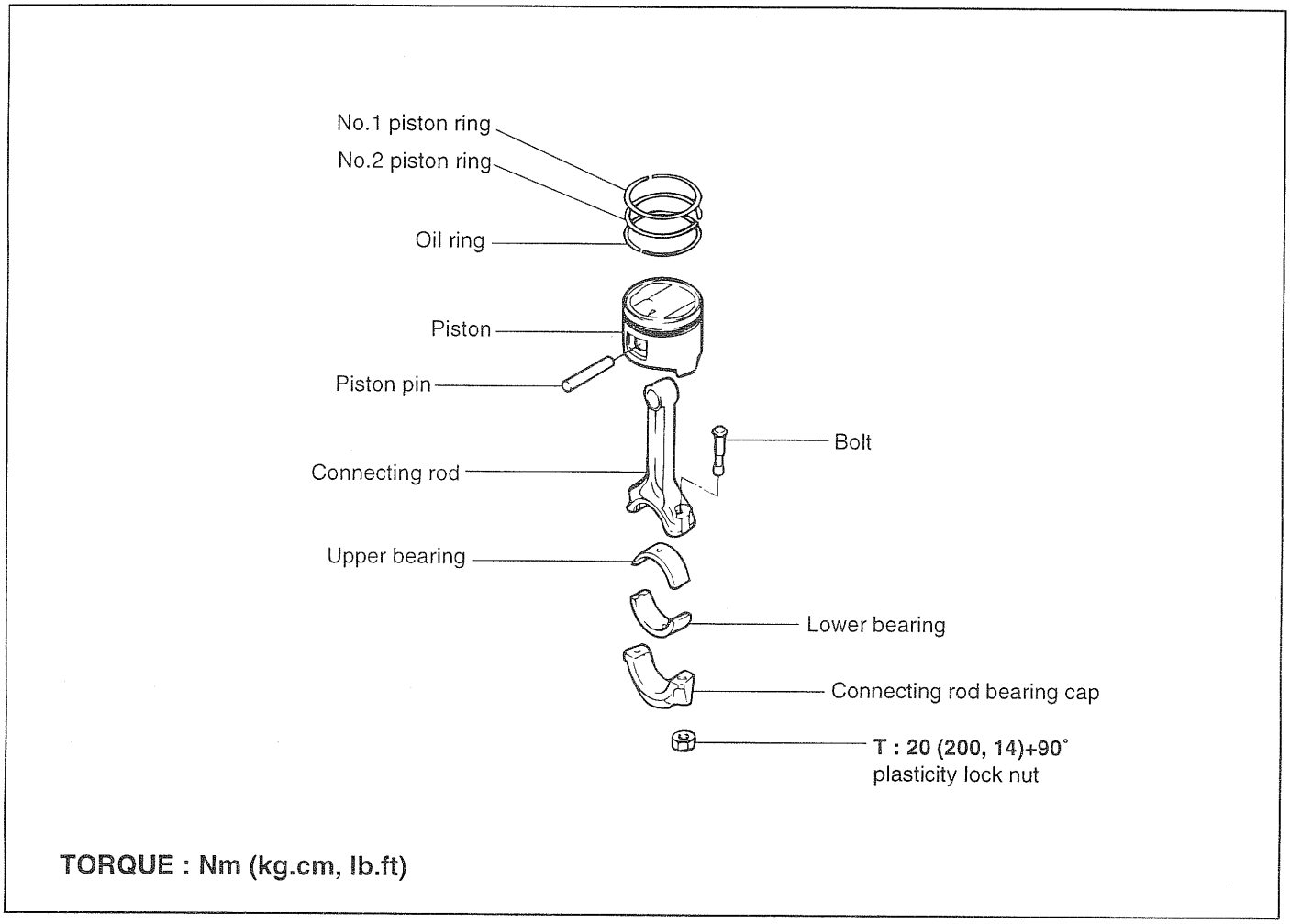
11. Install the crank position sensor support assembly after installing the crank position sensor cylinder on the camshaft (Ex).



ECHA008B

CONNECTING ROD

PISTON AND CONNECTING ROD ECHA3500



ECHA350A

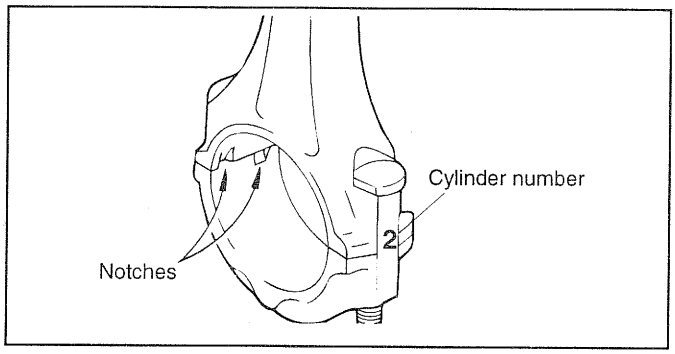
DISASSEMBLY ECHA3600

CONNECTING ROD CAP

NOTE

Keep the bearings in order with their corresponding connecting rods (according to cylinder numbers) for proper reassembly.

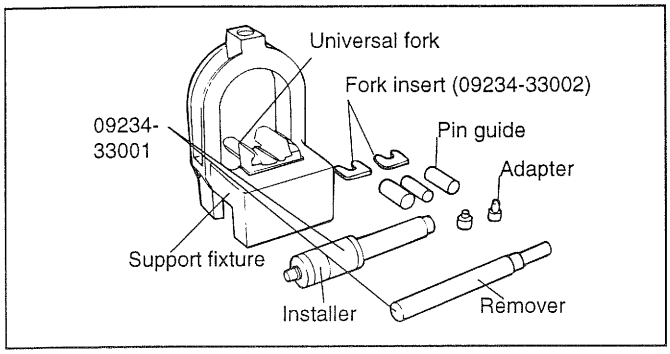
1. Remove the connecting rod cap nuts and then remove the caps and the big end lower bearing.
2. Push each piston-connecting rod assembly toward the top of the cylinder.



ECA9360A

DISASSEMBLY AND REASSEMBLY OF

1. Use the special tools (09234-33001, 09234–33002) disassemble and reassemble the piston and connecting rod.
2. Place the proper insert (09234–33002) in the fork of the tool. Position the insert between the connecting rod and the piston.



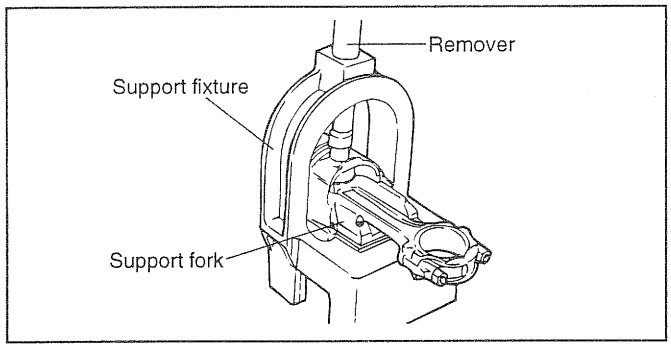
ECA9361A

3. Insert the proper tool for removal 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.

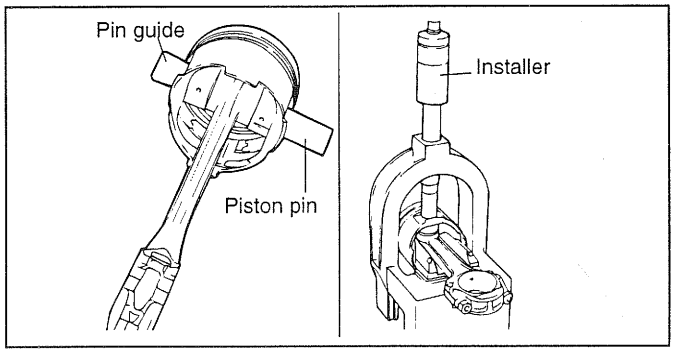


ECA9361B

5. Install the proper pin guide through the piston and into the connecting rod. Hand tap the pin guide into the piston for proper retention. Drop the piston pin into the other side of the piston.

NOTE

The pin guide should be centered on the connecting rod though the piston. If the piston, connecting rod, piston pin and pin guide assembly are accurately positioned on the fork of the tool, pin guide will also be placed on the center of assembly line without fail. If a pin guide which is too small is used, damage may occur to the fork or insert of the tool because piston assembly is not centered on the tool.



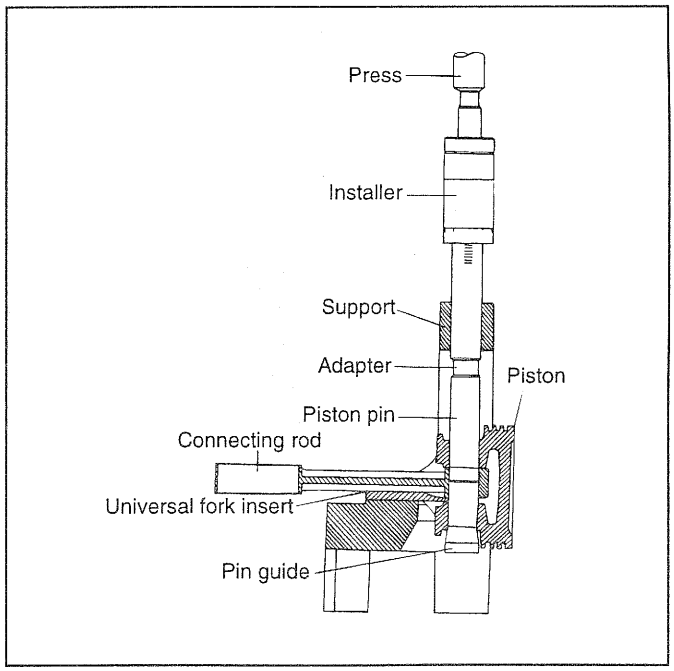
ECA9361C

6. Install the piston assembly onto the fork assembly of the tool. The tool will support the connecting rod. Be sure that the piston assembly slide down onto the fork until the pin guide contacts the fork insert.

7. Insert the installing arbor through the hole in the arch of the tool. Press the 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 1250±500 kg (2756±1102 lb) of force when stopping the installing arbor sleeve against the arch.



EOY055C

INSPECTION ECHA3700

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, 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 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 ring only.

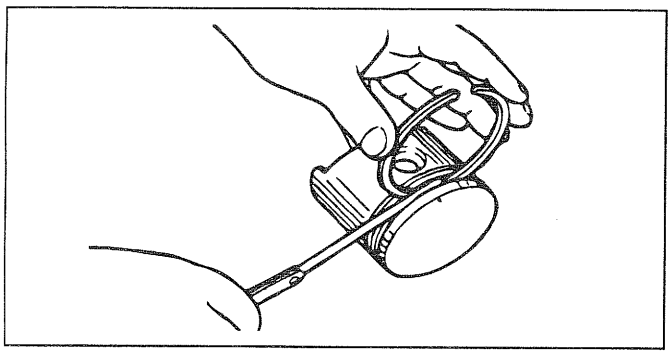
Standard value

Piston ring side clearance :

No. 1 : 0.03-0.07mm(0.0012-0.0028 in.)

No. 2 : 0.02-0.06mm(0.0008-0.0024 in.)

Oil ring : 0.06-0.15 mm (0.0024-0.0059 in.)



ECA9370A

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.

Piston ring end gap

[Standard dimensions]

No.1 : 0.25-0.35mm(0.0098-0.0138 in.)

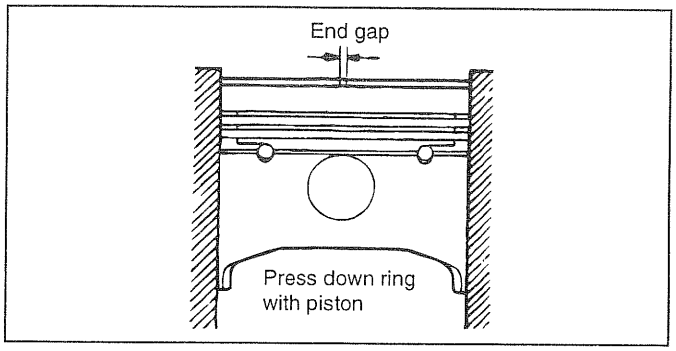
No.2 : 0.40-0.55mm(0.0157-0.0216 in.)

Oil ring side rail : 0.10-0.40mm(0.0039-0.0157 in.)

[Limit]

No.1, No.2 : 0.8mm(0.031 in.)

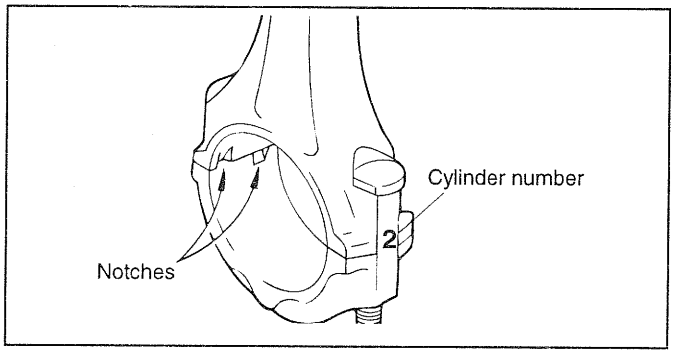
Oil ring side rail : 1.0mm(0.039 in.)



ECA9370B

CONNECTING RODS

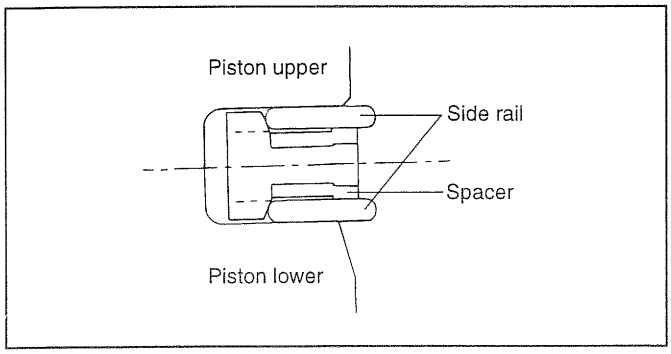
1. When the connecting rod cap is installed, make sure that cylinder numbers marked on rod end cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged at either end of the thrust faces or if it has stratified wear in, or if the surface of, the inside diameter of the small end is severely rough.



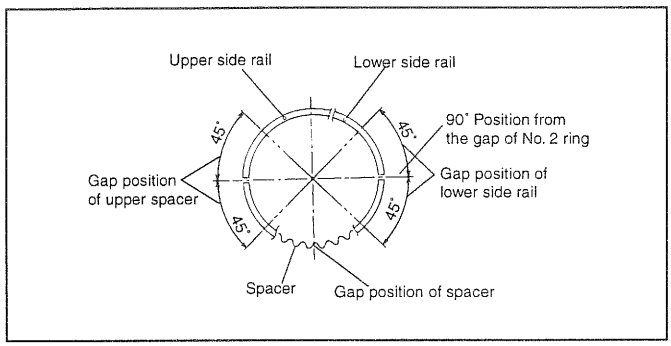
ECA9360A

REASSEMBLY ECHA3800

1. Install the spacer.



ECA9082A



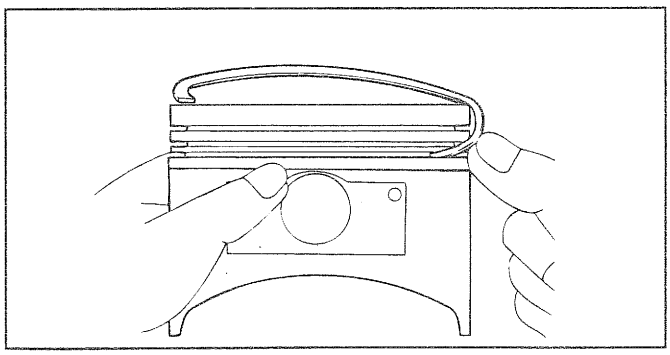
EDJA490A

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, then press down with your finger the portion to be inserted into groove as illustrated.

NOTE

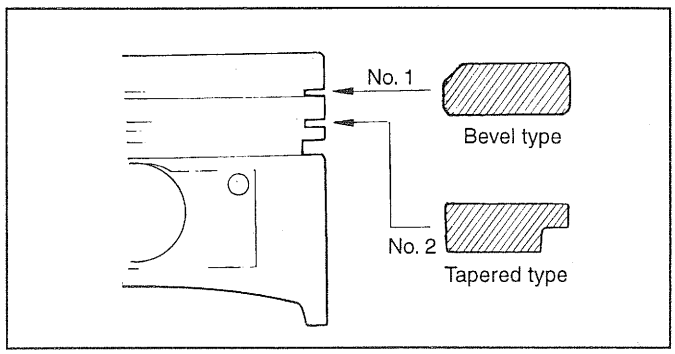
Do not use a piston ring expander when installing the side rail.

3. Install the lower side rail by the same procedure as described in Step No. 2.



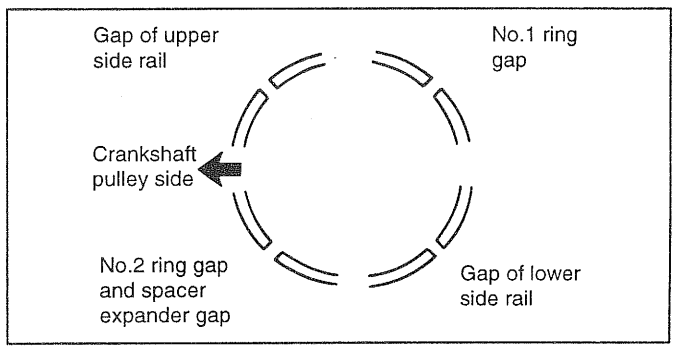
ECA9380B

4. Apply engine oil around a piston and piston rings.
5. Using piston ring expander, install No. 2 piston ring.
6. Install No. 1 piston ring.



EDJA490B

7. Position each piston ring end gap as apart from neighboring gaps as possible. Make sure that gaps are not positioned in the thrust and pin directions.
8. Hold piston rings firmly with a piston ring compressor as they are inserted into cylinder.



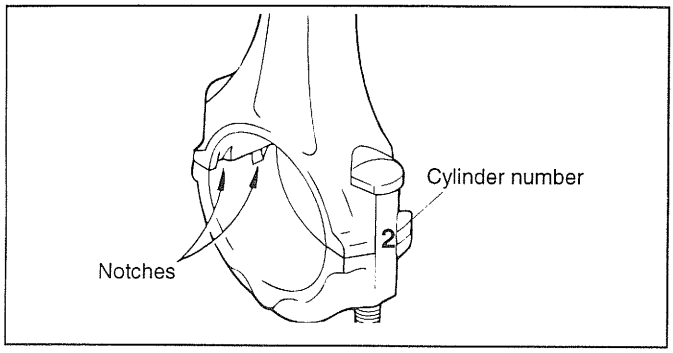
ECA9380D

9. 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.
10. When the connecting rod cap is installed, make sure that the cylinder numbers put on the rod and cap at disassembly match.
11. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
12. Tighten the connecting rod cap nuts.

Tightening torque

Connecting rod cap nuts :

20Nm(200kg.cm, 14 lb.ft)+90°



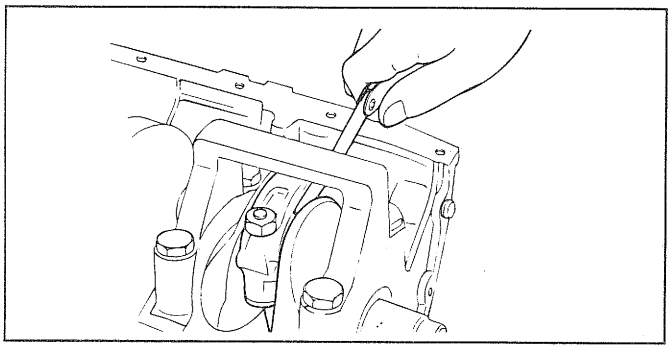
ECA9360A

13. Check connecting rod side clearance.

Connecting rod side clearance

standard : 0.10-0.25mm(0.004-0.0098 in.)

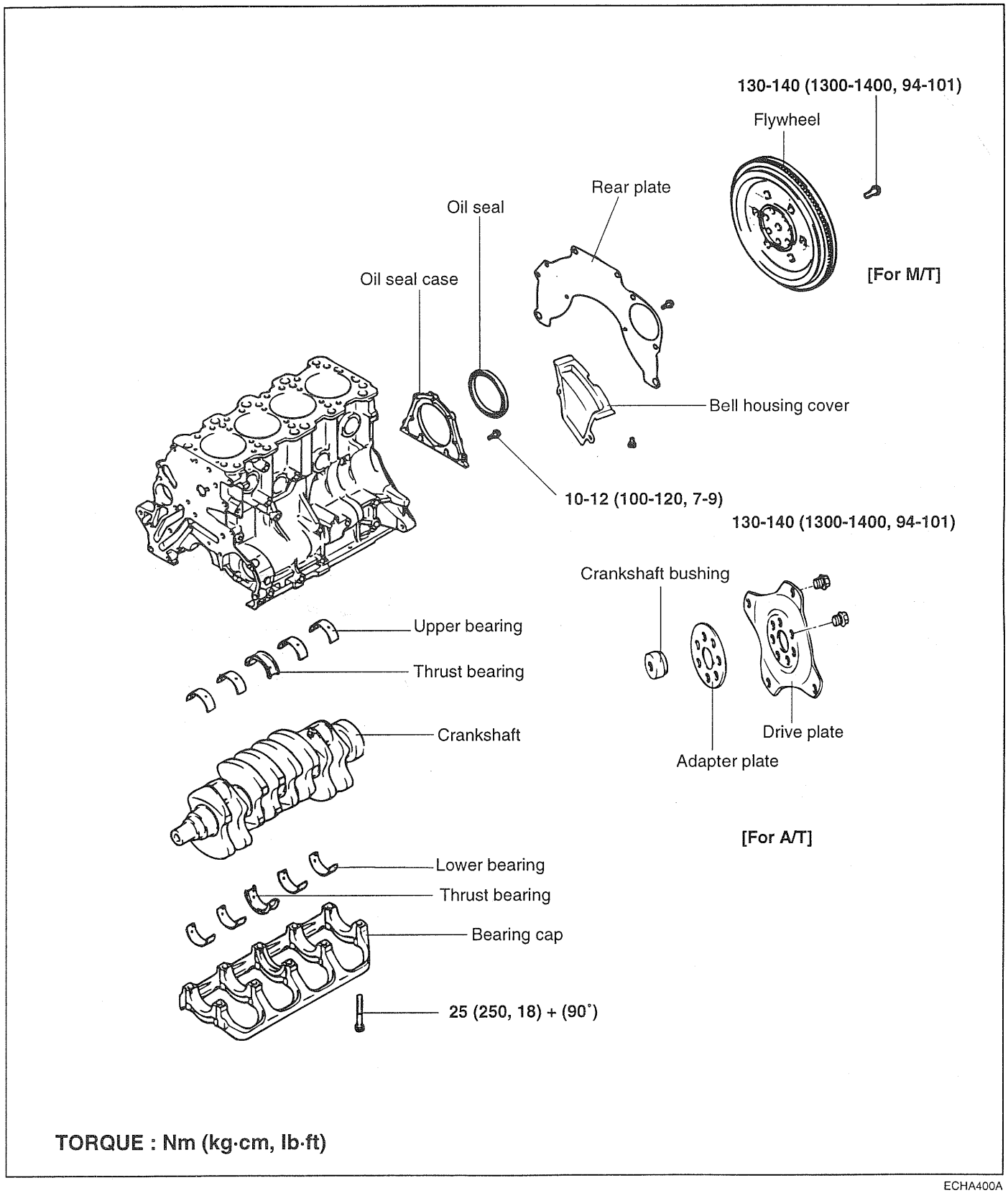
Limit : 0.4 mm (0.0157 in.)



ECA9380F

CRANK SHAFT

CRANKSHAFT, FLYWHEEL ECHA4000



ECHA400A

DISASSEMBLY ECHA4100

1. Remove the timing belt train, front case, flywheel cylinder head assembly and oil pan. For details, refer to respective chapters.
2. Remove the rear plate and the rear oil seal.
3. Remove the connecting rod caps.

NOTE

Mark the main bearing caps to be able to reassembl in the original position and direction.

4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.

INSPECTION ECHA4200

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 out-of-round and taper of the crankshaft journal and pin.

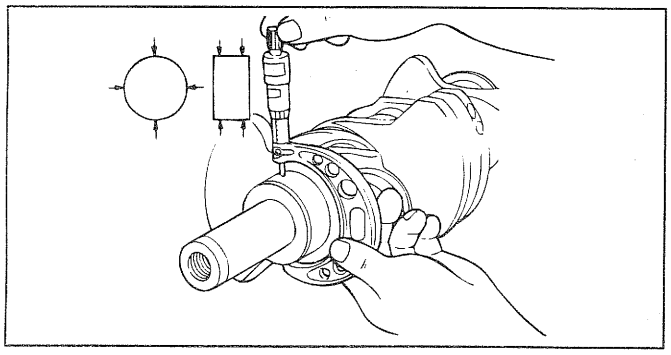
Standard value

Crankshaft journal O.D :

56.982-57.000mm(2.2434-2.2441 in.)

Crankshaft pin O.D :

44.980-45.000mm(1.7709-1.7717 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

To check the oil clearance by measuring the outside diameter of the crankshaft journal and the inside diameter of the bearing. The clearance can be obtained by calculating the difference between the measured outside diameters.

Standard value

Oil clearance

Crankshaft main bearing

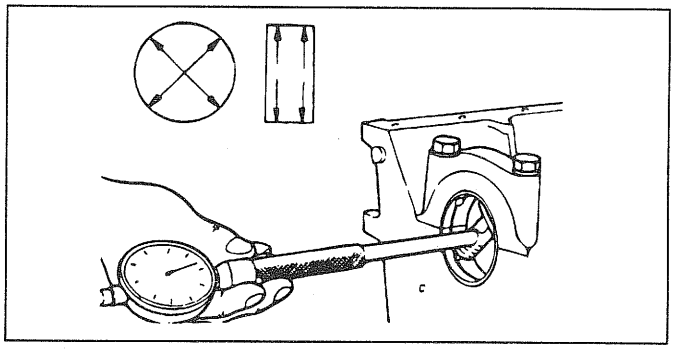
No.1,2,4,5 : 0.018-0.036 mm (0.0007-0.0014 in.)

No.3 : 0.024-0.042 mm (0.0009-0.0017 in.)

Connecting rod bearing :

0.015-0.048 mm (0.0006-0.0019 in.)

Limit : 0.1 mm (0.0039 in.)

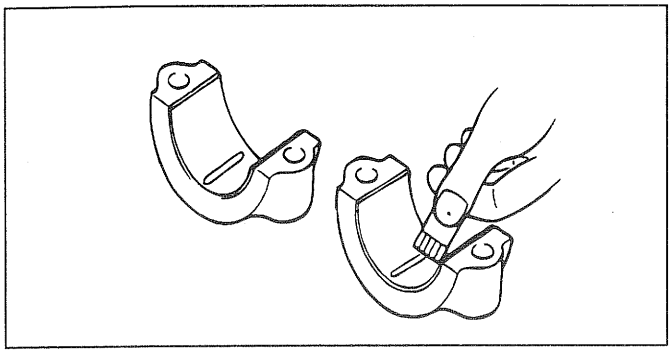


ECA9410B

HOW TO USE PLASTIC GAUGE

Plastic gauge may be used to measure the clearance.

1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plastic gauge 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. The standard clearance not be obtained even after replacing the bearing, the journal and pin should be ground to thr undersize and a bearing of the corresponding size should be installed.



ECA9410C

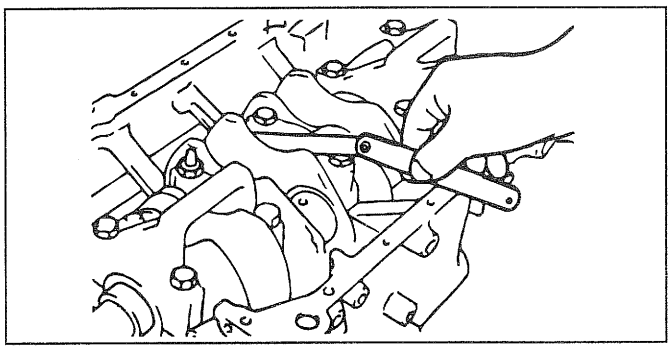
OIL SEAL

Check the front and rear oil seals for damage or worn surfaces. Replace any seat that is defective.

BEARING CAPS

After installing the bearing caps, make sure the crankshaft turns smoothly and the end play is correct. If the end play exceeds the limit, replace crankshaft bearings.

Standard value : 0.05-0.25mm(0.0020-0.0098 in.)



ECA9410D

DRIVE PLATE

Replace distorted, damaged, or cracked drive plates.

FLYWHEEL

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.

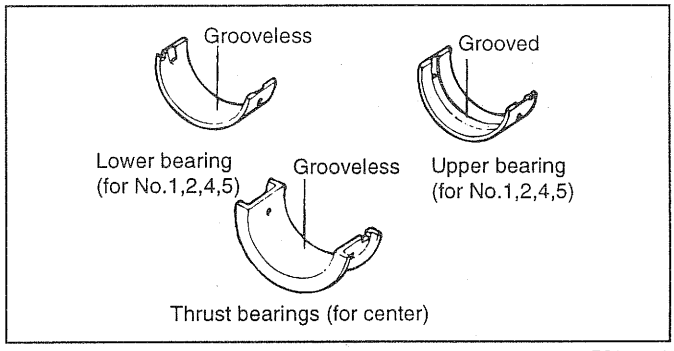
Limit

Flywheel run-out : 0.13mm(0.0051 in.)

3. Check the ring gear for damage, cracks and wear. Replace if necessary.

REASSEMBLY ECHA4300

1. Install grooved main bearing (upper bearing) on cylinder block side.
2. Install grooveless main bearing (lower bearing) on main bearing cap side.
3. Both upper and lower bearings for center are grooveless.



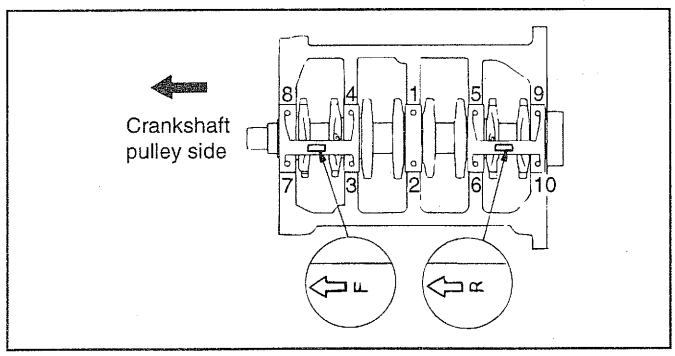
ECA9420A

4. Install the crankshaft. Apply engine oil to journals and pins.
5. Install caps with the arrow mark directed toward front of engine. Cap number must be correct.
6. Tighten cap bolts to specified torque.

Tightening torque

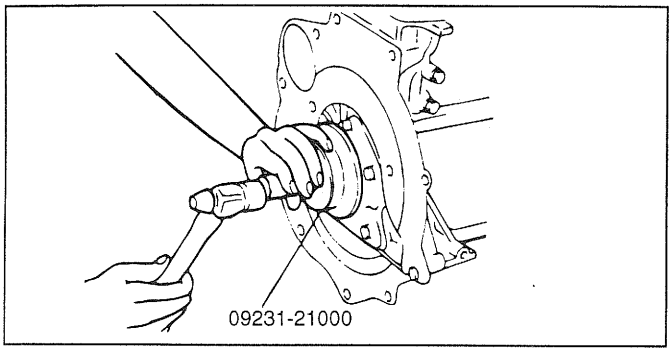
Main bearing cap bolts : 25 Nm (250, 18lb.ft) + (90°)

7. Cap bolts should be tightened evenly in from 4 to 5 stages before they are tightened to the specified torque.
8. Make sure that the crankshaft turns freely to check end play of the crankshaft.



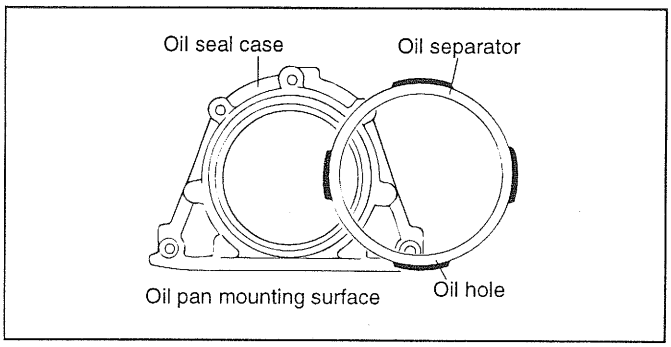
EOY062B

9. Using a special tool (09231–21000). Install the rear and the new oil seal should be used. Oil seal in the oil seal case.



ECA9420C

10. Install the oil seal into the oil seal case so that the oil hole in the separator may be directed downward (arrow in illustration)



ECA9053A

11. Install the new oil seal case gasket and oil seal case assembly.

Tightening torque

oil seal case :

10-12N.m (100-120kg.cm, 7-9 lb.ft)

<For M/T>

12. Install the rear plate to the cylinder block.
13. Install the flywheel assembly and tighten the bolts to the specified torque.

Tightening torque

Flywheel bolt :

130-140 Nm (1300-1400kg.cm,94-101lb.ft)

<For A/T>

14. Install the adapter plate to the cylinder block.
15. Install the drive plate and tighten the bolts to the specified torque.

Tightening torque

Drive plate :

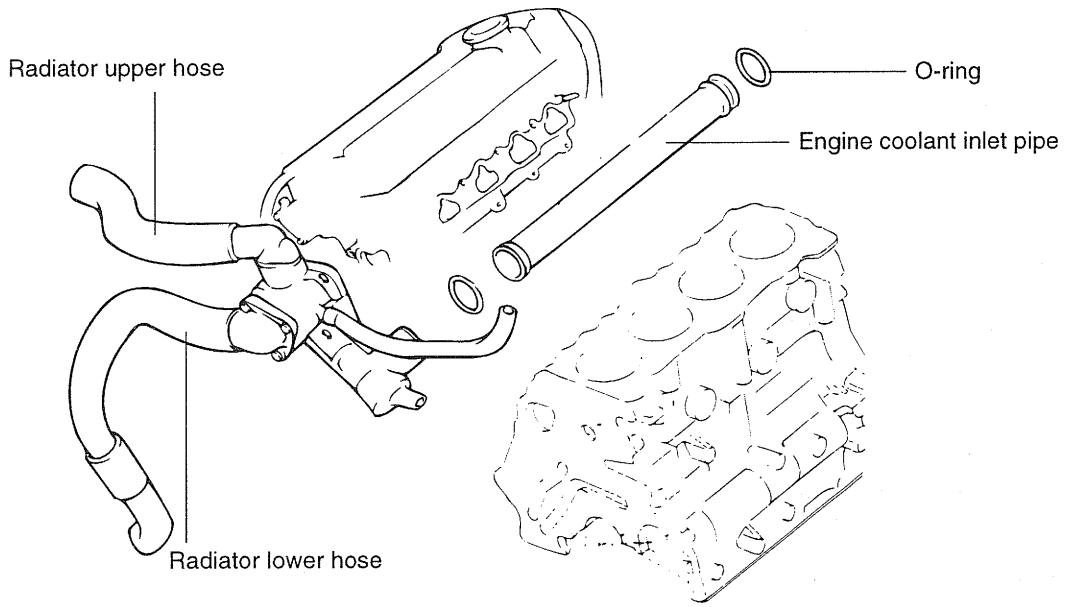
130-140 Nm (1300-1400kg.cm,94-101lb.ft)

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

ENGINE COOLANT HOSE AND PIPE ECHA4500

[DOHC ENGINE]



ECA9081B

INSPECTION ECHA4600

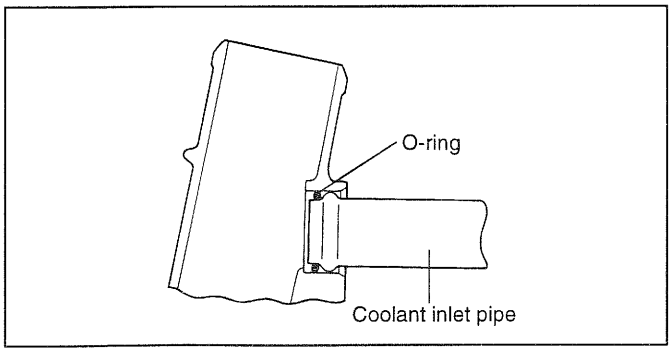
Check the engine coolant pipe and hose for cracks, damage and restrictions. Replace if necessary.

REASSEMBLY ECHA4700

Fit 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 to the end of engine coolant pump inlet.**
4. **whenever installing the engine coolant inlet pipe, always replace the O-ring with a new one.**

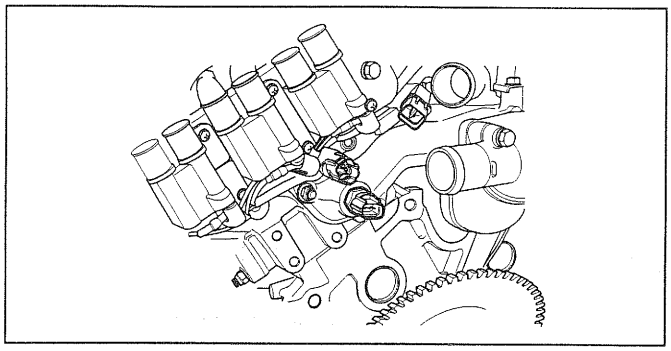


ECA9570A

THE COOLANT SENSOR ECHA4800

REMOVAL

1. Drain the coolant to the bottom of the sensor.
2. Disconnect the ground cable from the battery and then remove the engine harness.
3. Remove the coolant sensor.



KFW5012A

INSTALLATION ECHA4900

1. Tighten the coolant temperature sensor to the specified torque after applying the sealant to the screw area.

Recommened sealant :

Threebond No. 1324 or LOCTITE 262

Tightening torque

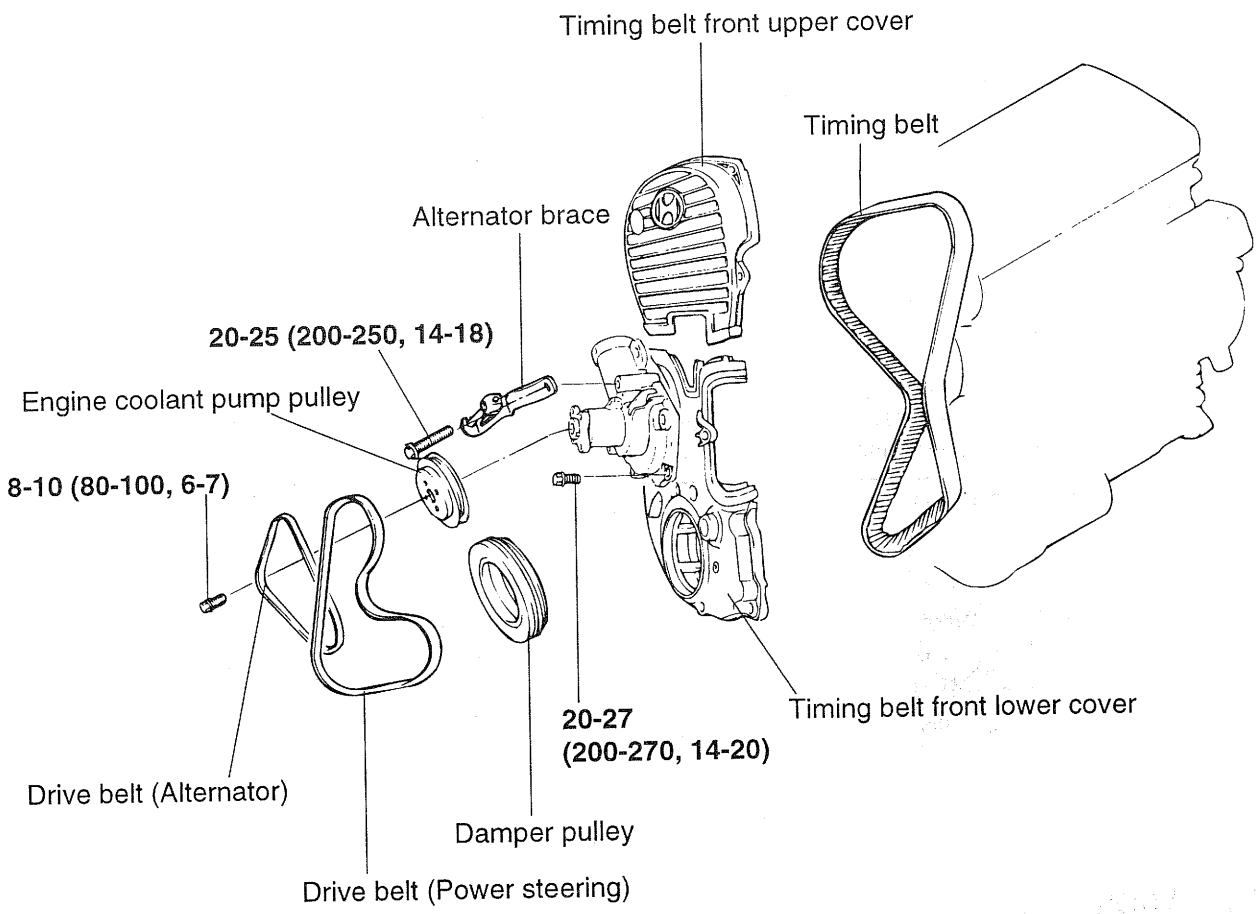
The coolant temperature sensor :

20-40Nm (200-400 kg.cm, 14-29 lb.ft)

2. Connect sensor to the harness.
3. Connect the ground cable to the battery.
4. Refill the engine coolant.

ENGINE COOLANT PUMP

ENGINE COOLANT PUMP [FOR DOHC ENGINE] ECHA5000



TOR QUE : Nm (kg·cm, lb·ft)

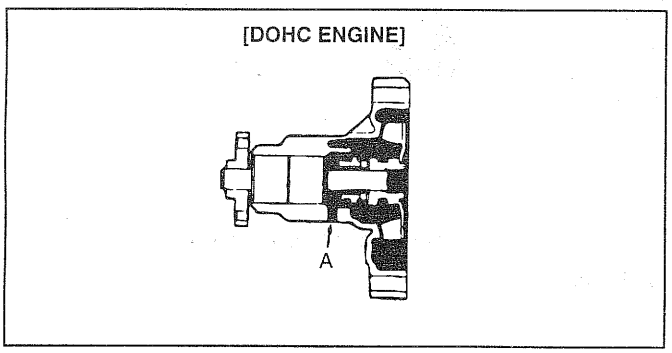
ECA9022A

REMOVAL ECHA5100

1. Drain the coolant and disconnect the coolant pump inlet pipe.
2. Remove the drive belt and engine coolant pump pulley.
3. Remove the timing belt covers and the timing belt tensioner.
4. Remove the engine coolant pump mounting bolts, then remove the alternator brace.
5. Remove the engine coolant pump assembly from the cylinder block.

INSPECTION ECHA5200

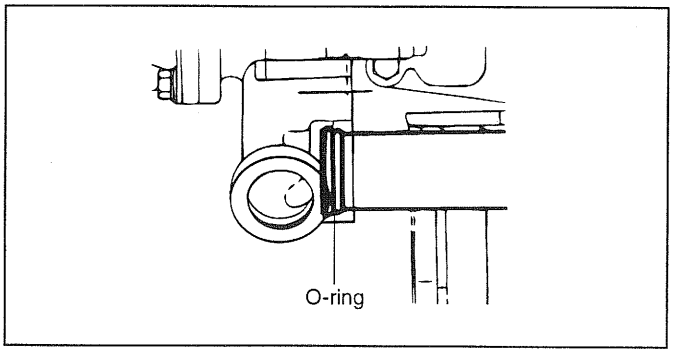
1. Check the engine coolant pump for cracks, damage or wear. Replace the engine coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise, and sluggish rotation. Replace the engine coolant pump assembly if necessary.
3. Check the seal unit for leaks. Replace the engine coolant pump assembly if necessary.
4. Check for engine coolant leakage. If the engine coolant leaks from hole "A", seal unit is defective. Replace engine coolant pump assembly.



ECA9560A

INSTALLATION ECHA5300

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.



ECHA013A

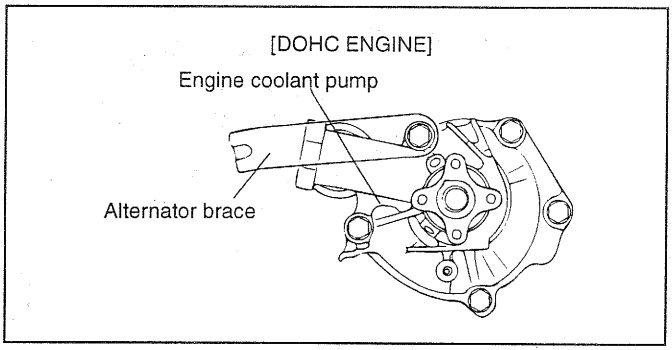
3. Install a new engine coolant pump gasket and engine coolant pump assembly. Tighten the bolts to specified torque.

Tightening torque

Engine coolant pump bolt :

20-27Nm(200-270kg.cm, 14-20lb.ft)

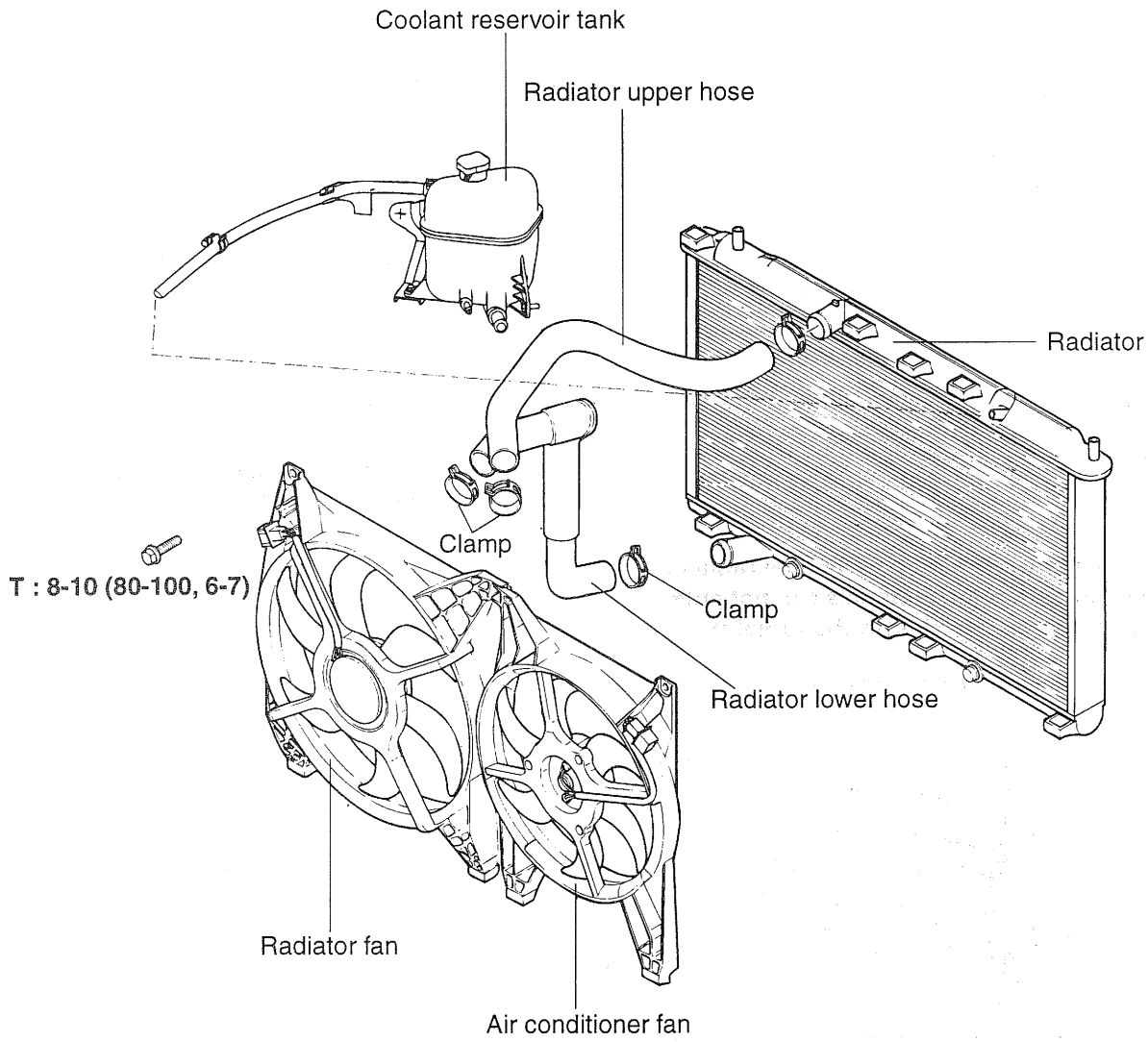
4. Install the timing belt tensioner and timing belt. Adjust timing belt tension, then install timing belt covers.
5. Install the engine coolant pump pulley and drive belt, then adjust the belt tension.
6. Refill the coolant.
7. Run the engine and check for leak.



ECHA530A

RADIATOR

RADIATOR ECHA5500

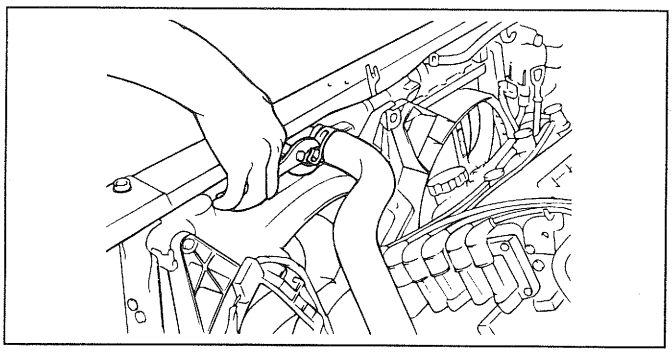


TORQUE : Nm (kg·cm, lb·ft)

EDHA001A

REMOVAL ECHA5600

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.



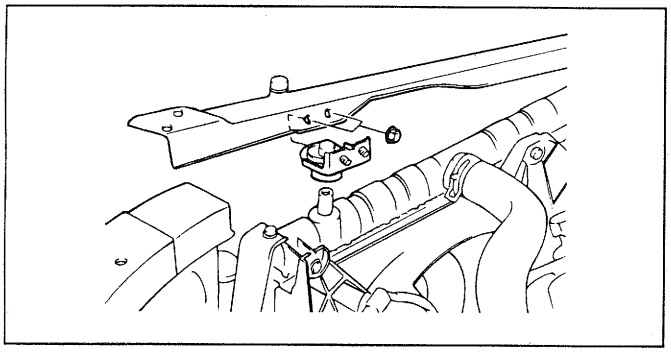
EDHA004D

5. For vehicles with automatic transaxles, disconnect the return oil cooler hoses from the automatic transaxle.

CAUTION

Cover or plug the hose and nipple part 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.



EDHA001C

7. Remove the radiator together with the fan motor.
8. Remove the radiator fan motor and condenser fan motor from the radiator.

INSPECTION ECHA5700

1. Check for foreign material between 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)

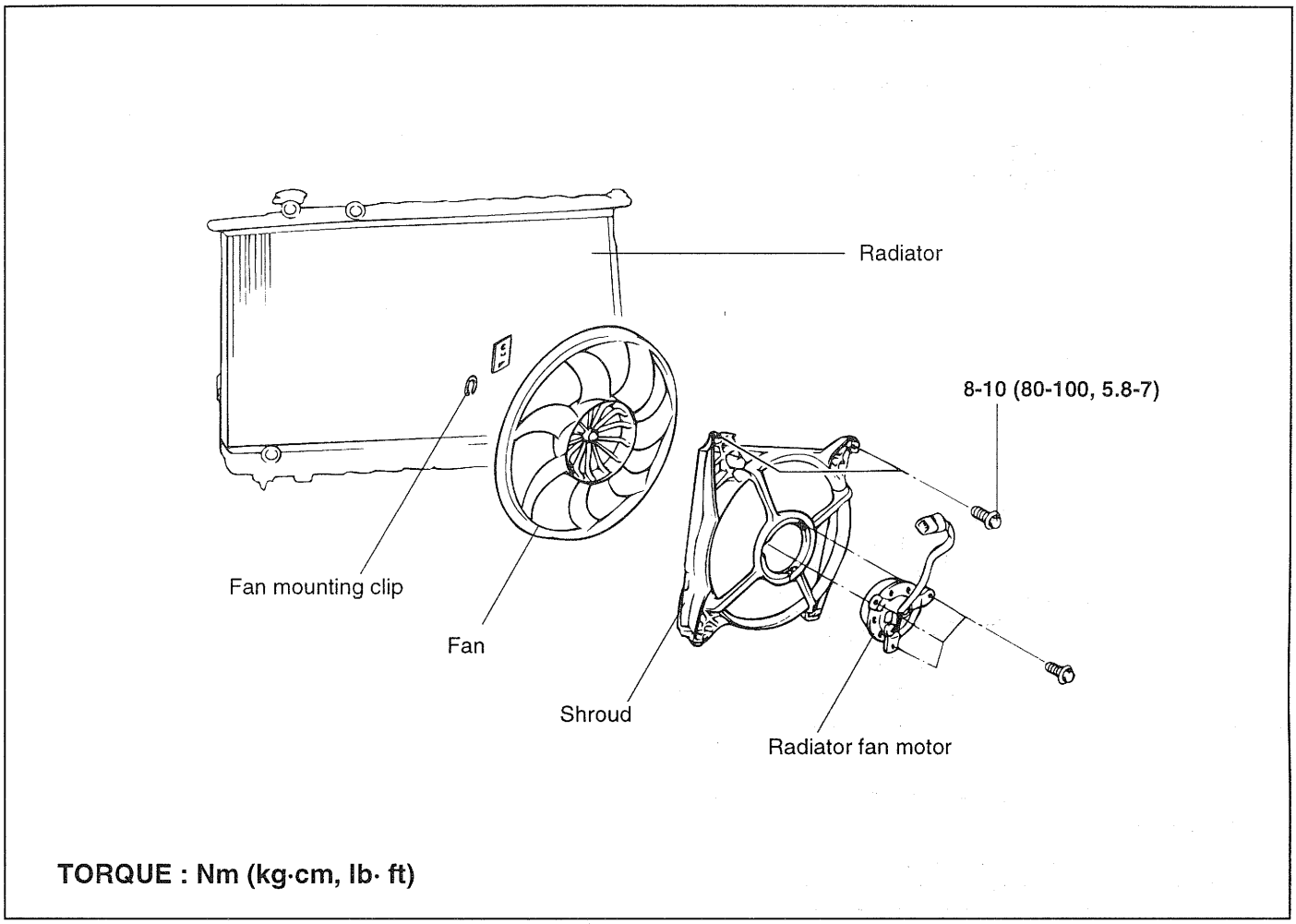
INSTALLATION ECHA5800

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 may open and then stop the engine.
3. Remove the radiator cap and pour the coolant to the filler neck of the radiator. Fill the reservoir tank with the coolant to the upper level.
4. Check that there is no leakage from the radiator, hoses or connections.

RADIATOR PAN MOTOR

RADIATOR FAN MOTOR

ASSEMBLY ECHA6200

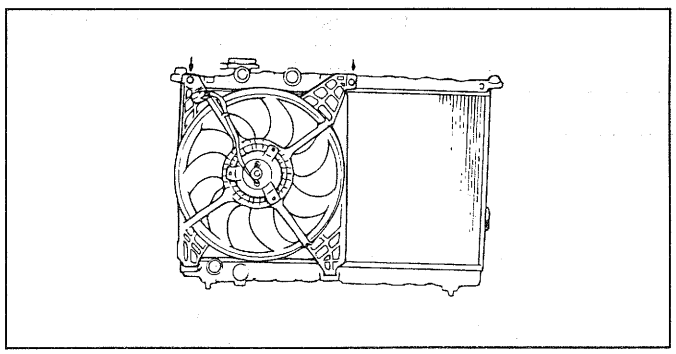


TORQUE : Nm (kg·cm, lb· ft)

ECA9059A

REMOVAL ECHA6300

1. Disconnect the ground cable from the battery cable.
2. Disconnect the connectors from the fan motor and the harness from shroud.
3. For vehicles with automatic transaxle, remove the oil cooler hose from the shroud.
4. Remove the four bolts fixing shroud.
5. Remove the shroud with the fan motor.
6. Remove the fan mounting clip and detach the fan from fan motor.
7. Remove three screws and detach the fan motor.



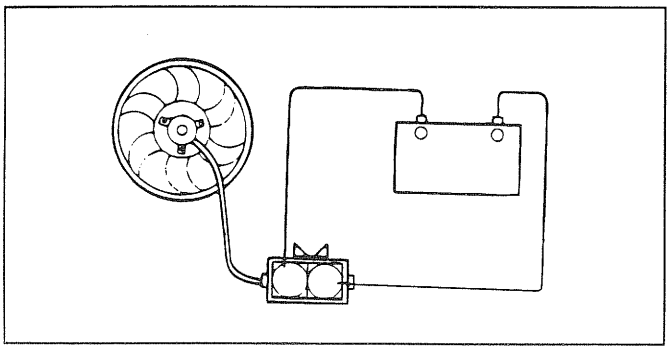
ECA9060A

INSPECTION

RADIATOR FAN MOTOR

1. Check that the radiator fan rotates when battery voltage is applied between the terminals (as shown table below).

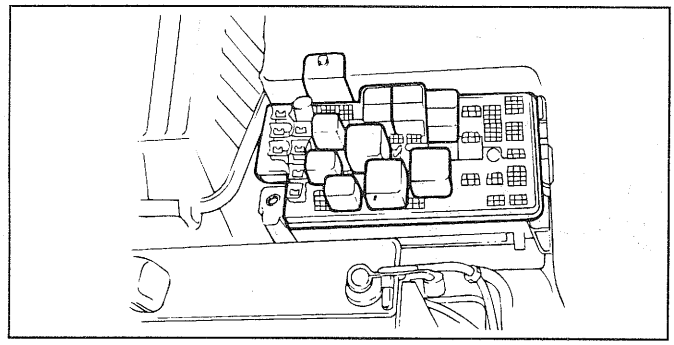
2. Check that abnormal noise is not produced while the motor is turning.



ECHA011C

RADIATOR FAN MOTOR RELAY

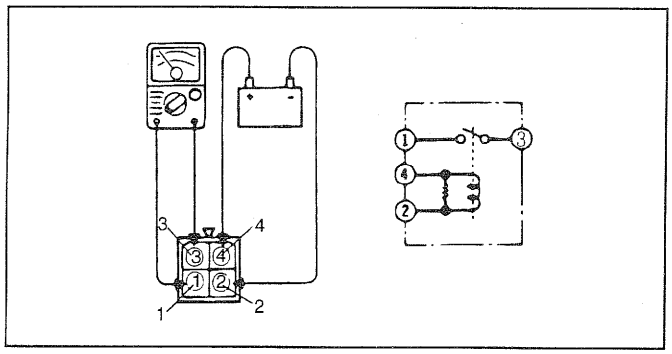
1. Remove the radiator fan motor relay (High and Low) from the relay box in engine room.



EDAA094A

2. Check the continuity of the terminals "2" and "4" with an ohmmeter.

Item	Terminal NO.	Yes or not
ON	Terminal 1-3	Continuity
OFF	Terminal 1-3	Non continuity
	Terminal 2-4	Continuity



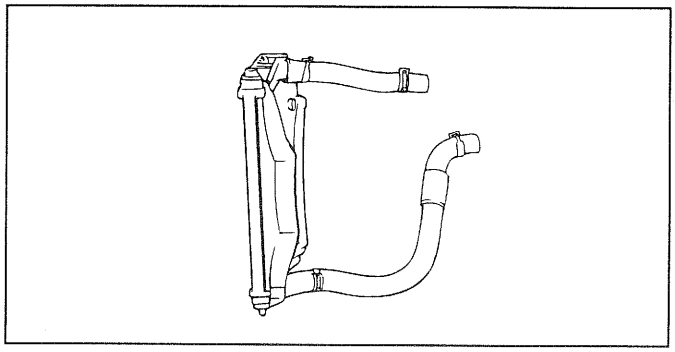
HFR25016

INSTALLATION ECHA6400

Installation is in the reverse order of removal procedures.

NOTE

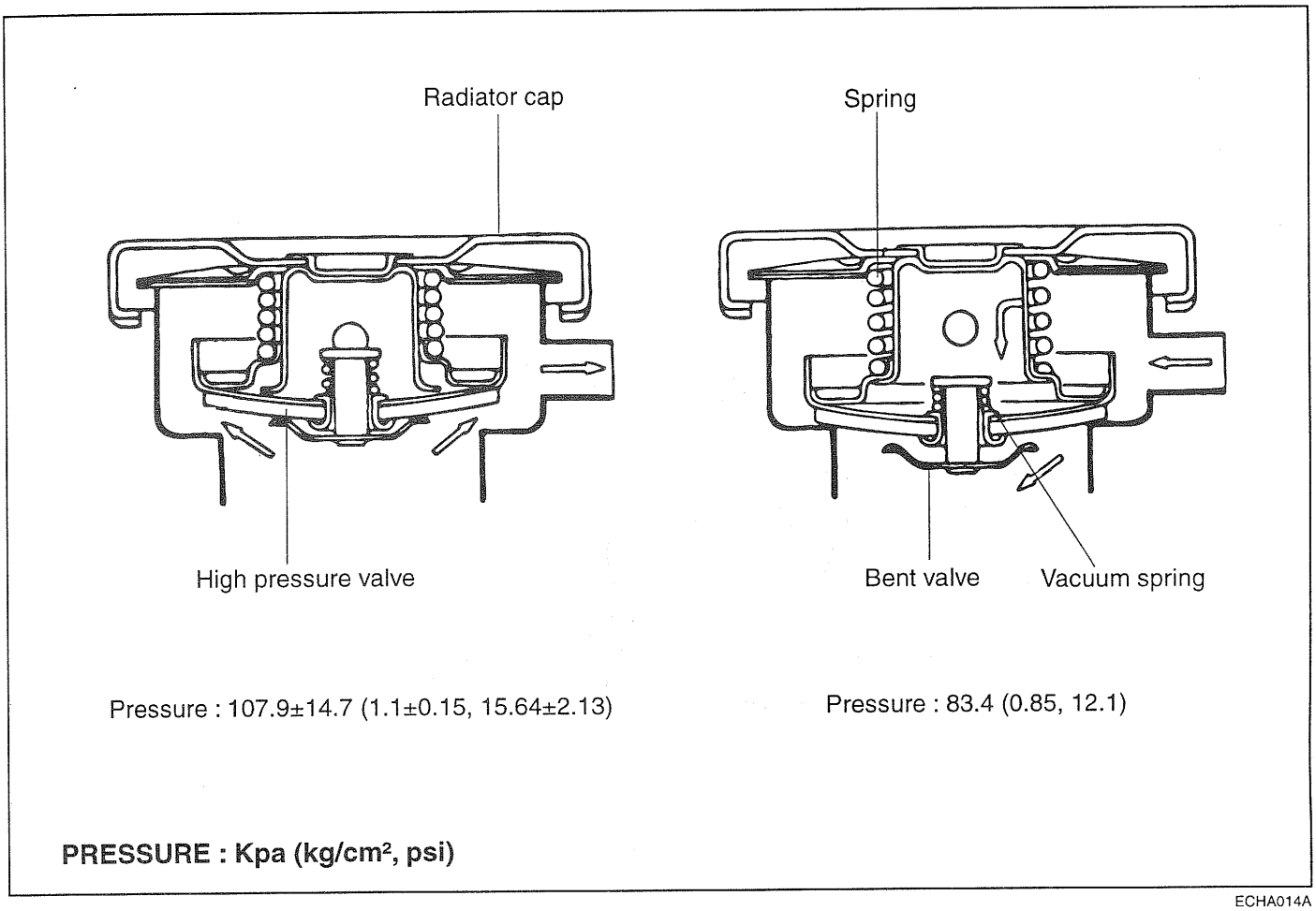
- **Make sure the cooling fan does not come into contact with the shroud when installed.**
- **After installation, make sure there is no unusual noise or vibration when the fan is rotated.**



ECA9061A

RADIATOR CAP

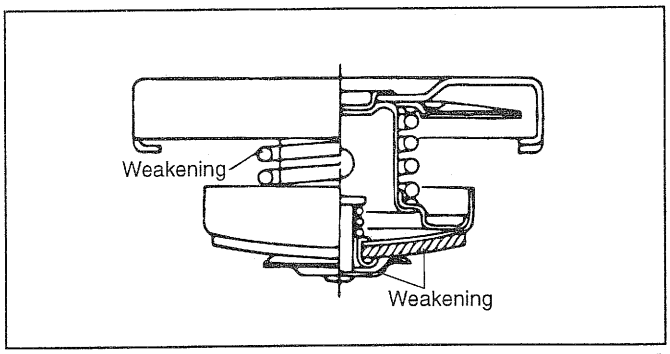
RADIATOR CAP ECHA5900



ECHA014A

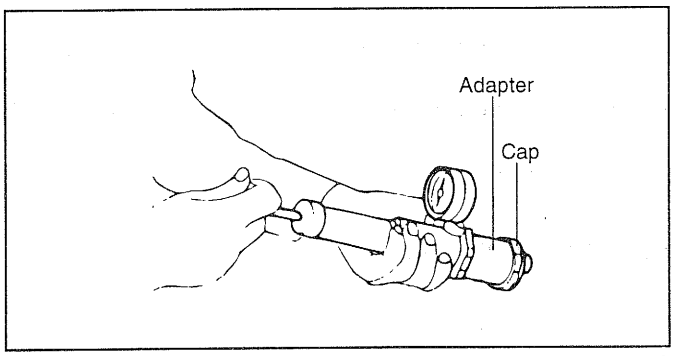
INSPECTION ECHA6000

1. Check the radiator cap for damage, crack or weakening.



ECHA014B

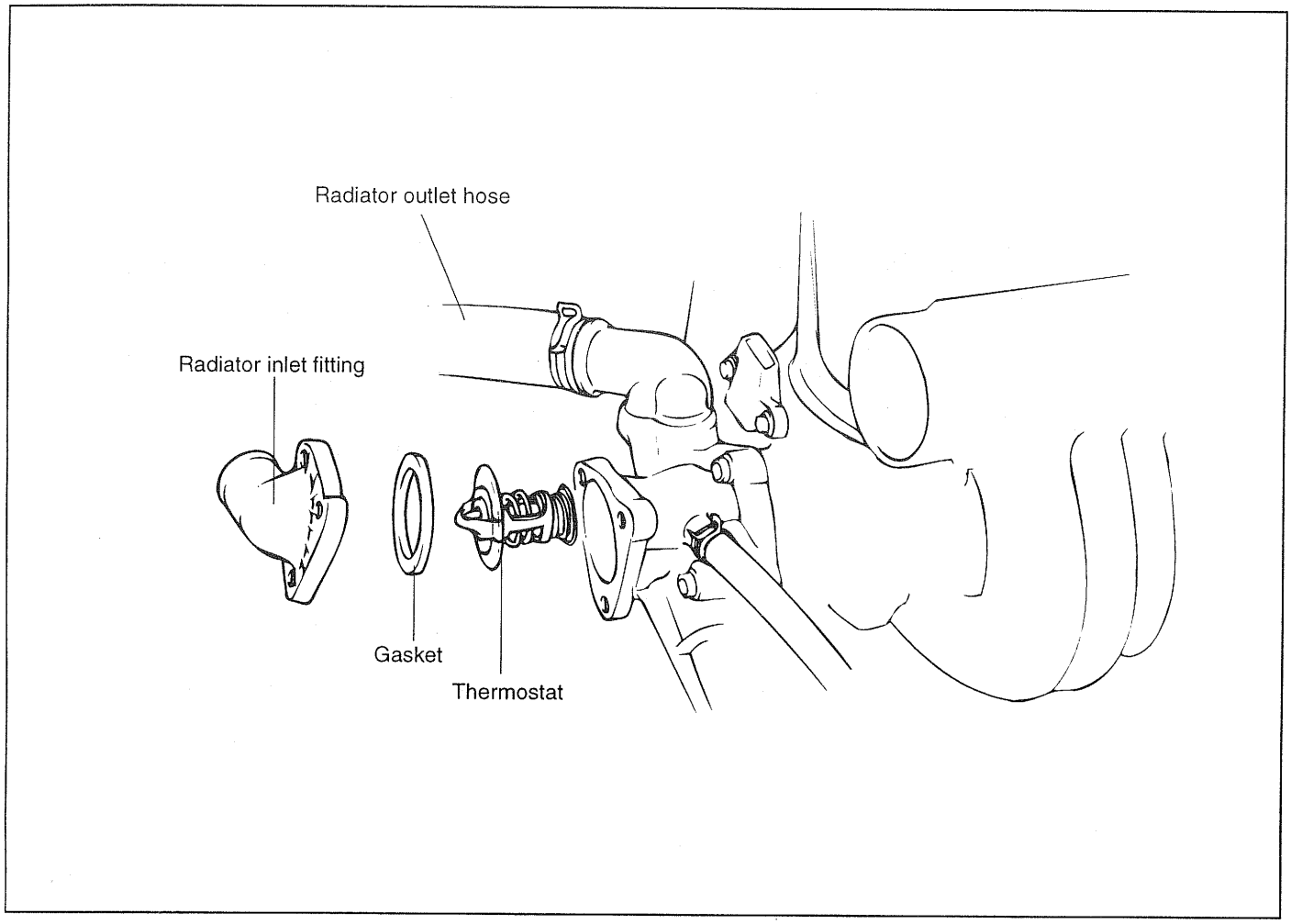
2. Connect the tester to the radiator cap.
3. Increase the pressure until the indicator stops moving.
4. Replace the radiator cap if the reading does not remain about 10 seconds.



ECHA014C

THERMOSTAT

THERMOSTAT ECHA6600



ECHA660A

REMOVAL ECHA6700

1. Drain the coolant to the thermostat level or below.
2. Remove the engine coolant inlet fitting and gasket.
3. Remove the thermostat.

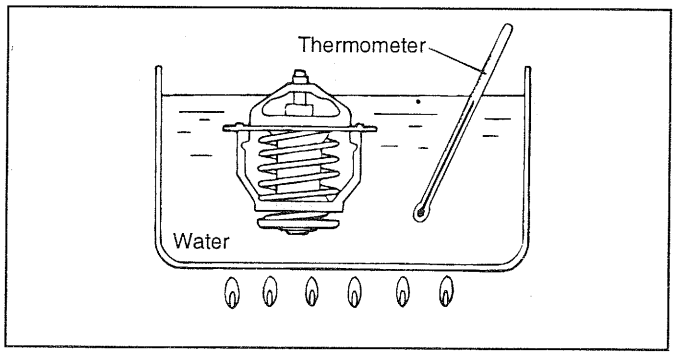
INSPECTION ECHA6800

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.
3. Check to determine the temperature at which the valve begins to open.

Valve opening temperature :

80-84°C(176-183.2°F)

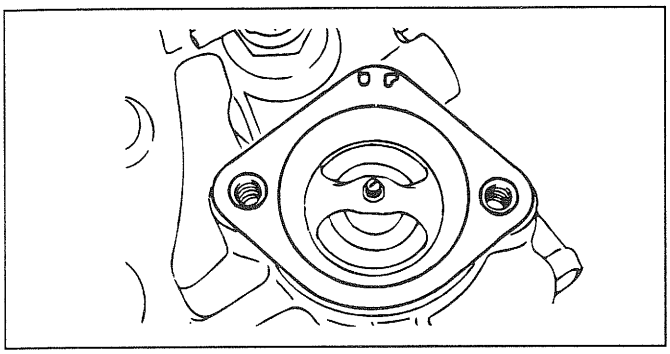
Full opening temperature : 95°C(203°F)



ECA9600A

INSTALLATION ECHA6900

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing.
2. Install the engine coolant inlet fitting.



ECHA013B

Tightening torque

Engine coolant inlet fitting bolt :

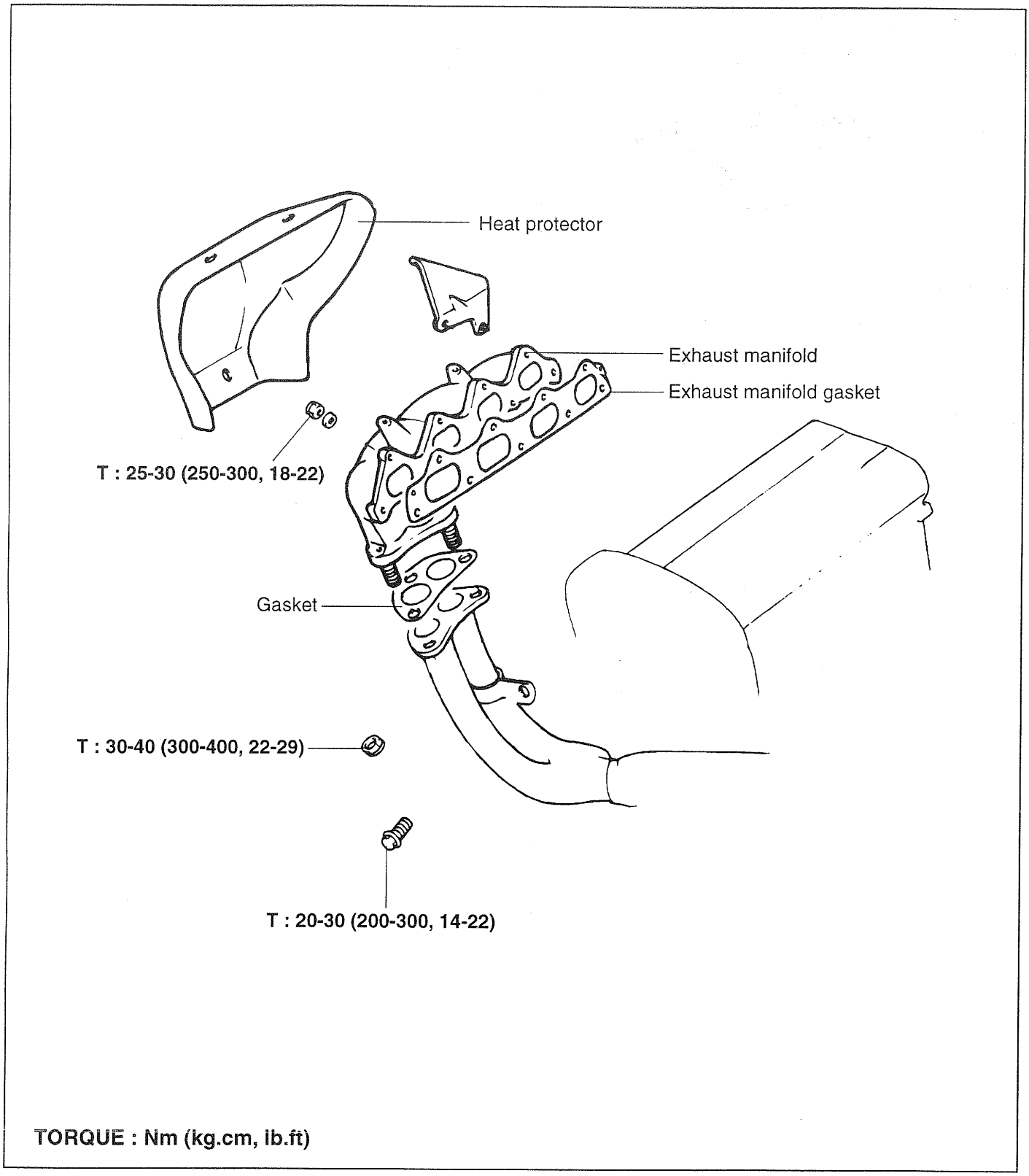
10-15Nm(100-150kg.cm, 7-11lb.ft)

3. Refill the coolant

INTAKE AND EXHAUST SYSTEM

EXHAUST PIPE

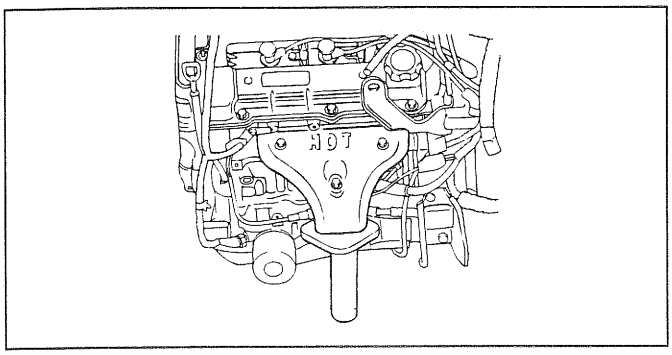
EXHAUST MANIFOLD ECHA7000



ECHA017A

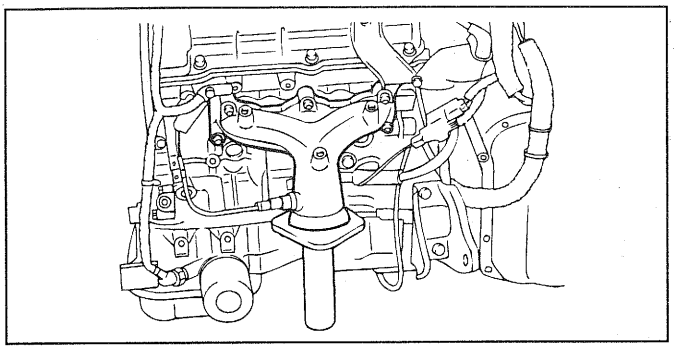
REMOVAL ECHA7100

1. Remove the heat protector.



EDHA011A

2. Remove the exhaust manifold.



EDHA011B

3. Remove the exhaust manifold gasket.

INSPECTION

1. Check for damage or cracking.
2. Using a straight edge and feeler gauge, check for distortion on the cylinder head matching surface.

Standard value : 0.15 mm (0.006 in.)

Service limit : 0.3 mm (0.012 in.)

3. Check the exhaust manifold for damage crack.

INSTALLATION ECHA7200

1. Install the exhaust manifold with gasket

Tightening torque

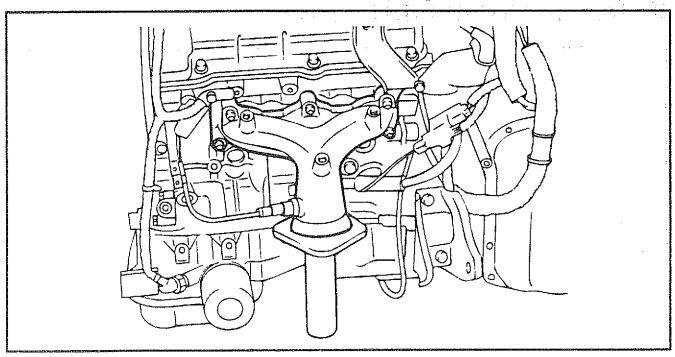
Exhaust manifold

M8 : 25-30 N.m (250-300 kg.cm, 18-22 lb.ft)

M10 : 35-55 N.m (350-550 kg.cm, 25-40 lb.ft

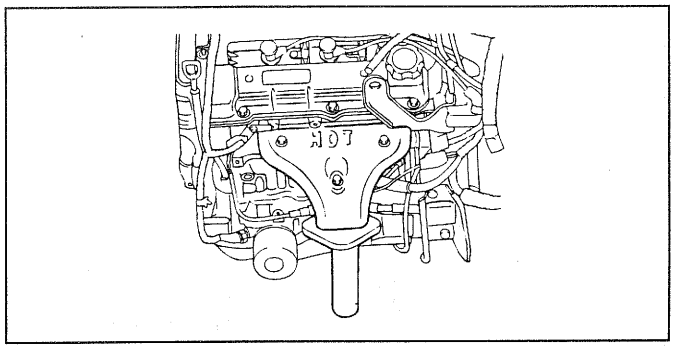
NOTE

Do not use the used exhaust manifold gasket.



EDHA011B

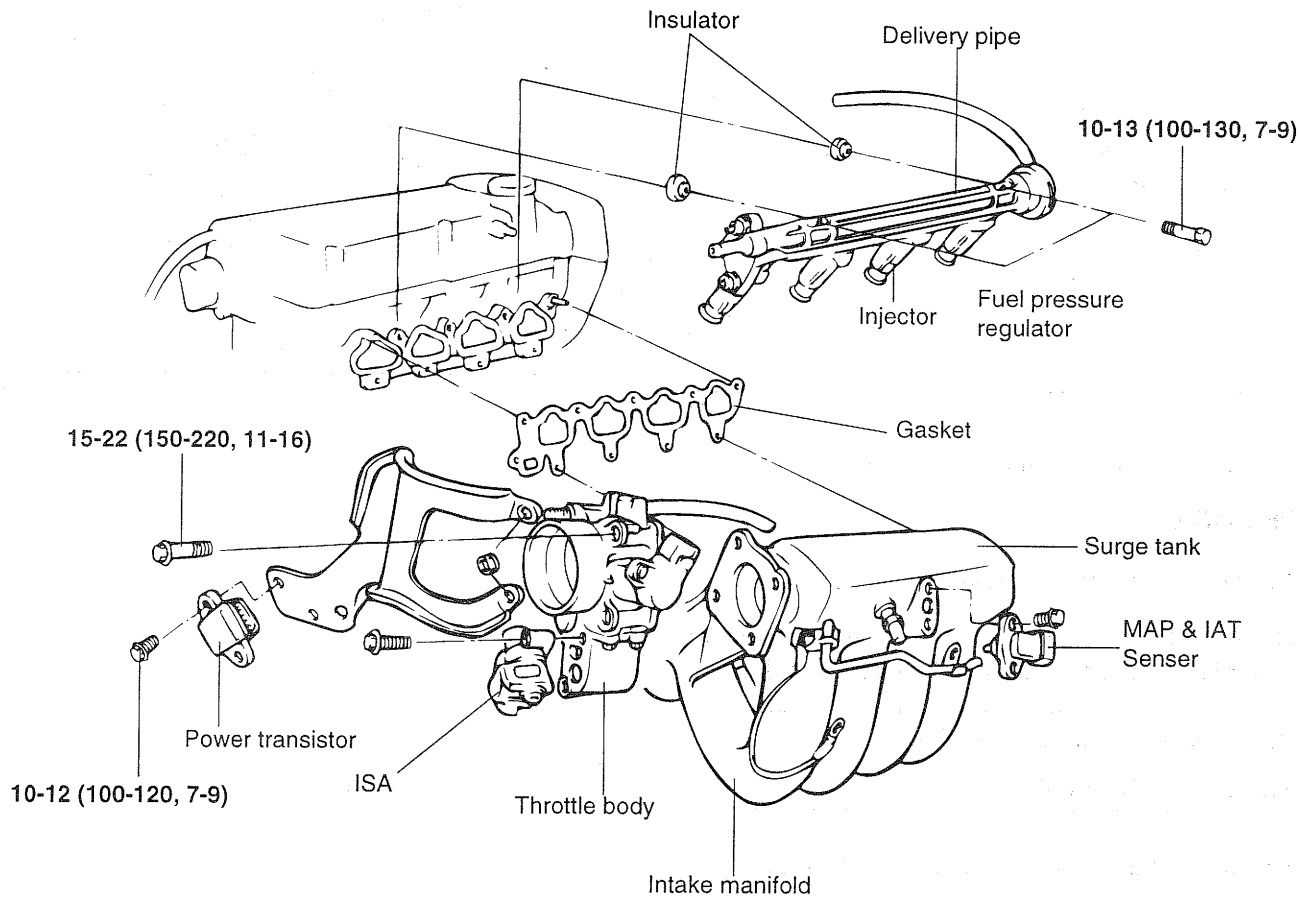
2. Install the heat protector.



EDHA011A

INTAKE MANIFOLD

INTAKE MANIFOLD ECHA7500

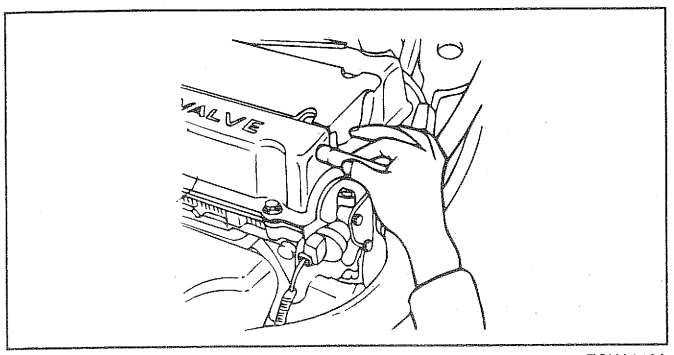


TORQUE : Nm (kg·cm, lb·ft)

ECA9067A

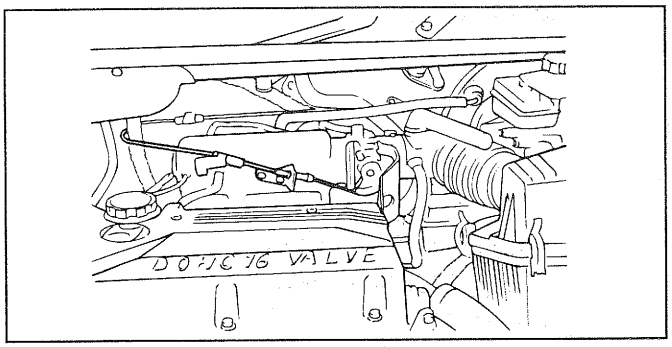
REMOVAL ECHA7600

1. Remove the air breather hose connected on the throttle body.



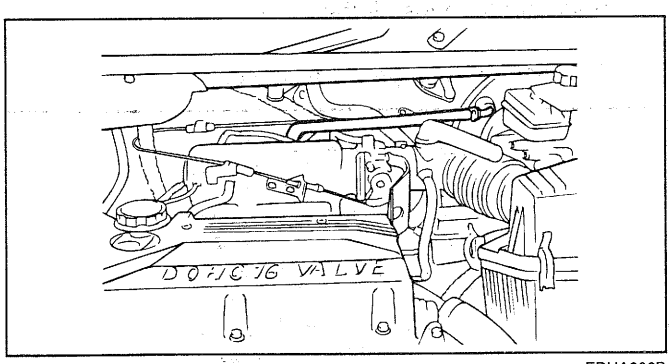
ECHA016A

2. Remove the accelerator cable.



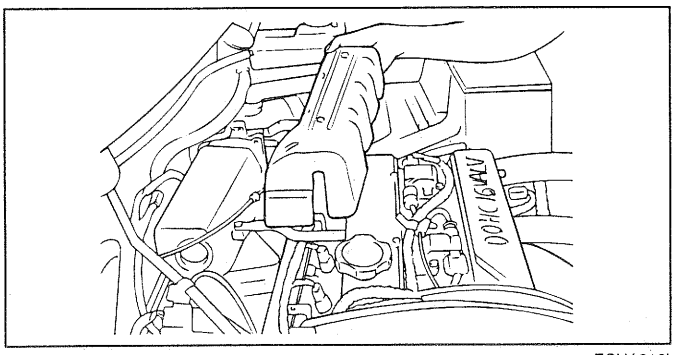
EDHA006E

3. Remove the engine coolant hose and throttle body.
4. Remove the P.C.V valve and brake boost vacuum hose.
5. Disconnect the vacuum hose connector.



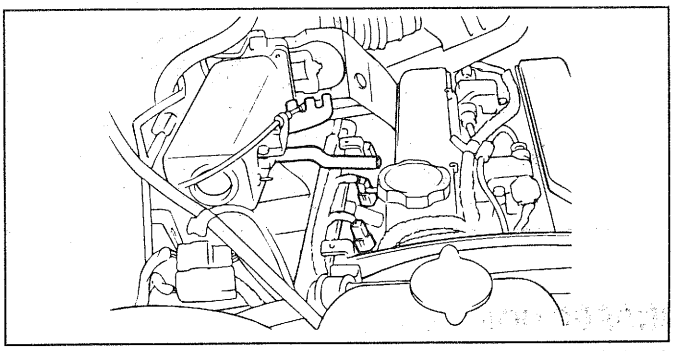
EDHA006B

6. Remove the injector cover.



ECHA016I

7. Decrease the pressure in the fuel pipe line to prevent fuel from flowing over and then disconnect the connector of high pressure hose.
8. Disconnect the fuel injector harness connector.

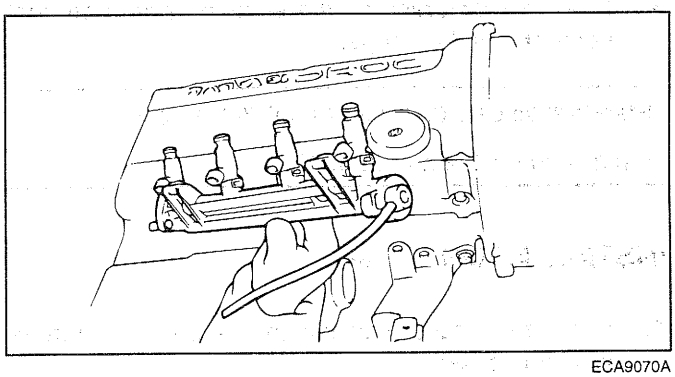


ECHA055A

9. Remove the delivery pipe with fuel injector and pressure regulator.

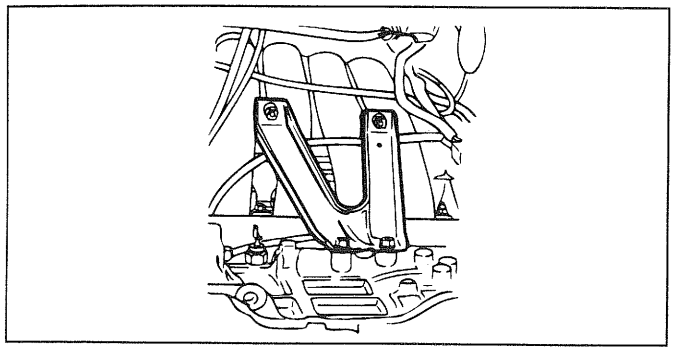
NOTE

When the delivery pipe is removed, notice not to drop the injector.



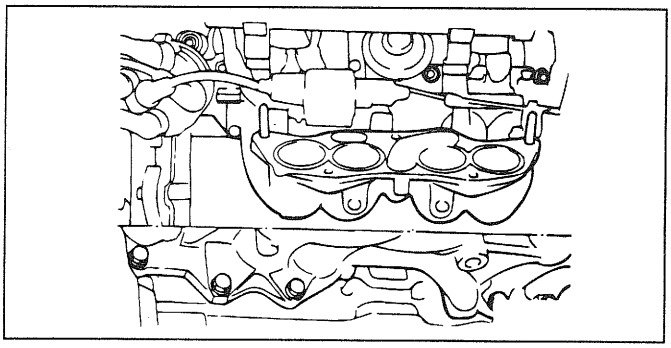
ECA9070A

10. Remove the intake manifold stay.



ECHA016C

11. Remove the intake manifold.



ECHA016J

INSPECTION ECHA7700

INTAKE MANIFOLD AND SURGE TANK

1. Check for damage or cracking of any part.
2. Check for restriction of the vacuum outlet port, water or gas passage.
3. Check for distortion on the surface using a straight edge and feeler gauge.

Standard value : 0.15 mm (0.06 in.) or less

Service limit : 0.2 mm (0.0078 in.)

INSTALLATION ECHA7800

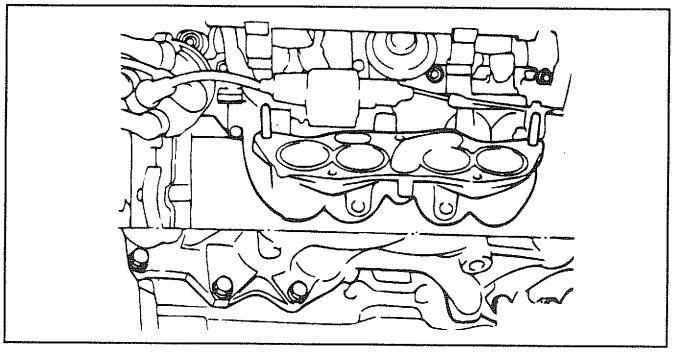
1. Install the intake manifold to the specified torque with new gasket.

Tightening torque

Intake manifold

Bolt : 15-20Nm (150-120 kg.cm, 11-14 lb.ft)

Nut : 30-42Nm (300-420 kg.cm, 22-30 lb.ft)

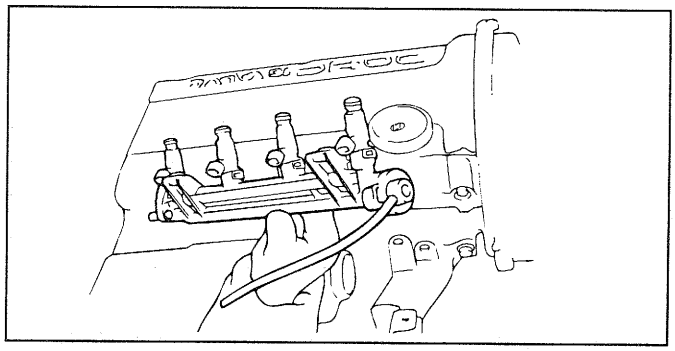


ECHA016J

2. Install the delivery pipe and injector assembly to the intake manifold.

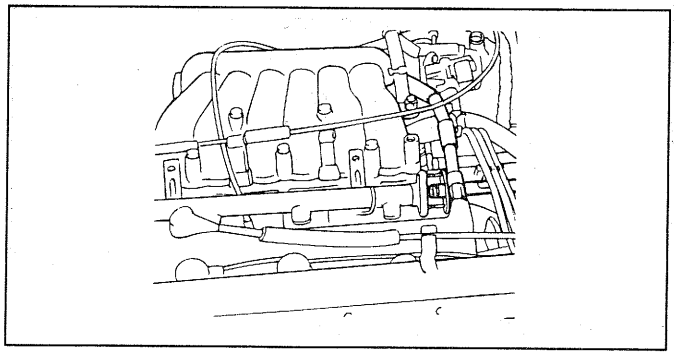
NOTE

Make certain that there is any interference between the injectors and injector holes on the intake manifold.



ECA9070A

3. Install the surge tank stay.
4. Connect the fuel injector connector and wiring harness and then install the cover.
5. Connect the high pressure hose.



ECHA016B

6. Connect the vacuum hoses.

Tightening torque

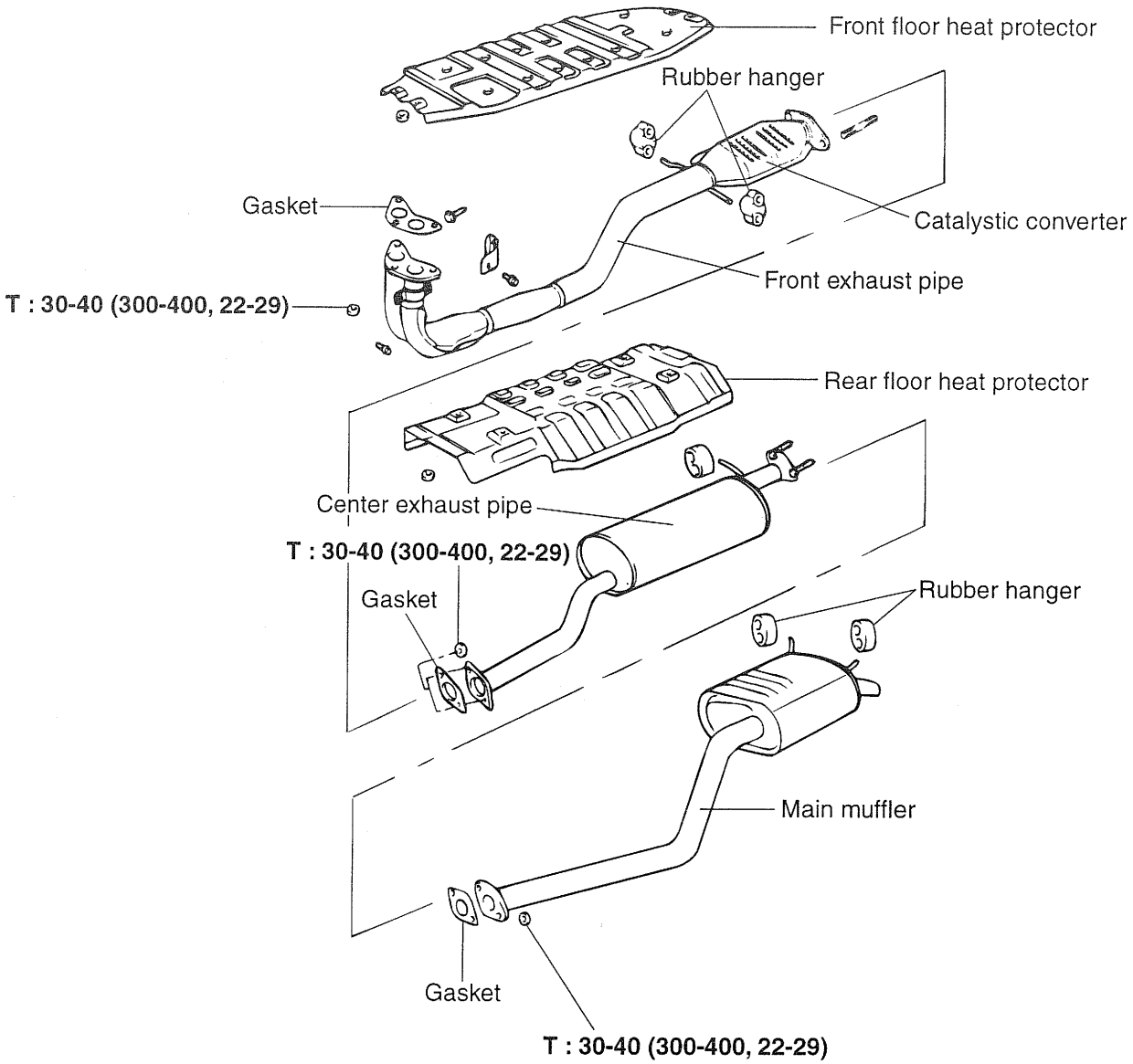
Intake manifold stay and cylinder block :

18-251Nm (180-250 kg.cm, 13-18 lb.ft)

7. Connect the PCV valve and brake boost hose.
8. Install the air breather hose.
9. Install the accelerator cable.

MUFFLER

MUFFLERS ECHA8000



TOR QUE : Nm (kg·cm, lb·ft)

ECHA018A

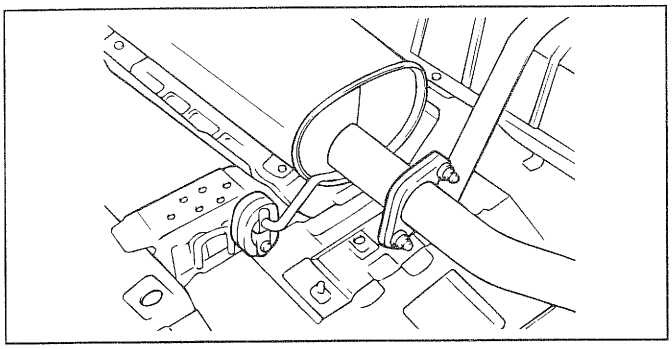
REMOVAL ECHA8100

MAIN MUFFLER

CAUTION

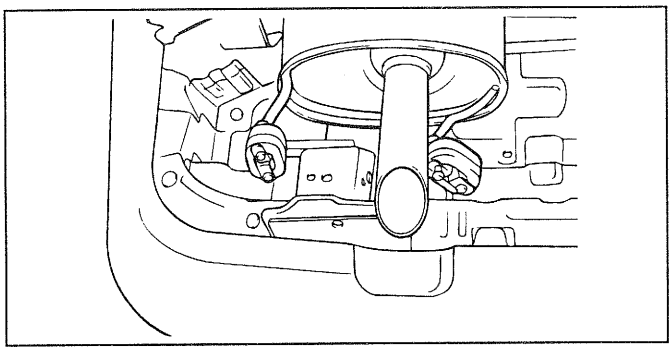
Before removing or inspecting the exhaust system, ensure that the exhaust system is cool enough.

1. Disconnect the main muffler from the center exhaust pipe.



ECHA019E

2. Remove the rubber hangers and take out the main muffler.

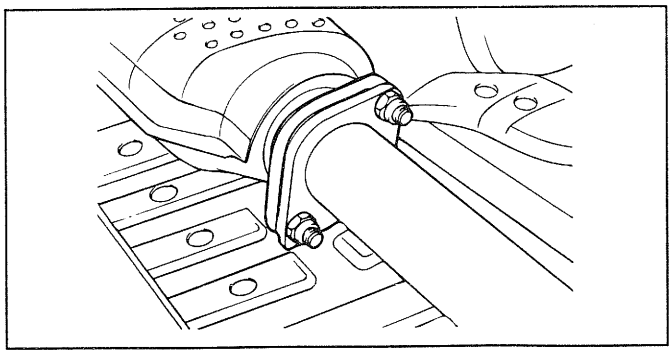


ECHA019B

CENTER EXHAUST PIPE

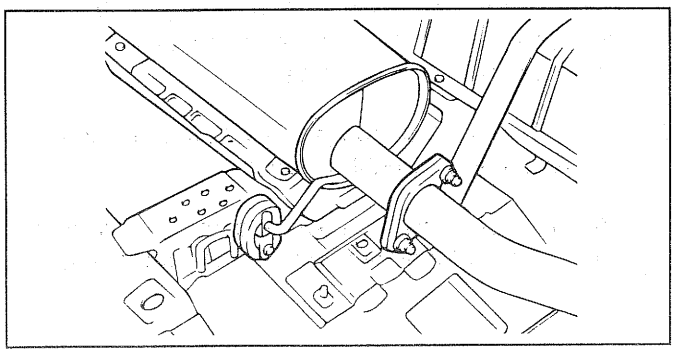
1. Disconnect the center exhaust pipe from the main muffler.

2. Remove the center exhaust pipe from the front exhaust pipe.



ECHA019D

3. Remove the rubber hangers and take out the center exhaust pipe.

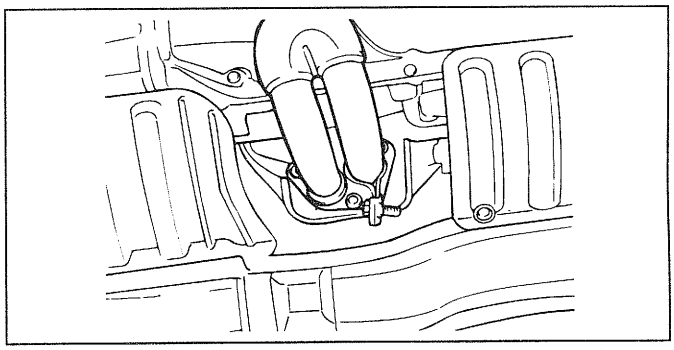


ECHA019E

FRONT EXHAUST PIPE (INCLUDING CATALYTIC CONVERTER)

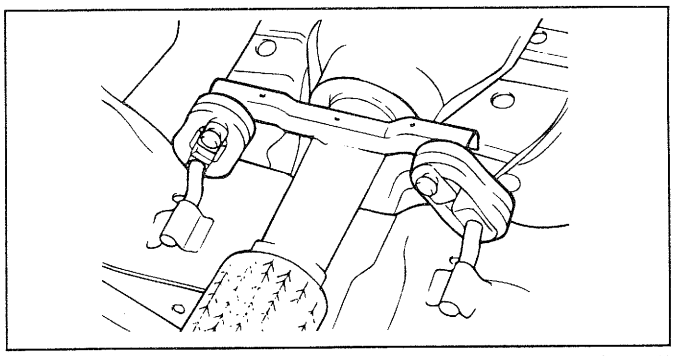
1. Remove the front exhaust pipe from the center exhaust pipe.

2. Remove the front exhaust pipe bolts and exhaust manifold pipe mounting nuts.



ECHA004M

3. Remove the front exhaust pipe from the rubber hanger.



ECHA019H

INSPECTION ECHA8200

1. Check the mufflers and pipes for corrosion and damage.

2. Check the rubber hangers for deterioration and cracks.

INSTALLATION ECHA8300

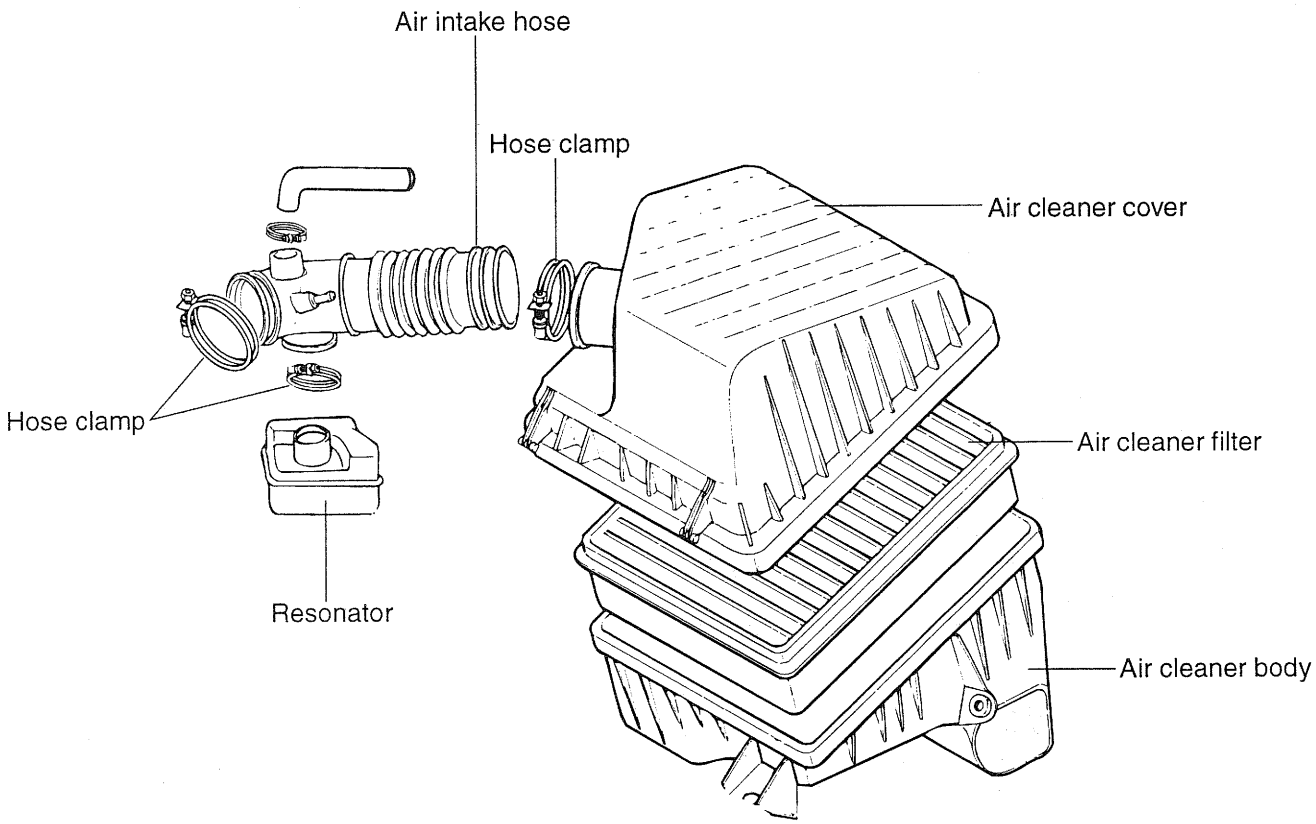
1. Temporarily, install the front exhaust pipe (catalytic converter assembly), the center exhaust pipe and the main muffler in this order.

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.

AIR CLEANER (ACL)

AIR CLEANER ECHA8500

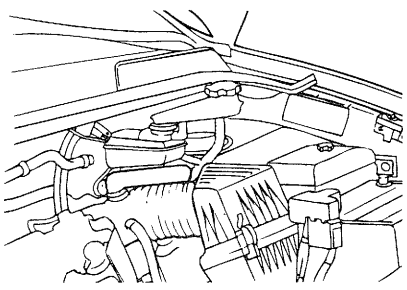


TOR QUE : Nm (kg·cm, lb·ft)

ECHA015A

REMOVAL ECHA8600

1. Disconnect the air flow sensor connector.
2. Remove the air intake hose connected to the air cleaner and the resonator.
3. Remove the three bolts attaching the air cleaner mounting brackets.
4. Detach the air cleaner.



ECHA004A

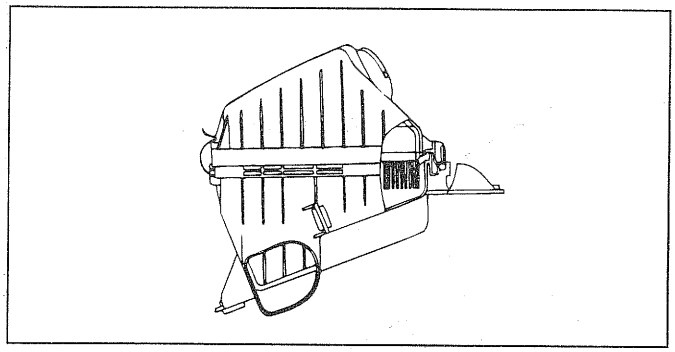
5. Remove the air flow sensor from the air intake hose.

CAUTION

Donot pull the air flow sensor harness.

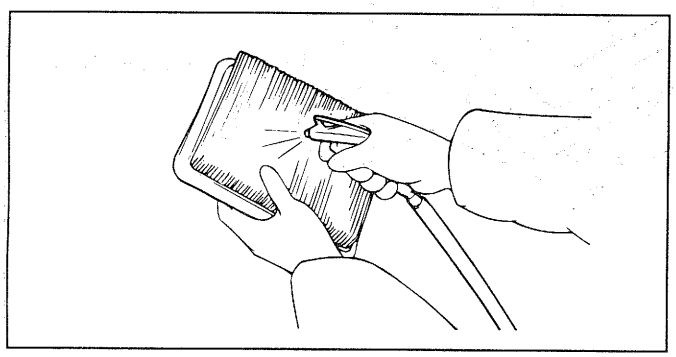
INSPECTION ECHA8700

1. Check the air cleaner body, cover, or packing for distortion, corrosion or damage.
2. Check the air duct for damage.



ECHA015C

3. Check the air cleaner element for restriction, contamination or damage. If the element is slightly restricted, remove the dust and debris by blowing the inside of the element.



ECA9066A

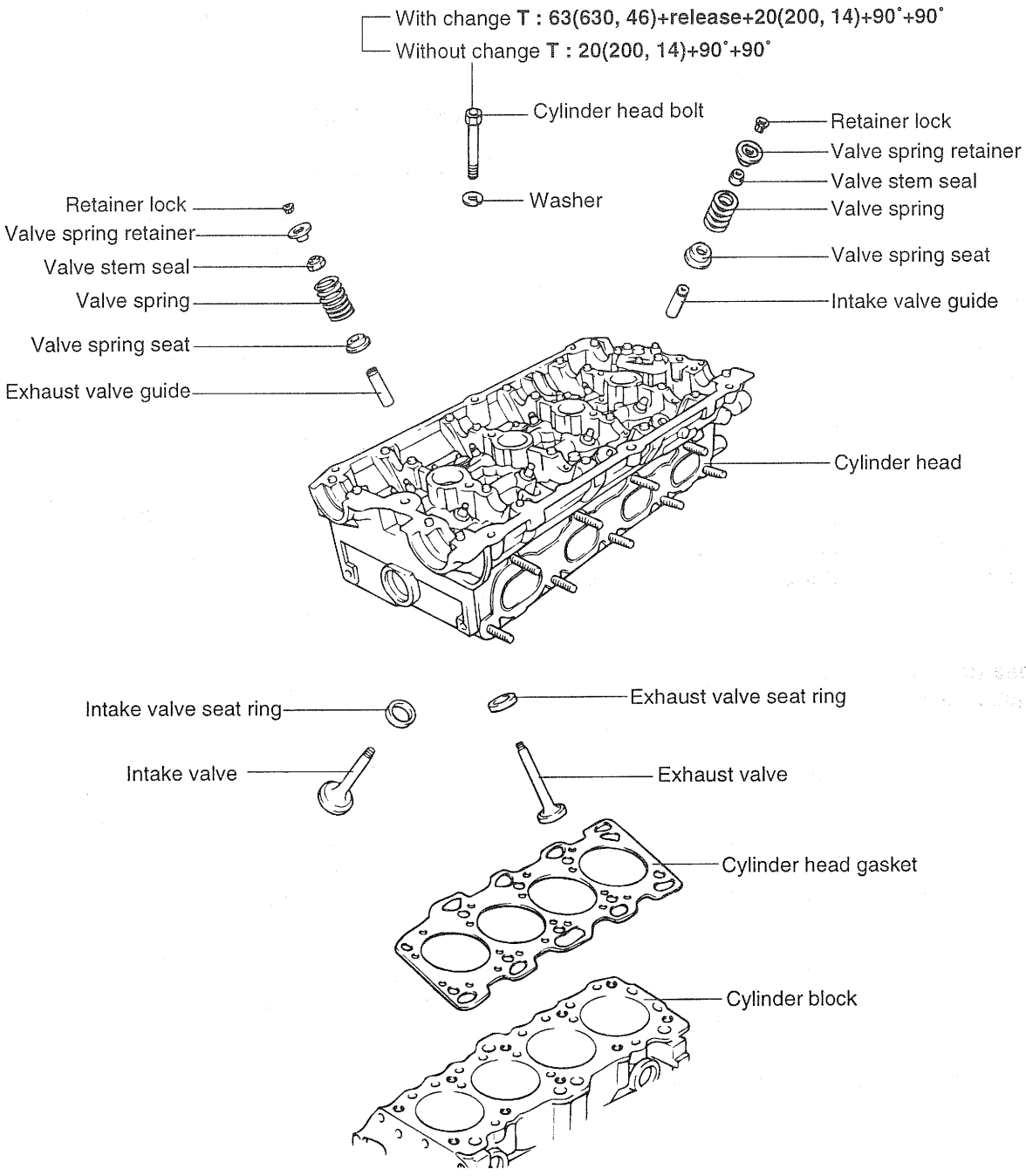
INSTALLATION ECHA8800

Install the air cleaner according to the reverse order of removal.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

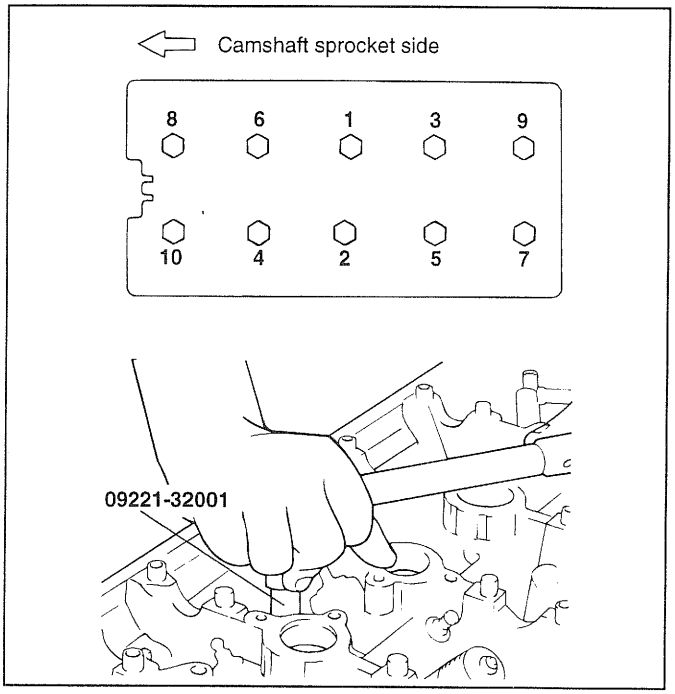
CYLINDER HEAD AND VALVES ECHA9000



ECHA900A

DISASSEMBLY ECHA9100

1. Using a special tool (09221–32001), remove the cylinder head bolts as shown in the illustration.

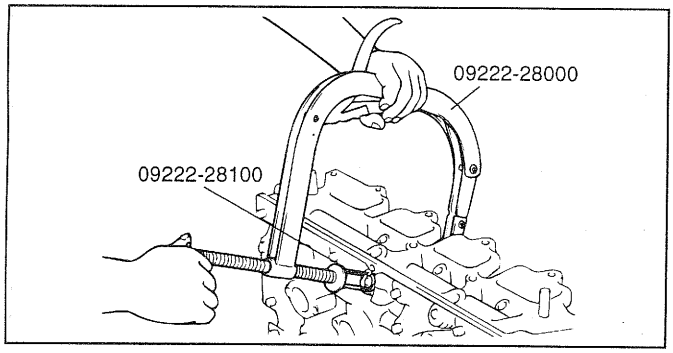


ECHA910A

2. Using the special tool (09222–28000, 09222–28100), remove the retainer lock. Next remove the spring retainer, valve spring, spring seat and valve.

NOTE

Keep these parts so that they can be reinstalled in their original positions.

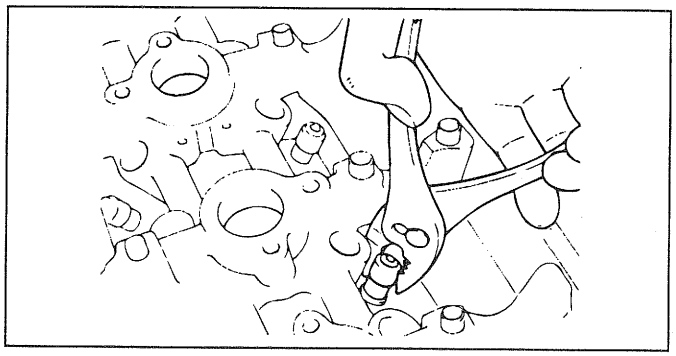


ECHA910B

3. Remove the valve stem seals with pliers.

NOTE

Do not reuse the valve stem seals.



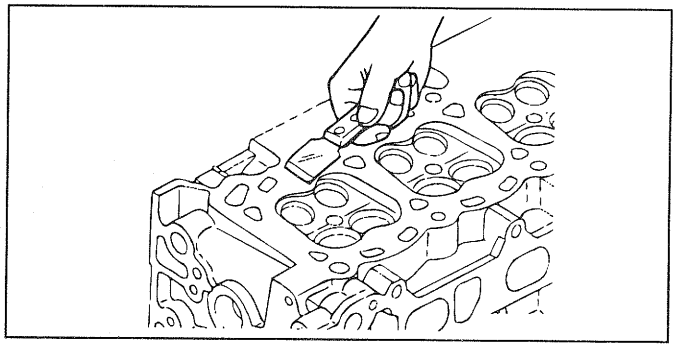
ECA9270C

INSPECTION ECHA9200

CYLINDER HEAD

1. Check the cylinder head for crack, damage and coolant leakage. If cracked, replace the cylinder head.

2. Remove scale, sealing compound and carbon deposit completely. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.



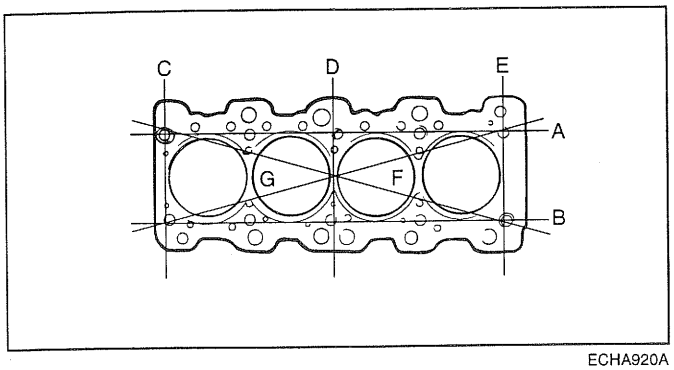
ECA9280A

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 gasket surface lightly.

Flatness of cylinder head gasket surface

Standard : Less than 0.03mm(0.0012 in.)

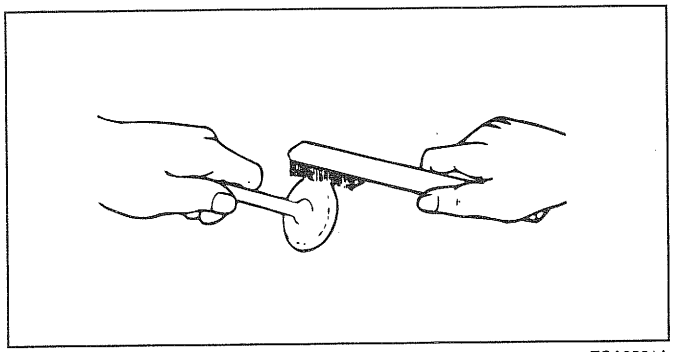
Limit : 0.2 mm (0.008 in.)



ECHA920A

VALVES

1. Using a wire brush, clean the valve thoroughly.



ECA9281A

2. Check each valve for wear, damage and distortion of head and stem at B Position. Repair or correct, 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]

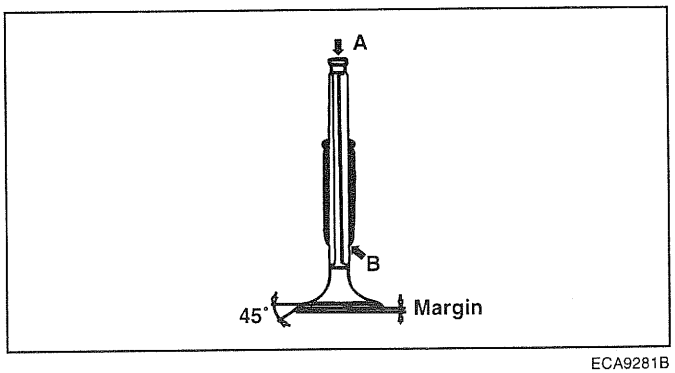
Intake : 1.0mm(0.040 in.)

Exhaust : 1.5mm(0.059 in.)

[Limit]

Intake : 0.7mm(0.028 in.)

Exhaust : 1.0mm(0.040 in.)



ECA9281B

VALVE SPRINGS

1. Check free height of each valve spring. If they exceed the service limit, replace the spring.

2. Using a square, test the squareness of each spring. If the spring is excessively out— of-square, replace it.

Valve spring

[Standard]

Free height : 45.82mm(1.804 in.)

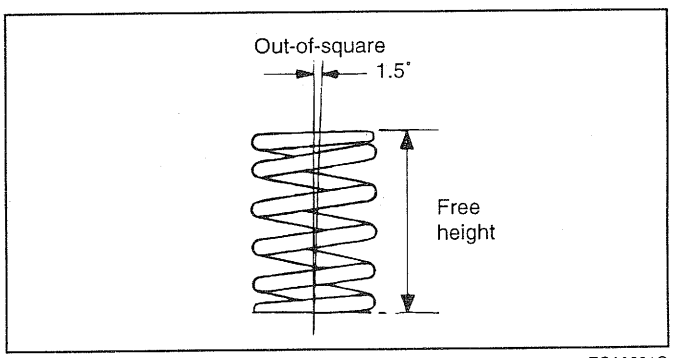
Load : 25.3kg/40mm (55.8 lb/1.57 in.)

Out of square : 1.5° or less

[Limit]

Free height : 44.82mm(1.7646in.)

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]

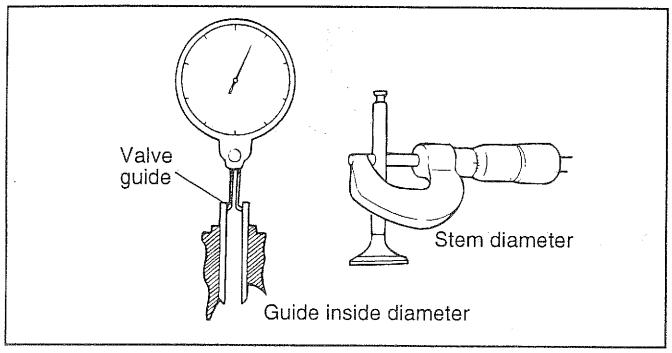
Intake : 0.020-0.047mm(0.0008-0.0020 in.)

Exhaust : 0.050-0.085mm(0.0020-0.0033 in.)

[Limit]

Intake : 0.1mm(0.0040 in)

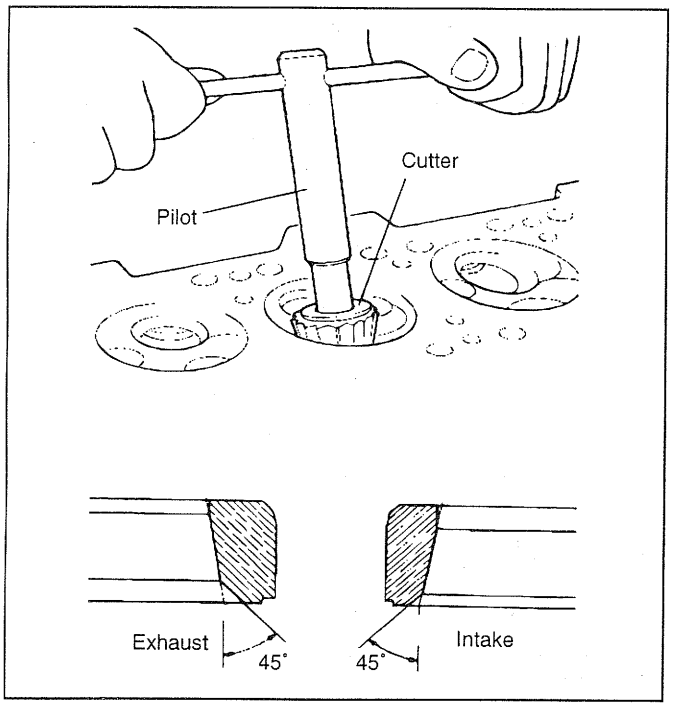
Exhaust : 0.15mm(0.0059 in.)



ECA9281D

RECONDITIONING VALVE SEAT

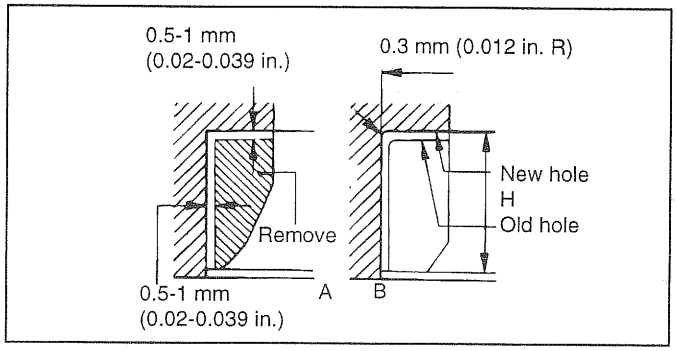
Check the valve seat for overheating and improper contact with the valve face. Recondition or replace the seat if necessary. Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it and then recondition the seat. Recondition the valve seat with a valve seat 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.



ECHA920B

REPLACING VALVE SEAT RING

1. Cut away the inner face of the valve seat to reduce the wall thickness.



ECA9281F

2. Adjust diameter of the valve seat on the cylinder head side so that if can match the diameter of the oversize 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 at normal temperature.

4. Using the lapping compound, lap the valve.

Valve seat contact width :

0.9 -1.3 mm (0.035-0.051 in.)

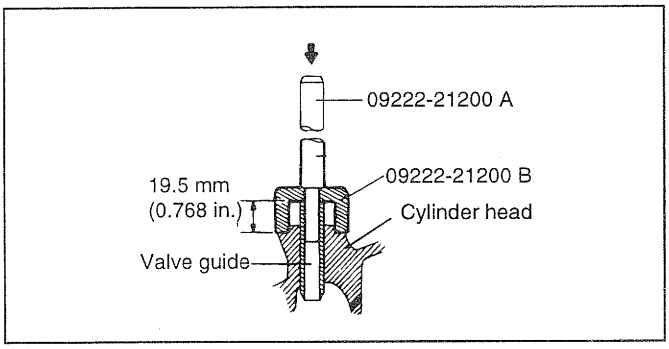
VALVE SEAT INSERT OVERSIZES

Description	Size mm (in.)	Size mark	Seat ring height H mm(in.)	Oversize hole diameter I.D. mm(in.)
Intake valve	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	35.300-35.325 (1.3898-1.3907)
Seat ring	0.6 (0.024) O.S.	60	8.2-8.4 (0.323-0.331)	35.600-35.625 (1.4016-1.4026)
Exhaust valve	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	33.300-33.325 (1.3110-1.3120)
Seat ring	0.6 (0.024) O.S	60	8.2-8.4 (0.323-0.331)	33.600-33.625 (1.3228-1.3238)

REPLACING VALVE GUIDE

1. Using the special tool (09222–21200A), press down 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..

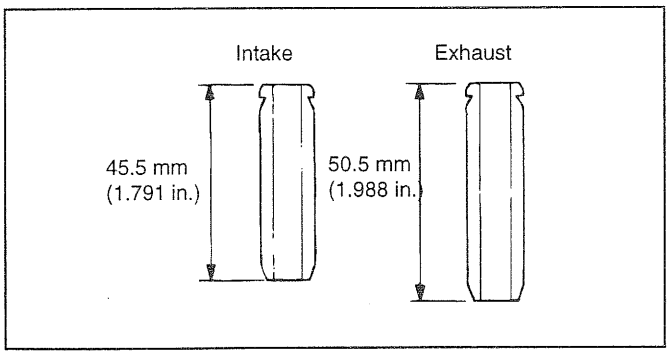


ECA9281G

3. Using the special tool (09222–21200 A, B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the valve guides are different in length.

NOTE

Do not install a valve guide of the same size again.



ECA9281H

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 in contact with them and recondition the valve seats as necessary.

VALVE GUIDE OVERSIZES

Size mm (in.)	Size mark	Oversize valve guide hole size mm (in.)
0.05(0.002) O.S.	5	12.050-12.068 (0.4744-0.4751)
0.25 (0.010) O.S.	25	12.250-12.268 (0.4823-0.4830)
0.50 (0.020) O.S.	50	12.500-12.518 (0.4921-0.4928)

REASSEMBLY ECHA9300

NOTE

1. **Clean each part before assembly.**
2. **Apply engine oil to the sliding and rotating parts.**

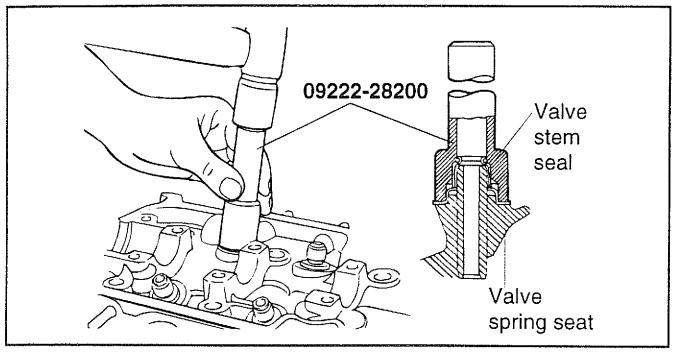
1. Install the spring seats.

   Using a special tool (09222–28200), tap the seal in position lightly.

NOTE

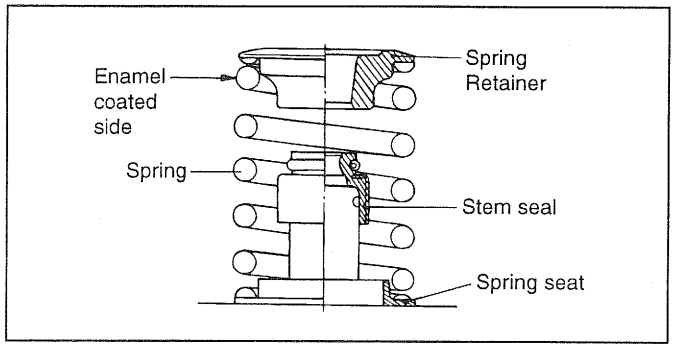
- **Do not reuse old valve stem seals.**
- **Incorrect installation of the seal could result in oil leakage of the valve guides.**

2. Apply engine oil to each valve. Insert the valves into the valve guides. Avoid pushing the valve into the seal by force. After inserting the valve, check that it moves smoothly.



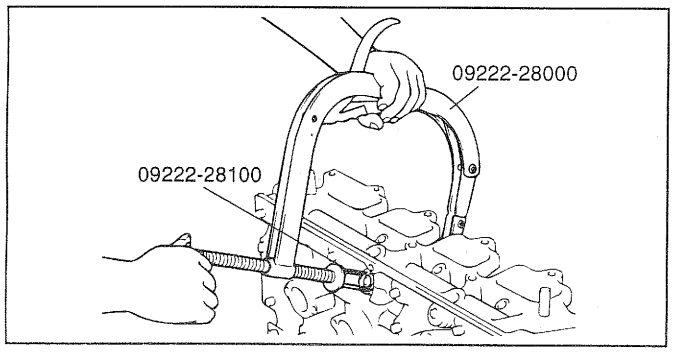
ECHA930A

3. Place valve springs so that the side coated with enamel may face to ward the valve spring retainer and then install.



ECA9290B

4. Using the special tool (09222–28000, 09222–28100), push 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 sea 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.

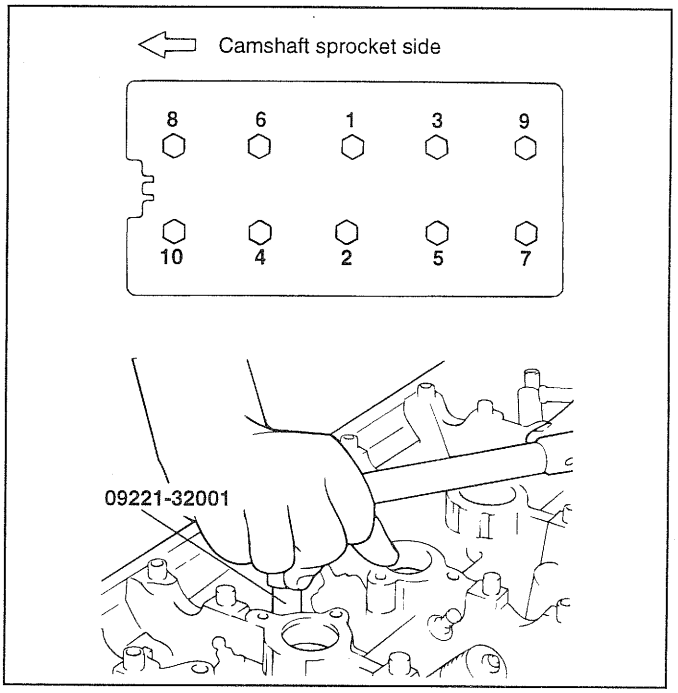
7. Install the gasket so that the surface with hte identification mark may force toward the cylinder head.

NOTE

Check and measure the length of bolt.

Maximum length : 99.4 mm (3.9 in.)

8. Tighten the bolts to the specified torque.



ECHA910A

Tightening torque

Without replacement (head bolt, head gasket, cylinder head, cylinder block) :

20Nm (200 kg.cm, 14 lb.ft)+90°+90°

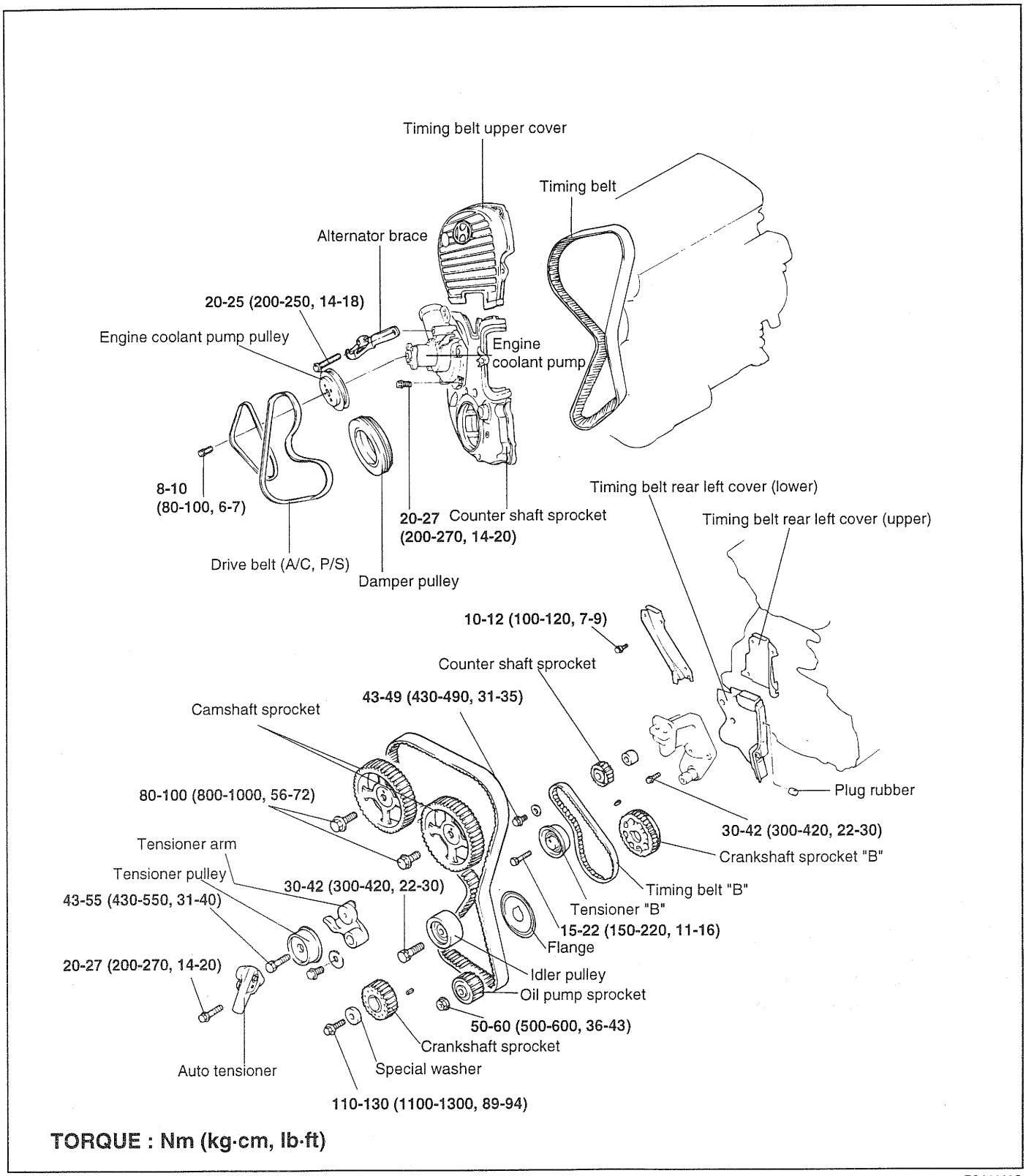
With replacement (even if onething is replaced) :

64Nm (640 kg.cm, 46 lb.ft)+release+20Nm (200 kg.cm, 14 lb.ft)+90°+90°

TIMING SYSTEM

TIMMING BELT

TIMING BELT ECHA9500



ECA9022C

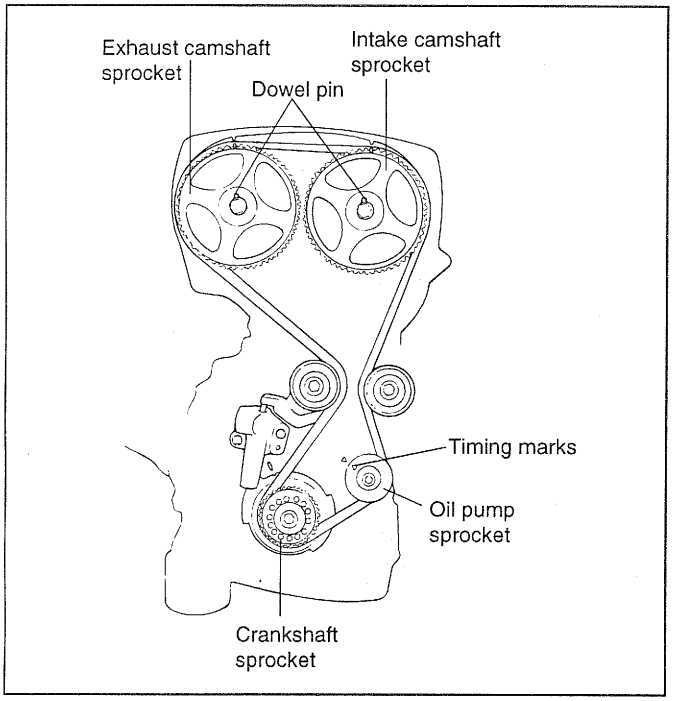
REMOVAL ECHA9600

1. Remove the crankshaft pulley, engine coolant pump pulley and drive belt.
2. Remove the timing belt cover.
3. Remove the auto tensioner.

CAUTION

Rotate the crankshaft clockwise and align the timing marks to aet the No. 1 cylinder's piston to TDC.

At this time, the timing marks of the camshaft sprocket and cylinder head cover should coincide with eachother and the dowel pin of the camshaft sprocket should be at the upper side.

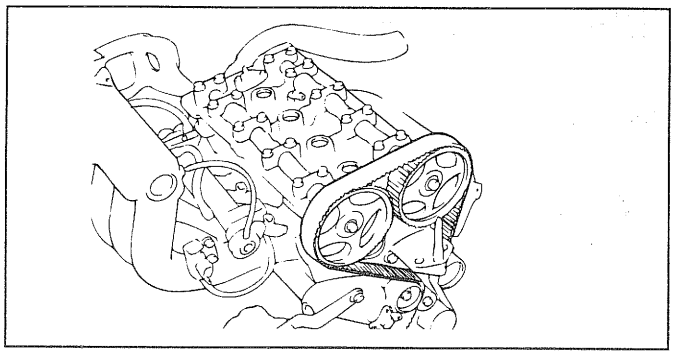


ECA9023A

4. 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.

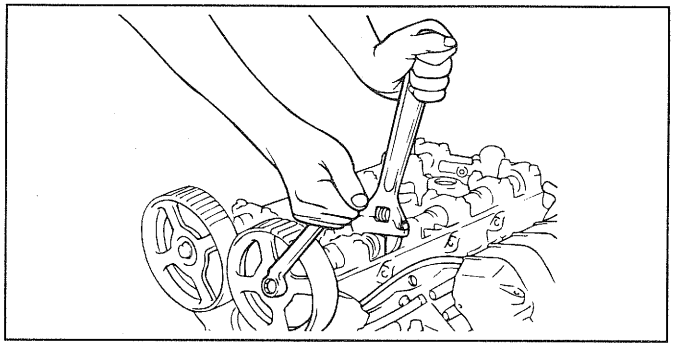


ECA9024A

5. Remove the camshaft sprockets.

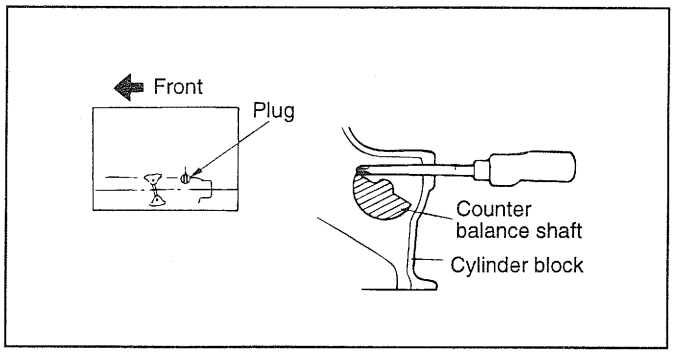
NOTE

Be careful not to damage the cylinder head and camshaft sprocket with a wrench.



ECA9170C

6. When the oil pump sprocket nut is removed, first remove the plug at the left side of the cylinder block and insert a screwdriver to keep the left counter balance shaft in position. Use a screwdriver with a shaft measuring 8 mm (0.3in.) in diameter which can be inserted being more than 60 mm (2.36 in.)
7. Remove the oil pump sprocket retaining nut and the oil pump sprocket.



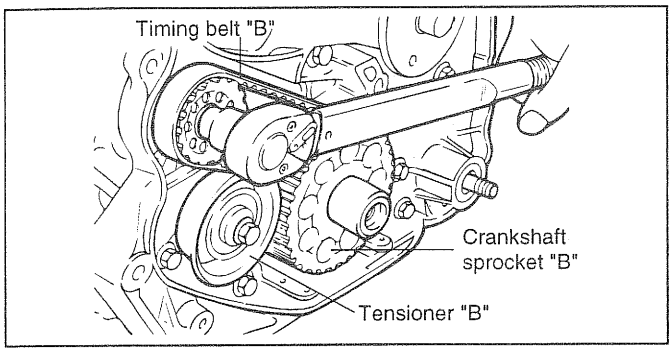
ECA9170D

8. Loosen the right counter balance shaft sprocket mounting bolt until it can be loosened by hand.
9. Next, remove the tensioner "B" and then the timing belt "B."

CAUTION

After the timing belt "B" is removed, do not attempt to loosen bolts while holding the sprocket with pliers, etc.

10. Remove the crankshaft sprocket "B" from the crankshaft.



ECA9025A

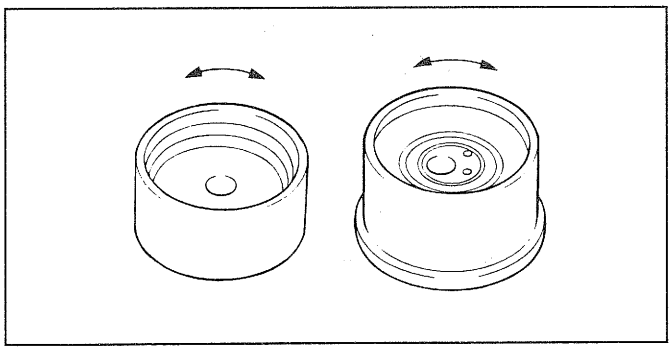
INSPECTION ECHA9700

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 if there is grease leak.

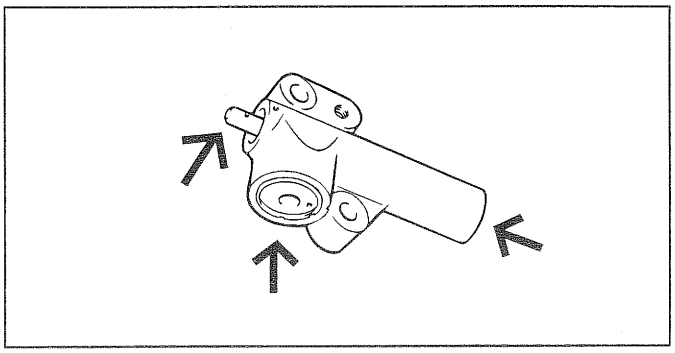


EOY025A

AUTO TENSIONER

1. Check the auto tensioner for leak and replace if necessary.

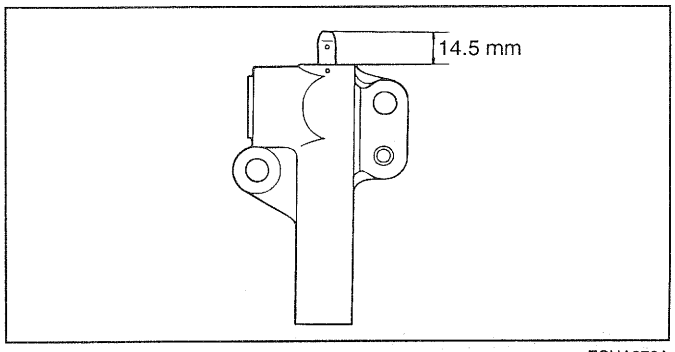
2. Check the rod end for wear or damage and replace if necessary.



ECA9026A

3. Measure the rod protrusion. If it is out of specification, replace the auto tensioner.

Standard value : 14.5 mm (0.39-0.43 in)

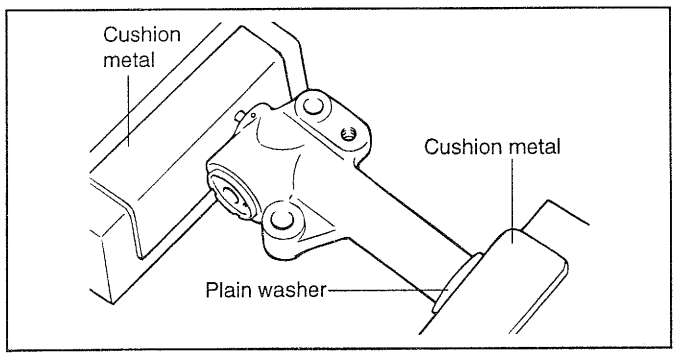


ECHA970A

4. Using a vise soft jaw, push the auto tensioner rod. If the rod can be easily retracted, replace the auto tensioner. You should feel a lot of resistance when pushing the rod in.

NOTE

Clamp the auto tensioner in the vise so that it can be level. Use soft jaws in the vise to avoid damaging the auto tensioner.

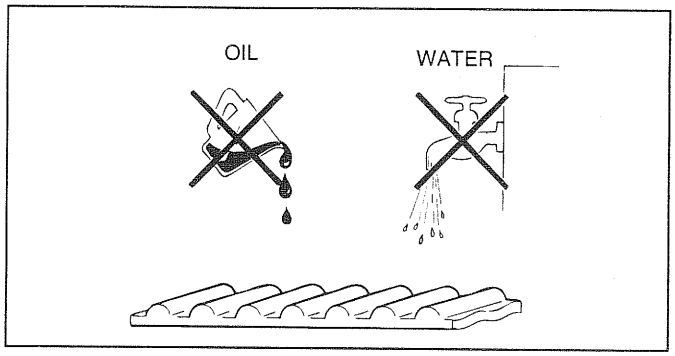


ECA9028A

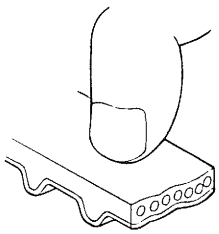
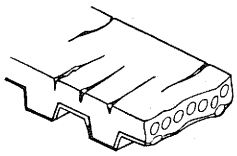
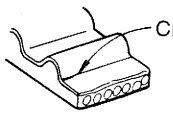
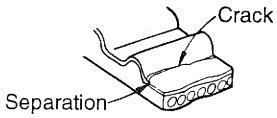
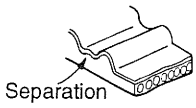
TIMING BELT

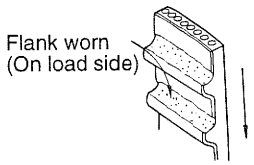
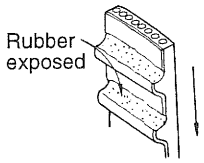
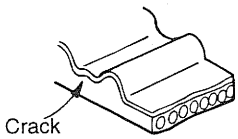
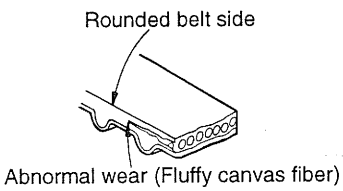
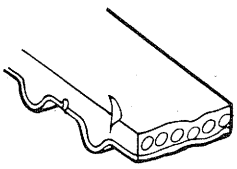
1. Check the belt for oil or dust deposit. Replace if necessary. Small deposit should be wiped away with a dry cloth or paper. Do not clean with solvent.

2. When the engine is overhauled or belt tension is adjusted, check the belt in detail. If any of the following flaws are evident, replace the belt with a new one.



ECA9200A

Description	Flaw conditions
1. Hardened back surface of rubber	Back surface 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 teeth (initial stage)	Tooth flank worn of canvas on load side (Fluffy canvas fibers, rubber changed into white color and unclear canvas texture)

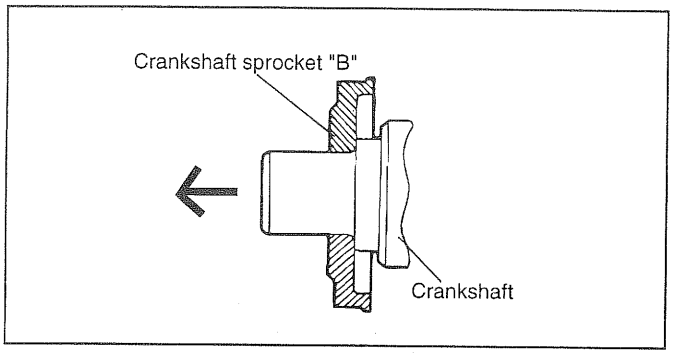
Description	Flaw conditions
	 ECA9200C
5. Badly worn teeth (last stage)	Tooth flank worn and rubber exposed of canvas on load side (tooth width reduced)  ECA9200D
6. Cracked tooth bottom	 ECA9200E
7. Missing tooth	 ECA9200F
8. Badly worn side of belt	 ECA9200G
9. Cracked side of belt	 ECA9200H

INSTALLATION ECHA9800

1. Install the crankshaft sprocket "B" into the crankshaft.

CAUTION

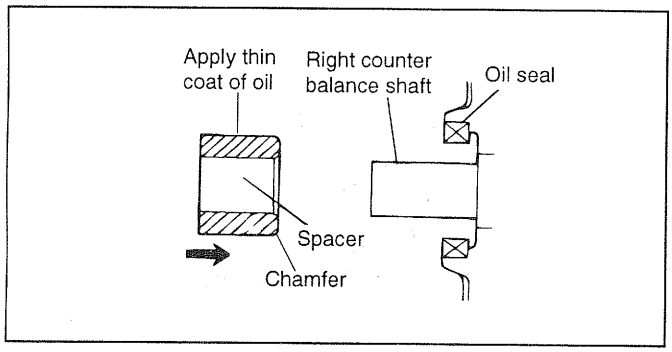
Pay attention to the direction of the flange. If it is installed in the wrong direction, a broken belt could result from it.



ECA9210A

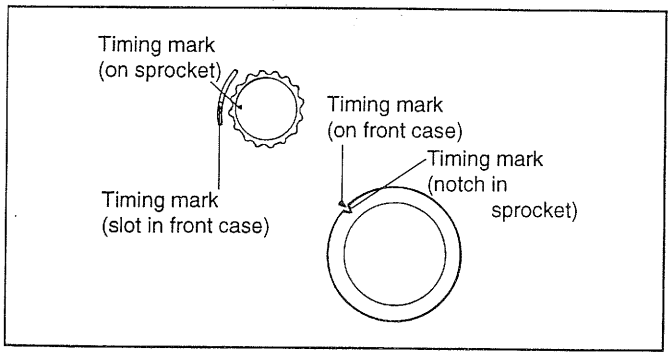
2. Apply engine oil to the outer surface of spacer lightly and then install the spacer to the right counter balance shaft. Be sure to install as the direction shown in illustration.

3. Install the counter balance shaft sprocket onto the right counterbalance shaft and then tighten a flange bolt by hand tightly.



ECA9210B

4. Align the timing mark on each sprocket with the corresponding timing mark on the front case.

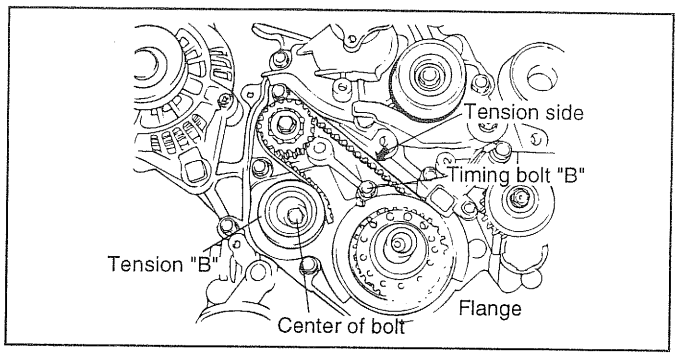


ECA9210C

5. When the timing belt "B" is installed, make certain that tension side has no slack.

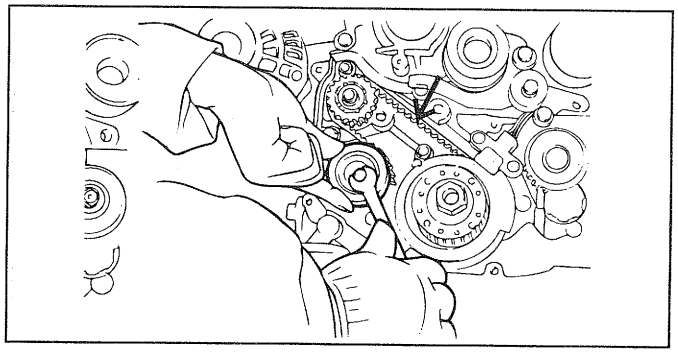
   Install the tensioner "B" in the center of pulley located on the left side of mounting bolt and in the pulley flange directed toward front of engine.

   Align the timing mark on the right counter balance shaft sprocket with the timing mark on the front case.



ECA9084A

6. Lift the tensioner "B" to tighten the timing belt "B" so that its tension side will be pulled tight. In this condition, tighten a bolt to secure tensioner "B". When a bolt is tightened, be careful to prevent shaft from turning together. If the shaft is turned together, the belt will be tightened excessively.



ECA9083A

7. Check to ensure that timing marks are in alignment.

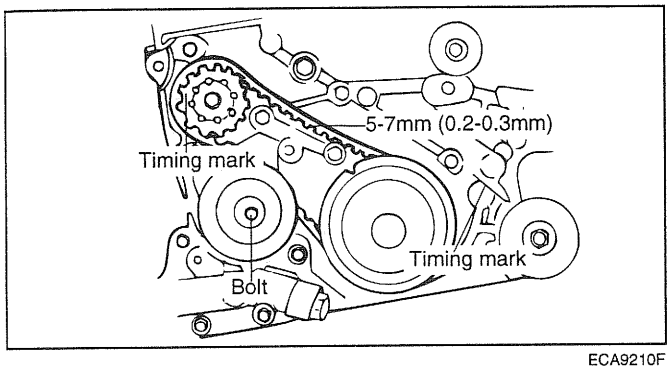
8. Check the tension of the timing belt.

   Method 1 : Check to ensure that when the center of span on the tension side is depressed with an index finger in direction of arrow, deflection of belt is within specification.

Belt deflection : 5-7 mm (0.20-0.28 in)

   Method 2 : Measure the tension of the timing belt by using the frequency instrument.

Span length	Pressure	Torque
139mm (5.47 in.)	0.42 kg/cm^2 (42 kPa)	50-100Nm (500-1000kg.cm, 36-72 lb.ft)

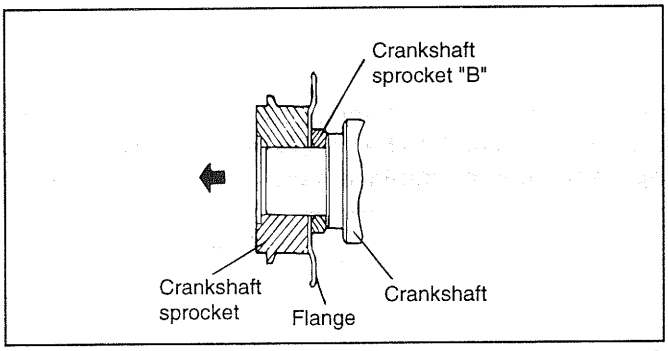


ECA9210F

9. Install the flange and crankshaft sprocket onto the crankshaft. Be sure to install as the direction shown in illustration.

CAUTION

Pay attention to direction of flange. If it is installed in wrong direction, a broken belt could result from it.



ECA9210G

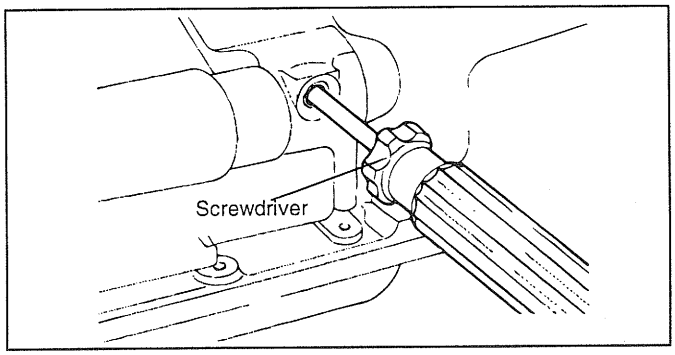
10. Install the special washer and sprocket bolt to the crankshaft and then tighten the sprocket bolt.

Tightening torque

Crankshaft sprocket bolt :

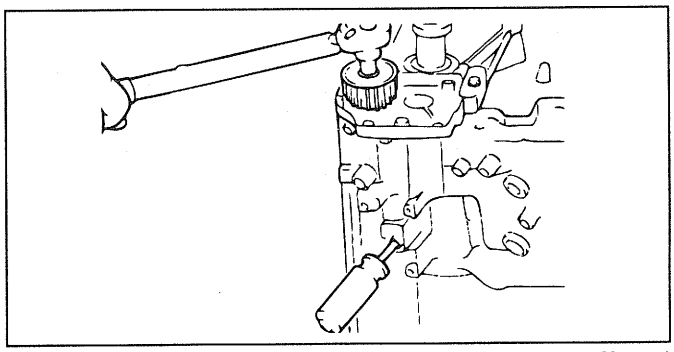
110-130 Nm (1100-1300 kg.cm, 80-94 lb.ft)

11. Insert a screwdriver through the plug hole in left side of cylinder block to keep the shaft in position.



ECA9210H

12. Install the oil pump sprocket and tighten the nut to the specified torque.



ECA9210I

Tightening torque

Oil pump sprocket :

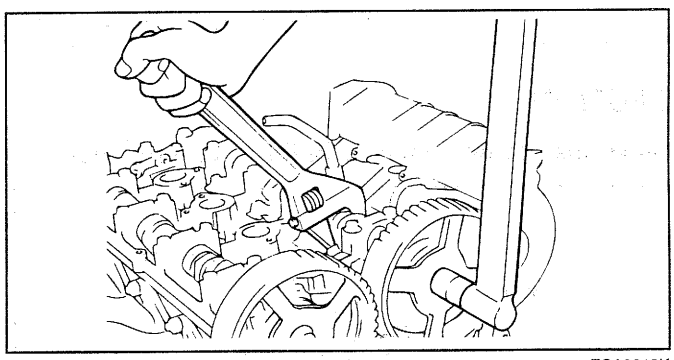
50-60 Nm (500-600 kg.cm, 36-43 lb.ft)

13. Install the camshaft sprocket and tighten the bolt to the specified torque.

Tightening torque

Camshaft sprocket bolt :

80-100 Nm (800-1000 kg.cm, 58-72 lb.ft)

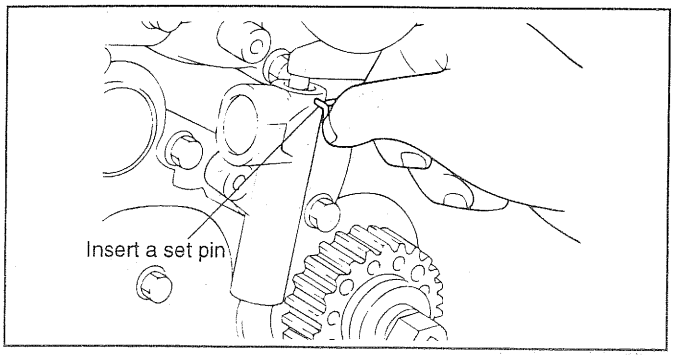


ECA9210K

14. Install the auto tensioner.

CAUTION

Leave the set pin installed in the auto tensioner.

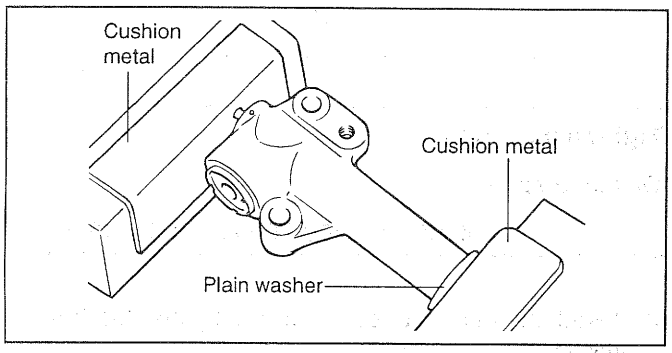


ECHA980A

NOTE

If the auto tensioner rod is in its fully extended position, reset it as follows.

1. **Clamp it in a vise equipped with soft jaws in a level position. Apply a plain washer if there is a plug at the bottom of the auto tensioner.**
2. **Push the rod slowly with the vise until the set hole in the rod is aligned with set hole in the cylinder.**



ECA9028A

15. Install the tensioner pulley onto the tensioner arm.

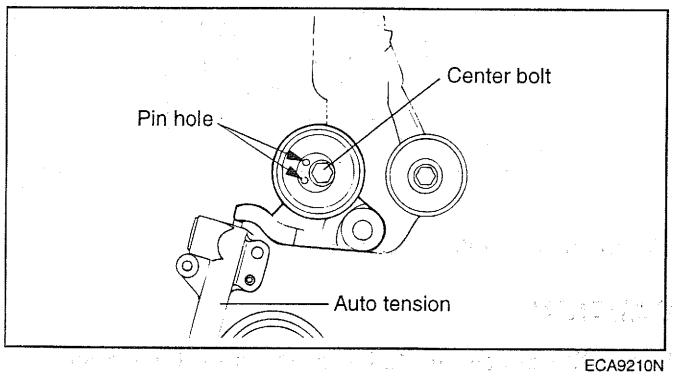
Tightening torque

Tensioner pulley

43-55 N.m (430-550 kg.cm, 31-40 lb.ft)

CAUTION

Leave the set pin installed in the auto tensioner.

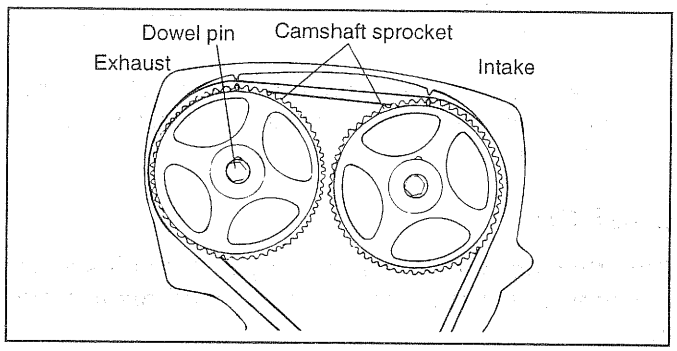


ECA9210N

16. Rotate the camshaft sprockets so that the dowel pin of camshaft sprocket may be at the upper side, set the timing mark of sprocket correctly.

NOTE

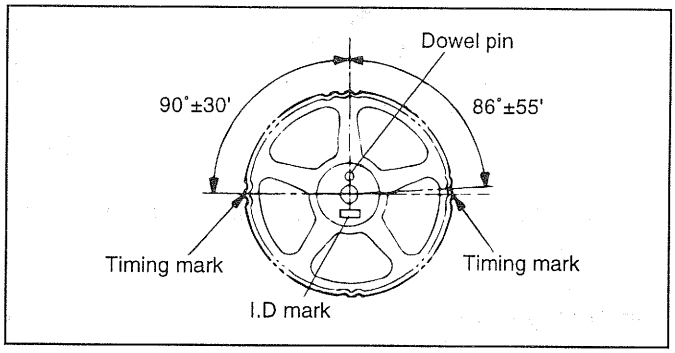
1. **Before installing the timing belt, if the timing mark of camsprocket doesn't coincide with that of rocker cover, do not rotate the cam sprocket more than 2 teeth of sprocket in any direction. Rotating sprocket more than 2 teeth night make valve and piston be touched each other.**
2. **In case of rotating the cam sprocket unavoidably more than 2 teeth, rotate the cam sprocket after rotating 2 teeth in the side of crank sprocket counterclock wise on basis of timing mark.**



ECA9029A

NOTE

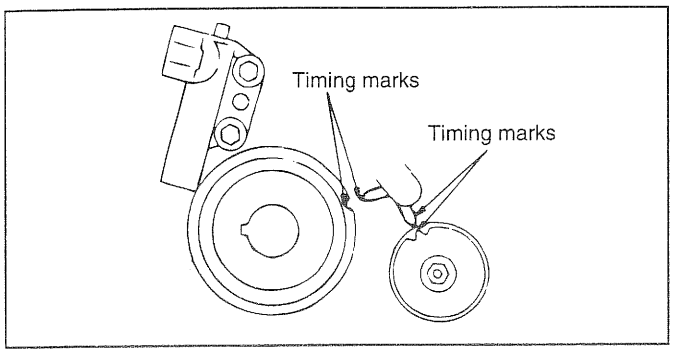
Same thing as exhaust and intake camshaft sprocket is used and install it after checking I.D mark depending on the engine deplacemeat.



ECHA007C

17. Align the crankshaft sprocket timing marks.

18. Align the oil pump sprocket timing marks.



ECHA007D

19. Install the timing belt around the tensioner pulley and crankshaft sprocket. Then secure the timing belt onto the tensioner pulley with your left hand.

20. Pulling the belt with your right hand, install it around the oil pump sprocket.

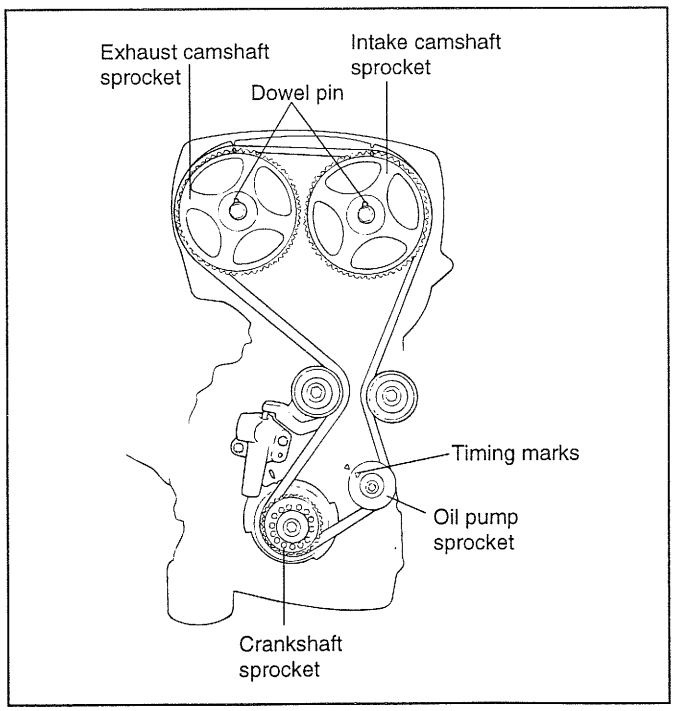
21. Install the belt around the idler pulley.

22. Install the belt around the intake camshaft sprocket.

23. Turn the exhaust camshaft sprocket one tooth clockwise to align its timing mark with the cylinder head top surface [see illustration in step 16]. Then, pulling the belt with both hands, it around the exhaust camshaft sprocket.

24. Gently raise the tensioner pulley so that the belt can't sag and tighten the center bolt temporarily.

25. Check again whether the timing mark of each sprocket is correct or not.

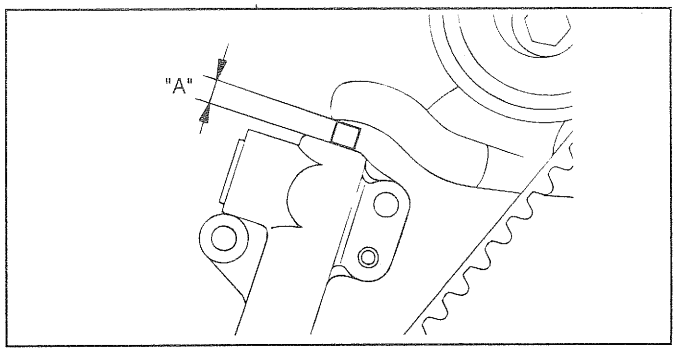


ECA9023A

26. Remove the set pin that is attached to auto tensioner.

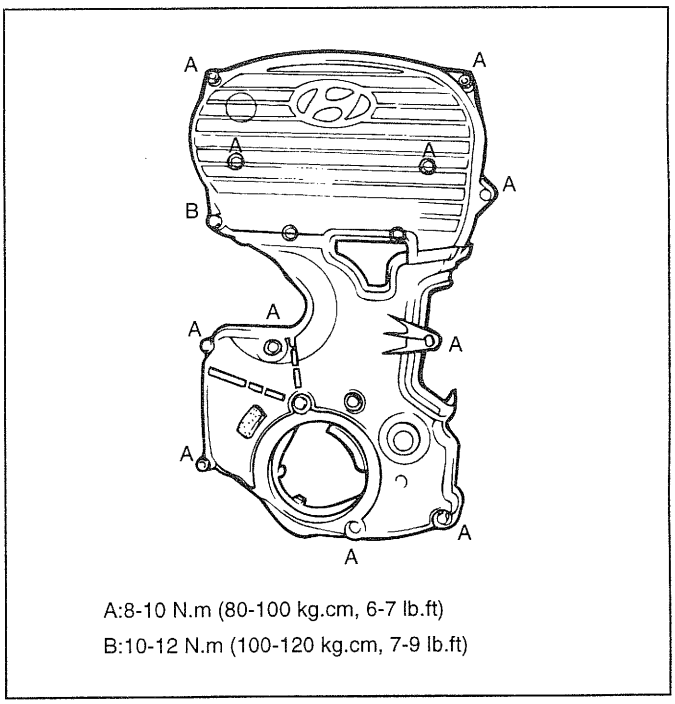
27. Rotate the crankshaft two revolutions turns clockwise and leave it for about 15 minutes. Then, measure the auto tensioner protrusion "A" (Distance between the tensioner arm and auto tensioner body) to ensure that it is within the specification.

Standard value : 6-9 mm (0.24-0.35 in)



ECA9210R

28. Install the timing belt lower cover and the timing belt upper cover.



ECHA980B

Engine Mechanical System

GENERAL

GENERAL EDHA0100

SPECIFICATIONS

Description.	Specification	Limit
General		
Type	V-type, DOHC	
Number of cylinders	6	
Bore	86.7 mm (3.4133 in.)	
Stroke	75 mm (2.9528 in.)	
Total displacement	2,656 cc	
Compression ratio	10 : 1	
Firing order	1-2-3-4-5-6	
Idle R.P.M	725 ± 100	
Ignition timing at idling speed	BTDC 12° ± 8°	
Valve timing		
Intake valve		
Opens (BTDC)	6°	
Closes (ABDC)	46	
Exhaust valve		
Opens (BBDC)	44°	
Closes (ATDC)	8°	
Camshaft		
Drive mechanism	Cogged type belt	
Cam height		
Intake	43.95-44.15 mm (1.7303-1.7382 in.)	43.45mm (1.7106 in.)
Exhaust	43.95-44.15 mm (1.7303-1.7382 in.)	43.45 mm (1.7106 in.)
Journal diameter	25.964-25.980 mm (1.0222-1.0228 in.)	25.914 mm (1.0202 in.)
Bearing oil clearance	0.02-0.061 mm (0.0007-0.0024 in.)	0.1 (0.0039 in.)
End play	0.1-0.15 mm (0.0039-0.0059 in.)	
Cylinder head		
Flatness of cylinder head surface	Max. 0.03 mm (0.0012 in.)	0.05 mm (0.0020 in.)
Flatness of manifold mounting surface		
Intake	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)
Exhaust	Max. 0.15 mm (0.0059 in.)	0.15 mm (0.0059 in.)
Valve guide hole diameter		
0.05 (0.002) O.S.	11.05-11.068 mm (0.435-0.436 in.)	

Description.	Specification	Limit
0.25 (0.010) O.S.	11.25-11.268 mm (0.443-0.444 in.)	
0.50 (0.020) O.S.	11.50-11.518 mm (0.453-0.453 in.)	
Intake valve seat ring hole diameter		
0.3 (0.012) O.S.	33.300-33.325 mm (1.311-1.312 in.)	
Exhaust valve seat ring hole diameter		
0.3 (0.012) O.S.	28.600-28.625 mm (1.126-1.127 in.)	
Valve		
Overall length		
Intake	96.1 mm (3.783 in.)	
Exhaust	97.15 mm (3.825 in.)	
Stem diameter		
Intake	5.965-5.98 mm (0.235-0.2354 in.)	
Exhaust	5.95-5.965 mm (0.234-0.235 in.)	
Face angle	45°-45.5°	
Margin		
Intake	1.0 mm (0.0394 in.)	0.5 mm (0.0197 in.)
Exhaust	1.3 mm (0.0512 in.)	0.8 mm (0.0315 in.)
Clearance (stem- to- guide)		
Intake	0.02-0.05 mm (0.0008-0.0020 in.)	0.10 mm (0.0039 in.)
Exhaust	0.035-0.065 mm (0.0014-0.0026 in.)	0.15 mm (0.0059 in.)
Valve spring		
Free height	42.5 mm (1.6732 in.)	41.5 mm (1.6339 in.)
Load	21.9 kg/ 35 mm (48.4 lb/1.3780 in.)	21.9 kg/ 34 mm (48.4 lb/ 1.3386 in.)
Out of squareness	Max 1.5°	Max 3°
Piston		
Diameter (Standard)	86.68-86.71mm (3.413-3.414 in.)	
Clearance (Piston -to - cylinder)	0.01-0.03 mm (0.0004-0.0012 in.)	
Ring groove width		
No.1	1.230-1.250 mm (0.0484-0.0492 in.)	
No.2	1.220-1.240 mm (0.0480-0.0488 in.)	
Oil	2.515-2.535 mm (0.0990-0.0998 in.)	
Piston for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.)	
Piston ring		
Number of rings per piston	3	
Compression ring	2	

Description.	Specification	Limit
Oil ring	1	
Compression ring type		
No.1	Inside bevel type, steel	
No.2	Taper type	
Oil ring type	3-piece type	
Ring end gap		
No.1	0.20-0.35 mm (0.0079-0.0138 in.)	0.8 mm (0.031 in.)
No.2	0.37-0.52 mm (0.0146-0.0205 in.)	0.8 mm (0.031 in.)
Oil ring side rail	0.2-0.7 mm (0.0079-0.0276 in.)	1.0 mm (0.039 in.)
Ring side clearance		
No.1	0.04-0.08 mm (0.0016-0.0031 in.)	0.1 mm (0.004 in.)
No.2	0.03-0.07 mm (0.0012-0.0028 in.)	0.1 mm (0.004 in.)
Rings for service	0.25 mm (0.010 in.), 0.50 mm (0.020 in.)	
Connecting rod		
Piston pin press-in load	2,450-12,255 N (250-1,250 kg, 551-2,755 lb)	
Side clearance (Big end)	0.10-0.25 mm (0.0039-0.0098 in.)	0.4 mm (0.016 in.)
Bend	0.05 mm or less/100 mm (0.0020 in. or less/3.937 in.)	
Bearing oil clearance	0.018-0.036 mm(0.0007-0.0014 in.)	0.1 mm (0.004 in.)
Crankshaft		
Journal O.D.	61.982-62.000 mm (2.4402-2.4409 in.)	
Pin O.D.	47.982-48.000 mm (1.8891-1.8898 in.)	
Out-of-roundn of journal and pin	Max. 0.003 mm (0.00012 in.)	
Taper of journal and pin	Max. 0.005 mm (0.00020 in.)	
End play	0.070-0.250 mm (0.0028-0.0098 in.)	0.4 mm (0.016 in.)
Main bearing oil clearance	0.004-0.022 mm (0.0002-0.0009 in.)	0.1 mm (0.004 in.)
Cylinder block		
Cylinder bore	86.7 mm (3.4134 in.)	
Flatness of gasket surface	Max. 0.03 mm (0.0012 in.)	0.05 mm (0.002 in.)
Out-of-round of cylinder bore	Max. 0.02 mm (0.0008 in.)	
Oil pump		
Side clearance		
Body clearance	0.100-0.181 mm (0.0039-0.0071 in.)	
Side clearance	0.040-0.095 mm (0.0016-0.0037 in.)	
Relief spring		

Description.	Specification	Limit
Free length	43.8 mm (1.724 in.)	
Load	4.6 kg/39.3 mm (10.lb/1.547 in.)	
Oil filter		
Type	Cartridge, full flow	
Engine oil pressure	50 kPa (7.3 psi) or more	
	[Conditions: Oil temperature is 75 to 90°C (167 to 194°F)]	
Cooling method	Engine coolant cooling, forced circulation with electric fan	
Cooling system quantity	7.0 lit (7.4 U.S.qts., 6.1 Imp.qts.) [For V6]	
Thermostat		
Type	Wax pellet type with jiggle valve	
Normal opening temperature	82±2.0°C (179.6±35.6°F)	
Opening temperature range	80°C-84°C (176-183.2°F)	
Wide open temperature	95°C (203°F)	
Radiator cap		
Main valve opening pressure	107.9±14.7 kPa (1.1±0.15 kg/cm^2, 15.64±2.13 psi)	
Main valve closing pressure	83.4 kPa (0.85 kg/ cm^2, 12.1 psi)	
Vacuum valve opening pressure	-6.86 kPa (-0.07 kg/ cm^2, -1.00 psi)	
Air cleaner		
Type	Dry type	
Element	Paper type	
Exhaust pipe		
Muffler	Expansion resonance type	
Suspension system	Rubber hangers	

SERVICE STANDARD

Standard value	
Coolant concentration	
Tropical area	40%
Other area	50%

LUBRICANT

Engine coolant	Ethylence glycol base for aluminum radiator

SEALANT

Engine coolant temperature sensor	LOCTITE 262 or equivalent, Three bond No. 1324 or equivalent.
Oil pressure switch	3M ATD No. 8660 or Three bond No. 1141E
PCV valve	LOCTITE 242 or equivalent

TIGHTENING TORQUE

EDHA0200

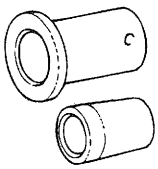
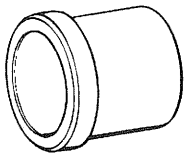
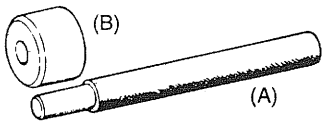
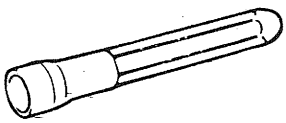
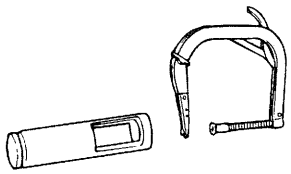
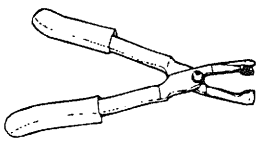
Item	Nm	kg.cm	Lb.ft
Camshaft sprocket bolt	90-110	900-1, 100	65-80
Cylinder head cover bolt	5-6	50-60	3.6-4.3
Main bearing cap bolt			
M10	14-16	140-160	10-12
M7	10-12	100-120	7-9
Connecting rod bolt	16-20+(90°-94°)	160-200+(90°-94°)	12-15+(90°-94°)
Cylinder head bolt (Cold engine)	25+(58°-62°)+(43°-47°)	250+(58°-62°)+(43°-47°)	18+(58°-62°)+(43°-47°)
Oil pan drain plug	35-45	350-450	25-33
Lower oil pan bolt	10-12	100-120	7-9
Upper oil pan bolt			
[10x38 mm (0.937x1.4961 in.)]	30-42	300-420	22-30
[8x22 mm (0.3150x0.866a in.)]	19-28	190-280	14-20
[171.5 mm (6.7519 in.)]	5-7	50-70	4-5
[152.5 mm (6.7520 in.)]	5-7	50-70	4-5
Oil screen bolt	15-22	150-220	11-16
Oil pump case bolt	12-15	120-150	9-11
Oil relief valve plug	40-50	400-500	29-36
Oil pressure switch	15-22	150-220	11-16
Oil pump cover screw	8-12	80-120	6-9
Oil filter	12-16	120-160	9-12
Fly wheel bolt	73-77	730-770	53-56
Drive plate and adaptor plate bolt	73-77	730-770	53-56
Air cleaner body installation bolt	8-12	80-120	6-9
Surge tank stay	15-20	150-200	11-14
Air intake surge tank to intake manifold (bolt)	15-20	150-200	11-14
Air intake surge tank to intake manifold (nut)	15-20	150-200	11-14
Intake manifold to cylinder head	19-21	190-210	14-15
Heat protector to exhaust manifold	12-15	120-150	9-11
Exhaust manifold to cylinder head(Self-locking nut)	25-30	250-300	18-22

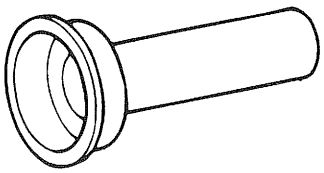
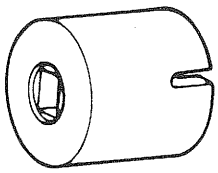
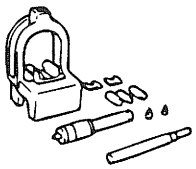
Oil level gauge guide to engine	12-15	120-150	9-11
Water outlet fitting bolt	17-20	170-200	12-14
Power steering oil pump bracket to cylinder head	17-26	170-260	12-19
Power steering oil pump to bracket	17-26	170-260	12-19
Crank position sensor wheel screw	5-6	50-60	3.6-4.3
Engine mounting insulator bolt	40-55	400-550	29-40
Engine mounting bracket nut.	60-80	600-800	43-58
Engine mounting bracket bolt	60-80	600-800	43-58
Engine support bracket stud	30-40	300-400	22-29
Front roll stopper bracket to sub cross member bolt	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 bolt	40-55	400-550	29-40
Rear roll stopper insulator bolt and nut	50-65	600-650	36-47
Transaxle mounting bracket bolt	40-55	400-550	29-40
Transaxle mounting insulator bolt	90-110	900-1,100	65-80
Fuel hose clamp to rear cylinder head assembly	12-15	120-150	9-11
Transaxle mounting plate	10-12	100-120	7-9
Rear plate	10-12	100-120	7-9
Oil seal case	10-12	100-120	7-9
Crankshaft pulley bolt	180-190	1,800-1,900	130-138
Timing belt cover bolt	10-12	100-120	7-9
Engine hanger bracket to engine	20-27	200-270	14-20
Alternator mounting bracket to engine	20-30	200-300	14-22
Alternator mounting nut (Engine front case side)	20-30	200-300	14-22
Alternator mounting bolt (Alternator mounting bracket side)	20-30	200-300	14-22

Starter to transmission (Nut)	20-30	200-300	14-22
Starter to transmission (Bolt)	27-34	270-340	20-25
Drive belt pulley bolt	35-55	350-550	25-40
Drive belt tensioner bolt	20-27	200-270	14-20
Engine coolant pump to cylinder block bolt (Head mark "7" bolt)	15-22	150-220	11-16
Engine coolant temperature sensor	20-40	200-400	14-29
Engine coolant inlet fitting attaching bolt	17-20	170-200	12-14
Throttle body to surge tank bolt	15-20	150-200	11-14
Oxygen sensor to exhaust manifold	40-50	400-500	29-36
Front exhaust pipe to exhaust manifold nut	30-40	300-400	22-29
Front exhaust pipe to catalytic converter bolt	40-60	400-600	29-43
Catalytic converter to center exhaust pipe nut	30-40	300-400	22-29
Center exhaust pipe to main muffler nut	30-40	300-400	22-29
Main muffler hanger support bracket bolt	10-15	100-150	7-11
Delivery pipe installation bolt	10-15	100-150	7-11
Timing belt tensioner pulley bolt	43-55	430-550	31-40
Timing belt idler pulley bolt	50-60	500-600	36-43
Timing belt tensioner arm Fixed bolt	35-55	350-550	25-40
Auto tensioner fixed bolt	20-27	200-270	14-20
Accelerator cable bracket	4-6	40-60	3-4
Spark plug	20-30	200-300	14-22

SPECIAL TOOLS

EDHA0300

Tool (Number and name)	Illustration	Use
Crankshaft front oil seal installer (09214-33000)	 HFR20A01	Installation of the crankshaft front oil seal
Camshaft oil seal installer (09221-21000)	 HFR20A02	Installation of the camshaft oil seal
Valve guide installer (09222-22000 (B)) (09221-29000 (A))	 KFW3003A	Removal and installation of the valve guide
Valve stem oil seal installer (09222-22001)	 KFW3002A	Installation of the valve stem oil seal
Valve spring compressor (09222-28000) (09222-28100)	 J20-008F	Removal and installation of the intake or exhaust valve
Valve stem oil seal remover (09222-29000)	 KFW3009A	Removal of valve stem oil seal

Tool (Number and name)	Illustration	Use
Cranksha ft rear oil seal installer (09231-33000)	 KFW3004A	Installation of the crankshaft rear oil seal
Crankshaft wrench (09231-33100)	 KFW3008A	Used if the crankshaft needs to be rotated to attach the timing belt, etc.
Piston pin remover and installer (09234-33001)	 HFR20A10	Removal and installation of the piston pin

TROUBLESHOOTING

EDHA0400

Symptom	Probable cause	Remedy
Knocking of crankshaft and bearing	Worn main bearing	Replace
	Seized bearing	Replace
	Bent crankshaft	Replace
	Excessive crankshaft end play	Replace thrust bearing
Knocking of piston and connecting rod	Worn bearing	Replace
	Seized bearing	Replace
	Worn piston pin	Replace piston and pin or connecting rod
	Worn piston in cylinder	Recondition cylinder
	Broken piston ring	Repair or replace
	Improper connecting rod alignment	Re-align
Noisy valves	Faulty auto-lash adjuster	Replace
	Thin or diluted engine oil (low oil pressure)	Change
	Worn or damaged valve stem or valve guide	Replace
Excessively worn cylinder and piston	Shortage of engine oil	Add or replace
	Dirty engine oil	Replace
	Poor quality of engine oil	Use proper oil
	Improperly assembled piston and connecting rod	Repair or replace
	Improper piston ring end clearance	Replace
	Dirty air cleaner	Clean air cleaner assembly and replace the air filter
Connecting rod and main beaing noise	Insufficient oil supply	Check engine oil level
	Thin or diluted engine oil	Change and find out cause
	Excessive bearing clearance	Replace
Damaged crankshaft bearing	Shortage of engine oil	Add or replace
	Low oil pressure	Adjust or repair
	Poor quality of engine oil	Use proper engine oil
	Worn or out-of -round of crankshaft journal	Repair or replace
	Restricted oil passage in crankshaft	Clean
	Worn bearing	Replace bearing and check engine oil and lubrication system
	Bearing improperly installed	Repair or replace
	Non-concentric crankshaft or bearing	Replace
Timing belt noise	Incorrect belt tension	Adjust belt tension

Symptom	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 valve 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
	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 rolling and 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 engine mount insulator	Replace
	Broken engine roll stopper insulator	Replace
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 radiator	Foreign material in coolant	Replace

Symptom	Probable cause	Remedy
Abnormally high coolant temperature	Faulty thermostat	Replace parts
	Faulty radiator cap	Replace
	Restriction of flow in cooling system	Clear restriction or replace parts
	Loose or missing drive belt	Adjust or replace
	Faulty engine coolant pump	Replace
	Faulty temperature sender or 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 gauge or wiring	Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection Blocked or collapsed hose and pipe	Replace Repair or replace
Inoperative electrical cooling fan	Damaged	Replace or repair
Exhaust gas leakage	Loose connections Broken pipe or muffler	Re-tighten Repair or replace
Abnormal noise	Detached baffle plate in muffler Broken rubber hanger Pipe or muffler contacting vehicle body Broken pipe or muffler	Replace Replace Correct Repair or replace

CHECKING ENGINE OIL EDHA0500

1. Position a vehicle on a level surface.
2. Turn off the engine.

NOTE

In the case of a vehicle that has not been used for a prolonged period, run the engine for several minutes.

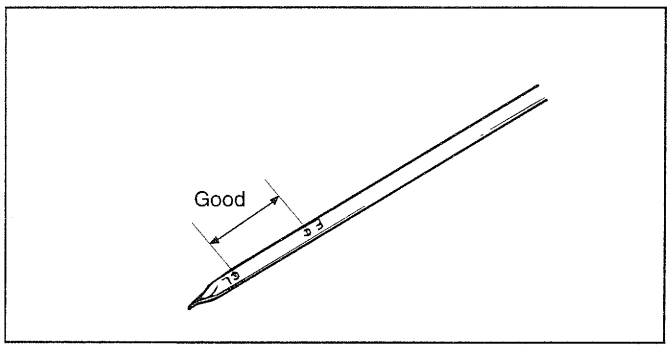
Turn off the engine and wait for 5 minutes at least, then check the oil level.

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 same type of engine oil as the used one.

4. Check that the oil is not dirty or mixed with coolant or gasoline, and that it has the proper viscosity.

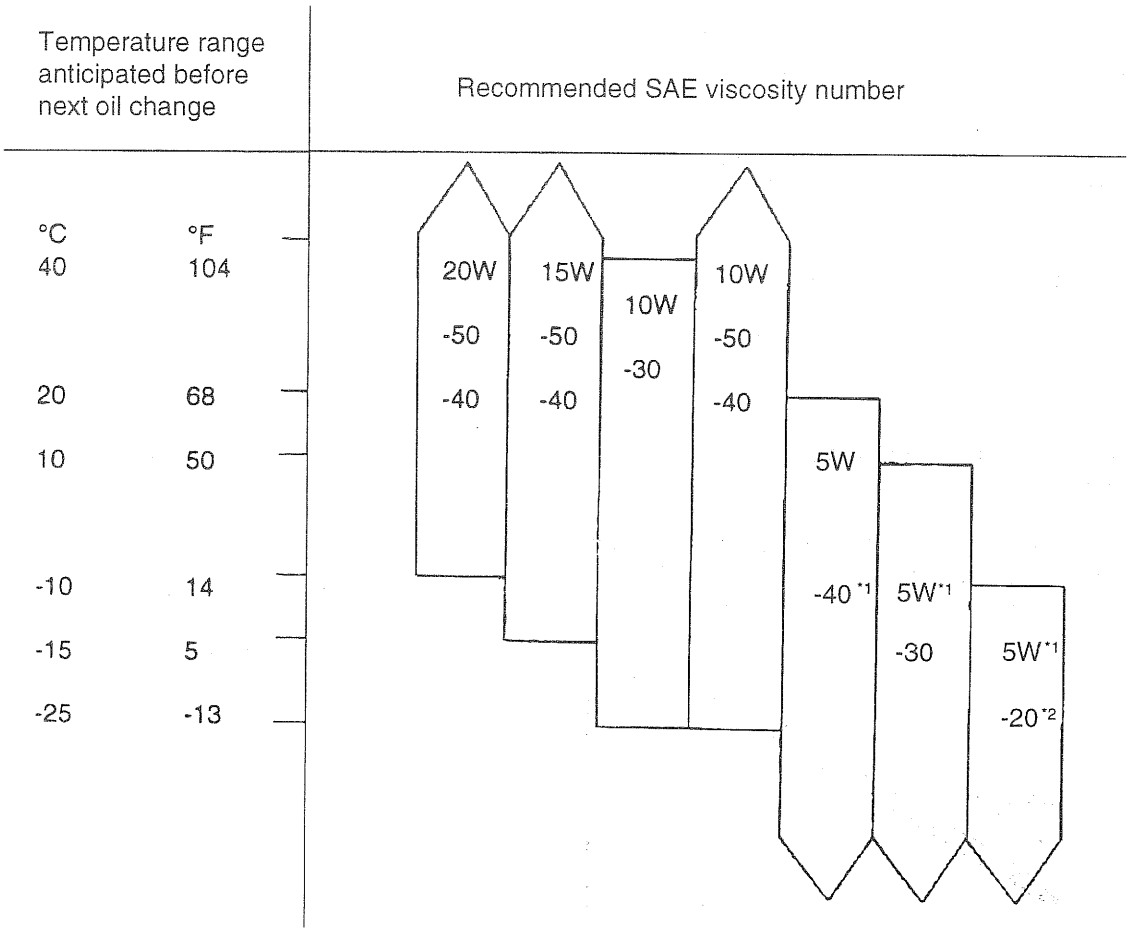


EDA9000A

SELECTION OF ENGINE OIL EDHA0600

Recommended API classification: SD OR ABOVE SE OR ABOVE [For EC.]

Recommended SAE viscosity grades:



***1 Restricted by driving and climate condition.**
***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 a SAE grade number and an API service classification on the container should not be used.

CHANGE ENGINE OIL EDHA0700

1. Run the engine until it reaches normal operating temperature.
2. Stop the engine.
3. Remove the oil filler cap and oil filter and then 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)

NOTE

Whenever tightening the oil drain plug, use a new drain plug gasket.

5. Fill the new engine oil through the oil filler cap.

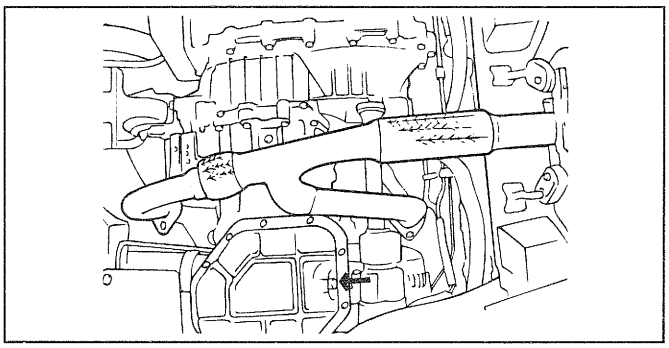
Drain and Refill

Oil quantity : 4.5 lit (4.74 U.S. qts., 3.95 Imp. qts.)

NOTE

Do not over fill. This will cause oil aeration and loss of oil pressure.

6. Install the oil filler cap.
7. Start and run the engine.
8. Stop the engine and then check the oil level. Add oil if necessary.



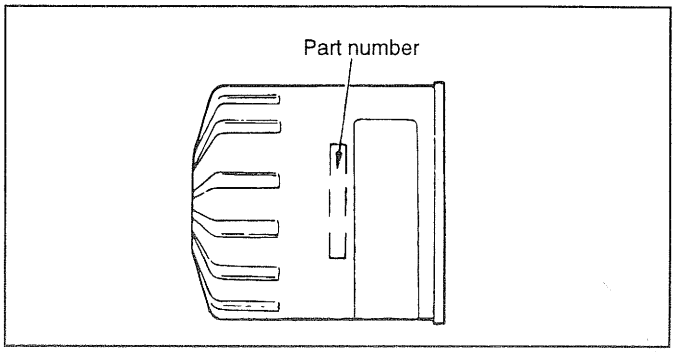
ECHA015B

REPLACEMENT-OIL FILTER EDHA0800

FILTER SELECTION

All Hyundai Motor Company engines are equipped with a high quality, throw-away oil filter. This filter is recommended as a replacement filter on all vehicles. The quality of replacement filters is various considerably.

High quality of replacement 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 a new filter.



ECA9970A

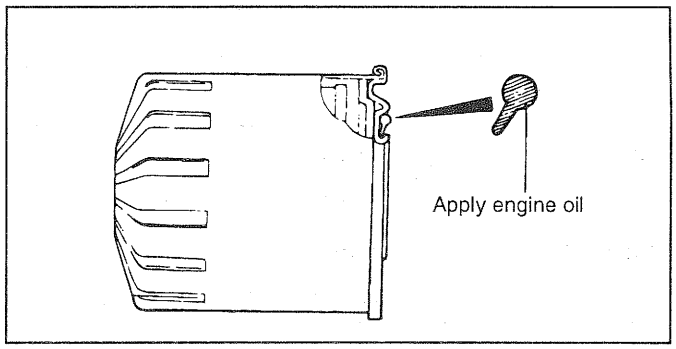
PROCEDURE FOR REPLACING OIL FILTER

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 of 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 engine oil leaks.
5. After stopping the engine, check the oil level and add oil as necessary.



ECA9970B

CHECKING COOLANT LEAK CHECK EDHA0900

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/cm^2) pressure. Hold for two minutes in that condition, while checking for leakage from the radiator, hoses or connections.

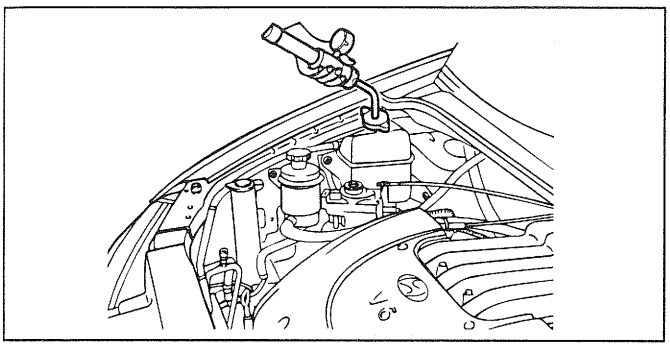
CAUTION

1. **Radiator coolant may be extremely hot. Do not open the system while hot, or scalding**

engine coolant could gush out causing personal injury. Allow vehicle to cool before servicing this system.

2. **Be sure to clean away any moisture completely from the places checked.**
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.



ECHA010A

RADIATOR CAP PRESSURE TEST EDHA1000

1. Use an adapter to attach the cap to the tester.
2. Increase the pressure until the indicator of the gauge stops moving.

Main valve opening pressure :

107.9±14.7 kPa (1.1±0.15 kg/cm^2 15.64±2.13 psi)

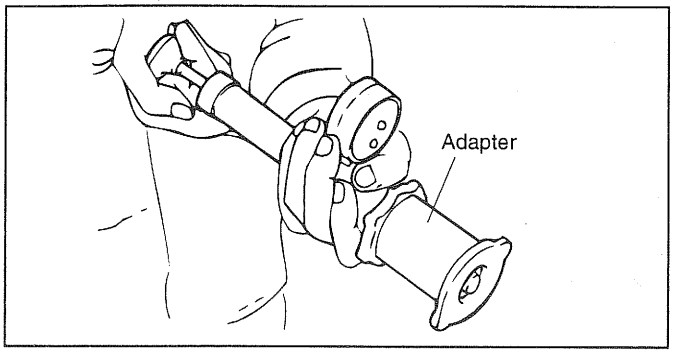
Main valve closing pressure :

83.4 kPa (0.85 kg/cm^2, 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

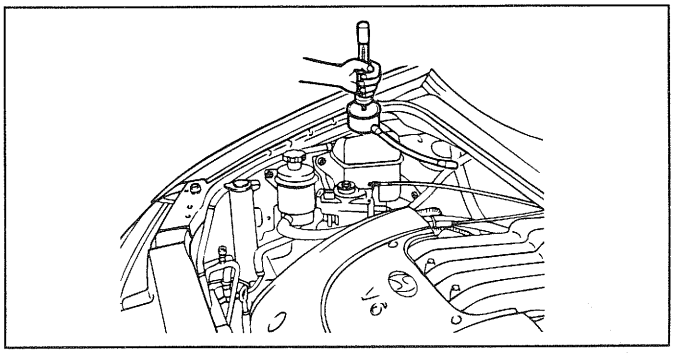
Be sure that the cap is clean before testing, since rust or other foreign material on the cap seal will cause an incorrect indication.



ECA9090A

SPECIFIC GRAVITY TEST EDHA1100

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. Use the following table for reference.



ECHA010C

RELATION BETWEEN 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%, the anti-corrosion property 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 use together with another brand'sproduct.**

RECOMMENDED COOLANT

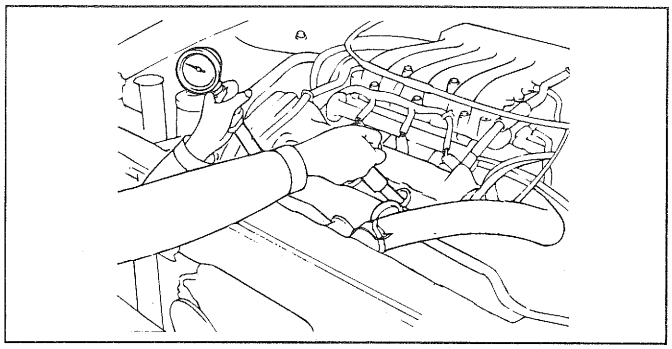
Antifreeze	Mixture ratio of antifreeze in coolant
ETHYLENE GLYCOL BASE FOR ALUMINUM	50% [Except tropical areas]
	40% [Tropical areas]

CHECKING COMPRESSION PRESSURE EDHA1200

1. Before checking compression pressure, check the engine oil level. Also check that the starter motor and battery are all in normal operating conditions.
2. Start the engine and wait until engine coolant temperature reaches 80~95°C (176~205°F).
3. Stop the engine and disconnect the spark plug cables.
4. Remove the spark plugs.

5. Crank the engine to remove any foreign material in the cylinders.
6. Insert the compression gauge into the spark plug hole.
7. Depress the accelerator pedal to open the throttle fully.
8. Crank the engine and read the gauge.

Standard value :	1,200kpa(12.2 kg/cm^2 , 170psi)
Limit :	1,050kpa(10.7kg/cm^2 , 149psi)



EDHA015A

9. Repeat steps 6 to 8 for all cylinders, making sure that the pressure difference for each of the cylinders is within the specified limit.

Limit :	Max. 100kpa (1.0 kg/cm^2 , 14psi) between cylinders

10. If a cylinder's compression or pressure differential is below specifications, add a small amount of oil through the spark plug hole, and repeat steps from 6 to 9.
    1) If the addition of oil causes the compression to rise, it is possible that Between the piston ring and cylinder wall may be worn out
    2) If the 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)

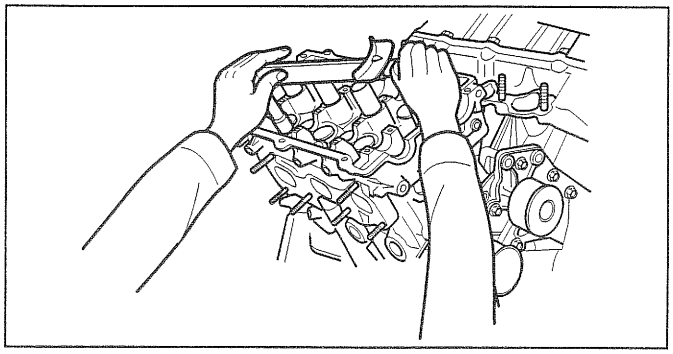
TIGHTENING CYLINDER HEAD BOLTS EDHA1300

1. First loosen slightly and then tighten to the specified torque.

Tightening torque

Cylinder head bolts cold [Engine temperature approximately 20°C (68°F)] ;

25 Nm (250 kg.cm, 18 lb ft)+(58°-62°)+(43°-47°))

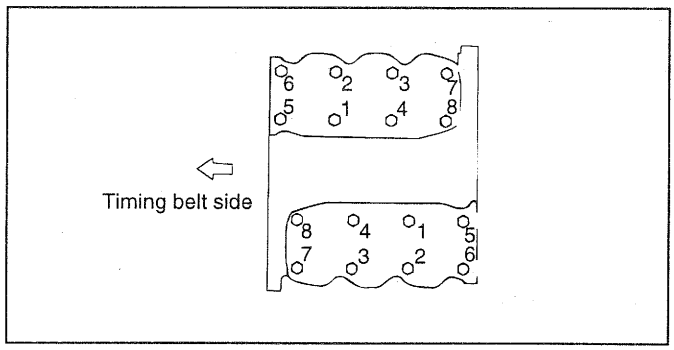


KFW3010A

2. Be sure to follow the specific torque sequence as shown in the illustration.

NOTE

Run the engine to normal operating temperature and make it cool, and then re-torque the bolts to specifications.



EDA9060B

ADJUSTING VALVE CLEARANCE EDHA1400

As the intake and exhaust valves are equipped with hydraulic lash adjustment mechanism, there is no need to adjust the valve clearance. The proper function of the hydraulic lash mechanism may be determined by checking for tappet noise. When there is a tappet noise or any unusual noise, check the hydraulic lash by removing and bleeding or replacing it.

ADJUSTING DRIVE BELT AND TENSIONER EDHA1500

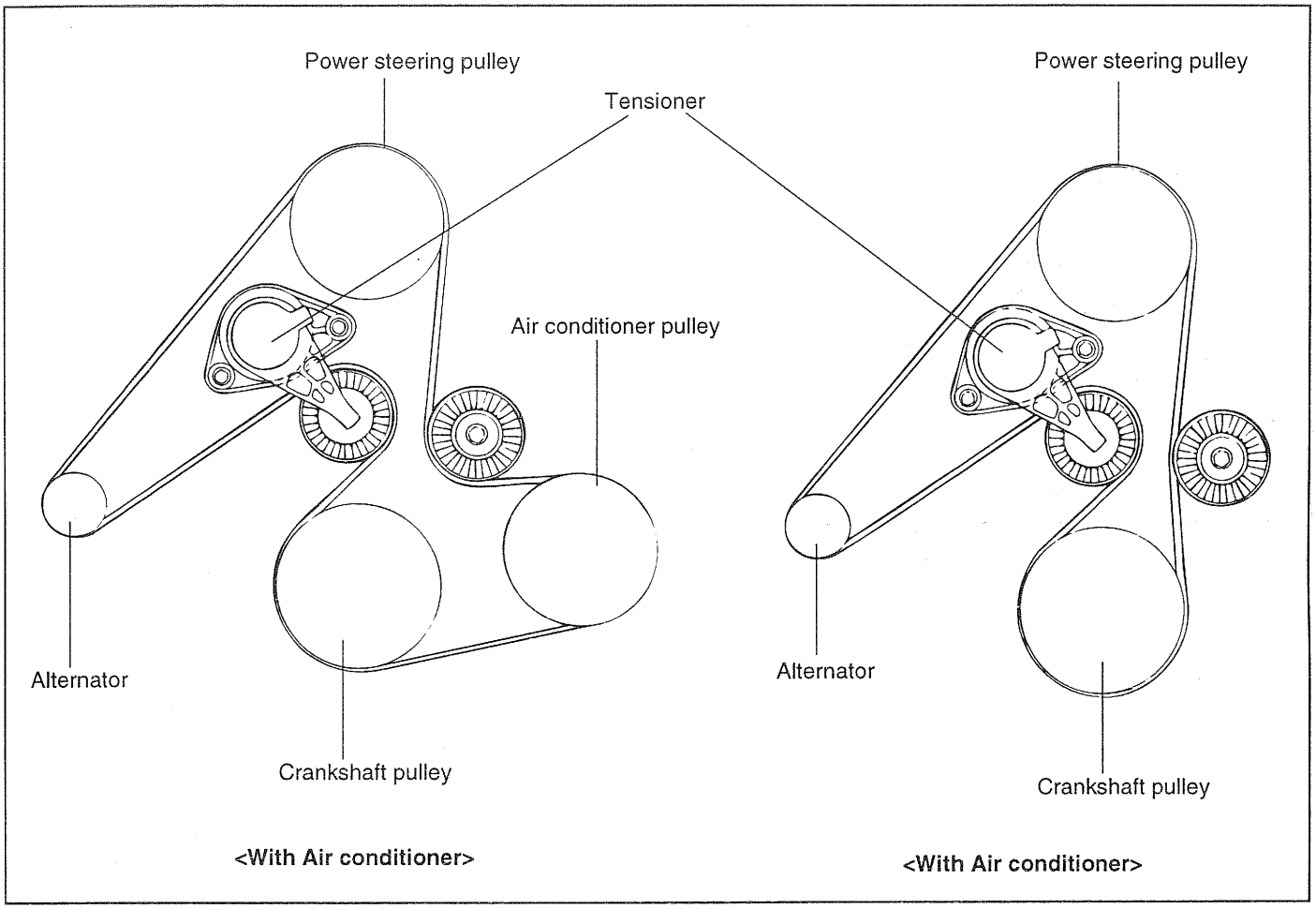
1. Hang the belt on the pulley of the tensioner and install the tensioner.

   (When the tensioner is installed before inserting the belt between the timing belt cover and tensioner pulley.)

Tightening torque

Tensioner assembly bolt ;

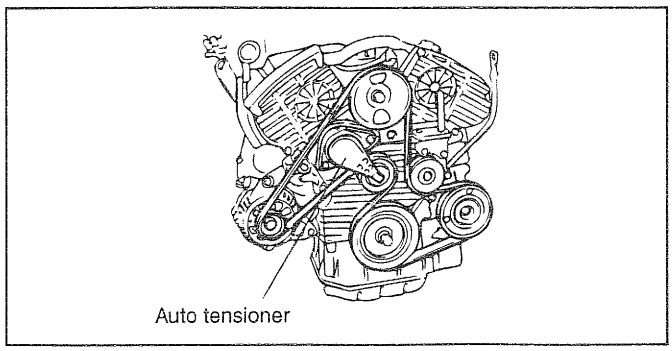
20-27 Nm (200-270 kg.cm, 14-20 lb.ft)



EDA9090A

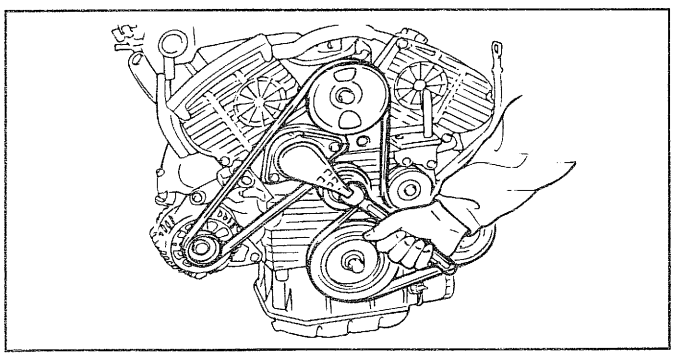
2. Install the belt in the fllowing order.

   [Alternator ⇒ Power steering ⇒ Crankshaft pulley ⇒ Air conditioner pulley.]



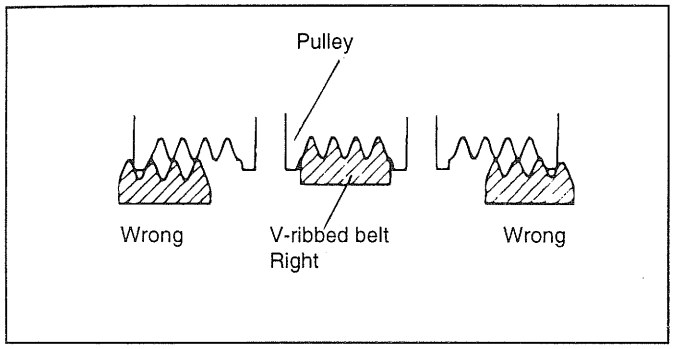
EDA9031A

3. Rotate the tensioner arm clockwise (about 14°) with a spaner (16 mm) and hang the belt to the idler pulley.



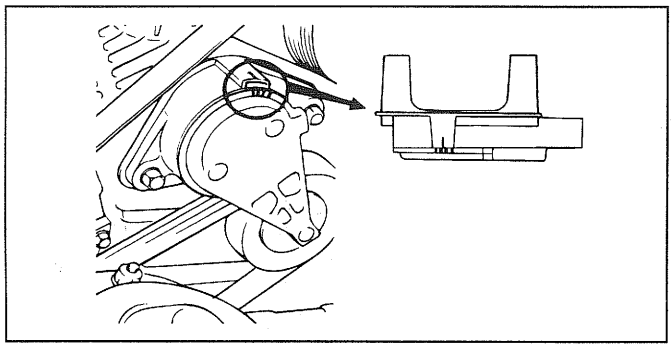
EDA9031B

4. When installing the belt on the hole of the pulley, make sure there is no tooth gap of belt.



EOYR0020

5. The tensioner mark should be between the "MIN" and "MAX" position. If not, replace the belt.

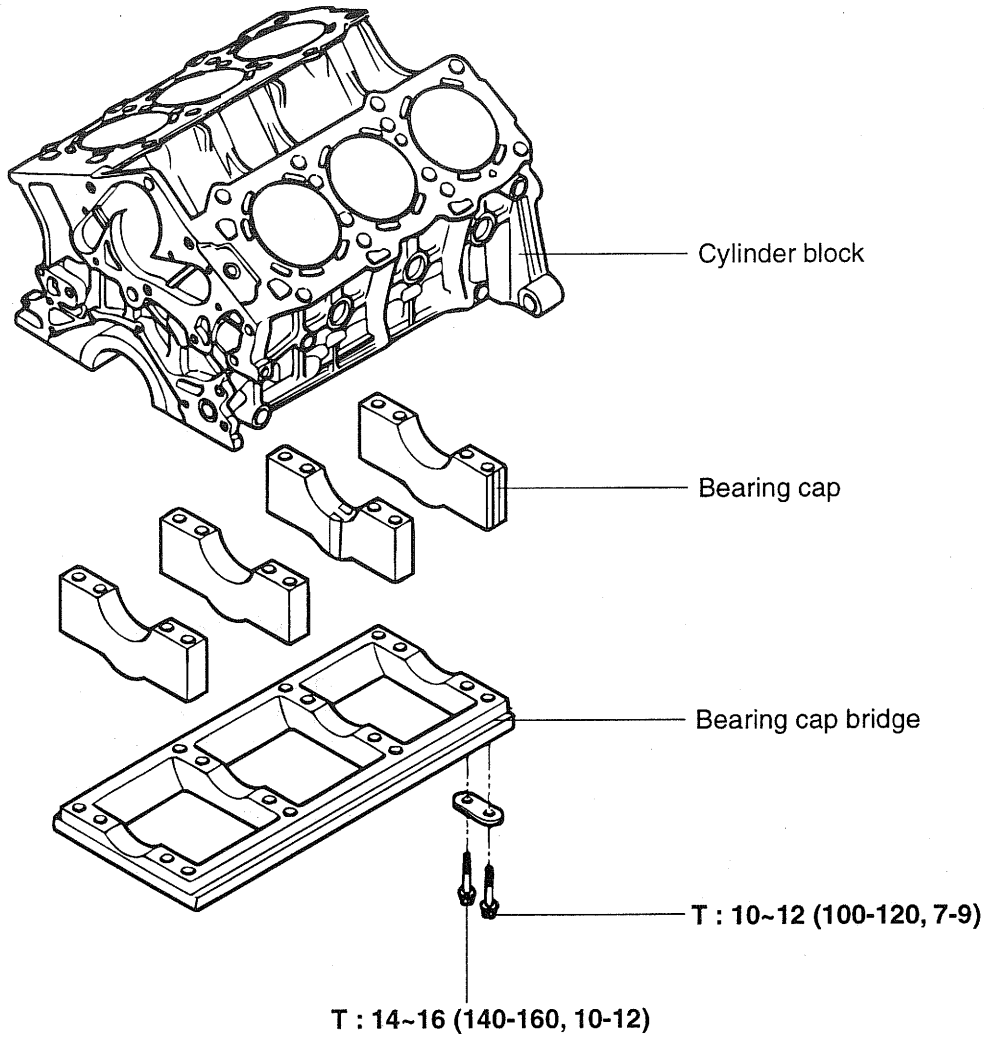


EDA9200A

ENGINE BLOCK

ENGINE BLOCK

CYLINDER BLOCK EDHA2000



TORQUE : Nm (kg·cm, lb·ft)

EDJA200A

DISASSEMBLY EDHA2200

Remove the timing belt, cylinder head assembly, drive plate, transaxle mounting plate, oil pan and oil pump case.

For further details, refer to the appropriate section.

INSPECTION EDHA2300

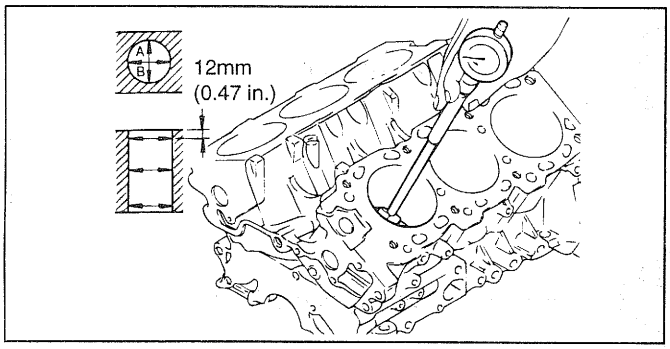
CYLINDER BLOCK

1. Visually check the cylinder block for scores, rust and corrosion. Also check for cracks or any other defects. Repair or replace the block if defective.
2. Measure the cylinder bore with a cylinder gauge at the three levels indicated in the directions A and B.

   Level 1 : No.1 piston ring position at TDC

   Level 2: Center of cylinder

   Level 3 : Bottom of cylinder



EDA9460A

3. If the cylinder bores show more than the specified out-of-round or taper, or if the cylidner walls are badly scuffed or scored, the cylinder block should be rebored and honed. New oversize pistons and rings should be installed.

Standard value

Cylinder bore : 86.7 mm (3.41 in.)

Out-of-round and taper of cylinder bore :

Max. 0.02 mm (0.0008 in.)

4. If a ridge exists at the top of the cylinder, cut it off with a ridge reamer.
5. Oversize pistons are available in two sizes.

Piston service size and mark mm (in.)

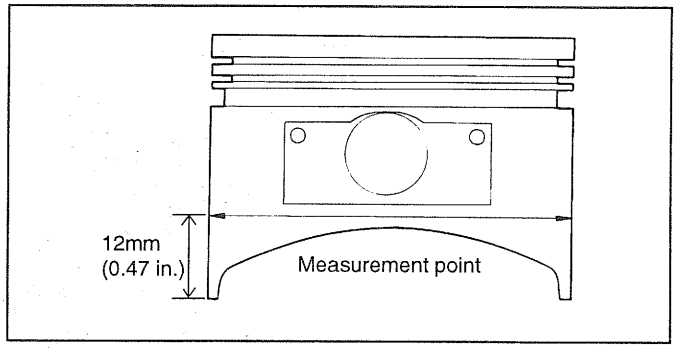
0.25 (0.010) O.S : 0.25

0.50 (0.020) O.S : 0.50

6. To rebore the cylinder bore to the oversize, keep the specified clearance between the oversize piston and the bore and make sure that all used pistons are the same oversize. The standard measurement of the piston outside diameter is taken at a level of 12mm (0.47 in.) above the bottom of the piston skirt and across the thrust faces.

Piston-to-cylinder wall clearance :

0.01-0.03 mm (0.0004-0.0012 in.)



ECA9451A

7. Check for damage or cracks in the cylinders.
8. Check the top surface of the cylinder block for flatness. If the top surface exceeds the limit, grind to the minimum limit or replace.

Standard value

Flatness of gasket surface :

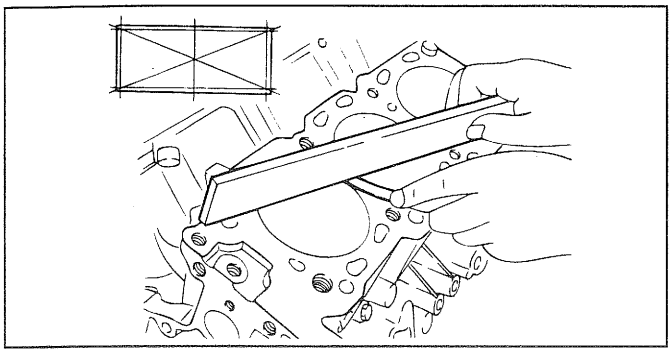
Max. 0.03 mm (0.0012 in.)

Service limit

Flatness of gasket surface : 0.05 mm (0.0020 in.)

CAUTION

When the cylinder head is assembled, grinding less than 0.2mm (0.008in.) is permissible.



EDA9460B

BORING CYLINDER EDHA2400

1. Oversize pistons used should be determined according to the largest bore cylinder.

Identification Mark	Size
0.25	0.25 mm (0.010 in.)
0.50	0.50 mm (0.020 in.)

NOTE

The size of the mark is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.
3. According to the measured O.D., calculate the boring dimensions.

   Boring dimension = Piston O.D + 0.01 to 0.03 mm (0.0004 to 0.0012 in.) (clearance between piston and cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

4. Bore each of the cylinders to the calculated size.

CAUTION

To prevent distortion that may result from temperature rise during honing, bore the cylinder holes in the firing order of sequence.

5. Hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).
6. Check the clearance between the piston and cylinder.

Standard : 0.01-0.03 mm (0.0004-0.0012 in.)

NOTE

When boring the cylinders, finish all of the cylinders to the same oversize. Do not bore only one cylinder to the oversize.

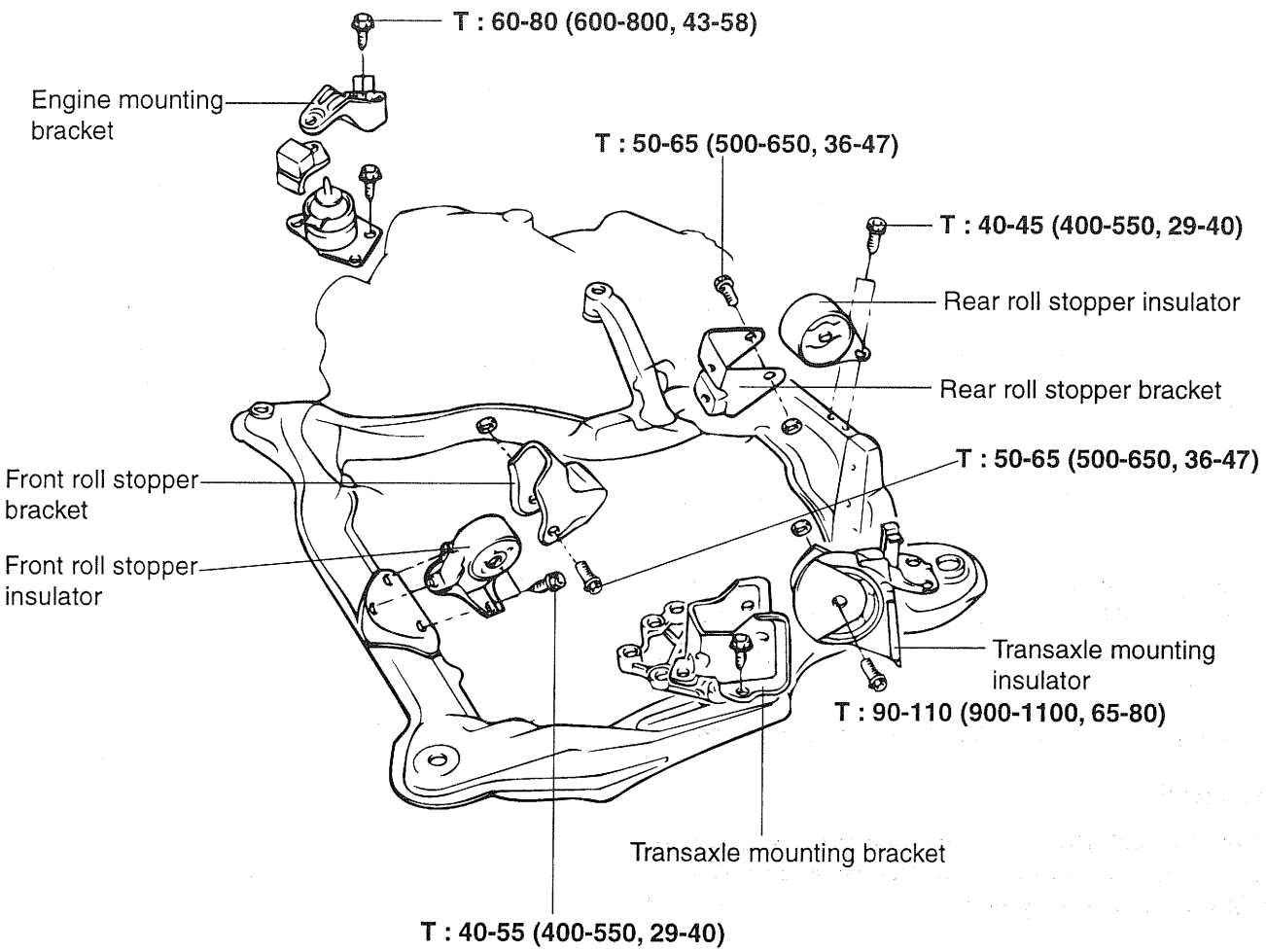
REASSEMBLY EDHA2500

Install the following parts by referring to their respective sections.

1. Crankshaft
2. Drive plate
3. Piston
4. Cylinder head
5. Timing belt
6. Oil pump case

ENGINE MOUNTS

ENGINE MOUNTING EDHA3000



TORQUE : Nm (kg·cm, lb·ft)

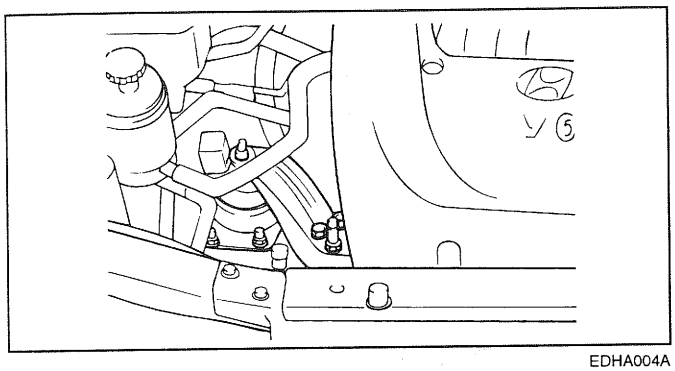
EDJA300A

REMOVAL EDHA3100

Hang a cable or chain from the engine hooks and lift so that there is no pressure on the insulators.

ENGINE MOUNTING

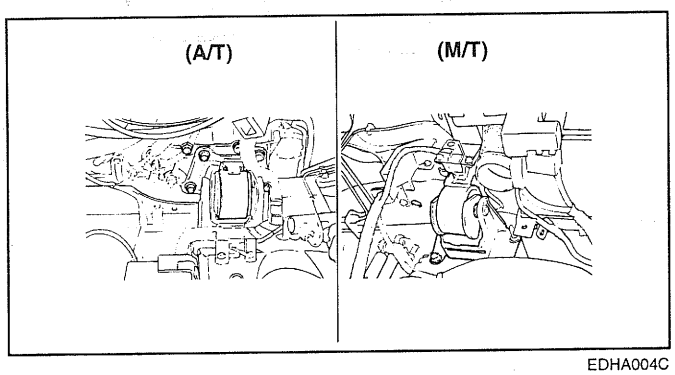
1. Remove the engine mount insulator bolts.
2. Remove the engine mount bracket from the engine.



EDHA004A

TRANSAXLE MOUNTING

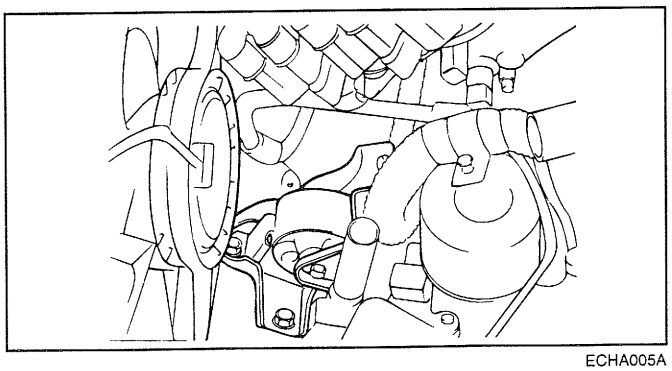
1. Remove the transaxle mounting bolt.
2. Remove the transaxle bracket.



EDHA004C

FRONT ROLL STOPPER

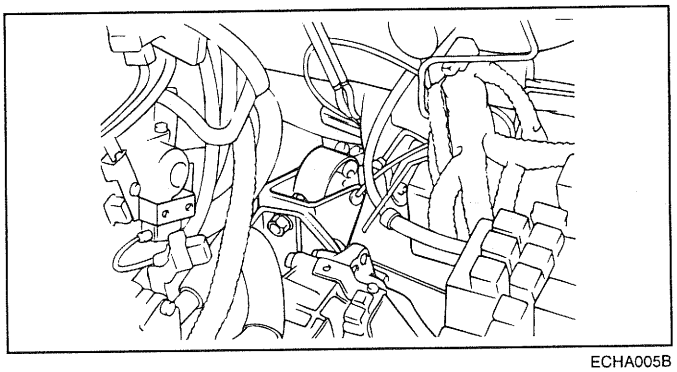
1. Remove the front roll stopper upper and lower bolts.
2. Remove the front roll rod assembly.



ECHA005A

REAR ROLL STOPPER

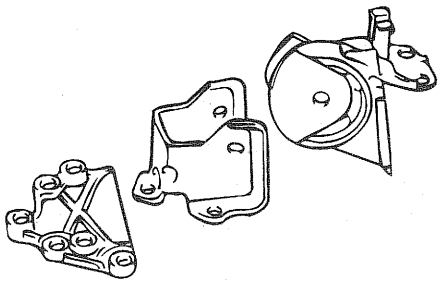
1. Remove the bolt from the rear roll stopper.
2. Remove the rear roll stopper from the sub-frame.



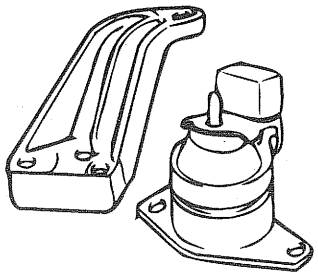
ECHA005B

INSPECTION ITEMS EDHA3200

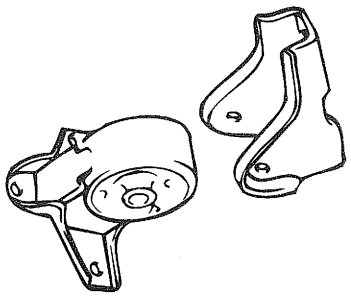
Transaxle mount



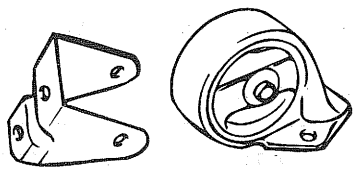
Engine mount



Front roll stopper assembly



Rear roll stopper assembly



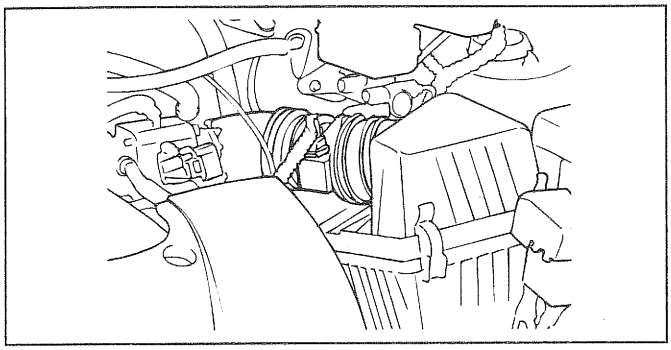
EDHA005E

ENGINE AND TRANSAXLE ASSEMBLY

ENGINE AND TRANSAXLE ASSEMBLY EDHA3300

REMOVAL

1. Remove the battery and engine cover.
2. Detach the air cleaner.



EDHA006A

3. Disconnect the connectors for the engine harness.
   1. Alternator, starter
   2. Power steering switch connector, oil pressure gauge connector
   3. TPS connector
   4. Back up lamp switch connector
   5. A/T solenoid, inhibit switch connector
   6. Coolant temperature
   7. Ignition coil, power TR connector
   8. Idle speed control valve (ISCV) connector
   9. MAP and ATS sensor
   10. Oxygen sensor connector etc.
4. Drain the engine coolant.
5. Disconnect the transaxle oil cooler hoses (A/T).

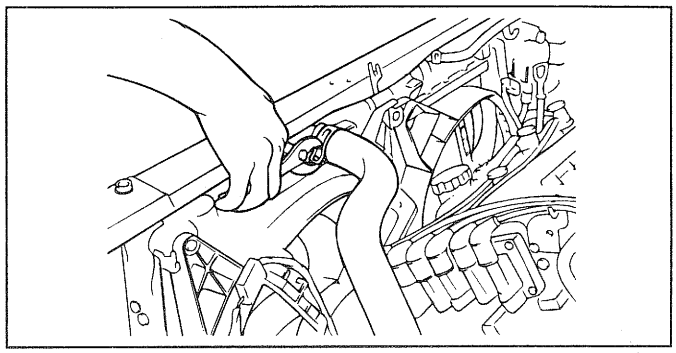
NOTE

When disconnecting the hoses, make identification marks to avoid making any mistake when installing them again.

CAUTION

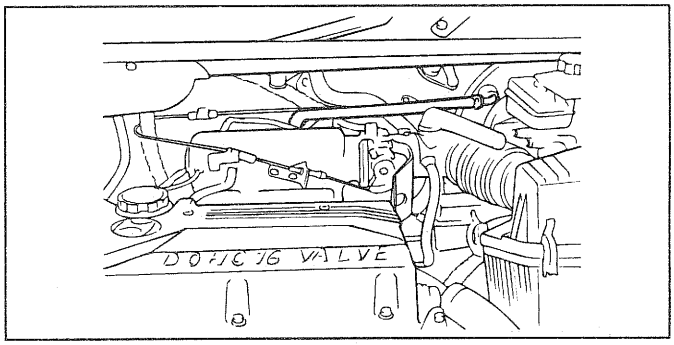
Be careful not to spill any of the oil or fluid the hoses. Plug the openings to prevent the entry of foreign material.

6. Disconnect the radiator upper and lower hoses on the engine side then remove the radiator assembly.



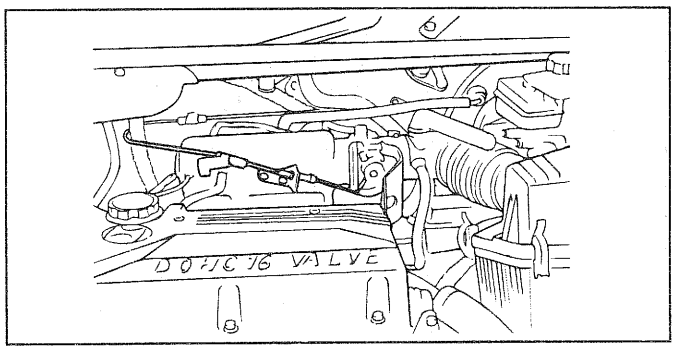
EDHA004D

7. Disconnect the engine ground.
8. Disconnect the brake booster vacuum hose.



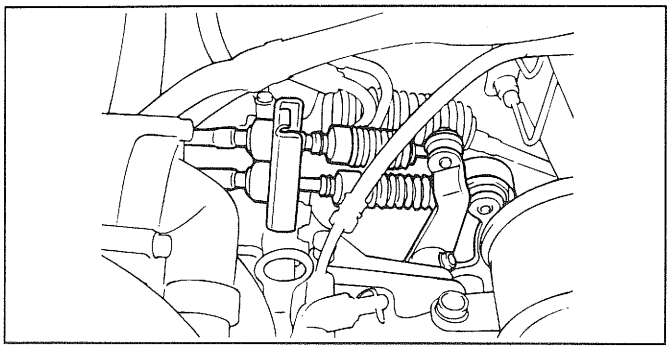
EDHA006B

9. Disconnect the heater hoses (inlet and outlet) on the engine side.
10. Disconnect the accelerator cable and cruise control cable at the engine side.



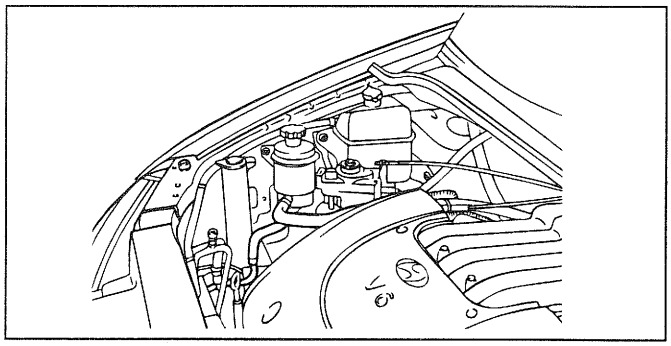
EDHA006E

11. Using the special tool, remove the main fuel line (supply and return) connected to delivery pipe.
12. Disconnect the speedometer cable from the transaxle.
13. Disconnect the clutch cable or control cable from the transaxle.



EDHA006F

14. Remove the power steering hose from the oil pump.

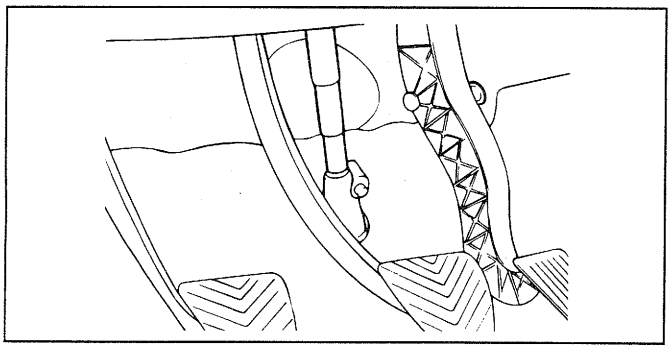


EDHA006G

15. Detach the steering dust cover in the room and then disassemble the gear box by loosening the universal joint bolt.

NOTE

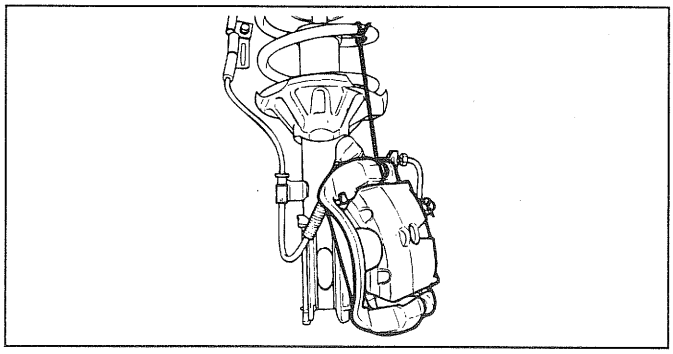
Make sure to make identification marks between the universal joint and the gear box for the assembly.



ECHA004I

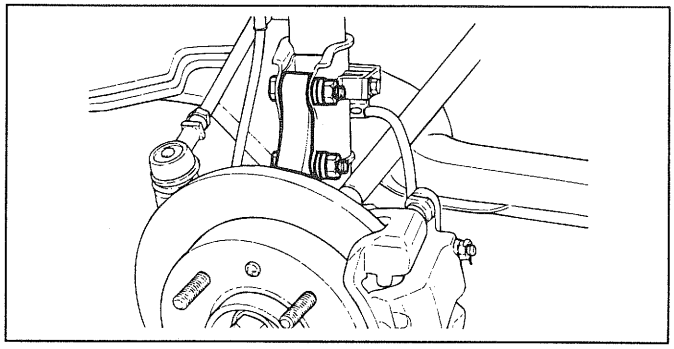
16. Raise the vehicle and then remove the front tire.

17. Remove the calliper assembly from the knuckle and then tie it upside down.



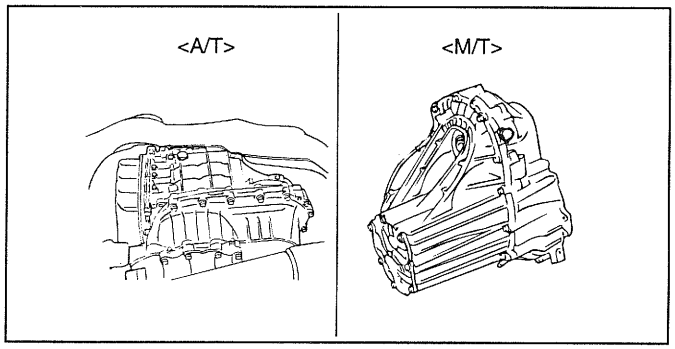
ECHA004J

18. Loosen the strut lower bolts and then remove it.



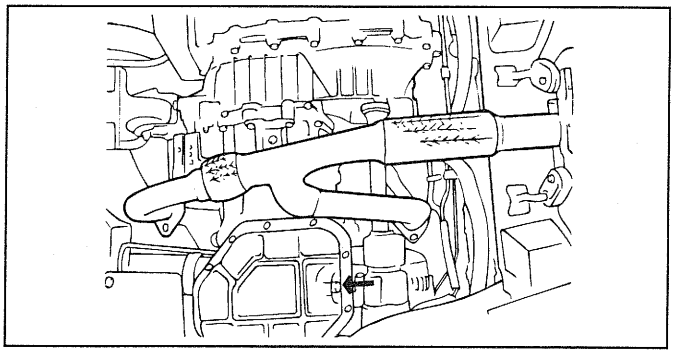
ECHA004K

19. Drain the transaxle oil.



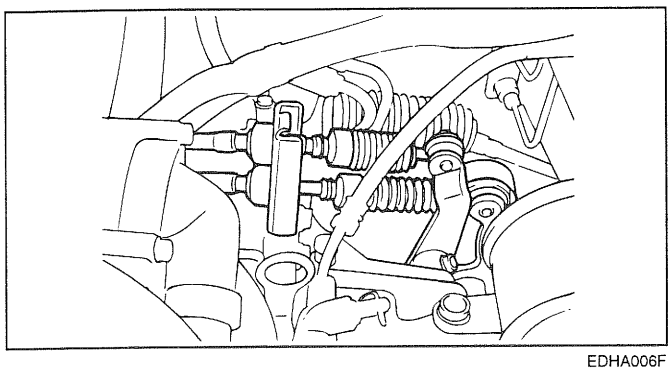
ECHA004Z

20. Remove the front muffler.



ECHA015B

21. Remove the transaxle control rod and extension rod (M/T only).

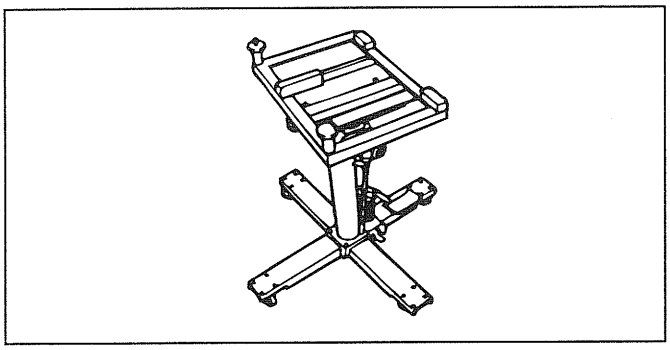


EDHA006F

22. Put the special die on the T/M jack and then adjust it to the sub-frame.

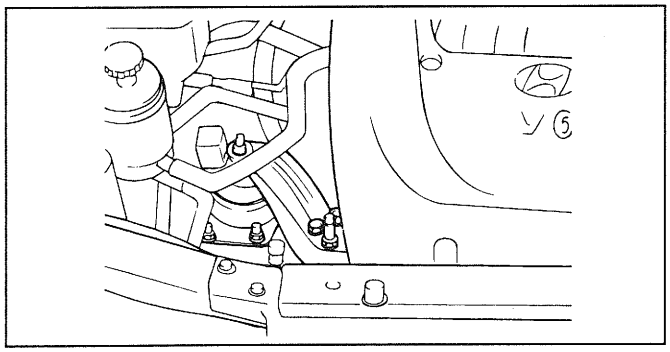
NOTE

Check that the cables, harness connector, and hose are disconnected from the engine and transaxle assembly.

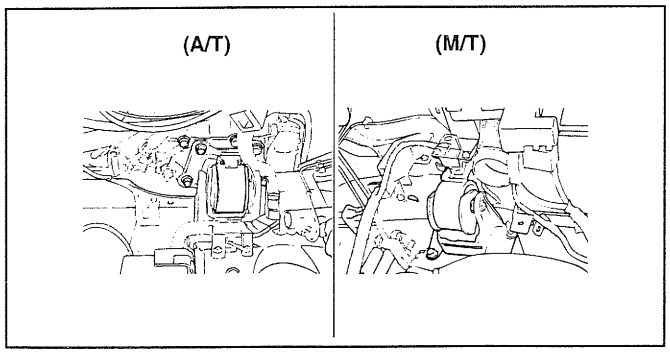


ECHA004O

23. Remove the engine mount bracket and transaxle mount bracket.

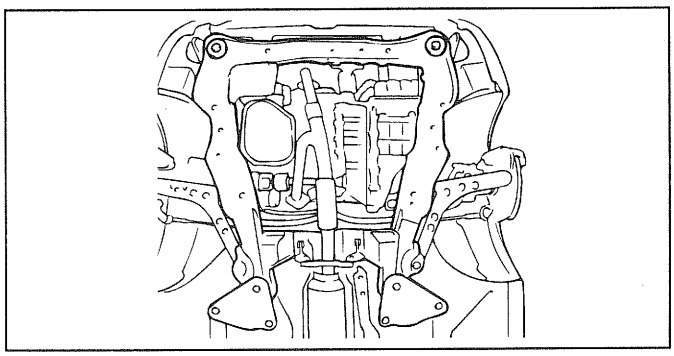


EDHA004A

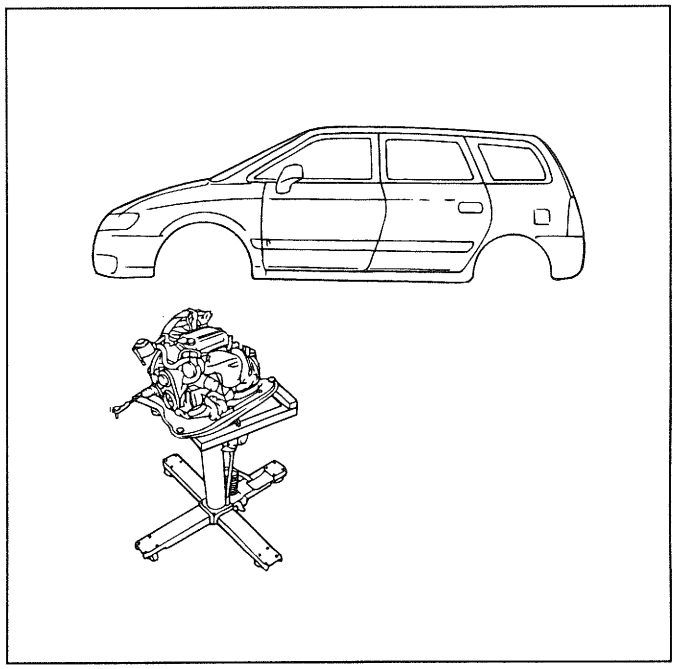


EDHA004C

24. Remove the sub-frame installation bolts.

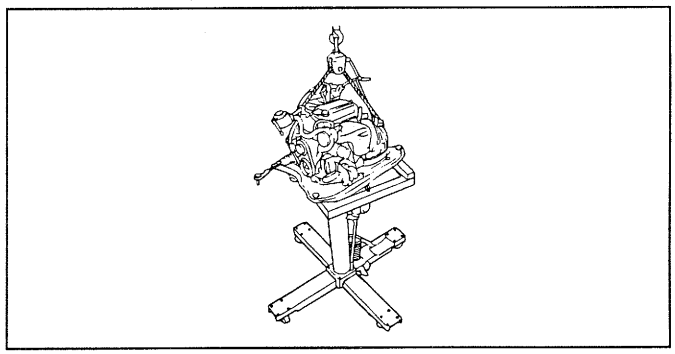


EDHA006K



EDHA006I

25. After removing the drive shaft, hang the engine and transaxle assembly on the hoist and then remove the front roll stopper and the rear roll stopper.

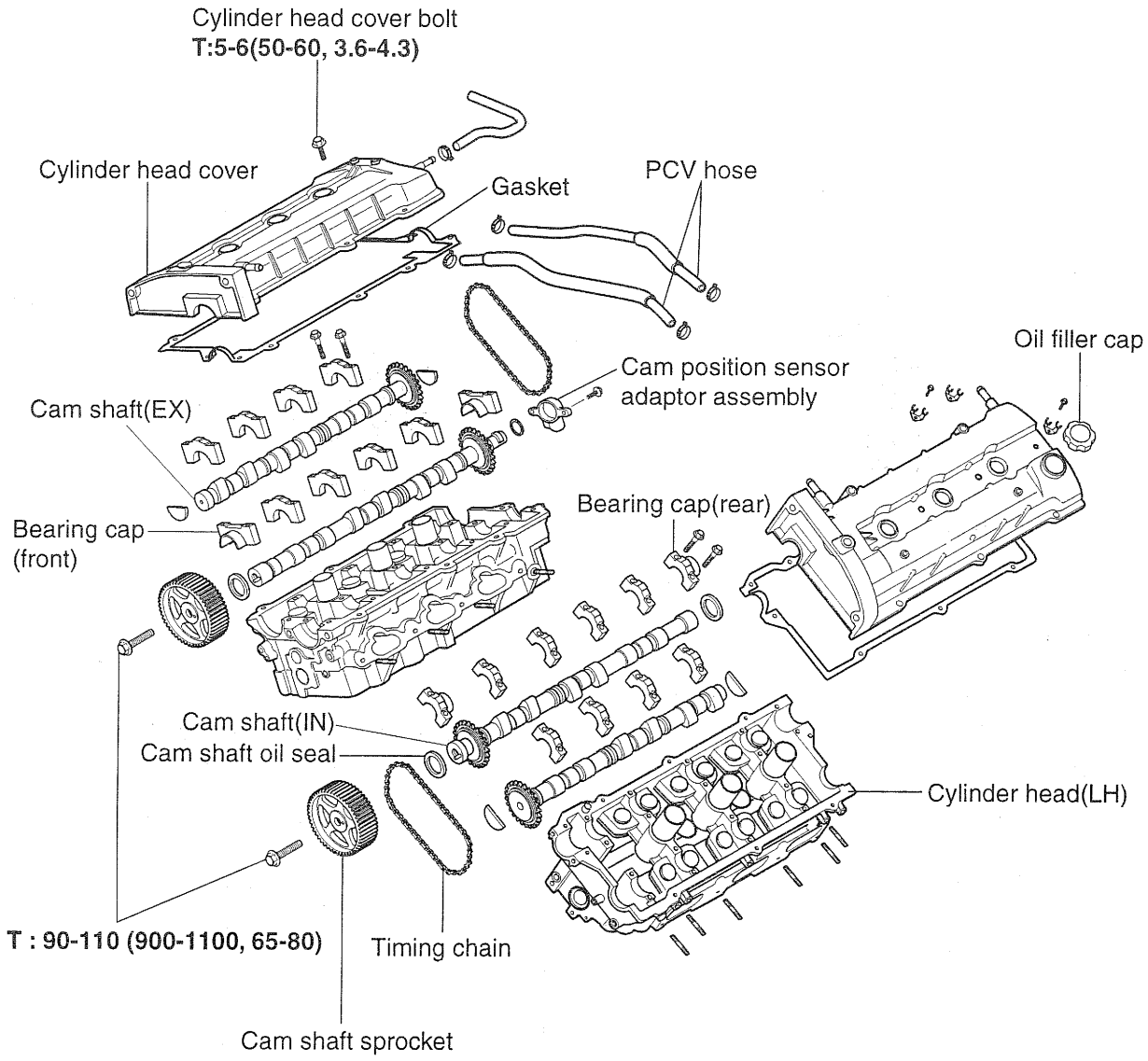


EDHA006L

MAIN MOVING SYSTEM

CAM SHAFT

CAMSHAFTS EDHA4000

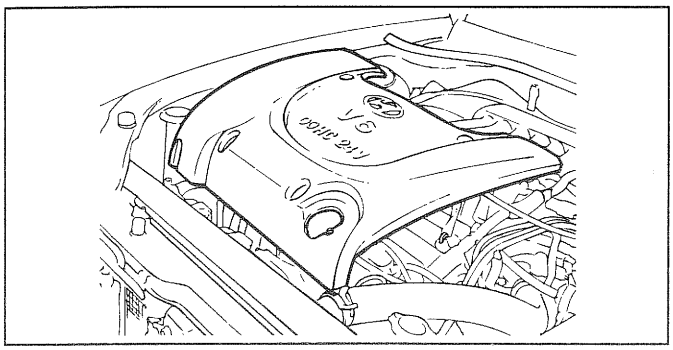


TORQUE : Nm (kg·cm, lb·ft)

KFW3031A

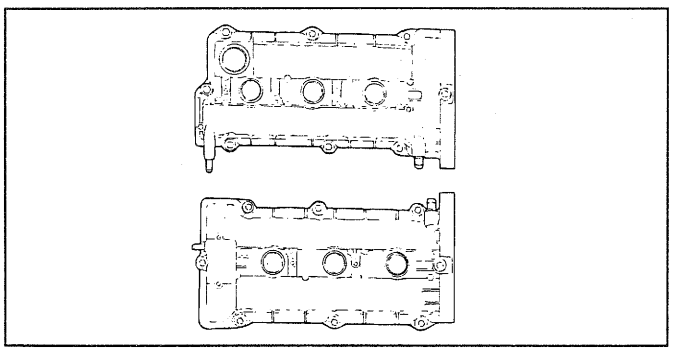
DISASSEMBLY EDHA4100

1. Remove the engine cover and intake manifold.



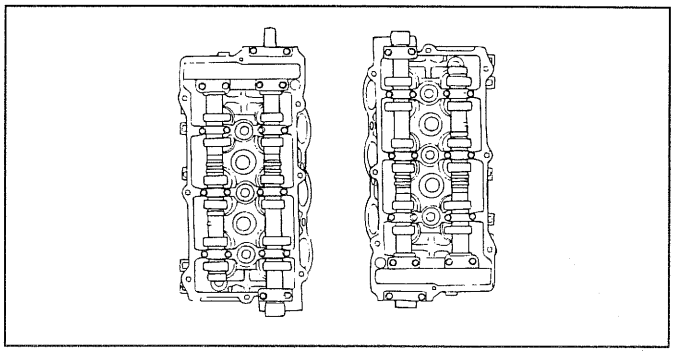
EDHA007A

2. Disconnect the breather hose and the engine harness.
3. Remove the power steering pulley, air conditioner pulley, crankshaft pulley, idler pulley and tensioner pulley.
4. Remove the timing belt cover.
5. Loosen the auto tensioner.
6. Remove the timing belt from the camshaft sprocket.
7. Remove the spark plug cables.
8. Loosen the cylinder head cover bolts and then remove it.



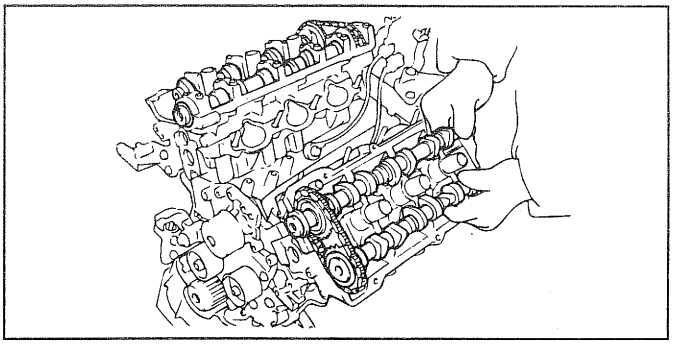
EDA9091A

9. Remove the camshaft sprocket.
10. Remove the camshaft bearing caps.



EDA9036A

11. Remove the camshaft.



EDA9032A

INSPECTION EDHA4200

CAMSHAFTS

1. Check the camshaft journals for wear. If the journals are badly worn out, replace the camshaft.
2. Check the cam lobes for damage. If the lobe is damaged or excessively worn out, replace the camshaft.

Cam height

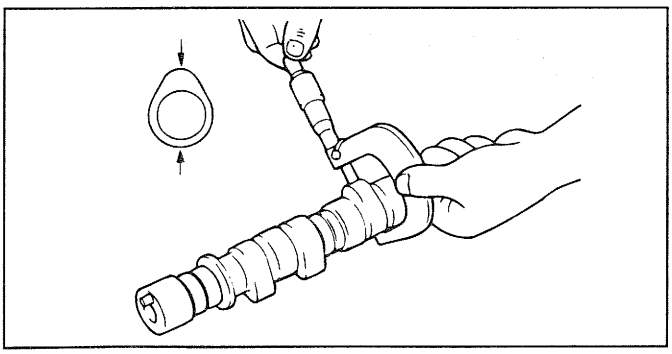
[Standard]

Intake : 43.95-44.15 mm(1.7303-1.7382 in.)

Exhaust : 43.95-44.15mm(1.7303-1.7382 in.)

[Limit]

Intake/Exhaust : 43.45mm(1.7106 in.)



EDA9260A

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 : 0.1-0.15mm(0.0039-0.0059 in.)

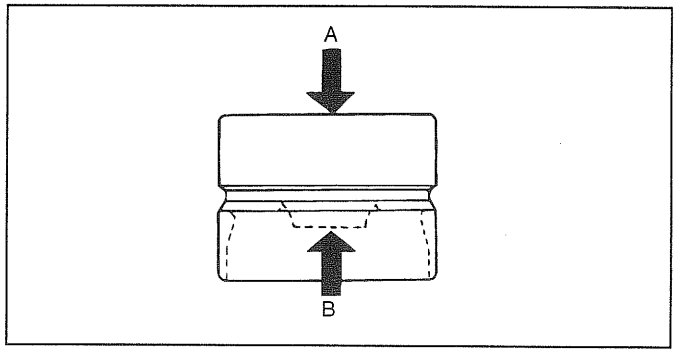
OIL SEAL (CAMSHAFT FRONT)

1. Check the lips for wear. If lip threads are worn out, replace the oil seal with new one.

2. Check a contact surface of oil seal lip on camshaft. If there stratified wear, replace the camshaft.

HLA (HYDRAULIC LASH ADJUSTER)

With the HLA filled with engine oil, hold A and press B by hand. If B moves, replace the HLA.

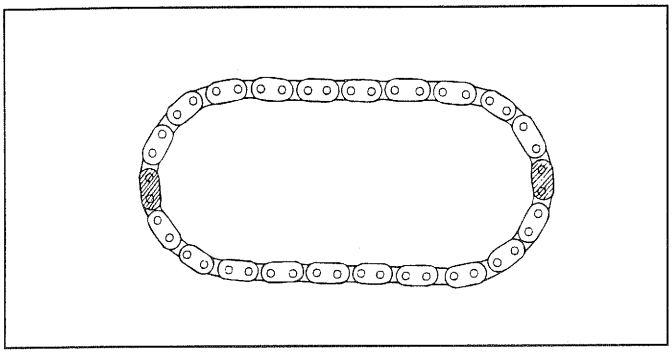


EDA9260B

Problem	Possible cause	Action
1. Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2. Continuous noise when engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the 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 step 7 below.
3. Continuous noise when engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
4. Continuous noise when engine is started after excessivly craking the engine by the starter motor or band.	Oil leakage of the high-pressure chamber in the HLA, allowing air to get in. Insufficient oil in the HLA,	
5. Continuous noise when engine is running after changing the HLA.		**CAUTION** **Do not run engine at a speed higher than 3000 rpm, as this may damage the HLA.**
6. Continuous noise during idle after high running speed.	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. If deteriorated, replace with specitied type and amount of oil.
7. Noise cotinues 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 HLA down by hand. If it moves, replace the HLA. **WARNING** **Be careful with hot HLA.**

TIMING CHAIN

Check the bushing and plate of timing chain for wear. Replace if there is severe wear.

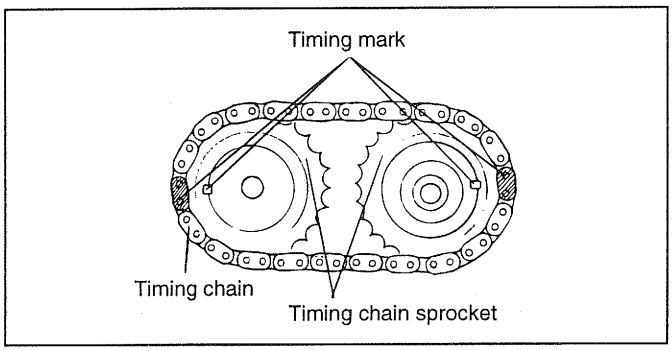


EDA9033A

REASSEMBLY EDHA4300

1. Install the HLA.

2. Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown in the illustration.

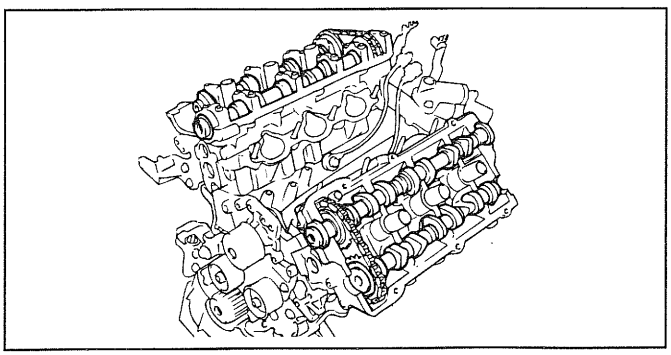


EDA9270A

3. Install the camshaft after lubricating the journal of camshaft with engine oil.

NOTE

Pull-off force between camshaft (IN) and timing chain sprocket should be 1000kg (MIN.) at room temperature.

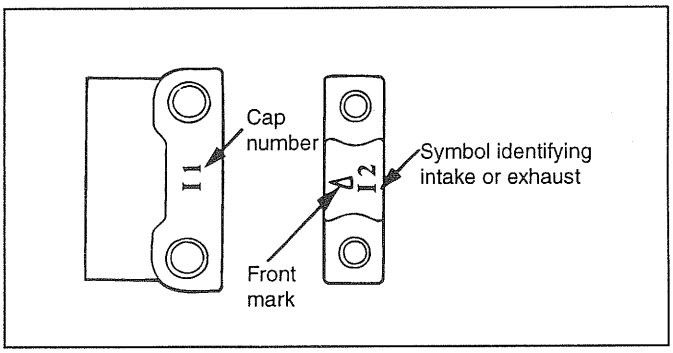


EDA9035A

4. Install the bearing caps. Check the markings on the caps for intake/exhaust identification symbol.

   I: Intake camshaft

   E: Exhaust camshaft



HFR20B64

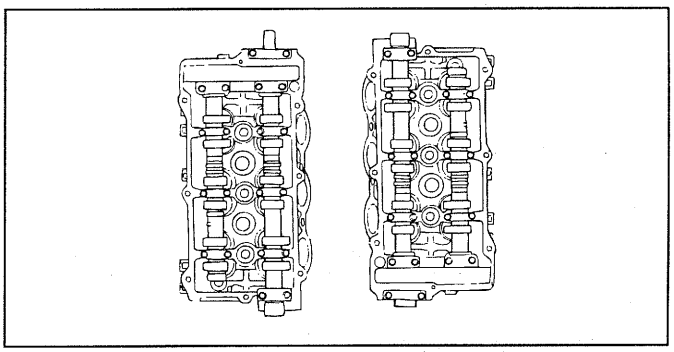
5. Tighten the bearing caps to the specified torque in two or three steps as shown.

Tightening torque

Bearing cap bolt :

M 10 : 14-16 Nm(140-160 kg.cm, 10-12 lb.ft)

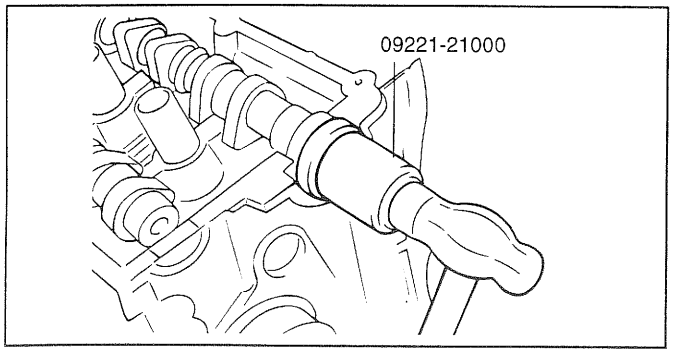
M 7 : 10 -12 Nm(100-120 kg.cm, 7-9 lb.ft)



EDA9036A

6. Using the special tool, the camshaft oil seal installer (09221-21000), press the camshaft oil seal. 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 by with a hammer until it is fixed.



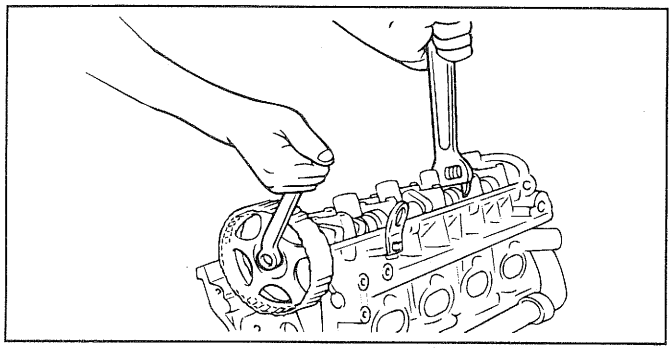
EDA9270E

7. Install the camshaft sprocket to the specified torque.

Tightening torque

Camshaft sprocket bolt :

90-110Nm(900-1100kg.cm, 65-80lb.ft)



EDA9270F

8. Install the cylinder head cover.

Tightening torque

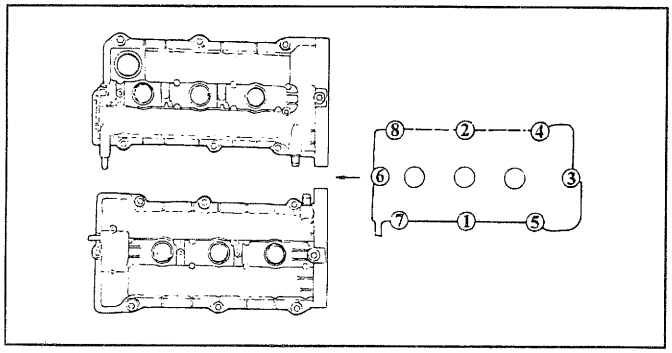
Cylinder head cover bolts :

5-6Nm(50-60kg.cm, 3.6-4.4 lb.ft)

<Tightening procedure>

1) Tighten all bolts with temporary torque.(half of the standard torque) in the sequence of 1.2.3.4.5.6.7.8

2) Tighten all bolts with standard torque.



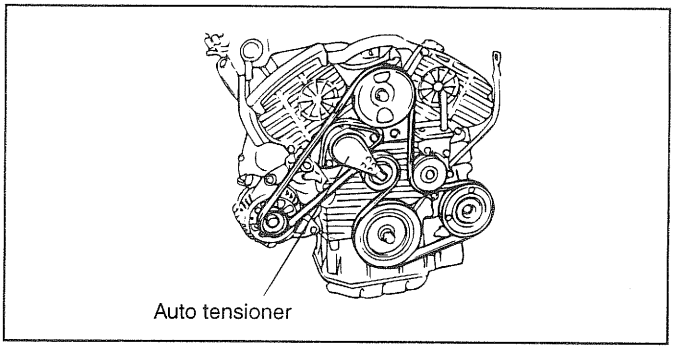
KFW3066A

9. Install the spark plug cables, center cover.

10. Install the timing belt and then tighten the auto tensioner pulley.

11. Install the timing belt cover.

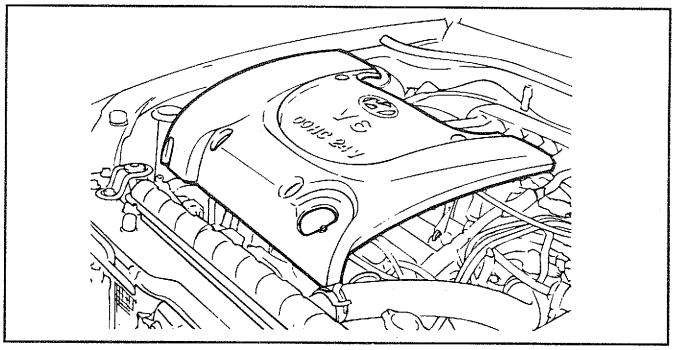
12. Install the power steering pulley, air conditioner pulley, crankshaft pulley and tensioner pulley.



EDA9031A

13. Install the intake manifold and engine cover.

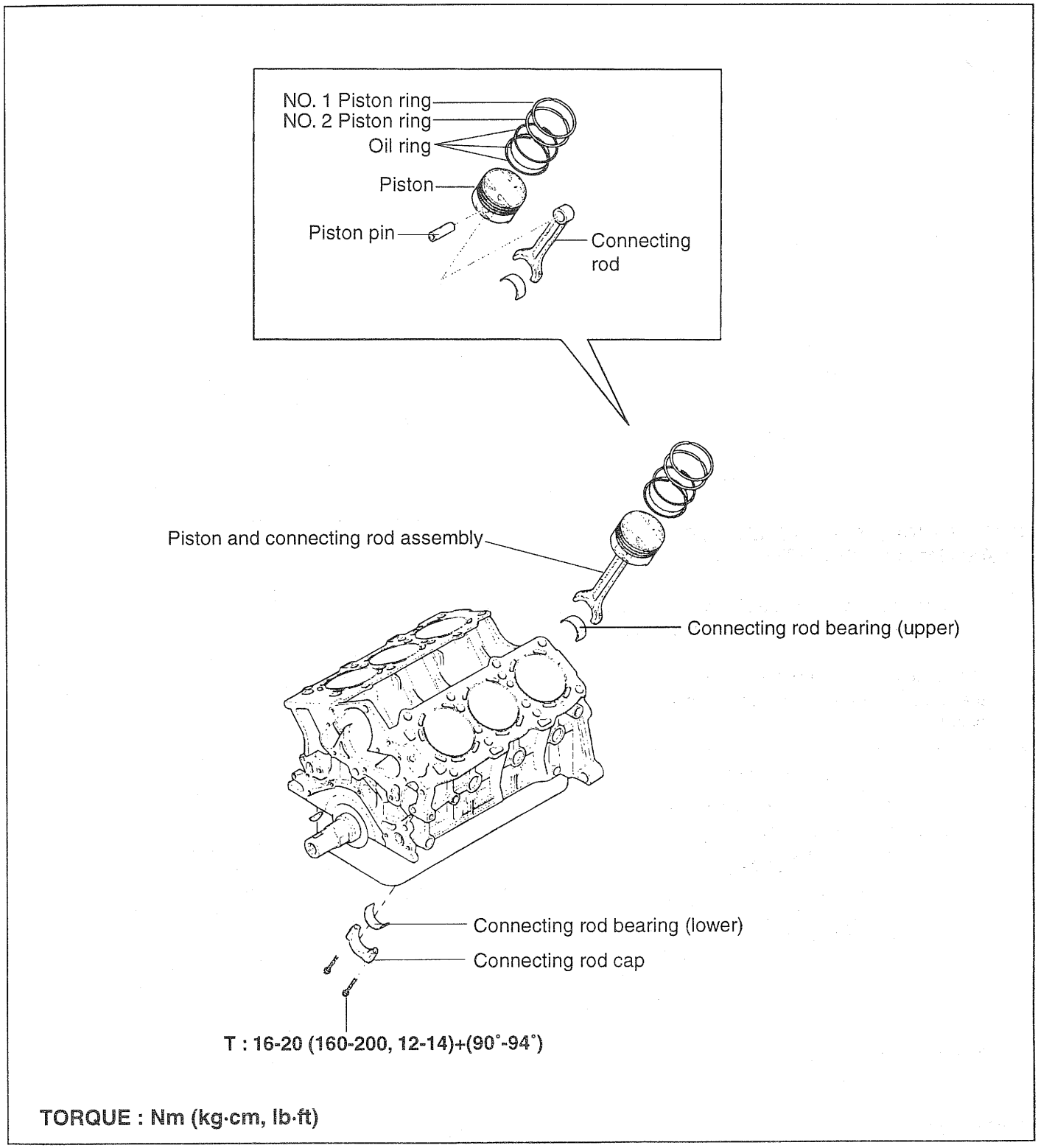
14. Connect the breather hose and engine harness.



EDA9022A

CONNECTING ROD

PISTONS AND CONNECTING RODS EDHA4600



EDJA460A

DISASSEMBLY EDHA4700

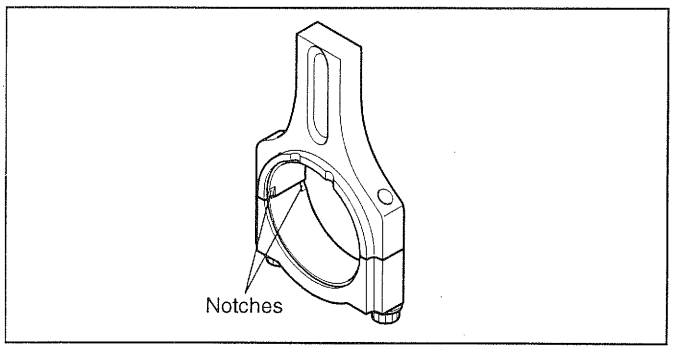
CONNECTING ROD CAP

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.

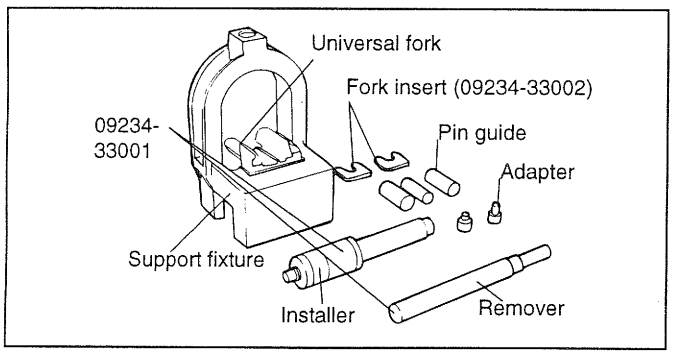


KFW3049A

PROCEDURES FOR DISASSEMBLY AND REASSEMBLY OF PISTON PIN

1. Using the special tools (09234-33001), disassemble and reassemble the piston and connecting rod.

2. Place the proper insert in the fork of the tool.Position the insert between the connecting rod and the piston.



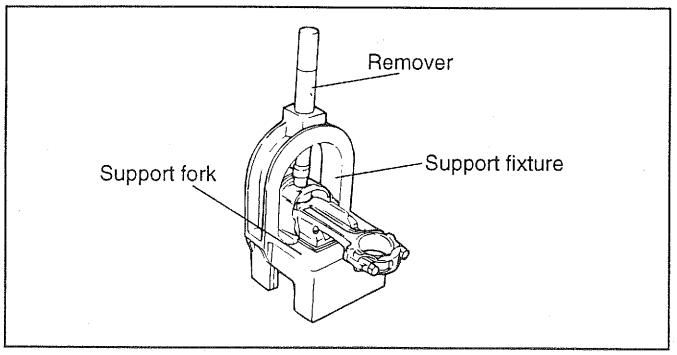
ECA9361A

3. Insert the proper tool for removal through the hole in the arch of the tool.

CAUTION

Center the piston, rod and pin assembly with the removal arbor.

4. Press the piston pin out of the connecting rod.



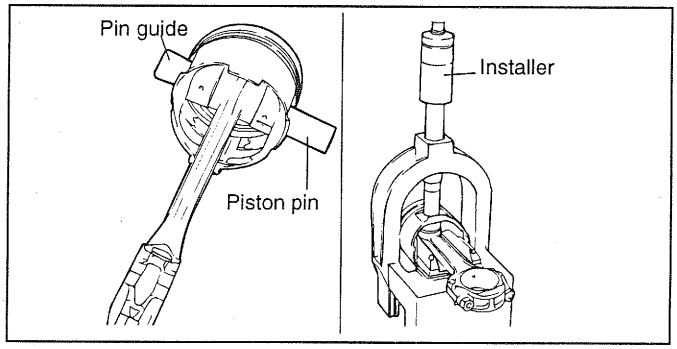
EDA9048A

5. Install the proper pin guide through the piston and into the connecting rod. Tap the pin guide into the piston for proper retention by hand. Drop the piston pin into the other side of the piston.

CAUTION

The pin guide should be centered on the connecting rod through the piston. If the piston, connecting rod, piston pin and pin guide assembly are accurately positioned on the fork of the tool, pin guide will also be placed on the center of assembly line without fail.

If a pin guide which is too small is used, damage may occur to the fork or insert of the tool because piston assembly is not centered on the tool.



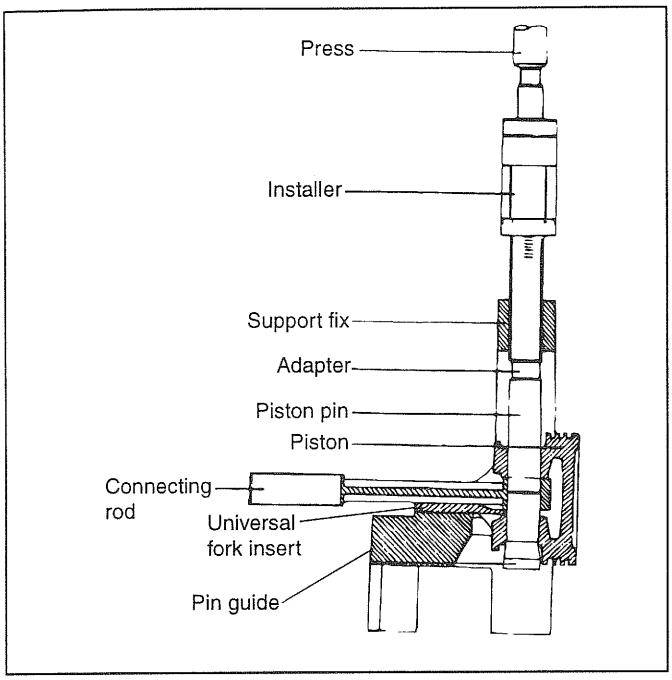
ECA9361C

6. Install piston assembly onto fork assembly of a tool. The tool will support the connecting rod. Be sure that piston assembly slide down onto the fork until the pin guide touches the fork insert.

7. Insert the installing arbor through the hole in the arch of the tool. Press the 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 2756±1100lb of fressure when stopping the installing arbor sleeve against the arch.



HEW20A55

INSPECTION EDHA4800

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 smoothly 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 only the piston rings only.

Piston ring side clearance

No.1 : 0.04-0.08 mm (0.0016-0.0031 in.)

No.2 : 0.03-0.07 mm (0.0012-0.0028 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 of 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 (0.0146-0.0205 in.)

Oil ring side rail : 0.2-0.7 mm (0.0079-0.0276)

[Limit]

No.1, No.2 : .0.8 mm (0.031 in.)

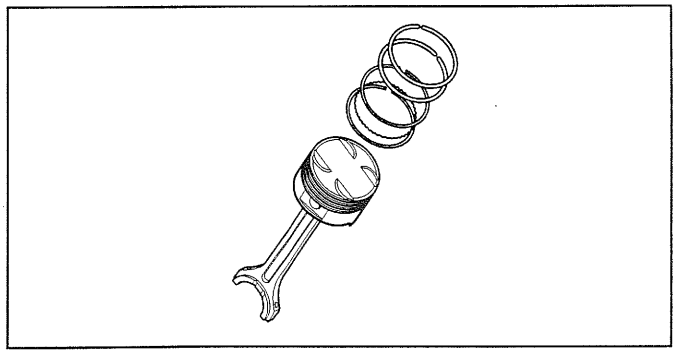
Oil ring side rail : 1.0 mm (0.039 in)

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
0.25mm (0.010 in.) O.S	25
0.50mm (0.020 in.) O.S	50

NOTE

The mark can be found on the upper side of the ring next to the end.



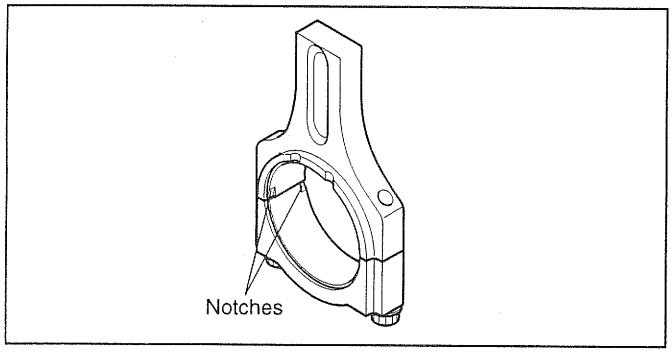
KFW3037C

CONNECTING RODS

1. When the connecting rod cap is installed, make sure that the cylinder numbers are 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.

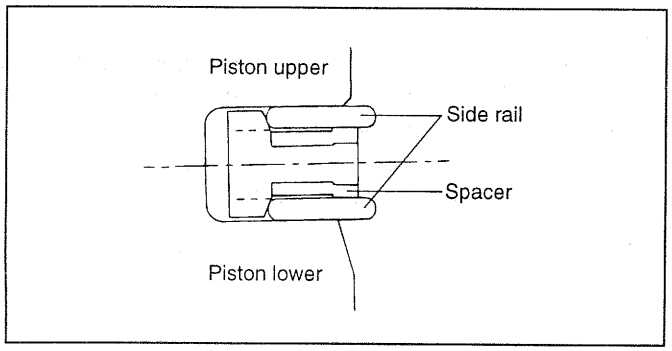
2. Replace the connecting rod if it is damaged at either end of the thrust faces or if it has a stratified wear in, or if the surface of the inside diameter of the small end is severely rough .



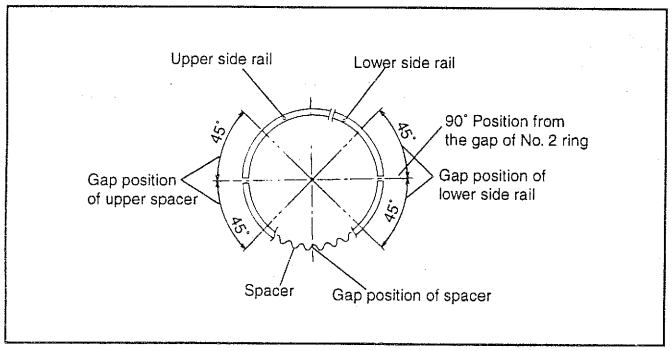
KFW3049A

REASSEMBLY EDHA4900

1. Install the spacer.



ECA9082A



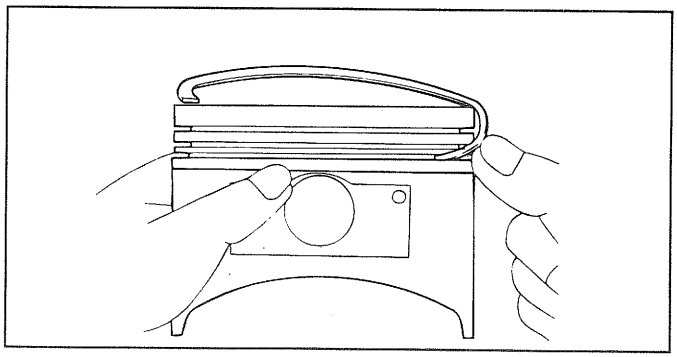
EDJA490A

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.

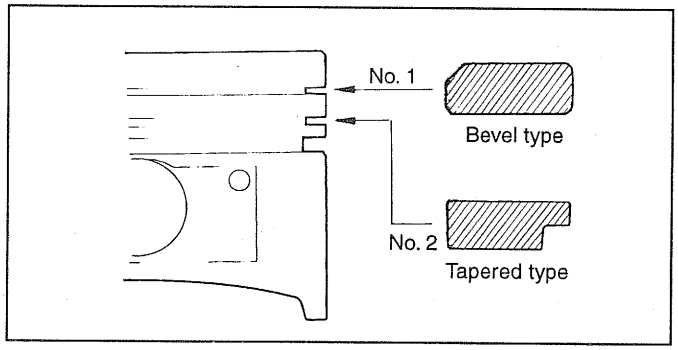


ECA9380B

4. Apply engine oil around the piston and piston rings.

5. Using a piston ring expander, install the No.2 piston ring.

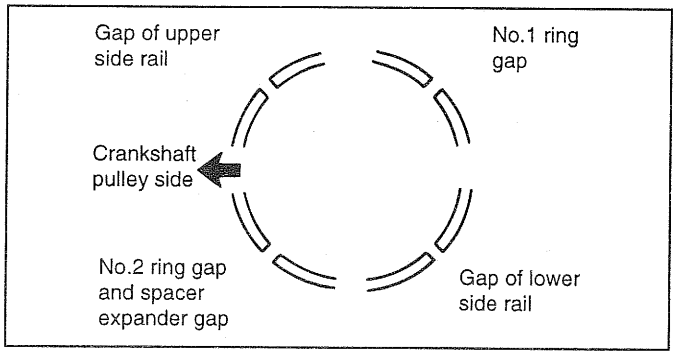
6. Install the No. 1 piston ring.



EDJA490B

7. Position each piston ring end gap as far away from neighboring gaps as possible. Make sure that the gaps are not positioned in the thrust and pin directions.

8. Hold piston rings firmly with a piston ring compressor as they are inserted into cylinder.



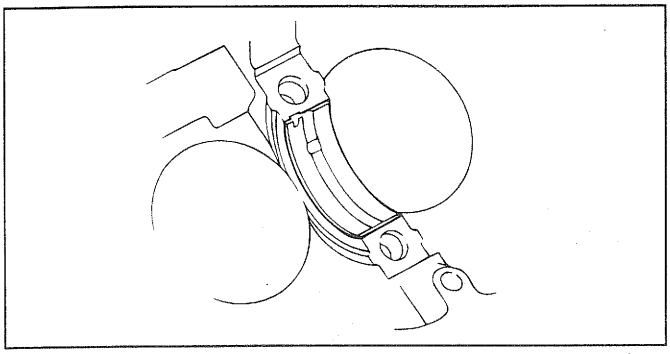
ECA9380D

9. Install the upper main bearings in the cylinder block.

10. Install the lower main bearings in the main bearing caps.

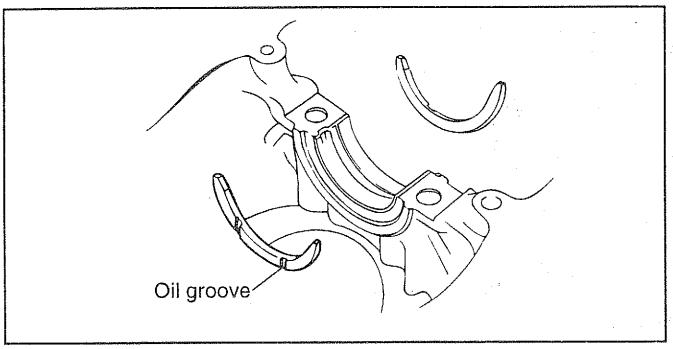
CAUTION

Install the bearing to the oil hole in the block.



EDA9390E

11. Install the thrust washers in the No. 3 main bearing cap with the oil grooves facing outward.



EDA9390F

12. 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.

13. When the connecting rod cap is installed, make sure that the cylinder numbers are placed on the rod and cap at disassembly match.

14. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.

15. When assembling, bolts should be fastened by the plastic region angle - controlled method as the following.

    1) Apply oil to the thread of nuts and spot areas.

    2) Tighten the connecting rod bolt.

Tightening torque

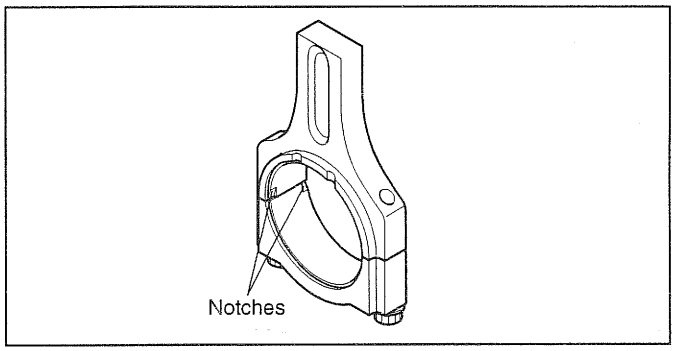
Connecting rod bolt :

16-20 Nm (160-200 kg.cm, 12-15 lb.ft)+(90°-94°)

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.



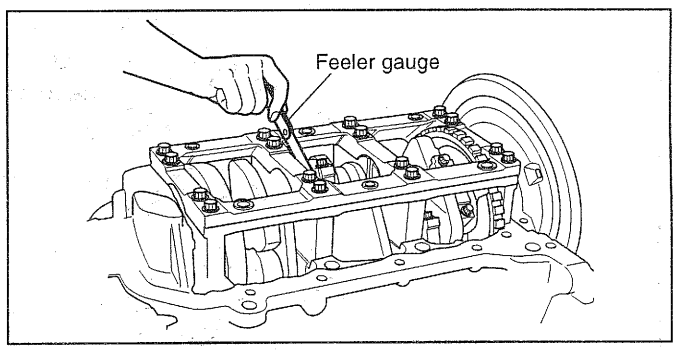
KFW3049A

16. Check the connecting rod side clearance.

Connecting rod side clearance

Standard : 0.10-0.25 mm (0.0039-0.0098 in.)

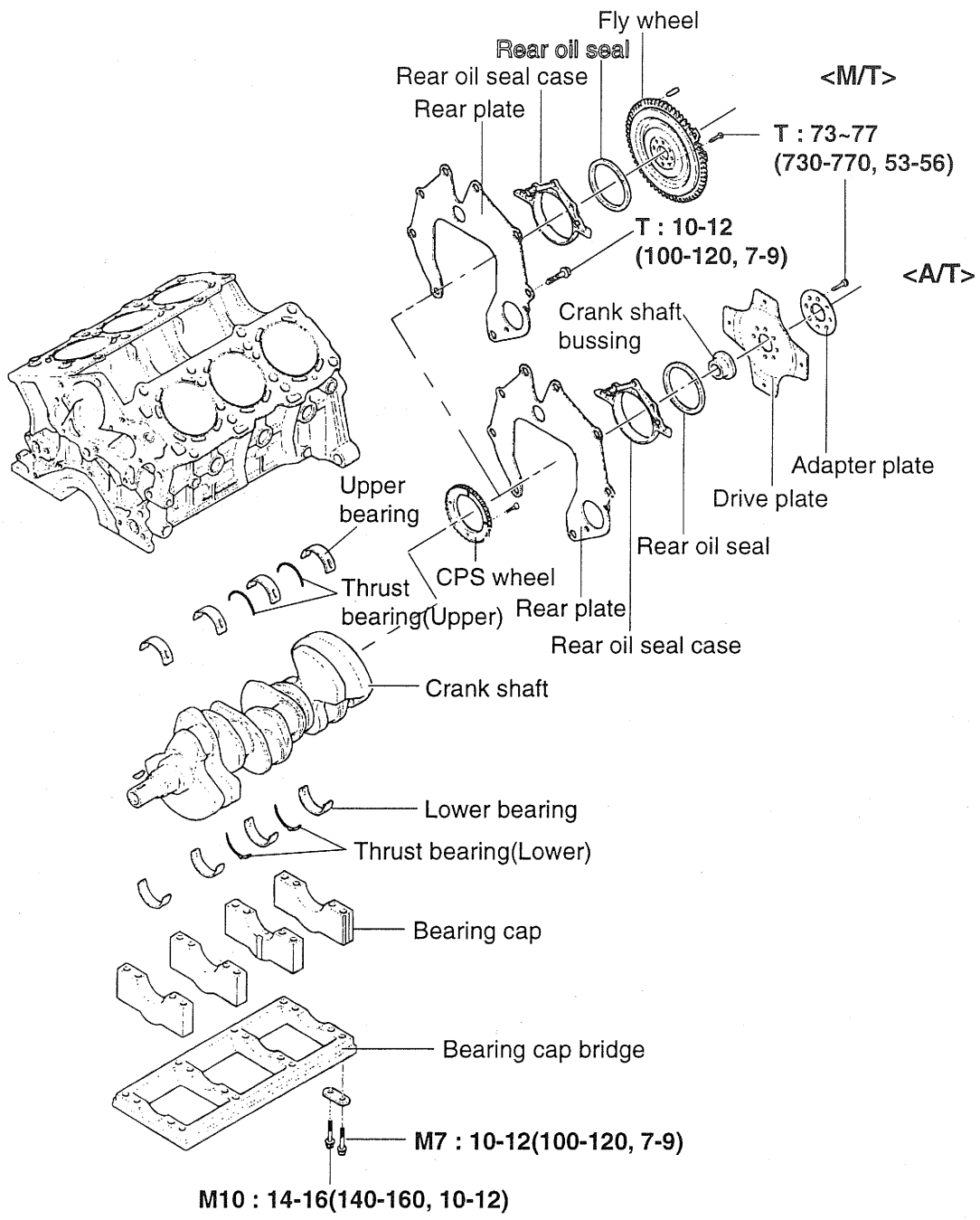
Limit : 0.4 mm (0.0157 in.)



KFW3056A

CRANK SHAFT

CRANKSHAFT EDHA5000



TORQUE : Nm (kg·cm, lb·ft)

EDJA500A

DISASSEMBLY EDHA5100

1. Remove the timing belt train, 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.

NOTE

Mark the main bearing caps to be able to reassemble in the original position and direction.

4. Remove the main bearing caps and remove the crankshaft. Keep the bearings in order according to the cap number.

INSPECTION EDHA5200

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 parts.
2. Inspect for out-of-round and taper of the crankshaft journal and pin.

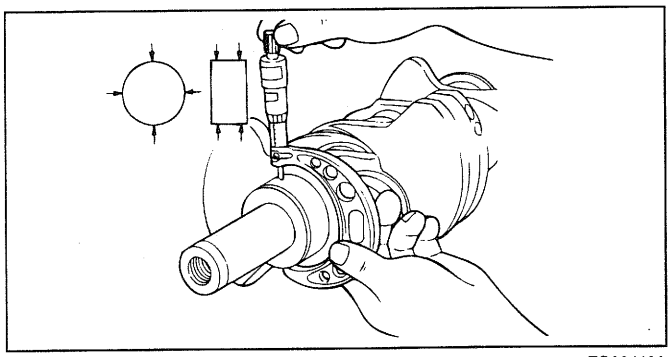
Standard value

Crankshaft journal O.D :

61.982-62.000 mm (2.4402-2.4409 in.)

Crankshaft pin O.D :

47.982-48.000 mm (1.8890-1.8898 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 for oil clearance by measuring the outside diameter of the crankshaft journal and the inside diameter of the bearing. The clearance can be obtained by calculating the difference between the measured outside diameters.

Standard value

Oil clearance

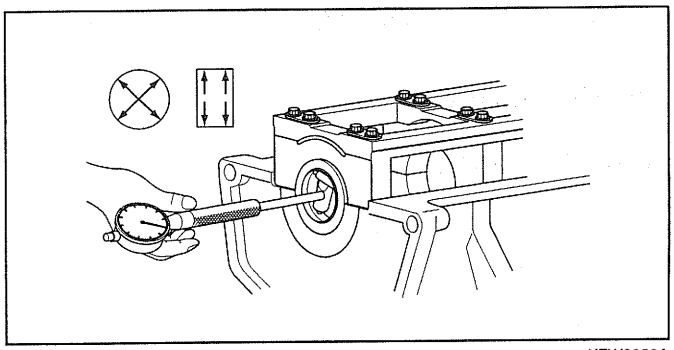
Crankshaft main bearing :

0.004-0.022 mm (0.00015-0.00087 in.)

Connecting rod bearing :

0.018-0.036 mm (0.00071-0.00141 in.)

LIMIT : 0.1mm (0.004 in.)



KFW3058A

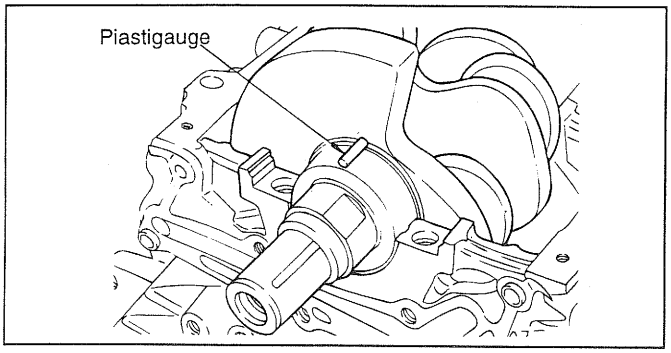
PLASTIC GAUGE METHOD

Plastic gauge may be used to measure the clearance.

1. Remove oil, grease and any other dirt from the bearings and journals.
2. Cut the plastic gauge 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.

   The standard clearance 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.



EDA9420C

OIL SEAL

Check the front and rear oil seals for damage or worn surfaces. Replace any seat that is defective.

DRIVE PLATE

Replace distorted, damaged, or cracked drive plates.

REASSEMBLY EDHA5300

MAIN BEARING

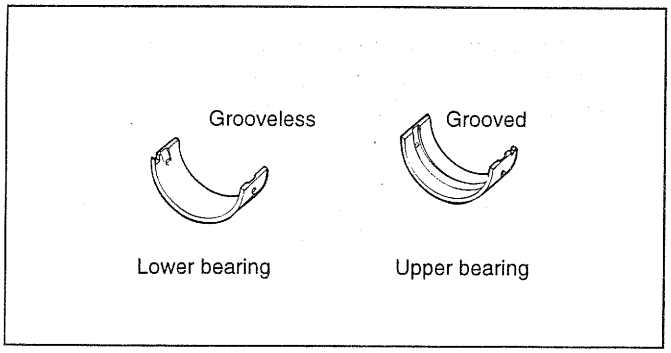
1. Install grooved main bearing (upper bearing) on cylinder block side.
2. Install grooveless main bearing (lower bearing) on main bearing cap side.
3. Install crankshaft. Apply engine oil to journal and pin.
4. Install caps with arrow mark directed toward front of engine. Cap number must be correct.
5. Tighten cap bolts to specified torque.

Tightening torque

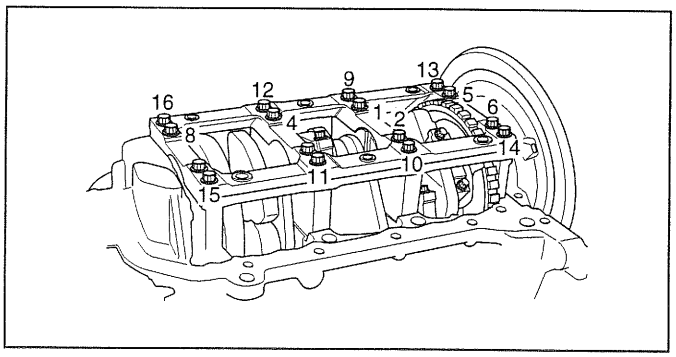
Main bearing cap bolts :

M7(9-16) : 10-12Nm (100-120 kg.cm, 7-9 lb.ft)

M10(1-8) : 14-16 Nm(140-160 kg.cm, 10-12 lb.ft)



EDA9420D



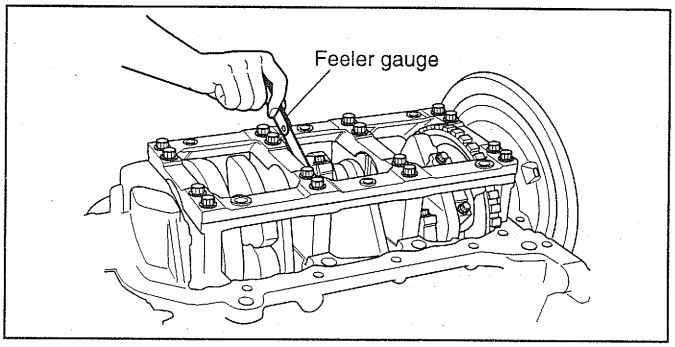
KFW3056B

6. Cap bolts should be tightened evenly in stages 4 to 5 before they are tightened to specified torque.
7. Make certain that crankshaft turns freely to check end play of the crankshaft.

Crankshaft end play

Standard : 0.070-0.250mm (0.0028-0.0098 in.)

Limit : 0.4 mm (0.016 in.)



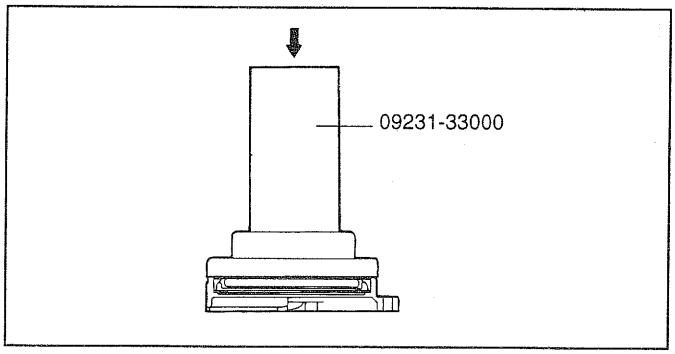
KFW3056A

8. Using special tool(09231-33000), install the rear oil seal in oil seal case.
9. Apply sealant to the area shown in the illustration. Install the oil seal case in the cylinder block.

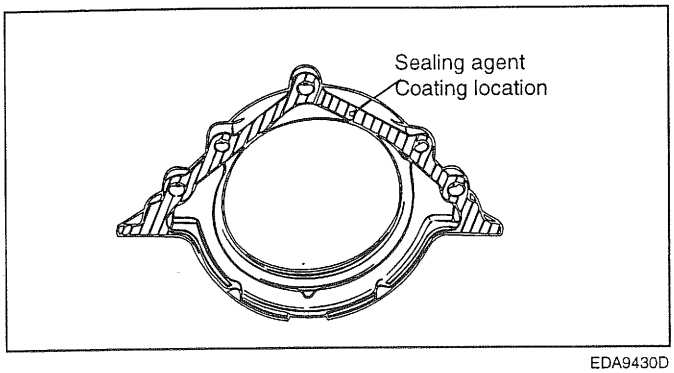
Tightening torque

Oil seal case bolt :

10-12Nm (100 -120 kg.cm, 7-9 lb.ft)



EDA9430C



EDA9430D

10. Tighten the rear plate to the specified torque.

Tightening torque

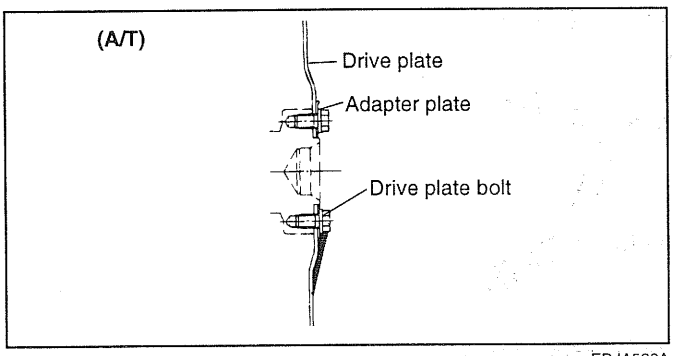
Rear plate : 10 -12 Nm (100 -120 kg.cm, 7-9 lb.ft)

11. Tighten the drive plate and the adapter plate (A/T).

Tightening torque

Drive plate and adapter plate bolt :

73-77 Nm (730-770 kg.cm, 53-56 lb.ft)



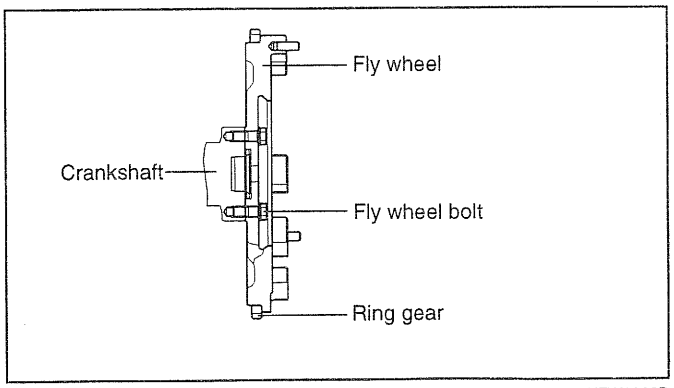
EDJA530A

12. Tighten the fly wheel (M/T).

Tightening torque

Fly wheel installation bolt :

73-77 Nm (730-770 kg.cm, 53-56 lb.ft)

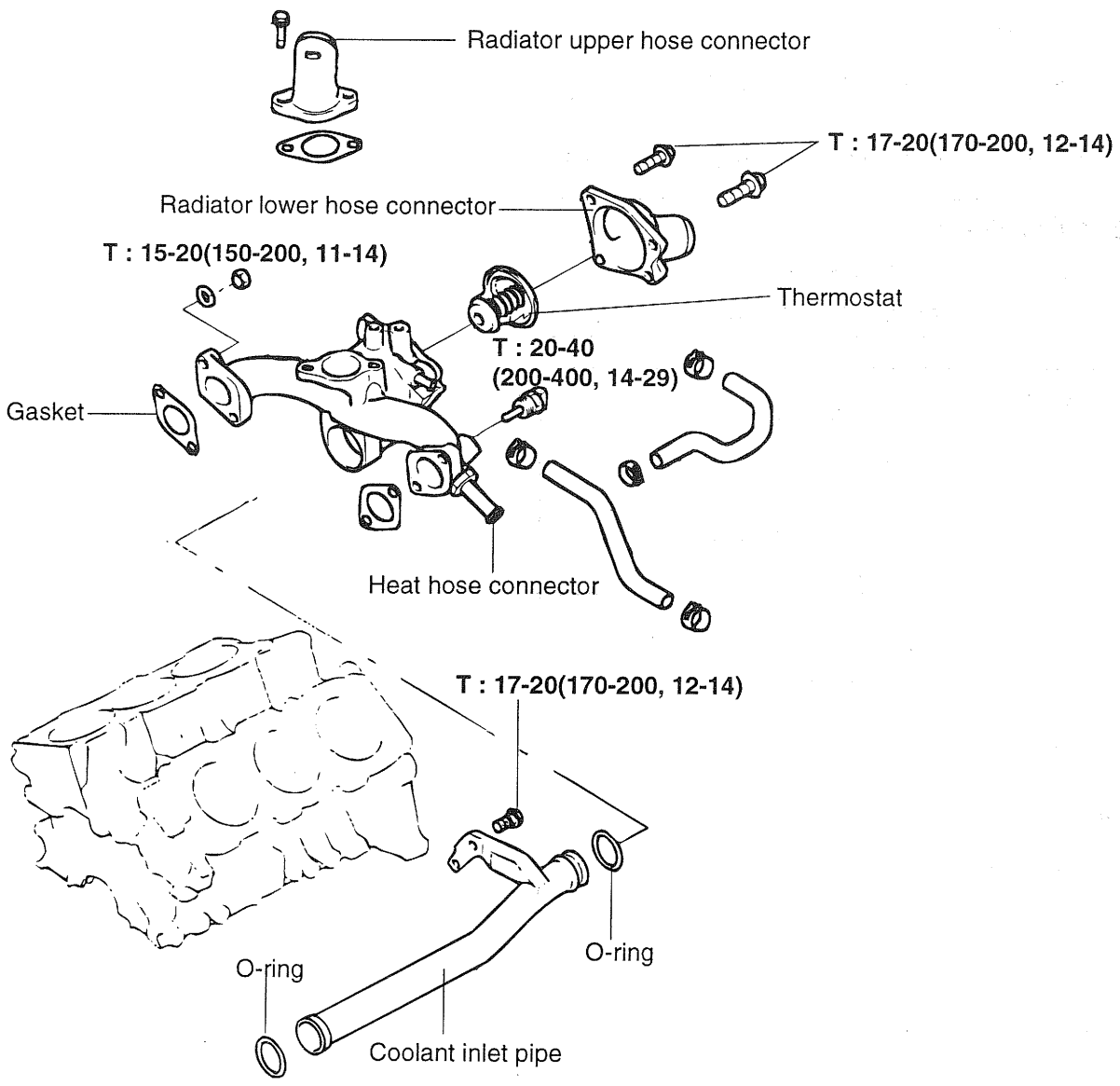


KFW3062B

COOLING SYSTEM

ENGINE COOLANT HOSE/PIPES

ENGINE COOLANT HOSE AND PIPE EDHA6000



TORQUE : Nm (kg·cm, lb·ft)

EDJA600A

INSPECTION EDHA6100

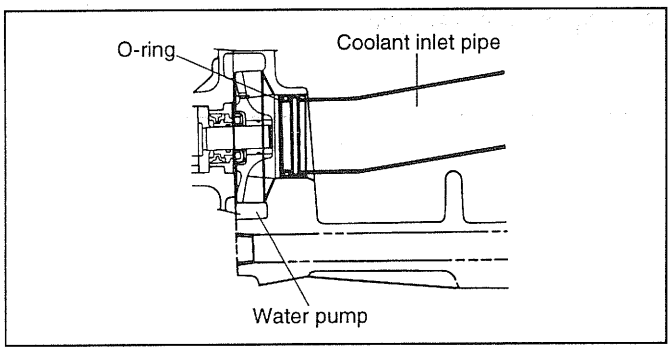
Check the engine coolant pipe and hose for cracks, damage and restrictions. Replace if necessary.

REASSEMBLY EDHA6200

Fit the O-ring in the groove provided by 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 the engine coolant pipe O-ring.**
2. **Keep the engine coolant pipe connections free of sand, dust, etc.**
3. **Insert the engine coolant pipe to the end of engine coolant pump inlet.**
4. **Whenever installing the engine coolant inlet pipe, always replace the O-ring with a new one.**

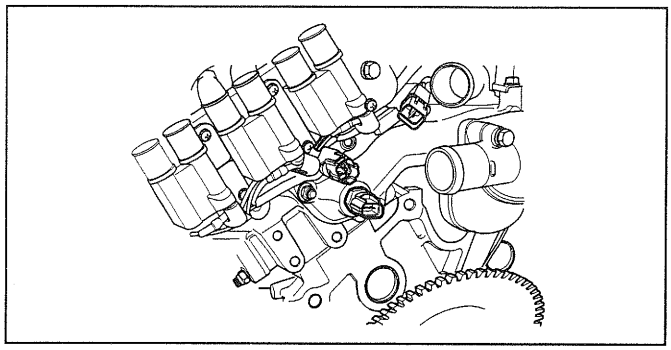


HEW2513B

COOLANT TEMPERATURE SENSOR EDHA6300

REMOVAL

1. Drain the engine coolant.
2. Remove the engine harness after disconnecting the ground cable of battery.
3. Remove the engine coolant sensor.



KFW5012A

INSTALLATION EDHA6400

1. Apply sealant to the area of screw. Tighten it to the specified torque.

Recommended sealant :

Three bond NO. 1324 or LOCTITE 262

Tightening torque

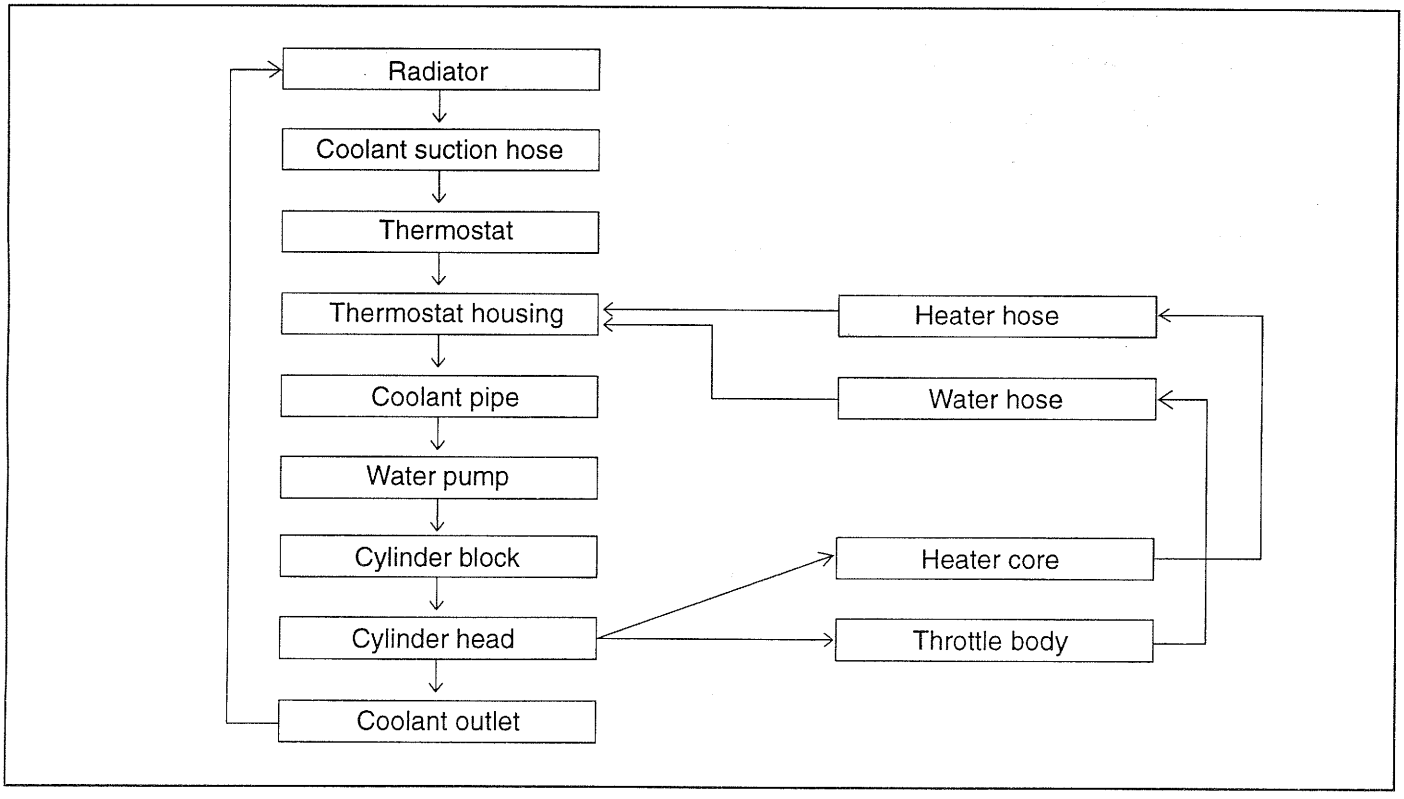
The coolant sensor :

20-40Nm(200-400 kg.cm, 14-29 lb.ft)

2. Connect the coolant sensor to the harness.
3. Connect the ground cable of battery.
4. Fill the coolant.

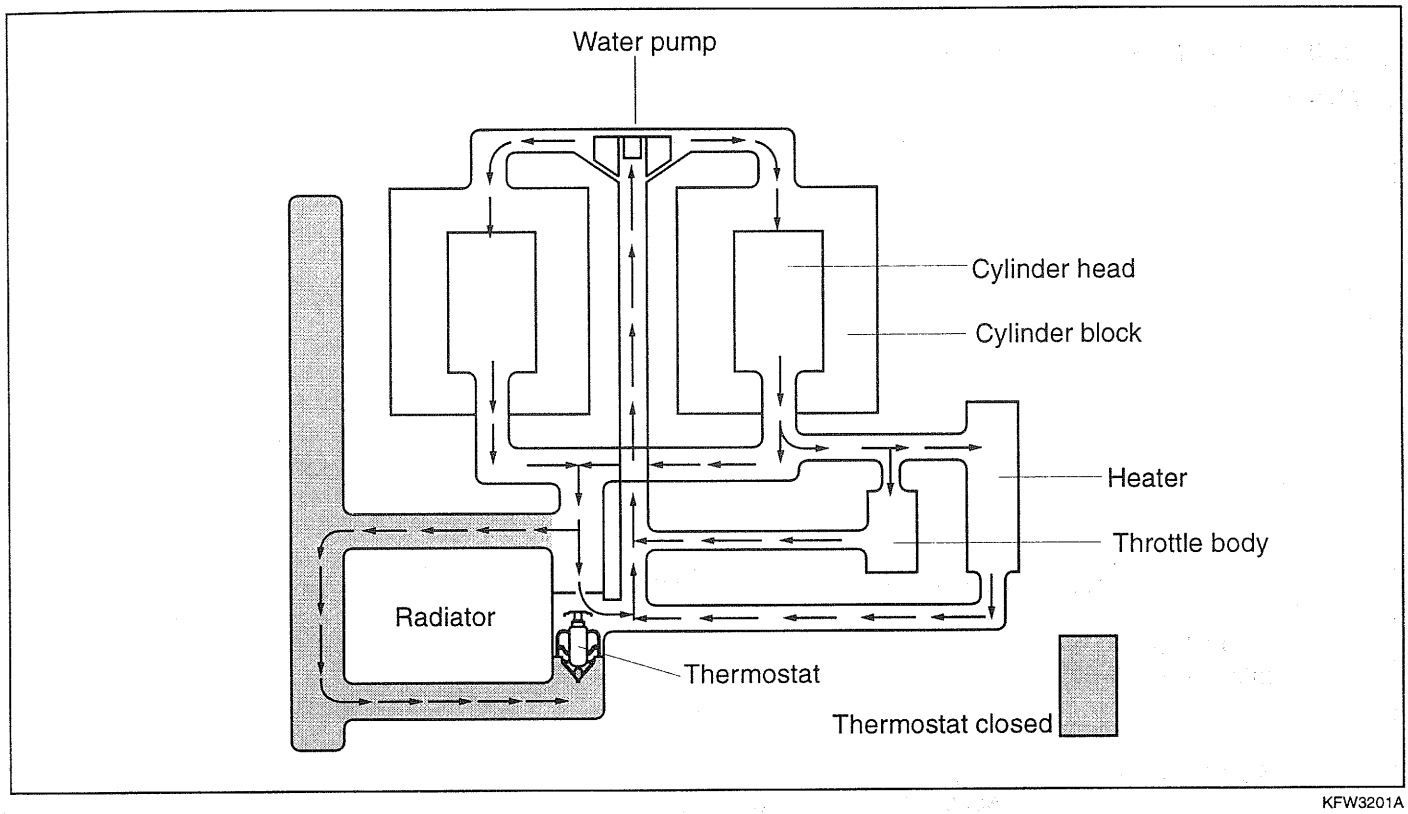
COOLING SYSTEM EDHA6500

INLET CONTROL



EDHA650A

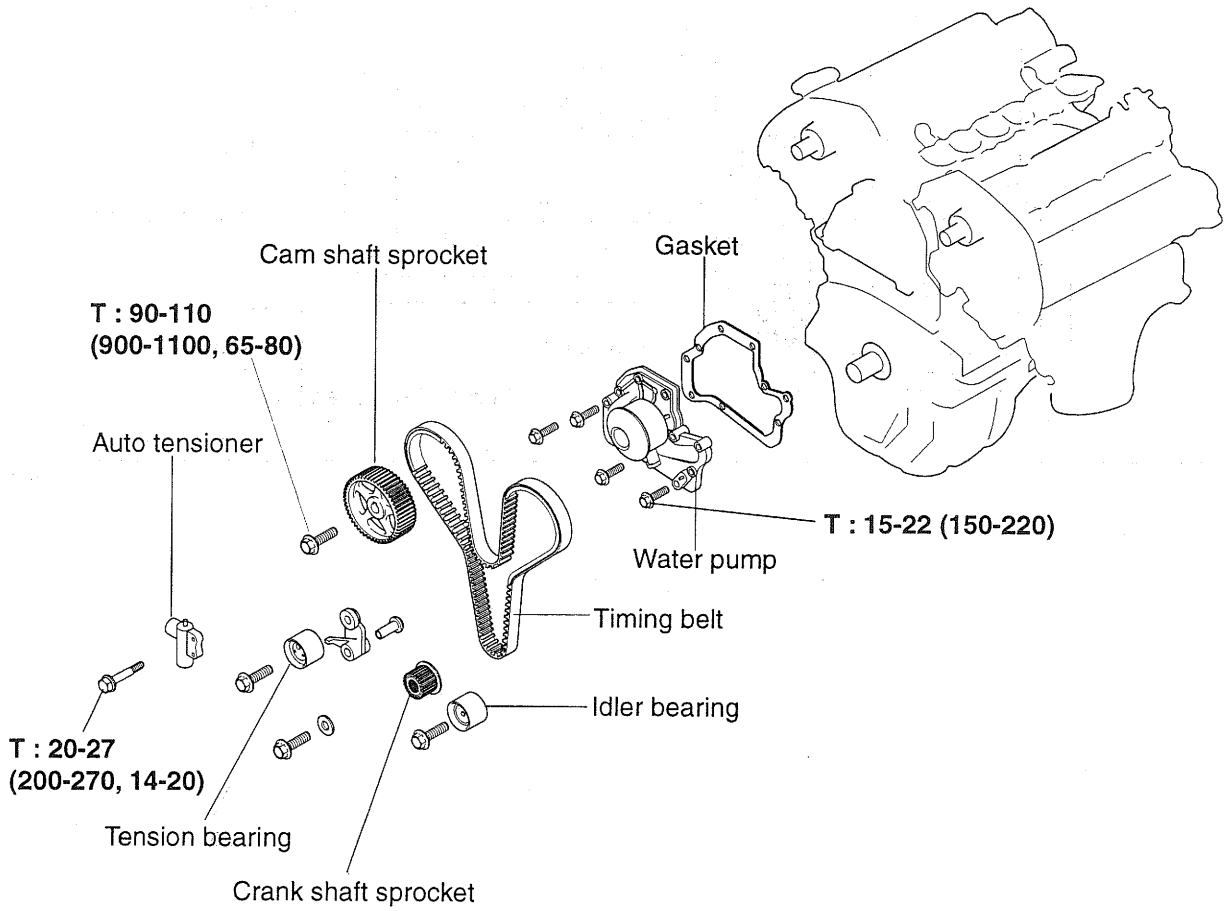
FLOW CHART



KFW3201A

ENGINE COOLANT PUMP

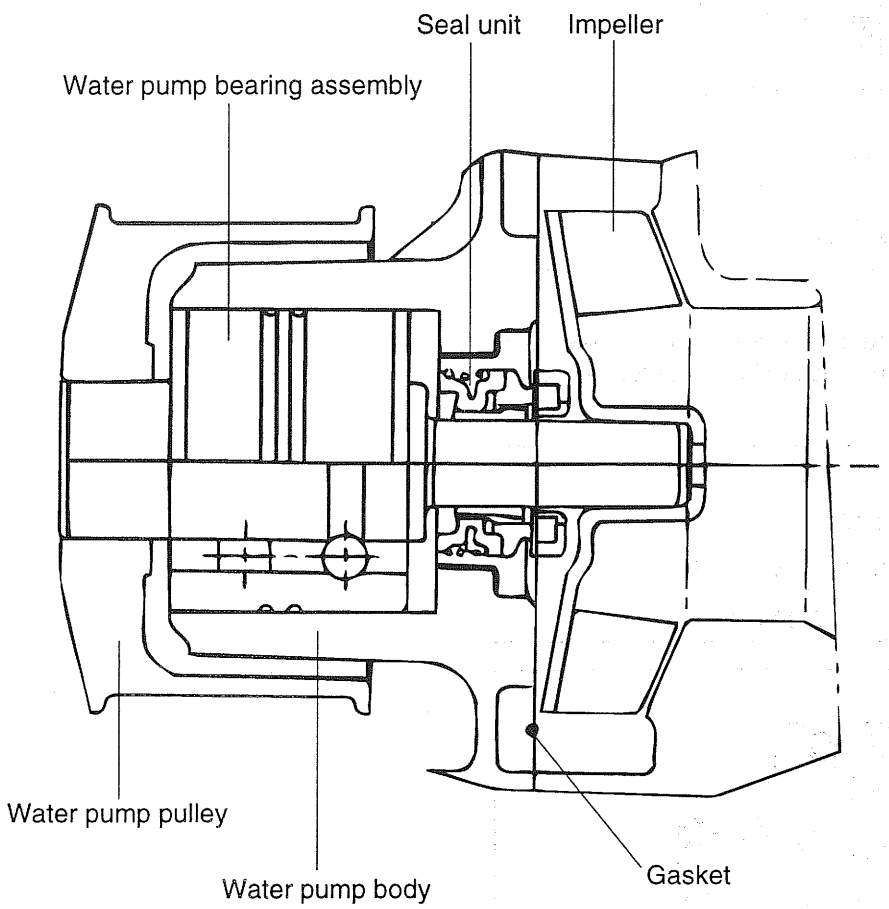
ENGINE COOLANT PUMP [FOR V-6 ENGINE EDHA7000



TORQUE : Nm (kg·cm, lb·ft)

EDJA700A

WATER PUMP EDHA7100



EDJA710A

REMOVAL EDHA7200

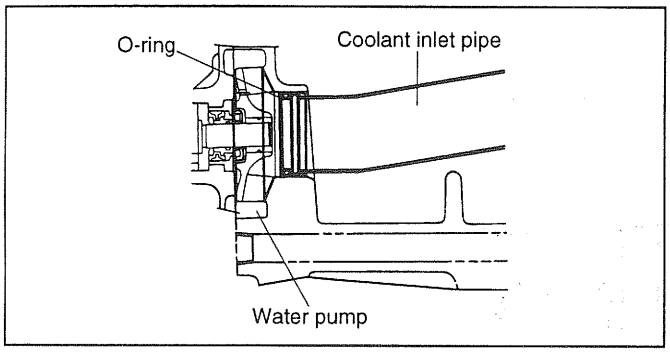
1. Using the drain plug, drain the coolant.
2. Remove the drive belt and the engine coolant pump pulley.
3. Remove the timing belt cover, the auto tensioner and idler pulley.
4. Remove the engine coolant pump mounting bolts.
5. Remove the engine coolant pump assembly from the cylinder block.

INSPECTION EDHA7300

1. Check the engine coolant pump for cracks, damage or wear, and replace the engine coolant pump assembly if necessary.
2. Check the bearing for damage, abnormal noise and sluggish rotation and replace the engine coolant pump assembly if necessary.
3. Check the seal unit for leaks and replace the engine coolant pump assembly if necessary.

INSTALLATION EDHA7400

1. Clean the gasket surfaces of the engine coolant pump body and the cylinder block.



HEW2513B

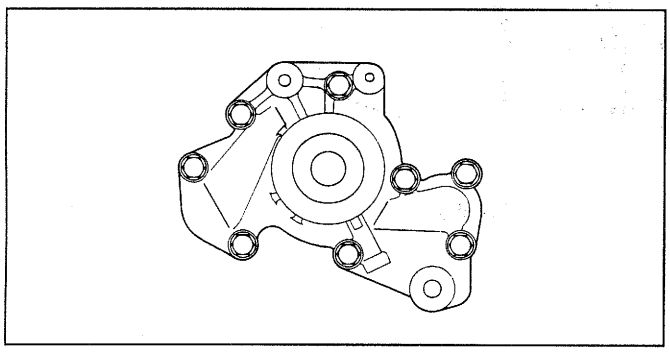
2. Install the new engine coolant pump gasket and engine coolant pump assembly. Tighten the bolts to specified torque.

Tightening torque

Engine coolant pump bolt :

Head mark "4" : 12-15 (120-150, 9-11)

Head mark "7" : 15-22 (150-220, 11-16)

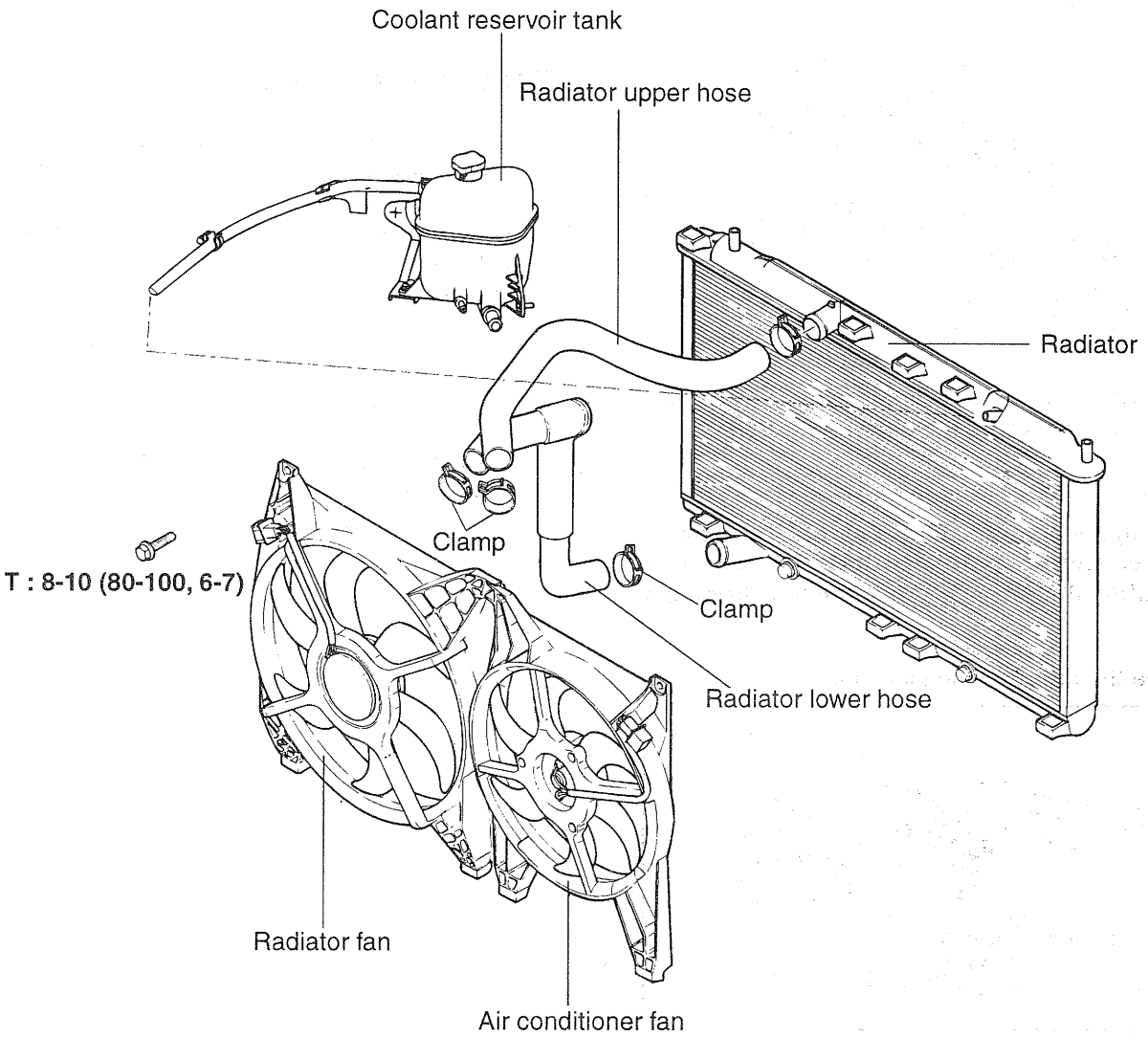


HEW2512A

3. Install the timing belt tensioner and timing belt. Adjust the timing belt tension, then install the timing belt cover.
4. Install the drive belt, and then adjust the auto tension.
5. Refill the coolant.
6. Run the engine and check for leak.

RADIATOR

RADIATOR EDHA7800

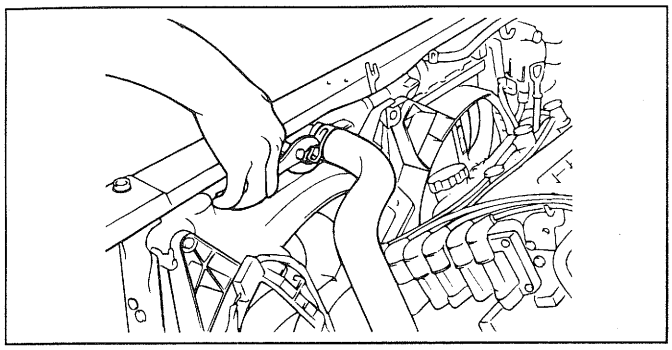


TORQUE : Nm (kg·cm, lb·ft)

EDHA001A

REMOVAL EDHA7900

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 marking the radiator hose and the hose clamp.



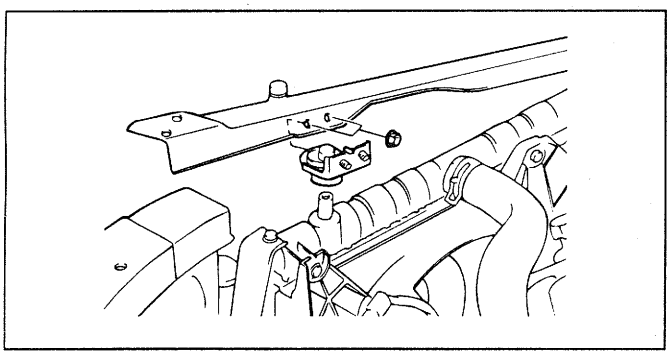
EDHA004D

5. For vehicles with automatic transaxles, disconnect the oil cooler hoses from the automatic transaxle.

CAUTION

Cover or plug the hose and nipple part of the radiator so that dust and other foreign material etc. can not enter after the hose is disconnected from the radiator.

6. Remove the radiator mounting bolt.



EDHA001C

7. Remove the radiator and the fan motor.
8. Remove the radiator fan motor and condenser fan motor from the radiator.

INSPECTION EDHA8000

1. Check for foreign material between 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)

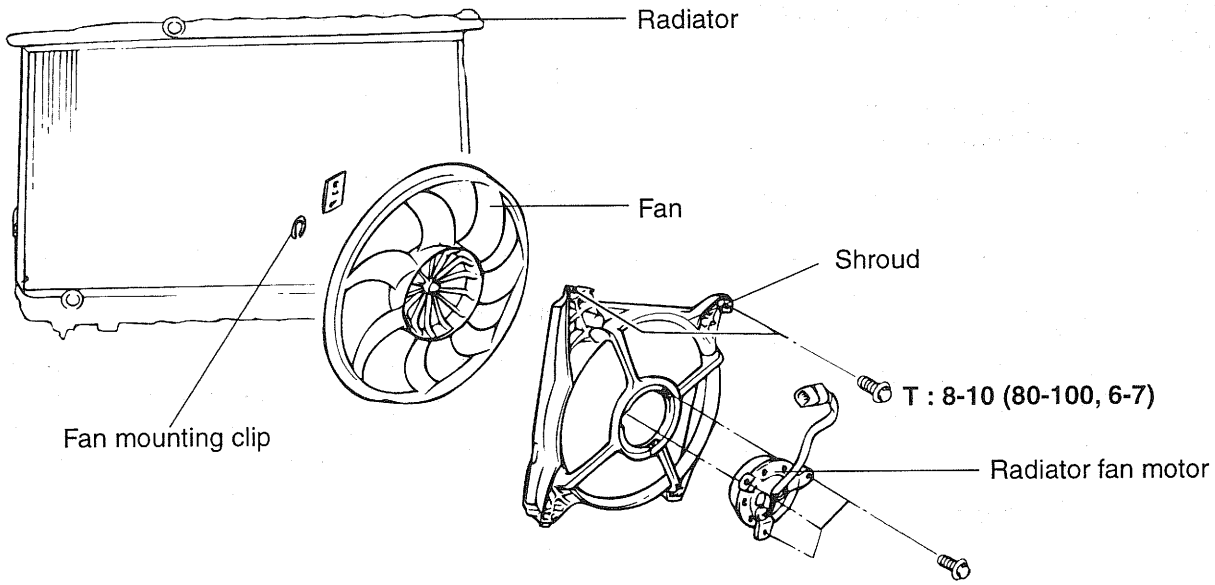
INSTALLATION EDHA8100

1. Fill the radiator and reservoir tank with a clean coolant mixture.
2. Run the engine until the coolant warms up enough so that the thermostat valve opens and then stop the engine.
3. Remove the radiator cap and pour the coolant up to the filler neck of the radiator. Fill the reservoir tank to the upper level.
4. Check that there is no leakage from the radiator, hoses or connections.

RADIATOR PAN MOTOR

RADIATOR FAN MOTOR

ASSEMBLY EDHA8500

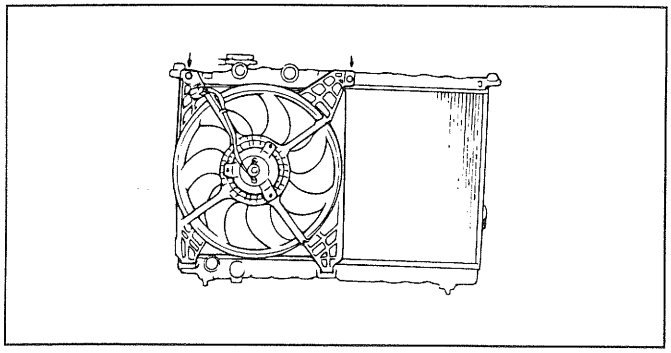


TORQUE : Nm (kg·cm, lb·ft)

ECHA011A

REMOVAL EDHA8600

1. Disconnect the ground cable from the battery cable.
2. Disconnect the connectors from the fan motor and the harness from the shroud.
3. For vehicles with automatic transaxle, remove the oil cooler hose from the shroud.
4. Remove the four bolts fixing shroud.
5. Remove the shroud with the fan motor.
6. Remove the fan mounting clip and detach the fan from fan motor.
7. Remove the three screws and detach the fan motor.

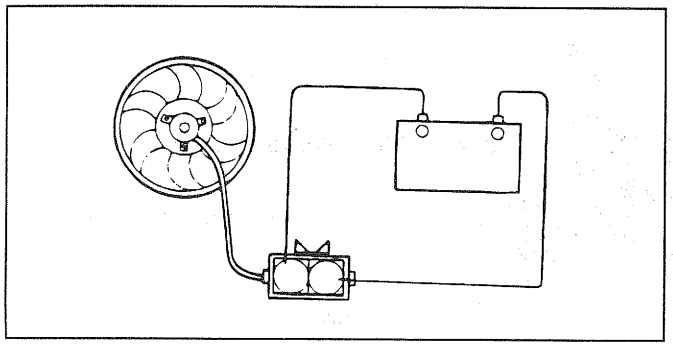


ECA9060A

INSPECTION EDHA8700

RADIATOR FAN MOTOR AND CONDENSER FAN MOTOR

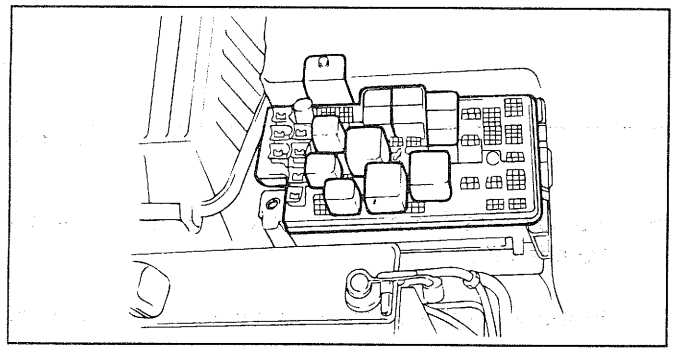
1. Check that the radiator fan rotates when battery voltage is applied between the terminals.
2. Check that there are no abnormal noises while the motor is running.



ECHA011C

RADIATOR FAN MOTOR RELAY

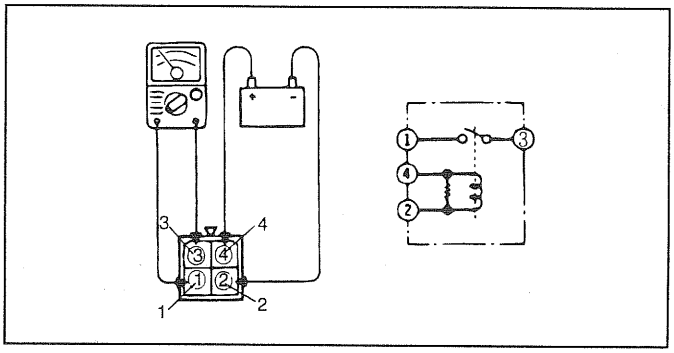
1. Remove the radiator fan motor relay (High and Low) from the relay box in the engine room.



EDAA094A

2. Check the continuity of the terminals.

Current	Terminal NO.	Yes or no
ON	Terminal 1-3	Continuity
OFF	Terminal 1-3	Non continuity
	Terminal 2-4	Continuity



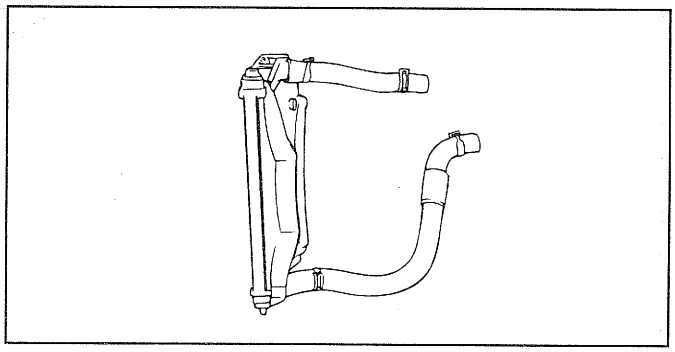
HFR25016

INSTALLATION EDHA8800

Installation is in the reverse order of removal procedures.

NOTE

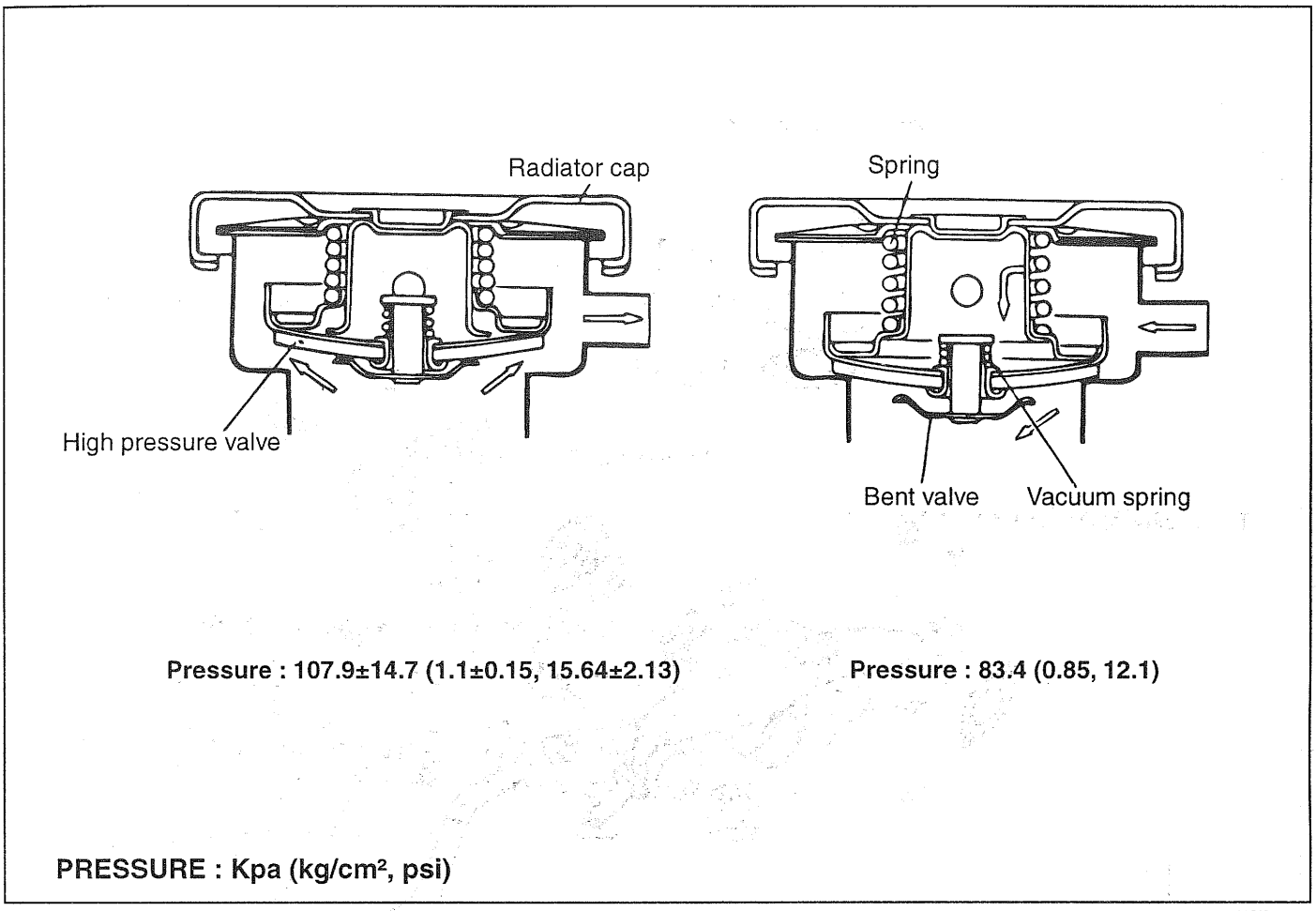
1. **Make sure the cooling fan does not come into contact with the shroud when installed.**
2. **After installation, make sure there is no unusual noise or vibration when fan is rotating.**



ECA9061A

RADIATOR CAP

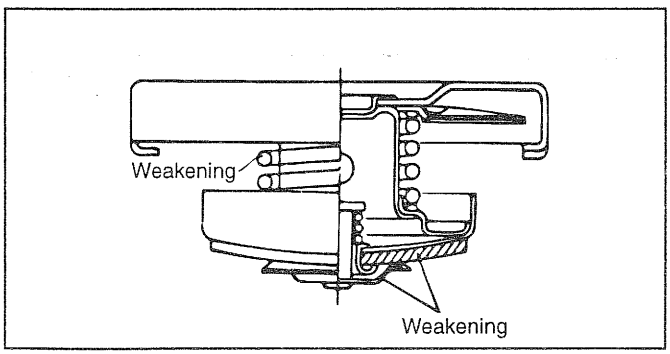
RADIATOR CAP EDHA8200



HCT25012

INSPECTION EDHA8300

1. Check the radiator cap for damage, crack and weakening.

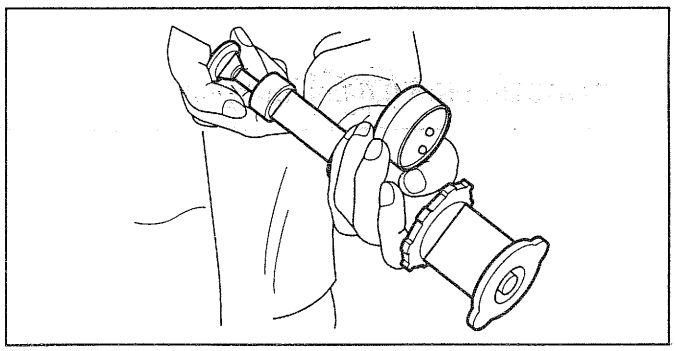


HCT25013

2. Connect the tester to the radiator cap.

3. Increase the pressure until the indicator of the gauge stops moving.

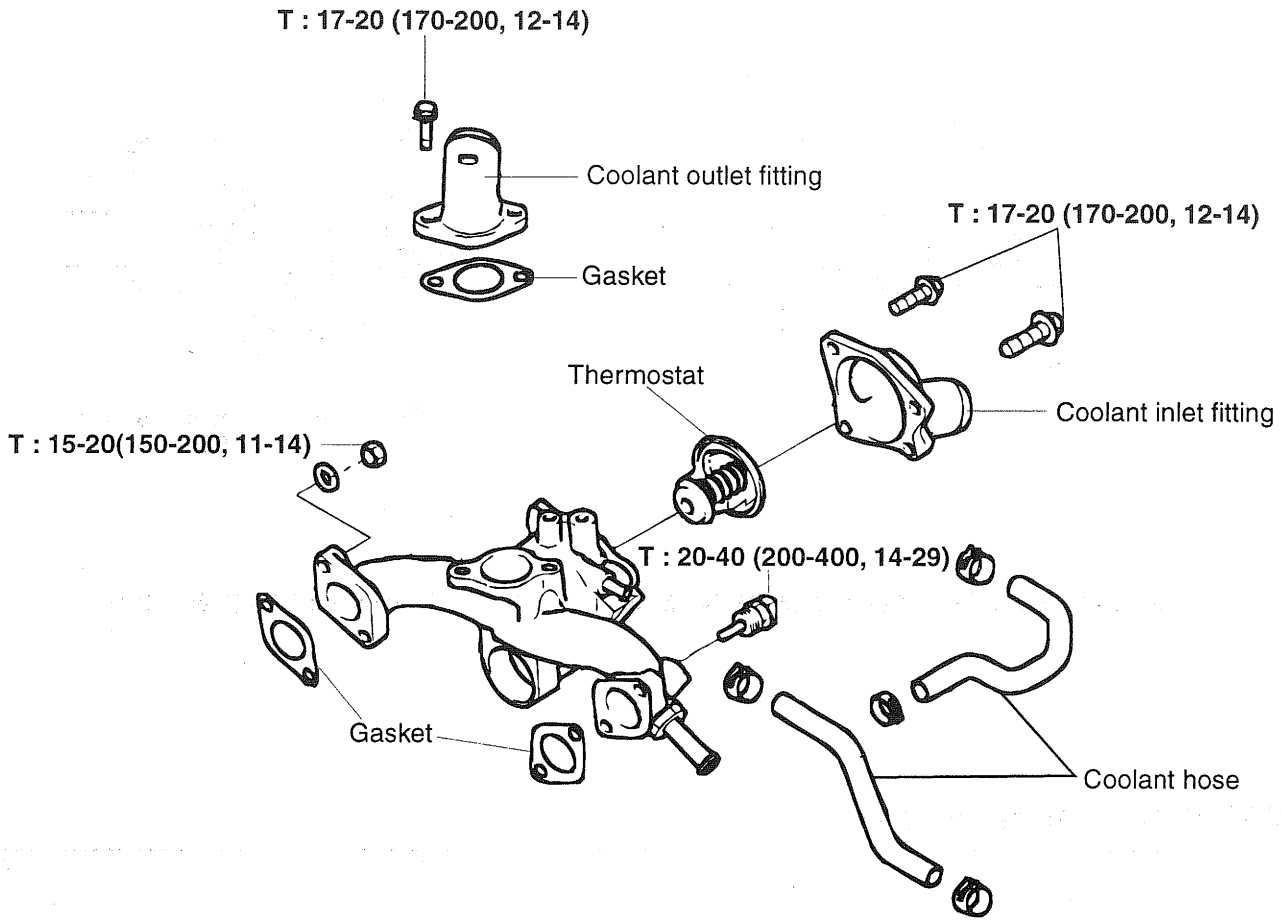
4. Replace the radiator cap if the reading does not remain for about 10 seconds.



KFW3203A

THERMOSTAT

THERMOSTAT EDHA9000

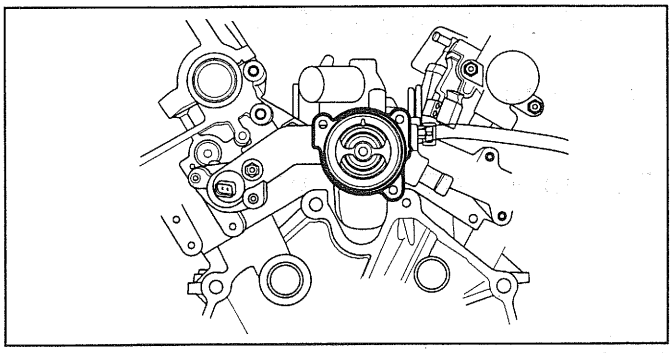


TORQUE : Nm (kg·cm, lb·ft)

EDJA900A

REMOVAL EDHA9100

1. Drain the coolant to thermostat level or below.
2. Remove the engine coolant inlet fitting and gasket.
3. Remove the thermostat.



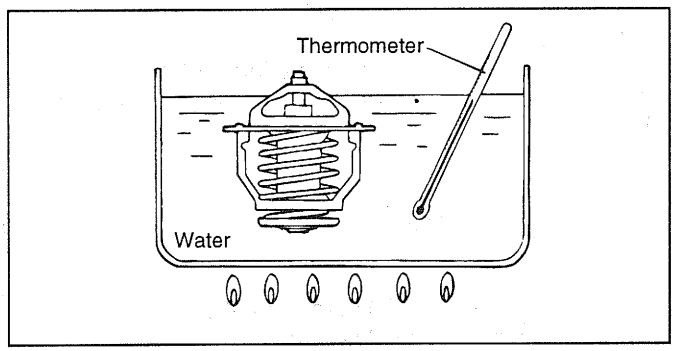
KFW3223A

INSPECTION EDHA9200

1. Heat the thermostat as shown in the illustration.
2. Check that the valve operates properly.
3. Check to determine the temperature at which the valve begins to open.

Valve opening temperature : 80-84°C (176-183.2°F)

Full opening temperature : 95°C (203°C)



ECA9600A

INSTALLATION EDHA9300

1. Check that the flange of the thermostat is correctly placed in the socket of the thermostat housing.
2. Install the engine coolant inlet fitting.

Tightening torque

Engine coolant inlet fitting bolt :

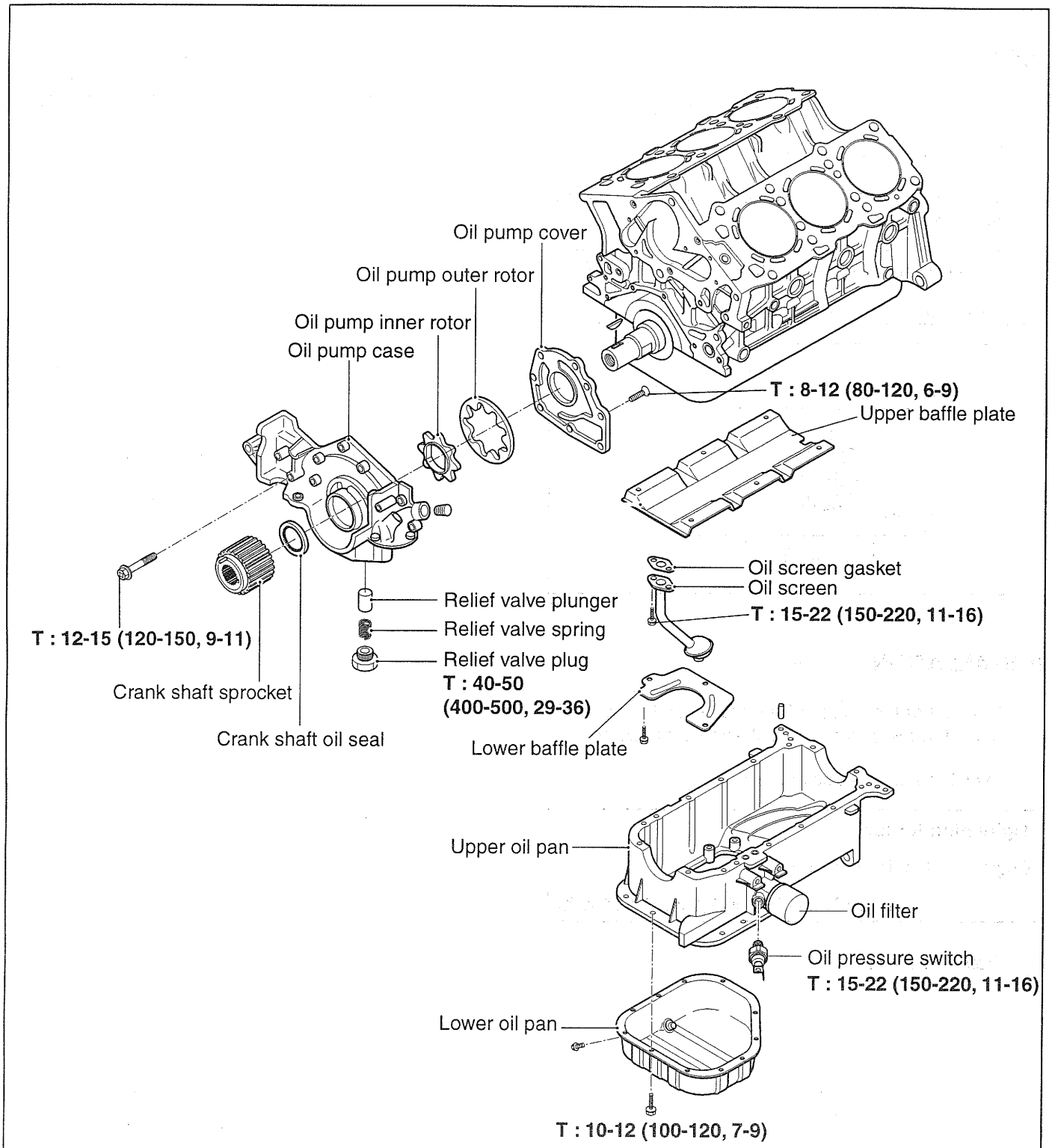
17-20 Nm (170-200 kg.cm, 12-14 lb.ft)

3. Refill the coolant.

LUBRICATION SYSTEM

OIL PUMP

OIL PUMP AND OIL PAN EDHA9400



TORQUE : Nm (kg·cm, lb·ft)

KFW3036A

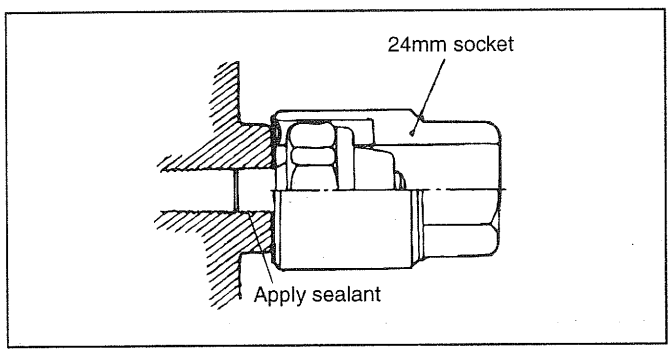
DISASSEMBLY EDHA9500

1. Remove the oil pressure switch, using 24 mm deep socket.

NOTE

Since a sealant is used on the threaded area, be careful not to damage the oil pressure switch.

2. Remove the oil filter and the oil pan.
3. Remove the oil screen and gasket.
4. Remove the three bracket securing bolts and remove the oil filter bracket and gasket.
5. Remove the oil relief valve plug from the oil pump case.
6. Remove the oil pump case.



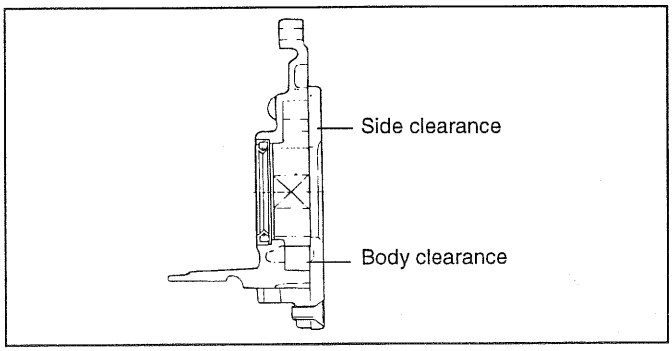
HFR20A33

INSPECTION EDHA9600

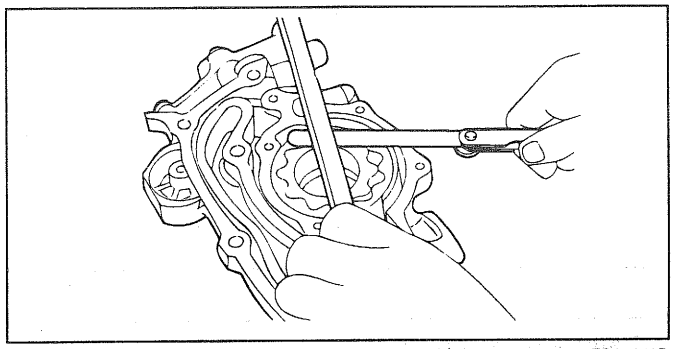
OIL PUMP

1. Visually check the parts of the oil pump case for cracks and damage.
2. Assemble the motor on the oil pump and then check the clearance with a thickness gauge.

Oil pump side clearance
Standard value
Body clearance:0.100-0.181mm (0.0039-0.0071 in.)
Side clearance:0.040-0.095mm (0.0016-0.0037 in.)



EDA9041A



EDA9340B

RELIEF PLUNGER AND SPRING

1. Check the relief plunger for smooth operation.
2. Check the relief spring for a deformation or break.

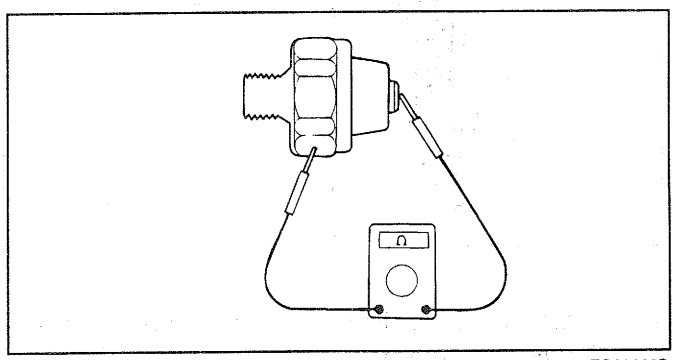
OIL FILTER BRACKET

1. Make sure that there is no damage on the surface that contacts with oil filter.
2. Check the oil filter bracket for oil leak or cracks.

OIL PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.

   If there is non continuity, replace the oil pressure switch.



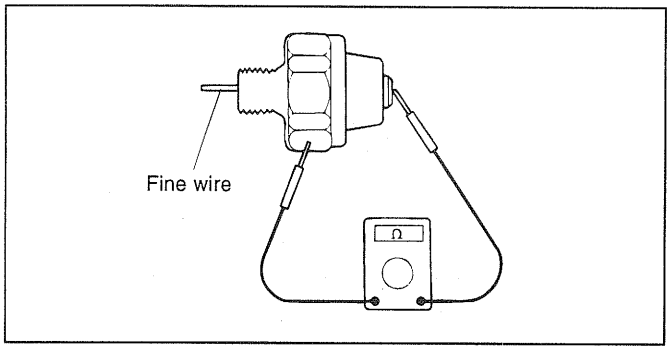
ECA9320D

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 it.

3. Or, if there is non continuity when a 50 kpa (7 psi) vacuum is applied through the oil hole, the switch is operating properly.

   Check the leakage of air. If air leaks, the diaphragm is broken, and replace it.



ECA9320E

Operation Pressure

Oil pressure switch :

20 ~40 kpa (0.2 ~ 0.4 kg/cm^2. 2.9 ~ 5.8 psi)

REASSEMBLY EDHA9700

1. Install the oil pump case with the gasket.

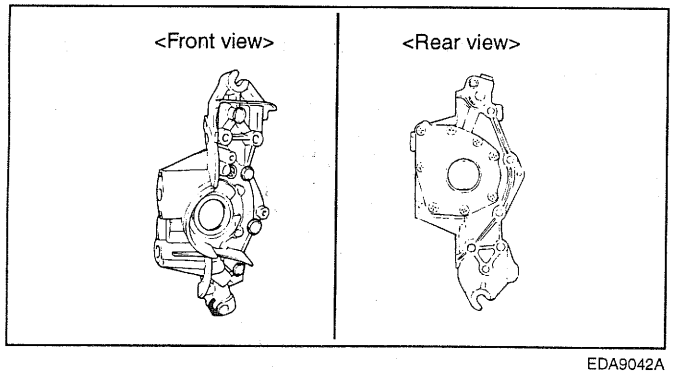
Tightening torque

Oil pump case bolt :

12-15 Nm (120-150 kg.cm, 9-11 lb.ft)

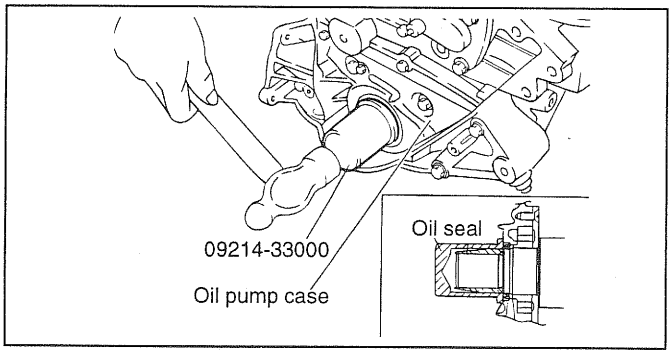
Oil pump cover screw :

8-12 Nm (80-120 kg.cm, 6-9 lb.ft)



EDA9042A

2. Install the oil seal into the oil pump case as fightly as possible, using the special tool (09214-33000).



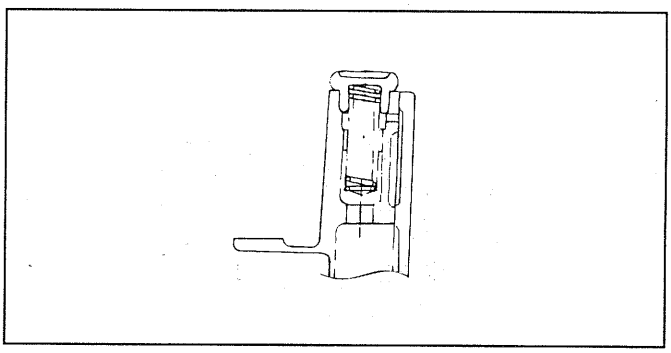
EDA9350B

3. Install the relief plunger and spring, and tighten the oil relief valve plug to the specified torque.

Tightening torque

Oil relief valve plug :

40-50 Nm (400-500 kg.cm, 29-36 lb.ft)



EDA9044A

4. Install the oil screen and a new gasket.

Tightening torque

Oil screen bolt :

15-22 Nm (150-220 kg.cm, 11-15 lb.ft)

5. Clean the gasket surfaces of the cylinder block and the oil pan.

6. Apply sealant to the groove of the oil pan flange.

NOTE

1. **Make the first cut from the end of the nozzle furnished with the sealant approx. 4 mm. After application of the sealant, do not exceed 15 minutes before installing the oil pan.**
2. **Make sure so that the sealant can't enter the inside of the oil pan.**

7. Install the oil pan and tighten the bolts to the specified torque.

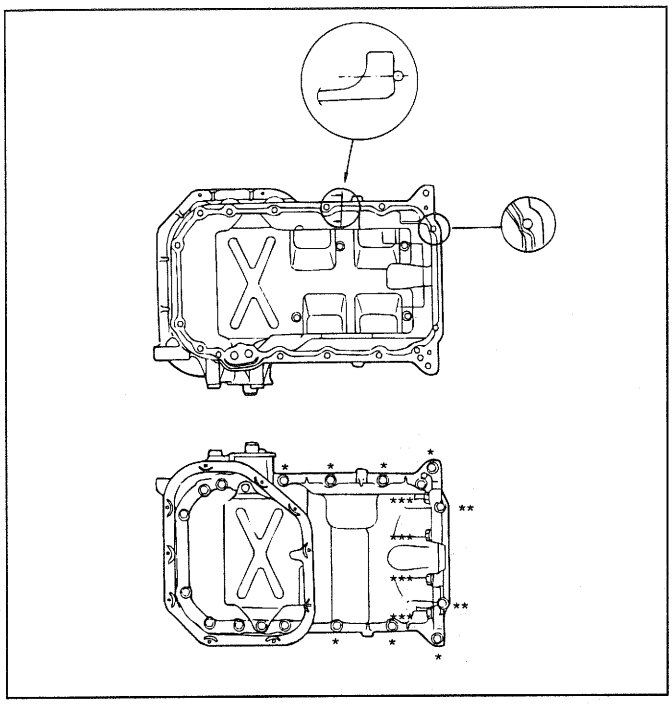
Tightening torque

Oil pan bolt :

* : 19-28 Nm (190-280 kg.cm, 14-20 lb.ft)

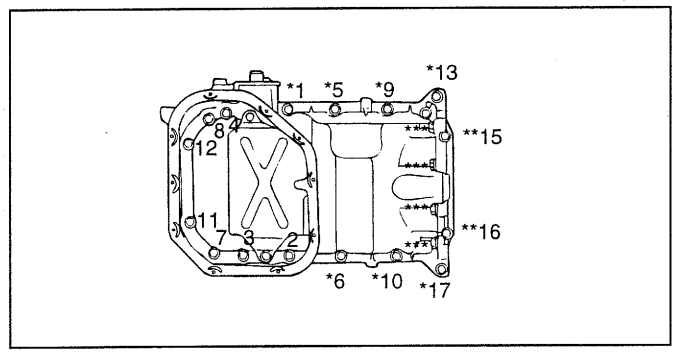
** : 5-7 Nm (50-70 kg.cm, 4-5 lb.ft)

*** : 30-42 Nm (300-420 kg.cm, 22-30 lb.ft)



EDA9045A

8. Tighten the oil pan bolt as shown in the illustration.



EDA9045B

9. Using 24 mm deep socket, install the oil pressure switch after applying sealant to the threaded area.

Sealant :

Three bond No.1141E or 3M ATD No. 8660 or equivalent

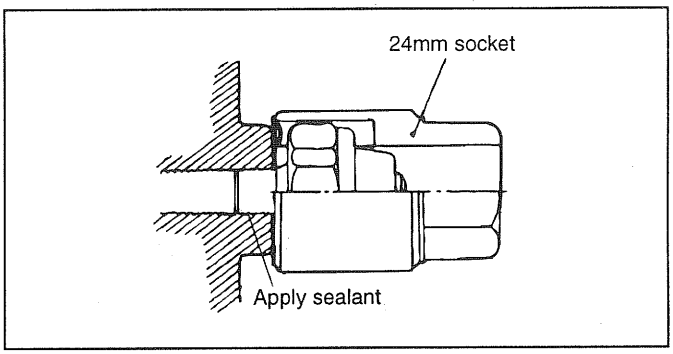
NOTE

Do not torque the oil pressure switch too much.

Tightening torque

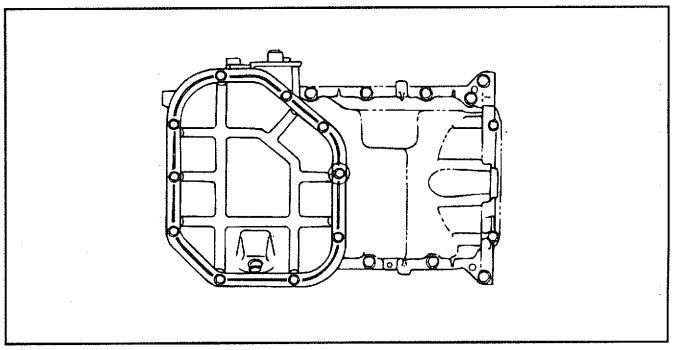
Oil pressure switch :

15-22 Nm (150-220 kg.cm, 11-16 lb.ft)



HFR20A33

10. Tighten the lower oil pan bolt as shown in figure.

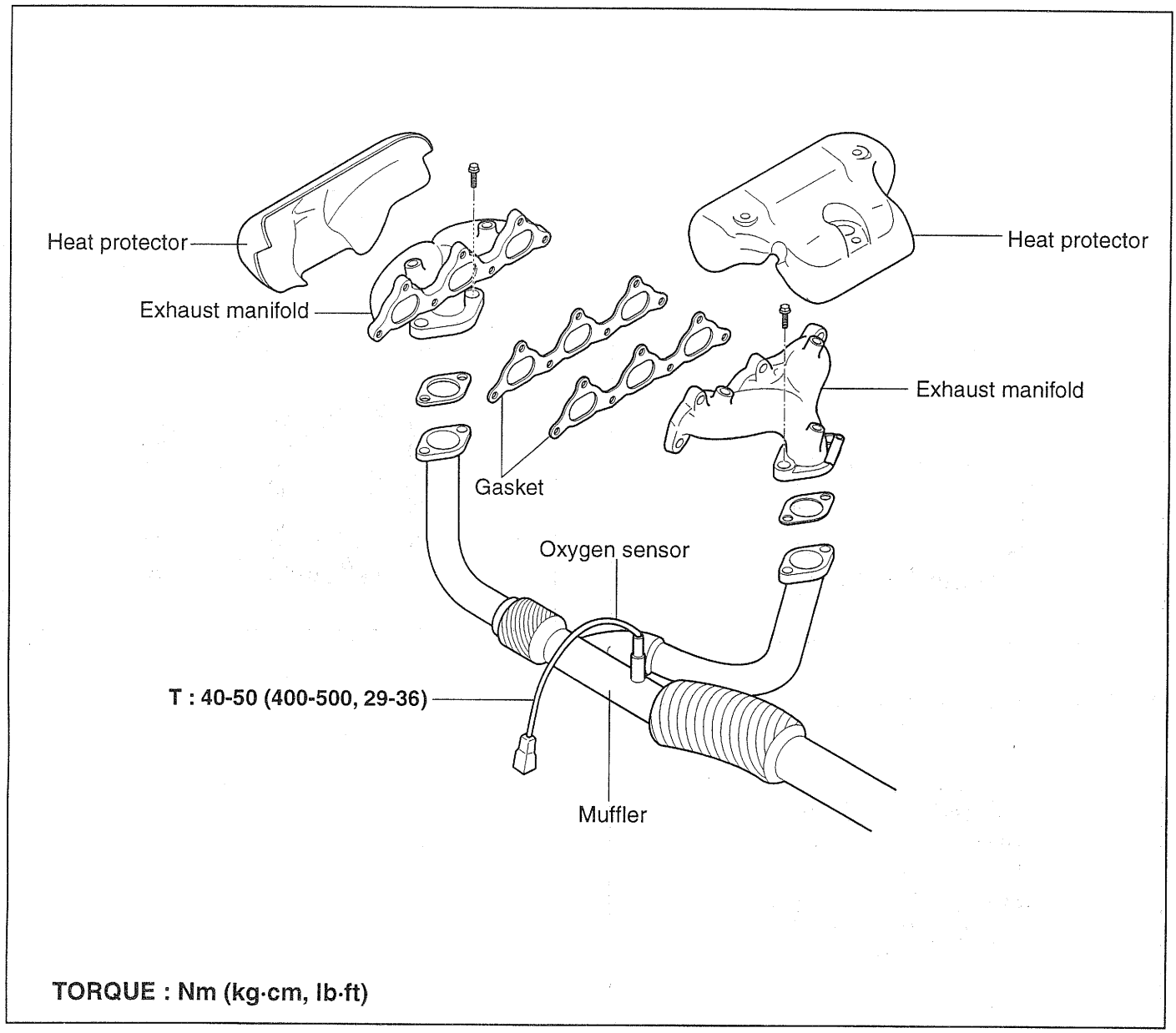


EDJA970A

INTAKE AND EXHAUST SYSTEM

EXHAUST MANIFOLD

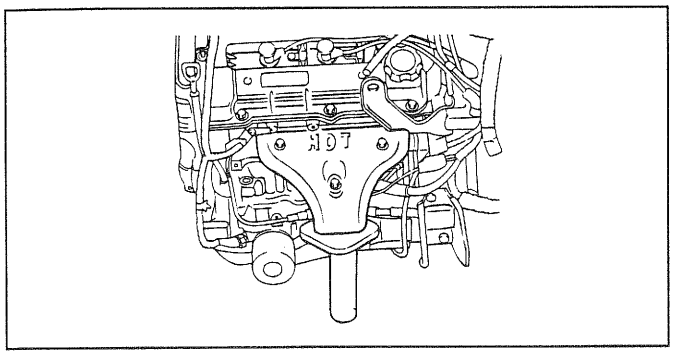
EXHAUST MANIFOLD EDHAA000



KFW3242A

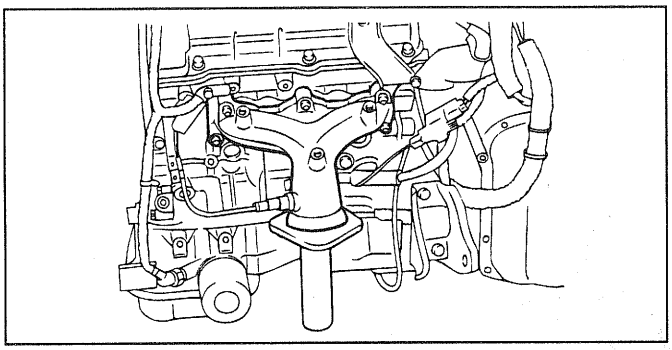
REMOVAL EDHAA100

1. Remove the heat protector.



EDHA011A

2. Remove the exhaust manifold.



EDHA011B

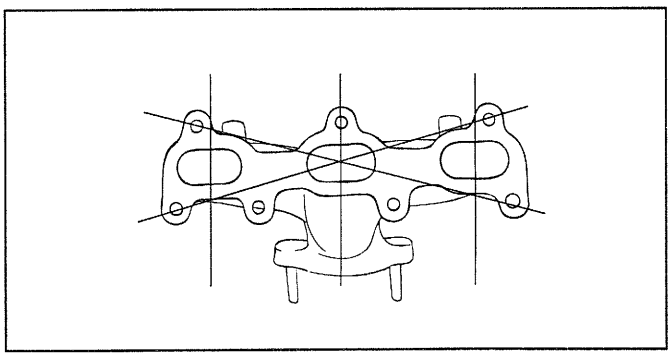
3. Remove the exhaust manifold gasket.

INSPECTION EDHAA200

1. Check for damage or crack.
2. Using a straight edge and feeler gauge, check for distortion on the cylinder head matching surface.

Standard value : 0.15 mm (0.006 in.) or less

Service limit : 0.3 mm (0.012 in.) or less



EDA9069A

3. Check the exhaust manifold for damage, crack.

INSTALLATION EDHAA300

1. Install the exhaust manifold with gasket.

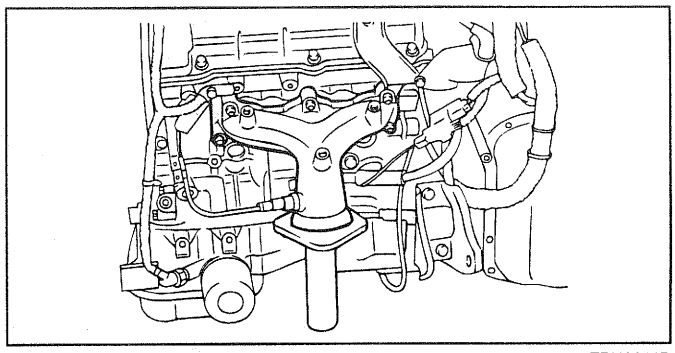
Tightening torque

Exhaust manifold :

25-30N.m (250-300 kg.cm, 18-22 lb.ft)

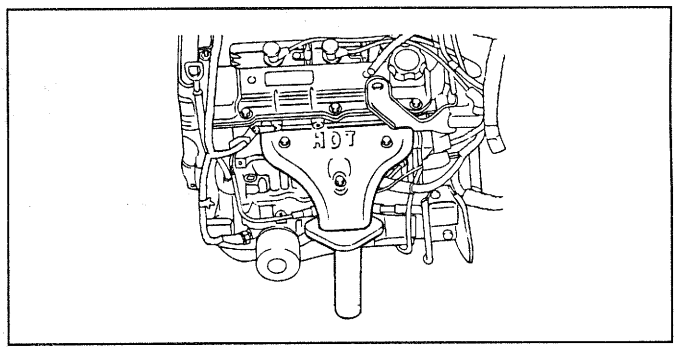
NOTE

Do not use the used exhaust manifold gasket.



EDHA011B

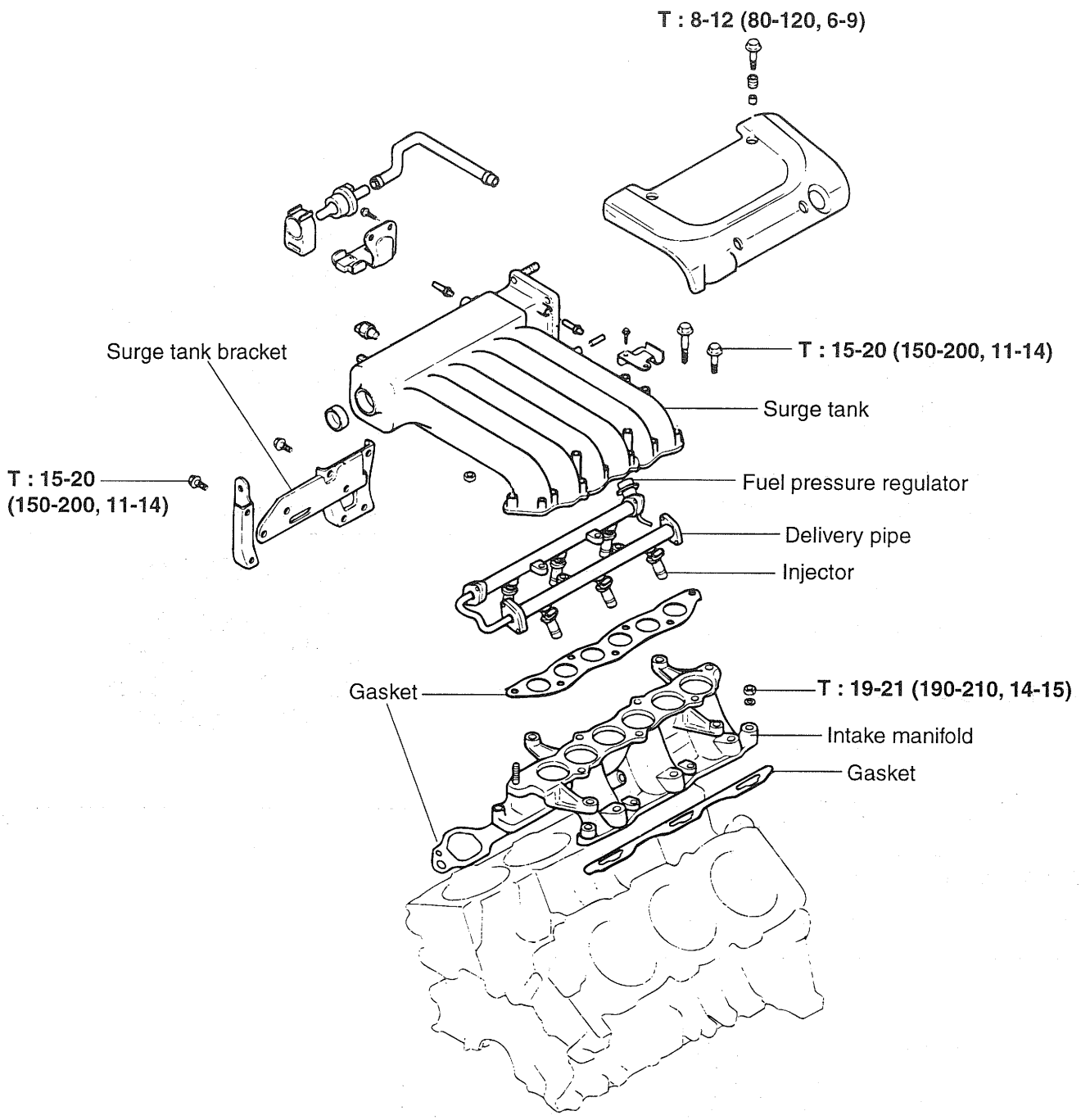
2. Install the heat protector



EDHA011A

INTAKE MANIFOLD

INTAKE MANIFOLD EDHAA500

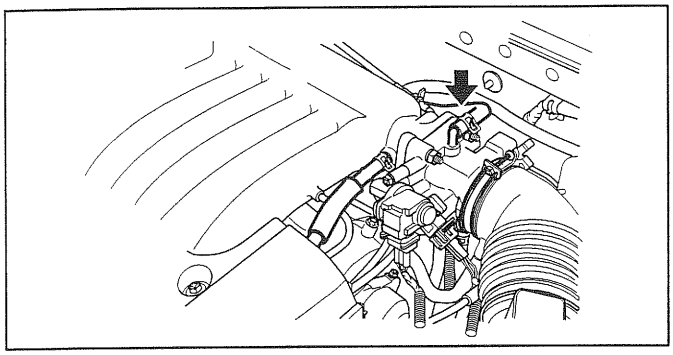


TORQUE : Nm (kg·cm, lb·ft)

ECB9505E

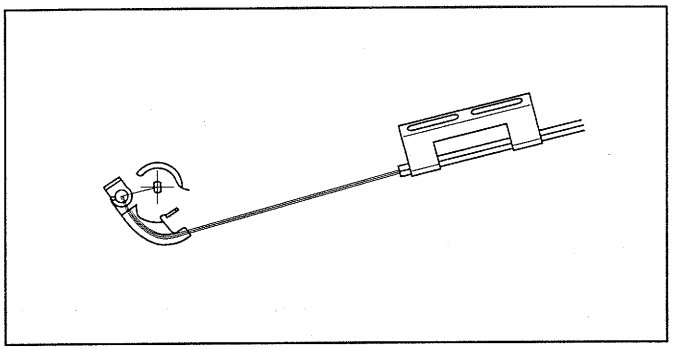
REMOVAL EDHAA600

1. Remove the air intake hose connected to the throttle body.



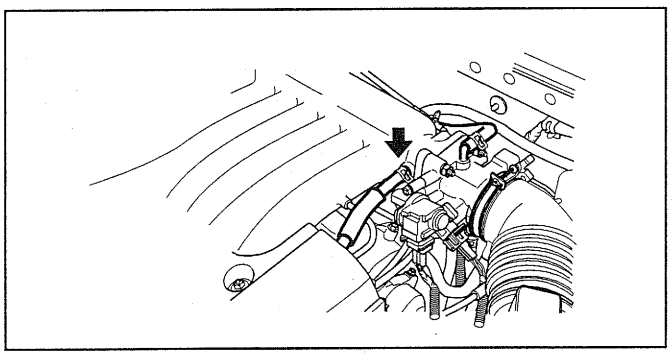
KFW3230A

2. Remove the accelerator and cruise control cables.
3. Remove the engine coolant hose and throttle body.



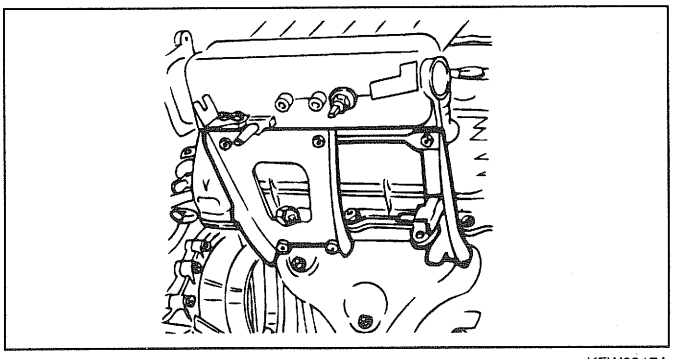
KFW3231A

4. Remove the P.C.V. hose and brake booster vacuum hoses.
5. Disconnect the vacuum hose connections.



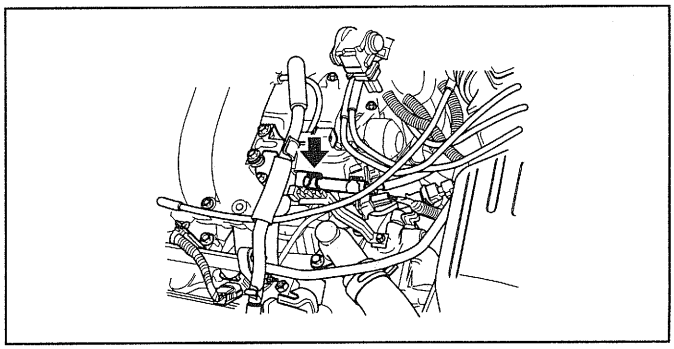
KFW3230B

6. Remove the surge tank stay.



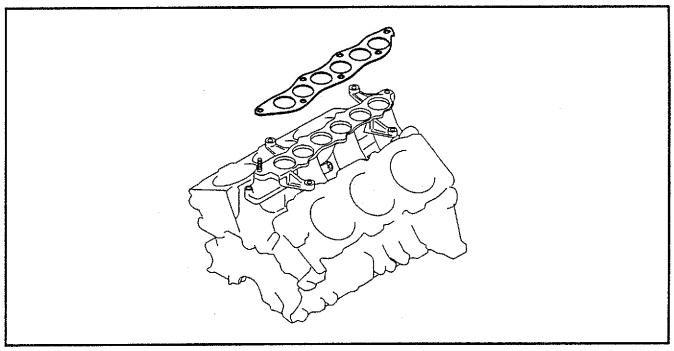
KFW2817A

7. Decrease the pressure in the fuel pipe line to prevent the fuel from flowing over.
8. Disconnect the connector from high pressure hose.



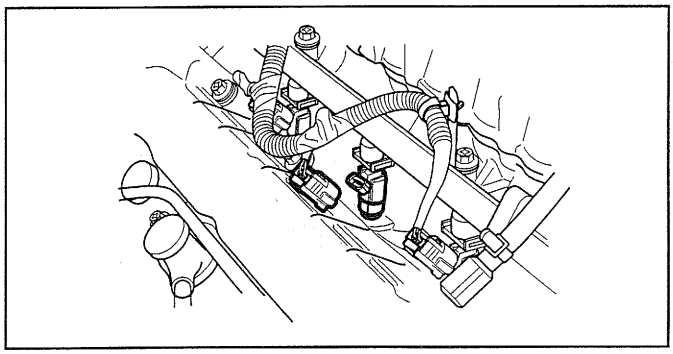
KFW3234A

9. Remove the surge tank and gasket.



KFW3236A

10. Disconnect the fuel injector harness connector.

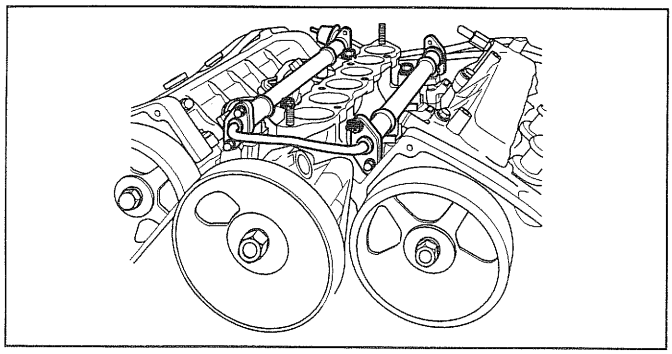


KFW3237A

11. Remove the delivery pipe with the fuel injector and the pressure regulator.

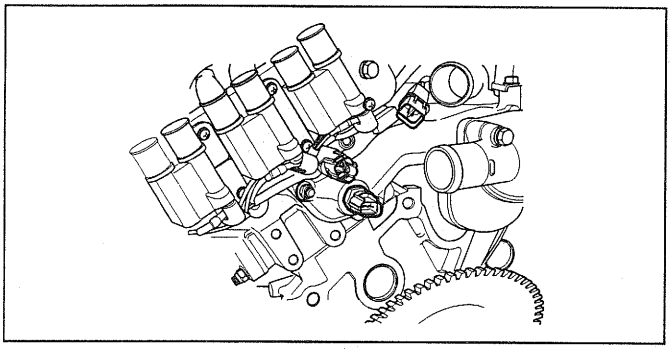
NOTE

When the delivery pipe is removed, careful not to drop the injector.

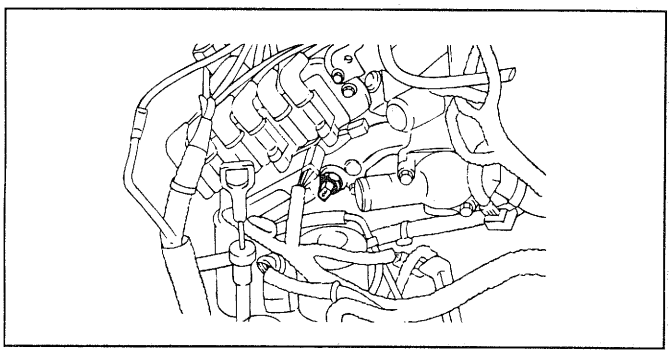


KFW3238A

12. Disconnect the wiring harness of coolant sensor assembly.

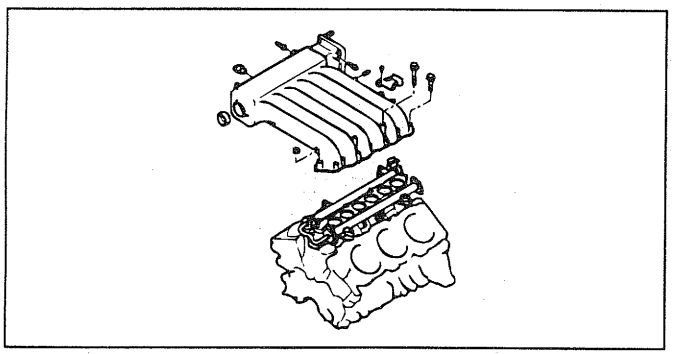


KFW5012A



EDHA021B

13. Remove the surge tank.



KFW3239A

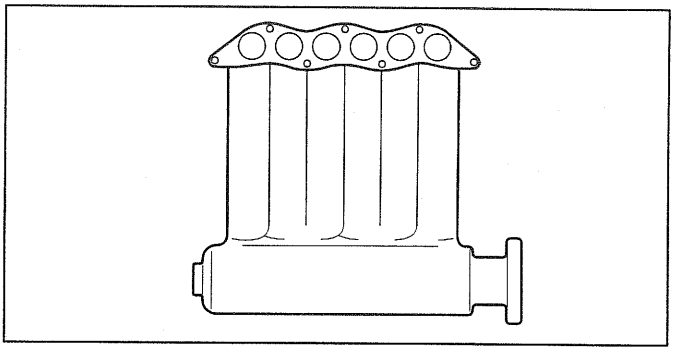
INSPECTION EDHAA700

SURGE TANK AND INTAKE MANIFOLD

1. Check the surge tank and intake manifold for damage, cracking or restriction of the vacuum outlet port, water or gas passages.
2. Check for distortion on the surface using a straight edge and feeler gauge.

Standard value : 0.15 mm (0.006 in.) or less

Service limit : 0.2 mm (0.0078 in.)



KFW3240A

INSTALLATION EDHAA800

1. Install the intake manifold and delivery pipe according to the reverse order of the removal procedure.

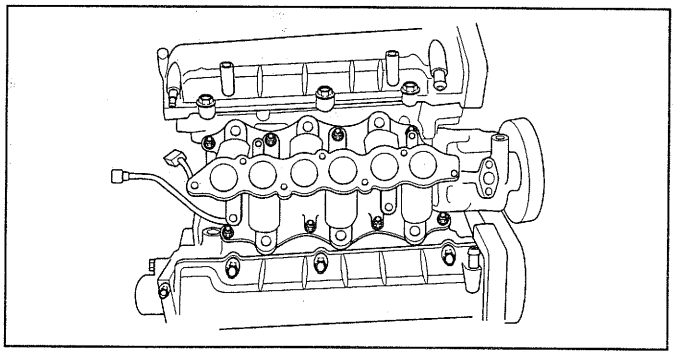
Tightening torque

Intake manifold :

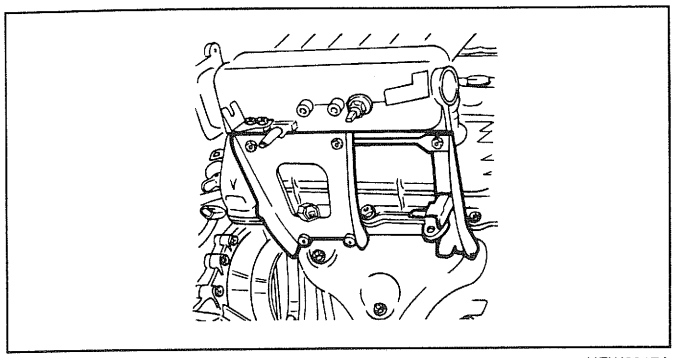
19-21 N.m (190-210 kg.cm, 14-15 lb.ft)

Surge tank :

15-20 N.m (150-200 kg.cm, 11-14lb.ft)



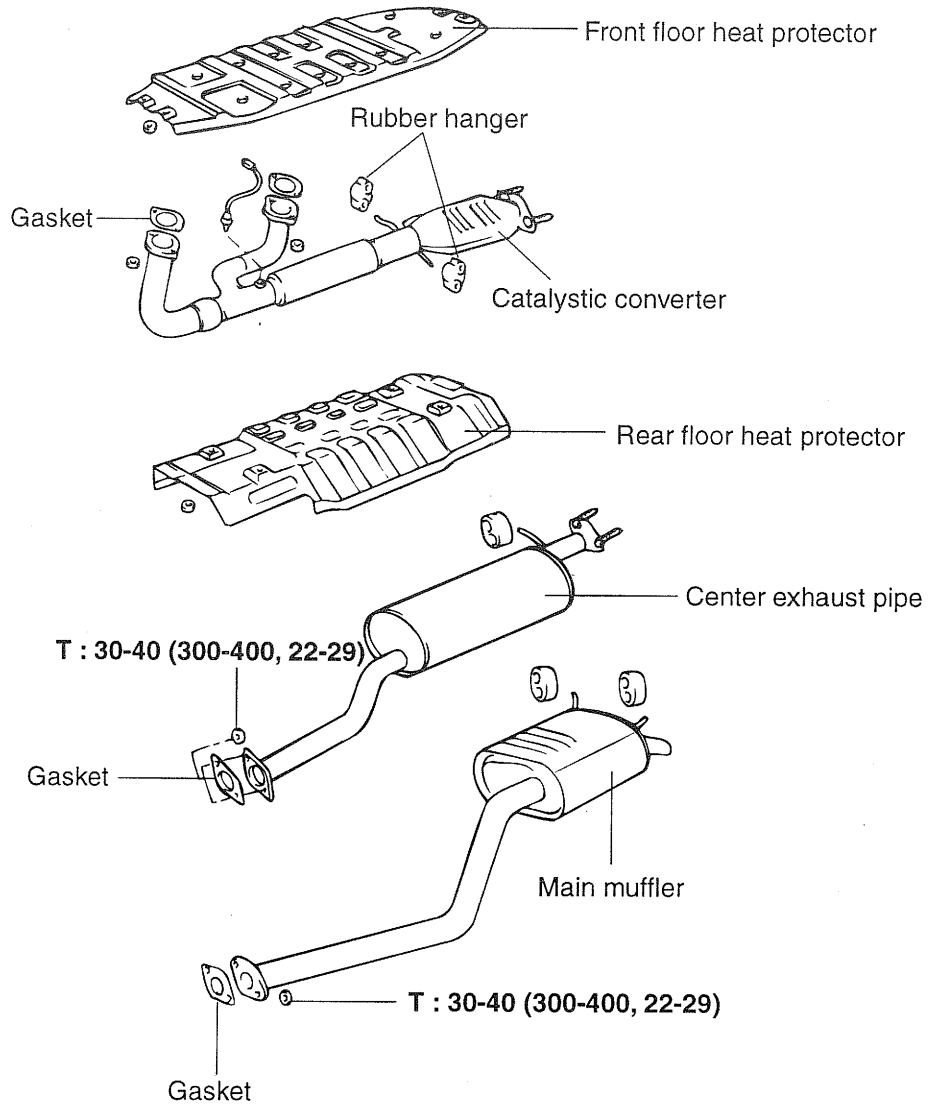
KFW3241A



HEW2817A

MUFFLER

MUFFLERS EDHAB000



TORQUE : Nm (kg·cm, lb·ft)

EDHA012A

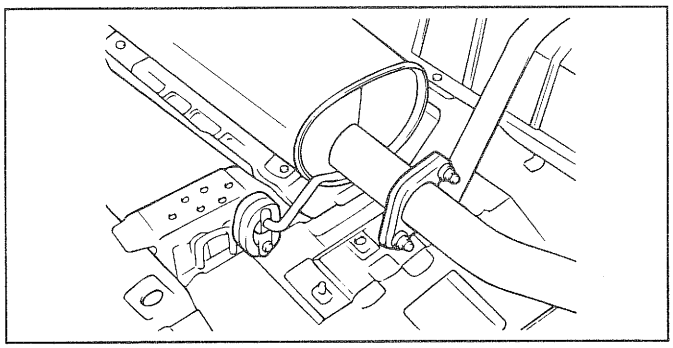
REMOVAL EDHAB100

MAIN MUFFLER

CAUTION

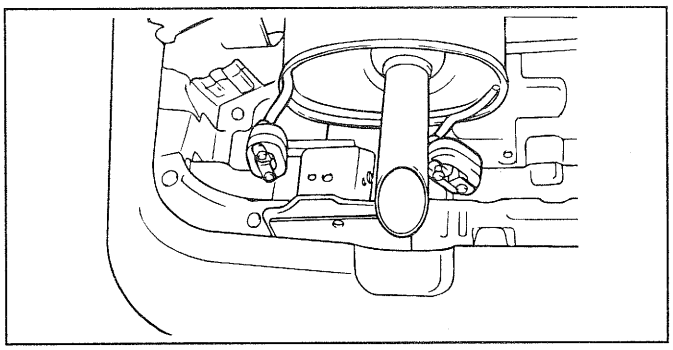
Before removing or inspecting the exhaust system, ensure that the exhaust system is cool enough.

1. Disconnect the main muffler from the center exhaust pipe.



ECHA019E

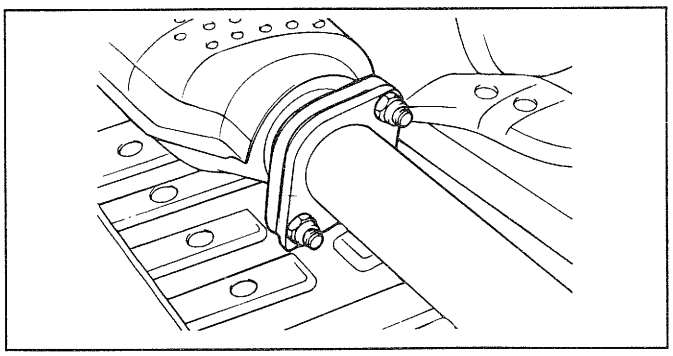
2. Remove the rubber hangers and the main muffler.



ECHA019B

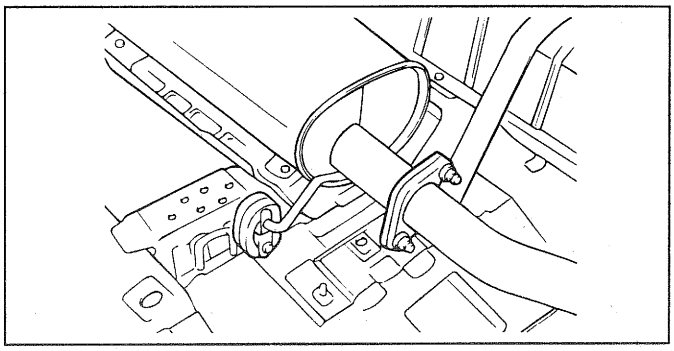
CENTER EXHAUST PIPE

1. Disconnect the center exhaust pipe from the main muffler.
2. Remove the center exhaust pipe from the front exhaust pipe .



ECHA019D

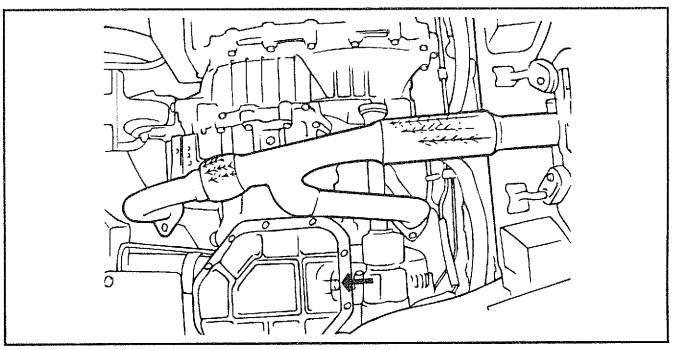
3. Remove the rubber hangers and take out the center exhaust pipe.



ECHA019E

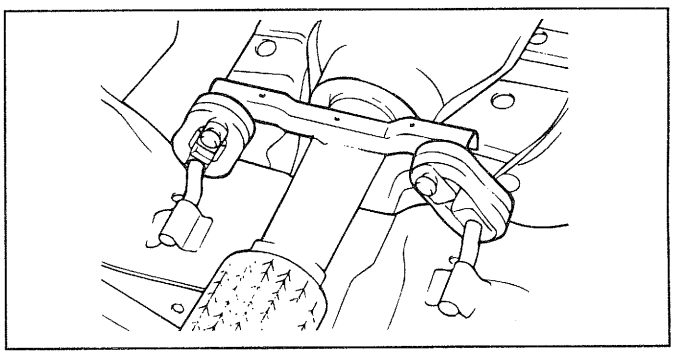
FRONT EXHAUST PIPE (INCLUDING CATALYTIC CONVERTER)

1. Remove the front exhaust pipe from the center exhaust pipe.
2. Remove the front exhaust pipe bolt and the exhaust manifold pipe mounting nuts.



ECHA015B

3. Remove the front exhaust pipe from the rubber hanger.



ECHA019H

INSPECTION EDHAB200

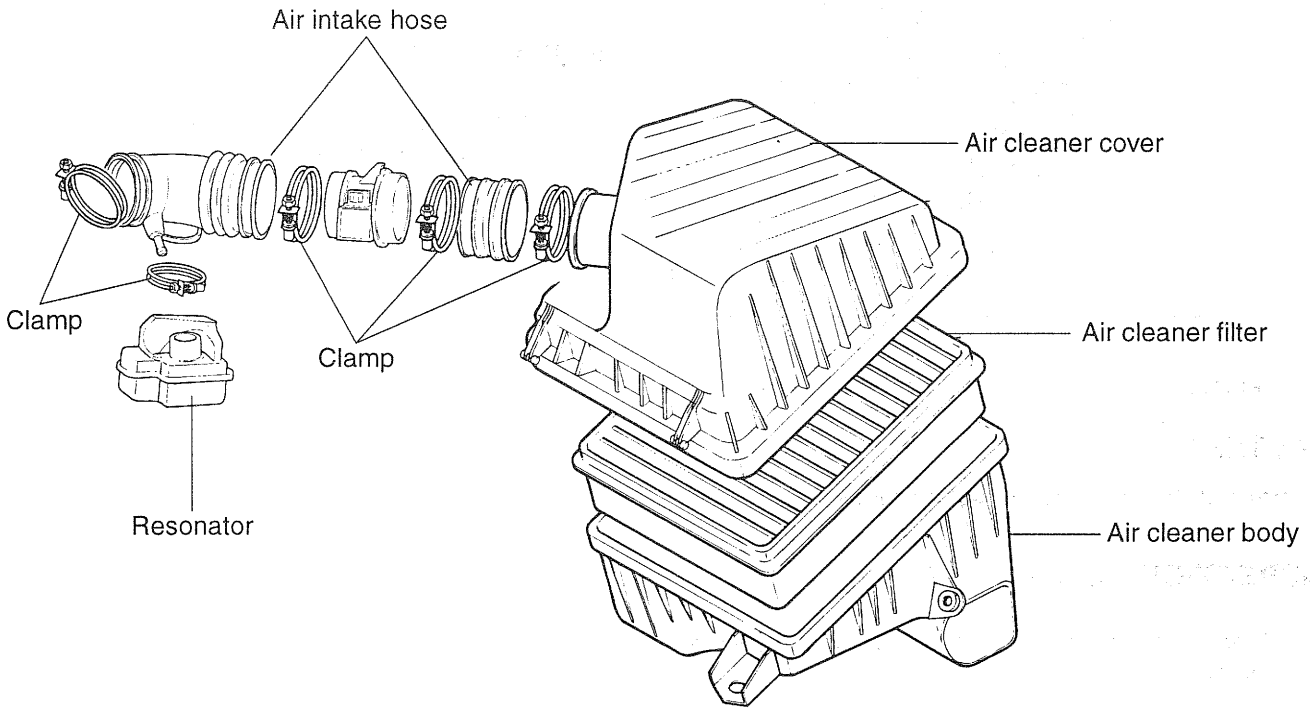
1. Check the mufflers and pipes for corrosion and damage.
2. Check the rubber hangers for deterioration and cracks.

INSTALLATION EDHAB300

1. Temporarily, install the front exhaust pipe, the catalytic converter assembly, the center exhaust pipe and the main muffler, in this order.
2. Install the rubber hangers so that they are identical (left and right) in length.
3. Tighten the parts securely and then confirm that there is no interference with any components.

AIR CLEANER (ACL)

AIR CLEANER EDHAB500

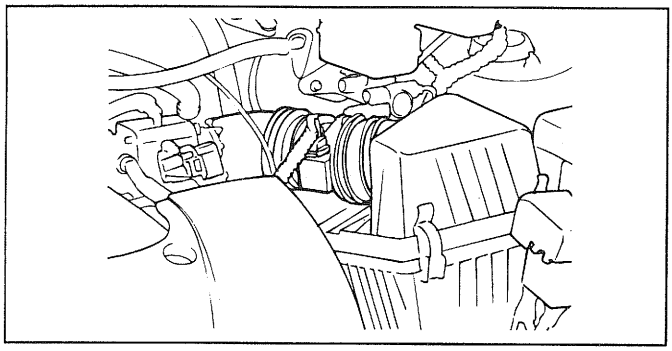


TORQUE : Nm (kg·cm, lb·ft)

EDHA010A

REMOVAL EDHAB600

1. Disconnect the air flow sensor connector.
2. Remove the air intake hose and air duct connected to the air cleaner.
3. Remove the three bolts attaching the air cleaner mounting brackets.
4. Detach the air cleaner.



EDHA006A

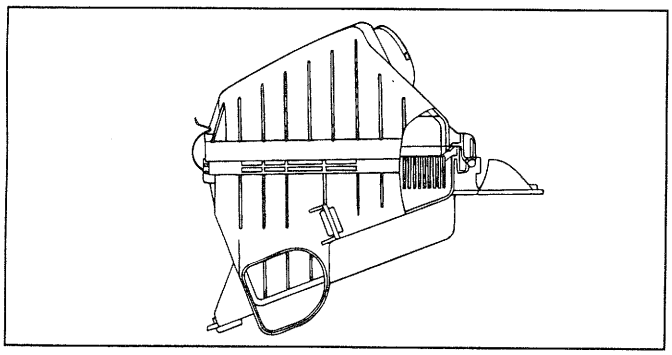
5. Remove the air flow sensor from the air intake hose.

CAUTION

Do not pull the air flow sensor harness.

INSPECTION EDHAB700

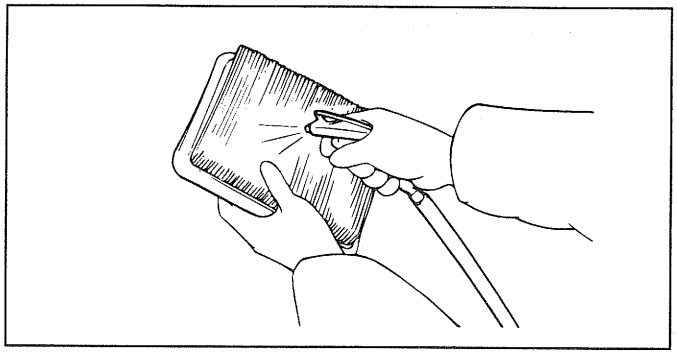
1. Check the air intake hose, air cleaner cover for damage.
2. Check the air duct for damage.



HEW2804A

3. Check the air cleaner element for restriction, contamination or damage.

   If the element is slightly restricted, remove dust and debris by blowing through the inside of the element. Replace the element if it cannot be cleaned.



ECA9066A

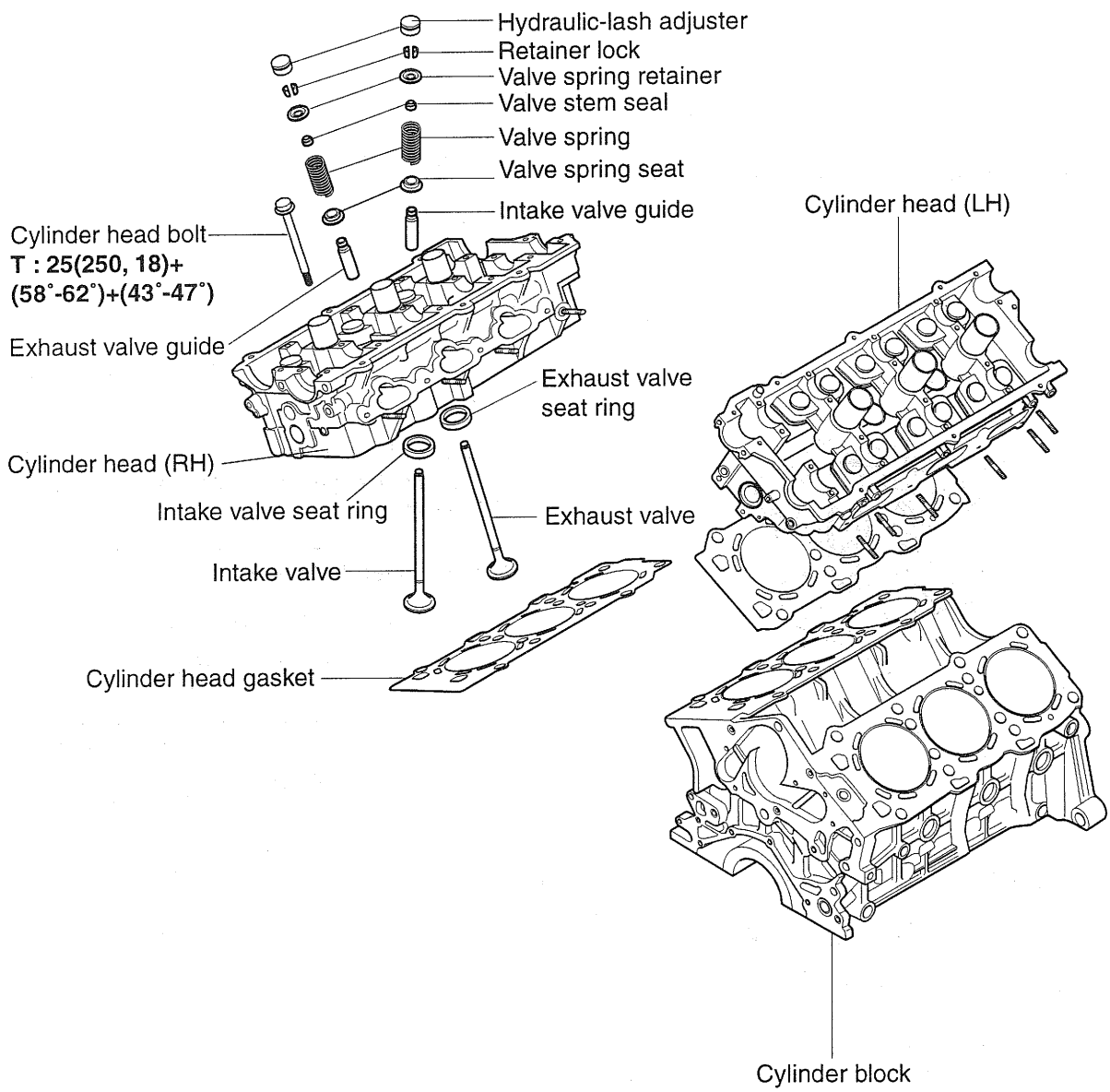
INSTALLATION EDHAB800

1. Install the air cleaner according to the reverse order of the removal procedure.

CYLINDER HEAD ASSEMBLY

CYLINDER HEAD

CYLINDER HEADS, VALVES AND VALVE SPRINGS EDHAC000

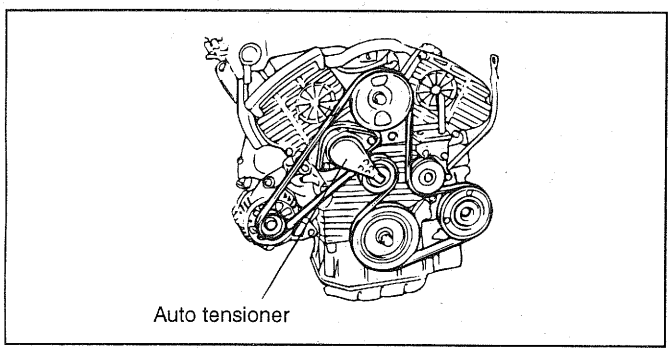


TORQUE : Nm (kg·cm, lb·ft)

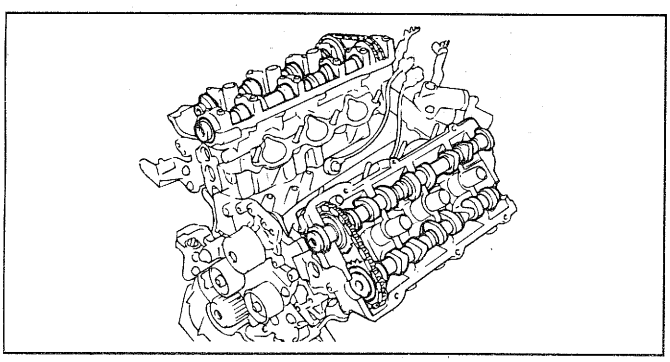
KFW3033A

DISASSEMBLY EDHAC100

1. Drain the coolant and disconnect the upper radiator hose.
2. Remove the breather hose and air-intake hose.
3. Remove the vacuum hose, fuel hose and coolant hose.
4. Remove the intake manifold.
5. Remove the cables from the spark plugs. The cables should be removed by holding the boot portion.
6. Remove the ignition coil.
7. Remove the upper and lower timing belt cover.
8. Remove the timing belt and camshaft sprockets.
9. Remove the heat protector and exhaust manifold assembly.
10. Remove the coolant pump pulley and head cover.
11. Remove the intake and exhaust camshaft.



EDA9031A

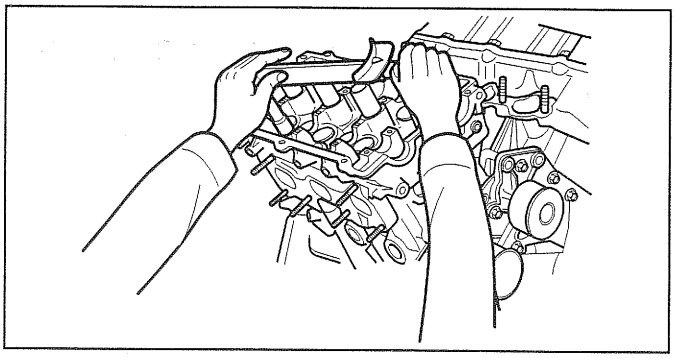


EDA9035A

12. Remove the cylinder head assembly. The cylinder head bolts should be removed using the S12 mm socket, in two or three steps.
13. Remove the gasket pieces from the cylinder block top surface and cylinder head bottom surface.

NOTE

Make sure that fragments from the gasket do not fall in the engine.



KFW3010A

INSPECTION EDHAC200

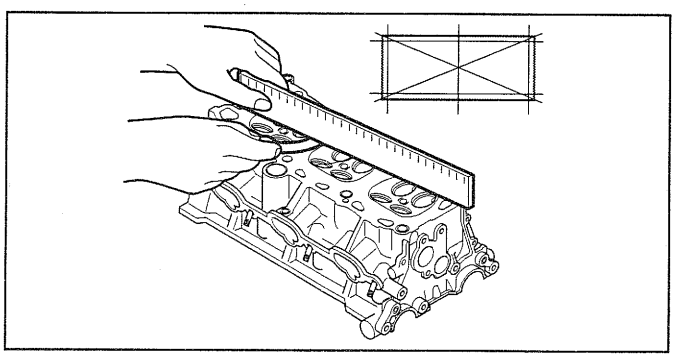
CYLINDER HEAD

1. Remove scale, sealing compound and carbon deposits. After cleaning oil passages, apply compressed air to make certain that the passages are not clogged.
2. Visually check the cylinder head for cracks, damage or water leakage.
3. Check the cylinder head surface for flatness with a straight edge and feeler gauge as shown in the illustration.

Cylinder head flatness:

Standard dimensions : Max. 0.03mm(0.0059 in.)

Service limit : 0.05mm(0.0020 in.)



KFW3047A

VALVE GUIDES

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with a new oversize guide.

Valve stem-to-guide clearance

Standard value

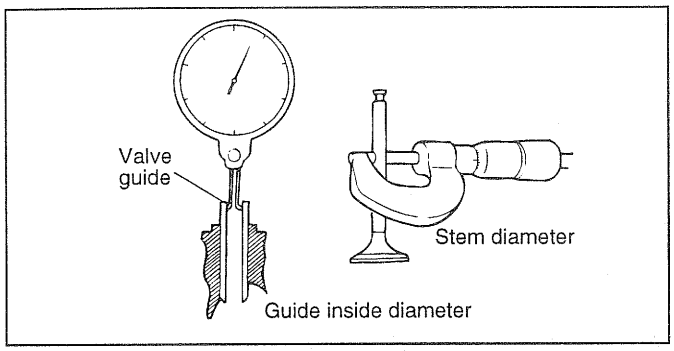
Intake : 0.02-0.05mm(0.0009-0.0020 in.)

Exhaust : 0.035-0.065mm(0.0014-0.0026 in.)

Service limit

Intake : 0.10mm(0.0039 in.)

Exhaust : 0.15mm(0.0059 in.)

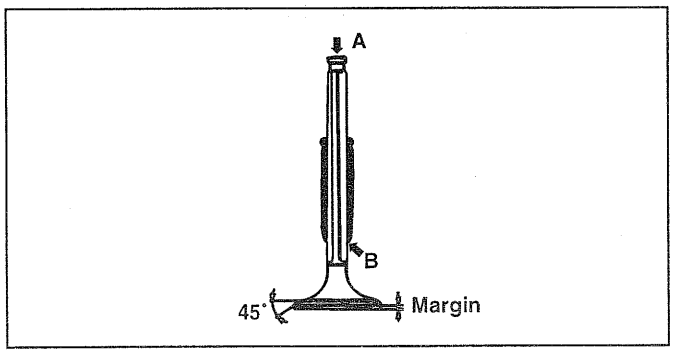


ECA9281D

VALVE

1. Replace the valve stem if it is worn (bent, worn or damaged). Also replace if the stem end (the surface contacting the hydraulic-lash adjuster) is hollowed out.

2. Check the valve face contact area, and recondition or replace as necessary.



ECA9281B

3. Replace the valve if the width of the margin (thickness of the valve head) is less than the minimum specified.

Valve margin

Standard value

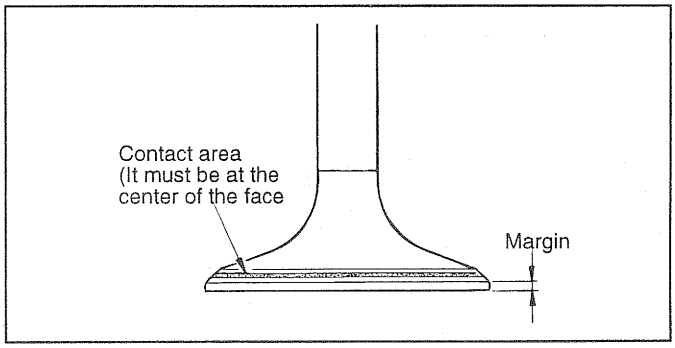
Intake : 1.0mm(0.0394 in.)

Exhaust : 1.3mm(0.0512 in.)

Service limit

Intake : 0.5mm(0.0197 in.)

Exhaust : 0.8mm(0.0315 in.)



EDA9300D

VALVE SPRING

1. Check free height of each valve spring and replace if necessary.

2. Using a square, test the squareness of each valve spring. If the spring is excessively out-of-square, replace it.

Valve spring

Standard value

Free height : 42.5mm(1.6732 in.)

Load : 21.9kg/35mm(48.4 lb/1.3780 in.)

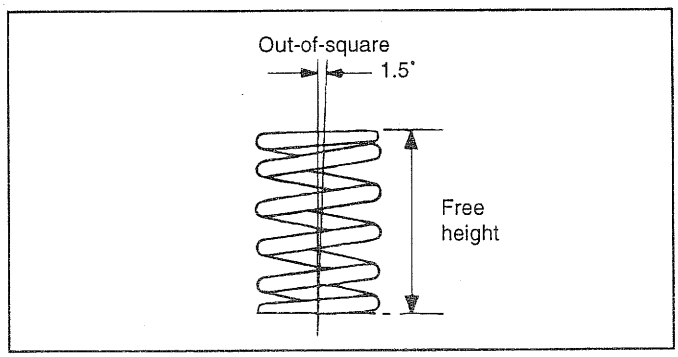
Out of squareness : Max. 1.5°

Service limit

Free height : .41.5mm(1.6339 in.)

Load : 21.9kg/34mm(48.4 lb/1.3386 in.)

Out of squareness : Max. 3°



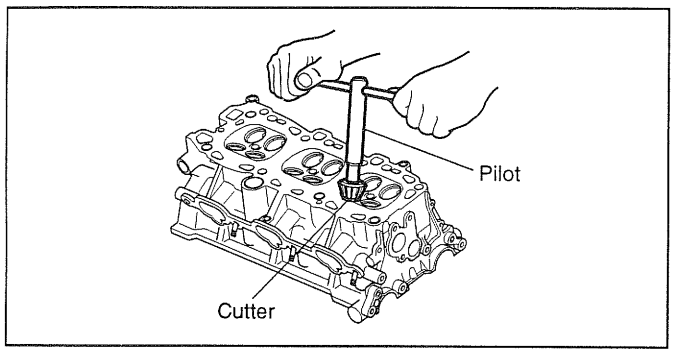
ECA9281C

RECONDITIONING VALVE SEAT

1. Before reconditioning, check the valve guide for wear. Replace worn guide if necessary and then recondition the valve seat.

2. To recondition the valve seat, use the Valve Seat Cutter and Pilot.

3. After reconditioning, the valve and valve seat should be lapped lightly with a lapping compound.



KFW3048A

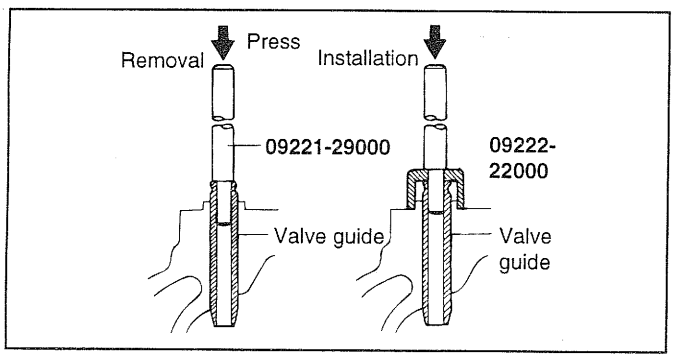
REPLACING VALVE GUIDE

1. Using the special tool (09221-29000), press down 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.

VALVE GUIDE OVERSIZES

Size mm (in.)	Size Mark	Oversize valve guide hole size mm (in.)
0.05 (0.002) O.S.	5	11.050-11.068 (0.435-0.4357)
0.25 (0.010) O.S.	25	11.250-11.268 (0.443-0.4436)
0.50 (0.020) O.S.	50	11.500-11.518 (0.453-0.4535)



EDA9300G

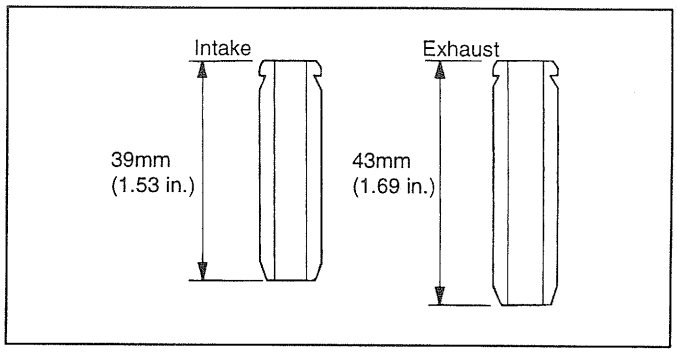
3. Using the special tool (09221-29000(A), 09222-22000(B)) press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the valve guides are different in length.

4. After the valve guide is press-fitted, insert a new valve and check for proper clearance.

5. After the valve guide is replaced, check that the valve is seated in contact with them and recondition the valve seats as necessary.

NOTE

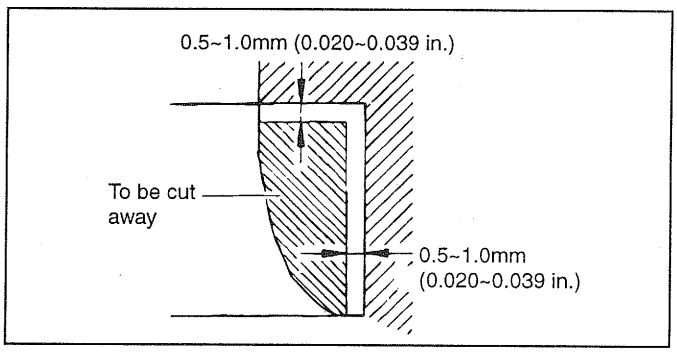
Do not install a valve guide of the same size again.



EOY168A

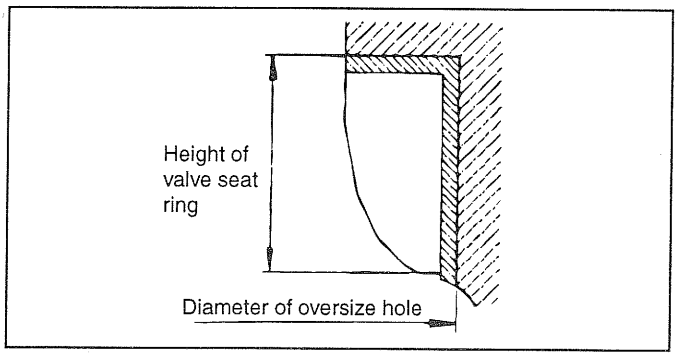
REPLACING VALVE SEAT RING

1. Cut away the inner face of the valve seat to reduce the wall thickness.



EOYR3940

2. Adjust diameter of the valve seat on the cylinder head side so that it can match the diameter of the oversize valve seat ring.



EOY167A

VALVE SEAT RING 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	7.9-8.1 (0.311-0.319)	33.300-33.325 (1.311-1.312)
Exhaust valve seat ring	0.3 (0.012) O.S.	30	7.9-8.1 (0.311-0.319)	28.600-28.625 (1.126-1.127)

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 at normal temperature.
4. Using the lapping compound, lap the valve.

Valve seat contact width

Intake : 1.1-1.5mm(0.043-0.059 in.)

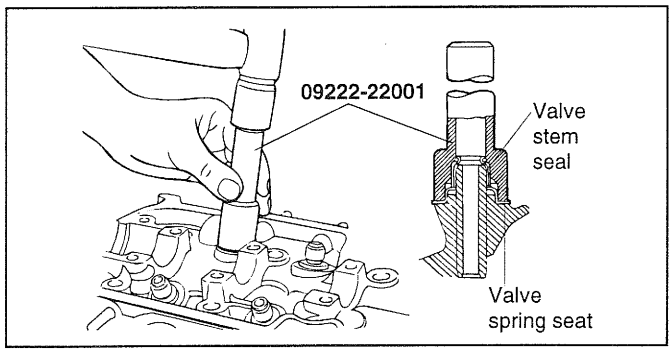
Exhaust : 1.3-1.7mm(0.051-0.067 in.)

REASSEMBLY EDHAC300

1. Install the spring seats.
2. Using a special tool (09222-22001), lightly tap the seal in position.

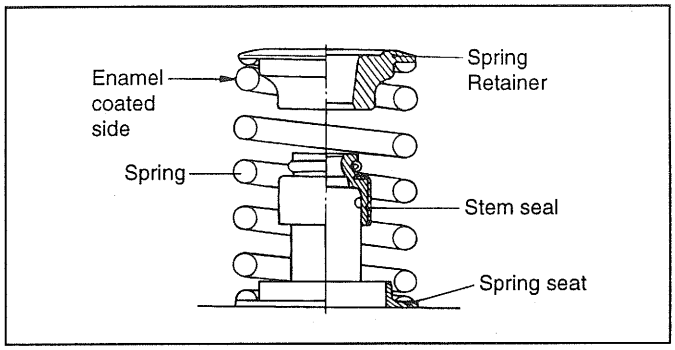
NOTE

- **Do not reuse old valve stem seals.**
- **Incorrect installation of the seal could result in oil leakage of from the valve guides.**



EDHAC30A

3. Apply engine oil to each valve. Insert valves into guides. Avoid pushing the valve into the seal by force. After installing the valve, check that it moves smoothly.
4. Place valve springs so that the side coated with enamel may face toward the valve spring retainer and then install.

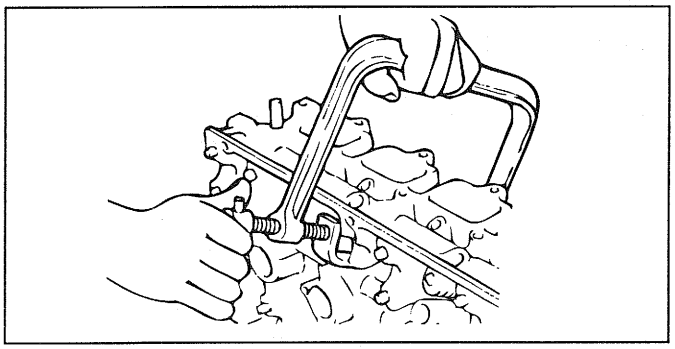


ECA9290B

5. Using the special tool (09222–28000, 09222–28100), push 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.

NOTE

When the spring is compressed, check that the valve stem seal is not pressed against the bottom of the retainer.

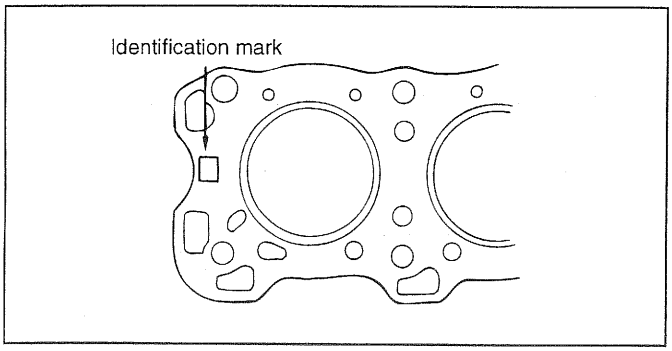


EDAA040B

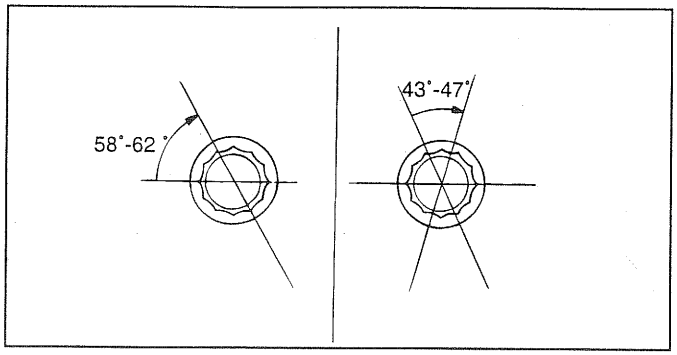
6. Clean both gasket surfaces of the cylinder head and cylinder block.
7. Verify the identification marks on the cylinder head gasket.
8. Install the gasket so that the surface with the identification mark may face toward the cylinder head.

NOTE

Do not apply sealant to these surfaces.

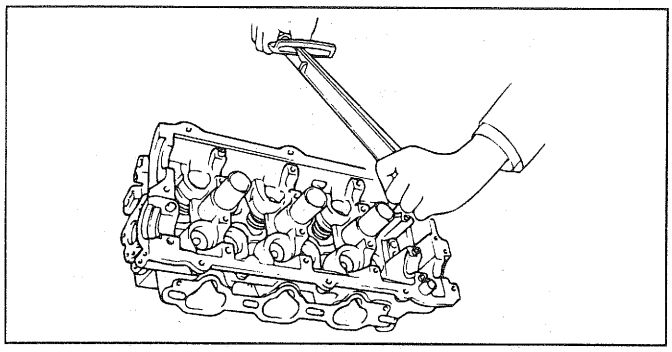


EDA9310D



EDAA086B

9. Tighten the cylinder head bolts in the sequence shown in the illustration with a torque wrench.



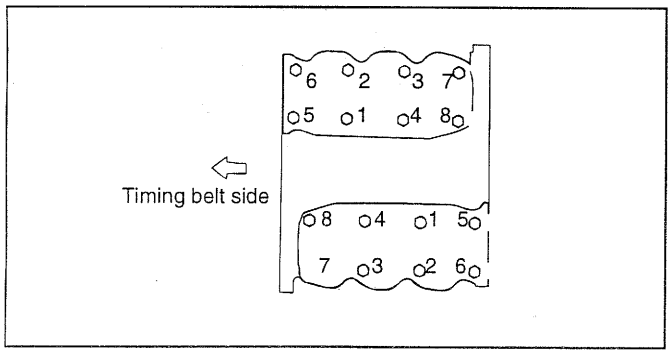
EDA9010A

10. Tighten the cylinder head bolts. Starting at top center, tighten all cylinder head bolts in sequence as shown in the illustration, using the 12 mm socket. Repeat the procedures, tighten all cylinder head bolt to the specified torque again.

Tightening procedure

Cylinder head bolt :

25 Nm (250kg.cm, 18.1 lb.ft)+(58°-62°)+(43°-47°)

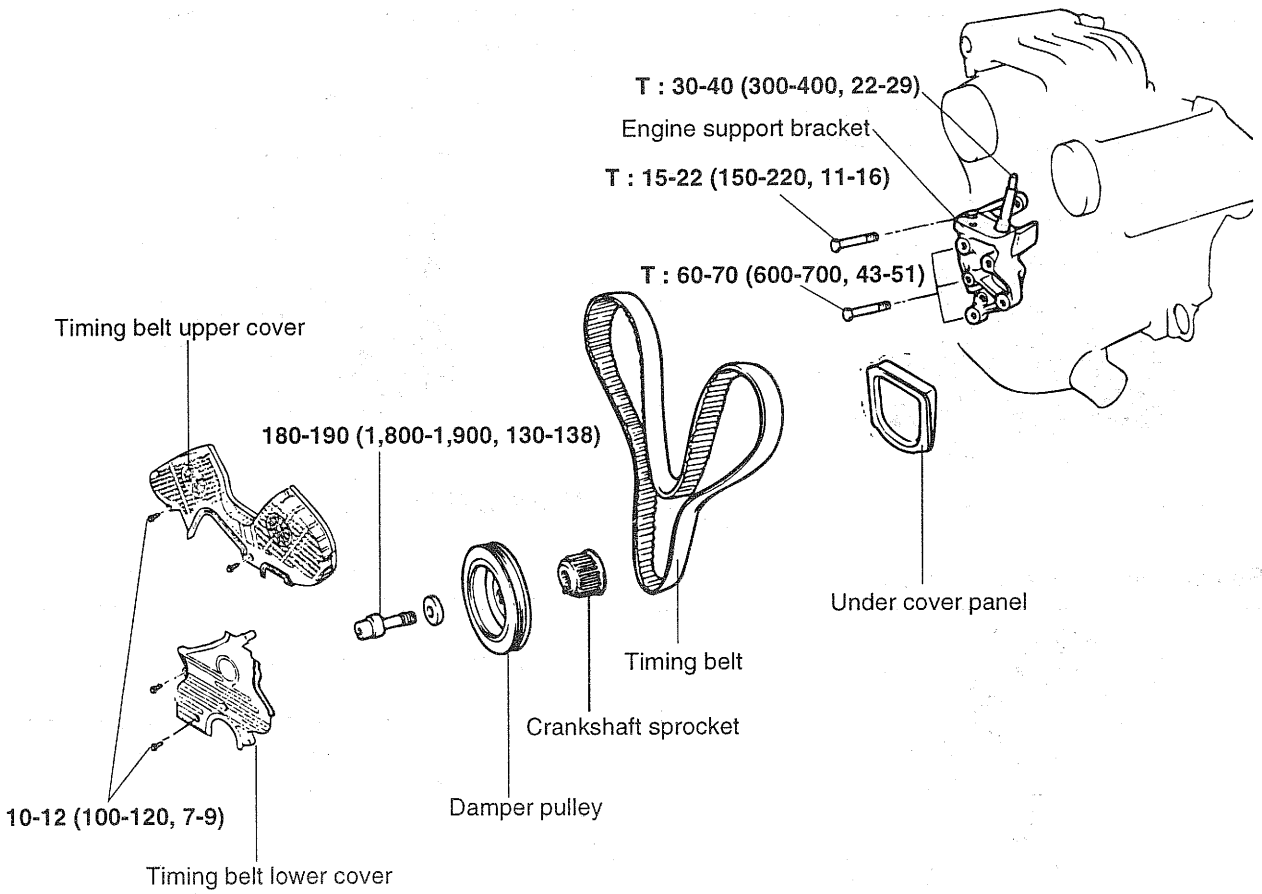


EDA9960B

TIMING SYSTEM

TIMMING BELT

TIMING BELT EDHAD000

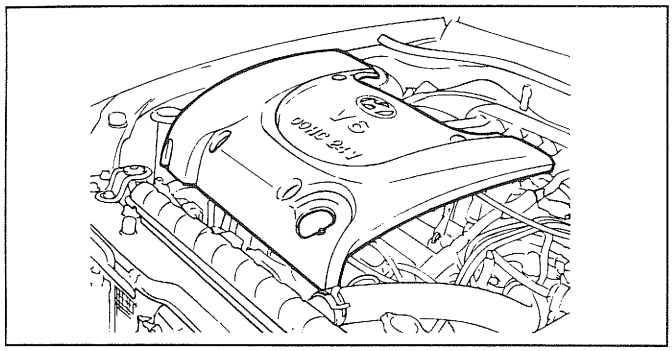


TORQUE : Nm (kg.cm, lb.ft)

EDJAD00A

REMOVAL EDHAD100

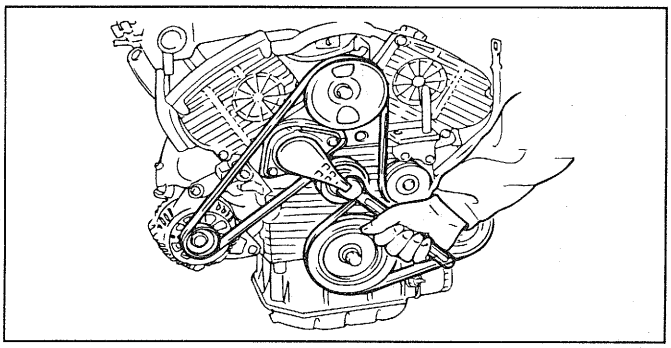
1. Remove the engine cover.



EDA9022A

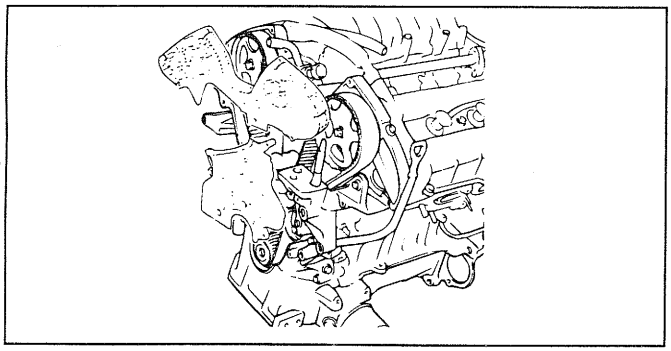
2. Using the spanner [16 mm], rotate the tensioner arm clockwise. (about 14°)and remove the belt from the pulley.

3. Remove the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.



EDA9031B

4. Remove the upper and lower timing belt covers.



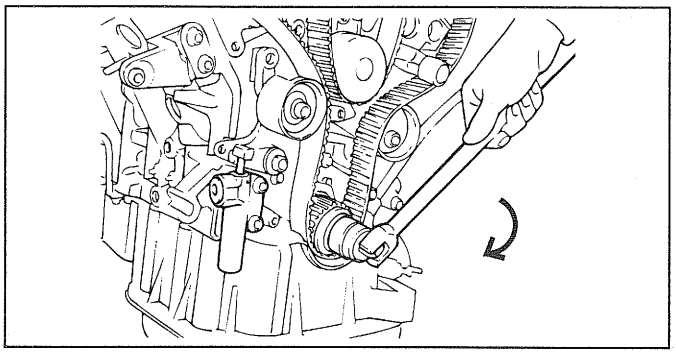
EDA9027A

5. Remove the auto tensioner.

NOTE

Rotate the crankshaft clockwise and align the timing mark to set the No.1 cylinder's piston to TDC (compression stroke).

At this time, the timing marks of the camshaft sprocket and cylinder head cover should concide with each other.

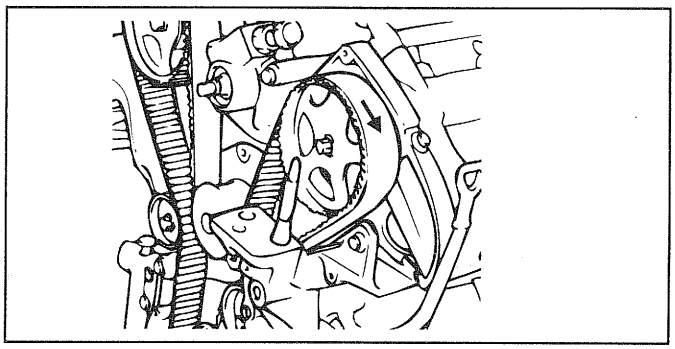


EDA9024A

6. Remove the timing belt.

NOTE

When using the timing belt again, make sure to mark the rotating direction on the belt so as to install correctly.



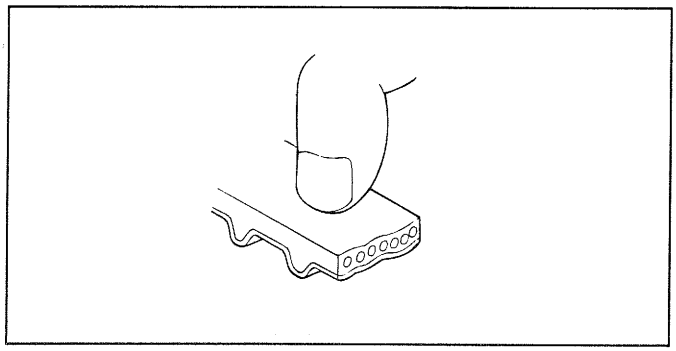
EDA9023A

INSPECTION EDHAD200

1. Inspect the belt closely. If the following problems are evident, replace the belt with a new one.

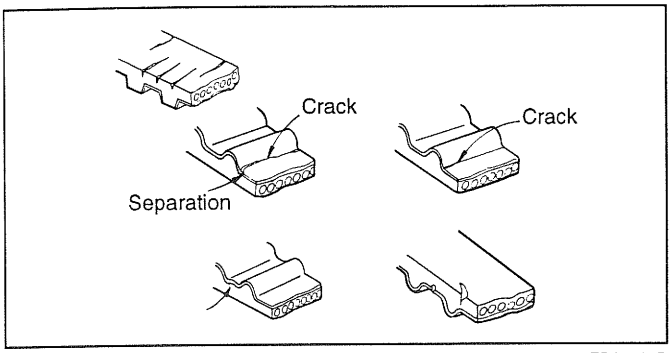
   1) Hardened back surface of rubber

      Back surface is glossy. Non-elastic and so hard that when the nail of your finger is pressed into it, no mark is produced.



ECA9200B

   2) Cracked back surface of rubber.

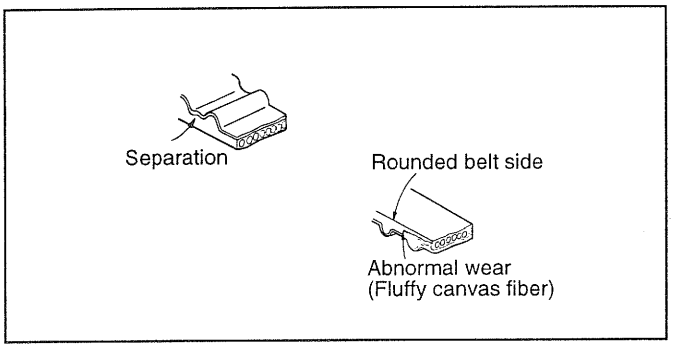


EDA9220B

3) Side of belt is badly worn.

NOTE

A belt in gool condition should have clear-cut sides as if it is cut with a sharp knife.



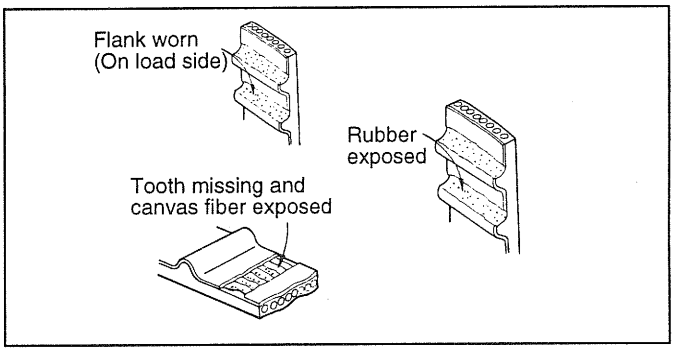
EDA9220C

4) Teeth are badly worn out.

Initial stage : Canvas on load side tooth flank worn (fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture)

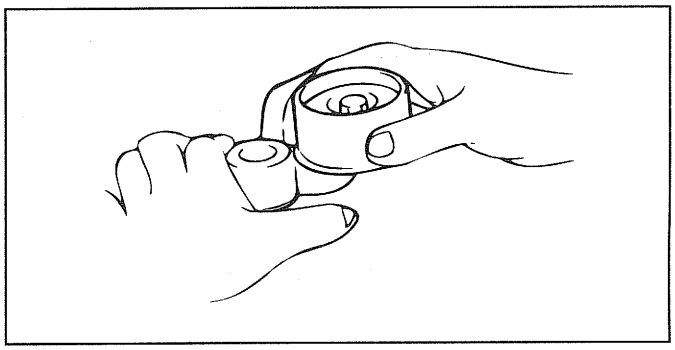
Last stage : Canvas on the load side of the tooth flank worn down and rubber exposed (tooth width reduced).

5) Missing tooth



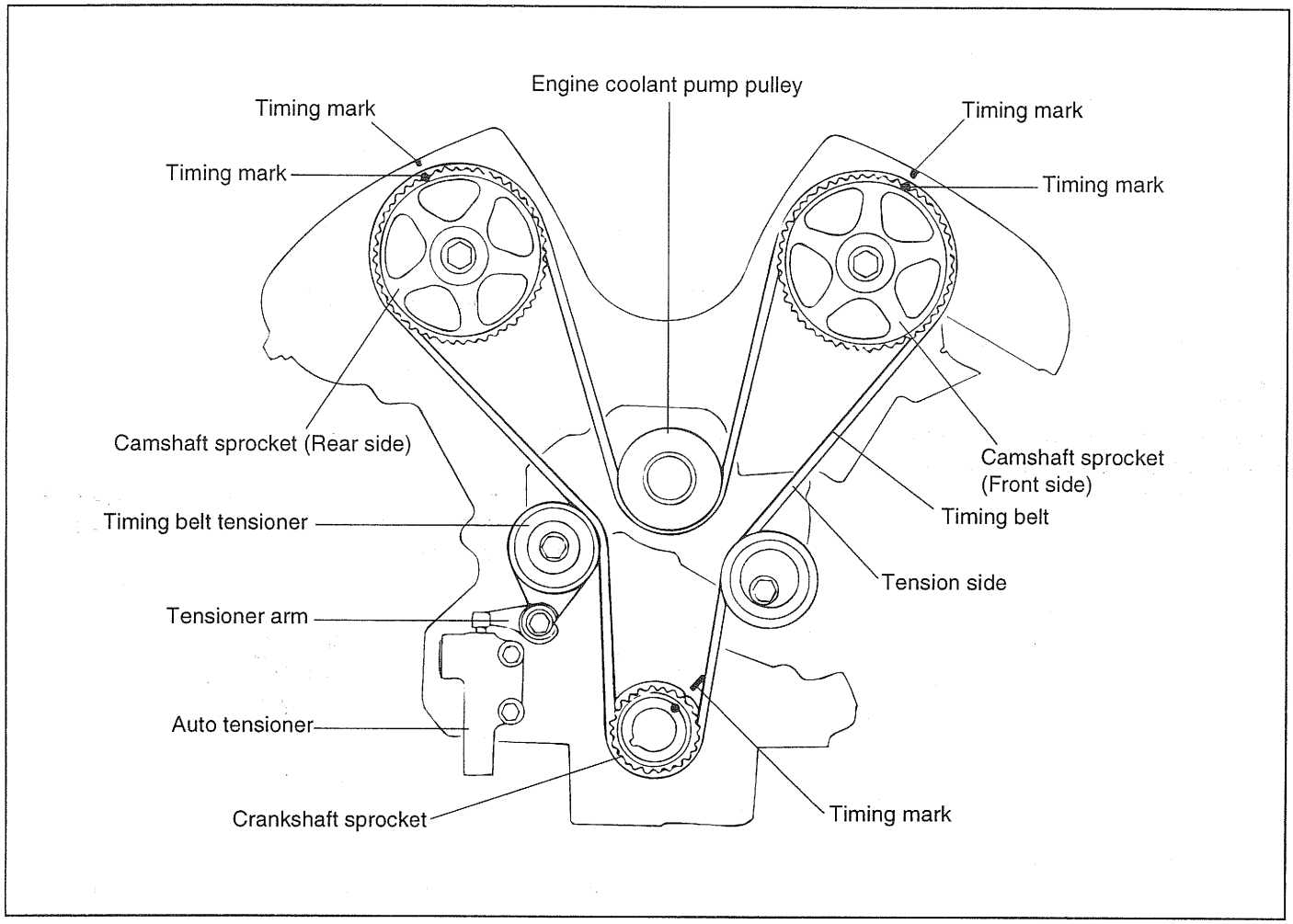
EDA9220D

2. If backlash or an irregular noise is observed when rotating the pulley, replace the timing belt tensioner and idler pulley.



EDA9025A

TIMING BELT EDHAD500



EDJAD50A

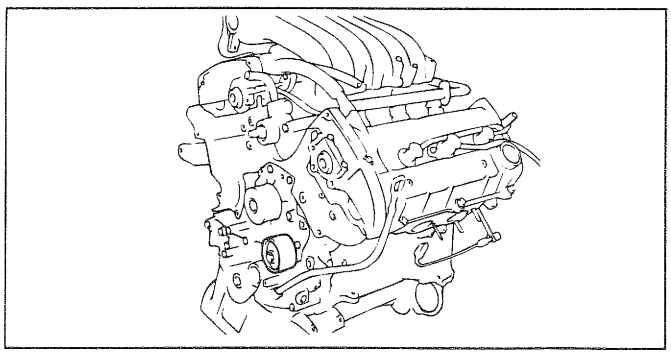
INSTALLATION EDHAD600

The method of installing timing belt and auto tensioner.

1. Install the idler pulley to water pump boss.

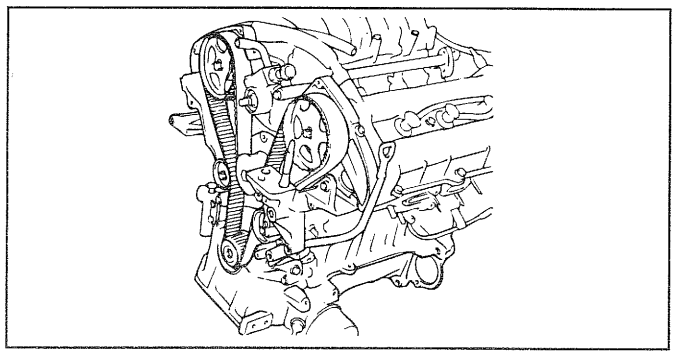
NOTE

Insert and install the idler pulley to the pin spring that is pressed and inserted in the water pump boss.



EDA9028A

2. Install the tensioner arm and plane washer to cylinder block.
3. Install the tensioner pulley to the tensioner arm.
4. Install sprockets and align the timing marks.



EDA9029A

NOTE

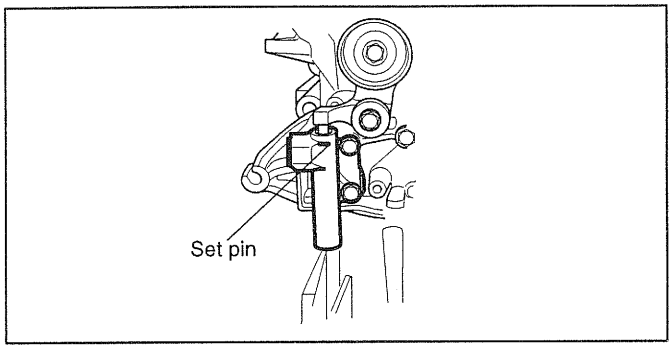
- **When installing the camshaft sprocket, fasten the sprocket tightly while holding the hexagonal part of the camshaft.**

- **Before installing the timing belt, if the timing marks of the cam sprocket and the cylinder head cover do not coincide, do not rotate the cam sprocket more than 3 teeth of the sprocket in any direction.**
- **Rotating sprocket more than 3 teeth may allow the valve and piston to touch each other.**
- **If the cam sprocket is rotated more than 3 teeth unavoidably, rotate the cam sprocket after rotating 3 teeth from the side of the crank counter-clockwise according to the timing mark.**

5. Install the auto tensioner to the front case.

NOTE

At this time auto tensioner's set pin should be assembled completely.



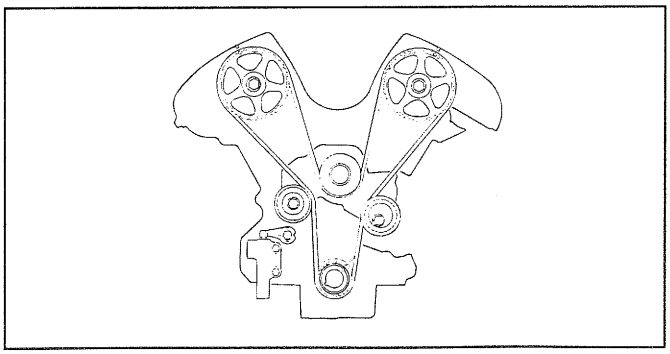
KFW3026C

6. Align the timing marks of each sprocket and install the timing belt in the following order.

   Crankshaft sprocket ⇒ Idler pulley ⇒ camshaft sprocket (LH side) ⇒ Water pump pulley ⇒ camshaft sprocket (RH side) ⇒ Tensioner pulley.

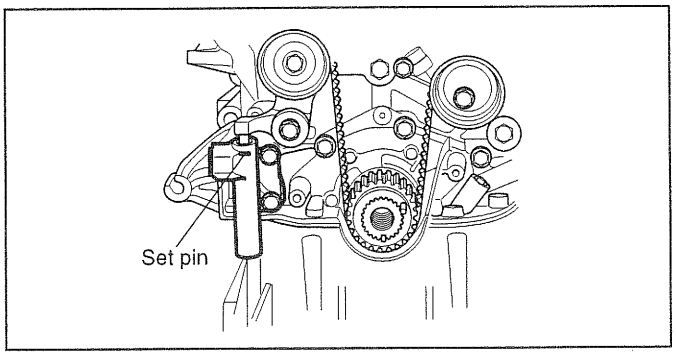
NOTE

- **In this step, No. 1 cylinder is in the TDC (Compression stroke).**
- **Do not use your fingers.**



EDA9009D

7. Pull out the set pin of the auto tensioner.



KFW3026A

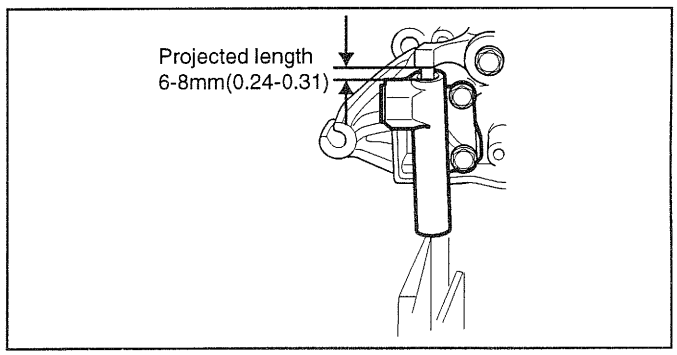
8. Install the upper and lower timing belt covers.
9. Install the power steering pump pulley, idler pulley, tensioner pulley and crankshaft pulley.
10. Using the spanner [16mm], rotate the tensioner arm clockwise (about 14°) and install the belt to the pulley.
11. Install the engine cover.

HOW TO ADJUST THE TENSION OF THE TIMING BELT

1. Rotate the crankshaft 2 turns clockwise and measure the projected length of auto tensioner in the TDC (# 1 Compression stroke) after 5 minutes.
2. Check the projected length to be 6-8 mm.
3. Check again if the timing marks of each sprocket are in their specified position.

NOTE

If not in their specified position, repeat from procedure 6 of the method of installing timing belt and auto tensioner.



KFW3026B

Fuel System

GENERAL

EFHA0010

GENERAL SPECIFICATIONS

Items				Specifications
Throttle body	Throttle position sensor (TPS)	Type		Variable resistor
		Resistance at curb idle	2.0 I4	3.5 ~ 6.5 KΩ
			2.7 V6	1.6 ~ 2.4 KΩ
		Output voltage at curb idle	2.0 I4	300 ~ 900 mV
			2.7 V6	250 ~ 800 mV
	Idle speed control (ISC) actuator	Type		Double Coil
		Resistance		90 ~ 110 Hz
Sensors	Air flow sensor	Type	2.0 I4	MAP sensor
			2.7 V6	HOT Film sensor
	Intake air temperature (IAT) sensor	Type	2.0 I4 & 2.7 V6	Thermistor type
		Resistance		2.33 ~ 2.97 KΩ at 20°C (68°F)
	Engine coolant temperature (ECT) sensor	Type		Thermistor type
		Resistance		2.5 KΩ at 20°C (68°F)
				0.3 KΩ at 80°C (176°F)
	Heated oxygen sensor (HO2S)	Type	2.0 I4	Zirconia type
			2.7 V6	Titania type
	Vehicle speed sensor	Type		Hall effect type
	Camshaft position (CMP) sensor	Type		Hall effect sensor
	Crankshaft position (CKP) sensor	Type		Hall effect sensor
Actuators	Injector	Type, number	2.0 I4	Electromagnetic type, 4
			2.7 V6	Electromagnetic type, 6
		Resistance		13 ~ 16Ω at 20°C (68°F)
	Evaporative emission purge solenoid	Type		Duty cycle type
Fuel pressure regulator	Pressure regulator			300 ± 1.5 kPa (3.35 ± 0.06 kg/cm^2)
Fuel tank	Tank capacity (2.0 I4) Tank capacity (2.7 V6) Return system			65 lit (14.3 Imp.gal) 75 lit (16.5 Imp.gal) Equipped
Canister	Volume/Nominal working capacity			3.0 liter/150g

SEALANT

EFA90020

Item	Specified sealant
Engine coolant temperature sensor	LOCTITE 962T or equivalent

SERVICE STANDARDS

EFHA0030

Items			Standard value
Basic ignition timing	2.0 I4		BTDC 10° ± 5° at curb idle
	2.7 V6		BTDC 12° ± 8° at curb idle
Curb idle speed (rpm)	2.0 I4	D-range (A/T)	750 ± 100
		P,N-range	800 ± 100 (A/CON OFF)
		(A/T, M/T)	900 ± 100 (A/CON ON)
	2.7 V6	D-range (A/T)	725 ± 100
		P,N-range	725 ± 100 (A/CON OFF)
		(A/T, M/T)	900 ± 100 (A/CON ON)
Fuel pressure kPa (psi)	Vacuum hose disconnection		330 ~ 350 (47-50) at curb idle
	Vacuum hose connection		Approx. 270 (38) at curb idle
Evap canister purge solenoid valve resistance			20-32Ω

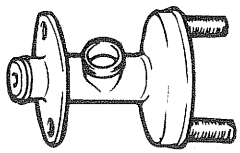
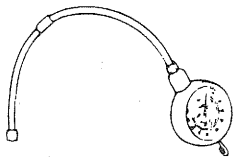
TIGHTENING TORQUE

EFA90040

Item	Nm	Kg.cm	lb.ft
Delivery pipe installation bolt	10-15	100-150	7-11
Engine coolant temperature sensor	20-40	200-400	14-29
Heated oxygen sensor	40-50	400-500	29-36
Heated oxygen sensor connector bracket bolt	8-12	80-120	5.8-8.7
Fuel pressure regulator installation bolt	4-6	40-60	2.9-4.4
High pressure hose and fuel main pipe	30-40	300-400	22-29
High pressure hose and fuel filter	25-35	250-350	18-25
High pressure hose to delivery pip	3-4	30-40	2.2-3
Fuel pump assembly to fuel tank	2-3	20-30	1.4-2.2
High pressure hose at fuel tank	30-40	300-400	22-29
Throttle body to surge tank	15-20	150-200	11-14
Fuel tank drain plug	15-25	150-250	11-18
Fuel filter mounting bolts	9-14	90-140	6.5-10
Accelerator arm bracket bolts	8-12	80-120	5.8-8.7
ISC actuator	6-8	60-80	4.4-5.8
Fuel sender to fuel tank	2-3	20-30	1.4-2.2

SPECIAL TOOLS

EFA90050

Tool (Number and name)	Illustration	Use
09353-38000 Fuel pressure gauge adapter	 EFA9005A	Connection of fuel pressure gauge to delivery pipe for measurement of fuel pressure.
09353-24100 Fuel pressure gauge & hose	 EFA9005B	

TROUBLESHOOTING EFA90060

When checking 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 EFDA0070

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										
PNP 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 ring			8		9						9			
Ignition timing					10						11	14		
Timing mark			9								12			
Injectors			10		13	8	8		7	4	13	15	4	
ECM			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 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

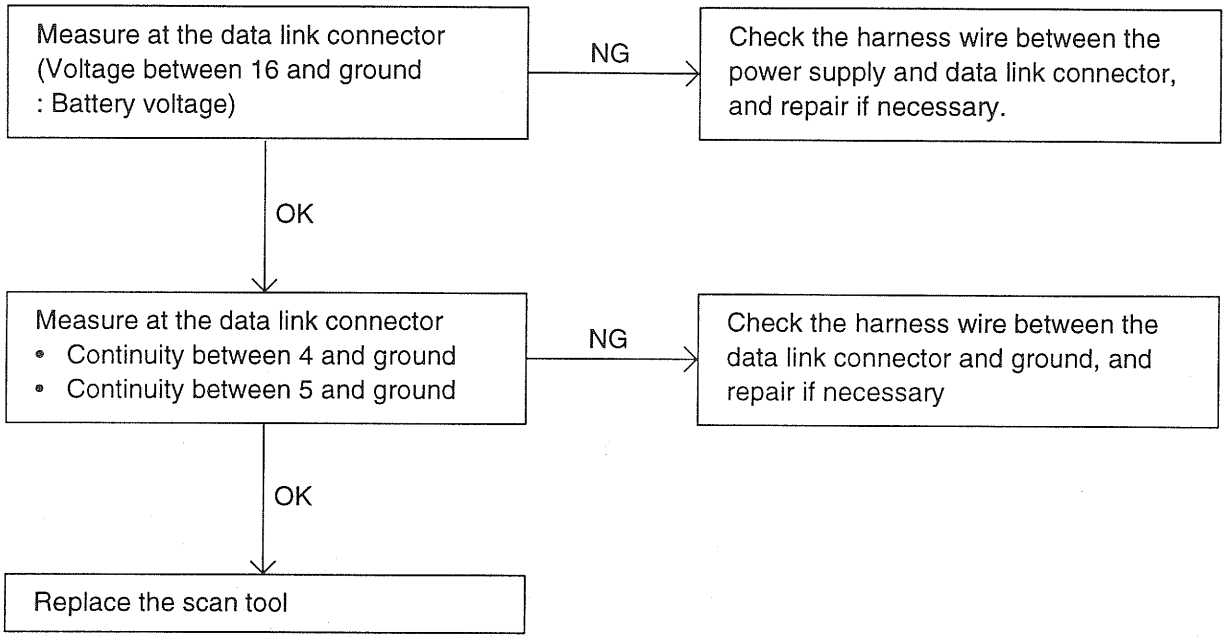
NOTE

The number herein means the check order.

MFI TROUBLESHOOTING PROCEDURES EFA90080

PROBLEM

Communication with scan tool is not possible.
(Communication with all system is not possible)

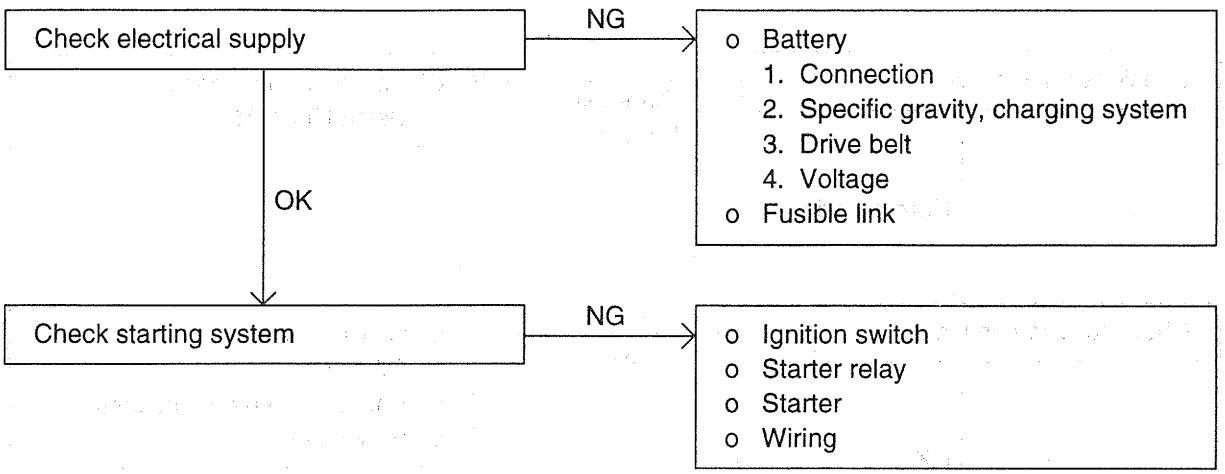


EFA9008A

SCAN TOOL COMMUNICATION WITH ECM IS NOT POSSIBLE EFA90090

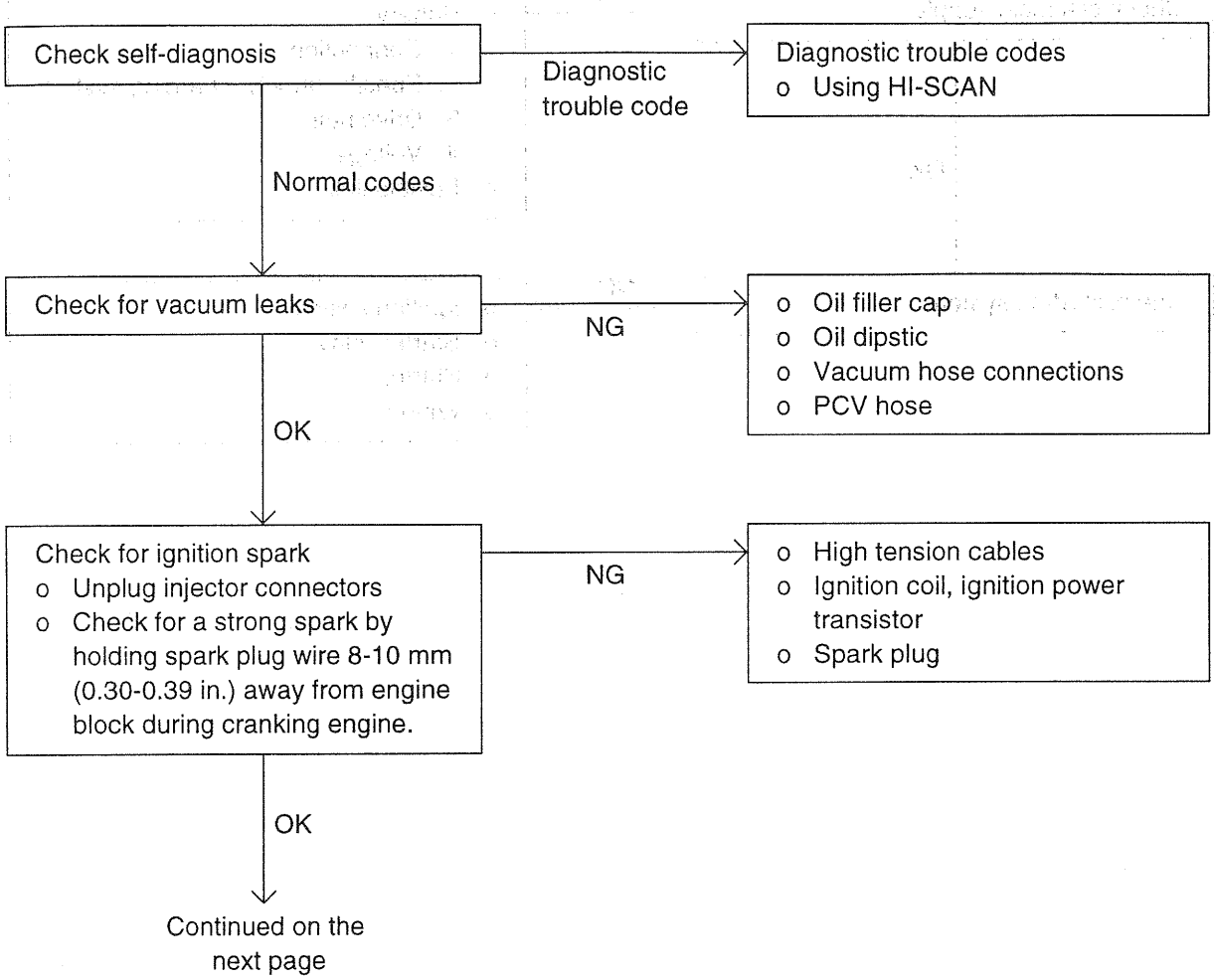
Comment	Probable cause
One of the following causes may be suspected • No power supply to ECM • Defective ground circuit of ECM • Defective ECM • Improper communication line between ECM and scan tool	• Malfunction of ECM power supply circuit. • Malfunction of the ECM. • Open circuit between ECM and DLC.

ENGINE WILL NOT START EFA90100

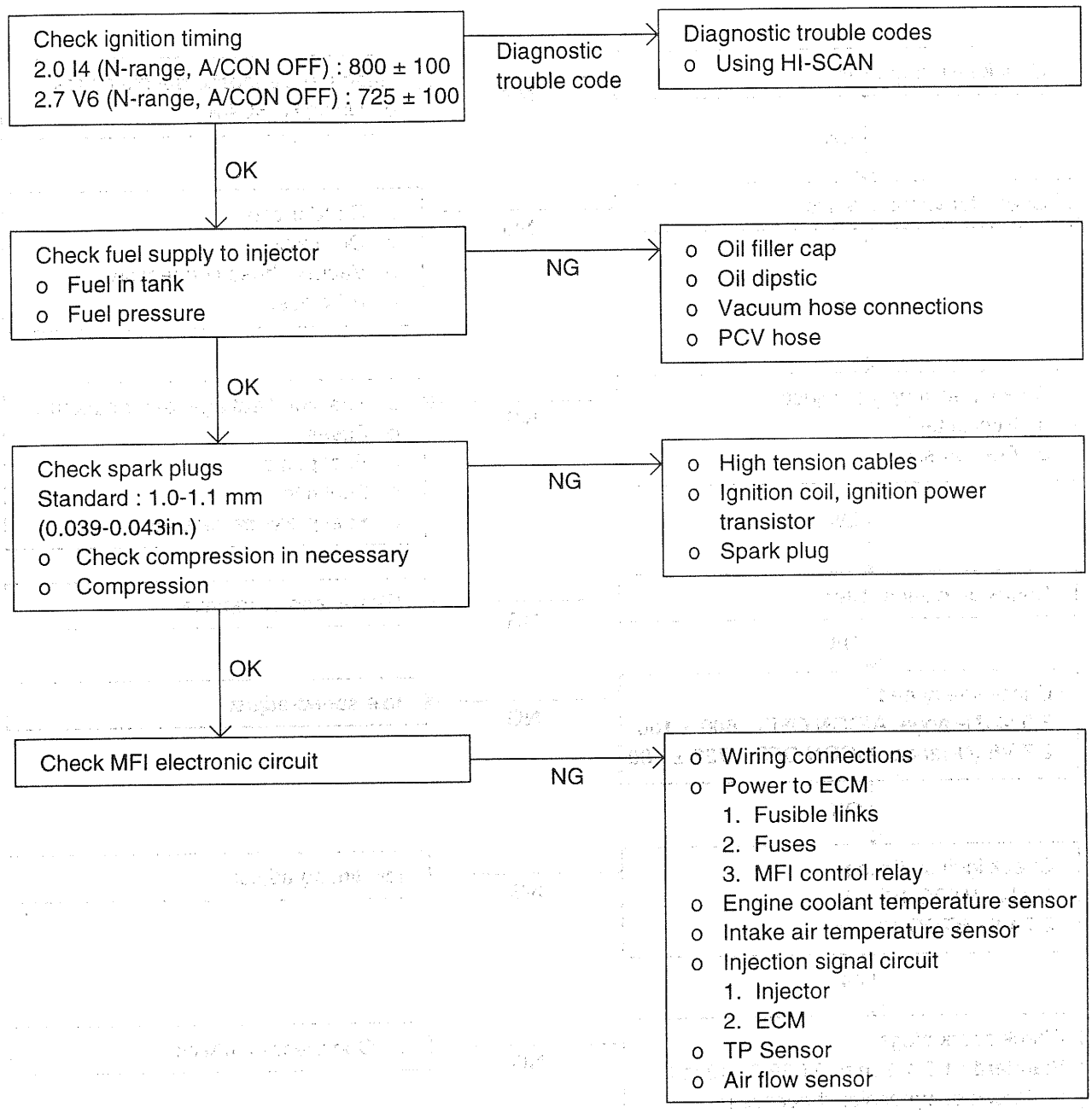


EFA9010A

DIFFICULT TO START (ENGINE TURNS OVER) EFHA0110

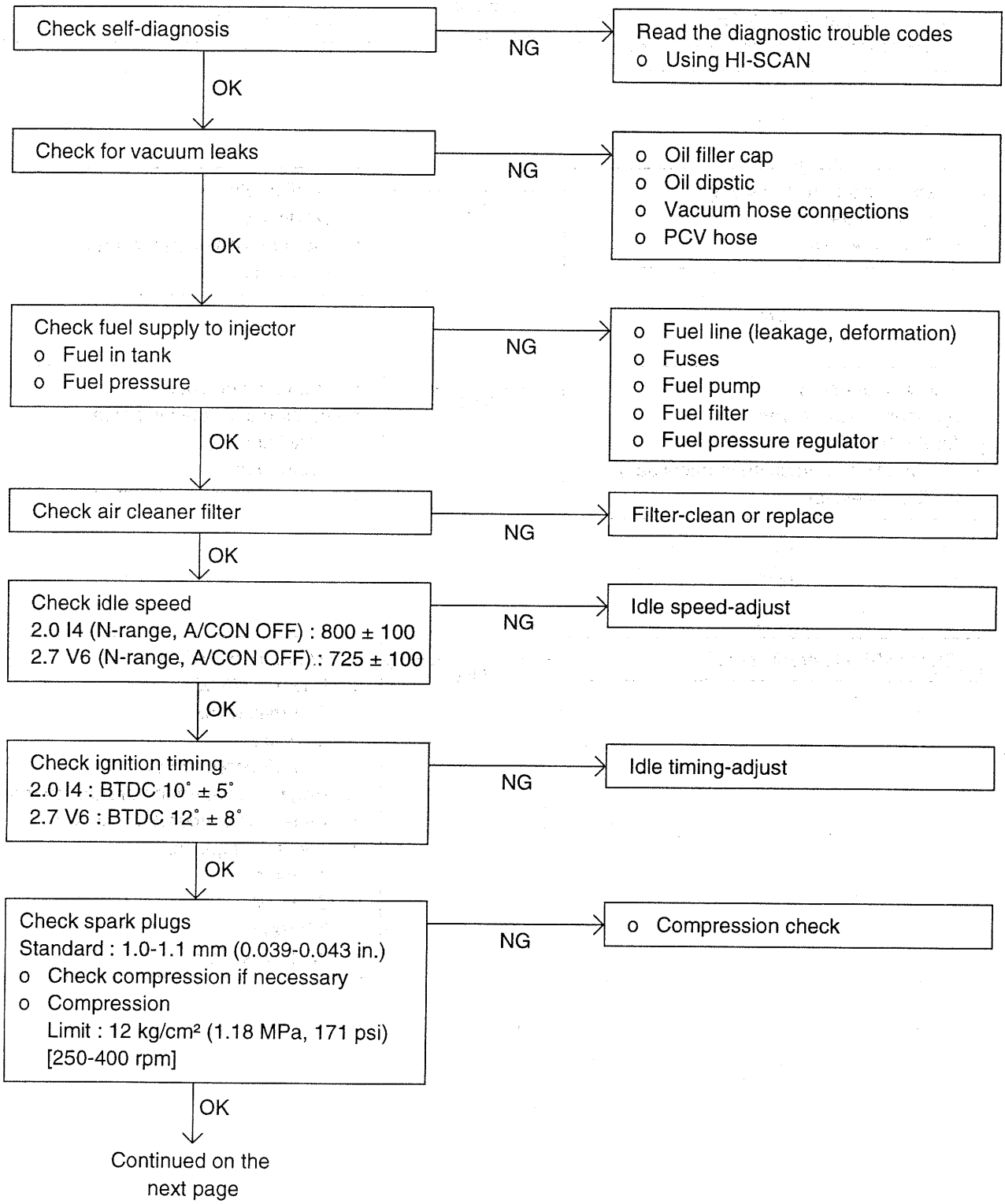


EFA9011A

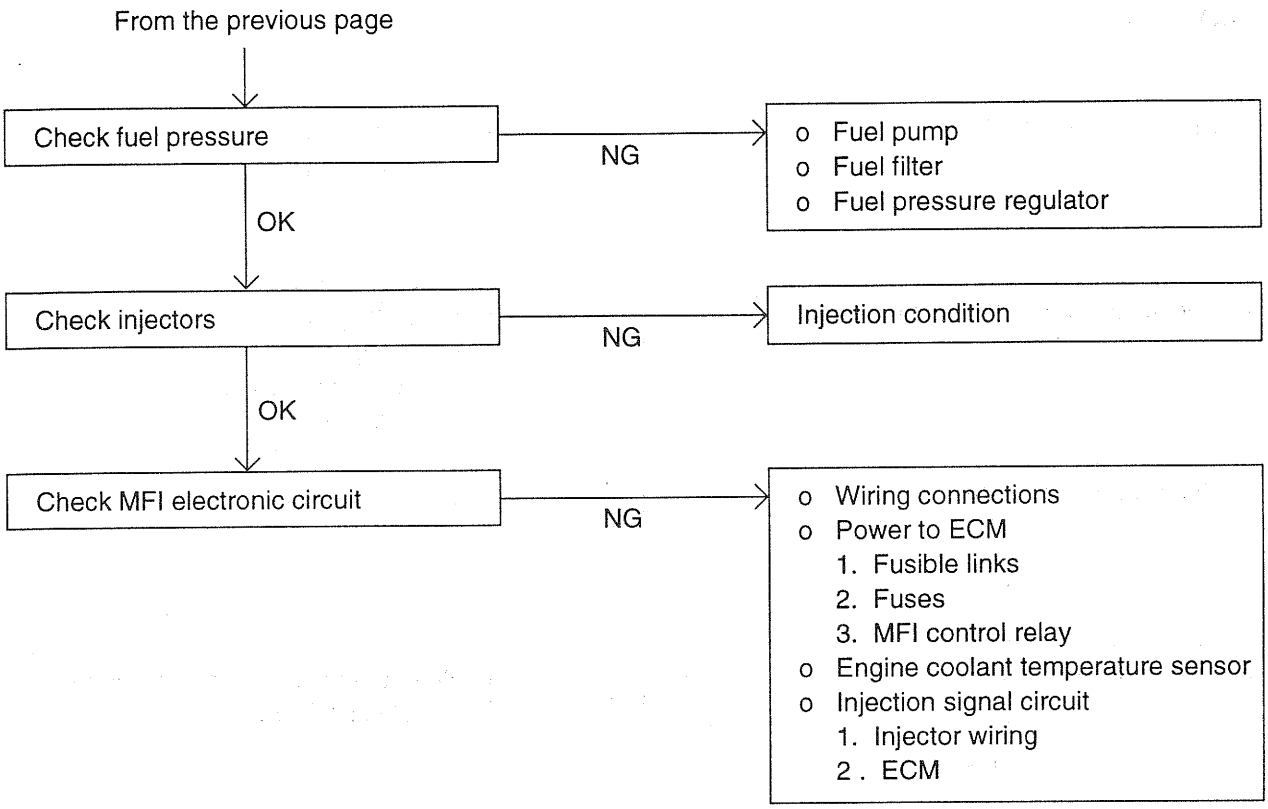

Check ignition timing
2.0 I4 (N-range, A/CON OFF) : 800 ± 100
2.7 V6 (N-range, A/CON OFF) : 725 ± 100
Diagnostic trouble code
Diagnostic trouble codes
o Using HI-SCAN
OK
Check fuel supply to injector
o Fuel in tank
o Fuel pressure
NG
o Oil filler cap
o Oil dipstic
o Vacuum hose connections
o PCV hose
OK
Check spark plugs
Standard : 1.0-1.1 mm
(0.039-0.043in.)
o Check compression in necessary
o Compression
NG
o High tension cables
o Ignition coil, ignition power transistor
o Spark plug
OK
Check MFI electronic circuit
NG
o Wiring connections
o Power to ECM
1. Fusible links
2. Fuses
3. MFI control relay
o Engine coolant temperature sensor
o Intake air temperature sensor
o Injection signal circuit
1. Injector
2. ECM
o TP Sensor
o Air flow sensor

EFHA011B

ROUGH IDLE OR ENGINE STALLS EFHA0120

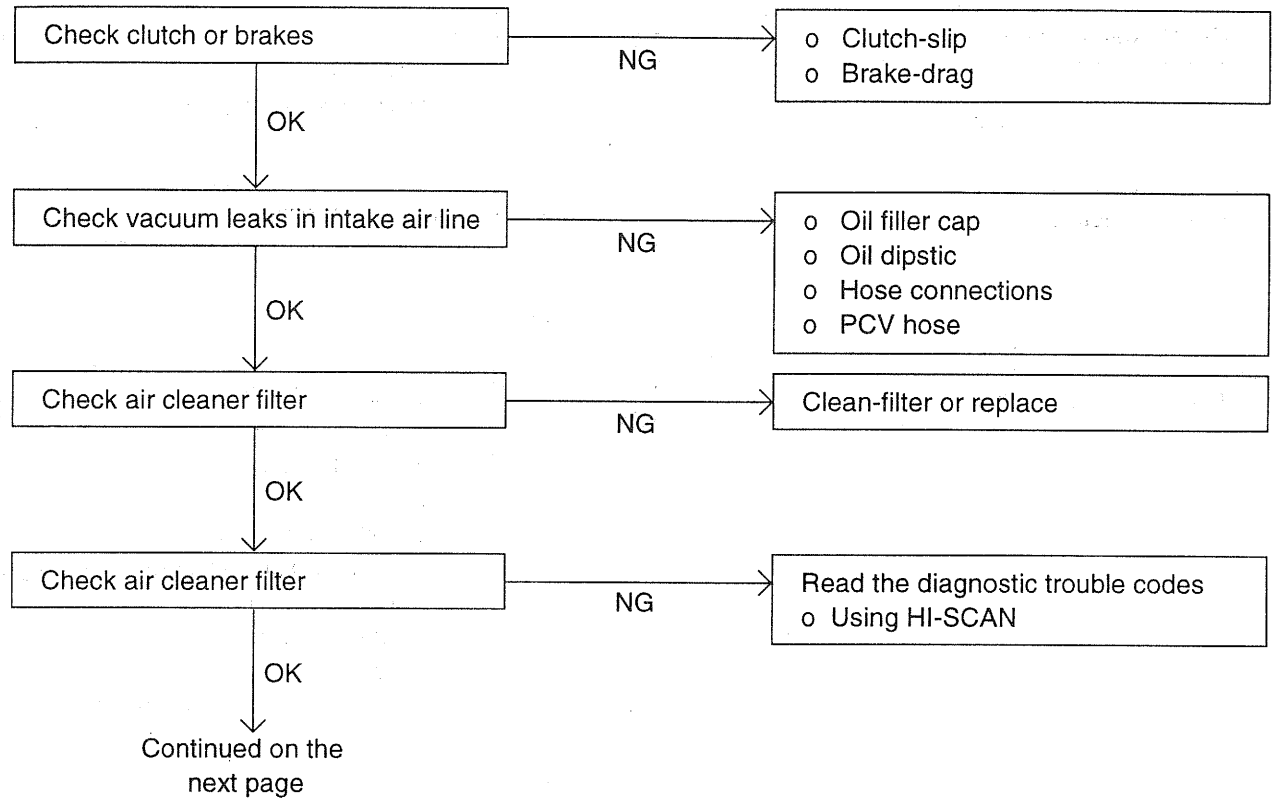


EFHA012A

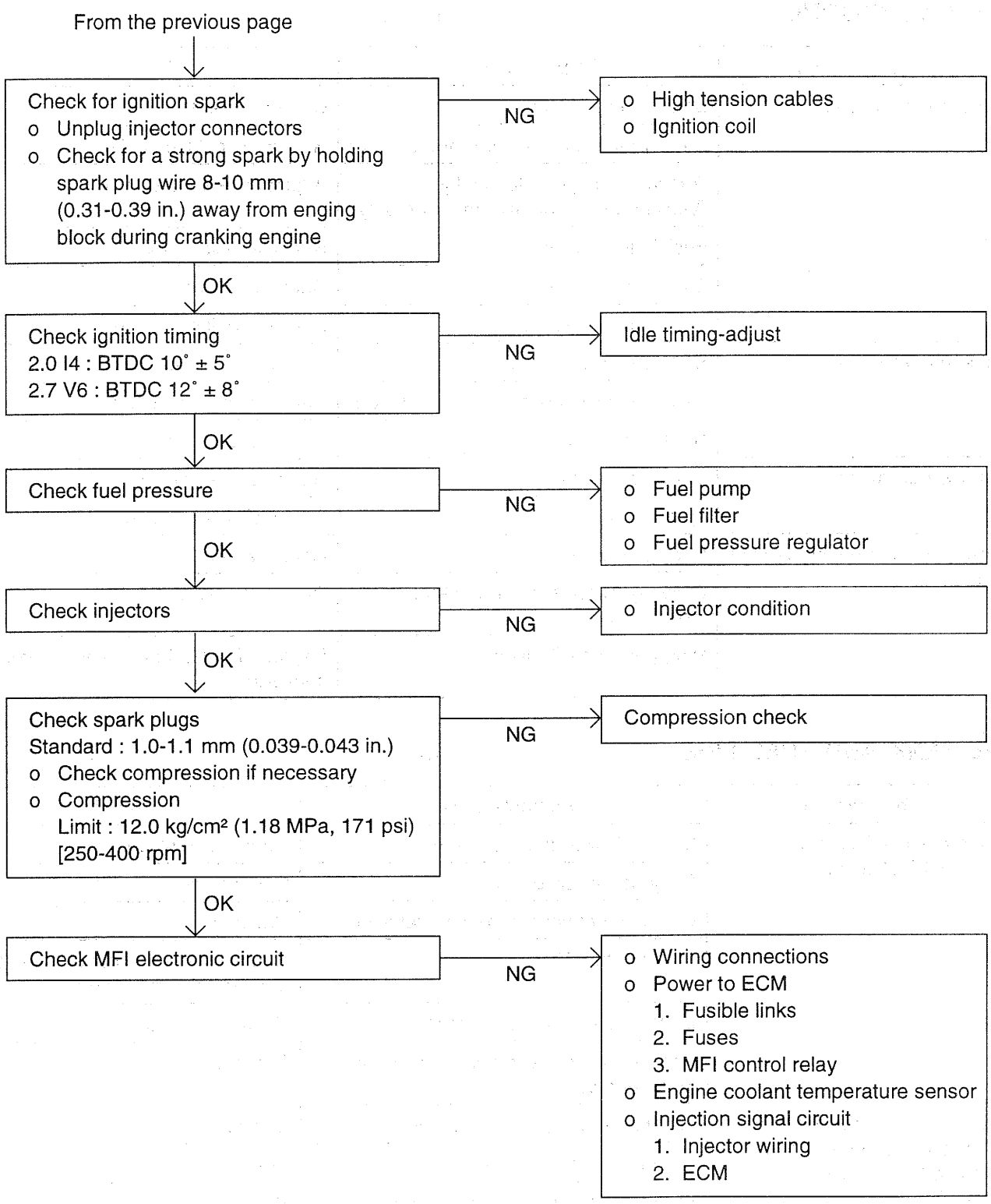

From the previous page
Check fuel pressure
NG
o Fuel pump
o Fuel filter
o Fuel pressure regulator
OK
Check injectors
NG
Injection condition
OK
Check MFI electronic circuit
NG
o Wiring connections
o Power to ECM
1. Fusible links
2. Fuses
3. MFI control relay
o Engine coolant temperature sensor
o Injection signal circuit
1. Injector wiring
2 . ECM

EFA9012B

ENGINE HESITATES OR ACCELERATES POORLY EFHA0130



EFA9013A


From the previous page
Check for ignition spark
o Unplug injector connectors
o Check for a strong spark by holding spark plug wire 8-10 mm (0.31-0.39 in.) away from enging block during cranking engine
NG
o High tension cables
o Ignition coil
OK
Check ignition timing
2.0 I4 : BTDC 10° ± 5°
2.7 V6 : BTDC 12° ± 8°
NG
Idle timing-adjust
OK
Check fuel pressure
NG
o Fuel pump
o Fuel filter
o Fuel pressure regulator
OK
Check injectors
NG
o Injector condition
OK
Check spark plugs
Standard : 1.0-1.1 mm (0.039-0.043 in.)
o Check compression if necessary
o Compression
Limit : 12.0 kg/cm² (1.18 MPa, 171 psi) [250-400 rpm]
NG
Compression check
OK
Check MFI electronic circuit
NG
o Wiring connections
o Power to ECM
1. Fusible links
2. Fuses
3. MFI control relay
o Engine coolant temperature sensor
o Injection signal circuit
1. Injector wiring
2. ECM

EFHA013B

TROUBLESHOOTING

EFA90140

Trouble symptom	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
	Ignition switch faulty	Replace ignition switch
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
	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

FUEL TANK AND FUEL LINE

EFA90150

Trouble 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
Evaporative emission system malfunctions (when fuel filler cap is removed, pressure is released)	Incorrect routing of a vapor line	Correct
	Disconnected vapor line	Correct
	Folded, bent, cracked or clogged vapor line	Replace
	Faulty fuel tank cap	Replace
	Malfunctioning overfill limiter (Two-way valve)	Replace

MULTIPORT FUEL INJECTION (MFI) EFA90160

GENERAL INFORMATION

The Multiport Fuel Injection System consists of sensors which detect the engine conditions, the ENGINE CONTROL MODULE (ECM) which controls the system based on signals from these sensors, and actuators which operate under the control of the ECM. The ECM carries out activities such as fuel injection control, idle air control and ignition timing control. In addition, the ECM is equipped with several diagnostic test modes which simplify troubleshooting when a problem occurs.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions. A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump. with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors. Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-3-4-2. This is called multiport. The ECM provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the ECM controls the air/fuel mixture by using the heated oxygen sensor signal to carry out "closed-loop" control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst.

IDLE SPEED CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The ECM drives the idle speed control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air conditioning load. In addition, when the air conditioning switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The ignition power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the ECM from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

OTHER CONTROL FUNCTIONS EFA90170

1. Fuel Pump Control. :
   Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Compressor Clutch Relay Control. :
   Turns the compressor clutch of the A/C ON and OFF.
3. Fan Relay Control. :
   The radiator fan and condenser fan speeds are controlled in response to the engine coolant temperature and vehicle speed.
4. Evaporative Emission Purge Control (Refer to GROUP EC).

DIAGNOSTIC TEST MODE EFA90180

- When an abnormality is detected in one of the sensors or actuators related to emission control, the CHECK ENGINE/MALFUNCTION INDICATOR LAMP illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnostic trouble code corresponding to the abnormality is output.
- The RAM data inside the ECM that is related to the sensors and actuators can be read by means of the scan tool In addition, the actuators can be controlled under certain circumstances.

HOW TO COPE WITH INTERMITTENT MALFUNCTIONS EFA90190

Most intermittent malfunctions occur under certain conditions. If those conditions can be identified, the cause will be easier to find.

TO COPE WITH INTERMITTENT MALFUNCTION;

1. Ask the customer about the malfunction.
   Ask what it feels like, what it sounds like, etc. Then ask about driving conditions, weather, frequency of occurrence, and so on.
2. Determine the conditions from the customer's responses.
   Typically, almost all intermittent malfunctions occur from conditions like vibration, temperature and/or moisture change, poor connections. From the customer's replies, it should be reasoned which condition is influenced.
3. Use the simulation test

In the cases of vibration or poor connections, use the simulation tests below to attempt to duplicate the customer's complaint. Determine the most likely circuit(s) and perform the simulation tests on the connectors and parts of that circuit(s). Be sure to use the inspection procedures provided for diagnostic trouble codes and trouble symptoms. For temperature and/or moisture conditions related intermittent malfunctions, using common sense, try to change the conditions of the suspected circuit components, then use the simulation tests below.

4. Verify the intermittent malfunction is eliminated. Repair the malfunctioning part and try to duplicate the condition(s) again to verify the intermittent malfunction has been eliminated.

SIMULATION TESTS

For these simulation tests, shake, then gently bend, pull and twist the wiring of each of these examples to duplicate the intermittent malfunction.

- Shake the connector up-and-down, right-and-left.
- Shake the wiring harness up-and-down, right-and-left.
- Vibrate the part or sensor.

SERVICE POINTS IN INSPECTING A BLOWN FUSE EFAA0200

Remove the fuse and measure the resistance between the load side of the fuse and ground. Set the switches of all circuits which are connected to this fuse to a condition of continuity. If the resistance is almost 0Ω at this time, there is a shortage somewhere between these switches and the load. If the resistance is not 0Ω, there is no shortage at the present time, but a momentary shortage has probably caused the fuse to blow.

The main causes of a short circuit are the following.

- Harness being clamped by the vehicle body.
- Damage to the outer casing of the harness due to wear or heat.
- Water getting into the connector or circuitry.
- Human error (mistakenly shorting a circuit, etc.).

INSPECTING THE MFI SYSTEM EFHA0210

If the MFI system components (sensors, ECM, injector, etc.) fail, the interruption 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 is noted, first perform an inspection by self-diagnosis and subsequent basic engine checks (ignition system malfunction, incorrect engine adjustment, etc.), and then inspect the MFI system components.

ON-BOARD DIAGNOSTICS

- The recording condition of diagnostic trouble code. After the ECM first detects a malfunction, a diagnostic trouble code is recorded when the engine is restarted and the same malfunction is re-detected. (Malfunction is detected in driving cycle). However, for fuel system rich/lean misfiring, a diagnostic trouble code is recorded on the first detection of the malfunction.
- The erasing condition of diagnostic trouble code. After recording the diagnostic trouble code, if the ECM does not re-detect the malfunction for 40 driving cycles, the diagnostic trouble code will be erased from the ECM memory. However, for fuel system rich/lean or misfiring, the diagnostic trouble code will be erased under the following conditions.
  - When driving conditions (engine speed, engine coolant temperature, etc.) are similar to those when the malfunction was first recorded.
  - When the ECM does not re-detect the malfunction for 80 driving cycles.

NOTE

A "driving cycle" consists of the engine start, vehicle operation beyond the beginning of closed loop operation.

MALFUNCTION INDICATOR LIGHT (MIL)

An On Board Diagnostic lamp lights up to notify the driver that there is a problem with the vehicle.

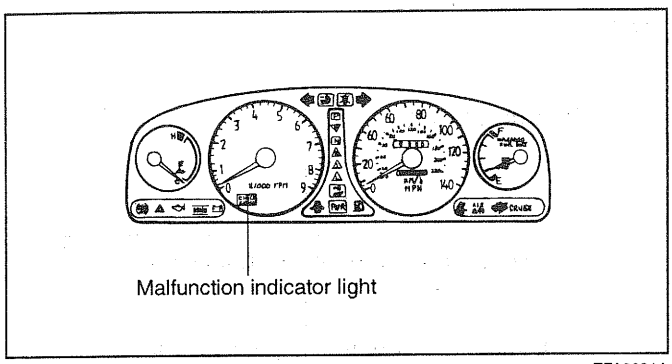
However MIL will go off automatically after 3 subsequent sequential driving cycles that do not redetected the same malfunctions.

Immediately after the ignition switch is turned on, the malfunction indicator light is lit for 5 seconds to indicate that the malfunction indicator light operates normally.

Following Items will be indicated by the MIL

- Catalyst
- Fuel system
- Air flow sensor (MAF sensor)
- Intake Air Temperature Sensor (IAT sensor)
- Engine Coolant Temperature Sensor (ECT sensor)
- Throttle Position Sensor (TPS)
- Upstream Oxygen Sensor
- Downstream Oxygen Sensor Heater
- Downstream Oxygen Sensor
- Upstream Oxygen Sensor Heater

- Injector
- Misfire
- Crankshaft Position Sensor (CKP sensor)
- Camshaft Position Sensor (CMP sensor)
- Evaporative Emission Control System
- Vehicle Speed Sensor (VSS)
- Idle Speed Control
- ECM
- Manifold Absolute Pressure (MAP) Sensor (Except 2.5L V6 engine)
- Idle Switch
- EGR System (Except 2.5L V6 engine)



EFA9021A

INSPECTING THE MALFUNCTION INDICATOR LAMP (MIL)

1. After turning on the ignition key, check that the light illuminates for 5 seconds without the engine running.
2. If the light does not illuminate, check for an open circuit in harness, blown fuse and blown bulb.

SELF-DIAGNOSIS

The ECM monitors the input/output signals (some signals at all times and others under specified conditions). When the ECM detects that an irregularity, it memorizes the diagnostic trouble code, and outputs the signal to the self-diagnosis output terminal. The diagnosis results can be read by the Generic Scan Tool (GST). Diagnostic trouble code (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble code will however be erased when the battery terminal or the engine control module (ECM) connector is disconnected or erased by the Generic Scan Tool.

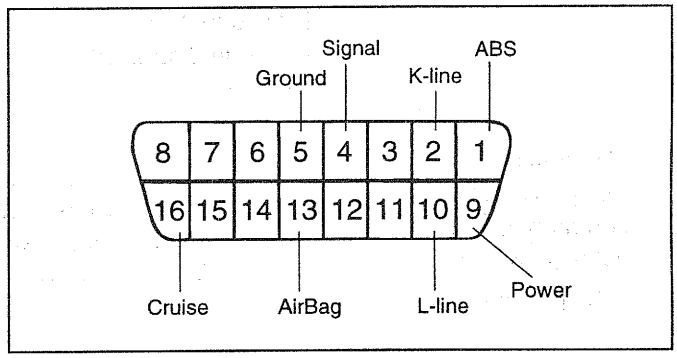
CHECKING PROCEDURE (SELF-DIAGNOSIS)

NOTE

1. **When battery voltage is low, diagnostic trouble codes can not be read. Be sure to check the battery for voltage and charging system before starting the test.**
2. **Diagnosis memory is erased if the battery or the ECM connector is disconnected. Do not disconnect the battery before the diagnostic trouble codes are completely read and recorded.**

Inspection Procedure (Using Generic Scan Tool)

1. Turn OFF the ignition switch.
2. Connect the scan tool to the data link connector on the lower crash pad.
3. Turn ON the ignition switch.
4. Use the GST to check the diagnostic trouble code.
5. Repair the faulty part from the diagnosis chart.
6. Erase the diagnostic trouble code.
7. Disconnect the GST.

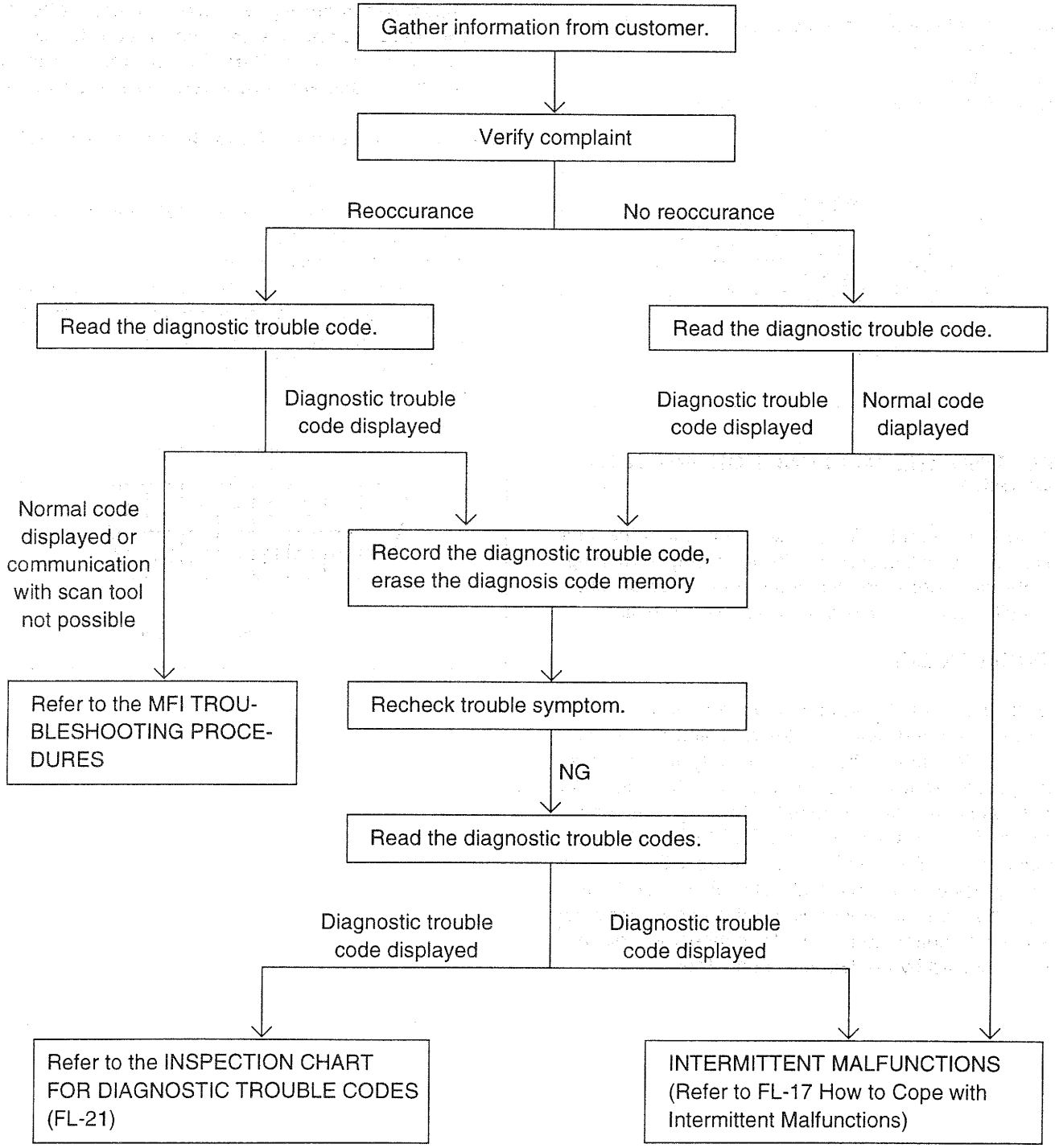


EFHA021B

MFI CONTROL SYSTEM

TROUBLESHOOTING EFHA0220

DIAGNOSTIC TROUBLESHOOTING FLOW



EFHA022A

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (FOR 2.0 I4 OBD-II) EFHA0240

[FOR 2.0 I4 OBD-II]

DTC NO.	CONTENT	Memory	MIL
P0107	Manifold Absolute Pressure Sensor Low Voltage	O	O
P0108	Manifold Absolute Pressure Sensor High Voltage	O	O
P0112	Intake Air Temp. Low Voltage	O	O
P0113	Intake Air Temp. High Voltage	O	O
P0115 (FL-106)	Engine Coolant Temp. Circuit Malfunction	O	O
P0116	Engine Coolant Temp. Sensor Drift	O	O
P0122	Throttle Position Sensor Low Voltage	O	O
P0123	Throttle Position Sensor High Voltage	O	O
P0132	Oxygen Sensor Circuit Open (Bank 1, Sensor 1)	O	O
P0133 (FL-114)	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 1)	O	O
P0134 (FL-119)	Excessive Time to Enter Closed Loop Fuel Control	O	O
P0135 (FL-122)	Oxygen Sensor Heater Circuit Malfunction (Bank 1, Sensor 1)	O	O
P0136 (FL-125)	Oxygen Sensor Circuit Open (Bank 1, Sensor 2)	O	O
P0140	Oxygen Sensor Circuit Short (Bank 1, Sensor 2)	O	O
P0141 (FL-130)	Oxygen Sensor Heater Circuit Malfunction (Bank 1, Sensor 2)	O	O
P0171	Fuel System Too Lean	O	O
P0172	Fuel System Too Rich	O	O
P0201 (FL-133)	Injector Circuit Malfunction (Cylinder -1,)	O	O
P0202 (FL-133)	Injector Circuit Malfunction (Cylinder -2)	O	O
P0203 (FL-133)	Injector Circuit Malfunction (Cylinder -3)	O	O
P0204 (FL-133)	Injector Circuit Malfunction (Cylinder -4)	O	O
P0300 (FL-137)	Random Misfire Detected	O	O
P0301 (FL-142)	Misfire Detected (Cylinder -1)	O	O
P0302 (FL-142)	Misfire Detected (Cylinder -2)	O	O
P0303 (FL-142)	Misfire Detected (Cylinder -3)	O	O
P0304 (FL-142)	Misfire Detected (Cylinder -4)	O	O
P0325	Knock Sensor Circuit Malfunction	O	X
P0335 (FL-145)	Crankshaft Position Sensor Circuit Malfunction	O	O
P0340 (FL-148)	Camshaft Position Sensor Circuit Malfunction	O	O
P0350	Ignition Coil Malfunction	O	O
P0421 (FL-150)	Warm-up Catalyst Efficiency Below Threshold	O	O

DTC NO.	CONTENT	Memory	MIL
P0443 (FL-152)	Evaporative Emission Control System Purge Control Valve Circuit Malfunction	O	O
P0500 (FL-155)	Vehicle Speed Sensor Malfunction	O	O
P0507	Idle Speed Control - High RPM	O	O
P1330	Spark Timing Adjust Malfunction	O	O

[FOR 2.0 I4 NON OBD-II]

DTC NO.	CONTENT	Memory	MIL
P0105 (FL-99)	Manifold Absolute Pressure Sensor Malfunction	O	O
P0110 (FL-103)	Intake Air Temp. Circuit Malfunction	O	O
P0115 (FL-106)	Engine Coolant Temp. Circuit Malfunction	O	O
P0120 (FL-110)	Throttle Position Circuit Malfunction	O	O
P0130 (FL-114)	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 1)	O	O
P0136 (FL-125)	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 2)	O	O
P0201 (FL-133)	Injector Circuit Malfunction (Cylinder -1,)	O	O
P0202 (FL-133)	Injector Circuit Malfunction (Cylinder -2)	O	O
P0203 (FL-133)	Injector Circuit Malfunction (Cylinder -3)	O	O
P0204 (FL-133)	Injector Circuit Malfunction (Cylinder -4)	O	O
P0325	Knock Sensor Circuit Malfunction	O	X
P0335 (FL-145)	Crankshaft Position Sensor Circuit Malfunction	O	O
P0340 (FL-148)	Camshaft Position Sensor Circuit Malfunction	O	O
P0350	Ignition Coil Malfunction	O	O
P0500 (FL-155)	Vehicle Speed Sensor Malfunction	O	X
P1330	Spark Timing Adjust Malfunction	O	O

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (FOR 2.7 V6) EFHA0242

[FOR 2.7 V6 OBD-II]

DTC NO.	CONTENT	Memory	MIL
P0100	Mass or Volume Air Flow Circuit Malfunction	O	O
P0101	Mass or volume Air Flow Circuit Range/Performance Problem	O	X
P0110	Intake Air Temperature Circuit Malfunction	O	O
P0115	Engine Coolant Temperature Circuit Malfunction	O	O
P0120	Throttle Pedal Position Circuit Malfunction	O	O
P0121	Throttle/Pedal Position Circuit Range/Performance problem	O	X
P0130	O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	O	O

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (FOR 2.0 I4 OBD-II) EFHA0240

[FOR 2.0 I4 OBD-II]

DTC NO.	CONTENT	Memory	MIL
P0107	Manifold Absolute Pressure Sensor Low Voltage	O	O
P0108	Manifold Absolute Pressure Sensor High Voltage	O	O
P0112	Intake Air Temp. Low Voltage	O	O
P0113	Intake Air Temp. High Voltage	O	O
P0115 (FL-106)	Engine Coolant Temp. Circuit Malfunction	O	O
P0116	Engine Coolant Temp. Sensor Drift	O	O
P0122	Throttle Position Sensor Low Voltage	O	O
P0123	Throttle Position Sensor High Voltage	O	O
P0132	Oxygen Sensor Circuit Open (Bank 1, Sensor 1)	O	O
P0133 (FL-114)	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 1)	O	O
P0134 (FL-119)	Excessive Time to Enter Closed Loop Fuel Control	O	O
P0135 (FL-122)	Oxygen Sensor Heater Circuit Malfunction (Bank 1, Sensor 1)	O	O
P0136 (FL-125)	Oxygen Sensor Circuit Open (Bank 1, Sensor 2)	O	O
P0140	Oxygen Sensor Circuit Short (Bank 1, Sensor 2)	O	O
P0141 (FL-130)	Oxygen Sensor Heater Circuit Malfunction (Bank 1, Sensor 2)	O	O
P0171	Fuel System Too Lean	O	O
P0172	Fuel System Too Rich	O	O
P0201 (FL-133)	Injector Circuit Malfunction (Cylinder -1,)	O	O
P0202 (FL-133)	Injector Circuit Malfunction (Cylinder -2)	O	O
P0203 (FL-133)	Injector Circuit Malfunction (Cylinder -3)	O	O
P0204 (FL-133)	Injector Circuit Malfunction (Cylinder -4)	O	O
P0300 (FL-137)	Random Misfire Detected	O	O
P0301 (FL-142)	Misfire Detected (Cylinder -1)	O	O
P0302 (FL-142)	Misfire Detected (Cylinder -2)	O	O
P0303 (FL-142)	Misfire Detected (Cylinder -3)	O	O
P0304 (FL-142)	Misfire Detected (Cylinder -4)	O	O
P0325	Knock Sensor Circuit Malfunction	O	X
P0335 (FL-145)	Crankshaft Position Sensor Circuit Malfunction	O	O
P0340 (FL-148)	Camshaft Position Sensor Circuit Malfunction	O	O
P0350	Ignition Coil Malfunction	O	O
P0421 (FL-150)	Warm-up Catalyst Efficiency Below Threshold	O	O

DTC NO.	CONTENT	Memory	MIL
P0443 (FL-152)	Evaporative Emission Control System Purge Control Valve Circuit Malfunction	O	O
P0500 (FL-155)	Vehicle Speed Sensor Malfunction	O	O
P0507	Idle Speed Control - High RPM	O	O
P1330	Spark Timing Adjust Malfunction	O	O

[FOR 2.0 I4 NON OBD-II]

DTC NO.	CONTENT	Memory	MIL
P0105 (FL-99)	Manifold Absolute Pressure Sensor Malfunction	O	O
P0110 (FL-103)	Intake Air Temp. Circuit Malfunction	O	O
P0115 (FL-106)	Engine Coolant Temp. Circuit Malfunction	O	O
P0120 (FL-110)	Throttle Position Circuit Malfunction	O	O
P0130 (FL-114)	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 1)	O	O
P0136 (FL-125)	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 2)	O	O
P0201 (FL-133)	Injector Circuit Malfunction (Cylinder -1,)	O	O
P0202 (FL-133)	Injector Circuit Malfunction (Cylinder -2)	O	O
P0203 (FL-133)	Injector Circuit Malfunction (Cylinder -3)	O	O
P0204 (FL-133)	Injector Circuit Malfunction (Cylinder -4)	O	O
P0325	Knock Sensor Circuit Malfunction	O	X
P0335 (FL-145)	Crankshaft Position Sensor Circuit Malfunction	O	O
P0340 (FL-148)	Camshaft Position Sensor Circuit Malfunction	O	O
P0350	Ignition Coil Malfunction	O	O
P0500 (FL-155)	Vehicle Speed Sensor Malfunction	O	X
P1330	Spark Timing Adjust Malfunction	O	O

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES (FOR 2.7 V6) EFHA0242

[FOR 2.7 V6 OBD-II]

DTC NO.	CONTENT	Memory	MIL
P0100	Mass or Volume Air Flow Circuit Malfunction	O	O
P0101	Mass or volume Air Flow Circuit Range/Performance Problem	O	X
P0110	Intake Air Temperature Circuit Malfunction	O	O
P0115	Engine Coolant Temperature Circuit Malfunction	O	O
P0120	Throttle Pedal Position Circuit Malfunction	O	O
P0121	Throttle/Pedal Position Circuit Range/Performance problem	O	X
P0130	O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	O	O

DTC NO.	CONTENT	Memory	MIL
P0150	O2 Sensor Circuit Malfunction (Bank 2 Sensor 1)	O	O
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	O	O
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	O	O
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	O	X
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	O	X
P0135	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	O	O
P0155	O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)	O	O
P0136	O2 Sensor Circuit Malfunction (Bank 1 Sensor 2)	O	O
P0156	O2 Sensor Circuit Malfunction (Bank 2 Sensor 2)	O	O
P0140	Downstream O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	O	X
P0160	Downstream O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	O	X
P0141	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	O	O
P0161	O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)	O	O
P0170	Fuel Trim Malfunction (Bank 1)	O	O
P0173	Fuel Trim Malfunction (Bank 2)	O	O
P0201	Cylinder 1 - Injector Circuit Malfunction	O	O
P0202	Cylinder 2 - Injector Circuit Malfunction	O	O
P0203	Cylinder 3 - Injector Circuit Malfunction	O	O
P0204	Cylinder 4 - Injector Circuit Malfunction	O	O
P0205	Cylinder 5 - Injector Circuit Malfunction	O	O
P0206	Cylinder 6 - Injector Circuit Malfunction	O	O
P0230	Fuel Pump Circuit Malfunction	O	X
P0301	Cylinder 1 - Misfire Detected	O	O
P0302	Cylinder 2 - Misfire Detected	O	O
P0303	Cylinder 3 - Misfire Detected	O	O
P0304	Cylinder 4 - Misfire Detected	O	O
P0305	Cylinder 5 - Misfire Detected	O	O
P0306	Cylinder 6 - Misfire Detected	O	O
P0325	Knock Sensor 1 Circuit Malfunction	O	X
P0330	Knock Sensor 2 Circuit Malfunction	O	X
P0335	Crankshaft Position Sensor 'A' Circuit Malfunction	O	O
P0340	Camshaft Position Sensor (TDC Sensor) Circuit Malfunction	O	O
P0350	Ignition Coil Primary/Secondary Circuit Malfunction	O	X
P0351	Ignition Coil 'A' Primary/Secondary Circuit Malfunction	O	X
P0352	Ignition Coil 'B' Primary/Secondary Circuit Malfunction	O	X

DTC NO.	CONTENT	Memory	MIL
P0353	Ignition Coil 'C' Primary/Secondary Circuit Malfunction	O	X
P0354	Ignition Coil 'D' Primary/Secondary Circuit Malfunction	O	X
P0355	Ignition Coil 'E' Primary/Secondary Circuit Malfunction	O	X
P0356	Ignition Coil 'F' Primary/Secondary Circuit Malfunction	O	X
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	O	O
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	O	O
P0443	Purge Control Valve Circuit Malfunction	O	O
P0500	For OBD2 Rough Road Detection, Vehicle Speed Malfunction From ABS/TCS	O	O
	For OBD2 Rough Road Detection, Vehicle Speed Malfunction From Front Right Inductive Wheel Sensor	O	O
P0505	Idle Control System Malfunction (Mechanical Error)	O	X
P0506	Idle Speed Control RPM Lower Than Expected	O	X
P0507	Idle Speed Control RPM Higher Than Expected	O	X
P0550	Powersteering Pressure Sensor Circuit Malfunction	O	X
P1134	O2 Sensor Circuit - Transition Switch Time Malfunction/Slop (Bank 1 Sensor 1)	O	O
P1154	O2 Sensor Circuit - Transition Switch Time Malfunction/Slop (Bank 2 Sensor 1)	O	O
P1166	O2 Sensor - Controller Adaption Diagnosis Malfunction (Bank 1)	O	O
P1167	O2 Sensor - Controller Adaption Diagnosis Malfunction (Bank 2)	O	O
P1372	Segment Time Acquisition Incorrect	O	O
P1510	Idle Charge Actuator Command Signal Incorrect (Coil 1)	O	O
P1511	Idle Charge Actuator Command Signal Incorrect (Coil 2)	O	O
P1529	Customer Snapshot (MIL Request/Freeze Frame) Request VIA CAN	O	O
P1602	Serial Communication Problem With TCU (TIMEOUT)	O	O
P1613	ECU - Selftest Failed	O	X
P1616	Main Relay Malfunction	O	X
P1623	Diagnostic Lamp powerstage Malfunction	O	X
P1624	Cooling Fan Relay - Circuit Malfunction ("LOW" Circuit)	O	X
P1625	Cooling Fan Relay - Circuit Malfunction ("HIGH" Circuit)	O	X

[FOR 2.7 V6 NON OBD-II]

DTC NO.	CONTENT	Memory	MIL
P0100	Mass or Volume Air Flow Circuit Malfunction	O	X
P0110	Intake Air Temperature Circuit Malfunction	O	X
P0115	Engine Coolant Temperature Circuit Malfunction	O	X

DTC NO.	CONTENT	Memory	MIL
P0120	Throttle Pedal Position Circuit Malfunction	O	X
P0130	O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	O	X
P0150	O2 Sensor Circuit Malfunction (Bank 2 Sensor 1)	O	X
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	O	X
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	O	X
P0135	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	O	X
P0155	O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)	O	X
P0201	Cylinder 1 - Injector Circuit Malfunction	O	X
P0202	Cylinder 2 - Injector Circuit Malfunction	O	X
P0203	Cylinder 3 - Injector Circuit Malfunction	O	X
P0204	Cylinder 4 - Injector Circuit Malfunction	O	X
P0205	Cylinder 5 - Injector Circuit Malfunction	O	X
P0206	Cylinder 6 - Injector Circuit Malfunction	O	X
P0230	Fuel Pump Circuit Malfunction	O	X
P0325	Knock Sensor 1 Circuit Malfunction	O	X
P0330	Knock Sensor 2 Circuit Malfunction	O	X
P0335	Crankshaft Position Sensor 'A' Circuit Malfunction	O	X
P0340	Camshaft Position Sensor (TDC Sensor) Circuit Malfunction	O	X
P0350	Ignition Coil Primary/Secondary Circuit Malfunction	O	X
P0351	Ignition Coil 'A' Primary/Secondary Circuit Malfunction	O	X
P0352	Ignition Coil 'B' Primary/Secondary Circuit Malfunction	O	X
P0353	Ignition Coil 'C' Primary/Secondary Circuit Malfunction	O	X
P0354	Ignition Coil 'D' Primary/Secondary Circuit Malfunction	O	X
P0355	Ignition Coil 'E' Primary/Secondary Circuit Malfunction	O	X
P0356	Ignition Coil 'F' Primary/Secondary Circuit Malfunction	O	X
P0500	For OBD2 Rough Road Detection, Vehicle Speed Malfunction From ABS/TCS	O	X
	For OBD2 Rough Road Detection, Vehicle Speed Malfunction From Front Right Inductive Wheel Sensor	O	X
P1166	O2 Sensor - Controller Adaption Diagnosis Malfunction (Bank 1)	O	X
P1167	O2 Sensor - Controller Adaption Diagnosis Malfunction (Bank 2)	O	X
P1510	Idle Charge Actuator Command Signal Incorrect (Coil 1)	O	X
P1511	Idle Charge Actuator Command Signal Incorrect (Coil 2)	O	X
P1602	Serial Communication Problem With TCU (TIMEOUT)	O	X
P1613	ECU - Self-test Failed	O	X
P1616	Main Relay Malfunction	O	X

TROUBLE AREA RELATED TO DTC (FOR 2.0 I4)

EFHA0243

DTC No.	Diagnostic items	Check items (Remedy)
P0110	Intake Air Temperature Circuit Malfunction	• Harness and connector • Intake air temperature sensor • Open or short in intake air temp. sensor circuit • Intake air temp. sensor • ECM
P0115	Engine Coolant Temperature Circuit Malfunction	• Harness and connector • Engine coolant temperature sensor • Open or short in engine coolant temp. sensor circuit • ECM
P0120	Throttle Position Circuit Malfunction	• Harness and connector • Throttle position sensor • Idle switch • Open or short in throttle position sensor circuit • ECM
P0130	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	• Harness and connector • Oxygen sensor
P0133	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	
P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Harness and connector • Oxygen sensor (rear)
P0201	Injector Circuit Malfunction - Cylinder 1	• Harness and connector • Injector
P0202	Injector Circuit Malfunction - Cylinder 2	
P0203	Injector Circuit Malfunction - Cylinder 3	
P0204	Injector Circuit Malfunction - Cylinder 4	
P0325	Knock Sensor 1 Circuit Malfunction	• Open or short between knock sensor and ECM • Harness and connector • Knock sensor
P0335	Crankshaft Position Sensor Circuit Malfunction	• Harness and connector • Open or short in crankshaft position sensor • Crankshaft position sensor • ECM
P0340	Camshaft Position Sensor Circuit Malfunction	• Harness and connector (If harness and connector are normal replace camshaft position sensor)
P0500	Vehicle Speed Sensor Malfunction	• Harness and connector • Vehicle speed sensor

TROUBLE AREA RELATED TO DTC (FOR 2.7 V6)

EFHA0244

DTC No.	Diagnostic items	Trouble Area (Check Point)
P0100	Mass or Volume Air Flow Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor
P0101	Mass or Volume Air Flow Circuit Range/ Performance Problem	• Foreign material deposit in the sensor • Bad connection of connectors/bad wiring
P0110	Intake Air Temperature Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor
P0115	Engine Coolant Temperature Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor
P0120	Throttle/Pedal Position Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor
P0121	Throttle/Pedal Position Circuit Range/ Performance Problem	• Sensor's wearness or improper installation • Bad connection of connectors/bad wiring • Malfunction of the sensor
P0130	O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B1/S1)
P0150	O2 Sensor Circuit Malfunction (Bank 2 Sensor 1)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B2/S1)
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	• Sensor deteriorated or contamination deposit • Sensor pin corrosion
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	• Sensor deteriorated or contamination deposit (B2/S1) • Sensor pin corrosion
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	• Sensor deteriorated or contamination deposit (B1/S1) • Sensor pin corrosion
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	• Sensor deteriorated or foreign material deposit (B2/S1) • Sensor pin corrosion
P0135	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B1/S1)
P0155	O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 1)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B2/S1)
P0136	O2 Sensor Circuit Malfunction (Bank 1 Sensor 2)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B1/S2)
P0156	O2 Sensor Circuit Malfunction (Bank 2 Sensor 2)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B2/S2)

DTC No.	Diagnostic items	Trouble Area (Check Point)
P0140	Downstream O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	• Sensor deteriorated or contamination deposit
P0160	Downstream O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	• Sensor deteriorated or contamination deposit
P0141	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B1/S2)
P0161	O2 Sensor Heater Circuit Malfunction (Bank 2 Sensor 2)	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Malfunction of the sensor (B2/S2)
P0170	Fuel Trim Malfunction (Bank 1)	• Fuel system (Fuel tank/Press. regulator/Fuel pump/ PCSV) • Connection of the fuel line hose/sealing/cut • Sealing beween the purge valve and fuel tank • Air leak in the exhaust system • Ignition system • Engine
P0173	Fuel Trim Malfunction (Bank 2)	• Fuel system (Fuel tank/Press. regulator/Fuel pump/ PCSV) • Connection of the fuel line hose/seatling/cut • Sealing beween the purge valve and fuel tank • Air leak in the exhaust system • Ignition system • Engine
P0201	Cylinder 1 - Injector Circuit Malfunction	• Open or short between the injector and ECM • Bad connection of connectors/bad wiring • Bad No.1 injector
P0202	Cylinder 2 - Injector Circuit Malfunction	• Open or short between the injector and ECM • Bad connection of connectors/bad wiring • Bad No.2 injector
P0203	Cylinder 3 - Injector Circuit Malfunction	• Open or short between the injector and ECM • Bad connection of connectors/bad wiring • Bad No.3 injector
P0204	Cylinder 4 - Injector Circuit Malfunction	• Open or short between the injector and ECM • Bad connection of connectors/bad wiring • Bad No.4 injector
P0205	Cylinder 5 - Injector Circuit Malfunction	• Open or short between the injector and ECM • Bad connection of connectors/bad wiring • Bad No.5 injector
P0206	Cylinder 6 - Injector Circuit Malfunction	• Open or short between the injector and ECM • Bad connection of connectors/bad wiring • Bad No.6 injector
P0230	Fuel Pump Circuit Malfunction	• Open or short between the pump and ECM • Bad connection of connectors/bad wiring • Bad pump relay
P0301	Cylinder 1 - Misfire Detected	• Bad ignition system (Spark plug to ECM) • Check the injector #1 • Check the moving time of HLA plunger

DTC No.	Diagnostic items	Trouble Area (Check Point)
P0302	Cylinder 2 - Misfire Detected	• Bad ignition system (Spark plug to ECM) • Check the injector #2 • Check the moving time of HLA plunger
P0303	Cylinder 3 - Misfire Detected	• Bad ignition system (Spark plug to ECM) • Check the injector #3 • Check the moving time of HLA plunger
P0304	Cylinder 4 - Misfire Detected	• Bad ignition system (Spark plug to ECM) • Check the injector #4 • Check the moving time of HLA plunger
P0305	Cylinder 5 - Misfire Detected	• Bad ignition system (Spark plug to ECM) • Check the injector #5 • Check the moving time of HLA plunger
P0306	Cylinder 6 - Misfire Detected	• Bad ignition system (Spark plug to ECM) • Check the injector #6 • Check the moving time of HLA plunger
P0325	Knock Sensor 1 Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Bad knock sensor in bank 1
P0330	Knock Sensor 2 Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Bad knock sensor in bank 2
P0335	Crankshaft Position Sensor 'A' Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Bad CKP sensor
P0340	Camshaft Position Sensor (TDC Sensor) Circuit Malfunction	• Open or short between the sensor and ECM • Bad connection of connectors/bad wiring • Bad CMP sensor
P0350	Ignition Coil Primary/Secondary Circuit Malfunction	• Bad ignition system (Spark plug to ECM) • Bad connection of connectors/bad wiring
P0351	Ignition Coil 'A' Primary/Secondary Circuit Malfunction	• Bad ignition system (Spark plug to ECM) • Bad connection of connectors/bad wiring
P0352	Ignition Coil 'B' Primary/Secondary Circuit Malfunction	• Bad ignition system (Spark plug to ECM) • Bad connection of connectors/bad wiring
P0353	Ignition Coil 'C' Primary/Secondary Circuit Malfunction	• Bad ignition system (Spark plug to ECM) • Bad connection of connectors/bad wiring
P0354	Ignition Coil 'D' Primary/Secondary Circuit Malfunction	• Bad ignition system (Spark plug to ECM) • Bad connection of connectors/bad wiring
P0355	Ignition Coil 'E' Primary/Secondary Circuit Malfunction	• Bad ignition system (Spark plug to ECM) • Bad connection of connectors/bad wiring
P0356	Ignition Coil 'F' Primary/Secondary Circuit Malfunction	• Bad ignition system (Spark plug to ECM) • Bad connection of connectors/bad wiring
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	• Catalytic converter melting/broken
P0430	Catalyst System Efficiency Below Threshold (Bank 2)	• Catalytic converter melting/broken

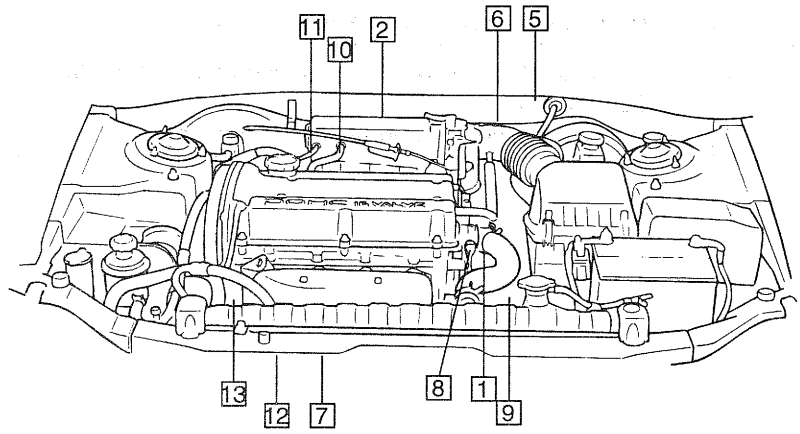
DTC No.	Diagnostic items	Trouble Area (Check Point)
P0443	Evap. Emission Control System - Purge Control Valve Circuit Malfunction	• Open or short between the PCSV and ECM • Bad connection of connectors/bad wiring • Bad PCSV
P0500	For OBD2 Rough Road Detection, Vehicle Speed Malfunction From ABS/ TCS	• Open or short between the TCS or ABS and ECM • Check the connection of related parts • Check the open or short • Bad wheel sensor or TCS/ABS
	For OBD2 Rough Road Detection, Vehicle Speed Malfunction From Front Right Inductive Wheel Sensor	• Check the connection of related parts • Check the open or short • Bad wheel sensor
P0505	Idle Control System Malfunction (Mechanical Error)	• ISA stick in the open position
P0506	Idle Speed Control RPM Lower Than Expected	• Bad return spring of ISA or foreign material deposit
P0507	Idle Speed Control RPM Higher Than Expected	• Bad return spring of ISA or foreign material deposit
P1134	O2 Sensor circuit - Transition Switch Time Mulfunction/Slop (B1/S1)	• O2 sensor deteriorated or foreign material deposit
P1154	O2 Sensor circuit - Transition Switch Time Mulfunction/Slop (B2/S1)	• O2 sensor deteriorated or foreign material deposit
P1166	O2 Sensor - Controller Adaption diagnosis Malfunction (Bank 1)	• Fuel system (Fuel tank/Press. regulator/Fuel pump/ PCSV) • Connection of the fuel line hose/sealing/cut • Sealing beween the purge valve and fuel tank • Air leak in the exhaust system • Ignition system • Engine
P1167	O2 Sensor - Controller Adaption diagnosis Malfunction (Bank 2)	• Fuel system (Fuel tank/Press. regulator/Fuel pump/ PCSV) • Connection of the fuel line hose/sealing/cut • Sealing beween the purge valve and fuel tank • Air leak in the exhaust system • Ignition system • Engine
P1372	Segment Time Acquisition Incorrect	• Bad installation of tarqet wheel in crankshaft • Bad signal of the CKP sensor • Bad connection of connectors/bad wiring
P1510	Idle Charge Actuator Command Signal Incorrect (Coil 1)	• Open or short between the ISA and ECM • Bad connection of connectors/bad wiring • Bad ISA
P1511	Idle Charge Actuator Command Signal Incorrect (Coil 2)	• Open or short between the ISA and ECM • Bad connection of connectors/bad wiring • Bad ISA
P1529	Customer Snapshot (MIL Request/ Freeze Frame) Request Via Can	• TCM error (check the TCM DTC)
P1602	Serial Communication Problem With TCU (Timeout)	• Open or short of CAN wire • Bad TCM

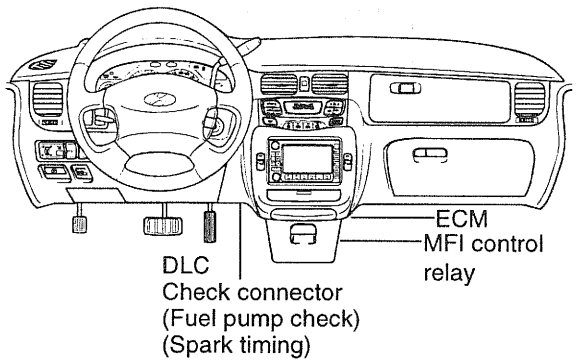
DTC No.	Diagnostic items	Trouble Area (Check Point)
P1616	Main Relay Malfunction	• Bad main relay • Open battery fuse • Bad connection of connectors/bad wiring
P1623	Diagnostic Lamp Powerstage Malfunction	• Open or short between the MIL lamp and ECM • Bad MIL lamp • Bad connection of connectors/bad wiring
P1624	Cooling Fan Relay - Circuit Malfunction ("LOW" Circuit)	• Open or short between the cooling fan and ECM • Bad main relay • Bad connection of connectors/bad wiring
P1625	Cooling Fan Relay - Circuit Malfunction ("HIGH" Circuit)	• Open or short between the cooling fan and ECM • Bad main relay • Bad connection of connectors/bad wiring

MFI COMPONENT INSPECTION EFHA0250

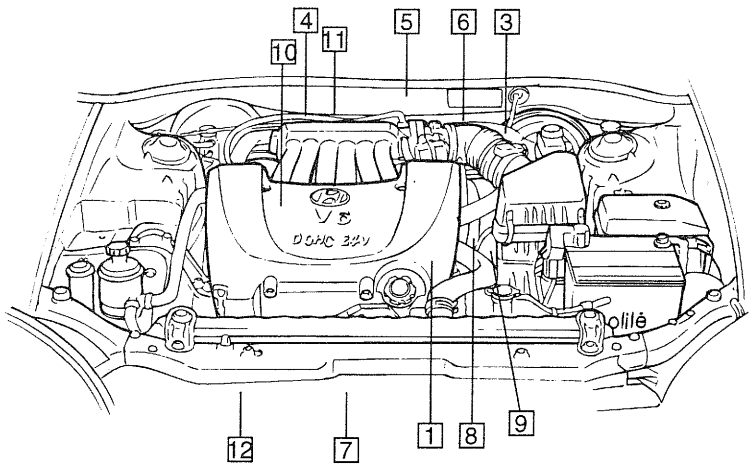
LOCATION OF MFI COMPONENTS

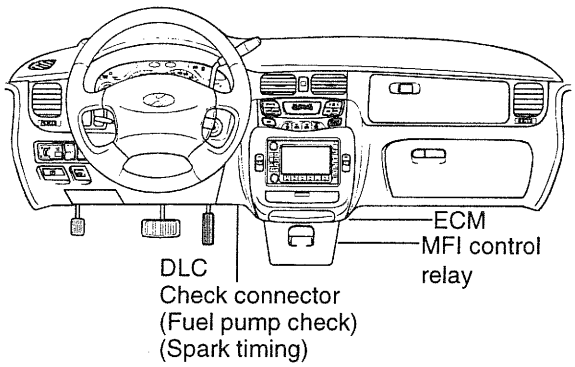
[2.0 I4]





[2.7 V6]



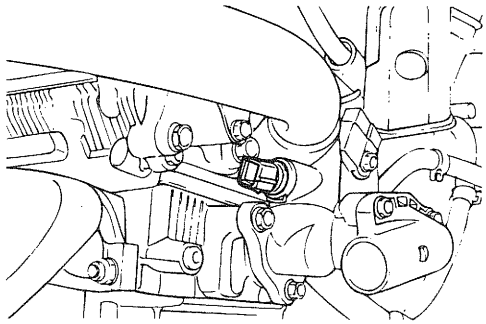


EFHA025A

1 Engine coolant temperature (ECT) sensor. (FL-36)
2 Manifold absolute (MAP) sensor. (FL-40)
3 Mass air flow sensor (Hot film sensor) (FL-43)
4 Intake air temperature (IAT) sensor (FL-40, 46)
5 Throttle position sensor (TPS) (FL-49)
6 Idle speed actuator (ISA) (FL-52)
7 Heated oxygen sensor (HO2S) (FL-55, 58)
8 Camshaft position sensor (CMP) (FL-61)
9 Crankshaft position sensor (CKP) (FL-65)
10 Injector (FL-69, 71)
11 Evap. canister purge control solenoid valve (PCSV) (FL-74)
12 Knock sensor (FL-77)
13 Power steering oil pressure switch (FL-80)

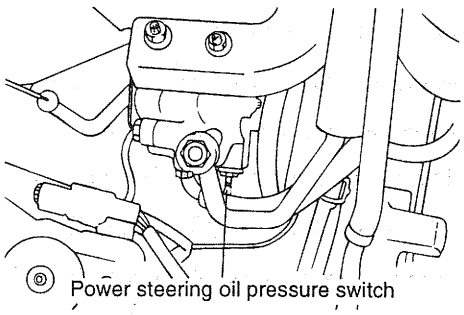
EFHA025B

ECT Sensor



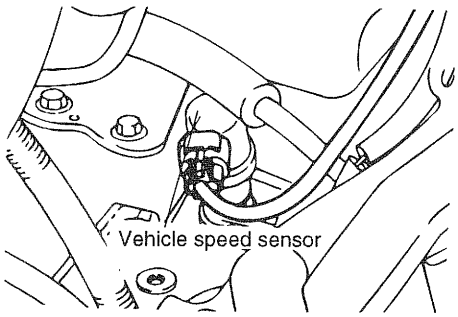
EFA9025C

Power Steering Oil Pressure Switch



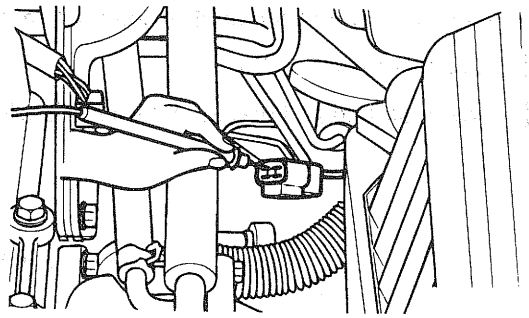
EFA9025D

Vehicle Speed Sensor



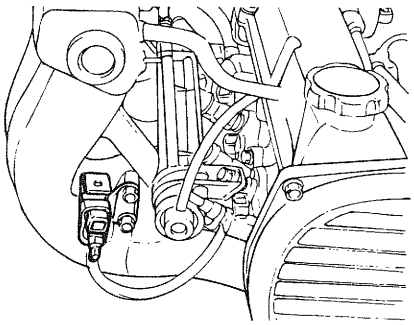
EFA9025E

Ignition Timing Adjustment Terminal



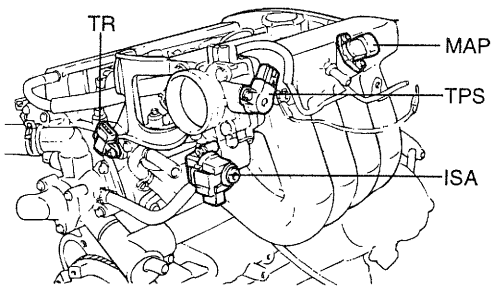
HEW31002

EVAP Solenoid Valve



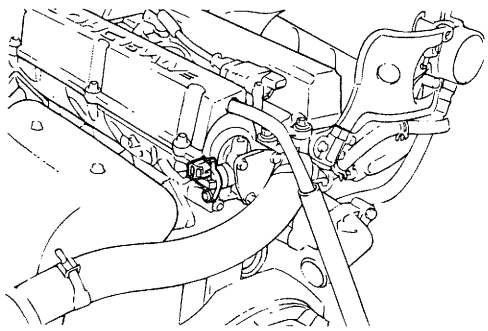
EFA9025G

MAP, TPS, ISA, TR



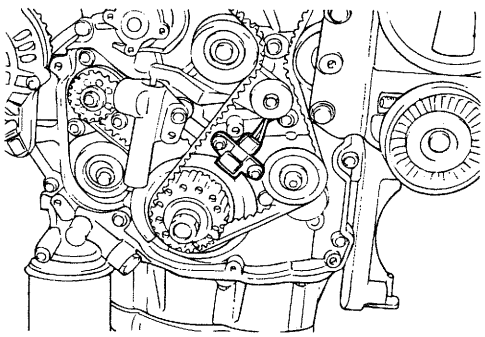
EFA9025H

CMP Sensor



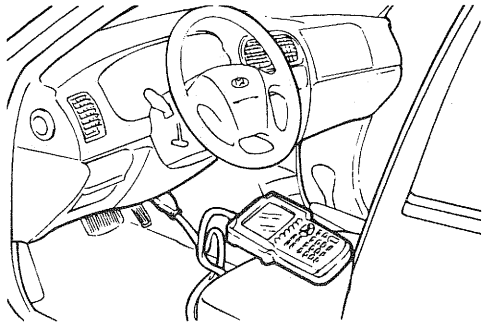
EFA9025I

CKP



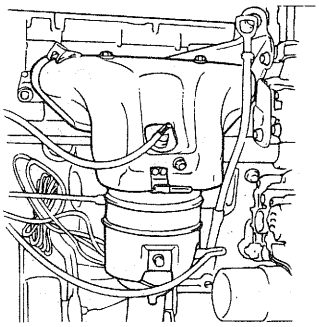
EFA9025J

Data Link Connector



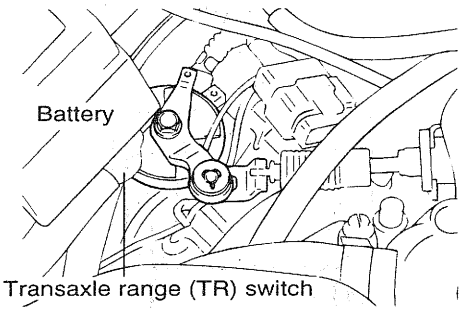
EFA9025K

Heated Oxygen Sensor (HO2S)



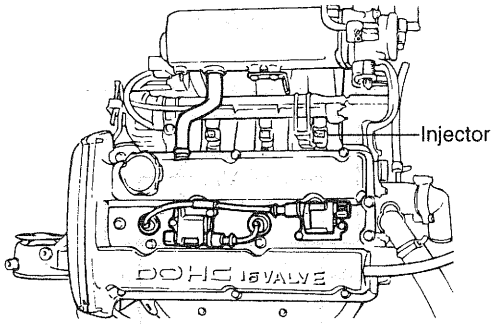
EFA9025L

Transaxle Range (TR) Switch



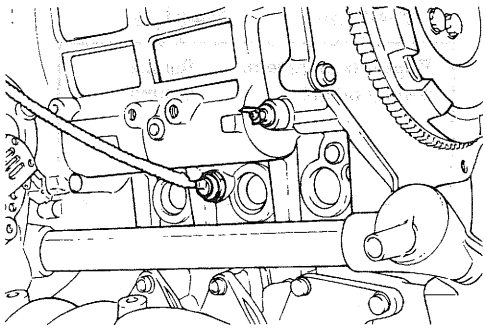
EFA9025M

Injectors



EFA9025N

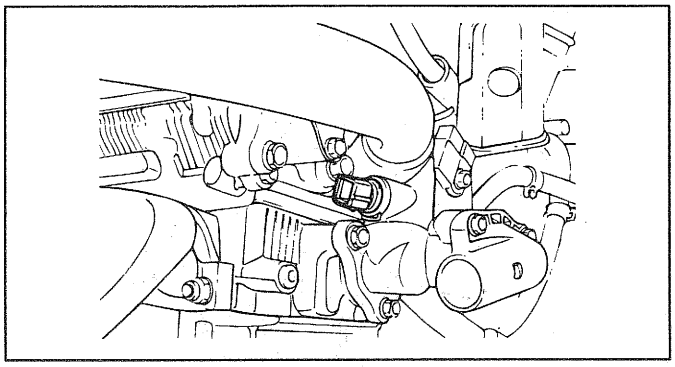
Knock



EFA9025O

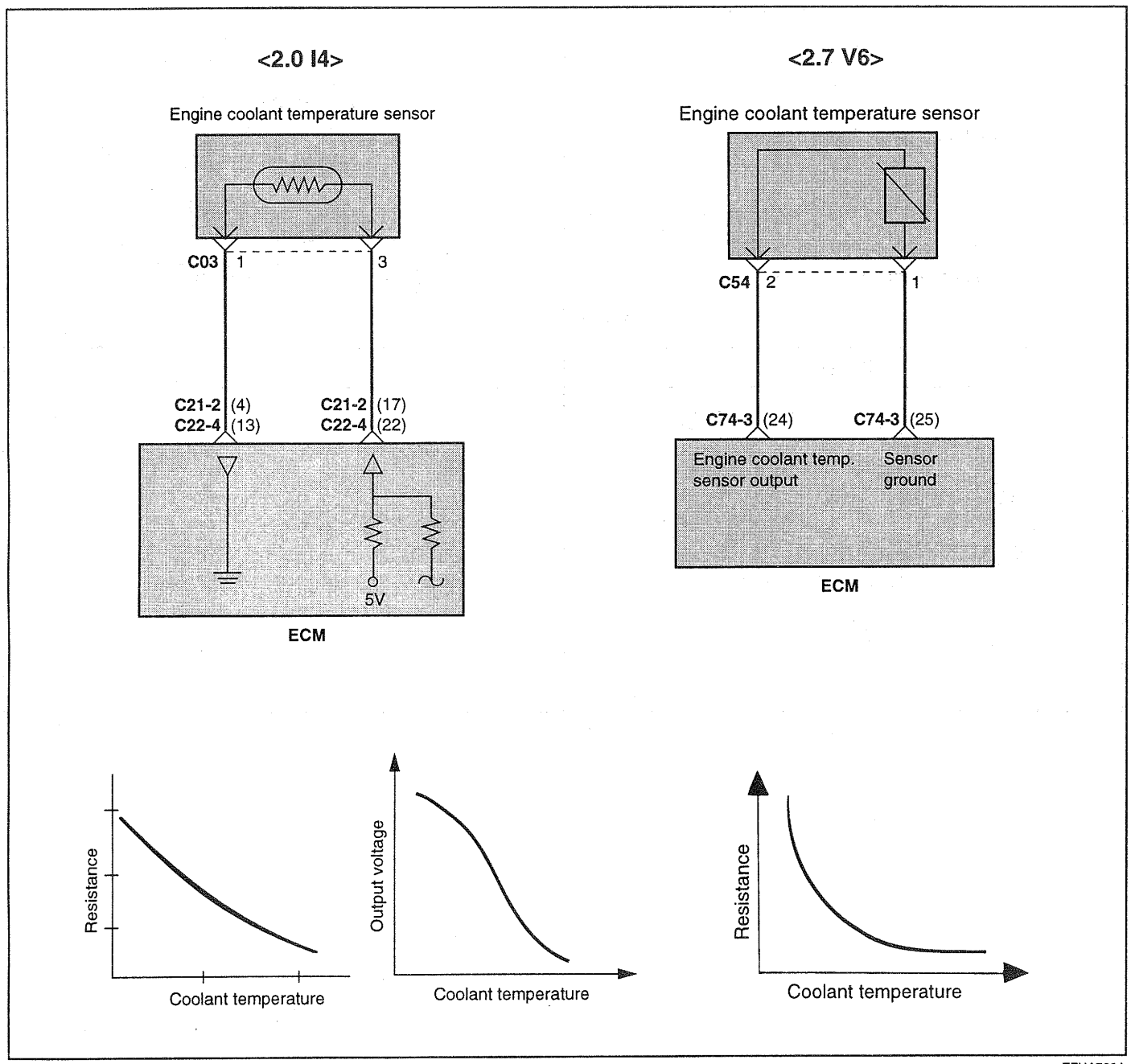
ENGINE COOLANT TEMPERATURE (ECT) SENSOR EFHA7030

The engine coolant temperature sensor installed in the engine coolant passage of the cylinder head detects the engine coolant temperature and emits signals to the ECM. This part employs a thermistor which is sensitive to changes in temperature. The electric resistance of the thermistor decreases in response to a temperature rise. The ECM determines engine coolant temperature by the sensor output voltage and provides optimum fuel enrichment when the engine is cold.



EFA9026A

CIRCUIT DIAGRAM



EFHA703A

SENSOR CHECKING

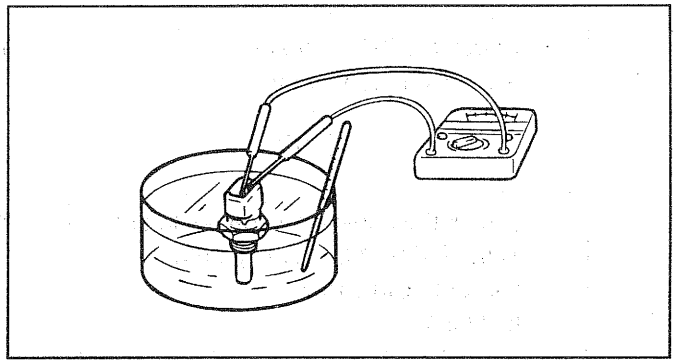
USING HI-SCAN

Check item	Data display	Check conditions	Intake air temperature	Test specification
Engine coolant temperature sensor	Sensor temperature	Ignition switch : ON or engine running	When -20°C (-4°F)	-20°C
			When 0°C (32°F)	0°C
			When 20°C (68°F)	20°C
			When 40°C (104°F)	40°C
			When 80°C (176°F)	80°C

USING MULTI-METER

1. Remove the engine coolant temperature sensor from the intake manifold.
2. With temperature sensing portion of engine coolant temperature sensor immersed in hot engine coolant, check resistance.

Temperature [°C (°F)]	Resistance (kΩ)
0 (32)	5.9
20 (68)	2.5
40 (104)	1.1
80 (176)	0.3

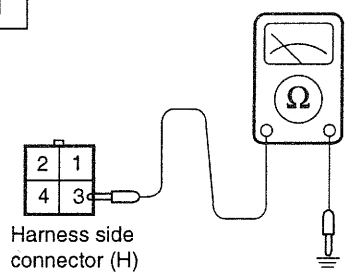


EFA9028A

3. If the resistance deviates from the standard value greatly, replace the sensor.

HARNESS INSPECTION

1



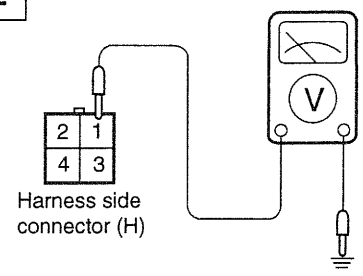
Check for continuity of the ground circuit.
o Connector: Disconnected

OK ⇒ 2

NG ⇒ Repair the harness.

EFHA703B

2



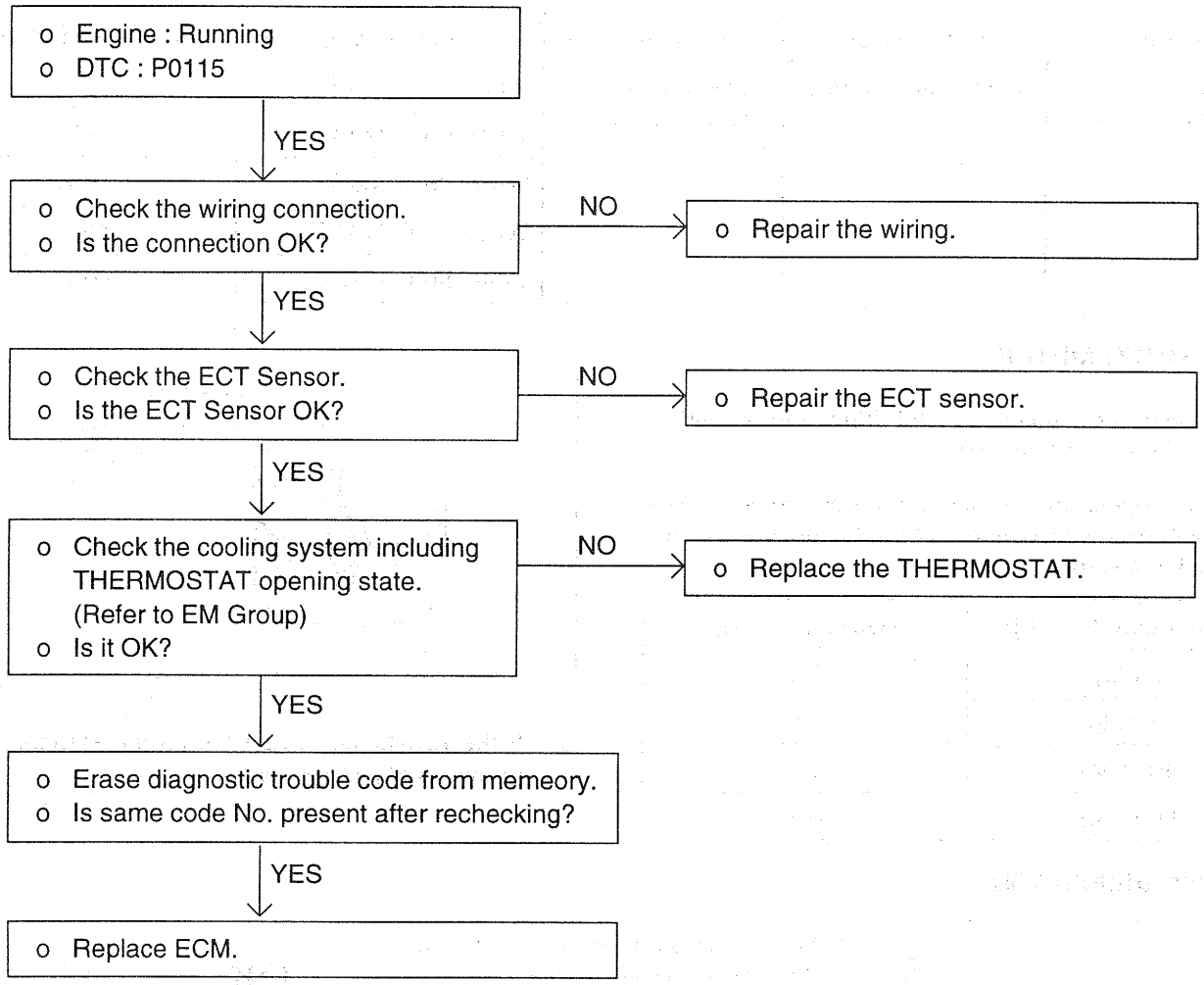
Measure the power supply voltage.
o Connector: Disconnected
o Ignition switch: ON
o Voltage (V): 4.5-4.9V

OK ⇒ END !

NG ⇒ Repair the harness.

EFHA703C

TROUBLESHOOTING PROCEDURES



DTC : Diagnosis Trouble Code
ECM : Engine Control Module
ECT : Engine coolant Temperature

EFA9030A

USING VOLTMETER

Check item	Coolant temperature	Test specification
Engine coolant temperature sensor output voltage	When 0°C	4.05V
	When 20°C	3.44V
	When 40°C	2.72V
	When 80°C	1.25V

TROUBLEHSOOTING HINTS

If the fast idle speed is not enough or the engine gives off dark smoke during the warming-up of the engine, the engine coolant temperature sensor might be the cause.

INSTALLATION

1. Apply sealant LOCTITE 962T or the equivalent to threaded portion.
2. Install the engine coolant temperature sensor and tighten it to specified torque.

Tightening torque
Engine coolant temperature sensor :
20-40 Nm (200-400 kg.cm, 14-29 lb.ft)

3. Securely connect the harness connector.

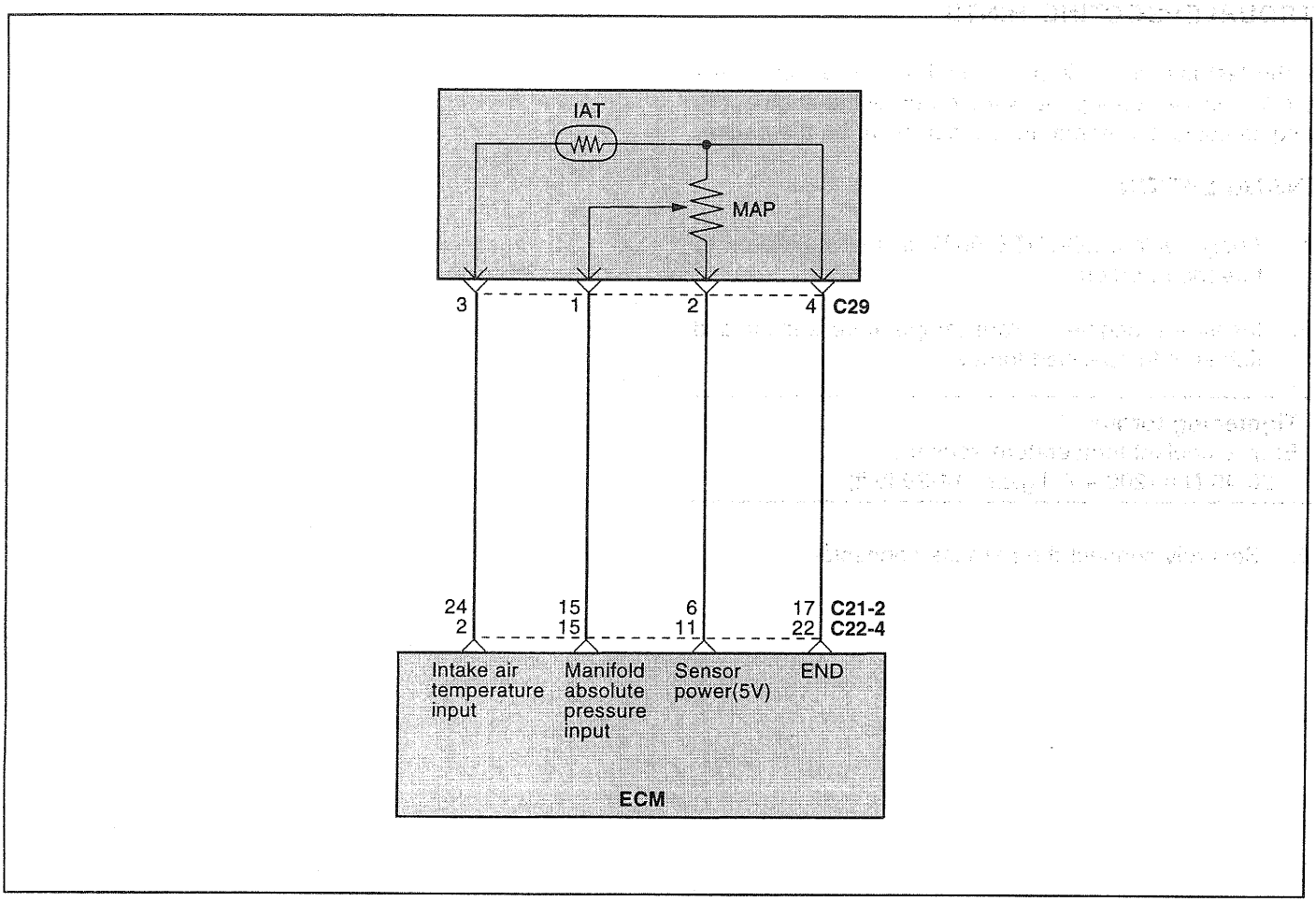
MANIFOLD ABSOLUTE PRESSURE(MAP) & INTAKE AIR TEMPERATURE(IAT) SENSOR EFHA7050

The manifold absolute pressure(MAP) sensor converts intake manifold pressure into a voltage signal. The engine control module(ECM) uses this signal to determine the condition of the engine load.

The intake air temperature(IAT) sensor, built in the MAP sensor, is a resistor-based sensor for detecting the intake air temperature.

According to the intake air temperature information from the sensor, the ECM provides necessary fuel injection amount control.

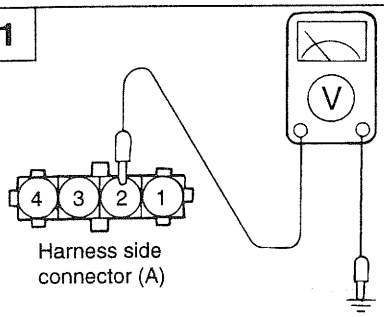
CIRCUIT DIAGRAM <2.0 I4>



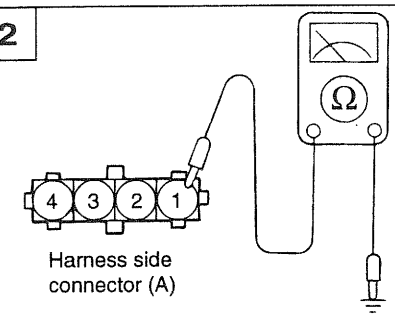
EFHA705A

Check item	Data display	Check conditions	Engine state	Test specification
MAP sensor	Inlet manifold pressure	• Engine coolant temperature : 18°C (65.4°F) • Lamps, electric cooling fan, accessory units: All OFF • Transaxle: Neutral (P range for vehicle with A/T) • Steering wheel: Neutral	Idle	0.8-2.4V
			When the accel pedal is depressed suddenly at idle	Rise from 0.8-2.4V

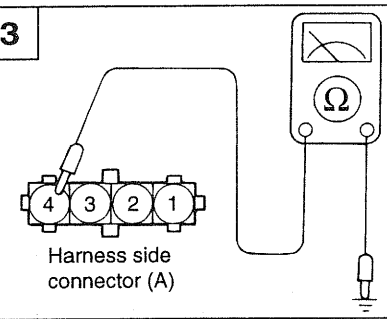
HARNESS INSPECTION PROCEDURE

1 	Measure the power supply voltage. o Connector: Disconnected. o Ignition switch : ON. o Voltage (V) : 4.8-5.2 V.	OK ⇨ NG ⇨	2 Repair the harness.

EFAA705B

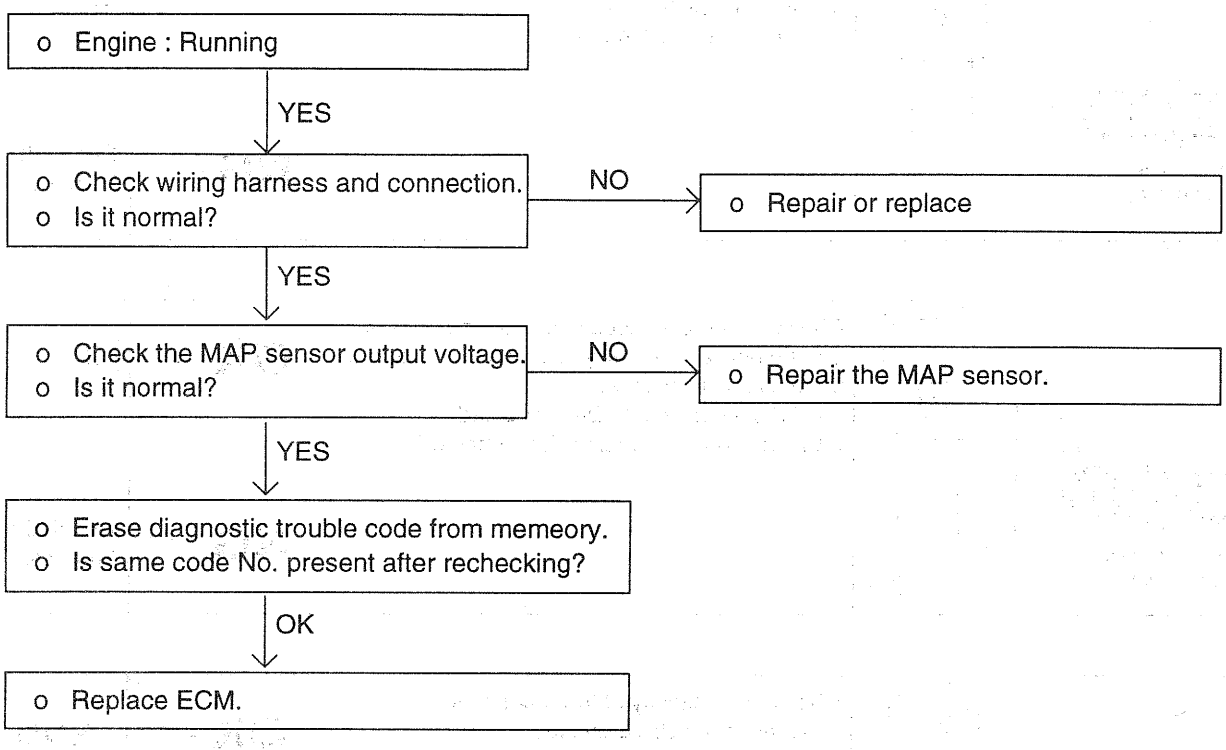
2 	Check for an open-circuit, or a short-circuit ot ground between the engine control module and the mass air flow sensor. o MAP sensor circuit : Disconnected o Engine control module : Disconnected	OK ⇨ NG ⇨	3 Repair the harness.

EFAA705C

3 	Check for continuity of the ground circuit. o Connector : Disconnected.	OK ⇨ NG ⇨	END ! Repair the harness.

EFAA705D

TROUBLESHOOTING PROCEDURES [MAP SENSOR]



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

EFAA705E

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 4.5V or more for 4 second.
2. When the manifold pressure is 0.2V or lower for 4 second.

SENSOR INSPECTION [MAP SENSOR]

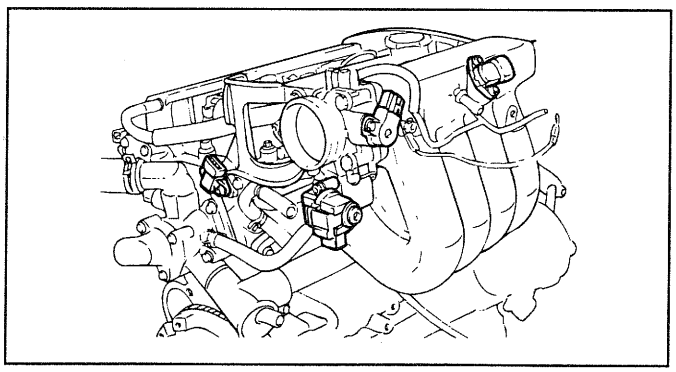
1. Connect the voltmeter between 1 and 4 of the MAP sensor connector

   Terminal 4 : MAP sensor ground

   Terminal 1 : MAP sensor output

2. Measure the voltage of terminals.

Engine state	Test specification
Ignition SW. ON.	4 - 5V
At idle	0.8 - 2.4V

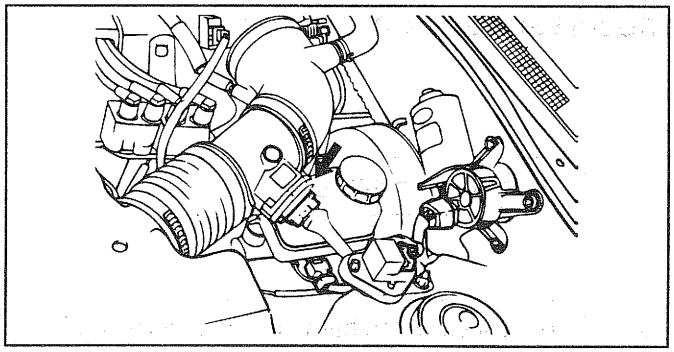


EFAA705F

3. If the voltage deviates from the standard value, replace the MAP sensor assembly.

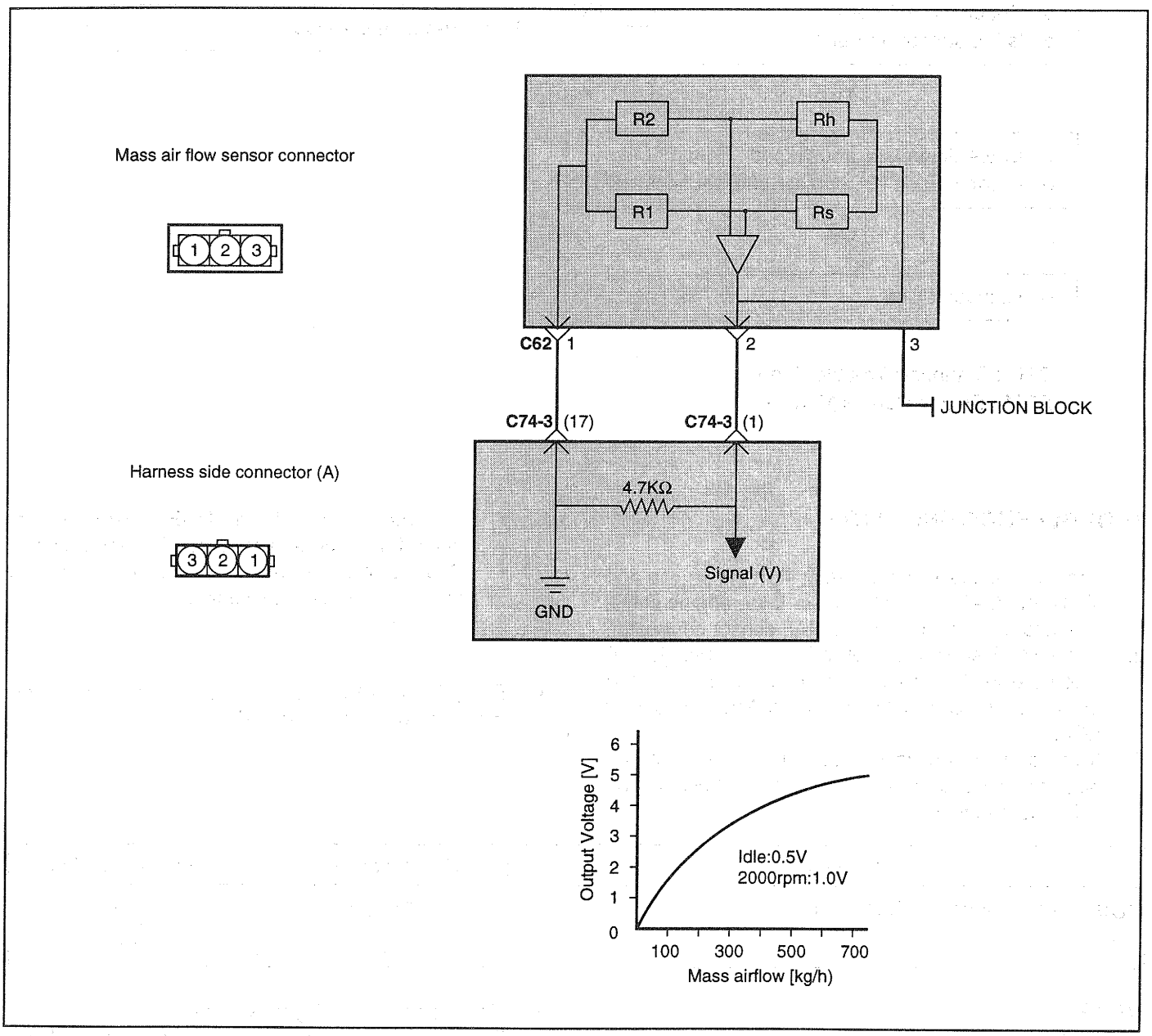
MASS AIR FLOW (MAF) SENSOR EFHA7090

This hot film type air flow sensor is composed of a hot film sensor, housing and metering duct (hybrid, sensor element). Mass air flow rate is measured by detection of heat transfer from a hot film probe because the change of the mass air flow rate causes change in the amount of heat being transferred from the hot film probe surface to the air flow. The air flow sensor generates a pulse so it repeatedly opens and closes between the 5V voltage supplied from the engine control module. This results in the change of the temperature of the hot film probe and in the change of resistance.



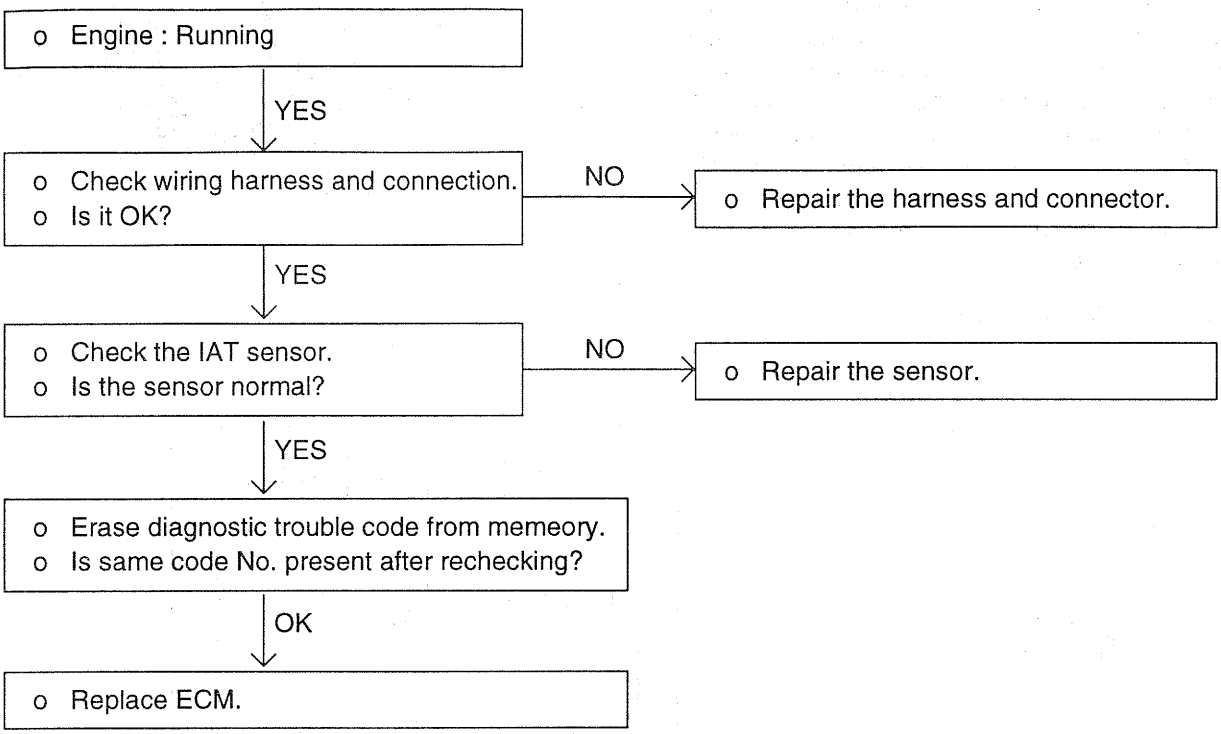
EFA9040A

CIRCUIT DIAGRAM <2.7 V6>



EFHA709A

TROUBLESHOOTING PROCEDURES



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

EFAA709E

TROUBLESHOOTING HINTS

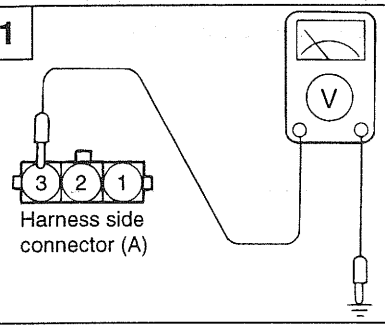
1. If the engine stalls occasionally, start the engine and shake the MAF sensor harness. If the engine stalls, check for poor contact at the MAF sensor connector.
2. If the MAF sensor output voltage is other than 0 when the ignition switch is turned on (do not start the engine). Check for the faulty MAF sensor or ECM.
3. If the engine can be idle even if the MAF sensor output voltage is out of specification, check for the following conditions;
   - Disturbed air flow in the MAF sensor, disconnected air duct, and clogged air cleaner filter.
   - Poor combustion in the cylinder, faulty ignition plug, ignition coil, injector, and incorrect comparison.
4. Even if no AFS malfunction occurs, check the mounting direction of the AFS.

Check item	Check condition	Test specification
Mass air flow sensor output voltage	Idle rpm	0.5V
	2000 rpm	1.0V

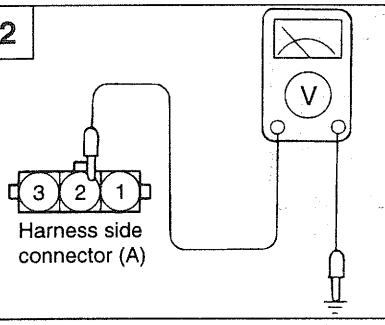
NOTE

1. **When the vehicle is new [within initial operation of about 500 km (300 miles)], the mass air flow sensor air quantity will be about 10% higher.**
2. **Use an accurate digital voltmeter.**
3. **Before checking, warm up the engine until the engine coolant temperature reaches 80 to 90°C (176 to 198°F).**

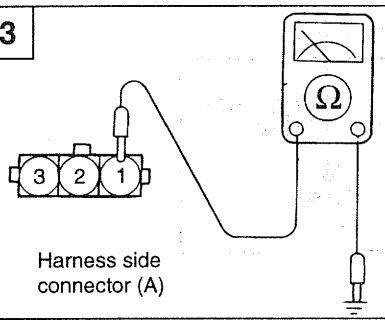
HARNESS INSPECTION PROCEDURE

1 	Measure the power supply voltage. o Connector : Disconnected. o Ignition switch : ON. o Voltage (V) : Battery voltage.	OK ⇒ NG ⇒	2 Repair the harness

EFHA709B

2 	Check for an open-circuit, or a short-circuit to ground between the engine control module and the mass air flow sensor. o Engine control module connector : Disconnected. o Mass air sensor connector : Disconnected.	OK ⇒ NG ⇒	3 Repair the harness

EFAA709C

3 	Check for continuity of the ground circuit. o Connector : Disconnected.	OK ⇒ NG ⇒	END ! Repair the harness

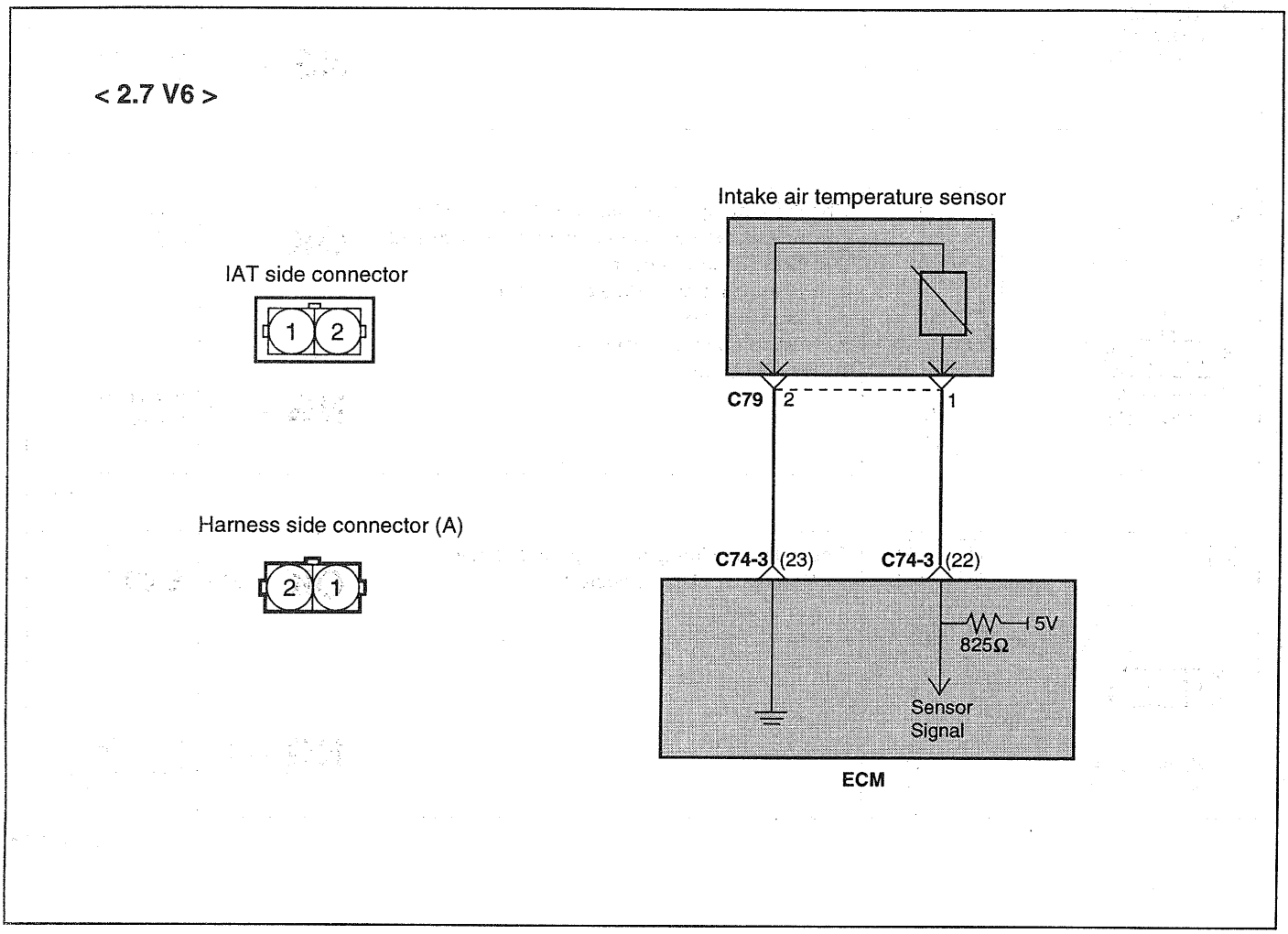
EFAA709D

INTAKE AIR TEMPERATURE (IAT) SENSOR EFHA7110

The intake air temperature sensor (IAT Sensor), located in the intake air hose, is a resistor-based sensor for detecting the intake air temperature. According to the intake air temperature information from the sensor, the ECM provides the necessary fuel injection.

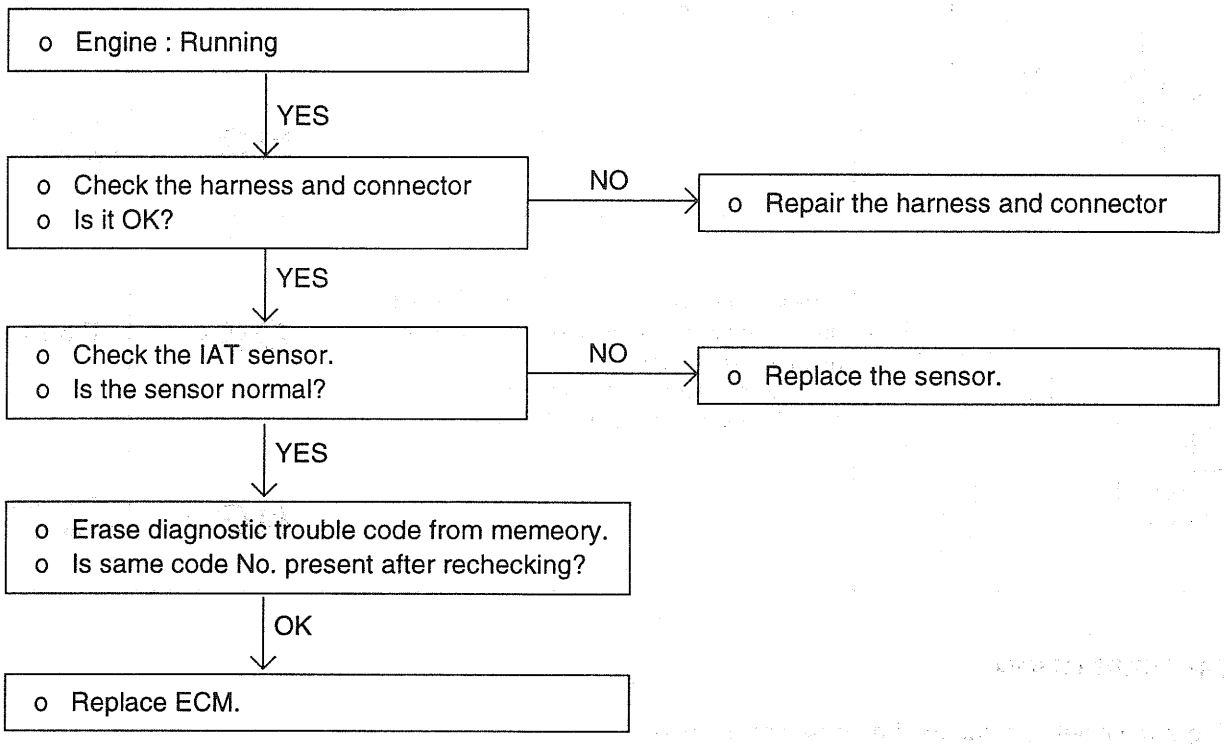
CIRCUIT DIAGRAM

< 2.7 V6 >



EFHA711A

TROUBLESHOOTING PROCEDURES



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

EFAA711D

TROUBLESHOOTING HINTS

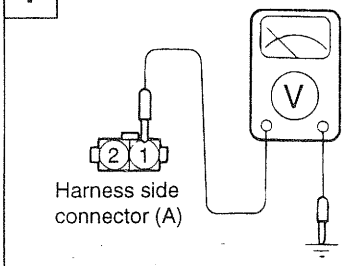
The MIL is ON or the DTC is displayed on the HI-SCAN under the following condition:

1. When the intake air temperature is detected as below -40°C or higher than 120°C
2. Input from intake air temperature sensor is below 0.1V or above 4.8V when engine is in a full warm-up condition.

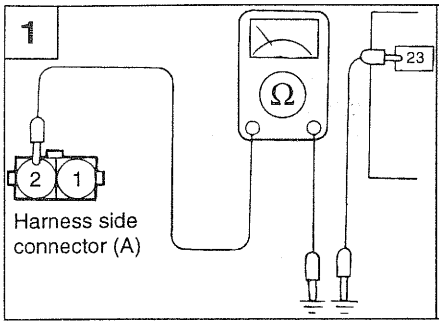
USING HI-SCAN

Check item	Data display	Check conditions	Intake air temperature	Test specification
Intake air temperature sensor	Air temperature	Ignition switch : ON or engine running	When -20°C (-4°F)	-20°C
			When 0°C (32°F)	0°C
			When 20°C (68°F)	20°C
			When 40°C (104°F)	40°C
			When 80°C (176°F)	80°C

HARNESS INSPECTION PROCEDURE <2.7 V6>

1 	Measure the power supply voltage of the IAT Sensor. o Connector : Disconnected. o Ignition switch : ON. o Voltage : 4.8-5.2 V.	OK ⇨ NG ⇨	2 Repair the harness.

EFAA711B

1 	Check for an open-circuit, or a short-circuit to ground between the engine control module and the IAT sensor o ECM connector : Disconnected o IAT sensor connector : Disconnected	OK ⇨ NG ⇨	END ! Repair the harness.

EFAA711C

SENSOR INSPECTION

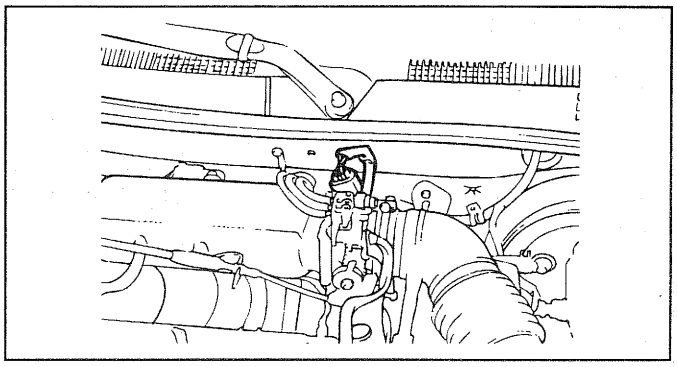
1. Using a multimeter, measure the sensor resistance.
2. Measure the rersistance between the IAT sensor terminal 1 and 2.

IG.SW. ON	Temperature °C (°F)	Resistance (Ω)
	0 (32)	3.3 - 3.7V
	20 (68)	2.4 - 2.8V
	40 (104)	1.6 - 2.0V
	80 (176)	0.5 - 0.9V

3. If the resistance deviates from the standard value, replace the intake air temperature sensor assembly.

THROTTLE POSITION (TP) SENSOR EFHA7130

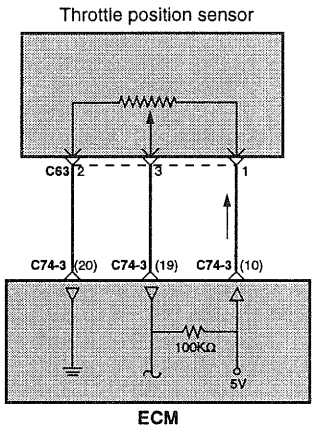
The TPS is a variable resistor type that rotates with the throttle shaft of the throttle body to sense the throttle valve angle. As the throttle shaft rotates, the output voltage of the TP Sensor changes. The ECM detects the throttle valve opening based on voltage change.

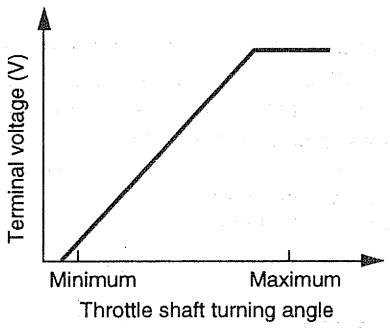


EFA9049A

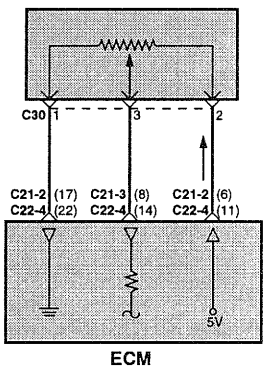
CIRCUIT DIAGRAM

< 2.7 V6>





< 2.0 I4 >



EFHA713A

SENSOR CHECKING

USING HI-SCAN

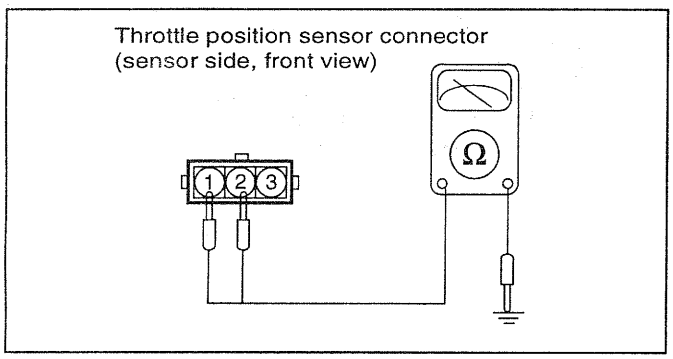
Check item	Data display	Check conditions	Throttle valve	Test specification
Throttle position sensor	Sensor voltage	Ignition switch : ON	At idle position	300-900 mV (2.0 I4) 250-800 mV (2.7 V6)
			Open slowly	Increases with valve opening
			Open widely	4,250-4,700 mV

USING VOLTMETER

1. Disconnect the throttle position sensor connector.
2. Measure resistance between terminal 1 (sensor ground) and terminal 2 (sensor power) for 2.0 I4, between terminal 2 (sensor ground) and terminal 1 (sensor power) for 2.7 V6.

Standard value : 3.5 - 6.5 kΩ

3. Connect a pointer type ohmmeter between terminal 1 (sensor ground) and terminal 3 (sensor output) for 2.0 I4 and between terminal 2 (sensor ground) and terminal 3 (sensor output) for 2.7 V6.

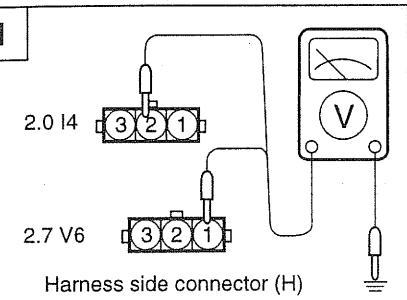


EFHA713E

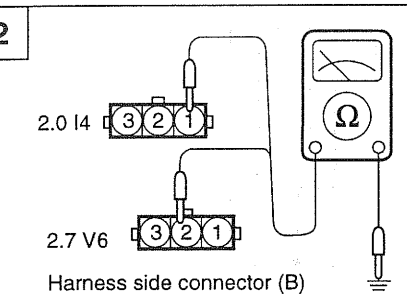
4. Operate the throttle valve slowly from the idle position to the full open position and check that the resistance changes smoothly in proportion with the throttle valve opening angle.
5. If the resistance is out of specification, or fails to change smoothly, replace the throttle position sensor.

Tightening torque
TP Sensor : 1.5-2.5 Nm (15-25 kg.cm, 1.1-1.8 lb.ft)

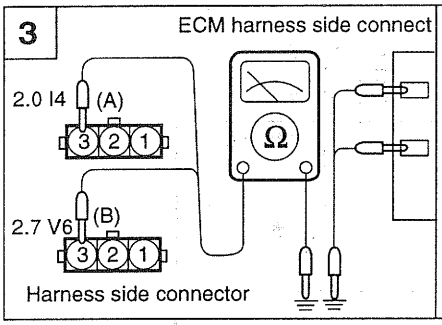
HARNESS INSPECTION

1 	Measure the power supply voltage of the throttle position sensor. o Connector: Disconnected o Ignition switch: ON o Voltage (V): 4.25-4.7	OK ⇨ NG ⇨	2 Repair the harness.

EFHA713B

2 	Check for continuity of the ground circuit. o Connector : Disconnected	OK ⇨ NG ⇨	3 Repair the harness.

EFHA713C

3 	Check for an open-circuit, or a short-circuit or ground between the engine control module and the throttle position sensor. o Throttle position sensor connector : Disconnected o Engine control module connector : Disconnected	OK ⇨ NG ⇨	END ! Repair the harness. A3-C21-3 (8) A3-C22-4 (14) B3-C74-3 (19)

EFHA713D

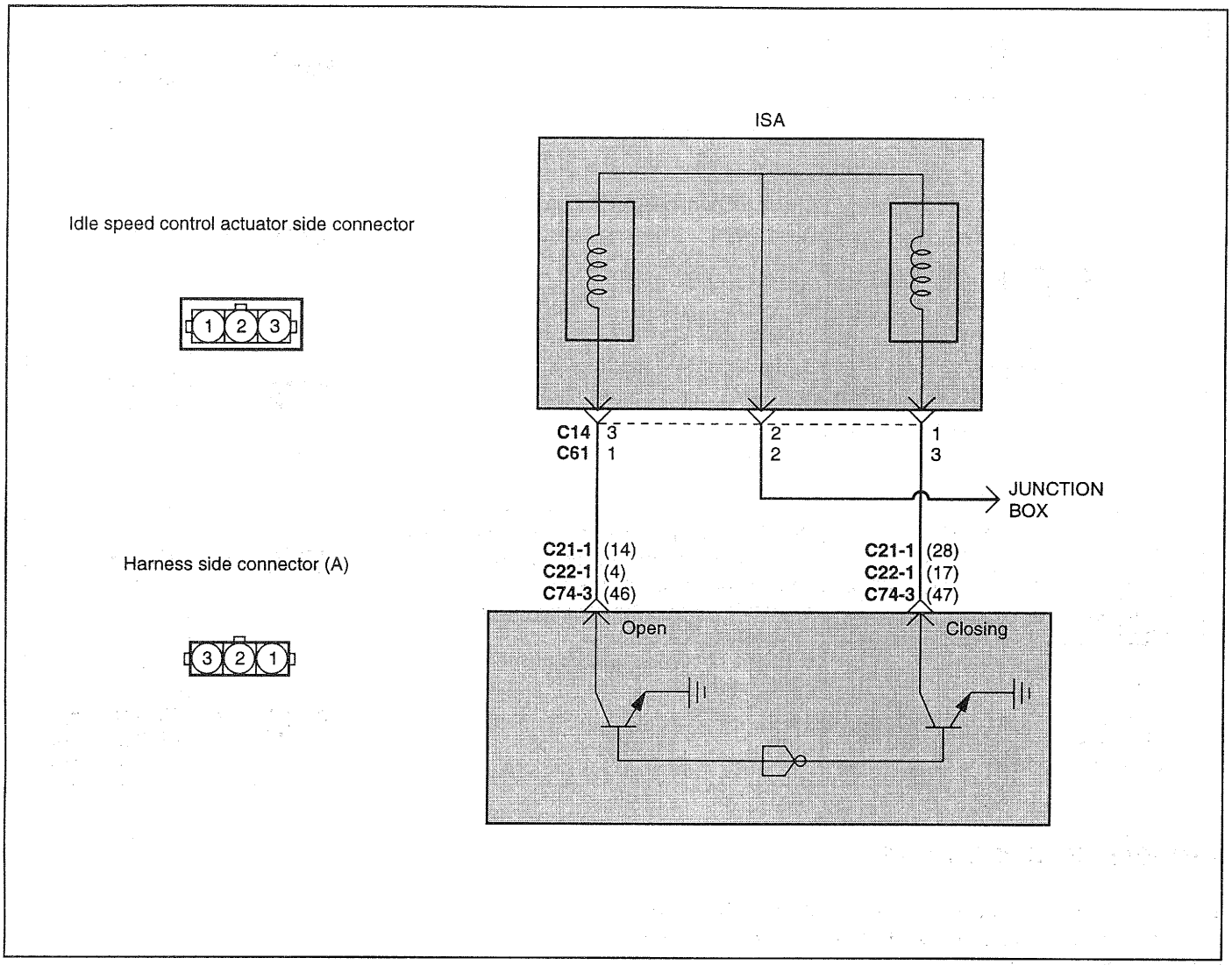
TROUBLESHOOTING HINTS

The TPS signal is important in the control of the automatic transaxle. Shift shock and other trouble will occur if the sensor is defective.

IDLE SPEED CONTROL ACTUATOR EFHA7170

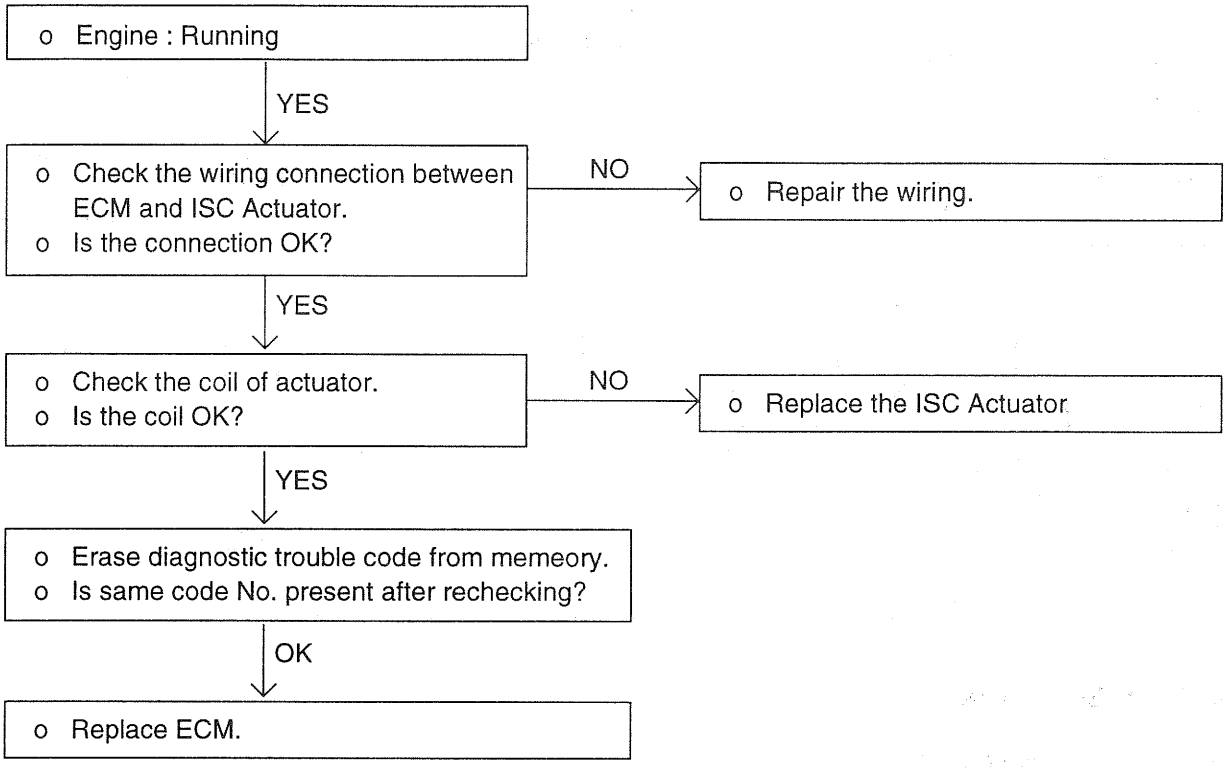
The idle speed control actuator is the double coil type and has two coils. The two coils are driven by separate driver stages in the ECM. Depending on the pulse duty factor, the equilibrium of the magnetic forces of the two coils will result in different angles of the motor. In parallel to the throttle valve, a bypass hose line is arranged, where the idle speed actuator is inserted in side.

CIRCUIT DIAGRAM



EFHA717A

TROUBLESHOOTING PROCEDURES



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

EFAA717E

TROUBLESHOOTING HINTS

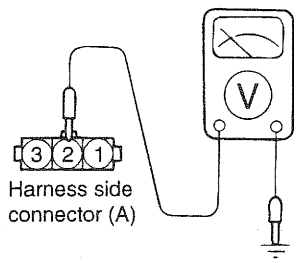
The MIL is ON or the DTC is displayed on the HI-SCAN under the following conditions;

- When the primary voltage side in ECM is in short or open circuit.
- The ignition closed loop control in the ECM is out of order.
- Open or short circuit is observed in idle air control system when ignition switch is turned on.

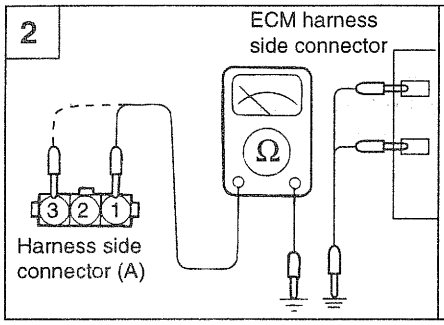
USING HI-SCAN

Check item	Check condition	HI-SCAN display	Type
Idle speed control actuator o Actuator	Start the engine	ISA	Activate

HARNESS INSPECTION PROCEDURE

1  	Measure the power supply voltage of the actuator. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇨ 2 NG ⇨ Repair the harness. Check the power supply

EFHA717B

2  	Check for an open-circuit, or a short-circuit to ground between the ECM and the idle speed control actuator. o ECM connector : Disconnected o Idle speed actuator connector : Disconnected	OK ⇨ END ! NG ⇨ Repair the harness. <CLOSING> A1-C21-1(28) A1-C22-1(17) A1-C74-3(47) <OPEN> A1-C21-1(14) A1-C22-1(4) A1-C74-3(46)

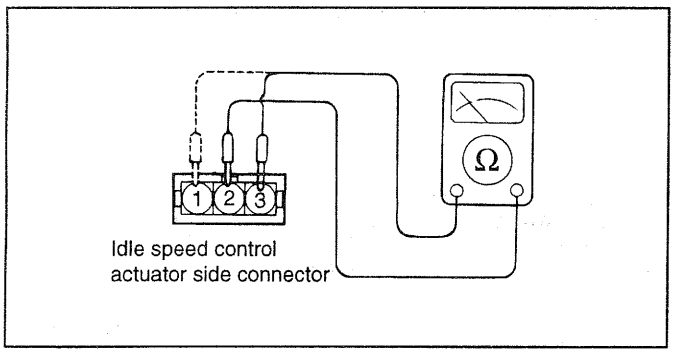
EFHA717C

ACTUATOR INSPECTION

1. Disconnect the connector at the idle speed control actuator.
2. Measure the resistance between terminals.

Standard value
Terminal 3 and 2 : 10.5 - 14Ω
Terminal 1 and 3 : 10 - 12.5Ω [at 20°C (68°F)]

3. Connector the connector to the idle speed control actuator

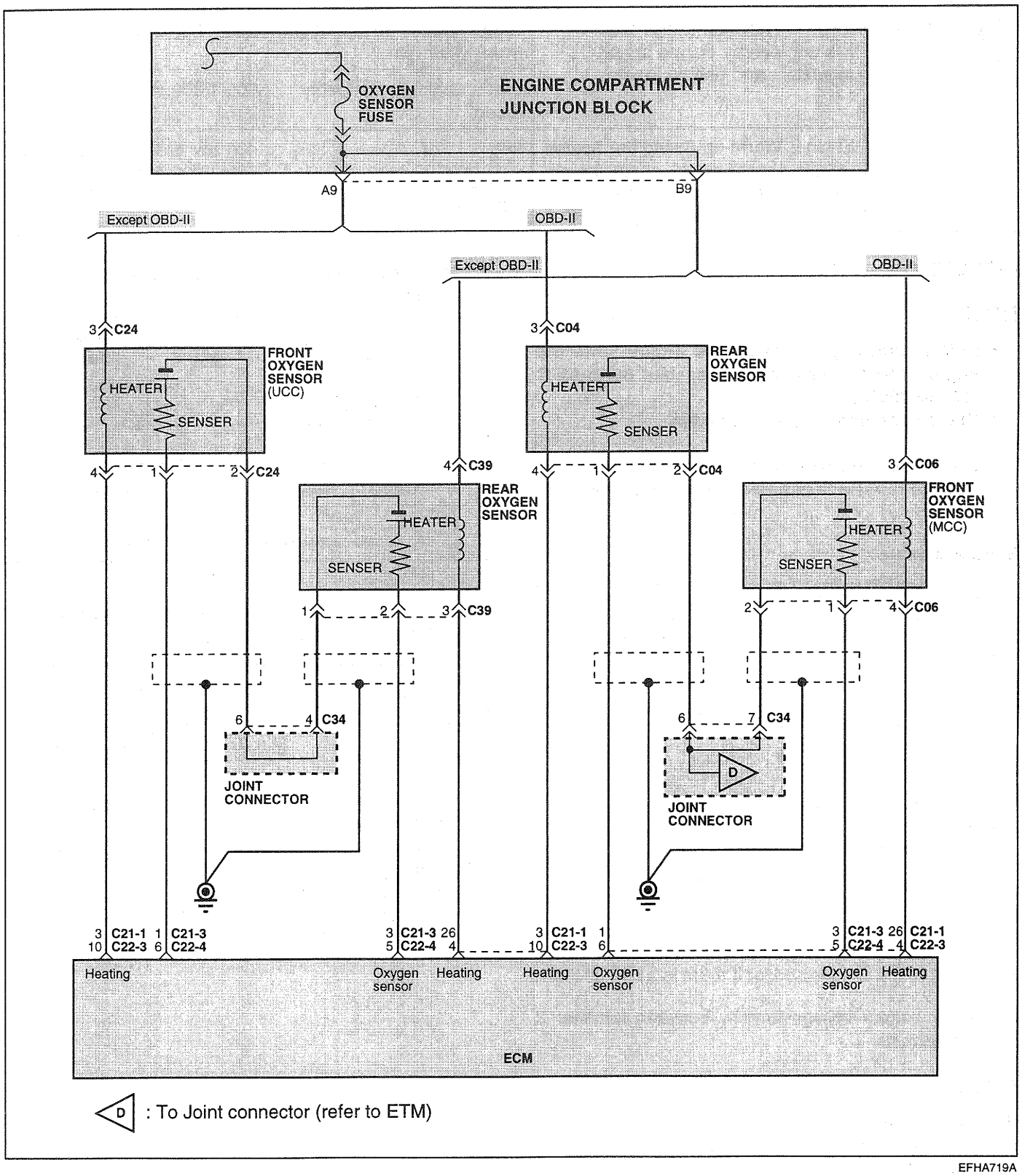


EFAA717D

HEATED OXYGEN SENSOR (HO2S) EFHA7190

The heated oxygen sensor senses the oxygen concentration in exhaust gas, converts it into a voltage, which is sent to the ECM. The oxygen sensor outputs about 1V when the air fuel ratio is richer than the theoretical ratio, and outputs about 0V when the ratio is leaner (higher oxygen concentration in exhaust gas.). The ECM controls the fuel injection ratio based on this signal so that the air fuel ratio is maintained at the theoretical ratio. The oxygen sensor has a heating element which ensures the sensor performance during all driving conditions.

CIRCUIT DIAGRAM <2.0 I4>



EFHA719A

1. If the HO2S is defective, abnormally high emissions may occur.
2. If the HO2S check results are normal, but the sensor output voltage is out of specification, check for the following items (related to air fuel ratio control system):
   - Defective injector
   - Air leaks in the intake manifold
   - Defective volume air flow sensor, intake air temperature sensor, barometric pressure sensor and engine coolant temperature sensor.

Check item	Check conditions	Engine state	Test specification
Oxygen sensor	Engine: Warm-up (make the mixture lean by engine speed reduction, and rich by racing)	When sudden deceleration from 4,000 rpm	200mV or lower
		When engine is suddenly raced	600-1,000 mV
	Engine: Warm-up (using the heated oxygen sensor signal, check the air/ fuel mixture ratio, and also check the condition of control by the ECU)	Idle	400 mV or lower - (oscilate) 600-1,000 mV
		2,000 rpm	

INSPECTION

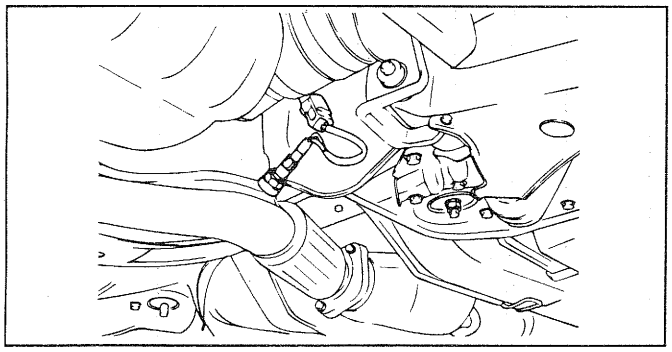
NOTE

- **Before checking, warm up the engine until the engine coolant temperature reaches 80 to 95°C (176 to 205°F).**
- **Use an accurate digital voltmeter.**

1. Disconnect the oxygen sensor connector, and measure the resistance between terminal 3 and terminal 4.

Standard value

Temperature °C (°F)	Resistance (Ω)
400 (752)	30 or more



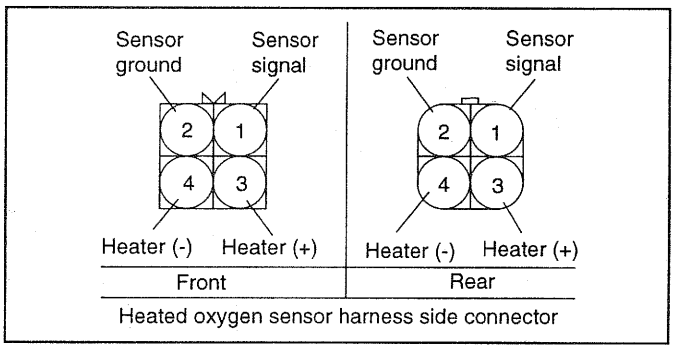
EFAA719E

2. Replace the oxygen sensor if there is a malfunction.
3. Apply battery voltage directly between terminal 3 and terminal 4.

NOTE

Be careful when applying the voltage. Damage will result if the terminals are incorrect or are short circuited.

4. Connect a digital-type volmeter between terminal 1 and terminal 2.



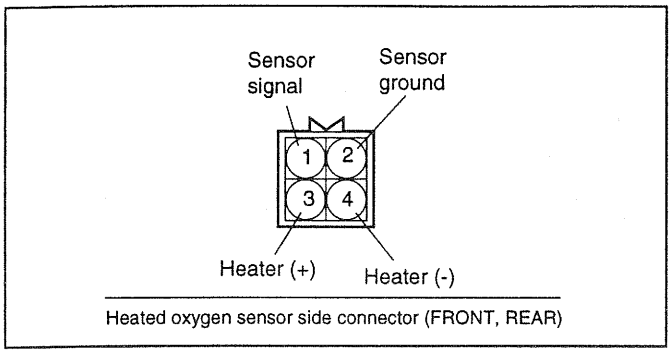
EFAA719F

5. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Engine	Oxygen sensor output voltage	Resistance (Ω)
Race	Min. 0.6V	30 or more

6. If there is a problem, there may be an oxygen sensor malfunction.

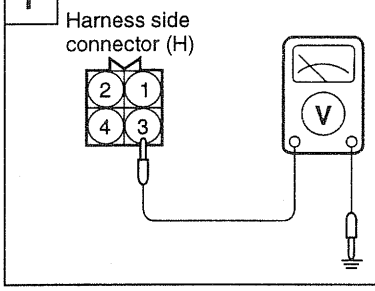
Tightening torque
Heated oxygen sensor :
40-50 Nm (400-500 kg.cm, 29-36 lb.ft)



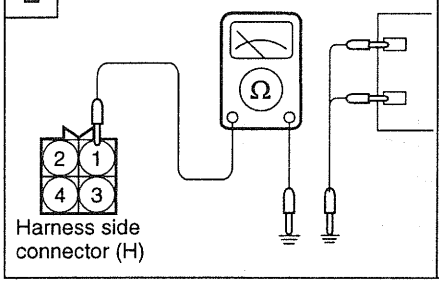
Heated oxygen sensor side connector (FRONT, REAR)

EFAA719G

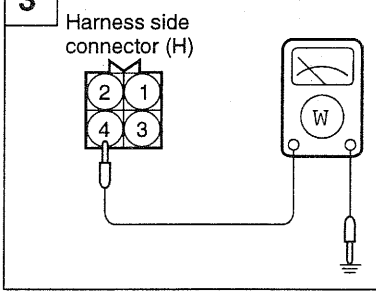
HARNESS INSPECTION PROCEDURES

1 	Measure the power supply voltage of the heated oxygen sensor. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇒	2
		NG ⇒	Repair the harness.

EFHA719B

2 	Check for open-circuit, or a short-circuit to ground between the ECM and the oxygen sensor. o Oxygen sensor connector : Disconnected o ECM connector : Disconnected	OK ⇒	3
		NG ⇒	Repair the harness.

EFHA719C

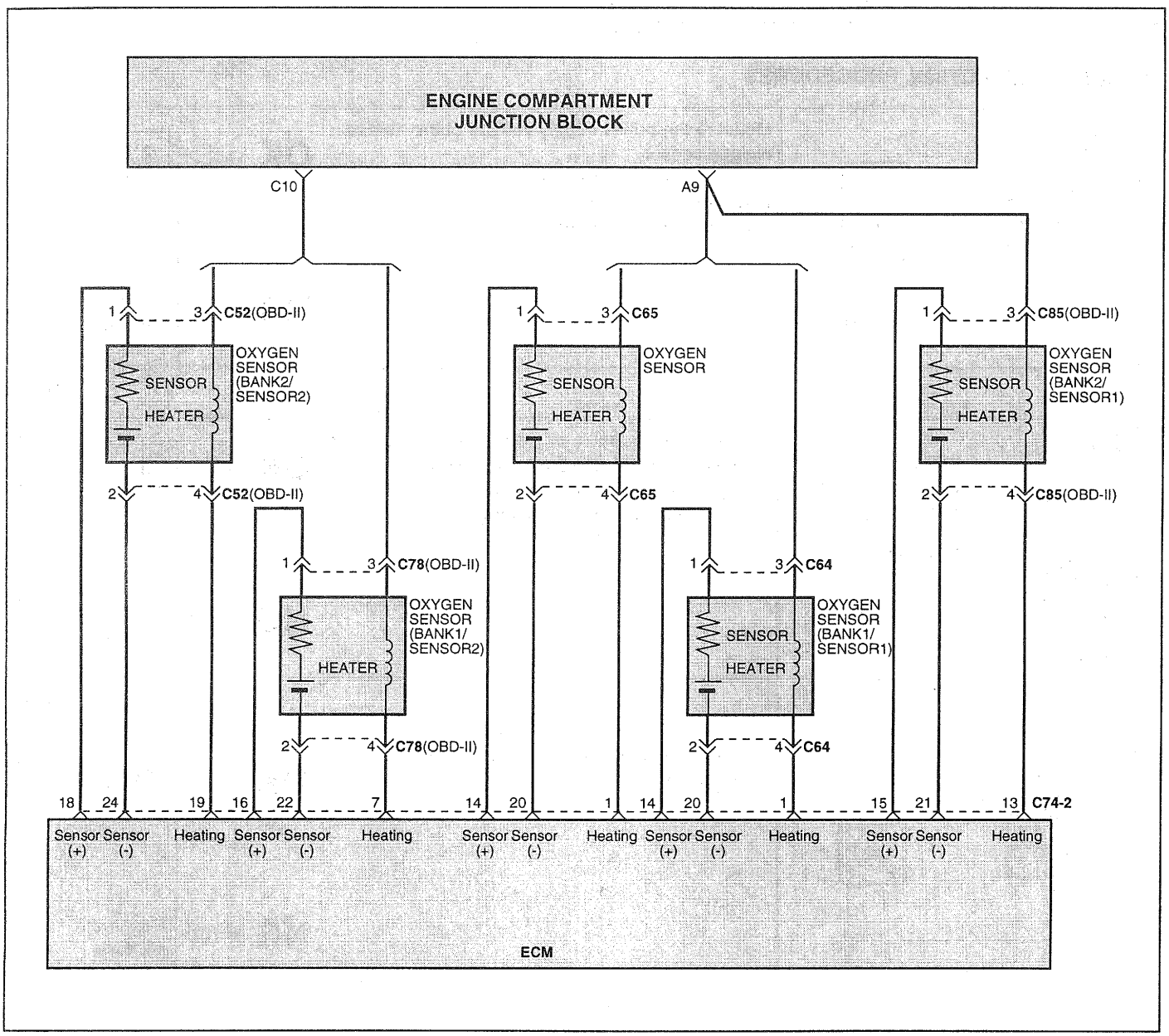
3 	Check for continuity of the ground circuit. o Connector : Disconnected	OK ⇒	END !
		NG ⇒	Repair the harness.

EFHA719D

HEATED OXYGEN SENSOR (HO2S) [2.7 V6] EFHA7210

The heated oxygen sensor senses the oxygen concentration in exhaust gas and converts it into a voltage, which is sent to the ECM. The oxygen sensor outputs about 0V when the air fuel ratio is richer than the theoretical ratio, and outputs about 5V when the ratio is more lean (higher oxygen concentration in exhaust gas.). The ECM controls the fuel injection ratio based on this signal so that the air fuel ratio is maintained at the theoretical ratio. The oxygen sensor has a heating element which ensures the sensor performance during all driving conditions.

CIRCUIT DIAGRAM



EFHA721A

TROUBLESHOOTING HINTS

1. If the HO2S is defective, abnormally high emissions may occur.
2. If the HO2S check results were normal, but the sensor output voltage is out of specification, check for the following items (related to air fuel ratio control system):
   - Defective injector
   - Air leaks in the intake manifold.
   - Defective air flow sensor, intake air temperature sensor, and engine coolant temperature sensor.

USING GST

Check Item	Check conditions	Engine state	Test specification
Oxygen sensor	Engine: Warm-up (make the mixture lean by engine speed reduction, and rich by racing)	When sudden deceleration from 4,000 rpm	300-900 mV
		When engine is suddenly raced	4000-4800 mV
	Engine: Warm-up (using the heated oxygen sensor signal, check the air/fuel mixture ratio, and also check the condition of control by the ECU)	At Idle rpm	300-4800 mV
		2,000 rpm	300-4800 mV

INSPECTION (USING VOLTMETER)

NOTE

Before checking, warm up the engine until the engine coolant temperature reaches 80 to 95°C (176 to 205°F).

1. Apply battery voltage directly between terminal 3 and terminal 4.

NOTE

Be careful when applying the voltage. Damage will result if the terminals are incorrect or are short circuited.

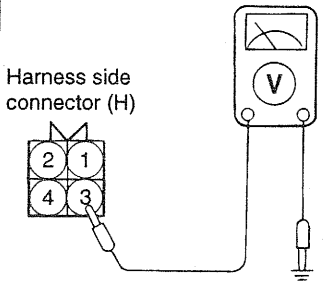
2. Connect a digital-type voltmeter between terminal 1 and terminal 2.
3. While repeatedly racing the engine, measure the oxygen sensor output voltage.

Engine	Oxygen sensor output voltage	Remarks
Race	4000-4800mV	Makes the air/fuel mixture rich by increasing engine speed

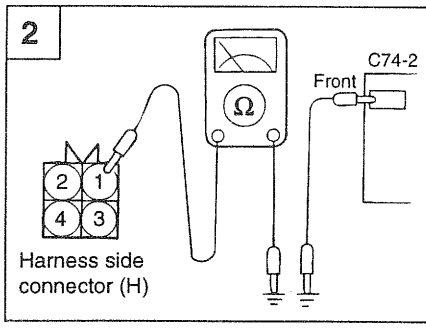
4. If there is a problem, there may be an oxygen sensor malfunction.

Tightening torque
Heated oxygen sensor :
40-50 Nm (400-500 kg·cm, 29-36 lb·ft)

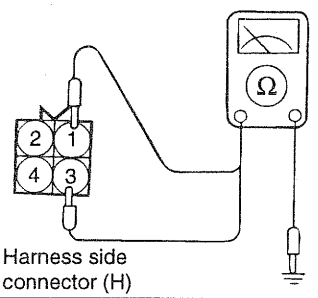
HARNESS INSPECTION PROCEDURES

1 	Measure the power supply voltage of the heated oxygen sensor. o Connector : Disconnected o Ignition switch : ON o Voltage (V) : Battery voltage	OK ⇒ NG ⇒	2 Repair the harness.

EFHA721B

2 	Check for open-circuit, or a short-circuit to ground between the engine control module and the heated oxygen sensor. o Heated oxygen sensor connector: Disconnected o ECM connector : Disconnected	OK ⇒ NG ⇒	3 Repair the harness.

EFHA721C

3 	Check for continuity of the ground circuit. o Connector : Disconnected	OK ⇒ NG ⇒	END ! Repair the harness.

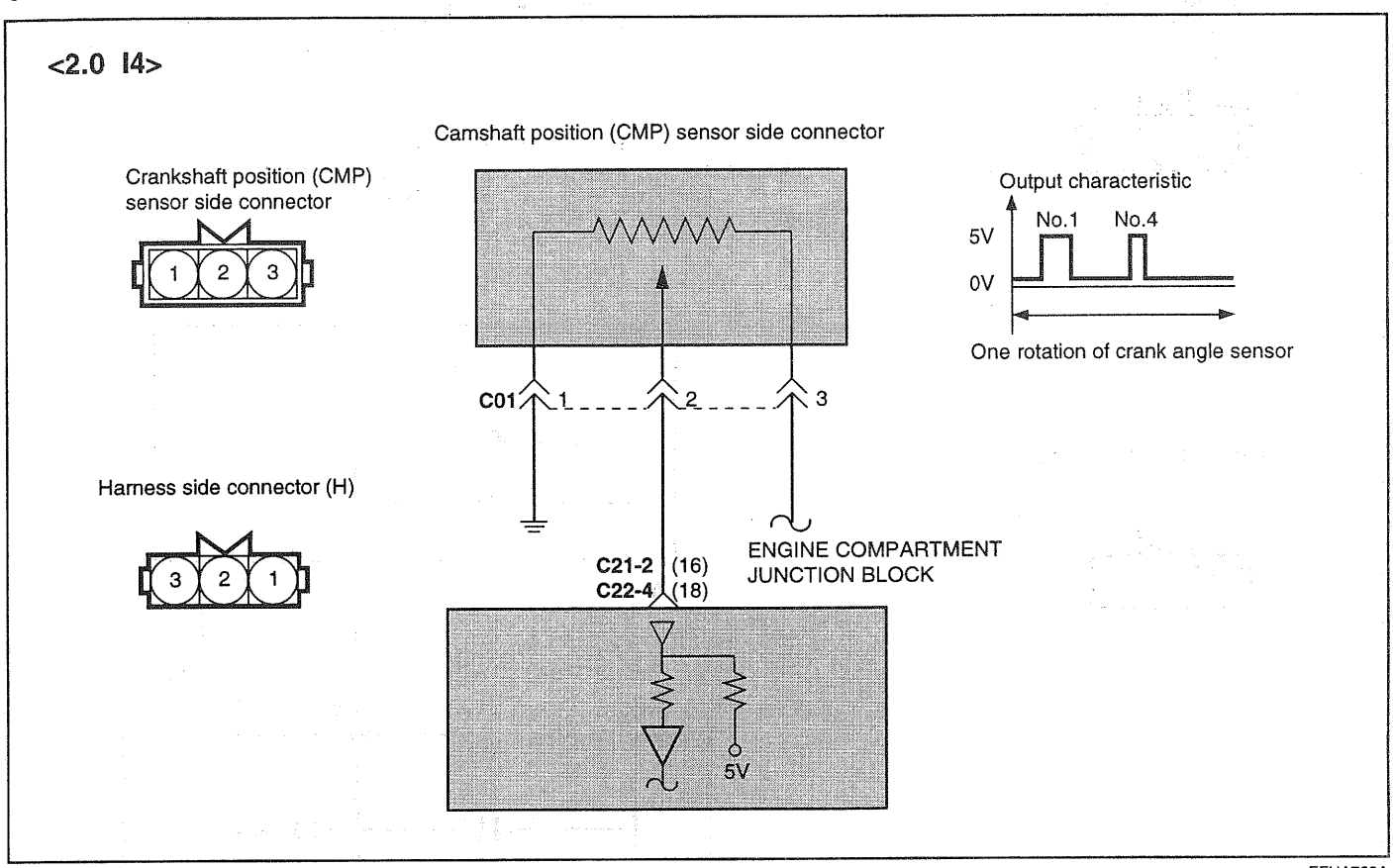
EFHA721D

CAMSHAFT POSITION SENSOR EFHA7230

The CMP sensor senses the camshaft position sensor on, the compression stroke of the No.1 and No.4 cylinders, converts it into a pulse signal, and inputs it to the ECM. The ECM then computes the fuel injection sequence, etc. based on the input signal.

CIRCUIT DIAGRAM

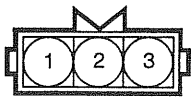
<2.0 I4>

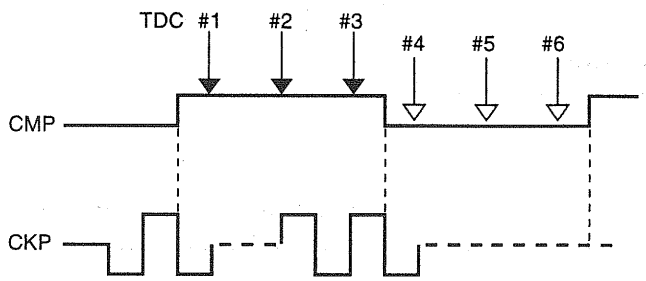


EFHA723A

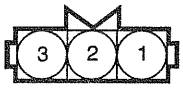
<2.7 V6>

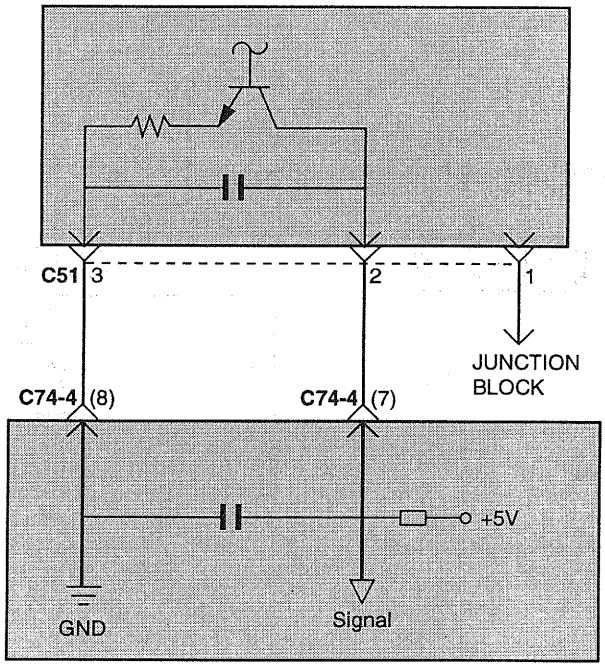
CMP Sensor side connector





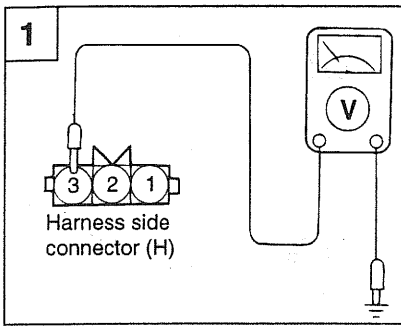
Harness side connector (H)



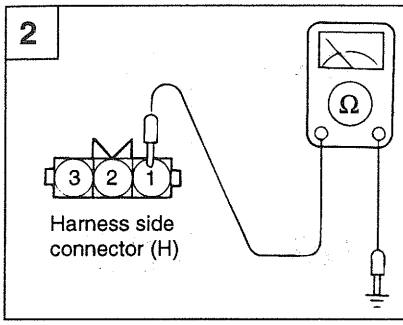


EFHA723E

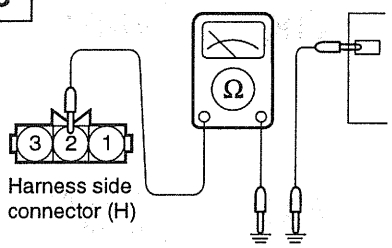
HARNESS INSPECTION PROCEDURE [2.0 I4]

1 	Measure the power supply voltage. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇒ NG ⇒	2 Repair the harness.

EFHA723B

2 	Check for continuity of the ground circuit. o Connector : Disconnected	OK ⇒ NG ⇒	3 Repair the harness.

EFHA723C

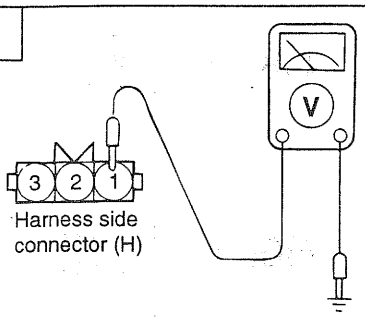
3 	Check the signal voltage. o Connector: Disconnected o Ignition switch : ON o Voltage : 4.8-5.2 V	OK ⇒ NG ⇒	END ! Repair the harness.

EFHA723D

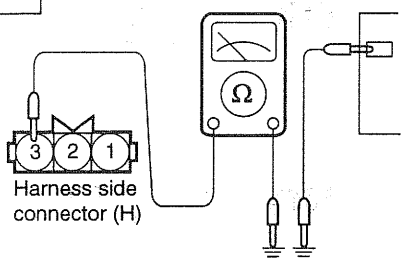
TROUBLESHOOTING HINTS

If the CMP Sensor does not operate correctly, correct sequential injection is not made so that the engine may stall or run irregularly at idle or fail to accelerate normally.

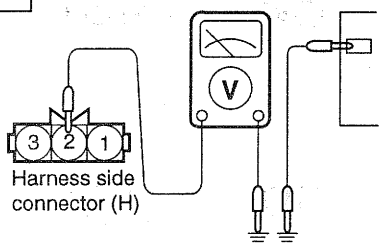
HARNESS INSPECTION PROCEDURE [2.7 V6]

1 	Measure the power supply voltage. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇒ NG ⇒	2 Repair the harness.

EFAA723F

2 	Check for continuity of the ground circuit. o Connector : Disconnected	OK ⇒ NG ⇒	3 Repair the harness.

EFHA723G

3 	Check the signal voltage. o Connector : Disconnected o Ignition ON o Voltage : 4.8-5.2V	OK ⇒ NG ⇒	END ! Repair the harness.

EFHA723H

TROUBLESHOOTING HINTS

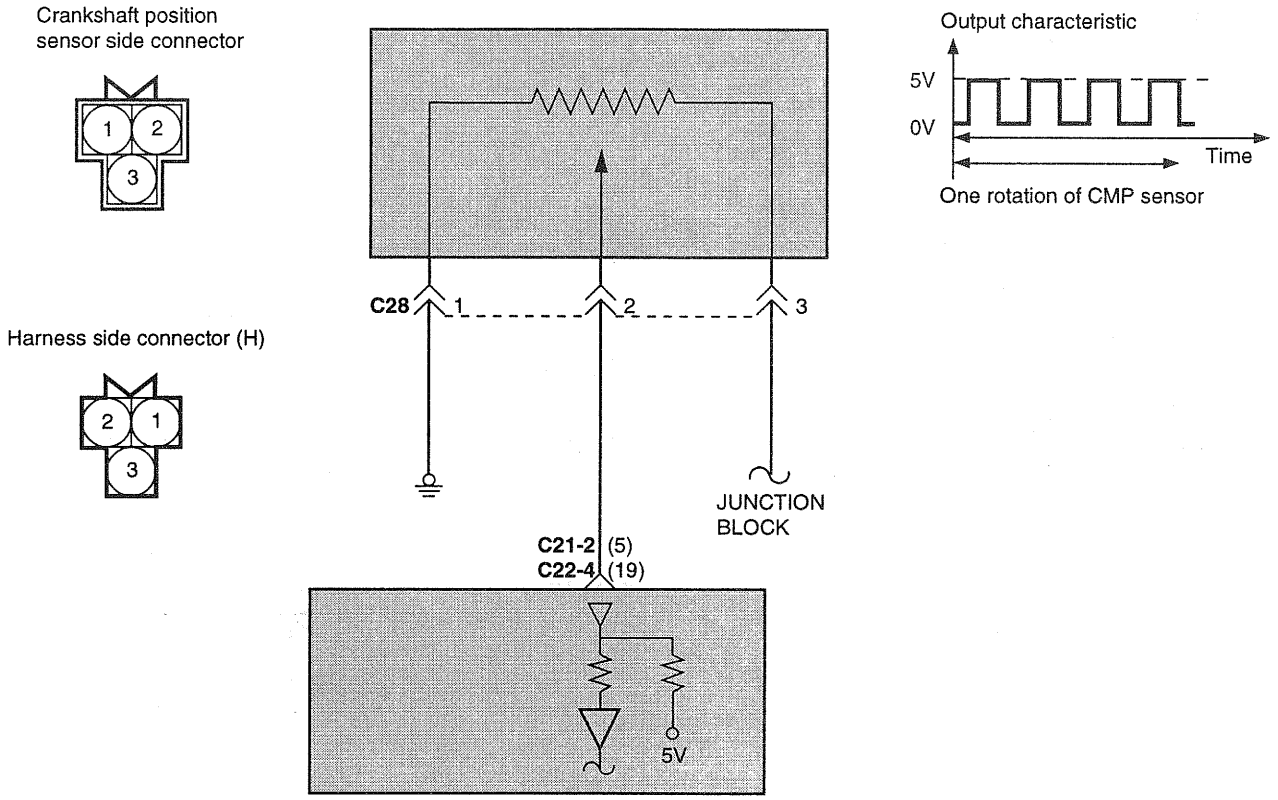
If the camshaft position sensor does not operate correctly, correct sequential injection is not made so that the engine may stall or run irregularly at idle or fail to accelerate normally.

CRANKSHAFT POSITION SENSOR EFHA7250

The crankshaft position sensor senses the crank angle (piston position) of each cylinder and converts it into a pulse signal. Based on the input signal, the ECM computes the engine speed and controls the fuel injection timing and ignition timing.

CIRCUIT DIAGRAM

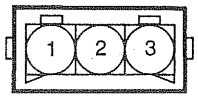
[2.0 I4]

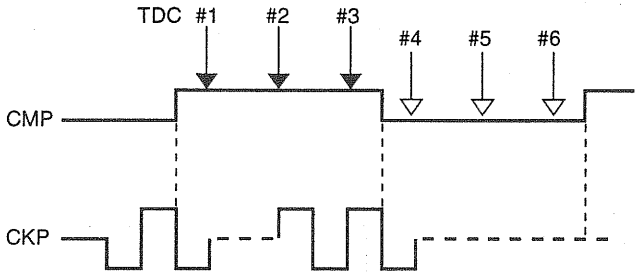


EFHA725A

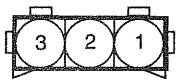
<2.7 V6>

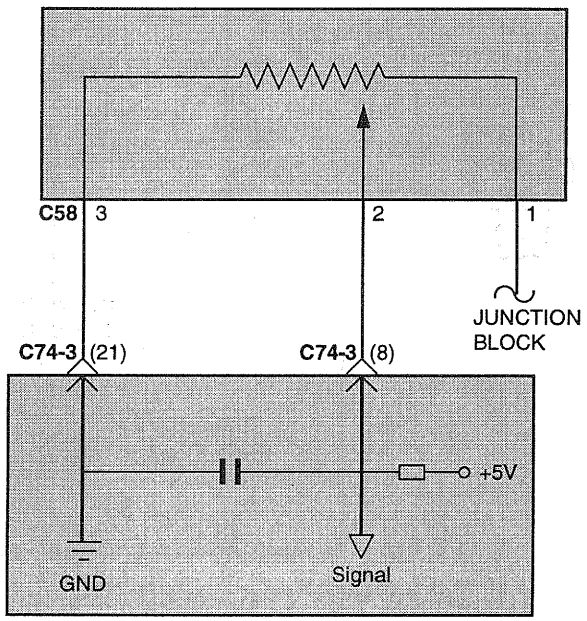
CMP Sensor side connector





Harness side connector (H)





EFHA725B

TROUBLESHOOTING HINTS

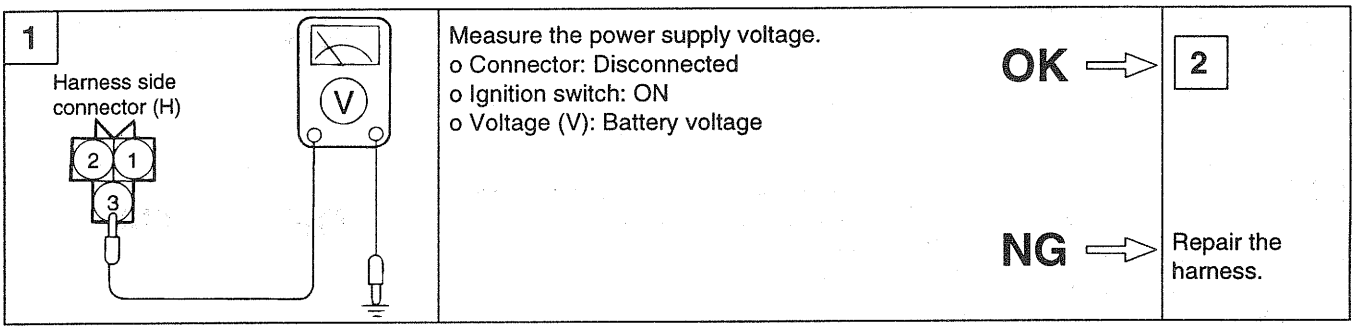
1. If unexpected shocks are felt during driving or the engine stalls suddenly, shake the crankshaft position sensor harness. If this causes the engine to stall, check for poor sensor connector contact.
2. If the tachometer reads 0 rpm when the engine is cranked, check for faulty crank angle sensor, broken timing belt or ignition system problems.
3. If the engine can be run at idle even if the crank angle sensor reading is out of specification, check the following:
   - Faulty engine coolant temperature sensor
   - Faulty idle speed control motor
   - Poorly adjusted reference idle speed

USING GST

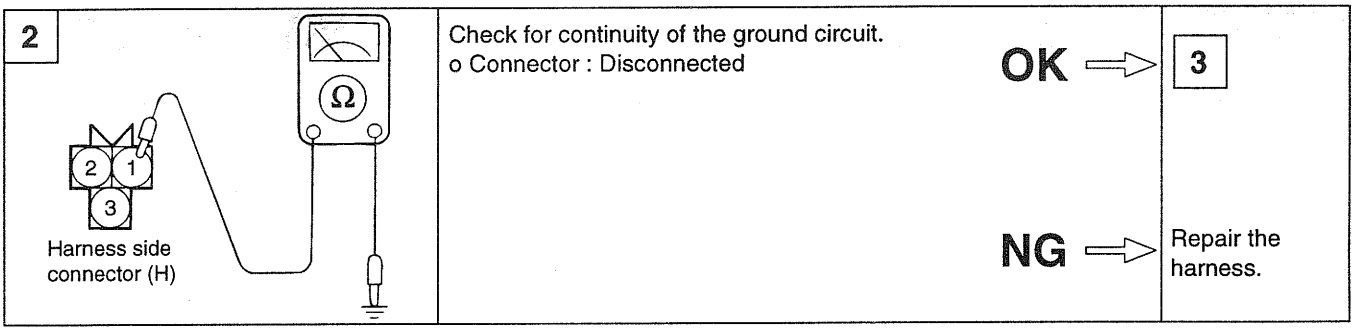
Check Item	Check conditions	Check content	Normal state
Crankshaft position sensor	• Engine cranking • Tachometer connected (check on and off ignition coil by tachometer)	Compare cranking speed and multi-tester reading	Indicated speed agrees

Check Item	Check conditions	Coolant temperature	Test specification
Crankshaft position sensor	• Engine: Running at idle • Idle position switch: ON	When -20°C (-4°F)	1,500-1,700 rpm
		When 0°C (-32°F)	1,350-1,550 rpm
		When 20°C (-68°F)	1,200-1,400 rpm
		When 40°C (-104°F)	1,000-1,200 rpm
		When 80°C (-176°F)	Idle rpm

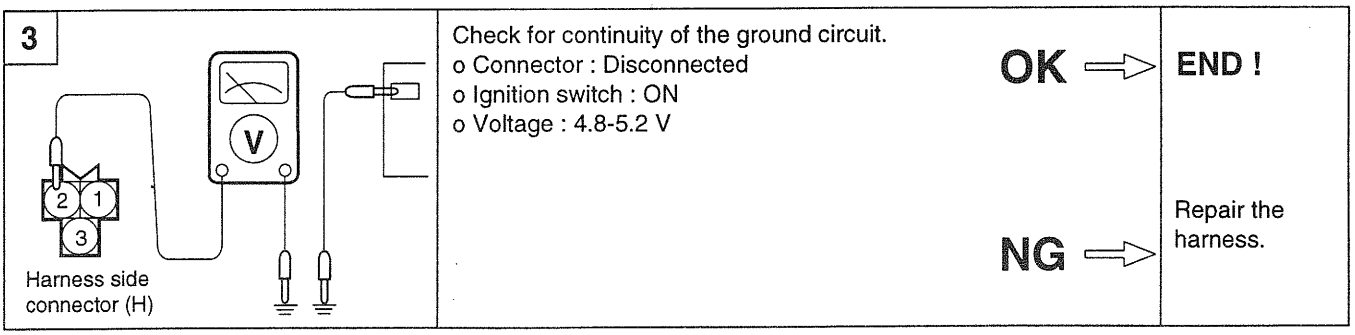
HARNESS INSPECTION PROCEDURE <2.0 I4>



EFAA725C

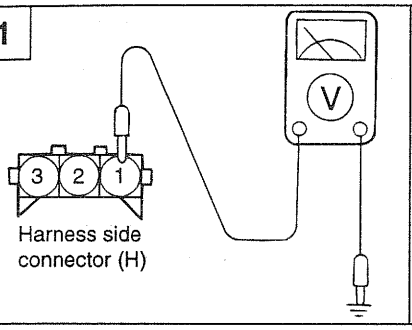


EFAA725D

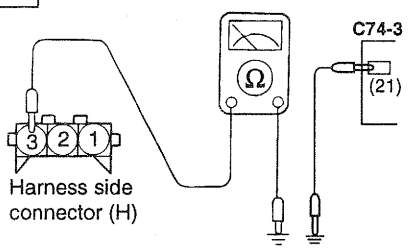


EFHA725E

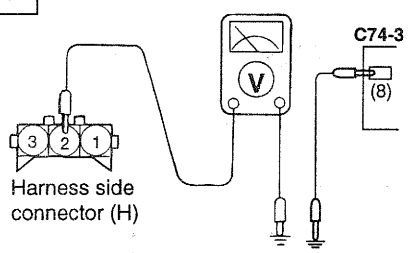
HARNESS INSPECTION PROCEDURE <2.7 V6>

1		Measure the power supply voltage. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇒ 2 NG ⇒ Repair the harness.

EFAA725F

2		Check for continuity of the ground circuit. o Connector : Disconnected o Continuity	OK ⇒ 3 NG ⇒ Repair the harness.

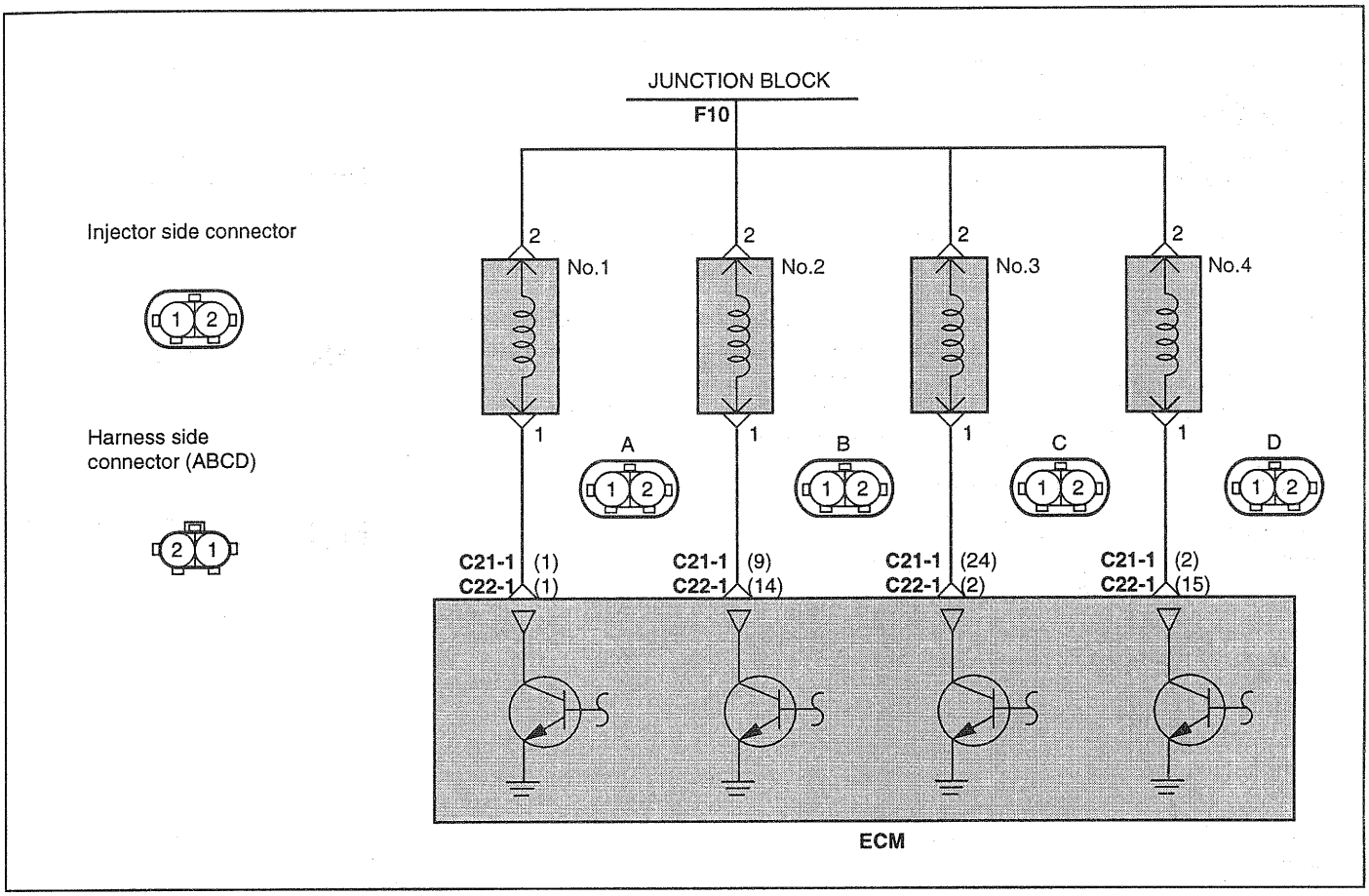
EFHA725G

3		Check for continuity of the ground circuit. o Connector : Disconnected o Ignition switch : ON o Voltage : 4.8-5.2 V	OK ⇒ END ! NG ⇒ Repair the harness.

EFHA725H

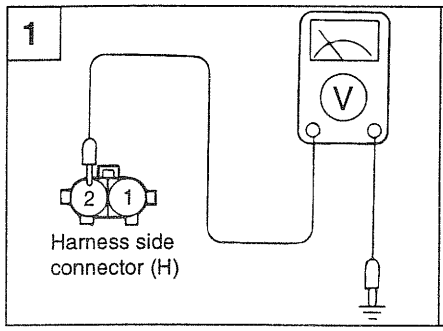
FUEL INJECTOR [2.0 I4] EFHA7270

The injectors inject fuel according to a signal coming from the ECM. The amount of fuel injected by the injectors is determined by the time which the solenoid valve is energized.

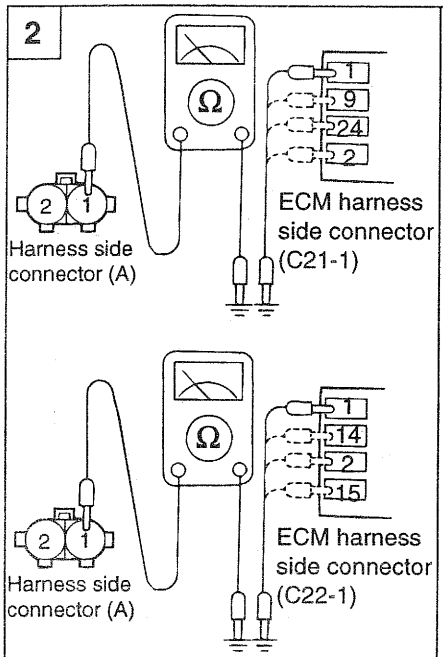


EFHA727A

HARNESS INSPECTION

1 	Measure the power supply voltage. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇒ 2 NG ⇒ Repair the harness.

EFAA727B

2 	Check for an open-circuit, or a short-circuit to ground between the engine control module and the injector. o ECM connector : Disconnected o Injector connector : Disconnected	OK ⇒ END ! NG ⇒ Repair the harness.

EFHA727C

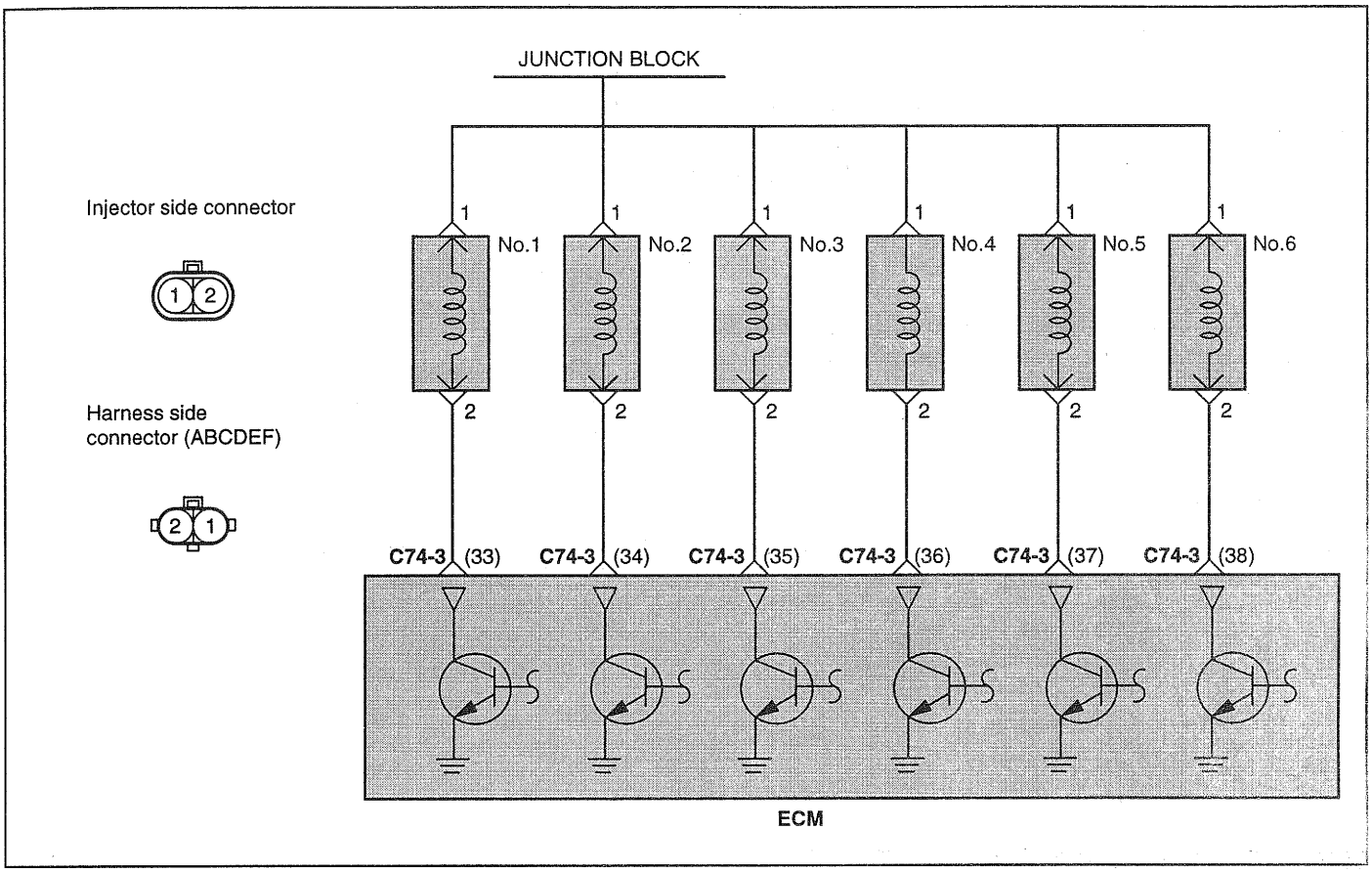
TROUBLESHOOTING HINTS

1. If the engine is hard to start when hot, check for fuel pressure and injector leaks.
2. If the injector does not operate when the engine is cranked, then check the followings:
   - Defective power supply circuit to the ECM, faulty ground circuit
   - Defective control relay
   - Defective crankshaft position (CKP) sensor, camshaft position (CMP) sensor
3. If there is any cylinder whose idle state remains unchanged when the fuel injection of injectors is cut one after another during idling, check for the following items about such a cylinder.
   - Injector and harness
   - Ignition 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 ignition plug, ignition coil, compression pressure, etc.)
   - Loose EGR valve seating

FUEL INJECTOR [2.7 V6] EFHA7290

The injectors inject fuel according to a signal coming from the ECM. The amount of fuel injected by the injectors is determined by the time during which the solenoid valve is energized.

CIRCUIT DIAGRAM



EFHA729A

INJECTOR CHECKING

USING HI-SCAN

Check Item	Data display	Check conditions	Check content	Test specification
Injector	Drive time	Engine: Cranking	0°C (32°F)	Approx. 17 ms
			20°C (68°F)	Approx. 35 ms
			80°C (176°F)	Approx. 8.5 ms

Check Item	Data display	Check conditions	Engine state	Test specification
Injector	Drive time	• Engine coolant temperature: 80 to 95°C (176 to 205°F) • Lamps, electric cooling fan, accessory modules: All OFF • Transaxle: Neutral (P range for vehicle with A/T) • Steering wheel: Neutral	Idle rpm	2.2-2.9 ms
			2,000 rpm	1.8-2.6 ms
			Rapid racing	To increase

NOTE

1. **The injector drive time is when the supply voltage is 11V and the cranking speed is less than 250 rpm.**
2. **When engine coolant temperature is lower than 0°C (32°F), the ECM fires all four cylinders simultaneously.**
3. **When the vehicle is new (within initial operation of about 500 km [300 miles]), the injector drive time may be about 10% longer.**

Check Item	Item No.	Drive content	Check condition	Normal state
Injector • Actuator test	01	No. 1 injector shut off	Engine: Idling after warm-up (Shut off the injectors in sequence during and after engine warm-up; check the idle condition)	Idle should become unstable as injector shuts off.
	02	No. 2 injector shut off		
	03	No. 3 injector shut off		
	04	No. 4 injector shut off		
	05	No. 5 injector shut off		
	06	No. 6 injector shut off		

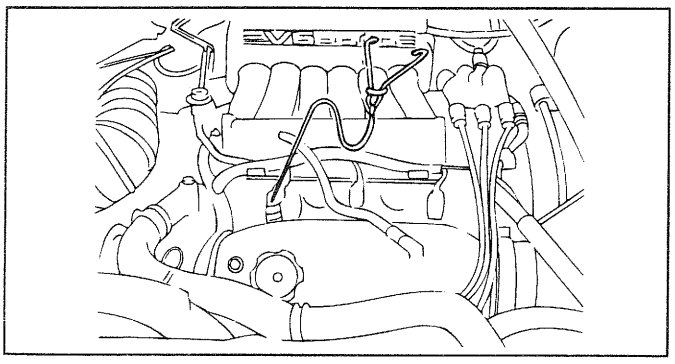
USING STETHOSCOPE AND VOLTMETER

Operation Sound Check

1. Using a stethoscope, check the injectors for clicking sound at idle. Check that the sound is produced at shorter intervals as the engine speed increases.

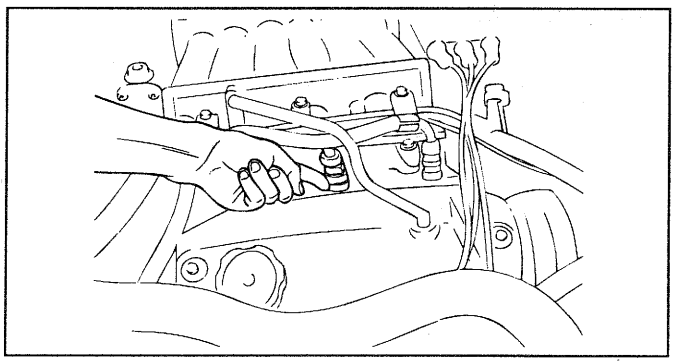
NOTE

Ensure that the sound from an adjacent injector is not being transmitted along with the delivery pipe to an inoperative injector.



EFA9087A

2. If a stethoscope is not available, check the injector operation with your finger. If no vibration is felt, check the wiring connector, injector or injection signal from the ECM.



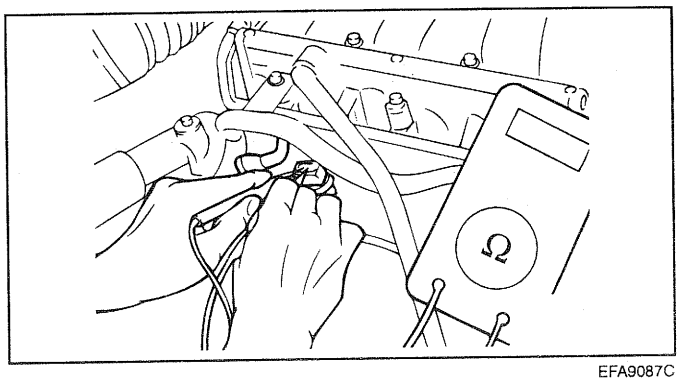
EFA9087B

Resistance Measurement Between Terminals

3. Disconnect the connector at the injector.
4. Measure the resistance between terminals.

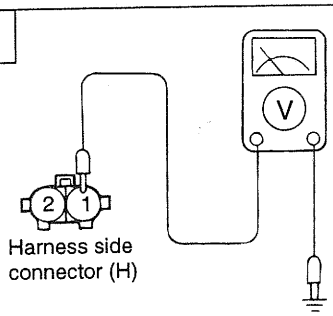
Standard value : 13–16Ω[at20°C(68°F)]

5. Connect the connector to the injector.

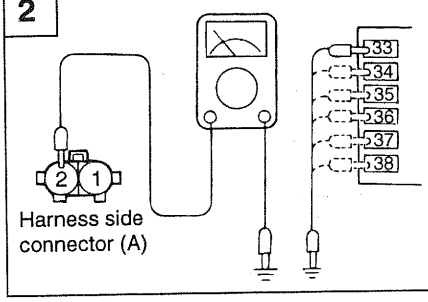


EFA9087C

HARNESS INSPECTION

1  Harness side connector (H)	Measure the power supply voltage. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇒	2
		NG ⇒	Repair the harness.

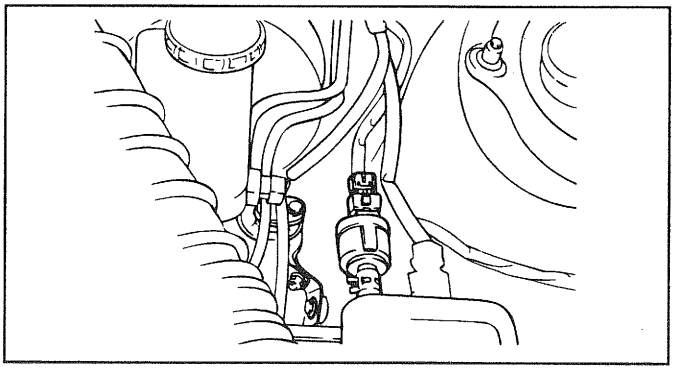
EFHA729B

2  Harness side connector (A)	Check for an open-circuit, or a short-circuit to ground between the engine control module and the injector. o ECM connector : Disconnected o Injector connector : Disconnected	OK ⇒	END !
		NG ⇒	Repair the harness.

EFHA729C

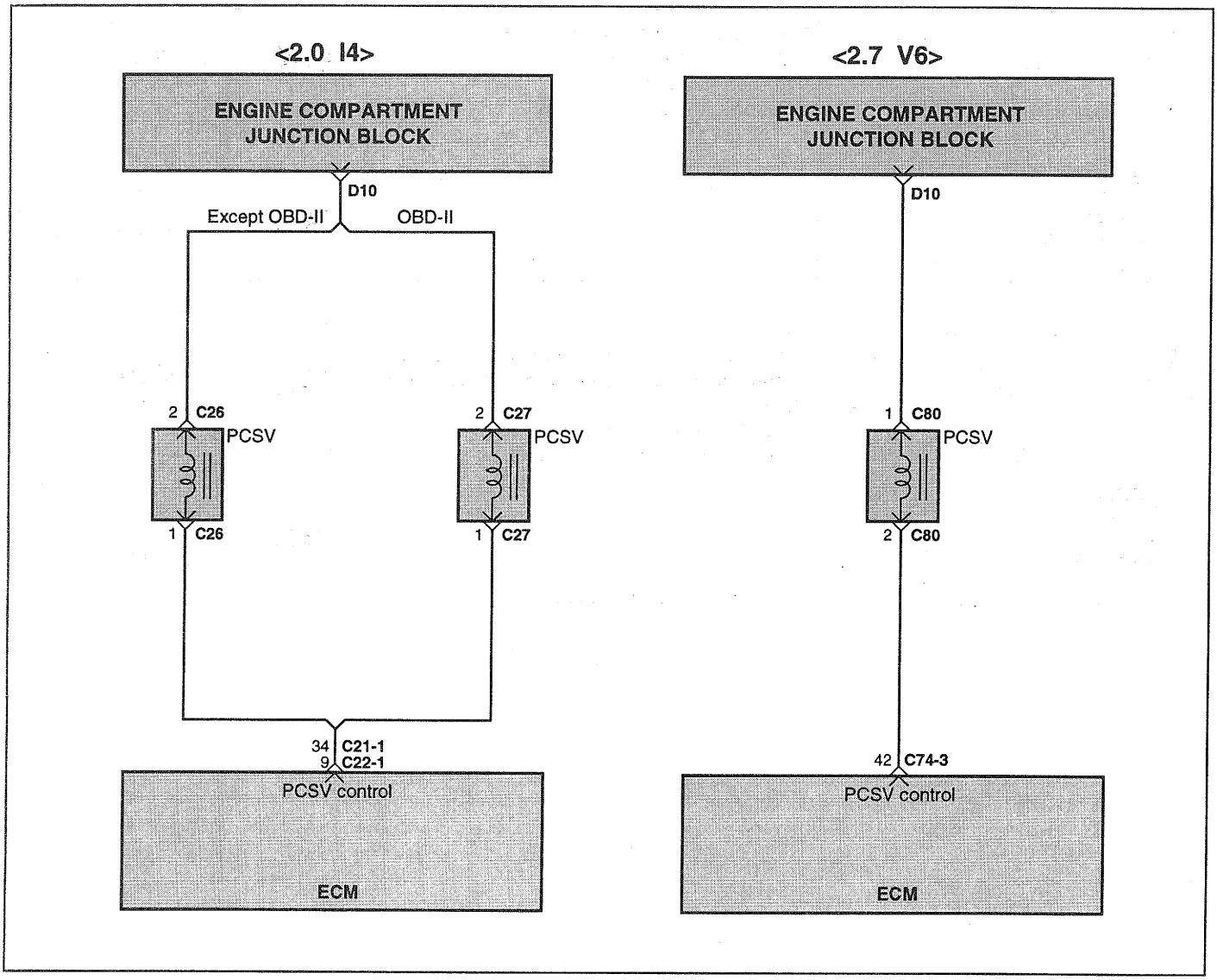
EVAPORATIVE EMISSION CANISTER PURGE SOLENOID VALVE EFHA7310

The evaporative emission canister purge solenoid valve is a duty control type, which controls purge air from the evaporative emission canister.



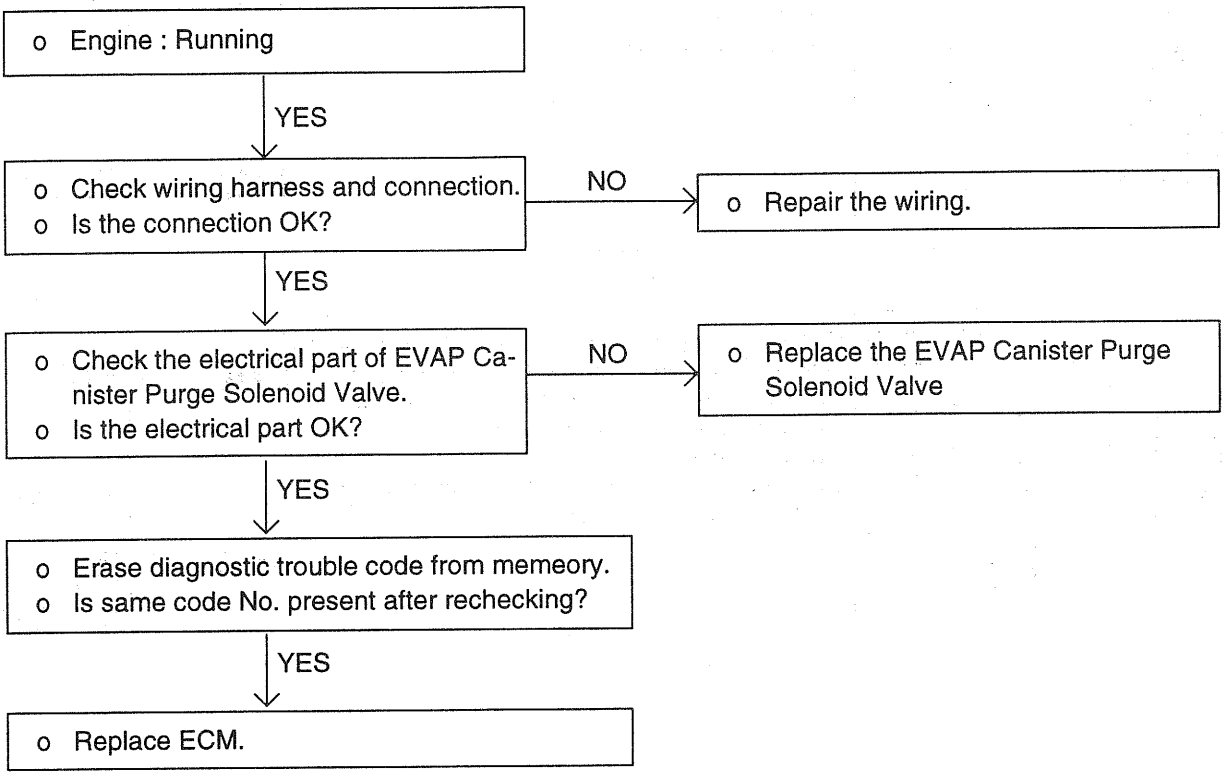
EFA9089A

CIRCUIT DIAGRAM



EFHA731A

TROUBLESHOOTING PROCEDURES



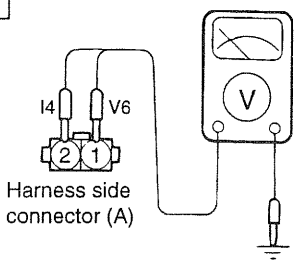
DTC : Diagnosis Trouble Code
ECM : Engine Control Module

EFAA731B

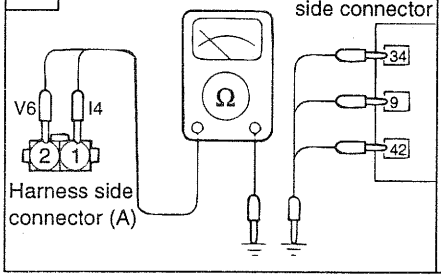
USING HI-SCAN

Check Item	Check conditions	HI-SCAN display	Type
Evaporative emission canister purge solenoid valve • Actuator test	IG. S/W ON (Do not start)	PCSV	Activate

HARNESS INSPECTION

1 	Measure the power supply voltage. o Connector: Disconnected o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇨ NG ⇨	2 Repair the harness.

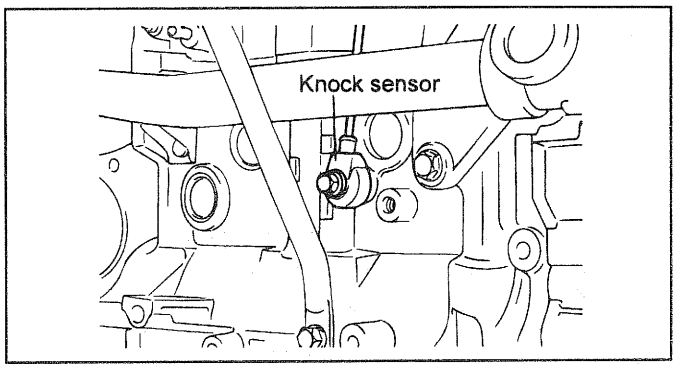
EFHA731C

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. o Engine control module connector : Disconnected o Evaporative emission canister purge solenoid valve connector : Disconnected	OK ⇨ NG ⇨	END ! Repair the harness. H2-C21-1:34 H2-C22-1:9 H1-C74-3:42

EFHA731D

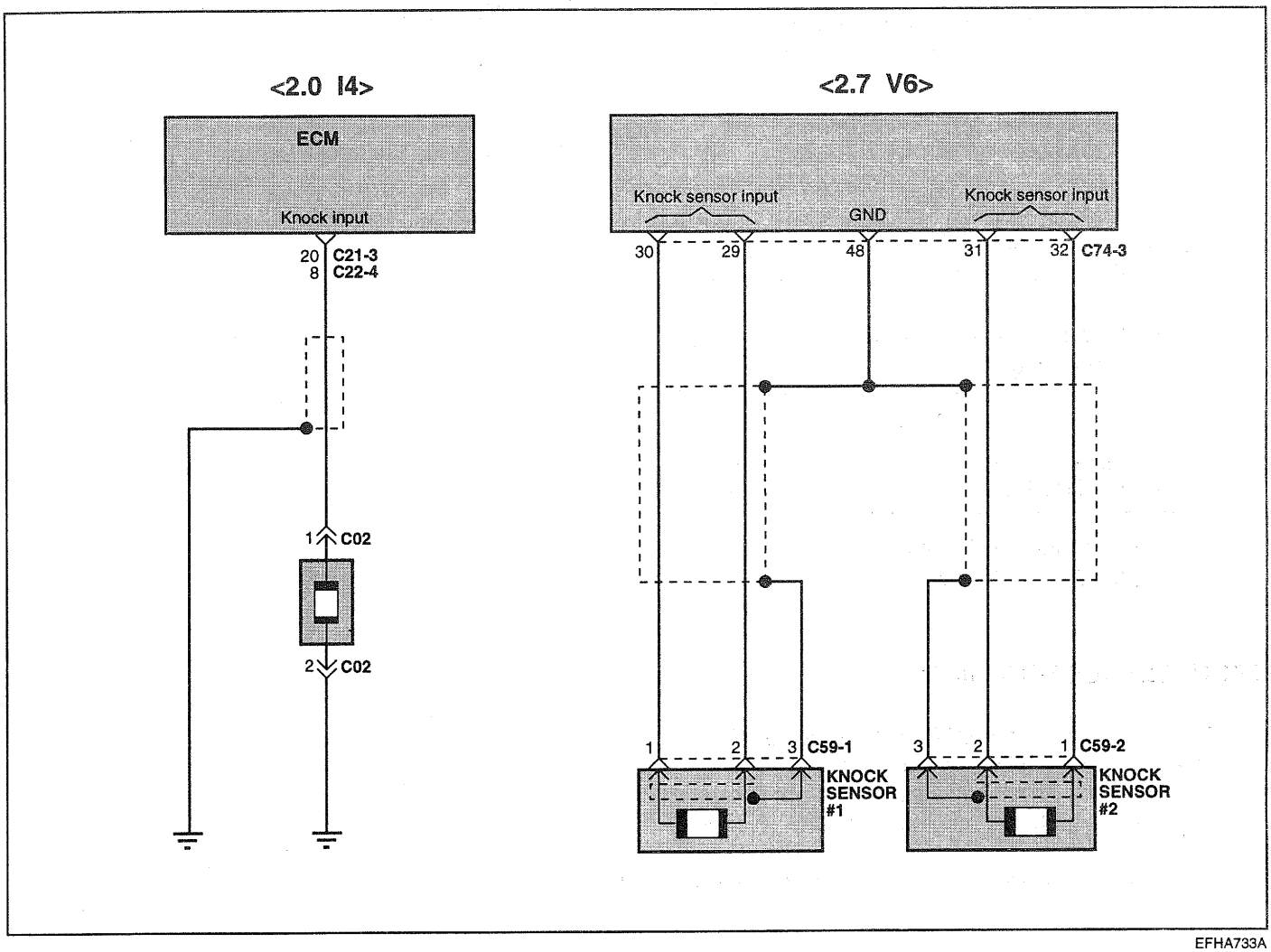
KNOCK SENSOR EFHA7330

The knock sensor is attached to the cylinder block and senses engine knocking conditions. 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 delivered as output. If engine knocking occurs, ignition timing is retarded to suppress it.



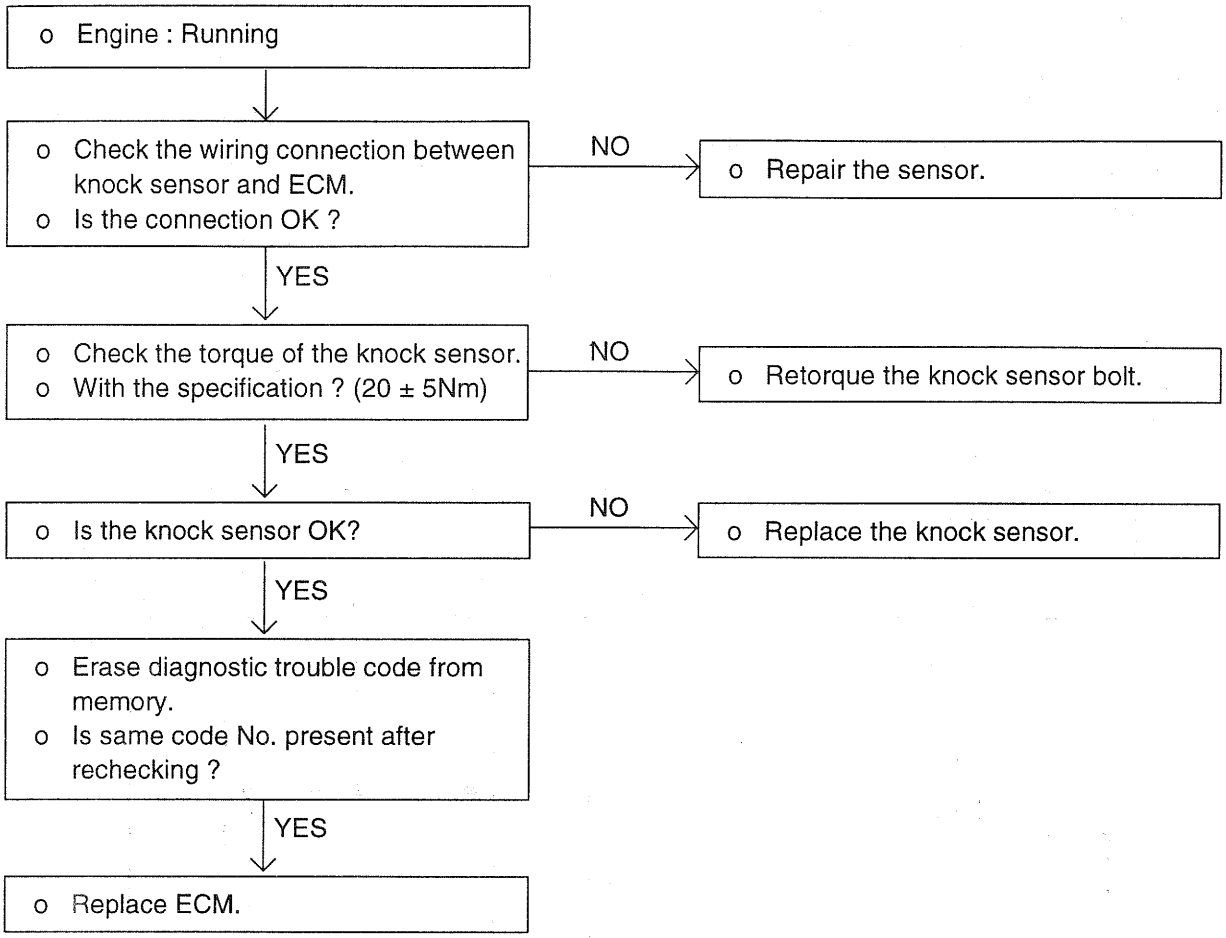
EFA9094A

CIRCUIT DIAGRAM



EFHA733A

TROUBLESHOOTING PROCEDURES



DTC : Diagnosis Trouble Code
ECM : Engine Control Module

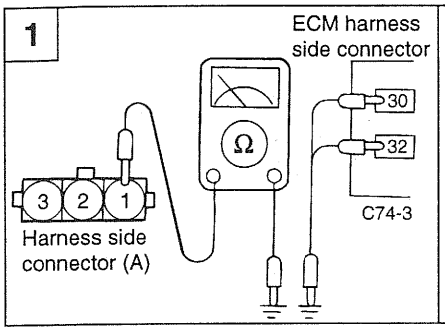
EFAA733B

TROUBLESHOOTING HINTS

1. The MIL is ON or the DTC is displayed on the HI-SCAN under the following condition:
   - When the knock sensor signal is not detected, even though the engine is in the over load condition.
   - When knock sensor signal is abnormally low.

HARNESS INSPECTION PROCEDURE <2.7 V6>

1



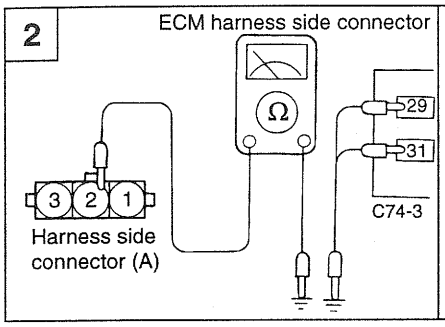
Check for an open-circuit, or a short-circuit to ground between the ECM and the knock sensor
- o ECM connector : Disconnected
- o Knock sensor connector : Disconnected

OK ⇒ 2

NG ⇒ Repair the harness.
A1 - C74-3 : 30
A1 - C74-3 : 32

EFHA733C

2



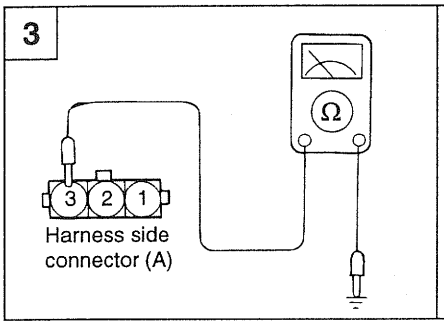
Check for continuity of the ground circuit
- o ECM Connector : Disconnected
- o Knock sensor connector : Disconnected

OK ⇒ 3

NG ⇒ Repair the harness.

EFHA733D

3



Check for continuity of the ground circuit
- o Continuity

OK ⇒ END !

NG ⇒ Repair the harness.

EFHA733F

SENSOR INSPECTION

1. Disconnect the knock sensor connector.
2. Measure resistance between the terminal 2 and 3.

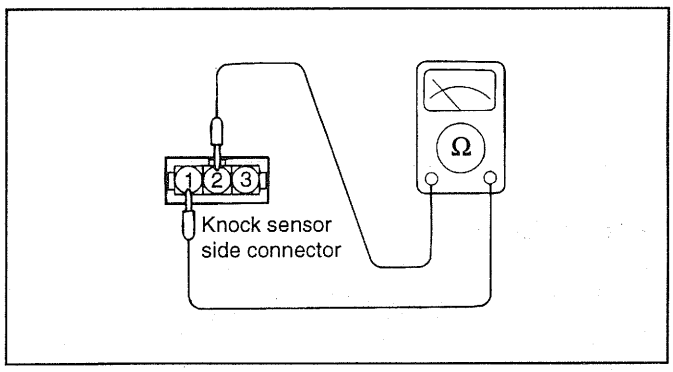
Standard value : about 5MΩ [at 20°C (68°F)]

3. If the resistance is continual, replace the knock sensor.

Knock sensor :
16-28Nm (160-250 kg·cm, 11.8-18.4 lb·ft)

4. Measure the capacitance between the terminal 2 and 3.

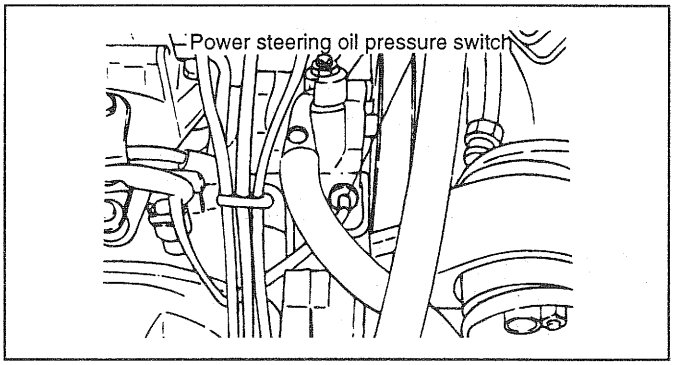
Standard value : 800-1600 pF



EFHA733E

POWER STEERING PRESSURE SWITCH EFHA7350

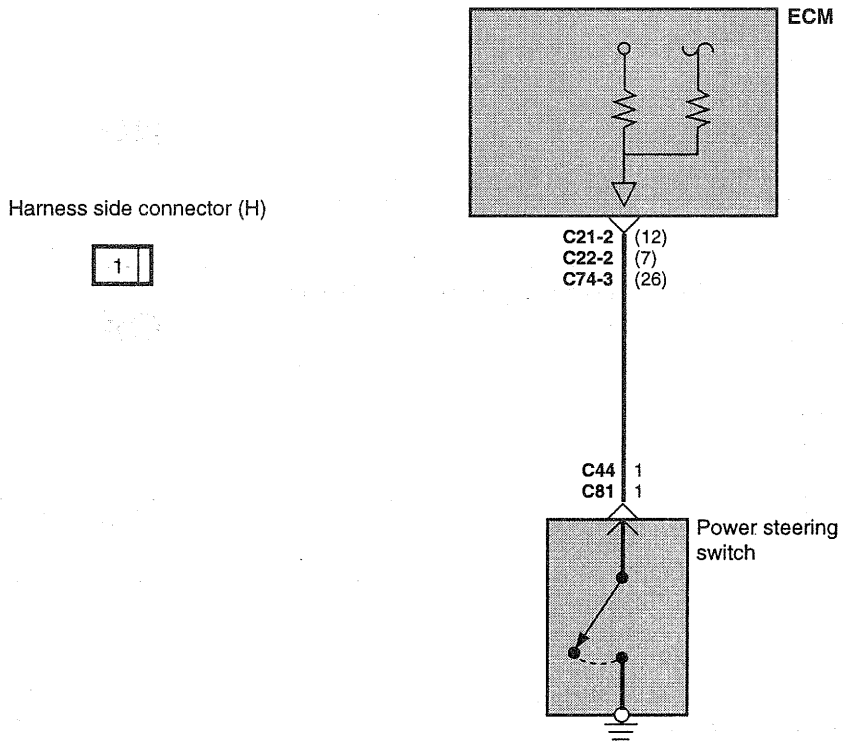
The power steering oil pressure switch senses the power steering load into low/high voltage and inputs it to ECM, which then controls the idle speed control motor based on this signal.



EFA9103A

CIRCUIT DIAGRAM

<2.0 I4 / 2.7 V6>

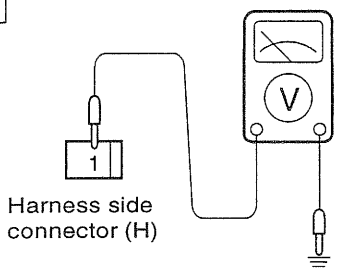


EFHA735A

USING HI-SCAN

Check item	Data display	Check conditions	Steering wheel	Normal indication
Power steering oil pressure switch	Switch state	Engine : Idling	Steering wheel neutral position (wheels straightahead direction)	OFF
			Steering wheel half turn	ON

HARNESS INSPECTION

1  Harness side connector (H)	Measure the power supply voltage. o Connector: Disconnect o Ignition switch: ON o Voltage (V): Battery voltage	OK ⇨	END !
		NG ⇨	Repair the harness.

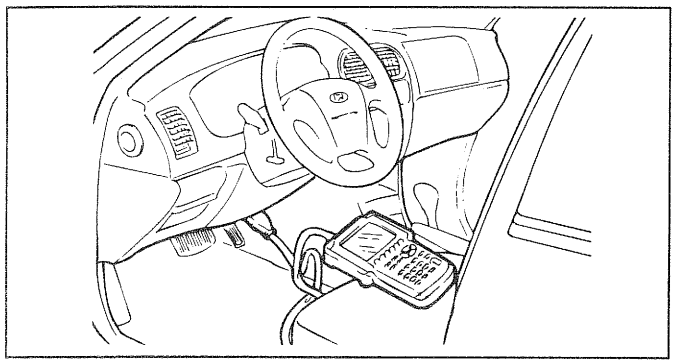
EFAA735B

THROTTLE POSITION SENSOR(TPS) ADJUSTMENT EFHA1060

1. Connect a HI-SCAN to the data link connector.

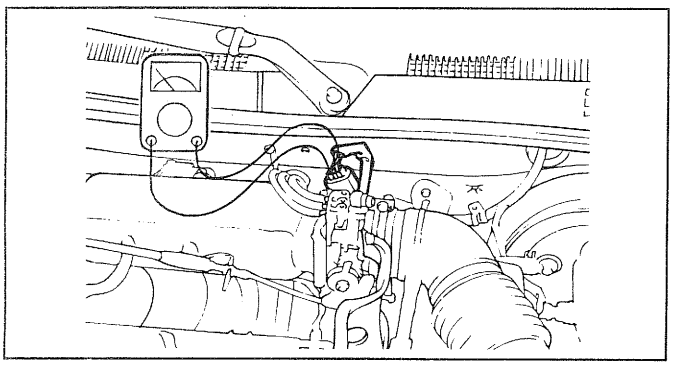
NOTE

Before adjusting the TPS, complete the basic idle speed adjustment.



EFA9100A

2. If a HI-SCAN is not used, connect a digital type voltmeter between ground and TPS input terminal.



EFA9106A

3. Turn the ignition switch to the ON position(do not start engine) and check that TPS output voltage is as specified. If a HI-SCAN is used, read the TPS voltage.

Standard value :
300-900mV (2.0 I4)
250-800mV (2.7 V6)

4. If it is out of specification, loosen TPS mounting screw and adjust by turning TPS.

NOTE

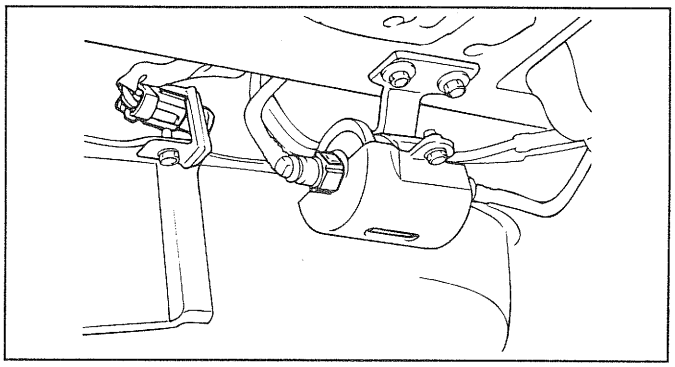
1. **Turning the TPS clockwise increases the output voltage.**
2. **Tighten the screws securely after adjustment.**

5. Turn the ignition switch to the OFF position.

FUEL SENDER REPLACEMENT EFHA1070

1. Remove the fuel tank cap to lower the fuel tank's internal pressure.

2. Raise the vehicle and disconnect the fuel pump connector, remove the fuel feed and return line from the fuel pump assembly.

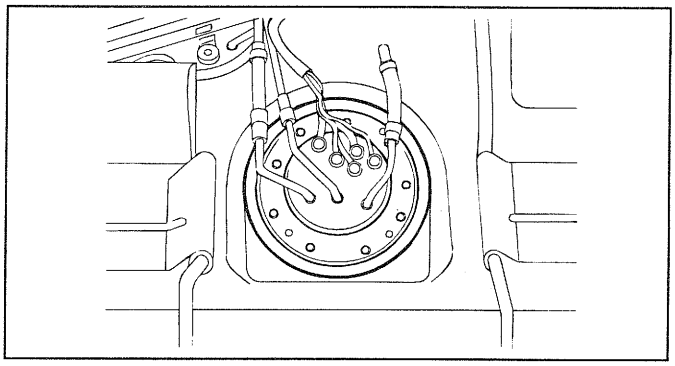


EFHA006B

3. Remove the fuel pump installation screws, then remove the fuel pump assembly from the fuel tank.

4. Remove the fuel sender from the fuel pump assembly.

5. Inspect and replace, if necessary.



EFHA006A

FUEL PUMP OPERATION CHECK EFHA1080

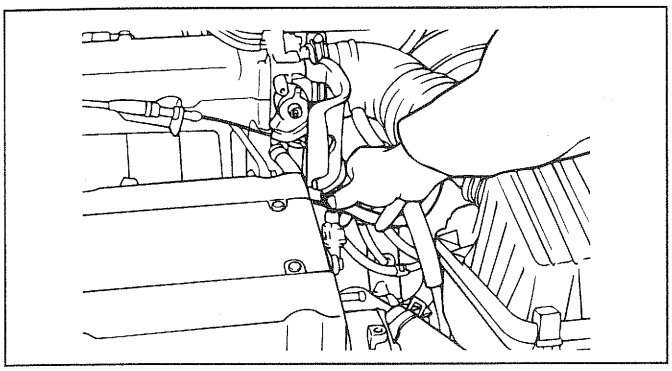
1. Turn the ignition switch to the OFF position.

2. Apply battery voltage to the fuel pump drive connector to check that the pump operates.

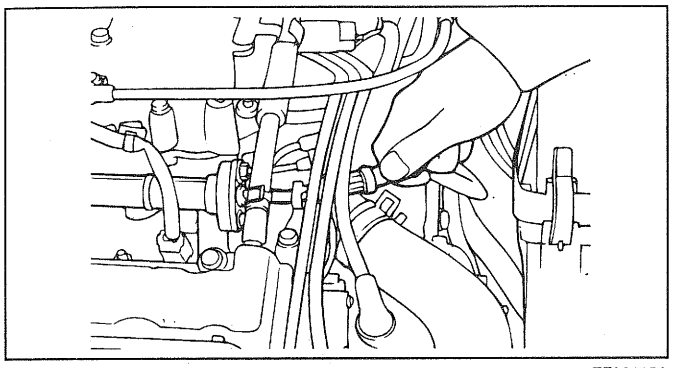
NOTE

The fuel pump is an in-tank type and its operating sound is hard to hear without removing the fuel tank cap.

3. Pinch the hose to check that fuel pressure is felt.



EFA9108A



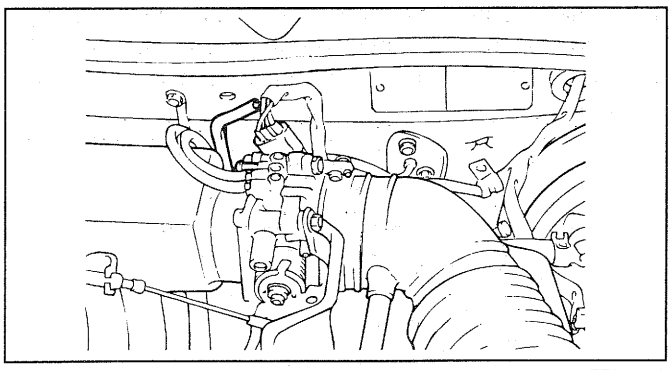
EFA9115A

EVAP CANISTER PURGE PORT VACUUM CHECK EFHA1090

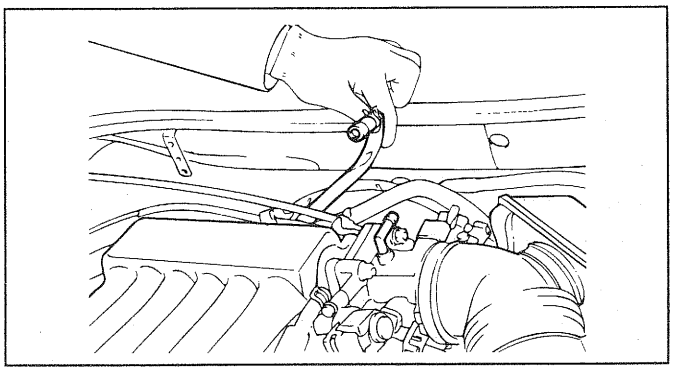
CHECKING CONDITION

Engine coolant temperature : 80-95°C (176-205°F)

1. Disconnect the vacuum hose from the throttle body EVAP Canister purge hose fitting and connect a vacuum pump.



EFA9109A

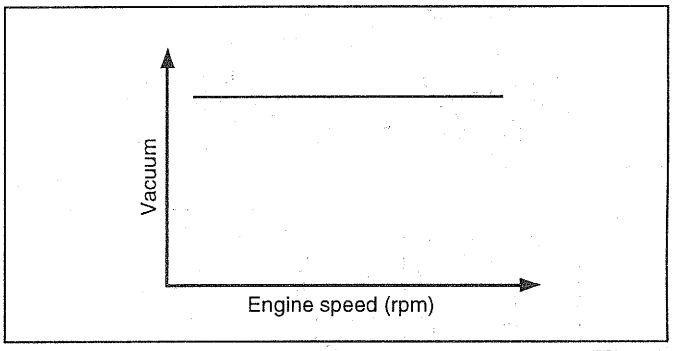


EFA9113A

2. Start the engine and check to see that, after increasing the engine speed, vacuum raises fairly constant.

NOTE

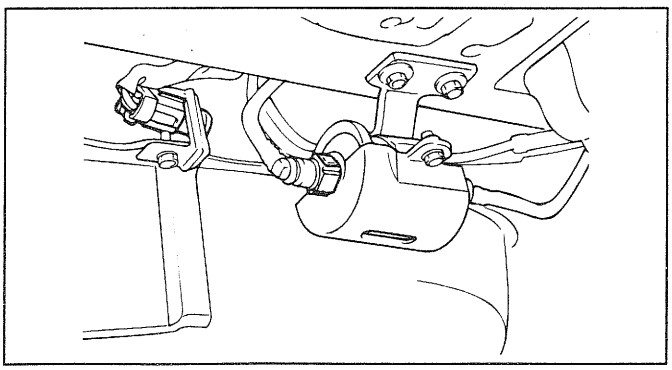
If there is no vacuum created, it is possible that the throttle body port may be restricted and may require cleaning.



EFA9109B

FUEL PRESSURE TEST EFHA1100

1. Reduce the internal pressure of the fuel pipes and hoses by the following procedures:
   - Open the trunk door and disconnect the fuel pump harness connector.
   - Start the engine and after it stalls, turn the ignition switch to the OFF position.
   - Disconnect the battery negative (-) terminal.
   - Connect the fuel pump harness connector.



EFHA006B

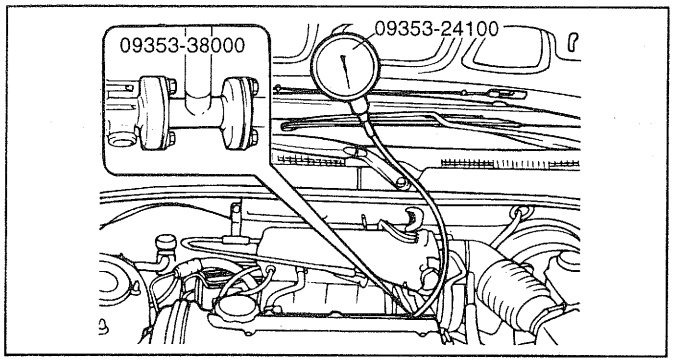
2. Remove the bolt connecting the fuel line to the fuel delivery pipe.

CAUTION

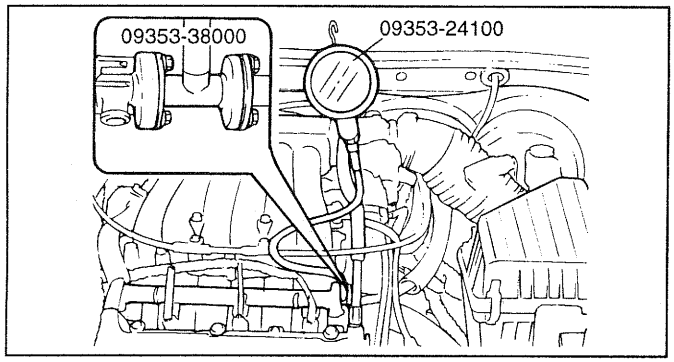
Cover the hose connection with a shop towel to prevent splashing of fuel caused by fuel residual pressure in the fuel line.

3. Using the fuel pressure gauge adapter, install the fuel-pressure gauge to the fuel pressure gauge adaptor. Tighten the bolt to the specified torque.

Fuel pressure gauge to fuel delivery pipe
25-35 Nm (250-350 kg·cm, 18-26 lb·ft)



EFA9110A



EFA9116B

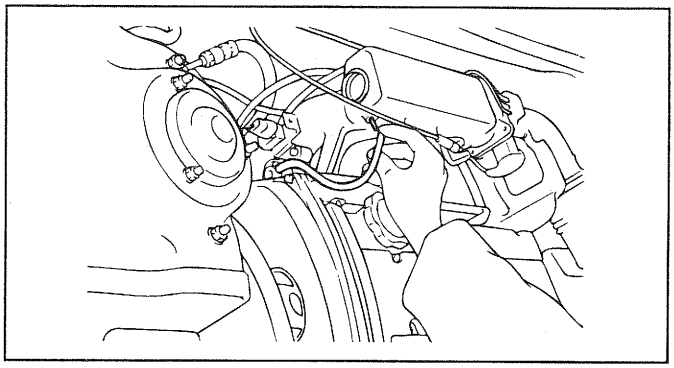
4. Connect the battery's negative (-) terminal.

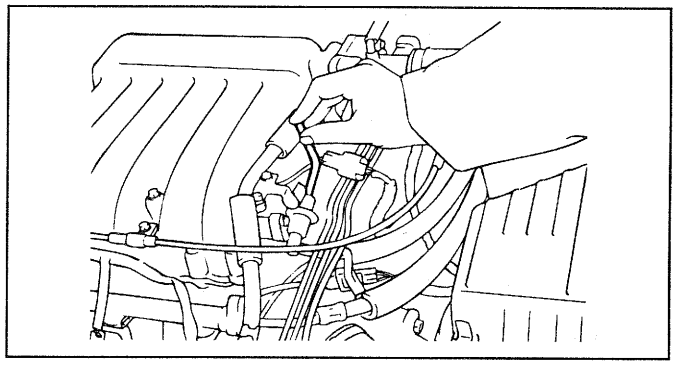
5. Apply battery voltage to the terminal for the pump drive and activate the fuel pump: then, with fuel pressure applied, check that there is no fuel leakage from the pressure gauge or connection part.

6. Start and run the engine at curb idle speed.

7. Disconnect the vacuum hose from the pressure regulator, and plug the hose end. Measure the fuel pressure at idle.

Standard value :
320-340 kPa (3.26-3.47 kg/cm^2, 46-49 psi)

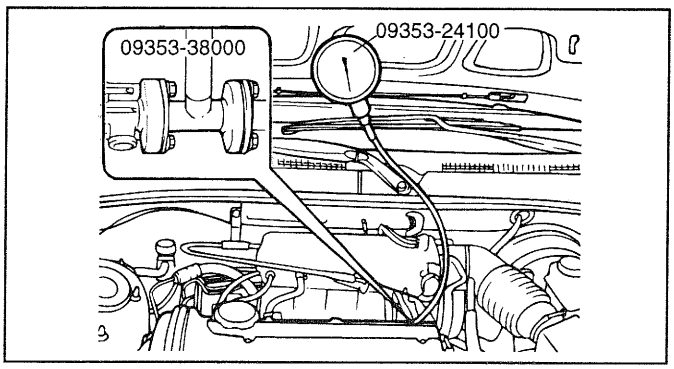

EFA9110B


EFA9116C

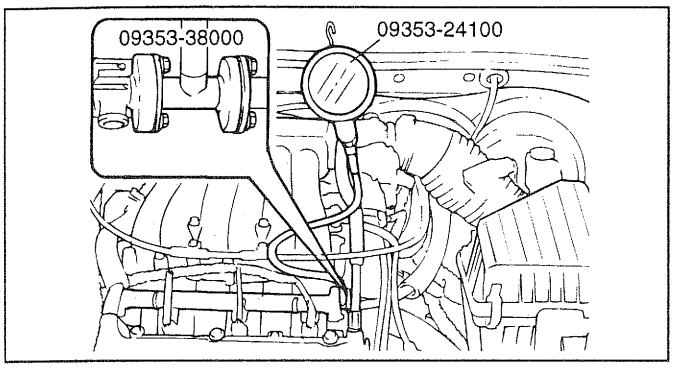
8. Measure the fuel pressure when the vacuum hose is connected to the pressure regulator.

Standard value :
Approx.255 kPa (2.57 kg/cm^2, 37 psi)

9. If the results 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.



EFA9110A



EFA9116B

Condition	Probable cause	Remedy
Fuel pressure is too low	• Clogged fuel filter • Fuel leakage to the return side, caused by poor seating of the fuel-pressure regulator	• Replace fuel filter • Replace fuel pressure regulator
	• Low discharge pressure of the fuel pump	• Check the in-tank fuel hose for lage or replace the fuel pump
Fuel pressure is too high	• Sticking fuel-pressure regulator • Clogged or bent fuel return hose or pipe	• Replace fuel pressure regulator • Repair or replace hose or pipe
There is no difference in fuel pressure when the vacuum hose is connected and when it is not.	• Clogging, or damaged vacuum hose or the nipple • Sticking or poor seating of the fuel pressure regulator	• Repair or replace the vacuum hose or the nipple • 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 at which it drops. Determine and remove the causes according to the following table.

Condition	Probable cause	Remedy
Fuel pressure drops slowly after engine is stopped	• Injector leakage	• Replace injector
Fuel pressure drops immediately after engine is stopped	• The check valve within the fuel pump is open	• Replace fuel pump

11. Reduce the pressure in the fuel line.
12. Disconnect the hose and the gauge.

CAUTION

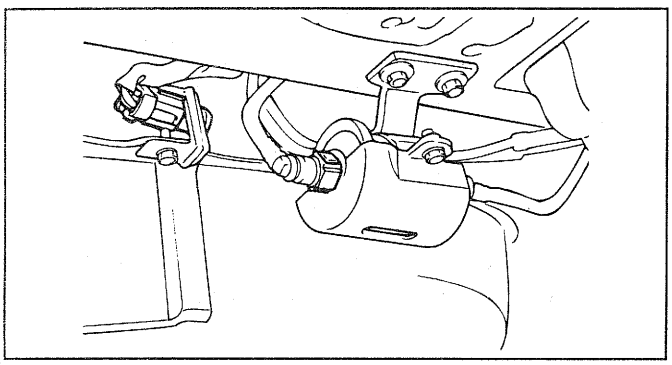
Cover the hose connection with a shop towel to prevent splashing of fuel caused by fuel residual pressure in the fuel line.

13. Replace the O-ring of the end of the hose.
14. Connect the fuel hose to the delivery pipe and tighten with the specified.
15. Check for fuel leakage.

FUEL FILTER REPLACEMENT EFHA1110

1. Reduce the internal pressure of the fuel lines and hoses and perform the following operations.
   - Disconnect the fuel pump harness connector in the trunk room.
   - Start the engine and, after it stops, turn the ignition switch to OFF.
   - Disconnect the battery negative (-) terminal.
   - Connect the fuel pump harness connector.
2. Remove the two fitting nuts while holding the fuel filter nuts securely.
3. Remove the fuel filter mounting bolts, and then remove the fuel filter from the fuel filter clamp.

Tightening torque
Fuel filter fitting nut :
25-35 Nm (250-350 kg·cm, 18-25 lb·ft)



EFHA006B

THROTTLE BODY CLEANING EFA91120

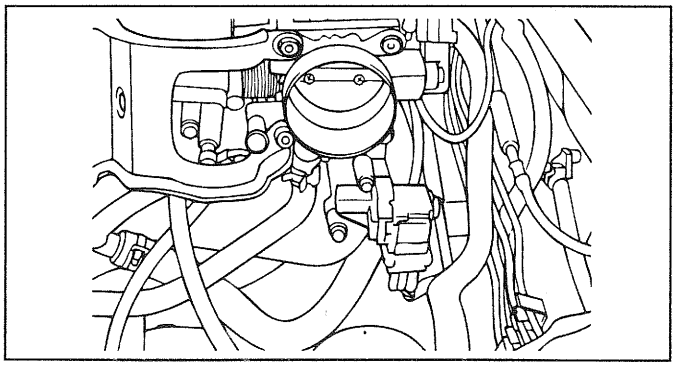
NOTE

Disconnect the intake air hose from the throttle body, and check the throttle valve surface for carbon deposits. Spray cleaning solvent on the valve to remove carbon deposits.

1. Warm up the engine, then stop it.
2. Remove the intake air hose from the throttle body.
3. Plug the bypass passage inlet of the throttle body.

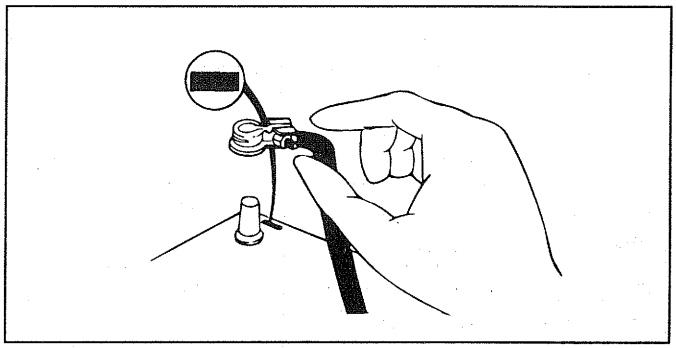
NOTE

Make sure the solvent does not enter the by-pass passage.



EFA9112A

4. Spray cleaning solvent into the valve through the throttle body intake port and let it soak for about 5 minutes.
5. Start the engine, race it several times and allow the engine to idle for 1 minute.
6. Repeat Steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the intake air hose.
9. Disconnect the battery ground cable for more than 10 seconds.
10. Adjust the SAS (Speed Adjusting Screw).

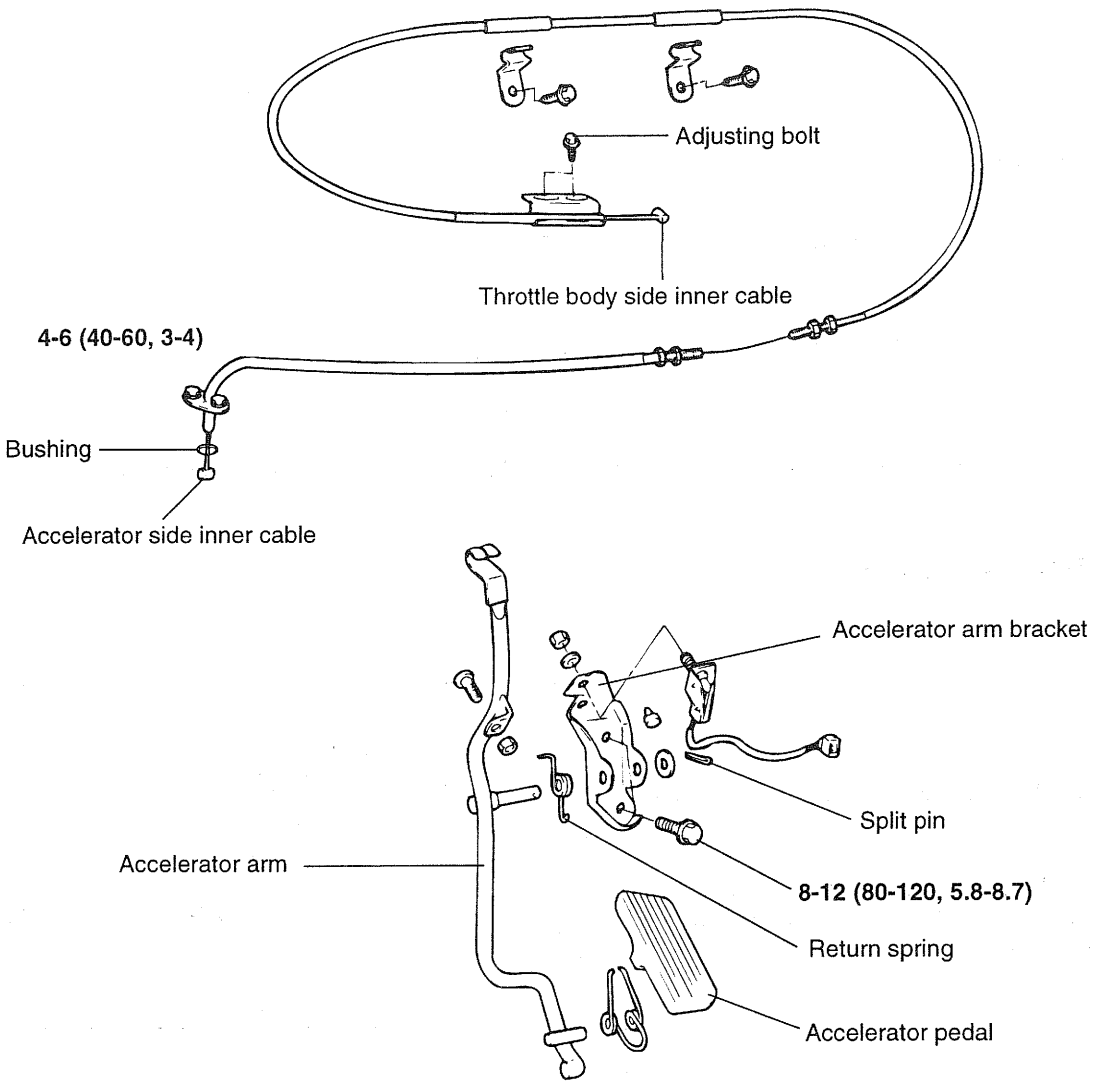


EFA9112B

FUEL DELIVERY SYSTEM

ACCELERATOR PEDAL EFA91190

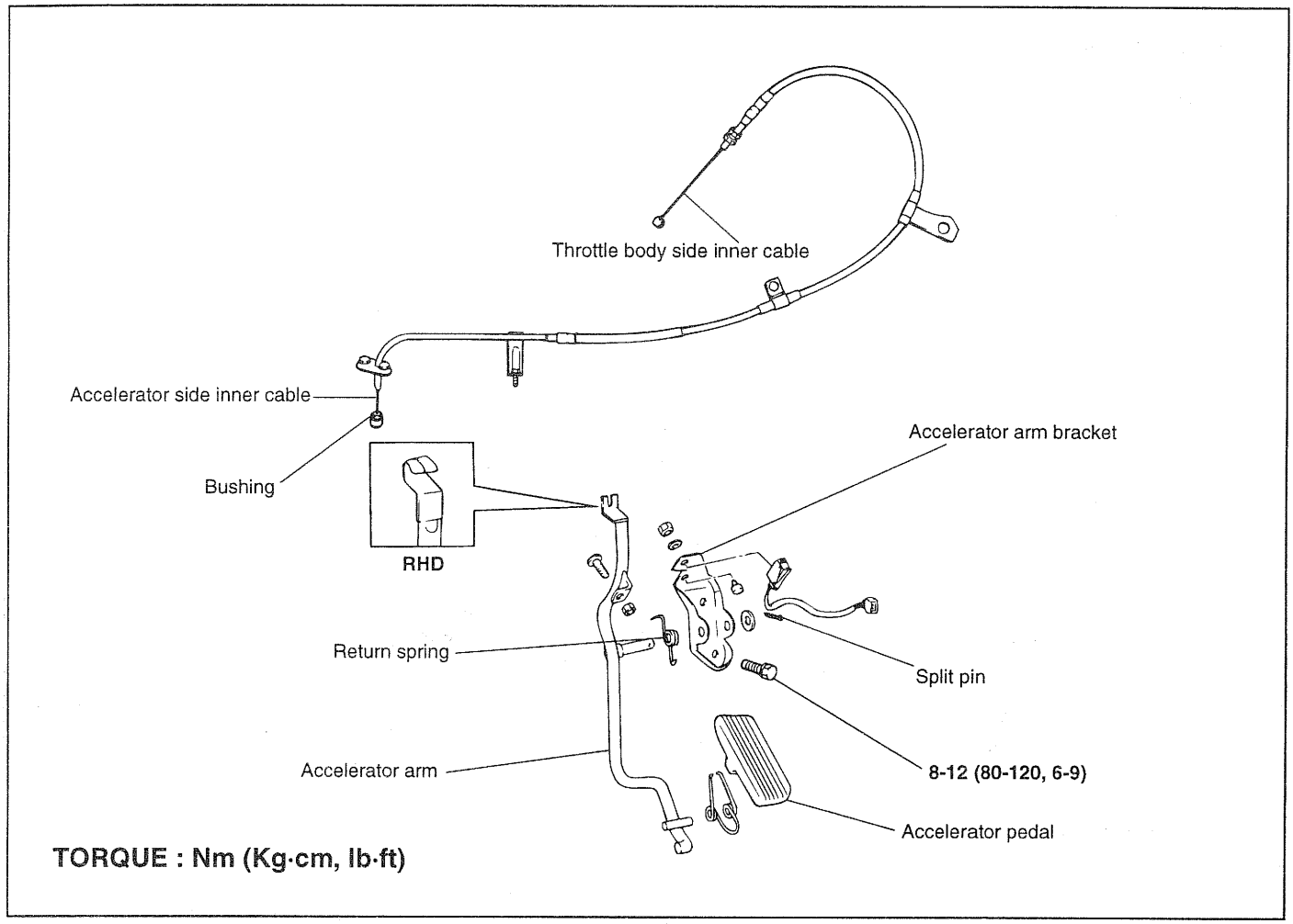
COMPONENTS



TORQUE : Nm (Kg·cm, lb·ft)

EFA9119A

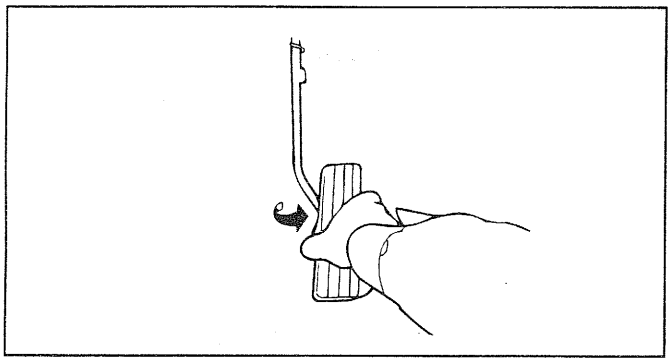
COMPONENTS EFA91200



EFA9120A

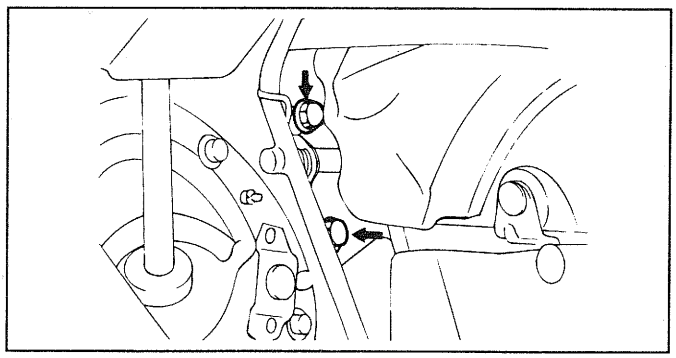
REMOVAL EFA91220

1. Remove the bushing and inner cable of the accelerator arm.
2. Pull the left side of the accelerator pedal toward you, and then remove the accelerator pedal from the accelerator arm.



EFA9122A

3. Loosen the bolts of the accelerator arm bracket and remove.



EFA9122B

INSPECTION EFA91230

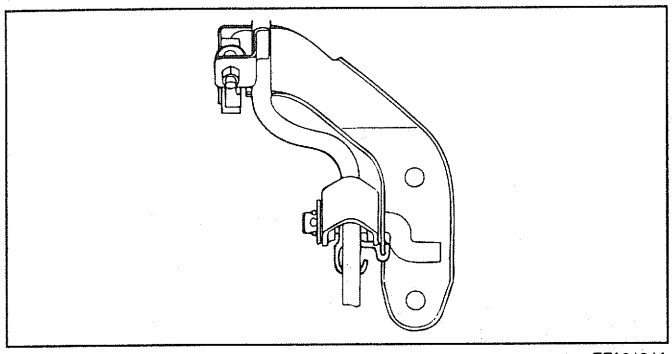
1. Check the inner and outer cable for damage.
2. Check the cable for smooth movement.
3. Check the accelerator arm for deformation.
4. Check the return spring for deterioration.

5. Check the connection of the bushing to end metal fitting.

6. Check the accelerator for proper operation.

INSTALLATION EFA91240

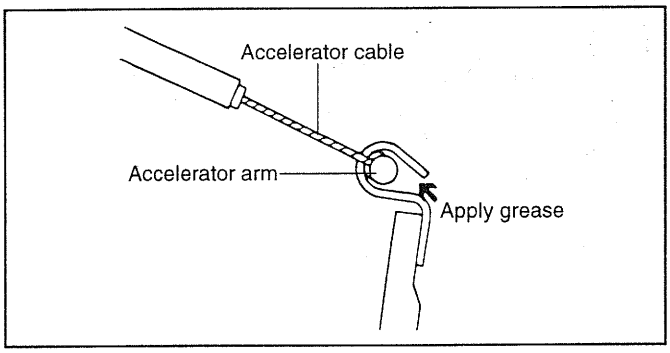
1. When installing the return spring and accelerator arm, apply multi-purpose grease around each moving point of the accelerator arm.



EFA9124A

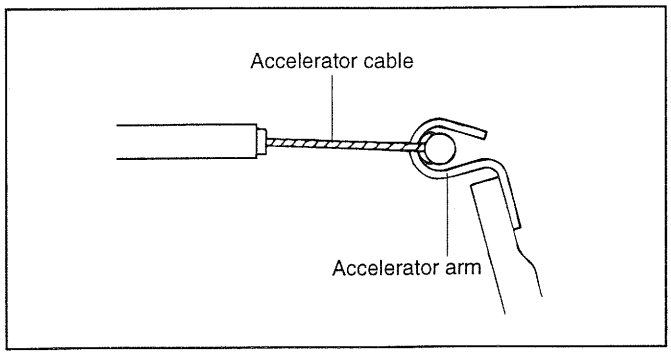
2. Apply sealant to the bolt mounting hole and tighten the accelerator arm bracket.

Tightening torque
Accelerator arm bracket bolts :
8–12 Nm(80–120 kg·cm, 6–7 lb·ft)



EFA9124B

3. Securely install the resin bushing of the accelerator cable on the end of the accelerator arm.



EFA9124C

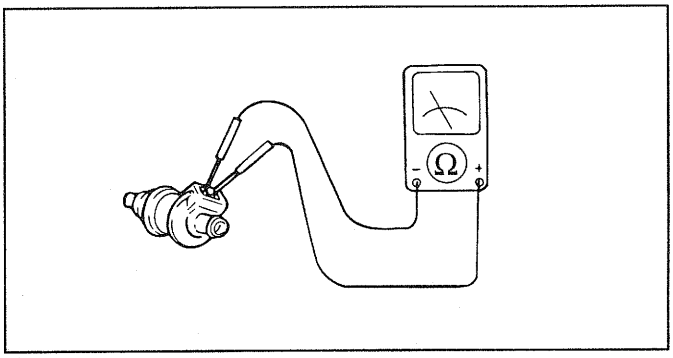
FUEL INJECTOR EFA91260

INSPECTION

1. Measure the resistance of the injectors between the terminals using an ohmmeter.

Resistance : 13–16Ω[at 20°C (68°F)]

2. If the resistance is not within specification, replace the injector.

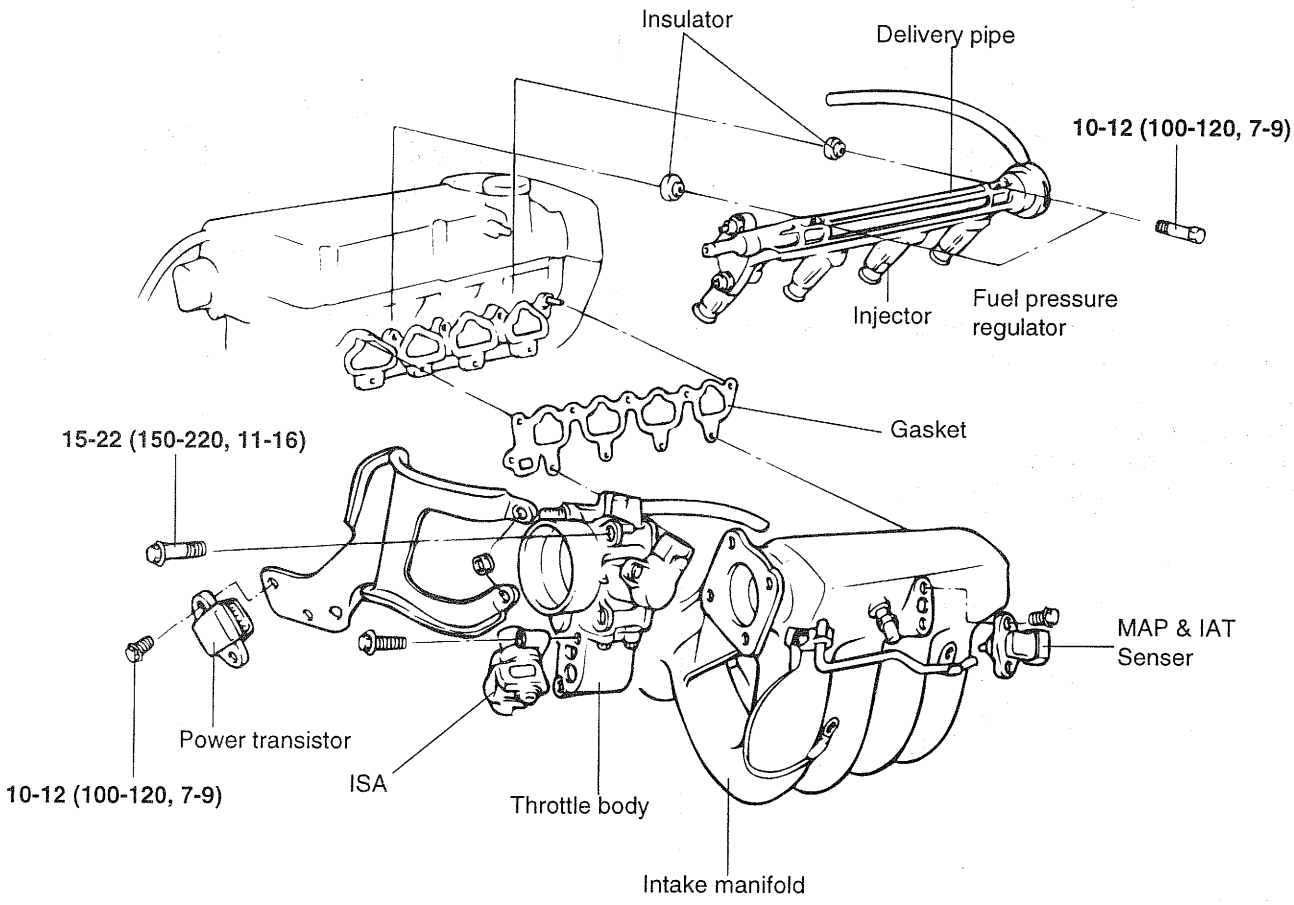


EFA9126A

FUEL LINE EFHA1270

COMPONENTS

<2.0 I4>

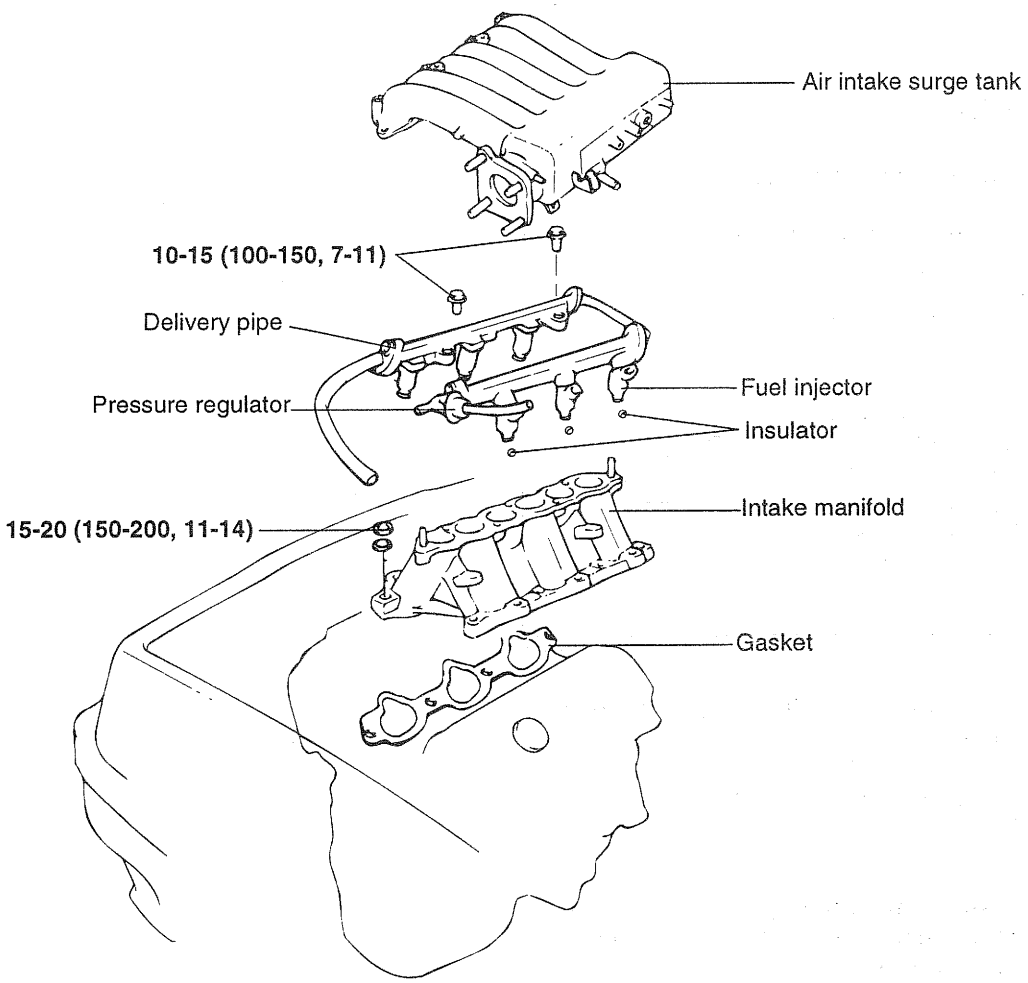


TORQUE : Nm (kg·cm, lb·ft)

EFHA127A

COMPONENTS EFHA1280

<2.7 V6>



TORQUE : Nm (kg·cm, lb·ft)

EFHA128A

REMOVAL EFA91290

1. Release residual pressure from the fuel line to prevent fuel from spilling.

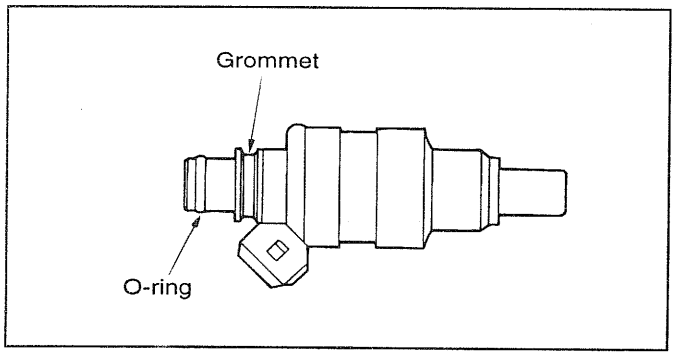
CAUTION

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 injector and pressure regulator.

INSTALLATION EFA91300

1. Install a new grommet and O-ring to the injector.
2. Apply a coating of solvent, spindle oil or gasoline to the injector O-ring.

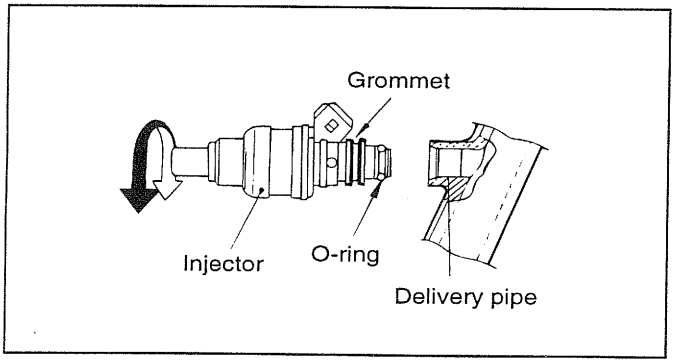


EFA9130A

3. While turning the injector left and right, install it on to the delivery pipe.
4. Be sure the injector turns smoothly.

NOTE

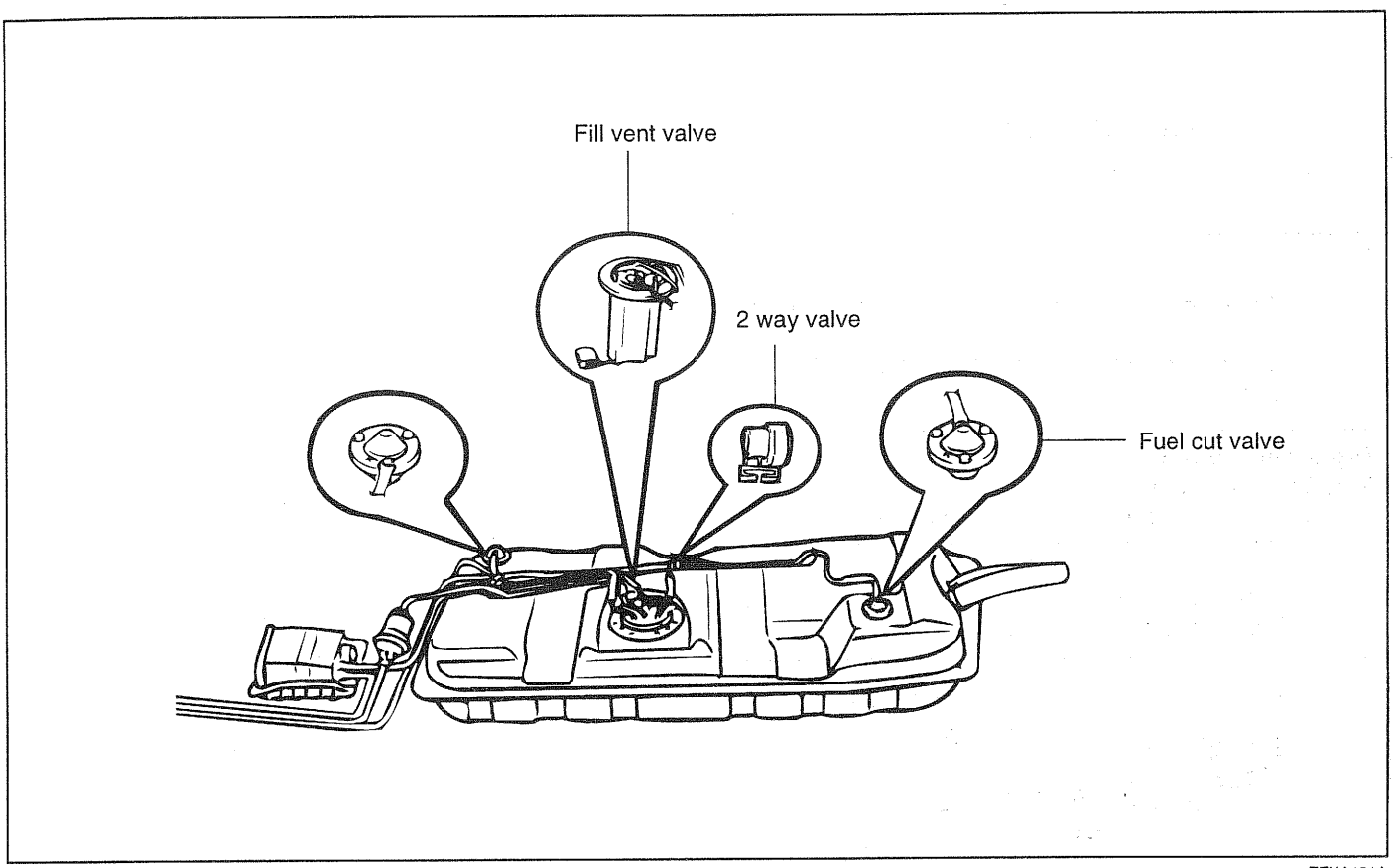
If injector does not turn smoothly, the O-ring may be jammed. Remove the injector and re-insert it into the delivery pipe and re-check.



EFA9130B

FUEL LINE AND VAPOR LINE EFHA1310

COMPONENTS



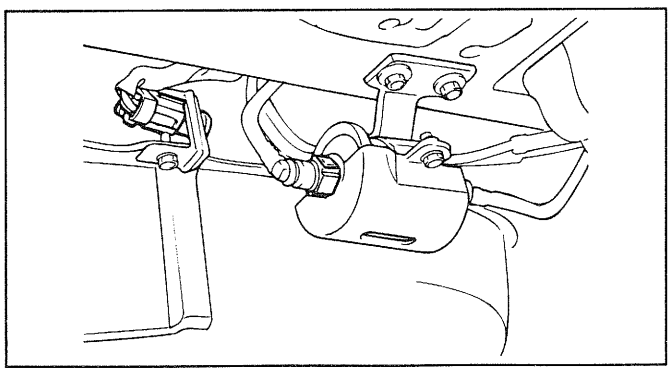
EFHA131A

REMOVAL EFHA1320

1. Raise the vehicle and remove the two fitting nuts while holding the fuel filter nut securely.

CAUTION

1. **Reduce the fuel pressure before disconnecting the fuel line and hose, or fuel will spill out.**
2. **Cover the pipe connection with a shop towel to prevent splashing of fuel that could be caused by residual pressure in the fuel line.**



EFHA006B

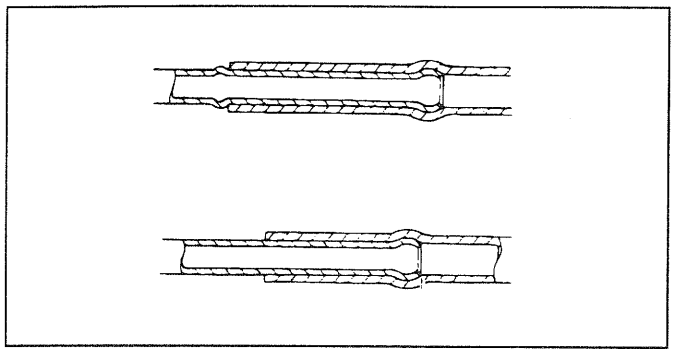
2. Remove the fuel filter mounting bolts, then remove the fuel filter from the bracket.
3. Remove the fuel return hose and line.
4. Remove the fuel vapor hose and line

INSPECTION EFA91330

1. Check the hoses and pipes for cracking, bending, deformation or restrictions.
2. Check the EVAP Canister for restrictions.
3. Check the fuel filter for restrictions and damage.

INSTALLATION EFHA1340

1. Install the fuel vapor hose and return hoses.
   - If the fuel line has a stepped section, connect the fuel hose to the line securely, as shown in the illustration.
   - If the fuel line does not have a stepped section, connect the fuel hose to the line securely.



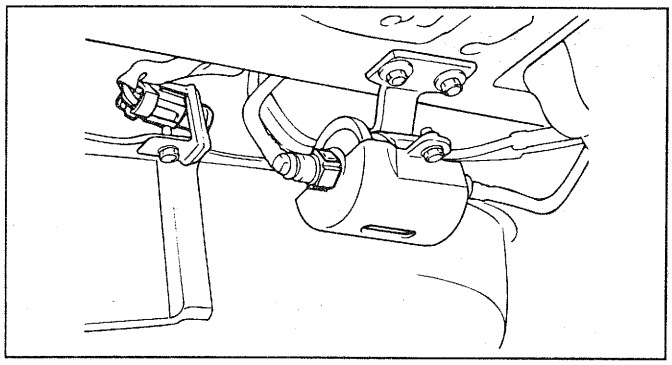
EFA9134A

2. Install the fuel filter and tighten the fuel filter bracket.

3. Tighten the two fitting nuts while holding the fuel filter nuts.

Tightening torque
Fuel filter fitting nuts :
30–40 Nm(300–400 kg·cm, 22.1–29.5 lb·ft)

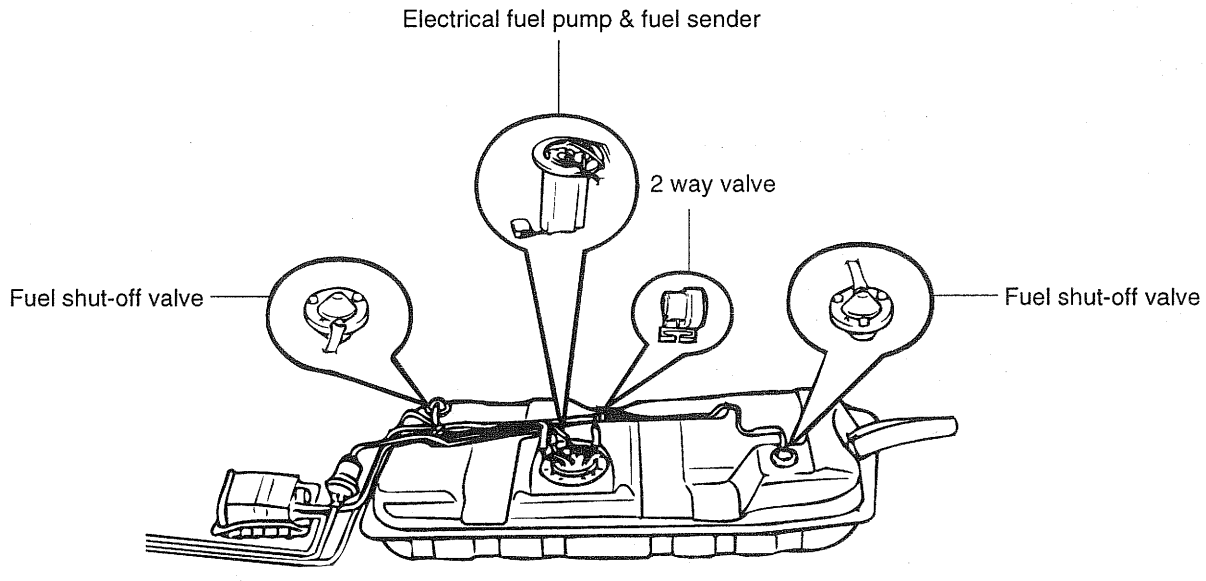
4. Install the clips and make sure that they do not interfere with other components.



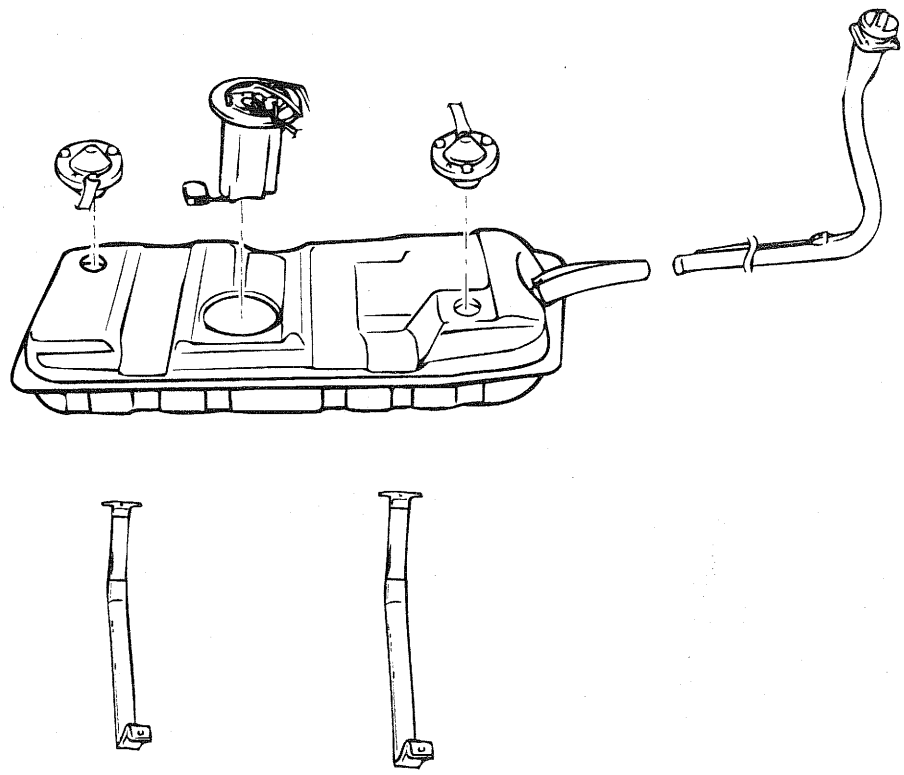
EFHA006B

FUEL TANK EFHA1350

COMPONENTS



EFHA131A



EFHA131B

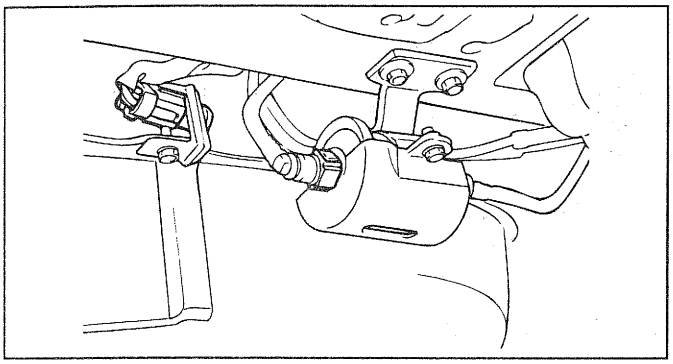
EFHA135A

REMOVAL EFHA1360

1. To reduce the internal pressure of the fuel main pipes and hose, first start the engine and then disconnect the electrical fuel pump connector located near the fuel filter.

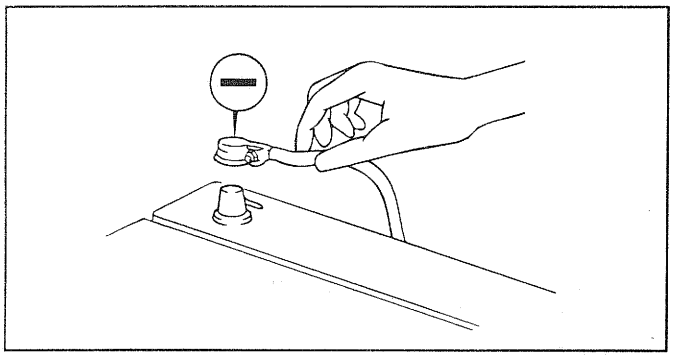
CAUTION

Be sure to reduce the fuel pressure before disconnecting the fuel main pipe and hose otherwise fuel will spill out.



EFHA006B

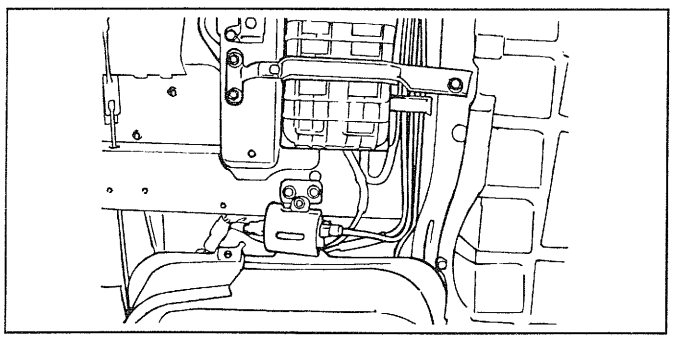
2. Disconnect the battery cable from the negative terminal of the battery.



EFA9136A

3. Remove the fuel tank cap.

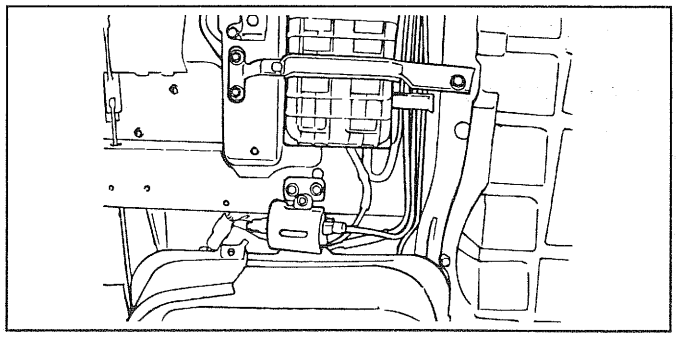
4. Disconnect the return hose and vapor hose.



EFHA136C

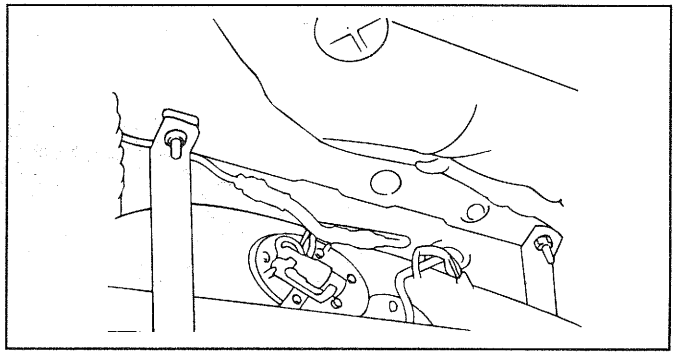
5. Disconnect the fuel sender connector.

6. Disconnect the high pressure hose from the fuel tank.



EFHA136C

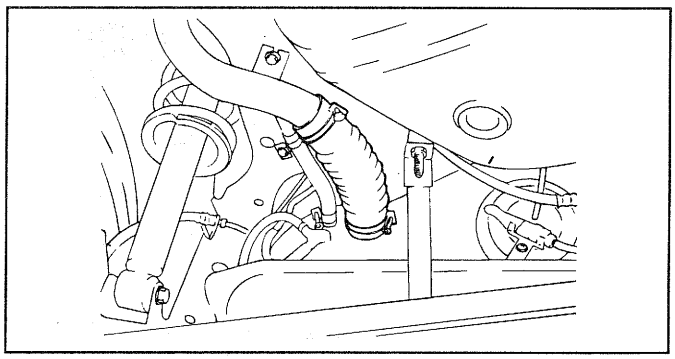
7. Loosen the two self-locking nuts that hold the tank in position and remove the two tank bands.



EFA9136D

8. Detach the fuel filler hose and leveling hose.

9. Remove the fuel vapor hose and the fuel tank.



EFA9136E

INSPECTION EFA91370

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.

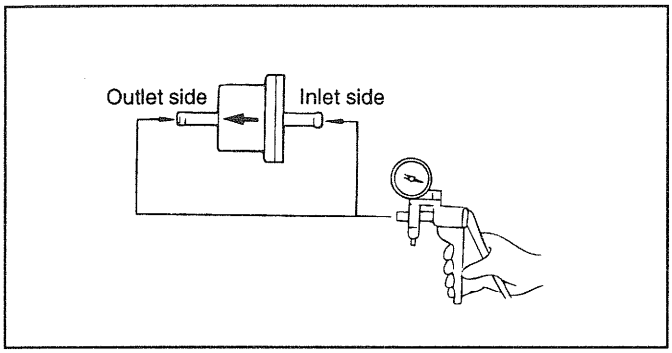
4. Check the fuel tank inside for dirt or contamination.

5. Check the in-tank fuel filter for damage or restriction.

6. Test the two-way valve for proper operation.

7. Using a vacuum hand pump, check the operation of the two-way valve.

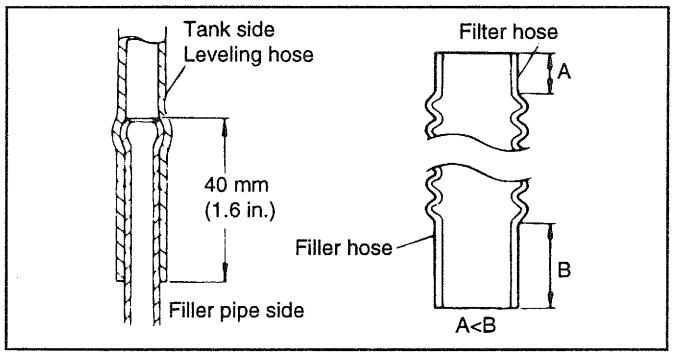
Valve pump	Guide lines for acceptance or rejection
When connected to inlet side	Negative pressure generated and vacuum maintained
When connected to outlet side	No negative pressure generated



EFA9137A

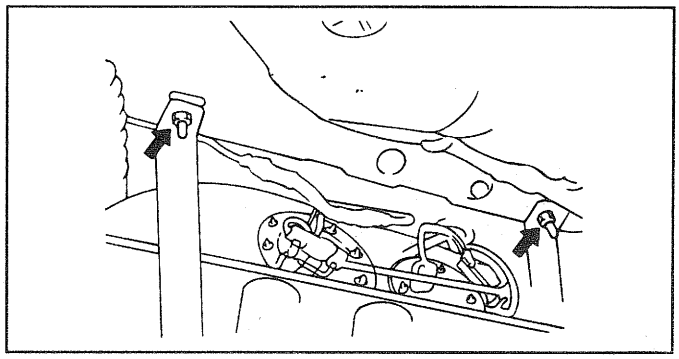
INSTALLATION EFHA1380

1. Connect the leveling hose to the tank at approximately 40 mm (1.6 in.) of the filler neck.
2. When connecting the filler hose, connect the end with the shorter straight pipe to the tank side.



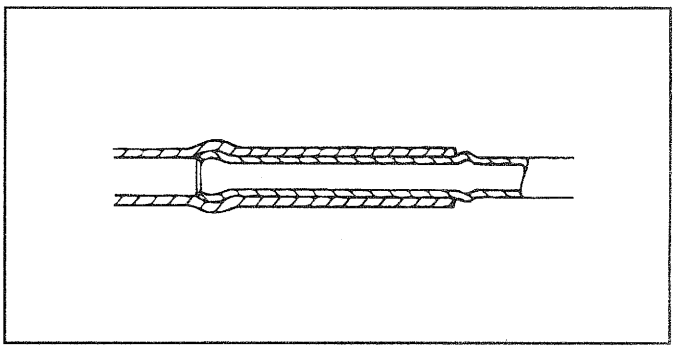
EFA9138A

3. Confirm that the pad is fully bonded to the fuel tank. Install the fuel tank by tightening the self-locking nuts to the tank bands until the rear end of the tank band contacts the body.



EFA9138B

4. Connect the vapor hose and return hose. Attach the fuel hose to the line as shown in the illustration.



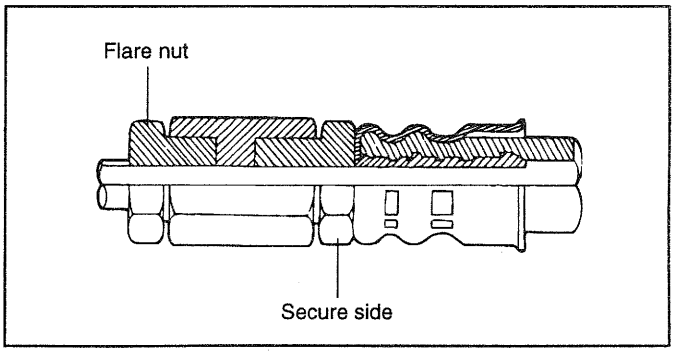
EFA9138C

5. To connect the high pressure hose to the fuel pump, temporarily tighten the flare nut by hand, and then tighten it to the specified torque. Be careful that the fuel hose does not twist.

Tightening torque
High pressure hose flare nut :
30–40 Nm(300–400 kg·cm, 22–29 lb·ft)

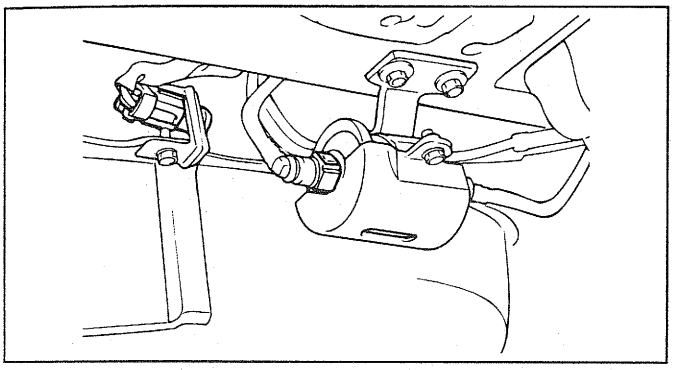
NOTE

When tightening the flare nut, be careful not to bend or twist the line to prevent damage to the fuel pump connection.



EFA9138D

6. Connect the electrical fuel pump and fuel sender connector.



EFHA006B

TROUBLESHOOTING FOR DTC

EFHA5010

DIAGNOSTIC ITEM

DTC	Diagnostic item
P0105	Manifold Absolute Pressure Sensor Circuit Malfunction

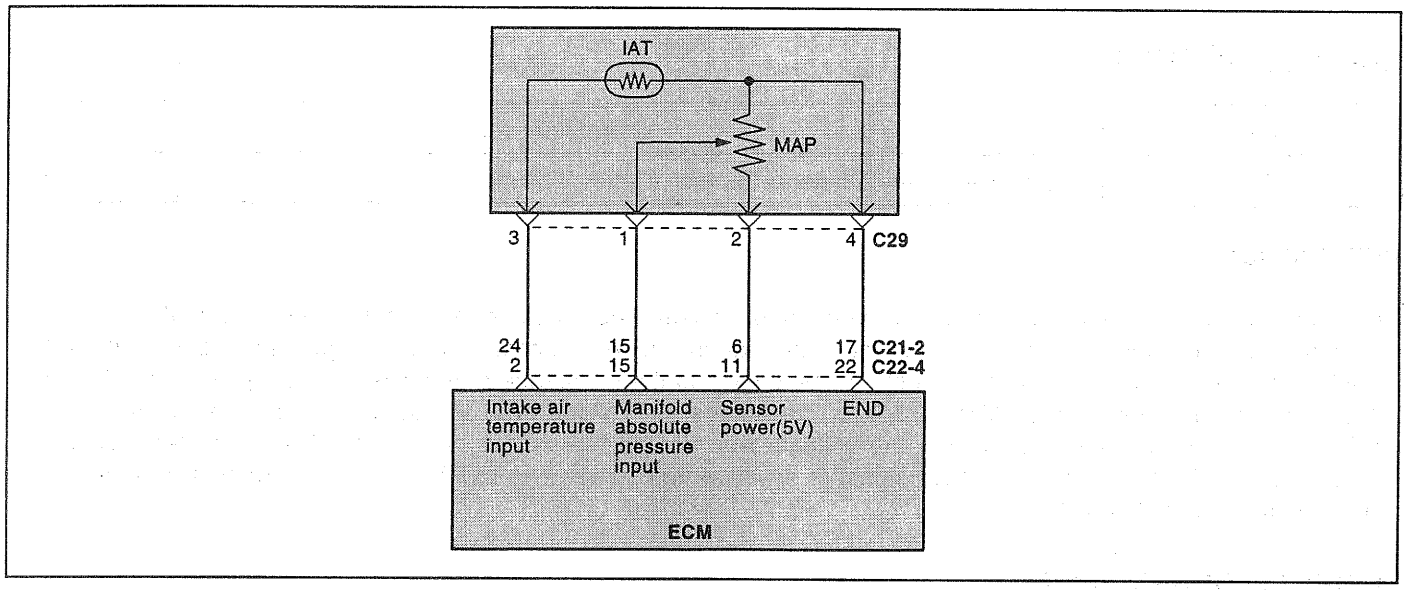
DESCRIPTION

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. The 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.

TROUBLESHOOTING GUIDE

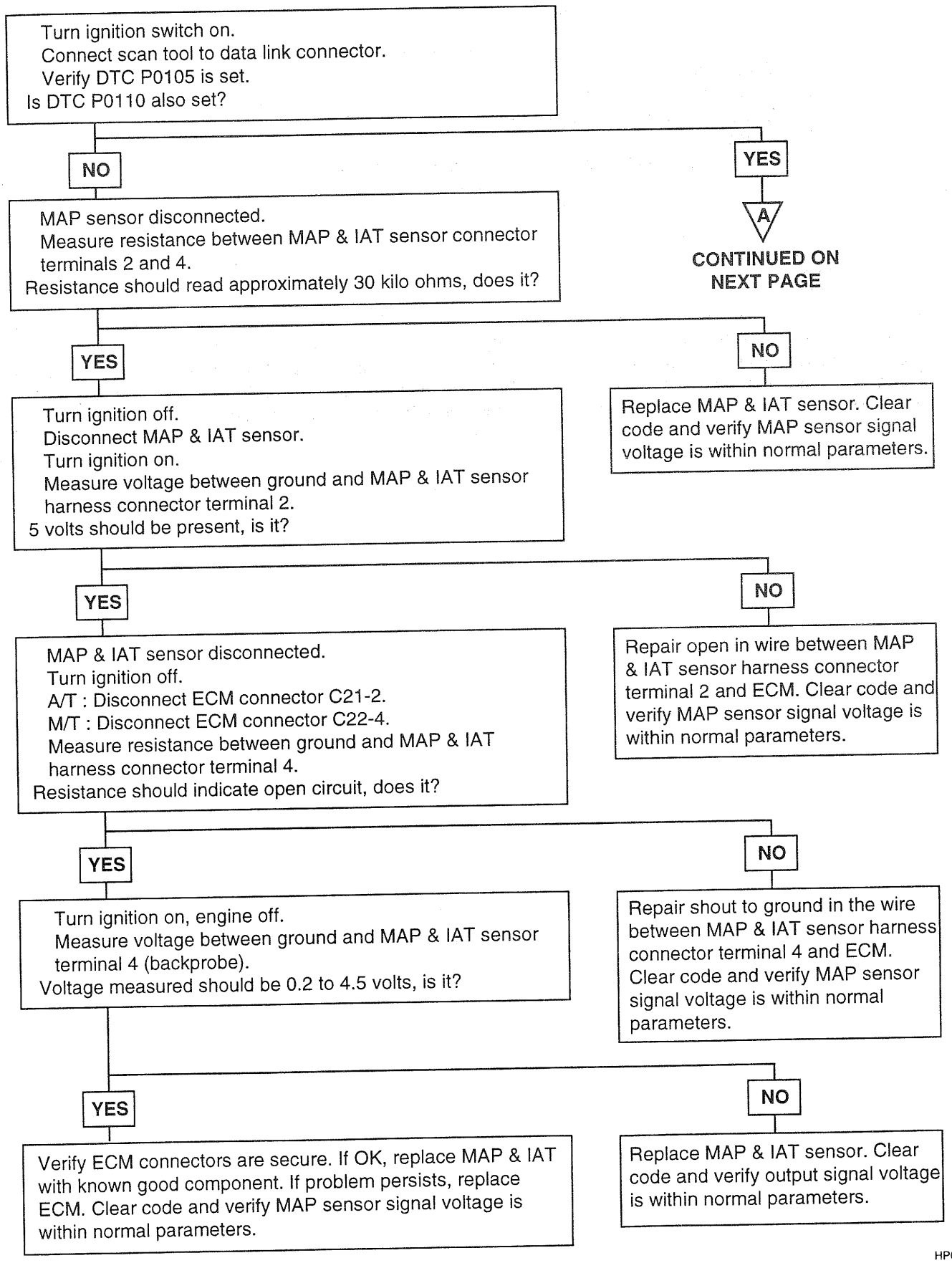
DTC detection condition	Probable cause
Background • The MAP sensor outputs a voltage which corresponds to the pressure of surge tank. • The Engine Control Module checks whether this voltage is within a specified range. Check Area • Ignition switch : ON • Sixty seconds or more have passed since the staring sequence was completed. • Battery voltage is 8V or more. Judgment Criteria • Sensor output voltage has continued to be 4.5V or higher [corresponding to a surge tank pressure of 114 kPa(17psi) or higher] for 4 sec. • Sensor output voltage has continued to be 1.95V or lower [corresponding to a surge tank pressure of 50 kPa(7.4 psi) or lower] for 4 sec.	• MAP sensor failed • Open or shorted MAP sensor circuit, or loose connector • Engine control module failed

CIRCUIT DIAGRAM

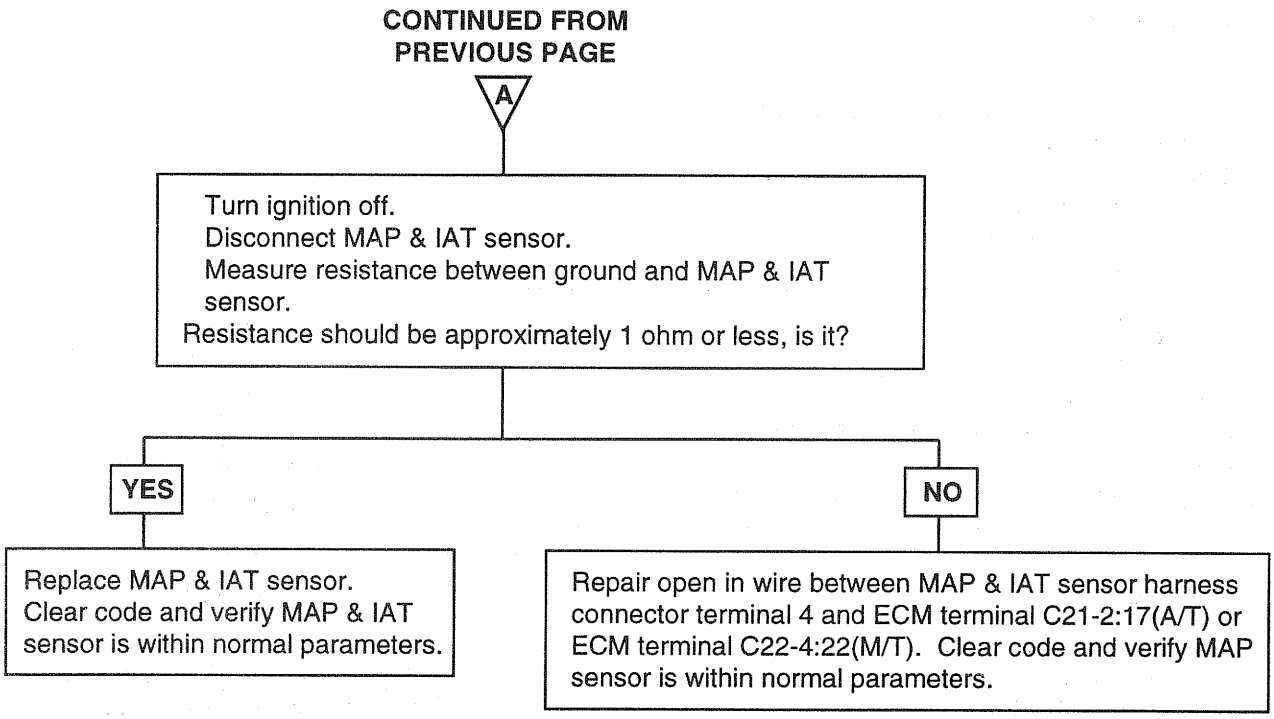


HP0105A

TEST PROCEDURE



HP0105B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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 & IAT sensor.
Clear code and verify MAP & IAT sensor is within normal parameters.
Repair open in wire between MAP & IAT sensor harness connector terminal 4 and ECM terminal C21-2:17(A/T) or ECM terminal C22-4:22(M/T). Clear code and verify MAP sensor is within normal parameters.

HP0105C

EFHA5020

DTC	Diagnostic item
P0110	Intake Air temperature Circuit Malfunction

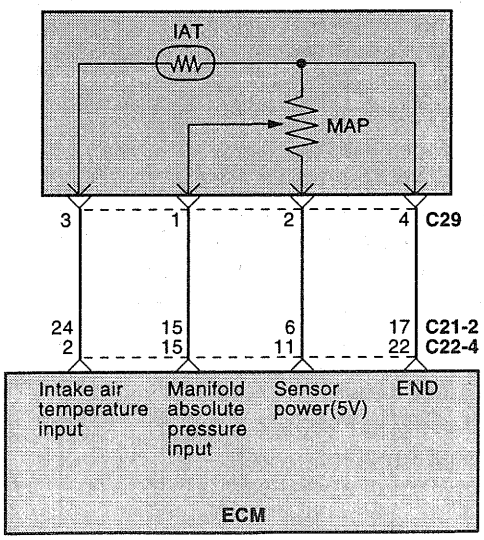
DESCRIPTION

The Intake Air Temperature (IAT) sensor is in 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.

TROUBLESHOOTING GUIDE

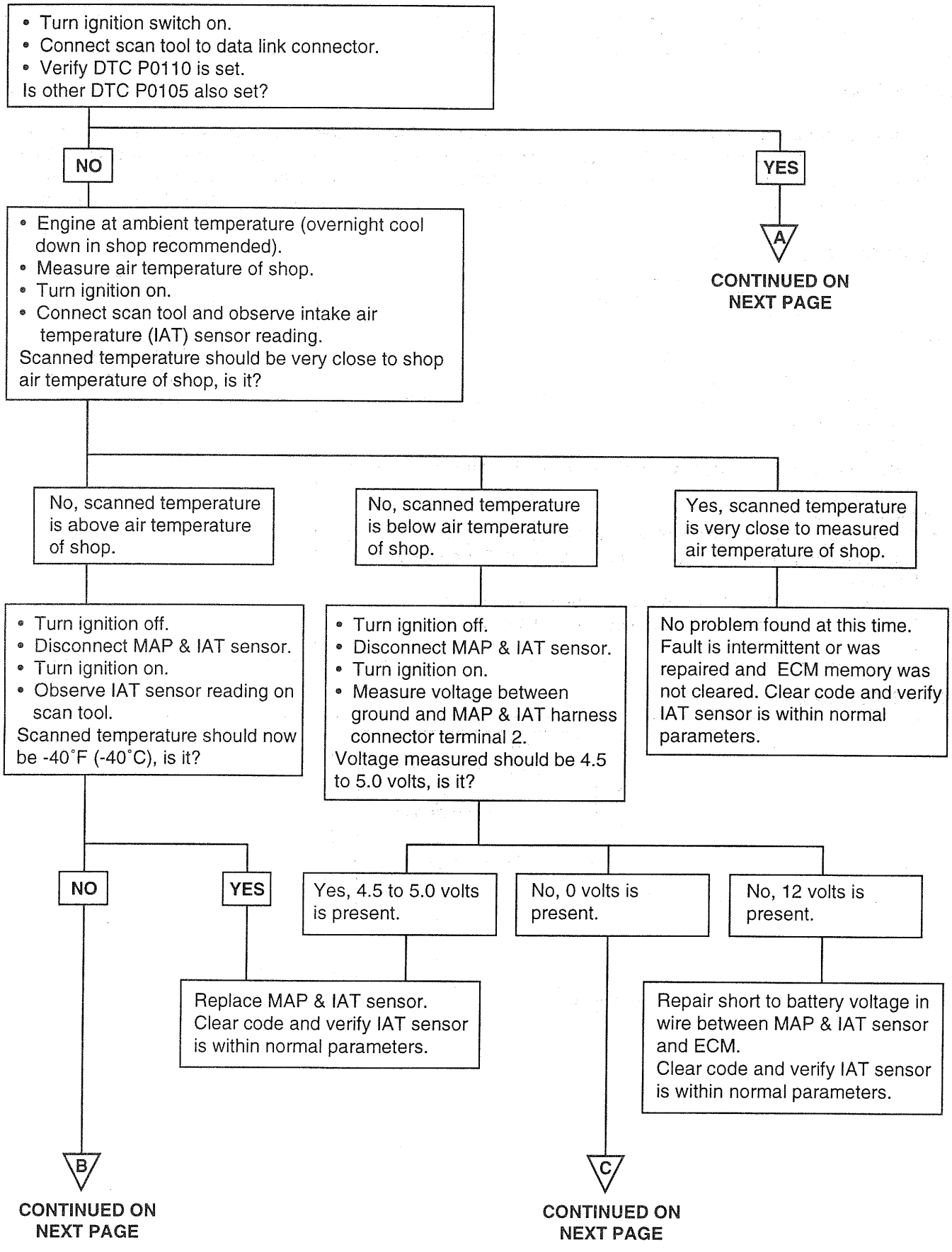
DTC detection condition	Probable cause
Background • The intake air temperature sensor converts the intake air temperature to a voltage and outputs it. • The engine control module checks whether the voltage is within a specified range. Check Area • Sixty seconds or more have passed since the starting sequence was completed. Judgment Criteria • Sensor output voltage has continued to be 4.6V or higher [corresponding to an intake air temperature of -45°C (-49°F) or lower] for 4 sec. • Sensor output voltage has continued to be 0.2V or lower [corresponding to an intake air temperature of 125°C (257°F) or higher] for 4 sec.	• MAP sensor failed • Open or shorted mass air flow sensor circuit, or loose connector • Engine control module failed

CIRCUIT DIAGRAM

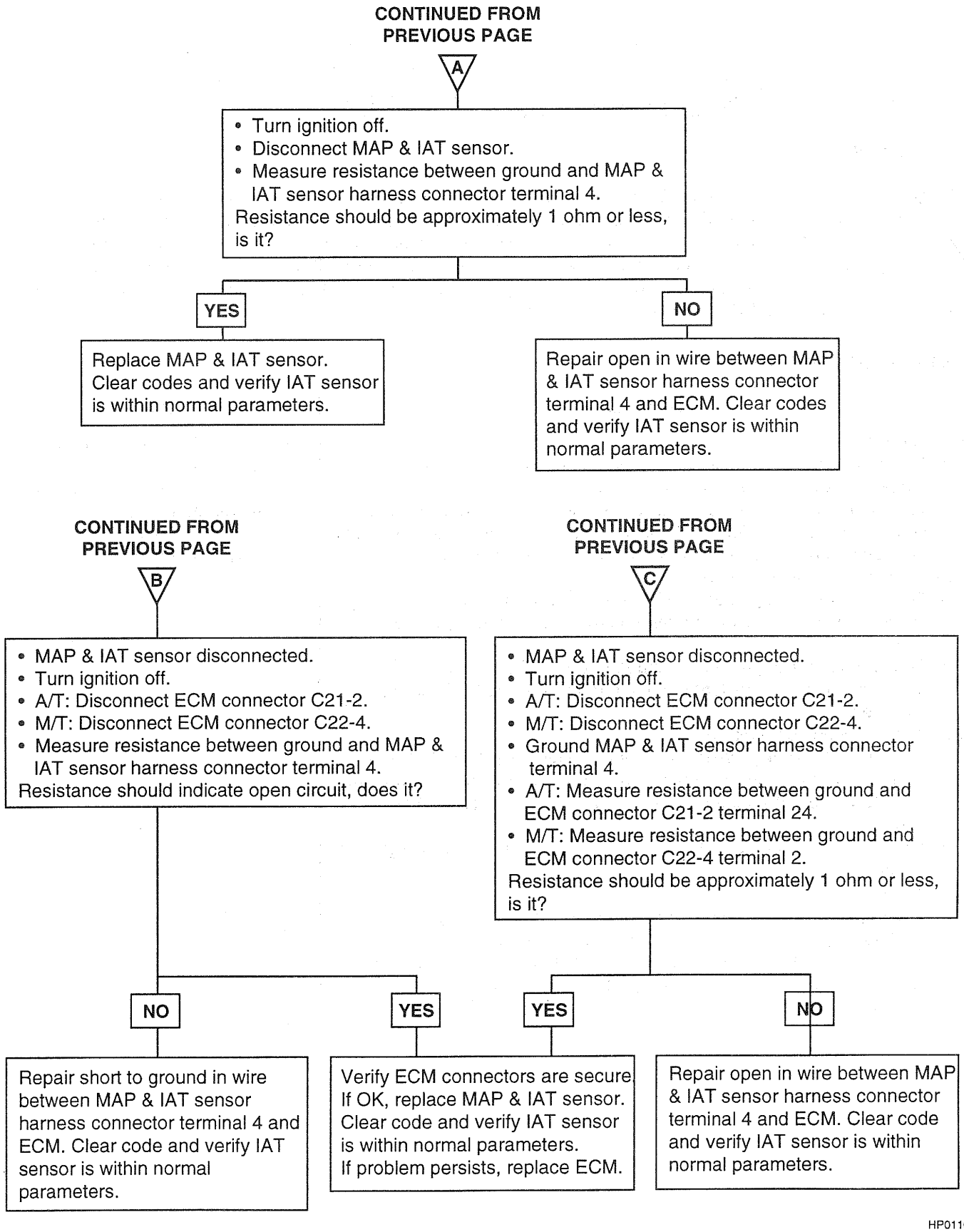


HP0105A

TEST PROCEDURE



HP0110B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A
• Turn ignition off.
• Disconnect MAP & IAT sensor.
• Measure resistance between ground and MAP & IAT sensor harness connector terminal 4.
Resistance should be approximately 1 ohm or less, is it?
YES
NO
Replace MAP & IAT sensor. Clear codes and verify IAT sensor is within normal parameters.
Repair open in wire between MAP & IAT sensor harness connector terminal 4 and ECM. Clear codes and verify IAT sensor is within normal parameters.
CONTINUED FROM PREVIOUS PAGE
B
• MAP & IAT sensor disconnected.
• Turn ignition off.
• A/T: Disconnect ECM connector C21-2.
• M/T: Disconnect ECM connector C22-4.
• Measure resistance between ground and MAP & IAT sensor harness connector terminal 4.
Resistance should indicate open circuit, does it?
NO
YES
Repair short to ground in wire between MAP & IAT sensor harness connector terminal 4 and ECM. Clear code and verify IAT sensor is within normal parameters.
Verify ECM connectors are secure. If OK, replace MAP & IAT sensor. Clear code and verify IAT sensor is within normal parameters. If problem persists, replace ECM.
CONTINUED FROM PREVIOUS PAGE
C
• MAP & IAT sensor disconnected.
• Turn ignition off.
• A/T: Disconnect ECM connector C21-2.
• M/T: Disconnect ECM connector C22-4.
• Ground MAP & IAT sensor harness connector terminal 4.
• A/T: Measure resistance between ground and ECM connector C21-2 terminal 24.
• M/T: Measure resistance between ground and ECM connector C22-4 terminal 2.
Resistance should be approximately 1 ohm or less, is it?
YES
NO
Repair open in wire between MAP & IAT sensor harness connector terminal 4 and ECM. Clear code and verify IAT sensor is within normal parameters.

HP0110C

EFHA5030

DTC	Diagnostic item
P0115	Engine Coolant Temperature Circuit Malfunction

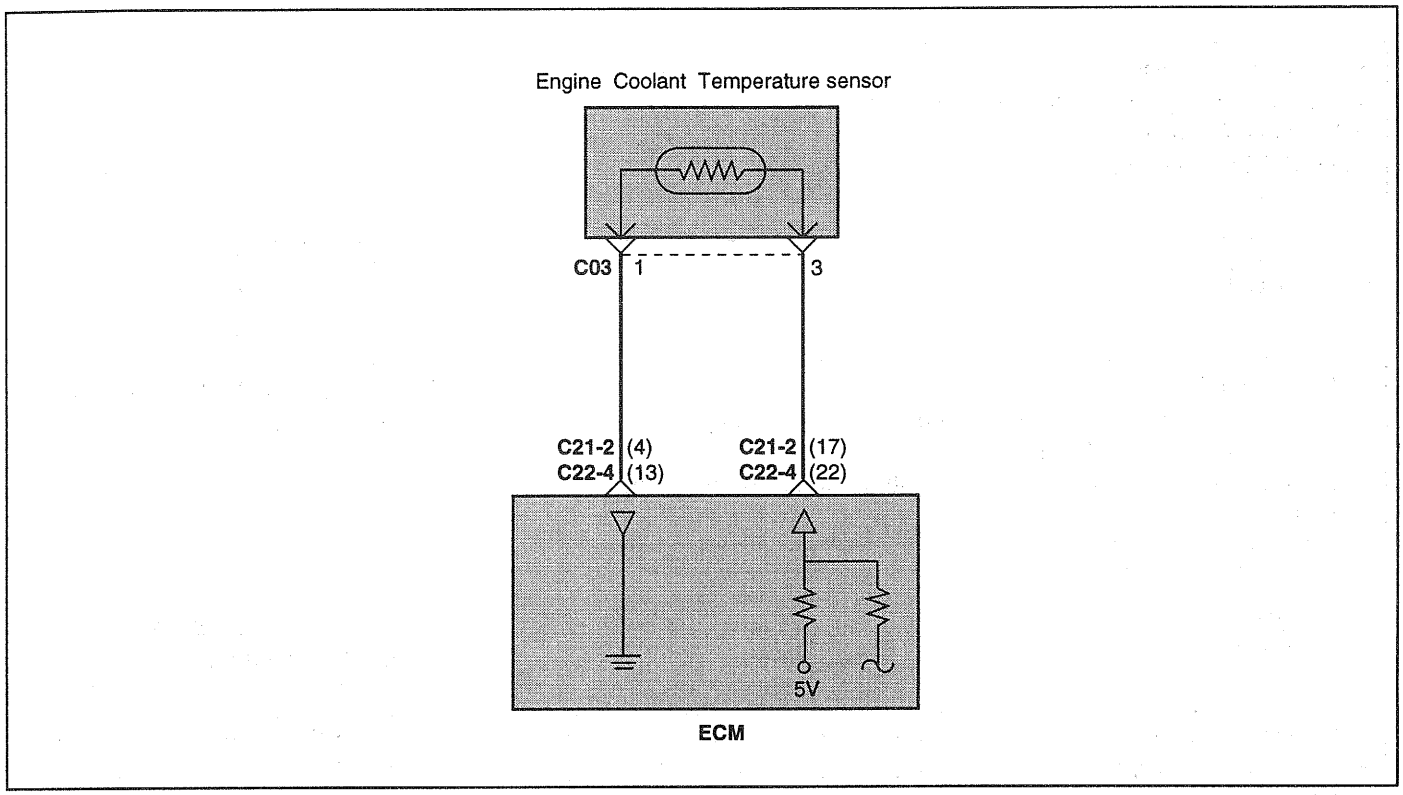
DESCRIPTION

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 the coolant temperature is low, the sensor resistance is high; when the coolant temperature is high, the sensor resistance is low. The Engine Control Module (ECM) checks ECT voltage fifty times per second and uses the information to adjust the fuel injector pulse width and ignition timing. When the temperature sensed is very cold, the ECM enriches the fuel mixture.

TROUBLESHOOTING GUIDE

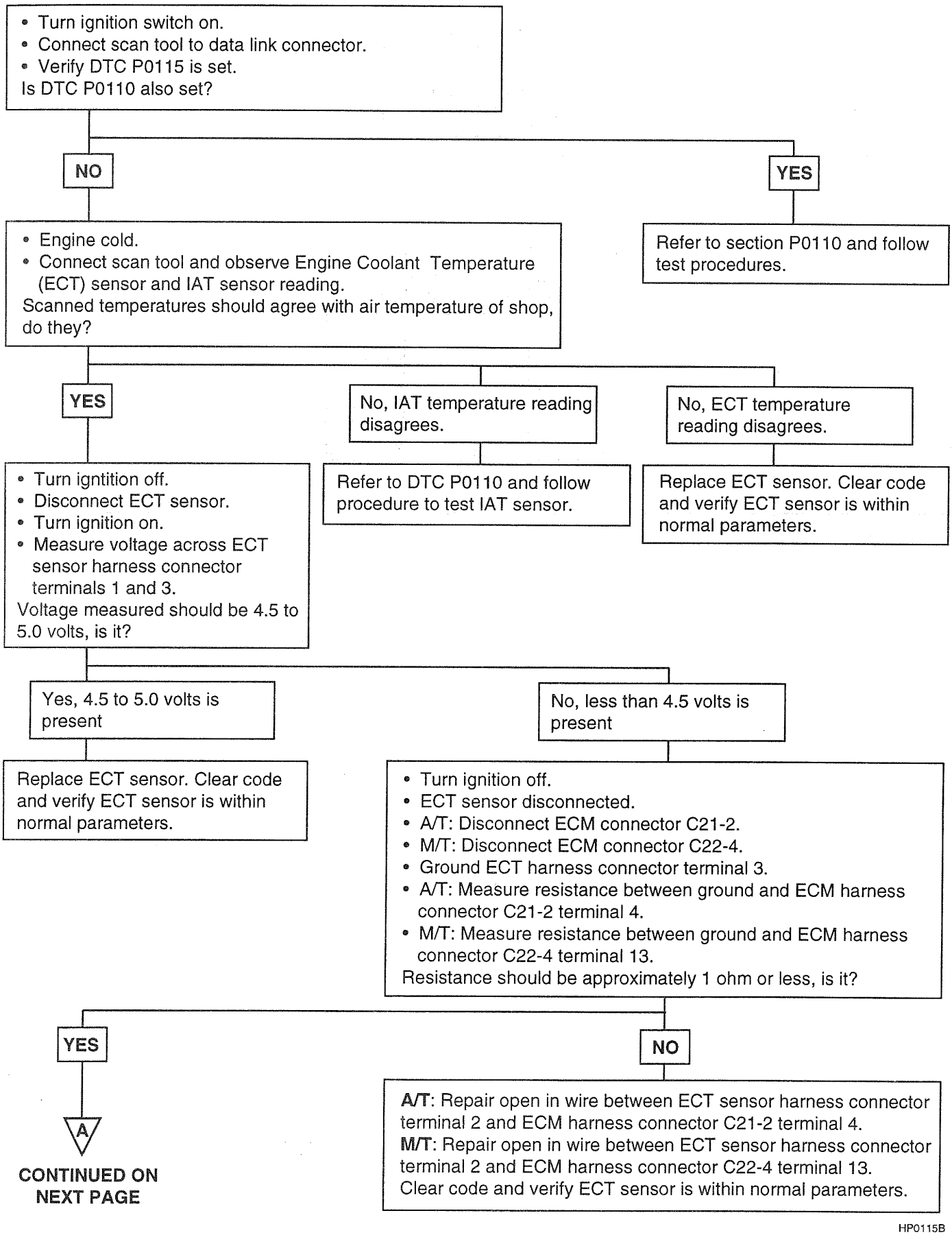
DTC detection condition	Probable cause
Background • The engine coolant temperature sensor converts the engine coolant temperature to a voltage and outputs it. • The Engine Control Module checks whether the voltage is within a specified range. In addition, it checks that the engine coolant temperature (signal) does not drop while the engine is warming up. Check Area, Judgment Criteria • Sensor output voltage has continued to be 4.6V or higher [corresponding to a coolant temperature of -45°C (-49°F) or lower] for 4 sec. • Sensor output voltage has continued to be 0.1V or lower [corresponding to a coolant temperature of 140°C (284°F) or higher] for 4 sec. Check Area, Judgment Criteria • Sensor output voltage increased from a value lower than 1.6V to a value higher than 1.6V [Coolant temperature decreases from a higher than 40°C (104°F) temperature to a lower than 40°C (104°F) temperature.]. • Then the sensor output voltage has continued to be 1.6V or higher for 5 min. Check Area • The Engine Coolant Temperature is approx. 40°C (104°F) or less after starting sequence is completed. Judgment Criteria • Approx. 60 - 300 seconds have passed for the engine coolant temperature to rise to about 40°C (104°F) after starting sequence was completed.	• Engine Coolant Temperature sensor failed. • Open or shorted Engine Coolant Temperature sensor circuit, or loose connector. • Engine Control Module failed.

CIRCUIT DIAGRAM



HP0115A

TEST PROCEDURE



HP0115B

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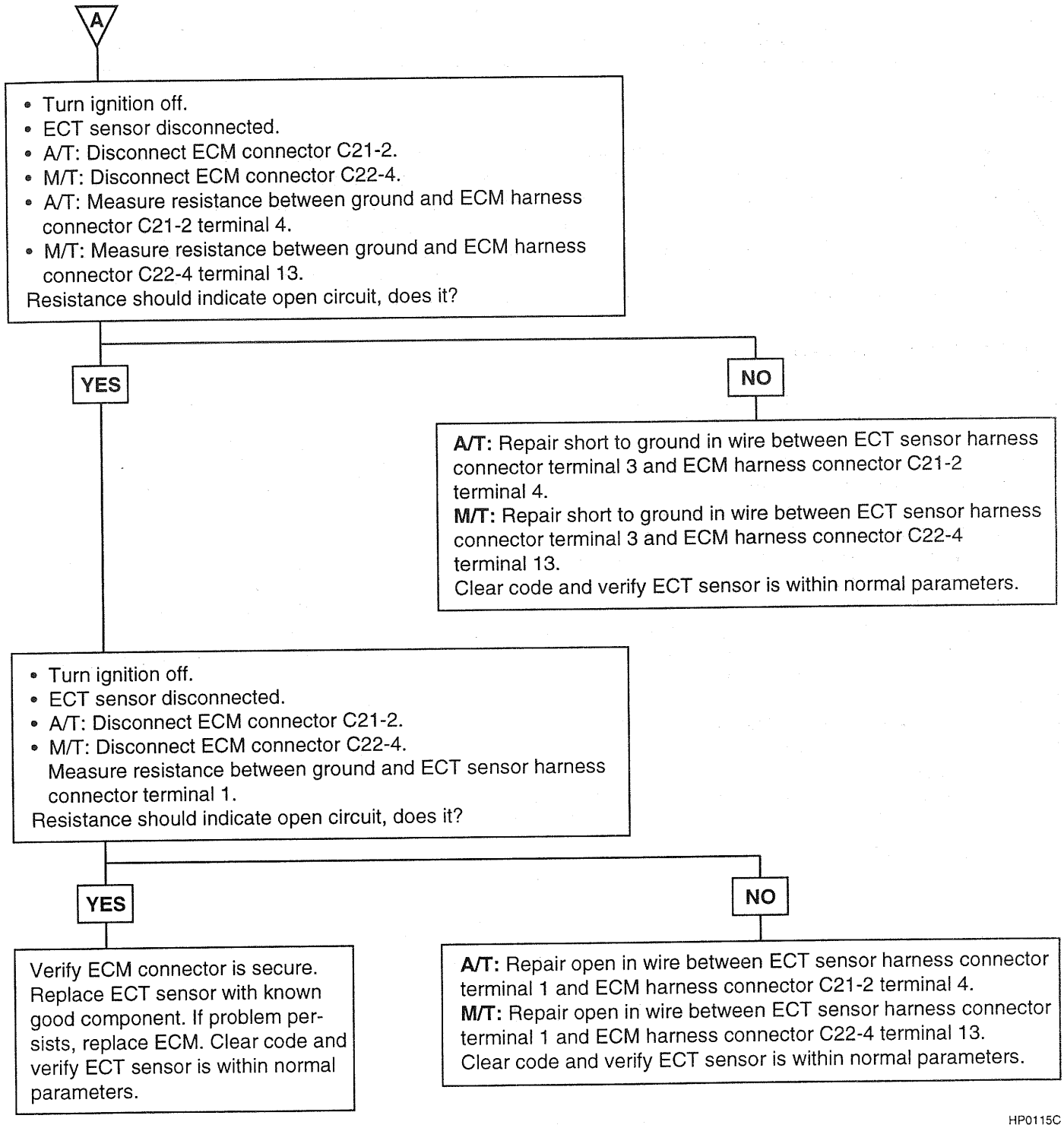


HP0115C

EFHA5040

DTC	Diagnostic item
P0120	Throttle Position Circuit Malfunction

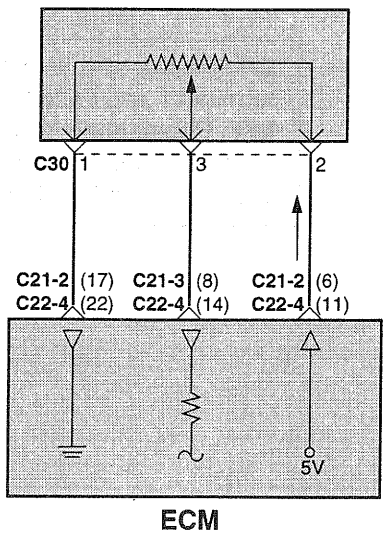
DESCRIPTION

The throttle position (TP) sensor mounts on the side of the throttle body and is connected to the throttle blade shaft. The TP sensor is a variable resistor (potentiometer) whose resistance changes according to the throttle blade shaft position. During acceleration, the TP sensor resistance decreases; during deceleration, the TP sensor resistance increases. The TP sensor also includes an idle position switch. The switch is closed in the idle position. The Engine Control Module (ECM) applies a reference voltage to the TP sensor and then measures the voltage that is present on the TP sensor signal circuit. The ECM uses the TP sensor signal to adjust the timing and injector pulse width. The TP sensor signal along with the MAP sensor signal is used by the ECM to calculate the engine load.

TROUBLESHOOTING GUIDE

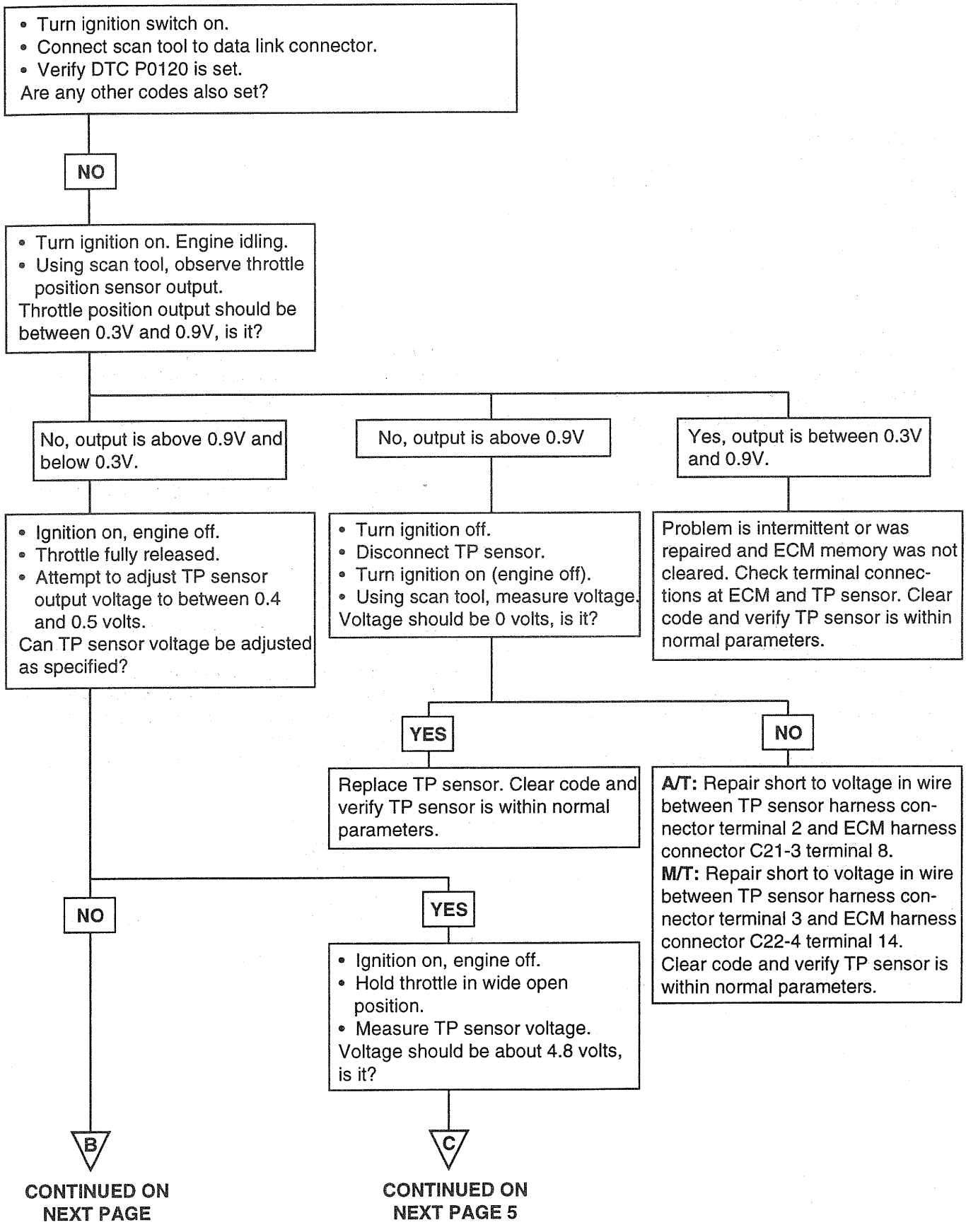
DTC detection condition	Probable cause
Background • The Throttle Position sensor outputs a voltage which is proportional to the throttle valve opening angle. • The Engine Control Module checks whether the voltage output by the throttle position sensor is within a specified range. In addition, it checks that the voltage output does not become too large while the engine is idling. Check Area, Judgment Criteria • With the close Throttle Position switch se to ON, the sensor output voltage has continued to be 2V or higher for 4 sec. • Sensor output voltage has continued to be 0.2V or lower for 4 sec. Check Area • Engine speed is between 500 and 3,000 r/min. • Engine load is lower than 30%. Judgment Criteria • Sensor output voltage has continued to be 4.6V or higher for 4 sec.	• Throttle Position sensor failed or maladjusted. • Open or shorted Throttle Position sensor circuit, or loose connector. • Closed Throttle Position switch ON malfunction. • Closed Throttle Position switch signal wire shorted. • Engine control module failed.

CIRCUIT DIAGRAM



HP0120A

TEST PROCEDURE



HP0120B

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B

- Turn ignition off.
- Disconnect TP sensor.
- Turn ignition on.
- Using voltmeter, measure voltage between ground and TP sensor harness connector terminal 2.

5 volts should be present, is it?

YES

- Ignition on, engine off.
- TP sensor disconnected.
- Measure resistance between ground and TP sensor harness connector terminal 1.

Resistance should be approximately 1 ohm or less, is it?

NO

A/T: Repair open in wire between TP sensor harness connector terminal 2 and ECM harness connector C21-2 terminal 6.
M/T: Repair short to voltage in wire between TP sensor harness connector terminal 2 and ECM harness connector C22-4 terminal 11.
Clear code and verify TP sensor is within normal parameters

YES

- Ignition on, engine off.
- TP sensor disconnected.
- Connect fused jumper across TP sensor harness connector terminals 1 and 2.
- Using scan tool, observe TP sensor's output voltage.

Voltage should be above 4.8 volts, is it?

NO

A/T: Repair poor ground or open in wire between TP sensor harness connector terminal 1 and ECM harness connector C21-3 terminal 17.
M/T: Repair poor ground or open in wire between TP sensor harness connector terminal 4 and ECM harness C22-4 terminal 13.
Clear code and verify TP sensor is within normal parameters.

NO

- Ignition off.
- TP sensor disconnected.
- Fused jumper in place.
- ECM connected.
- A/T: Measure voltage (backprobe) between ground and ECM connector C21-2 terminal 6.
- M/T: Measure voltage (backprobe) between ground and ECM connector C22-4 terminal 11.

5 volts should be present, is it?

YES

Replace TP sensor.
Clear code and verify TP sensor is within normal parameters.

D

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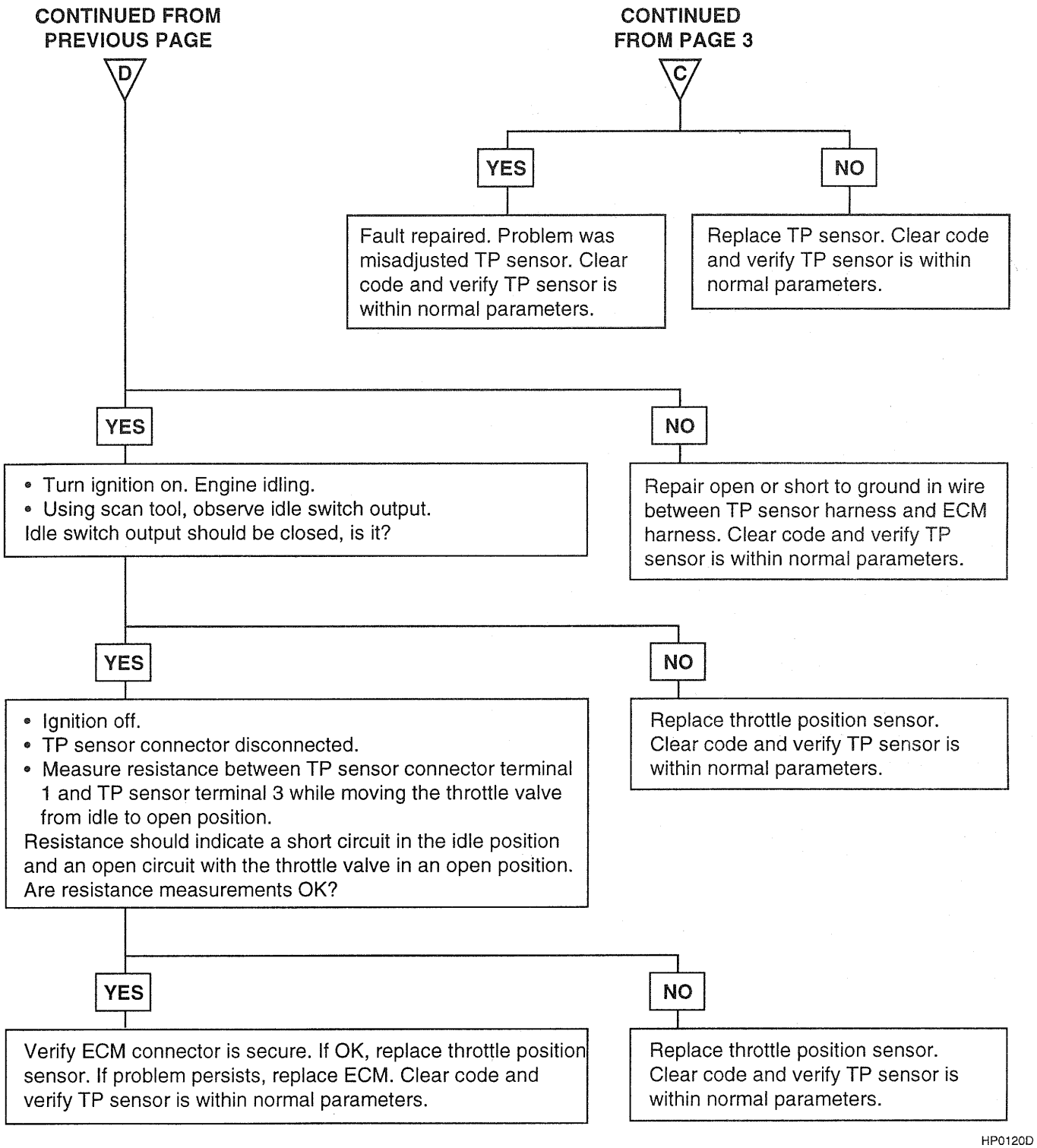
HP0120C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D
CONTINUED FROM PAGE 3
C
YES
NO
Fault repaired. Problem was misadjusted TP sensor. Clear code and verify TP sensor is within normal parameters.
Replace TP sensor. Clear code and verify TP sensor is within normal parameters.
YES
NO
• Turn ignition on. Engine idling.
• Using scan tool, observe idle switch output.
Idle switch output should be closed, is it?
Repair open or short to ground in wire between TP sensor harness and ECM harness. Clear code and verify TP sensor is within normal parameters.
YES
NO
• Ignition off.
• TP sensor connector disconnected.
• Measure resistance between TP sensor connector terminal 1 and TP sensor terminal 3 while moving the throttle valve from idle to open position.
Resistance should indicate a short circuit in the idle position and an open circuit with the throttle valve in an open position.
Are resistance measurements OK?
Replace throttle position sensor. Clear code and verify TP sensor is within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace throttle position sensor. If problem persists, replace ECM. Clear code and verify TP sensor is within normal parameters.
Replace throttle position sensor. Clear code and verify TP sensor is within normal parameters.

HP0120D

EFHA5060

DTC	Diagnostic item
P0130, P0133	Oxygen Sensor Circuit Malfunction (Bank 1, sensor 1)

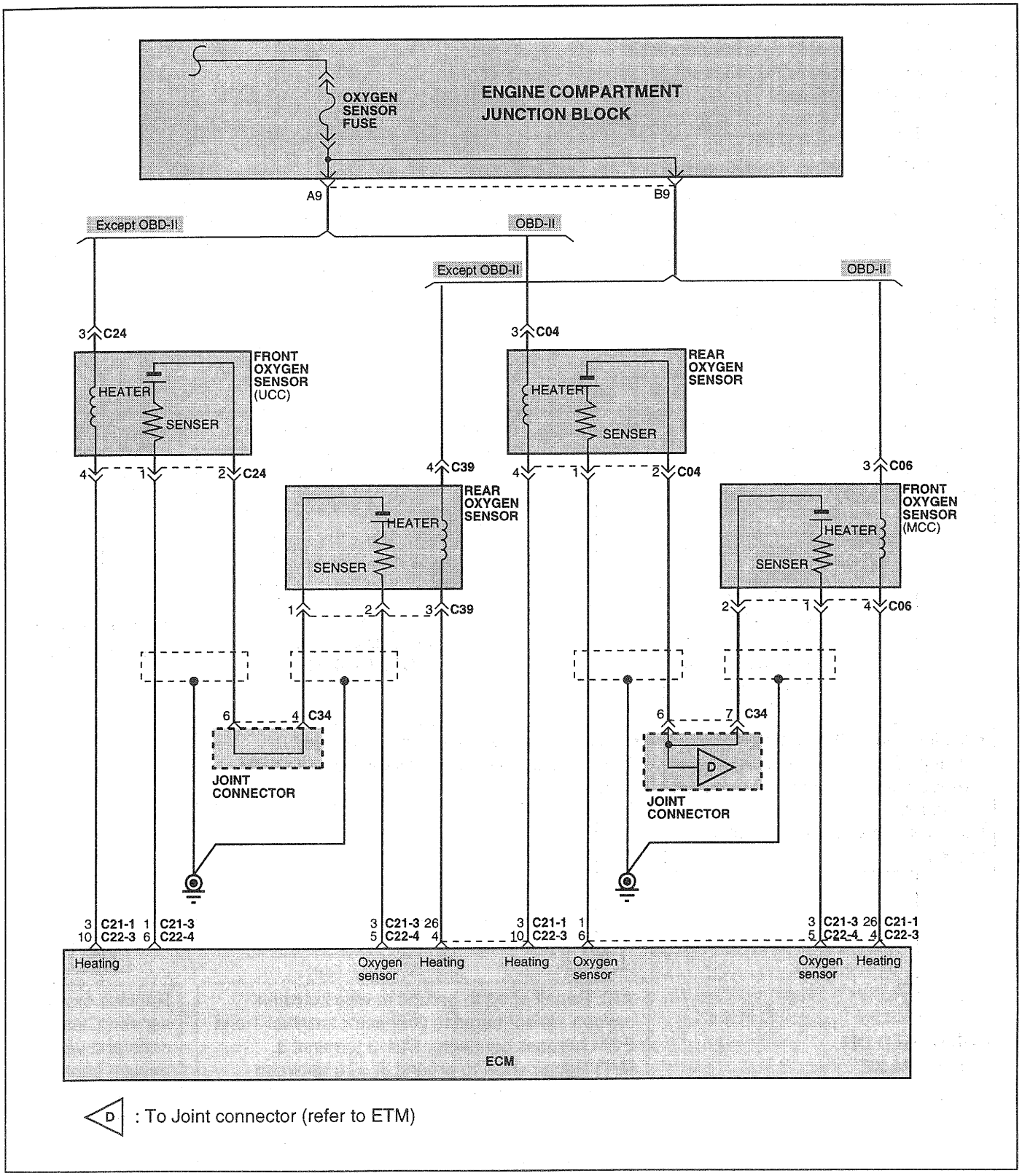
DESCRIPTION

Refer to excessive time to enter closed loop fuel control (P0134).

TROUBLESHOOTING GUIDE

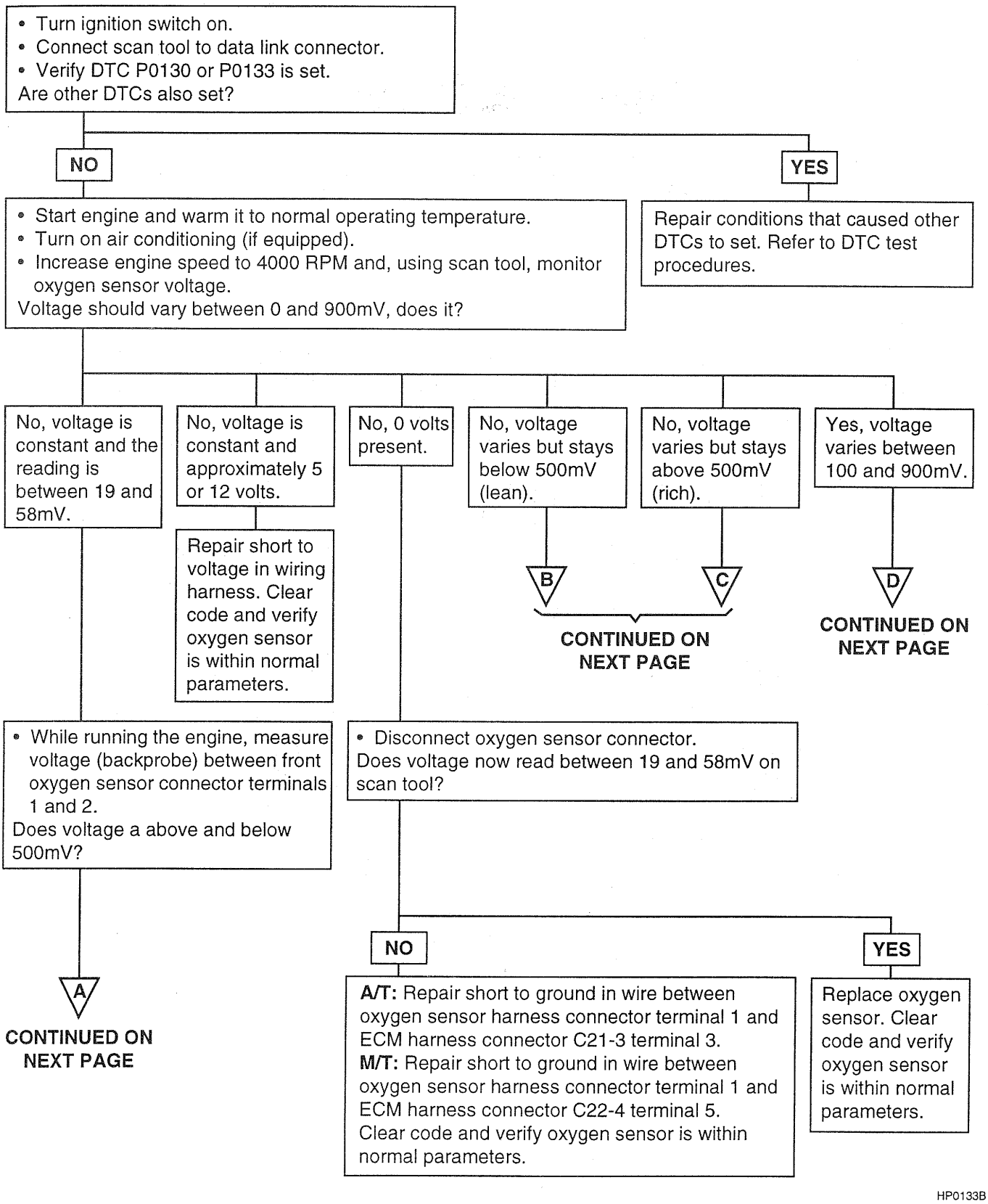
DTC detection condition	Probable cause
Background • When the heated oxygen sensor begins to deteriorate, the oxygen sensor signal response becomes poor. • The Engine Control Module forcibly varies the air/fuel mixture to make it leaner and richer and checks the response speed of the heated oxygen sensor. In addition, the Engine Control Module also checks for an open circuit in the heated oxygen sensor output line. Check Area • Coolant temperature sensor: Normal. • Heated oxygen sensor signal voltage has continued to be 0.1V or lower for 3 min. or more after the staring sequence was completed. • Engine Coolant Temperature is higher than 80°C (176°F). • Engine speed is higher than 1,200 r/min. • Engine load is 25% or more. Judgment Criteria • Input voltage supplied to the engine control module interface circuit is 4.5V or more when 5V is applied to the heated oxygen sensor output line via a resistor. Check Area • Coolant temperature sensor: Normal. • Engine Coolant Temperature is 50°C (122°F) or more. • Engine speed is between 1,500 and 3,000 r/min or 1,100 and 3,000 r/min. • Engine load is 25 - 60%. • Intake air temperature is -10°C (14°F) or more. • Under the closed loop air-fuel control. • Monitoring Time: 8sec. Judgment Criteria • When the air-fuel ratio is focibly changed (lean to rich and rich to lean), the heated oxygen sensor signal doesn't provide response within 1.28 sec. • Monitored only once per trip.	• Heated oxygen sensor deteriorated • Open circuit in heated oxygen sensor output line • Engine control module failed

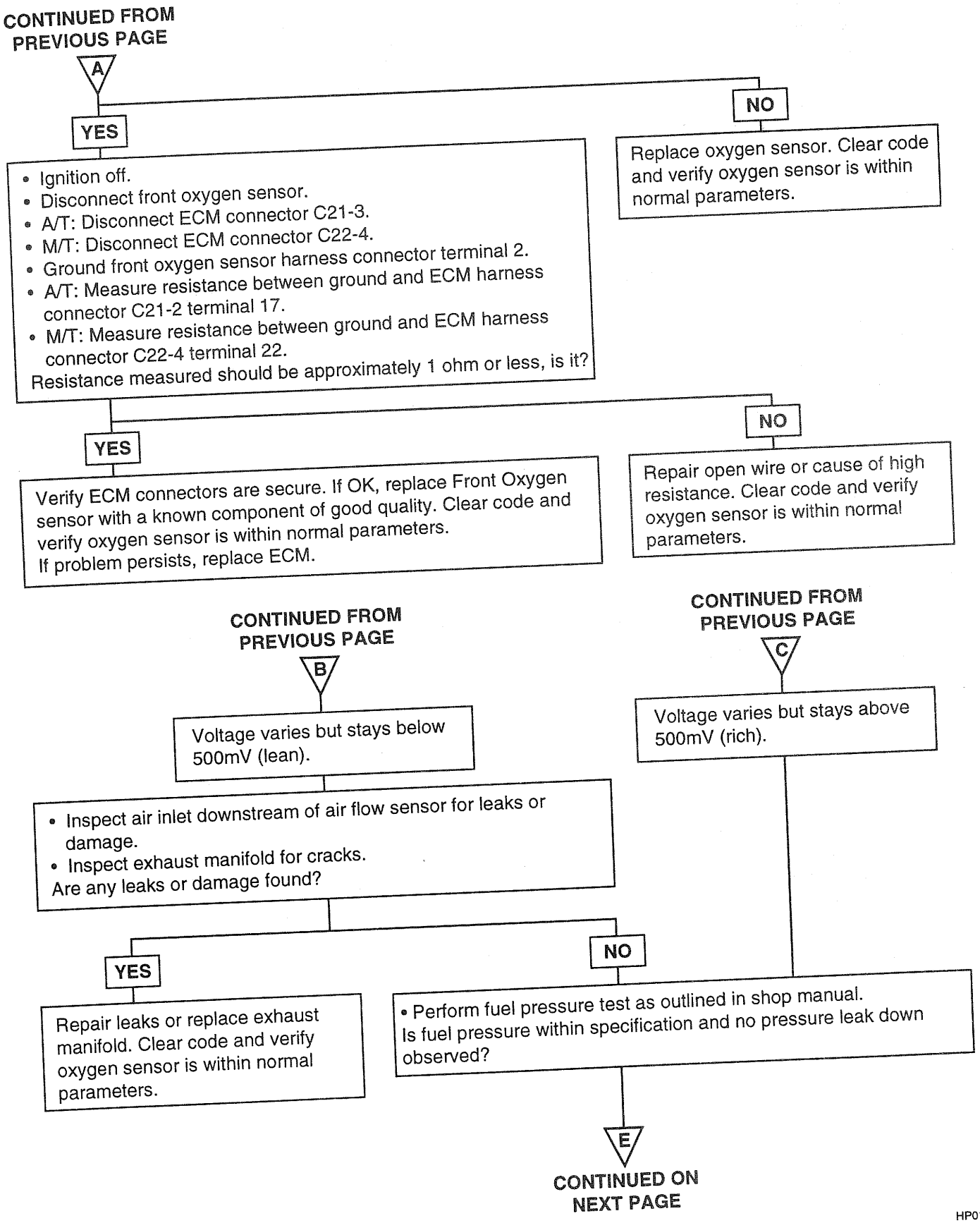
CIRCUIT DIAGRAM



HP0134A

TEST PROCEDURE

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A
YES
NO
• Ignition off.
• Disconnect front oxygen sensor.
• A/T: Disconnect ECM connector C21-3.
• M/T: Disconnect ECM connector C22-4.
• Ground front oxygen sensor harness connector terminal 2.
• A/T: Measure resistance between ground and ECM harness connector C21-2 terminal 17.
• M/T: Measure resistance between ground and ECM harness connector C22-4 terminal 22.
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 Front Oxygen sensor with a known component of good quality. 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 500mV (lean).
• Inspect air inlet downstream of air flow 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.
CONTINUED FROM PREVIOUS PAGE
C
Voltage varies but stays above 500mV (rich).
• 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

HP013

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D

Voltage varies between 0 and 900mV.

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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.

Measured voltage drop 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 parameters.

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 turned on intermittently and DTC P0133 is set, the 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 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.

HP0133D

EFHA5050

DTC	Diagnostic item
P0134	No Activity of Oxygen Sensor (Bank 1, Sensor 1)

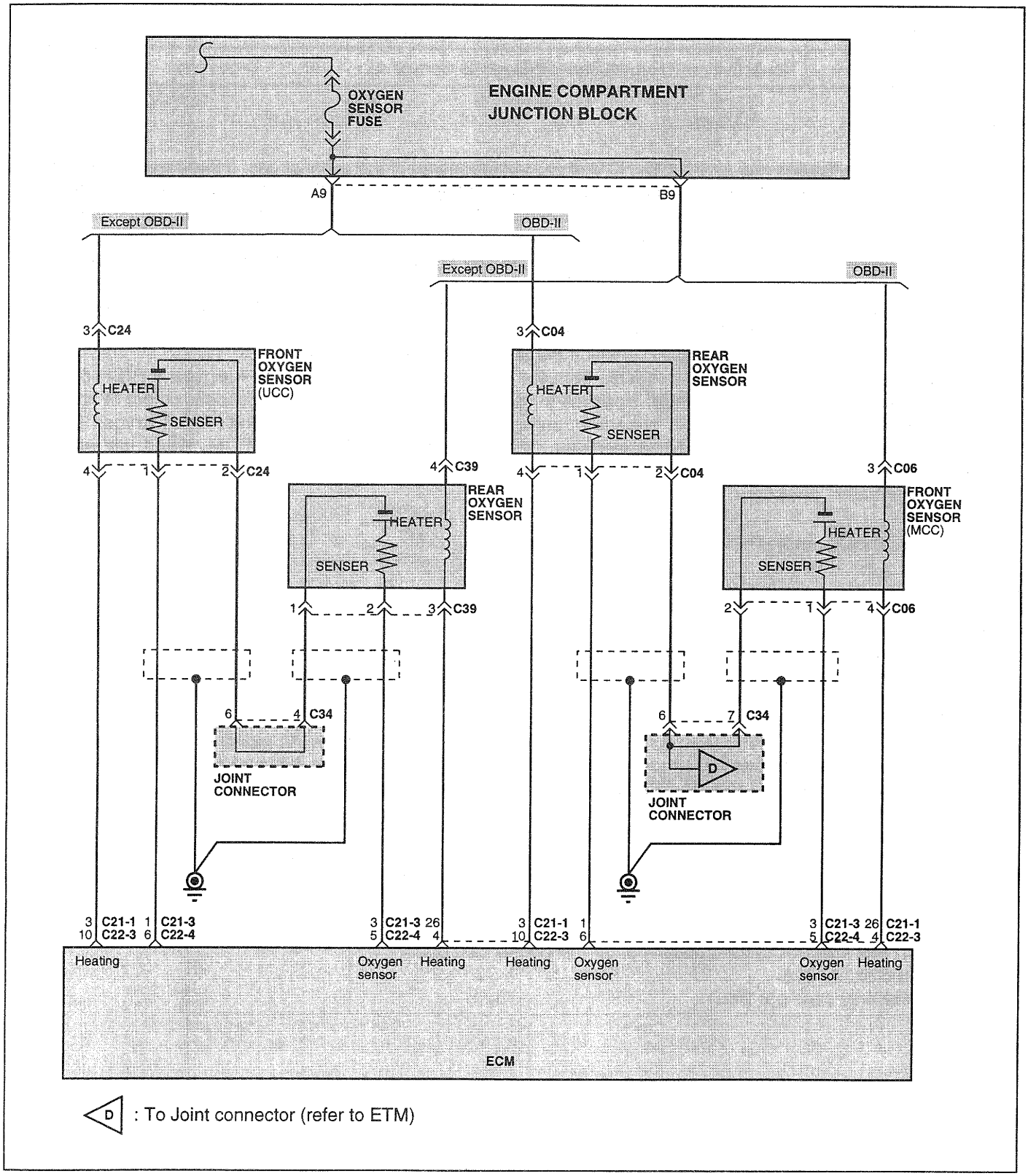
DESCRIPTION

To obtain a high purification rate for the CO, HC and NOx components of the exhaust gas, a three way catalytic converter is used, but for the most efficient use of the three-way catalytic inverter, the ratio of the air must be precisely controlled so that it is always close to the stoichiometric air-fuel ratio. The oxygen sensor has the characteristic whereby its output voltage changes suddenly in the vicinity of the stoichiometric air-fuel ratio. This characteristic is used to detect the oxygen concentration in the exhaust gas and provide feedback to the computer for control of the air-fuel ratio. When the air-fuel ratio becomes LEAN, the oxygen concentration in the exhaust increases and the oxygen sensor informs the ECM of the LEAN condition (small electromotive force: 0V). When the air-fuel ratio is RICHER than the stoichiometric air-fuel ratio the oxygen concentration in the exhaust gas is reduced and the oxygen sensor informs the ECM of the RICH condition (large electromotive force: 1V).
The ECM determined by the electromotive force from the oxygen sensor whether the air-fuel ratio is RICH or LEAN and controls the injection time accordingly. However, if malfunction of the oxygen sensor causes output of abnormal electromotive force, the ECM is unable to perform an accurate air-fuel ratio control. The heated oxygen sensors include a heater which heats the Zirconia element. The heater is controlled by the ECM. When the intake air volume is low (the temperature of the exhaust gas is low), current flows to the heater to heat the sensor for accurate oxygen concentration detection.

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • The MFI system reduces exhaust emissions by means of closed-loop fuel control. • The Engine Control Module checks the time taken until closed-loop fuel control commences. Check Area • Engine coolant temperature is higher than 80°C (176°F) • Intake air temperature is -10°C (14°F) or more. • Atmospheric pressure is 76 kPa (11.0 psi) or more. • Engine speed is between approx. 2,400 and 3,500 r/min. • Engine load is 26 - 60%. • In operation within air-fuel-ratio feeback zone. • Monitoring time: 128 sec. Judgment Criteria • Multiport fuel injection system doesn't enter the closed loop control within approx. 30 sec. • Monitored only once per trip.	• Heated oxygen sensor failed • Injector failed • Fuel pressure regulator failed • Fuel pump failed • Fuel filter clogged • Air intake in exhaust system • Exhaust gas leaks • Engine control module failed

CIRCUIT DIAGRAM



HP0134A

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0134 is set.

Is DTC P0125 the only code set?

YES

- Engine idling at normal operating temperature.
- Connect scan tool and observe Engine Coolant Temperature (ECT) sensor reading.

Scanned temperature should be between 170°F and 190°F (77°C and 88°C), is it?

No, scanned temperature is below 170°F (77°C).

- Turn ignition off.
- Disconnect ECT sensor.
- Turn ignition on.
- Measure voltage across ECT sensor harness connector terminals 1 and 3.

Voltage measured should be 4.5 to 5.0 volts, is it?

Yes, 4.5 to 5.0 volts is present

Replace ECT sensor. Clear code and verify ECT sensor is within normal parameters.

Yes, scanned temperature is between 170°F and 190°F (77°C and 88°C)

No problem found at this time. Fault is intermittent or was repaired and ECM memory was not cleared. Clear code and verify ECT sensor is within normal parameters.

No, less than 4.5 volts is present

- Turn ignition off.
- ECT sensor disconnected.
- A/T: Disconnect ECM connector C21-2.
- M/T: Disconnect ECM connector C22-4.
- Ground ECT harness connector terminal 1.
- A/T: Measure resistance between ground and ECM harness connector C21-2 terminal 4.
- M/T: Measure resistance between ground and ECM harness connector C22-4 terminal 13.

Resistance should be approximately 1 ohm or less, is it?

YES

Verify ECM connector is secure. Replace ECT sensor with known good component. If problem persists, replace ECM. Clear code and verify ECT sensor is within normal parameters.

NO

A/T: Repair open in wire between ECT sensor harness connector terminal 1 and ECM harness connector C21-2 terminal 4.
M/T: Repair open in wire between ECT sensor harness connector terminal 1 and ECM harness connector C22-4 terminal 13.
Clear code and verify ECT sensor is within normal parameters.

NO

Refer to appropriate section and fix other codes first.

HP0134B

EFHA5070

DTC	Diagnostic item
P0135	Oxygen Sensor Heater Circuit Malfunction (Bank 1, Sensor 1)

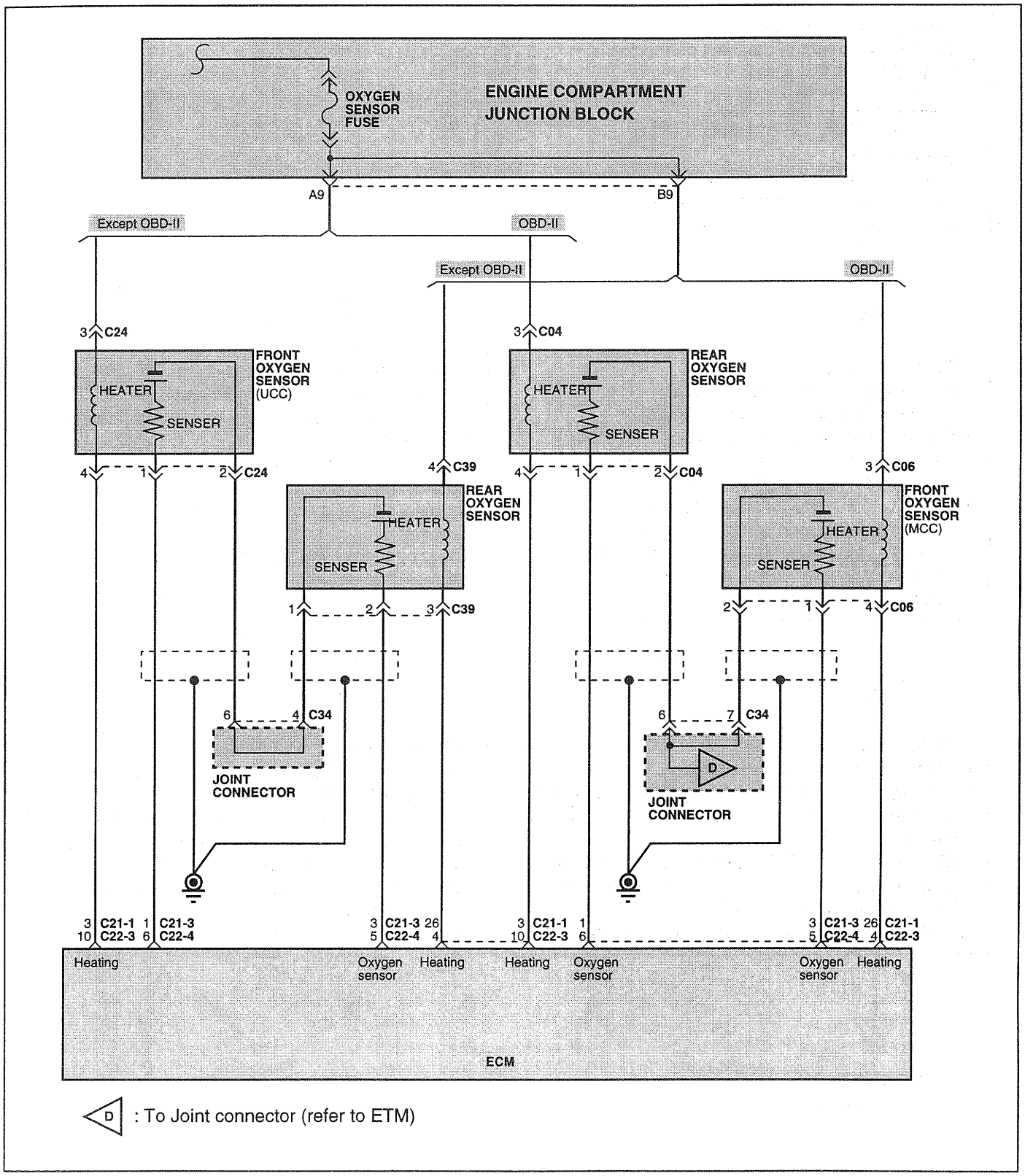
DESCRIPTION

Refer to excessive time to enter closed loop fuel control (P0134).

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • The Engine Control Module checks whether the heater current is within a specified range when the heater is energized. Check Area • Battery voltage is between 12 and 16V. Judgment Criteria • Heater current of the front heated oxygen sensor heater (Bank 1 Sensor 1) has continued to be 0.2 A or less, or 3.5 A or higher for 6 sec. • Monitored only once per trip.	• Open or shorted oxygen sensor heater circuit • Open circuit in oxygen sensor heater • Engine control module failed

CIRCUIT DIAGRAM



HP0134A

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0135 is set.

- Disconnect front oxygen sensor.
- Start engine.
- Measure voltage between oxygen sensor harness connector terminal 3 and ground.

Voltage should between 12 and 16 volts, is it?

YES

- Turn ignition switch off.
- Front oxygen sensor disconnected.
- A/T: Disconnect ECM connector C21-1.
- Ground front oxygen sensor harness terminal 4.
- Measure resistance between ground and ECM harness connector C21-1 terminal 26.
- M/T: Disconnect ECM connector C22-3.
- Ground front oxygen sensor harness terminal 4.
- Measure resistance between ground and ECM harness connector C22-3 terminal 4.

Resistance should be 1 ohm or less, is it?

YES

- Ignition switch off.
- Front oxygen sensor disconnected.
- A/T: Disconnect ECM connector C21-1. Measure resistance between ground and oxygen sensor harness connector terminal 4.
- M/T: Disconnect ECM connector C22-3. Measure resistance between ground and oxygen sensor harness connector terminal 4.

Resistance should indicate an open circuit, does it?

A

CONTINUED ON NEXT PAGE

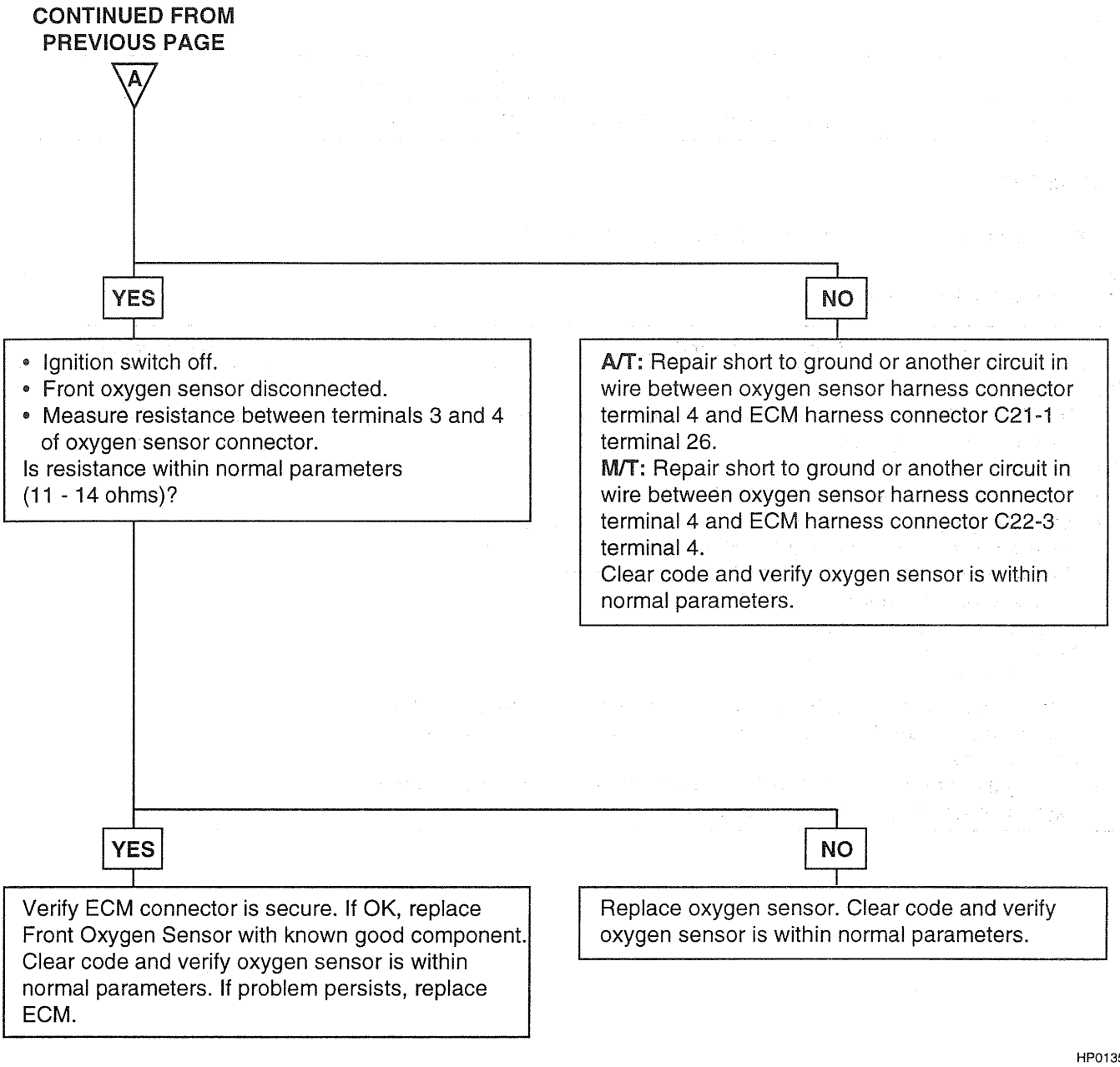
NO

A/T: Repair open or short to ground in wire between engine compartment junction block terminal and oxygen sensor harness connector terminal 3.
M/T: Repair open or short to ground in wire between engine compartment junction block terminal and oxygen sensor harness connector terminal 3.
Clear code and verify oxygen sensor is within normal parameters.

NO

A/T: Repair open in wire between oxygen sensor harness connector terminal 4 and ECM harness connector C21-1 terminal 26.
M/T: Repair open in wire between oxygen sensor harness connector terminal 4 and ECM harness connector C22-3 terminal 4.
Clear code and verify oxygen sensor is within normal parameters.

HP0135B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A
YES
NO
• Ignition switch off.
• Front oxygen sensor disconnected.
• Measure resistance between terminals 3 and 4 of oxygen sensor connector.
Is resistance within normal parameters (11 - 14 ohms)?
A/T: Repair short to ground or another circuit in wire between oxygen sensor harness connector terminal 4 and ECM harness connector C21-1 terminal 26.
M/T: Repair short to ground or another circuit in wire between oxygen sensor harness connector terminal 4 and ECM harness connector C22-3 terminal 4.
Clear code and verify oxygen sensor is within normal parameters.
YES
NO
Verify ECM connector 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.
Replace oxygen sensor. Clear code and verify oxygen sensor is within normal parameters.

HP0135C

EFHA5080

DTC	Diagnostic item
P0136	Oxygen Sensor Circuit Malfunction (Bank 1, Sensor 2)

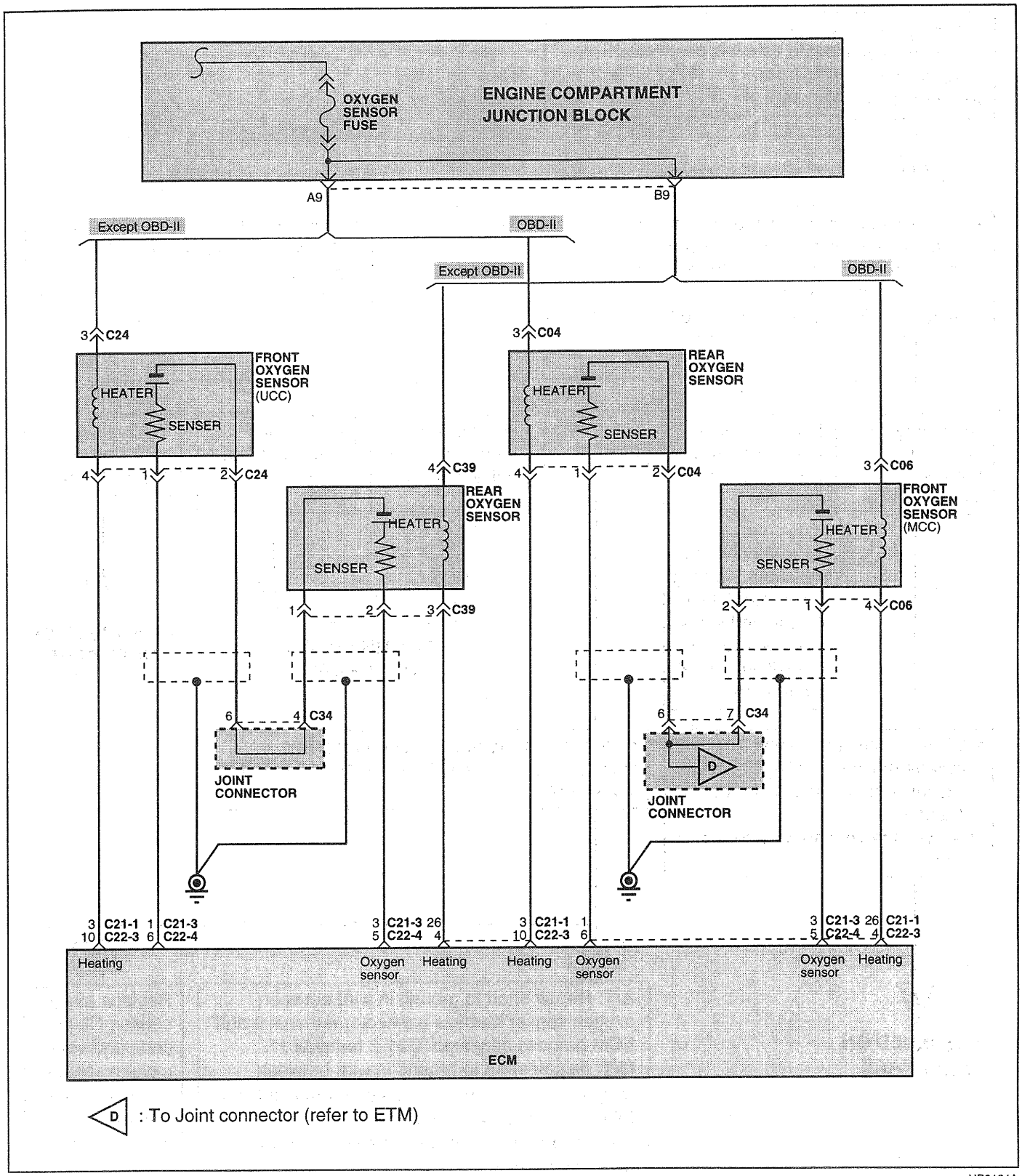
DESCRIPTION

Refer to excessive time to enter closed loop fuel control (P0134).

TROUBLESHOOTING GUIDE

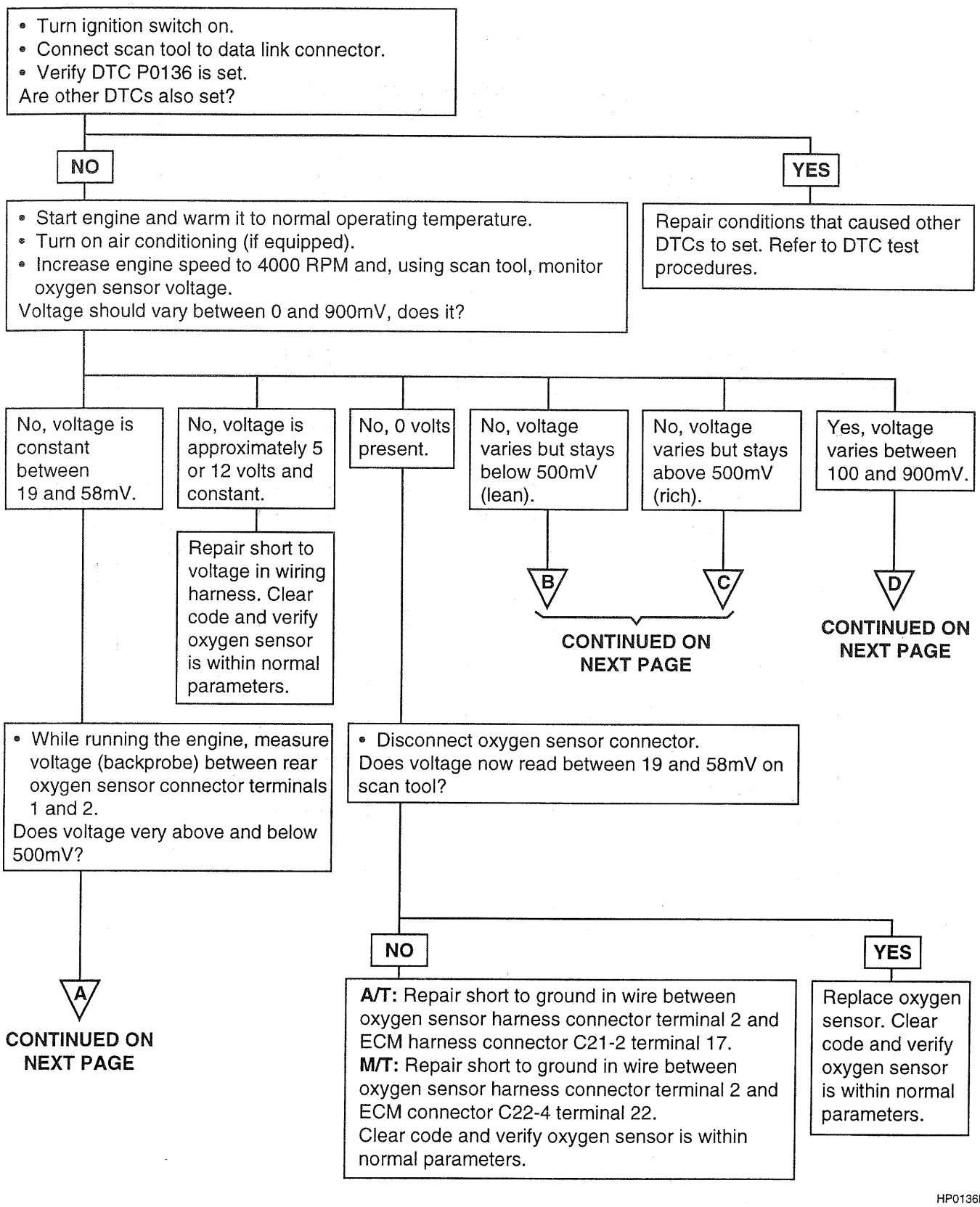
DTC detection condition	Probable cause
Background • The Engine Control Module checks for an open circuit in the heated oxygen sensor output line. Check Area • Coolant temperature sensor: Normal. • Heated oxygen sensor signal voltage has continued to be 0.1V or lower for 3 min. or more after the staring sequence was completed. • Engine coolant temperature is 80°C (176°F) or more. • Engine speed is higher than 1,200 r/min. • Engine load is 25% or more. • Monitoring Time: 7 - 10 sec. Judgment Criteria • Input voltage supplied to the engine control module interface circuit is 4.5V or more when 5V is applied to the heated oxygen sensor output line via a resistor. • Making the air-fuel ratio 15% richer doesn't result in raising the heated oxygen sensor output voltage beyond 0.1V.	• Heated oxygen sensor failed • Open circuit in heated oxygen sensor output line • Engine control module failed

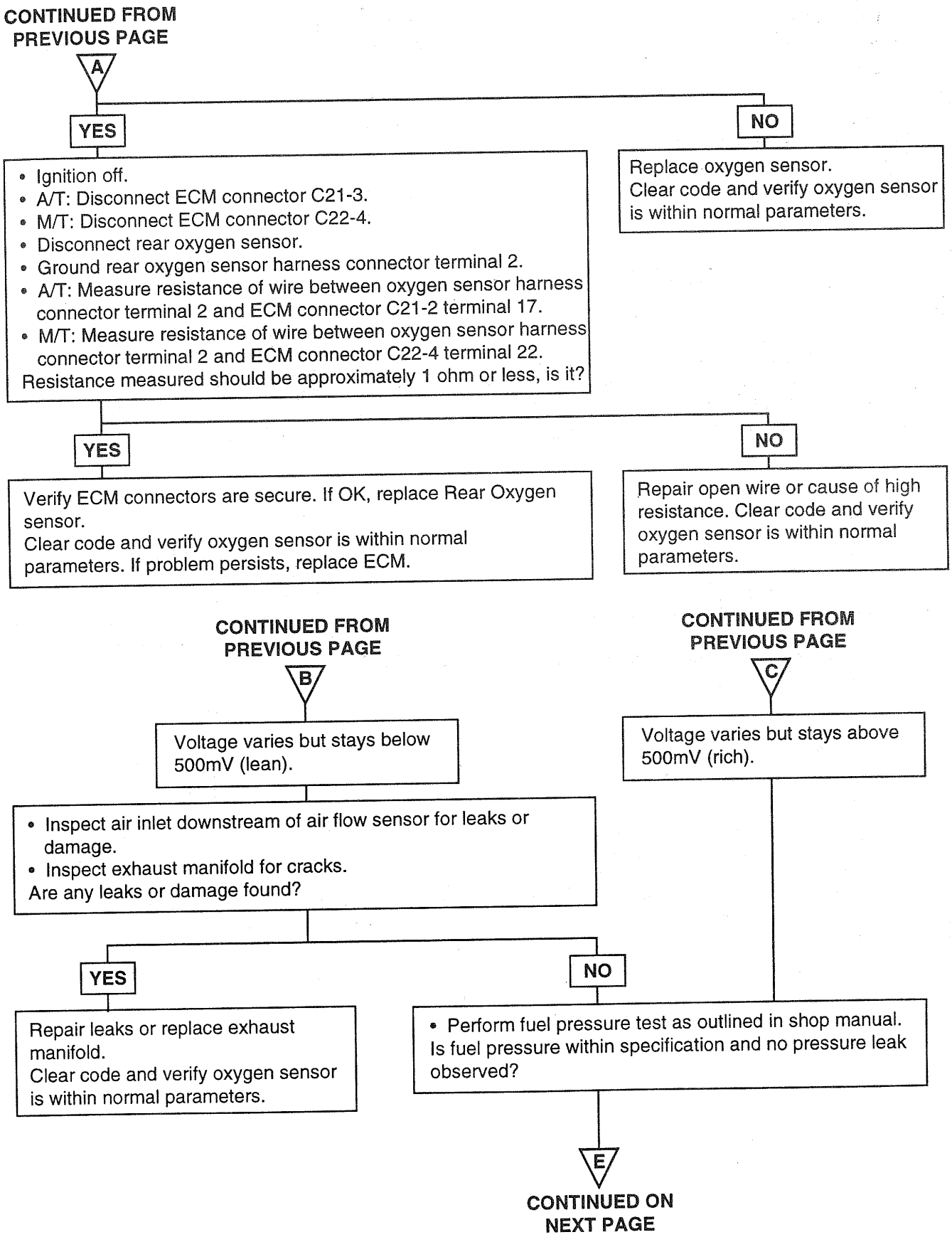
CIRCUIT DIAGRAM



HP0134A

TEST PROCEDURE

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A
YES
NO
• Ignition off.
• A/T: Disconnect ECM connector C21-3.
• M/T: Disconnect ECM connector C22-4.
• Disconnect rear oxygen sensor.
• Ground rear oxygen sensor harness connector terminal 2.
• A/T: Measure resistance of wire between oxygen sensor harness connector terminal 2 and ECM connector C21-2 terminal 17.
• M/T: Measure resistance of wire between oxygen sensor harness connector terminal 2 and ECM connector C22-4 terminal 22.
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 Rear Oxygen sensor.
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 500mV (lean).
CONTINUED FROM PREVIOUS PAGE
C
Voltage varies but stays above 500mV (rich).
• Inspect air inlet downstream of air flow 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 observed?
E
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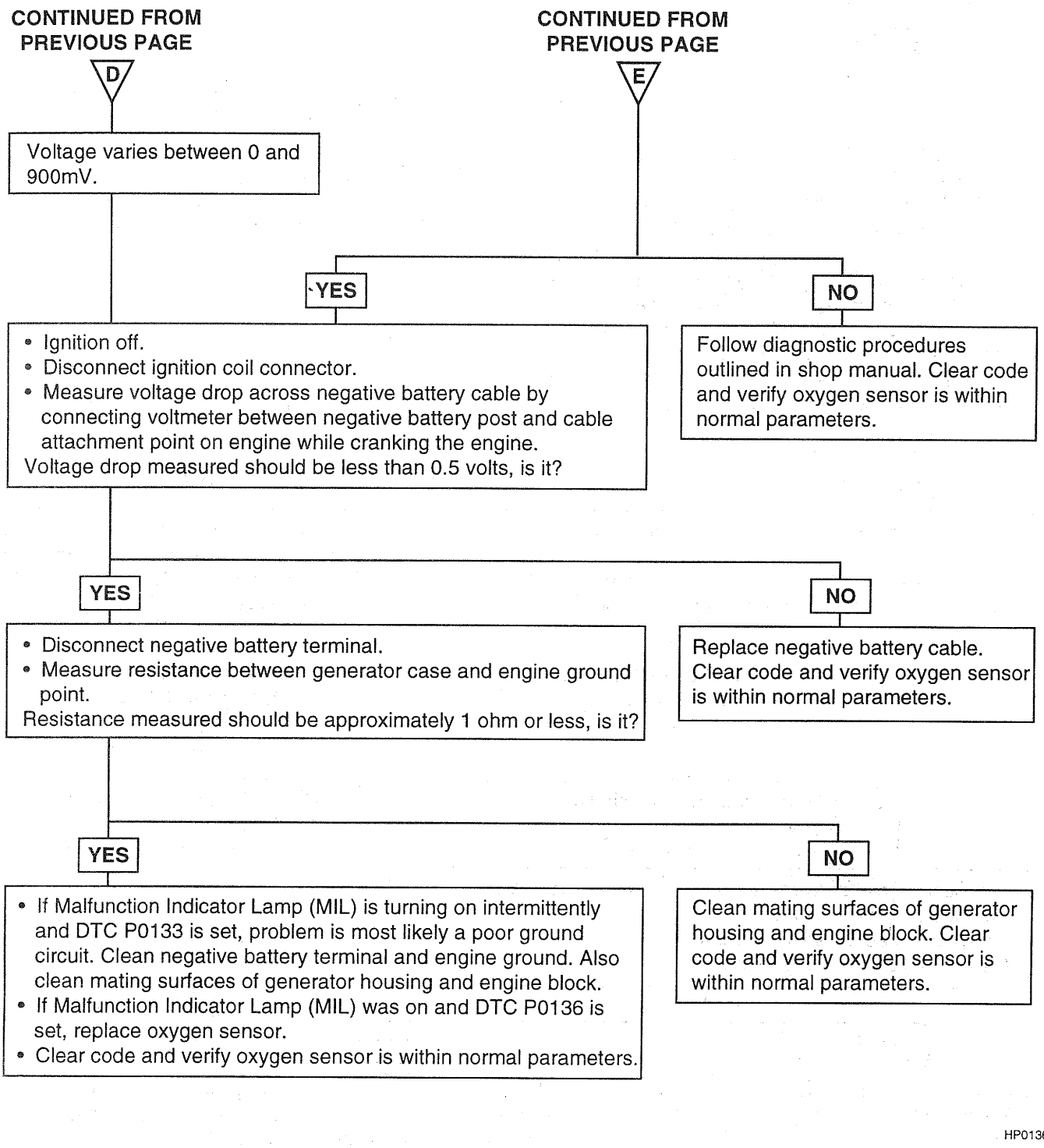
HP0136C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D
CONTINUED FROM PREVIOUS PAGE
E
Voltage varies between 0 and 900mV.
YES
NO
• Ignition off.
• Disconnect ignition coil connector.
• Measure voltage drop across negative battery cable by connecting voltmeter between negative battery post and 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 parameters.
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 P0136 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.

HP0136D

EFHA5090

DTC	Diagnostic item
P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1, Sensor 2)

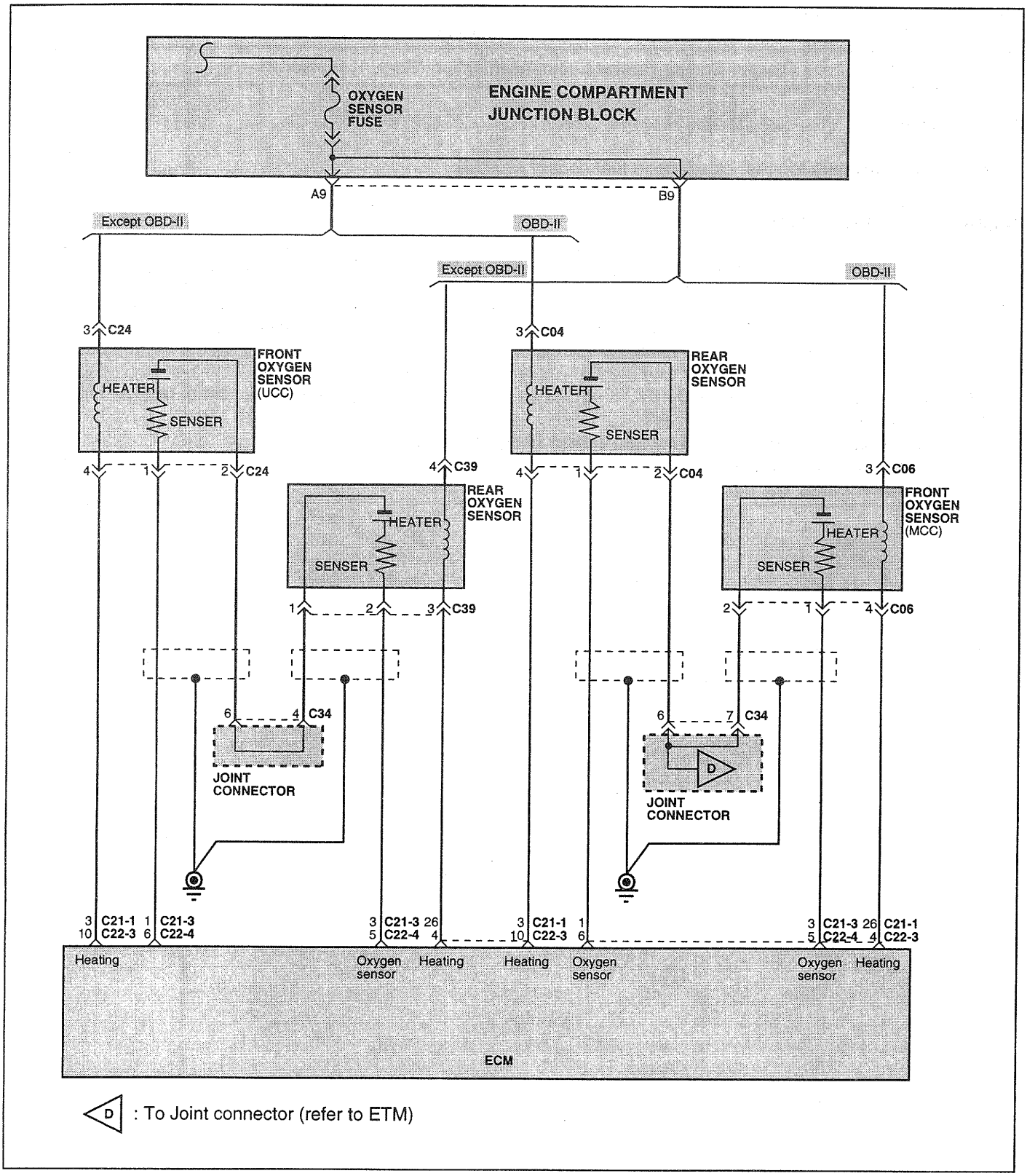
DESCRIPTION

Refer to excessive time to enter closed loop fuel control (P0134).

TROUBLESHOOTING GUIDE

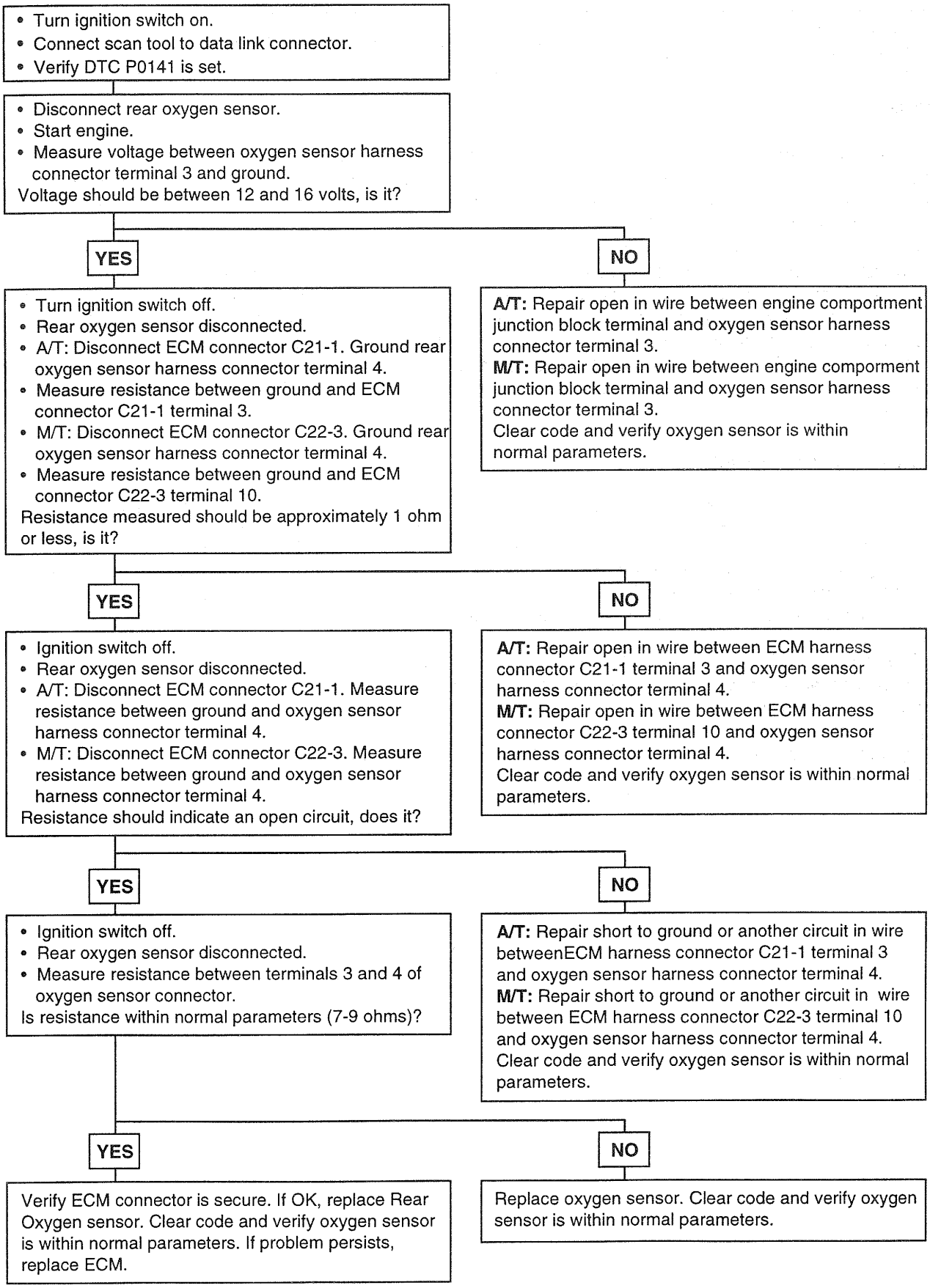
DTC detection condition	Probable cause
Background • The Engine Control Module checks whether the heater current is within a specified range when the heater is energized. Check Area • Battery voltage is between 12 and 16V. Judgment Criteria • Heater current of the front heated oxygen sensor heater (Bank 1 Sensor 2) has continued to be 0.2 A or less, or 3.5 A or more for 6 sec. • Monitored only once per trip.	• Open or shorted oxygen sensor heater circuit • Open circuit in oxygen sensor heater • Engine control module failed

CIRCUIT DIAGRAM



HP0134A

TEST PROCEDURE



HP0141B

EFHA5100

DTC	Diagnostic item
P0201, P0202 P0203, P0204	Injector Circuit Malfunction (Cylinder-1, Cylinder-2, Cylinder-3, Cylinder-4)

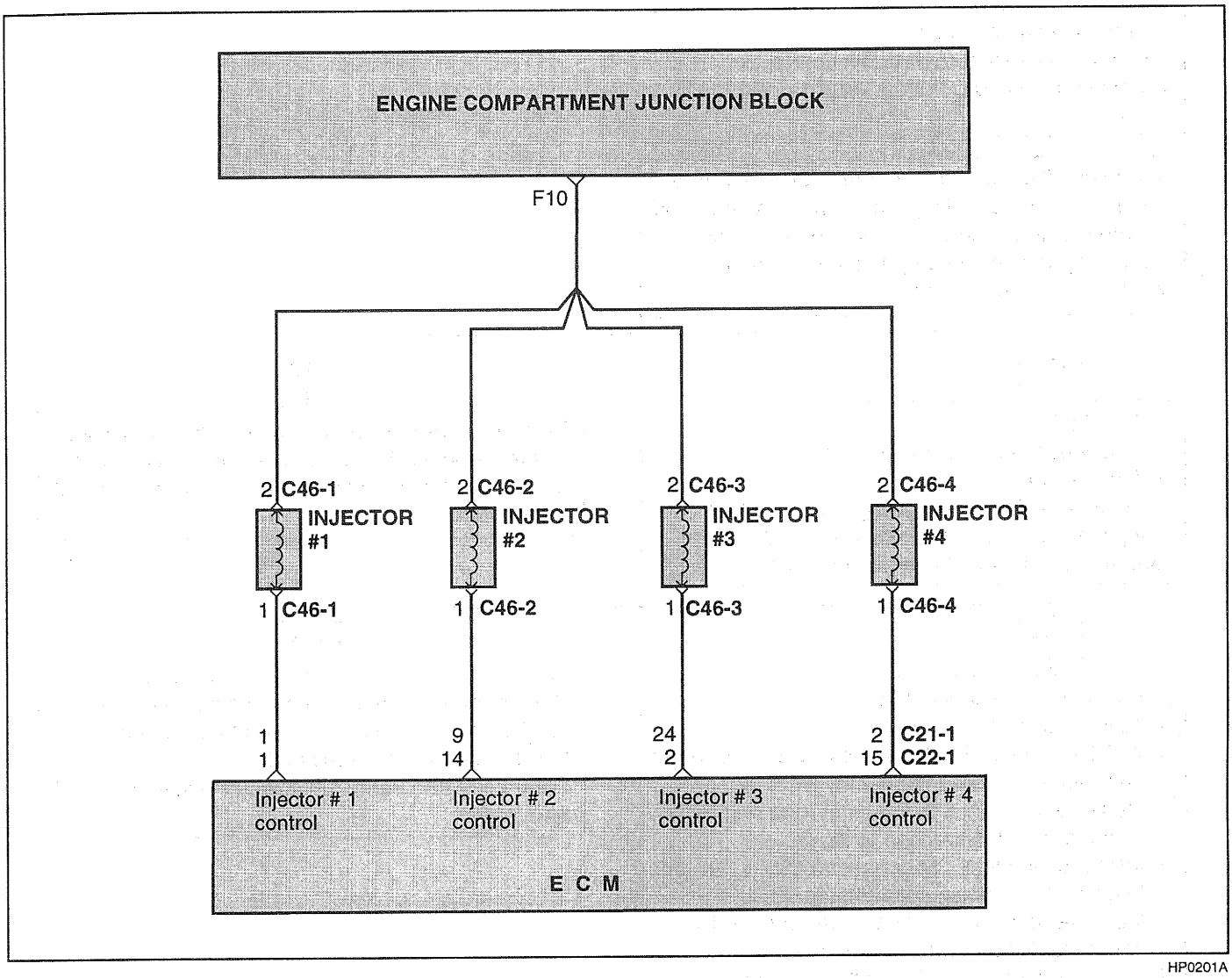
DESCRIPTION

The fuel injectors are solenoid operated valves that are normally closed. When a fuel injector solenoid is energized (pulsed) the injector needle valve moves, allowing pressurized fuel to pass through the injector and mix with the air entering the engine. Each fuel injector (there is one for each engine cylinder) is mounted in the intake manifold and is positioned to spray fuel into a cylinder head intake port.
The Engine Control Module (ECM) controls injector timing and pulse width (how long the fuel injectors are turned on). 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 and simultaneous injection may be used when the engine is being cranked.

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • A surge voltage is generated when the injectors are driven and the current flowing to the injector coil, is shut off. • The engine control module checks this surge voltage. Check Area • Engine speed is between 50 and 1,000 r/min • Throttle position sensor output voltage is 1.16V or less. • Monitoring Time: 4 sec. Judgment Criteria • Injector coil surge voltage (system voltage +2V) has not been detected for 4 sec.	• Injector failed • Open or shorted injector circuit, or loose connector • Engine control module failed

CIRCUIT DIAGRAM



HP0201A

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0201, P0202, P0203 or P0204 is set.

- Engine idling at normal operating temperature.
- Disconnect the fuel injectors, one at a time, and note the drop in engine speed for each one

Engine speed should drop the same amount for each fuel injector, does it?

NO

- Turn ignition off.
- Disconnect fuel injector connector.
- Turn ignition on.
- Measure voltage between ground and fuel injector harness connector terminal 2.

Battery voltage should be present, is it?

YES

- Fuel inector disconnected.
- Turn ignition off.
- A/T: Disconnect ECM connector C21-1. Ground fuel injector harness connector terminal 1. Measure resistance between ground and ECM connector C21-1 harness terminal.
- M/T: Disconnect ECM connector C22-1. Ground fuel injector harness connector terminal 1. Measure resistance between ground and ECM connector C22-1 harness terminal.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- Fuel injector disconnected.
- A/T: ECM connector C21-1 disconnected. Measure resistance between ground and fuel injector harness connector terminal 1.
- M/T: ECM connector C22-1 disconnected.
- Measure resistance between ground and fuel injector harness connector terminal 1.

Resistance should indicate open circuit, does it?

A

CONTINUED ON NEXT PAGE

NO

A/T: Repair open in wire between ECM harness connector C21-1 terminal and fuel injector harness connector terminal 1.
M/T: Repair open in wire between ECM harness connector C22-1 terminal and fuel injector harness connector terminal 1.
Clear code and verify fuel injector is within normal parameters.

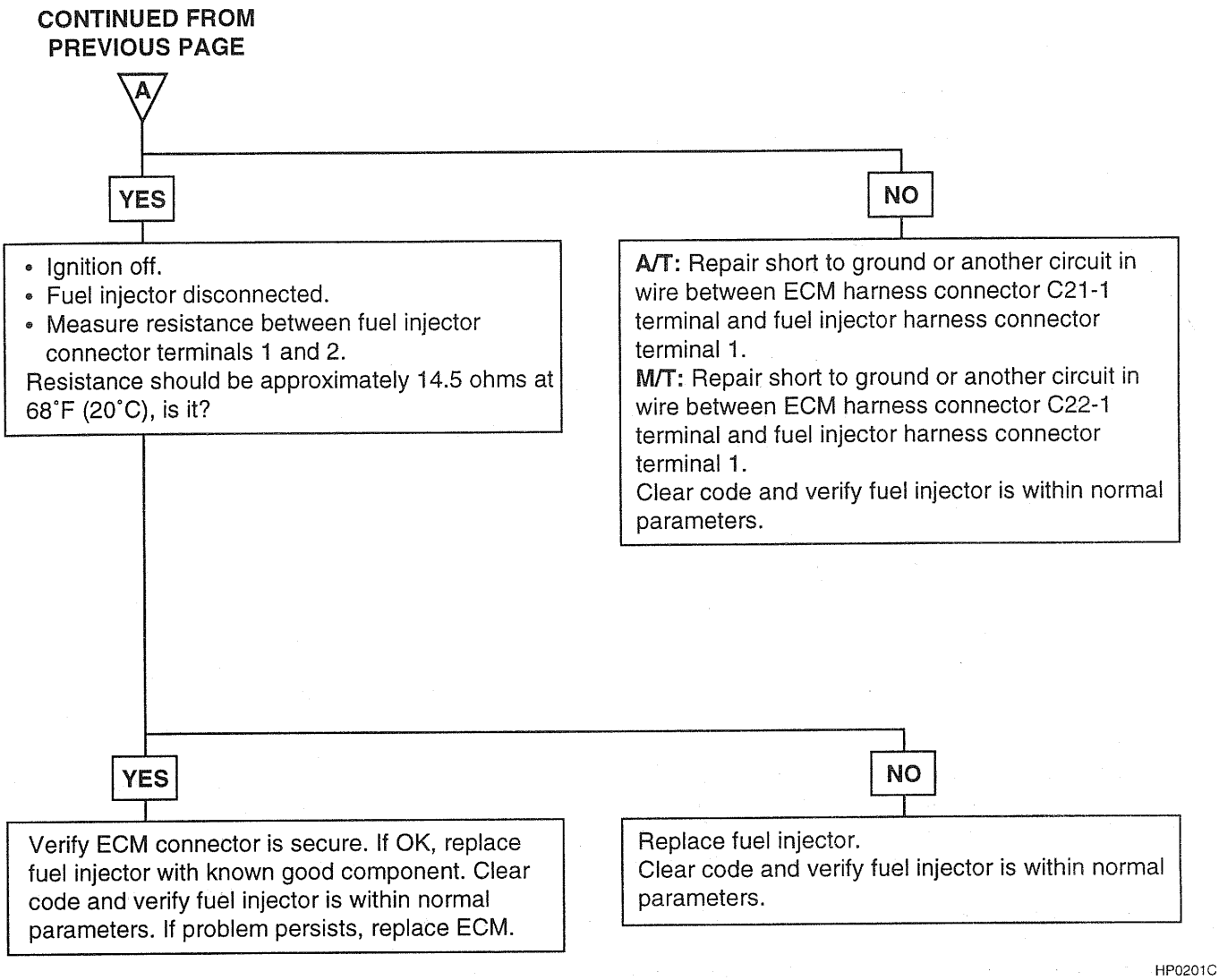
NO

Repair open in wire between engine compartment junction block terminal F10 and fuel injector harness connector terminal 2.
Clear code and verify fuel injector is within normal parameters.

YES

Problem is intermittent or was repaired and Engine Control Module (ECM) memory was not cleared.
Clear code and verify fuel injector is within normal parameters.

HP0201B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A
YES
NO
• Ignition off.
• Fuel injector disconnected.
• Measure resistance between fuel injector connector terminals 1 and 2.
Resistance should be approximately 14.5 ohms at 68°F (20°C), is it?
A/T: Repair short to ground or another circuit in wire between ECM harness connector C21-1 terminal and fuel injector harness connector terminal 1.
M/T: Repair short to ground or another circuit in wire between ECM harness connector C22-1 terminal and fuel injector harness connector terminal 1.
Clear code and verify fuel injector is within normal parameters.
YES
NO
Verify ECM connector is secure. If OK, replace fuel injector with known good component. Clear code and verify fuel injector is within normal parameters. If problem persists, replace ECM.
Replace fuel injector.
Clear code and verify fuel injector is within normal parameters.
HP0201C

EFHA5110

DTC	Diagnostic item
P0300	Random Misfire Detected

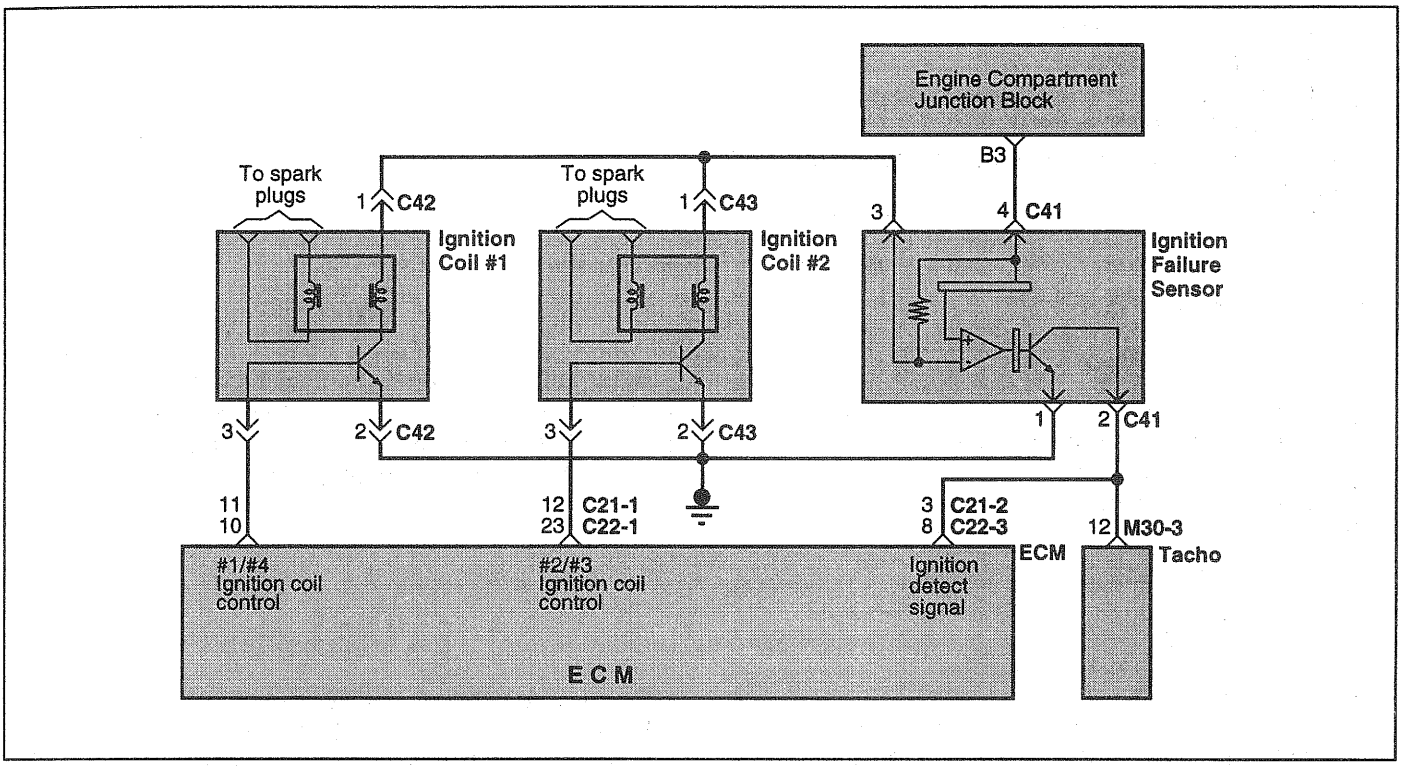
DESCRIPTION

With the ignition switch 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 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 ignition power transistor, controlled by the Engine Control Module (ECM), provides a switching circuit to ground for energizing the primary ignition coils. When a primary ignition coil is energized and deenergized, the secondary coil produces a high voltage spike across the attached spark plugs. At the same time, the tach interface (part of the ignition power transistor) provides the ECM and Transaxle Control Module (TCM) with an RPM signal.

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • If a misfiring occurs while the engine is running, the engine speed suddenly changes. • The Engine Control Module checks for changes in the engine speed. Check Area • Five seconds or more have passed after the engine was started. • Engine speed is between 500 and 6,000 r/min. • Engine Coolant Temperature is higher than -10°C(14°F). • Intake air temperature is higher than -10°C (14°F). • Running free from sudden accelerations/decelerations such as shift change. Judgment Criteria (change in the angular acceleration of the crankshaft is used for misfire detection.) • Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is higher than 950°C (1,742°F)]. • Misfire has occurred more frequently than the allowed number of times (2%) during 1,000 motor revolutions.	• Ignition system related part(s) failed • Poor crankshaft position sensor signal • Incorrect air/fuel ratio • Low compression pressure • Engine coolant temperature sensor failed • Timing belt missing teeth • Injector failed • Engine control module failed

CIRCUIT DIAGRAM



HP0300A

TEST PROCEDURE

- Check the fuel quality.
- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0300 is set.

Is DTC P0300 the only code set and fuel at least 87 octane?

YES

- Ignition on.
- Disconnect ignition coil connector. Measure voltage between ground and ignition coil connector terminal 1.

Battery voltage should be present, is it?

YES

- Turn ignition off.
- A/T: Disconnect ECM connector C21-1
- M/T: Disconnect ECM connector C22-1
- A/T: Ground ignition coil harness connector terminals 3. Measure resistance between ground and ECM connector C21-1 terminals 11 and 12.
- M/T: Ground ignition coil harness connector terminal 3. Measure resistance between ground and ECM harness connector C22-1 terminal 10 and 23.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- Measure resistance of wire between ignition failure sensor harness connector terminal 2 and ignition coil harness connector terminal 1.

Resistance measured should be approximately 1 ohm or less, is it?

A

CONTINUED ON NEXT PAGE

NO

Refer to the appropriate section and follow test procedures for the other set codes. Refuel vehicle with 87 or higher octane fuel. Clear codes and verify DTC P0300 is no longer set.

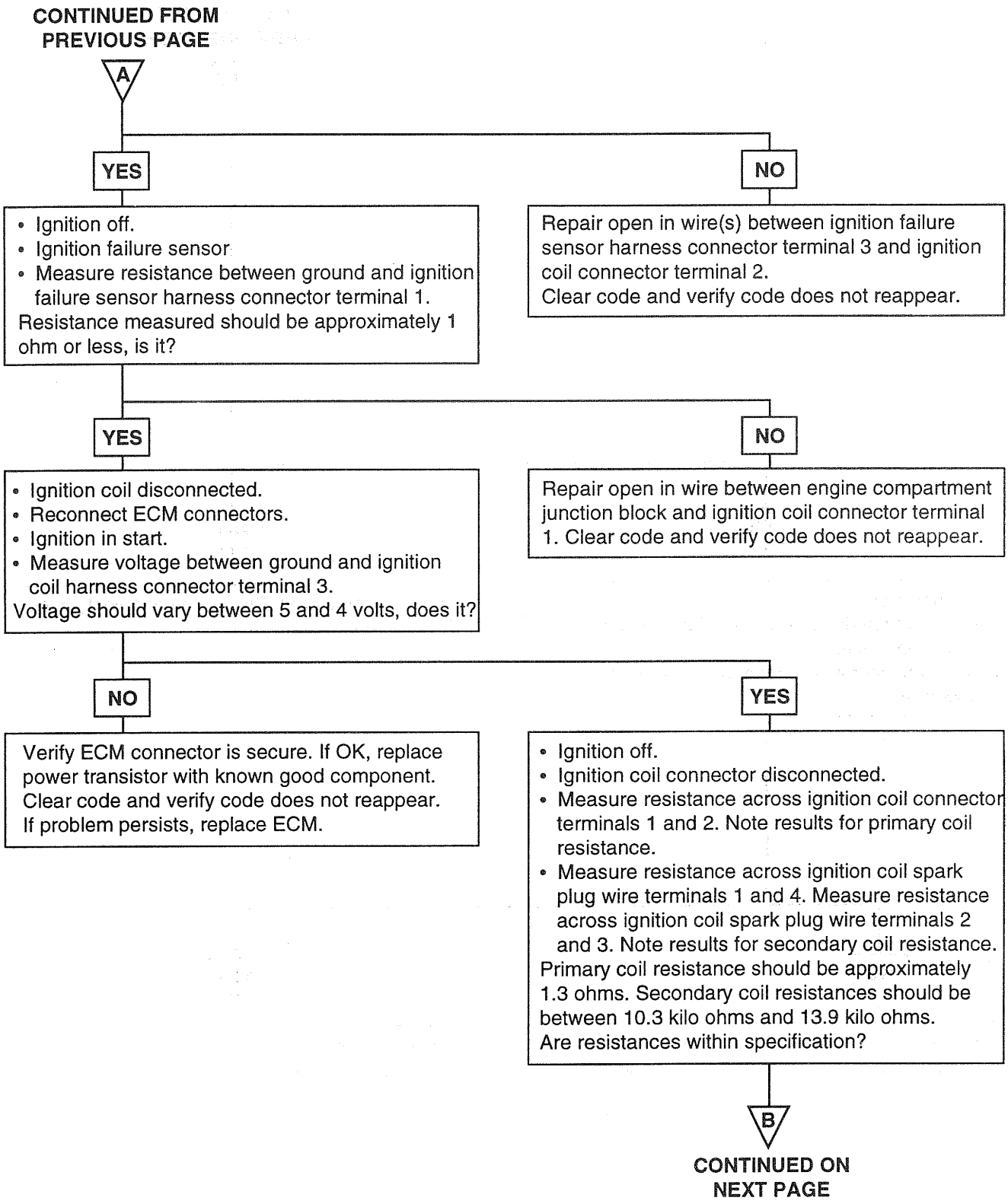
NO

Repair wire between engine compartment junction block and ignition coil connector terminal 1. Clear code and verify code does not reappear.

NO

A/T: Repair open in wire(s) between ignition coil connector terminal 3 and ECM connector C21-1 terminal 11 and 12.
M/T: Repair open in wire between ignition coil connector terminal 3 and ECM connector C22-1 connector terminal 10 and 23.
Clear code and verify code does not reappear.

HP0300B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A
YES
NO
• Ignition off.
• Ignition failure sensor
• Measure resistance between ground and ignition failure sensor harness connector terminal 1.
Resistance measured should be approximately 1 ohm or less, is it?
Repair open in wire(s) between ignition failure sensor harness connector terminal 3 and ignition coil connector terminal 2.
Clear code and verify code does not reappear.
YES
NO
• Ignition coil disconnected.
• Reconnect ECM connectors.
• Ignition in start.
• Measure voltage between ground and ignition coil harness connector terminal 3.
Voltage should vary between 5 and 4 volts, does it?
Repair open in wire between engine compartment junction block and ignition coil connector terminal 1. Clear code and verify code does not reappear.
NO
YES
Verify ECM connector is secure. If OK, replace power transistor with known good component.
Clear code and verify code does not reappear.
If problem persists, replace ECM.
• Ignition off.
• Ignition coil connector disconnected.
• Measure resistance across ignition coil connector terminals 1 and 2. Note results for primary coil resistance.
• Measure resistance across ignition coil spark plug wire terminals 1 and 4. Measure resistance across ignition coil spark plug wire terminals 2 and 3. Note results for secondary coil resistance.
Primary coil resistance should be approximately 1.3 ohms. Secondary coil resistances should be between 10.3 kilo ohms and 13.9 kilo ohms.
Are resistances within specification?
B
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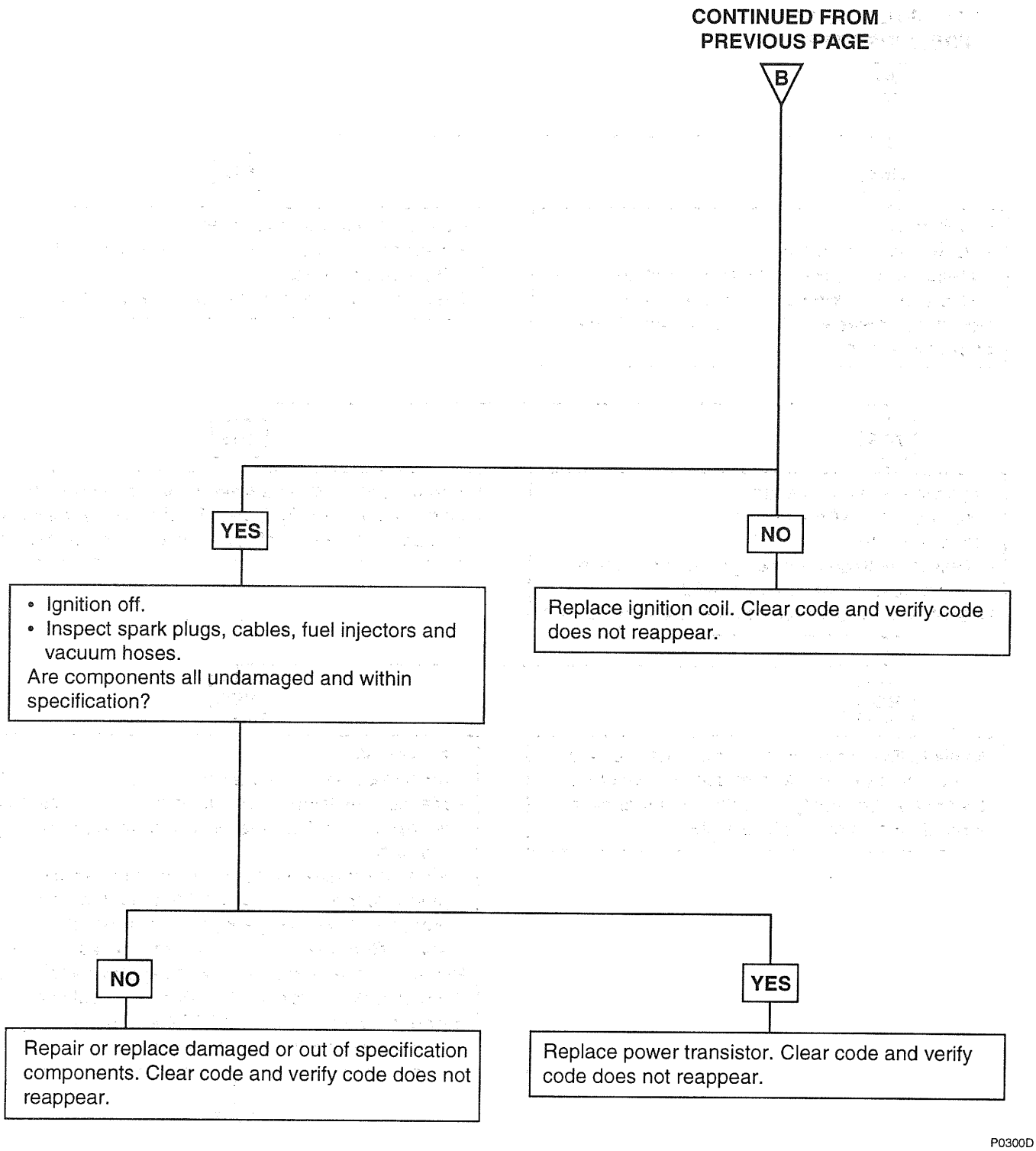
P0300C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B
YES
NO
• Ignition off.
• Inspect spark plugs, cables, fuel injectors and vacuum hoses.
Are components all undamaged and within specification?
Replace ignition coil. Clear code and verify code does not reappear.
NO
YES
Repair or replace damaged or out of specification components. Clear code and verify code does not reappear.
Replace power transistor. Clear code and verify code does not reappear.
P0300D

EFHA5120

DTC	Diagnostic item
P0301, P0302, P0303, P0304,	Misfire detected (Cylinder-1, Cylinder-2, Cylinder-3, Cylinder-4)

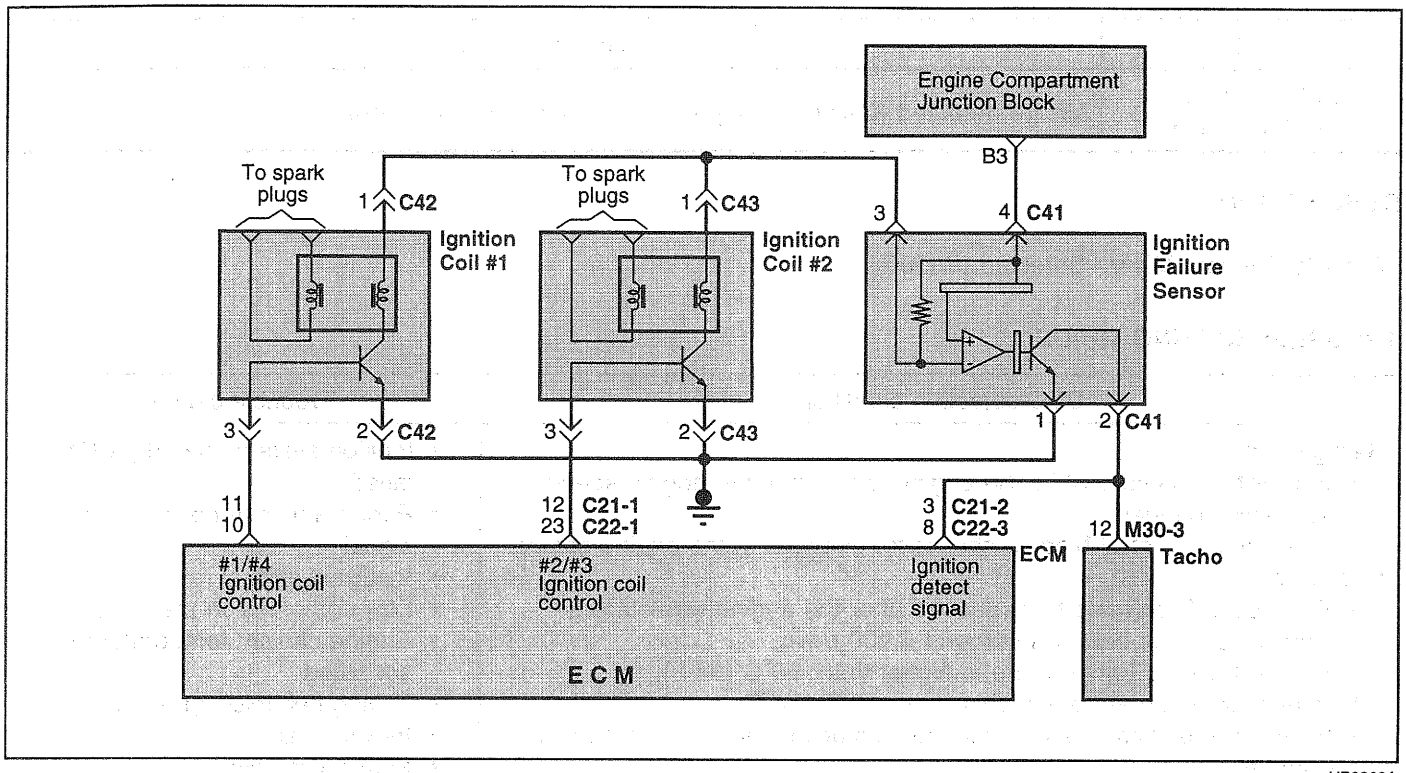
DESCRIPTION

Refer to Random Misfire Detected (P0300).

TROUBLESHOOTING GUIDE

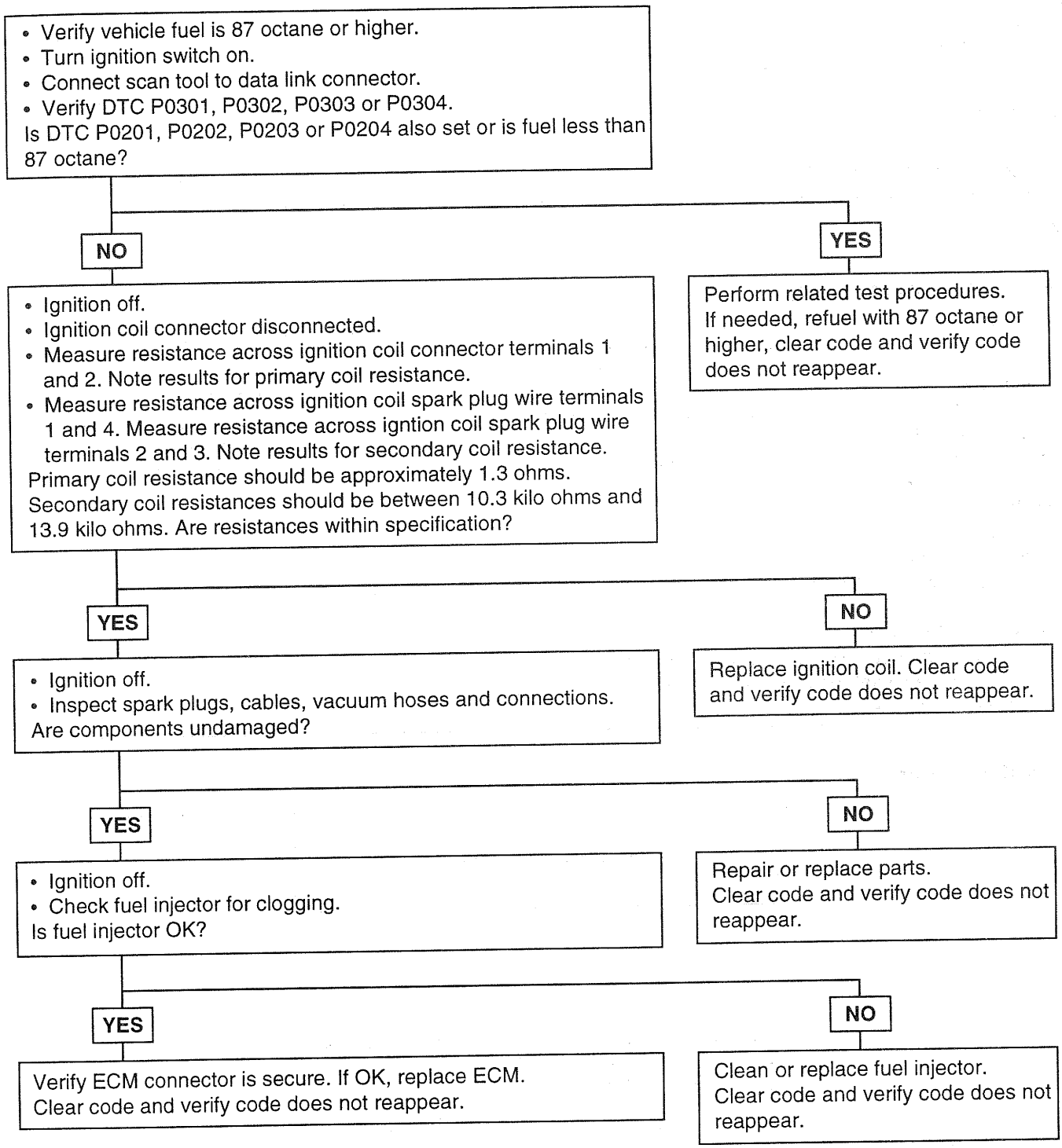
DTC detection condition	Probable cause
Background • If a misfiring occurs while the engine is running, the engine speed suddenly changes. • The Engine Control Module checks for changes in the engine speed. Check Area • Five seconds or more have passed after the engine was started. • Engine speed is between 500 and 6,000 r/min. • Engine Coolant Temperature is higher than -10°C (14°F). • Intake air temperature is higher than -10°C (14°F). • Running free from sudden accelerations/decelerations such as shift change. Judgment Criteria (change in the angular acceleration of the crankshaft is used for misfire detection.) • Misfire has occurred more frequently than allowed for during the last 200 revolutions [when the catalyst temperature is higher than 950°C (1,742°F)]. • Misfire has occurred more frequently than the allowed number of times (2%) during 1,000 motor revolutions.	• Ignition system related part(s) failed • Poor crankshaft position sensor signal • Incorrect air/fuel ratio • Low compression pressure • Engine coolant temperature sensor failed • Timing belt missing teeth • Injector failed • EGR valve failed • Engine control module failed

CIRCUIT DIAGRAM



HP0300A

TEST PROCEDURE



P0301B

EFHA5130

DTC	Diagnostic item
P0335	Crankshaft Position Sensor Circuit Malfunction

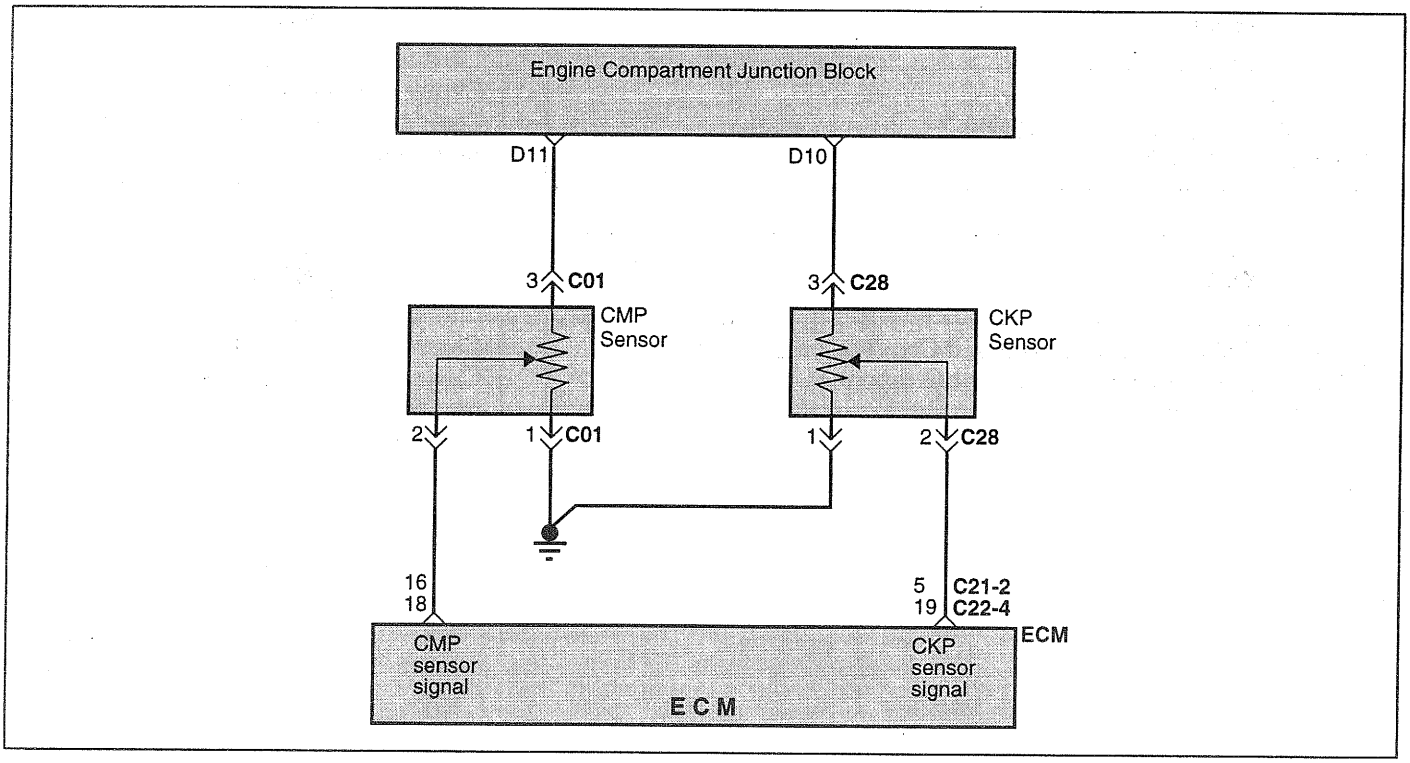
DESCRIPTION

The Crankshaft Position (CKP) sensor consists of a magnet and coil located next to the flywheel. The voltage signal from the CKP sensor allows the Engine Control Module (ECM) to determine the engine of the RPM and Crankshaft Position.

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • When the engine is running, the Crankshaft Position sensor outputs a pulse signal. • The Engine Control Module checks whether the pulse signal is input while the engine is cranking. Check Area • Engine is being cranked. Judgment Criteria • Sensor output voltage has not changed (no pulse signal is input) for 4 sec. Check Area, Judgment • Normal signal pattern has not been input for cylinder identification from the crankshaft position sensor signal and camshaft position sensor signal for 4 sec.	• Crankshaft position sensor failed • Open or shorted crankshaft position sensor circuit • Engine control module failed

CIRCUIT DIAGRAM



HP0335A

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0335 is set.

- Ignition on.
- Disconnect Crankshaft Position (CKP) sensor.
- Measure voltage between ground and CKP sensor harness connector terminal 3.

Battery voltage should be measured, is it?

YES

- Ignition off.
- CKP sensor disconnected.
- A/T: Disconnect ECM connector C21-2.
- M/T: Disconnect ECM connector C22-4.
- A/T: Ground CKP sensor harness connector terminal 2. Measure resistance between ground and ECM harness connector C21-2 terminal 5.
- M/T: Ground CKP sensor harness connector terminal 2. Measure resistance between ground and ECM harness connector C22-4 terminal 19.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- CKP sensor disconnected.
- A/T: Disconnect ECM connector C21-2. Measure resistance between ground and CKP sensor harness connector terminal 2.
- M/T: Disconnect ECM connector C22-4. Measure resistance between ground and CKP sensor harness connector terminal 2.

Resistance should indicate an open circuit, does it?

YES

A

CONTINUED ON NEXT PAGE

NO

Repair open in wire between CKP sensor harness connector terminal 3 and engine compartment junction block terminal D10.
Clear code and verify CKP sensor is within normal parameters.

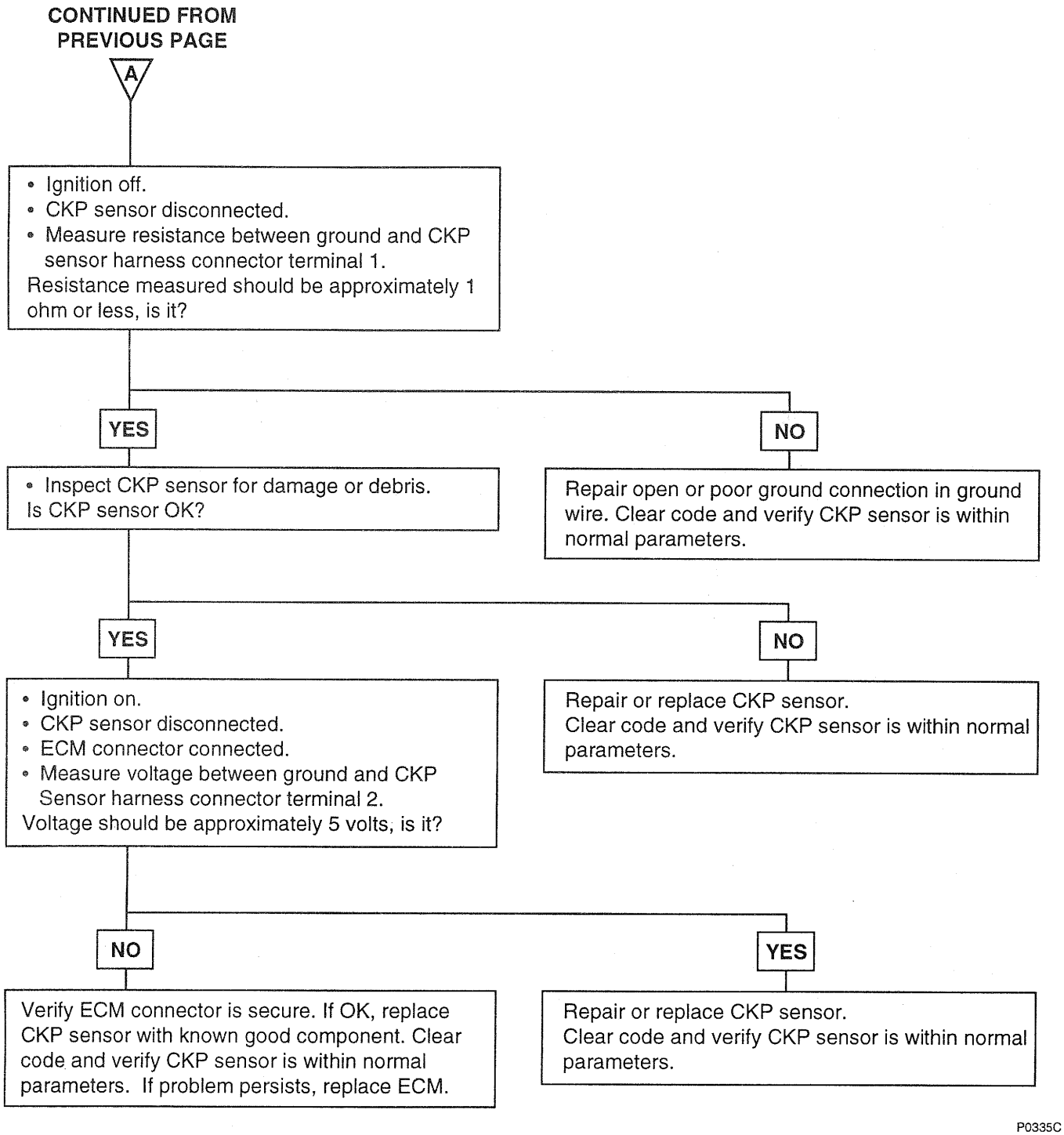
NO

A/T: Repair open in wire between CKP sensor harness connector terminal 2 and ECM harness connector C21-2 terminal 5.
M/T: Repair open in wire between CKP sensor harness connector terminal 2 and ECM harness connector C22-4 terminal 19.
Clear code and verify CKP sensor is within normal parameters.

NO

A/T: Repair short to ground or another circuit in wire between CKP sensor harness connector terminal 2 and ECM harness connector C21-2 terminal 5.
M/T: Repair short to ground or another circuit in wire between CKP sensor harness connector terminal 2 and ECM harness connector C22-4 terminal 19.
Clear code and verify CKP sensor is within normal parameters.

HP0335B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A
• Ignition off.
• CKP sensor disconnected.
• Measure resistance between ground and CKP sensor harness connector terminal 1.
Resistance measured should be approximately 1 ohm or less, is it?
YES
NO
• Inspect CKP sensor for damage or debris.
Is CKP sensor OK?
Repair open or poor ground connection in ground wire. Clear code and verify CKP sensor is within normal parameters.
YES
NO
• Ignition on.
• CKP sensor disconnected.
• ECM connector connected.
• Measure voltage between ground and CKP Sensor harness connector terminal 2.
Voltage should be approximately 5 volts, is it?
Repair or replace CKP sensor.
Clear code and verify CKP sensor is within normal parameters.
NO
YES
Verify ECM connector is secure. If OK, replace CKP sensor with known good component. Clear code and verify CKP sensor is within normal parameters. If problem persists, replace ECM.
Repair or replace CKP sensor.
Clear code and verify CKP sensor is within normal parameters.
P0335C

EFHA5140

DTC	Diagnostic item
P0340	Camshaft Position Sensor Circuit Malfunction

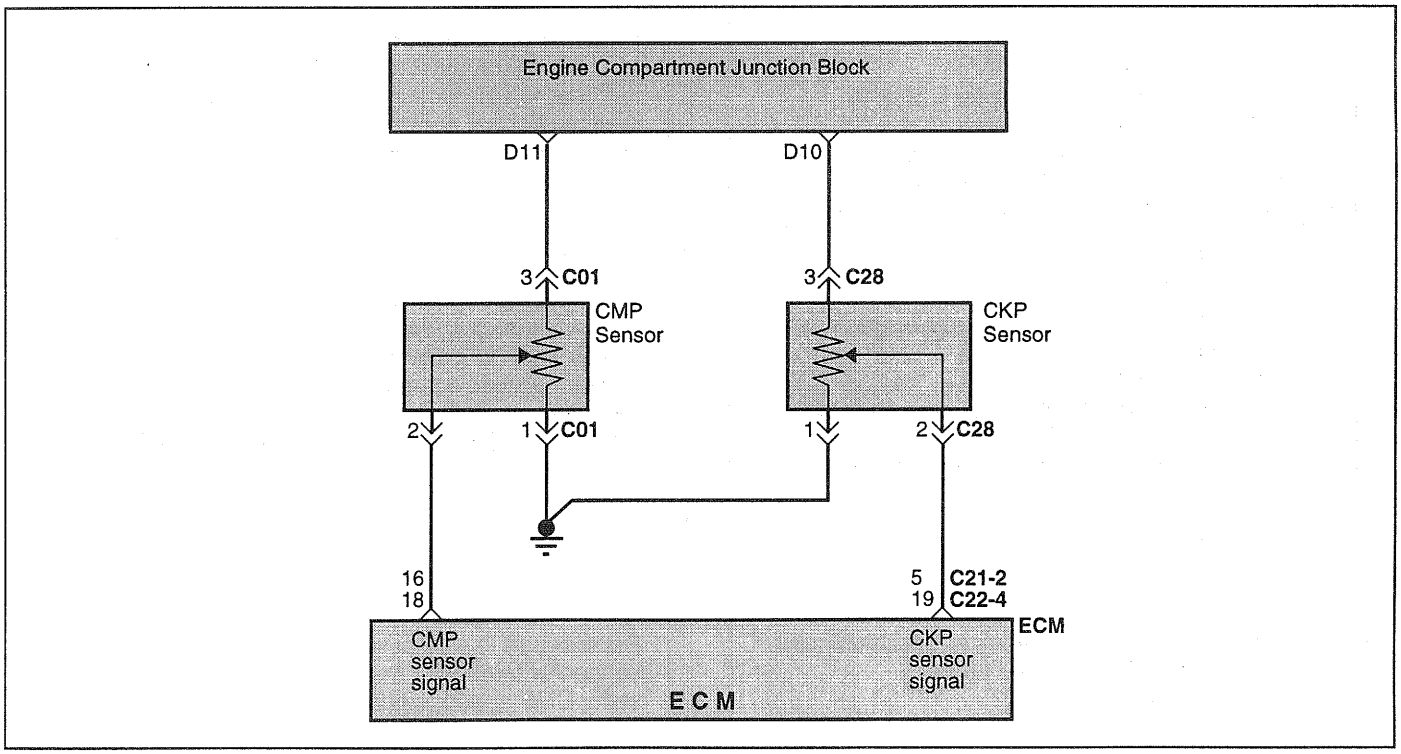
DESCRIPTION

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 ECM to determine the fuel injector sequence starting point.

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • When the engine is running, the Camshaft Position sensor outputs a pulse signal. • The Engine Control Module checks whether the pulse signal is input. Check Area, Judgement Criteria • Sensor output voltage has not changed (no pulse signal is input) for 4 sec. Check Area, Judgement Criteria • Normal signal pattern has not been input for cylinder identification from the camshaft position sensor signal for 4 sec.	• Camshaft Position sensor malfunction • Open or shorted camshaft position sensor circuit or loose connector • Engine control module failed

CIRCUIT DIAGRAM



HP0335A

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0340 is set.

- Ignition on.
- Disconnect Camshaft Position (CMP) sensor.
- Measure voltage between ground and CMP sensor harness connector terminal 3.

Battery voltage should be measured, is it?

YES

- Ignition off.
- CMP sensor disconnected.
- A/T: Disconnect ECM connector C21-2.
- M/T: Disconnect ECM connector C22-4.
- Ground CMP sensor harness connector terminal 2.
- Measure resistance between ground and ECM harness connector terminal 8 (for A/T) or 18 (for M/T).

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- CMP sensor disconnected.
- A/T: Disconnect ECM connector C21-2.
- M/T: Disconnect ECM connector C22-4.
- Measure resistance between ground and CMP sensor harness connector terminal 2.

Resistance should indicate an open circuit, does it?

YES

- Ignition off.
- CMP sensor disconnected.
- Measure resistance between ground and CMP sensor harness connector terminal 1.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Inspect CMP sensor for debris or misadjustment. Also verify timing is adjusted properly.

Is CMP sensor and timing OK?

YES

Verify ECM connector is secure. If OK, replace ECM. Clear code and verify CMP sensor signal is within normal parameters.

NO

Repair or replace CMP sensor as needed. Clear code and verify CMP sensor signal is within normal parameters.

NO

Repair open in wire between CMP sensor harness connector terminal 1 and ground. Clear code and verify CMP sensor signal is within normal parameters.

NO

Repair short to ground in wire between CMP sensor harness connector terminal 2 and ECM harness connector terminal. Clear code and verify CMP sensor signal is within normal parameters.

NO

Repair open in wire between CMP sensor harness connector terminal 2 and ECM harness connector terminal. Clear code and verify CMP sensor signal is within normal parameters.

NO

Repair open in wire between CMP sensor harness connector terminal 3 and engine compartment junction block terminal D11.
Clear code and verify CMP sensor signal is within normal parameters.

HP0340B

EFHA5170

DTC	Diagnostic item
P0421	Warm Up Catalyst Efficiency Below Threshold (Bank 1)

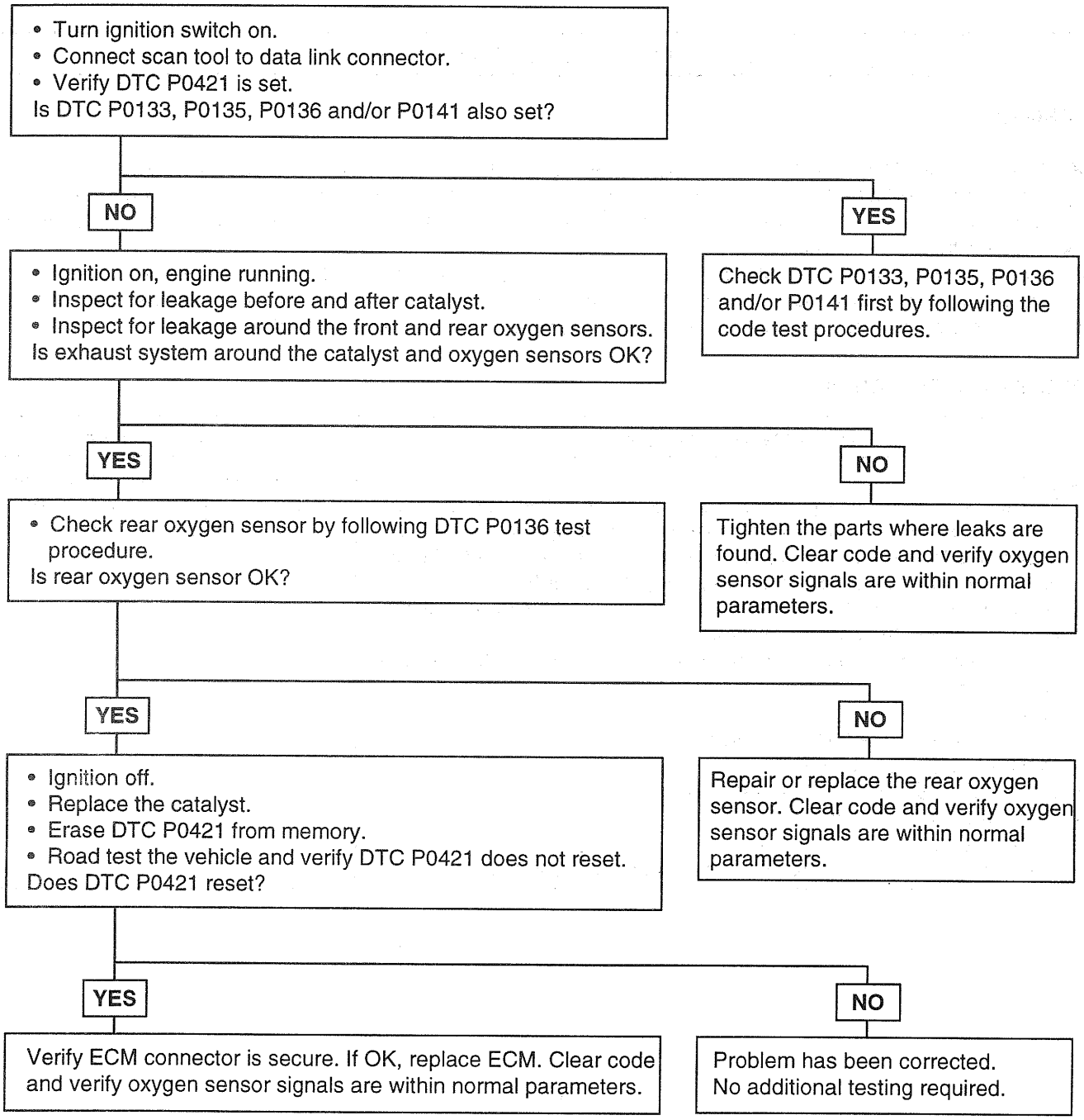
DESCRIPTION

The ECM compares the waveform of the oxygen sensor located in front of the catalyst with the waveform of the oxygen sensor located after the catalyst to determine whether or not catalyst performance has deteriorated. Air-fuel ratio feedback compensation keeps the waveform of the oxygen sensor in front of the catalyst repeatedly changing back and forth from rich to lean.
If the catalyst is functioning normally, the waveform of the oxygen sensor after the catalyst switches back and forth between rich and lean much more slowly than the waveform of the oxygen sensor in front of the catalyst. But when both waveforms change at a similar rate, it indicates that catalyst performance has deteriorated.

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • The signal from the heated oxygen sensor which follows the catalytic converter differs from that which precedes the catalytic converter. This is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the heated oxygen sensor which follows the catalytic converter becomes similar to that which precedes the catalytic converter. • The Engine Control Module checks the outputs of the heated oxygen sensor signals. Check Area • Engine speed is 3,000 r/min or higher. • Closed throttle position switch: OFF • Under the closed loop air-fuel ratio control • Monitoring Time: 140 sec. Judgment Criteria • The front or rear heated oxygen sensor signal is abnormal.	• Catalytic converter deteriorated • Heated oxygen sensor failed • Engine control module failed

TEST PROCEDURE



HP0421B

EFHA5190

DTC	Diagnostic item
P0443	Evaporative Emission Control System Purge Control Valve Circuit Malfunction

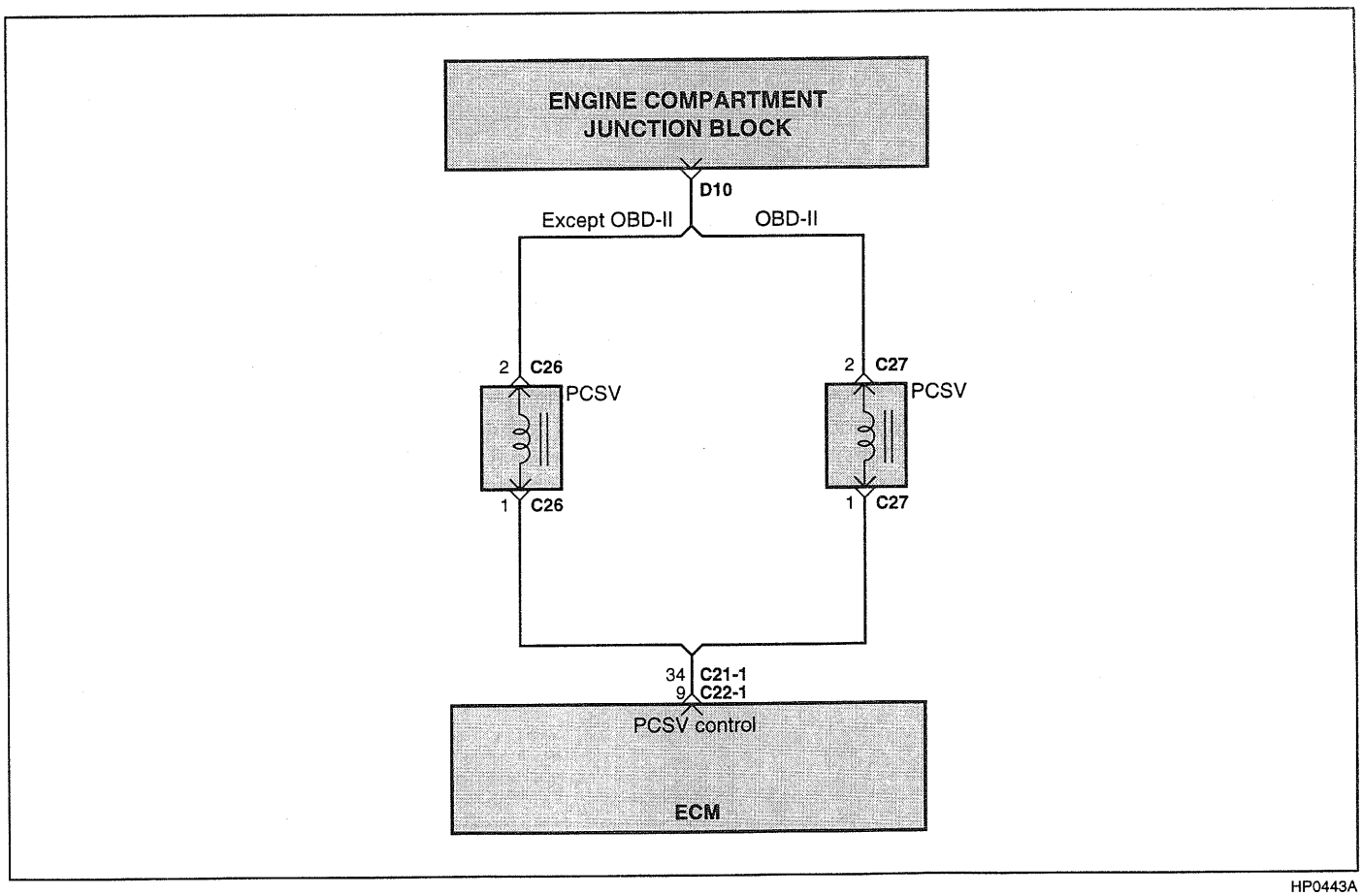
DESCRIPTION

The evaporative system reduces hydrocarbon emission by trapping fuel tank vapors until they can be burned as part of the incoming fuel charge. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold.

TROUBLESHOOTING GUIDE

DTC detection condition	Probable cause
Background • The engine control module checks current flows in the evaporative emission purge solenoid drive circuit when the solenoid is ON and OFF. Check Area • Battery voltage is 10V or higher. Judgment Criteria • Solenoid coil surge voltage (system voltage +2V) is not detected when the EVAP emission vent solenoid is turned on/off.	• Evaporative emission purge solenoid failed • Open or shorted evaporative emission purge solenoid circuit, or loose connector • Engine control module failed

CIRCUIT DIAGRAM



HP0443A

TEST PROCEDURE

- Turn ignition switch on.
- Connect scan tool to data link connector.
- Verify DTC P0443 is set.

- Turn ignition off
- Disconnect PCSV(Purge Control Solenoid Valve) connector.
- Turn ignition on.
- Measure voltage between ground and PCSV harness connector terminal 2.

Battery voltage should be present, is it?

YES

- Turn ignition off.
- PCSV disconnected.
- A/T: Disconnect ECM connector C21-1. Ground PCSV harness connector terminal 1.
- Measure resistance between ground and ECM harness connector C21-1 terminal 34.
- M/T: Disconnect ECM connector C22-1. Ground PCSV harness connector terminal 1. Measure resistance between ground and ECM harness connector C22-1 terminal 9.

Resistance measured should be approximately 1 ohm or less, is it?

YES

- Ignition off.
- ECM disconnected.
- EGR solenoid valve disconnected.
- Measure resistance between ground and EGR control solenoid valve harness connector terminal 1.

Resistance should indicate an open circuit, does it?

A

CONTINUED ON NEXT PAGE

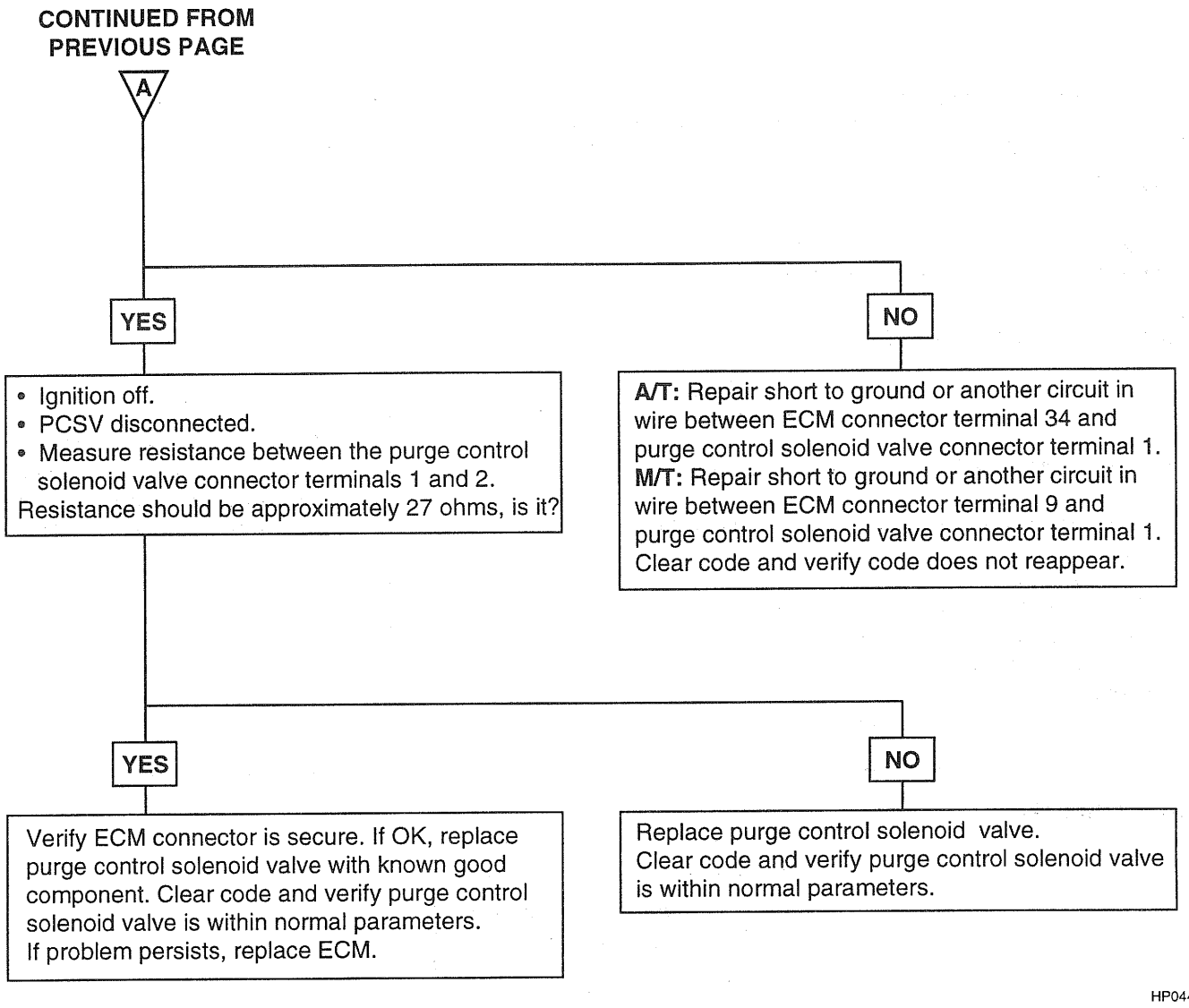
NO

Repair open or short to ground in wire between engine compartment junction block terminal D10 and PCSV connector terminal 2.
Clear codes and verify PCSV is within normal parameters.

NO

A/T: Repair open in wire between ECM connector C21-1 terminal 34 and PCSV harness connector terminal 1.
M/T: Repair open in wire between ECM connector C22-1 terminal 9 and PCSV harness connector terminal 1.
Clear codes and verify PCSV is within normal parameters.

HP0443B


CONTINUED FROM PREVIOUS PAGE
A
YES
NO
• Ignition off.
• PCSV disconnected.
• Measure resistance between the purge control solenoid valve connector terminals 1 and 2.
Resistance should be approximately 27 ohms, is it?
A/T: Repair short to ground or another circuit in wire between ECM connector terminal 34 and purge control solenoid valve connector terminal 1.
M/T: Repair short to ground or another circuit in wire between ECM connector terminal 9 and purge control solenoid valve connector terminal 1.
Clear code and verify code does not reappear.
YES
NO
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.
Replace purge control solenoid valve.
Clear code and verify purge control solenoid valve is within normal parameters.

HP0443C

EFHA5220

DTC	Diagnostic item
P0500	Vehicle Speed Sensor Malfunction

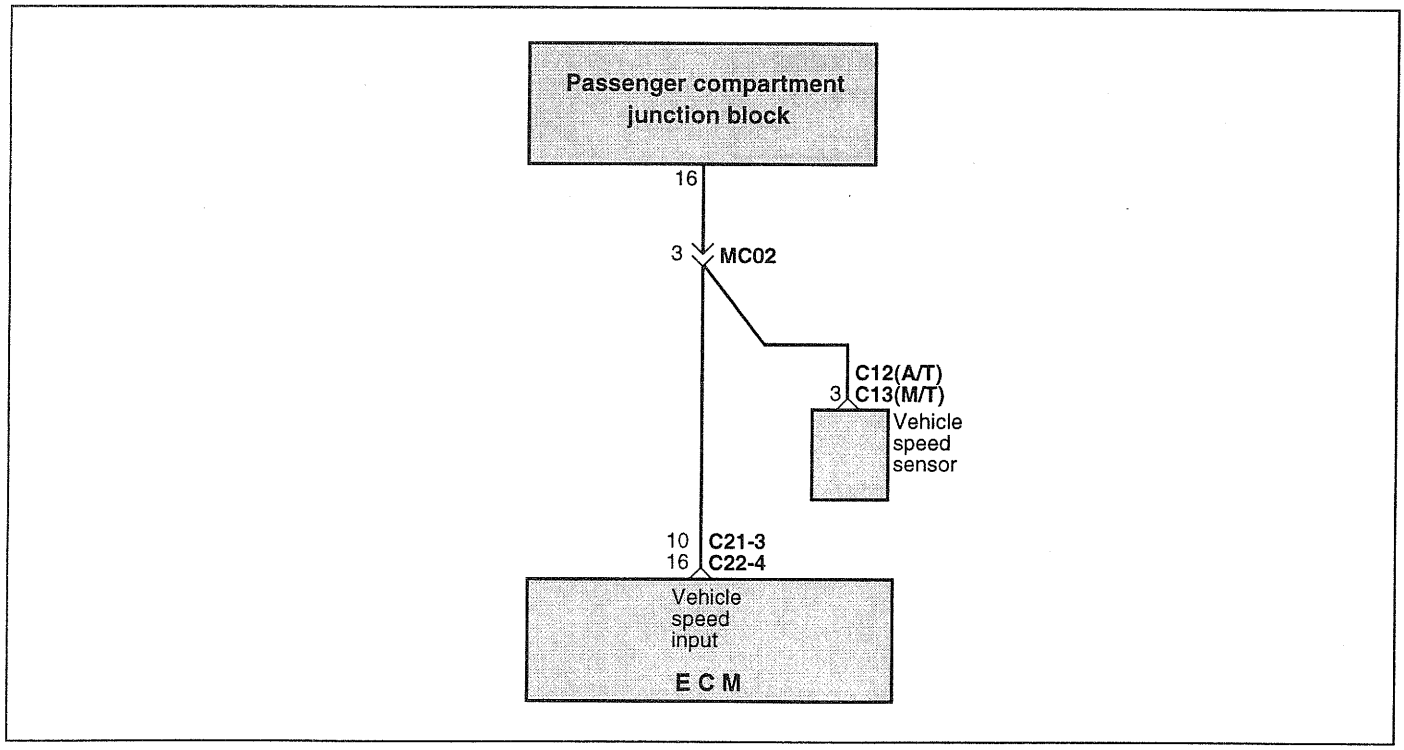
DESCRIPTION

The vehicle speed sensor outputs a pulse signal while the vehicle is driven.
The engine control module checks whether the pulse signal is output.

TROUBLESHOOTING GUIDE

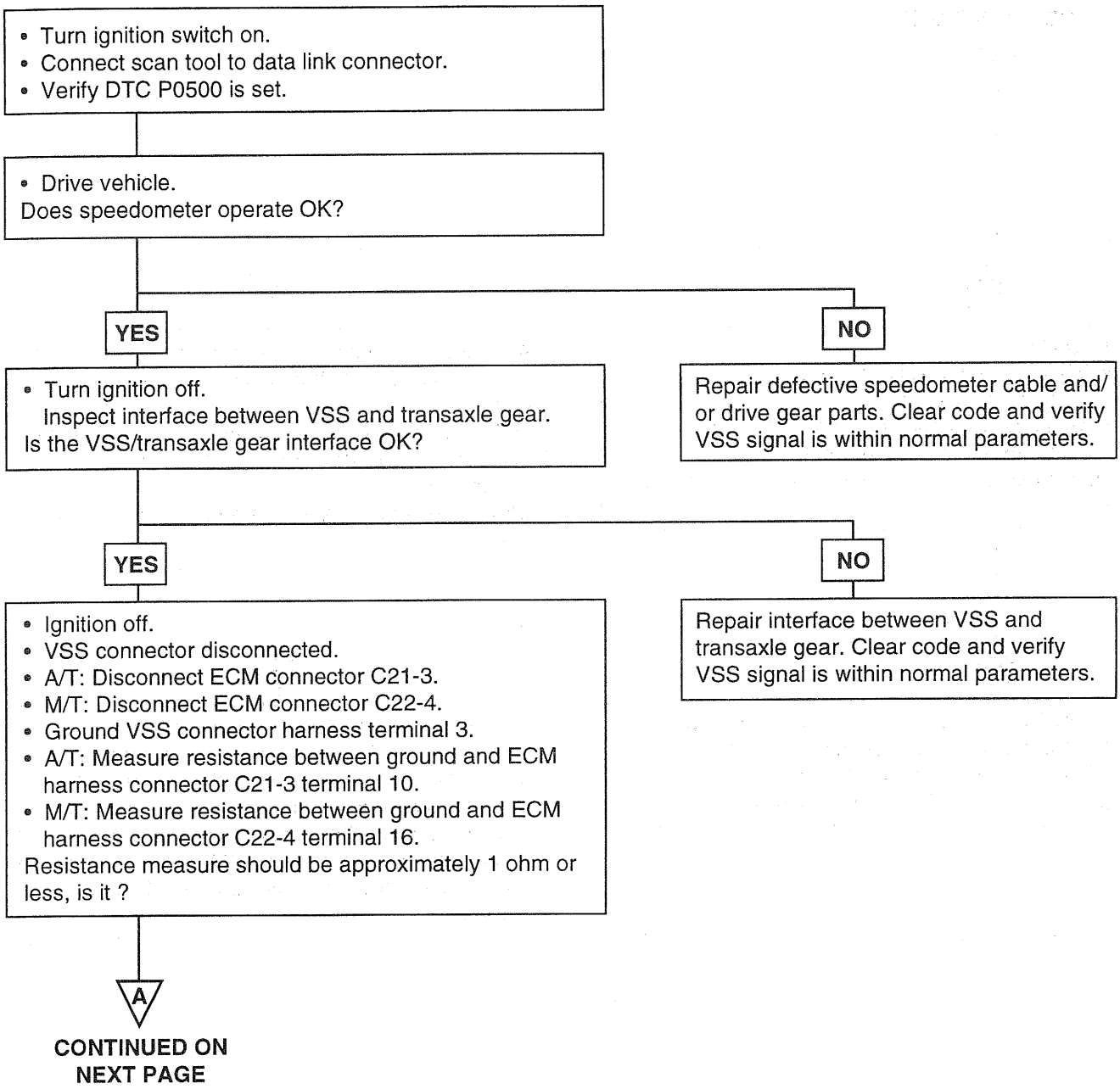
DTC detection condition	Probable cause
Background • The vehicle speed sensor outputs a pulse signal while the vehicle is driven. • The engine control module checks whether the pulse signal is outputted. Check Area • Closed throttle position switch: OFF • Engine speed is 3,000 r/min or more. • Engine load is 70% or more. Judgment Criteria • Sensor output voltage has not changed (no pulse signal is input) for 4 sec.	• Vehicle speed sensor failed • Open or shorted vehicle-speed sensor circuit, or loose connector • Engine control module failed

CIRCUIT DIAGRAM



HP0500A

TEST PROCEDURE



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HP0500B

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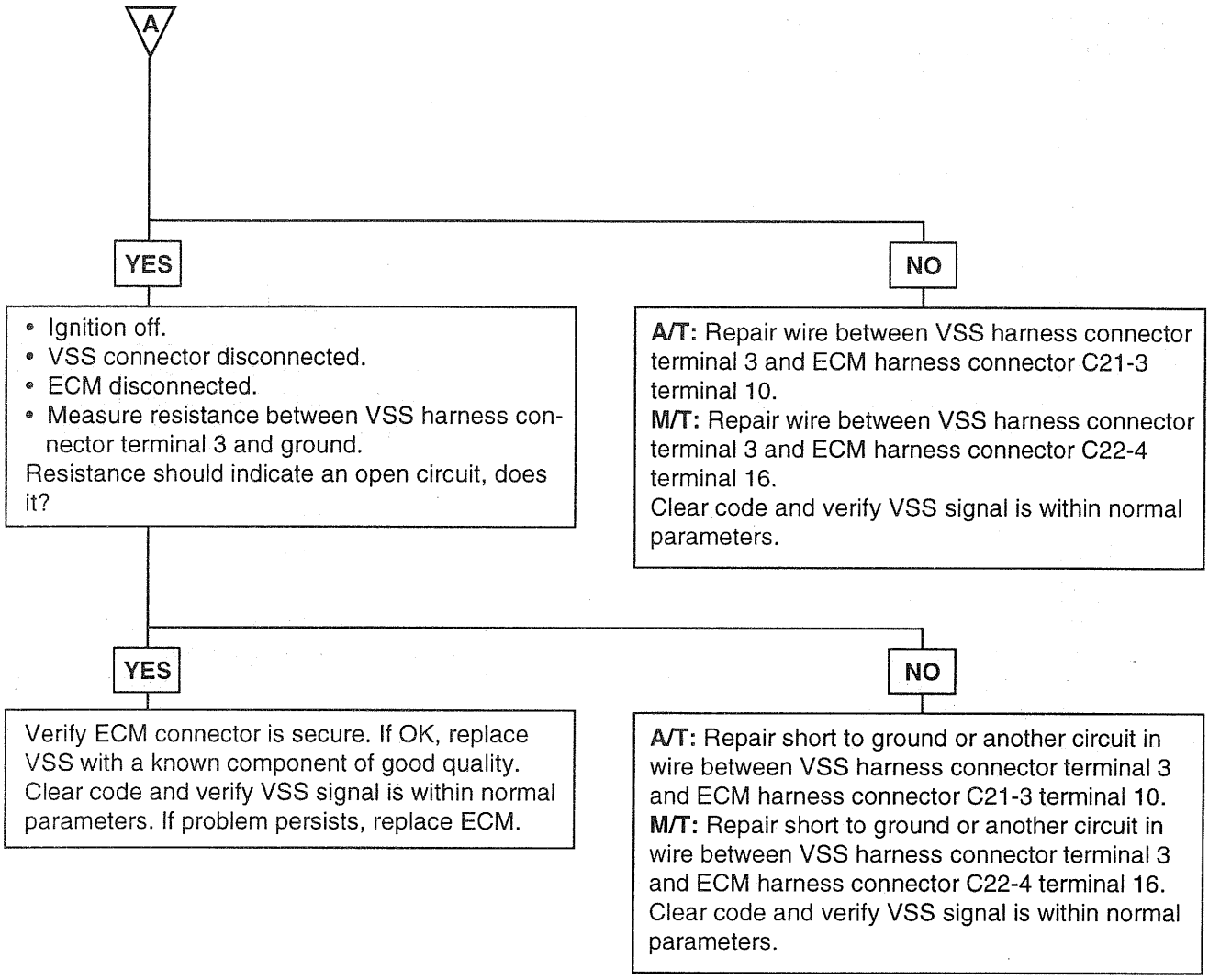


HP0500C

General Information

HOW TO USE THIS MANUAL EFHA0010

This manual is divided into 21 sections. The first page of each section is marked with a black tab at the edge of the page. You can quickly find the first page of each section without looking through the whole table of contents.

Each section includes the essential removal, installation, adjustment and maintenance procedures for servicing all body styles. This information is correct at the time of publication.

An **INDEX** is provided on the first page of each section to guide you to the related item.

TROUBLESHOOTING tables are included for each system to help you diagnose the system problem and find the cause. The repair for each possible cause is referred to the remedy column to lead you to the solution quickly.

DEFINITION OF TERMS

STANDARD VALUE (SERVICE STANDARD)

Indicates the value used when a part or assembled item should be inspected, or the value to which a part or assembled item should be adjusted after reinstallation. It is given by a tolerance.

SERVICE LIMIT

Indicates the maximum or minimum value that a part or assembled item must function when inspecting. It is a value established beyond the standard value.

NOTE, WARNING , CAUTION, ABBREVIATION NOTE

NOTE

Information to have to know in reference to a repair service.

CAUTION

Information about an activity that could cause damage to the vehicle.

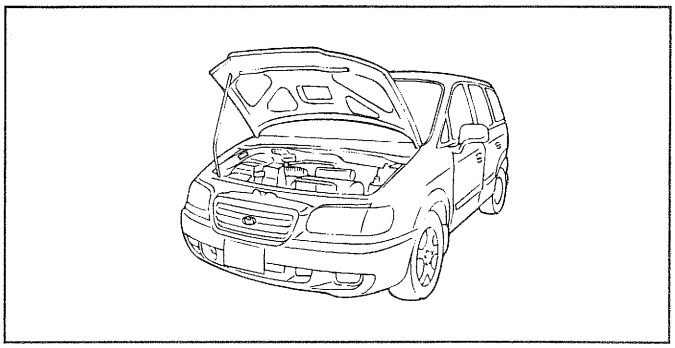
WARNING

Information about an activity that could cause injury or damage to the driver, occupants or repairman.

ABBREVIATIONS
DOHC : Double Over Head Camshaft
V-6 : V-typed 6 Cylinder

VEHICLE IDENTIFICATION NUMBER LOCATION

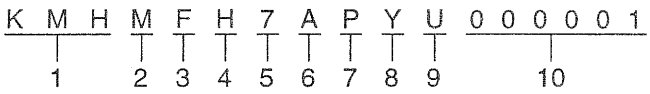
The vehicle identification number (VIN) is located on the top of the fire wall and on the side of the left front door pillar.



EGHA100A

VEHICLE IDENTIFICATION NUMBER

Vehicle identification number consists of 17 digit.



EAHA001B

1. W.I.C. (World manufacturer's Identification Code)
   KMH - Hyundai Motor Company, Korea
2. Vehicle Line
   M : TRAJET XG
3. Model & Series
   F : Standard (L) or Wagon
   G : Deluxe (GL)
   H : Super deluxe (GLS)
   J : Grand salon (GDS)
   K : Super grand salon (HGS)
4. Body Type
   H : Semi bonnet type
   8 : Wagon
   5 : Sedan 5DR
5. Restraint system or brake system
   1 - A/ Belt (Driver side + Passenger side)
   2 - P/ Belt (Driver side + Passenger side)
   3 - Driver side : A/ Belt + A/Bag, Passenger side : A/Belt or P/Belt
   4 - A/ Belt + A/ Bag (Driver side + Passenger side)
   7– Hydraulic brake

NOTE

A/Belt : Acfive belt

P/Belt : Passive belt

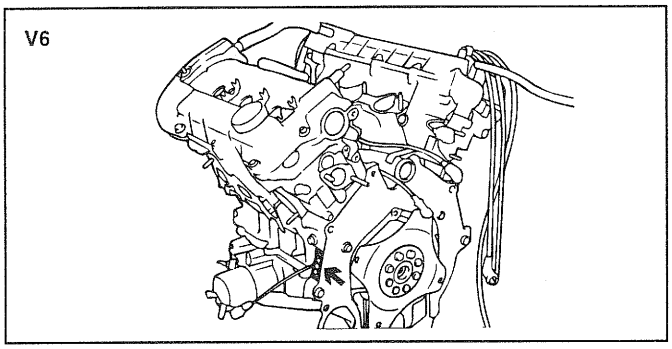
A/Bag : Air bag

6. Engine type

A : G 2.0 I4
C : G 2.7 V6
7. Driver side
P : LHD (Left hand driver)
R : RHD (Reft hand driver)
8. Production year
W - 1998 Model Year
X - 1999 Model Year
Y - 2000 Model Year
1 - 2001 Model Year
9. Production plant
U - Ulsan (Korea)
10. Vehicle production sequence number
000001 - 999999

ENGINE IDENTIFICATION NUMBER LOCATION

The engine identification number is stamped on the right front side of the top edge of the cylinder block.



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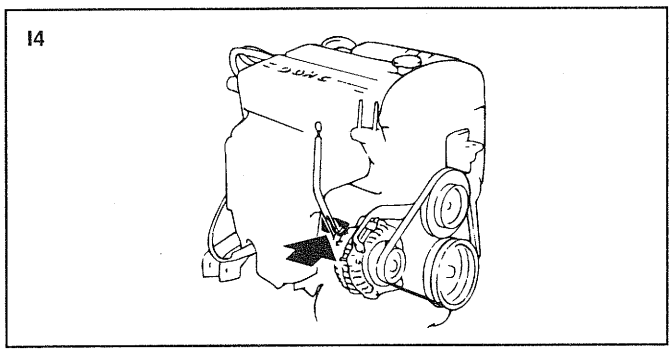
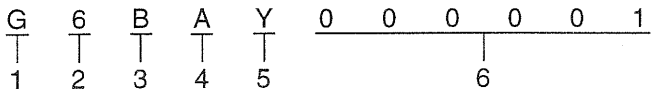


EAHA004B

DESCRIPTION OF ENGINE IDENTIFICATION NUMBER

The engine identification number consists of 11 digits.

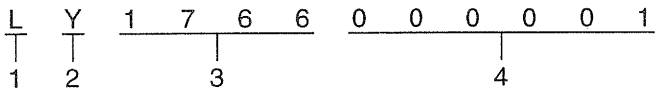


EAHA001D

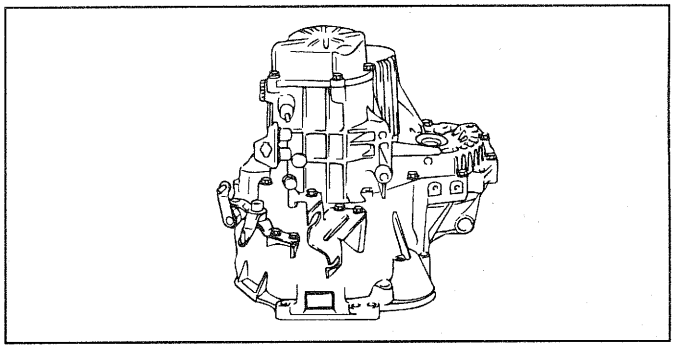
1. Engine fuel
G - Gasoline
2. Engine range
4 - In line 4 cycle 4 cylinder
6 - V type 4 cycle 6 cylinder
3. Engine development order
B - V6 delta Engine
J - SIRIUS II DOHC Engine
4. Engine capacity
P - 1997cc
A - 2656cc
5. Production year
X - 1999
Y - 2000
1 - 2001
2 - 2002
6. Engine production sequence number
000001 - 999999

TRANSAXLE IDENTIFICATION NUMBER LOCATION

DESCRIPTION (MANUAL TRANSAXLE)



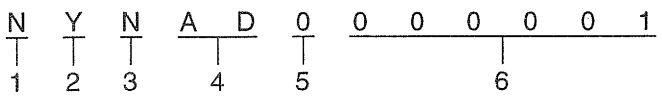
EAAA001E



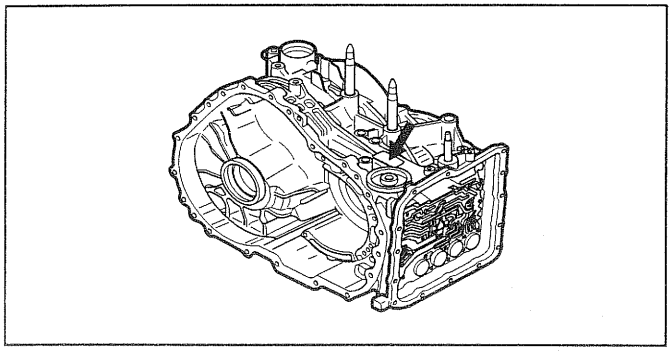
EAA9005A

1. Model
L : M5G Series.
2. Production year
W : 1998
X : 1999
Y : 2000
3. Final gear ratio
1766 : 3,882
1665 : 4,063
4. Transmission production sequence number
000001 ~ 999999

DESCRIPTION (AUTOMATIC TRANSAXLE)



EAHA001G



KFW9009T

1. Model
   N : F4A42 (2.0 I4)
   S : F4A51 (2.7 V6)
2. Production year
   W : 1998
   X : 1999
   Y : 2000
3. Final gear ratio
   N : 4.018 (F4A51)
   O : 4.407 (F4A42)
4. Classification of detail
   AD : Damper spring type
5. Spare
6. Transmission production sequence number.

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 possibly injuring you.

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.

A WORD ABOUT SAFETY

The following precautions must be followed when jacking up the vehicle.

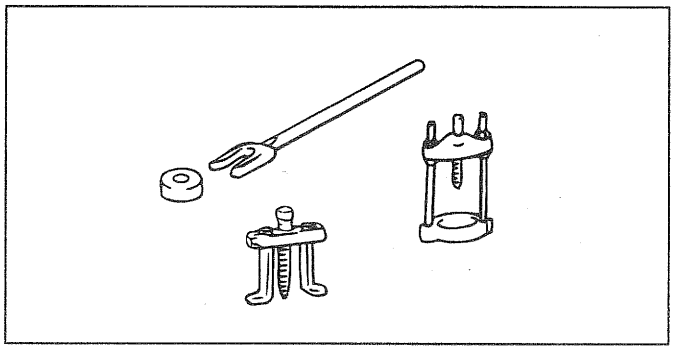
1. Block wheels.
2. Place a jack under the specified jacking point.
3. Support the vehicle with safety stands (jack stands) Refer to the page GI-10.
4. Start the engine when engine compartment is clean.

PREPARATION OF TOOLS AND MEASURING EQUIPMENT

Be sure that all necessary tools and measuring equipments are available before starting work.

SPECIAL TOOLS

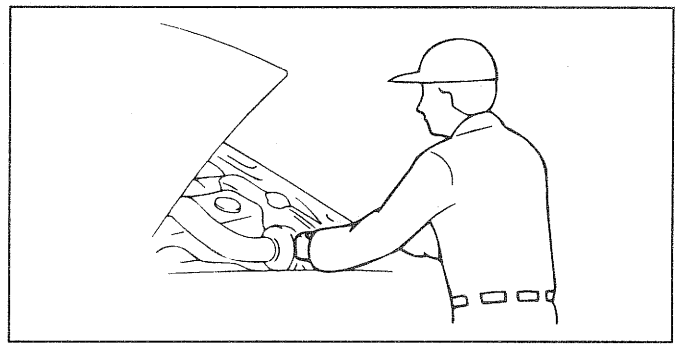
Use special tools when they are required.



EAA9006A

REMOVAL OF PARTS

First find the cause of trouble and then make sure whether removing or disassembling is required before starting the job.



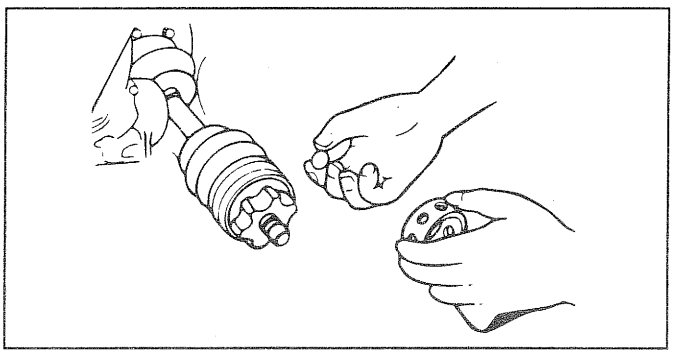
EADA010I

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 inspected for malfunction, deformation, damage, and other problems.

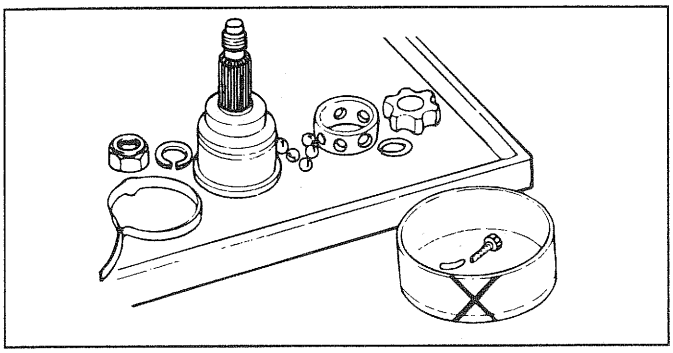


EADA010J

2. **Arrangement of parts**

All disassembled parts should be carefully arranged for effective reassembly.

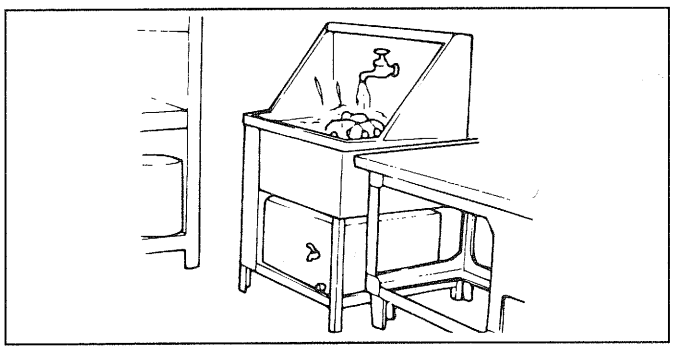
Be sure to separate and correctly identify the parts to be replaced from those that will be used again.



EAA9008B

3. **Cleaning parts for reuse**

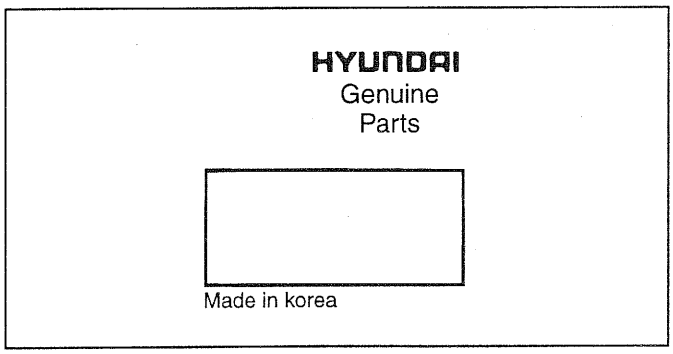
All parts to be used again should be carefully and thoroughly cleaned by the appropriate method.



EADA010K

PARTS

When replacing parts, use HYUNDAI genuine parts.



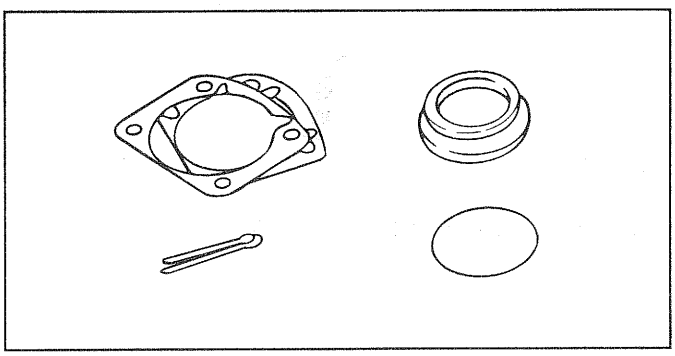
EADA010M

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 be replaced with new ones.

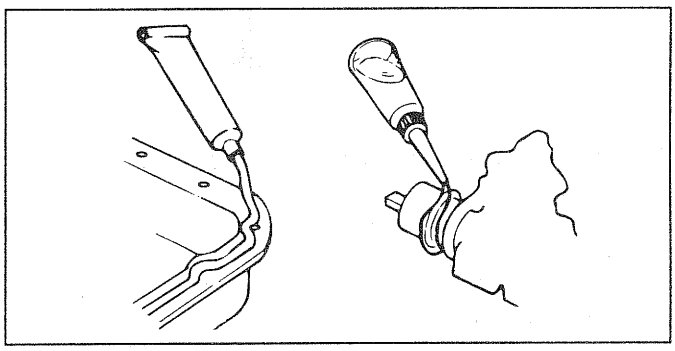
1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



EADA010N

Depending on their location.

1. Sealant should be applied to gaskets.
2. Oil should be applied to the moving components of parts.
3. Specified oil or grease should be applied to the prescribed locations (oil seals, etc.) before assembly.



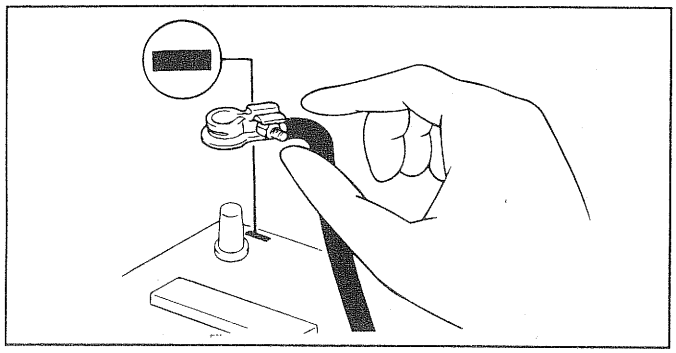
EADA010O

ADJUSTMENT

Use gauges and testers to correctly adjust the parts to standard values correctly.

ELECTRICAL SYSTEM

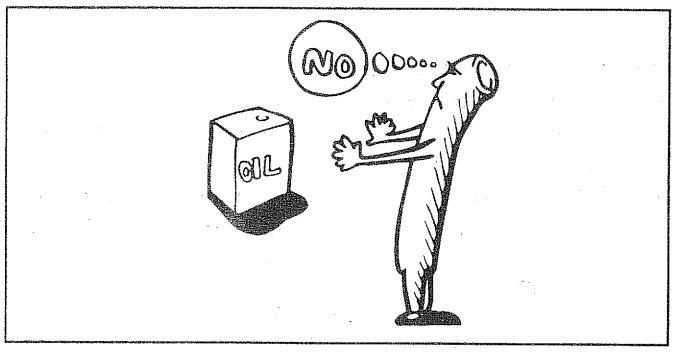
1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull the wiring when disconnecting connectors.
3. Locking connectors will click when the connector is secure.
4. Handle sensors and relays carefully. Be careful not to drop them or hit them against other parts.



EAA9011A

RUBBER PARTS AND TUBES

Always prevent gasoline or oil from touching rubber parts or tubing.



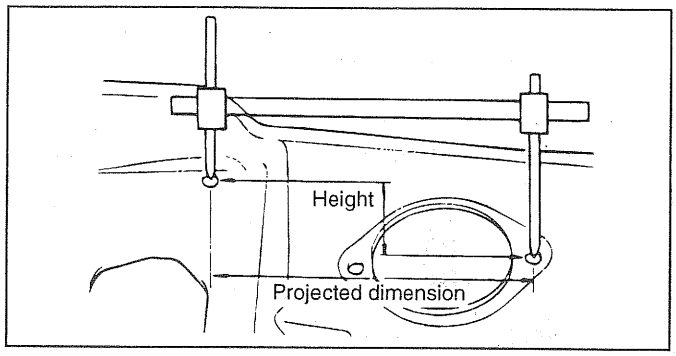
EADA010Q

MEASURING BODY DIMENSIONS

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 dimension and actual-measurement dimension are used in this manual.

DIMENSIONS PROJECTED

1. These are the dimensions measured when the measurement points are projected from the vehicles 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.



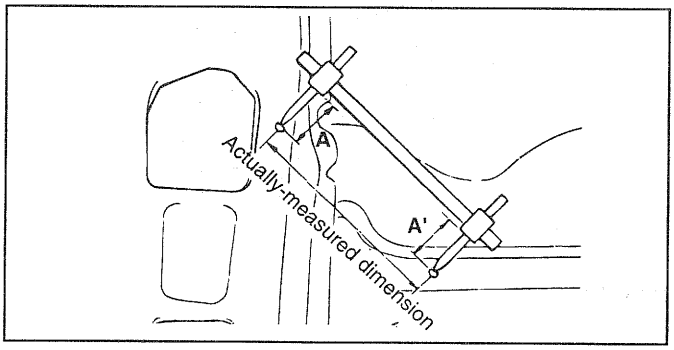
EADA011M

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

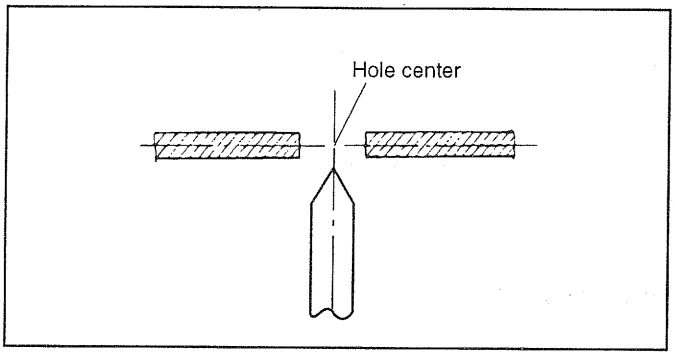
Check the probes and gauge itself to make sure there is no free play.



EADA011N

MEASUREMENT POINT

Measurement should be taken at the center of the hole.

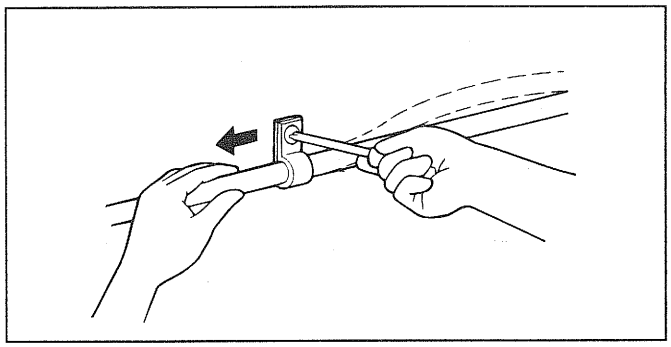


EADA011O

CHECKING CABLES AND WIRES

1. Check the terminal for tightness.
2. Check terminals and wires for corrosion by battery electrolyte, etc.

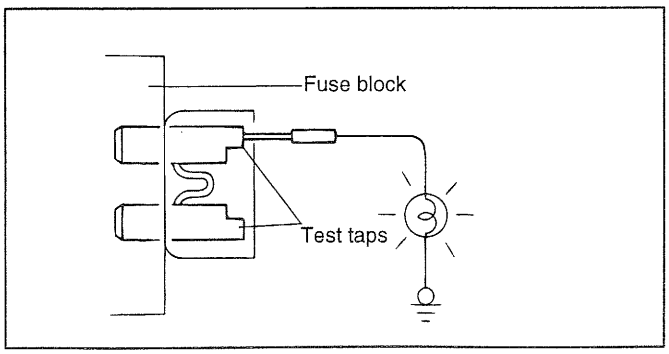
3. Check terminals and wires for open circuit or whether open circuit will happen or not.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounding parts to verify that there is complete continuity between attaching bolt(s) and vehicle body.
7. Check for incorrect wiring.
8. Check that wirings are so clamped as to prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, pipe, etc.)
9. Check that wirings are clamped firmly to secure enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wirings have a little space so that they can vibrate between the fixed parts such as the vehicle body and the vibrating parts such as the engine.



EADA011B

CHECKING FUSES

A blade type of fuse has test taps provided to allow to check the fuse itself without removing it from the fuse block. The fuse is good if the test lamp lights up when its one lead is connected to the test taps (one at a time) and the other lead is grounded. (Change the ignition switch position adequately so that the fuse circuit becomes operative.)



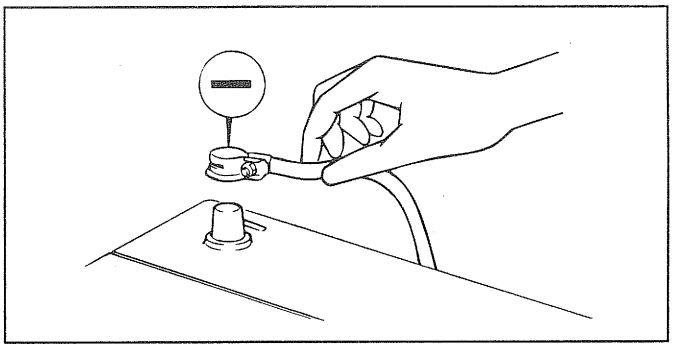
EAA9014B

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.

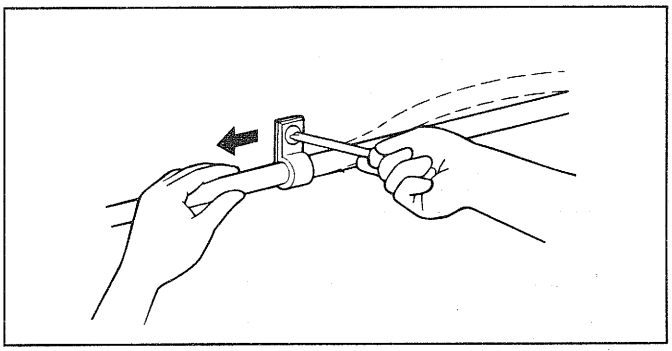
NOTE

In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic code retained by the computer will be cleared. Therefore, if necessary, read the diagnostic codes before removing the battery cable.



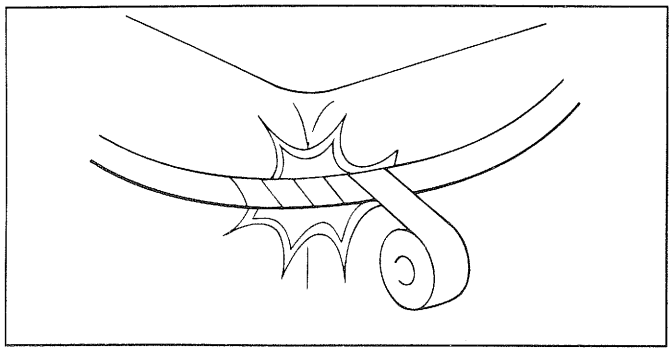
EADA011A

2. Fix the wiring harnesses by using clamps so that there may be 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.



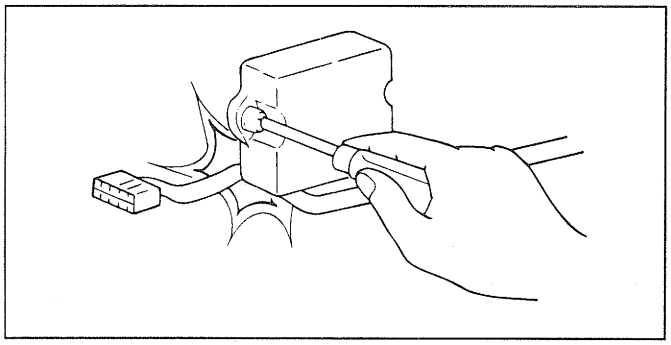
EADA011B

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.



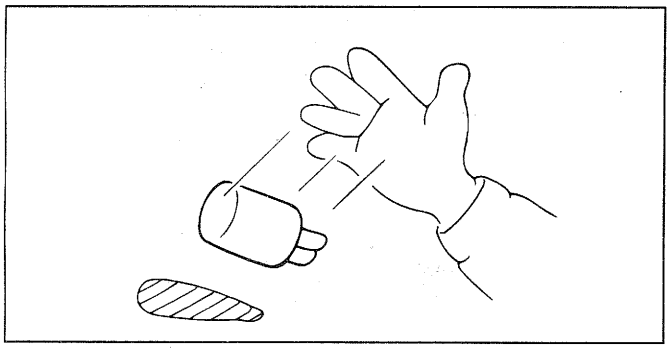
EADA011C

4. When installing any of the vehicle parts, be careful not to pinch or damage any of the wiring harnesses.



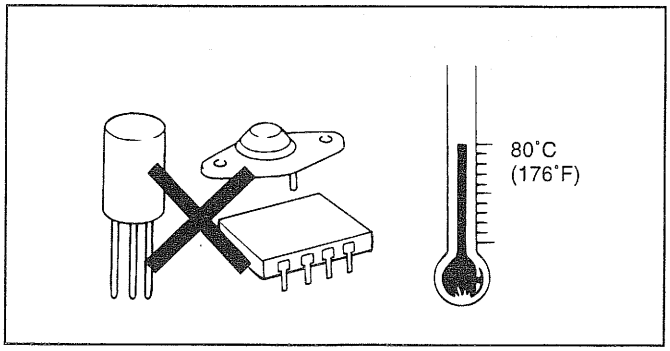
EADA011D

5. Never throw the relays, sensors and electrical parts, or expose them to strong shock.



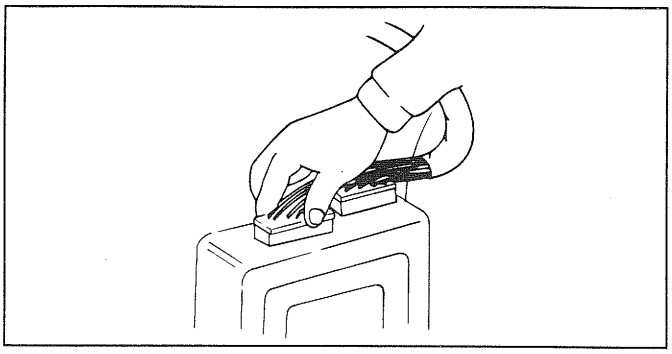
EADA011E

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 electronic parts beforehand.



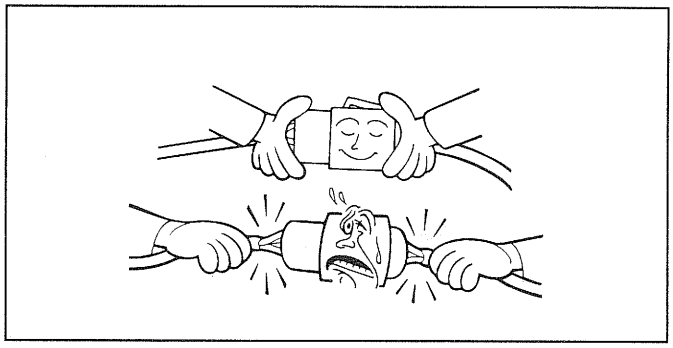
EADA011F

7. Loose connectors could make troubles. Make sure that the connectors are connected securely.



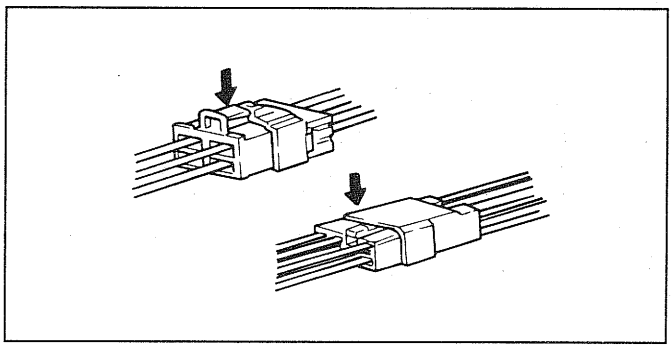
EADA011G

8. When disconnecting a connector, be sure to grip only the connector, not the harness.



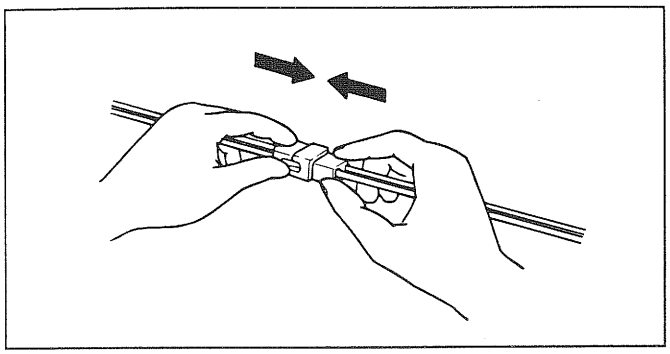
EADA011H

9. Disconnect connectors which have catches by pressing in the direction of the arrows shown the illustration.



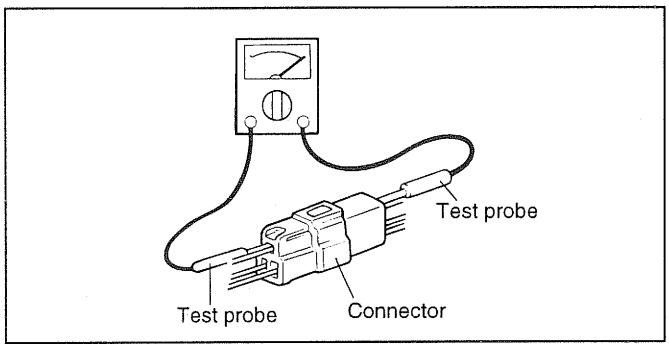
EADA011I

10. Connect connectors which have catches by inserting the connectors until they sound click.



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 connector is a sealed connector, insert the test probe through the hole in the rubber cap for the electrical wires 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 mm^2	AWG 22	-	5A
0.5 mm^2	AWG20	7A	13A
0.85 mm^2	AWG18	9A	17A
1.25 mm^2	AWG16	12A	22A
2.0 mm^2	AWG14	16A	30A
3.0 mm^2	AWG12	21A	40A
5.0 mm^2	AWG10	31A	54A

PRECAUTIONS FOR CATALYTIC CONVERTER

CAUTION

If a large amount of unburned 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 for a long time. Avoid running the engine at fast idle speed for more than 10 minutes and at idle speed for more than 20 minutes.
3. Avoid spark jump tests. Do spark jump only when absolutely necessary. Perform this test as rapidly as possible and, while testing, never race the engine.
4. Do not measure the engine compression for a long time. Engine compression tests must be made as rapidly as possible.
5. Do not run the engine when the fuel tank is nearly empty. This may cause the engine to misfire and create an extra load on the converter.
6. Avoid coasting with the ignition turned off and prolonged braking.
7. Do not dispose of the used catalytic converter together with parts contaminated with gasoline or oil.

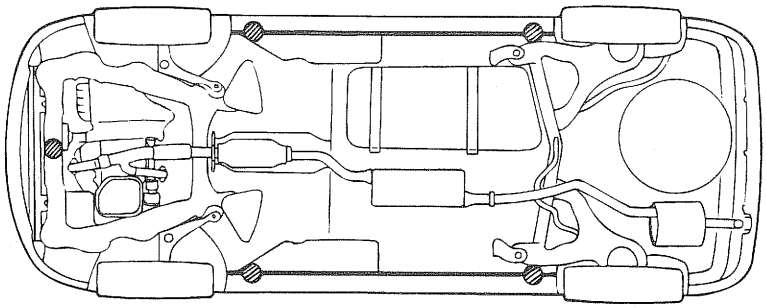
SRS SYSTEM COMPONENTS INFORMATION

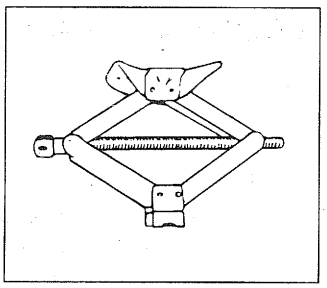
CUSTOMER CAUTIONS

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 the airbag may fail to operate when required. Before performing 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.

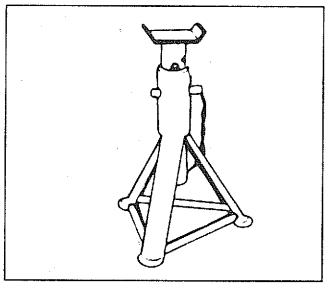
1. Work must be started after approx. 30 seconds or longer than the time when the ignition switch is turned to the LOCK position and the negative (-) terminal cable is disconnected from the battery. (The airbag system is equipped with a back-up power source so that if work is started within 30 seconds when disconnecting the negative (-) terminal cable of the battery, the airbag may be operative.) When the negative (-) terminal cable is disconnected from the battery, memory of the clock and audio systems will be cancelled. So before starting work, record the contents memorized by 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 confirm, so the diagnostic codes become the most important source of information when troubleshooting. When troubleshooting the airbag system, always inspect the diagnostic codes 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 Air-bag wiring harness in order to reuse it.
5. If the SRSCM or air-bag 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, check the SRS SRI.

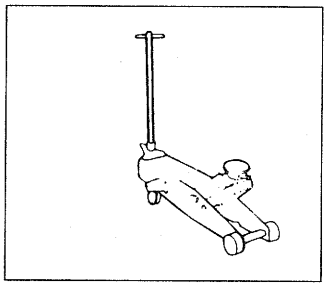




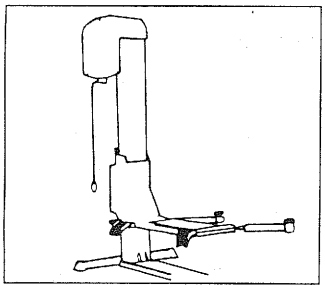
The jack provided with the vehicle (for reference)



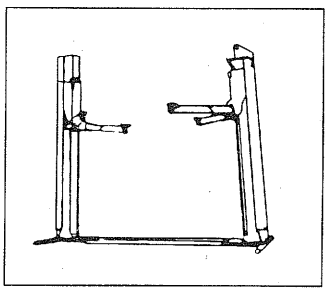
Rigid rack (Safety stand)



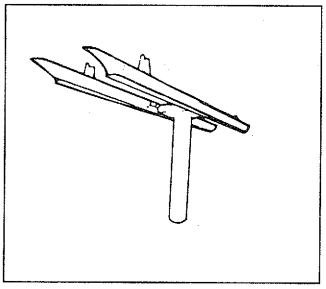
Garage jack (floor Jack)



Single post lift



Double post lift



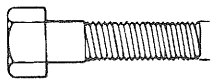
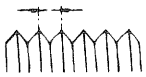
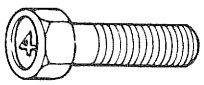
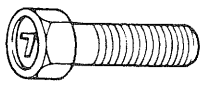
Free wheel type of auto lift (H bar lift)

EAHA018A

CAUTION

1. Never use a jack at the lateral rod or rear suspension assembly.
2. In order to prevent scarring the sub frame, place a piece of cloth on the jack's contact surface (to prevent corrosion caused by damage to the coating).
3. The vehick whick was supported only jack always should be supported with safety stand.
4. Do not attempt to raise one entire side of the vehicle by placing a jack midway between the front and rear wheels. To do so could result in permanent damage to the body.

TIGHTENING TORQUE TABLE OF STANDARD PARTS

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 applied to tightening performed under the following conditions:
   - Nuts and bolts are made of steel bar, and galvanized.
   - Galvanized plain steel washers are inserted.
   - All nuts, bolts, and plain washers are dry.
2. The torques shown in the table are not applicable:
   - 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 surface are coated with oil.
3. If you reduce the torques in the table to the percentage indicated below, under the following conditions, if will be the stand and value.
   - If spring washers are used. : 85%
   - If threads and bearing surfaces are stained with oil. : 85%

RECOMMENDED LUBRICANTS

EAHA0020

Parts	Specifications	Remarks
Engine oil	API Classification SE Above	For further details, refer to SAE viscosity number
Manual transaxle	API classification GL-4	SAE grade number: SAE 75W/90
Automatic transaxle	GENUINE HYUNDAI transaxle oil, GENUINE DIAMOND ATF SP-II M	
Brake	DOT 3 or DOT 4	
Cooling system	High quality ethylene glycol	Concentration level 40%
Power steering	PSF-3	
Transaxle linkage, parking brake cable mechanism, hood lock and hook, door latch, seat adjuster, trunk latch, door hinges, trunk hinges	Multipurpose grease NLGI grade #2	

M/EAST : Middle East, GEN.: General Areas AUST.: Australia, EC : European Communities

LUBRICANTS CAPACITIES

Description		Capacities	
		2.0I4	2.7 V6
Engine oil	Oil pan	4.0 (4.21, 3.52)	4.2 (4.44, 3.69)
	Oil filter	0.3 (0.32, 0.26)	0.3 (0.32, 0.26)
	Total	4.3 (4.53, 3.78)	4.5 (4.76, 3.95)
Cooling system		7.0 (7.35, 6.19)	7.0 (7.35, 6.19)
Manual transaxle		2.1 (2.20, 1.80)	2.1 (2.20, 1.80)
Automatic transaxle		7.8 (8.2, 6.90)	8.5 (8.94, 7.52)
Power steering		1.0 (1.05, 0.88)	1.0 (1.05, 0.88)

liter (U.S. qts., Imp. qts.)

CHANGING ENGINE OIL EAHA0030

1. If the engine is cold, run the engine until it reaches normal operating temperature.
2. Stop 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 N.m (350-450 kg.cm, 25-33 lb.ft)

NOTE

Whenever tightening the oil clrain 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.

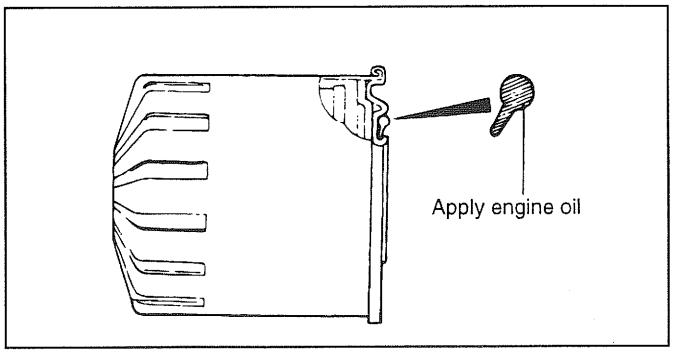
6. Install the oil filler cap.
7. Start and run the engine.
8. Stop the engine and them check the oil level. Add oil if necessary.

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 N.m (120-160 kg.cm, 9-12 lb.ft)

4. Start and run the engine and check for engine oil leak.
5. After stopping the engine, check the oil level and add oil as necessary.



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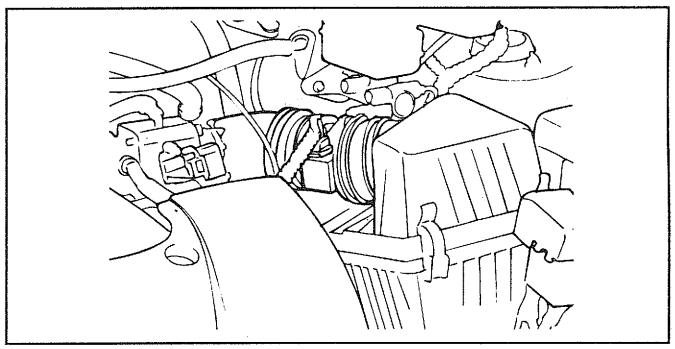
REPLACING THE AIR CLEANER FILTER

The air cleaner filter will become dirty during use and the filtering efficiency will be substantially reduced. Replace with a new one.

1. Disconnect the clip holding air cleaner filter cover.
2. Remove the air filter cover.

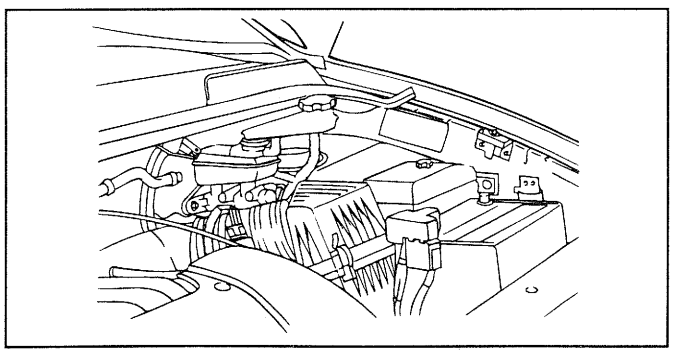
CAUTION

The air filter cover should be removed carefully because intake hose includes the air-flow sensor.



EDHA006A

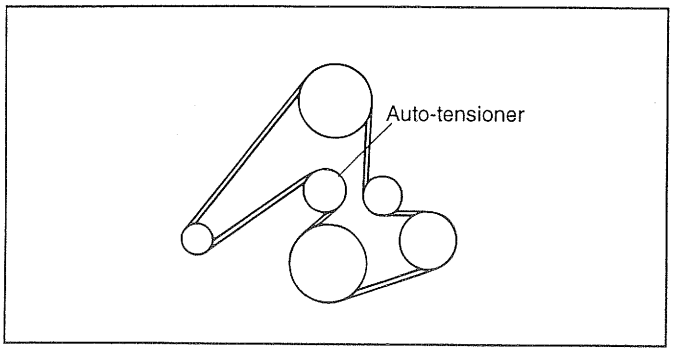
3. Remove the air cleaner filter.
4. Set a new air cleaner filter and the air cleaner filter cover.



EDHA058A

CHECKING BELT TENSION

The belt tension is automatically adjusted by the auto-tensioner.



EAHA010A

ADJUSTING BELT TENSION

Refer to EM-Section and EMA-Section.

COOLING SYSTEM

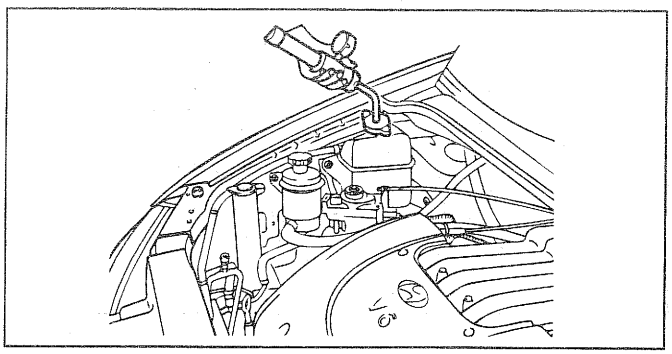
Check the cooling system for damaged hoses, loose or leaking connections, or other possible causes of coolant leaks.

ANTIFREEZE

The engine cooling system is provided with a mixture of 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 provide corrosion protection and freezing prevention.

CAUTION

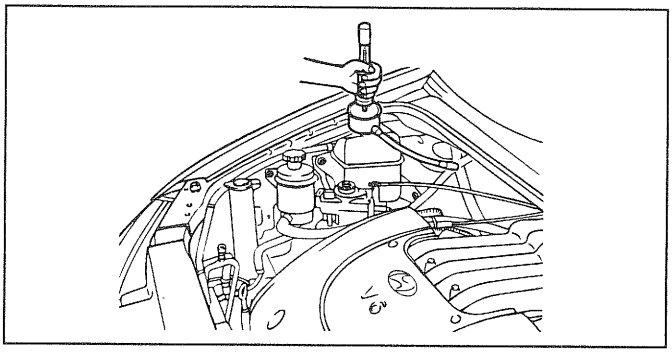
If the concentration of the antifreeze is below 30%, the anticorrosion property will be adversely affected. In addition, if the concentration is above 60%, both the antifreeze and engine cooling properties will decrease, adversely affecting the engine. For these reasons, be sure to maintain the concentration level within the specified range.



ECHA010A

MEASURING OF ANTIFREEZE CONCENTRATION

Run the engine until coolant is fully mixed. Drain some coolant (antifreeze), and then measure the temperature and specific gravity of the coolant. Determine concentration and safe working temperature. If the coolant is short of antifreeze, add antifreeze to a concentration of 50%. (Tropical Areas : 40%)



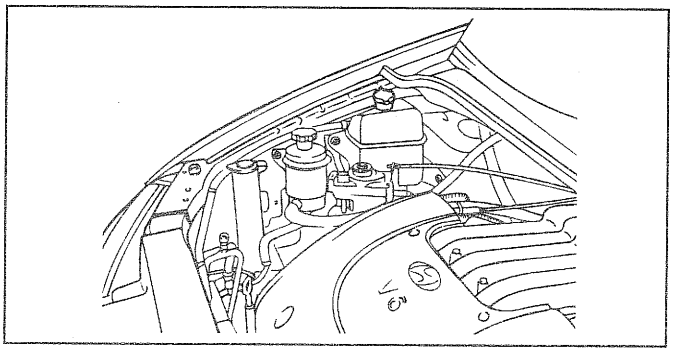
ECHA010C

REPLACING OF THE COOLANT

1. Set the temperature control lever to the hot position.
2. Remove the radiator cap.

CAUTION

Remove the cap slowly as the system is pressurized and the coolant may be hot. Do not open the cap when engine is hot.



ECHA059A

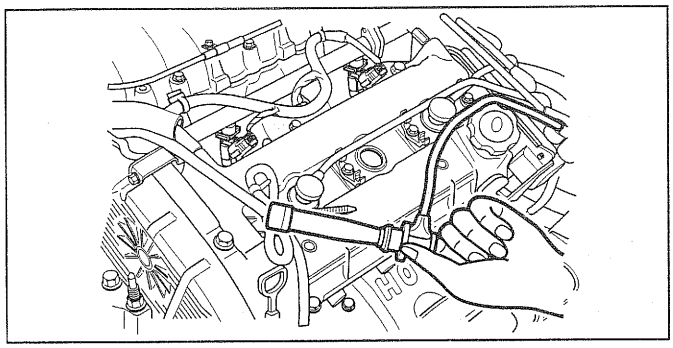
3. Loosen the drain plug to drain the coolant.
4. Drain the coolant from the reserve tank.
5. After draining the coolant, tighten the drain plug securely.
6. Supply the radiator with the coolant until it is filled up to its filler neck.
7. Supply the reserve tank with the coolant.
8. After warming up the engine until the thermostat opens, remove the radiator cap and check the coolant level.
9. Supply the coolant into the radiator until it is filled up to its filler neck, and install the radiator cap securely.
10. Fill the reserve tank with coolant up to the "FULL" line.

REPLACING IGNITION CABLES

The 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 form it.



KFW2005A

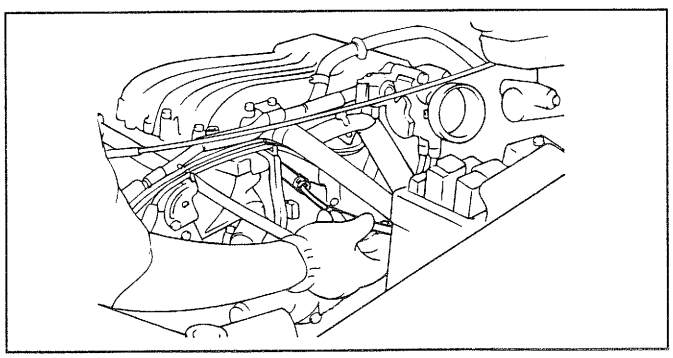
REPLACING OXYGEN SENSOR

The oxygen sensor is a device which controls the fuel mixture. If the oxygen sensor is damaged, the exhaust-gas cleaning efficiency as well as driveability deteriorates. Therefore, it should be replaced periodically with a new one.

FUEL SYSTEM

Tank, Lines And Connections

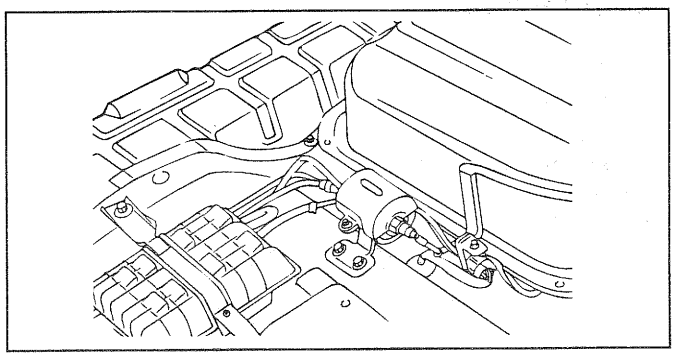
1. Check for damage or leakage in the fuel lines and connections.
2. Inspect the surface or fuel hoses for heat and mechanical damage. Hard and brittle rubber, cracking, tears, cuts, abrasions and excessive swelling indicate deterioration of the rubber.
3. If the fabric casing of the rubber hose is exposed by cracks and abrasions in the fuel system, the hoses should be changed.



ECHA060A

Fuel Filter

The fuel filter should be replaced regularly because its performance capacity is reduced by dirt and water collected over an extended period of use. Replace as required.

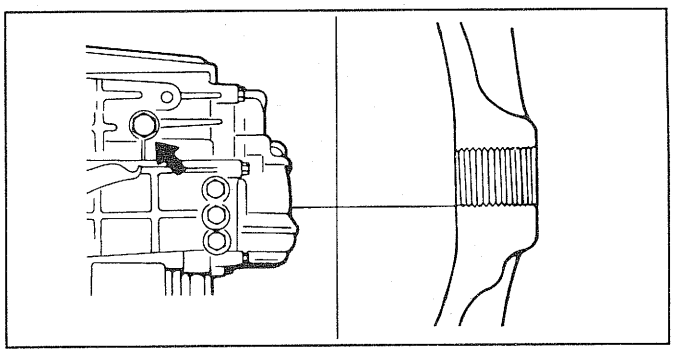


ECHA061A

MANUAL TRANSAXLE (INSPECT OIL LEVEL)

Inspect that there is leakage in each component and check the oil level by remaining the filler plug. If the oil is contaminated, it is necessary to replace it with new oil.

1. With the vehicle parked at a level place, remove the filler plug and make sure that 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 at a level place, remove the magnet plug to drain transaxle oil.
2. Replace packing with a new one and install the magnet plug.
3. Supply transaxle oil (through the filler plug part) until the oil level is the same level as the plug hole.

INSPECTING STEERING LINKAGE

1. Check steering wheel freeplay.

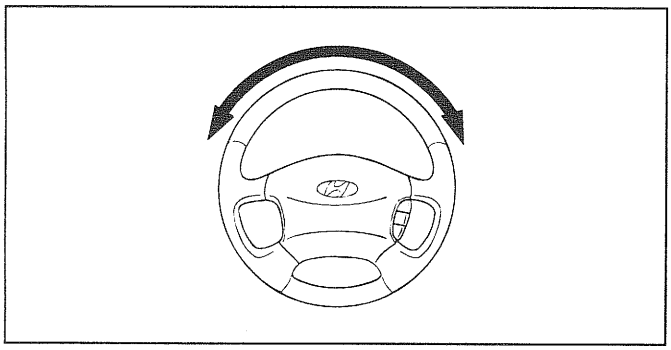
Maximum steering wheel freeplay : 30 mm (1.181 in.)

2. Check steering linkage for looseness and damage as follows.
   a) Tie rod ends do not have excessive play.

b) Dust seals and boots are not damaged.
c) Boot clamps are not loose.

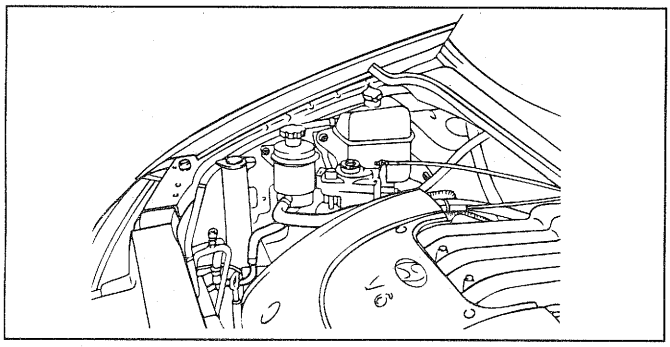
POWER STEERING FLUID LEVEL (INSPECT FLUID LEVEL)

1. Park the vehicle on a level place 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 vehicle still idling, turn the wheel all the way to the left and right several times. Check the fluid in the oil reservoir for foaming, the fluid level, and replenish the fluid in the oil reservoir through the oil filter if necessary.



EDHA006G

POWER STEERING HOSES (CHECK FOR DETERIORATION OR LEAKS)

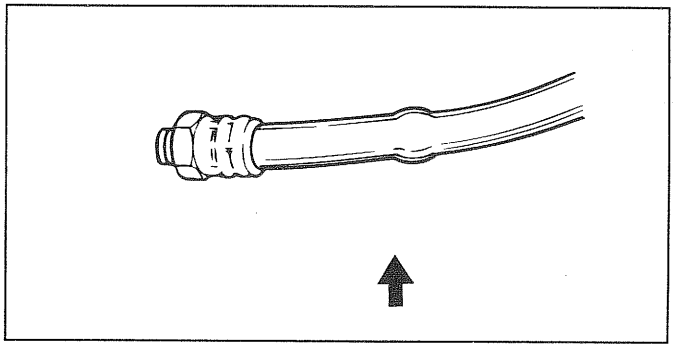
1. Check the hose connections for fluid leaks.
2. The power steering hoses should be replaced if there are severe surface cracking, pulling, scuffing or worn steps. Deterioration of the hoses could cause premature failure.

BALL JOINT AND STEERING LINKAGE SEALS, STEERING AND DRIVE SHAFT BOOTS

1. These components, which are permanently lubricated at the factory, do not require periodic lubrication. Damaged seals and boots should be replaced to prevent leakage or contamination of the grease.
2. Inspect the dust cover and boots for proper sealing leakage and damage. Replace them if defective.

INSPECTING BRAKE LINE

1. Check all brake pipes 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. Replace a set of pads if defective.

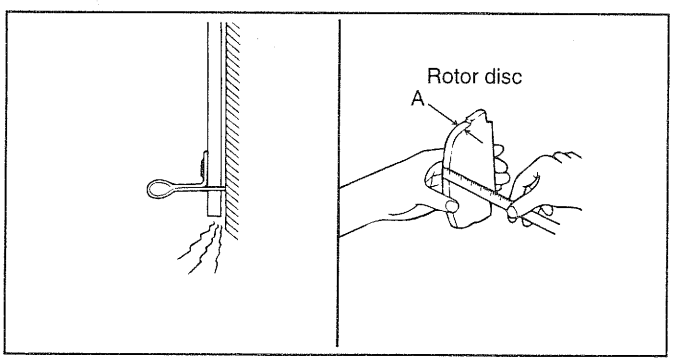
NOTE

If a squealing or scraping noise occurs from the brake during driving, check the pad wear indicator contacting the disc, 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] : 2.0 mm (0.079 in.)



EAA9034A

REAR DRUM BRAKE LININGS AND REAR WHEEL CYLINDERS

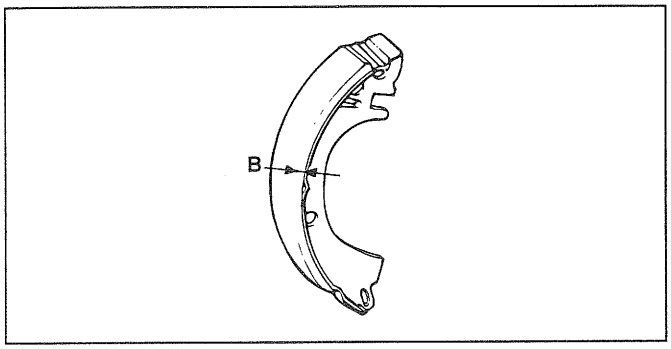
1. Remove the brake drum and check the thickness of brake shoe lining for wear. Check the automatic brake adjusting system by hand to see that it

operates smoothly and gears are in proper mesh each other. To assure functioning smoothly, apply a very thin coat of grease to the friction surface of adjuster and link shaft.

2. Inspect the wheel cylinder boots for fluid leak. Visually check the boots for cuts, tears or heat cracks. (A small amount of fluid on the boot may be not a leak but preservative fluid used at assembly.)

Checking the brake shoes for wear.

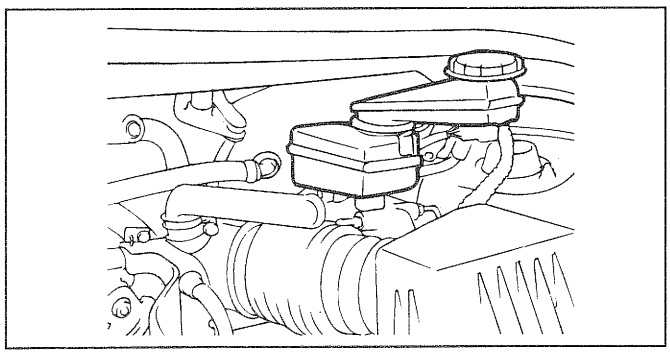
Thickness of lining [Limit] : 0.8 mm (0.031 in.)



EAA9035A

CHECKING THE BRAKE FLUID LEVEL

1. Visually 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.



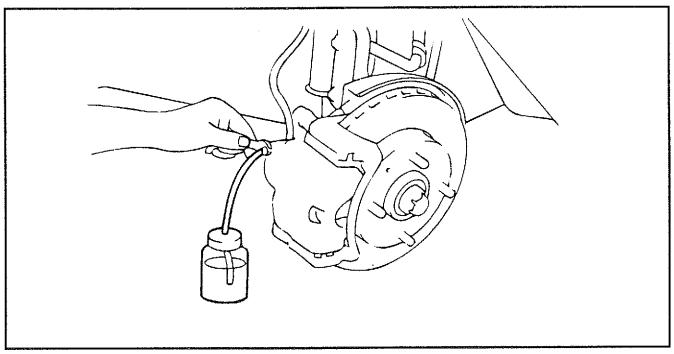
ECHA063A

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 BR-section.



EAA9037A

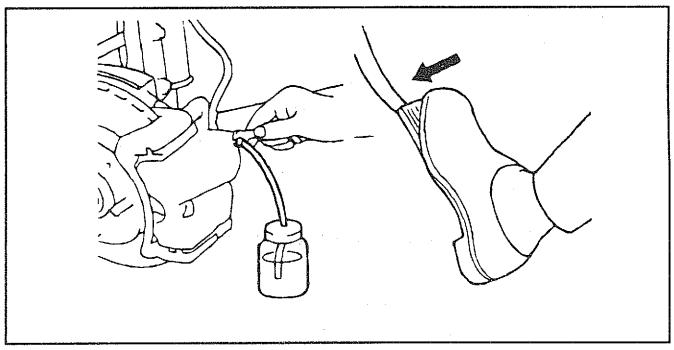
4. Depress the brake pedal a few times. Then loosen the bleeder screw(with the brake pedal still depressed), and tighten it after the brake fluid stops flowing.

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 DOT4



EAHA014B

CHECKING TIRE INFLATION PRESSURE

Check the tire inflation pressures as follows.

TIRE INFLATION PRESSURE (CHECK WITH TIRES COOL)

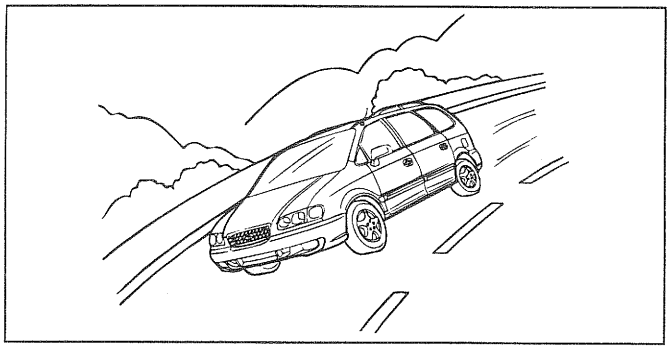
Tire size	Front	Rear
215/65 R 15	206 kPa (30 psi)	206 kPa (30 psi)

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 operation of brake booster.
4. Check operation of service brake and parking brake systems.

5. Check stroke of parking brake lever.
6. Check driveability of engine.
7. Check condition of instruments, gauges, indicators, exterior lamps, heater and ventilators.
8. Check abnormal noise of each part.



ECHA064A

STEERING AND DRIVE SHAFT BOOTS

1. Aluminum wheels should be paid special attention to. If salt or chemicals adhered to the wheels, they need to be rinsed off as soon as possible. After cleaning the wheels, apply a coating of wax to them to prevent corrosion.
2. When cleaning the vehicle with steam, do not directly steam onto the aluminum wheels.
   - Clean the hub surface.
   - After tightening the wheel nuts by hand, tighten them to specifications.
   - Do not use an impact wrench or push on the wrench with your foot to tighten the wheel nuts.
   - Do not apply oil to the threaded portions.

TIRE CHAINS AND SNOW TIRES

- Use tire chains only on the front wheels. Do not use tire chains on rear wheels.
- When using snow tires, use them on all four wheels for maneuverability and safety.

Heating, Ventilation & Air Conditioning

GENERAL

EQHA0010

SPECIFICATIONS

		2.0L, I4		2.7L, V6	
Compressor	Type	HS-18 (SWASH TYPE)		←	
	OIL (FD46 X G)	SIGNLE	DUAL	SIGNLE	DUAL
		150g	210g	150g	210g
	Capacity	180cc/rev		←	
	Thermal fuse	184°C OFF		←	
Refrigerant and quantity		670g (R-134a)	850g (R-134a)	670g (R-134a)	850g (R-134a)
Condensor	Quantity	290cc		←	
	Size	687W x 360.8H x 20T		←	
Heater Core	Type	Dimple		←	
Tripple Switch (Kgf/cm^2)	H/P	32.0 ± 2.0		←	
	M/P	14.0 ± 1.2		←	
	L/P	2.3 ± 0.25		←	

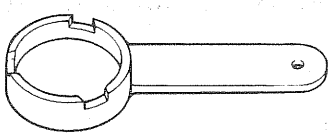
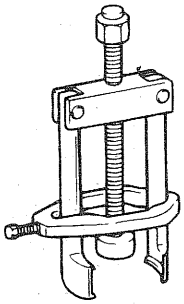
* H/P : High Pressure

M/P : Middle Pressure

L/P : Low Pressure

SPECIAL TOOLS

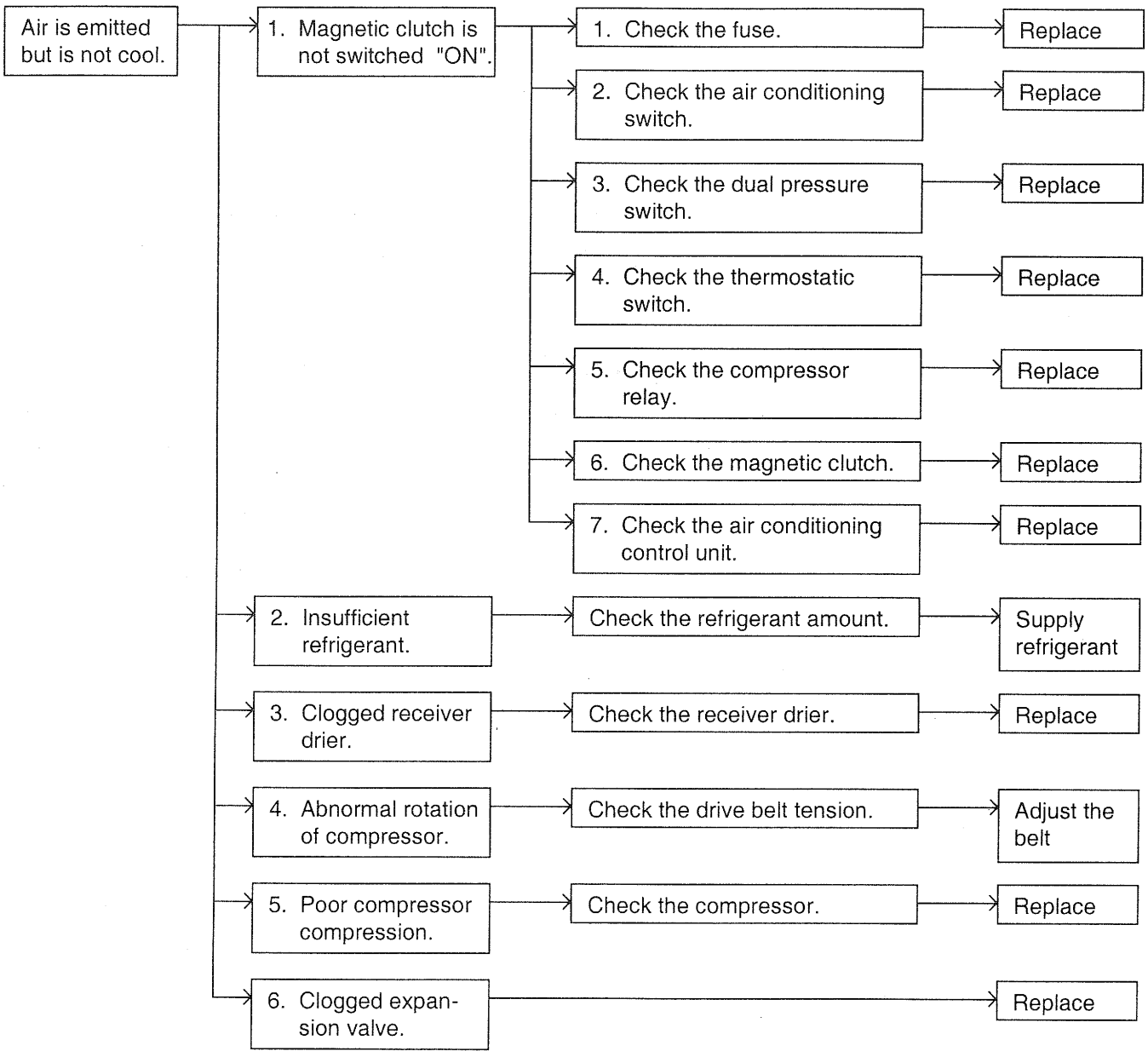
EQHA0050

Tool (Number and name)	Illustration	Use
09977-29000 Pressure plate bolt remover	 EQA9002A	Removal and installation of pressure plate
09455-34000 Bearing and gear puller	 EQA9002B	Removal of field coil

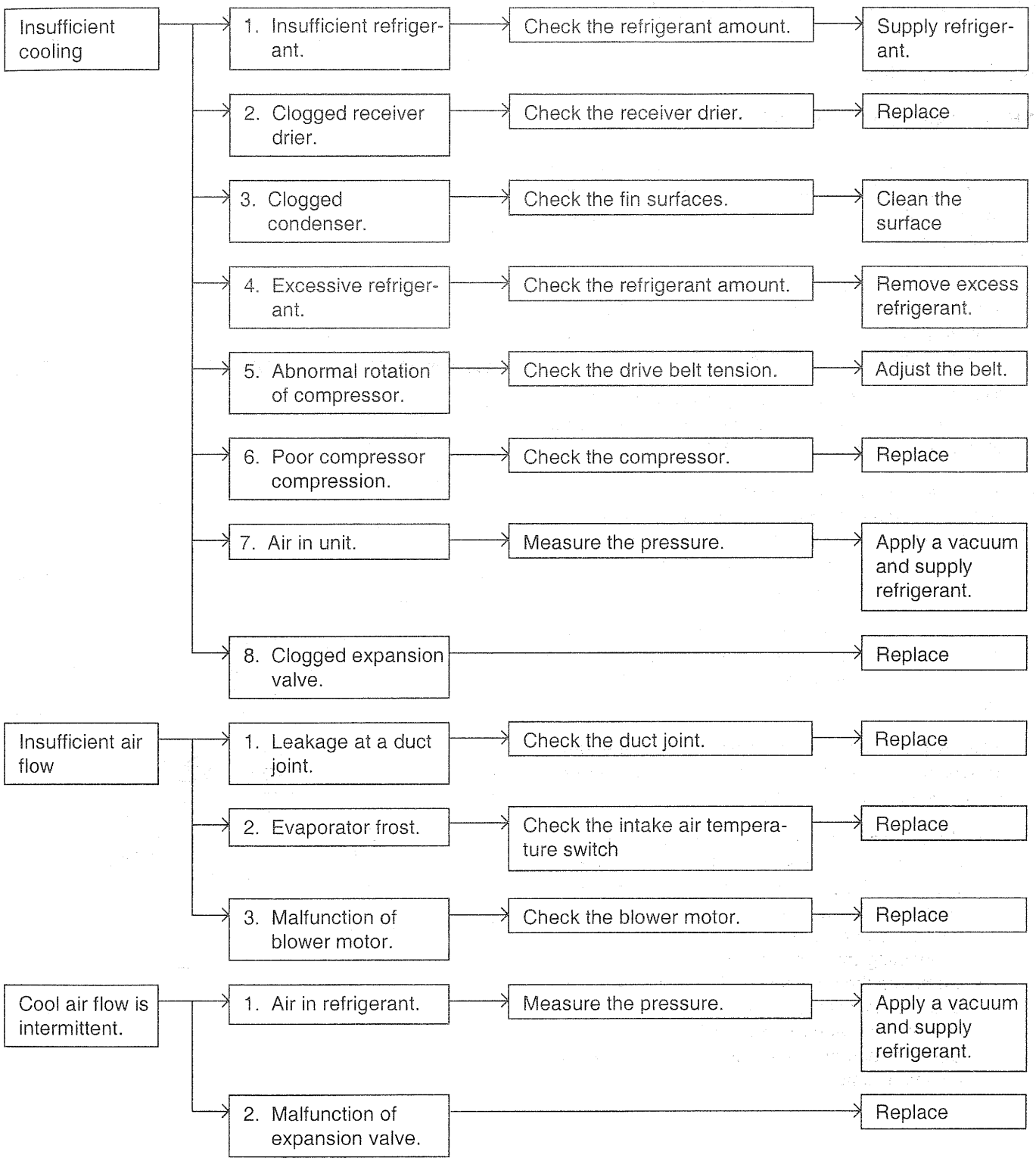
TROUBLESHOOTING EQHA0100

Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor. The following diagnostic charts have been developed as a quick reference for determining the cause of the malfunction. If these charts do not satisfactorily describe the problem, refer to the appropriate section for a more detailed explanation. After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

MALFUNCTION CAUSES AND REMEDIES (NUMBERS INDICATE CHECKING/INSPECTION ORDER.)



EQHA010A


Insufficient cooling
1. Insufficient refrigerant.
Check the refrigerant amount.
Supply 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 supply refrigerant.
8. Clogged expansion valve.
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 supply refrigerant.
2. Malfunction of expansion valve.
Replace

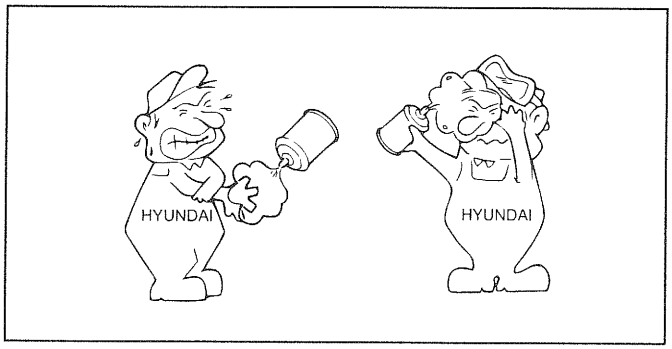
EQHA010B

AIR CONDITIONING SYSTEM

INSTRUCTIONS EQDA0100

WHEN HANDLING REFRIGERANT

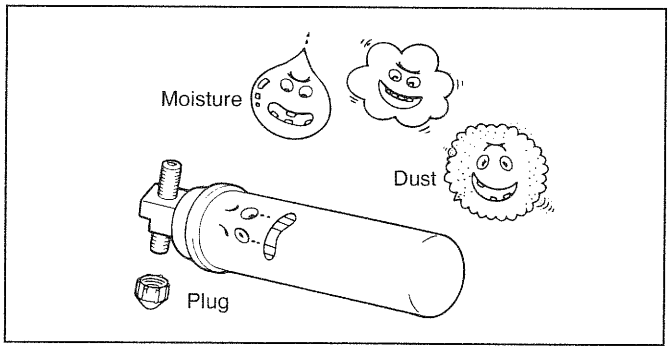
1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. If the refrigerant splashes into your eyes, wash them with clean water immediately. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands.
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 leak detector is often used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame (this detector burns propane to produce a small flame), produces phosgene and a toxic gas.
5. Use only recommended lubricant for R-134a A/C system and components. If lubricants other but recommended one used are system failure may occur.
6. The 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 A/C system 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 entry of 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 with a cap or plug immediately in disconnected parts to prevent intrusion 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.

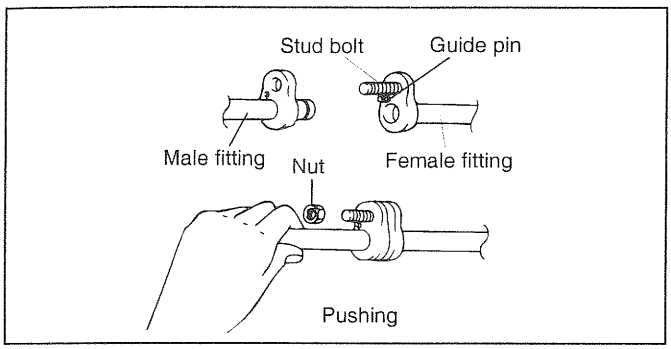


EQDA010B

WHEN INSTALLING CONNECTING PARTS

FLANGE WITH GUIDE PIN

Check the new O-ring for damage or something missed (use only specified one) and lubricate using compressor oil. Tighten with hand the nut by pushing the one side pipe. Tighten the nut to specified torque.



EQDA010C

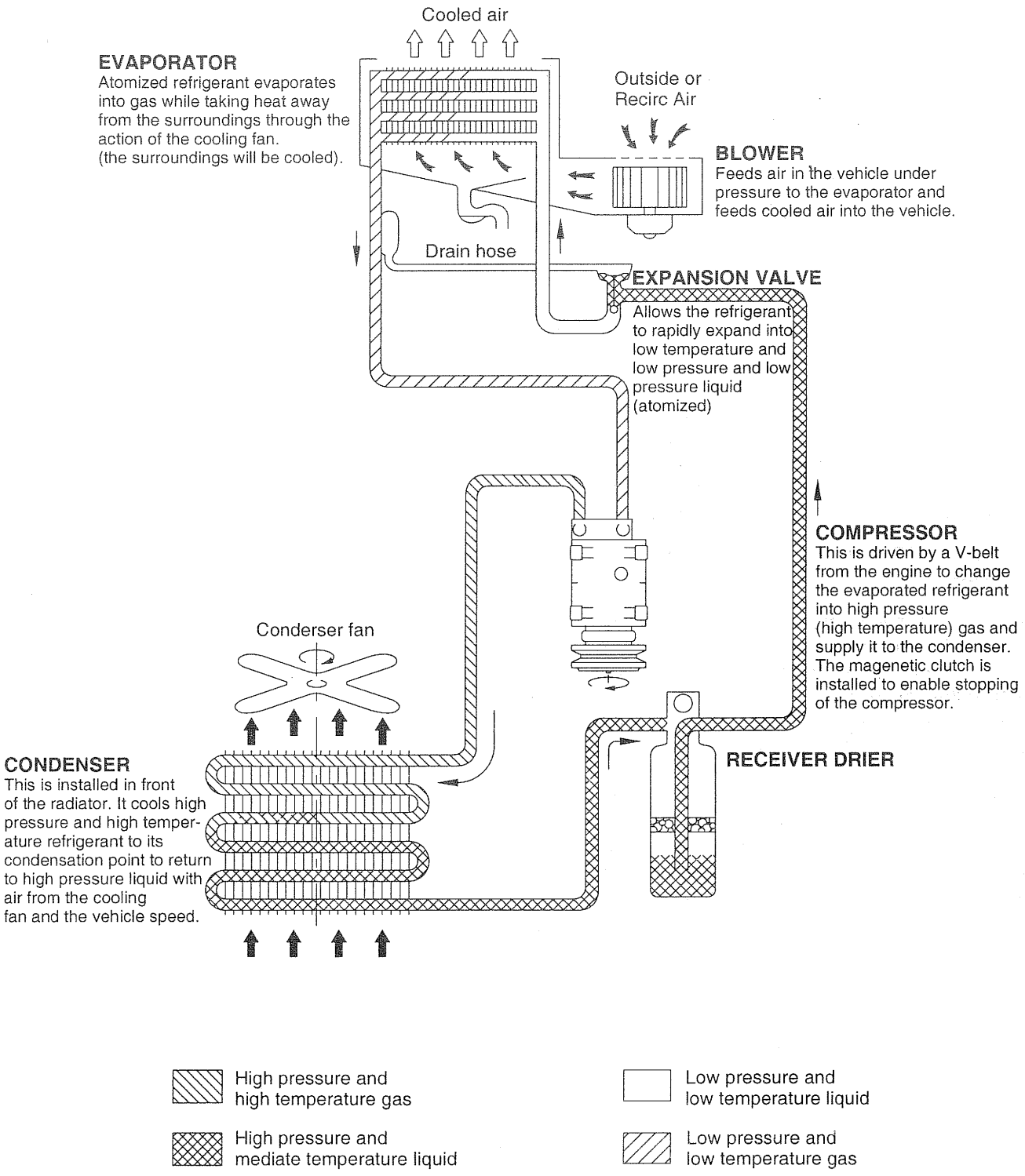
HANDLING TUBING AND FITTINGS

The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture-free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

THE FOLLOWING PRECAUTIONS MUST BE OBSERVED

1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to rebend formed lines to fit. Use the correct line for the installation you are servicing.
5. All tools, including the refrigerant dispensing manifold, the gauge set manifold and test hoses should be kept clean and dry.

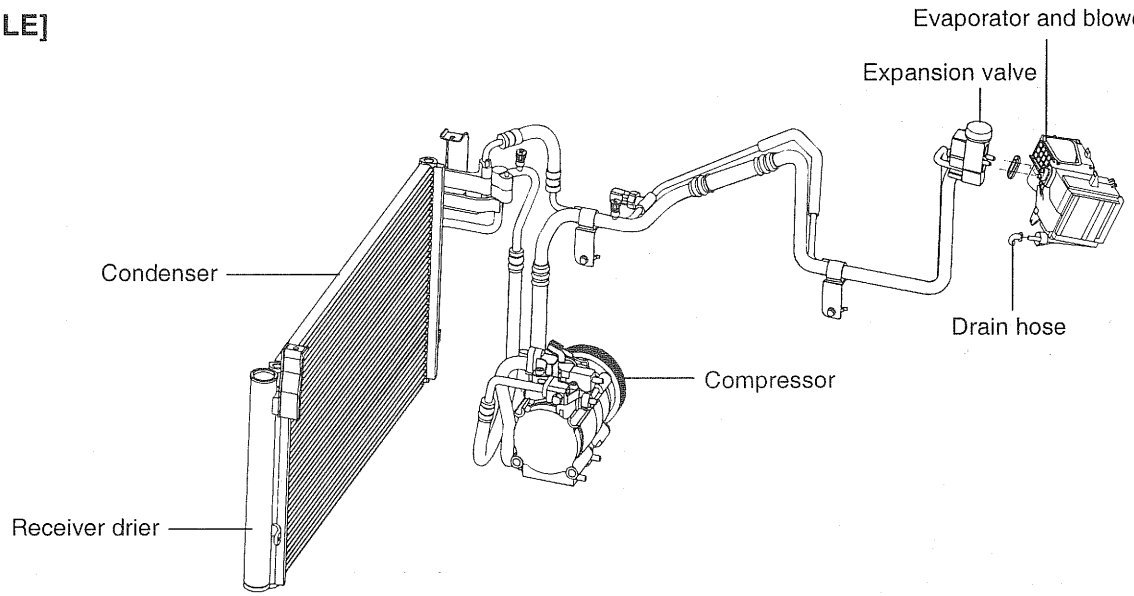
REFRIGERATION CYCLE EQHA0200



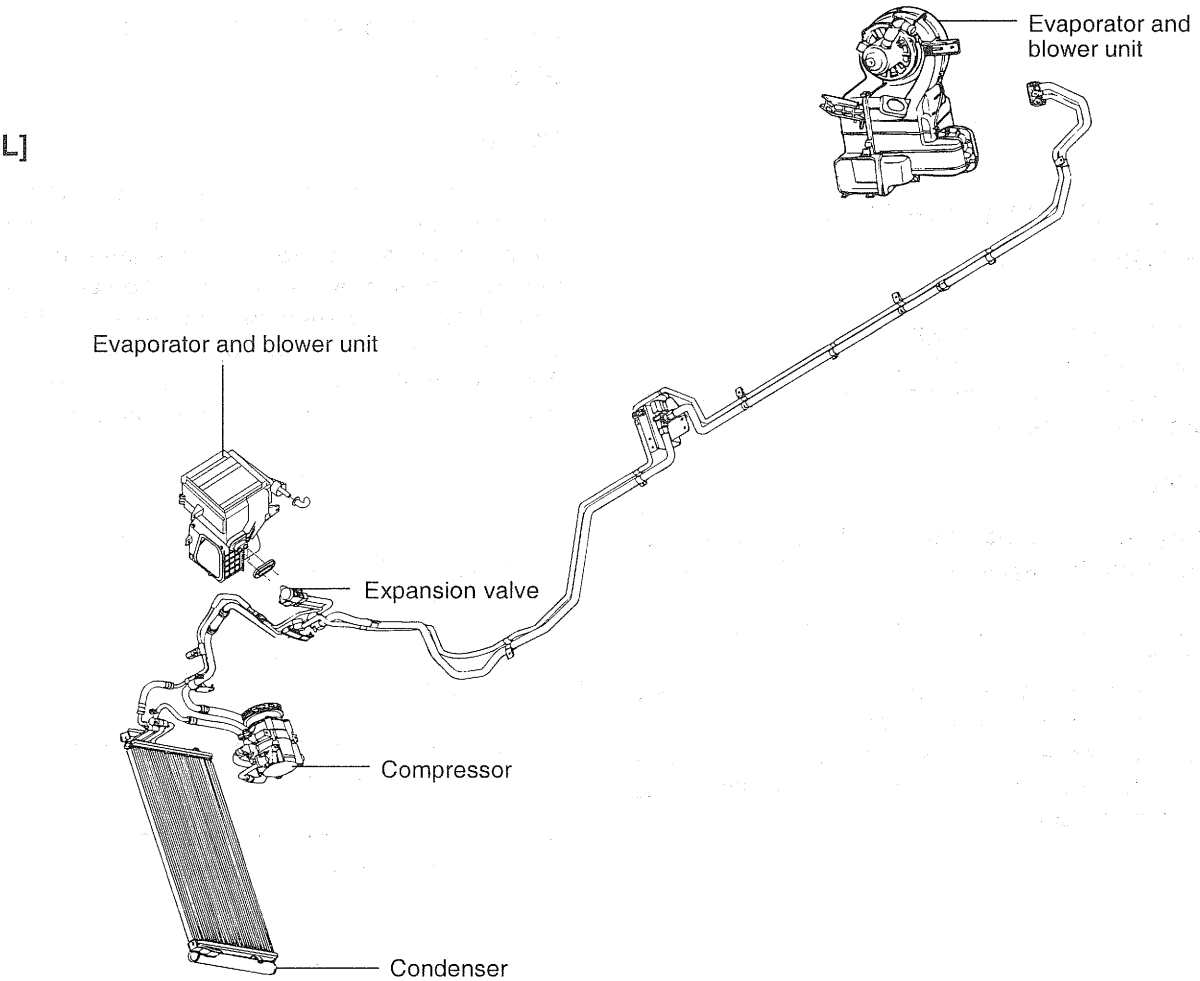
JCW97002

COMPONENTS EQHA0250

[SINGLE]



[DUAL]



EQHA001A+EQHA001B+KFWD042A

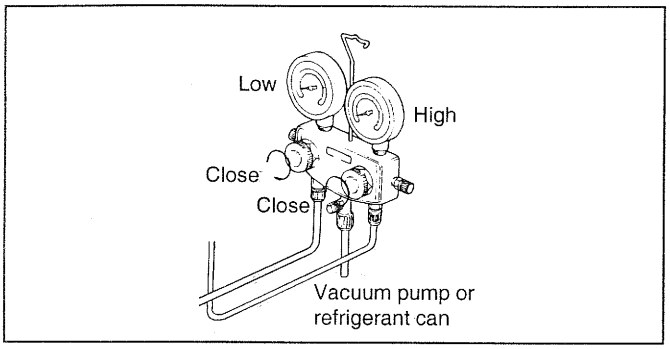
EQHA025A

INSTALLATION OF MANIFOLD GAUGE SET EQHA0300

CAUTION

When connecting the manifold gauge set test hoses, 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

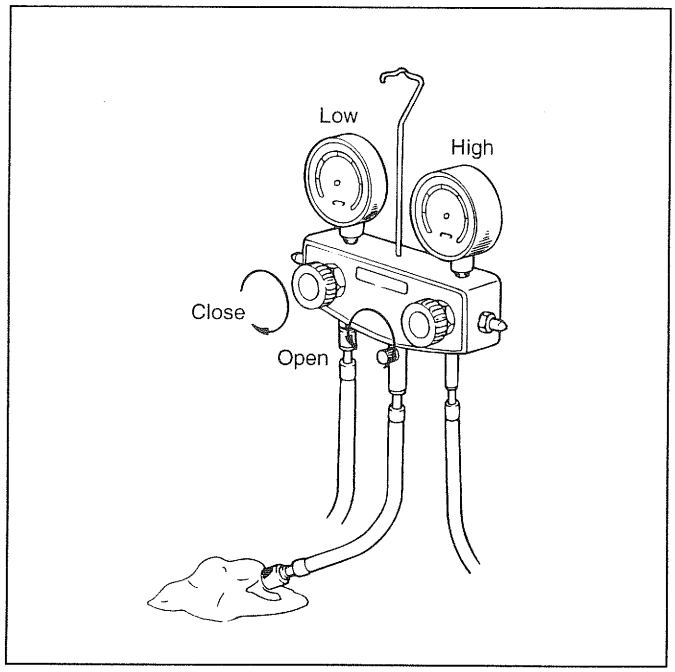
REFRIGERANT DISCHARGING PROCEDURE EQHA0350

1. Connect the manifold gauge set to the system.
2. Put a towel under the open end of the center hose.
3. Open the high pressure hand valve slowly to discharge the refrigerant slowly.

CAUTION

If discharging the refrigerant too fast, compressor may drain from the system.

4. Check if a towel is stained with oil. If so, gently lock the hand valve.
5. If the manifold gauge reading drops below 3.5kg/cm^2, open the low pressure hand valve slowly.
6. Open the high and low pressure hand valve slowly in order to drop the system pressure until the gauge indicates 0kg/cm^2.



EQHA035A

EVACUATING REFRIGERANT SYSTEM EQHA0400

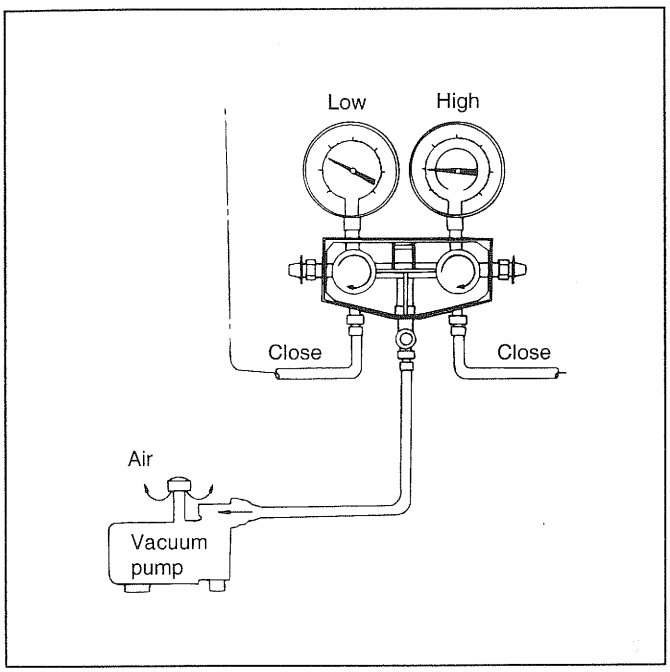
NOTE

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.

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/cm^2, 13.7 psi) vacuum. If negative pressure can not be obtained, there is a leak in the system. In this case, repair the leak as following:

a. Close both the manifold valves and stop the vacuum pump.
b. Charge system with a can or refrigerant [about 0.4 kg (0.9 lb)]. Refer to Charging Refrigerant.
c. Check for refrigerant leakage with a leak detector. Repair any leakage found. Refer to Checking Refrigerant Leak.
d. Discharge refrigerant again, and then evacuate the system. If no leaks are found, continue evacuating the system.

7. Start the vacuum pump.

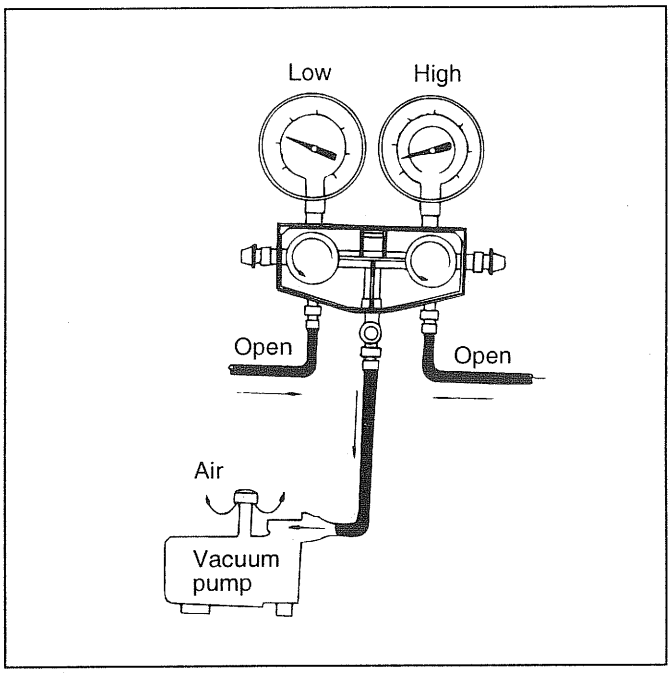


EQA9007A

8. Open both manifold pressure valves to obtain 94.39 kPa (0.96 kg/cm^2, 13.7 psi) of vacuum.

9. After the low pressure manifold gauge indicates close to 94.39 kPa (0.96 kg/cm^2, 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.



EQA9007B

HANDLING REFRIGERANT SERVICE TAP VALVE EQHA0450

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.

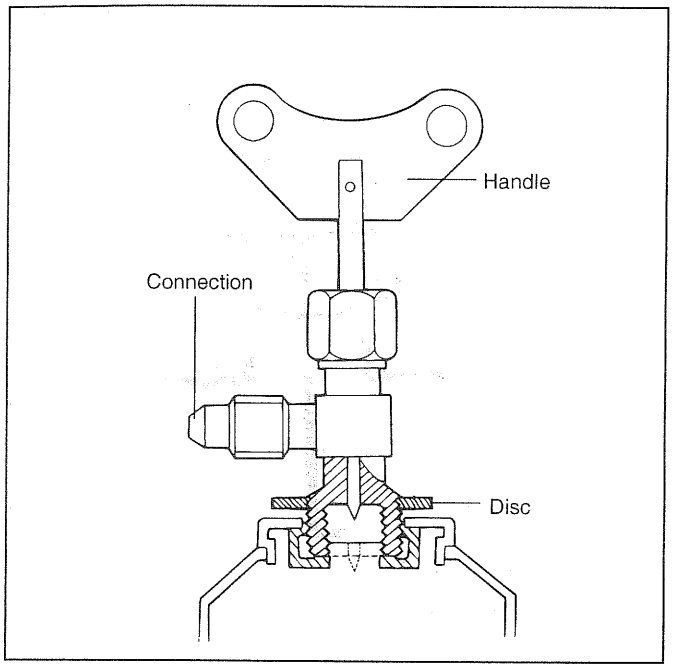
3. Connect the center hose to the valve fitting. Turn the disc fully clockwise by hand.

4. Turn the handle clockwise to make a hole in the sealed top.

5. Turn the handle fully counterclockwise to fill the center hose with air. Do not open the high and low-pressure hand valves.

6. Loosen the center hose nut connected to the center fitting of the manifold gauge.

7. Allow air to escape for a few seconds, and then tighten the nut.



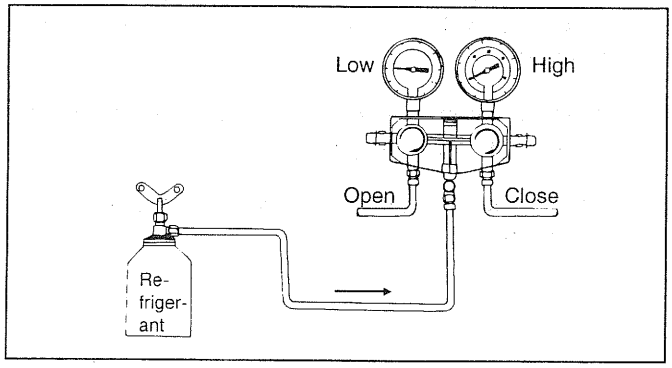
EQA9008A

CHARGING REFRIGERANT SYSTEM (VAPOR) EQHA0500

NOTE

This step is to charge the system through the low pressure side with refrigerant in a vapor state. When the refrigerant container is placed right side up, refrigerant will enter the system as a vapor.

1. Install the refrigerant can tap valve as described in Handling the Refrigerant Service 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/cm^2, 60 psi).

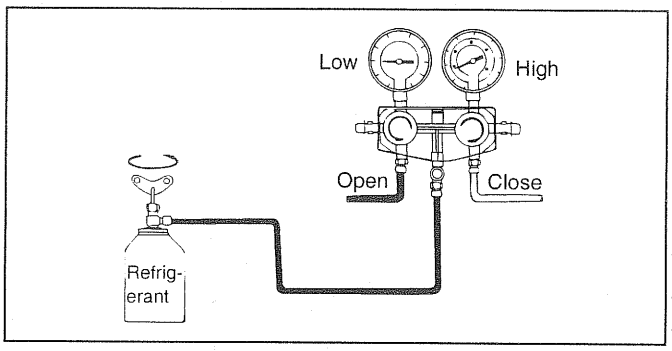


EQA9009A

3. Put the refrigerant in a pan of warm water (maximum temperature 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.

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.



EQA9009B

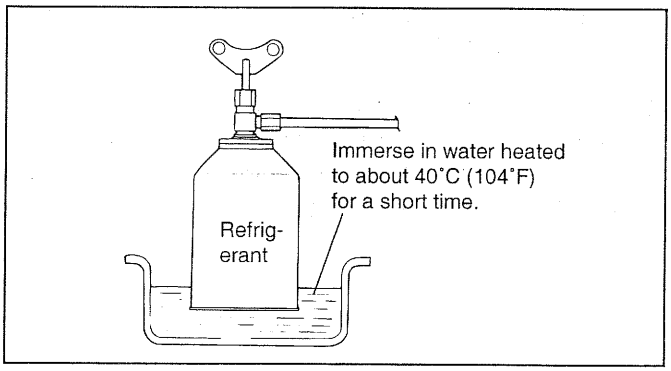
5. Charge the system to the specified amount. Then close the low pressure valve.

Specified amount
Single : 670g
Dual : 850g

When refrigerant charging speed is slow, immerse refrigerant can in water, heated to a temperature of about 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.**



EQA9009C

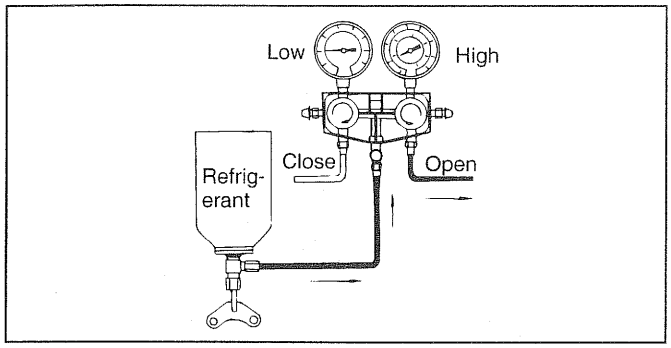
CHARGING REFRIGERANT SYSTEM (LIQUID)

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.



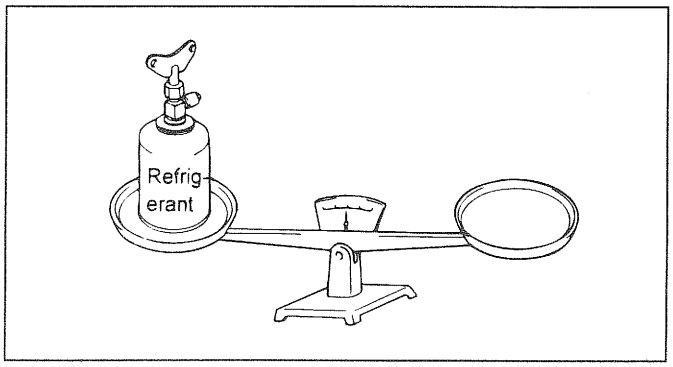
EQA9010A

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 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
Single : 670g
Dual : 850g

NOTE

If the low pressure gauge does not show a reading, the system is restricted and must be repaired.



EQA9010B

5. After the specified amount of refrigerant has been charged into 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 Refrigerant Leak.

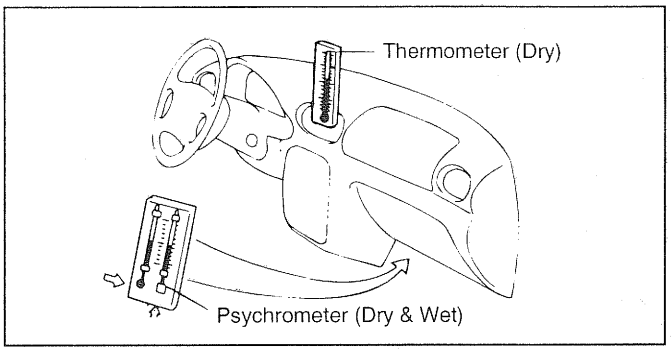
NOTE

Conducting a performance test prior to removing the manifold gauge is good service operation.

PERFORMANCE TEST EQHA0550

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 (14-16 kg/cm^2, 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.
7. Check that the reading on the dry-bulb thermometer at the air inlet at 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.



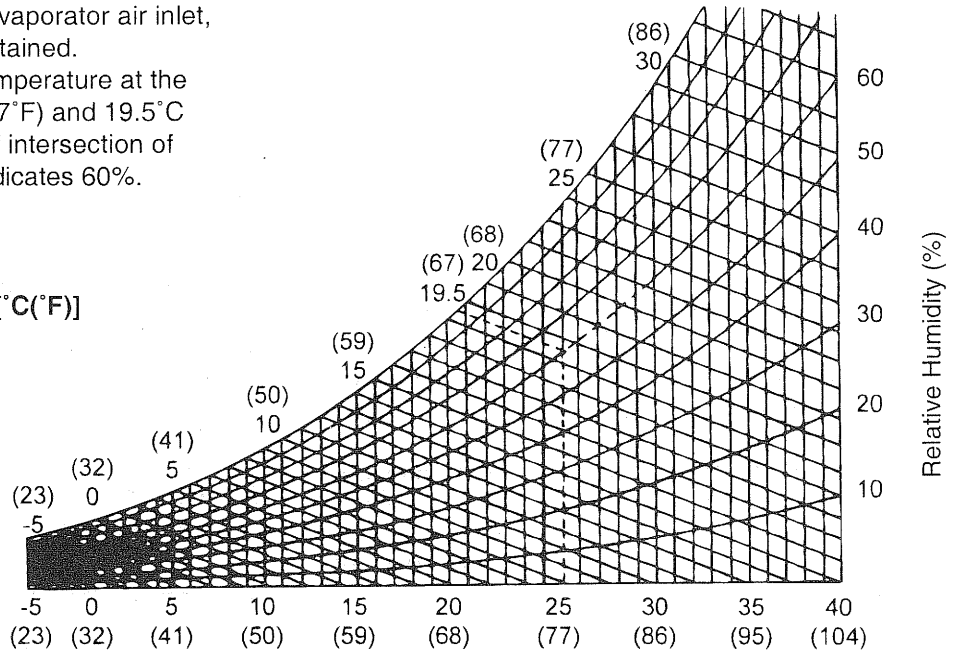
EQA9019A

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 temperature 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)]

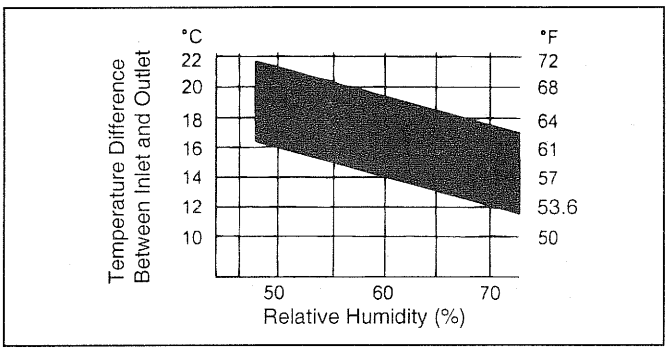
100 (212)
90 (194)
80 (176)
70 (158)
60 (140)
50 (122)
40 (104)
30 (86)
20 (68)
10 (50)



EQA9019B

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 between block hard line. If the intersection is within the block hard line, cooling performance is satisfactory.



EQA9019C

COMPRESSOR OIL EQHA0600

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 : 150g
Dual : 210g

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 the air for prolonged periods. After use, seal the container immediately.

OIL RETURN OPERATION

To check the oil level or add the oil, idle engine for 20–30 minutes by setting the control set to maximum cooling and blower level, to return the lubricant to compressor.

CHECKING AND ADDING OF COMPRESSOR OIL LEVEL

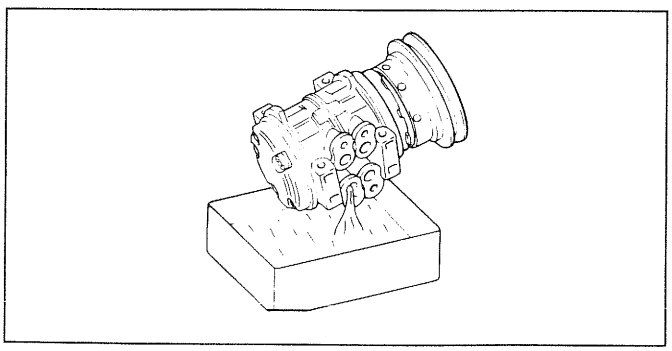
In order to add oil to operating compressor, check the compressor oil in the following procedure:

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

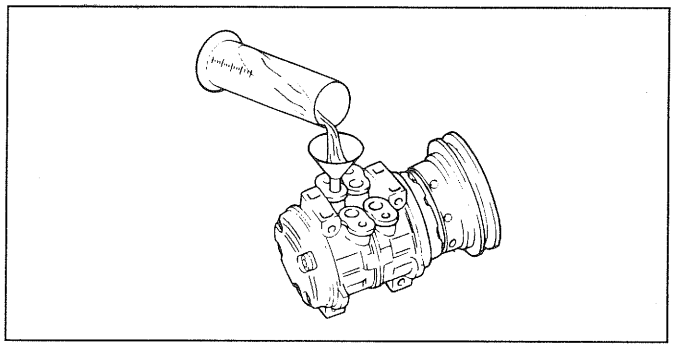
If compressor is cold, sometimes it can be hard to drain the oil. Then warm up the compressor (approx. 40–50°C) to drain the oil.



EQHA060A

3. Check the amount of the discharged oil. If it is less than 70cc, it means there is 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:



EQHA060B

a. 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.

b. If oil is contaminated with metal fragment or other material, clean the receiver drier after charging the refrigerant into the air conditioning system.

CHECKING REFRIGERANT LEAKS EQHA0650

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.

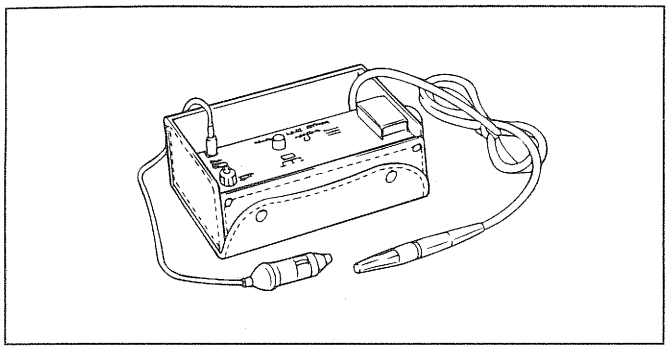
NOTE

In order to use the device properly, read the manuals supplied by the manufacturer to perform the specified maintenance and inspections.

If a gas leak is detected, proceed as follows:

1. Check the torque on the connection fitting 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 its seating face for damage. Always replace, even if the damage is slight.

3. Check 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.

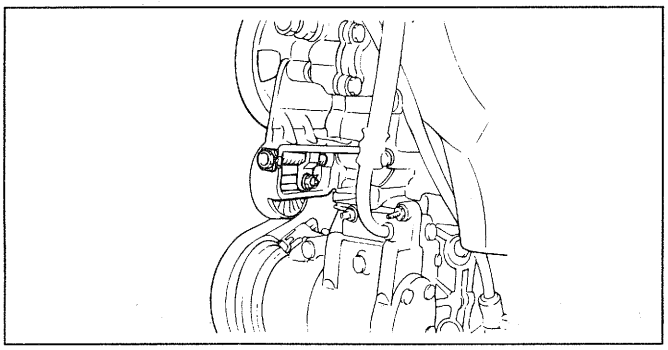


EQHA065A

[2.0L, I4 ENG] EQHA0700

Adjust the belt tension with tension bearing

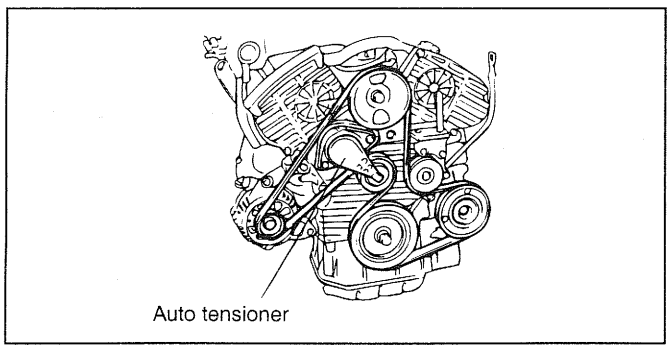
	Deflection (mm)	Tension(kg·f)
New one	8.8 - 11.0	75 ± 10
Used one	12.5 - 14.3	50 ± 5
After driving	11.7 - 15.3	50 ± 10



EPA9016D

[2.7L, V6 ENG]

The drive belt tension is adjusted automatically by auto tensioner.



EDA9031A

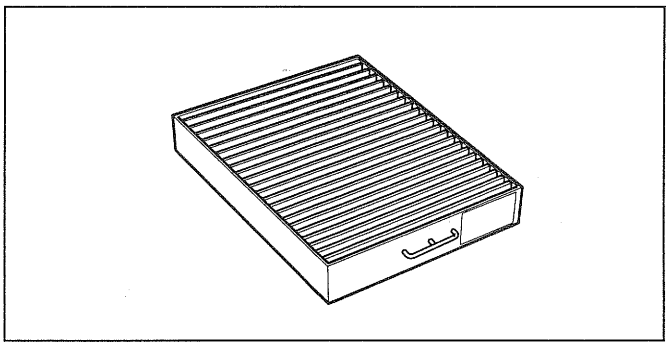
BLOWER UNIT AIR FILTER EQHA0750

Equus has combination filter which eliminates foreign materials and odor. The combination filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment. Vehicle equipped with rear air conditioning has one more air filter in the rear air conditioning unit.

Filter service life : 15,000km

CAUTION

In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

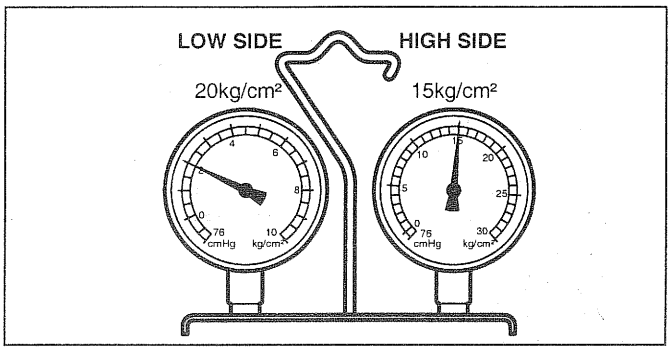


KFWD051A

PERFORMANCE TEST DIAGNOSIS USING MANIFOLD GAUGE EQHA0800

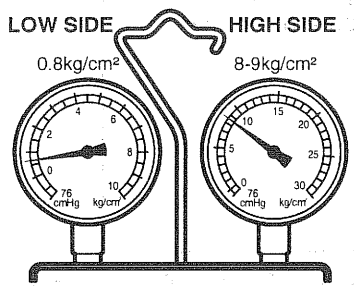
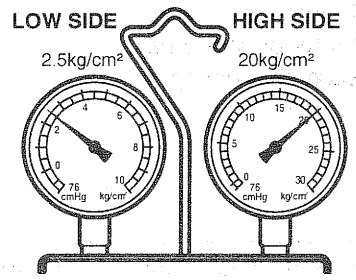
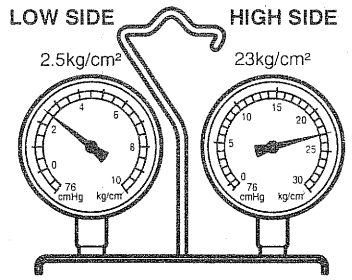
STANDARD VALUE

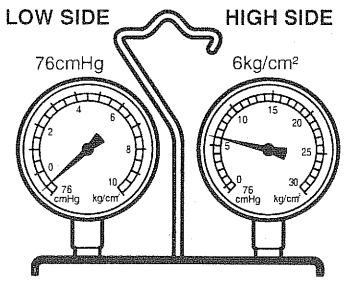
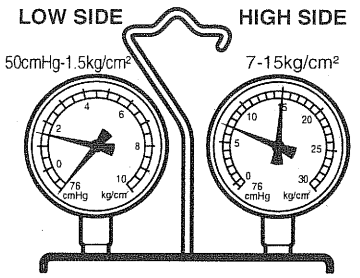
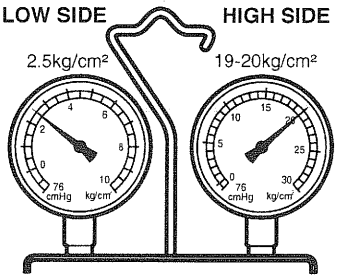
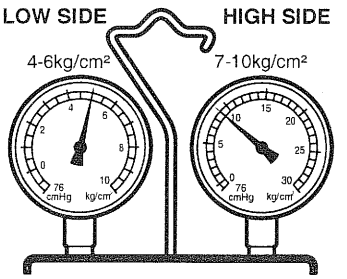
If cooling cycle is operating normally, manifold gauge reading will be approx. 1.5–2.0kg/cm^2 for low pressure side and approx. 14.5–15kg/cm^2 for high pressure side. When inlet temperature is 30–35°C, engine rpm is 2,000 max. cooling, and the blower is in highest level.



KFWD001A

DIAGNOSIS

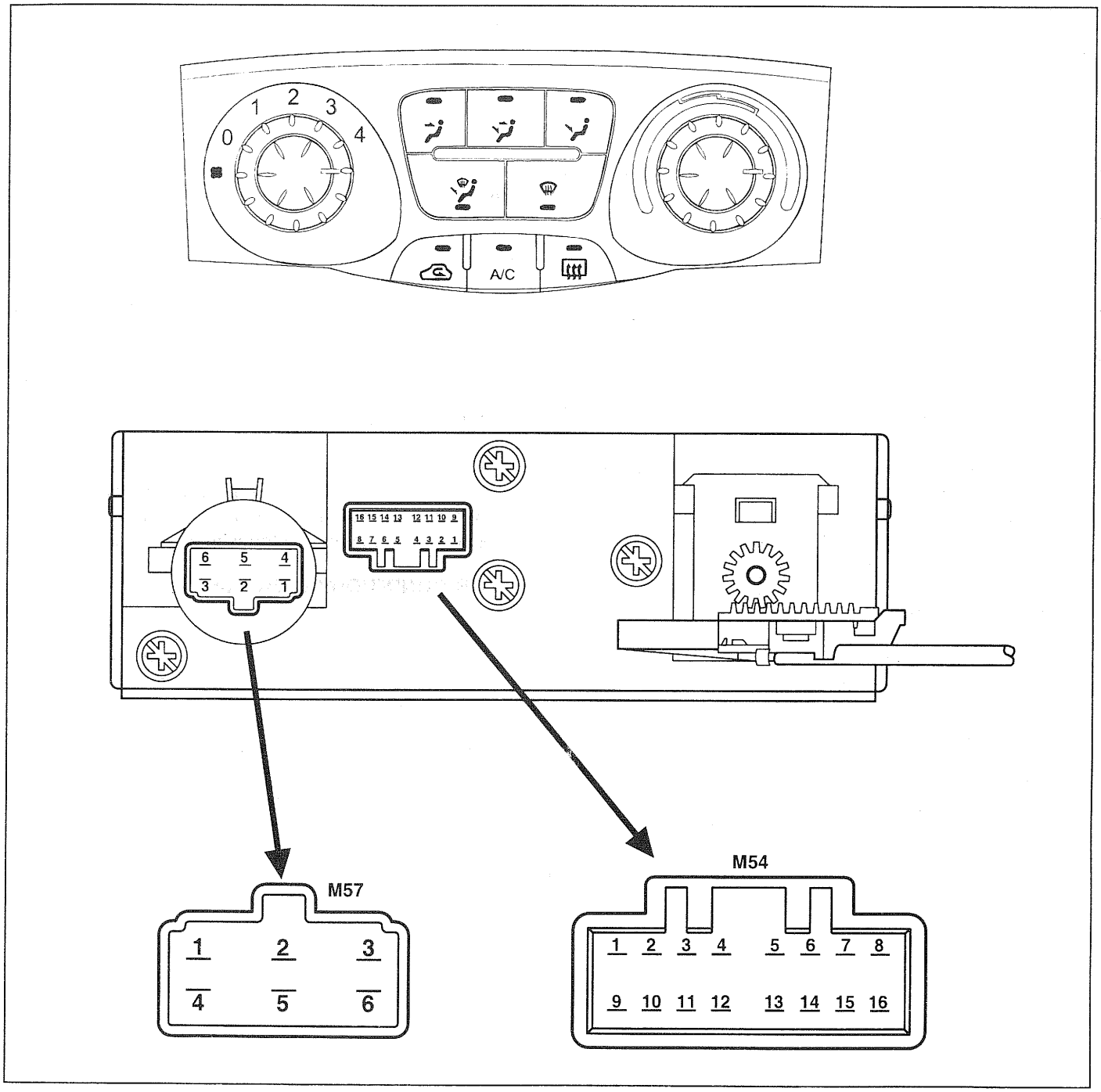
SYMPTOMS	PROBABLE CAUSES	REMEDY	MANIFOLD GAUGE READINGS
1. Low pressure and high pressure are low. 2. Cooler outlet air is a little cooler.	• Gas leak in freezing cycle.	• Checking, and repair. • Add refrigerant.	 KFWD002A
1. Low pressure and high pressure are high.	• Faulty cooling or faulty condenser freezing. • Belt slip.	• Maintain the proper level of refrigerant. Clean the condenser. • Repair the belt.	 KFWD003A
1. Low pressure and high pressure are high. 2. Low pressure pipe is not cold.	• Air intake in freezing cycle.	• Clean or repair the receiver drier. • Check for oil contamination.	 KFWD004A

SYMPTOMS	PROBABLE CAUSES	REMEDY	MANIFOLD GAUGE READINGS
1. Low pressure side indicates negative pressure and high pressure side indicates low pressure. 2. Front or dew on pipes connected with receiver or expansion valve.	• Dust or moisture frozen at expansion valve hole. • Gas leak at cooling vessel.	• Repair the receiver drier and replace the expansion valve. • Replace the expansion valve if cooling vessel is faulty.	 KFWD005A
1. Low pressure side pressure sometimes go to negative pressure or normal.	• Intaken moisture is frozen at expansion valve hole.	• Repair and bleed receiver drier	 KFWD006A
1. Low pressure and high pressure are high. 2. Much frost or dew sticks on low pressure side piping.	• Expansion valve failure. Cooling vessel inlet faulty. • Flow control faulty.	• Repair receiver drier. • Check oil contamination.	 KFWD007A
1. Low pressure side pressure is high and pressure side pressure is low.	• Leak inside compressor.	• Replace compressor.	 KFWD008A

MANUAL A/C COMPRESSOR CONTROLS

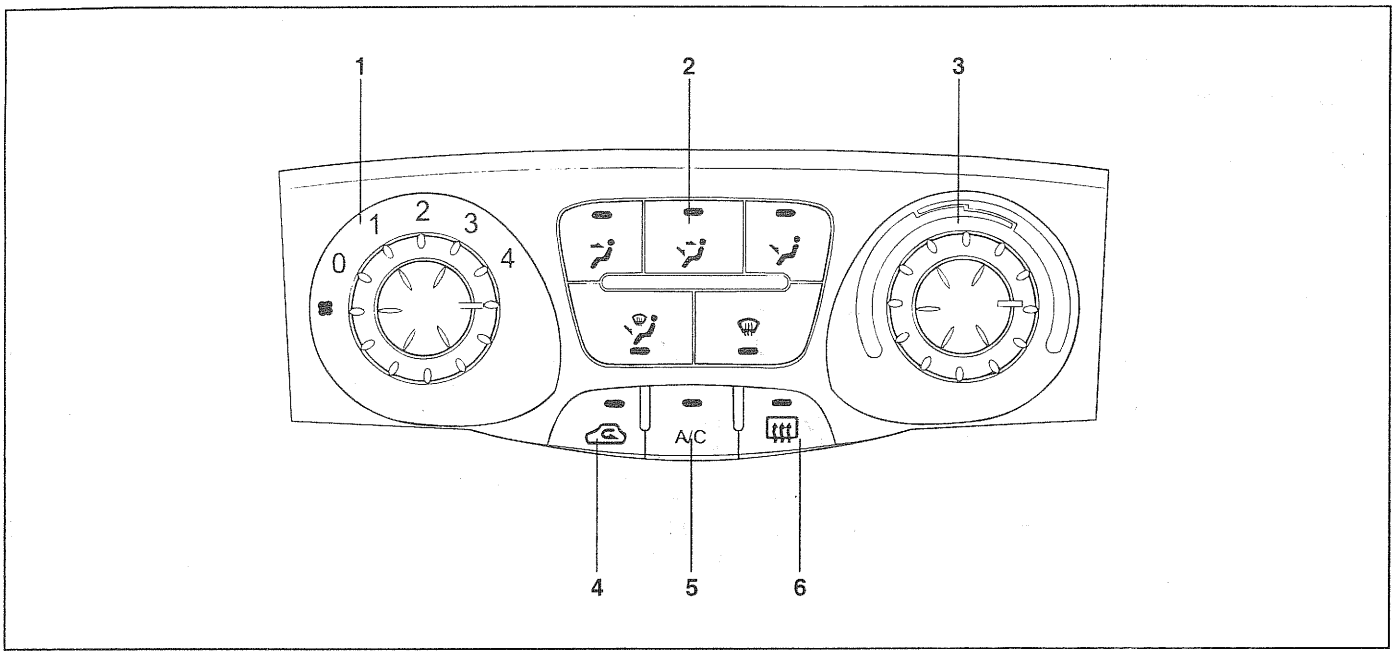
AIR CONDITIONER SWITCH (ROTARY + PUSH) EQHA0850

CONTROL PANEL



EQHA002A

SWITCH CONFIGURATION (ROTARY + PUSH) EQHA0860



EQHA086A

1. **BLOWER SWITCH**

   Blower switch controls blowing level of air conditioning system by controlling blower motor revolution. The switch has a electrical circuit containing a resister that will regulate blower motor input voltage, used to control the motor revolution.

2. **MODE SWITCH**

   Mode switch controls air conditioning system discharge level. The switch contains the electrical circuit be used to control actuator that is connected with mode door for discharge control.

3. **TEMPERATURE SWITCH**

   Temperature switch controls the temperature door position that will be used to regulate air conditioning system's discharge air temperature. The switch includes rack & pinion and cable.

4. **INTAKE SWITCH**

   Intake switch controls intake door used to regulate the intake air flow of air conditioning system. The switch contains the electrical circuit used to control actuator that is connected with intake door.

5. **AIR CONDITIONING SWITCH**

   Air conditioning switch on/off position of air conditioning system compressor. The switch contains the electrical circuit that will switch on/off the power supply of relay that is connected with compressor.

6. **REAR DEFOGGER SWITCH**

   REAR DEFOGGER switch is used to defog rear glass. Switching on the switch, ETACS will output rear glass heat wire control terminal level signal to operate the heat wire.

CHECKING EQHA0870

BLOWER SWITCH CHECK

Switching on blower, blower relay will be on to permit blower motor upper end voltage. Permitted voltage, blower motor and resisters will be used to determine current that go through blower motor and the resister of selected blower level, to ground.

DIAGNOSIS

Symptom	Probable causes	Checks
Blower malfunction	Broken circuit of resistor	Replace resistor
Blower discharge in "off" position	Blower switch is short-circuited	Switch off the switch and then check short-circuit between terminals of each blower level and GND/COMMON terminal.

AIR CONDITIONING SWITCH CHECK

Air conditioning system discharge requires the blower operation Upon selecting blower level 1, blower relay will be on and voltage will be permitted. The permitted voltage will go to control connector M53 terminal #3, and then pressing the switch, 9V or higher voltage will be output to connector M54 terminal #11.

DIAGNOSIS

Symptom	Probable causes	Checks
No discharge when switching on air conditioning switch.	Air conditioning system signal is faulty	With the air conditioning switch on, check voltage at connector M54 terminal #3. If the voltage is 9V or higher, check triple switch thermostat, engine ECU, and peripheral wiring.
		With the air conditioning switch on, check voltage at connector M54 terminal #3. If the voltage is 9V or lower, check voltage at terminal #9 and inspect peripheral wiring.

INTAKE SWITCH CHECK

Select fresh air mode using intake switch with ignition on, than 12V will be output from connector M54 terminal #6 and 0V will be permitted from terminal #13 to operate the motor in fresh air mode. Select recirculation mode using intake switch, than 12V will be output from the connector terminal #13 and 0V will be permitted from terminal #6 to operate the motor in recirculation mode.

DIAGNOSIS

Symptom	Probable causes	Checks
Fresh air mode failure	Actuator power supply failure	Disconnect the connector from actuator. Select fresh air mode using intake switch and check voltage at connector M54 terminal #5. If the voltage is 9V or higher, check actuator and peripheral wiring. If lower than 9V, it means internal defect of controller.
Recirculation mode failure	Actuator power supply failure	Disconnect the connector from actuator. Select recirculation mode using intake switch and check voltage at connector M54 terminal #13. If the voltage is 9V or higher, check actuator and peripheral wiring. If lower than 9V, it means internal defect of controller.

MODE SWITCH CHECK

Select mode switch with ignition on, than it will operate at the selected mode.
Selecting vent mode using the switch, 0V(ground) will be permitted at connector M54 terminal #9, and 9V or higher voltage will be set at other terminals(6, 7, 8, 14 & 15). The voltage signal will be sent to mode actuator that contains motor drive.
Motor drive will operate motor to set vent mode. Therefore mode selection will be enabled among bi-level, floor, mix. & defroster.

DIAGNOSIS

Symptom	Probable causes	Checks
A specific mode is impossible to select	Faulty signal transmission of the selected mode	Disconnect the connector from actuator. Check voltage at the wiring of selected mode. If the voltage is 8V or higher, it is controller's internal defect.
	Mode actuator, drive failure	Disconnect the connector from actuator. Check voltage at the wiring of selected mode. If the voltage is 1V or lower, check mode actuator and peripheral wiring.
Mode actuator, drive failure	Mode actuator, internal defect	If motor drive IC installed inside mode actuator is faulty, mode selection will be impossible. If 0V(ground) is permitted at selected mode wiring by means of controller but the actuator does not operate, it means mode actuator's internal defect.

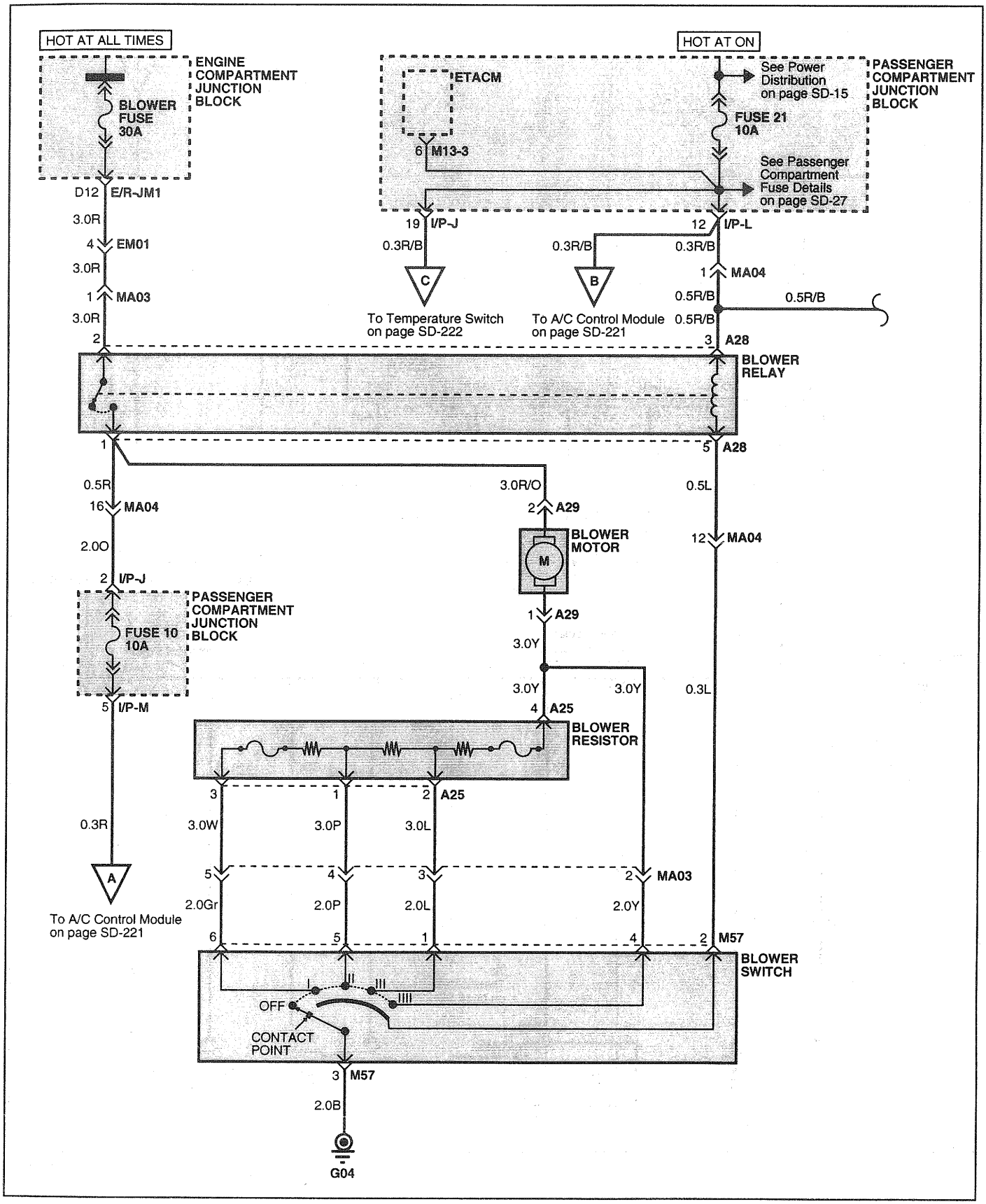
TEMPERATURE SWITCH CHECK

Temperature switch will use the internal mechanism including gear and shaft to operate temperature door that will shift between "WARM" and "COOL".
Temperature door is manually driven by cable that is connected with the switch.

DIAGNOSIS

Symptom	Probable causes	Checks
Warm/cool shift is impossible	Poor connection of temperature cable.	Check connection between temperature cable and temperature door.
		Check if the cable is separated from temperature switch.

SCHEMATIC DIAGRAM EQHA0900



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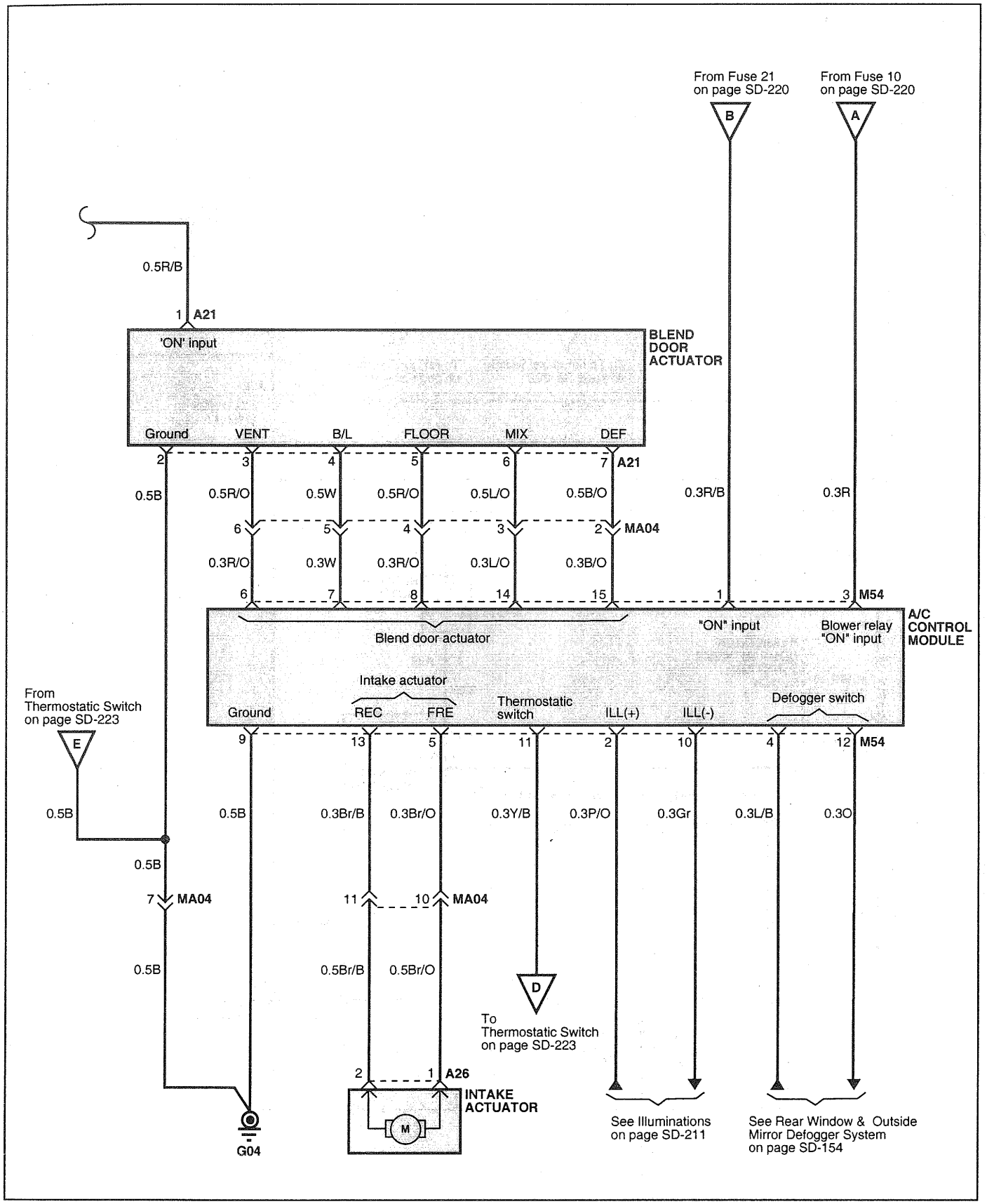
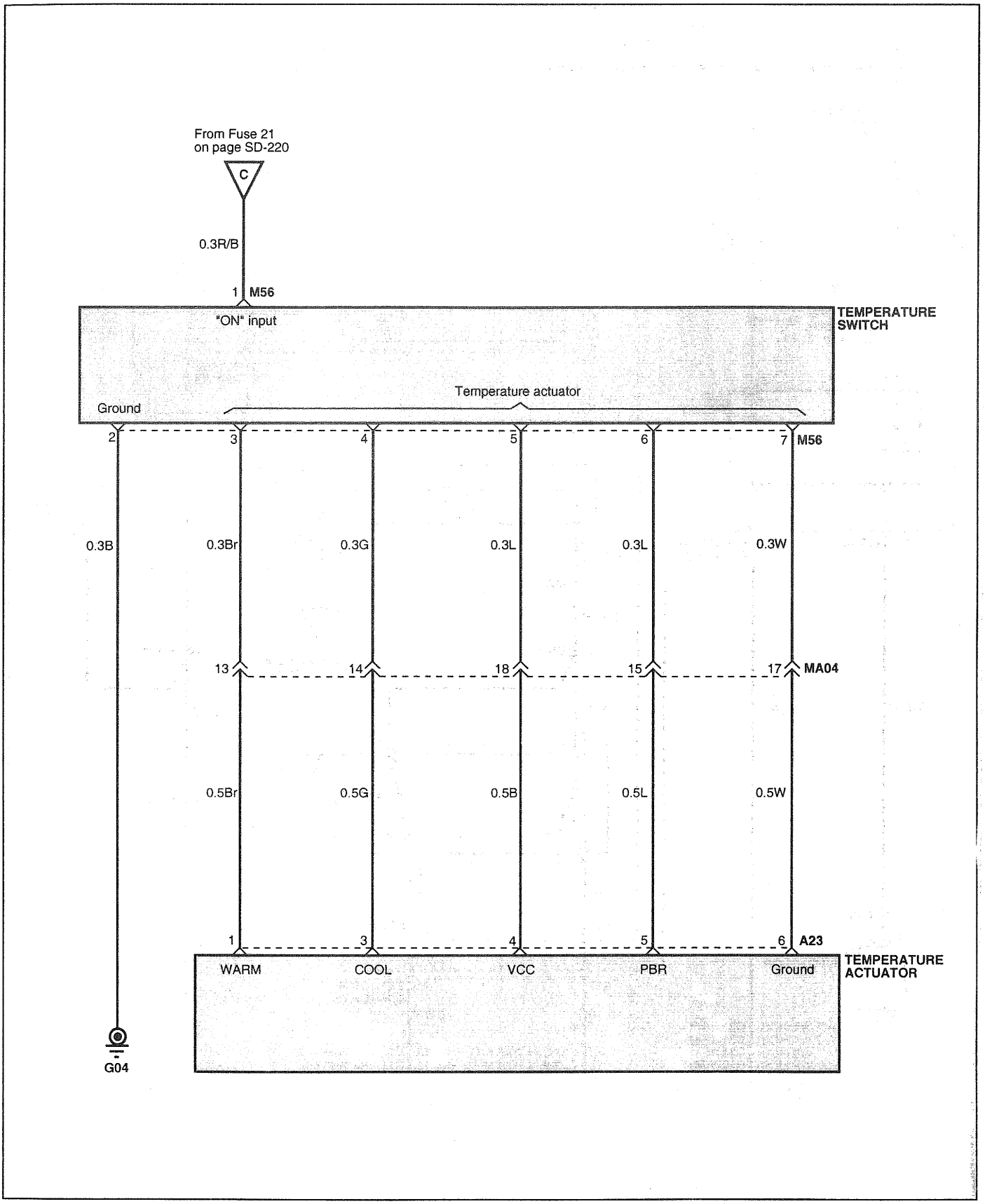
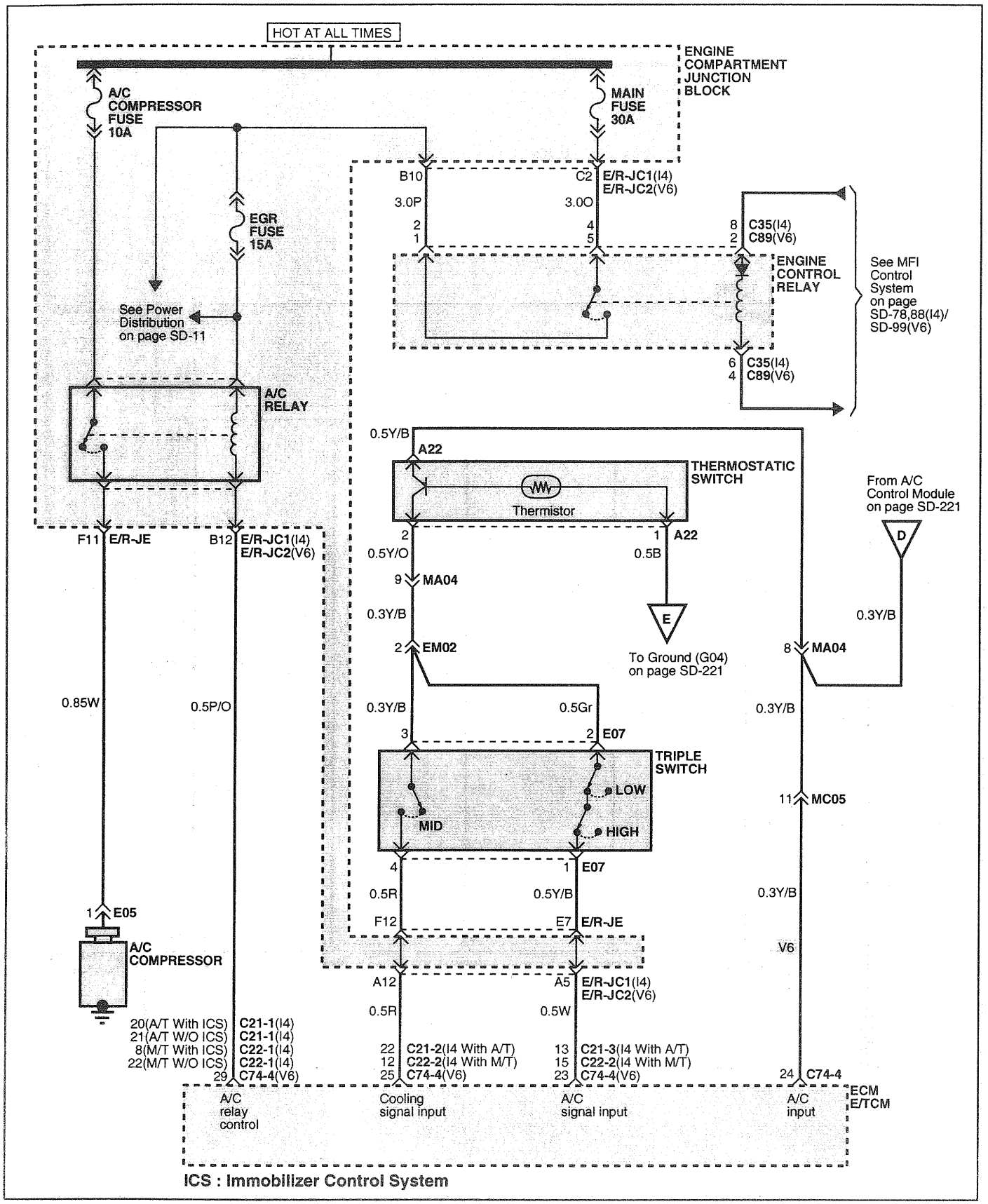

From Fuse 21
on page SD-220
From Fuse 10
on page SD-220
B
A
0.5R/B
1 A21
'ON' input
BLEND
DOOR
ACTUATOR
Ground
VENT
B/L
FLOOR
MIX
DEF
2
3
4
5
6
7 A21
0.5B
0.5R/O
0.5W
0.5R/O
0.5L/O
0.5B/O
0.3R/B
0.3R
6
5
4
3
2 MA04
0.3R/O
0.3W
0.3R/O
0.3L/O
0.3B/O
6
7
8
14
15
1
3 M54
Blend door actuator
"ON" input
Blower relay
"ON" input
A/C
CONTROL
MODULE
Intake actuator
From
Thermostatic Switch
on page SD-223
Ground
REC
FRE
Thermostatic
switch
ILL(+)
ILL(-)
Defogger switch
E
9
13
5
11
2
10
4
12 M54
0.5B
0.5B
0.3Br/B
0.3Br/O
0.3Y/B
0.3P/O
0.3Gr
0.3L/B
0.3O
0.5B
7 MA04
11
10 MA04
0.5B
0.5Br/B
0.5Br/O
D
To
Thermostatic Switch
on page SD-223
2
1 A26
INTAKE
ACTUATOR
M
G04
See Illuminations
on page SD-211
See Rear Window & Outside
Mirror Defogger System
on page SD-154

E2HA054B


From Fuse 21
on page SD-220
C
0.3R/B
1 M56
"ON" input
TEMPERATURE SWITCH
Temperature actuator
Ground
2
3
4
5
6
7 M56
0.3B
0.3Br
0.3G
0.3L
0.3L
0.3W
13
14
18
15
17 MA04
0.5Br
0.5G
0.5B
0.5L
0.5W
1
3
4
5
6 A23
WARM
COOL
VCC
PBR
Ground
TEMPERATURE ACTUATOR
G04

E2HA054C


HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
A/C COMPRESSOR FUSE 10A
MAIN FUSE 30A
EGR FUSE 15A
B10
C2 E/R-JC1(I4) E/R-JC2(V6)
3.0P
3.0O
2
1
4
5
8 C35(I4)
2 C89(V6)
ENGINE CONTROL RELAY
See MFI Control System on page SD-78,88(I4)/ SD-99(V6)
6 C35(I4)
4 C89(V6)
See Power Distribution on page SD-11
A/C RELAY
0.5Y/B
A22
THERMOSTATIC SWITCH
Thermistor
From A/C Control Module on page SD-221
D
F11 E/R-JE
B12 E/R-JC1(I4) E/R-JC2(V6)
2
0.5Y/O
1 A22
0.5B
9 MA04
0.3Y/B
0.3Y/B
E
2 EM02
To Ground (G04) on page SD-221
8 MA04
0.85W
0.5P/O
0.3Y/B
0.5Gr
0.3Y/B
3
2 E07
TRIPLE SWITCH
LOW
MID
HIGH
11 MC05
4
1 E07
0.5R
0.5Y/B
0.3Y/B
F12
E7 E/R-JE
V6
1 E05
A/C COMPRESSOR
A12
A5 E/R-JC1(I4) E/R-JC2(V6)
0.5R
0.5W
20(A/T With ICS) C21-1(I4)
21(A/T W/O ICS) C21-1(I4)
8(M/T With ICS) C22-1(I4)
22(M/T W/O ICS) C22-1(I4)
29 C74-4(V6)
22 C21-2(I4 With A/T)
12 C22-2(I4 With M/T)
25 C74-4(V6)
13 C21-3(I4 With A/T)
15 C22-2(I4 With M/T)
23 C74-4(V6)
24 C74-4
A/C relay control
Cooling signal input
A/C signal input
A/C input
ECM E/TCM
ICS : Immobilizer Control System

E2HA054D

CHECKING OF THE CONTROL PANEL ASSEMBLY EQHA0950

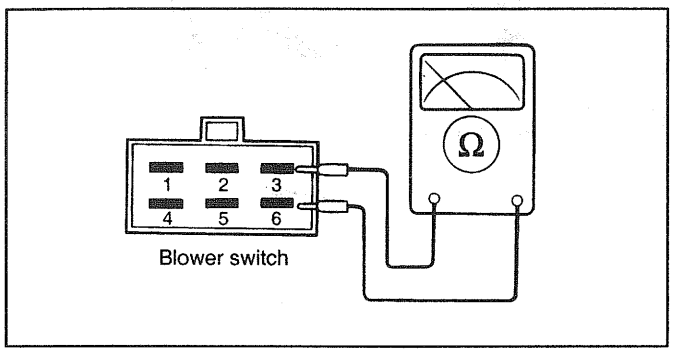
BLOWER SWITCH

Check for continuity between terminals as shown below.

Switch position \ Terminal	1 (M.H)	2 (B+)	3 (Ground)	4 (High)	5 (M.L)	6 (Low)
OFF						
1 (LOW)		○	○			○
2 (M.L)		○	○		○	
3 (M.H)	○	○	○			
4 (HIGH)		○	○	○		

EQHA095A

If continuity is not as specified, replace the control panel.



X97-023A

AIR CONDITIONING SWITCH

Check for continuity between terminals No. 12 and No.22.

MODE CONTROL SWITCH

Check for continuity between terminals.

Mode switch	Terminals
PANEL	6 ↔ 9
PANEL/FLOOR	7 ↔ 9
FLOOR	8 ↔ 9
FLOOR/DEFROST	14 ↔ 9
DEFROST	15 ↔ 9

EQHA095B

If continuity is not as specified, replace the control panel.

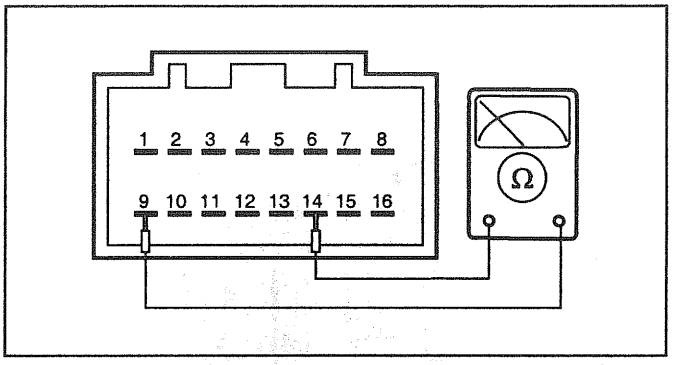
FRESH/RECIRCULATION BUTTON

Check for continuity between terminals.

Mode switch	Terminals
FRESH	4 ↔ 22
RECIRCULATION	12 ↔ 22

EQHA095C

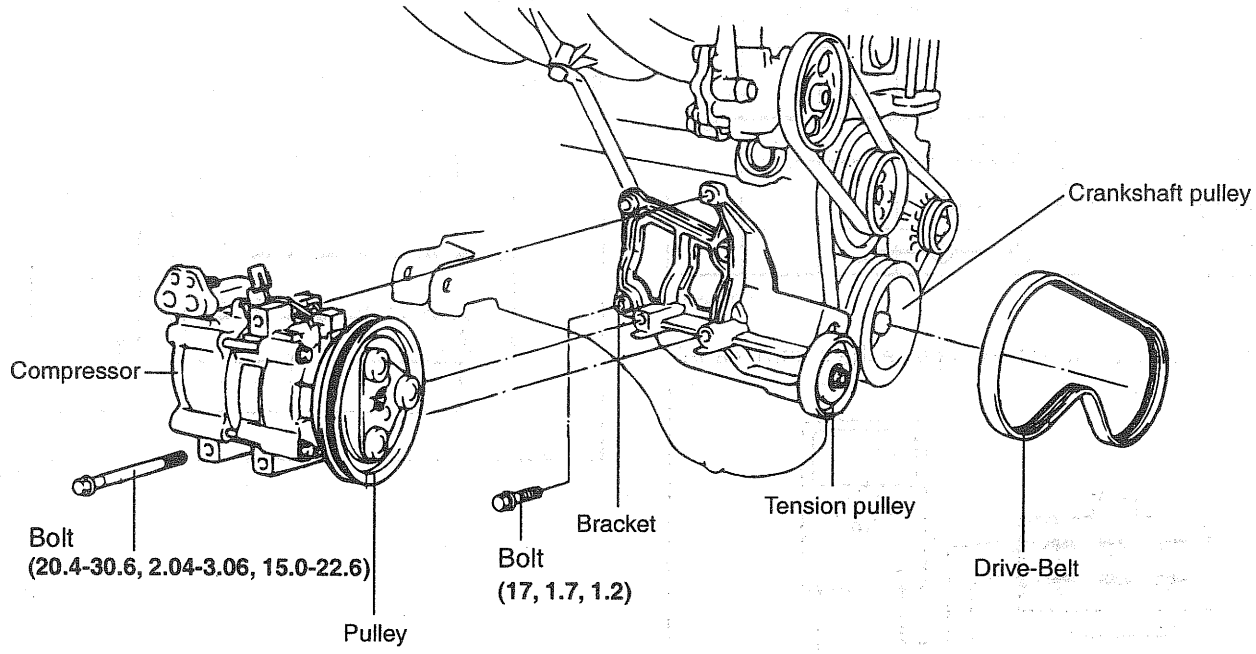
If continuity is not as specified, replace the control panel.



EQB9008A

COMPRESSOR EQHA1150

COMPONENTS



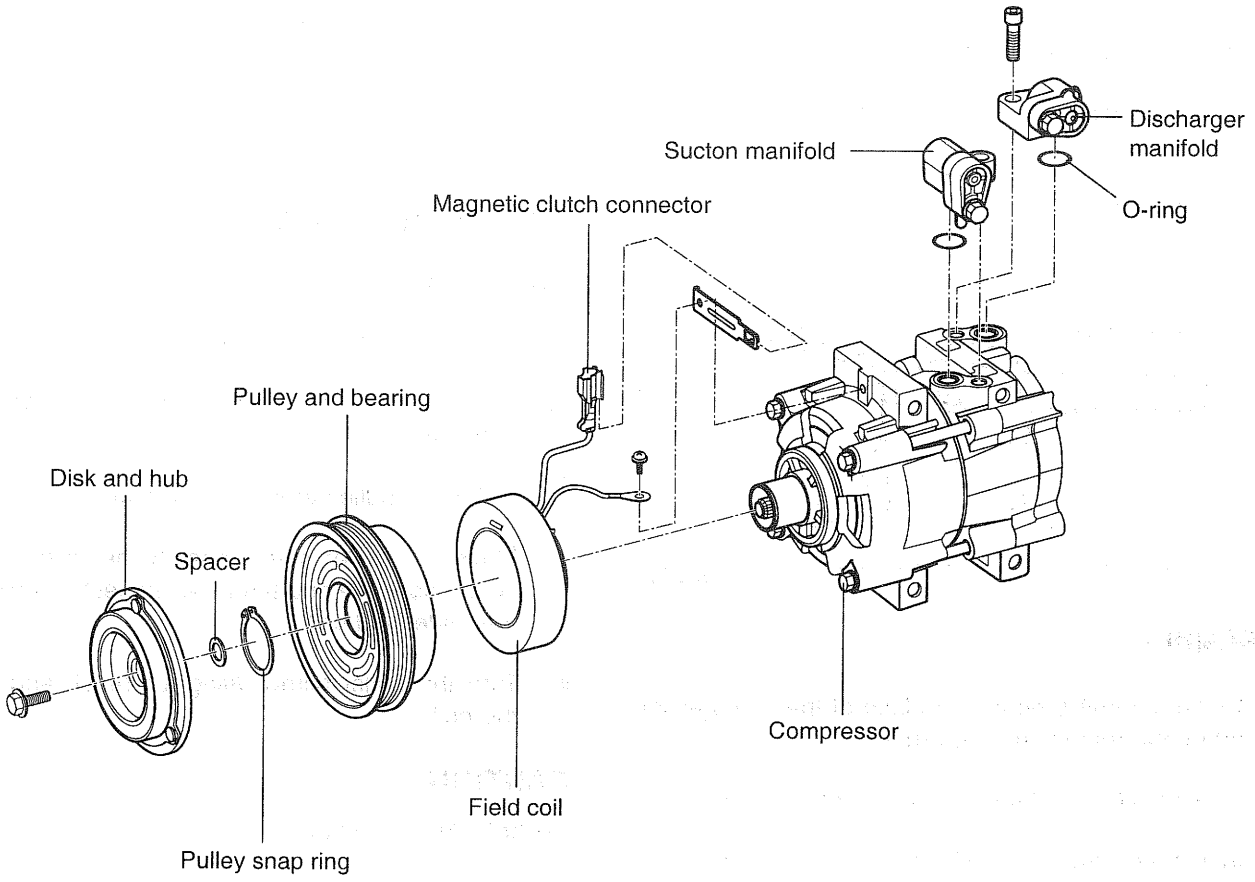
TORQUE : N.m (kg·m, lb·ft)

EQDA026B

REMOVAL AND INSTALLATION EQHA1200

1. Remove the drive belt after that loosed tension pulley.
2. Discharge the refrigerant.
3. Remove the discharge and suction hose.
4. Remove the compressor.
5. Installation is the reverse of removal.

COMPONENTS EQHA1250

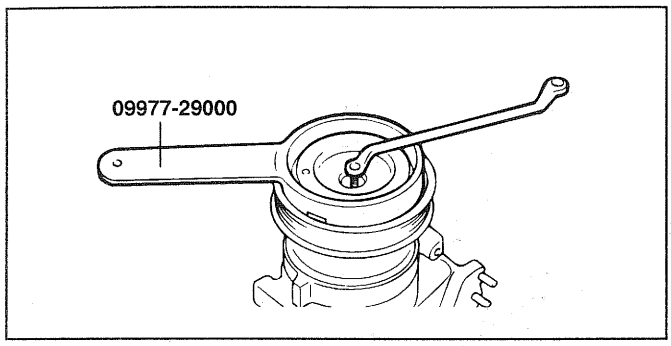


EQDA125A

CLUTCH HUB AND PULLEY EQHA1300

DISASSEMBLY

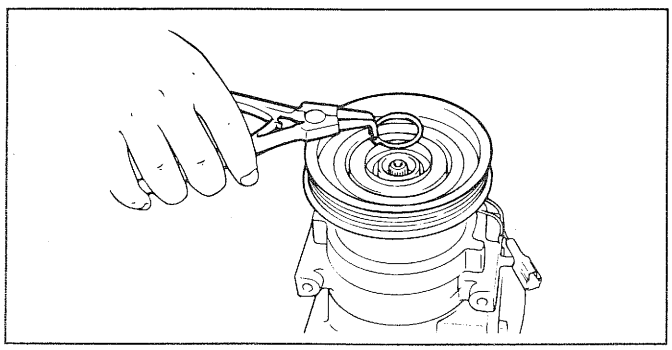
1. Remove the clutch hub supporting bolt using spanner wrench.
2. Pull out the clutch hub and shim from the compressor shaft. If it is hard to pull out the hub from compressor, insert 8mm bolt into the shaft hole to remove the hub from the shaft.
3. Remove the pulley supporting the snap ring.
4. Remove the pulley and bearing assembly from the compressor.



EQA9014A

ASSEMBLY

1. Clean the pulley bearing surface of the compressor head and remove dirt and rust.
2. Install pulley and bearing on the compressor.
3. Install the snap ring with bevelled side facing outside.
4. Place one space shim of specified side at the hub spline opening inside and slide the hub onto the compressor shaft end.
5. Install a new hub supporting bolt at the compressor shaft end. Tighten the bolt with tightening torque.

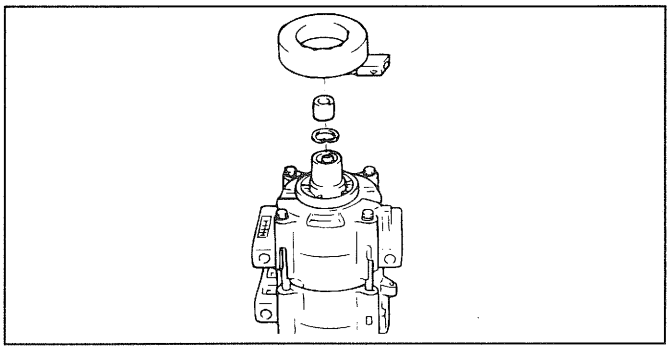


EQA9014B

Tightening torque : 102~153kg.cm

CAUTION

Do not use air tools.



EQHA130A

CLUTCH FIELD COIL

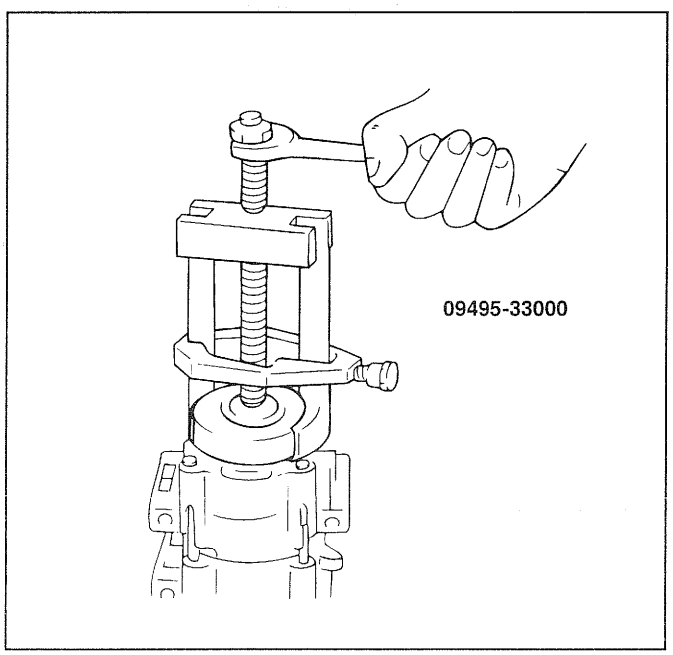
DISASSEMBLY

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 protector 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.



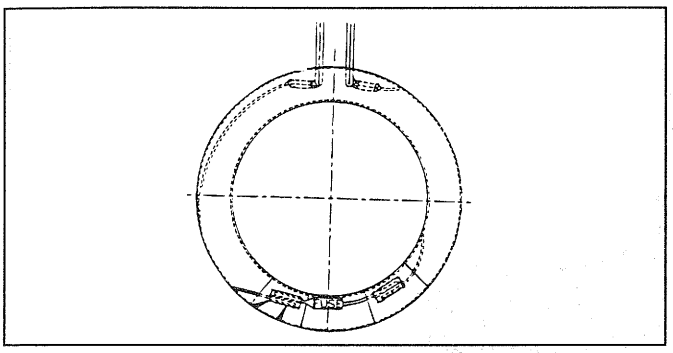
EQHA130B

THERMAL FUSE

1. Thermal fuse is located on the compressor clutch coil.

2. Outline

   Thermal fuse will detect clutch slip heat (184°C off) generated by compressor faulty operation, then interrupt coil power supply to stop the clutch operation. Therefore the clutch bearing and the pulley bearing damage will not be continued, to protect the belt and engine. Once thermal fuse operates, vehicle power supply will be interrupted and the compressor will not operate. Then check the clutch oil resistance (3.0–3.2Ω) to find thermal fuse condition, and replace the clutch coil if required.



HEW97018

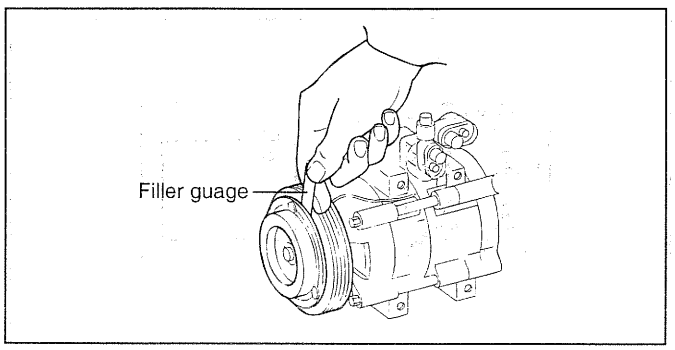
CLUTCH AIR GAP CHECKING

1. Check clutch air gap between clutch hub and pulley contact surface using filler gauge.

Clutch air gap : 0.35~0.65mm

2. Check gaps around pulley at 3 points.

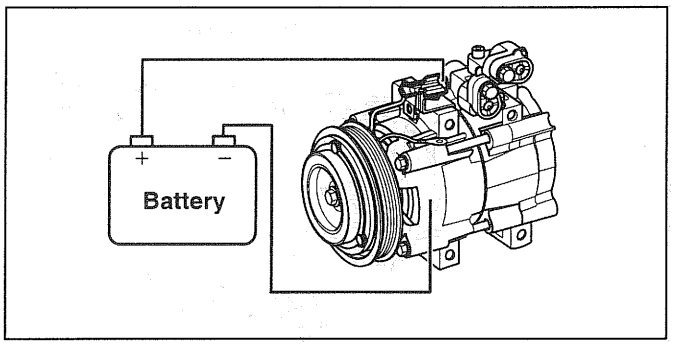
3. If clutch air gap is outside normal range, correct clutch air gap into normal range using a shim of proper size.



KFWD052A

MAGNETIC CLUTCH, OPERATION CHECK

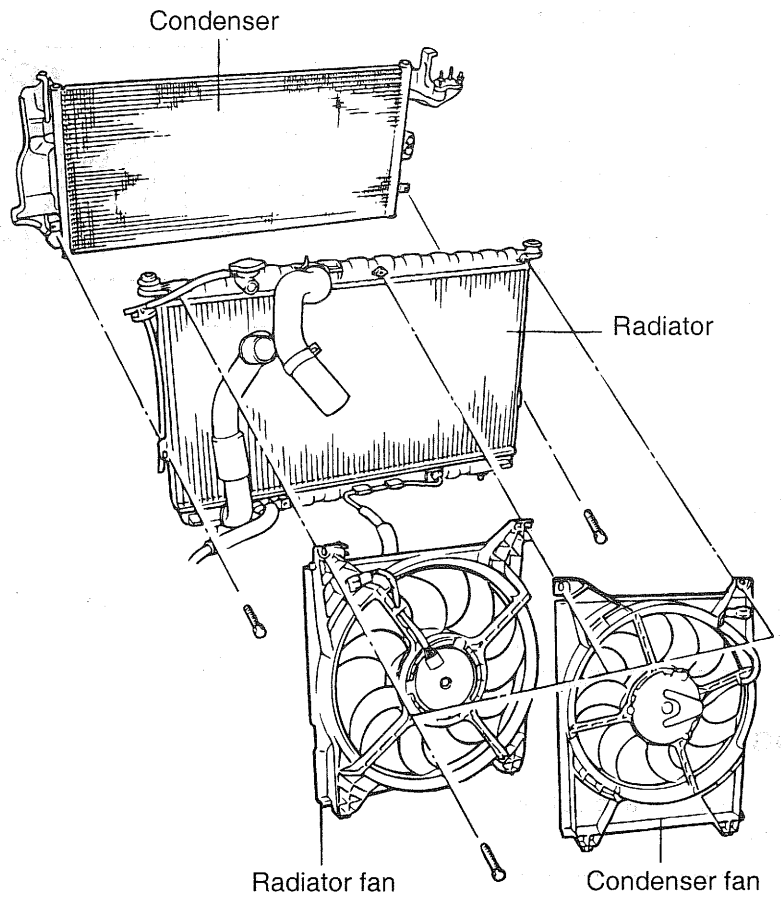
Connect the compressor side terminal to battery(+) terminal and ground battery(-) terminal to the compressor body. Check magnetic clutch operation noise to determine condition.



KFWD053A

CONDENSER FAN AND RELAY EQHA1350

COMPONENTS



HEW97019

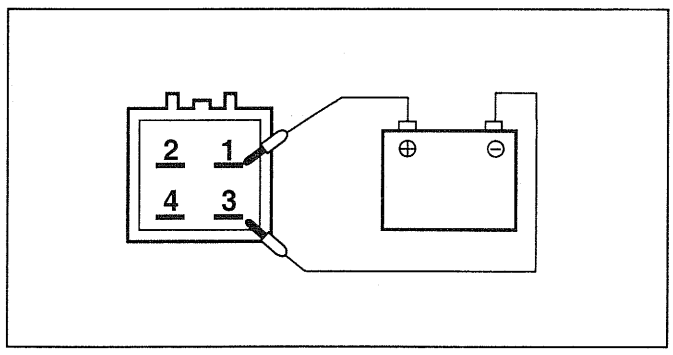
CHECKING EQHA1400

CONDENSER

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 a plier.
2. Check condenser connection area for leakage, and repair or replace it, if required.

CONDENSER FAN

1. Check the condenser fan for leakage.
2. Check the harness coupler for connection condition.
3. Check the condenser fan motor using battery voltage.



EQA9038A

CONDENSER AND RADIATOR FAN OPERATION CONDITION

COM-PRESSOR ON/OFF	VEHI-CLE SPEED (KPH)	FAN	COOLANT TEMPERATURE -30	90	95	100	105	110	115	120
OFF	44KPH below	R/FAN	OFF			LOW	MID-DLE	HIGH		
		C/FAN	OFF				MIDDLE			
	44KPH over	R/FAN	OFF		LOW		HIGH			
		C/FAN	OFF				MIDDLE			
	80 KPH over	R/FAN	OFF				HIGH			
		C/FAN	OFF				MIDDLE			
ON	20 KPH below	R/FAN	OFF		LOW		MID-DLE	HIGH		
		C/FAN	OFF		LOW		MID-DLE	HIGH		
	20 KPH over	R/FAN	OFF		LOW		HIGH			
		C/FAN	OFF		LOW		HIGH			
	80 KPH over	R/FAN	OFF				HIGH			
		C/FAN					HIGH			

* R/FAN : Radiator Fan C/FAN : Condenser Fan

ECU OPERATION CONDITION

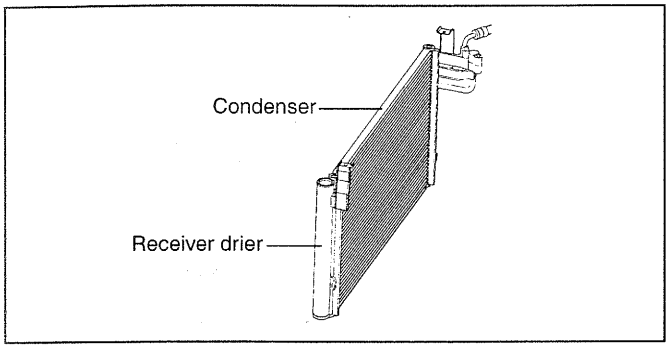
		ECU "HI"					
		OFF		ON			
ECU "LO"	OFF	OFF	OFF	MID	MID	OFF	
		OFF	OFF	MID	MID	ON	A/C
	ON	OFF	OFF	HIGH	HIGH	OFF	S/W
		LOW	LOW	HIGH	HIGH	ON	
		RAD FAN	COND FAN	RAD FAN	COND FAN		

EQHA140A

RECEIVER/DRIER EQHA1450

1. Check the fusible plug and the fittings for leakage, using a leak detector.

2. Run the engine at fast idle with the air conditioning "ON", and check both the inlet and outlet temperature. If difference in temperatures between the inlet and outlet is large, replace the receiver-drier.



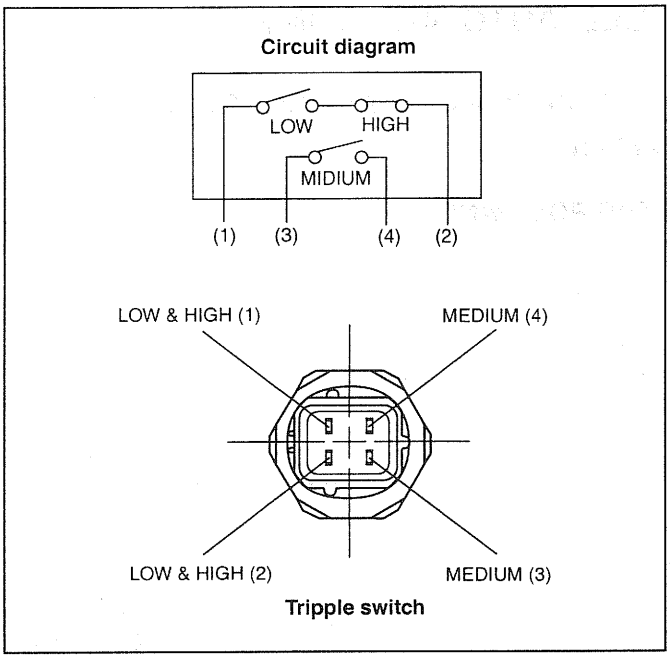
EQHA201A

NOTE

1. **Plug the all open fittings immediately to keep moisture out of the system.**
2. **Do not remove the blind plugs until ready for connection.**
3. **If the receiver-drier is replaced with a new unit, add 40cc of compressor oil to the compressor.**
4. **Evacuate, charge and test refrigeration system.**

TRIPLE SWITCH EQHA1500

Triple switch is a combination of the medium switch as well as conventional low pressure and high pressure switches. Low pressure switch will be turned off to stop compressor operation if refrigerant pressure is low. High pressure switch will be turned off to stop compressor operation if refrigerant pressure is too high. Medium switch will be turned on at medium level pressure to determine the A/C system overheating, in order to cool the A/C system operating radiator fan and condenser fan at high speed.



KFWD009A

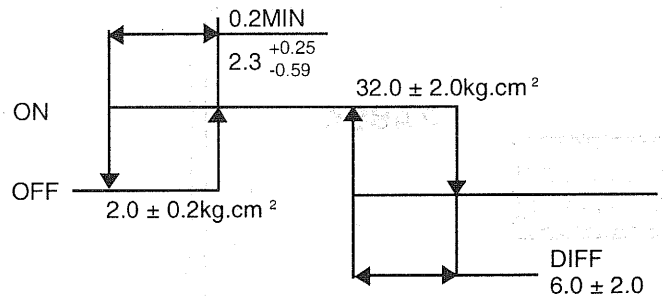
OPERATING CHARACTERISTIC

kg·cm²

Pressure	ON	OFF
High	32.0 ± 2.0	32.0 ± 2.0
Low	2.0 ± 0.2	2.3 ± 0.25
Medium	15.5 ± 0.8	11.5 ± 1.2

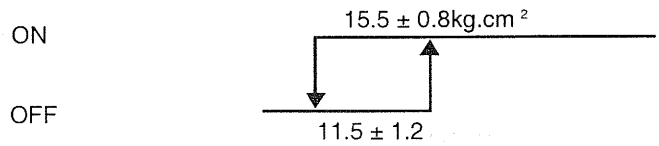
EQHA150B

LOW & HIGH



EQHA150A

MEDIUM

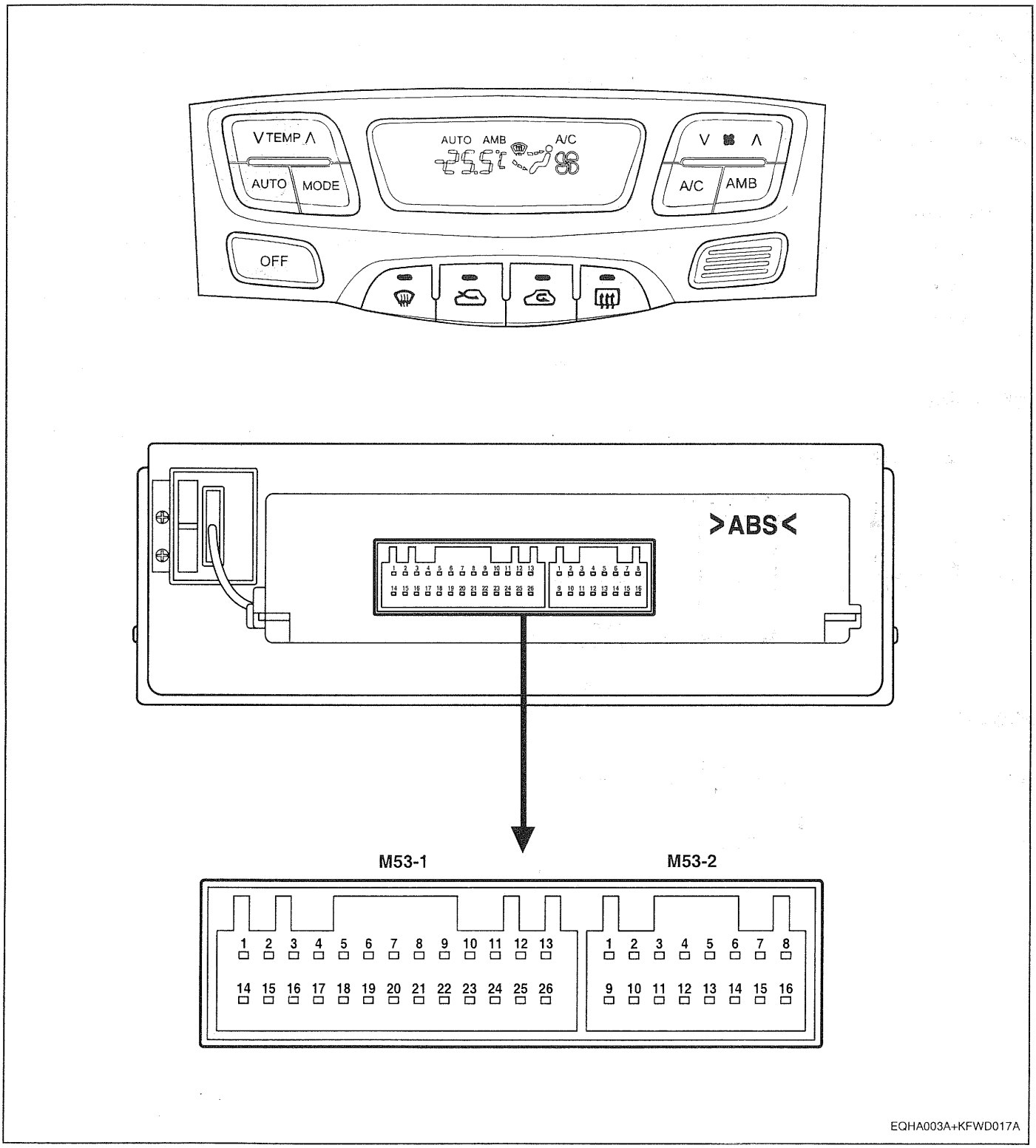


EQHA150C

FULL AUTO A/C COMPRESSOR

FULL AUTOMATIC AIR CONDITIONER (FATC) EQHA1000

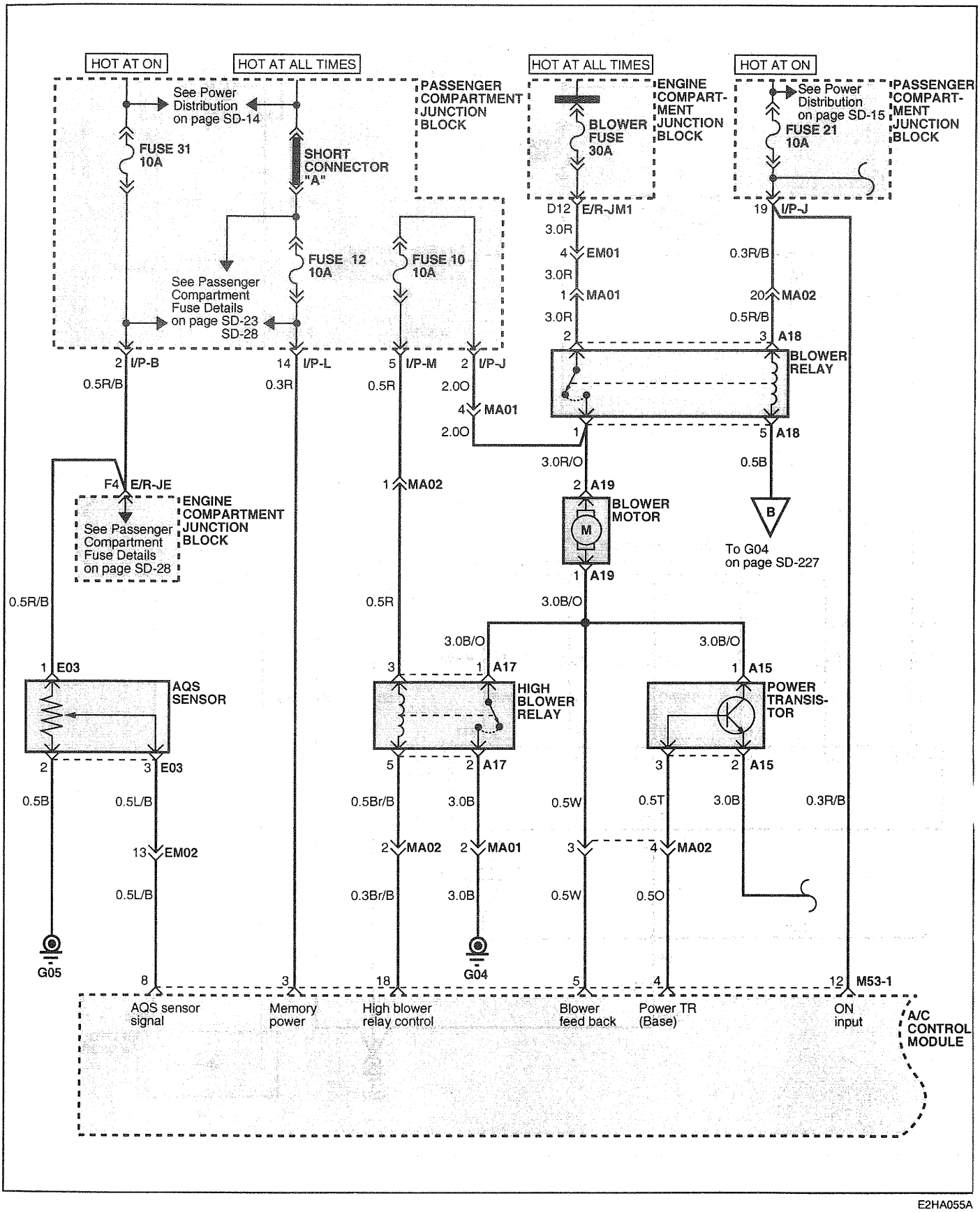
CONTROL PANEL



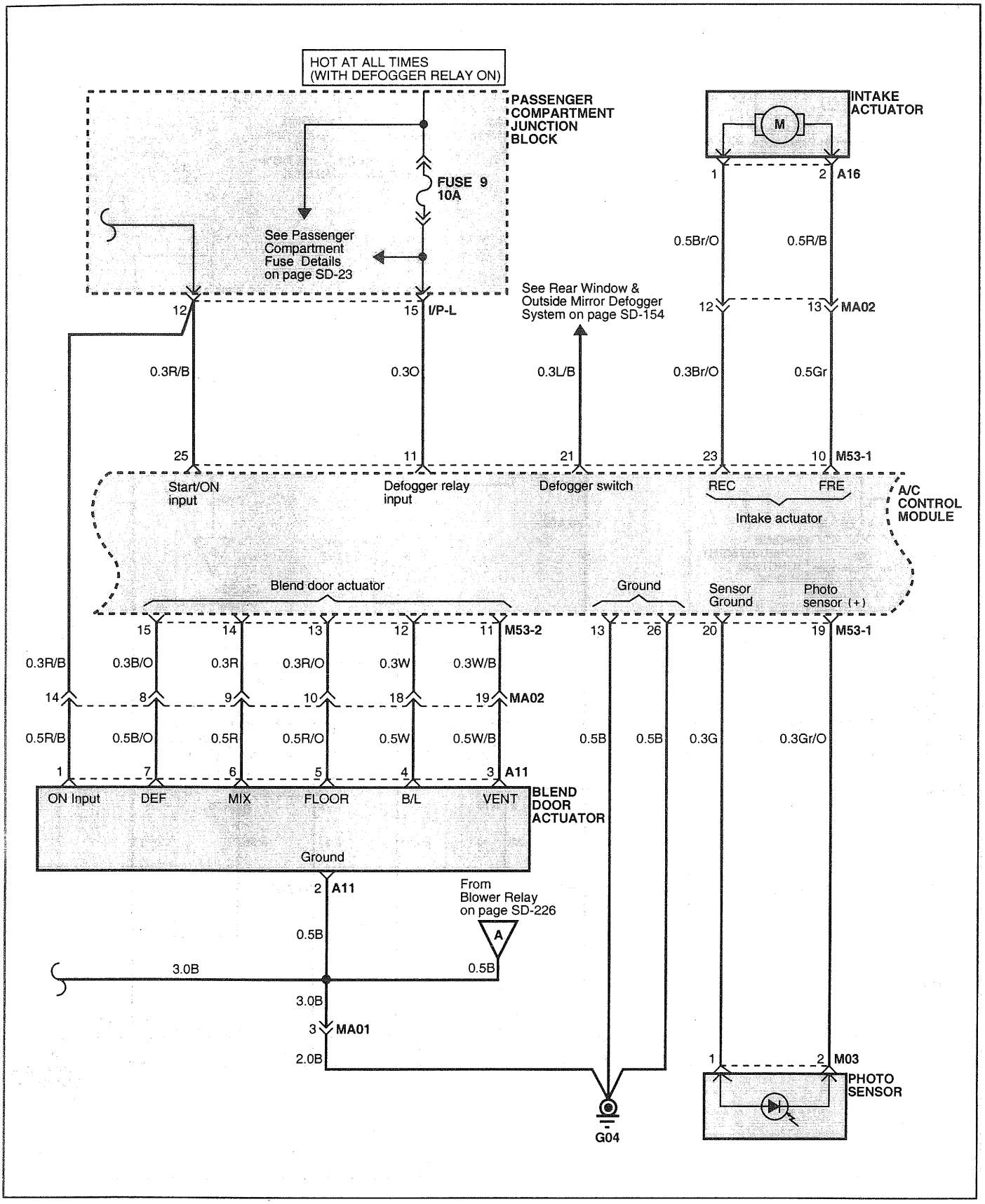
EQHA003A+KFWD017A

EQHA100A

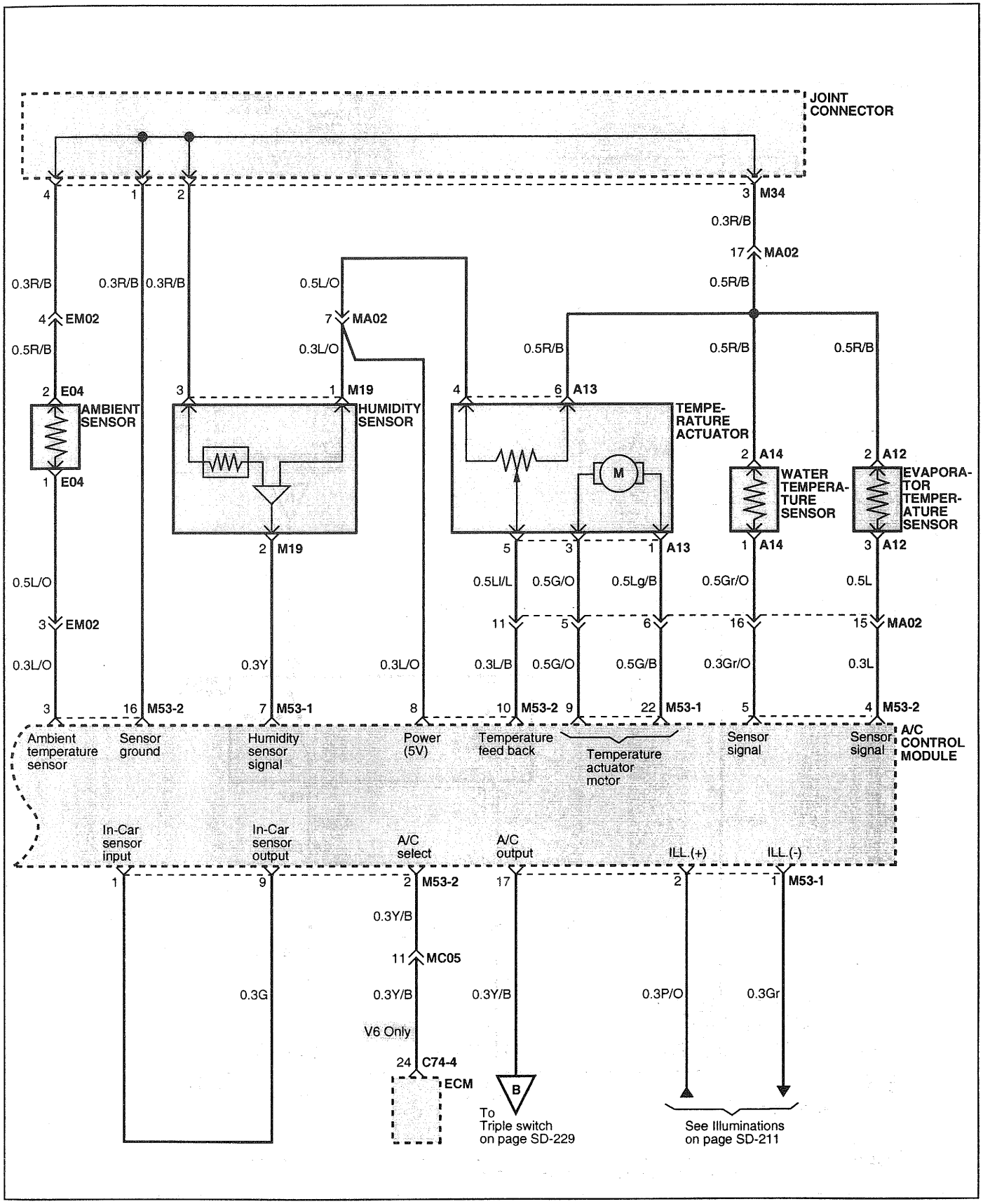
SCHEMATIC DIAGRAM EQHA1050



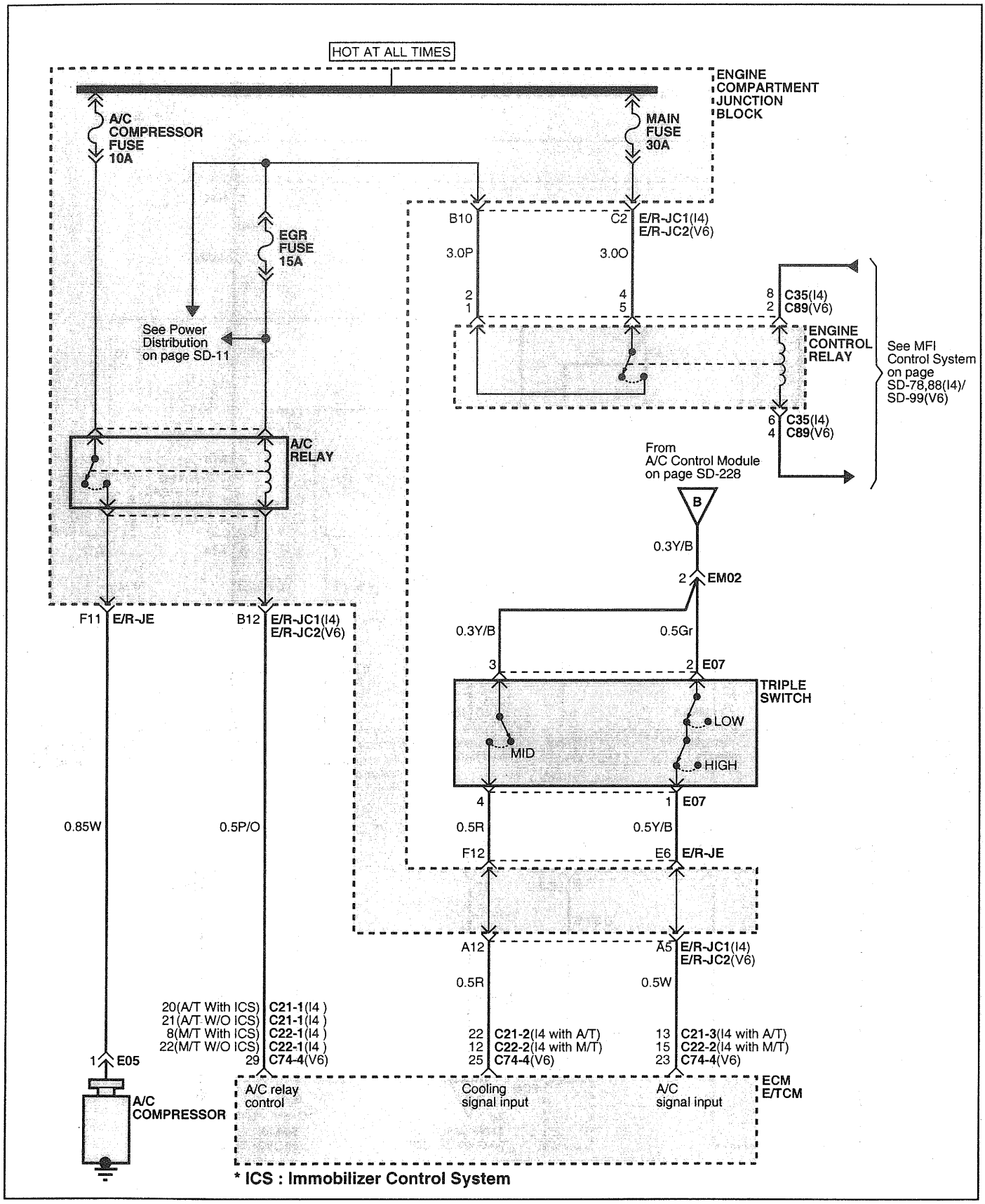
E2HA055A


HOT AT ALL TIMES
(WITH DEFOGGER RELAY ON)
PASSENGER COMPARTMENT JUNCTION BLOCK
FUSE 9
10A
See Passenger Compartment Fuse Details on page SD-23
INTAKE ACTUATOR
M
1
2
A16
0.5Br/O
0.5R/B
See Rear Window & Outside Mirror Defogger System on page SD-154
12
15
I/P-L
12
13
MA02
0.3R/B
0.3O
0.3L/B
0.3Br/O
0.5Gr
25
11
21
23
10
M53-1
Start/ON input
Defogger relay input
Defogger switch
REC
FRE
Intake actuator
A/C CONTROL MODULE
Blend door actuator
Ground
Sensor Ground
Photo sensor (+)
15
14
13
12
11
M53-2
13
26
20
19
M53-1
0.3R/B
0.3B/O
0.3R
0.3R/O
0.3W
0.3W/B
14
8
9
10
18
19
MA02
0.5R/B
0.5B/O
0.5R
0.5R/O
0.5W
0.5W/B
0.5B
0.5B
0.3G
0.3Gr/O
1
7
6
5
4
3
A11
ON Input
DEF
MIX
FLOOR
B/L
VENT
BLEND DOOR ACTUATOR
Ground
2
A11
From Blower Relay on page SD-226
A
0.5B
3.0B
0.5B
3.0B
3
MA01
2.0B
G04
1
2
M03
PHOTO SENSOR

E2HA055B


JOINT CONNECTOR
4
1
2
3 M34
0.3R/B
17 MA02
0.5R/B
0.3R/B
0.3R/B
0.3R/B
0.5L/O
4 EM02
7 MA02
0.5R/B
0.3L/O
0.5R/B
0.5R/B
0.5R/B
2 E04
AMBIENT SENSOR
3
1 M19
HUMIDITY SENSOR
4
6 A13
TEMPE-RATURE ACTUATOR
M
2 A14
WATER TEMPERA-TURE SENSOR
2 A12
EVAPORA-TOR TEMPER-ATURE SENSOR
1 E04
2 M19
5
3
1 A13
1 A14
3 A12
0.5L/O
0.5LI/L
0.5G/O
0.5Lg/B
0.5Gr/O
0.5L
3 EM02
11
5
6
16
15 MA02
0.3L/O
0.3Y
0.3L/O
0.3L/B
0.5G/O
0.5G/B
0.3Gr/O
0.3L
3
16 M53-2
7 M53-1
8
10 M53-2
9
22 M53-1
5
4 M53-2
Ambient temperature sensor
Sensor ground
Humidity sensor signal
Power (5V)
Temperature feed back
Temperature actuator motor
Sensor signal
Sensor signal
A/C CONTROL MODULE
In-Car sensor input
In-Car sensor output
A/C select
A/C output
ILL.(+)
ILL.(-)
1
9
2 M53-2
17
2
1 M53-1
0.3Y/B
11 MC05
0.3G
0.3Y/B
0.3Y/B
0.3P/O
0.3Gr
V6 Only
24 C74-4
ECM
B
To Triple switch on page SD-229
See Illuminations on page SD-211

E2HA055C


HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
A/C COMPRESSOR FUSE 10A
MAIN FUSE 30A
EGR FUSE 15A
See Power Distribution on page SD-11
B10
C2
E/R-JC1(I4)
E/R-JC2(V6)
3.0P
3.0O
2
1
4
5
8
2
C35(I4)
C89(V6)
ENGINE CONTROL RELAY
See MFI Control System on page SD-78,88(I4)/ SD-99(V6)
6
4
C35(I4)
C89(V6)
A/C RELAY
From A/C Control Module on page SD-228
B
0.3Y/B
2
EM02
F11
E/R-JE
B12
E/R-JC1(I4)
E/R-JC2(V6)
0.3Y/B
0.5Gr
3
2
E07
TRIPLE SWITCH
LOW
MID
HIGH
4
1
E07
0.85W
0.5P/O
0.5R
0.5Y/B
F12
E6
E/R-JE
A12
A5
E/R-JC1(I4)
E/R-JC2(V6)
0.5R
0.5W
20(A/T With ICS)
21(A/T W/O ICS)
8(M/T With ICS)
22(M/T W/O ICS)
C21-1(I4)
C21-1(I4)
C22-1(I4)
C22-1(I4)
29
C74-4(V6)
22
12
25
C21-2(I4 with A/T)
C22-2(I4 with M/T)
C74-4(V6)
13
15
23
C21-3(I4 with A/T)
C22-2(I4 with M/T)
C74-4(V6)
1
E05
A/C COMPRESSOR
A/C relay control
Cooling signal input
A/C signal input
ECM E/TCM
* ICS : Immobilizer Control System

E2HA055D

SWITCH OPERATION AND FEATURES EQHA1010

1. Full auto air conditioning system: One-touch button type(back-up feature on operation).
2. Manual air conditioning system: Combination of dial switch and one-touch button.
3. Rear air conditioning system: Manual operation with main button of two-touch type.

CONTROL PANEL SWITCHES WILL GENERATE BUZZER SOUND ON OPERATION

Button	Function	Display	System operation	Stop switch and system operation
Temperature switch (Temperature control) (Manual air-conditioning systems have dial type switches)	Temperature setting UP/ DOWN	Temperature setting indication Range: 17°C-32°C Scale: 0.5°C User may chose the temperature indication between °C/°F. 17°C=62°F 32°C=90°F 25°C=77°F	1. The switch will operate temperature door to regulate cool/ warm air ratio and resultingly control discharge air control. 2. The switch will raise up or lower down the temperature by unit of 0.5. 3. Setting at 17°C (62°F) will provide max. cooling, and setting at 32°C (90°F) will provide max. heating. 4. Switching off→on, it will display the temperature setting just before the previous switching-off. 5. In shifting 17.5°C→17°C or 31.5°C→32°C, raising temperature setting will generate buzzer sound 5 times at interval of 0.15 seconds. 6. Lowering temperature setting at 17°C or raising temperature setting at 32°C, it will generate buzzer sound 5 times at interval of 0.15 sec. 7. Pressing repeatly on: Shift one unit every 0.7 second. Holding down: First shift in 0.7 seconds and than shift every 0.3 seconds (buzzer sound for 0.1 second upon each shift)	Turning off the switch, the system will be off. Control temperature setting up/down.
AUTO (Auto control)	Auto control of air conditioning system	"AUTO" will be displayed on control panel VFD.	1. The system will provide auto control of the below features on the basis of temperature setting: • Temperature door • Mode door • Intake door(Shift between fresh air/recirculation) • Blower speed • Compressor. 2. "AUTO" will disappear upon releasing AUTO switch. 3. Features except manually selected switches will be controlled automatically upon releasing auto switch.	Off→system off Blower switch : Manually control blower MODE : Manually control discharge mode A/C : Manually control compressor on/off. Fresh air : Manually control fresh air Recirculation : Manually control recirculation Defroster : Manually control defroster (at condition of air conditioning system on and recirculation)

Button	Function	Display	System operation	Stop switch and system operation
AMB	Indicate ambient air temperature	'AMB' lamp will come on indicate ambient air temperature other lamps will go out.	1. The system will operate in the condition just before pressing AMB switch. 2. Pressing AMB switch, any previous indication will go out and 'AMB' lamp and ambient air temperature will come on 5 seconds, and then it will return to the previous indication just before pressing AMB switch.	AMB: Pressing AMB switch during ambient air temperature is indicated, ambient air temperature indication will be extinguished. Other switches: Pressing another switch during ambient air temperature is indicated, ambient air temperature indication will be extinguished and selected switch control will be performed.
INTAKE	Recirculation	Recirculation lamp will come on. "AUTO" lamp will go out.	Fix intake door at the position of recirculation.	Selecting fresh air at the current condition : Fresh air control off switch Fixing at the current condition (Fresh air selection is possible)- IND lamp will come in. AUTO-auto control (fresh air, recirculation).
	Fresh air	Fresh air lamp will come on. "AUTO" lamp will go out.	Fix intake door at the position of fresh air.	Selecting fresh air at the current condition : Fresh air control off switch Fixing at the current condition (Fresh air selection is possible)- IND lamp will come in. AUTO-auto control (fresh air, recirculation).

<table>
<tr><th>Button</th><th>Function</th><th>Display</th><th>System operation</th><th>Stop switch and system operation</th></tr>
<tr><td rowspan="3">Blower fan speed UP/ DOWN</td><td>Blower fan speed, UP/ DOWN control</td><td>Indicate fan operation On/off</td><td rowspan="3">1. Control blower motor revolution by meas of POWER TR's current variation.
2. Pressing fan UP/DOWN switches during auto control, the speed will shift up/down based on the current fan level.
3. Switching on a switch except fan switch at 'off' condition, the speed will rise steadily from LOW to the target speed. (Require 6 seconds from LOW to HI).
4. Shifting a step will take 0.7 seconds when pressing the switch once. Holding on the switch, a shift will occur every 0.3 seconds and buzzer sounds for 0.1 second.
5. Pressing UP switch at HI position or DOWN switch at LOW position, buzzer sound will occur 5 times at 0.4 second interval.</td><td rowspan="3">AUTO: Auto control
OFF : System off
Fan speed control: Manually control blower fan speed.</td></tr>
<tr><td colspan="2">Output increment step by step</td></tr>
<tr><td colspan="2">Fan speed levels and voltages
- Auto cooling : No level(4.5V~B+)
- Auto heating: No level(4.5V~B+)
- Manual control: 7 levels (3.8V~B+)</td></tr>
<tr><td>A/C Air conditioning switch</td><td>Compressor on/off control</td><td>• A/C lamp (on/off)
• AUTO lamp off</td><td>Airconditioning ON/OFF</td><td>A/C: A/C on/off, manual control.
OFF: System off AUTO: Auto control.
DEF: Defroster, manual control.</td></tr>
<tr><td rowspan="2">MODE (Discharge mode)</td><td rowspan="2">Mode door control VENT, FLOOR, B/L, MIX</td><td rowspan="2">MODE indication (on/off)
AUTO lamp off</td><td>1. Fix mode door at B/L or MIX
2. Manually operating mode switch, the switch will shift in the order of VENT-B/L-FLOOR-MIX</td><td>MODE: Shift control in order of Vent-B/L-Floor-Mix-Vent.
DEF: Defroster, manual control.
AUTO: Auto control</td></tr>
<tr><td colspan="2">A/C may be turned on at MIX mode enabling to turn off the switch to A/C position.</td></tr>
<tr><td>DEF (Defroster)
• Remove moisture/ frost on windshield.</td><td>DEF control</td><td>• DEF IND on
• DEF indication on
• A/C lamp on
• INTAKE IND off
• AUTO lamp off</td><td>1. Mode door: Fixed at defroster.
2. Intake door: Fresh air control (Selecting recirculation is enabled).
3. A/C: on (Compressor will be controlled on/off based on detected temperature by fin sensor).
4. Prevails over max. cooling and max. heating.
5. Prevails over mix mode control</td><td>AUTO: System auto control.
MODE: Discharge mode, manual control (release the defroster control).
A/C: A/C on/off, manual control
DEF: Return to the previous condition before selecting DEF switch.</td></tr>
</table>

<table>
<tr><th>Button</th><th>Function</th><th>Display</th><th>System operation</th><th>Stop switch and system operation</th></tr>
<tr><td rowspan="4">OFF</td><td rowspan="4">System off</td><td rowspan="2">Control panel LCD off
Indicator lamps on</td><td rowspan="2">1. Blower fan speed off.
2. Airconditioning off.
3. Intake door: Fixed at the condition prior to system off.
4. Temperature door: Auto control.
5. Mode door: Fixed at the condition prior to system off.
6. AMB
Pressing AMB switch after system off, 'AMB' lamp/ambient air temperature will come on for 5 seconds and than go out.</td><td>AUTO: Auto control.
Blower speed: Return to MANUAL LOW.
Others: Return to the previous condition before system off</td></tr>
<tr><td>A/C: Airconditioning on.
Others: Return to the previous condition before system off (Blower speed: Return to MANUAL LOW)</td></tr>
<tr><td colspan="2">• INTAKE(recirc/fresh air) control at the system off condition
1) Selecting fresh air switch at the recirculation position after system off: It will shift to the fresh air position and extinguish the recirculation indicator lamp. The LCD will be held off.
2) Selecting recirculation switch at the fresh air position after system off: It will shift to the recirculation position and extinguish the recirculation indicator lamp. The LCD will be held off.
3) Other switches will be held off at the above condition.</td><td>MODE: Held at the previous condition before system off. (Auto control is released).
Others: Return to the previous condition before system off (Blower speed: Return to MANUAL LOW)</td></tr>
<tr><td colspan="2"></td><td>DEF: Shift to defroster mode
Air conditioning on/Intake(fresh air)
Others: Return to the previous condition before system off</td></tr>
<tr><td colspan="2"></td><td>TEMP: Held at the previous condition before system off.
Others: Return to the previous condition before system off.</td></tr>
<tr><td>DEFOG</td><td>Rear glass defogger on</td><td>Defogger switch indicator on/off</td><td>1. Pressing DEFOG switch, the switch signal will be sent to ETACS. Receiving HTD signal from ETACS, DEFOG indicator will be on.
2. Pressing the switch again, defogging will stop and the indicator will go out.
3. Released by ETACS after 15 minutes of control.</td><td>Pressing DEFOG switch again, it will be released.</td></tr>
</table>

Button	Function	Display	System operation	Stop switch and system operation
AQS switch	AQS	AQS indicator on/ off	AQS indicator will come on and intake control (intake door) will be effected depending on AQS signal. Selection buttons are provided individually for AQS, recirculation and fresh air.	Pressing the switch again during the switch is on, it will be released (Indicator will go out). Selecting fresh air or recirculation during AQS is on, AQS will be off and shift to the selected mode.
RR A/C switch	RR A/C switch indicator on Valve power supply on RR A/C floor power supply on		Pressing the switch again during the switch is on, the switch will be released. Interrupt power supply for RR A/C solenoid valve and blower motor.	Pressing the switch again during the switch is on, it will be released.
RR A/C blower switch	RR A/C blower speed control A/C operation (only)		RR A/C blower speed control: Controlled by manual selection for 3 Steps; HI-HID-LO	A/C switch off Blower switch off
How to change temperature display mode on control panel LCD: 1. Holding AMB button pressed, TEMP DOWN condition of 3 seconds or longer will shift the unit from °C to °F. 2. Switching on battery power from off condition, the default unit, °C will be displayed.				

SYSTEM CONTROL FEATURES

SIGNAL I/O FOR EACH CONTROL FEATURE

Control item	Input	Output	Remarks
Required discharge temperature control	Auto SW, A/C SW, TEMP SW, INCAR sensor, AMB sensor, Photo sensor, Water temperature sensor, Fin thermo sensor, TEMP actuator.	TEMP actuator	
Mode control	AUTO SW, MODE SW, TEMP SW, DEF SW, Blower SW, OFF SW, INCAR sensor, AMB sensor, Photo sensor, Water temperature sensor, Fin thermo sensor, Power TR.	Blower motor Power TR HI-blower relay	Blower Switch Manual selection Control in priority
Mode door control	AUTO SW, MODE SW, DEF SW, Blower SW, OFF SW, TEMP SW, INCAR sensor, AMB sensor, Photo sensor.	Mode actuator	
Intake control	AUTO SW, A/C SW, DEF SW, TEMP SW, OFF SW, Intake SW, INCAR sensor, AMB sensor, Photo sensor, Power TR.	Mode actuator	
Compressor control	AUTO SW, A/C SW, DEF SW, TEMP SW, OFF SW, INCAR sensor, AMB sensor, Photo sensor	Compressor relay	

- During mode control, A/C may operate at DEF or MIX mode In order to enable dehumidification, driver may select A/C OFF during the A/C on condition.

CONTROL SPECIFICATION

Control item	Control features	Remarks
Required discharge temperature	Required temperature determined by temperature setting and sensor inputs.	
Auto control	Required discharge temperature is determined by temperature setting and each sensor input. The feature will use the required discharge temperature to perform auto control of temp actuator, mode actuator, intake actuator, blower motor and compressor, and maintain temperature setting stably.	
INCAR temperature correction	Upon detecting rapid change of temperature from INCAR sensor, it will correct incar temperature value to change gradually.	- 1°C UP/4sec delay - 1°C DOWN/4sec delay
AMB temperature correction	Upon detecting rapid change of temperature from AMB sensor, it will correct ambient temperature value to change gradually.	- 1°C UP/3min delay - 1°C DOWN/4sec delay
Photo correction	Upon detecting rapid change of photo intensity from PHOTO sensor, it will correct photo intensity value to change gradually.	- 350→1000(W/m^2)/1min delay - 350→1000(W/m^2)/5min delay
TEMP door control	Auto control to maintain optimum TEMP door opening(0%~100%), that will be computed from temperature setting and the input signal from each sensor.	Temperature setting range 17°C→32°C, 0.5°C step (62°F→90°F, 1°F step)
Blower speed	Auto control of blower speed, of which target value will be computed from temperature setting and the input signal from each sensor. (7 levels may be selected in case of manual selection.)	- Auto mode blower low voltage (Manual low voltage: 3.8) - Auto mode HTR blower HI speed: 10.6V
Electro-motive mode control	During auto control motion of mode, it will raise permitted voltage of blower motor gradually in order to improve comfortability.	6seconds for shifting LO→MAX HI
Photo compensation	During auto control, it will compensate blower level and discharge temperature according to photo intensity detected from PHOTO sensor at VENT or B/L mode. PHOTO compensation will begin 5 seconds after ignition on.	
Mode door control	Auto control of discharge mode based on required discharge temperature, that will be computed from temperature setting and the input signal from each sensor. (VENT→B/L→FLOOR→VENT) In case of manual selection (VENT→B/L→FLOOR→MIX→VENT)	- Upon switching system off in auto condition, mode door will maintain auto control condition. - Upon switching system off in manual condition, mode door will maintain manual control condition.
MIX mod control(in auto control)	If ambient temperature is -13°C or less in AUTO mode, discharge mode will be controlled at MIX. (When front window glass be defogged.)	Entering MIX mode, A/C will operate.

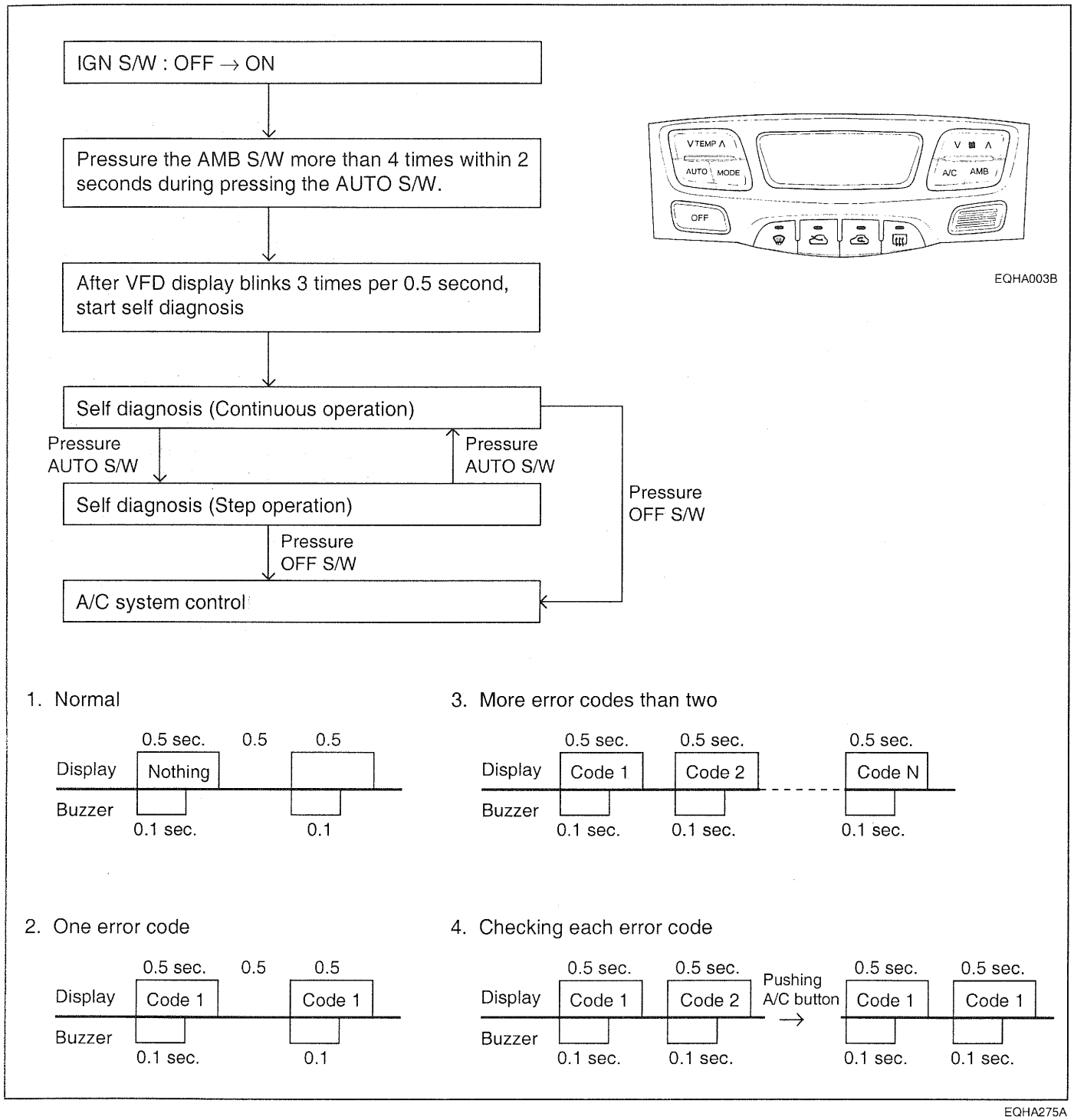
Control item	Control features	Remarks
INTAKE door control	Auto control of intake mode based on required discharge temperature that will be computed from temperature setting and the input signal from each sensor.	- Shift to REC upon selecting REC button at FRE condition (LED on). - Shift to FRE upon selecting FRE button at REC condition (LED on).
INTAKE control upon switching system off	Intake door will shift to REC position upon switching system off at auto condition, and maintain the previous condition upon switching system off at manual condition.	- F/R manual selection will be enabled upon switching system off. - REC indicator will come on upon switching system off at auto condition.
Compressor auto control	Auto control of Compressor on/off state based on temperature setting and input signal from each sensor.	- Auto control of compressor on/off upon selecting AUTO SW. - Compressor on upon manually selecting DEF SW.
Compressor clutch on/off control based on refrigerant temperature	If EVAP sensor detects temperature of 0.5°C or less, and temperature is 3°C or higher with compressor off, compressor will be on.	
MAX HOT	Selecting temperature setting at 32°C at auto condition, MAX HOT will be performed. It will prevail over MIX mode control.	- TEMP door: MAX HOT position - MODE door: FLOOR mode - INTAKE door: FRE mode - Compressor: off - Blower speed: auto HI(10.6V)
MAX COOL	Selecting temperature setting at 17°C at auto condition, MAX COOL will be performed.	- TEMP door: MAX COOL position - MODE door: FLOOR mode - INTAKE door: REC mode - Compressor: On - Blower speed: MAX HI
Electromotive heating control (CELO feature)	If temperature setting>incar temperature + 3°C at B/L or FLOOR at AUTO mode, and temperature sensor input is 68°C or less, it will effect electromotive heating control in order to prevent that cold air from outside may flow toward the feet of passengers.	- Blower speed: Controlled at AUTO LOW (0.5V)
	As coolant temperature will rise up, MODE door will shift in the order of DEF→MIX→AUTO.	Releasing condition 10 minutes after ignition on(In case of temperature sensor fail, it will apply substitute value, 20°C). Upon pressing blower switch when water temperature sensor detection is 58°C or higher. Upon pressing MODE switch.Upon pressing DEF switch.
	MODE: Manual selection is enabled (It will maintain the mode selection in case of manual mode, and blower will maintain CELO feature.) INTAKE door: As AUTO control or at manual selection mode.	
	Blower speed: Manual selection is enabled(No re-entry). Prevails over MAX HOT. No re-entry to CELO after releasing CELO with ignition on.	

<table>
<tr><th>Control item</th><th colspan="2">Control features</th><th>Remarks</th></tr>
<tr><td>Electromotive cooling control</td><td colspan="2">In order to prevent uncomfortableness by hot air from VENT or B/L discharge at AUTO mode (A/C on mode), blower speed will be held at LOW for approx. 9 seconds before entering AUTO control if EVAP sensor detection is 30°C or higher.</td><td></td></tr>
<tr><td>MAX HOT</td><td colspan="2">If the said condition is satisfied, electromotive cooling control will operate at any time.</td><td></td></tr>
<tr><td rowspan="5">Air Quality System (AQS)</td><td colspan="2">The AQS system will detect hazardous elements and odors contained in air as well as emission gas. If the harmful element concentration is higher than standard, the system will output LOW signal(0V) to ATC.</td><td>- Upon initial battery connection and ignition on, it will operate at AUTO mode. (AQS will not operate.)</td></tr>
<tr><td colspan="2">If the concentration is within the standard value, the system will output HI signal(3V) the ATC.</td><td>- Upon IGN 2 ON, the AQS assembly will be preheated for 34.5±5seconds. During the preheating, AQS will output 0V (ground). (REC mode)</td></tr>
<tr><td colspan="2">Depending on the signal from AQS, When AQS is on ATC will control INTAKE door as follows in order to prevent inflow of harmful gas:</td><td>- IGN2 ON: It will check circuit break on the AQS assembly's signal line for approx 7 seconds during the preheating, irrespective to the AQS switch condition.</td></tr>
<tr><td>Condition</td><td>INTAKE door position</td><td rowspan="3">- When AQS is selected prior to IGN2 OFF and IGN2 is turned off→on: AQS indicator will come on, and the system will operate at AQS mode. (Store the previous condition before IGN 2 OFF)</td></tr>
<tr><td>LOW</td><td>REC</td></tr>
<tr><td>HI</td><td>FRE</td></tr>
<tr><td>Initialization Upon battery-on</td><td colspan="2">Upon initial power supply, it will operate in the initial condition.</td><td>- Upon initial ignition on after battery connection, the system will operate at temperature setting 25°C and at AUTO mode.</td></tr>
<tr><td>Memory</td><td colspan="2">Upon removing ignition key, it will store FATC's operating condition</td><td>Turning ignition off and on again during FATC operation, the system will operate at the previous before the ignition off.</td></tr>
</table>

DIAGNOSIS SYSTEM EQHA2750

OPERATION METHOD (SELF-DIAGNOSIS)

The F.A.C. module self test feature will detect electrical malfunction and provide error codes for system components with suspected failures.



EQHA275A

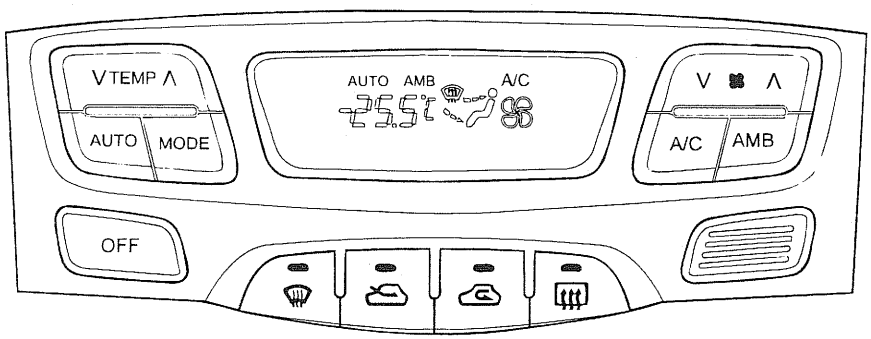
FAIL SAFE FUNCTION

EQHA1020

No.	Item	Failure	FAIL SAFE Function
1	Incar temperature sensor	Open/Short	25°C alternate value control
2	Ambient temperature sensor	Open/Short	20°C alternate value control
3	Pin thermo sensor	Open/Short	-2°C alternate value control
4	Water temperature sensor	Open/Short	-20°C alternate value control
5	Temperature door potentiometer	Open/Short setup temperature	For 17°C to 24.5°C, Set to maximum cooling position. For 25°C to 32°C, Set to maximum heating position.

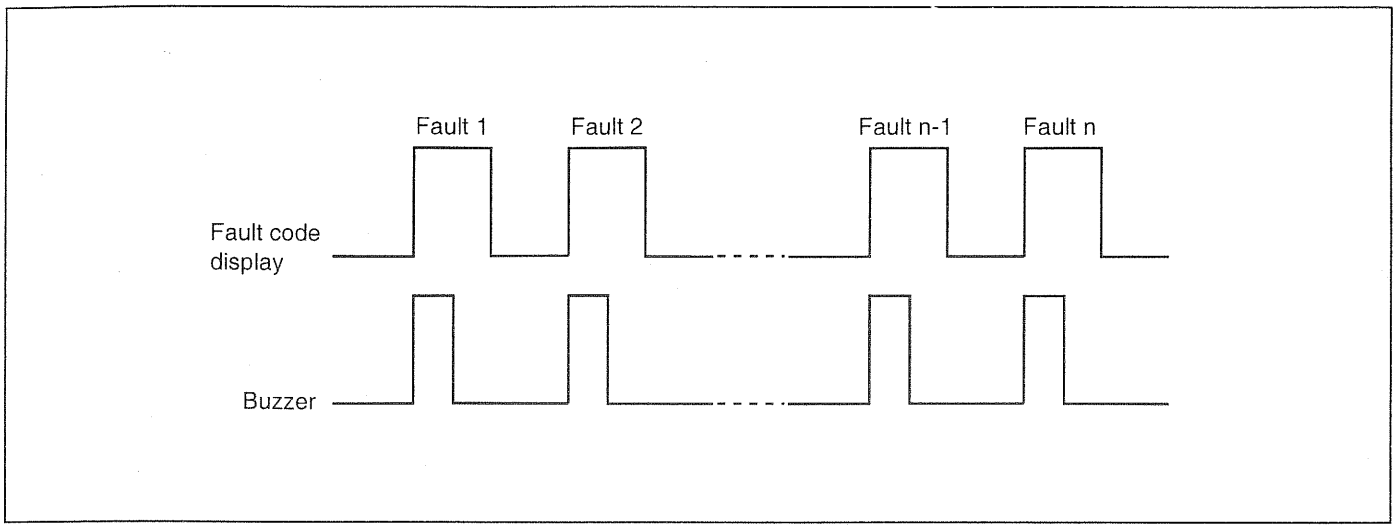
HOW TO READ SELF-DIAGNOSTIC CODE

1. After display panel flickers three times every 0.5 second, the corresponding error code flickers on setup temperature display panel every 0.5 second and shows two figures.
2. If error code is more than two, each code flickers 2 times in sequence.



EQHA003B

FAULT CODE DISPLAY



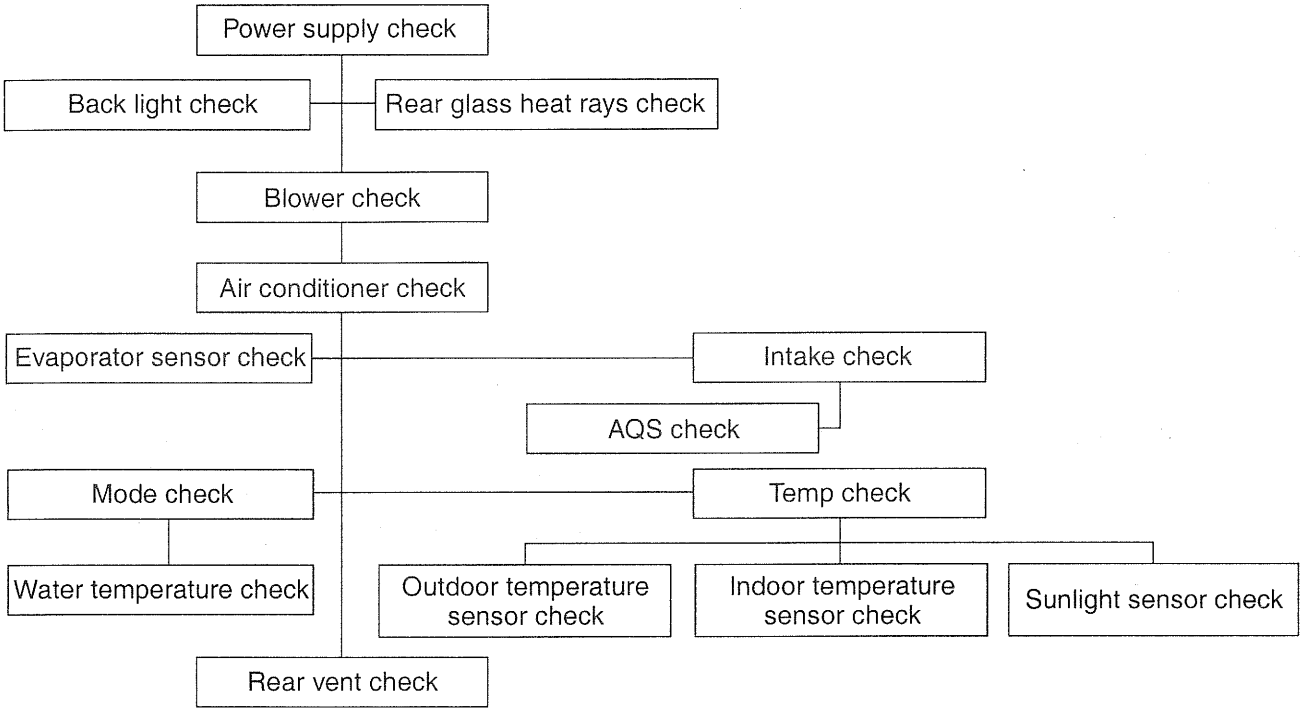
FO-HA01

DTC CHART

If a malfunction code is displayed during the DTC check, check the circuit listed for that code in the table below.

DTC code	Detection item	Trouble area
00	Normal	-
11	Open INCAR Sensor circuit	• Incar sensor • Harness or connector between incar sensor and A/C control assembly • A/C control assembly
12	Shorted INCAR Sensor circuit	
13	Open Ambient sensor circuit	• Ambient sensor • Harness or connector between ambient sensor and A/C control assembly. • A/C control assembly.
14	Shorted Ambient sensor circuit	
15	Open water temp. sensor	• Water temp. sensor • Harness or connector between water temp. sensor and A/C control assembly. • A/C control assembly
16	Shorted water temp. sensor	
17	Open pin thermo sensor	• Pin thermo sensor • Harness or connector between evap. sensor and A/C control assembly • A/C control assembly
18	Shorted pin thermo sensor	
19	Open or shorted temp. door potentiometer	• Harness or connector between temp. door potentiometer and A/C control assembly
20	Defective temp. door potentiometer	• Temp. door potentiometer

CHECKPOINT BY TYPE EQHA1030



EQHA103A

Since FATC controller is complicated in functions as shown in the above chart, it is impossible to conclude its reason at the occurrence of failure. All possibilities of failure shall be considered for the purpose of efficient How to check.

1. Power supply check
2. Back light and Rear glass heat rays check
3. Blower check
4. Air conditioner check
5. Intake check and AQS check
6. Mode check
7. Temp check
8. Each sensor check
9. Rear vent check

POWER SUPPLY CHECK

In turning off IGN, battery supplies power for ordinary power, FATC connector (M53-1) through battery fuse (30A). FATC performs memory function by means of battery power supplied as described above. In turning on IGN, alternator is driven. At this time, IG2 power generated in alternator FATC connector (M53-1) and (M53-2) terminal through IG1 fuse (30A) and air conditioner fuse (10A). FAT carried out actual system operation by means of IG2 power supplied as described above.

ERROR DIAGNOSTICS

Symptoms	Causes	How to check
When IF is ON, memory function error occurs	Battery power supply error	Check voltage of battery after turning off IG. If 10V and more, check FATC connector and if no problem, check the inside of controller. If 10V and less. check fuse or wiring state of battery power source.
When IG is ON, system running error occurs.	IG2 power supply error	Check voltage of IG2 after turning on IG. If 10V and more, check FATC connector and if no problem, check the inside of controller. If 10V and less. check fuse or wiring state of IG2 power source.

BACK LIGHT AND REAR GLASS HEAT RAYS CHECK

In turning on IG and then light switch, battery power is supplied for FATC connector (M53-1), 2 terminal through wiring. The supplied power passes connector (M53-1), 1 terminal through light bulb in FATC and flows into reostart as shown in the above figure. The brightness is adjusted according to resistance value of reostart. In turning on IG and pressing rear glass heat rays switch, GRD(0V) is supplied for FATC connector (M53-1), 21 terminal. At this time, when signal is sent to ETACS, rear glass heat rays runs and when ETACS sends signal(10V) to FATC connector (M53-1), 11 terminal through heating wiring, switch and indicator of rear glass heat rays are turned on.

ERROR DIAGNOSTICS

Symptoms	Causes	How to check
When light switch is ON, partial error occurs in back light.	Light bulb lighting error in FATC	
When light switch is ON, entire error occurs in back light.	Light power supply error	Measure voltage of tail light shown in the above figure after switching on light. If 10V and more, check FATC connector and if no problem, measure signal voltage of reostart shown in the above figure. If 8V and more, check reostart wiring and reostart.
		If tail light is below 1V, check tail light wiring.
When rear glass heat rays switch is ON, rear glass heat rays doesn't work.	Heat rays running error	Measure voltage of rear glass heat rays with heat rays switch on. If 0V, check rear glass heat rays.

BLOWER CHECK

Perform blower check in blower manual running state because it is difficult to check blower at automatic control. Blower is controlled from level I to level 7 equally as in button operation and running logic. In turning on IG, blower relay is ON and voltage of 0.1 to 1.4V is transferred from FATC connector (M53-1), 4 terminal to base source of power TF according to FATC control (selectable from level 1 to level 7). At this time, voltage of blower motor's both ends is determined according to collector voltage of FATC connector (M53-1). 5 terminal. If FATC is controlled in level 7, GND(0V) is supplied for FATC connector (M53-1), 19 terminal and high blower relay is driven.

ERROR DIAGNOSTICS

Symptoms	Causes	How to check
Amount of wind is wrong at manual selection of blower.	Power TR error	Check voltage of blower motor's both ends. (Level 1 : 3.8V, Level 2 : 5.3V, Level 3 : 6.7V, Level 4 : 8.1, Level 5 : 9.5V, Level 6 : 0.6V, Level 7 :13.5V [high-relay operation]) Measure voltage of each terminal and if there is difference more than ±0.6V, check power TR.
Blower wind is discharged despite pressing OFF switch.	Power TR error	Power TR change
Regular wind is discharged regardless of manual selection of blower.	Power TR error Internal error of FATC	Power TR change
Error occurs in High-relay operation	Power supply error of High blower relay	Select level 7 of blower and measure voltage of high speed relay. If 0V, check high blower relay state and wiring connection state. If 5V and more, check the inside of FATC.

AIR CONDITIONER CHECK

11V is outputted from connector (M53-1), 17 terminal in turning on INSULATING and pressing air conditioner switch. However, although 11V is outputted from FATC connector (M53-1), 17 terminal, compressor clutch isn't driven. Wind of air conditioner is discharged if only compressor clutch works. Output signal from air conditioner is inputted in engine computer through triple switch. Then, the engine computer considers several conditions and when output of air conditioner is judged to be practical, it gives GND to signal terminal of air conditioner relay. Accordingly, relay of air conditioner is ON and compressor clutch works. Triple switch checks pressure of refrigerant flowing through pipe and turns on/off switches in it according to standard. So, it controls that output signal of air conditioner outputted from FATC is inputted into engine computer, and also speed of condenser fan according to pressure level. (For high pressure, high-speed and for low pressure, low-speed)

ERROR DIAGNOSTICS

Symptoms	Causes	How to check
Wind of air conditioner isn't discharged into vehicle despite switching on air conditioner.	Signal output error of air conditioner	Switch on air conditioner and measure voltage of FATC connector (M53-1), 17 terminal as shown in the above figure. If 9V and more, check triple switch, air conditioner relay, engine computer and peripheral wiring.
		Switch on air conditioner and measure voltage of FATC connector (M53-1), 17 terminal as shown in the above figure. If 1V and less, check input value of evaporator sensor.
	Input error of evaporator sensor	If evaporator sensor is disconnected or short or voltage of its input source is more than 3.0V (below 0.5°C), output of air conditioner isn't made.

INTAKE AND AQS CHECK

In turning on IG and selecting outdoor mode with indoor switch, 12V is outputted from FATC connector (M53-1), 23 terminal, 0V is supplied for (M53-1), 10 terminal and motor works in direction of outdoor. In selecting indoor mode with indoor switch, 12V is outputted from FATC connector (M53-1), 10 terminal, 0V is supplied for (M53-1), 23 terminal and motor works in direction of indoor.

ERROR DIAGNOSTICS

Symptoms	Causes	How to check
Outdoor mode running error	Power supply error in actuator	Separate connector linked with actuator, select outdoor mode with indoor switch and measure voltage of FATC connector (M53-1), 23 terminal. If 8V and more, check actuator or peripheral wiring state and if 9V and less, check the inside of controller.
Indoor mode running error	Power supply error in actuator	Select indoor mode in the above method and measure voltage of FATC connector (M53-1), 10 terminal. If 8V and more, check actuator or peripheral wiring state and if 9V and less, check the inside of controller.
Fixed in outdoor or indoor mode at AQS selection.	AQS signal terminal output error	Select AQS switch and measure AQS signal terminal as shown in the above figure. If there is no change of voltage over 10 min, check AQS.

MODE CHECK

In turning on IG and selecting mode switch, sequential operation begins in order of Vent→Bi-level→Blower→Mix. DIP mode works regardless of order at selecting it. In selecting Vent mode as mode switch, GND(0V) is supplied for FATC connector (M53-2), 11(Vent) terminal. Voltage of 9V and more is set in the rest terminals (M53-2),12, (M53-2),13, (M53-2),14, (M53-2),15 and motor drive IC in mode actuator which receives the signal, works in direction of vent mode setup. Vent, Built-in-level, Blower, Mix and Defrost mode can be selected in the method described above.

ERROR DIAGNOSTICS

Symptoms	Causes	How to check
Specific mode isn't selected.	Signal transmission error of selected mode	Measure voltage of selected mode wiring without separating connector linked with actuator. If 8V and more, check the inside of controller.
	Mode actuator running error	If 1V and less at measuring in the above method, check mode actuator and peripheral wiring state.
Mode selection is impossible	Internal error of mode actuator	If motor driver IC built in mode actuator is bad, mode selection is impossible. When mode isn't selected though GND(0V) is supplied for selected mode wiring after selecting mode in controller, its cause is internal failure of mode actuator.

TEMP CHECK

In adjusting temp switch from 32°C to 17°C, 11V is outputted from FATC connector (M53-1), 9 terminal, 0V is supplied for (M53-1), 22 terminal and temp motor works in direction of COOL. In adjusting temp switch from 17°C to 32°C, 11V is outputted from FATC connector (M53-1), 22 terminal, 0V is supplied for A-9 terminal and temp motor works in direction of WARM. When temp actuator has to move to a certain location for its automatic control, temp feedback signal terminal moves equally in temp actuator and informs controller of location of temp actuator through FATC connector (M53-2), 10 terminal. Comparing original value with inputted value, it works until they are same. If 4.9V and more is inputted in (M53-2), 10 terminal, it is regarded as disconnection. If 0.1V and less is inputted in (M53-2), 10 terminal, it is regarded as short-circuit. In the case of disconnection or short-circuit as a result of self-diagnostic, substitute control is carried out as follows.

- If setup temperature is 17°C to 24.5°C, set to MAX COOL.
- If setup temperature is 25°C to 32.0°C, set to MAX WAR.

ERROR DIAGNOSTICS

Symptoms	Causes	How to check
Temp actuator running error	Power supply error in temp actuator	After altering 17°C to 32°C and adversely, measure voltage of (M53-1), 22 terminal. If Both of them are 9V and more, check temp actuator and peripheral wiring state and if one or both of them are 5V and less, its cause is internal failure of FATC.
	Sensor (+5) power supply error	If automatic control isn't operated smoothly, measure voltage of FATC connector (M53-2), 8 terminal. If under 4.8V or over 5.2V, its cause is internal failure of FATC.
	Driver error of temp actuator	If No. 20 is outputted as a result of self-diagnostic, check temp actuator driver.

EACH SENSOR CHECK

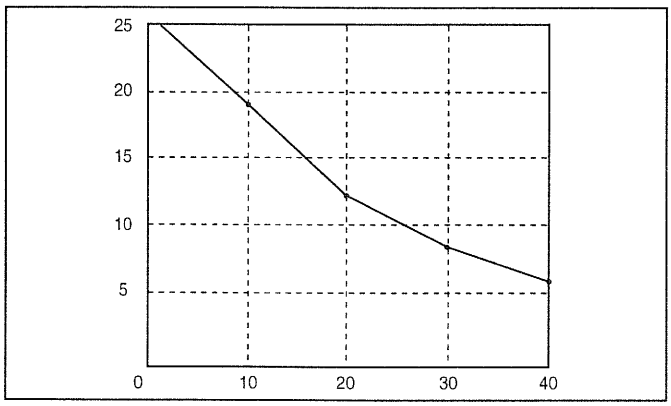
Resistance value set according to temperature of each part is inputted in FATC controller. Internal temperature of vehicle is automatically controlled by operating the inputted values. It is recommended to refer to resistance value and voltage value corresponding to each temperature and the followings explains essential functions of each sensor required for repair and self-diagnostics and substitute functions at disconnection or short-circuit.

- If 4.9V and more is inputted in (M53-2),1, (M53-2), 3, (M53-2), 4 and (M53-2), 5 terminal, it is regarded as disconnection.
- If 0.1V and less is inputted in (M53-2), 1, (M53-2), 3, (M53-2), 4 and (M53-2), 5 terminal, it is regarded as short-circuit.

IN CAR SENSOR

IN-CAR AIR TEMPERATURE SENSOR EQHA2200

In-car air temperature sensor is located at the control. It will detect interior temperature, which will be used for discharge temperature control, sensor failsafe, temperature door control, blower motor level control, A/C auto control, motive heating control and rear blower motor level control.

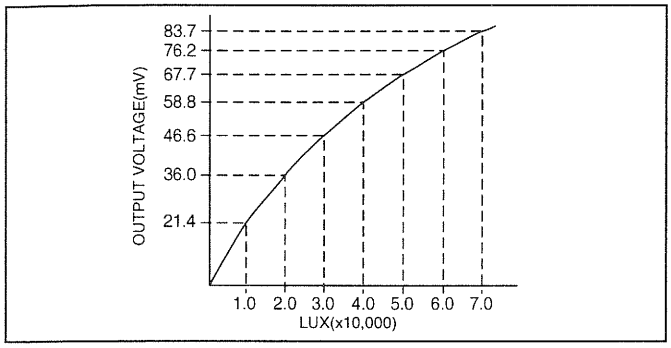


KFWD034A

PHOTO SENSOR

PHOTO SENSOR EQHA2050

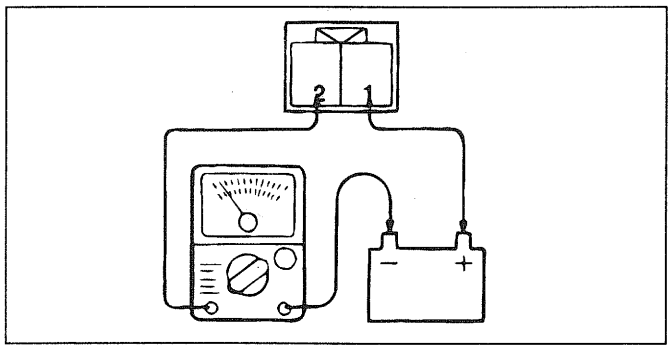
Photo sensor is located at left by driver side defrost nozzle. In response to photo intensity level in vehicle, the sensor will send signal to control unit for compensating blower level and discharge temperature.



KFWD028A

NOTE

Emit intensive light toward driver side and passenger side using the lamp, and check current change between terminal 1 & 2, and 2 & 3.



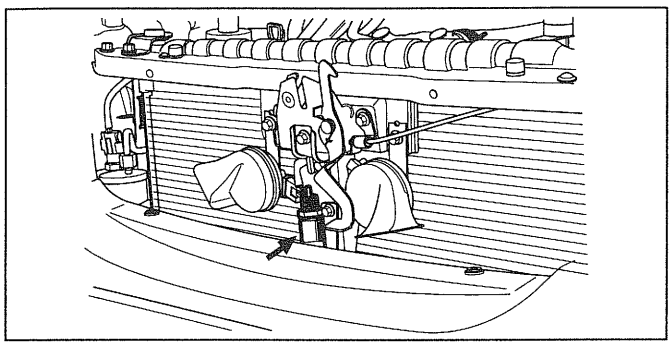
S6HA030C

AMBIENT TEMPERATURE SENSOR

AMBIENT AIR TEMPERATURE SENSOR EQHA2150

1. Air temperature sensor is located at front of the engine radiator, and detect ambient air temperature. It is a negative type thermistor, that resistance will rise with lower temperature, and reduce with higher temperature.

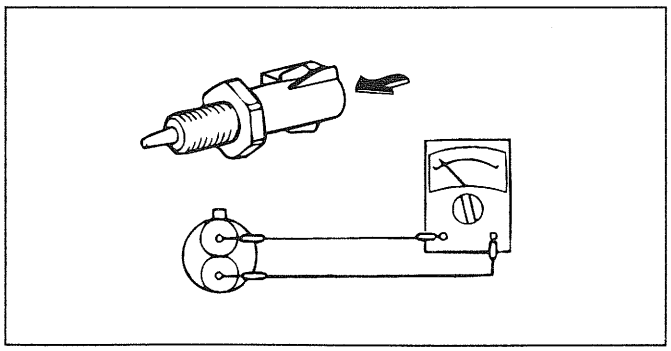
2. The sensor output will be used for discharge temperature sensor, sensor failsafe, temperature regulation door control, blower motor level control, mix mode control and in-car humidity control.



KFWD033A

CHECK

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-10	157.84	10	58.75
-5	122.00	20	37.30
0	94.98	30	24.26
5	74.45	40	16.14



HEW97038

A.Q.S (AIR QUALITY SENSOR)

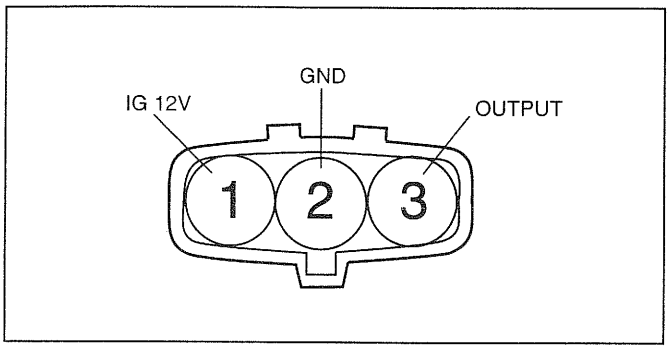
A.Q.S. SENSOR EQHA2100

1. A.Q.S. sensor is located at center support in front of the engine radiator, and detects hazardous elements in ambient air providing output signal to control.

2. It will detect sulfurous acid gas, carbon dioxide, carbon mondxide, hydrocarbon and allergen.

SENSOR OUTPUT

Condition	Resistance
Normal condition	5V
Hazardous gas detection	0V

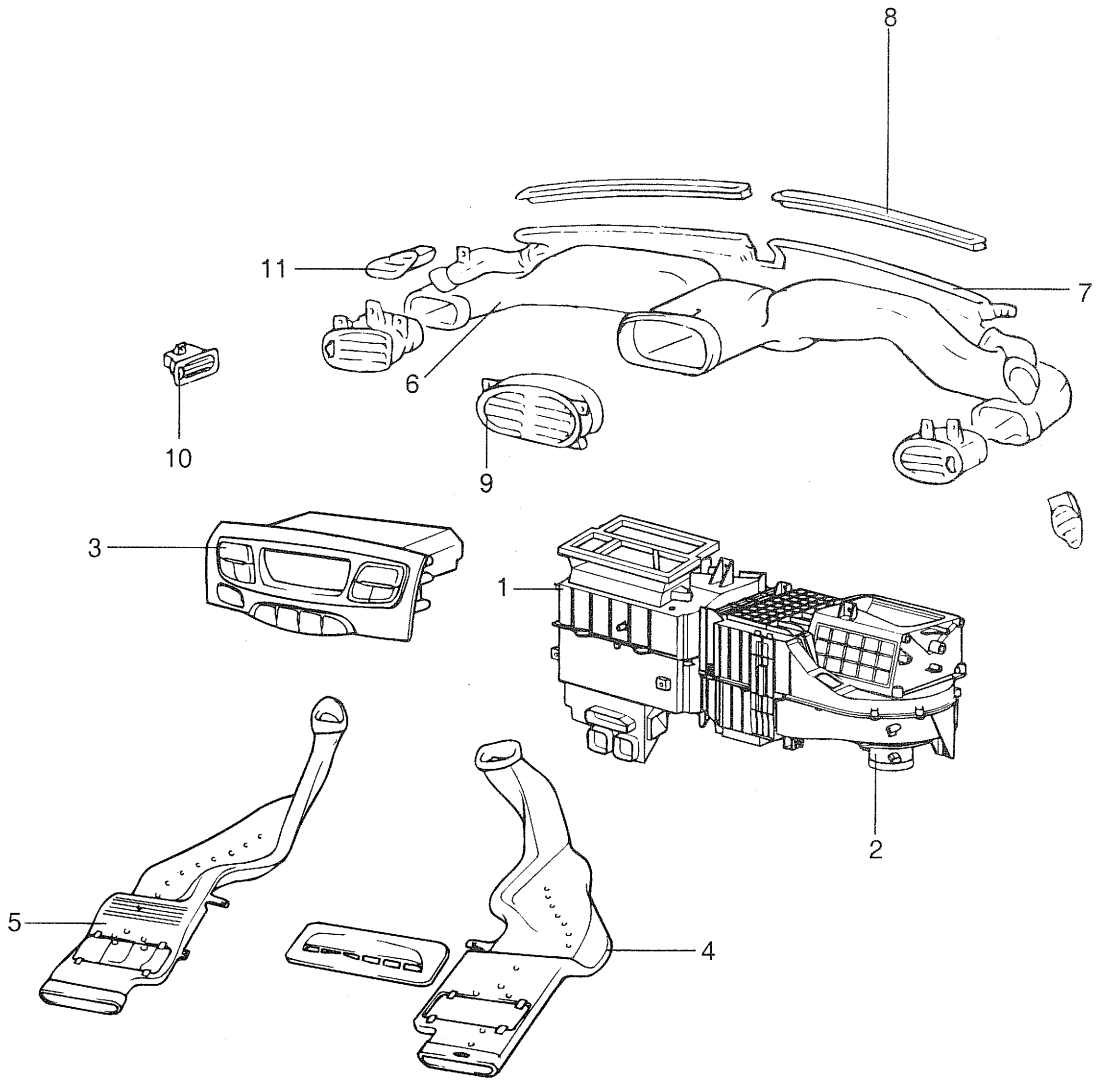


KFWD030A

VACUUM SYSTEM

VENTILATOR EQHA1550

COMPONENTS



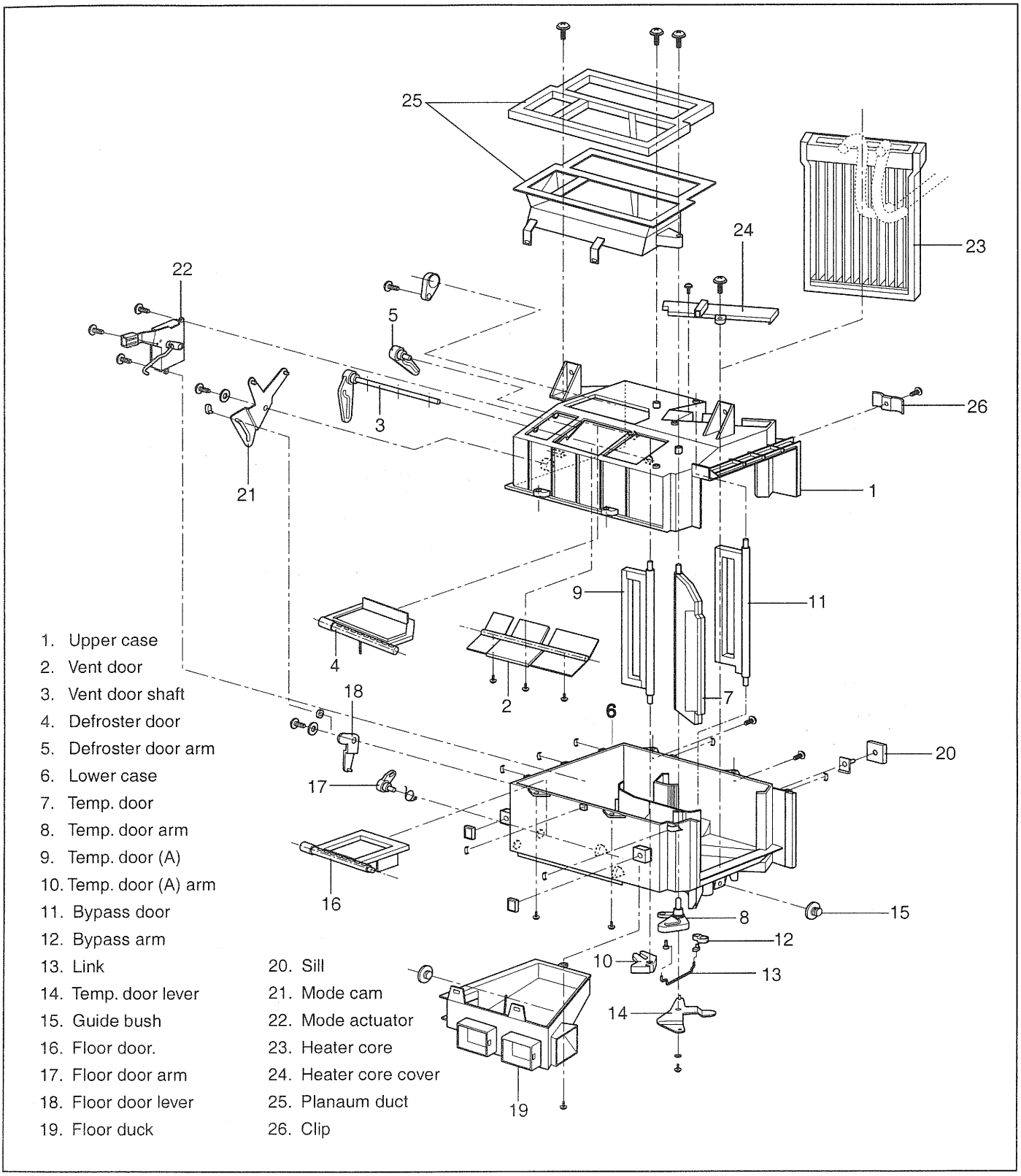
1. Heater unit
2. Eva and blower unit
3. Control switch
4. Floor (Rear) duct
5. Rear vent duct
6. Vent duct
7. Defroster duct
8. Defroster cover nozzle
9. Center nozzle
10. Side nozzle
11. Side defrostor nozzle

EQHA009A

HEATER

HEATER UNIT EQHA1600

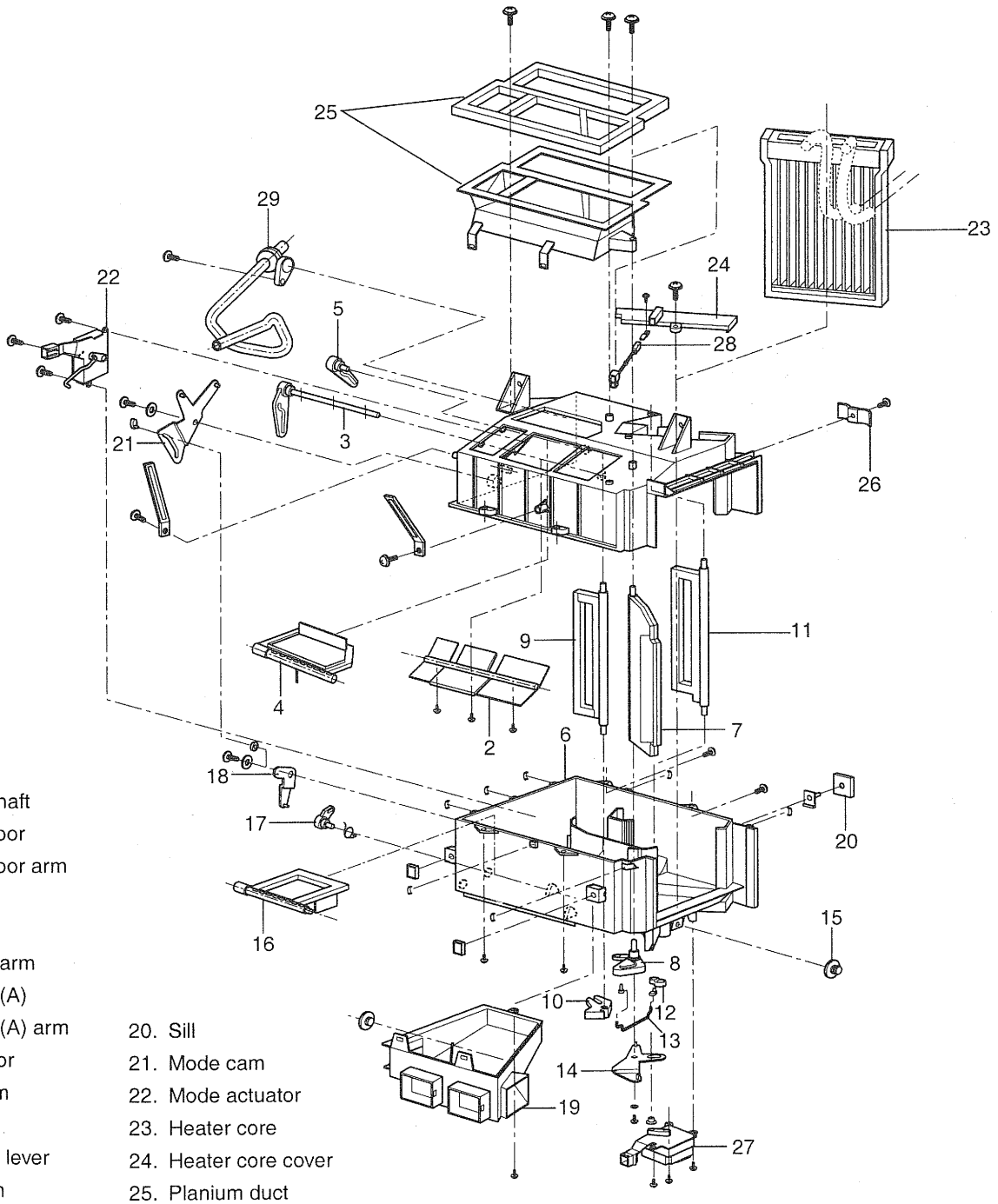
COMPONENTS (ROTARY+PUSH)



1. Upper case
2. Vent door
3. Vent door shaft
4. Defroster door
5. Defroster door arm
6. Lower case
7. Temp. door
8. Temp. door arm
9. Temp. door (A)
10. Temp. door (A) arm
11. Bypass door
12. Bypass arm
13. Link
14. Temp. door lever
15. Guide bush
16. Floor door.
17. Floor door arm
18. Floor door lever
19. Floor duck
20. Sill
21. Mode cam
22. Mode actuator
23. Heater core
24. Heater core cover
25. Planaum duct
26. Clip

KFWD037A

COMPONENTS EQHA1650



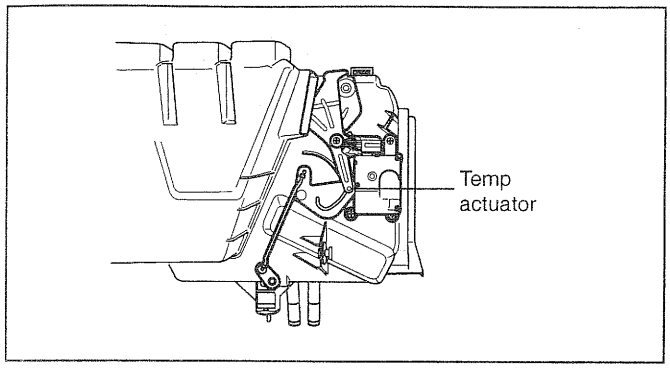
1. Upper case
2. Vent door
3. Vent door shaft
4. Defroster door
5. Defroster door arm
6. Lower case
7. Temp. door
8. Temp. door arm
9. Temp. door (A)
10. Temp. door (A) arm
11. Bypass door
12. Bypass arm
13. Link
14. Temp. door lever
15. Guide bush
16. Floor door.
17. Floor door arm
18. Floor door lever
19. Floor duck
20. Sill
21. Mode cam
22. Mode actuator
23. Heater core
24. Heater core cover
25. Planium duct
26. Clip
27. Temp. door actuator
28. Coolant temp. sensor
29. Intake hose

KFWD038A

HEATER UNIT

TEMPERATURE CONTROL ACTUATOR EQHA01700

1. Temperature control actuators are installed at heater unit case. Control switches and vent duct switch will operate actuators, that will regulate temperature control position and discharge air temperature.



KFWD043A

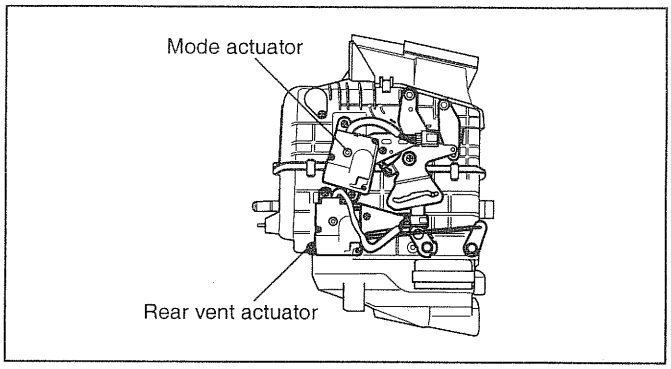
2. Temp actuator and terminal voltage check.

Terminal	Voltage	Remark
1	12V (+,-)	Change Polarity
3	12V (+,-)	Change Polarity
4	5V	Sensor Voltage
5	Change with resis-tance	Variable Resis-tance
6	Ground	Ground

MODE CONTROL ACTUATOR EQHA01750

1. Pressing mode select switch during IG2 on, driver side and passenger side mode door actuator will shift as follows :

   VENT ⇒ BL/LEVEL ⇒ FLOOR ⇒ MIX



KFWD044A

2. Mode actuator circuit diagram and voltage

Terminal	Descripton	Voltage
1	IG	12V
2	Ground	-
3	Vent	0V
4	Bilevel	12V
5	Floor	12V
6	Mix	12V
7	Defroster	12V

3. Heater

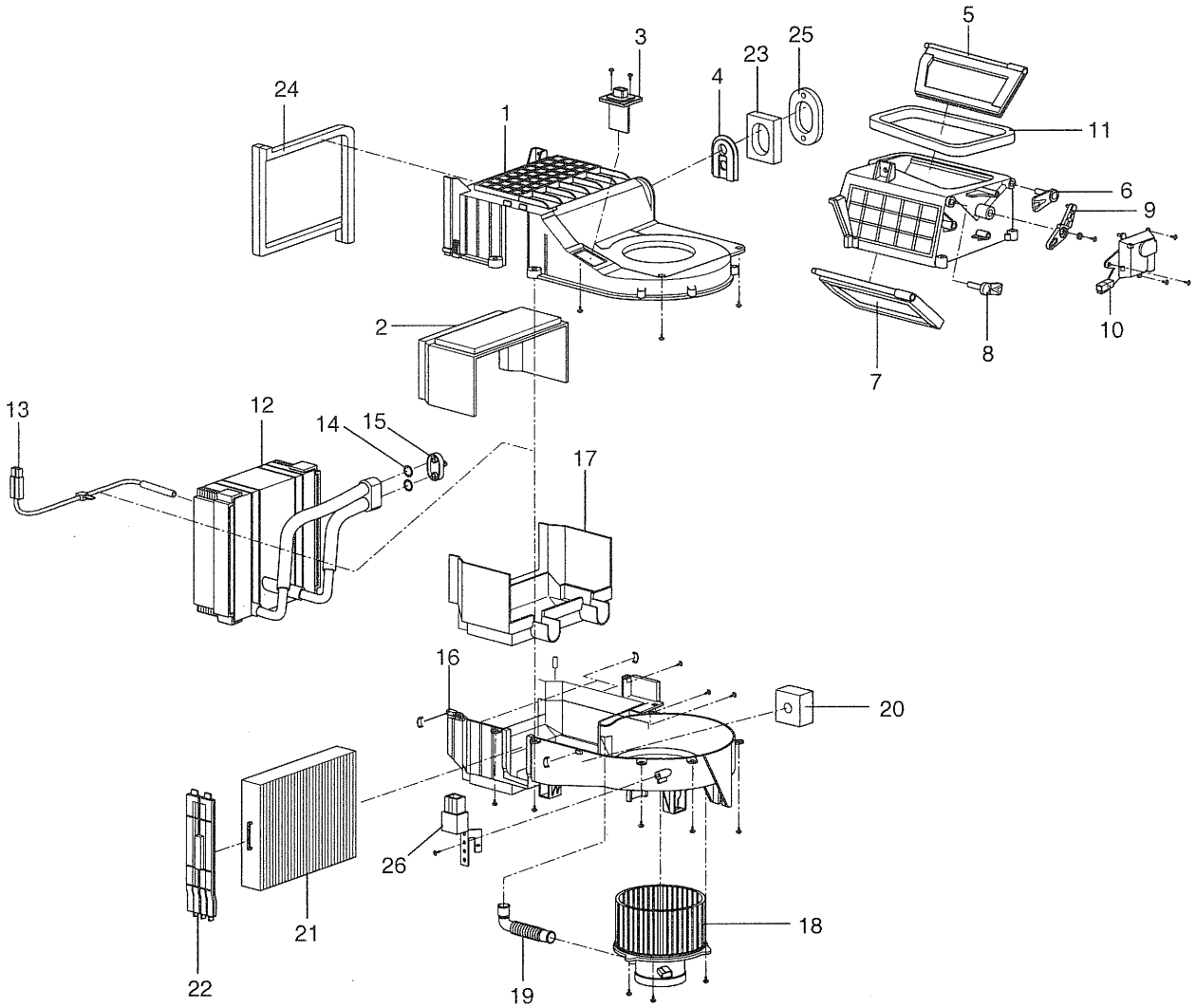
Mode / Positcon	Recirculation	Fresh				Remark
	COOL	1/2 COOL	WARM			
	Vent	Bi level	Floor	Mix	Defroster	
Vent	100	55±10	-	-	-	
Floor	-	45±10	54±5	42.9±7	-	
Defroster	-	-	18±5	35.1±7	72	
Side vent	-	-	28±4	22±4	28±4	

EQHA175A

BLOWER CONTROLS

BLOWER UNIT AND EVAPORATOR EQHA1800

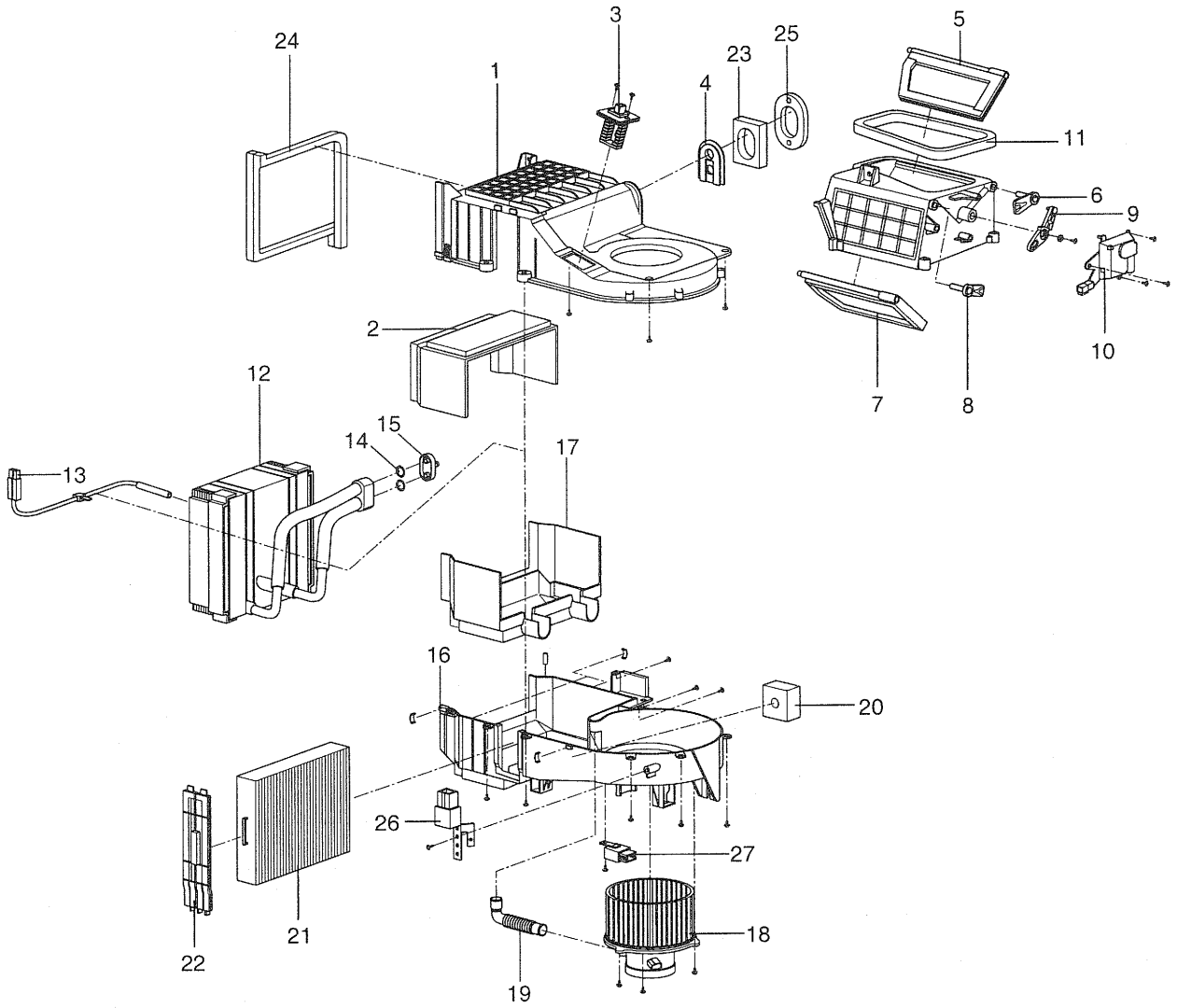
COMPONENTS (POTARY+PUSH)



1. Upper case
2. Evaporator upper case
3. Resistor
4. Bracket
5. Inlet duct door
6. Inlet duct arm
7. Inlet duct door (A)
8. Inlet duct arm (A)
9. Inlet duct lever
10. Actuator (Fresh/Recir)
11. Sill
12. Evaporator core
13. Thermistor
14. O-ring
15. Evaporator tube cap
16. Lower case.
17. Evaporator Lower cover
18. Motor and wheel
19. Blower motor cooling tube
20. Sill
21. Air filter
22. Air filter cover
23. Sill
24. Sill
25. Evaporator grommet
26. Power relay

KFWD040A

COMPONENTS(FATC) EQHA1850



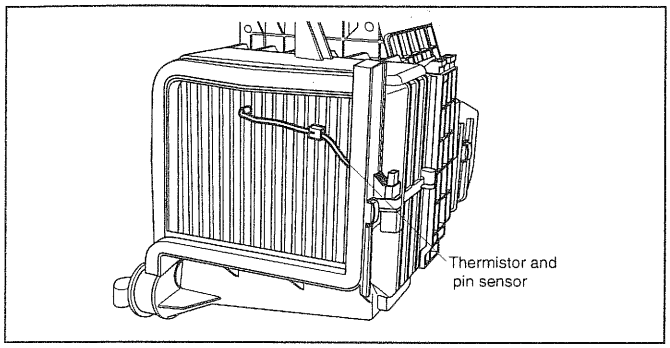
1. Upper case
2. Evaporator upper cover
3. Power TR
4. Bracket
5. Inlet duct door
6. Inlet duct arm
7. Inlet duct door (A)
8. Inlet duct arm (A)
9. Inlet duct lever
10. Actuator (Recir/Fresh)
11. Sill
12. Evaporator core
13. Pin sensor
14. O-ring
15. Evaporator tube cap
16. Lower case.
17. Evaporator lower cover
18. Motor and wheel
19. Blower motor cooling tube
20. Sill
21. Air filter
22. Air filter cover
23. Sill
24. Sill
25. Power relay
26. High relay

KFWD041A

SENSOR CHECKING EQHA1950

THERMISTOR AND PIN SENSOR

The thermistor and pin sensor will detect the core temperature and interrupt compressor relay power, in order to prevent evaporator freezing by excessive cooling.
The thermistor and pin sensor will use the negative characteristic of thermal.



KFWD049A

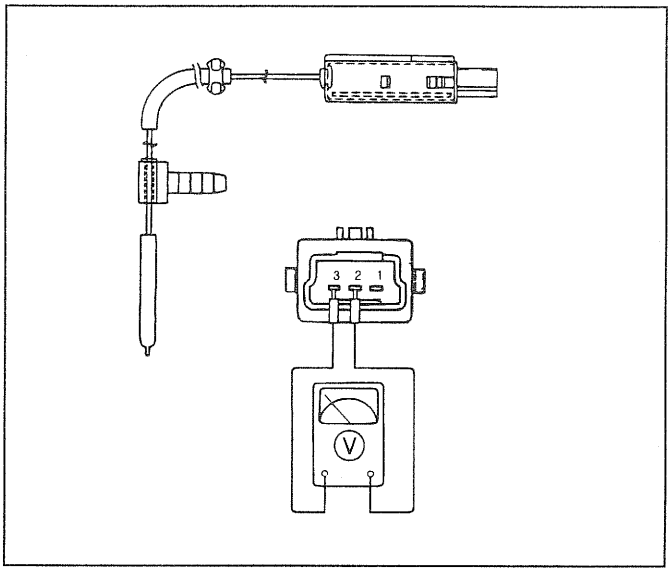
1. Thermistor (ROTARY+PUSH)

    1. Remove the glove box.
    2. Start the engine.
    3. Turn on the air conditioner.
    4. Using the multitester, check the output voltage terminal 2 and 3 in the thermistor.

Thermistor	Operating temperaturp	Outpul voltage
ON	0.5 ± 0.5°C	12V
OFF	2.5 ± 0.5°C	0V

2. Pin sensor (FATC)

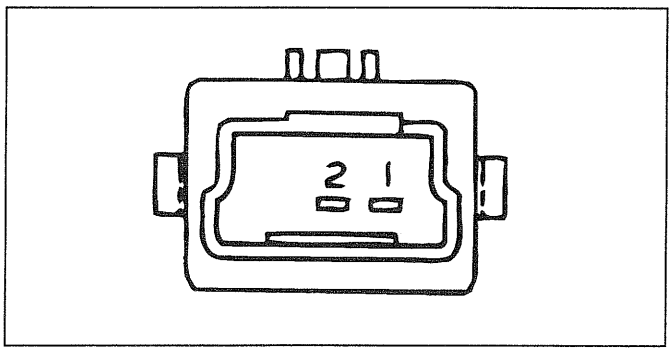
    1. This is the same method of the thermistor to check pin sensor.



HEW97015

Pin sensor tempenature-resistance-output voltage characteristic

Temp (°C)	Resistance (KΩ)	Output (V)	Temp (°C)	Resistance (KΩ)	Output (V)
-5	14.23	3.2	15	6	2.14
-2	12.42	3.04	20	4.91	1.9
0	11.36	2.93	25	4.03	1.67
2	10.4	2.83	30	3.34	1.47
5	9.12	2.66	35	2.78	1.29
10	7.38	2.4	40	2.28	1.11



HEW97016

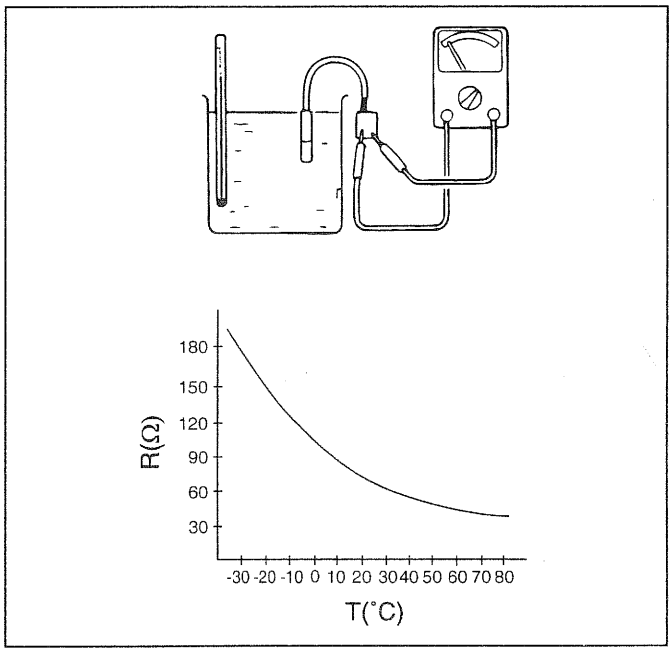
WATER TEMPERATURE SENSOR EQHA2000

1. Water temperature sensor is located at the heater core, and detect coolant temperature flowing through heater core. It is a negative type thermistor, that resistance will rise with lower temperature, and reduce with higher temperature.

2. The sensor will compare temperature setting with incar air temperature or ambient air temperature for motive heating control.

CHECK

Water temperature	Resistance
25°C	10KΩ
60°C	2.50KΩ



EQHA200A

3. Electromotive neating control

   At AUTO mode, discharge mode FLOOR or B/L, if coolant temperature is low, it will perform motive heating control to prevent cold air discharged toward passenger legs.

   1. Operation control

      - Discharge mode FLOOR or B/L at AUTO control
      - Coolant temperature is low

   2. System operation

      - Mode door : DEF⇒MIX⇒AUTO
      - Blower level : AUTO LO⇒AUTO HI
      - Intake door : Ambient air

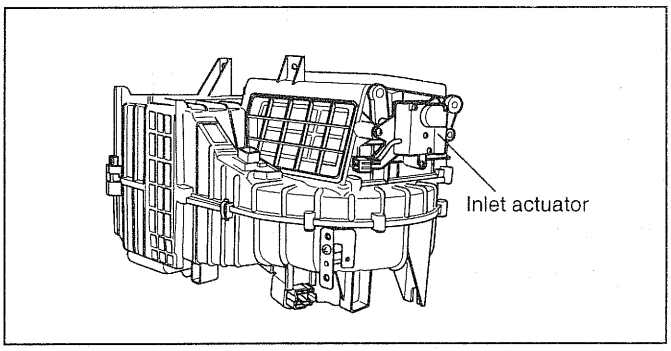
   3. Release operation condition

      - After the ignition is on for 10 minutes.
      - Coolant temperature high.
      - Upon selecting blower mode manual operation, it will release selected mode only. Upon selecting auto mode, it will re-enter.
      - No re-entering motive heating control after releasing motive heating control feature.
      - It will prevail over max. hot feature.

BLOWER MOTOR

FRESH RECIRCULATION SWITCHING ACTUATOR EQHA1900

Intake selection switch located at control panel will control the actuator. Pressing the switch, it will shift in the order of A.Q.S.-recirculation-fresh air-A.Q.S.



KFWD046A

CHECK

Input		Output
1	2	Fresh/recirculation shifting
-	+	Recirculation
+	-	Fresh

BLOWER MOTOR CHECKING (FATC) EQHA2250

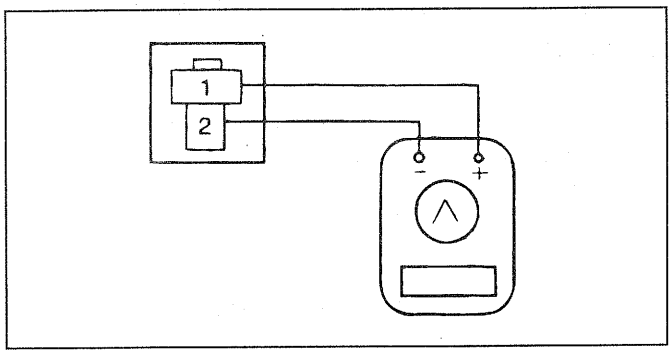
Connect battery voltage and check blower motor rotation.

POWER TR CHECKING

Operating the blower switch as AUTO⇒ LOW⇒ HIGH⇒ AUTO, and measure voltage between pin 1 and 2.

CHECK

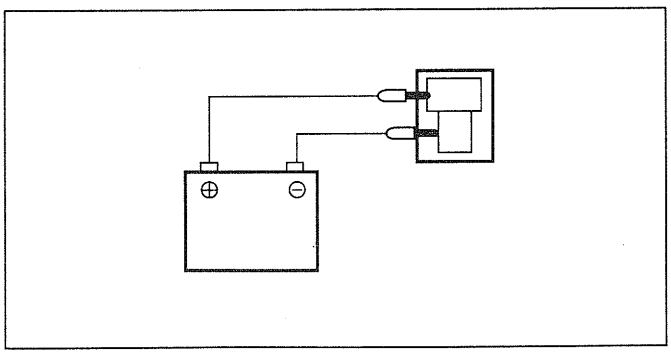
Fan	Motor Voltage
First speed	3.8V
Second speed	5.3V
Third speed	6.7V
Fourth speed	8.1V
Fifth speed	9.5V
Sixth speed	10.6V
Seventh speed	13.5V



HEW97039

BLOWER MOTOR CHECKING (ROTARY+PUSH) EQHA2350

Connect the battery voltage and check the blower motor rotation.



EQA9042A

BLOWER RELAY

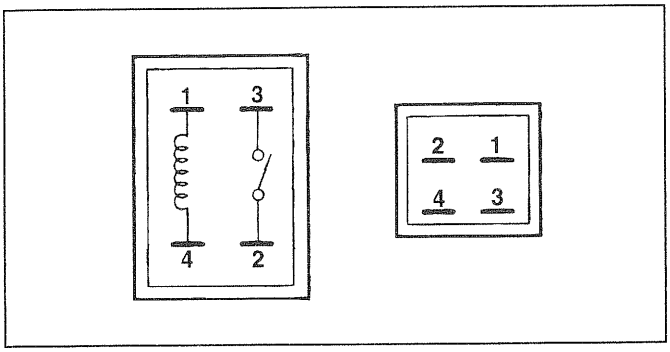
RELAY CHECKING EQHA2400

INSPECTION OF AIR CONDITIONING RELAY

1. Check for continuity between terminals.

Condition \ Terminal	1	2	3	4
A/C ON		○	○	
Apply battery voltage to terminal 2 and 3	○			○

EQHA240A



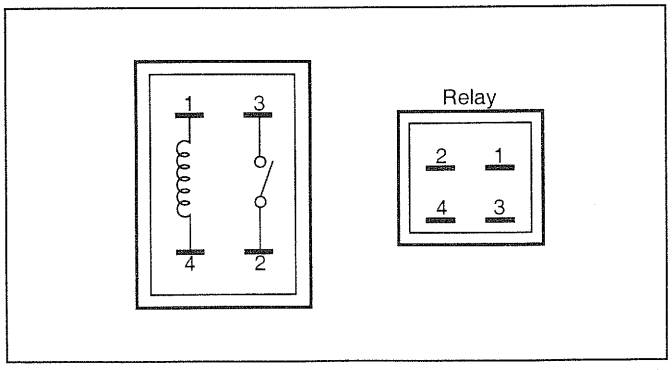
HEW97027

INSPECTION OF BLOWER RELAY EQHA2500

Check for continuity between terminals.

Condition \ Terminal	1	2	3	4
A/C ON	○	○		
Apply battery voltage to terminal 1 and 2			○	○

EQHA245B



EQA9042B

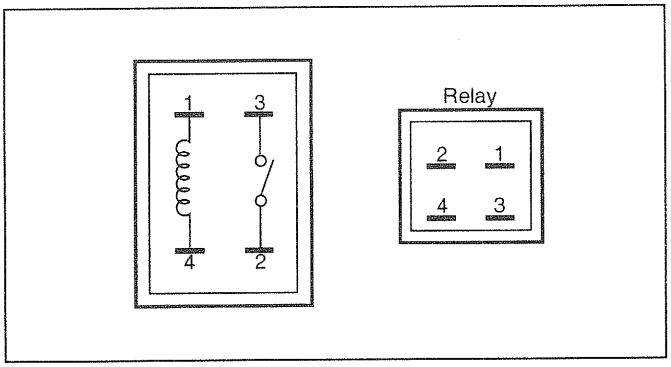
INSPECTION OF BLOWER RELAY AND HI-BLOW-ER RELAY EQHA2600

Check the continuity between terminals.

Condition \ Terminal	1	2	3	4
A/C ON		○	○	
Apply battery voltage to terminal 2 and 3	○			○

EQHA245A

[If continuity in not as specified, replace the relay.]



EQA9042B

Restraints

GENERAL

GENERAL ERHA0010

The supplemental restraint system (SRS AIRBAG) is designed to supplement the seat belt to help reduce the risk and/or severity of injury to the driver and passenger by activating and deploying the driver, and passenger in certain frontal collisions.

The SRS AIRBAG consists of : a driver side airbag module located in the center of the steering wheel, which contains a folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad which contains a folded cushion assembled with an inflator unit ; driver and passenger belt pretensioner, PPD (Passenger Presence Detection) sensor located in the passenger seat : SRSCM located on the floor under the audio which monitors the system: a spring interconnection (clock spring) located within the steering column ; system wiring and wiring connector. The impact sensing function of the SRSCM is carried out by an electronic accelerometer that continuously measures the vehicle's acceleration and delivers a corresponding signal through an amplifying and filtering circuity to the microprocessor.

Only authorized service personnel should work on or around the SRS components. Those service personnel should read this manual carefully before doing any such work. Extreme caution must be used when servicing the SRS to avoid injury to the service personnel (by inadvertent deployment of the air bag) or the driver (by render the SRS inoperative).

CUSTOMER CAUTIONS ERHA0050

Failure to carry out service procedure in the correct sequence could cause the airbag system to unexpectedly deploy during service, possibly leading to serious injury.

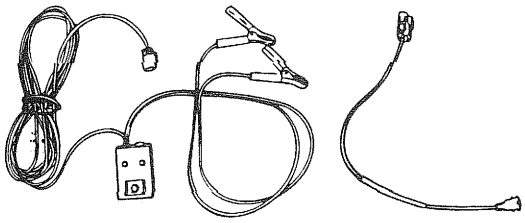
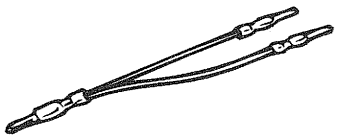
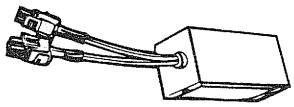
Further more, if a mistake is made in servicing the airbag system, it is possible that the airbag may fail to operate when required.

Before performing service (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 more from the time the ignition switch is turned to the LOCK position and the negative (-) battery terminal cable is disconnected from the battery. The airbag system is equipped with a back-up power source to assure the deployment of the airbag if the battery cable is disconnected due to an accident. The back-up power is available for approx. 150 ms.
2. When the negative (-) terminal cable is disconnected from the battery, the memory of the clock and audio systems will be canceled. So before starting work, record the contents in the memory of these systems. When the work is finished, reset the audio system and adjust the clock.
3. Malfunction symptoms of the airbag system are difficult to confirm, so the diagnostic trouble codes become the most important source of information when troubleshooting.
4. When troubleshooting the airbag system, always inspect the diagnostic trouble codes before disconnecting the battery.
5. Never use airbag component from another vehicle. When replacing parts, replace them with new parts.
6. Never attempt to disassemble and repair the airbag modules (DAB,PAB, BPT), clock spring and wiring in order to reuse them.
7. If any components of the SRS have 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 the SRS SRI check. The airbag indicator lamp can be interrupted by other circuit faults in some cases. Therefore, if the airbag indicator lamp is turned on, be sure to erase the DTC codes using the Hi-Scan just after repairing or replacing components, including the fuse.
9. Especially when welding the body, never fail to disconnect the negative (-) battery terminal.

SPECIAL SERVICE TOOL

ERHA0100

Tool (Number and name)	Illustration	Use
DAB, PAB : 0957A-38100 BPT : 0957A-34200 Deployment adaptor	 ERHA010A	Deployment inside the vehicle (when vehicle will no longer be driven)
0957A-38000 Diagnosis checker	 ERHA010B	Wring harness checker of each module
0957A-38200 Dummy and dummy adapter	 ERHA010C	Simulator to check the resistance of each wiring harness

* DAB : Driver side air bag

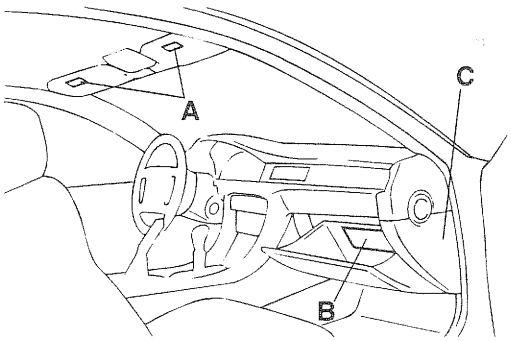
* PAB : Passenger side air bag

* BPT : Belt Pretensioner

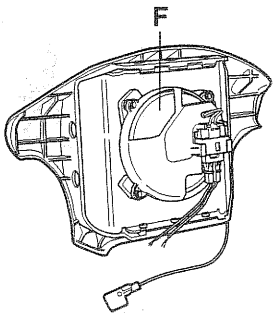
WARNING/CAUTION LABELS ERHA0150

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.

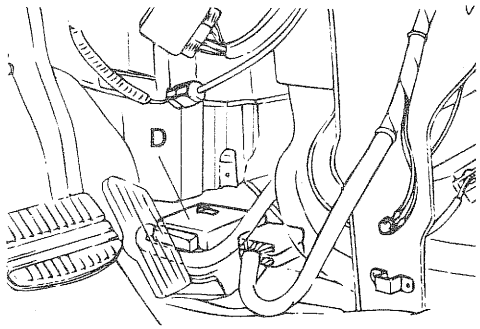
If labels are dirty or damaged, replace them with new ones.



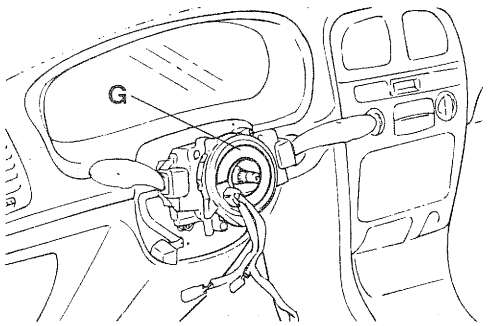
ERHA015A



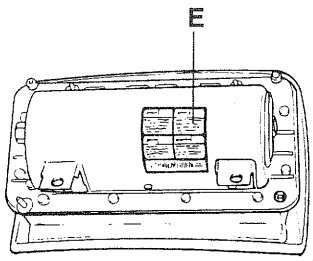
ERHA015B



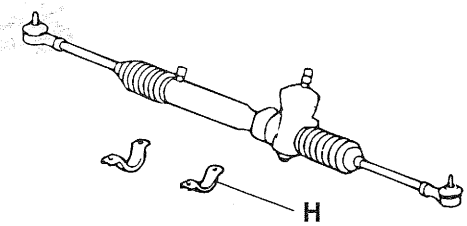
ERHA015C



ERHA015D



ERHA015E



ERHA015F

ERHA0200

<table>
<tr>
<td>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 sit child or infant in front passenger seat.
• 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.</td>
<td>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 when "SRS" lamp in cluster flashes approximately 6 times after the ignition key is turned on and then goes off.
If any of the following conditions occur, the system must be serviced.
1. "SRS" lamp does not light up 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 vehicle manufacture date shown on certification label, located on left front door opening area.

WARNING
Failure to follow above instructions may result in injury to you or other occupants in the vehicle.

See "SRS" section in Owner's Manual for more information about airbag.</td>
</tr>
<tr>
<td>C.
 

ERHA020A
Do not install a child seat in the front pasenger seat. The infant or child could be severely injured by an airbag deployment in case of an accident</td>
<td>D. CAUTION : AIRBAG ESPS UNIT
Detach connector before unmounting. Assemble strictly according to manual instructions.</td>
</tr>
<tr>
<td>E. CAUTION : SUPPLEMENTAL RESTRAINT SYSTEM MODULE
To help avoid personal injury due to unwanted inflation do not service or dispose of this unit without following instructions in the service manual.
Failure to do so may render the SRS system inoperative, risking serious driver injury.</td>
<td>F. WARNING
Contents are poisonous and extremely flammable.
Do not probe with electrical devices or otherwise tamper with in any way. Servicing of this unit should be performed only by authorized personnel.</td>
</tr>
</table>

ELECTRICAL SYSTEM ERHA0250

The SRS airbag system has sophisticated electrical and electronic components, therefore the airbag operating components should be handled with care.

SRSCM (Supplement Restraint System Control Module)

SRSCM will deploy the airbag module by sensing the frontal impact sensed by the sensor built in to the SRSCM.

1. DC/DC convertor : The DC/DC convertors of 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 which closes if it experiences a deceleration exceeding a specified threshold.

3. Back-up power : The SRSCM reserves an energy supply to provide deployment energy for a short second when the vehicle voltage is low or if lost in a vehicle frontal crash.

4. Malfunction detection : The SRSCM continuously monitors the current SRS operation status while the ignition key is turned on and detects possible malfunction of the system. The malfunction can be displayed in the form of a diagnostic trouble code using Scan tool.

5. MIL (Malfunction Indication Lamp) notification : If any fault is detected, the SRSCM sends a signal to the indicator lamp on the cluster to warn the vehicle driver.

   The MIL indicator is the key item in notifying the driver of SRS faults. Verify 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 the memory in the form of DTC and the DTC can only be erased by the Scan tool.

7. Data link connector : Data stored in he SRSCM memory is read by Scan tool through the data link connector.

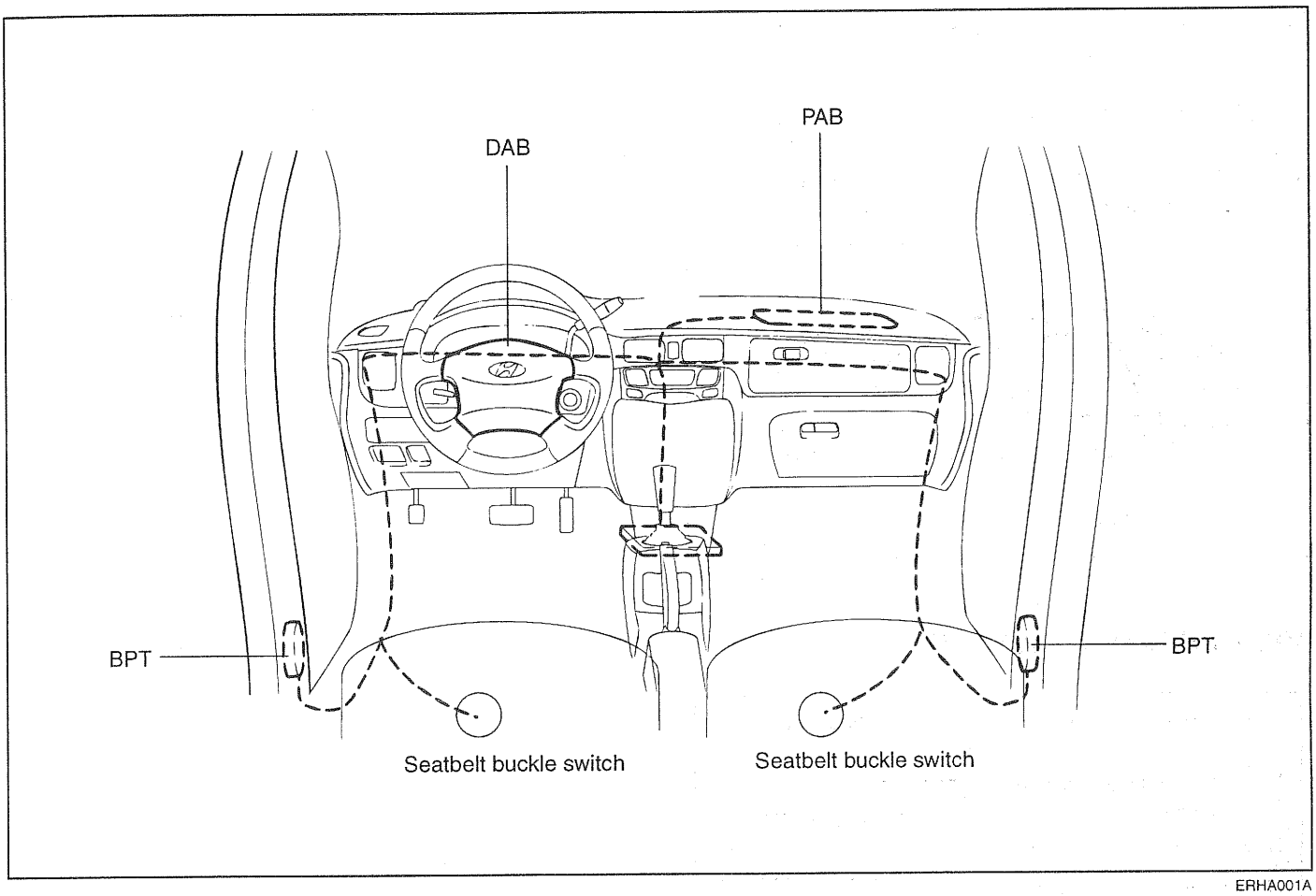
8. After firing the airbags once, the SRSCM cannot be used again and must be replaced.

9. Crash output

   The crash output is used to control an external device which will unlock the doors in case of a crash event. The crash output is specified as follows : 0-200 μA in OFF mode and 200mA in ON mode. In case of the unlock command, the switch is closed for 200 mS.

INFLATOR MODULE (DAB, PAB) ERHA0300

The DAB (Driver airbag), PAB (Passenger airbag) module and BPT (Belt pretensioner) are comprised of an inflator and cushion. The initiator (A gas generator igniting device) is positioned in the inflator. When the vehicle crashes from the front with sufficient force, closing the sensor of the SRSCM, current develops through the deployment loop. Current passing through the initiator ignites the material in the DAB and PAB module and inflates the airbag.



ERHA001A

1. When removing the air-bag module or handling a new airbag module, it should be placed with the pad top surface facing up. This way the twin-lock type connector lock lever should be in a locked state and care should be taken to place it so that the connector will not be damaged. Do not store a steering wheel pad on top of another one. (Storing the pad with its metallic surface facing up may lead to a serious accident if the airbag should inflate.)

2. Never measure the resistance of the airbag squib. (This may cause the airbag to deploy.)

3. Store the airbag module where the ambient temperature remains below 93°C (200°F), without high humidity and away from electrical noise.

4. When using electric welding, disconnect the battery(—) terminal before starting work.

SRS HARNESS ERHA0350

The SRS harness is wrapped in a yellow tube to enable it to be discriminated from other system harnesses. And the shorting bar is contained inside the wiring connectors of the DAB, PAB and BPT inflator side. The shorting bar shorts the current flow of the DAB, PAB 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 serving the airbag module.

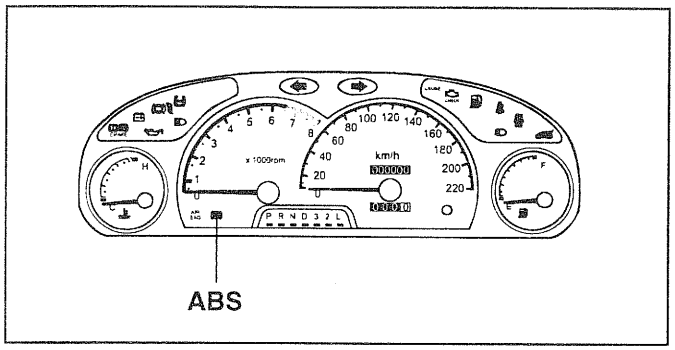
SRSCM INDEPENDENT LAMP ACTIVATION

The SRS malfunction indicator lamp (MIL) is located on the cluster giving information about SRS operating conditions by the control signals from SRSCM.

There are certain faulty 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 to the SRSCM : lamp turned on continuously.
3. SRSCM faults : lamp turned on continously
4. SRSCM not connected : lamp turned on through shorting bar in wiring harness connector.



ERHA003A

MIL OPERATING METHOD ERHA0400

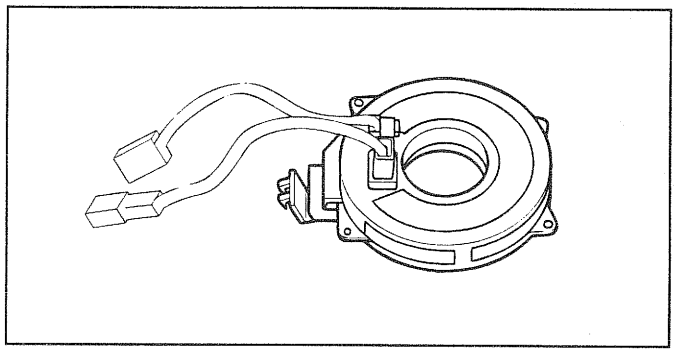
	Operating situation	Operating method
RUNNING	o Return to normal from temporary fault	ON → OFF
	o Σ Faults frequency >= 5 o Active fault	Turn it on continuously
STARTING	o Normal	Blink 6 times
	o Σ Faults frequency <= 4	On to off after 6 seconds
	o Σ Faults frequency >= 5 o Active fault	Turn it on continuously

ERDA009A

CLOCK SPRING ERHA0450

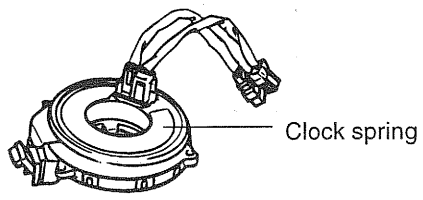
The clock spring (coil spring) consists of two current carrying coils. It is attached between the steering column and the steering wheel. It allows rotation of the steering wheel while maintaining continuous contact with the deployment loop through the inflator module.

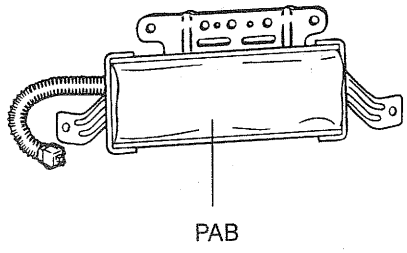
The steering wheel must be fitted correctly to the steering column with the clock spring at the neutral position, otherwise cable disconnection and other troubles may result.

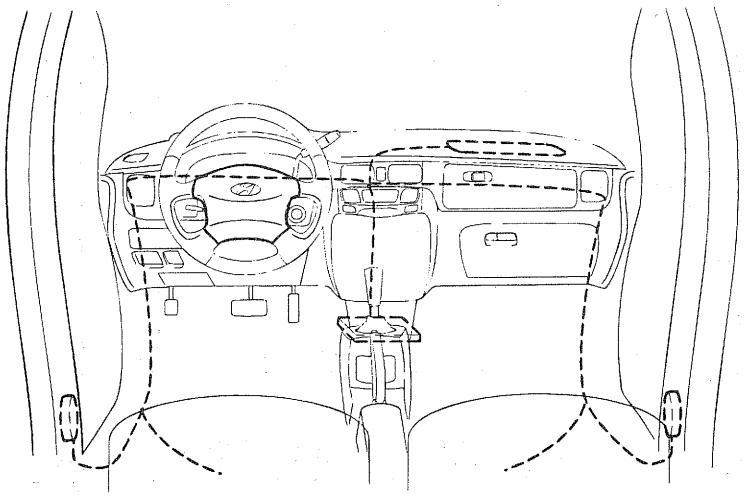


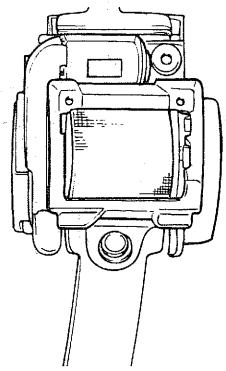
ERHA003B

SYSTEM COMPONENT AND LAYOUT ERHA0500



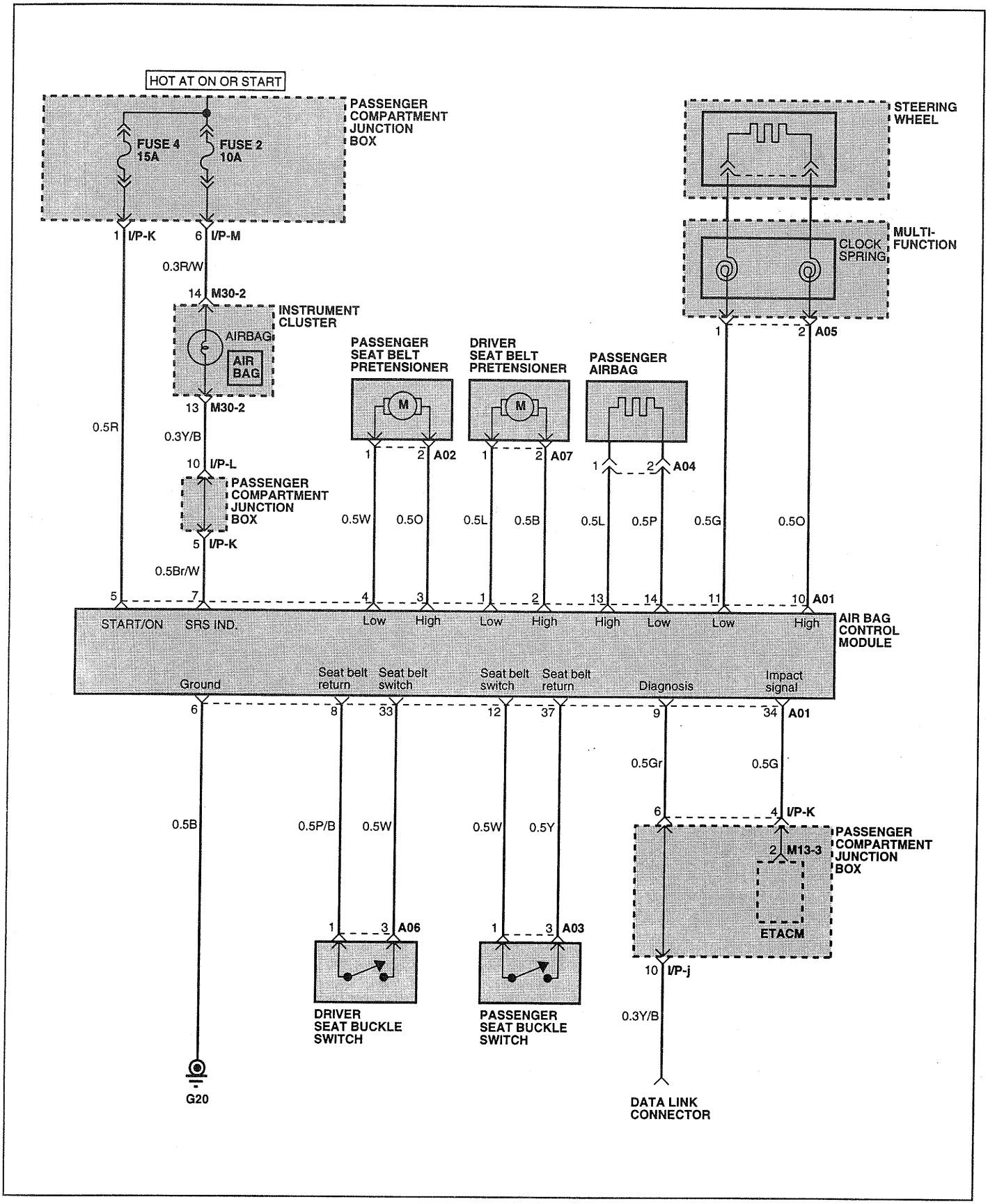






ERHA050A

AIRBAG ERHA0550

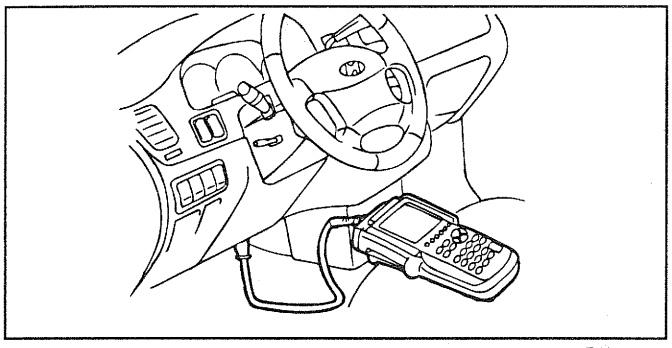


ERHA055A

DIAGNOSIS WITH SCAN TOOL ERHA1000

CHECK PROCEDURES

1. Turn the ignition key to “OFF” position.
2. Connect the Scan tool DLC to the vehicle data link connector in the lower dash panel.
3. Turn the ignition key to "ON" position and turn on Scan tool.
4. Perform the SRS diagnosis according to the vehicle's model configuration.
5. If a fault code is shown, replace the component. Never attempt to repair the component.
6. If the Scan tool finds that a component in the system is faulty, there is a possibility that the fault is not in the components but in the SRS wiring or connector.



ERHA006A

ERHA1050

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODE

DTC No.	Fault description	Remedy
B1111	Battery voltage too high	Erasible
B1112	Battery voltage too low	Erasible
B1346	DAB, Resistance too high	Erasible
B1347	DAB, Resistance too low	Erasible
B1348	DAB, Short to GND	Erasible
B1349	DAB, Short to Battery	Erasible
B1352	PAB, Resistance too high	Erasible
B1353	PAB, Resistance too low	Erasible
B1354	PAB, Short to GND	Erasible
B1355	PAB, Short to Battery	Erasible
B1361	Driver seat belt pretensioner, Resistance too high	Erasible
B1362	Driver seat belt pretensioner, Resistance too low	Erasible
B1363	Driver seat belt pretensioner, Short to GND	Erasible
B1364	Driver seat belt pretensioner, Short to Battery	Erasible
B1367	Passenger seat belt pretensioner, Resistance too high	Erasible
B1368	Passenger seat belt pretensioner, Resistance too low	Erasible
B1369	Passenger seat belt pretensioner, Short to GND	Erasible
B1370	Passenger seat belt pretensioner, Short to Battery	Erasible
B1511	Driver seat buckle switch, short to battery	Erasible
B1512	Driver seat buckle switch, short to battery	Erasible
B1513	Passenger seat buckle switch, short to battery	Erasible
B1514	Passenger seat buckle switch, short to ground	Erasible
B1620	Internal fault	Replace SRSCM
B1650	Crash recorded	Replace SRSCM
B1661	ECU mismatching	Erasible
B2500	Warning lamp failure	Erasible

ERHA1100

CIRCUIT INSPECTION

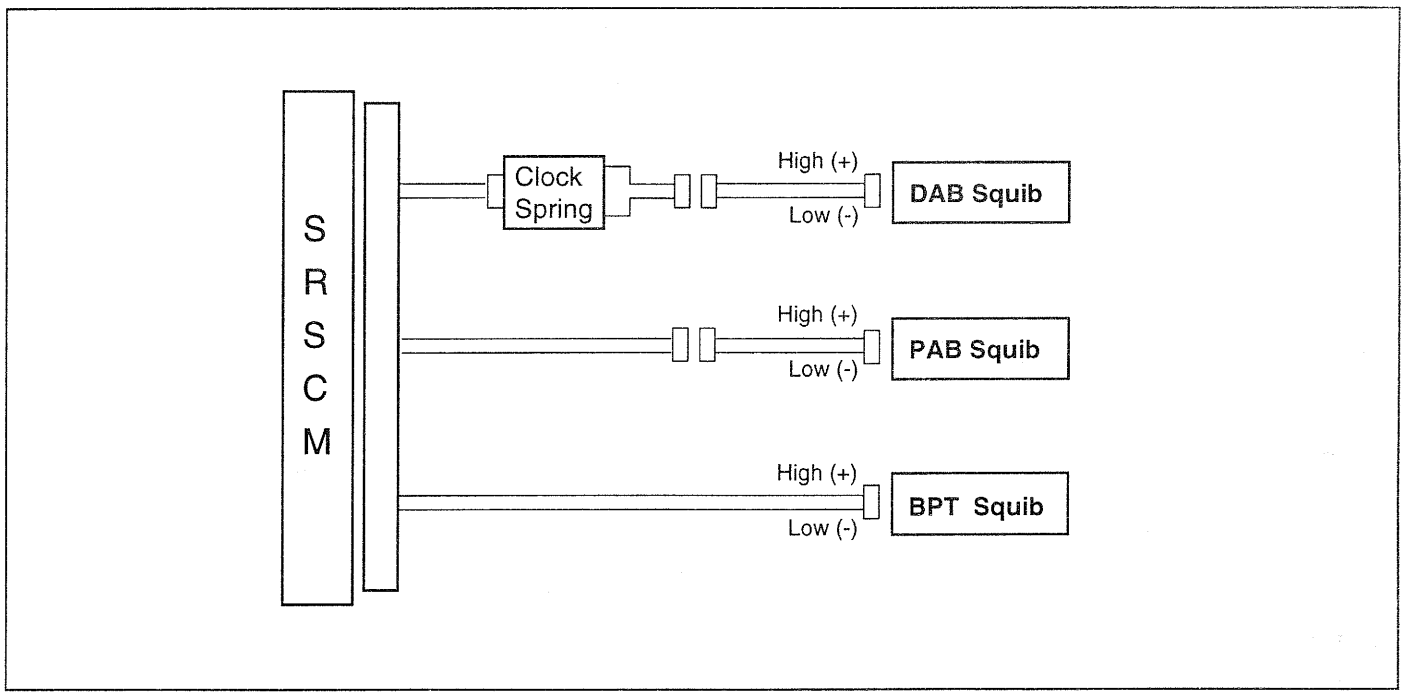
DTC	B1348	DAB Short to ground
	B1354	PAB Short to ground
	B1363	Driver BPT Short to ground
	B1369	Passenger BPT Short to ground

CIRCUIT DESCRIPTION

The squib circuit consists of the SRSCM, clock spring, DAB, PAB and BPT. It causes the SRS to deploy when the SRS deployment conditions are satisfied. The above DTCs are recorded when 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 • BPT squib • Clock spring • SRSCM • Wire harness

WIRING DIAGRAM



ERDA027A

INSPECTION PROCEDURE

1. **Preparation**

   1) Disconnect the battery negative terminal and wait for 30 seconds.

   2) Disconnect the DAB module connector.

   3) Disconnect the PAB and BPT connectors.

   4) Disconnect the SRSCM connector.

NOTE

Place the DAB module facing upward.

2. **Check DAB squib circuit.**

[CHECK]

For the connector (on the clock spring side) between clock spring and DAB, measure the resistance between DAB high and body ground.

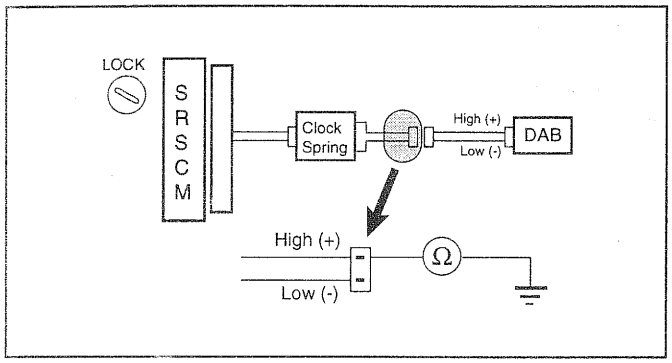
Resistance : ∞

NG → Go to step "9".

OK

Go to step "6".

ERDA027F



ERDA027J

3. **Check PAB squib circuit.**

[CHECK]

For the connector (on the SRSCM side) between SRSCM and PAB, measure the resistance between PAB high and body ground.

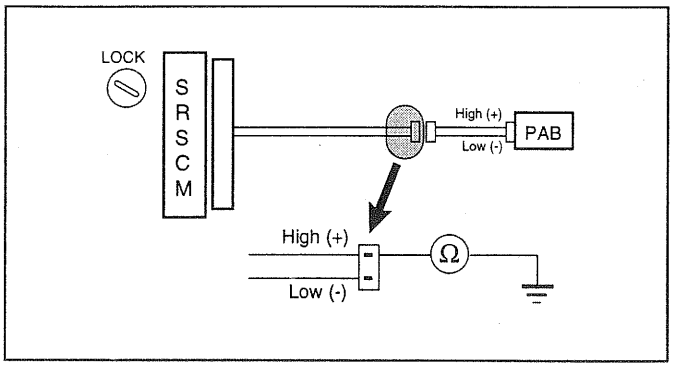
Resistance : ∞

NG → Repair or replace harness or connector between SRSCM and PAB.

OK

Go to step "7".

ERDA027G



ERDA027K

4. Check BPT squib circuit.

[CHECK]

For the connector (on the SRSCM side) between SRSCM and BPT, measure the resistance between BPT high and body ground.

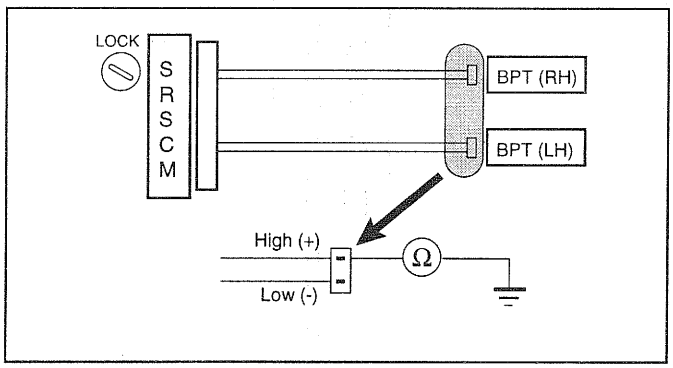
Resistance : ∞

NG → Repair or replace harness between SRSCM and BPT.

OK

Go to step "8".

ERDA027H



ERDA027L

5. **Check SRSCM.**

[PREPARATION]

1. Connector to SRSCM.
2. Using a service wire, connect DAB high and DAB low on the clock spring side of connector between clock spring and DAB.
3. Using a service wire, connect PAB high and low on SRSCM side of connector between SRSCM and PAB.
4. Connect BPT using the same method.

5. Connect negative (-) terminal cable to battery, and wait for 30 seconds.

[CHECK]

1. Turn ignition switch to "ON", and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Scan tool.
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 Scan tool, check the DTC.

DTC has no output.

[HINT]

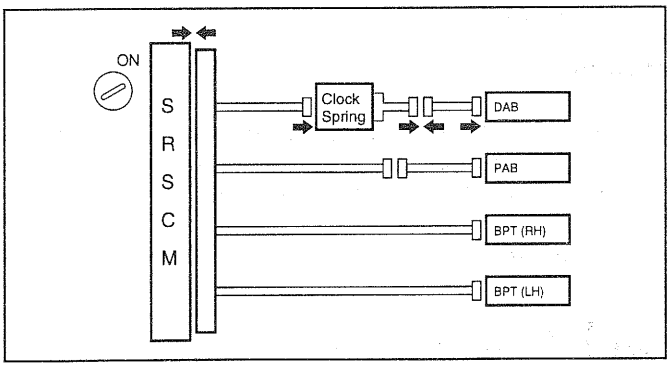
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG → Replace SRSCM.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027M



ERDA027C

6. **Check DAB squib.**

[PREPARATION]

1. Turn 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.

[CHECK]

1. Turn the ignition switch "ON", and wait for at least 30 seconds.
2. Clear malfunction code stored in the memory of the Scan tool.
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 Scan tool, check the DTC.

DTC has not output.

[HINT]

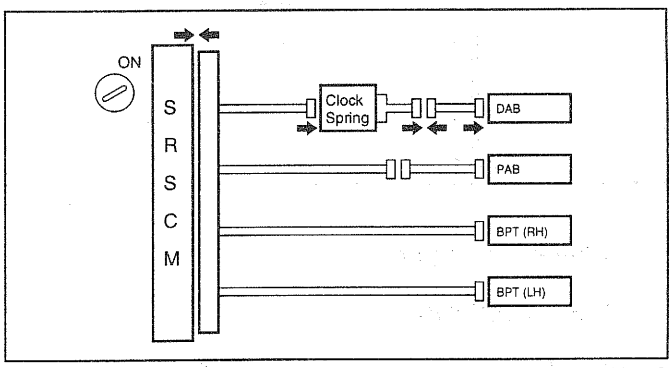
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG → Replace DAB.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027N



ERDA027C

7. **Check 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 from the battery, and wait for 30 seconds.

[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 Scan tool.

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 Scan tool, check the DTC.
   DTC has no output.

[HINT]

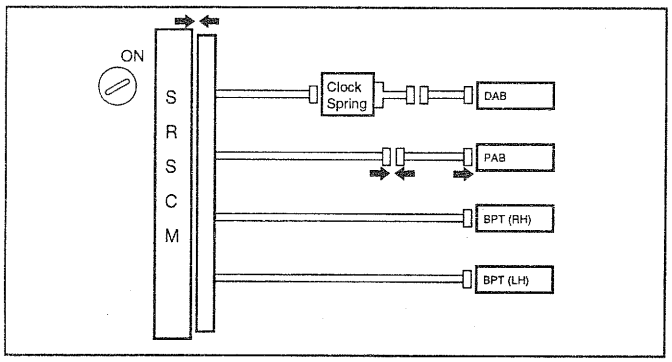
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG → Replace PAB.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027O



ERDA027D

8. **Check 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.

[CHECK]

1. Turn the ignition switch to "ON", and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with the Scan tool.
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 Scan tool, check the DTC.
   DTC is not the output.

[HINT]

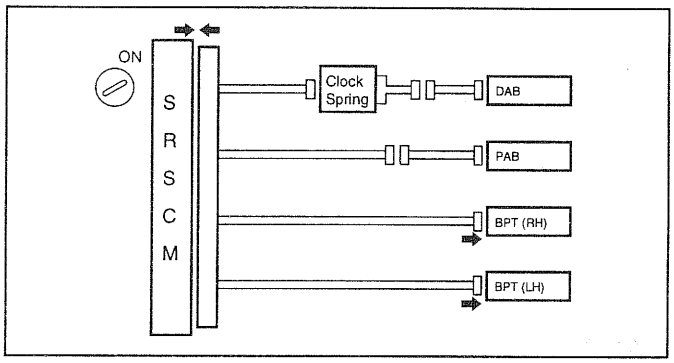
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG → Replace BPT.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027P



ERDA027E

9. **Check clock spring circuit.**

[PREPARATION]

Disconnect the connector between the SRSCM and clock spring.

[CHECK]

Measure the resistance between the DAB high on clock spring side of the connector between the clock spring and DAB and body ground.

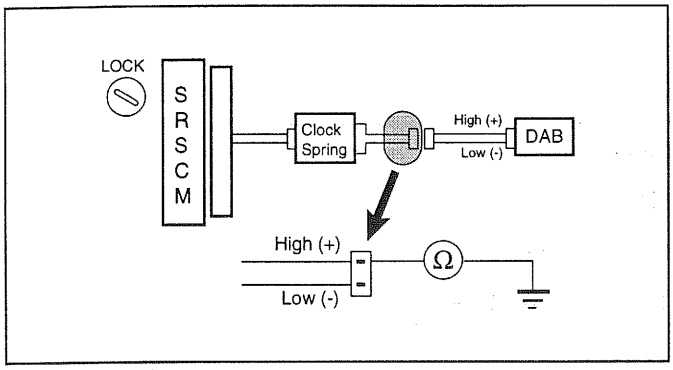
Resistance : ∞

NG → Replace clock spring.

OK

Repair or replace harness or connector between the SRSCM and clock spring.

ERDA027R



ERDA027Q

ERHA1150

CIRCUIT INSPECTION

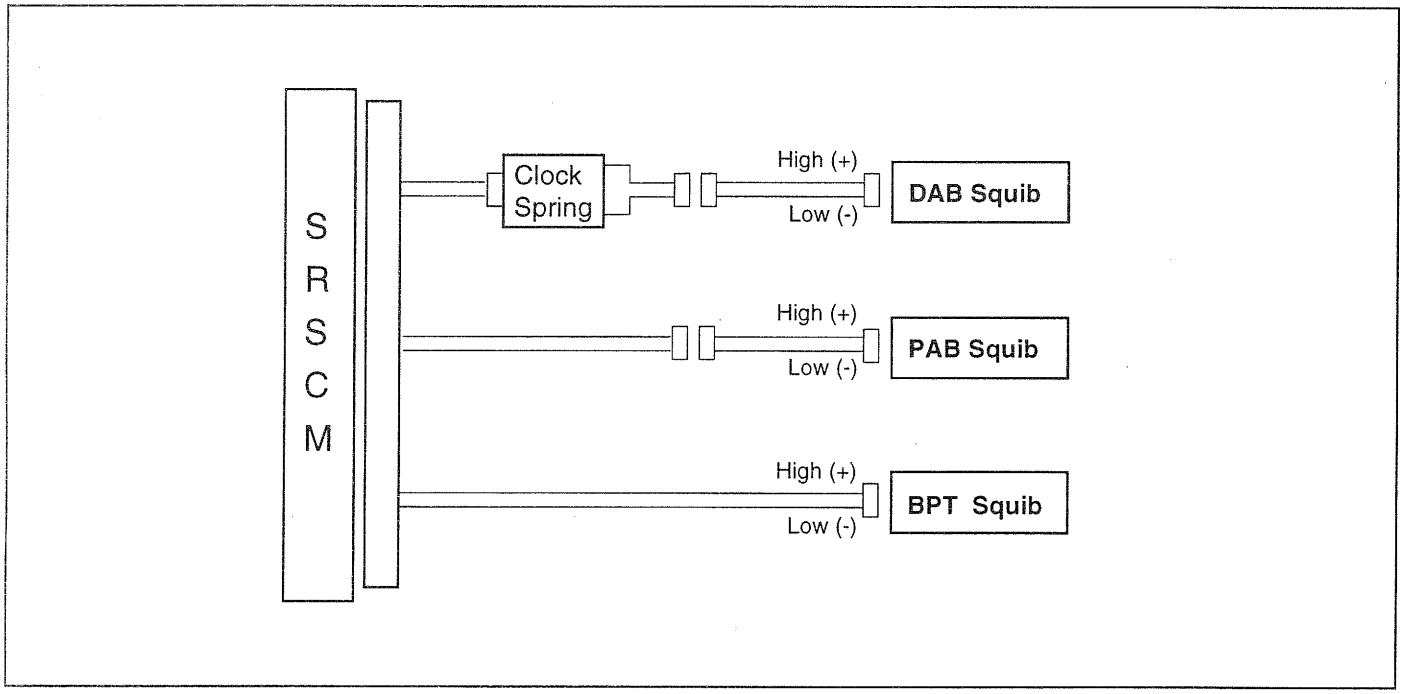
DTC	B1349	DAB Short to battery
	B1355	PAB Short to battery
	B1364	BPT (Driver) Short to battery
	B1370	BPT (Passenger) Short to battery

CIRCUIT DESCRIPTION

The squib circuit consists of the SRSCM, clock spring, DAB, PAB, and BPT. 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 • BPT squib • Wire harness

WIRING DIAGRAM



ERDA027A

INSPECTION PROCEDURE

1. **Preparation.**

   1) Disconnect the battery negative terminal and wait for 30 seconds.

   2) Disconnect the DAB module connector.

   3) Disconnect the PAB and BPT connectors.

   4) Disconnect the SRSCM connector.

NOTE

Place the DAB module facing upward.

2. **Check the DAB squib circuit.**

[CHECK]

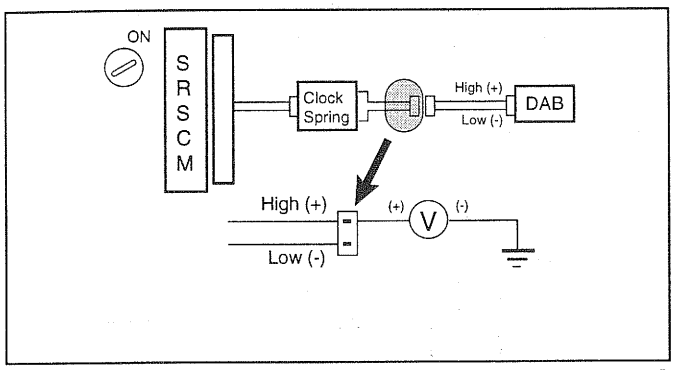
For the connector (on the clock spring side) between clock spring and DAB, measure the voltage between DAB high and body ground.

Voltage : 0 V

NG → Go to step "9".

OK
↓
Go to step "6".

ERDA027F



ERDA028B

3. **Check PAB squib circuit.**

[CHECK]

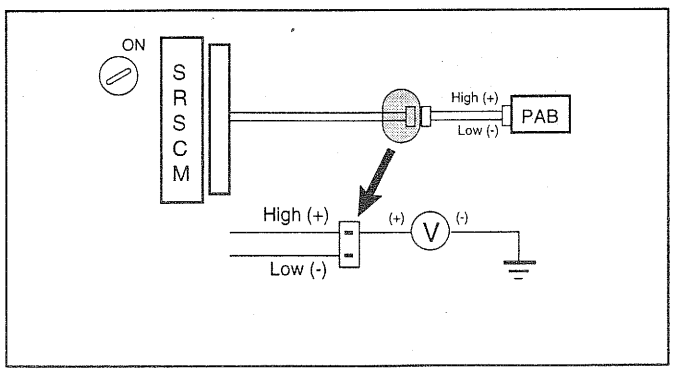
For the connector (on the SRSCM side) between SRSCM and PAB, measure the voltage between PAB high and body ground.

Voltage : 0 V

NG → Repair or replace harness or connector between SRSCM and PAB.

OK
↓
Go to step "7".

ERDA027G



ERDA028C

4. **Check BPT squib circuit.**

[CHECK]

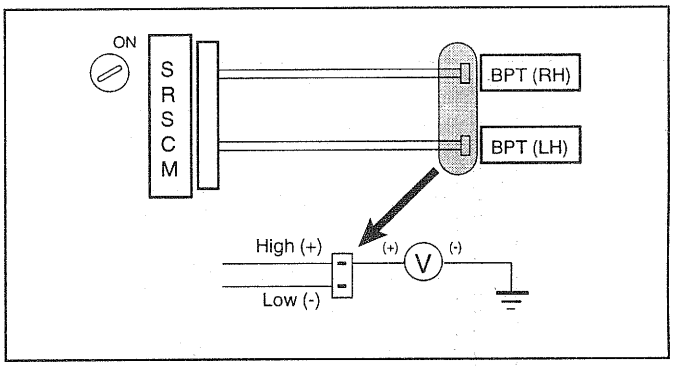
For the connector (on the SRSCM side) between SRSCM and BPT, measure the voltage between BPT high and body ground.

Voltage : 0 V

NG → Repair or replace harness between SRSCM and BPT.

OK
↓
Go to step "8".

ERDA027H



ERDA028D

5. **Check SRSCM.**

[PREPARATION]

1. Connect the connector to the SRSCM.
2. Using a service wire, connect DAB high and low on the clock spring side of the connector between the clock spring and DAB.
3. Using a service wire, connect PAB high and low on the SRSCM side of the connector between the SRSCM and PAB.
4. Using a service wire, connect BPT high and low on the SRSCM side of the connector between SRSCM and BPT.
5. Connect the negative (-) terminal cable to battery, and wait for 30 seconds.

[CHECK]

1. Turn the ignition switch "ON", and wait for at least 30 seconds.
2. Clear the malfunction code stored in the memory with Scan tool.
3. Turn the ignition switch to "LOCK", and wait for 30 seconds.

4. Turn the ignition switch to "ON", and wait for at least 30 seconds.
5. Using the Scan tool, check the DTC.
   DTC is no output.

[HINT]

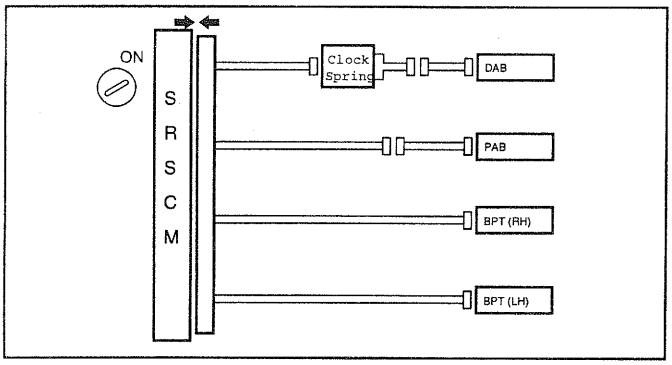
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG ➔ Replace SRSCM.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027M



ERFA028A

6. **Check 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.

[CHECK]

1. Turn the ignition switch to "ON", and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with Scan tool.
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 Scan tool, check the DTC.
   DTC is no output.

[HINT]

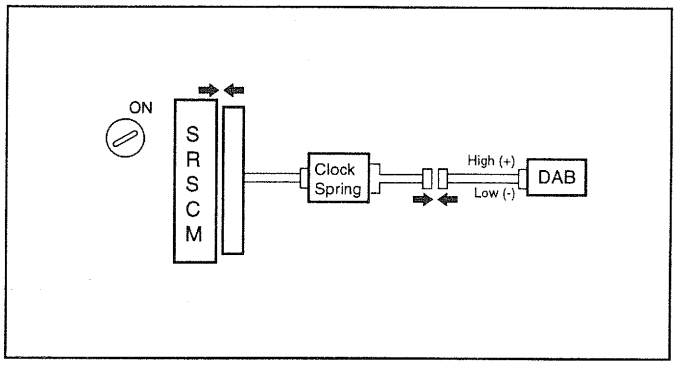
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG ➔ Replace DAB.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027N



ERDA028E

7. **Check PAB squib.**

[PREPARATION]

1. Turn the ignition switch to "LOCK".
2. Disconnect the negative (-) terminal cable from the battery, and wait for at least 30 seconds.
3. Connect the PAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.

[CHECK]

1. Turn the ignition switch to "ON", and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with Scan tool.
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 Scan tool, check the DTC.
   DTC is no output.

[HINT]

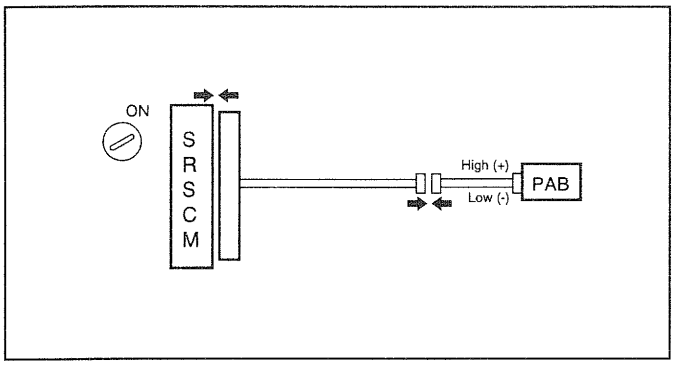
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG → Replace PAB.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027O



ERDA028F

8. **Check 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 from the battery, and wait for 30 seconds.

[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 Scan tool.
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 Scan tool, check the DTC.
   DTC is no output.

[HINT]

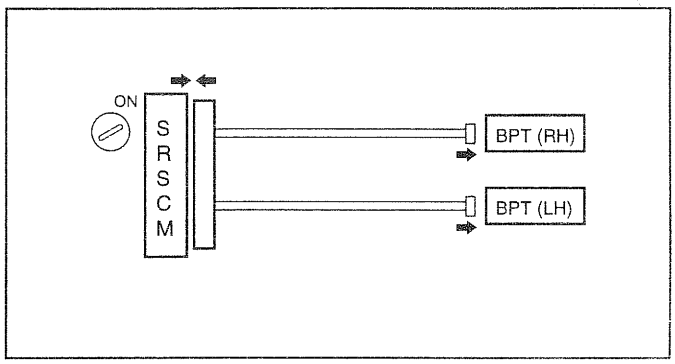
Codes other than these ones may be the output at this time, but they are not relevant to this checking procedure.

NG → Replace BPT.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027P



ERDA028G

9. **Check Clock spring.**

[PREPARATION]

1. Turn the ignition switch to "LOCK".
2. Disconnect the connector between the SRSCM and clock spring.

[CHECK]

Turn the ignition switch to "ON", and measure voltage between DAB high on the side and body ground.

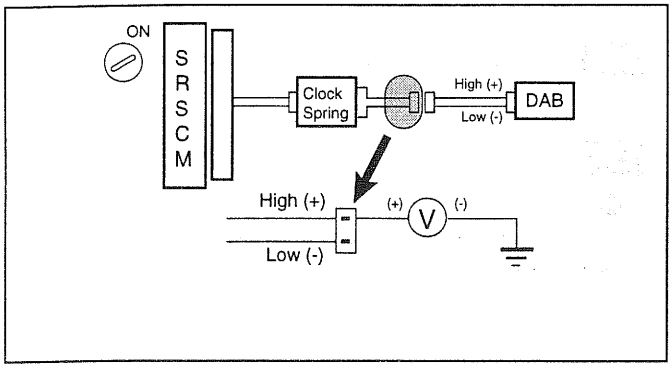
Voltage : 0 V

NG → Replace clock spring.

OK

Repair or replace harness or connector between the SRSCM and clock spring.

ERDA027R



ERDA028B

ERHA1200

CIRCUIT INSPECTION

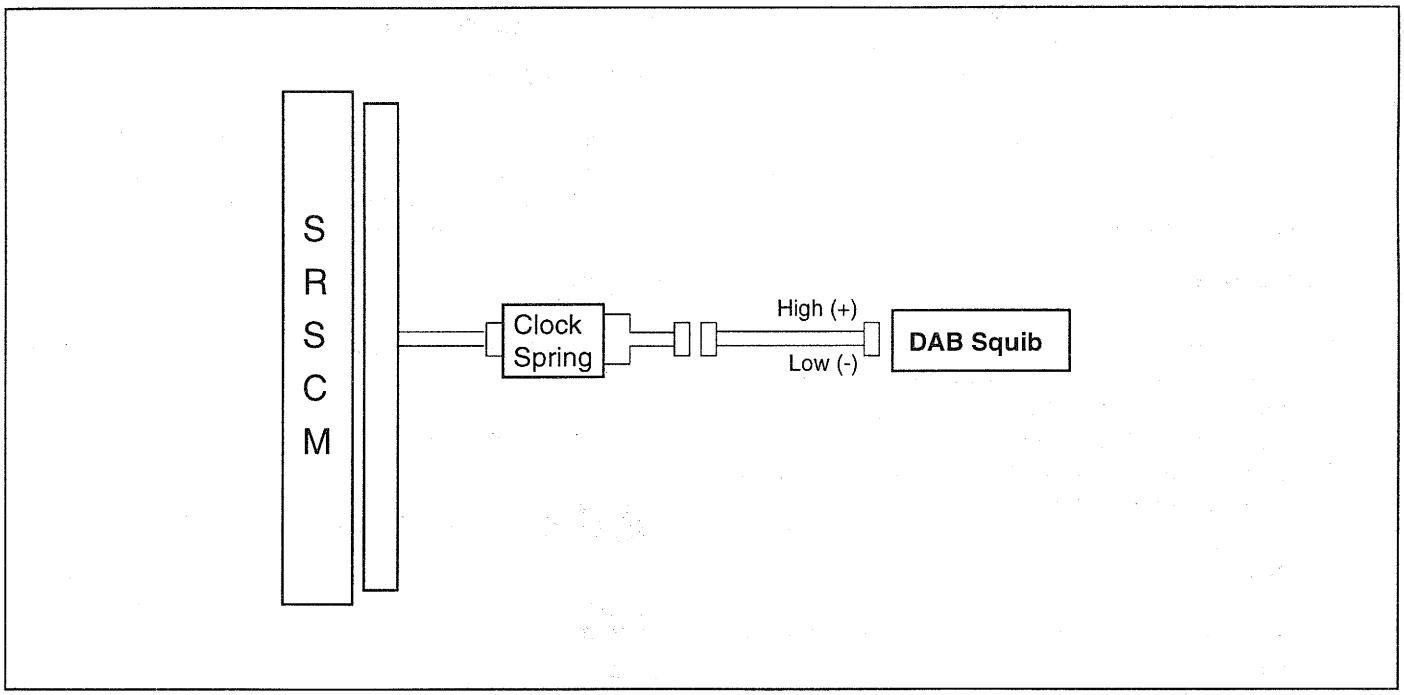
DTC	B1346	DAB resistance too high (R ≥ 6.7 Ω)
	B1347	DAB resistance too low (R ≤ 1.06 Ω)

CIRCUIT DESCRIPTION

The DAB squib circuit consists of the SRSCM, clock spring and DAB. It causes the airbag to deploy when the airbag deployment conditions are satisfied. The above DTCs are recorded when 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 squib
• DAB malfunction • Clock spring malfunction • SRSCM malfunction	• Clock spring • SRSCM • Wire harness

WIRING DIAGRAM



ERDA029A

INSPECTION PROCEDURE

1. **Preparation.**

   1) Disconnect the battery negative terminal and wait for 30 seconds.

   2) Disconnect the DAB module connector.

   3) Disconnect the PAB and BPT connectors.

   4) Disconnect the SRSCM connector.

NOTE

Place the DAB module facing upward.

2. **Check the DAB resistance.**

[PREPARATION]

Release the airbag activation prevention mechanism on the SRSCM side of airbag squib. Connect the dummy (0957A-38200) to the clock spring side connector.

[CHECK]

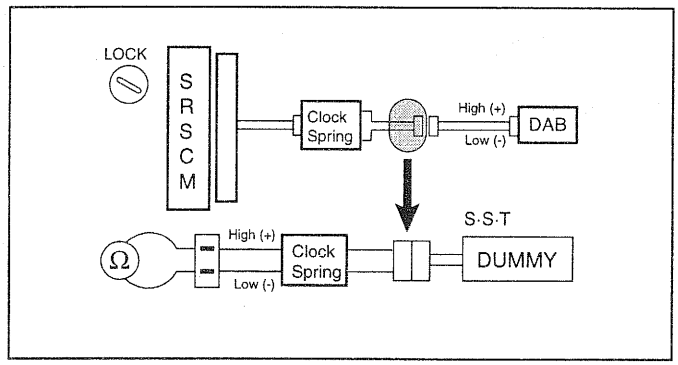
Measure the resistance between DAB high (+) and low (-).

1.8 Ω < R < 3.4 Ω

NG → Go to step "4".

OK

ERDA029C



ERDA029B

3. **Check 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.

[CHECK]

1. Turn the ignition switch to "ON", and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with Scan tool.
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 Scan tool, check the DTC.
   DTC is no output.

[HINT]

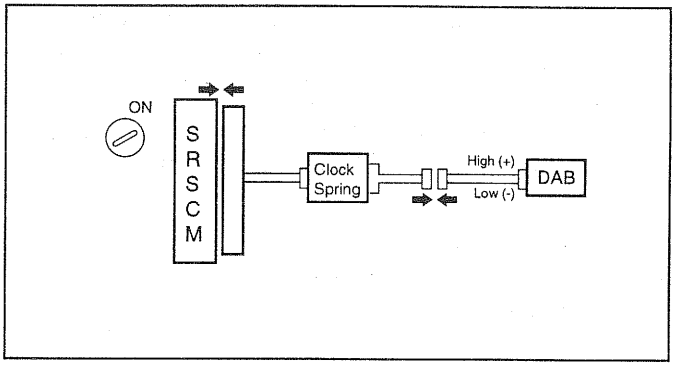
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG → Replace DAB.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027N



ERDA028E

4. **Check Clock spring.**

[PREPARATION]

Disconnect the connector between the SRSCM clock spring, and connect the dummy connector (0957A-38200) to the clock spring side of the connector as illustrated.

[CHECK]

Measure the resistance between DAB high (+) and low (-).

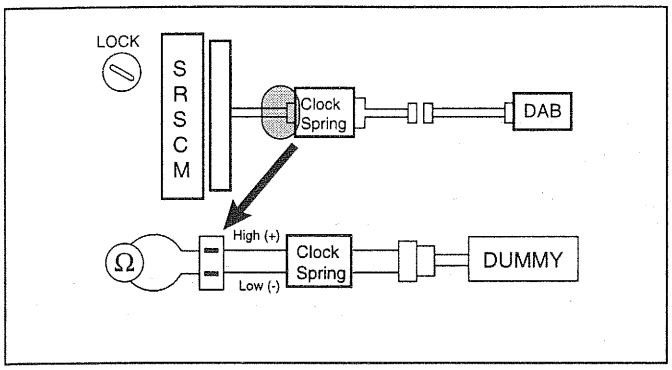
1.8 Ω < R < 3.4 Ω

NG → Replace clock spring.

OK

Repair or replace harness or connector between the SRSCM and clock spring.

ERDA027R



ERDA029D

ERHA1250

CIRCUIT INSPECTION

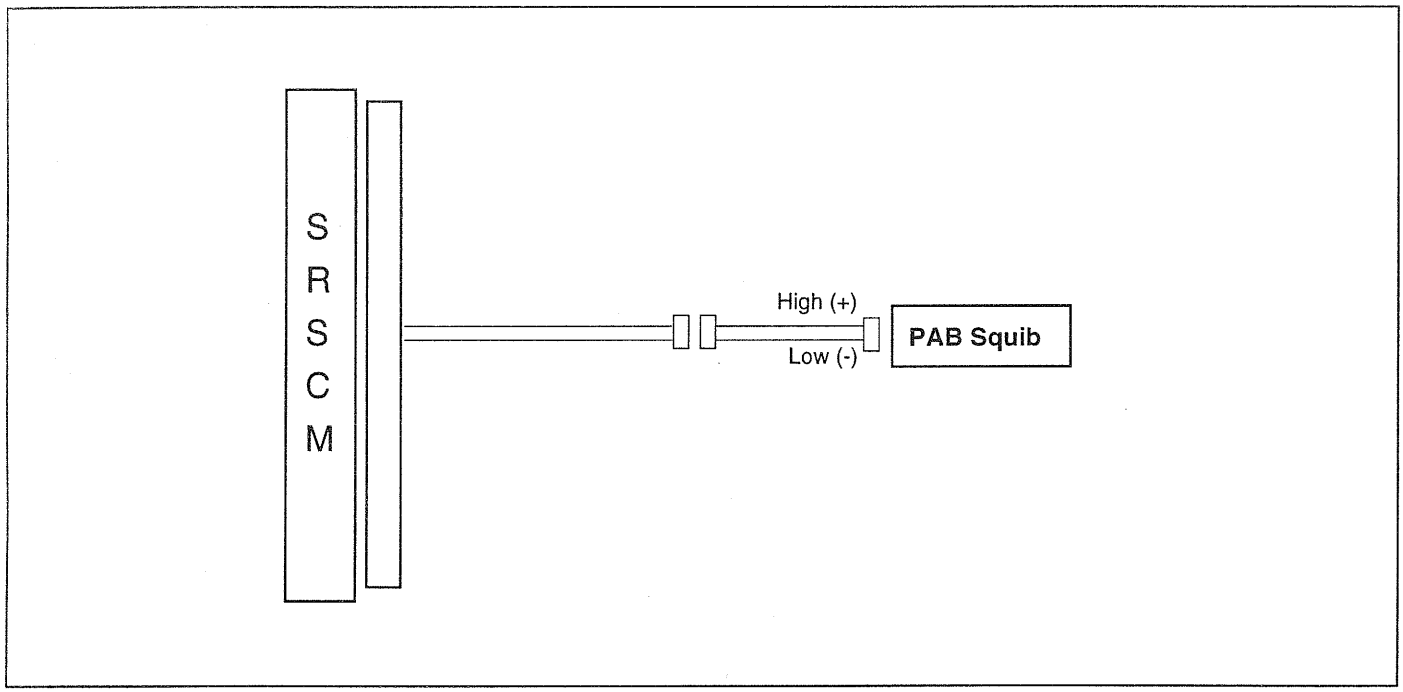
DTC	B1352	PAB resistance too high (R ≥ 5.4 Ω)
	B1347	PAB resistance too low (R ≤ 0.4 Ω)

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 PAB resistance too high or low 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 squib
• PAB malfunction • SRSCM malfunction	• SRSCM • Wire harness

WIRING DIAGRAM



ERDA030A

INSPECTION PROCEDURE

1. **Preparation.**

   1) Disconnect the battery negative terminal and wait for 30 seconds.

   2) Disconnect the DAB module connector.

   3) Disconnect the PAB and BPT connectors.

   4) Disconnect the SRSCM connector.

NOTE

Place the DAB module facing upward.

2. **Check the PAB resistance.**

[PREPARATION]

Release the airbag activation prevention mechanism on the SRSCM side of the airbag squib. Connect the dummy connector (0957A-38200)to the PAB connector of the SRSCM connector side.

[CHECK]

Measure the resistance between PAB high (+) and PAB low (-).

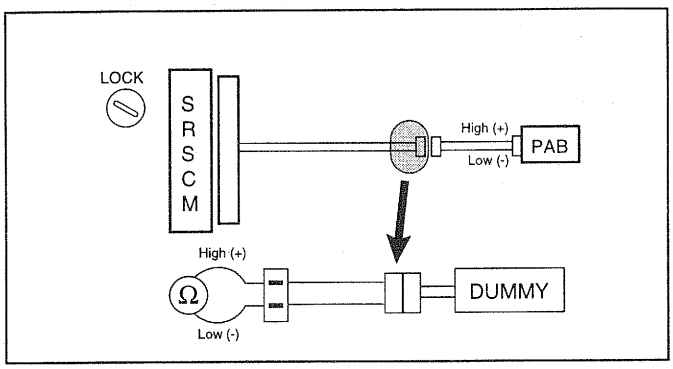
1.6 Ω < R < 2.8 Ω

NG → Repair or replace harness or connector between the SRSCM and PAB.

OK

Go to step "3".

ERHA125A



ERDA030B

3. **Check PAB squib.**

[PREPARATION]

1. Turn the ignition swich to "LOCK".
2. Disconnect the negative (-) terminal cable from the battery, and wait for at least 30 seconds.
3. Connect the PAB connector.
4. Connect the negative (-) terminal cable to the battery, and wait for 30 seconds.

[CHECK]

1. Turn the ignition switch to "ON", and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with Scan tool.
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 Scan tool, check the DTC.
   DTC is no output.

[HINT]

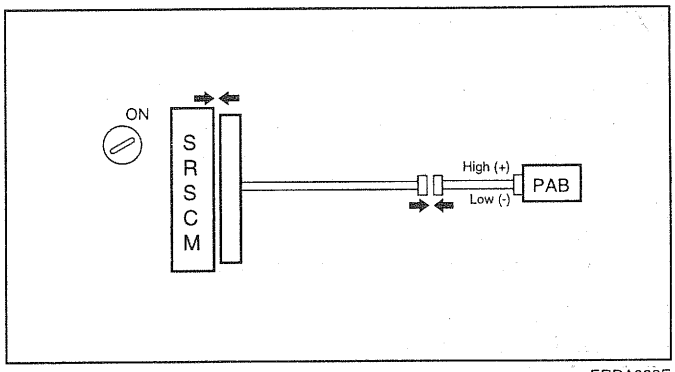
Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

NG → Replace PAB.

OK

From the results of the above inspection, the part can now be considered to be normal.

ERDA027O



ERDA028F

ERHA1260

CIRCUIT INSPECTION

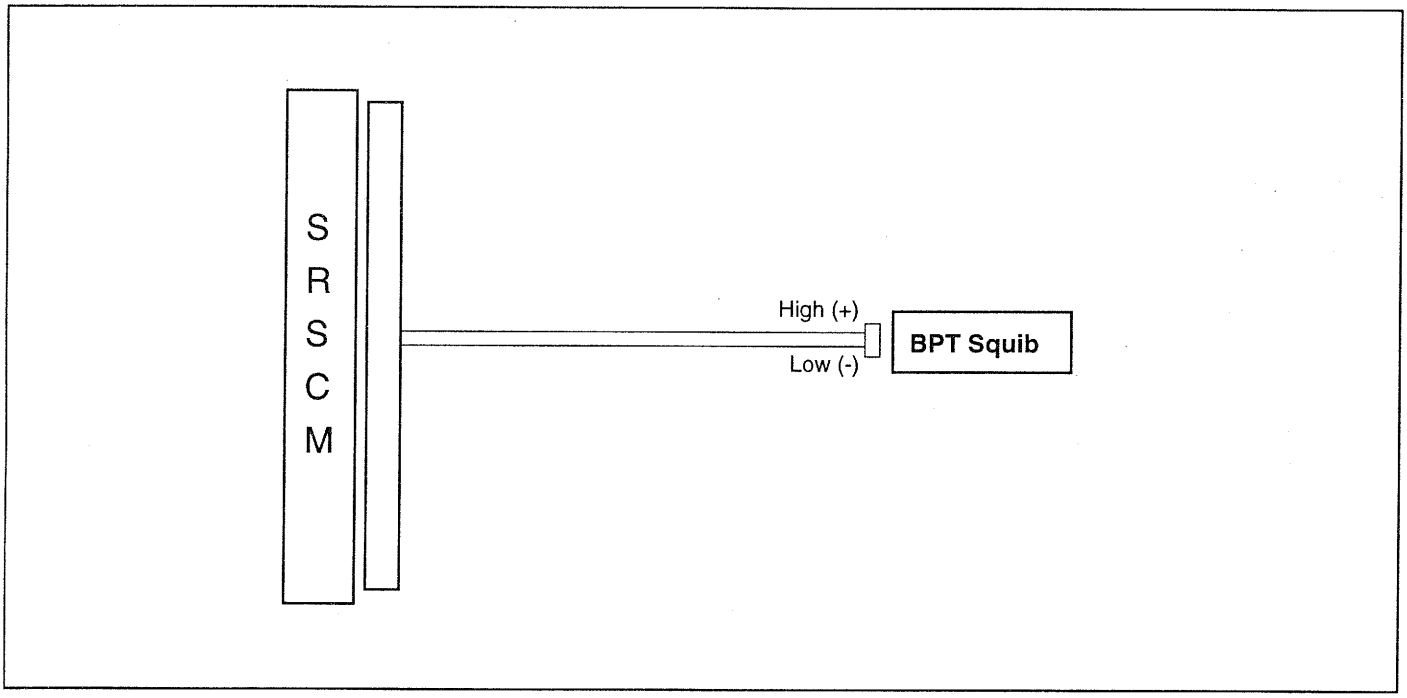
DTC	B1361	Driver seat belt pretensioner, resistance too high (R≥5.4Ω)
	B1362	Driver seat belt pretensioner, resistance too low (R≤0.4Ω)
	B1367	Passenger seat belt pretensioner, resistance too high (R≥5.4Ω)
	B1368	Passenger seat belt pretensioner, resistance too low (R≤0.4Ω)

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 BPT resistance too high or low is detected in the BPT squib circuit.

DTC Detecting Condition	Trouble Area
• Too high or low resistance between BPT high(+) and BPT low(-) wiring harness of squib	• BPT squib
• SRSCM malfunction • BPT malfunction	• SRSCM • Wire harness

WIRING DIAGRAM



ERHA126A

INSPECTION PROCEDURE

1. **Preparation**

   1) Disconnect the negative(-) terminal cable from the battery, and wait for 30 seconds.

   2) Disconnect the BPT connector.

   3) Disconnect the SRSCM connector.

2. **Check DAB squib circuit..**

[PREPARATION]

Release the airbag activation prevention mechanism on the SRSCM side of the airbag squib side. Connect the dummy connector(0957A-38200) to the BPT connector of the SRSCM connector side.

[NOTE]

Before checking the resistance, you have to insert the shorting bar with the insert plastic attached diagnosis checker into the SRSCM connector.

[CHECK]

Measure the resistance between BPT high(+) and BPT low(-).

1.8Ω < R < 2.5Ω

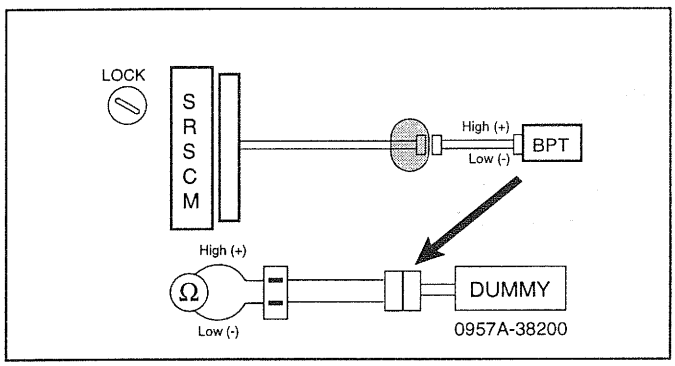
NG → Repair or replace harness or connector between the SRSCM and BPT.

OK

↓

Go to step "3"

ERHA126B



ERHA126C

3. **Check BPT squibt.**

[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.

[CHECK]

1. Turn the ignition switch to "ON", and wait for 30 seconds.
2. Clear the malfunction code stored in the memory with Scan tool.
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 Scan tool, check the DTC.
   DTC is not output.

[HINT]

Codes other than these ones may be output at this time, but they are not relevant to this checking procedure.

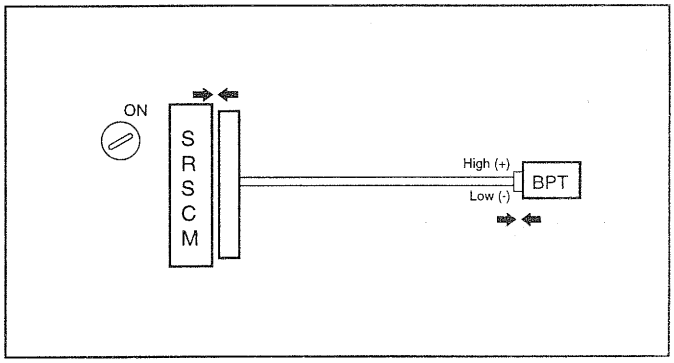
NG → Replace BPT

OK

↓

From the results of the above inspection, the part can now be considered to be normal.

ERHA126D



ERHA126E

ERHA1300

CIRCUIT INSPECTION

DTC	B2500	Warning lamp failure

CIRCUIT DESCRIPTION

The SRS warning lamp is located on 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 stays on to inform the driver of the abnormality. The SRSCM measures the voltage at the airbag SRI (Service Reminder Indicator) output pin, both when the lamp is on and when the lamp is off, to detect whether the requested state matches the actual state.

INSPECTION PROCEDURE

1. Check the fuse.

   [PREPARATION]

   1. Remove fuse No. 2 and 4 from the junction block.
   2. Inspect the state of the fuses.
   3. Replace if necessary.

2. Check SRS warning lamp circuit.

   [PREPARATION]

   1. Connect the negative (-) terminal cable to the battery.
   2. Turn the ignition switch to "ON".

   [CHECK]

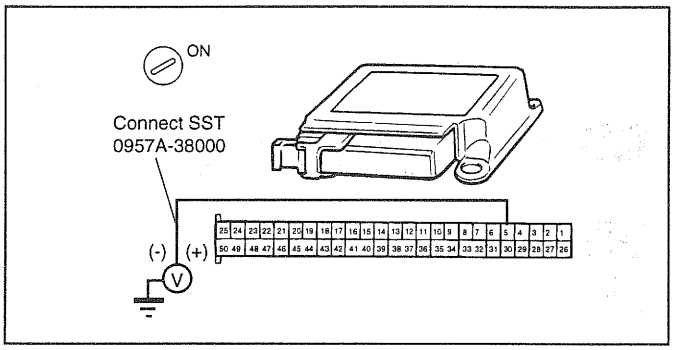
   1. Measure voltage of the harness side connector of the SRSCM.
      Voltage : 10-16.5 V

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



ERHA130A

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

ERHA1350

CIRCUIT INSPECTION

DTC	B1620	Internal fault
	B1650	Crash recorded
	B1661	ECU mismatching

CIRCUIT DESCRIPTION

SRSCM MALFUNCTION

The SRSCM shall also cyclically monitor the following :

1. Functional readiness of the firing circuit activation transistors.
2. Adequacy of deployment energy reserves.
3. Safety sensor integrity : detection of faulty closure.
4. Plausibility of accelerometer signal.
5. Operation of 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 SRSCM and activate the SRI (Service Reminder Indicator). The SRSCM must be replaced, once the fault codes mentioned above are confirmed.

FIELD DEPLOYMENT PROCEDURES ERHA1400

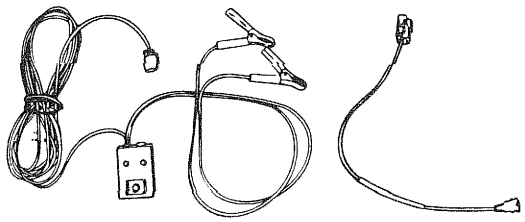
CAUTION

When handling the deployed airbag, be careful not to allow by-product dust to enter the eyes and always wear gloves to avoid direct contact with by-product material.

AIRBAG MODULE DISPOSAL PROCEDURES

Before either 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.

AIRBAG REMOTE DEPLOYMENT DEVICES

Tool, Number, Name	Use
Deployment tool (0957A-34100-A) SRS DEPLOYMENT ADAPTER HARNESS DAB : 0957A-38000 PAB : 0957A-34200  ERDA034A	Deployment inside the vehicle (when vehicle will no longer be driven)

DISPOSAL PLAN

When the problem occurs, take the following disposal steps.

CASE		DISPOSAL PLAN
Car scrapping	DAB, PAB, BPT	Deploy the airbag module in the scrapper yard with SST
Crash (Deployed)		Service station disposes of the airbag module

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 out a warning.**
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.**

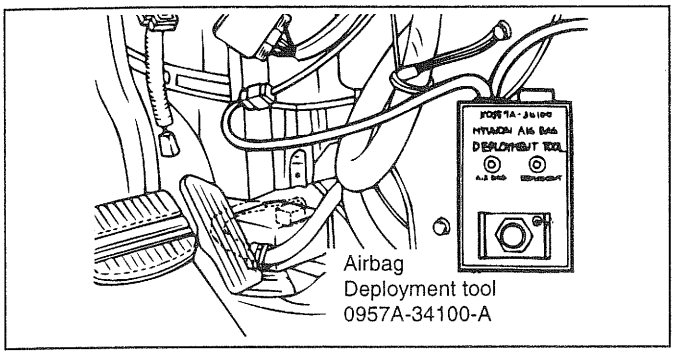
DEPLOYMENT INSIDE THE VEHICLE

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.

CAUTION

Wait for at least 30 seconds after disconnecting the battery cable before doing any further work.



ERDA034B

3. Remove the airbag SRSCM connector.

4. Connect the deployment tool to the connector of each module.

5. As far away from the vehicle as possible, press the push button (removed from the vehicle) to deploy the airbag.

CAUTION

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 for 30 minutes to allow it to cool before attempting to handle it. Although not poisonous, do not inhale gas from the airbag deployment. See the Deployed Airbag Module Disposal Procedures for the 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 parts, except that the following points should be carefully noted during disposal.

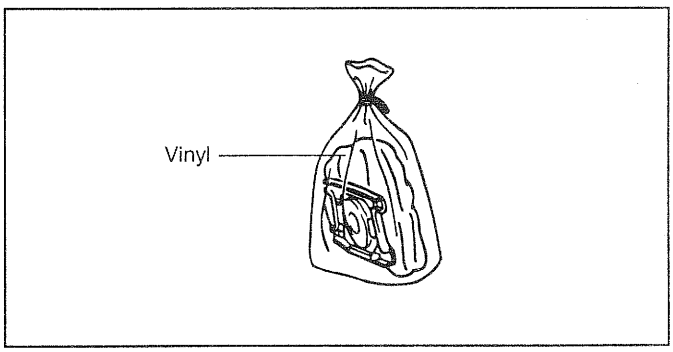
1. The inflator will be quite hot immediately following deployment, so wait for 30 minutes to allow it to cool before attempting to handle it.

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 THE EYES OR ON THE 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.

5. Be sure to always wash your hands after completing this operation.

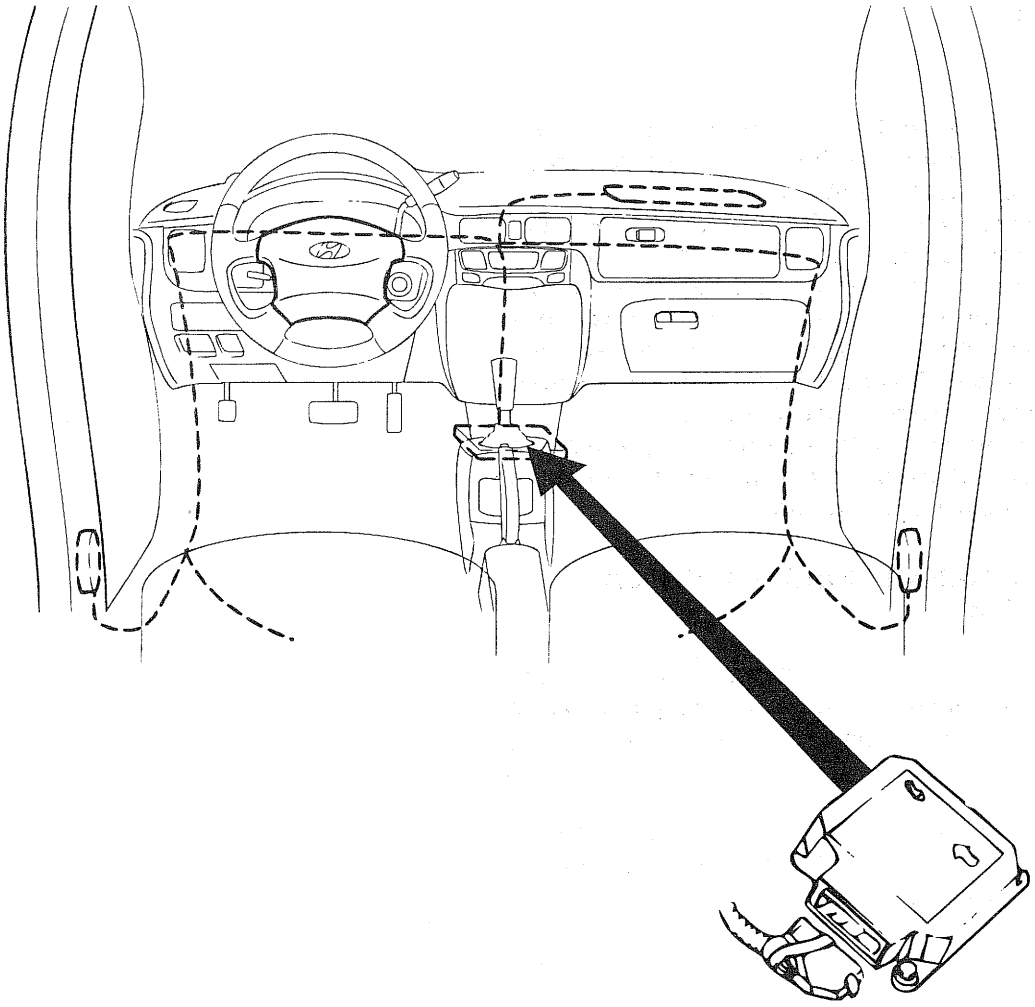


ERDA034D

SRSCM (SUPPLEMENTAL RESTRAINTS SYSTEM CONTROL MODULE)

SRSCM (SRS CONTROL MODULE)

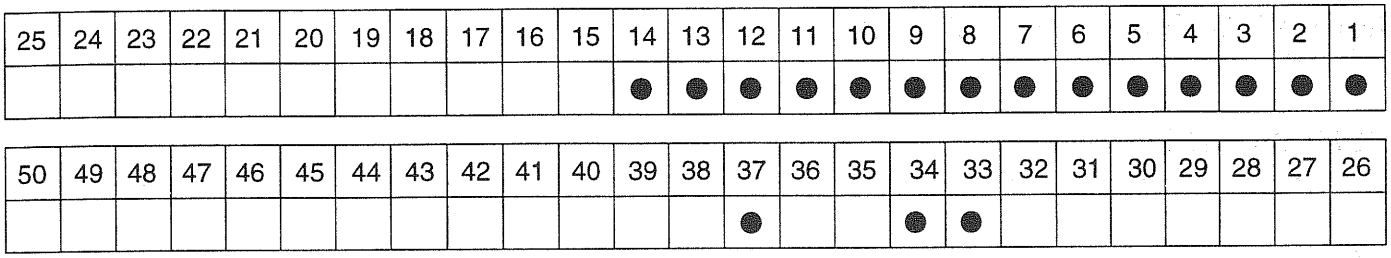
COMPONENT ERHA0600



SRSCM

ERHA060A

SRSCM CONNECTOR (DAB+PAB+BPT) ERHA0650



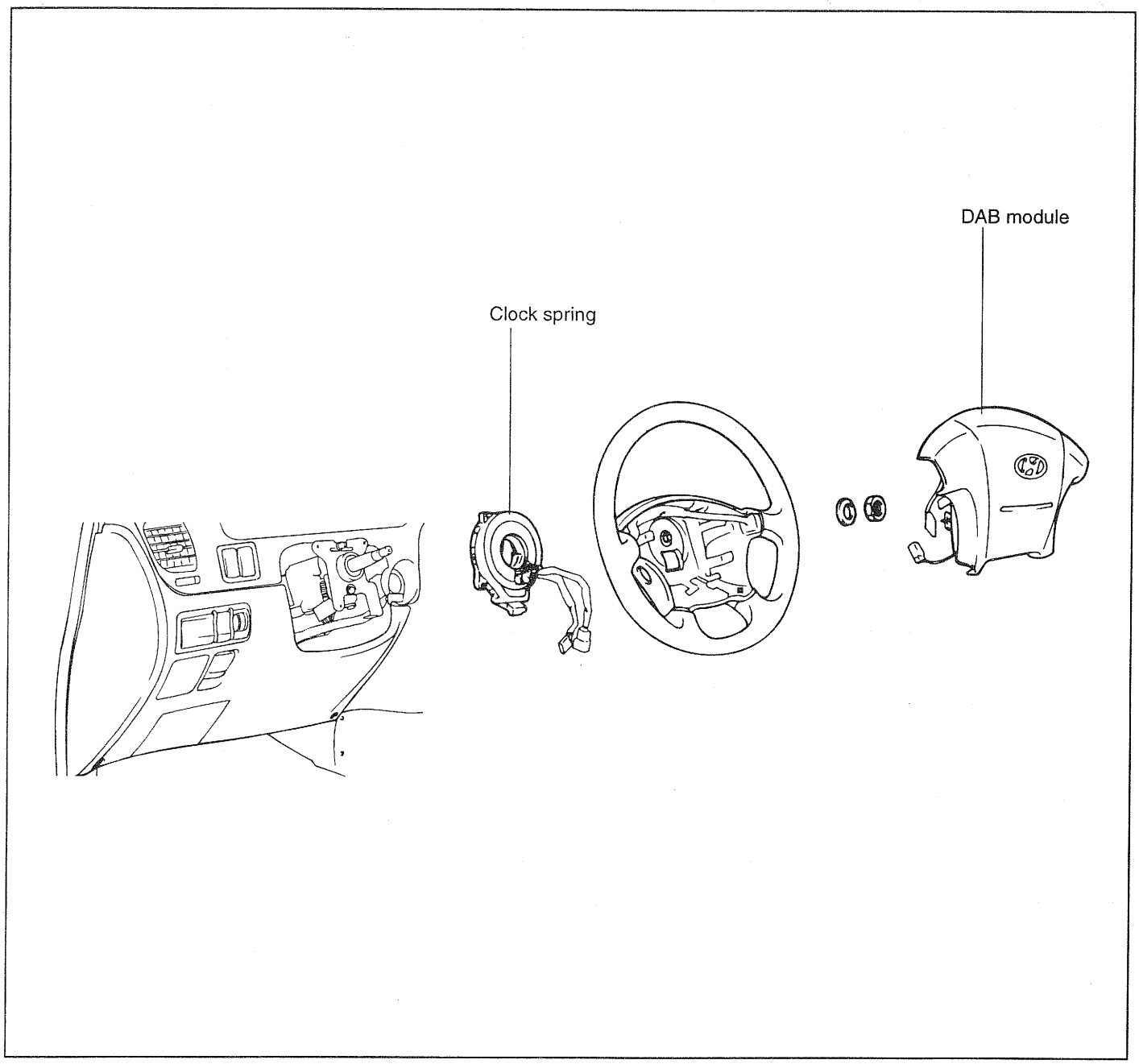
ERHA065A

PIN NO	Description	Input/output
1	Driver seat BPT	Output
2	Driver seat BPT	Output
3	Passenger seat BPT	Output
4	Passenger seat BPT	Output
5	Battery (+)	Input
6	Ground	Input
7	Indicator	Output
8	Driver seat belt switch	Output
9	Diagnosis	Input/output
10	DAB high	Output
11	DAB low	Output
12	Passenger seat belt switch	Output
13	PAB high	Output
14	PAB low	Output
15-25	-	-
26-29	Shorting bar	-
30-32	-	-
33	Driver seat belt switch	Output
34	Crash output	Output
35-36	Shorting bar	-
37	-	-
38-39	Shorting bar	-
40-45	-	-

AIR BAG MODULE (DRIVE SIDE) AND CLOCK SPRING

AIR BAG MODULE (DRIVER) AND CLOCK SPRING

COMPONENTS ERHA0700



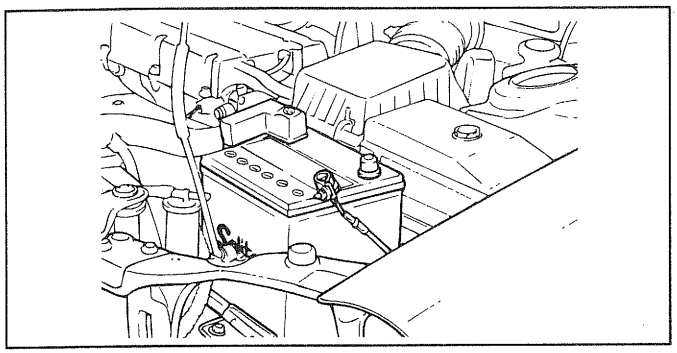
ERHA070A

REMOVAL ERHA0750

1. Disconnect the negative battery cable and keep it secure away from battery.

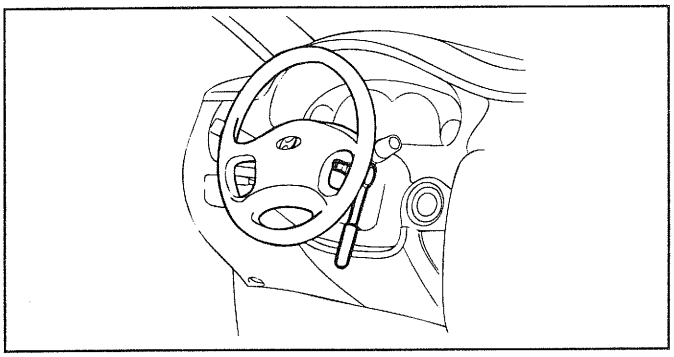
CAUTION

Wait for 30 seconds after disconnecting the battery cable before doing any further work.



ERA9007A

2. Remove the side protect cover of the steering wheel and the airbag module mounting bolts using a hexagonal wrench.



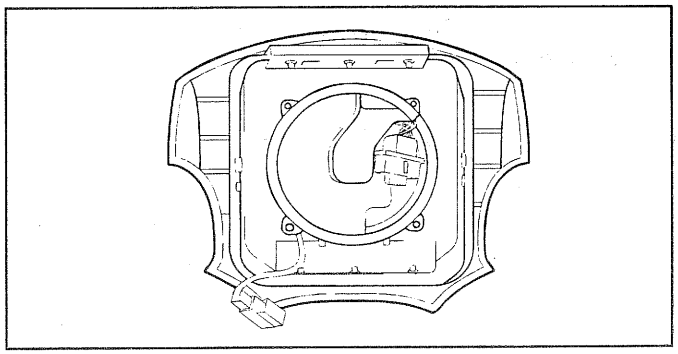
EPHA002A

3. 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.

4. Remove the driver's airbag module.

CAUTION

1. **When disconnecting the airbag module-clock spring connector, take care not to apply excessive force to it.**
2. **The removed airbag module should be stored in a clean, dry place with the pad cover facing up.**

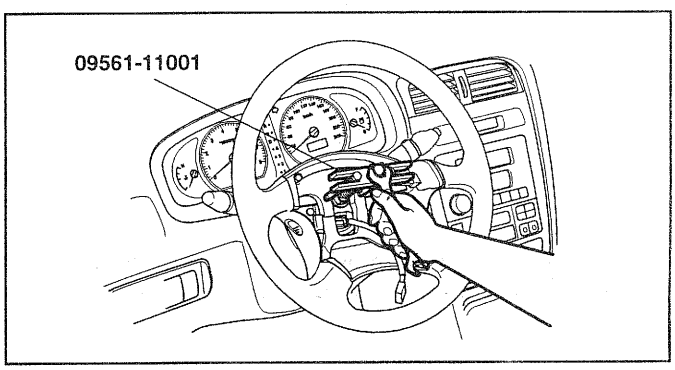


ERHA004A

5. Remove the steering wheel using the SST (09561–11002).

CAUTION

Do not hammer on the steering wheel. Doing so may damage the collapsible column mechanism.



KFWC003A

INSPECTION ERHA0800

AIRBAG MODULE

If any damaged or worn parts are found during the following inspection, replace the airbag module with a new one.

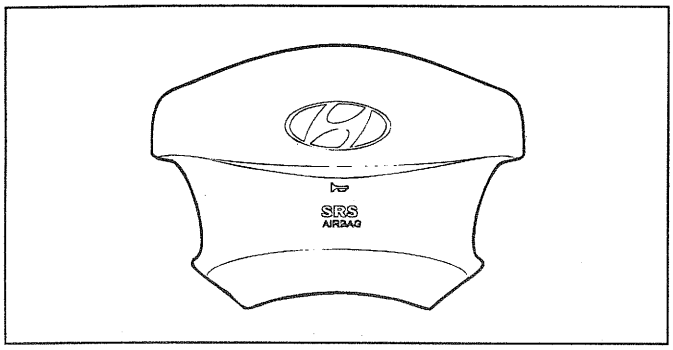
Dispose the old one according to the specified procedure.

CAUTION

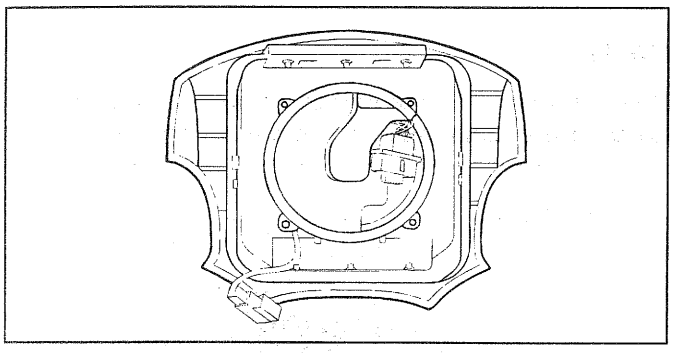
Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment could result in serious personal injury.

1. **Check the 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 harnesses for binds.**

4. **Check the airbag inflator case for dents, cracks or deformities.**

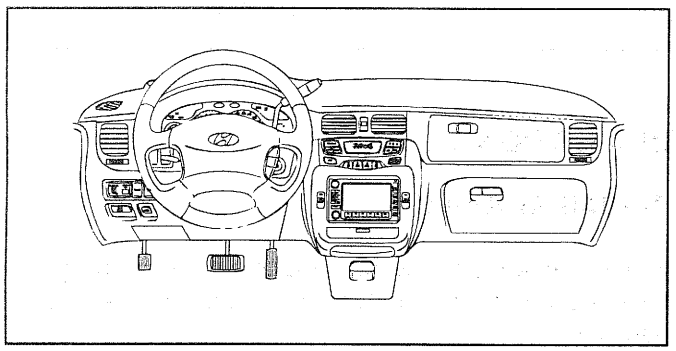


ERHA005A

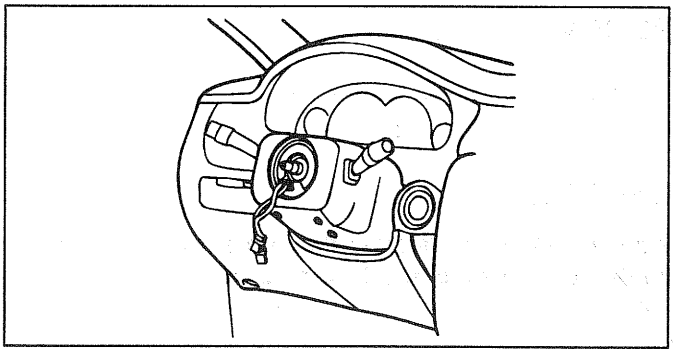


ERHA004A

5. **Install the airbag module to the steering wheel to check the fit and alignment with the wheel.**



ERHA004B



ERHA004C

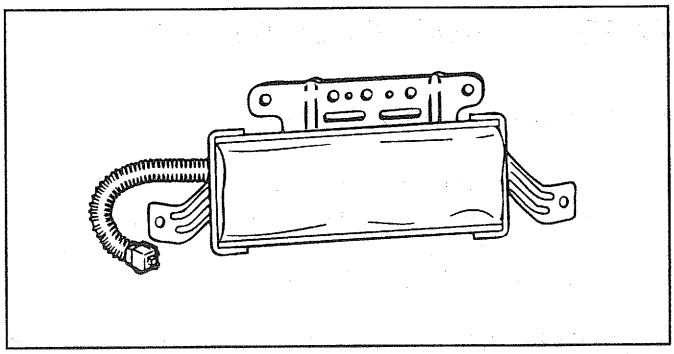
CLOCK SPRING

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 the connectors and protective tube for damage, and terminals for deformities.

AIR BAG MODULE (PASSENGER SIDE)

AIR BAG MODULE (PASSENGER)



HEW56A-1

REMOVAL ERHA0850

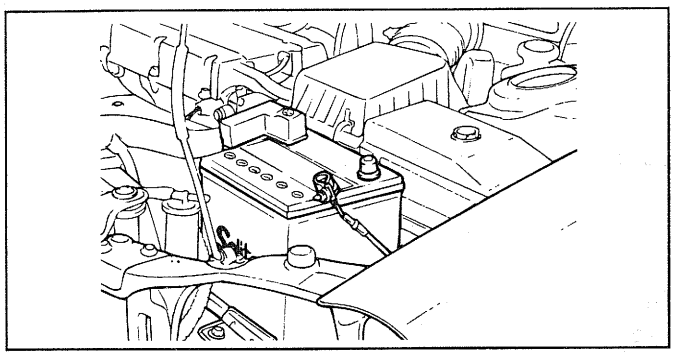
CAUTION

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. **An undeployed airbag module should only be disposed of in accordance with the procedures.**
5. **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 could result in serious personal injury.**
6. **Whenever the PAB is deployed it should be replaced with a new one assembled with an extension wire, because the squib is a 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.



ERA9007A

2. Remove the glove box.
3. Disconnect the PAB module connector.
4. Remove the crash pad assembly and then undo the PAB module.

PASSIVE SEAT BELT SYSTEM

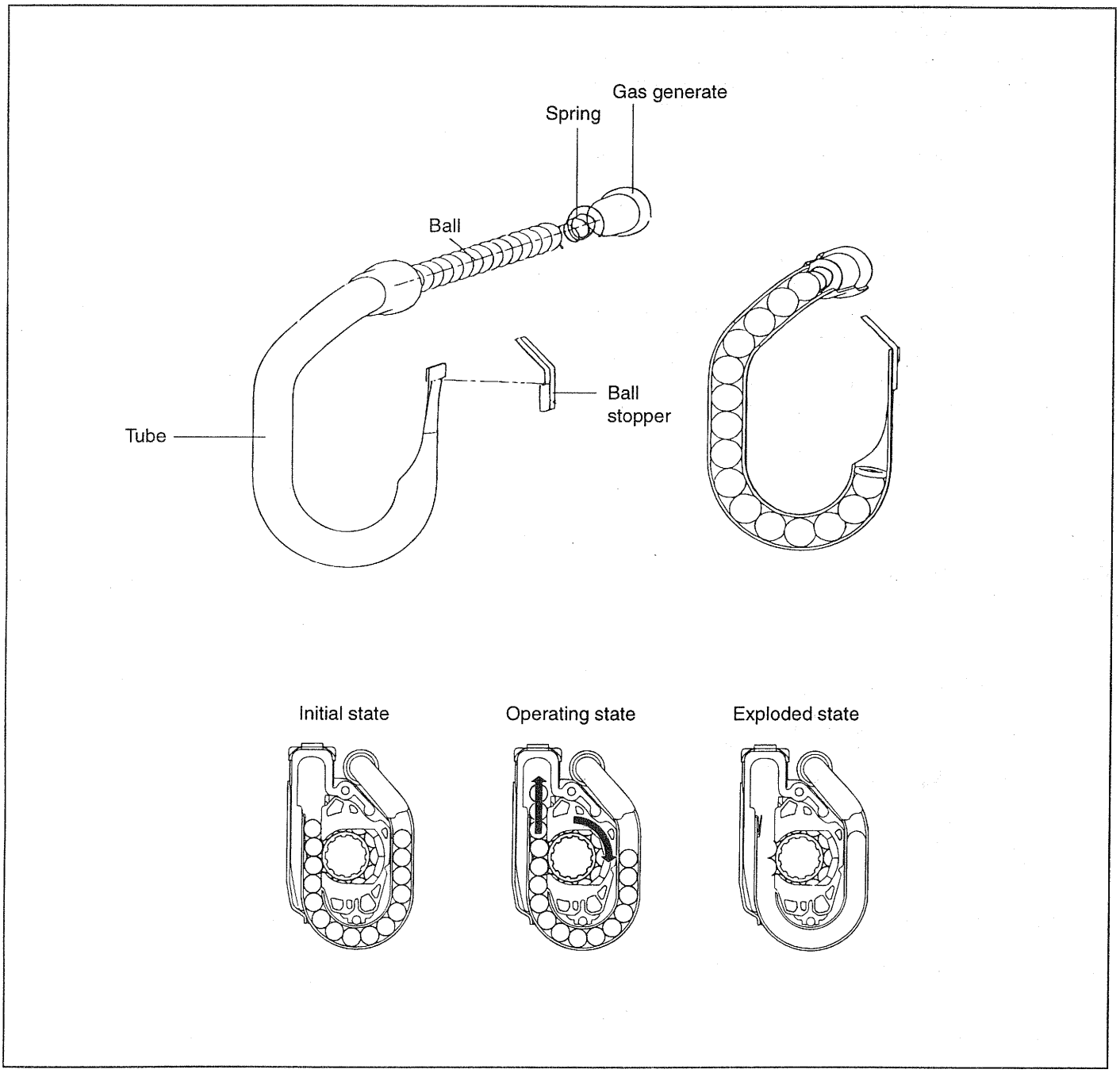
FUNCTION OF PRETENSIONER ERHA0900

When a vehicle crashes with a certain degree of impact from the front, the gas generator is made to ignite by the 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 to prevent the occupant from thrusting forward and hitting the steering wheel or instrument panel when the vehicle crashes.

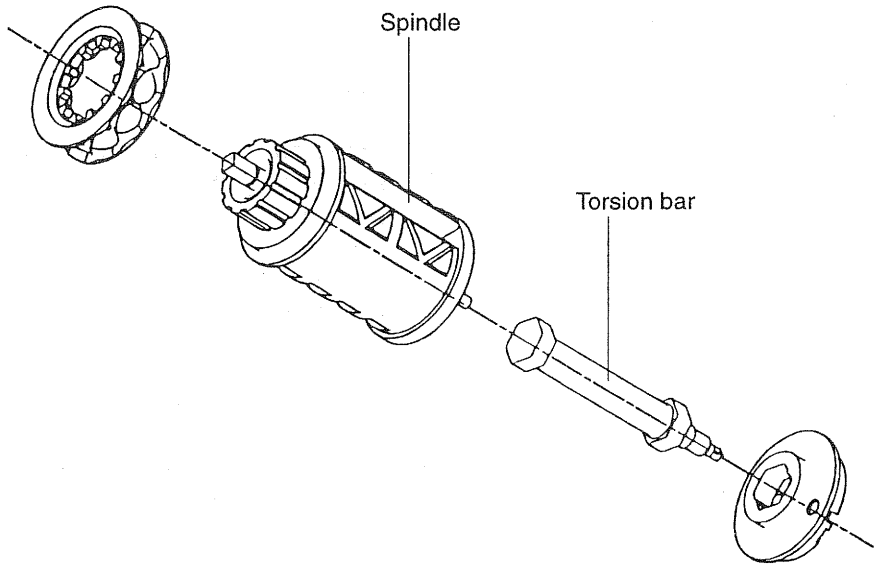


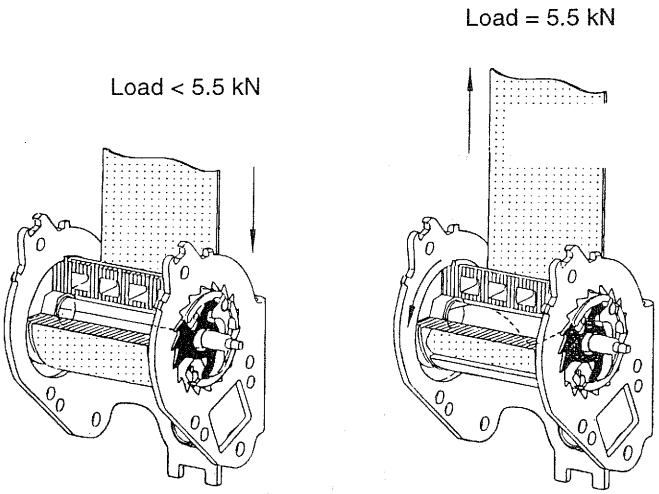
KFWE005A

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 is deformed and this causes the webbing to be extracted from the seat belt thus relieving the impact force.





Webbing retracted **Torsion bar deformed**

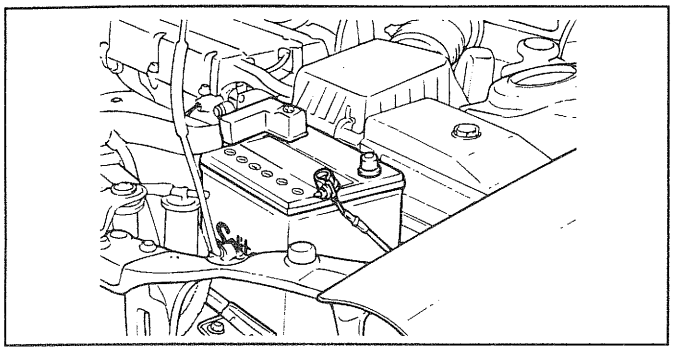
KFWE006A

REMOVAL ERHA0950

1. Disconnect the battery negative (-) terminal.

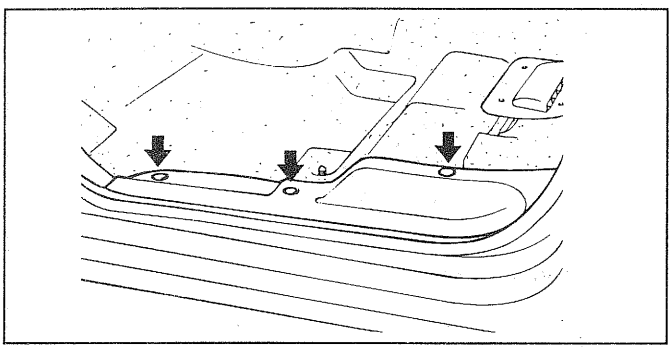
CAUTION

Wait at least 30 seconds.



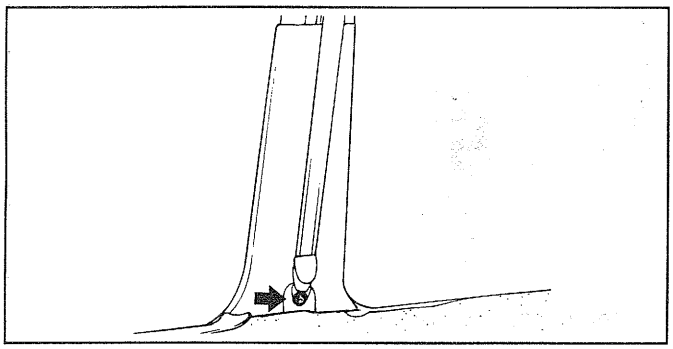
ERA9007A

2. Remove the door scuff trim.



ESHA040H

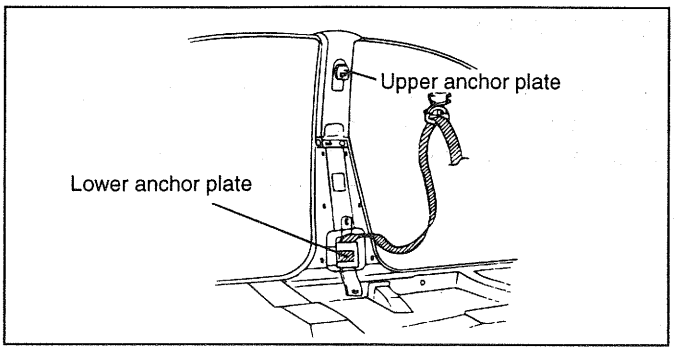
3. Remove the center pillar lower trim after removing seat belt lower anchor bolt.



ESHA040I

4. Remove the upper anchor plate cover and upper anchor plate.

5. Remove the lower anchor plate and front seat belt.



HEW6015A

CAUTION

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.**

Suspension System

GENERAL

SPECIFICATIONS EHHA1000

Front suspension system	Macpherson stabilizer bar

Coil spring free height and identification color

Model	Free height mm (in.)	I.D. color
2.0 GL MT (S/R) AT 7 9 GLS MT (S/R) AT 6 (S/R) 7 9	340.6(13.4)	White - Yellow
2.0 GL AT 9 (S/R) GLS AT 7 (S/R) 9 (S/R) 2.7 GL AT (S/R) GLS AT (S/R)	353.1(13.9)	White - Red

- o GL, GLS : Trim level
- o M/T : With manual T/M
- o A/T : With automatic T/M
- o S/R : With sun roof

Shock absorber	Gas pressurized type	
Type	173 (6.8)	
Stroke mm (in)		
Damping force at 0.3 m/s	1510 ± 260 (151 ± 26)	
Expansion N(kg)	380 ± 70 (38 ± 7)	
Compression N(kg)		
Wheel and Tire		
Wheel type	Steel	Aluminum
Wheel size	6J x 15	6J x 15
Tire size	215 / 65 R 15	215 / 65 R 15
Tire inflation pressure kPa (psi)	206 (30)	206 (30)

EHHA100A

Rear suspension system	Semi trailing arm type
Coil spring free height and Identification color	
Free height mm (in.)	345.7 (13.6)
Identification color	Blue
Shock absorber	
Type	Gas pressurized type
Stroke mm (in.)	119.5 (4.7)
Damping force at 0.3 m/s	
Expension N (kg)	1230 ± 220 (123 ± 22)
Compression N (kg)	330 ± 60 (33 ± 6)

EHHA100B

SERVICE STANDARD

EHHA1100

Standard value			
Toe-in	Front	0± 3 mm (Standard diameter of tire : ø660mm)	
	Rear	3± 3 mm (Standard diameter of tire : ø660mm)	
Camber	Front	0° ± 30′ (Max. difference between LH and RH : 0°30′)	
	Rear	-0° ± 30′ (Max. difference between LH and RH : 0°30′)	
Caster	Front	3°4′±30′(Max. difference between LH and RH : 0°30′)	
King pin angle	Front	3°4′	
Wheel runout		[Steel wheel]	[Aluminum wheel]
Radial	mm (in.)	0.6 (0.024) : Average of LH & RH	0.3 (0.012)
Axial	mm (in.)	1.0 (0.039)	0.3 (0.012)

TIGHTENING TORQUE

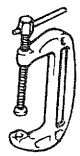
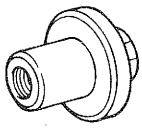
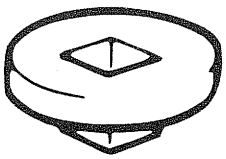
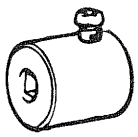
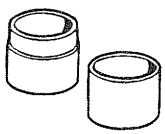
EHHA1200

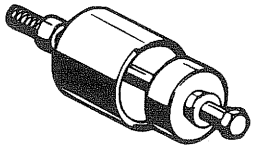
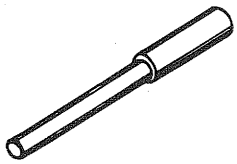
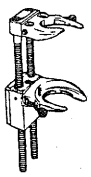
	Nm	Kg·cm	lb·ft
Wheel nut	90-110	900-110	67-81
Lower arm ball joint self-locking nut	90-120	900-1100	74-88
Lower arm bushing (A) to sub-frame mounting bolt	100-120	1000-1200	74-88
Lower arm bushing (G) to sub-frame mounting bolt	100-120	1000-1200	74-88
Front strut lower mounting nut	110-130	1100-1300	81-96
Front strut upper mounting nut	40-50	400-500	30-37
Front strut self-locking nut	60-70	600-700	44-52
Stabilizer link mounting self-locking nut	100-120	1000-1200	74-88
Stabilizer bar bracket to sub-frame bolt	44-55	450-550	33-41
Rear shock absorber complete upper mounting nut	90-110	900-1100	66-81
Rear shock absorber complete lower mounting bolt	90-110	900-1100	66-81
Rear stabilizer bracket mounting	40-50	400-500	30-37

Rear suspension arm to crossmember bolt	140-160	1400-1600	103-118
Rear suspension arm to cam bolt	140-160	1400-1600	103-118
Crossmember to body mounting bolt	140-160	1400-1600	103-118
Crossmember stopper to body mounting bolt	40-50	400-500	30-37
Rubber bumper mounting bolt	18-25	180-250	13-18
Brake tube flare nut	13-17	130-170	10-13
Tie rod end castle nut	24-34	240-340	18-25
Tie rod end lock nut	50-55	500-550	37-41

SPECIAL TOOLS

EHHA1400

Tool(Number and Name)	Illustration	Use
09493-43000 Universal joint remover and installer	 E9343000	Installation of rear crossmember bushing
09529-21000 Wheel alignment gauge attachment	 F2921000	Measurement of the wheel alignment
09532-11600 Preload socket	 F3211600	Measurement of the stabilizer bar link ball joint starting torque (use with torque wrench)
09532-3A000 Preload socket	 F323A000	Measurement of the front lower arm ball joint starting torque (use with torque wrench)
09545-11000 Ball joint remover installer	 F4511000	Installation of the front lower arm ball joint and dust cover (use with 09545-21100)

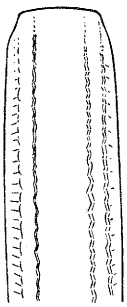
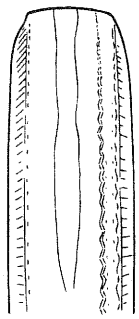
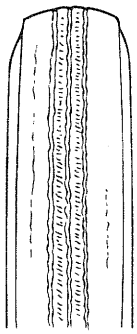
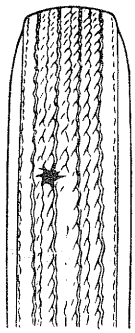
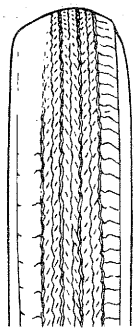
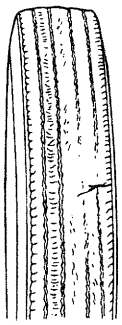
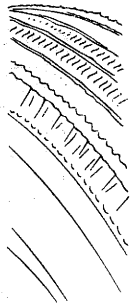
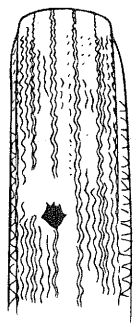
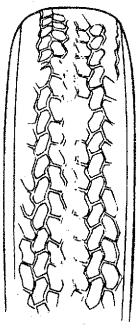
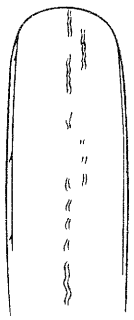
Tool(Number and Name)	Illustration	Use
09545-21100 Ball joint dust cover installer	 F4521100	Installation of the front lower arm ball joint and dust cover (use with 09545-11000
09552-3A000 Lower arm bushing remover and installer	 G2434000	Removal and installation of rear arm bushing(G)
09554-M3000 Lower arm bushing arbor	 F54M3000	Removal and installation of rear crossmember bushing
A-40 Strut compressor adapter	 EHHA140I	Compression of the coil spring (use with J38402)
J38402 Strut spring compressor	 J38402	Compression of the coil spring (use with A-40)

TROUBLESHOOTING

EHHA1500

Trouble symptom	Probable cause	Remedy
Hard steering	Improper front wheel alignment	Correct
	Excessive turning resistance of lower arm ball joint	Replace
	Flat tire	Adjust
	No power assist	Repair or replace
Poor return of steering wheel to center	Improper front wheel alignment	Correct

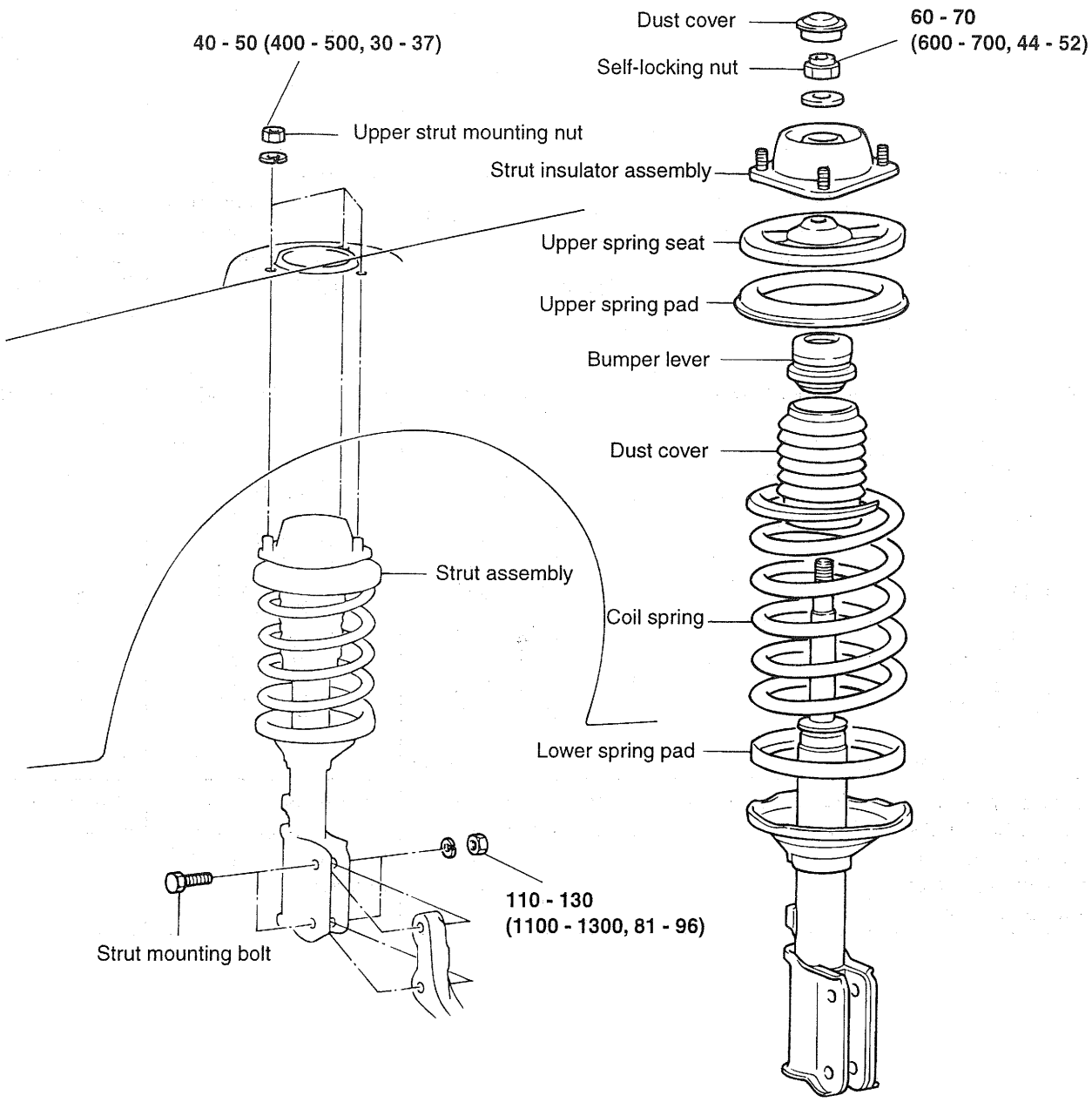
Trouble symptom	Probable cause	Remedy
Poor riding	Improper front wheel alignment	Correct
	Malfunction of shock absorber	Repair or replace
	Broken or worn stabilizer	Replace
	Broken or worn coil spring	Replace
	Worn lower arm bushing	Replace
	Improper tire inflation pressure	Replace
Abnormal tire wear	Improper front wheel alignment	Correct
	Malfunction of shock absorber	Replace
Wandering	Improper front wheel alignment	Correct
	Poor turning resistance of lower arm ball joint	Repair
	Loose or worn lower arm bushing	Retighten or replace
Vehicle pulls to one side	Improper front wheel alignment	Correct
	Excessive turning resistance of lower arm ball joint	Replace
	Broken or worn coil spring	Replace
	Bent lower arm	Repair
Steering wheel shimmy	Improper front wheel alignment	Correct
	Excessive turning resistance of lower arm ball joint	Replace
	Broken or worn stabilizer	Replace
	Worn lower arm bushing	Replace
	Malfunction of shock absorber	Replace
	Broken or worn coil spring	Replace
Bottoming	Broken or worn spring	Replace
	Malfunction of shock absorber	Replace
Abnormal sound	Loose installation parts	Retighten
	Damaged or worn wheel bearings	Replace
	Faulty shock absorber	Replace damaged parts
	Defective tire	Replace
Poor ride control	Excessive tire pressure	Adjust pressure
	Faulty shock absorber	Replace
	Loose wheel nuts	Tighten to specified torque
	Sagging or broken coil spring	Replace
Vehicle body tilts to one side	Defective tire	Replace
	Worn bushing	Replace
	Deformation of driveshaft and arm assembly	Replace
	Sagging or broken coil spring	Replace

WHEEL AND TYPE DIAGNOSIS				
CENTER OF TREAD WORN		BOTH SIDES OF TREAD WORN	CHUNKING OF TIRE	ONE SIDE OF TIRE WORN
 EHA9150A	 EHA9150B	 EHA9150C	 EHA9150D	 EHA9150E
*Over-Inflation	*Center-tread down to fabric due to excessive over-Inflation	*Under-Inflation *Bulge at the shoulder *Wear rapidly	*When a patch of tread has loosened, it is torn off the tire by centrifugal force at high speed	*Incorrect camber angle *Inferionity of comber and Toe-in *Frequent sharp curve
FLAT SPOT	FEATHERING	BAD PLUGGING	UNEVEN TIRE WEAR	TOTALLY UNSAFE TIRE
 EHA9150F	 EHA9150G	 EHA9150H	 EHA9150I	 EHA9150J
*Caused by heavy braking which makes the wheels lock and scrubs the 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, and steering gear or bearing	*Tread worn below the limit

FRONT SUSPENSION SYSTEM

STRUT ASSEMBLY

COMPONENTS EHHA2000



TORQUE : Nm (kg·cm, lb·ft)

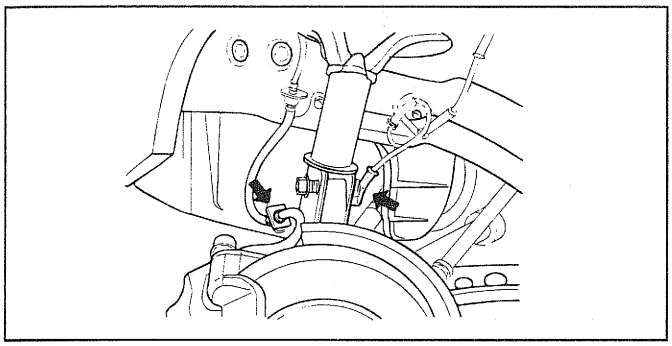
S5SS011A

REMOVAL EHHA2010

1. Remove the wheel and tire.
2. Detach the brake hose clip from the strut assembly mounting bracket.
3. Detach the wheel speed sensor harness from the front axle knuckle.

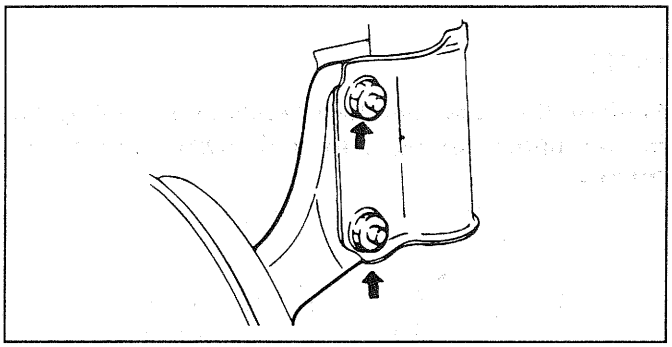
CAUTION

Be careful not to damage the wheel speed sensor.



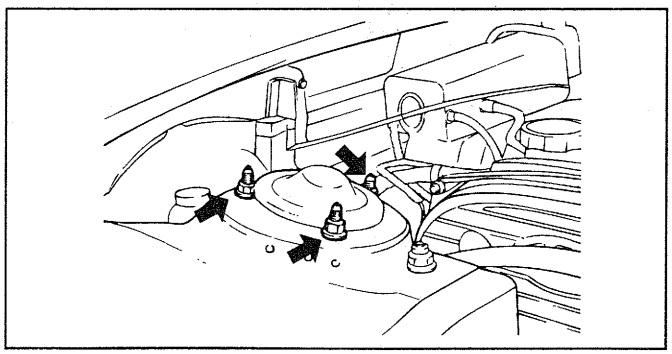
EHHA001A

4. Remove the knuckle from the strut assembly.



S5SS012B

5. Remove the upper mounting 3 nuts of the strut.



EHA9201D

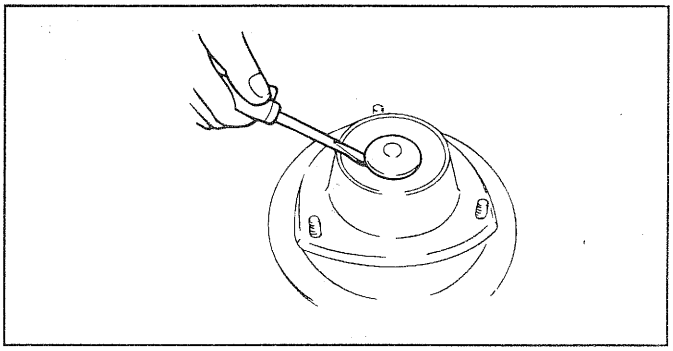
6. Remove the strut assembly.

INSTALLATION EHHA2020

1. Installation is the reverse of removal.

DISASSEMBLY EHHA2030

1. Remove the dust cover with a flat-tip screw driver.

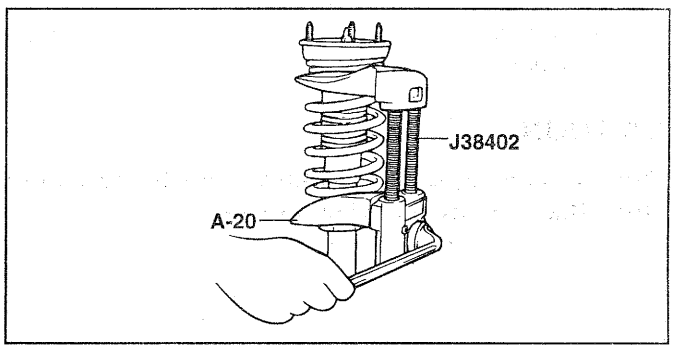


S5SS013A

2. Using the special tool, compress the coil spring until there is only a little tension on the strut.

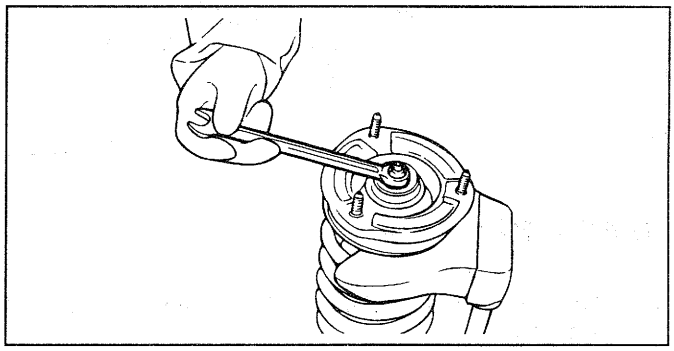
NOTE

Do not use an impact gun.



EHHA203A

3. Remove the self-locking nut.



EHA9203B

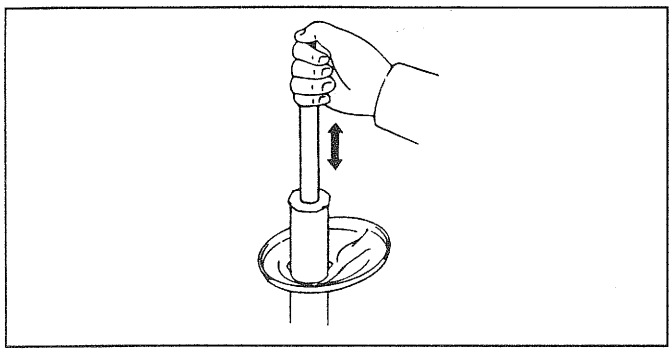
4. Remove the washer, strut insulator assembly, upper spring seat, upper spring pad, bumper rubber, dust cover, coil spring and lower spring pad.

INSPECTION EHHA2040

1. Check whether the rubber components for wear or damage.
2. Check the spring for deformation or damage.

3. Hold the shock absorber and push. Then pull it up and down for more than three times. Check for strange noise and irregular elasticity.

4. Check the shock absorber for damage or leakage.



EHHA002A

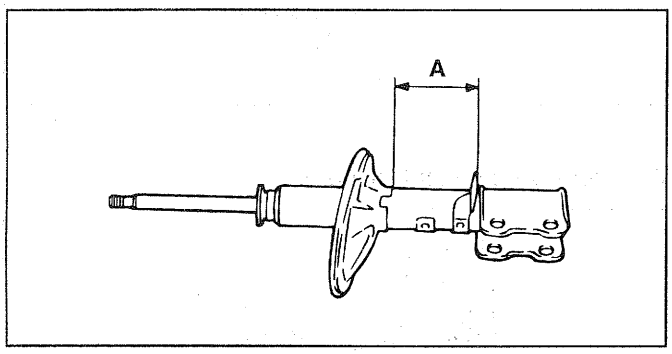
DISPOSAL EHHA2050

1. Fully extend the shock absorber rod.

2. Drill a hole on the A dimension to remove gas from the cylinder.

CAUTION

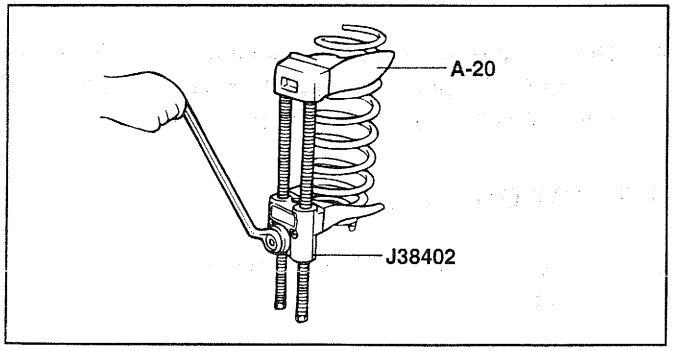
The gas coming out is harmless, but be careful of chips that may fly out when drilling.



EHHA003A

REASSEMBLY EHHA2060

1. Using a special tool, compress the coil spring perfectly.



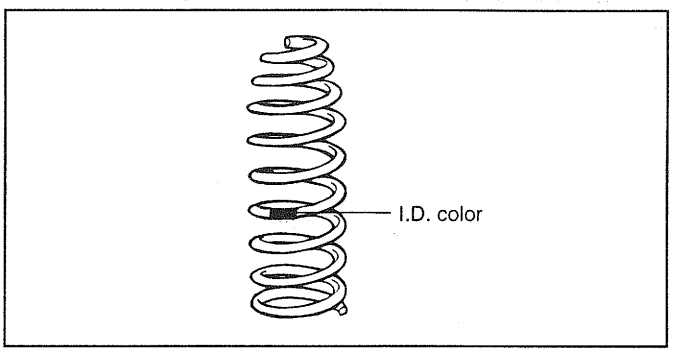
EHHA206B

NOTE

1. **Do not use an impact gun.**
2. **Coil spring installation chart to load classification.**

LH spring		RH spring
Blue	⟷	Blue
White	⟷	White
Red	⟷	Red

EHHA206A

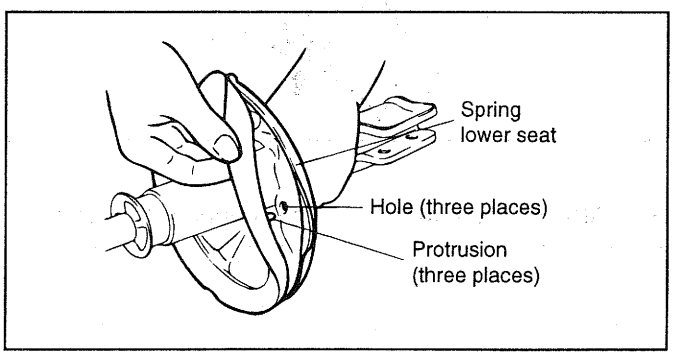


EHA9206B

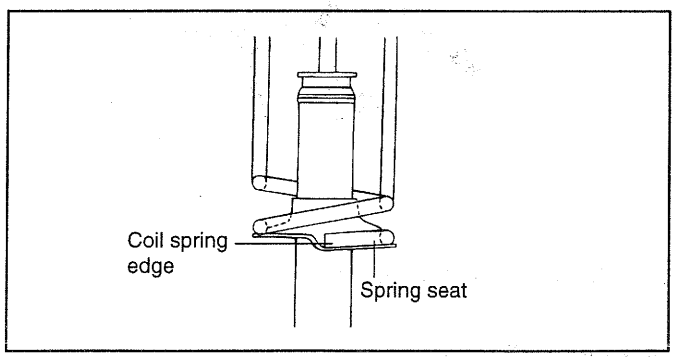
2. Install the lower spring pad so that the protrusions may fit in the holes of the spring lower seat.

NOTE

Position the upper and lower ends of the coil spring in the upper spring pad and lower spring seat groove.



EHDA204A

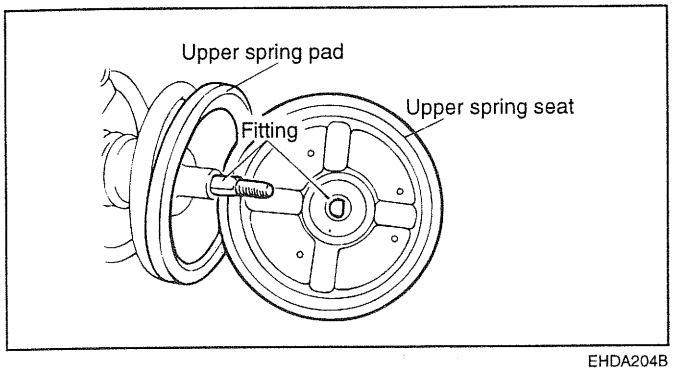


EHDA204C

3. Install the upper spring seat to the piston rod.

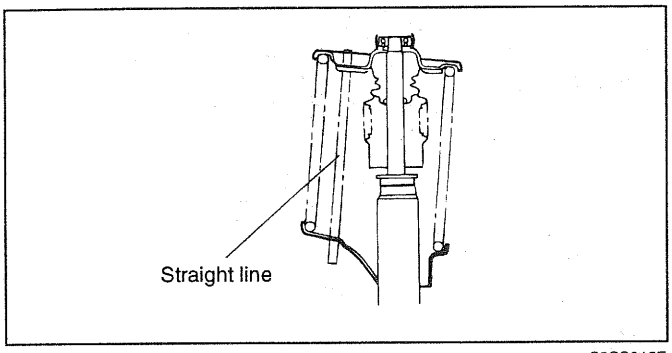
NOTE

Align the D-shaped hole in the upper spring seat assembly with the indentation on the piston rod.



EHDA204B

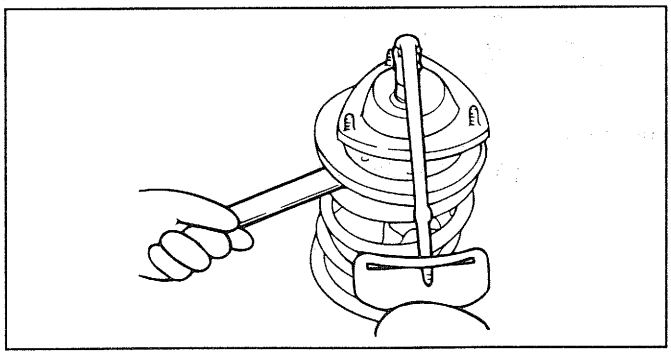
4. Place the bracket to align the holes on the upper spring seat and lower spring seat in a straight line.



S5SS015E

5. Tighten the new self-locking nut lightly.
6. Loosen the special tool.
7. While holding the piston rod, tighten the new self-locking nut to the specified torque.

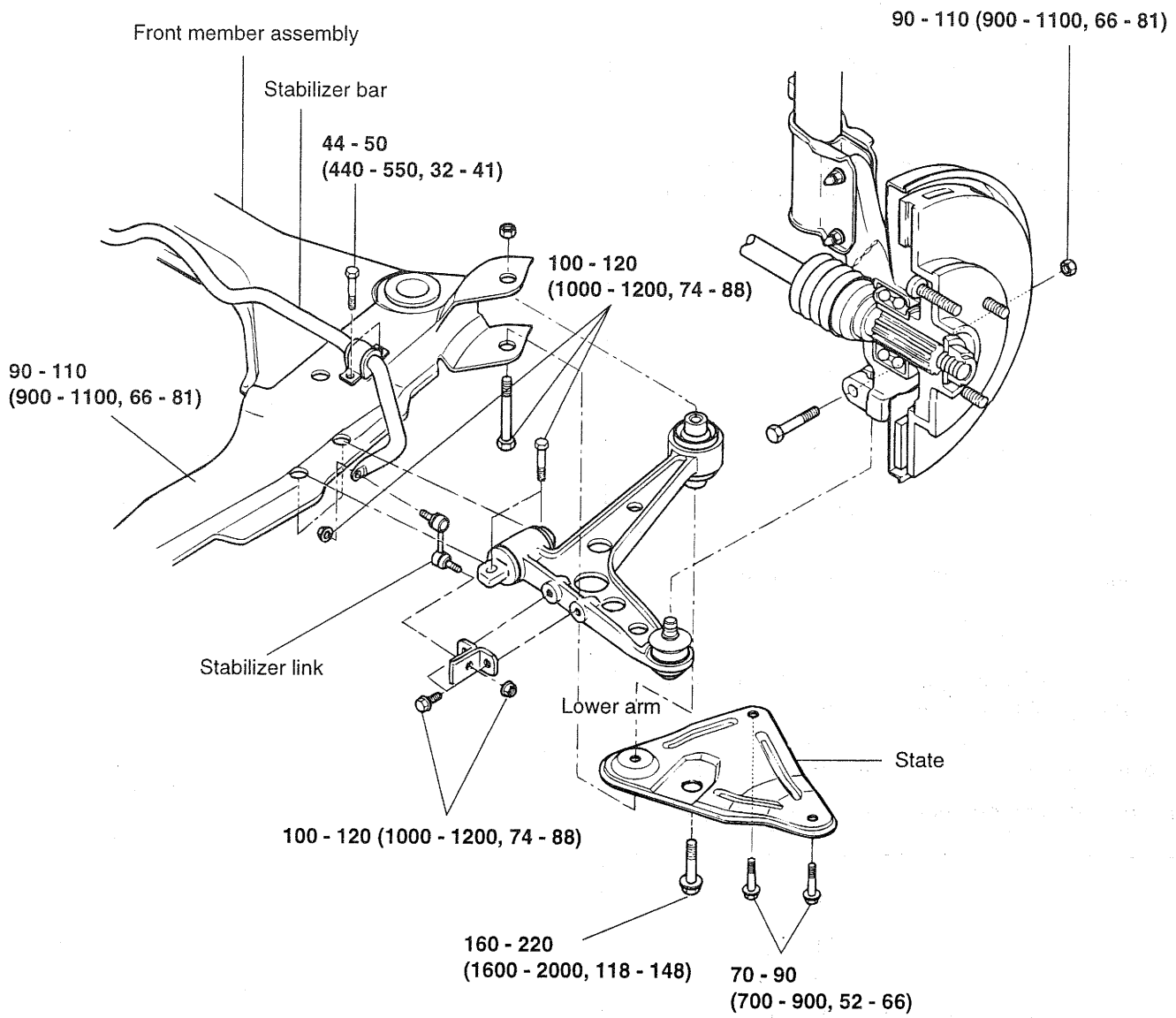
Tightening torque	Nm (kg·cm, lb·ft)
Piston rod to bracket nut	60-70 (600-700, 44-52)



S5SS015F

LOWER ARM

COMPONENTS EHHA2500



TORQUE : Nm (kg·cm, lb·ft)

EHHA004A

REMOVAL EHHA2510

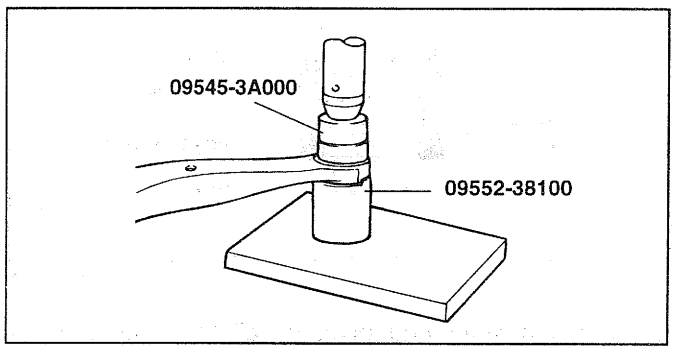
1. Remove the wheel.
2. Loosen the knuckle to the lower arm ball joint mounting bolt.
3. Remove the stabilizer link from the lower arm.
4. Remove the sub frame and 3 mounting bolts of lower arm.
5. Raising the stabilizer, remove the lower arm assembly.

INSTALLATION EHHA2520

1. Installation is the reverse of removal.

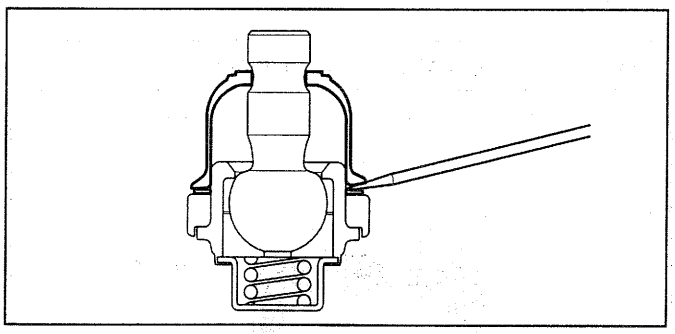
DISASSEMBLY EHHA2530

1. Using the special tool, remove the lower arm bushing (G).



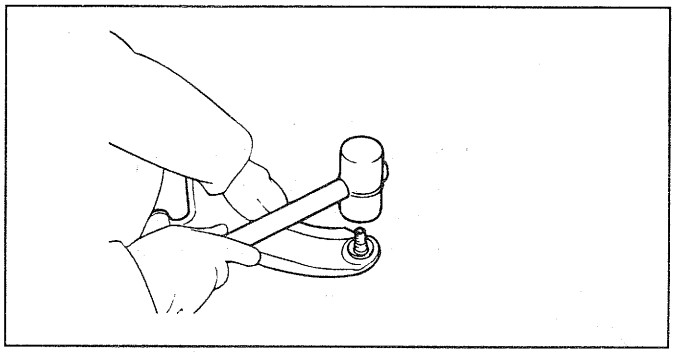
EHHA253B

2. Using a screwdriver, remove the dust cover from the lower arm ball joint.



KGX6028A

3. Remove the snap ring.
4. Using a plastic hammer, disconnect the ball joint from the lower arm assembly.



EHDA253A

INSPECTION EHHA2540

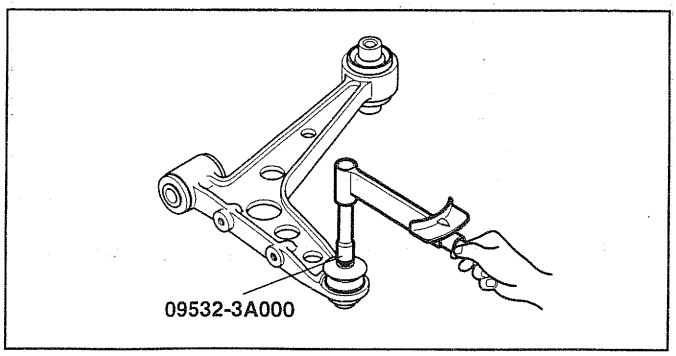
1. Check the bushing for wear and deterioration.
2. Check the lower arm for bend and damage.
3. Check the ball joint dust cover for cracks.
4. Check the lower arm connecting bolt.
5. Check lower arm ball joint for rotating starting torque.
   a. If there is a crack on the dust cover, replace the ball joint dust cover.
   b. Shake the ball joint stud several times.
   c. Measure the ball joint rotation starting torque.

Standard value :
1.5 - 3.5 Nm [15 - 35kg·cm, 1.1 - 2.6 lb·ft]

NOTE

Measure at the range of 0.5–2rpm after vibrating 3° at room temperature after approx.24 hours from assembly.

   d. When the starting torque is above standard value, replace the ball joint.
   e. When the starting torque is less than standard value, the ball joint may be used again if there is no ball joint rubbing or excessive gap.



KGX6027A

6. Check the stabilizer bar link ball joint for rotation starting torque.

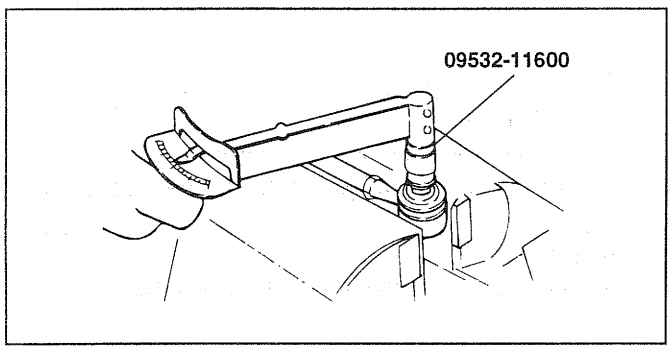
   a. If there is a crack on the dust cover, replace the ball joint dust cover and apply grease.
   b. Shake stabilizer link ball joint several times.
   c. Install the self locking nut on the ball joint and measure the ball joint turning motion torque.

Standard value :
0.7 - 2 Nm [7 - 20kg·cm, 0.52 - 1.5 lb·ft]

NOTE

Measure at the range of 0.5–2rpm after vibrating 3° and turning 30° at room temperature after approx.24 hours from assembly.

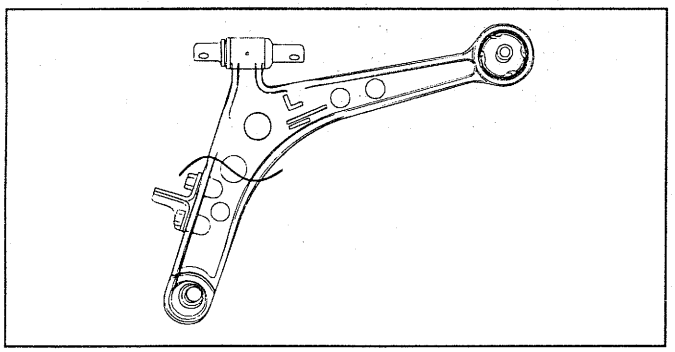
   d. When the starting torque is above standard value, replace stabilizer link.
   e. Even if the rotation starting torque is less than the standard value, the ball joint may be used again if there is ball joint abnormal wear or excessive gap.



S5SS021A

REASSEMBLY EHHA2550

1. Position the lower arm bushing (G) at an angle indicated in the illustration.

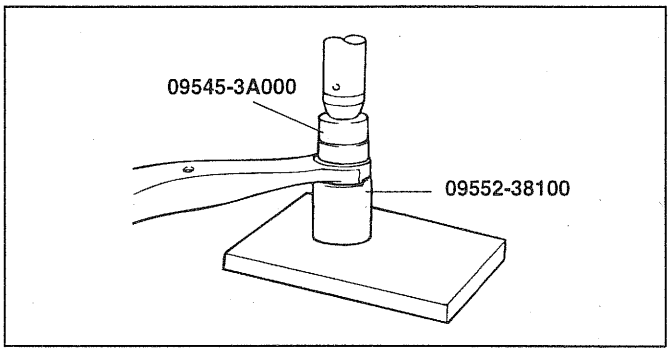


EHHA006A

2. Using the special tool, press-fit the lower arm bushing (G).

NOTE

The standard pull out force for the bushing : more than 100 N [1000 kg(f), 2205 lb(f)].

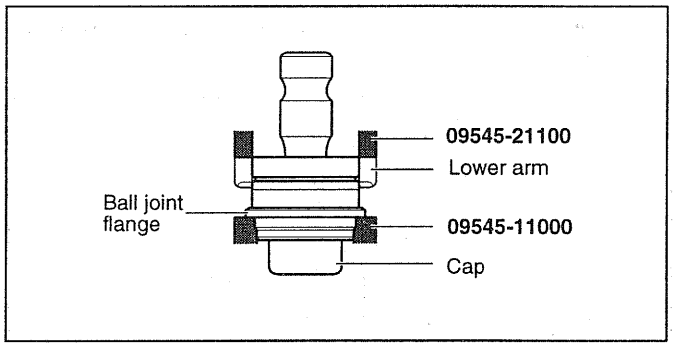


EHHA253B

3. Supporting the ball joint flange, press down the lower arm until the flange is placed on the lower arm surface.

NOTE

Do not press the ball joint cap.

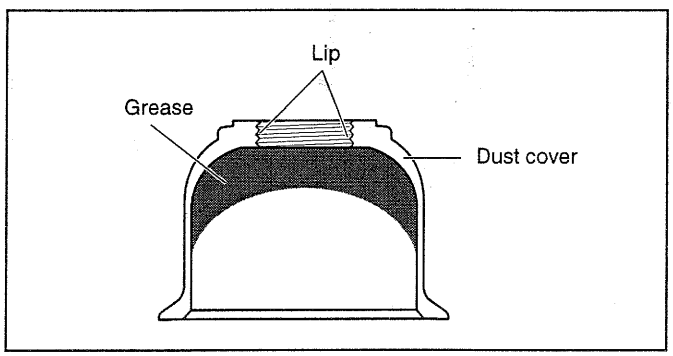


KGX6030A

4. Using a snap ring plier, install the snap ring by keeping the amount of the snap ring expansion as small as possible.

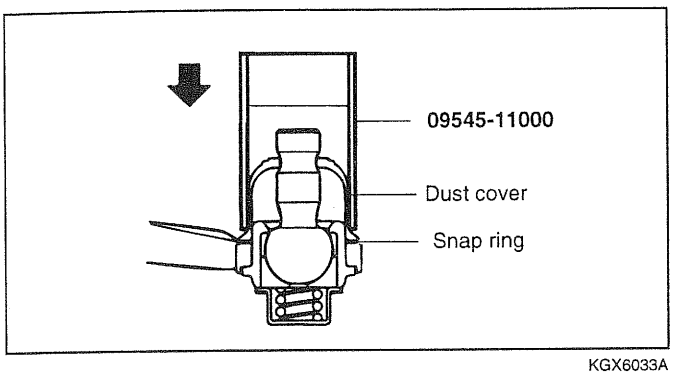
5. Apply multi-purpose grease at the dust cover lip and inside.

Grease : Sunlight MB-2 or equivalent



KGX6032A

6. Compress the dust cover until it is placed on the snap ring using the special tool.

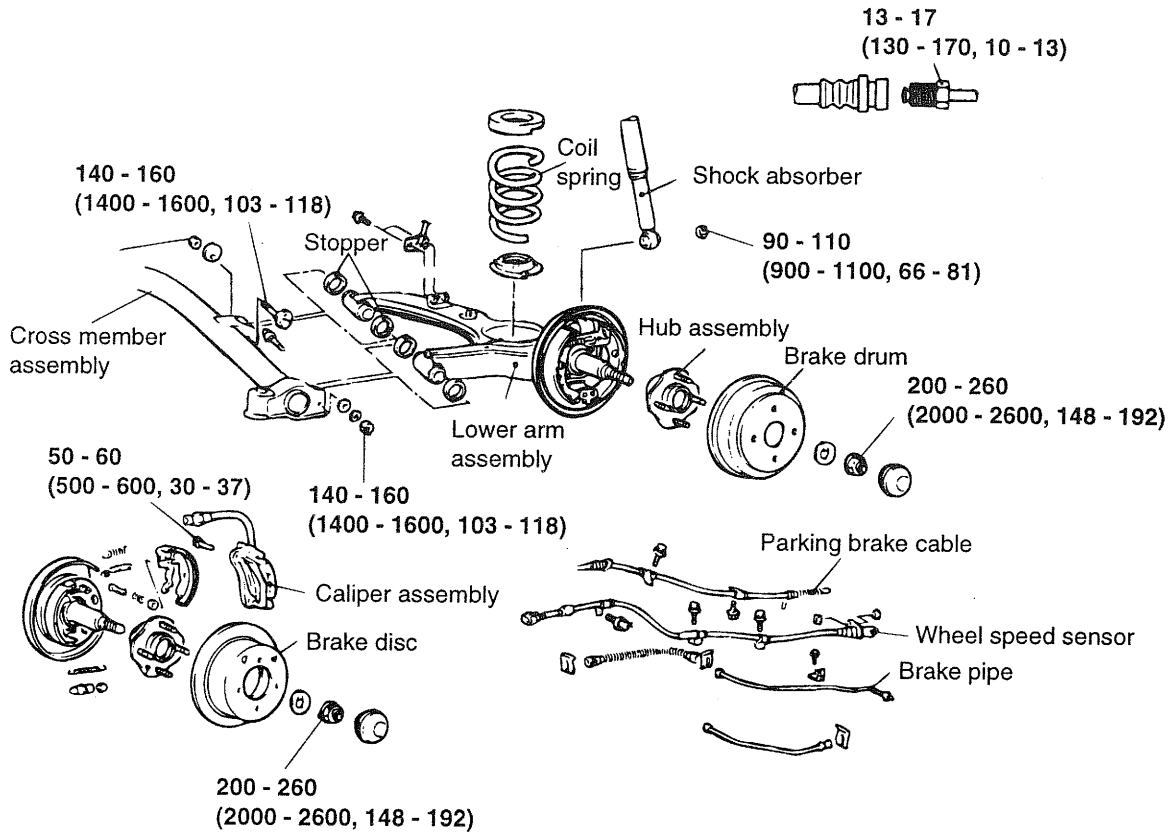


KGX6033A

REAR SUSPENSION SYSTEM

REAR SUSPENSION ARM

COMPONENTS EHHA5000

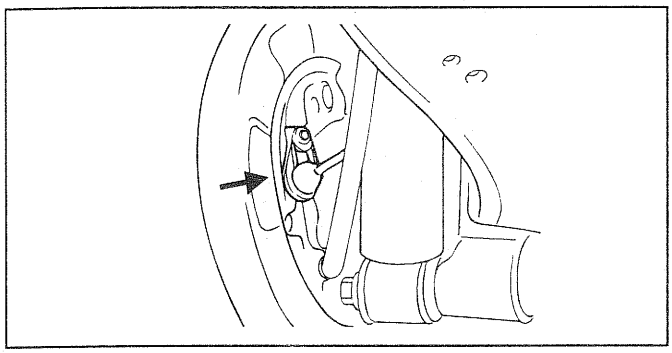


TORQUE : Nm (kg·cm, lb·ft)

EHHA007A

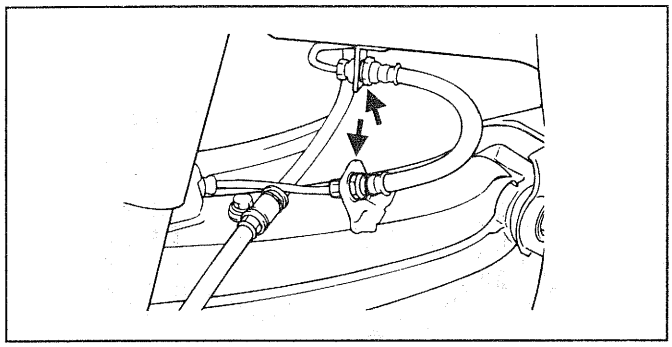
REMOVAL EHHA5010

1. Remove the wheel and tire.
2. Remove the wheel speed sensor harness.



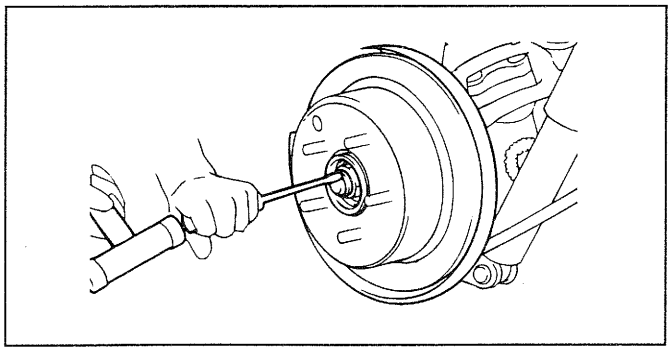
EHHA008A

3. After removing the bleeder screw, drain brake oil.
4. After removing the clip, remove the brake hose and caliper.



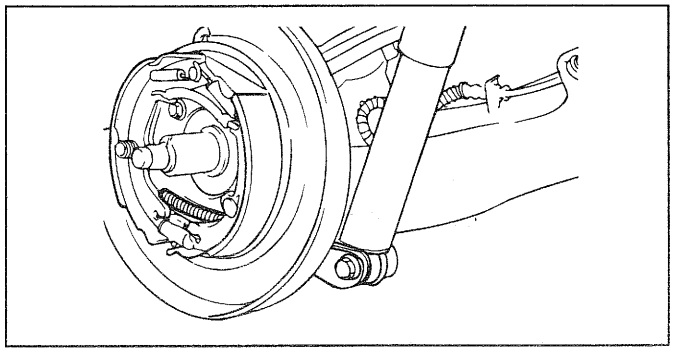
EHHA009A

5. Remove the rear axle hub cap and stretch the caulking part in grooves of the lock nut with a chisel and then remove the lock nut.



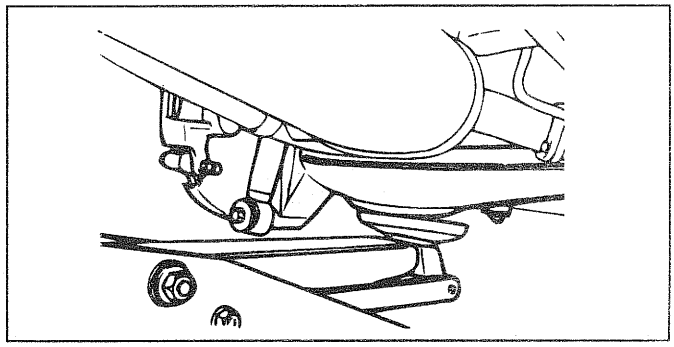
EHHA010A

6. Remove the brake disc and axle hub.
7. After removing the pin, disconnect the parking brake cable.
8. Remove brake assembly.



EHHA011A

9. Remove the stabilizer bar.
10. Support the lower arm not to sag and remove the shock absorber.



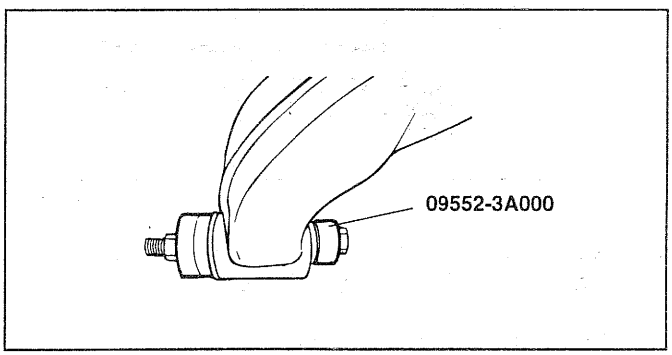
EHHA012A

11. Remove the rear suspension arm.
12. Remove the cross member.

UPPER ARM, LOWER ARM, AND ASSIST LINK EHHA5020

REAR LOWER ARM BUSHING REPLACEMENT

1. Using the special tool, remove the bushing.

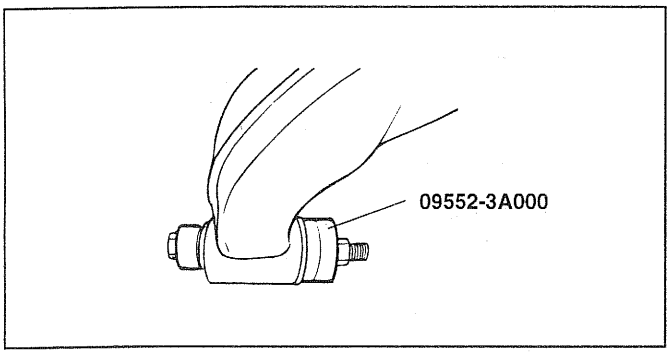


EHHA019A

2. Using the special tool, press fit the bushing.

NOTE

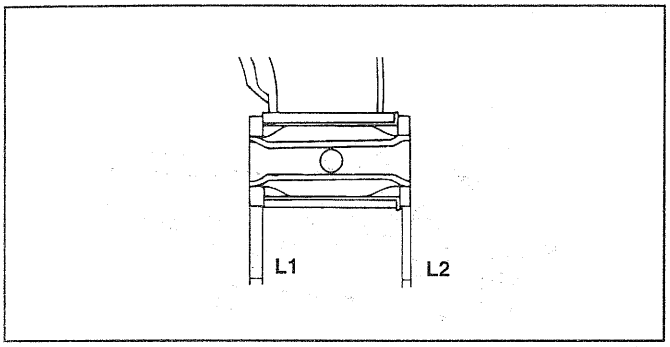
The standard pull out force for the bushing : More than 100 N(f) [1000 kg(f), 22.5 lb(f)].



EHHA020A

3. After press-fitting the bushing, the specified value should be satisfied as below:

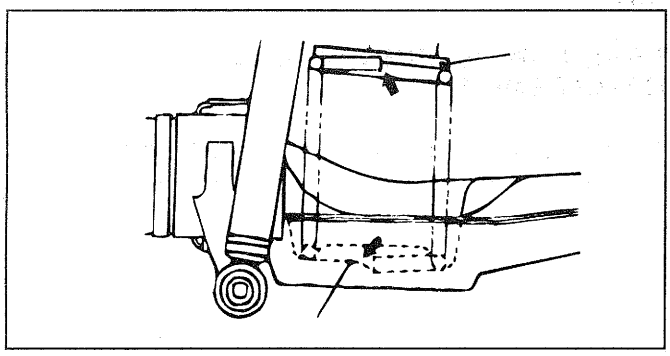
   L1 — L2 = 1mm or less



EHHA021A

INSTALLATION EHHA5030

1. To install, reverse the removal operation process.
2. Install to align the upper and lower end of the spring with grooves of the spring seat.

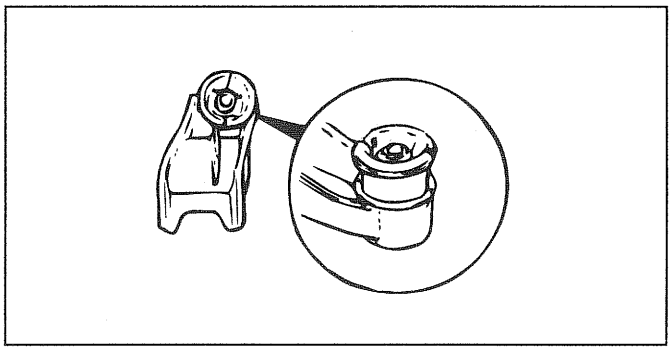


EHHA013A

3. After installing, replenish with brake fluid, and bleed the system. (Refer to the "Brake")
4. Check the wheel alignment.

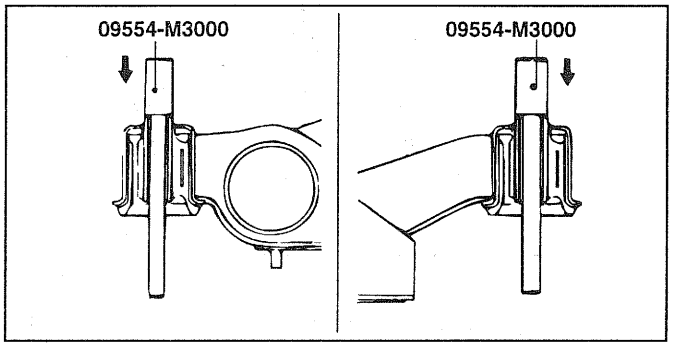
SUSPENSION CROSSMEMBER BUSHING REPLACEMENT

1. Make a mark on the crossmember bracket to match the slits on the old bushing, and use these marks to position the new bushing.



EHHA014A

2. Insert a flat-tipped screwdriver between the old bushing and the crossmember bracket and lever around the bushing to break the seal.
3. Use the special tool, tap out the bushing from the crossmember bracket.



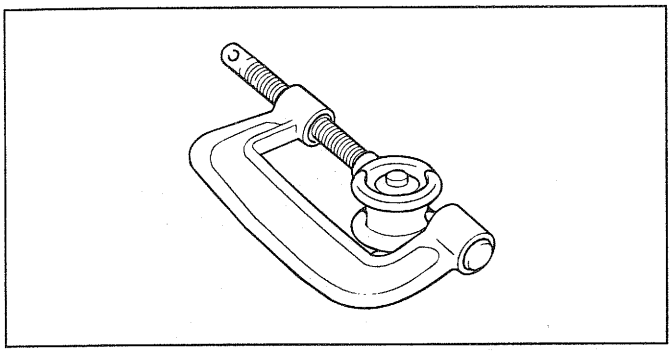
EHHA015A

REAR CROSS MEMBER

REASSEMBLY EHHA7100

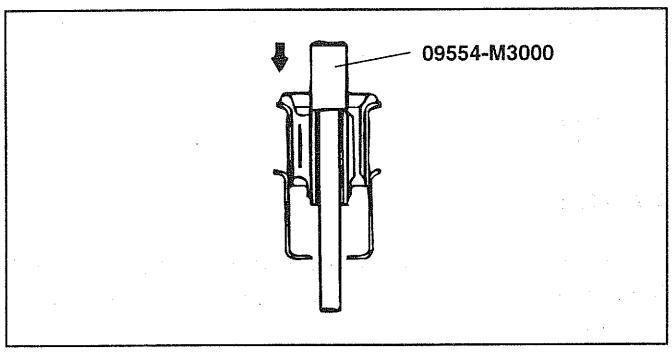
1. Align the slits on the new bushing with the mating marks on the crossmember bracket.

2. Use the special tool to reduce the size of the rear end of the bushing.



EHHA016A

3. Use the special tool to press-fit the bushing until the outside case of the bushing is fitted securely in the crossmember flange.



EHHA017A

TIRES/WHEELS

TIRE

FRONT WHEEL ALIGNMENT EHHA8500

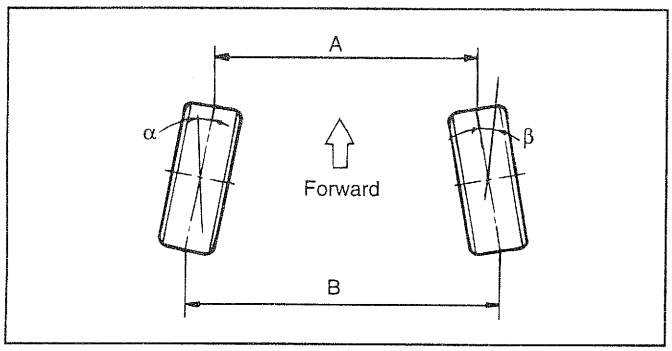
When using a wheel alignment tester to inspect the front wheel alignment, always position the car on a levelled surface with the front wheels facing straight ahead. Prior to inspection, make sure that the front suspension and steering system are in normal operating conditions and that the wheels and tires are free of deflection and tires are inflated to specification.

TOE-IN

Toe-in (B-A or angle a+b) 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 rear of the car. Toe change is achieved by turning the tie for the right and left wheels simultaneously the same amount as follows:

Toe-in (B-A) mm (in.) [Standard value] :

0±3 mm (0±0.12 in.)



EHHA850A

SIDE SLIP AND WHEEL STEERING ANGLE ADJUSTMENT

1. Side slip shall be adjusted within 0±3mm/m loading one person, by rotation the tie rod.
2. Steering angle shall be adjusted by turning the right and left tie rods each toward the opposite direction for the same amount.

Outer wheel steering angle : 32°73′±2

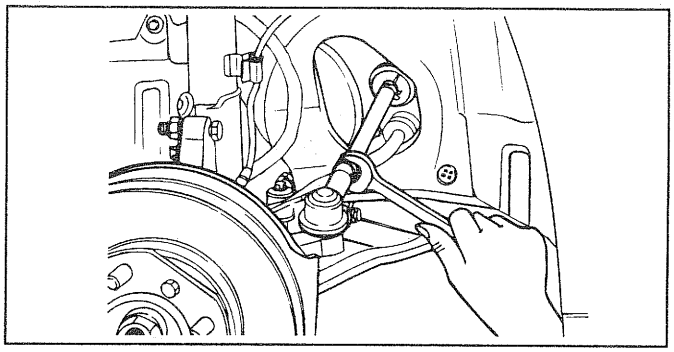
Inner wheel steering angle (difference between right and left should be within 2°) : 37°41′±2°

Inner wheel steering angle variation per tie rod revolution : 0.65°

NOTE

- **Remove the clip before rotating the tie rod and do not to twist the bellows.**
- **Check the bellows for twists after setting the steering angle and reassemble it correctly.**

Tie rod end lock nut tightening torque :
50-55 Nm [500-550kg·cm, 37-41 lb·ft]



EHHA850B

CAMBER

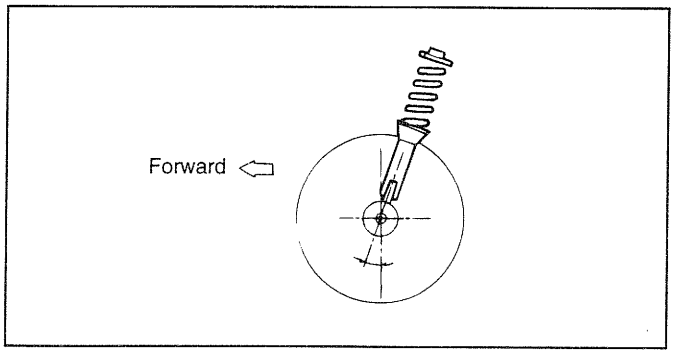
The steering knuckle which is integral with the strut assembly is preadjusted to the specified camber at the factory and requires no adjustment.

Camber : 0°±30′

CASTER

Caster is pre-set at the factory and can not be adjusted. If caster is not within standard value, replace the bent or damaged parts.

Caster : 3°4′±30′

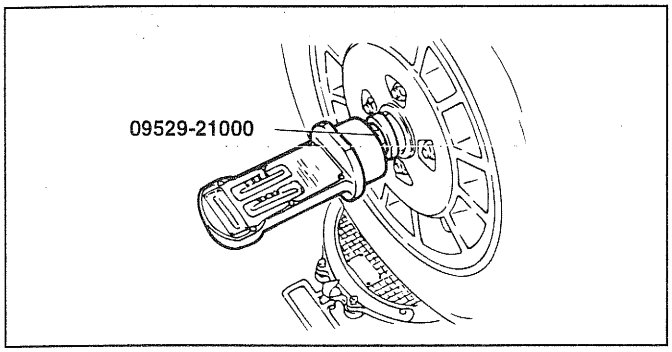


EHHA850C

NOTE

1. **The front suspension assembly must be free of being worn out, loose or damaged parts prior 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.**
4. **If camber and caster are not within specifications, replace bent or damaged parts.**



EHHA850D

REAR WHEEL ALIGNMENT

TOE-IN

Standard value mm (in.) : 3±3(0.12±0.12)

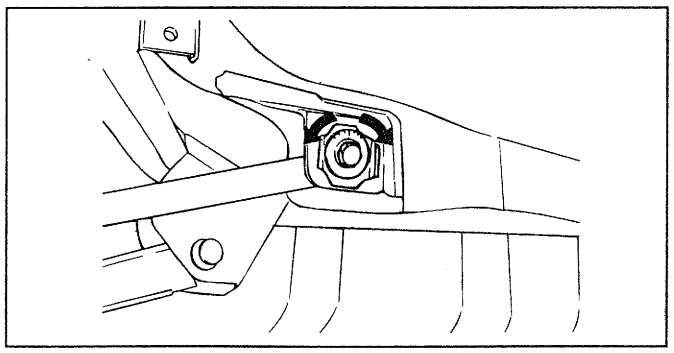
NOTE

The assist arm mounting bolt (crossmember side) should be turned an equal amount at both sides when adjusting.

Inside direction of the vehicle : toe-in

Outside direction of the vehicle : toe-out

The scale has gradations of approximately 3.6 mm (0.14 in.)
(single side toe angle equivalent to 37′)



EHA9851A

CAMBER

Standard value : -0°30′±30′

NOTE

1. **The rear suspension assembly must be free of being worn out, loose or damaged parts prior to measuring rear wheel alignment.**
2. **Camber is pre-set at the factory and cannot be adjusted.**
3. **If camber is not within the specifications, replace bent or damaged parts.**

TIRE WEAR

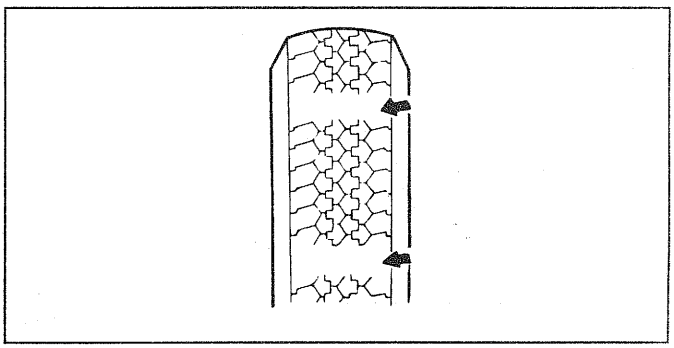
1. Measure the tread depth of the tires.

Tread depth of tire [Limit] : 1.6 mm (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 reduced to 1.6 mm (0.06 in.) or less, the wear indicators will appear.



EHA9850E

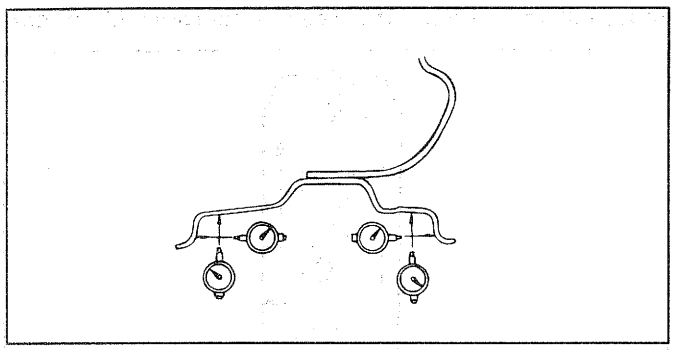
WHEEL

WHEEL RUNOUT EHHA9000

1. Jack the vehicle up and support it with jack stands.
2. Measure wheel runout with a dial indicator as illustrated.
3. Replace the wheel, if wheel runout exceeds the limit.

Wheel run-out [Limit]

Steel wheel : Rdial - 0.6mm (0.024 in)
Axial - 1.0mm (0.039 in)
Aluminum wheel : Radial - 0.3mm (0.012 in)
Axial - 0.3mm (0.012 in)



EHHA900A

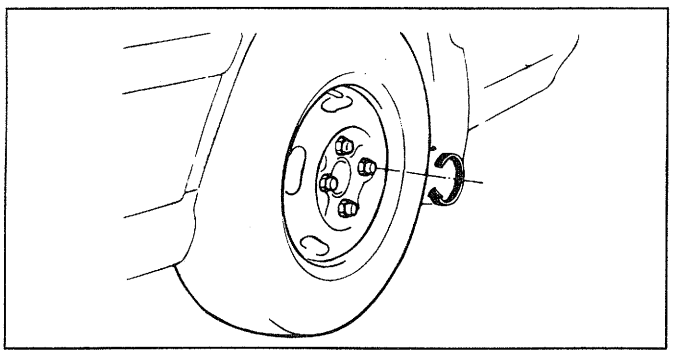
WHEEL NUT TIGHTENING

1. Tightening torque

Aluminum wheel :
90-110 Nm [900-1100kg·cm, 66-81 lb·ft]

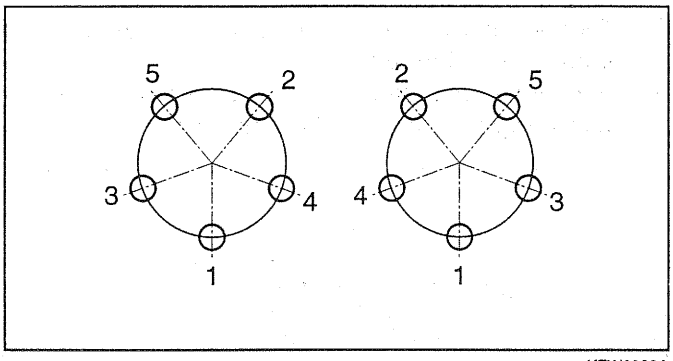
NOTE

When using an impact gun, ensure to use the correct tightening torque.



Y54-010A

2. Tighten up all wheel nuts in the order illustrated.



KFW6020A

Steering System

GENERAL

EPHA0010

SPECIFICATIONS

Shaft and joint type	Collapsible, crossjoint with tilt column
Steering gear type	Rack and pinion
Rack stroke	150 ± 1 mm
Oil pump type	Vane type
Displacement	9.6 cm^3/rev.

SERVICE STANDARD

Steering wheel free play	0-30 mm (0-1.1 in.)
Steering angle	
Inner wheel	37.34°
Outer wheel	32.73°
Tie rod end ball joint starting torque	0.5-2.5 Nm (5-25 kg·cm, 0.36-1.78 lb·ft)
Steering effort	3.5 kgf Max.
Drive belt tension	75 ± 10kg (New one)
	50 ± 5kg (Used one)
Oil pump max. pressure	94-99 kgf/cm^2

TIGHTENING TORQUE

EPHA0050

Item	Nm	kg·cm	lb·ft
Steering column and shaft			
Airbag module mounting bolt	15-20	150-200	10.8-14.5
Steering column to column member mounting (upper)	13-18	130-180	9.4-13.0
Steering column to column member mounting (lower)	13-18	130-180	9.4-13.0
Steering column member to cowl panel	9-14	90-140	6.5-10.1
Steering wheel lock nut	40-50	400-500	28.9-36.1
Joint assembly	15-20	150-200	10.8-14.5
Steering gear box			
Pressure hose to gear box	12-18	120-180	8.7-13.0
Return tube to gear box	12-18	120-180	8.7-13.0
Tie rod to rack	80-100	800-1000	57.8-72.3
Tie rod end lock nut	50-55	500-550	36.1-39.8
Rack support plug lock nut	50-70	500-700	36.1-50.6
Pinion and valve assembly to self locking nut	50-70	500-700	36.1-50.6
End plug	50-70	500-700	36.1-50.6

Item	Nm	kg·cm	lb·ft
Feed tubes	10-16	100-160	7.2-11.6
Tie rod end to knuckle	24-34	240-340	17.3-24.6
Mounting bracket to crossmember	60-80	600-800	43.4-57.8
Oil pump			
Pressure hose to oil pump	55-69	550-690	39.8-50
Oil pump mounting bolt	35-50	350-500	25.3-36.1
Oil pump pressure switch	17-23	170-230	12.3-16.6
Oil pump bracket mounting bolt	35-50	350-500	25.3-36.1
Pump cover to pump body	33-43	330-430	23.8-31.1
Suction connector to oil pump body	13.6-18.4	136-184	9.8-13.3
Flow control valve connector to pump body	70-80	700-800	50.6-57.8
Steering hoses and oil reservoir			
Oil reservoir bracket mounting bolt	4-6	40-60	2.9-4.3
Cooler tube clamp mounting bolt	4-6	40-60	2.9-4.3
Tube clip and tube bracket	4-6	40-60	2.9-4.3
Pressure hose bracket mounting bolt	4-6	40-60	2.9-4.3
Clamp hose	4-6	40-60	2.9-4.3

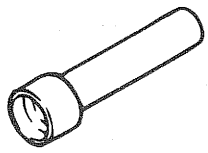
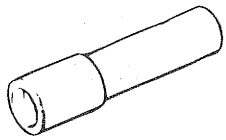
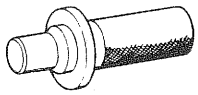
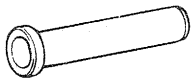
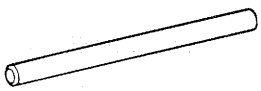
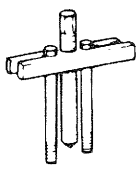
LUBRICANTS

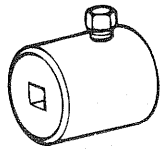
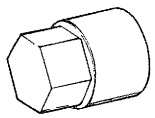
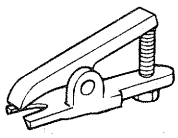
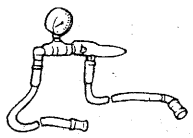
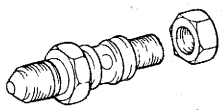
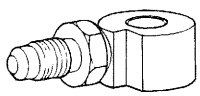
EPHA0150

Items	Specified lubricant	Quantity
Steering column bearing	Multipurpose grease SAE J310a, NLGI No.2	As required
Steering gear box rack, pinion gear part	Multipurpose grease SAE J310a, NLGI No.2	As required
Bellows	Silicone grease	As required
Oil pump	Power steering fluid (PSF-3)	As required
Power steering fluid	Power steering fluid (PSF-3)	1.0 lit (0.88 qts.)

SPECIAL TOOLS

EPHA0200

Tool (Number and Name)	Illustration	Use
09222-21100 Valve stem oil seal installer	 HCT56-01	Installation of the pinion gear bearing
09222-32100 Valve stem oil seal installer	 HCT56-02	Installation of the oil pump oil seal
09431 - 11000 Front oil seal installer	 EPA9005C	Installation of the pinion gear oil seal
09432-21601 Bearing installer	 EPA9005D	Installation of the pinion gear bearing
09517-21400 Drift	 EPA9005E	1. Removal of pinion gear bearing 2. Removal of pinion bearing outer race
09561-11001 Steering wheel puller	 HCT56-07	Removal of the steering wheel

Tool (Number and Name)	Illustration	Use
09565-11100 Pre-load socket	 EPA9005G	Measurement of the main shaft pre-load
09565-21000 Pinion bearing remover and installer	 EPA9005H	Removal and installation of pinion gear bearing
09565-31300 Yoke plug torque wrench socket	 EPA9005I	Removal, installation and adjustment of steering gear yoke plug
09568-31000 Tie rod end puller	 EPA9005J	Separation of the tie rod end ball joint
09572-21000 Oil pressure gauge	 EPA9005K	Measurement of the oil pressure (use with 09572-33100, 09572-21200)
09572-21200 Oil pressure gauge adapter	 EPA9005L	Measurement of the oil pressure (use with 09572-21000, 09572-33100)
09572-33100 Oil pressure gauge adapter	 EPA9005M	Measurement of the oil pressure (use with 09572-21000, 09572-21200)

TROUBLESHOOTING

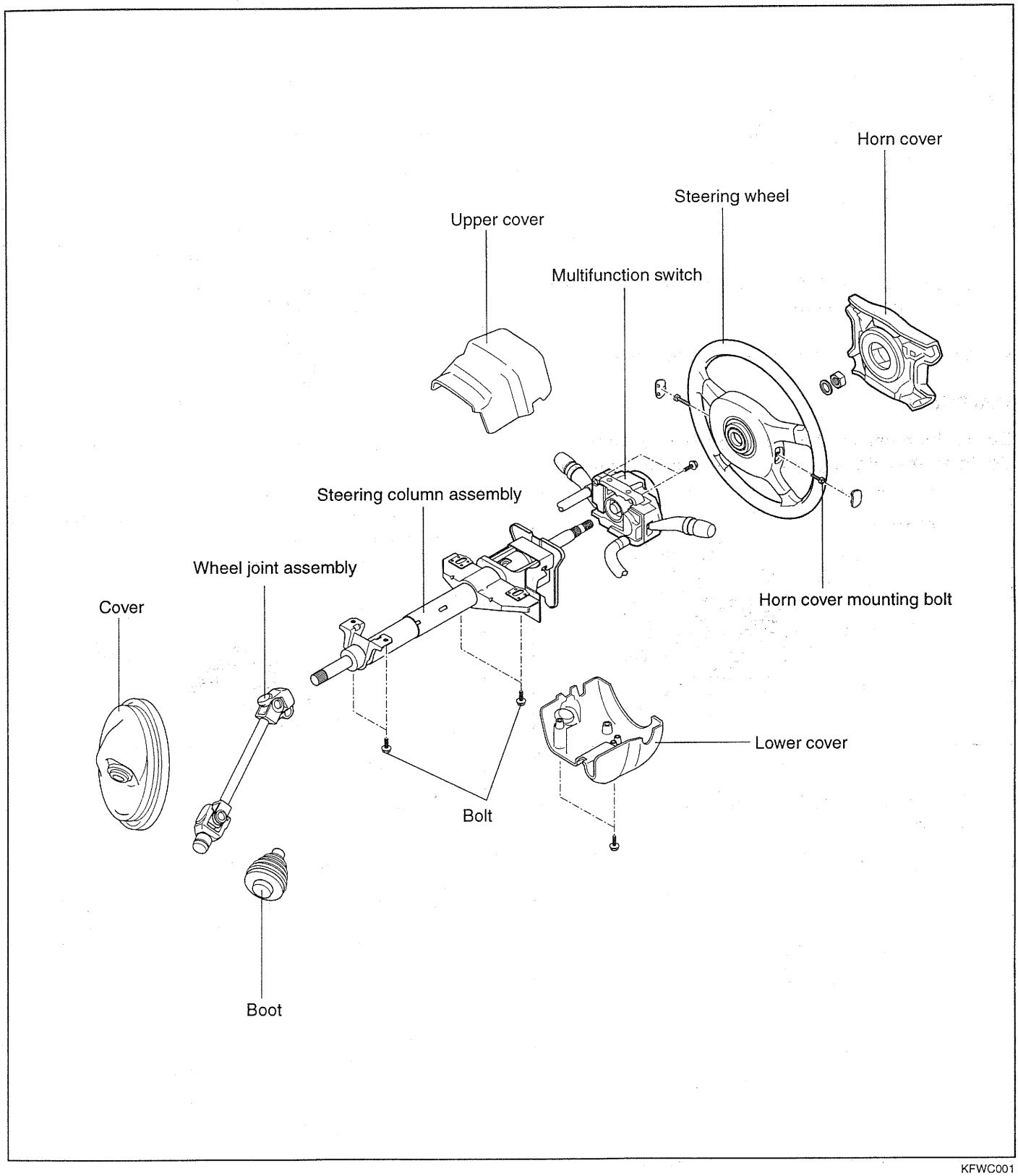
EPHA0250

Trouble symptom	Probable cause	Remedy
Excessive steering wheel free play	York plug loosened	Retighten
	Steering gear mounting bolts loosened	Retighten
	Stud of tie rod end is worned or loosened	Retighten or replace
Steering wheel operation is "hard"	Incorrect tire pressure	Adjust the tire pressure
	Loosed belt	Adjust the belt tension
	Damaged belt	Replace the belt
	Low fluid level	Refill fluid
	Air in fluid line	Bleed the system
	Fluid hose is twisted or damaged	Replace fluid hose
	Insufficient of oil pressure	Replace or repair oil pump
	Control vlave is sticked	Replace control valve
	Oil leakage in the oil pump	Replace the damaged part
	Deteriorated or damaged the gear box or valve	Replace the damaged part
Poor recovery of steering wheel	Tie rod ball joint rotational resistance is excessive	Replace
	Over tightened the york plug	Adjust
	Tie rod or ball joint is damaged	Replace
	Loosened the gear box mountings	Tighten
	Worned steering shaft or body grommet	Repair or replace
	Twisted rack	Replace
	Deteriorated pinion bearing	Replace
	Fluid hose is twisted or damaged	Replace
	Damaged oil pressure control valve	Replace
	Damaged oil pump input shaft bearing	Replace
Abnormal noise at the rack and pinion	Interference between body and fluid hose	Adjust
	Loosen gear box	Retighten
	Loosen the tie rod end ball joint	Retighten
	Worn the tie rod end ball joint	Replace
Abnormal noise at the oil pump	Insufficient power steering fluid	Add fluid
	Air in fluid line	Bleeding the air
	Loosen the oil pump mounting	Retighten

STEERING COLUMN & SHAFT

STEERING COLUMN/SHAFT

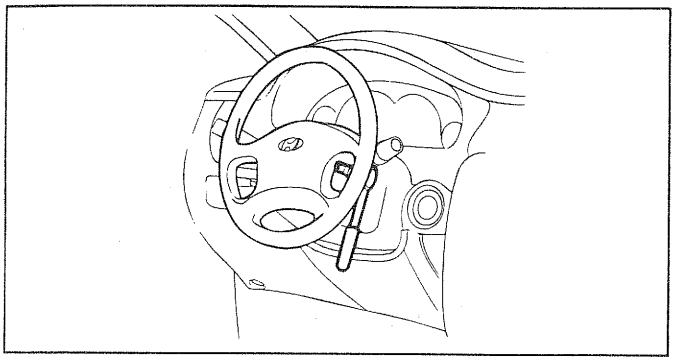
COMPONENTS EPHA0700



KFWC001

REMOVAL EPHA0750

1. Remove the cover in the steering wheel below.
2. Remove the bolt by using the hexagonal wrench.

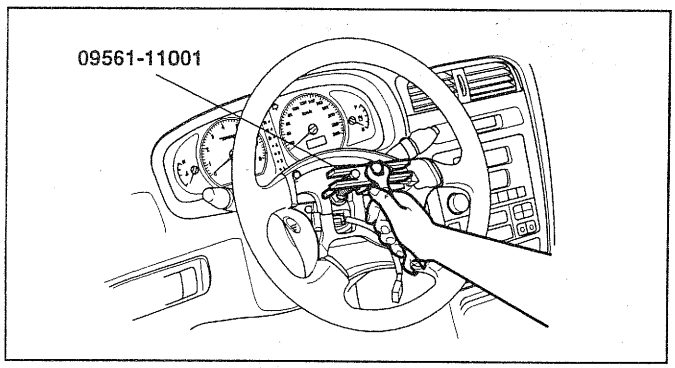


EPHA002A

3. Disconnect the DAB and horn connector, and remove the steering wheel nut.
4. Using the SST, remove the steering wheel.

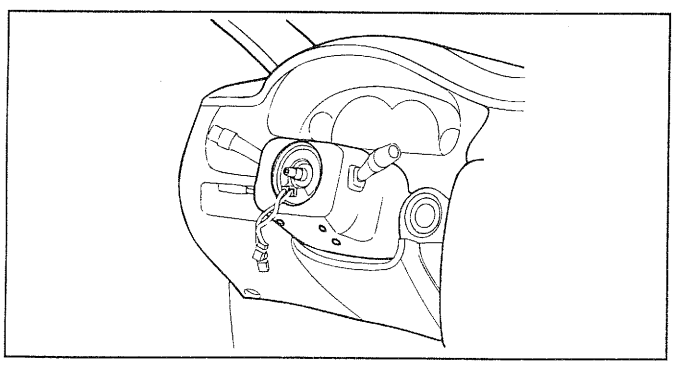
CAUTION

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



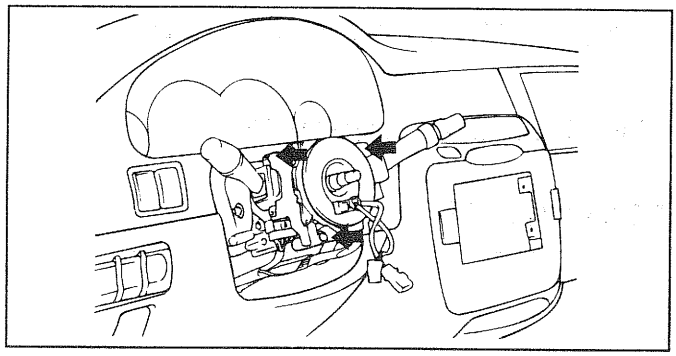
KFWC003A

5. Remove the steering column lower and upper shrouds.



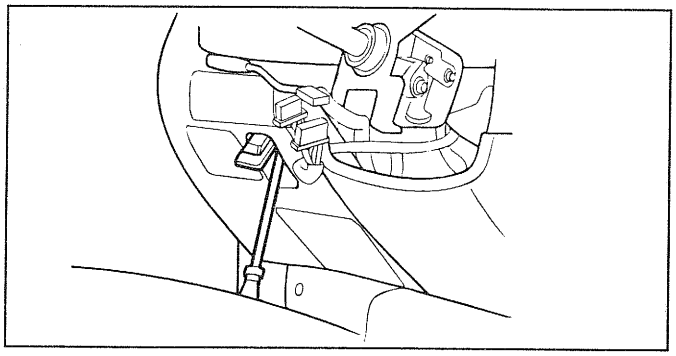
EPHA002B

6. Disconnect the connectors and remove the multi-function switch.



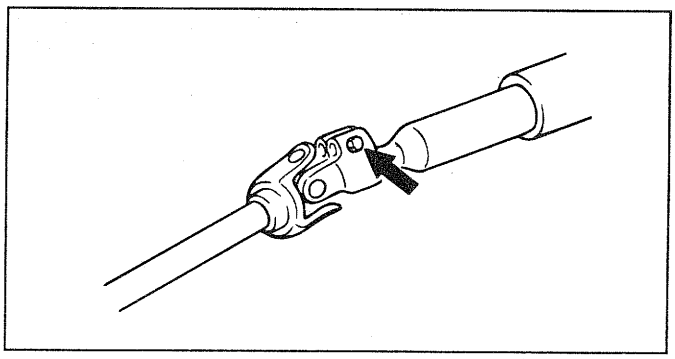
ESHA040P

7. Remove the lower cover.
8. Remove the hood release lever.



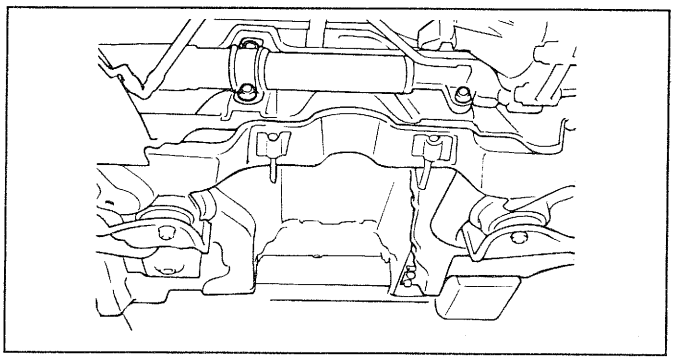
EPHA002C

9. Remove the bolts securing the coupling and universal joint. Pull out the coupling and universal joint from the gear box.



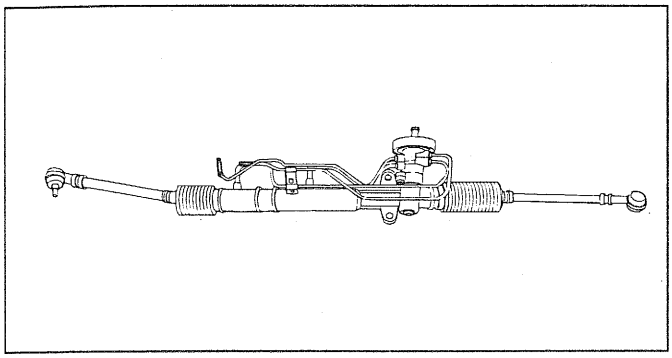
HEW56-10

10. Remove the dust cover mounting bolts.
11. Remove the steering column mounting 4 bolts.



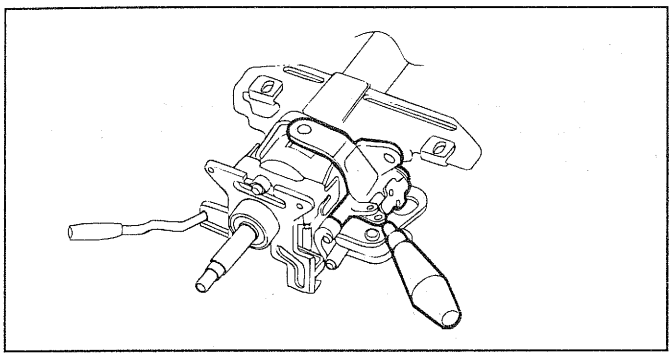
EPHA002D

12. Drain the power steering fluid and disconnect the return hose.



EPHA002F

13. Remove the lever sub in the A/T equipped vehicle.



EPHA002E

14. Remove the steering column and shaft together with the universal joint and dust cover.

INSPECTION EPHA0800

1. Check the steering shaft for damage or distortion.
2. Check the upper and lower bearing for worn out or damaged.
3. Check the joints for excessive play, damage or tightness.
4. Check the tilt bracket for cracks or damage.
5. Check the cover or boot for damage.
6. Check that the steering lock mechanism operates properly.

   If necessary, replace.

ASSEMBLY EPHA0850

1. Assembly is the reverse of disassembly.
2. When installing the steering lock, align the hook and shaft groove with the steering column.

INSTALLATION EPHA0900

1. Before installation, apply multipurpose grease to the groove on the inside of the bearing and mating surfaces of the boot and cover assembly.
2. Connect the steering lower shaft and joint assembly.

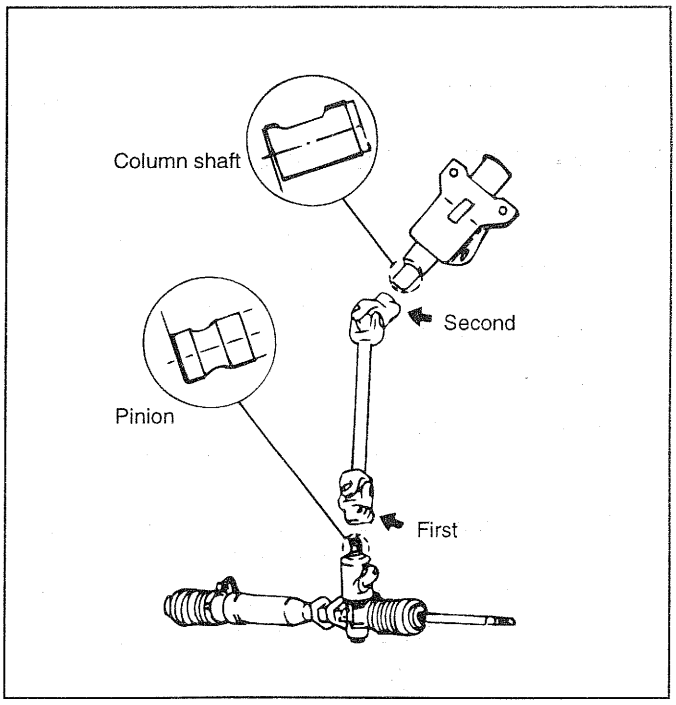
NOTE

When installing, secure the U-joint to the gear box first, then to the steering column shaft.

3. Install the dust cover with column shaft assembly.
4. Install the steering column assembly to the column member assembly.
5. Install the multifunction switch and connect the connectors.
6. Install the lower cover and upper and lower shroud.
7. Install the steering wheel.

NOTE

When installing, do not use a hammer as the collapsible column shaft could be damaged.



HCT56-39

POWER STEERING SYSTEM

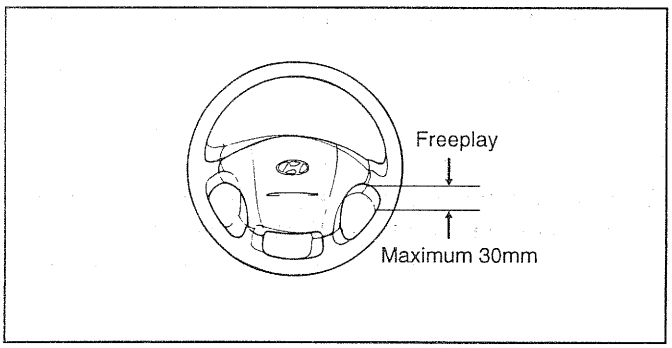
SERVICE ADJUSTMENT PROCEDURE EPHA0300

CHECKING STEERING WHEEL FREE PLAY

1. Start the engine with the steering wheel in the straight ahead position.
2. Measure the free play at the circumference of the steering wheel.

Steering wheel free play [Standard value] : 30 mm (1.1 in.)

3. If the play exceeds the standard value, inspect the contact of the steering shaft and steering linkage.



EPA9001A

CHECKING STEERING ANGLE

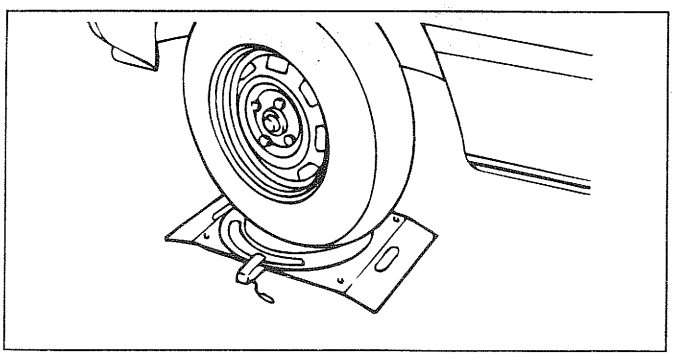
1. Place the front wheel on a turning radius gauge and measure the steering angle.

Wheel angle [Standard value]

Inside wheel : 37.34°

Outside wheel : 32.73°

2. If the measured value is not within the standard value, adjust the toe and reinspect.



EPA9002A

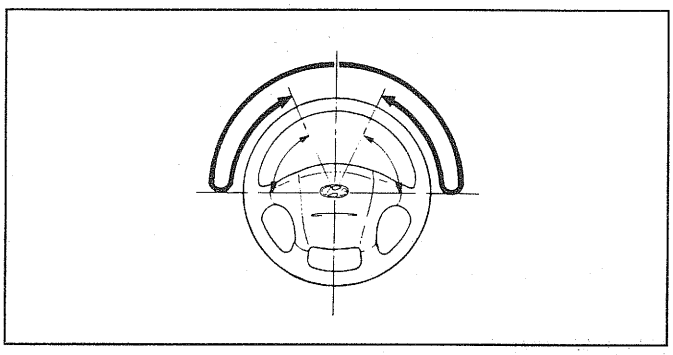
CHECKING STEERING WHEEL RETURN EPHA0350

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 moderate turns and sharp turns.
2. When the steering wheel is turned 90° and held for a couple of seconds while the vehicle is being driven at 0–80kph (0–50 mph), the steering wheel should return at least 20° from the neutral position when it is released and max vehicle speed is 35kph at that time.

NOTE

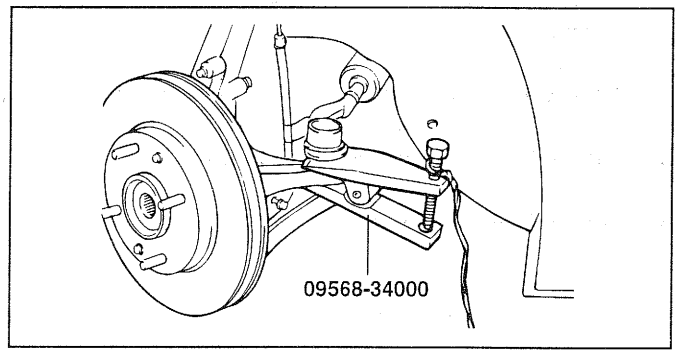
If the steering wheel is turned very quickly, the steering wheel operation may be momentarily difficult. This is not a malfunction.



EPHA035A

CHECKING TIE ROD END BALL JOINT STARTING TORQUE EPHA0400

1. Disconnect the tie rod and knuckle by using the SST.



EIA9401A

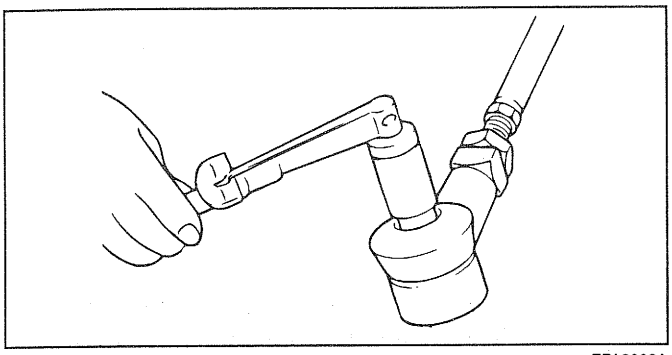
2. Shake the ball joint stud several times, mount the nuts on the ball joint, and then measure the ball joint starting torque.

Standard value :

0.5-2.5 Nm (5-25 kg·cm, 0.36-1.78 lb·ft)

3. If the starting torque exceeds the standard value, replace the tie rod end.

4. Even if the starting torque is below the lower limit of the standard value, the ball joint may be reused unless it has drag and excessive play.



EPA9003A

CHECKING POWER STEERING FLUID LEVEL EPHA0450

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 from 50-60°C (122-140°F).

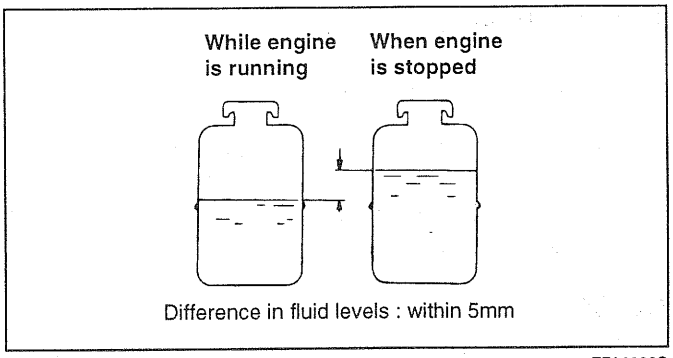
3. With the engine idle, turn the steering wheel fully clockwise and counterclockwise several times.

4. Make sure that there is no foaming or cloudiness in the reservoir fluid.

5. Stop the engine and check for any difference in fluid level between a stopped and a running engine.

NOTE

1. **If the fluid level varies 5 mm (0.2 in.) or more, bleed the system.**
2. **If the fluid level suddenly rises after stopping the engine, it shows that bleeding is not satisfactory.**
3. **Incomplete bleeding will produce a chattering sound decreasing durability of the pump, etc.**



EPA9003C

REPLACING POWER STEERING FLUID EPHA0500

1. Jack the front wheels up and support with rigid racks.

2. Disconnect the return hose from the oil reservoir and install a plug on 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 hoses securely, and then fill the oil reservoir with the specified fluid.

6. Start the engine and check for oil leakage.Then stop the engine.

   Then stop the engine.

7. Bleed the system.

   Power steering fluid (PSF-3) type

   Total quantity : Approx. 1.0 liter

AIR BLEEDING EPHA0550

1. Fill the oil in the reservoir.
2. Disconnect the high tension cable, and while operating the starting motor intermittently (for 15-20 seconds), turn the steering wheel all the way to the left and to the right five or six times.

NOTE

1. **During air bleeding, replenish the fluid supply so that the level never falls 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.**

3. Connect the high tension cable, and then start the engine (idling).
4. Turn the steering wheel to the left and then to the right until there are no air bubbles in the oil reservoir.

CAUTION

Do not hold the steering wheel turned all the way to either side for longer than ten seconds.

5. Confirm that the fluid is not milky, and that the level is up to the specified position on the level gauge.
6. Confirm that there is little change in the surface of the fluid when the steering wheel is turned left and right.

CAUTION

1. **If the surface of the fluid changes considerably, air bleeding should be done again.**
2. **If the fluid level rises suddenly when the engine is stopped, it indicates that there is still air in the system.**
3. **If there is air in the system, a jingling noise may be heard from the pump and the control valve may also produce unusual noises. Air in the system will shorten the useful life of the pump and other parts.**

CHECKING POWER STEERING BELT TENSION EPHA0600

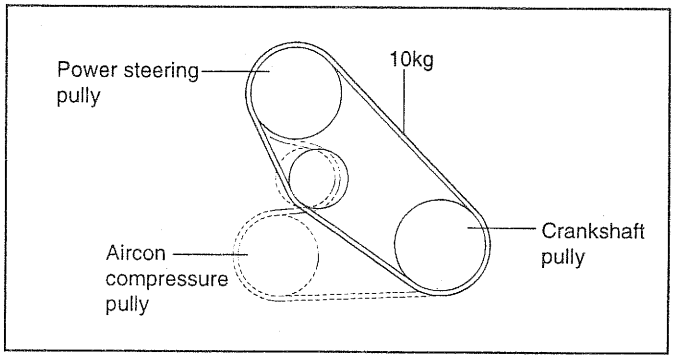
1. Press the belt applying a pressure of 98 N (10 kg, 22 lb) at the specified point, and measure the deflection to confirm that it is within the standard value range.

Belt deflection [Standard value]

Regular inspection : 11.7-15.3 mm(0.46-0.60 in.)

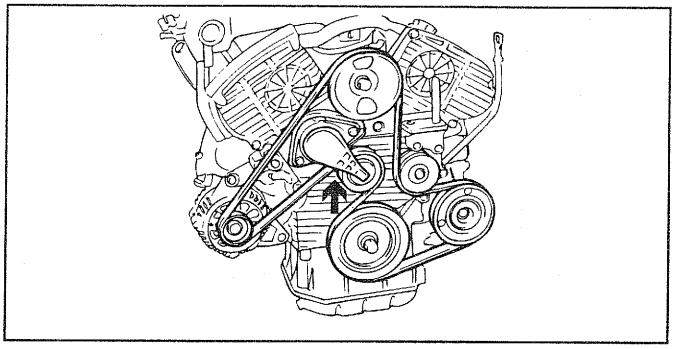
New belt : 8.8-11.0 mm(0.35-0.43 in.)

Used belt : 12.5-14.3mm (0.43-0.56 in.)



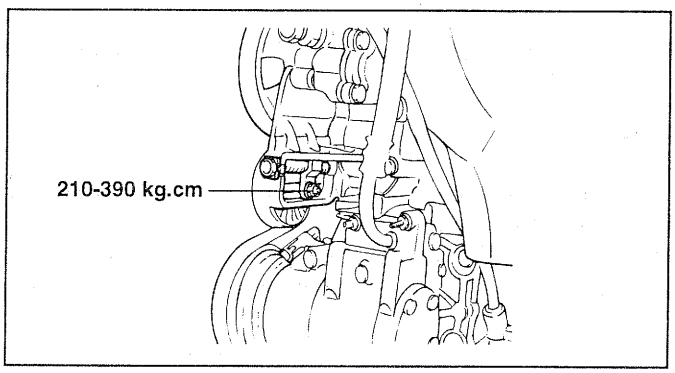
EPHA001A

2. To adjust the belt tension, the auto tensioner automatically adjusts to the standard value (Delta 2.7 Liter).



EPA9004A

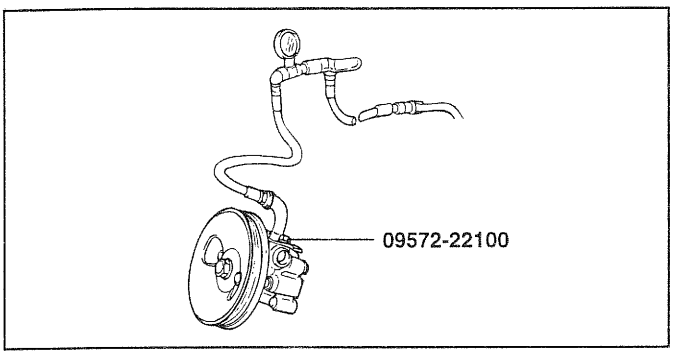
3. To adjust the belt tension, loosen the tensioner adjusting bolt, and then retighten the bolts (DOHC ENG.).



EPHA060A

OIL PUMP PRESSURE TEST EPHA0650

1. Disconnect the pressure hose from the oil pump, and then connect the special tool between the oil pump and pressure hose as illustrated.



EPHA065A

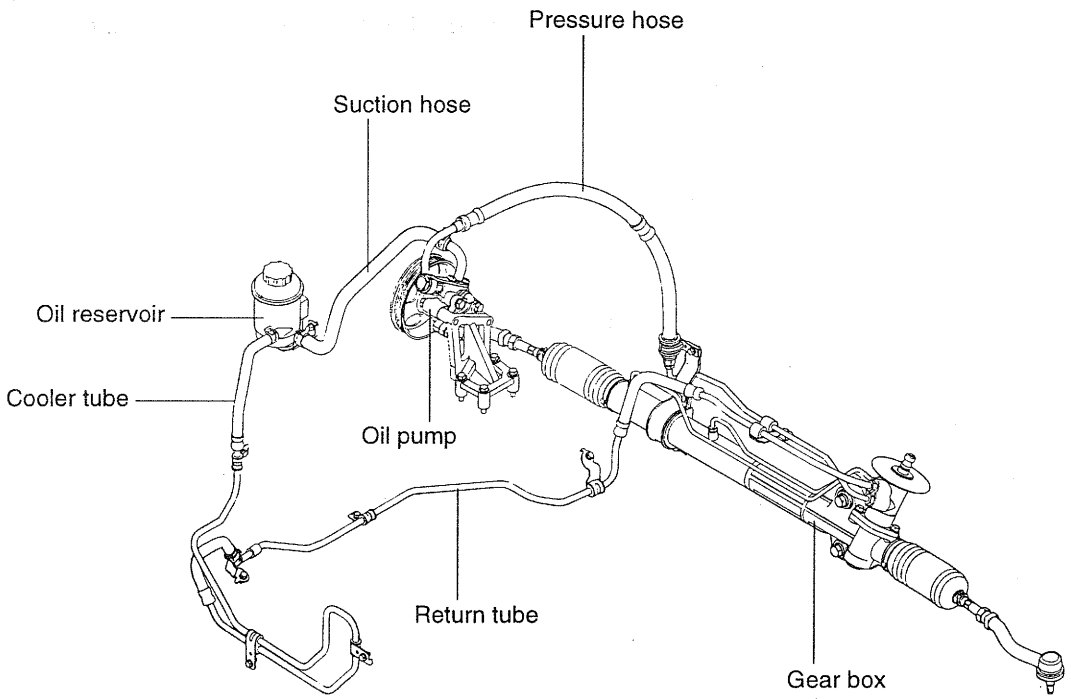
2. Bleed the air. Start the engine and turn the steering wheel several times so that the fluid temperature rises to approximately 50°C (122°F) operating temperature.
3. Set the engine speed to 1,000 rpm.
4. Fully close and then fully open the shut-off valve of the special tool and measure the fluid pressure to confirm that it is within the standard value range.

Oil pump pressure [Standard value] : 94-99 kg/cm^2

5. Remove the special tools and then tighten the pressure hose to the specified torque.

POWER STEERING HOSE EPHA1500

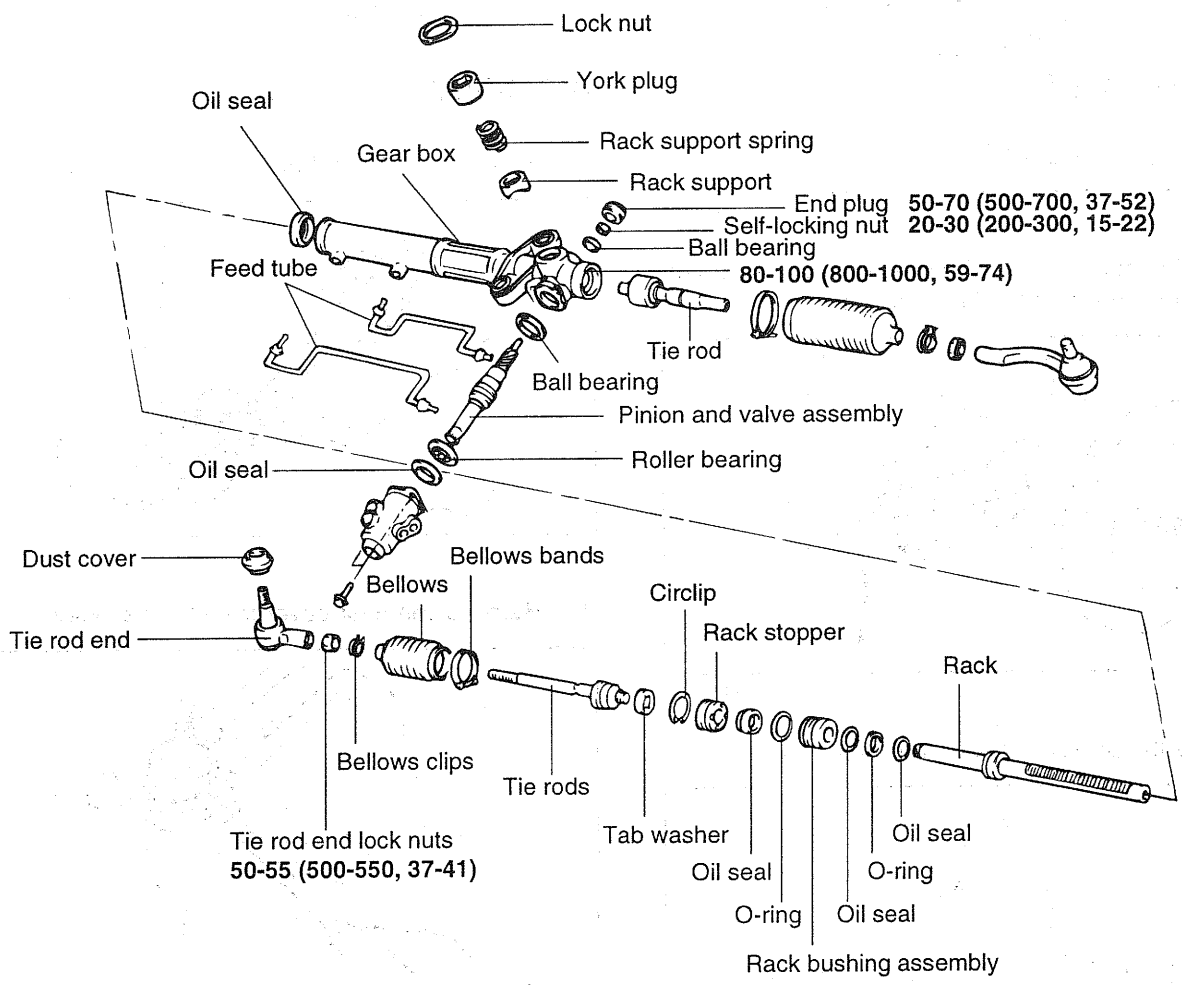
COMPONENTS



HEW56-18

POWER STEERING GEAR BOX

COMPONENTS EPHA0950

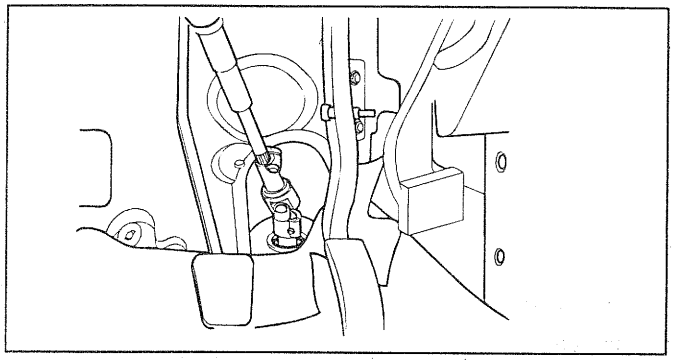


TORQUE : Nm (kg·cm, lb·ft)

EPA9012A

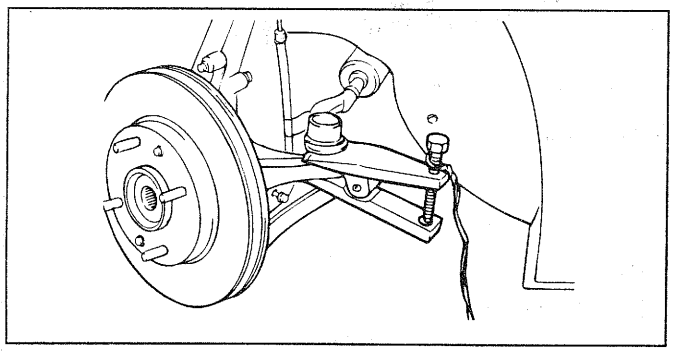
REMOVAL EPHA1000

1. Drain the power steering fluid.
2. Disconnect the pressure hose and return tube.
3. Remove the joint assembly connecting bolt.



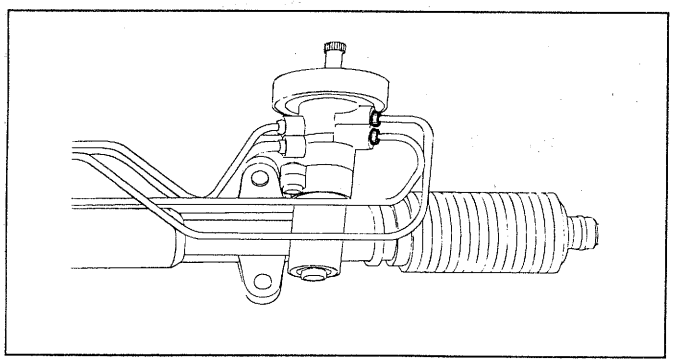
EPHA003A

4. Using the special tool (09568-31000), disconnect the tie rod end from the knuckle arm.



EPA9020F

5. Remove the pressure hose and return tube.

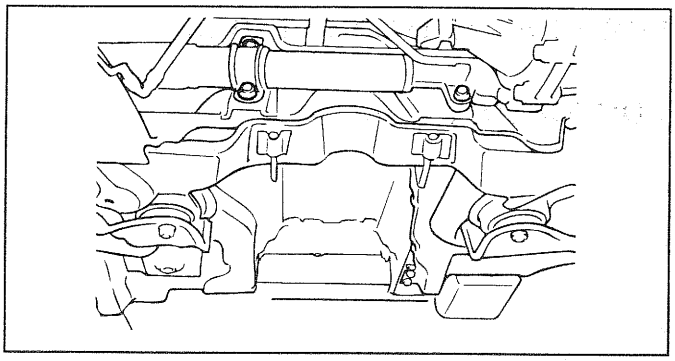


EPHA003B

6. Remove the steering gear box mounting brackets and remove the steering gear box assembly together with mounting rubber.

CAUTION

When removing the gear box, pull it out carefully and slowly to avoid damaging the boots.

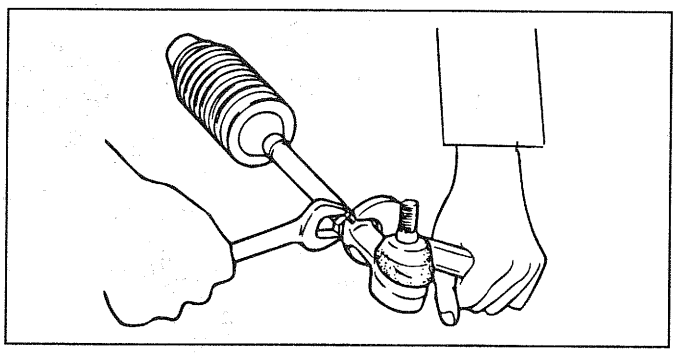


EPHA002D

7. Remove the stabilizer bar.

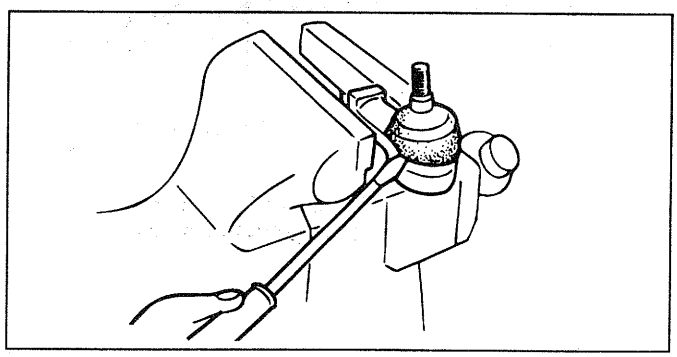
DISASSEMBLY EPHA1050

1. Remove the tie rod end from the tie rod.



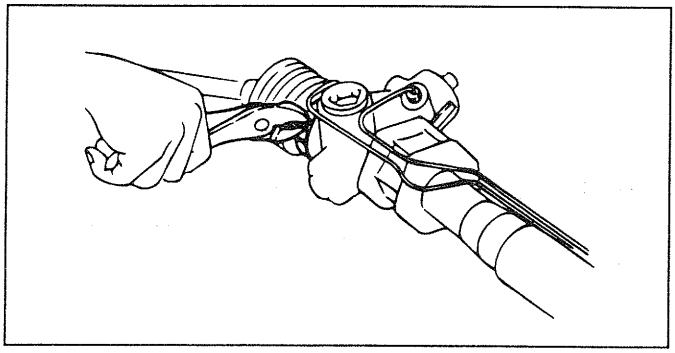
EPA9013F

2. Remove the dust cover from the ball joint.



EPA9013G

3. Remove the bellows band.



EPA9013H

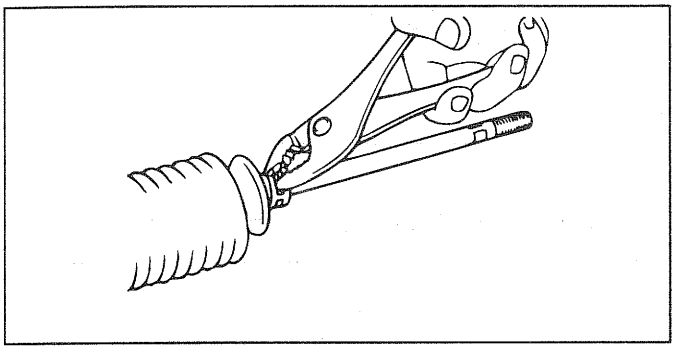
4. Remove the bellows clip.

5. Pull the bellows out toward the tie rod.

NOTE

Check for rust on the rack when the bellows are replaced.

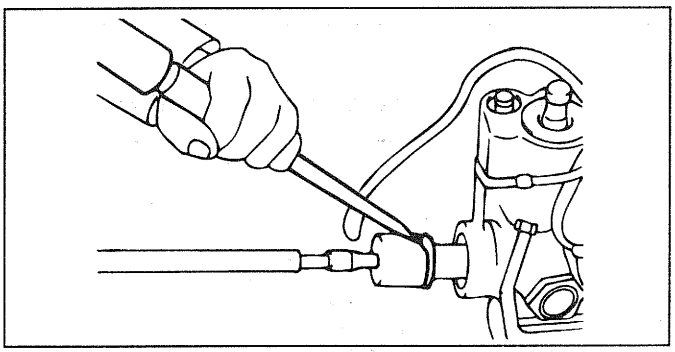
6. Remove the feed tube from the gear housing.



EPA9013I

7. While moving the rack slowly, drain the fluid from the gear housing.

8. Unstake the tab washer which fixes the tie rod and rack with a chisel.

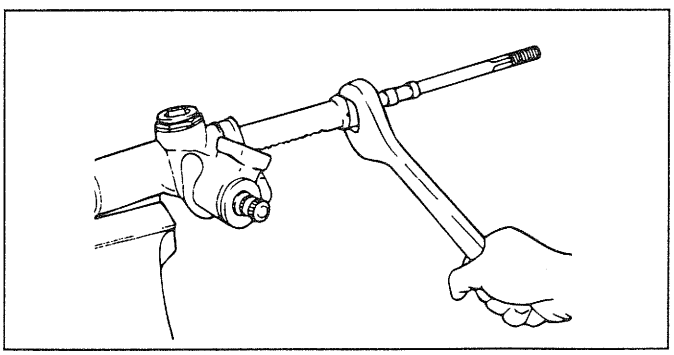


EPA9013J

9. Remove the tie rod from the rack.

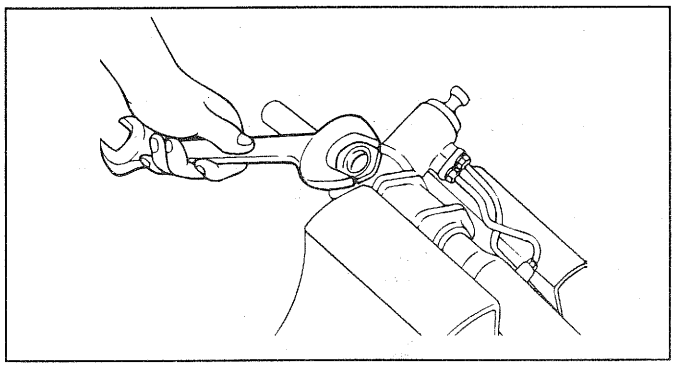
CAUTION

Remove the tie rod from the rack, taking care not to twist the rack.



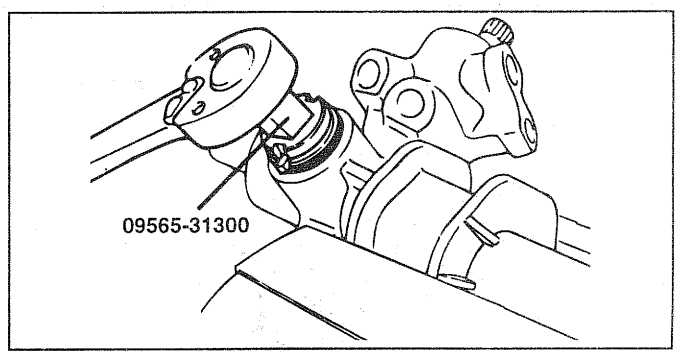
EPA9013K

10. Remove the york plug lock nut.



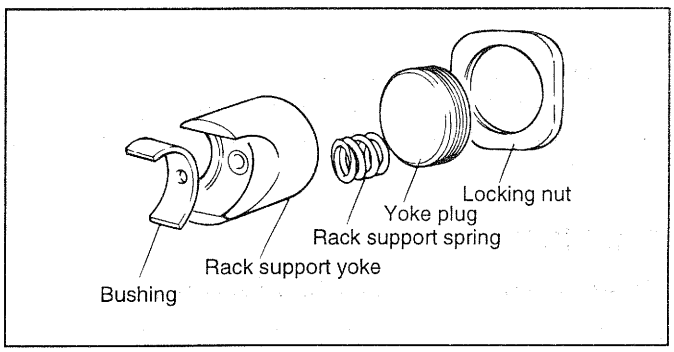
EPDA036H

11. Using the special tool (09565-31300), remove the york plug.



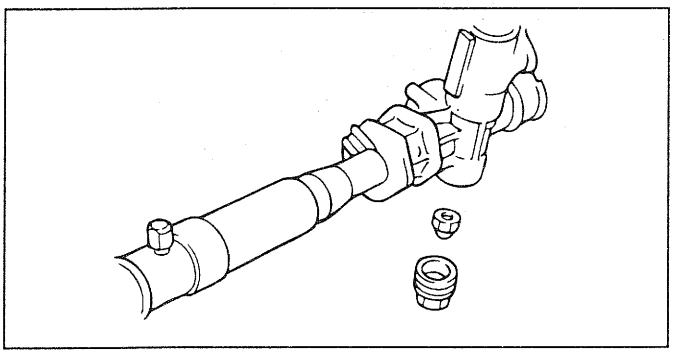
EPA9013M

12. Remove the rack support spring, rack support and bushing from the gear box.



EPA9013N

13. Remove the end plug self-locking nut.

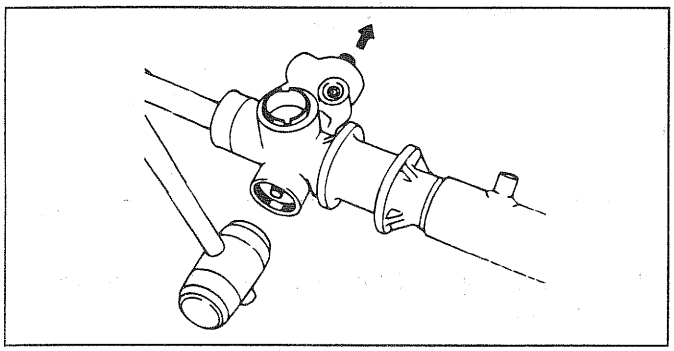


EPA9013O

14. Detach the dust seal.

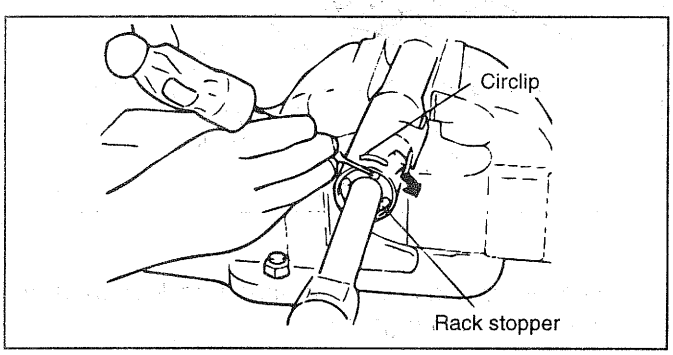
15. Remove the snap ring with a snap ring plier.

16. Remove the pinion and valve assembly together with the oil seal (upper) using a soft hammer.



EPA9013P

17. Turn the rack stopper clockwise until the end of the circlip comes out of the slot in the gear housing.

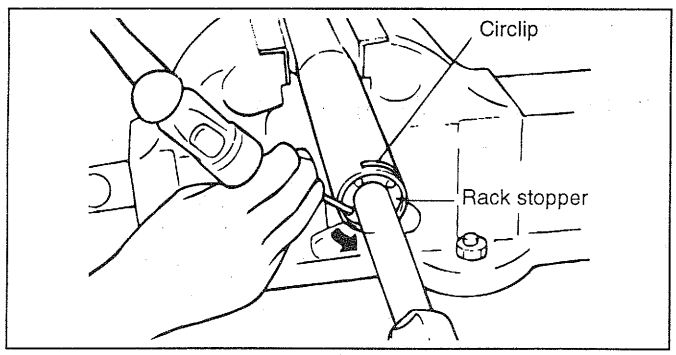


EPA9013Q

18. When the end of the circlip comes out from the notched hole of the housing rack cylinder, turn the rack stopper counter clockwise and remove the circlip.

CAUTION

Do not damage the rack when disassemble.

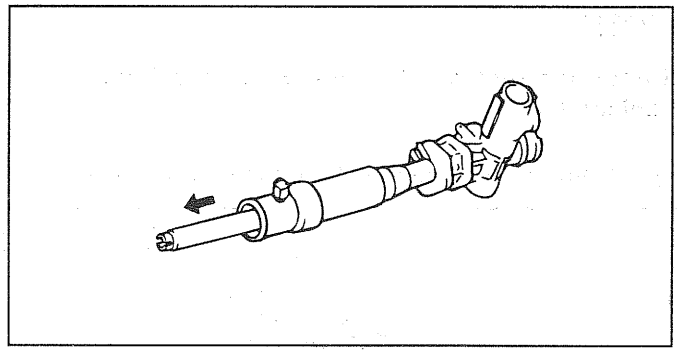


EPA9013R

19. Remove the rack stopper, rack bushing and rack from the gear housing by moving it toward the piston side.

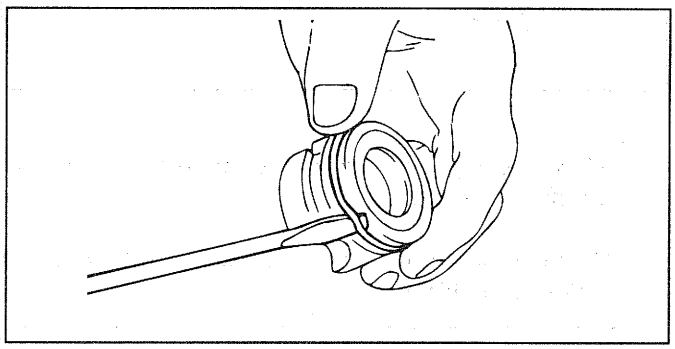
CAUTION

When the rack has been removed, be sure to replace the housing side oil seal with a new one.



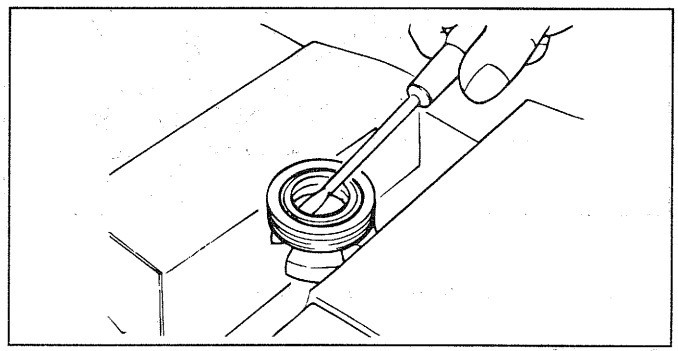
EPA9013S

20. Remove the O-ring from the rack bushing.



EPA9013T

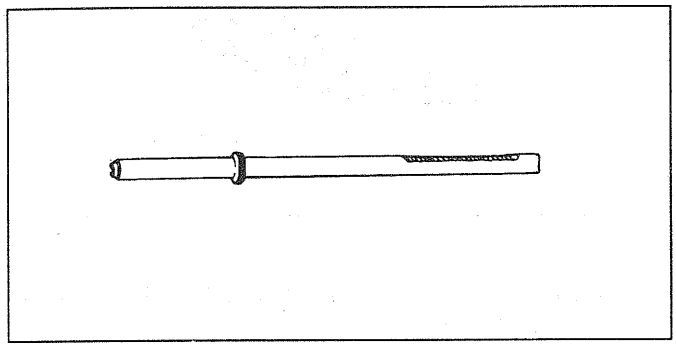
21. Remove the oil seal from the rack bushing.



EPA9013U

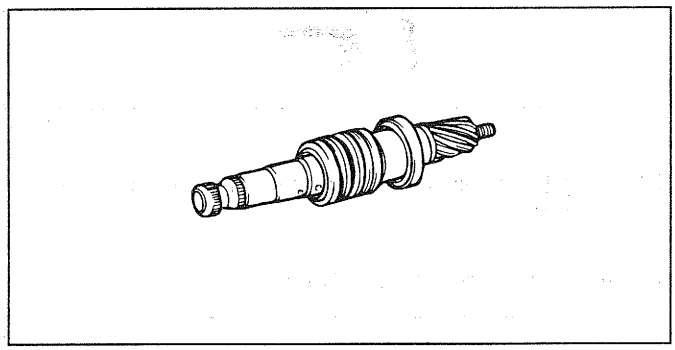
INSPECTION EPHA1100

1. **Rack**
   1) Rack tooth face damage or wear
   2) Oil seal contact surface damage or wear
   3) Bending or twisting of rack
   4) Oil seal ring damage or wear
   5) Oil seal damage or wear



EPA9013Y

2. **Pinion valve**
   1) Pinion gear tooth face damage or wear
   2) Oil seal contact surface damage
   3) Seal ring damage or wear
   4) Oil seal damage or wear



EPA9013Z

3. **Bearing**
   1) Seizure or abnormal noise during bearing rotation
   2) Excessive play
   3) Missing needle bearing rollers
4. **Others**
   1) Damage of the gear housing cylinder bore
   2) Boot damage, cracking or ageing

ASSEMBLY EPHA1150

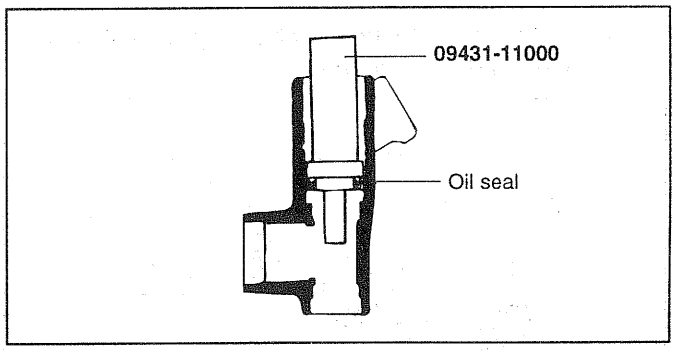
1. Apply the specified fluid to the entire surface of the oil seal and gear housing.

Recommended fluid :Power steering fluid (PSF-3)

2. Using the special tools (09431–11000), install the oil seal to the specified position in the gear housing.

CAUTION

1. **Note the direction of the oil seal.**
2. **Use a new oil seal.**

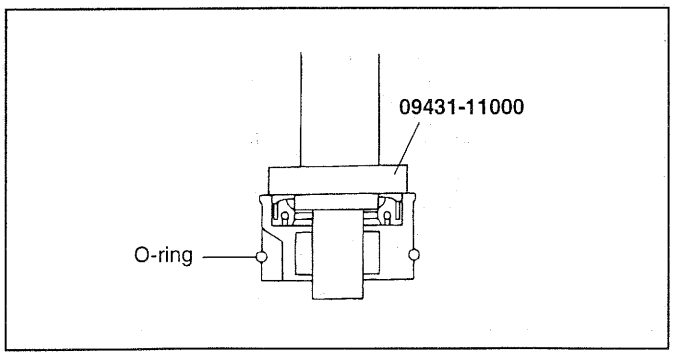


EPA9014C

3. Apply the specified fluid to the entire surface of the rack bushing oil seal.

Recommended fluid :Power steering fluid (PSF-3)

4. Install the oil seal on the rack bushing.
5. Apply the specified fluid to the entire surface of the O-ring and install to the rack bushing using the special tool (09431-11000).



EPA9014D

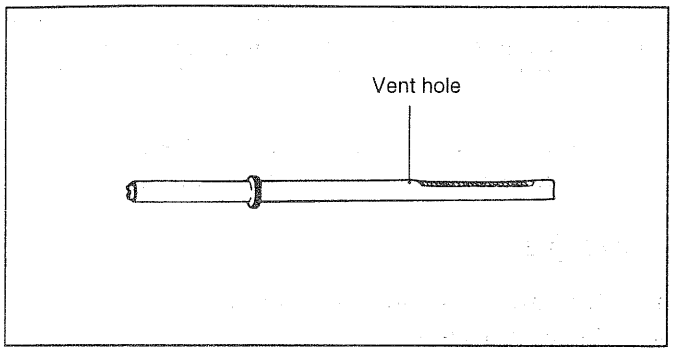
6. Apply the specified grease to the rack teeth and wrap with vinyl tape.

Recommended grease :

Multipurpose grease SAE J310a, NLGI grade #2 EP

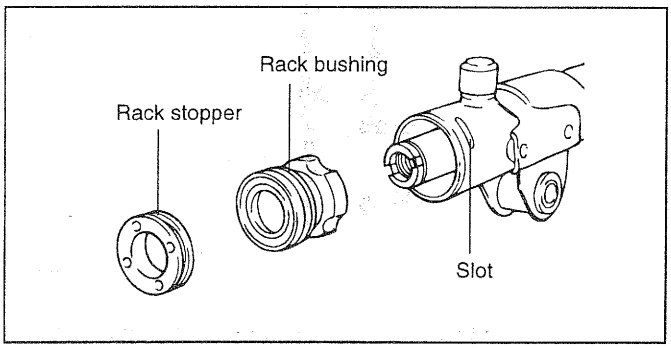
CAUTION

Do not plug the vent hole in the rack with grease.



EPA9014E

7. Insert the rack into the gear housing. Install the rack bushing and rack stopper.

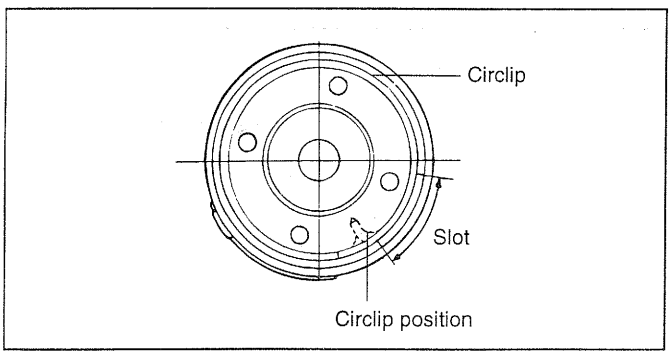


EPA9014F

8. Push in the rack stopper until the circlip groove of the rack stopper is aligned with the notched hole of the rack housing and then install the circlip while turning the rack stopper.

CAUTION

The circlip end should not be visible through the notched hole of the rack housing.



EPA9014G

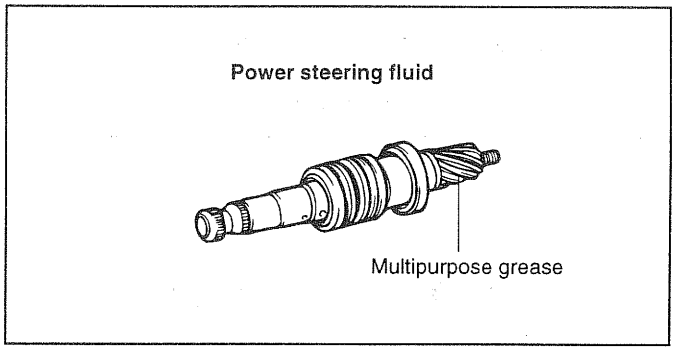
9. Apply the specified fluid and grease to the pinion valve assembly and install to the gear housing assembly.

Recommended fluid :

Power steering fluid (PSF-3)

Recommended grease :

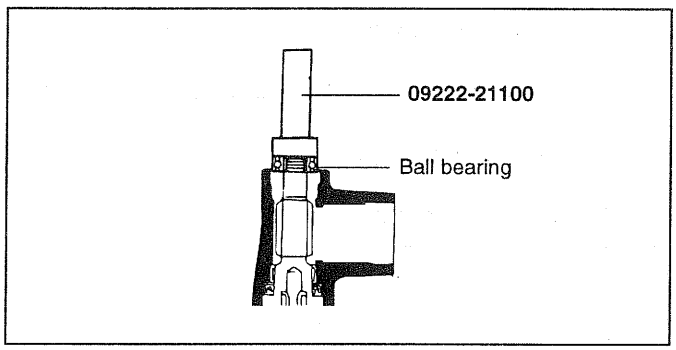
Multipurpose grease SAE J310a, NLGI #2 EP



EPA9014H

10. Install the ball bearing using special tool (09222-21100).

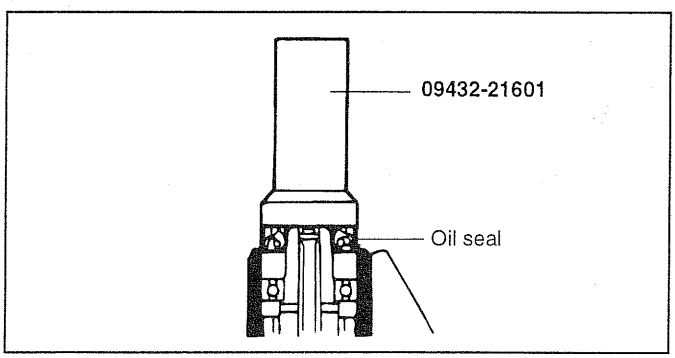
11. Install the pinion and valve assembly to the valve housing.



EPA9014I

12. Install the oil seal using the special tool (09432-21601).

13. Install the snap ring with snap ring plier

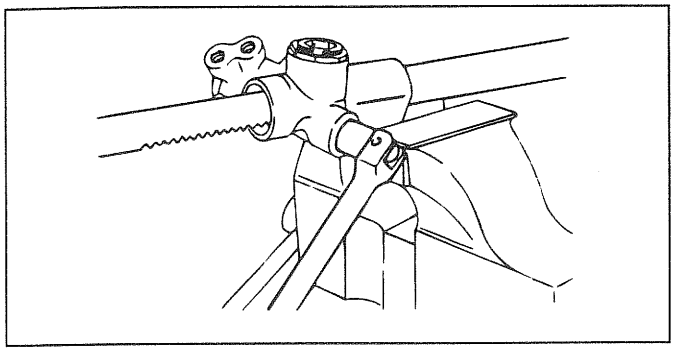


EPA9014J

14. With the pinion turned all the way clockwise, tighten the self-locking nut.

CAUTION

Always replace the self-locking nut with a new one.

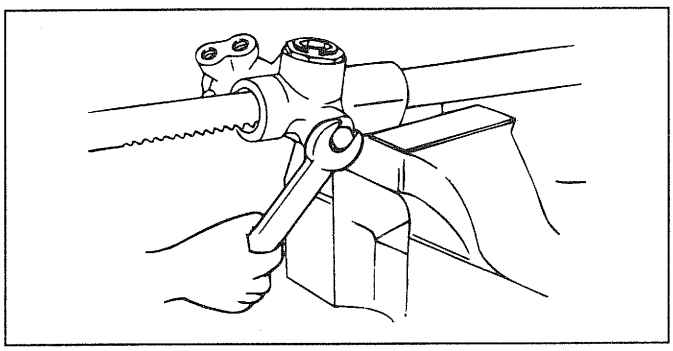


EPA9014K

15. Apply semi-drying sealant to the threaded section of the end plug and tighten to the specified torque.

Tightening torque :
50-70 Nm (500-700 kg·cm, 36-51 lb·ft)

16. Stake the end plug at two points on its circumference with a punch.

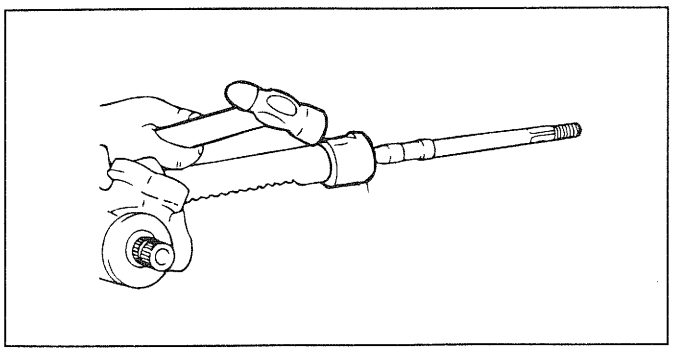


EPA9014L

17. Install the tab washer and then the tie rod and peen the tab washer end at two points to the tie rod.

CAUTION

1. **Align the tab washer pawls with the rack grooves.**
2. **Use a new tab washer.**

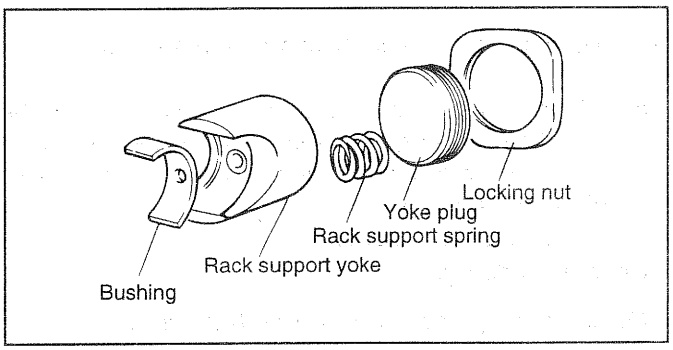


EPA9014M

18. Install the bushing, rack support, rack support spring and rack support cover in the order shown. Apply thread sealant to the threaded section of the rack support cover before installation.

19. With the rack placed at the center position, attach the rack support plug to the gear housing. Tighten the rack support plug within the range of 20-25 Nm (200-250 kg.cm, 14.5-18 lb.ft), using the special tool. Loosen the rack support plug for approximately 20° and adjust torque to the standard value.

Tightening torque
Locking nut : 50-70 Nm (500-700 kg·cm, 36-51 lb·ft)



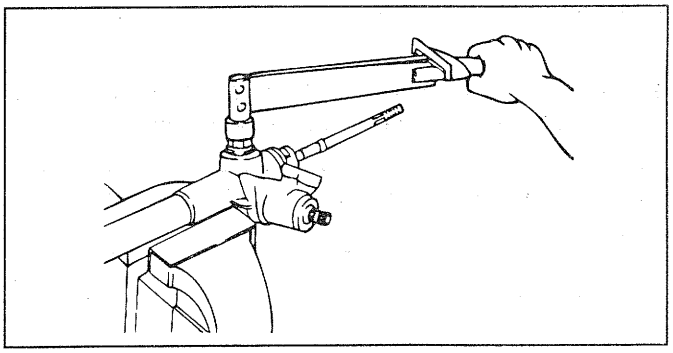
EPA9013N

20. After adjusting, york plug with lock nut.

NOTE

When it cannot be adjusted within the specified return angle, check rack support plug components or replace.

21. Tighten the feed tube to the specified torque and install the mount rubber using adhesive.



EPA9014O

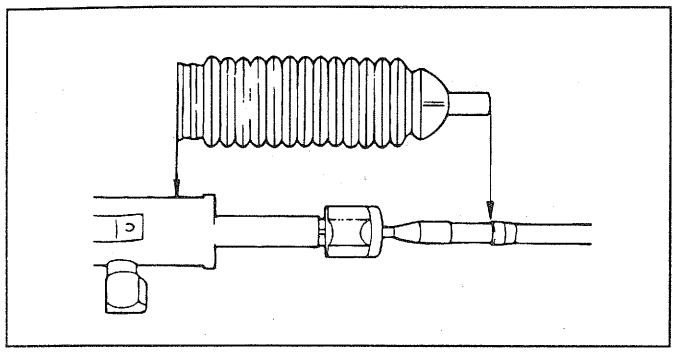
22. Apply the specified grease to the bellows fitting position (fitting groove) of the tie rod.

Recommended grease
Multipurpose grease SAE J310a, NLGI #2 EP

23. Install the new attaching band to the bellows.

CAUTION

Whenever the bellows are installed, a new band must be used.

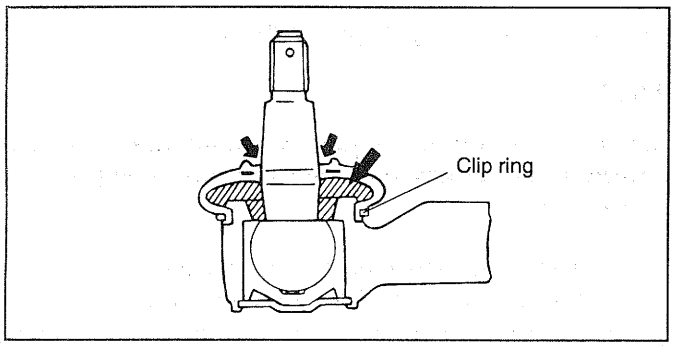


EPA9014P

24. Install the bellows in, taking care not to twist it.

25. Fill the dust cover inner side and lip with the specified multipurpose grease, and fix the dust cover in position with the clip ring attached in the groove of the tie rod end.

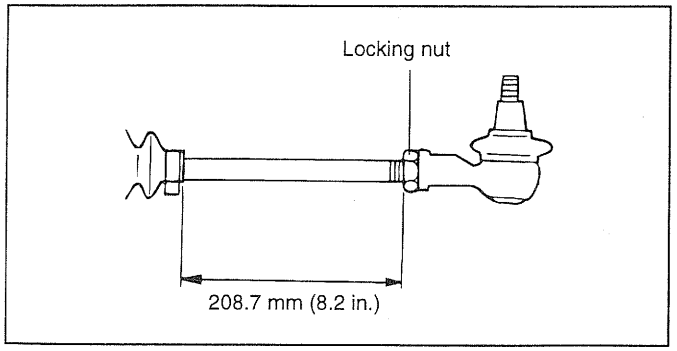
Recommended grease
Multipurpose grease SAE J310a, NLGI #2 EP



EPA9014Q

26. Install the tie rods so that the length of the left and right tie rods will be equal to the standard value.

Tie rod free length [Standard value] :208.7 mm (8.2 in.)

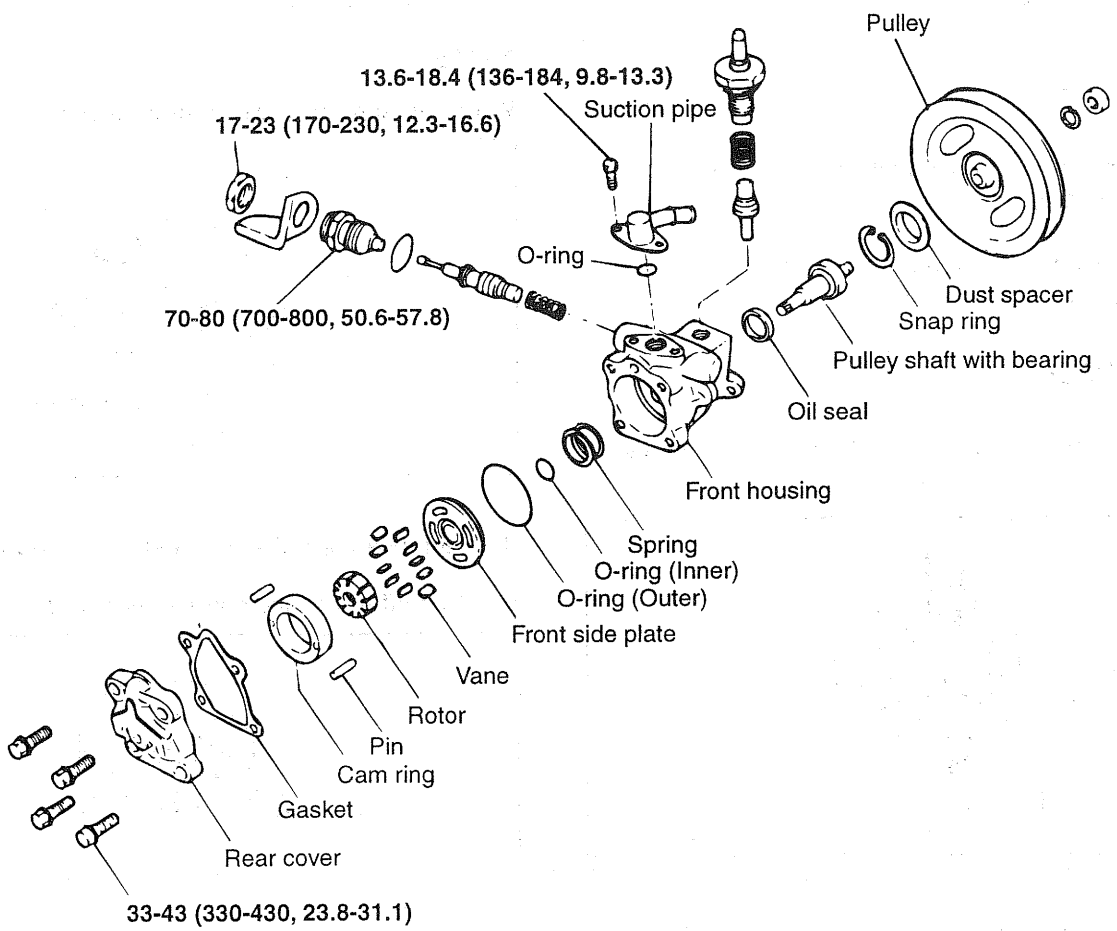


EPHA115A

27. Install the rack, pinion, tie rod assembly to the vehicle.

POWER STEERING OIL PUMP

COMPONENTS EPHA1200

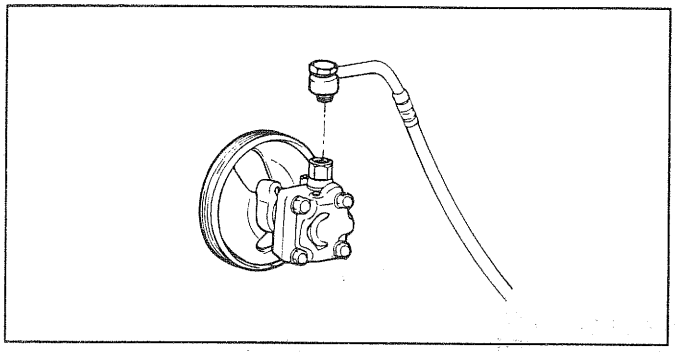


TORQUE : Nm (kg.cm, lb.ft)

HCT56-85

REMOVAL EPHA1250

1. Remove the pressure hose from the oil pump.
2. Disconnect the suction hose from the suction connector and drain the fluid into a container.

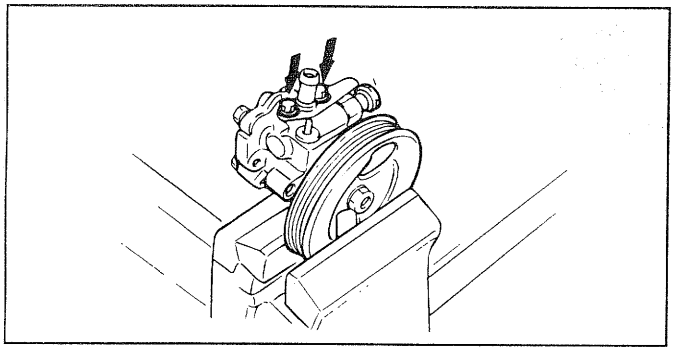


EPA9016A

3. To remove the drive belt, loosen the oil pump mounting bolt.
4. Remove the oil pump mounting bolts and disconnect the pressure switch connector.

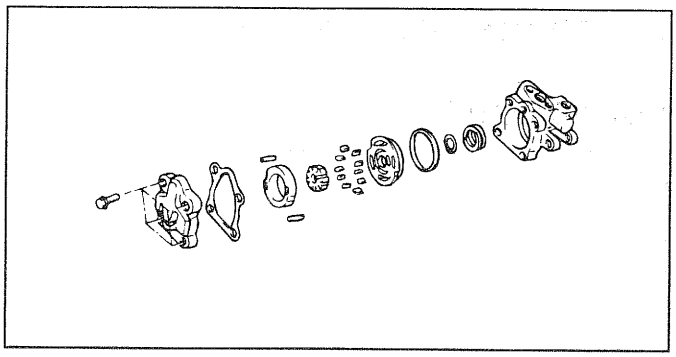
DISASSEMBLY EPHA1300

1. Remove the suction pipe and the O-ring from the oil pump.



EPA9017A

2. Remove the rear cover with the gasket and pin.
3. Remove the cam ring.
4. Remove the rotor and vanes
5. Remove the front side plate.

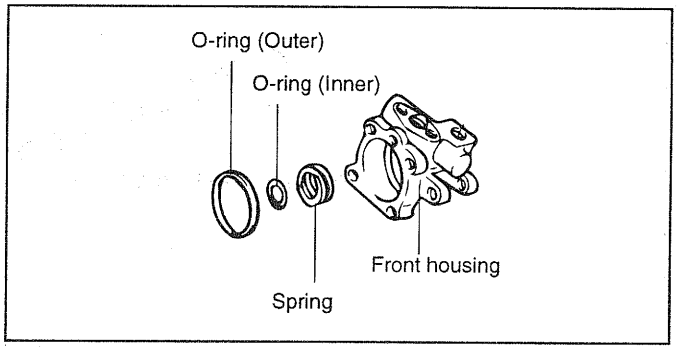


EPA9017B

6. Remove the inner and outer O-ring.
7. Remove the spring.

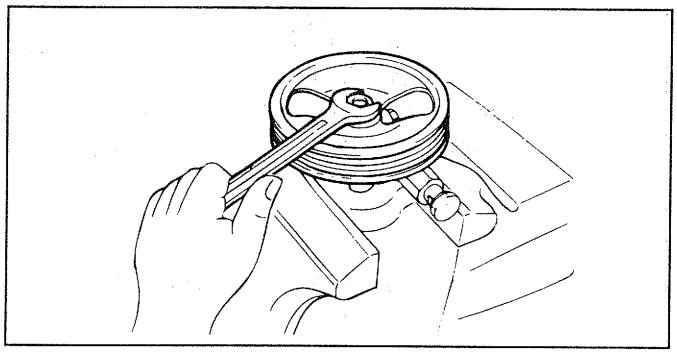
NOTE

When assembling, use a new gasket and O-ring.



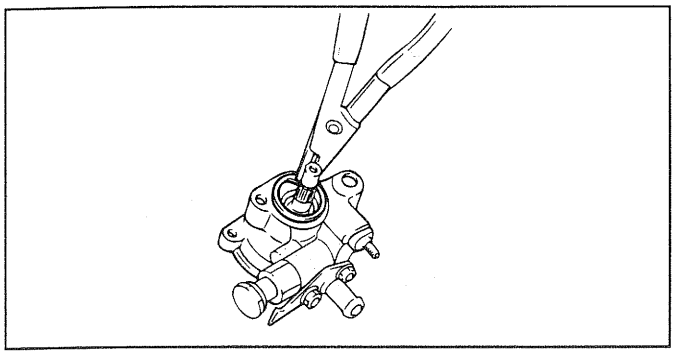
EPA9017C

8. Remove the pulley nut and the spring washer.
9. Pull off the pulley and the woodruff key.



EPA9017D

10. Remove the snap ring using the snap ring pliers.
11. Pull off the pulley shaft and bearing by using a plastic hammer.

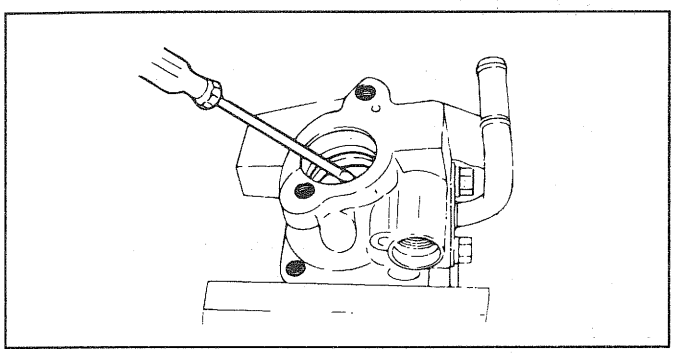


EPA9017E

12. Remove the oil seal from the oil pump body.

NOTE

When assembling, use a new oil seal.

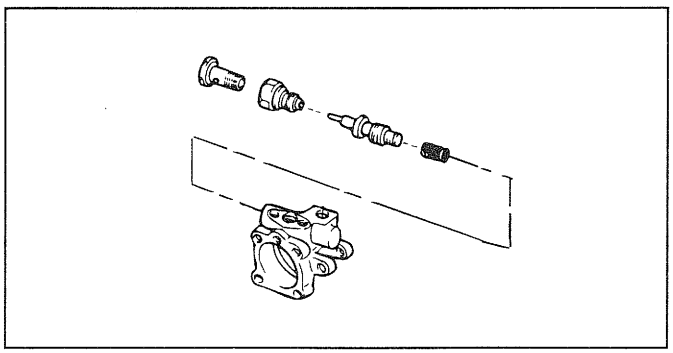


HCT56-94

13. Remove the guide bracket and nut.
14. Remove the connector from the oil pump body, and then remove the flow control valve and flow control spring.
15. Remove the O-ring from the connector.

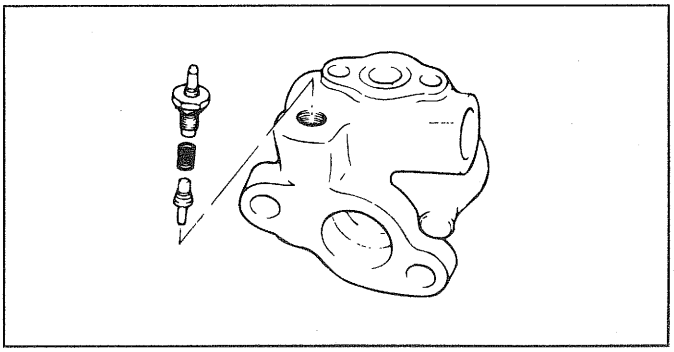
CAUTION

Do not disassemble the flow control valve.



EPA9017G

16. Remove the oil pump switch.
17. Take the spring and the spool out.
18. Remove the O-ring from the oil pump switch.



HCT56-96

INSPECTION EPHA1350

1. Clean all disassembled parts with a suitable cleaning solvent.
2. If any inside parts of the oil pump have been damaged, replace the pump as an assembly.
3. If the pulley is cracked or deformed, replace it.
4. If oil leaks around the pulley shaft oil seal, replace the oil seal.
5. If the serrations of the pulley or pulley shaft are deformed or worn out, replace them.

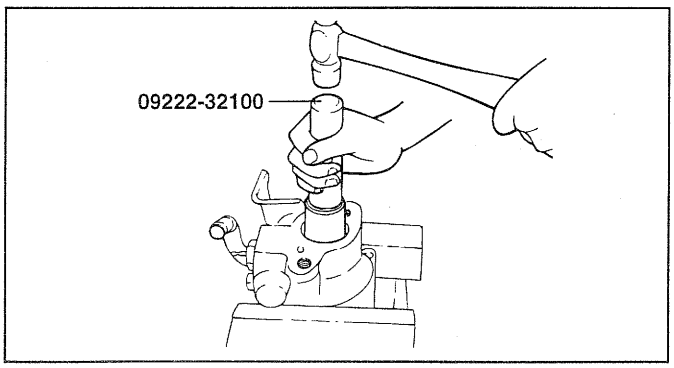
ASSEMBLY EPHA1400

1. Install the oil pump switch.
2. Install the flow control valve spring, valve and connector in the pump body.

NOTE

Apply a thin coat of power steering fluid to all parts including the oil seal and O-ring.

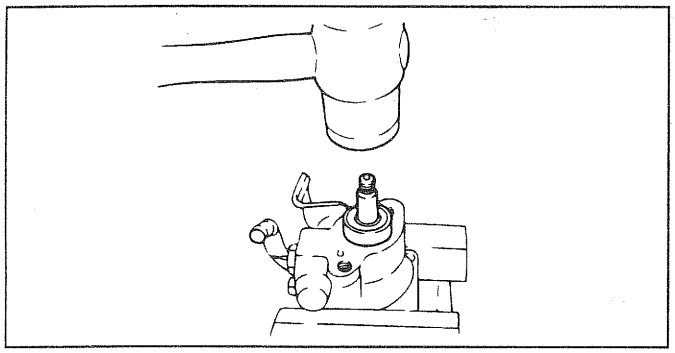
3. Install the guide bracket and nut.
4. Using special tool (09222-32100), install the oil seal into the pump body.



EPDA044A

5. Gently insert the shaft assembly and install the snap ring.

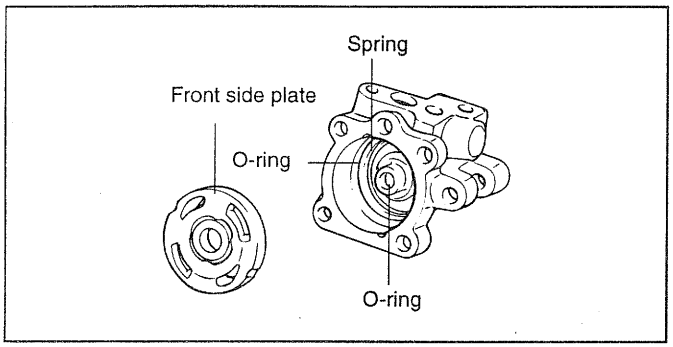
6. Install the pump pulley with woodruff key in place.



HCT56-98

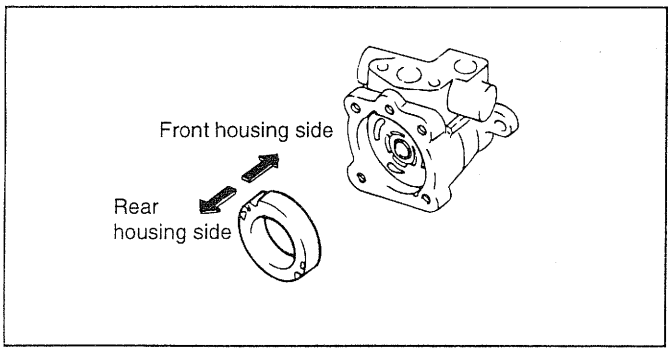
7. Install the spring and the inner and outer O-rings.

8. Install the front side plate.



EPA9018C

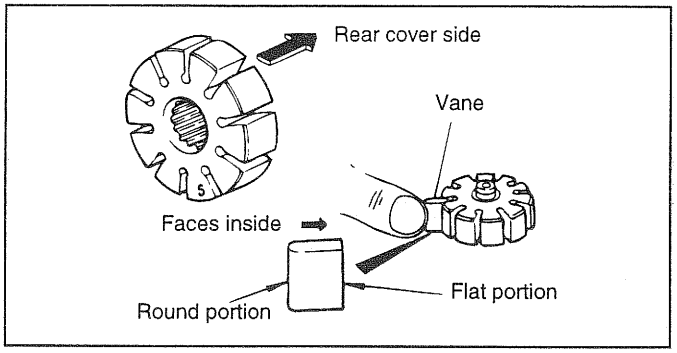
9. Insert the pins into the pin grooves of the front housing, then install the cam ring, paying attention to its direction.



EPA9018D

10. Install the rotor with its punch marked side facing towards the front side plate.

11. Install the vane plates with the round end facing outward.



EPA9018E

12. Install the gasket and rear cover.

13. Tighten the suction connector.

INSTALLATION EPHA1450

1. Install the oil pump to the oil pump bracket.

2. Install the suction hose.

3. Install the ribbed V-belt and adjust its tension.

4. Connect the pressure hose to the oil pump, and the suction hose to the oil reservoir.

NOTE

Install the hoses so that they are not twisted and they do not come in contact with any other parts.

5. Replenish the reservoir.

   Recommended fluid : Power steering fluid (PSF-3)

6. Bleed the system.

7. Check the oil pump pressure.

8. Install parts by reference to the torque specification.

Transaxle/ Transmission

NOTE : 1. For Automatic Transaxle overhaul, please refer to the "Overhaul Manual" (Publication No.: PESE A007A).
2. For Manual Transaxle overhaul, please refer to the "Overhaul Manual" (Publication No.: PESE A006A)

GENERAL

EMHA0010

SPECIFICATIONS(M/T)

Model		M5GF1
Type		Forward 5 speed, reverse 1 speed
Gear ratio	First	3.455
	Second	1.947
	Third	1.296
	Fourth	0.943
	Fifth	0.775
	Reverse	3.455
Final gear ratio		3.882

SERVICE STANDARD

EMAA0020

Standard value	mm (in.)
Differential side bearing end play	0.05T-0.10T (0.0019T-0.0039T)
Gear backlash in differential	0.025L-0.150L (0.00095L-0.0057L)
Input front bearing snap ring end play	0.01L-0.12L (0.00038L-0.0045L)
Input rear bearing snap ring end play	0.01L-0.12L (0.00038L-0.0045L)
Output front bearing snap ring end play	0.01L-0.12L (0.00038L-0.0045L)
Output rear bearing snap ring end play	0.01L-0.09L (0.00038L-0.00342L)
5TH input gear snap ring end play	0.01L-0.05L (0.00038L-0.0019L)
3RD output gear snap ring end play	0.01L-0.05L (0.00038L-0.0019L)

TIGHTENING TORQUE

EMHA0030

Item	Nm	Kg.cm	lb.ft
Release bearing sleeve bolt	5-8	50-80	4-6
Clutch housing and bearing cover	38-50	380-500	27-35
Select lever	20-27	200-270	15-20
Oil drain plug	30-35	300-350	22-26
Poppet ball	35-42	350-420	26-31
Clutch housing to transmission case	35-42	350-420	26-31
Speedometer driven gear	4-6	40-60	3-4
Reverse idler bolt	43-55	430-550	32-40
Side cover bolt	10-12	100-120	7-8
Shift control cable bracket	20-27	200-270	15-20
Cylinder and hose assembly	15-22	150-220	11-16
Shift lever bracket	9-14	90-140	7-10
Front roll stopper bracket to subframe bolts	60-80	600-800	43-58
Front roll stopper insulator bolt and nut	50-65	500-650	36-47
Front roll stopper bracket to transaxle bolts	60-80	600-800	43-58
Rear roll stopper bracket to subframe bolts	50-65	500-650	36-47
Rear roll stopper insulator bolt and nut	50-65	500-650	36-47
Rear roll stopper bracket to transaxle bolts	60-80	600-800	43-58
Transaxle mounting sub bracket nut	60-80	600-800	43-58
Transaxle mounting bracket bolts	60-80	600-800	43-58
Transaxle mounting insulator bolt	90-110	900-1100	65-80
Front bearing retainer & detent body cover bolt	15-22	150-220	10-16

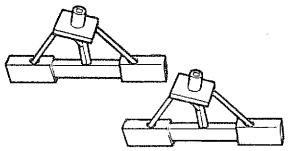
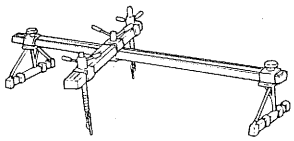
LUBRICATIONS

EMA90040

Item	Recommended lubricant	Quantity
Transaxle gear oil lit (U.S. Imp.qts.)	Hypoid gear oil, SAE 75W/90, API-GL4	2.1 (2.2, 1.8)
Transaxle input shaft spline	CASMOLY L9508	As required
Transaxle oil seal lip	RETINAX AM, MOLYTEX GREASE EP-2	As required
Transaxle case and clutch housing alignment surface	THREE BOND 1216	As required
Transaxle case and rear cover alignment surface	THREE BOND 1216	As required
Bearing retain bolt (flush bolt only)	THREE BOND1303	As required

SPECIAL TOOLS

EMHA0050

Tool(Number and Name)	Illustration	Use
09210-3A000 Engine support fixture adaptor	 EMHA005A	Removal and installation of transaxle assembly (use with 09200-38000)
09200-38001 Engine support fixture	 D0038001	Removal and installation of transaxle assembly

TROUBLESHOOTING

EMA90060

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
	Use of 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 oil seal or O-ring
Hard shift	Faulty control cable	Replace control cable
	Poor contact or wear of cynchronizer ring and gear cone	Correct or replace
	Weakened synchronizer spring	Replace synchronizer spring
	Use of inadequate grade of oil	Replace with specified oil
Jumps out of gear	Worn gear shift fork or broken poppet spring	Replace shift fork or popet spring
	Synchronizer hub to sleeve spline clearance too large	Replace synchronizer hub and sleeve

SPECIFICATIONS(A/T)

EKHA0010

Item	F4A42-2	F4A51-2
Torque converter type	3-element, 1-stage, 2-phase type	
Transission type	4-speed forward, 1-speed reverse	
Engine displacement	2.0D	2.7D
Gear ratio		
1st	2.842	2.842
2nd	1.529	1.495
3rd	1.000	1.000
4th	0.712	0.731
Reverse	2.480	2.720
Final gear ratio	4.407	4.018

SERVICE SPECIFICATIONS

EKHA0020

Items	Standard value
Output shaft preload	0.01-0.09 mm
Brake reaction plate end play	0-0.16 mm
Low-reverse brake end play	1.35-1.81 mm
Second brake end play	0.79-1.25 mm
Underdrive sun gear end play	0.25-0.45 mm
Input shaft end play mm	0.70-1.45 mm
Differential case preload	0.045-0.105 mm
Underdrive clutch end play	1.65-1.85 mm
Reverse and overdrive clutch return spring end play	0-0.09 mm
Overdrive clutch end play	1.6-1.8 mm
Reverse clutch end play	1.5-1.7 mm
Backlash between differential side gear and pinion	0.025-0.150 mm

TIGHTENING TORQUE

EKA90030

Item	Nm	kg·cm	lb·ft
Wiring harness bracket	20-26	200-260	14-18
Control cable bracket bolt	20-26	200-260	14-18
Fluid temperature sensor	27-33	270-330	19-23
Eye bolt	10-12	100-120	7-8
Oil cooler feed tube	11-13	110-130	8-9
Oil filter	10-12	100-120	7-8
Input shaft speed sensor	10-12	100-120	7-8
Output shaft speed sensor	18-25	180-250	13-18
Manual control lever	10-12	100-120	7-8
Transaxle range switch	4-6	40-60	3-4
Speedometer gear	8-10	80-100	6-7
Valve body cover	10-12	100-120	7-8
Valve body mounting bolt	10-12	100-120	7-8
Manual control shaft detent	5-7	50-70	4-5
Rear cover	20-26	200-260	14-18
Torque converter housing	42-54	420-540	29-38
Oil pump	20-261	200-260	14-18
Transfer drive gear	6-22	160-220	11-15
Output shaft lock nut	160-180	1600-1800	110-126
Output shaft bearing retainer	20-26	200-260	14-18
Oil filler plug	29-34	290-340	20-24
Oil drain plug	29-34	290-340	20-24
Transfer drive gear lock nut	180-210	1800-2100	126-147
Differential drive gear to subframe bolts	130-140	1300-1400	91-98
Valve body	10-12	100-120	7-8
Solenoid valve support	5-7	50-70	4-5
Plate	5-7	50-70	4-5
Pressure check plug	8-10	80-100	6-7
Front roll stopper bracket to subframe bolts	60-80	600-800	43-58
Front roll stopper insulator bolt and nut	50-65	500-650	36-47
Front roll stopper bracket to transaxle bolts	60-80	600-800	43-58
Rear roll stopper bracket	50-65	500-650	36-47
Rear roll stopper insulator bolt and nut	50-60	500-650	36-47
Rear roll stopper bracket to transaxle bolts	60-80	600-800	43-58

Item	Nm	kg·cm	lb·ft
Transaxle mounting sub bracket nut	60-80	600-800	43-58
Transaxle mounting bracket bolts	60-80	600-800	43-58
Transaxle mounting insulator bolt	90-110	900-1100	65-80

EKHA0040

LUBRICATIONS

Items	Specified lubricant	Quantity
Transaxle fluid lit. (U.S. qts., Imp,qts.)	GENUINE DIAMOND ATF SP-II M	7.8 (8.2,6.9) ; 2.0D 8.5 (8.9,7.5) ; 2.7D

SEALANTS

Items	Specified sealant
Rear cover	Hyundai genine sealant TB1281B or equivalent
Torque converter housing	Hyundai genine sealant TB1281B or equivalent
Valve body cover	Hyundai genine sealant TB1281B or equivalent

SNAP RING FOR ADJUSTMENT AND SPACER

EKA90050

Part name	Thickness mm	Identification Symbol
Thrust washer (For adjustment of input shaft end play)	1.8	18
	2.0	20
	2.2	22
	2.4	24
	2.6	26
	2.8	28

Part name	Thickness mm	Identification Symbol
Snap ring (For adjustment of underdrive clutch and overdrive clutch end plays)	1.6	None
	1.7	Blue
	1.8	Brown
	1.9	None
	2.0	Blue
	2.1	Brown
	2.2	None
	2.3	Blue
	2.4	Brown
	2.5	None
	2.6	Blue
	2.7	Brown
	2.8	None
	2.9	Blue
	3.0	Brown
Snap ring (For adjustment of low-reverse brake and second brake reaction plates end plays)	2.2	Blue
	2.3	Brown
	2.4	None
	2.5	Blue
Pressure plate (For adjustment of low-reverse brake and second brake end plays)	1.6	6
	1.8	1
	2.0	0
	2.2	2
	2.4	4
	2.6	6
	2.8	8
	3.0	D

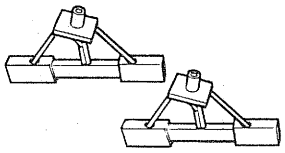
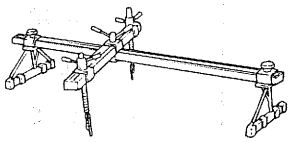
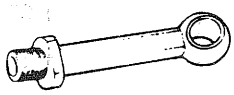
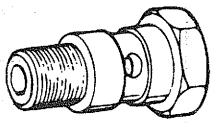
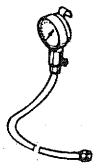
Part name	Thickness mm	Identification Symbol
Snap ring (For adjustment of reverse cluth end play)	1.9	None
	2.0	Blue
	2.1	Brown
	2.2	None
	2.3	Blue
	2.4	Brown
	2.5	None
	2.6	Blue
	2.7	Brown
	2.8	None
Snap ring (For adjustment of reverse clutch and overdrive clutch spring retainers end plays)	1.48	Brown
	1.53	None
	1.58	Blue
	1.63	Brown
Thrust race (For adjustment of underdrive sun gear end play)	1.6	-
	1.7	-
	1.8	-
	1.9	-
	2.0	-
	2.1	-
	2.2	-
	2.3	-
	2.4	-
	2.5	-
	2.6	-

Part name	Thickness mm	Identification Symbol
Spacer (For adjustment of output shaft preload)	1.88	88
	1.92	92
	1.96	96
	2.00	00
	2.04	04
	2.08	08
	2.12	12
	2.16	16
	2.20	20
	2.24	24
	2.28	28
	2.32	32
	2.36	36
	2.40	40
	2.44	44
	2.48	48
	2.52	52
	2.56	56
	2.60	60
	2.64	64
	2.68	68
	2.72	72
	2.76	76

Part name	Thickness mm	Identification Symbol
Spacer (For adjustment of differential case preload)	0.71	71
	0.74	74
	0.77	77
	0.80	80
	0.83	83
	0.86	86
	0.89	89
	0.92	92
	0.95	95
	0.98	98
	1.01	01
	1.04	04
	1.07	07
	1.10	J
	1.13	D
	1.16	K
	1.19	L
	1.22	G
	1.25	M
	1.28	N
	1.31	E
	1.34	O
	1.37	P
Spacer (For adjustment of backlash between differential side gear and pinion)	0.75 - 0.82	-
	0.83 - 0.92	-
	0.93 - 1.00	-
	1.01 - 1.08	-
	1.09 - 1.16	-

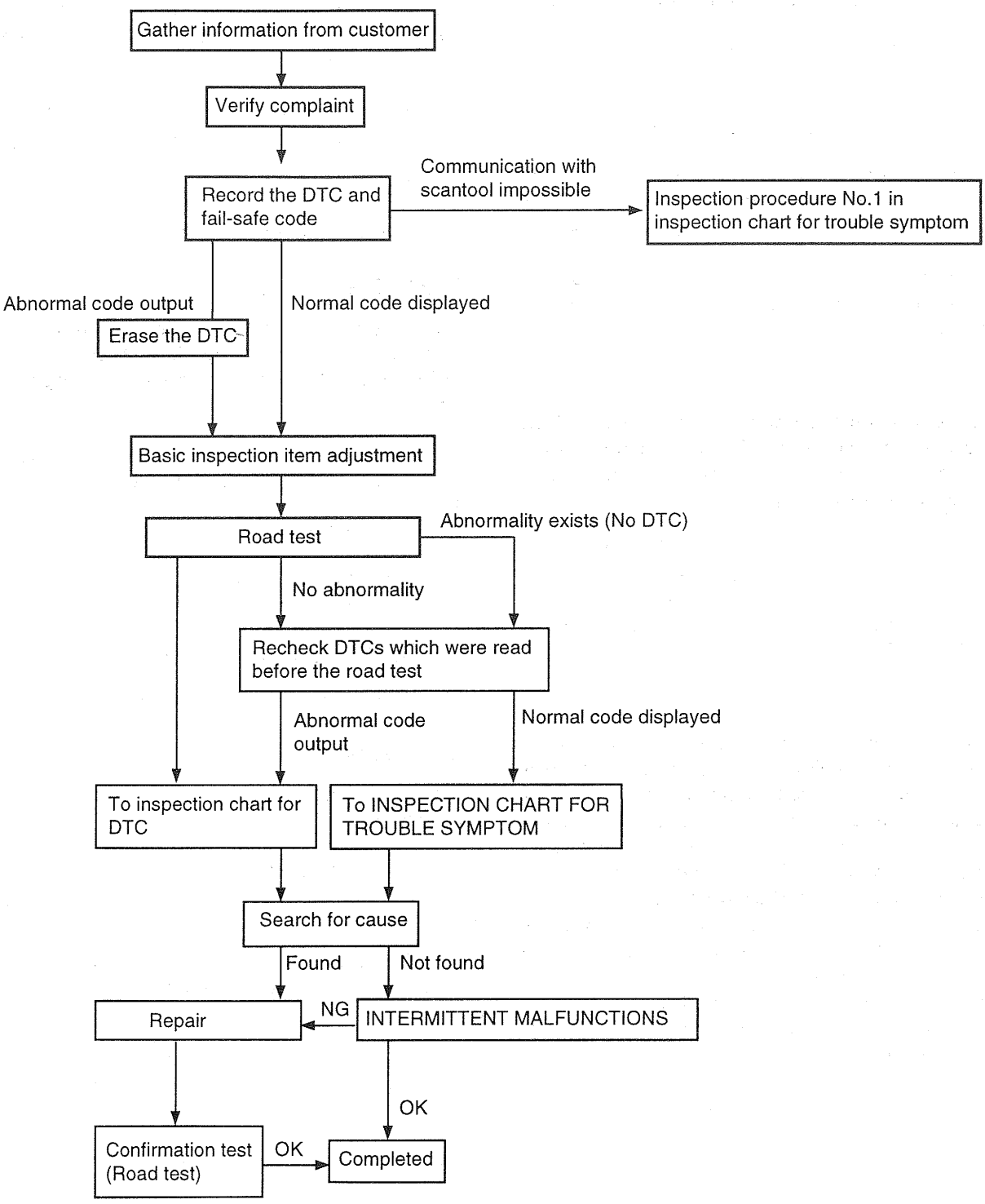
SPECIAL TOOLS

EKHA0060

Tool (Number and name)	Illustration	Use
09210-3A000 Engine support fixture adaptor	 EMHA005A	Removal and installation of transaxle (use with 09200-38000)
09200-38001 Engine support fixture	 D0038001	Removal and installation of transaxle.
09452-21001 Oil pressure gauge adapter	 EKAA006A	Measurement of the oil pressure. (use with 09452-21500 and 09452-21002)
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 09452-21002 and 09452-21002)

AUTOMATIC TRANSAXLE SYSTEM

TROUBLESHOOTING (A/T) EKA90070



EKA9007D

BASIC INSPECTION ITEM ADJUSTMENT EKHA0080

AUTOMATIC TRANSMISSION FLUID CHECK

1. Drive the vehicle until the fluid temperature rises to the normal temperature (70-80°C).
2. Park the vehicle on a levelled surface.
3. Move the selector lever through all positions to fill the torque converter and the hydraulic circuits with fluid, and then move the selector lever to the N position.
4. After wiping off any dirt around the oil level gauge, remove the oil level gauge and check the condition of the fluid.

NOTE

If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction materials, A transmission overhaul may be necessary.

5. Check that the fluid level is at the HOT mark on the oil level gauge. If the fluid level is lower than this, pour in more fluid until the level reaches the HOT mark. Automatic transmission fluid : GENUINE HYUNDAI ATF SP-II M.

NOTE

If the fluid level is low, the oil pump will draw in air along with the fluid, which will cause bubbles to form inside the hydraulic circuit. This will in turn cause the hydraulic pressure to drop, which will result in late shifting and slipping of the clutches and brakes. If there is too much fluid, the gears can churn it up into foam and cause the same conditions that can occur with low fluid levels. In either case, air bubbles can cause overheating and oxidation of the fluid which can interfere with normal valve, clutch, and brake operation. Foaming can also result in fluid escaping from the transmission vent, in which case it may be mistaken for a leak.

6. Insert the oil level gauge securely.
7. The fluid and the oil filters should always be replaced when overhauling the transmission or after the vehicle has been driven under severe conditions. The replacement procedures are given below. Furthermore, the oil filters are special filters which are only to be used for the automatic transmission.

AUTOMATIC TRANSMISSION FLUID

REPLACEMENT

If you have a fluid changer, use this changer to replace the fluid. If you do not have a fluid changer, replace the fluid by the following procedure.

1. Disconnect the hose which connects the transmission and the oil cooler (inside the radiator).
2. Start the engine and let the fluid drain out.

   Running conditions : N range with engine idling.

CAUTION

The engine should be stopped within one minute after it is started. If the fluid has all drained out before then, the engine should be stopped at that point.

3. Remove the drain plug from the bottom of the transmission case to drain the fluid.
4. Replace the oil filters.
5. Install the drain plug via the gasket, and tighten it the specified torque.

   Tightening torque : 32 Nm

6. Pour the new fluid in through the oil filler tube.

CAUTION

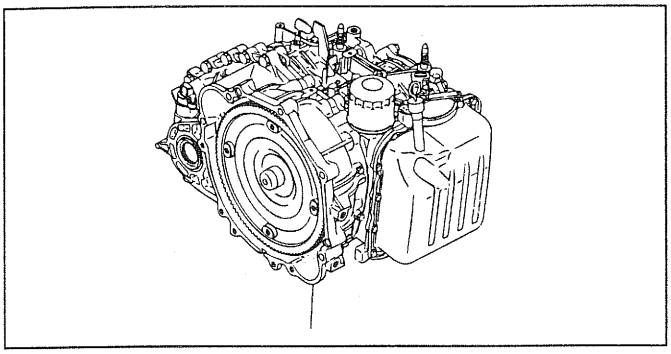
Stop pouring if the full volume of fluid cannot be poured in.

7. Repeat the procedure in step (2).

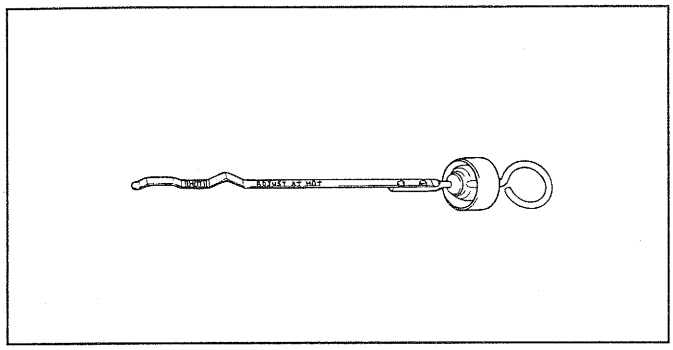
NOTE

Check the old fluid for contamination. If it has been contaminated, repeat the steps (6) and (7).

8. Pour the new fluid in through the oil filler tube.
9. Reconnect the hose which was disconnected in step (1) above, and firmly replace the oil level gauge.
10. Start the engine and run it at idle for 1-2 minutes.
11. Move the select lever through all positions, and then move it to the N position.
12. Drive the vehicle until the fluid temperature rises to the normal temperature (70-80°C), and then check the fluid level again. The fluid level must be at the HOT Mark.
13. Firmly insert the oil level gauge into the oil filler tube.



EKA9009E



EKA9059A

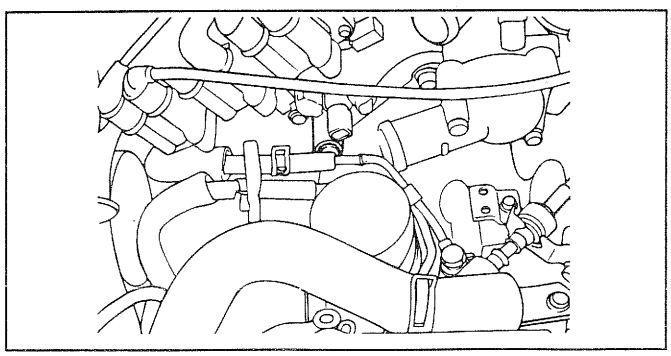
OIL FILTER REPLACEMENT

1. Remove the automatic transmission oil filter by filter wrench (chain, etc,) if available, after removing air cleaner assembly.
2. After removing, clean away automatic transaxle fluid, mud etc. adhered around the transaxle by cloth gloves or rags.
3. Clean the filter bracket side mounting surface.
4. Apply a small amount of automatic transmission fluid to the O-ring of the new oil filter.
5. Install the automatic transmission oil filter.

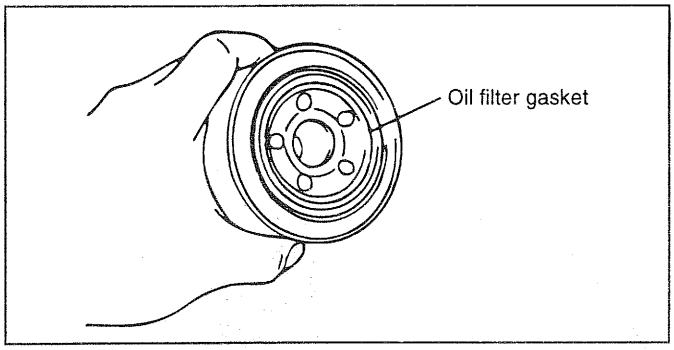
NOTE

Tightening torque : 11-13 Nm

6. Check the quantity of the automatic transmission fluid.



EKA9009C

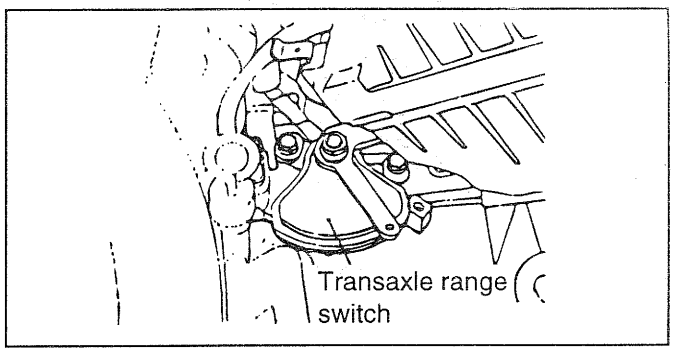


EKA9001A

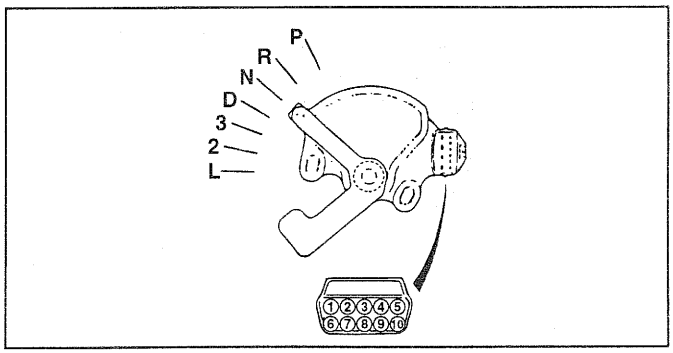
TRANSAXLE RANGE SWITCH CONTINUITY CHECK

Items	Terminal No.									
	6	5	4	3	2	1	10	9	8	7
P				○			○	○	○	
R									○	○
N			○				○	○	○	
D						○			○	
3		○							○	
2					○				○	
L	○								○	

EKAA008A



EKA9002A



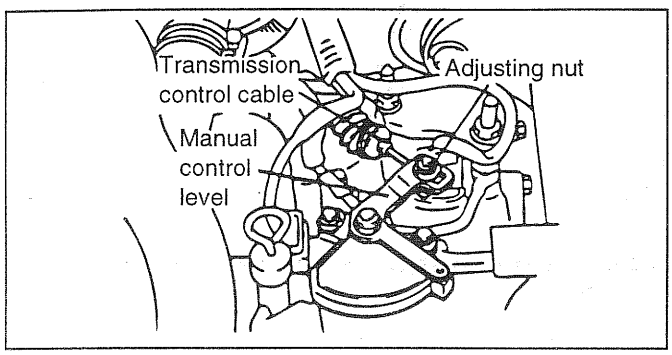
EKA9002B

TRANSAXLE RANGE SWITCH AND CONTROL CABLE ADJUSTMENT

1. Set the selector lever to the "N" position.

2. Loosen the control cable to manual control lever coupling nut to free the cable and lever.

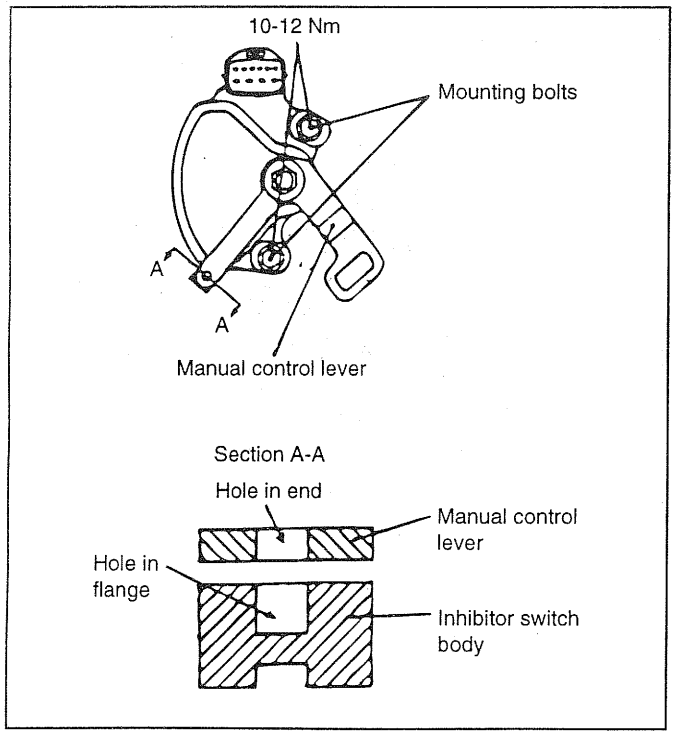
3. Set the manual control lever to the neutral position.



EKA9002C

4. Loosen the transaxle range switch body mounting bolts and then turn the transaxle range switch body so the hole in the end of the manual control lever and the hole (cross section A-A in the figure) in the flange of the transaxle range switch body flange are aligned.

5. Tighten the transaxle range switch body mounting bolts to the specified torque. Be careful at this time that the position of the switch body is not changed.

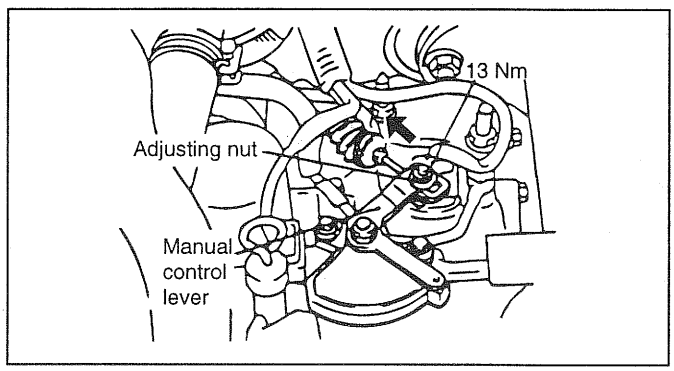


EKA9003A

6. Gently pull the transmission control cable in the direction of the arrow, and then tighten the adjusting nut.

7. Check that the selector lever is in the "N" position.

8. Check that each range on the transmission side operates and functions correctly for each position of the selector lever.



EKA9003B

A/T CONTROL COMPONENT CHECK

1. THROTTLE POSITION SENSOR CHECK.

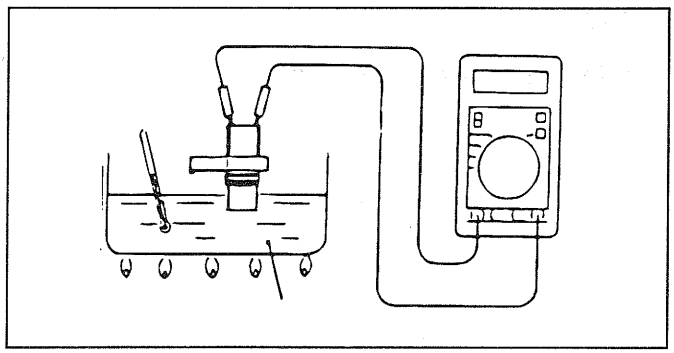
   The TP Sensor is a variable resistor type that rotates with the throttle body shaft to sense the throttle valve angle. As the throttle shaft rotates, the output voltage of the TP Sensor changes. The ECM detects the throttle valve opening based on voltage change. (Refer to FL-section).

2. OIL TEMPERATURE SENSOR CHECK

   a. Remove the oil temperature sensor.
   b. Measure the resistance between terminals No.1 and No.2 of the oil temperature sensor connector.

   Standard value :

Oil temperature (°C)	Resistance (KΩ)
0	16.7-20.5
100	0.57-0.69

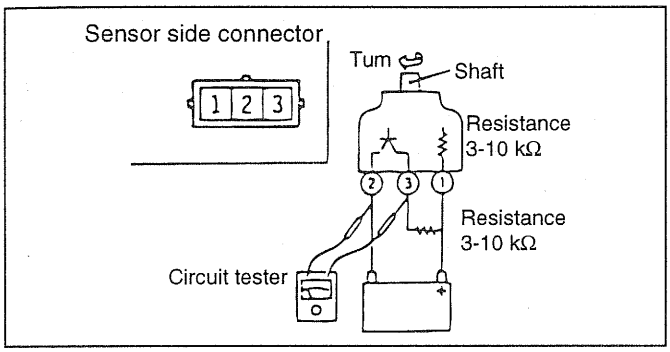


EKA9004A

3. VEHICLE SPEED SENSOR CHECK

   a. Remove the vehicle speed sensor and connect a 3-10 KΩ resistance as shown in the illustration.

b. Turn the shaft of the vehicle speed sensor and check that there is voltage between terminals 2-3 (1 turn=4 pulses).

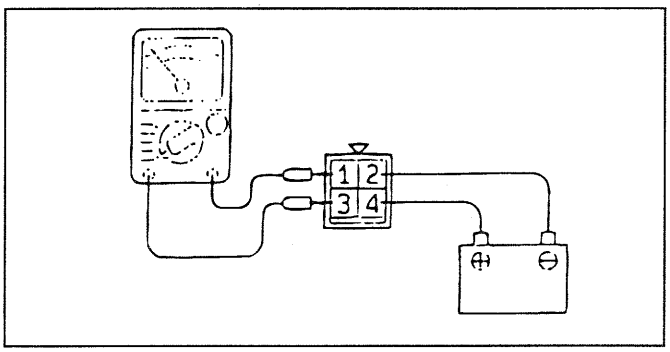


EKA9004B

4. A/T CONTROL RELAY CHECK

a. Remove the A/T control relay.
b. Use jumper wires to connect A/T control relay terminal (2) to the battery (-) terminal and terminal (4) to the battery (+) terminal.
c. Check the continuity between terminal (1) and terminal (3) of the A/T control relay when the jumper wires are connected to and disconnected from the battery.
d. If there is a problem, replace the A/T control relay.

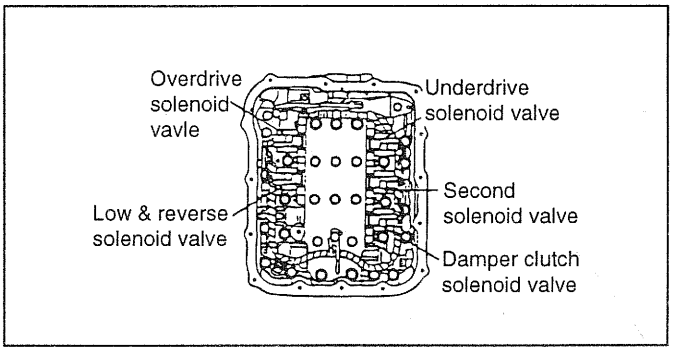
Jumper wire	Continuity between terminal No.1
Connected	Continuity
Disconnected	No continuity



EKA9005B

5. SOLENOID VALVE CHECK

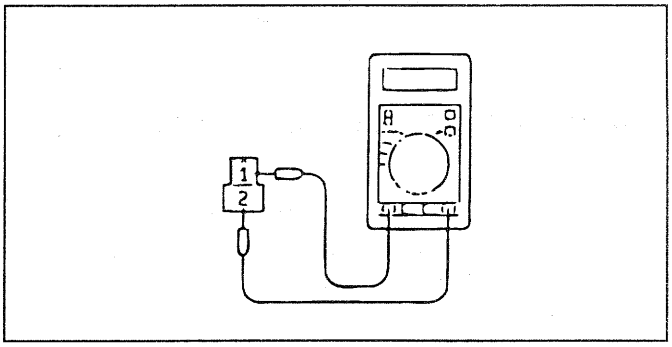
a. Remove the valve body cover.
b. Disconnect the connectors of each solenoid valve.



EKA9005C

c. Measure the resistance between terminals 1 and 2 of each solenoid valve.
Standard value :

Name	Resistance
Damper clutch solenoid valve	2.7-3.4 Ω (at 20°C)
Low and reverse solenoid valve	
Second solenoid valve	
Underdrive solenoid valve	
Overdrive solenoid valve	



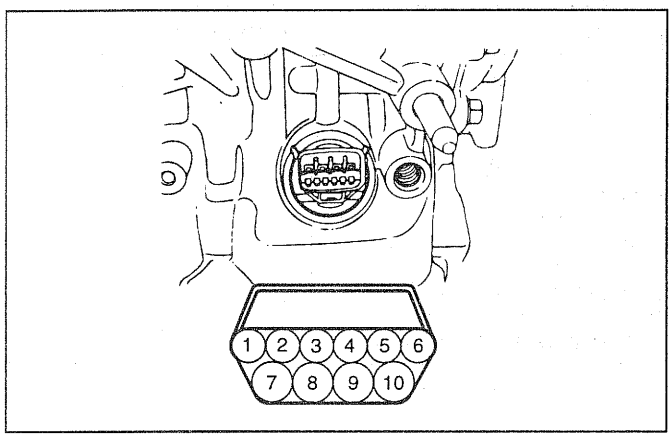
EKA9005D

d. If the resistance is outside the standard value, replace the solenoid valve.

NOTE

Resistance of the solenoid valve connector.

Terminal No.	Name	Resistance
7 & 10	Damper clutch solenoid valve	2.7-3.4 Ω (at 20°C)
10 & 6	Low and reverse solenoid valve	
9 &4	Second solenoid valve	
9 & 3	Underdrive solenoid valve	
9 & 5	Overdrive solenoid valve	



EKA9017B

TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the selector lever is at the D or R position. The torque converter stalls to test the operation of the torque converter, starter motor, one-way clutch operation, the holding performance of the clutches, and brakes in the transmission.

CAUTION

Do not let anybody stand in front of or behind the vehicle while this test is being carried out.

a. Check the automatic transmission fluid level and temperature and the engine coolant temperature.
   - Fluid level : At the HOT mark on the oil level gauge
   - Fluid temperature : 80-100°C
   - Engine coolant temperature : 80-100°C

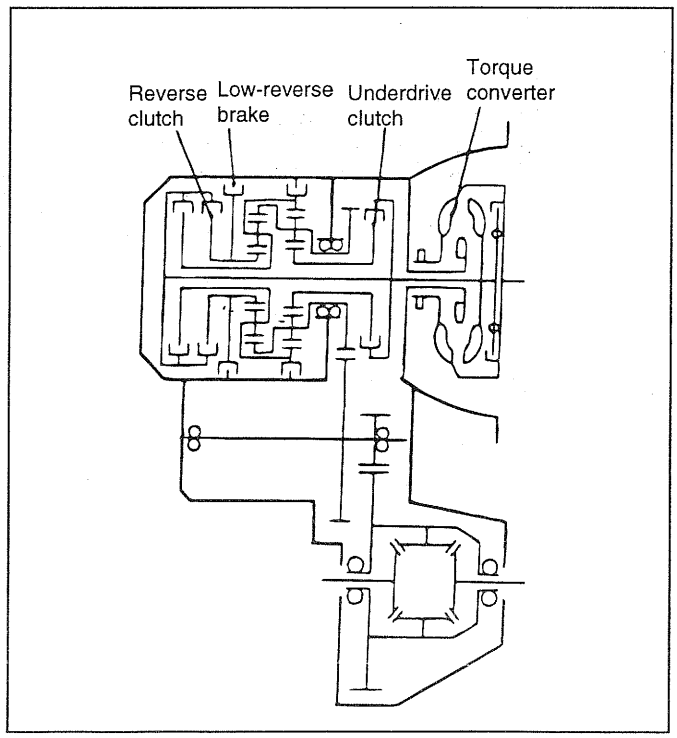
b. Check both rear wheels (left and right).
c. Pull the parking brake lever on with the brake pedal fully depressed.
d. Start the engine.
e. Move the selector lever to the D position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

CAUTION

1. **The throttle should not be left fully open for any more than eight seconds.**
2. **If carrying out the stall test two or more times, move the selector lever to the n position and run the engine at 1,000 r/min to let the automatic transmission fluid cool down before carrying out subsequent tests.**
   Standard value
   Stall speed : 2,000–2,900 r/min
3. **Move the selector lever to the R position and carry out the same test again.**
   Standard value Stall speed : 2,000–2,900 r/min

TORQUE CONVERTER STALL TEST JUDGEMENT RESULTS

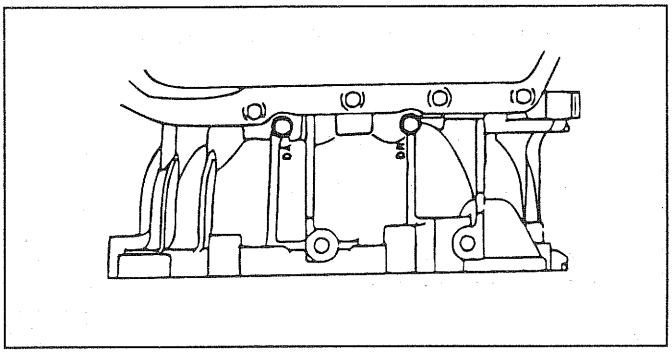
1. Stall speed is too high in both D and R ranges
   - Low line pressure
   - Low & reverse brake Slippage
2. Stall speed is too high in D range only
   - Underdrive clutch slippage
3. Stall speed is too high in R range only
   - Reverse clutch slippage
4. Stall speed too low in both D and R ranges
   - Malfunction of torque converter
   - Insufficient engine output



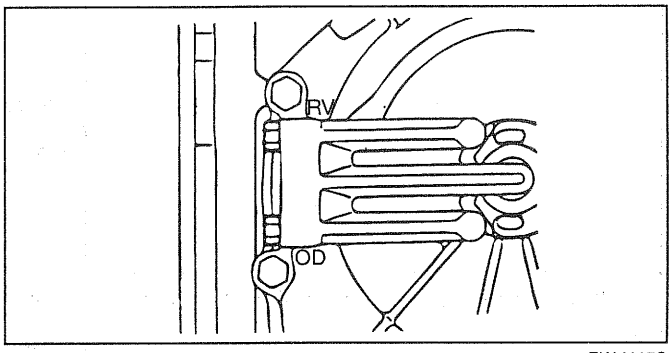
EKA9006A

HYDRAULIC PRESSURE TEST

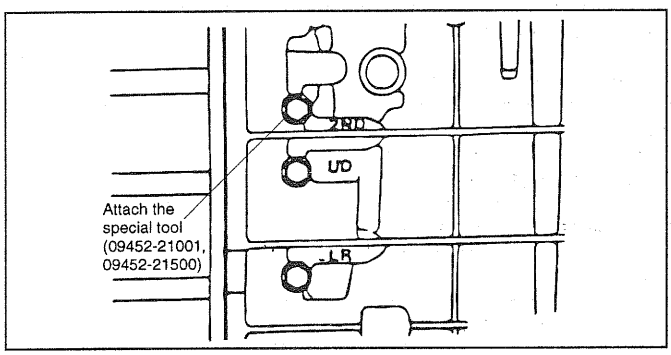
1. Warm up the engine until the automatic transmission fluid temperature is 80-100°C.
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the special tools (oil pressure gauge) to each pressure discharge port.
4. Measure the hydraulic pressure at each port under the conditions given in the standard hydraulic pressure table, and check that the measured values are within the standard value ranges.
5. If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.



EKA9007B



EKA9007C



EKA9007A

STANDARD HYDRAULIC PRESSURE TEST

Measurement condition			Standard hydraulic pressure kPa						
Selector lever position	Shift position	Engine speed (rpm)	Under drive clutch pressure(UD)	Reverse clutch pressure(REV)	Over-drive clutch pressure(OD)	Low and reverse brake pressure(LR)	Second brake pressure(2ND)	Damper clutch apply pressure(DA)	Damper clutch release pressure(DR)
P	-	2,500	-	-	-	310-390	-	-	-
R	Reverse	2,500	-	1,270-1,770	-	1,270-1,770	-	-	-
N	Neutral	-	-	-	-	310-390	-	-	-
D	1st gear	2,500	1,010-1,050	-	-	1,010-1,050	-	-	-
	2nd gear	2,500	-	-	-	-	1,010-1,050	-	-
	3rd gear	2,500	-	-	-	-	-	More than 7.5	0-0.1
	4th gear	2,500	-	-	-	-	590-690	More than 7.5	0-0.1

HYDRAULIC PRESSURE TEST DIAGNOSIS TABLE

Trouble symptom	Probable cause
All hydraulic pressures are high	Incorrect transmission control cable adjustment
	Malfunction of the regulator valve
All hydraulic presures are low	Incorrect transmission control cable adjustment
	Malfunction of the oil pump
	Clogged internal oil filter
	Clogged external oil filter
	Clogged oil cooler
	Malfunction of the regulator valve
	Malfunction of the relief valve
	Incorrect valve body installation
Hydraulic pressure is abnormal in "R" range only	Malfunction of the regulator valve
	Clogged orifice
	Incorrect valve body installation
Hydraulic pressure is abnormal in "3" or "4" range only	Malfunction of the regulator valve
	Clogged orifice
	Incorrect valve body installation
	Malfunction of the overdrive solenoid valve
	Malfuction of the overdrive pressure control valve
	Malfunction of the regulator valve
	Malfunction of the switch valve
	Clogged orifice
	Incorrect valve body installation
Only underdrive hydraulic pressure is abnormal	Malfunction of the oil seal K
	Malfunction of the oil seal L
	Malfunction of the oil seal M
	Malfunction of the underdrive solenoid valve
	Malfunction of the underdrive pressure control valve
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal	Malfunction of the oil seal A
	Malfunction of the oil seal B
	Malfunction of the oil seal C
	Clogged orifice
	Incorrect valve body installation

Trouble symptom	Probable cause
Only overdrive hydraulic pressure is abnormal	Malfunction of the oil seal D
	Malfunction of the oil seal E
	Malfunction of the oil seal F
	Malfunction of the overdrive solenoid valve
	Malfunction of the overdrive pressure control valve
	Malfunction check ball
	Clogged orifice
	Incorrect valve body installation
Only low and reverse hydraulic pressure is abnormal	Malfunction of the oil seal I
	Malfunction of the oil seal J
	Malfunction of the low and reverse solenoid valve
	Malfunction of the low and reverse pressure control valve
	Malfunction of the switch valve
	Malfunction of the fail safe valve A
	Malfunction of check ball
	Clogged orifice
	Incorrect valve body installation
Only second hydraulic pressure is abnormal	Malfunction of the oil seal G
	Malfunction of the oil seal H
	Malfunction of the oil seal O
	Malfunction of the second solenoid valve
	Malfunction of the second pressure control valve
	Malfunction of the fail safe valve B
	Clogged orifice
	Incorrect valve body installation
Only reverse clutch hydraulic pressure is abnormal	Malfunction of the oil cooler
	Malfunction of the oil seal N
	Malfunction of the damper clutch control solenoid valve
	Malfunction of the damper clutch control valve
	Malfunction of the torque converter pressure control valve
	Clogged orifice
Pressure applied to non operating element	Incorrect valve body installation
	Incorrect transmission control cable adjustment
	Malfunction of the manual valve
	Malfunction of check ball
	Incorrect valve body installation

DIAGNOSIS FUNCTION EKAA0090

1. Connect HI-SCAN to the connector for diagnosis.

2. Read the output diagnostic trouble codes. Then follow the remedy procedures according to the "DIAGNOSTIC TROUBLE CODE DESCRIPTION" on the following page.

NOTE

- **A maximum of 8 diagnostic trouble codes (in the sequence of occurrence) can be stored in the Random Access Memory (RAM) incorporated within the control module.**
- **The same diagnostic trouble code can be stored at one time.**
- **If the number of stored diagnostic trouble codes or diagnostic trouble patterns exceeds 8, already stored diagnostic trouble codes will be erased in sequence, beginning with the oldest.**
- **Do not disconnect the battery until all diagnostic trouble codes or diagnostic trouble patterns have been read out, because all stored diagnostic trouble codes or diagnostic trouble patterns will be cancelled when the battery is disconnected.**

3. If the fail-safe system is activated and the transaxle is locked in third gear, the diagnostic trouble code in the Fail-safe code description will be stored in the RAM. Three of these diagnostic trouble codes can be stored.

4. The cancelation will occur if, with the transaxle locked in third gear, the ignition key is turned to the OFF position, but the diagnostic trouble code is stored in the RAM.

5. Memorization.

   - Up to 8 diagnosis items and 3 fail-safe items can be memorized.
   - If the memory capacity is exceeded, diagnosis and fail-safe items in the memory are overwritten, starting with the oldest.
   - No code can be memorized more than once.

6. Diagnosis Code Deletion.

   1) Automatic Deletion

      All diagnosis codes are deleted from memory the 200 th time the ATF temperature reaches 50°C after memorization of the most recent diagnosis code.

   2) Forced Deletion.

      Memorized diagnosis codes can be deleted using the SCAN-TOOL provided the following conditions are satisfied :

      - The ignition switch is ON
      - There is no detection pulse from the crank angle sensor
      - There is no detection pulse from the output shaft speed sensor
      - There is no detection pulse from the vehicle speed sensor
      - The fail-safe function is not operational

EKHA0100

ROAD TEST

No	Condition	Operation	Judgement : Value	Check item
1	Ignition switch : OFF	Ignition switch 1. ON	Battery voltage (mV)	Control relay
2	Ignition switch : ON Engine : Stoped Select lever position : P	Selector lever position 1. P, (2) R, 2. N, (4) D 3. 3, (6) 2, (7) L	(1) P, (2) R, (3) N, (4) D, (5) 3, (6) 2 (7) L	Transaxle range switch
		Accelerator pedal 1. Released 2. Half depressed 3. Depressed	1. 400-1,000 mV 2. Gradually rises from (1) 3. 4,500-5,000 mV	Throttle position sensor
		Brake pedal • Depressed • Released		Stop lamp switch

No	Condition	Operation	Judgement : Value	Check item
3	Ignition switch : ST Engine : Stopped	Starting test with lever P or N range	Starting should be possible	Starting possible or impossible
4	Warming up	Drive for 15 minutes or more so that the automatic fluid temperature becomes 70-90°C	Gradually rises to 70-90°C	Oil temperature sensor
5	Engine : Idling Selector lever position : N	A/C switch 1. ON 2. OFF	1. ON 2. OFF	Dual pressure switch
		Accelerator pedal 1. Released 2. Half depressed	1. ON 2. OFF	Idle position
			1. 650-900 rpm 2. Gradually rises form (1)	
			1. Data changes	Communication with engine-ECU
		Selector lever position 1. N → D 2. N → R	Should be no abnormal shifting shocks Time lag should be within 2 seconds	Malfunction when starting
				Malfunction when starting
6	Selector lever position : N (Carry out on a flat and straight road)	Selector lever position and vehicle speed 1. Idling in L range (Vehicle stopped) 2. Driving at constant speed of 20 km/h L position 3. Driving at constant speed of 30 km/h in 2 position 4. Driving at 50 km/h in 3 position with accelerator fully closed 5. Driving at constant speed of 50 km/h in D position (Each condition 6. Should be maintained for 10 seconds or more)	(2) 1st, (4) 3rd, (3) 2nd, (6) 4th	Shift condition
			(2) 0%, (4) 100%, (3) 100%, (6) 100%	Low and reverse solenoid valve
			(2) 0%, (4) 0%, (3) 0%, (6) 100%	Underdrive solenoid valve
			(2)100%, (4)0%, (3) 100%, (6) 0%	Second solenoid valve
			(2) 100%, (3) 100%, (4)0%, (6) 0%	Overdrive solenoid valve
			(1) 0 km/h (4) 50 km/h	Vehicle speed sensor
			(4) 1,800-2,100 rpm	Input shaft speed sensor
			(4) 1,800-2,100 rpm	Output shaft speed sensor
7	Selector lever position : 3 (Carry out on a flat and straight road)	Selector lever position and vehicle speed 1. Releasing the accelerator pedal fully while driving at 50 km/h in 3rd gear 2. Driving at constant speed of 50 km/h in 3rd gear	(3) 0% (5) Approx. 70-90%	Damper clutch control solenoid valve
			(3) Approx. 100-300 rpm (5) Approx. 0-10 rpm	

No	Condition	Operation	Judgement : Value	Check item
8	Seletor lever position : D (Carry out on a flat and straight road)	1. Accelerator to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). 2. Gently decelerate to a standstill 3. Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). 4. While driving at 60 km/h in 4th gear, shift down to 3 range. 5. While driving at 40 km/h in 3rd gear, shift down to 2 range. 6. While driving at 20 km/h in 2nd gear, shift down to L range.	For (1),(2), and (3), the reading should be the same as the specified output shaft torque, and no abnormal shocks should occur. For (4),(5), and (6), downshifting should occur immediately after the shifting operation is made.	Malfunction when shifting Displaced shift points Does not shift Does not shift from 1 to 2 or 2 to 1 Does not shift from 2 to 3 or 3 to 2
	Selector lever position : D (Carry out on a flat and straight road).	1. Accelerate to 4th gear at a throttle position sensor output of 1.5V (accelerator opening angle of 30 %). 2. Gently decelerate to a standstill 3. Accelerate to 4th gear at a throttle position sensor output of 2.5 V (accelerator opening angle of 50%). 4. While driving at 60 km/h in 4th gear, shift down to 3 range. 5. While driving at 40 km/h in 3rd gear, shift down to 2 range. 6. While driving at 20 km/h in 2nd gear, shift down to L range.	For (1),(2), and (3), the reading should be the same as the specified output shaft torque, and no abnormal shocks should occur. For (4),(5), and (6), downshifting should occur immediately after the shifting operation is made.	Does not shift from 3 to 4 or 4 to 3

No	Condition	Operation	Judgement : Value	Check item
9	Selector lever position : N (Carry out on a flat and straight road).	Move selector lever to R range drive at constant speed of 10 km/h	The ratio between input and output speed sensor data should be the same as the gear ratio when reversing.	Does not shift

DIAGNOSTIC TROUBLE CODE DESCRIPTION

EKA90110

DTC No	Diagnosis item		Probable cause
P1704	Throttle position sensor	Short circuit	TPS output > 4.8 V with engine idling
P1703		Open circuit	TPS output<0.2V with engine not idling
P1702		Sensor Maladjustment	TPS output < 0.2V or >1.2V with engine idling
P0713	Fluid temperature sensor	Open circuit	Oil temperature sensor output > 4.57 V for 1 second or longer (oil temperature does not increase)
P0712		Short circuit	Output < 0.49V for 1 second
P0725	CKP sensor	Open circuit	No crank angle sensor output > pulse detected for 5 seconds at vehicle speed of 25 km/h
P0715	Input speed sensor	Short circuit/open circuit	No input speed sensor output pulse detected for > 1 second at vehicle speed of > 30 km/h
P0720	Output speed sensor	Short circuit/open circuit	At vehicle speed of > 30 km/h, output speed sensor output < 50% of vehicle speed sensor output for > 1 second. At vehicle speed of 6 km/h, stop lamp switch is ON continuously for 5 minutes
P0703	Stop lamp switch	Short circuit/open circuit	With relay voltage > 10V, open or short circuit is continuously for 5 minutes
P0750	LR solenoid valve	Short circuit/open circuit	With relay voltage>10V, open or short circuit is continuously for 5 minutes.
P0755	UD solenoid valve	Short circuit/open circuit	
P0760	2nd solenoid valve	Short circuit/open circuit	
P0765	UD solenoid valve	Short circuit/open circuit	
P0743	TCC solenoid valve	Short circuit/open circuit	
P0731	Gear shift incomplete	1st	After gear shift, output shaft speed sensor output x gear ratio of new gear= input shaft speed sensor output
P0732		2nd	
P0733		3rd	
P0734		4th	
P0736		Reverse	

DTC No	Diagnosis item		Probable cause
P1749	Serial communication	Short circuit/open circuit	With ignition ON, battery voltage > 10V, and engine speed > 450 r/min, communication is continuously irregular for 1 second or communication error signal is received for > 4 seconds continuously
P0740	TCC solenoid valve	System defect/stuck on	DCC solenoid valve drive duty ratio is 100% for 4 seconds continuously
P1723	A/T control relay	Earth short circuit/open circuit	After ignition ON, A/T control relay voltage < 7V
P0707	Transaxle range switch	Open circuit	No signal is continuous for > 30 seconds
P0708		Short circuit	Above 2 kinds signals are continuous for 30 seconds
P1630	CAN-BUS OFF	TCU Fail/open/short	Receive BUS-OFF information from CAN CONTROLLER
P1631	CAN-TIME OUT ECU	ECU Fail/open/short	No output signal for 1.5 second
P1764	CAN CONTROLLER CIRCUIT	Circuit mal-function	Communication error output is continuously for > 1 second

INSPECTION CHART FOR DIAGNOSIS CODES

EKHA0120

Code	Diagnosis item		Probable cause
P1704	**Throttle position sensor system** If the TPS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnosis code P1704 is the output. If the TPS output voltage is 0.2 V or lower at times other than when the engine is idling the output is judged to be too low and diagnosis code P1703 is the output. If the TPS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS adjustment is judged to be incorrect and diagnosis code P1702 is the output.	Short circuit	Malfunction of the throttle position sensor Malfunction of connector Malfunction of the TCM
P1703		Open circuit	
P1702		Sensor Maladjustment	
P0713 P0712	**Fluid temperature sensor system** If the fluid temperature sensor output voltage is 4.57 V or more even after driving for 10 minutes or more (if the fluid temperature does not increase), it is judged that there is an open circuit in the fluid temperature sensor and diagnosis code P0713 is the output.	Open circuit	Malfunction of the oil temperature sensor Malfunction of connector Malfunction of the TCM

Code	Diagnosis item		Probable cause
P0725	**CKP sensor system** If no output pulse is detected from the crank angle sensor for 5 seconds or more while driving at 25 km/h or more, it is judged that there is an open circuit in the crank angle sensor and diagnosis code P0725 is the output.	Open circuit	Malfunction of the crank angle sensor Malfunction of connector Malfunction of the TCM
P0715	**Input speed sensor system** If no output pulse is detected from the input shaft speed sensor for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, there is judged to be an open circuit or short. Circuit in the input shaft speed sensor and diagnosis code P0715 is the output. If diagnosis code P0715 is the output four times, the transmission is locked into 3rd gear (D range) or 2nd gear as a fail-safe measure.	Short circuit/open circuit	Malfunction of the input shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of connector Malfunction of the TCM
P0720	**Output speed sensor system** If the output from the output shaft speed sensor is continuously 50% lower than the vehicle speed for 1 second or more while driving in 3rd or 4th gear at a speed of 30 km/h or more, there is judged to be an open circuit or short-circuit in the output shaft speed sensor and diagnosis code P0720 is output. If diagnosis code P0720 is output four times, the transmission is locked into 3rd gear (D range) or 2nd gear as a fail-safe measure, and the N range lamp flashes at a frequency of 1 Hz.Malfunction of the input shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of connector Malfunction of the TCM	Short circuit/open circuit	Malfunction of the wide open throttle switch Malfunction of connector Malfunction of the TCM Malfunction of solenoid valve Malfunction of connector Malfunction of the TCM
P0703	**Stop lamp switch system** If the stop lamp switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop lamp switch and diagnosis code P0703 is the output.	Short circuit/open circuit	Malfunction of the stop lamp switch Malfunction of connector Malfunction of the TCM
P0750	**Low and reverse solenoid valve system**	Short circuit/Open circuit	Malfunction of solenoid valve Malfunction of connector Malfunction of the TCM
P0755	**Underdrive solenoid valve system**	Short circuit/Open circuit	
P0760	**Second solenoid valve system**	Short circuit/Open circuit	
P0765	**Overdrive solenoid valve system** If the resistance value for a solenoid valve is tool large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure.	Short circuit/Open circuit	

Code	Diagnosis item		Probable cause
P0743 P0740	**Torque converter clutch solenoid valve system** If the resistance value for a solenoid valve is tool large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnosis code is output. The transmission is locked into 3rd gear as a fail-safe measure.	Short circuit/Open circuit Defective system	Malfunction of solenoid valve Malfunction of connector Malfunction of the TCM
P0731	**1st gear ratio does not meet the specification** If the output from the output shaft speed sensor multiplied by the 1st gear ratio is not the same as the output from the input shaft speed sensor after shifting to 1st gear has been completed, diagnosis code P0731 is the output. If diagnosis code P0731 is output four times, the transmission is locked into 3rd gear as a fail-safe measure.		Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the low ad reverse brake system Malfunction of the underdrive clutch system Noise generated
P0732	**2nd gear ratio does not meet the specification** If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code P0732 is the output. If diagnosis code P0732 is the output four times, the transmission is locked into 3rd gear as a fail-safe measure.		Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear malfunction of the underdrive clutch system Malfunction of the overdrive clutch system Noise generated
P0733	**3rd gear ratio does not meet the specification** If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 3rd gear has been completed, diagnosis code P0733 is the output. If diagnosis code P0733 is the output four times, the transmission is locked into 3rd gear as a fail-safe measure.		Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer alfunction of the transfer drive gear or driven gear malfunction of the second brake system Malfunction of the overdrive clutch system Noise generated

Code	Diagnosis item		Probable cause
P0734	**4th gear ratio does not meet the specification** If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnosis code P0734 is the output. If diagnosis code P0734 is the output four times, the transmission is locked into 3rd gear as a fail-safe measure.		Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the low and reverse brake system Malfunction of the reverse clutch system Noise generated
P0736	**Reverse gear ratio does not meet the specification** If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnosis code P0736 is the output. If diagnosis code P0736 is the output four times, the transmission is locked into 3rd gear as a fail-safe measure.		Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the low and reverse brake system Malfunction of the reverse brake system Malfunction of the reverse clutch system Noise generated
P1749	**Serial communication** If normal communication is not possible for a continuous period of 1 second or more when the ignition switch is at the ON position, the battery voltage is 10 V ore more and the engine speed is 450 r/min or more, diagnosis code No.51 is the output. Diagnosis code No.51 is also output if the data being received is abnormal for a continuous period of 4 seconds under the same conditions.		Malfunction of connector Malfunction of the engine-ECU Malfunction of the TCM
P1723	**A/T control relay system** If the A/T control relay voltage is less than 7 V after the ignition switch has been turned ON, it is judged that there is an open circuit or a short-circuit in the A/T control relay earth and iagnosis code P1723 is the output. Then the transmission is locked into 3rd gar as a fail-safe measure.	Short circuit to earth/ Open circuit	Malfunction of the A/T control relay Malfunction of connector Malfunction of the TCM
P0707	**Transaxle range switch**	Open circuit	No signal is continuous for > 30 seconds
P0708		Short circuit	Above 2 kinds signals are continuous for 30 seconds
P1630	**CAN-BUS OFF** • No 3 speed hold fail • No PGA, B fail • Battry voltage > 10V continuously for 0.5 second • No engine stop • Receive BUS OFF information from CAN CONTROLLER		• TCM Fail • TCM side open & short

Code	Diagnosis item	Probable cause
P1631	**CAN-TIME OUT ECM** • No 3 speed hold fail • No PGA, B fail o Battry voltage > 10V continuously for 0.5 second • No engine stop • No output signal for 1.5 second	• ECM fail • ECM side open & short
P1764	**TCM CAN CAN CONTROLLER** • No 3 speed hold fail • No PGA, B fail • Battry voltage > 10V continuously for 0.5 second • No engine stop • Communication error output is continuously for > 1 second	• CAN CONTROLLER circuit malfunction

INSPECTION CHART FOR THROUBLE SYMPTOMS

EKA90130

Trouble symptom		Probable cause
Communication with HI-SCAN is not possible If communication with the HI-SCAN is not possible, the cause is probably a defective diagnosis line or the **TCM** is not functioning.		Malfunction diagnosis line Malfunction of connector Malfunction of the TCM
Driving impossible	**Starting impossible** Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump.	Malfunction of the engine system Malfunction of the torque converter Malfunction of the oil pump
	Does not move forward If the vehicle does not move forward when the selector lever is shifted from N to D,3,2 or L range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	Abnormal line pressure Malfunction of the underdrive solenoid valve Malfunction of the underdrive clutch Malfunction of the valve body
	Does not reverse If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	Abnormal reverse clutch pressure Abnormal low and reverse brake pressure Malfunction of the low and reverse brake solenoid valve Malfunction of the reverse clutch Malfunction of the low and reverse brake Malfunction of the valve body
	Does not move (forward or reverse) If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the power train, oil pump or valve body.	Abnormal line pressure Malfunction of power train Malfunction of the oil pump Malfunction of the valve body

Trouble symptom		Probable cause
Malfunction when starting	**Engine stalling when shifting** If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, damper clutch solenoid valve, valve body or torque converter (damper clutch malfunction).	Malfunction of the engine system Malfunction of the damper clutch control solenoid valve Malfunction of the valve body Malfunction of the torque converter (Malfunction of the damper clutch)
	Shocks when changing from N to D and large time lag If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or idle position switch.	Abnormal underdrive clutch pressure Abnormal low and reverse brake pressure Malfunction of the underdrive solenoid valve Malfunction of the valve body Malfunction of the idle position switch
Malfunction when starting	Shocks when changing from N to R and large time lag. If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or idle position switch.	Abnormal reverse clutch pressure Abnormal low and reverse brake pressure Malfunction of the low and reverse solenoid valve Malfunction of the reverse clutch Malfunction of the low and reverse brake Malfunction of the valve body Malfunction of the idle position switch
	Shocks when changing from N to D, N to R and large time lag. If abnormal shocks or a time lag of 2 seconds or more occur when the selector lever is shifted from N to D range and from N to R range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the oil pump or valve body.	Abnormal line pressure Malfunction of the oil pump Malfunction of the valve body
Malfunction when shifting	Shocks and running up. If shocks occur when driving due to upshifting or downshifting and the transmission speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	Abnormal line pressure Malfunction of each solenoid valve Malfunction of the oil pump Malfunction of the valve body Malfunction of each brake or each clutch
Displaced shifting points	All points. If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or of a solenoid valve.	Malfunction of the output shaft speed sensor Malfunction of the throttle position sensor Malfunction of each solenoid valve Abnormal line pressure Malfunction of the valve body Malfunction of the TCM
	Some points. If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	Malfunction of the valve body
Does not shift	No diagnosis codes. If shifting does not occur while driving and no diagnosis codes are output, the cause is probably a malfunction of the transaxle range switch, or TCM	Malfunction of the transaxle range Malfunction of the TCM

Trouble symptom		Probable cause
Malfunction while driving	Poor a acceleration. If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	Malfunction of the engine system Malfunction of the brake of clutch
Malfunction while driving	Vibration. If vibration occurs when driving at constant speed or when accelerating and deceleration in top range, the cause is probably abnormal damper clutch pressure or a malfunction of the engine system, damper clutch control solenoid valve, torque converter or valve body.	Abnormal damper clutch pressure Malfunction of the engine system Malfunction of the damper clutch control solenoid valve Malfunction of the torque converter Malfunction of the valve body
Transaxle range switch system. The cause is probably a malfunction of the inhibitor switch circuit, ignition switch circuit or a defective TCM.		Malfunction of the transaxle range switch Malfunction of the ignition switch Malfunction of connector Malfunction of the TCM
Idle position switch system. The cause is probably a defective idle position switch circuit, or a defective TCM.		Malfunction of the dual pressure switch Malfunction of connector Malfunction of the TCM
Dual pressure switch system. The cause is probably a defective dual pressure switch circuit or a defective TCM.		Malfunction of the dual pressure switch Malfunction of connector Malfunction of A/C system Malfunction of the TCM
Vehicle speed sensor system. The cause is probably a defective vehicle speed sensor circuit or a defective TCM.		Malfunction of the vehicle speed sensor Malfunction of connector Malfunction of the TCM

ELEMENT IN USE AT EACH POSITION OF SELECTOR LEVER

EKA90140

Operating element / Selector lever position		Underdrive clutch (UD)	Reverse clutch (REV)	Overdrive clutch (OD)	low-and reverse brake (LR)	Second brake (2nd)
P	Parking	-	-	-	O	-
R	Reverse	-	O	-	O	-
N	Neutral	-	-	-	O	-
D	1st	O	-	-	O	-
	2nd	O	-	-	-	O
	3rd	O	-	O	-	-
	4th	-	-	O	-	O
3	1st	O	-	-	O	-
	2nd	O	-	-	-	O
	3rd	O	-	O	-	-
2	1st	O	-	-	O	-
	2nd	O	-	-	-	O
L	1st	O	-	-	O	-

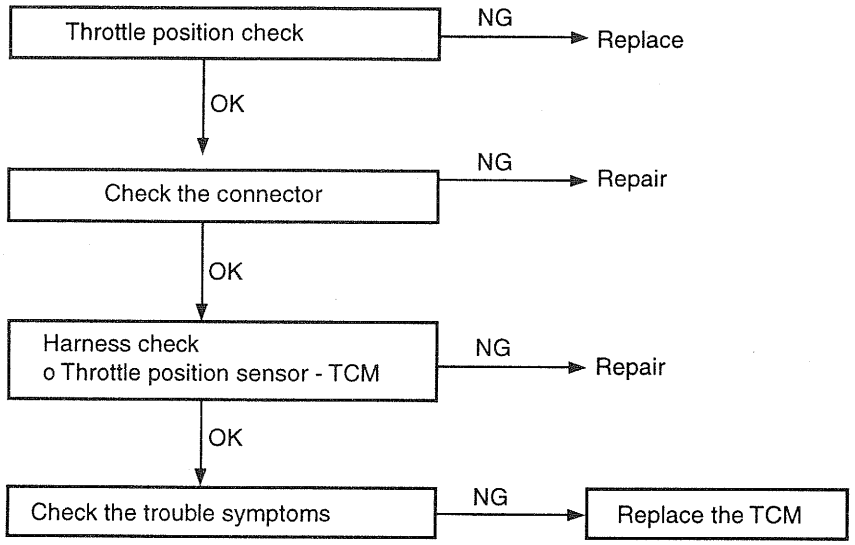
OPERATING ELEMENT AND THEIR FUNCTIONS

Operating element	Code	Function
Underdrive clutch	UD	Connects input shaft underdrive sun gear
Reverse clutch	REV	Connects input shaft and reverse sun gear
Overdrive clutch	OD	Connects input shaft and overdrive planetary carrier
Low-and-reverse brake	LR	Locks low-and-reverse annulus gear and overdruve planetary carrier
Second brake	2ND	Locks reverse sun gear

INSPECTION PROCESS FOR DIAGNOSTIC TROUBLE CODES

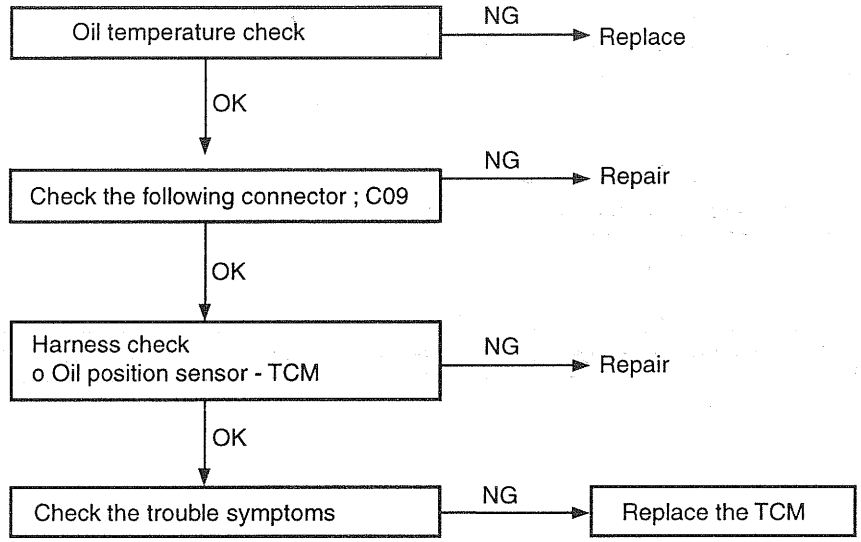
EKHA0270

Code No. P1704,P1703,P1702 throttle position sensor system	Probable cause
If the TPS output voltage is 4.8 V or higher when the engine is idling, the output is judged to be too high and diagnostic trouble code No.P1704 is the output. If the TPS output voltage is 0.2 V or lower at times other than when the engine is idling, the output is judged to be too low and diagnostic trouble code and No.P1703 is the output. If the TPS output voltage is 0.2 V or lower or if it is 1.2 V or higher when the engine is idling, the TPS adjustment is judged to be incorrect and diagnostic trouble and code No.P1702 is the output.	Malfunction of the throttle position sensor Malfunction of connector Malfunction of the TCM



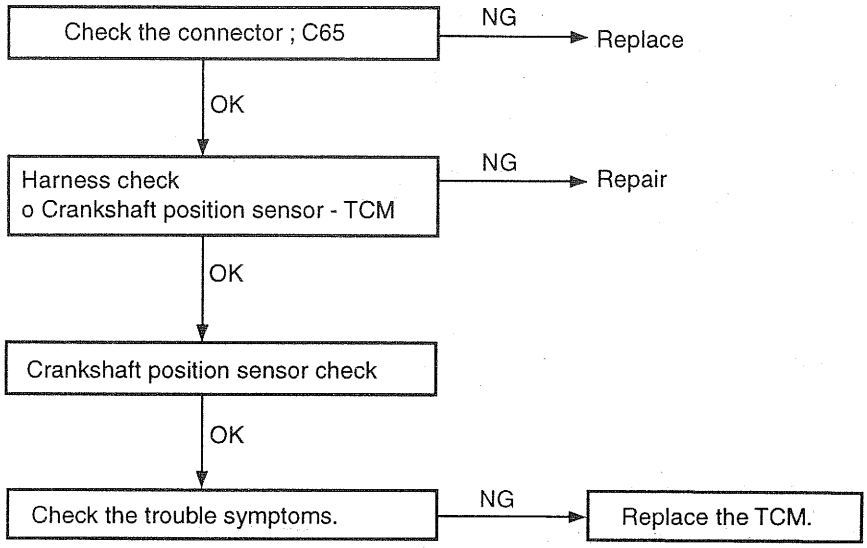
EKAA010A

Code No. P0710, Oil temperature sensor system	Probable cause
If the oil temperature sensor output voltage is 2.6 V or more even after driving for 10 minutes or more (If the oil temperature does not increase), it is judged that there is an open circuit in the oil temperature sensor and diagnostic trouble code No.P0710 is the output. If the oil temperature sensor output detects the voltage which corresponds to 200°C(392°F) or more for more than one second, it is judged that there is an open circuit in oil temperature sensor and diagnostic trouble code No. P0710 is the output.	Malfunction of the oil temperature sensor Malfunction of connector Malfunction of the TCM



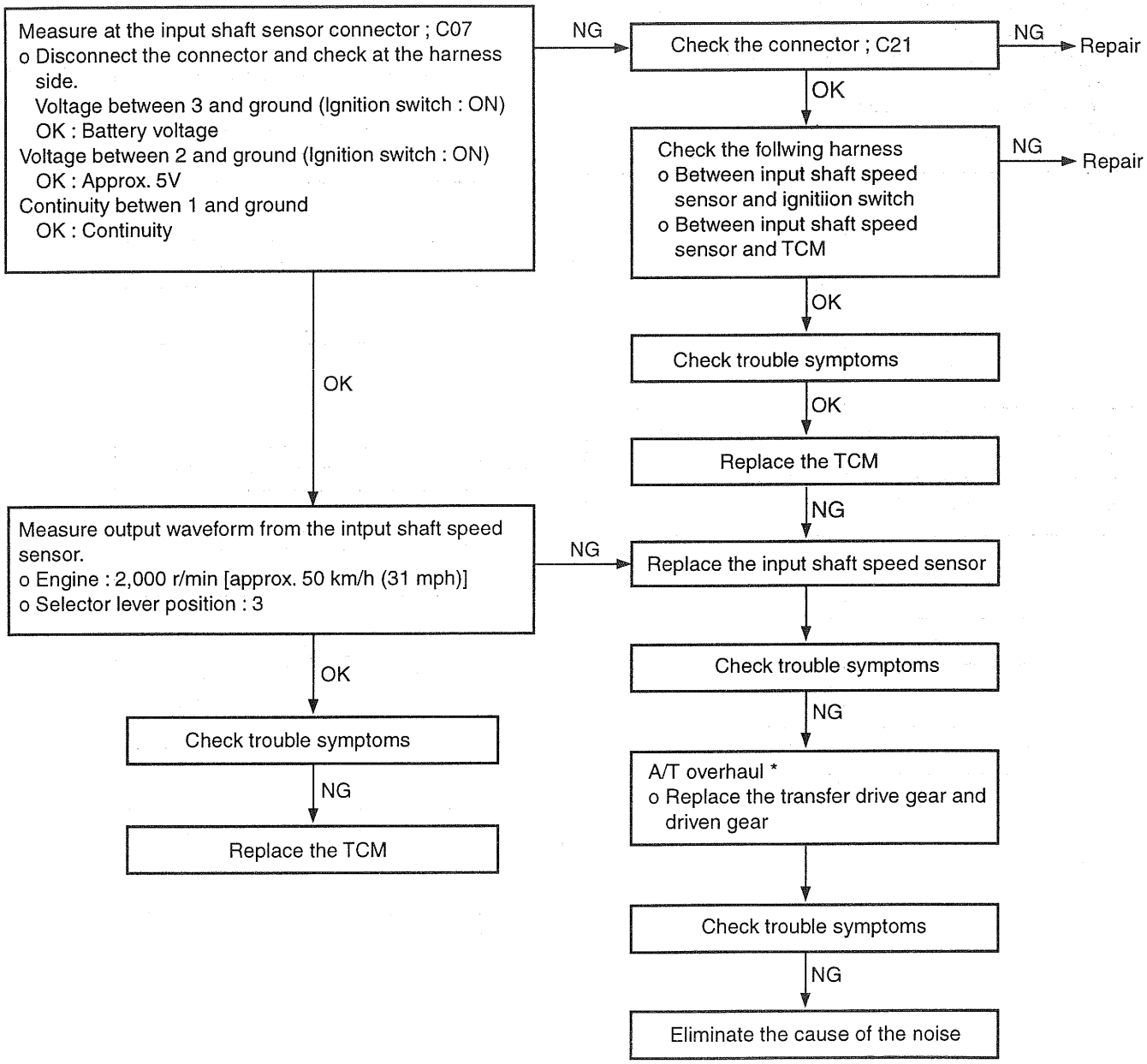
EKAA010B

Code No. P0725 Crankshaft position sensor system	Probable cause
If no output pulse is detected from the crankshaft position sensor for 5 seconds or more while driving at 25 km/h (16 mph) or more, it is judged that there is an open circuit in the crankshaft position sensor and diagnostic trouble code No.P0725 is the output.	Malfunction of the crankshaft position sensor Malfunction of connector Malfunction of the TCM



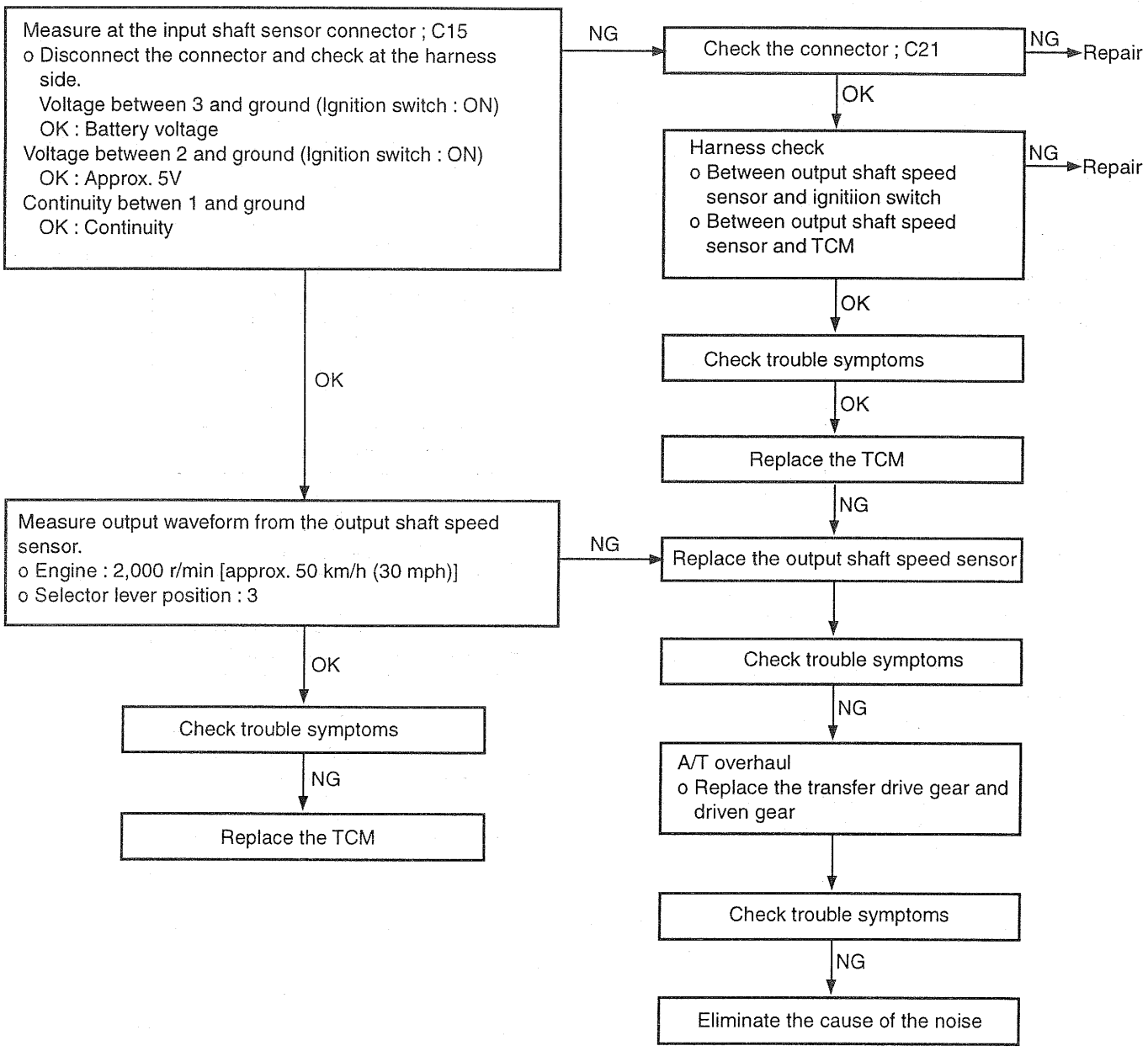
EKAA010C

Code No. P0715 input shaft speed sensor system	Probable cause
If no output pulse is detected from the input shaft speed sensor for 1 seconds or more while driving in 3rd or 4th gear at a speed of 30 km/h (19 mph) or more, it is judged to be an open circuit or short-circuit in the input shaft speed sensor and diagnostic trouble code No.P0715 is the output. If diagnostic trouble code P0715 is the output four times, the transaxle is locked into 3rd gear or 2nd gear as a fail-safe measure.	Malfunction of the input shaft speed sensor Malfunction of underdrive clutch retainer Malfunction of connector Malfunction of the TCM



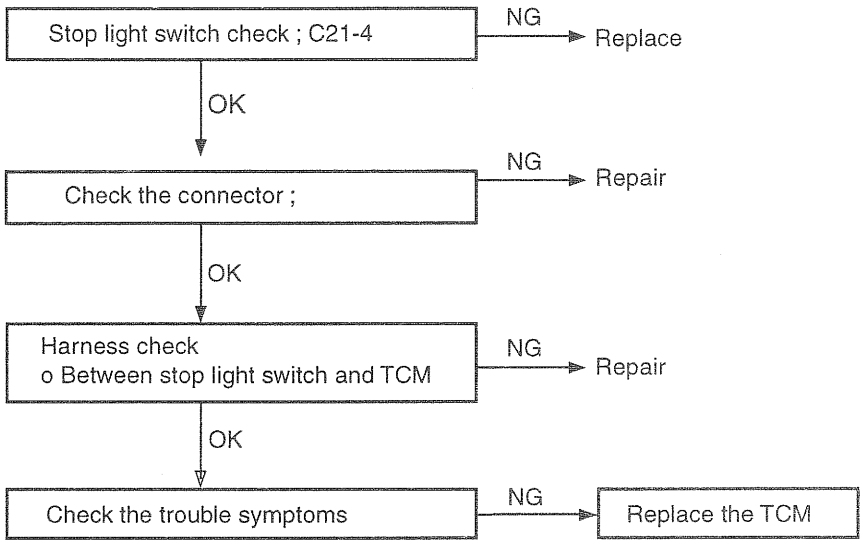
EKAA010D

Code No. P0720 Output shaft sensor system	Probable cause
If the output from the output shaft speed sensor is continuously 50% lower than the vehicle speed for 1 second or more, it is judged to be an open circuit or short- circuit in the output shaft speed sensor and diagnostic trouble code No.P	Malfunction of the throttle position sensor Malfunction of connector Malfunction of the TCM



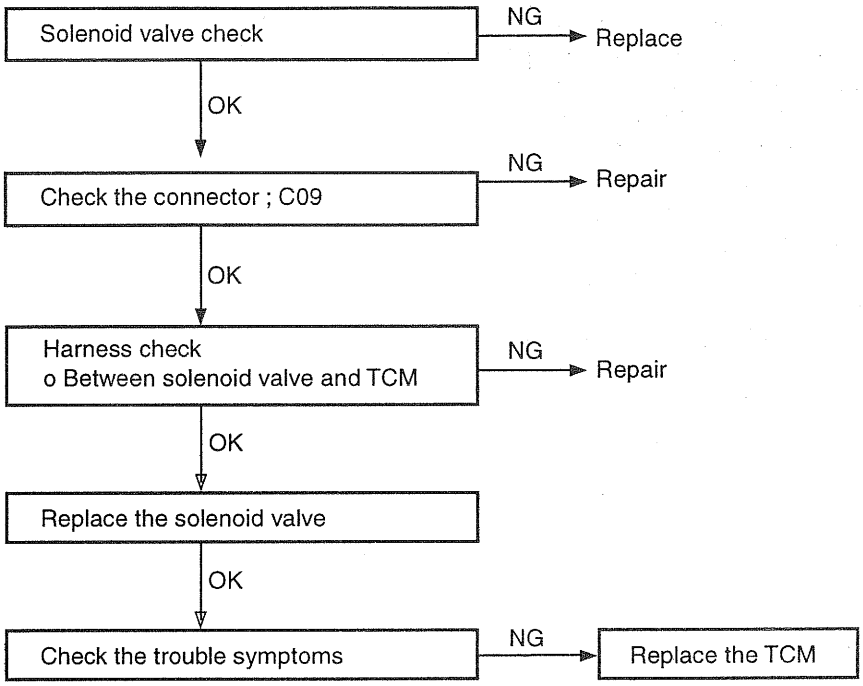
EKAA010E

Code No.P0703 Stop light switch system	Probable cause
If the stop light switch is on for 5 minutes or more while driving, it is judged that there is a short circuit in the stop light switch and diagnostic trouble code P0703 is the output.	Malfunction of the stop light switch Malfunction of connector Malfunction of the TCM



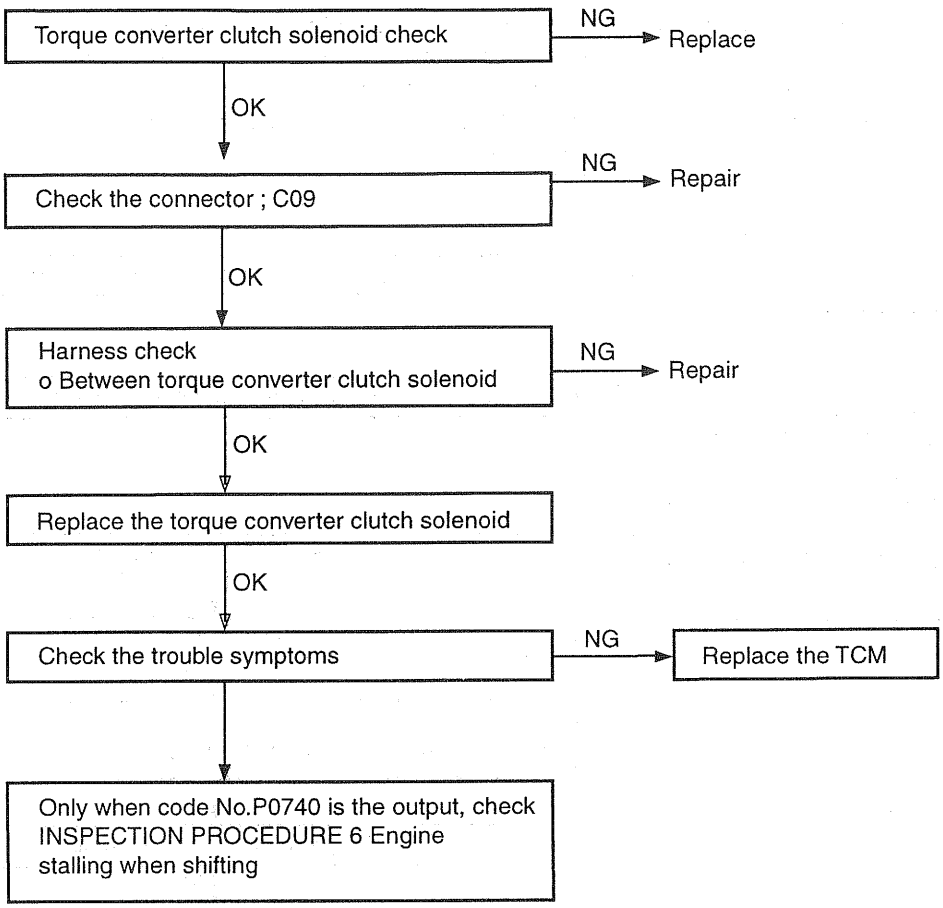
EKAA010F

Code No.P0750 Low and reverse solenoid valve system	Probable cause
Code No.P0755 Underdrive solenoid valve system	
Code No.P0760 Second solenoid valve system	
Code No.P0765 Overdrive solenoid valve system	
If the resistance value for a solenoid valve is too large or too small, it is judged that there is a short-circuit or an open circuit in the solenoid valve and the respective diagnostic trouble code is output. The transaxle is locked into 3rd gear as a fail-safe measure.	Malfunction of the solenoid valve Malfunction of connector Malfunction of the TCM


Solenoid valve check
NG
Replace
OK
Check the connector ; C09
NG
Repair
OK
Harness check
o Between solenoid valve and TCM
NG
Repair
OK
Replace the solenoid valve
OK
Check the trouble symptoms
NG
Replace the TCM

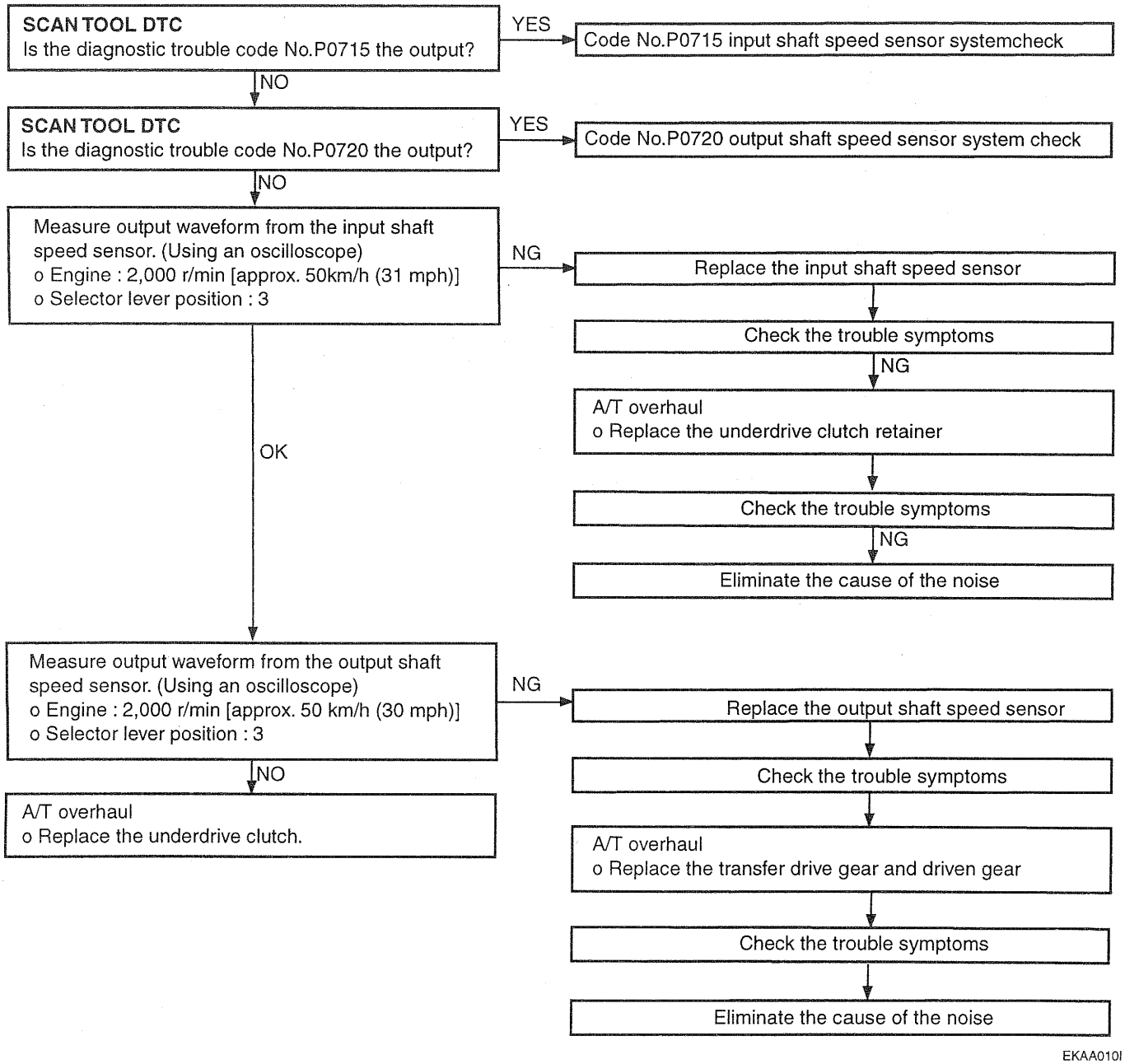
EKAA010G

Code No.P0743 /P0740 Torque converter clutch solenoid system	Probable cause
If the resistance value for the torque converter clutch solenoid is too large or too small, it is judged that there is a short-circuit or an open circuit in the torque converter clutch solenoid and diagnostic trouble code No.P0743 is the output. If the drive duty rate for the torque converter clutch solenoid is 100% for a continuous period of 4 seconds or more, it is judged that there is an abnormality in the torque converter clutch system and diagnostic trouble code No.P0740 is the output. When diagnostic trouble code No.P0743 is the output, the transaxle is locked into 3rd gear as a fail-safe measure. If the lock-up clutch remains engaged for a continuous period of 10seconds when the TCM is attempting to disengage the lock-up clutch, it is judged that the torque converter clutch is stuck on and diagnostic trouble code P0740.	Malfunction of the torque converter clutch solenoid Malfunction of connector Malfunction of the TCM

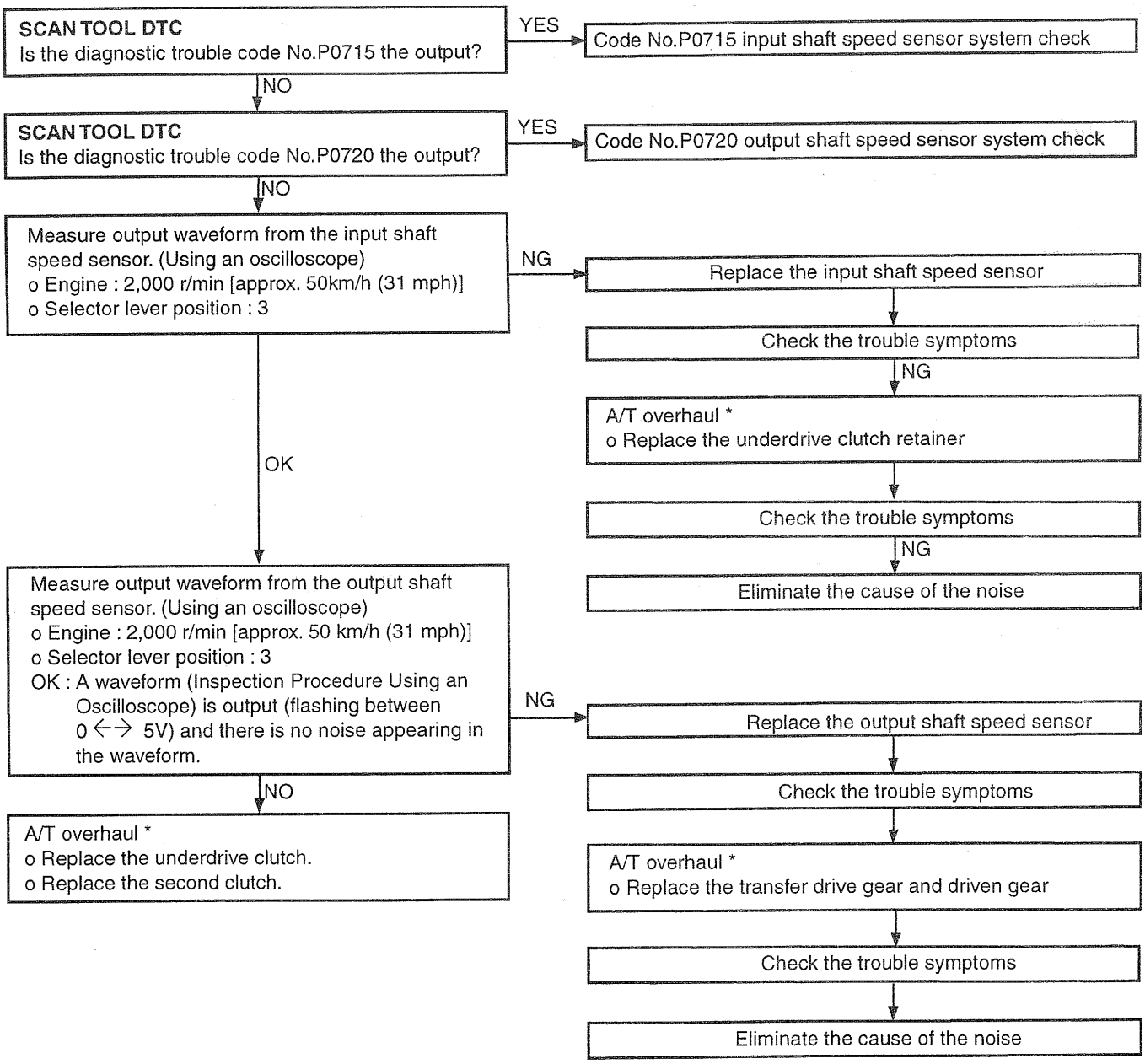

Torque converter clutch solenoid check
NG
Replace
OK
Check the connector ; C09
NG
Repair
OK
Harness check
o Between torque converter clutch solenoid
NG
Repair
OK
Replace the torque converter clutch solenoid
OK
Check the trouble symptoms
NG
Replace the TCM
Only when code No.P0740 is the output, check INSPECTION PROCEDURE 6 Engine stalling when shifting

EKAA010H

Code No.P0731 1st gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnostic trouble code No.P0732 is the output four times, the transaxle is locked into 3rd gear as a fail-safe measure.	Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the second brake system Malfunction of the underdrive clutch system Noise generated

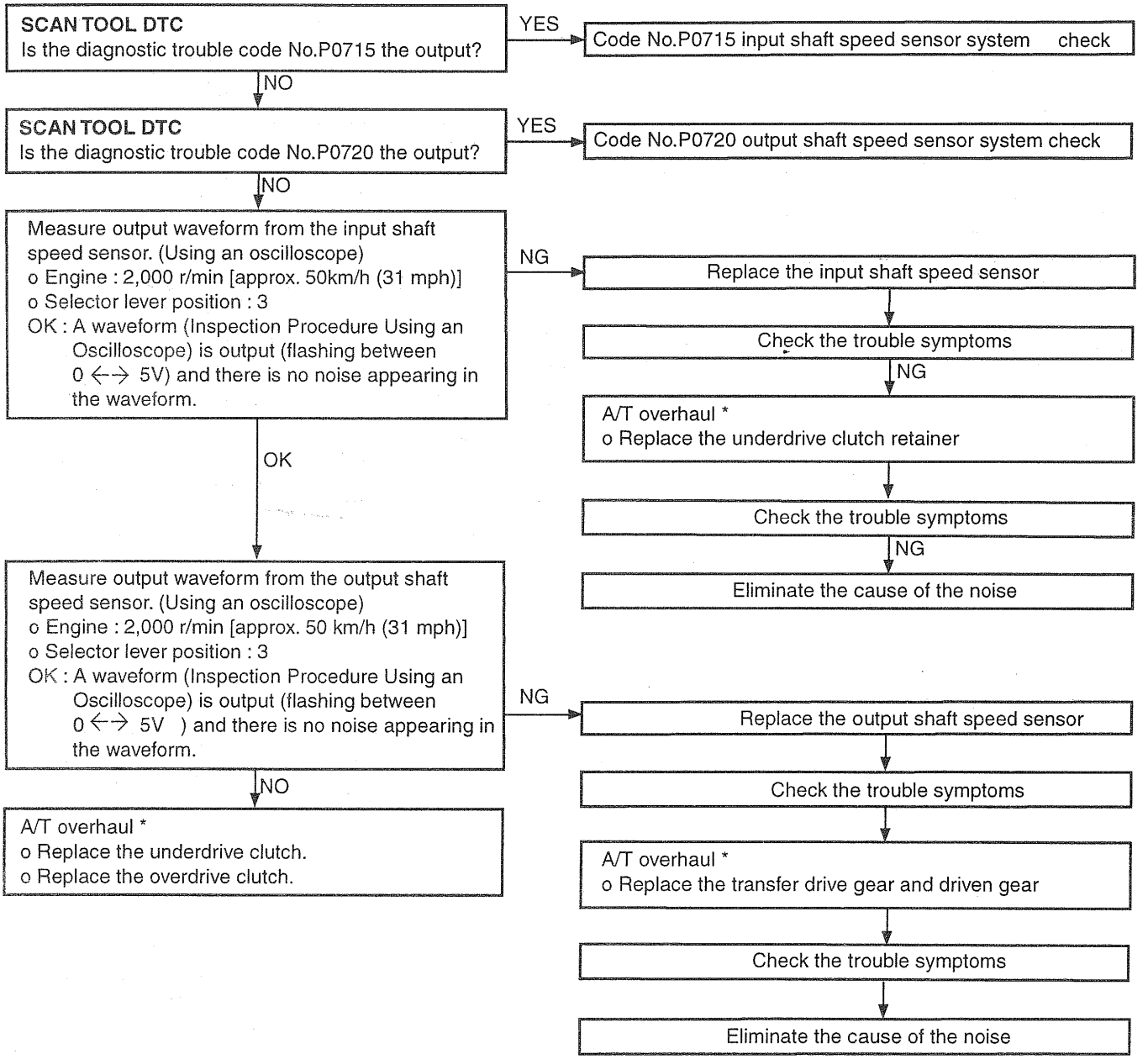


Code No.P0732 2nd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 2nd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnostic trouble code No.P0732 is the output. If diagnostic trouble code No.P0732 is the output four times, the transaxle is locked into 3rd gear as a fail-safe measure.	Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the second brake system Malfunction of the underdrive clutch system Noise generated



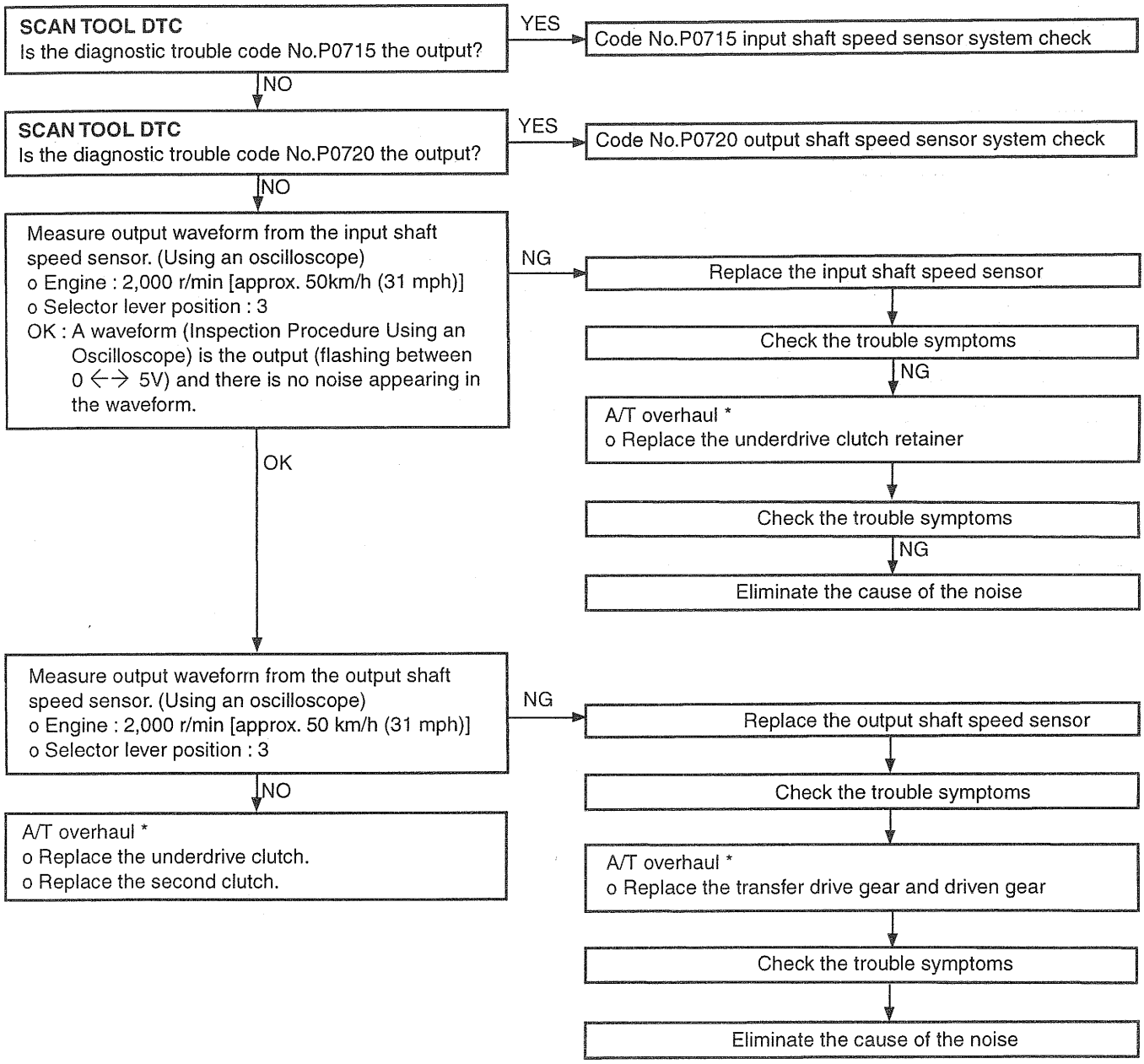
EKAA010J

Code No.P0733 3rd gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 3rd gear ratio is not the same as the output from the input shaft speed sensor after shifting to 2nd gear has been completed, diagnostic trouble code No.P0732 is the output. If diagnostic trouble code No.P0732 is the output four times, the transaxle is locked into 3rd gear as a fail-safe measure.	Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the low and reverse brake system Malfunction of the underdrive clutch system Noise generated



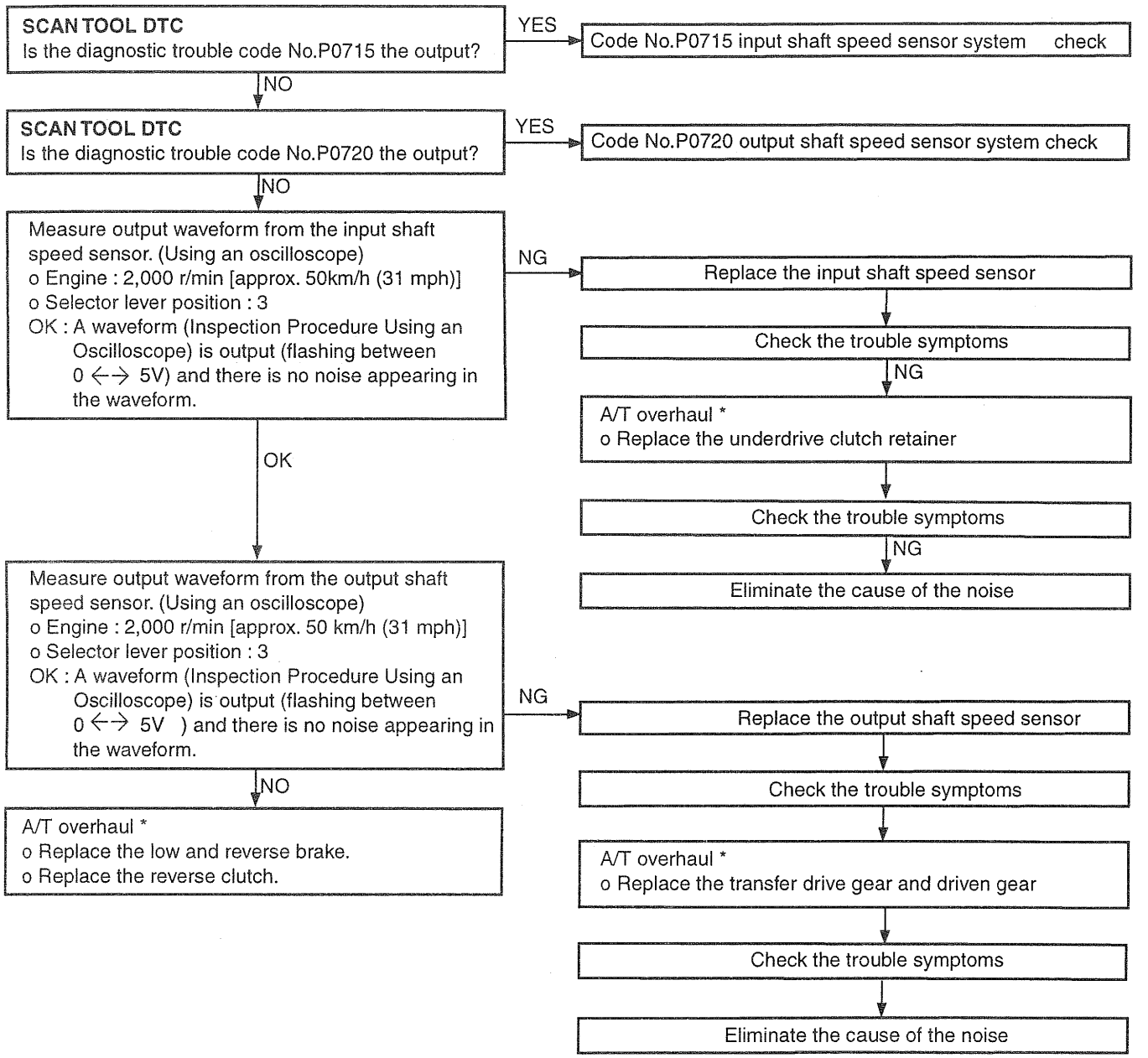
EKAA010K

Code No.P0734 4th gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the 4th gear ratio is not the same as the output from the input shaft speed sensor after shifting to 4th gear has been completed, diagnostic trouble code No.P0734 is the output. If diagnostic trouble code No.P0734 is the output four times, the transaxle is locked into 3rd gear as a fail-safe measure.	Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the low and reverse brake system Malfunction of the underdrive clutch systme Noise generated



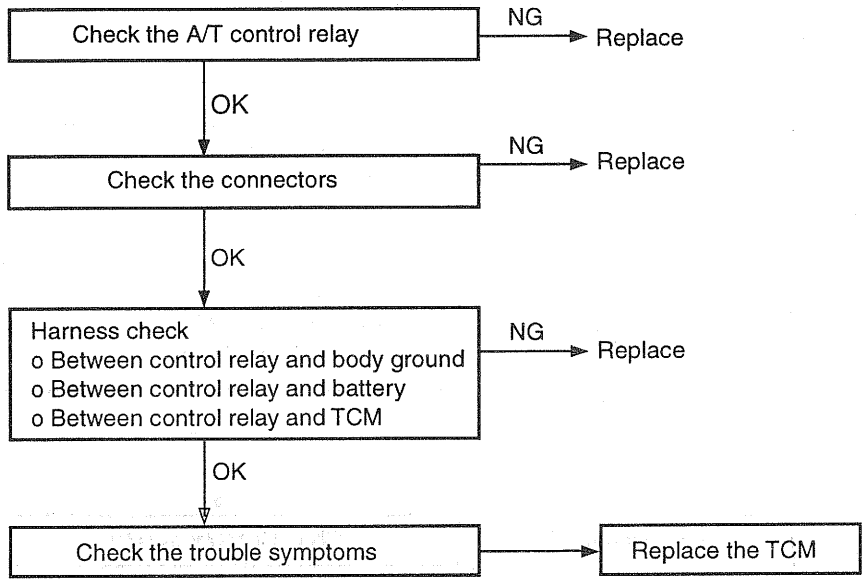
EKAA010L

Code No.P0736 reverse gear incorrect ratio	Probable cause
If the output from the output shaft speed sensor multiplied by the reverse gear ratio is not the same as the output from the input shaft speed sensor after shifting to reverse gear has been completed, diagnostic trouble code No.P0736 is the output. If diagnostic trouble code No.P0736 is output four times, the transaxle is locked into 3rd gear as a fail-safe measure	Malfunction of the input shaft speed sensor Malfunction of the output shaft speed sensor Malfunction of the underdrive clutch retainer Malfunction of the transfer drive gear or driven gear Malfunction of the low and reverse brake system Malfunction of the underdrive clutch systme Noise generated



EKAA010M

Code No.P1723 A/T Control relay system	Probable cause
If the relay voltage is less than 7 V after the ignition switch has been turned to ON, it is judged that there is an oped circuit or a short-circuit in the A/T control relay earth and diagnostic trouble code P1723 is the output. The transaxle is locked into 3rd gear as a fail-safe measure.	Malfunction of the A/T control relay Malfunction of connector Malfunction of the TCM

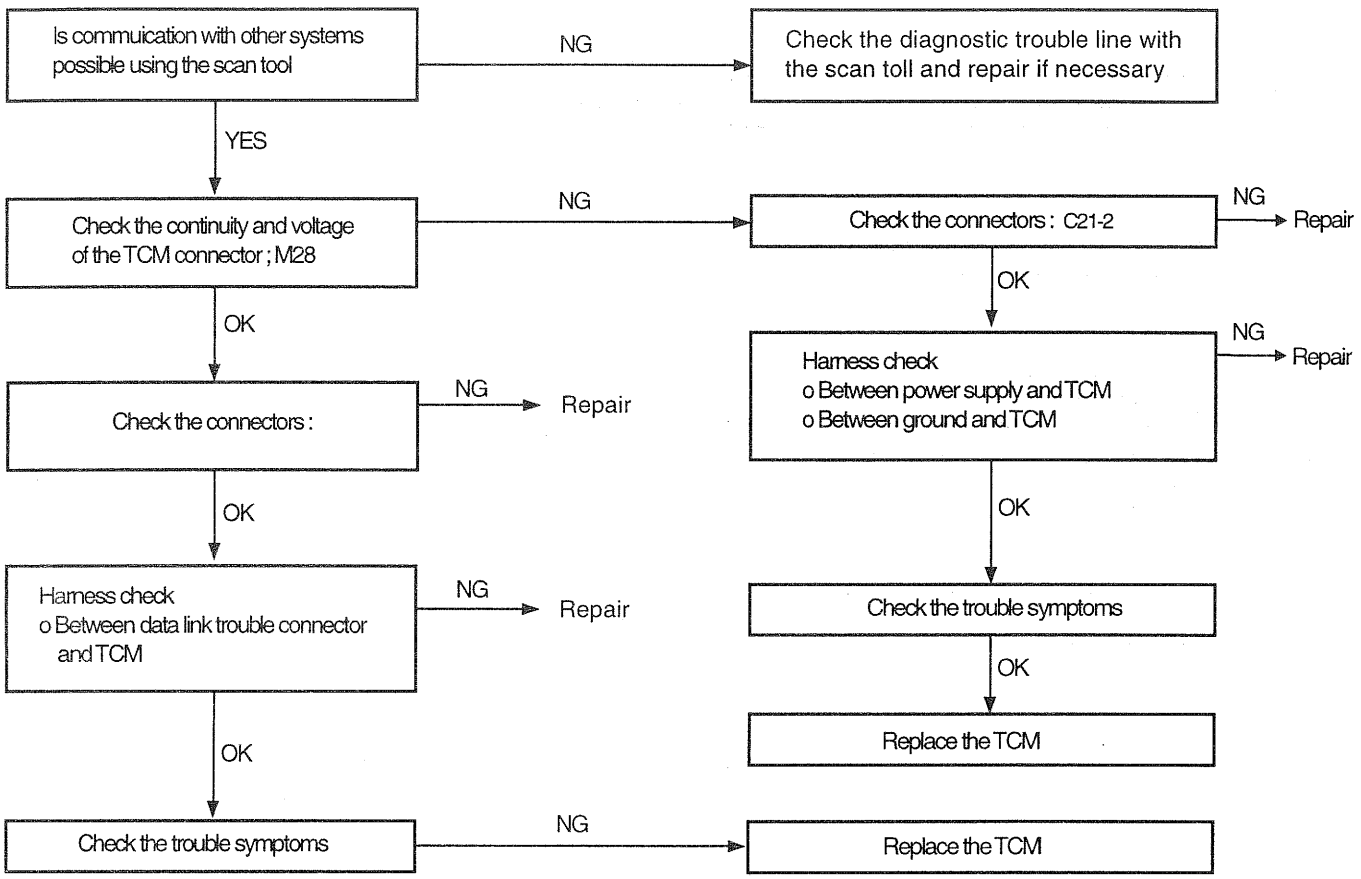


EKAA010N

INSPECTION PROCESS FOR TROUBLE SYMPTOMS EKHA280

INSPECTION PROCEDURE 1

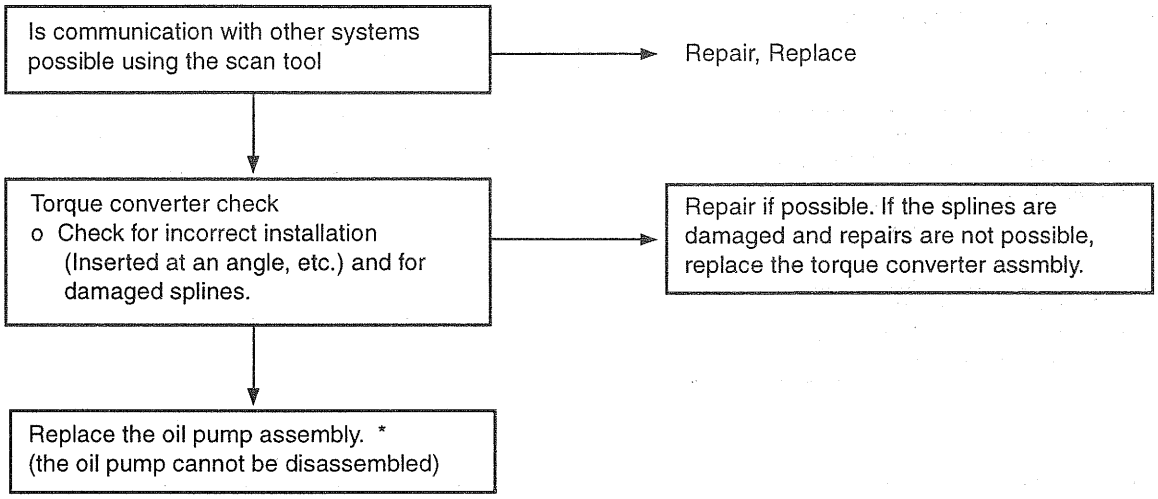
Communication with the scan tool	Probable cause
If communication with the scan tool is not possible, the cause is probably a defective diagnostic trouble line or the TCM is not functioning.	Malfunction of diagnostic trouble line Malfunction of connector Malfunction of the TCM



EKAA011A

INSPECTION PROCEDURE 2

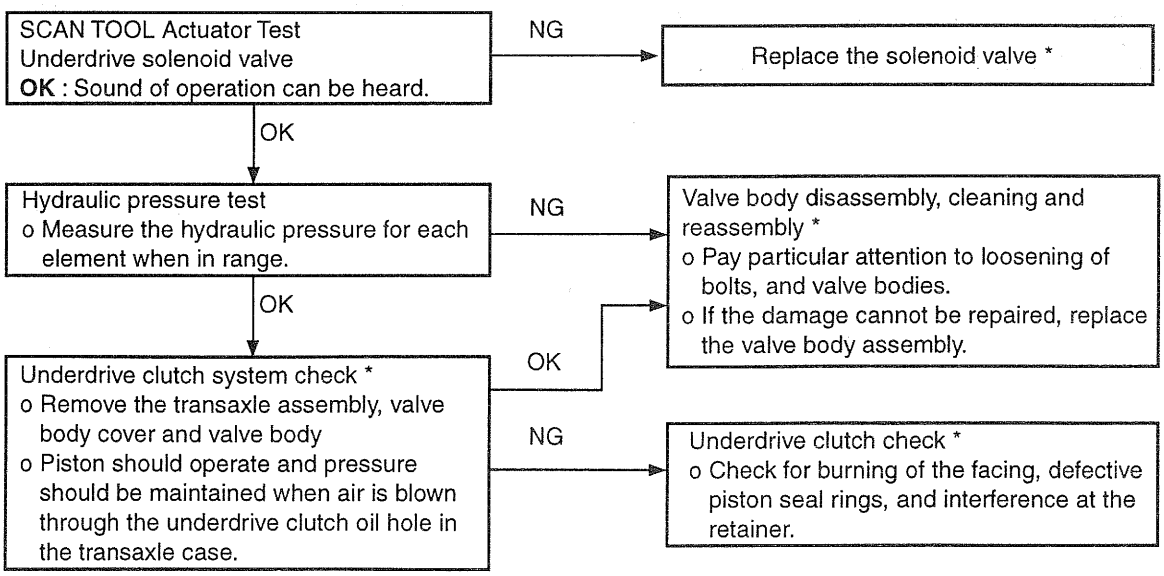
Starting impossible	Probable cause
Starting is not possible when the selector lever is in P or N range. In such cases, the cause is probably a defective engine system, torque converter or oil pump.	Malfunction of the engine system Malfunction of the torque converter Malfunction of the oil pump



EKAA011B

INSPECTION PROCEDURE 3

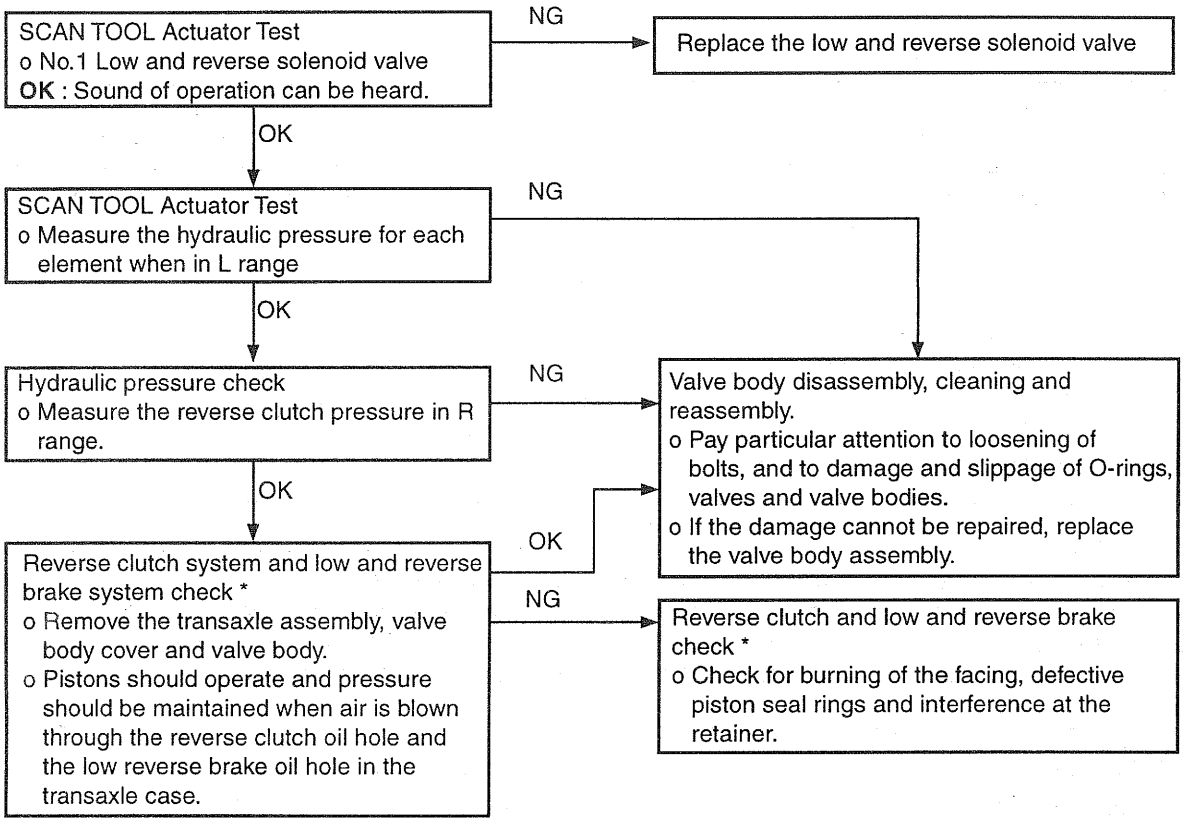
Does not move	Probable cause
If the vehicle does not move forward when the selector lever is shifted from N to D,3,2 or L range while the engine is idling, the cause is probably abnormal line pressure or a malfunction of the underdrive clutch or valve body.	Abnormal line pressure Malfunction of the underdrive solenoid valve Malfunction of the underdrive clutch Malfunction of the valve body



EKAA011C

INSPECTION PROCEDURE 4

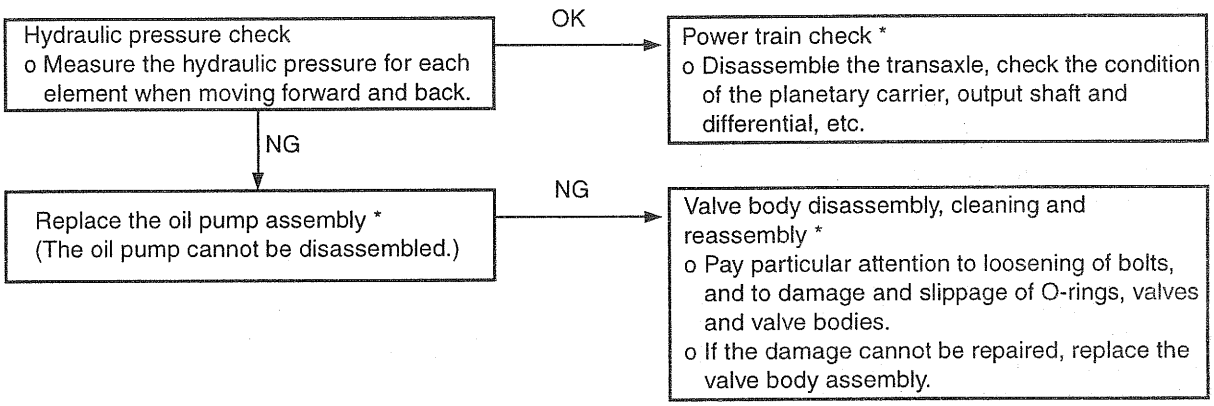
Does not reverse	Probable cause
If the vehicle does not reverse when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal pressure in the reverse clutch or low and reverse brake or a malfunction of the reverse clutch, low and reverse brake or valve body.	Abnormal reverse clutch pressure Abnormal low and reverse brake pressure Malfunction of the low and reverse solenoid valve Malfunction of the reverse clutch Malfunction of the low and reverse brake Malfunction of the valve body



EKAA011D

INSPECTION PROCEDURE 5

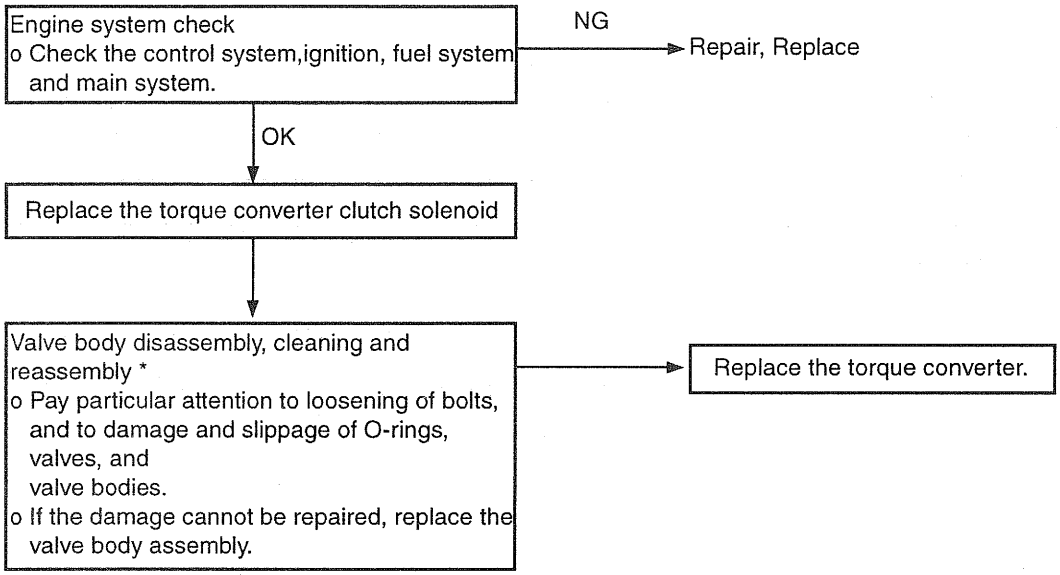
Does not move (forward or reverse)	Probable cause
If the vehicle does not move forward or reverse when the selector lever is shifted to any position while the engine is idling, the cause is probably abnormal line pressure, or a malfunction of the power train, oil pump or valve body.	Abonormal line pressure Malfunction of the underdrive solenoid valve Malfunction of the underdrive clutch Malfunction of the valve body



EKAA011E

INSPECTION PROCEDURE 6

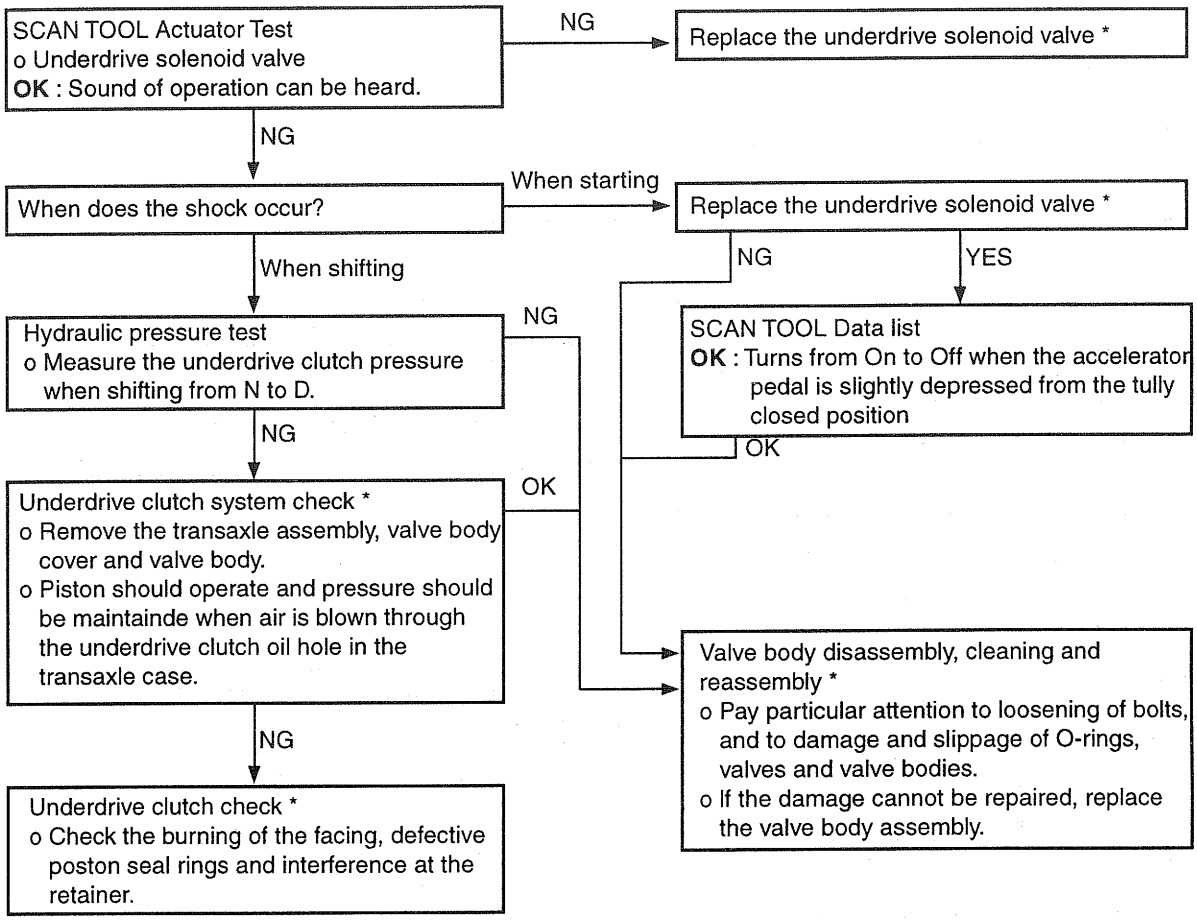
Engine stalling when shifting	Probable cause
If the engine stalls when the selector lever is shifted from N to D or R range while the engine is idling, the cause is probably a malfunction of the engine system, torque converter clutch soledoid, valve body or torque converter (torque converter clutch malfunction).	Malfunction of the engine system Malfunction of the torque converter clutch solenoid Malfunction of the valve body Malfunction of the torque converter (Malfunction of the torque converter clutch)



EKAA011F

INSPECTION PROCEDURE 7

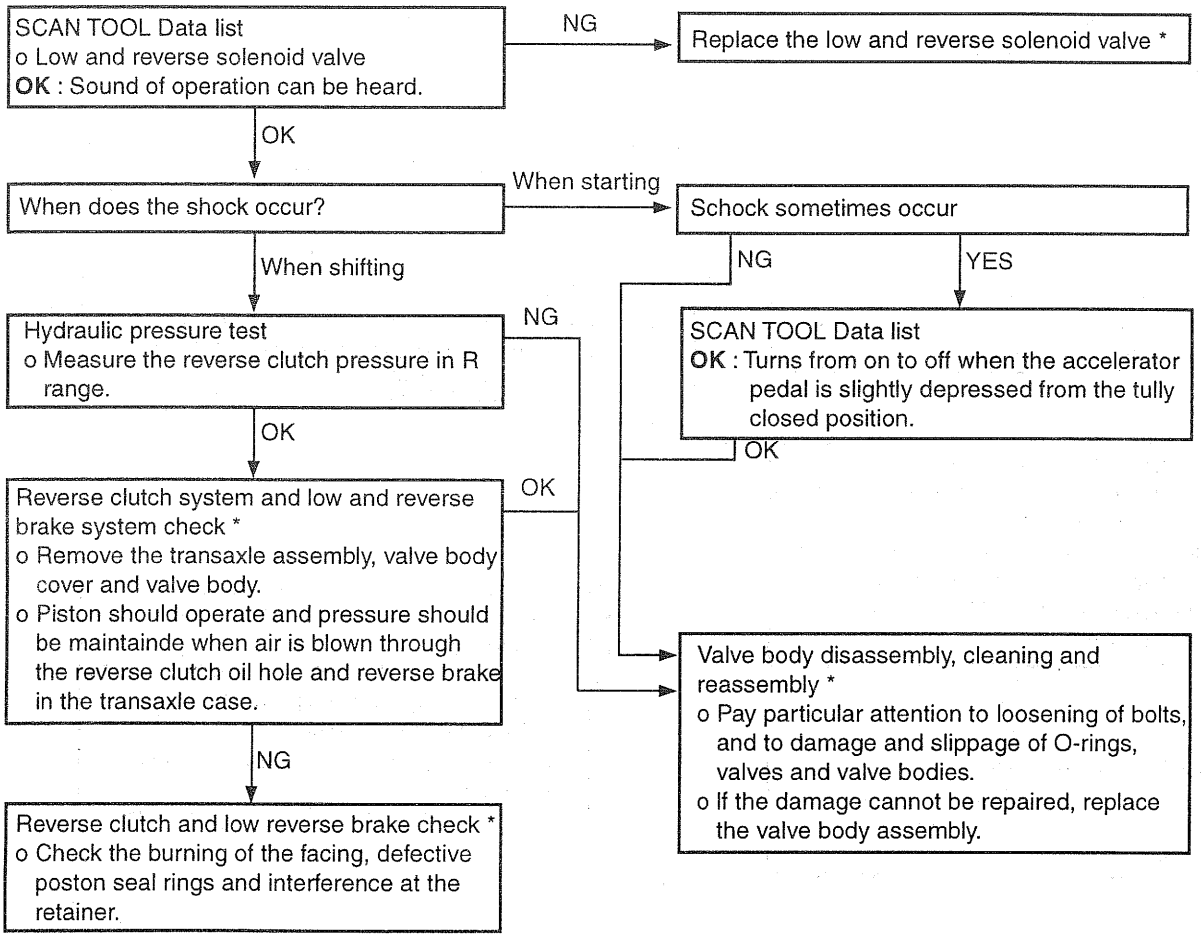
Shocks when changing from N to D and range time lag	Probable cause
If abnormal shocks or a time lag of 2 second or more occurs when the selector lever is shifted from N to D range while the engine is idling, the cause is probably abnormal underdrive clutch pressure or a malfunction of the underdrive clutch, valve body or closed throttle position switch.	Abnormal line pressure Malfunction of the underdrive solenoid valve Malfunction of the underdrive clutch Malfunction of the valve body Malfunction of the closed throttle position switch



EKAA011G

INSPECTION PROCEDURE 8

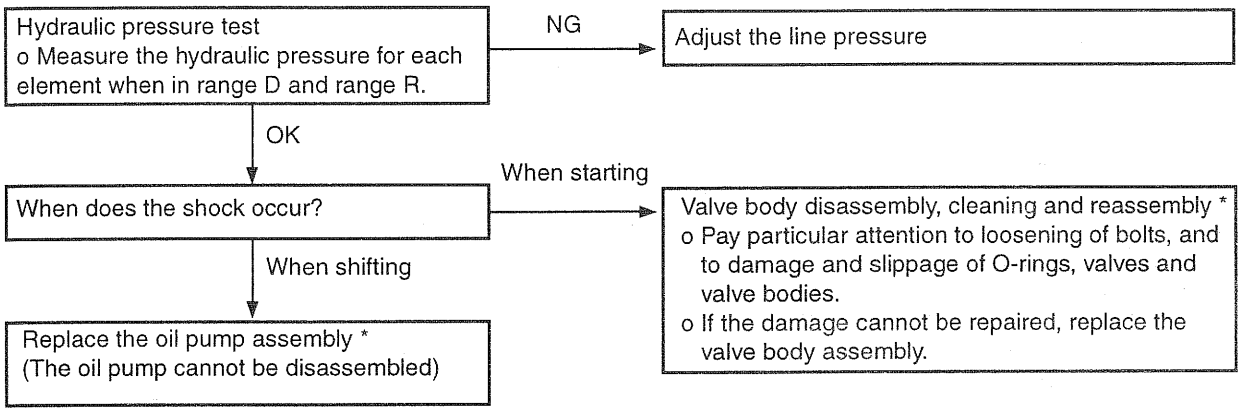
Shock when changing from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction or the reverse clutch, low and reverse brake, valve body or closed throttle position switch.	Abnormal reverse clutch pressure Abnormal low and reverse brake pressure Malfunction of the low and reverse solenoid valve Malfunction of the reverse clutch Malfunction of the low and reverse brake Malfunction of the valve body Malfunction of the closed throttle position switch



EKAA011H

INSPECTION PROCEDURE 9

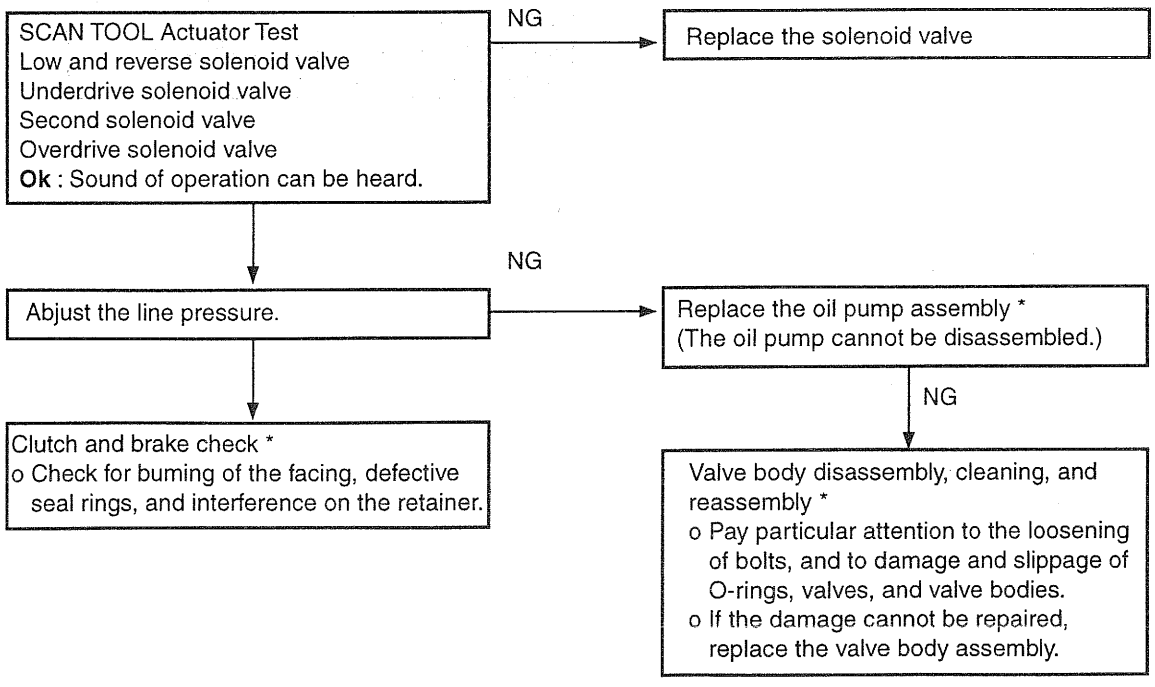
Shocks when changine from N to R and large time lag	Probable cause
If abnormal shocks or a time lag of 2seconds or more occurs when the selector lever is shifted from N to R range while the engine is idling, the cause is probably abnormal reverse clutch pressure or low and reverse brake pressure, or a malfunction of the reverse clutch, low and reverse brake, valve body or closed throttle position switch.	Abnormal reverse clutch pressure Abnormal low and reverse brake pressure Malfunction of the low and reverse solenoid valve Malfunction of the reverse clutch Malfunction of the low and reverse brake Malfunction of the valve body Malfunction of the closed throttle position switch



EKAA011I

INSPECTION PROCEDURE 10

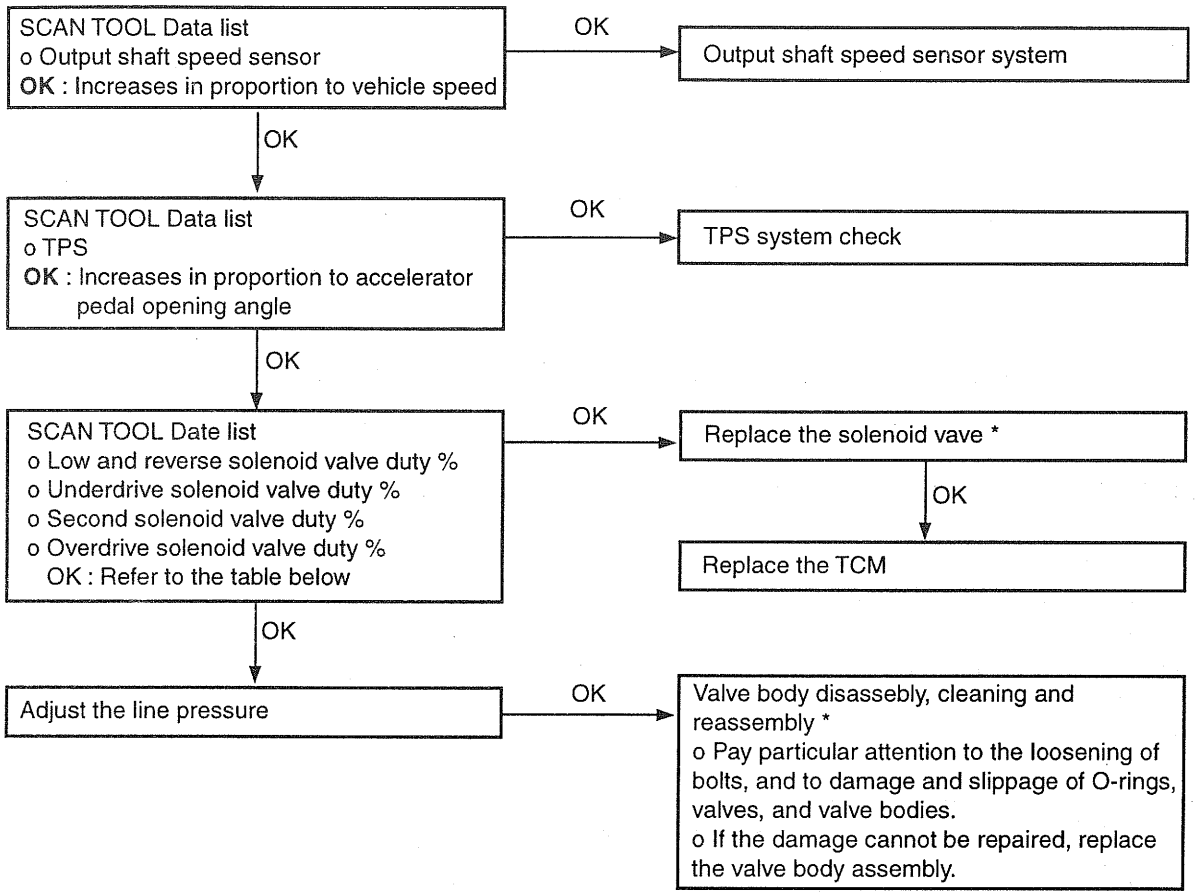
Shocks and running up	Probable cause
If shocks occur when driving due to upshifting or downshifting and the transaxle speed becomes higher than the engine speed, the cause is probably abnormal line pressure or a malfunction of a solenoid valve, oil pump, valve body or of a brake or clutch.	Abnormal line pressure Malfunction of each solenoid valve Malfunction of the oil pump Malfunction of the valve body Malfunction of each brake or each clutch



EKAA011J

INSPECTION PROCEDURE 11

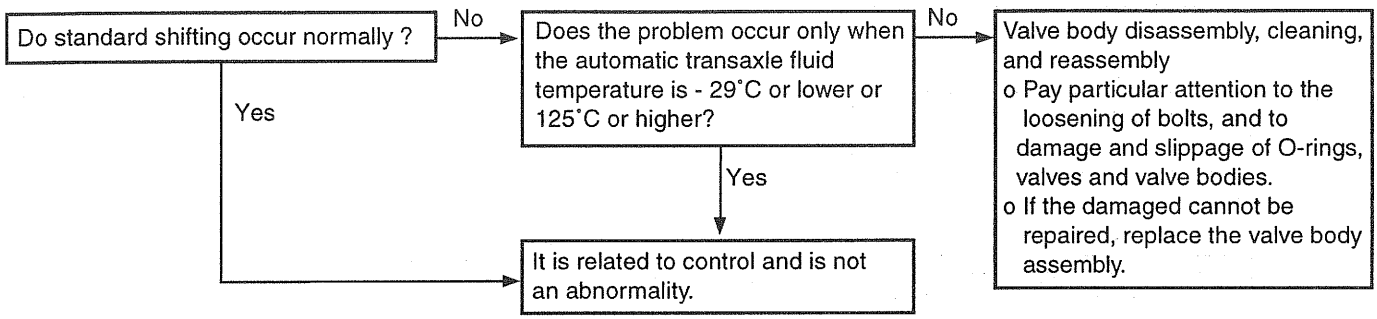
All points (Displaced shifting points)	Probable cause
If all shift points are displaced while driving, the cause is probably a malfunction of the output shaft speed sensor, TPS or a solenoid valve.	Malfunction of the output shaft speed sensor Malfunction of the throttle position sensor Malfunction of each solenoid valve Abnormal line pressure Malfunction of the valve body Malfunction of the TCM



EKAA011K

INSPECTION PROCEDURE 12

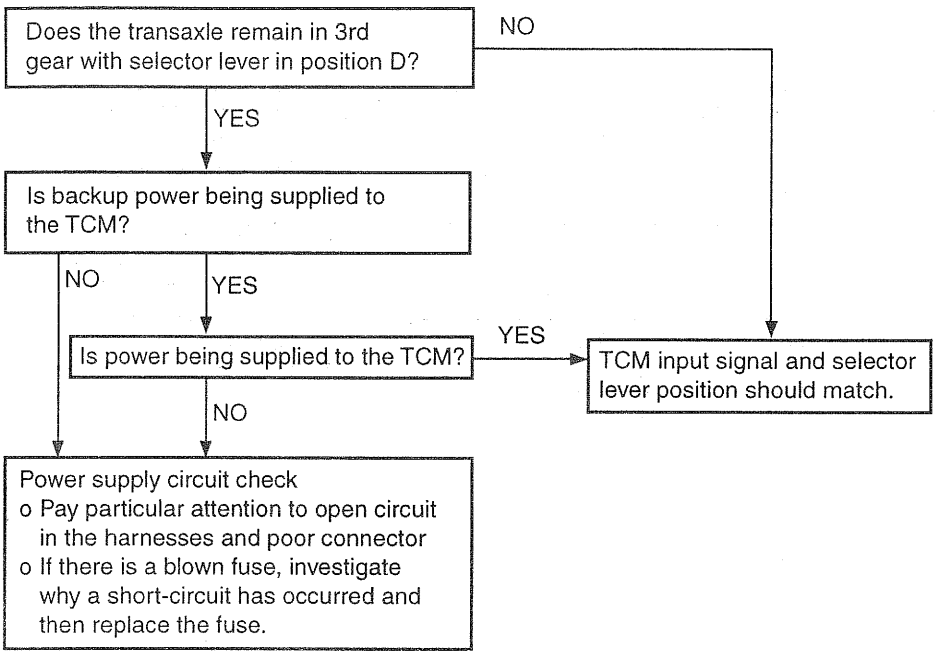
Some points (Displaced shifting points)	Probable cause
If some of the shift points are displaced while driving, the cause is probably a malfunction of the valve body, or it is related to control and is not an abnormality.	Malfunction of the valve body



EKAA011L

INSPECTION PROCEDURE 13

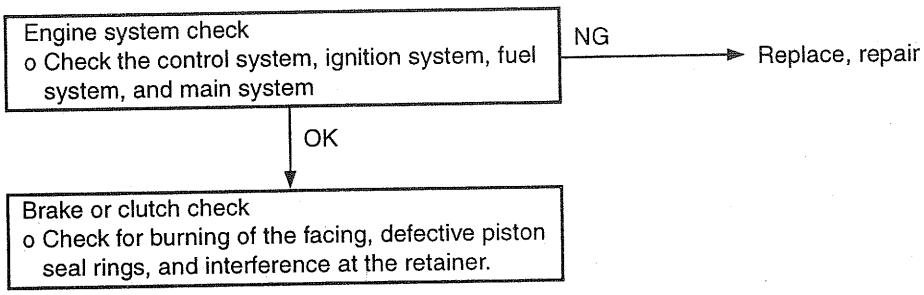
No diagnostic trouble codes (Does not shift)	Probable cause
If shifting does not occur while driving and no diagnostic trouble codes are given, the cause is probably a malfunction of the Park/Neutral position switch, or TCM.	Malfunction of the Park/Neutral position switch Malfunction of the TCM



EKAA011M

INSPECTION PROCEDURE 14

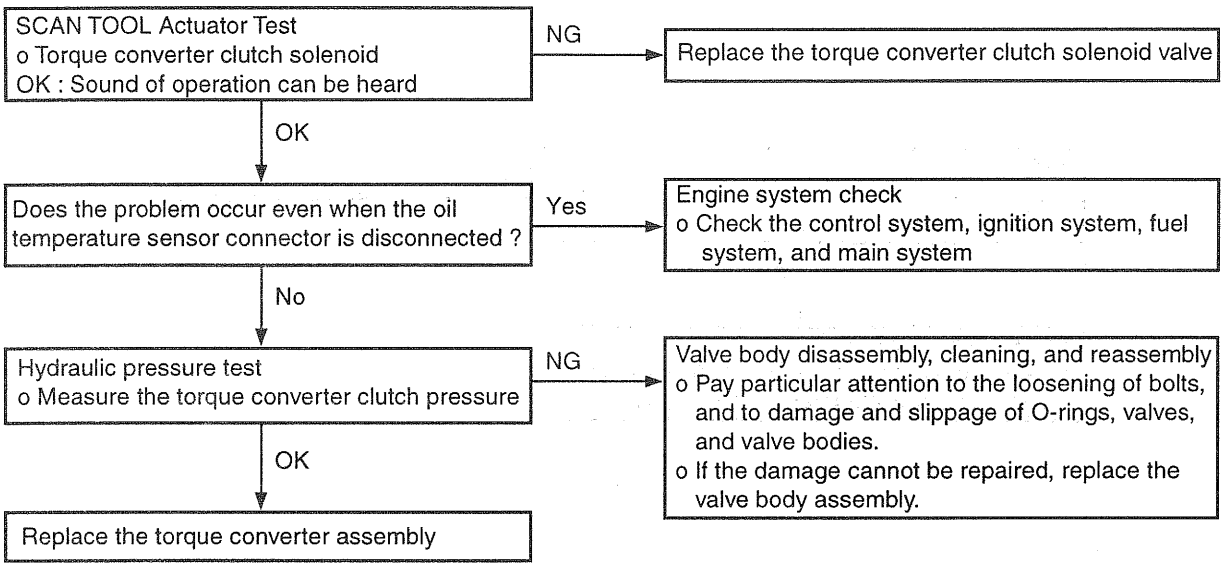
Poor acceleration	Probable cause
If acceleration is poor even if downshifting occurs while driving, the cause is probably a malfunction of the engine system or of a brake or clutch.	Malfunction of the engine system Malfunction of the brake or clutch



EKAA011N

INSPECTION PROCEDURE 15

Vibration	Probable cause
If vibration occurs when driving at constant speed or when accelerating in top range, the cause is probably abnormal torque converter clutch pressure or a malfunction of the engine system, torque converter clutch solenoid, torque converter or valve body.	Abnormal torque converter clutch pressure Malfunction of the engine system Malfunction of the torque converter clutch solenoid Malfunction of the torque converter Malfunction of the valve body



EKAA011O

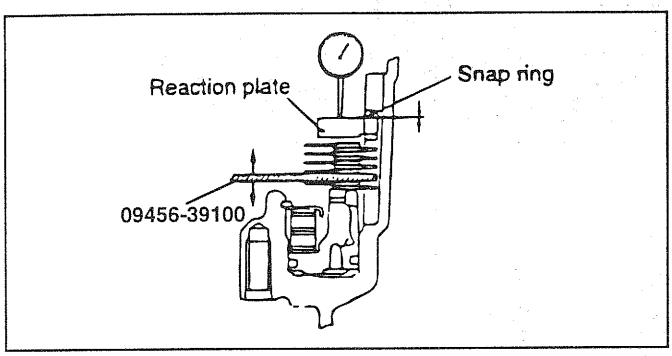
SERVICE ADJUSTMENT PROCEDURES EKHA0150

BRAKE REACTIONPLATE END PLAY ADJUSTMENT

Replace the pressure plate of the low-reverse brake with the special tool, and then install the brake disc, brake plate, and snap ring as shown in the figure. Install the reaction plate and the used snap ring. Move the special tool to measure the end play, and then replace the snap ring to adjust the end play to standard value.

Standard value : 0-0.16 mm

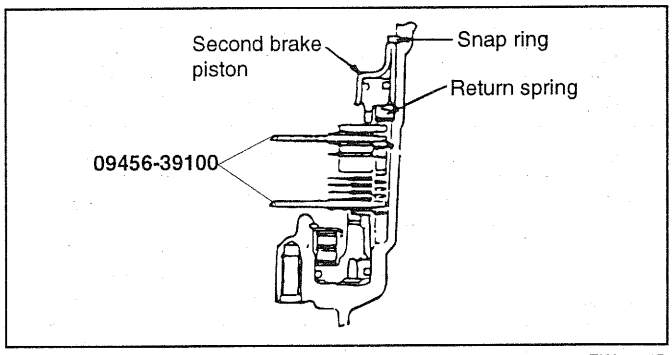
(Refer to the "Snap ring and spacer for adjustment")



EKA9011A

SECOND BRAKE END PLAY ADJUSTMENT

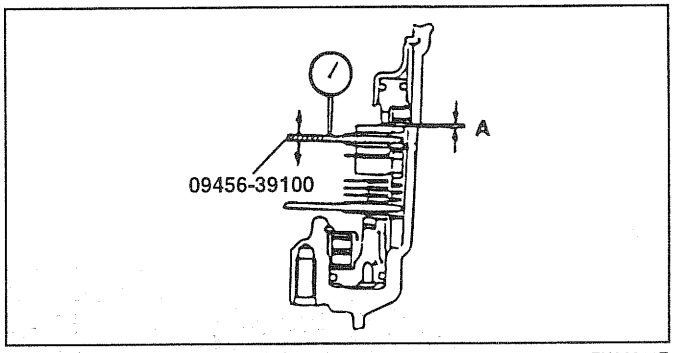
Replace the pressure plate of the second brake with the special tool, and then install the brake disc and brake plate as shown in the figure. Install the return spring, second brake piston, and snap ring.



EKA9011B

Standard value : 0.79-1.25 mm

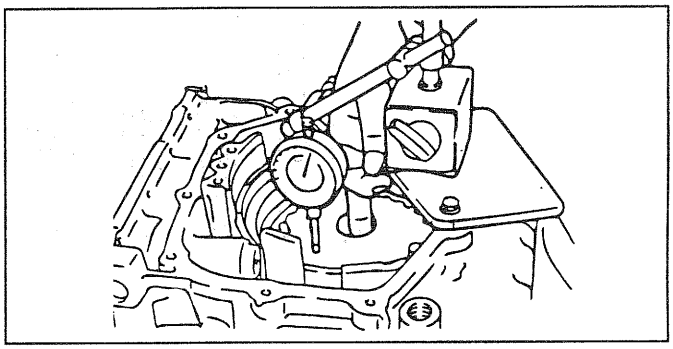
Reference Select a pressure plate whose thickness is within the following value. [A (moving amount) + thickness of the special tool — 1.25] to [A (moving amount) + thickness of the special tool — 0.79]. (Refer to the "Snap ring and spacer for adjustment")



EKA9011E

LOW-REVERSE BRAKE END PLAY ADJUSTMENT

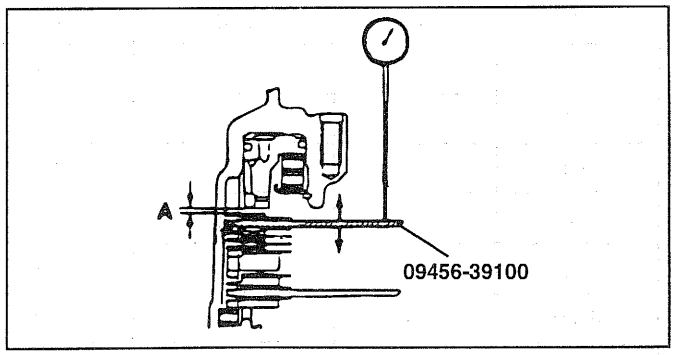
Reverse the transmission and install the dial gauge. Move the special tool up and down to measure the end play.



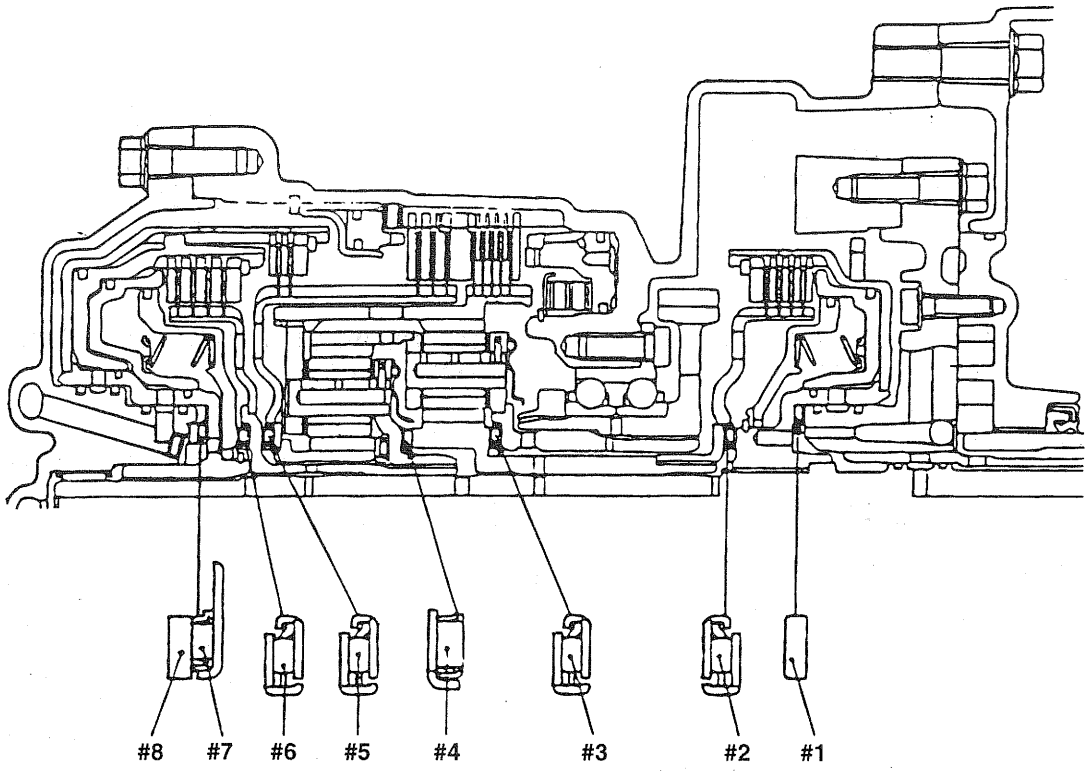
EKA9011D

Standard value : 1.35-1.81 mm

Reference Select a pressure plate whose thickness is within the following value. [A (moving amount) + thickness of the special tool — 1.81] to [A (moving amount) + thickness of the special tool — 1.35]. (Refer to the "Snap ring and spacer for adjustment").



EKA9011F



EKA9012A

IDENTIFICATION OF THRUST BEARING, THRUST RACES, AND THRUST WASHERS

O.D.	I.D.	Thickness	Symbol	O.D.	I.D.	Thickness	Symbol
59	47	1.8	#1	48.9	37	1.6	#8
59	47	2.0	#1	48.9	37	1.7	#8
59	47	2.2	#1	48.9	37	1.8	#8
59	47	2.4	#1	48.9	37	1.9	#8
59	47	2.6	#1	48.9	37	2.0	#8
59	47	2.8	#1	48.9	37	2.1	#8
49	36	3.6	#2	48.9	37	2.2	#8
49	36	3.6	#3	48.9	37	2.3	#8
45.3	31	3.3	#4	48.9	37	2.4	#8
49	36	3.6	#5	48.9	37	2.5	#8
49	36	3.6	#6	48.9	37	2.6	#8
59	37	2.8	#7	-	-	-	-

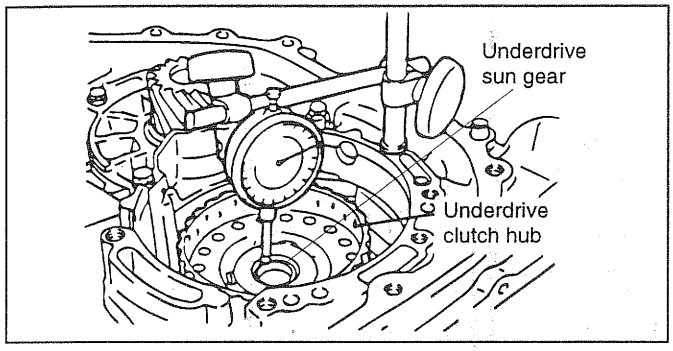
UNDERDRIVE SUN GEAR END PLAY ADJUSTMENT

Install the used thrust race #8, and then the rear cover. Measure end play of the underdrive sun gear. Replace thrust race #8 to adjust the play to the standard value.

Standard value : 0.25-0.45 mm

NOTE

Installing the underdrive clutch hub makes it easy to measure the end play of the underdrive sun gear.



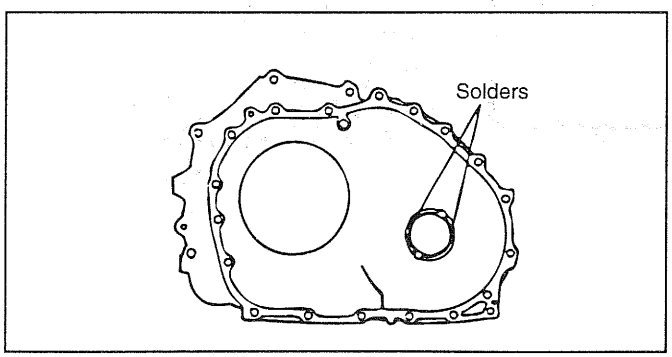
EKA9013A

DIFFERENTIAL CASE PRELOAD ADJUSTMENT

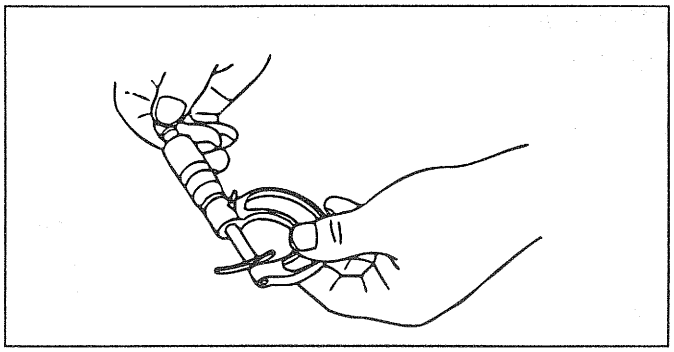
Place a solder (approx. 10 mm in length, 3 mm in diameter) on the torque converter housing as shown in the figure.

Install the torque converter housing to the transmission case without applying sealant. Tighten its mounting bolts to the specified torque. Loosen the bolts, and remove the solder. Use a micrometer to measure the thickness (T) of the pressed solder. Select a-spare with a thickness that is within the following value.

Standard value : (T+0.045 mm) to (T+0.105 mm)



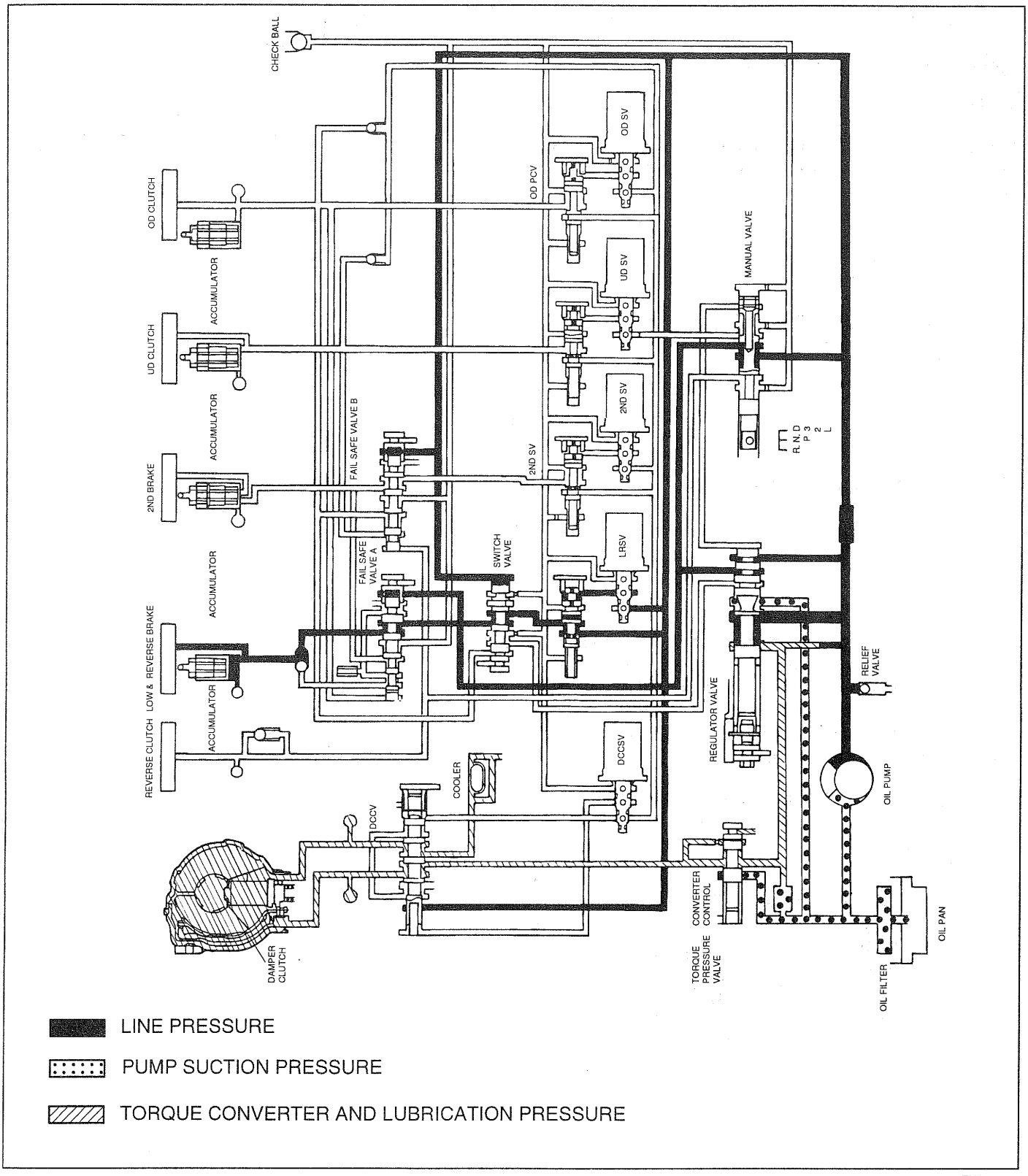
EKA9013B



EKA9013C

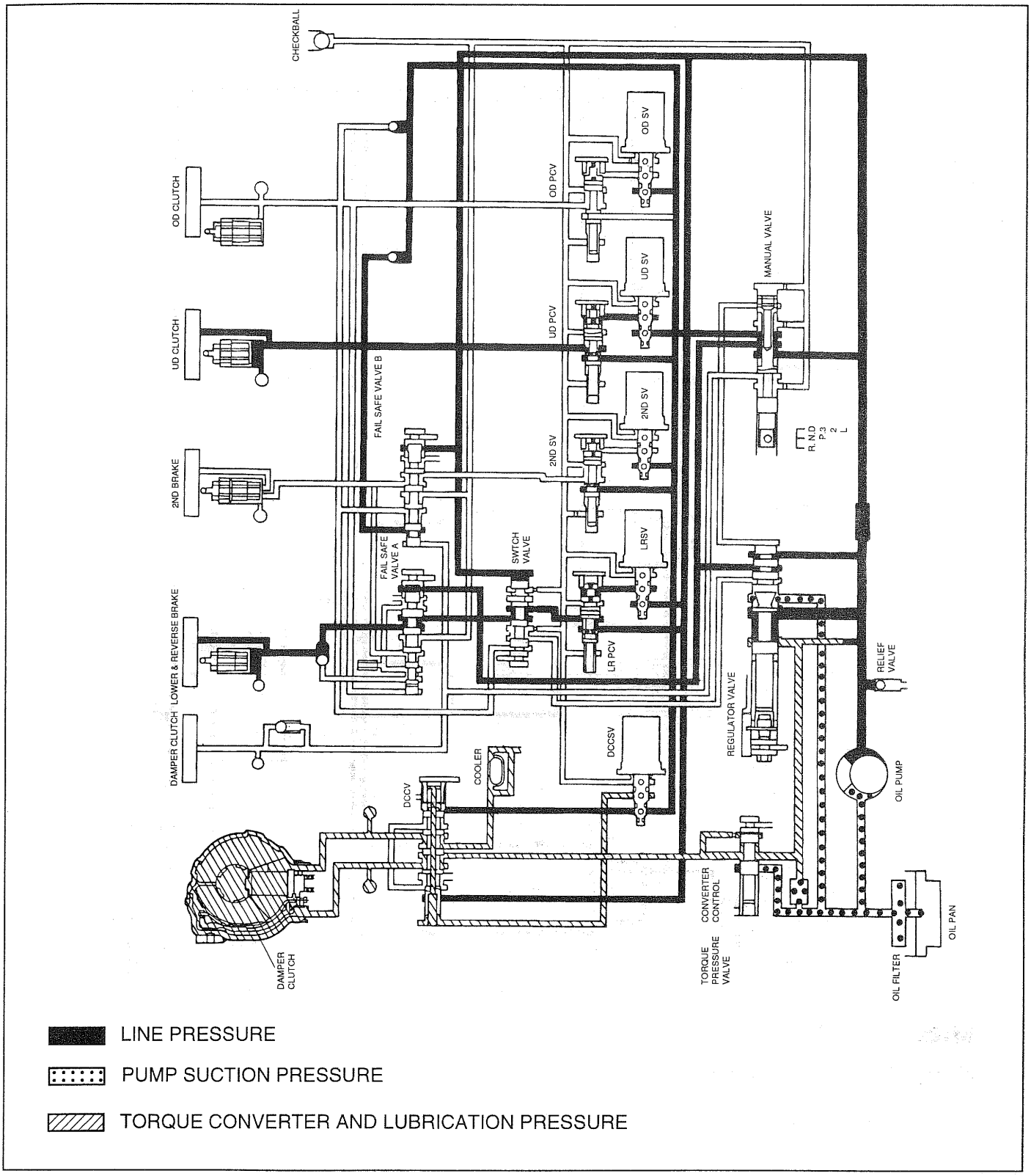
AUTOMATIC TRANSAXLE HYDRAULIC CIRCUIT EKA90170

PARKING & NEUTRAL



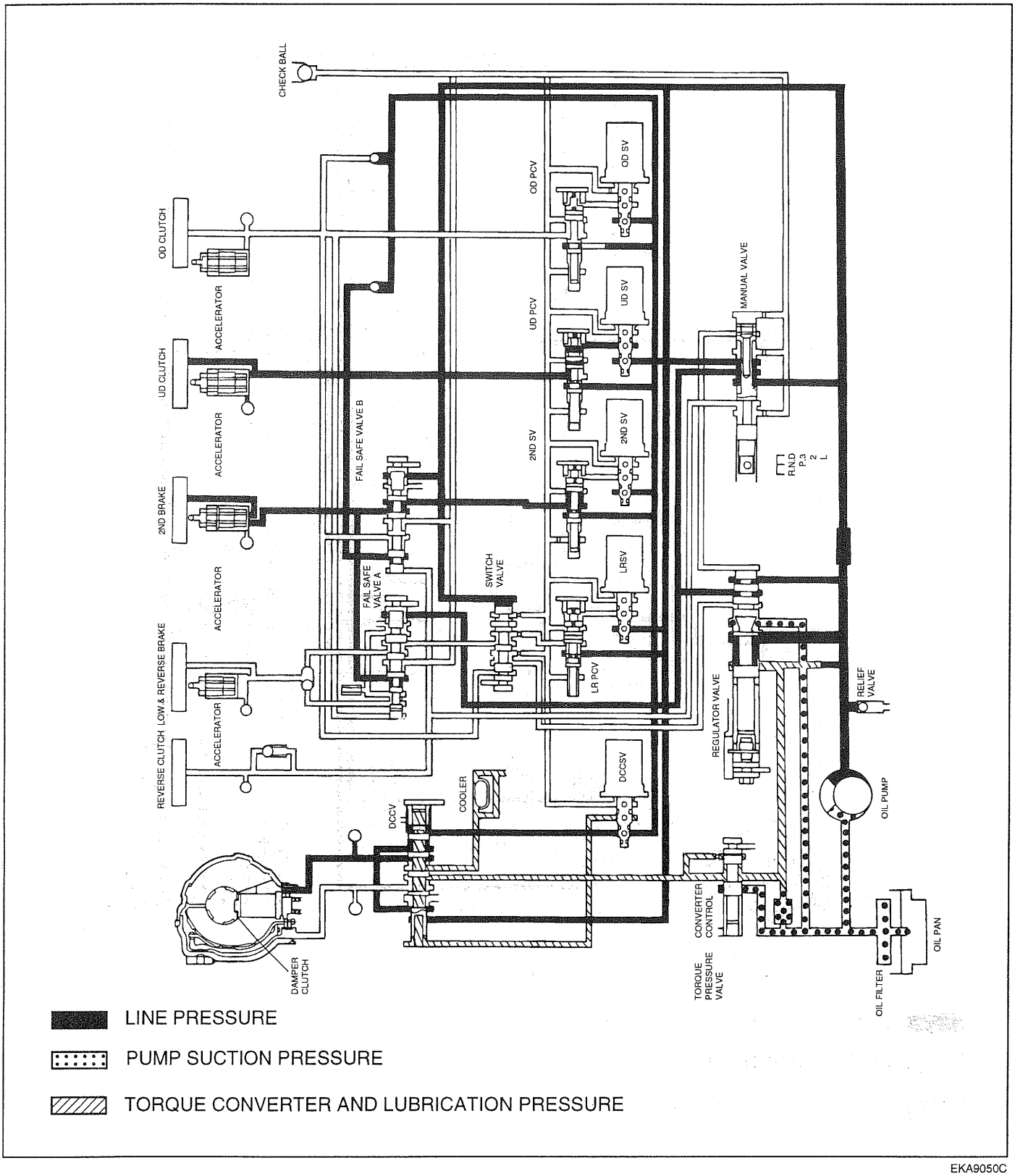
EKA9050A

FIRST



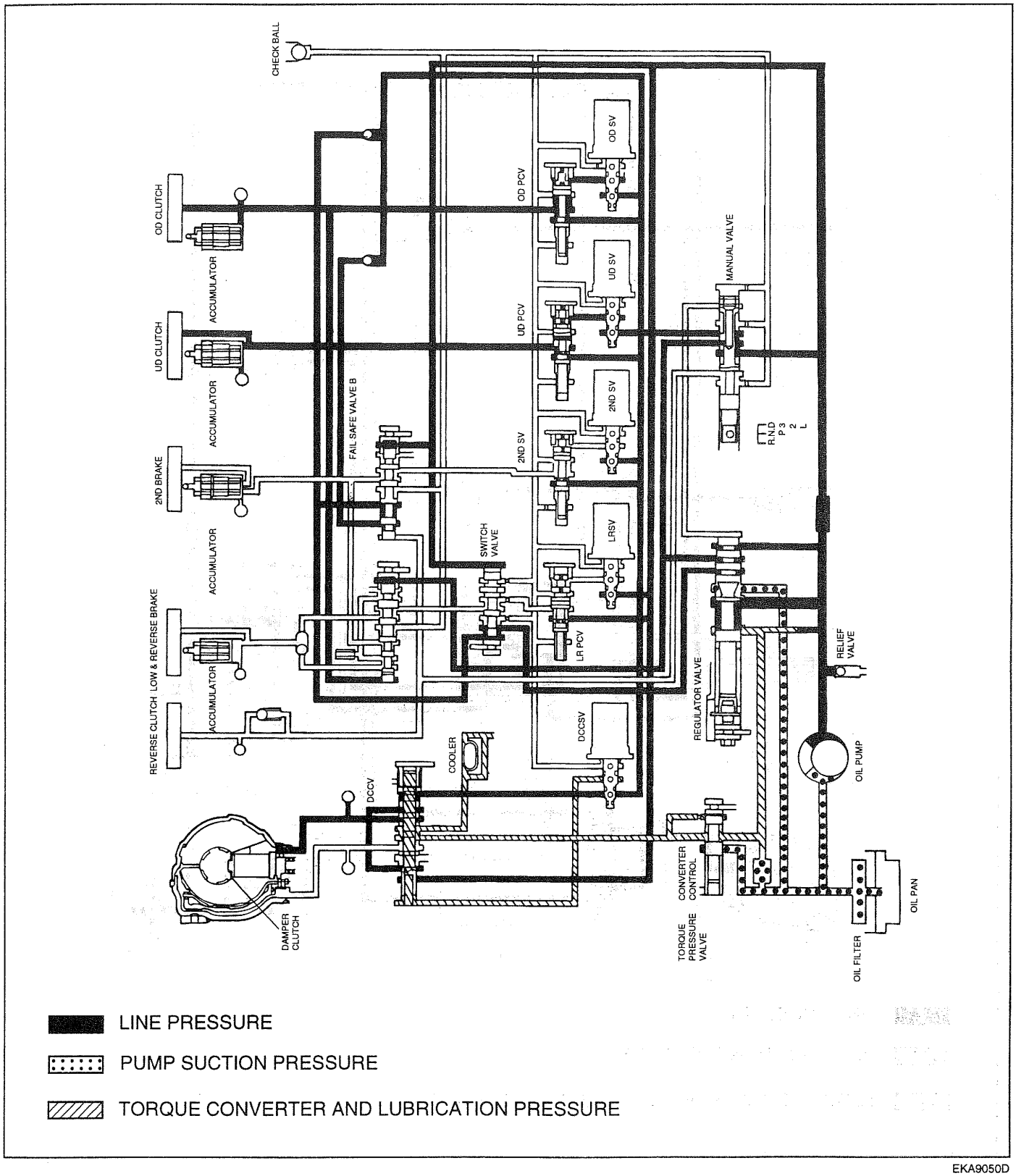
EKA9050B

SECOND



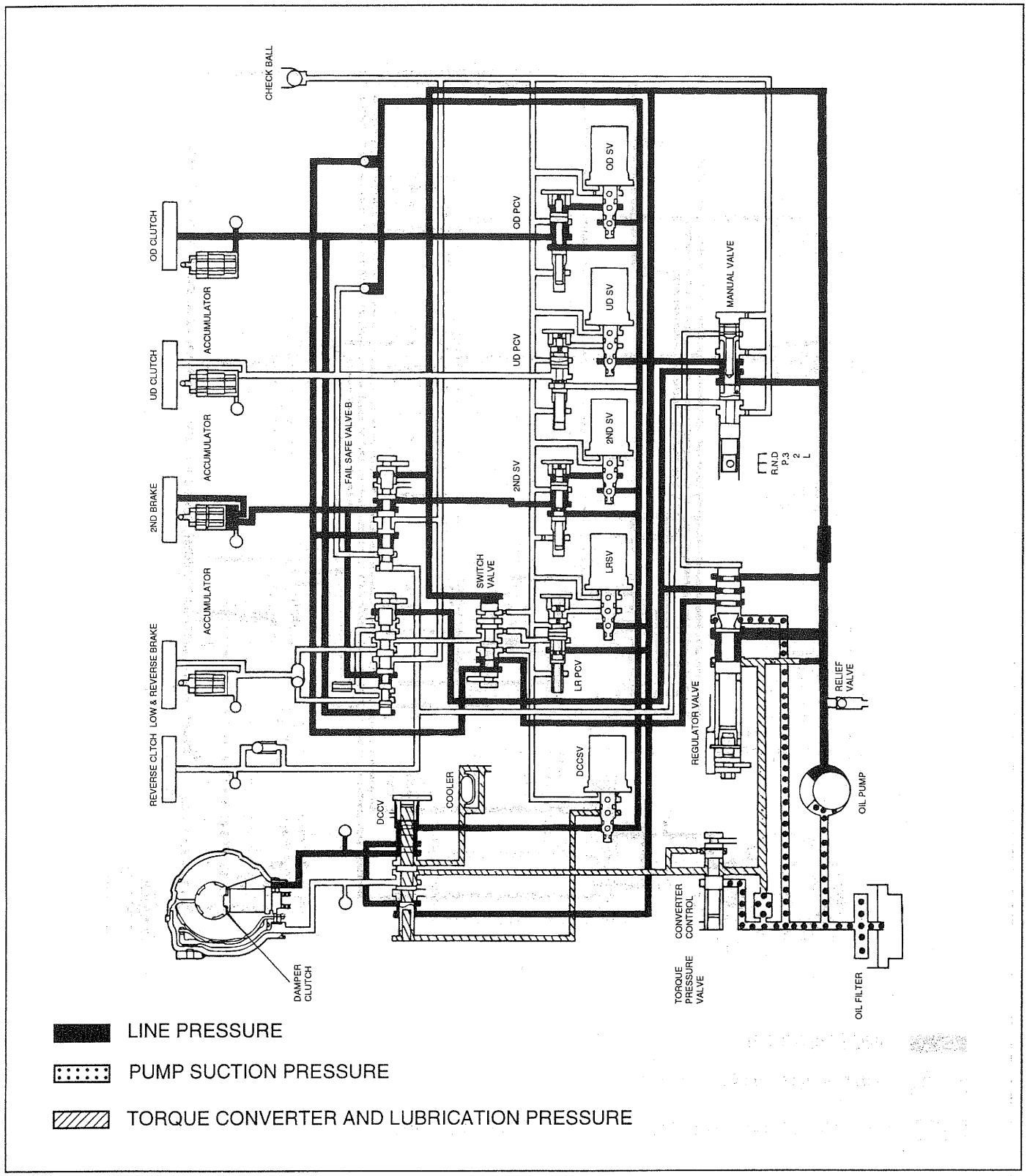
EKA9050C

THIRD



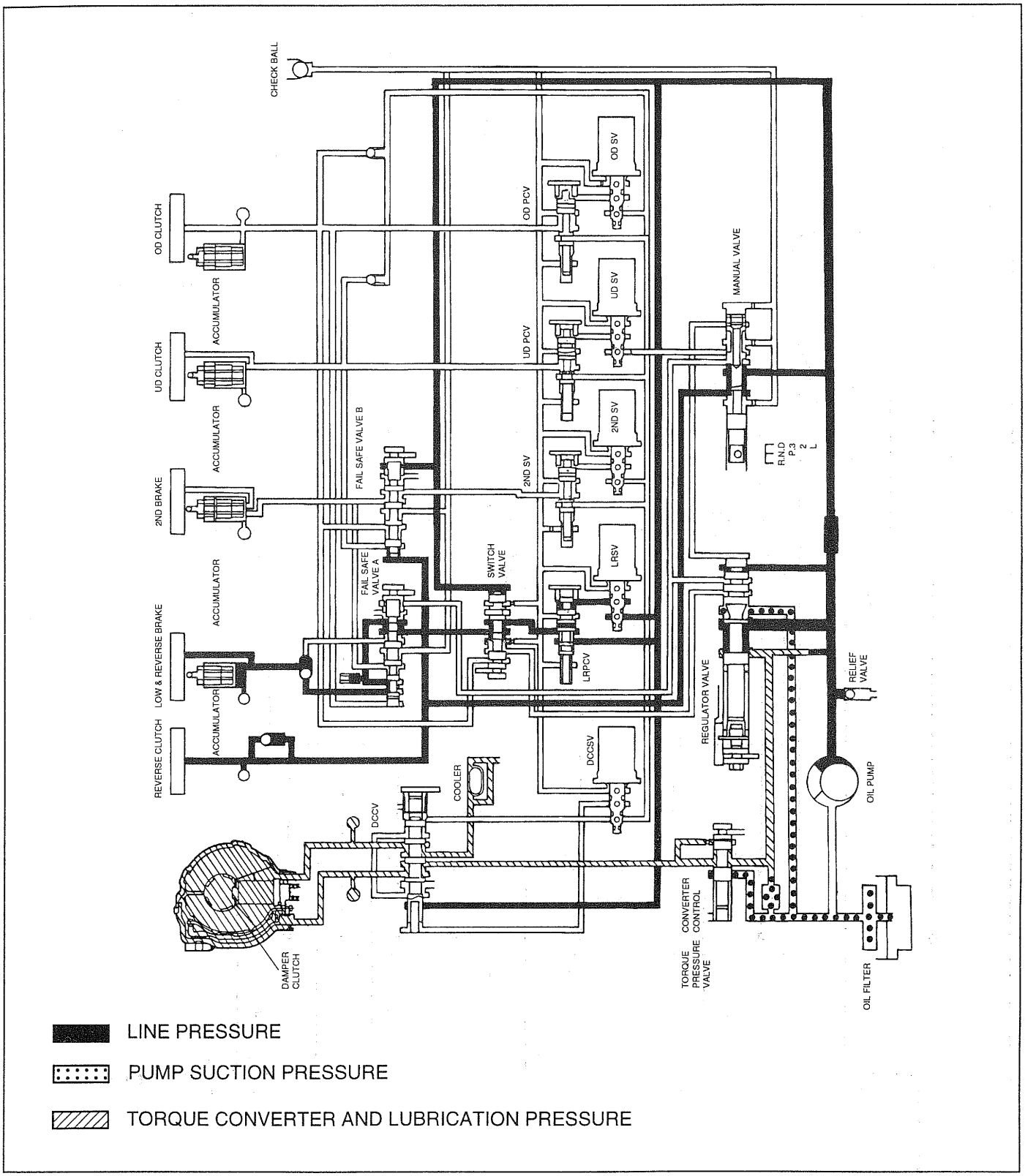
EKA9050D

FOURTH



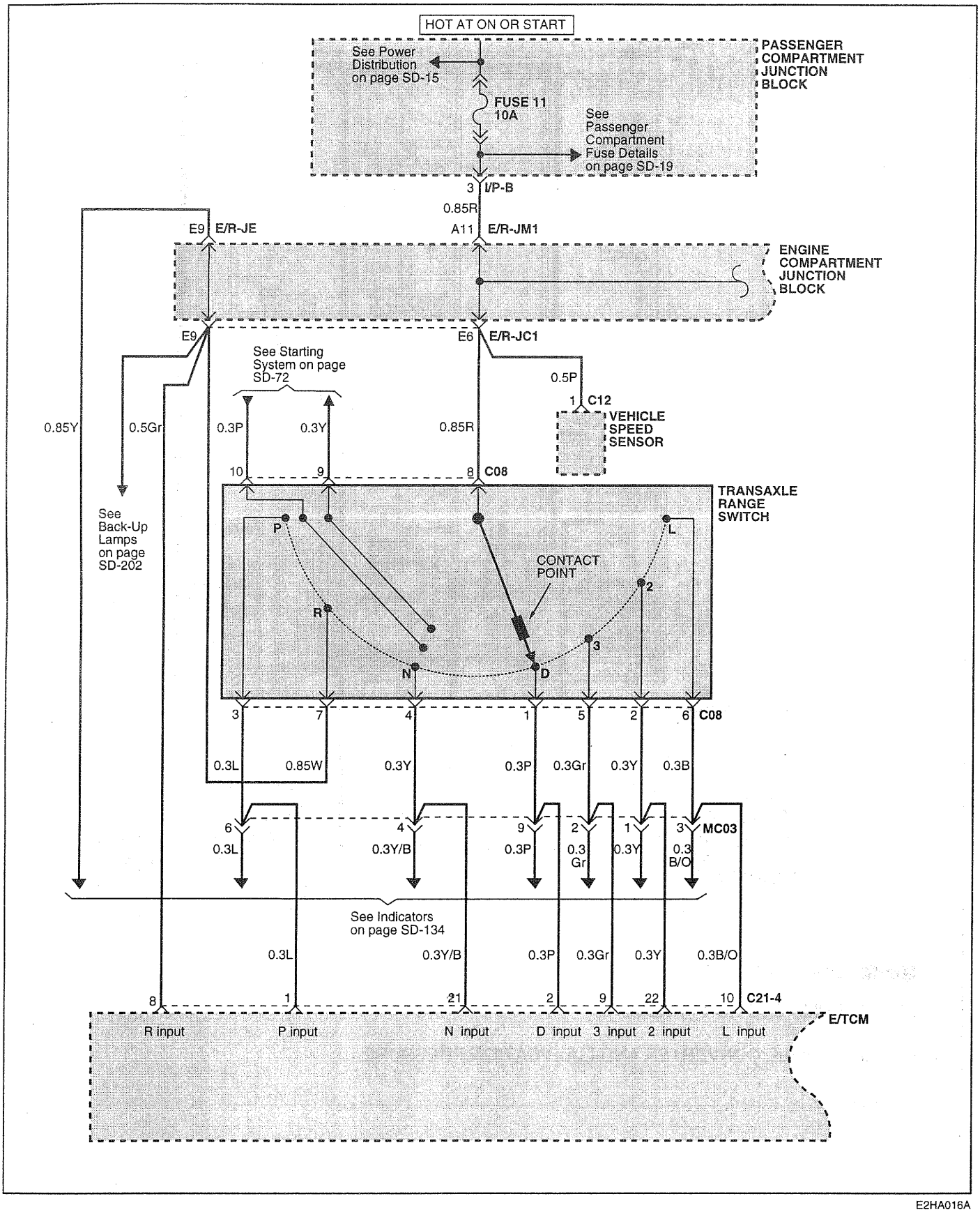
EKA9050E

REVERSE

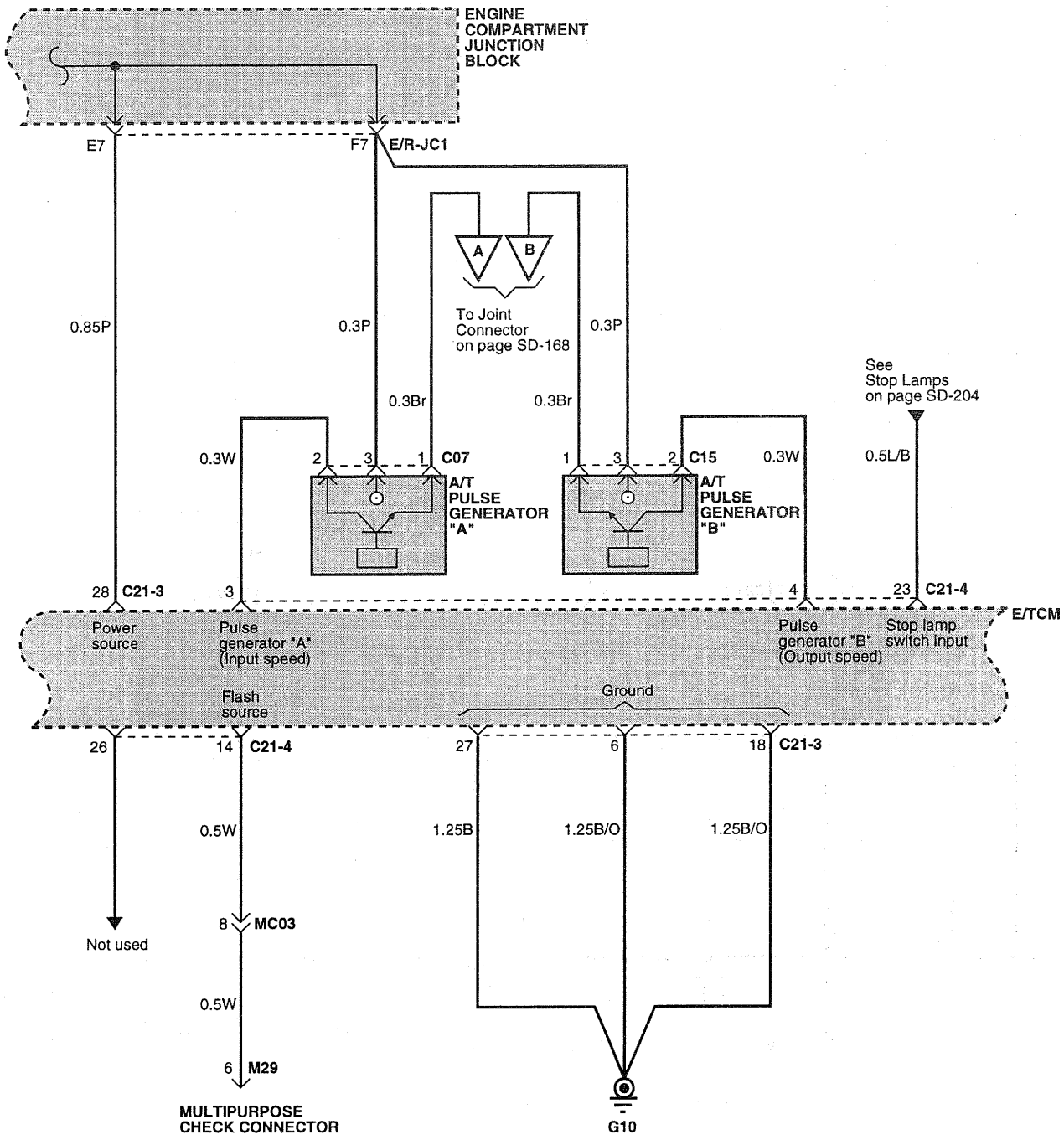


EKA9050F

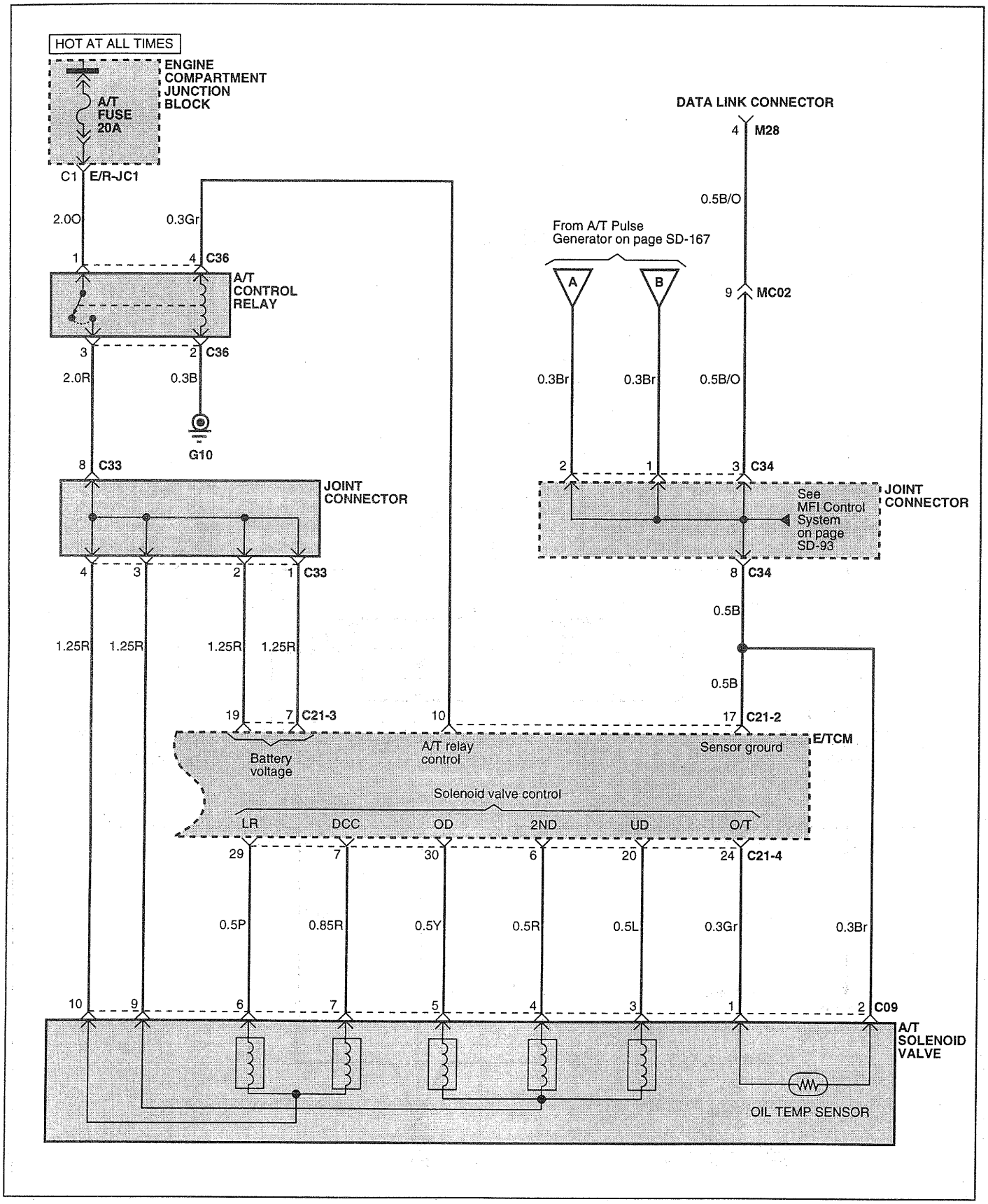
TCM CIRCUIT DIAGRAM (I4) (1) EKHA0300



E2HA016A

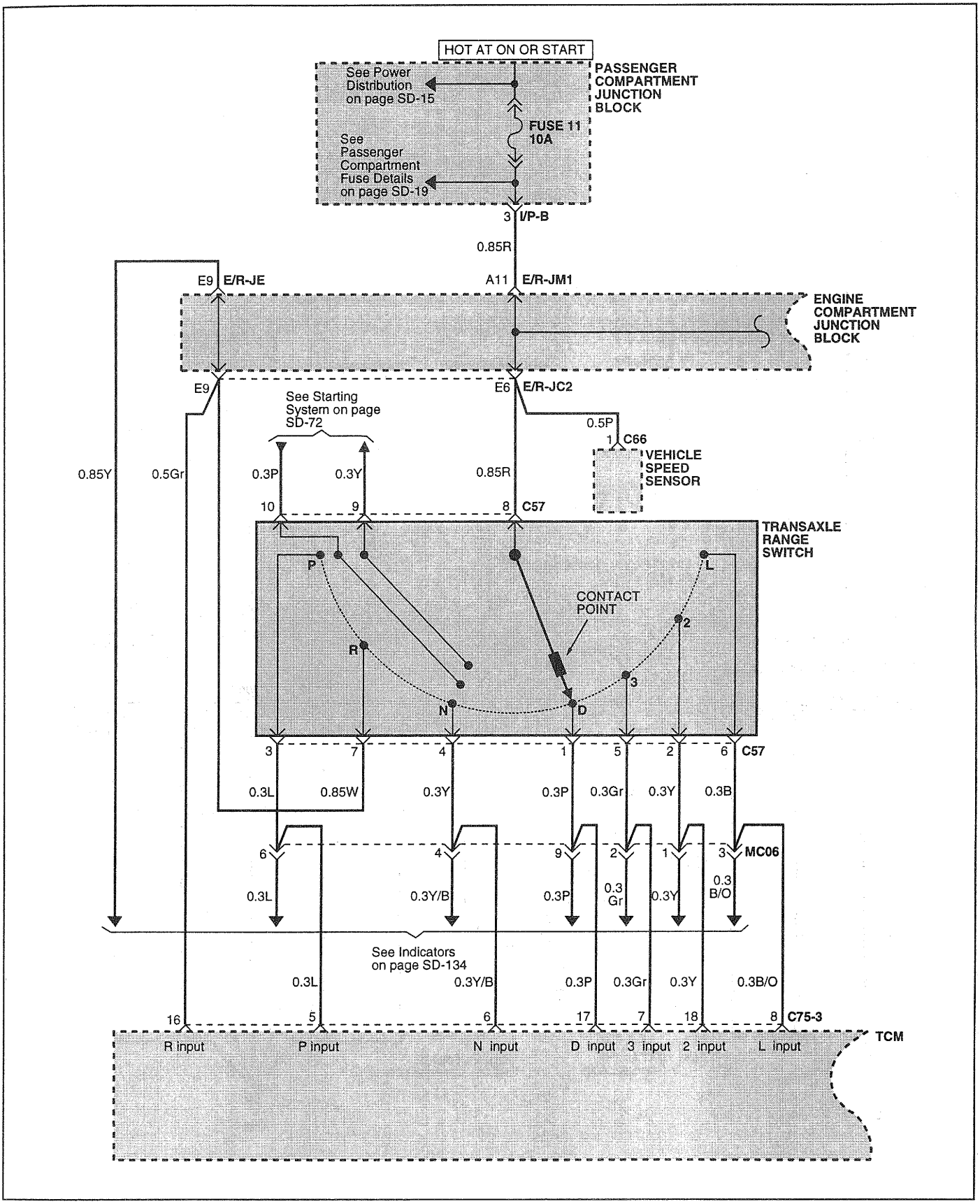

ENGINE COMPARTMENT JUNCTION BLOCK
E7
F7
E/R-JC1
A
B
To Joint Connector on page SD-168
0.85P
0.3P
0.3P
0.3Br
0.3Br
See Stop Lamps on page SD-204
0.3W
2
3
1
C07
A/T PULSE GENERATOR "A"
1
3
2
C15
A/T PULSE GENERATOR "B"
0.3W
0.5L/B
28
C21-3
3
4
23
C21-4
E/TCM
Power source
Pulse generator "A" (Input speed)
Flash source
Ground
Pulse generator "B" (Output speed)
Stop lamp switch input
26
14
C21-4
27
6
18
C21-3
0.5W
1.25B
1.25B/O
1.25B/O
8
MC03
Not used
0.5W
6
M29
MULTIPURPOSE CHECK CONNECTOR
G10

E2HA016B

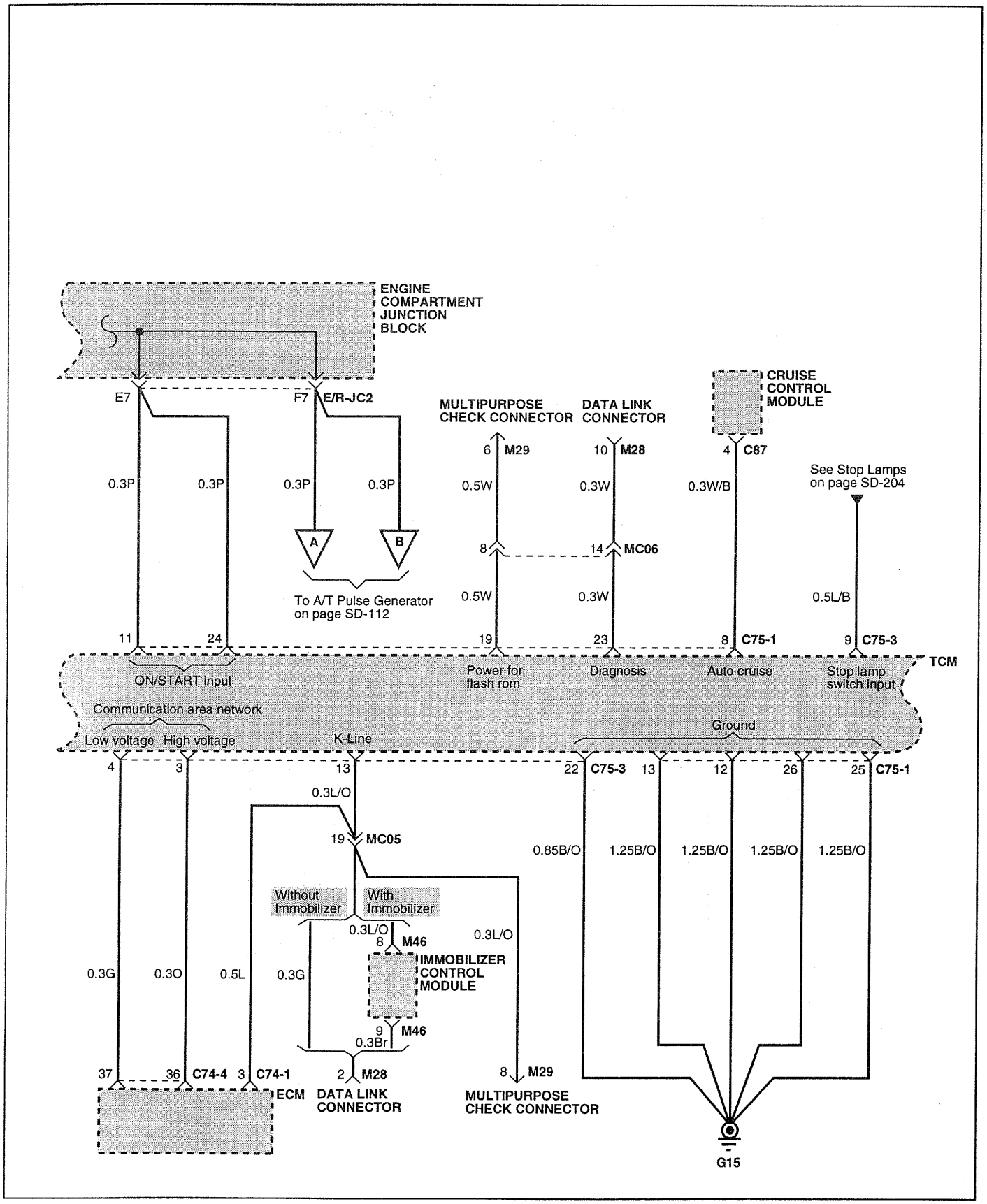

HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
A/T FUSE 20A
C1 E/R-JC1
2.0O
0.3Gr
1
4 C36
A/T CONTROL RELAY
3
2 C36
2.0R
0.3B
G10
8 C33
JOINT CONNECTOR
4 3 2 1 C33
1.25R 1.25R 1.25R 1.25R
19 7 C21-3
10
DATA LINK CONNECTOR
4 M28
0.5B/O
From A/T Pulse Generator on page SD-167
A
B
9 MC02
0.3Br
0.3Br
0.5B/O
2 1 3 C34
See MFI Control System on page SD-93
JOINT CONNECTOR
8 C34
0.5B
0.5B
17 C21-2
E/TCM
Battery voltage
A/T relay control
Sensor grourd
Solenoid valve control
LR DCC OD 2ND UD O/T
29 7 30 6 20 24 C21-4
0.5P 0.85R 0.5Y 0.5R 0.5L 0.3Gr 0.3Br
10 9 6 7 5 4 3 1 2 C09
A/T SOLENOID VALVE
OIL TEMP SENSOR

E2HA016C

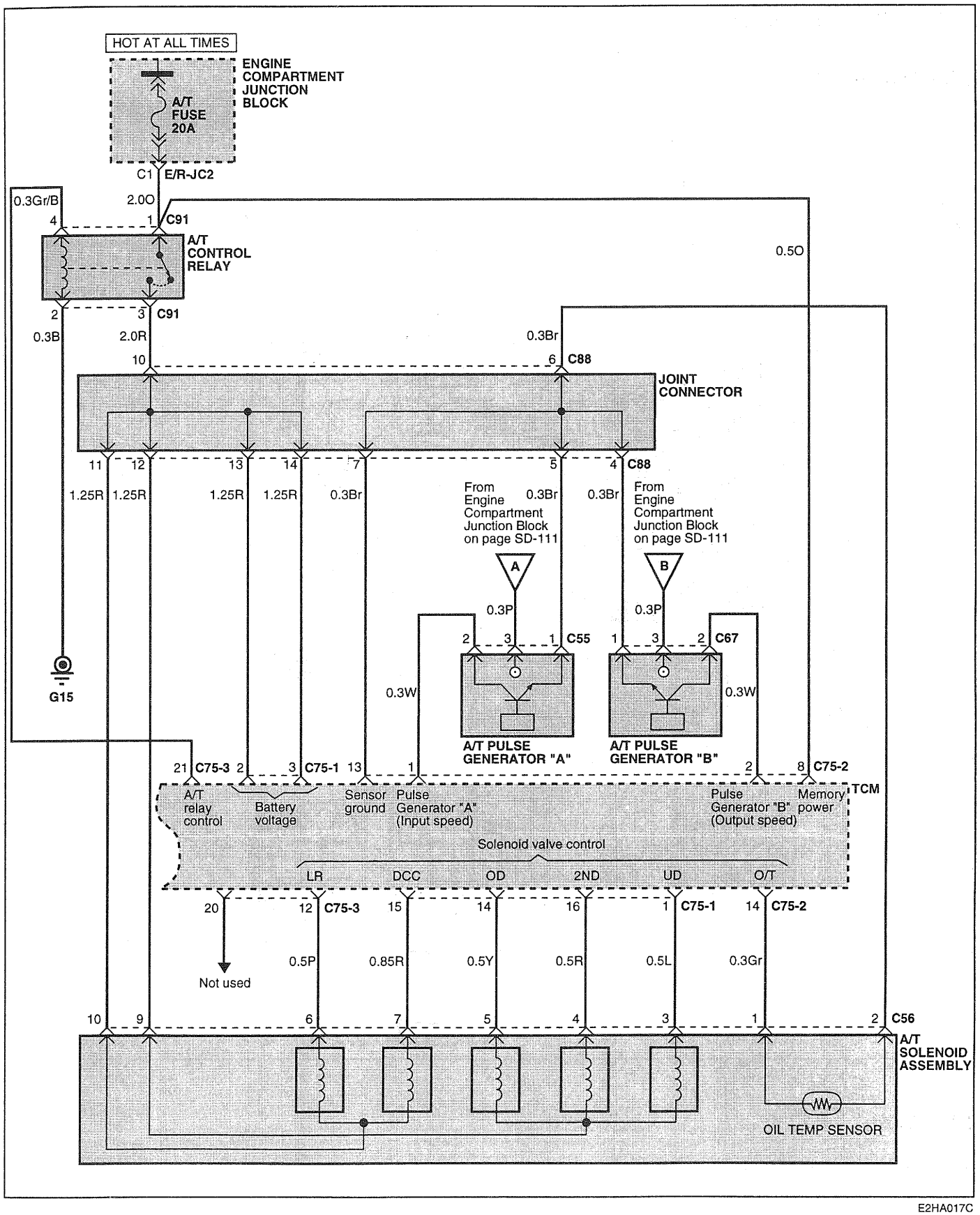
TCM CIRCUIT DIAGRAM (V6) (1)



E2HA017A


ENGINE COMPARTMENT JUNCTION BLOCK
E7
F7
E/R-JC2
0.3P
0.3P
0.3P
0.3P
A
B
To A/T Pulse Generator on page SD-112
MULTIPURPOSE CHECK CONNECTOR
DATA LINK CONNECTOR
CRUISE CONTROL MODULE
6 M29
10 M28
4 C87
0.5W
0.3W
0.3W/B
See Stop Lamps on page SD-204
8
14 MC06
0.5W
0.3W
0.5L/B
11
24
19
23
8 C75-1
9 C75-3
TCM
ON/START Input
Power for flash rom
Diagnosis
Auto cruise
Stop lamp switch input
Communication area network
Low voltage
High voltage
K-Line
Ground
4
3
13
22 C75-3
13
12
26
25 C75-1
0.3L/O
19 MC05
0.85B/O
1.25B/O
1.25B/O
1.25B/O
1.25B/O
Without Immobilizer
With Immobilizer
0.3L/O
8 M46
0.3L/O
0.3G
0.3O
0.5L
0.3G
IMMOBILIZER CONTROL MODULE
9 M46
0.3Br
37
36 C74-4
3 C74-1
2 M28
8 M29
ECM
DATA LINK CONNECTOR
MULTIPURPOSE CHECK CONNECTOR
G15

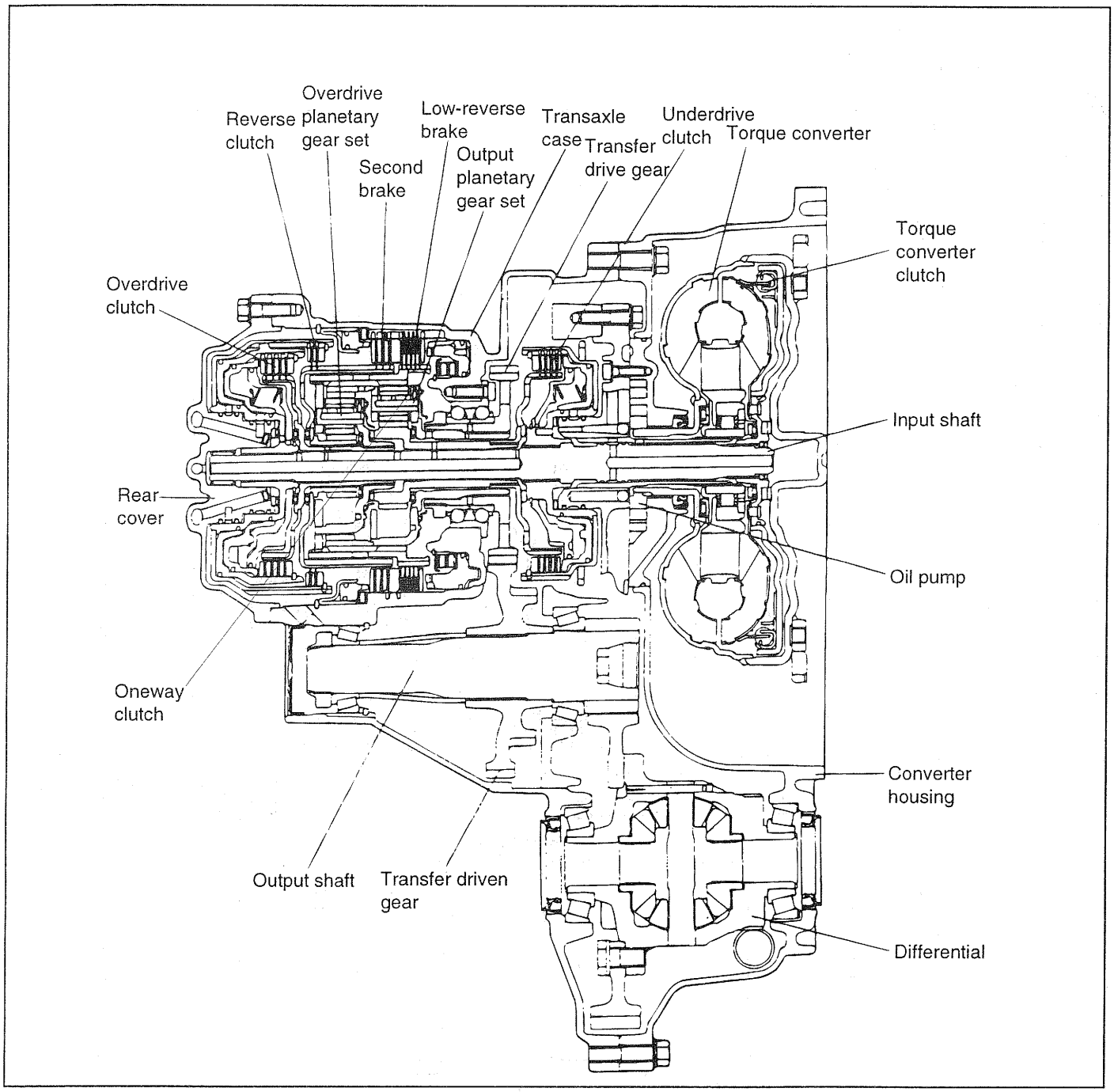
E2HA017B


HOT AT ALL TIMES
ENGINE COMPARTMENT JUNCTION BLOCK
A/T FUSE 20A
C1 E/R-JC2
0.3Gr/B
2.0O
4
1 C91
A/T CONTROL RELAY
0.5O
2
3 C91
0.3B
2.0R
0.3Br
10
6 C88
JOINT CONNECTOR
11 12 13 14 7 5 4 C88
1.25R 1.25R 1.25R 1.25R 0.3Br
From Engine Compartment Junction Block on page SD-111
0.3Br
From Engine Compartment Junction Block on page SD-111
A
B
0.3P
0.3P
2 3 1 C55
1 3 2 C67
0.3W
0.3W
G15
A/T PULSE GENERATOR "A"
A/T PULSE GENERATOR "B"
21 C75-3 2 3 C75-1 13 1 2 8 C75-2
TCM
A/T relay control
Battery voltage
Sensor ground
Pulse Generator "A" (Input speed)
Pulse Generator "B" (Output speed)
Memory power
Solenoid valve control
LR DCC OD 2ND UD O/T
20 12 C75-3 15 14 16 1 C75-1 14 C75-2
Not used
0.5P 0.85R 0.5Y 0.5R 0.5L 0.3Gr
10 9 6 7 5 4 3 1 2 C56
A/T SOLENOID ASSEMBLY
OIL TEMP SENSOR

E2HA017C

AUTOMATIC TRANSAXLE

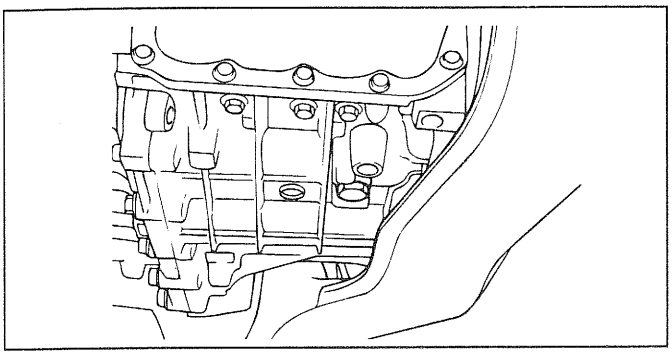
COMPONENTS EKA90240



EKA9008A

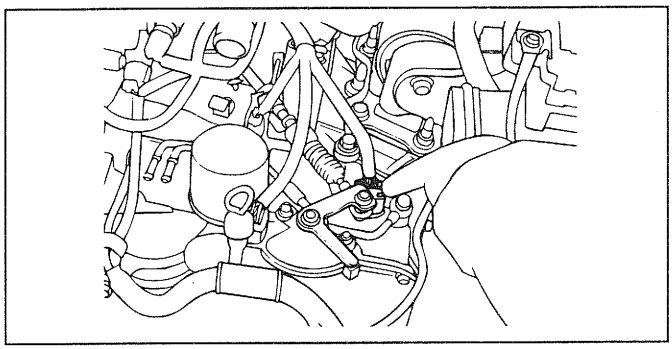
REMOVAL EKHA0250

1. Remove the drain plug and drain the automatic transaxle fluid.
2. Remove the air cleaner assembly.



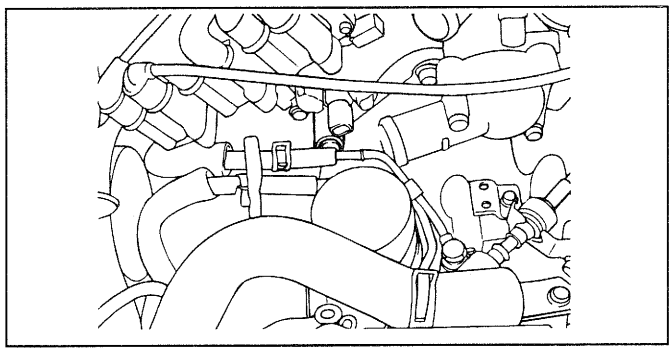
EKA9009A

3. Remove the control cable.
4. Disconnect the speedometer sensor connector.
5. Disconnect the transaxle range switch connector, solenoid connector, and oil temperature sensor connector.



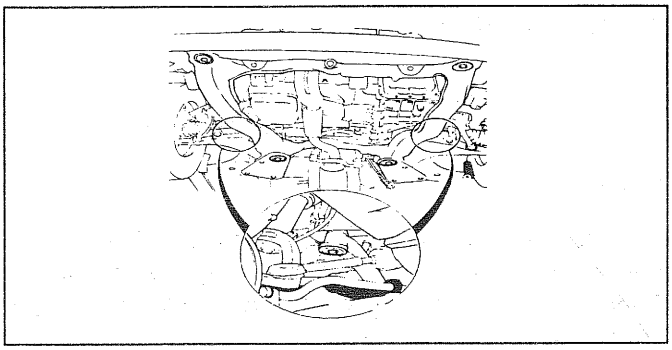
EKA9009B

6. Remove the oil cooler hose.



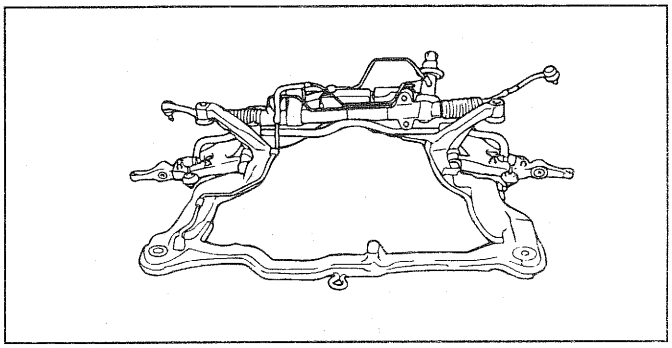
EKA9009C

7. Attach the special tool (09210–3A000,09200–38001) and engine support fixture to the engine.
8. Remove the gear box, stabilizer bar, tie rod end, lower arm ball joint, and drive shaft.
9. Remove the gear box u-joint bolt and return the tube mounting bolts.
10. Remove the subframe mounting bolts and the sub-frame.



ECA9020A

11. Remove the starter motor.

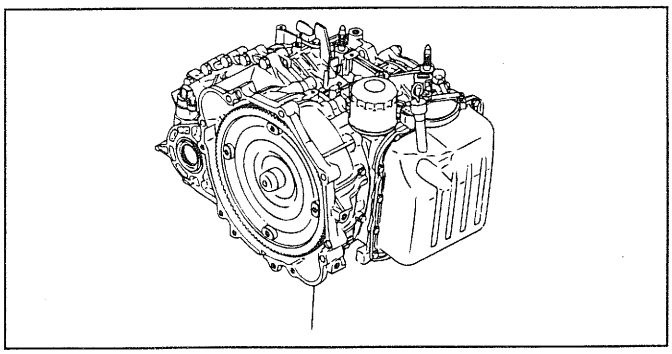


EKA9009F

12. Remove the automatic tranaxle mounting bolts.
13. Remove the engine to automatic transaxle bolts.
14. Remove the automatic transaxle assembly by jack.

CAUTION

1. **Engine and transmission mounting insulators should be installed as specified.**
2. **Mounting bracket installation procedures.**
   1) **Engine mounting bracket.**
   2) **T/M mounting bracket.**
   3) **Rear roll stopper mounting bracket.**
   4) **Front roll stopper mounting bracket.**
3. **When installing the front roll stopper mounting bracket, be especially careful not to crush the insulator. If crushed, idle vibration will most probably occur.**



EKA9009E

INSTALLATION EKHA0260

1. Attach the torque converter on the transaxle side and mount the transaxle assembly onto the engine.

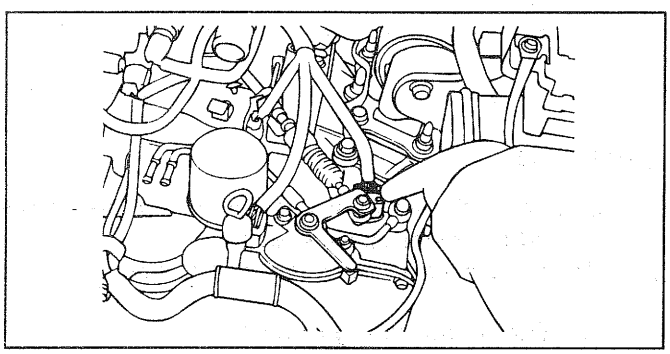
CAUTION

If the torque conveter is mounted first on the engine, the oil seal on the transaxle may be damaged. Therefore, first be sure to assemble the torque converter to the transaxle.

2. Install the transaxle control cable and adjust as follows:

    1. Move the shift lever and the transaxle range swth to the "N" position and install the control cale.
    2. When connecting the control cable to the transaxle mounting bracket, install the clip until it contacts to the control cable.
    3. Remove any free-play in the control cable by adjusting the nut and then check to see that the selected lever moves smoothly.
    4. Check to see that the control cable has been adjusted correctly.

3. Installation is the reverse of removal.



EKA9009B

NOTE

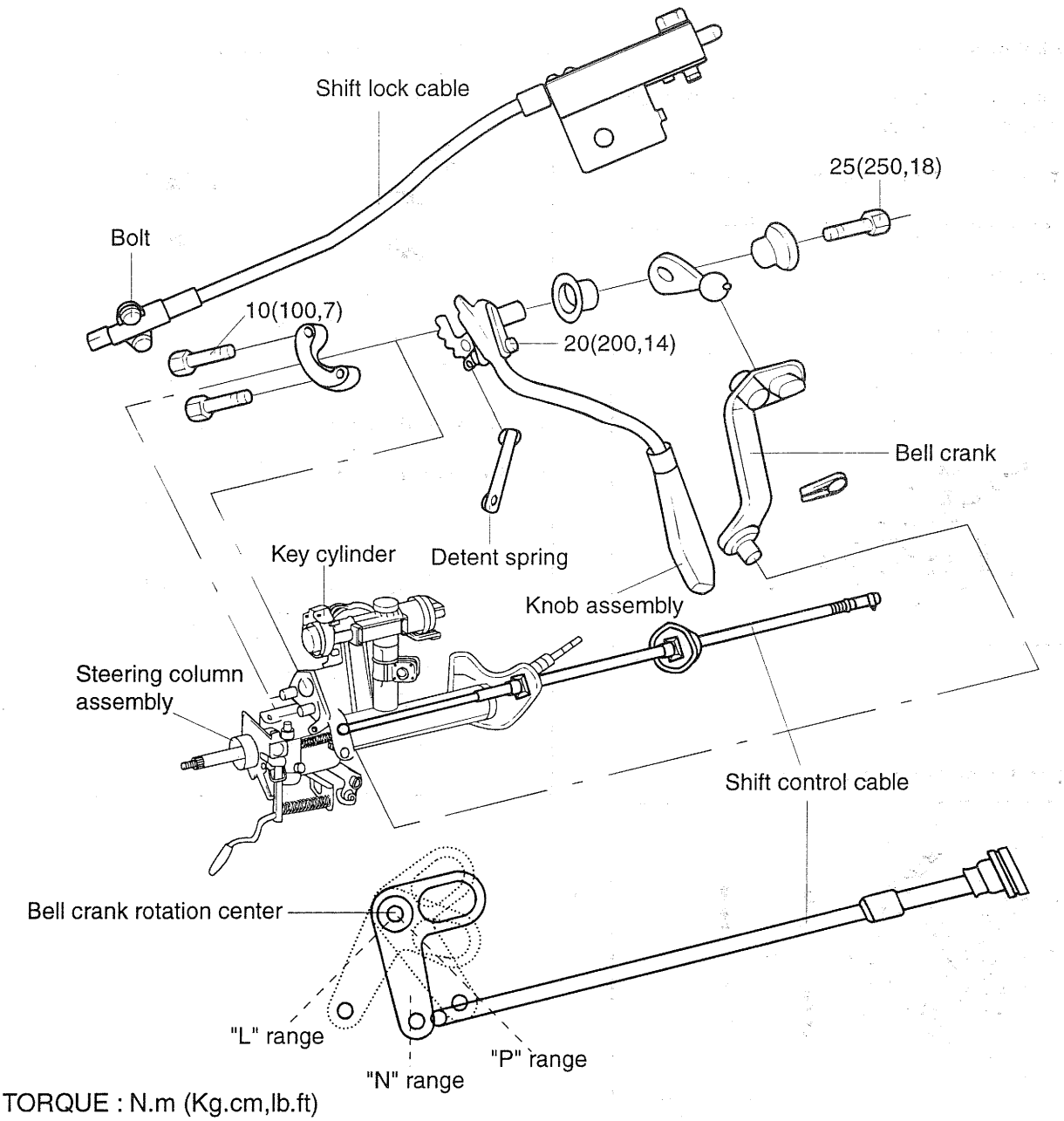
For Manual Transaxle and Automatic Transaxle overhaul, refer to the "Overhaul Manual".

AUTOMATIC TRANSAXLE SHIFT CONTROL

AUTOMATIC TRANSAXLE CONTROL SYSTEM EKHA0180

AUTOMATIC TRANSAXLE SHIFT CONTROL

COMPONENTS

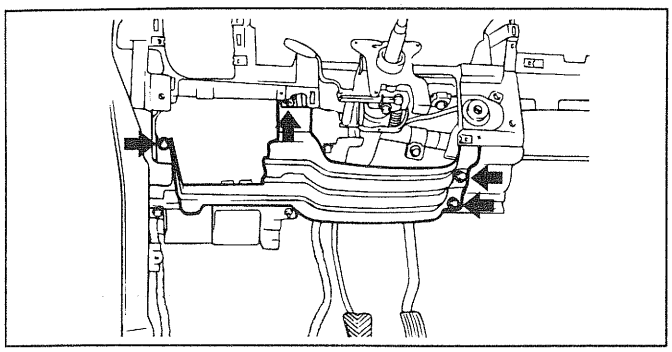


TORQUE : N.m (Kg.cm,lb.ft)

EKHA030A

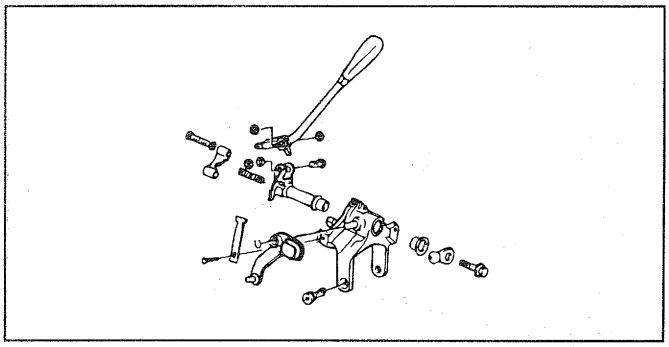
REMOVAL EKHA0190

1. Remove lower and the upper cover of the steering column.



ESHA040X

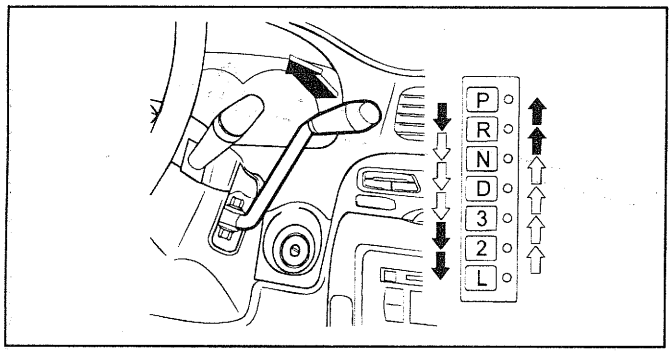
2. Remove the lower shroud cover.
3. Remove the shift control cable, the shift lock cable, and the key inter lock cable.
   1) Remove the clip of the control cable side.
   2) Remove the bolt and the air cleaner assembly.
   3) Remove battery.
   4) Remove cables.



EKHA040A

Shift lever

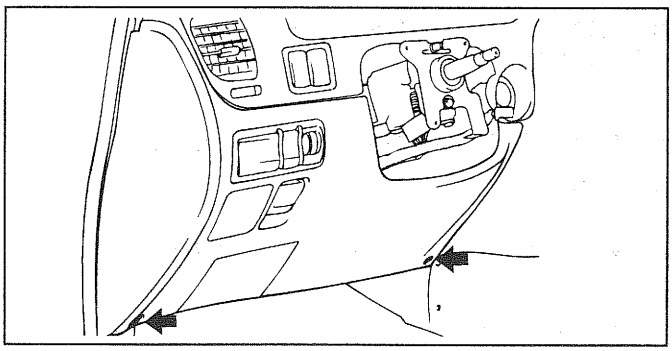
It is installed on the steering column side.



EKHA035A

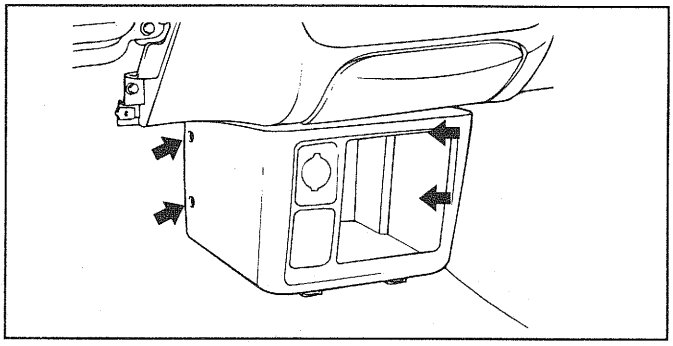
TCM REPLACEMENT

1. Remove the lowler shroud cover.



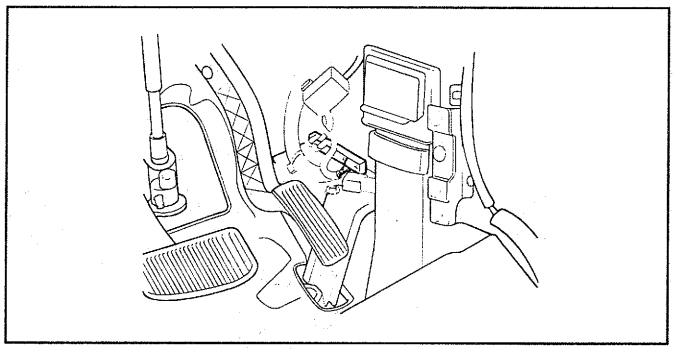
ESHA040S

2. Remove the multi box housing.



ESHA040L

3. Remove the center lower side cover.
4. Remove the TCM.



EKHA031A

MANUAL TRANSAXLE SYSTEM

MANUAL TRANSAXLE SYSTEM EMA90070

SERVICE ADJUSTMENT PROCEDURES

TRANSAXLE GEAR OIL LEVEL INSPECTION

Inspect each component 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 oil filler plug and check level with finger.
2. Oil level must be up to fill the hole, add oil until it runs over. Then reinstall plug.
3. Replace the oil so that the transaxle gear oil is not dirty, and that it is not of a suitable viscosity.

REPLACEMENT OF TRANSAXLE GEAR OIL EMA90080

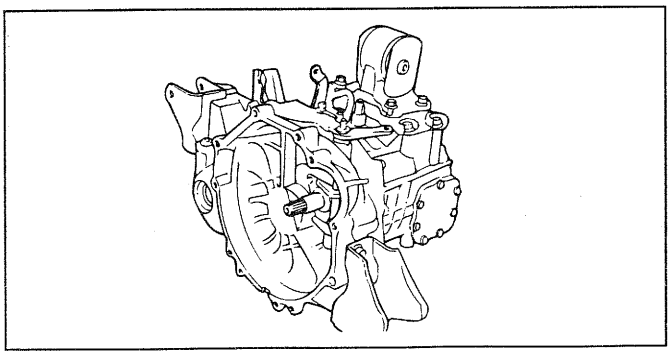
Use HP Gear Oil SAE 75W/90 (API-GL-4).

1. With the vehicle parked on a levelled surface, remove the drain plug and drain the transaxle oil.
2. Replace the gasket with a new one and install the drain plug.
3. Add new oil through the filler plug and, fill it to below the plug opening.

Standard value :
Transaxle oil total capacity .....
2.1 lit (2.2 U.S.qts., 1.8 imp.qts.)

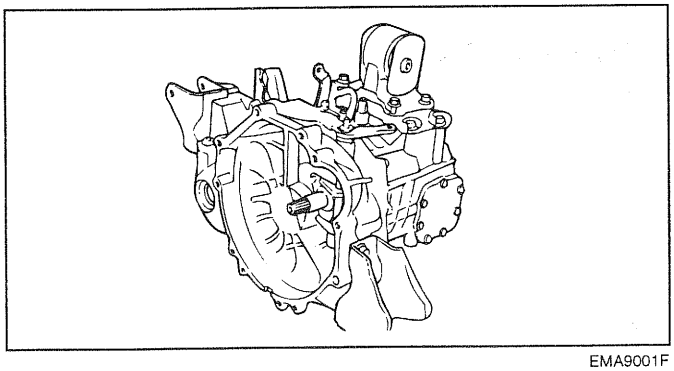
DRIVE SHAFT OIL SEAL REPLACEMENT EMA90090

1. Disconnect the drive shaft form the transaxle (Refer to "DS" group).



EMA9001F

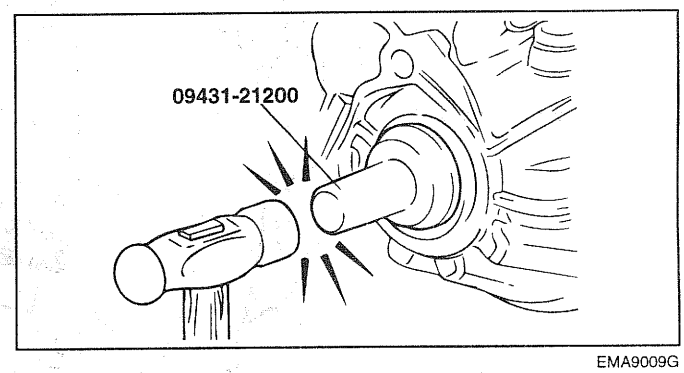
2. Using a flat-tip screwdriver, remove the oil seal.



EMA9001F

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 oil seal.

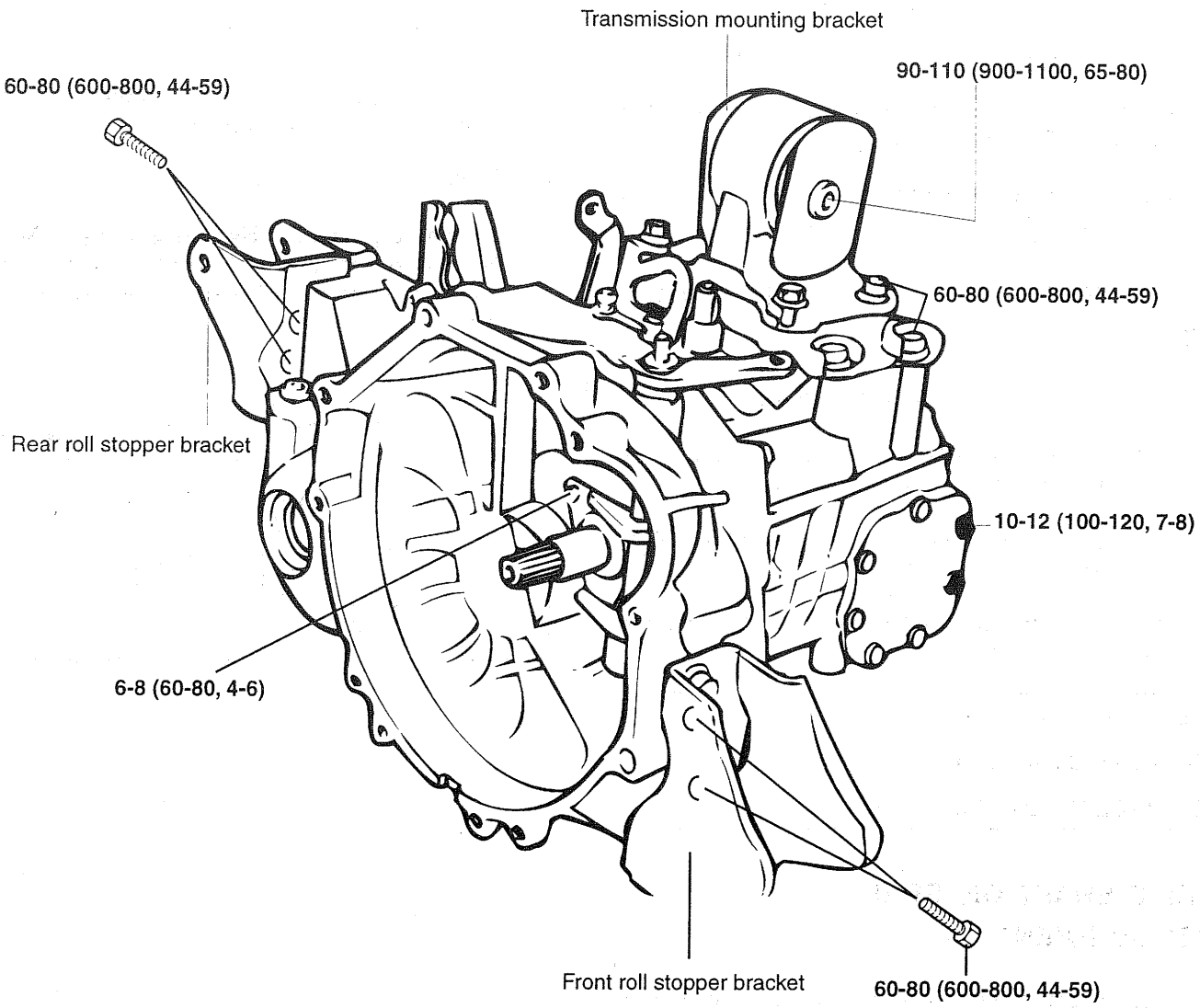
   Transaxle gear oil : Hypoid gear oil, SAE 75W/90 conforming to API GL-4 or higher. Disconnect the drive shaft form the transaxle (Refer to "DS" group).



EMA9009G

MANUAL TRANSAXLE

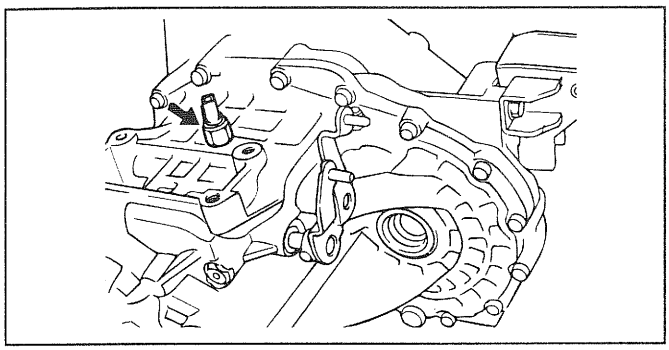
COMPONENTS EMA90180



EMA9001A

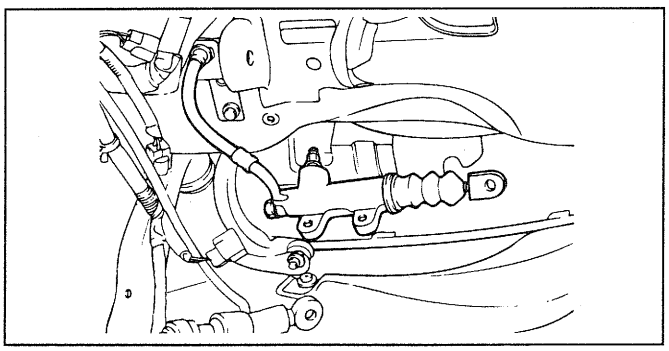
REMOVAL EMHA0190

1. Remove the battery (-) cable.
2. Remove the air duct.
3. Remove the air cleaner and air flow hose assembly.
4. Disconnect the backup light switch connector.
5. Disconnect the clutch tube and clip.



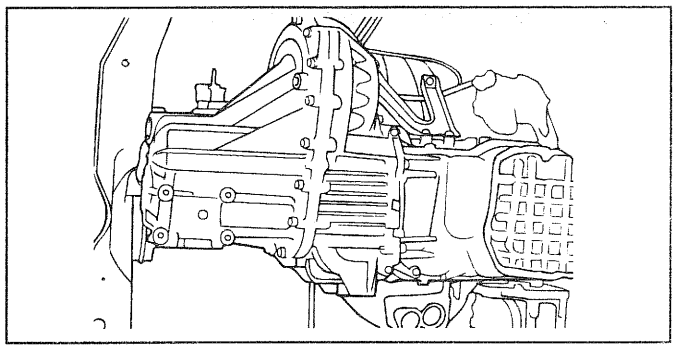
EMA9001D

6. Remove the clutch release cylinder (Refer to "CH" Group).
7. Remove the speedometer cable.
8. Remove the select cable and shift cable (Refer to "MT" Group).



EOA9014D

9. Remove the starter motor mounting bolts, and remove the transaxle assembly upper connecting bolts.
10. Attach to the engine hooks using the special tool (09210-3A000,09200–38001).
11. Remove the transaxle mounting bracket and insulator.
12. Lift the vehicle up.
13. Remove the front tire.
14. Remove the drain plug and drain the transaxle gear oil.
15. Disconnect the tie rod end. Lower arm ball joint and drive shaft. (Refer to "DS" Group).
16. Remove the gear box u-joint bolt and the return tube mounting bolts.
17. Remove the front muffler.
18. Remove the sub-frame mounting bolts and the sub-frame.
19. Remove the transaxle front and rear mounting bracket.
20. Remove the transaxle side mounting bolts.



EMA9019B

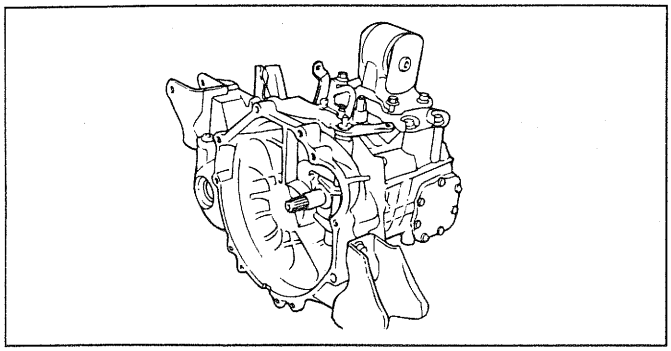
21. Remove the transaxle assembly supporting it with a jack.

NOTE

When supporting the transaxle assembly, make sure that the lifting force is applied to a wide area and, not to a small localized area.

CAUTION

1. **Engine and transmission mounting insulators should be installed in the specified manner.**
2. **Mounting bracket installation procedures.**
   - **Engine mounting bracket.**
   - **T/M mounting bracket.**
   - **Rear roll stopper mounting bracket.**
   - **Front roll stopper mounting bracket.**
3. **When installing front roll stopper mounting bracket, be especially careful not to crush the insulator, if crushed, idle vibration will most probably occur.**



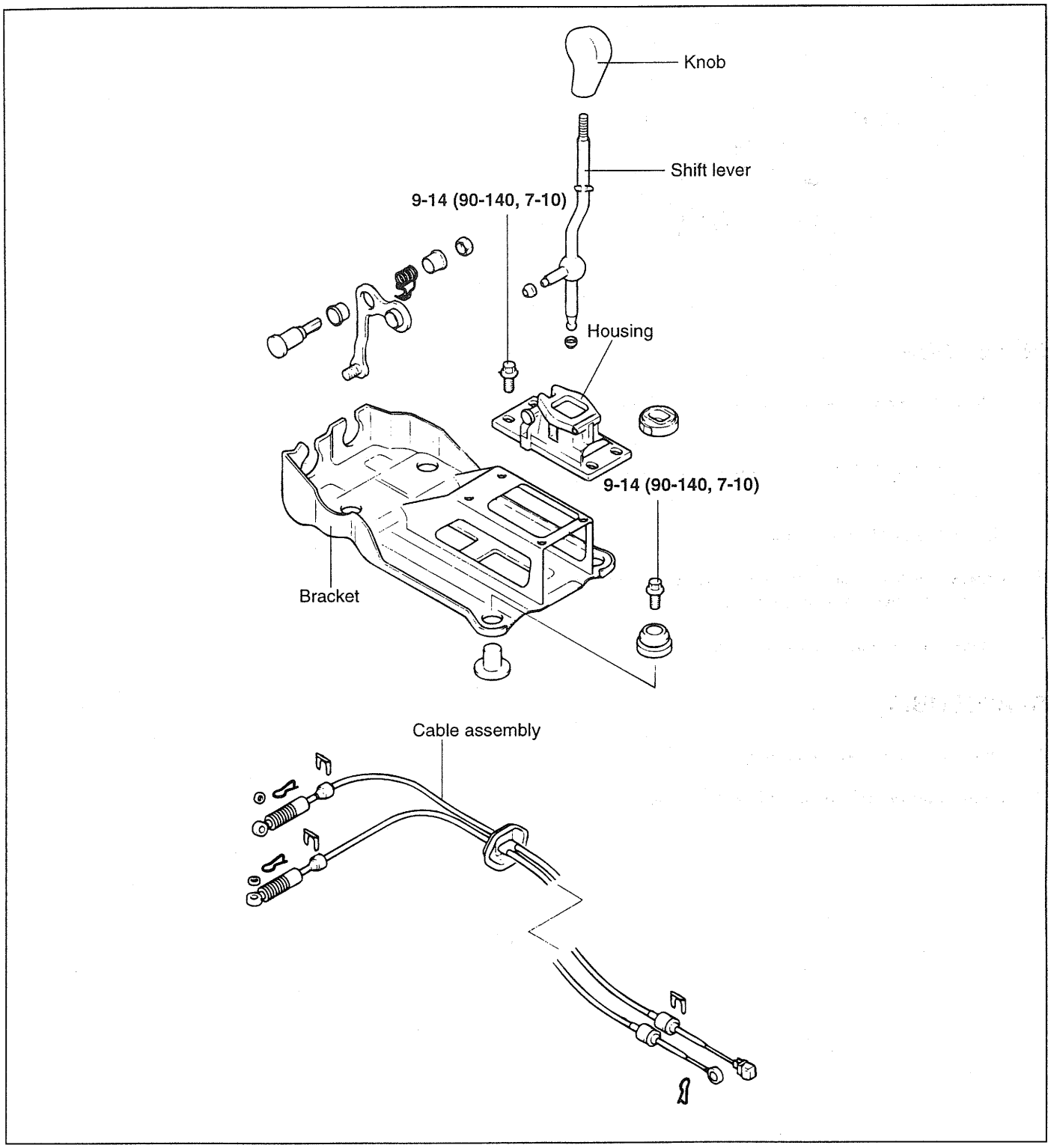
EMA9001F

INSTALLATION EMA90200

1. Installation is the reverse of removal.

MANUAL TRANSAXLE SHIFT CONTROL

COMPONENTS EMA90110

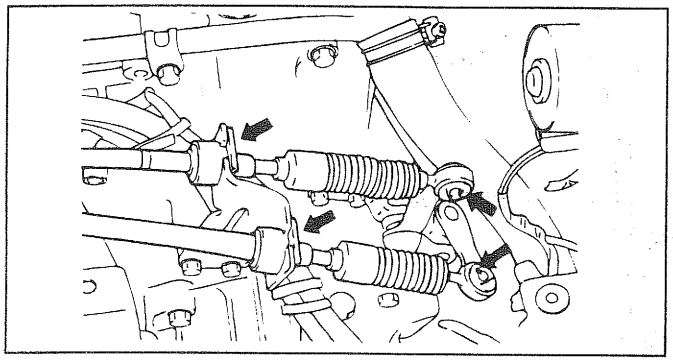


EMA9020A

REMOVAL EMA90120

1. Remove the console assembly (Refer to CONSOLE).
2. Remove the cotter pins and clips (shift lever side).
3. Remove the shift lever assembly.

4. Remove the retainer and bolts.
5. Remove the cotter pins and clips (Transaxle side).
6. Remove the shift cable and select cable.



EMA9012E

INSPECTION EMA90130

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.

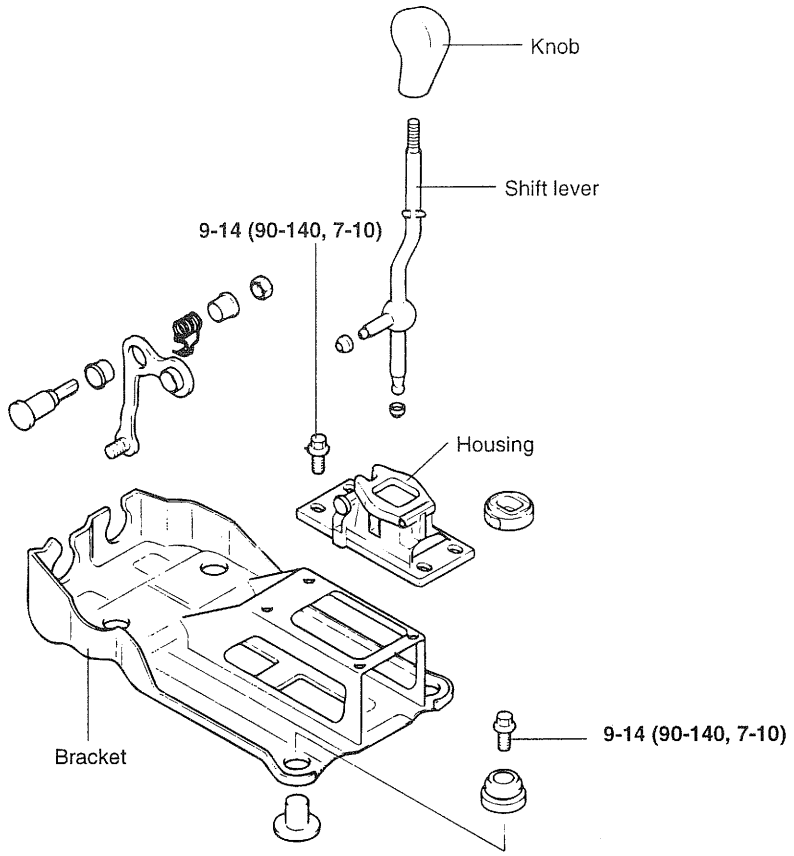
REASSEMBLY EMA90140

1. Install the shift lever assembly.
2. Installation of shift lever and select cable.

SHIFT LEVER

COMPONENTS EMA90150

CiOMPONENTS



TORQUE : Nm (kg·cm, lb·ft)

EMA9020B

INSPECTION EMA90160

1. Inspect the bushing for wear or damage.
2. Inspect the return spring for damage or deterioration.

REASSEMBLY EMA90170

1. Apply multi-purpose grease to the sliding part of the bushings.
2. Reassembly is reverse of the disassembly.