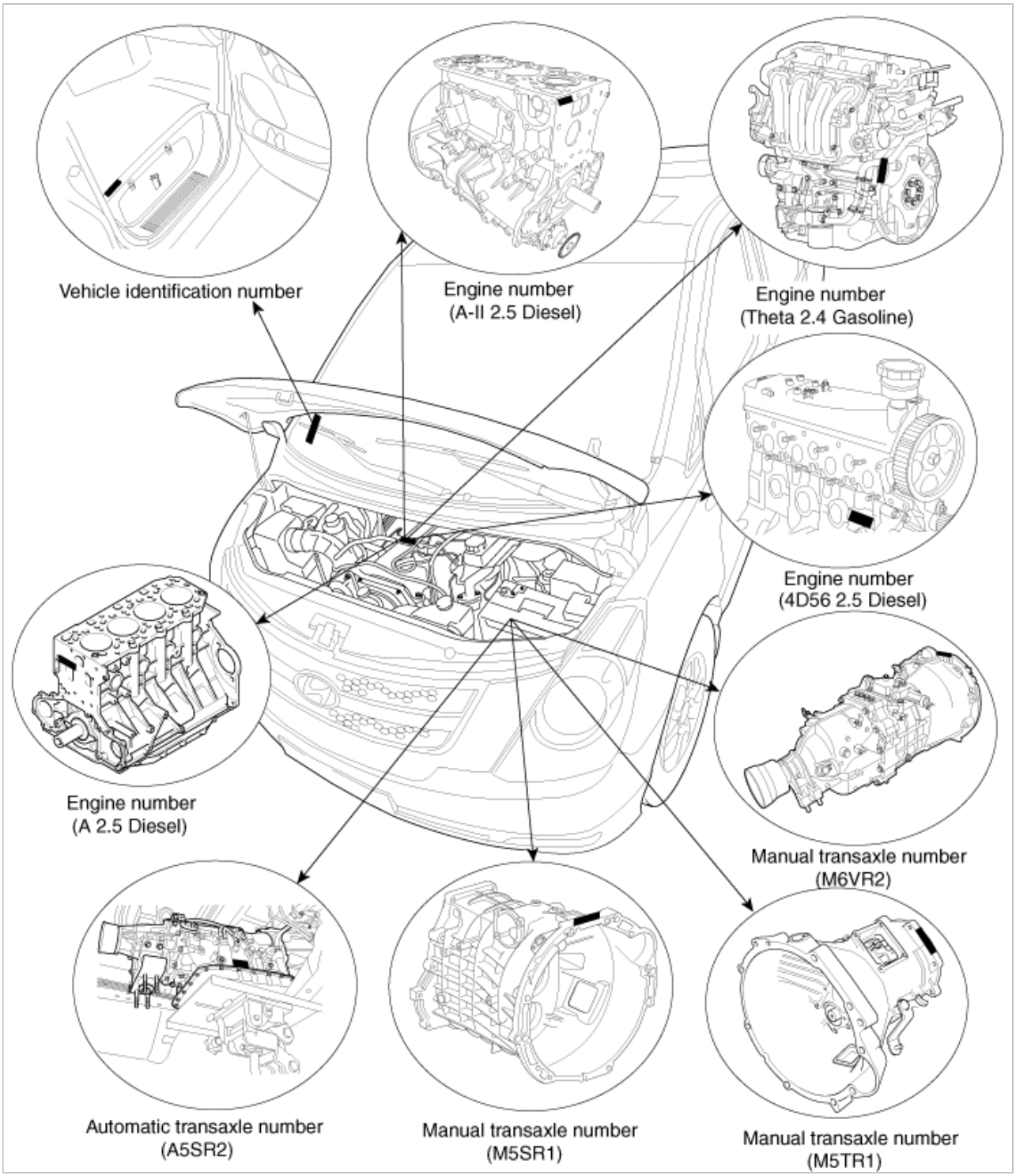
Identification Number Locations



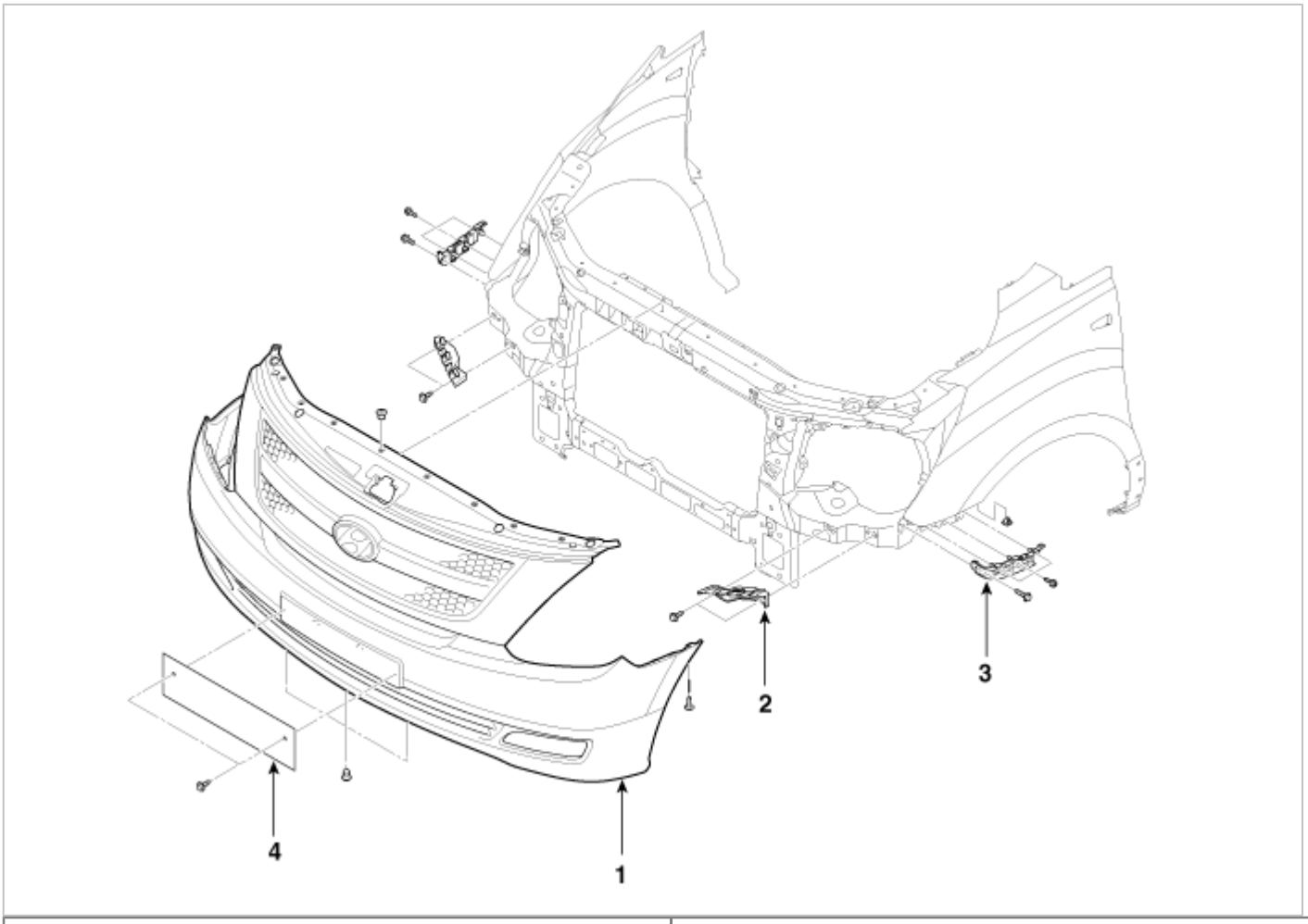
Identification Number Description

Vehicle Identification Number

Replacement

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not bend or scratch the cover and other parts.

1. Remove the front bumper (1).
2. Installation is the reverse of removal.



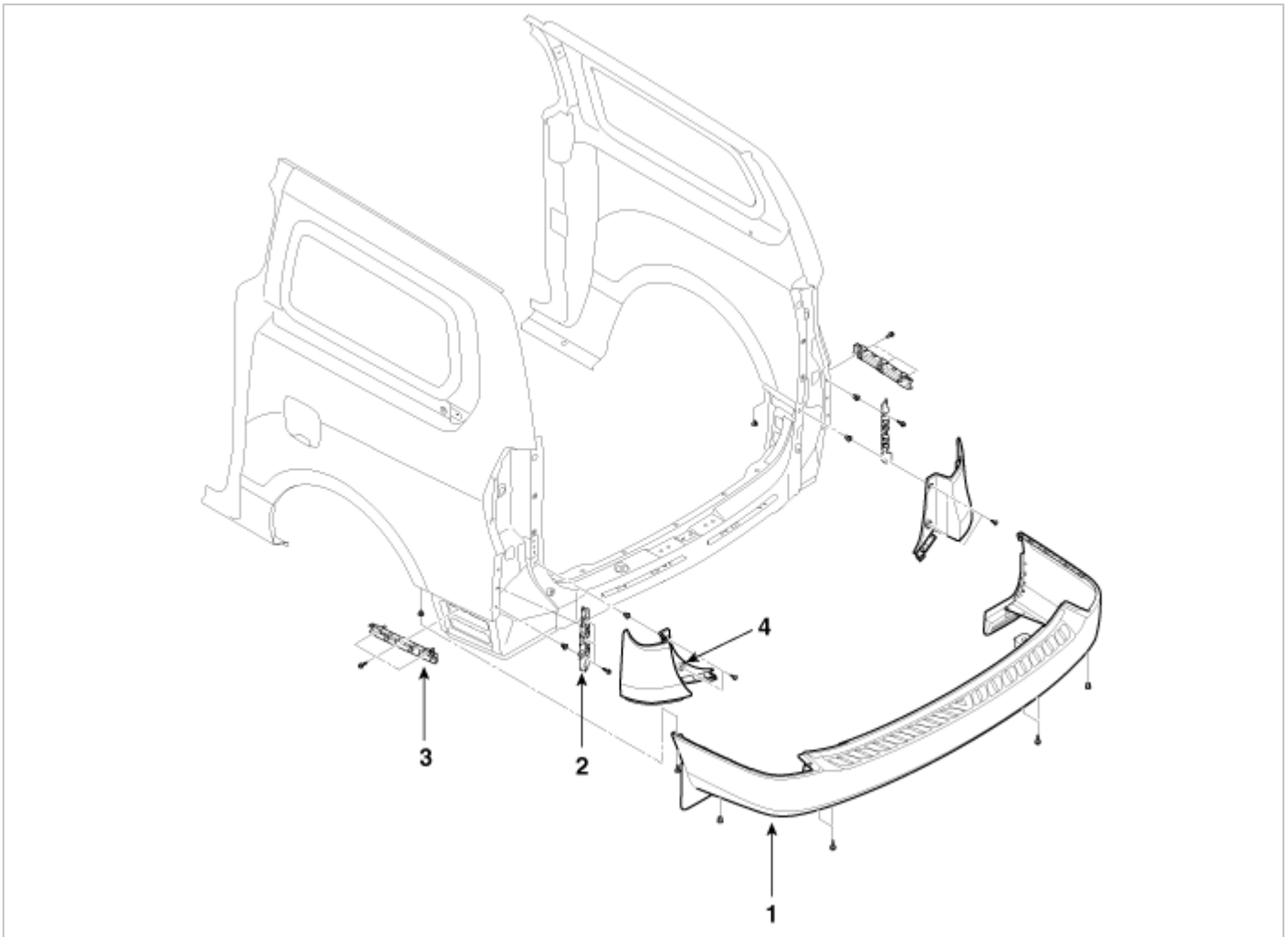
1. Front bumper 2. Front bumper upper support bracket	3. Front bumper side mounting bracket

Replacement

- After remove the rear combination lamp.
- When prying with a flat-tip screwdriver, wrap it with protective tape , and apply protective tape around the related parts your hands.
- Put on gloves to protect your hands.
- Take care not bend or scratch the cover and other parts.

1. Loosen the rear bumper cover screws and clips.
2. Remove the rear bumper cover (1).
3. Installation is the reverse of removal.

- Replace any damage clips.



1. Rear bumper	3. Rear bumper side bracket

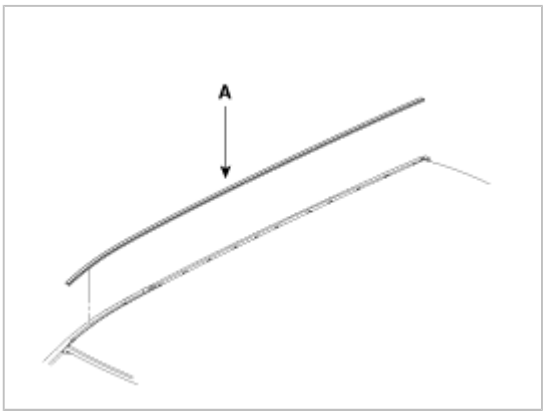
2. Rear bumper side bracket	4. Guarinish

Replacements

Roof Garnish Replacement

- When prying with a flat-tip screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.
- Take care not to scratch the body surface.

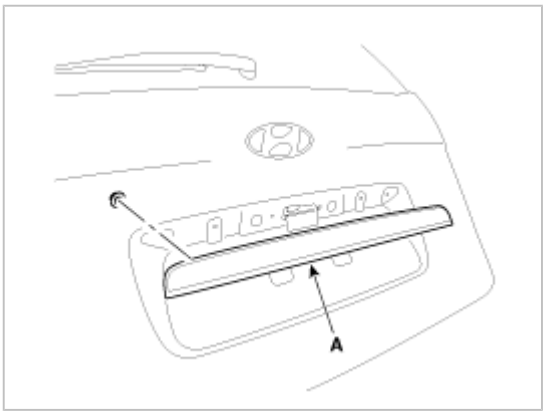
1. Remove the roof garnish (A).



2. Installation is the reverse of removal.

Tailgate Garnish Replacement

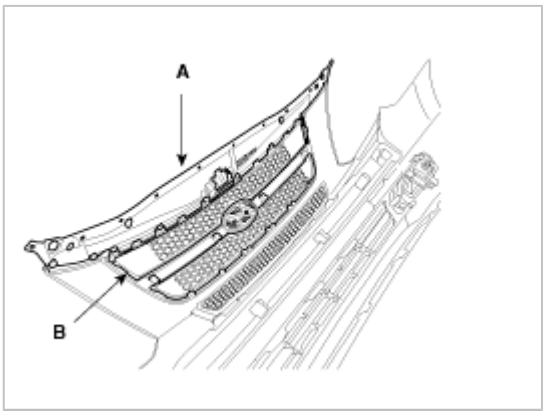
1. Remove the tailgate trim.
2. Remove the tailgate garnish (A).



3. Installation is the reverse of removal.

Radiator Grille Replacement

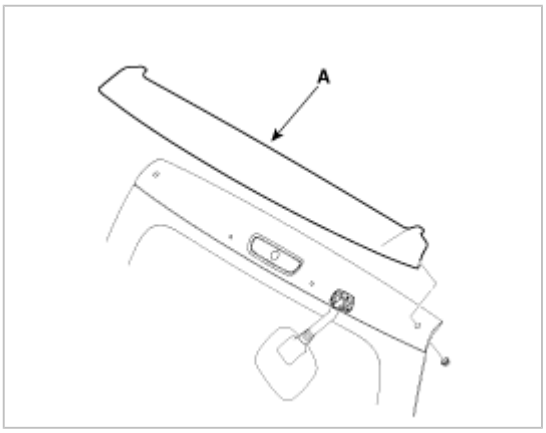
1. Remove front bumper.
2. Remove the radiator grille (A).



3. Installation is the reverse of removal.

Spolier Replacement

1. Remove the tailgate upper trim.
2. Remove the spolier (A).

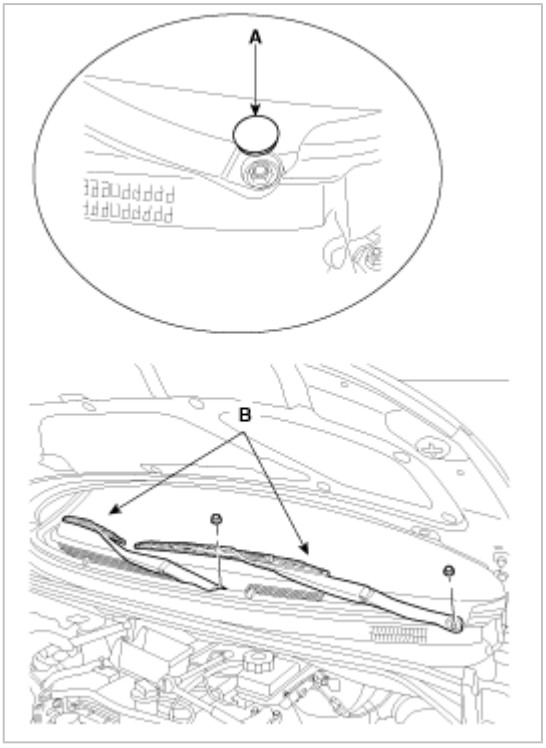


3. Installation is the reverse of removal.

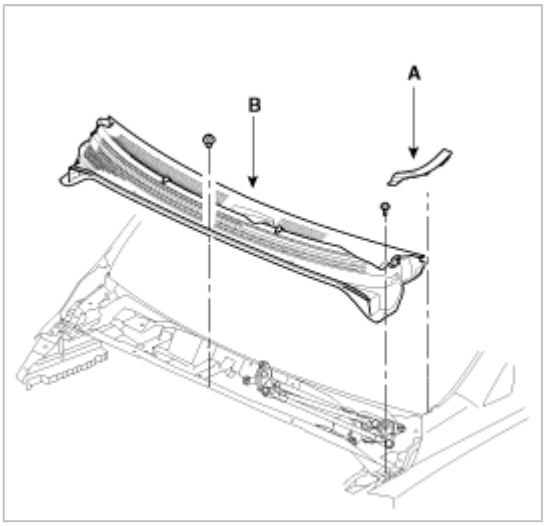
Replacement

1. Remove the cover (A).
2. Remove the wiper arm (B).

Tightening torque : 3.9~4.9 N.m (0.4~0.5 kgf.m, 2.9~3.6 lb-ft)



3. Remove the side cover (A).
4. Detach the clips, then remove the cowl top cover (B).

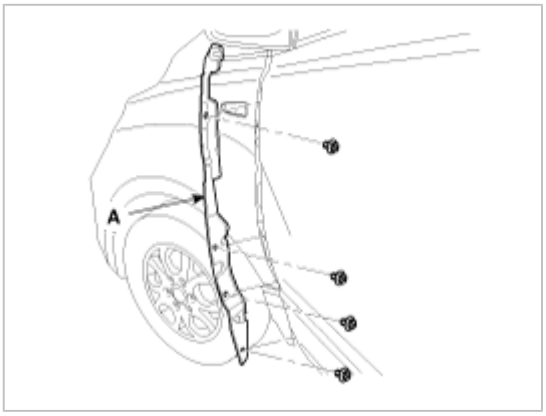


5. Installation is the reverse of removal.

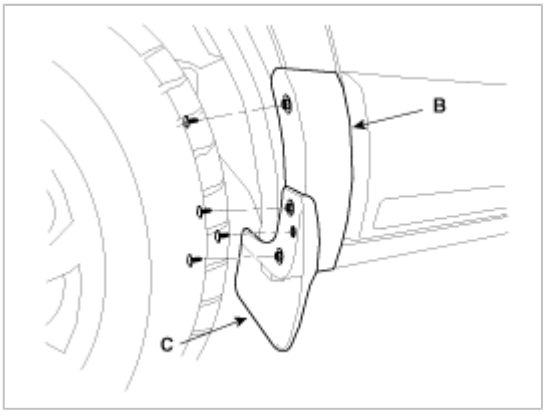
Replacement

- Take care not to damage the hood and body.
- When removing the clips, use a clip remover.

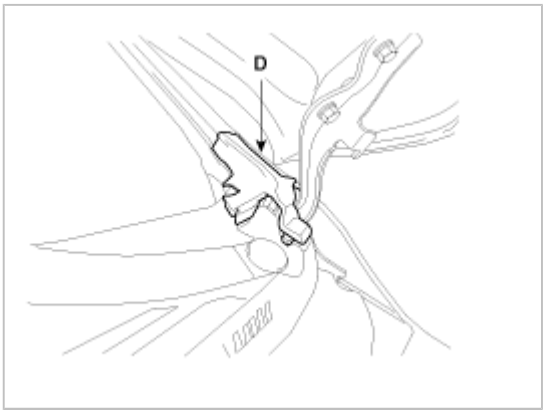
1. After loosening the mounting clips, then remove the fender insulator (A).



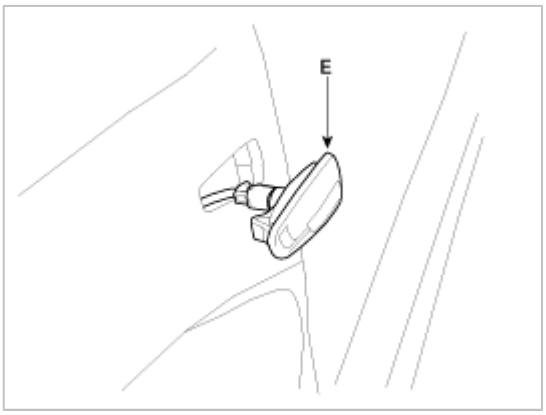
2. Remove the side garnish (B), mud guide (C).



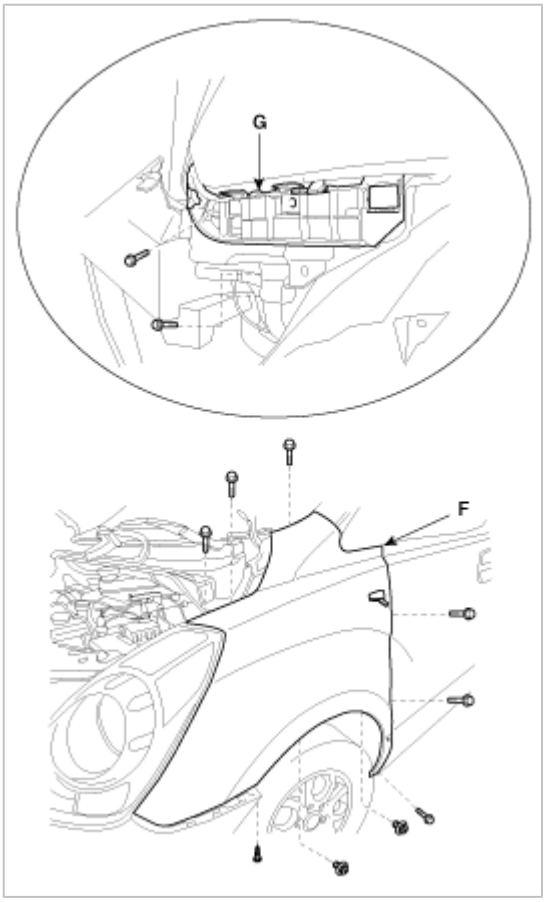
3. Remove the cover (D).



4. Remove the side lamp (E).

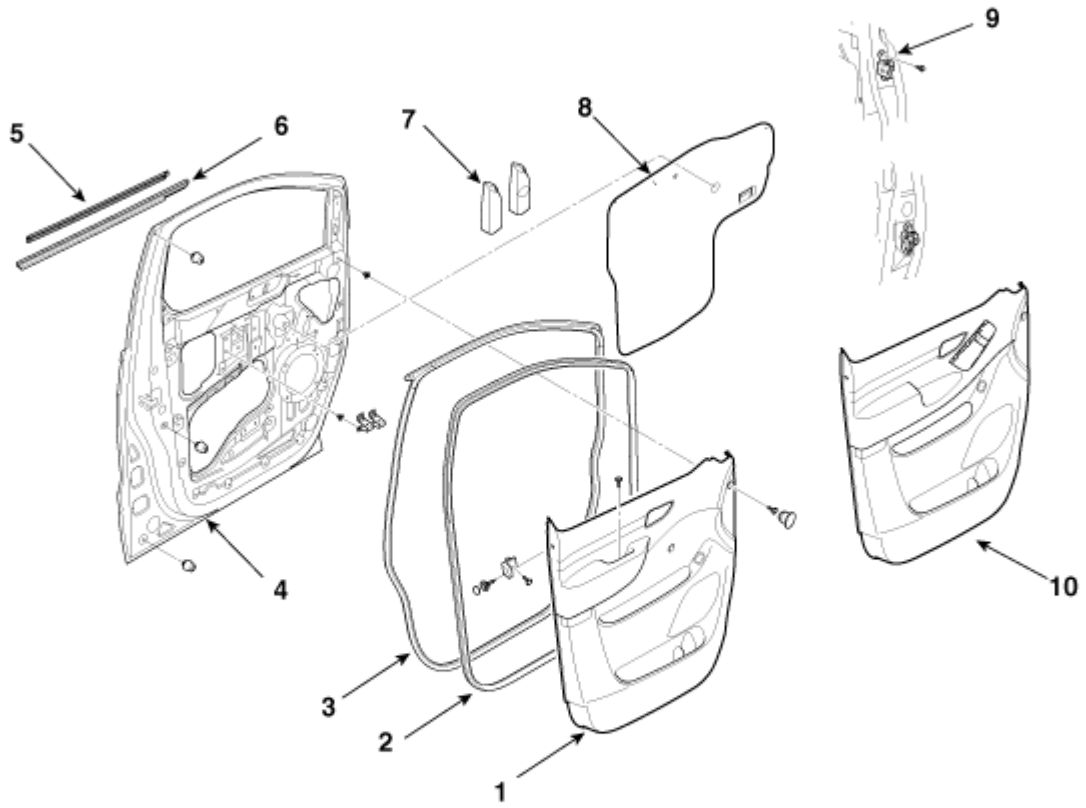


5. Remove the front bumper side's bracket (G).
6. After loosening the fender mounting bolts, remove the fender (F).



7. Installation is the reverse of removal.

Components

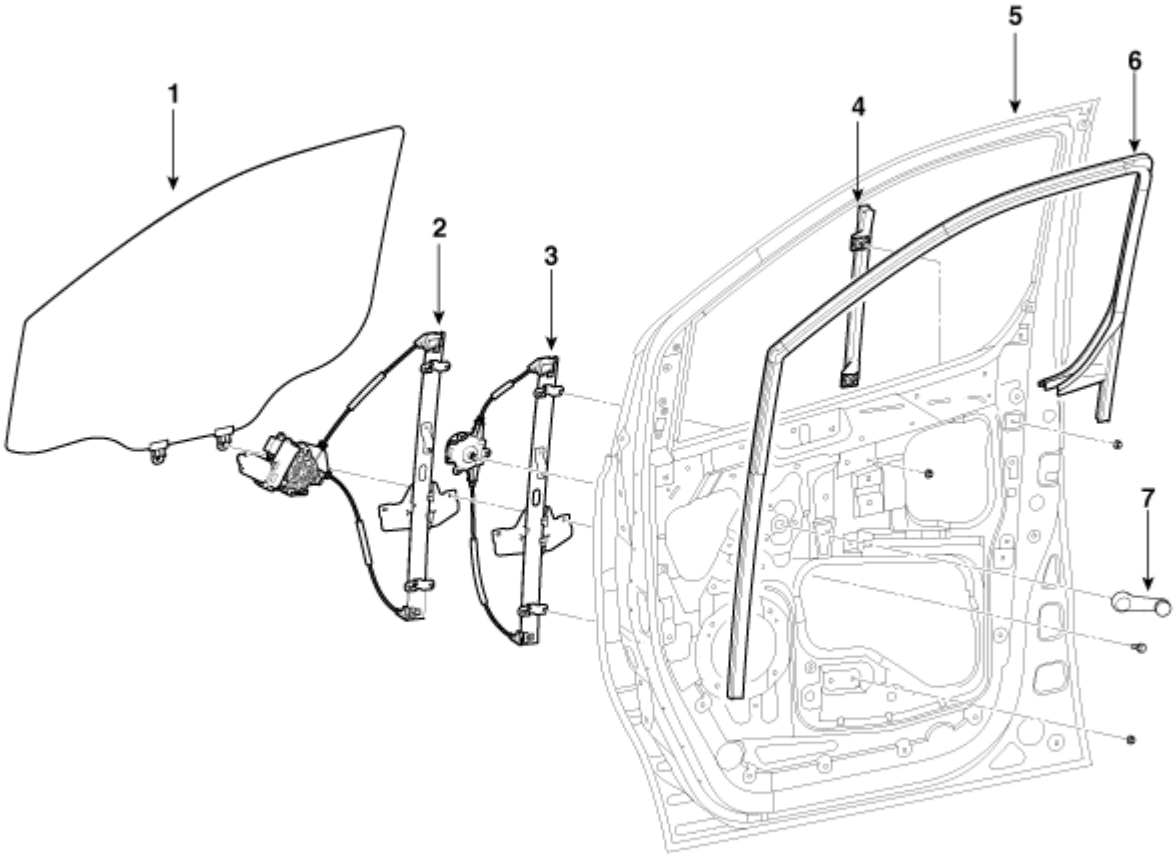


1. Door trim
2. Door weatherstrip
3. Door body weatherstrip
4. Door pannel
5. Door belt weatherstrip
6. Door belt weatherstrip
7. Quadrant inner cover
8. Door screen
9. Door hinge
10. Door trim

1. Door trim
2. Door weatherstrip
3. Door body weatherstrip
6. Door belt weatherstrip
7. Quadrant inner cover
8. Door screen

4. Door pannel 5. Door belt weatherstrip	9. Door hinge 10. Door trim

Door Window

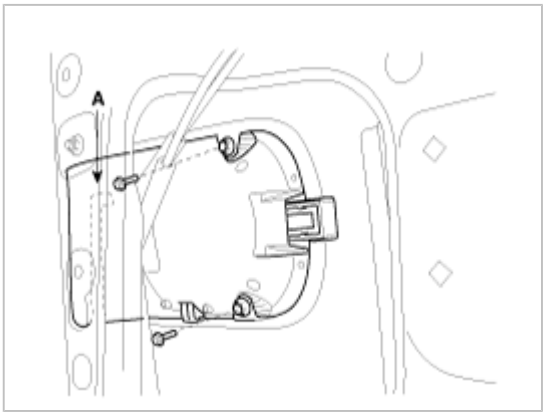


1. Door grass 2. Door regulator 3. Door regulator	4. Rear channel 5. Door pannel 6. Grass run 7. Regulator handle

Replacements

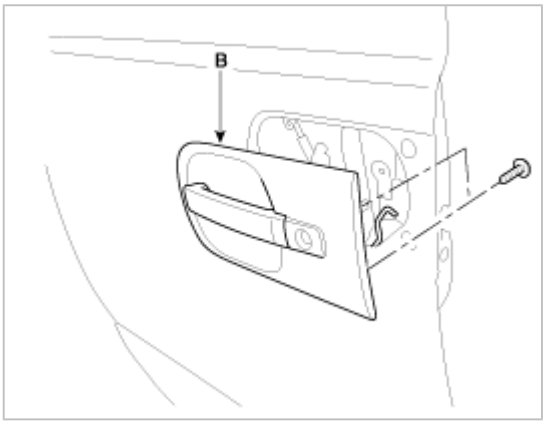
Out Side Handle Replacement

1. Remove the trim.
2. Disconnect the outside handle rod (A).
3. Loosening the mounting bolt.



4. Remove the outside handle (B) by sliding it rearward.

Tightening torque : 7.8~11.8 N.m (0.8~1.2 kgf,m. 5.8~8.7 lb-ft)

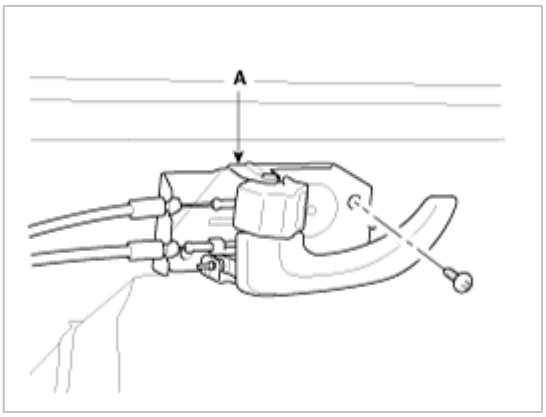


5. Installation is the reverse of removal.

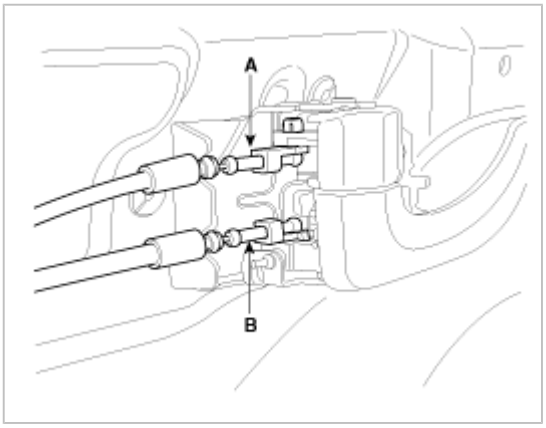
- Make sure the door lock and open properly.

Inside Handle Replacement

1. Remove the door trim.
2. After loosening the mounting screw, then remove the inside handle (A).



3. Disconnect the cable (A) and (B).

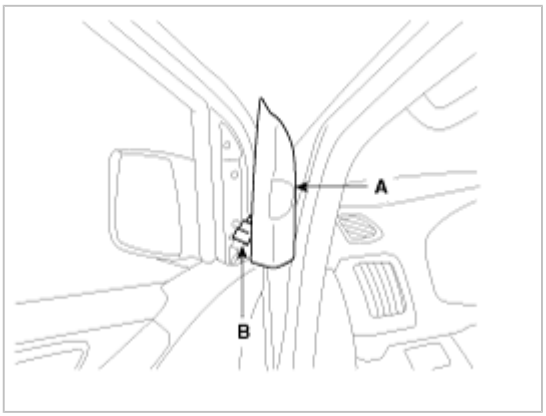


4. Installation is the reverse of removal.

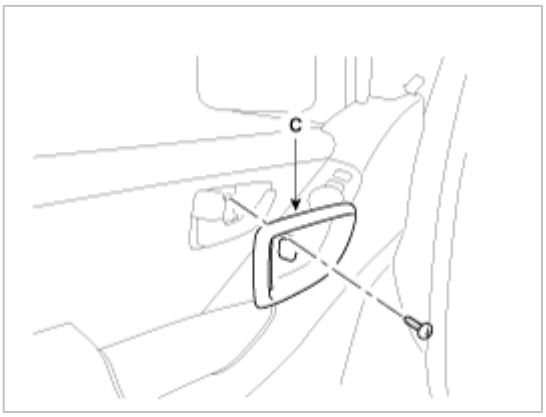
Door Trim Replacement

- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

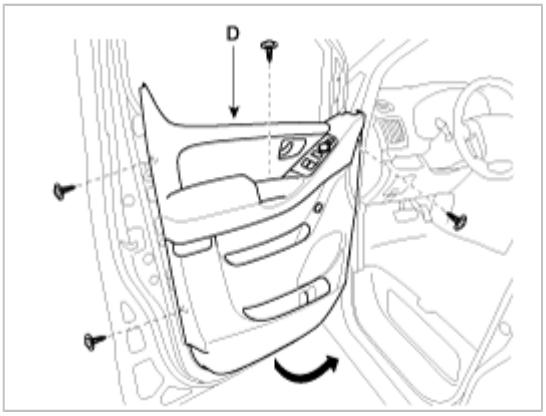
1. Remove the quadrant inner cover (A).
2. Disconnect the connector (B).



3. Remove the inside handle cover (C).



4. Loosen the door trim (D) mounting screws. Release the clips that hold the door trim, then remove the door trim by pulling it upward. Disconnect the power window switch connector, power mirror connector.



5. Installation is the reverse of removal.

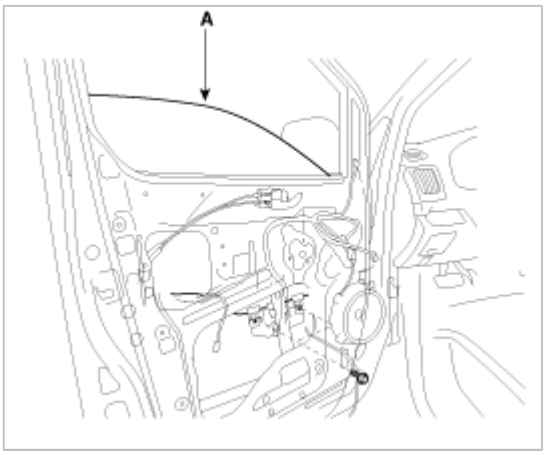
- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.

Glass Replacement

1. Remove the front door trim.

- Using the door switch to align the mounting hole with the hole on the door glass.
- If it is impossible, align the hole with hands after removing the motor.
- Take care not to drop to glass and scratch the glass surface.

2. Carefully move the glass (A) until you can see the bolts, then loosen them. Separate the glass from the glass run and carefully pull the glass out through the window slot.

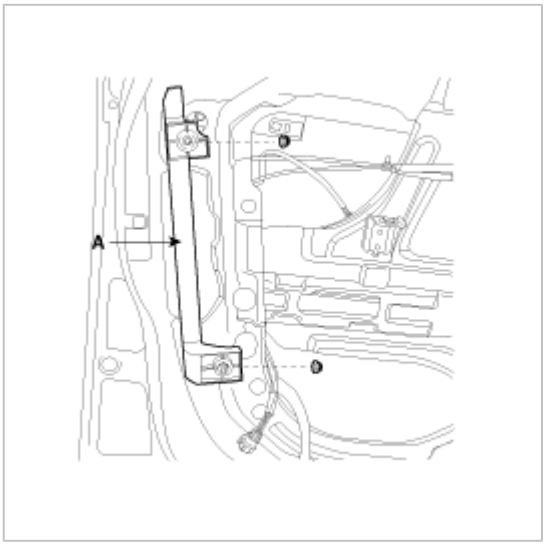


3. Installation is the reverse of removal.

- Roll the glass up down to see if it move freely without binding.
- Adjust the position of the glass as necessary.

Rear Channel Replacement

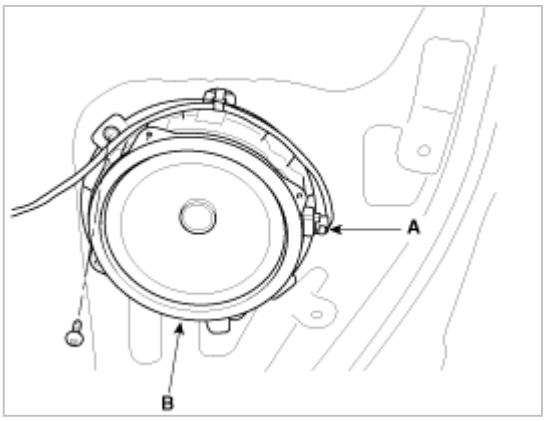
1. Remove the door trim.
2. Remove the window glass.
3. After loosening the mounting nuts, then remove the rear channel (A).



4. Installation is the reverse of removal.

Speaker Replacement

1. Remove the door trim.
2. Drill out the rivets to remove the speaker (A) from the door module.
3. Disconnect the speaker connector (B).

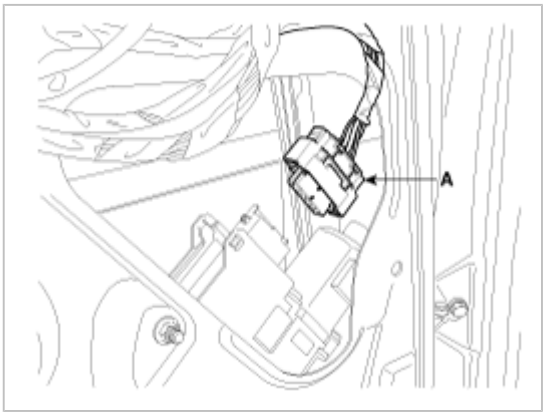


4. Installation is the reverse of removal.

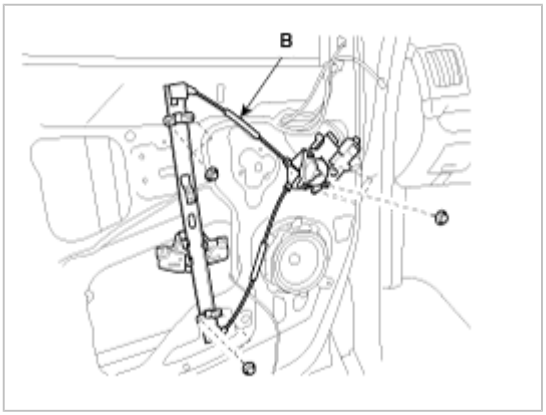
- Use sheet metal screws to secure the speaker.

Power Window Motor And Regulater Replacement

1. Remove the door trim.
2. Disconnecting the connector (A).



3. After loosening the mounting nuts, then remove the power window motor (B).

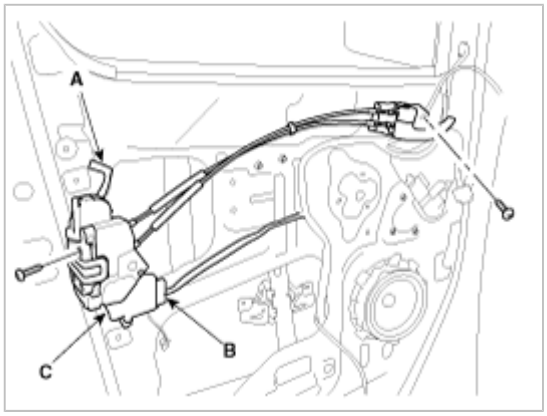


4. Installation is the reverse of removal.

- The area of rotational parts and springs should be applied with sufficient grease.
- Roll the glass up down to see if it move freely without binding.

Latch Assembly Replacement

1. Remove the following parts.
   A. Door trim.
   B. Glass.
   C. Rear channel.
2. Disconnect the lod (A).
3. Disconnect the latch connector (A), then remove the latch assembly (B).



4. Installation is the reverse the removal.

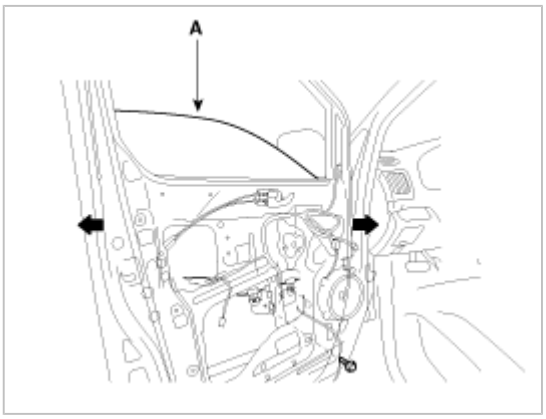
- Make sure the door locks and opens properly.

Adjustment

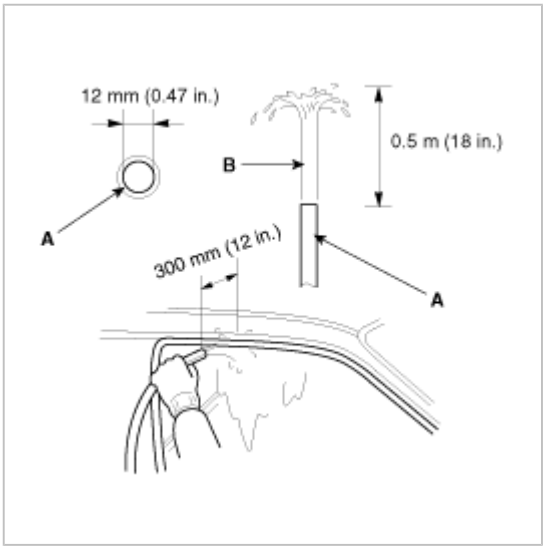
Glass Adjustment

- Check the glass run channel for damage or deterioration, and replace them necessary.

1. Remove the following parts.
   A. Quadrant inner cover.
   B. Door trim.
2. Carefully move the glass (A) until you can see the glass mounting bolts, then loosen them.



3. Check that the glass moves smoothly.
4. Raise the glass fully, and check for gaps.
   Check that the glass contacts the glass run channel evenly.
5. Check for water leaks. Run water over the roof andon the sealing area as shown, and note these items:
   A. Use a 12mm (1/2lin.) diameter hose (A).
   B. Adjust the rate of water flow as shown (B).
   C. Do not use a nozzle.
   D. Hold the hose about 300mm(12in.) away from the door (C).



Door Position Adjustment

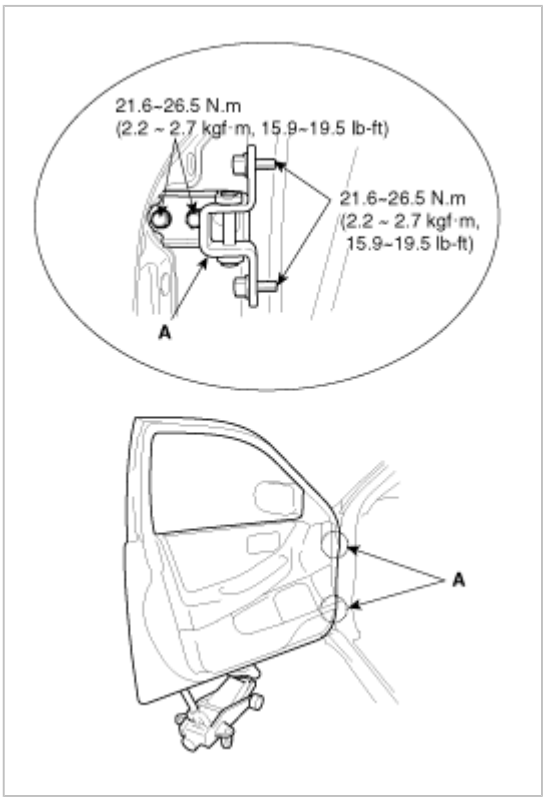
- After installing the door, check for a flush fit with the body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. Before adjusting, replace the mounting bolts.

1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust at the hinges (A):
   A. Loosen the door mounting bolts slightly, and move the door IN or OUT until it aligns flush with the

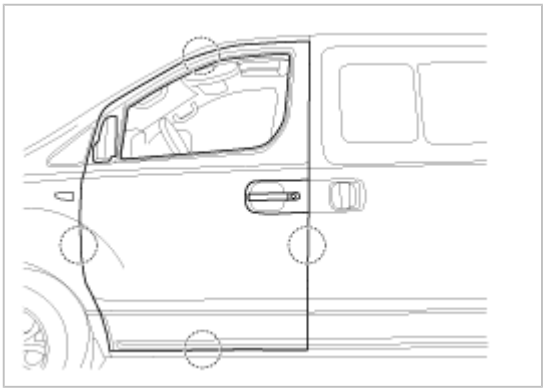
body.

B. Loosen the hinge mounting bolts slightly, and move the door BACKWARD or FORWARD, UP or DOWN as necessary to equalize the gaps.

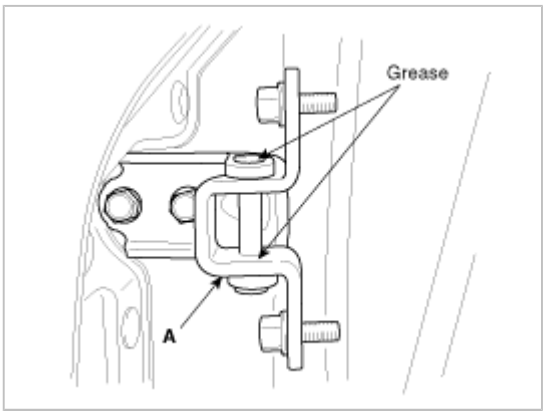
C. Place a shop towel on the jack to prevent damage to the door when adjusting the door.



3. Check that the door and body edges are parallel.



4. Grease the pivot portions of the hinges indicated by the arrows.

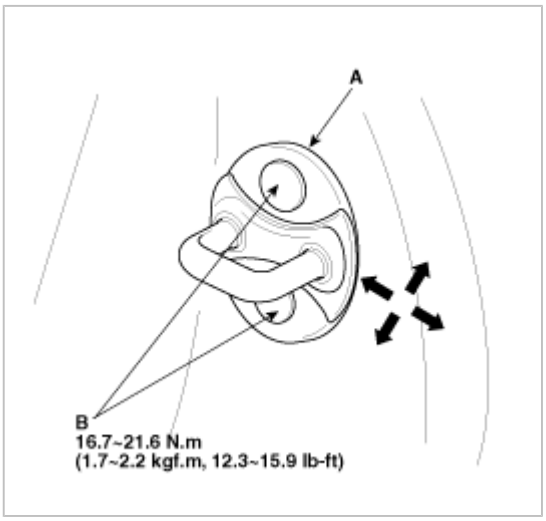


5. Check for water leaks.

Door Striker Adjustment

Make sure the door latches securely without slamming it.
If necessary adjust the striker (A): The striker nuts are fixed.
The striker can be fine adjusted up or down, and in or out.

1. Loosen the screws (B), then insert a shop towel between the body and striker.

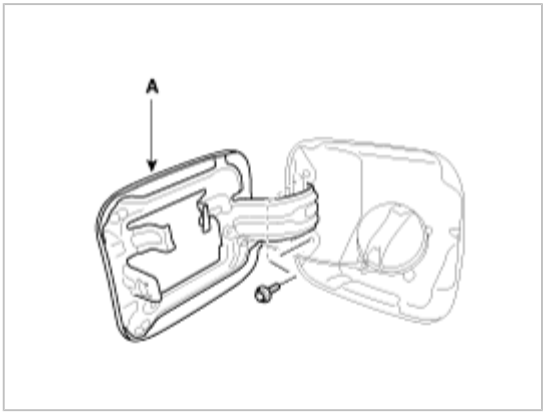


2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
   Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit.
   If the door latches properly, tighten the screws and recheck.

Replacement

1. Open the fuel door.
2. Loosen the bolts, then remove the fuel filler door (A).

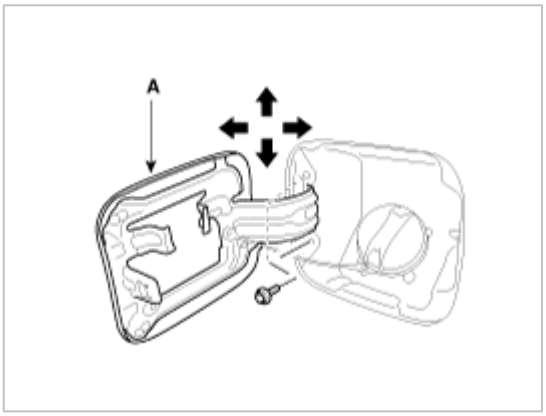
Tightening torque : 0.9~7.8 N.m (0.7~0.8 kgf.m, 5.1~5.8 lb-ft)



3. Installation is the reverse of removal.

- Make sure the fuel fill door opens properly and locks securely.

4. Check that the fuel fill door (A) fit flush against the body. If necessary, adjust it.

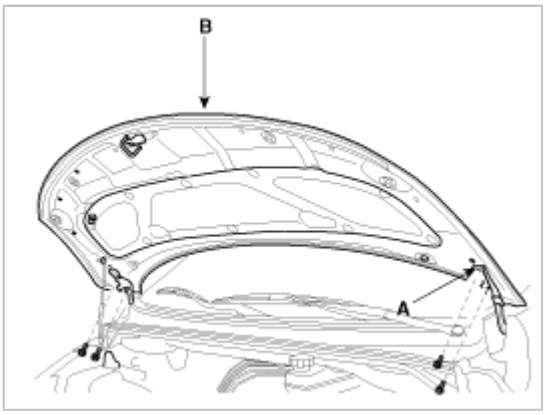


Replacements

Hood Assembly Replacement

- When removing and installing the hood, an assistant is necessary.
- Take care not to damage the hood and body.
- When removing the clips, use a clip remover.

1. After loosening the hood hinge (A) mounting bolts, remove the hood (B).



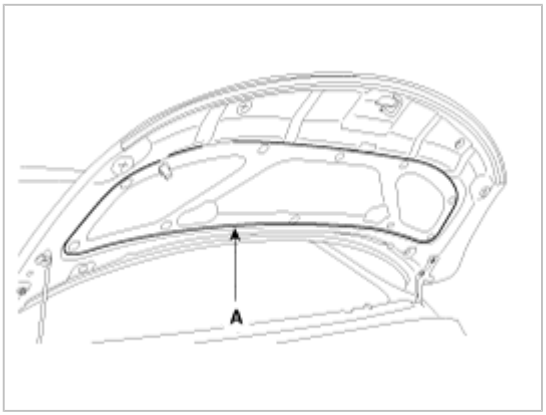
2. Installation is the reverse of removal.

- Make sure the hood opens properly and locks securely.
- Adjust the hood alignment.

Hood Insulator Replacement

1. Using a clip remover, detach the clips, and remove the hood insulator (A).

- Take care not to scratch the hood panel.

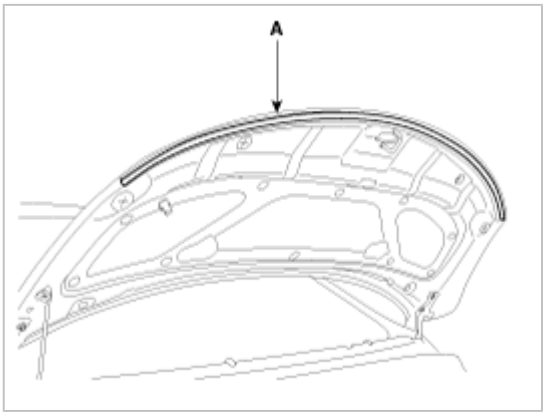


2. Installation is the reverse of removal.

- Replace any damaged clips.

Hood Seal Weatherstrip Replacement

1. Detach the clips, then remove the hood weatherstrip (A). Take care not to scratch the hood.

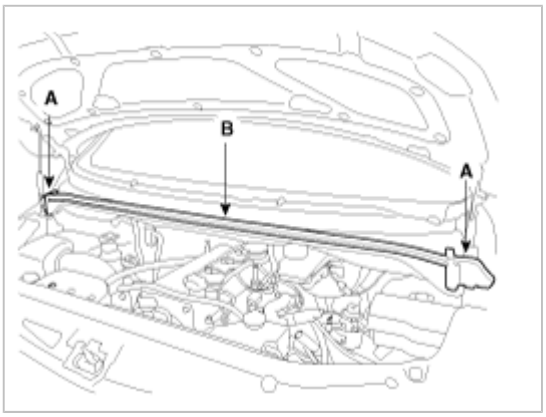


2. Installation is the reverse of removal.

- Replace any damaged clips.

Hood Weatherstrip Replacement

1. Detach the clips, then remove the hood weatherstrip (A). Take care not to scratch the hood.

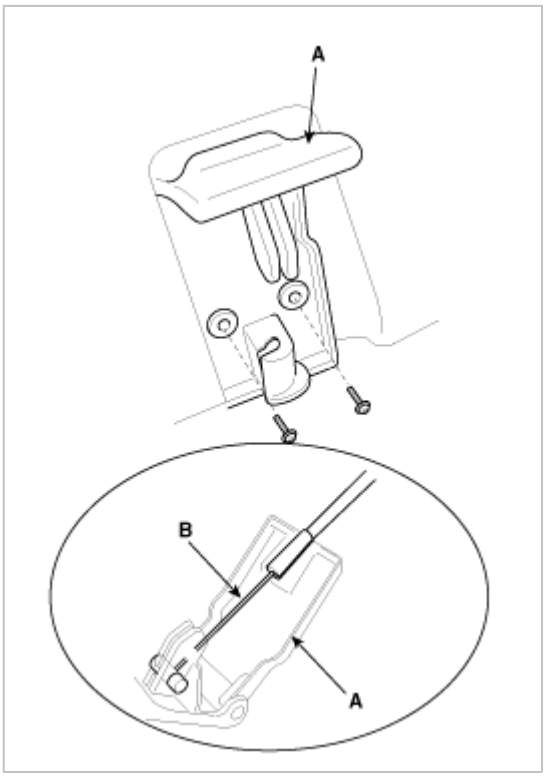


2. Installation is the reverse of removal.

- Replace any damaged clips.

Hood Release Handle Replacement

1. After loosening the mounting screw, then remove the hood release handle (A).
2. Disconnect the hood release handle cable (B).

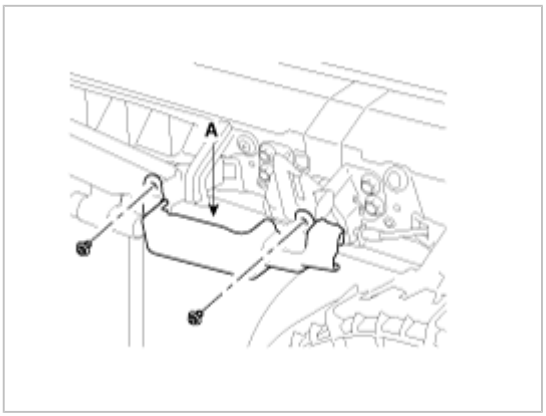


3. Installation is the reverse of removal.

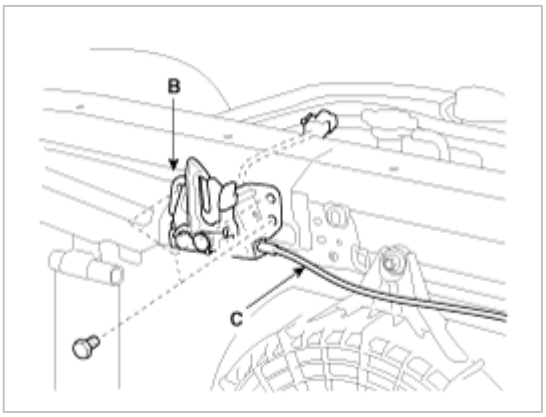
- Make sure the hood latch cable is connected properly.
- Make sure the hood locks securely.

Hood Latch Replacement

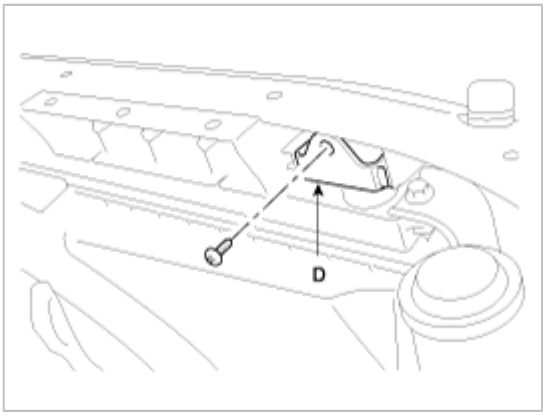
1. Remove the front bumper cover.
2. Detach the clips, then remove the hood latch cover (A).



3. Remove the hood latch (B) mounting bolts.
4. Disconnect the hood latch cable (C) and remove the latch (B).



5. Remove the mounting bracket (D).
6. Disconnect the connector.



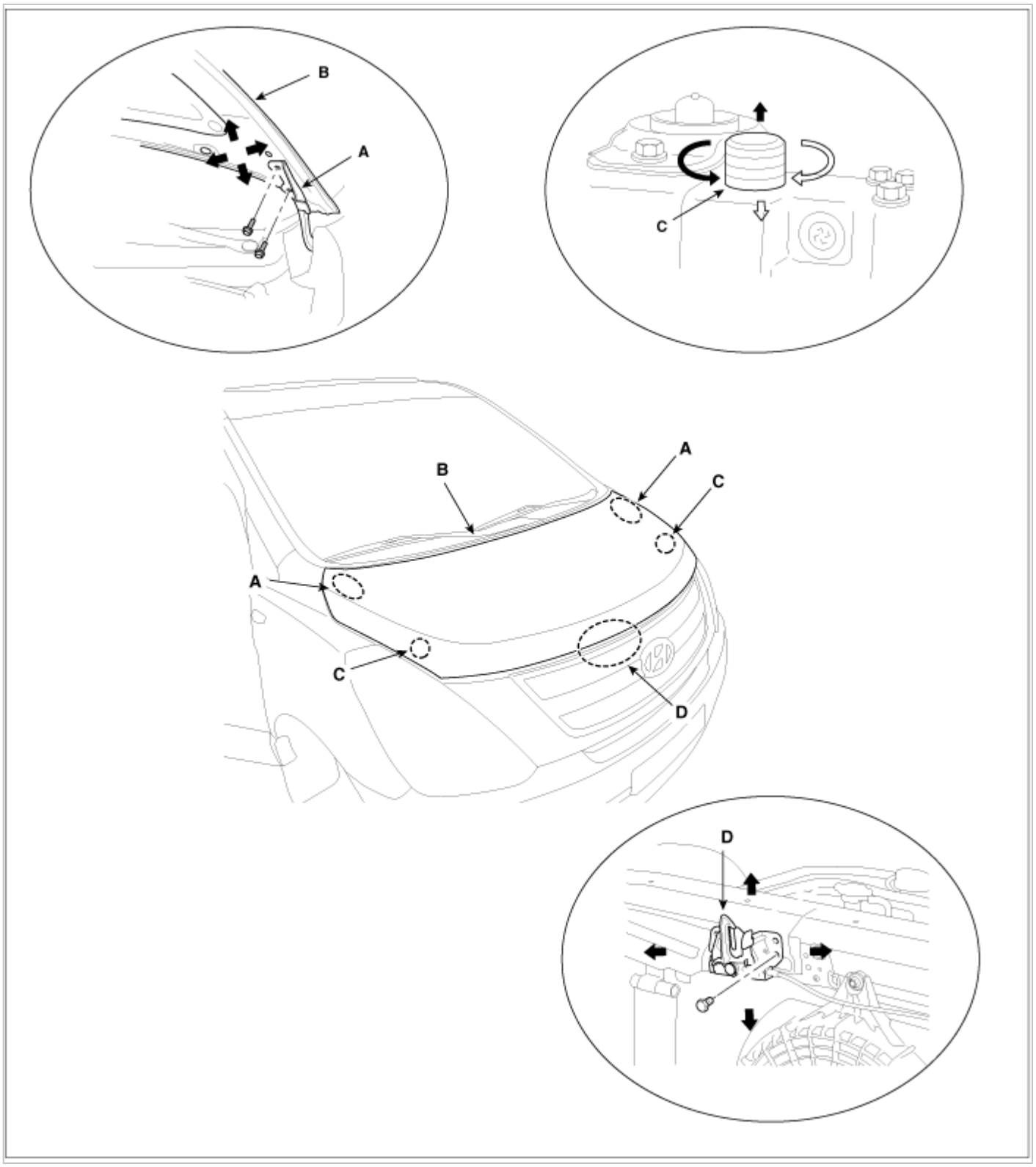
7. Installation is the reverse of removal.

- Make sure the hood latch cable is connected properly.
- Make sure the hood locks securely.

Adjustment

Adjust Hood

1. After loosening the hinge (A) mounting bolt, adjust the hood (B) by moving it up or down, or right or left.
2. Adjust the hood height by turning the hood overslam bumpers (C).
3. After loosening the hood latch (D) mounting bolts, adjust the latch by moving it up or down, or right or left.

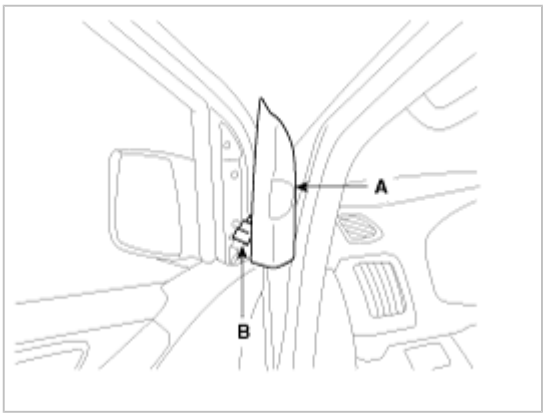

B
A
C
B
A
C
A
C
D
D

Replacements

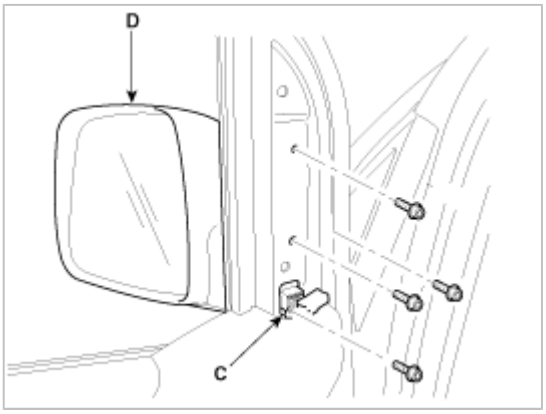
Outside Rear View Mirror Relplacement

- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the quadrant inner cover (A).
2. Disconnect the connector (B).



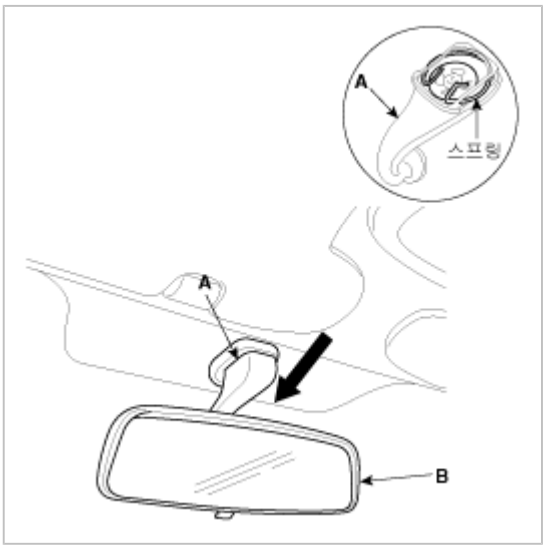
3. After disconnecting the connector (C), remove the outside rear view mirror (D).



4. Installation is the reverse of removal.

Inside Rear View Mirror Replacement

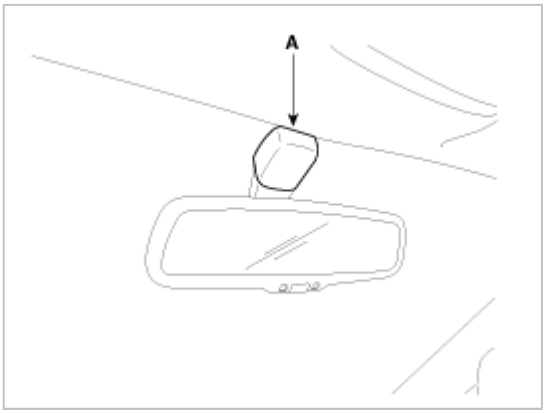
1. Push the inside rear view mirror base (A) down to remove to inside rear view mirror assembly (B).



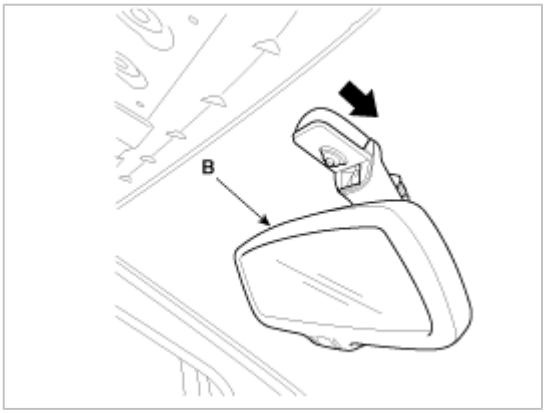
2. Installation is the reverse of removal.

Ecm Mirror Replacement

1. Gently detach the hook, then remove the ECM mirror cover (A).



2. Disconnect the connector.
3. Push the ECM mirror base down to remove the ECM mirror assembly (B).

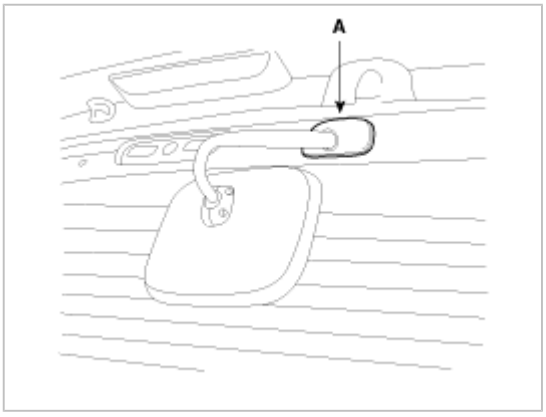


4. Installation is the reverse of removal.

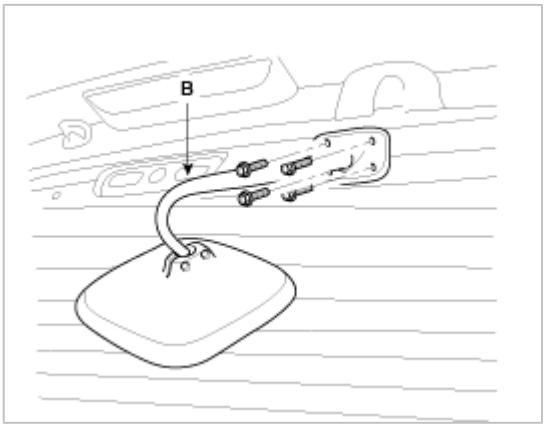
Under View Mirror Replacement

1. Remove the spoiler.

2. Remove the cover (A).

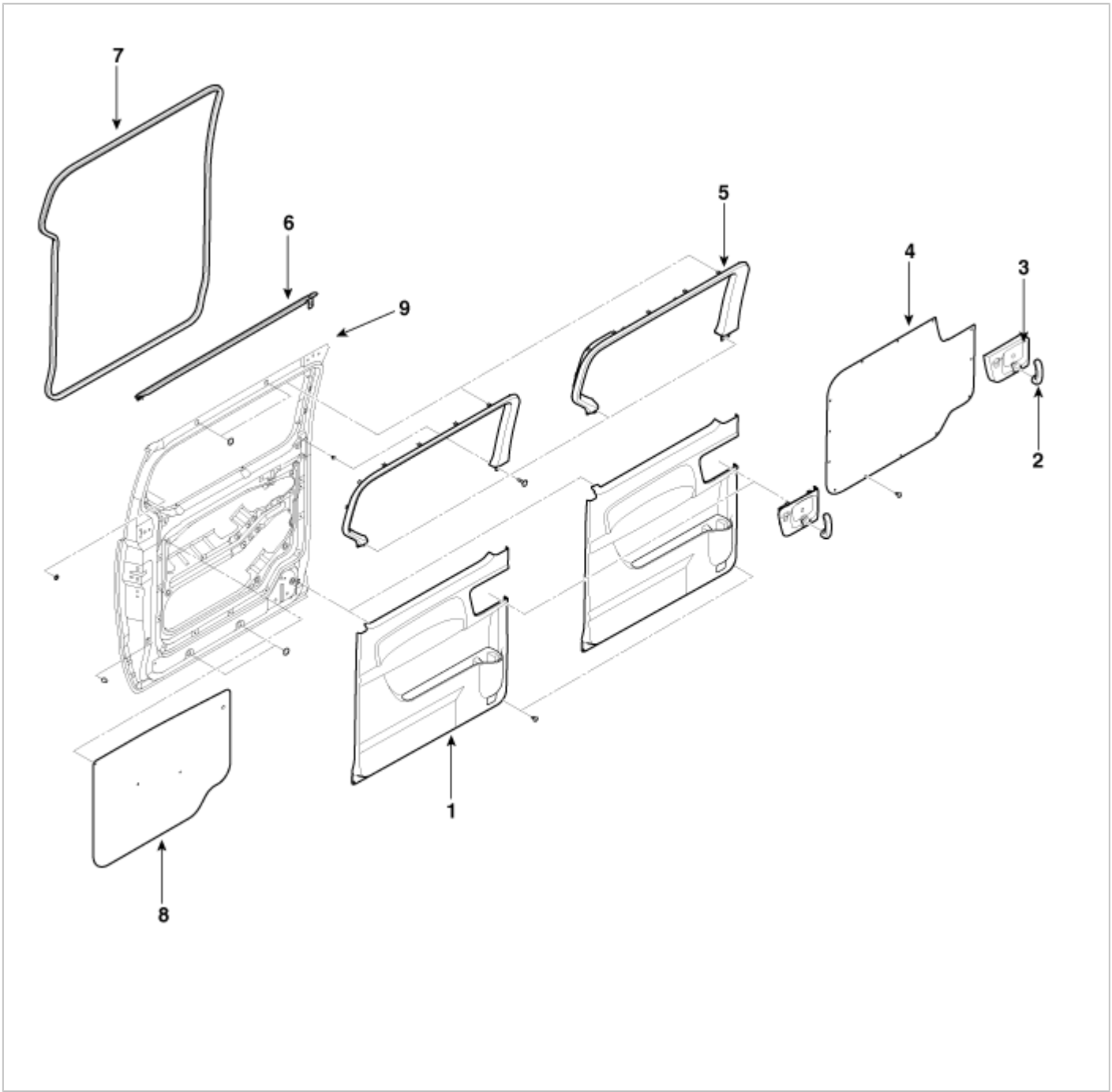


3. Remove the under view mirror (B).

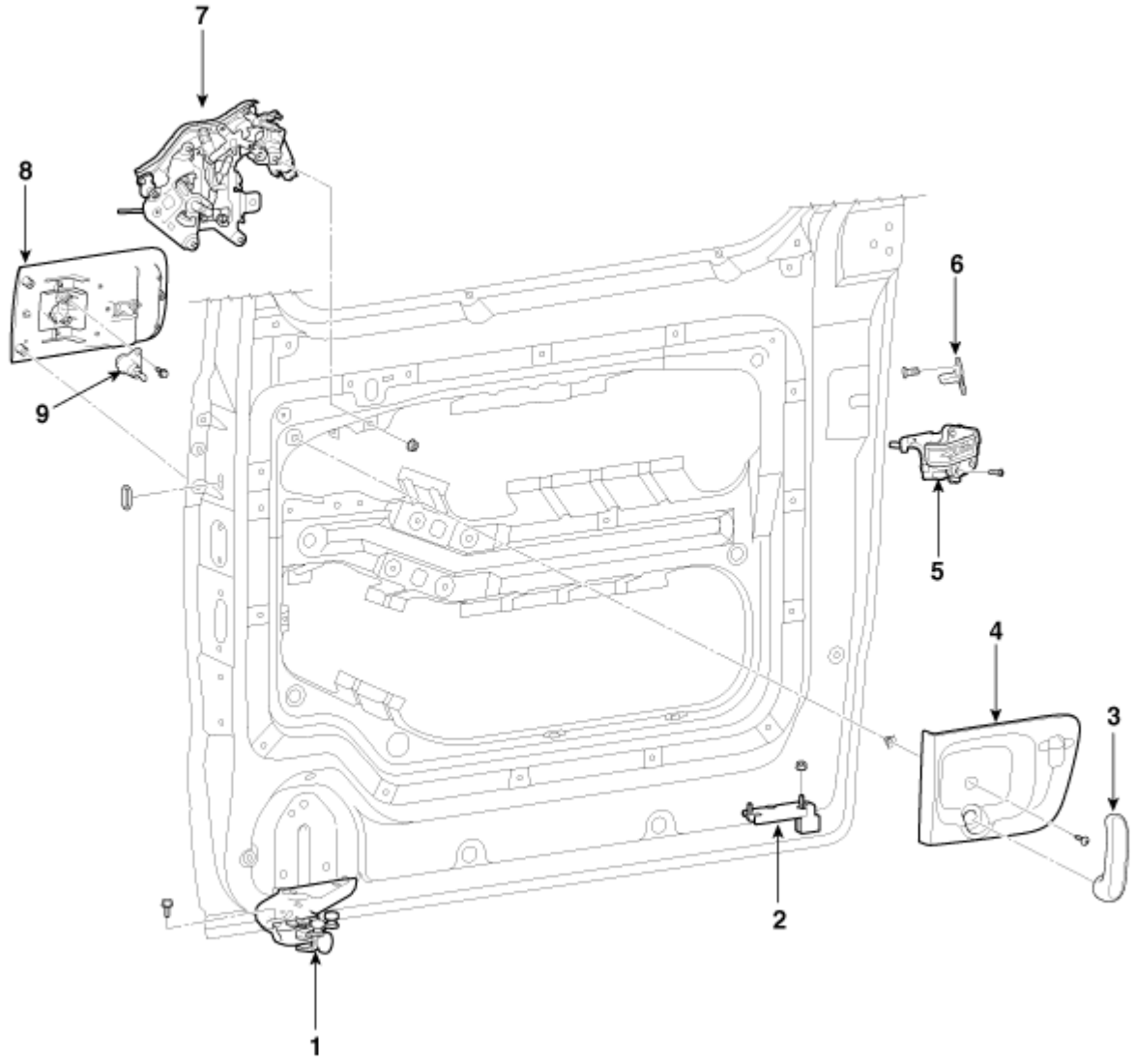


4. Installation is the reverse of removal.

Components



1. Door trim	5. Door inner trim
2. Inside handle	6. Door upper weatherstrip
3. Inside handle cover	7. Door weather strip
4. Door screen	8. Door screen
	9. Door pannel

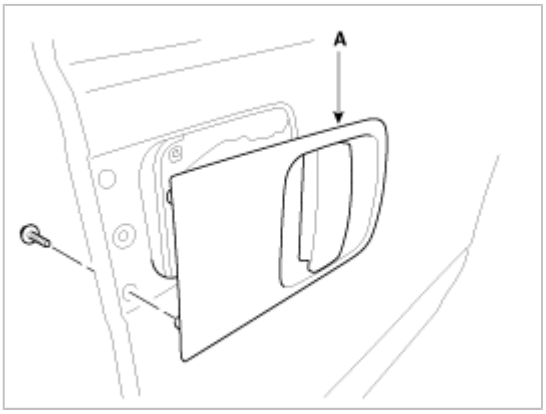


1. Door hinge 2. Door hinge 3. Inside handle 4. Inside handle cover	5. Door latch 6. Door strake 7. Remote control 8. Door outside handle 9. Key cylinder

Replacements

Out Side Handle Replacement

1. Remove the door trim.
2. Remove the acture.
3. After loosening the mounting bolt, then remove the handle cover (A).

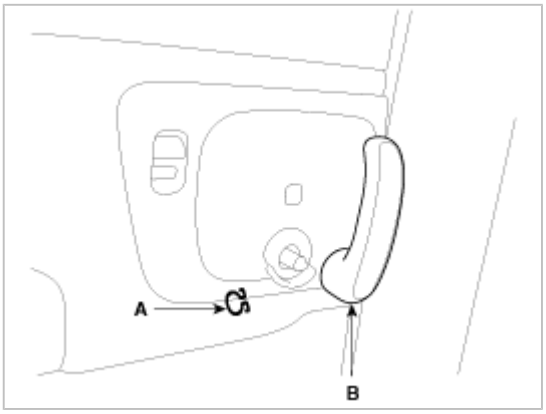


4. Installation is the reverse of removal.

- Make sure the door lock and open properly.

Inside Handle Replacement

1. Remove the clip (A).
2. Remove the inside handle (B).



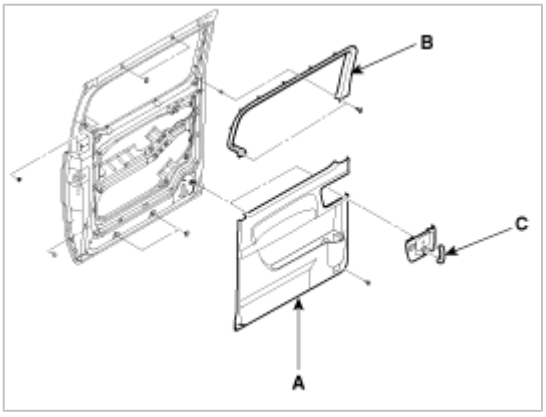
3. Installation is the reverse of removal.

Door Trim Replacement

- Take care not to scratch the door trim and other parts.
- Put on gloves to protect your hands.

1. Remove the inside handle (C).
2. After loosening the mounting screws, then remove the door trim (A).

3. Remove the inner trim (B).

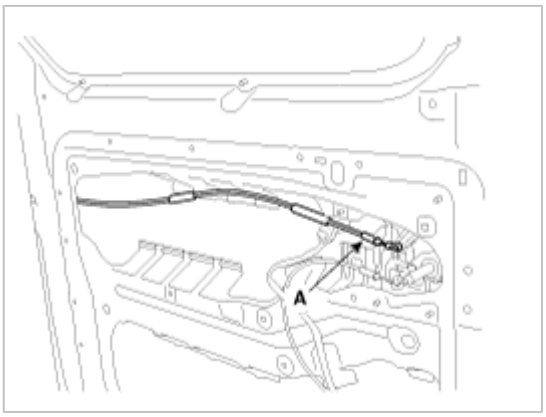


4. Installation is the reverse of removal.

- Make sure of connectors is plugged in properly and each rod is connected securely.
- Make sure the door lock and opens properly.

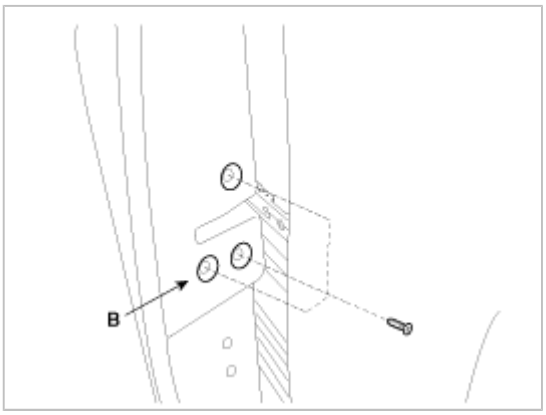
Latch Assembly Replacement

1. Remove the inside handle.
2. Remove the door trim.
3. Disconnect the latch cable (A).



4. After loosening the mounting screws, then remove the latch assembly (B).

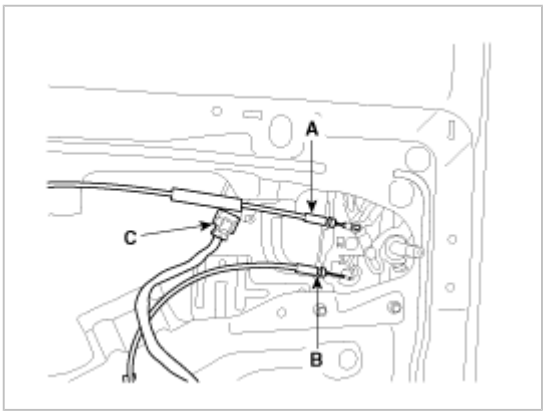
Tightening torque : 6.9~10.8 N.m (0.7~1.1 kgf.m, 5.1~5.8 lb-ft)



5. Installation is the reverse of removal.

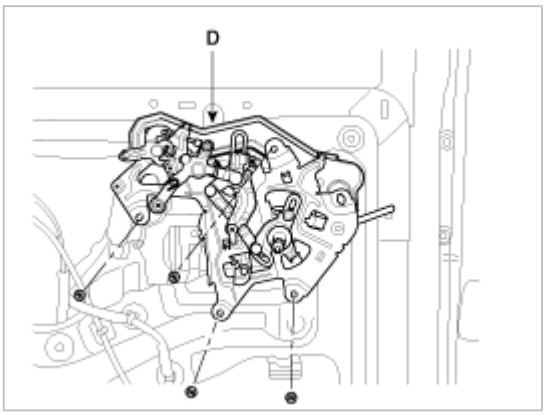
Door Remote Control Assembly Replacement

1. Remove the door trim.
2. Disconnect the cable (A), (B) and connector (C).



3. After loosening the mounting nuts, then remove the remote control (D).

Tightening torque : 6.9~10.8 N.m (0.7~1.1 kgf.m, 5.1~5.8 lb-ft)



4. Installation is the reverse of removal.

Adjustment

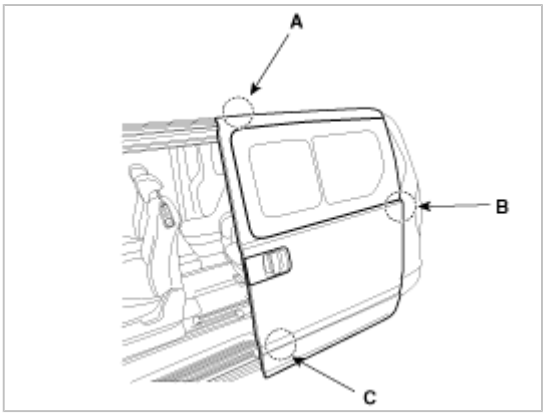
Door Position Adjustment

- After installing the door, check for a flush fit with the body, then check for equal gaps between the front, rear, and bottom, door edges and the body. Check that the door and body edges are parallel. Before adjusting, replace the mounting bolts.

1. Place the vehicle on a firm, level surface when adjusting the doors.

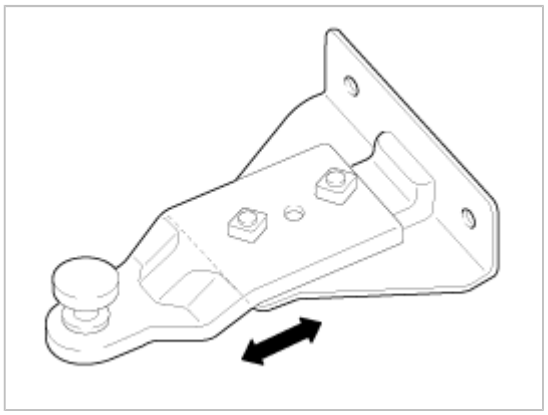
Door Position Adjustment

1. Place the vehicle on a firm, level surface when adjusting the doors.
2. Adjust the bolts of upper roller (A), center roller (B) and lower roller (C), if the door and body surface have not keep uniform gap.



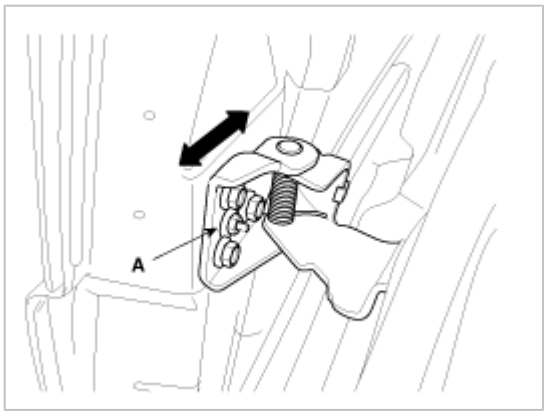
UPPER ROLLER (A)

A. Loosen the bolt to adjust the bracket and then tighten a bolt.



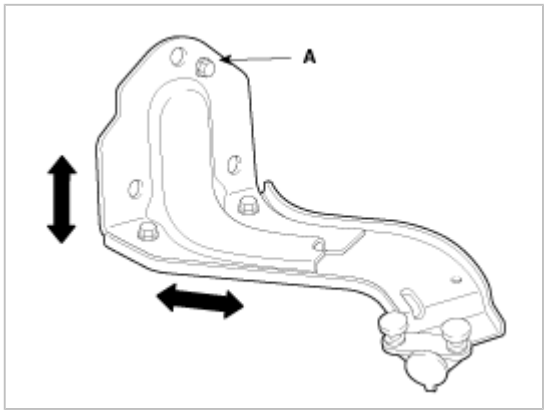
CENTER ROLLER (B)

A. Loosen the standard pin nut(A) using the hand tool.
B. Loosen the roller mounting bolts slightly, and level the door surface.
C. Tighten the standard pin nut and mounting bolt.



LOWER ROLLER (C)

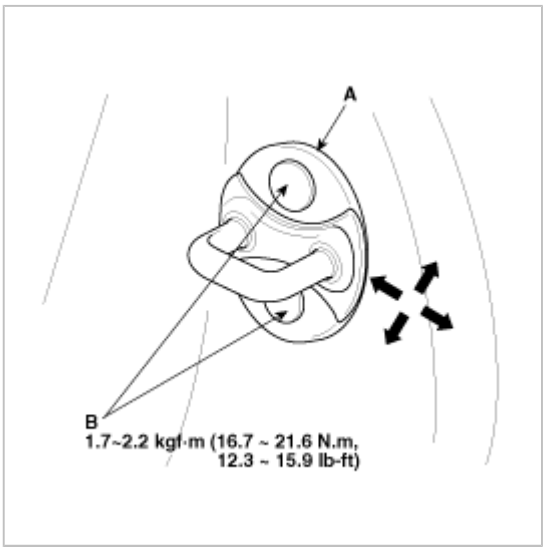
A. Remove the A/S cover.
B. Loosen the standard pin nut (A) using the hand tool slightly.
C. Loosen the roller mounting bolts slightly, and level the door surface.
D. Tighten the standard pin nut and mounting bolt.



Door Striker Adjustment

Make sure the door latches securely without slamming it.
If necessary adjust the striker (A): The striker nuts are fixed.
The striker can be fine adjusted up or down, and in or out.

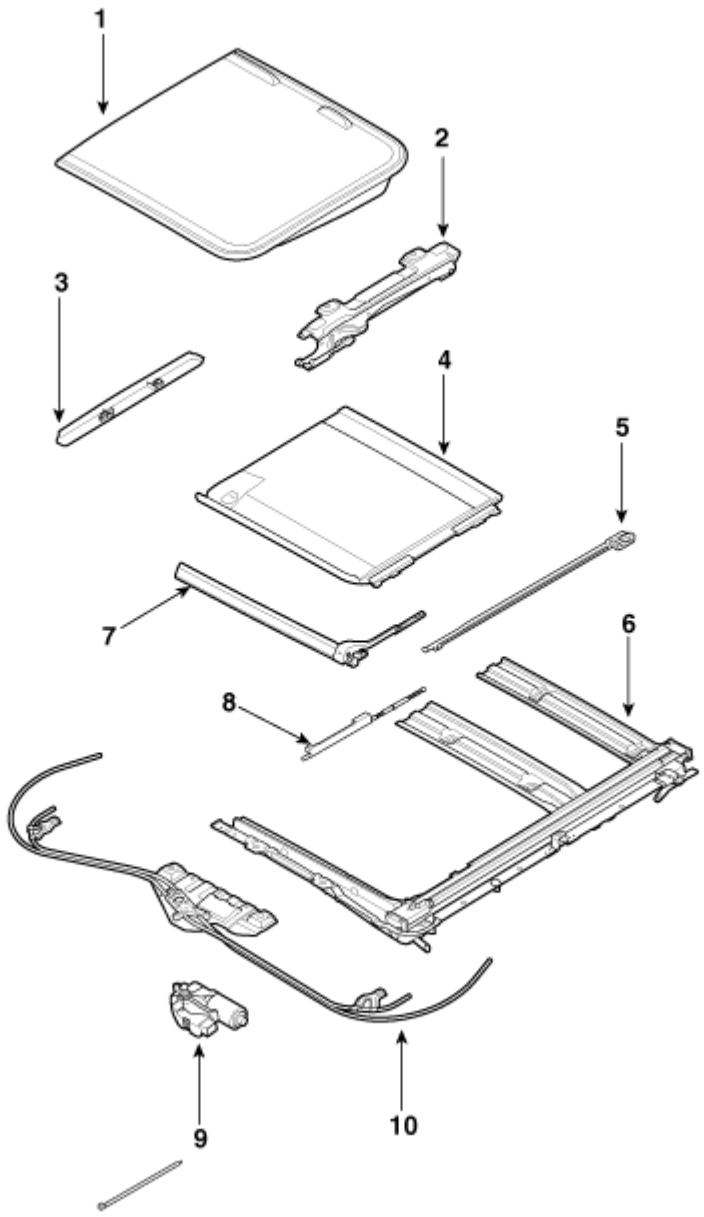
1. Loosen the screws (B), then insert a shop towel between the body and striker.



2. Lightly tighten the screws.
3. Wrap the striker with a shop towel, then adjust the striker by tapping it with a plastic hammer.
   Do not tap the striker too hard.
4. Loosen the screws and remove the shop towel.
5. Lightly tighten the screws.
6. Hold the outer handle out, and push the door against the body to be sure the striker allows a flush fit.
   If the door latches properly, tighten the screws and recheck.

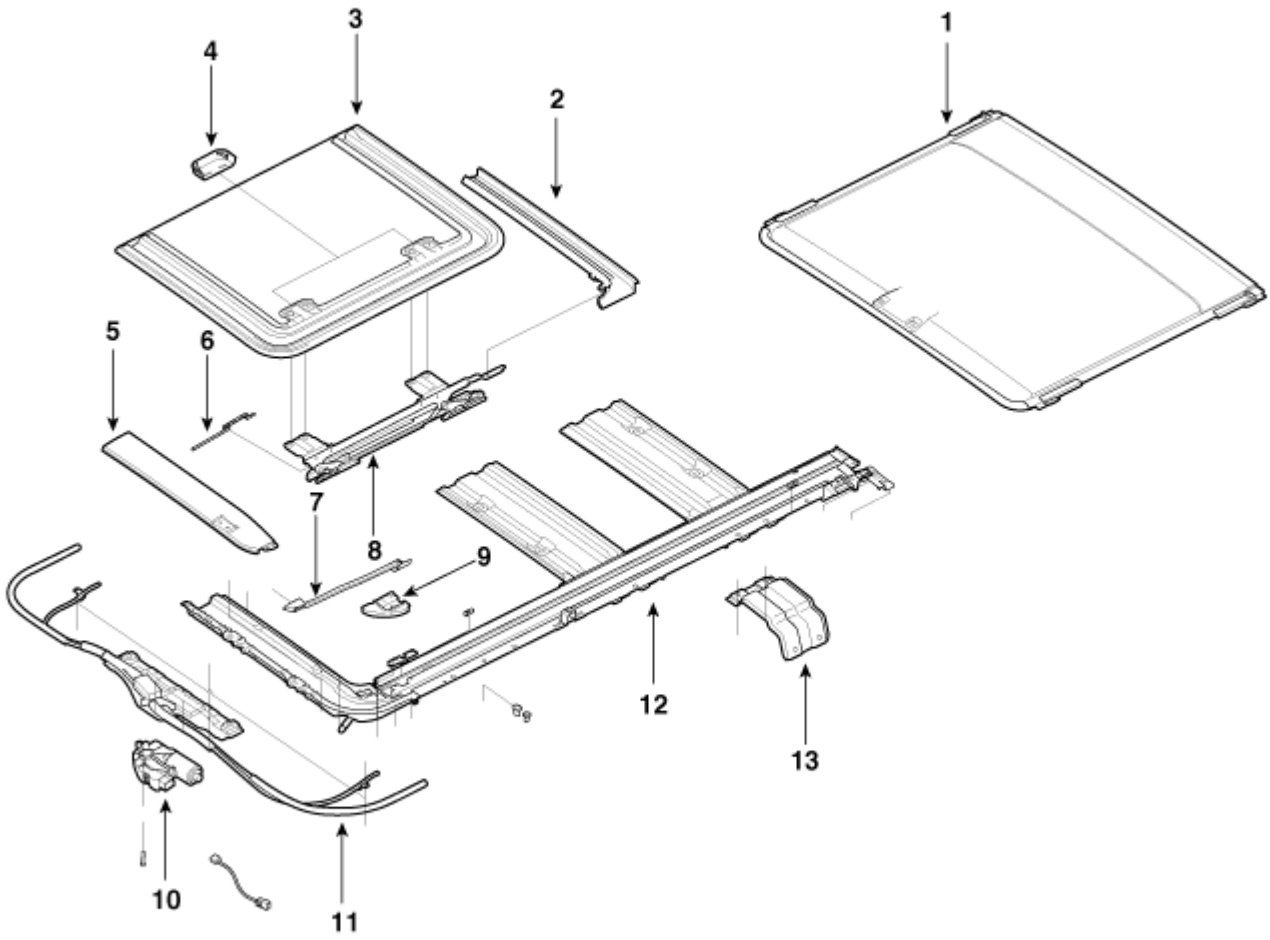
Components

Front



1. Glass 2. Guide 3. Decoration cover 4. Sunshade	5. Shooting assey 6. Sube frame 7. Defector	8. Cable 9. Motor assembly 10. Drive unit

Rear



1. Sunshade	6. Calbe	11. Drive unit
2. Drip rail	7. Defector link	12. Sube frame
3. Glass	8. Slide	13. Bracket
4. Decoration cover	9. Rail cover	
5. Defector	10. Motor assembly	

Replacements

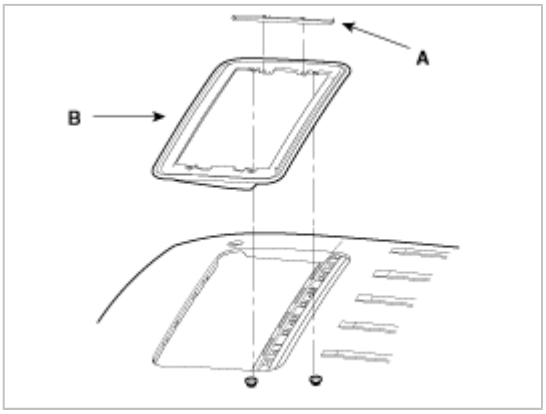
Front sunroof

Glass Replacement

- Put on glove to protect your hands.

1. Remove both decoration cover (A).
2. Remove the glass (B) by lifting it up.

- Do not damage the roof panel.



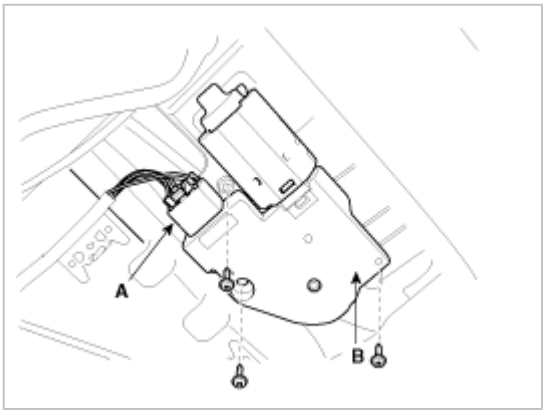
3. Installation is the reverse of removal.

Motor Replacement

1. Remove the over head console.

- Confirm the position of guide whether it is closed or not when you remove the motor.

2. Disconnect the motor connector (A), remove the screws and then remove the motor (B).



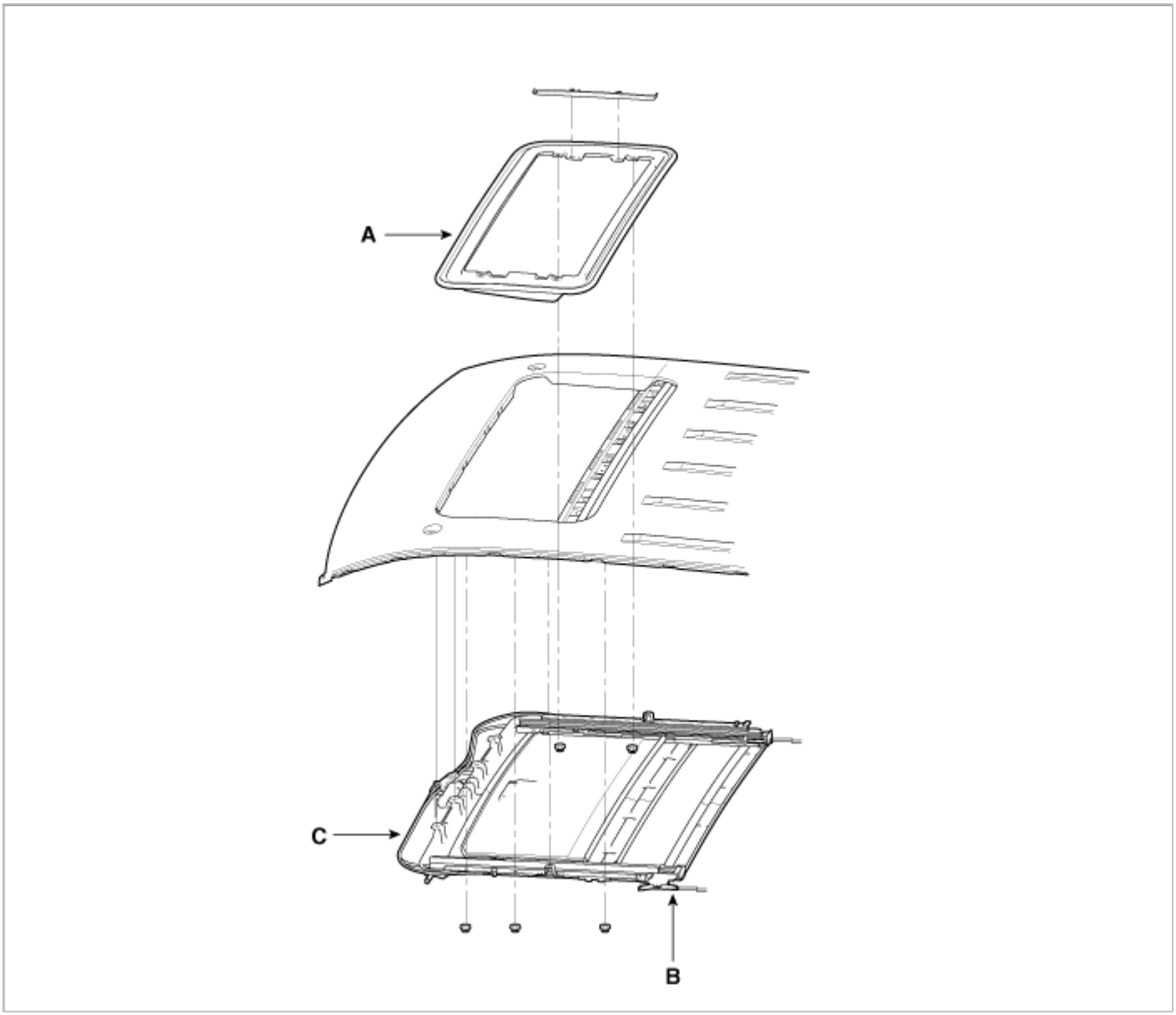
3. Installation is the reverse of removal.

- Make sure to initialize the motor.

Front Sunroof Assembly Replacement

1. Remove the follows parts.
   A. Door scuff trim.
   B. Front pillar trim.
   C. Center pillar trim.
   D. Rear pillar trim.
   E. Headlining.
   F. Sunroof glass (A).
2. Disconnect the drain tubes (B).
3. After loosening the mounding bolts and nuts, remove the sunroof assembly (C).

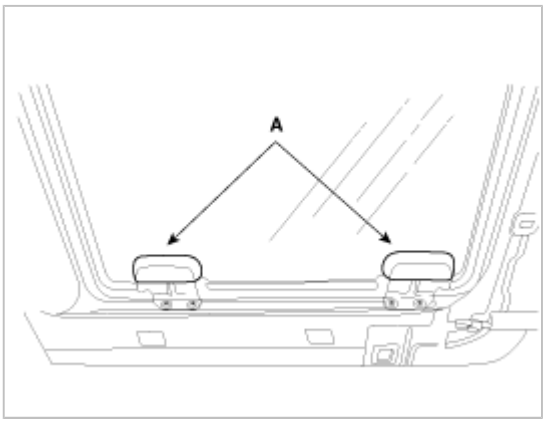
   A. Take care not to scratch the interior trims and other parts.
4. Installation is the reverse of removal.



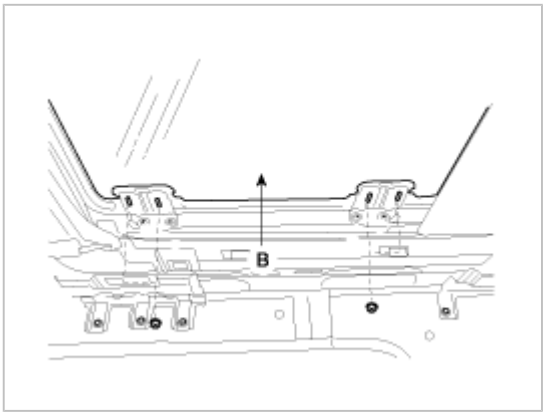
Rear Sunroof

Glass Replacement

1. Remove the decoration cover (A).



2. After loosening the mounting nuts, then remove the glass (B).



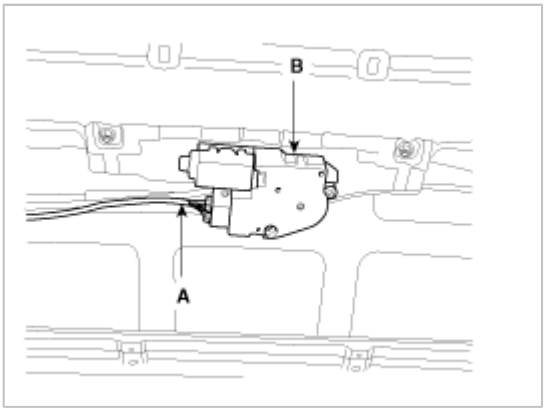
3. Installation is the reverse of removal.

Motor Replacement

1. Remove the roof trim.

- Confirm the position of guide whether it is closed or not when you remove the motor.

2. Disconnect the motor connector (A), remove the screws and then remove the motor (B).



3. Installation is the reverse of removal.

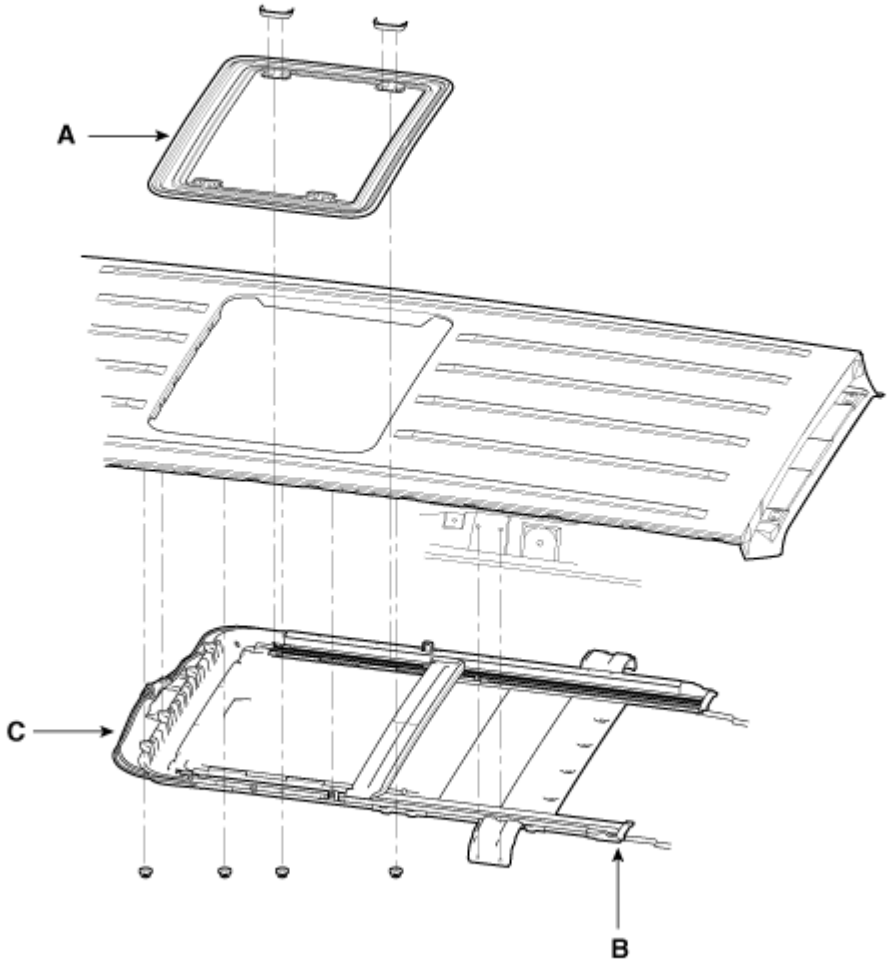
- Make sure to initialize the motor.

Rear Sunroof Assembly Replacement

1. Remove the follows parts.
   A. Door scuff trim.
   B. Front pillar trim.
   C. Center pillar trim.
   D. Rear pillar trim.
   E. Headlining.
   F. Sunroof glass.
2. Disconnect the drain tubes (B).
3. Remove the bracket (A).
4. After loosening the mounting bolts and nuts, remove the sunroof assembly (C).

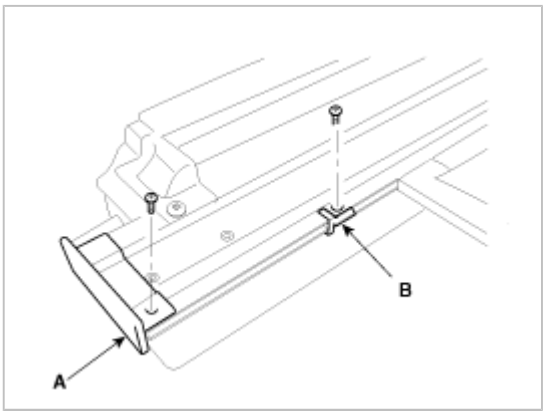
- Take care not to scratch the interior trims and other parts.

5. Installation is the reverse of removal.

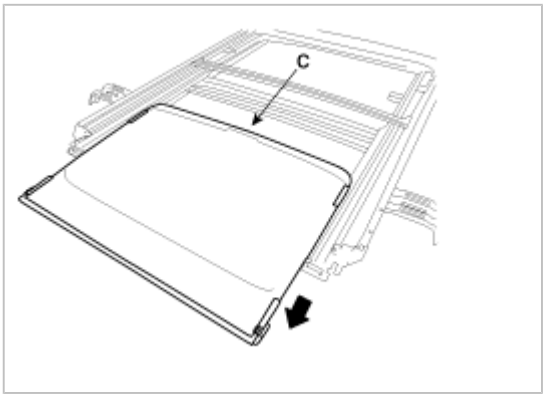


Sunshade And Drip Rail Replacement

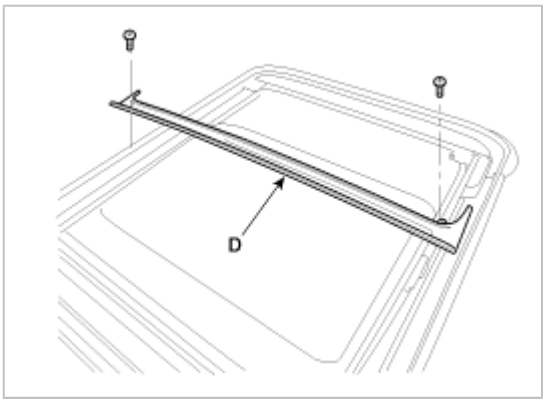
1. Remove the sunroof assembly.
2. Remove the drip (A) and sunshade stopper (B).



3. Remove the sunshade (C).



4. After loosening the mounting screws, then remove the drip rail (D).

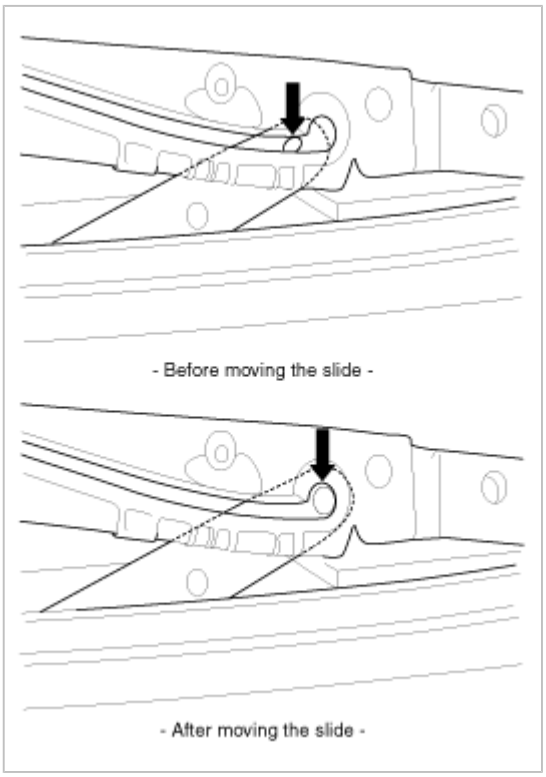


5. Installation is the reverse of removal.

Adjustment

How To Initialize

1. Check that the glass has been installed.
   A. Finished height adjustment.
2. Push the up switch. (Keep on pushing the switch)
   A. the slide moved 5mm forward after 15 seconds.



3. After moving the slide 5mm forward, turn OFF the switch and push the UP switch (Keeping on pushing the switch with continuous operation)
   A. If the operation above is normal condition, the sunroof once and closes.
4. When the sunroof is closed completely, turn OFF the UP switch initialize the motor completely.

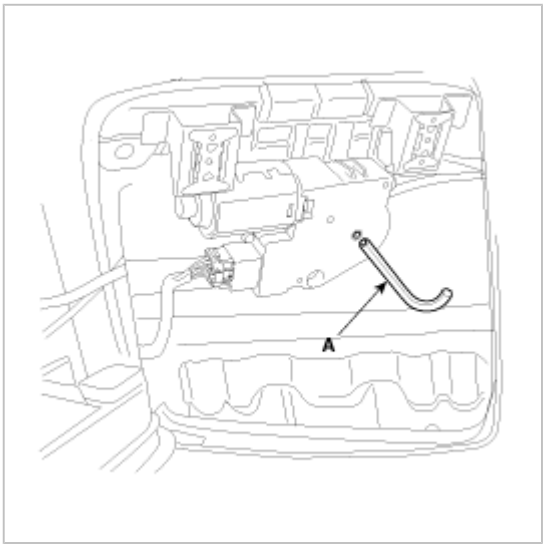
When To Initialize The Motor

1. First operation the vehicle after manufacture it.
2. Initial value is erased or damaged because of short power electric discharge during operation.
3. After using the manual handle.

Operating The Sunroof Emergency Handle

1. Use the sunroof emergency handle to close and open the sunroof manually for the following case only.
   A. To close the sunroof before driving a vehicle in arainy day or on the highway if the sunroof can not be closed due to failure of the sunroof motor or controller.
2. Operating method
   A. Remove the overhead console.
   B. Push the emergency handle up into the hexagonal drive (A) of the sunroof motor. You must push hard enough to disengage the motor clutch; other wise the emergency handle will slip due to in complete fit in the motor.
   C. Carefully turn the emergency handle clock wise to close the sunroof.
   D. After closing the sunroof, wiggle the handle back and forth as you remove the tool from the motor,to ensure the motor clutch reengages.
   E. A 5mm hex socket may be used in place of thee mergency handle, with a” Speeder” type handle.

- Do not use power tools to operate the sunroof.
  Damage to the components may occur.



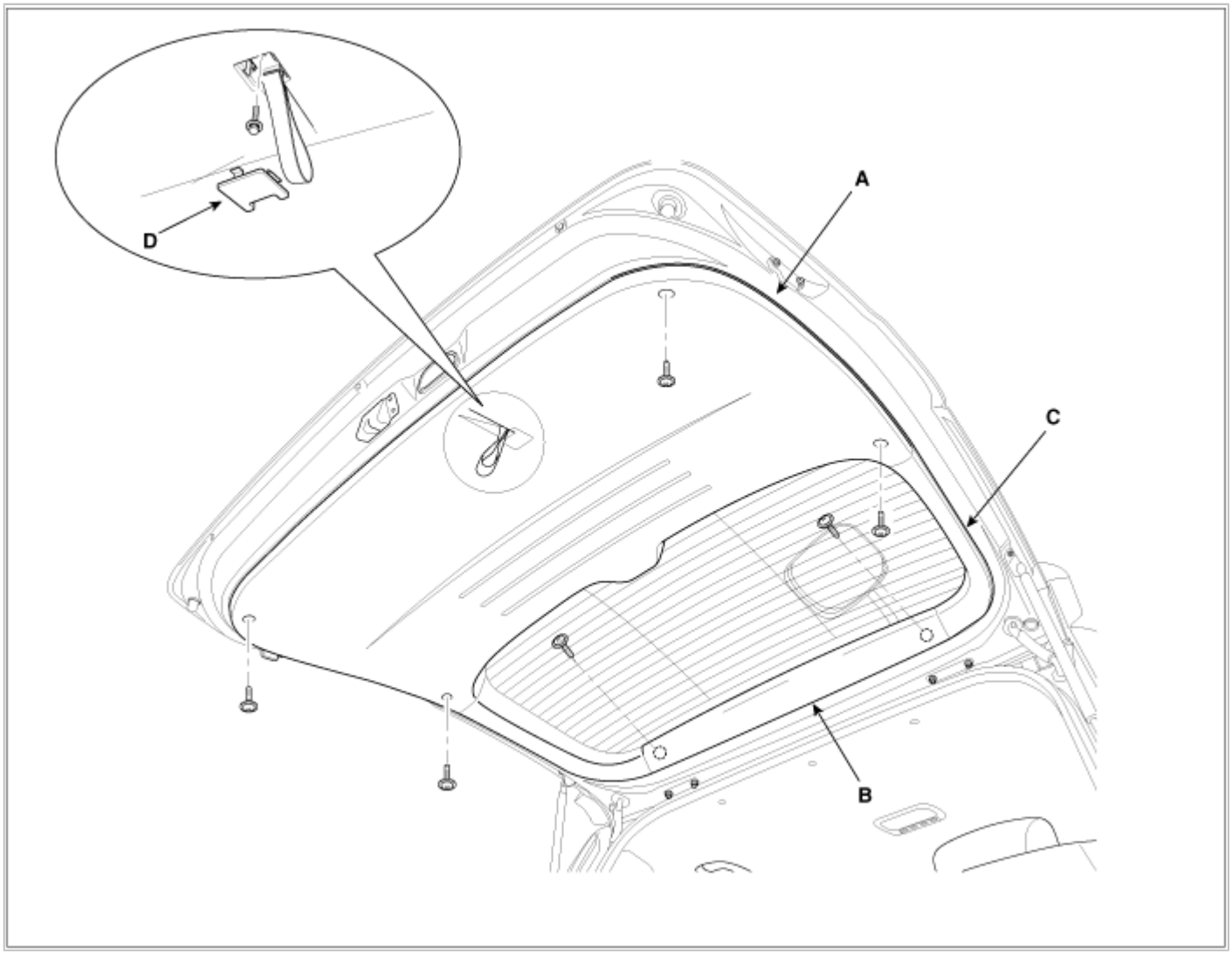
Replacement

Tailgate Trim Replacement

- When prying with a flat-tipped screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

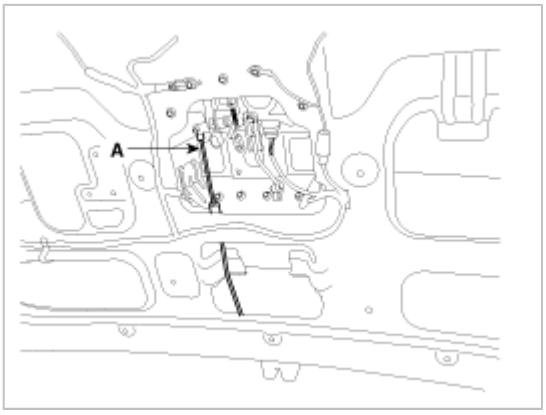
1. Remove the cover (D).
2. After loosening the screws the remove the tailgate trim (A).
3. Remove the upper trim (B) and side trim (C).
4. Installation is the reverse of removal.

- Replace and damaged clips.



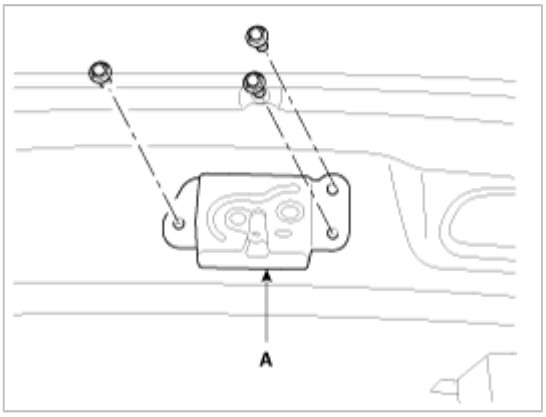
Latch Assembly Replacement

1. Remove the tailgate trim.
2. Disconnect the actuator rod (A).



3. After loosening the mounting screws, then remove the latch assembly (A).

Tightening torque : 6.9~10.8 N.m (0.7~1.1 kgf.m, 5.1~8.0 lb-ft)



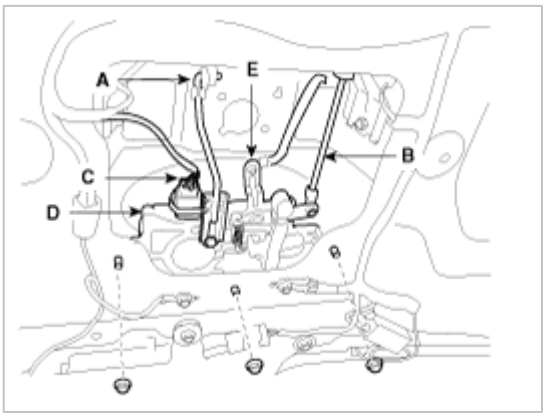
4. Installation is the reverse of removal.

- Make sure the connector is connected properly and the connecting rod is connected properly.
- Make sure the tailgate opens properly and locks securely.

Actuator Assembly Replacement

1. Remove the tailgate trim.
2. Disconnect the outside handle rod (A), key cylinder rod (B) and connector (C).
3. After loosening the mounting bolt and nuts, then remove the actuator assembly (D).

Tightening torque : 6.9~10.8 N.m (0.7~1.1 kgf.m, 5.1~8.0 lb-ft)

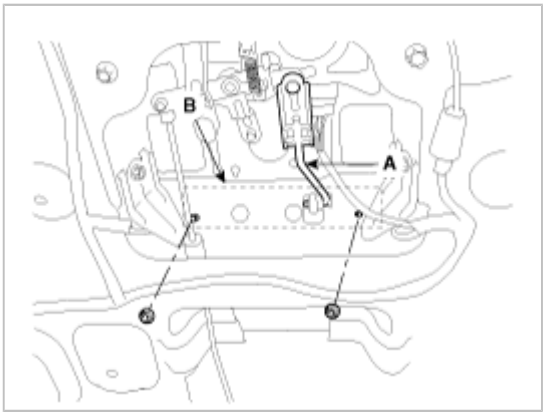


4. Installation is the reverse of removal.

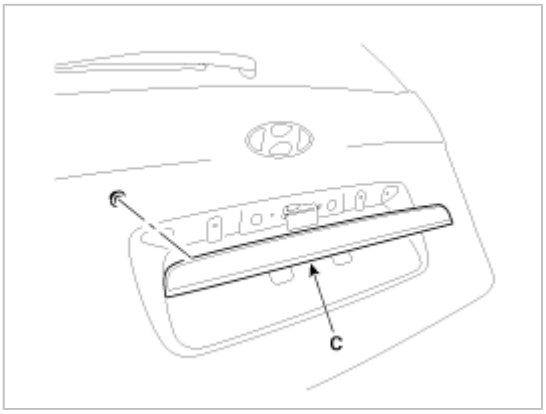
- Make sure the connector is connected properly and the connecting rod is connected properly.
- Make sure the tailgate opens properly and locks securely.

Outside Handle Replacement

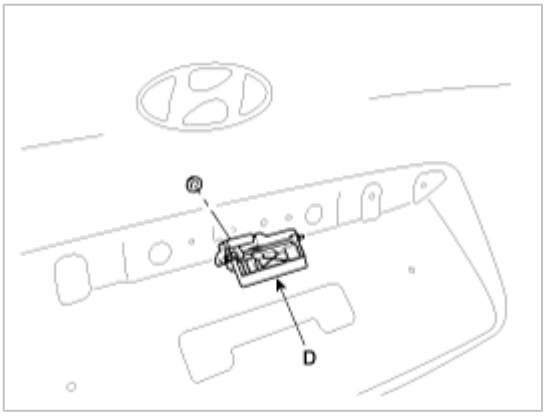
1. Remove the tailgate trim.
2. Remove the actuator assembly.
3. Disconnect the outside handle rod (A).
4. Loosen the outside handle (B) mounting nuts.



5. Remove the tailgate garnish (C).



6. Remove the outside handle (D).

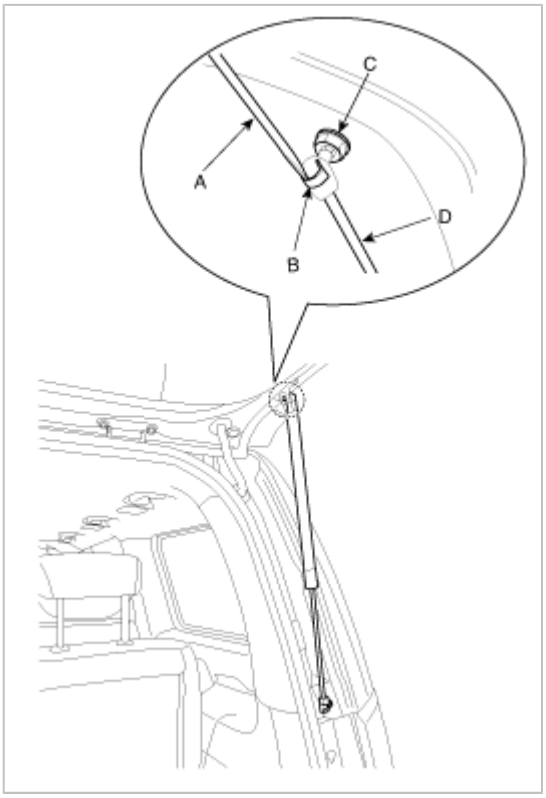


7. Installation is the reverse of removal.

- Make sure the tailgate opens properly and locks securely.

Lifter Replacement

1. Using a screwdriver (A), lift up slightly the socket clips (B) of both ends on the lifer (D), and then remove the lifter from the bracket (C).

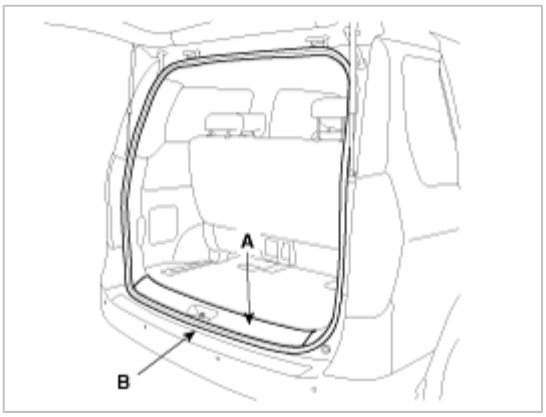


2. Push the socket of the lifter into the bracket for installation.

Tailgate Weatherstrip Replacement

- Do not apply sealant to the body.

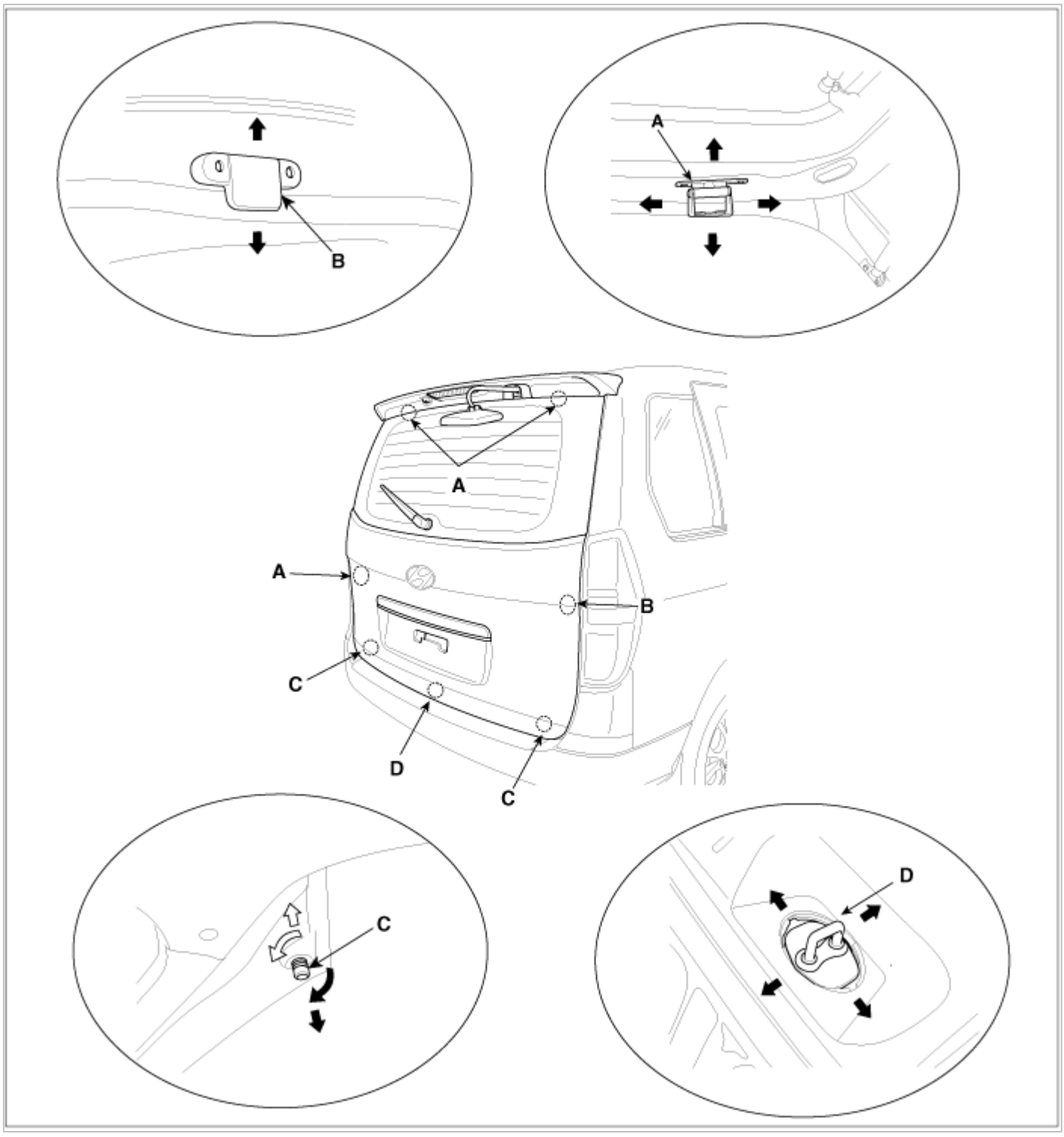
1. Remove the transverse trim (A).
2. Remove the tailgate weather strip (B).



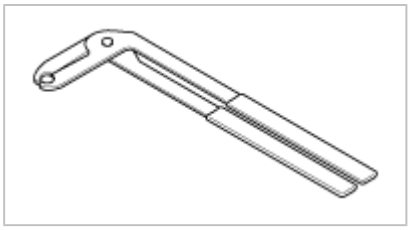
3. Installation is the reverse of removal.

Adjustment

1. After loosening the tailgate hinge (A) mounting bolt, adjust the tailgate by moving it up or down, or right or left.
2. Adjust the tailgate fit by turning the tailgate over slam bumper and side bumper (C).
3. Adjust the striker (D) by moving it up or down, or right or left.


B
A
A
A
B
C
D
C
C
D

Special Tools

Tool (Number and name)	Illustration	Use
09880-4F000 Hog ring clip installer		Hog ring clip Installation

Specifications

HOOD	Type	Rear hinged, gas lifter 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
Glass thicknes	Windshield glass	5mm
	Front door glass	4mm
	Tailgate glass	3.5mm
Seat belts	Front	3 point type with Emergency Locking Retractor (E.L.R)
	Rear	2 point type

Tightening Torque

Items		N·m	kgf·m	Lb-ft
Foont and rear doors	Door hinge to body	21.6~26.5	2.2~2.7	15.9~19.5
	Door hinge to door	21.6~26.5	2.2~2.7	15.9~19.5
	Door Striker	16.7~21.6	1.7~2.2	12.3~15.9
	Checker to body	16.7~21.6	1.7~2.2	12.3~15.9
	Checker to door	6.9~10.8	0.7~1.1	5.1~8.0
Tailgate	Tailgate latch	6.9~10.8	0.7~1.1	5.1~8.0
Hood	Hood hinge to body	21.6~26.5	2.2~2.7	15.9~19.5
	Hoodl hinge to hood	21.6~26.5	2.2~2.7	15.9~19.5
	Hood latch to body	6.9~10.8	0.7~1.1	5.1~8.0
Seat	Front seat mounting bolts	34.3 ~ 53.9	3.5~5.5	25.3~39.8
	Front seat mounting nut	23.5~35.3	2.4~3.6	17.4~26.0

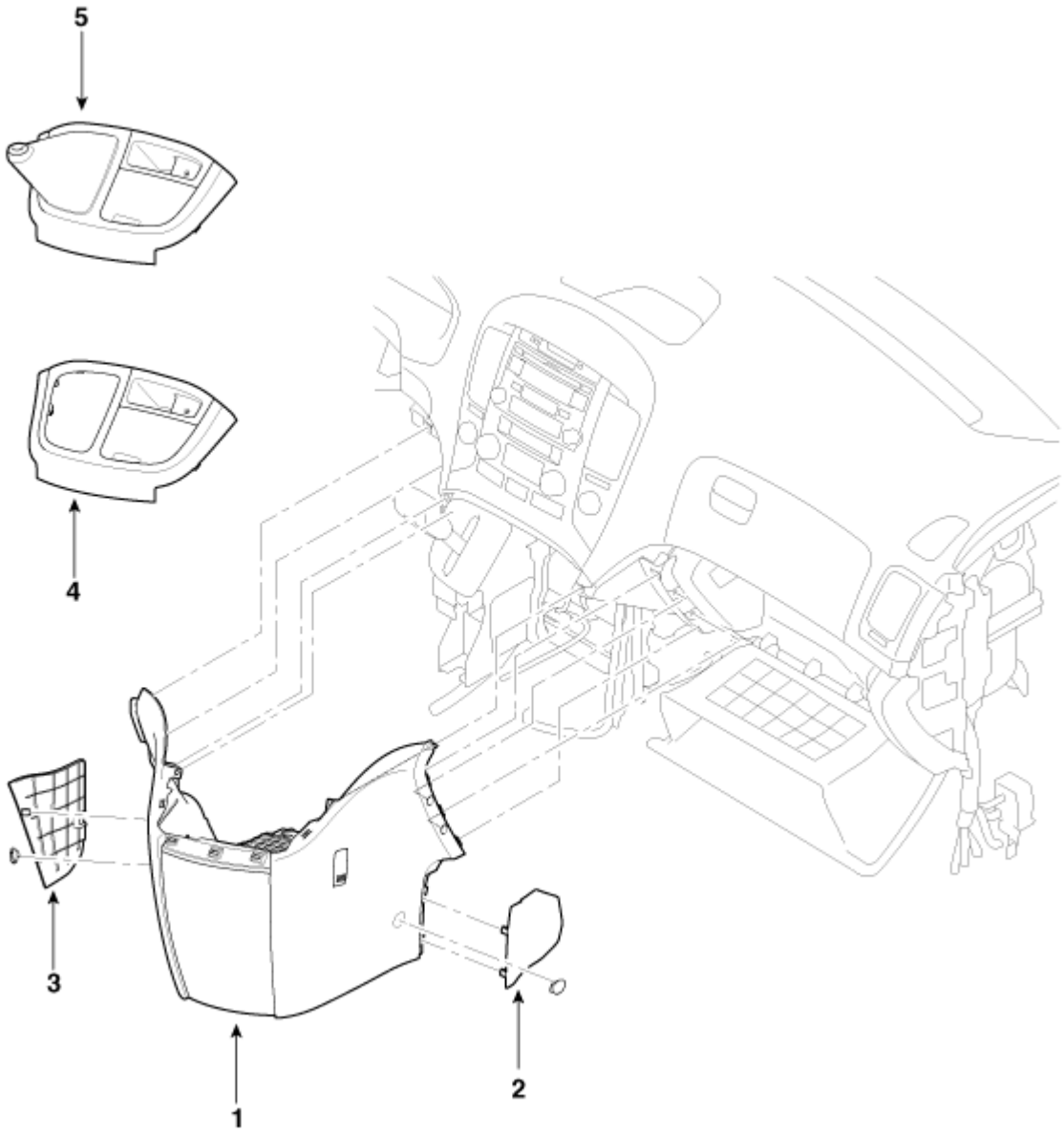
	Rear seat mounting bolts	16.7~25.5	1.7~2.6	12.3~18.8
	Rear seat mounting bolts	16.7~25.5	1.7~2.6	12.3~18.8
Seat belt	Front seat belt height adjuster	39.2~53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt buckle mounting bolt	39.2~53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt anchor mounting bolt	39.2~53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt lower anchor	39.2~53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Front seat belt upper anchor	39.2~53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Rear seat belt anchor attaching bolt	39.2~53.9	4.0 ~ 5.5	28.9 ~ 39.8
	Rear seat belt retractor or mounting bolt	39.2~53.9	4.0 ~ 5.5	28.9 ~ 39.8

Troubleshooting

Symptom	Suspect Area	Remedy (Refer to page)
Water leaks from sunroof	Dirt accumulated in drain tube	Clear dirt inside of drain
	Clogged drain tube	Blow air into drain to remove dirt
	Broken or dislocated drain tube, defective or cracked clip	Check tube installation and flange contact
	Deteriorated roof lid weatherstrip	Replace
	Excessive roof lid-to-body clearance and improperly fitted weatherstrip	Adjust
Wind noise around sunroof	Loose or deformed deflector, gaps in body work	Retighten adjust or replace
Sunroof lid makes a noise when move	Foreign particles lodged in guide rail	Check drive cable and guide rails for foreign particles
	Loose guide rails and lid	Retighten
Motor runs but sunroof does not move or moves only partially	Foreign particles lodged in guide rail	Adjust or replace
	Incorrect engagement of motor pinion with drive cable	
	Decrease in motor`s clutch slipping force	
	Increased sunroof sliding resistanceor interference of sunroof with drive cables, weatherstrip, etc. due tomal adjustment of sunroof	
Noise in motor (clutch slipping noise from motor when sunroofIs 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 assembly	Correct or replace

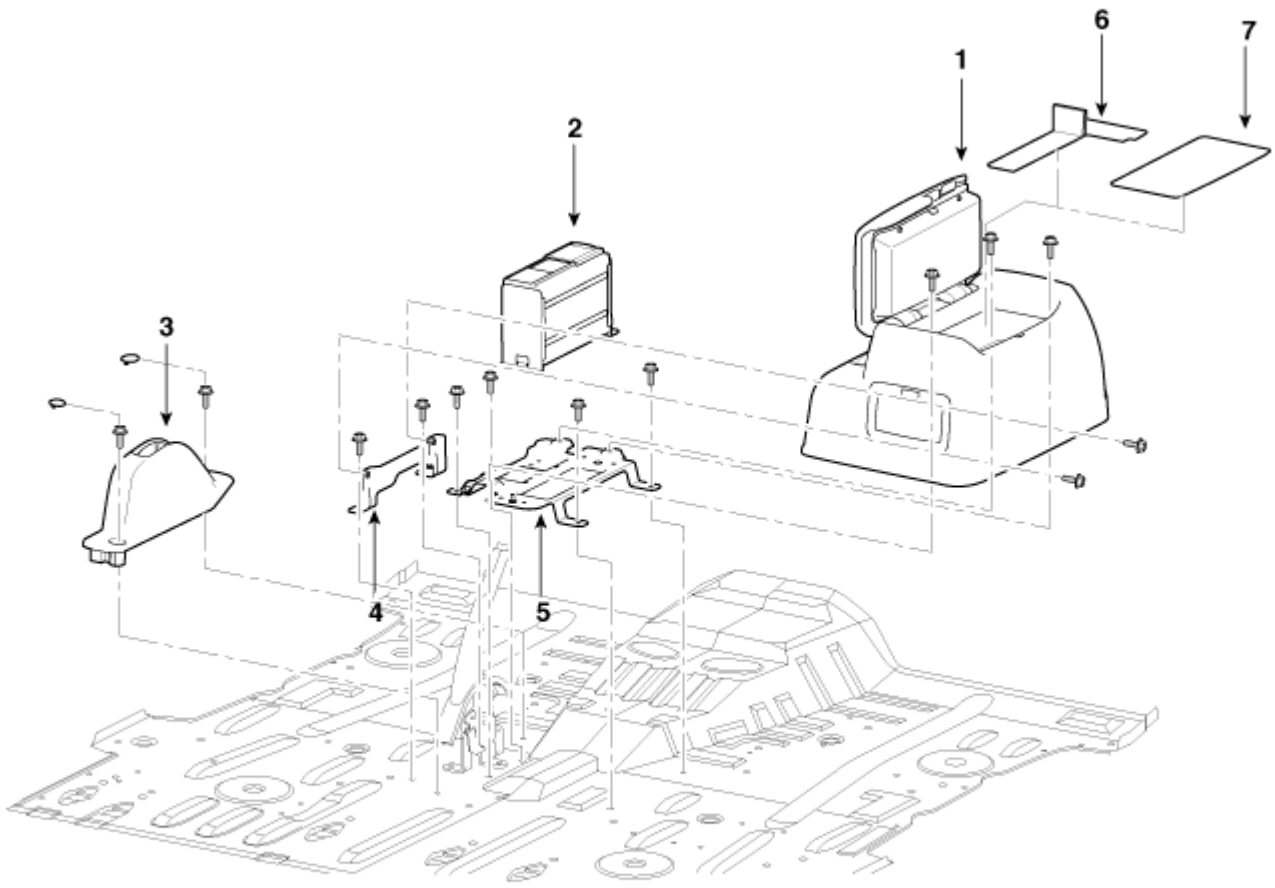
	Door hinge requires grease	Apply grease
Hood does not open or close completely	Striker and latch not properly aligned	Adjust
	Incorrectly installed hood	Adjust
	Incorrect hood bumper height	Adjust
Water leak through windshield end rear window	Defective seal	Fill with sealant
	Defective flange	Correct

Components



1. Front console 2. Extensor side cover 3. Extensor side dover	4. Front console under cover (A/T) 5. Front console under cover (M/T)

Floor Console

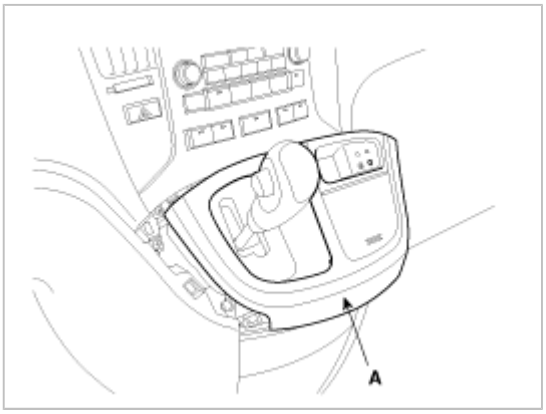


1. Floor center console 2. DVDC 3. Parking brake cover	4. Center console mounting bracket 5. Center console mounting bracket 6. DVDC tray pad 7. N/DVDC tray pad

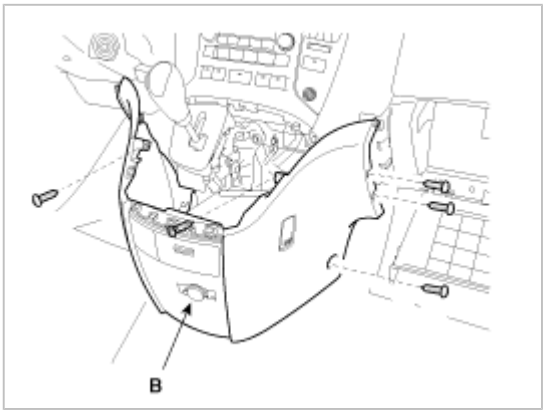
Replacements

Front Console Replacement

1. Remove the crash pad lower driver cover.
2. Remove the glove box.
3. Remove the front console under cover (A).



4. After loosening the mounting screws, then remove the front console (B).

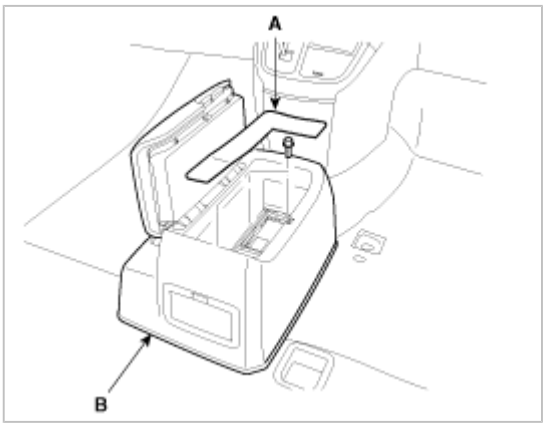


5. Installation is the reverse of removal.

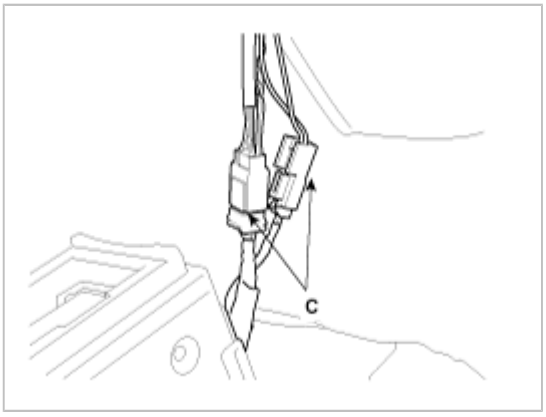
Floor Console Replacement

- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the under cover (A).
2. After loosening the console mounting screws, remove the floor console assembly (B).



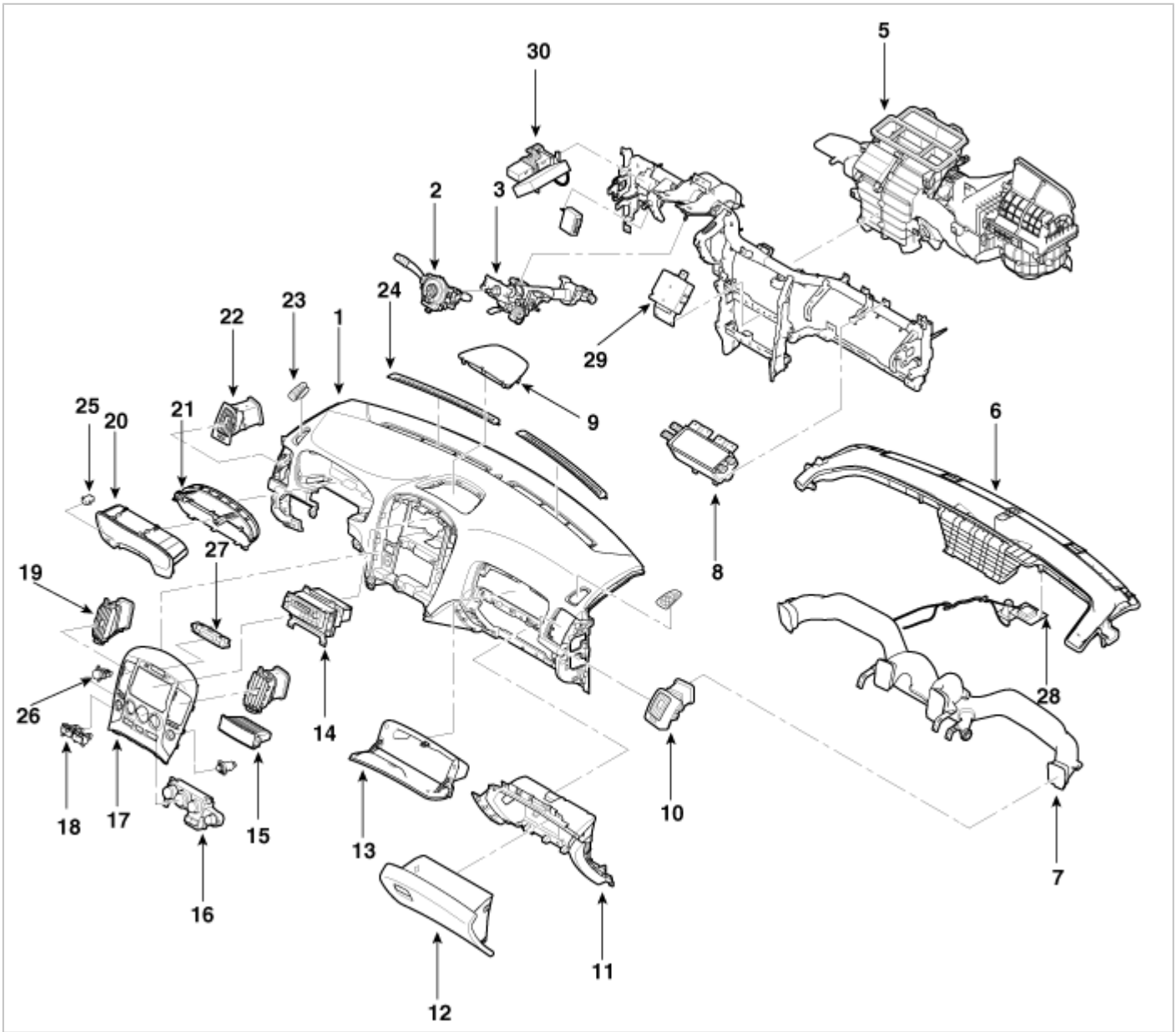
3. Disconnect the connector (C).



4. Installation is the reverse of removal.

- Make sure the connector is plugged in properly.
- Replace any damage clips.

Components



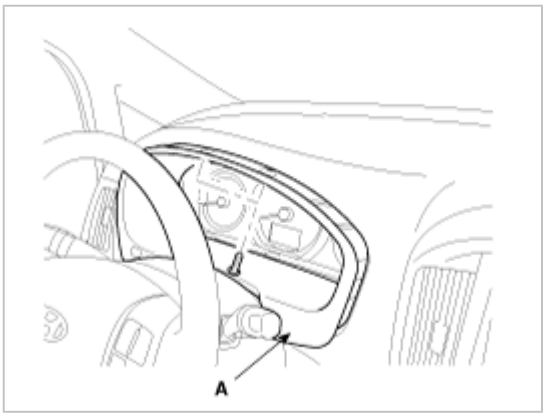
1. Crash pad	11. Crash pad lower pannel	21. Cluster
2. Steering column	12. Glove box	22. Side air vent duct
3. Multi function switch	13. Glove upper tray	23. Side defroster cover
4. Cowl cross bar	14. Audio assembly	24. Defroster hozzle
5. Havc unit	15. Tray	25. Auto switch
6. Defrost	16. Heater control	26. Switch
7. Heater airvent connation	17. Center fascia	27. Clock
8. Airvent	18. Switch assembly	28. CDMA
9. Center upper tray	19. Airvent duct	29. Hanse free unit
10. Side airvent duct	20. Cluster fascia panel	30. ICM/BCM

Replacements

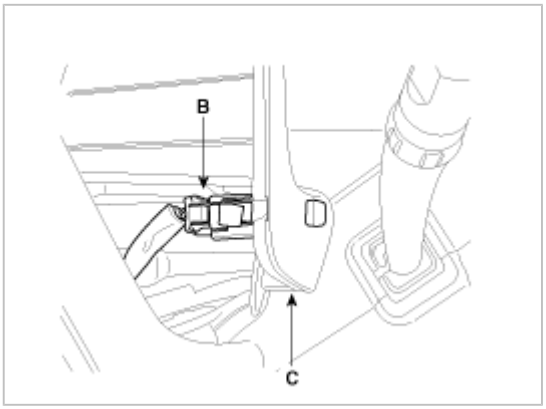
Cluster Fascia Replacement

- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

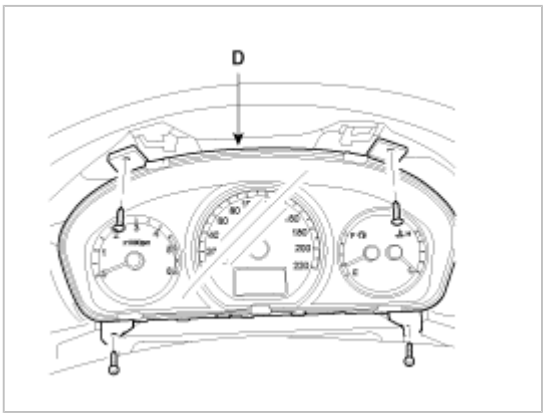
1. ilt the steering column down.
2. Remove the cluster fascia panel (A).



3. Disconnect the connector (B).
4. Remove the cluster fascia panel (C).



5. After loosening the mounting screws, then remove the cluster fascia (D).



6. Disconnect the connector.
7. Installation is the reverse the removal.

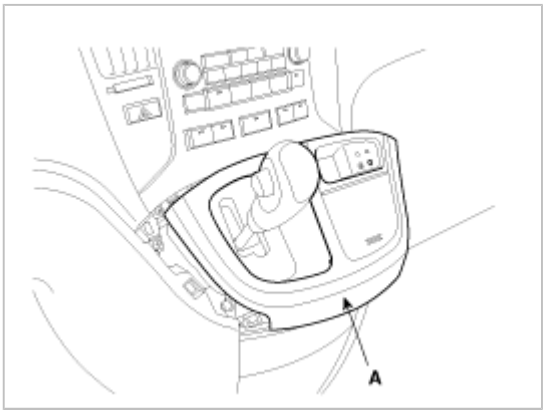
- Make sure the connector is plugged in properly.

Replacements

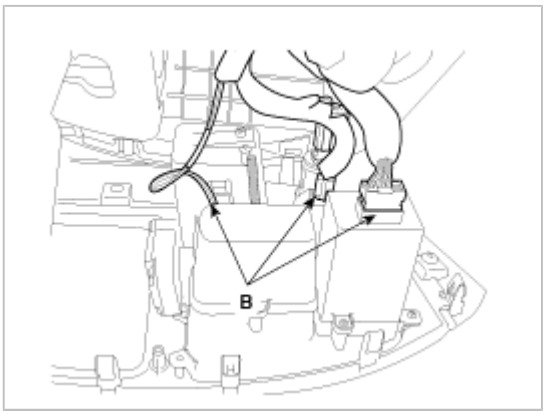
Center Fascia Panel Replacement

- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

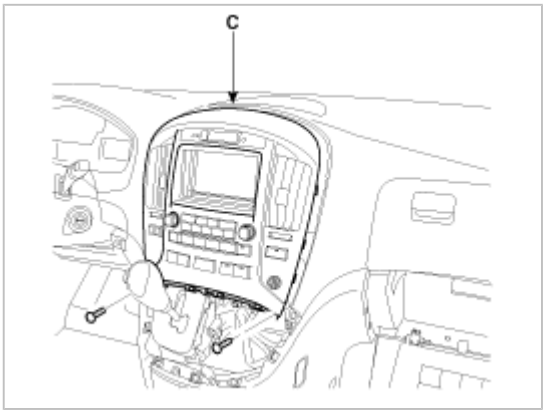
1. Remove the under cover (A).



2. Disconnect the connector (B).



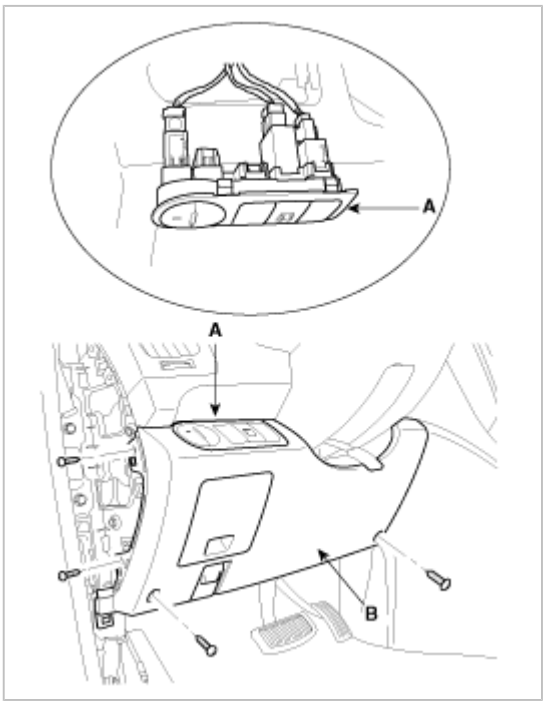
3. After loosening the mounting screws, then remove the fascia panel (C).



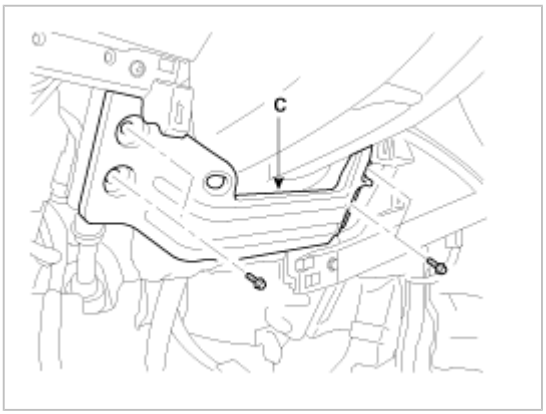
4. Installation is the reverse of removal.

Lower Panel Replacement

1. Remove the crash pad side cover.
2. Disconnecting the connector (A).
3. After loosening the crash pad lower panel mounting screws, then remove the lower panel (B).



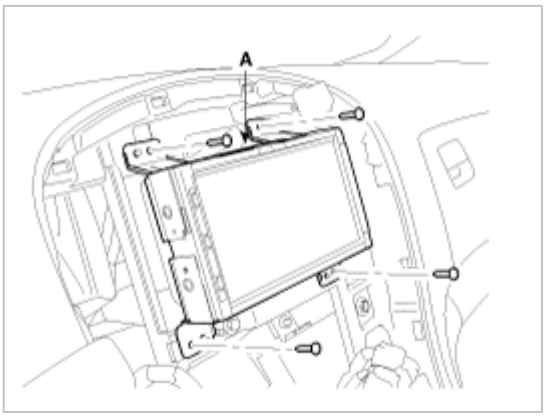
4. After loosening the mounting bolts, then remove the reinforcing panel (C).



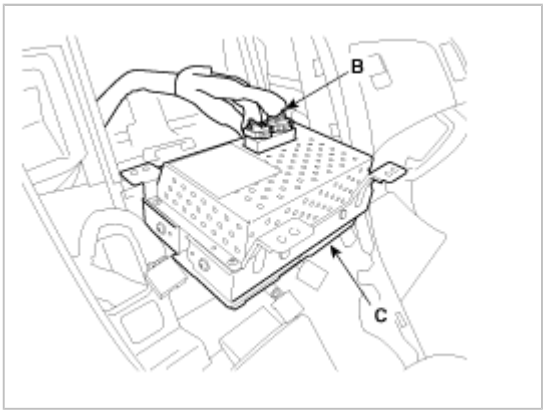
5. Installation is the reverse of removal.

Audio Assembly Replacement

1. Remove the center fascia panel.
2. Loosen the audio (A) mounting screws.



3. Disconnect the connector (B).
4. Remove the audio (C).

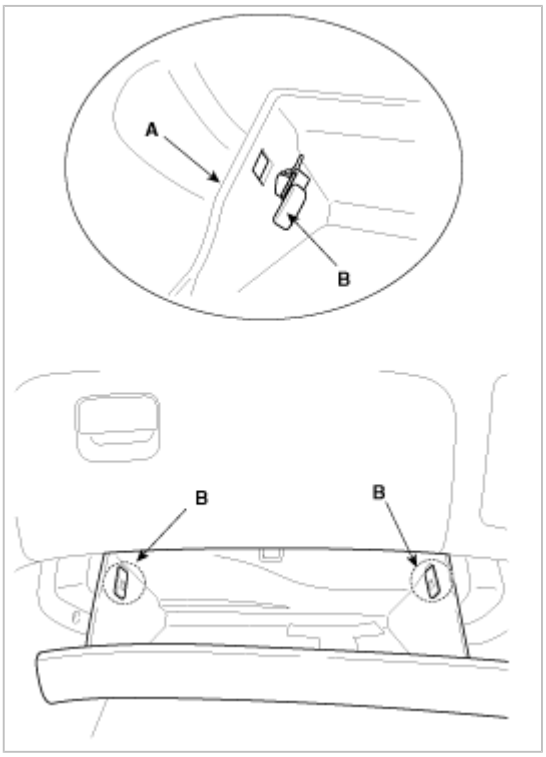


5. Installation is the reverse of removal.

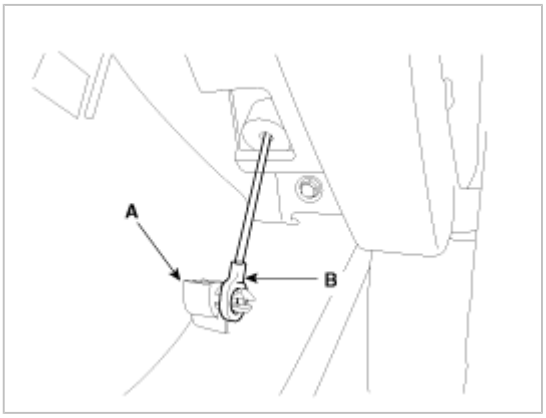
- Make sure the connector is plugged in properly.

Glove Box Replacement

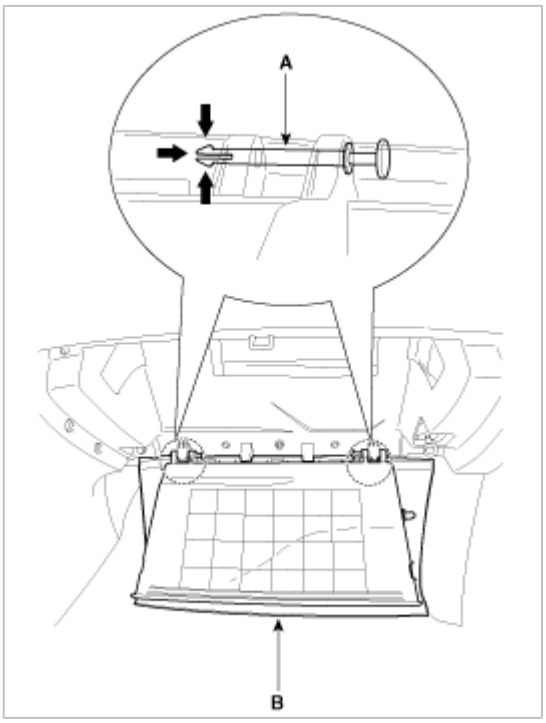
1. Disconnect the damper (B) from the glove box (A).



2. Remove the glove box (A) from the lift (B).



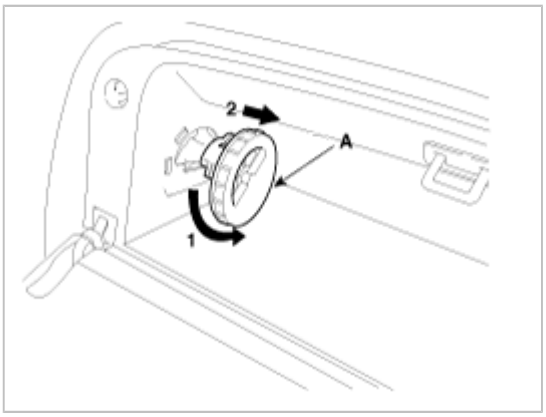
3. Disconnect the pine (A), then remove the glove box (B).



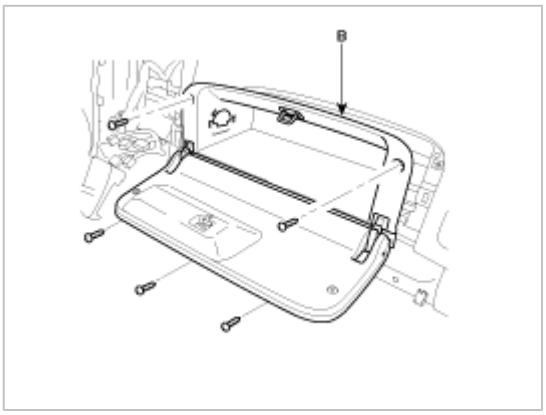
4. Installation is the reverse of removal.

Crash Pad Lower Panel Replacement

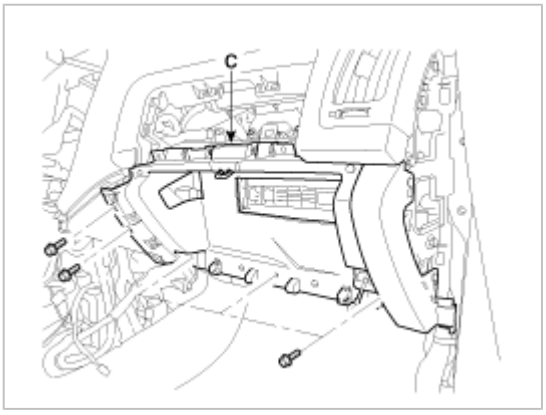
1. Remove the knob (A).



2. After loosening the mounting screws, then remove the upper tray (B).



3. After loosening the mounting screws, then remove the glove box housing (C).

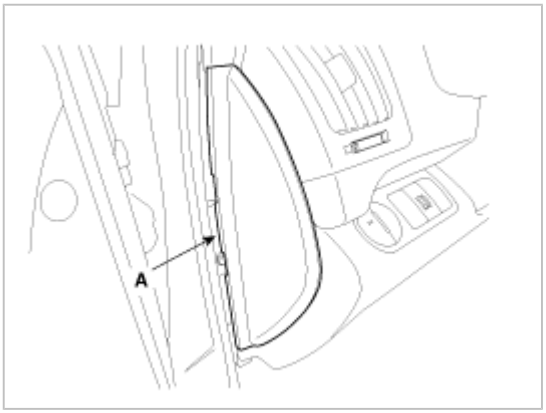


4. Installation is the reverse of removal.

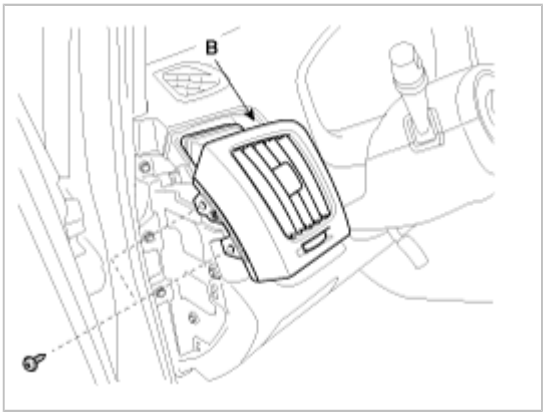
Air Vent Replacement

- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the crash pad side cover (A).



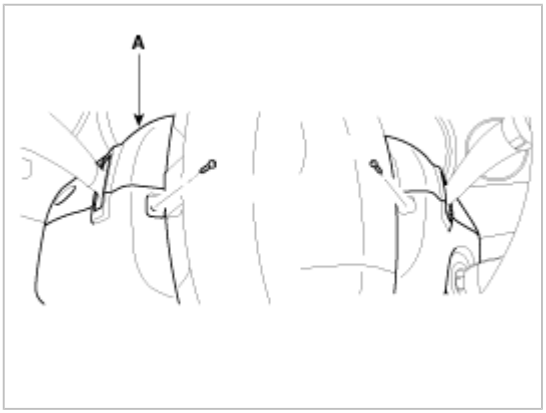
2. Loosen the mounting screws, then remove the air vent (B).



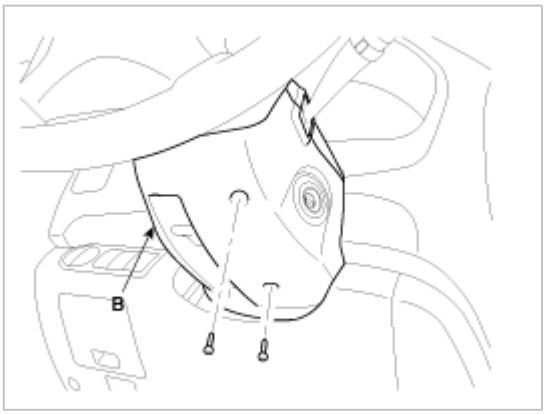
3. Installation is the reverse of removal.

Shroud Replacement

1. Loosen the shrond (A) screws.



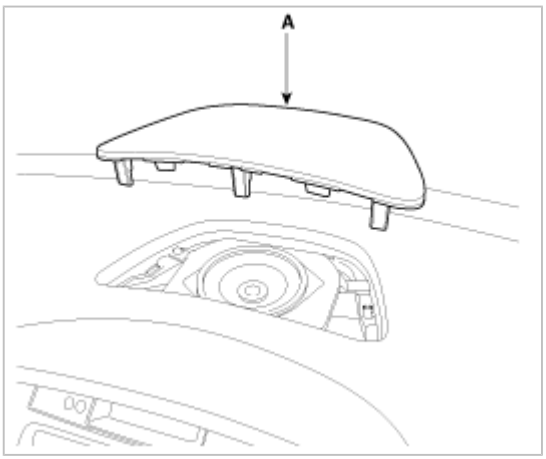
2. Remove the shroud assembly (B).



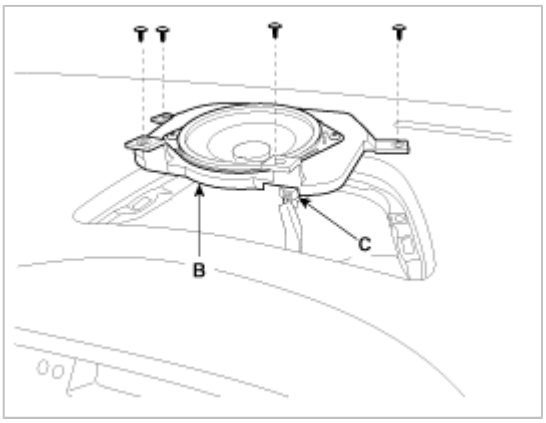
3. Installation is the reverse of removal.

Center Speaker Replacement

1. Remove the center speaker grill (A).



2. After loosening the mounting screws, then remove the speaker (B).
3. Disconnect the connector (C).

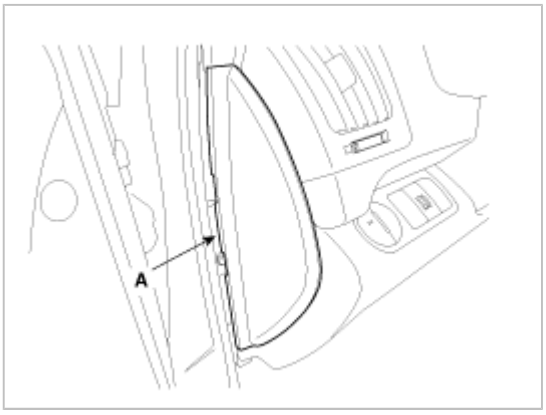


4. Installation is the reverse of removal.

Cover Replacement

- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the crash pad side cover (A).



2. Installation is the reverse of removal.

Crash Pad Replacement

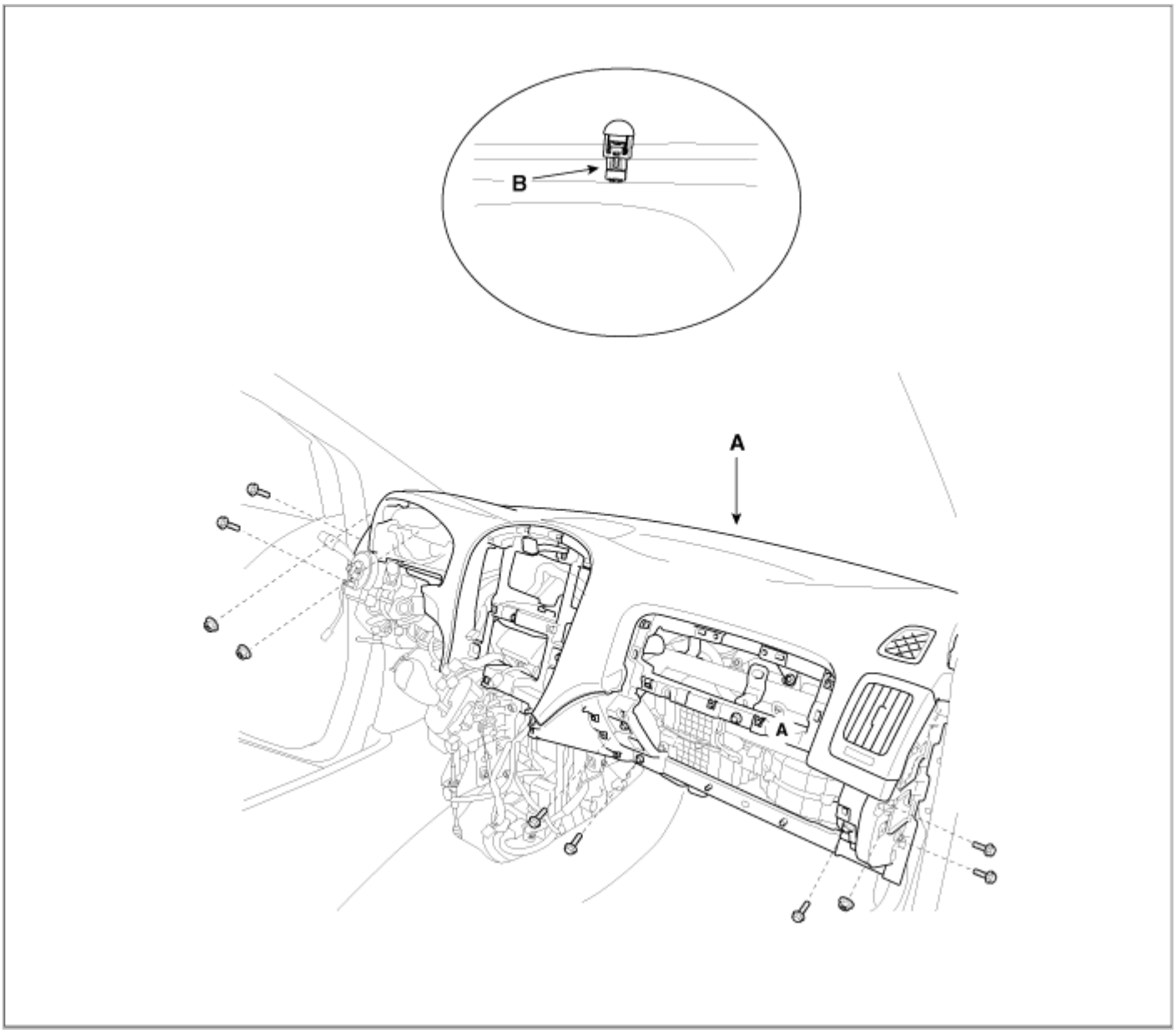
- When prying with a flat-up screwdriver, wrap it with protective tape, and apply protective tape around the related parts, to prevent damage.
- Put on gloves to protect your hands.

1. Remove the following items.
   A. Front seat.
   B. Cluster fascia panel, cluster.
   C. Audio assembly.
   D. Glove box.

E. Crash pad side cover.
F. Front pillar trim.

2. Remove the photo sensor (B).
3. Disconnect the passenger`s air bag connector.
   Loosen the bolts and nuts, then remove the crash pad (A).
4. Installation is the reverse of removal.

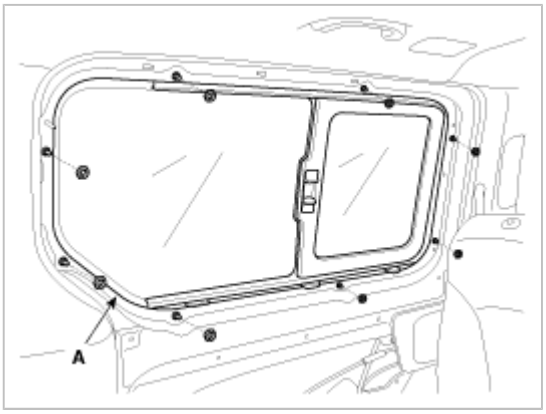
- Make sure the crash pad fits onto the guide pins correctly.
- Before tightening the bolts, make sure the crash pad wire harnesses are not pinched.
- Make sure the connectors are plugged in properly, and the antenna lead is connected properly.
- Enter the anti- theft code for the radio, then enter the customer`s radio station presets.


B
A
A

Removal

- Put on gloves to protect your hands.
- Be careful not to damage the painted surface.

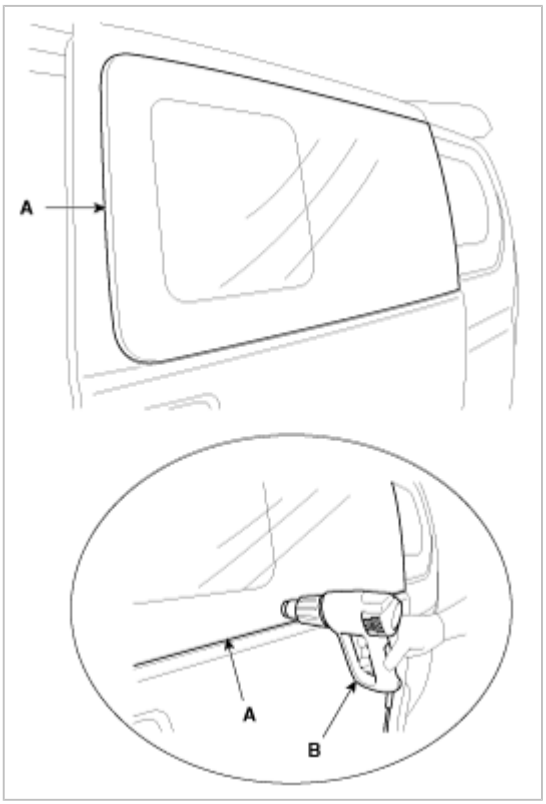
1. Remove the following items.
   A. Rear door trim (Refer to Exterior - "Rear door")
   B. Rear door window trim (Refer to Exterior - "Rear door")
2. Remove the nut from the plush glass (A).



3. Push the plush glass (A) after heating it with heater gun and then remove the plush glass.

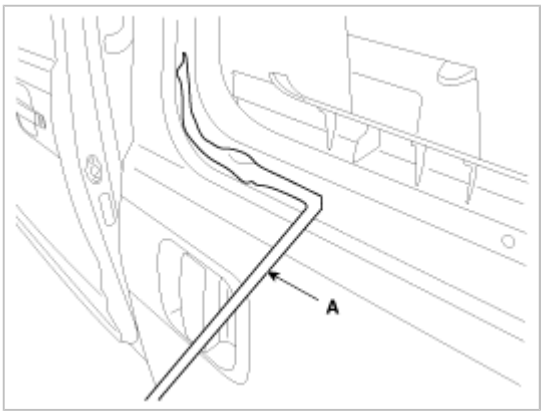
- Use the 1500-1600W heater gun to prevent the damage of glass or painted surface.
- Spread the repair paint or rust inhibitor on the damaged painted surface.

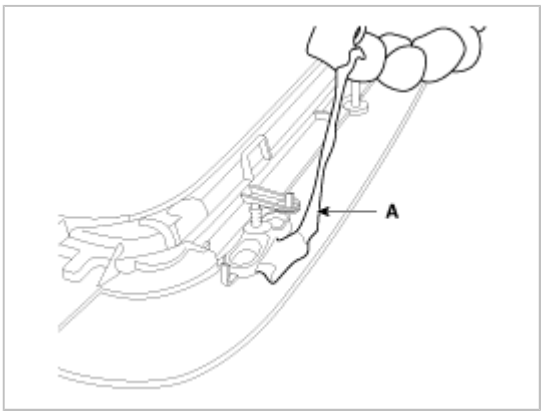
- When removing plush glass, an assistant is necessary.
  One worker push the glass from inside during another one using the heat gun from outside.



Installtion

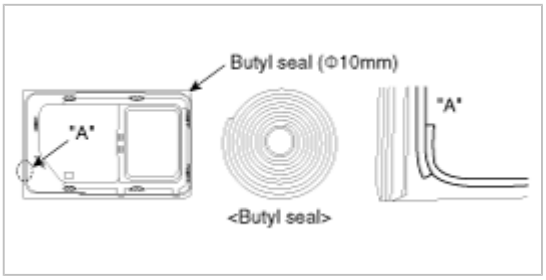
1. Remove the sealant and clean the bonding surface and plush glass with a sponge dampened in alcohol. After cleaning, keep dust, oil, grease and water from getting on the clean surface.





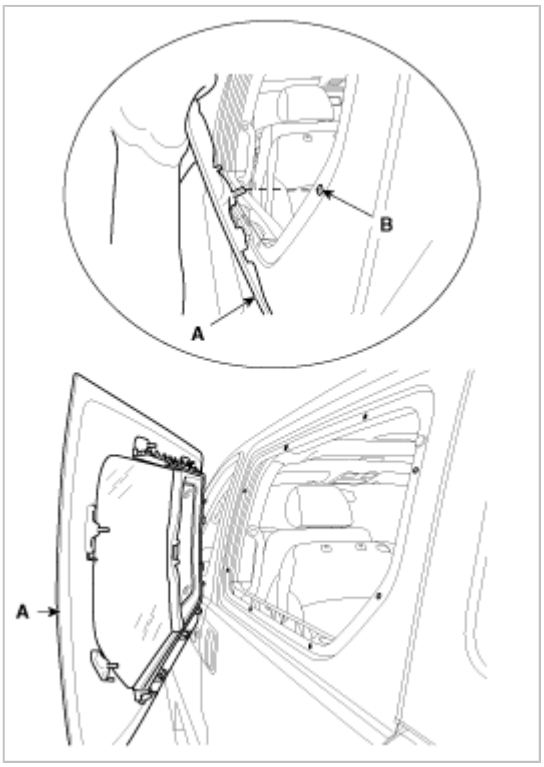
2. Install the sealant (butyl seal) on the glass.

- Plush glass have to be installed using the sealant (butyl seal) (Φ10mm) which has a viscosty and not changing until the time passes.

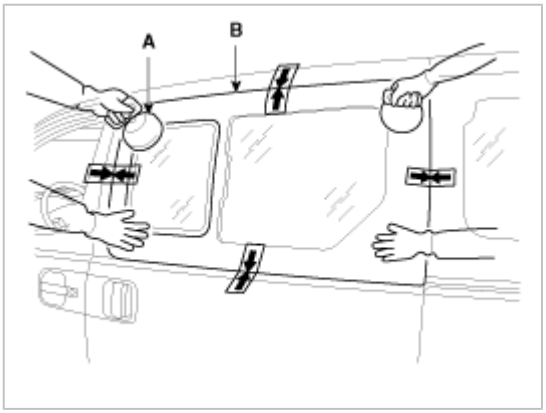


A. A roll of sealant (butyl seal) is for a one plush glass and sealant (butyl seal) have to be overlapped on area "A".
(Area "A" is starting and ending point of sealant (butyl seal))

3. Insert the plush glass screw (A) into the hole of body.



4. Use suction cups (A) to hold the plush glass, lightly push on the plush glass (B) until its edges are fully seated on the adhesive all the way around. Do not open or close the doors until the adhesive is dry.



5. Spray water over the glass and check for leaks.

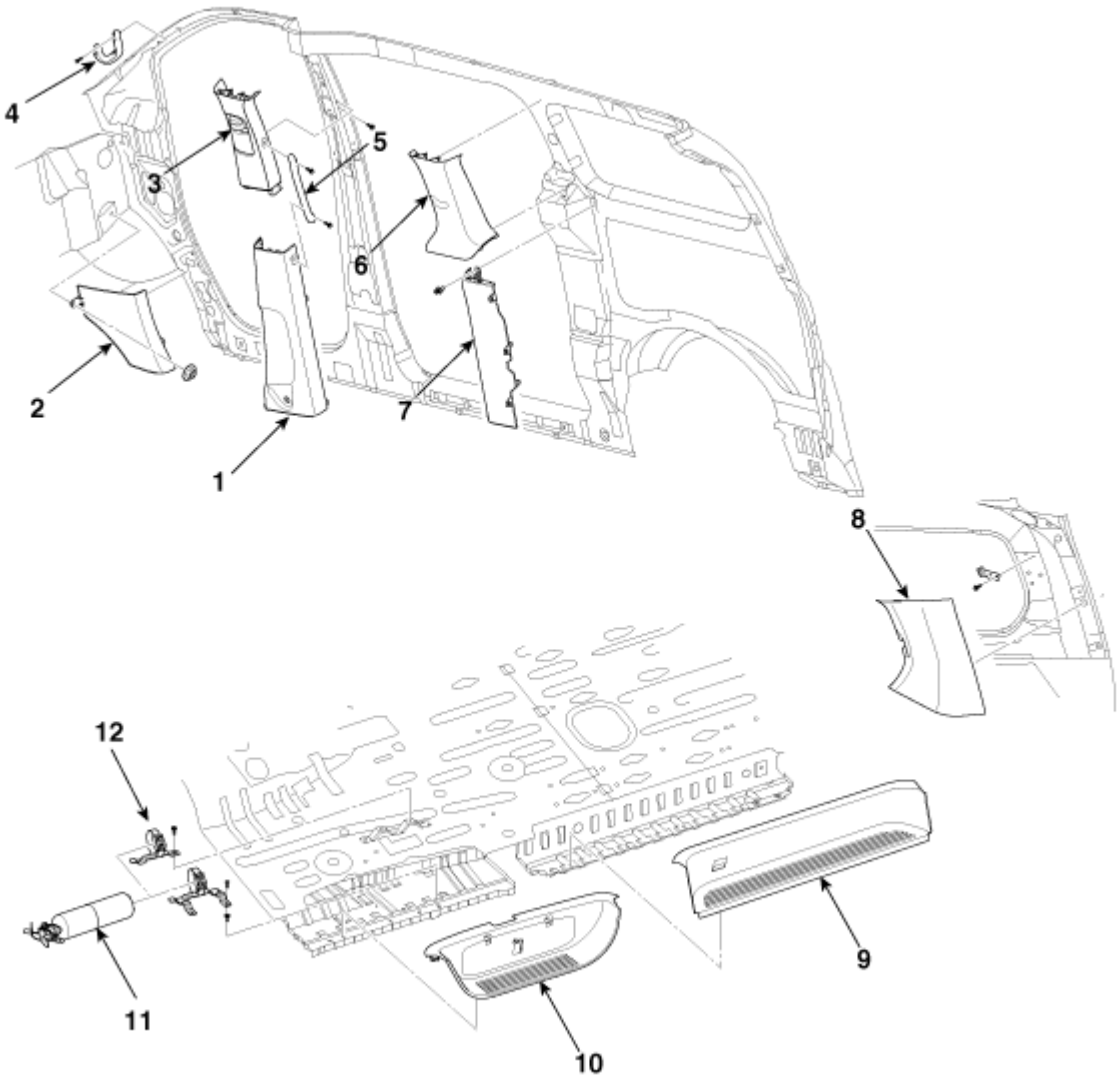
- Do not spray to sealant area directly. Spray water over the glass and then spill water around the glass.

6. Make leaking areas, and let the glass dry, then seal with sealant.

- Let the vehicle stand for at least four hours after glass installation. If the vehicle has to be used within the first eight, it must be driven slowly.
- Keep the glass dry for the first hour after installation.

7. Reinstall all remaining removed parts.
   A. Rear door trim (Refer to Exterior - "Rear door")
   B. Rear door window trim (Refer to Exterior - "Rear door")

Components



1. Center pillar lower trim	5. Assist handle	9. Rear door scuff trim
2. Cowl side trim	6. Rear pillar trim	10. Front door scuff trim
3. Center pillar upper trim	7. Luggage side trim	11. Rear door scuff trim
4. Assist handle	8. Gate pillar trim	12. Front door scuff trim

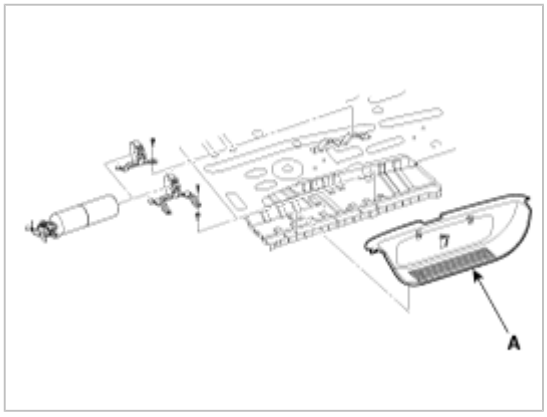
Replacements

Door Scuff Trim Replacement

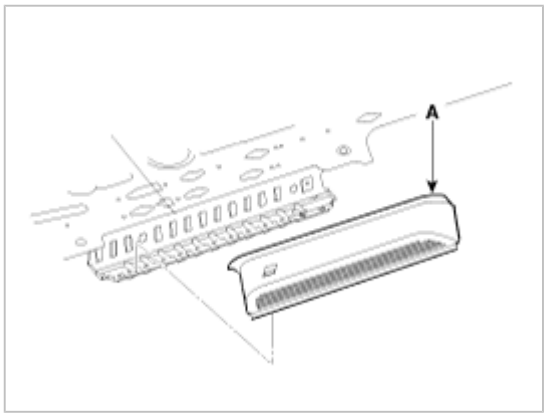
- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the front door scuff trim (A).

Front



Rear



2. Installation is the reverse of removal.

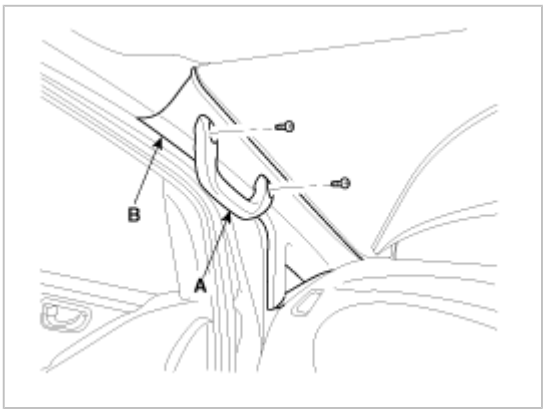
- Replace any damage clips.

Front Pillar Trim

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
-

Take care not to bend or scratch the trim and panels.

1. Remove the assist handle (A).
2. Remove the front pillar trim (B).



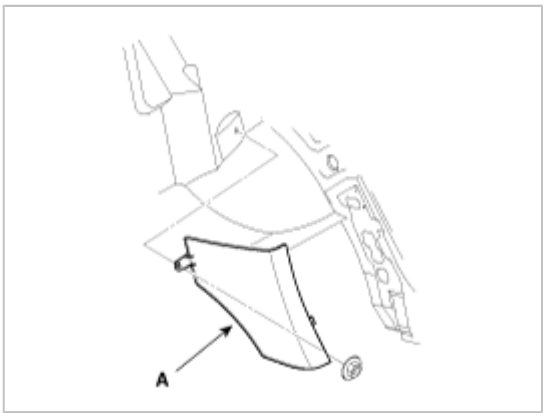
3. Installation is the reverse of removal.

- Replace any damage clips.

Cowl Side Trim Replacement

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the front door scuff trim.
2. Remove the cowl side trim (A).



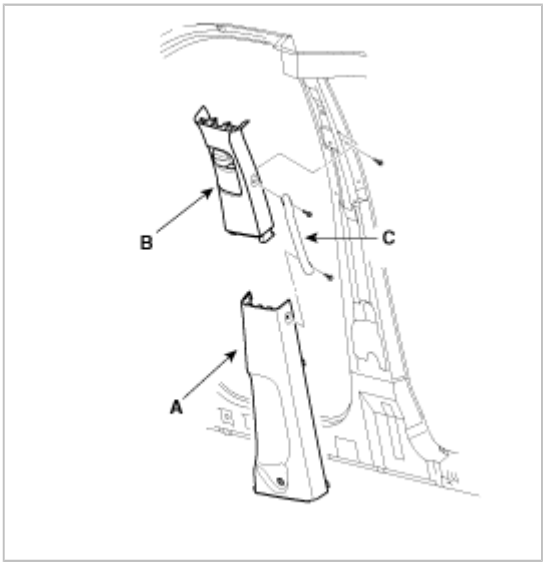
3. Installation is the reverse of removal.

- Replace any damage clips.

Center Pillar Trim Replacement

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the front seat belt lower anchor.
2. Remove the front door scuff trim.
3. Remove the center lower pillar trim (A).
4. Remove the center upper pillar trim (B).



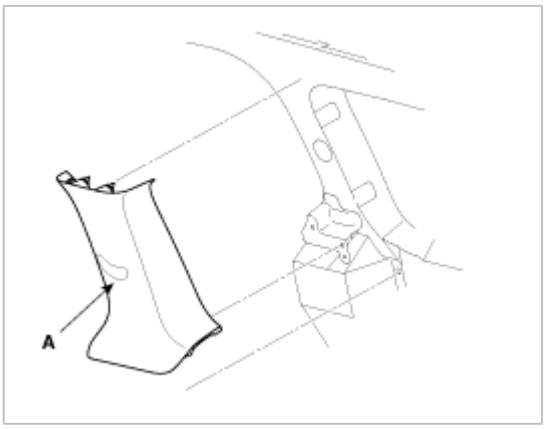
5. Installation is the reverse of removal.

- Replace any damage clips.

Rear Pillar Trim Replacement

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the rear pillar lower trim (A).



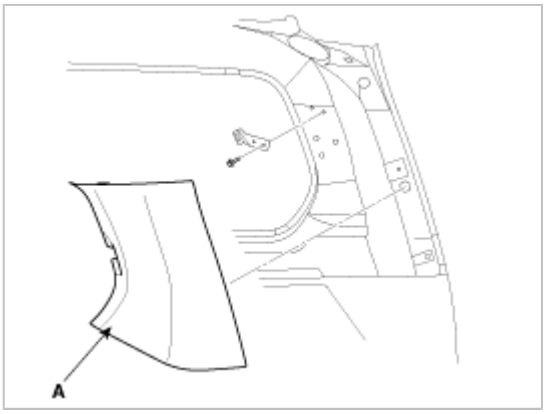
2. Installation is the reverse of removal.

- Replace any damage clips.

Gate Pillar Trim Replacement

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

1. Remove the gate pillar trim (A).



2. Installation is the reverse of removal.

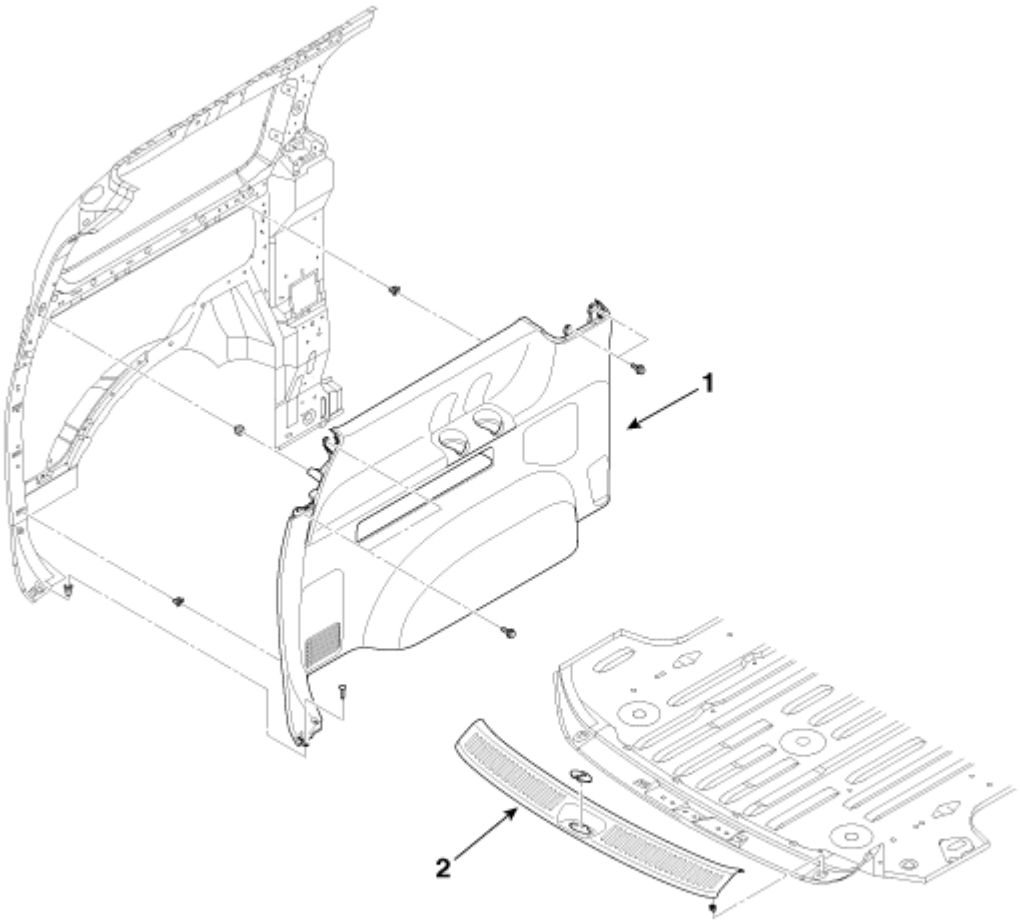
- Replace any damage clips.

Luggage Side Trim Replacement

- Put on gloves to protect your hands.
- When prying with a flat-tipped screwdriver, wrap it with protective tape to prevent damaged.

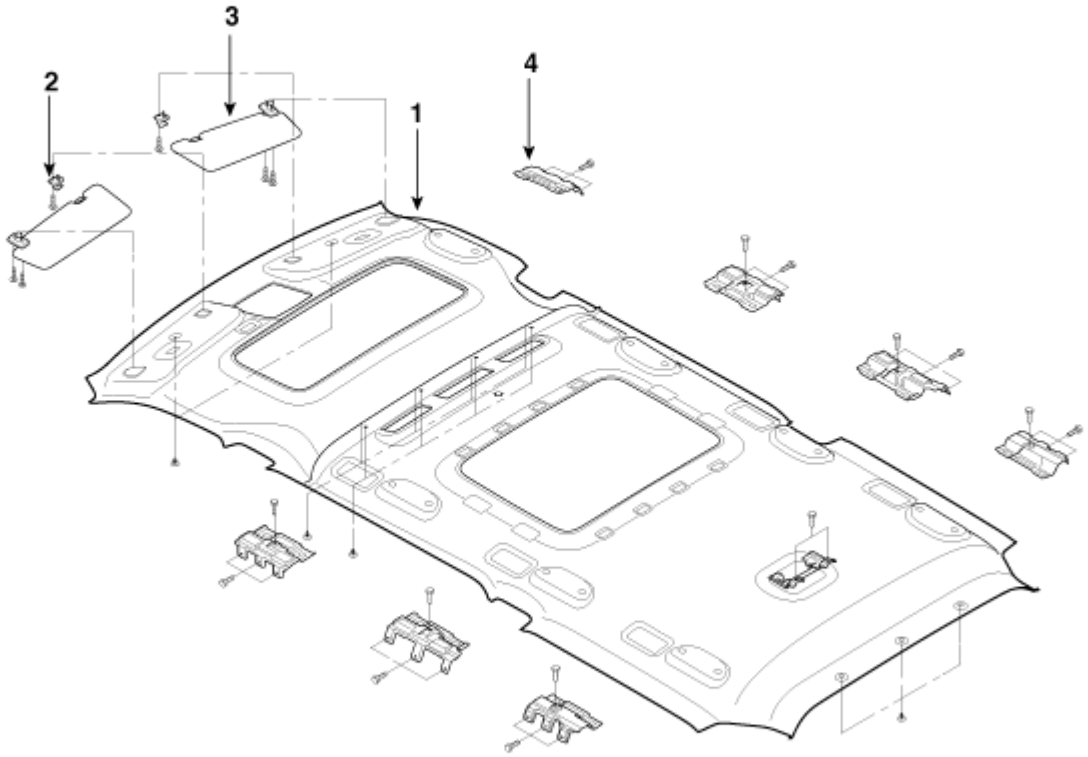
- Take care not to bend or scratch the trim and panels.

1. Remove the rear seat.
2. Remove the rear pillar trim.
3. Remove the gate pillar trim.
4. Remove the transvers trim (2).
5. After loosening the mounting screws, then remove the luggage side trim (1).
6. Installation is the reverse of removal.



1. Luggage side trim	2. Transverse trim

Components



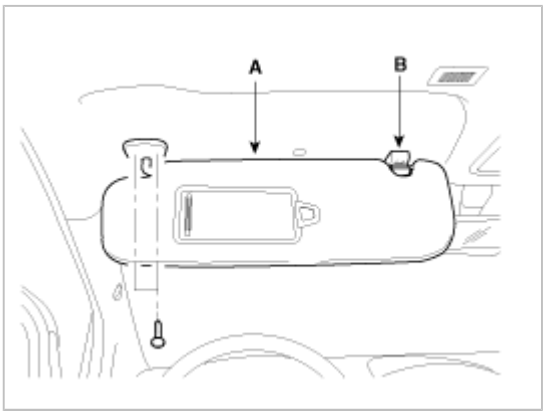
1. Roof trim 2. Sunvisor	3. Holder 4. Assist handle bracket

Replacements

Sunvisor Replacement

- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

1. Remove the sunvisor (A) and holder (B) from each side.

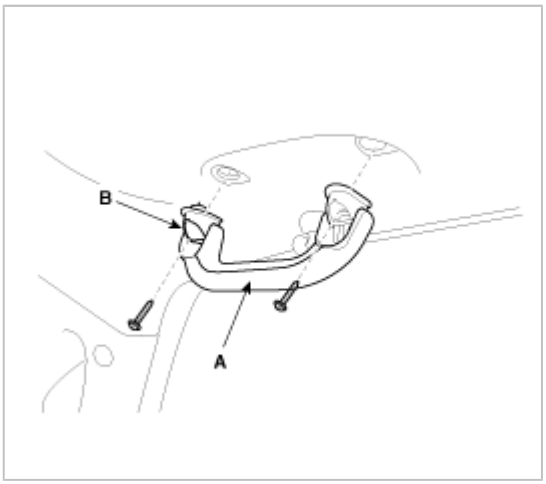


2. Installation is the reverse of removal.

Assist Handle Replacement

- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

1. Remove the covers (B), and remove the screws, then remove the assist handle (A).

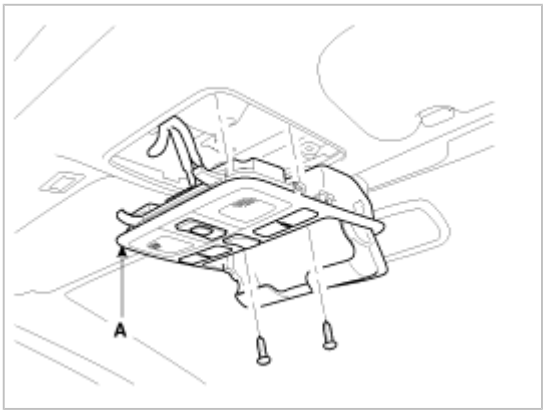


2. Installation is the reverse of removal.

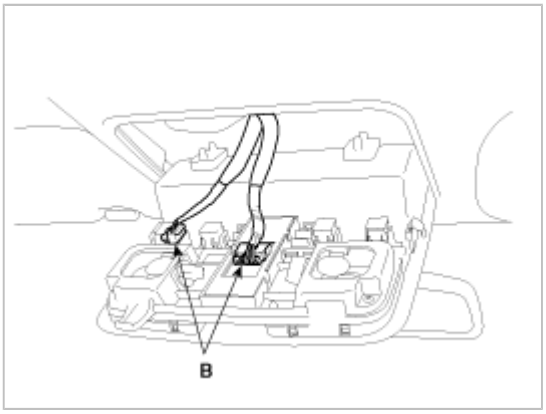
Overhead Console Lamp Replacement

- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

1. Remove the overhead console
   A. Remove the screw.
   B. Pull out the roof console (A).



2. Disconnect the connector (B).

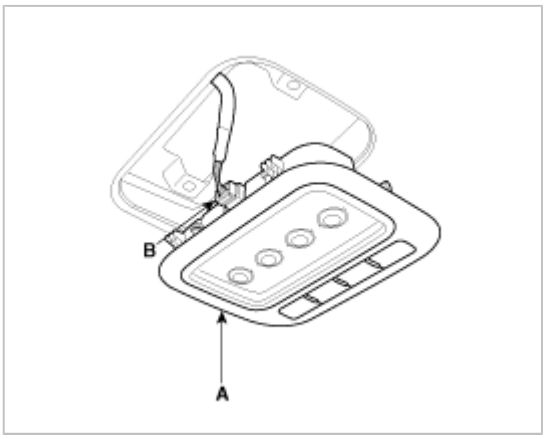


3. Installation is the reverse of removal.

Room Lamp Replacement

- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Put on gloves to protect your hands.

1. Remove the room lamp (A).
2. Disconnect the connector (B).

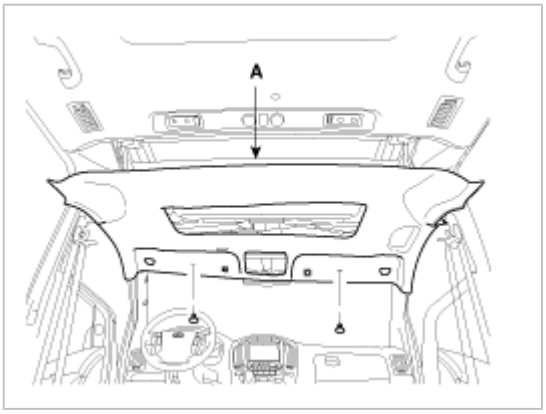


3. Installation is the reverse of removal.

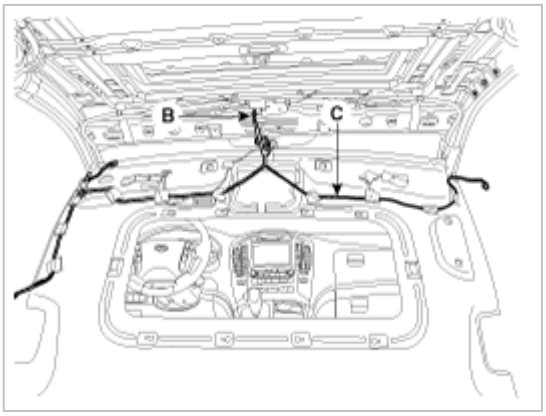
Headliner Replacement

- Put on gloves to protect your hands.
- When prying with a flat-tip screwdriver, wrap it with protective tape to prevent damage.
- Take care not to bend or scratch the trim and panels.

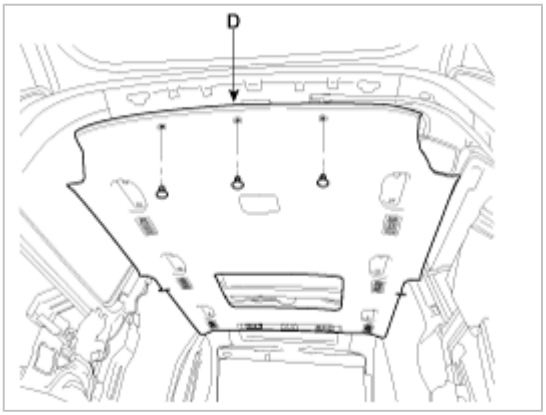
1. Remove the following items.
   A. Rear pillar trim.
   B. Overhead console.
   C. Room lamp.
   D. Sunvisor.
   E. Assist handle.
2. Remove the front roof trim (A).



3. Disconnect the sunroof motor connector (B).
4. Disconnect the main waring (C).



5. Remove the rear roof trim (D).



6. Installation is the reverse of removal.

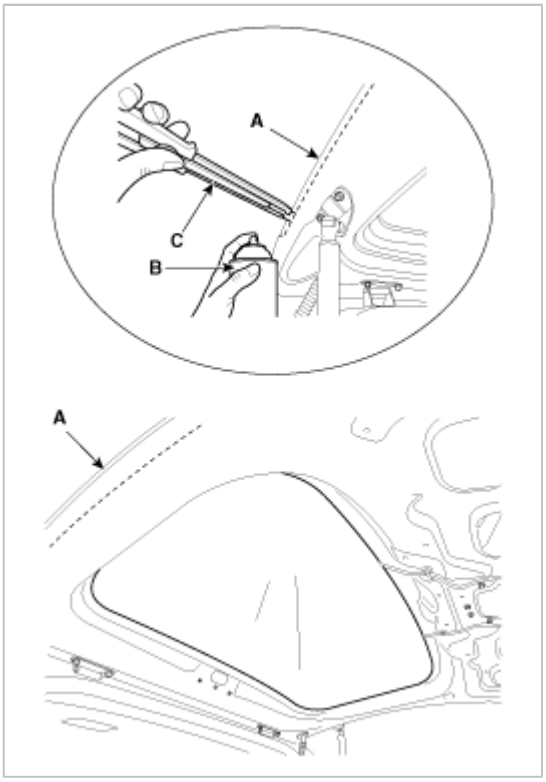
- Replace any damage clips.

Removal

- Put on gloves to protect your hands.
- Be careful not to damage the painted surface.

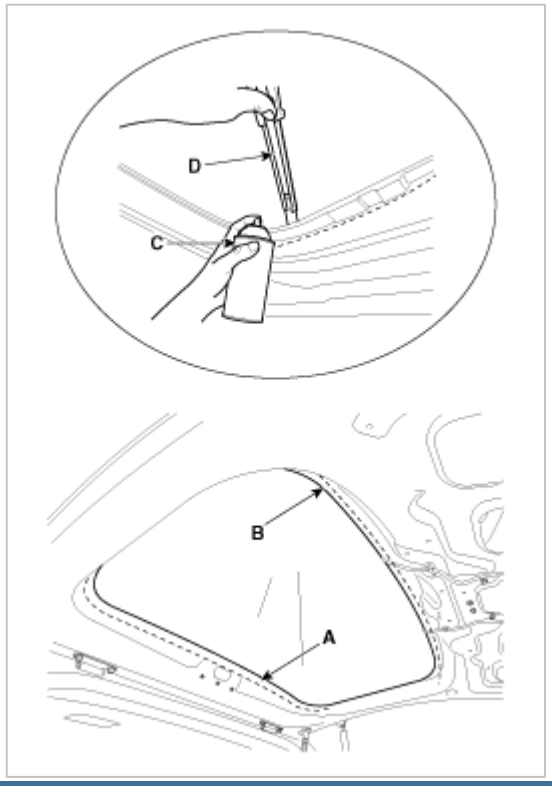
1. Remove the following items.
   A. Tailgate upper trim (Refer to Exterior - "Tailgate")
   B. Tailgate side trim (Refer to Exterior - "Tailgate")
   C. Tailgate trim (Refer to Exterior - "Tailgate")
   D. Rear wiper arm
      (Refer to BE group - "Rear Wiper/washer")
   E. Tailgate glass heater connector
      (Refer to BE group - "Rear Window Defogger")
   F. Rear spoiler
      (Refer to Exterior - "Body Side Molding")
2. Spread the WD-40 (B) on the side of tailgate glass (A) after opening the tailgate.
3. Cut out the adhesive using the cutter (C).

- Please use the cutter which balde length is between 8-12 inches.



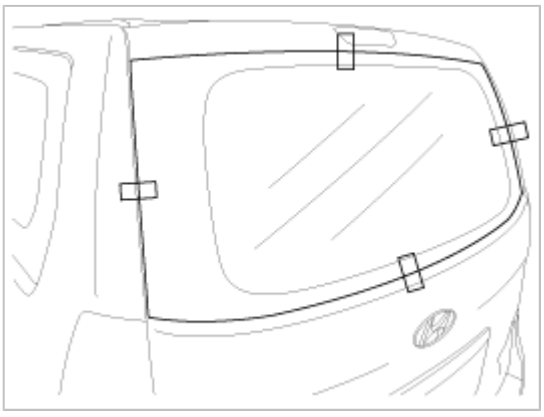
4. Spread the WD-40 (C) enough on the upper(A) and lower(B) side of tailgate glass. And then cut out the

adhesive using the cutter (D).



Installtion

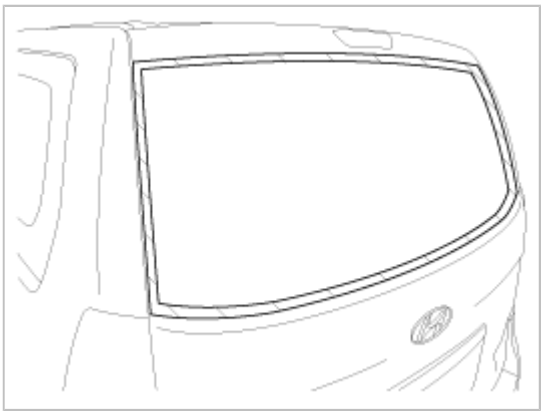
1. With a cutting knife, remove the adhesive on the bonding surface around the body panel.
2. Clean the bonding surface with a sponge dampened in alcohol. After cleaning, keep dust, oil, grease and water from getting on the clean surface.
3. Install the tailgate glass (A) temporarily with marking sure to position them on the center, and then place the alignment mark (B).



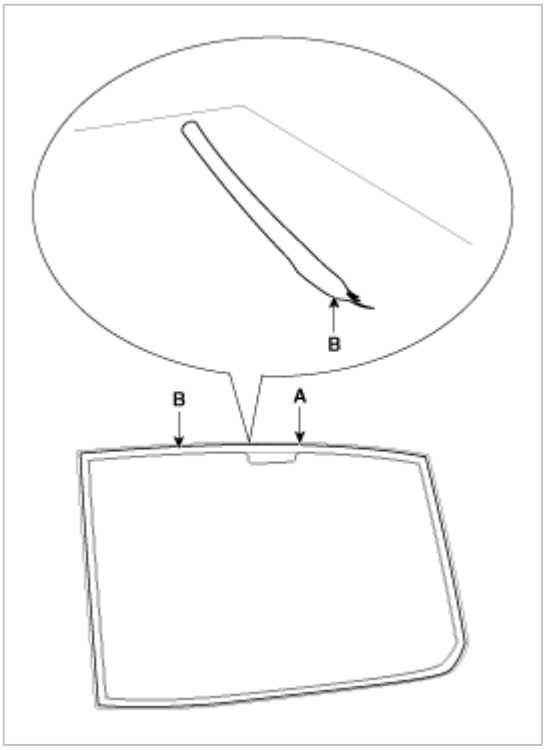
4. Apply a light coat of glass primer to the outside of the fasteners.

- Never touch the primed surface with your hand. If you do, the adhesive may not bond to the glass properly, causing a leak after the tailgate glass is installed.

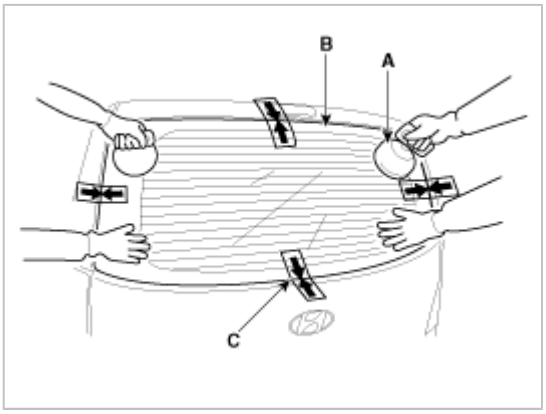
- Do not apply body primer to the glass.
- Keep water, dust, and abrasive materials away from the primer.



5. Pack adhesive into the cartridge without air pockets to ensure continuous delivery. Put the cartridge in a caulking gun, and run a bead of adhesive (B) around the edge of the tailgate glass (A). Apply the adhesive within 30 minutes after applying the glass primer.



6. Use suction cups (A) to hold the tailgate glass (B) over the opening, align it with the alignment marks (C) made in step 3, and set it down on the adhesive. Lightly push on the tailgate glass until its edges are fully seated on the adhesive all the way around. Do not open or close the doors until the adhesive is dry.



7. Let the adhesive dry for at least 3-4 hour, then spray water over the glass and check for leaks.

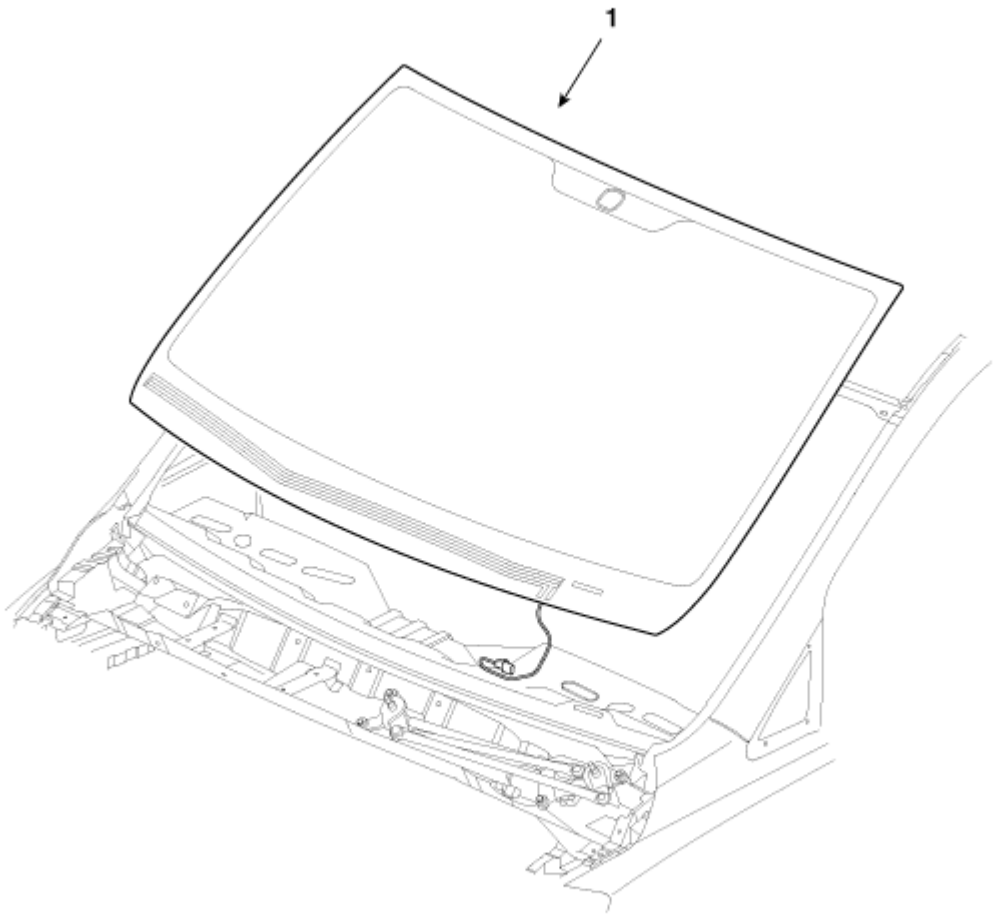
- Do not spray to adhesive area directly. Spray water over the glass and then spill water around the glass.

8. Make leaking areas, and let the glass dry, then seal with adhesive.

- Let the vehicle stand for at least four hours after glass installation. If the vehicle has to be used within the first eight, it must be driven slowly.
  Keep the glass dry for the first hour after installation.
- Please caution to driver not to drive vehicle along an uneven dirt load or violently

9. Reinstall all remaining removed parts.
   A. Tailgate upper trim (Refer to Exterior - "Tailgate")
   B. Tailgate side trim (Refer to Exterior - "Tailgate")
   C. Tailgate trim (Refer to Exterior - "Tailgate")
   D. Rear wiper arm
      (Refer to BE group - "Rear Wiper/washer")
   E. Tailgate glass heater connector
      (Refer to BE group - "Rear Window Defogger")
   F. Rear spoiler
      (Refer to Exterior - "Body Side Molding")

Components



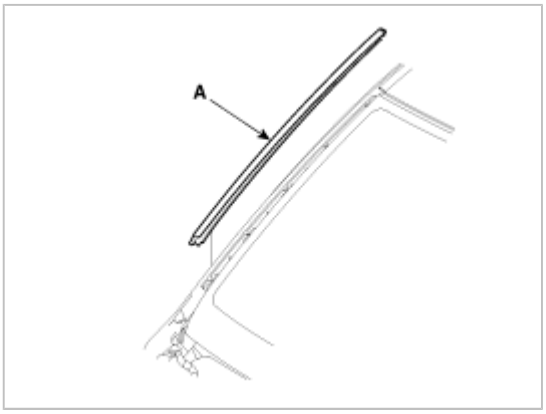
1. Windshield glass

Replacement

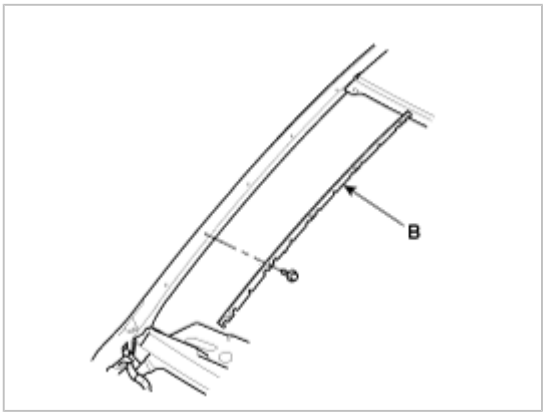
Removal

- Put on gloves to protect your hands.
- Use seat covers to avoid damaging any surfaces.

1. Remove the following items.
   A. Front pillar trim, both sides.
   B. Windshield wiper arms and cowl cover
   (Refer to page BE-"Windshield wiper").
2. Remove the windshield glass side molding (A).

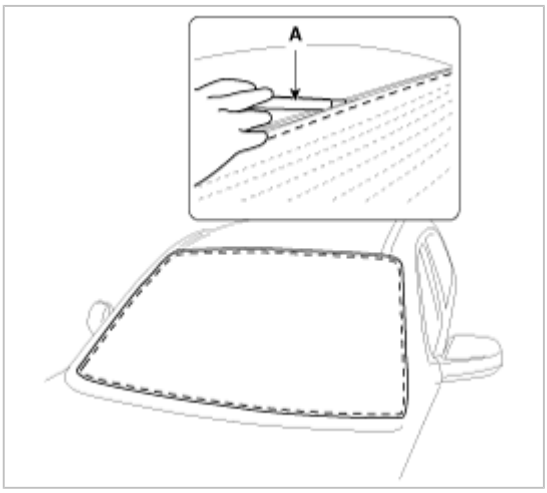


3. Remove the side molding bracket (B).



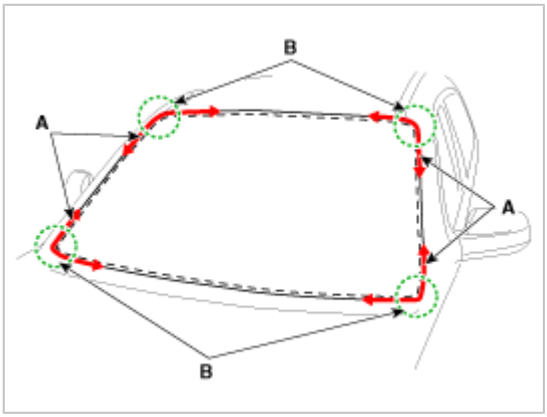
4. Using a screwdriver or remover, remove the windshield glass side molding (A).

- Please use a cutter with a blade length between 8-12 inches.

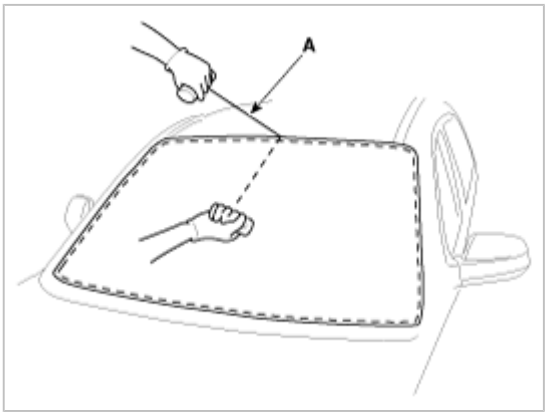


5. Cut off the sealant on the edge (B) while pulling the piano wire (A) left and right.

- Put on gloves to protect your hands.
- Heat may occur when working on the wires. Be careful not to burn your hands.
- Be careful not to disconnect the piano wire.

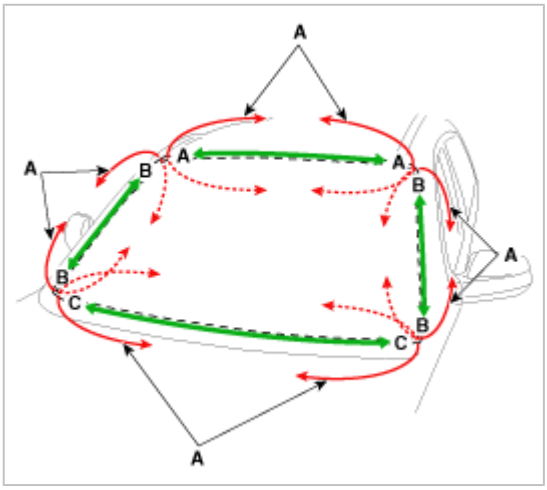


6. If a piano wire is visible inside the chassis, pull the piano wire (A) line inside.

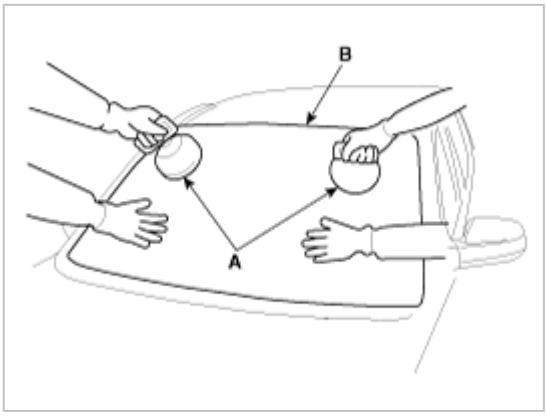


7. Cut off the sealant on (A-A), (B-B), (C-C), while pulling a piano wire (A) left and right.

- Put on gloves to protect your hands.
- Heat may occur when working on the wires. Be careful not to burn your hands.
- Be careful not to disconnect the piano wire.

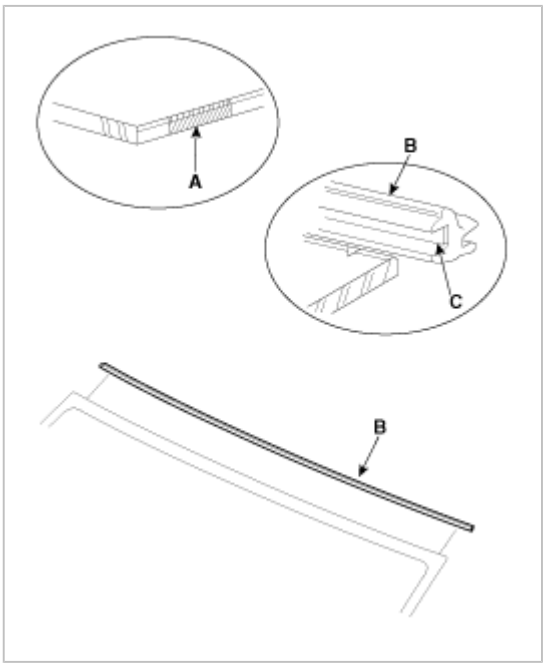


8. Remove the windshield glass (B) carefully using the glass holder (A).

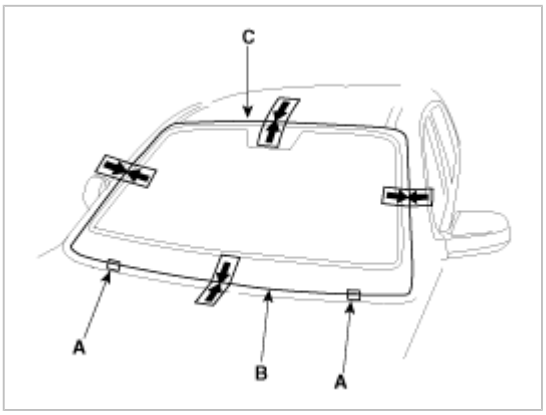


Installtion

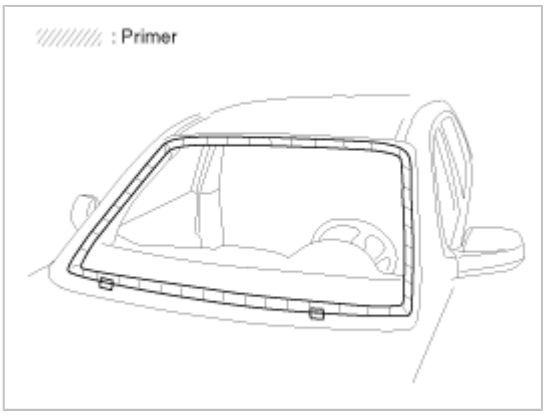
1. With a knife, scrape the old adhesive smooth to a thickness of about 2mm (0.08 in.) on the bonding surface around the entire windshield opening flange:
   A. Do not scrape down to the painted surface of the body; damaged paint will interfere with proper bonding.
   B. Remove the rubber dam and fastereners from the body.
   C. Mask off surrounding surfaces before painting
2. Clean the bonding surface with a sponge dampened in alcohol. After cleaning, keep oil, grease and water from getting on the clean surface.
3. Install the windshield (A) upper molding (B) and fasteners (C). Do not allow any gaps.



4. Install the spacer (A) install the windshield glass (B) temporarily with marking sure to position them on the center, and then place the alignment mark (C).
5. Remove the windshield.

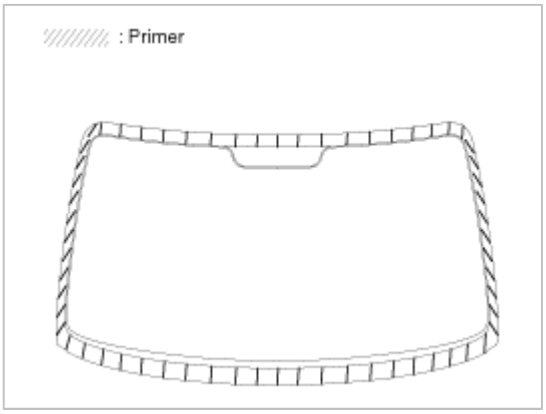


6. With a sponge, apply a light coat of body primer to the original adhesive remaining around the windshield opening flange. Let the body primer dry for at least 10 minutes.
   A. Do not apply glass primer to the body, and be careful not to mix up glass and body primer sponges.
   B. Never touch the primed surfaces with your hands.
   C. Mask off the dashboard before painting the flange.

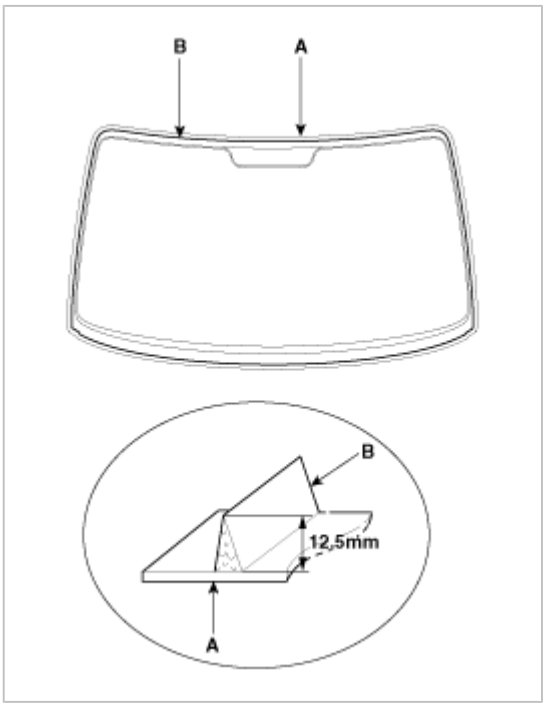


7. Apply a light coat of glass primer to the outside of the fasteners.

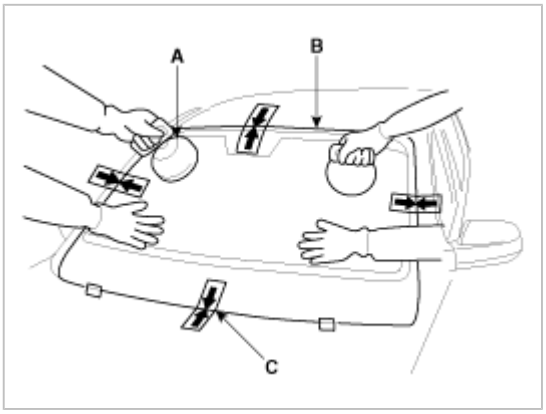
- Never touch the primed surface with your hand.
  If you do, the adhesive may not bond to the glass properly, causing a leak after the windshield glass is installed.
- Do not apply body primer to the glass.
- Keep water, dust, and abrasive materials away from the primer.



8. Pack adhesive into the cartridge without air pockets to ensure continuous delivery. Put the cartridge in a caulking gun, and run a bead of adhesive (A) around the edge of the windshield (B) between the fastener and molding as shown.
   Apply the adhesive within 30 minutes after applying the glass primer.
   Make a slightly thicker bead at each corner.



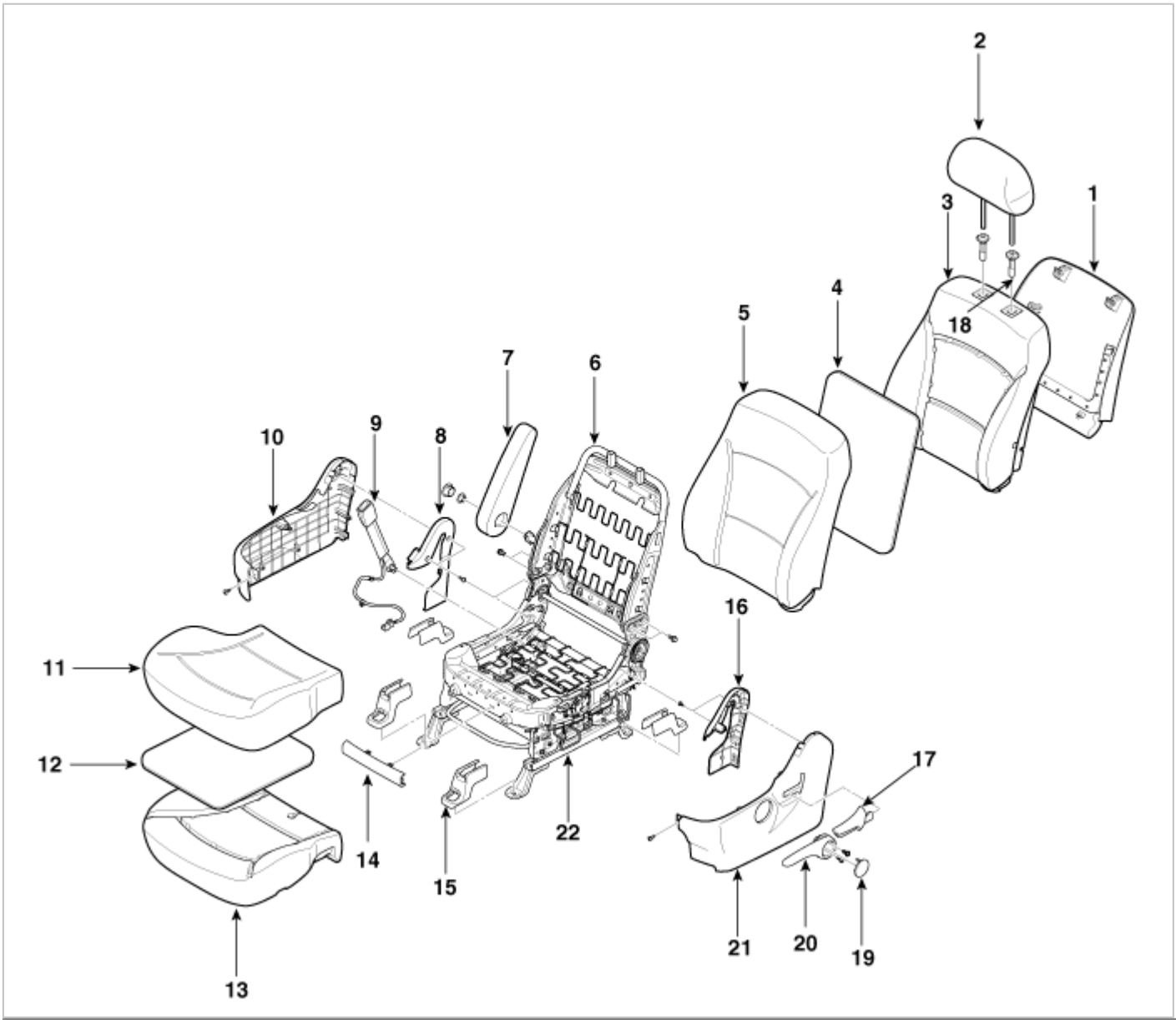
9. Use suction cups (A) to hold the windshield over the opening, align it with the alignment marks (B) made in step 15, and set it down on the adhesive. Lightly push on the windshield until its edges are fully seated on the adhesive all the way around. Do not open or close the doors until the adhesive is dry.



10. Scrape or wipe the excess adhesive off with a putty knife or towel. To remove adhesive from a painted surface or the windshield, wipe with a soft shop towel dampened with alcohol.
11. Let the adhesive dry for at least one hour, then spray water over the windshield and check for leaks. Make leaking areas, and let the windshield dry, then seal with sealant:
    A. Let the vehicle stand for at least four hours after windshield installation. If the vehicle has to be used within the first four, it must be driven slowly.
    B. Keep the windshield dry for the first hour after installation.
12. Reinstall all remaining removed parts. Install the rearview mirror after the adhesive has dried thoroughly. Advise the customer not to do the following things for two the three days:
    A. Slam the door with all the windows rolled up.
    B. Twist the body excessively (such as when going in and out of driveways at an angle or driving over

rough, uneven roads)

Components



1. Seat track cover	7. Armrest	13. Seat cushion pad	19. Jump knob cap
2. Headrest	8. Recliner inner cover	14. Front cover	20. Jump knob
3. Seat back pad	9. Seat buckle	15. Seat mounting cover	21. Recliner cover
4. Seat back heater	10. Side cover	16. Recliner inner cover	22. Seat cushion frame
5. Seat back cover	11. Seat cushion ocver	17. Recliner knob	
6. Seat back frame	12. Seat cushion heater	18. Headrest guide	

Replacement

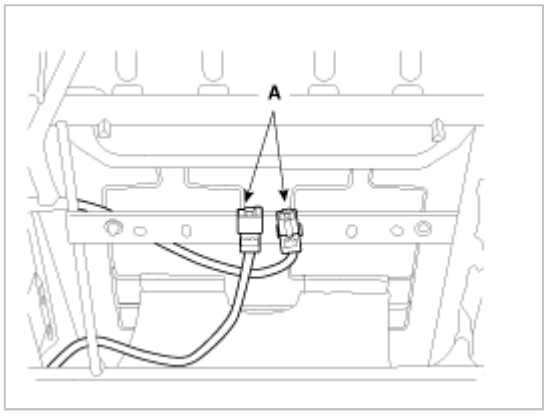
Seat Assembly Replacement

1. Remove the seat assembly mounting cover.
2. After loosening the seat assembly mounting bolts and nuts, remove the seat assembly (A).

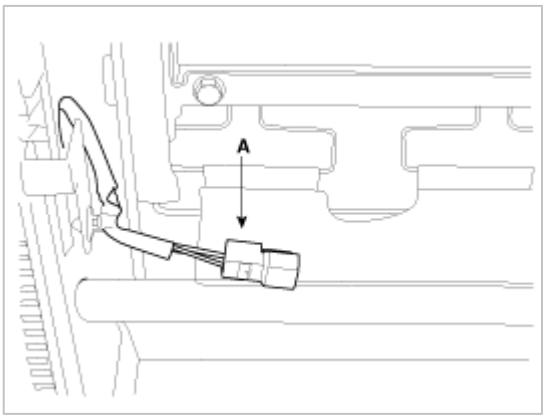
Tightening torque : 34.3~53.9 N.m (3.5~5.5 kgf.m, 25.3~39.8 lb-ft)

3. Disconnect the connectors (A), and remove the seat assembly.

DRIVER`S



PASSENGER`S



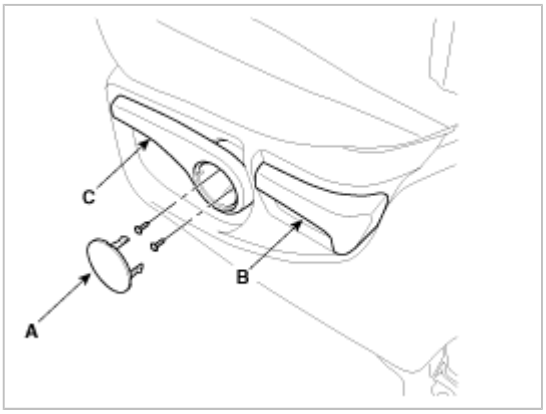
4. Installation is the reverse of removal.

SEAT MOUNTING BOLT INSTALLATION PROCE-DURE (manual seat only)

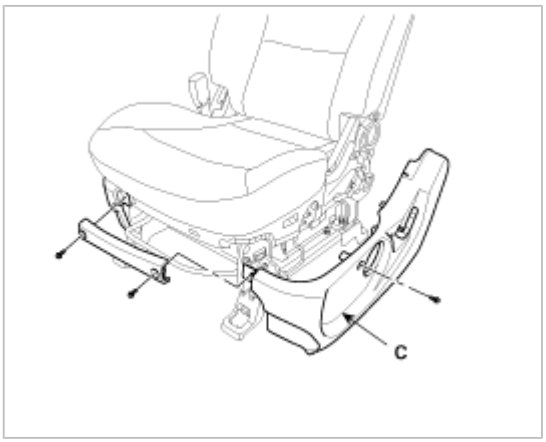
- Set the into the most rearward position.Check then each slide is locked, and then tighten the front mounting bolt temporarily.
- Set the seat into most forward position.Check that each slide is locked, and then tighten the rear mounting bolt completely.
- Set the seat into the most rearward position.
  Check the front mounting bolt completely.
- Check that the seat operates to and fro smoothy and the locking portion locks properly.

Recliner Cover Replacement

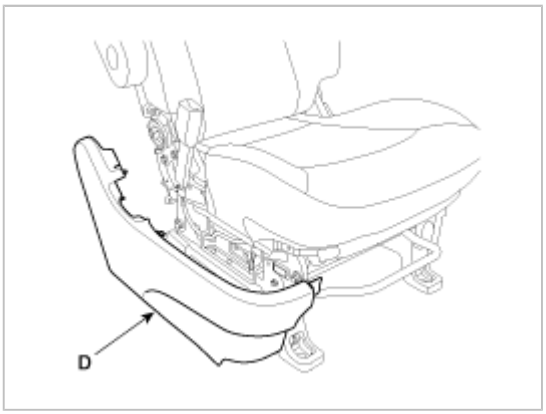
1. Remove the cover (A).
2. After loosening the recliner mounting screw, then remove the recliner lever (B) and height lever (C).



3. After loosening the mounting screws, then remove the recliner cover (C).



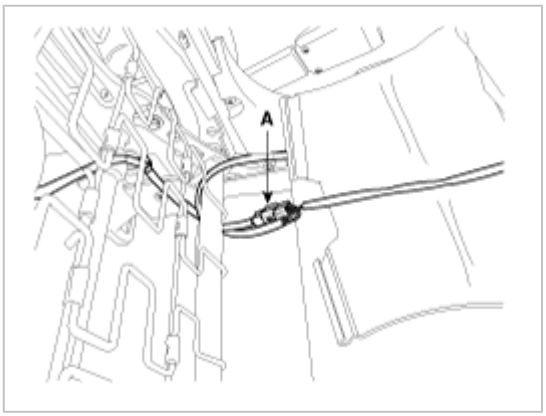
4. Gently detach the hook, remove the recliner cover (D).



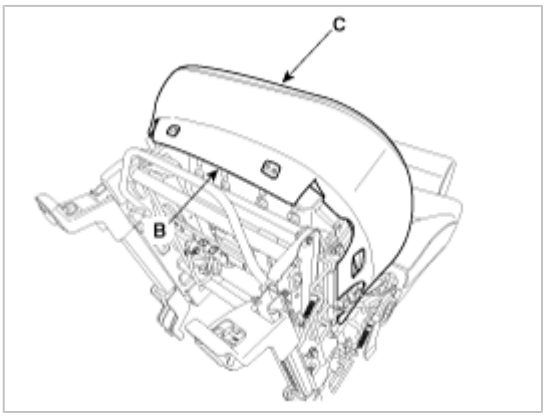
5. Installation is the reverse of removal.

Seat Cushion Cover Replacement

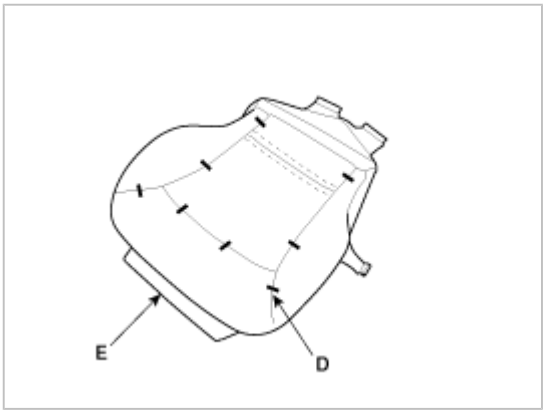
1. Remove front seat assembly .
2. Remove the recliner cover .
3. Disconnect the connector (A).



4. After disconnect the protector (B), then remove the seat cushion (C).



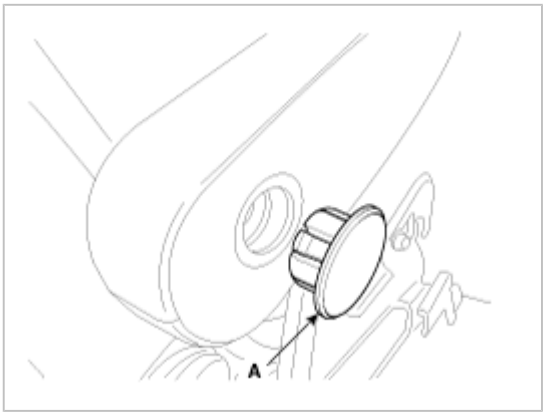
5. After removing the hogring clip (D) on the front of seat cushion and remove the seat cushion cover (E).



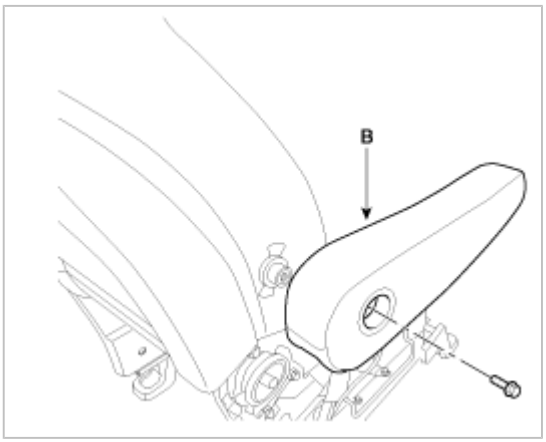
6. Installation is the reverse of removal.

Seat Back Cover Replacement

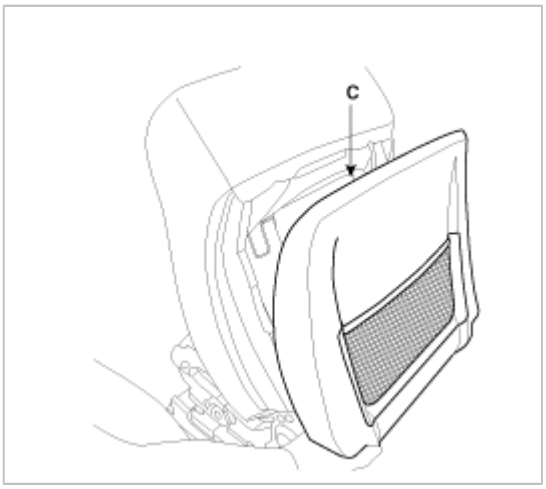
1. Remove front seat assembly.
2. Remove the headrest.
3. Remove the mounting cover (A).



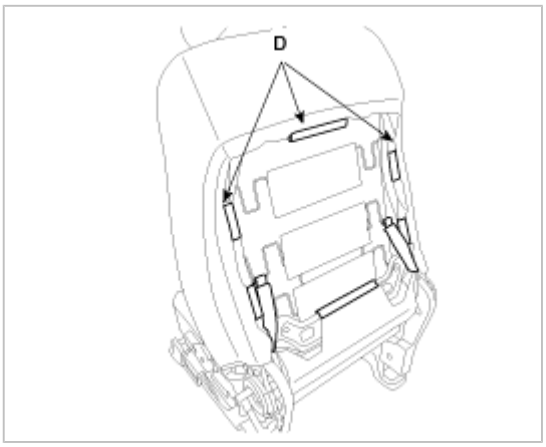
4. Remove the armrest (B).



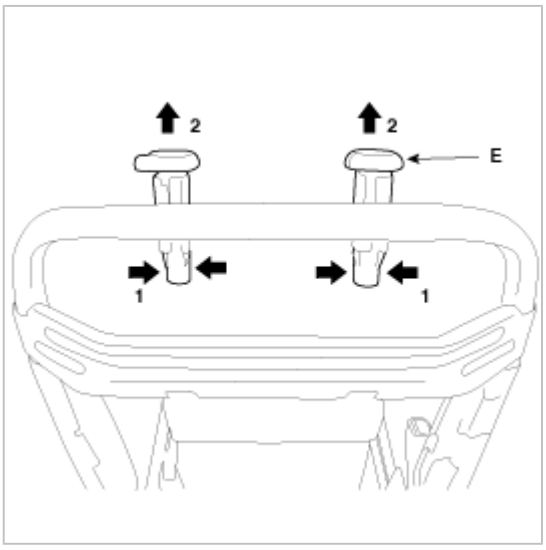
5. Remove the seat back panel (C).



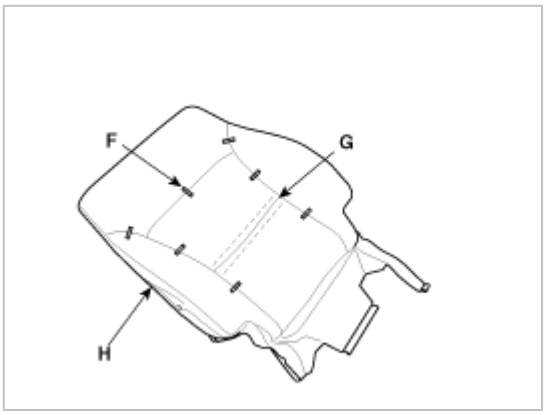
6. Disconnect the protector (D) from the back frame.



7. Pull out the headrest guides (E) while pinching the end of the guides, and remove them.



8. After removing the tape (G) and the horging clip (F) on the front of seat back remove the seat back cover (H).

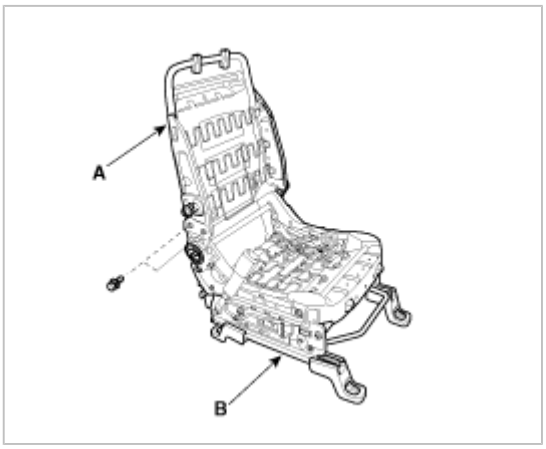


9. Installation is the reverse of removal.

Seat Frame Replacement

1. Remove the following items.
   A. Recliner cover
   B. Seat back panel
   C. Headrest guide
   D. Seat back cover
2. After loosening the mounting bolts, then disconnect the seat back frame (A) and seat cushion frame (B).

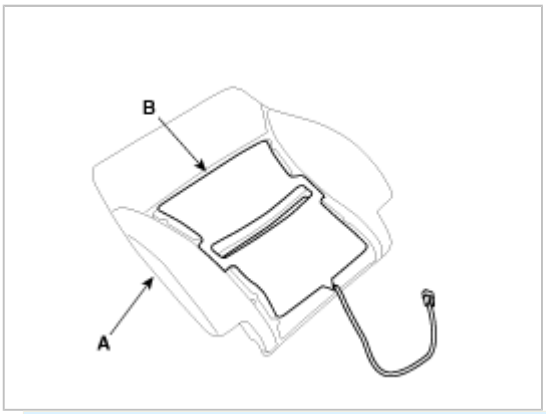
- Remove the side air bag for replacing side air bag installation seat.
- Be fore service, be fully aware of precautions and service procedure relevant to air bag (Refer to page RT-Airbag)



3. Installation is the reverse of removal.

Seat Cushion Heater Replacement

1. Remove the seat cushion cover.
2. Disconnect the heater (B) from the seat back sponge (A).



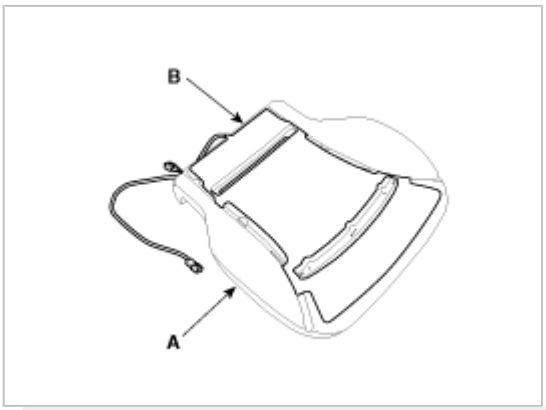
- Take care not to damage the slave sponge.

3. Install the seat back cover.
   A. Detach the paper from the back of the heater assembly.
   B. Attach the heater to the main part of the sponge.

- Be sure to match the heater with main appearance.

Seat Cushion Heater Replacement

1. Remove the seat back cover.
2. Disconnect the heater (B) from the seat back sponge (A).

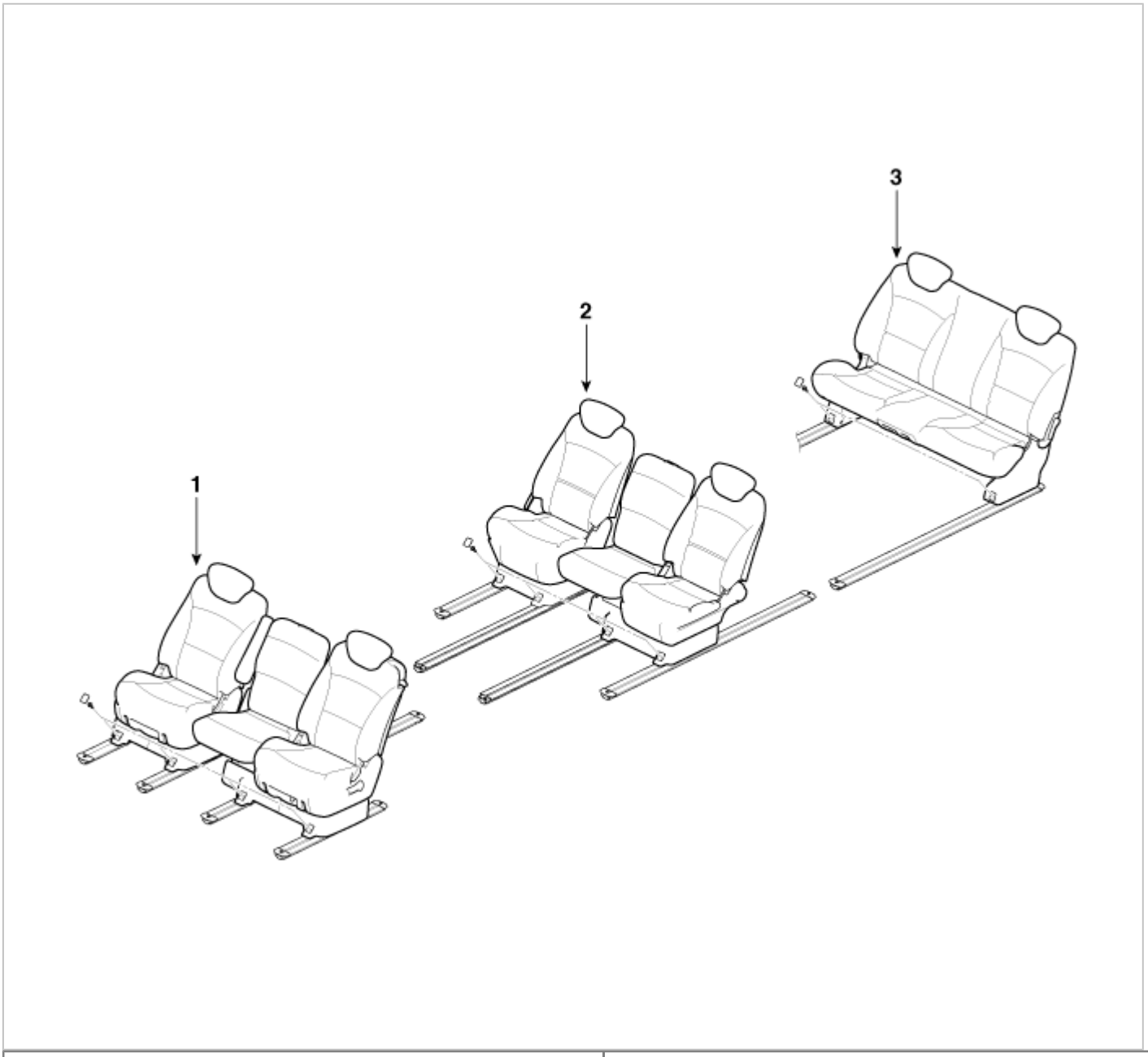


- Take care not to damage the slave sponge.

3. Install the seat back cover.
   A. Detach the paper from the back of the heater assembly.
   B. Attach the heater to the main part of the sponge.

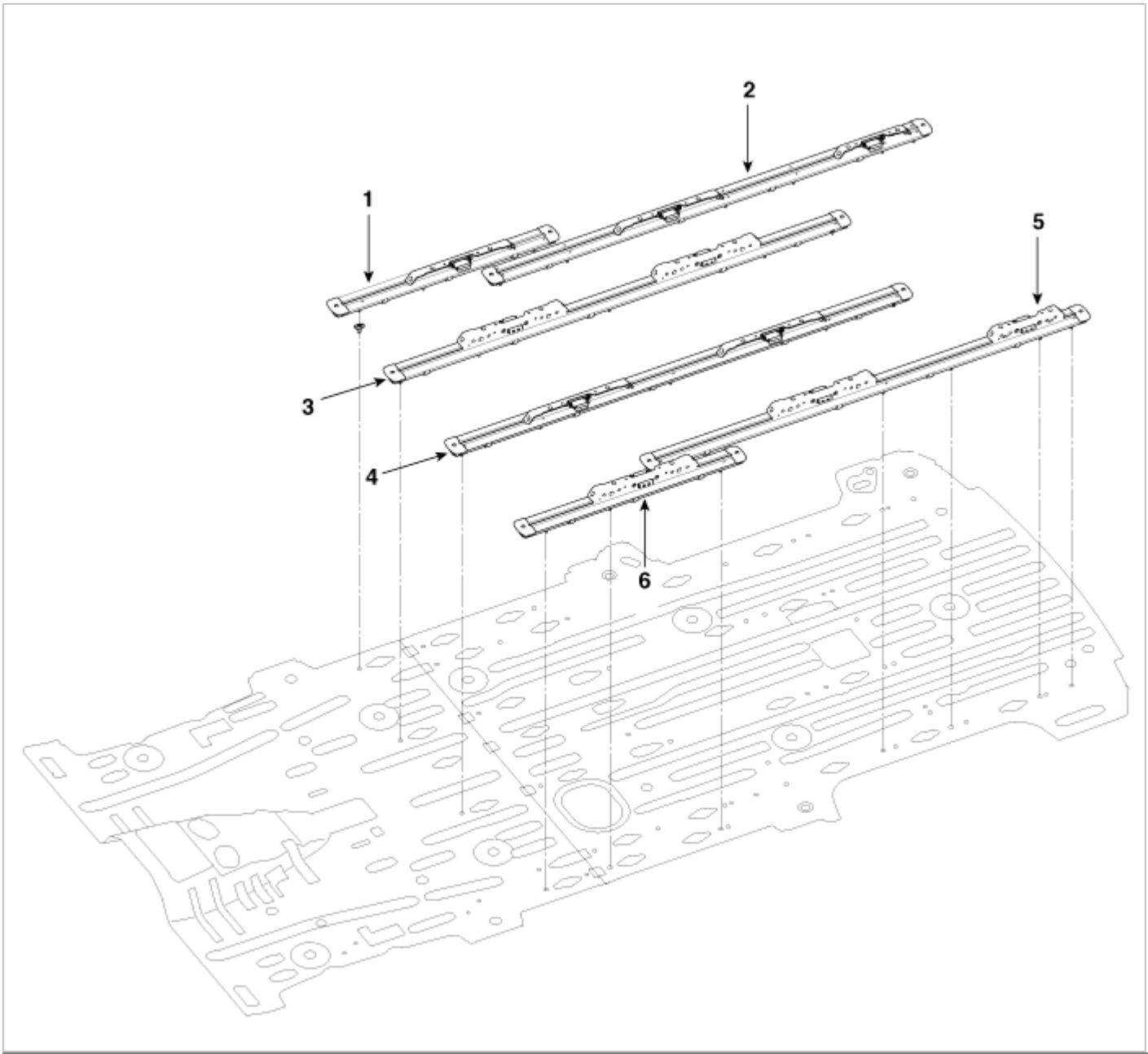
- Be sure to match the heater with main appearance.

Components



1. Second seat 2. Third seat	3. Fourth seat

Slide Rail Components



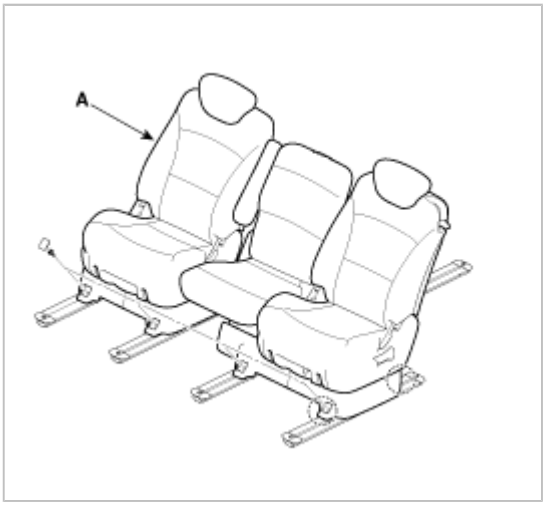
1. Rear slide 2. Rear slide	3. Rear slide 4. Rear slide	5. Rear slide 6. Rear slide

Replacement

Secondary Seat And Third Seat

Seat Assembly Replacement

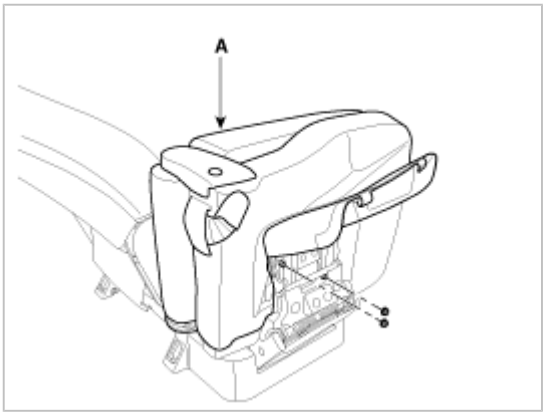
1. Loosen the mounting bolt, then remove the rear seat assembly (A).



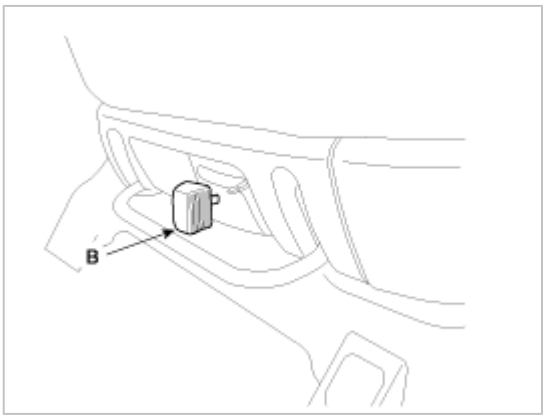
2. Installation is the reverse of removal.

Seat Cushion Cover Replacement

1. After loosening the mounting nuts, then remove the jump seat (A).

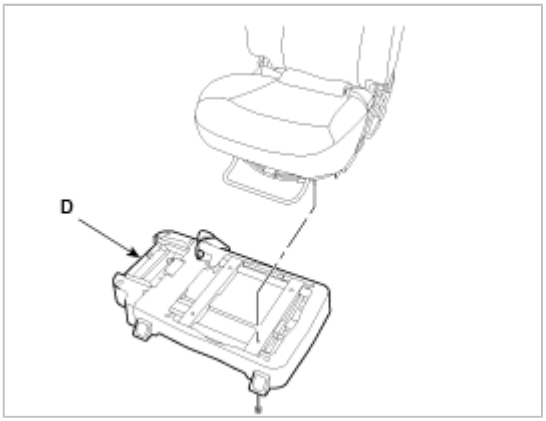


2. Remove the recliner lever (B).

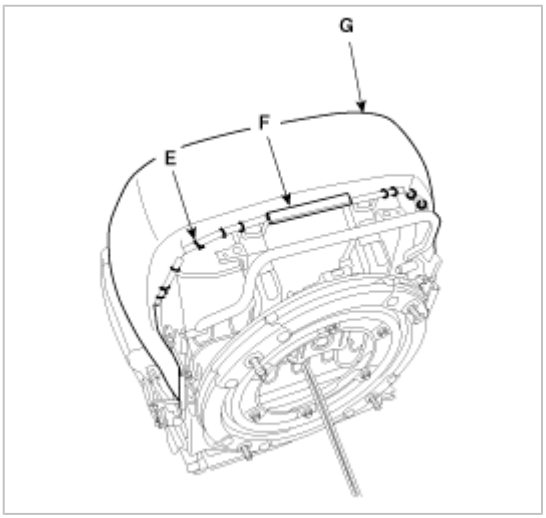


3. After loosening mounting screws, then remove the recliner cover (C).

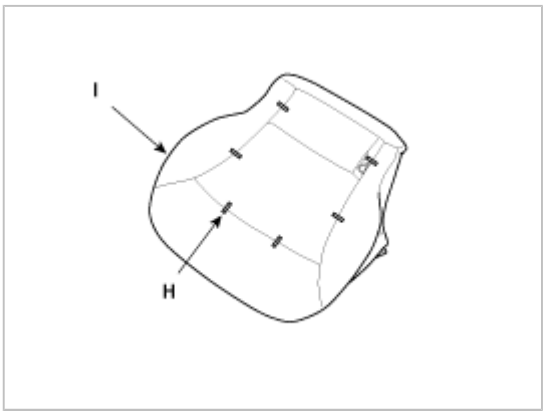
4. After loosening the mounting bolts, then remove the leg assembly (D).



5. Remove the horg ring clip (E).
6. Disconnect the scuff bend (F).
7. Remave the seat cushion (G)



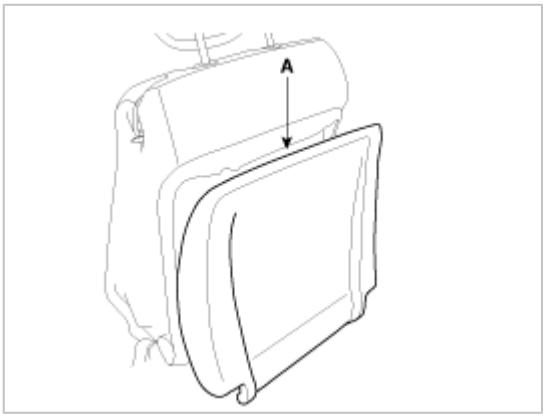
8. After removing the horg ring clip (H) on the front of seat cushion, remove the seat cushion cover (I).



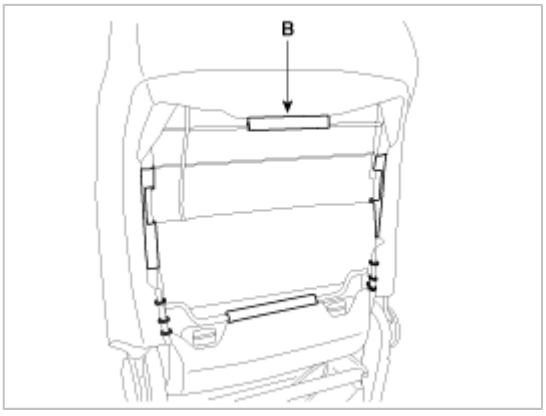
9. Installation is the reverse of removal.

Seat Back Cover Replacement

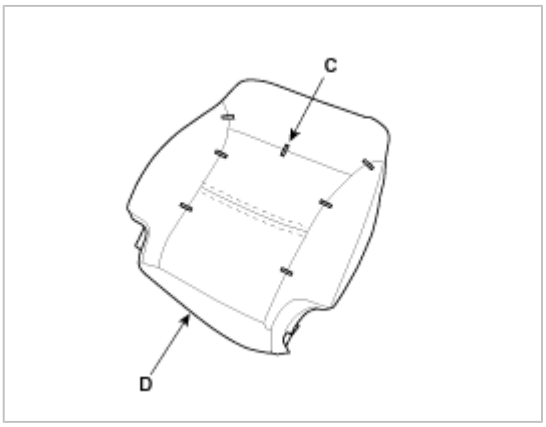
1. Remove the back panel (A).



2. Disconnect the protector (B).



3. Remove the headrest and headrest guide.
4. After removing the horg ring clip (C) on the front of seat back remove the seat back cover (D).

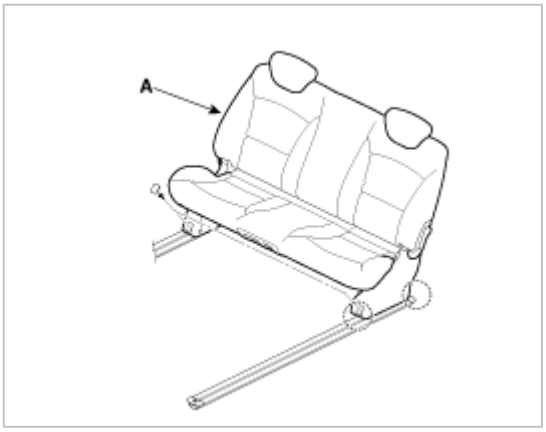


5. Installation is the reverse of removal.

Fourth Seat

Seat Assembly Replacement

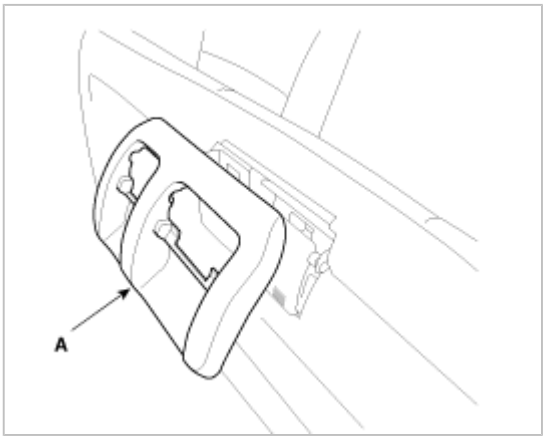
1. After loosening the mounting bolts, then remove the seat assembly (A).



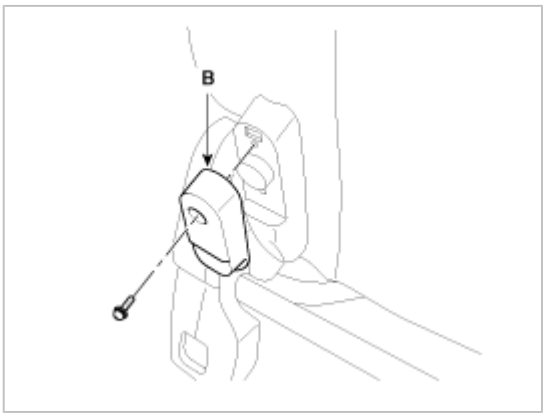
2. Installation is the reverse of removal.

Seat Chusion Cover Replacement

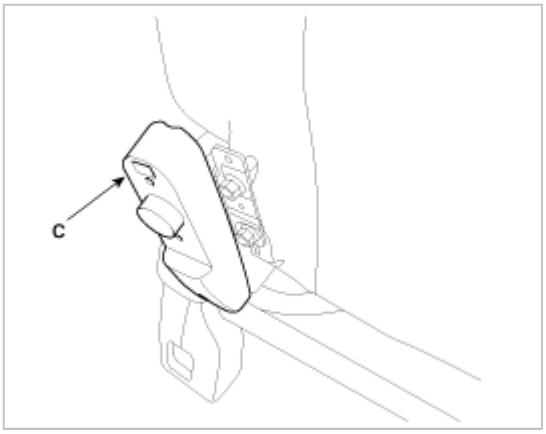
1. Remove the recliner cover (A).



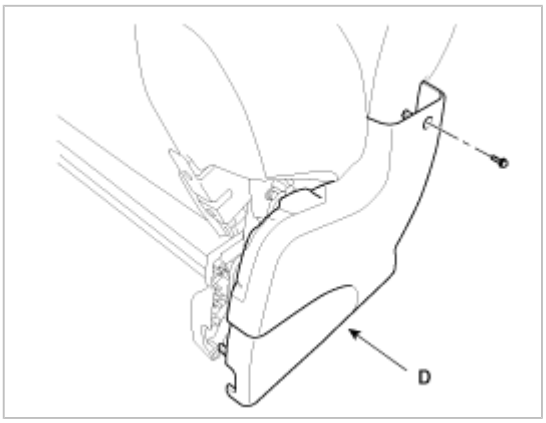
2. Remove the bumper (B).



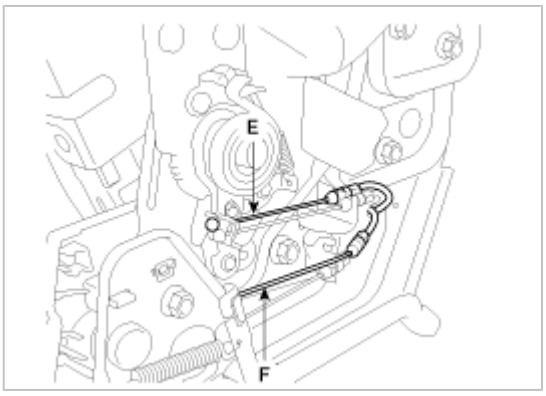
3. Remove the cover (C).



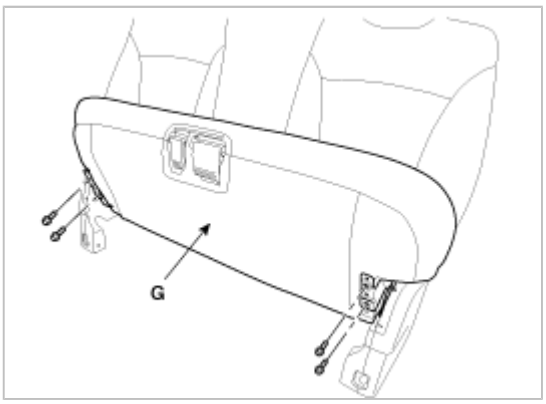
4. Remove the side cover (D).



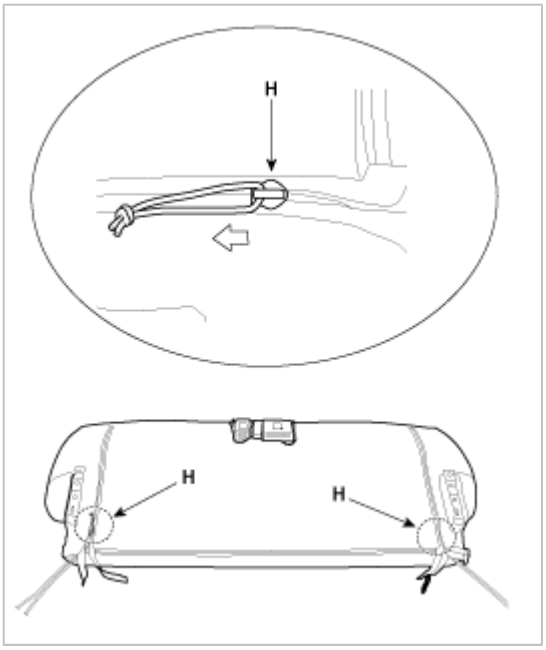
5. Disconnect the recliner cable (E)and (F).



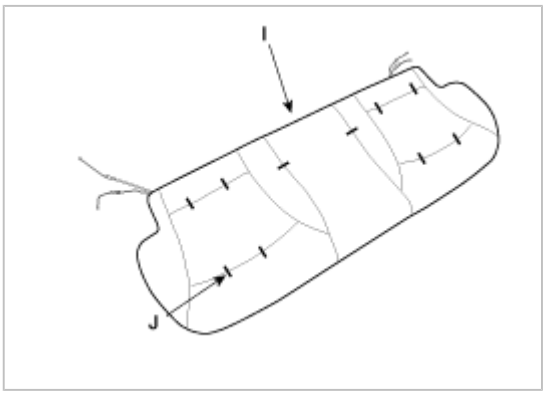
6. After loosening the mounting bolts, then remove the seat cushion (G).



7. Open the zipper (H).

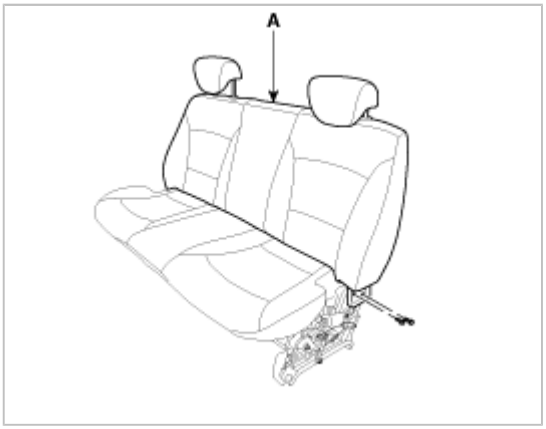


8. After removing the horg ring clip (J) on the front of seat back remove the sear back cover (I).

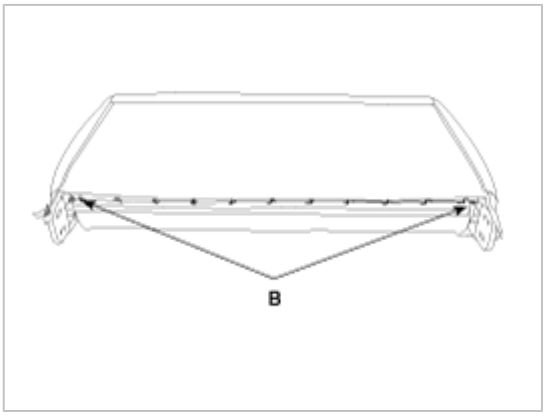


Seat Back Cover Replacement

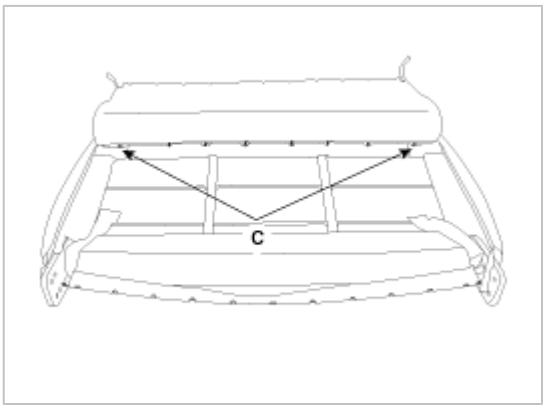
1. Remove the side cover.
2. After loosening the mounting bolts, then remove the seat cushion (A).



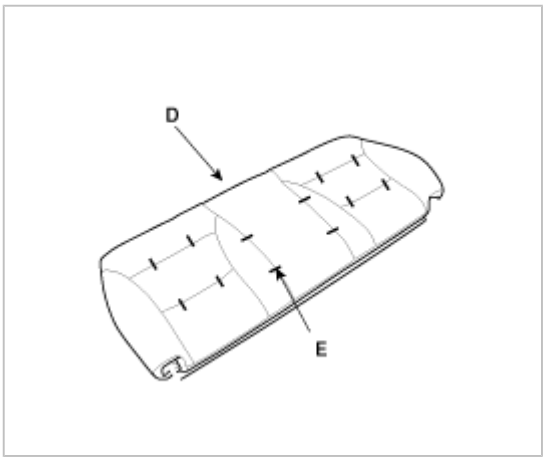
3. Remove the hogring clip (B).



4. Remove the hogring clip (C).



5. After removing the horging clips (E) on the front of seat back remove the seat back cover (D)



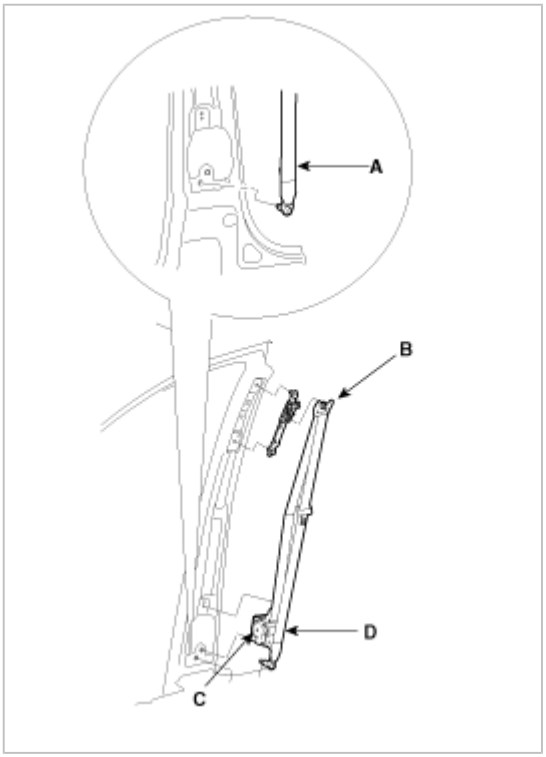
6. Installation is the reverse of removal.

Replacements

Front Seat Belt Replacement

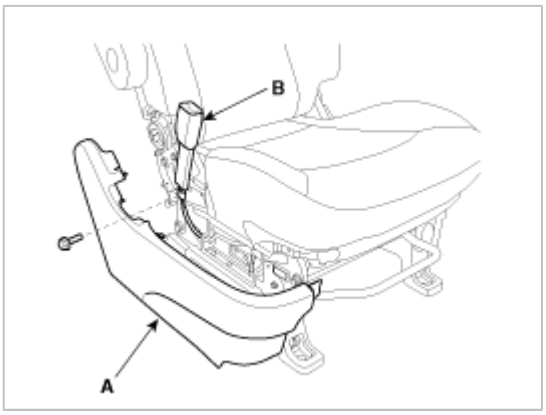
- When installing the belt, make sure not to damage the pretensioner.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the following items fist.
   A. Front seat assembly
   B. Door scuff trim
3. Loosen the lower anchor mounting bolt (A).
4. Remove the center pillar lower trim.
5. Remove the center pillar upper trim.
6. Remove the upper anchor (B)
7. After disconnecting the pretensioner connector lock pin, remove the SIS connector, Loosen the mounting bolt, then remove the pretensioner (C).



Front Seat Belt Buckle Replacement

1. Remove the following items first.
   A. Front seat assembly
2. Remove the recliner cover (A).
3. Remove the seat belt buckle (B).



4. Installation is the reverse of removal.

Hight Adjuster Replacement

1. Remove the following items first.
   A. Front seat assembly.
   B. Door scuff trim.
   C. Front seat belt.
   D. Center pillar trim.
2. After loosening the mounting bolt, then remove the height adjuster (A).

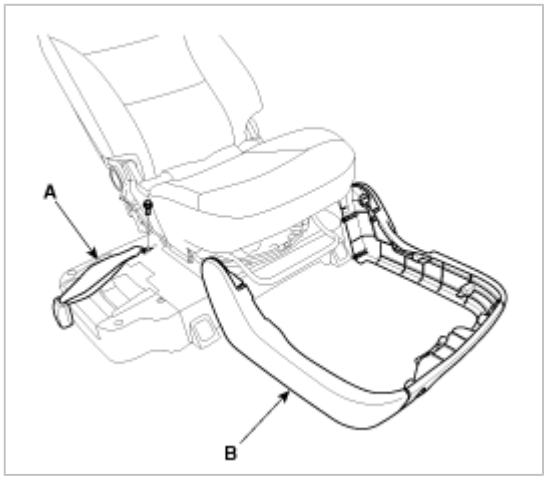
3. Installation is the reverse of removal.

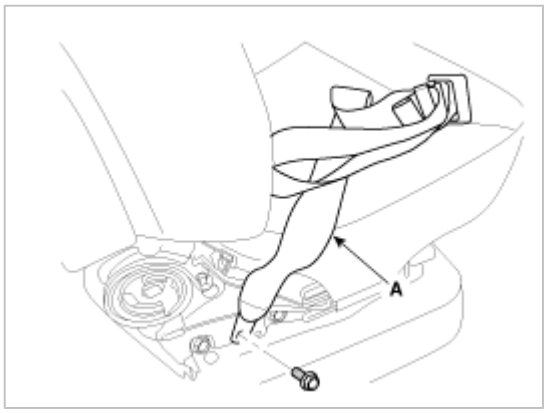
Replacements

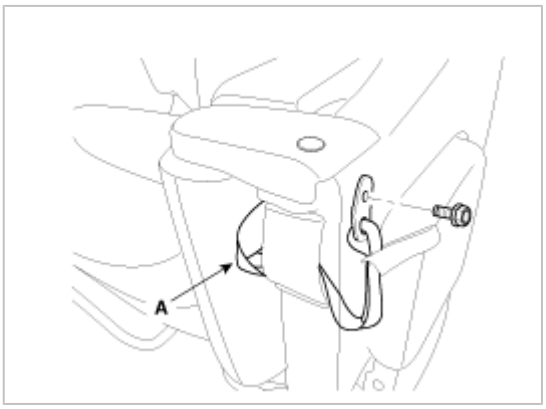
Secondary Seat Belt And Buckle Replacement

- When installing the belt, make sure not to damaged the pretensioner.

1. Remove the following items first.
   A. Rear seat assembly.
   B. Rear recliner cover.
2. Remove the recliner cover (B).
3. Remove the seat buckle (A).



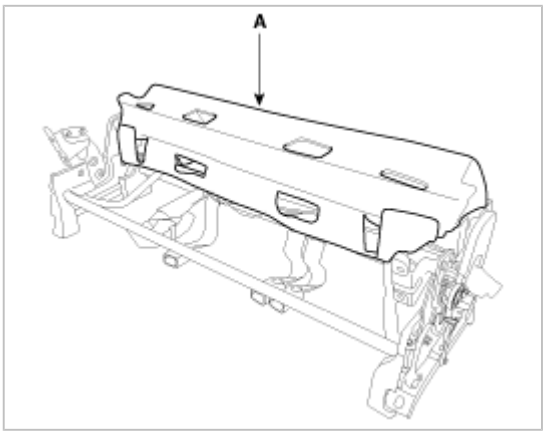




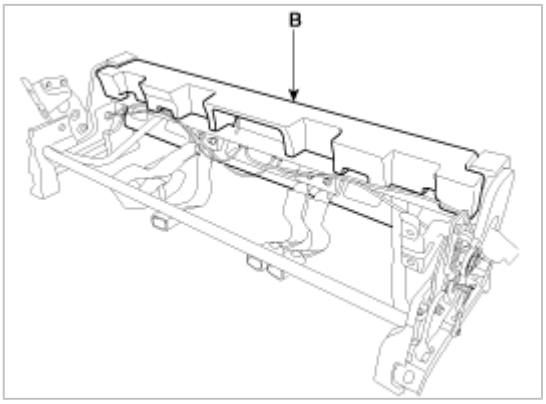
4. Installation is the reverse of removal.

Fourth Center Seat Belt Replacement

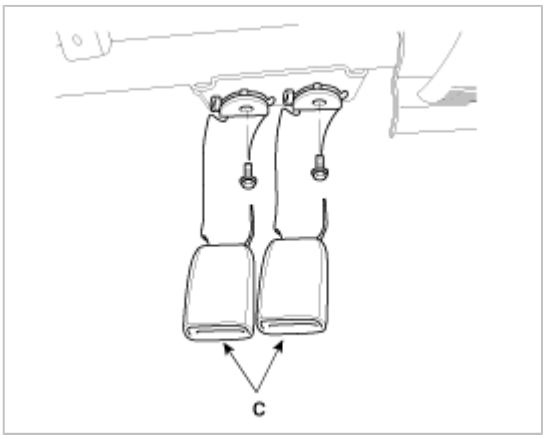
1. Remove the seat assembly.
2. Remove the seat cushion assembly.
3. Remove the seat back assembly.
4. Remove the cover (A).

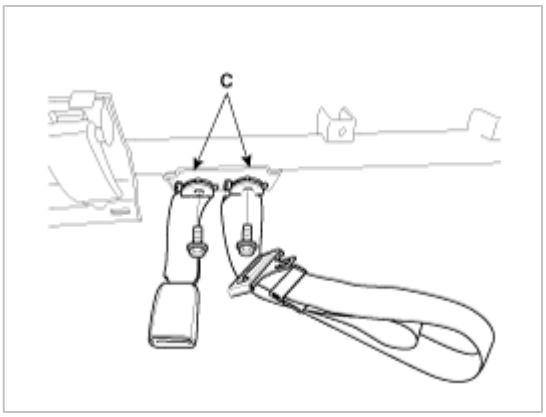


5. Remove the form (B).



6. After loosening the mounting bolts, then remove the seat belt (C).





7. Installation is the reverse of removal.

Airbag Disposal

Special Tool Required

Deployment tool 0957A-34100A

Before scrapping any airbags or side airbags (including those in a whole vehicle to be scrapped), the airbags or side airbags must be deployed. If the vehicle is still within the warranty period, before deploying the airbags or side airbags, the Technical Manager must give approval and/or special instruction. Only after the airbags or side airbags have been deployed (as the result of vehicle collision, for example), can they be scrapped.

If the airbags or side airbags appear intact (not deployed), treat them with extreme caution. Follow this procedure.

Deploying Airbags In The Vehicle

If an SRS equipped vehicle is to be entirely scrapped, its airbags or side airbags should be deployed while still in the vehicle. The airbags or side airbags should not be considered as salvageable parts and should never be installed in another vehicle.

1. Turn the ignition switch OFF, and disconnect the battery negative cable and wait at least three minutes.
2. Confirm that each airbag or side airbag is securely mounted.
3. Confirm that the special tool is functioning properly by following the check procedure.

Driver's Airbag :

(1) Remove the driver's airbag and install the SST (0957A-38500).
(2) Install the driver's airbag on the steering wheel.

Front Passenger's Airbag :

(1) Remove the glove box, then disconnect the 2P connector between the front passenger's airbag and SRS main harness.
(2) Install the SST (0957A-3F100).

Seat Belt Pretensioner :

(1) Disconnect the 2P connector from the seat belt pretensioner.
(2) Install the SST (0957A-38500).

4. Place the deployment tool at least thirty feet (10 meters) away from the airbag.
5. Connect a 12 volt battery to the tool.
6. Push the tool's deployment switch. The airbag should deploy (deployment is both highly audible and visible: a loud noise and rapid inflation of the bag, followed by slow deflection)
7. Dispose of the complete airbag. No part of it can be reused. Place it in a sturdy plastic bag and seal it securely.

Deploying The Airbag Out Of The Vehicle

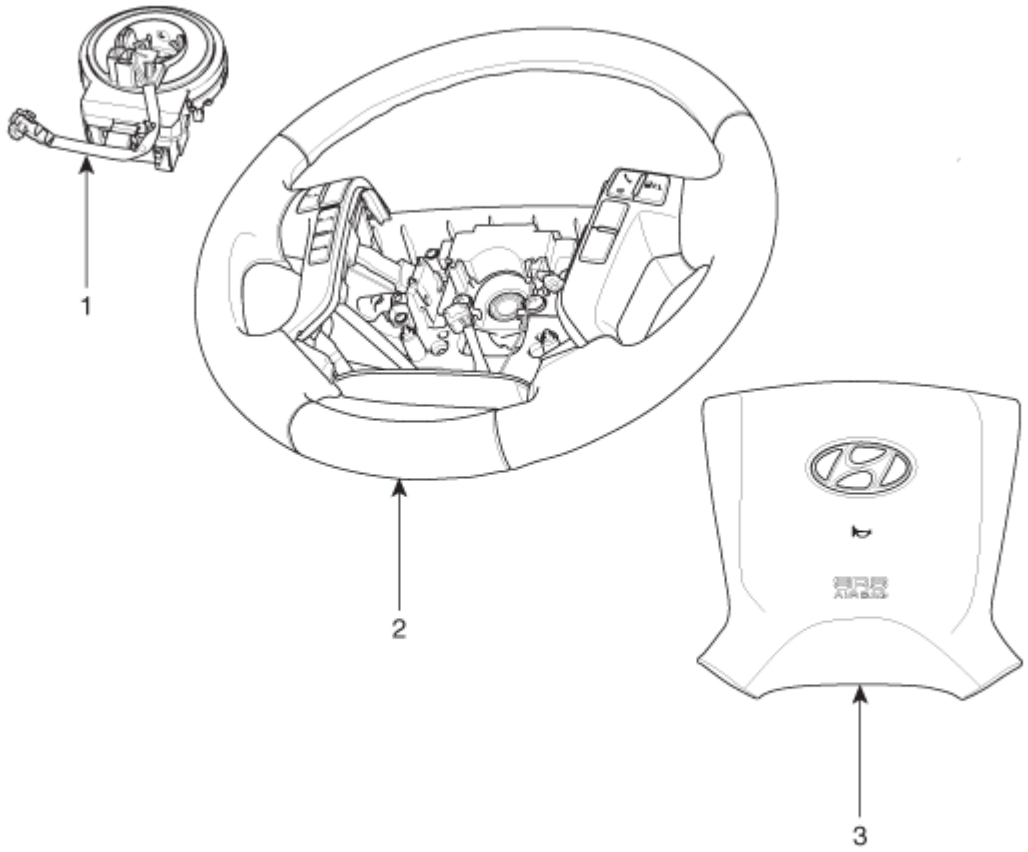
If an intact airbag has been removed from a scrapped vehicle, or has been found defective or damage during transit, storage or service, it should be deployed as follows :

1. Confirm that the special tool is functioning properly by following the check procedure.
2. Position the airbag face up, outdoors on flat ground at least thirty feet (10meters) from any obstacles or people.

Disposal Of Damaged Airbag

1. If installed in a vehicle, follow the removal procedure of driver's airbag front passenger's and side airbag.
2. In all cases, make a short circuit by twisting together the two airbag inflator wires.
3. Package the airbag in exactly the same packing that the new replacement part come in.

Components



1. Clock Spring
2. Steering Wheel
3. Driver Airbag (DAB)

1. Clock Spring 2. Steering Wheel	3. Driver Airbag (DAB)

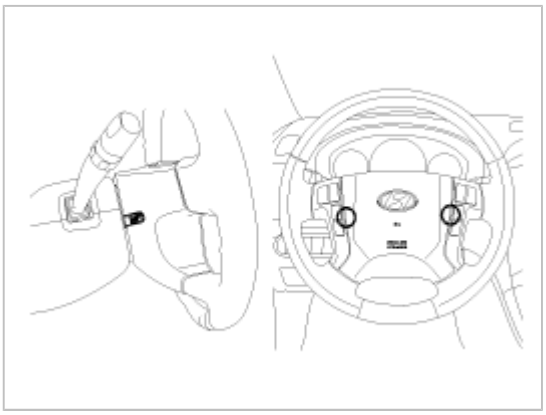
Description

Driver Airbag (DAB) is installed in steering wheel and electrically connected to SRSCM via clockspring. It protects the driver from danger by deploying a bag when frontal crash occurs. The SRSCM determines deployment of Driver Airbag (DAB).

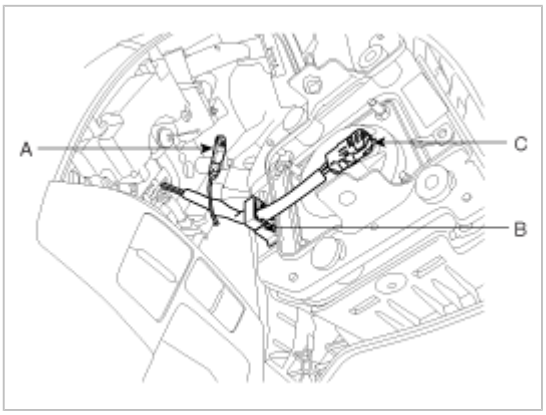
Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the airbag module mounting bolts (2EA).



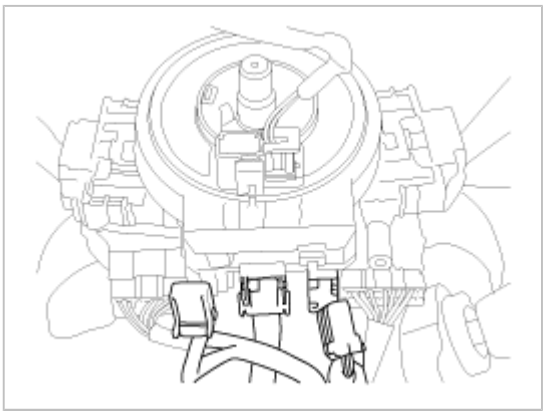
3. Disconnect the horn connector (A).



4. Seperate the airbag module from the steering wheel after disconnecting the connector (C) , with removing airbag module connector locking pin after removing the wiring fixing clip (B).

> The removed airbag module should be stored in a clean, dry place with the pad cover face up.

5. Remove the steering wheel and steering wheel column cover.
   (Refer to the Steering System group - "Steering Column and Shaft")
6. Disconnect the clock spring and horn connector, then remove the clock spring.



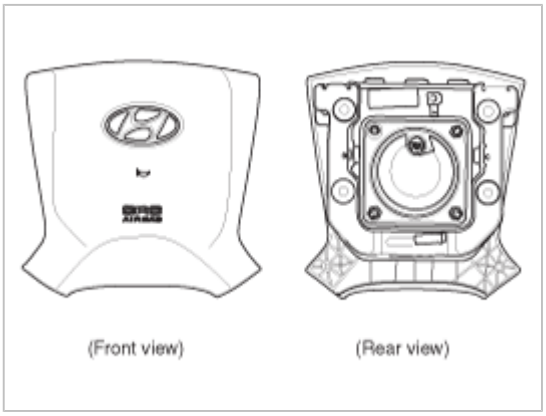
Inspection

Driver Airbag (DAB)

If any improper parts are found during the following inspection, replace the airbag module with a new one.

> Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

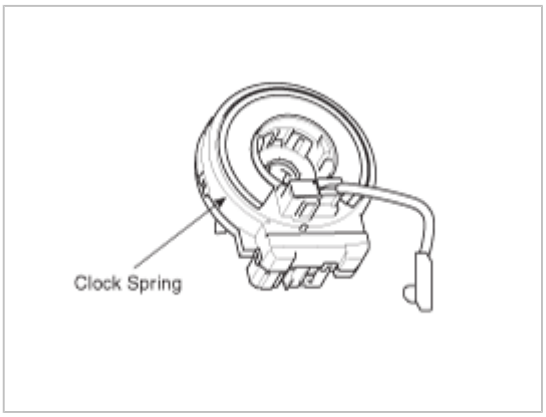
1. Check pad cover for dents, cracks or deformities.
2. Check the airbag module for denting, cracking or deformation.
3. Check hooks and connectors for damage, terminals for deformities, and harness for binds.
4. Check airbag inflator case for dents, cracks or deformities.



5. Install the airbag module to the steering wheel to check for fit or alignment with the wheel.

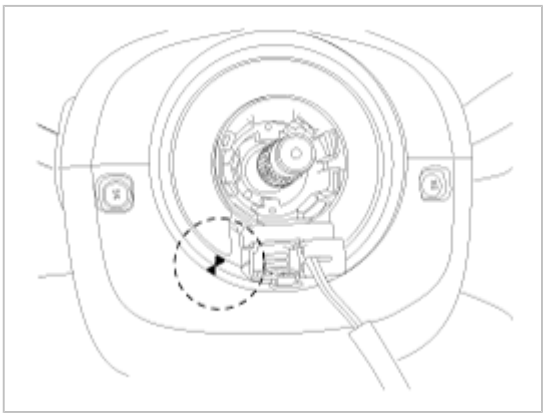
Clockspring

1. If, as a result of the following checks, even one abnormal point is discovered, replace the clock spring with a new one.
2. Check connectors and protective tube for damage, and terminals for deformities.



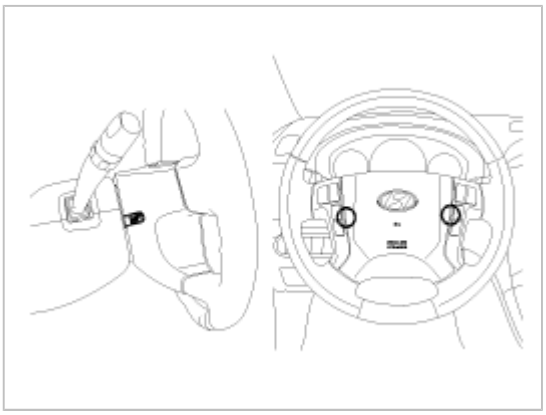
Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.
3. Connect the clock spring harness connector and horn harness connector to the clock spring.
4. Set the center position by getting marks between the clock spring and the cover into line. Make an array the mark (□□) by turnig the clock spring clockwise to the stop and then 2,4revolutions counterclockwise.



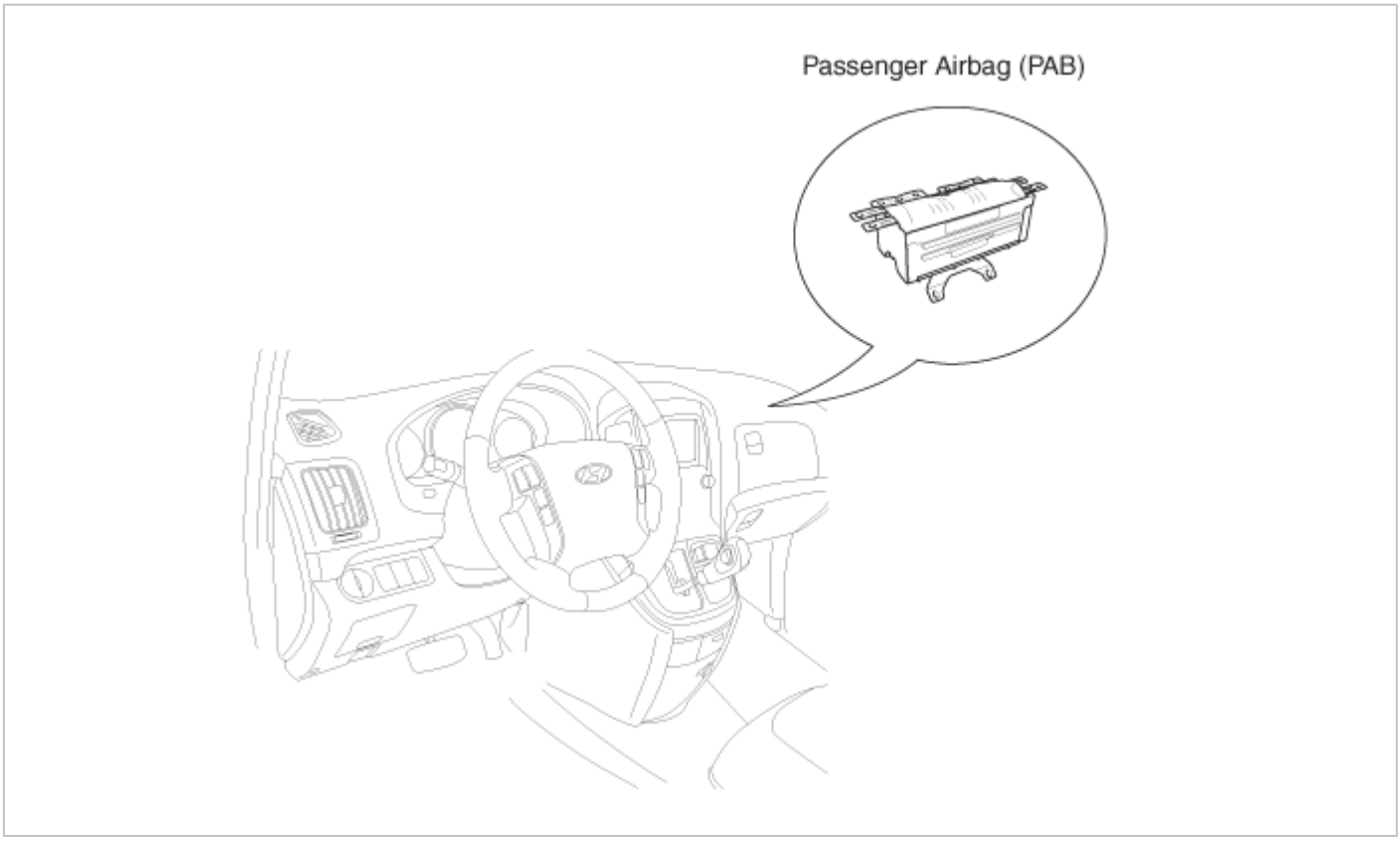
5. Install the steering wheel column cover and the steering wheel.
   (Refer to the Steering System group - "Steering Column and Shaft")
6. Connect the Driver Airbag (DAB) module connector and horn connector, then instal l the Driver Airbag (DAB) module on the steering wheel.
7. Secure the Driver Airbag (DAB) with the new mounting bolts.

Tightening torque (DAB Mounting Bolt)
: 7.9 ~ 10.8 N.m (0.8 ~ 1.1 kgf.m, 5.8 ~ 8.0 lb-ft)



8. Connect the battery negative cable.
9. After installing the airbag, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.
   B. Make sure horn button works.

Components



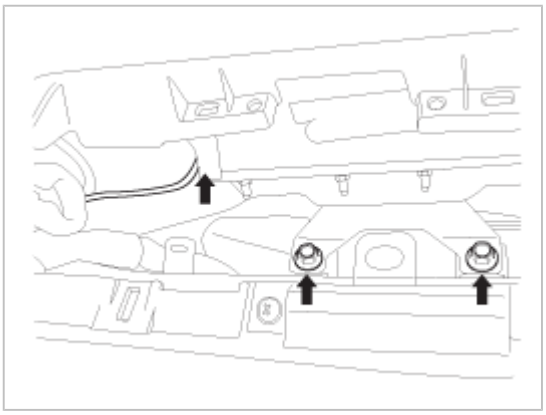
Description

The passenger Airbag (PAB) is installed inside the crash pad and protects the front passenger in the event of a frontal crash. The SRSCM determines if and when to deploy the PAB.

Never attempt to measure the circuit resistance of the airbag module (squib) even if you are using the specified tester. If the circuit resistance is measured with a tester, accidental airbag deployment will result in serious personal injury.

Removal

1. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
2. Remove the glove box upper tray.
   (Refer to the Body group - "Crash Pad")
3. Disconnect the PAB connector.

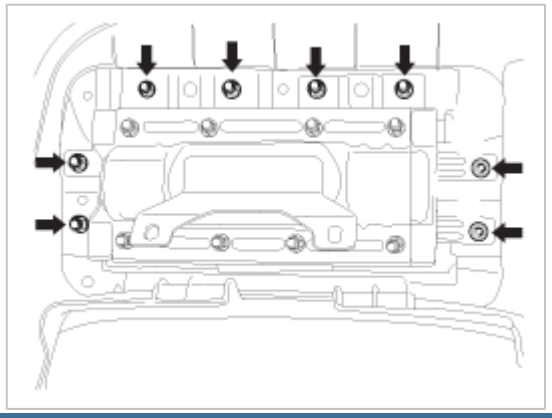


4. Remove the PAB mounting bolts (2EA).
5. Remove the crash pad.
   (Refer to the Body group - "Crash Pad")

> If the crash pad is damaged when the PAB is deployed, replace the damaged crash pad and PAB together.

6. Remove the heater duct from the crash pad.
7. Remove the mounting nuts (8EA) from the crash pad. Then remove the passenger airbag.

> The removed airbag module should be stored in a clean and dry place with the pad cover face up.



Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable from battery and wait for at least three minutes before beginning work.

3. Place a Passenger Airbag (PAB) on the crash pad and tighten the Passenger Airbag (PAB) mounting nuts.

   Tightening torque
   : 5.9 ~ 6.9 N.m (0.6 ~ 0.7 kgf.m, 4.3 ~ 5.0 lb-ft)

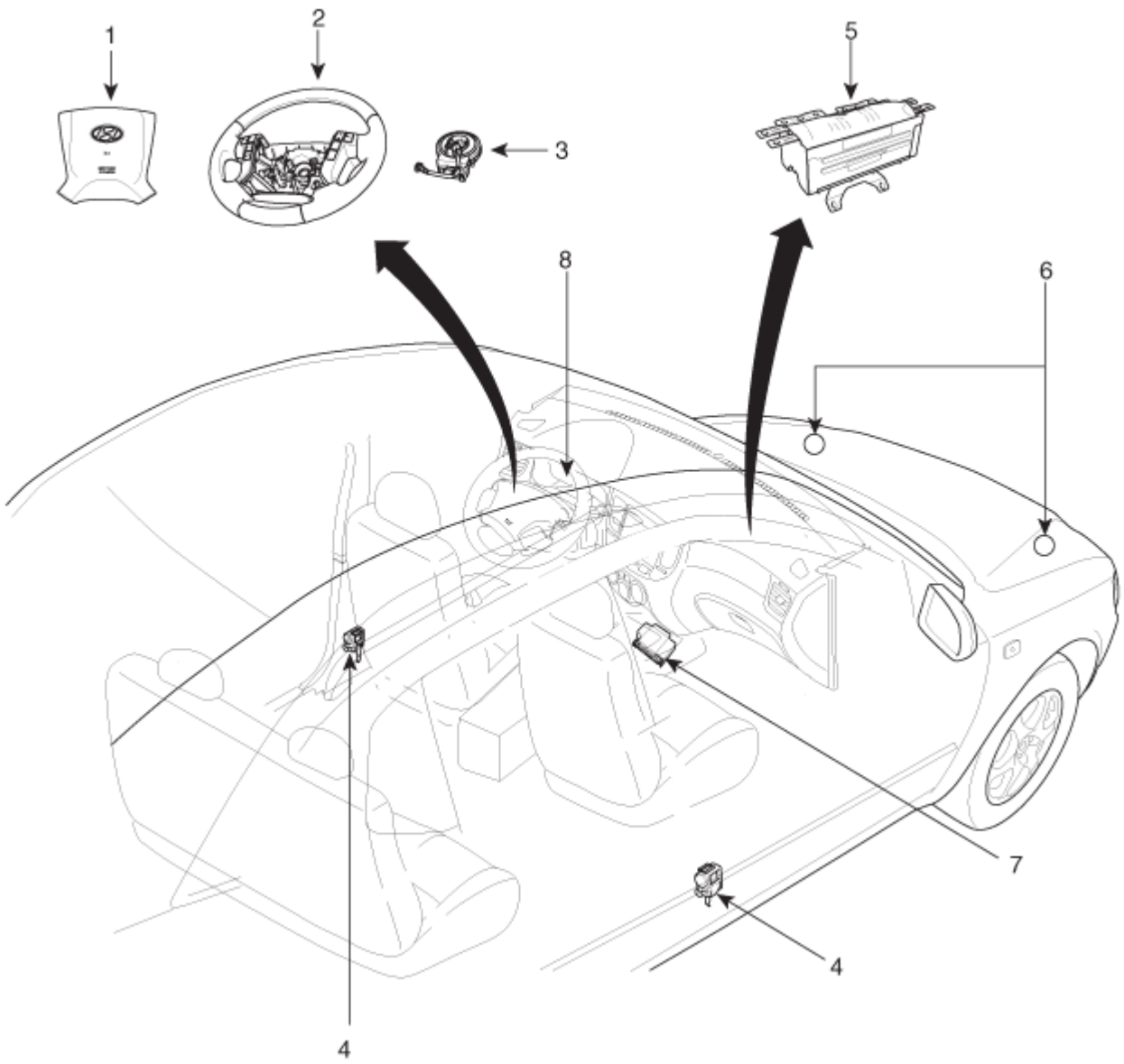
4. Install the heater duct to the crash pad.
5. Install the crash pad.
   (Refer to the Body group - "Crash Pad")
6. Tighten the PAB mounting bolt.

   Tightening torque
   : 7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

7. Connect the Passenger Airbag (PAB) harness connector to the SRS main harness connector.
8. Reinstall the glove box.
   (Refer to the Body group - "Crash Pad")
9. Reconnect the battery negative cable.
10. After installing the Passenger Airbag (PAB), confirm proper system operation:
    A. Turn the ignition switch ON ; the SRS indicator light should be turned on for about six seconds and then go off.

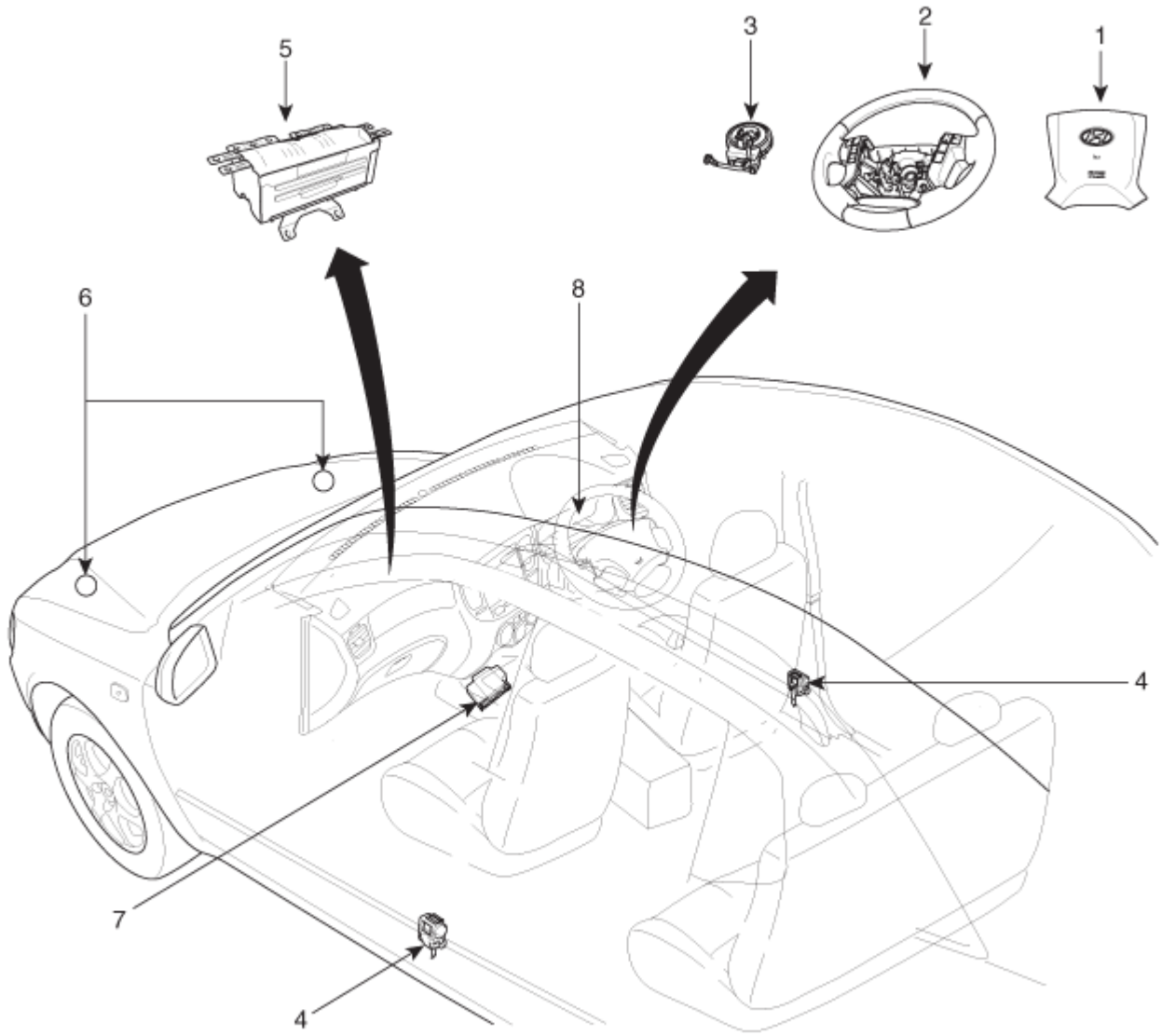
Components

[LHD]



1. Driver Airbag (DAB)	5. Passenger Airbag (PAB)
2. Steering Wheel	6. Front Impact Sensor (FIS)
3. Clock Spring	7. Supplemental Restraint System Control Module (SRSCM)
4. Seat Belt Pretensioner (BPT)	8. Airbag Warning Lamp

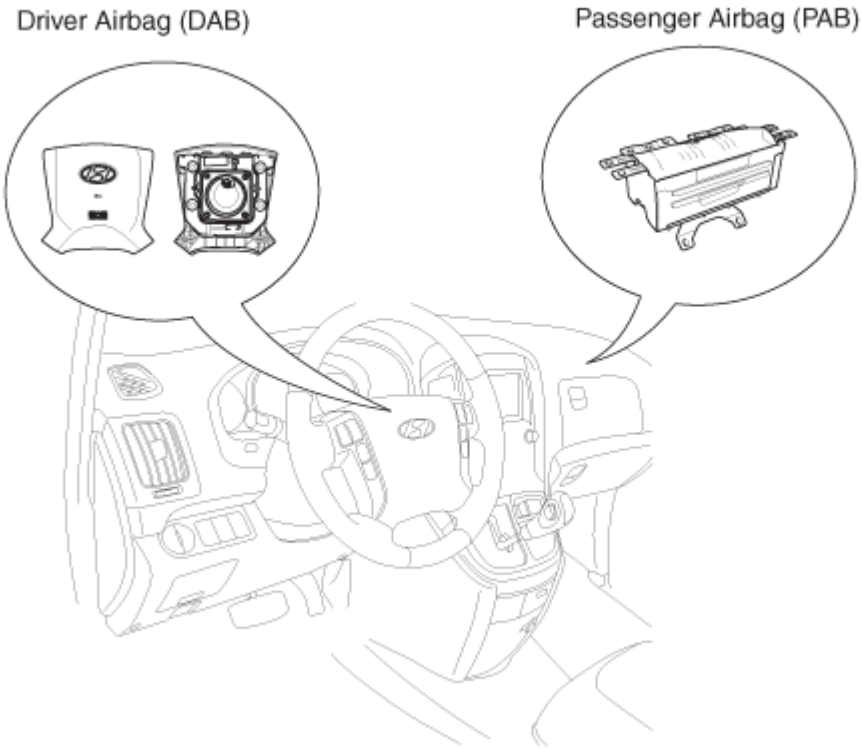
[RHD]



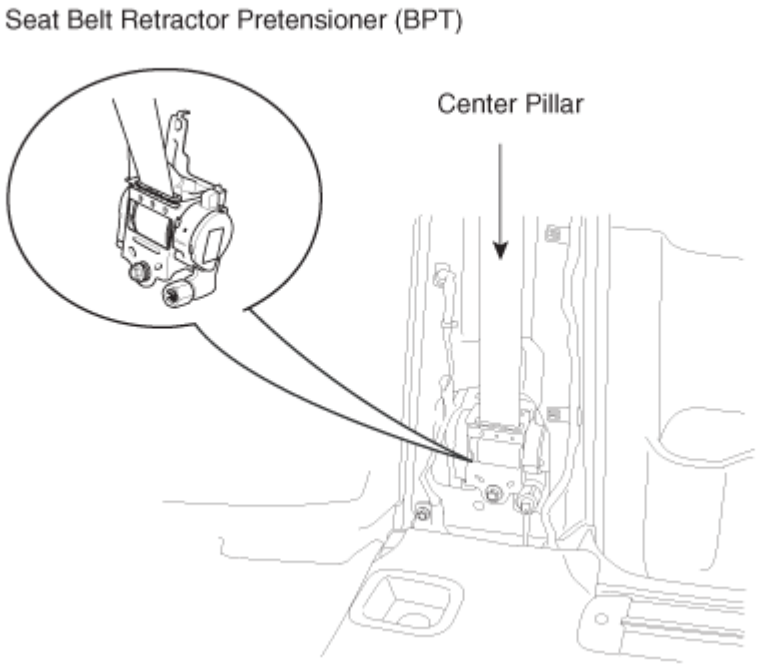
1. Driver Airbag (DAB)	5. Passenger Airbag (PAB)
2. Steering Wheel	6. Front Impact Sensor (FIS)
3. Clock Spring	7. Supplemental Restraint System Control Module(SRSCM)
4. Seat Belt Pretensioner (BPT)	8. Airbag Warning Lamp

Components Location

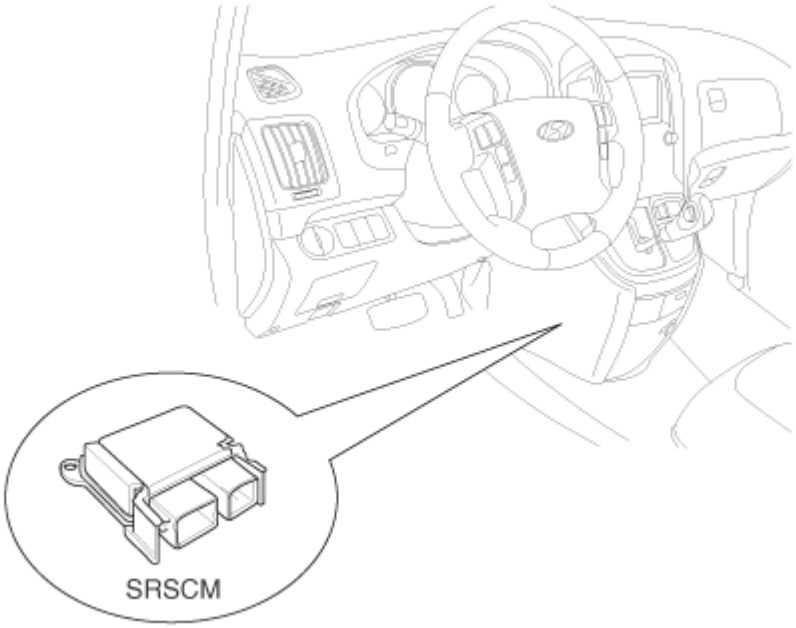
Driver Airbag (DAB) / Passenger Airbag (PAB)



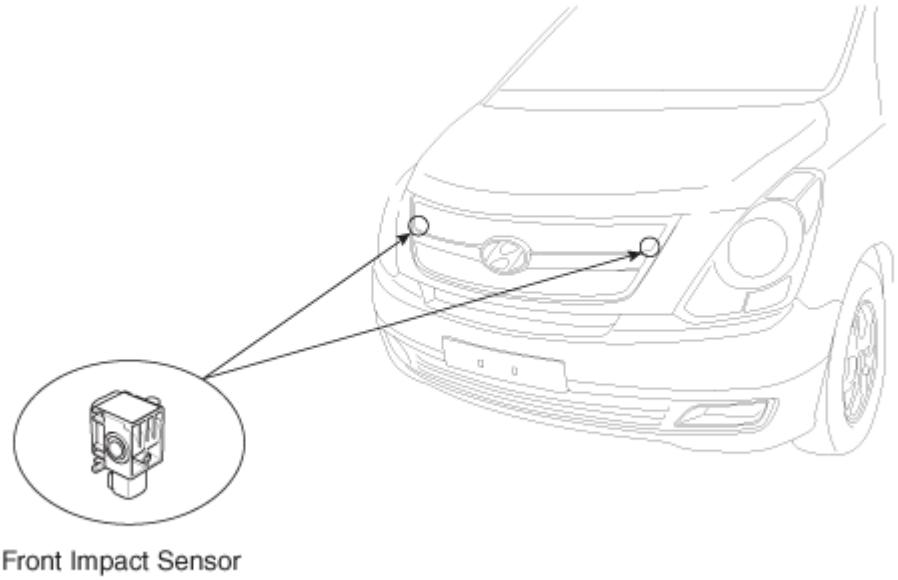
Seat Belt Retractor Pretensioner (BPT)



Supplemental Restraint System Control Module (SRSCM)



Front Impact Sensor (FIS)



Warning Lamp Activation

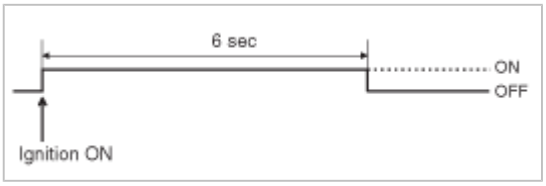
Warning Lamp Behavior After Ignition On

As soon as the operating voltage is applied to the SRSCM ignition input, the SRSCM activates the warning lamp for a bulb check.

The lamp shall turn on for 6 seconds during the initialization phase and be turned off afterward. However, in order to indicate the driver, the warning lamp shall turn on for 6 seconds and off for one second then on continuously after the operating voltage is applied if any active fault exists.

1. Active fault or historical fault counter is greater or equal to 10

2. Normal or historical fault counter is less than 10

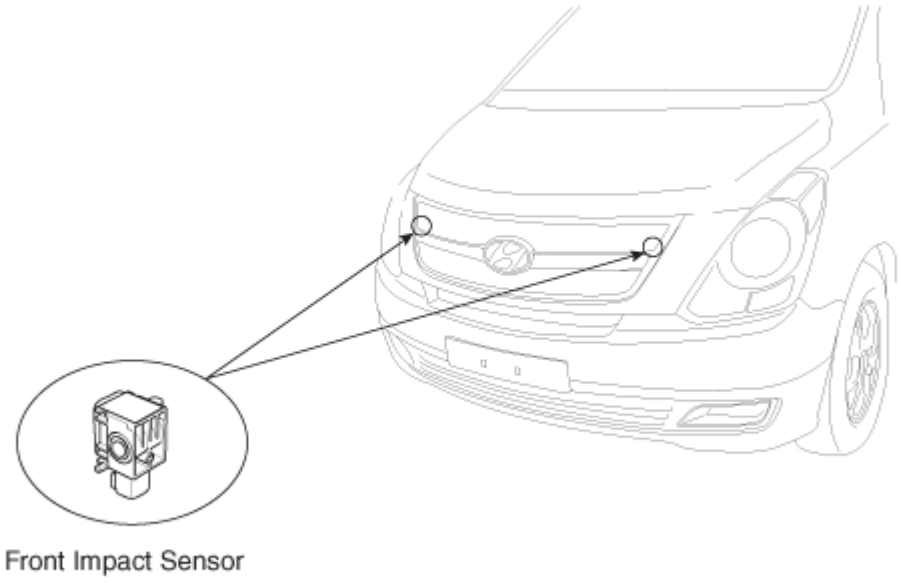


Srscm Independent Warning Lamp Activation

There are certain fault conditions in which the SRSCM cannot function and thus cannot control the operation of the standard warning lamp. In these cases, the standard warning lamp is directly activated by appropriate circuitry that operates independently of the SRSCM. These cases are:

1. Loss of battery supply to the SRSCM : warning lamp turned on continuously.
2. Loss of internal operating voltage : warning lamp turned on continuously.
3. Loss of Microprocessor operation : warning lamp turned on continuously.
4. SRSCM not connected : warning lamp turned on continuously through the shorting bar.

Components



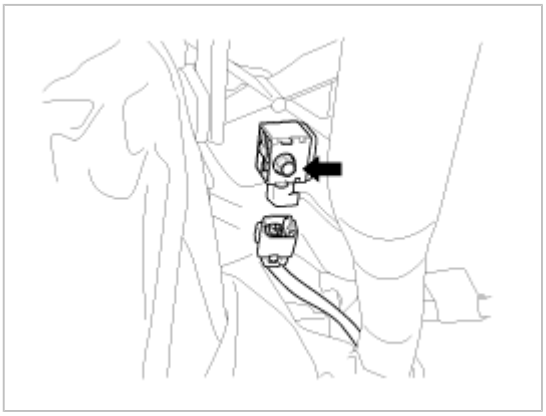
Description

The front impact sensor (FIS) is installed in the Front End Module (FEM). They are remote sensors that detect acceleration due to a collision at its mounting location. The primary purpose of the Front Impact Sensor (FIS) is to provide an indication of a collision. The Front Impact Sensor(FIS) sends acceleration data to the SRSCM.

Removal

- Removal of the airbag must be performed according to the precautions/ procedures described previously.
- Before disconnecting the front impact sensor connector, disconnect the front airbag connector(s).
- Do not turn the ignition switch ON and do not connect the battery cable while replacing the front impact sensor.

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Disconnect the Front Impact Sensor connector.
3. Remove the Front Impact Sensor mounting bolt, then remove the front Impact Sensor.



Installation

- Do not turn the ignition switch ON and do not contact the battery cable while replacing the front impact sensor.

1. Install the new Front Impact Sensor with bolt then connect the SRS harness connector to the Front Impact Sensor.

Tightening torque
: 6.8 ~ 9.2 N.m (0.7 ~ 0.9 kgf.m, 5.0 ~ 6.8 lb-ft)

2. Reconnect the battery negative cable.
3. After installing the Front Impact Sensor, confirm proper system operation: Turn the ignition switch ON the SRS indicator light should be turned on for about six seconds and then go off.

General

The supplemental restraint system (SRS) is designed to supplement the seat belt to help reduce the risk or severity of injury to the driver and passenger by activating and deploying the driver, passenger, and belt pretensioner in certain frontal or side collisions.
The SRS (Airbag) consists of : a driver side airbag module located in the center of the steering wheel, which contains the folded cushion and an inflator unit ; a passenger side airbag module located in the passenger side crash pad contains the folded cushion assembled with inflator unit. The impact sensing function of the SRSCM is carried out by electronic accelerometer that continuously measure the vehicle's acceleration and delivers a corresponding signal through amplifying and filtering circuitry to the microprocessor.

SRSCM (SRS Control Module)

SRSCM will detect front impact with front impact sensor, and side impact with side impact sensor, and determine airbag module deployment.

1. DC/DC converter: DC/DC converter in power supply unit includes up/down transformer converter, and provide ignition voltage for 2 front airbag ignition circuits and the internal operation voltage of the SRSCM. If the internal operation voltage is below critical value setting, it will perform resetting.
2. Safety sensor: Safety sensor is located in airbag ignition circuit. Safety sensor will operate airbag circuit at any deployment condition and release airbag circuit safely at normal driving condition. Safety sensor is a double contact electro-mechanical switch that will close detecting deceleration above certain criteria.
3. Back up power supply: SRSCM has separate back up power supply, that will supply deployment energy instantly in low voltage condition or upon power failure by front crash.
4. Self diagnosis: SRSCM will constantly monitor current SRS operation status and detect system failure while vehicle power supply is on, system failure may be checked with trouble codes using scantool. (Hi-Scan)
5. Airbag warning lamp on: Upon detecting error, the module will transmit signal to SRSCM indicator lamp located at cluster. MIL lamp will indicate driver SRS error. Upon ignition key on, SRS lamp will turn on for about six seconds.
6. Trouble code registration: Upon error occurrence in system, SRSCM will store DTC corresponding to the error. DTC can be cleared only by Hi-Scan. However, if an internal fault code is logged or if a crash is recorded the fault clearing should not happen.
7. Self diagnostic connector: Data stored in SRSCM memory will be output to Hi-Scan or other external output devices through connector located below driver side crash pad.
8. Once airbag is deployed, SRSCM should not be used again but replaced.
9. SRSCM will determine whether passenger put on seat belt by the signal from built-in switch in seat belt buckle, and deploy front seat airbag at each set crash speed.

Precautions

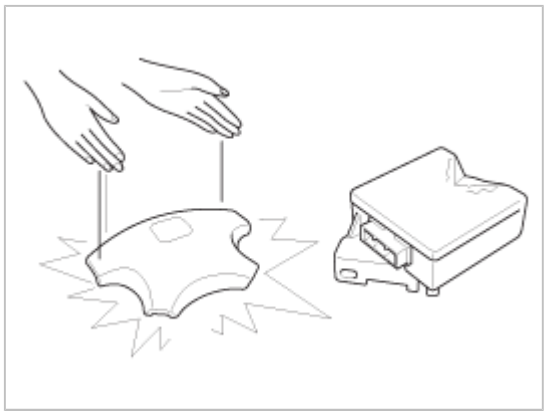
General Precautions

Please read the following precautions carefully before performing the airbag system service. Observe the instructions described in this manual, or the airbags could accidentally deploy and cause damage or injuries.

- Except when performing electrical inspections, always turn the ignition switch OFF and disconnect the negative cable from the battery, and wait at least three minutes before beginning work.

  The contents in the memory are not erased even if the ignition switch is turned OFF or the battery cables are disconnected from the battery.

- Use the replacement parts which are manufactured to the same standards as the original parts and quality.
  Do not install used SRS parts from another vehicle.
  Use only new parts when making SRS repairs.
- Carefully inspect any SRS part before you install it.
  Do not install any part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



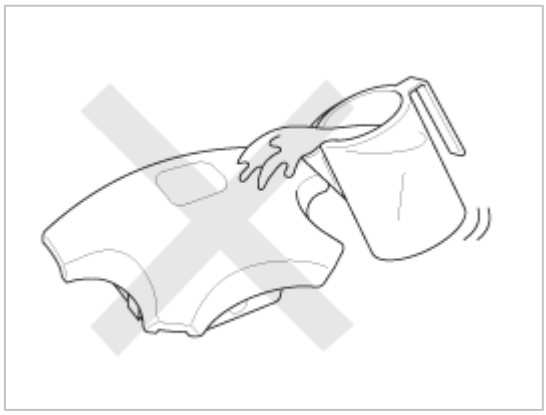
- Before removing any of the SRS parts (including the disconnection of the connectors), always disconnect the SRS connector.

Airbag Handling And Storage

Do not disassemble the airbags; it has no serviceable parts. Once an airbag has been deployed, it cannot be repaired or reused.

For temporary storage of the air bag during service, please observe the following precautions.

- Store the removed airbag with the pad surface up.
- Keep free from any oil, grease, detergent, or water to prevent damage to the airbag assembly.



- Store the removed airbag on secure, flat surface away from any high heat source (exceeding 60℃/140°F).
- Never perform electrical inspections to the airbags, such as measuring resistance.
- Do not position yourself in front of the airbag assembly during removal, inspection, or replacement.
- Refer to the scrapping procedures for disposal of the damaged airbag.
- Be careful not to bump or impact the SRS unit or the side impact sensors whenever the ignition switch is ON, wait at least three minutes after the ignition switch is turned OFF before begin work.
- During installation or replacement, be careful not to bump (by impact wrench, hammer, etc.) the area around the SRS unit and the side impact sensor. The airbags could accidentally deploy and cause damage or injury.
- After a collision in which the airbags were deployed, replace the front airbags and the SRS unit. After a collision in which the side airbag was deployed, replace the side airbag, the front impact sensor and side impact sensor on the side where the side airbag deployed and the SRS unit. After a collision in which the airbags or the side air bags did not deploy, inspect for any damage or any deformation on the SRS unit and the side impact sensors. If there is any damage, replace the SRS unit, the front impact sensor and/or the side impact sensors.
- Do not disassemble the SRS unit, the front impact sensor or the side impact sensors
- Turn the ignition switch OFF, disconnect the battery negative cable and wait at least three minutes before beginning installation or replacement of the SRS unit.
- Be sure the SRS unit, the front impact sensor and side impact sensors are installed securely with the mounting bolts.
- Do not spill water or oil on the SRS unit,or the front impact sensor or the side impact sensors and keep them away from dust.
- Store the SRS unit, the front impact sensor and the side impact sensors in a cool (15 ~ 25℃/59 ~ 77℉) and dry (les30 ~ 80% relative humidity, no moisture) area.

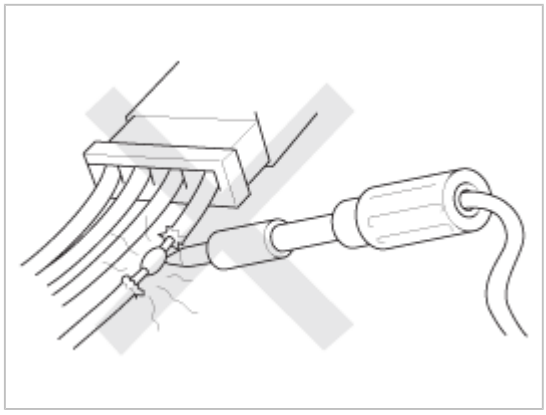
Wiring Precautions

SRS wiring can be identified by special yellow outer covering (except the SRS circuits under the front seats).

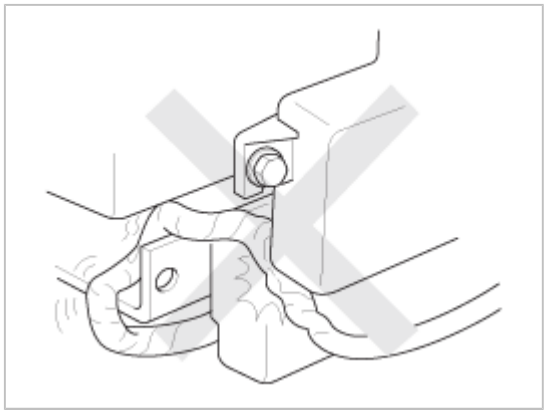
Observe the instructions described in this section.

-

Never attempt to modify, splice, or repair SRS wiring.
If there is an open or damage in SRS wiring, replace the harness.



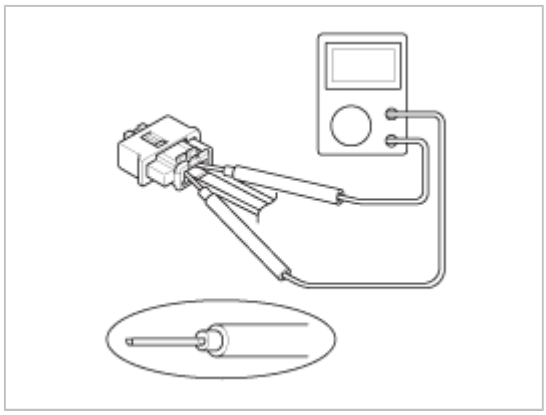
- Be sure to install the harness wires so that they are not pinched, or interfere with other parts.



- Make sure all SRS ground locations are clean, and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

Precautions For Electrical Inspections

- When using electrical test equipment, insert the probe of the tester into the wire side of the connector. Do not insert the probe of the tester into the terminal side of the connector, and do not tamper with the connector.



- Use a u-shaped probe. Do not insert the probe forcibly.

- Use specificed service connectors for troubleshooting.
  Using improper tools could cause an error in inspection due to poor metal contact.

Component Replacement After Deployment

Before doing any SRS repairs, use the Hi-Scan Pro to check for DTCs. Refer to the Diagnostic Trouble Code list for repairing of the related DTCs.

When the front airbag(s) deployed after a collision, replace the following items.

- SRSCM
- Deployed airbag(s)
- Seat belt pretensioner(s)
- Front impact sensors
- SRS wiring harnesses
- Inspect the clock spring for heat damage.
  If any damage found, replace the clock spring.

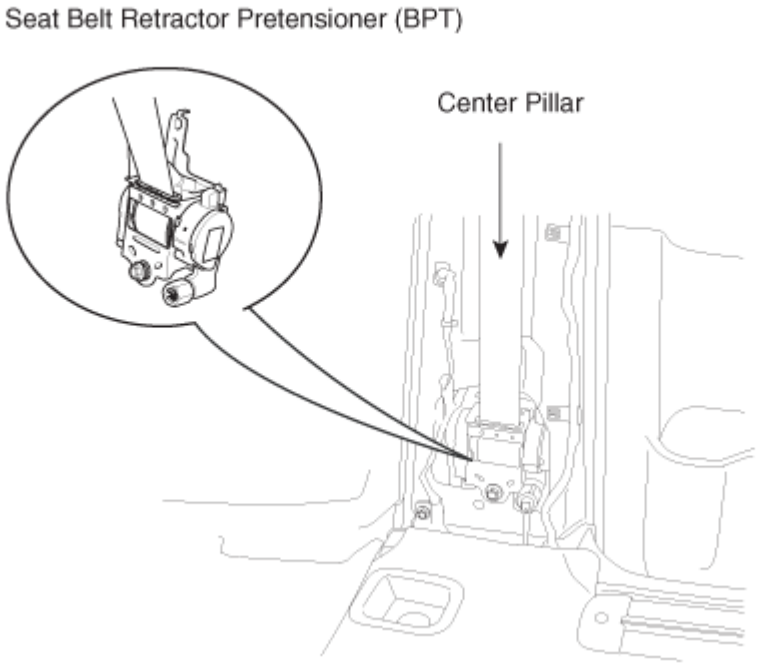
When the seat belt pretensioner(s) deployed after a collision, replace the following items.

- Seat belt pretensioner(s)
- SRSCM (if B1658 detected)
- Front impact sensors
- SRS wiring harnesses

After the vehicle is completely repaired, confirm the SRS airbag system is OK.

- Turn the ignition switch ON, the SRS indicator should come on for about 6 seconds and then go off.

Components



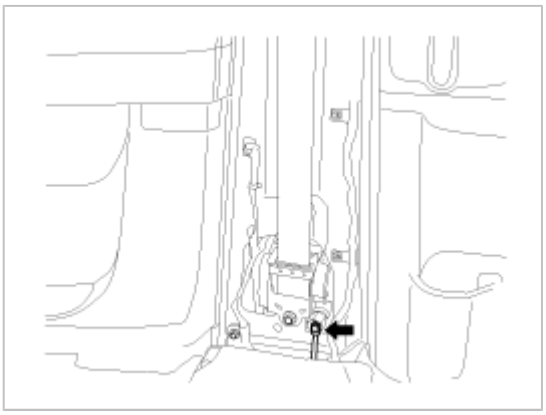
Description

The Seat Belt Pretensioners (BPT) are installed inside Center Pillar (LH □ RH). When a vehicle crashes with a certain degree of frontal impact, the pretensioner seat belt helps to reduce the severity of injury to the front seat occupants by retracting the seat belt webbing. This prevents the front occupants from thrusting forward and hitting the steering wheel or the instrument panel when the vehicle crashes.

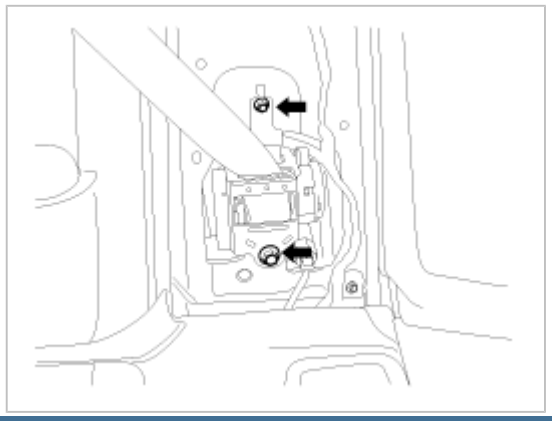
Never attempt to measure the circuit resistance of the Seat Belt Pretensioner (BPT) even if you are using the specified tester. If the circuit resistance is measured with a tester, the pretensioner will be ignited accidentally. This will result in serious personal injury.

Removal

1. Disconnect the battery negative cable, and wait for at least three minutes before beginning work.
2. Remove the following parts.
   (Refer to the BD group)
   A. Front seat assembly.
   B. Door scuff trim.
3. Remove the lower anchor bolt.
4. Remove the center pillar trim.
   (Refer to the BD group - "Interior trim")
5. Remove the upper anchor bolt.
6. Disconnect the Seat Belt Pretensioner connector.



7. Loosen the Seat Belt Pretensioner mounting bolt and remove the Seat Belt Pretensioner.

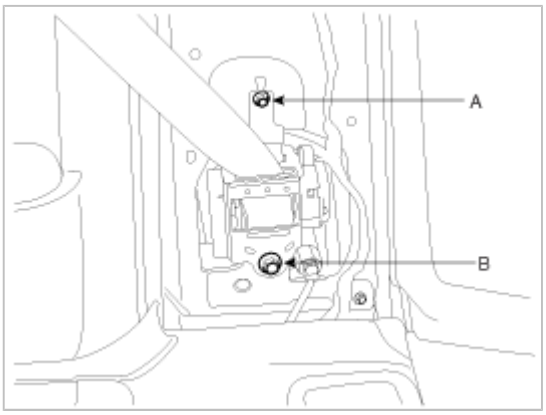


Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes.
3. Install the Seat Belt Pretensioner (BPT) with a bolt.

Tightening torque

A - 7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)
B - 39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)



4. Install the upper anchor bolts.

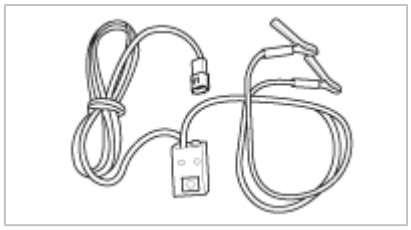
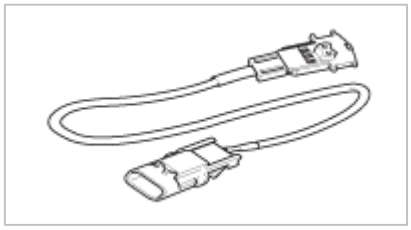
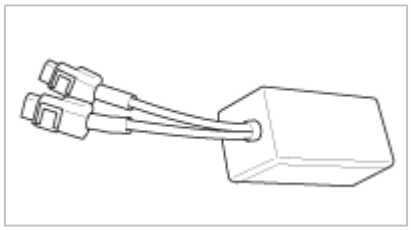
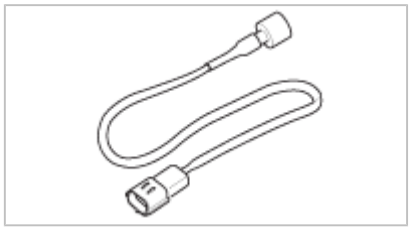
Tightening torque (Seat Belt Anchor Bolt)
: 39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

5. Connect the Seat Belt Pretensioner (BPT) connector.
6. Install the center pillar trim.
7. Install the door scuff trim.
8. Install the lower anchor bolts.

Tightening torque
: 39.2 ~ 53.9 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

9. Install the frant assembly.
   (Refer to the Body group - "Seat")
10. Reconnect the battery negative cable.
11. After installing the Seat Belt Pretensioner (BPT), confirm proper system operation:
    A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Special Service Tools

Tool(Number and Name)	Illustration	Use
Deployment tool 0957A-34100A		Airbag deployment tool
Deployment adapter 0957A-38500		Use with deployment tool. (DAB, PAB, BPT)
Dummy 0957A-38200		Simulator to check the resistance of each wiring harness
Dummy adapter 0957A-2G000		Use with dummy (DAB, PAB, BPT)

DAB : Driver Airbag
PAB : Passenger Airbag
BPT : Seat Belt Pretensioner

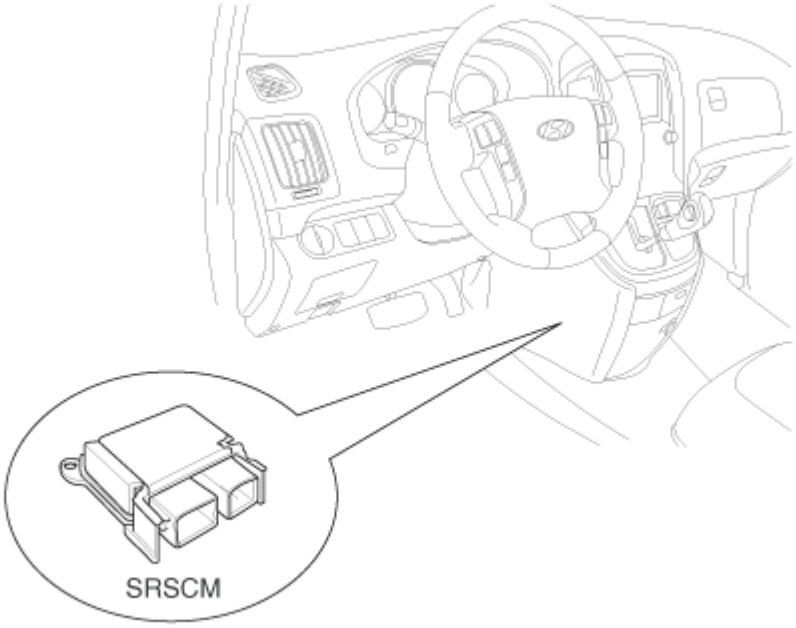
Specification

Item	Resistance (Ω)
Driver Airbag (DAB)	1.5 ~ 5.7
Passenger Airbag (PAB)	1.5 ~ 5.7
Seat Belt Retractor Pretensioner (BPT)	1.5 ~ 5.7

Tightening Torques

Item	N.m	kgf.m	lb-ft
Driver Airbag (DAB)	7.9 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0
Passenger Airbag (PAB)	Bolt : 7.8 ~ 11.8 Nut : 5.9 ~ 6.9	0.8 ~ 1.2 0.6 ~ 0.7	5.8 ~ 8.7 4.3 ~ 5.0
Seat Belt Anchor Bolt (BPT)	39.2 ~ 53.9	4.0 ~ 5.5	28.9 ~ 39.8
SRSCM	6.8 ~ 9.2	0.7 ~ 0.9	5.0 ~ 6.8
Front Impact Sensor (FIS) Mounting Bolt	6.8 ~ 9.2	0.7 ~ 0.9	5.0 ~ 6.8

Components



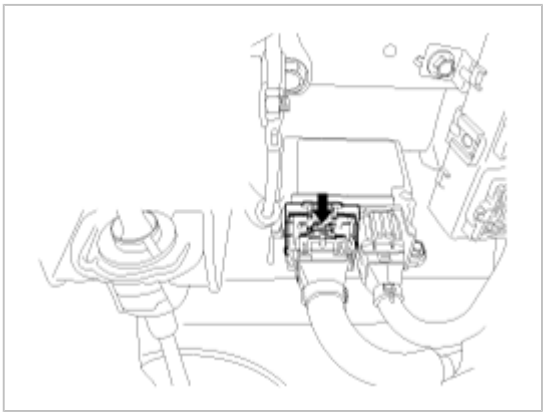
Description

The primary purpose of the SRSCM (Supplemental Restraints System Control Module) is to discriminate between an event that warrants restraint system deployment and an event that does not. The SRSCM must decide whether to deploy the restraint system or not. After determining that pretensioners and/or airbag deployment is required, the SRSCM must supply sufficient power to the pretensioners and airbag igniters to initiate deployment.

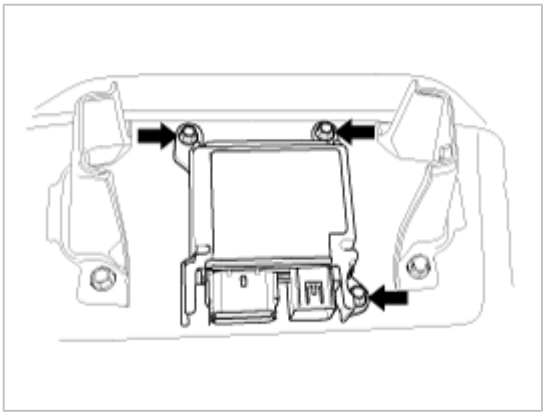
The SRSCM determines that an impact may require deployment of the pretensioners and airbags from data obtained from impact sensors and other components in conjunction with a safing function. The SRSCM will not be ready to detect a crash or to activate the restraint system devices until the signals in the SRSCM circuitry stabilize. It is possible that the SRSCM could activate the safety restraint devices in approximately 2 seconds but is guaranteed to fully function after prove-out is completed. The SRSCM must perform a diagnostic routine and light a system readiness indicator at key-on. The system must perform a continuous diagnostic routine and provide fault annunciation through a warning lamp indicator in the event of fault detection. A serial diagnostic communication interface will be used to facilitate servicing of the restraint control system.

Removal

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Disconnect the DAB, PAB and BPT connectors.
4. Remove the front console upper cover and front console.
   (Refer to the Body group - "Console")
5. Disconnect the SRSCM harness connector from the SRSCM.



6. Remove the SRSCM mounting nuts (3EA) from the SRSCM, then remove the SRSCM.



Installation

1. Remove the ignition key from the vehicle.
2. Disconnect the battery negative cable and wait for at least three minutes before beginning work.
3. Install the SRSCM with the SRSCM mounting nuts.

Tightening torque (SRSCM Mounting bolt)
: 6.8 ~ 9.2 N.m (0.7 ~ 0.9 kgf.m, 5.0 ~ 6.8 lb-ft)

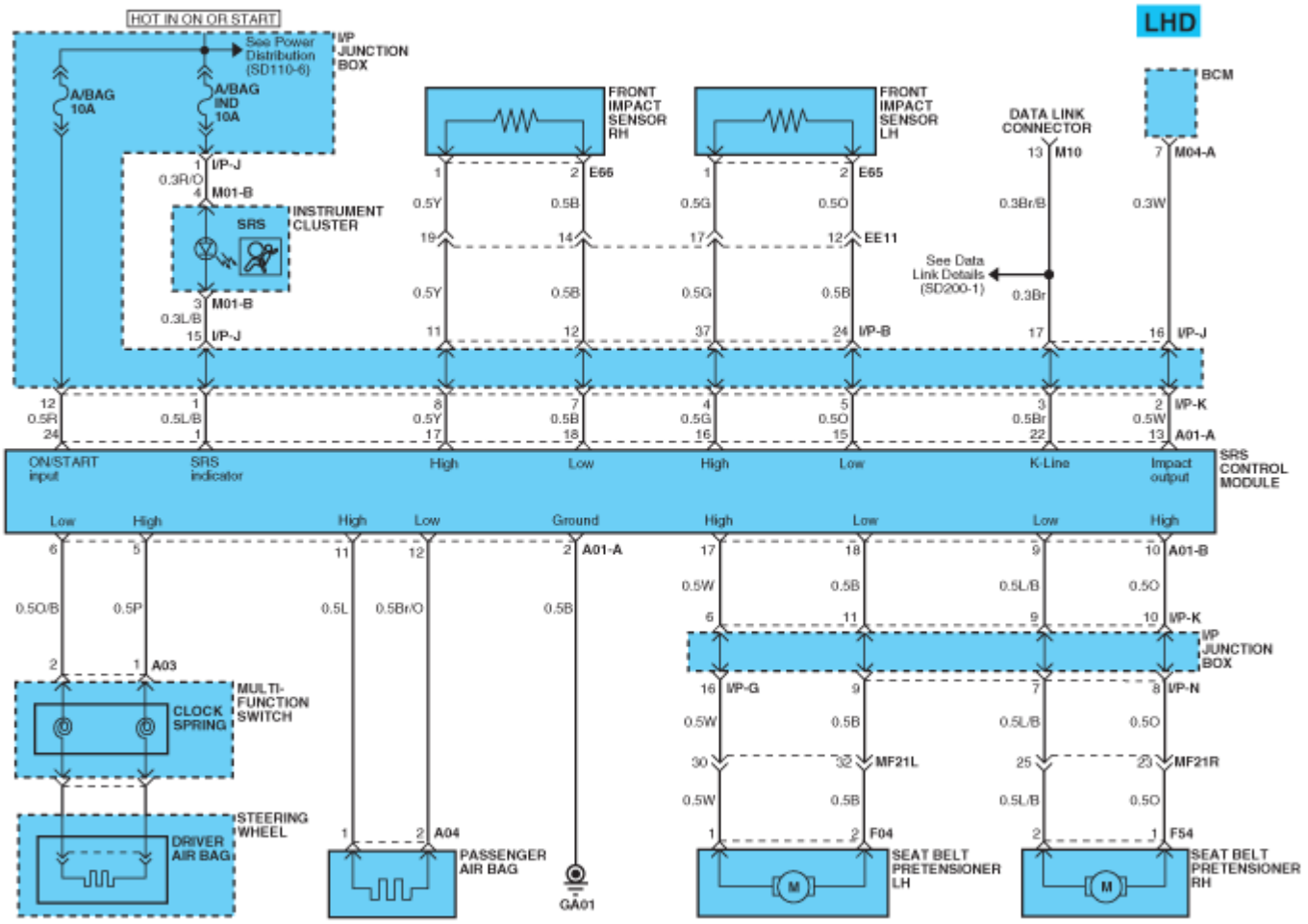
Use new mounting bolts when replacing the SRSCM after a collision.

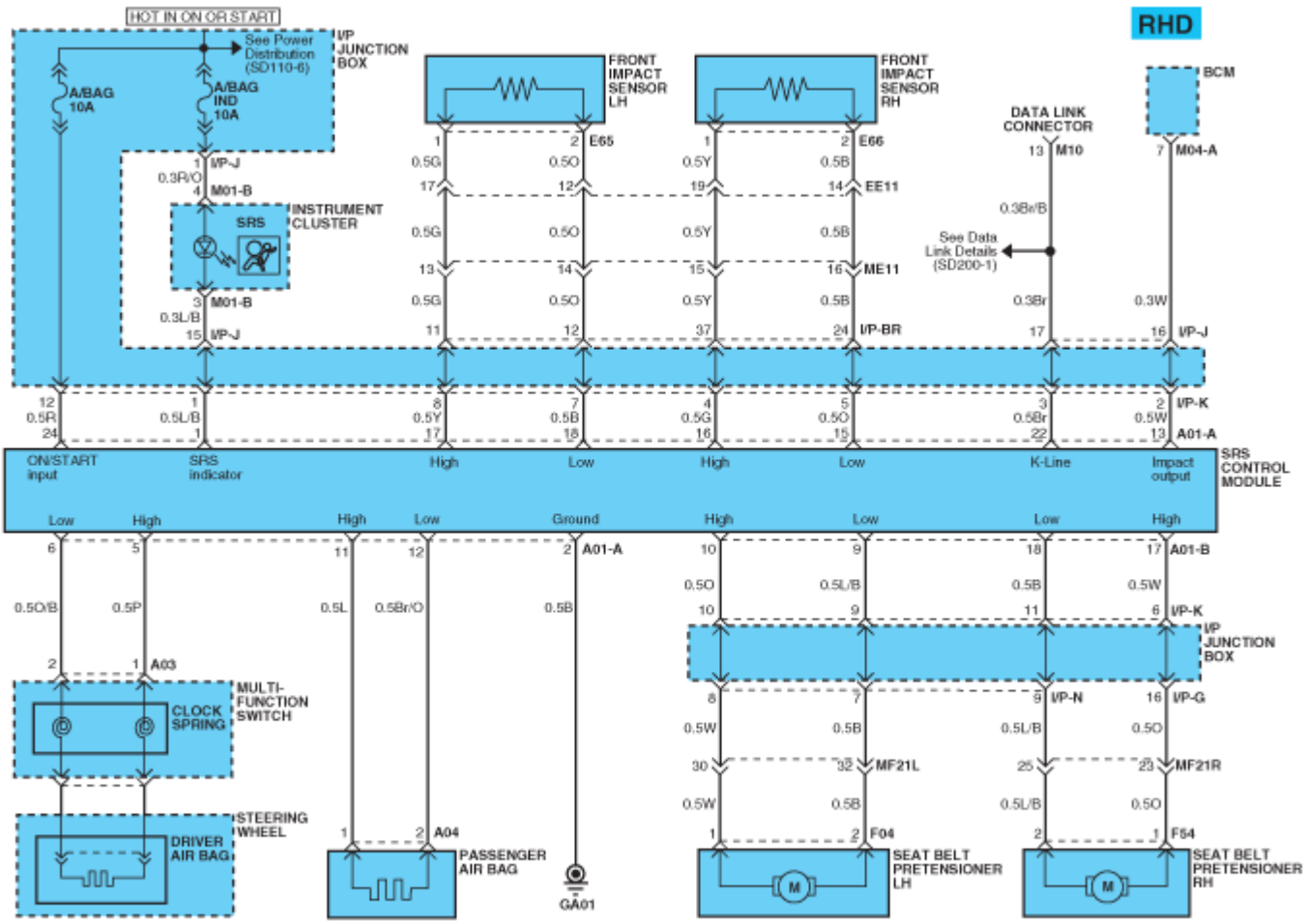
4. Connect the SRSCM harness connector.
5. Install the front console and front console upper cover.

(Refer to the Body group - "Console")

6. Connect the DAB, PAB and BPT connectors.
7. Reconnect the battery negative cable.
8. After installing the SRSCM, confirm proper system operation:
   A. Turn the ignition switch ON; the SRS indicator light should be turned on for about six seconds and then go off.

Circuit Diagram





SRSCM Connector Terminal

Harness Connector

6	5	4	3	2	1
12	11	10	9	8	7
18	17	16	15	14	13
24	23	22	21	20	19

CONNECTOR A (I01-A)

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

CONNECTOR B (I01-B)

Shorting bar (▭) : located on the upper side of pin 1 and 2 of SRSCM connector A
Note : For short circuit check, shorting bar must be opened. Use a plastic clip as a shorting bar opener for disconnecting shorting bar.

Pin	Function (Connector A)	Pin	Function (Connector B)
1	Airbag Warning Lamp	1	-

2	Ground	2	-
3	-	3	-
4	-	4	-
5	Driver Airbag High	5	-
6	Driver Airbag Low	6	-
7	-	7	-
8	-	8	-
9	-	9	Seat Belt Pretensioner [Front-Passenger] Low
10	-	10	Seat Belt Pretensioner [Front-Passenger] High
11	Passenger Airbag High	11	-
12	Passenger Airbag Low	12	-
13	Crash Output	13	-
14	-	14	-
15	Front Impact Sensor [Driver] Low	15	-
16	Front Impact Sensor [Driver] High	16	-
17	Front Impact Sensor [Passenger] High	17	Seat Belt Pretensioner [Front-Driver] High
18	Front Impact Sensor [Passenger]	18	Seat Belt Pretensioner [Front-Driver] Low
19	Low PAD Switch High	19	-
20	-	20	-
21	PAD Switch Low	21	-
22	KLine Diagnostic	22	-
23	PAD Lamp	23	-
24	Ignition	24	-
		25	-
		26 ~ 40	-

HYUNDAI
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Body Repair Manual

FOREWORD

This Body Repair Manual provides detailed repair procedures for repair of commonly damaged structural panels on the 2008 H-1(TQ). To aid in the information of the damaged vehicle, body construction, body dimensions, Body Panel Repair Procedure, Body Sealing Locations, Corrosion Protection, Body Modification Tools and Plastic Parts are contained herein.

The repair procedures specify locations where body members may be structurally sectioned.

All of the repair procedures have been performed on H-1(TQ) body shells and that is currently available in most auto body repair shops.

The repair procedures illustrated in this manual were developed to simplify body repair in order to reduce insurance costs, and indirectly, cost of ownership.

The vehicle should not be sectioned in locations other than those illustrated in this repair manual. Furthermore, these repair procedures DO NOT apply to any other vehicle. The individuals performing the work must assume full responsibility for the quality of their workmanship.

We believe this manual to be helpful for Hyundai dealers, and anticipate it to be effectively used for Hyundai vehicle bodies.

For the services of other than collision-damaged body parts of the H-1(TQ), refer to the H-1(TQ) shop manual.

The illustrations and descriptive text in this manual were corrected at the time of printing.

It is the policy of HYUNDAI MOTOR COMPANY to continuously improve its products.

Specifications and procedures are subject to change at any time without notice.

CONTENTS

TITLE	GROUP
General Information	GI
Body Construction	BC
Body Dimensions	BD
Body Panel Repair Procedure	BP
Body Sealing Locations	BS
Corrosion Protection	CP
Body Modification Tools	BT
Plastic Parts	PP

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IMPORTANT SAFETY NOTICE

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

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

IN THIS MANUAL

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

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

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

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

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

General Information

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FUNDAMENTAL PROCEDURES

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GENERAL GUIDE LINES AND PRECAUTIONS

The H-1 is a completely new vehicle design. During its development, close attention has been given to safety, stability, weight and corrosion protection. Typical of unit body design, the H-1 is designed so that the front and rear compartments will absorb much of the collision energy so that the passengers are better protected. During collisions, these front and rear energy absorbing systems may be severely damaged. During repair, these damaged areas must be returned to their original strength and geometry. If this is not properly done, the vehicle will not provide the intended level of protection to its occupants in the event of another collision.

The repairs described in this manual were performed on H-1 body shells. In some instances special fixtures were welded in place to support the structure. During the repair of an actual vehicle, the interior would be fully disassembled and standard jack screws or portable braces may be used for temporary support.

During the repair of an accident involved vehicle, the vehicle must first be returned to pre-impact dimensions prior to beginning the sectioning repair procedures. The extent of damage that must be repaired should then be evaluated to determine the appropriate repair procedures. This manual provides locations and procedures where structural sectioning may be employed. It is the responsibility of the repair technician, based upon the extent of damage, to determine which location and procedure is suitable for the particular damaged vehicle.

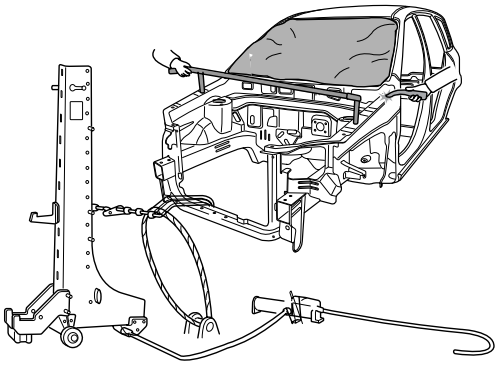
During the repair of a collision damaged automobile, it is impossible to fully duplicate the methods used in the factory during the vehicle manufacture. Therefore, auto body repair techniques have been developed to provide a repair that has strength properties equivalent to those of the original design and manufacture.

FUNDAMENTAL PROCEDURES

VEHICLE PROTECTION

1. Cover the seats before performing any procedure to keep them from getting dirty.

2. Cover all glasses, seats and mats with a heat resistant cover when welding.



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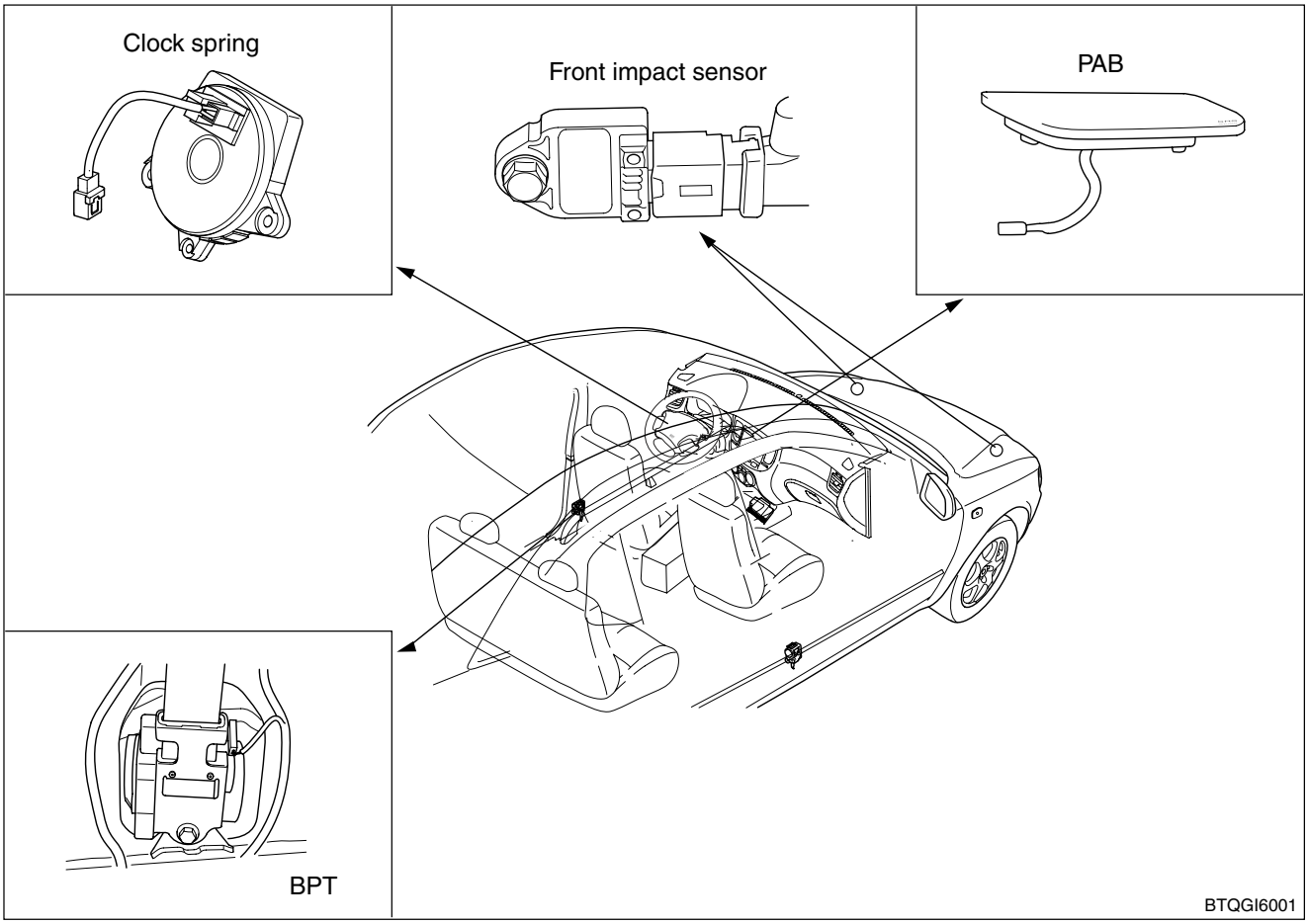
3. Protect moldings, garnishes and ornaments.

SAFETY FACTORS

1. Disconnect the negative(-) battery cable before performing any work on the vehicle.
2. Protect yourself by wearing goggles, earplugs, respirators, gloves, safety shoes, caps, etc. when working on a vehicle.
3. Safely support the vehicle before any work is done. Block the front or rear wheels if the vehicle is not lifted off of the ground.
4. When welding or performing other procedures that require the use of an open flame near the fuel tank, disconnect and remove the tank and fuel pipe, and cap the pipe to prevent fuel leakage.
5. Insure proper ventilation of your working area. Some paint and sealant can generate toxic gases when heated. Use an air chisel or saw to remove damaged panels instead of a gas torch.
6. Observe all local and national safety regulations when performing any work.
7. Cover interior with heat-resistant cover to insure safety when welding.
8. Take care when using gas or cutting torches so as not to burn body sealer or interior. Extinguish immediately if they should catch fire.

SRS AIR-BAG



The H-1 is equipped with a Supplemental Restraint System AIR-BAG to provide the vehicle's driver and/or the front passenger with additional protection than that offered by the seat-belt system alone, in case of a frontal impact of sufficient severity.

When handling airbag components (removal, installation or inspection, etc.), always follow the directions given in the repair manual for the relevant model to prevent the occurrence of accidents and airbag malfunction.

Also take the following precautions when repairing the body:

1. Work must be started after approximately 30 seconds or longer from the time 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 of disconnecting the negative (-) terminal cable of the battery, the airbag may be deployed.)
   When the negative(-) terminal cable is disconnected from the battery, memory of the clock and audio systems will be cancelled. So before starting work, make a record of the contents memorized by the audio memory system. Then when work is finished, reset the audio system as before and adjust the clock.
2. When using electric welding, first disconnect the air-bag connectors under the steering column near the MULTI-FUNCTION SWITCH and the passenger's side crash pad before starting work.
3. Store the air-bag modules where the ambient temperature remains below 93 C°(200 F°), without high humidity and away from electrical noise.
4. WARNING/CAUTION labels are attached to the periphery of the air-bag components.
   Refer to the H-1 SHOP MANUAL.

WELDING

All repairs in this manual require the use of a Metal-Inert Gas (MIG) welder, Gas (oxyacetylene) welding must not be used. Both high strength steel and mild steel can be welded using the MIG welder. The I-CAR recommendations for welding should be followed. The shielding gas should be 75% Argon and 25% CO_2.
The recommended welding wire size is 0.23" and the wire should satisfy the American Welding Society standard code AWSER70S-6.

During the repair process, plug welds are used to duplicate original factory spot welds. All plug welds should be done with the MIG welder. An 8 mm (5/16") hole is placed in the top (welding side) sheetmetal.

You then begin welding along the edges and the spiral towards the center (see illustration). This is important so that weld penetration between the two metal pieces takes place along the circumference of the circle.

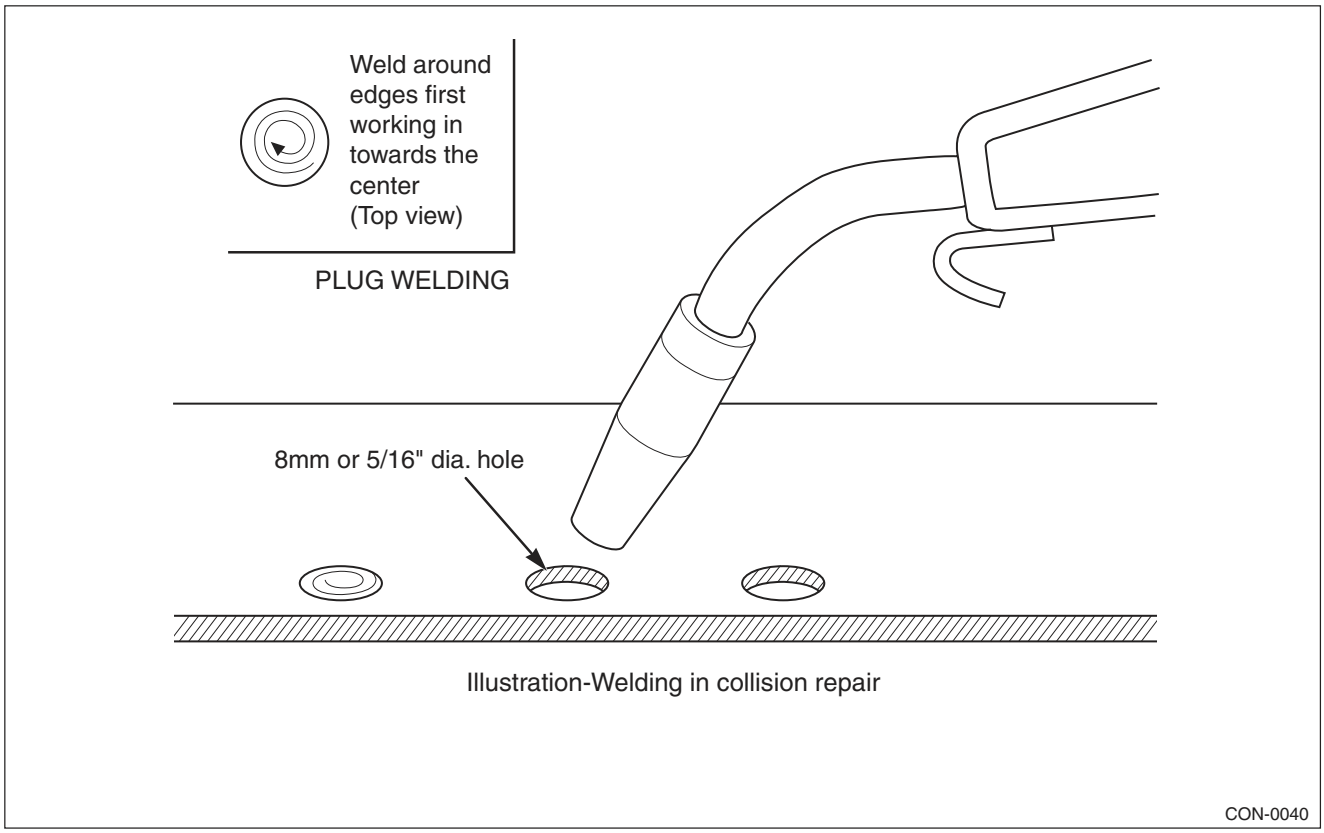


Illustration-Welding in collision repair

Observe the following tips when welding.
1. Wear appropriate eye protection.

2. Carefully follow the manufacturers operating instructions for the welding machine you are using.

3. Do not weld, smoke or allow open flames around volatile chemicals, cleaners or solvents or in any area where they have just been used.

BODY FRAME STRAIGHTENER

When using a frame straightener, do not enter the area where the body is being straightened by the chain.

ELECTRONIC PARTS

Vehicles today include a great many electronic parts and components, and these are in general very susceptible to adverse effects caused by overcurrent, reverse current, electromagnetic waves, high temperature, high humidity impacts, etc.
In particular such electronic components can be damaged if there is a large current flow during welding from the body side.
Therefore, take the following precautions during body repair to prevent damage to the CONTROL MODULES (ECM, TCM, ABS CM, SRS CM, etc.)

1. Before removing and inspecting the electrical parts or before starting electric welding operations, disconnect the negative (-) terminal cable from the battery.
2. Do not expose the CONTROL MODULES to ambient temperatures above 80°C (176°F).

   NOTE

   If it is possible the ambient temperatures may reach 80°C (176°F) or more, remove the CONTROL MODULES from the vehicle before starting work.

3. Be careful not to drop the CONTROL MODULES and not to apply physical shocks to them.

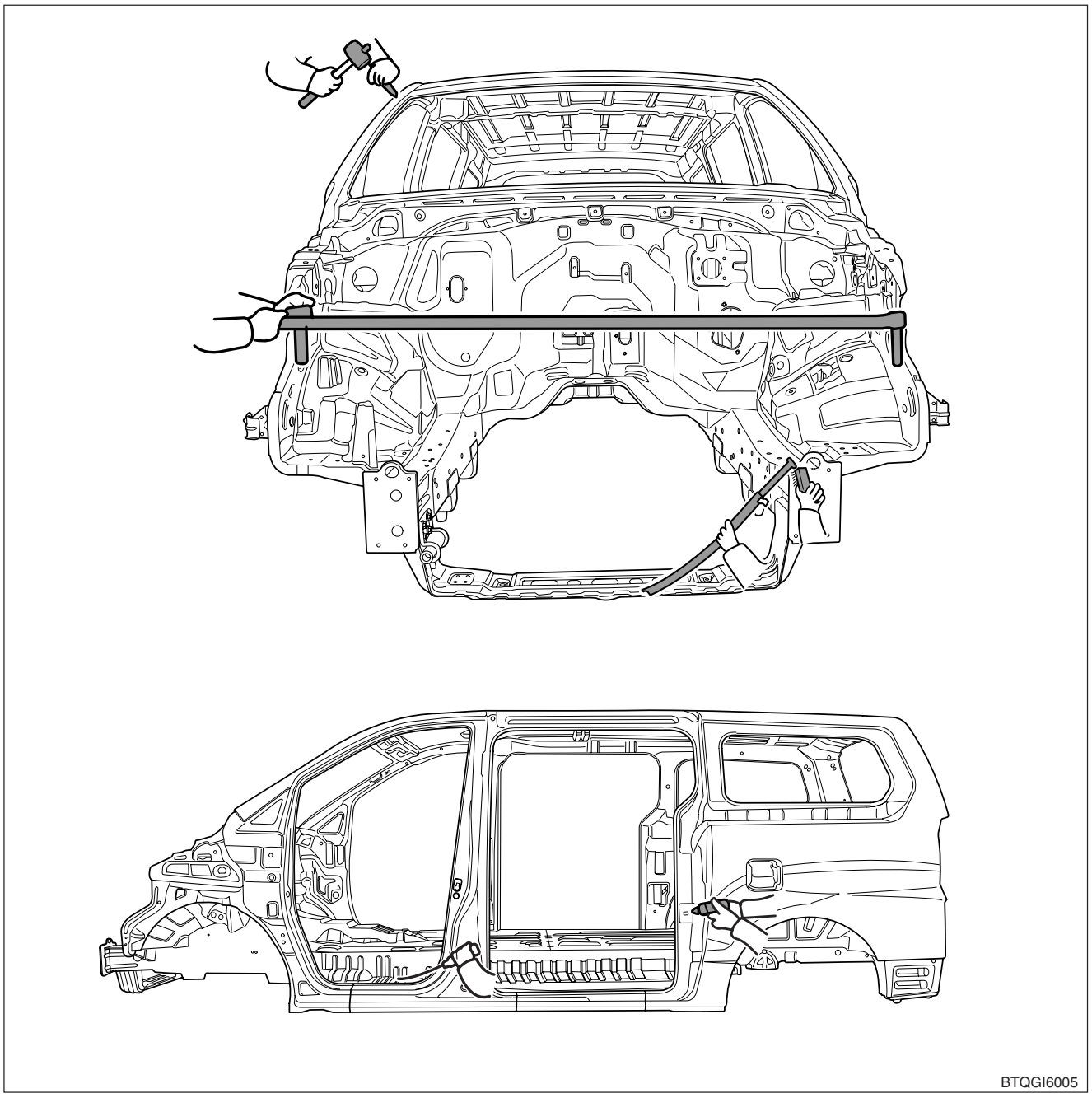
FOR BEST RESULTS

REMOVAL

Measuring dimensions before beginning
Measure the dimensions of the damaged area according to the body dimension drawings before removing and repairing. Adjust dimensions with body frame adjuster if deformed.

Selecting cutting area
Select a cutting area that is easily accessible and that is prone to the least amount of distortion when welding. Select an area that would allow the new part to overlap repair area by 30~50 mm (1.2~2.0 in) .

Protecting body from damage
Secure the body with clamps and jacks to prevent damage to the body when working on it.

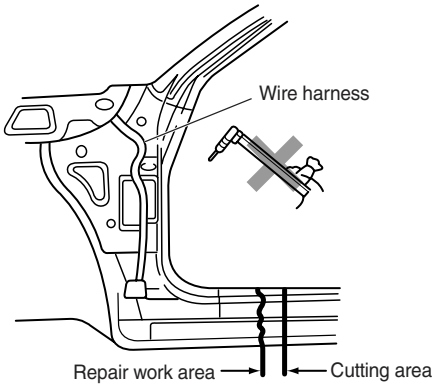


Removing

Use caution when removing body molding and trim from the area to be worked.

Apply masking tape where needed to prevent damage to the part being removed or to the vehicle body.

Before starting repairs, check if pipes, hoses or electrical components are present near damaged area.



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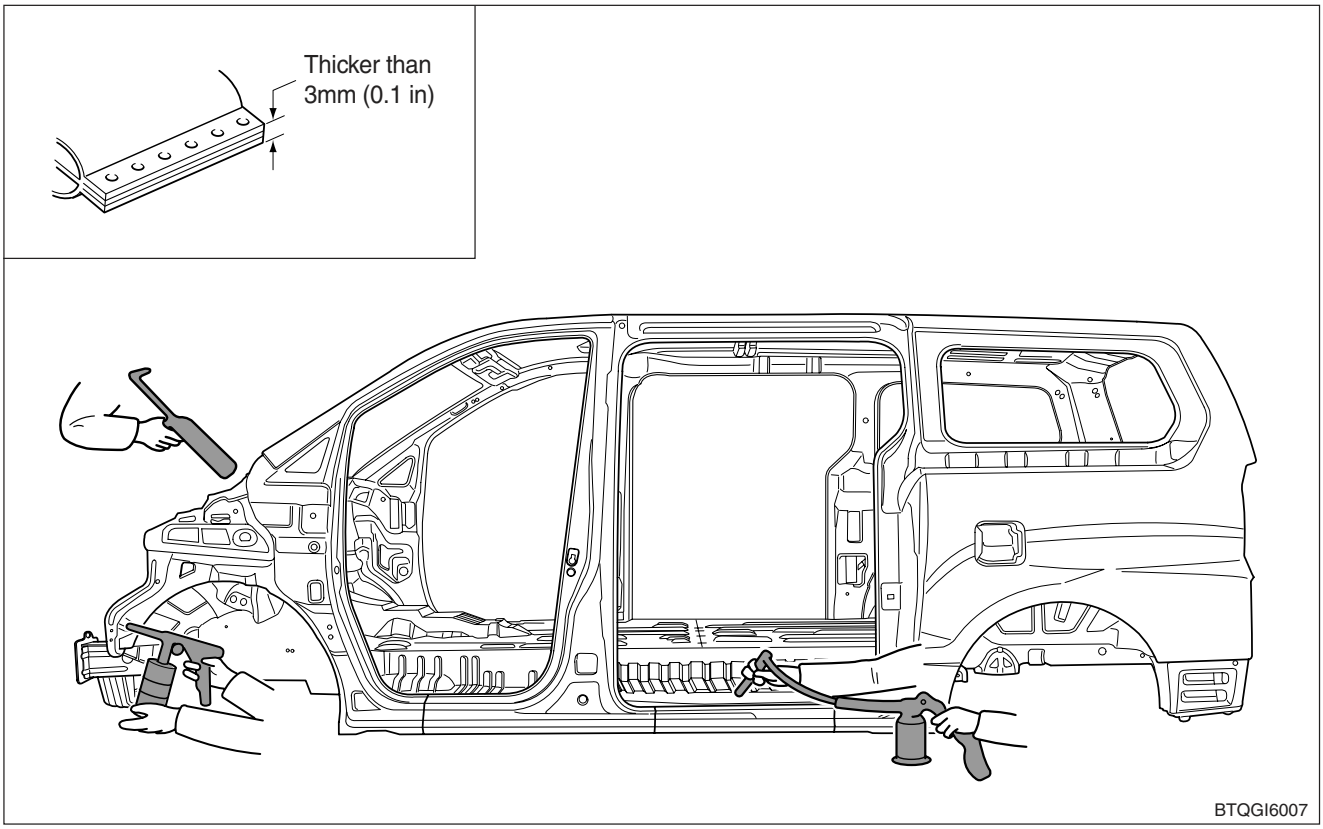
PREPARATION OF INSTALLATION

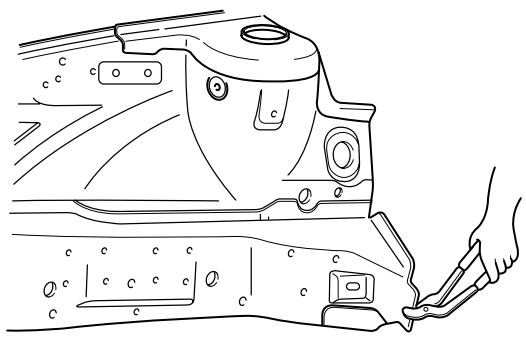
Applying spot sealer
Remove paint from the surface of new parts and body to be spot welded, and apply spot sealer for rustproofing.

Selecting a welding method
If the thickness of the area to be welded with the panels overlapped is greater than 3 mm (0.1 in), do plug welding using a carbon arc welding machine.

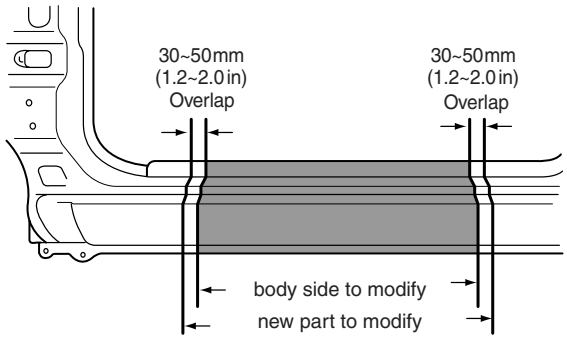
Protecting body from damage
Secure the body with clamps and jacks to prevent damage to the body when working on it.



Machining holes for plug welding
Drill a hole of approximately 5~6 mm (0.2~0.24 in) in diameter in those areas which are not suitable for spot welding.



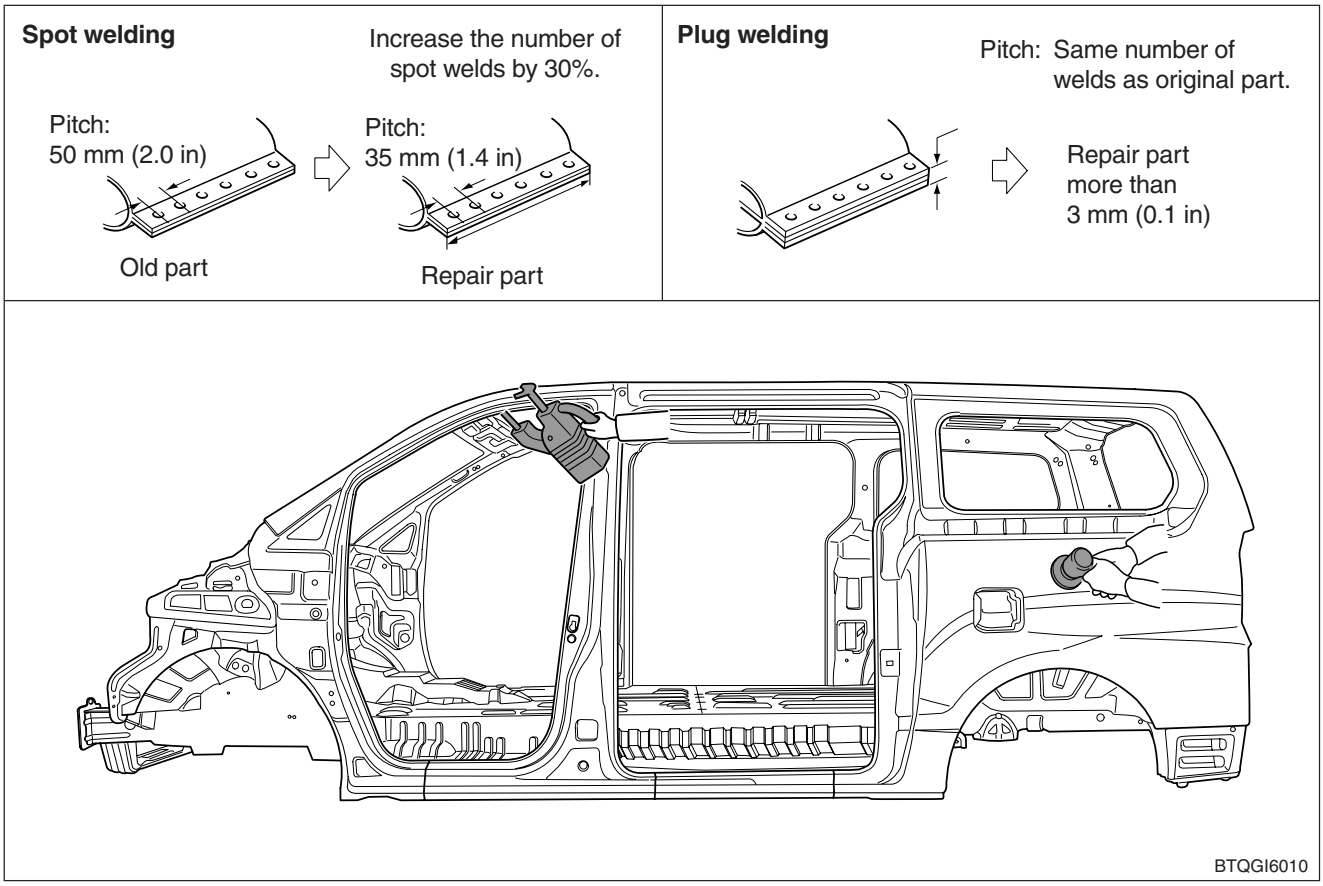
Adjusting a new part
The new part should be cut larger than the repair area, overlapping the repair area by 30~50 mm (1.2~2.0 in).



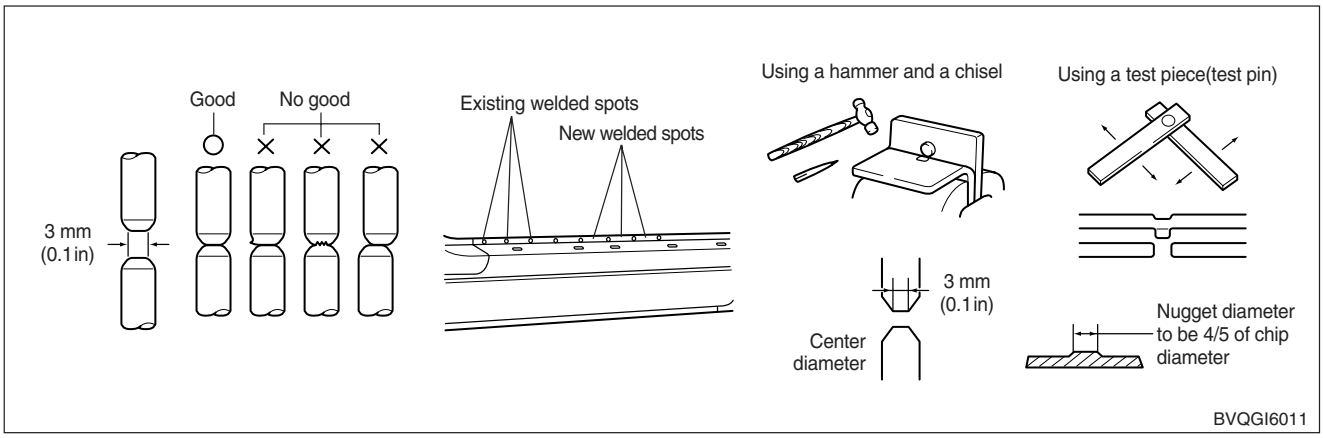
INSTALLATION

Measuring dimensions before welding
When installing a new part, assemble it according to the body dimensions given in Section BD, and start welding after checking the gaps with nearby parts.

Caution when welding
The number of welding points should be determined based on the criteria below:



Caution when spot welding
The tip of the spot welding machine should be maintained to a minimum of 3 mm (0.1 in) because it greatly affects welding strength. When possible, spot welding should be done between the existing spot welded points.
Before and after spot welding, weld a test piece(test pin) of the same material as the body panel, and check the welding strength.



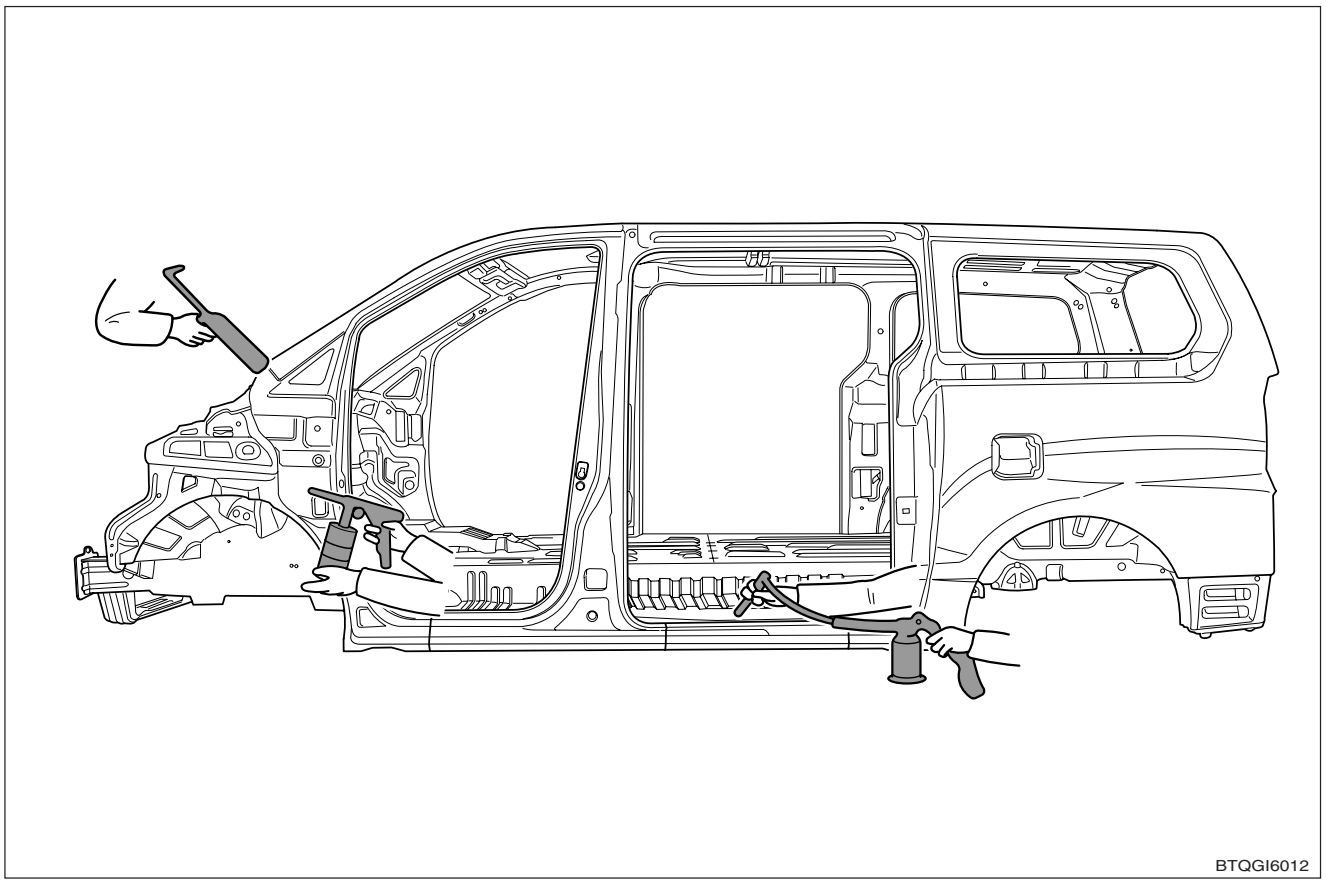
CORROSION PROTECTION AND SEALING

Proper corrosion protection and sealing is an important part of any repair. When reviewing these repair procedures, it is important to recognize the need for corrosion restoration to provide for long term strength of the repaired member.

A two part epoxy primer was applied to the metal surfaces during the latter part of the repair. For closed sections, such as front and rear rails, rocker panels and pillars, the primer is applied without applying the metal conditioner and the conversion coating. These steps are omitted to insure that no rinse water is trapped in the closed sections. The primer application in followed by an application of an oil or wax based rust proofing material.

After the corrosion restoration process for the closed sections are completed, then the process can be applied to all exterior sections. For exterior surfaces, both metal conditioner and conversion coating treatments are applied to the exterior surface prior to application of the epoxy primer. The procedure in applying the corrosion restoration process is important order to insure that moisture, due to the water rinsing of the metal conditioner and conversion coating is not inadvertently trapped inside any closed section before the epoxy primer and rust proofing materials have been applied.

Appropriate seam sealers are then applied to all joints. Follow manufacturer's recommendations for the appropriate type of seam sealer to be used at each seam or joint.



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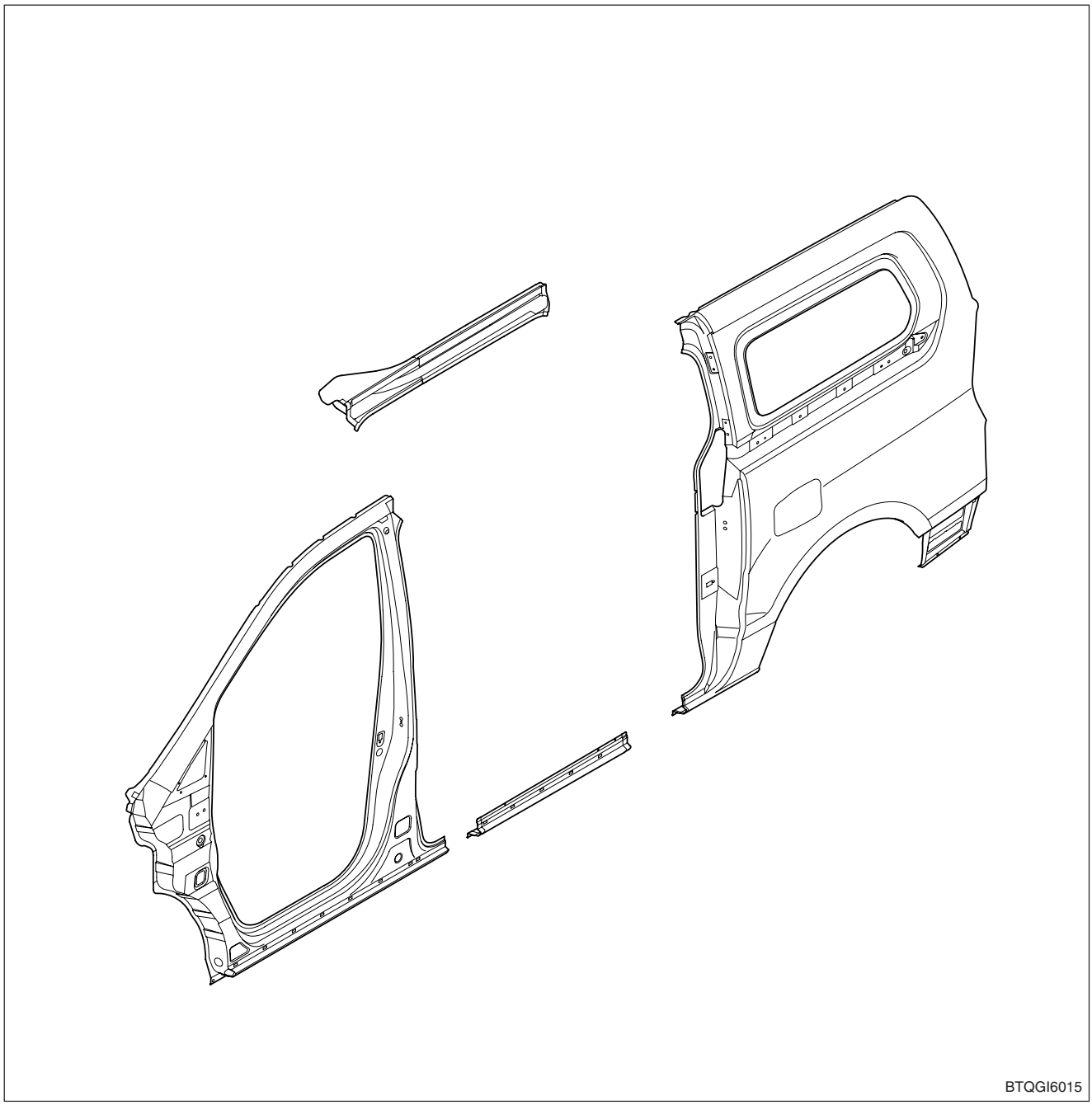
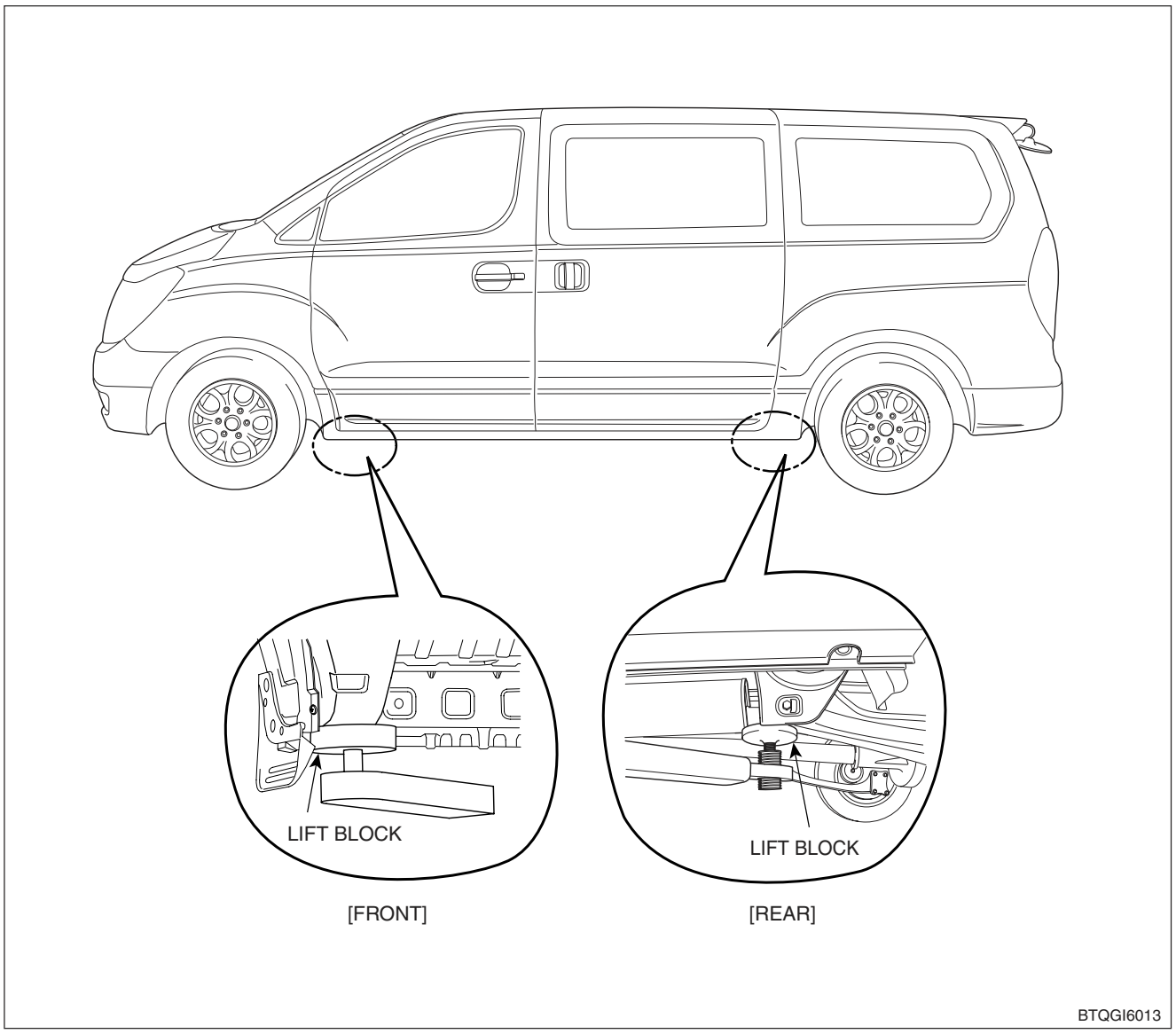
SIDE BODY PANELS

The side body panel for H-1 S is designed and stamped from a single piece of sheet metal in factory as shown in the figure. While the entire side panel is available for service, the partial panels sectioned by several damaged areas are also available. Therefore when repairing side body, refer to "Replacement parts section" of this manual to select and use the appropriate part.



VEHICLE LIFT (2-SUPPORT TYPE) AND SAFETY STAND POSITIONS

1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height to inspect the lift points for secure support.



Body Construction

FRONT SIDE MEMBER ..... BC - 2

REAR SIDE MEMBER ..... BC - 5

FENDER APRON PANEL(RH) ..... BC - 9

FENDER APRON PANEL(LH) ..... BC -11

DASH PANEL ..... BC -13

SIDE BODY PANEL ..... BC -17

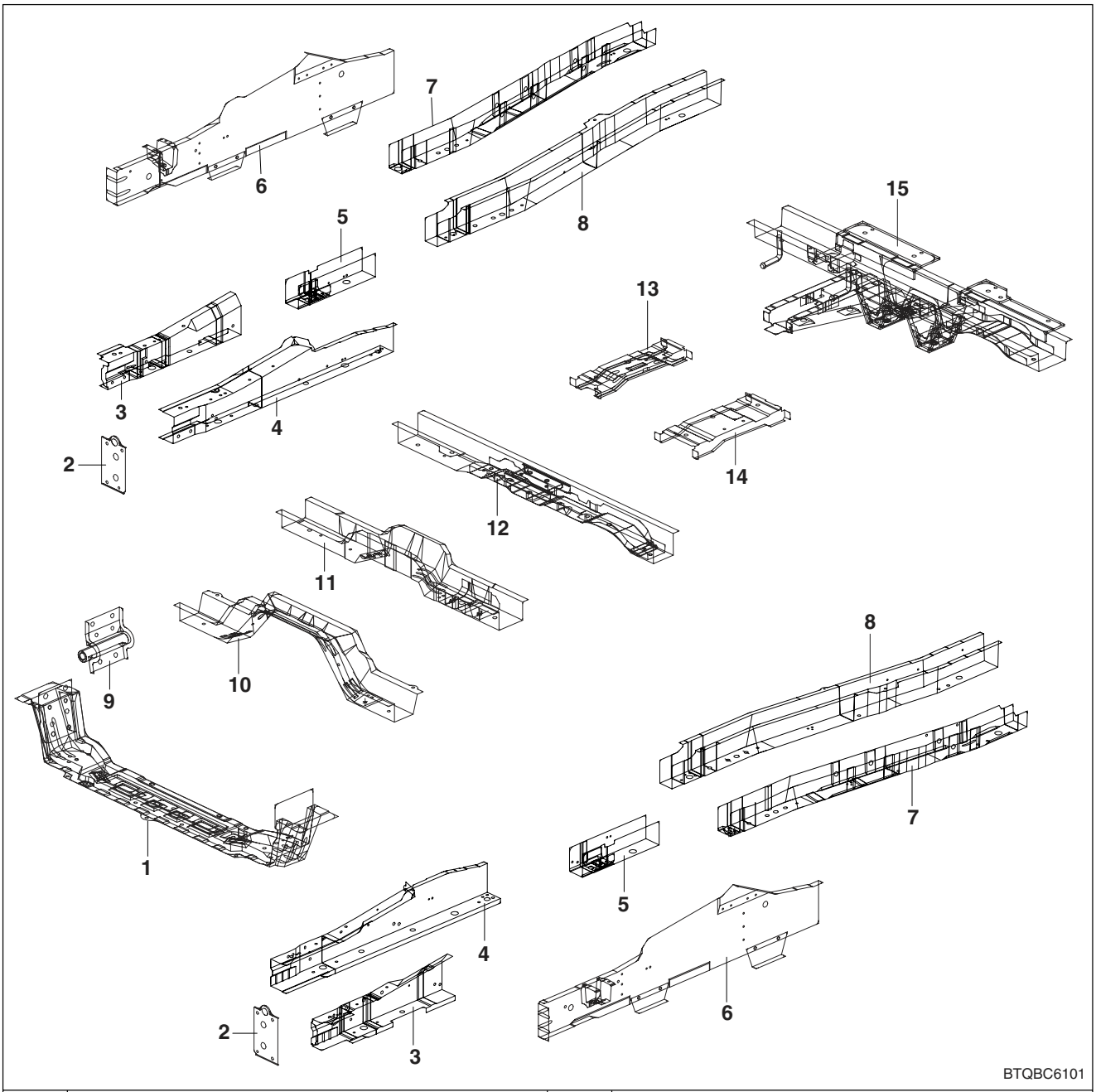
FLOOR PANEL ..... BC -20

ROOF PANEL ..... BC -24

SIDE BODY DIMENSIONS ..... BC -27

REAR BODY DIMENSIONS ..... BC -31

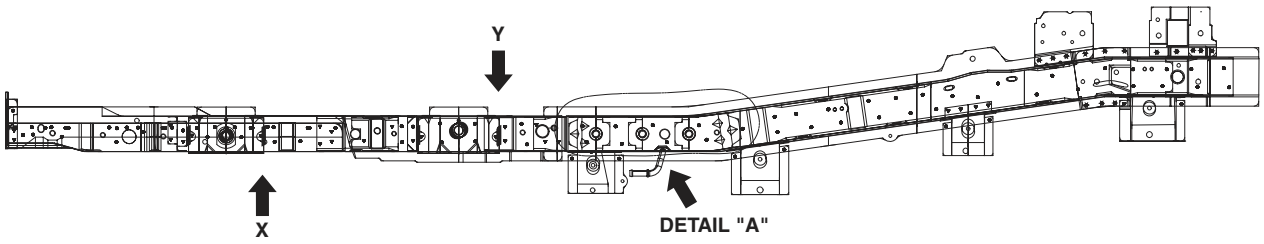
FRONT SIDE MEMBER

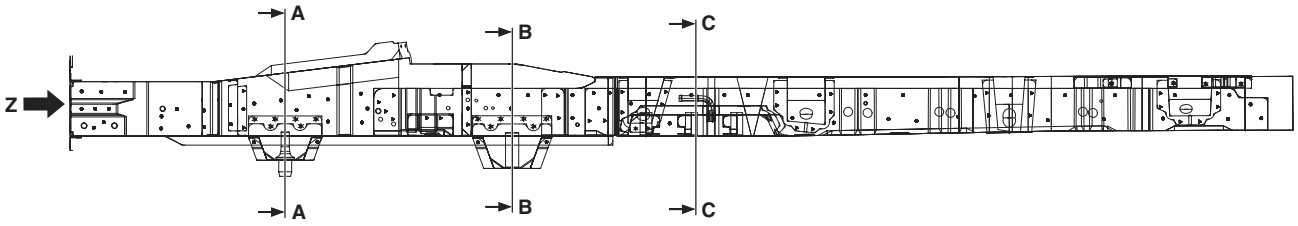


BTQBC6101

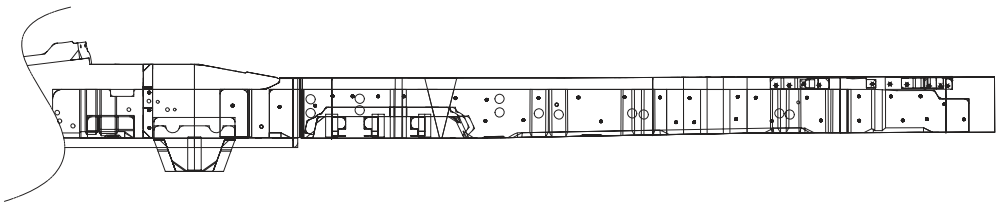
No.	PART NAME	No.	PART NAME
1	Front end cross member	9	Towing hook bracket
2	Front end module mounting bracket	10	No.1 Cross member
3	Member front side reinforcement	11	No.2 Cross member
4	Front side inner member	12	No.3 Cross member
5	Member front side reinforcement	13	Rear slide mounting member
6	Front side outer member	14	Rear slide mounting member
7	Center side member reinforcement	15	No.4 Cross member
8	Center side member		

< Cross-Sectional Views >





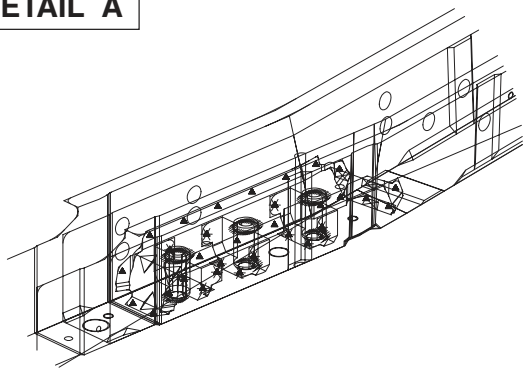
[VIEW "X"]



[VIEW "Y"]

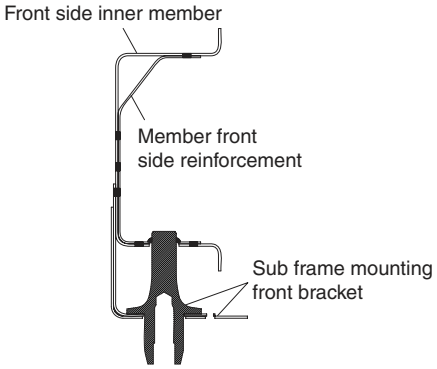
BTQBC6104

DETAIL A



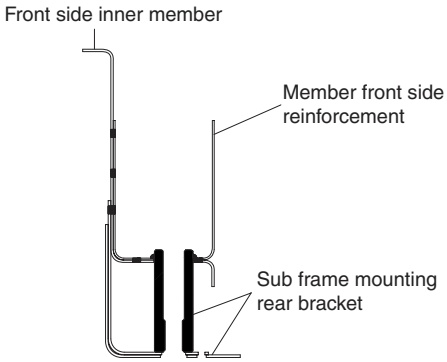
BTQBC6105

A - A



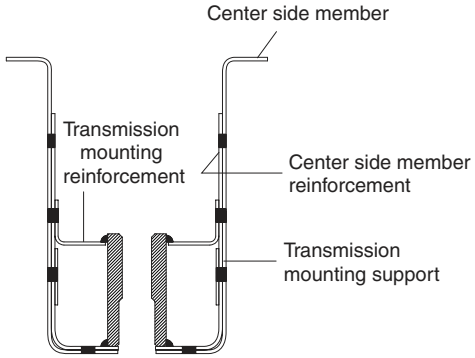
BTQBC6106

B - B



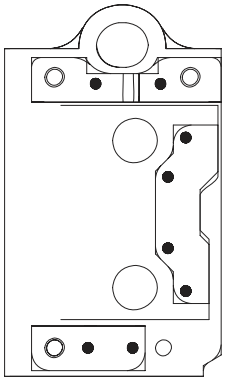
BTQBC6107

C - C



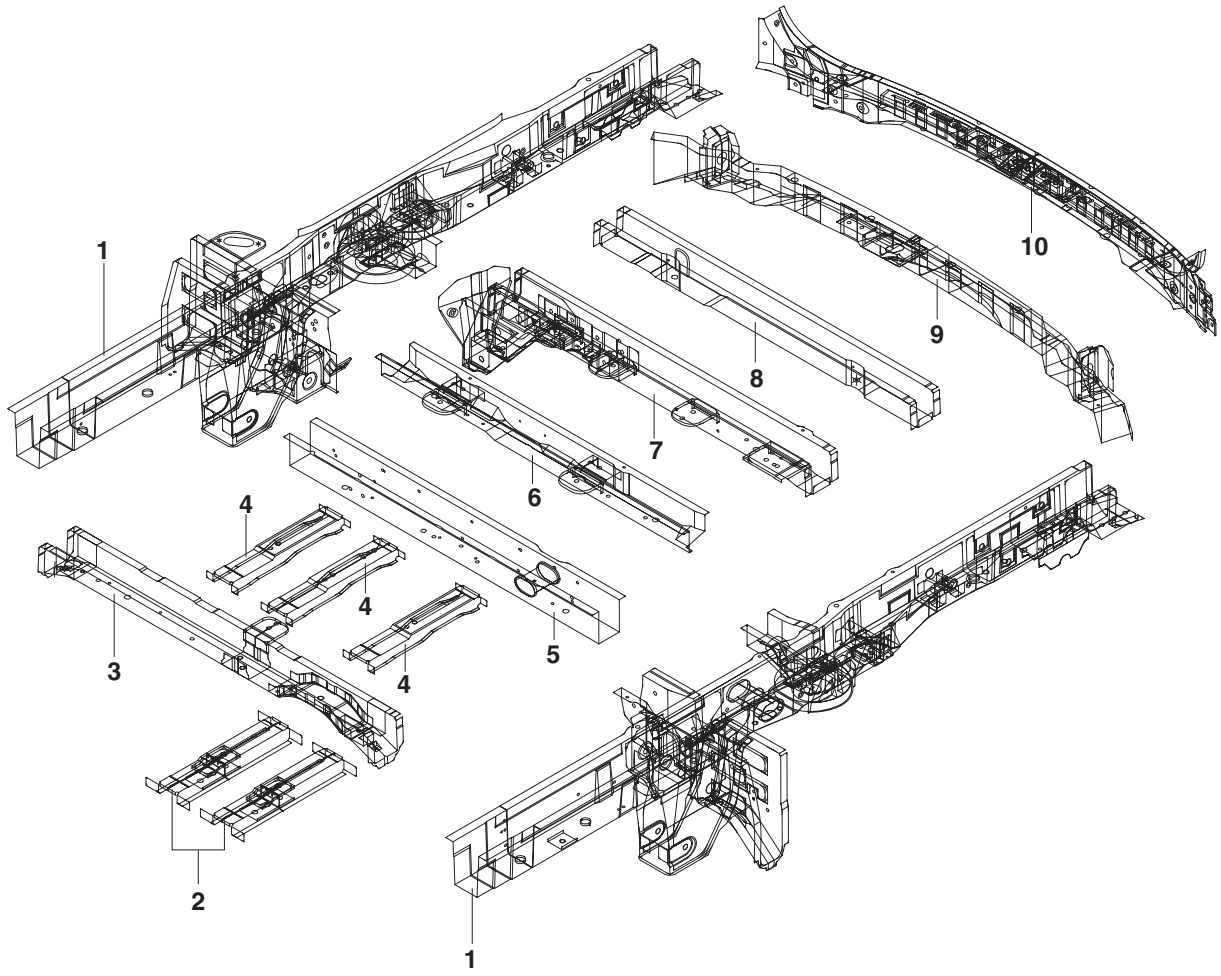
BTQBC6108

VIEW Z



BTQBC6109

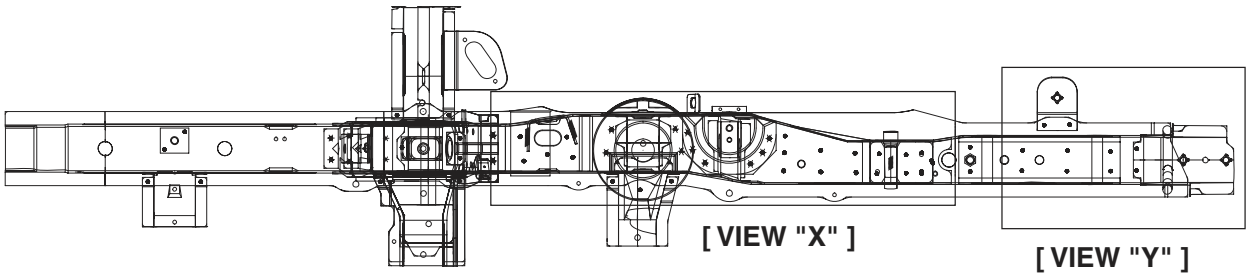
REAR SIDE MEMBER

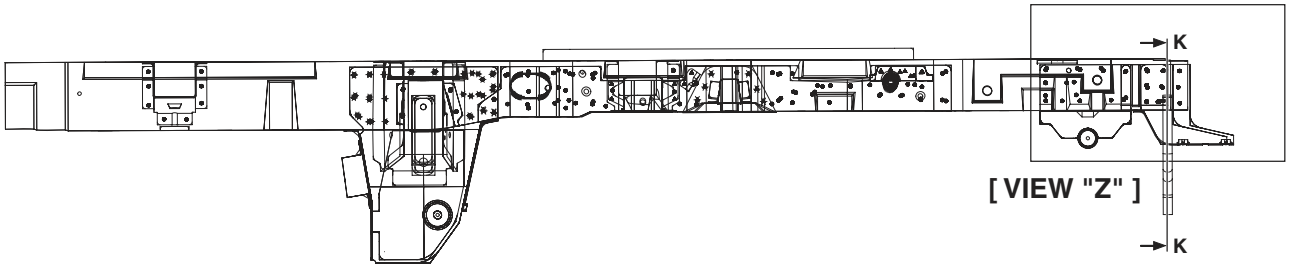


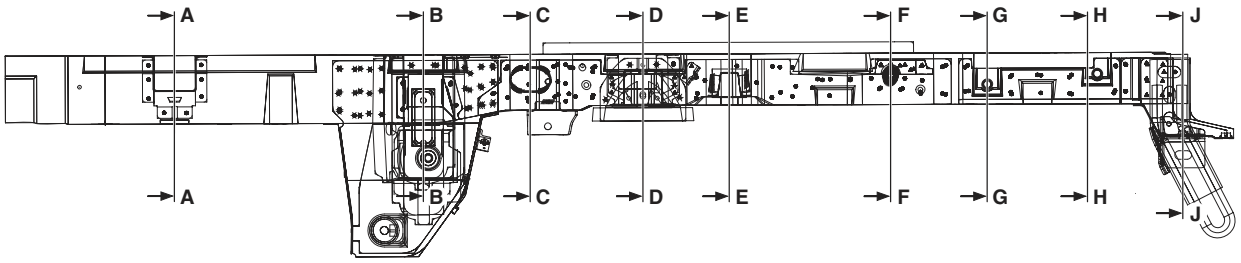
BTQBC6196

No.	PART NAME	No.	PART NAME
1	Rear side member	6	No.7 Cross member
2	Seat anchor reinforcement	7	No.8 Cross member
3	No.5 Cross member	8	No.9 Cross member
4	Seat anchor reinforcement	9	Rear end cross inner member
5	No.6 Cross member	10	Rear end cross outer upper member

< Cross-Sectional Views >

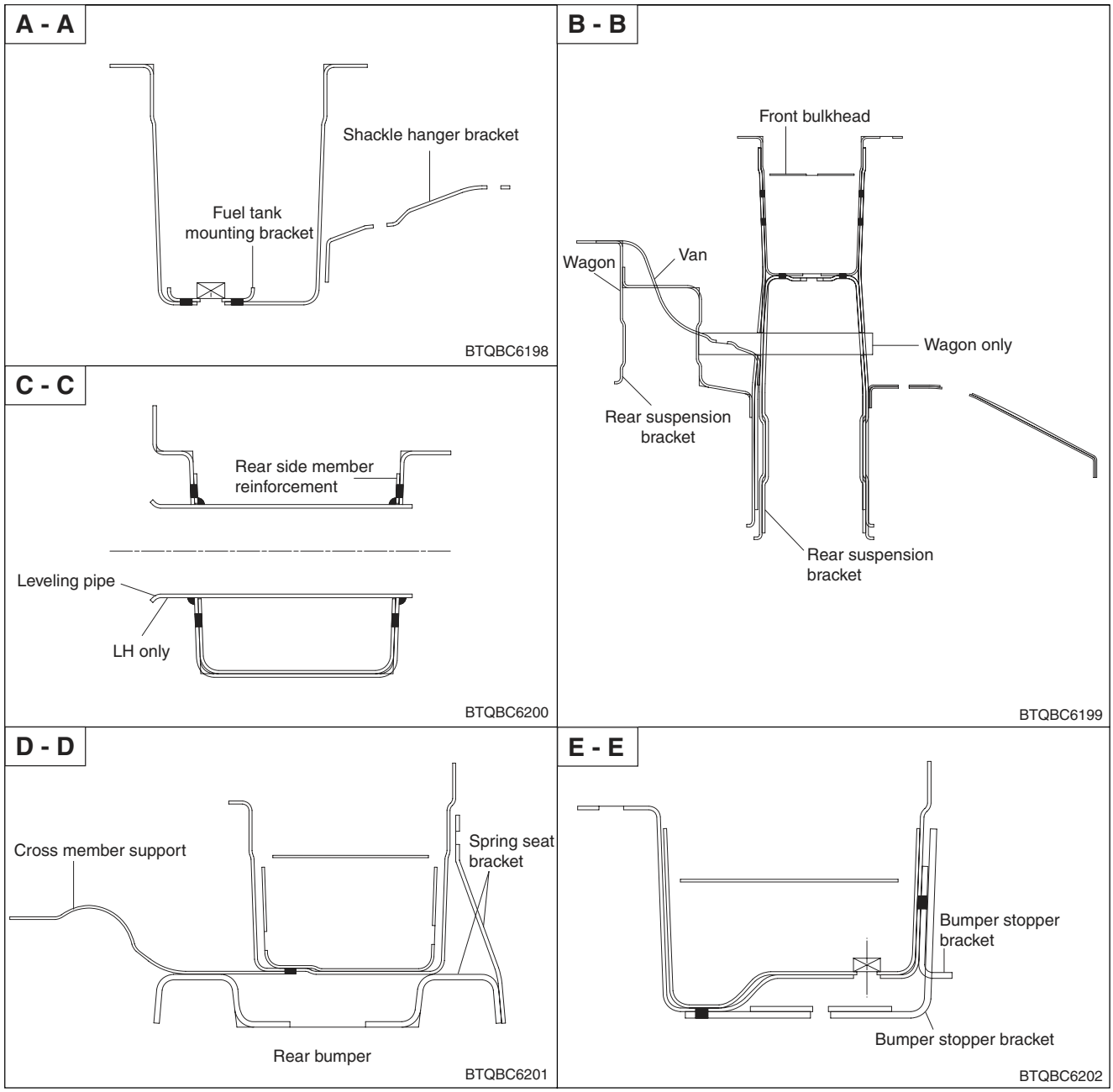




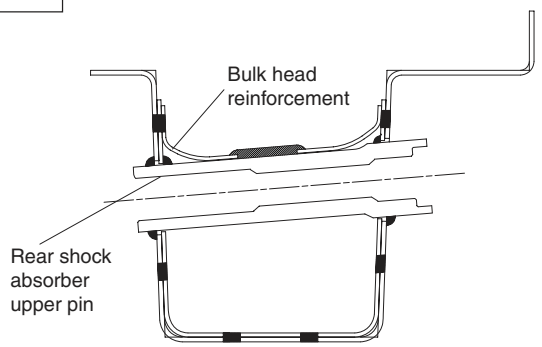


[Wagon]

BTQBC6197

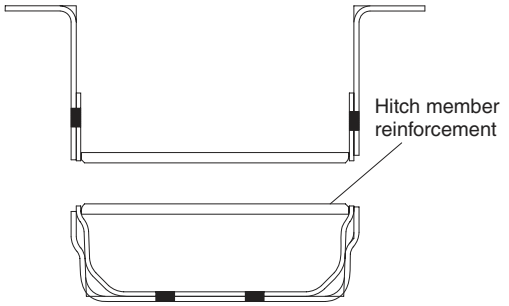

A - A
Shackle hanger bracket
Fuel tank
mounting bracket
BTQBC6198
B - B
Front bulkhead
Wagon
Van
Wagon only
Rear suspension
bracket
Rear suspension
bracket
BTQBC6199
C - C
Rear side member
reinforcement
Leveling pipe
LH only
BTQBC6200
D - D
Cross member support
Spring seat
bracket
Rear bumper
BTQBC6201
E - E
Bumper stopper
bracket
Bumper stopper bracket
BTQBC6202

F - F



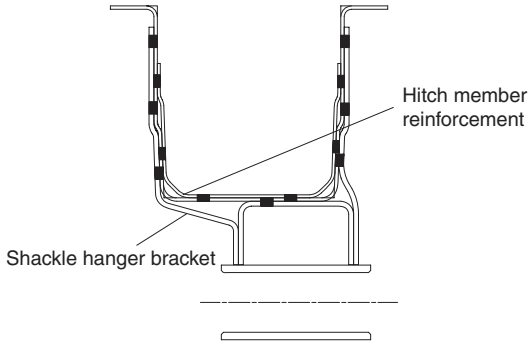
BTQBC6169

G - G



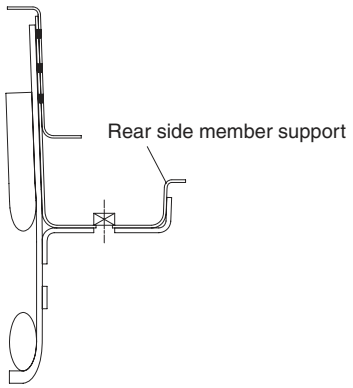
BTQBC6170

H - H



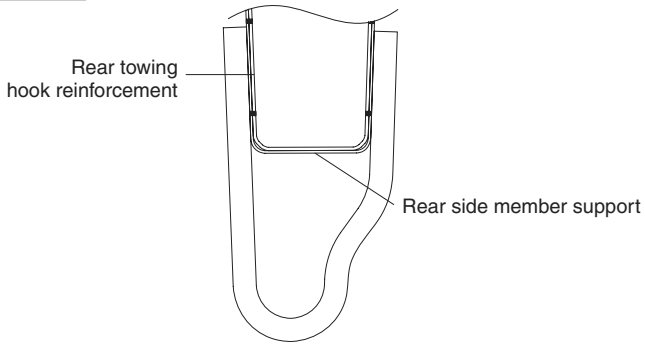
BTQBC6171

J -J



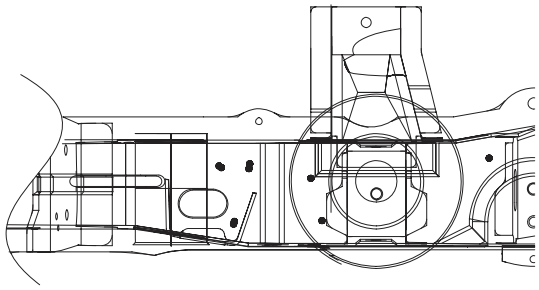
BTQBC6172

K - K



BTQBC6173

X



BTQBC6174

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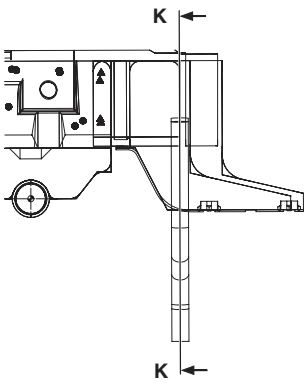

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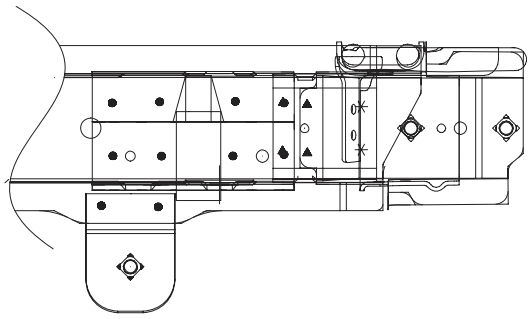
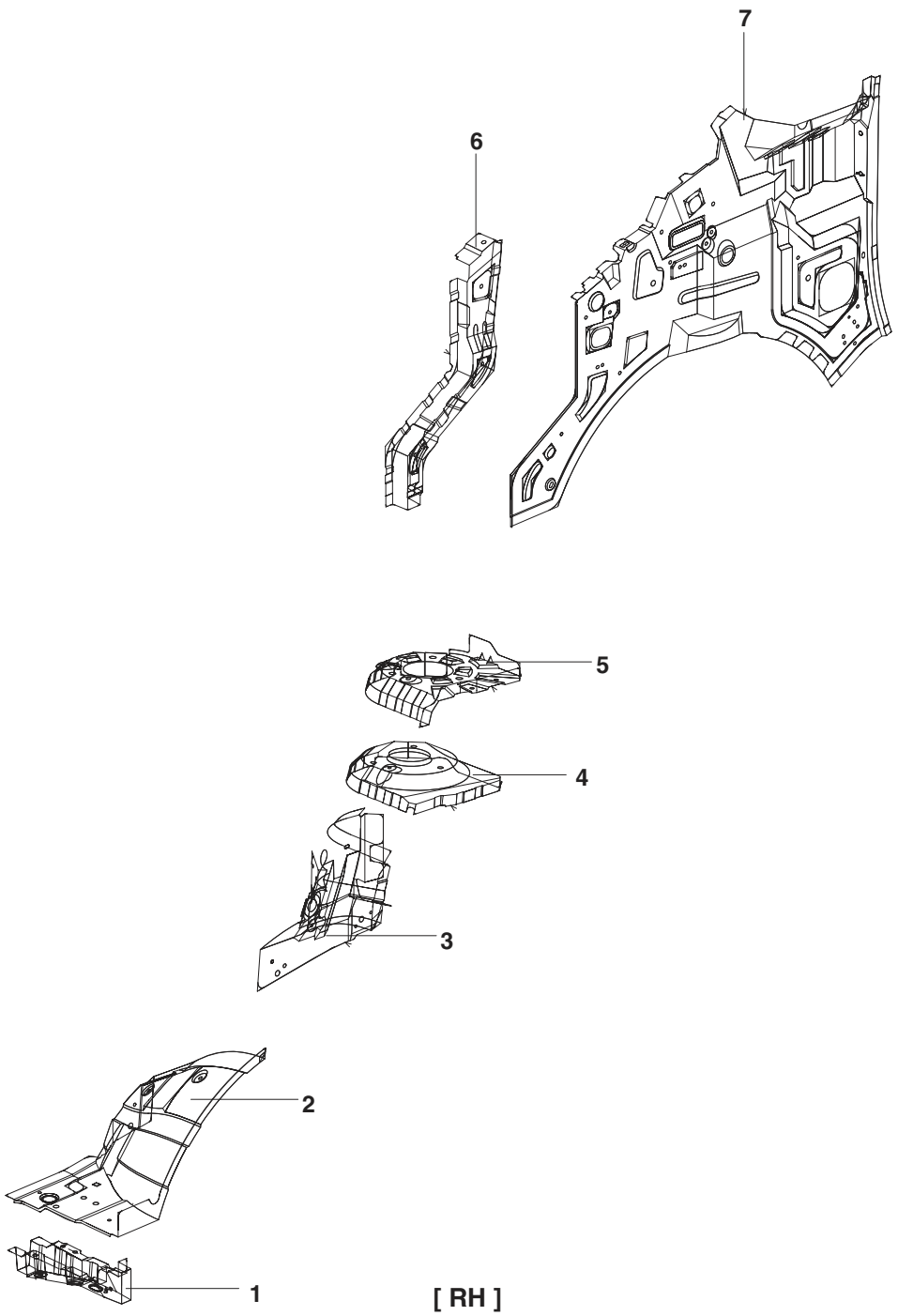
Z



BTQBC6176

FENDER APRON PANEL (RH)

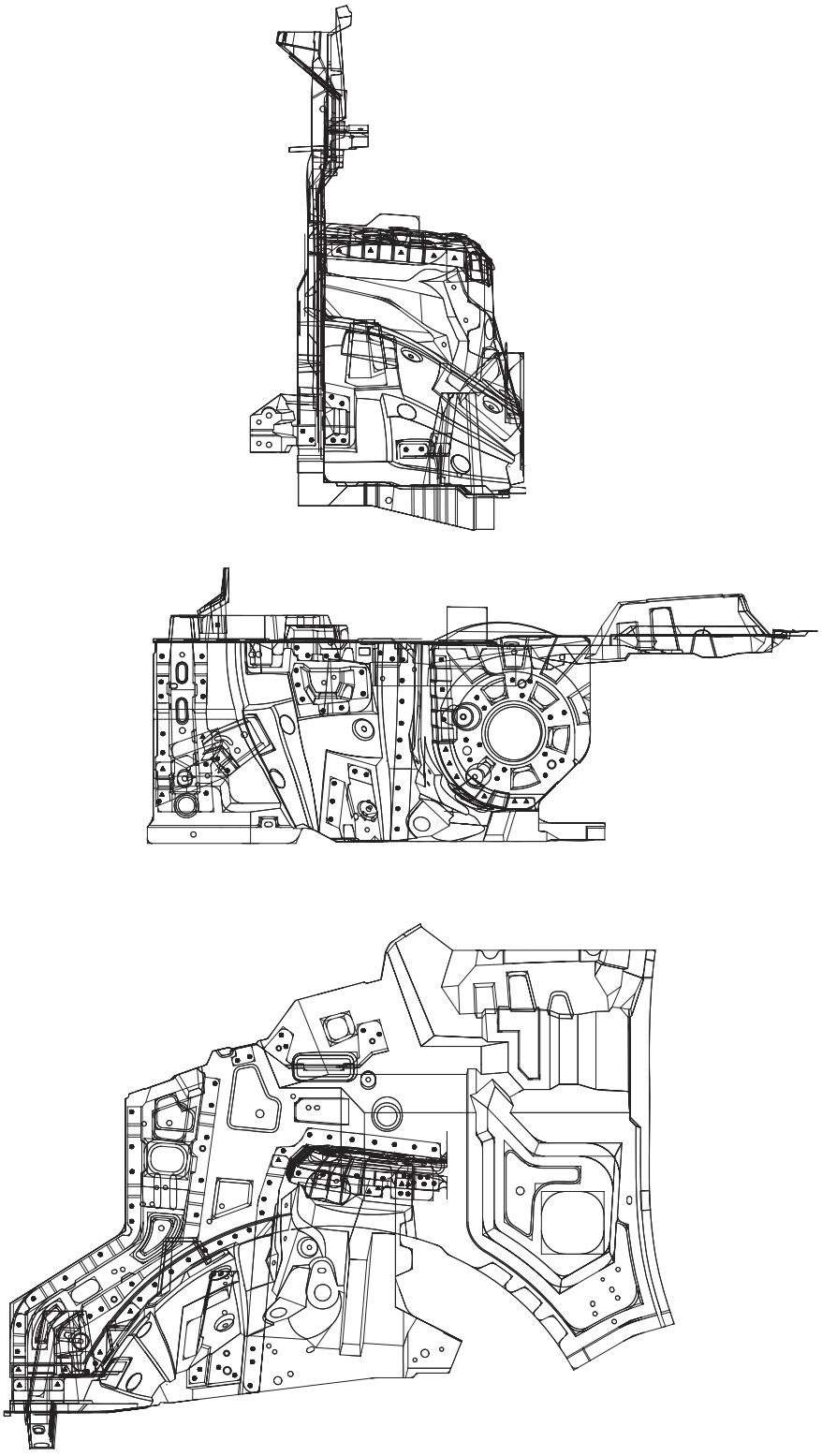


[RH]

BTQBC6111

No.	PART NAME	No.	PART NAME
1	Front wheel housing support	5	Shock absorber housing reinforcement
2	Front wheel housing panel	6	Fender apron inner support
3	Shock absorber housing panel	7	Fender apron inner panel
4	Shock absorber housing cover		

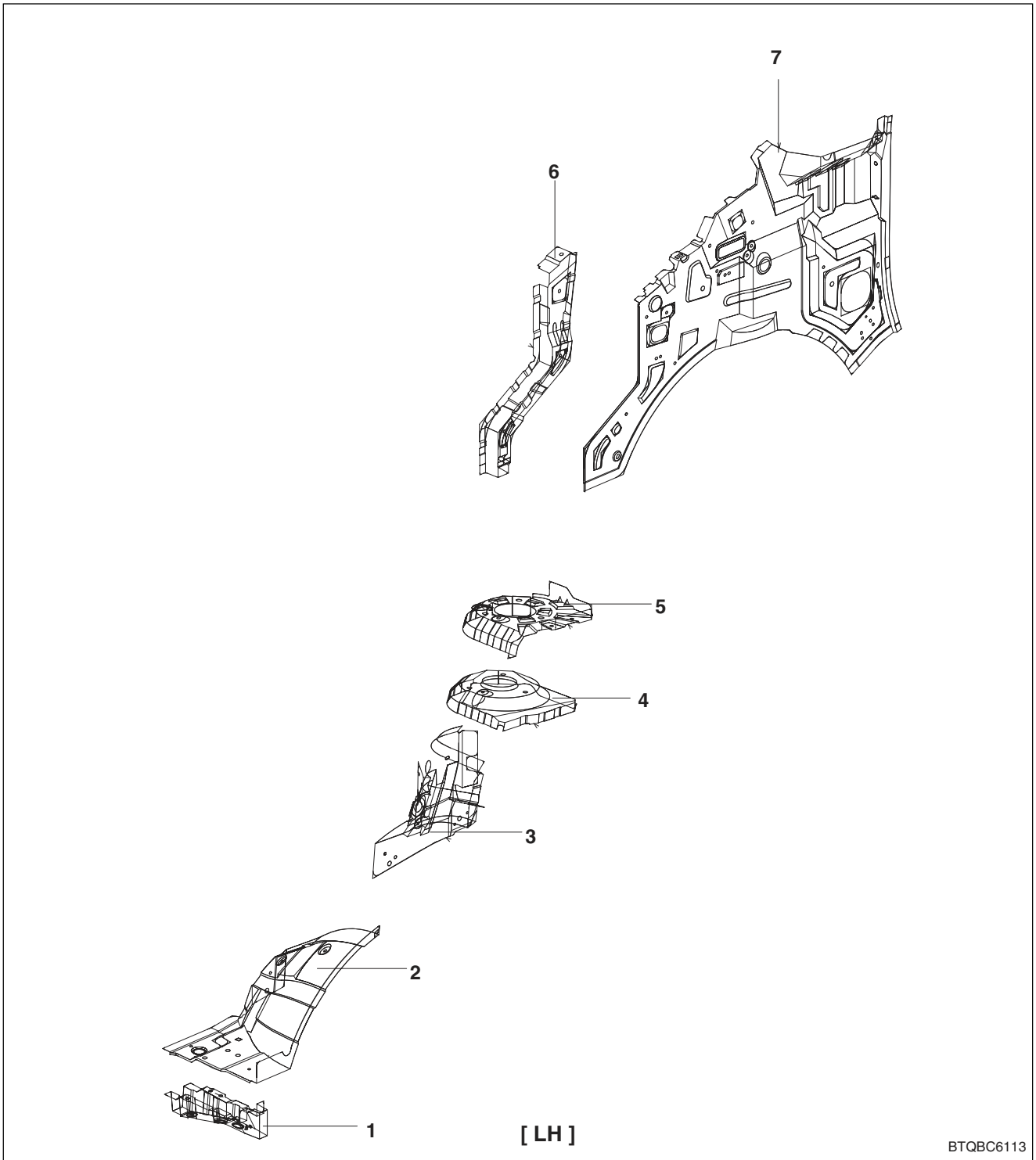
< Cross-Sectional Views >



[VIEW RH]

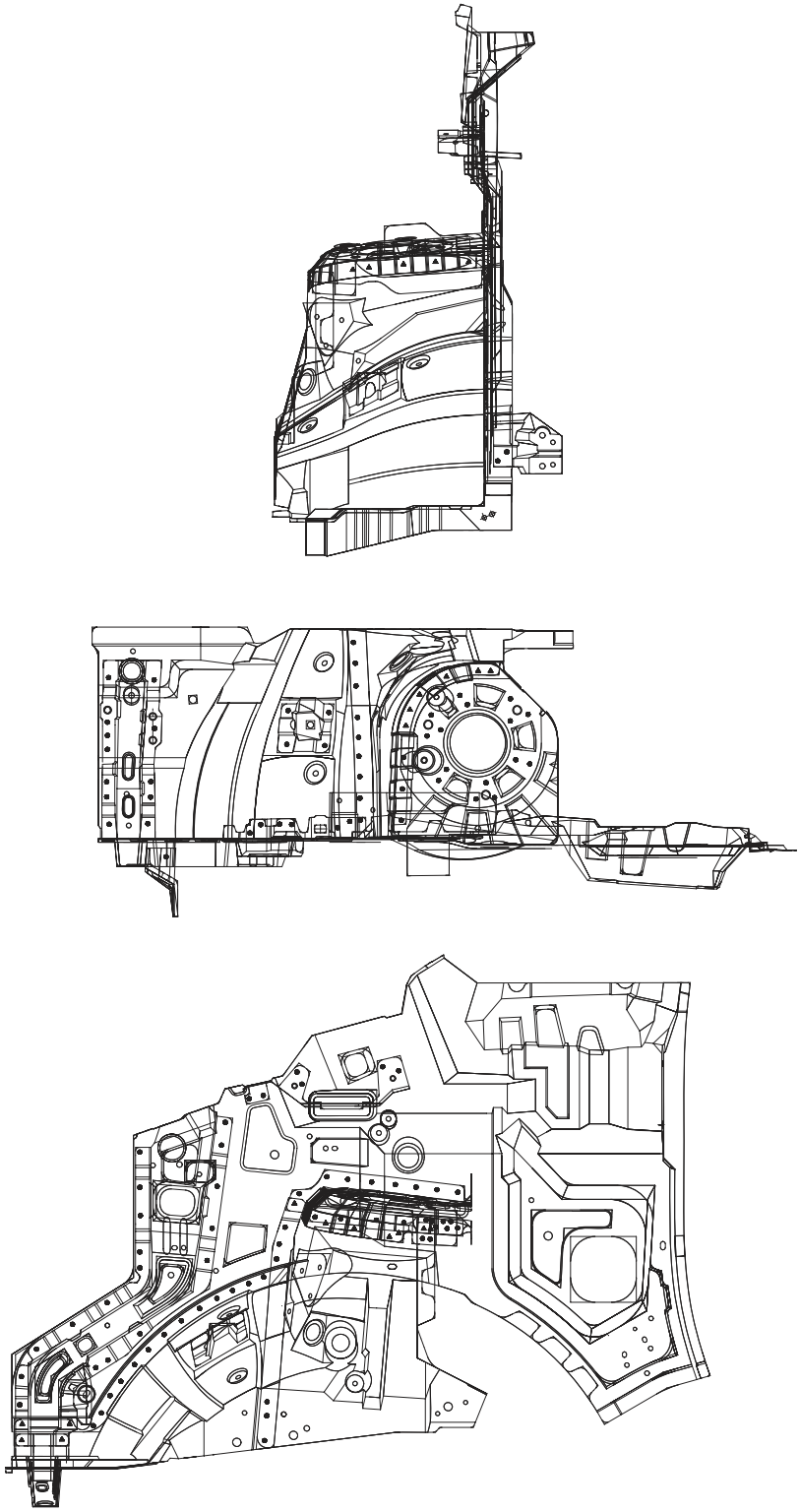
BTQBC6112

FENDER APRON PANEL (LH)



No.	PART NAME	No.	PART NAME
1	Front wheel housing support	5	Shock absorber housing reinforcement
2	Front wheel housing panel	6	Fender apron inner support
3	Shock absorber housing panel	7	Fender apron inner panel
4	Shock absorber housing cover		

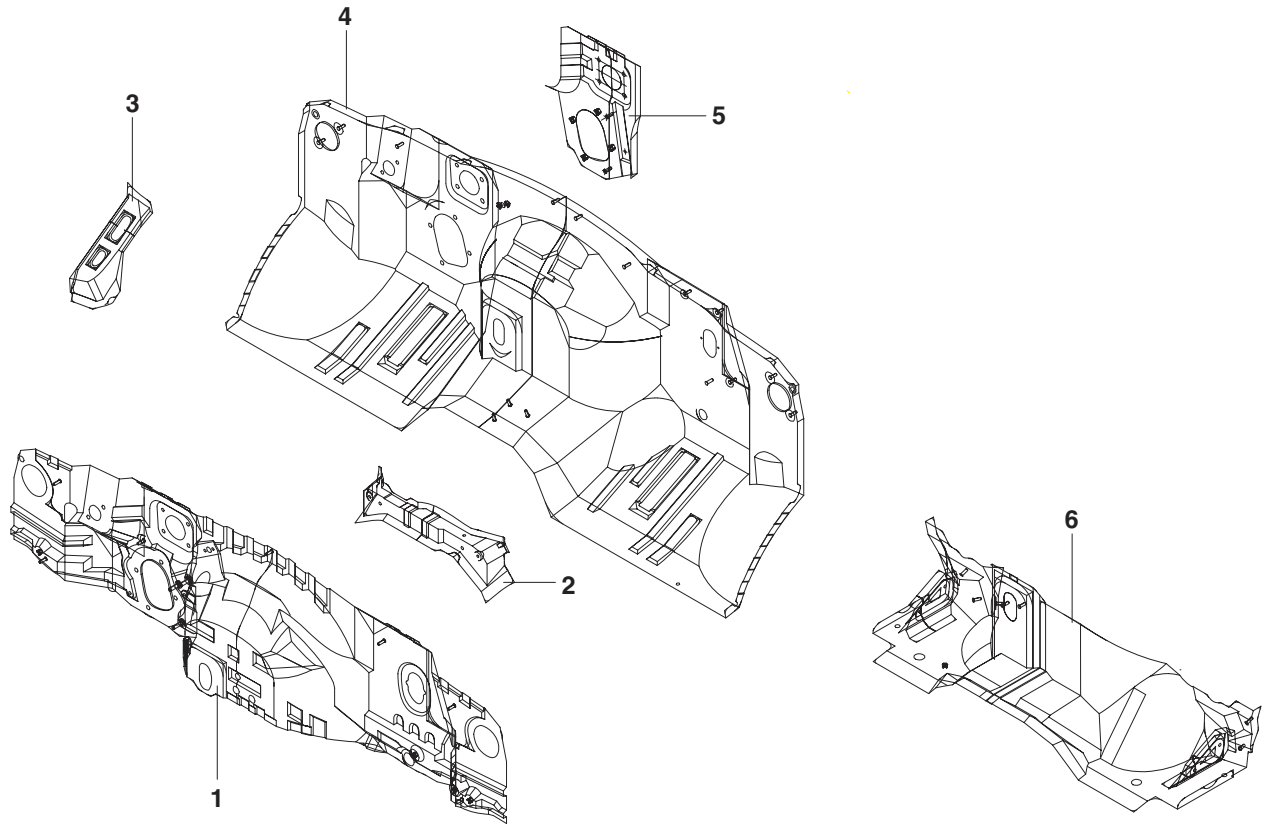
< Cross-Sectional Views >



[VIEW LH]

BTQBC6115

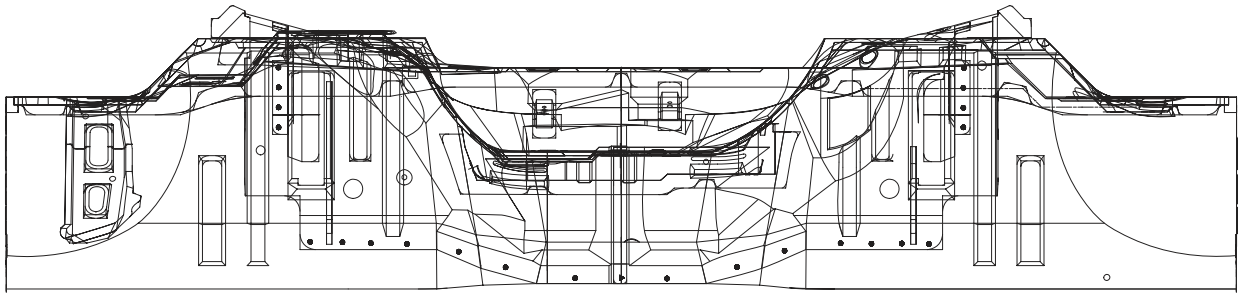
DASH PANEL

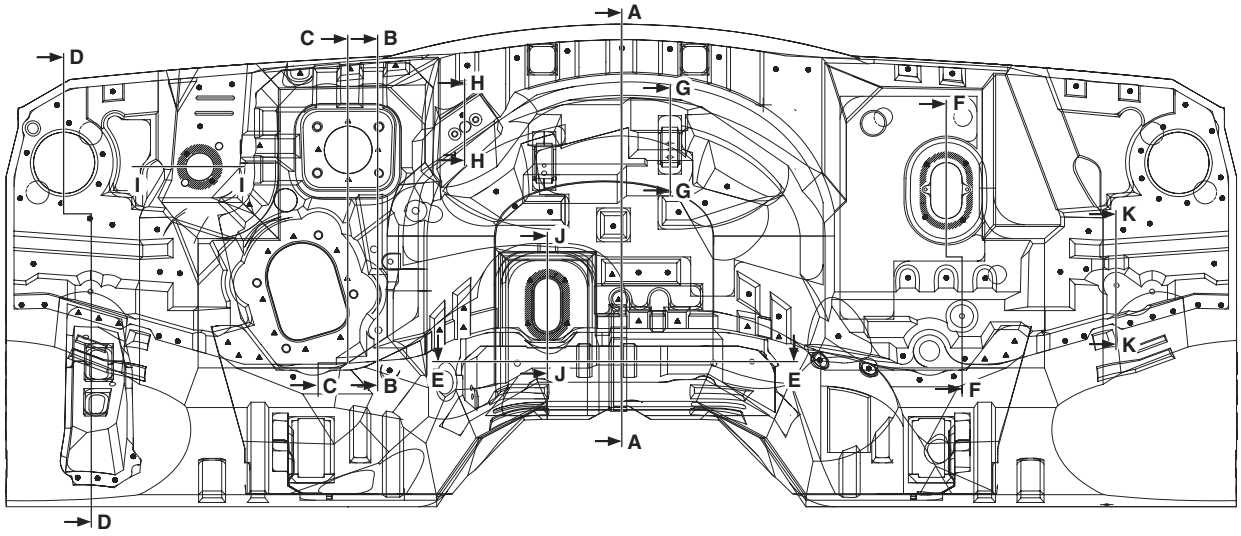


BTQBC6116

No.	PART NAME	No.	PART NAME
1	Dash panel reinforcement	4	Dash panel
2	Heater mounting bracket	5	Brake booster mounting reinforcement
3	Foot rest bracket	6	Dash lower member

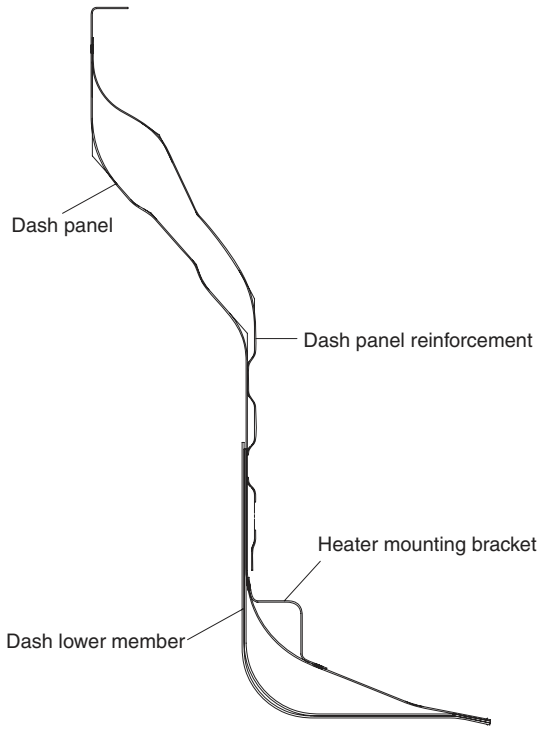
< Cross-Sectional Views >





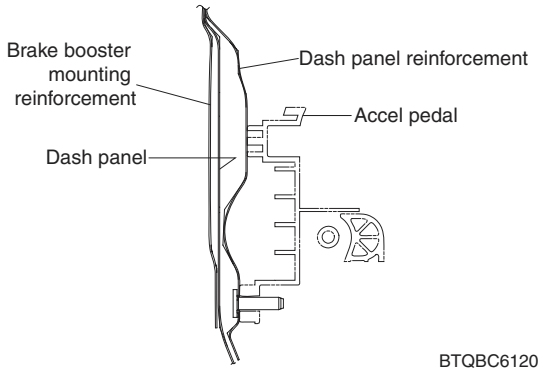
BTQBC6118

A - A



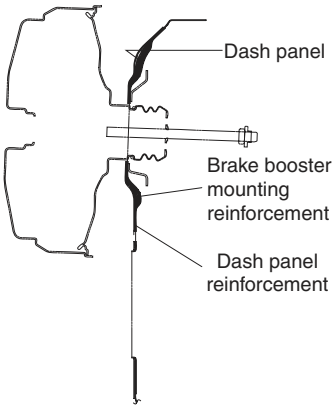
BTQBC6119

B - B



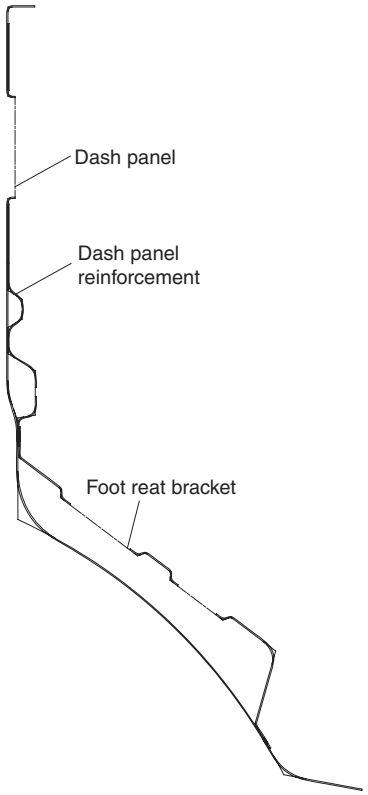
BTQBC6120

C - C



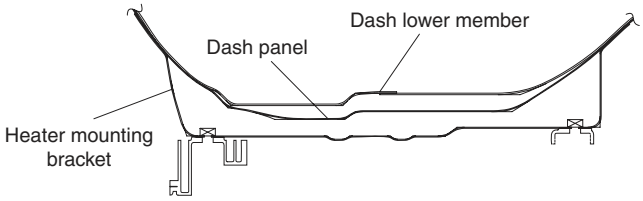
BTQBC6121

D - D



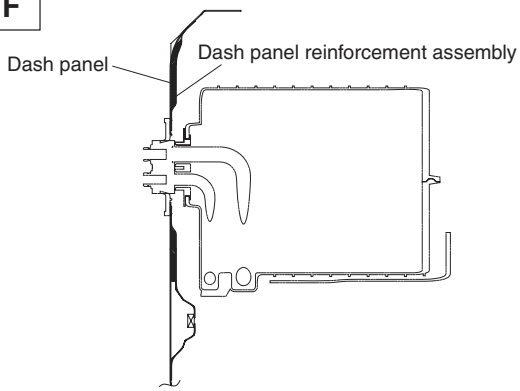
BTQBC6122

E - E

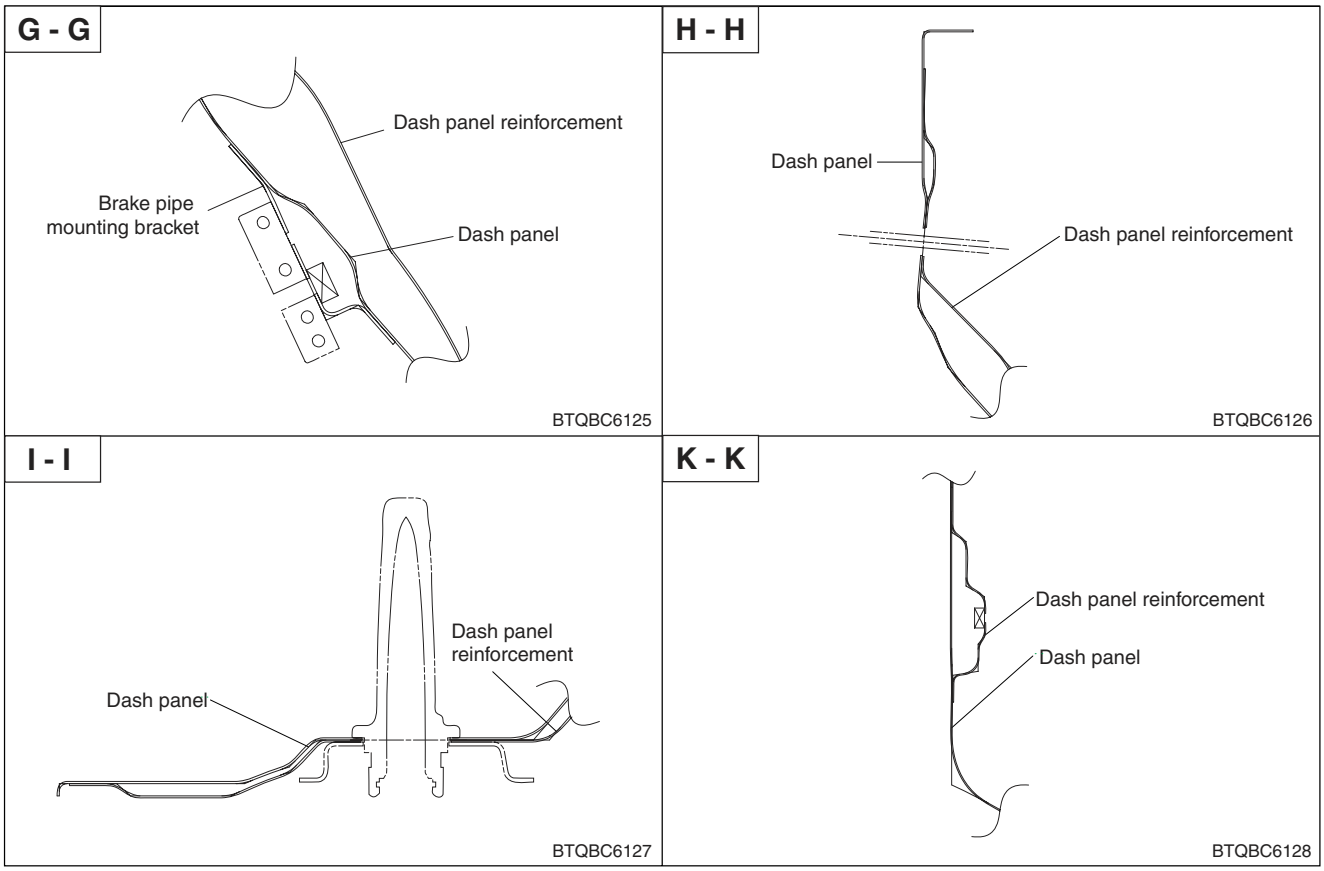


BTQBC6123

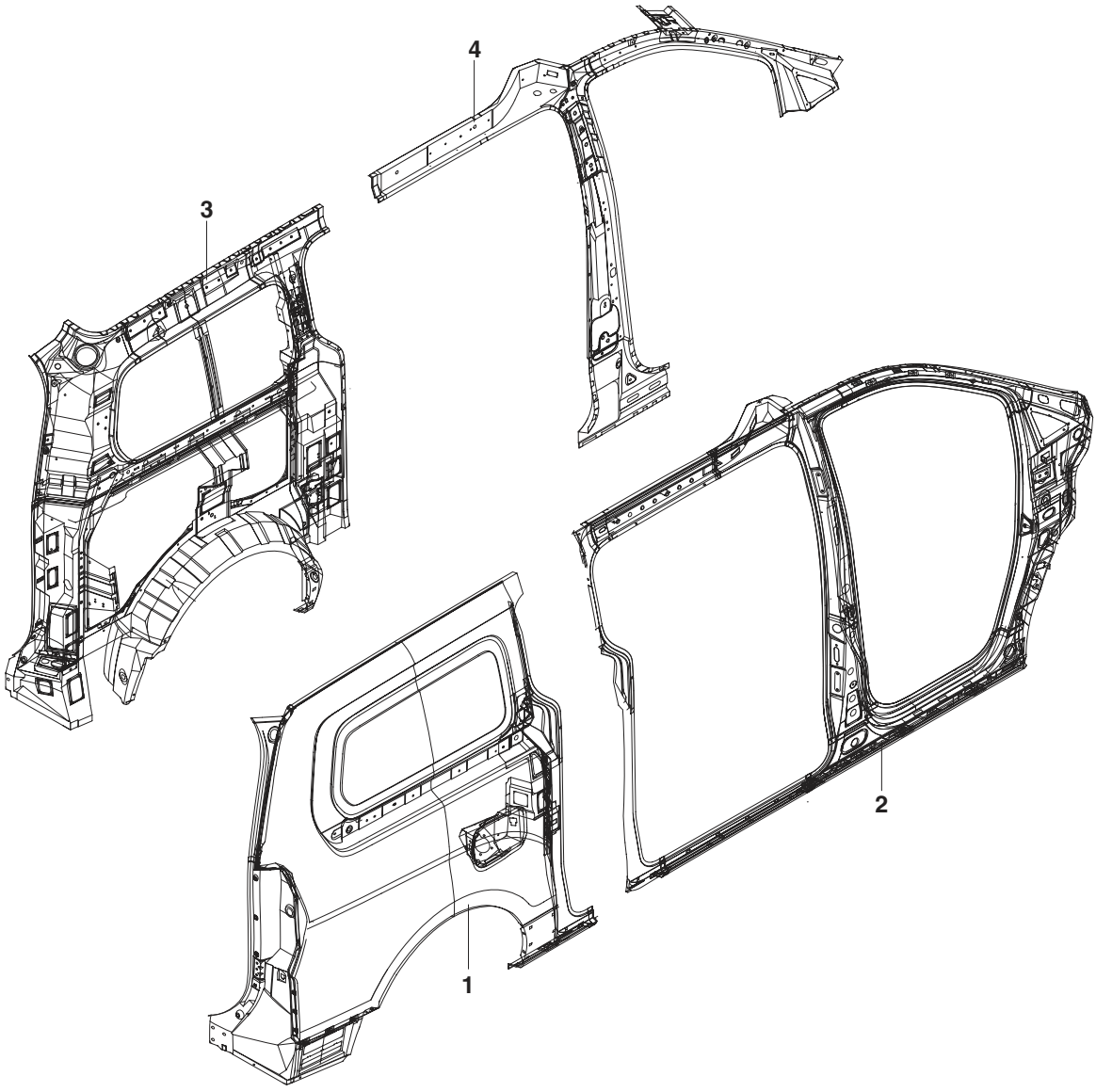
F - F



BTQBC6124


G - G
Dash panel reinforcement
Brake pipe
mounting bracket
Dash panel
BTQBC6125
H - H
Dash panel
Dash panel reinforcement
BTQBC6126
I - I
Dash panel
reinforcement
Dash panel
BTQBC6127
K - K
Dash panel reinforcement
Dash panel
BTQBC6128

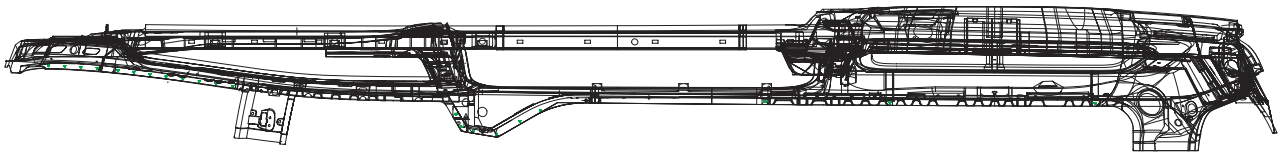
SIDE BODY PANEL

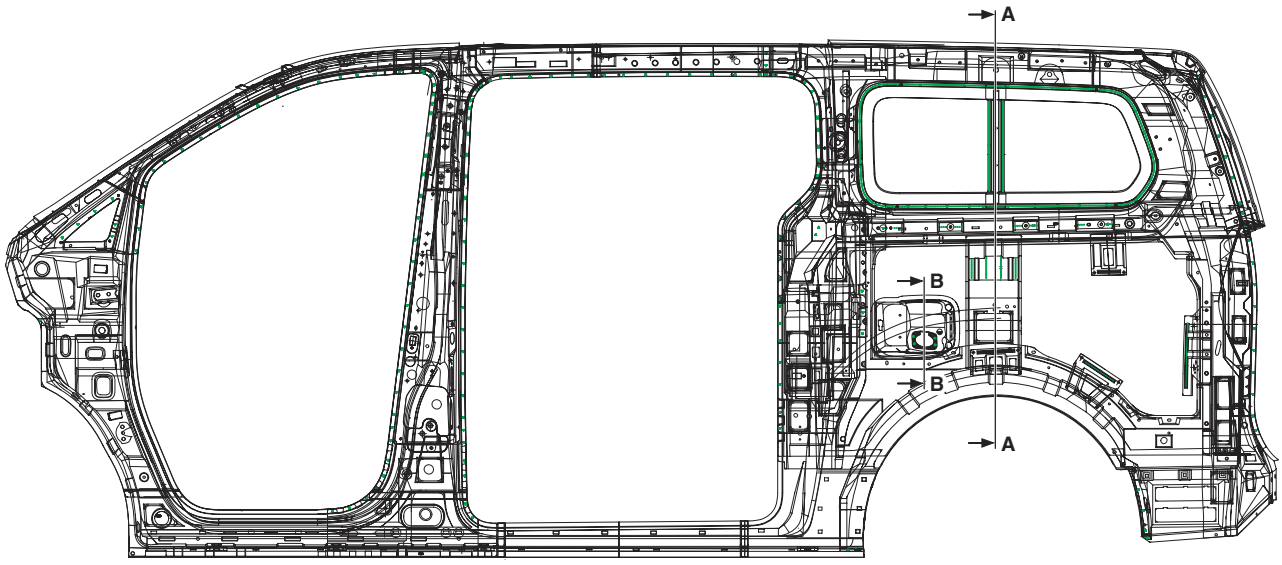


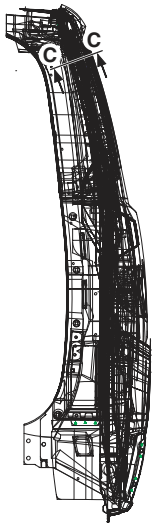
BTQBC6129

No.	PART NAME	No.	PART NAME
1	Quarter outer panel	3	Quarter inner panel
2	Side outer panel	4	Side inner panel

< Cross-Sectional Views >

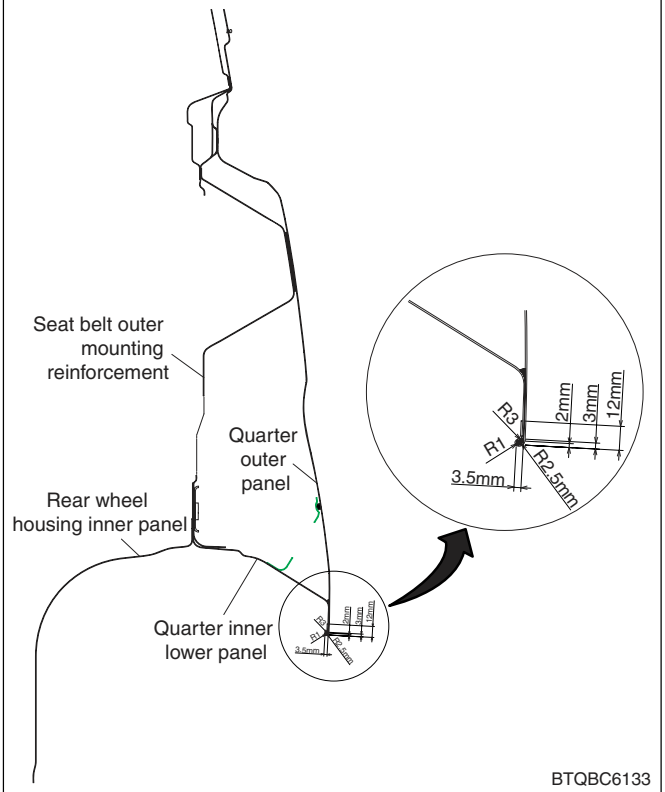






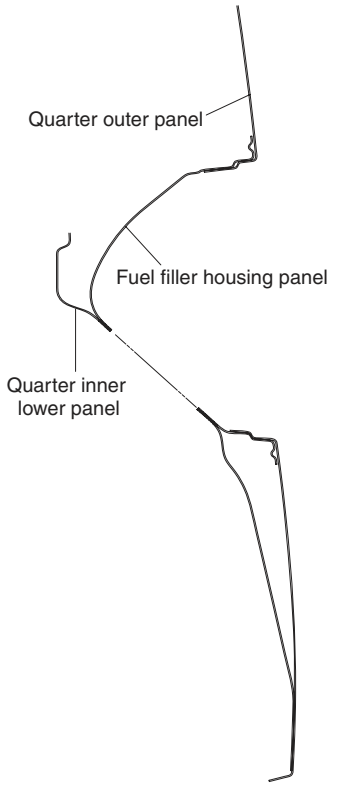
BTQBC6132

A - A



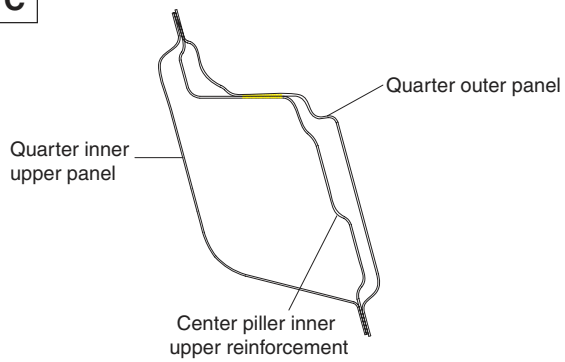
BTQBC6133

B - B



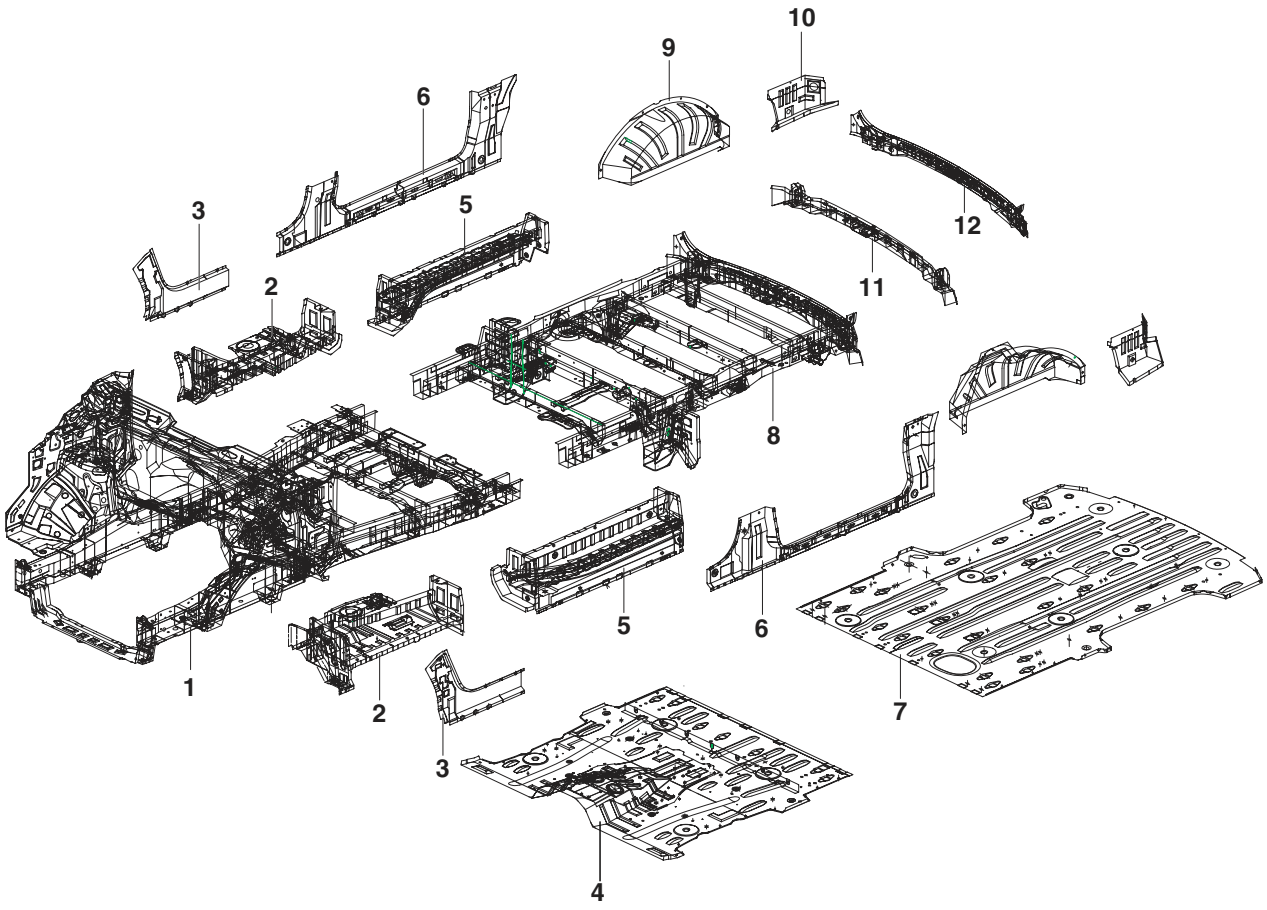
BTQBC6134

C - C



BTQBC6135

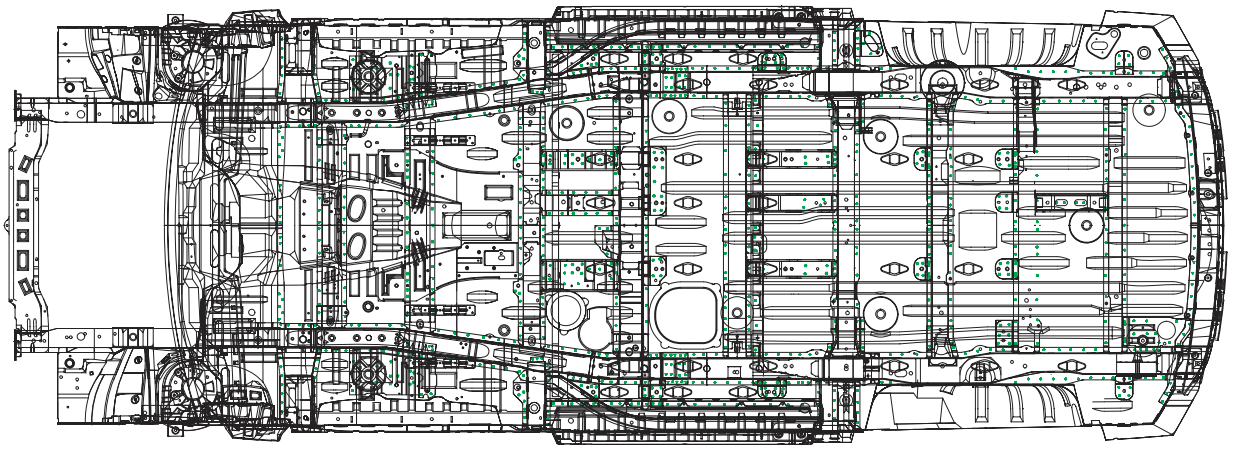
FLOOR PANEL

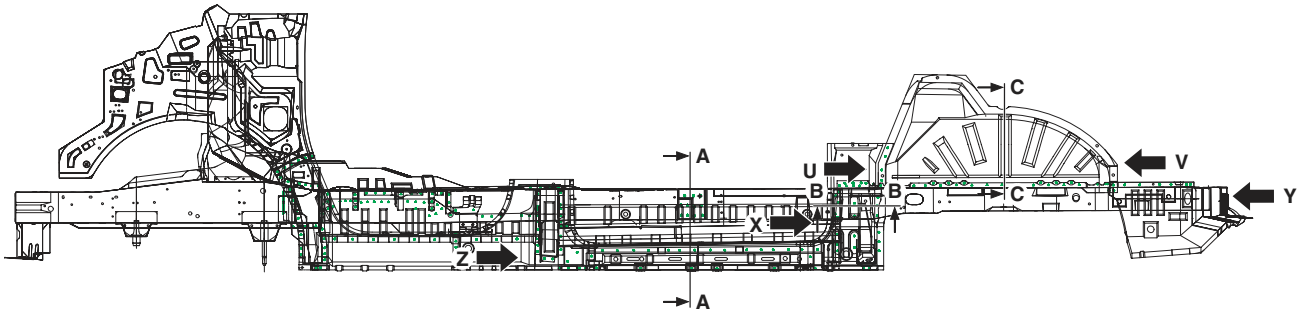


BFDBC6136

No.	PART NAME	No.	PART NAME
1	Front frame	7	Rear floor panel
2	Front step panel	8	Rear frame
3	Front side sil inner panel	9	Rear wheel housing inner panel
4	Center floor panel	10	Quarter inner lower rear panel
5	Rear step panel	11	Rear end cross inner member
6	Quarter inner lower panel	12	Rear end cross outer upper member

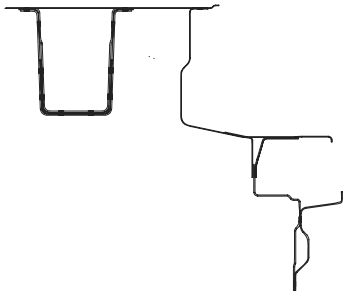
< Cross-Sectional Views >





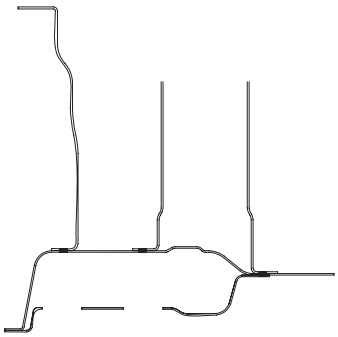
BTQBC6138

A - A



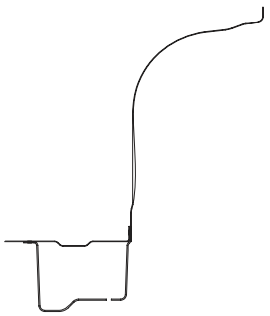
BTQBC6139

B - B



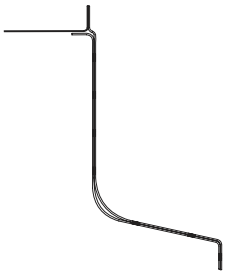
BTQBC6140

C - C



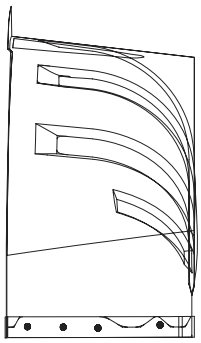
BTQBC6141

D - D



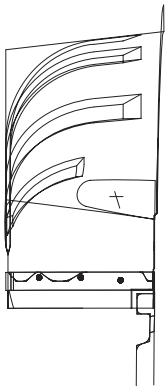
BTQBC6142

U



BTQBC6143

V



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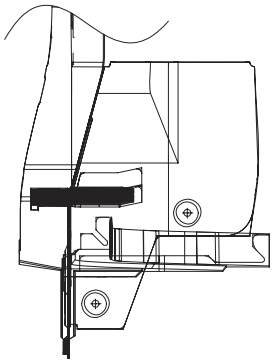

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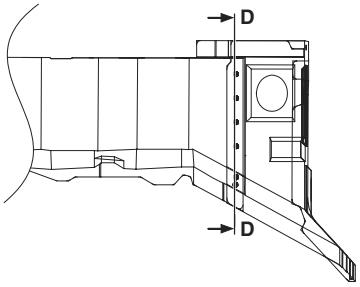

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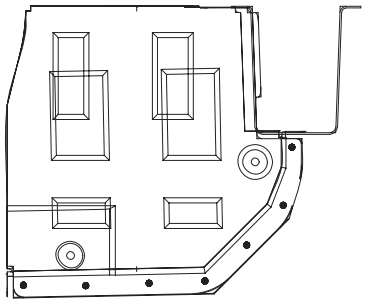

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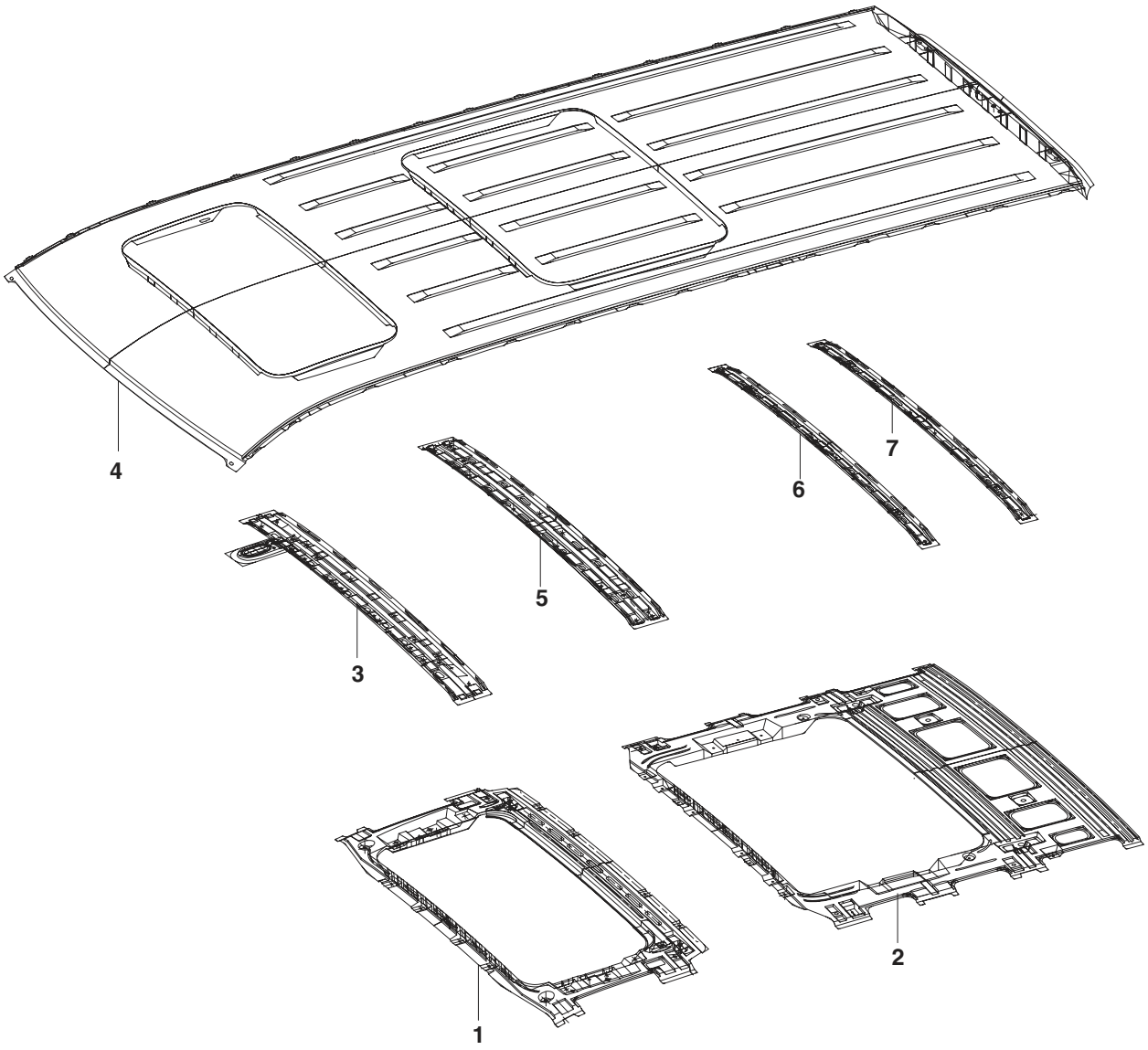
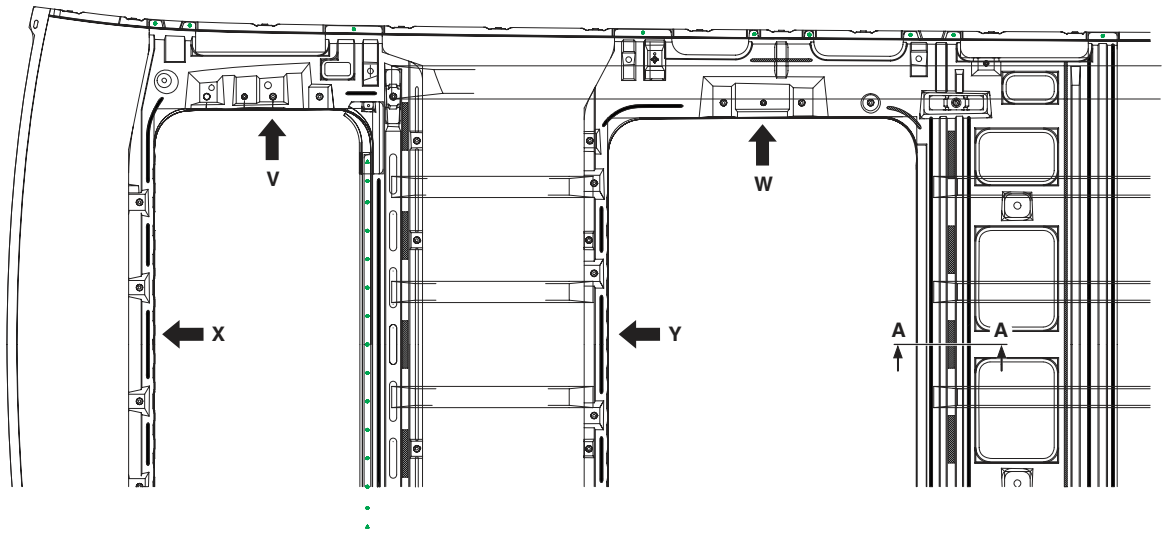
ROOF PANEL



BTQBC6148

No.	PART NAME	No.	PART NAME
1	Sunroof front reinforcement	5	Roof B bow
2	Sunroof rear reinforcement	6	Roof D bow
3	Roof A bow	7	Roof E bow
4	Roof panel		

< Cross-Sectional Views >



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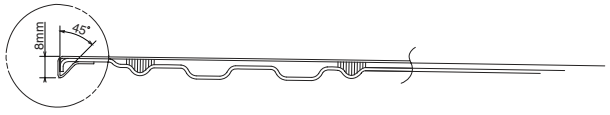
BTQBC6153

A - A



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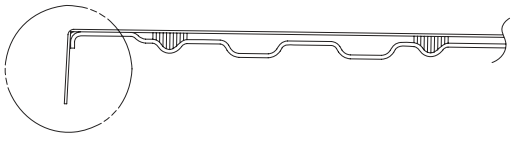

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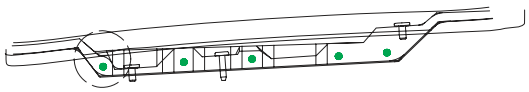

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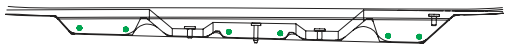

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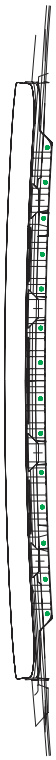

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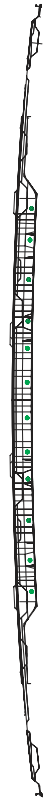
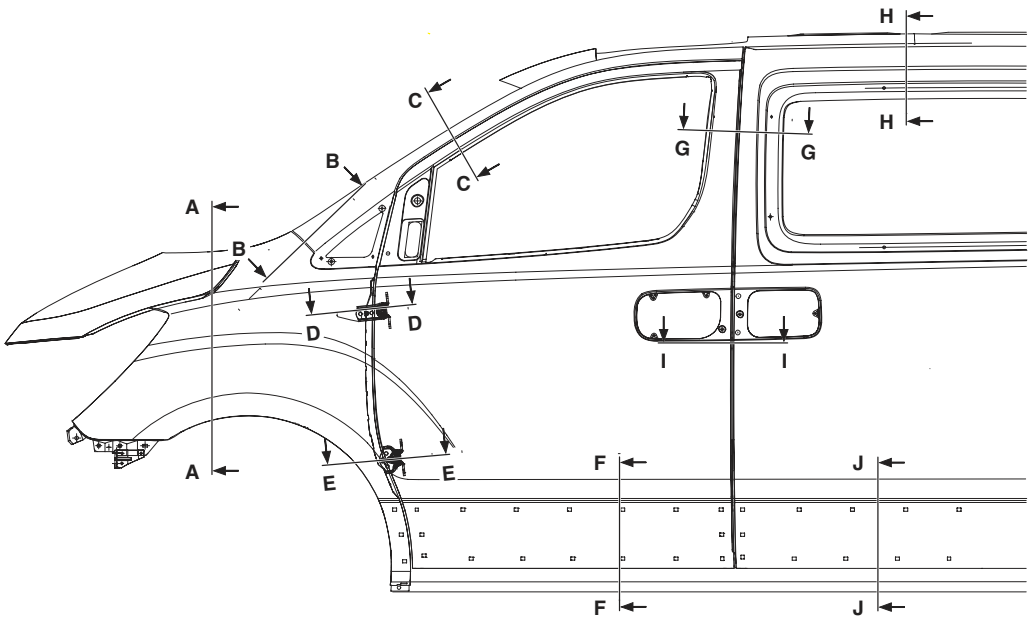
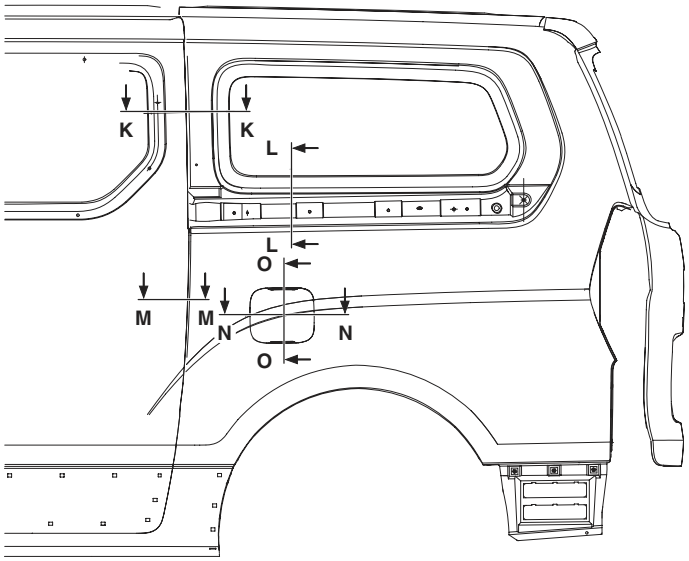


BTQBC6159

SIDE BODY DIMENSIONS

< Cross-Sectional Views >





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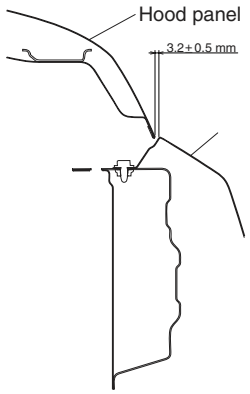

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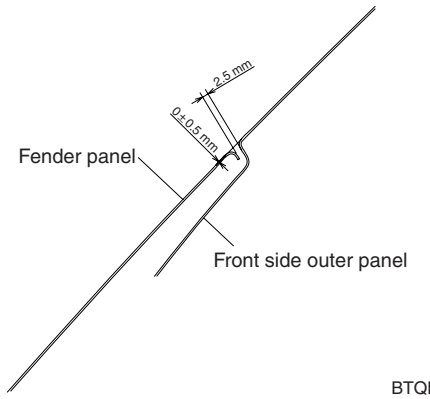

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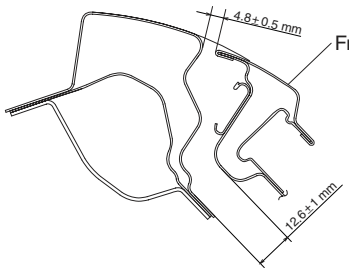

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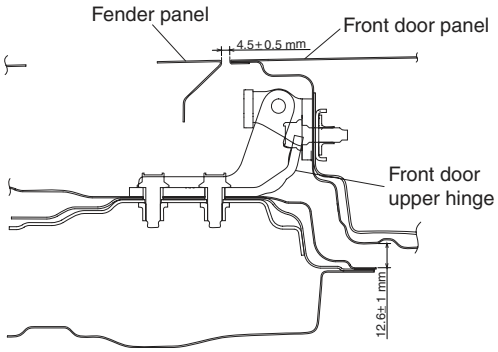

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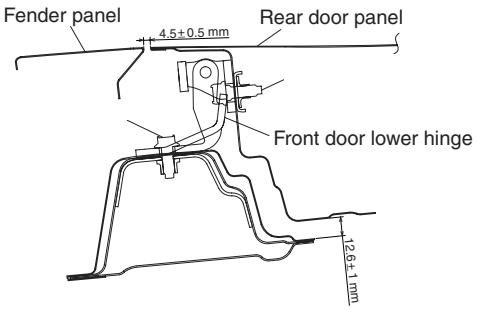
E - E



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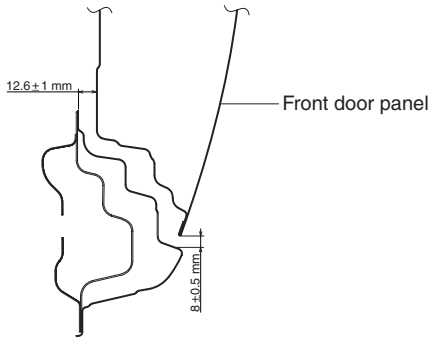

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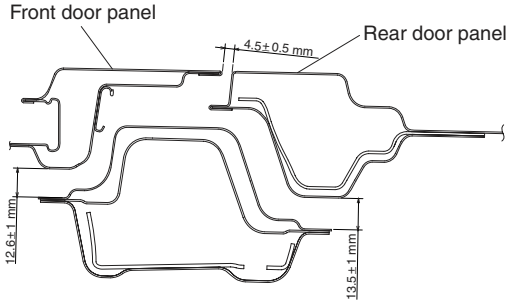

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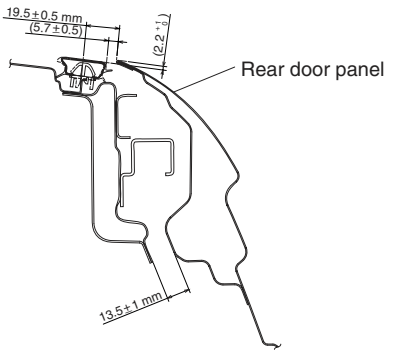

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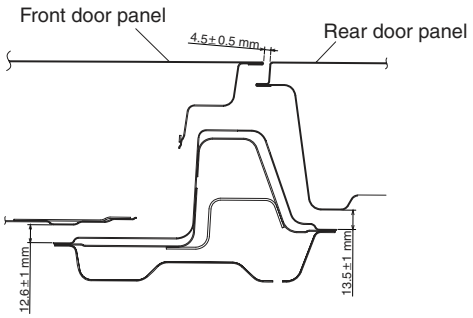

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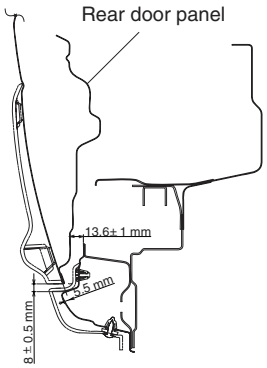

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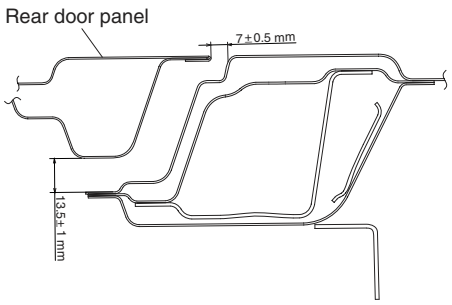

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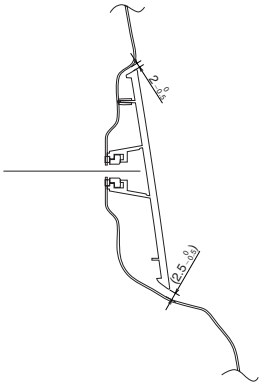

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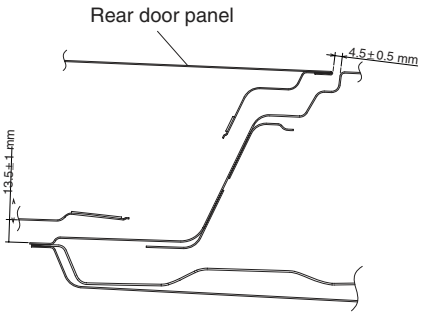

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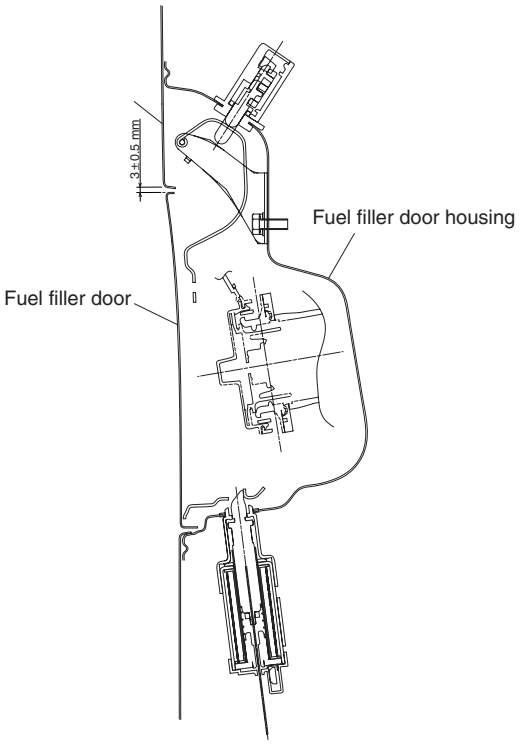

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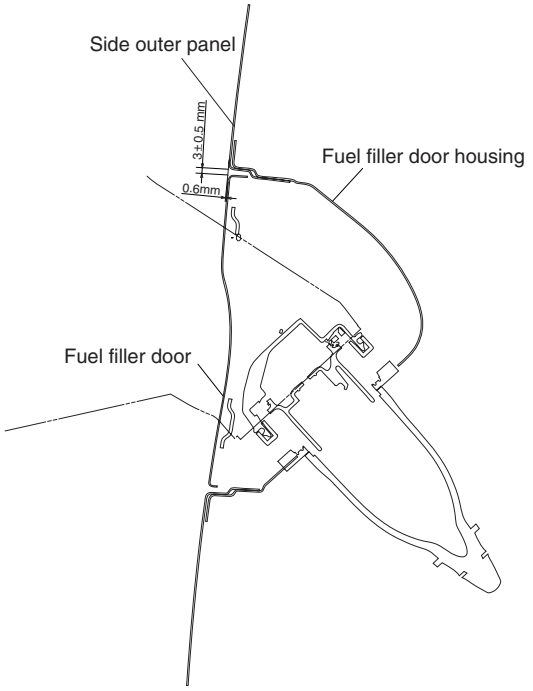

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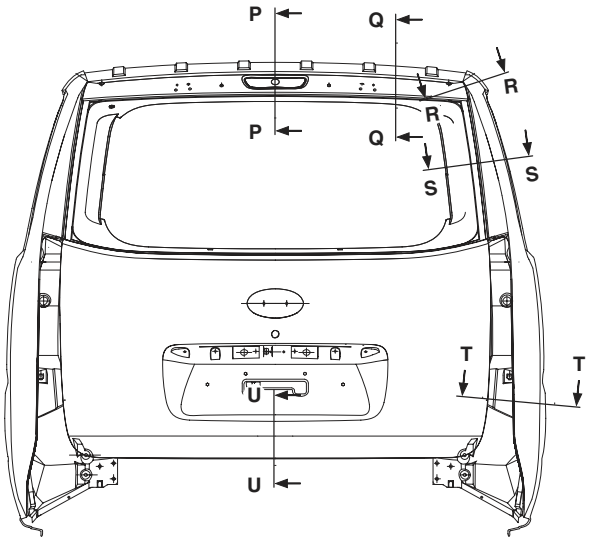
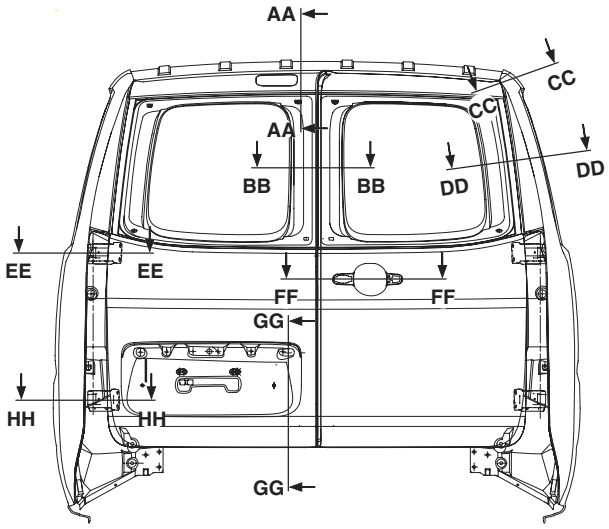
REAR BODY DIMENSIONS

< Cross-Sectional Views >





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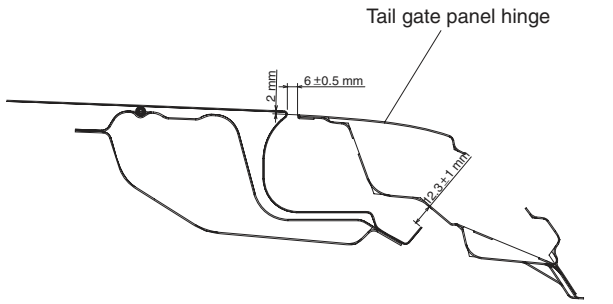

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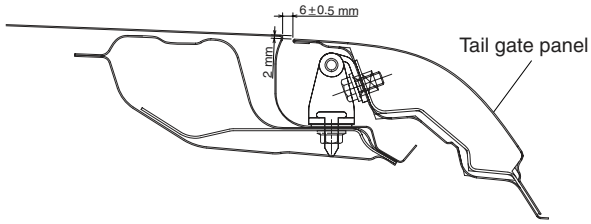

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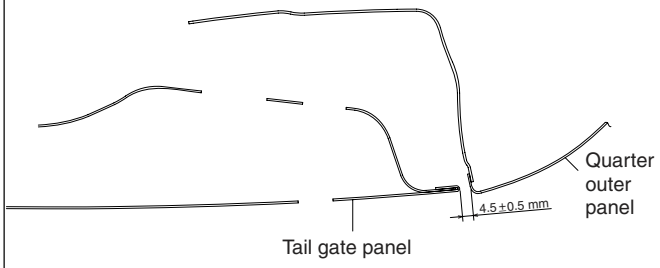

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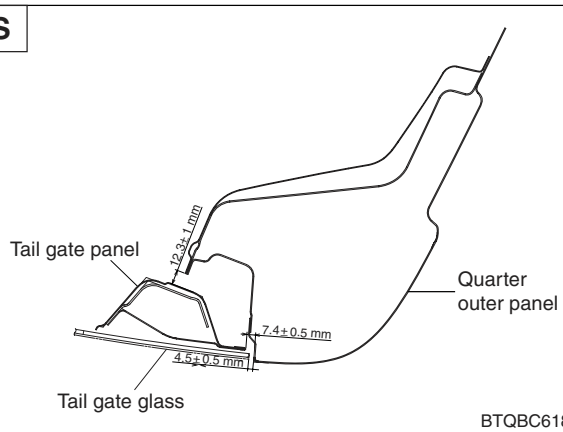

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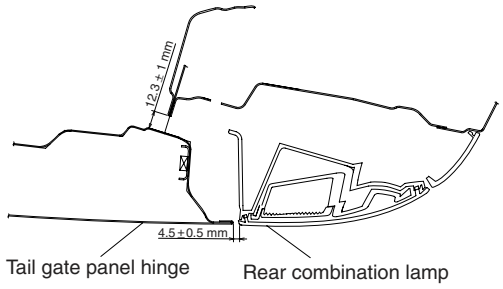

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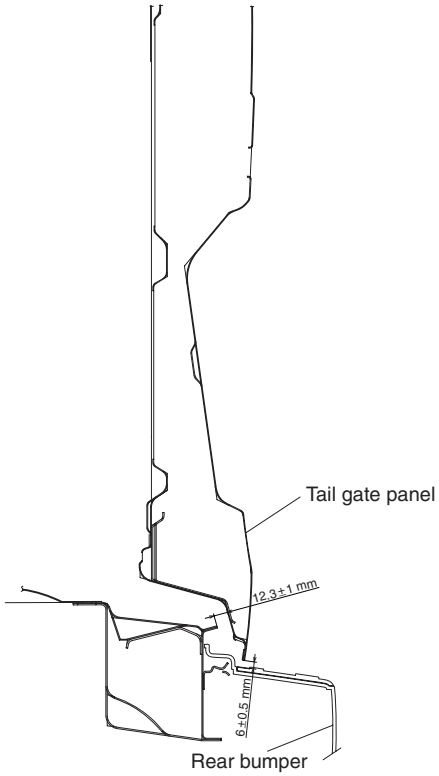

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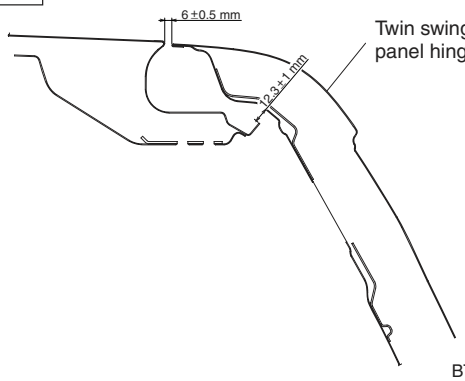

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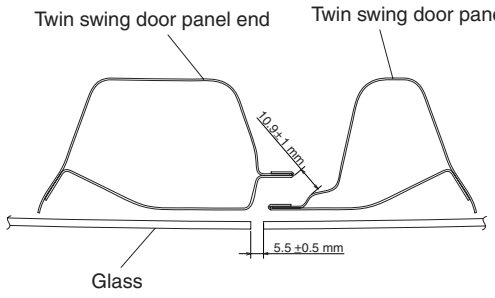

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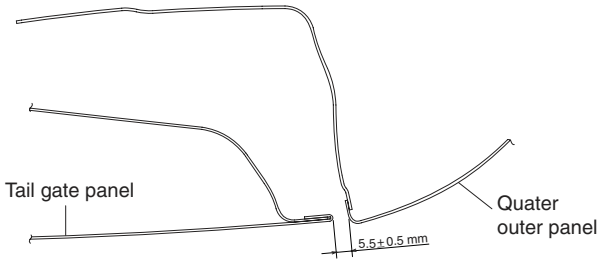

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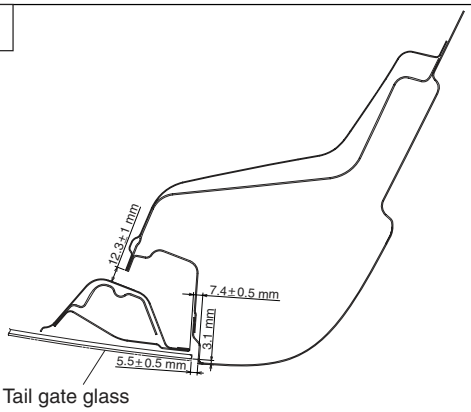

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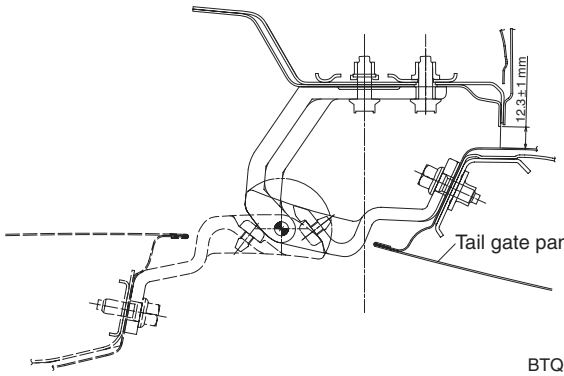

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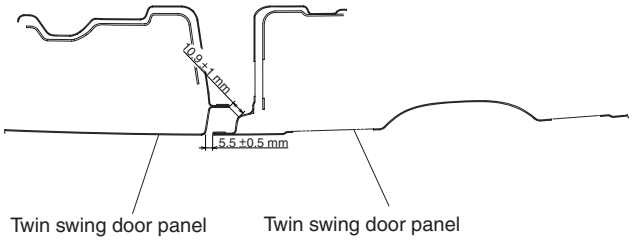

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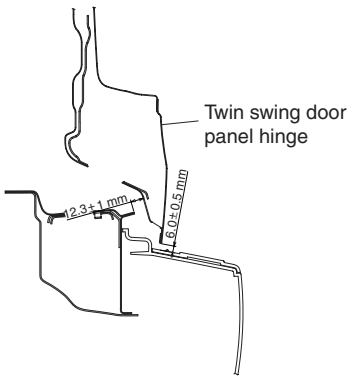


BTQBC6195

Body Dimensions

GENERAL ..... BD - 2

MEASUREMENT METHOD ..... BD - 2
- PROJECTED DIMENSIONS ..... BD - 2
- ACTUAL-MEASUREMENT DIMENSIONS ..... BD - 2
- MEASUREMENT POINT ..... BD - 2

FRONT BODY A ..... BD - 3

FRONT BODY B ..... BD - 5

SIDE BODY A ..... BD - 7

SIDE BODY B ..... BD - 9

SIDE BODY C ..... BD - 11

SIDE BODY D ..... BD - 13

INTERIOR A ..... BD - 15

INTERIOR B ..... BD - 17

INTERIOR C ..... BD - 20

INTERIOR D ..... BD - 22

REAR BODY ..... BD - 24

UNDER BODY (PROJECTED DIMENSIONS) ..... BD - 26

UNDER BODY (ACTUAL-MEASUREMENT DIMENSIONS) ..... BD - 29

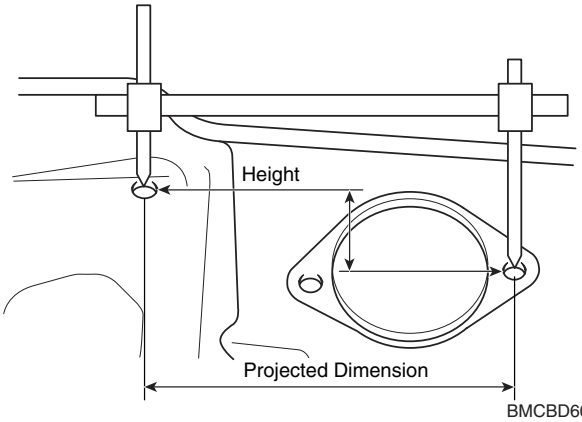
GENERAL

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.

MEASUREMENT METHOD

PROJECTED DIMENSIONS

1. These are the dimensions measured when the measurement points are projected into the reference plane, and are the reference dimensions used for body alterations.
2. If the length of the tracking gauge probes are adjustable, make the measurement by lengthening one probe by the amount equivalent to the difference in height of the two surfaces.

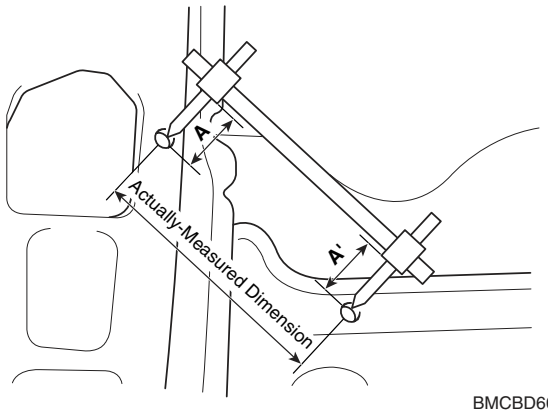


BMCBD6001

ACTUAL-MEASUREMENT DIMENSIONS

1. These dimensions indicate the actual linear distance between measurement points, and are the reference dimensions for use if a tracking gauge is used for measurement.
2. Measure by first adjusting both probes to the same length (A=A')

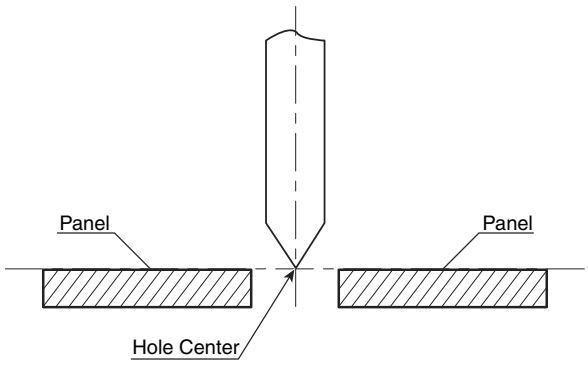
CAUTION
Check the probes and gauge itself to make sure there is no free play.



BMCBD6002

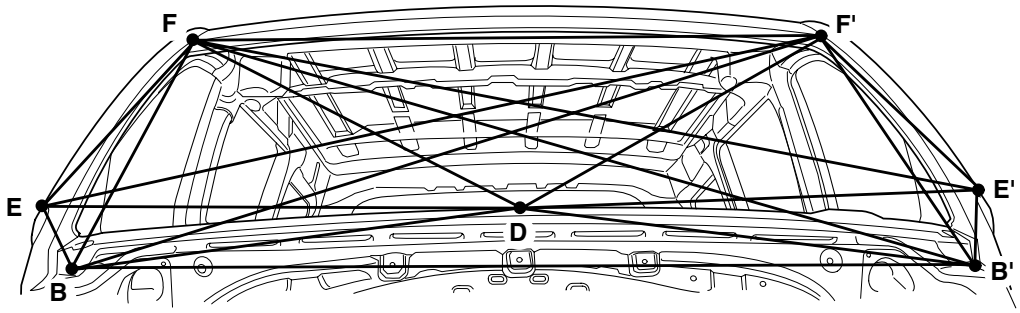
MEASUREMENT POINT

1. Measurements should be taken at the hole center.



BMCBD6003

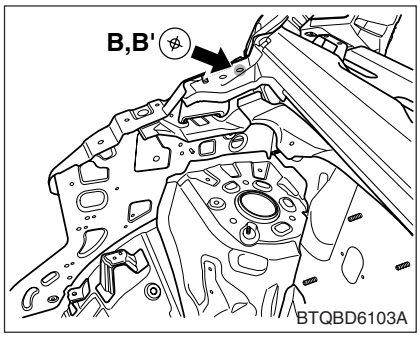
FRONT BODY A



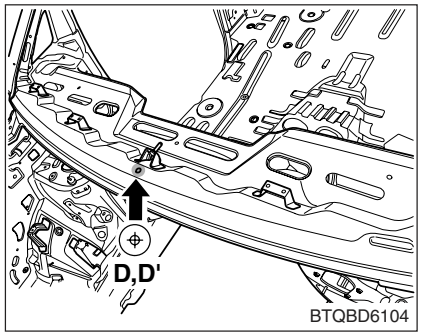
BTQBD6101

* These dimensions indicated in this figure are actual-measurement dimensions.

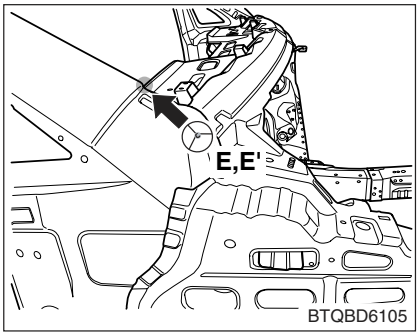
Point symbol	B-B'	B-D	B-E	B-F	B-F'	D-E	D-F	E-E'
Length(mm)	1477	745	201	1012	1701	757	1171	1419
Point symbol	**E-F**	**E-F'**	**F-F'**					
Length(mm)	892	1610	1266					



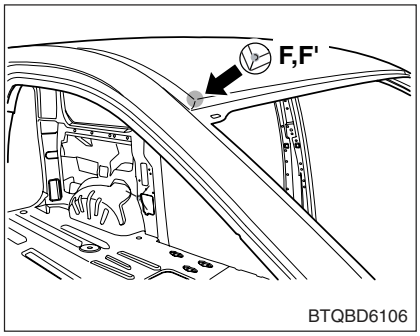
Hood hinge mounting hole (ø12)



Cowl panel hole (ø12)

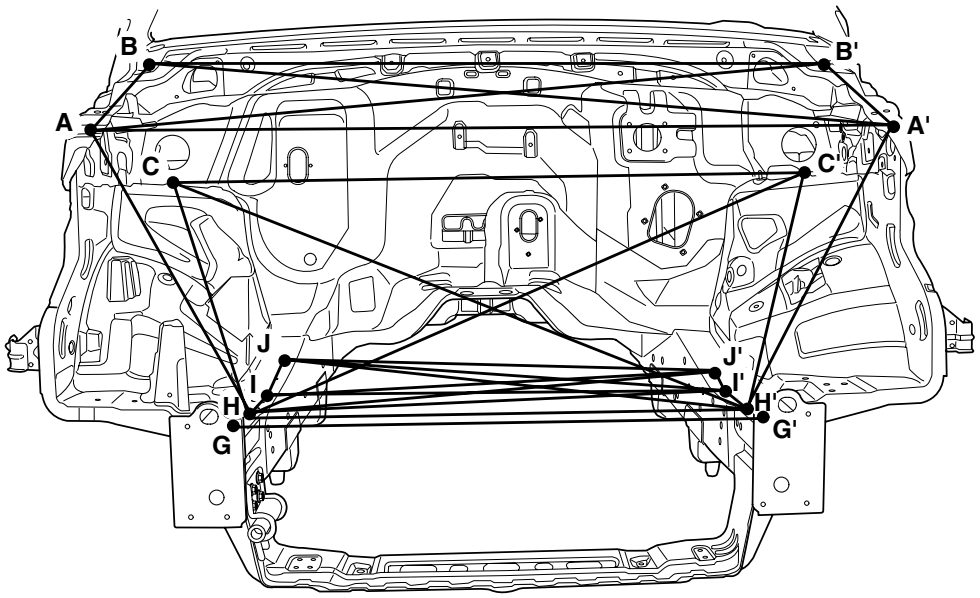


Front pillar outer panel corner



Roof panel front corner

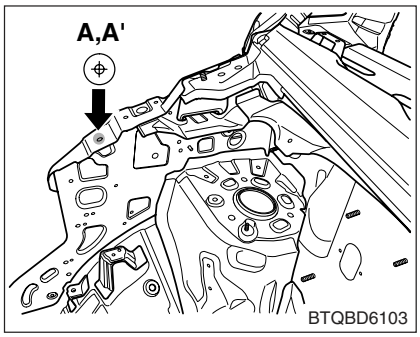
FRONT BODY B



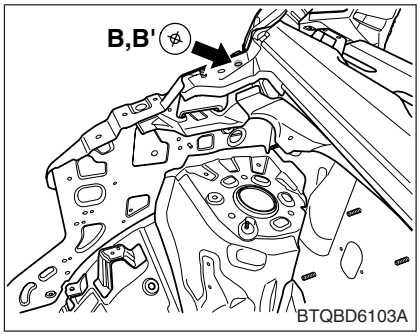
BTQBD6101A

* These dimensions indicated in this figure are actual-measurement dimensions.

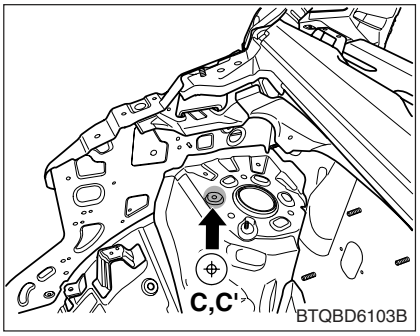
Point symbol	A-A'	A-B	A-B'	A-H	B-B'	C-C'	C-H	C-H'
Length(mm)	1582	284	1554	711	1477	1357	719	1331
Point symbol	G-G'	H-H'	H-I	H-I'	H-J'	I-H'	I-I'	I-J
Length(mm)	1024	924	220	919	953	922	867	264
Point symbol	I-J'	J-H'	J-I'	J-J'	H'-I'	I'-J'		
Length(mm)	874	1017	910	867	207	120		



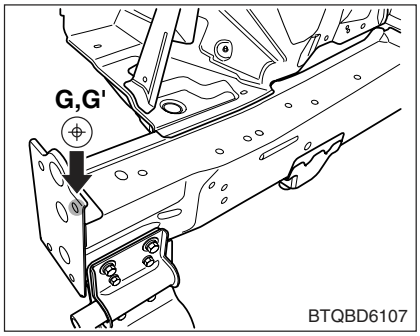
Fender panel mounting hole
(ø11)



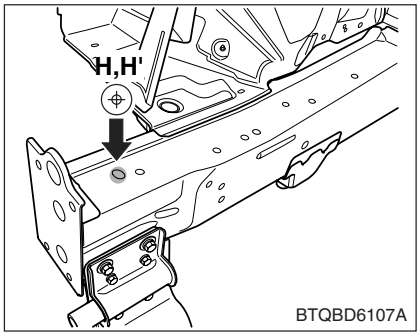
Hood hinge monting hole
(ø12)



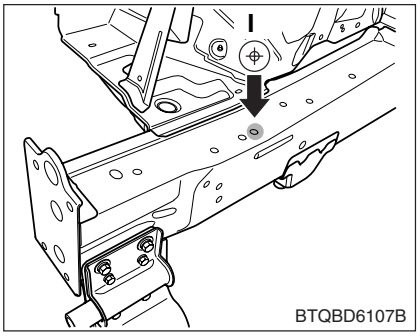
Front suspension mounting hole
(ø6.6)



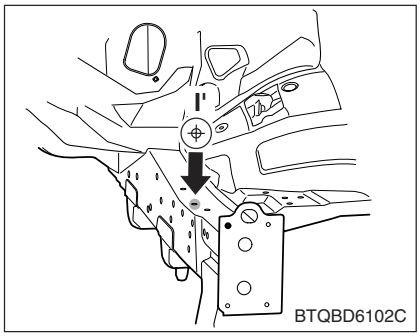
Front end module mounting hole
(ø11)



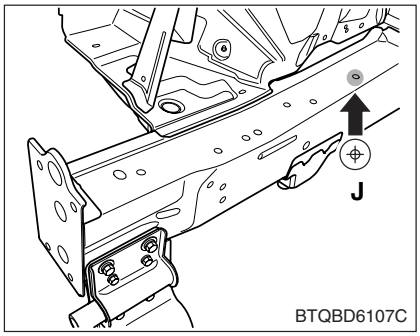
Front side member tooling hole
(6X12)



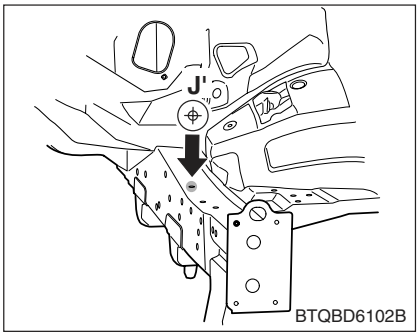
Front side member tooling hole
(ø9)



Front side member tooling hole
(ø11)

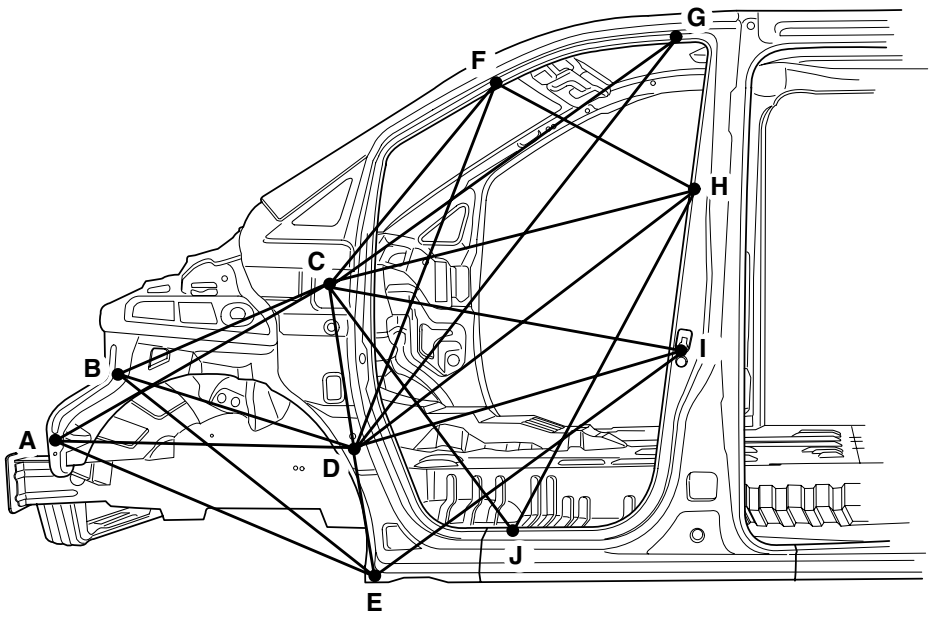


Front side member tooling hole
(ø10)



Front side member tooling hole
(ø11)

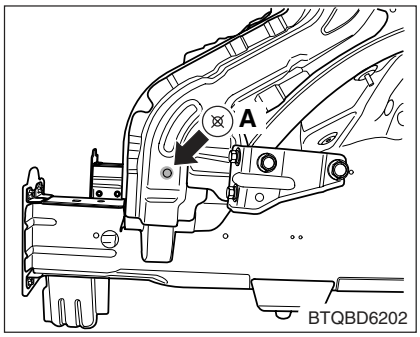
SIDE BODY A



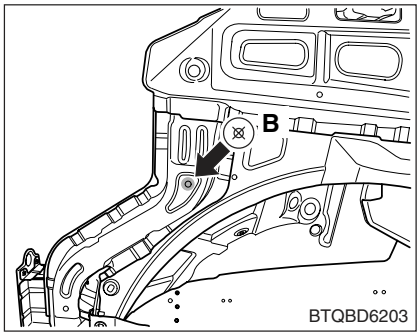
BTQBD6201

* These dimensions indicated in this figure are actual-measurement dimensions.

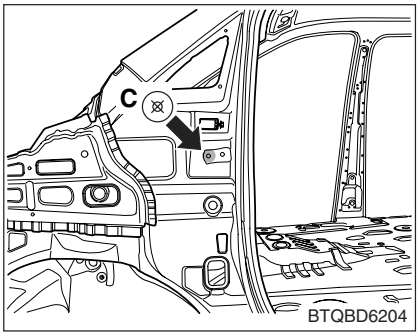
Point symbol	A-C	A-D	A-E	B-C	B-D	B-E	C-D	C-F
Length(mm)	914	871	980	699	722	922	471	622
Point symbol	C-G	C-H	C-I	C-J	D-E	D-F	D-G	D-H
Length(mm)	1105	1055	1008	827	370	1016	1404	1209
Point symbol	D-I	E-I	F-H	H-J				
Length(mm)	967	1103	699	1132				



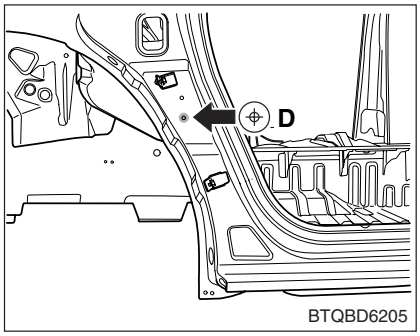
Fender apron inner support tooling hole (ø8)



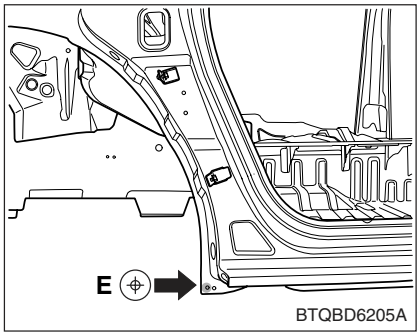
Fender apron inner support tooling hole (ø8)



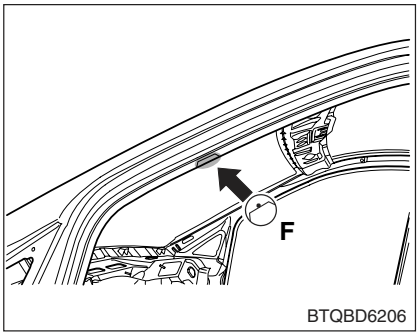
Front door hinge upper mounting hole (ø11)



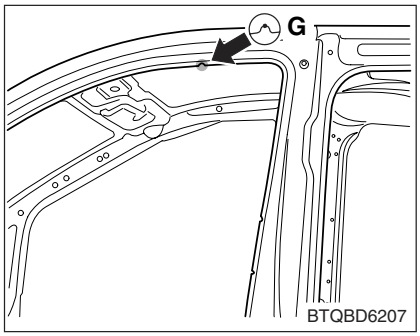
Front door hinge lower mounting hole (ø11)



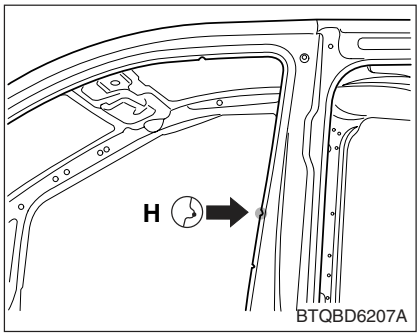
Front fender panel mounting hole (ø11)



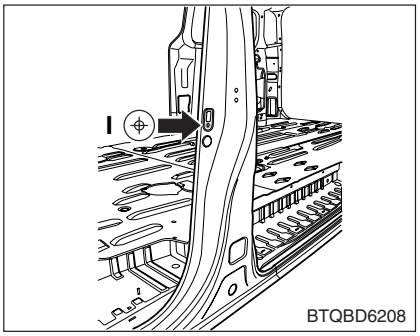
Front pillar outer panel notch



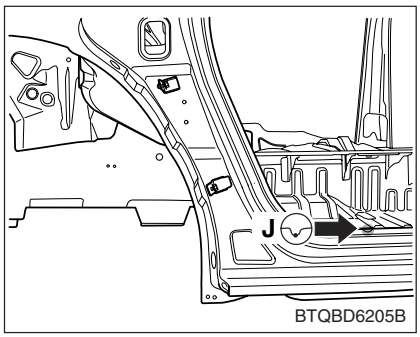
Side outer panel notch



Center pillar outer panel notch

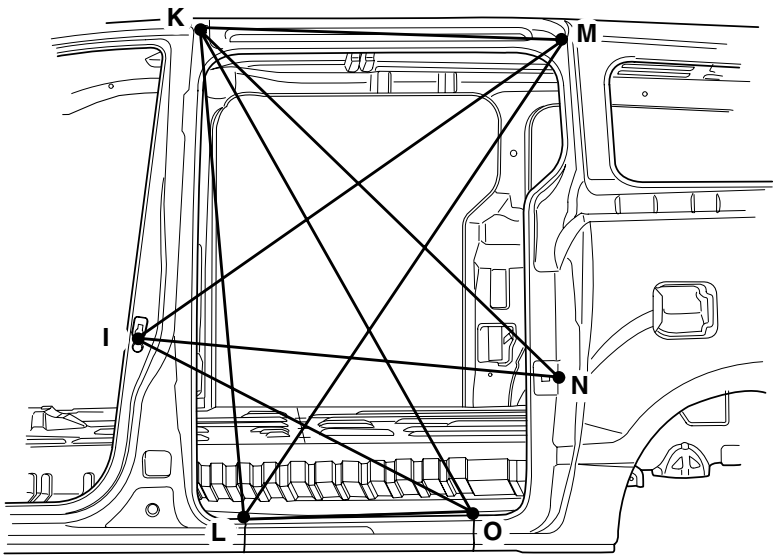


Front door switch mounting hole (ø7)



Side sill outer panel notch

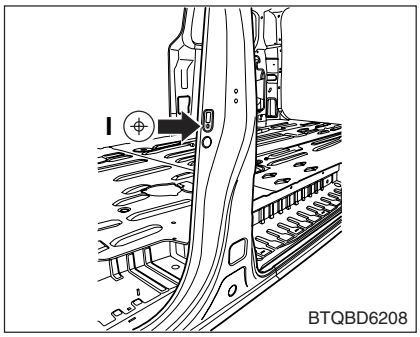
SIDE BODY B



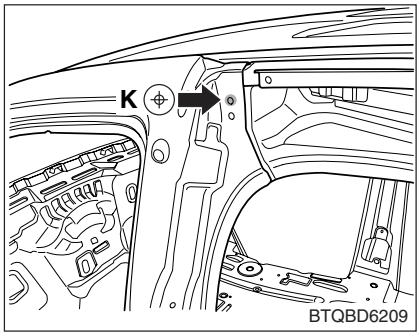
BTQBD6201A

* These dimensions indicated in this figure are actual-measurement dimensions.

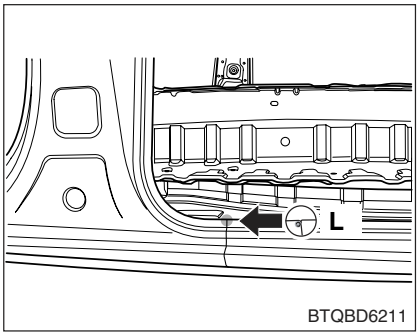
Point symbol	I-M	I-N	I-O	K-L	K-M	K-N	K-O	L-M
Length(mm)	1622	1255	1188	1495	1121	1511	1720	1831
Point symbol	L-O							
Length(mm)	758							



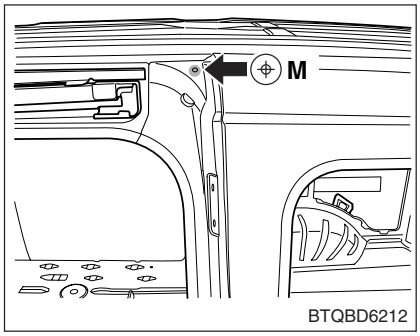
Front door switch mounting hole (ø7)



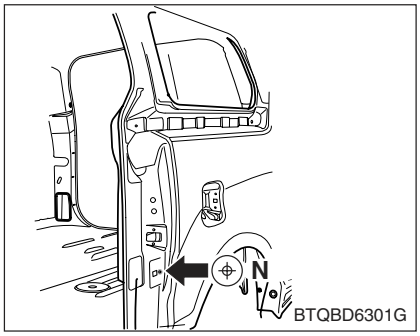
Center pillar outer panel hole (ø8)



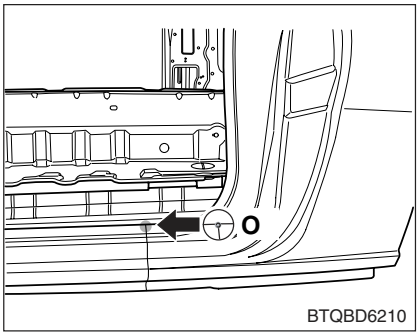
Center pillar outer panel end corner



Quarter outer panel hole (ø6.8)

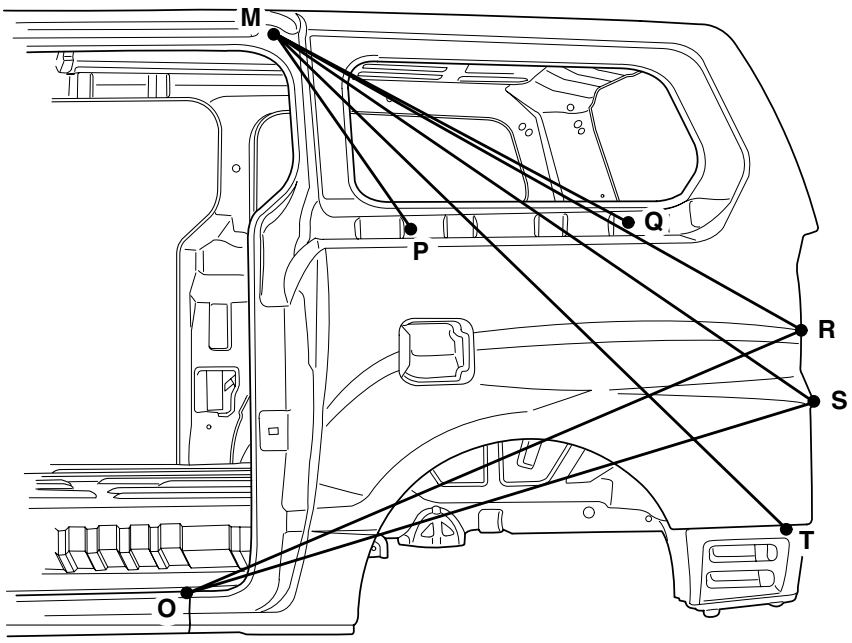


Rear door switch mounting hole (ø10)



Quarter outer panel lower front end corner

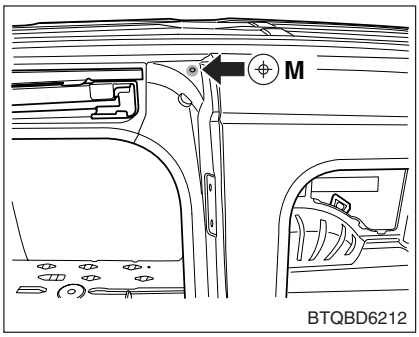
SIDE BODY C



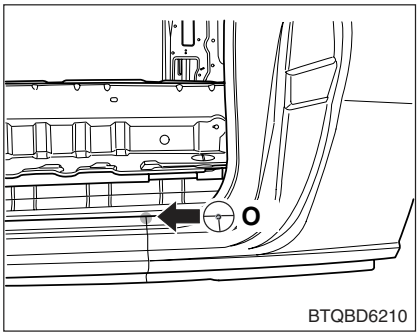
BTQBD6201B

* These dimensions indicated in this figure are actual-measurement dimensions.

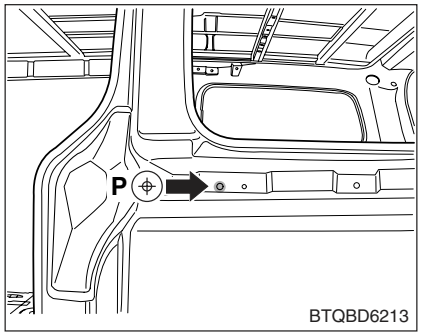
Point symbol	M-P	M-Q	M-R	M-S	M-T	O-R	O-S	
Length(mm)	624	1065	1515	1701	1876	1668	1664	



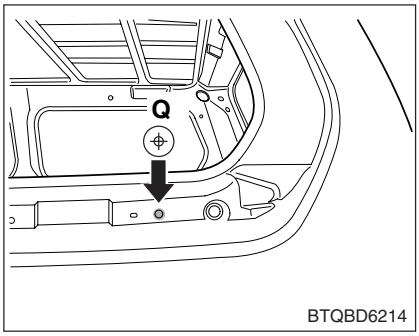
Quarter outer panel hole (ø6.8)



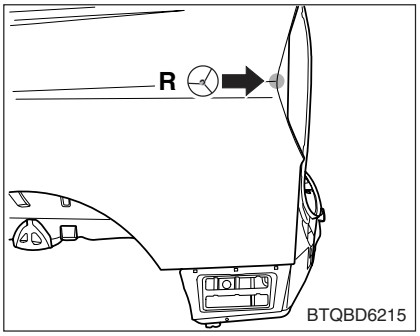
Quarter outer panel lower front end corner



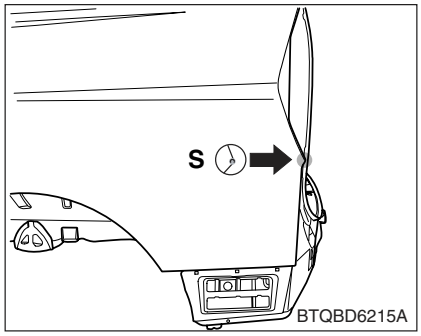
Rear door center rail mounting hole (ø8)



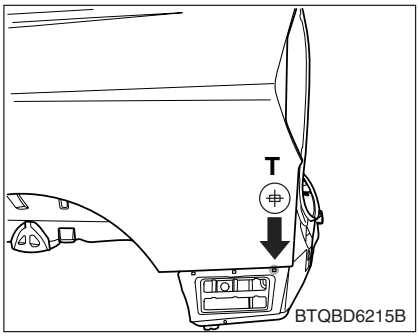
Rear door center rail mounting hole (ø8)



Quarter outer panel rear corner

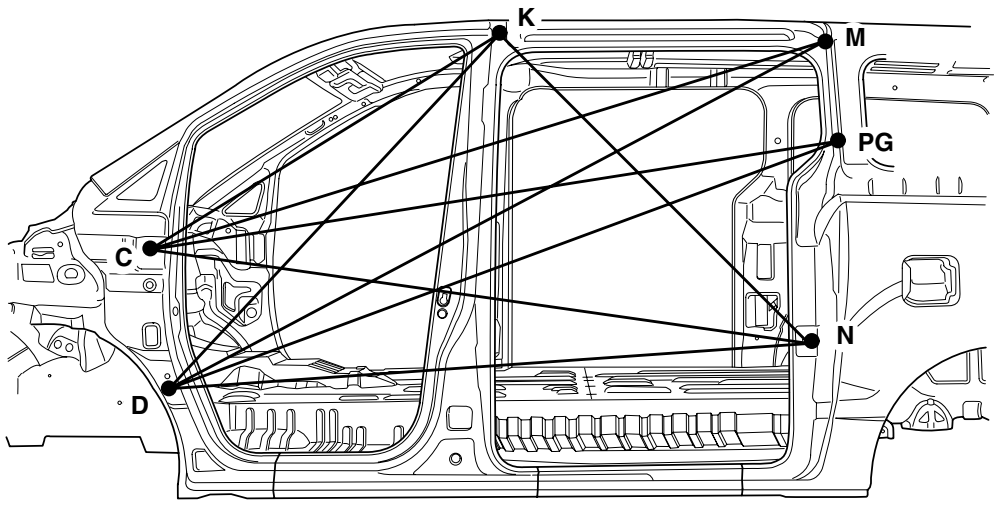


Quarter outer panel rear corner



Rear bumper mounting hole (8.5X8.5)

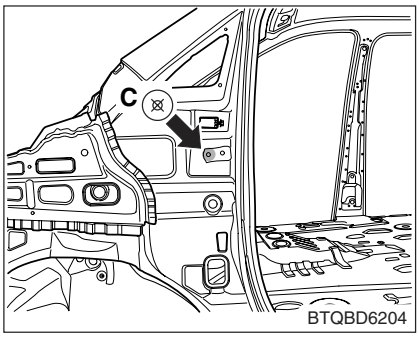
SIDE BODY D



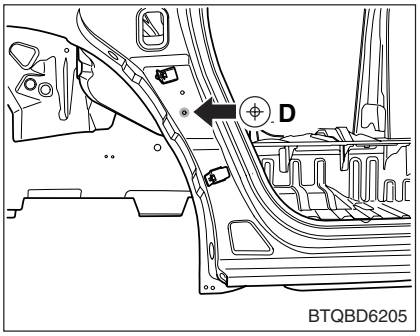
BTQBD6201D

* These dimensions indicated in this figure are actual-measurement dimensions.

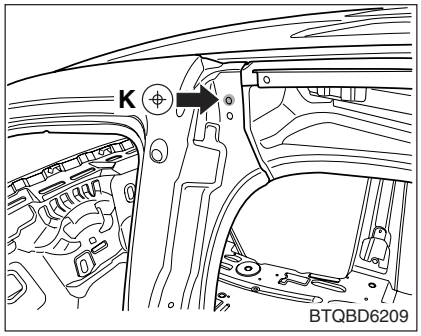
Point symbol	C-K	C-M	C-PG	C-N	D-K	D-M	D-PG	D-N
Length(mm)	1400	2430	2346	2261	1648	2556	2384	2173
Point symbol	K-M	K-N						
Length(mm)	1121	1511						



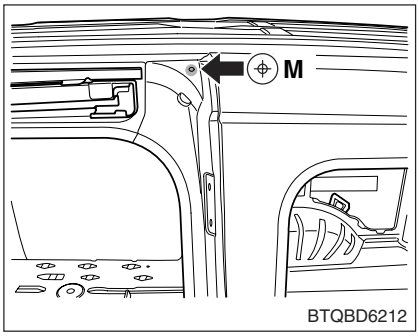
Front door hinge upper mounting hole (ø11)



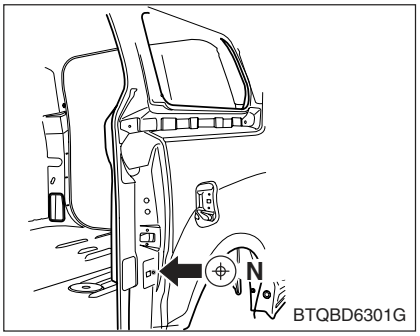
Front door hinge lower mounting hole (ø11)



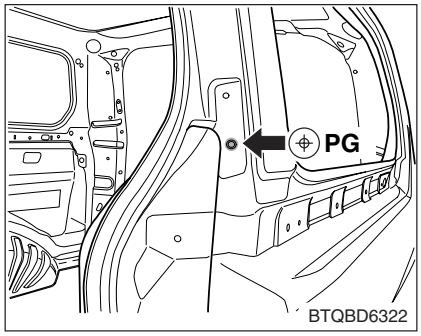
Center pillar outer panel hole (ø8)



Quarter outer panel hole (ø6.8)

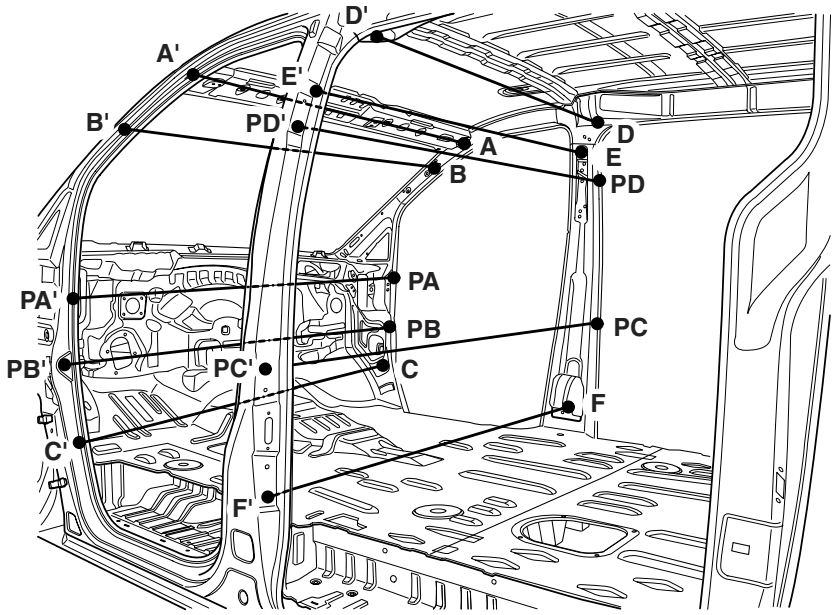


Rear door switch mounting hole (ø10)



Quarter window glass mounting hole (ø9)

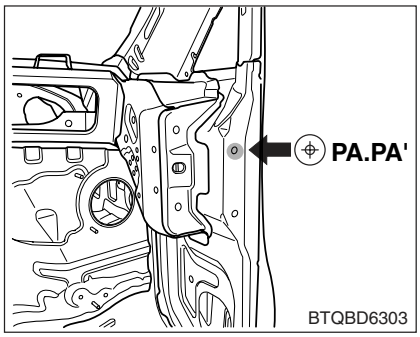
INTERIOR A



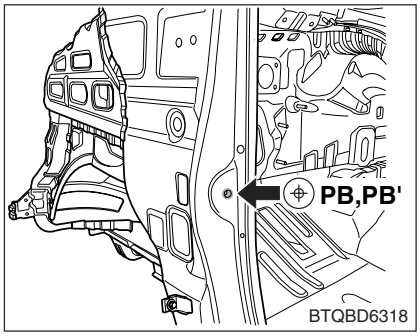
BTQBD6301H

* These dimensions indicated in this figure are actual-measurement dimensions.

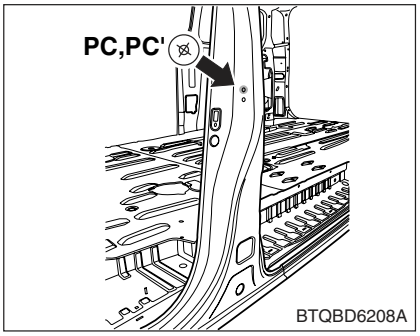
Point symbol	PA-PA'	PB-PB'	PC-PC'	PD-PD'	A-A'	B-B'	C-C'	D-D'
Length(mm)	1585	1657	1736	1603	1384	1441	1602	1250
Point symbol	E-E'	F-F'						
Length(mm)	1435	1605						



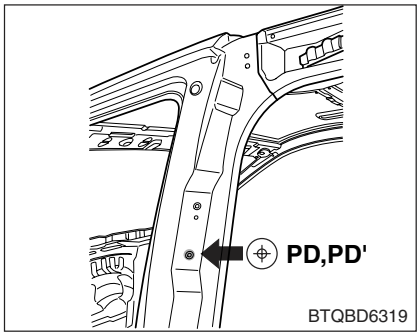
Crash pad mounting guide hole (ø9)



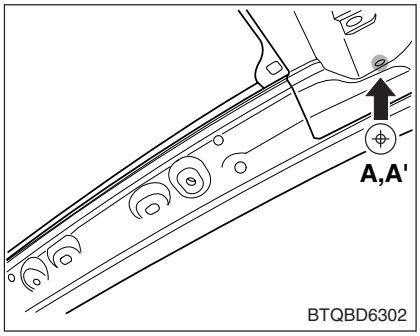
Front door checker mounting hole (ø11)



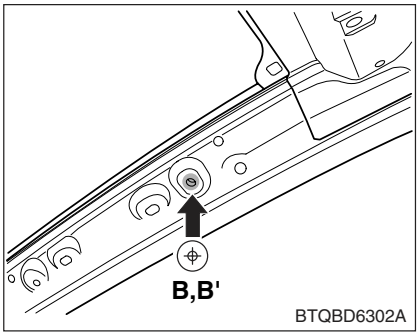
Front door striker mounting hole (ø13)



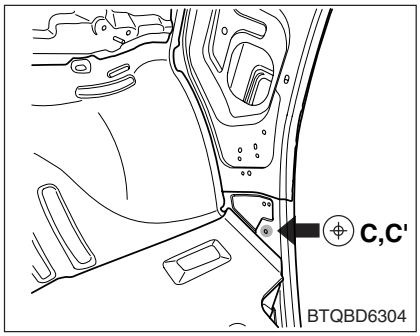
Rear door stopper mounting hole (ø9)



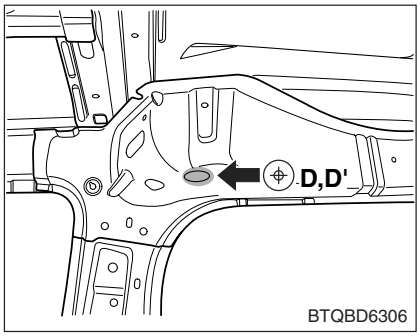
Roof front rail tooling hole (ø7)



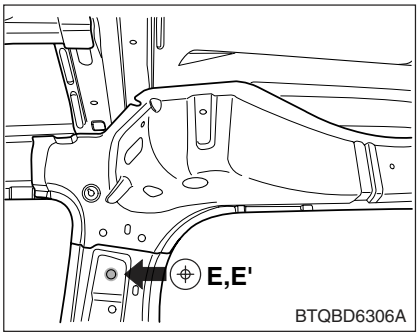
Front pillar trim mounting hole (ø6.6)



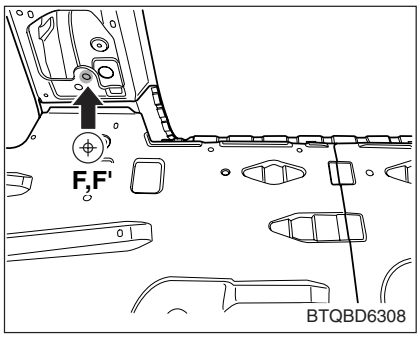
Front pillar inner panel tooling hole (ø6.6)



Roof side inner rail tooling hole (ø30)

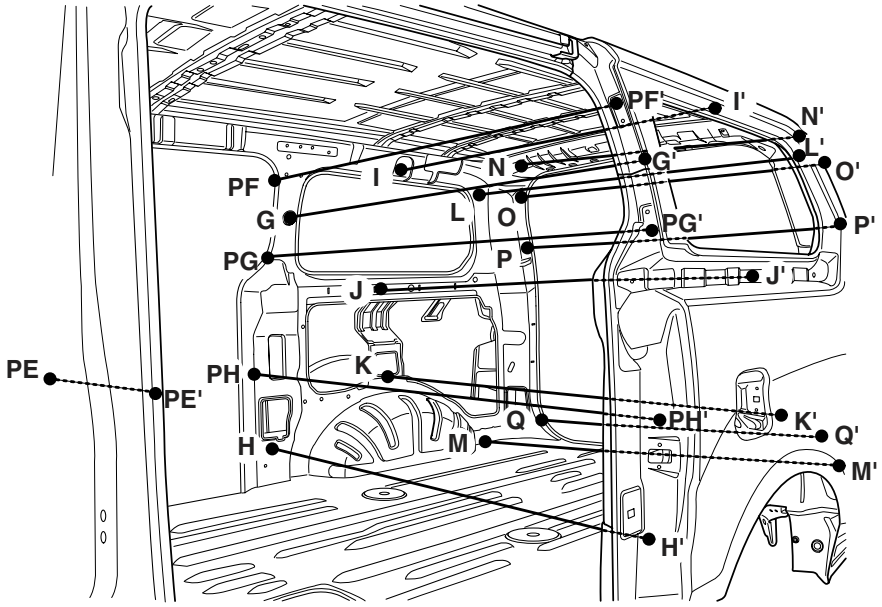


Front seat belt upper anchor mounting hole



Front seat belt retractor mounting hole (ø16)

INTERIOR B



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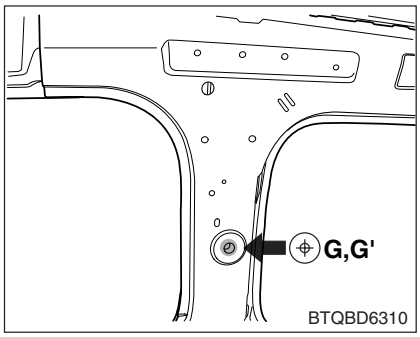
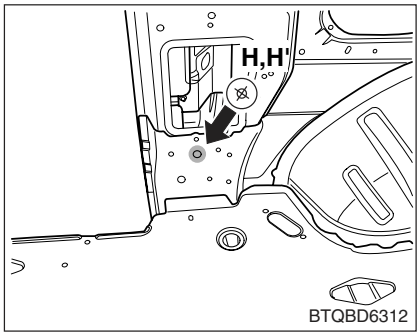
* These dimensions indicated in this figure are actual-measurement dimensions.

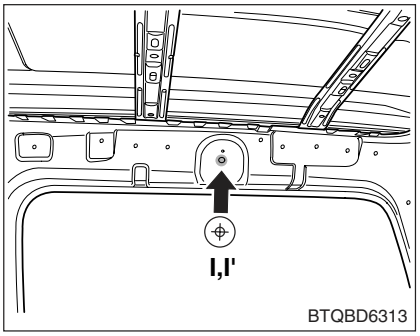
Point symbol	G-G'	H-H'	I-I'	J-J'	K-K'	L-L'	M-M'	N-N'
Length(mm)	1513	1569	1376	1622	1625	1456	1596	973
Point symbol	**O-O'**	**P-P'**	**Q-Q'**	**PE-PE'**	**PF-PF'**	**PG-PG'**	**PH-PH'**	
Length(mm)	1211	1338	1332	1742	1498	1670	1750	



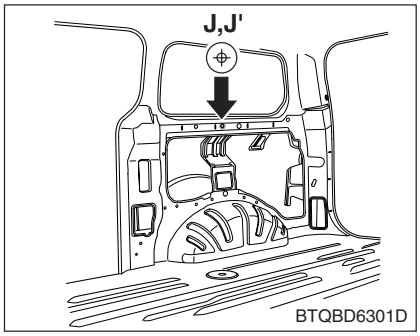
Quarter inner panel tooling hole (ø19)



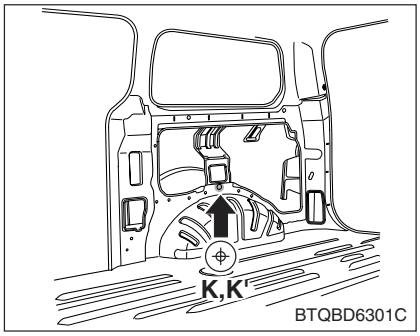
Quarter inner panel tooling hole (ø15)



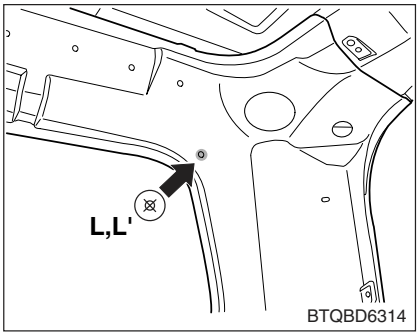
Quarter inner panel tooling hole (ø17.2)



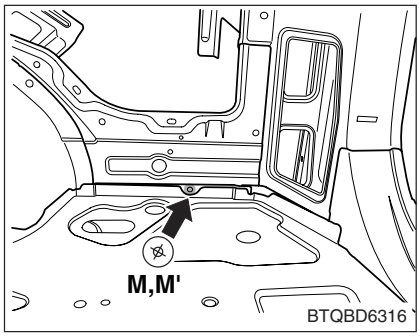
Quarter inner panel tooling hole (ø8.5)



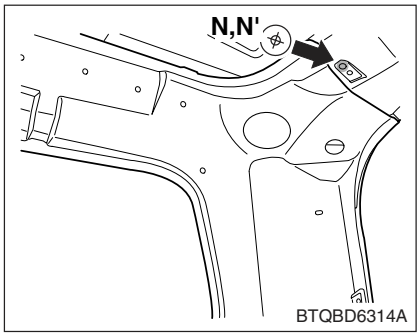
Quarter inner panel tooling hole (ø16)



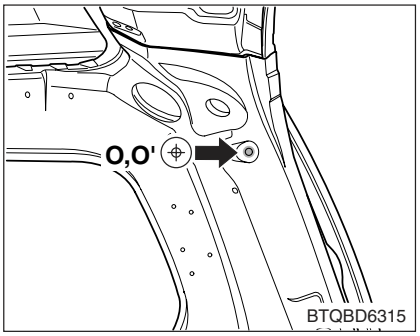
Quarter inner panel tooling hole (ø8.5)



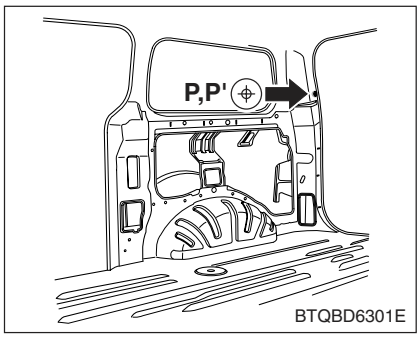
Quarter inner panel tooling hole (ø7)



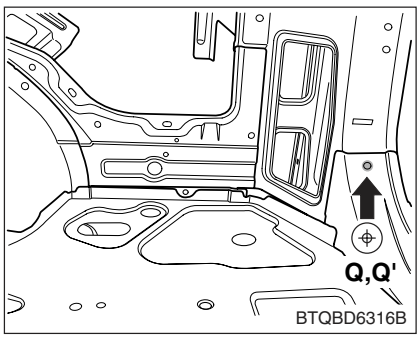
Roof rear rail tooling hole (ø8.5)



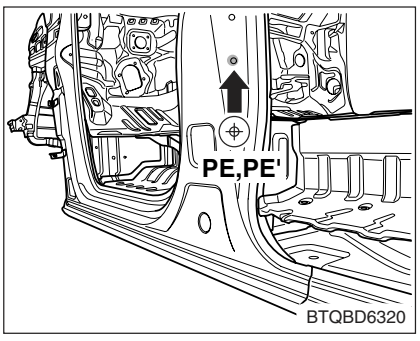
Quarter inner panel tooling hole (ø8.5)



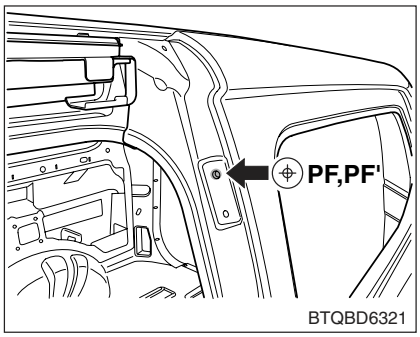
Quarter inner panel tooling hole (ø6.6)



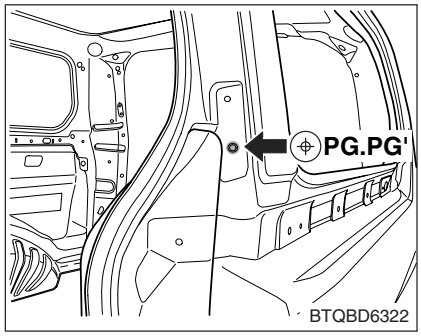
Quarter inner lower rear extension tooling hole (ø7)



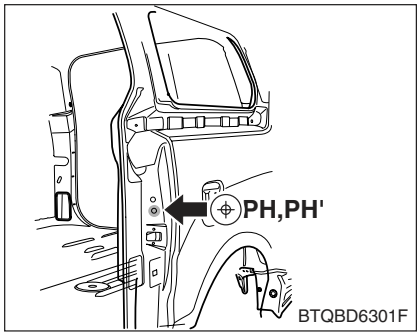
Rear door stopper mounting hole (ø6.6)



Quarter outer panel tooling hole (ø9)

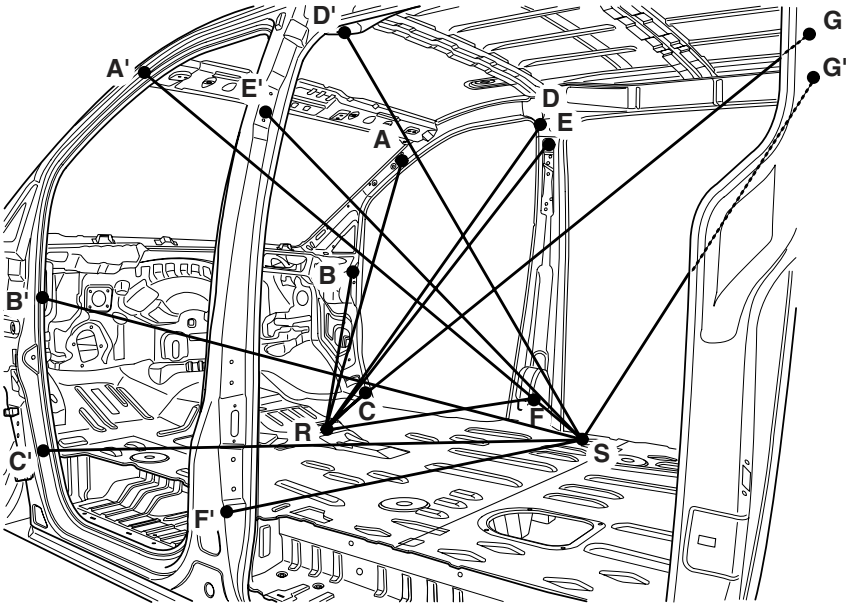


Quarter outer panel tooling hole (ø9)



Quarter outer panel tooling hole (ø13)

INTERIOR C



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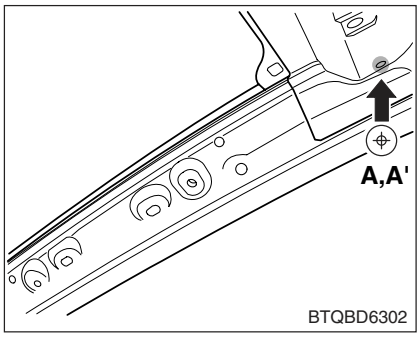
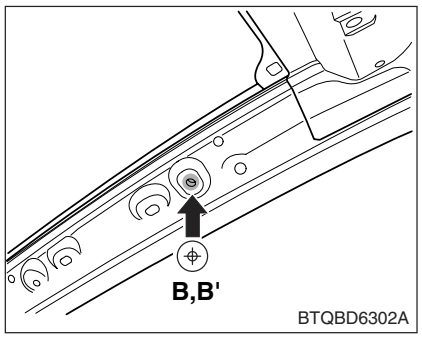
* These dimensions indicated in this figure are actual-measurement dimensions.

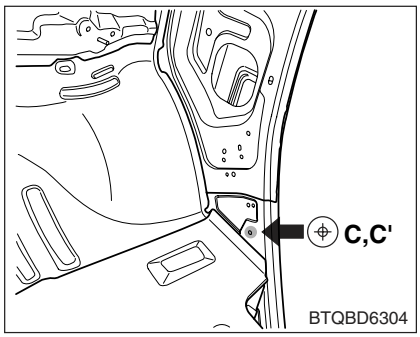
Point symbol	R-A	R-B	R-C	R-D	R-E	R-F	R-G	S-A'
Length(mm)	1324	1286	926	1467	1390	925	2136	1410
Point symbol	**S-B'**	**S-C'**	**S-D'**	**S-E'**	**S-F'**	**S-G'**		
Length(mm)	1426	1179	1220	1134	301	1454		



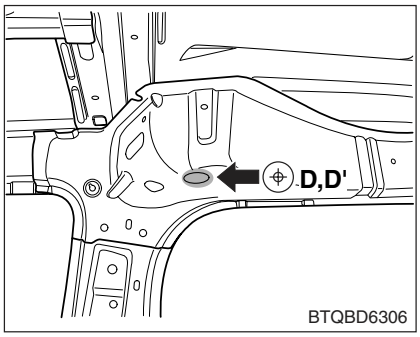
Roof front rail tooling hole (ø7)



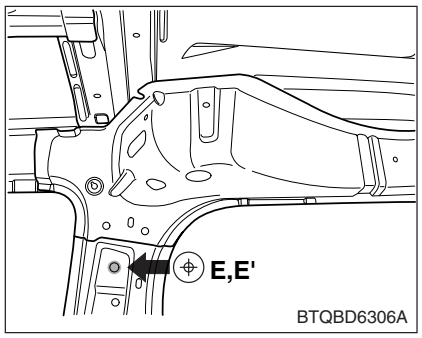
Front pillar trim mounting hole (ø6.6)



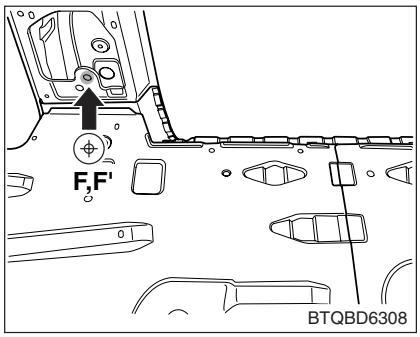
Front pillar inner panel tooling hole (ø6.6)



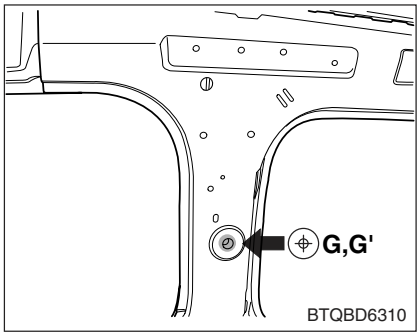
Side inner panel tooling hole (ø30)



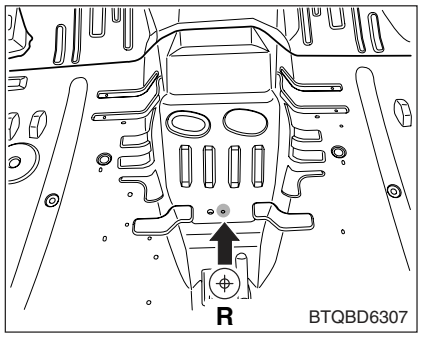
Front seat belt upper anchor mounting hole



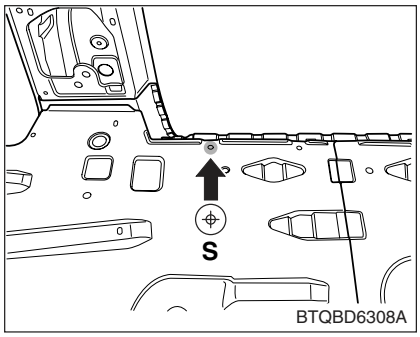
Front seat belt retractor mounting hole (ø16)



Quarter inner panel tooling hole (ø19)

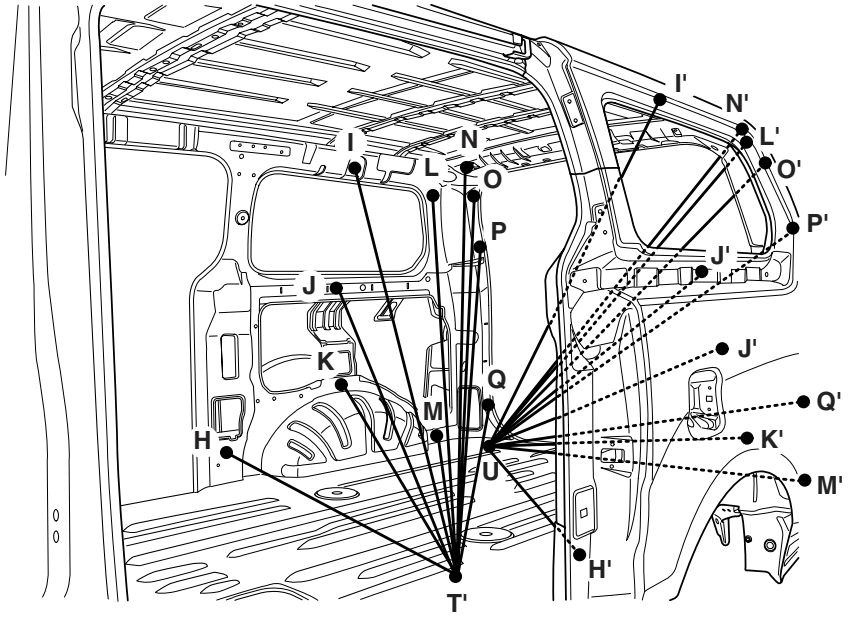


Center floor front rainforcement tooling hole (ø11)



Center floor panel tooling hole (ø11)

INTERIOR D



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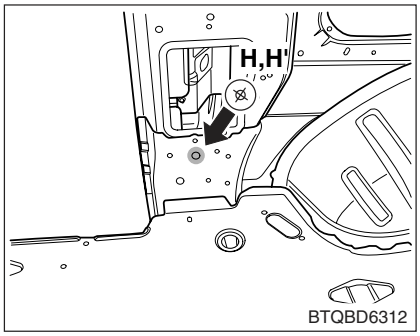
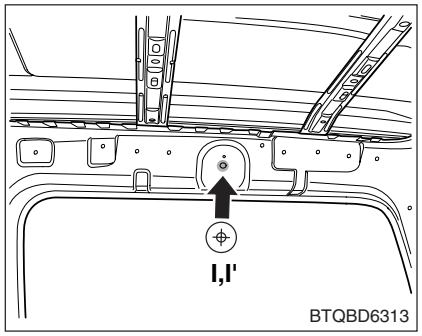
* These dimensions indicated in this figure are actual-measument dimensions.

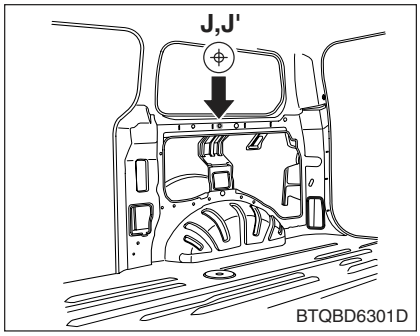
Point symbol	T'-H	T'-I	T'-J	T'-K	T'-L	T'-M	T'-N	T'-O
Length(mm)	1481	2022	1866	1739	2236	2054	2175	2260
Point symbol	**T'-P**	**T'-Q**	**U-H'**	**U-I'**	**U-J'**	**U-K'**	**U-L'**	**U-M'**
Length(mm)	2231	2124	1800	1848	1657	1536	1726	1361
Point symbol	**U-N'**	**U-O'**	**U-P'**	**U-Q'**				
Length(mm)	1640	1632	1449	1249				



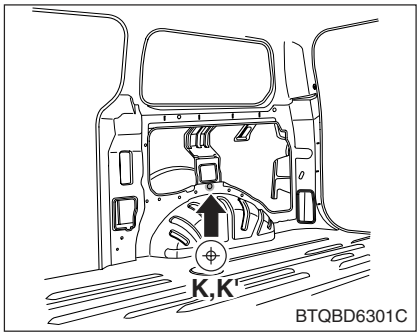
Quarter inner panel tooling hole (ø15)



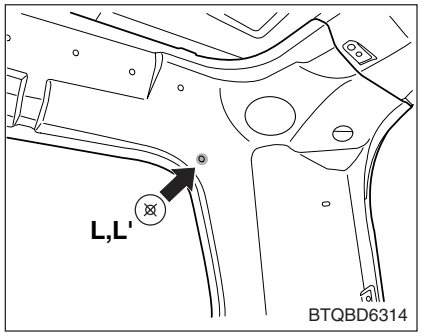
Quarter inner panel tooling hole (ø17.2)



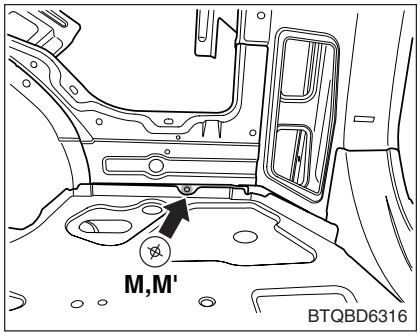
Quarter inner panel tooling hole (ø8.5)



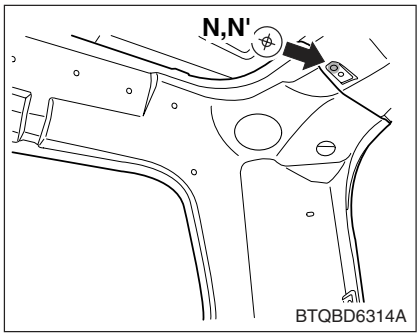
Quarter inner panel tooling hole (ø16)



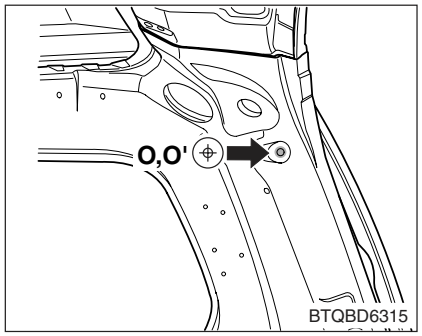
Quarter inner panel tooling hole (ø8.5)



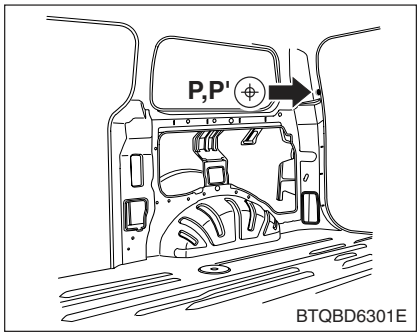
Quarter inner panel tooling hole (ø7)



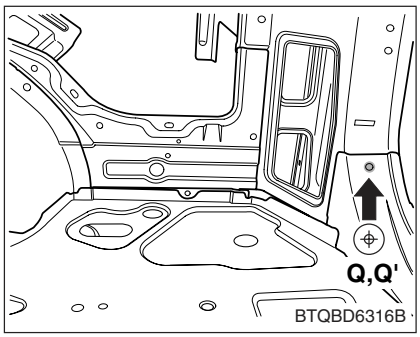
Roof rear rail tooling hole (ø8.5)



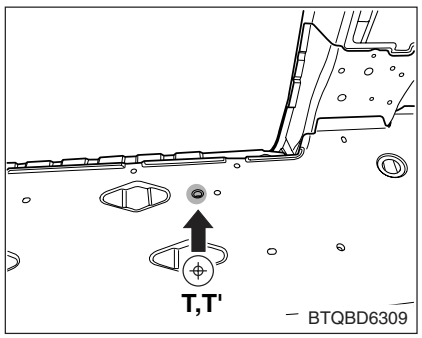
Quarter inner panel tooling hole (ø8.5)



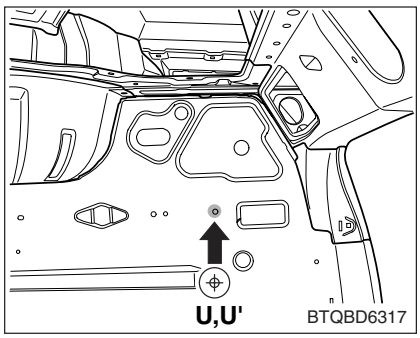
Quarter inner panel tooling hole (ø6.6)



Quarter inner lower rear extension tooling hole (ø7)

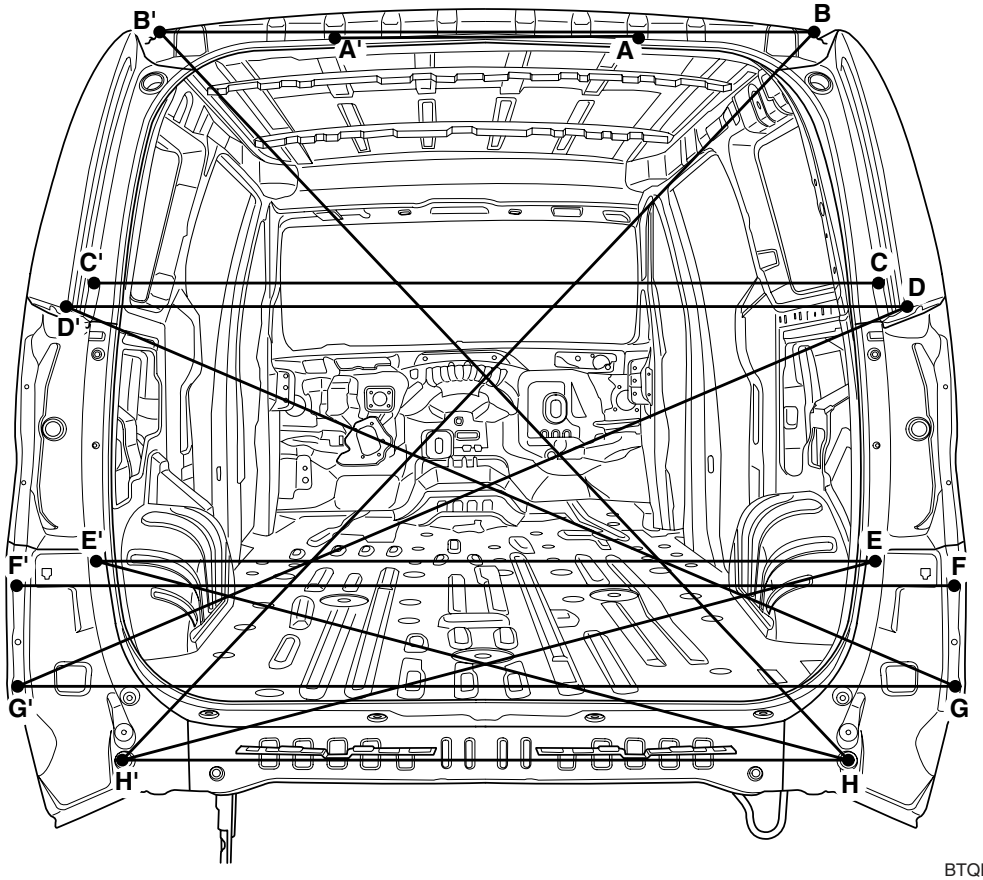


Rear floor panel tooling hole (ø15)



Rear floor panel tooling hole (ø15)

REAR BODY



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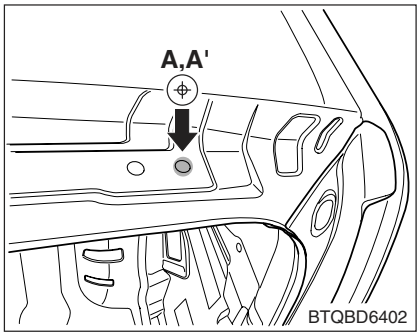
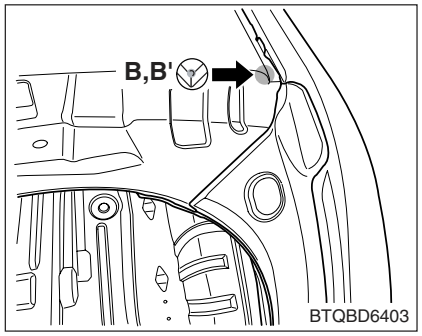
* These dimensions indicated in this figure are actual-measurement dimensions.

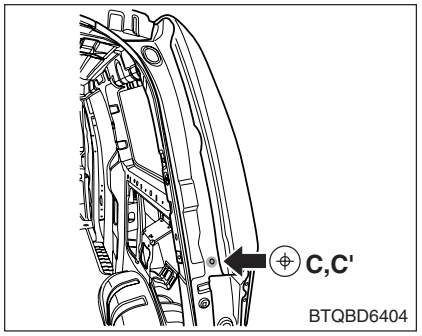
Point symbol	A-A'	B-B'	B-H'	C-C'	D-D'	D-G'	E-E'	E-H'
Length(mm)	840	1272	1933	1455	1514	1797	1447	1450
Point symbol	**F-F'**	**G-G'**	**H-H'**					
Length(mm)	1769	1789	1360					



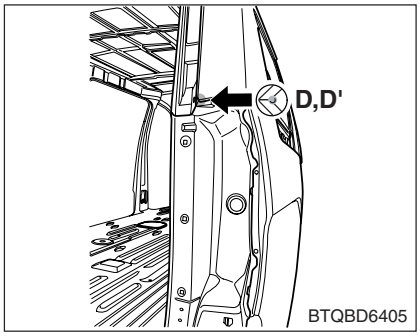
Tailgate hinge mounting hole (ø12)



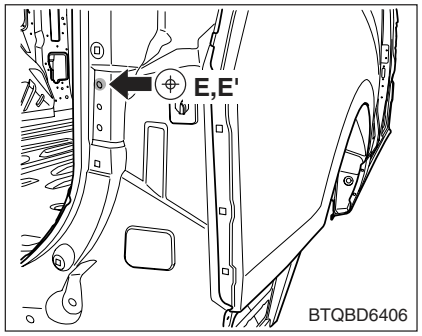
Roof panel rear corner



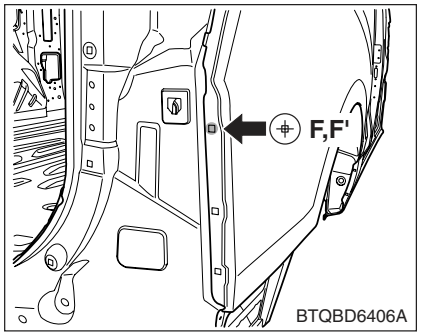
Quarter outer panel rear tooling hole (ø12)



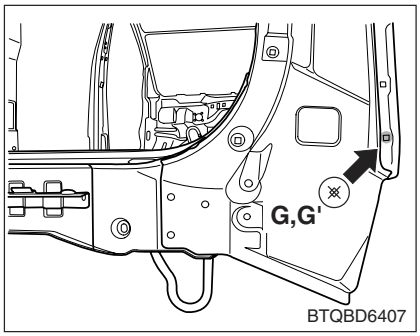
Quarter outer panel rear corner



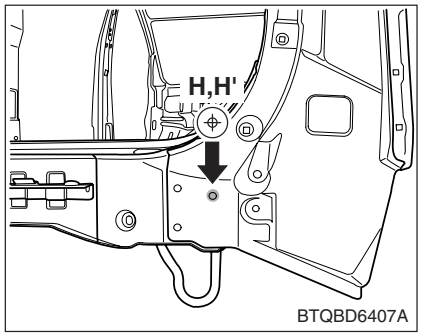
Quarter outer rear extension tooling hole (ø6.6)



Quarter outer panel rear tooling hole (8.5 X 8.5)

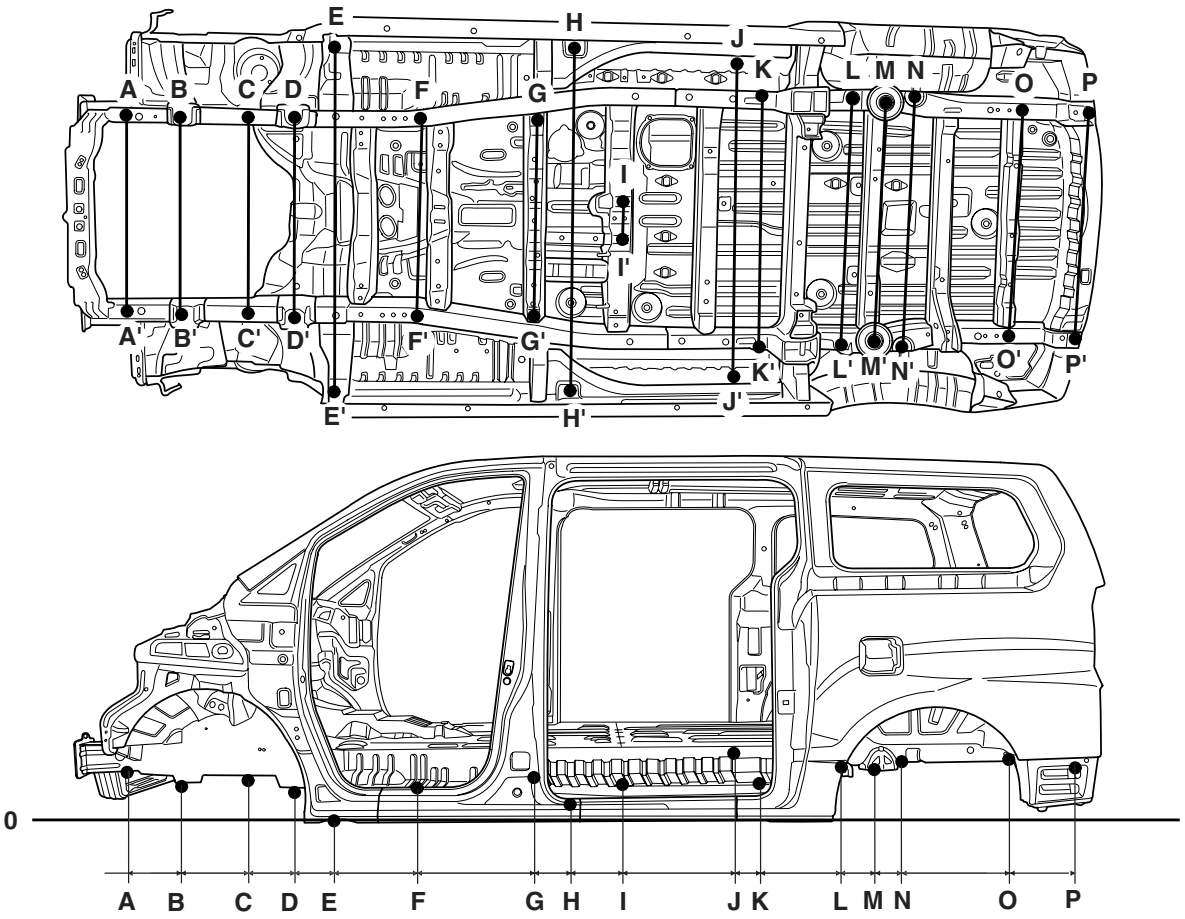


Quarter outer panel rear tooling hole (8.5 X 8.5)



Rear end cross member tooling hole (ø13)

UNDER BODY (PROJECTED)



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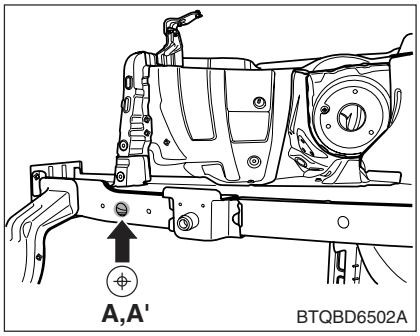
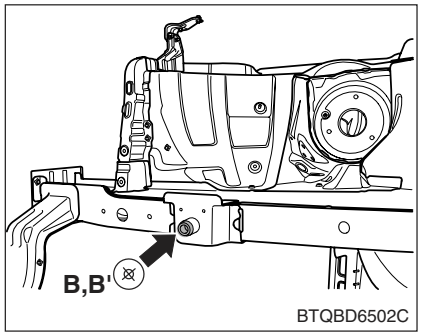
* These dimensions indicated in this figure are projected dimensions.

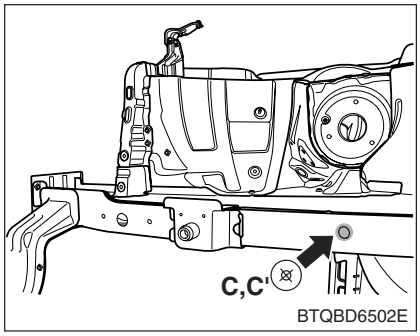
Point symbol	A-A'	B-B'	C-C'	D-D'	E-E'	F-F'	G-G'	H-H'
Length(mm)	896	893	900	916	1540	907	923	1563
Point symbol	I-I'	J-J'	K-K'	L-L'	M-M'	N-N'	O-O'	P-P'
Length(mm)	170	1334	1180	1183	1140	1218	1106	1106
Point symbol	0-A	0-B	0-C	0-D	0-E	0-F	0-G	0-H
Length(mm)	155	102	155	84	-2.9	155	195	56
Point symbol	0-I	0-J	0-K	0-L	0-M	0-N	0-O	0-P
Length(mm)	144	289	169	193	172	217	204	145
Point symbol	A-B	B-C	C-D	D-E	E-F	F-G	G-H	H-I
Length(mm)	265	278	222	190	365	540	156	243
Point symbol	I-J	J-K	K-L	L-M	M-N	N-O	O-P	
Length(mm)	540	60	477	167	151	544	327	



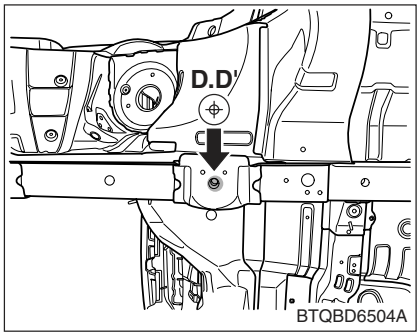
Front side member tooling hole (ø11)



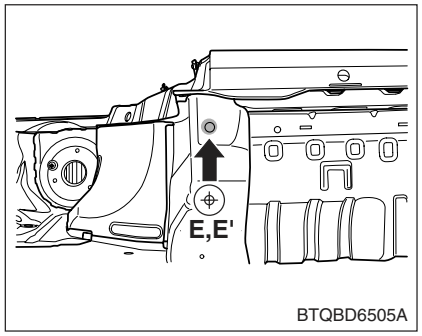
Sub frame front mounting pipe (ø30)



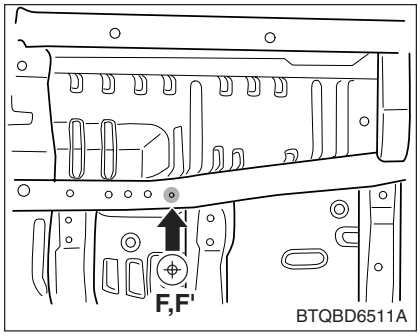
Front side member tooling hole (ø20)



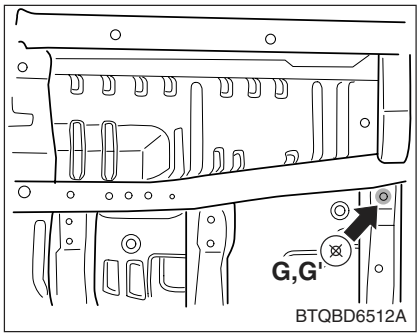
Front side member tooling hole (ø18)



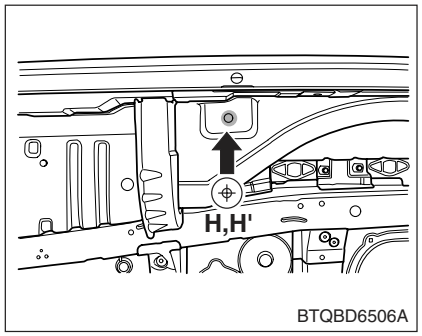
Dash panel tooling hole (ø15)



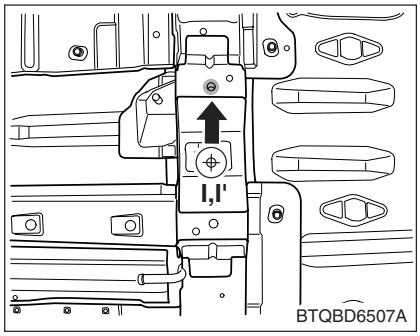
Front side member tooling hole (ø11)



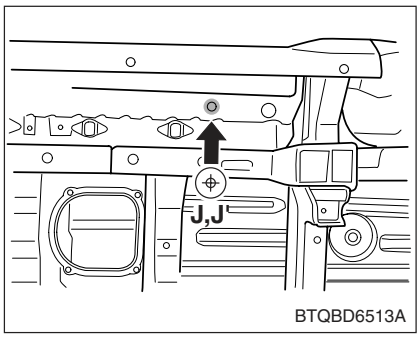
Cross member tooling hole (ø8)



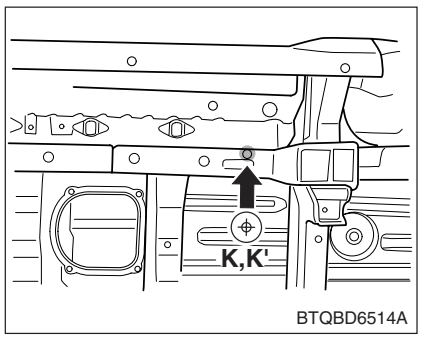
Center floor panel tooling hole (ø16)



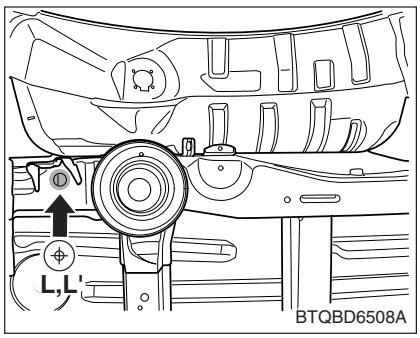
Cross member tooling hole (ø15)



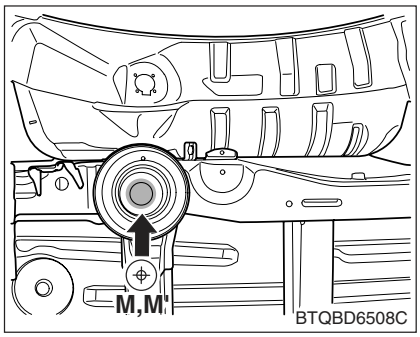
Rear floor panel tooling hole (ø15)



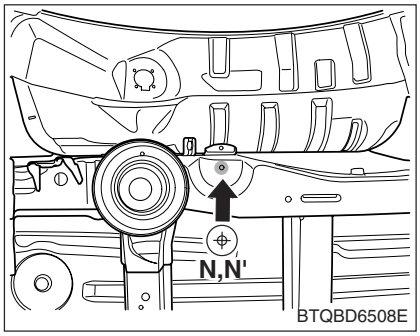
Rear side member tooling hole (ø6.6)



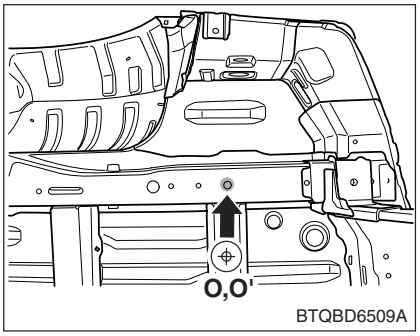
Rear side member tooling hole



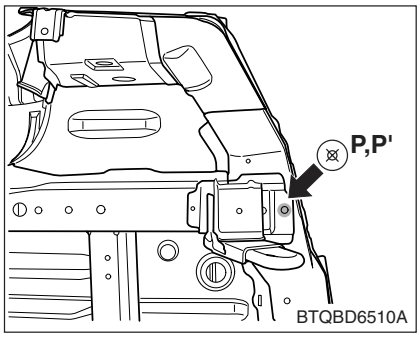
Spring mounting hole
(ø40)



Rear side member tooling hole
(ø9)

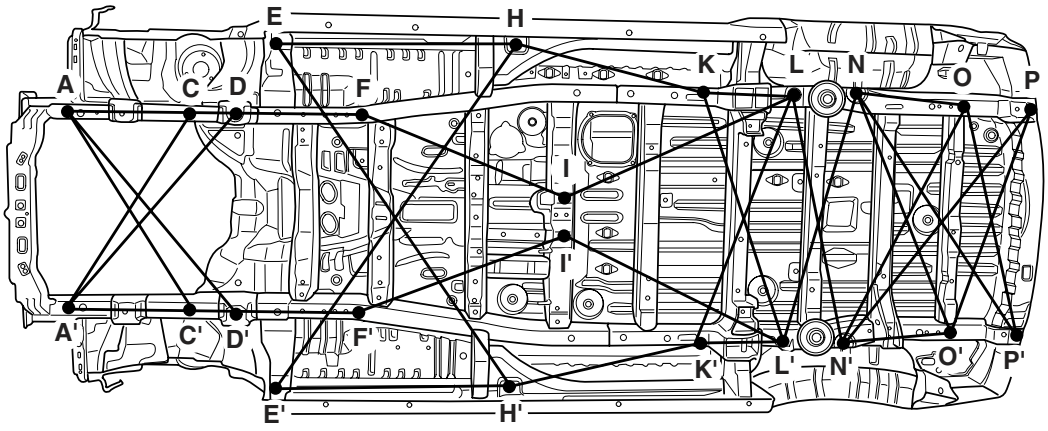


Rear side member tooling hole
(ø16)



Rear side member tooling hole
(ø11)

UNDER BODY (ACTUAL-MEASUREMENT DIMENSIONS)



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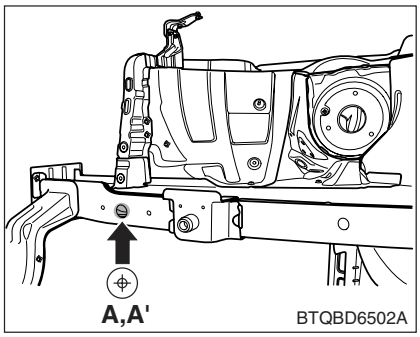
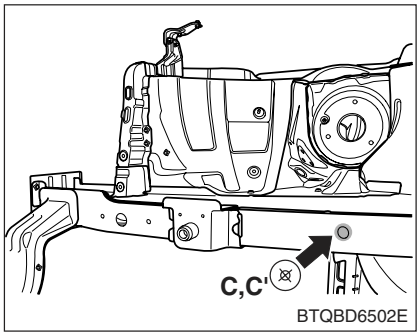
* These dimensions indicated in this figure are actual-measurement dimensions.

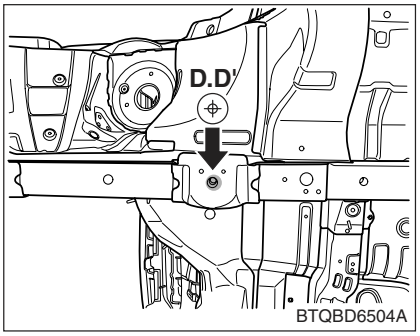
Point symbol	A-C'	A-D	A-D'	D-F	E-H	E-H'	F-I	H-K'
Length(mm)	1049	768	1188	560	1063	1881	1010	1614
Point symbol	**I-L**	**K-L'**	**L-N'**	**N-O**	**N-O'**	**N-P'**	**O-P'**	
Length(mm)	1191	1274	1242	547	1283	1454	1155	



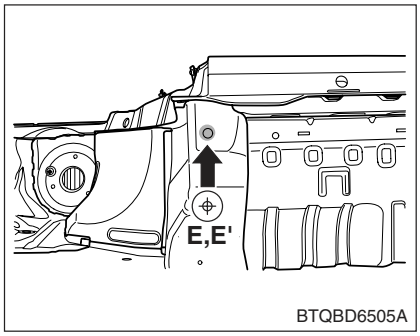
Front side member tooling hole (ø11)



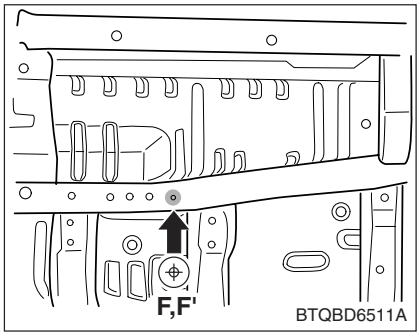
Front side member tooling hole (ø20)



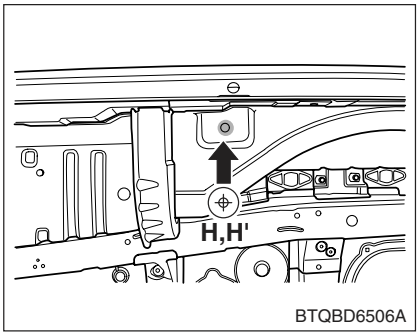
Front side member tooling hole (ø18)



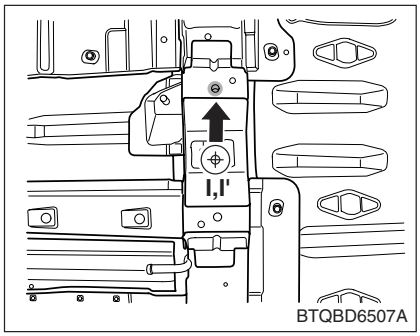
Dash panel tooling hole (ø15)



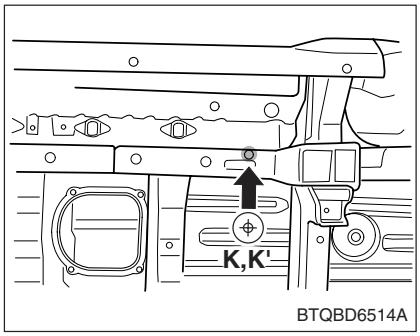
Front side member tooling hole (ø11)



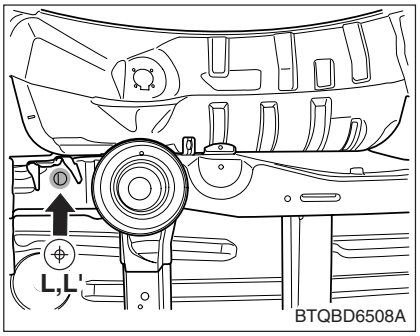
Center floor panel tooling hole (ø16)



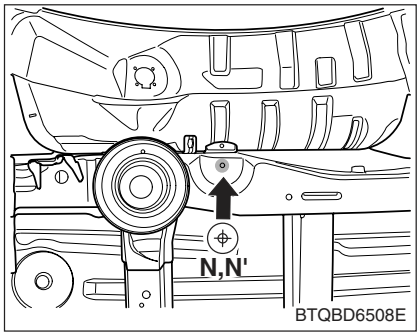
Cross member tooling hole (ø15)



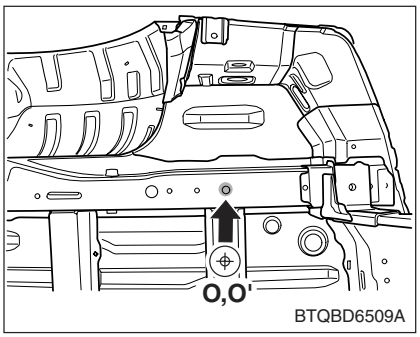
Rear side member tooling hole (ø6.6)



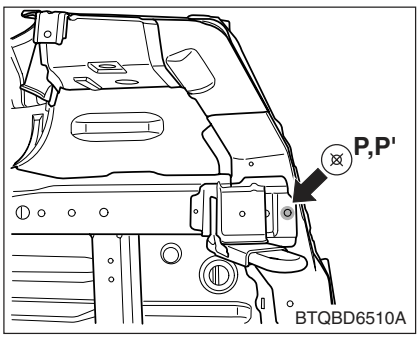
Rear side member tooling hole



Rear side member tooling hole (ø9)



Rear side member tooling hole (ø16)



Rear side member tooling hole (ø11)

Body Panel Repair Procedure

REPLACING BODY PANELS
- CODES FOR REMOVING AND INSTALLING BODY PANELS ..... BP - 2

NOTES WHEN WELDING BODY
- REMOVING SPOT WELDED AREA ..... BP - 3
- INSTALLING A NEW BODY FRAME ..... BP - 5
- DETERMINING A WELDING METHOD ..... BP - 5
- SPOT WELDING ..... BP - 5
- CARBON ARC WELDING ..... BP - 6
- REPLACING BODY PANEL
  - REMOVAL ..... BP - 7
  - PREPARATION FOR INSTALLATION ..... BP - 9
  - INSTALLATION ..... BP - 10

FENDER APRON PANEL ..... BP - 12
- REMOVAL ..... BP - 13
- INSTALLATION ..... BP - 14

FRONT SIDE MEMBER ..... BP - 17
- REMOVAL ..... BP - 18
- INSTALLATION ..... BP - 21

FRONT PILLAR ..... BP - 23
- REMOVAL ..... BP - 24
- INSTALLATION ..... BP - 28

CENTER PILLAR ..... BP - 31
- REMOVAL ..... BP - 32
- INSTALLATION ..... BP - 35

FRONT SIDE SILL PANEL ..... BP - 37
- REMOVAL ..... BP - 38
- INSTALLATION ..... BP - 39

REAR SIDE SILL PANEL ..... BP - 40
- REMOVAL ..... BP - 41
- INSTALLATION ..... BP - 41

QUARTER PANEL ..... BP - 43
- REMOVAL ..... BP - 44
- INSTALLATION ..... BP - 45

LOWER QUARTER PANEL ..... BP - 47
- REMOVAL ..... BP - 48
- INSTALLATION ..... BP - 49

QUARTER OUTER REAR EXTENSION ..... BP - 50
- REMOVAL ..... BP - 51
- INSTALLATION ..... BP - 51

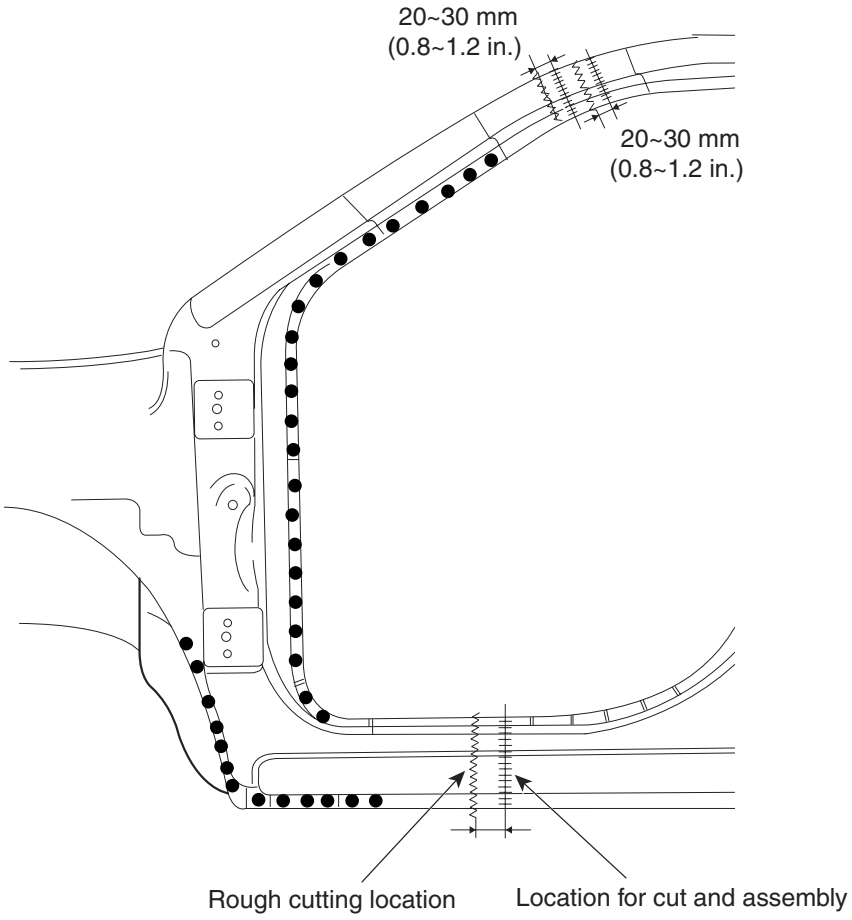
REAR END CROSS MEMBER ..... BP - 53
- REMOVAL ..... BP - 54
- INSTALLATION ..... BP - 55

REAR END CROSS OUTER LOWER MEMBER ..... BP - 58
- REMOVAL ..... BP - 59
- INSTALLATION ..... BP - 60

REAR SIDE MEMBER ..... BP - 62
- REMOVAL ..... BP - 63
- INSTALLATION ..... BP - 64

REPLACING BODY PANELS

CODES FOR REMOVING AND INSTALLING BODY PANELS



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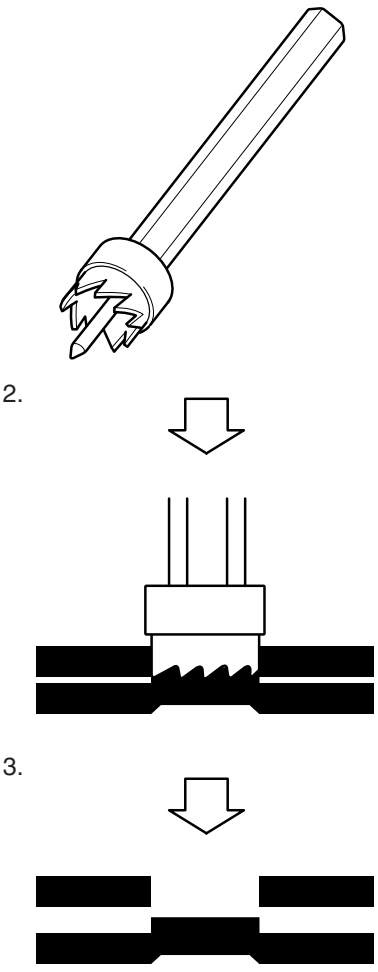
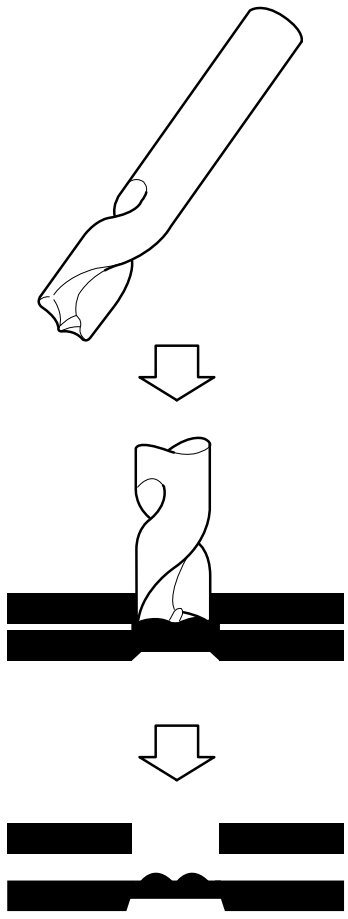
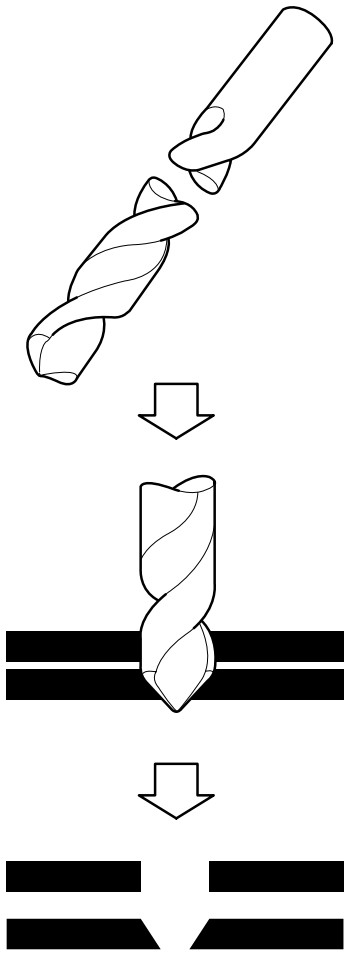
NOTES WHEN WELDING BODY

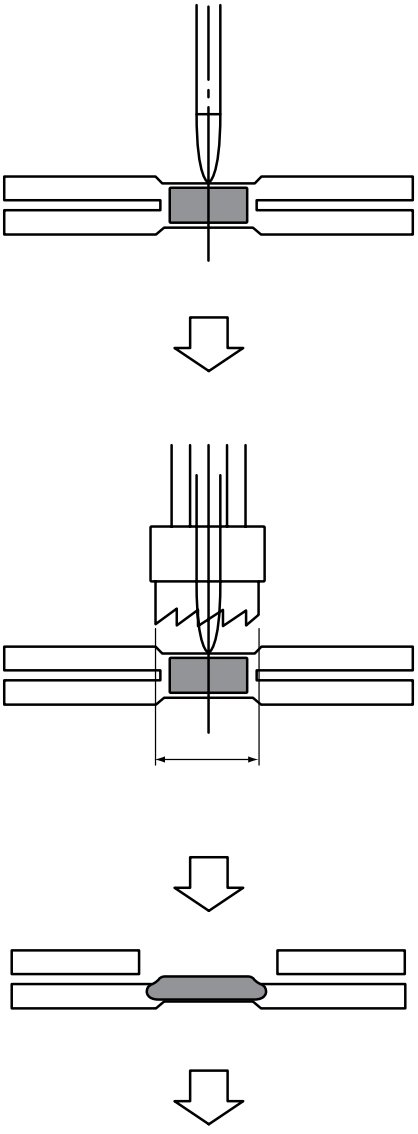
REMOVING SPOT WELDED AREA

Most body parts are spot welded. In order to remove the damaged area, it is best to remove the spot welded area from the body frame using a spot cutter or candle type edge drill bit.
Do not use a drill bit with a tapered edge. Center punch middle of spot weld to insure the entire spot weld will be removed.

1. Spot cutter	1. Drill(candle type edge)	1. Drill(taper edge)
		
Correct	Correct	Not correct

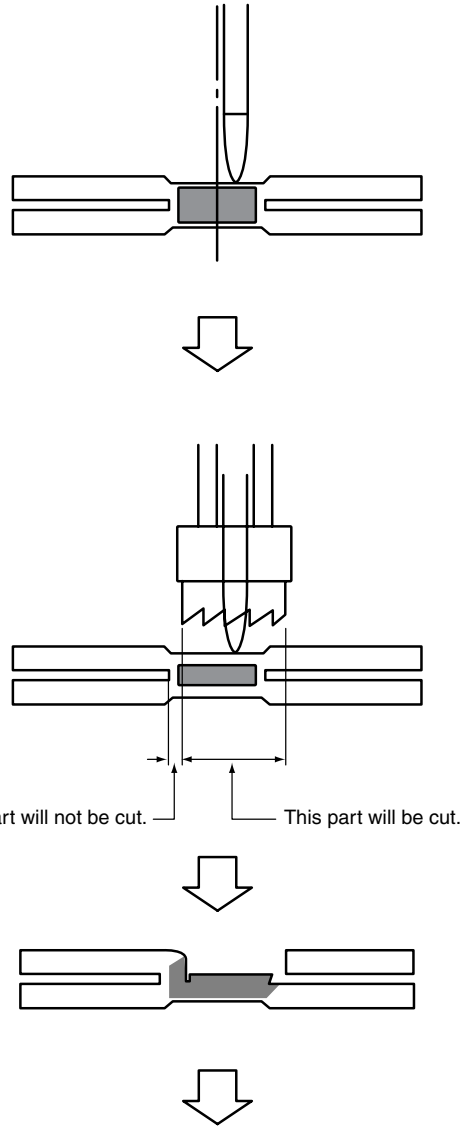
BVQBP6002

Center punch the middle(nugget) of the spot weld.



Spot welded area can be removed from the body frame.

Otherwise,



Spot welded area cannot be removed from the body frame.

BVQBP6003

INSTALLING A NEW BODY FRAME

The efficiency of the transmission and load distribution are determined by many complicated factors such as thickness of plate, shape and size of a cross section, damage of parts, variance of joints, welding method, and/or welding locations. Therefore, a new part should be fitted to the body frame using the proper procedures to avoid reducing the strength of the body.

DETERMINING A WELDING METHOD

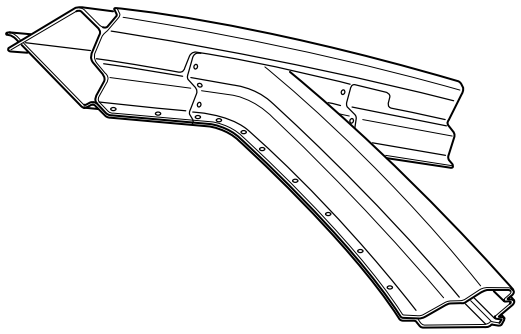
It is extremely important that appropriate welding methods, which don't reduce the original strength and durability of the body be used when making repairs. Try to use either spot welding or carbon arc(plug) welding. Do not braze any body components other than the ones brazed at the factory. Do not use an oxy-acetylene torch for welding.

Welding	Symbol	Details
Spot welding	●	The most reliable welding method (provides high efficiency and quality of assembled part.)
Carbon arc welding (Plug welding)	■	Use when spot welding cannot be done or spot welding is not necessary.
Oxygen-acetylene welding	✖	Not used

BVQBP6004

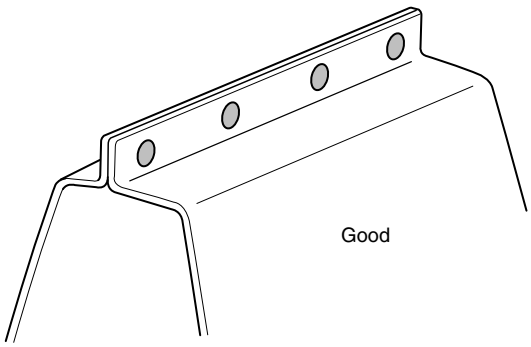
SPOT WELDING

1. Commercial spot welding machines do not perform as well as the machines used in the manufacturing process. When spot welding, increase the number of spot welds by 30% (1.3 times the original number of welds).



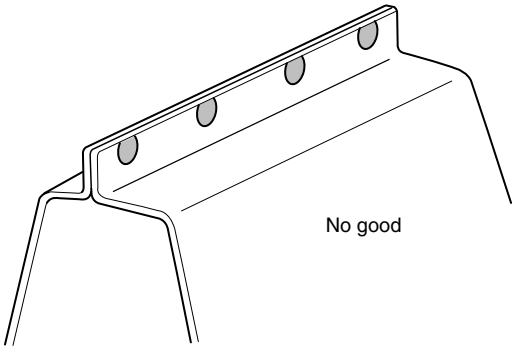
BVQBP6005

2. When spot welding, weld in the middle of the joint.



BVQBP6006

- Spot welding on the edge of the joint will reduce welding strength.

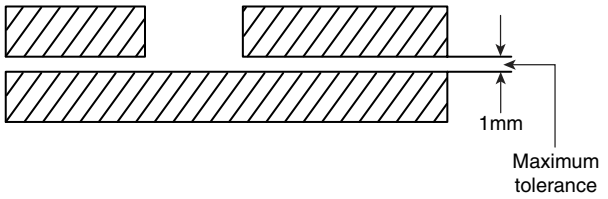


BVQBP6007

CARBON ARC WELDING

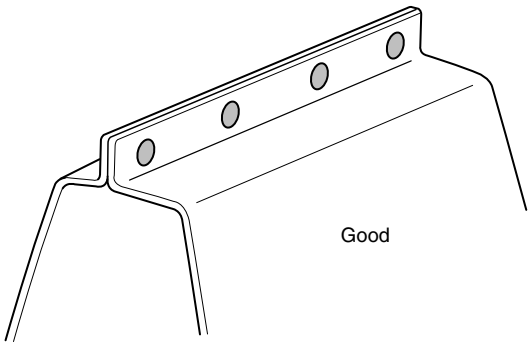
In areas where spot welding is not suitable, do plug welding using a carbon welding machine.

1. Clamp the parts to be welded together tightly. Do not exceed 1 mm of space between parts. A tolerance greater than 1 mm will reduce the strength of the welded area.



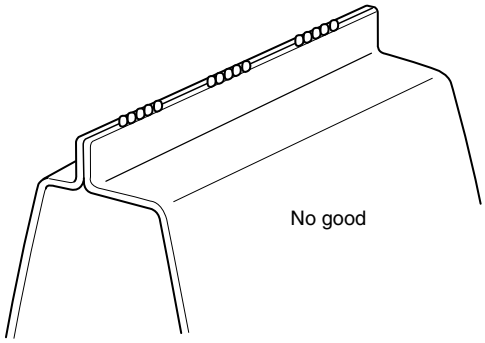
BVQBP6008

2. Weld in the middle of the flange joint.
   a) Drill a hole 5~6 mm on one side of the flange only, and weld within the hole.



BVQBP6006

   b) Do not weld on the edge of the flange joint.

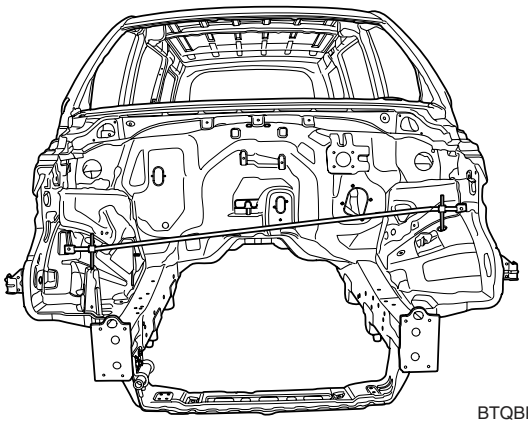


BVQBP6009

REPLACING BODY PANEL

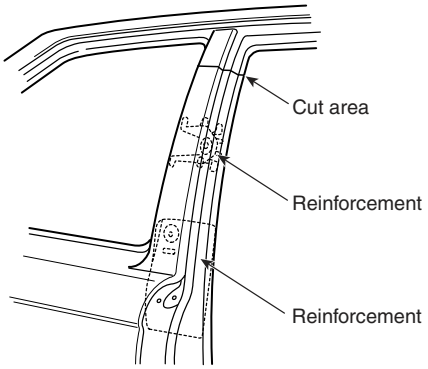
REMOVAL

1. **Body measurement**
   a) Before removing, measure the damaged area according to the dimensions supplied in Body Dimension, section BD. If deformation is present, use a frame straightener to adjust.
   b) When removing a panel, apply clamps to prevent damage of each part, and support the lower end of the frame to prevent deformation during the procedure.



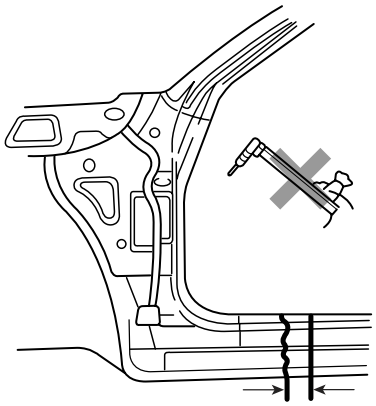
BTQBP6104

2. **Cut and welding point selection**
   Cutting, if necessary, should not be done in a reinforcement area. Select an area which will result in the least amount of deformation after welding.



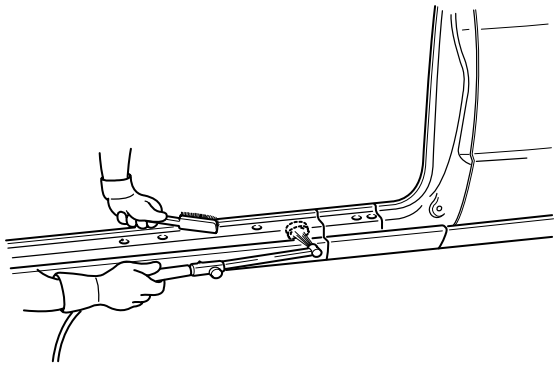
BVQBP6011

3. **Cutting rough area for replacement part**
   Cutting should be done according to the following steps to make removal easy:
   a) Use care when cutting an area close to a pipe or wiring harness.
   b) Cut an area leaving 30~50 mm of tolerance.



BVQBP6012

4. **Removing paint from an area to be spot welded**
   Using a torch and wire brush, remove paint completely before beginning welding.

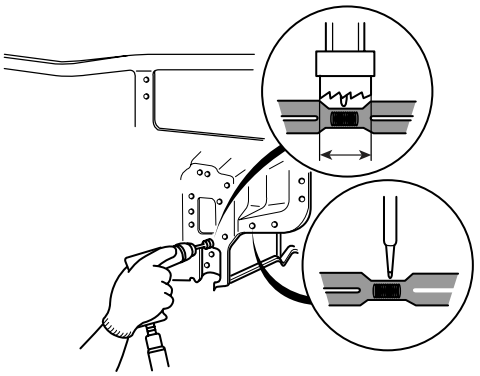


BVQBP6013

5. Determine a cutting method

a) Cutting a spot welded area

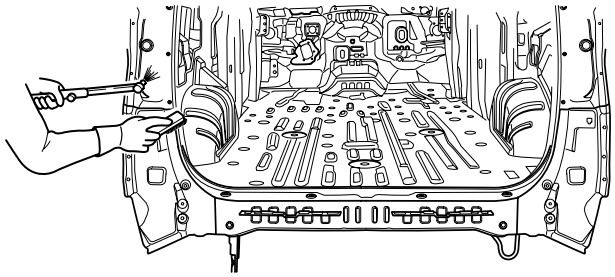
Make a hole in the middle of spot welded area with a punch, remove welded area using a spot cutter and remove using a chisel.



BVQBP6014

b) Removing brazed area

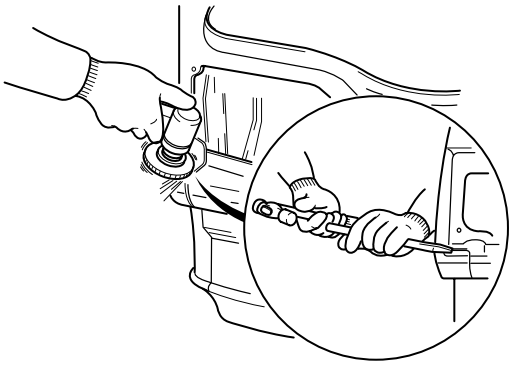
Remove brazed area using a torch and wire brush, and chisel.



BTQBP6401D

c) Removing plug welded area

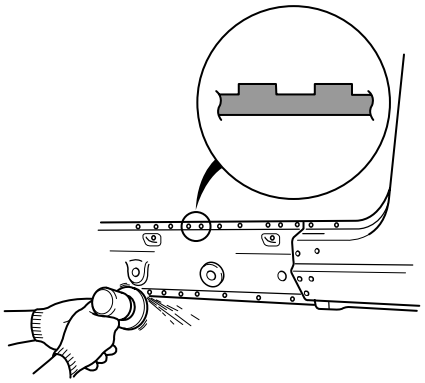
Remove plug welded area using a disk grinder and chisel.



BVQBP6016

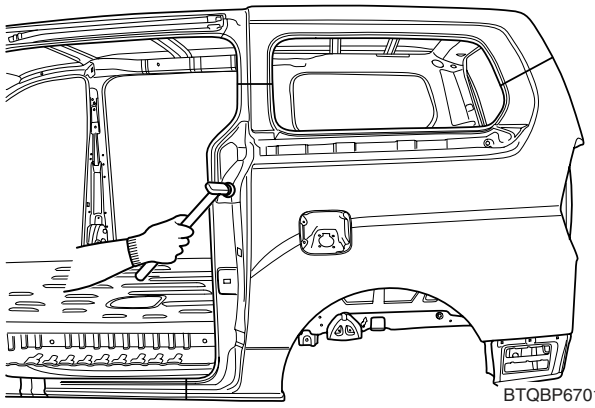
PREPARATION FOR INSTALLATION

1. **Spot weld finish**
   Use a disk grinder or similar tool to finish spot weld mark. Do not grind more than necessary to smooth surface.



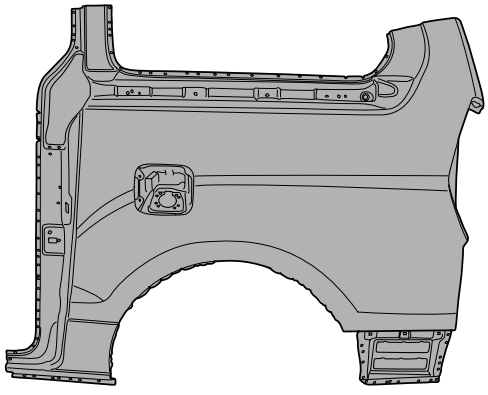
BVQBP6017

2. **Panel preparation**
   Repair any bent or uneven areas with a hammer to improve the installation process.



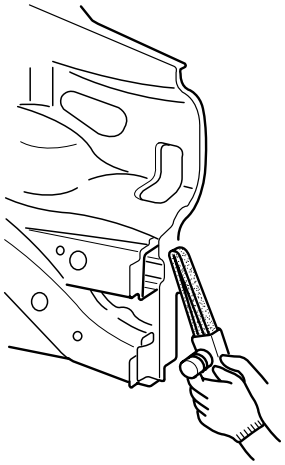
BTQBP6701B

3. **Cutting a rough area for a new part**
   When cutting an rough area for a new part, leave a tolerance of 30~50 mm.



BTQBP6707A

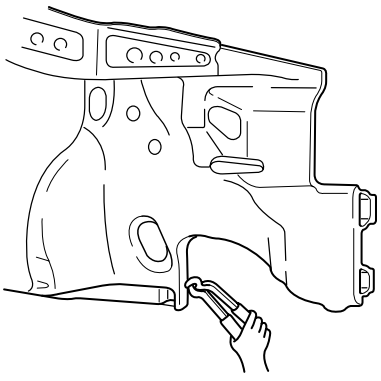
4. **Preparation for spot welding**
   Remove paint on spot welded area and on the area overlapped by the new part using a belt sander or similar tool.



BVQBP6020

5. **Drilling a hole for plug welding**
   If the thickness of the part to be welded is less than 3 mm, drill a 5~6 mm diameter hole. If the thickness of the part to be welded is greater than 3 mm, drill a hole using a 7 mm diameter drill.

NOTE
Do not spot weld where thickness is greater than 3 mm.

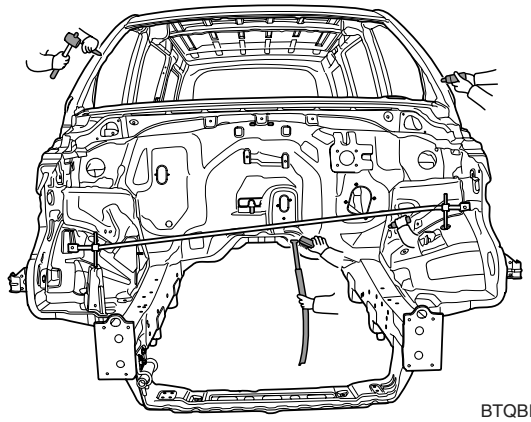


BVQBP6021

INSTALLATION

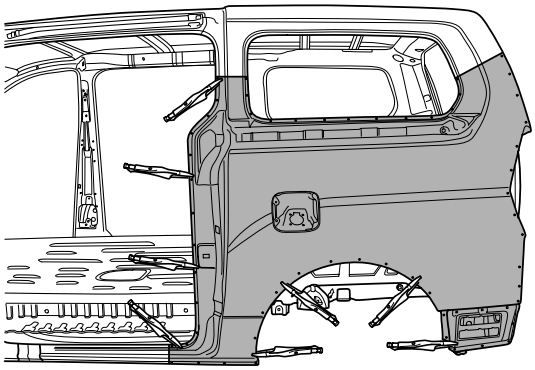
1. Checking welding and fitting in advance

a) When installing a new part, measure the dimensions of each part according to the body dimensions given in Section BD, and set part to the reference dimensions.



BTQBP6104

b) Prior to final welding, check the fit of all related parts.



BTQBP6701G

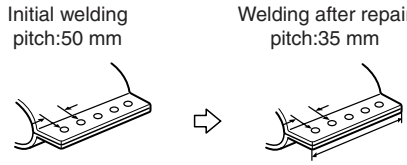
2. Selecting number of welding points

Spot welding : Multiply the original number of factory welds by 1.3 times

Plug welding : Same number as original number of factory welds

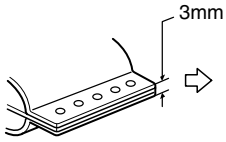
NOTE

- *Plug welding should be done using a carbon arc welding machine.*
- *Brazing should be done only on areas that were originally brazed at the factory.*



Spot welding:initial number of welds x1.3

Welding points-same number as original number of factory welds.



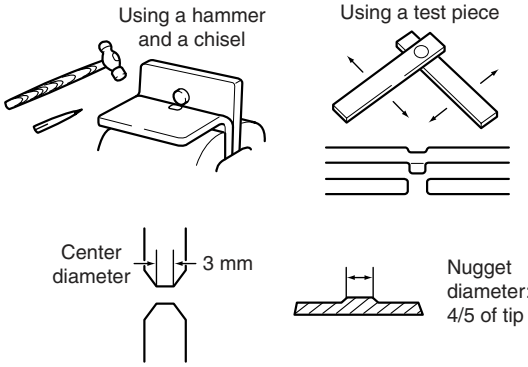
Plug welding-used when spot welding is not feasible or material is thicker than 3 mm.

BVQBP6024A

3. Caution when spot welding

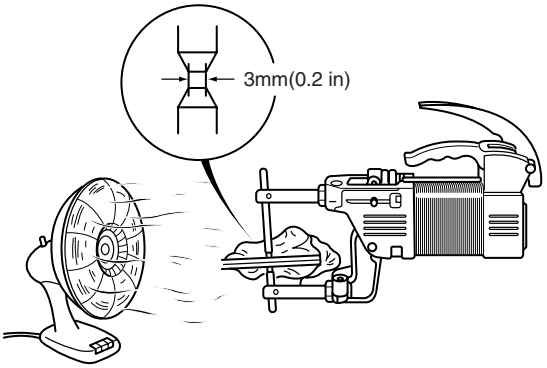
a) Do a test welding on a piece of material of the same type and thickness as the part to be welded and proceed if test weld is good.

b) Before spot welding, check if welding debris, oil or paint is present on the area where surfaces meet.
Clean or sand as necessary.



BVQBP6025

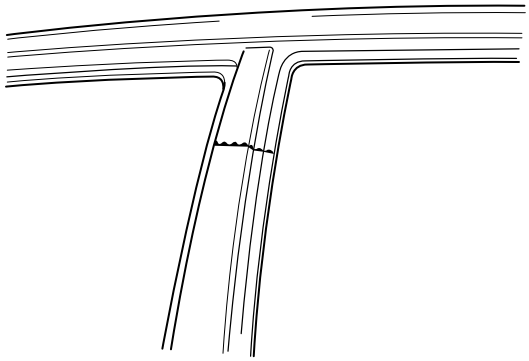
c) The tip of the spot welding machine should be maintained to a minimum tolerance of 3 mm. Also let area cool after 5 or 6 welds to minimize problems caused by excessive heat.



BVQBP6026

4. Cutting and welding an removed area

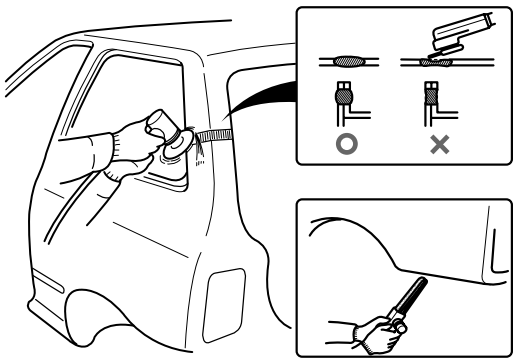
To align a roof panel and a center pillar together for butt welding, temporarily fasten a steel flange to the roof panel and then apply the new center pillar panel. Remove the flange when final welding is done.



BVQBP6027

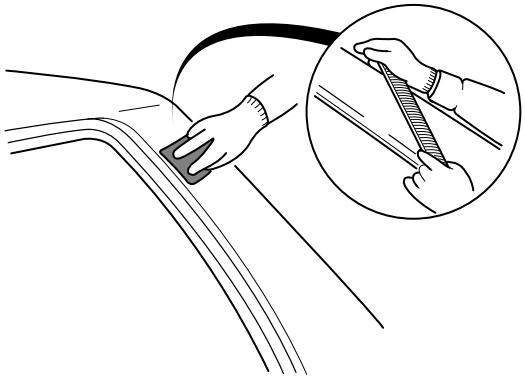
5. Finishing after welding

a) Grind any areas that were plug welded or butt welded using a disk grinder. Grind carefully to avoid removing too much material. This degrades the strength of the weld.



BVQBP6028

b) Finish areas that have been brazed by applying body filler then smooth the area with a flexible file and sander.



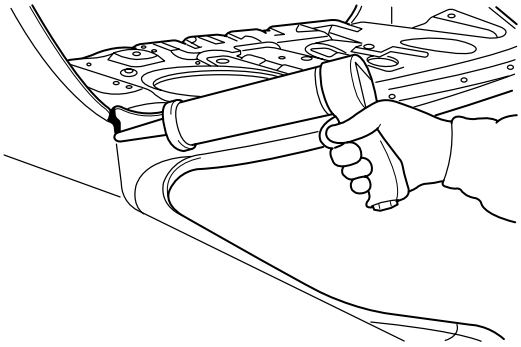
BVQBP6029

6. Applying anti-rust agent and body sealer

After coating the surface with anti-rust agent, apply body sealer where necessary.

NOTE

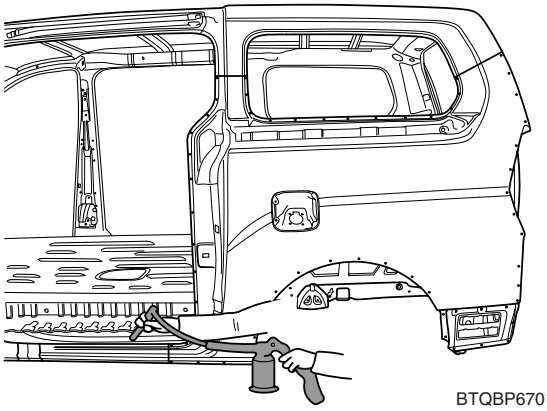
Apply body sealer before assembly.



BVQBP6030

7. Anti-rust treatment

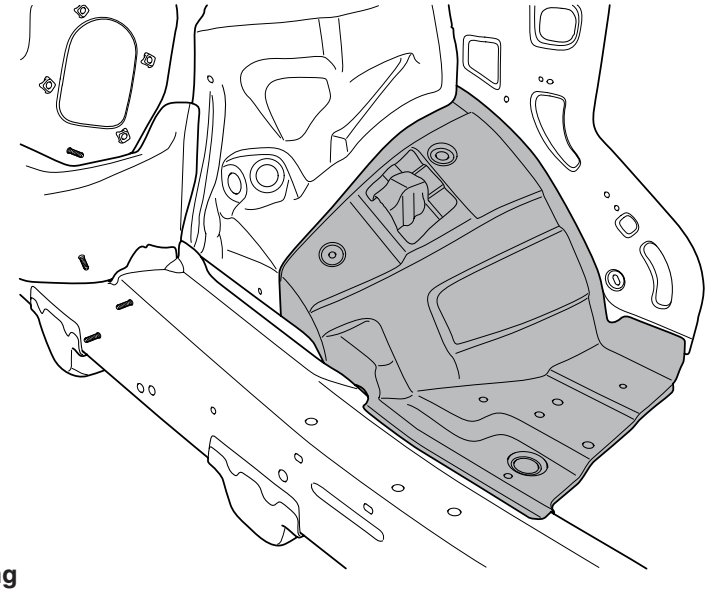
Apply anti-rust agent to inside of doors and sills by spraying through access holes provided.



BTQBP6701H

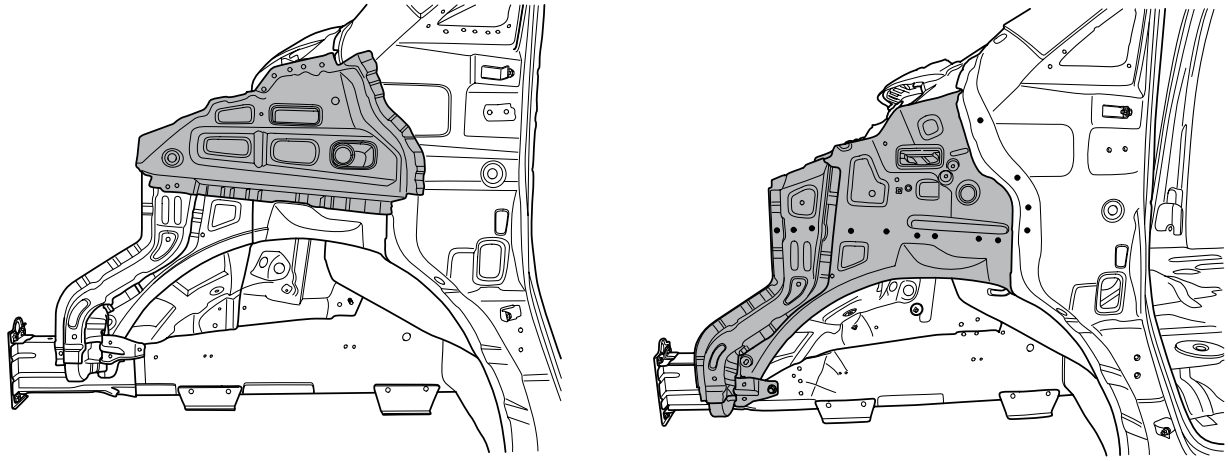
FENDER APRON PANEL

WELDING POINTS



- ● MIG plug welding
- ⫲ MIG butt welding
- ⤫ MIG lap welding

BFDBP6102



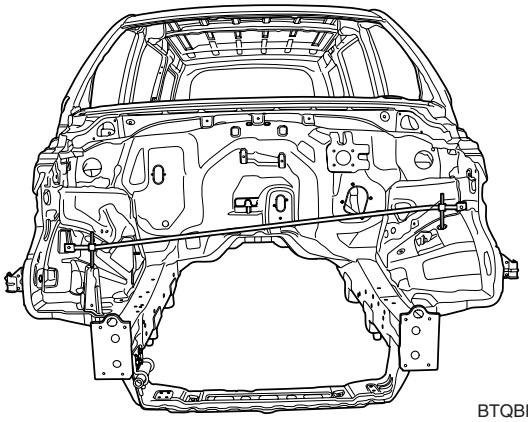
- ● MIG plug welding
- ⫲ MIG butt welding
- ⤫ MIG lap welding

BTQBP6103

REMOVAL

NOTE

Before repairing, remove Engine and Suspension Components.
Refer to the body dimension charts and measure the vehicle to determine straightening and alignment requirements. The body must be returned to its original dimension before begining the repair procedure.

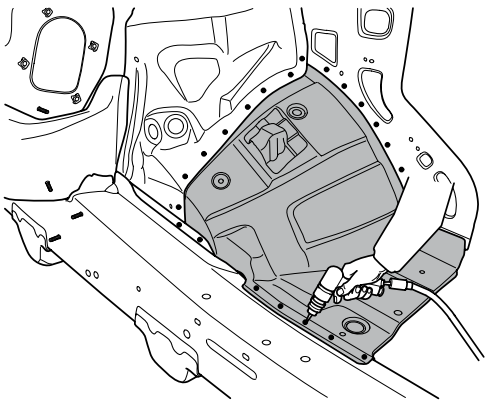


BTQBP6104

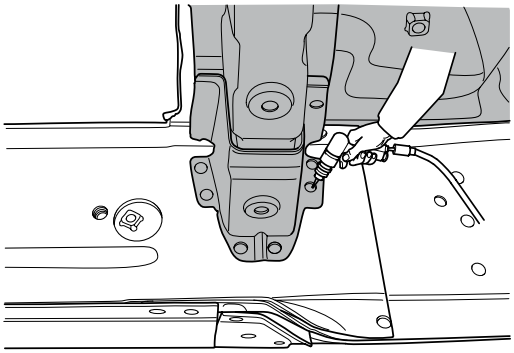
1. 1. Drill out all the spotwelds(47) to separate front wheel housing panel from shock absorber housing panel, fender apron inner panel and front side member.

NOTE

When spotwelded portions are not apparent, remove paint with a rotary wire brush.

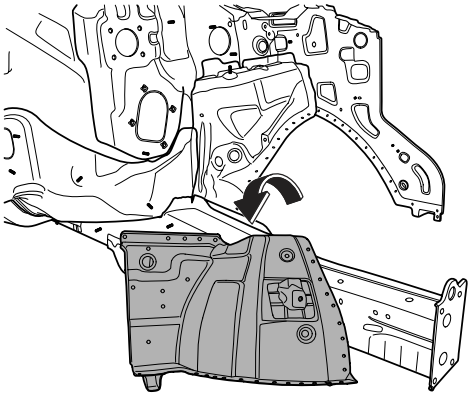


BTQBP6101A



BTQBP6105

2. Remove the front wheel housing panel.

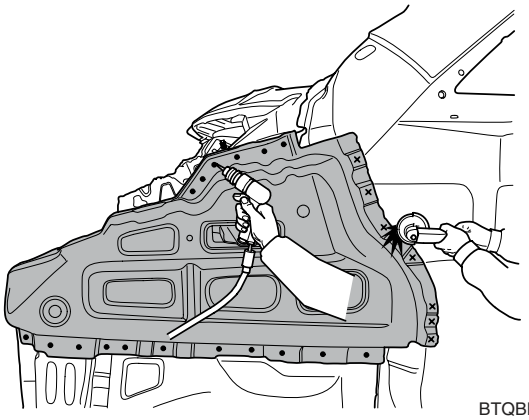


BTQBP6106

3. Drill out and grind away all spotwelds(23) and MIG lap welds(6) attaching the fender apron outer panel.

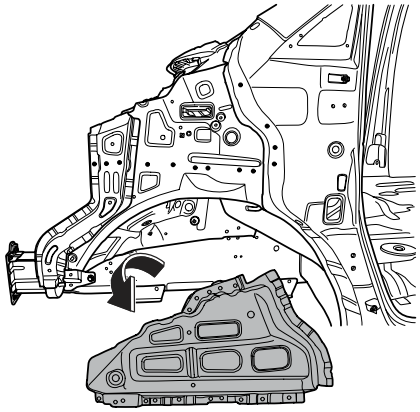
NOTE

If it is possible that the fender apron outer panel is reusable, be careful not to damage it while removing.



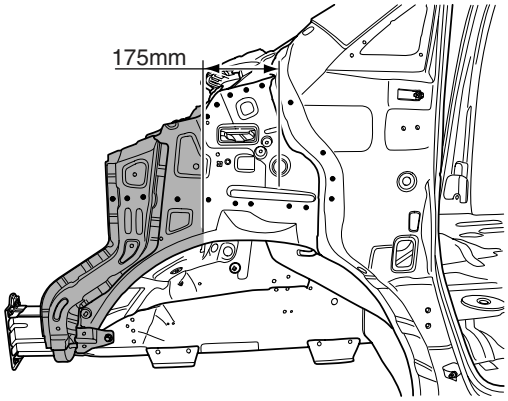
BTQBP6107

4. Remove the fender apron outer panel.



BTQBP6108

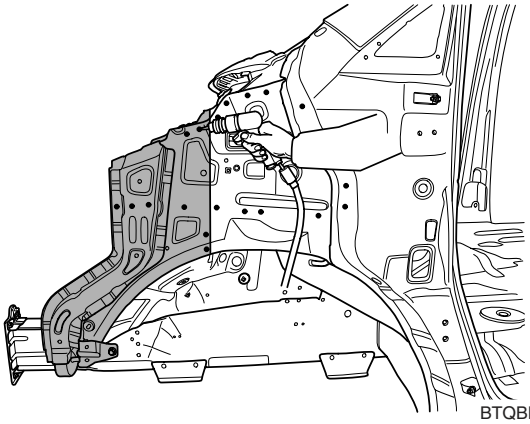
5. Measure and mark the vertical cutline on the fender apron inner panel 175mm from the fender apron inner panel tooling hole center.



BTQBP6108A

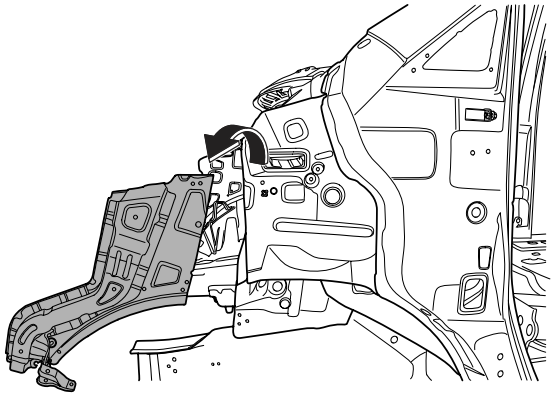
6. Cut the fender apron inner panel along the cutline.

7. Drill out and grind away all spotwelds(5) attaching the fender apron inner panel and fender apron support.



BTQBP6108B

8. Remove the fender apron inner panel.



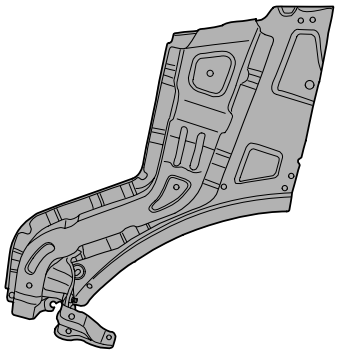
BTQBP6109A

9. Prepare all surfaces to be welded.

10. After removing, apply the welding primer.

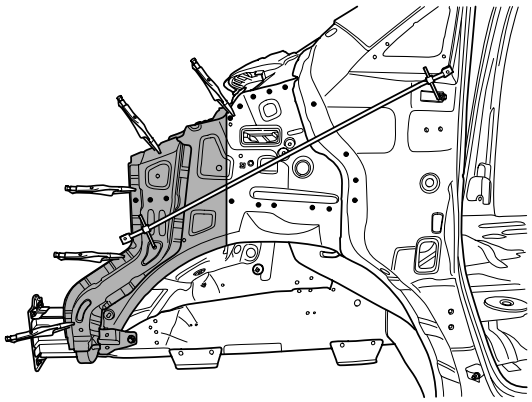
INSTALLATION

1. Transcribe the fender apron inner panel cutline to the new fender apron inner panel, cut to length and chamfer butt end to improve weld surface.



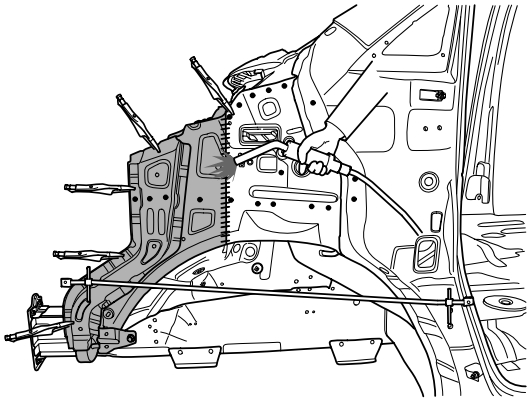
BTQBP6109A

2. Fit and clamp the fender apron upper inner panel in place.
3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



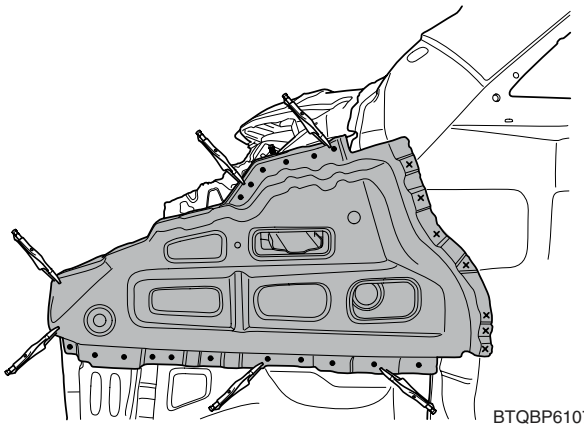
BTQBP6108C

4. MIG plug weld all holes and MIG butt weld all seams.



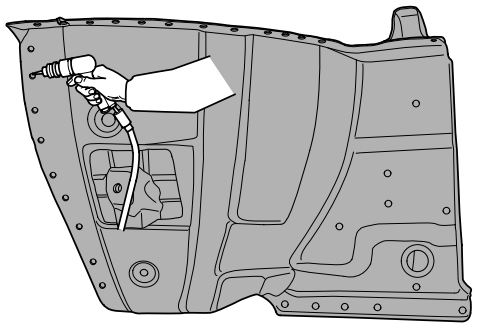
BTQBP6108D

5. Clean and prepare all welds, and remove all residue.
6. After removing, apply the welding primer.
7. Fit and clamp the fender apron outer panel in place.
8. MIG plug weld all holes and MIG lap weld all seams.



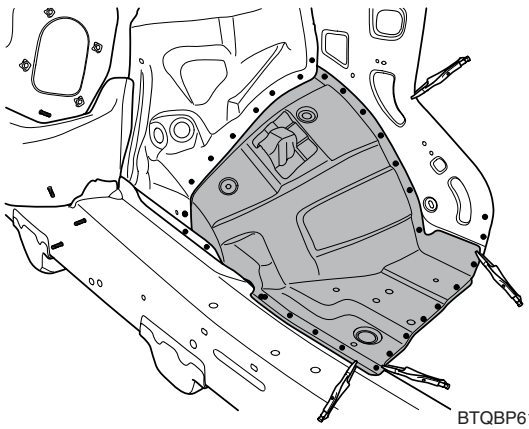
BTQBP6107A

9. Drill 8mm holes in the new wheel housing panel for MIG plug welding.



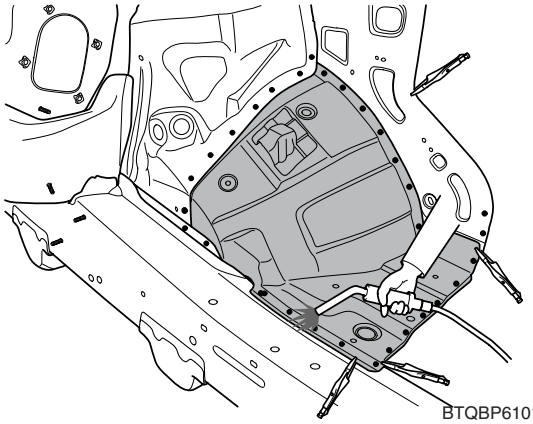
BTQBP6109B

10. Fit and clamp the wheel housing panel in place.
11. Measure each measurement point and correct the installation position.

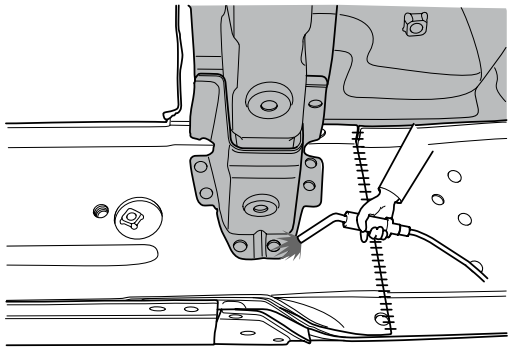


BTQBP6101B

12. MIG plug weld all holes.



BTQBP6101C



BTQBP6105A

13. Clean and prepare all welds, and remove all residue.

14. Apply the two-part epoxy primer to the interior of each panel.

15. Apply an anti-corrosion agent as required. (Refer to the BODY CORROSION PROTECTION)

16. Prepare the exterior surfaces for priming using wax and grease remover.

17. Apply metal conditioner and water rinse.

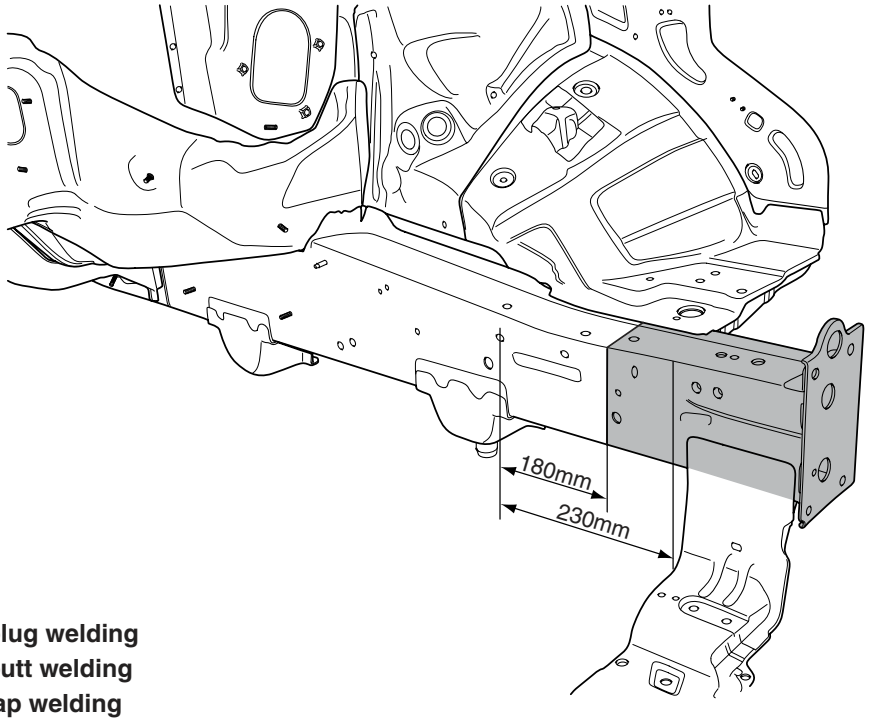
18. Apply conversion coating and water rinse.

19. Apply the two-part epoxy primer.

20. Apply the correct seam sealer to all joints carefully. (Refer to the BODY SEALING LOCATION)

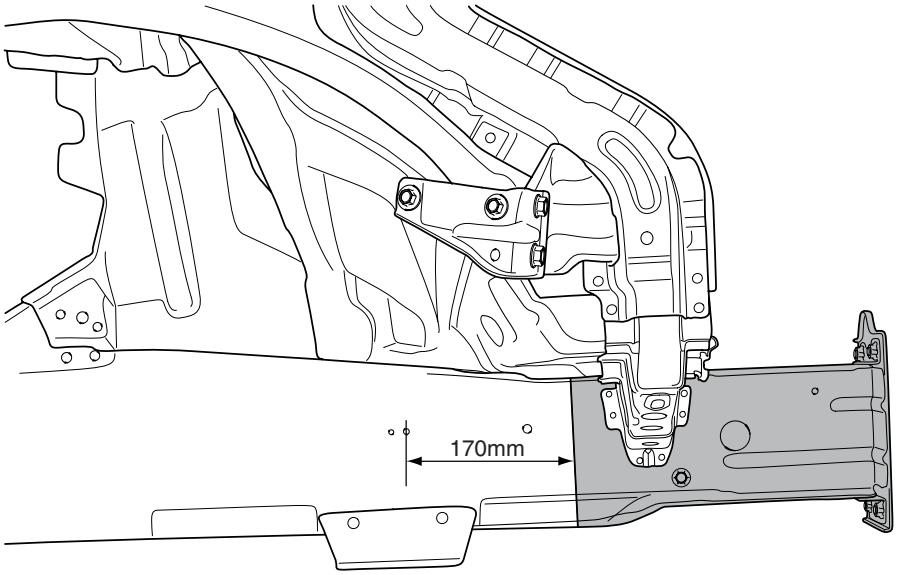
FRONT SIDE MEMBER

WELDING POINTS



● MIG plug welding
MIG butt welding
MIG lap welding

BTQBP6201



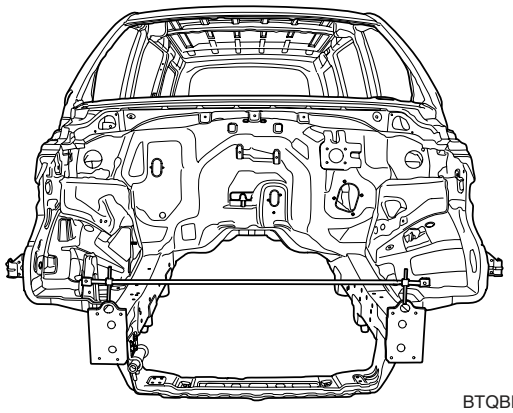
● MIG plug welding
MIG butt welding
MIG lap welding

BTQBP6202

REMOVAL

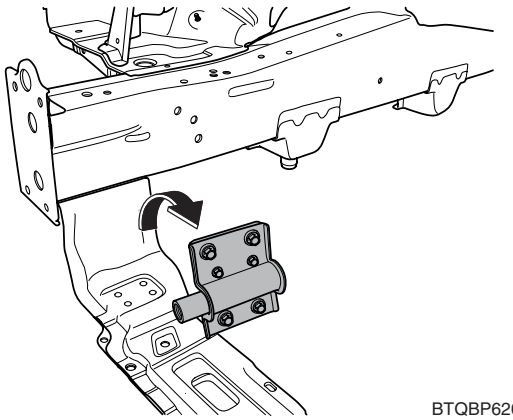
NOTE

Before repairing, remove Engine and Suspension Components.
Refer to the body dimension charts and measure the vehicle to determine straightening and alignment requirements. The body must be returned to its original dimension before begining the repair procedure.



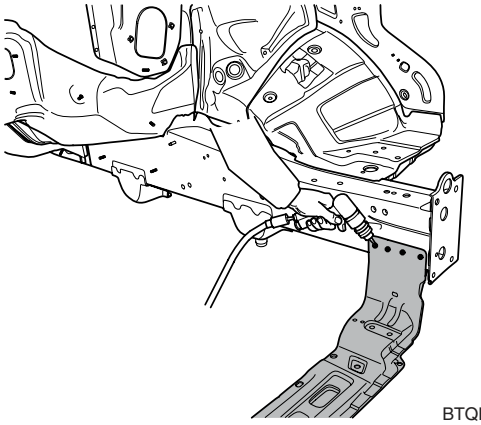
BTQBP6104A

1. Before cutting the front side member, remove the towing hook bracket.



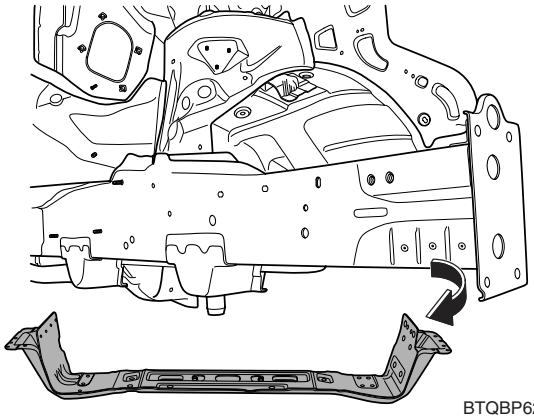
BTQBP6203A

2. Drill out the sportwelds(18) to separate front end cross member.



BTQBP6201A

3. Remove front end cross member.

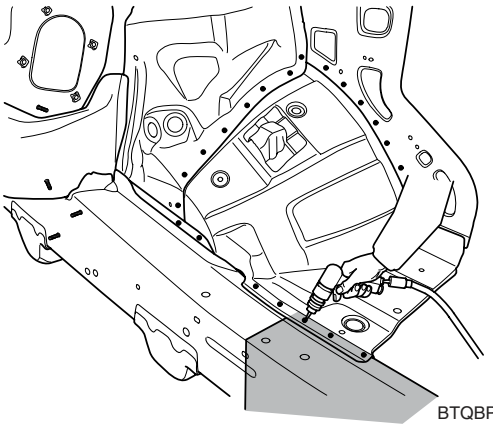


BTQBP6204

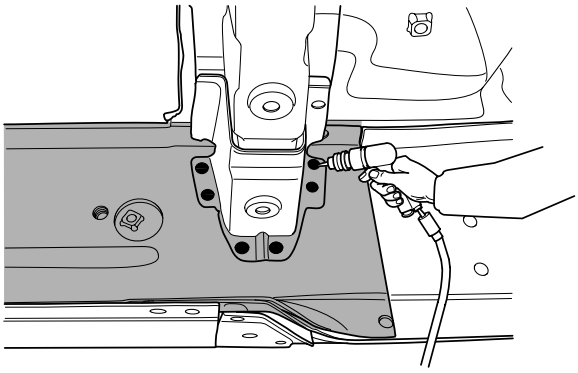
4. Drill out all the spotwelds(12) attaching the front side member.

NOTE

When spotwelded portions are not apparent, remove paint with a rotary wire brush.

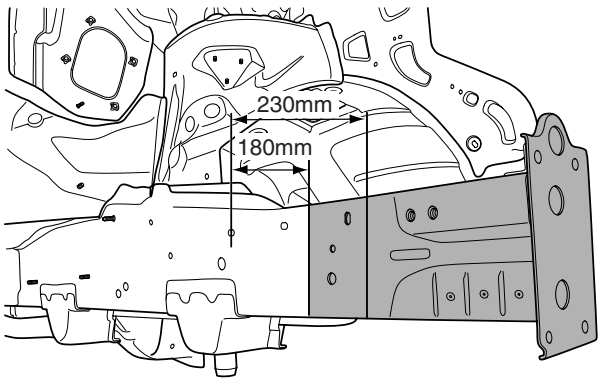


BTQBP6101E



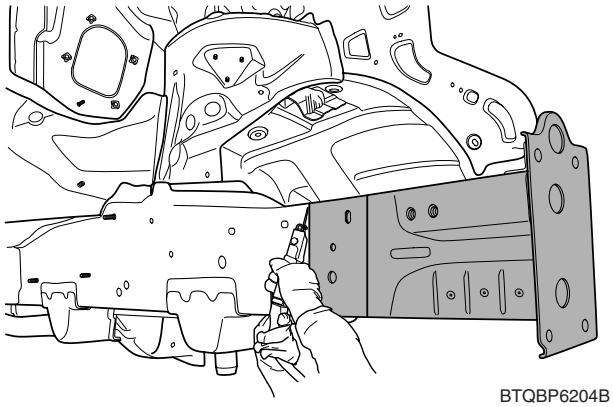
BTQBP6105C

5. Measure and mark the vertical cutlines on front side inner member 180mm and 230mm from the front side inner member tooling hole center.



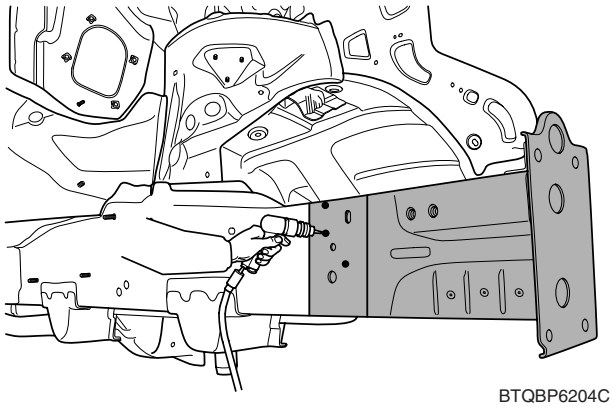
BTQBP6204A

6. Cut the front side inner member along the cutlines.



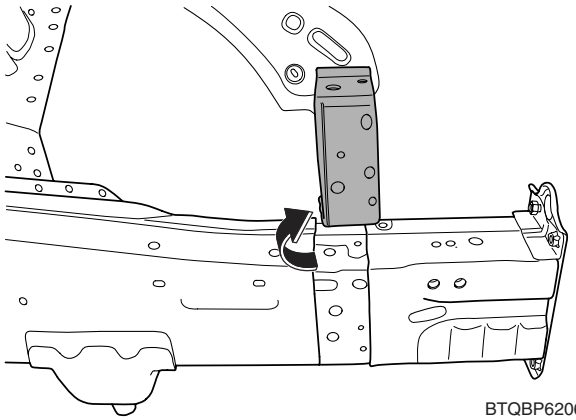
BTQBP6204B

7. Drill out all the spotwelds(7) to front side inner member section.



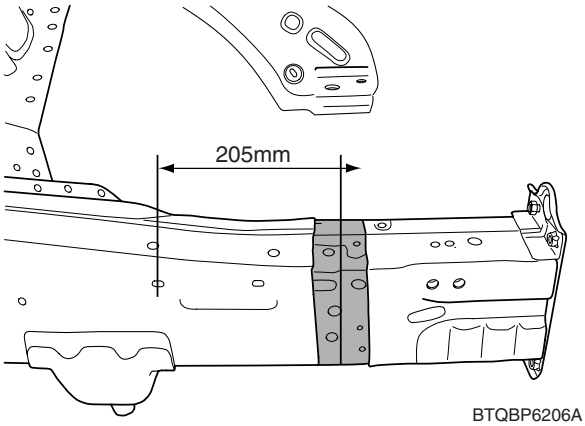
BTQBP6204C

8. Remove the front side inner member section.



BTQBP6206

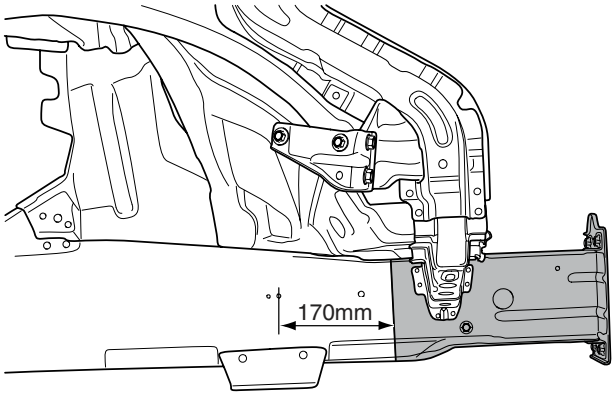
9. Measure and mark the vertical cutline on front side inner member reinforcement 205mm from front side inner member tooling hole center.



BTQBP6206A

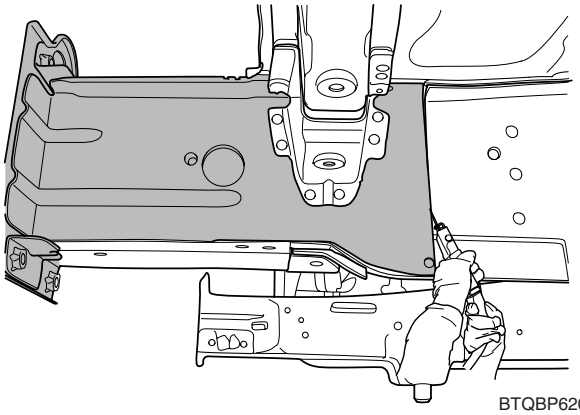
10. Cut the front side member reinforcement along the cutline.

11. Measure and mark the vertical cutline on the front side outer member 170mm from front side outer member tooling hole center.



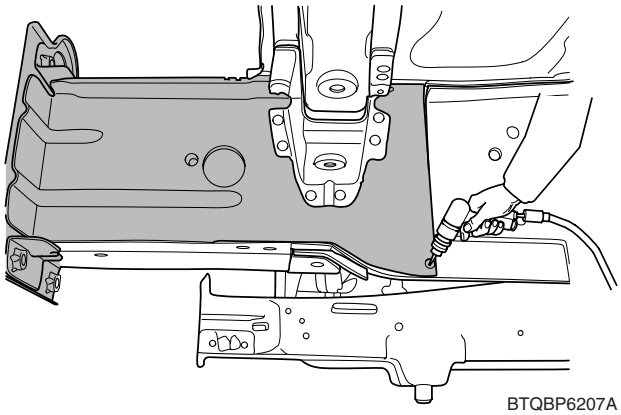
BTQBP6202A

12. Cut the front side outer member along the cutline.



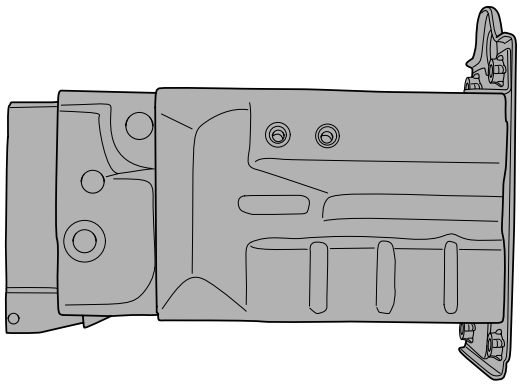
BTQBP6207

13. Drill out all the spotwelds(2) to front side outer member.



BTQBP6207A

14. Remove the front side member.



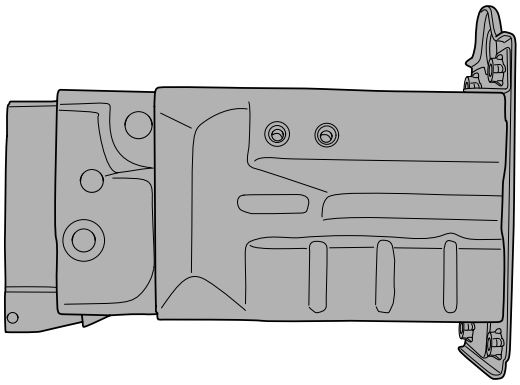
BTQBP6208

15. Prepare all surfaces to be welded.

16. After removing, apply the welding primer.

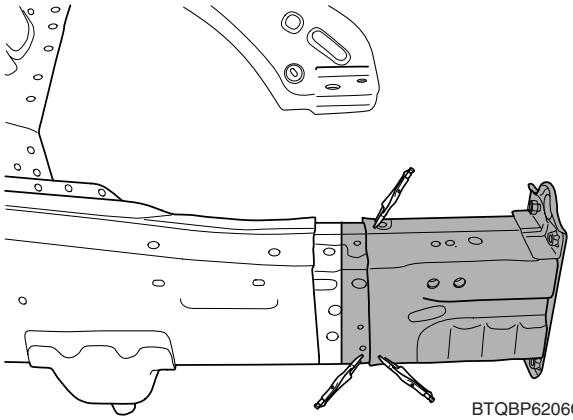
INSTALLATION

1. Transcribe the front side member inner and outer cutline to the new front side member, cut to length and chamfer butt end to improve weld surface.



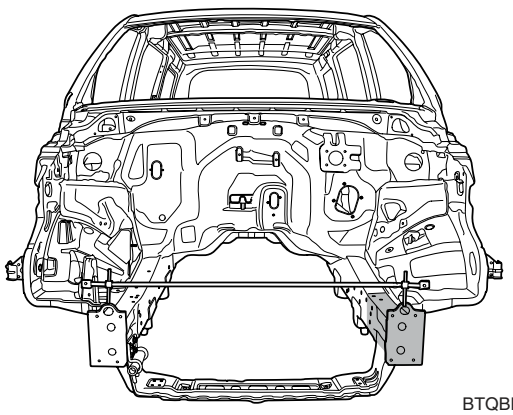
BTQBP6208

2. Fit and clamp the front side member in place.



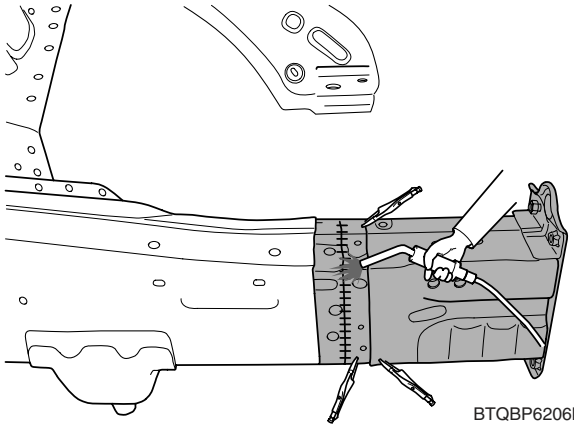
BTQBP6206C

3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

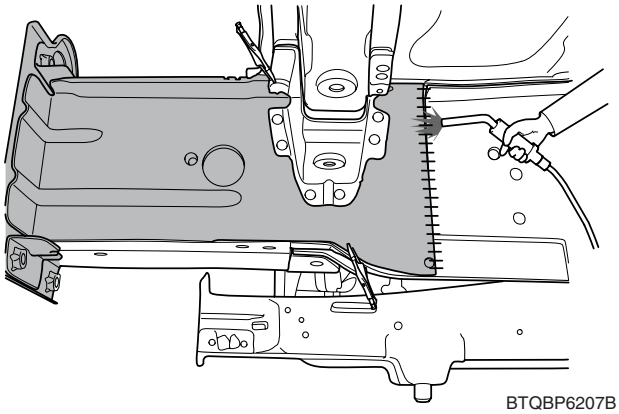


BTQBP6104B

4. MIG plug weld all holes and MIG butt weld all seams.

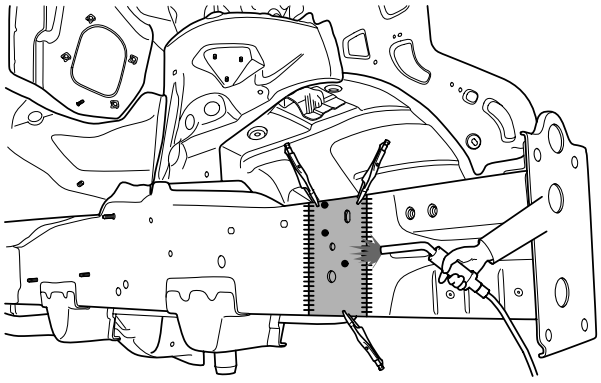


BTQBP6206B



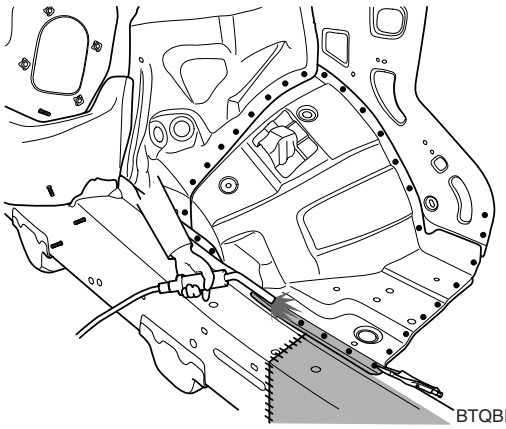
BTQBP6207B

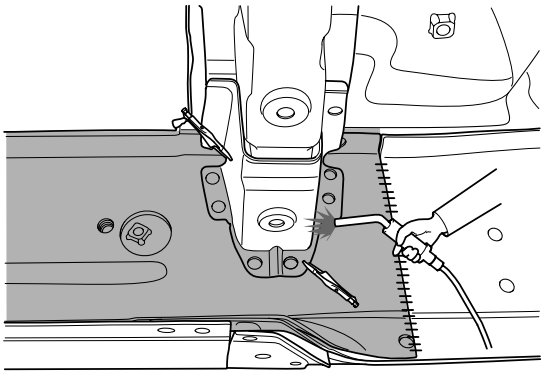
5. Clean and prepare all welds, and remove all residue.
6. After removing, apply the welding primer.
7. Reattach the cut front side inner member section, then MIG plug weld all holes and MIG butt weld seams.



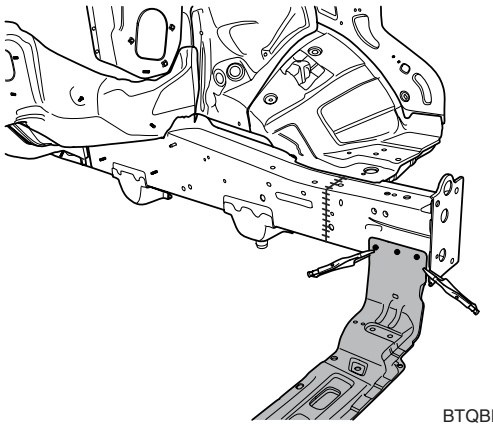
BTQBP6204E

8. MIG plug weld all holes.


BTQBP6101D

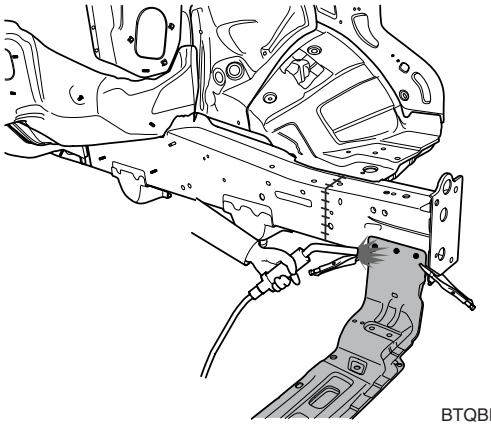

BTQBP6105D

9. Fit and clamp the front end cross member in place.


BTQBP6201B

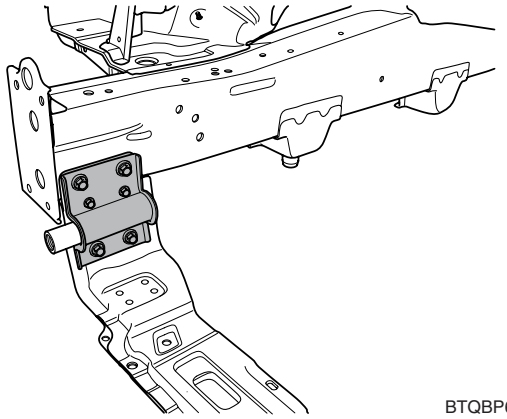
10. Measure each measurement point and correct the installation position.

11. MIG plug weld all holes.


BTQBP6201C

12. Clean and prepare all welds, and remove all residue.

13. Install the towing hook bracket.


BTQBP6203

14. Apply the two-part epoxy primer to the interior of each panel.

15. Apply an anti-corrosion agent as required. (Refer to the BODY CORROSION PROTECTION)

16. Prepare the exterior surfaces for priming using wax and grease remover.

17. Apply metal conditioner and water rinse.

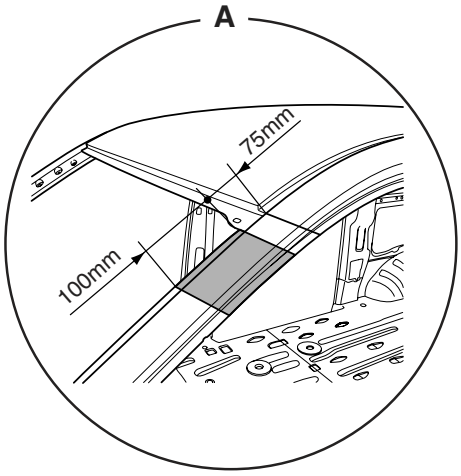
18. Apply conversion coating and water rinse.

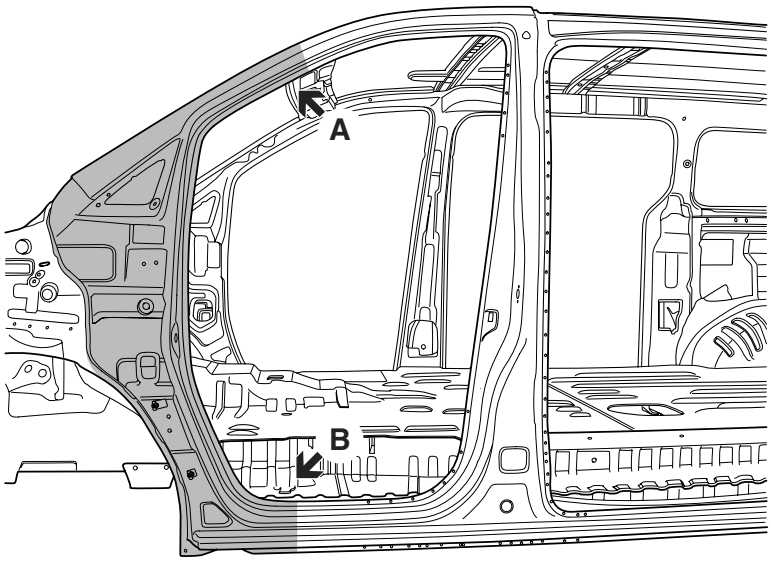
19. Apply the two-part epoxy primer.

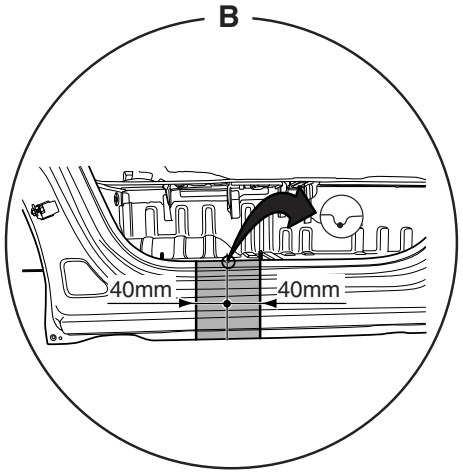
20. Apply the correct seam sealer to all joints carefully. (Refer to the BODY SEALING LOCATION)

FRONT PILLAR

WELDING POINTS







- ● MIG plug welding
- ⫲ MIG butt welding
- ⫘ MIG lap welding

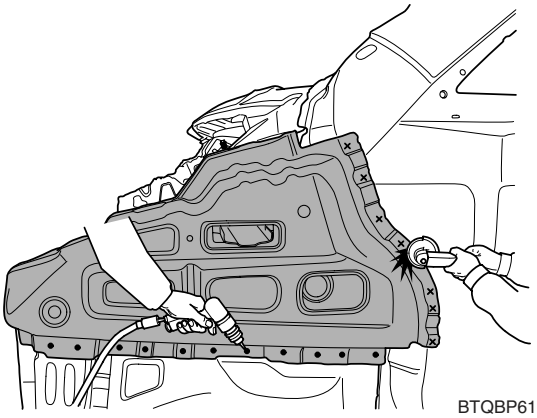
BTQBP6303

REMOVAL

1. To remove the front pillar, drill out and grind away all spotwelds(23) and MIG lap welds(6) attaching the fender apron outer panel.

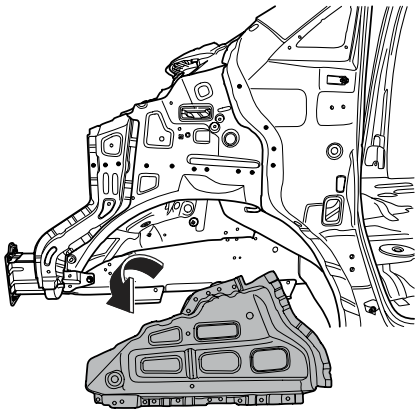
NOTE

If it is possible that the fender apron outer panel is reusable, be careful not to damage it while removing.



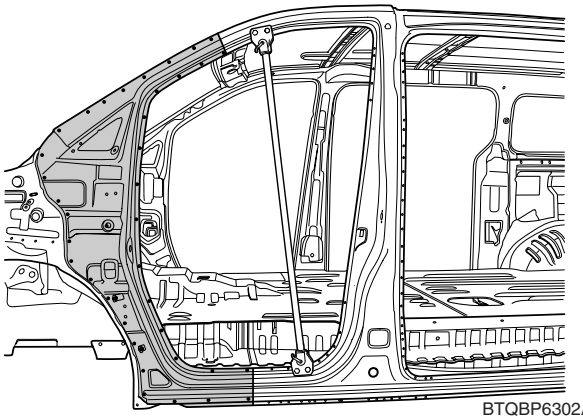
BTQBP6107B

2. Remove the fender apron outer panel.



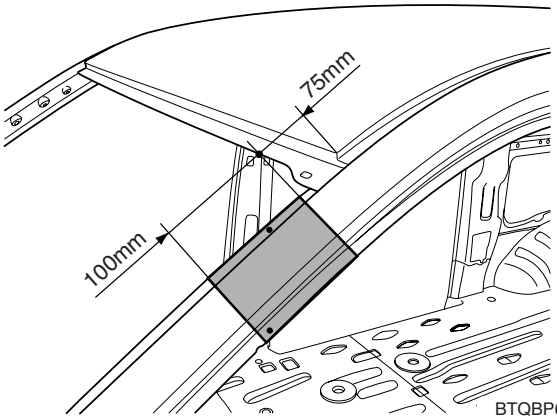
BTQBP6108

3. Before cutting front pillar, be sure to support roof panel.



BTQBP6302A

4. Measure and mark each cutline on the front pillar outer panel 75mm and 175mm from the roof panel front corner as indicated in the illustration.

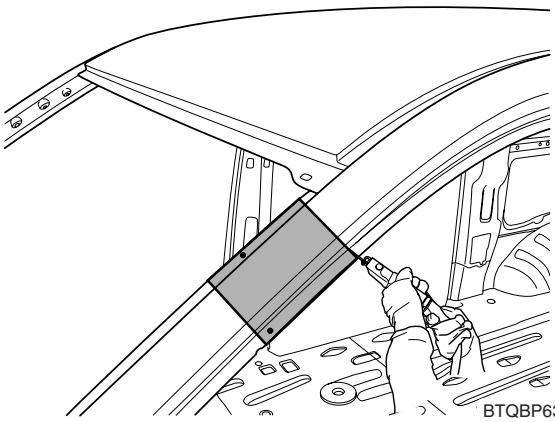


BTQBP6301

5. Cut the front pillar outer panel along the cutlines.

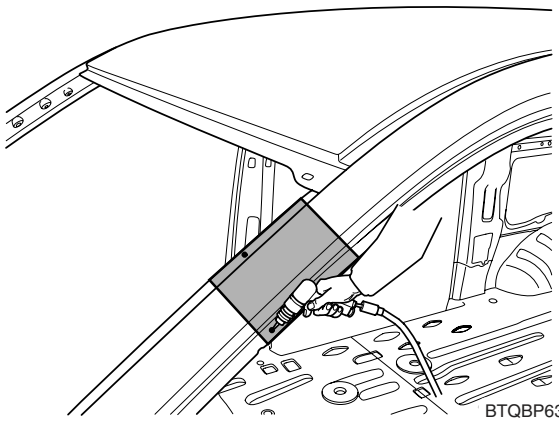
NOTE

When cutting the front pillar outer panel, take care not to cut through mating flanges or front pillar outer reinforcement.



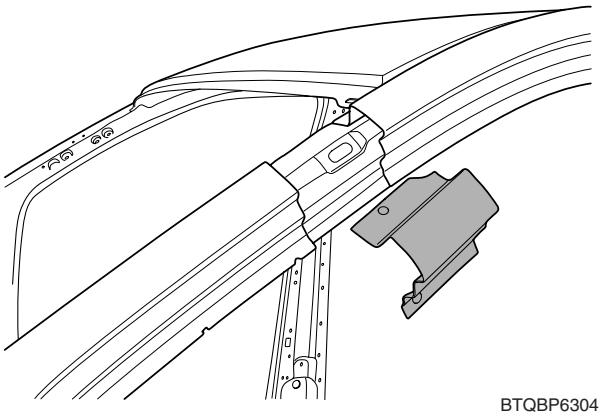
BTQBP6301A

6. Drill out all the spotwelds(2) attaching the front pillar outer panel section.



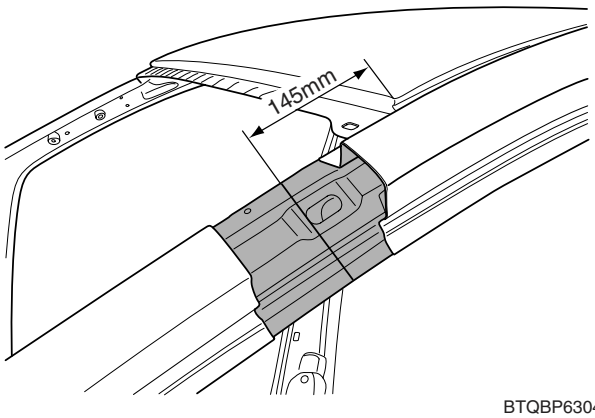
BTQBP6301B

7. Remove the front pillar outer panel section.



BTQBP6304

8. Measure and mark the cutline on the front pillar outer reinforcement 145mm from the roof panel front corner as shown in the illustration.

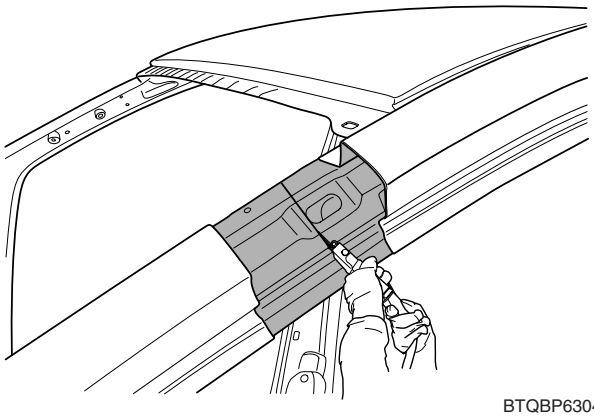


BTQBP6304A

9. Cut the front pillar outer panel reinforcement along the cutline.

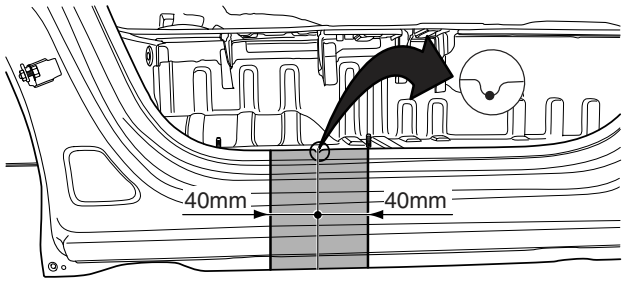
NOTE

When cutting the front pillar outer panel reinforcement, be careful not to cut front pillar inner panel.



BTQBP6304B

10. Measure and mark each cutline on the side sill outer panel as indicated in the illustration.

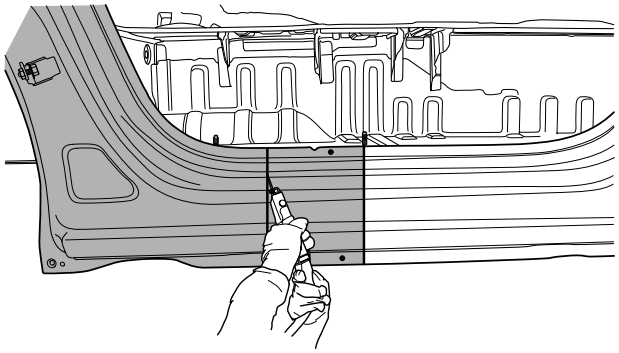


BTQBP6305

11. Cut the side sill outer panel along the cutlines.

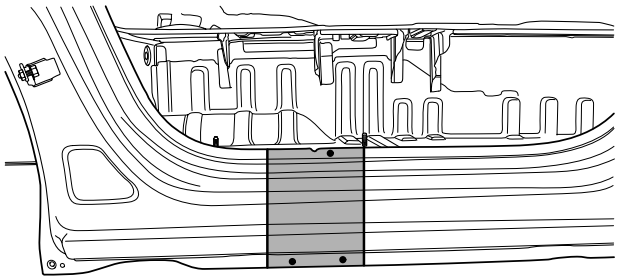
NOTE

When cutting the side sill outer panel, take care not to cut through mating flanges or side sill outer reinforcement.



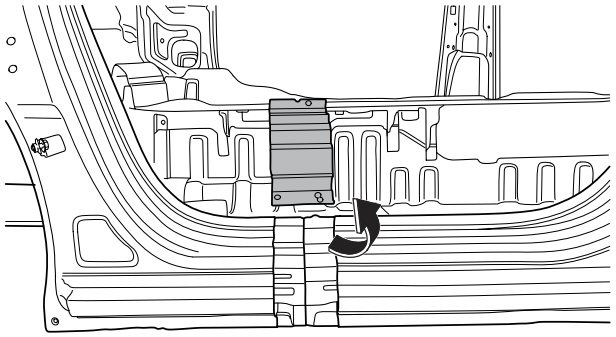
BTQBP6305A

12. Drill out all the spotwelds(3) attaching the side sill outer panel section.



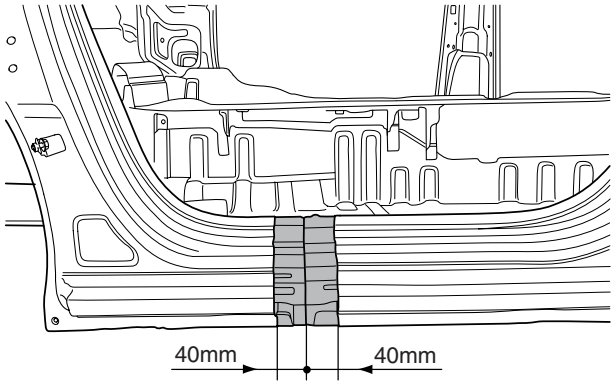
BTQBP6305B

13. Remove the side sill outer panel section.



BTQBP6306

14. Measure and mark the cutline on side sill outer reinforcement as shown in the illustration.

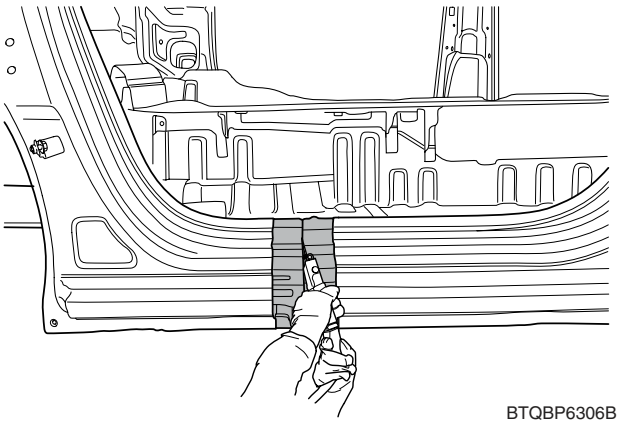


BTQBP6306A

15. Cut the side sill outer reinforcement along the cutline.

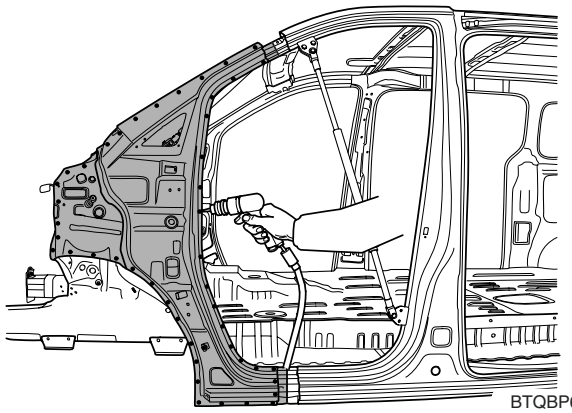
NOTE

When cutting the side sill outer reinforcement, be careful not to cut side sill inner panel.

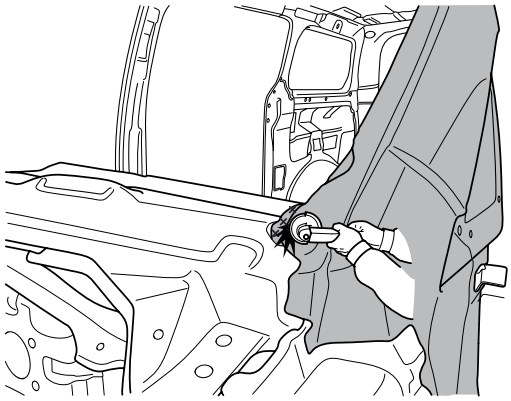


BTQBP6306B

16. To remove the front pillar outer panel, drill out all spotwelds(83).

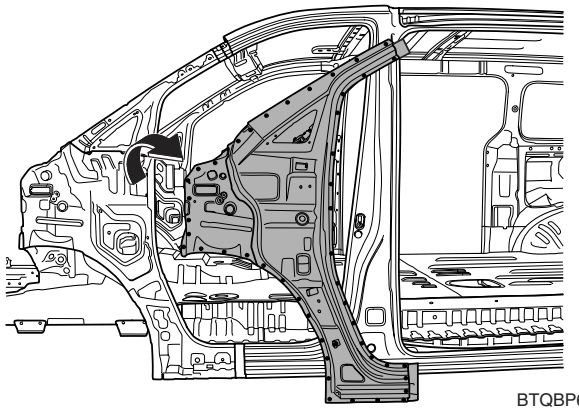


BTQBP6307



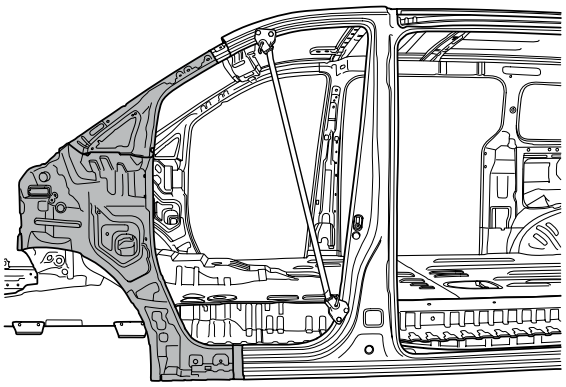
BTQBP6308

17. Remove the front pillar outer panel.

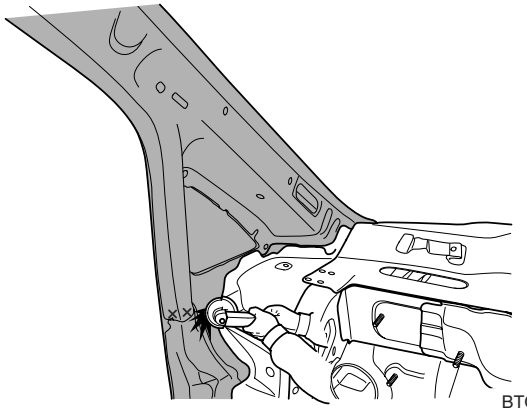


BTQBP6309

18. To remove the front pillar inner panel, drill out and grind away all spotwelds(37) and lap welds(2).

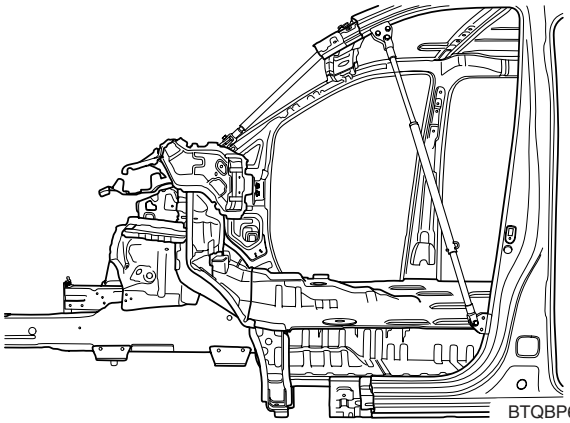


BTQBP6309A

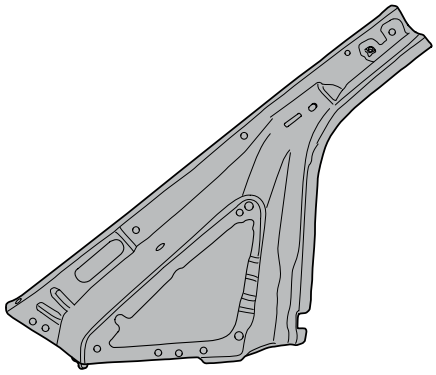


BTQBP6310

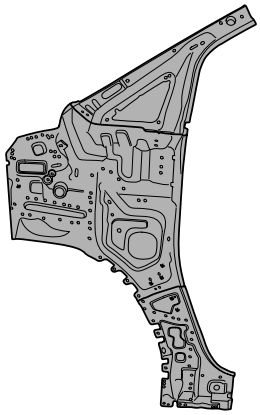
19. Remove the front pillar inner panel.



BTQBP6313



BTQBP6311



BTQBP6312

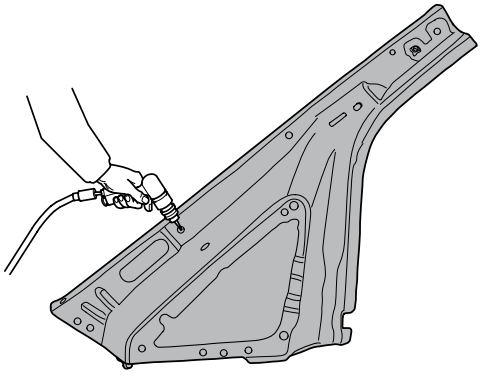
20. Straighten all flanges as necessary, prepare all surfaces to be welded.

21. Clean and prepare all welds, and remove all residue.

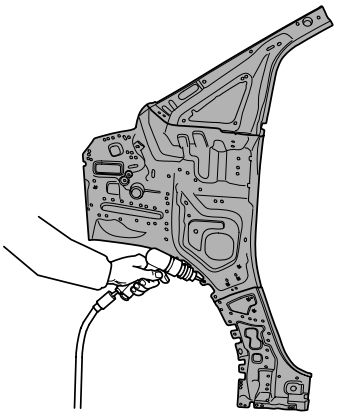
22. After removing, apply the welding primer.

INSTALLATION

1. Drill 8mm holes in the new front pillar inner panel for MIG plug welding.



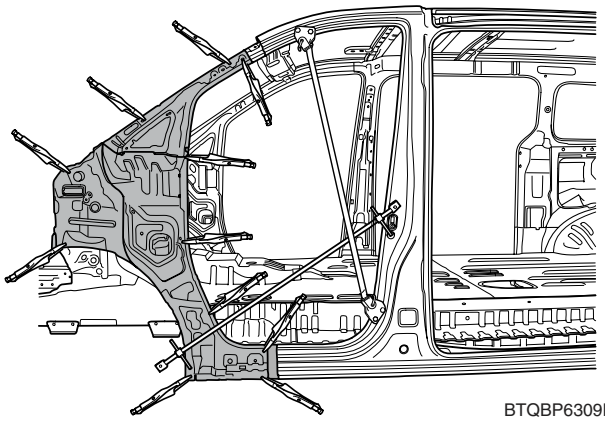
BTQBP6311A



BTQBP6312A

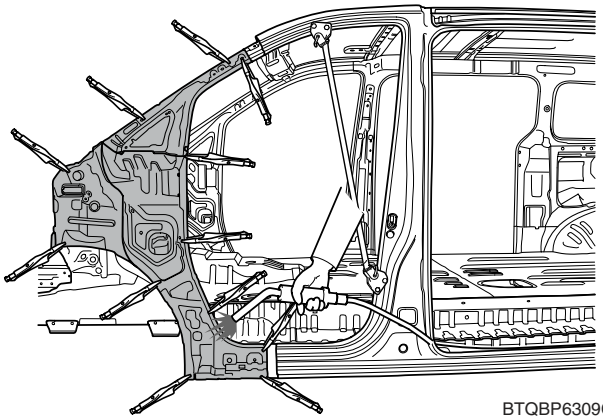
2. Fit and clamp the new front pillar inner panel in place.

3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6309B

4. MIG plug weld all holes and MIG lap weld seams.



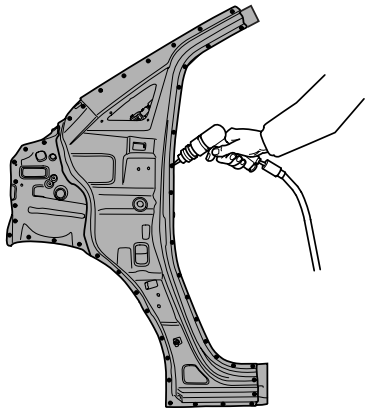
BTQBP6309C

5. Clean and prepare all welds, and remove all residue.

6. After removing, apply the welding primer.

7. Transcribe the cutlines to the new front pillar outer panel, adding 30mm overlap to each end and cut to length.

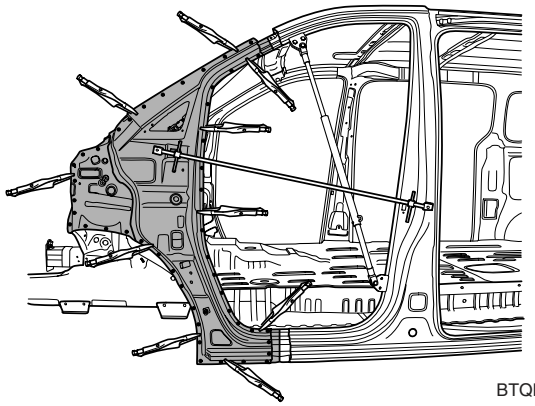
8. Drill 8mm holes along new front pillar outer panel flanges for MIG plug welding.



BTQBP6309D

9. Fit and clamp the new front pillar outer panel in place.

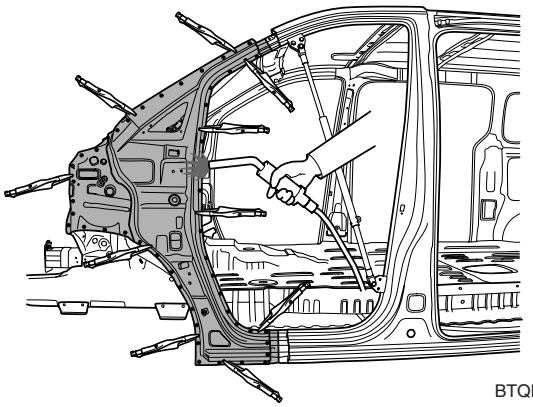
10. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6307A

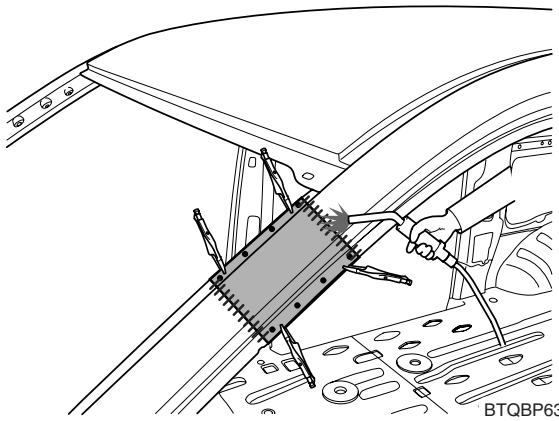
11. If necessary, make temporary welds, and then check to confirm that the closing and fit for windshield glass, door and fender are correct.

12. MIG butt weld front pillar outer reinforcement and side sill outer reinforcement.



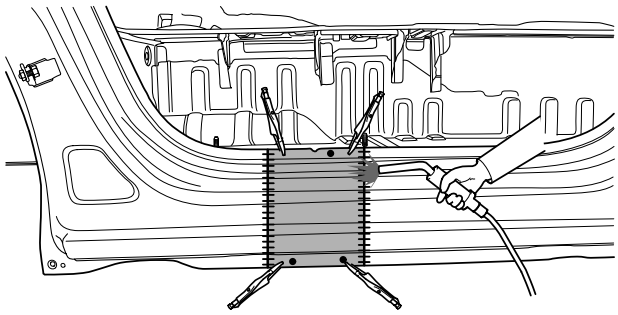
BTQBP6307B

13. Reattach the cut front pillar outer panel section, then MIG plug weld all holes and MIG butt weld seams.



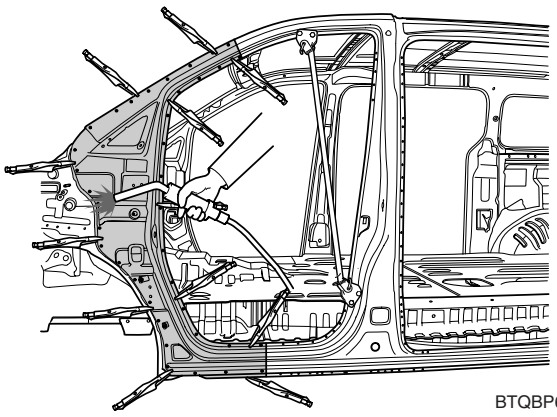
BTQBP6301C

14. Reattach the cut side sill outer panel section, then MIG plug weld all holes and MIG butt weld seams.



BTQBP6305C

15. MIG plug weld all holes.



BTQBP6302B

16. Clean and prepare all welds, and remove all residue.

17. Apply body filler to joints and sand as need.

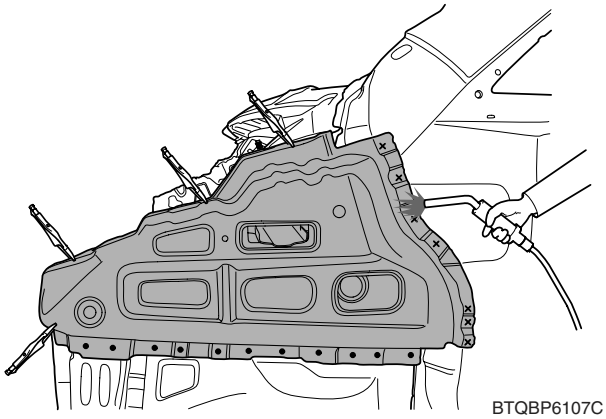
18. Apply the two-part epoxy primer to the interior of the front pillar.

19. Clean all welds with a disc grinder.

20. Before welding the fender apron outer panel, apply the two-part epoxy primer and anti-corrosion agent to the interior of the fender apron panel.

21. Install the fender apron outer panel in place.

22. MIG plug weld all holes and MIG lap weld seams.



BTQBP6107C

23. Clean and prepare all welds, remove all residue.

24. Apply an anti-corrosion agent to the welded parts and inside of front pillar (Refer to the CORROSION PROTECTION).

25. Prepare exterior surfaces for priming, using wax and grease remover.

26. Apply metal conditioner and water rinse.

27. Apply conversion coating and water rinse.

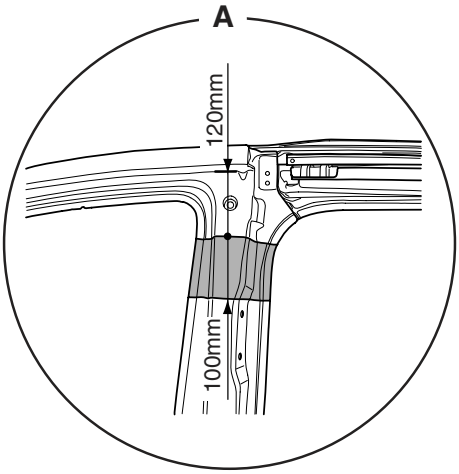
28. Apply the two-part epoxy primer.

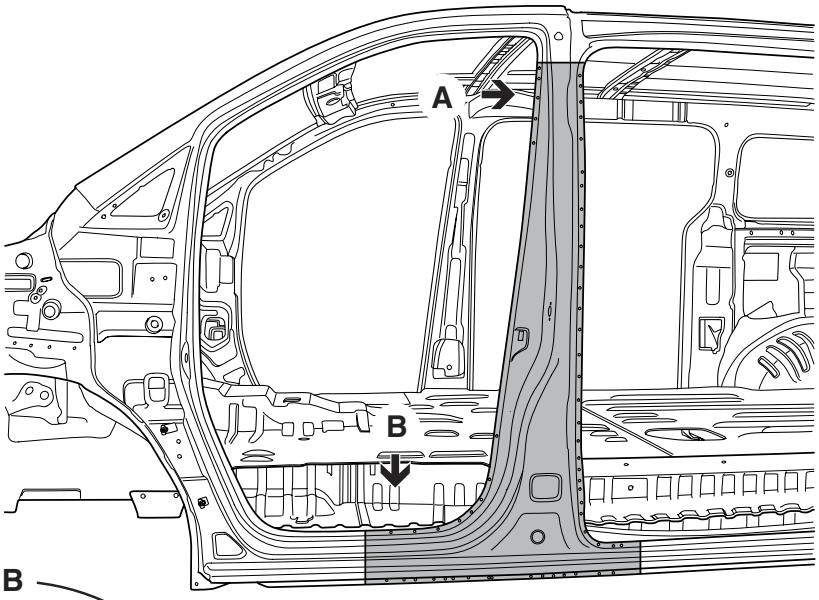
29. Apply the correct seam sealer to all joints carefully (Refer to the BODY SEALING LOCATIONS).

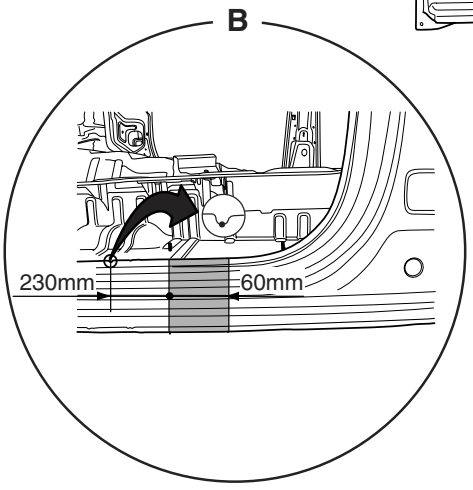
30. Reprime over the seam sealer to complete the repair.

CENTER PILLAR

WELDING POINTS





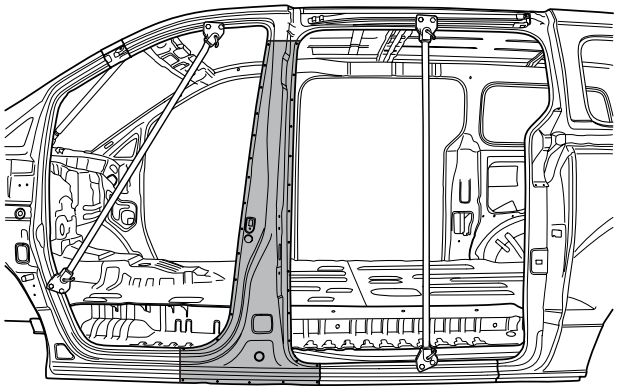


- ● MIG plug welding
- ⫲ MIG butt welding
- ⫘ MIG lap welding

BTQBP6501

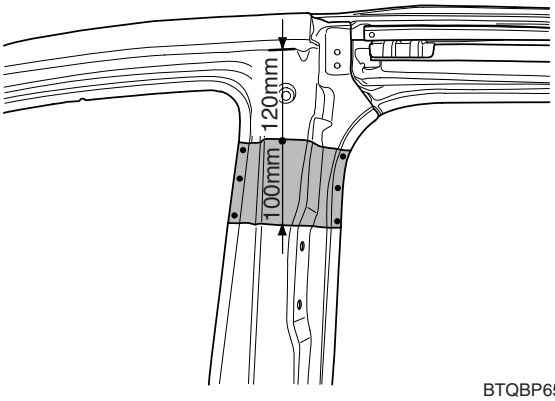
REMOVAL

1. Before cutting center pillar, be sure to support roof panel.



BTQBP6503

2. Measure and mark the horizontal cutlines on center pillar outer panel as indicated in the illustration.

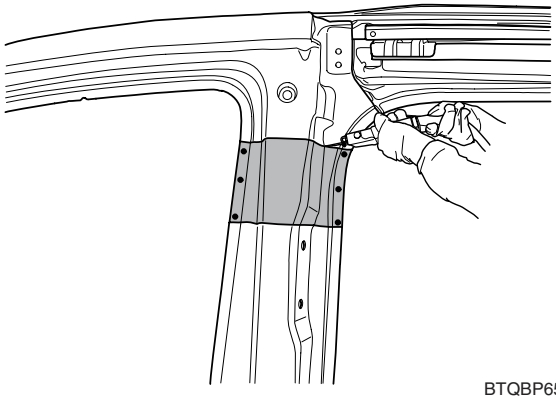


BTQBP6501A

3. Cut center pillar outer panel along the cutlines.

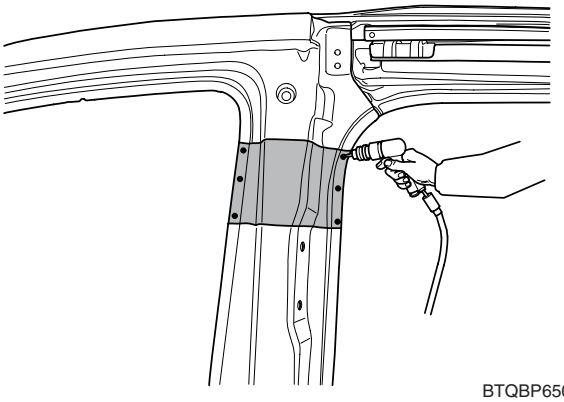
NOTE

When cutting center pillar outer panel, take care not to cut through mating flanges or center pillar outer reinforcement.



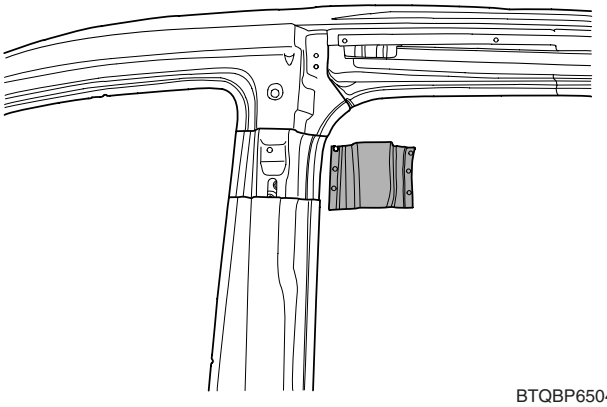
BTQBP6501B

4. Drill out all spotwelds(6), attaching the center pillar outer panel section.



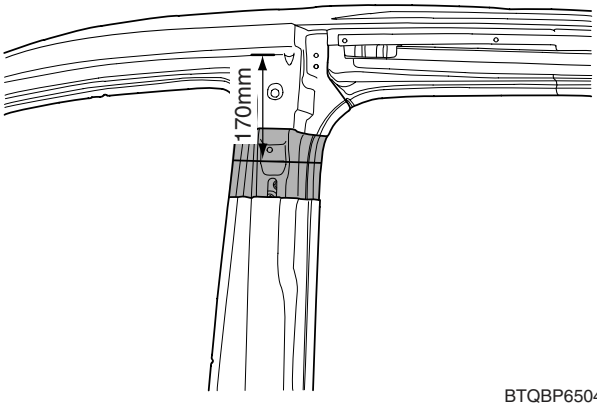
BTQBP6501C

5. Remove the center pillar outer panel section.



BTQBP6504

6. Measure and mark the horizontal cutline on center pillar outer reinforcement as indicated in the illustration.

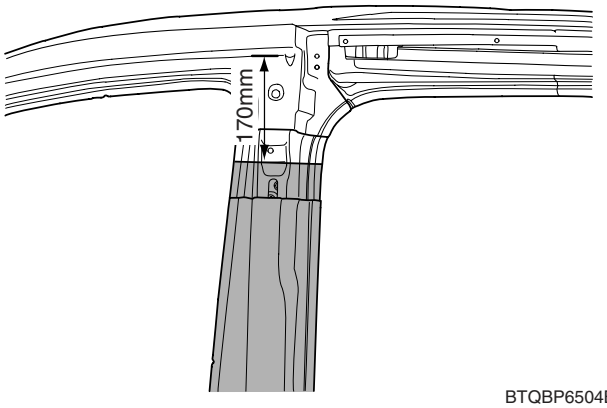


BTQBP6504A

7. Cut the center pillar outer reinforcement along the cutline.

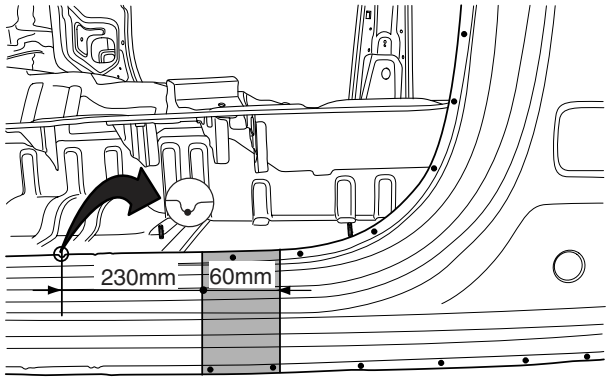
NOTE

When cutting center pillar outer reinforcement, take care not to cut through mating flanges or front seat belt mounting upper bracket.



BTQBP6504B

8. Measure and mark the vertical cutlines on front side sill outer panel 230mm and 290mm from the side sill outer panel notch center.

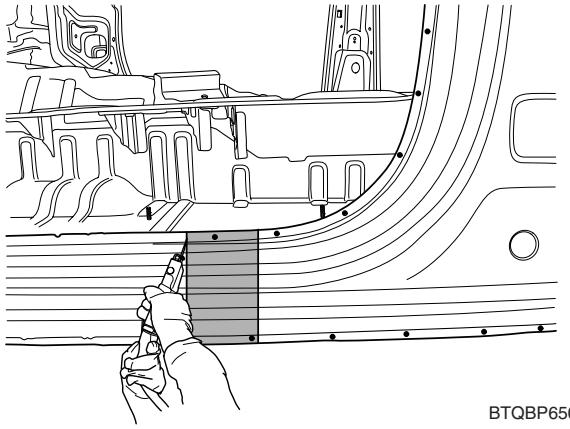


BTQBP6502A

9. Cut the front side sill outer panel along the cutlines.

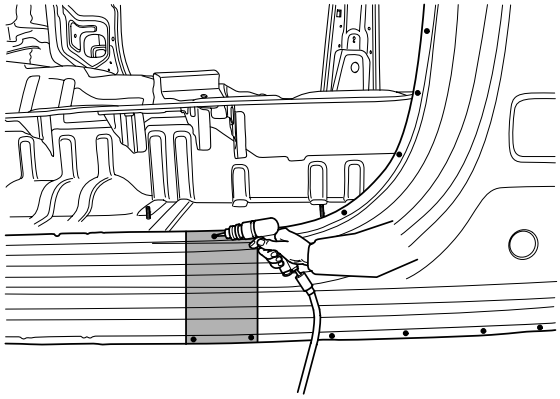
NOTE

When cutting front side sill outer panel, take care not to cut through mating flanges or side sill outer reinforcement.



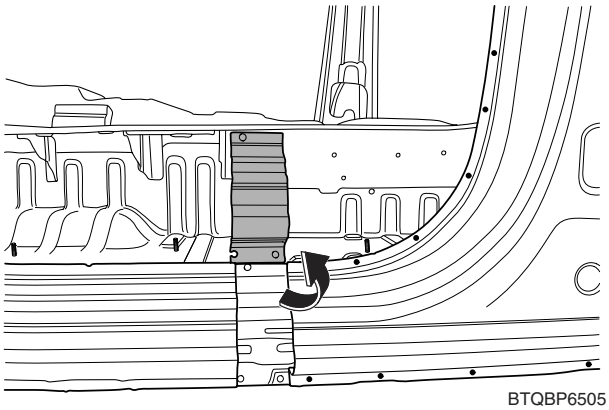
BTQBP6502B

10. Drill out all spotwelds (3) attaching the front side sill outer panel section.



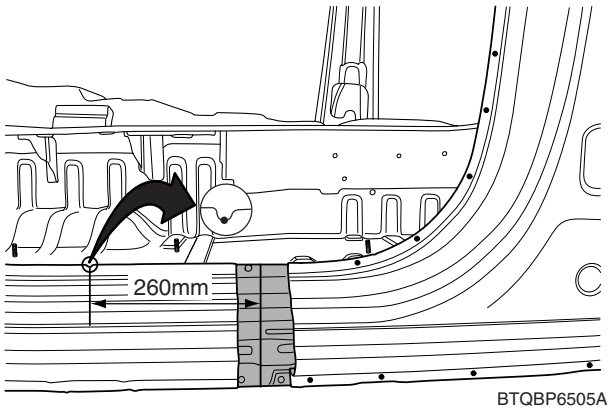
BTQBP6502C

11. Remove the front side sill outer panel section.



BTQBP6505

12. Measure and mark the vertical cutline on front side sill outer reinforcement 260mm from the side sill outer panel notch center as indicated in the illustration.

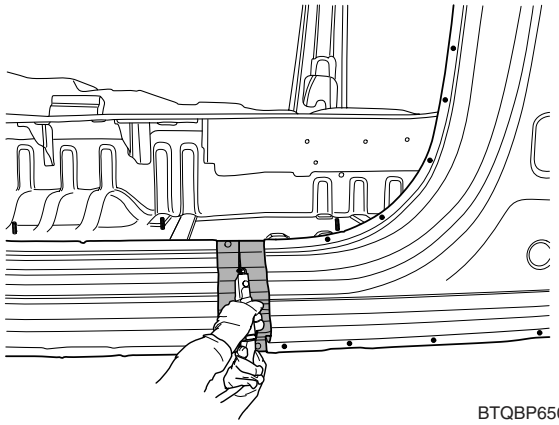


BTQBP6505A

13. Cut the front side sill outer reinforcement aiong the cutline.

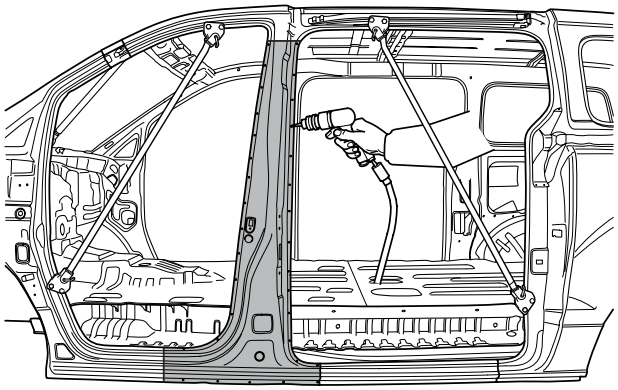
NOTE

When cutting front side sill outer reinforcement, take care not to cut through mating flanges.



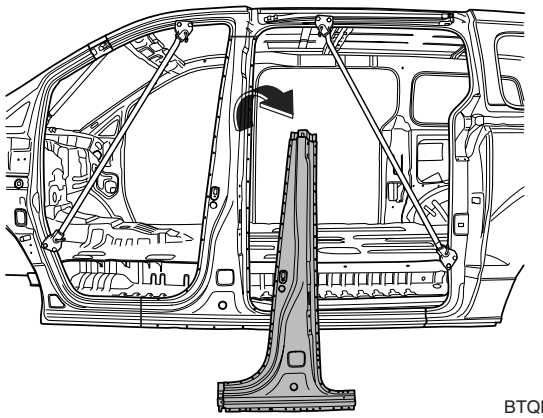
BTQBP6505B

14. Drill out all spotwelds(70), attaching the center pillar outer panel.



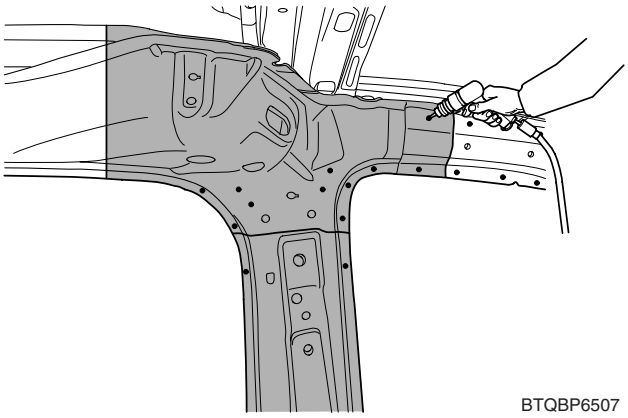
BTQBP6503A

15. Remove the center pillar outer panel.

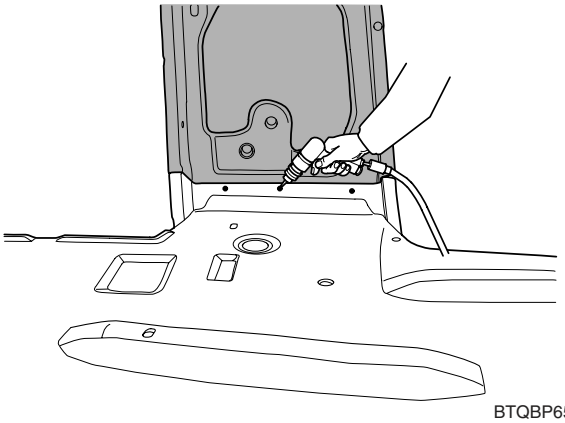


BTQBP6506

16. Drill out all spotwelds(30), attaching the center pillar inner panel.

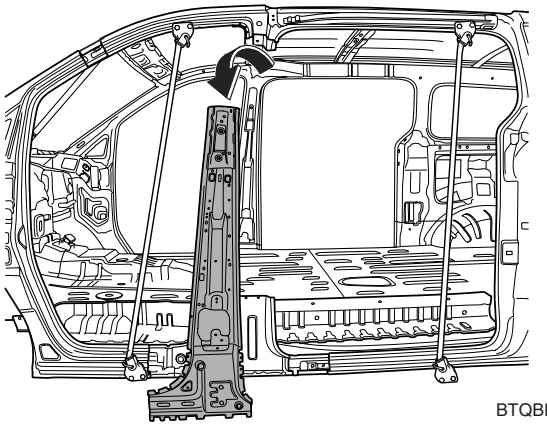


BTQBP6507



BTQBP6508

17. Remove the center pillar inner panel.

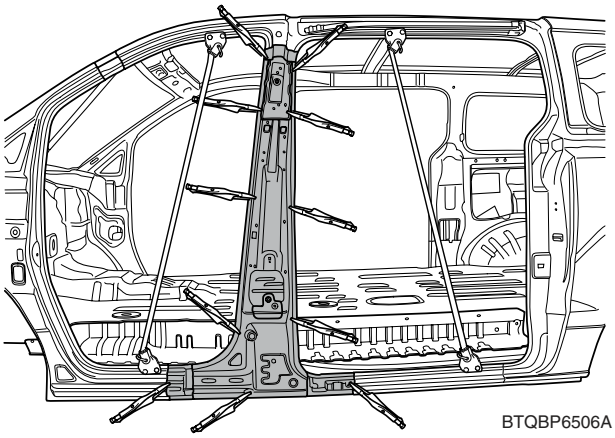


BTQBP6509

18. Prepare all surfaces to be welded.
19. After removing, apply the welding primer.

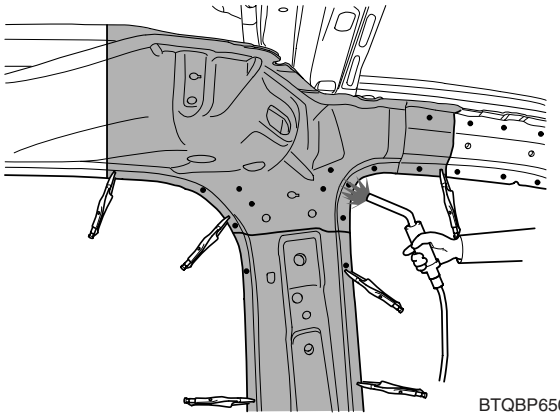
INSTALLATION

1. Fit and clamp the new center pillar inner panel in place.
2. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

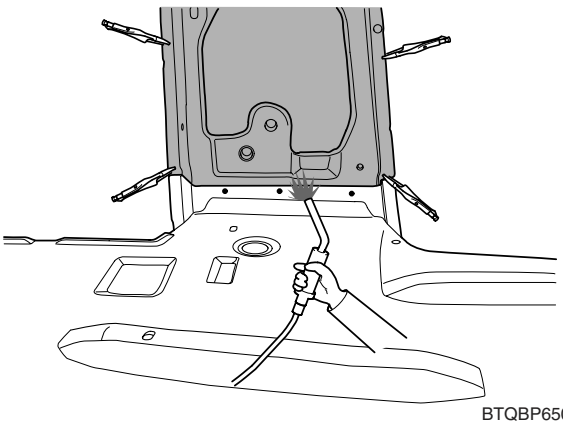


BTQBP6506A

3. MIG plug weld all holes.



BTQBP6507A



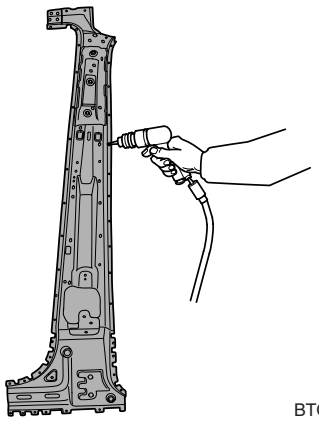
BTQBP6508A

4. Clean and prepare all welds, and remove all residue.

5. After removing, apply the welding primer.

6. Transcribe the cutlines to the new center pillar outer panel, adding 30mm overlap to each end and cut to length.

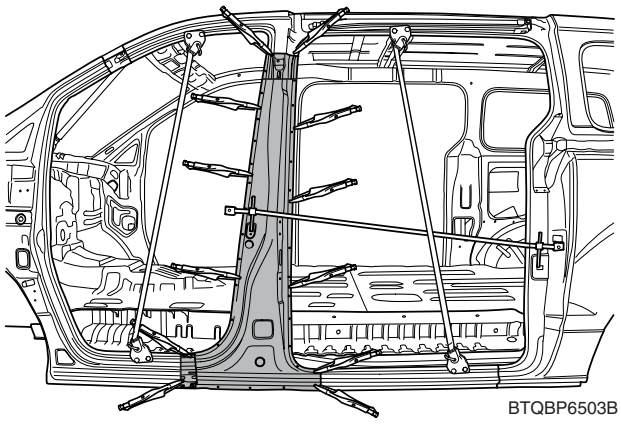
7. Drill 8mm holes in overlap areas along center pillar outer panel flanges.



BTQBP6509A

8. Fit and clamp the new center pillar outer panel in place.

9. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



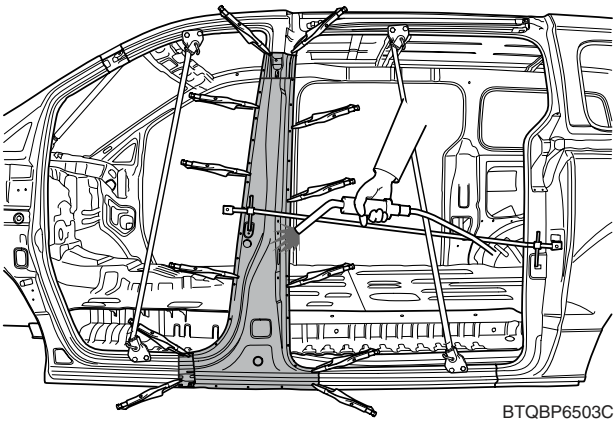
BTQBP6503B

10. Check the fit of the front and rear doors.

11. Reinstall center pillar outer panel.

12. Apply body filler to the outer center pillar seam. Sand and finish.

13. MIG plug weld all holes and MIG butt weld seams.

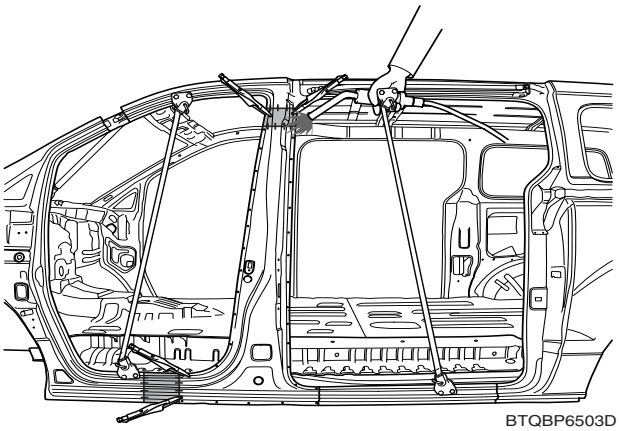


BTQBP6503C

14. Clean and prepare all welds, and remove all residue.

15. After removing, apply the welding primer.

16. Reattach the cut center pillar outer panel section, then MIG plug weld all holes and MIG butt weld seams.



BTQBP6503D

17. Clean all welds with a disc grinder.

18. Apply the two-part epoxy primer to the interior of the center pillar.

19. Apply an anti-corrosion agent to the welded parts and interior of the center pillar (Refer to the CORROSION PROTECTION).

20. Prepare exterior surfaces for priming, using wax and grease remover.

21. Apply metal conditioner and water rinse.

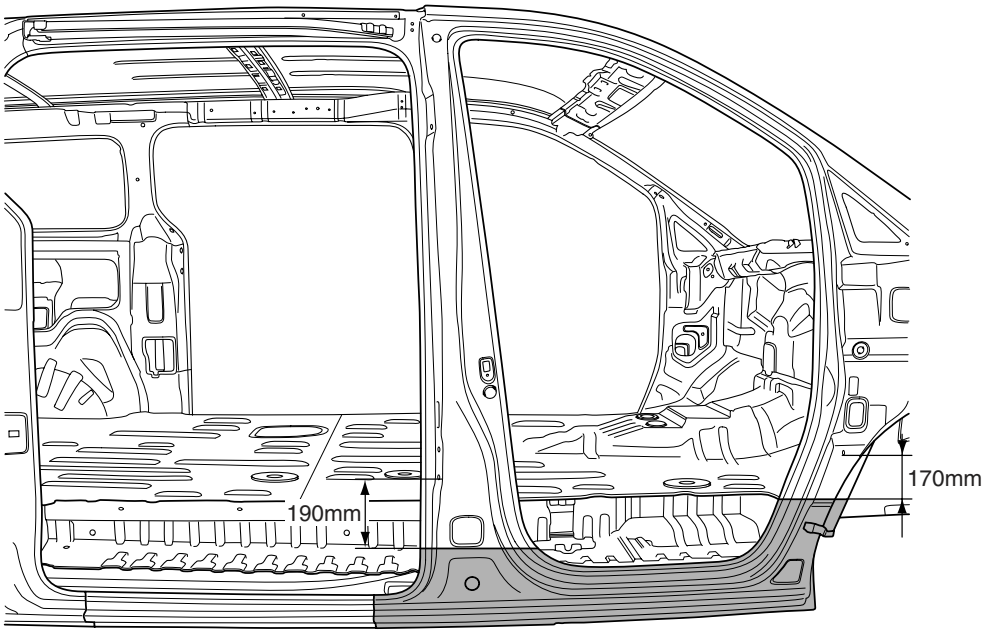
22. Apply conversion coating and water rinse.

23. Apply the two-part epoxy primer.

24. Apply the correct seam sealer to all joints carefully (Refer to the BODY SEALING LOCATIONS).

FRONT SIDE SILL PANEL

WELDING POINTS

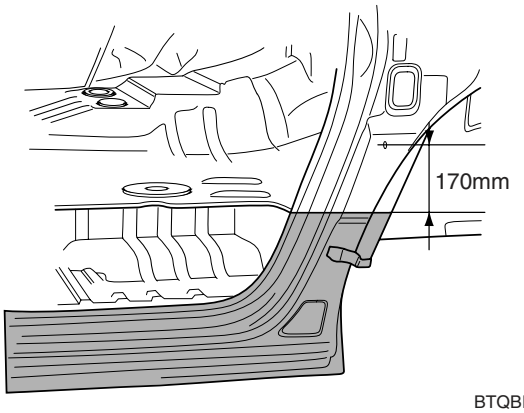


- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

BTQBP6601

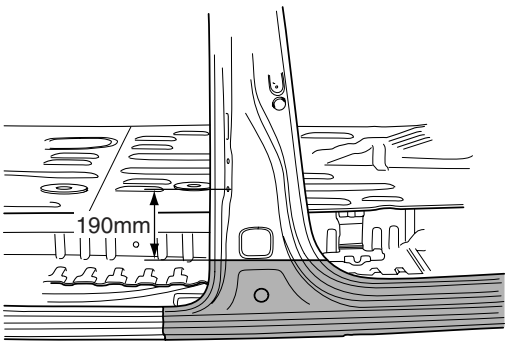
REMOVAL

1. Measure and mark the horizontal cutline on front side sill outer panel 170mm from front door lower hinge mounting hole center as indicated in the illustration.



BTQBP6601A

2. Measure and mark the horizontal cutline on front side sill outer panel 190mm from rear lower stopper mounting hole center as indicated in the illustration.

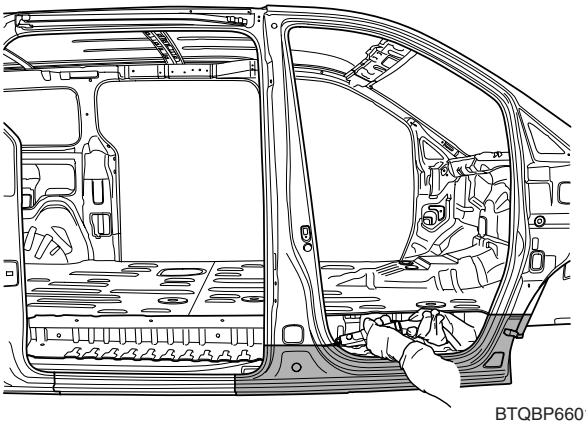


BTQBP6601L

3. Cut the front side sill outer panel along the cutlines.

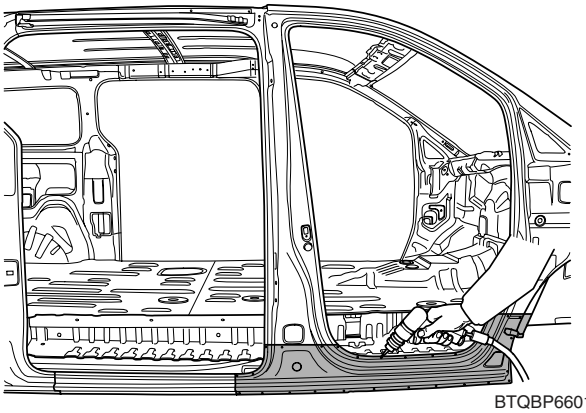
NOTE

When cutting the front side sill outer panel, take care not to cut through mating flanges or front and center pillar outer reinforcement.



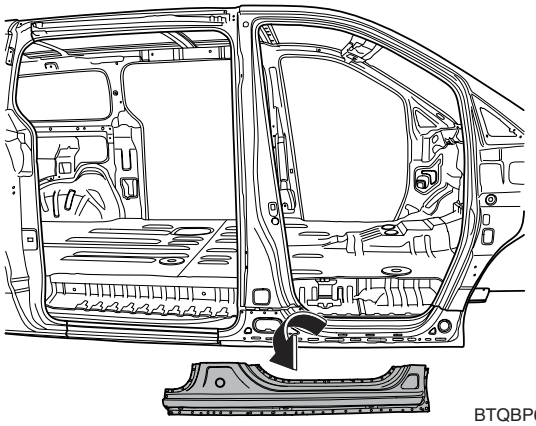
BTQBP6601B

4. Drill out all spotwelds(56), attaching the front side sill outer panel.



BTQBP6601C

5. Remove the front side sill outer panel.



BTQBP6602

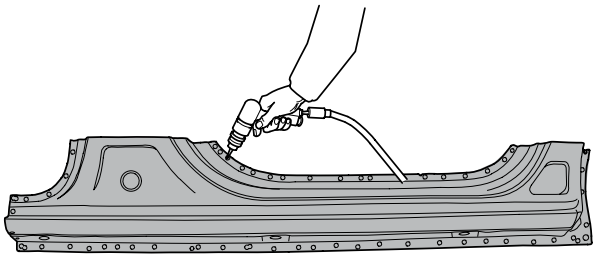
6. Clean cut portions with a grinder.

7. After removing, apply the welding primer.

INSTALLATION

1. Transcribe the cutlines to the new front side sill outer panel, adding 30mm overlap to each end and cut to length.

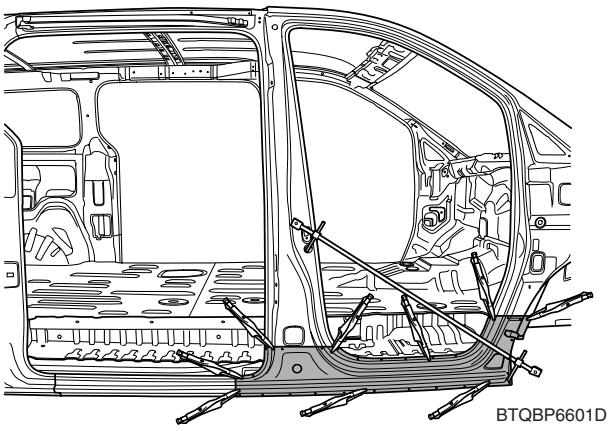
2. Using service panel for replacement of front side sill outer panel, drill 8mm holes in overlap areas along upper and lower flanges.



BTQBP6603

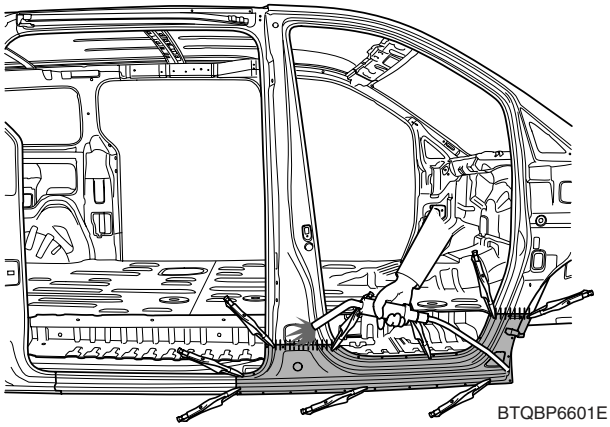
3. Fit and clamp the front side sill outer reinforcement in place.

4. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6601D

5. MIG plug weld all holes and MIG butt weld seams.



BTQBP6601E

6. Clean and prepare all welds and remove all residue.

7. Apply body filler to the side sill outer panel seams.

8. Apply the two-part epoxy primer to the interior of the side sill outer panel.

9. Apply an anti-corrosion agent to welded parts and interior of the side sill outer panel (Refer to the CORROSION PROTECTION).

10. Prepare the exterior surfaces for priming, using wax and grease remover.

11. Apply metal conditioner and water rinse.

12. Apply conversion coating and water rinse.

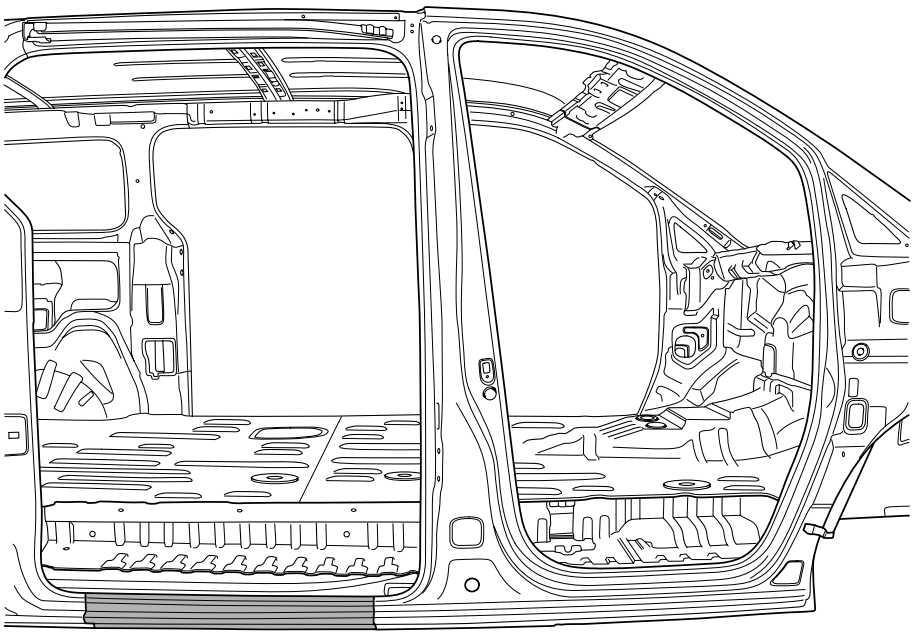
13. Apply the two-part epoxy primer.

14. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

15. Reprime over the seam sealer.

REAR SIDE SILL PANEL

WELDING POINTS

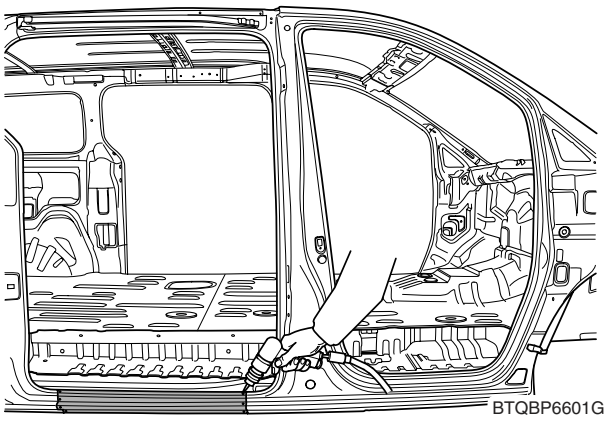


Laser welding
MIG plug welding
MIG butt welding
MIG lap welding

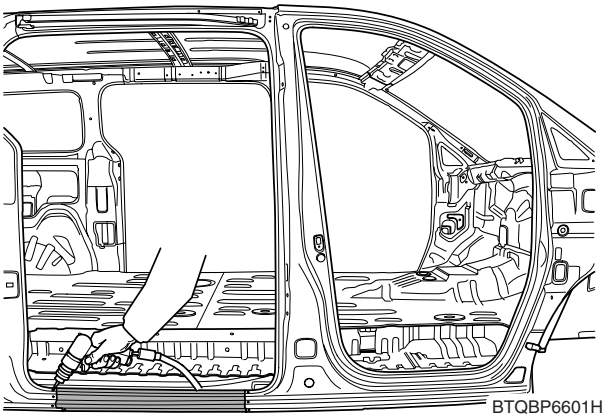
BTQBP6601F

REMOVAL

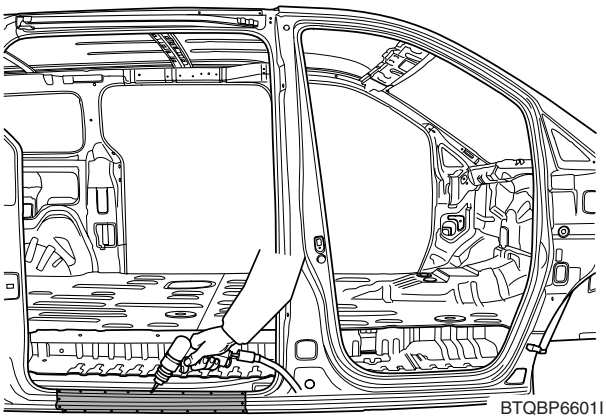
1. Drill out all spotwelds(7), attaching the rear side sill outer panel to the front side sill outer panel.


BTQBP6601G

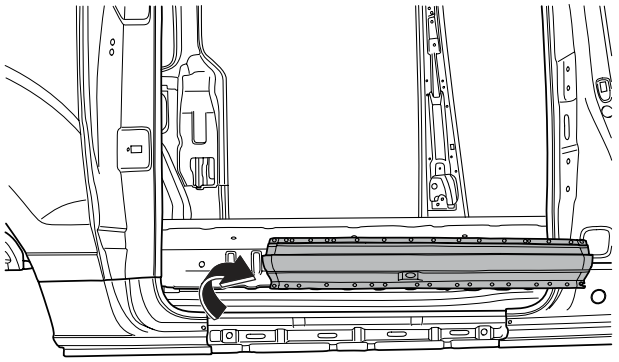
2. Drill out all spotwelds(6), attaching the rear side sill outer panel.


BTQBP6601H

3. Drill out all spotwelds(32), attaching the rear side sill outer panel.


BTQBP6601I

4. Remove the rear side sill outer panel.

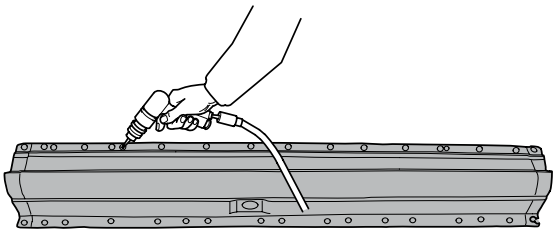

BTQBP6604

5. Clean cut portions with a grinder.

6. After removing, apply the welding primer.

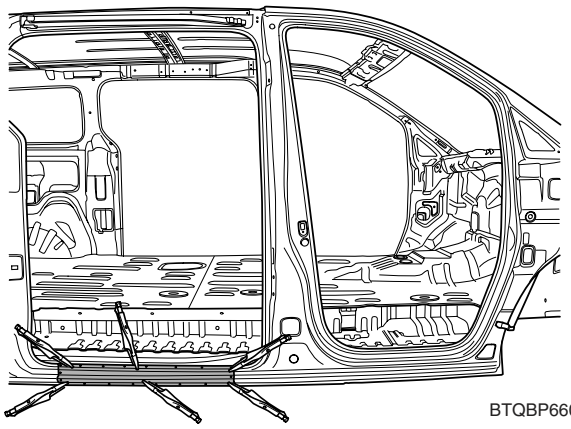
INSTALLATION

1. Using service panel for replacement of new rear side sill outer panel, drill 8mm holes in overlap areas along upper and lower flanges.


BTQBP6605

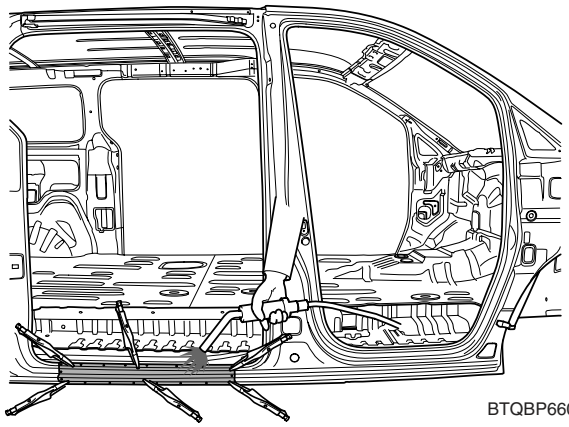
2. Fit and clamp the new rear side sill outer panel in place.

3. Measure each measurement point and correct the installation position.



BTQBP6601J

4. MIG plug weld all holes.



BTQBP6601K

5. Clean and prepare all welds and remove all residue.

6. Apply body filler to the side sill outer panel seams.

7. Apply the two-part epoxy primer to the interior of the side sill outer panel.

8. Apply an anti-corrosion agent to welded parts and interior of the side sill outer panel(Refer to the CORROSION PROTECTION).

9. Prepare the exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

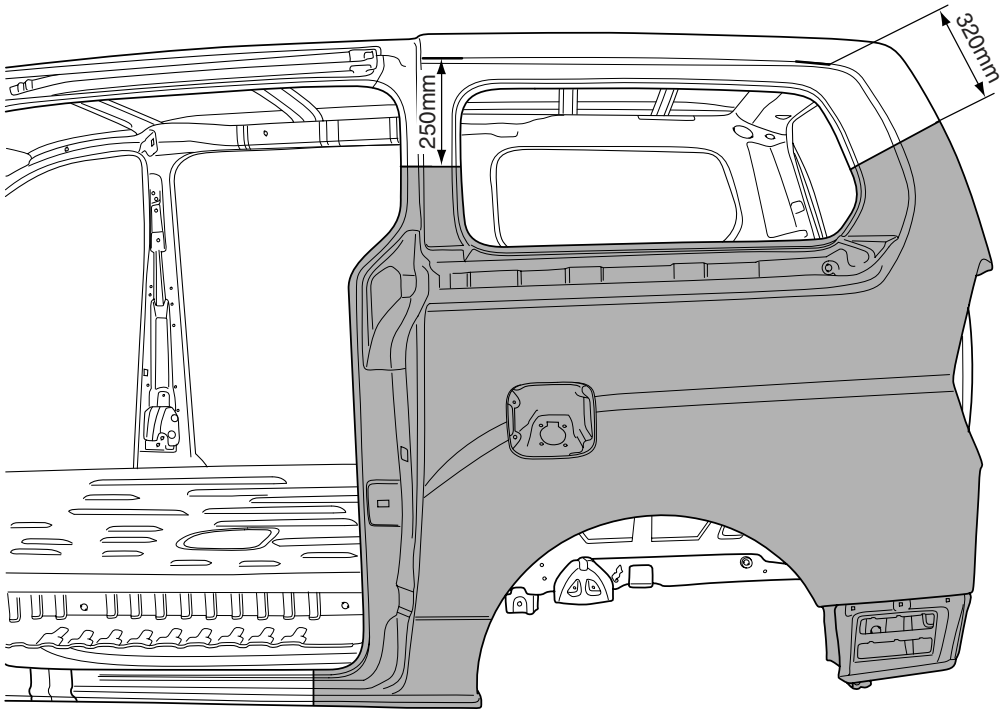
12. Apply the two-part epoxy primer.

13. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

14. Reprime over the seam sealer.

QUARTER PANEL

WELDING POINTS

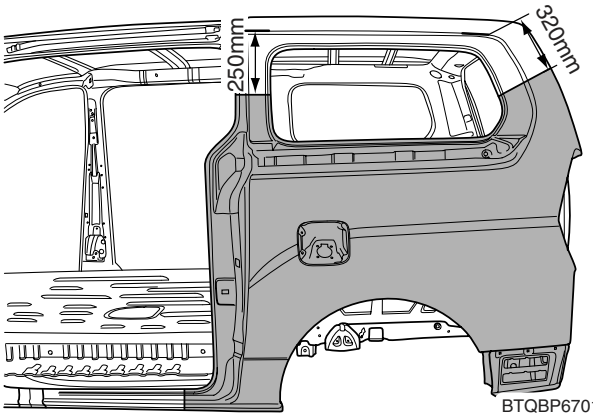


- ● MIG plug welding
- ⫼ MIG butt welding
- ⫘ MIG lap welding

BTQBP6701

REMOVAL

1. Measure and mark the cutlines on the quarter outer panel as indicated in the illustration.

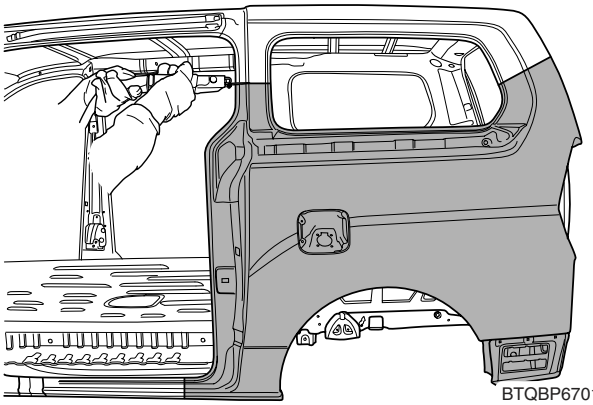


BTQBP6701A

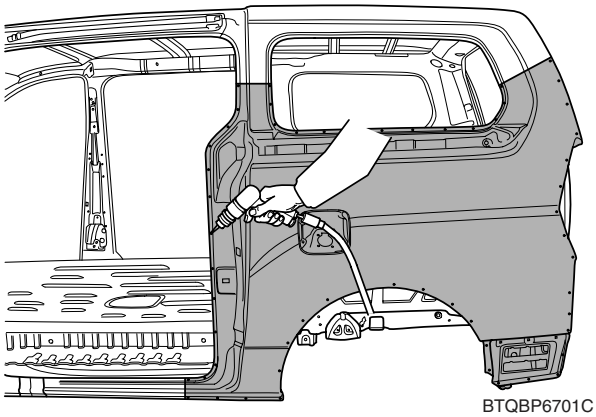
2. Cut the quarter outer panel along the cutlines.

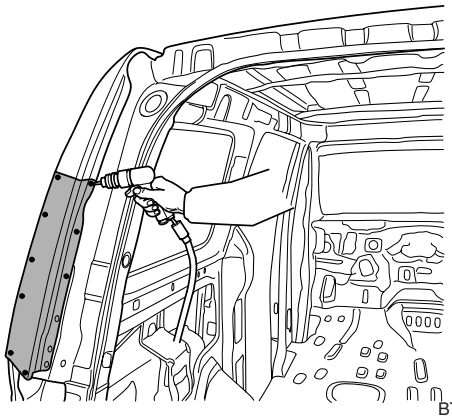
NOTE

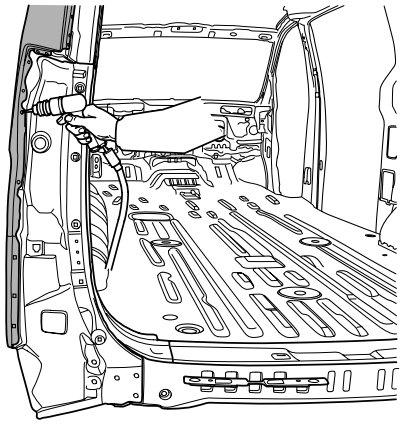
When cutting the quarter outer panel, be careful not to cut quarter inner panel.

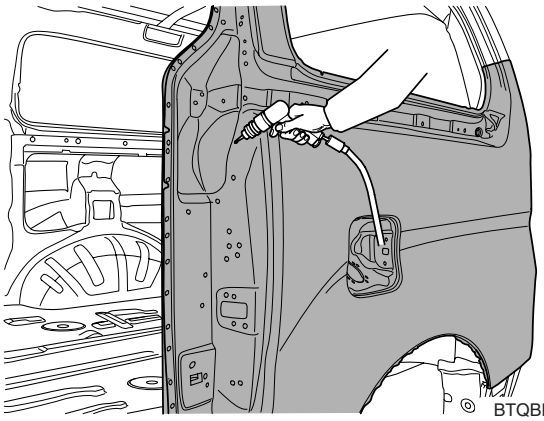

BTQBP6701B

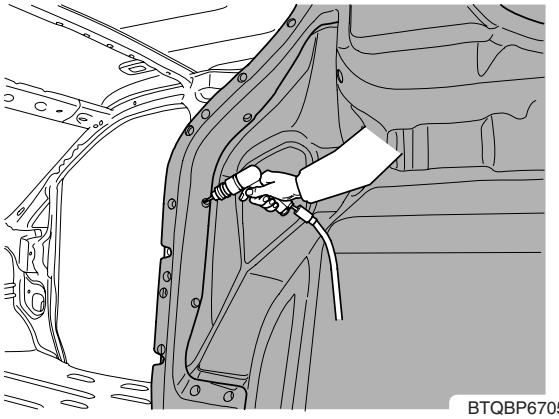
3. Drill out all spotwelds(142), attaching on the quarter outer paneal.

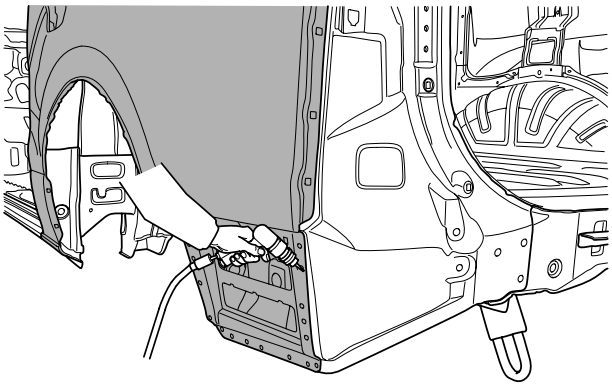

BTQBP6701C


BTQBP6702

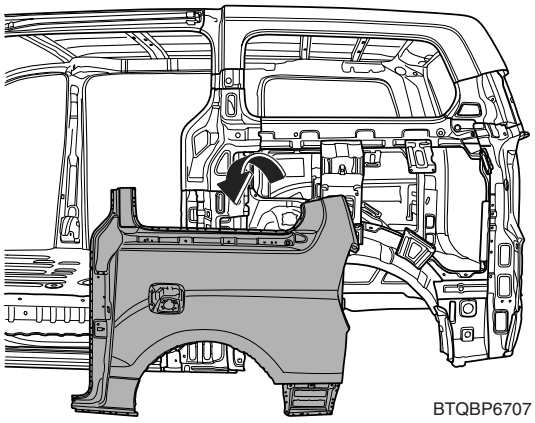

BTQBP6703


BTQBP6704


BTQBP6705


BTQBP6706

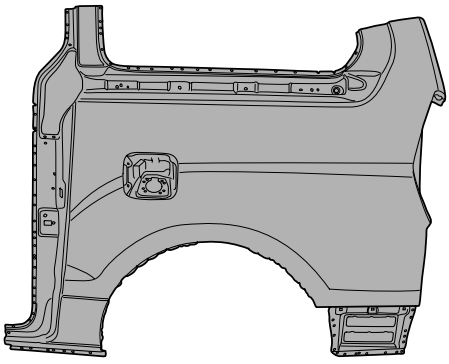
4. Remove the quarter outer panel.


BTQBP6707

5. Clean cut portions with a disc grinder.
6. Prepare all surfaces to be welded.
7. After removing, apply the welding primer.

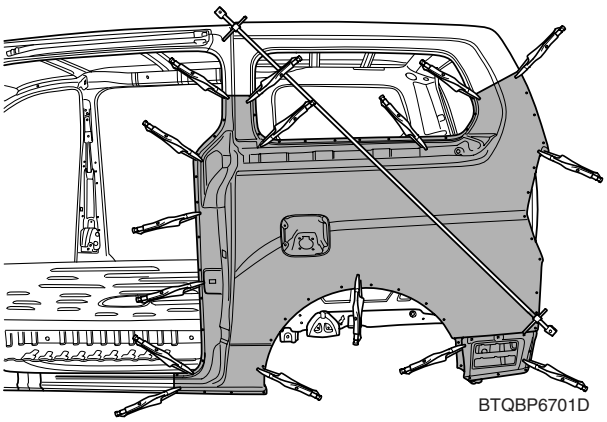
INSTALLATION

1. Transcribe the cutlines to the new quarter outer panel, adding 30 mm overlap each end.
2. Drill 8 mm holes in overlap areas along upper and lower flanges of the new quarter outer panel for MIG plug welding.

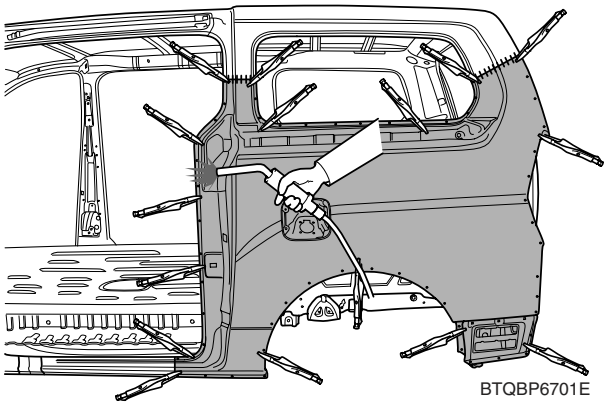

BTQBP6708

3. Apply body filler to the welded seam. Sand and finish. Apply the two-part epoxy primer to the interior of the quarter outer panel.
4. Fit and clamp the quarter outer panel in place.

5. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.


BTQBP6701D

6. MIG plug weld all holes and MIG butt weld seams.


BTQBP6701E

7. Clean and prepare all welds, remove all residue.

8. Apply an anti-corrosion agent to the welded parts and interior of the quarter outer panel (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

12. Apply the two-part epoxy primer.

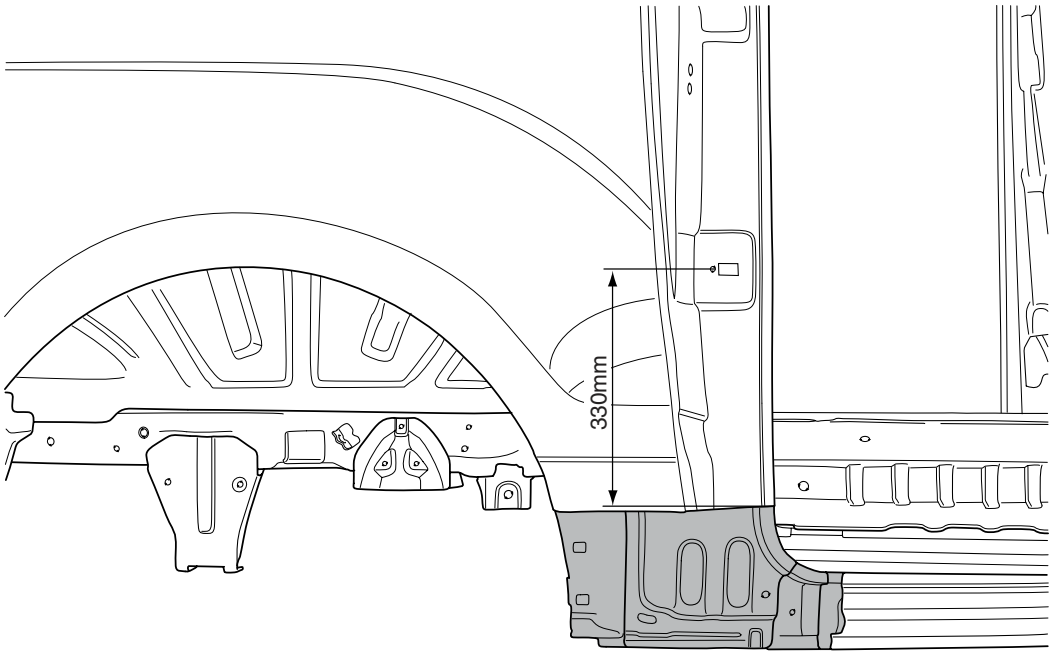
13. Apply the correct seam sealers to all joints.

14. Reprime over the seam sealer to complete the repair.

15. In order to improve corrosion resistance, if necessary, apply an under body anti-corrosion agent to the wheel well (Refer to the CORROSION PROTECTION).

LOWER QUARTER PANEL

WELDING POINTS

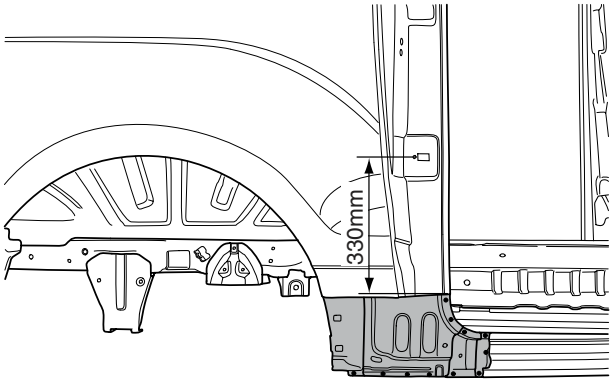


- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

BTQBP6709

REMOVAL

1. Measure and mark cutline on the lower quarter outer panel 330mm from door switch mounting hole center as indicated in the illustration.

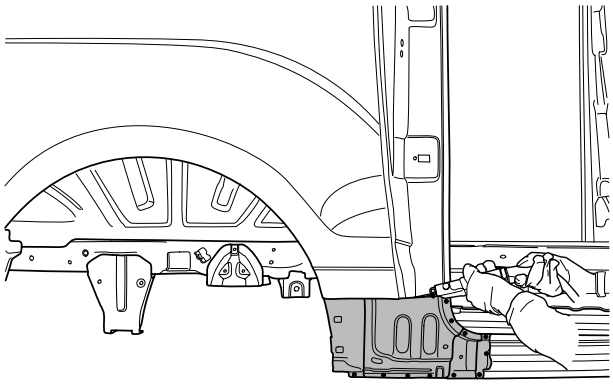


BTQBP6709A

2. Cut the lower quarter outer panel along the cutline.

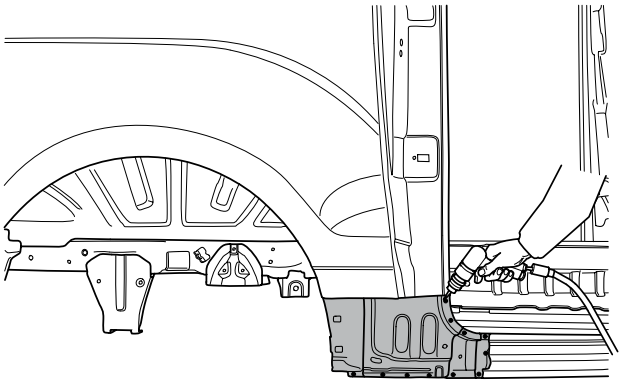
NOTE

When cutting the lower quarter outer panel, be careful not to cut quarter inner panel.



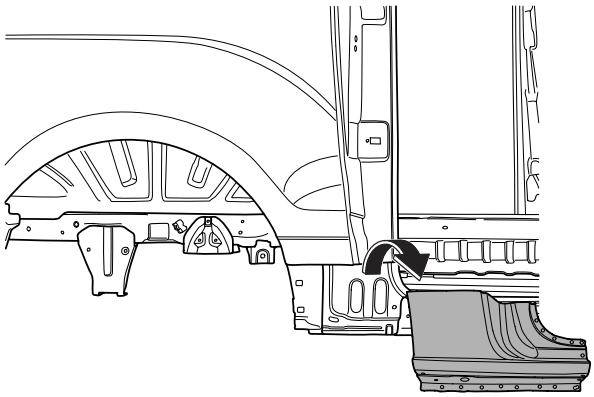
BTQBP6709B

3. Drill out all spotwelds(21), attaching on the lower quarter outer panel.



BTQBP6709C

4. Remove the lower quarter outer panel.



BTQBP6710

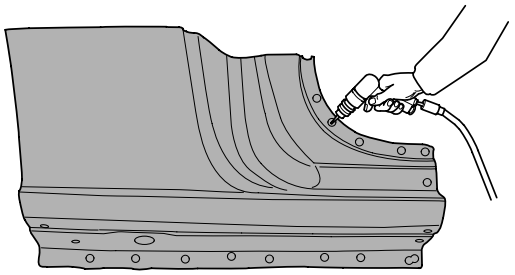
5. Prepare all surfaces to be welded.

6. After removing, apply the welding primer.

INSTALLATION

1. Transcribe the cutline to the new lower quarter outer panel, adding 30 mm overlap each end.

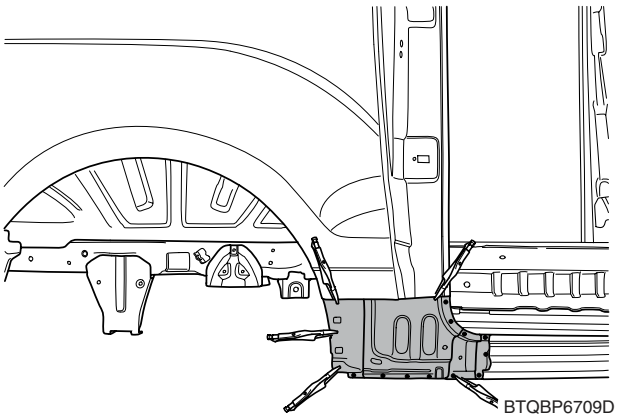
2. Drill 8 mm holes in overlap areas along upper and lower flanges of the new lower quarter outer panel for MIG plug welding.



BTQBP6710B

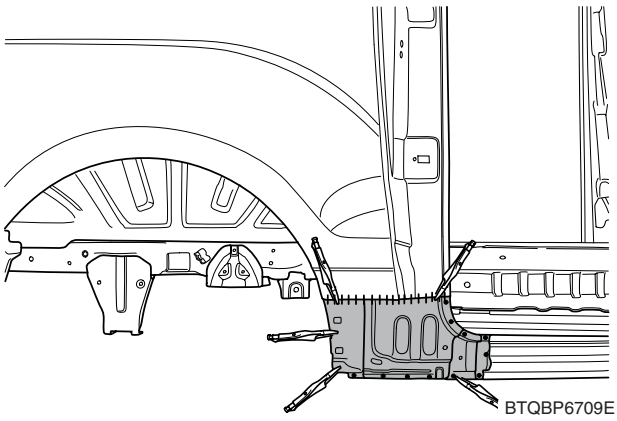
3. Fit and clamp the lower quarter outer panel in place.

4. Measure each measurement point and correct the installation position.



BTQBP6709D

5. MIG plug weld all holes and MIG butt weld seams.



BTQBP6709E

6. Clean and prepare all welds, remove all residue.

7. Apply body filler to the welded seam. Sand and finish. Apply the two-part epoxy primer to the interior of the lower quarter outer panel.

8. Apply an anti-corrosion agent to the welded parts and interior of the lower quarter outer panel (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

12. Apply the two-part epoxy primer.

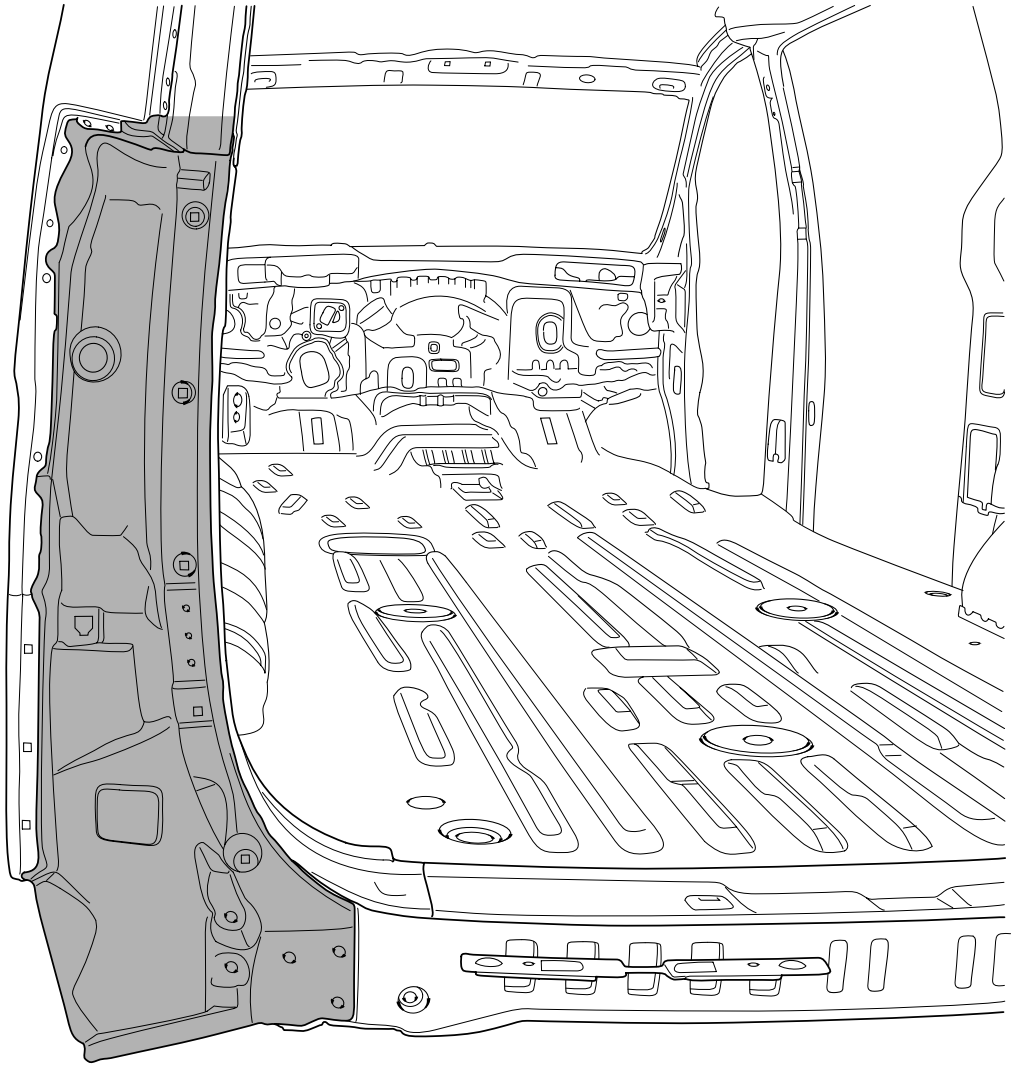
13. Apply the correct seam sealers to all joints.

14. Reprime over the seam sealer to complete the repair.

15. In order to improve corrosion resistance, if necessary, apply an under body anti-corrosion agent to the wheel well (Refer to the CORROSION PROTECTION).

QUARTER OUTER REAR EXTENSION

WELDING POINTS

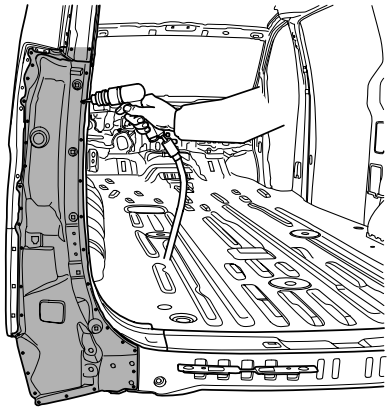


- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

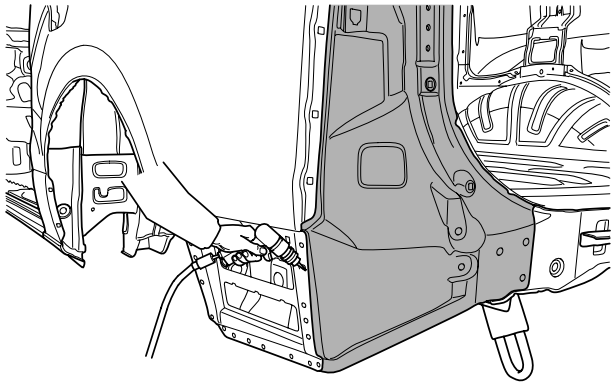
BTQBP6703A

REMOVAL

1. Drill out all spotwelds(46), attaching the quarter outer rear extension.

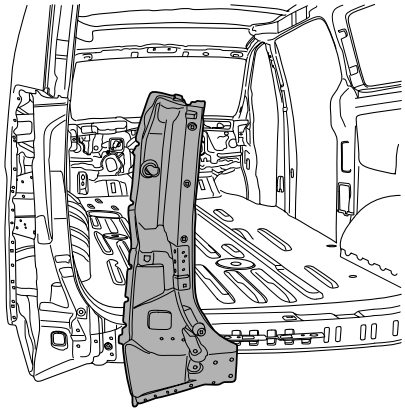


BTQBP6703B



BTQBP6706A

2. Remove the quarter outer rear extension.



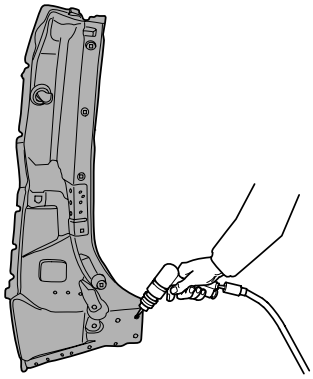
BTQBP6801

3. Prepare all surfaces to be welded.

4. After removing, apply the welding primer.

INSTALLATION

1. Drill 8 mm holes in overlap areas along upper and lower flanges of the new quarter outer rear extension for MIG plug welding.

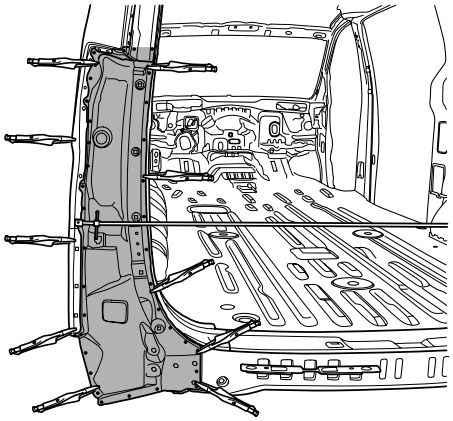


BTQBP6802

3. Apply body filler to the welded seam. Sand and finish. Apply the two-part epoxy primer to the interior of the quarter outer panel.

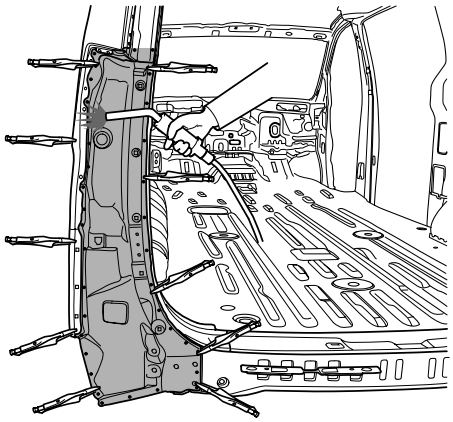
4. Fit and clamp the quarter outer rear extension in place.

5. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

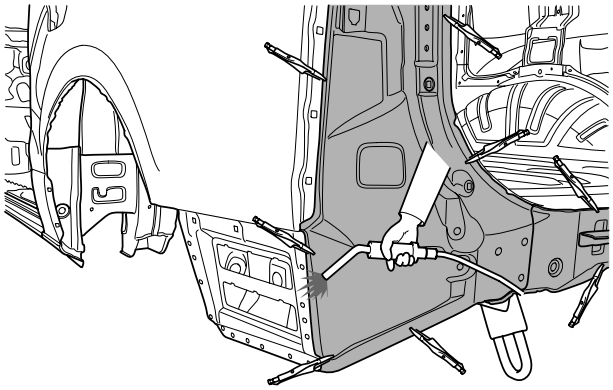


BTQBP6703C

6. MIG plug weld all holes.



BTQBP6703D



BTQBP6706B

7. Clean and prepare all welds, remove all residue.

8. Apply an anti-corrosion agent to the welded parts and interior of the quarter outer rear extension (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

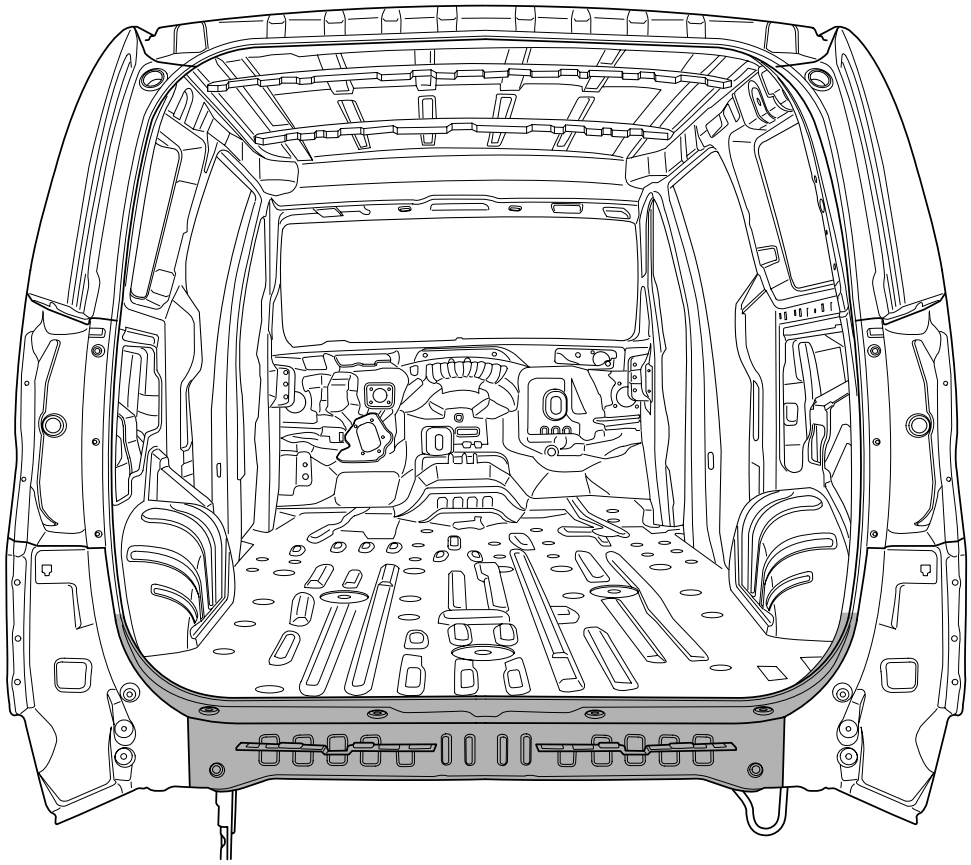
12. Apply the two-part epoxy primer.

13. Apply the correct seam sealers to all joints.

14. Reprime over the seam sealer to complete the repair.

REAR END CROSS MEMBER

WELDING POINTS

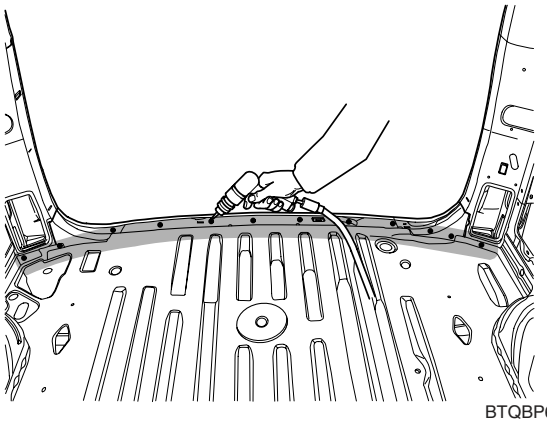


● MIG plug welding
MIG butt welding
MIG lap welding

BTQBP6401

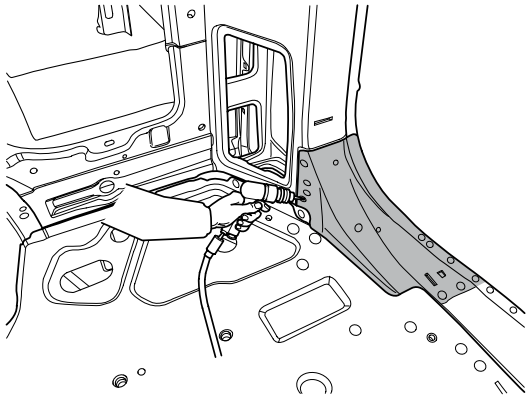
REMOVAL

1. Drill out all the spotwelds(36) attaching the rear end cross outer upper member to the rear floor panel.



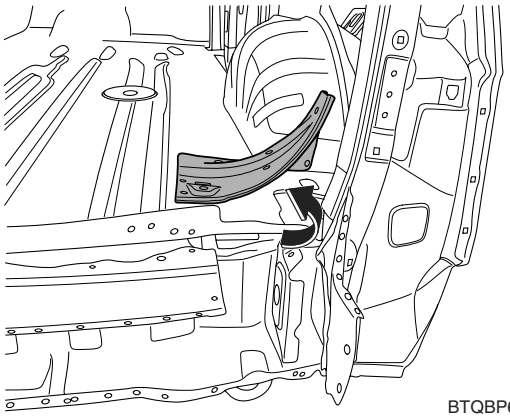
BTQBP6803

2. Drill out all the spotwelds(23) attaching the quarter inner lower rear extension.



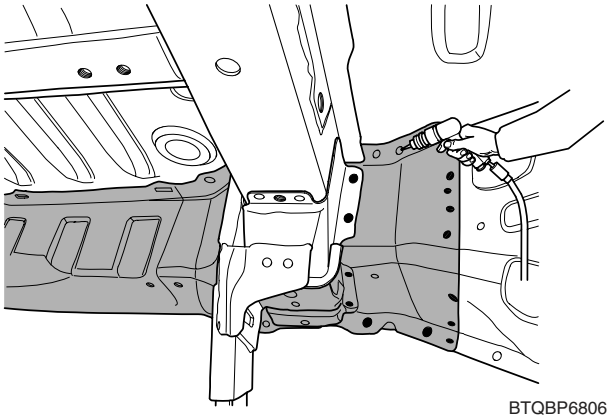
BTQBP6804

3. Remove the quarter inner lower rear extension.

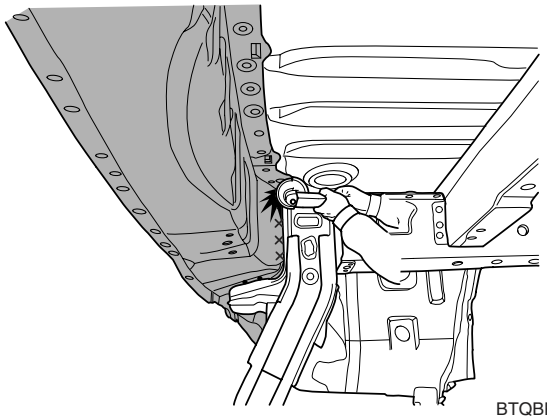


BTQBP6805

4. Drill out and grind away all the spotwelds(18) and lap weld attaching the rear end cross inner member to the rear side member (LH side).

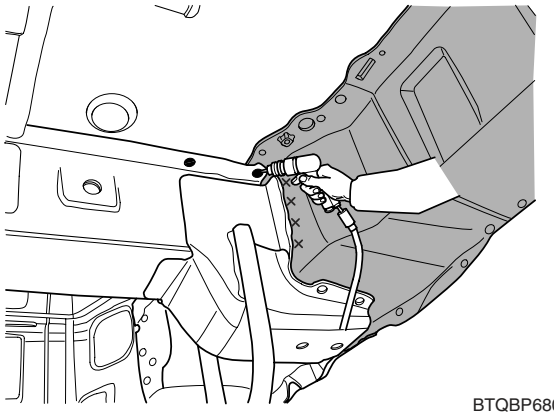


BTQBP6806

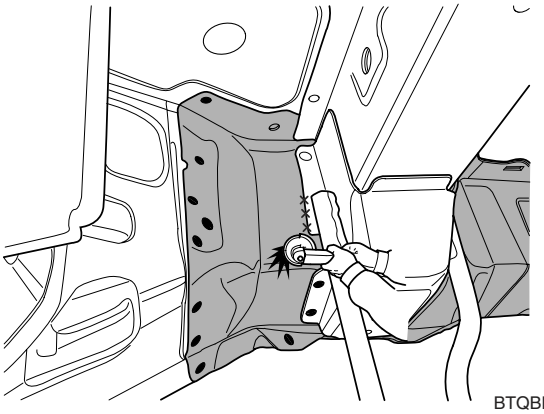


BTQBP6807

5. Drill out and grind away all the spotwelds(18) and lap welds(2) attaching the rear end cross inner member to the rear side member (RH side).

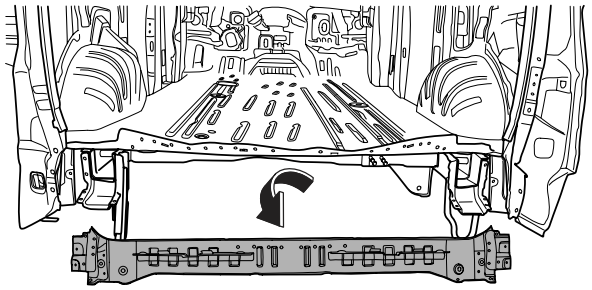


BTQBP6808



BTQBP6809

6. Remove the rear end cross member.



BTQBP6810

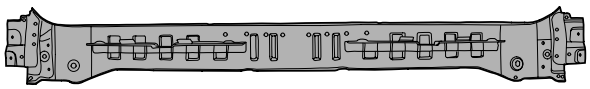
7. Straighten all flanges as necessary, p
repare
all surfaces to be welded.

8. Prepare all surfaces to be welded.

9. After removing, apply the welding primer.

INSTALLATION

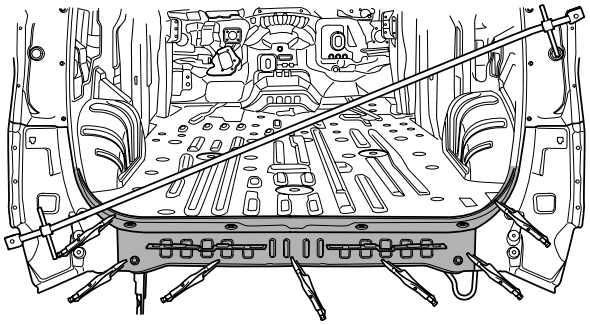
1. Drill 8 mm holes in rear end cross member for MIG plug welding.



BTQBP6811

2. Fit and clamp the rear end cross member in place.

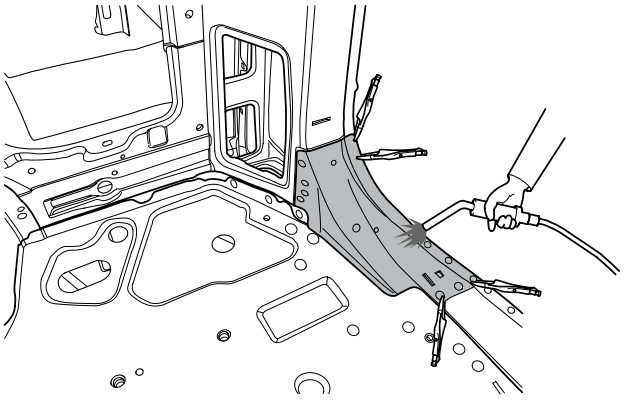
3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6401A

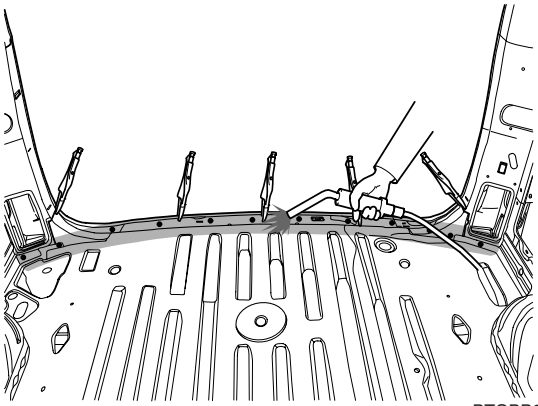
4. Fit and clamp the quarter inner lower rear extension in place.

5. MIG plug weld all holes and MIG lap weld seams.



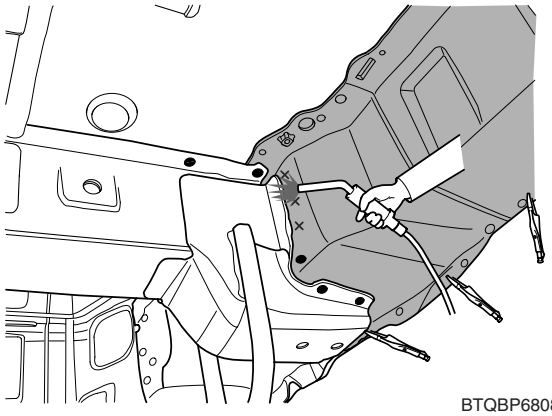
BTQBP6804A

6. MIG plug weld all holes and MIG lap weld seams.

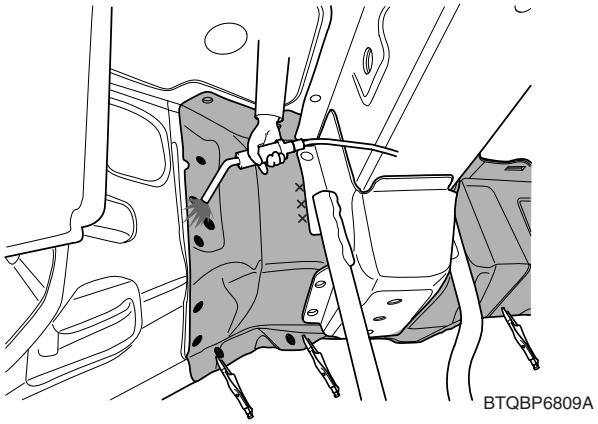


BTQBP6803A

7. MIG plug weld all holes and MIG lap weld seams.

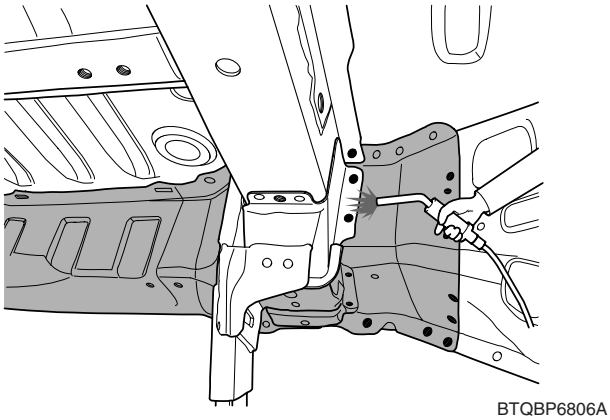


BTQBP6808A

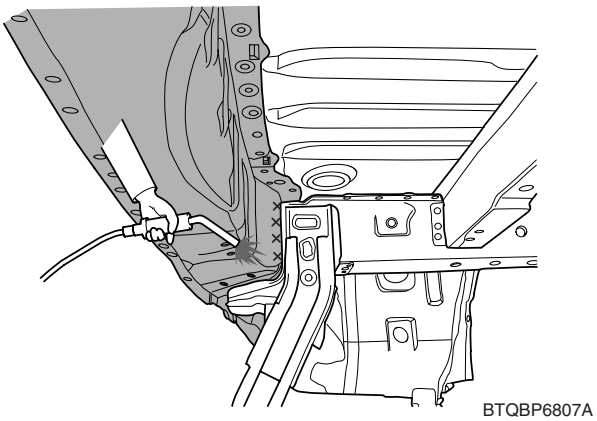


BTQBP6809A

8. MIG plug weld all holes and MIG lap weld seams.



BTQBP6806A



BTQBP6807A

9. Clean and prepare all welds, remove all residue.

10. Apply the two-part epoxy primer to the interior of the rear end cross member.

11. Apply an anti-corrosion to the interior of the rear end cross member (Refer to the CORROSION PROTECTION).

12. Prepare exterior surfaces for priming, using wax and grease remover.

13. Apply metal conditioner and water rinse.

14. Apply conversion coating and water rinse.

15. Apply the two-part epoxy primer.

16. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

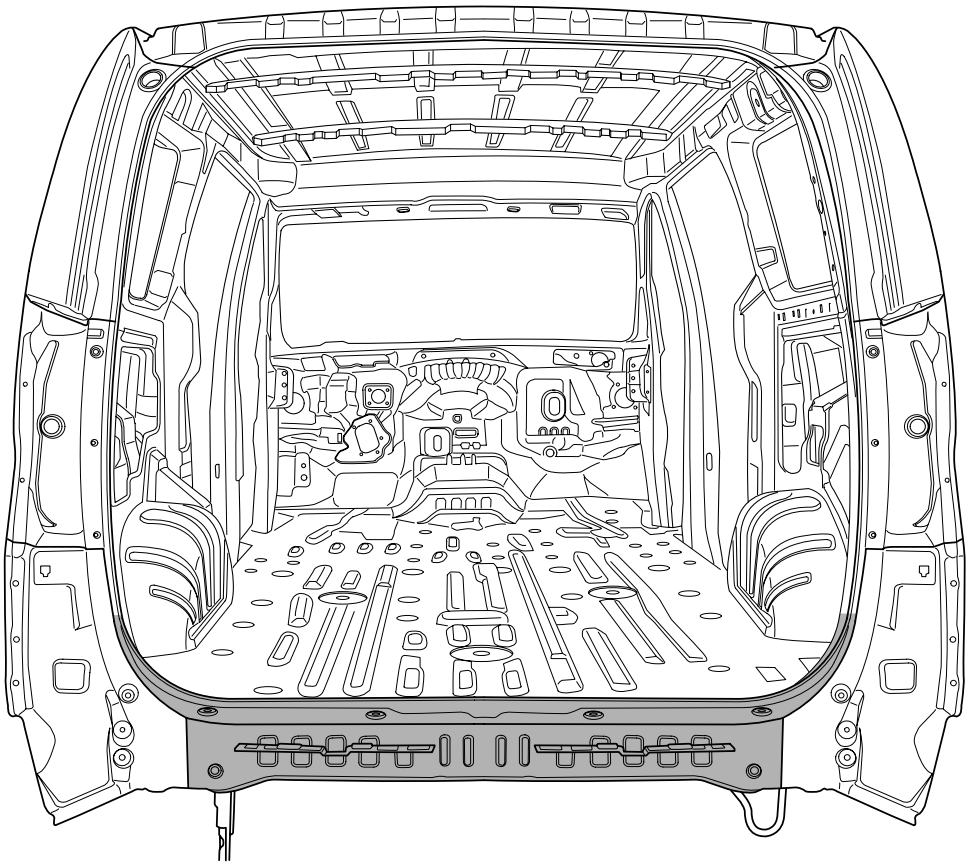
17. Reprime over the seam sealer to complete the repair.

18. After completing body repairs, carefully apply Under coating to the Under body (Refer to the CORROSION PROTECTION).

19. In order to improve corrosion resistance, if necessary, apply an Under body anti-corrosion agent to the panel which is repaired or replaced (Refer to the CORROSION PROTECTION).

REAR END CROSS OUTER LOWER MEMBER

WELDING POINTS

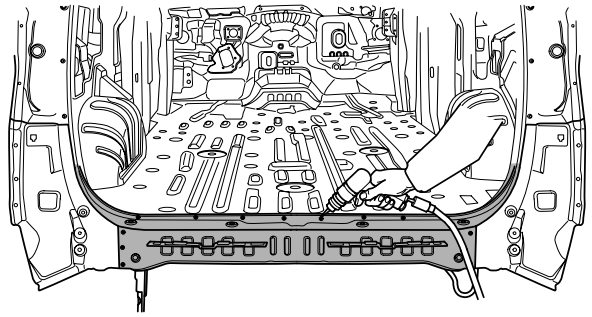


● MIG plug welding
⫫ MIG butt welding
⤫ MIG lap welding

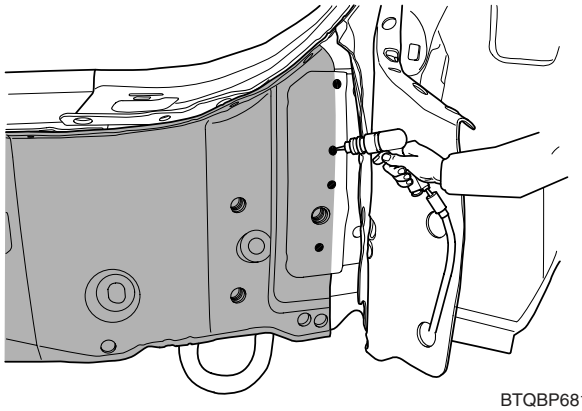
BTQBP6401

REMOVAL

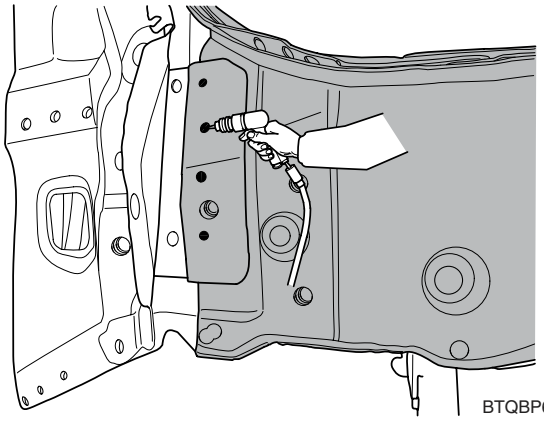
1. Drill out and grind away all the spotwelds(43) and lap weld all seams attaching the rear end cross outer lower member.



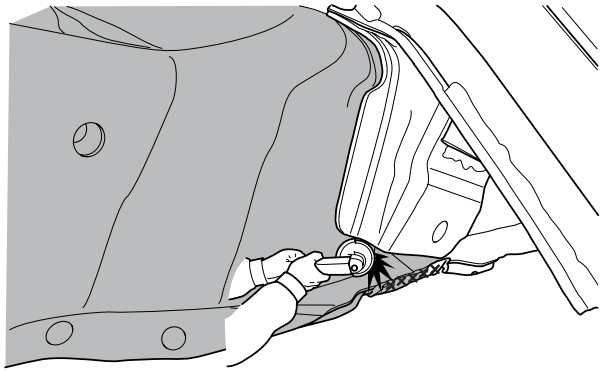
BTQBP6401B



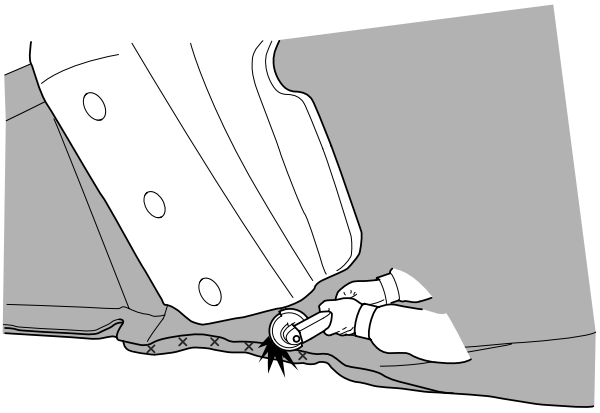
BTQBP6812



BTQBP6813

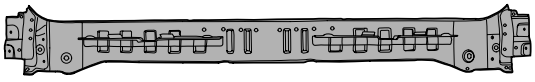


BTQBP6814



BTQBP6815

2. Remove the rear end cross outer lower member.



BTQBP6816

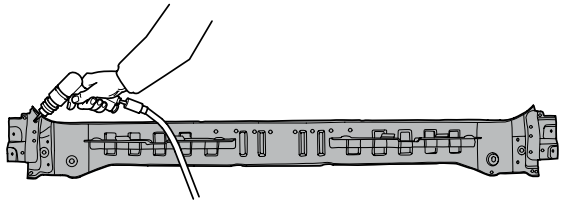
3. Straighten all flanges as necessary, Prepare all surfaces to be welded.

4. Prepare all surfaces to be welded.

5. After removing, apply the welding primer.

INSTALLATION

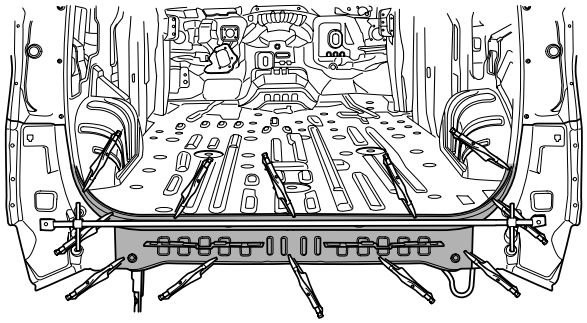
1. Drill 8 mm holes in new rear end cross outer lower member for MIG plug welding.



BTQBP6817

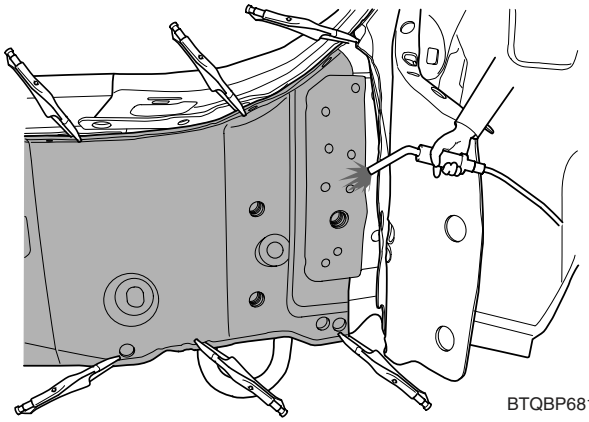
2. Fit and clamp the rear end cross outer lower member in place.

3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

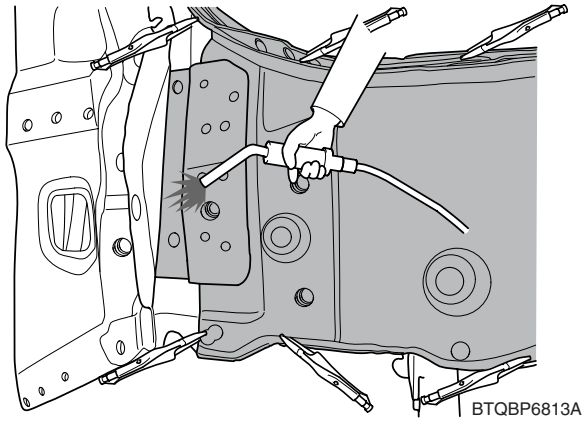


BTQBP6401C

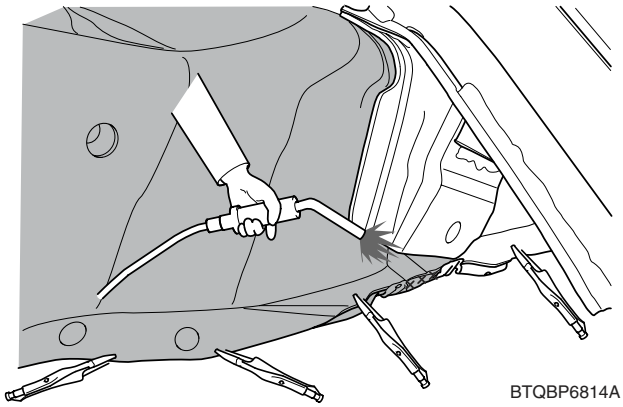
4. MIG plug weld all holes and MIG butt weld seams.



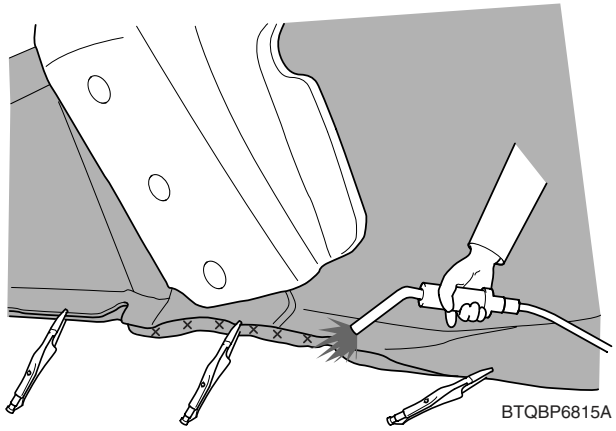
BTQBP6812A



BTQBP6813A



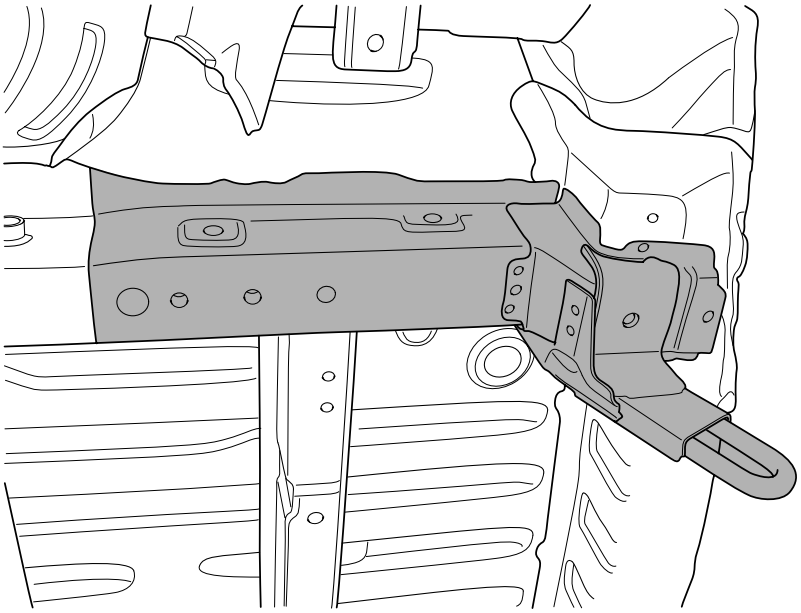
BTQBP6814A

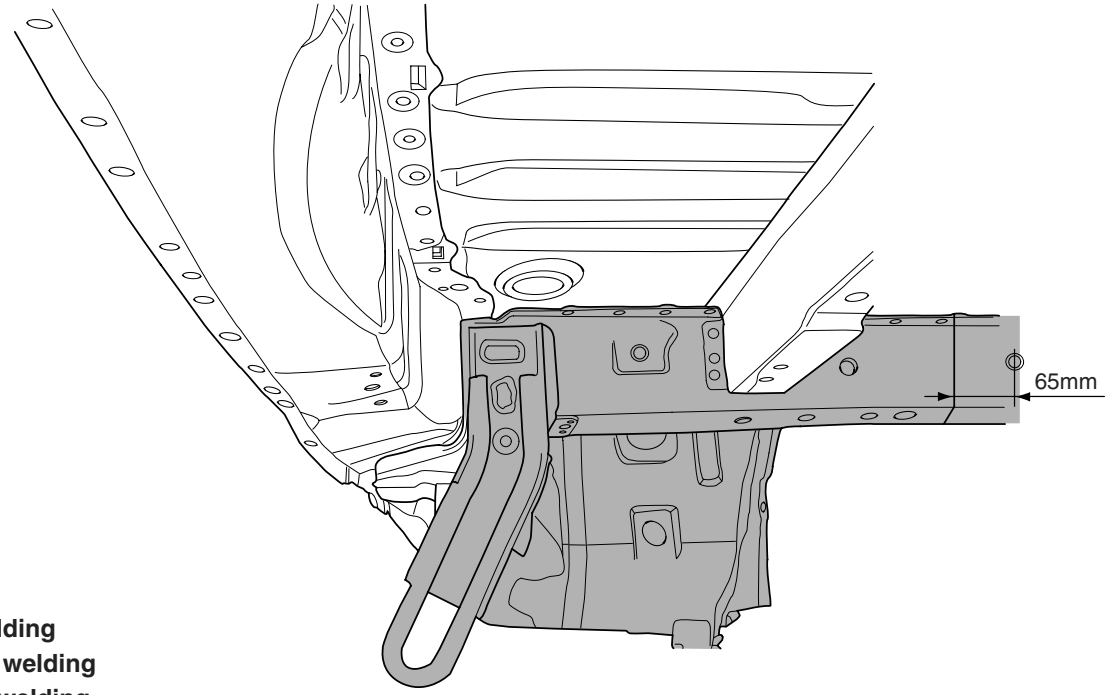

BTQBP6815A

5. Clean and prepare all welds, remove all residue.
6. Apply the two-part epoxy primer to the interior of the rear end cross member.
7. Apply an anti-corrosion to the interior of the rear end cross member (Refer to the CORROSION PROTECTION).
8. Prepare exterior surfaces for priming, using wax and grease remover.
9. Apply metal conditioner and water rinse.
10. Apply conversion coating and water rinse.
11. Apply the two-part epoxy primer.
12. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).
13. Reprime over the seam sealer to complete the repair.
14. After completing body repairs, carefully apply Under coating to the Under body (Refer to the CORROSION PROTECTION).
15. In order to improve corrosion resistance, if necessary, apply an Under body anti-corrosion agent to the panel which is repaired or replaced (Refer to the CORROSION PROTECTION).

REAR SIDE MEMBER

WELDING POINTS





- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

BTQBP6902

REMOVAL

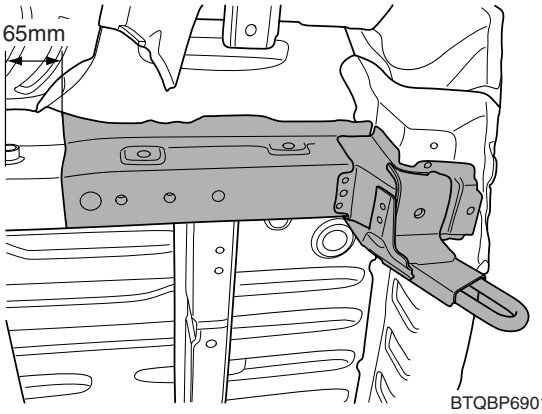
NOTE

Because the rear side members are designed to absorb energy during a rear collision, care must be used when deciding to use this repair method. This repair is recommended only for moderate damage to the vehicle, where distortions do not extend forward of the luggage region. If the damage is more severe, then the entire side member assembly should be replaced at the factory seams without employing this sectioning procedure.

The following procedure applys when only one rear side member needs to be replaced. If both side members are damaged and need to be replaced, then the procedure of rear side members and rear floor section should be followed.

Refer to the body dimension charts and measure the vehicle to determine straightening and alignment requirements.
The body must be returned to its original dimensions before beginning the repair procedure.

1. Measure and mark cutline on the rear side member as indicated in the illustration.

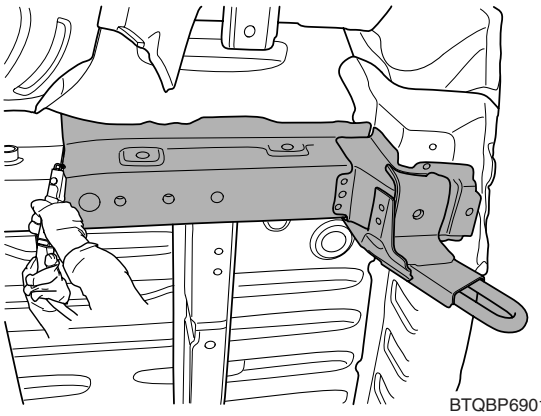


BTQBP6901A

2. Cut the rear side member along the cutline.

NOTE

When cutting the rear side member, be careful not to cut rear side member reinforcement.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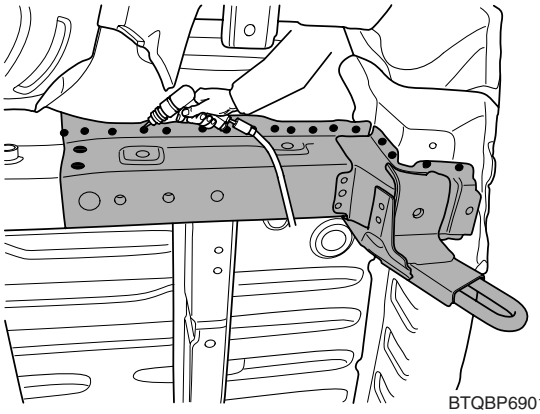
3. Drill out all the spotwelds(29) and lap weld attaching the rear side member.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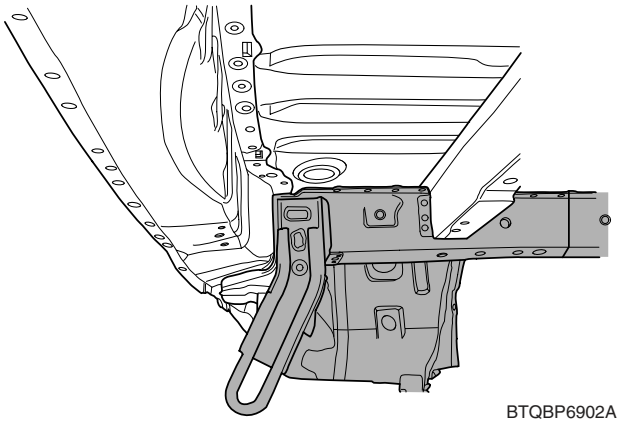
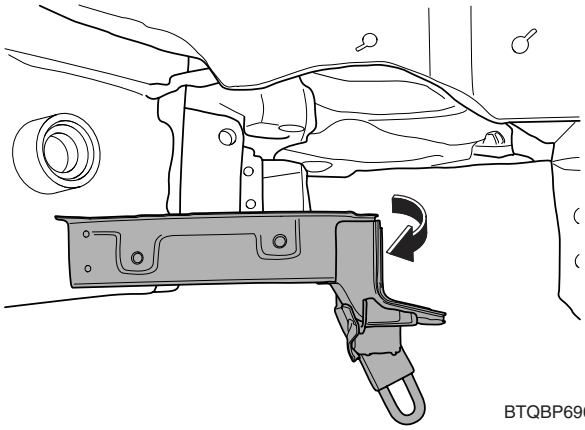

BTQBP6902A

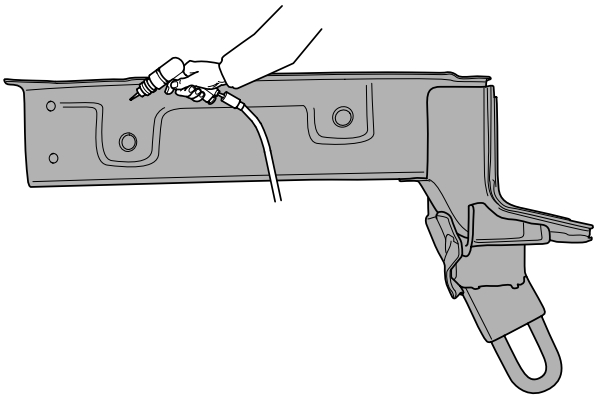
4. Remove the rear side member.


BTQBP6904

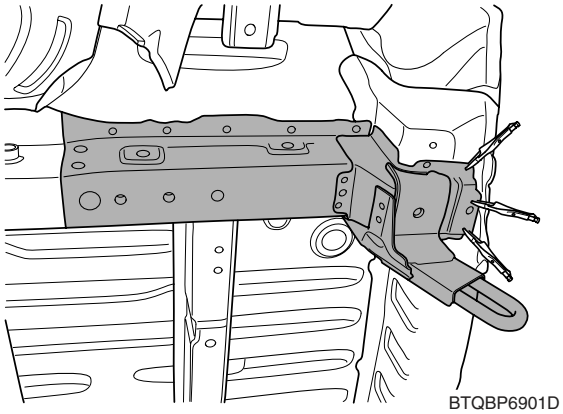
5. Clean cut portions with a disc grinder.
6. Prepare all surfaces to be welded.
7. After removing, apply the welding primer.

INSTALLATION

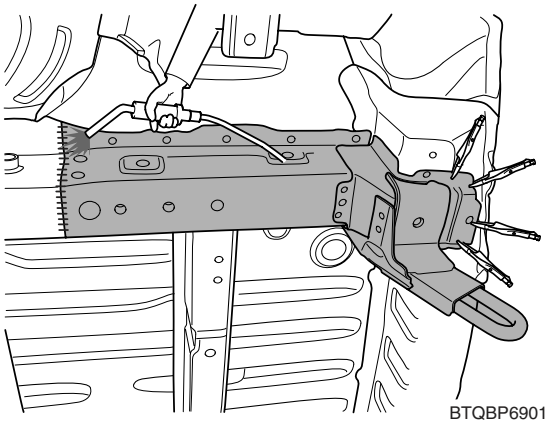
1. Transcribe the cutline to the new rear side member, adding 30 mm overlap to the rear end.
2. Drill 8 mm holes in new rear side member for MIG plug welding.


BTQBP6904A

3. Fit and clamp the rear side member in place.
4. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.


BTQBP6901D

5. MIG plug weld all holes and MIG butt weld seams.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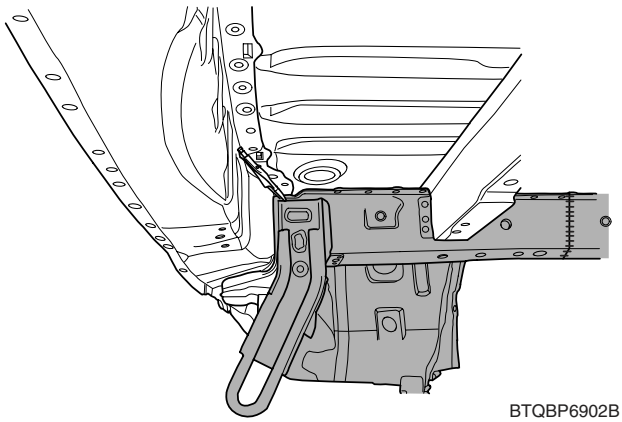

BTQBP6902B

6. Clean and prepare all welds, remove all residue.

7. Apply the two-part epoxy primer to the interior of the rear side member.

8. Apply an anti-corrosion to the interior of the rear side member (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

12. Apply the two-part epoxy primer.

13. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

14. Reprime over the seam sealer to complete the repair.

15. After completing body repairs, carefully apply Under coating to the Under body (Refer to the CORROSION PROTECTION).

16. In order to improve corrosion resistance, if necessary, apply an Under body anti-corrosion agent to the panel which is repaired or replaced (Refer to the CORROSION PROTECTION).

Body Sealing Locations

FRONT BODY & INTERIOR ..... BS - 2

EXTERIOR ..... BS - 5

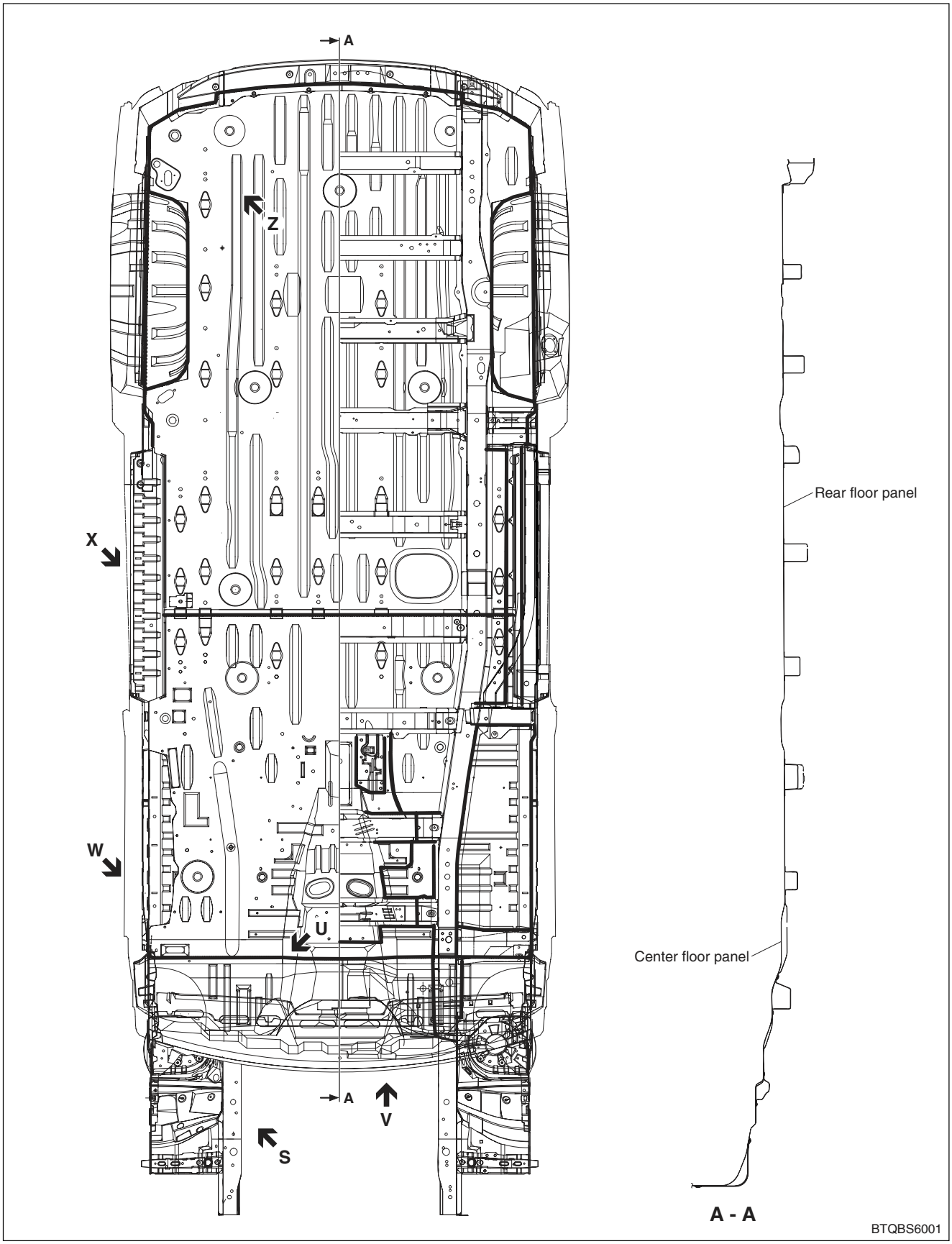
ROOF PANEL ..... BS - 8

HOOD ..... BS - 10

FRONT & REAR DOOR ..... BS - 12

TAIL GATE ..... BS - 14

FRONT BODY & INTERIOR



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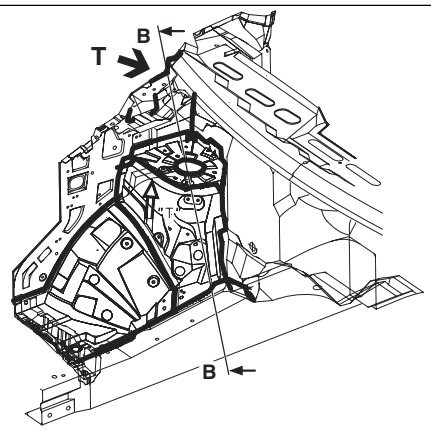

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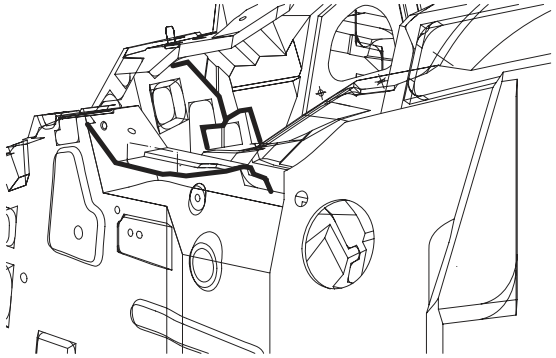

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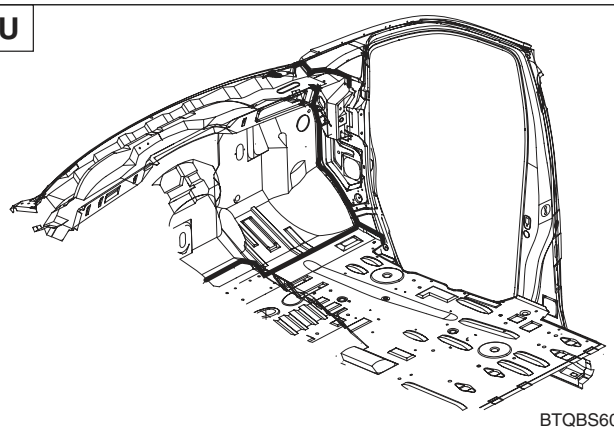

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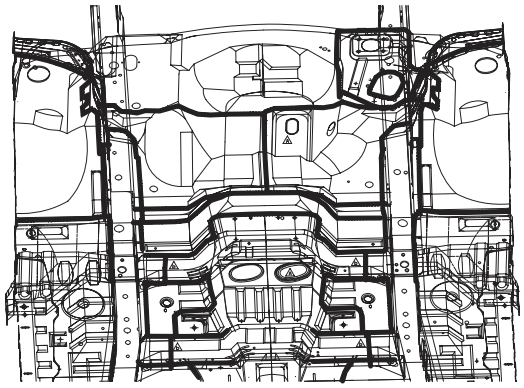

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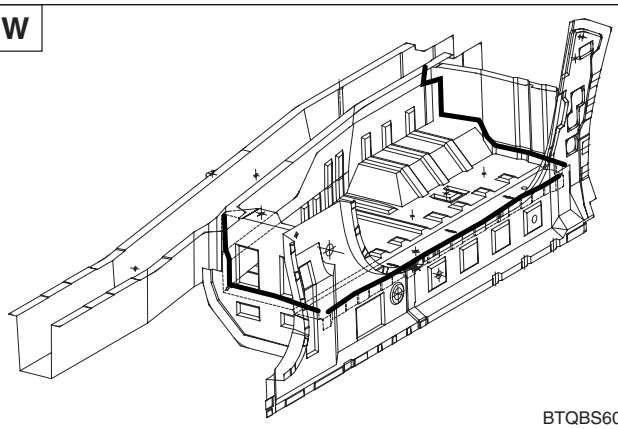

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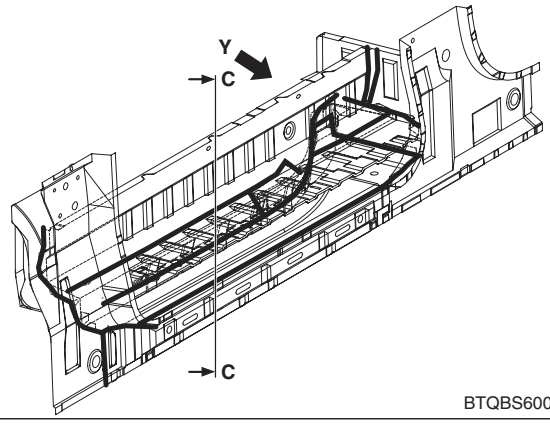

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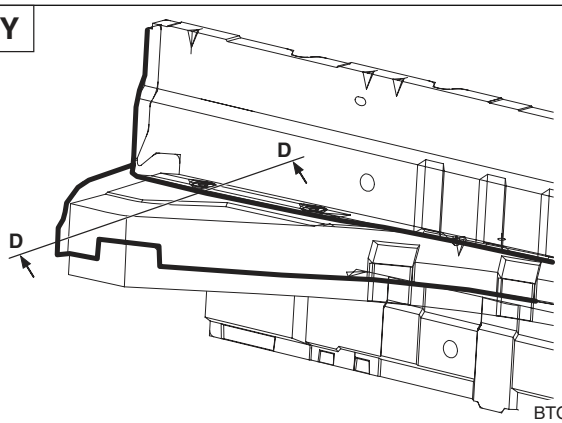

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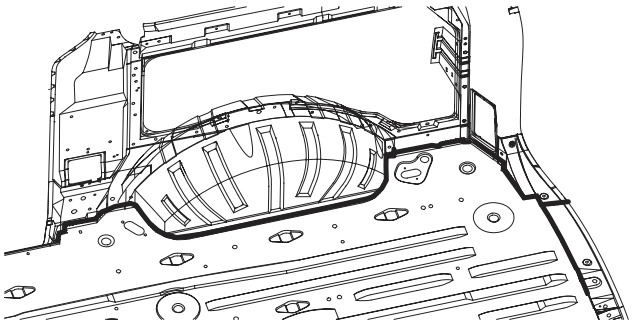

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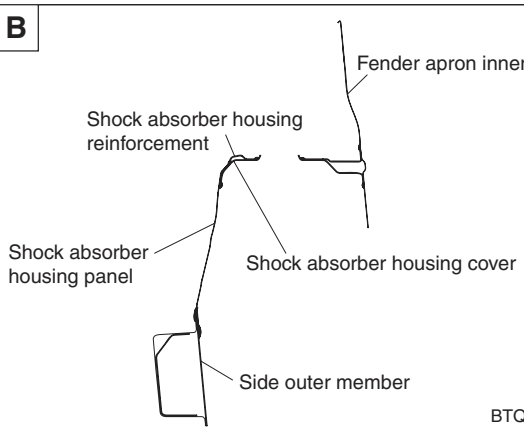

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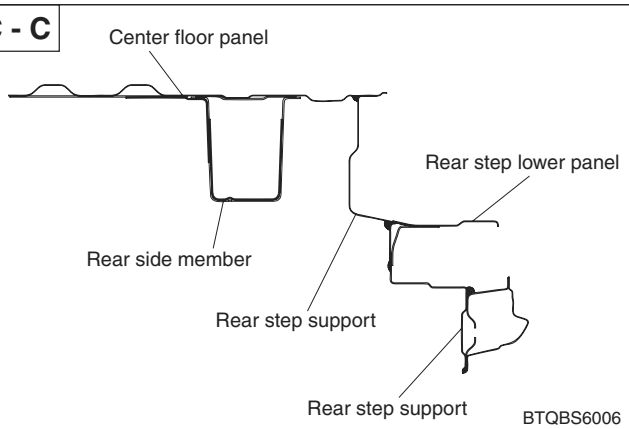

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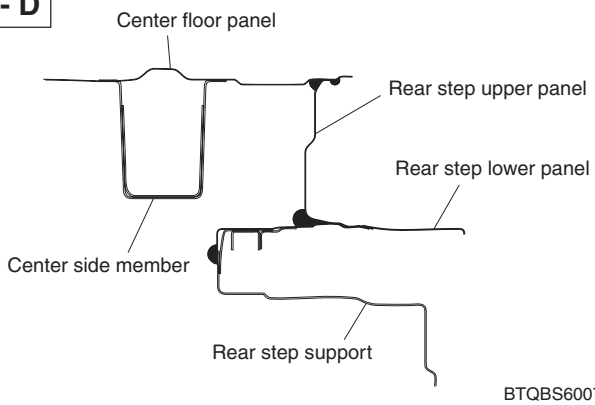

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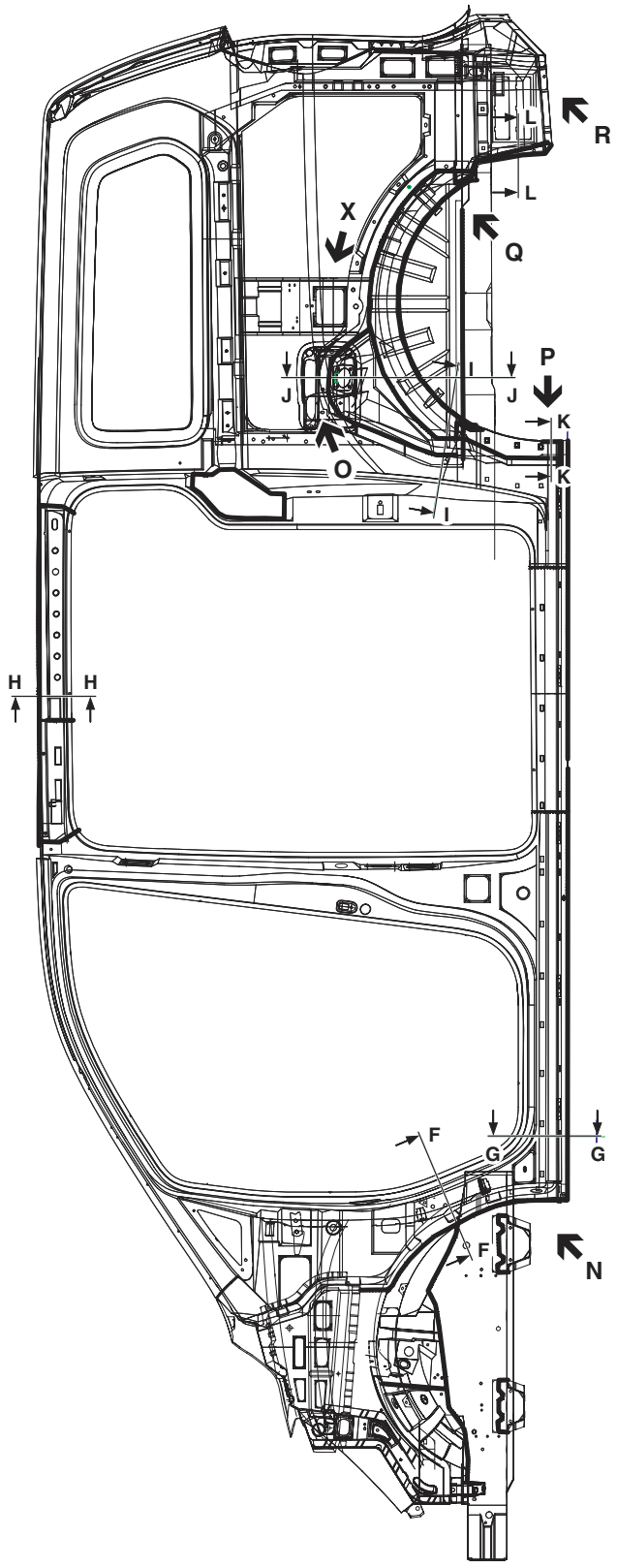

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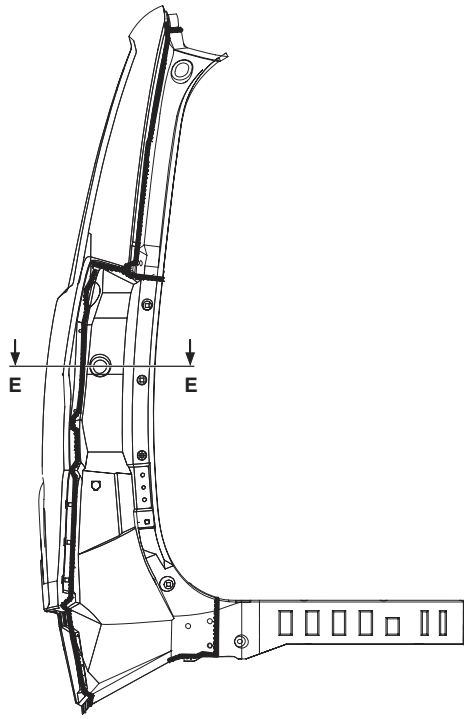

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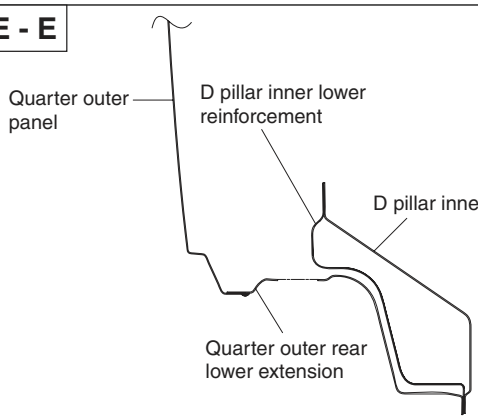

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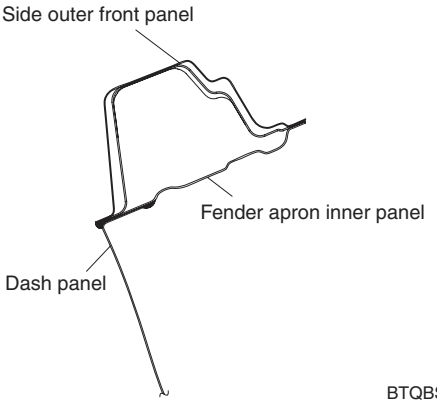

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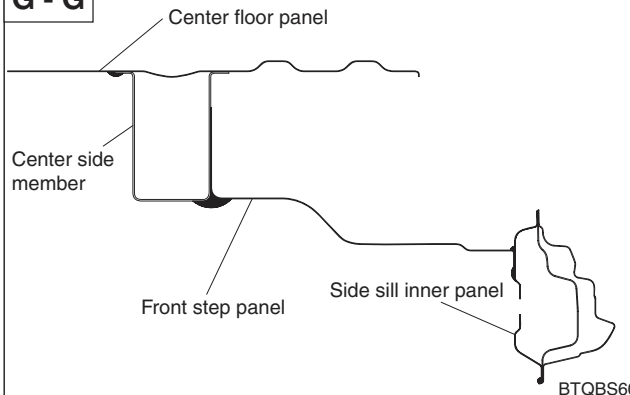

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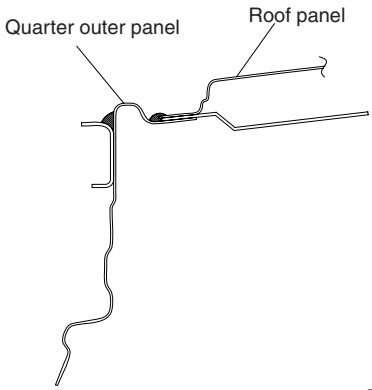

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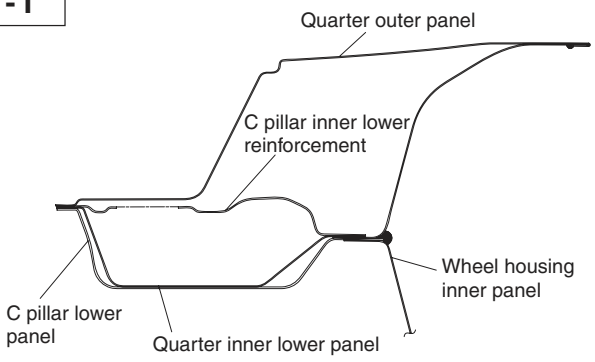

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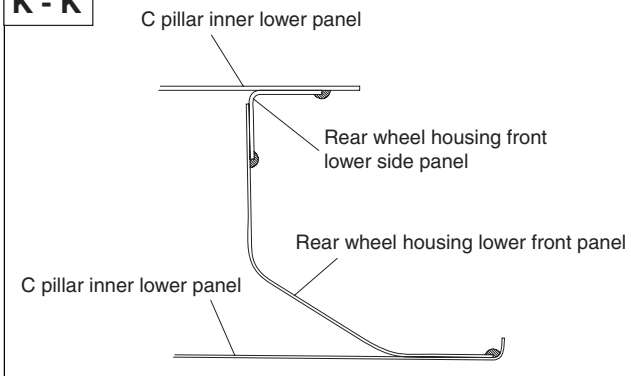

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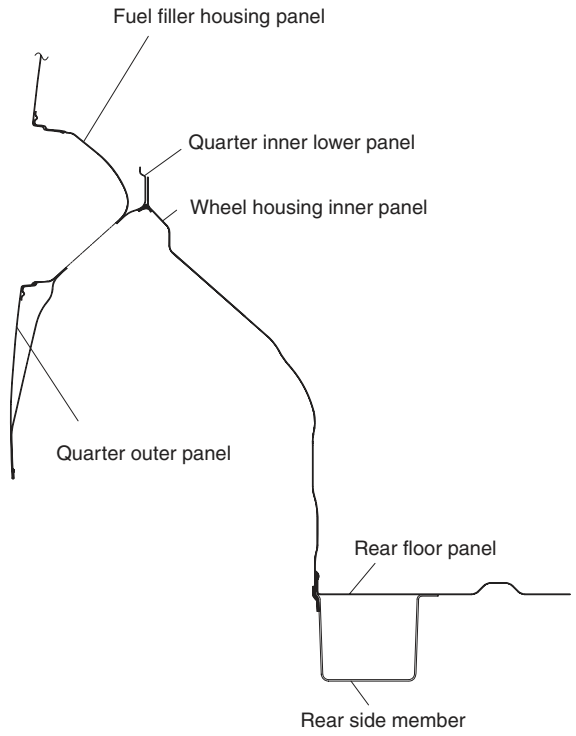

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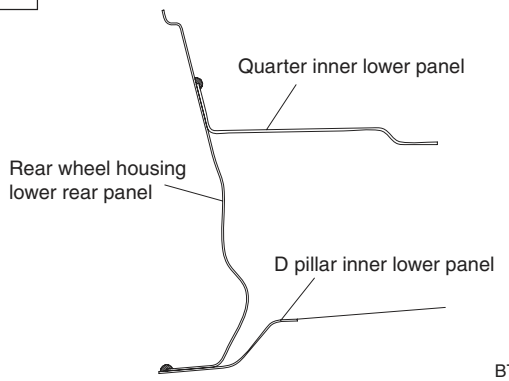

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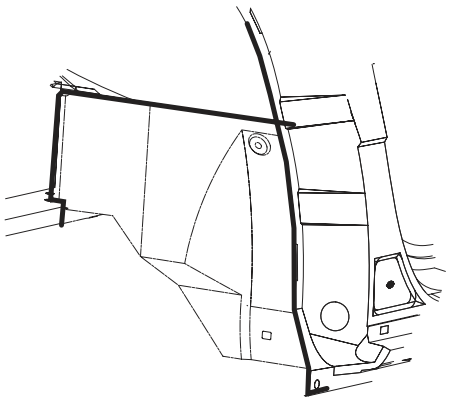

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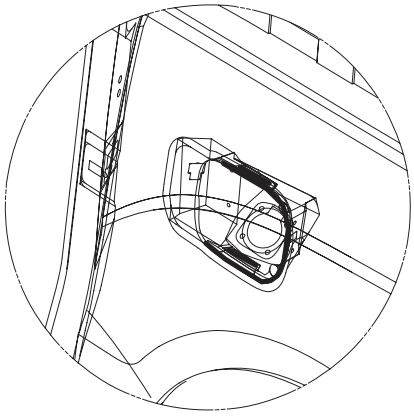

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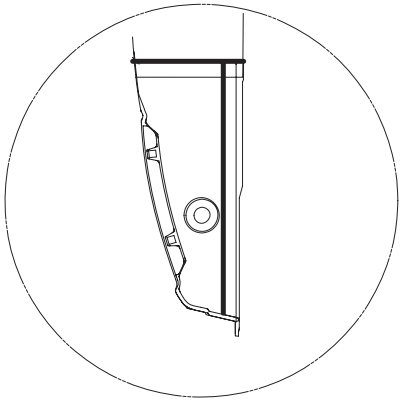

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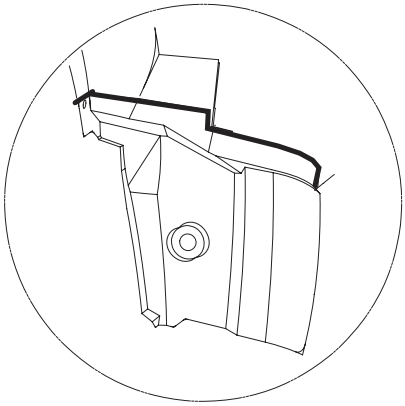

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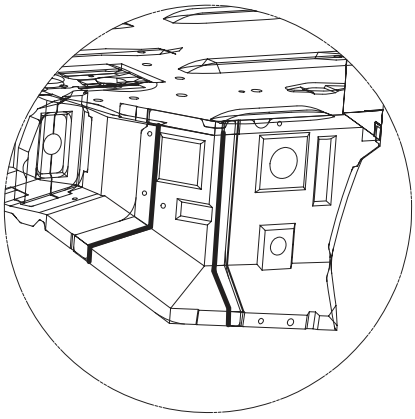

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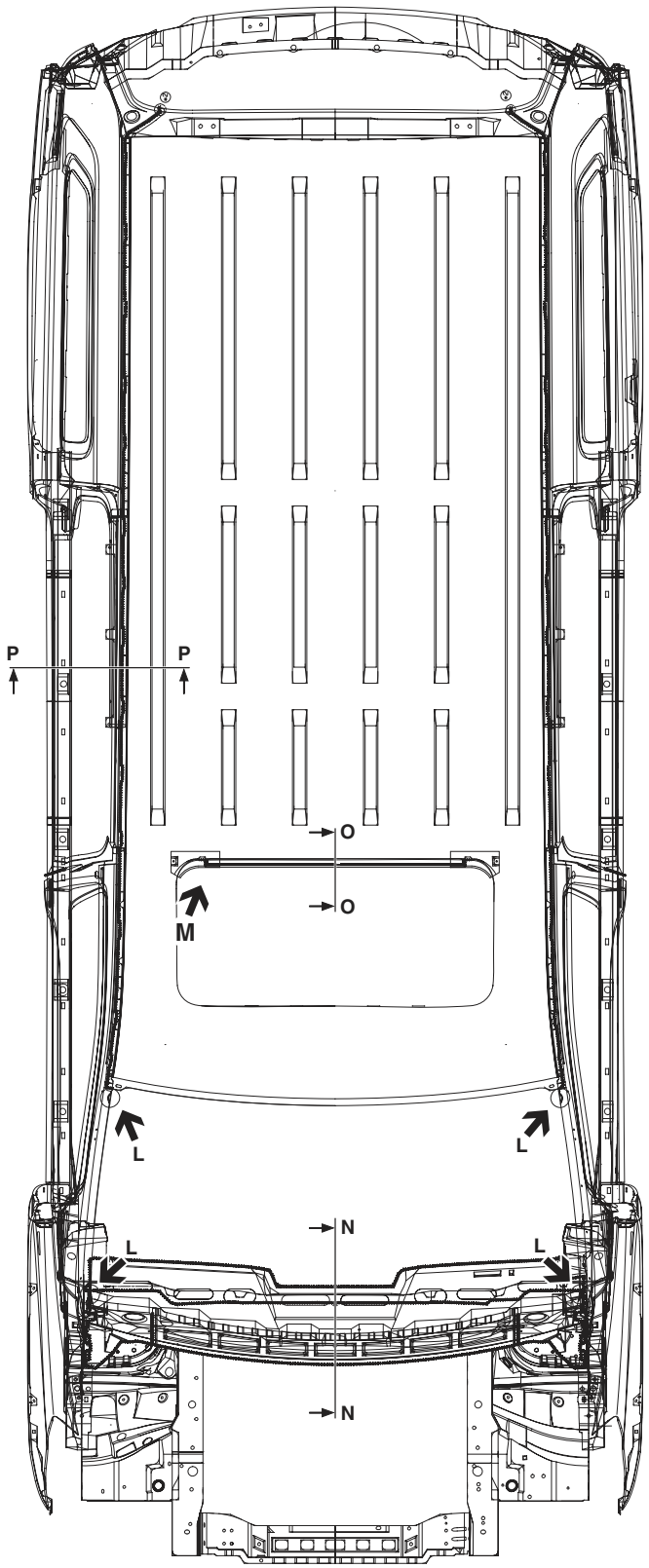
ROOF PANEL



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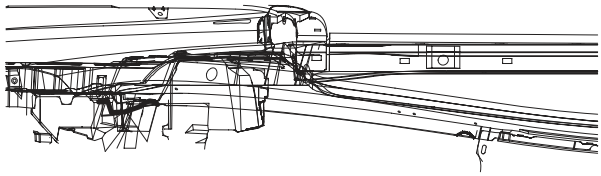

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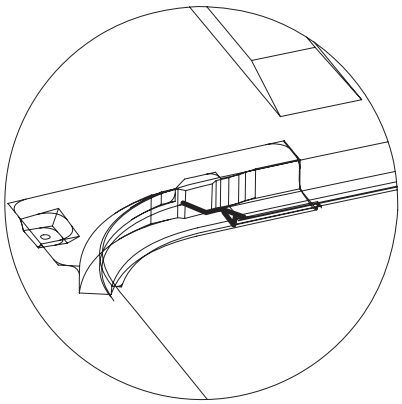

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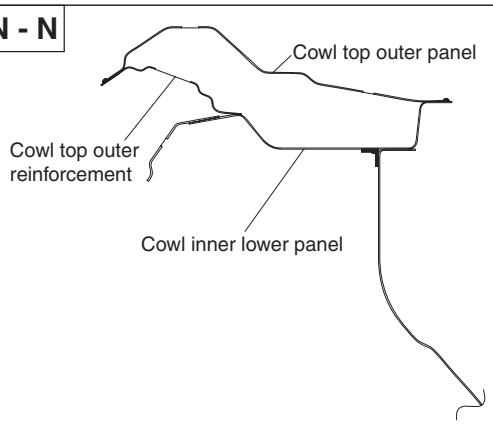

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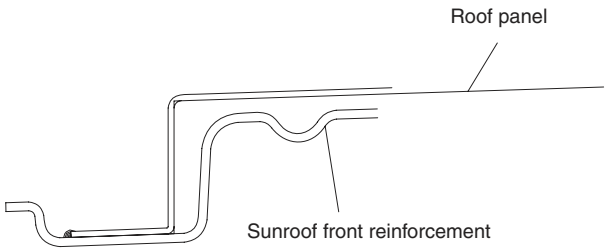

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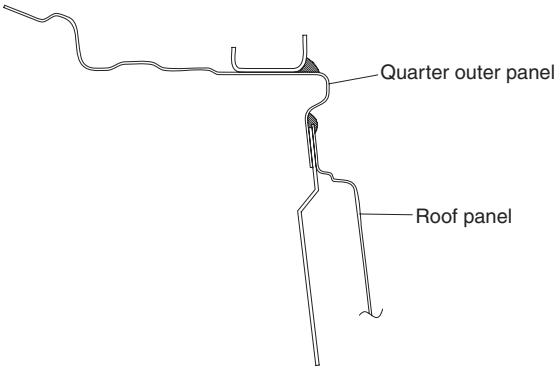

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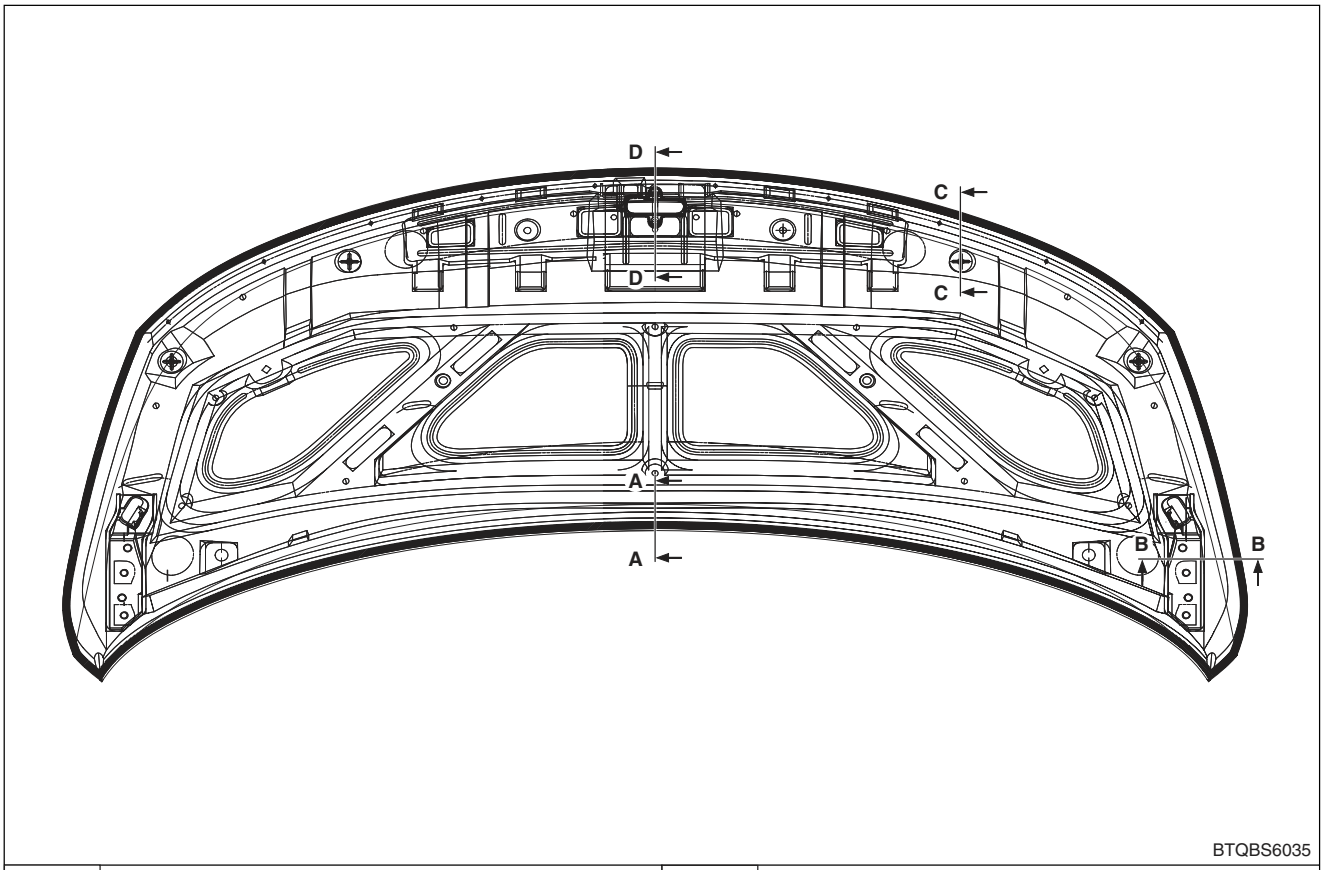

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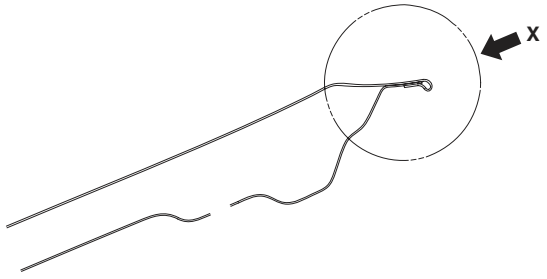

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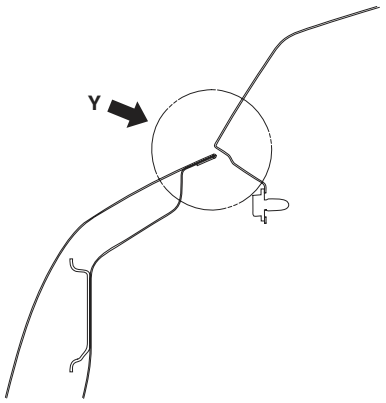

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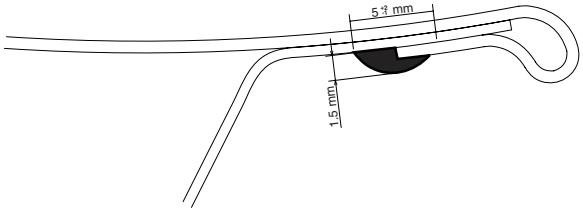

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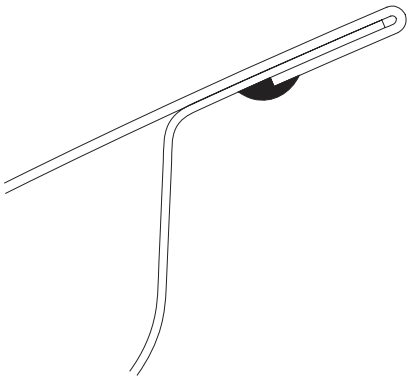

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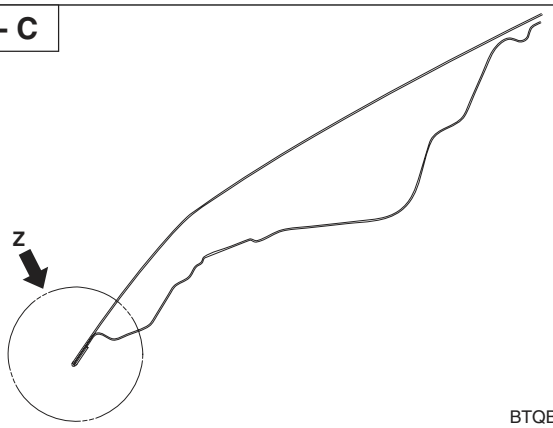

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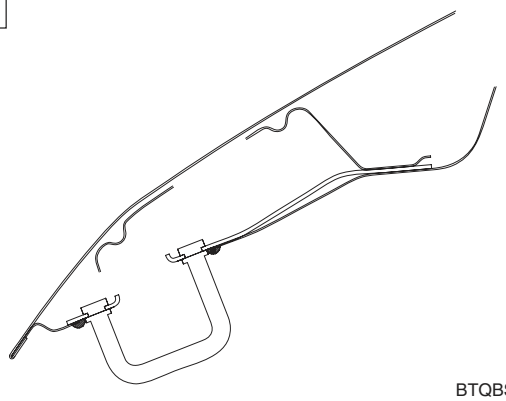

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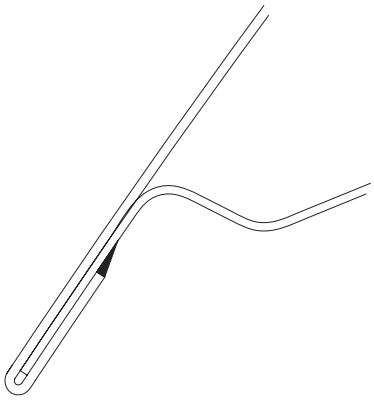
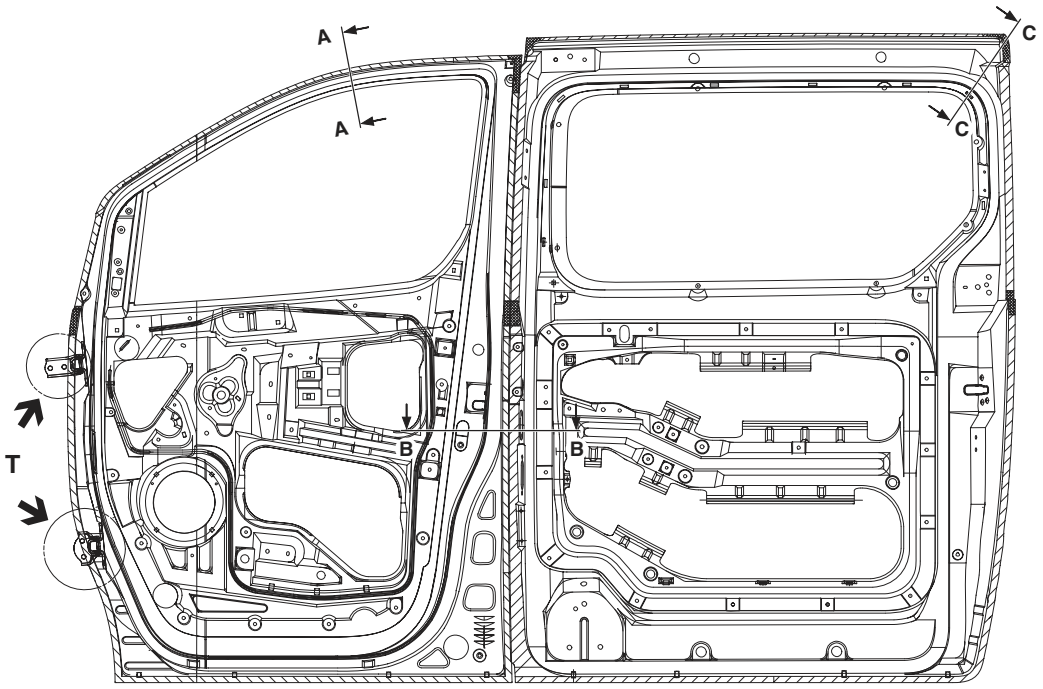


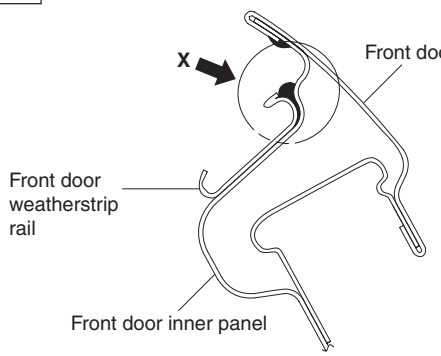
BTQBS6042

FRONT & REAR DOOR



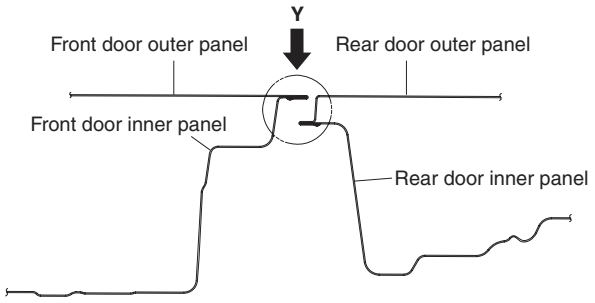
BTQBS6042

A - A



BTQBS6043

B - B



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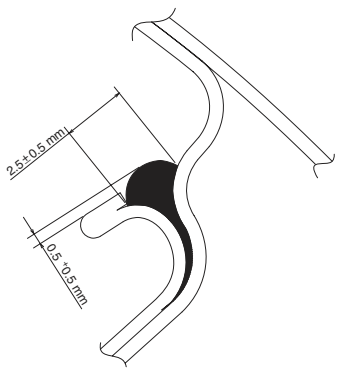

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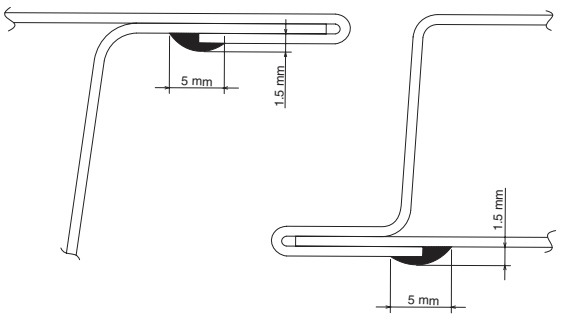
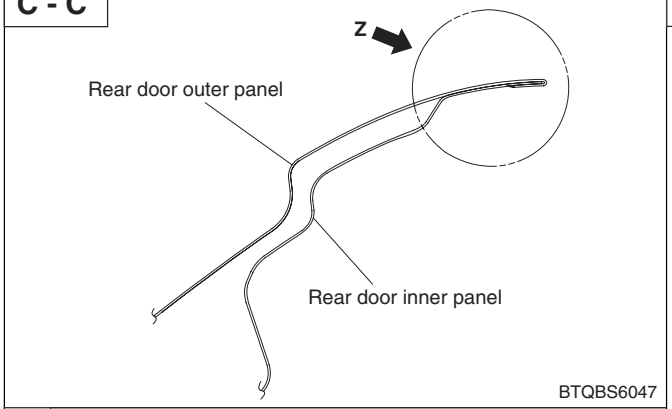


BEDBS6046

C - C



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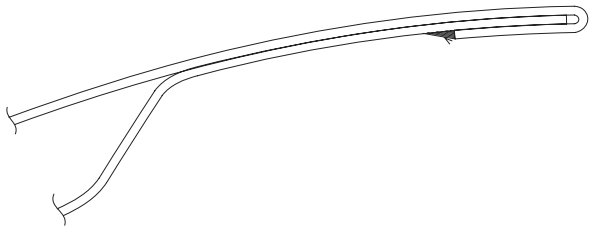

BTQBS6049

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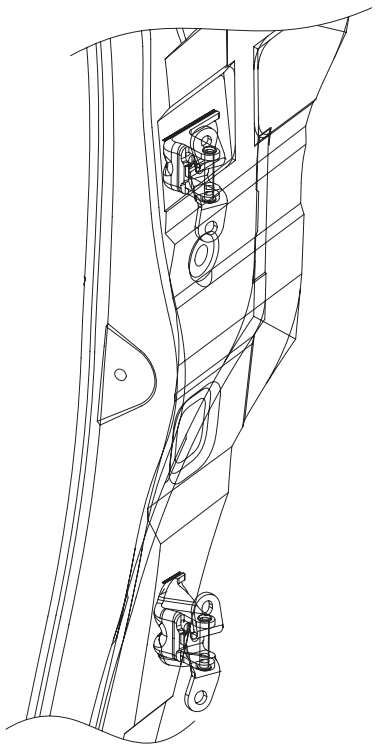
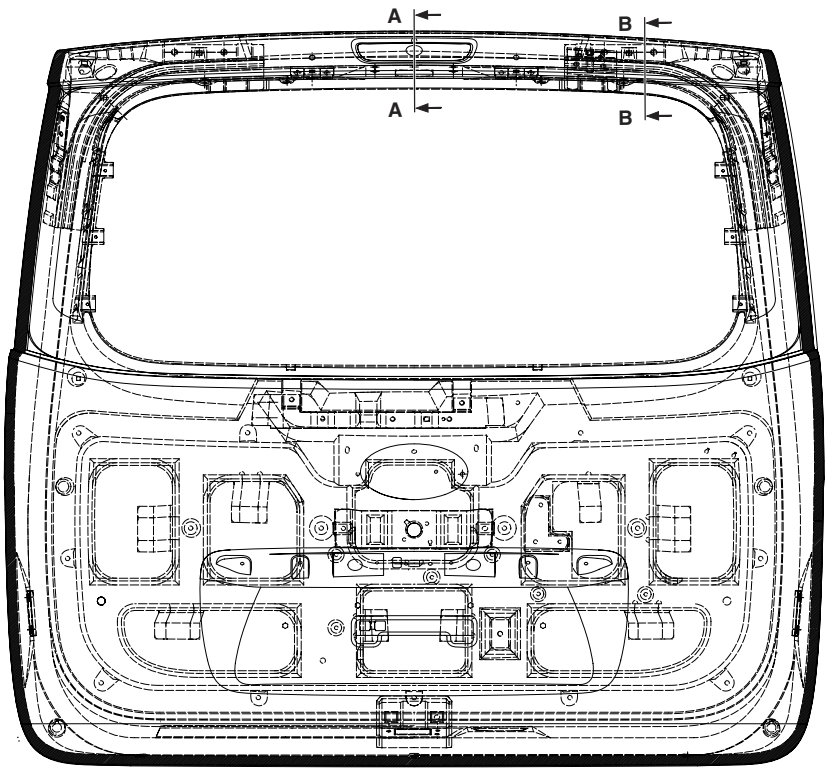


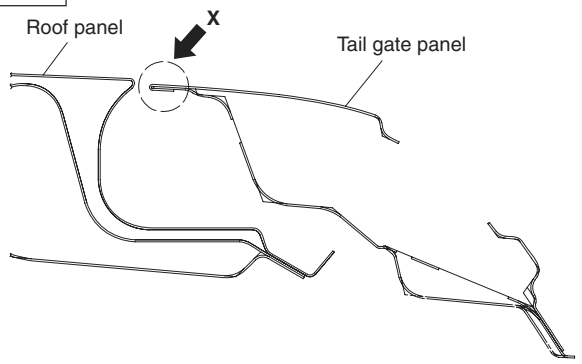
BTQBS6048

TAIL GATE



BTQBS6050

A - A



BTQBS6051

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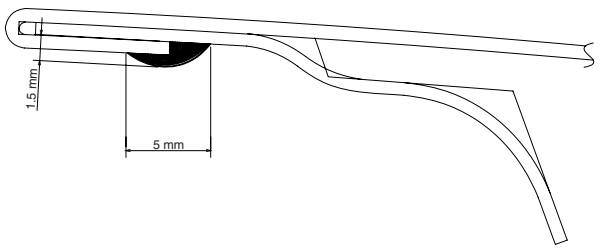
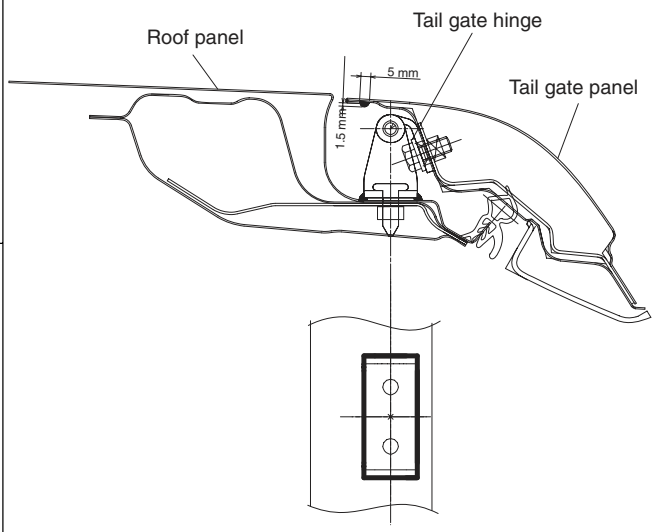


BTQBS6052

B - B



BEDBS6053

Corrosion protection

ZINC-PHOSPHATE COAT & CATIONIC ELECTRODEPOSITION PRIMER ..... CP - 2

ATTACHMENT OF ANTIVIBRATION PADS ..... CP - 3

ANTIVIBRATION PADS-LOCATION & SECTION ..... CP - 4

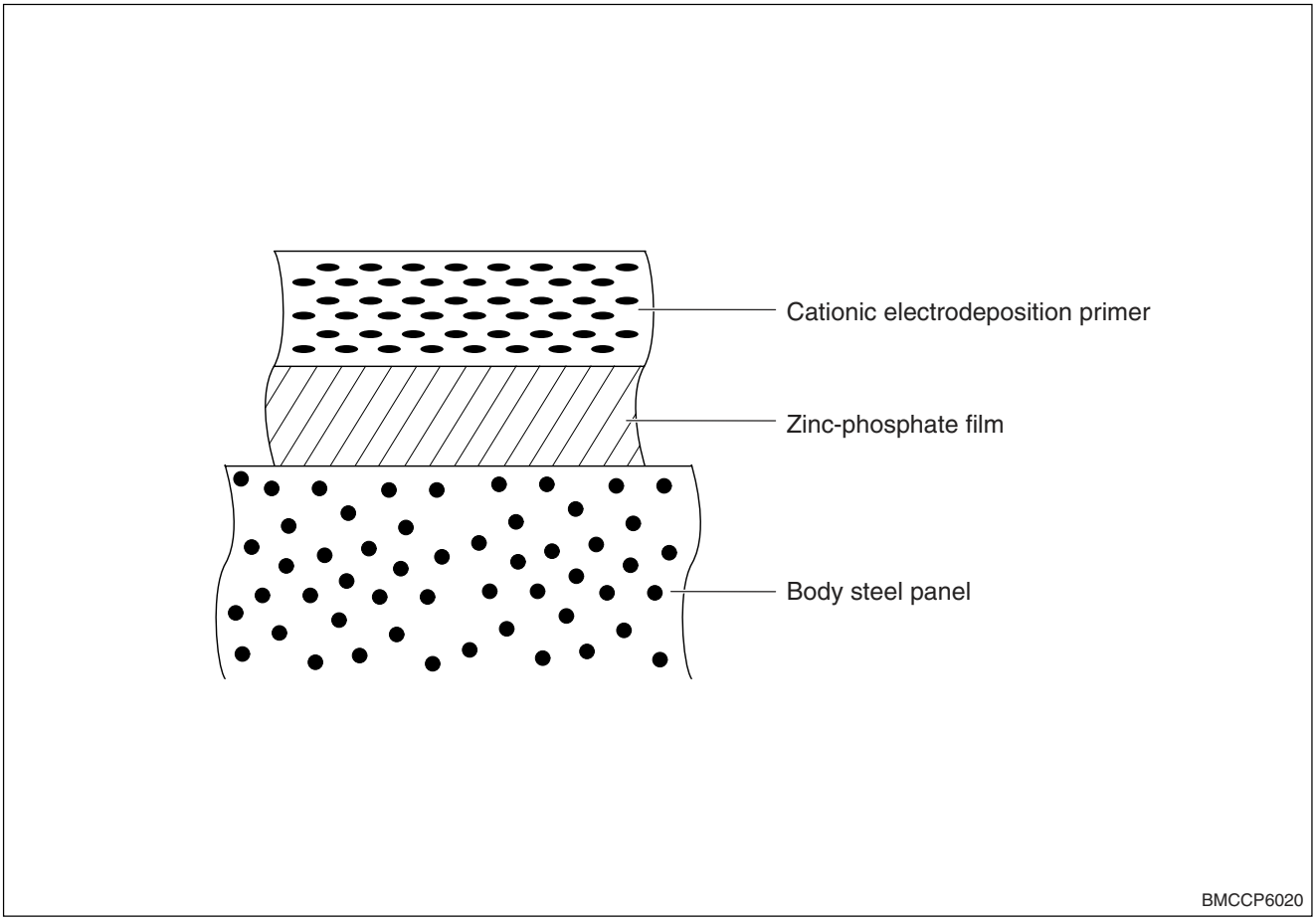
UNDER BODY ..... CP - 7

CAVITY WAX INJECTION ..... CP - 10
- HOOD ..... CP - 10
- SIDE BODY ..... CP - 11
- FRONT & REAR DOOR ..... CP - 12
- TAIL GATE ..... CP - 13
- TWIN SWING DOOR ..... CP - 14
- UNDER FLOOR ..... CP - 15

UNDER BODY ANTI-CORROSION AGENT ..... CP - 17

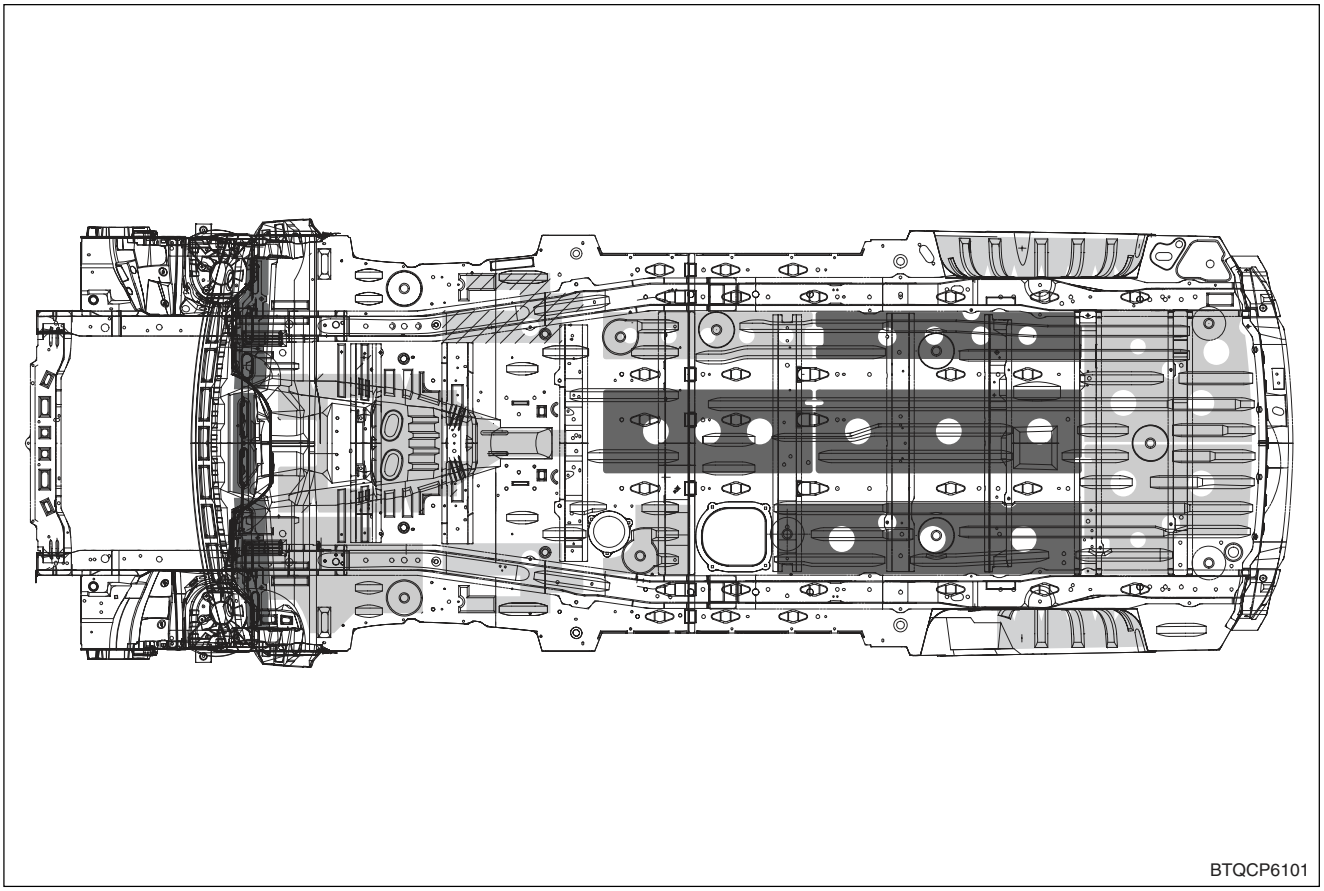
ZINC-PHOSPHATE COAT & CATIONIC ELECTRODEPOSITION PRIMER

In order to improve the adhesion of the paint coat on the steel panel, and also to improve the corrosion resistance, the entire body is coated with a film of Zinc-phosphate and a cationic electrodeposition primer.



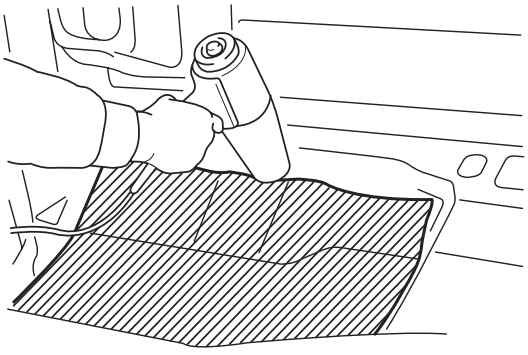
ATTACHMENT OF ANTIVIBRATION PADS

Antivibration pads are attached to the upper surface of the floor and at the interior side of the dash panel in order to absorb vibrations and shut out exhaust gas heat. If these antivibration pads are peeled off in the course of replacement or repair of a welded panel, cut and attach replacement material (in the shape shown in the figure).



BTQCP6101

1. Heat the "antivibration pad" with a blow drier to soften it.



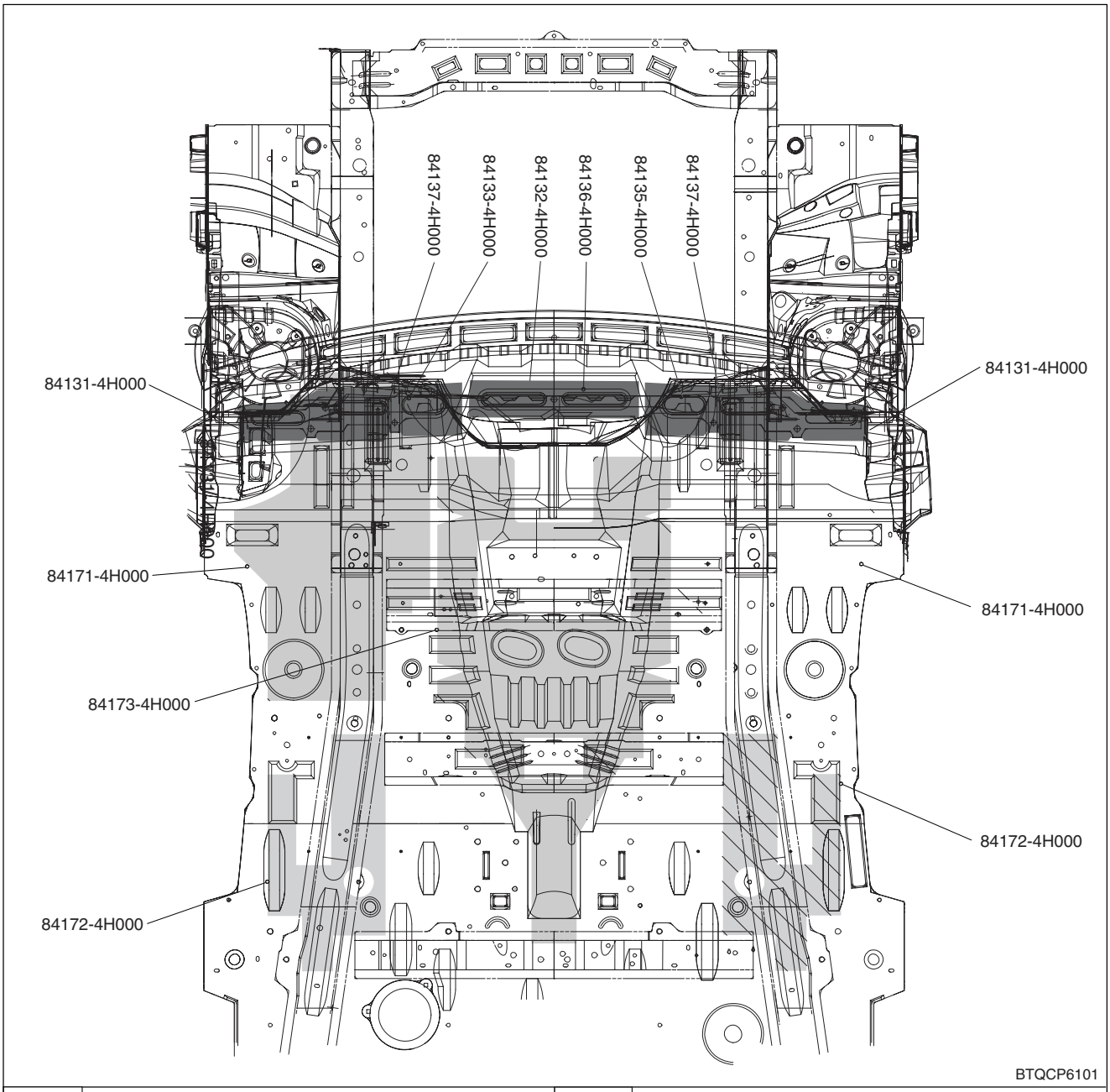
BMCCP6041

2. Align the antivibration pad layer in the position where it is to be installed, and then press it down with a roller or a block of wood so that it adheres well.

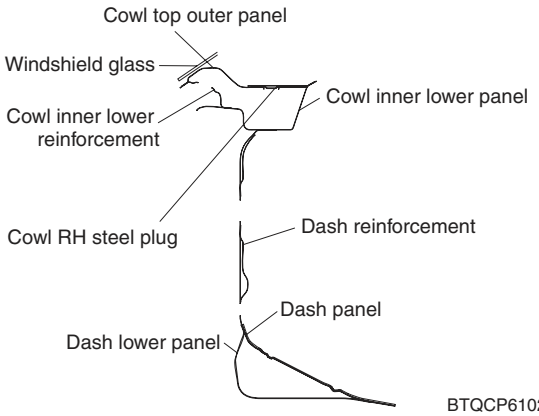
NOTE

An infrared lamp can also be used to heat both the antivibration pad layer and the body panels(be sure to wear gloves).

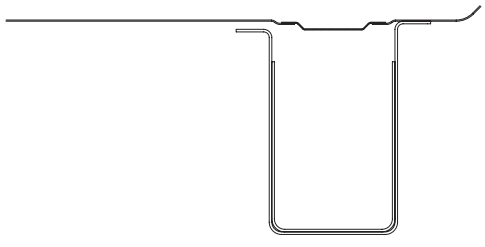
ANTIVIBRATION PADS-LOCATION & SECTION

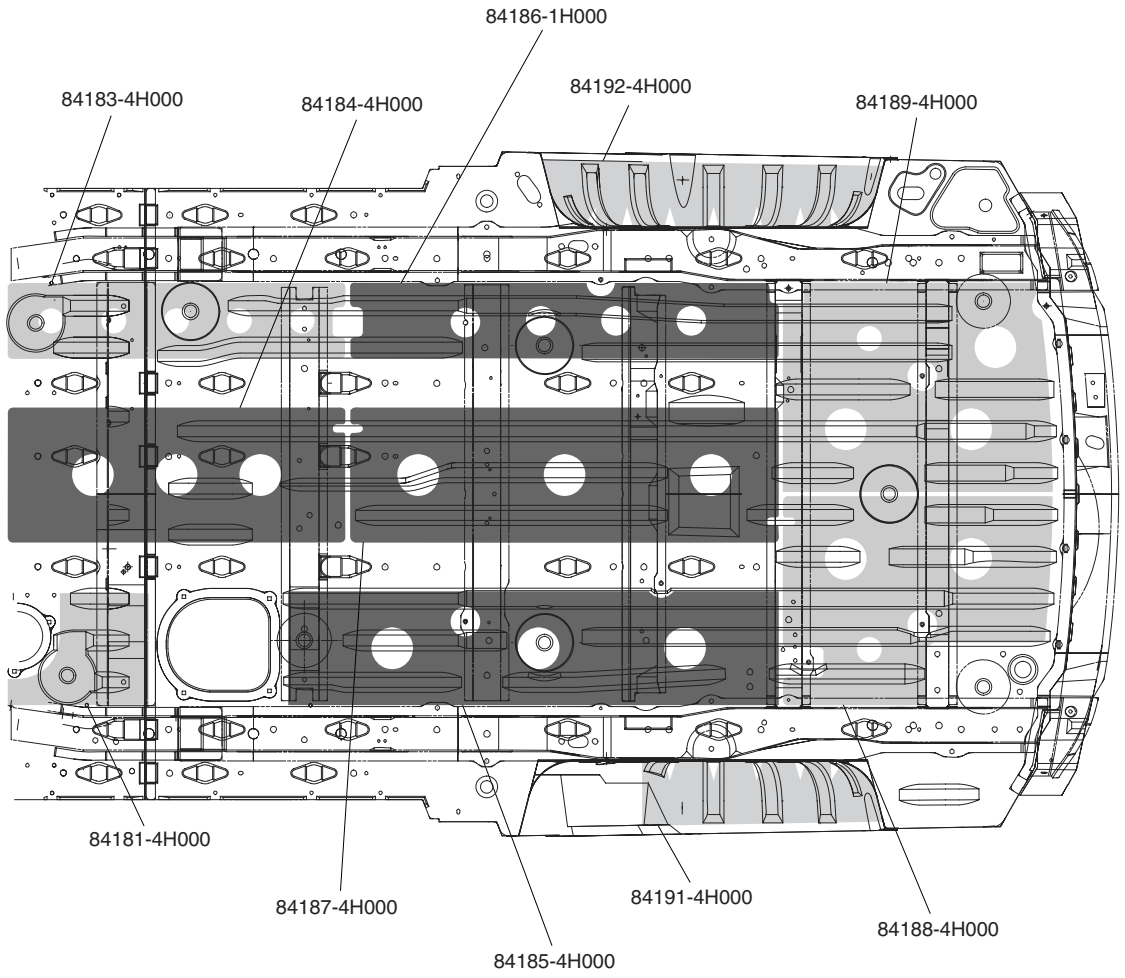


A - A



B - B




84186-1H000
84183-4H000
84184-4H000
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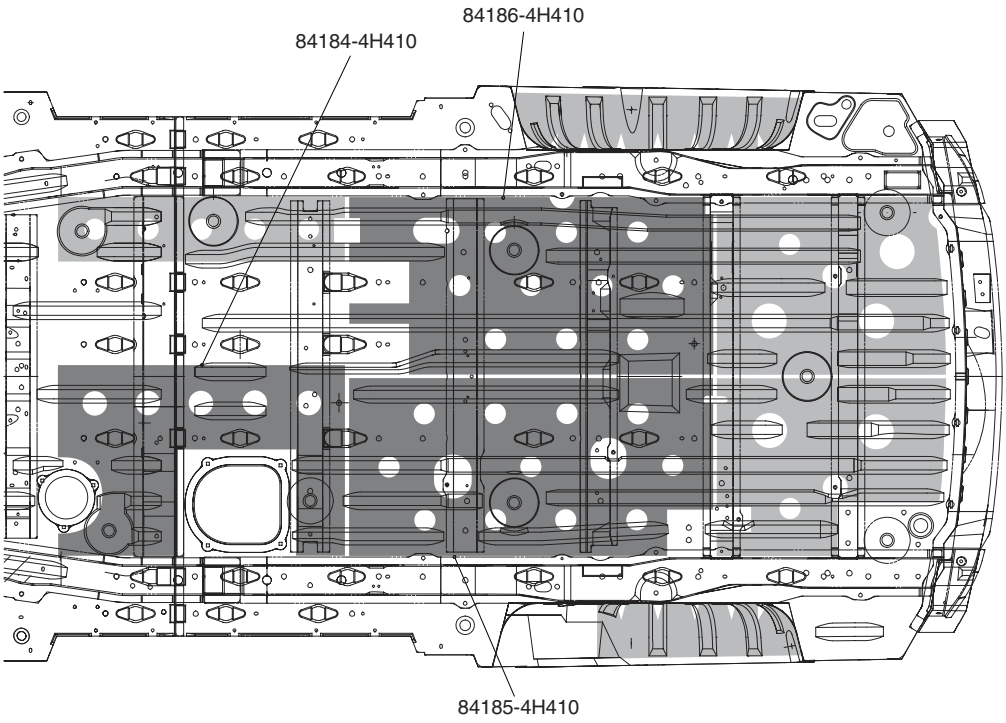
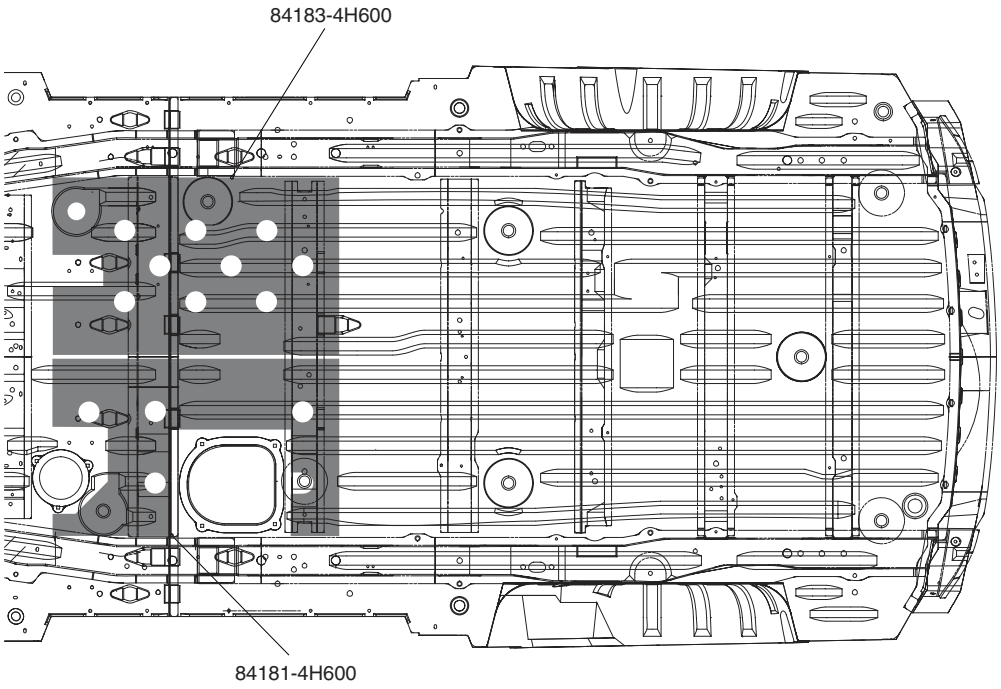
84188-4H000
84185-4H000

BTQCP6133



[Wagon]

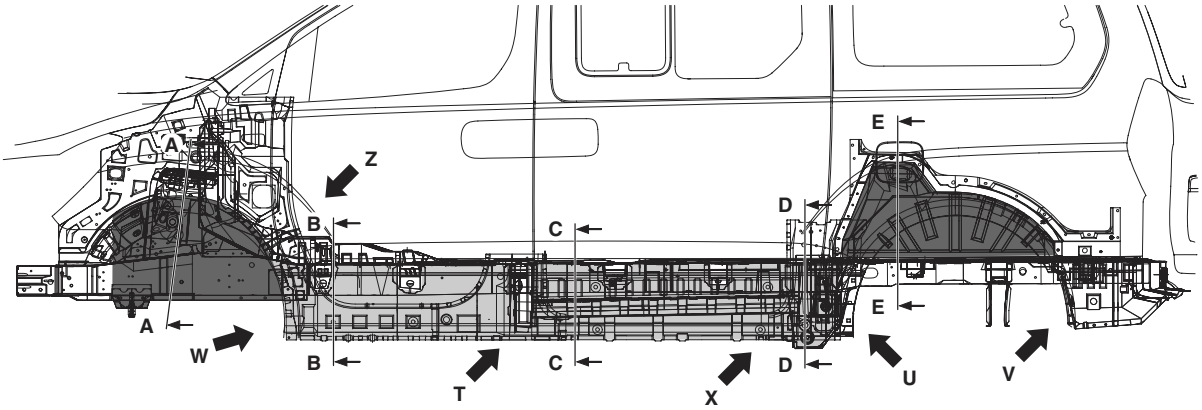


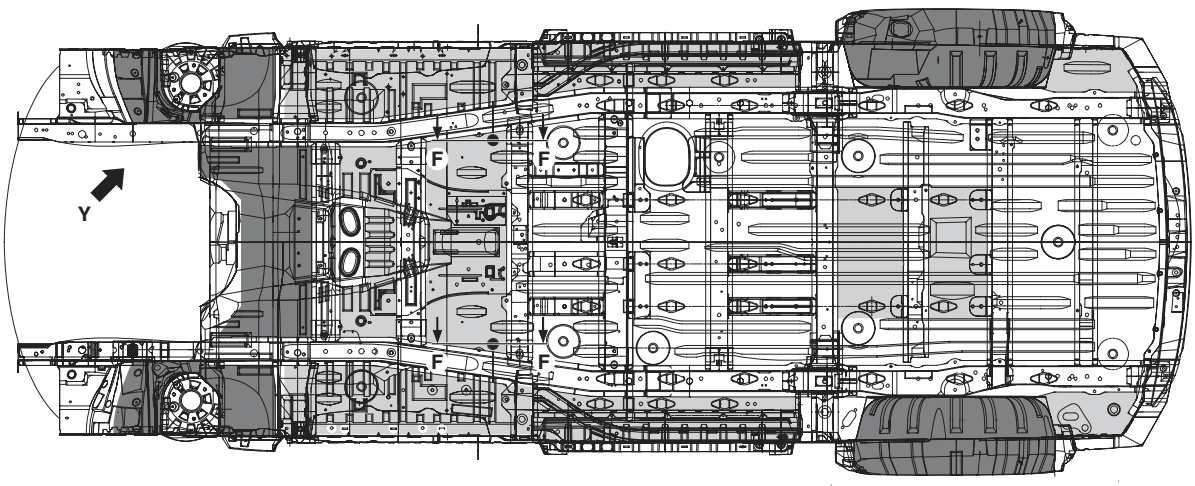
[VAN]

BTQCP6105

UNDER BODY COAT

In order to provide corrosion, stone chipping and vibration resistance, under body coat is applied to the under sides of the floor and wheel house.
Therefore, when such panel is replaced or repaired, apply under body coat to that part.

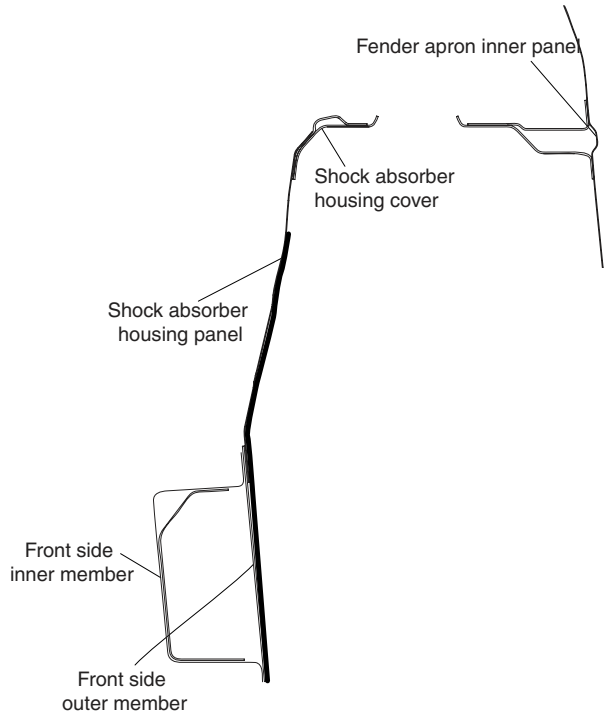




Under body coating (Thickness : 1.0 mm , :2.0 mm)

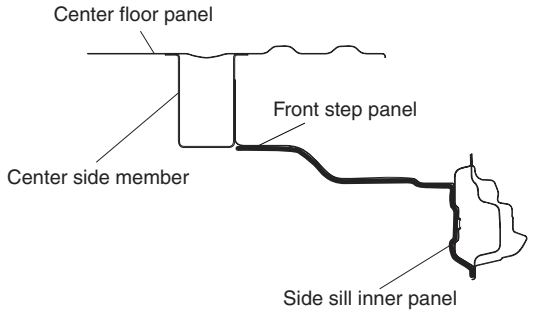
BTQCP6107

A - A



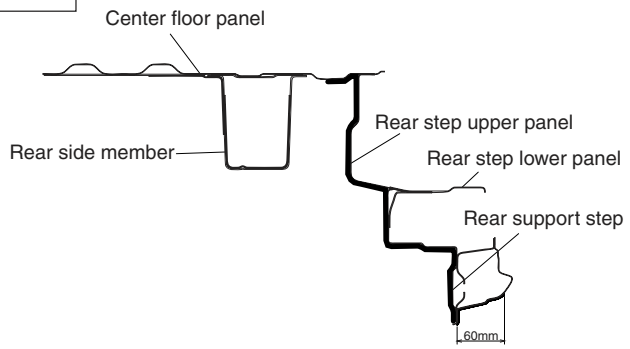
BTQCP6108

B - B



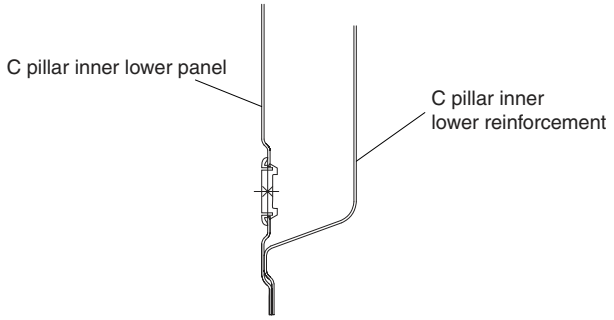
BTQCP6109

C - C



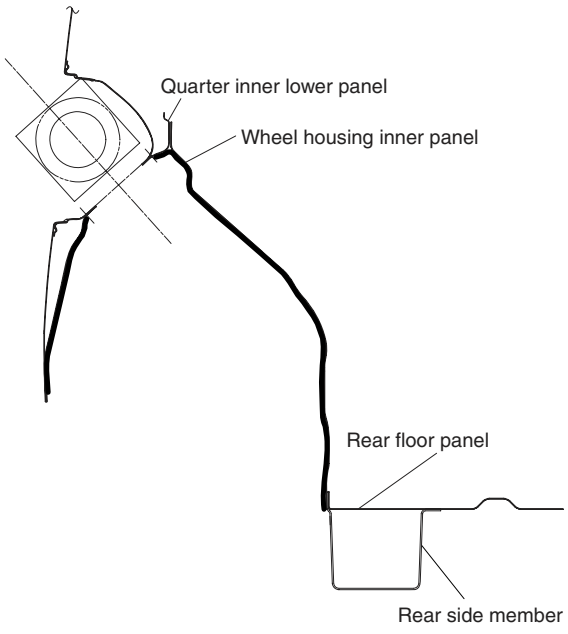
BTQCP6110

D - D



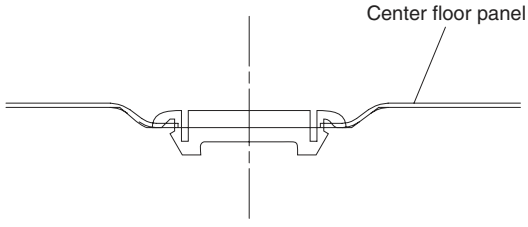
BTQCP6111

E - E



BTQCP6112

F - F



BTQCP6113

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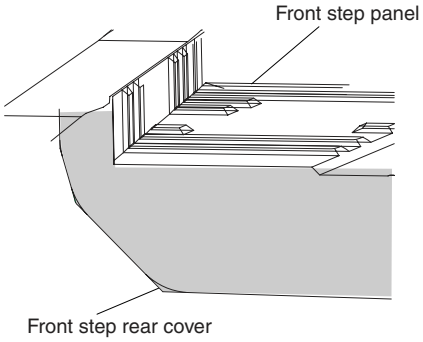

BTQCP6114

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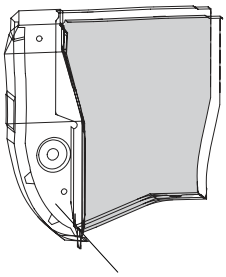

BTQCP6115

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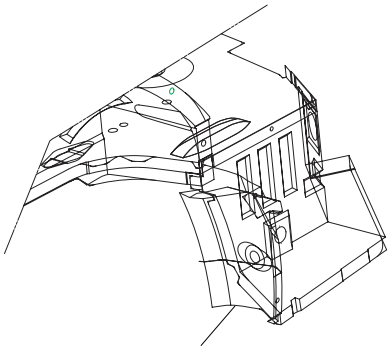

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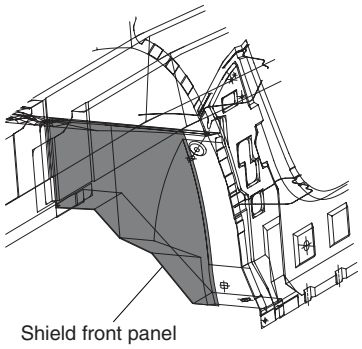

BTQCP6117

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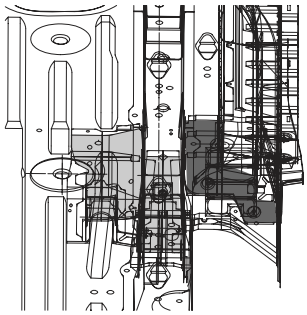

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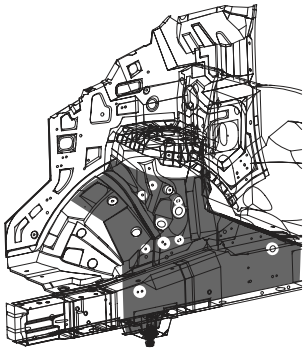
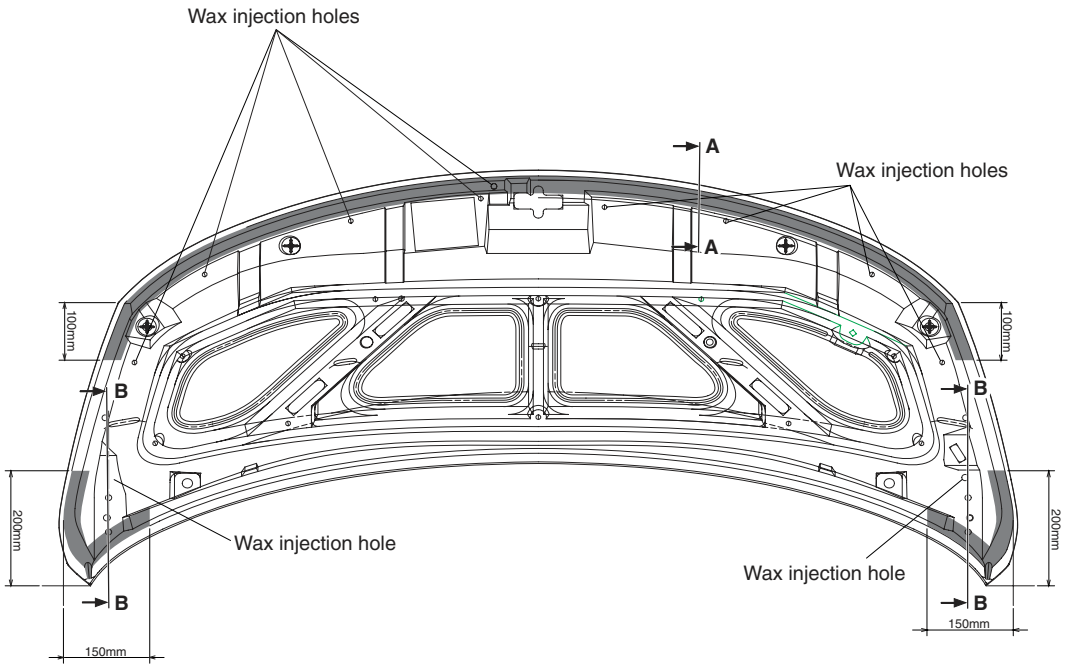


BTQCP6119

CAVITY WAX INJECTION

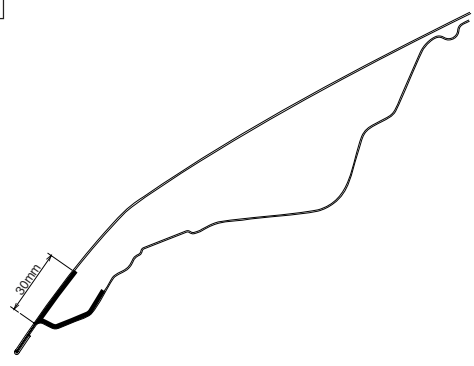
In order to provide greater corrosion resistance, cavity wax injection has been performed for the lower areas of the vehicle, such as the sidemember, the side sill and the inside of other panels which are a hollow construction.
When replacing these parts, be sure to apply cavity wax to the appropriate areas of the new parts.

HOOD



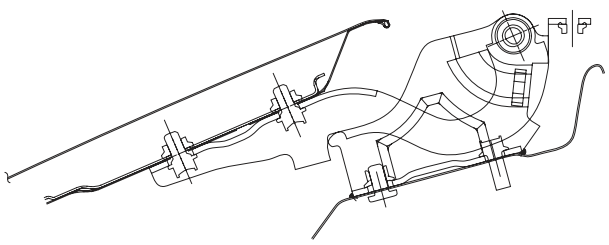
BTQCP6122

A - A



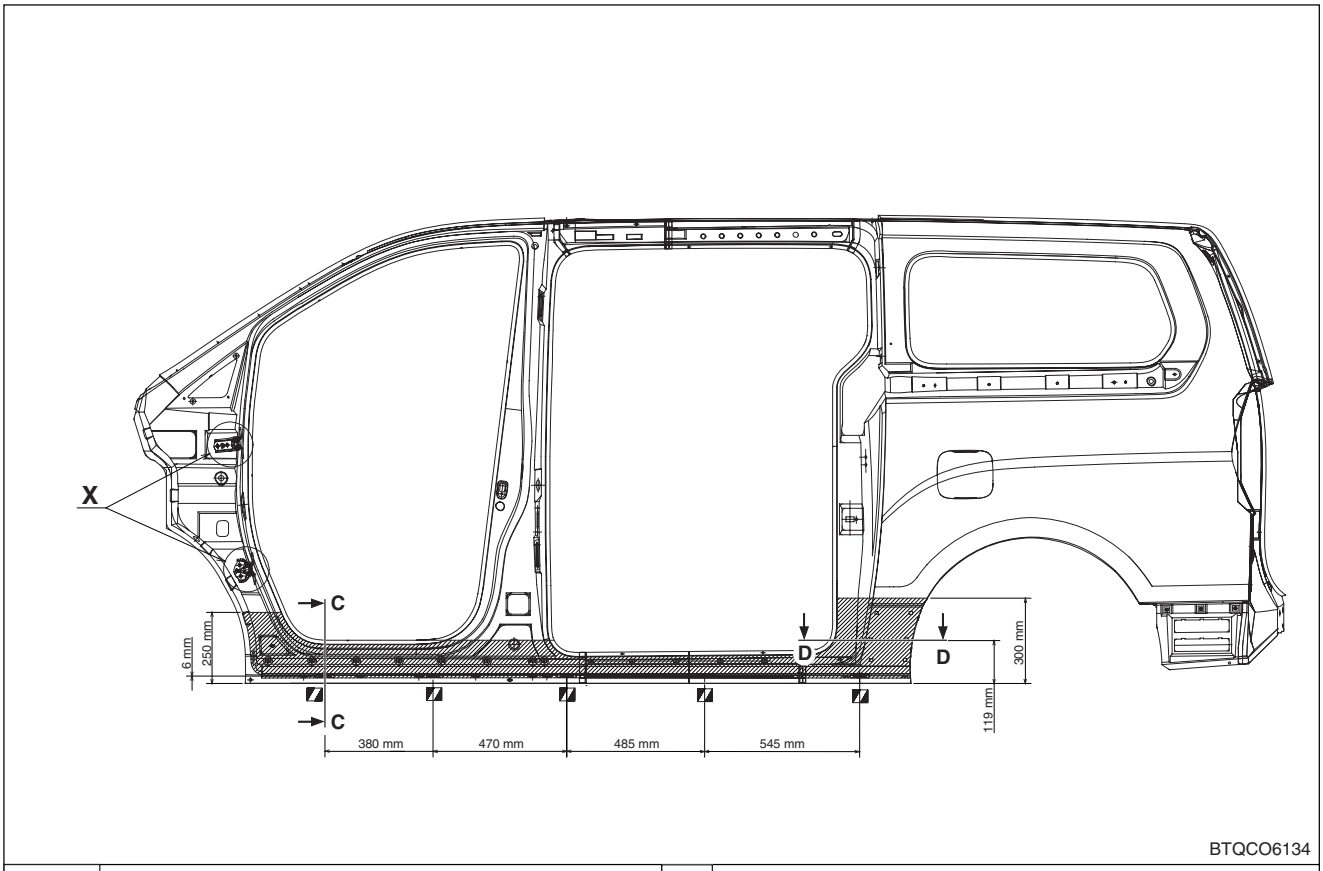
BTQCP6123

B - B



BTQCP6124

SIDE BODY



BTQCO6134

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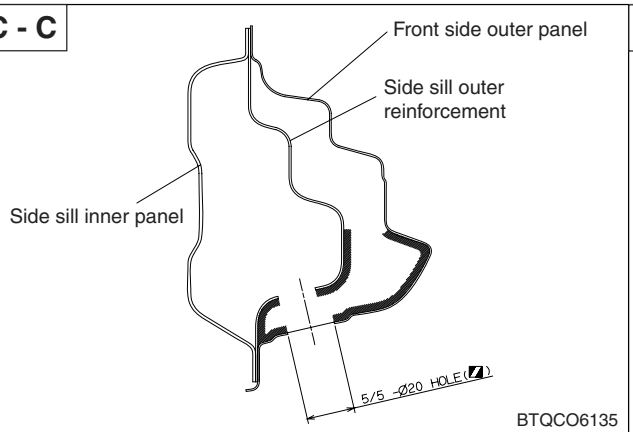
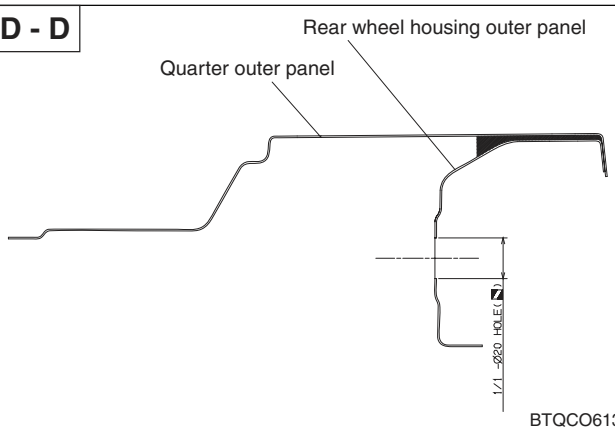


BTQCO6135

D - D



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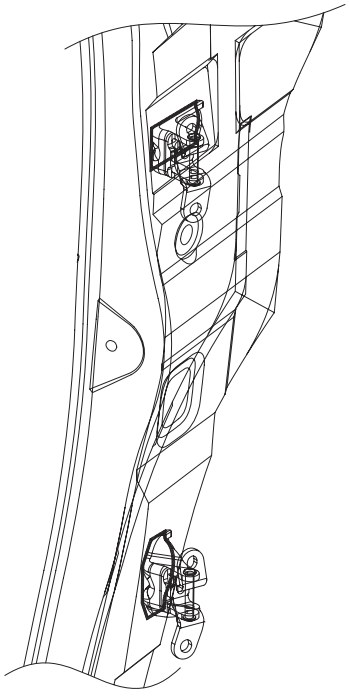
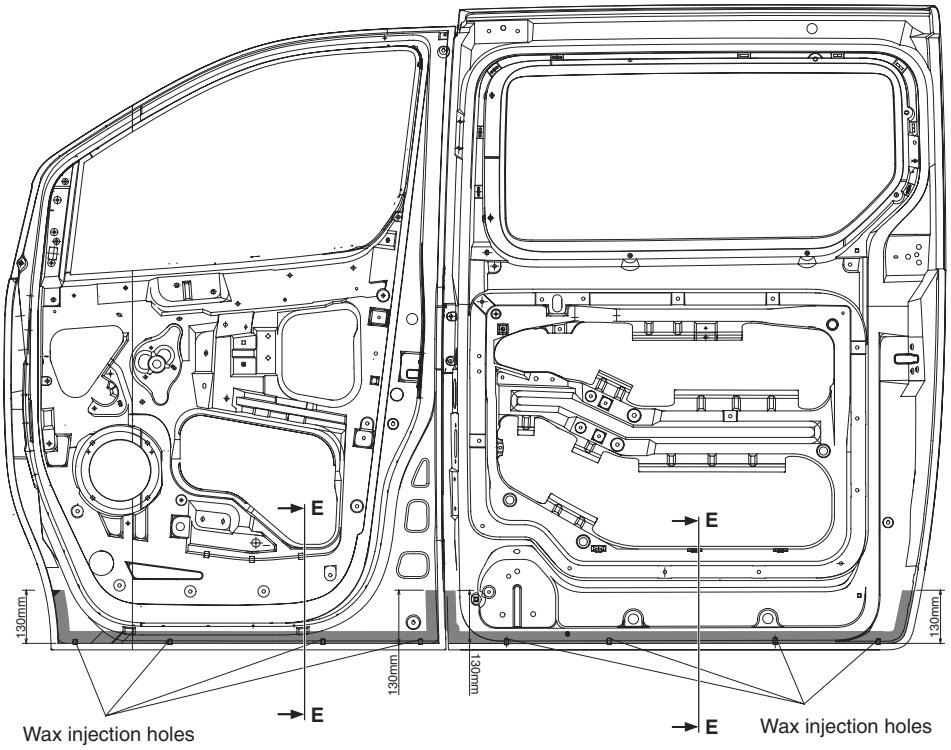


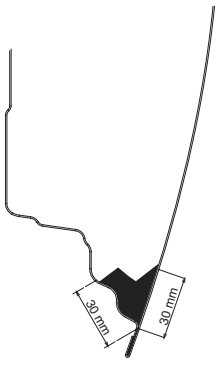
BTQCO6137

FRONT & REAR DOOR



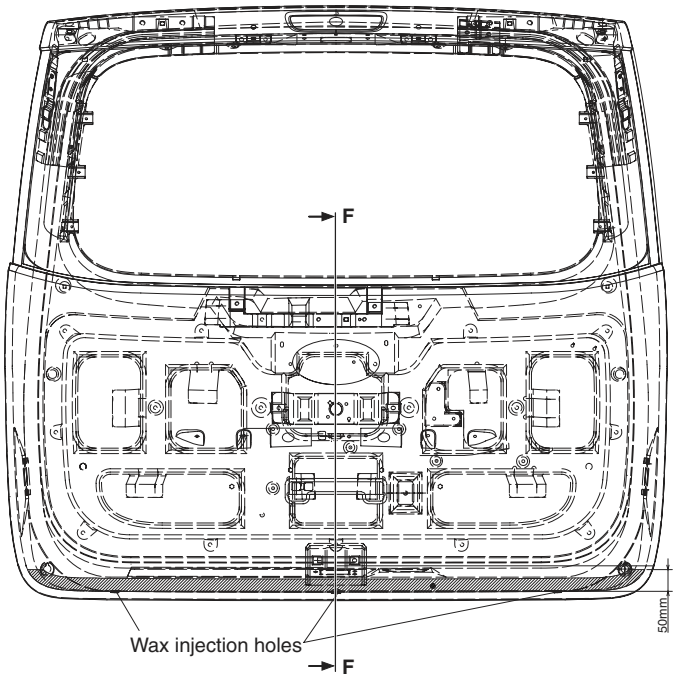
BTQCP6131

E - E



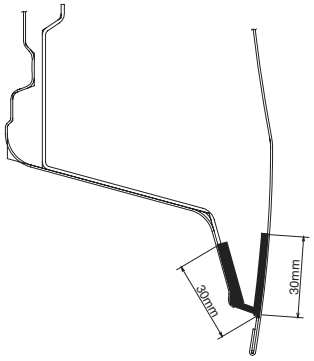
BTQCP6132

TAIL GATE



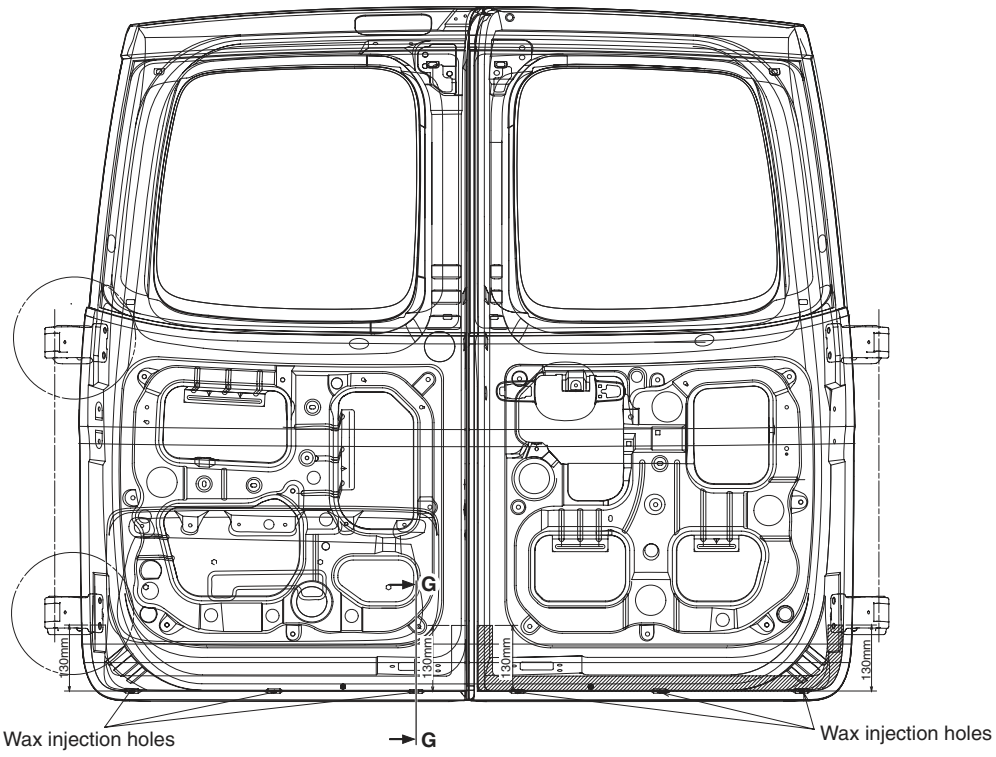
BTQCP6125

F - F



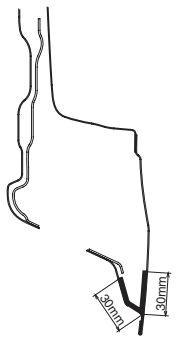
BTQCP6126

TWIN SWING DOOR



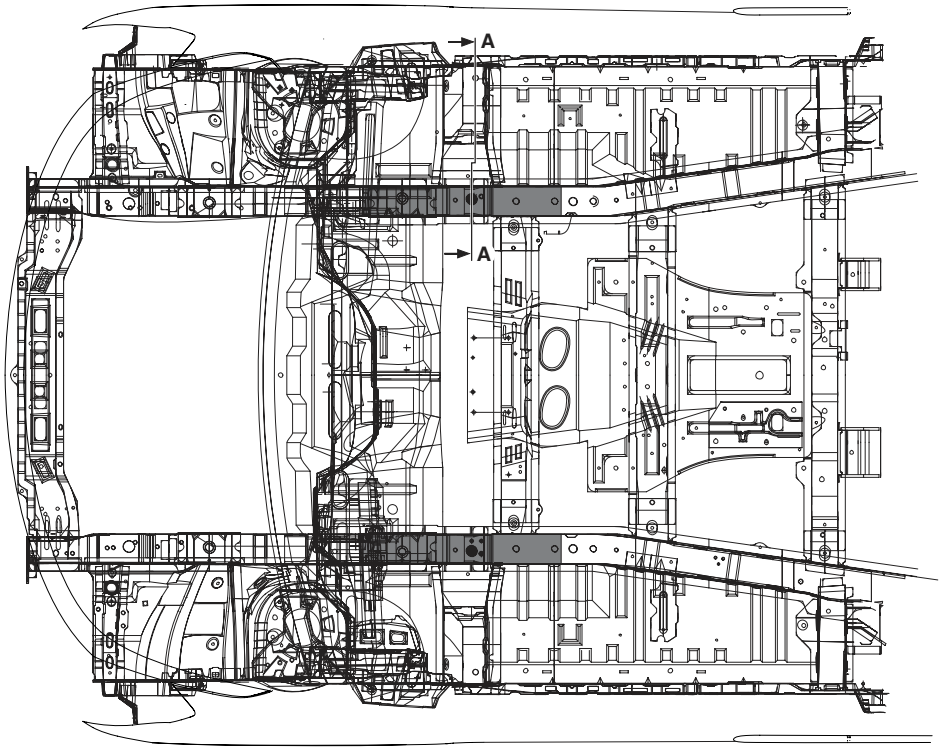
BTQCP6128

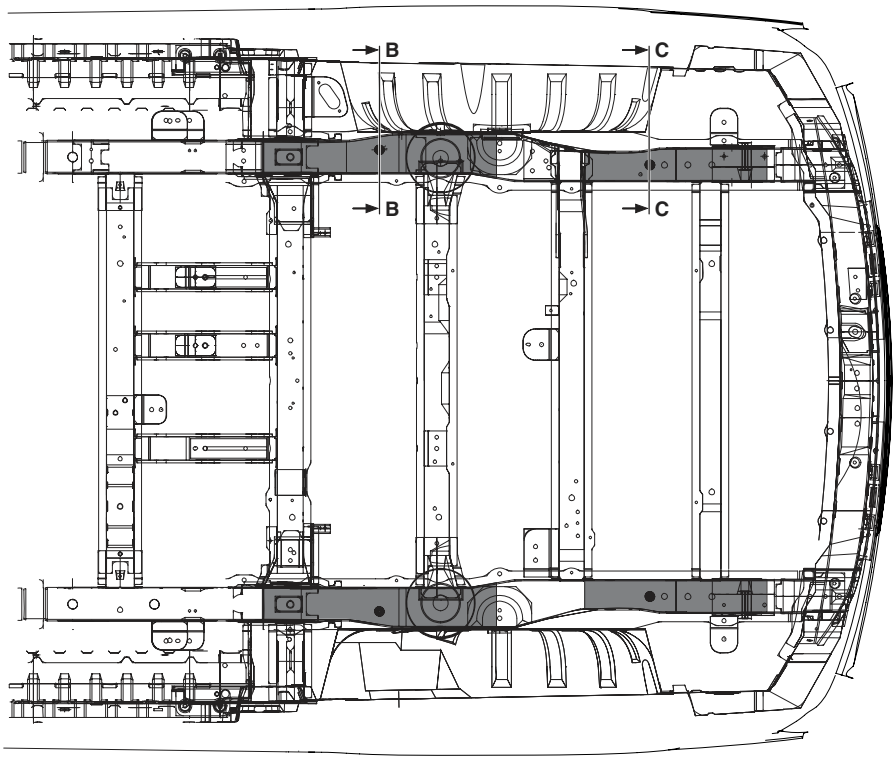
G - G



BTQCP6129

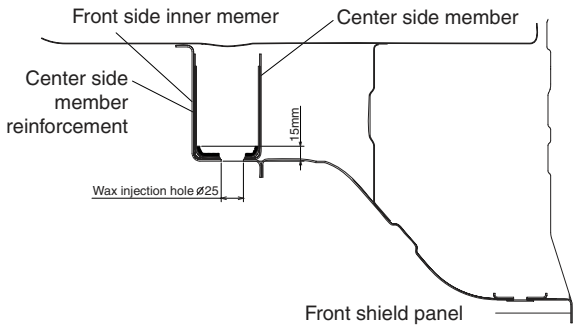
UNDER BODY





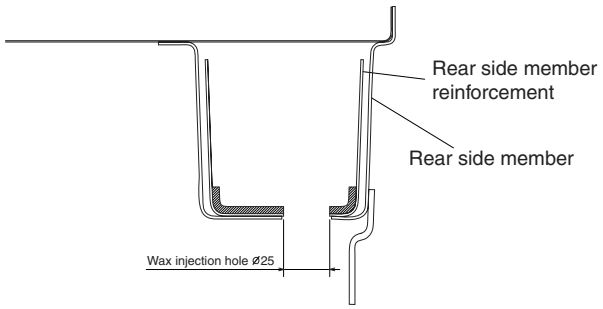
BTQCP6138

A - A



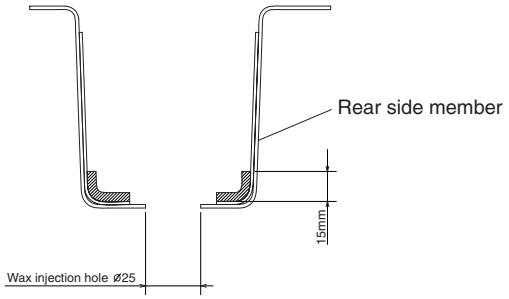
BTQCP6139

B - B



BTQCP6140

C - C



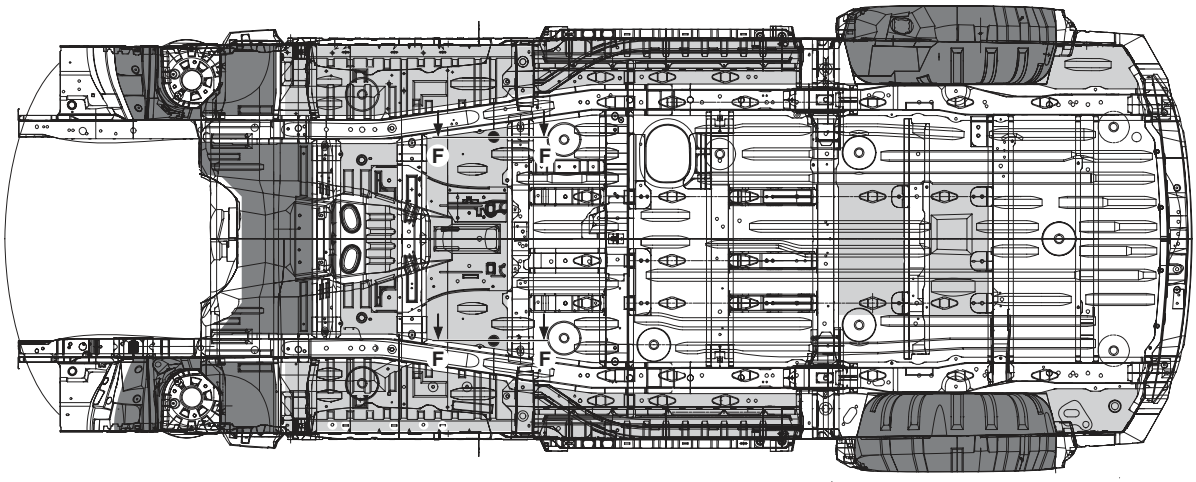
BTQCP6141

UNDER BODY ANTI-CORROSION AGENT

The undersides of the floor and wheel house are undercoated to provide greater corrosion resistance. Therefore, when such panel is replaced or repaired, apply under body anti-corrosion agent to that part.

NOTE

Do not apply the under body anti-corrosion agent to come in contact with tires, muffler and exhaust pipe.



Under body coating (Thickness : 1.0mm , :2.0 mm)

BTQCP6107A

Body Modification Tools

MODIFICATION TOOLS ..... BT - 2

CUT AND DISASSEMBLY TOOLS ..... BT - 3

ASSEMBLY TOOLS ..... BT - 4

MEASUREMENT TOOLS ..... BT - 4

WELDING MACHINE ..... BT - 5

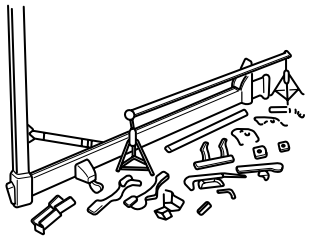
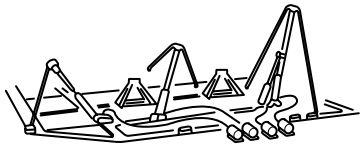
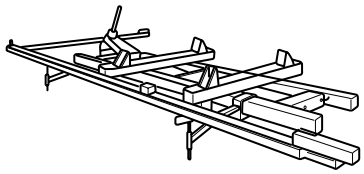
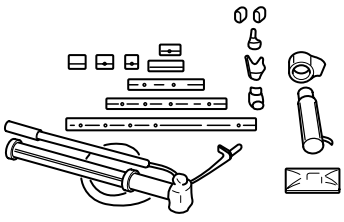
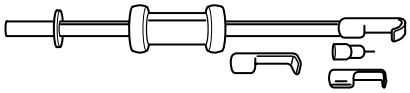
BUFFING AND GRINDING TOOLS ..... BT - 6

HANDHELD TOOLS ..... BT - 8

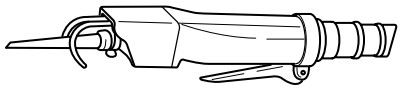
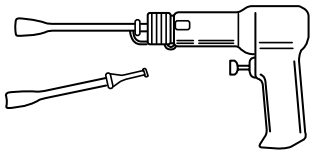
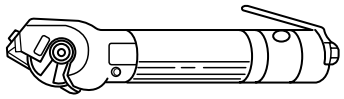
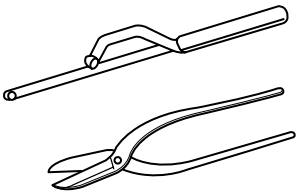
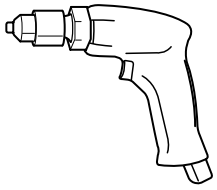
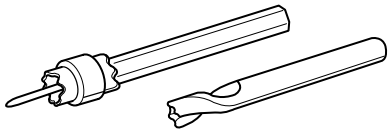
REPAIR TOOLS SET ..... BT - 9

BODY MODIFICATION TOOLS

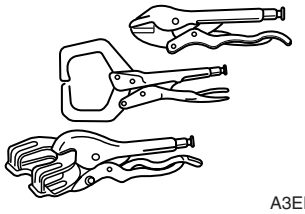
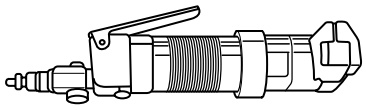
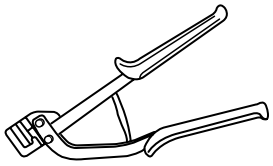
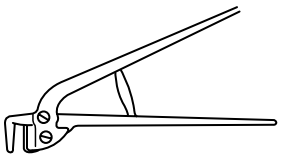
MODIFICATION TOOLS

Name	Used for	Figure
Frame straightener	Modify twisted or bent body	 A3EB3501
		 A3EB3502
		 A3EB3503
Port power	Push out, stretch, pull in damaged area	 A3EB3504
Body puller	Stretch damaged area	 A3EB3505

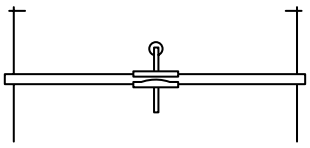
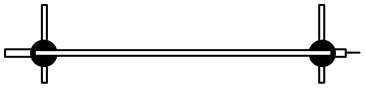
CUT AND DISASSEMBLY TOOLS

Name	Used for	Figure
Air saw	Cut a panel	 A3EB3506
Air chisel	Cut or bend a panel, cut and disassemble spot welded area	 A3EB3507
Rotary cutter	Cut a panel	 A3EB3508
Hand saw and metal scissors	Cut a panel	 A3EB3509
Air drill	Fix a spot cutter or drill to cut or disassembly spot welding area, to finish a hole	 A3EB3510
Spot cutter	Cut and disassemble spot welded area	 A3EB3511

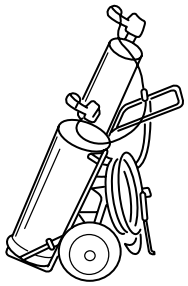
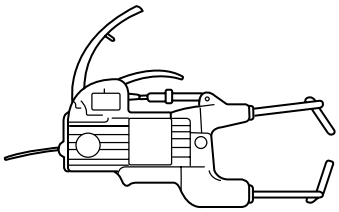
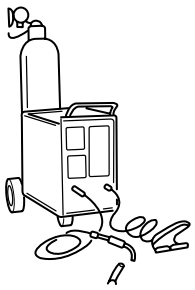
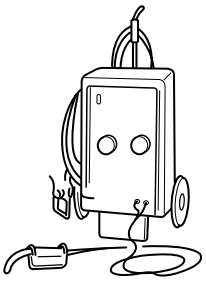
ASSEMBLY TOOLS

Name	Used for	Figure
Vice pliers	Fix a panel or area to weld	 A3EB3512
Air bench	Finish contact area of flange and finish a hole for plug welding	 A3EB3513
Quick bench	Finish a hole for plug welding	 A3EB3514
Flanging tool	Finish contact area of flange	 A3EB3515

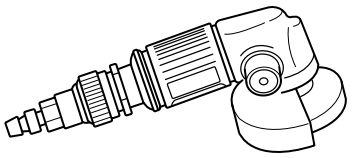
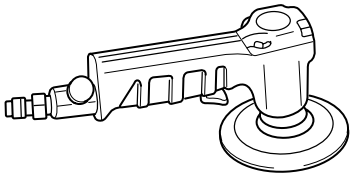
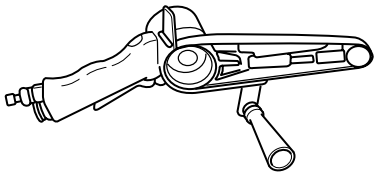
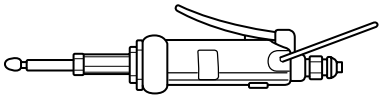
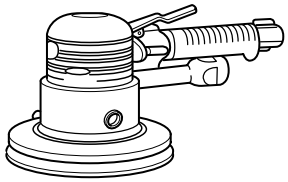
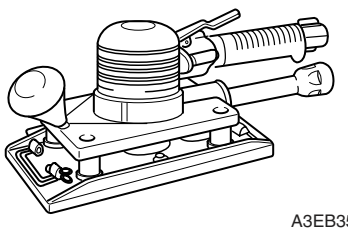
MEASUREMENT TOOLS

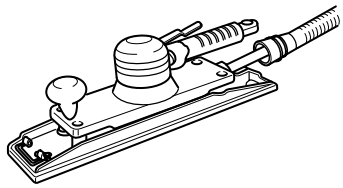
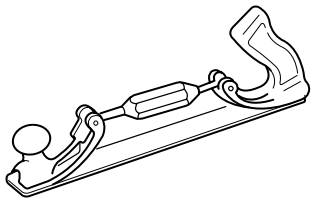
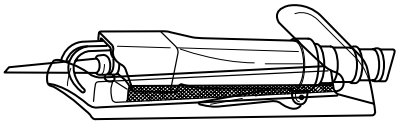
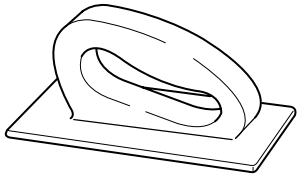
Name	Used for	Figure
Centering gauge	Measure distortion of body and frame	 A3EB3516
Tracking gauge	Measure body and frame	 A3EB3517

WELDING MACHINE

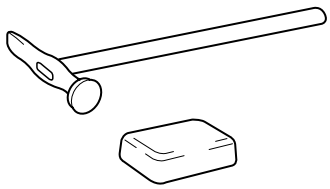
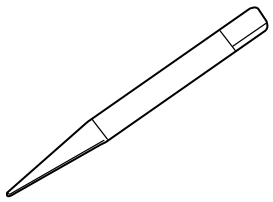
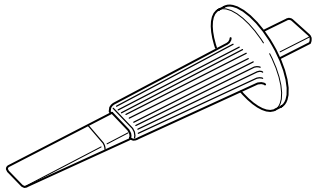
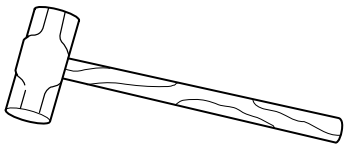
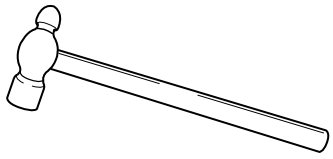
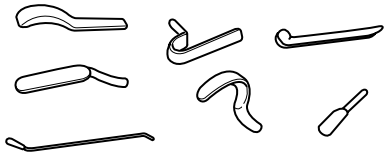
Name	Used for	Figure
Gas welding machine	Cut a panel	 A3EB3518
Spot welding machine	Weld a panel	 A3EB3519
Carbon arc welding machine	Weld a panel	 A3EB3520
Stud welding machine	Stretch a panel, weld a stud bolt to fix front window mold clip	 A3EB3521

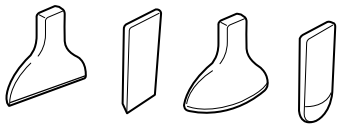
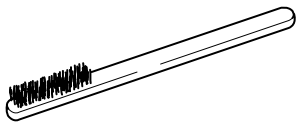
BUFFING AND GRINDING TOOLS

Name	Used for	Figure
Disk grinder	Buff	 A3EB3522
Disk sander	Buff	 A3EB3523
Belt sander	Buff paints	 A3EB3524
Small sized grinder	Buff paints or smooth finishing	 A3EB3525
Double action sander	Grind rough area of puttee assembled area	 A3EB3526
Orbital sander(short)	Grind rough area of puttee assembled area	 A3EB3527

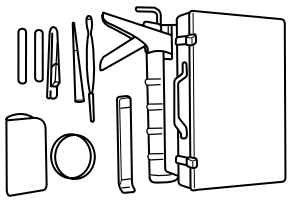
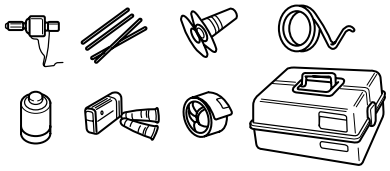
Name	Used for	Figure
Orbital sander(long)	Used for puttee grinding of wide area	 A3EB3528
Flexible file	Grind touch up area, uneven area of a panel	 A3EB3529
Surform tool	Buff rough area of puttee area	 A3EB3530
Hand file	Grind body puttee, pulley, finish puttee	 A3EB3531

HANDHELD TOOLS

Name	Used for	Figure
Body hammer and dolly	-	 A3EB3532
Center punch	Punch a hole in the middle of a spot welding area	 A3EB3533
Plane chisel	Cut and disassemble a panel	 A3EB3534
Weight hammer	Used when greater force is required	 A3EB3535
Bowl pin hammer	Used when smaller force is required	 A3EB3536
Spoon	Used for an area where not reached by hand	 A3EB3537

Name	Used for	Figure
Body chisel	Bend rough body line damaged or sheet metal etc.	 A3EB3538
Wire brush	Remove paints, rust, slag on welded area which are hard to recognize	 A3EB3539

REPAIR TOOLS SET

Name	Used for	Figure
Window tool set	Repair window collar	 A3EB3540
Repair tool set for plastics	Repair plastic parts	 A3EB3541

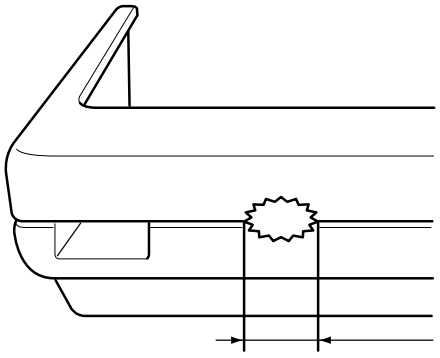
Plastic Parts

POLYPROPYLENE(PP) BUMPER REPAIRABILITY ..... PP - 2
BUMPER REPAIR PROCEDURE ..... PP - 3
REPAIR METHOD FOR PP BUMPER ..... PP - 4

POLYPROPYLENE(PP) BUMPER REPAIRABILITY

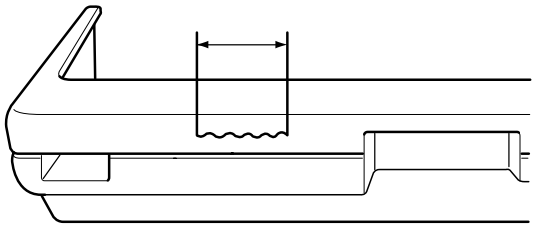
The three types of damaged bumpers shown below can be repaired. Because of cost and quality considerations, bumpers with more damage may be repaired, but replacing the bumper is encouraged.

1. If a hole on a bumper is less than 2 in.(50 mm).



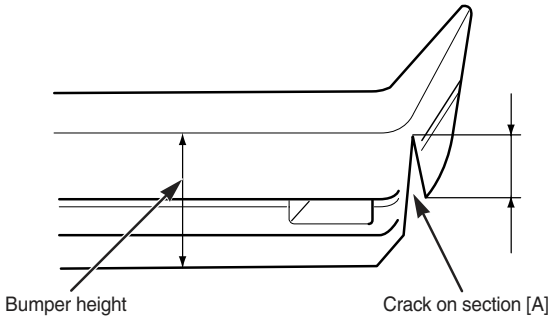
A3EB3601

2. If a crack on a bumper is less than 100 mm(4 in).



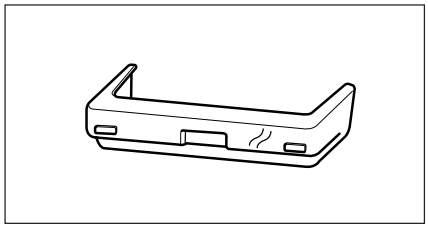
A3EB3602

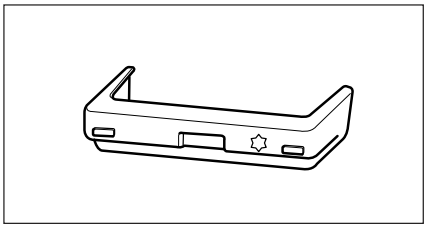
3. If a crack on bumper sectionis [A] is less than 100 mm (4 in) (less than half of the bumper height).

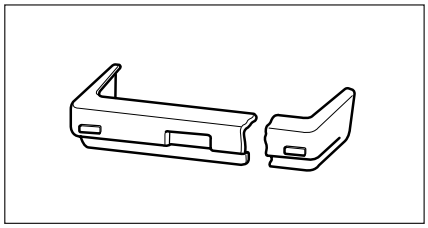


A3EB3603

BUMPER REPAIR PROCEDURE







Surface of bumper is not visible.

Surface of bumper is visible.

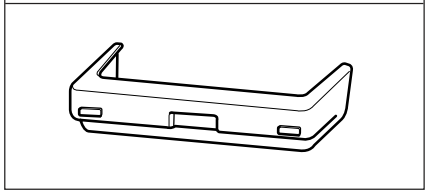
Remove paint.

Sand damaged area smooth.

Apply aluminum tape on the rear side of bumper.

Weld damaged area.

- Replace damaged bumper with a new bumper.
- Apply primer for polypropylene over bumper surface.



Sand damaged area with a rough sandpaper.

Clean and degrease damaged area(use TCE de-oil material).

Apply primer for polypropylene over damaged area.

Apply solvent over damaged area.

Spray primer surface over bumper and let dry.

Sand surface of bumper with sandpaper.

Clean and degrease with TCE de-oil material.

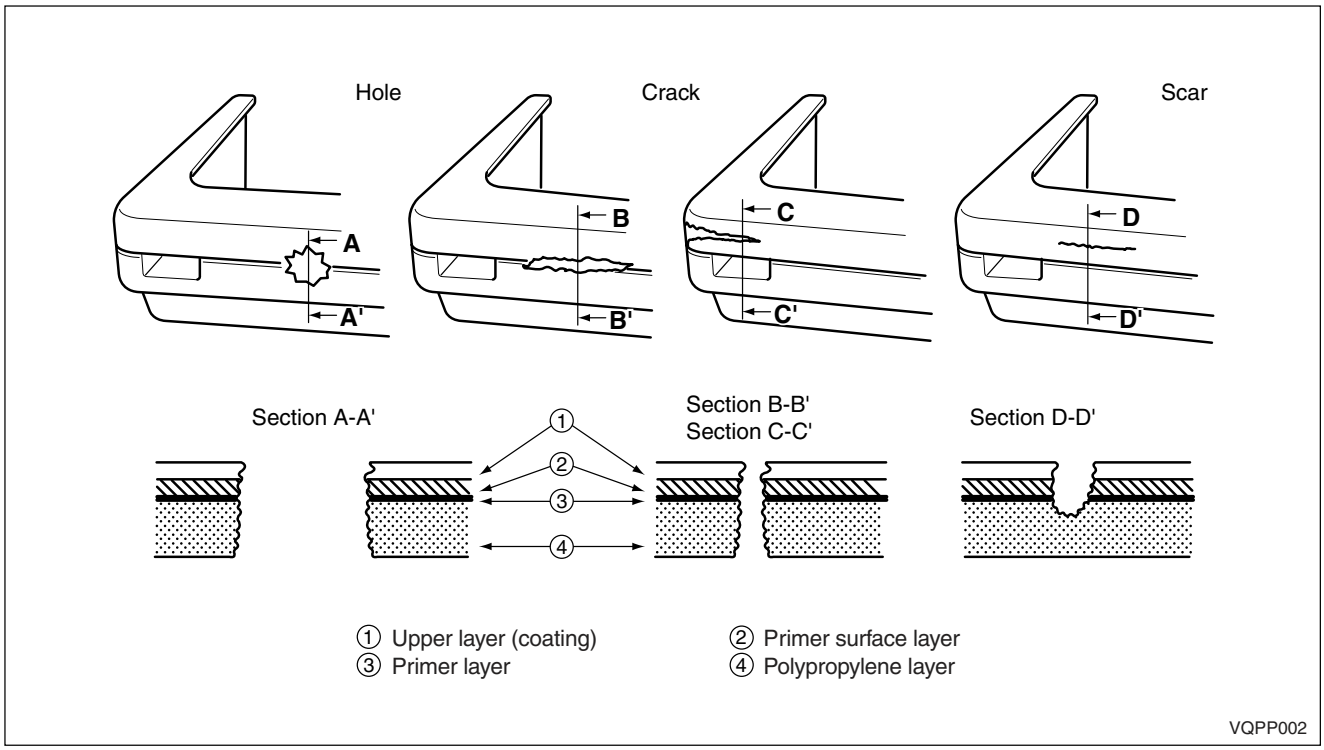
Wipe the surface of bumper with a tack cloth.

Paint bumper with a paint of the same color and let dry.

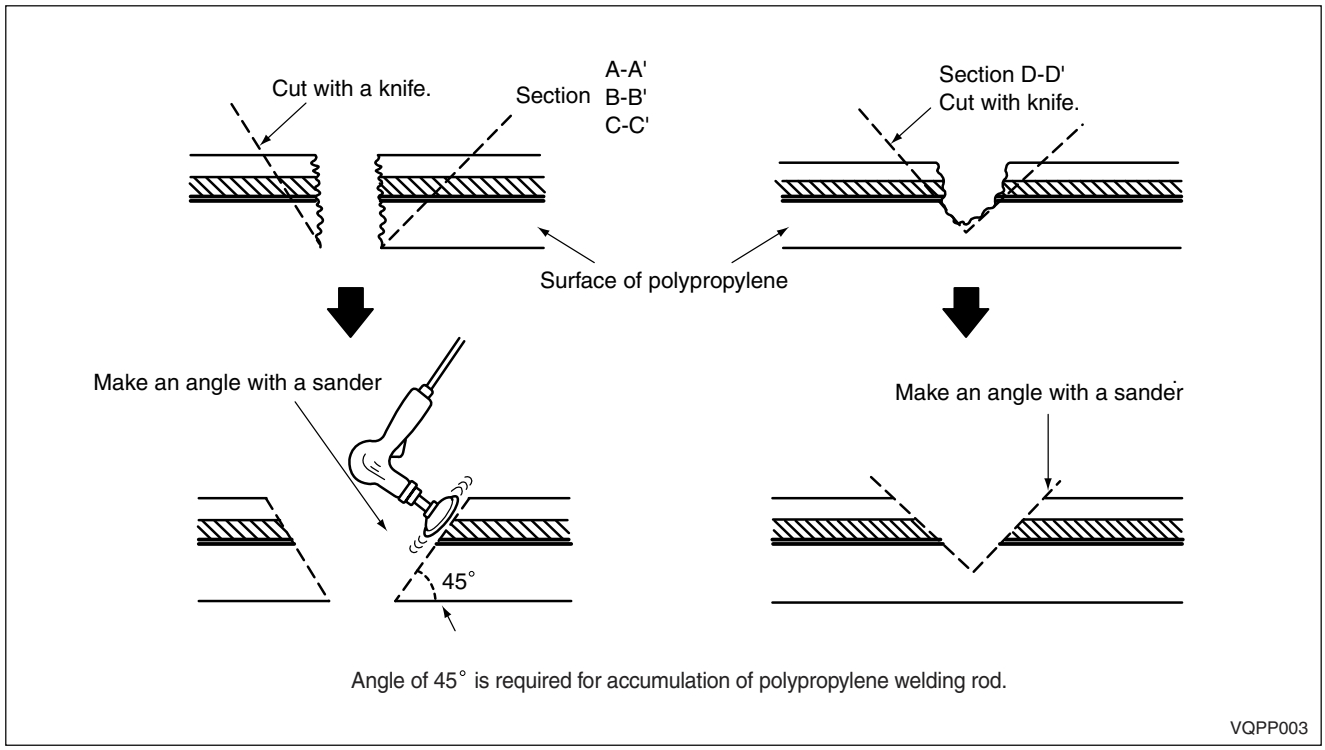
VQPP001

REPAIR METHOD FOR PP BUMPER

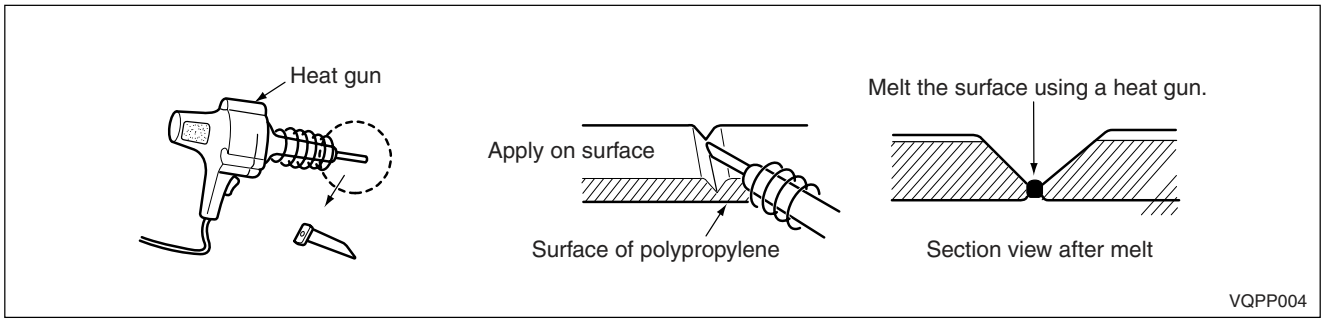
Damage to the bumper that reaches the surface of the polyporpylene cannot be fixed just by painting. Use the repair methods shown below to repair damage that reaches the surface of the polypropylene.



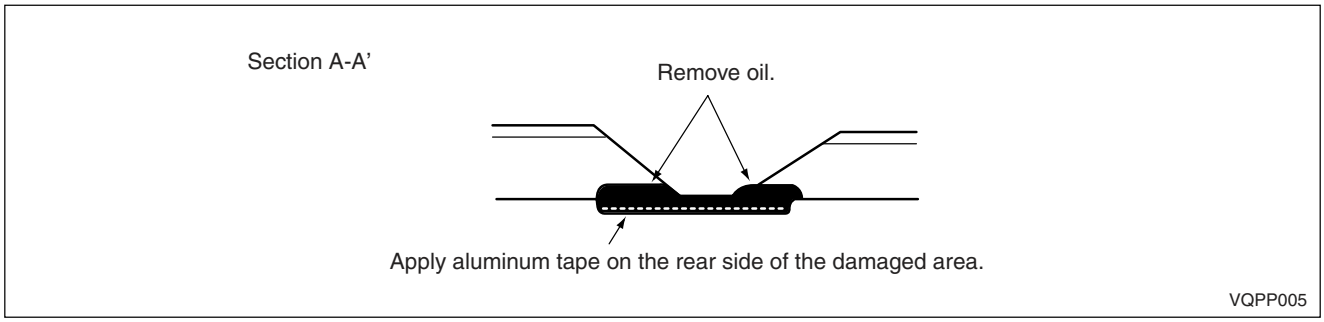
1. Rough cut the damaged area 45° using a knife and then sand the angle smooth.



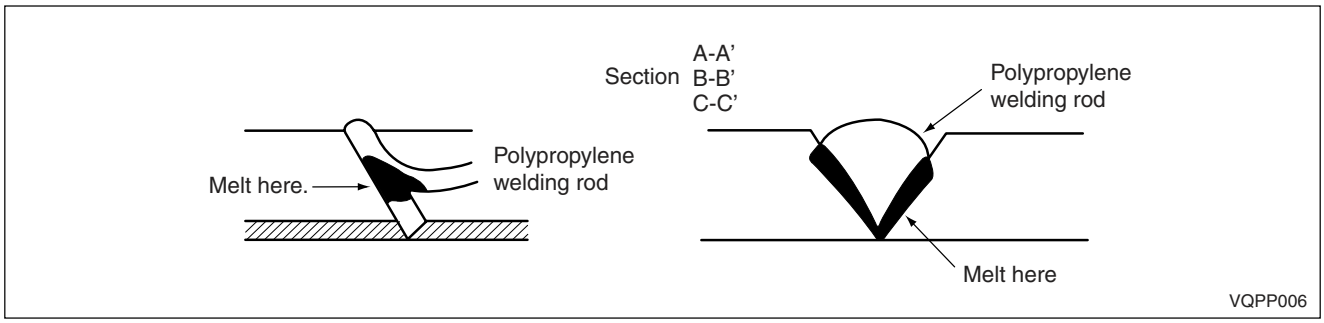
2. Welding damaged area
   a) To repair cracked area, melt the area using a heat gun and attachment.



   b) To repair a hole, remove oil from the damaged area and apply aluminum tape to the rear side of the damaged area.

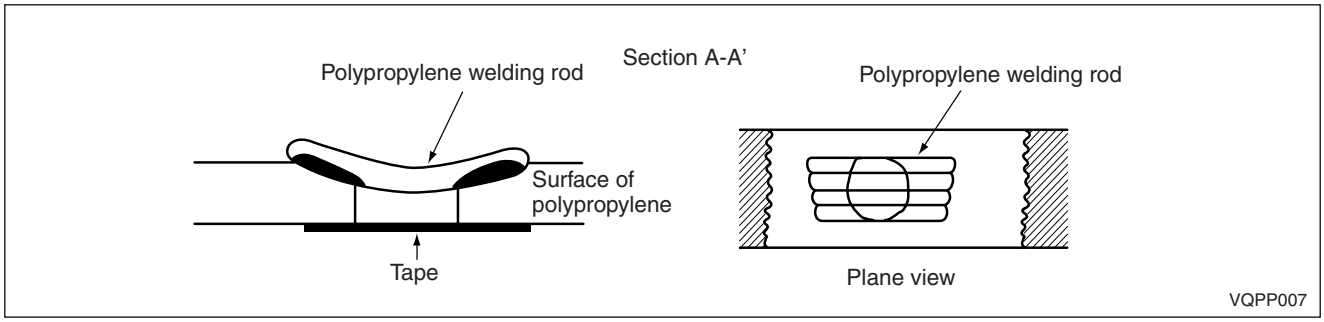


3. Melt polypropylene welding rod using a heat gun and fill in the cracked area.

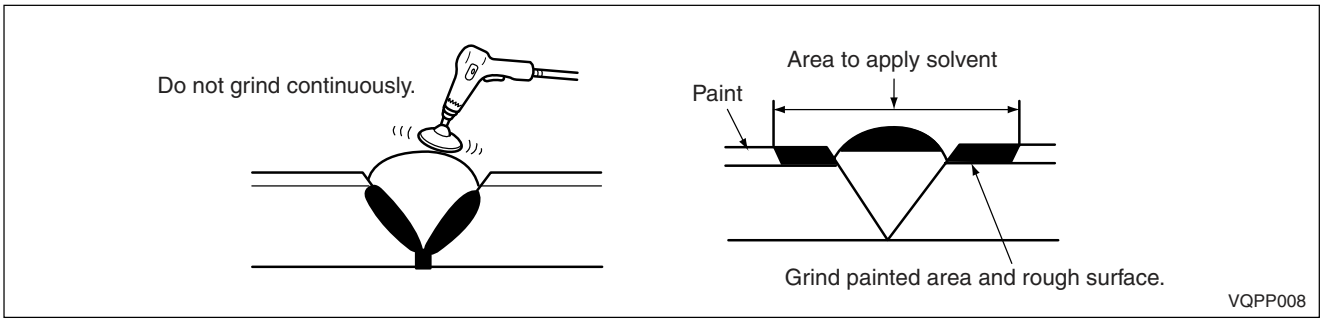


NOTE

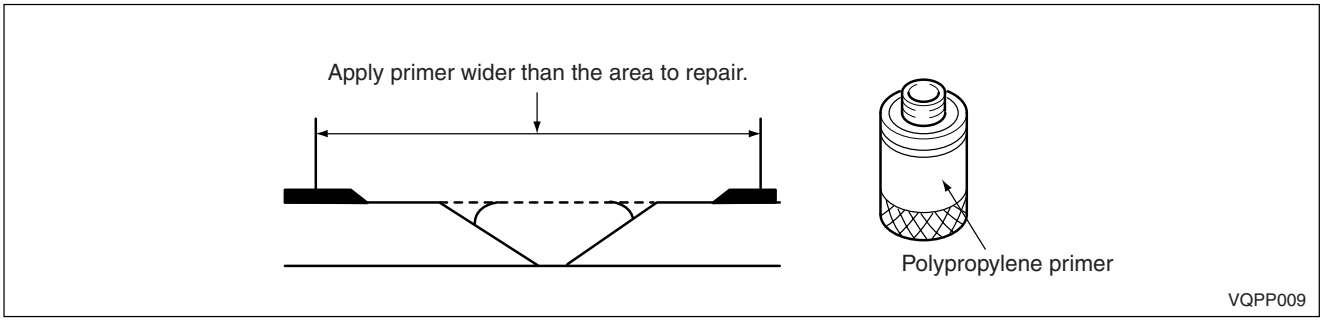
- *Heat and melt the area indicated.*
- *Melt the welding rod carefully so that it does not over-melt. If the welding rod over-melts like jelly, the welding strength will deteriorate.*
- *Use the heat gun 10~20 mm(0.4~0.8 in) away from the repair area to be welded. Welding rod should not move until the welded area is cooled.*



4. Grind polypropylene surface carefully. It melts easily due to the heat generated by friction. If melted, remove that area. Also, grind the area where solvent is to be applied.



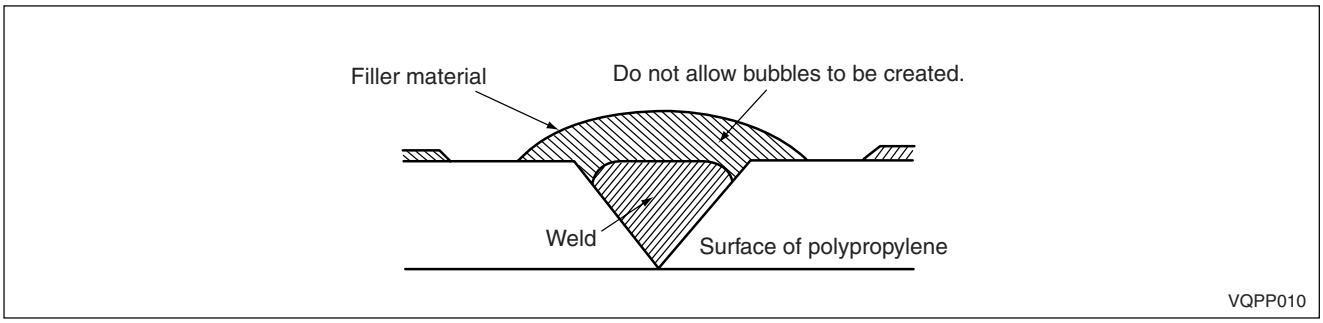
5. Apply polypropylene primer evenly with a brush over an area wider than the area to be repaired. Dry it at 20°C (68°F) for more than 10 minutes.



6. Mix main filler material and hardener at a ratio depending on paint specifications. Mix filler material and apply over the damaged area.

NOTE

- *Mix main filler material and hardener so that no bubbles are made.*
- *Work immediately after mixing filler material because the filler material hardens quickly(in about 5 minutes).*
- *Dry it at 20°C (68°F) for about 30 minutes before sanding.*

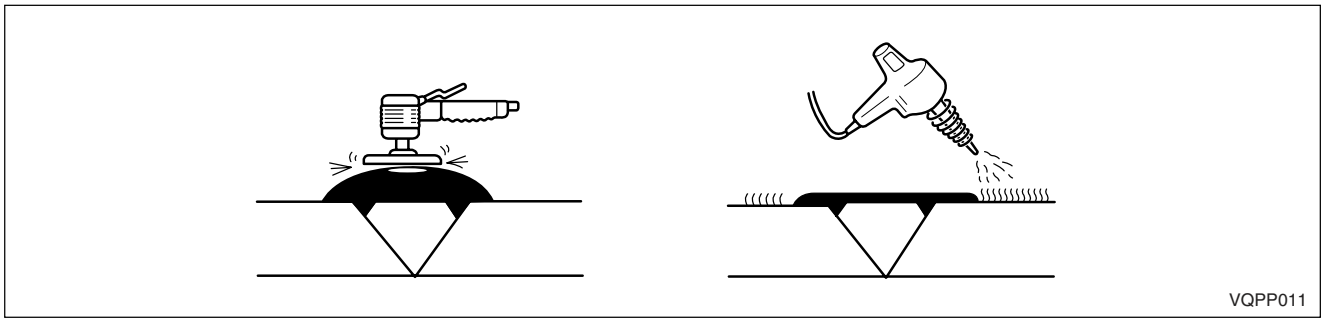


- *Filler material consists of two types of epoxy.*
  When the filler material hardens, you will have a desirable finish with flexibility like polypropylene.
- *Use only filler material designed for use on polypropylene bumpers.*

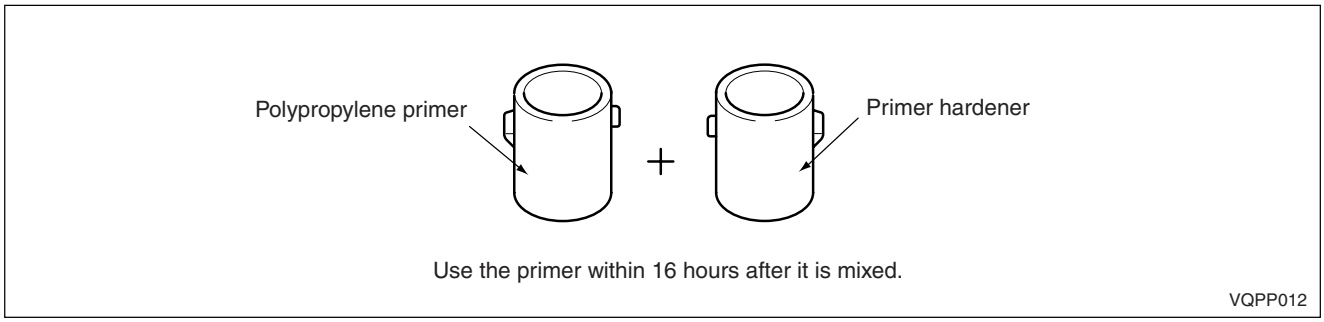
7. Sand the damaged area with sandpaper using #180~#240 grit paper.

NOTE
- *The surface will not be even if excessive force is applied during sanding.*
- *If there is fuzz in the damaged area, heat it a little bit with a heater gun and melt it.*

8. Degrease the painted surface.



9. Mix polypropylene primer and hardener at a ratio depending on paint specifications.
Spray polypropylene primer on the surface of the damaged area and the bumper.



10. Apply polypropylene primer.

NOTE
Use only water to clean after applying polypropylene primer. Solvent, if used, will melt the primer.

11. Lightly sand the sprayed area using a primer a sandpaper(#400~#600).
The polypropylene surface should not be exposed.(Either wet sanding or dry sanding is all right.)

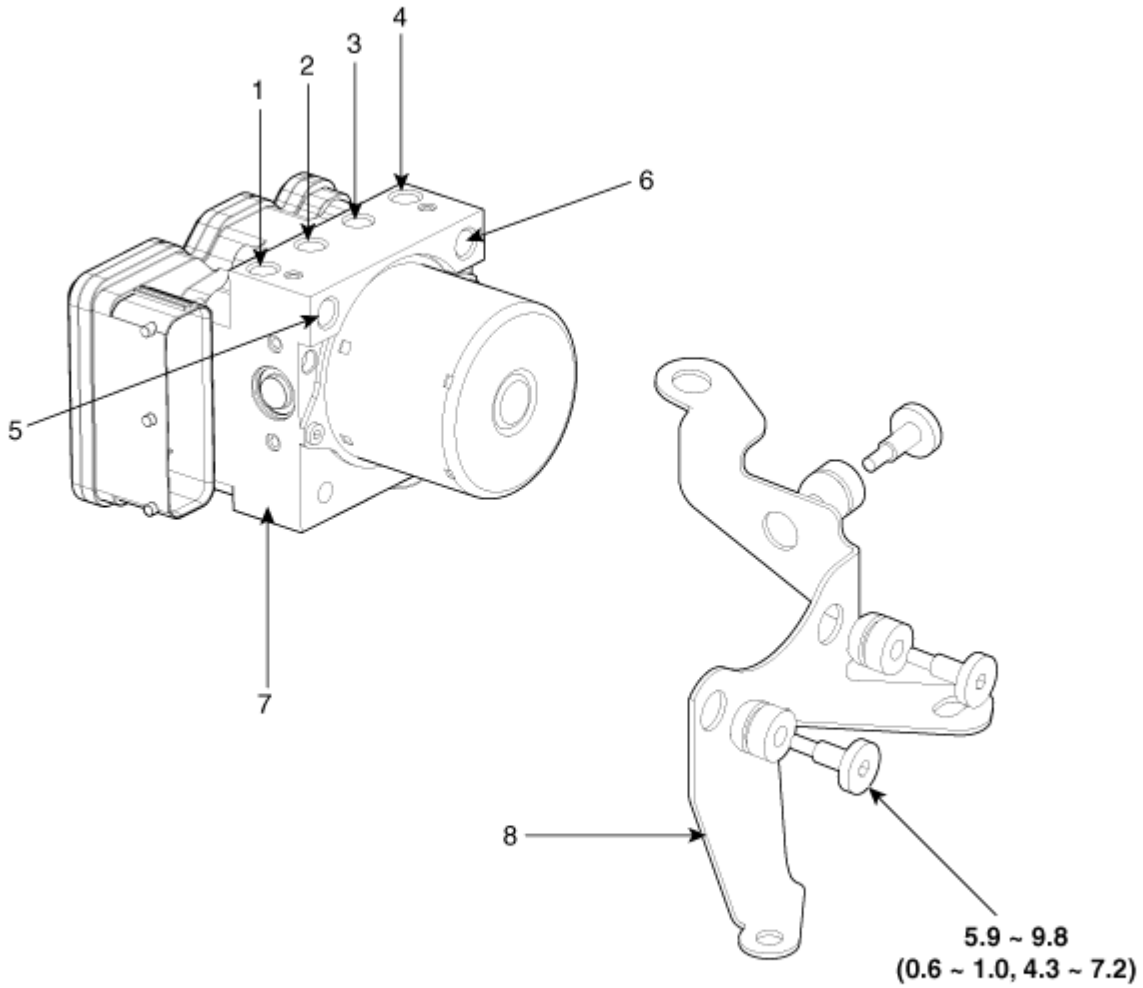
12. Use agent(TCE(Tri Chloro Ethane) degreasing material) to remove any grease or oil, and wipe the finished surface of the bumper quickly with a clean cloth.

NOTE
- *The painting method for the polypropylene bumper is the same used to paint the urethane bumper.*
- *Therefore, use urethane primer only on urethane bumpers and polypropylene primer on polypropylene bumpers.*

13. Air dry at 20°C(68°F) for about 8 hours, or dry in 60°C(140°F) for about 2 hours.
(Since drying time varies according to the type of paint used, follow paint manufacturers directions for drying times.)

NOTE
Air dry if possible. Forced drying may create air bubbles on the top layer.

Components

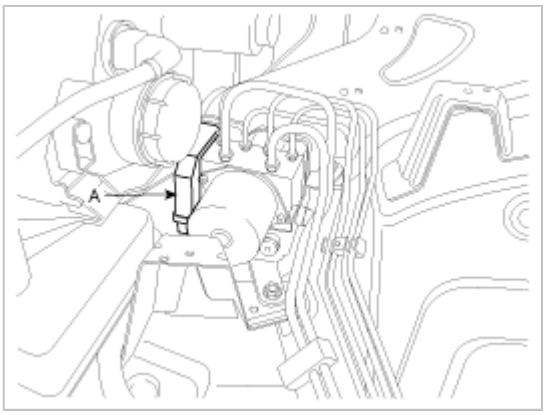


Torque : N.m (kgf.m, lb-ft)

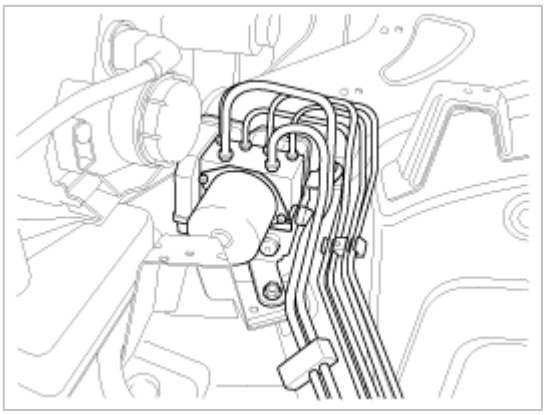
1. Front-left tube	5. MC2
2. Rear-right tube	6. MC1
3. Rear-left tube	7. ABS control module(HECU)
4. Front-right tube	8. Bracket

Removal

1. Turn the ignition switch OFF.
2. Pull up the lock (A) of the ABS control unit connector , then disconnect the connector.



3. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.



4. Loosen the 3 ABS HECU bracket bolts, then remove HECU and bracket.

1. Never attempt to disassemble the HECU.
2. The HECU must be transported and stored in.
3. Never shock to the HECU.

5. Remove the 3 bolts, then remove the bracket from HECU.

Installation

1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and nuts to the specified torque.

Tightening torque

HECU bracket bolts :
5.9 ~ 9.8 N.m (0.6 ~ 1.0kgf.m, 4.3 ~ 7.21lb-ft)
HECU bracket mounting bolt :
10.8 ~ 13.7N.m (1.1 ~ 1.4kgf.m, 8.0 ~ 10.1lb-ft)

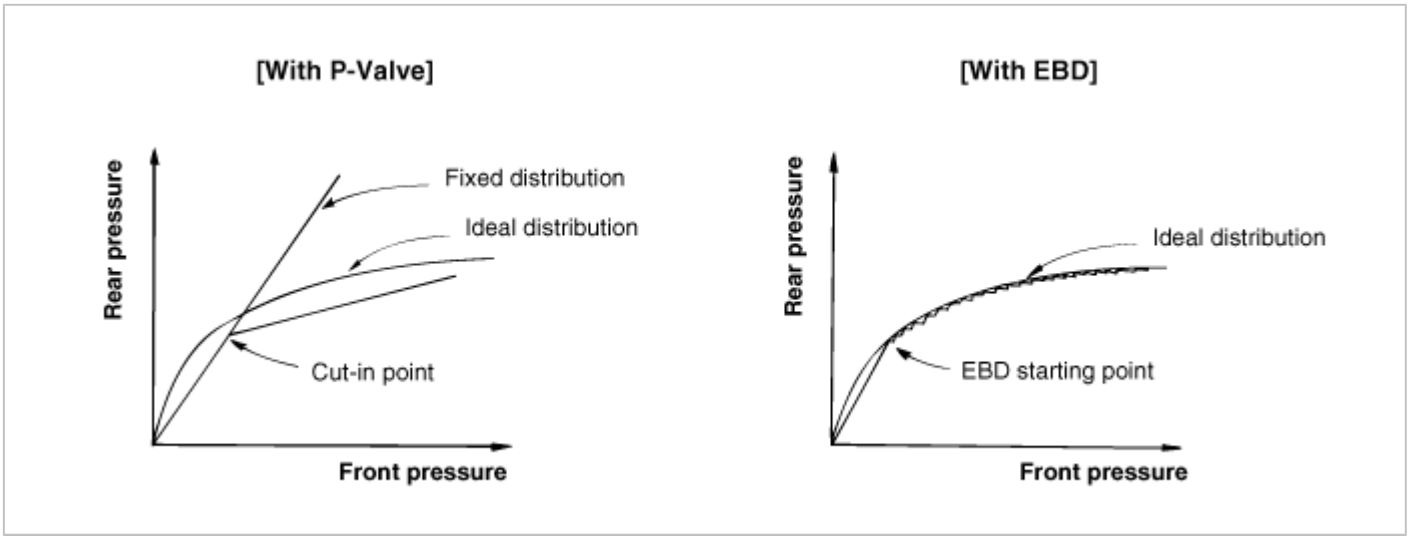
EBD (Electronic Brake-force Distribution) Operation

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.
It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.
The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.
The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution tothe rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.
If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

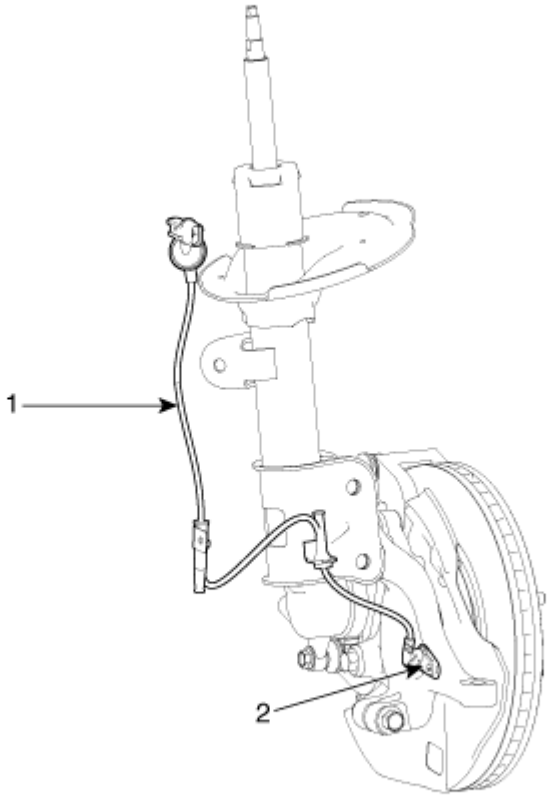
Advantages

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

Comparison between Proportioning valve and EBD



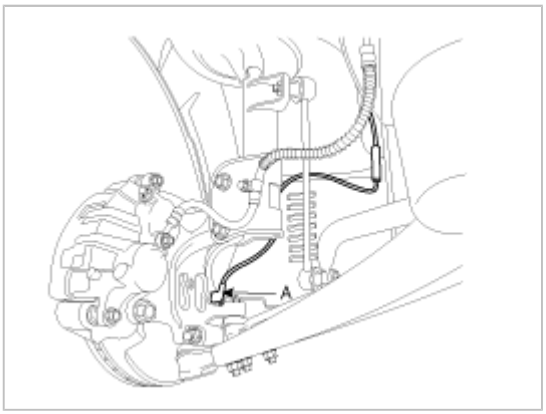
Components



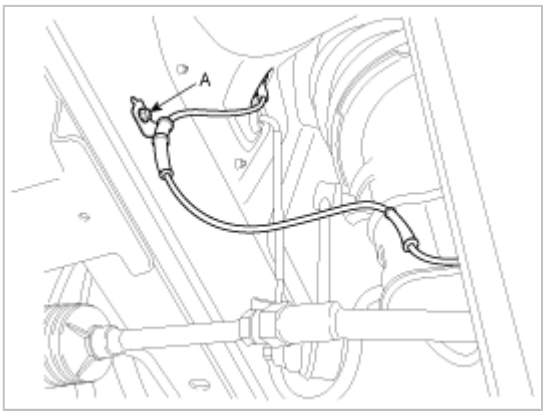
1. Front wheel speed sensor cable 2. Front wheel speed sensor	

Removal

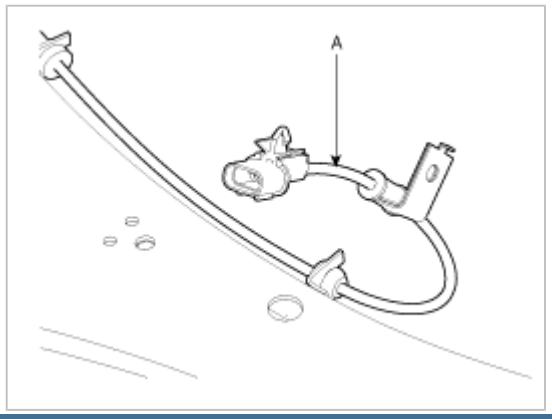
1. Remove the front wheel speed sensor mounting bolt (A).



2. Remove the front wheel speed sensor bracket (A).



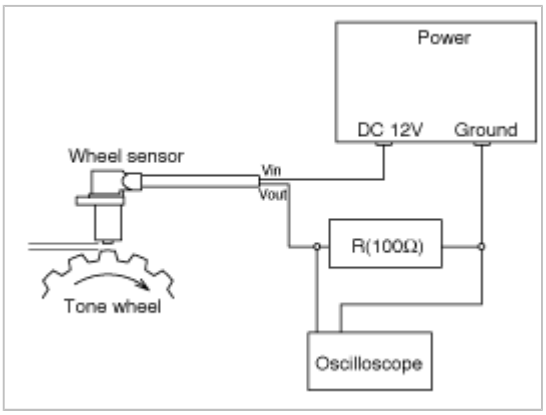
3. Remove the front wheel guard .
4. Disconnect the front wheel speed sensor connector (A) , then remove the front wheel speed sensor.



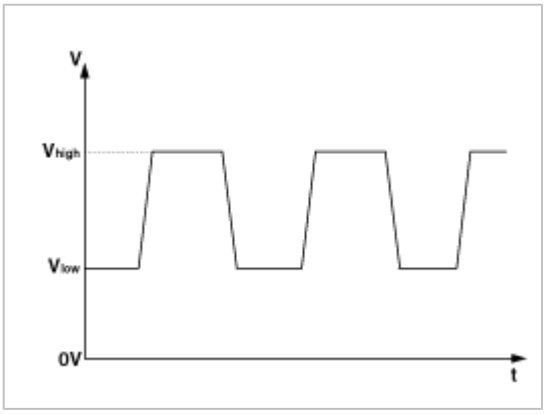
Inspection

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resister must be used as shown.

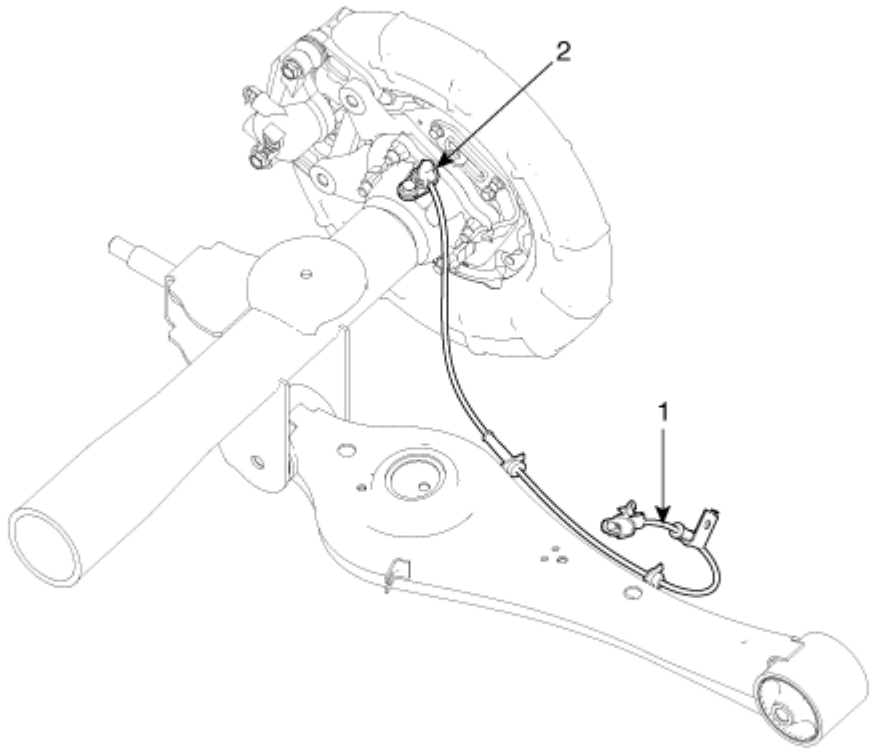


2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



V_low : 0.59V ~ 0.84V
V_high : 1.18V ~ 1.68V
Frequency range : 1 ~ 2,500Hz

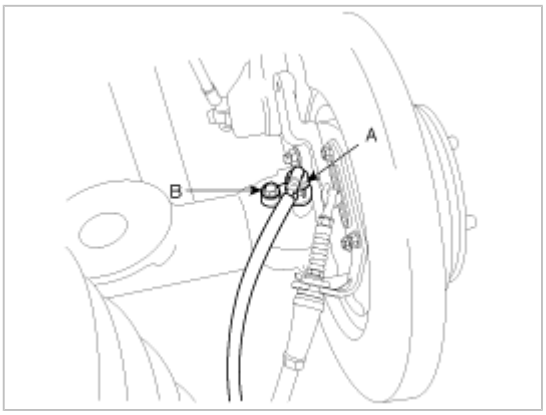
Components



1. Rear wheel speed sensor cable 2. Rear wheel speed sensor	

Removal

1. Remove the rear driveshaft.
   (Refer to Driveshaft group - "Rear driveshaft assembly removal")
2. Disconnect the rear wheel speed sensor connector (A).



3. Remove the rear wheel speed sensor after remove the rear wheel speed sensor mounting bolts (B).

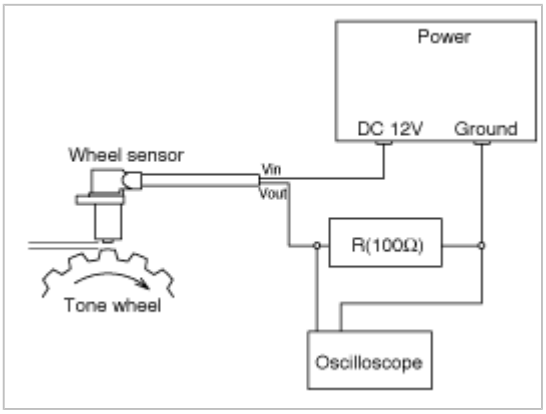
Tightening torqu
78.5 ~ 88.3N.m (8.0 ~ 9.0kgf.m, 57.9 ~ 65.1lb-ft)

4. Installation is the reverse of removal.

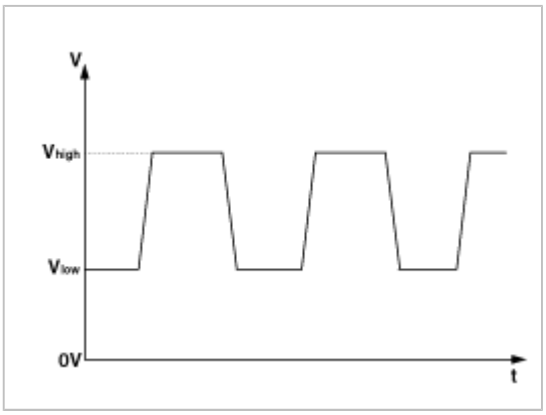
Inspection

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

In order to protect the wheel speed sensor, when measuring output voltage, a 100 Ω resister must be used as shown.

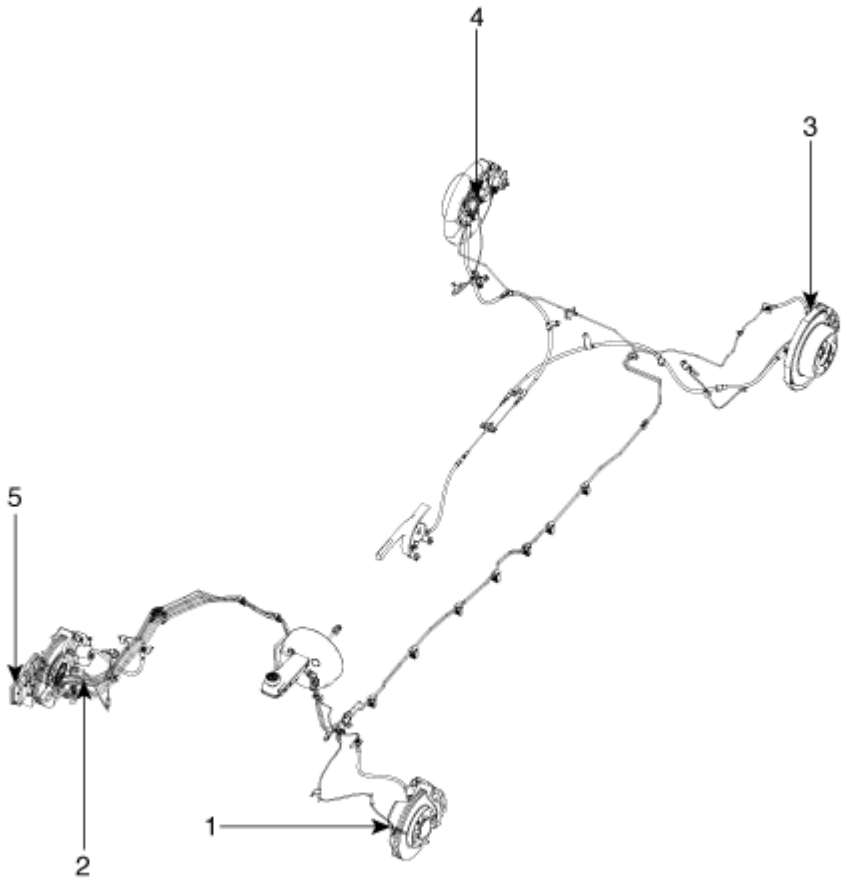


2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



V_low : 0.59V ~ 0.84V
V_high : 1.18V ~ 1.68V
Frequency range : 1 ~ 2,500Hz

Components



1. Front left wheel speed sensor 2. Front right wheel speed sensor 3. Rear left wheel speed sensor	4. Rear right wheel speed sensor 5. ABS control module (HECU)

Description

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU. (Hydraulic and Electronic Control Unit)
This specification is for the wiring design and installation of ABS/ESP ECU.
This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw □ Lateral G sensor,the wheel speed sensors attached to each wheel.
- Control of braking force / traction force / yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

Operation

The ECU shall be put into operation by switching on the operating voltage (IGN).
On completion of the initialization phase, the ECU shall be ready for operation.
In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

Wheel Sensor Signal Processing

The ECU shall receive wheel speed signal from the four active wheel sensors.
The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the MCU.

Solenoid Valve Control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.
The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

Voltage limits

- Overvoltage
  When overvoltage is detected(above 17 ± 0.5 V), the ECU switches off the valve relay and shuts down the system.
  When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.
- Undervoltage
  In the event of undervoltage(below 9.5 ± 0.5V), ABS control shall be inhibited and the warning lamp shall be turned on.

When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

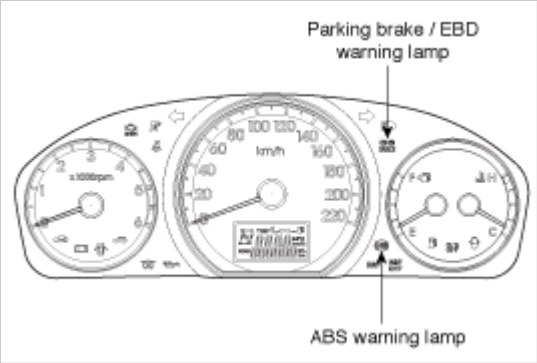
Pump Motor Checking

The ECU performs a pump motor test at a speed of 12 km/h(7 MPH) once after IGN is switched on.

Diagnostic Interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.
The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU in the test line of manufactories (Air-bleeding line or Roll and Brake Test line).

Warning Lamp Module



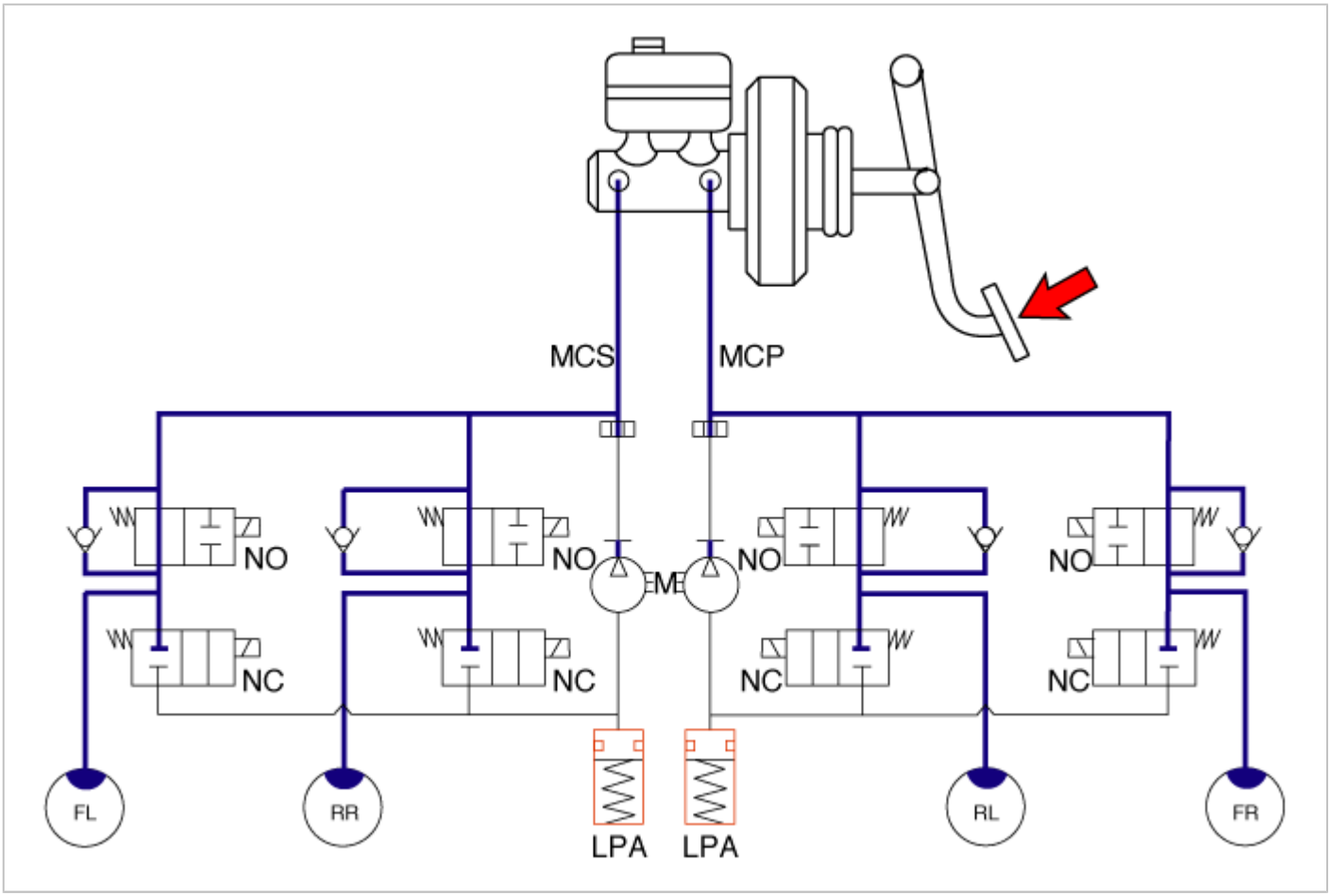
1. ABS Warning Lamp module
   The active ABS warning lamp module indicates the self-test and failure status of the ABS.
   The ABS warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. In the event of inhibition of ABS functions by failure.
   C. During diagnostic mode.
   D. When the ECU Connector is seperated from ECU.
2. PARKING/EBD warning lamp module
   The active EBD warning lamp module indicates the self-test and failure status of the EBD.
   However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.
   The EBD warning lamp shall be on:
   A. During the initialization phase after IGN ON. (continuously 3 seconds).
   B. When the Parking Brake Switch is ON or brake fluid level is low.
   C. When the EBD function is out of order.
   D. During diagnostic mode.
   E. When the ECU Connector is seperated from ECU.

ABS Control

1. NORMAL BRAKING without ABS
   Under the normal braking, voltage is not supplied to solenoid valve, inlet valve is opened and outlet

valve is closed.When the brake is depressed, brake fluid is supplied to the wheel cylinder via solenoid valve to activate the brake.When the brake is released, brake fluid is back to the master cylinder via inlet valve and check valve.

Solenoid valve	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	Open	Master cylinder □ Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder □ Reservoir	

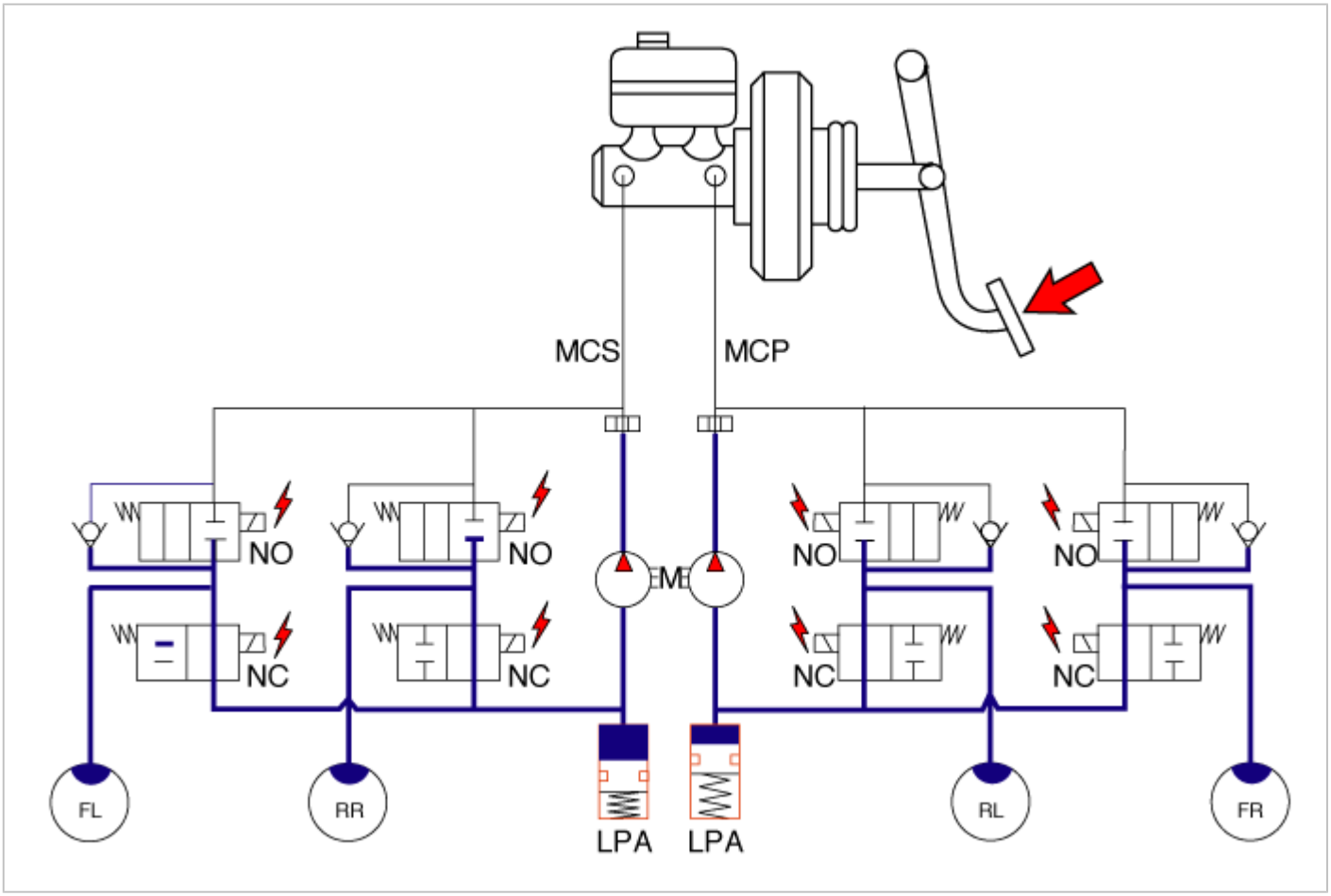


2. DUMP MODE

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

Solenoid	State	Valve	Passage	Pump motor

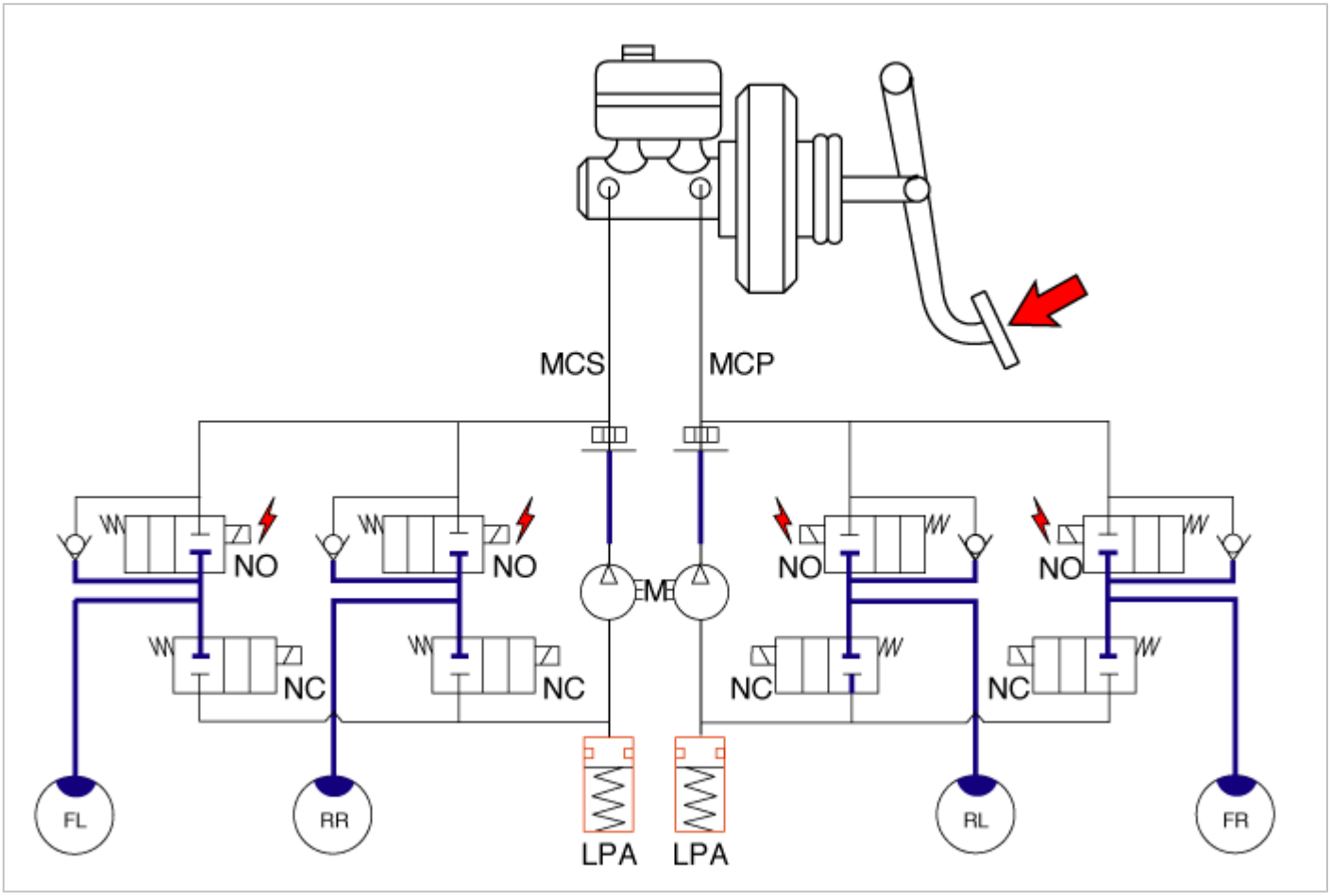
Inlet valve (NO)	ON	Close	Master cylinder □ Wheel cylinder	ON
Outlet valve (NC)	ON	Open	Wheel cylinder □ Reservoir	



3. HOLD MODE

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

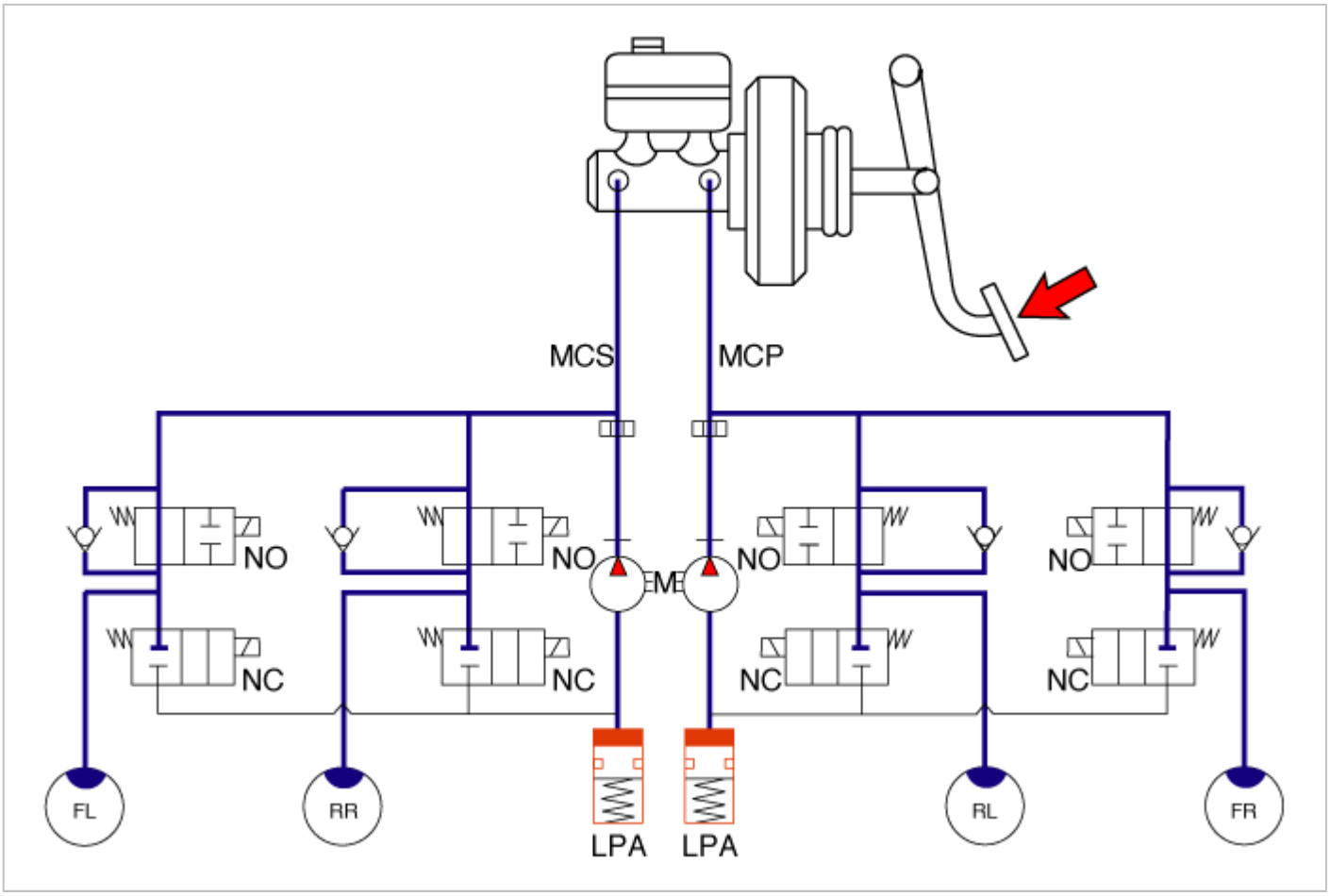
Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	Close	Master cylinder □ Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder □ Reservoir	



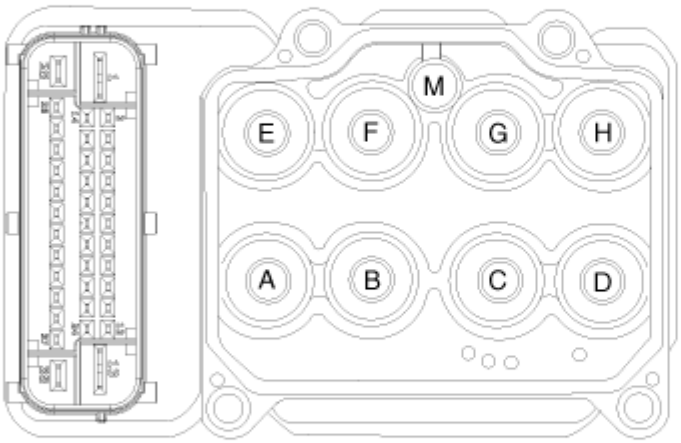
4. INCREASE MODE

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

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	Open	Master cylinder □ Wheel cylinder	ON
Outlet valve (NC)	OFF	Close	Wheel cylinder □ Reservoir	

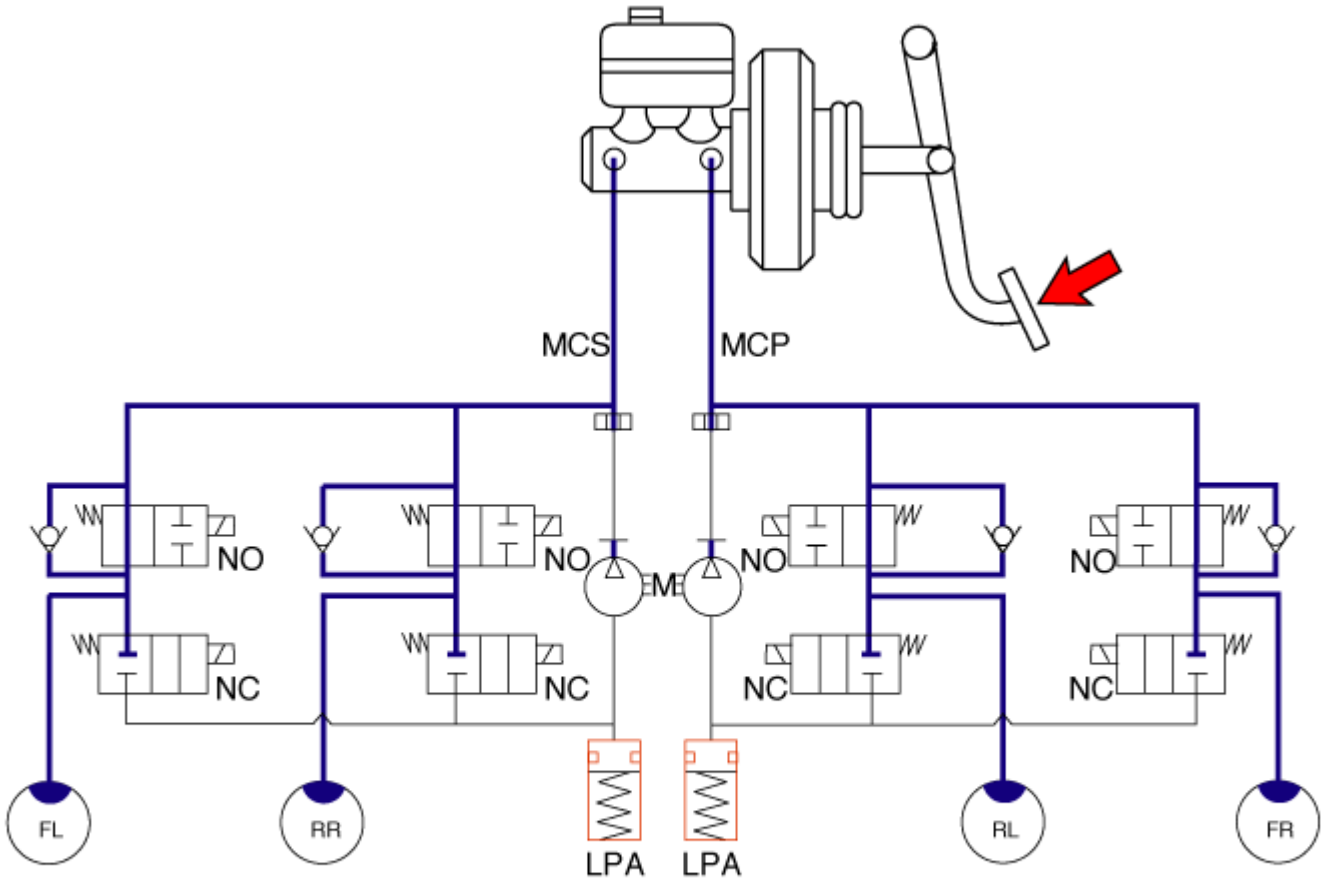


ABS Hecu External Diagram



A : OUTLET VALVE (FL)
B : OUTLET VALVE (RR)
C : OUTLET VALVE (RL)
D : OUTLET VALVE (FR)
E : INLET VALVE (FL)
F : INLET VALVE (RR)
G : INLET VALVE (RL)
H : INLET VALVE (FR)
M : MOTOR CONNECTOR

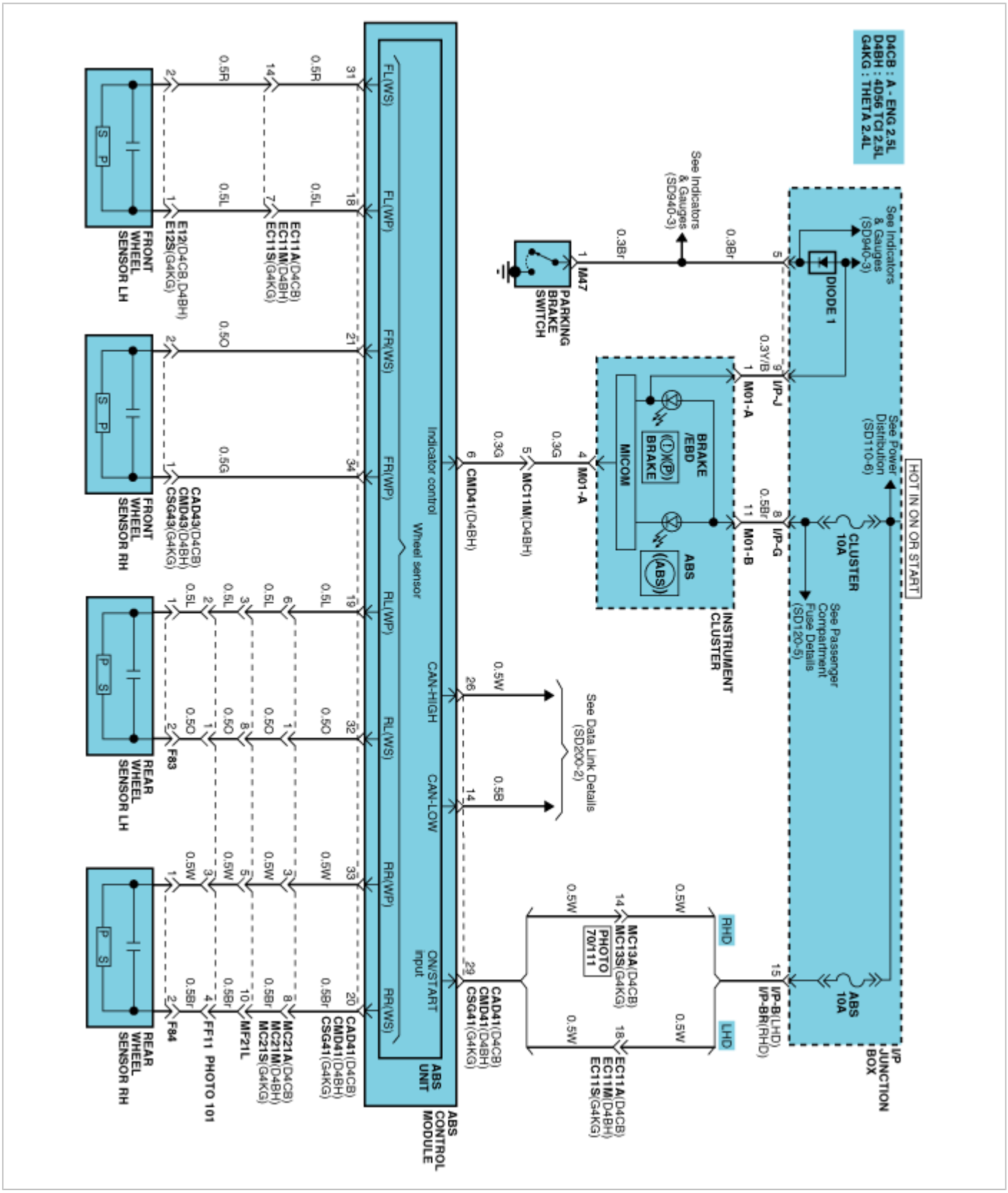
Hydraulic System Diagram

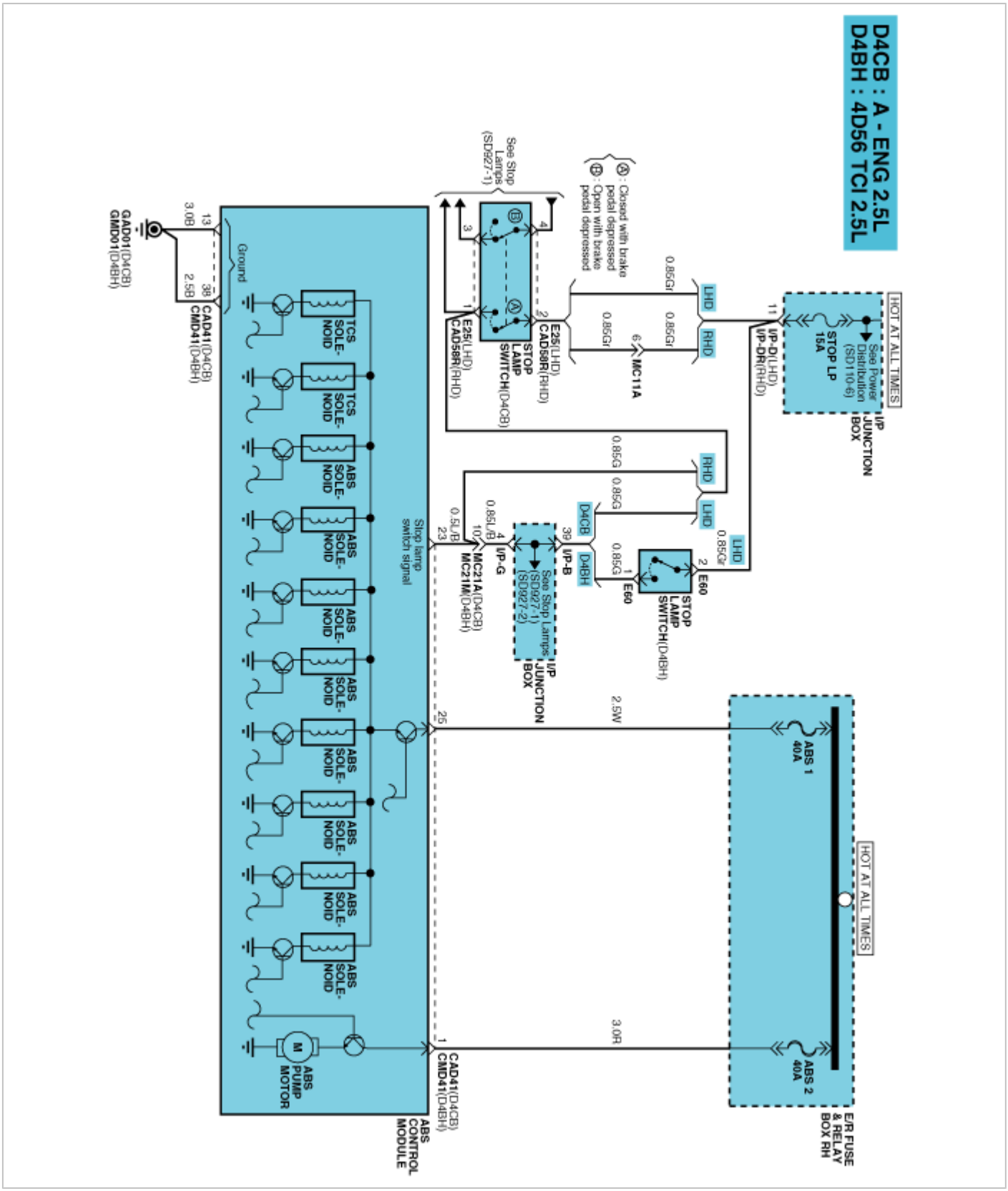


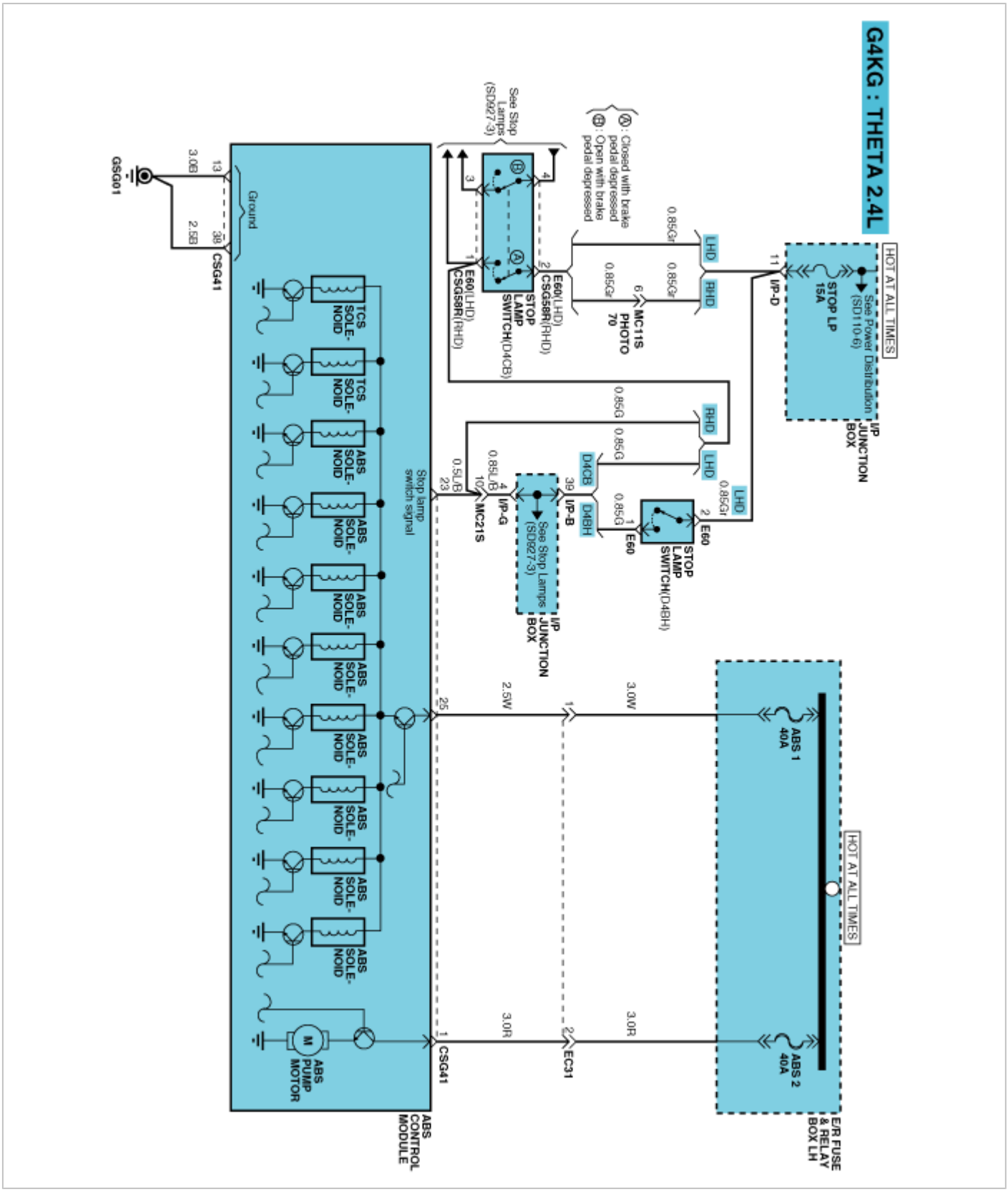
MCP : Primary master cylinder
MCS : Secondary master cylinder
LPA : Low pressure accumulator

M : Motor pump
NO : Normal open valve
NC : Normal close valve

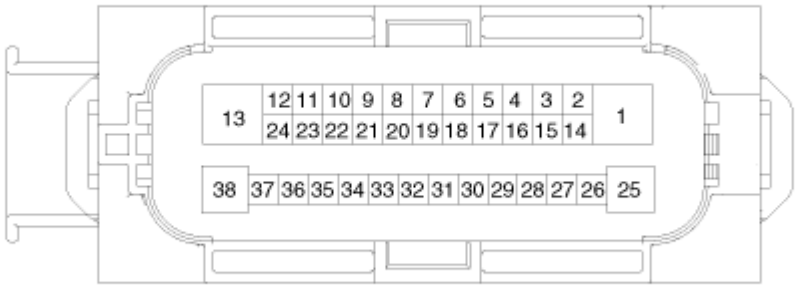
ABS Circuit Diagram




D4CB : A - ENG 2.5L
D4BH : 4D56 TCI 2.5L
HOT AT ALL TIMES
See Power Distribution (SD110-6)
I/P JUNCTION BOX
STOP LP 10A
I/P-D(LHD)
I/P-DR(RHD)
LHD
RHD
0.85Gr
MC11A
: Closed with brake pedal depressed
: Open with brake pedal depressed
See Stop Lamps (SD927-1)
E25(LHD)
CAD58R(RHD)
STOP LAMP SWITCH(D4CB)
E60
STOP LAMP SWITCH(D4BH)
D4CB
D4BH
I/P-B
I/P-G
See Stop Lamps (SD927-1) (SD927-2)
MC21A(D4CB)
MC21M(D4BH)
0.5L/B
0.85G
2.5W
3.0R
ABS 1 40A
ABS 2 40A
E/R FUSE & RELAY BOX RH
Stop lamp switch signal
Ground
GAD01(D4CB)
GMD01(D4BH)
CAD41(D4CB)
CMD41(D4BH)
3.0B
2.5B
TCS SOLE-NOID
ABS SOLE-NOID
ABS PUMP MOTOR
ABS CONTROL MODULE



ABS Connector Input/output

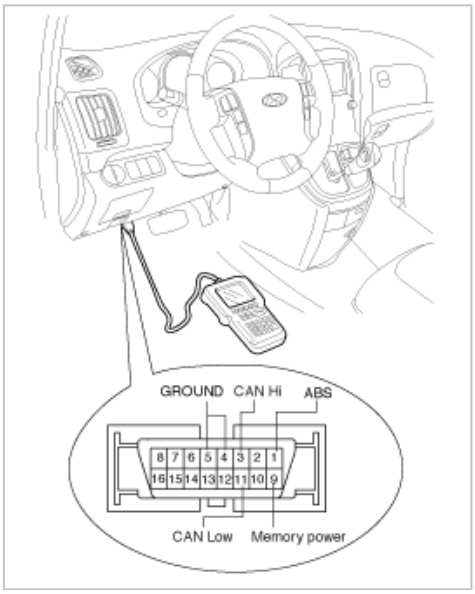


Connector Terminal		Specification	Remark
No	Description		
29	IGNITION1(+)	High level of wake up voltage : 4.5V < V < 16.0V Low level of wake up voltage : V < 2.4V Max. current : I < 50mA	□
25	POS. BATTERY 1. (SOLENOID)	Over voltage range : 17.0 ± 0.5V Operating voltage range : 10.0 ± 0.5V □ V □ 16.0 ± 0.5V Low voltage range : 7.0 ± 0.5V □ V □ 9.5 ± 0.5V Max. current : I □ 25A Max. leakage current : I < 0.25mA	□
1	POS. BATTERY 2.(MOTOR)	Operating voltage range: 10.0 ± 0.5V □ V □ 16.0 ± 0.5V Rush current : I □ 110A Max. current : I □ 40A Max. leakage current : I □ 0.25mA	□
38	GROUND	Rated current : I □550mA Max. current: I □ 25A	□
13	PUMP MOTOR GROUND	Rush current : I □ 110A Max. current : I □ 40A	□
23	BRAKE LIGHT SWITCH	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V Max. Input current : I < 3mA (@12.8V)	□
14	CAN BUS LINE(LOW)	Max. Input current : I □ 10mA	□
26	CAN BUS LINE(HIGH)		

18	SENSOR FRONT LEFT POWER	Output voltage : V_BAT1 -0.6V ~ V_BAT1 -1.1V Output current : Max. 30mA	□
34	SENSOR FRONT RIGHT POWER		
19	SENSOR REAR LEFT POWER		
33	SENSOR REAR RIGHT POWER		
31	SENSOR FRONT LEFT SIGNAL	Input current Low : 5.9 ~ 8.4mA Input current High :11.8 ~ 16.8mA Frequency range :1 ~ 2500Hz Input duty : 50 ± 10%	Typ. 7mA Typ. 14mA
21	SENSOR FRONT RIGHT SIGNAL		
32	SENSOR REAR LEFT SIGNAL		
20	SENSOR REAR RIGHT SIGNAL		
6	ABS/EBD LAMP	Max. current : I □ 70mA Max. output Low voltage : V□ 0.7V	□

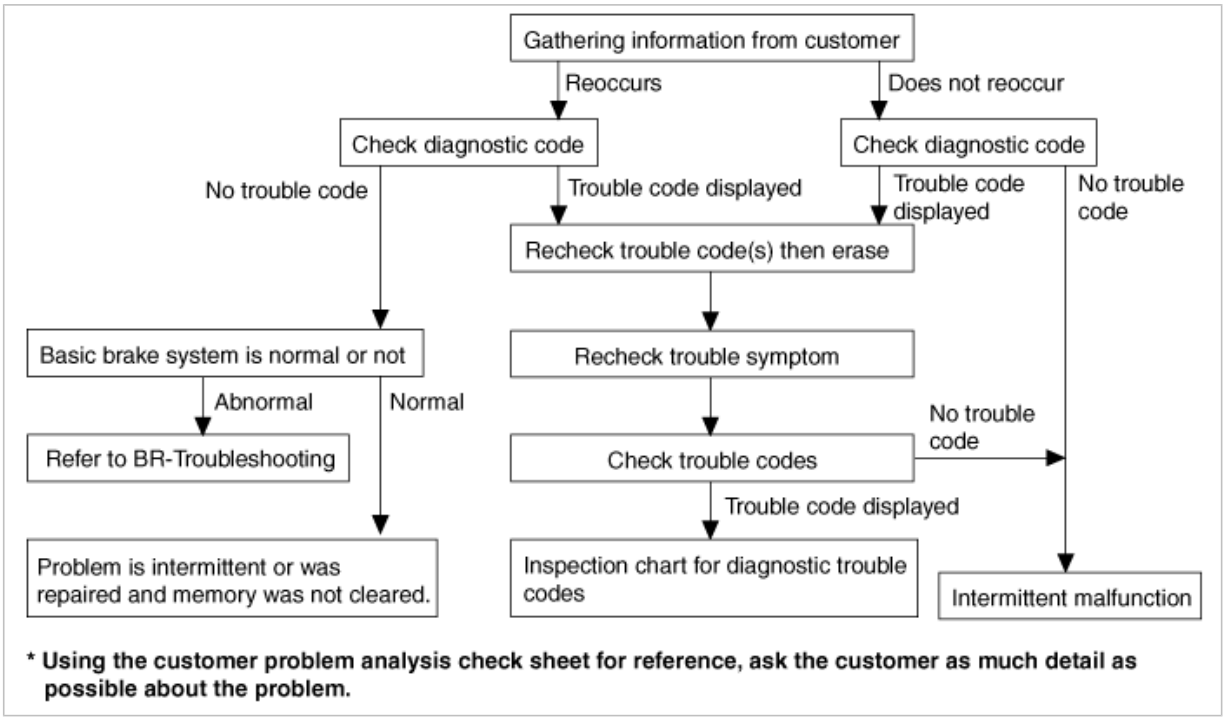
GDS Check

1. Turn the ignition switch OFF.
2. Connector the GDS to the 16P data link connector located the driver'd side kick panel.



3. Turn the ignition switch ON.
4. Check for diagnostic trouble using the GDS
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes the clear key on the GDS.
6. Disconnect the GDS from the 16P data link connector.

Standard Flow Of Diagnostic Troubleshooting



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

Notes With Regard To Diagnosis

The phenomena listed in the following table are not abnormal.

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

ABS Check Sheet

ABS Check Sheet

Inspector's Name _____

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

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

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

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

Problem Symptoms Table

If a normal code is displayed during the DTC check but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

Symptom	Suspect Area
ABS does not operate.	Only when 1. -4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when 1. -4. are all normal and the problem is

	still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the normal code is output. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with GDS is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line
Communication with GDS is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU

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.

ABS Does Not Operate.

Detecting Condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection Procedures

DTC Inspection

1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

   Is the normal code output?

NO	□ Check the power source circuit.
YES	□ Erase the DTC and recheck using GDS.

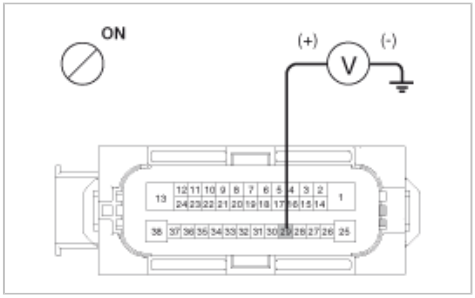
Check The Power Source Circuit

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ABS control module harness side connector and body ground.

Specification : approximately B+

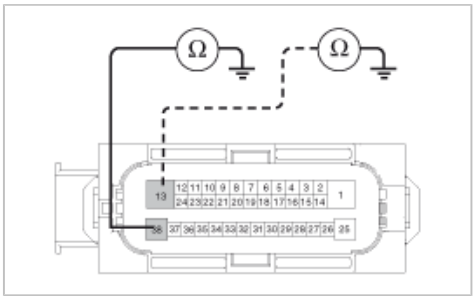
Is the voltage within specification?

NO	□ Check the ground circuit.
YES	□ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



Check The Ground Circuit

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 13, 38 of the ABS control module harness side connector and ground point.
   Is there continuity?



Check The Wheel Speed Sensor Circuit

Refer to the DTC troubleshooting procedures.
Is it normal?

YES	□ Check the hydraulic circuit for leakage.
NO	□ Repair or replace the wheel speed sensor.

Check The Hydraulic Circuit For Leakage

Refer to the hydraulic lines.
Inspect leakage of the hydraulic lines.
Is it normal?

YES	□ The problem is still occurring, replace the ABS control module.
NO	□ Repair the hydraulic lines for leakage.

ABS Does Not Operate (Intermittently).

Detecting Condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection Procedures

DTC Inspection

1. Connect the GDS with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
   Is the normal code output?

NO	□ Check the wheel speed sensor circuit.
YES	□ Erase the DTC and recheck using GDS.

Check The Wheel Speed Sensor Circuit.

Refer to the DTC troubleshooting procedures.
Is it normal?

YES	□ Check the stop lamp switch circuit.
NO	□ Repair or replace the wheel speed sensor.

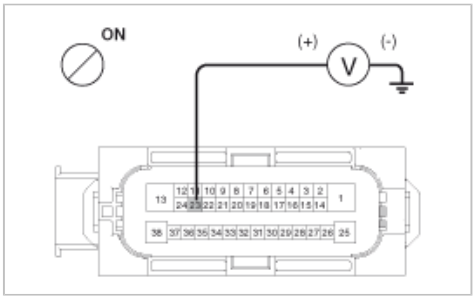
Check The Stop Lamp Switch Circuit

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 23 of the ABS control module harness side connector and body ground when brake pedal is depressed.

   Specification : approximately B+

   Is the voltage within specification?

YES	□ Check the hydraulic circuit for leakage.
NO	□ Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.



Check The Hydraulic Circuit For Leakage.

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.
Is it normal?

YES	□ The problem is still occurring, replace the ABS control module.
NO	□ Repair the hydraulic lines for leakage.

Communication with GDS is not possible.
(Communication with any system is not possible)

Detecting Condition

Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Faulty power source circuit

Inspection Procedures

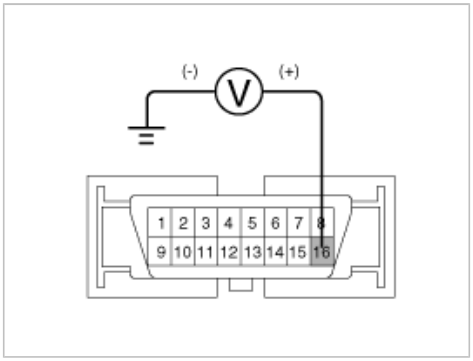
Check The Power Supply Circuit For The Diagnosis

Measure the voltage between terminal 16 of the data link connector and body ground.

Specification : approximately B+

Is voltage within specification?

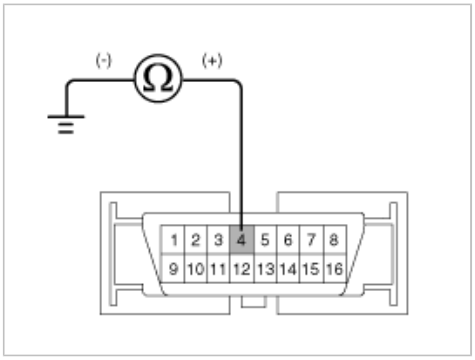
YES	□ Check the ground circuit for the diagnosis.
NO	□ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



Check The Ground Circuit For The Diagnosis

Check for continuity between terminal 4 of the data link connector and body ground.
Is there continuity?

NO	□ Repair an open in the wire between terminal 4 of the data link connector and ground point.



Communication with GDS is not possible.
(Communication with ABS only is not possible)

Detcting Condition

Trouble Symptom	Possible Cause
When communication with GDS is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Faulty HECU - Faulty power source circuit

Inspection Procedures

Check For Continuity In The GDS Line

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 26, 14 of the ABS control module connector and 3, 11 of the data link connector.
   Is there continuity?

YES	□ Check the power source of ABS control module.
NO	□ Repair an open in the wire.

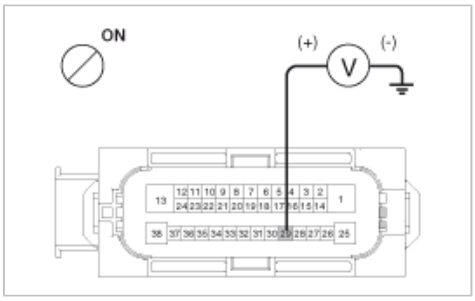
Check The Power Source Of Abs Control Module

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ABS control module harness side connector and body ground.

Specification : approximately B+

Is voltage within specification?

YES	□ Check for poor ground.
NO	□ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.

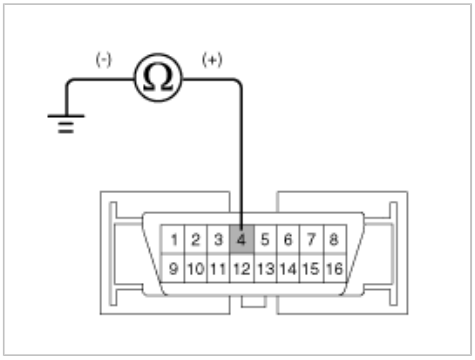


Check For Poor Ground

Check for continuity between terminal 4 of the data link connector and ground point.

Is the continuity?

YES	□ Replace the ABS control module and recheck.
NO	□ Repair an open in the wire or poor ground.



When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting Condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	- Faulty ABS warning lamp bulb - Blown fuse is related to ABS in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

Inspection Procedures

Problem Verification

Disconnect the connector the ABS HECU and turn the ignition switch ON.

Does the ABS waring lamp light up?

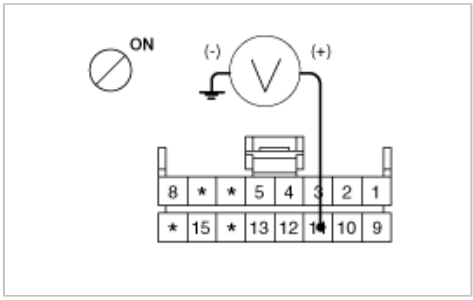
NO	□ Check the power source for the ABS warning lamp.
YES	□ Inspect again after replacing the ABS HECU.

Check The Power Source For The Abs Warning Lamp

1. Disconnect the instrument cluster connector (M01-B) and turn the ignition switch ON.
2. Measure the voltage between terminal (M01-B) 11 of the cluster harness side connector and body

ground.

Specification : approximately B+



Is voltage within specification?

NO	□ Check for blown fuse.
YES	□ Check the CAN circuit resistance for ABS warning lamp.

Check For Blown Fuse

Check continuity of use (10A) from the engine compartment junction block.
Is there continuity?

NO	□ Repair an open in the wire between CLUSTER fuse and 11 of cluster connector (M01-B)
YES	□ Replace the blown fuse.

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

Detecting Condition

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	- An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

Inspection Procedures

Check DTC Output

1. Connect the GDS to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using GDS.

Is DTC output?

NO	□ Repair circuit indicated by code output.
YES	□ Check instrument cluster.

Check Instrument Cluster

Disconnect the cluster connector and turn the ignition switch ON.
Does the ABS warning lamp remains ON?

NO	□ Replace the instrument cluster.
YES	□ Check for open the wire.

Check For Open In The Wire

Check for continuity in the wire between cluster and ABS control module.
Is there continuity?

NO	□ Replace the ABS control module and recheck.
YES	□ Repair an open in the wire between cluster and ABS control module.

Bleeding of Brake System

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

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

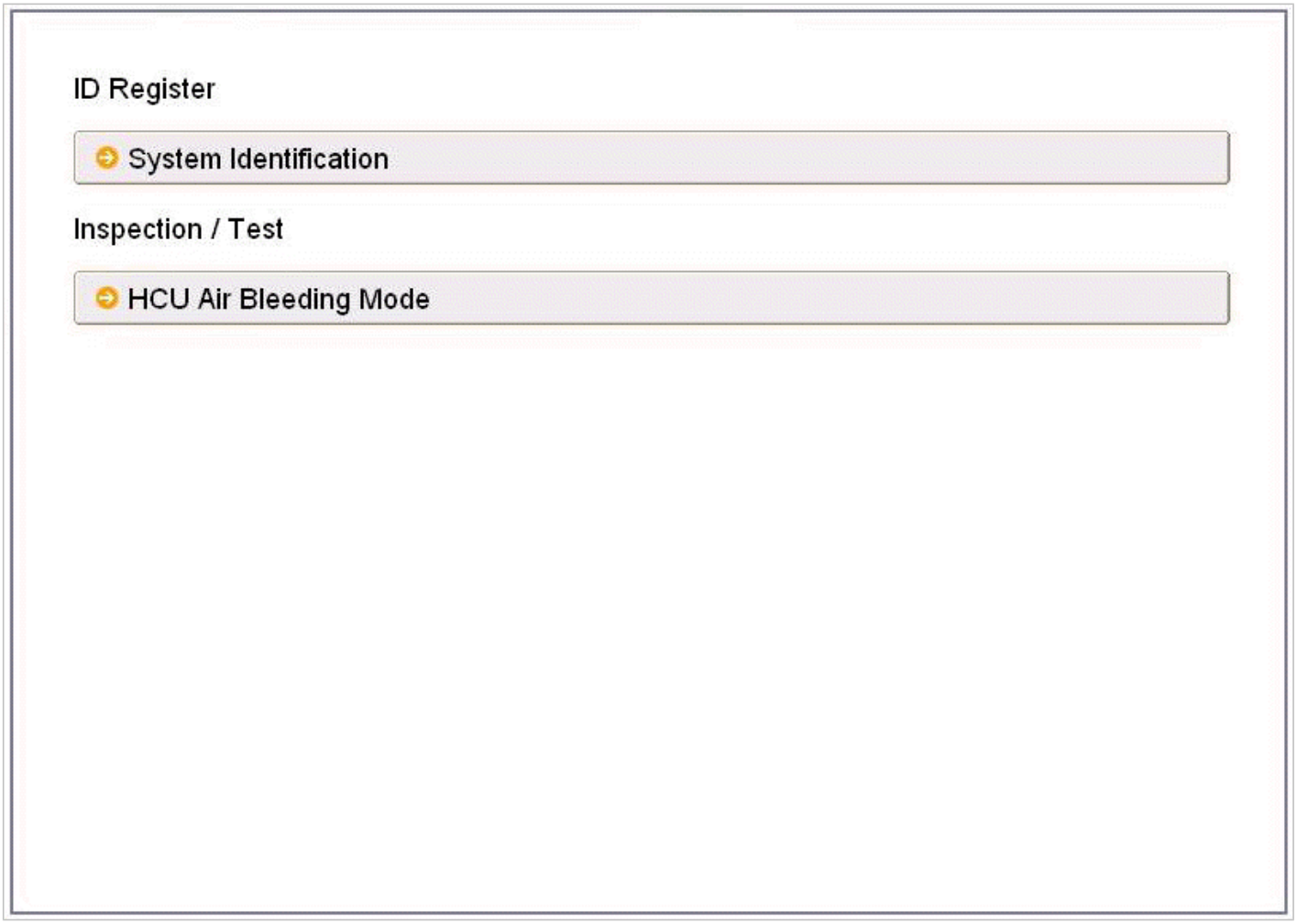
   If there is any brake fluid on any painted surface, wash it off immediately.

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

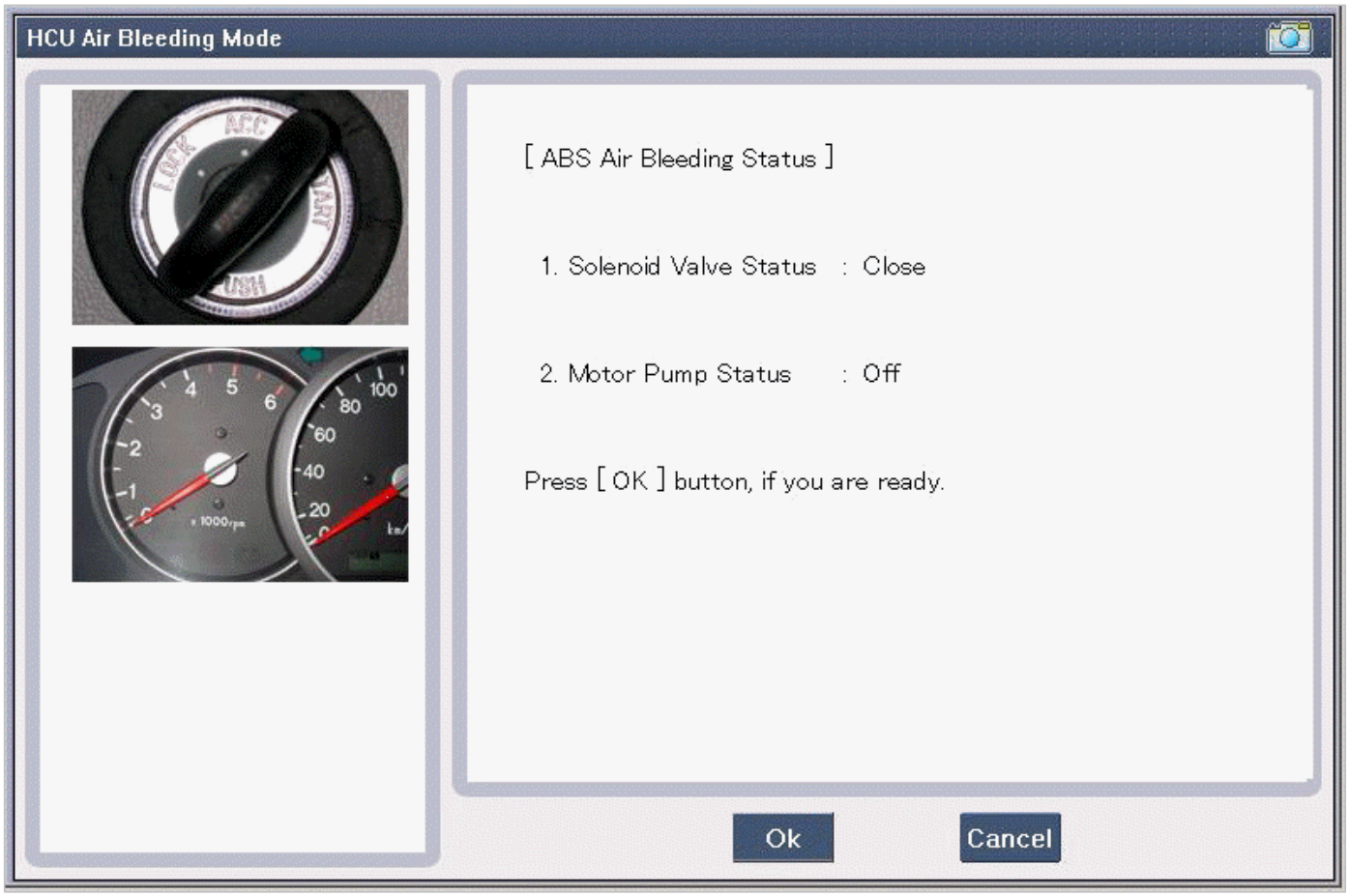
2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the GDS to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the GDS screen.

   You must obey the maximum operating time of the ABS motor with the GDS to prevent the motor pump from burning.

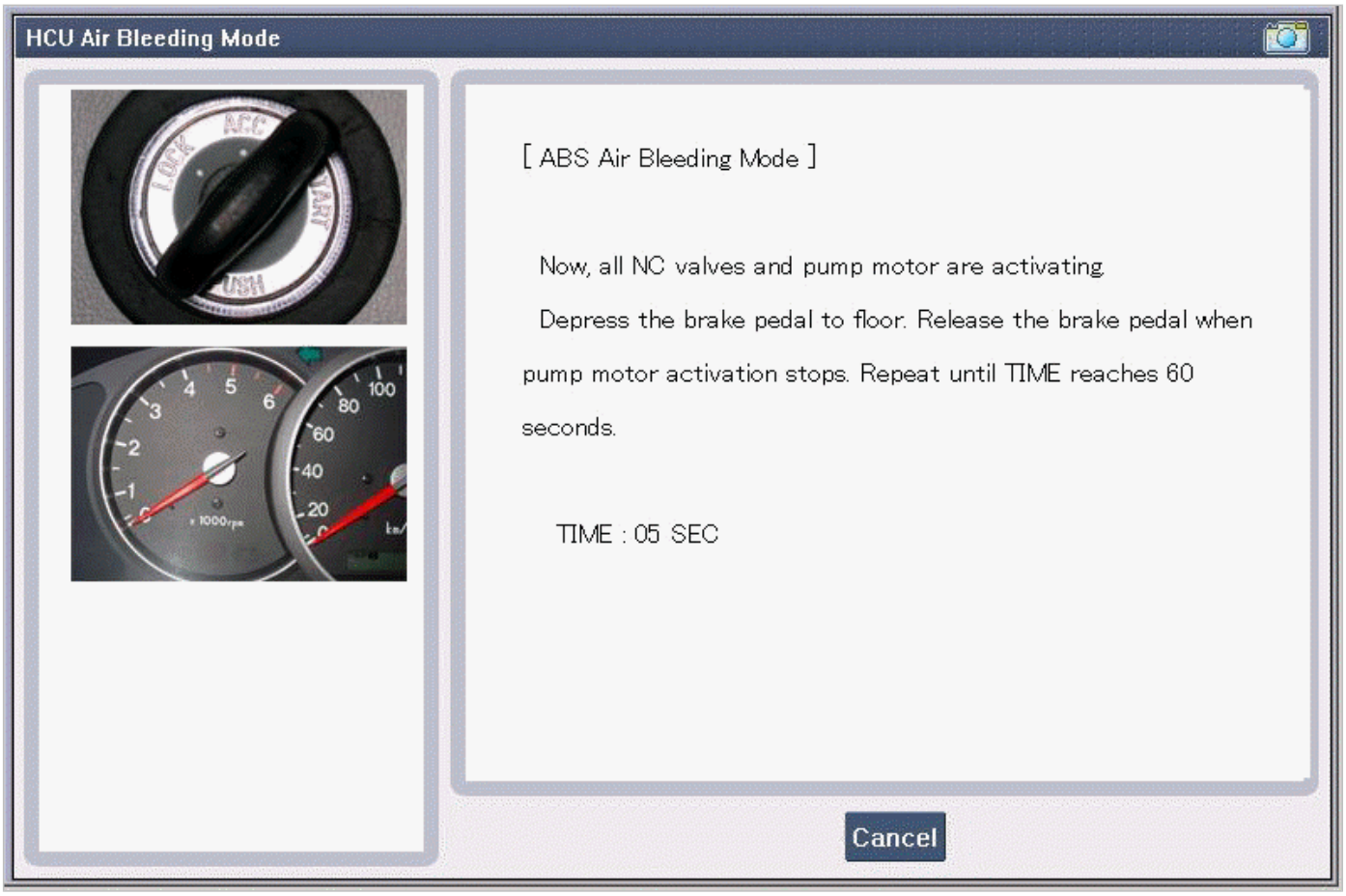
   (1) Select vehicle name.
   (2) Select Anti-Lock Brake system.
   (3) Select HCU air bleeding mode.



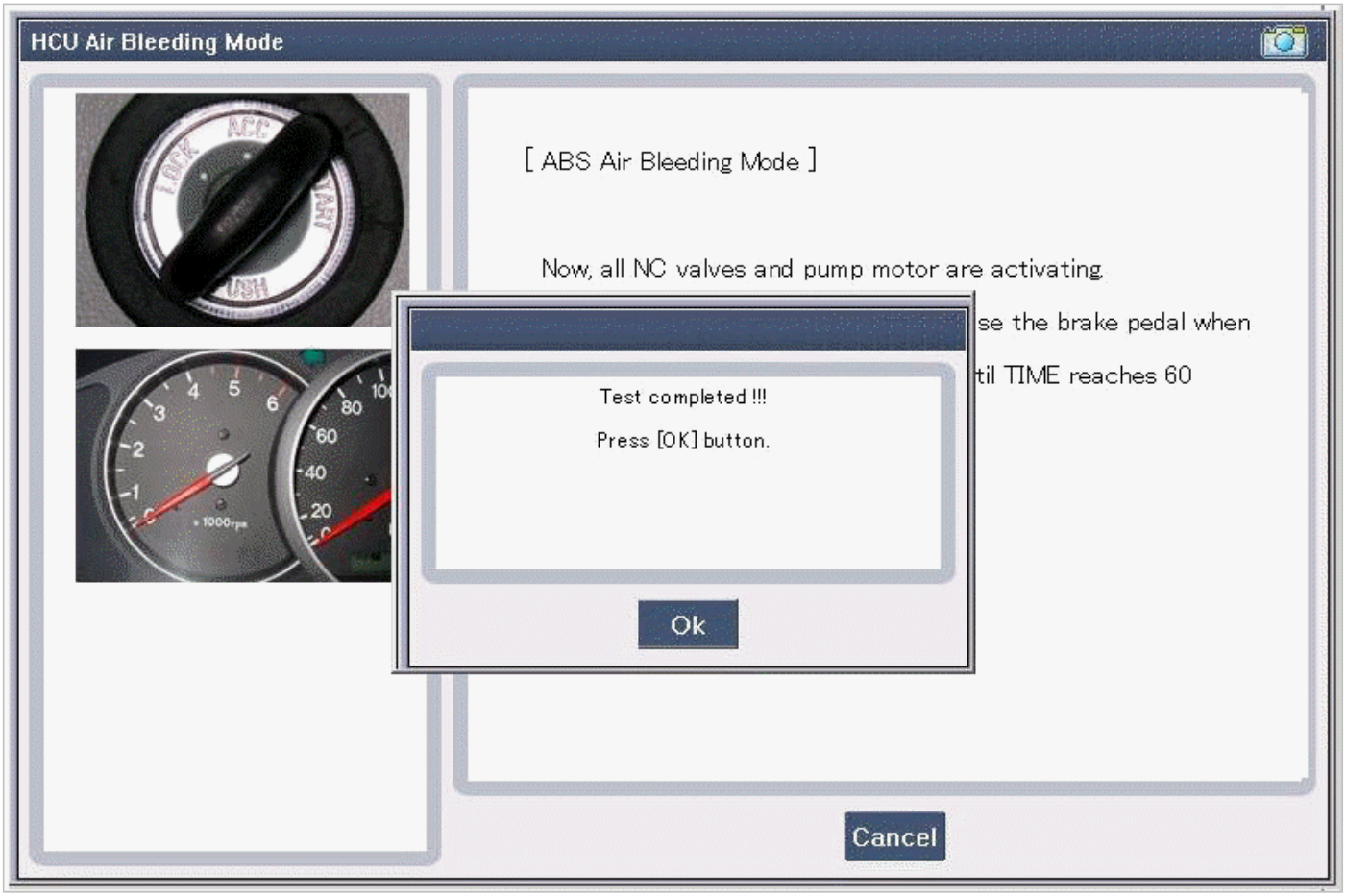
(4) Press "OK" to operate motor pump and solenoid valve.



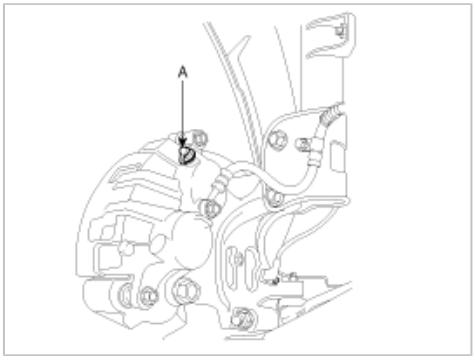
(5) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)



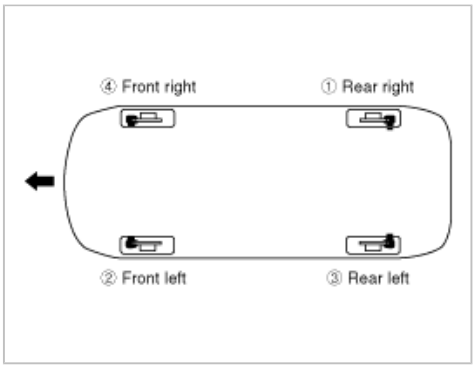
(6) Perform the air bleeding.



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



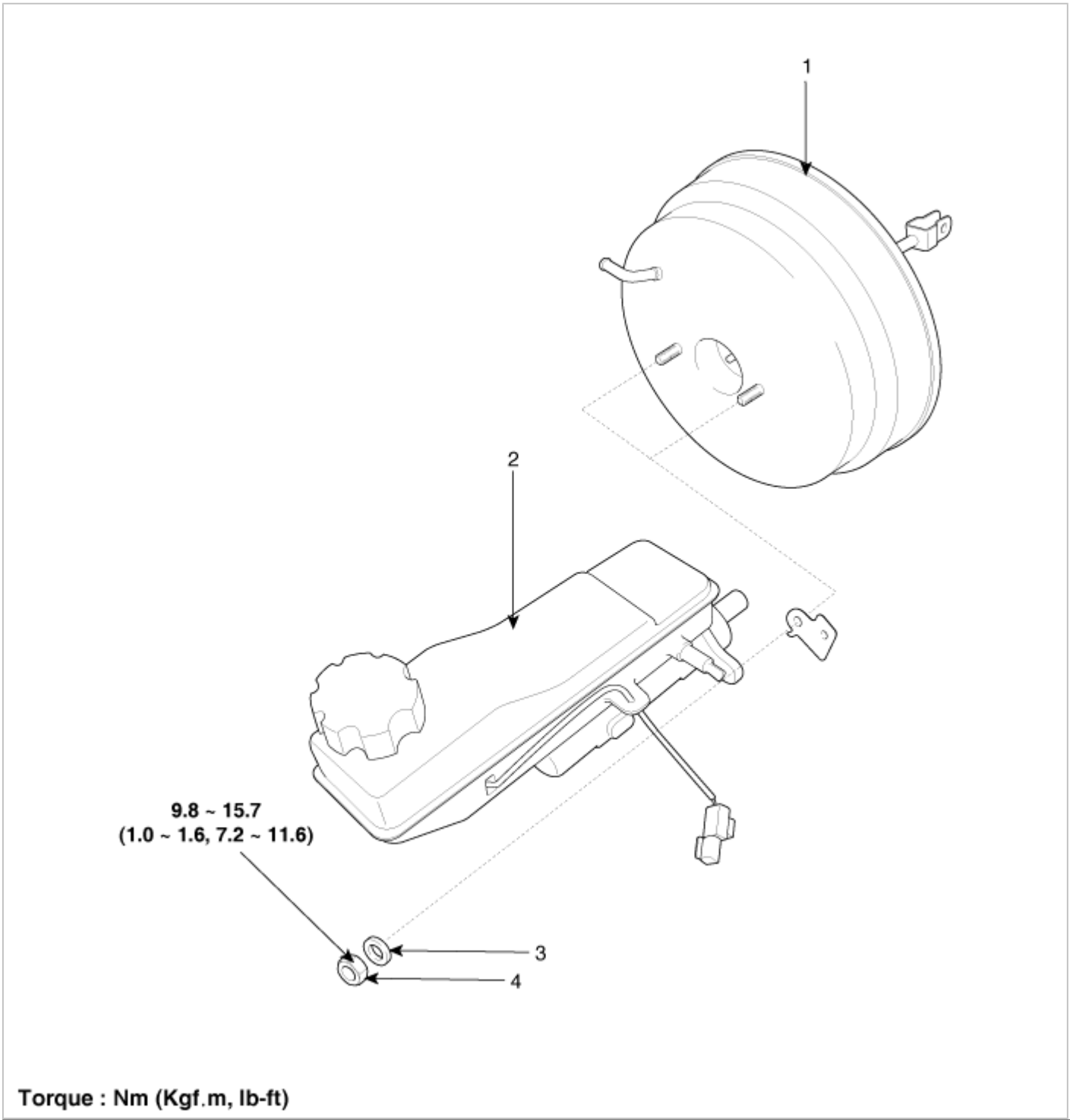
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



7. Tighten the bleeder screw.

Bleed screw tightening torque:
6.86 ~ 12.74 N.m (0.7 ~ 1.3 kgf.m, 5.09 ~ 9.45 lb-ft)

Components



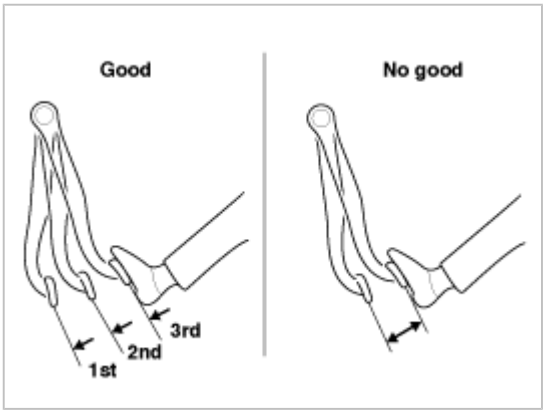
Torque : Nm (Kgf.m, lb-ft)

1. Brake booster 2. Master cylinder assembly	3. Washer 4. Nut

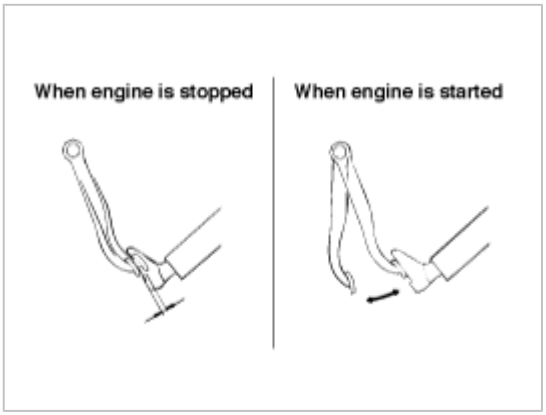
Brake Booster Operating Test

For simple checking of the brake booster operation, carry out the following tests

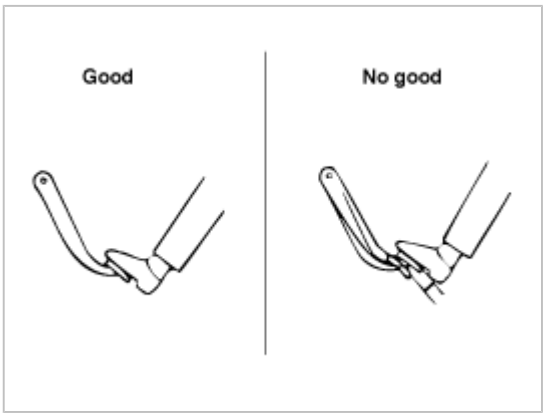
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, thebooster is inoperative.



2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is inoperative.

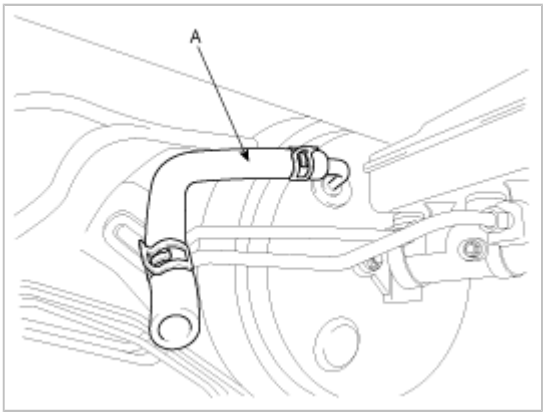


3. With the engine running, step on the brake pedal and then stop the engine.
   Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is inoperative.
   If the above three tests are okay, the booster performance can be determined as good.
   Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.

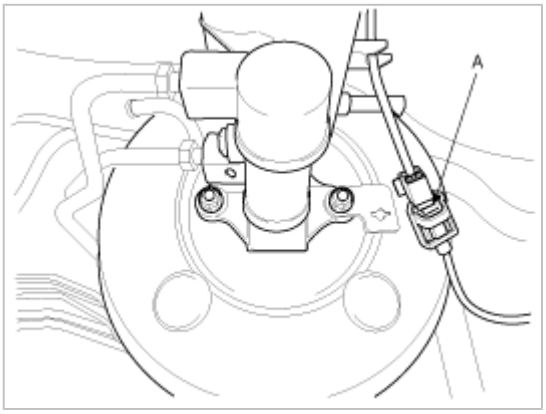


Removal

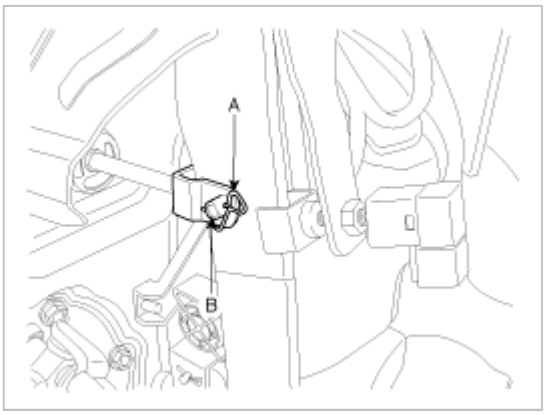
1. Disconnect the vacuum hose (A) from the brake booster.



2. Disconnect the brake fluid level switch connector (A) from the reservoir.

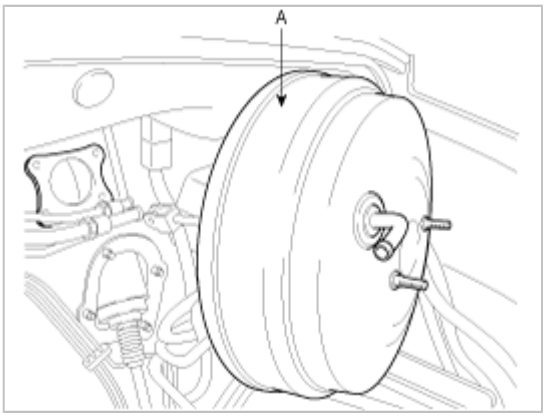


3. Remove the master cylinder. (Refer to Master cylinder)
4. Remove the snap pin (A) and clevis pin (B).



5. Remove the brake booster (A) by loosening the mounting nuts.

Tightening torque Nm :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



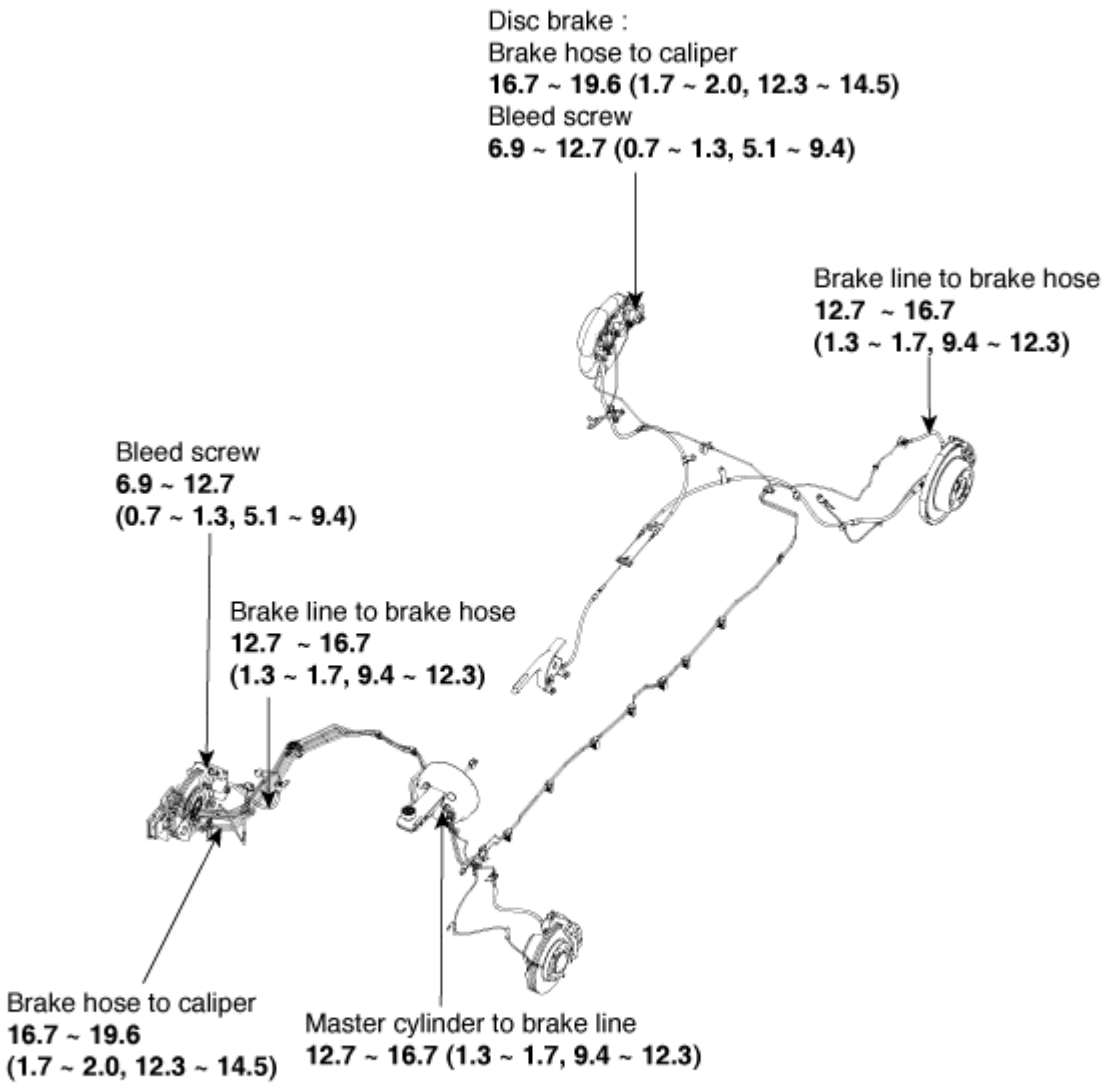
Installation

1. Installation is the reverse of removal.

- Before installing the pin, apply the grease to the clevis pin.
- Use a new snap pin whenever installing.

2. After installing, bleed the brake system. (Refer to Brake system bleeding)
3. Adjust the brake pedal height and free play. (Refer to Brake pedal height and free play adjustment)

Components

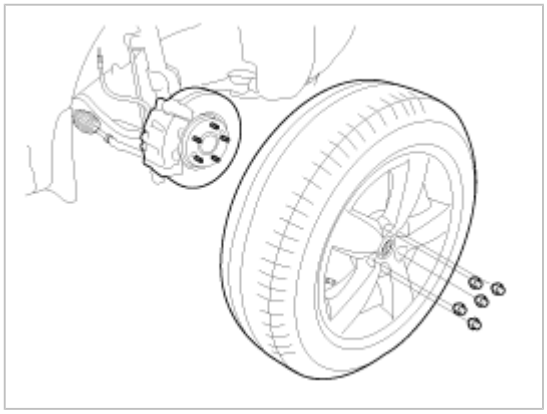


Torque : N.m (Kgf.m, lb-ft)

Removal

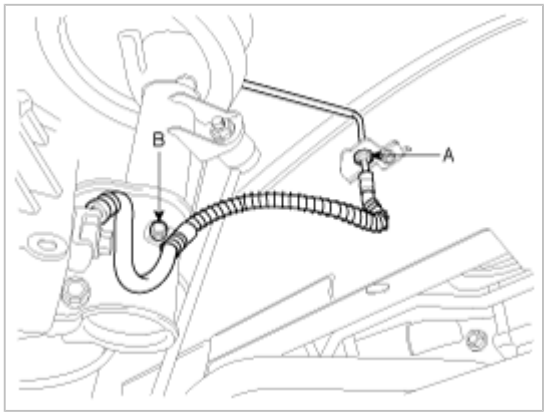
Front Brake Line

1. Remove the wheel □ tire.



2. Disconnect the brake tube by loosening the tube flare nut (A) and brake hose mounting bolt (B).

Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)

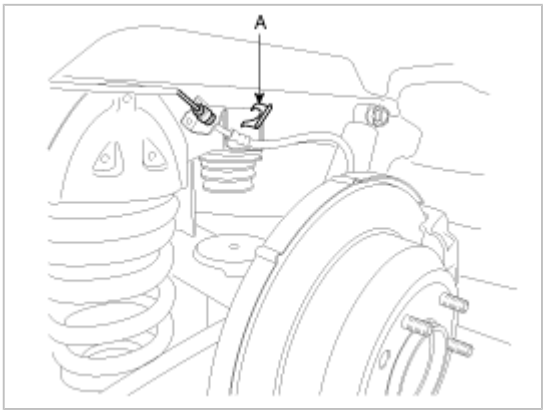


3. Disconnect the brake hose (A) from the brake caliper by loosening the bolt.

Tightening torque :
16.7 ~ 19.6N.m (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)

Rear Brake Line

1. Remove the wheel & tire.
2. Remove the brake hose clip (A).

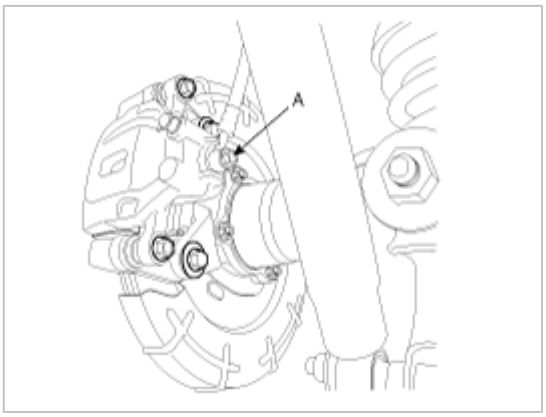


3. Disconnect the brake tube by loosening the tube flare nut (A).

Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)

4. Disconnect the brake hose (A) from the brake caliper by loosening the bolt.

Tightening torque :
16.7 ~ 19.6N.m (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)



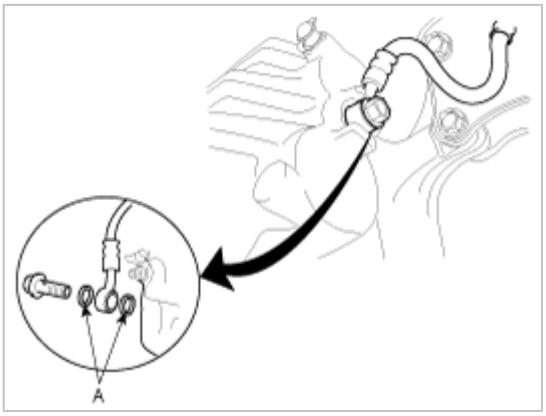
Inspection

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

Installation

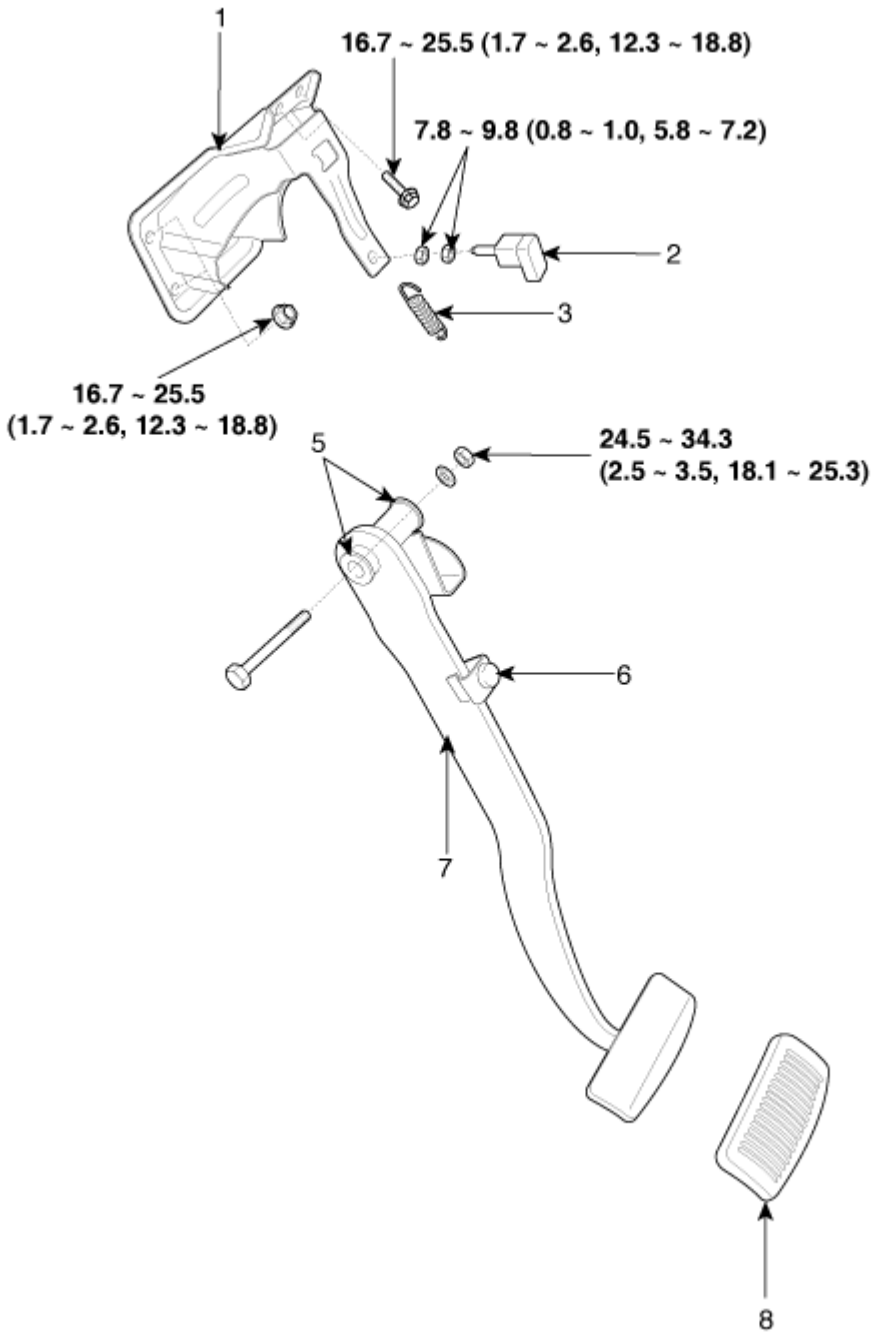
1. Installation is the reverse of removal.

Use a new washer (A) whenever installing.



2. After installation, bleed the brake system (Refer to Brake system bleeding)

Components

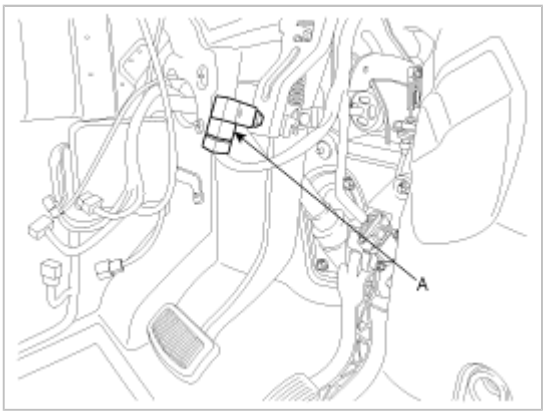


TORQUE : N.m (Kgf.m, lb-ft)

1. Brake pedal member assembly	5. Bushing
2. Stop lamp switch	6. Brake pedal stopper
3. Return spring	7. Brake pedal
4. Bolt	8. Pedal pad

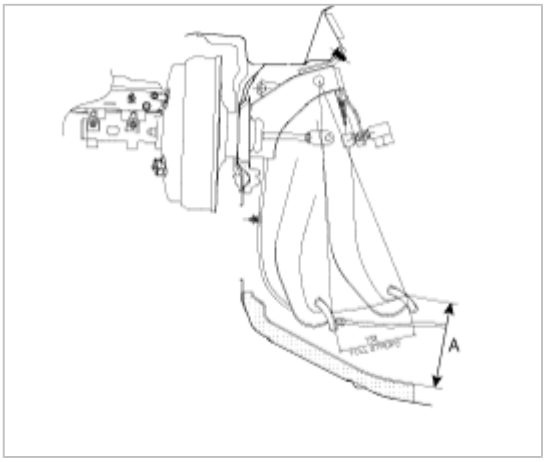
Brake Pedal Height And Free Play Adjustment

1. Disconnect the stop lamp switch connector (A) and loosen the stop lamp switch lock nut.



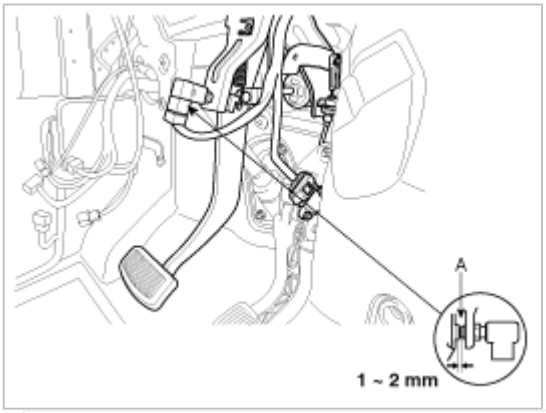
2. Adjust the brake pedal height (A) as illustration below.

Pedal height : 149.8mm (5.78in)



3. Adjust the stop lamp switch clearance (A) and brake pedal free play.

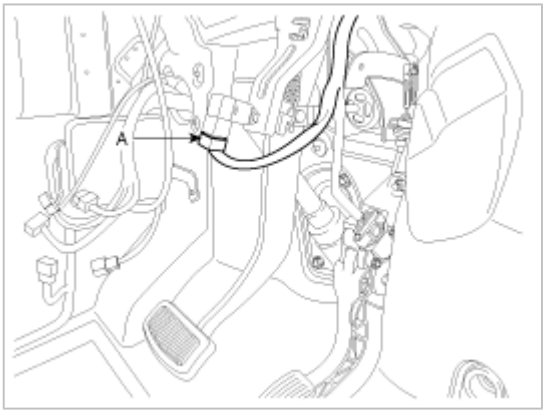
Stop lamp clearance : 1.0 ~ 2.0 mm (0.04 ~ 0.08 in)
Pedal free play : 3.0 ~ 8.0 mm (0.12 ~ 0.31 in)



Adjust the brake pedal free play using the stop lamp switch lock nut.

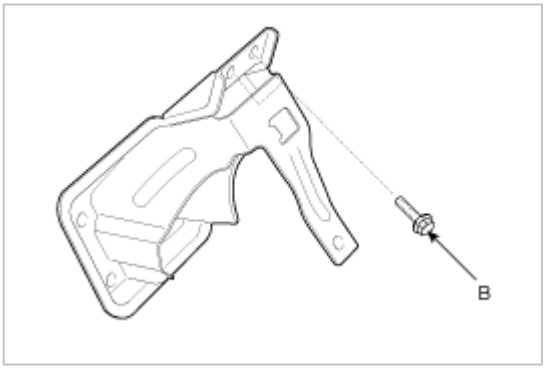
Removal

1. Remove the lower crash pad. (Refer to BD Gr.)
2. Disconnect the stop lamp switch connector (A).

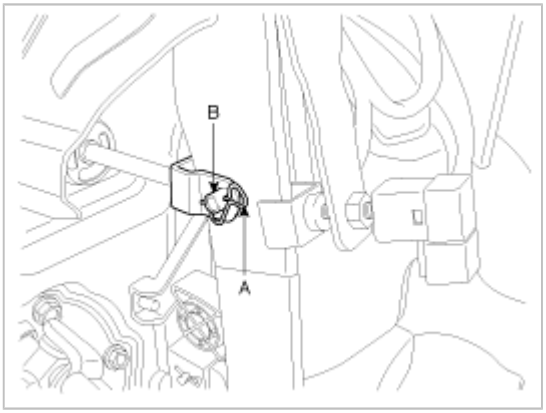


3. Remove the mounting bracket bolts (B).

Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



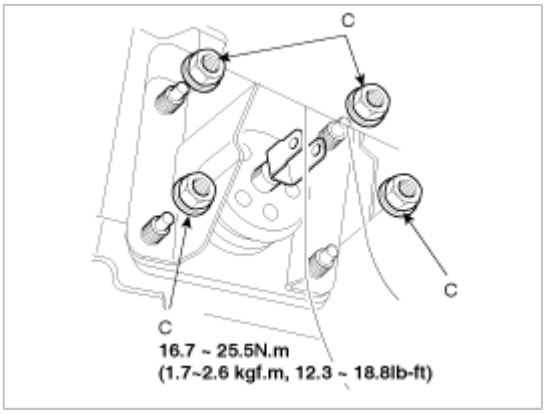
4. Remove the snap pin (A) and clevis pin (B).



5. Remove the brake pedal member assembly mounting nuts (C) and then remove the brake pedal

assembly.

Tightening torque :
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



Installation

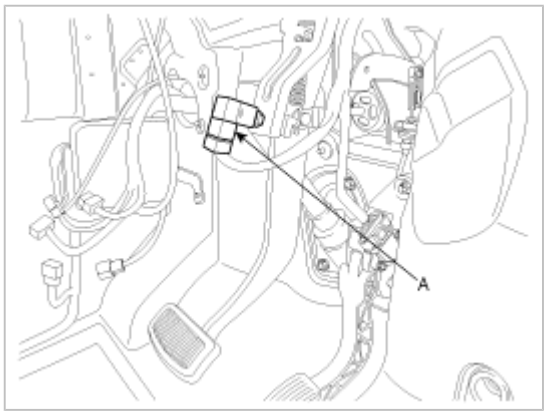
1. Installation is the reverse of removal.

- Before installing the pin, apply the grease to the clevis pin.
- Use a new snap pin whenever installing.

2. Check the brake pedal operation.

Removal

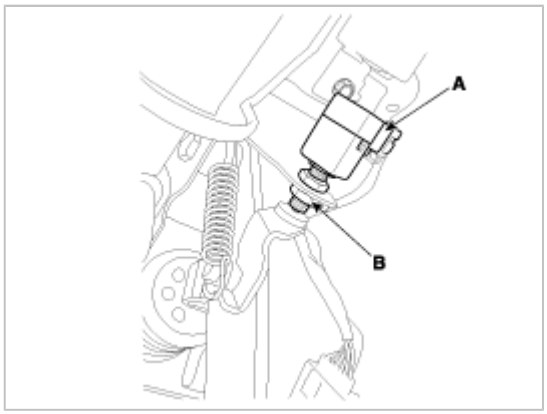
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the lower crash pad.
   (Refer to the Body - "Crash Pad")
3. Disconnect the stop lamp switch connector (A) and loosen the stop lamp switch lock nut.



4. Remove the stop lamp switch.

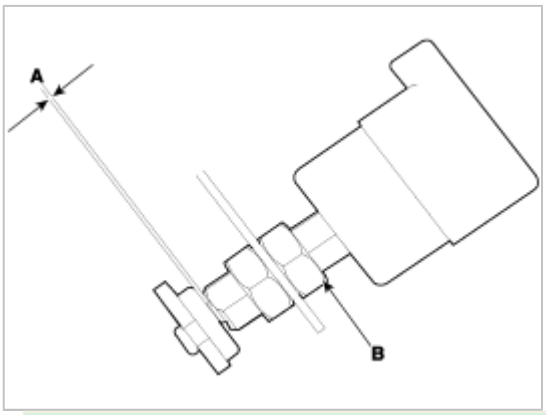
Installation

1. Insert the stop lamp switch into the hole of the brake pedal member assembly.
2. Tighten the stop lamp switch lock nut (B) while pushing the brake pedal and connect the stop lamp switch connector (A).



3. Adjust the stop lamp switch clearance(A) and brake pedal free play.

Stop lamp clearance : 1 ~ 2 mm (0.04 ~ 0.08 in)
Pedal free play : 3.0 ~ 8.0 mm (0.12 ~ 0.31)



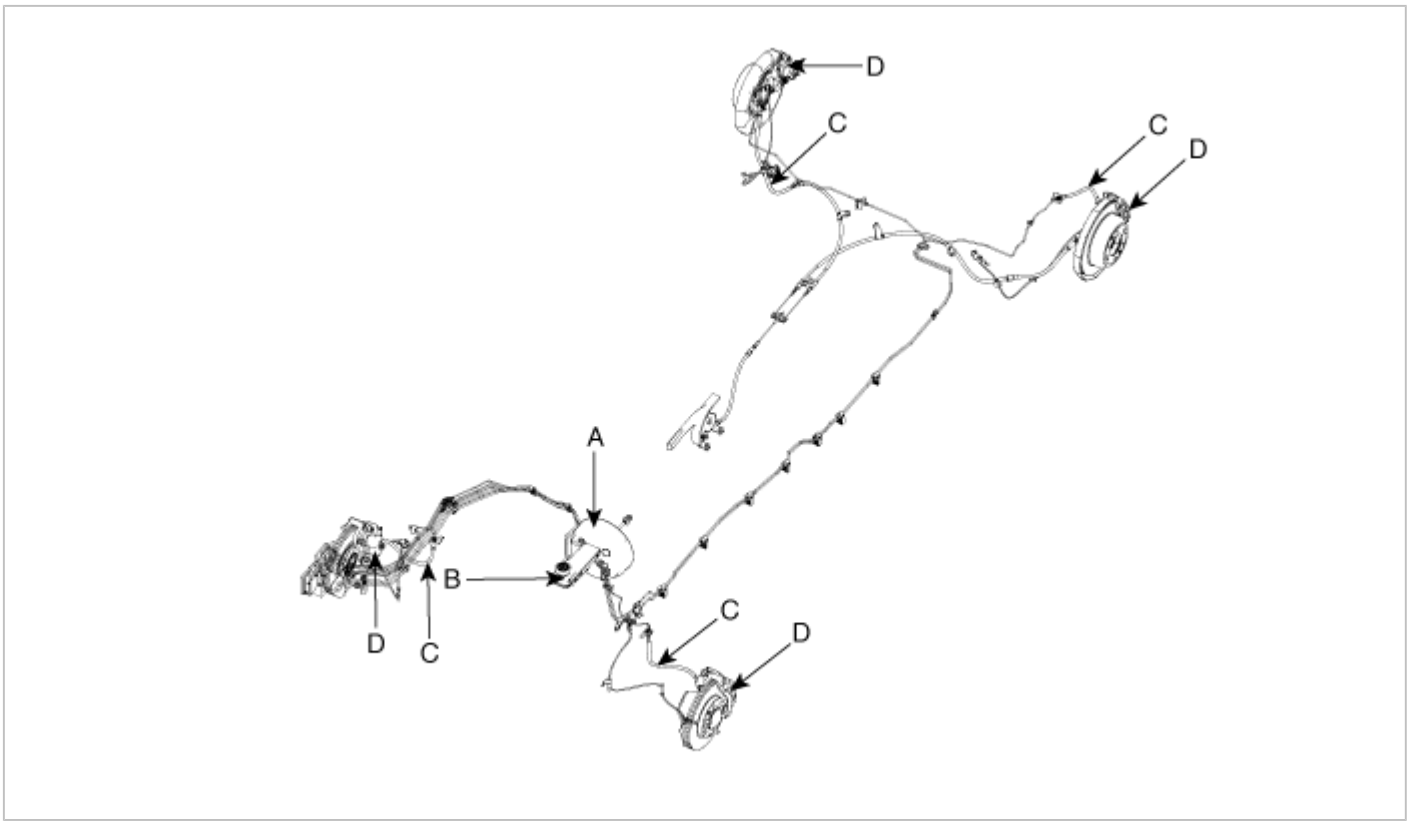
Adjust the brake pedal free play using the stop lamp switch adjustment nut (B).

4. Install the lower crash pad.
   (Refer to the Body - "Crash Pad")

Operation and Leakage Check

Check all of the following items:

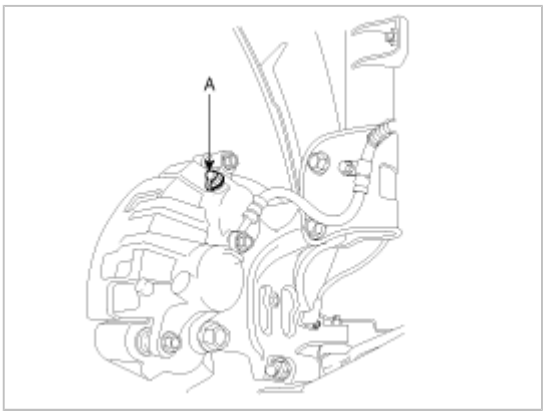
Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	• Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. • Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.



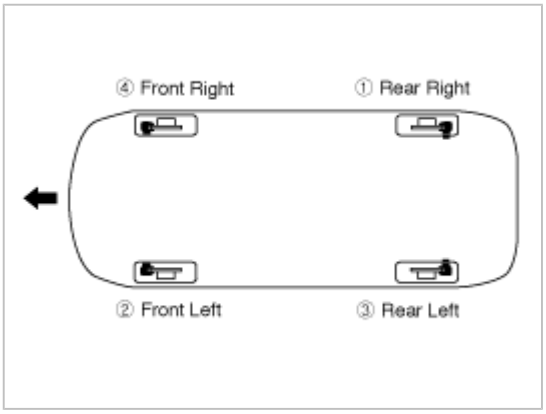
Brake System Bleeding

- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid.
  Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

1. Make sure the brake fluid in the reservoir is at the MAX (upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply pressure.
3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

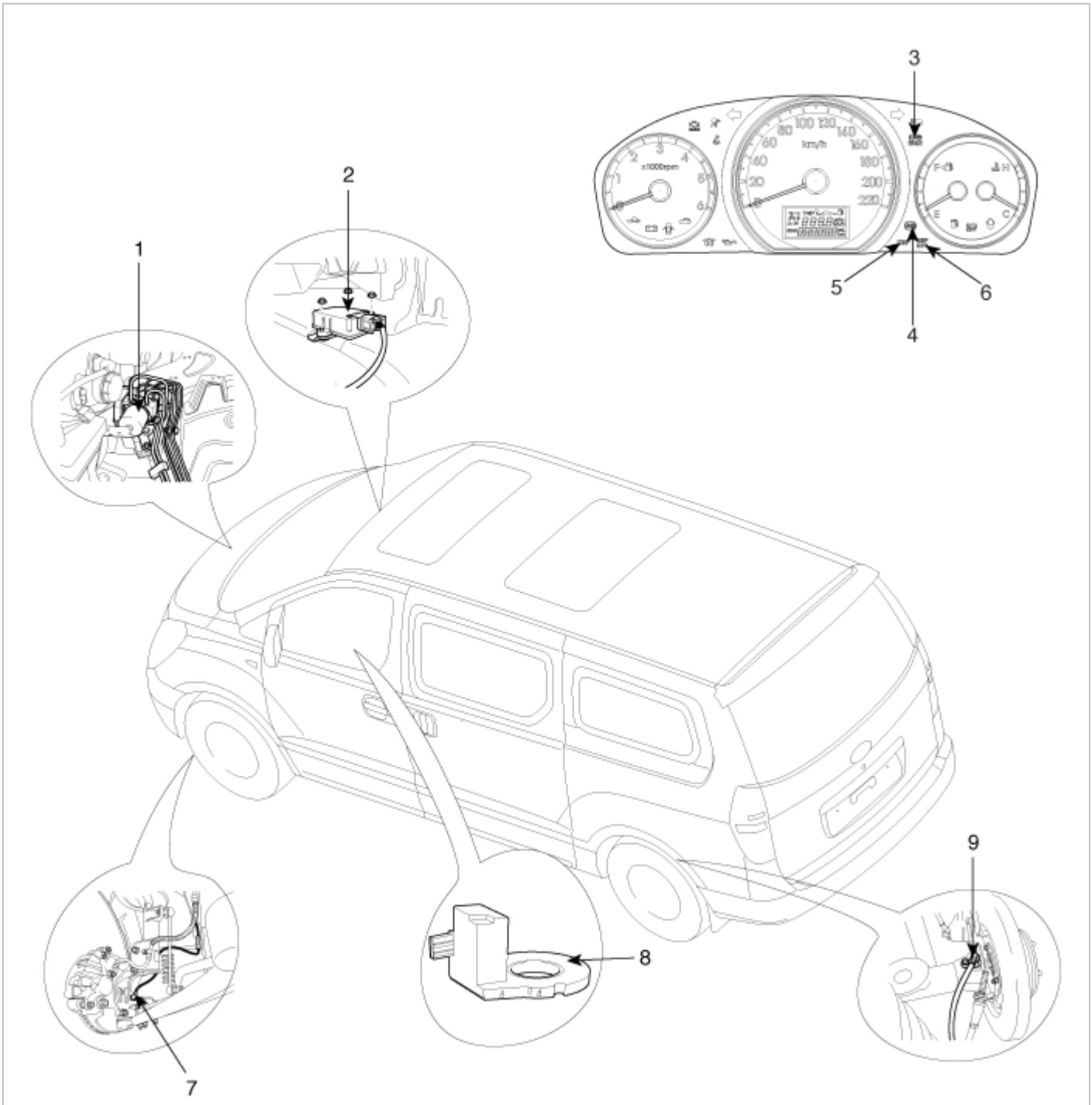


4. Repeat the procedure for wheel in the sequence shown below unit air bubbles no longer appear in the fluid.



5. Refill the master cylinder reservoir to MAX (upper) level line.

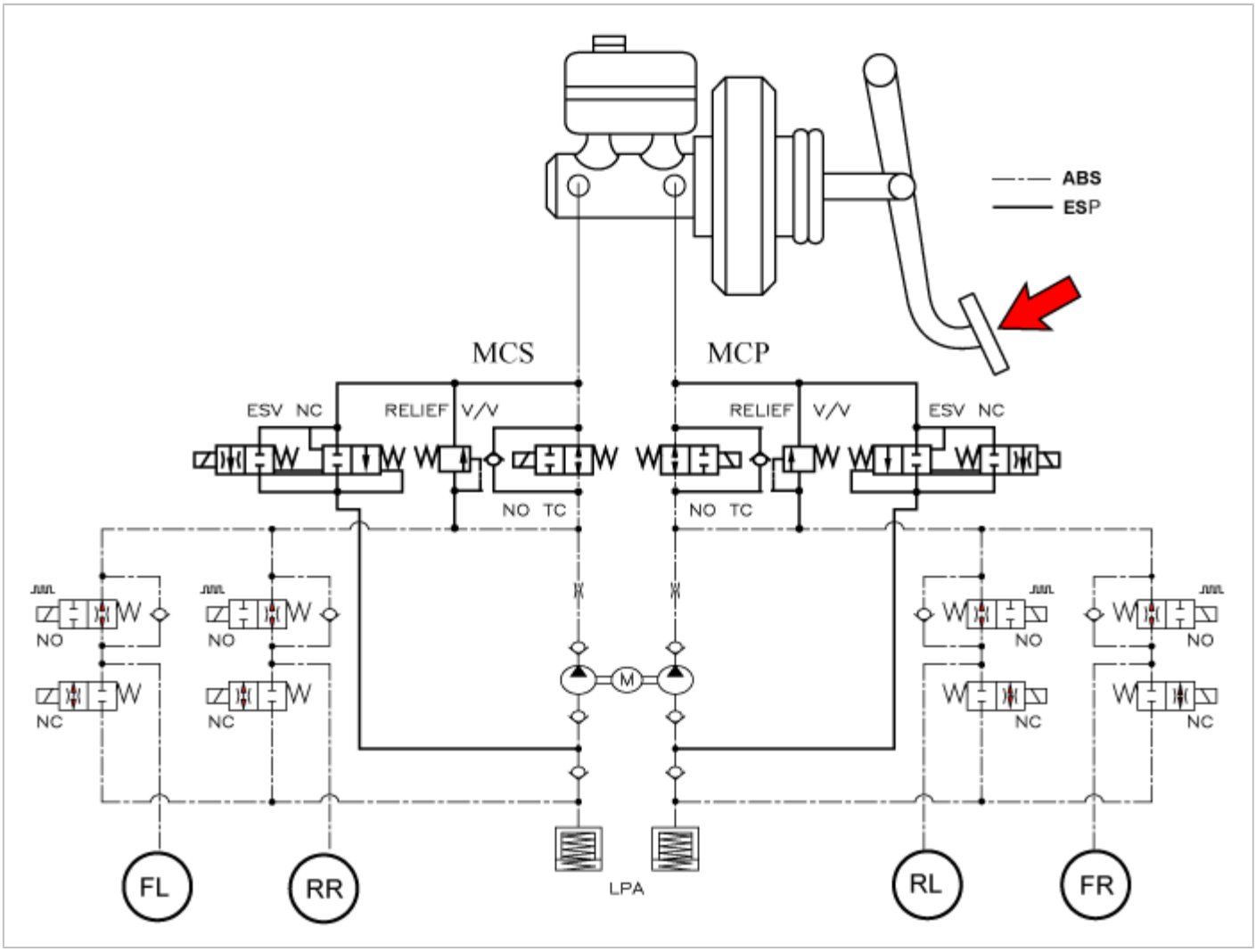
Components



1. HECU module	6. ESP OFF warning lamp
2. Yaw rate & Lateral G sensor	7. Front wheel speed sensor
3. Parking brake/EBD warning lamp	8. Steering angle sensor
4. ABS Warning lamp	9. Rear wheel speed sensor
5. ESP function lamp	

ESP Operation Mode

ESP Hydraulic System Diagram



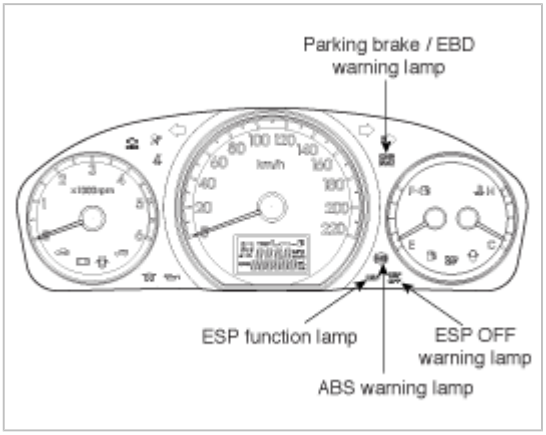
1. ESP Non-operation : Normal braking.

Solenoid valve	Continuity	Valve	Motor pump	TC Valve
IN (NO)	OFF	OPEN	OFF	OFF
OUT (NC)	OFF	CLOSE		

2. ESP operation

Solenoid valve		Continuity	Valve	Motor pump	TC Valve
Understeering (Only inside of rear wheel)	IN(NO)	OFF	OPEN	ON	ON
	OUT (NC)	OFF	CLOSE		
Oversteering	IN(NO)	OFF	OPEN		

(Only outside of front wheel)	OUT (NC)	OFF	CLOSE		



ABS Warning Lamp module

The active ABS warning lamp module indicates the self- test and failure status of the ABS .The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.

EBD/Parking Brake Warning Lamp Module

The active EBD warning lamp module indicates the self- test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shallbe on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.

ESP Warning Lamp (ESP System)

The ESP warning lamp indicates the self-test and failure status of the ESP.
The ESP warning lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESP functions by failure.
- When driver trun off the ESP function by on / off switch.
- During diagnostic mode.

ESP Function Lamp (ESP System)

The ESP function lamp indicates the self-test and operating status of the ESP.

The ESP Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESP control is operating. (Blinking - 2Hz)

ESP On/Off Switch (ESP System)

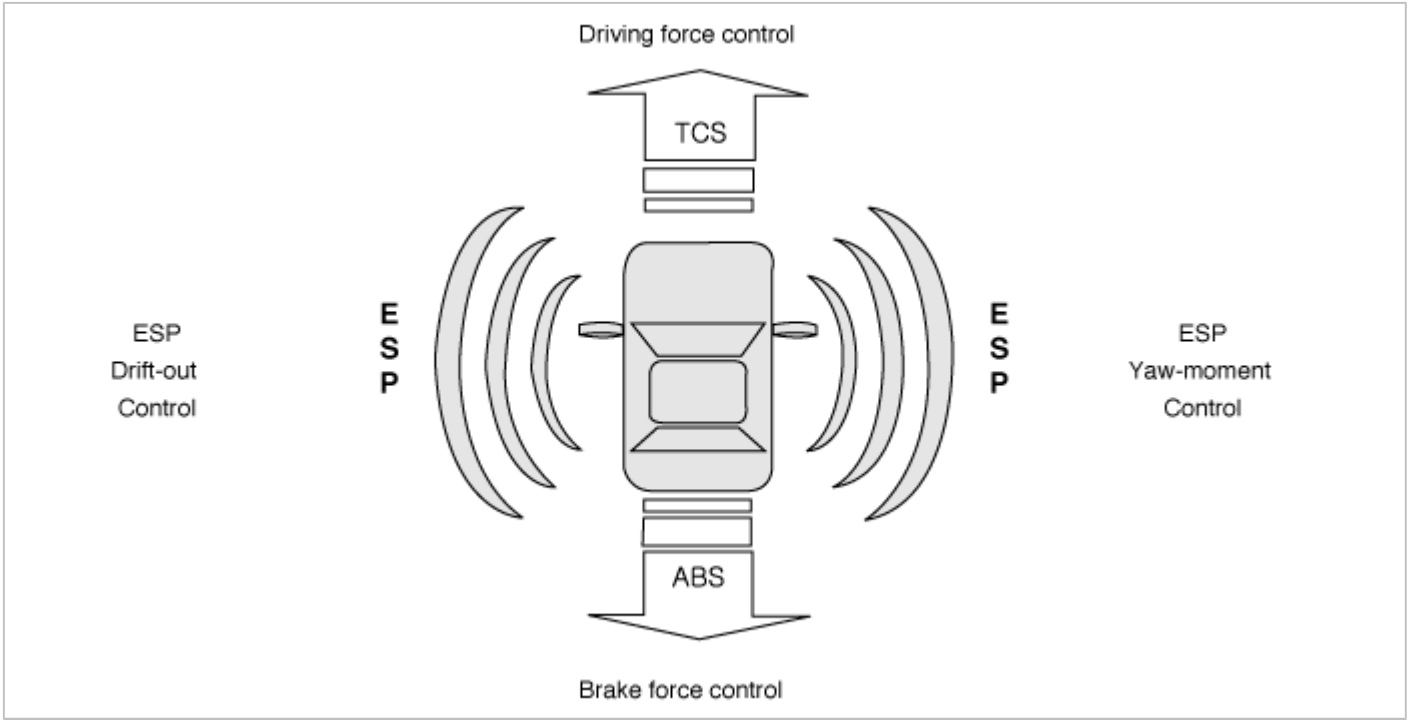
The ESP On/Off Switch shall be used to toggle the ESP function between On/Off states based upon driver input.

The On/Off switch shall be a normally open, momentary contact switch.Closed contacts switch the circuit to ignition.

Initial status of the ESP function is on and switch toggle the state.

Description Of ESP

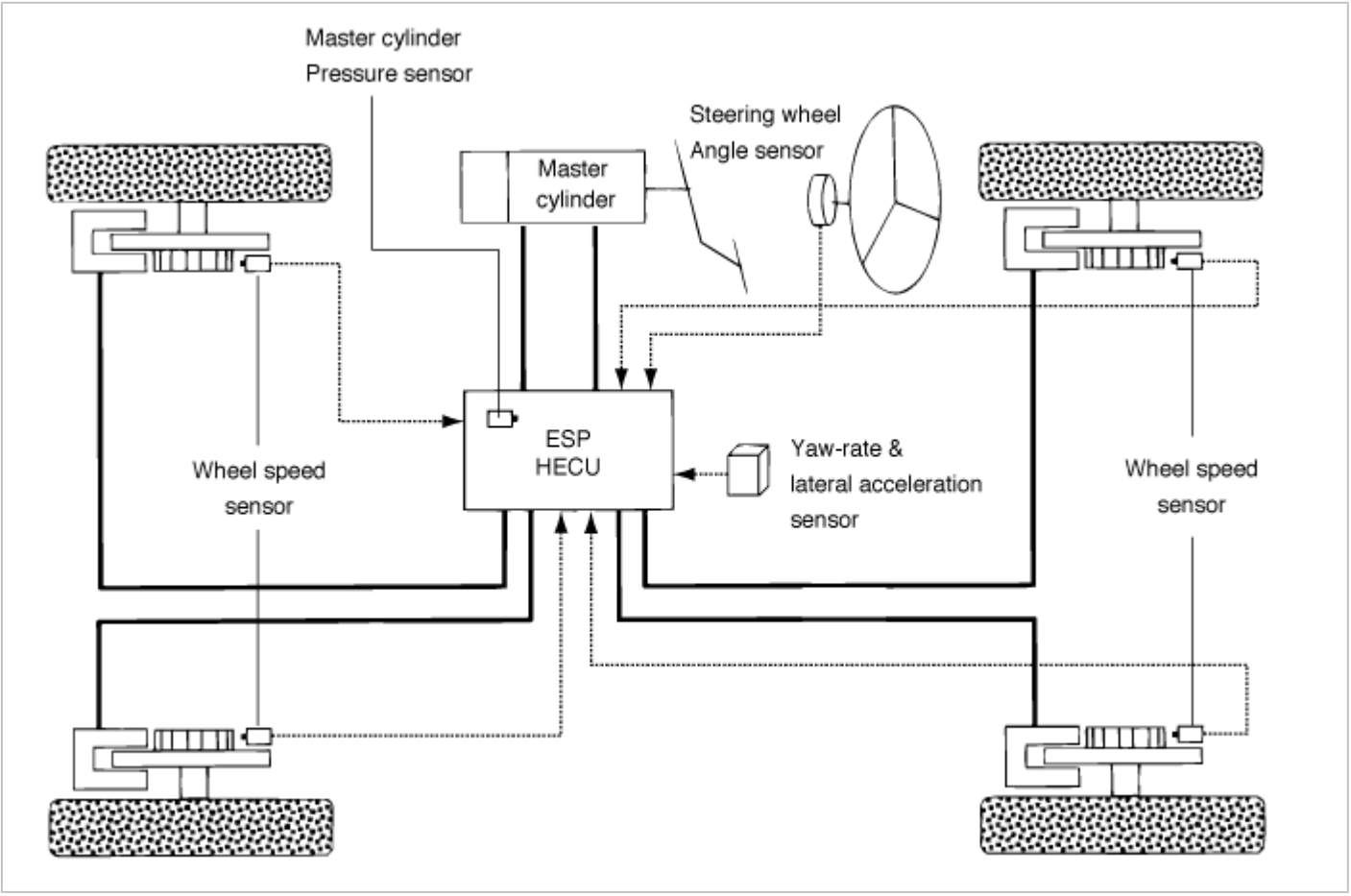
Optimum driving safety now has a name : ESP, the Electronic Stability Program.
ESP recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention.
ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and EDC functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.
ESP essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.
The stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESP function in response to a command by the driver.
In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



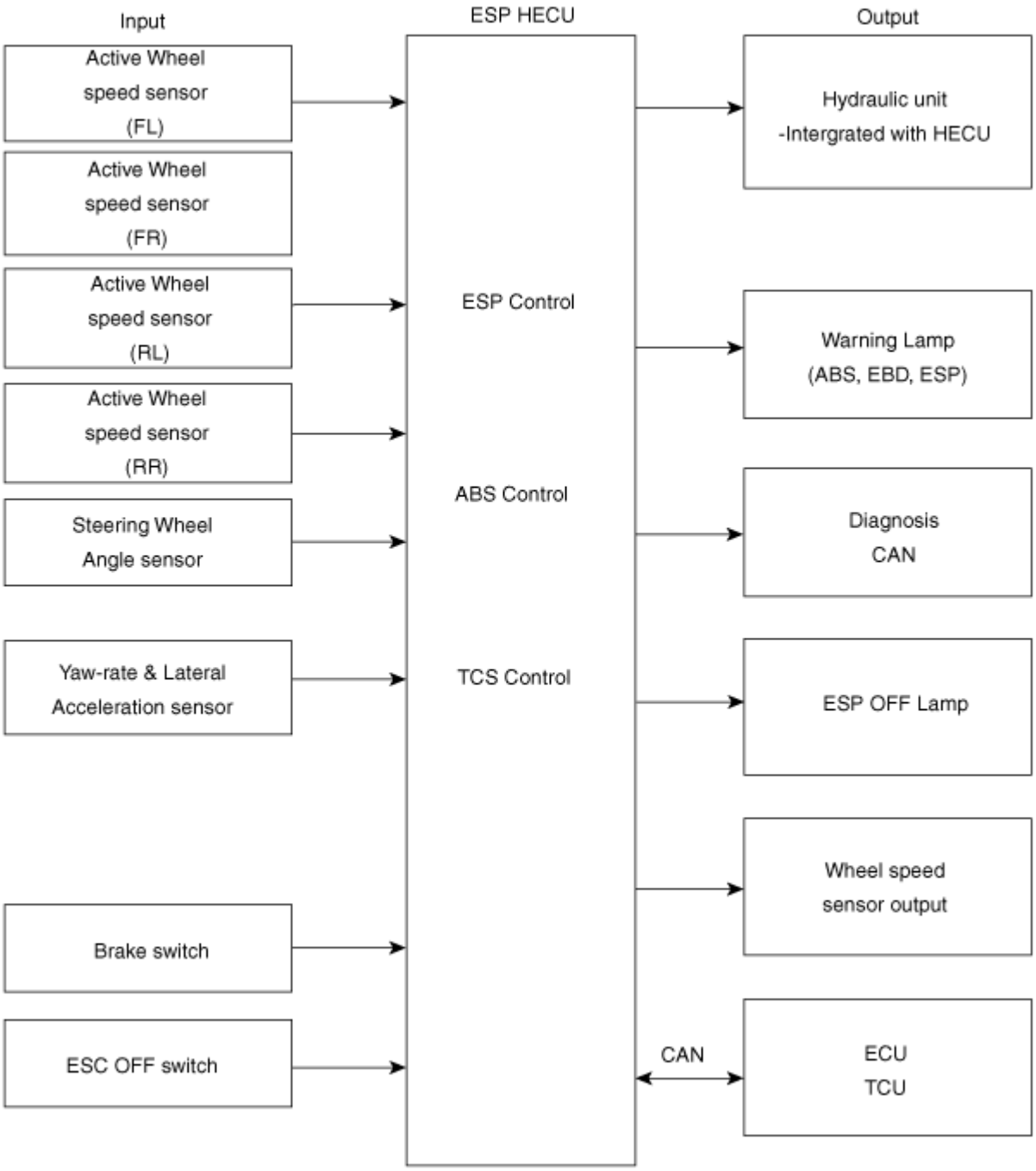
Description Of Esp Control

ESP system includes ABS/EBD, TCS and AYC function.
ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave.By using the input of above signals, the ECU calculates the vehicle speed and the acceleration □ deceleration of the four wheels.And, the ECU judges whether the ABS/EBD should be actuated or not.
TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication.TCS function uses the wheel speed sensor signal to determine the

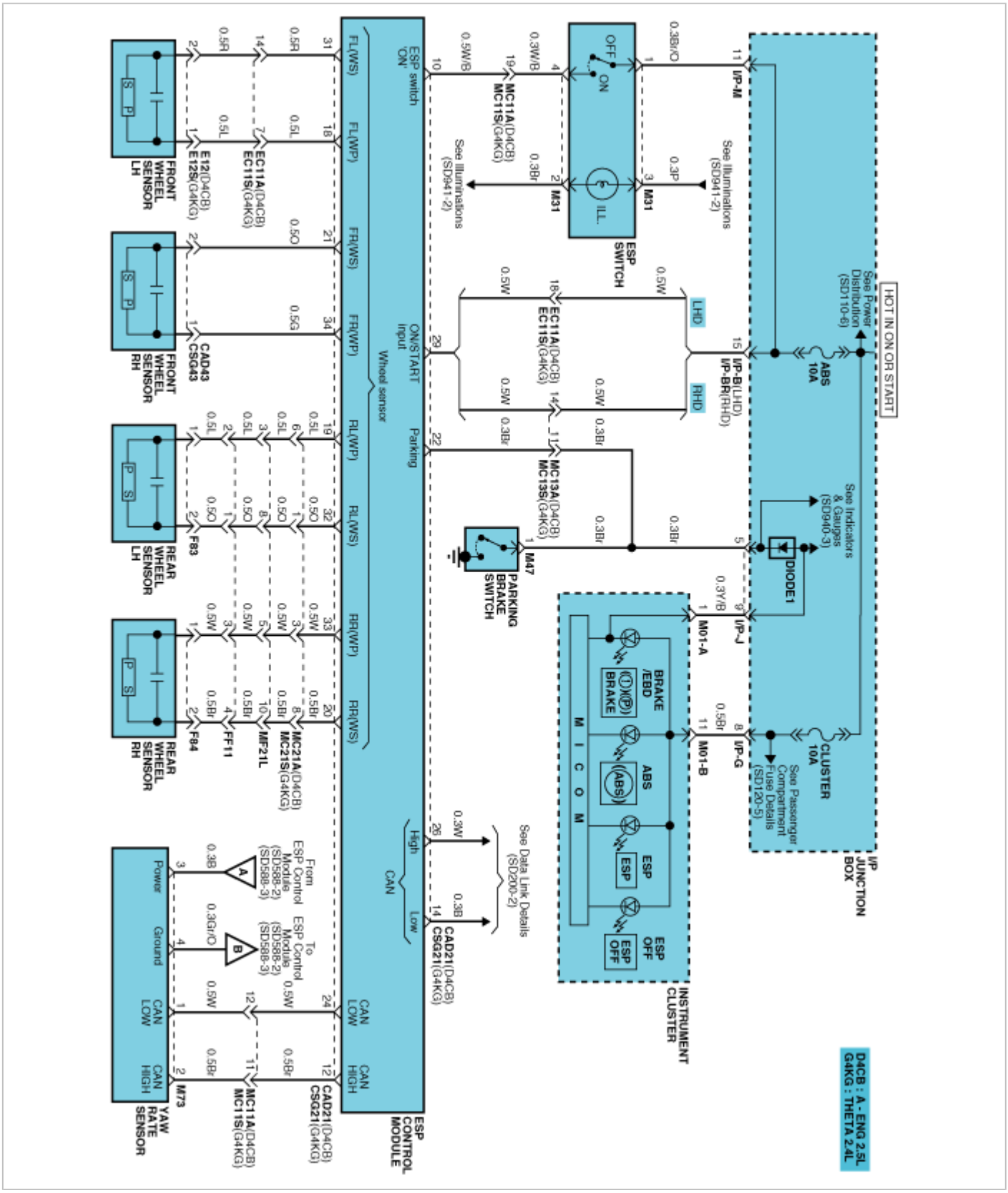
wheel slip as far as ABS function.
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.
After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESP warning lamp. (fail-safe warning)



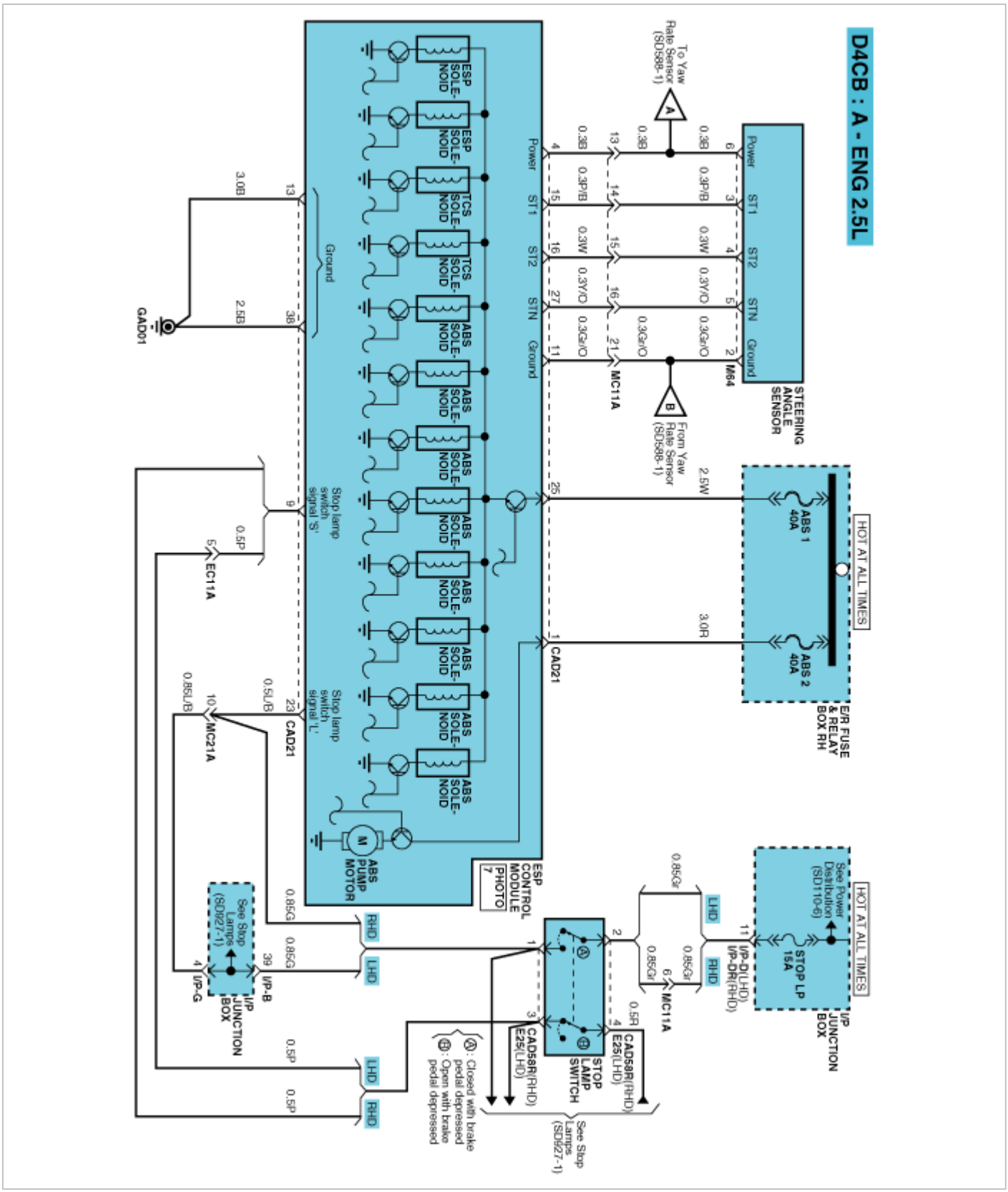
Input And Output Diagram


Input
ESP HECU
Output
Active Wheel speed sensor (FL)
Active Wheel speed sensor (FR)
Active Wheel speed sensor (RL)
Active Wheel speed sensor (RR)
Steering Wheel Angle sensor
Yaw-rate & Lateral Acceleration sensor
Brake switch
ESC OFF switch
ESP Control
ABS Control
TCS Control
Hydraulic unit -Intergrated with HECU
Warning Lamp (ABS, EBD, ESP)
Diagnosis CAN
ESP OFF Lamp
Wheel speed sensor output
CAN
ECU TCU

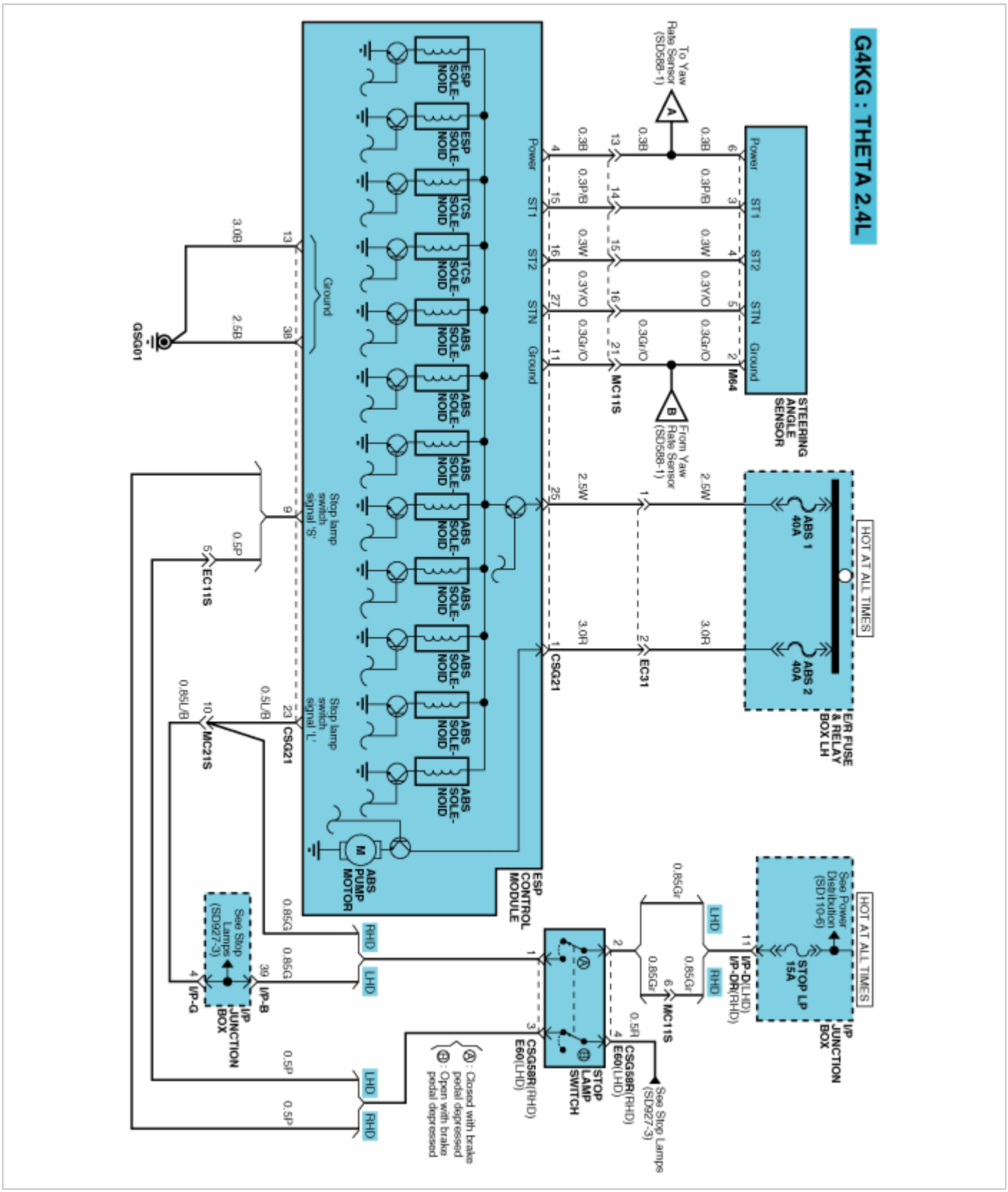
Circuit Diagram - ESP(1)



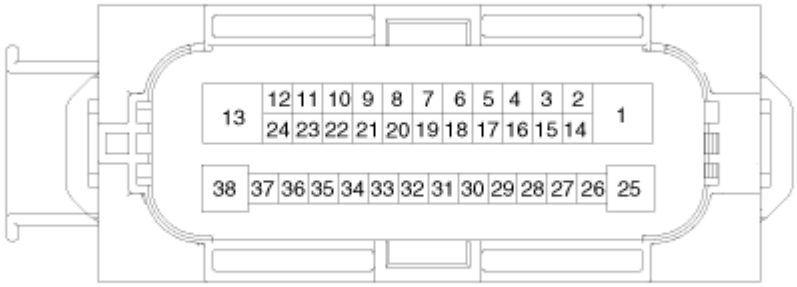
Circuit Diagram - ESP(2)



Circuit Diagram - ESP(3)



ESP Connector Input/Output



Connector Terminal		Specification	Remark
No	Description		
29	IGNITION1(+)	High level of wake up voltage :4.5V < V < 16.0V Low level of wake up voltage : V < 2.4V Max. current : I < 50mA	□
25	POS. BATTERY 1.(SOLENOID)	Over voltage range : 17.0 ± 0.5V Operating voltage range : 10.0 ± 0.5V □ V □ 16.0 ± 0.5V Low voltage range : 7.0 ± 0.5V □ V □ 9.5 ± 0.5V Max. current : I □ 40A Max. leakage current : I < 0.25mA	□
1	POS. BATTERY 2.(MOTOR)	Operating voltage range: 10.0 ± 0.5V □ V □ 16.0 ± 0.5V Rush current : I □ 110A Max. current : I □ 40A Max. leakage current : I □ 0.25mA	□
38	GROUND	Rated current : I □550mA Max. current: I □ 40A	□
13	PUMP MOTOR GROUND	Rush current : I □ 110A Max. current : I □ 40A	□
10	ESP ON/OFF SWITCH	Input voltage (Low) : V < 2V Input voltage (High) : V > 6V Max. Input current : I < 3mA (@12.8V)	□
23	BRAKE LIGHT SWITCH		□
9	BRAKE SWITCH		

11	SENSOR GROUND	Rated current : I □250mA	□
4	SENSOR POWER	Max. current Capability : I □ 250mA Max. voltage : V_BAT1 -0.8V	□
22	PARKING BRAKE SWITCH	Input voltage (Low) : V □ 2V Input voltage (High) : V > 6V Max input current : I □ 5mA (@12.8V)	□
14	CAN BUS LINE(LOW)	Max. Input current : I □ 10mA	□
26	CAN BUS LINE(HIGH)		
18	SENSOR FRONT LEFT POWER	Output voltage : V_BAT1 -0.6V ~ V_BAT1 -1.1V Output current : Max. 30mA	□
34	SENSOR FRONT RIGHT POWER		
19	SENSOR REAR LEFT POWER		
33	SENSOR REAR RIGHT POWER		
31	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH :11.8 ~ 16.8mA Frequency range :1 ~ 2500Hz Input duty : 50 ± 10%	Typ. 7mA Typ. 14mA
21	SENSOR FRONT RIGHT SIGNAL		
32	SENSOR REAR LEFT SIGNAL		
20	SENSOR REAR RIGHT SIGNAL		
12	CAN SENSOR LINE (HIGH)	Max. input current : I □ 10mA	□
24	CAN SENSOR LINE (LOW)		
15	STEERING ANGLE SENSOR PHASE A	Input duty (STG A, STG B) : 50 ± 10% phase Differenoe (STG A, STG B) 2 ± 0.6deg High voltage : 3.0V < VH < 4.1V Low voltage : 1.3V < VL < 2.0V	□
16	STEERING ANGLE SENSOR PHASE B		
27	STEERING ANGLE SENSOR PHASE Z		

Failure Diagnosis

1. In principle, ESP and TCS controls are prohibited in case of ABS failure.
2. When ESP or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESP failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESP is not installed.

Memory Of Fail Code

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as far as the HCU power is on. (X)

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.
4. Initial checkup is made in the following cases.
   (1) When the failure is not detected now
   (2) When ABS and ESP are not in control.
   (3) Initial checkup is not made after ECU power on.
   (4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
   (5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESP control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
   (1) When the power is normal.
   (2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power on.

Countermeasures In Fail

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

Warning Lamp On

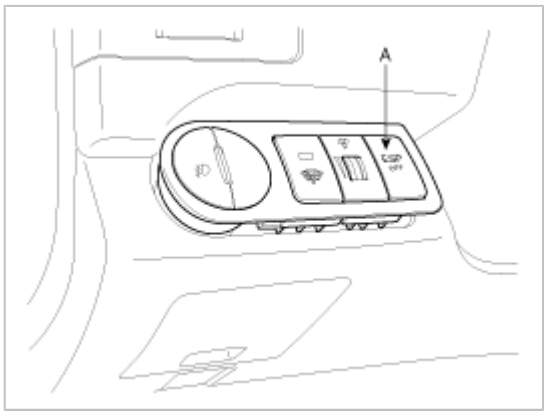
1. ESP operation lamp turn on for 3sec after IGN ON.
2. ESP operation lamp blinks when ESP Act.
3. ESP OFF warning lamp turn on in case of
   A. ESC Switch OFF.
   B. ESC Failure Detect.
   C. 3sec after IGN ON.

Description

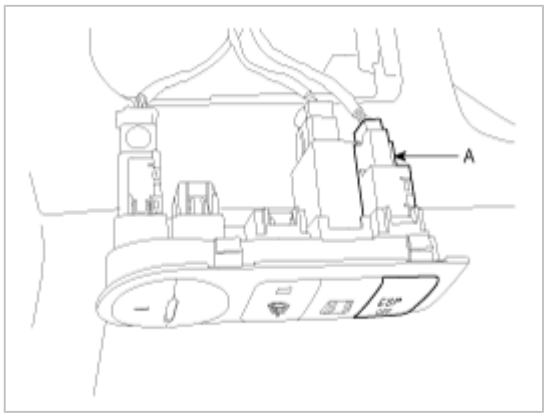
1. The ESP OFF switch is for the user to turn off the ESP system.
2. The ESP OFF lamp is on when ESP OFF switch is engaged.

Inspection

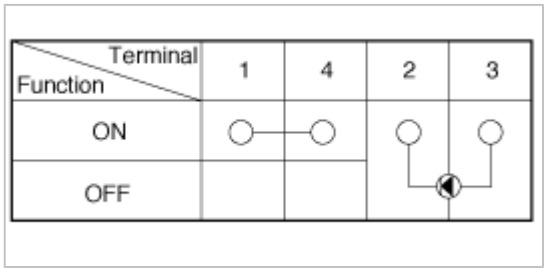
1. Disconnect the nagative (-) battery terminal.
2. Remove the lower side crash pad switch assembly(A) by using the trim remover tool.



3. Disconnect the "ESP OFF" switch connector (A).



4. Check the continuity between the switch terminals as the ESP OFF switch is engaged. (Refer to circuit diagram)

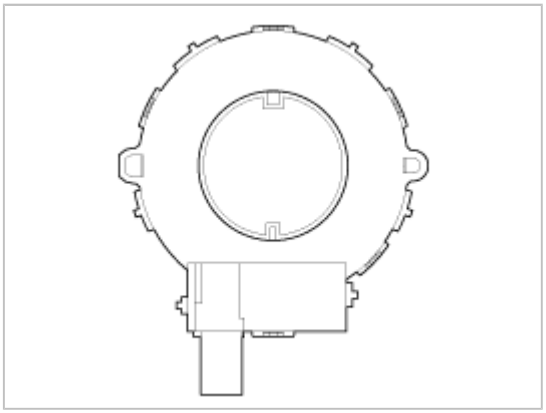


Description

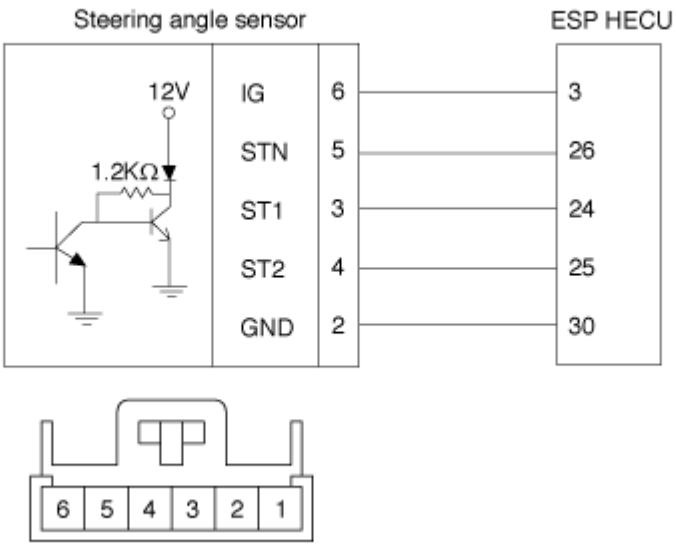
The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.The sensor is detached on the MPS(Mutil-Function Switch) under the steering wheel.

Measureing Principle

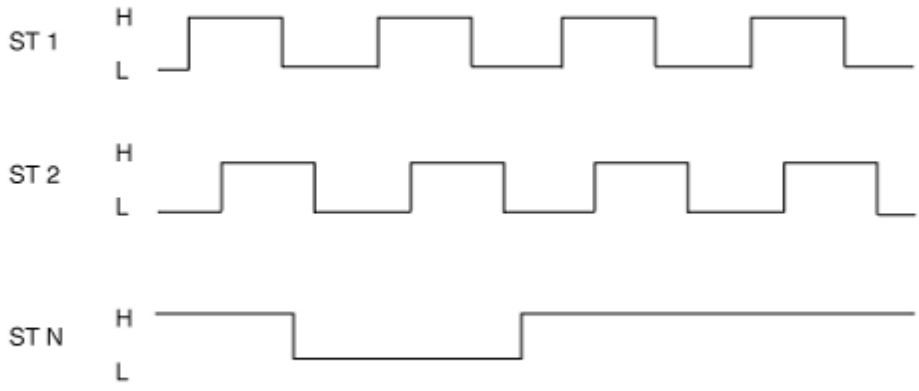
The split of the steering angle sensor detects a steering angle of the steering wheel by a ON/OFF pulse caused by whether or not the LED lights go through the hole of the split, rotating as the steering wheel revolves. There are three LEDs, two(ST1, ST2) for detecting a steering direction, and the other for the neutral position.The HECU calculates the steering angle by the pulse from the steering angle sensor.



Circuit Diagram (Steering Wheel Speed Angle Sensor)



Output Characteristic



No.	INPUT		OUTPUT	Steering direction	Remark
1	ST1	L	L	Right	
	ST2	L	H		
	ST1	L	H	Left	
	ST2	L	L		
	ST1	L	L		

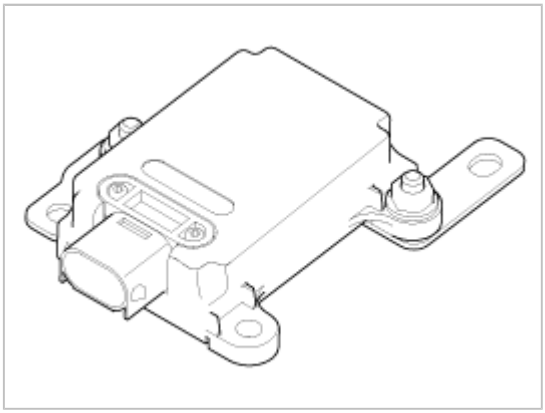
2				Left	
	ST1	H	L		
	ST1	L	H	Right	
	ST2	H	H		
3	ST1	H	H	Left	
	ST2	L	H		
	ST1	H	L	Right	
	ST2	L	L		
4	ST1	H	H	Right	
	ST2	H	L		
	ST1	H	L	Left	
	ST2	H	H		

Specification

Description	Specification
Operating voltage	9 ~ 16V
Operating temperature	-30 ~ 75□
Current consumption	Max.100mA
Steering angle velocity	Max. ± 1500°/sec
Voltage(high)	3.0V ~ 4.1V
Voltage(low)	1.3V ~ 2.0V
Pulse duty	40 ~ 60%

Description

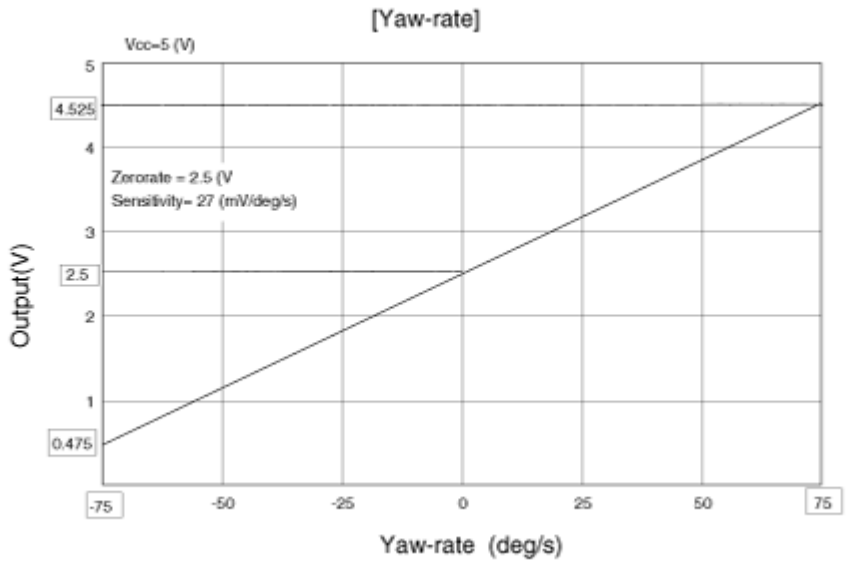
When the vehicle is turning with respect to a vertical axis the yaw rate sensor detects the yaw rate electroniclly by the vibration change of plate fork inside the yaw rate sensor.
If yaw velocity reaches the specific velocity after it detects the vehicle□yawing, the ESP control is reactivated.
The later G sensor senses vehicle□s lateral G. A small element inside the sensor is attached to a deflectable leverarm by later G.
Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G.
The sensor is located in the front passenger seat lower floor on vehicle.

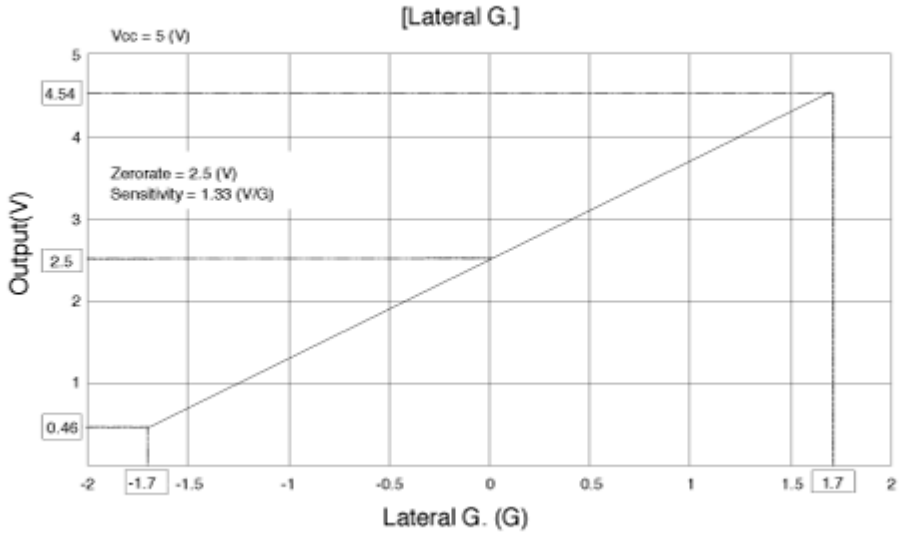


Specifications

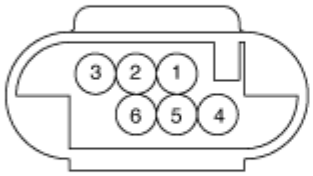
Description		Specification	Remarks
Operating voltage		8 ~ 17V	
Current consumption		Max. 140mA	
Operating temperature		-40 ~ 85℃	
Yaw-rate sensor	Measurement range	-75 ~ 75°/sec	
	Frequency response	18 ~ 22Hz	
Lateral G sensor	Measurement range	-14.715 ~ +14.715m/s²	
	Frequency response	50Hz±60%	

Output Characteristic

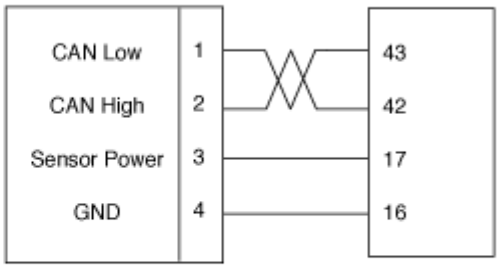




External Diagram

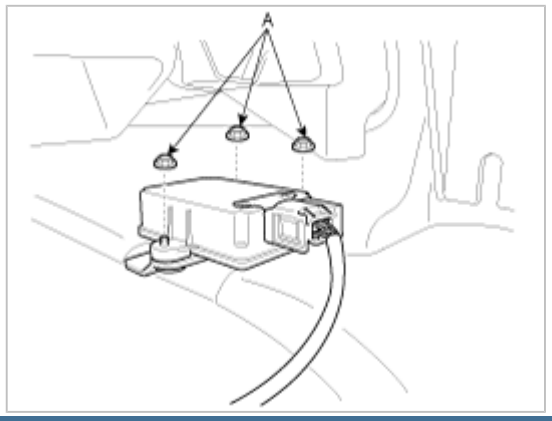


[Yaw-rate & Lateral G sensor's connector]



Removal

1. Remove the floor console. (refer to BD- "console")
2. Disconnect the yaw rate □ lateral G sensor connector.
3. Remove the mounting bolts(A).



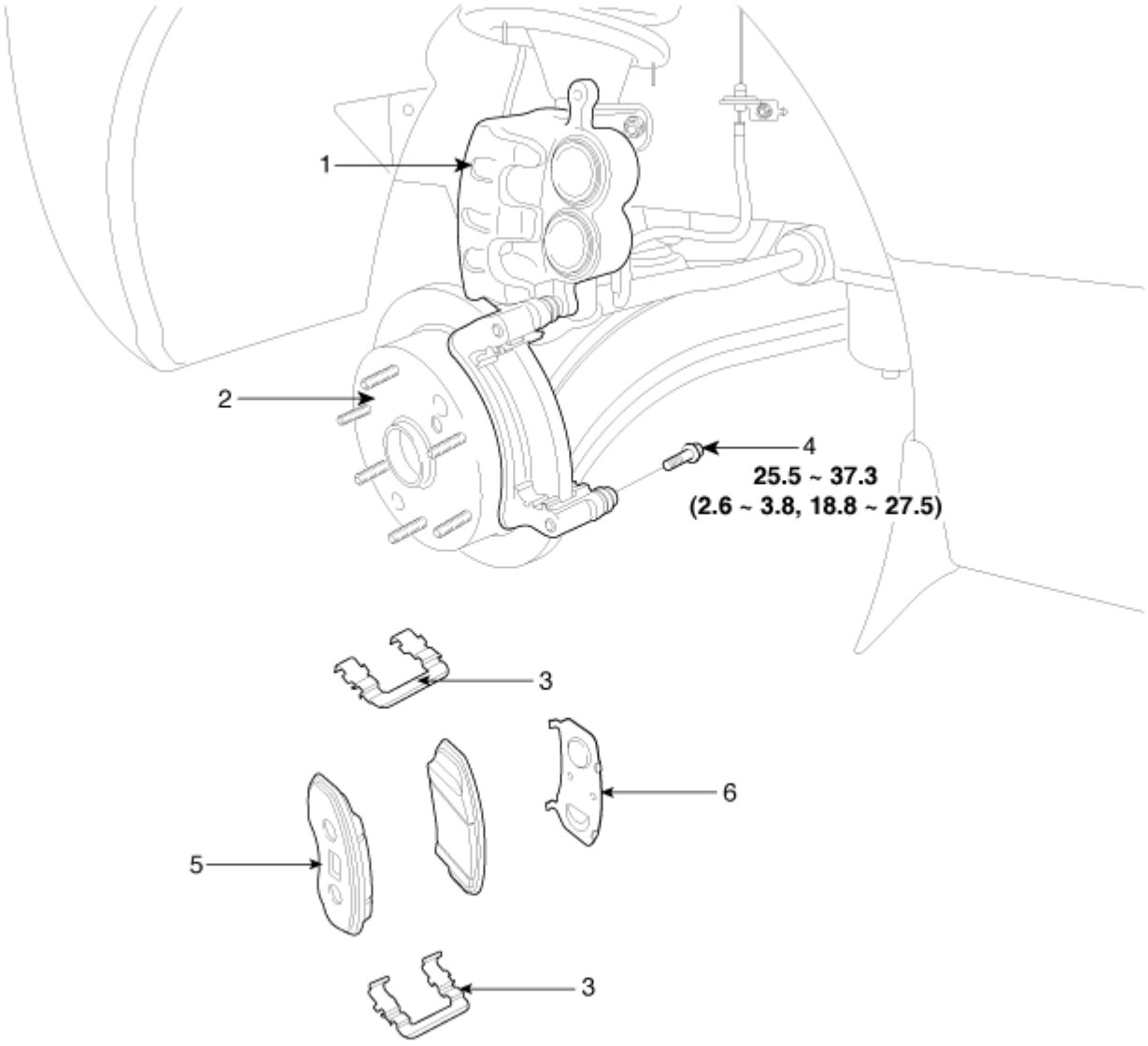
Installation

1. Connect the yaw rate & lateral G sensor connector.
2. Install the mounting bolts.

Tightening torque :
7.8 ~ 10.8N.m (0.8 ~ 1.1kgf.m. 5.8 ~ 8.0lb-ft)

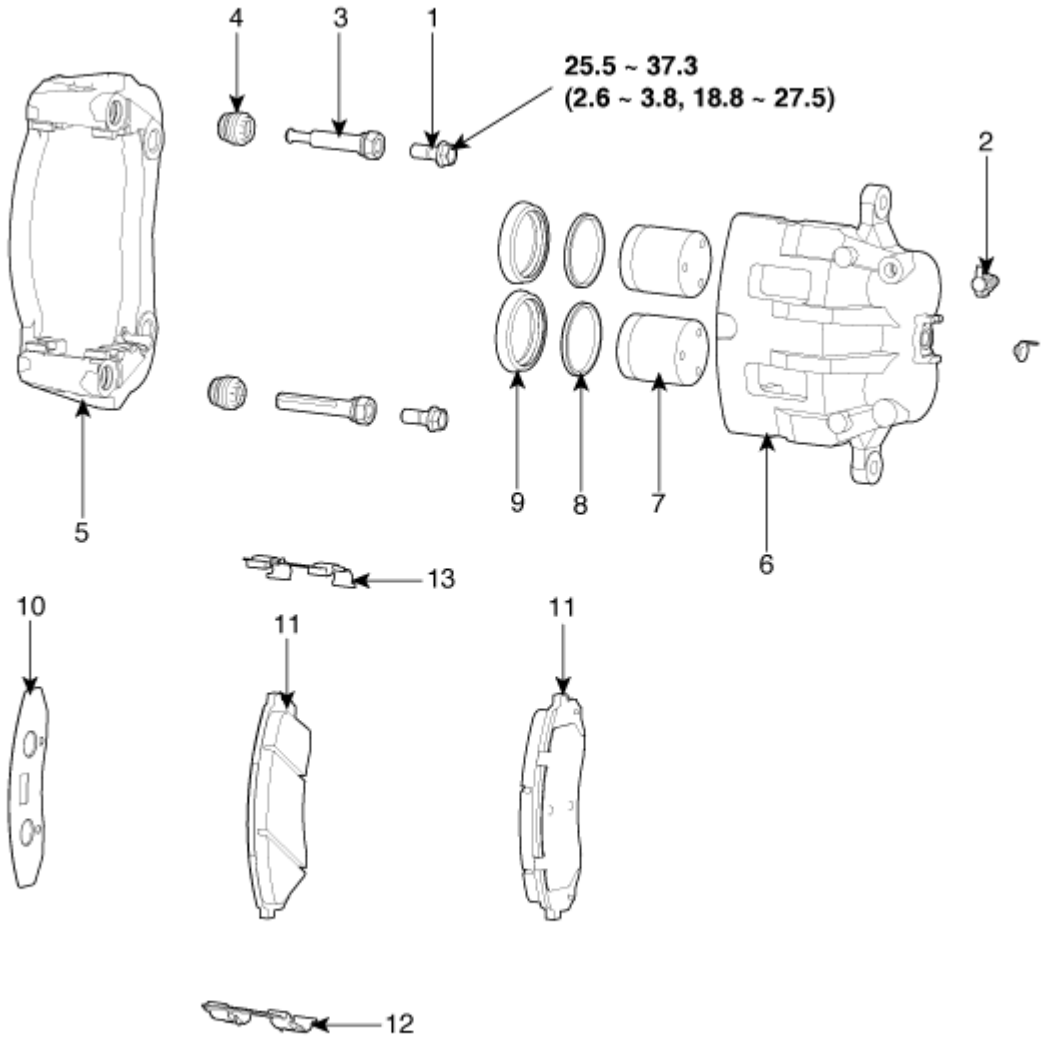
3. Install the floor console.

Components



TORQUE : N.m (Kgf.m, lb-ft)

1. Brake caliper assembly	4. Guide rod bolt
2. Brake disc	5. Brake pad
3. Pad retainer	6. Pad shim



TORQUE : N.m (Kgf.m, lb-ft)

1. Guide rod bolt	7. Piston
2. Bleed screw	8. Piston seal
3. Guide rod	9. Piston boot
4. Boot	10. Inner pad shim
5. Caliper bracket	11. Brake pad
6. Caliper body	12. Pad retainer

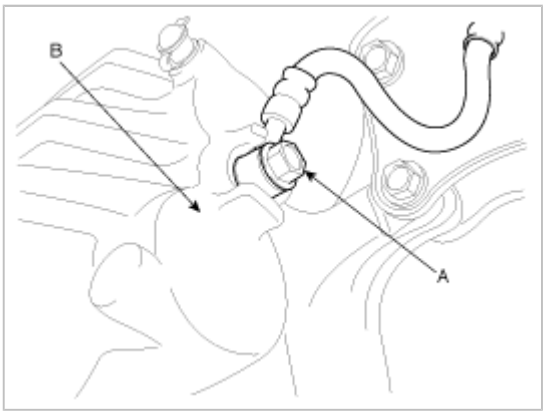
Removal

1. Remove the front wheel □ tire.

Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

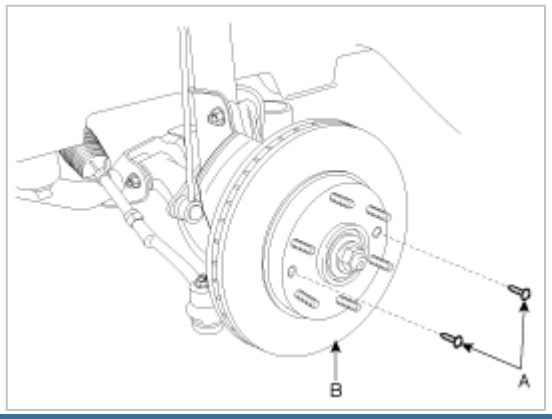
2. Loosen the hose eye-bolt (A) and caliper mounting bolts, then remove the front caliper assembly (B).

Tightening torque :
Brake hose to caliper:
16.7 ~ 19.6N.m (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)
Caliper assembly to knuckle:
98.0 ~ 117.8N.m (10.0 ~ 12.0kgf.m, 72.3 ~ 86.8lb-ft)



3. Remove the front brake disc by loosening the screws (A).

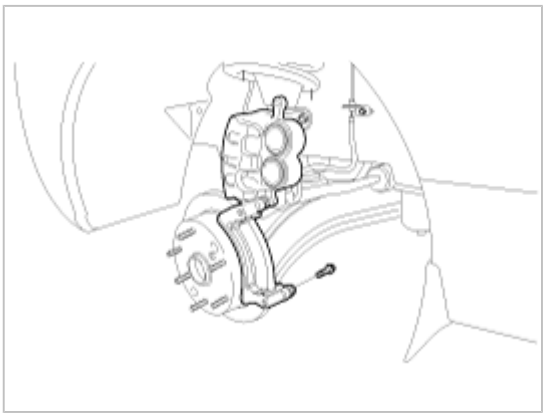
Tightening torque :
4.9 ~ 5.9N.m (0.5 ~ 0.6kgf.m, 3.6 ~ 4.3lb-ft)



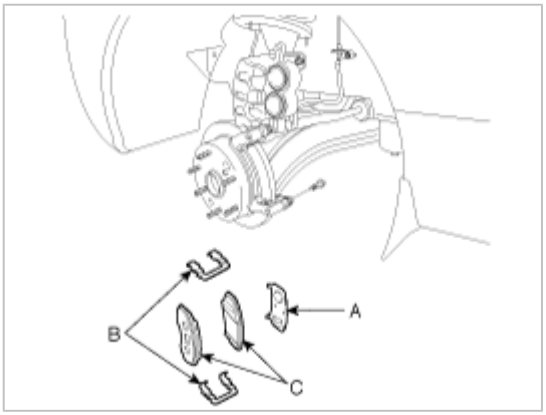
Replacement

Front Brake Pads

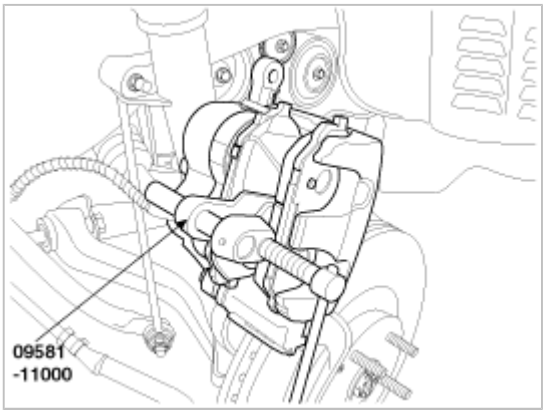
1. Loosen the guide rod bolt and pivot the caliper up out of the way.



2. Replace shims (A), pad retainers (B), and brake pads (C).



3. Push the piston in the cylinder using a SST (09581- 11000)



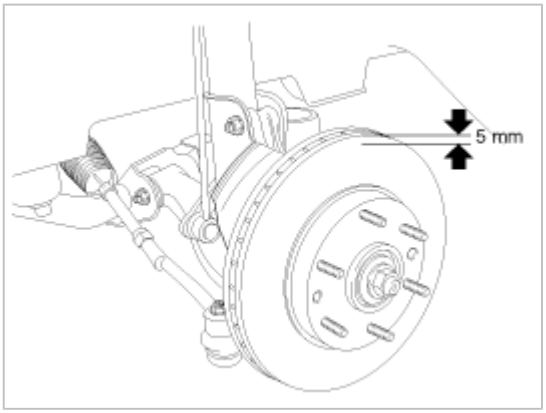
4. Pivot the caliper down and tighten the guide rod bolt.

Tightening torque :
25.5 ~ 37.3N.m (2.6 ~ 3.8kgf.m, 18.8 ~ 27.5lb-ft)

Inspection

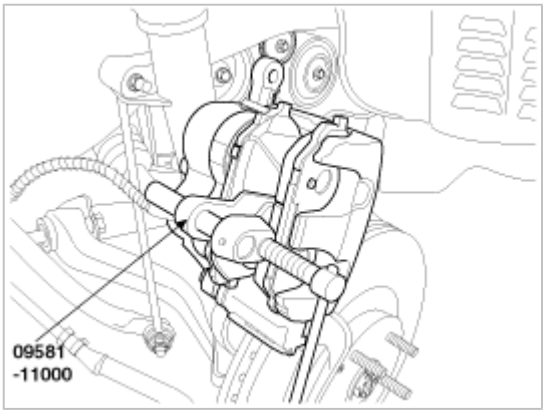
1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Check the thickness of the brake disc and run-out using a micrometer and a dial gauge on the part dotted line in the illustration below.

Brake disc thickness
Standard: 30mm (1.18in)
Service limit: 28.4mm (1.12in)
Deviation: Less than 0.01mm (0.00039in)
Run-out
Standard: 0.03mm (0.00118in) or less



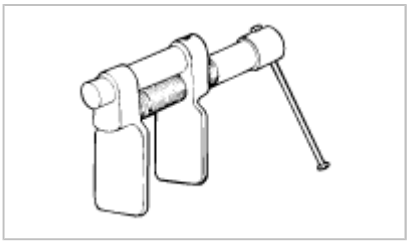
Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.



3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Special Service Tools

Tool(Number and Name)	Illustration	Use
09581-11000 Piston expander		Spreading the front disc brake piston

Specifications

Item		Specification
Master cylinder	Type	Tandem
	Cylinder I.D.	26.99mm (1.063in)
	Piston stroke	30mm (1.18in)
	Fluid level switch	Provided
Brake booster	Type	9" + 10" Tandem
	Boosting ratio	9 : 1
Front brake	Type	Ventilated disc
	Disc O.D.	300mm (11.81in)
	Disc thickness	30mm (1.18in)
	Caliper piston	Double
Rear brake (Disc)	Type	Solid disc
	Disc O.D.	324mm (12.76in)
	Disc thickness	18mm (0.71in)
	Caliper piston	Single
Rear brake (Drum)	Type	Leading trailing drum
	Drum O.D.	295.0mm (11.61in)
	Brake lining thickness	4.8mm (0.19in)
	Clearance adjustment	Automatic
Parking brake	Type	DIH (Drum in hat)
	Drum I.D.	210mm (8.27in)
Brake fluid		DOT 3 or DOT 4

O.D. : Outer Diameter
I.D : Inner Diameter

Specification (ABS)

Part	Item	Standard value	Remark
	System	4 Channel 4 Sensor (Solenoid)	

HECU	Type	ABS + EBD	
	Operating Voltage	10 ~ 16V	
	Operating Temperature	-25 ~ 120℃	
	Motor power	270W	
Warning lamp	Min. Operating Voltage	12V	
	Max. Current consumption	200mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 20V	
	Output current low	5.9 ~ 8.4mA	Typ. 7mA
	Output current high	11.8 ~ 16.8mA	Typ. 14mA
	Output range	1 ~ 2500Hz	
	Tone wheel	52teeth	
	Air gap	TBD	

Specification(ESP)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	Total control (ABS, EBD, TCS, ESP)
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-25 ~ 120 ℃	
	Motor power	270 W	
Warning lamp	Min. Operating Voltage	12 V	
	Max. Current consumption	200 mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 20 V	
	Output current low	5.9 ~ 8.4 mA	Typ. 7 mA
	Output current high	11.8 ~ 16.8 mA	Typ. 14 mA
	Output range	1 ~ 2000 Hz	
	Tone wheel	52 teeth	
	Air gap	TBD	

Steering Wheel Angle Sensor	Operating Voltage	9 ~ 16 V	
	Output Voltage (High)	3.0 V ~ 4.1 V	
	Output Voltage (Low)	1.3 V ~ 2.0 V	
	Operating Angular velocity	Max. 1500 °/sec	
Yaw rate □ Lateral G sensor (CAN TYPE)	Operating Voltage	8 V ~ 17 V	
	Current Consumption	Max. 140 mA	
	Yaw rate sensor measurement range	± 75 °/sec	
	Lateral G sensor measurement range	± 1.5 g	

Service Standard

Items	Standard vale
Brake pedal height	146.8mm (5.78in)
Brake pedal stroke	140.0mm (5.51in)
Stop lamp clearance	1.0 ~ 2.0mm (0.04 ~ 0.08in)
Brake pedal free play	3 ~ 8mm (0.12 ~ 0.31in)
Front brake disc thickness	30mm (1.18in)
Front brake disc pad thickness	10.5mm (0.41in)
Rear brake disc thickness	18mm (0.71in)
Rear brake disc pad thickness	10mm (0.35in)
Rear brake lining thickness	4.8mm (0.19in)

Tightening Torques

Items	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Master cylinder to brake booster	9.8 ~ 15.7	1.0 ~ 1.6	7.2 ~ 11.6
Brake booster mounting nuts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Air bleeding screw	6.7 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube flare nuts	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Front caliper guide rod bolts	25.5 ~ 37.3	2.6 ~ 3.8	18.8 ~ 27.5

Rear caliper guide rod bolts	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Front caliper mounting bolt	98.0 ~ 117.8	10.0 ~ 12.0	72.3 ~ 86.8
Rear caliper mounting bolt	73.5 ~ 83.4	7.5 ~ 8.5	54.2 ~ 61.5
Brake hose to caliper	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Brake pedal member bracket bolts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake pedal shaft nut	24.5 ~ 34.3	2.5 ~ 3.5	18.1 ~ 25.3
Stop lamp switch lock nut	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.0 ~ 8.0
HECU bracket mounting bolt and nut	10.8 ~ 13.7	1.1 ~ 1.4	8.0 ~ 10.1
HECU bracket bolt	5.9 ~ 9.8	0.6 ~ 1.0	4.3 ~ 7.2
Yaw rate □ G sensor mounting bolts	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0

Lublicants

Items	Recommended	Quantity
Brake pedal bushing and bolt	Chassis grease	As required
Parking brake shoe and backing plate contacting surface	Heat resistance grease	As required
Caliper guide rod and boot	AI-11P	0.8 ~ 2.0 g (Front) 0.7 ~ 1.5 g (Rear)

Troubleshooting

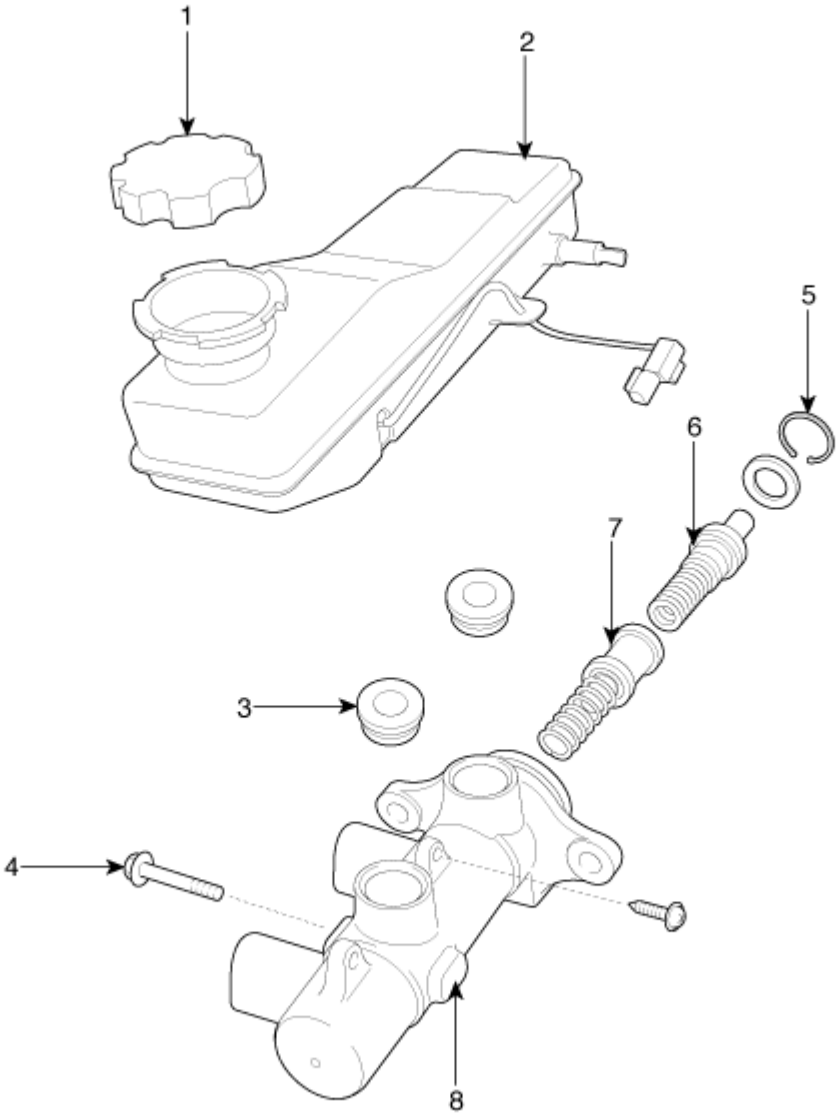
Problem Symptoms Table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the like cause of the problem. Check each part in order. If necessary, Replace these parts.

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance(Out of adjustment) 5. Master cylinder (Inoperative)	repair air·bleed replace adjust replace
Brake drag	1. Brake pedal freeplay (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Rear brake shoe clearance(Out of adjustment) 5. Pad or lining (Cracked or distorted) 6. Piston (Stuck) 7. Piston (Frozen) 8. Anchor or Return spring (Inoperative) 9. Booster system (Vacuum leaks) 10. Master cylinder (Inoperative)	adjust adjust repair adjust replace replace replace replace repair replace
Brake pull	1. Piston (Sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted)	replace replace replace replace replace
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	repair air·bleed replace replace adjust adjust replace replace repair
Noise from brake	1. Pad or lining (Cracked or distorted)	replace

	2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	adjust replace replace clean replace replace replace replace
Brake fades	1. master cylinder	replace
Brake vibration, pulsation	1. brake booster 2. pedal free play 3. master cylinder 4. caliper 5. master cylinder cap seal 6. damaged brake lines	replace adjust replace replace replace replace
Brake Chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

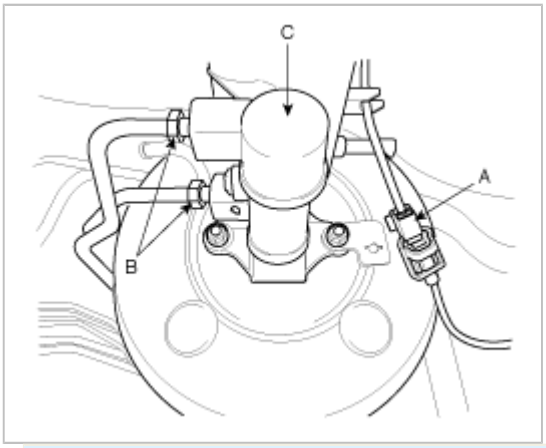
Components



1. Reservoir cap	5. Retainer
2. Reservoir	6. Primary piston assembly
3. Grommet	7. Secondary piston assembly
4. Cylinder pin	8. Master cylinder body

Removal

1. Disconnect the brake fluid level switch connector (A) from the reservoir.



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

2. Disconnect the brake tube (B) from the master cylinder (C) by loosening the tube flare nut.

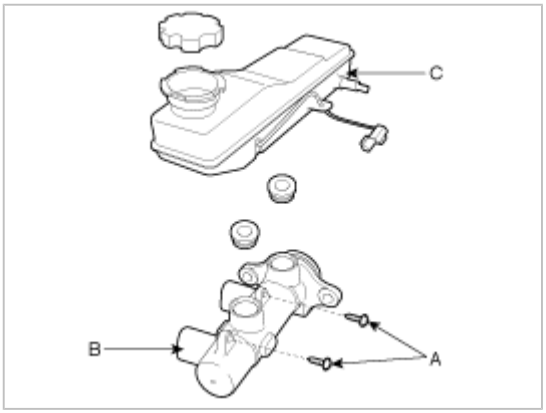
Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)

3. Remove the master cylinder (C) from the brake booster after loosening the mounting nuts.

Tightening torque Nm :
9.8 ~ 15.7N.m (1.0 ~ 1.6kgf.m, 7.2 ~ 11.6lb-ft)

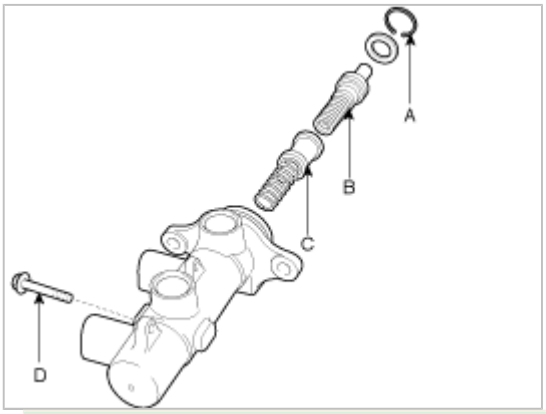
Disassembly

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the fluid level sensor.
3. Remove the reservoir (C) from the master cylinder (B), after remove mounting screw (A).



4. Remove the retainer ring (A) by using the snap ring pliers.

5. Remove the primary piston assembly (B).
6. Remove the pin (D) with the secondary piston (C) pushed completely using a screwdriver. Remove the secondary piston assembly (C).



Do not disassemble the primary and secondary piston assembly.

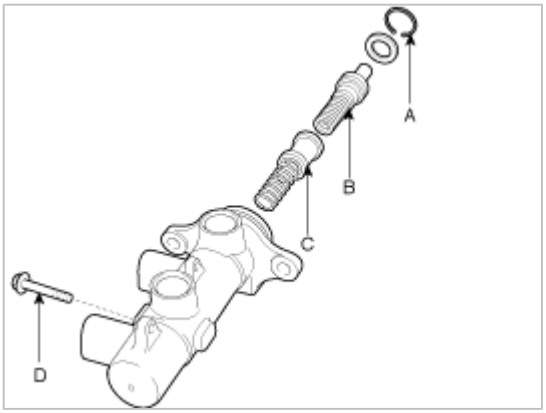
Inspection

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

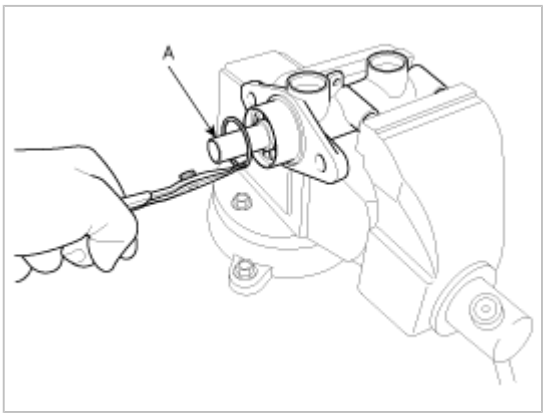
- If the cylinder bore is damaged, replace the master cylinder assembly.
- Wash the contaminated parts in alcohol.

Reassembly

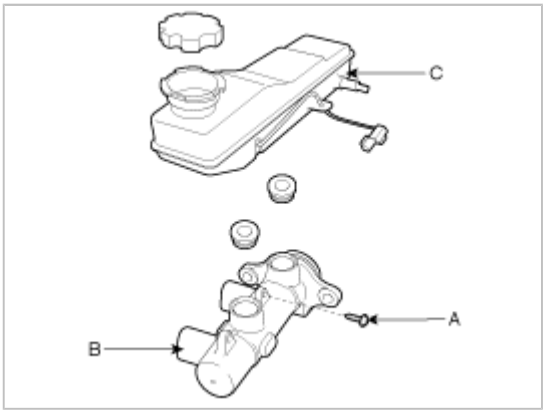
1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.
2. Carefully insert the springs and pistons in the proper direction.
3. Press the secondary piston (C) with a screwdriver and install the cylinder pin (D).



4. Install the retainer ring (A) after installing primary piston assembly.



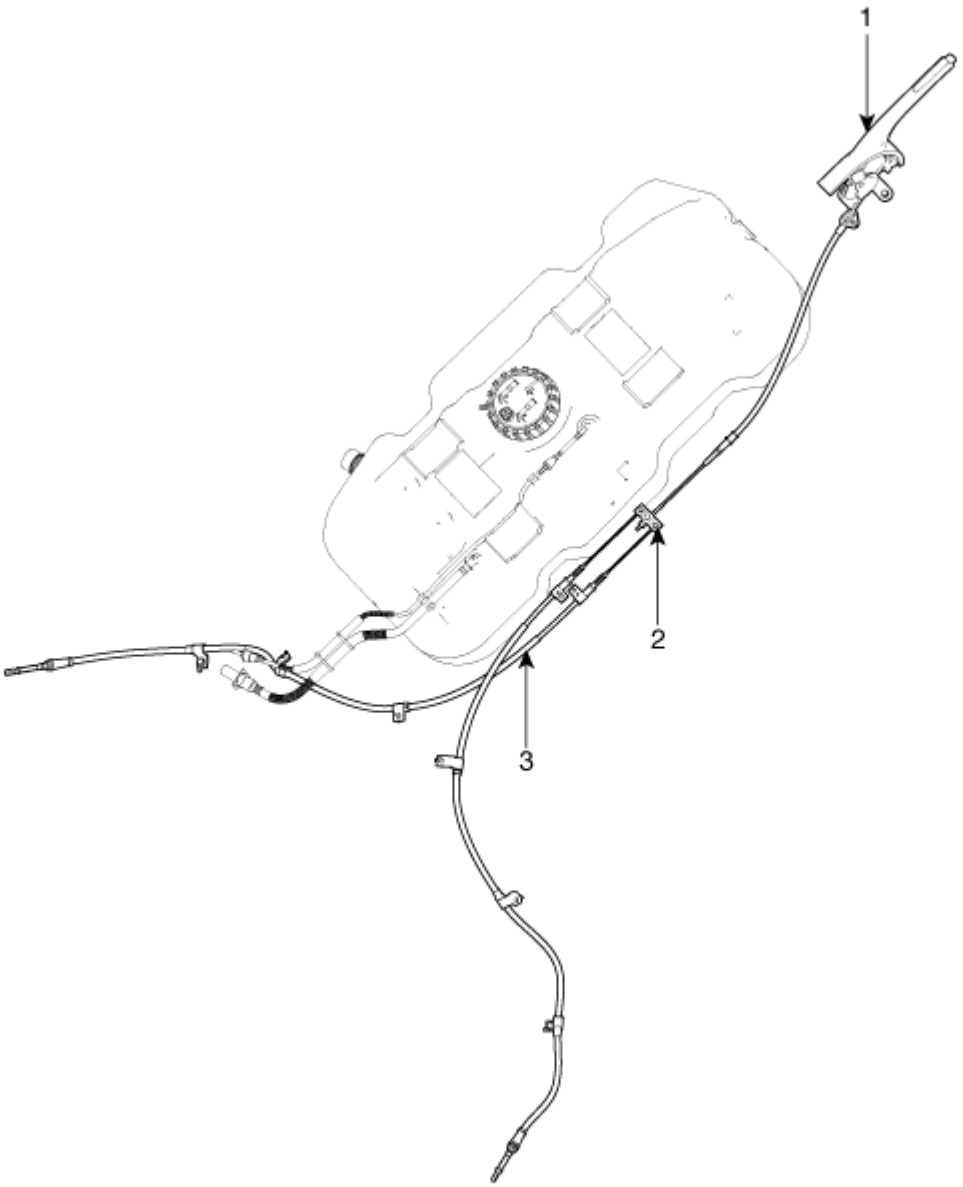
5. Mount two grommets.
6. Install the reservoir (C) on the cylinder (B), and then install the mounting screw (A).



Installation

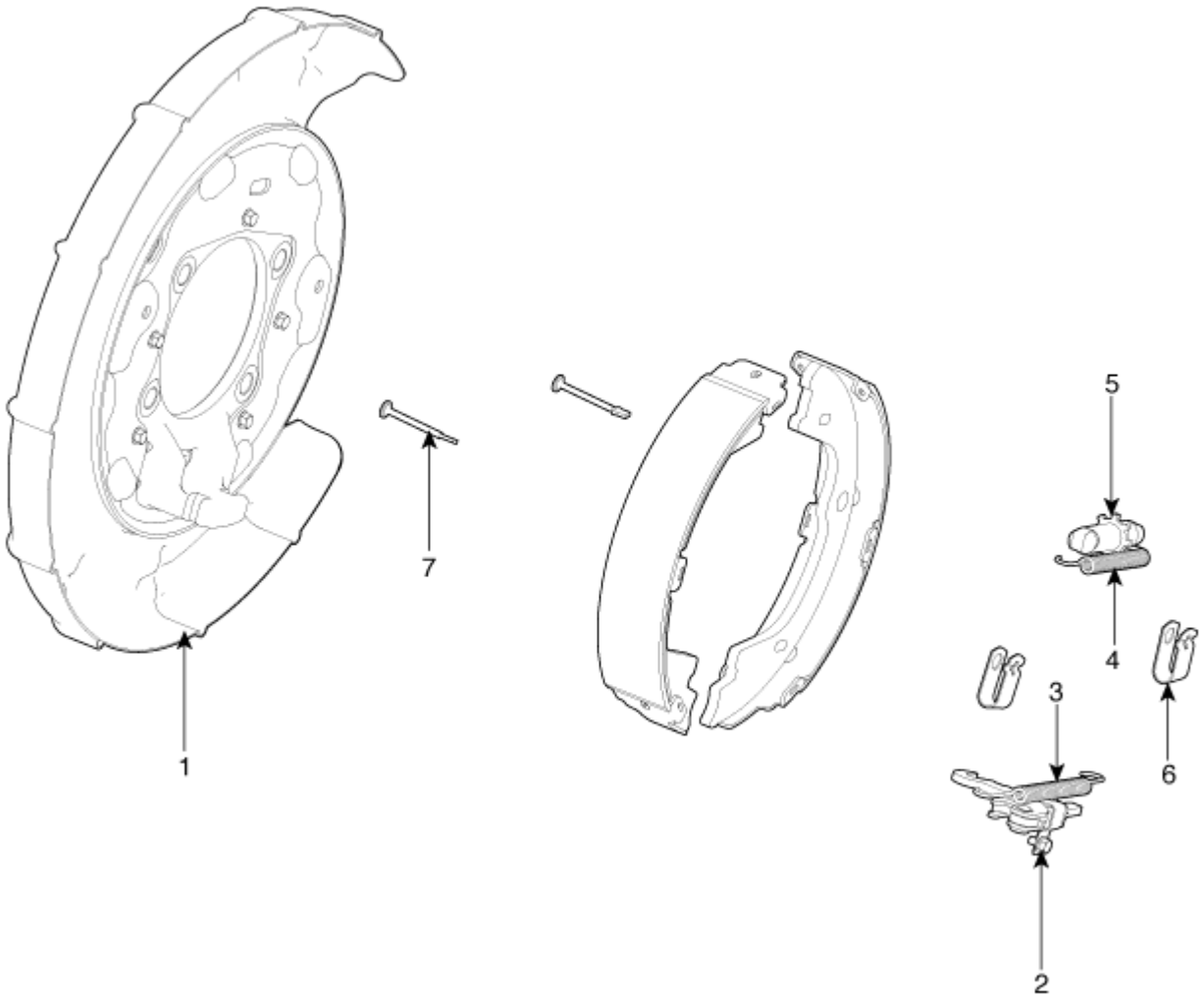
1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to Brake system bleeding)

Components Location



1. Parking brake lever 2. Equalizer assembly	3. Parking brake cable

Component



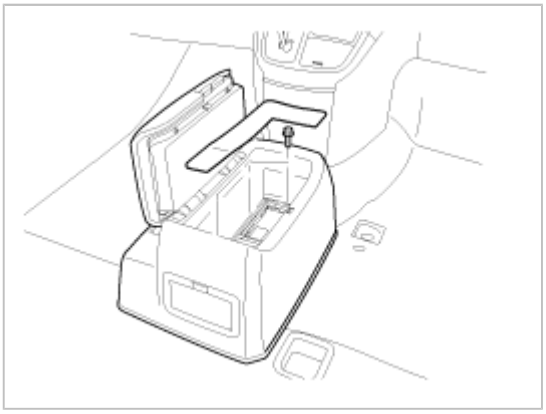
1. Backing plate 2. Operating lever 3. Upper spring 4. Lower spring	5. Adjuster 6. Shoe hold down spring 7. Shoe hold down pin

Installation

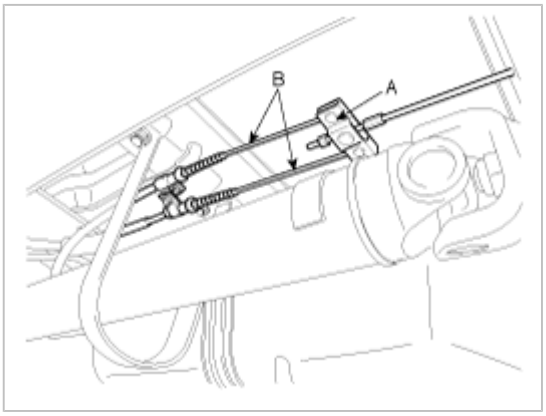
1. Installation is the reverse of removal.
2. After installation, adjust the parking brake.

Removal

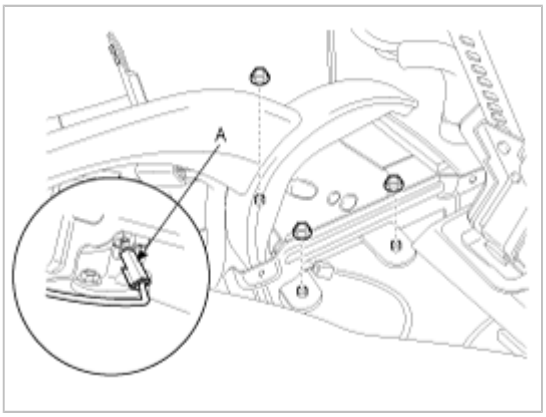
1. Release the parking brake lever thoroughly.
2. Remove the center console. (Refer to Body group. - "Center console")



3. Disconnect the parking brake cable (B) from the equalizer assembly (A).



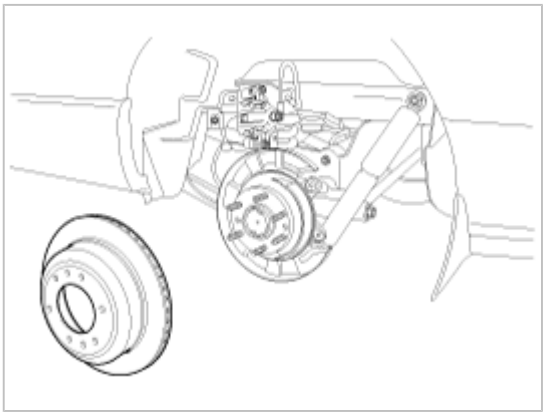
4. Disconnect the parking brake switch connector (A). Remove the parking brake lever assembly by loosening the mounting nuts(B).



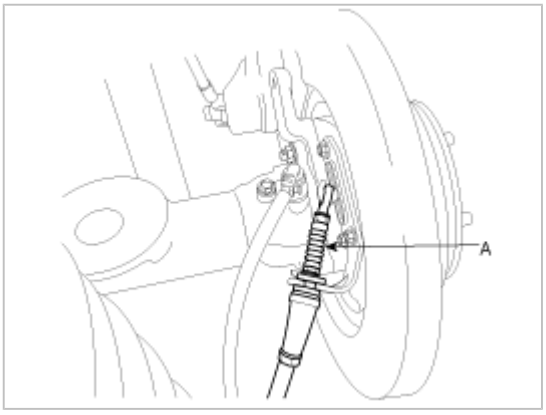
5. Remove the rear wheel □ tire.

Tigthening torque :
88.2~107.9N.m (9.0~11.0kgf.m, 65.1~79.6lb-ft)

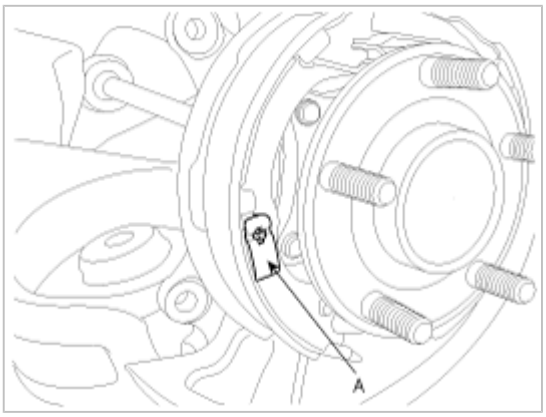
6. Remove the rear brake caliper and disc.



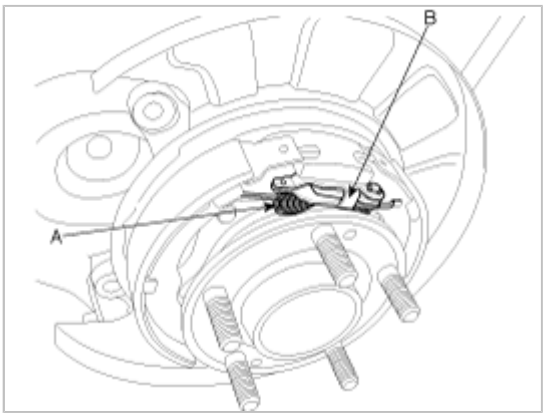
7. Disconnect the brake cable (A) from the parking brake assembly.



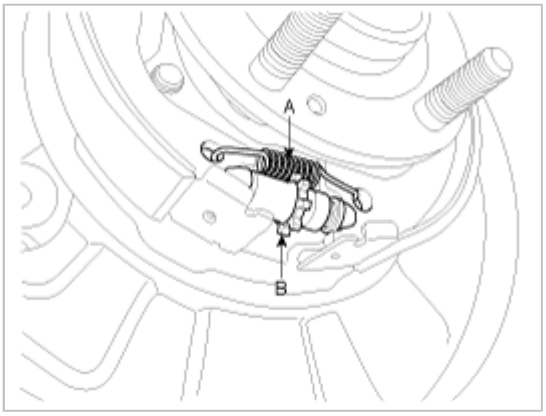
8. Loosen all of the cable guide bracket bolts.
   (Refer to Parking brake components)
9. Remove the both of brake shoes holder (A) and pin.



10. Remove the upper return spring (A) and strut (B).



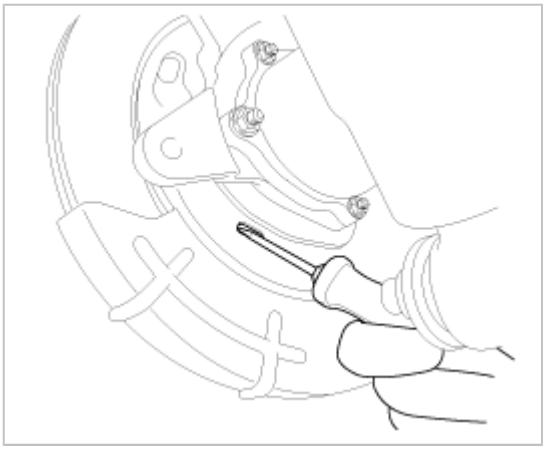
11. Remove the lower return spring (A), adjuster assembly (B), and brake shoes.

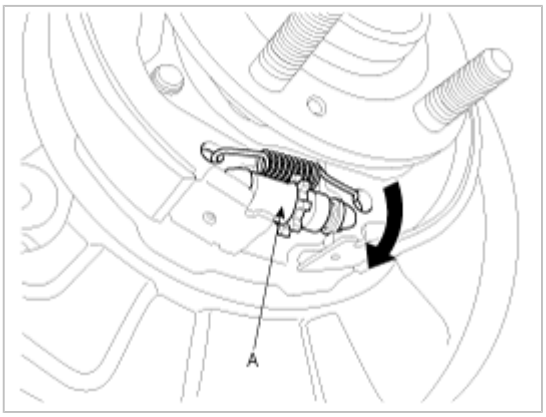


Adjustment

Parking Brake Shoe Clearance Adjustment

1. Remove the rear tire and wheel.
2. Remove the plug from the rear brake disc.
3. Rotate adjuster assembly (A) downward until it can not be rotate by using a screw driver.



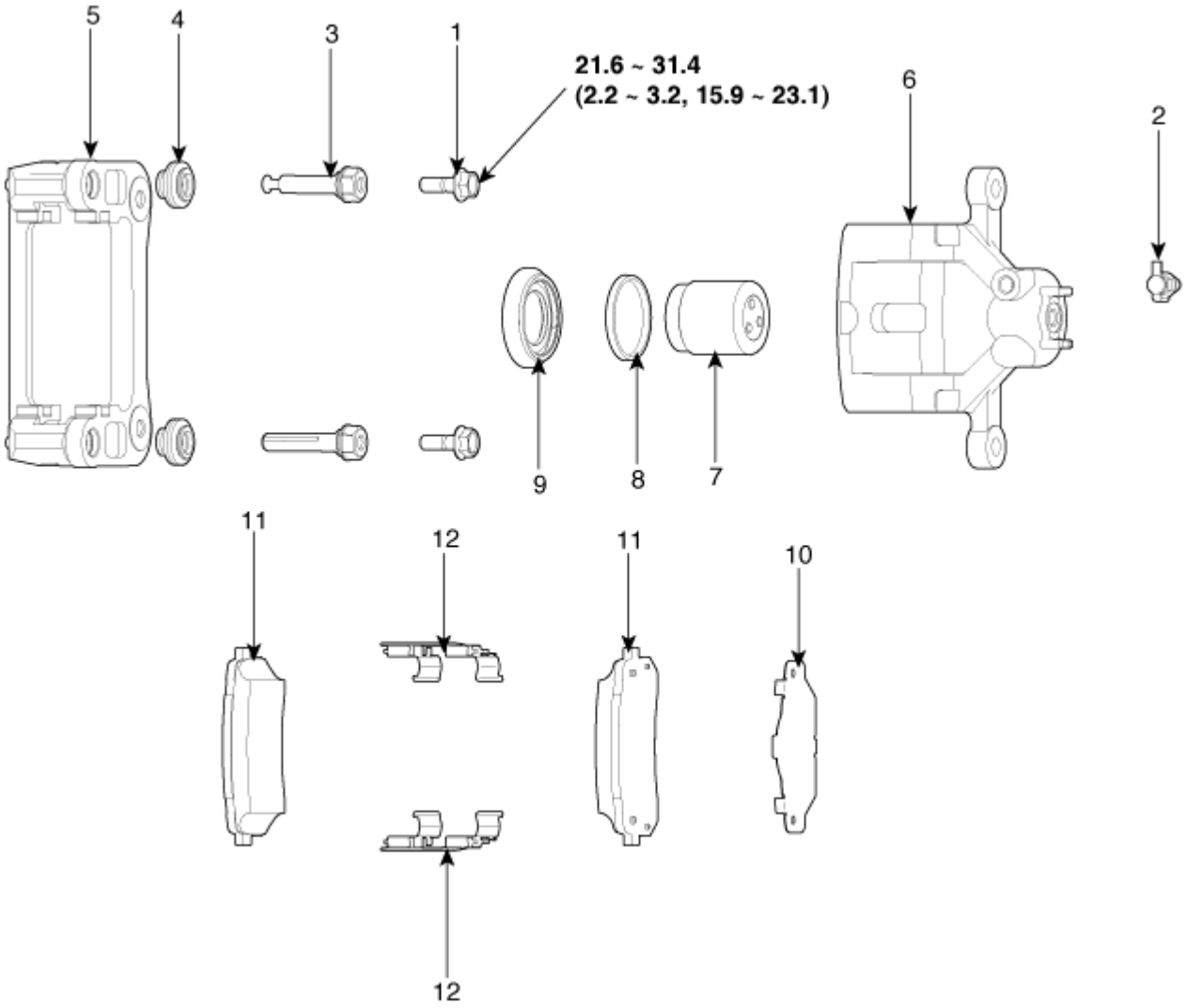


4. Rotate the adjust assembly by 5 notches in the opposite direction.

Parking Brake Cable Adjustment

1. Operate the parking brake lever through a full stoke over 3 times for setting the cables.
2. The travel must be between 7~8 notches when applying a force of approx. 20kgf (196N, 44.1lb)
3. The parking brake indicator lamp must be OFF when lever assembly is released, and ON when operating by 1 notch.

Components



TORQUE : N.m (Kgf.m, lb-ft)

1. Guide rod bolt	7. Piston
2. Bleed screw	8. Piston seal
3. Guide rod	9. Piston boot
4. Boot	10. Inner pad shim
5. Caliper bracket	11. Brake pad
6. Caliper body	12. Pad retainer

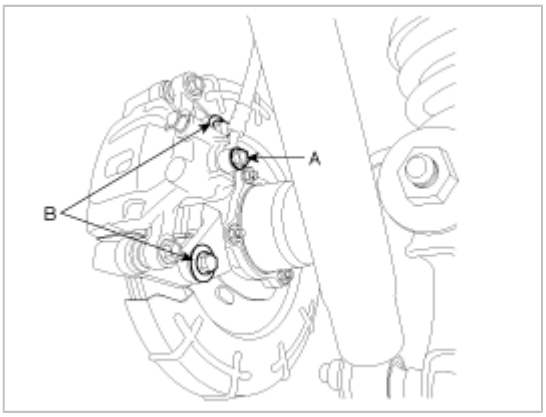
Removal

1. Remove the rear wheel □ tire.

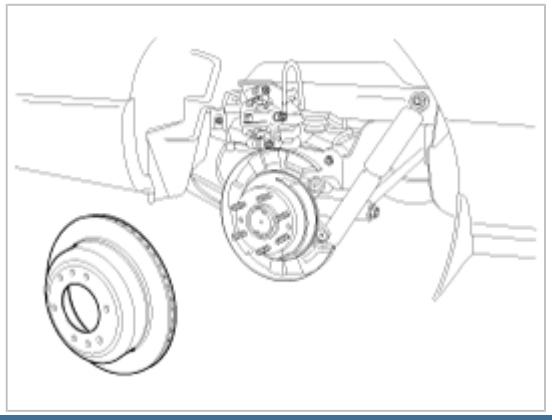
Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)

2. Loosen the hose eye-bolt (A) and caliper mounting bolts, then remove the rear caliper assembly (B).

Tightening torque :
Brake hose to caliper:
16.7 ~ 19.6N.m (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)
Caliper assembly to carrier:
63.7 ~ 73.5N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.2lb-ft)



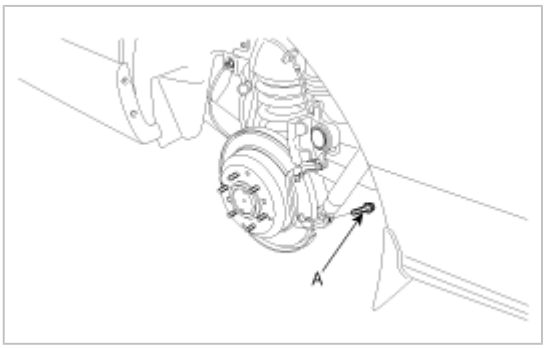
3. Remove the rear brake disc by loosening the screws.



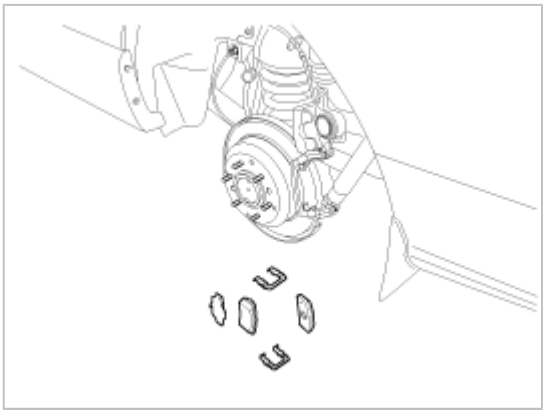
Replacement

Rear Brake Pads

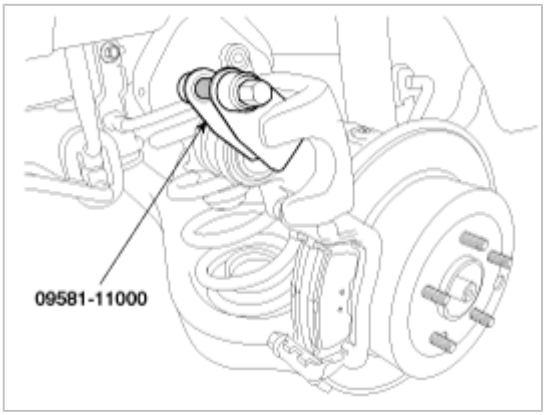
1. Loosen the guide rod bolt (A) and pivot the caliper up out of the way.



2. Replace shims, pad retainers, and brake pads.



3. Push the piston in the cylinder using a SST (09581- 11000)



4. Pivot the caliper down and tighten the guide rod bolt.

Tightening torque :
21.6 ~ 31.4N.m (2.2 ~ 3.2kgf.m, 15.9 ~ 23.1lb-ft)

Inspection

1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Check the thickness of the brake disc and run-out using a micrometer and a dial gauge on the part dotted line in the illustration below.

Brake disc thickness

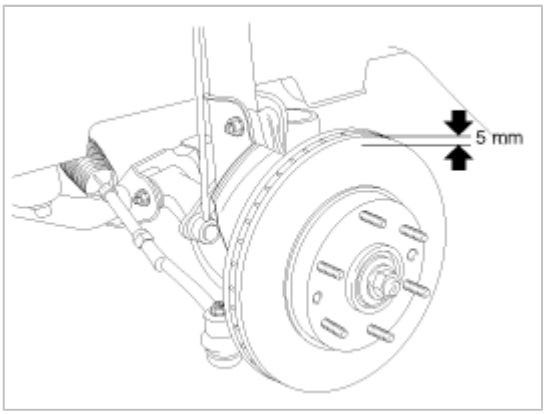
Standard: 18mm (0.71in)

Service limit: 16.4mm (0.65in)

Deviation: less than 0.01mm (0.000039in)

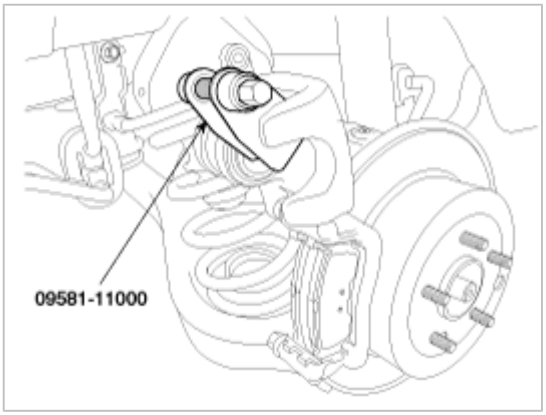
Run-out

Standard: 0.03mm (0.00118in) or less



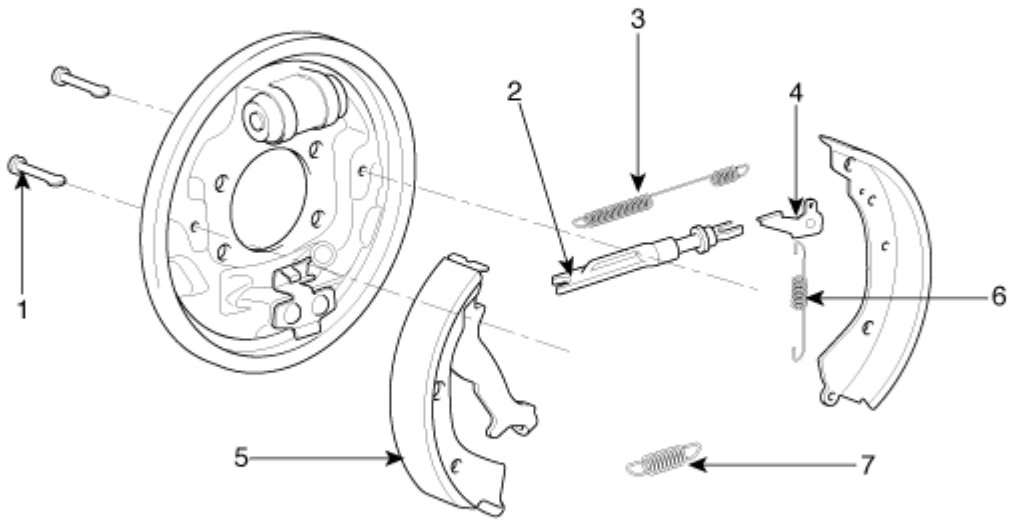
Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.



3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Components

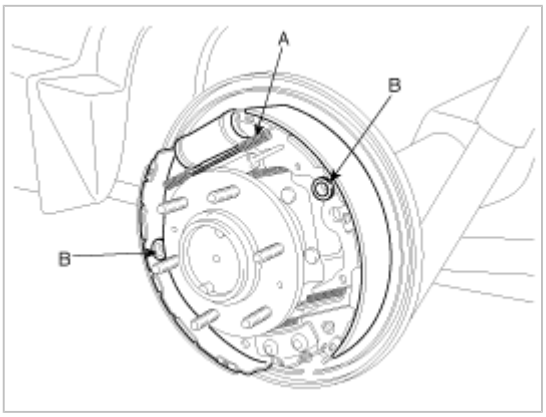


1. Shoe hold down pin 2. Shoe adjuster 3. Upper return spring 4. Adjusting lever	5. Shoe 6. Adjusting lever spring 7. Lower return spring

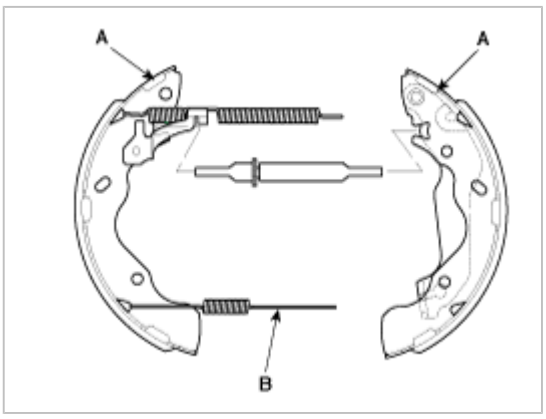
Removal

- Frequent inhalation of brake pad dust regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

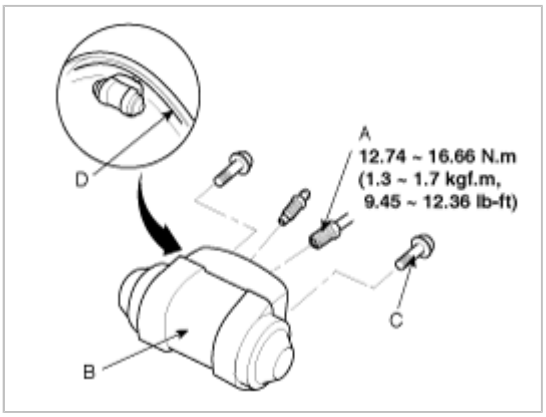
1. Release the pariking brake.
2. Remove the rear tire and wheel.
3. Remove the rear brake drum.
4. Remove the shoe hold spring and shoe hold pin (B).
5. Remove the upper return spring (A).



6. Lower the brake shoe assembly (A), and remove the lower return spring (B). Make sure not to damage the dust cover on the wheel cylinder.



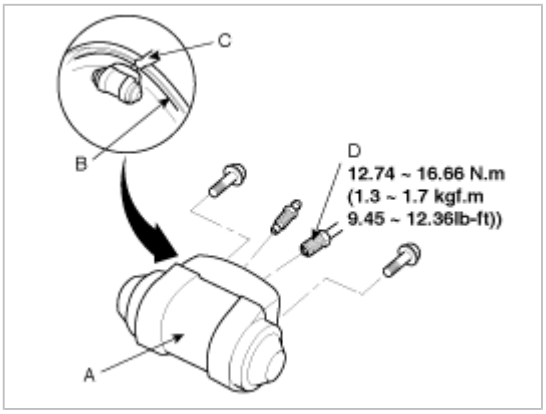
7. Remove the parking brake cable from the brake assembly.
8. Remove the brake shoe assembly.
9. Disconnect brake tubes (A) from the wheel cylinder (B).
10. Remove the bolt (C) and the wheel cylinder (B) from the backing plate (D).



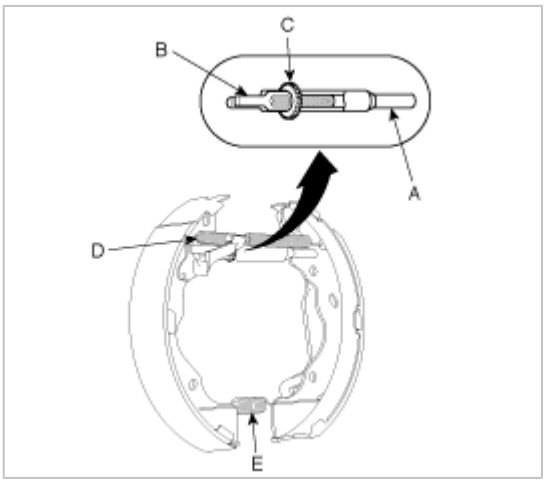
Installation

- Do not spill brake fluid on the vehicle : it may damage the paint; if brake fluid does contact the paint Wash it off immediately with water.
- To prevents spills, cover the hose joints with rags or shop towels.
- Use only a genuine wheel cylinder special bolt.

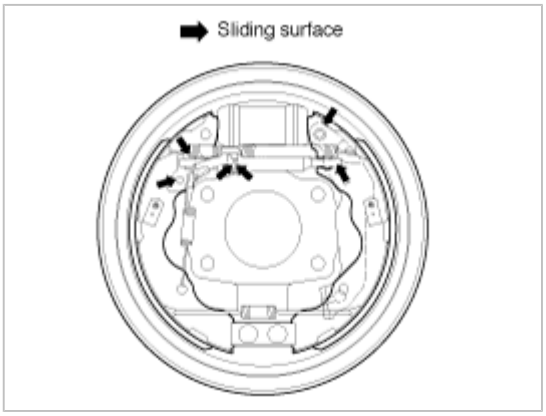
1. Apply sealant (C) between the wheel cylinder (A) and backing plate (B), and install the wheel cylinder.



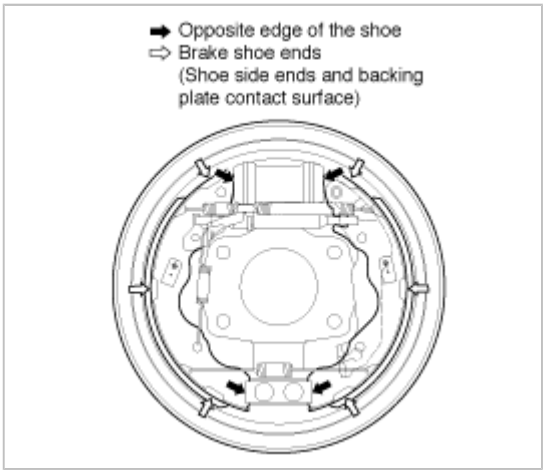
2. Connect the brake tubes (D) to the wheel cylinder.
3. Connect the parking brake cable to the brake assembly.
4. Clean the threaded portions of adjuster sleeve (A) and push rod female (B). Coat the threads of the adjuster assembly with grease. To shorten the clevises, turn the adjuster bolt (C).



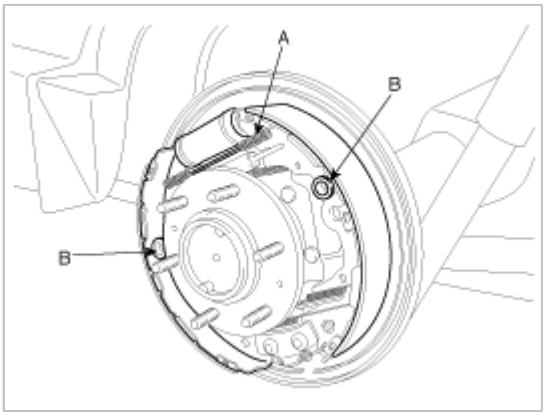
5. Hook the shoe adjuster lever, then install it to the brake shoe.
6. Install the adjuster assembly and upper return spring (D) as right direction. Be careful not to damage the wheel cylinder dust covers.
7. Install the lower return spring (E).
8. Apply brake cylinder grease or equivalent rubber grease to the sliding surfaces shown. Don't get grease on the brake linings.



9. Apply brake cylinder grease or equivalent rubber grease to the brake shoe ends and opposite edges of the shoes shown. Don't get grease on the brake linings.



10. Install the brake shoes (A) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.
11. Install the shoe hole down pins (B) and the shoe hole down springs.



12. Install the rear brake drum.
13. If the wheel cylinder has been removed, bleed the brake system.
14. Depress the brake pedal several times to set the self-adjusting brake.
15. Adjust the parking brake.

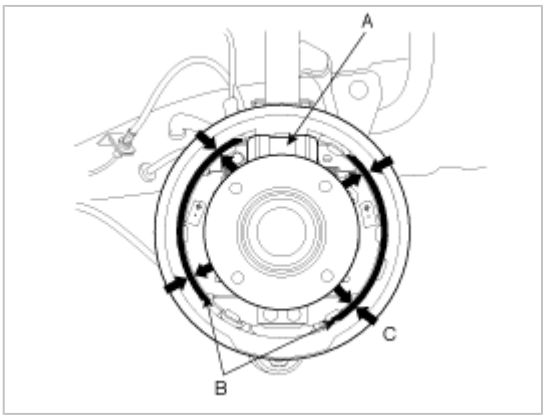
Inspection

- Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.
- Avoid breathing dust particles.
- Never use an air hose or brush to clean brake assemblies.

- Contaminated brake linings or drums reduce stopping ability.
- Block the front wheels before jacking up the rear of the vehicle.

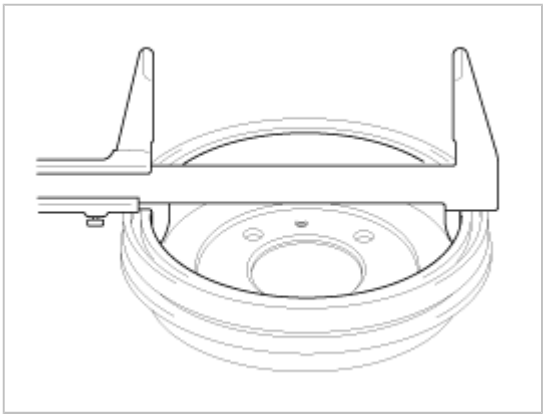
1. Raise the rear of the vehicle, and make sure it is securely supported.
2. Release the parking brake, and remove the rear brake drum.
3. Check the wheel cylinder (A) for leakage.
4. Check the brake linings (B) for cracking, glazing, wear, and contamination.
5. Measure the brake lining thickness (C).
   Measurement does not include brake shoe thickness.

Brake lining thickness
Standard : 4.9 ~ 5.4mm (0.19 ~ 0.21in)
Service limit : 1.0mm (0.039in)

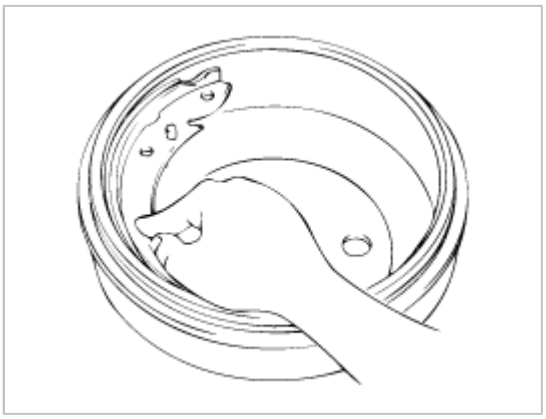


6. If the brake lining thickness is less than the service limit, replace the brake shoes as a set.
7. Check the bearings in the hub unit for smooth operation. If it requires servicing, replace it.
8. Measure the inside diameter of the brake drum with inside vernier calipers.

Drum inside diameter
Standard : 295.0mm (11.61in)
Service limit : 297.0mm(11.69in)
Drum roundness
Service limit : 0.06 mm(0.00236 in)

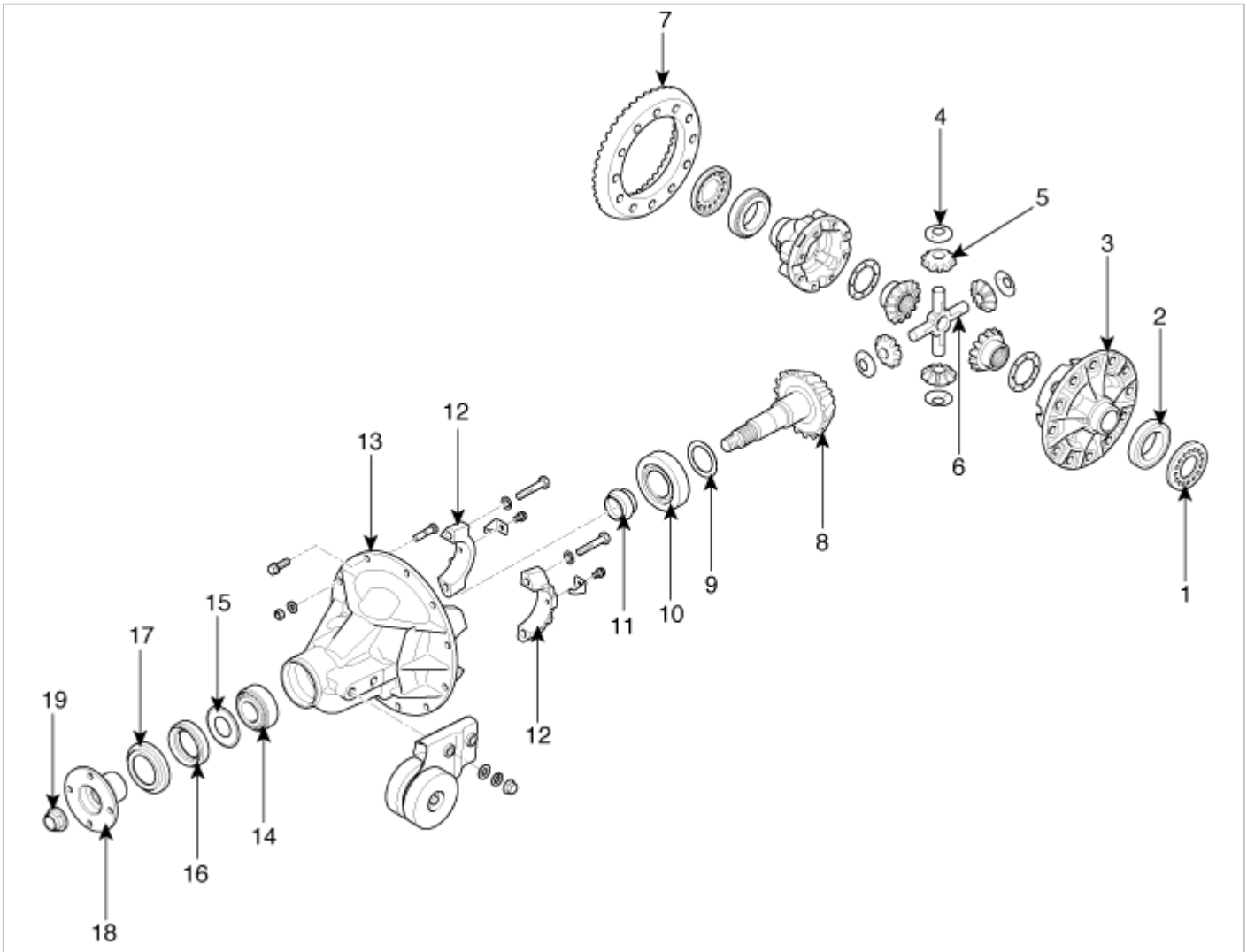


9. If the inside diameter of the brake drum is more than the service limit, replace the brake drum.
10. Check the brake drum for scoring, grooves, and cracks.
11. Inspect the brake lining and drum for proper contact.



12. Inspect the wheel cylinder outside for excessive wear and damage.
13. Inspect the backing plate for wear or damage.

Components



1. Adjust screw	11. Distance pice
2. Side bearing	12. Bearing cap
3. Differential case assembly	13. Differential carrier
4. Pinion washer	14. Drive pinion outer bearing
5. Pinion gear	15. Oil slinger
6. Pinion shaft	16. Oil seal
7. Drive gear	17. Dust cover
8. Drive pinion	18. Companion flange
9. Drive pinion inner bearing	19. Lock nut
10. Drive pinion inner bearing	

Removal

1. Drain the differential gear oil.
2. Remove the rear brake assembly.
3. Remove the parking brake cable attaching bolt.
4. Remove the brake tube connection.
5. Remove the left and right axle shaft.

> Be careful not to damage the oil seal when pulling axle shaft.

6. Remove the flange yoke of the rear propeller shaft from the companion flange of the differential carrier.

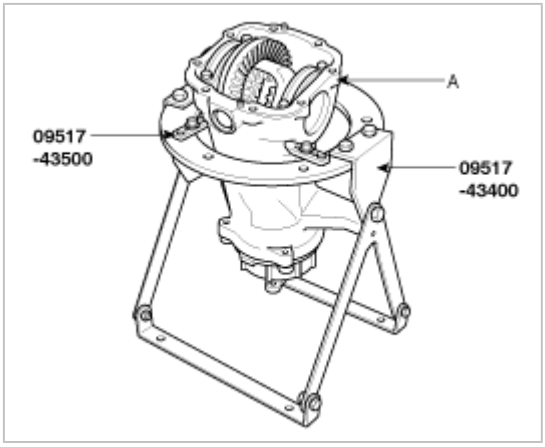
> Suspend the propeller shaft from the body with wire, etc.

7. Remove the attaching nuts and strike the lower part of differential carrier assembly with a piece of times several times to loosen, then remove the differential carrier assembly.

> Use care not to strike the companion flange.

Inspection Before Disassembly

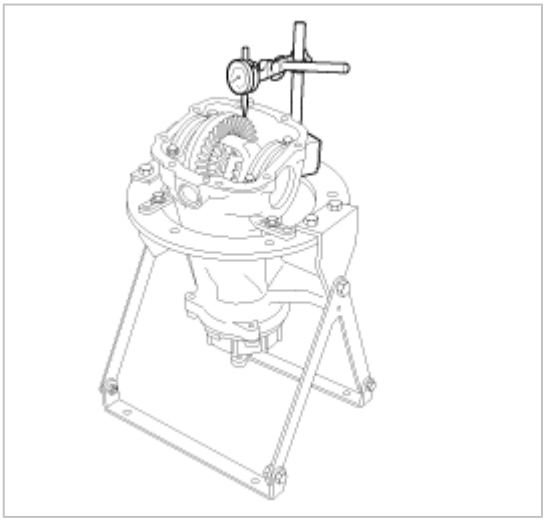
Secure the special tool(09517-43400 & 09517-43500) and install the differential carrier assembly with the attachment. Then carry out the following inspection.



1. Final drive gear backlash
   Check the final drive gear backlash by the following procedure.
   (1) Place the drive pinion and move the drive gear to check backlash is within the standard range.

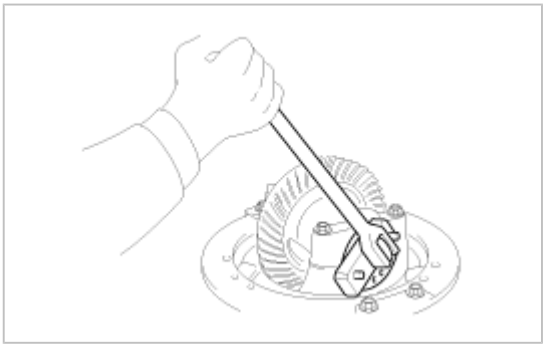
> Measure at 4 points on the gear periphery.

Standard value:
0.13 ~ 0.18mm (0.005 ~ 0.007in.)



(2) Adjust with the side bearing nuts if backlash values are not within standard range.

After adjusting, check the state of the final drive gear's tooth contact.

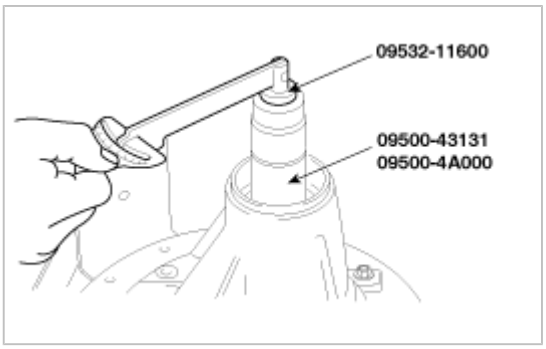


2. Drive gear runout

Check the back-face lash as follows:

(1) Place a dial gauge on the back-face of the drive gear and measure the runout.

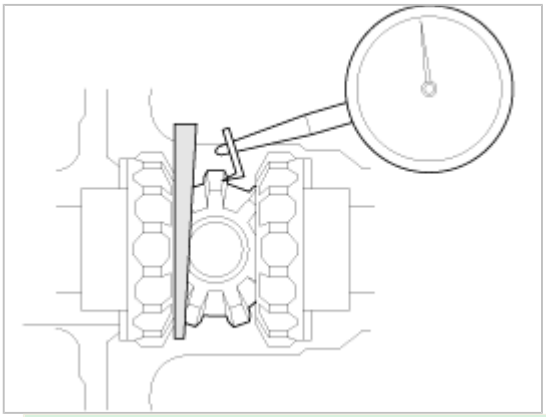
Limit : 0.05mm (0.0020in.)



(2) If the runout is beyond the limit, check that there are no foreign substances between the drive gear and differential case and, that the bolts fixing the drive gear are not loose.

3. Differential gear backlash

(1) Fix the side gear with a wedge so it cannot move and measure the differential gear backlash with a dial indicator on the pinion gear.



Take the measurements at two places on the pinion gear.

Standard value :
0 ~ 0.076mm (0 ~ 0.003in.)

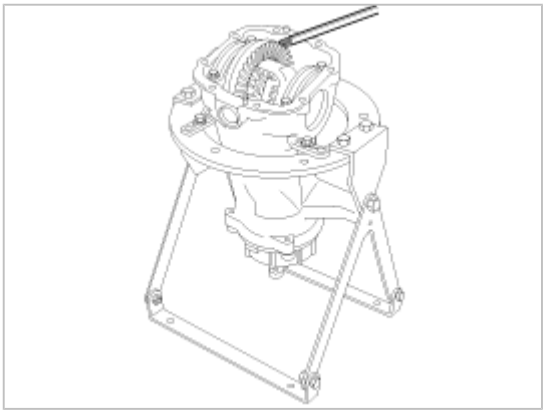
(2) If the backlash exceeds the limit, adjust using side bearing spacers.

If adjustment is impossible, replace the side gear and pinion gears as a set.

4. Final drive gear tooth contact

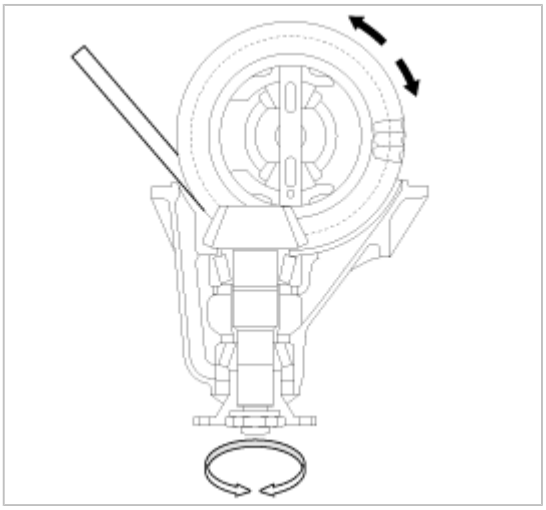
Check the final drive gear tooth contact by following the steps below :

(1) Apply the same amount of machine blue slightly to both surfaces of the drive gear teeth.

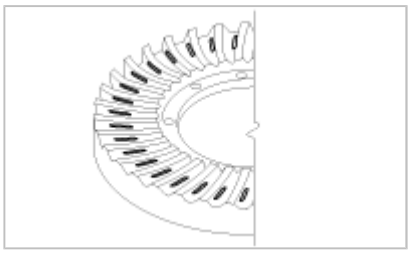
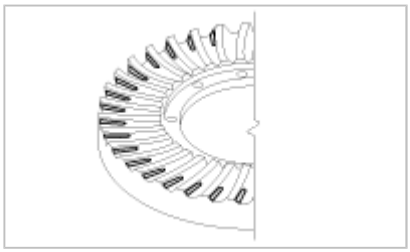
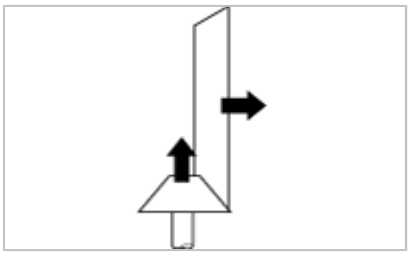
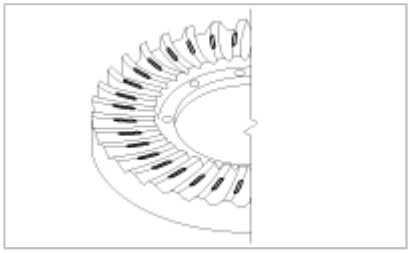


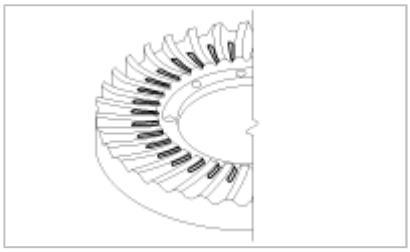
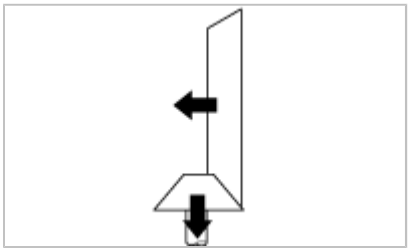
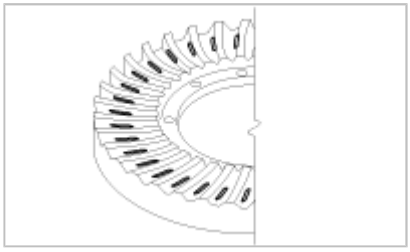
(2) Insert a brass rod between the differential carrier and the differential case, and then rotate the companion flange by hand (once in the normal direction, and then once in the reverse direction) while applying a load to the drive gear sothat some torque (approximately 25-30kg.cm) is applied to the drive pinion.

If the drive gear is rotated too much, the tooth contact pattern will become unclear and difficult to check.



(3) Check the tooth contact pattern.

Tooth contact	Contact state	Solution	
Standard contact			
1. Heal contact		Increase the thickness of the pinion height adjusting shim, and position the drive pinion closer to the center of the drive gear. Also, for backlash adjustment, reposition the drive gear further from the drive pinion.	
2. Face contact			

3. Toe contact		Decrease the thickness of the pinion height adjusting shim, and position the drive pinion further from the center of the drive gear. Also, for backlash adjustment, reposition the drive gear closer to the drive pinion.	
4. Flank contact			

- Tooth contact pattern is a method for judging the result of the adjustmentof drive pinion height and final drive gear backlash. The adjustment of drivepinion height and final drive gear backlash should be repeated until the toothcontact patterns are similar to the standard tooth contact pattern.
- Tooth contact pattern is a method for judging the result of the adjustmentof drive pinion height and final drive gear backlash. The adjustment of drivepinion height and final drive gear backlash should be repeated until the toothcontact patterns are similar to the standard tooth contact pattern.

Installation

1. Dirrerential carrier assembly
   Apply specified sealant to axle housing flange surface, and install the differential carrier assembly.

   Specified sealant : LOCTITE 587

2. Propeller shaft
   Install the propeller shaft to the companion flange, aligning with matchmark as closely as possible.

   Tightening torque:
   60 ~ 70N.m (6.0 ~ 7.0kgf.m, 43 ~ 51lb-ft)

3. Axle shaft assembly
   (1) Apply specified sealant to the axle housing and bearing case end faces.

   Specified sealant : LOCTITE 587

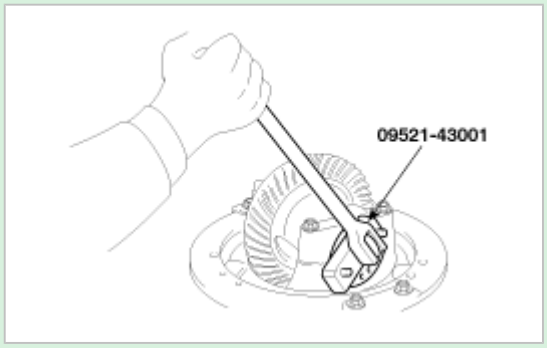
(2) Install the axle shaft assembly after installing new O-ring into the axle shaft.

Disassembly

1. Side bearing nut

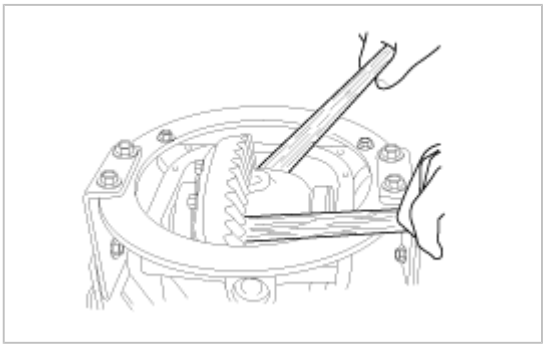
Using the special tool (09521-43001), remove the side bearing nut.

Keep the right and left side bearing nuts separate so that they are not mixed during reassembly.



2. Removal of the differential case assembly

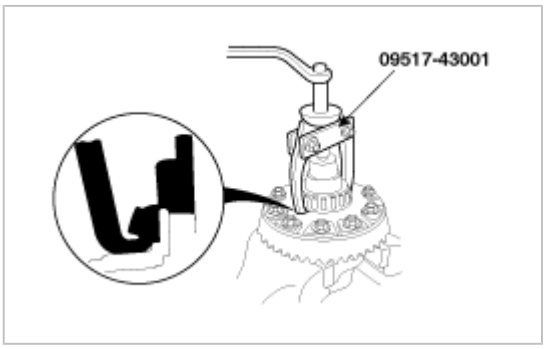
- Remove the differential case assembly slowly and carefully.
- Be caurful so that the side bearing outer race is not dropped.
- Keep the right and left side bearing outer races separate so that they are not mixed during reassembly.



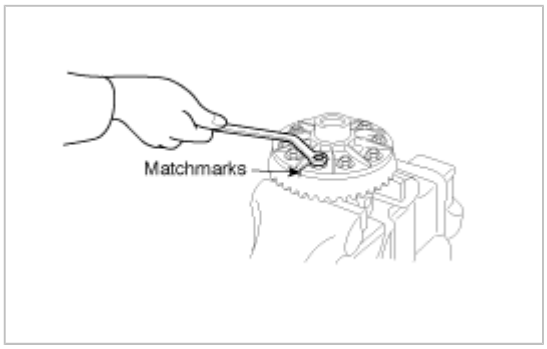
3. Removal of the side bearing inner races

Fit the nut on top of the differential case, and then use the special tool to remove the side bearing inner race.

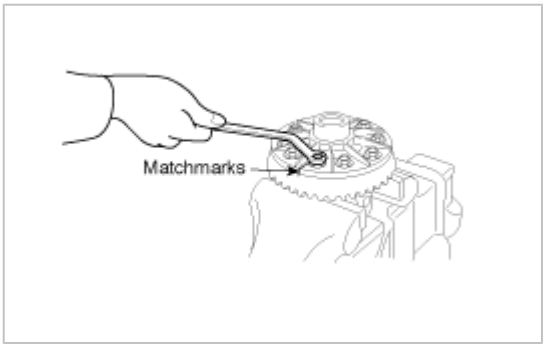
Attach the prongs of the special tool(09517-43001) to the inner race of the side bearing through the notched section in the differential case.



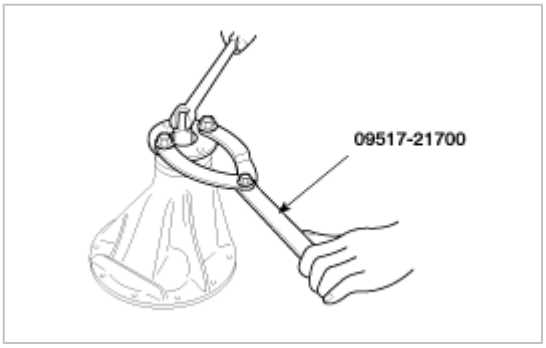
4. Removal of drive gear
   A. Make the matchmarks to the differential case and the drive gear.
   B. Loosen the drive gear attaching bolts in diagonal sequence to remove the drive gear.



5. Removal of lock pin (For conventional differential)



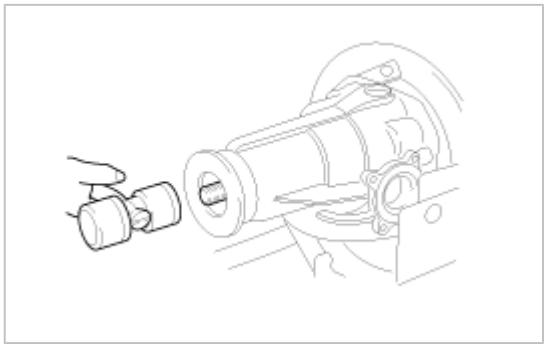
6. Removal of self-locking nut



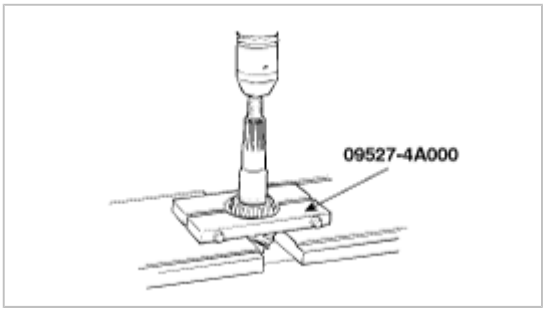
7. Removal of drive pinion
   A. Make the matchmarks on the drive pinion and companion flange.

Matchmarks should not be made on the contact surfaces of the companion flange and the propeller shaft.

B. Drive out the drive pinion together with the drive pinion spacer and drive pinion front shims.



8. Removal of drive pinion rear bearing inner race



9. Removal of oil seal/drive pinion front bearing inner race/drive pinion front bearing outer race.
10. Removal of drive pinion rear bearing outer race.

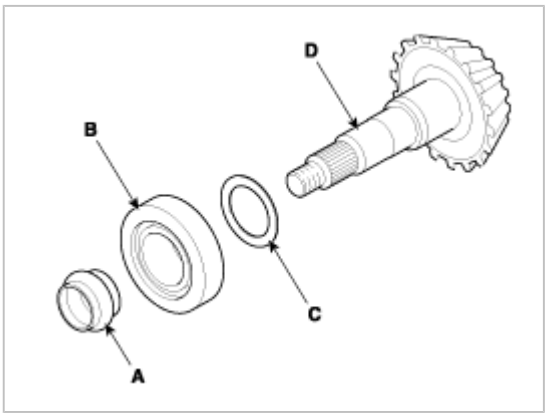
Inspection

1. Check the companion flange for wear or damage.
2. Check the bearings for wear or discoloration.
3. Check the gear carrier for cracks.
4. Check the drive pinion and drive gear for wear or cracks.
5. Check the side gears, pinion gears and pinion shaft for wear or damage.
6. Check the side gear spline for wear or damage.

Reassembly

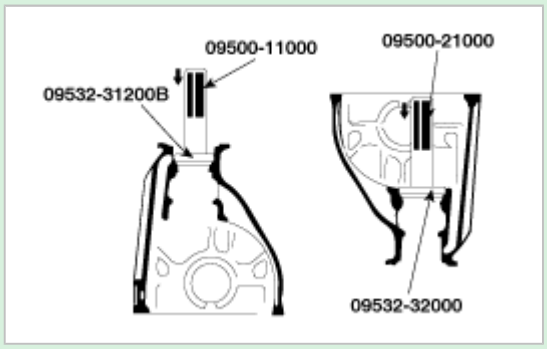
Adjustment Of Pinion Height

1. Reassembly spacer (A), drive pinion inner bearing (B), shim (C) to the pinion drive gear (D).

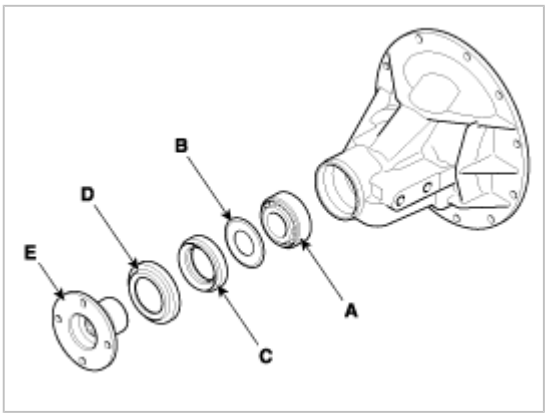


2. Install the drive pinion rear bearing outer race and drive pinion front bearing outer race using the special tools (09500-11000, 09500-21000, 09532-31200B and 09532-32000).

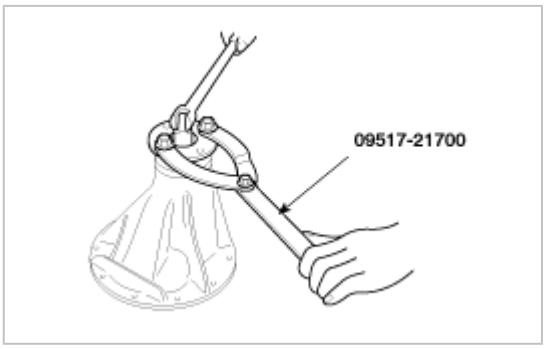
Be careful not to press in the outer race when it is inclined.



3. Reassembly drive pinion outer bearing (A), oil slinger (B), oil seal (C), dust cover (D) and companion flange (E) to the differential carrier.

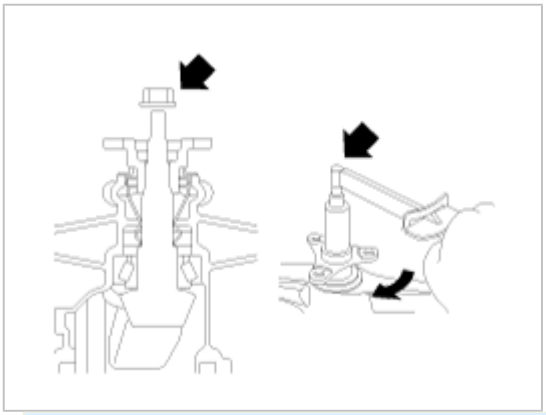


4. Tighten the lock nut.
   (1) Assembly the differential carrier assy and the pinion drive gear assy.
   (2) Tighten the lock nut properly .



(3) Measure the pinion bearing pre-load.

Pinion bearing pre-load :
1.1 ~ 1.6 N.m (11.5 kgf.cm ~ 16.5 kgf.cm, 0.84 ~ 1.2 lb-ft)

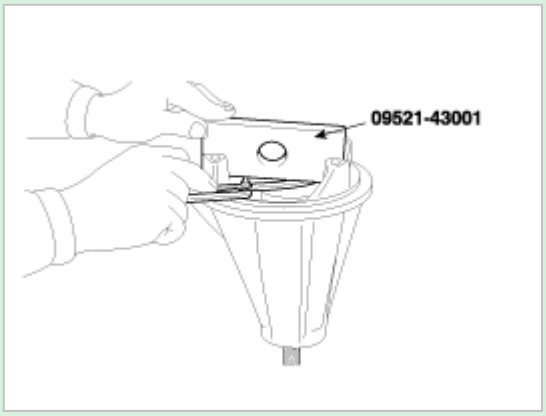


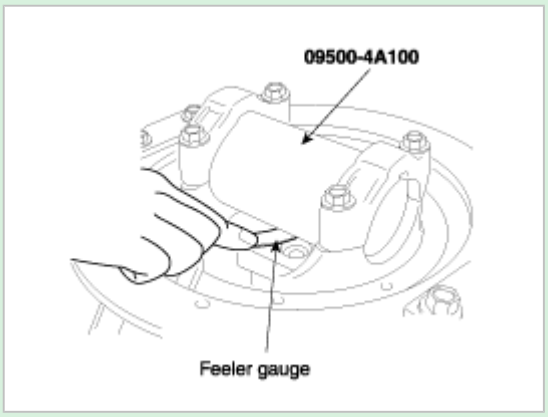
Maintain the constant speed rotation (60rpm).

(4) If does not satisfied standard value, tighten or loosen the lock nut .
(5) Remeasure the pinion bearing pre-load.

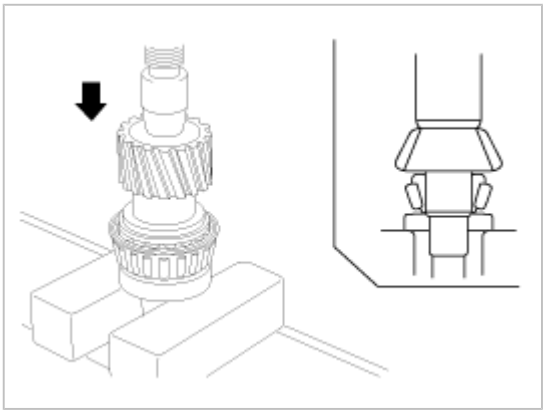
5. Position the special tool in the side bearing seat of the gear carrier and select a drive pinion rear shim of a thickness which corresponds to the gap between the special tools.

- Clean the side bearing seat thoroughly. When positioning the special tool, confirm that the cut-out sections of the special tools touch the side bearing seat very closely.
- When selecting the drive pinion rear shims, use the fewest number of shims necessary.



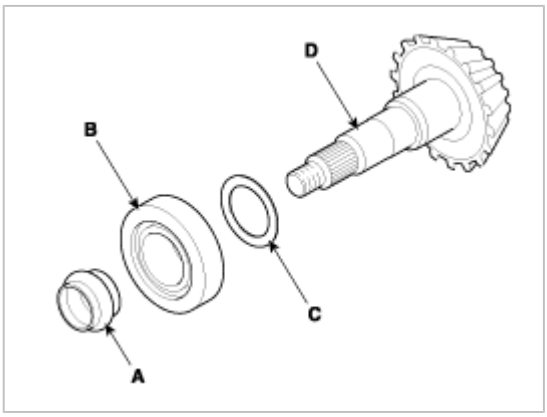


6. Fit the selected drive pinion rear shim(s) to the drive pinion, and press-fit the drive pinion rear bearing inner race using the special tool (09535-11000).



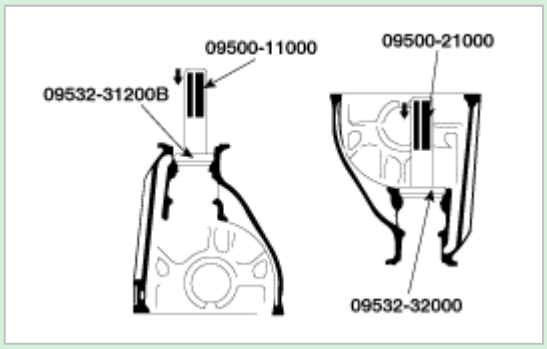
Adjustment Of Drive Pinion Preload

1. Reassembly spacer (A), drive pinion inner bearing (B), shim (C) to the pinion drive gear (D).

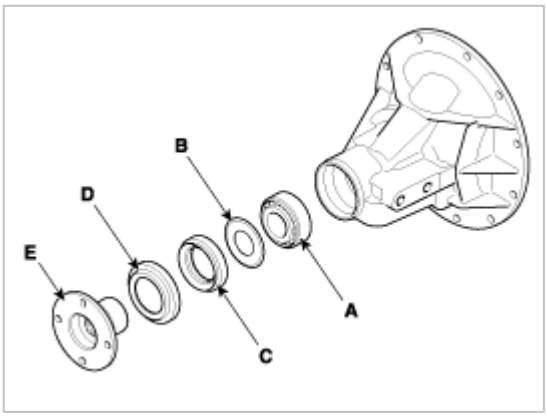


2. Install the drive pinion rear bearing outer race and drive pinion front bearing outer race using the special tools (09500-11000, 09500-21000, 09532-31200B and 09532-32000).

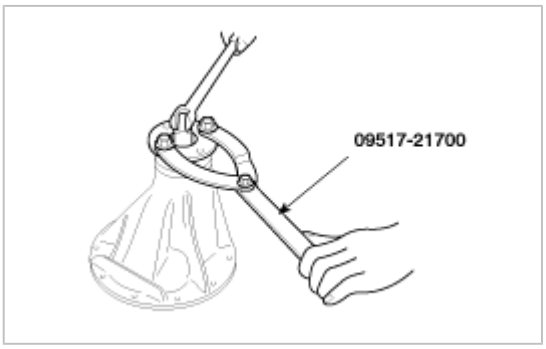
Be careful not to press in the outer race when it is inclined.



3. Reassembly drive pinion outer bearing (A), oil slinger (B), oil seal (C), dust cover (D) and companion flange (E) to the differential carrier.

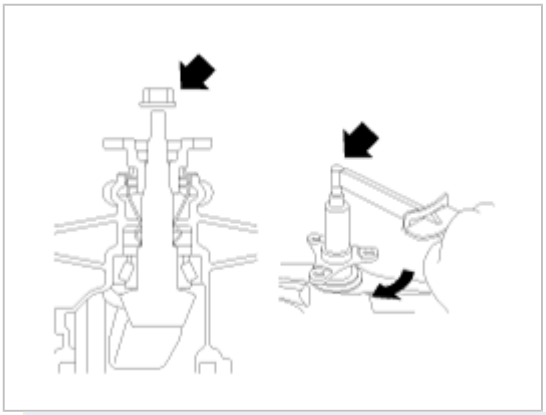


4. Tighten the lock nut.
   (1) Assembly the differential carrier assy and the pinion drive gear assy.
   (2) Tighten the lock nut properly .



(3) Measure the pinion bearing pre-load.

Pinion bearing pre-load :
1.1 ~ 1.6 N.m (11.5 kgf.cm ~ 16.5 kgf.cm, 0.84 ~ 1.2 lb-ft)



Maintain the constant speed rotation (60rpm).

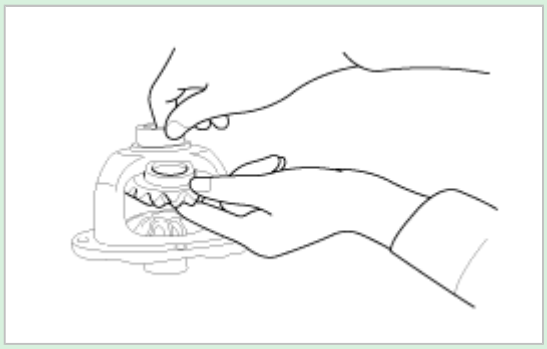
(4) If does not satisfied standard value, tighten or loosen the lock nut .
(5) Remeasure the pinion bearing pre-load.

Adjustment Of Differential Gear Backlash

Adjust the differential gear backlash according to thefollowing procedures :

1. Assemble the side gears, side gear spacers, piniongears, and pinion washers into the differential case.
2. Temporarily, install the pinion shaft.

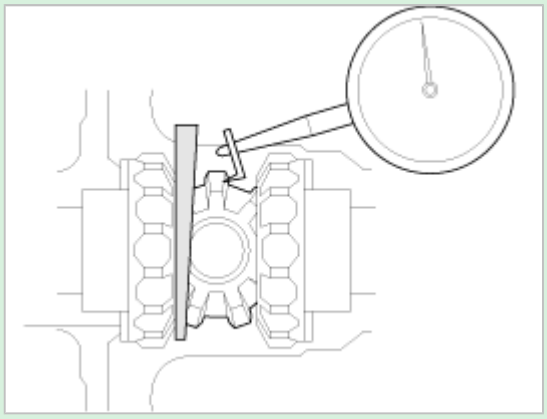
Do not install the lock pin yet.



3. Insert a wedge in the side gear and measure thedifferential gear backlash with a dial indicator on thepinion gear.

Measure both pinion gears separately.

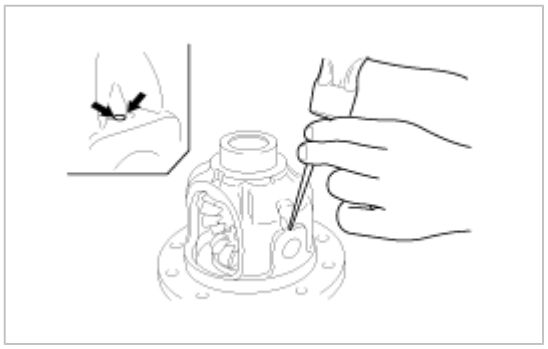
Standard value : 0 ~ 0.05mm (0 ~ 0.002in.)



4. If the differential gear backlash exceeds the limit,adjust the backlash by installing thicker side gearthrust spacers.
5. Measure the differential gear backlash once again,and confirm that it is within the limit.

- After adjustment, check that the backlash is withinthe limit and the differential gear rotates smoothly.
- When adjustment is impossible, replace the sidegear and the pinion gear as a set.

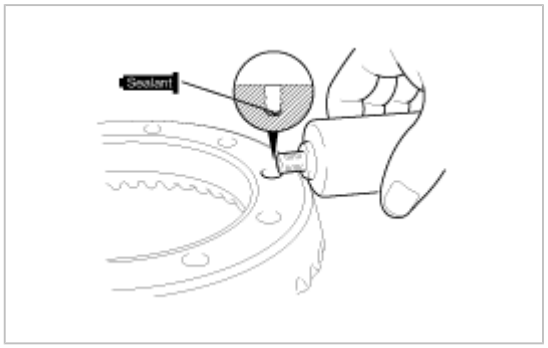
6. Installation of the lock pin
   A. Align the pinion shaft lock pin hole with thedifferential case lock pin hole, and drive in thelock pin.
   B. Fix the lock pin in place by staking two pointsaround the lock pin hole with a punch.



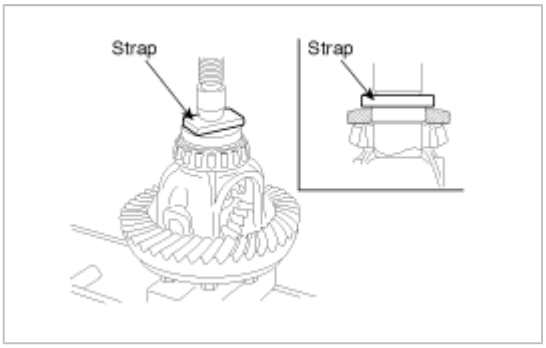
7. Installation of the drive gear
   A. Clean the drive gear attaching bolts.
   B. Remove the adhesive on the threaded holes ofthe drive gear with a tap (M10 x 1.25), and thenclean the threaded holes with compressed air.
   C. Apply the specified adhesive to the threadedholes of the drive gear.

   Specified adhesive : TB2442

   D. Install the drive gear in the differential case withthe matchmarks properly aligned. Tighten thebolts to the specified torque (80-90 Nm, 800-900kg·cm) in a diagonal sequence.

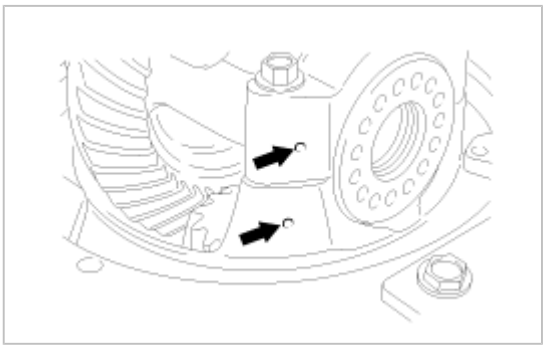


8. Press-fit the side bearing inner race.



9. Align the matchmark on the gear carrier and thebearing cap, and then tighten the bearing cap.

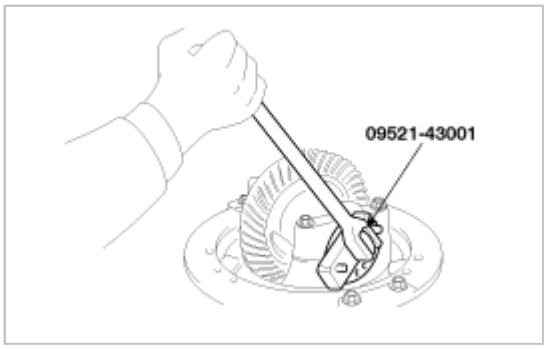
Tightening torque :
53.9 ~ 63.7 Nm (5.5 ~ 6.5 Kgf.m, 39.7 ~ 47.0 b-ft)



10. Adjustment of final drive gear backlash

Adjust final drive gear backlash as follows :

(1) Using the special tool(09521-43001), temporarilytighten the side bearing nut until it is in the statejust before preloading of the side bearing.



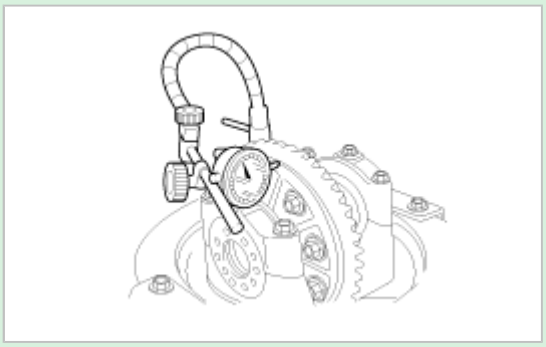
(2) Measure the final drive gear backlash.

Standard value

No. 6 : 0.11-0.16 mm (0.0043-0.0063 in.)

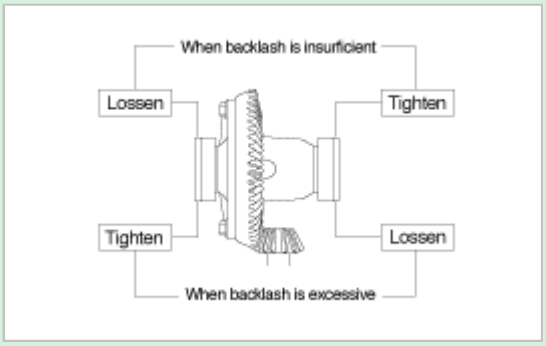
No. 7 : 0.13-0.18 mm (0.0051-0.0071 in.)

Measure at lease 4 point on the drive gearperiphery.

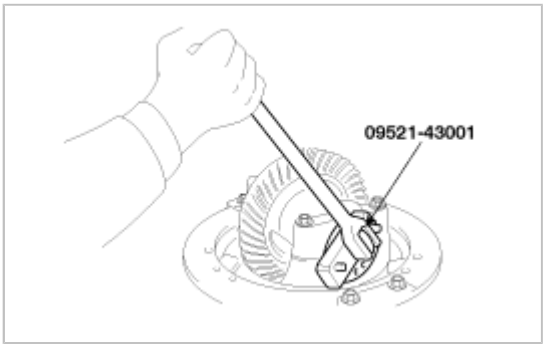


(3) Using the special tool(09521-43001), adjust thebacklash to standard value by moving the sidebearing nut as shown.

First turn the side bearing nut for loosening, andthen turn(by the same amount) the side bearingnut for tightening.



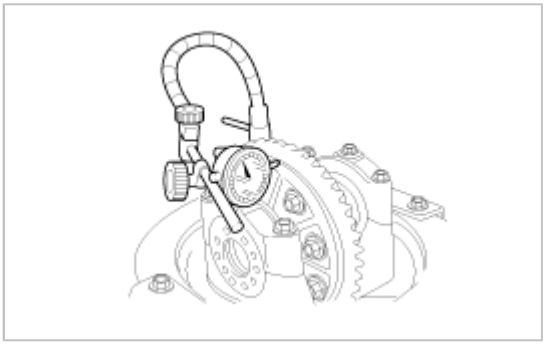
(4) Using the special tool(09521-43001) to apply thepreload, turn down both right and left side bearingnut on half the distance between centers of twoneighboring holes.



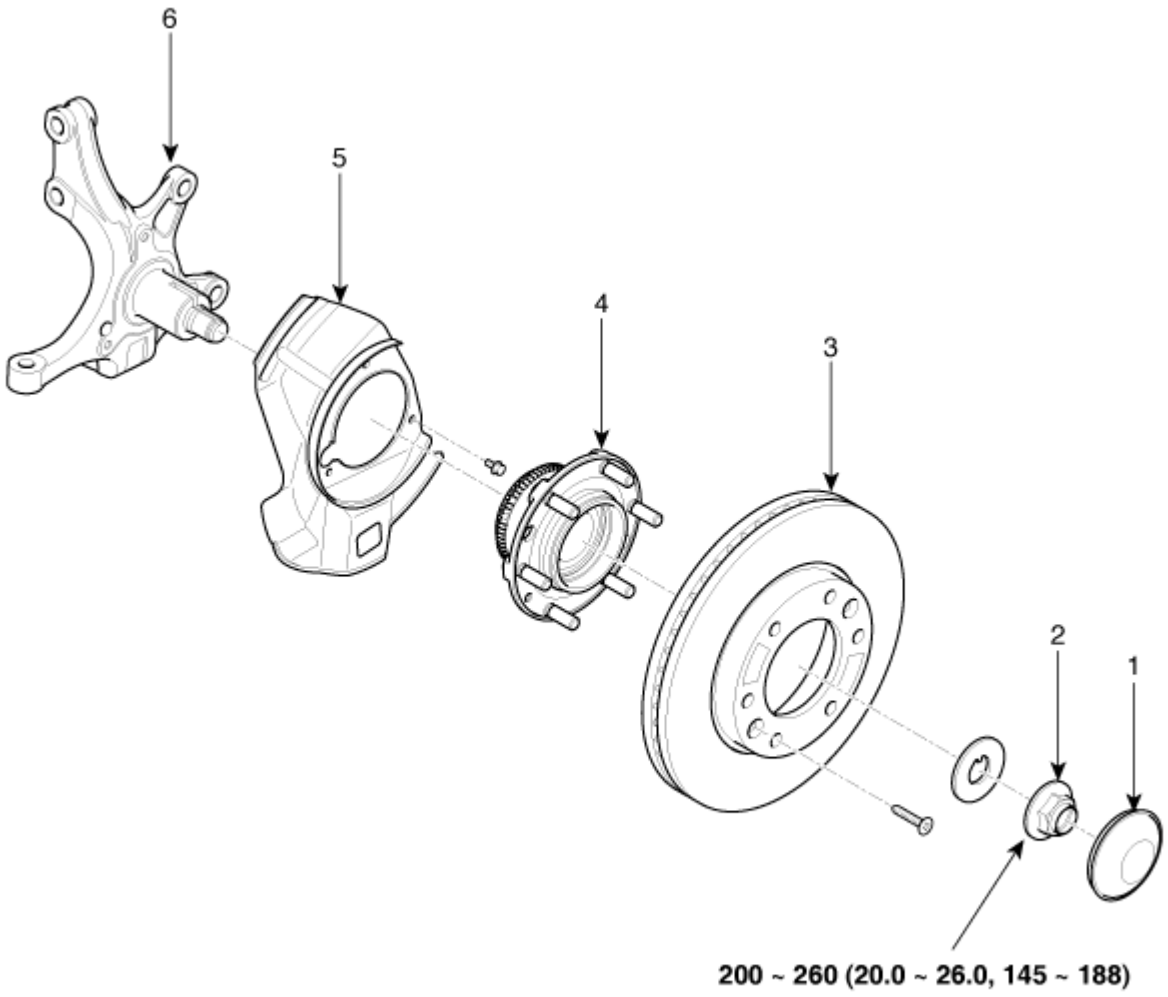
(5) Choose and install the lock plates two kinds.
(6) Check the final drive gear tooth contact. If poorcontact is evident, make adjustment.
(7) Measure the drive gear runout.

Limit : 0.05mm (0.0020in.)

(8) When drive gear runout exceeds the limit, removethe differential case and then the drive gears,moving them to different positions and reinstallingthem.



Components



Torque : N.m (kgf.m, lb-ft)

1. Hub cap	4. Hub & Bearing assembly
2. Lock nut	5. Dust cover
3. Brake disc	6. Knuckle

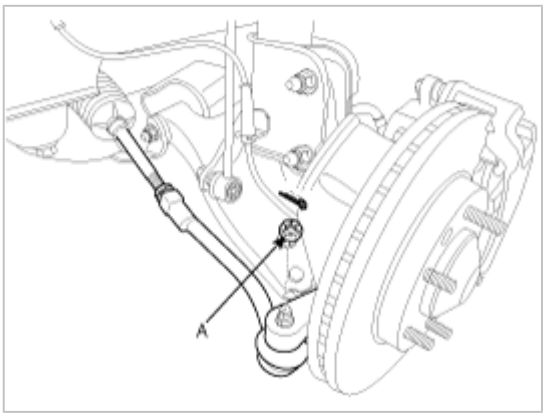
Replacement

1. Remove the front wheel & tire.

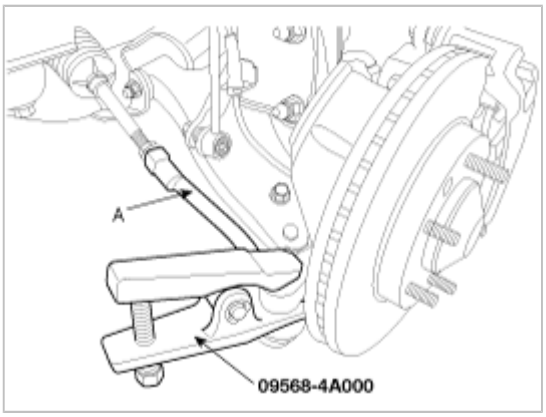
Tightening torque:
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Remove the wheel speed sensor from the knuckle.
3. Remove the split pin and castle nut (A).

Tightening torque:
35 ~ 45N.m (3.5 ~ 4.5kgf.m, 25 ~ 32lb-ft)



4. Disconnect the tie-rod end (A) with the knuckle using a SST (09568-4A000).



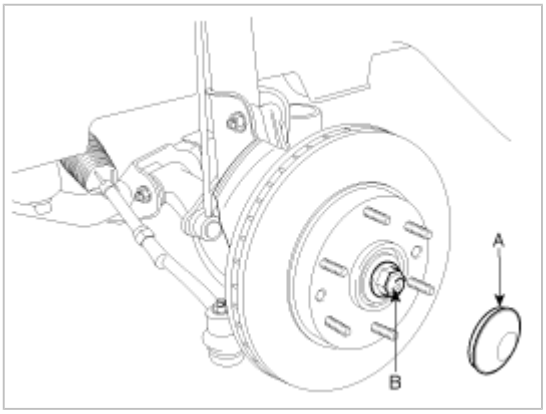
5. Remove the front brake caliper from the knuckle and suspend it with wire.

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

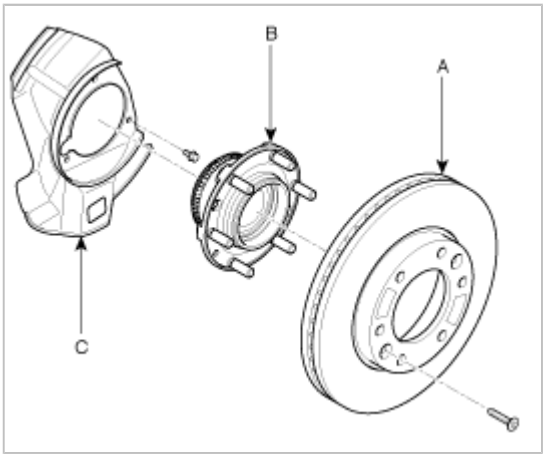
6. Remove the hub cap (A).
7. Unstake the lock nut (B) and remove it.

Tightening torque:

200 ~ 260N.m (20.0 ~ 26.0kgf.m, 145 ~ 188lb-ft)

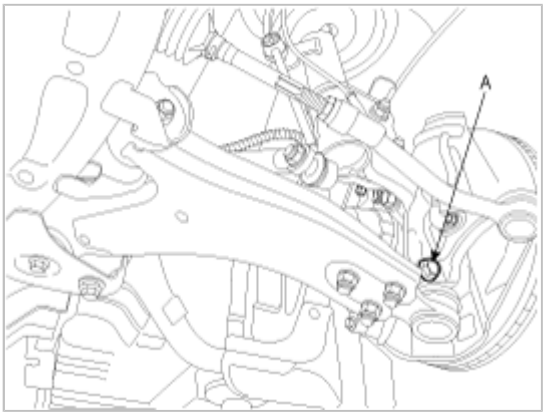


8. Remove the brake disc (A), hub & bearing assembly (B), and dust cover (C) from the knuckle.



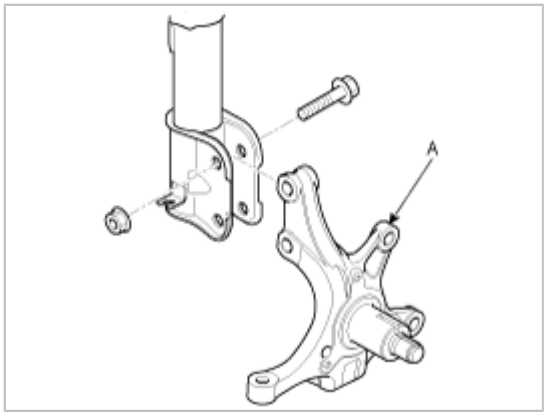
9. Remove the wheel speed sensor from the knuckle.
10. Disconnect the knuckle with the lower arm by loosening the bolt and nut (A).

Tightening torque:
90 ~ 120N.m (9.0 ~ 12.0kgf.m, 65 ~ 87lb-ft)



11. Disconnect the front strut assembly with the knuckle (A) by loosening the bolt and nut.

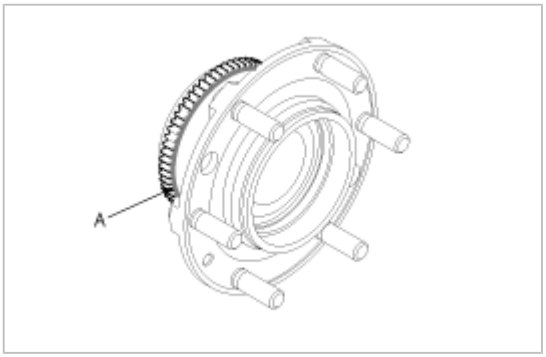
Tightening torque:
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)



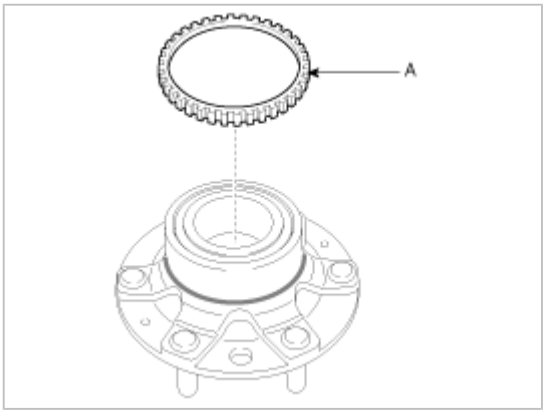
12. Installation is the reverse of the removal.

Tone wheel replacement

1. Remove the hub & bearing assembly.
2. Matchmark (A) the hub and remove the tone wheel from the hub.

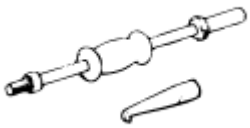
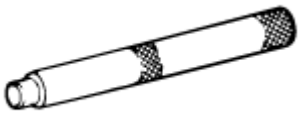
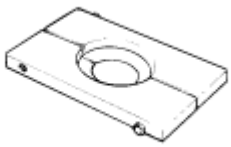


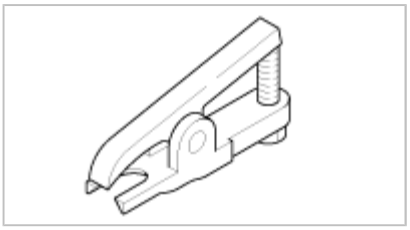
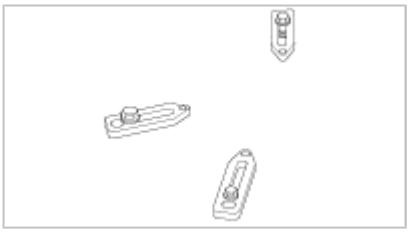
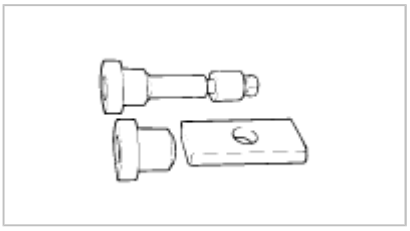
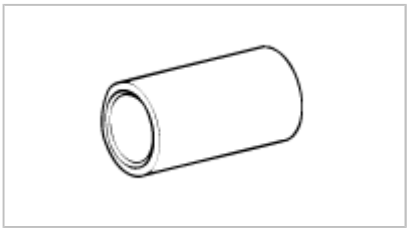
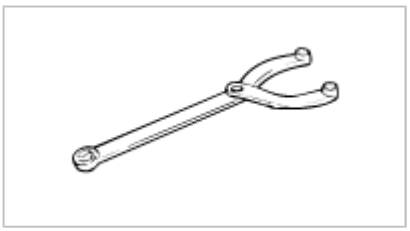
3. Clean the portion where new tone wheel is installed.
4. Heat a new tone wheel to 280 ~ 300□ for 10minutes and below using a hot plate or a heat gun. Do not heat it excessively over 350□.
5. Put on the gloves and slide the heated tone wheel (A) to the machmark on the hub.



6. Wait for the new tone wheel cools down and then reinstall the hub & bearing assembly.

Special Service Tools

Tool (Number and Name)	Illustrator	Use
09493-43000 Universal joint remover and innstaller		Removal and installation of the journal bearing (Use with 09432-43100)
09517-43001 Bearing and gear puller		• Removal of the center bearing • Removal of the differential side bearing
09526-11100 Sliding hammer		Removal of the oil seal
09500-21000 Bar		• Installation of the axle shaft bearing outer race • Installation of the drive pinion bearing outer race • Installation of the oil seal
09432-33400 Bearing race installer		
09527-4A000 Removing plate		Removal of the drive pinion rear bearing inner race
09568-34000 Ball joint puller		Disconnection of the tie rod

		
09517-43401 Working base		Support for the differential carrier
09517-43500 Adapter		
09521-43001 Side bearing adjust spanner		Measurement of the drive pinion height
09500-4A100 (NO.7) Pinion height gauge base		
09517-21700 End yoke holder		Removal and installation of the companion flange

Specifications

Item			Specification
Rear axle type			Semi-Floating
Rear axle housing type			Banjo
Differential	Reduction gear type		Hypoid gear
	Reduction gear ratio	CRDI MT	3.615 (No.7)
		CRDI AT	2.929 (No.7)
		TCI MT	4.222 (No.7)
		TCI AT	3.909 (No.7)
		GSL	4.222 (No.7)

Lubricants

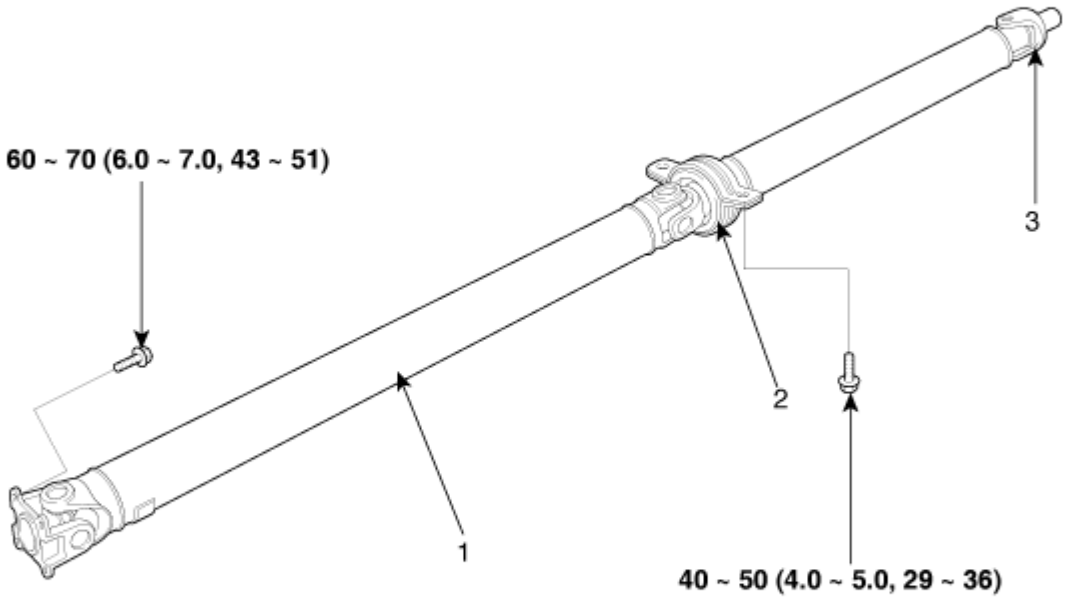
Item	Specified lubricants	Quantity
Propeller shaft joint	ALVANIA EP Grade No.2	As required
Differential	General zone (-30□ ~ 30□): API GL-4 class (SAE 90)	Fill the reservoir to the plug hole
	Severe heat zone (30□ Min.): API GL-4 class (SAE 140)	
	Severe frigid zone (-30□ Max.): API GL-5 class (SAE 80)	

Tightening Torques

Item	Tightening torque		
	Nm	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Front axle lock nut	196.1 ~ 255.0	20.0 ~ 26.0	144.7 ~ 188.1
Front strut assembly to knuckle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Front brake caliper to knuckle	98.1 ~ 117.1	10.0 ~ 12.0	72.3 ~ 86.8
Front lower arm to knuckle	88.3 ~ 117.7	9.0 ~ 12.0	65.1 ~ 86.8
Tie-rod end to knuckle	23.5 ~ 33.3	2.4 ~ 3.4	17.4 ~ 24.6
Rear shock absorber to body	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Rear shock absorber to rear axle	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Rear upper arm to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Rear upper arm to rear axle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7

Rear stabilizer bar link to body	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Rear stabilizer bar to rear axle	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Lateral rod to body	176.5 ~ 205.9	18.0 ~ 21.0	130.2 ~ 151.9
Lateral rod to rear axle	176.5 ~ 205.9	18.0 ~ 21.0	130.2 ~ 151.9
Rear shock absorber to spring seat	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Leaf spring assembly to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Leaf spring assembly to shackle	58.8 ~ 74.5	6.0 ~ 7.6	43.4 ~ 55.0
Leaf spring assembly U-bolt to nut	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8

Components



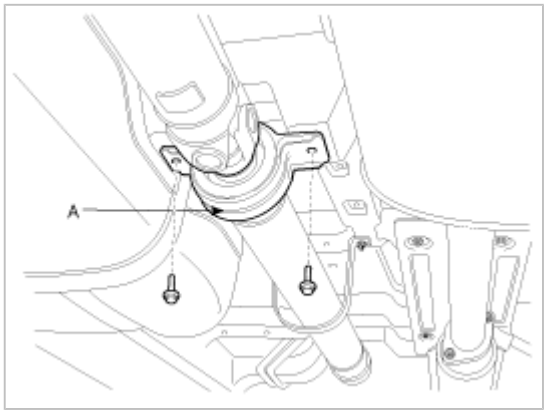
Torque : N.m (Kgf.m, lb-ft)

1. Front propeller shaft 2. Center bearing bracket 3. Rear propeller shaft	

Inspection

CV joint and boots

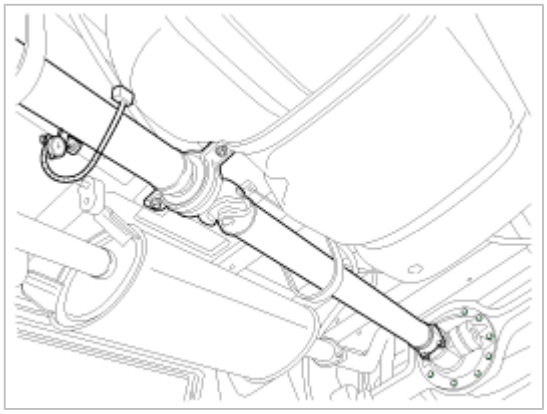
1. Shift the transaxle to neutral.
2. Raise the vehicle off the ground, and support it with safety stands in the proper locations.
3. Check the center bearing (A) excessive play or rattle and rubber for rent if the center bearing has excessive play or rattle and rubber has rent, replace the propeller shaft assembly.

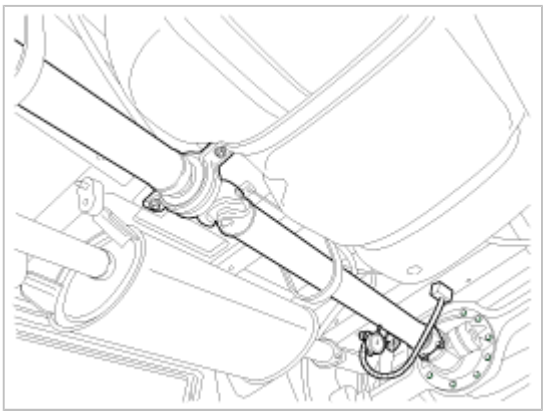


Propeller shaft run-out

1. Install a dial indicator with its needle on the center of front propeller shaft or rear propeller shaft.
2. Turn the propeller shaft slowly and check the run-out. Repeat this procedure for the other propeller shaft.

Front Propeller Shaft Run-out:
0.6mm (0.024in.) and less



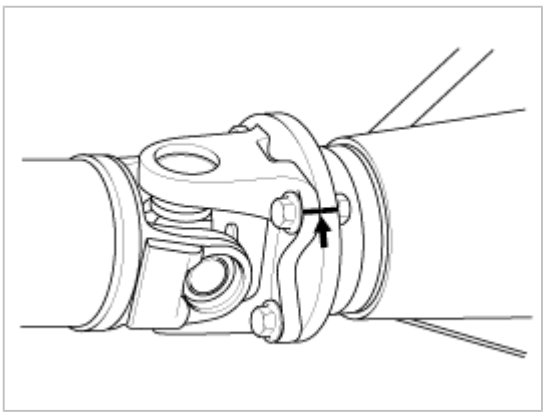


3. If the run-out on either propeller shaft exceeds the service limit, replace the propeller shaft assembly.

Replacement

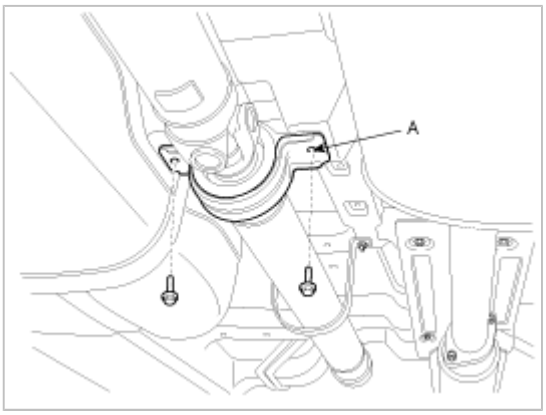
1. After making a match mark on the coupling and rear differential companion, remove the propeller shaft mounting bolts.

Tightening torque:
60 ~ 70Nm (6.0 ~ 7.0kgf.m, 43 ~ 51lb-ft)



2. Remove the center bearing bracket (A) mounting bolts.

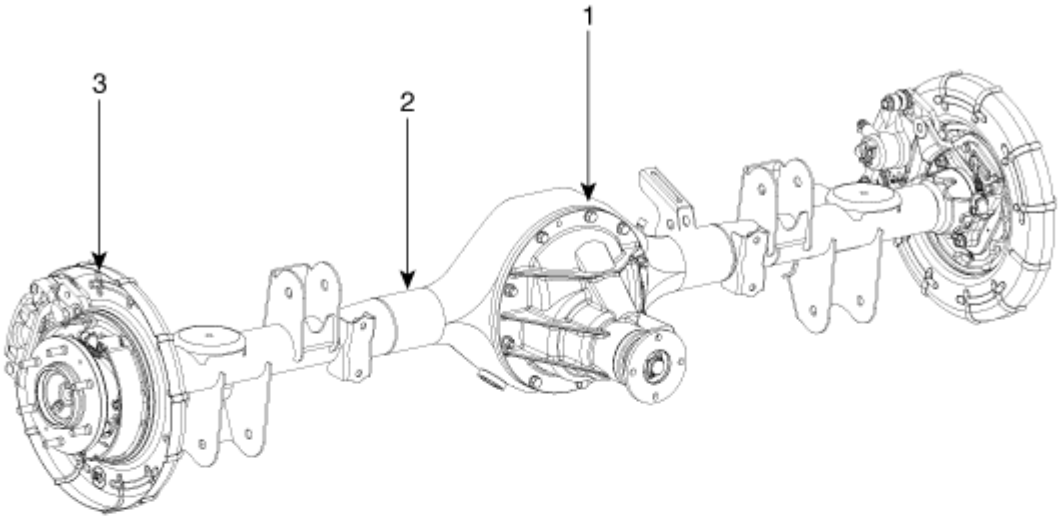
Tightening torque:
40 ~ 50Nm (4.0 ~ 5.0kgf.m, 29 ~ 36lb-ft)



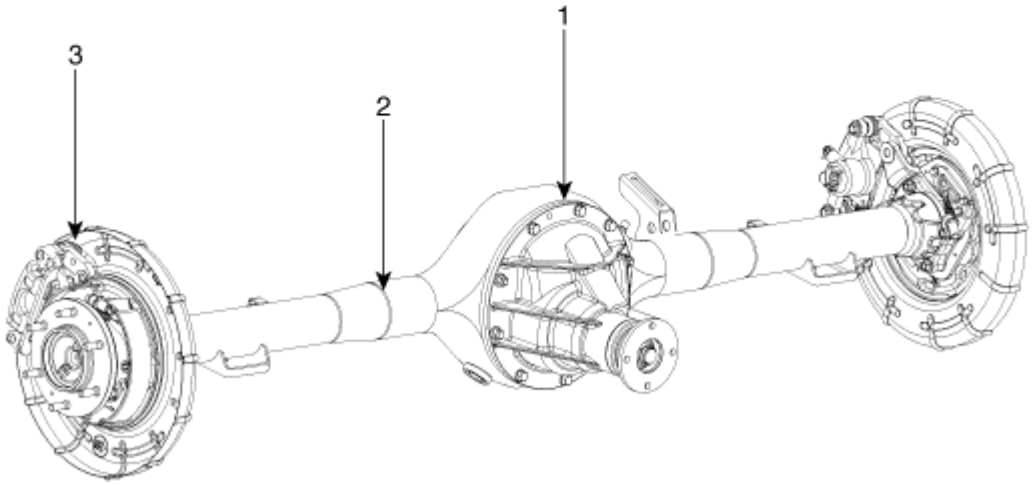
3. Installation is the reverse of the removal.

Components

[Wagon]



[Van]



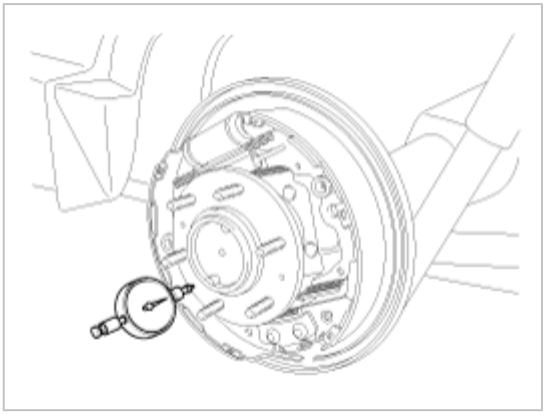
1. Differential carrier assembly 2. Rear axle housing assembly 3. Shaft & Brake assembly	

Inspection

Axle shaft end play check

1. Measure the axle shaft end play using a dial gauge.

Standard value: 0.06mm (0.0024in.) and less

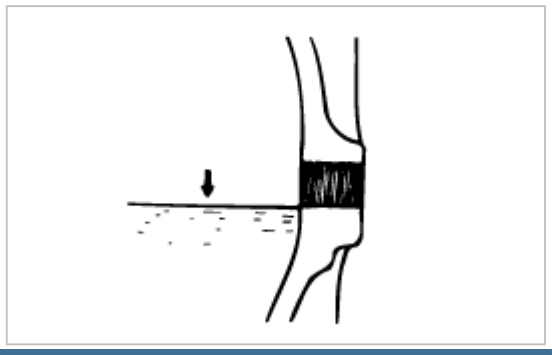


2. If the axle shaft end play exceeds the standard value, replace the bearing with a new one.

Gear oil level check

1. Remove the filler plug and check the quantity of oil in the differential carrier.
2. It is enough if oil is applied until the filler plug.

Specified gear oil
General zone (-30□ ~ 30□): API GL-4 class (SAE 90)
Severe heat zone (30□ Min.): API GL-4 class (SAE 140)
Severe frigid zone (-30□ Max.):
API GL-5 class (SAE 80)

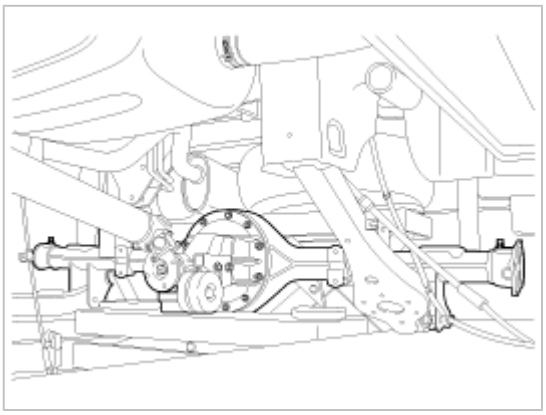


Removal

1. Remove the rear brake & carrier assembly.
2. Remove the parking brake cable and wheel speed sensor.
3. Disconnect the brake tube connection.
4. Disconnect the load sensing proportioning valve connection.
5. Disconnect the propeller shaft from the companion flange.

6. Remove the stabilizer bar mounting clamp. (Coil spring type)
7. Remove the lateral rod. (Coil spring type)
8. Remove the shock absorber assembly.

Support the rear axle housing with rigid jack before removing the shock absorber mounting nut.



9. Remove the lower arm and upper control arm assembly. (Coil spring type)

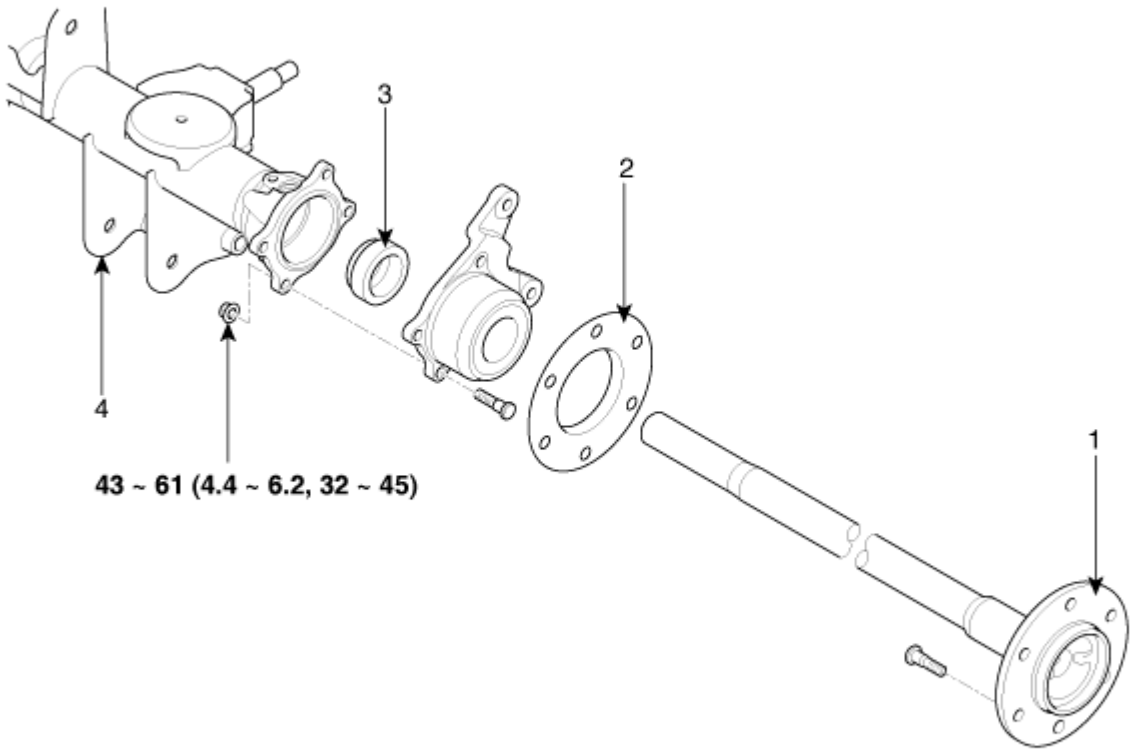
Be careful not to drop the rear axle assembly.

Installation

1. Installation is the reverse of the removal.
2. Tighten the parts with the specified torque as follows:

Hub nut:
90 ~ 110Nm (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)
Rear shock absorber to rear axle:
120 ~ 140Nm (12.0 ~ 14.0kgf.m, 87 ~ 101bl.ft)
Rear upper arm to rear axle:
140 ~ 160Nm (14.0 ~ 16.0, 101 ~ 116lb-ft)
Rear lower arm to rear axle:
140 ~ 160Nm (14.0 ~ 16.0, 101 ~ 116lb-ft)
Lateral rod mounting bolt & nut:
180 ~ 210Nm (18.0 ~ 21.0kgf.m, 130 ~ 152lb-ft)

Components

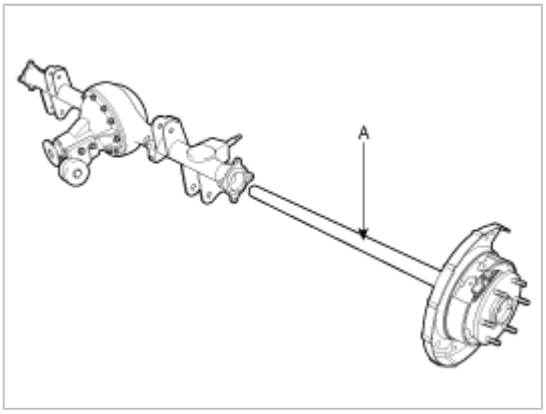


Torque : N.m (Kgf.m, lb-ft)

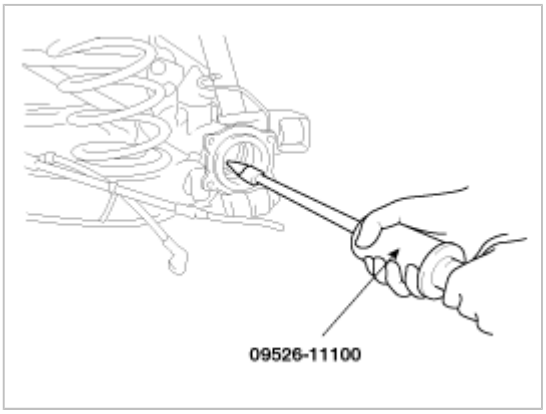
1. Rear axle shaft assembly	3. Retainer ring
2. Dust cover	4. Rear axle housing

Removal

1. Remove the rear brake & carrier assembly.
2. Remove the parking brake cable and wheel speed sensor cable.
3. Disconnect the brake hose and tube connection.
4. Remove the rear axle housing and axle shaft mounting bolts.
5. Remove the axle shaft (A).

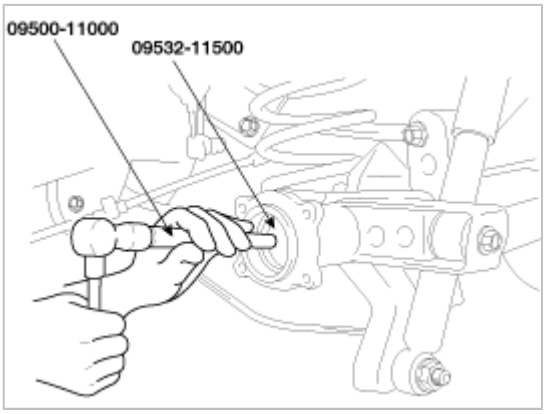


6. Using the special service tool (09526-11100), remove the oil seal.



Installation

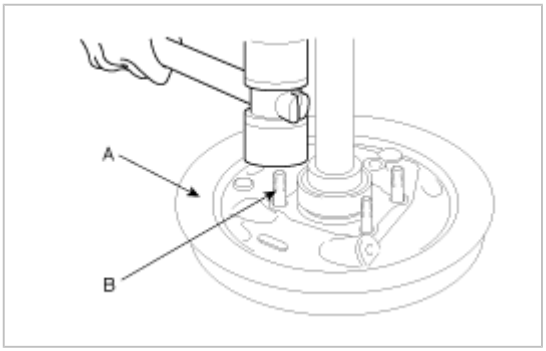
1. Installation is the reverse of the removal.
2. Apply the grease to the oil seal lip.
3. Using the special tools (09500-11000, 09532-11500), install the oil seal.



4. After installing the axle shaft, bleed the brake line. (Refer to BR group.)
5. Adjust the parking brake lever stroke. (Refer to the BR group.)

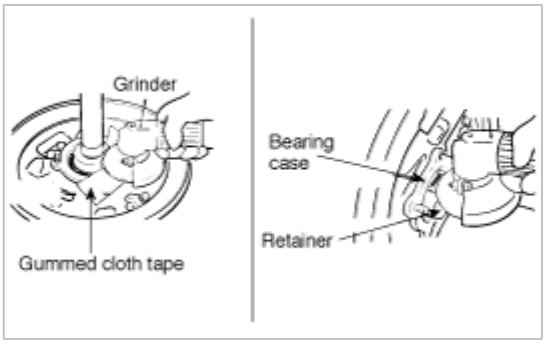
Disassembly

1. Remove the snap ring.
2. Remove the retainer bolts (B) from the backing plate (A).



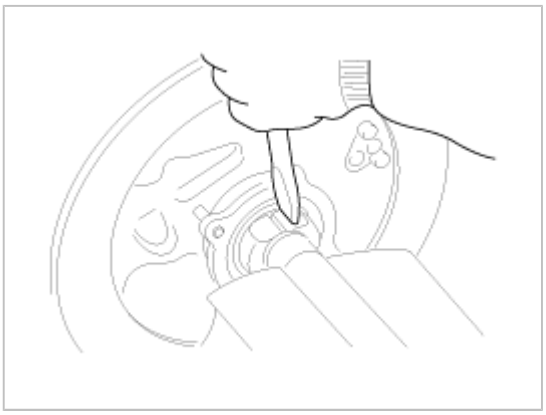
3. Apply gummed cloth tape around the edge of the bearing case for protection.
4. As shown in the figure, fix the axle shaft and shave off with grinder a point of its circumference locally until the wall thickness on the side of axle shaft of retainer becomes approximately 1.0 ~ 1.5 (0.039 ~ 0.059in.)

> Be careful not to damage the bearing case and the axle shaft.



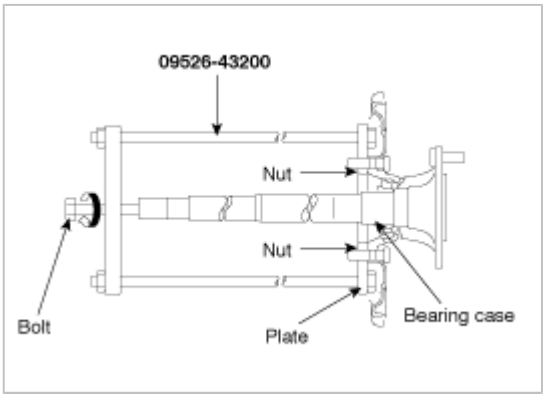
5. Cut in with a chisel the place where retainer ring has been shaven.

> Be careful not to damage the axle shaft.

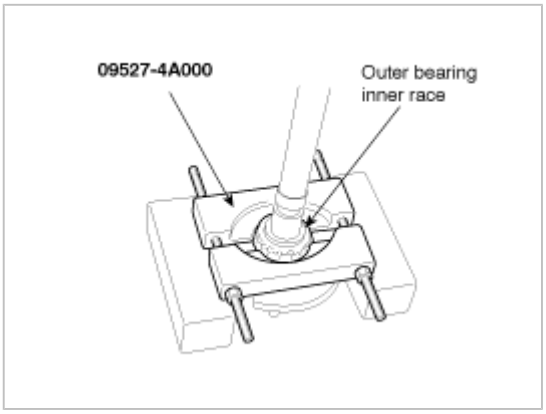


6. Install the special service tool (09526-43200) and then separate the bearing case and backing plate from the axle shaft.

Secure the plate of the special service tool (09526-43200) and bearing case with the bolts (length: 100mm or longer).



7. Using the special service tool (09527-4A000), remove the outer bearing inner race from the axle shaft.

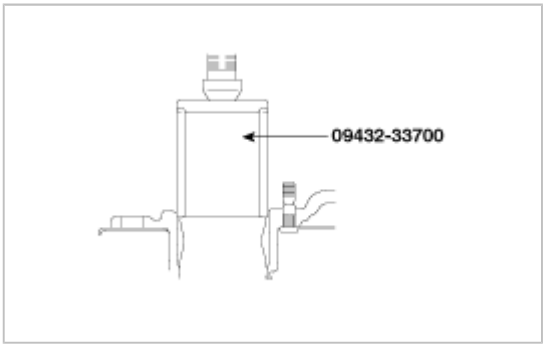


Inspection

1. Check the axle shaft spline part for wear or damage.
2. Check the backing plate for deformation and damage.
3. Check the bearing for seizure and discoloration.
4. Check the axle shaft for bend, wear or damage.

Reassembly

1. Press-fit bearing outer race to the bearing case.

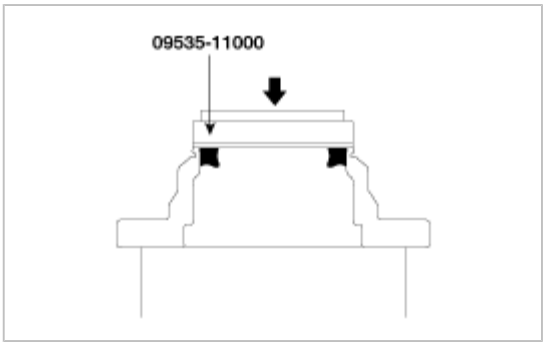


2. Apply multi-purpose grease to the roller surface and ends of the bearing inner race and fit it to the bearing case.

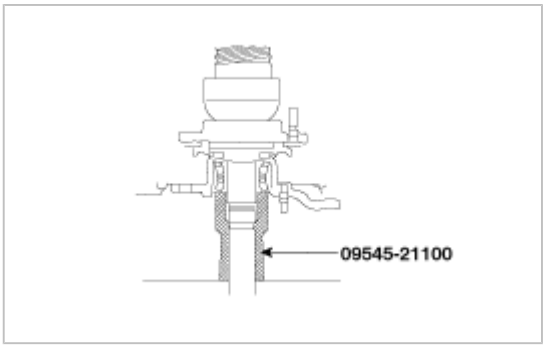
Recommended Grease: Retinax 0419

3. Press-fit the oil seal into the bearing case until it is flush with the face of the bearing case using the special service tool (09535-11000).

Apply multi-purpose grease to the lip of the oil seal.

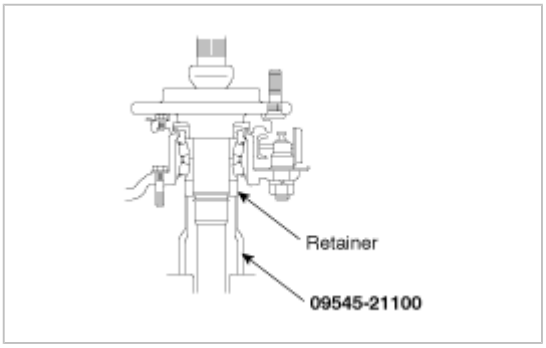


4. Install the backing plate.
5. Using the special service tool (09545-21100), press- fit the bearing case, inner bearing inner race, and outer bearing inner race to the axle shaft.



6. Using the special service tool (09545-21100), press- fit the retainer at the initial force of 5000kg or more

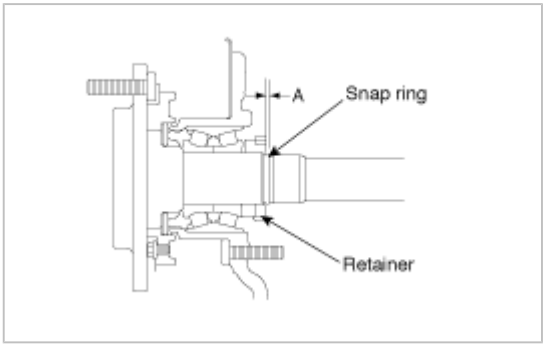
and at the final force of 10,000 ~ 11,000kg.



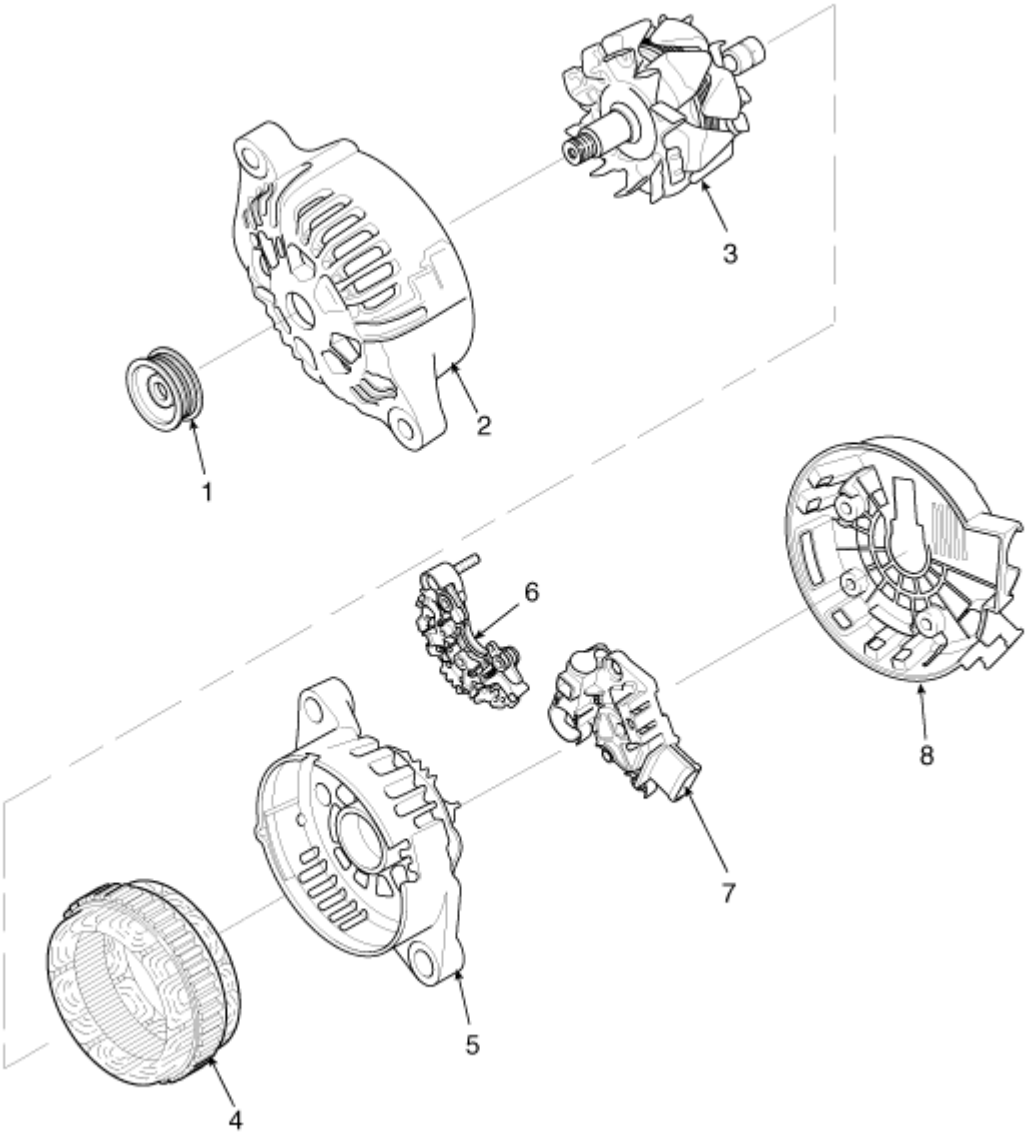
7. After installing the snap ring, measure the clearance (A) between the snap ring and the retainer.

Standard value (A): 0 ~ 0.16mm (0 ~ 0.0063in.)

If the clearance exceeds the standard value, change the snap ring so that the clearance is at the standard value.



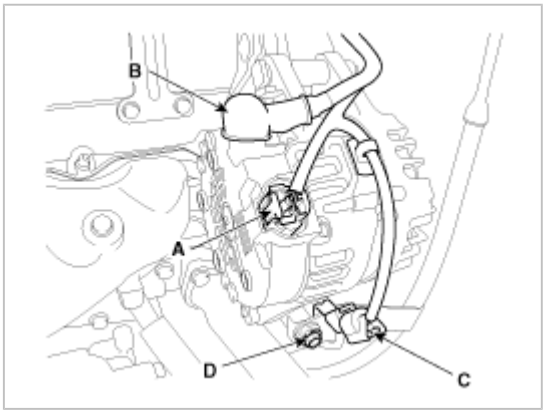
Components



1. Pulley	5. Rear bracket
2. Front bracket	6. Regulator assembly
3. Rotor	7. Rectifier assembly
4. Stator	8. Rear cover

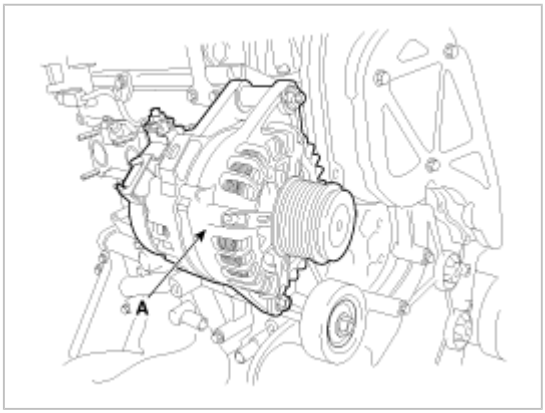
Replacement

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Disconnect the alternator connector(A) and "B" terminal cable(B) from the alternator.
3. Disconnect the oil pressure switch connector (C) and remove the oil level gauge mounting bolt (D).



4. Remove the drive belt.
5. Remove the through bolt and the alternator(A).

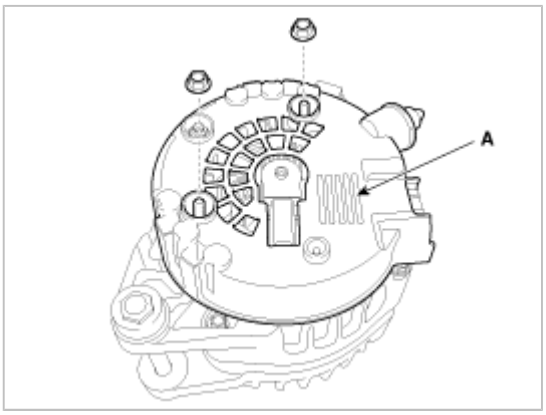
Tightening torque:
38.2 ~ 58.8N.m (3.9 ~ 6.0kgf.m, 28.2 ~ 43.4lb-ft)



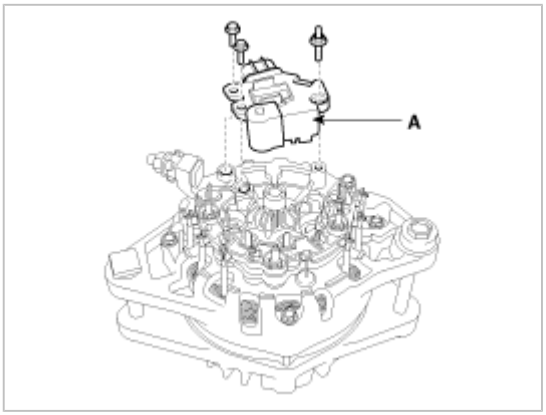
6. Installation is the reverse of removal.

Disassembly

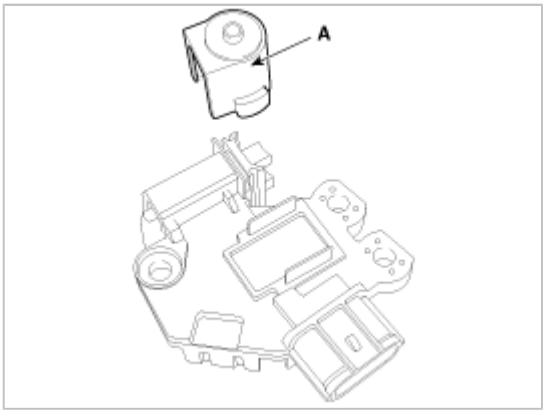
1. Remove the rear cover(A).



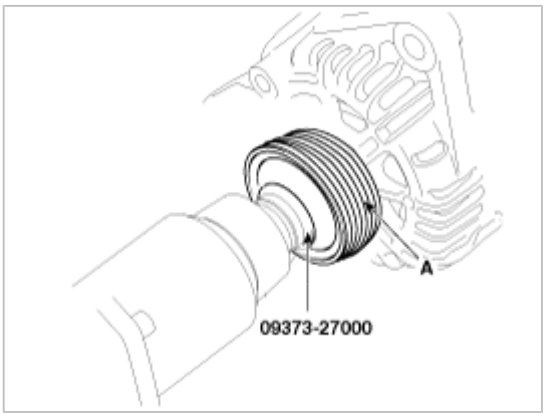
2. Remove the brush holder assembly(A).



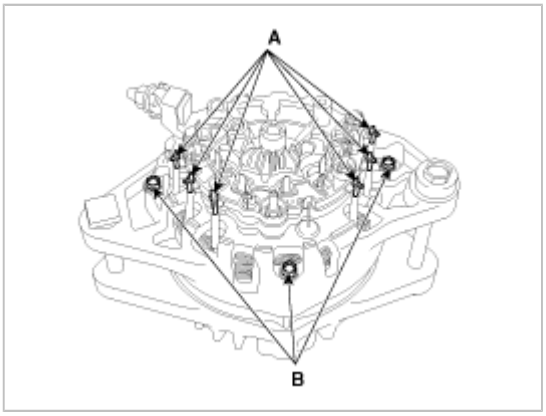
3. Remove the slip ring guide (A).



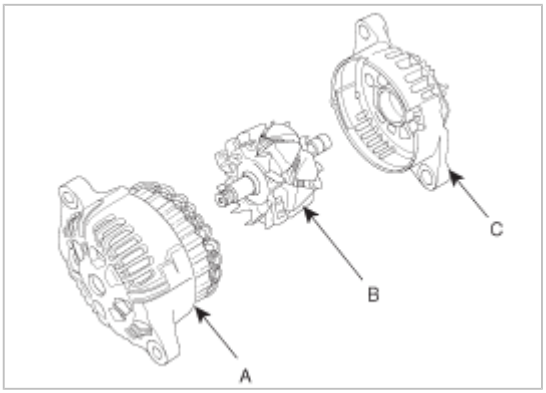
4. Remove the alternator pulley(A). If necessary, use the SST (09373-27000).



5. Unsolder the 6 stator leads (A).
6. Loosen the 4 through bolts (B).



7. Separate the front bracket (A), rotor (B) rear bracket (C).

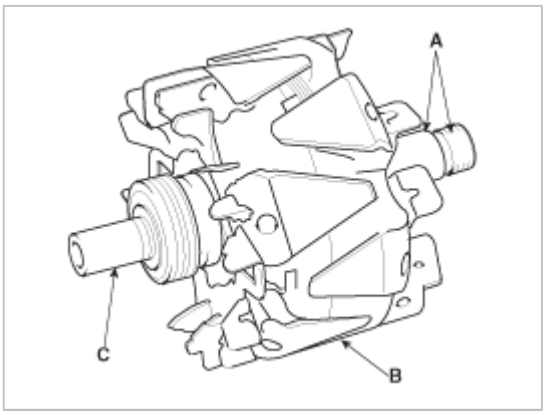


8. Installation is the reverse of removal.

Inspection

Inspect Rotor

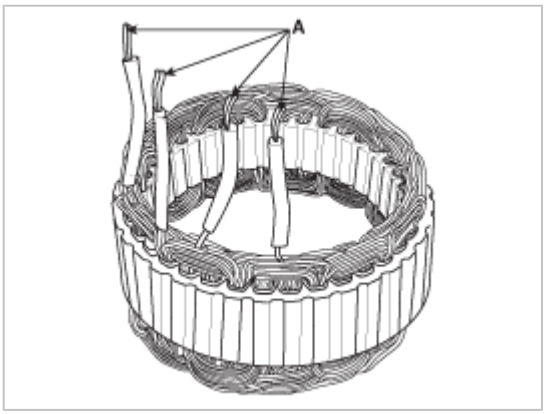
1. Check that there is continuity between the slip rings (A).



2. Check that there is no continuity between the slip rings and the rotor(B) or rotor shaft(C).
3. If the rotor fails either continuity check, replace the alternator.

Inspect Stator

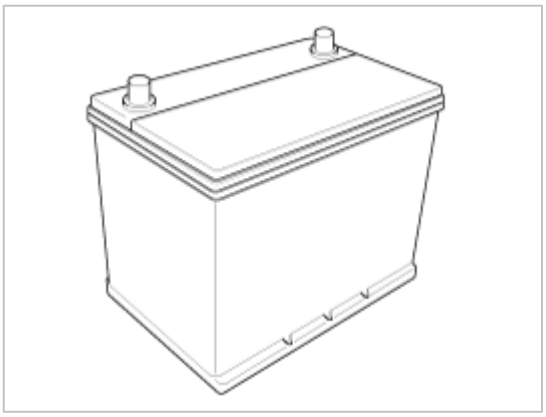
1. Check that there is continuity between each pair of leads(A).



2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the generator.

Description

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.



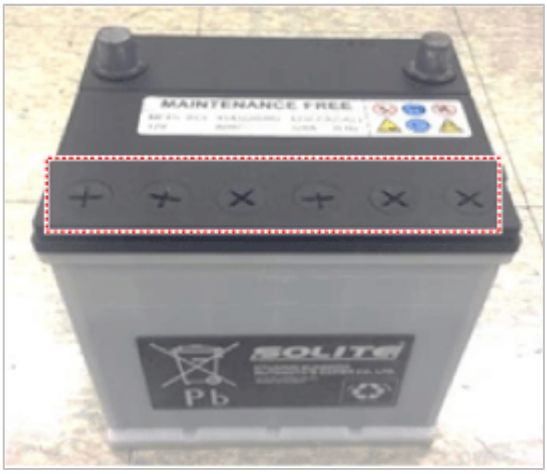
Adjustment

1. How to distinguish the openable between openable battery and other batteries.

Openable battery has 6 openable caps (red rectangle) on the upper side of the batter and color of the side cover is white.

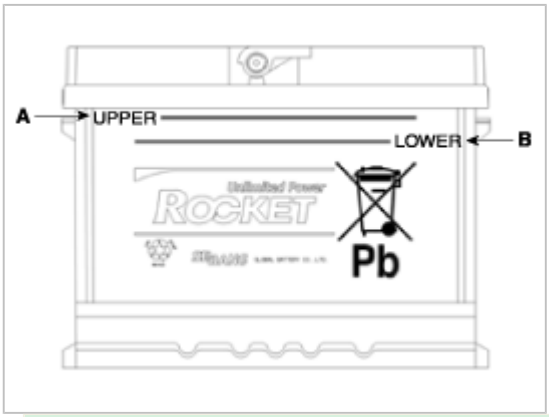
Normal Battery

Openable Battery



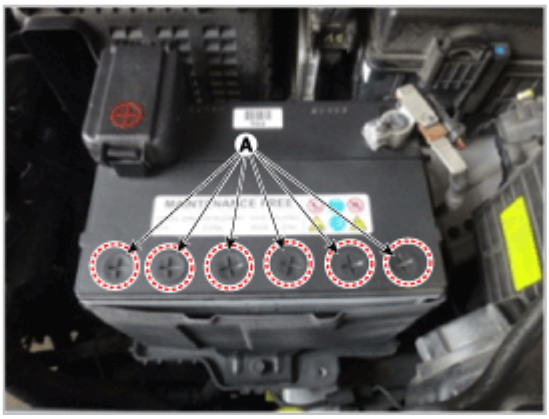
2. Fluid level check

(1) Battery fluid level should be between the ‘UPPER’ (A) and ‘LOWER’ (B) line of the battery

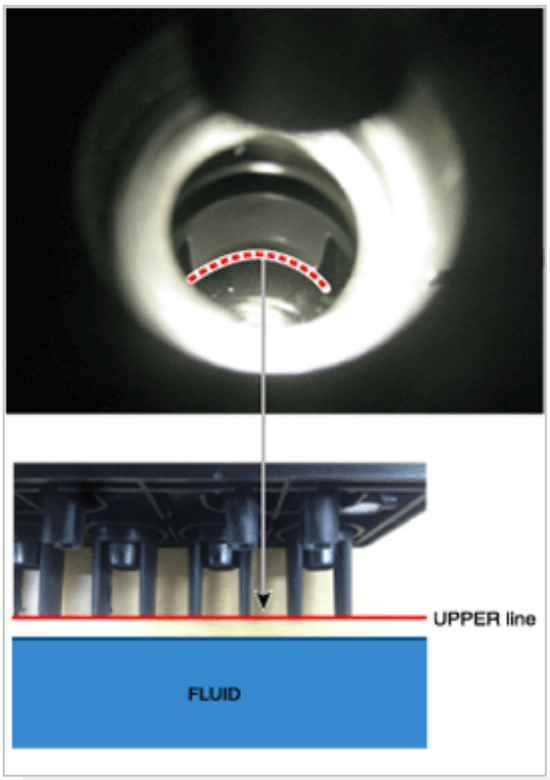


- Basically, battery fluid level should be checked once per an year or every 20,000 Km.
- To check the battery fluid level, remove the battery from the vehicle and check the battery level.
  However, you can also check the battery fluid level as below

(2) Open the battery cap (A).

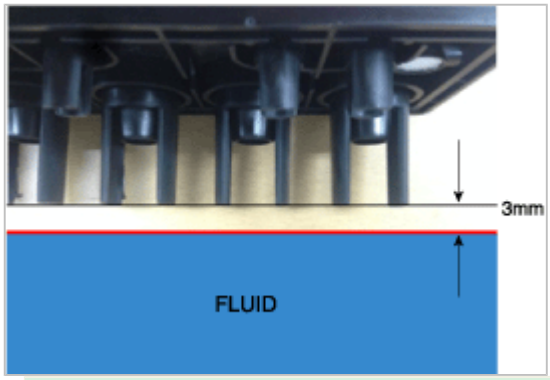


(3) Check the level from the hole.

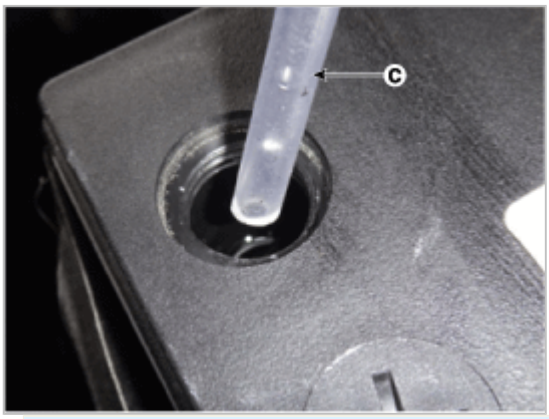


The red line in the up picture is the 'UPPER' line. When checking the level, it is highly recommended to use a flash light. Otherwise, the level might not be seen from the hole.

3. Replenish the battery fluid 3mm below the 'UPPER' level.



- DO NOT overfill the fluid. It can cause corrosion on the other parts.
- When replenishing the battery fluid, add the fluid slowly using a dropper (C). USE ONLY distilled (demineralized) water. NEVER USE TAP WATER.



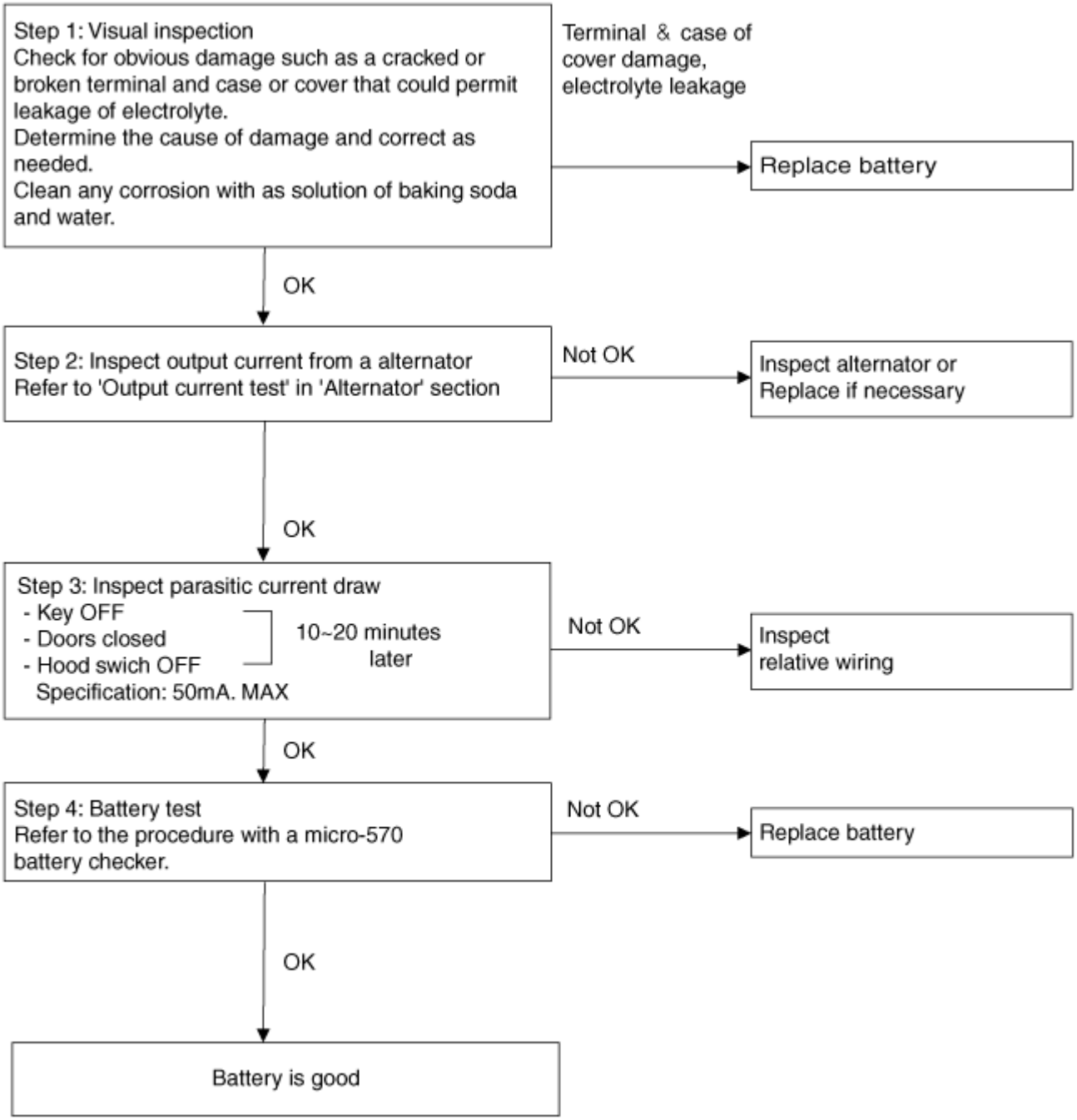
- Be careful not to break the caps when opening and closing them.
- Before opening the caps, clean the surface of the battery.

Before cleaning

After cleaning

Inspection

Battery Diagnostic Flow



Vehicle parasitic current inspection

1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   (1) Disconnect the hood switch connector.
   (2) Close the trunk lid.

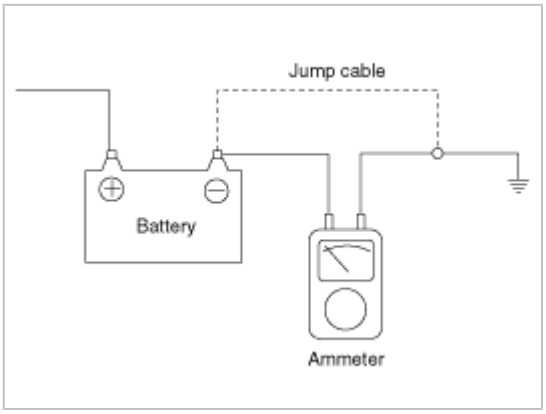
(3) Close the doors or remove the door switches.

3. Wait a few minutes until the vehicle's electrical systems go to sleep mode.

> For an accurate measurement of a vehicle parasitic current, all electriacl systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10~20 minutes.

4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

> Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.
> To prevent the battery from being reset during the inspection,
> 1) Connect a jump cable between the battery (-) terminal and the ground cable.
> 2) Disconnect the ground cable from the battery (-) terminal.
> 3) Connect an ammeter between the battery (-) terminal and the ground cable.
> 4) After disconnecting the jump cable, read the current value of the ammeter.



5. Read the current value of the ammeter.
   A. If the parasitic current is over the limit value, search for abnormal circuit by removing a fuse one by one and checking the parasitic current.
   B. Check the parasitic current again, and search for suspected unit by removing a unit connected with the abnormal circuit one by one.

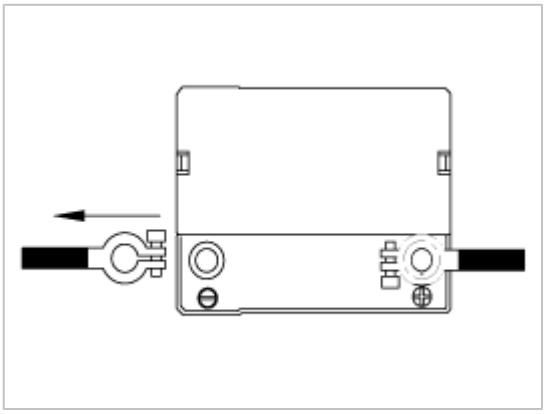
Limit value (after 10~20 min.) : Below 50mA

Cleaning

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).

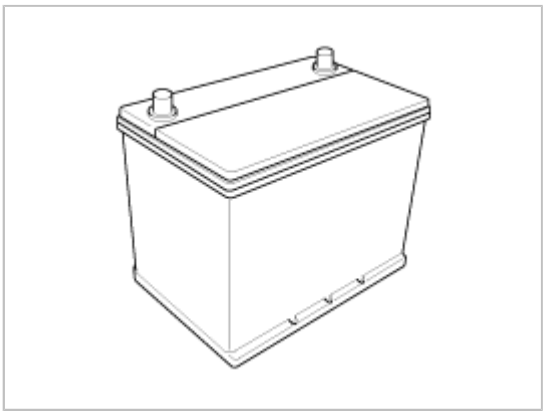
3. Remove the battery from the vehicle.

Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte.
Heavy rubber gloves (not the household type) should be wore when removing the battery.



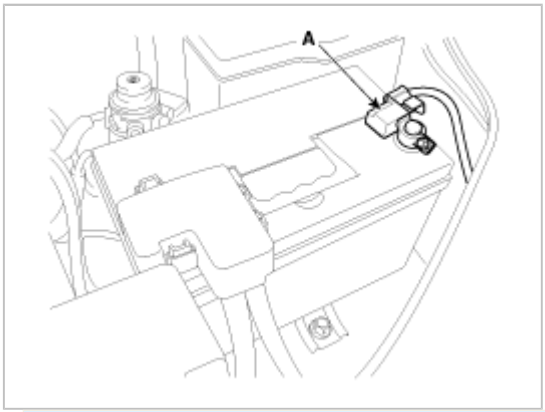
4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
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 tool.
8. Clean the inside surface of the terminal clamps with a suitable battery 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 tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

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 circuit at the terminals of batteries being charged.
A spark will occur when the circuit is broken. Keep open flames away from battery.



Description

Vehicles have many control units that use more electricity. These units control their own system based on information from diverse sensors. It is important to have a stable power supply as there diverse sensors giving a variety of information. Battery sensor (A) is mounted on battery (-) terminal. It transmits battery voltage, current, temperature information to ECM. ECM controls generating voltage by duty cycle based on these signals.



When battery sensor signal fault occurs, inspect the vehicle parasitic draw in advance after inspecting the sensor because the sensor will behave abnormally when the parasitic draw is more than 100mA. (Refer to vehicle parasitic current inspection)

It takes a few hours for a new battery sensor to detect the battery state correctly.
Perform the following process after replacing the battery sensor.

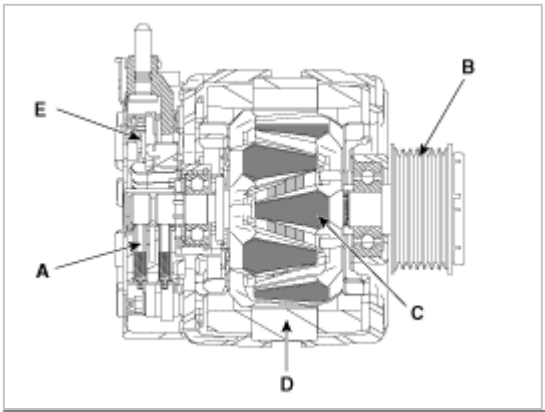
1. Ignition switch ON/OFF.
2. Park the vehicle about 4 hours.
3. After 4 hours later, check that the SOC (State of charge) of battery is displayed on GDS properly.

For the vehicle equipped with a battery sensor, be careful not to damage the battery sensor when the battery is replaced or recharged.

- When replacing the battery, it should be same one (type, capacity and brand) that is originally installed on your vehicle. If a battery of a different type is replaced, the battery sensor may recognize the battery to be abnormal.
- When installing the ground cable on the negative post of battery, tighten the clamp with specified torque of 4.0~6.0N.m (0.4~0.6kgf.m, 3.0~4.4lb-ft). An excessive tightening torque can damage the PCB internal circuit and the battery terminal.
- When recharging the battery, ground the negative terminal of the booster battery to the vehicle body.

Description

The charging system includes a battery, an alternator with a built-in regulator, and the charging indicator light and wire.
The Alternator has built-in diodes, each rectifying AC current to DC current.
DC current appears at alternator "B" terminal.
The charging voltage of this alternator is regulated by the ECM.
The main components of the alternator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.



A : Brush B : Drive belt pulley C : Rotor	D : Stator E : Regulator

Alternator Management System

Alternator management system controls the charging voltage set point in order to improve fuel economy, manage alternator load under various operating conditions, keep the battery charged, and protect the battery from over-charging. Battery sensor is mounted on battery (-) terminal. It transmits battery voltage, current, temperature information to ECM. ECM controls generating voltage by duty cycle based on the signals from battery sensor and vehicle operating conditions.
The system conducts discharging control when accelerating a vehicle. Vehicle reduces an alternator loadand consumes an electric power form a battery. The system conducts charging control when decelerating a vehicle. Vehicle increases an alternator load and charges a battery.

On-Vehicle Inspection

- Check that the battery cables are connected to the correct terminals.
- Disconnect the battery cables when the battery is given a quick charge.
- Do not perform tests with a high voltage insulation resistance tester.
- Never disconnect the battery while the engine is running.

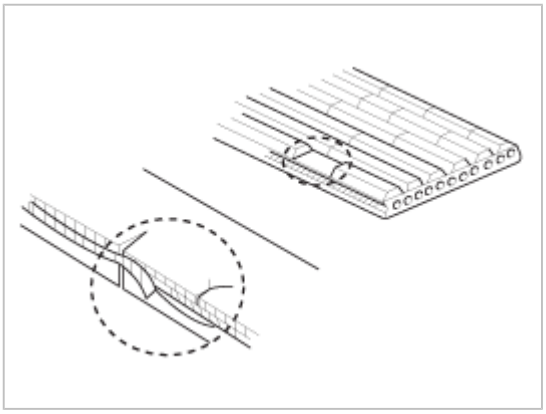
Check Battery Terminals, Fusible Link And Fuses

1. Check that the battery terminals are not loose or corroded.
2. Check the fusible link and fuses for continuity.

Inspect Drive Belt

1. Visually check the belt for excessive wear, frayed cords etc.
   If any defect has been found, replace the drive belt.

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



2. Using a belt tension gauge, measure the drive belt tension.

Visually Check Alternator Wiring And Listen For Abnormal Noises

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the alternator while the engine is running.

Check Discharge Warning Light Circuit

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is it.
4. Start the engine. Check that the light goes off.

Inspect Charging System

Voltage Drop Test Of Alternator Output Wire

This test determines whether or not the wiring between the alternator "B" terminal and the battery (+)

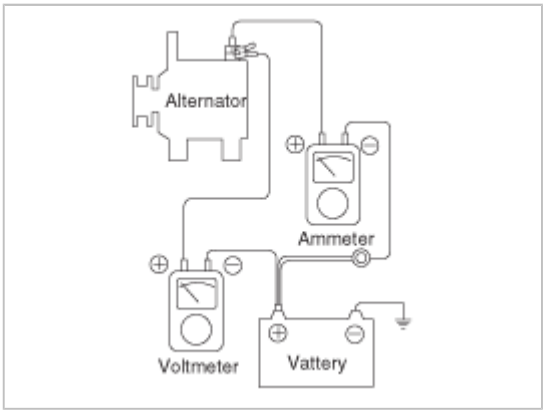
terminal is good by the voltage drop method.

Preparation

1. Turn the ignition switch to "OFF".

   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 alternator "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.



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 alternator "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 alternator gives an output current that is equivalent to the nominal output.

Preparation

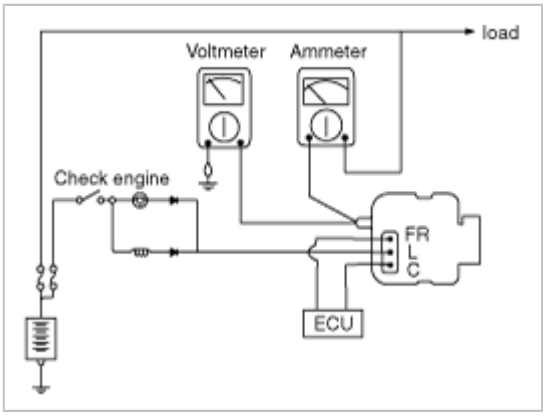
1. Prior to the test, check the following items and correct as necessary.
   Check the battery installed in the vehicle to ensure that it is in good condition. The battery checking

method is described 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.
Check the tension of the alternator drive belt.

2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the alternator output wire from the alternator "B" terminal.
5. Connect a DC ammeter (0 to 150A) 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.

> 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 alternator "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.



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 alternator "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.

> 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 alternator output wire is in good condition, remove the alternator from the vehicle and test it.

Limit value : 50% of the rated current

- The nominal output current value is shown on the nameplate affixed to the alternator body.
- The output current value changes with the electrical load and the temperature of the alternator 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 alternator itself or ambient temperature is too high.
  In such a case, reduce the temperature before testing again.

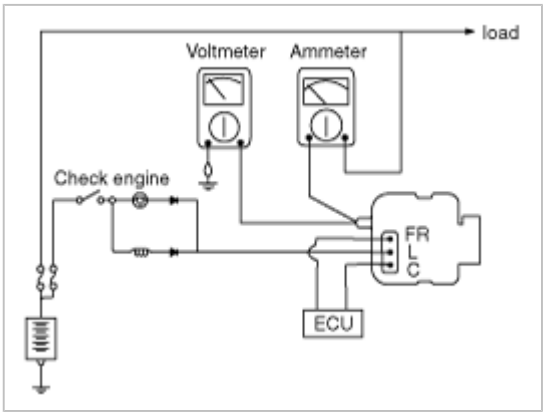
2. Upon completion of the output current test, lower the engine speed to idle and turn "OFF" the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the alternator output wire to the alternator "B" terminal.
6. Connect the 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.
   Check that the battery installed on the vehicle is fully charged. For battery checking method, see "BATTERY".
   Check the alternator drive belt tension.
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "B" terminal.
6. Connect a DC ammeter (0 to 150A) 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.



Test

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

   Voltage : Battery voltage

2. If it reads 0V, there is an open circuit in the wire between the alternator "B" terminal and the battery and the battery (-), or the fusible link is blown.
3. Start the engine. Keep all lights and accessories off.
4. Run the engine at a speed of about 2,500rpm and read the voltmeter when the alternator output current drops to 10A or less.

Result

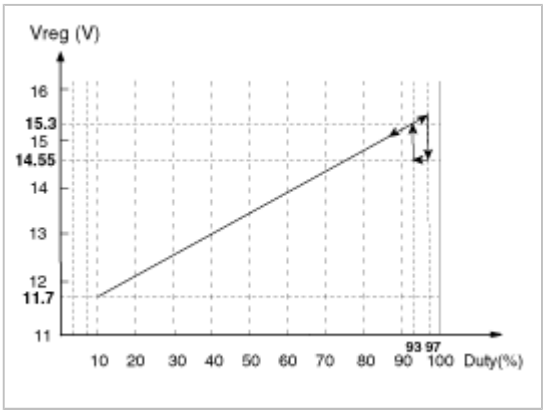
1. If the voltmeter reading agrees with the value listed in the Regulating Voltage Table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.

   Regulating Voltage Table (Internal mode)

Voltage regulator ambient temperature ℃ (℉)	Regulating voltage (V)
-30 (-22) 25 (77) 135 (275)	14.2 ~ 15.3 14.2 ~ 14.8 13.3 ~ 14.8

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 alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Regulating Voltage Table (External mode)


Vreg (V)
16
15.3
15
14.55
14
13
12
11.7
11
10 20 30 40 50 60 70 80 90 100 Duty(%)
93 97

The Micro 570 Analyzer

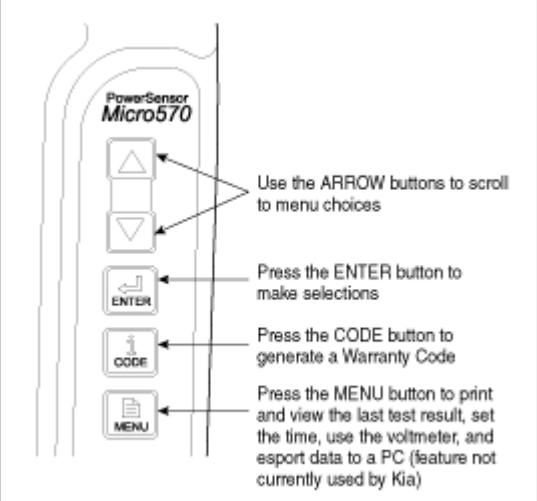
The Micro 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

- Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.
- When charging battery by test result, Battery must be fully charged.

To get accurate test result, battery surface voltage must have subsided ahead before test when you test battery after charged. (See following Battery Test Results)

Keypad

The Micro 570 button on the key pad provide the following functions :

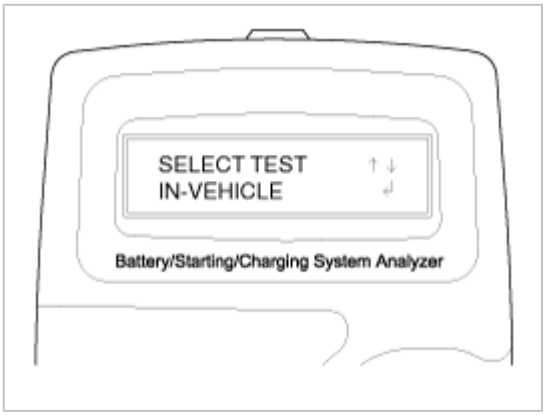


Battery Test Procedure

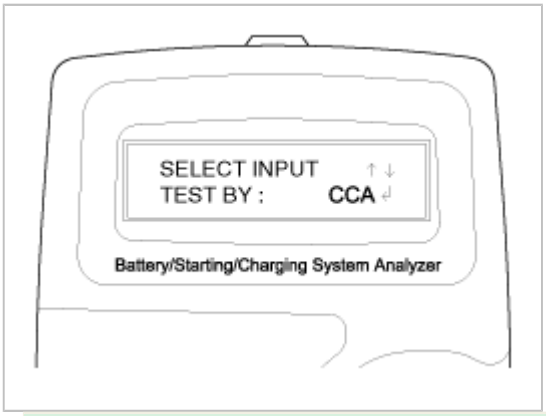
1. Connect the tester to the battery.
   A. Red clamp to battery positive (+) terminal.
   B. Black clamp to battery negative (-) terminal.

Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN-VEHICLE" or "OUT-OF-VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



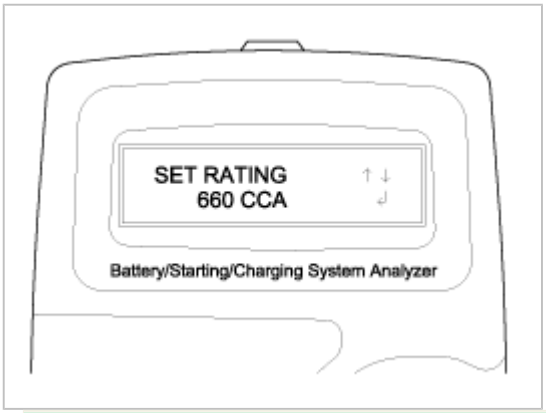
3. Select CCA and press the ENTER button.



CCA : Cold cranking amps, is an SAE specification for cranking batteried at -0.4℉ (-18℃).

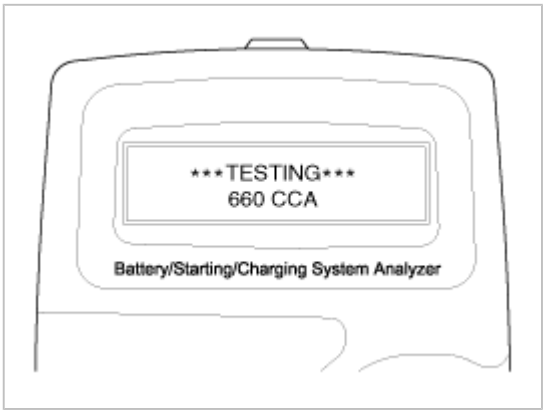
4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up

and down buttons and press ENTER.

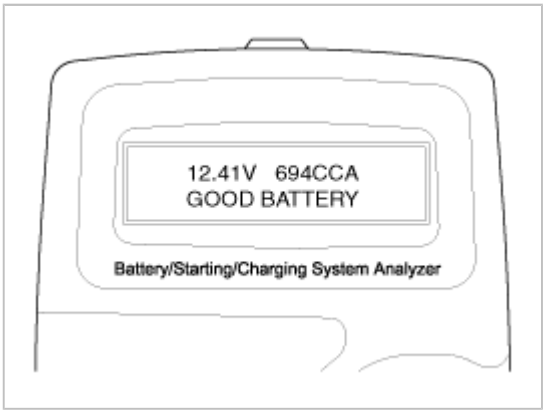


The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

5. The tester will conduct battery test.



6. The tester displays battery test results including voltage and battery ratings.
   Refer to the following table and take the appropriate action as recommended by the Micro 570.



Battery Test Results

Result On Printer	Remedy
GOOD BATTERY	No action is required.

GOOD RECHARGE	Battery is in a good state. Recharge the battery and use. □ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and Retest method after battery charge' below.)
CHARGE & RETEST	Battery is not charged properly. - Charge and test the battery again. □ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and Retest method after battery charge' below.)
REPLACE BATTERY	Replace battery and recheck the charging system. - Improper connection between battery and vehicle cables may cause "REPLACE BATTERY". Retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery.
BAD CELL-REPLACE	Charge and retest the battery. - If the Micro 570 recommends "REPLACE BATTERY", replace the battery and recheck the charging system.

[Charge and Retest method after battery charge]

Battery charge

Set battery charger to 'Auto Mode' (The Mode that charging current drops as the battery charges.) and charge battery until charging current down close to zero or the charger alerts you with an alarm when charge is complete.

(Minimum charging time recommended: More than 3 hours with Auto Mode that explained above)

A. If battery is not fully charged, battery surface voltage will be high while the amount of current charged (CCA) in battery is low. If you measure the battery under this condition, tester may misjudge that battery sulfation occurred because the amount of current in battery is too low in comparison with battery voltage.

* Surface voltage: When battery is charged electrolyte temperature increases and chemical reaction become active resulting in an excessive increase of battery voltage.

It is known that it takes approximate one day to subside this increased surface voltage completely.

Battery Test after charge

Do not test battery right after the charge. Test battery after battery surface voltage has subsided as instructed in the following procedure.

(1) When battery charge is complete, install the battery in the vehicle.

(2) Put IG key to ON position and turn on head lamp with low beam, and wait 5 minutes. (Discharge for 5 minutes)

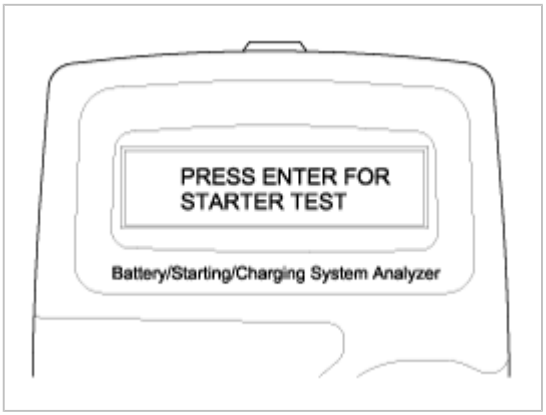
(3) Turn off the head lamp and IG key, and wait 5 minutes. (Waiting for 5 minutes)

(4) Remove +, - cable from the battery and test battery.

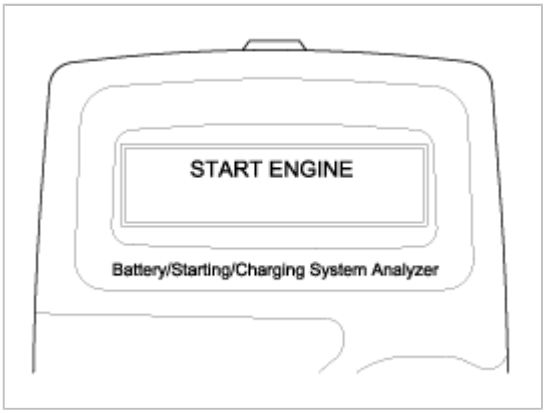
Whenever filing a claim for battery, the print out of the battery test results must be attached.

Starter Test Procedure

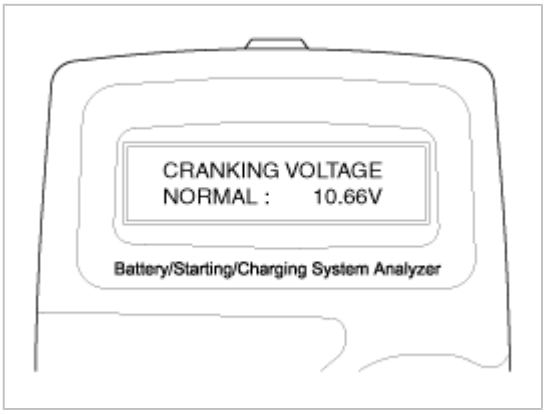
7. After the battery test, press ENTER immediately for the starter test.



8. Start the engine.



9. Cranking voltage and starter test results will be displayed on the screen.
   Refer to the following table and take the appropriate action as recommended by the Micro 570.



Starter Test Results

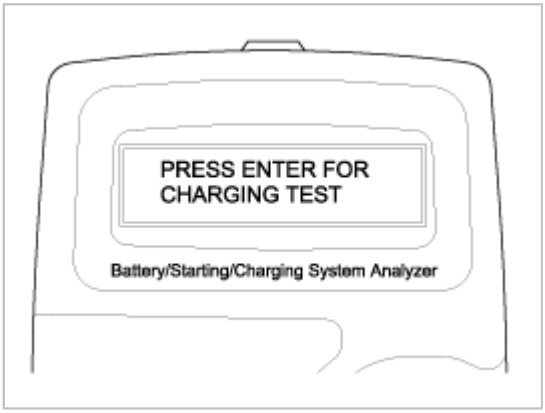
Result On Printer	Remedy

CRANKING VOLTAGE NORMAL	System shows a normal starter draw.
CRANKING VOLTAGE LOW	Cranking voltage is lower than normal level. - Check starter.
CHARGE BATTERY	The state of battery charge is too low to test. - Charge the battery and retest.
REPLACE BATTERY	Replace battery. - If the vehicle is not started though the battery condition of "GOOD BATTERY" is displayed, check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. - If the engine does crank, check fuel system.

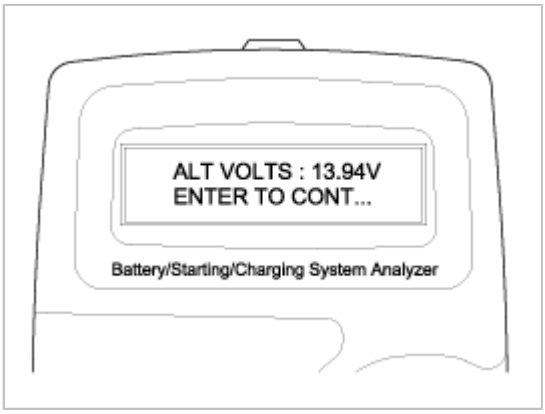
When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

Charging System Test Procedure

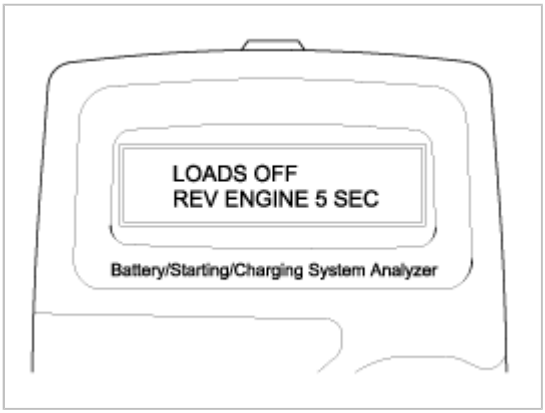
10. Press ENTER to begin charging system test.

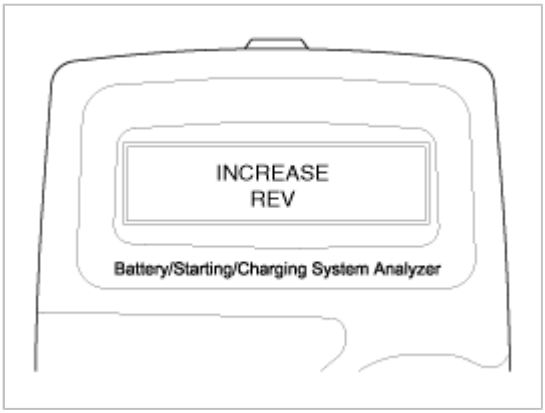


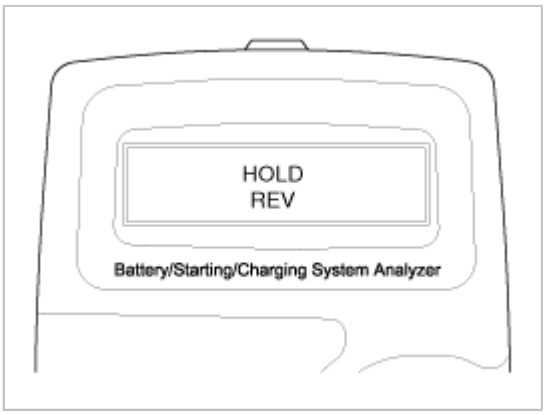
11. The tester displays the actual voltage of alternator.
    Press ENTER to continue.



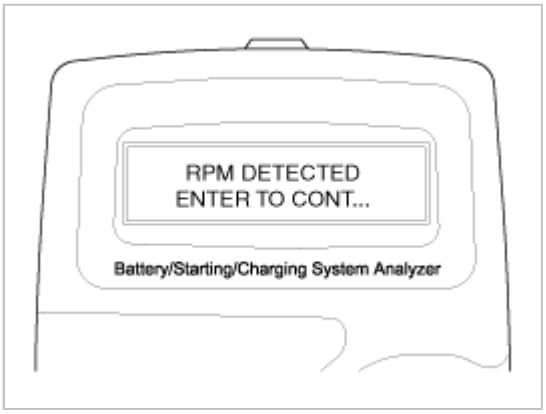
12. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)



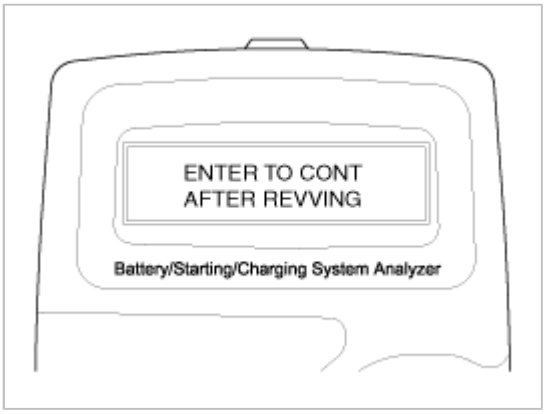




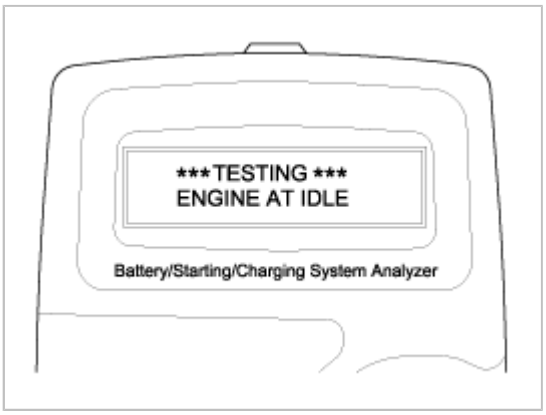
13. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.

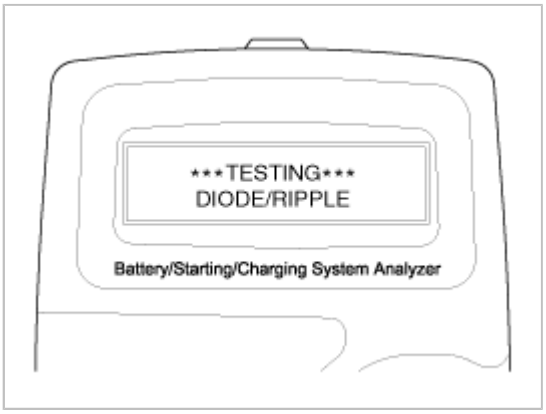


14. If the engine RPM is not detected, press ENTER after revving engine.

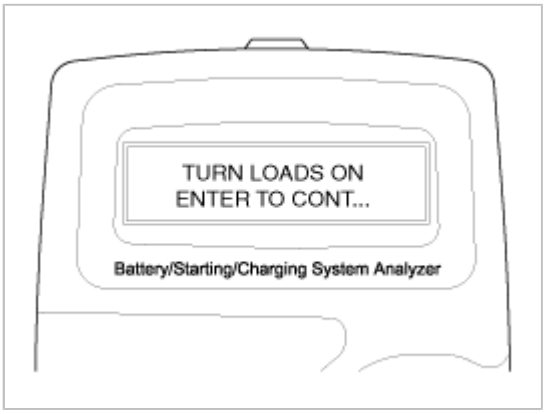


15. The tester will conduct charging system test during loads off.

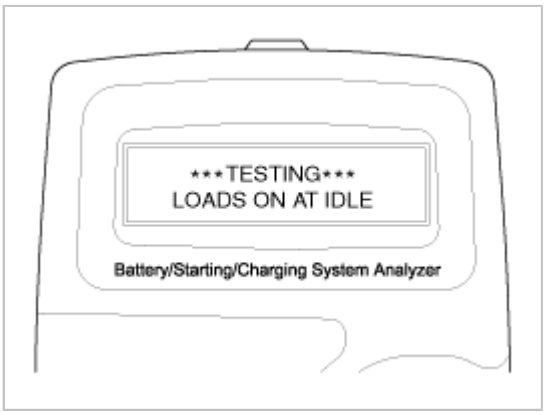




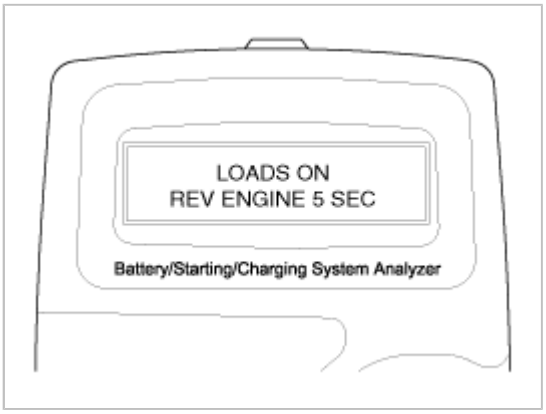
16. Turn on electrical loads (air conditioner, lamps, audio and etc). Press ENTER to continue.

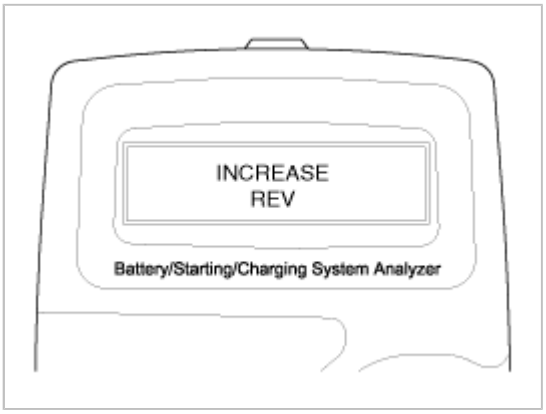


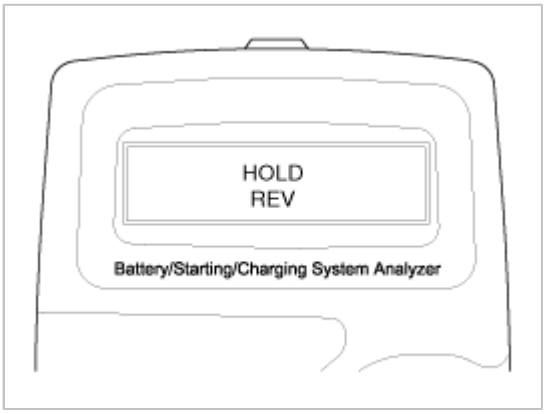
17. The tester will conduct charging system test during loads on.



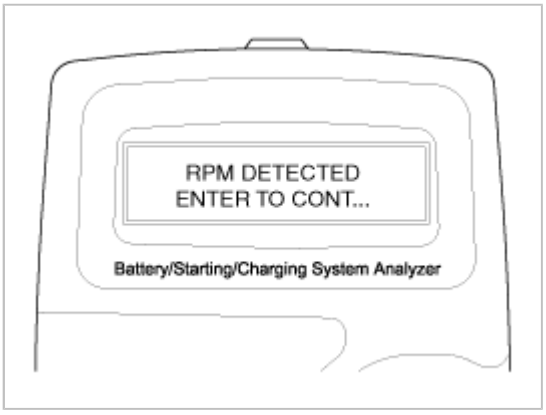
18. Rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)



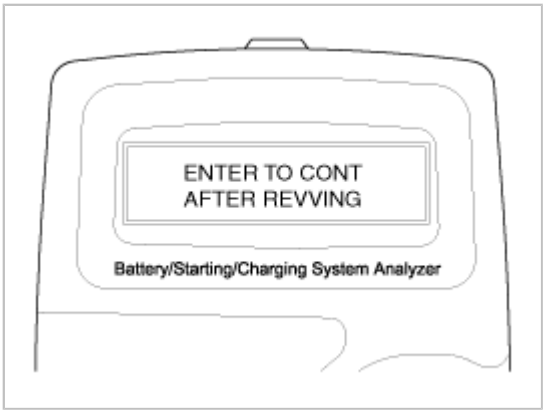




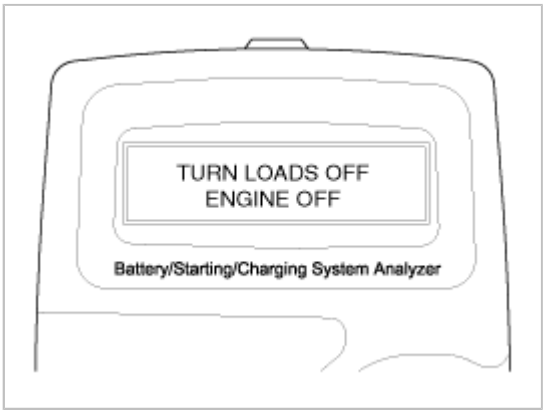
19. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.



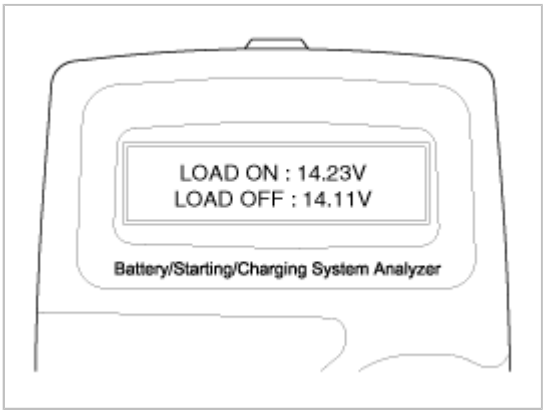
20. If the engine RPM is not detected, press ENTER after revving engine.

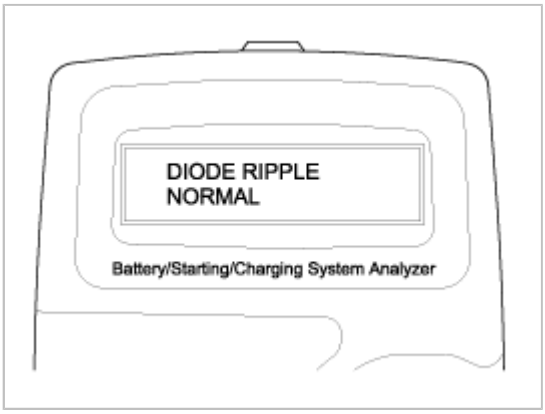


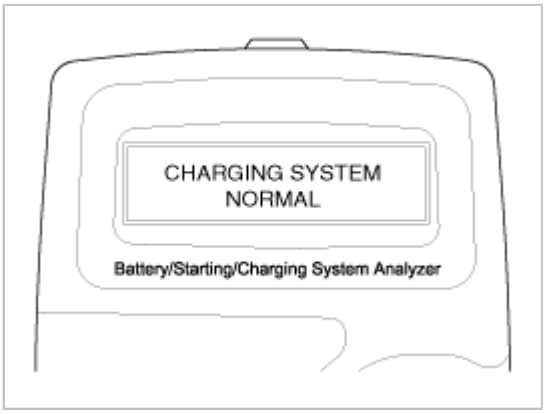
21. Turn off electrical loads (air conditioner, lamps, audio and etc). Turn the engine off.



22. Charging voltage and charging system test results will be displayed on the screen.
    Shut off engine end disconnect the tester clamps from the battery. Refer to the following table and take the appropriate action as recommended by the Micro 570.







Charging System Test Results

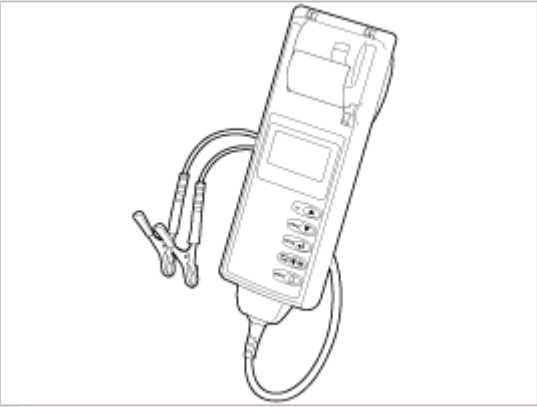
Result On Printer	Remedy
CHARGING SYSTEM NORMAL / DIODE RIPPLE NORMAL	Charging system is normal.
NO CHARGING VOLTAGE	Alternator does not supply charging current to battery. - Check belts, connection between alternator and battery and replace belts or cable or alternator as necessary.
LOW CHARGING VOLTAGE	Alternator does not supply charging current to battery and electrical load to system fully.

	- Check belts and alternator and replace as necessary.
HIGH CHARGING VOLTAGE	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check connection and ground and replace regulator as necessary. - Check electrolyte level in the battery.
EXCESS RIPPLE DETECTED	One or more diodes in the alternator is not functioning properly. - Check alternator mounting and belts and replace as necessary.

The MDX-670P Analyzer

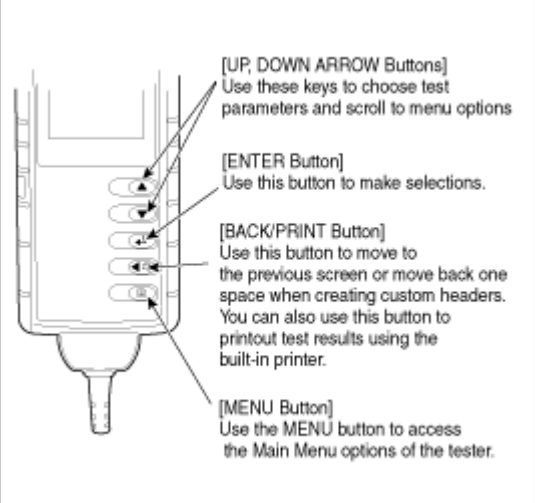
The MDX-670P battery conductance and electrical system analyzer tests batteries as well as starting and charging systems for vehicle.

It displays the test results in seconds and features a built-in printer to provide a copy of the results.



1. Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.
2. When charging battery by test result, Battery must be fully charged. To get accurate test result, battery surface voltage must have subsided ahead before test when you test battery after charged. (See following Battery Test Results)

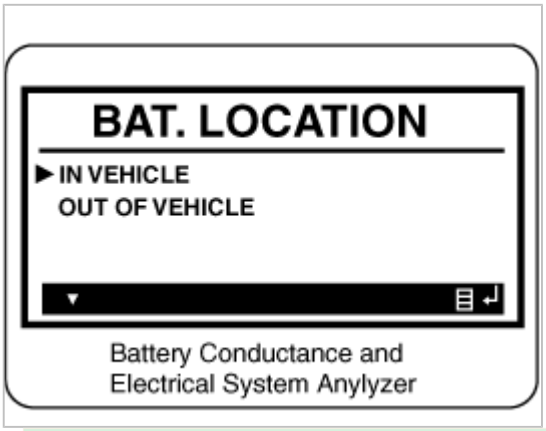
When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.



1. Connect the red clamp to the positive (+) terminal and the black clamp to the negative (–) terminal.

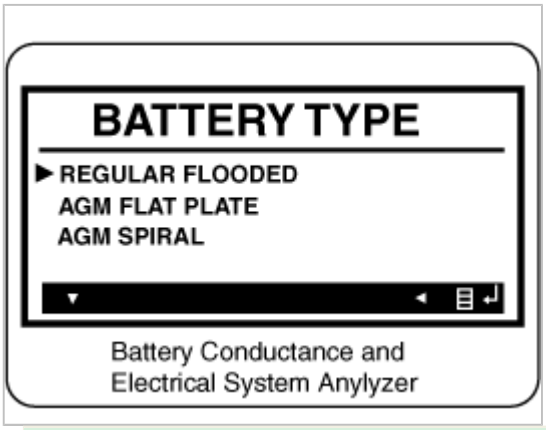
For a proper connection, rock the clamps back and forth. The tester re¬quires that both sides of each clamp be firmly connected before testing. A poor connection will produce a CHECK CONNECTION or WIGGLE CLAMPS message. If the message appears, clean the terminals and reconnect the clamps.

2. Scroll to and select IN VEHICLE or OUT OF VEHICLE for a battery not connected to a vehicle.



Following an IN VEHICLE test you will be prompted to test the starting and charging systems.

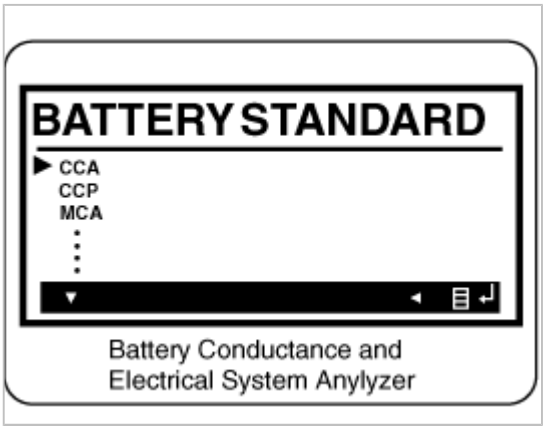
3. Scroll to and select REGULAR FLOODED, AGM FLAT PLATE, or AGM SPIRAL where applicable.



If the vehicle equipped with ISG function, select the AGM FLAT PLATE.

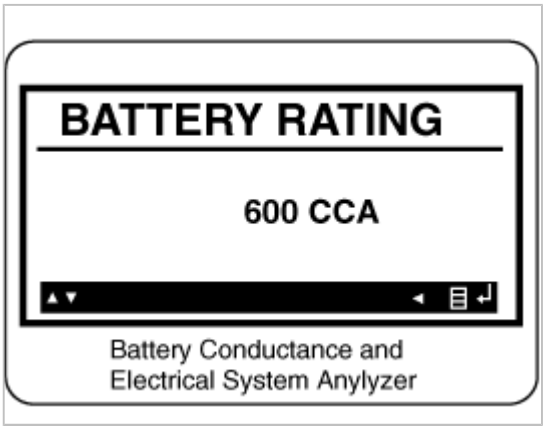
4. Scroll to and select the battery's rating system.

Mostly, the CCA value is marked on the battery label, but sometimes marked EN or SEA value. Select one of them.

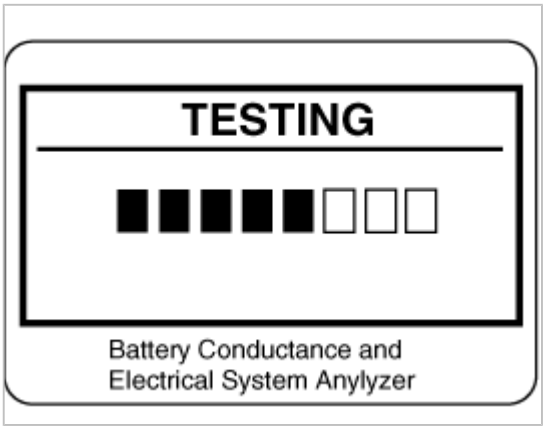


A. CCA: Cold Cranking Amps, as specified by SAE. The most common rating for cranking batteries at 0 ºF (–17.8 ºC).
B. EN: Europe-Norm
C. SAE: Society of Automotive Engineers, the European labeling of CCA

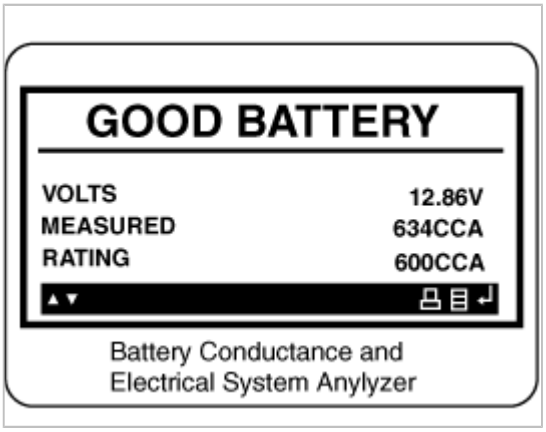
5. Set the selected rating value displayed on the screen to the value marked on the battery label by pressing up and down arrow buttons.



6. Press ENTER to start test.



7. After several seconds the tester displays the decision on the battery's condition and the measured voltage. The tester also displays your selected battery rating and the rating units.



Battery Test Results

Result On Printer	Remedy
GOOD BATTERY	No action is required.
GOOD RECHARGE	Battery is in a good state. Recharge the battery and use. □ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and Retest method after

	battery charge' below.)
CHARGE & RETEST	Battery is not charged properly. - Charge and test the battery again. □ You have to follow instruction below when you charge battery and retest, otherwise test result can be inaccurate. (See 'Charge and retest method after battery charge' below.)
REPLACE BATTERY	Replace battery and recheck the charging system. - Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery.
BAD CELLREPLACE	Charge and retest the battery. - If recommends "REPLACE BATTERY", replace the battery and recheck the charging system.

[Charge and Retest method after battery charge]

Battery charge

Set battery charger to 'Auto Mode' (The Mode that charging current drops as the battery charges.) and charge battery until charging current down close to zero or the charger alerts you with an alarm when charge is complete.(Minimum charging time recommended: More than 3 hours with Auto Mode that explained above)

A. If battery is not fully charged, battery surface voltage will be high while the amount of current charged (CCA) in battery is low. If you measure the battery under this condition, tester may misjudge that battery sulfation occurred because the amount of current in battery is too low in comparison with battery voltage.
   * Surface voltage: When battery is charged electrolyte temperature increases and chemical reaction become active resulting in an excessive increase of battery voltage.
   It is known that it takes approximate one day to subside this increased surface voltage completely.

Battery Test after charge

Do not test battery right after the charge. Test battery after battery surface voltage has subsided as instructed in the following procedure.

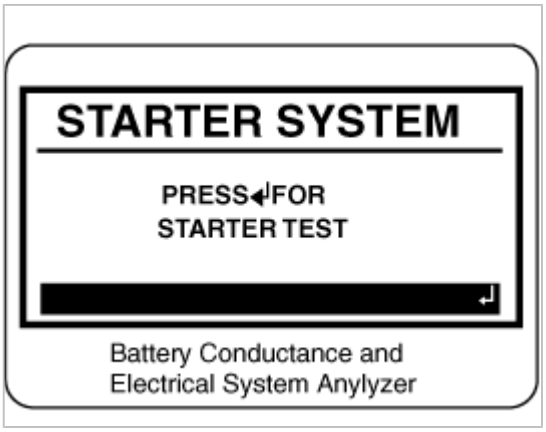
(1) When battery charge is complete, install the battery in the vehicle.
(2) Put IG key to ON position and turn on head lamp with low beam, and wait 5 minutes. (Discharge for 5 minutes)
(3) Turn off the head lamp and IG key, and wait 5 minutes. (Waiting for 5 minutes)
(4) Remove +, - cable from the battery and test battery.

For an in-vehicle test, the display alternates between the test results and the message "PRESS

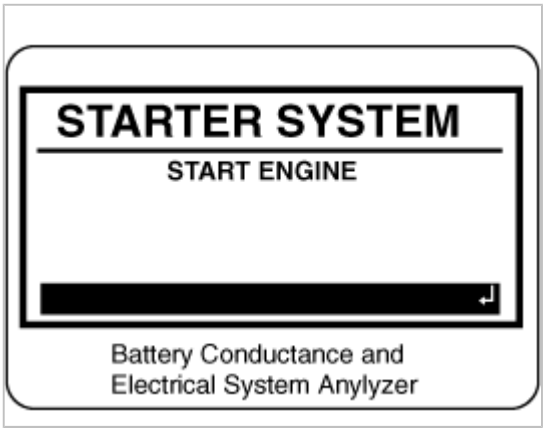
FOR STARTER TEST.

Before starting the test, inspect the alternator drive belt. A belt that is glazed or worn, or lacks the proper tension, will prevent the en¬gine from achieving the rpm levels needed for the test.

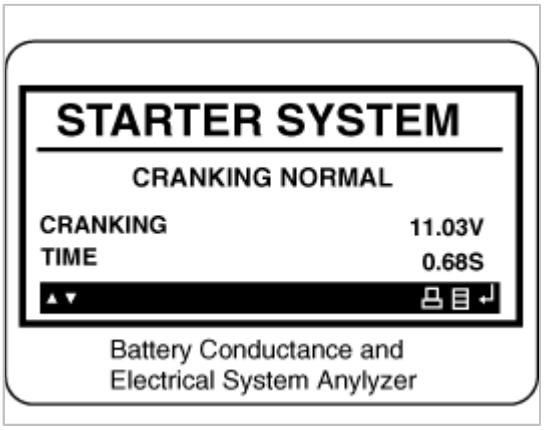
8. Press the ENTER button to proceed with the starter test.



9. Start the engine when prompted.



10. The tester displays the decision on the starter system, cranking voltage, and cranking time in milliseconds.



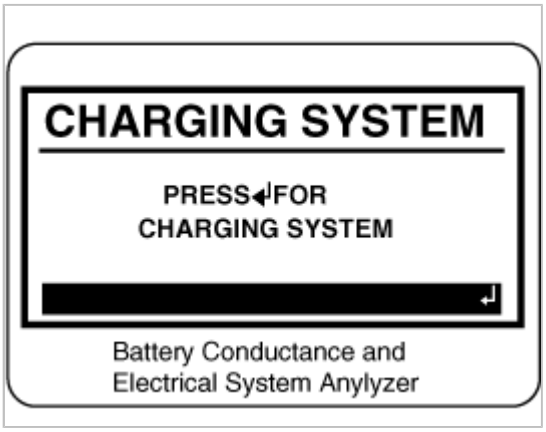
Starter Test Results

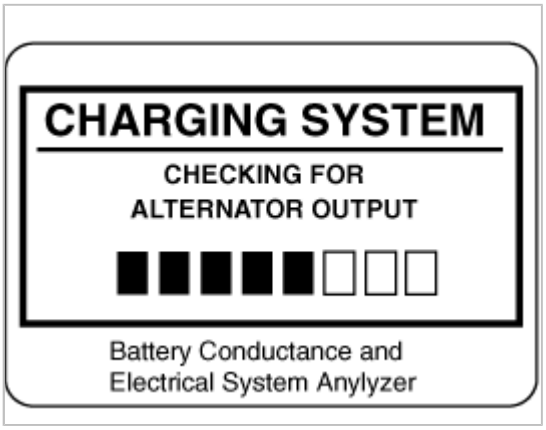
Result On Printer	Remedy
CRANKING VOLTAGE NORMAL	System shows a normal starter draw.
CRANKING VOLTAGE LOW	Cranking voltage is lower than normal level. - Check starter.
CHARGE BATTERY	The state of battery charge is too low to test. - Charge the battery and retest.
REPLACE BATTERY	Replace battery. - If the vehicle is not started though the battery condition of "GOOD BATTERY" is displayed, check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. - If the engine does crank, check fuel system.

For an in-vehicle test, the display alternates between the test results and the message “PRESS FOR CHARGING TEST.

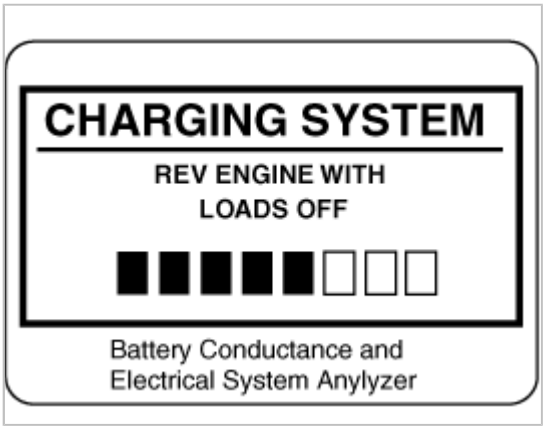
Step 3: Charging System Test

11. Press the ENTER button to proceed with the charging test.

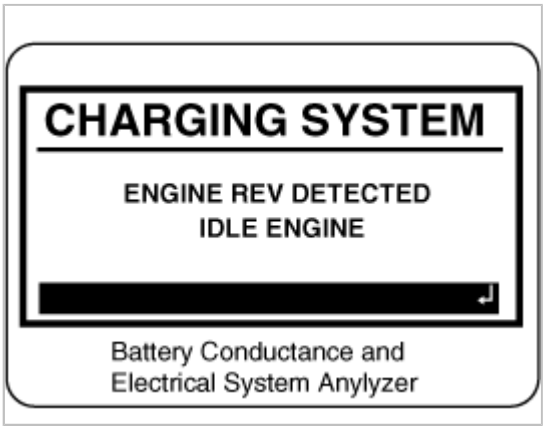




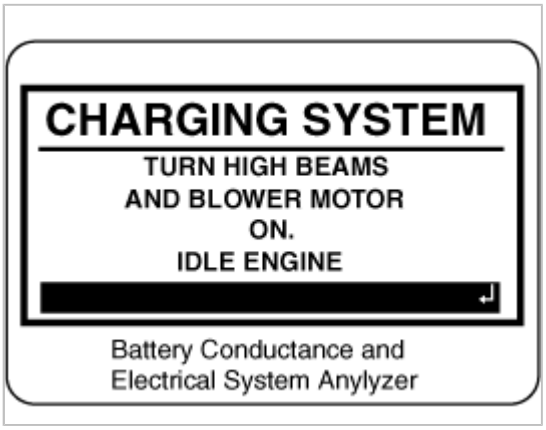
12. Rev the engine with loads off. (Following the on-screen prompts)



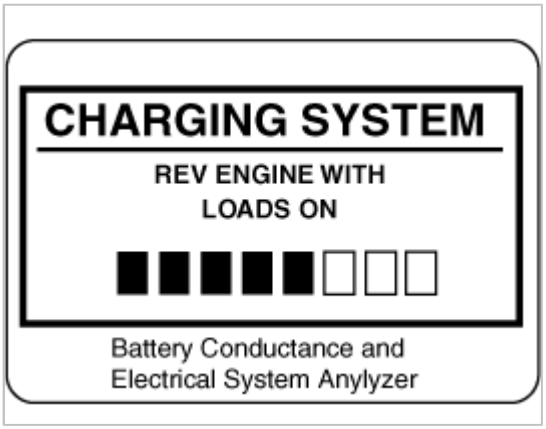
13. The message that engine RPM is detected will be displayed on the screen, idle the engine.



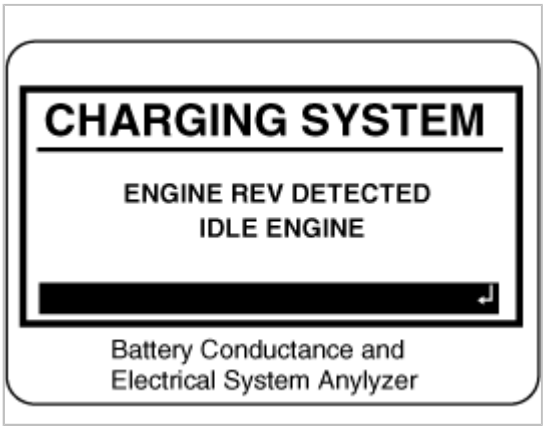
14. Turn on electrical loads (air conditioner, lamps, audio and etc). Press ENTER to continue.



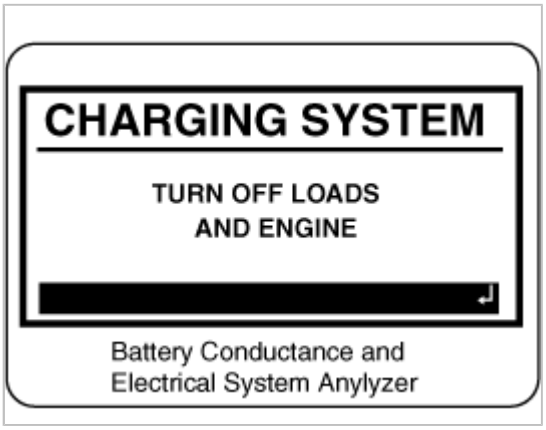
15. Turn on electrical loads (air conditioner, lamps, audio and etc). Press ENTER to continue.



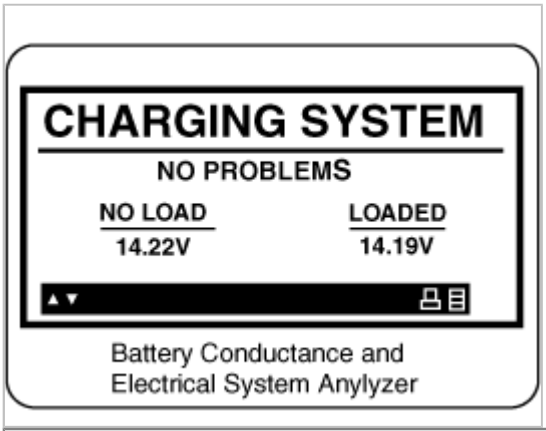
16. The message that engine RPM is detected will be displayed on the screen, idle the engine.



17. Turn off loads and engine.



18. The Charging System decision is displayed at the end of the procedure.

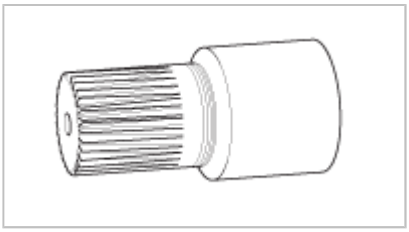
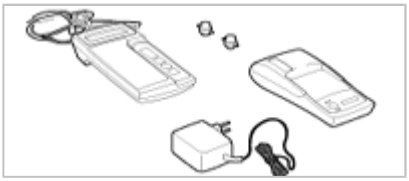
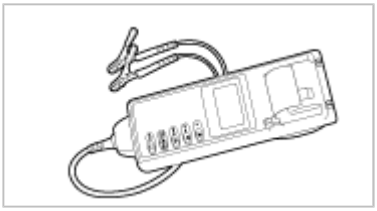


Result On Printer	Remedy
NO PROBLEMS	System is showing normal output from the alternator.
NO OUTPUT	No alternator output detected. - Check all connections to and from the alternator, especially the connection to the battery. If the connection is loose or heavily corroded, clean or replace the cable and retest.

	- If the belts and connections are in good working condition, replace the alternator. (Older vehicles use external voltage regulators, which may require only replacement of the voltage regulator.)
LOW OUTPUT	Alternator does not supply charging current to battery and electrical load to system fully. - Check belts and alternator and replace as necessary.
HIGH OUTPUT	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check connection and ground and replace regulator as necessary. - Check electrolyte level in the battery.
EXCESSIVE RIPPLE	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check alternator mounting and belts and replace as necessary.
CHARGE BATTERY	The starter voltage is low and the battery is discharged. Fully charge the battery and repeat the starter system test.
REPLACE BATTERY	Battery must be replaced before the starting system can be tested.

19. Press the BACK/PRINT button to print the test results or MENU to return to the Options Menu.

Reference Service Tools

Tool (Number and name)	Illustration	Use
Alternator pulley remover wrench (09373-27000)		Removal and installation of alternator pulley
Micro-570 Battery checker		- Check the battery condition - Check the charging and starting system
MDX-670P Battery checker		- Check the battery condition - Check the charging and starting system

Specification

Starting System

Item			Specifications
Starter	Rated voltage		12V, 2.2KW
	No. of pinion teeth		11
	No-load charasteristics	Voltage	11V
		Amperage	125A, MAX
		Speed	2,900 rpm, MIN

Charging System

Item			Specifications
Alternator	Type		Battery voltage sensing
	Rated voltage		13.5V, 130A
	Voltage regulator		I.C regulator built-in type
	Regulator setting voltage	External mode	ECU control
		Internal mode	14.55 ± 0.3V
Battery	Type		72-30GR
	Cold cranking amperage at-18℃ (0℉)		720A
	Reserve capacity		160min
	Specific gravity at 20℃ (77℉)		1.280 ± 0.01

- COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.
- REVERSE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7℃(80℉)

- Battery type notation : MF 48 - 23 G L
  (① ② ③ ④ ⑤)

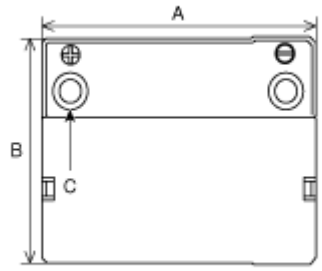
① : Battery type
- MF : Maintenance Free

② : Battery capacity (5HR)
- 48 : 48AH

③ : Battery length (A)
- 23 : 230mm (9.06in)

④ : Battery width (B)
- A : 127mm (5.00in)
- B : 129mm (5.08in)
- C : 132mm (5.20in)
- D : 135mm (5.31in)
- E : 154mm (6.06in)
- F : 173mm (6.81in)
- G : 175mm (6.89in)
- H : 176mm (6.93in) or above

⑤ : Terminal location (C)
- L : Positive terminal is left
- R : Positive terminal is right



Preheating System

Item		Specifications
Glow plug	Rated voltage	DC 11V
	Resistance	550 mΩ

Troubleshooting

Charging System

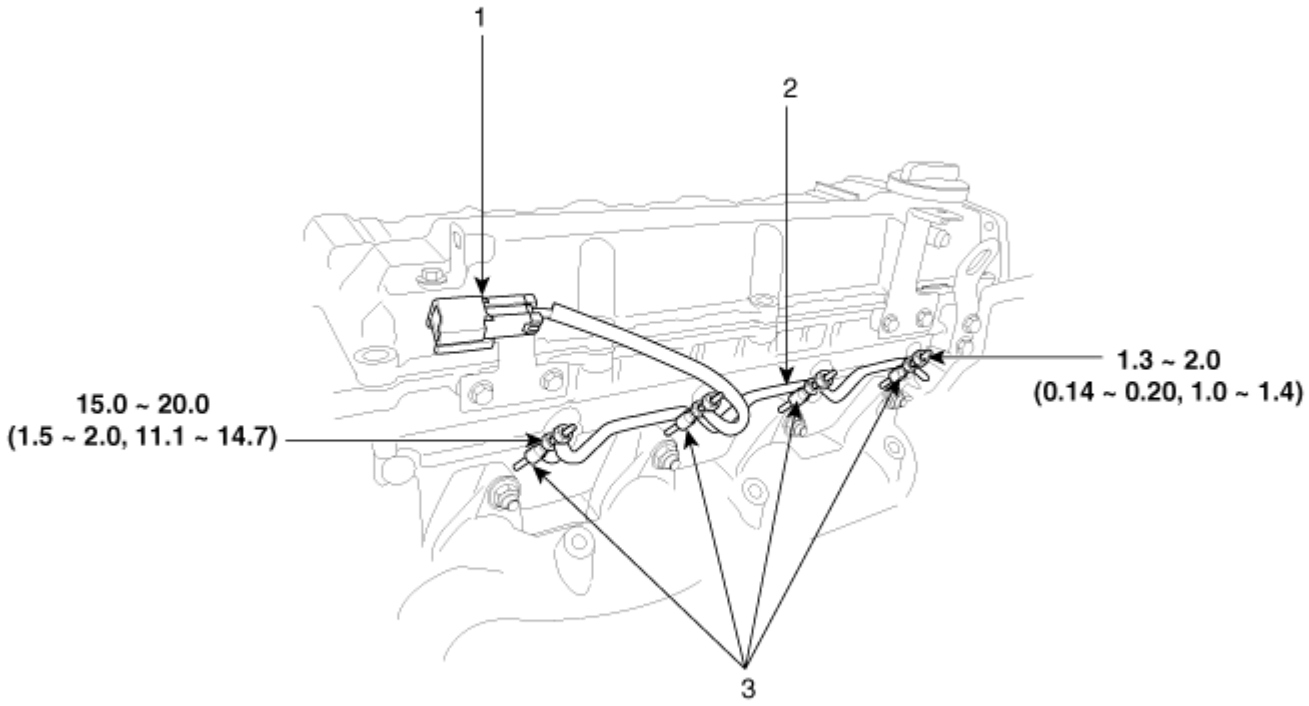
Symptom	Suspect Area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connections
	Electronic voltage regulator	Replace voltage regulator
Charging warning indicator does not go out with engine running (Battery requires frequent rech	Drive belt loose or worn	Adjust tension or replace drive belt
	Battery cables loose, corroded or worn	Repair or replace cavles
	Fuse blown	Check fuses
	Fusible link blown	Replace fusible link
	Electronic voltage regulator or alternator	Test alternator
	Wiring	Repair wiring
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 alternator	Test alternator, if faulty, repair or replace
	Worn battery	Replace battery
	Electronic voltage regulator	Replace voltage regulator
	Voltage sensing wire	Repair wire

Starting System

Symptom	Suspect Area	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 (Vehicle with automatic transaxle only)	Adjust or replace switch
	Fusible link blown	Replace fusible link

	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Inspect
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Starter motor	Repair starter motor
Starter keeps running	Starter motor	Repair starter motor
	Ignition switch	Inspect
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor	Repair starter motor
	Ring gear teeth broken	Replace flywheel ring gear or torque converter

Components



Torque : N.m (kgf.m, lb-ft)

1. Glow plug connector 2. Plate	3. Glow plug

Inspection

Preheating System

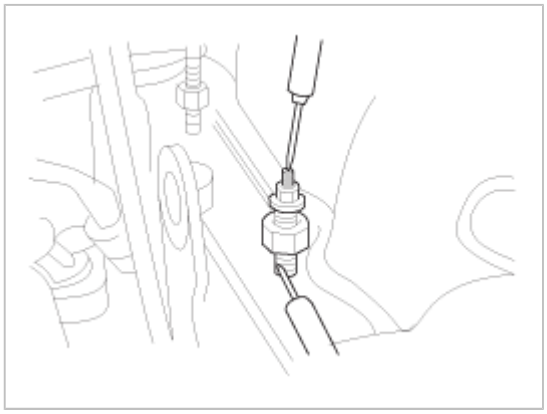
Conditions before inspection :

Battery voltage : 12V

1. Connect voltmeter between glow plug plate and plug body (ground).
2. Check indicated value on voltmeter with ignition switch ON.
3. Check that preheat indication lamp lights for about 6 seconds and indicates battery voltage (about 9V or over) for about 36 seconds immediately afterignitionswitch is turned on. [At cooling water temperature 20℃ (68℉)]

   Continuity time varies depending upon cooling water temperature.

4. After checking 3, set ignition switch at START position.
5. The system is normal if battery voltage (about 9V or over) is generatedforabout 6 seconds during engine cranking and after start operation. [at coolingwater temperature 20℃ (68℉)]
6. When the voltage or continuity time is not normal, check the terminal voltage in glow control unit, and single parts.



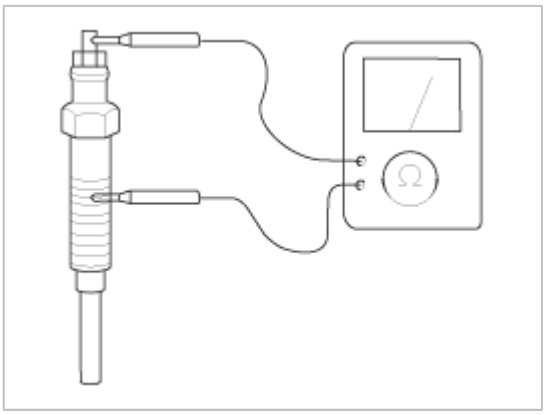
Glow Plug

1. Check the continuity between the terminal and body as illustrated. Replaceif discontinuity or with large resistance.

   Standard value : 0.55Ω

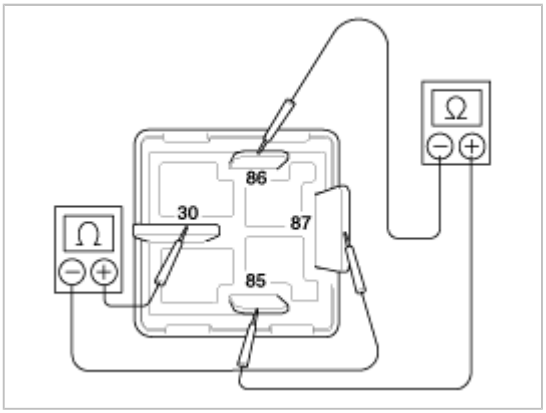
   Remove oil from plug before measuring as glow plug resistance is verysmall.

2. Check for rust on glow plug plate.
3. Check glow plug for damage.

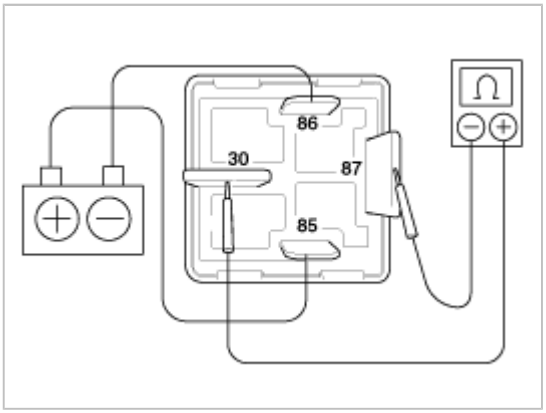


Inspection

1. Remove the glow plug relay.
2. Inspect the relay continuity.
   A. Using an ohmmeter, check that there is continuity between terminals 85 and 86.
      If there is no continuity, replace the relay.
   B. Check that there is no continuity between terminals 30 and 87.
      If there is continuity, replace the relay.



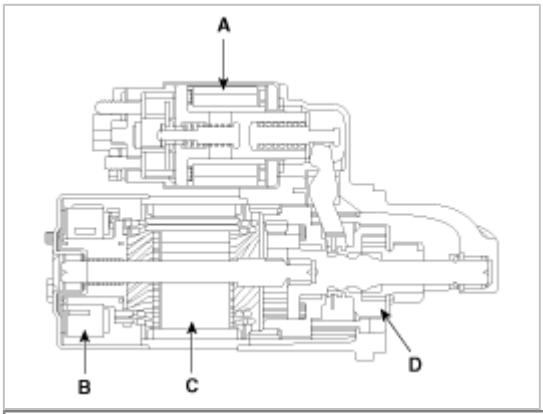
3. Inspect the relay operation.
   A. Apply battery positive voltage across terminals 85 and 86.
   B. Using an ohmmeter, check that there is continuity between terminals 30 and 87.
      If there is no continuity, replace the relay.



4. Install the glow plug relay.

Description

The starting system includes the battery, starter motor, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.
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.



A : Solenoid B : Brush assembly	C: Armature D : Overrun clutch

Inspection

Starter Test

The air temperature must be between 59 and 100℉ (15 and 38℃) before testing.

Recommended procedure :

- Use a starter system tester.
- Connect and operate the equipment in accordance with the manufacturer's instructions.
- Test and troubleshoot as described.

Alternate Procedure :

- Use the following equipment :
  - Ammeter, 0~400A
  - Voltmeter, 0~20V (accurate within 0.1 volt)
  - Tachometer, 0~1,200 rpm
- Hook up a voltmeter and ammeter as shown.

After this test, or any subsequent repair, reset the ECM/PCM to clear any codes.

Check the Starter Engagement :

1. Remove the ECM(B+) fuse from the fuse/relay box.
2. Turn the ignition switch to START (III) with the shift lever in N or P position (A/T) or with the clutch pedal depressed (M/T). The starter should crank the engine.
   A. If the starter does not crank the engine, go to step 3.
   B. If it cranks the engine erratically or too slowly, go to "Check for Wear and Damage" on the next page.
3. Check the battery, battery positive cable, ground, starter cut relay, and the wire connections for looseness and corrosion. Test again.
   If the starter still does not crank the engine, go to step 4.
4. Unplug the connector from the starter.
5. Connect a jumper wire from the battery positive (+) terminal to the solenoid terminal.
   The starter should crank the engine.
   A. If the starter still does not crank the engine, remove it, and diagnose its internal problem.
   B. If the starter cranks the engine, go to step 6.
6. Check the ignition switch.
7. Check the starter relay.
8. Check the A/T gear position switch (A/T) or the clutch interlock switch (M/T).
9. Check for an open in the wire between the ignition switch and starter.

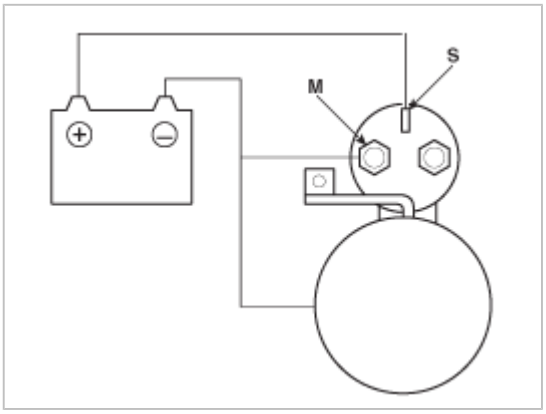
Check For Wear And Damage

The starter should crank the engine smoothly and steadily. If the starterengages, but cranks the engine erratically, remove it, and inspect the starterdrive gear and torque converter ring gear for damage.

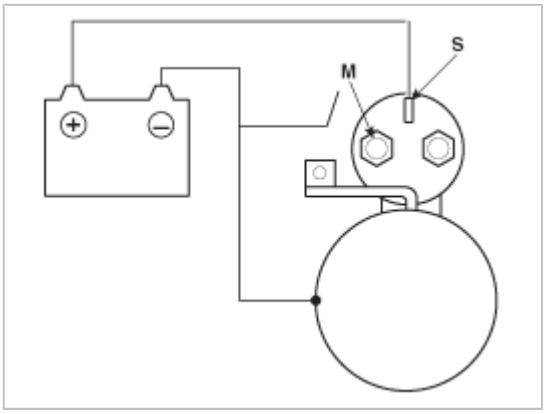
Check the drive gear overrunning clutch for binding or slippingwhen the armature is rotated with the drive gear held. If damaged, replacethe gears.

Starter Solenoid Test

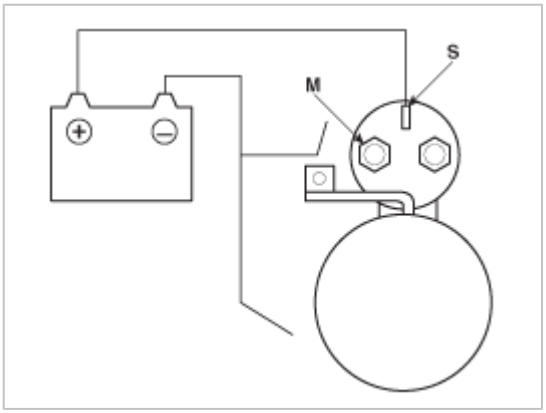
1. Disconnect the wires from the Sterminal and the M terminal.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



3. Disconnect the battery from the M terminal.
   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



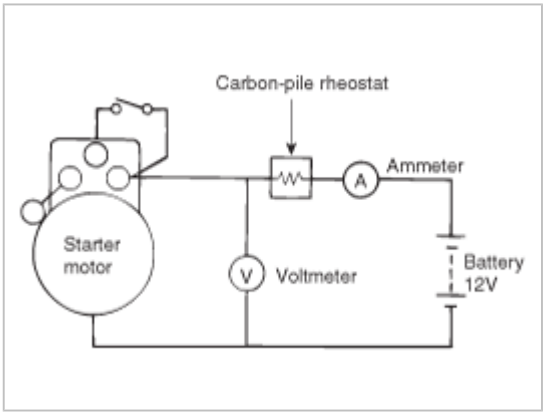
4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly.
   To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



Free Running Test

1. Place the starter motor in a vise equipped with soft jaws and connecta fully-charged 12-volt battery to starter motor as follows :
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostatas 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 :

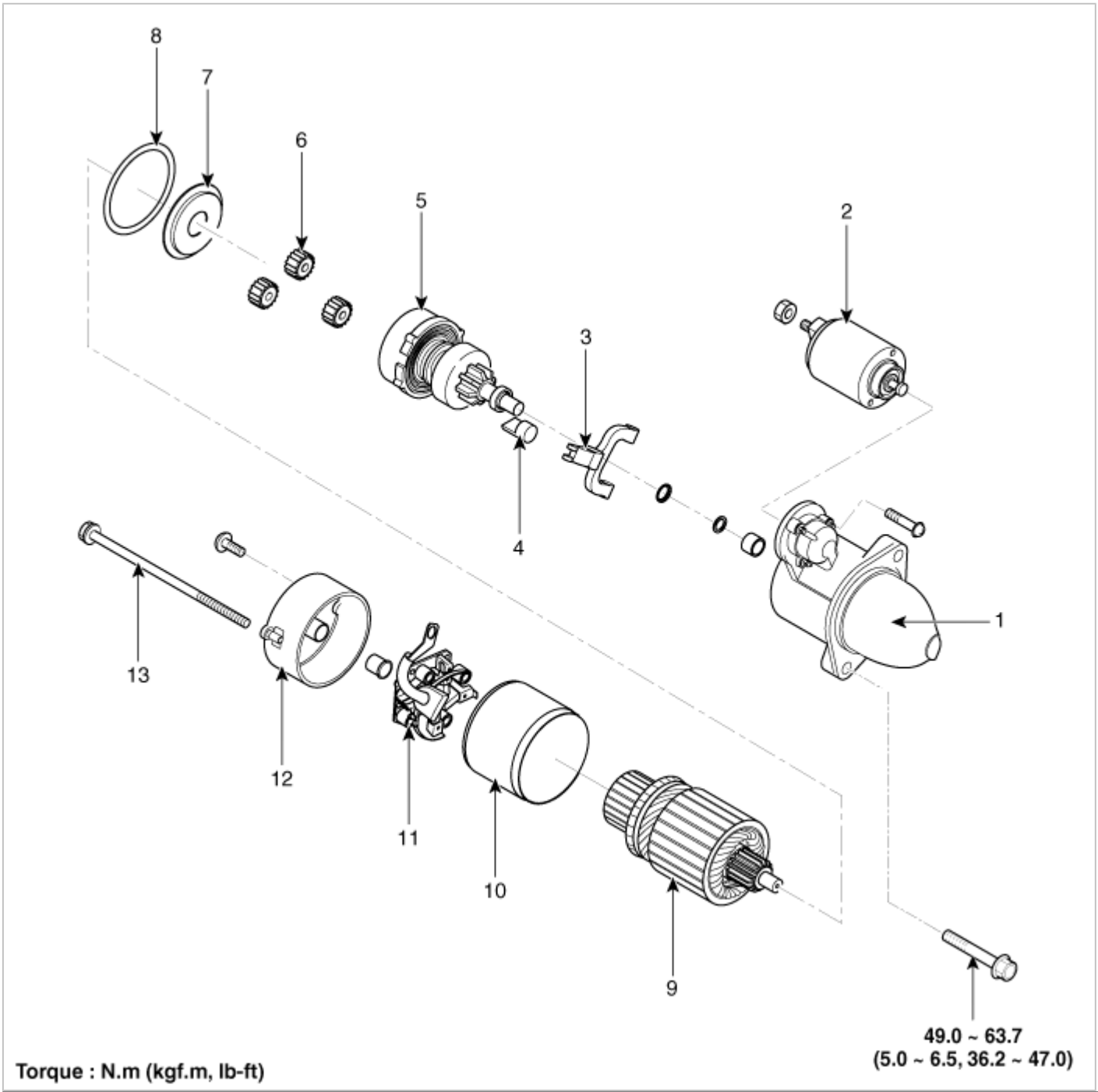
Current : Max. 125Amps
Speed : Min. 2,900rpm



Cleaning

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

Components

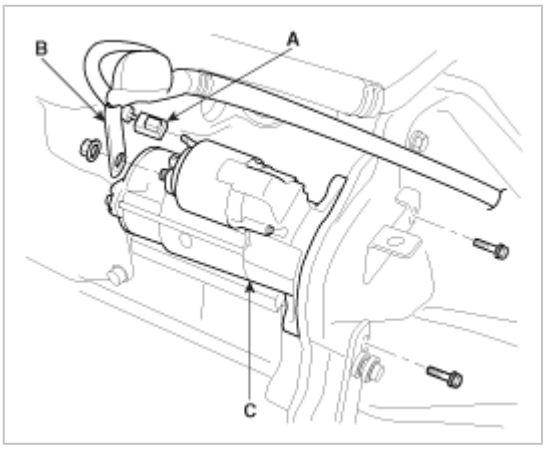


1. Front bracket	8. Gasket
2. Magnet switch assembly	9. Amature assembly
3. Lever	10. Yoke assembly
4. Lever packing	11. Brush holder assembly
5. Planet shaft assembly	12. Rear bracket
6. Planetary gear assembly	13. Through bolt

7. Shield	

Replacment

1. Disconnect the negative cable.
2. Disconnect the stater cable from the "B" teminal(B) on the solenoid then disconnect the "S" teminal connector(A).
3. Remove the 2bolts holding the stater, then remove the stater(C).

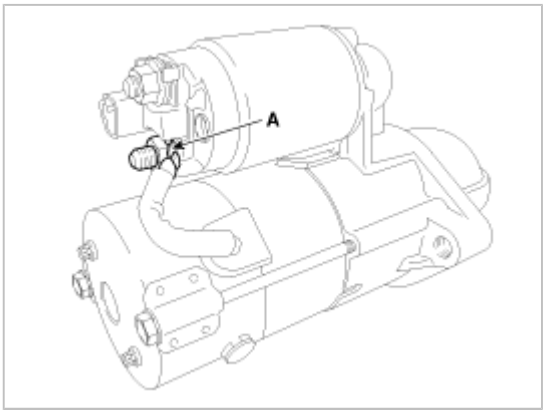


4. Installation is the reverse of removal.

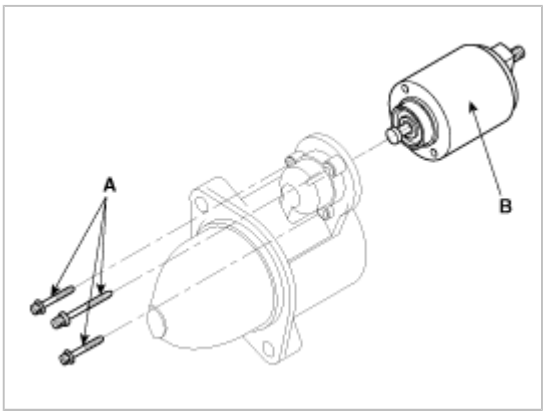
Tightening torque:
49.0 ~ 63.7N.m (5.0 ~ 6.5kgf.m, 36.2 ~ 47.0lb-ft)

Disassembly

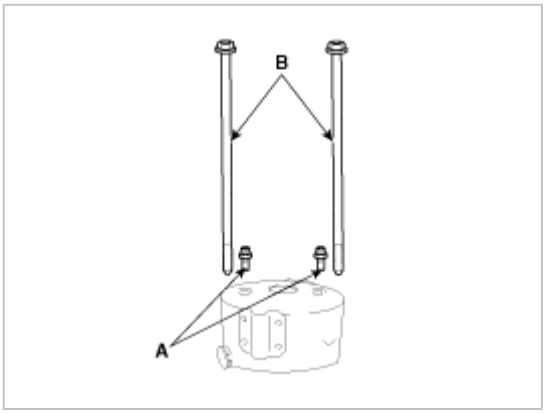
1. Disconnect the M-terminal (A) on the starter solenoid assembly (B).



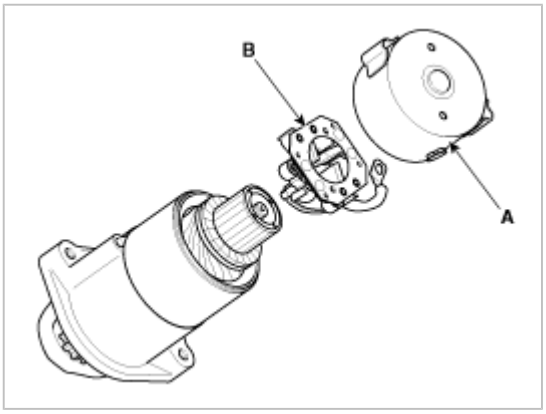
2. After loosening the screws (A), detach the magnet switch assembly (B).



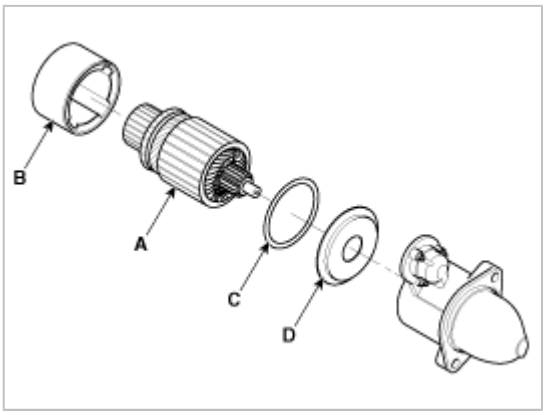
3. Loosen the brush holder mounting screw (A) and through bolts (B).



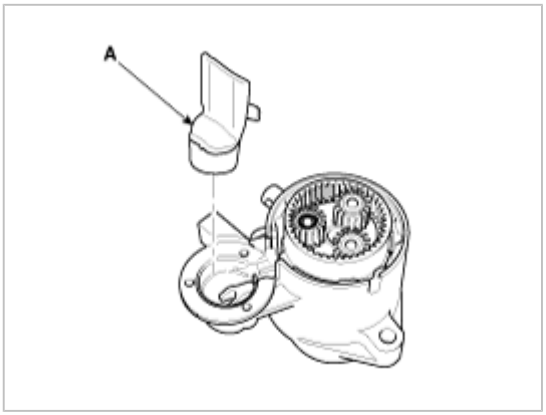
4. Remove the rear bracket (A) and brush holder assembly (B).



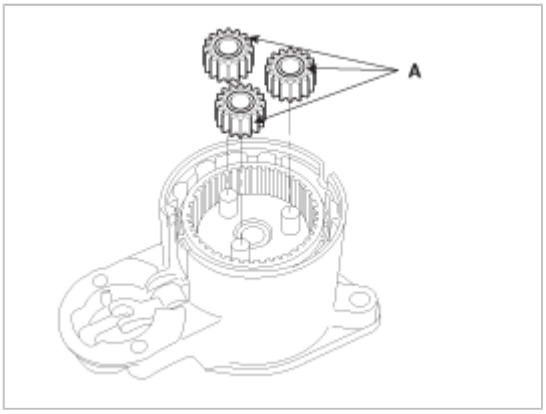
5. Remove the amature (A), yoke (B), gasket (C) and shield (D).



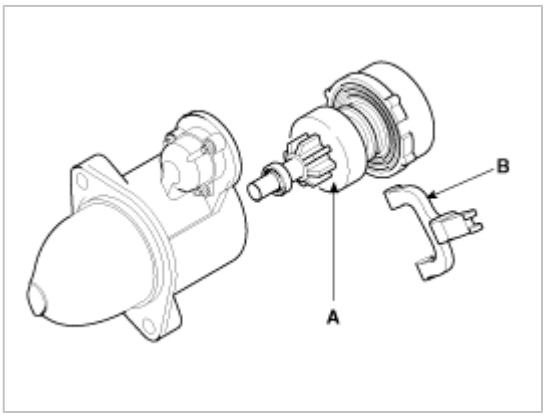
6. Remove the lever packing (A).



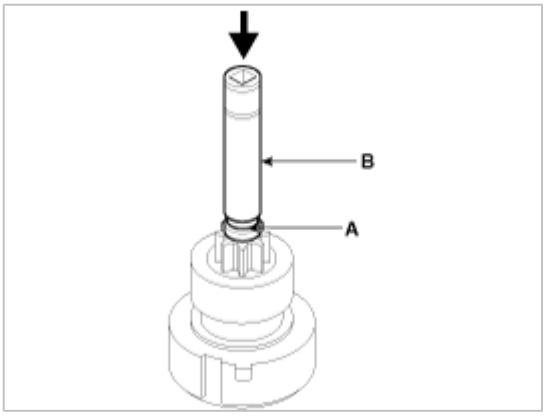
7. Disconnect the planet gear (A).



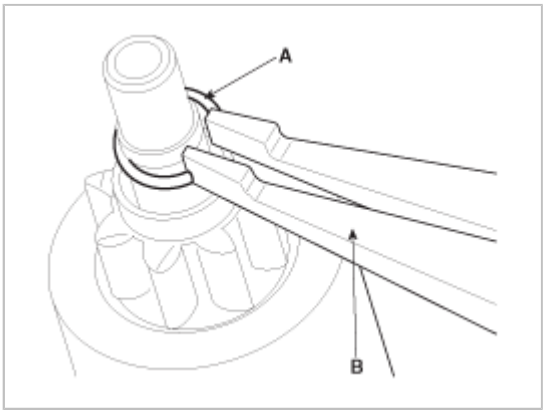
8. Disconnect the planet gear shaft assembly (A) and lever (B).



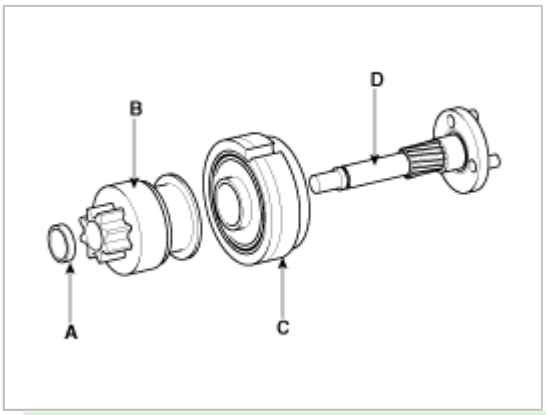
9. Press the stopper (A) using a socket (B).



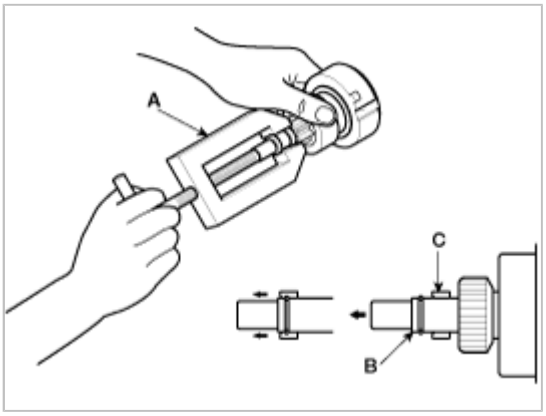
10. After removing the stop ring (A) using stop ring pliers (B).



11. Disconnect the stopper (A), overrunning clutch (B), internal gear (C) and planet shaft (D).



Using a suitable pulling tool (A), pull the stopper (C) over the stop ring (B).

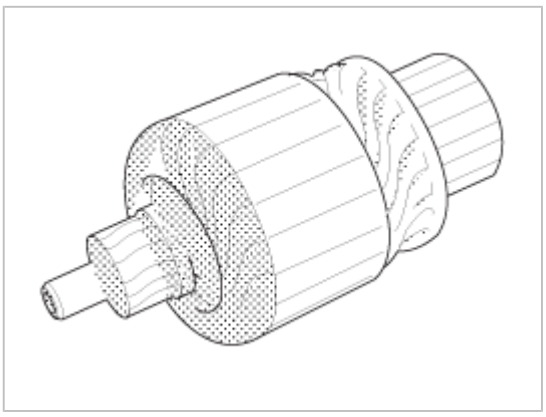


12. Reassembly is the reverse of disassembly.

Inspection

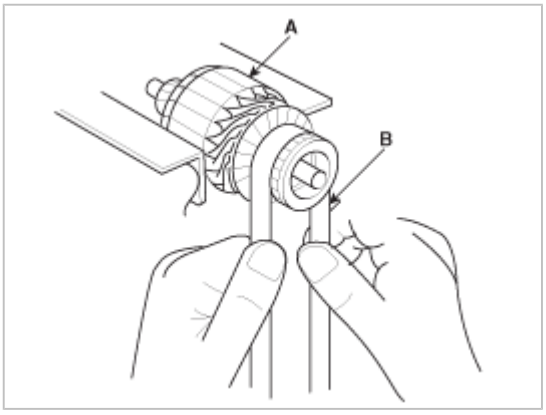
Armature Inspection And Test

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.



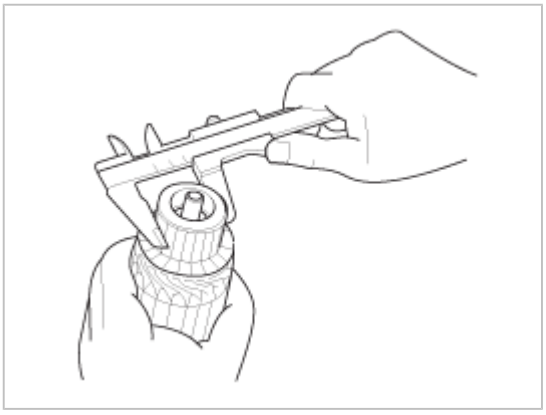
4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe

within the following specifications, or recondition with #500 or #600 sandpaper (B).



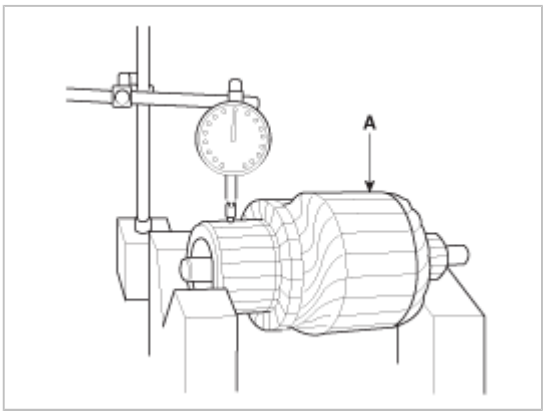
5. Check the commutator diameter. If the diameter is below the service limit, replace the armature.

Commutator diameter
Standard (New) : 33.0 mm (1.2992 in)
Service limit : 32.8 mm (1.2913 in)



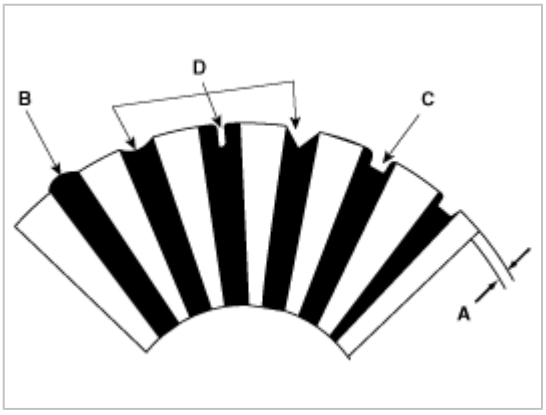
6. Measure the commutator (A) runout.
   A. If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   B. If the commutator run out is not within the service limit, replace the armature.

Commutator runout
Standard (New) : 0.05mm (0.0020in.) max
Service limit : 0.08mm (0.0031in.) max

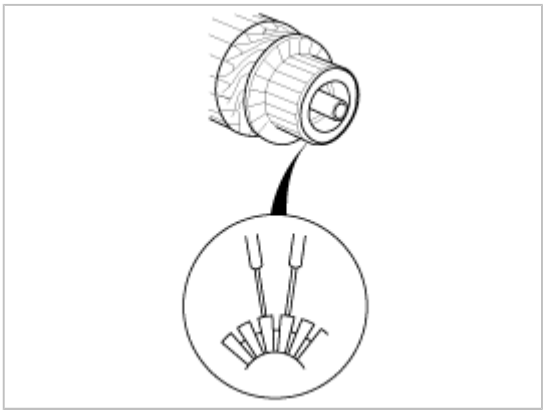


7. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

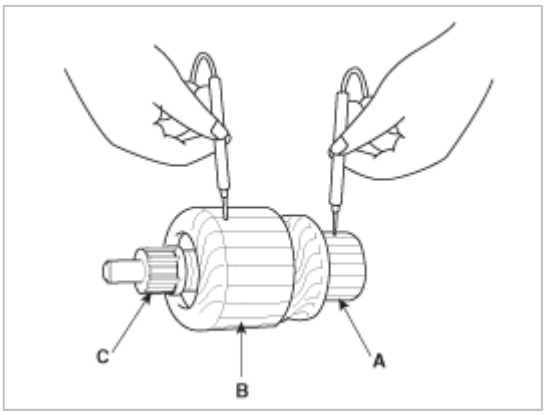
Commutator mica depth
Standard (New) : 0.5mm (0.0197in.)
Limit : 0.2mm (0.0079 in.)



8. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.

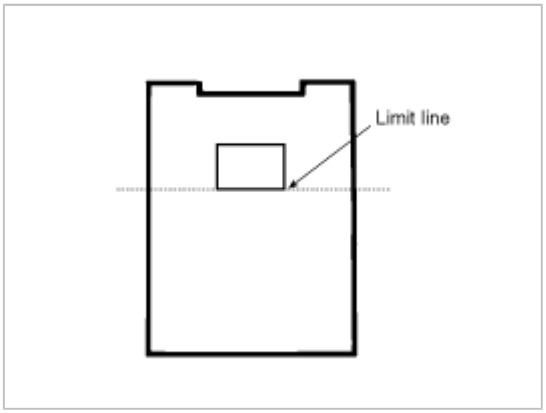


Inspect Starter Brush

Brushes that are worm out, or oil-soaked, should be replaced.

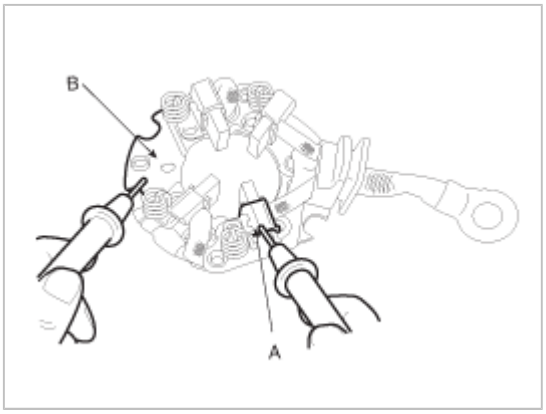
Bruch length

Standard : 12.3 mm (0.4843 in)
Service limit : 5.5 mm (0.2165 in)



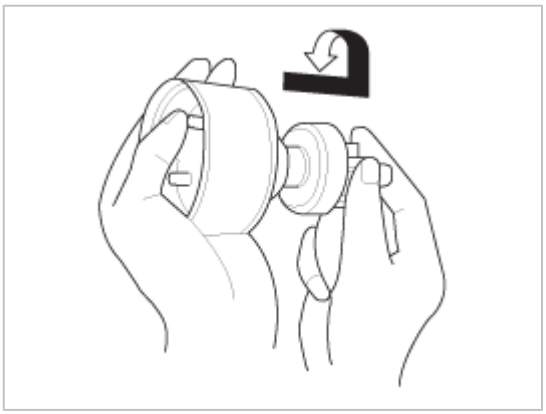
Starter Brush Holder Test

Make sure there is no continuity between the (+) brush holder (A) and (-) plate (B). If there is continuity, replace the brush holder assembly.



Overrunning Clutch

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.
2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction or it locks in both directions, replace it.



3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

Cleaning

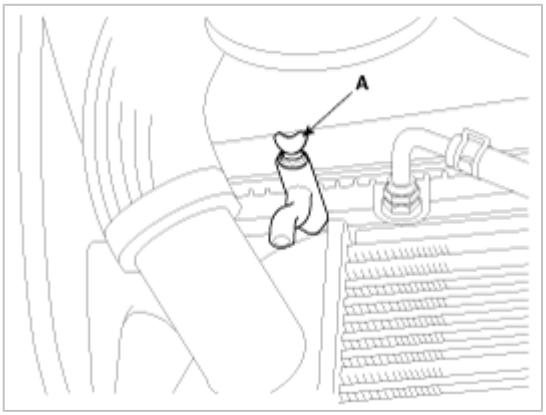
1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

Engine Coolant Refilling And Bleeding

Never remove the radiator cap when the engine is hot. Serious scalding could be caused by hot fluid under high pressure escaping from the radiator.

When pouring engine coolant, be sure to shut the relay box lid and not to let coolant spill on the electrical parts or the paint. If any coolant spills, rinse it off immediately.

1. Make sure the engine and radiator are cool to the touch.
2. Remove radiator cap.
3. Loosen the drain plug(A), and drain the coolant.



4. Tighten the radiator drain plug(A) securely.
5. After draining engine coolant in the reservoir tank, clean the tank.
6. Fill the radiator with water through the radiator cap and tighten the cap.

To that the air in radiator is flown off easily, slowly pour water and press the upper/lower radiator hoses.

7. After warming up the engine until the cooling fan operates several times, accelerate it at idle.
8. Wait until the engine is cool.
9. Repeat the step 1 to 8 until the drained water is clean.
10. Fill fluid mixture with coolant and water (55~60%) (except for North America, Europe and China : 45~50%) slowly through the radiator cap. Push the upper/lower hoses of the radiator so as bleed air easily.

- Use only genuine antifreeze/coolant.
- For best corrosion protection, the coolant concentration must be maintained year-round at 55% (except for North America, Europe and China : 45%) minimum.
  Coolant concentrations less than 55% (except for North America, Europe and China : 45%)

may not provide sufficient protection against corrosion or freezing.
- Coolant concentrations greater then 60% will impair cooling efficiency and are not recommended.

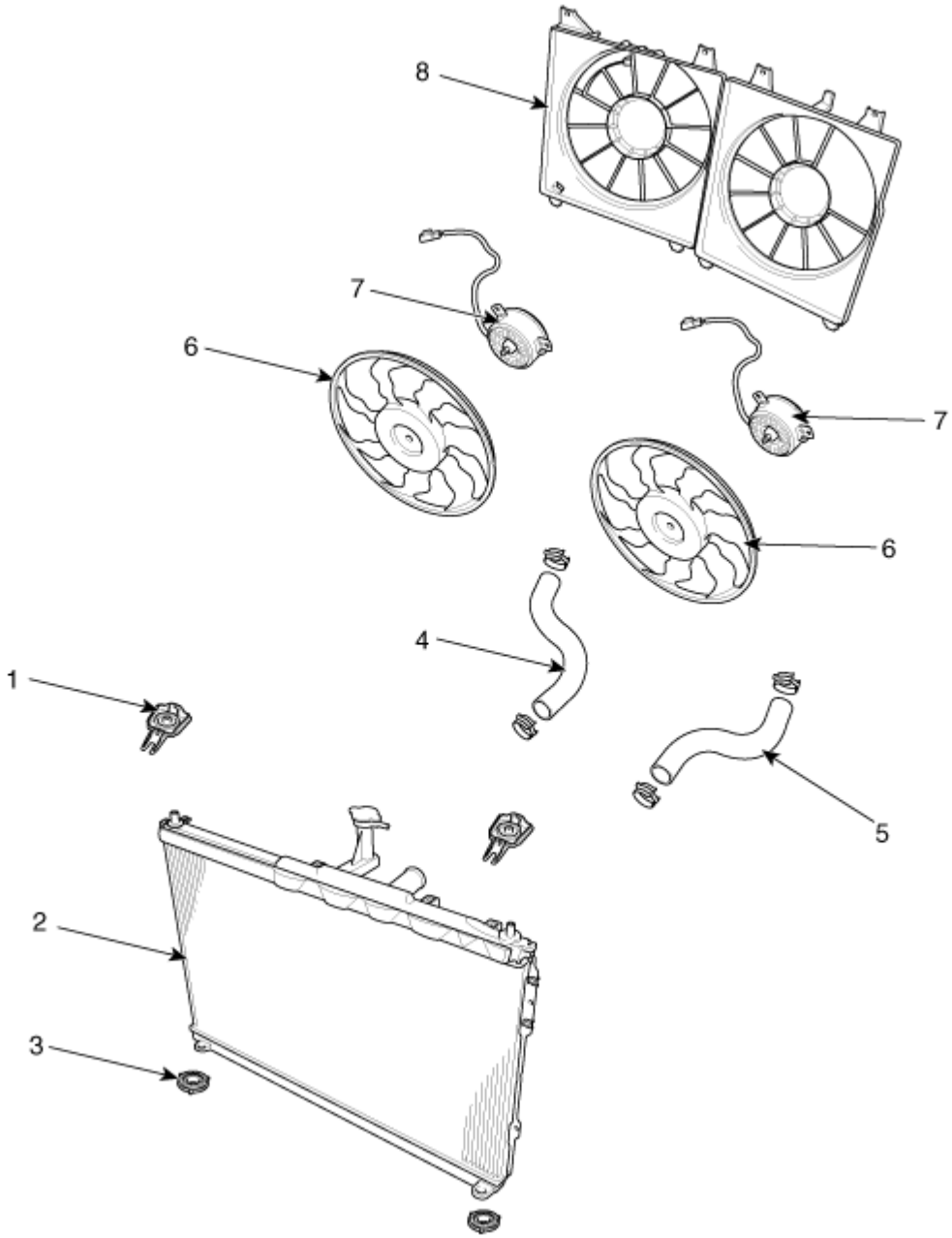
- Do not mix different brands of antifreeze/coolants.
- Do not use additional rust inhibitors or antirust products; they may not be compatible with the coolant.

11. Start the engine and run coolant circulates.
    When the cooling fan operates and coolant circulates, refill coolant through the radiator cap.
12. Repeat 11 until the cooling fan 3 ~ 5times and bleed air sufficiently out of the cooling system.
13. Install the radiator cap and fill the reservoir tank to the "MAX" line with coolant.
14. Run the vehicle under idle until the cooling fan operates 2 ~ 3 times.
15. Stop the engine and wait coolant gets cool.
16. Repeat 10 to 15 until the coolant level doesn't fall any more, bleed air out of the cooling system.

As it is to bleed air out to the cooling system and refill coolant when coolant gets cool completely, recheck the coolant level in the reservoir tank for 2~3 days after replacing coolant.

Coolant capacity
Wagon : 13L (13.74 US.qt, 11.44 Imp.qt)
Van : 10L (10.57 US.qt, 8.80 Imp.qt)

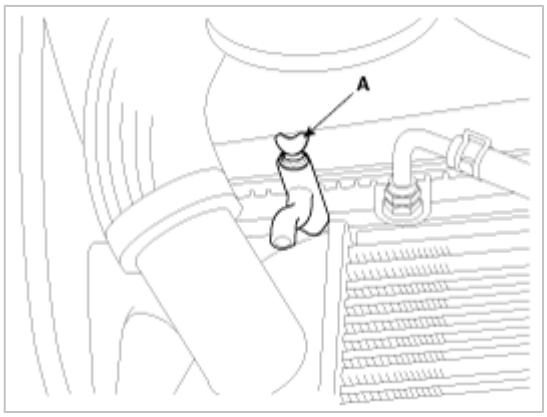
Components



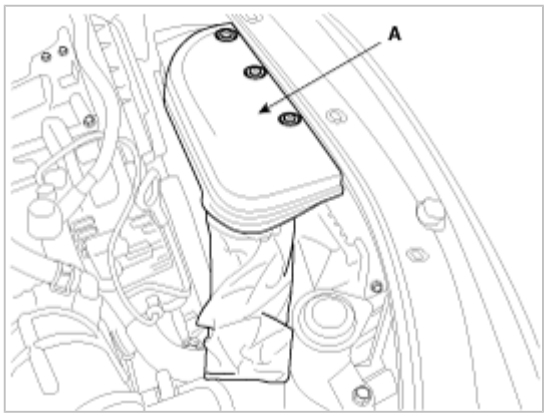
1. Radiator upper mounting bracket	5. Radiator upper hose
2. Radiator	6. Cooling fan
3. Radiator lower mounting insulator	7. Fan motor
4. Radiator lower hose	8. Cooling fan shroud

Removal

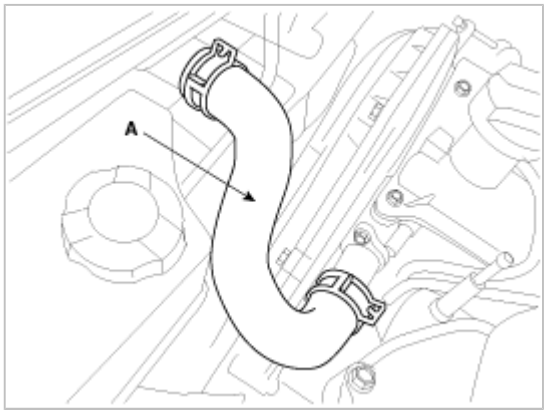
1. Loosen the plug(A) and drain the engine coolant.
   Remove the radiator cap to speed draining.



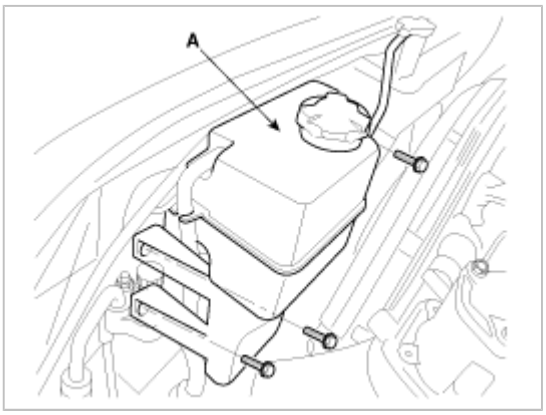
2. Remove the air duct(A).



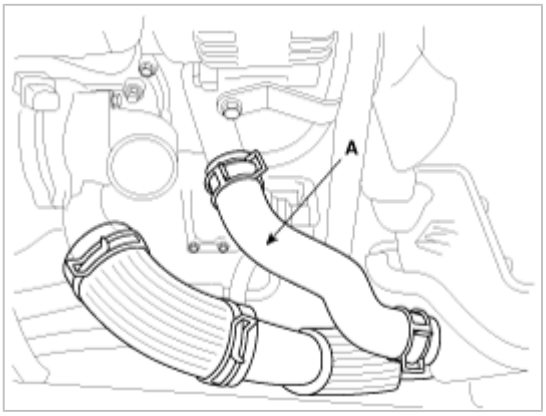
3. Disconnect the radiator upper hose(A).



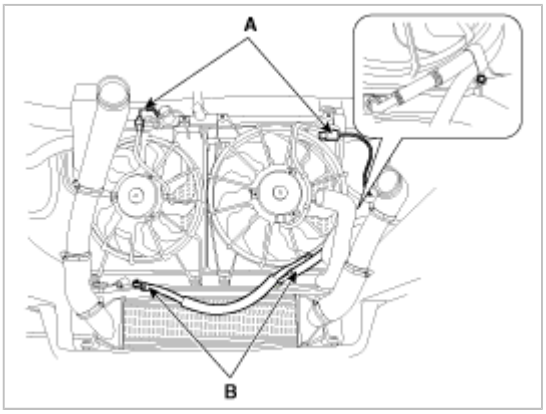
4. Remove the coolant reservoir tank(A).



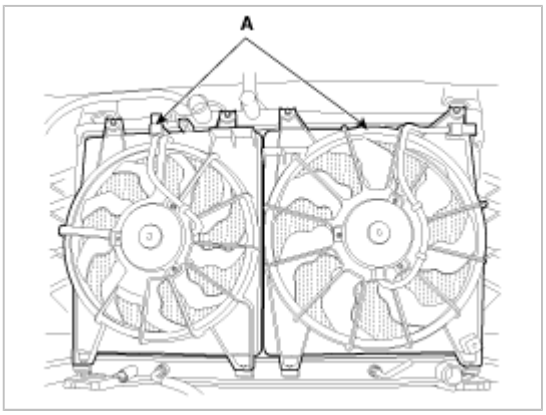
5. Disconnect the radiator lower hose(A).



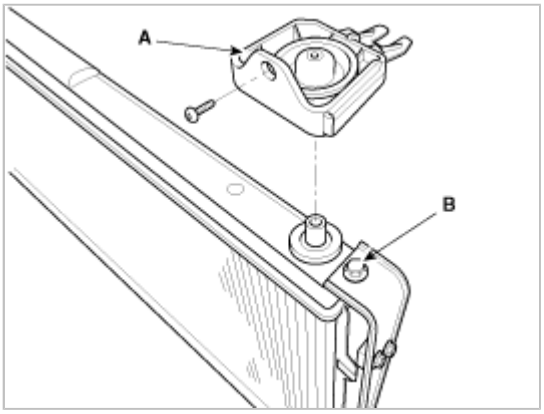
6. Disconnect the fan motor connectors (A).
7. Disconnect the auto transmission oil cooler hose (B).



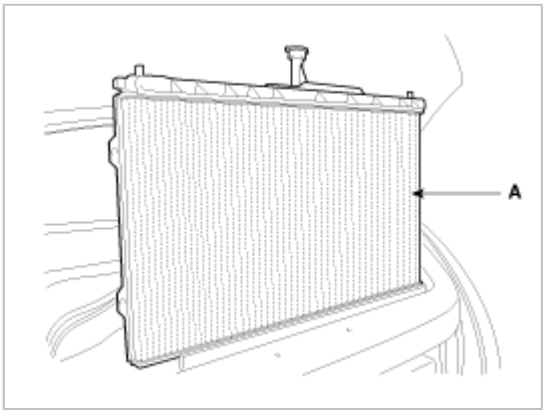
8. Install the cooling fans (A).



9. Remove the radiator upper bracket(A).
10. Remove the air conditioner condenser bracket mounting bolt(B).

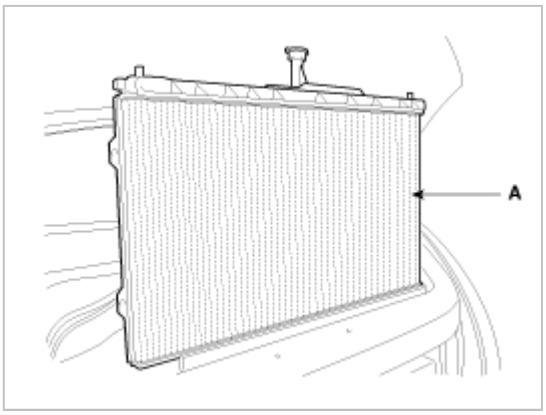


11. Remove the condenser from the radiator.
    (Refer to HA group)
12. Remove the radiator (A)from engine room.



Installation

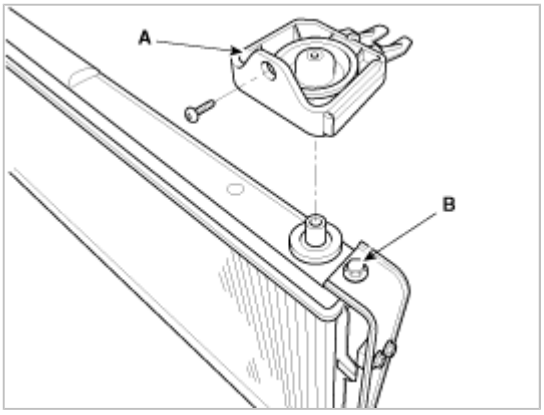
1. Install the radiator.



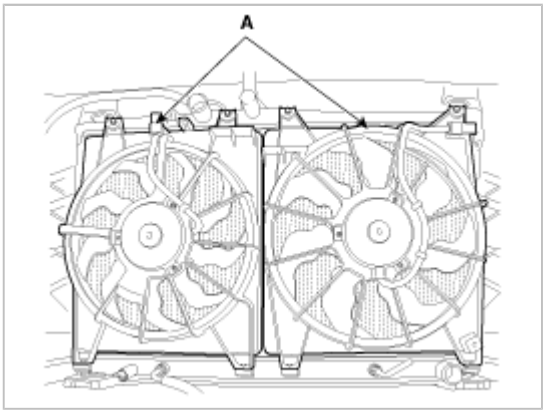
2. Install the condenser to the radiator.
   (Refer to HA group)
3. Install the air conditioner condenser bracket mounting bolt(B).

Tightening torque :
11.8 ~ 14.7N.m(1.2 ~ 1.5kgf-m,8.7 ~ 10.8lb-ft)

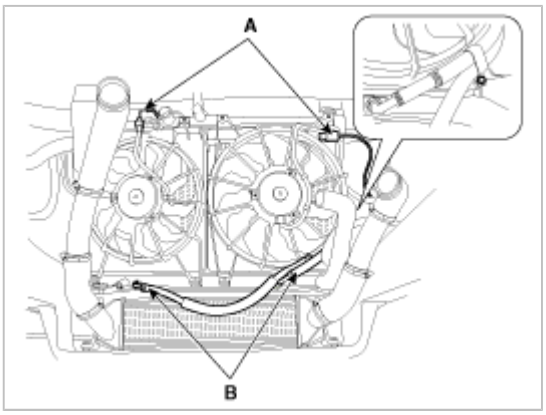
4. Install the radiator upper bracket (A).



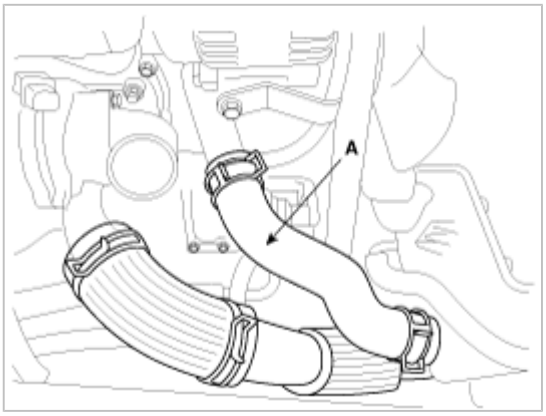
5. Install the cooling fans (A).



6. Reconnect the auto transmission oil cooler hose (B).
7. Connect the fan motor connectors (A).

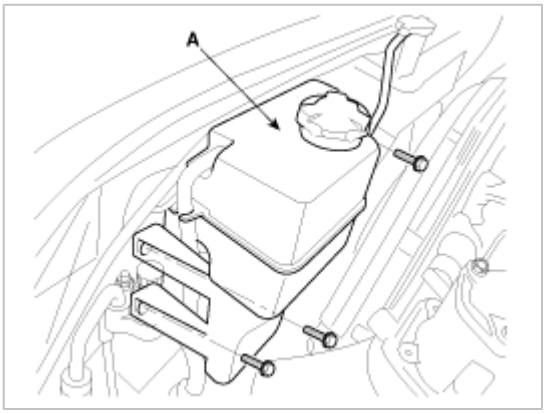


8. Reconnect the radiator lower hose(A).

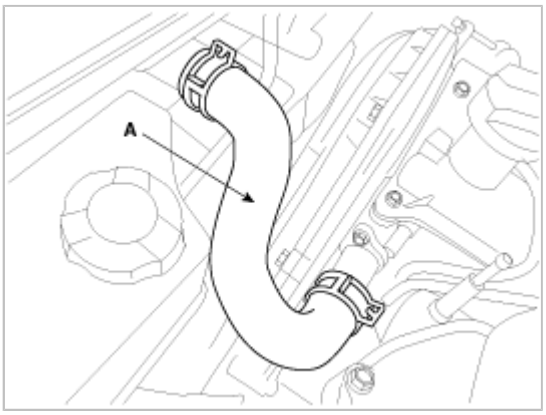


9. Install the coolant reservoir tank(A).

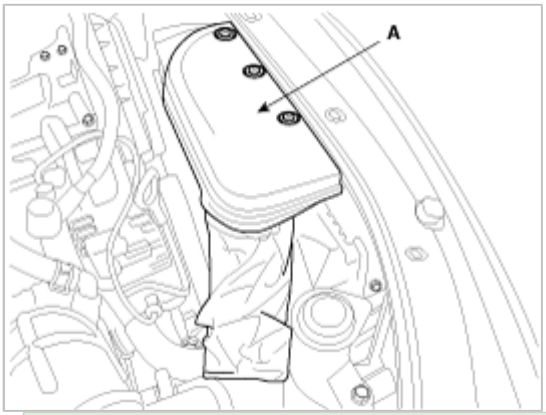
Tightening torque :
11.8 ~ 14.7N.m (1.2 ~ 1.5kgf.m,8.7 ~ 10.8lb-ft)



10. Reconnect the radiator upper hose(A).



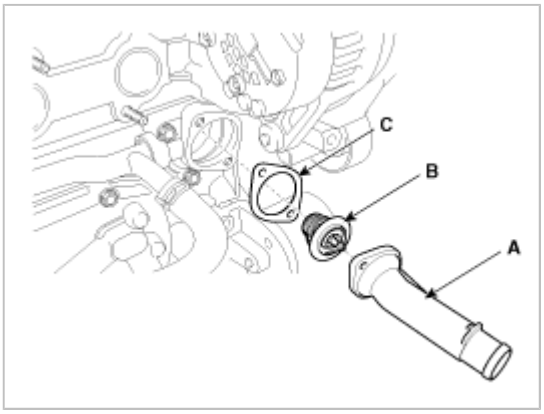
11. Install the air duct(A).



- Refill a radiator with engine coolant.
- Bleed air from the cooling system.
  - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
  - Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - Put radiator cap on tightly, then run the engine again and check for leaks.

Removal

1. Drain the coolant so its lever is below the thermostat.
2. Remove the water inlet fitting(A).

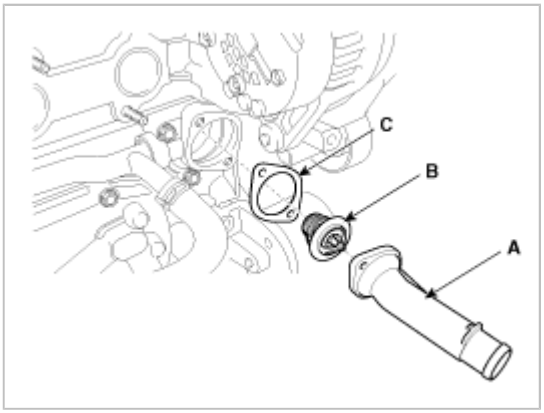


3. Remove the thermostat (B) with the gasket (C).

Installation

1. Check that the flange of the thermostat is correctly seated in the socket of the thermostat housing.
2. Install the thermostat (B) and the inlet fitting (A) with a new gasket (C).

Tightening torque :
Engine coolant inlet fitting bolt :
19.6 ~ 26.5N.m(2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



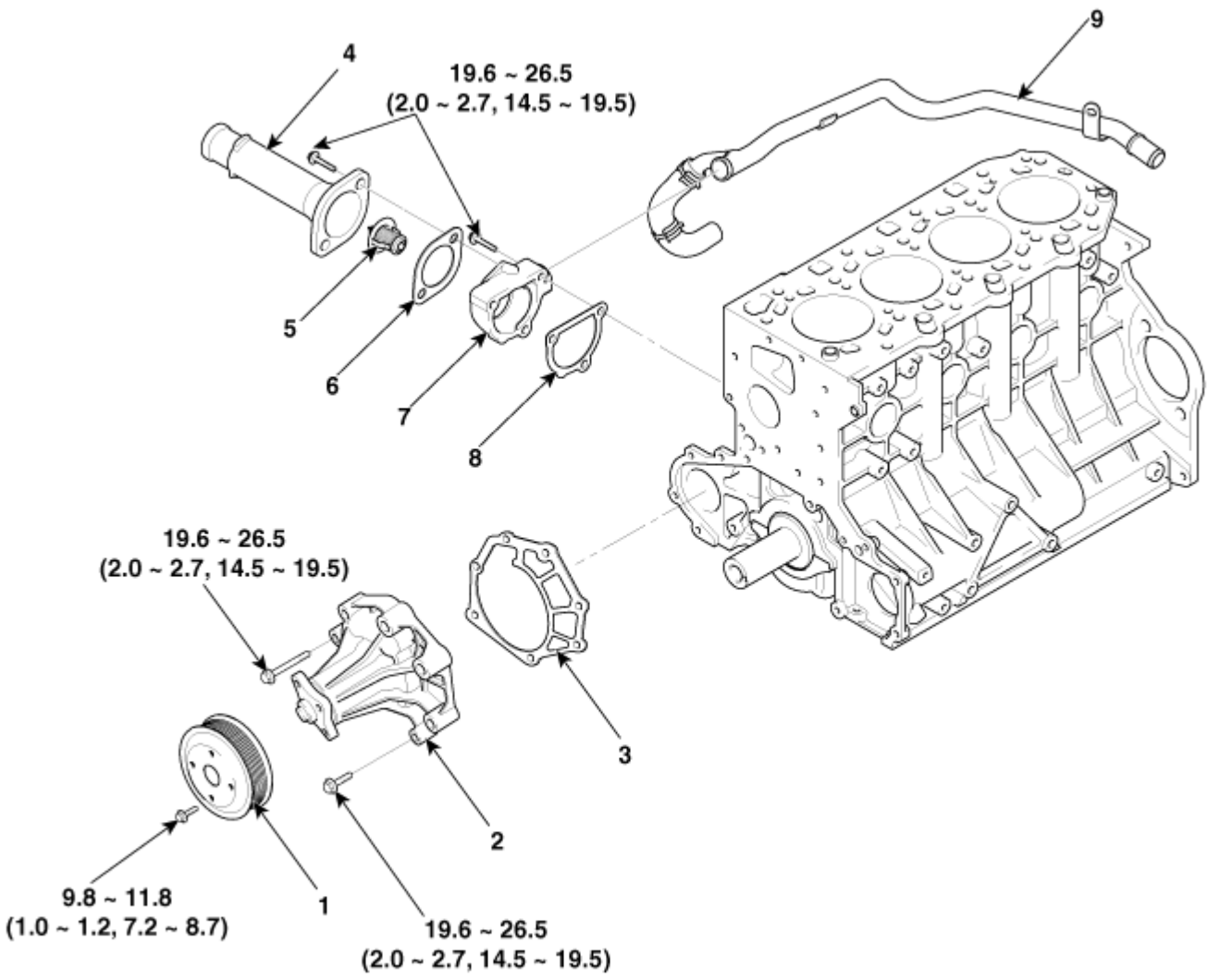
3. Refill the coolant.

Troubleshooting

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the thermostat gasket	Check the mounting bolts	• Check the torque of the mounting bolts	• Retighten the bolts and check leakage again.
		Check the gasket for damage	• Check gasket or seal for damage	• Replace gaskets and reuse the thermostat.
Cooled excessively	• Low heater performance (cool air blowed-out) • Thermogauge indicates 'LOW'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage.	• After refilling coolant, recheck.
		GDS checkΦ Starting engine	• Check DTCs • Check connection of the fan clutch or the fan motor. Φ If the fan clutch is always connected, there will be a noise at idle.	• Check the engine coolant sensor, wiring and connectors. • Replace the componants.
		Remove the thermostat and inspect	• Check if there are dusts or chips in the thermostat valve. • Check adherence of the thermostat.	• Clean the thermostat valve and reuse the thermostat. • Replace the thermostat, if it doesn't work properly.
Heated excessively	• Engine overheated • Thermogauge indicates 'HI'	Visually check after removing the radiator cap.	• Insufficient coolant or leakage. Φ Be careful when removing a radiator cap of the overheated vehicle. • Check air in cooling system.	• After refilling coolant, recheck. • Check the cylinder head gaskets for damage and the tightening torque of the mounting bolts.
		GDS checkΦ Starting engine	• Check DTCs • Check the fan motor performance as temperature varies. • Check if the fan	• Check the engine coolant sensor, wiring and connectors. • Check the fan motor, the relay and the

			clutch slips. • Check the water pump adherence or impeller damaged.	connector. • Replace the fan clutch, if it doesn't work properly. • Replace the water pump, if it doesn't work properly.
		Immerse the thermostat in boiling water and inspection.	• After removing the thermostat, check it works properly. Φ Check the thermostat opens at the valve opening temperature.	• Replace the thermostat, if it doesn't work properly.

Components

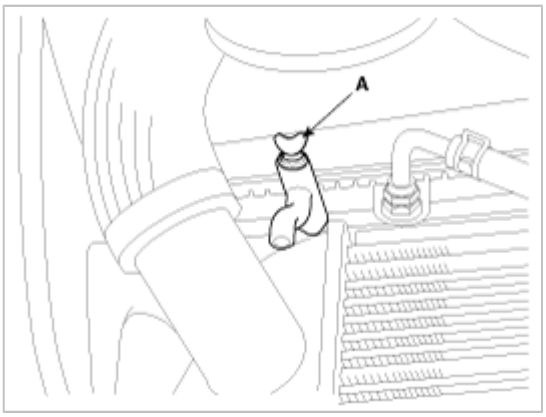


Torque : N.m (kgf.m, lb-ft)

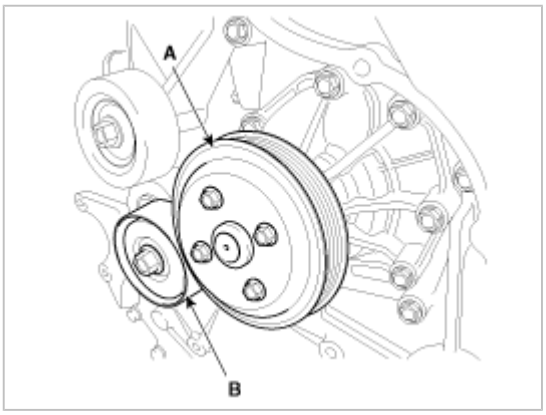
1. Water pump pulley	6. Gasket
2. Water pump	7. Thermostat housing
3. Gasket	8. Gasket
4. Water inlet fitting	9. Heater pipe
5. Thermostat	

Removal

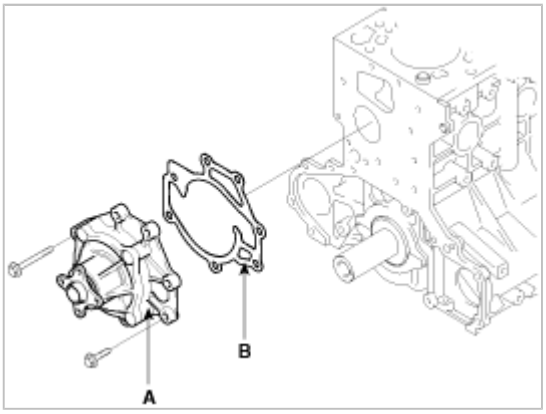
1. Remove the drain plug(A).



2. Remove the drive belt.
3. Remove the water pump pulley (A) and auto tensioner pulley (B).



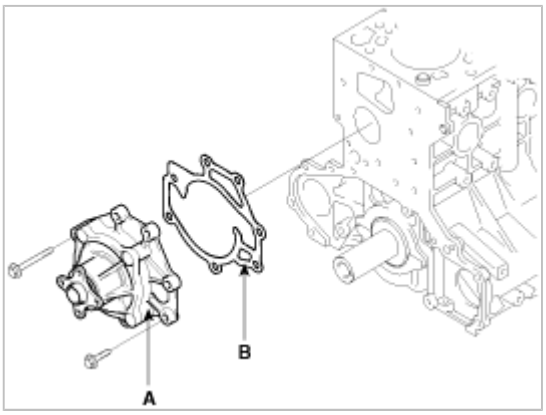
4. Remove the water pump(A) with the gasket (B) from cylinder block.



Installation

1. Install the water pump (A) with a new gasket (B) to the cylinder block.

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

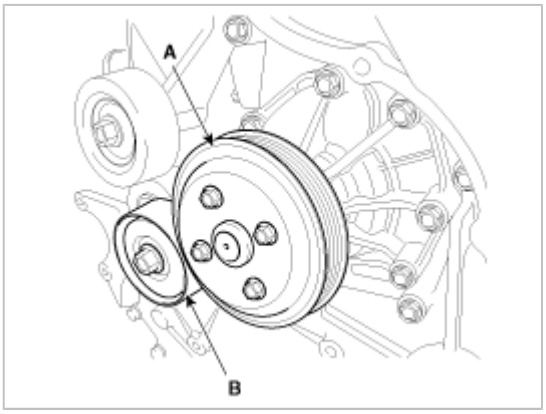


2. Install the water pump pulley (A) and auto tensioner pulley (B).

Tightening torque

A : 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

B : 47.1 ~ 53.0N.m (4.8 ~ 5.4kgf.m, 34.7 ~ 39.1lb-ft)



3. Install the drive belt.
4. Refill the engine coolant.

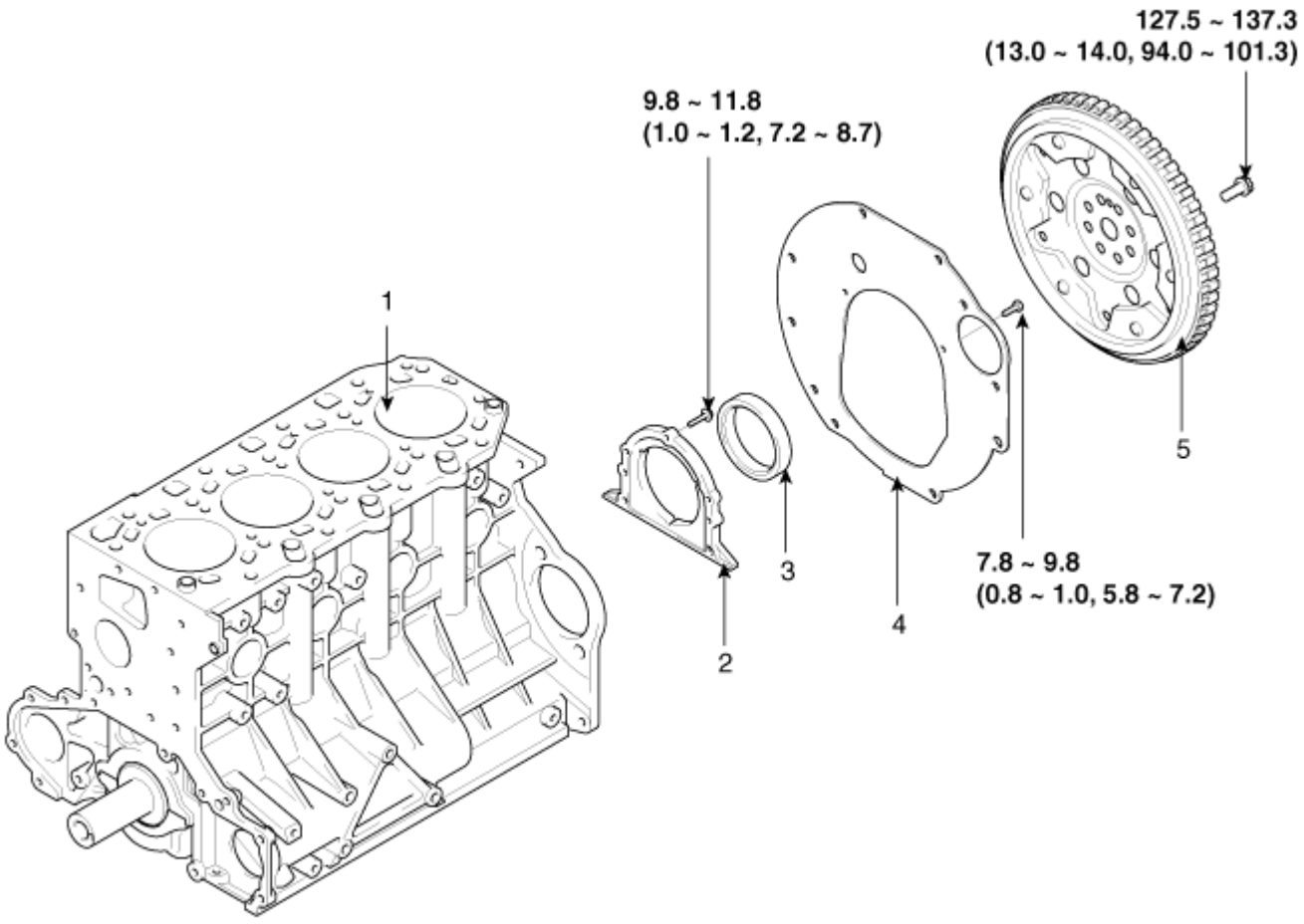
Troubleshooting

Water Pump

Symptoms		Possible Causes		Remedy
Coolant leakage	• From the bleed hole of the water pump	Visually check	• Check leaks after about ten-minute warming up.	• If coolant still leaks, replace a water pump.
				• If leakage stops, reuse the water pump (Do not replace the pump with a new one).
	• From gaskets or bolts		• Check the tightening of the water pump mounting bolts.	• Retighten the mounting bolts.
			• Check damage of gaskets or inflow of dust.	• Replace the gasket and clean dust off.
	• From outer surface of water pump		• Check the material or any cracks of the water pump.	• Poor material. If any crack found, replace the water pump.
Noise	• From bearings • From mechanical seals • Impeller interference	Inspection with a stethoscope	• After starting the engine, check noise with a stethoscope.	• If there is no noise, reuse the water pump (do not replace it).
				• If there is any noise from the water pump, remove the drive belt and recheck.
		Inspection after removing a drive belt	• After removing a water pump and a drive belt, check noise again.	• If there is noise, reuse the water pump. Check other drive line parts.
				• If there is no noise, replace the water pump with a new one.
		Inspection after removing a water	• After removing a water pump and	• If there is any interference between

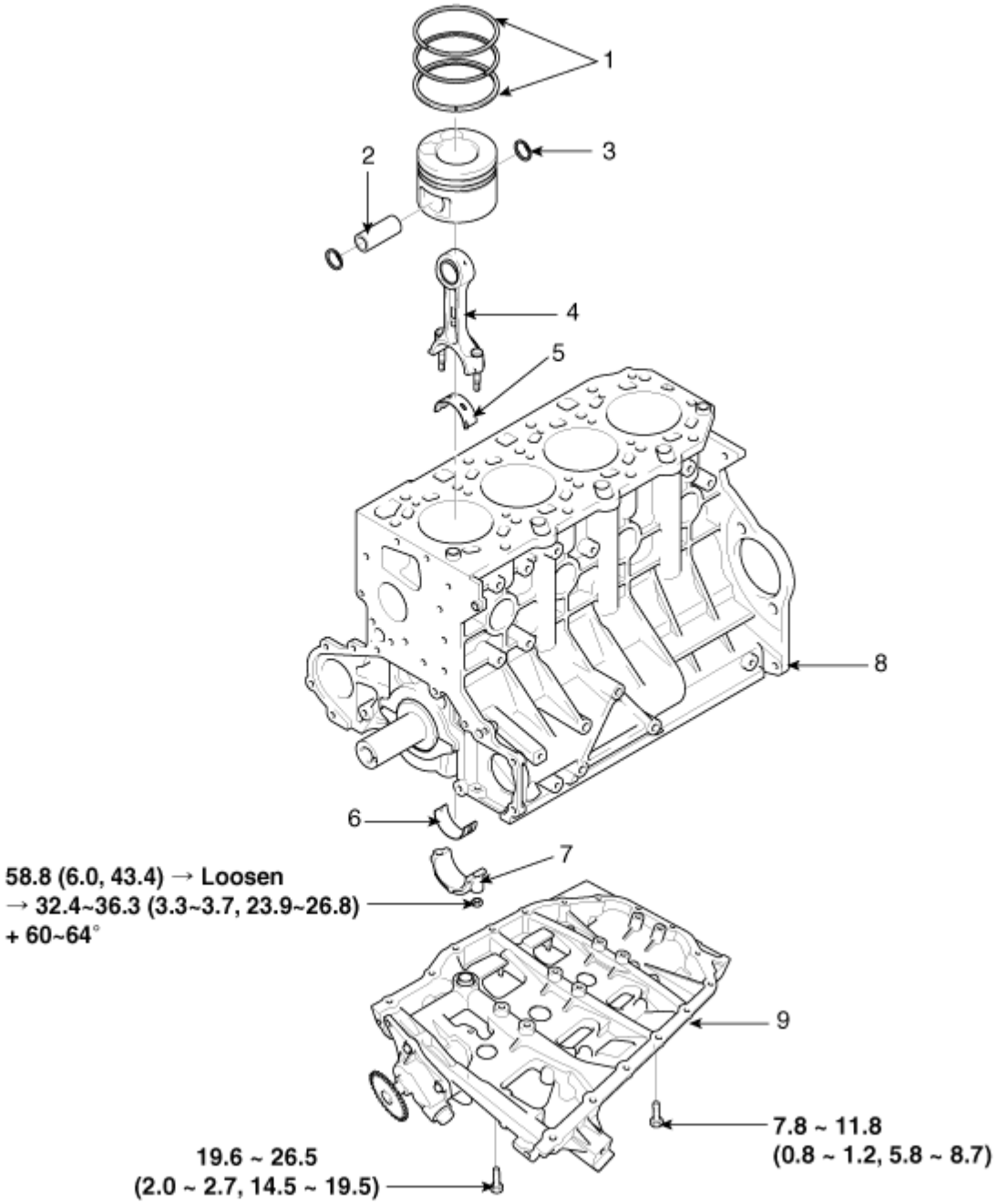
		pump	a drive belt, check noise again.	them, replace the water pump with a new one.
Overheating	• Damaged impeller • Loosened impeller	Loosened impeller	• Corrosion of the impeller wing	• Check engine coolant. • Poor coolant quality / Maintenance check
			• Impeller seperation from the shaft	• Replace the water pump.

Components



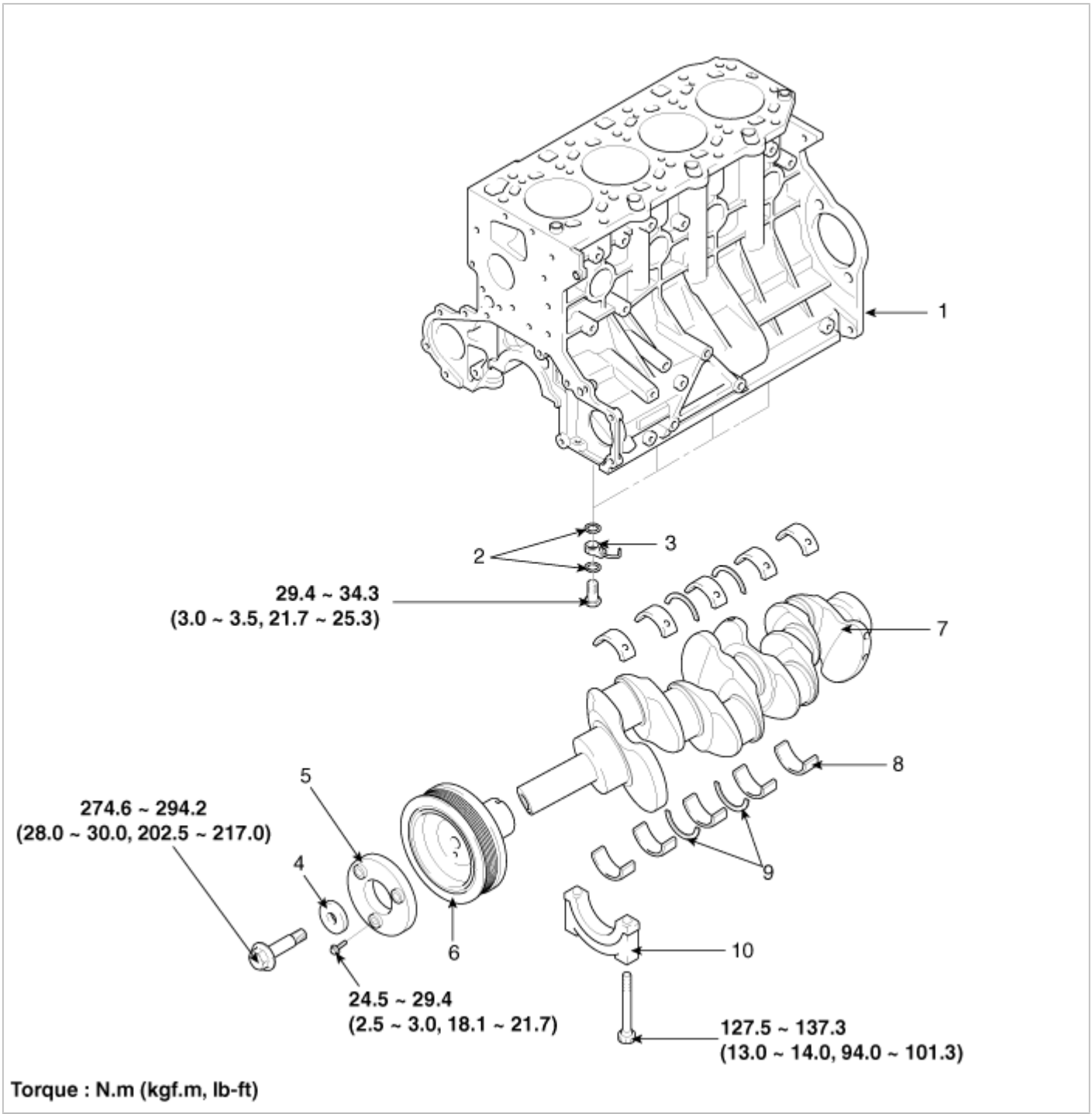
Torque : N.m (kgf.m, lb-ft)

1. Cylinder block 2. Rear seal case 3. Rear oil seal	4. Rear plate 5. Fly wheel or drive plate

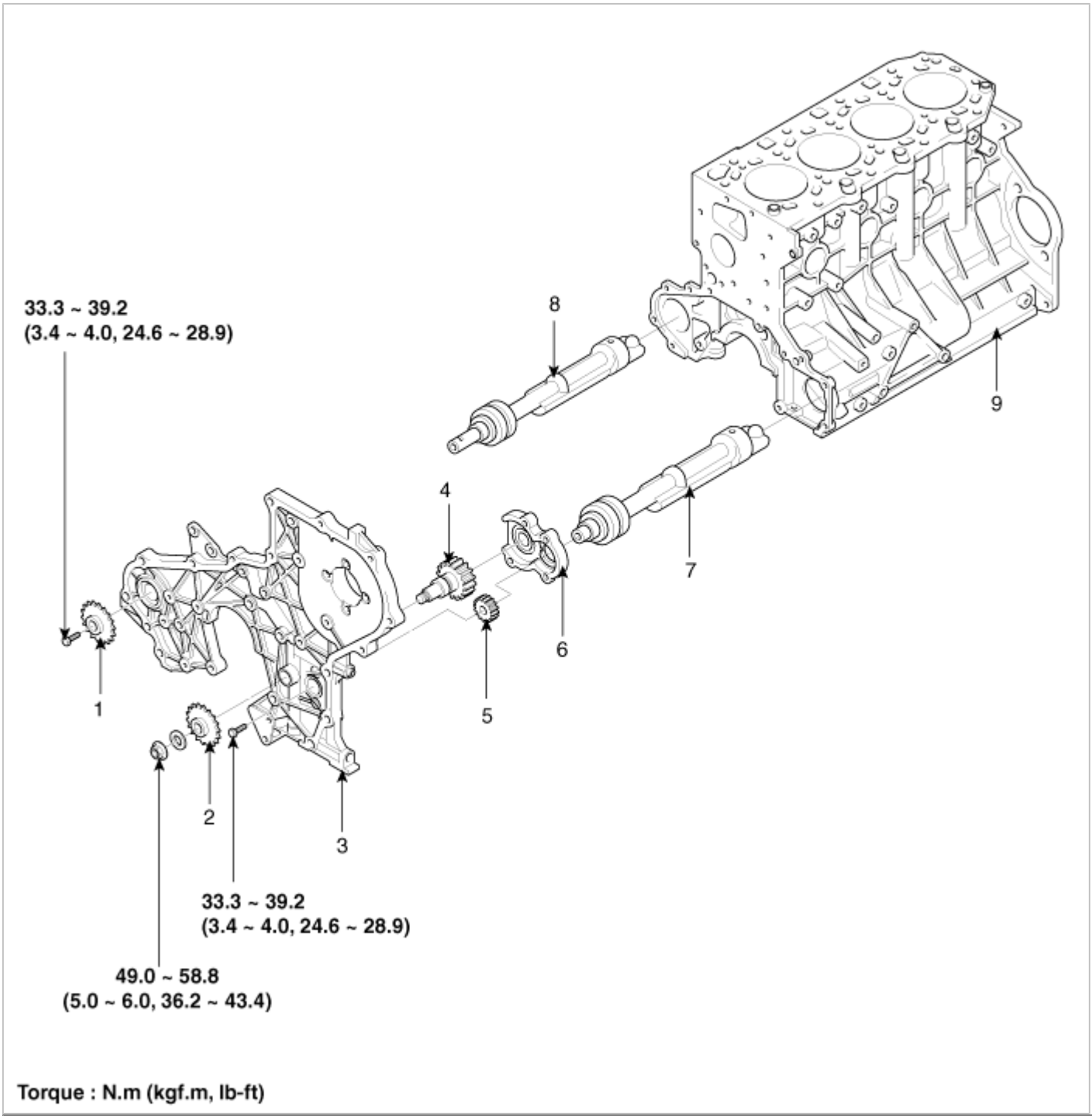


Torque : N.m (kgf.m, lb-ft)

1. Piston ring	4. Connecting rod	7. Connecting rod bearing cap
2. Piston pin	5. Connecting rod bearing	8. Cylinder block
3. Snap ring	6. Connecting rod bearing	9. Oil pump complete



1. Cylinder block 2. Gasket 3. Oil jet 4. Washer	5. Damper pulley plug 6. Crankshaft pulley 7. Crankshaft	8. Main bearing 9. Thrust bearing 10. Main bearing cap

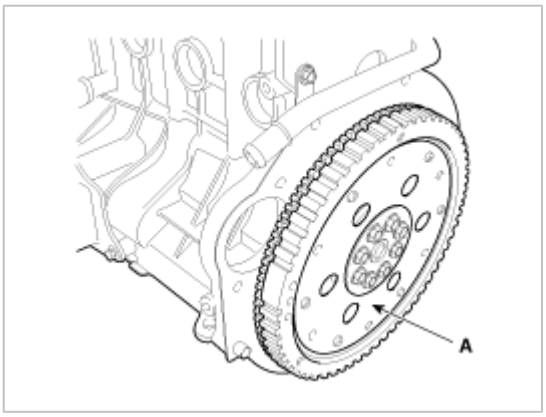


Torque : N.m (kgf.m, lb-ft)

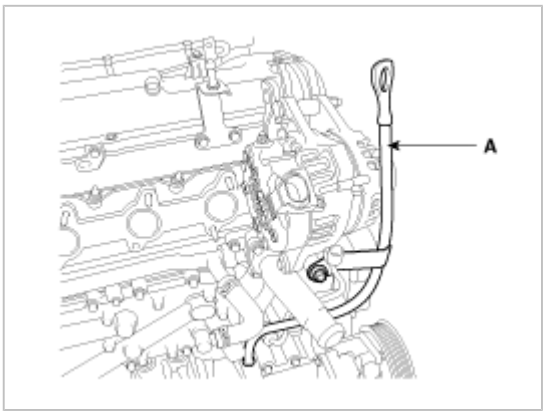
1. RH Balance shaft sprocket	6. Cover
2. LH Balance shaft sprocket	7. LH Balance shaft
3. Timing chain lower under cover	8. RH Balance shaft
4. Drive gear	9. Cylinder block
5. Driven gear	

Removal

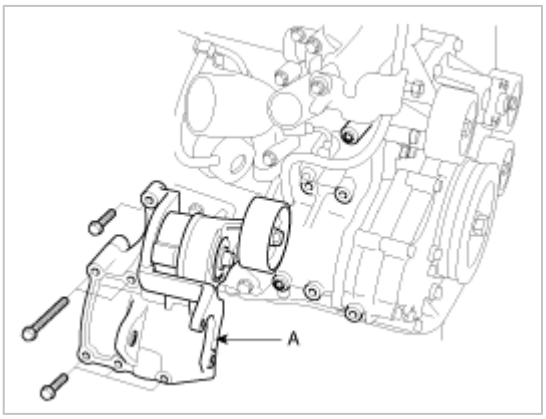
1. Remove the transmission assembly.
   (Refer to AT or MT group)
2. Remove the engine assembly. (Refer to Engine and transmission assembly in this group)
3. Remove the fly wheel (A) or drive plate.



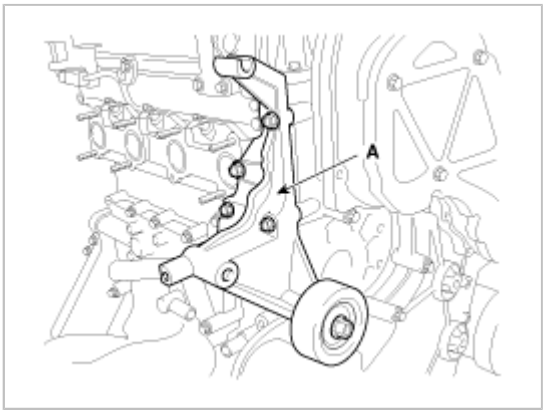
4. Remove the timing chain. (Refer to Timing system in this group)
5. Remove the intake manifold and exhaust manifold.
   (Refer to Intake and exhaust system in this group)
6. Remove the cylinder head assembly.
   (Refer to Cylinder head assembly in this group)
7. Remove the oil lever gauge assembly (A).



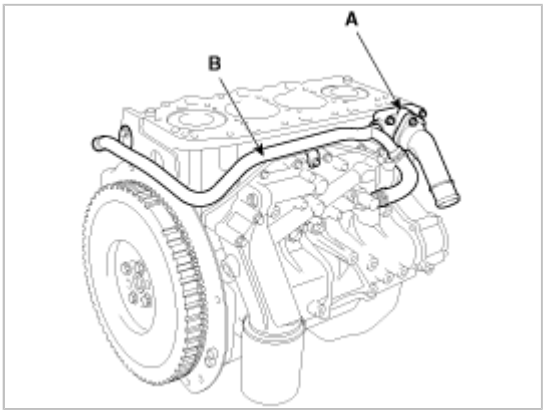
8. Remove the power steering pump.
   (Refer to ST group)
9. Remove the power steering pump bracket (A).



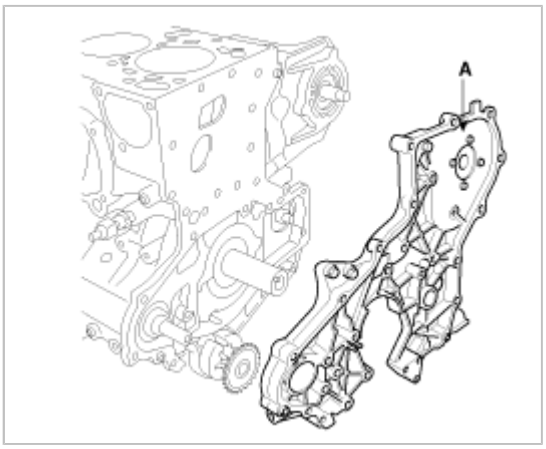
10. Remove the alternator. (Refer to EE group)
11. Remove the alternator bracker (A).



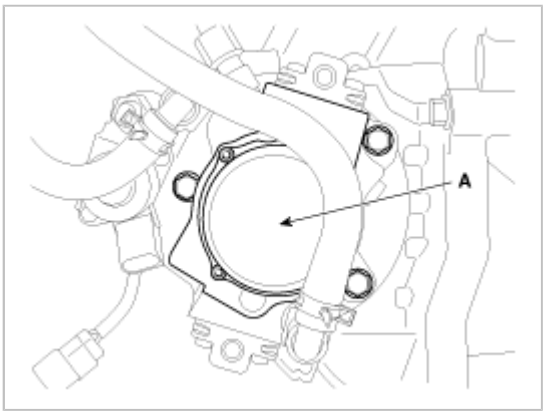
12. Remove the thermostat housing (A) and heater pipe (B).



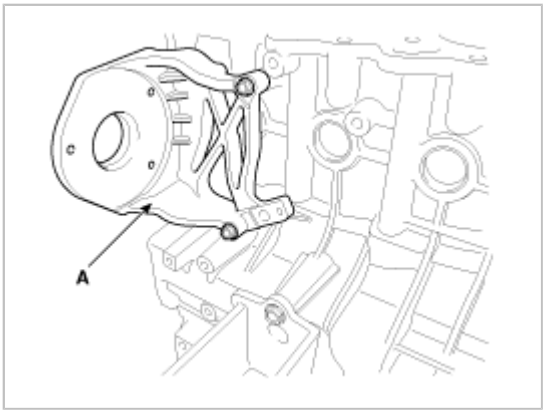
13. Remove the oil cooler.
    (Refer to Lubrication system in this group)
14. Remove the water pump.
    (Refer to Cooling system in this group)
15. Remover the timing lower under cover (A).



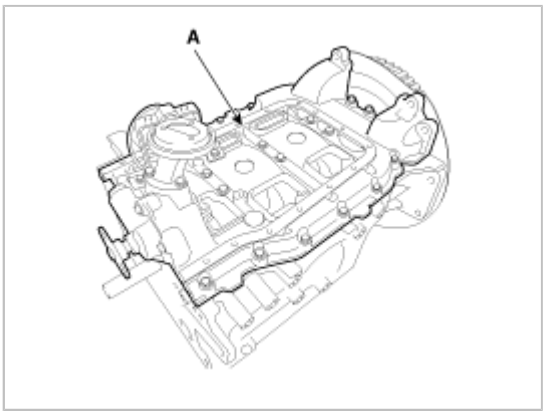
16. Remove the fuel pump (A).



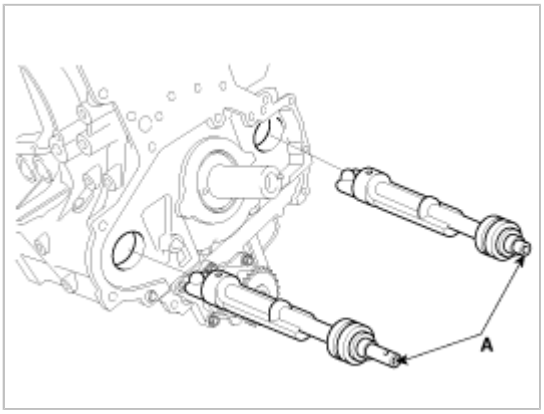
17. Remove the fuel pump bracket (A).



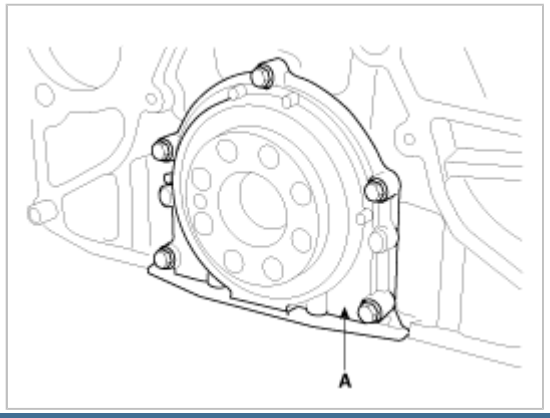
18. Remove the air conditioner compressor. (Refer to HA group)
19. Remove the oil pump complete (A).



20. Remove the balance shaft (A) from cylinder block.

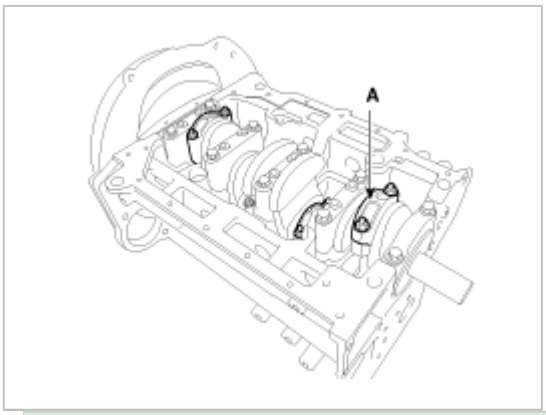


21. Remove the rear oil seal case (A).



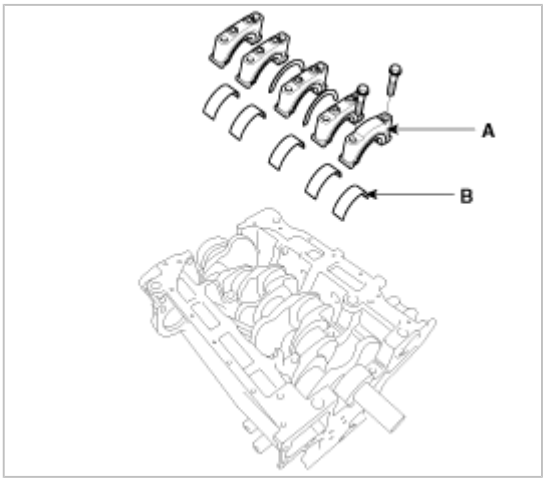
Disassembly

1. Remove the connecting rod bearing cap (A) and bearing.



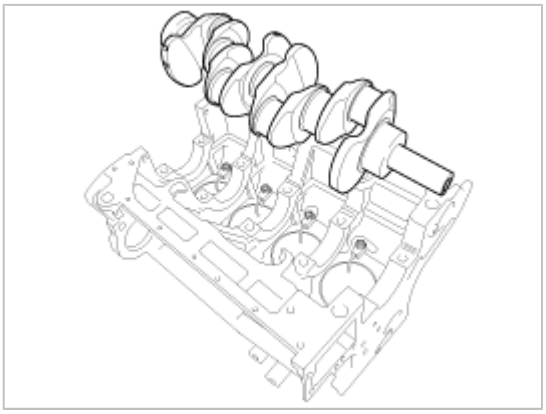
Mark the connecting rod bearing caps to be able to reassemble in the original position and direction.

2. Remove the piston and connecting rod assembly from the cylinder block.
3. Remove the main bearing cap (A) and bearing (B).

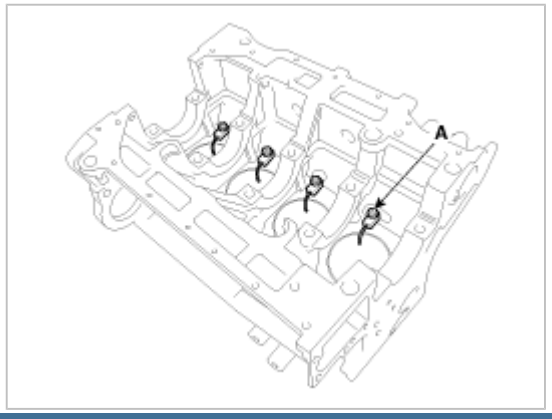


4. Remove the crankshaft (A) from cylinder block.

Crankshaft being careful not to damage the journals.



5. Remove the oil jet (A).

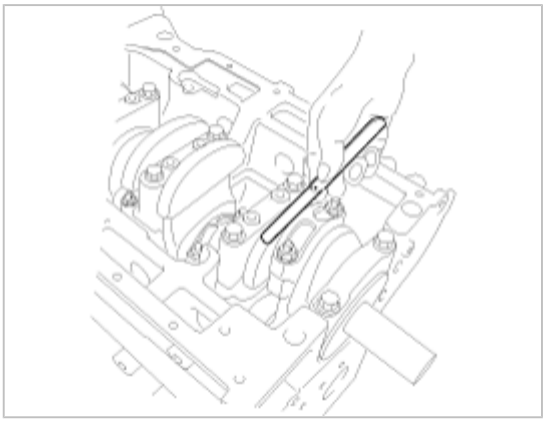


Inspection

Connecting Rod Bearing

1. Before removing the connecting rod cap, measure connecting rod side clearance. If side clearance exceeds specification, replace the connecting rod.

Side clearance : 0.05 ~ 0.25 mm (0.0020 ~ 0.0098 in)



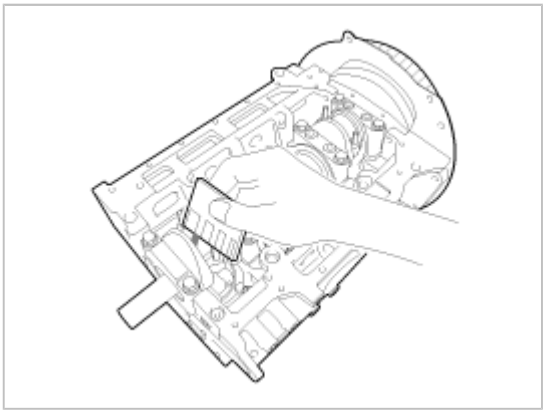
2. Remove the connecting rod cap.
3. Measure connecting rod bearing oil clearance.
   A. Remove all foreign material and oil from the pin journals and connecting rod bearing surface.
   B. Position a plastic gauge atop the pin journals in axial direction.
   C. Install the connecting rod cap and tighten nuts.

Tightening torque :
58.8 N.m (6.0 kgf.m, 43.4 lb-ft) → Loosen → 32.4~36.3 N.m (3.3~3.7 kgf.m, 23.9~26.8 lb-ft) + 60~64°

Always use new connecting rod bolts.

D. Remove the connecting rod cap, and measure oil clearance at each journal.

Oil clearance :
0.024 ~ 0.042 mm (0.0009 ~ 0.0017 in)

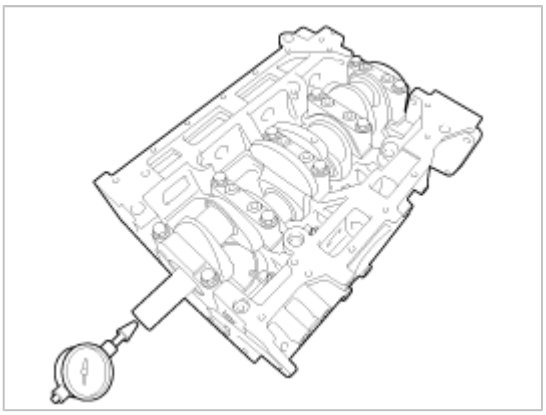


4. If oil clearance exceeds specification, replace the connecting rod bearing.

Crankshaft Main Bearing

1. Before removing the main bearing cap, measure crankshaft end play. If end play exceeds specification, replace the thrust bearing.

End play : 0.05 ~ 0.25 mm (0.0020 ~ 0.0098 in)

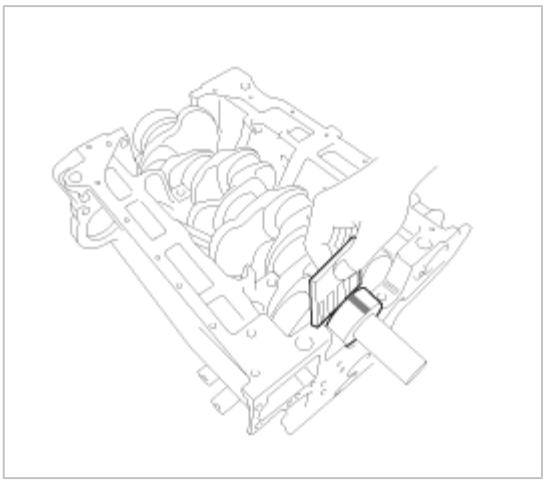


2. Remove the main bearing cap.
3. Measure main bearing oil clearance.
   A. Remove all foreign material and oil from the main journals and main bearing surface.
   B. Position a plastic gauge atop the main journals in axial direction.
   C. Install the main bearing cap and tighten bolts.

Tightening torque :
127.5 ~ 137.3N.m (13.0 ~ 14.0kgf.m, 94.0 ~ 101.3lb-ft)

   D. Remove the main bearing cap, and measure oil clearance at each journal.

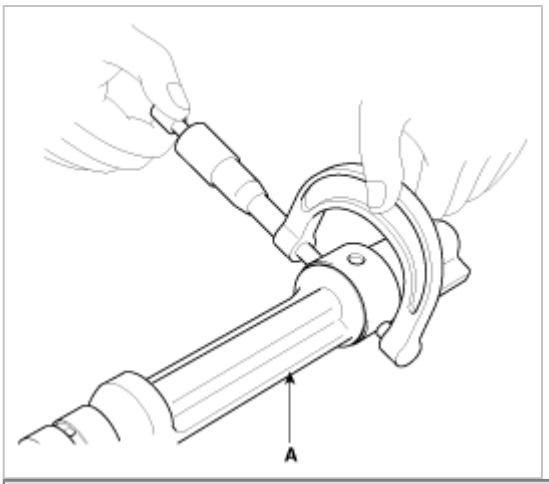
Oil clearance :
0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in)



4. If oil clearance exceeds specification, replace the main bearing.

Balance Shaft

1. The oil holes must be free from clogging.
2. Check damage for balance shaft journal. If defects are evident, replace the balance shaft.
3. Check the balance shaft for oil clearance. If wear is excessive, replace the balance shaft or cylinder block.



Item		Specification (mm(in))
Balance shaft Journal Outer diameter	Front	48.975 ~ 49.000 (1.9281 ~ 1.9291)
	Rear	47.965 ~ 47.990 (1.8884 ~ 1.8894)
Balance shaft	Front	49.050 ~ 49.080

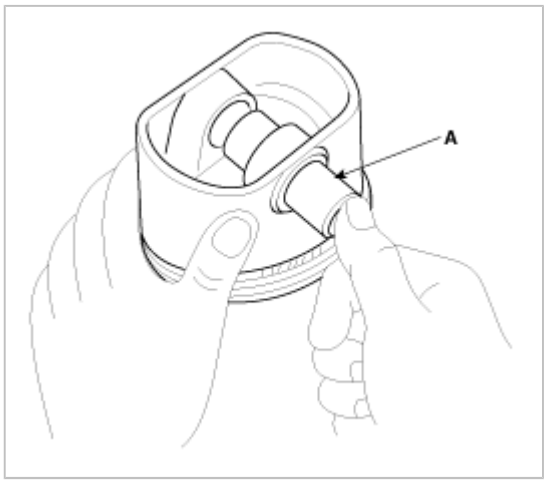
Bearing (Bush) Inner diameter		(1.9311 ~ 1.9323)
	Rear	48.050 ~ 48.080 (1.8917 ~ 1.8929)
Oil clearance	Front	0.050 ~ 0.105 (0.0020 ~ 0.0041)
	Rear	0.060 ~ 0.115 (0.0024 ~ 0.0045)

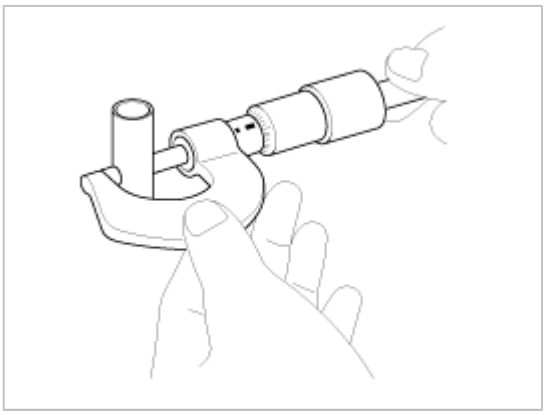
4. Check the drive gear shaft of LH balance shaft for oil clearance. If wear is excessive, replace the drive gear or timing chain lower under cover.

Item	Specification (mm(in))
Drive gear shaft Outer diameter	23.968 ~ 23.980 (0.9436 ~ 0.9441)
Drive gear shaft bearing (bush) Inner diameter	24.004 ~ 24.025 (0.9450 ~ 0.9459)
Oil clearance	0.024 ~ 0.057 (0.0009 ~ 0.0022)

Piston Pin

1. Check each piston for scuffing, scoring, wear and other defects. Replace any piston that is defective.
2. Check that the piston pin fits in the piston pin hole. Replace any piston and pin assembly that is defective. The piston pin must be smoothly pressed by hand into the pin hole (at room temperature).



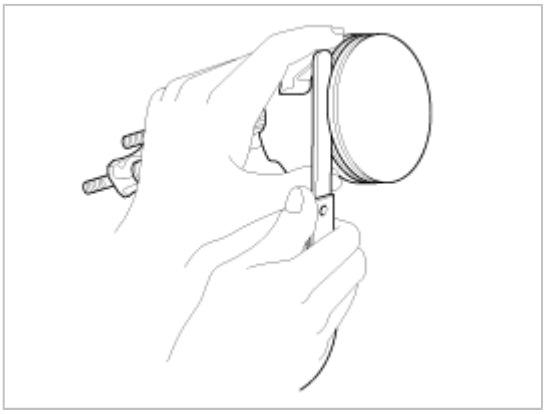


Piston pin outer diameter :
32.993 ~ 32.998 mm (1.2989 ~ 1.2991 in)
Piston pin hole inner diameter :
33.014 ~ 33.019mm (1.2998 ~ 1.3000 in)
Connecting rod small-end inner diameter :
33.020 ~ 33.033 mm (1.3000 ~ 1.3005 in)

Piston Ring

1. Check each piston ring for breakage, damage and abnormal wear. Replace the defective rings.
2. When the piston requires replacement, its ring should also be replaced.
3. Measure the clearance between piston ring and ring groove.

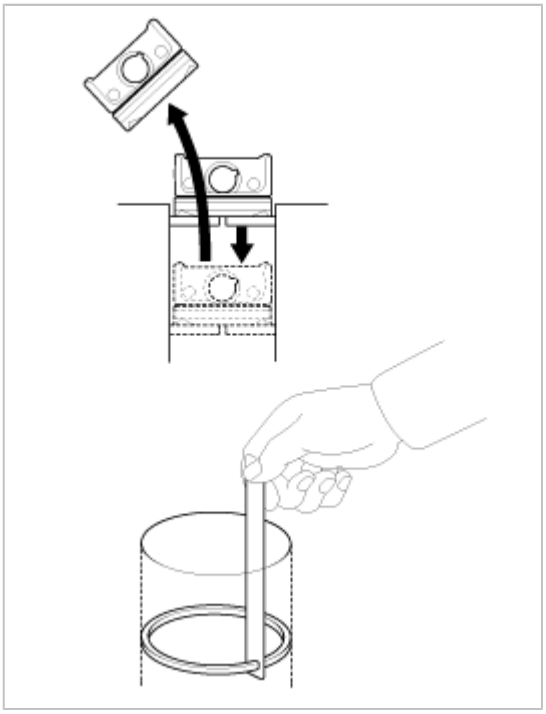
Piston ring side clearance :
No.1 ring : 0.08 ~ 0.12 mm (0.0031 ~ 0.0047 in)
No.2 ring : 0.07 ~ 0.11 mm (0.0028 ~ 0.0043 in)
Oil ring : 0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)



4. Place a piston ring in the cylinder bore and set it square by pushing it down with piston.

Eng gap :
No.1 ring : 0.20 ~ 0.35 mm (0.0079 ~ 0.0138 in)

No.2 ring : 0.70 ~ 0.90 mm (0.0276 ~ 0.0354 in)
Oil ring : 0.20 ~ 0.40 mm (0.0079 ~ 0.0157 in)

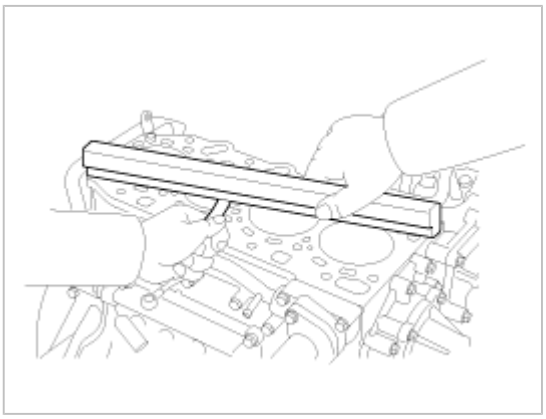


Cylinder Block

- Before inspection and repair, clean parts to remove dirt, oil, carbon, deposits, and scale.
- Before cleaning the cylinder block, be sure to check for evidences of water leaks and damage.
- Remover contaminants from oil holes with compressed air and, at the same time, make sure that they are not blocked.

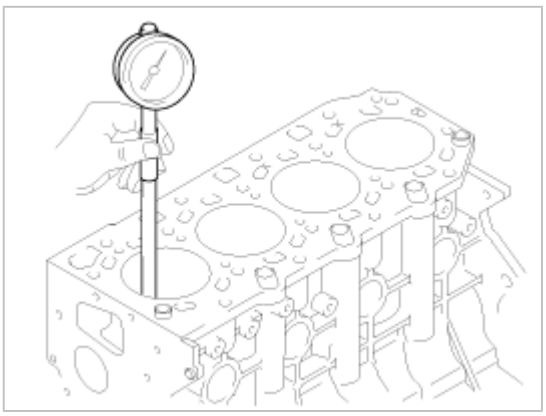
1. Check for scratches, rust, and corrosion. Use also a flaw-detecting agent for the check. If defects are evident, correct or replace.
2. Using a straightedge and thickness gauge, check the cylinder block top surface for flatness. Lay the straightedge long ways and crossways as indicated by A, B,... in illustration. If flatness is flatness is not within the limit, replace the cylinder block top surface is free from any traces of gasket material.

Standard value : 0.05 mm (0.002 in.)
Limit : 0.1 mm (0.004 in.)



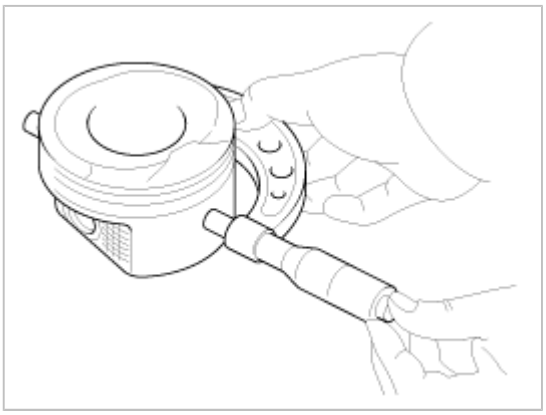
3. Check cylinder wall for scratches and seizure.
   If defects are evident, correct (to oversize) or replace.
4. Using cylinder gauge, measure the cylinder bore.
   If it wears out excessively, bore the cylinder to oversize and replace the piston and piston rings.
   Measurement points are as shown.

Standard value :
91.000 ~ 91.030 mm (3.5827 ~ 3.5839 in)



5. Measure the outside diameter of the piston.

Standard value :
90.910 ~ 90.940 mm (3.5791 ~ 3.5803 in)



6. Calculate the difference between the cylinder bore inner diameter and the piston outer diameter.

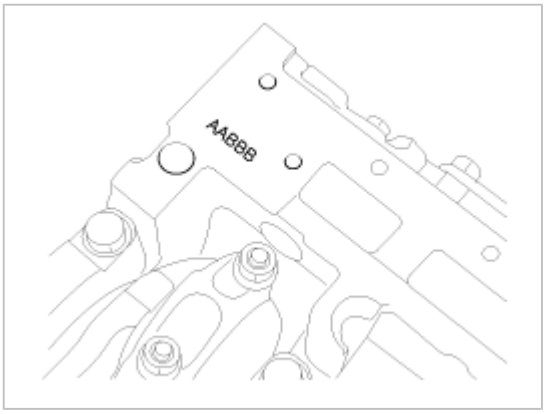
Piston-to-cylinder clearance :
0.080 ~ 0.100 mm (0.0031 ~ 0.0039 in)

Replacement

Main Journal Bearing

1. Check the cylinder block main bearing bore size code.

Record the cylinder block main bearing bore size code letters on cylinder block as shown.
Reading order is from left to right with front main bearing bore size code shown first.

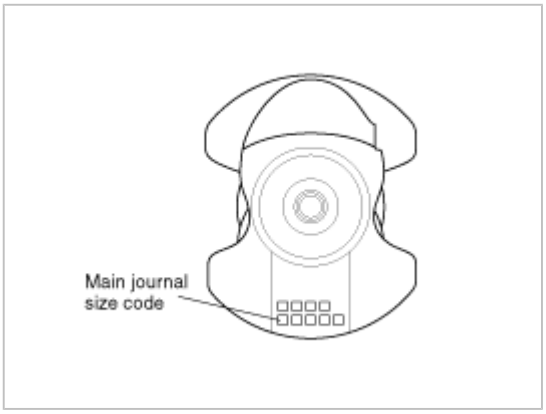


Cylinder Block Main Bearing Bore Diameter

Code	Cylinder block main bearing
A	71.000 ~ 71.008 (2.7953 ~ 2.7956)
B	71.006 ~ 71.016 (2.7956 ~ 2.7959)
C	71.016 ~ 71.024 (2.7957 ~ 2.7962)

2. Check the crankshaft main journal size code.

Record the main journal size code letters on the crankshaft balance weight.
Reading order is from left to right as shown, with No. 1 main journal size code shown first.



Crankshaft Main Journal Diameter

Code	Crankshaft main journal diameter (mm (in))
A	66.994 ~ 67.000 (2.6376 ~ 2.6378)
B	66.988 ~ 66.994 (2.6373 ~ 2.6376)
C	66.982 ~ 66.988 (2.6371 ~ 2.6373)

3. Choose proper main journal bearing in below table.

Main Journal Bearing Selection Table

Main journal bearing		Cylinder block main bearing bore size code		
		A	B	C
Crankshaft pin journal size code	A	Green	Yellow	None
	B	Yellow	None	Blue
	C	None	Blue	Red

Main journal bearing oil clearance :
0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in)

Main Journal Bearing Thickness

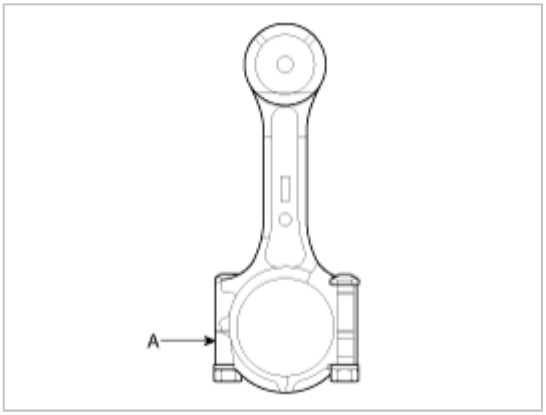
Grade	Color	Main journal bearing thickness mm (in)
A	Red	1.994 ~ 1.997 (0.0785 ~ 0.0786)
B	Blue	1.991 ~ 1.994 (0.0784 ~ 0.0785)
C	None	1.988 ~ 1.991 (0.0783 ~ 0.0784)

D	Yellow	1.985 ~ 1.988 (0.0781 ~ 0.0783)
E	Green	1.982 ~ 1.985 (0.0780 ~ 0.0781)

Connecting Rod Bearing

1. Check the connecting rod big-end bore size code(A).

Record the connecting rod big-end bore size code letters on connecting rod cap as shown.

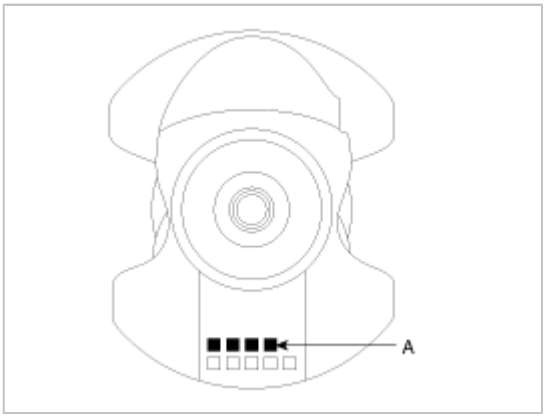


Connecting Rod Big-End Diameter

Code	Connecting rod big-end diameter mm (in)
A	60.000 ~ 60.006 (2.3622 ~ 2.3624)
B	60.006 ~ 60.012 (2.3624 ~ 2.3627)
C	60.012 ~ 60.018 (2.3627 ~ 2.3629)

2. Check the crankshaft pin journal size code(A).

Record the pin journal size code letters on the No. 1 crankshaft balance weight.
Reading order is from left to right as shown, with No. 1 pin journal size code shown first.



Crankshaft Pin Journal Diameter

Code	Crankshaft pin journal diameter mm (in)
1	56.994 ~ 57.000 (2.2439 ~ 2.2441)
2	56.988 ~ 56.994 (2.2436 ~ 2.2439)
3	56.982 ~ 56.988 (2.2434 ~ 2.2436)

3. Choose proper connecting rod bearing in below table.

Connecting Rod Bearing Selection Table

Connecting rod bearing		Connecting rod big-end bore size code		
		A	B	C
Crankshaft pin journal size code	1	Green	Yellow	None
	2	Yellow	None	Blue
	3	None	Blue	Red

Connecting rod bearing oil clearance :
0.024 ~ 0.042 mm (0.0009 ~ 0.0017 in)

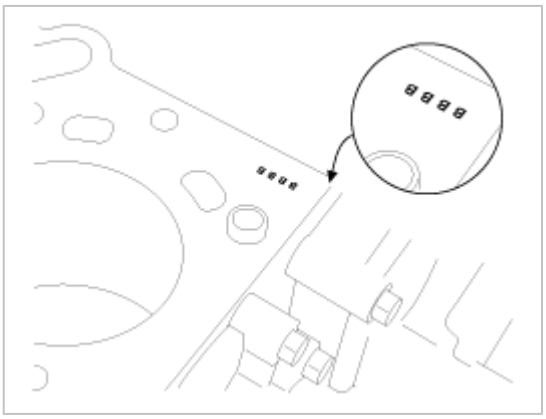
Connecting Rod Bearing Thickness

Grade	Color	Connecting rod bearing thickness mm (in)
A	Red	1.497 ~ 1.500 (0.0589 ~ 0.0591)
B	Blue	1.494 ~ 1.497 (0.0588 ~ 0.0589)
C	None	1.491 ~ 1.494 (0.0587 ~ 0.0588)
D	Yellow	1.488 ~ 1.491 (0.0586 ~ 0.0587)
E	Green	1.485 ~ 1.488 (0.0585 ~ 0.0586)

Piston

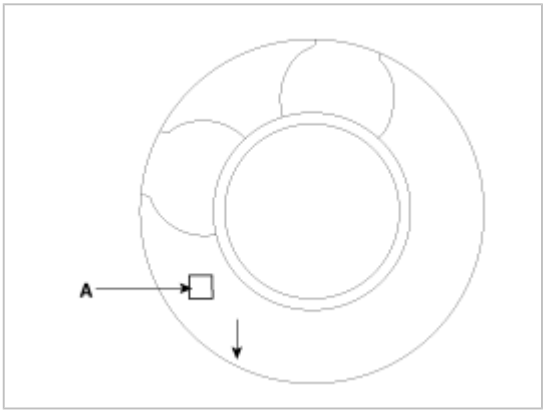
1. Check the cylinder bore size code on the cylinder block bottom face.

Code	Cylinder bore inner diameter (mm (in))
A	91.000 ~ 91.010 (3.5827 ~ 3.5831)
B	91.010 ~ 91.020 (3.5831 ~ 3.5835)
C	91.020 ~ 91.030 (3.5835 ~ 3.5839)



2. Check the piston size code(A) on the piston top face.

Code	Piston outer diameter (mm (in))
A	90.910 ~ 90.920 (3.5791 ~ 3.5795)
B	90.920 ~ 90.930 (3.5795 ~ 3.5799)
C	90.930 ~ 90.940 (3.5799 ~ 3.5803)



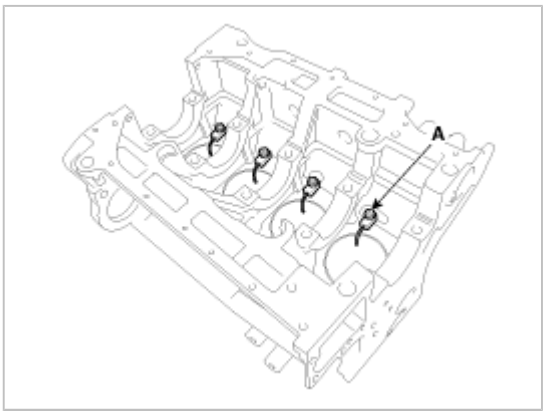
3. Select the piston related to cylinder bore size code.

Oil clearance : 0.080 ~ 0.100 mm (0.0031 ~ 0.0039 in)

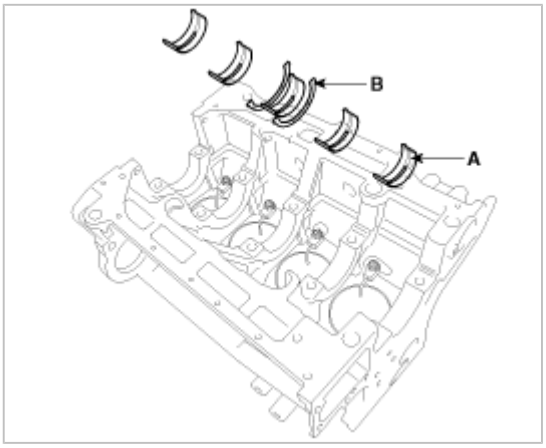
Reassembly

1. Install the oil jet (A).

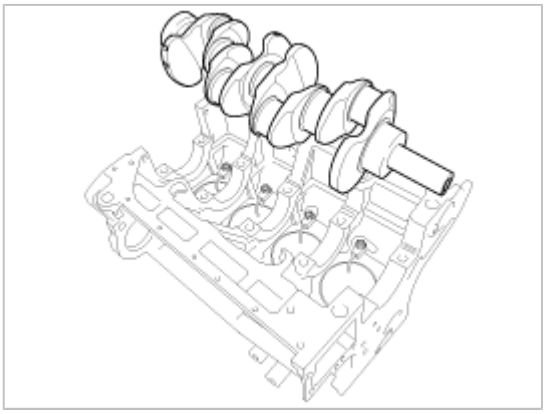
Tightening torque :
29.4 ~ 34.3N.m (3.0 ~ 3.5kgf.m, 21.7 ~ 25.3lb-ft)



2. Install the main bearing (A).

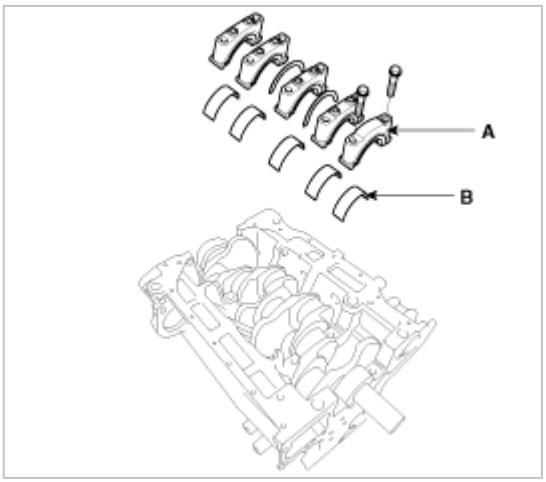


3. Install the thrust bearing (B).
4. Install the crankshaft (A).

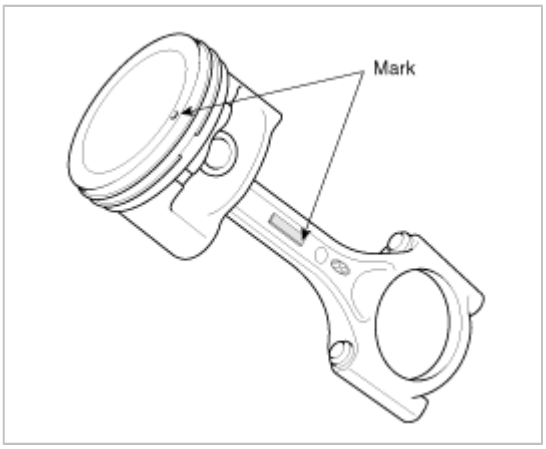


5. Check the main bearing, cap number. And then install the main bearing cap (A) and bearing (B).

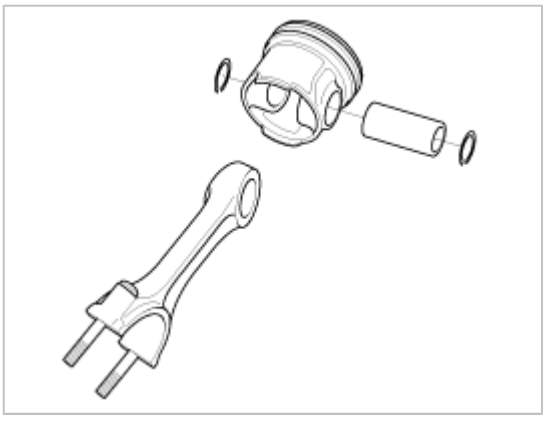
Tightening torque :
127.5 ~ 137.3N.m (13.0 ~ 14.0kgf.m, 94.0 ~101.3lb-ft)



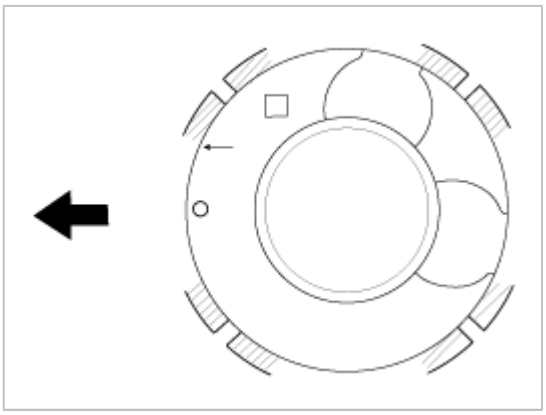
6. Check the front mark of the piston.



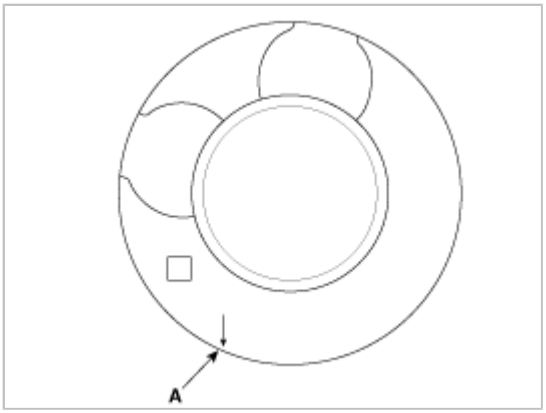
7. Line up the front marks and insert the piston pin. The piston pin must be smoothly pressed by hand into piston hole.



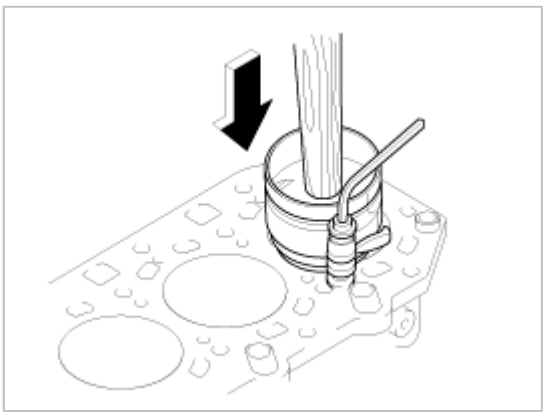
8. Install the snap ring.
9. Install the piston rings.
   A. Install the oil ring expander and 2 side rails by hand.
   B. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.
   C. Position the piston rings so that the ring ends are as shown.



10. Insert the piston and connecting rod assembly from above the top of cylinder. Ensure that the front mark (A) on the piston crown and that (front mark) on the connecting rod face toward the front of engine (to the crankshaft pulley side).



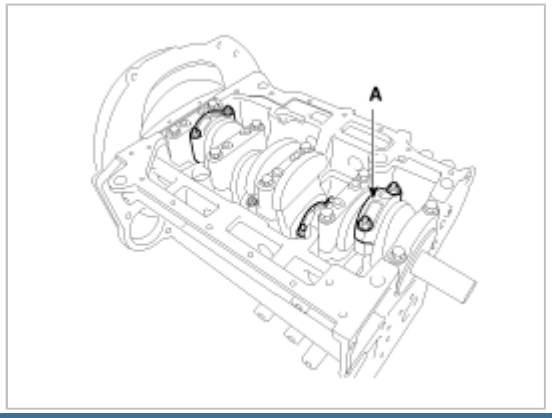
11. Clamp firm the piston rings with the ring band and install the piston assembly into cylinder. Do not strike it hard into the piston, as broken piston ring or damaged crankshaft pin journal could result.



12. Install the connecting rod bearing.
13. Install the connecting rod and cap (A) to crankshaft pin journal.

Tightening torque :
58.8 N.m (6.0 kgf.m, 43.4 lb-ft) → Loosen → 32.4~36.3 N.m (3.3~3.7 kgf.m, 23.9~26.8 lb-ft) + 60~64°

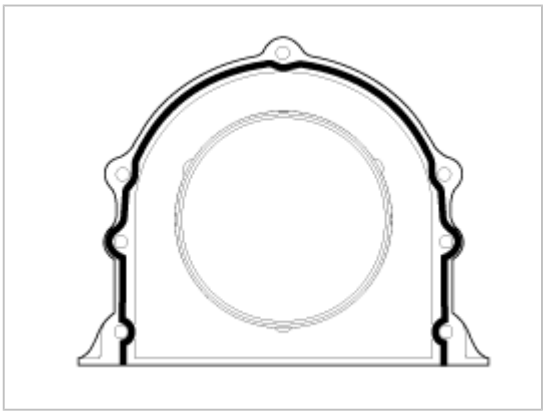
Always use new connecting rod bolts.



Installation

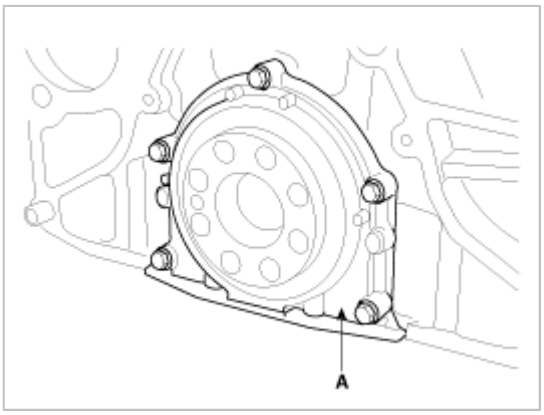
1. Apply sealant on the rear oil seal case.

Sealant type : Loctite #5900
Bead width : 0.3 ± 0.05 mm (0.0118 ± 0.0020 in)



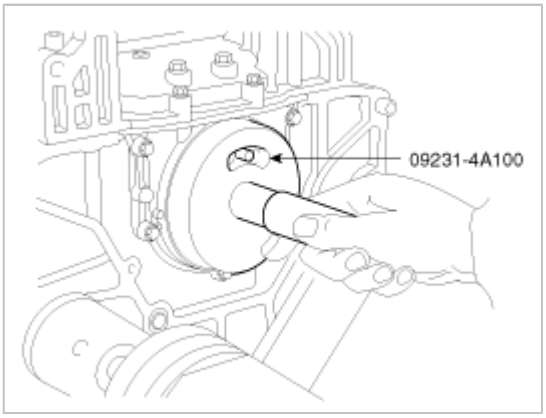
2. Install the rear oil seal (A).

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

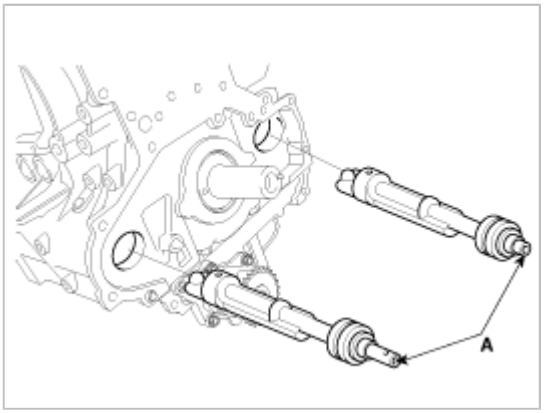


3. Temporarily install a new rear oil seal to the oil seal case and install the special service tool (09231-4A100) through the rear oil seal case.

Apply engine fluid to the circumference of oil seal lip.



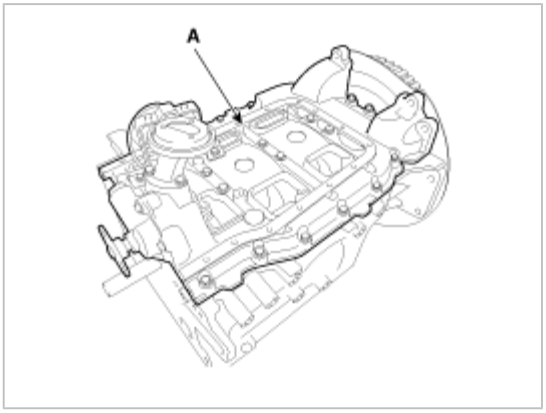
4. Apply engine fluid to the balance shaft journal and balance shaft bearing (bush).
5. Install the balance shaft(A) into cylinder block.

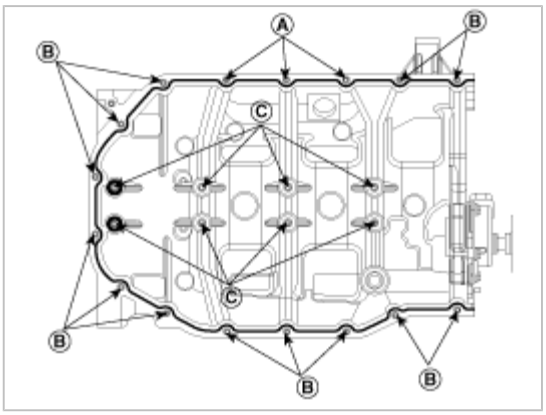


6. Install the oil pump.
   (Refer to Lubrication system in this group)
7. Apply sealant on the timing chain lower under cover after clean foreign material. And Install the oil pump complete (A).

Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)
A	6 x 18	3 EA	7.8~11.8(0.8~1.2, 5.8~8.7)
B	6 x 30	13 EA	7.8~11.8 (0.8~1.2, 5.8~8.7)
C	8 x 45	8 EA	19.6~26.5 (2.0~2.7, 14.5~19.5)

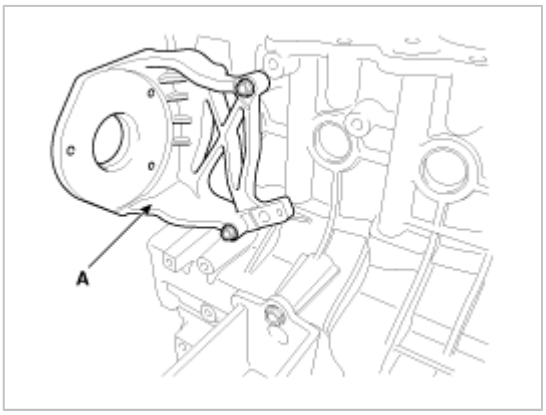
* Bolts size = Diameter x Length





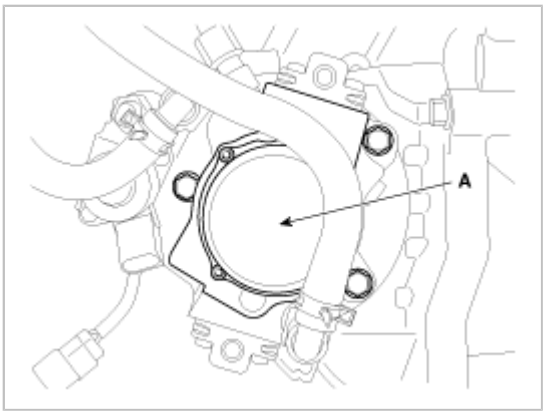
8. Install the air conditioner compressor. (Refer to HA group)
9. Install the fuel pump bracket (A).

Tightening torque :
19.6 ~ 25.5N.m (2.0 ~ 2.6kgf.m, 14.5 ~ 18.8lb-ft)



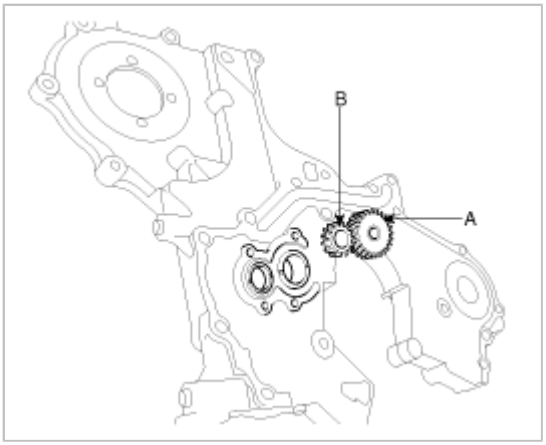
10. Install the fuel pump (A).

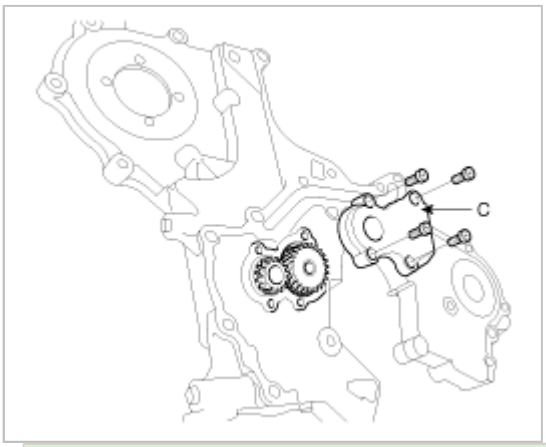
Tightening torque :
19.6 ~ 25.5N.m (2.0 ~ 2.6kgf.m, 14.5 ~ 18.8lb-ft)



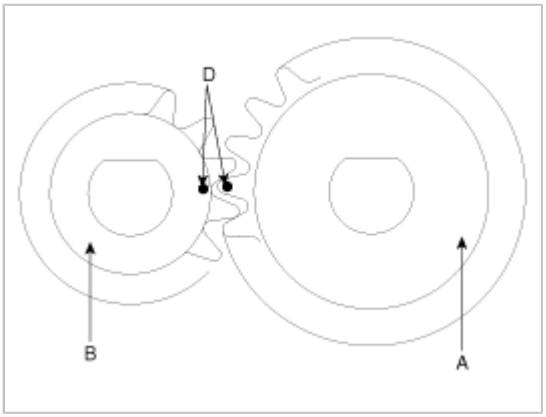
11. Install the balance shaft drive gear (A) and driven gear (B) on the timing chain lower under cover.

Tightening torque :
Drive gear and driven gear cover (C) :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)



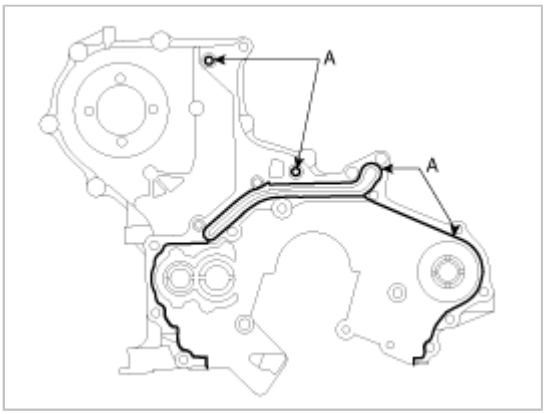


Align timing mark (D) on the drive gear (A) and driven gear (B).



12. Apply sealant (A) on the timing chain lower under cover after clean foreign material.

Sealant type : Lotite #5902
Bead width : 2 ~ 4mm (0.08 ~ 0.16 in)

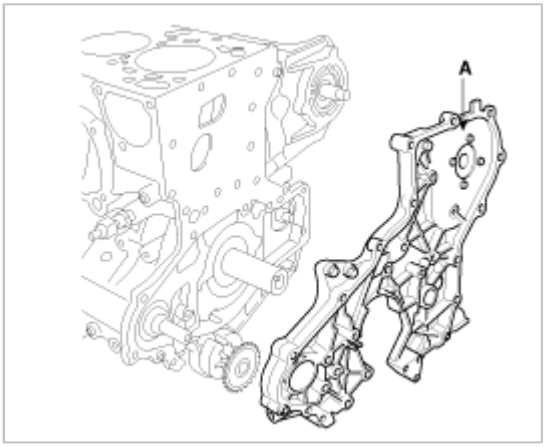


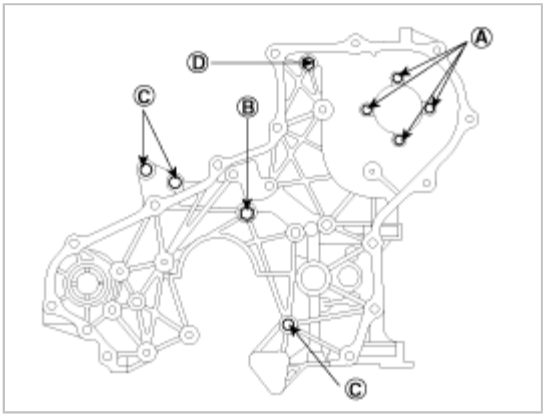
13. Install the timing chain lower under cover (A).

Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)

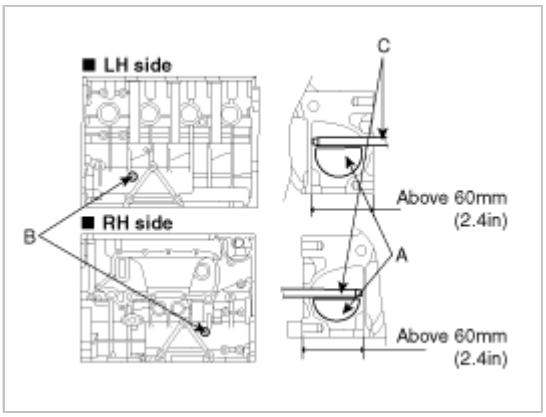
A	6 x 14	4 EA	9.8 ~ 11.8 (1.0 ~ 1.2, 7.2 ~ 8.7)
B	8 x 22	1 EA	19.6 ~ 26.5 (2.0~2.7, 14.5~19.5)
C	8 x 30	3 EA	19.6 ~ 26.5 (2.0~2.7, 14.5~19.5)
D	8 x 40	1 EA	19.6 ~ 26.5 (2.0~2.7, 14.5~19.5)

*Bolts size = Diameter x Length



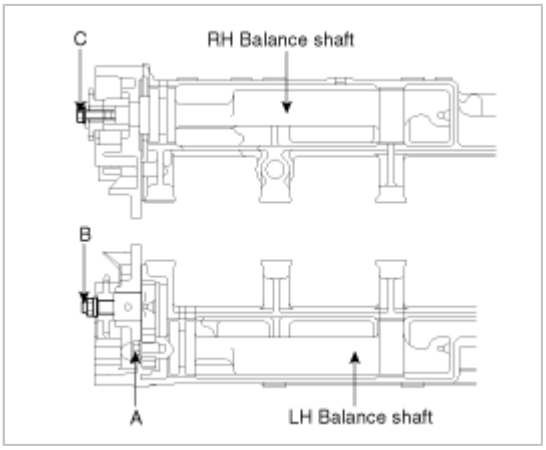


14. Insert a screw driver(C) in the cylinder block plug hole (B) to prevent rotation of balance shaft (A).



15. Install the LH balance shaft driven gear bolt (A). (8 x 16).

Tightening torque :
33.3 ~ 44.1N.m (3.4 ~ 4.0kgf.m, 24.6 ~ 32.5lb-ft)



16. Install the balance shaft sprocket.

Tightening torque :
LH balance shaft sprocket nut (B) :
49.0 ~ 58.8N.m (5.0 ~ 6.0kgf.m, 36.2 ~ 43.4lb-ft)
RH balance shaft sprocket bolt (8 x 16) (C) :
33.3 ~ 39.2N.m (3.4 ~ 4.0kgf.m, 24.6 ~ 28.9lb-ft)

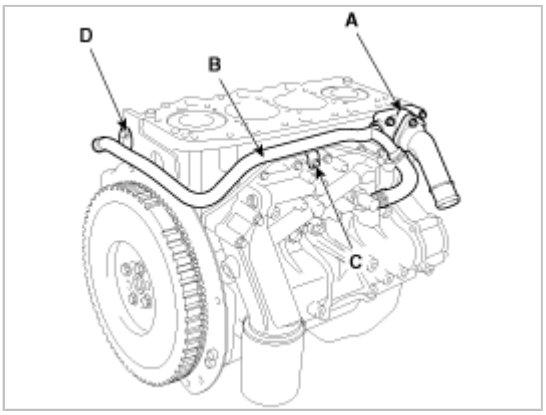
17. Install plug on the cylinder block after removing driver.

Tightening torque (plug) :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)

18. Install the water pump. (Refer to Cooling system in this group)
19. Install the oil cooler. (Refer to Lubrication system in this group)
20. Install the thermostat housing (A) and heater pipe (B).

Tightening torque

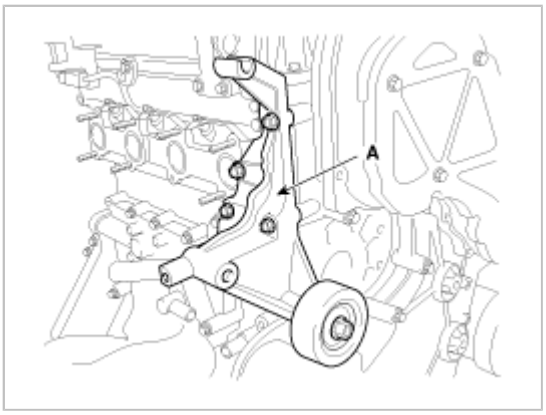
Thermostat housing: 19.6 ~ 26.5N.m
(2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)
Heater pipe (C) :
7.8 ~ 11.8N.m (0.8~1.2kgf.m, 5.8~8.7lb-ft)
Heater pipe (D) :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



21. Install the alternator bracket (A).

Tightening torque :

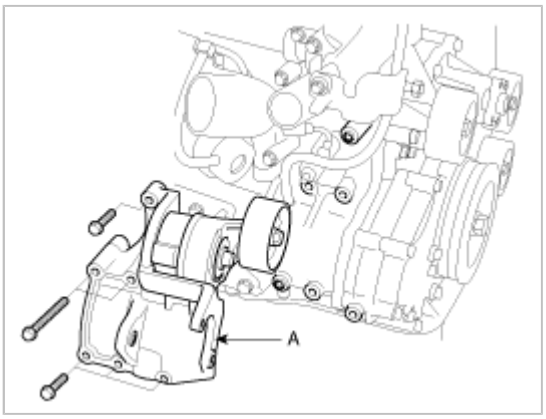
18.6 ~ 27.4N.m (1.9 ~ 2.8kgf.m, 13.7 ~ 20.3lb-ft)



22. Install the alternator. (Refer to EE group)
23. Install the power steering pump bracket (A).

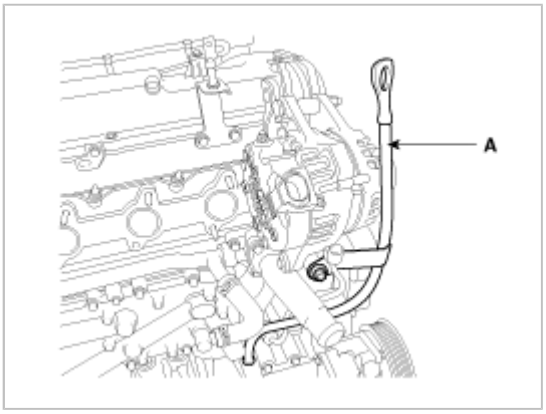
Tightening torque :

19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



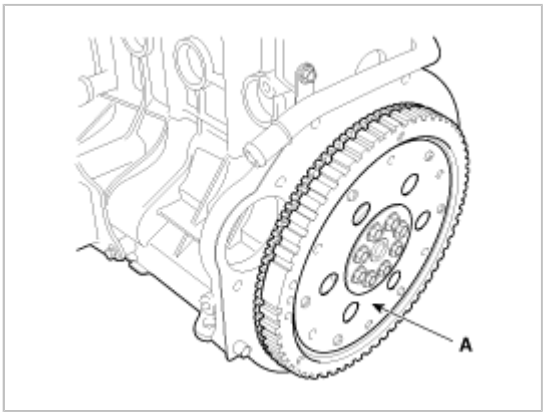
24. Install the power steering pump.(Refer to ST group)
25. Install the oil gauge assembly (A).

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



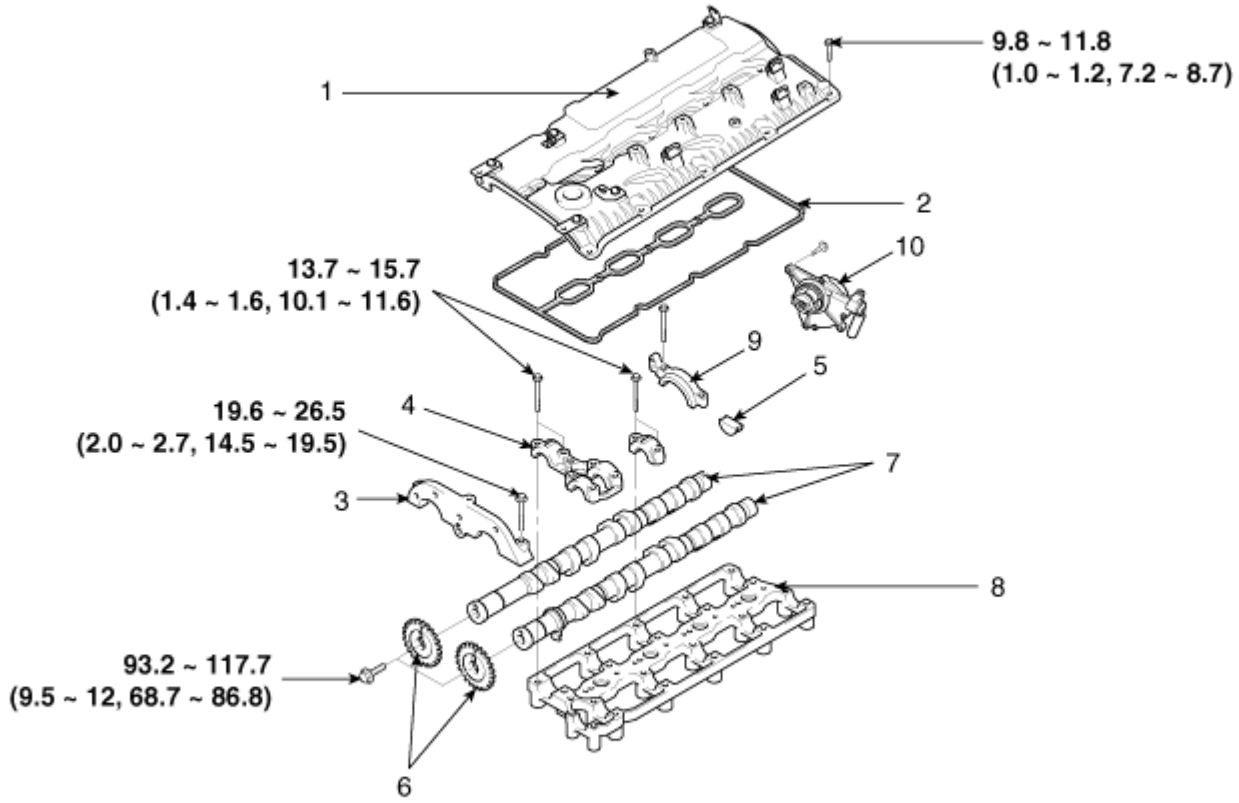
26. Install the cylinder head.
    (Refer to Cylinder head assembly in this group)
27. Install the intake manifold and exhaust manifold.
    (Refer to Intake and exhaust system in this group)
28. Install the timing chain.
    (Refer to Timing system in this group)
29. Install the fly wheel (A) or drive plate.

Tightening torque :
127.5 ~ 137.3 N.m (13.0 ~ 14.0 kgf.m, 94.0 ~ 101.3 lb-ft)



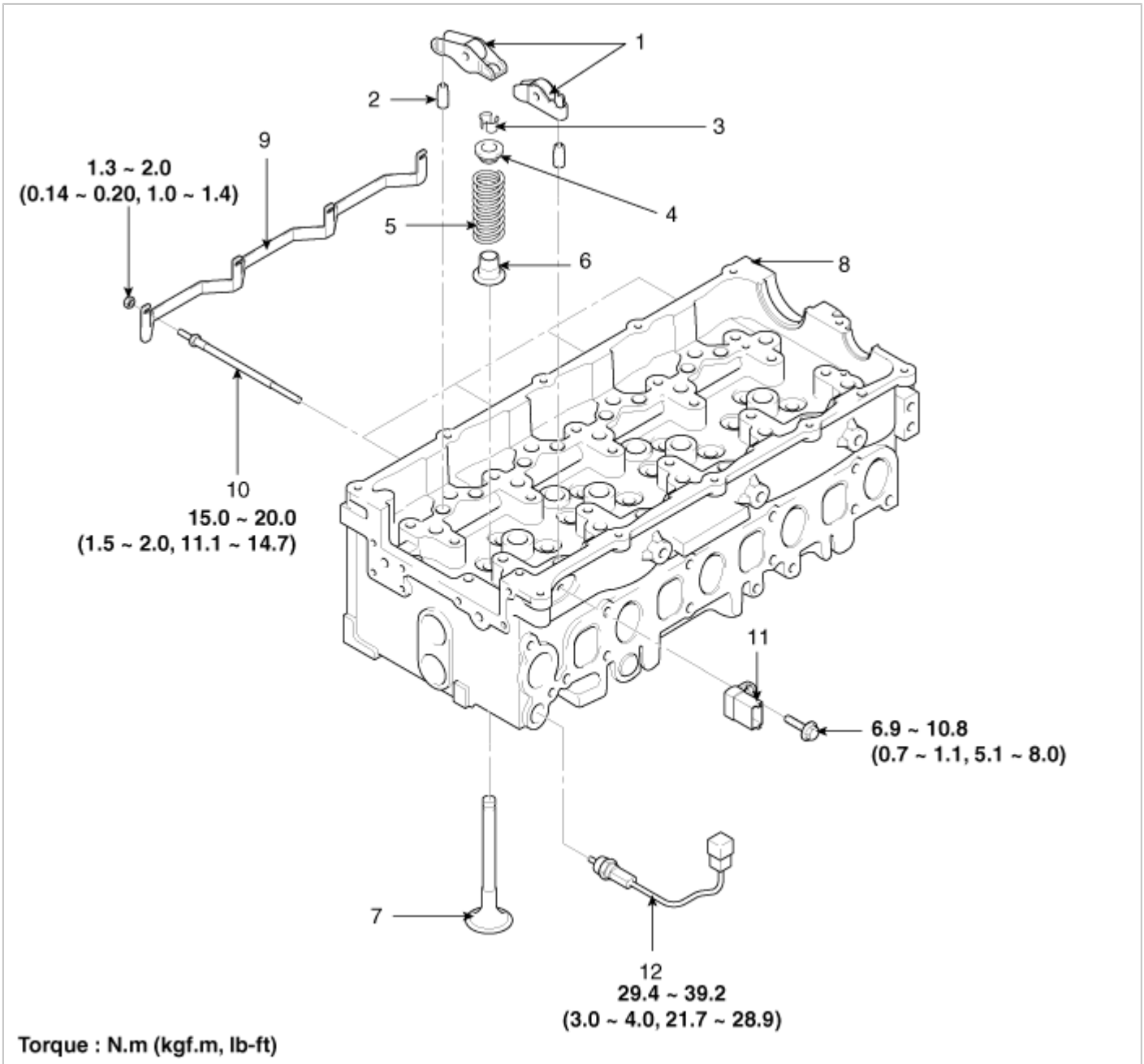
30. Install the engine assembly. (Refer to Engine and transmission assembly in this group)
31. Install the transmission assembly.
    (Refer to AT or MT group)

Components



Torque : N.m (kgf.m, lb-ft)

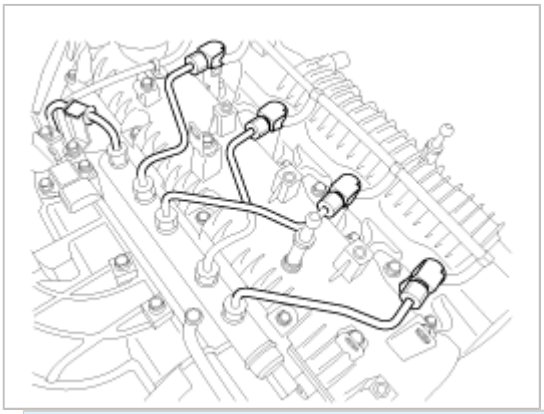
1. Cylinder head cover	6. Camshaft sprocket
2. Cylinder head cover gasket	7. Camshaft
3. Timing chain cover plate	8. Camshaft carrier
4. Camshaft bearing cap	9. Vacuum pump bracket
5. Semicircle packing	10. Vacuum pump



1. Cam follow	8. Cylinder head
2. HLA	9. Glow plug plate
3. Retainer lock	10. Glow plug
4. Valve retainer	11. TDC sensor
5. Valve spring	12. Water outlet fitting
6. Valve stem seal	13. Gasket
7. Valve	14. Water temperature sensor

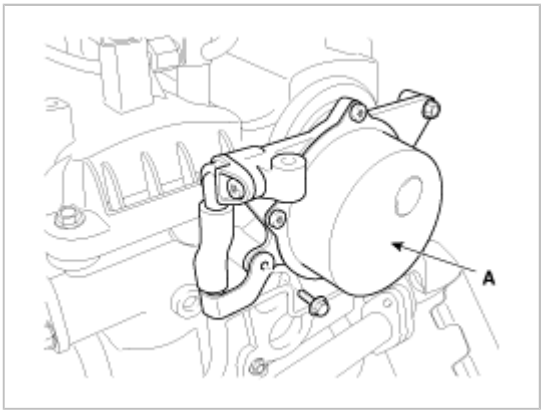
Removal

1. Remove the transmission assembly.
   (Refer to AT or MT group)
2. Remove the engine assembly. (Refer to Engine and transmission assembly in this group)
3. Remove the timing chain "C".
   (Refer to Timing system in this group)
4. Remove the high pressure pipes (A) and the injectors (B). (Refer to FL group)

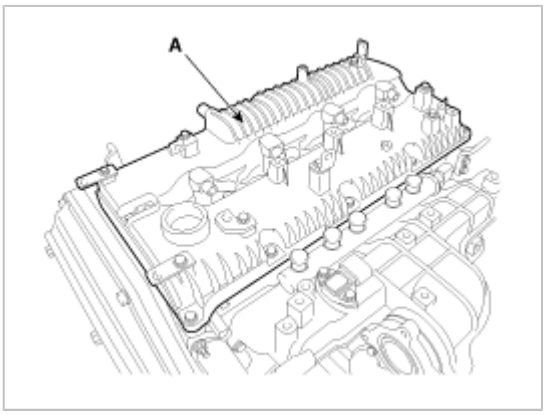


- Never perform any work on injection system with engine running or within 30 seconds after stopping the engine.
- Always pay attention to safety precautions.
- Do not reuse the high pressure pipe.

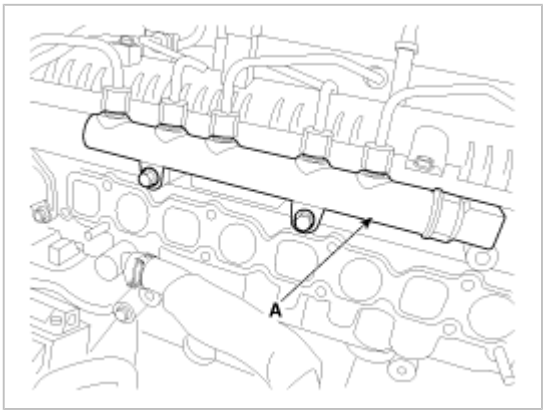
5. Remove the vacuum pump(A).



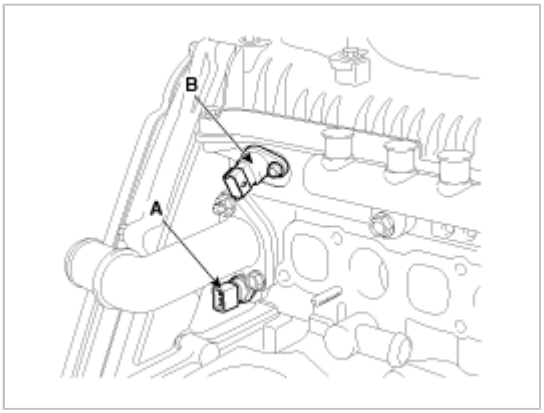
6. Remove the cylinder head cover(A).



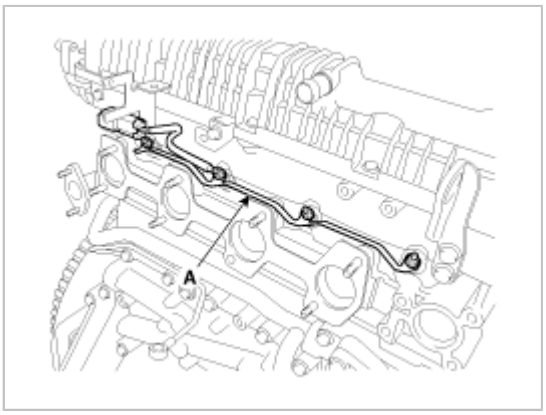
7. Remove the exhaust manifold.
   (Refer to Intake and exhaust system in this group)
8. Remove the intake manifold.
   (Refer to Intake and exhaust system in this group)
9. Remove the delivery pipe(A).



10. Remove the water temperature sensor (A) and TDC sensor (B).

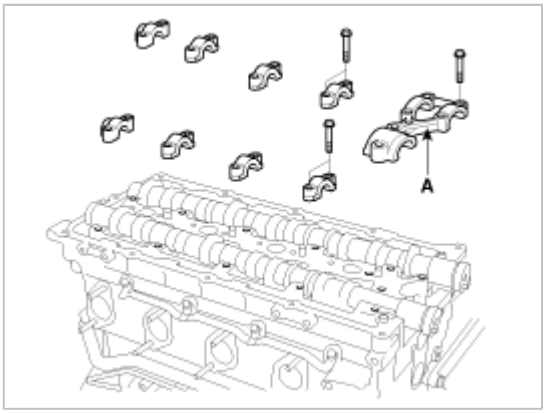


11. Remove the glow plug(A).

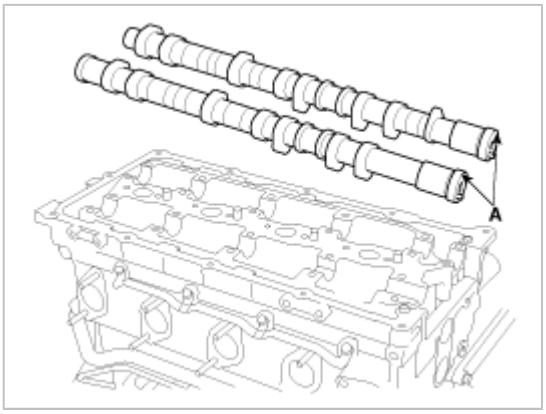


Disassembly

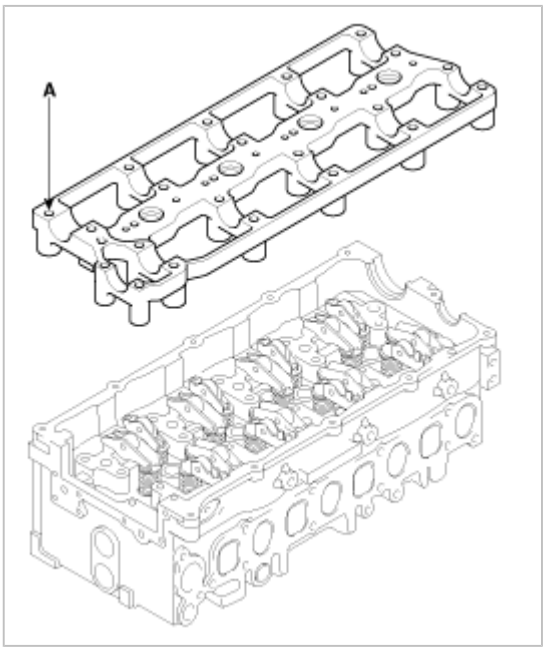
1. Remove the camshaft sprocket.
2. Remove the camshaft bearing cap(A).



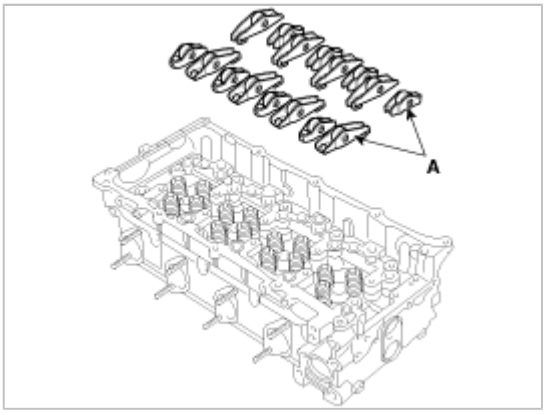
3. Remove the camshaft(A).



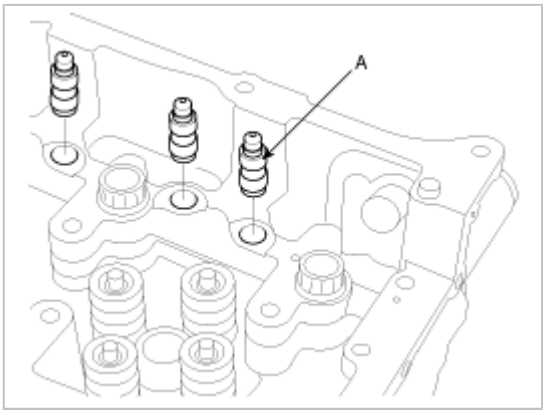
4. Remove the camshaft carrier (A).



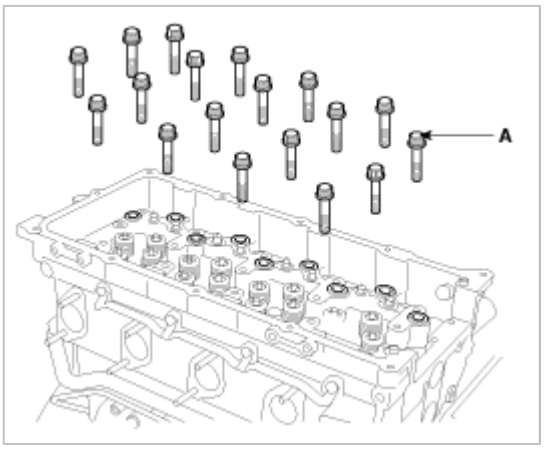
5. Remove the cam follow (A).



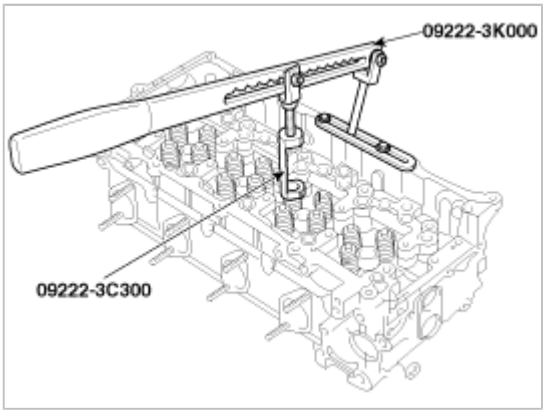
6. Remove the HLA (A).



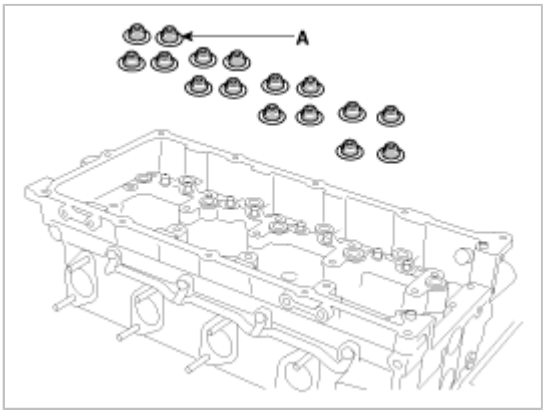
7. Remove the cylinder head bolts(A).



8. Remove the cylinder head.
9. Using the special service tool (09222-3K000, 09222-3C300), remove the valve.



10. Remove the valve stem seal (A).



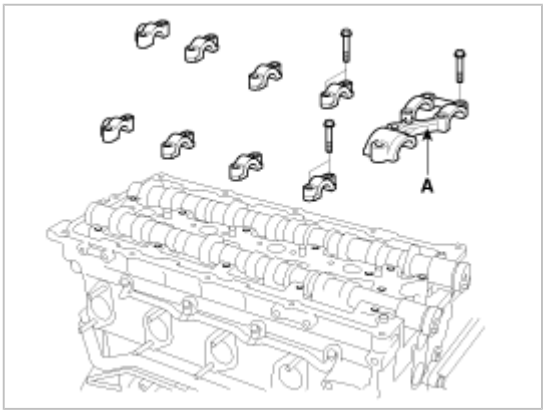
Inspection

Camshaft

Do not rotate the camshaft during inspection.

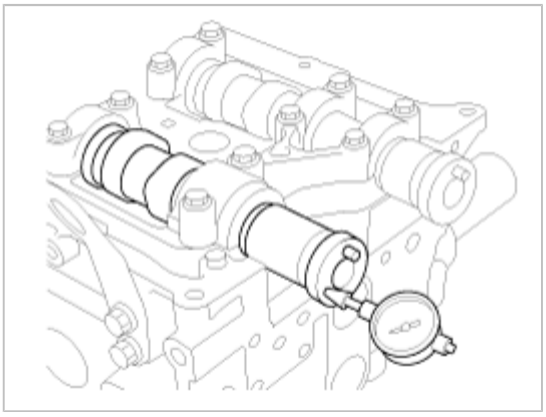
1. Put the cam shaft and the camshaft bearing caps(A) on the cylinder head, and then tighten the bolts to the specified torque with the following sequence below.

Tightening torque :
13.7 ~ 15.7N.m (1.4 ~ 1.6kgf.m,10.1~11.6lb-ft)

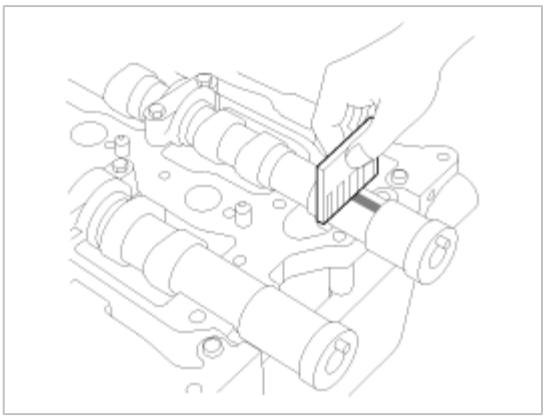


2. Check the camshaft journals for wear. If the journals are badly worn, replace the camshaft.

End play : 0.10 ~ 0.20 mm (0.0039 ~ 0.0079 in)

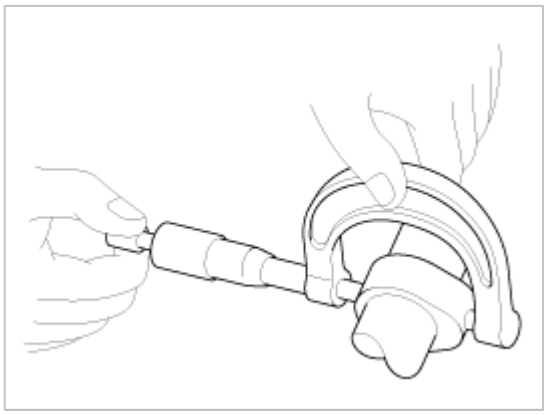


3. Clean the camshaft bearing surfaces in the cylinder head then set the camshaft back in place.
4. Install the camshaft bearing caps and tighten the bolts to the specified torque.
5. Remove the camshaft bearing caps, and then measure the widest portion of the plastic gage on each journal.



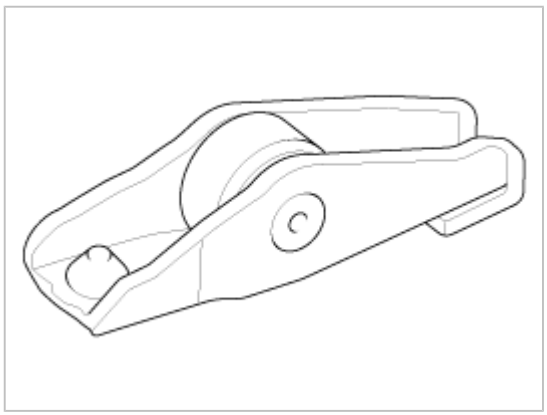
6. Check the cam lobes for damage. If the lobe is damaged or worn excessively, replace the camshaft.

Cam height (LH) :
Intake : 40.163 mm (1.5812 in)
Exhaust : 40.043 mm (1.5765 in)
Cam height (RH) :
Intake : 39.782 mm (1.5662 in)
Exhaust : 40.456 mm (1.5928 in)



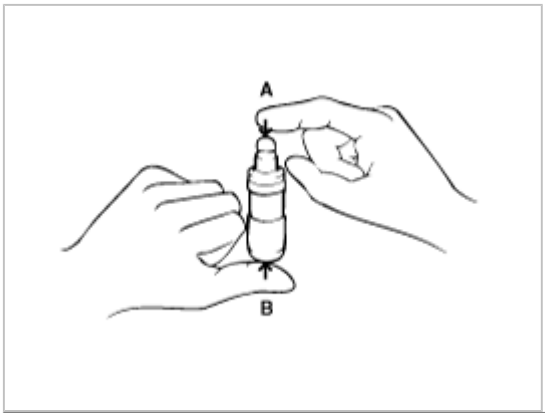
Cam Follow (Rocker Arm)

1. Check rotation of the roller. If they do not rotate smoothly or are loose, replace them.
2. Check the roller surface. Replace if there is any dent, damage or evidence of seizure.
3. Check the valve contact surface for possible damage or evidence of seizure. Replace if necessary.



HLA

With the HLA filled with engine oil, hold A and press B by hand, If B moves, replace the HLA.



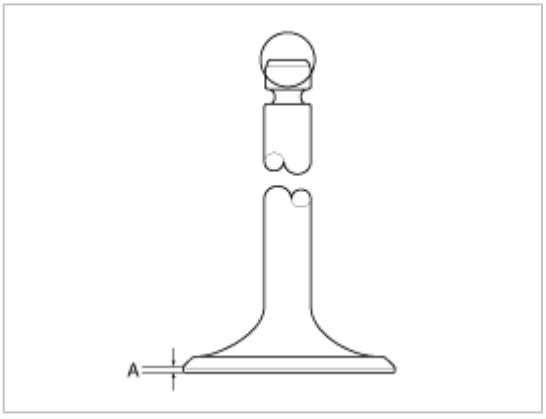
Problem	Possible cause	Action
1. Temporary noise when starting a cold engine	Normal	This noise will disappear after the oil in the engine reaches the normal pressure.
2. Continuous noise when the engine is started after parking more than 48 hours.	Oil leakage of the high pressure chamber on the HLA, 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 the engine is first started after rebuilding cylinder head.	Insufficient oil in cylinder head oil gallery.	
4. Continuous noise when the engine is started after excessively 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 the engine is running after changing the HLA.		Do not run engine at a speed higher than 3000 rpm, as this may damage the HLA.
6. Continuous noise during idle after high engine 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 specified type.
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. Be careful with the hot HLAS.

Valve And Valve Guide

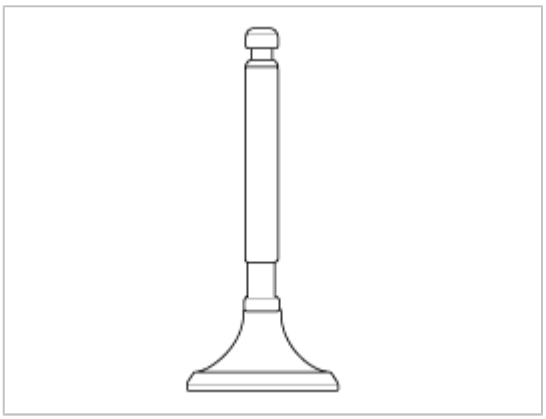
1. Inspect each valve for following. Replace of resurface if necessary.
   A. Damage or bent stem.
   B. Roughness or damage to face.
   C. Roughness or damage to face.
2. Check valve head margin thickness(A). Replace if necessary.

Margin thickness :
Intake, Exhaust : 1.8 ~ 2.0 mm (0.071 ~ 0.079 in)



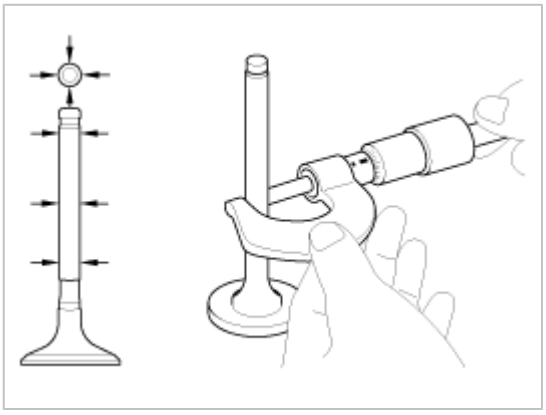
3. Measure valve length.

Valve length :
Intake, Exhaust : 110.55 mm (4.352 in)



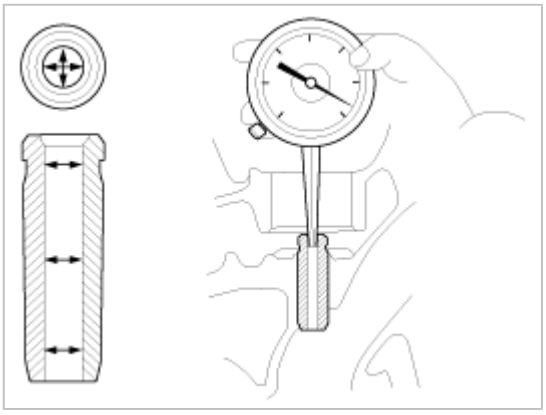
4. Measure valve stem diameter.

Valve stem diameter :
Intake : 6.965 ~ 6.980 mm (0.2742 ~ 0.2748 in)
Exhaust : 6.935 ~ 6.950 mm (0.2730 ~ 0.2736 in)



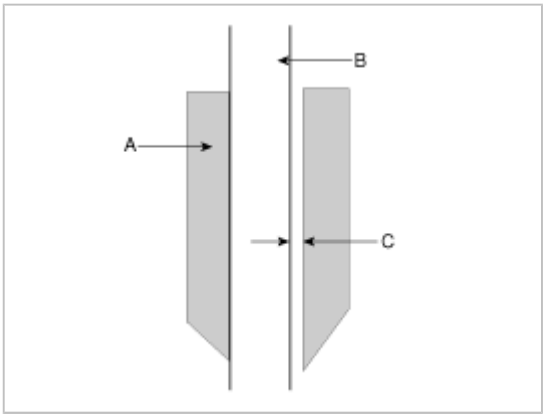
5. Measure valve guide inner diameter.

Inner diameter
Intake, Exhaust :
7.000 ~ 7.015 mm (0.2756 ~ 0.2762 in)



6. Measure valve stem to guide clearance(C) by subtract outer diameter of valve stem(B) from inner diameter of corresponding valve guide(A).

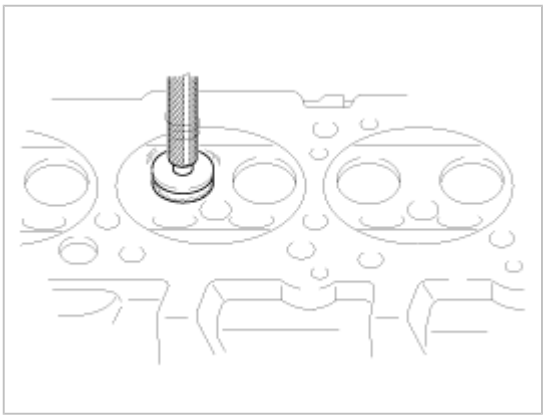
Clearance
Specification
Intake : 0.020 ~ 0.050 mm (0.0008 ~ 0.0020 in)
Exhaust : 0.050 ~ 0.080 mm (0.0020 ~ 0.0031 in)
Limit
Intake : 0.10 mm (0.0039 in)
Exhaust : 0.15 mm (0.0059 in)



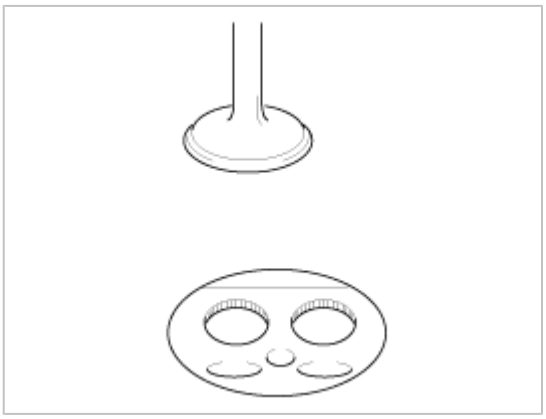
7. If clearance exceeds maximum, replace valve and/or cylinder head

Valve Seat

1. Inspect contact surface of valve seat and valve face for following.
   A. Roughness
   B. Damage
2. If necessary, resurface valve seat with a 45°(Intake), 45°(Exhaust) valve seat cutter and/or resurface valve face.

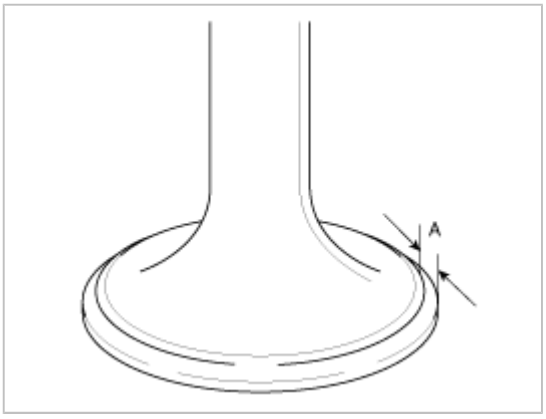


3. Apply a thin coat of Prussian blue to valve face.
4. Check valve seating by rotating valve against seat.
   A. If blue does not appear 360° around valve face, replace valve.
   B. If blue does not appear 360° around valve seat, resurface valve seat.

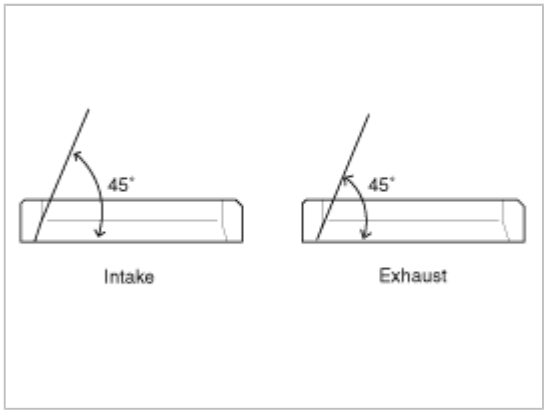


5. Check seat contact width (A).

Seat contact width :
Intake : 1.3 ~ 1.7 mm (0.0512 ~ 0.0669 in)
Exhaust : 1.5 ~ 1.9 mm (0.0591 ~ 0.0748 in)



6. Check that valve seating position is at center of valve face.
   A. If seating position is too high (low), correct valve seat with a 45° (Intake), 45° (Exhaust) cutter.



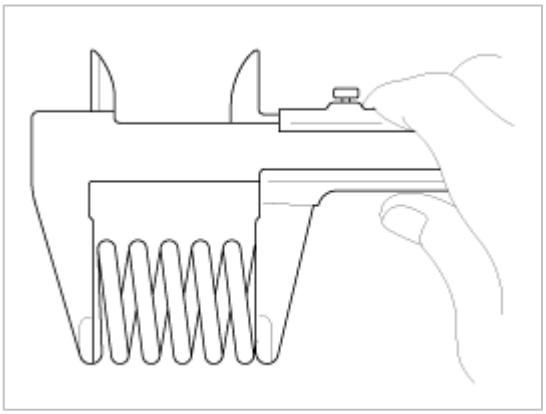
7. Seat the valve to the valve seat with a lapping compound.

Valve Spring

1. Inspect each valve spring for cracks or damage.

2. Check free length and out-of-square. Replace if necessary.

Free length : 48.2 mm (1.898 in)
Out-of-square : Below 1.5°



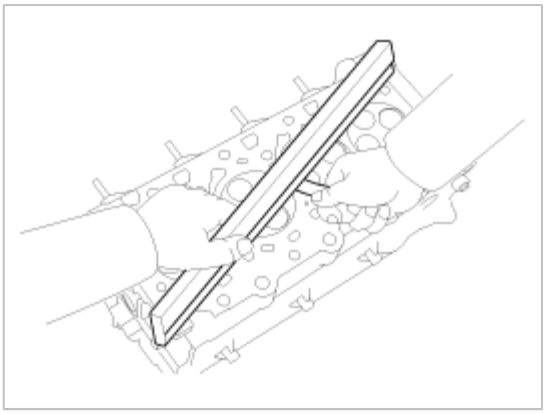
3. Check spring pressure, and replace it if necessary.

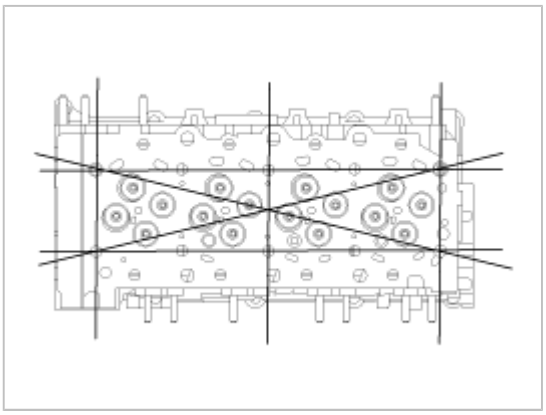
Spring pressure :
258 ± 12 N / 38 mm
(26.3 ± 1.2 kg/38 mm, 569 ± 26 lb / 1.496 in)
505.5 ± 24 N/ 28.8 mm
(51.5 ± 2.4 kg/28.8 mm, 1114.4 ± 53 lb / 1.134 in)

Cylinder Head

1. Inspect the cylinder head for damage, cracks and leakage of water and oil. Replace the cylinder head if necessary.
2. Measure cylinder head distortion in seven directions shown in figure.

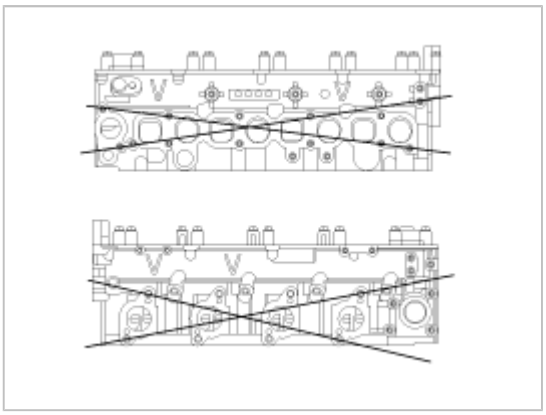
Distortion : 0.05 mm (0.0020 in)





3. Measure manifold contact surface distortion in four directions shown in figure.

Distortion : 0.15 mm (00059 in)

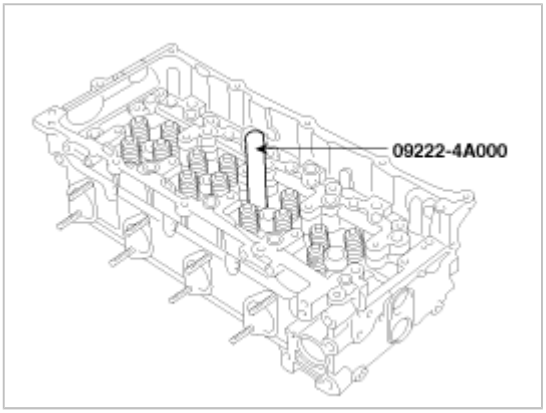


4. If distortion exceeds specification, grind surface or replace cylinder head.

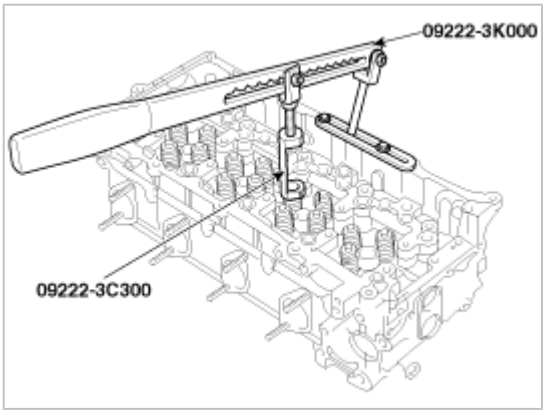
Reassembly

1. Install a new valve stem seal to the valve guide using the special service tool (09222-4A000).

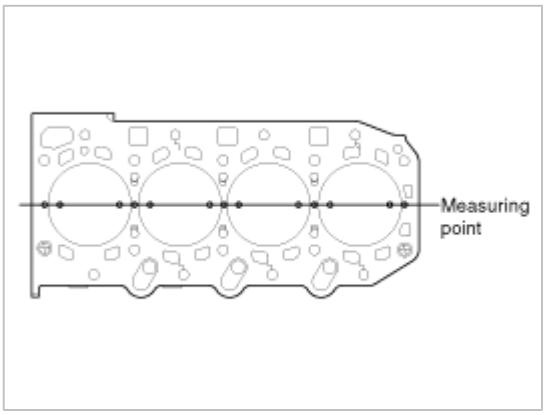
- Do not reuse the used valve stem seal.
- When installing the valve stem seal, using the special tool is needed, not to leak the fluid.

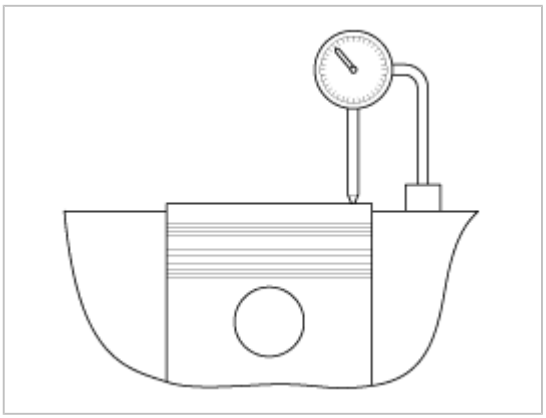


2. Using the special service tool (09222-3K000, 09222-3C300), remove the valve.



3. Select the cylinder head gasket.
   (1) Measure the piston protrusion (8 places) from the upper face of the cylinder block and calculate the average of the 8 piston protrusion.





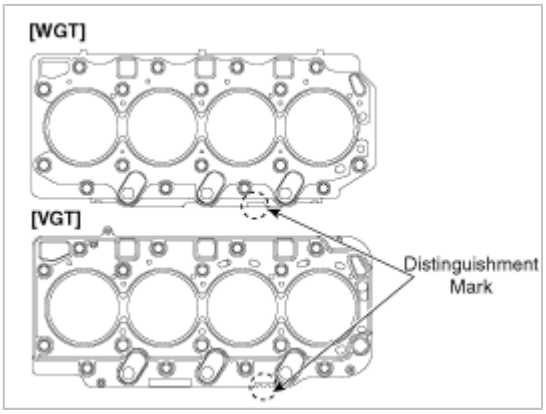
   (2) Select the gasket from the grade A to C in the table below using the average of the 8 piston protrusion.Even if only 1 point is over than the limit of piston protrusion at each grade, 1 grade upper gasket than specified below.

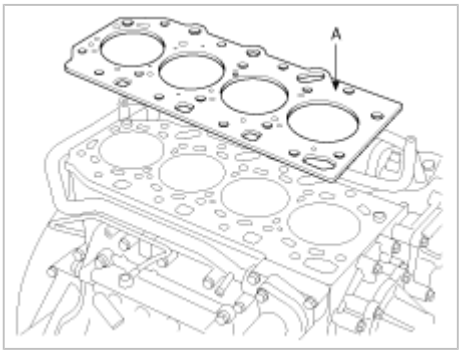
Cylinder Head Gasket (WGT) mm(in)

Gasket grade	A	B	C
Piston Protrusion	0.056-0.117 (0.0022-0.0046)	0.117-0.178 (0.0045-0.0070)	0.178-0.240 (0.0070-0.0094)
Limit of piston protrusion	0.167 (0.0066)	0.228 (0.0090)	-
Gasket Thickness	0.92-0.98 (0.0362-0.0386)	0.97-1.03 (0.0382-0.0406)	1.02-1.08 (0.0402-0.0425)
Mark for distinguishment	———	⌒	⌒⌒

Cylinder Head Gasket (VGT) mm(in)

Gasket grade	A	B	C
Piston Protrusion	0.006-0.101 (0.0002-0.0040)	0.101-0.196 (0.0040-0.0077)	0.196-0.290 (0.0077-0.0114)
Limit of piston protrusion	0.151 (0.0059)	0.246 (0.0097)	-
Gasket Thickness	0.92-0.98 (0.0362-0.0386)	0.97-1.03 (0.0382-0.0406)	1.02-1.08 (0.0402-0.0425)
Mark for distinguishment	———	⌒	⌒⌒

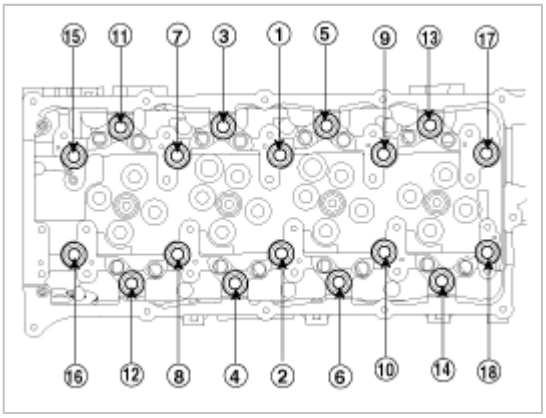




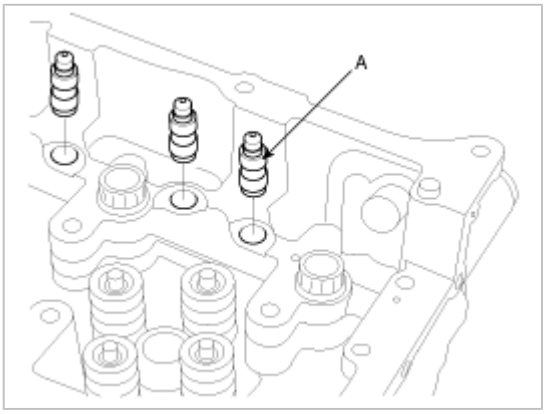
4. Install the cylinder head assembly with the cylinder head gasket.

Tightening torque :
49.0 N.m (5.0 kgf.m, 36.2 lb-ft) + 120° + 90°

Always use new cylinder head bolts.



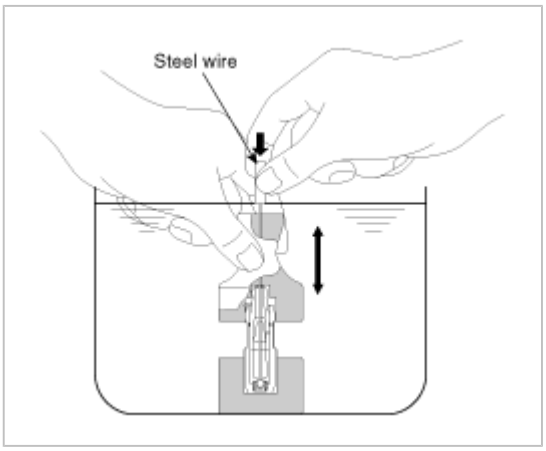
5. Install the HLA(A) to the cylinder head.



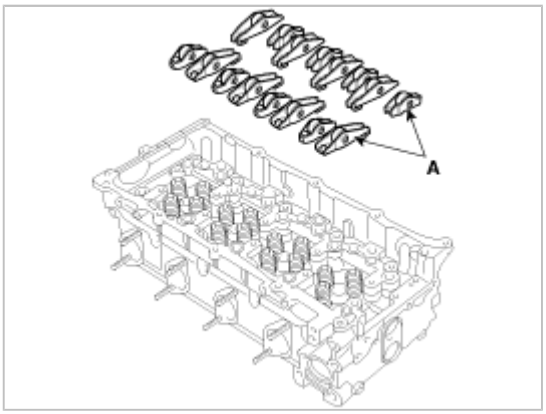
(1) Until installing HLA shall be held upright so that diesel oil in HLA should not spill and assured that dust does not adhere to HLA.

(2) HLA shall be inserted tenderly to the cylinder head not to spill diesel oil from HLA. In case of spilling, air bent shall be done in accordance with the air bent procedure.

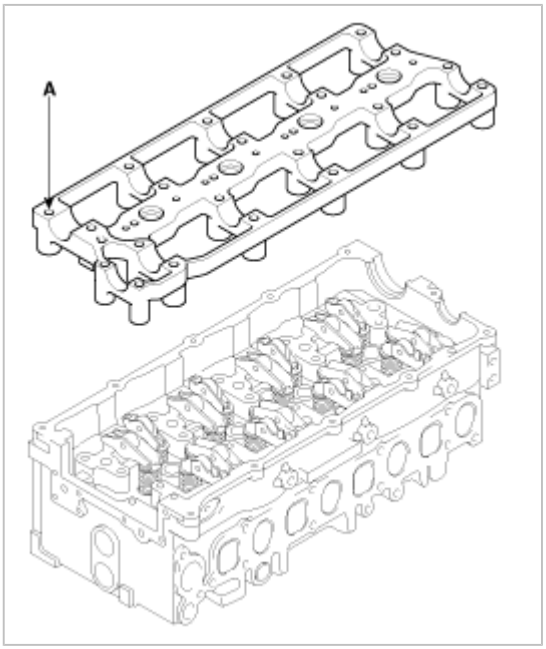
Stroke HLA in diesel oil 4~5 times by pushing its cap while pushing the ball down slightly by hard steel wire. (Take care not to severely push hard steel wire down since ball is several grams.)



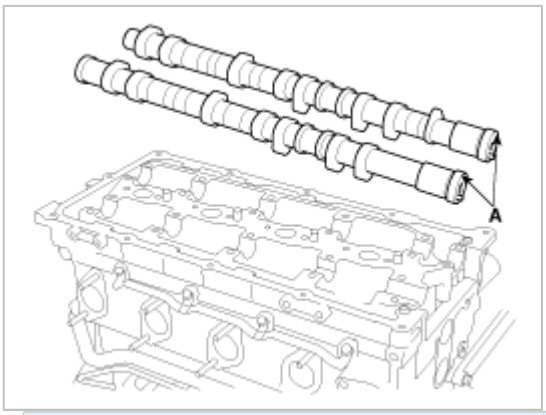
6. Install the cam follow(A) (rocker arm) on the HLA and valve.



7. Install the camshaft carrier (A) on the cylinder head.



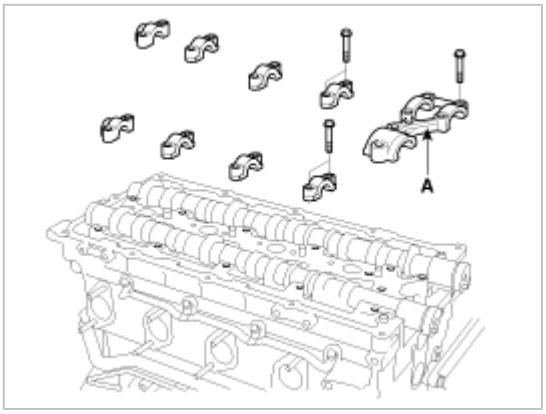
8. Install the camshaft (A) on the camshaft carrier.



In assembling camshaft cap, all pistons to be in the middle position between TDC and BDC not to interfere with valves.

9. Install the camshaft caps (A).

Tightening torque :
13.7 ~ 15.7N.m (1.4 ~ 1.6kgf.m, 10.1 ~ 11.6lb-ft)



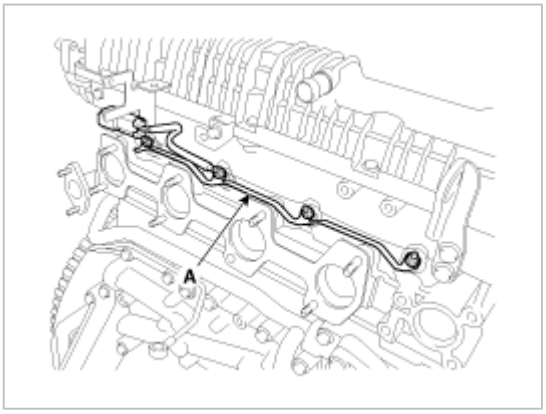
10. Install the camshaft sprocket.

Tightening torque :
93.2 ~ 117.7N.m (9.5 ~ 12.0kgf.m, 68.7 ~ 86.8lb-ft)

Installation

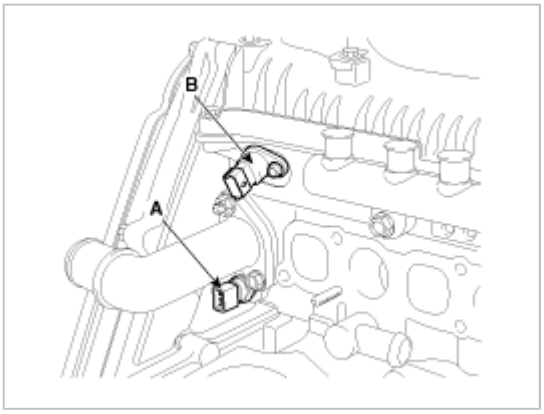
1. Install the glow plug (A).

Tightening torque :
Glow plug :
15.0 ~ 20.0N.m (1.5 ~ 2.0kgf.m, 11.1 ~ 14.7lb-ft)
Glow plug plate nut :
1.3 ~ 2.0N.m (0.14 ~ 0.20kgf.m, 1.0 ~ 1.4lb-ft)



2. Install the TDC sensor (B).

Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0lb-ft)

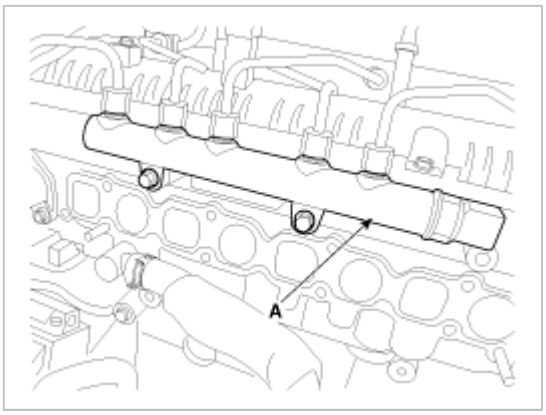


3. Install the water temperature sensor (A).

Tightening torque :
29.4 ~ 39.2N.m (3.0 ~ 4.0kgf.m, 21.7 ~ 28.9lb-ft)

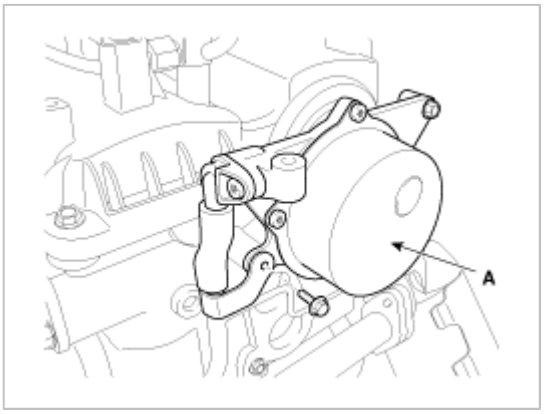
4. Install the delivery pipe (A).

Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



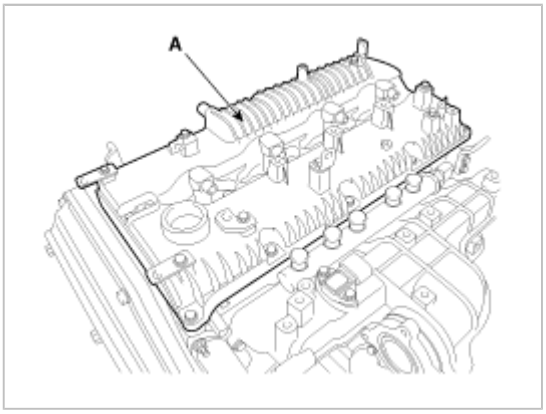
5. Install the exhaust manifold and intake manifold.
6. Install the vacuum pump (A).

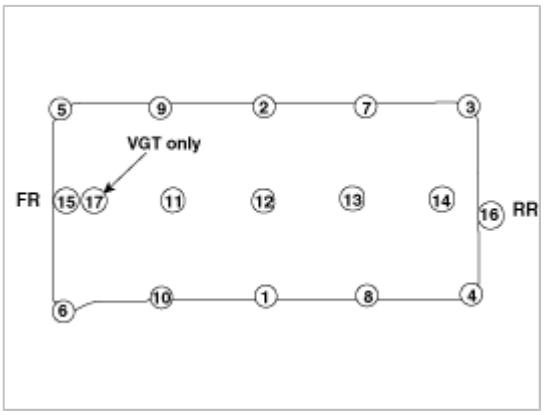
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



7. Install the cylinder head cover (A).

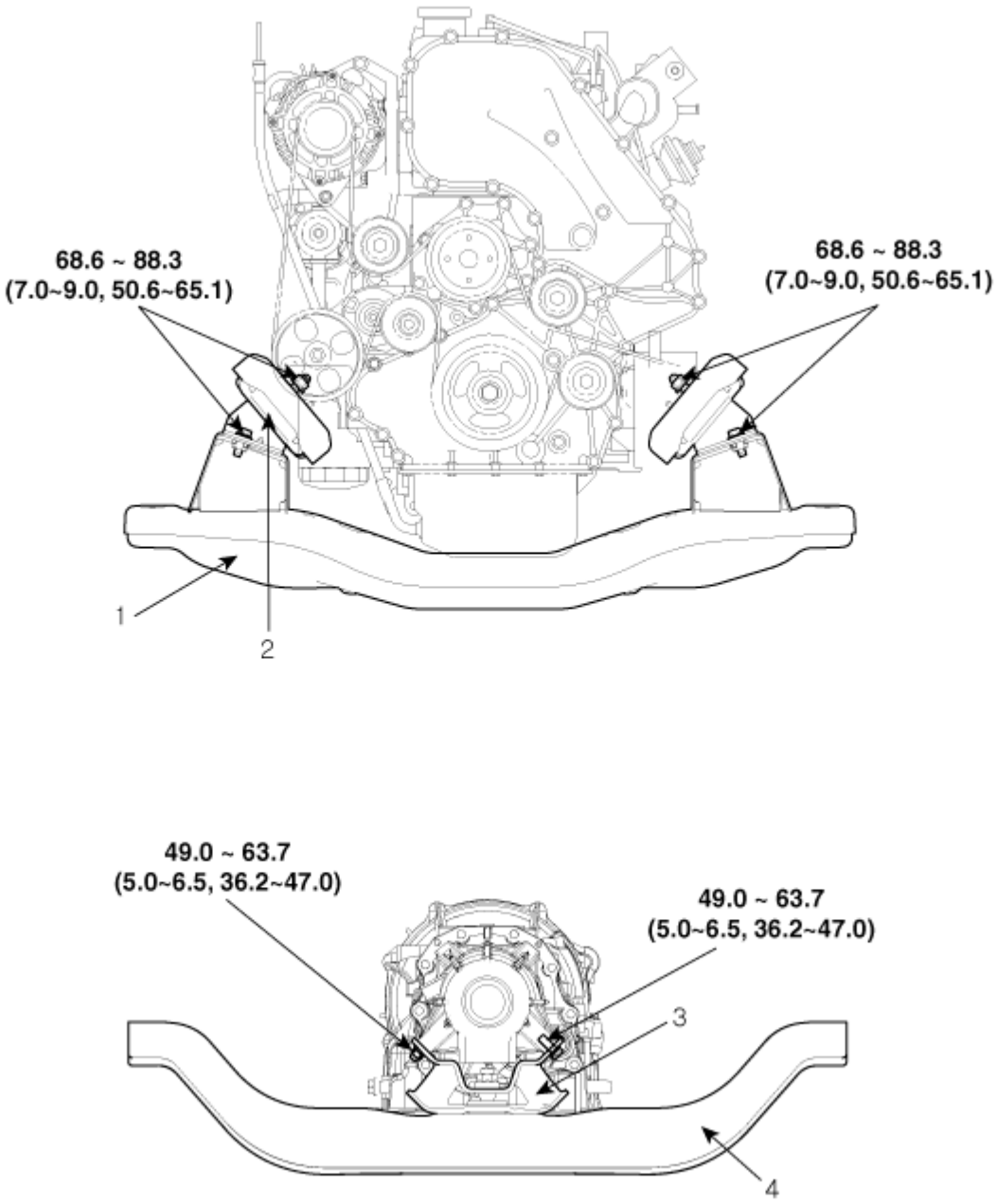
Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)





8. Install the injector and high pressure pipe.
   (Refer to FL group)
9. Install the timing chain "C".
   (Refer to Timing system in this group)
10. Install the engine assembly. (Refer to Engine assembly in this group)
11. Install the transmission assembly. (Refer to AT or MT group)

Components



Torque : N.m (kgf.m, lb-ft)

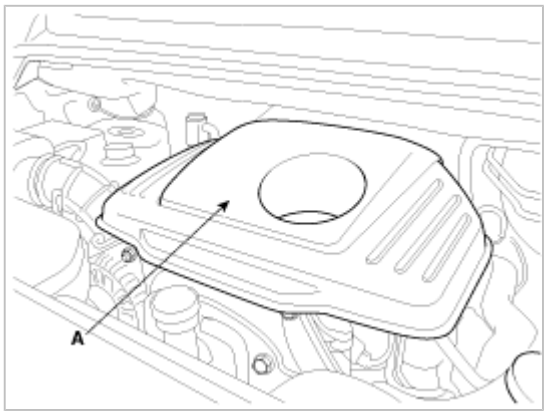
1. Sub frame 2. Engine mounting	3. Transmission mounting 4. Cross member

Removal

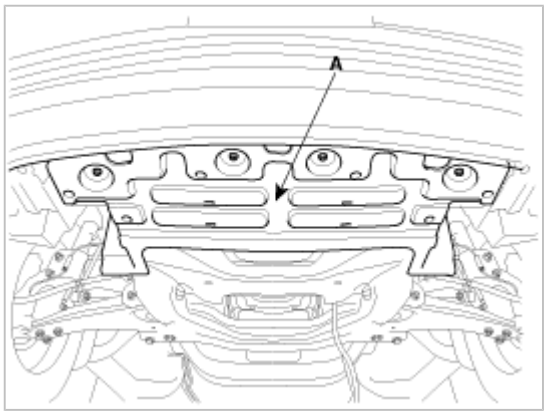
- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

- Mark all wiring and hoses to avoid misconnection.

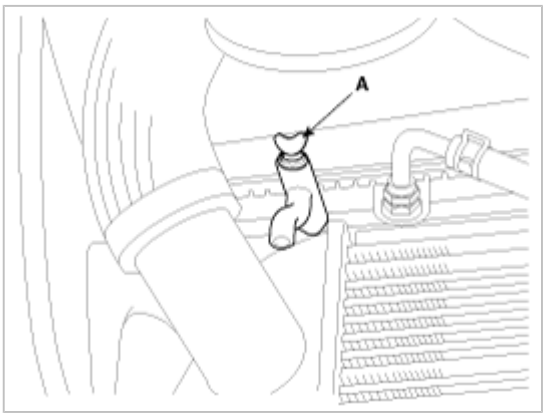
1. First, remove the transmission before removing the engine. (Refer to AT or MT group)
2. Remove the engine cover(A).



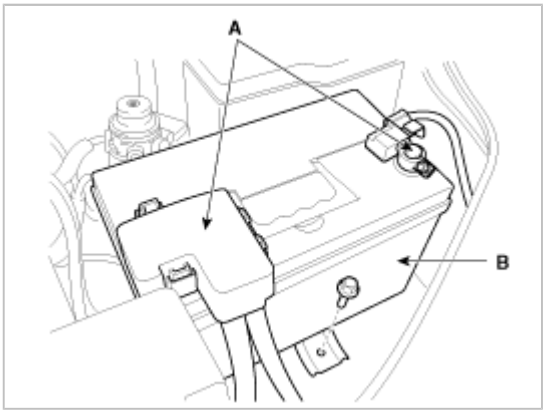
3. Remove the under cover (A).



4. Loosen the plug(A) and drain the engine coolant.
   Remove the radiator cap to speed draining.

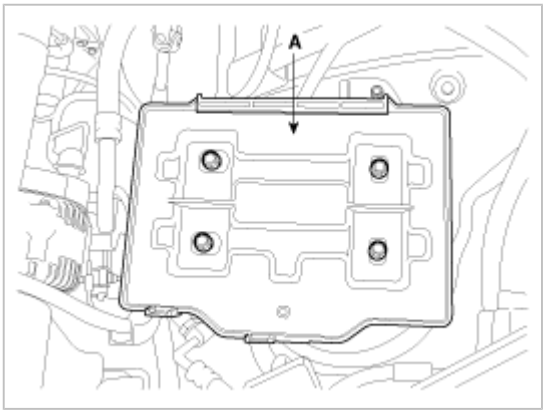


5. Recover refrigerant. (Refer to Air conditioner compressor in HA Group)
6. Disconnect the terminals (A) from the battery and remove the battery (B).

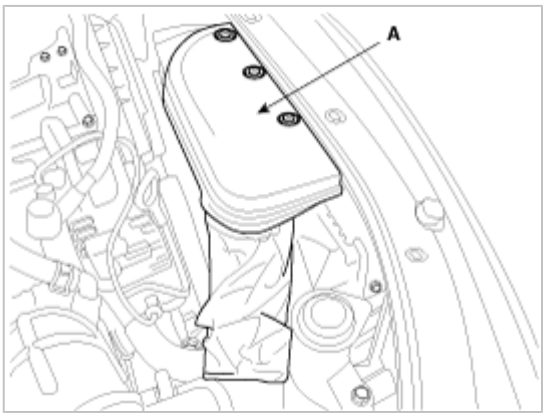


7. Remove the battery tray (A).

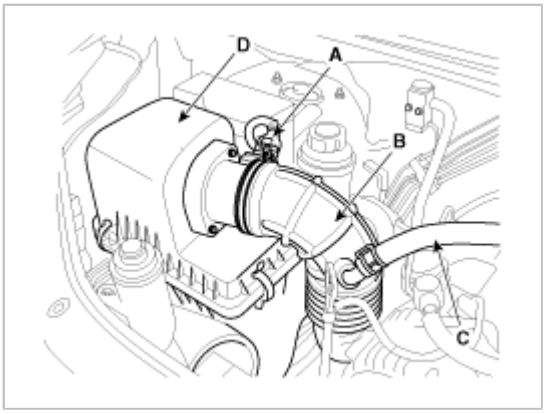
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



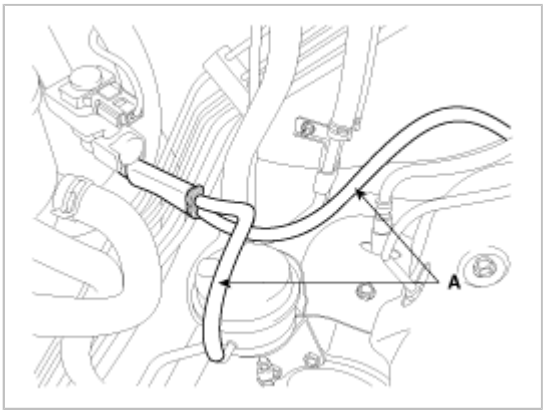
8. Remove the fuel fired heater hose. (Refer to Fuel fired heater in HA group)
9. Remove the air duct(A).



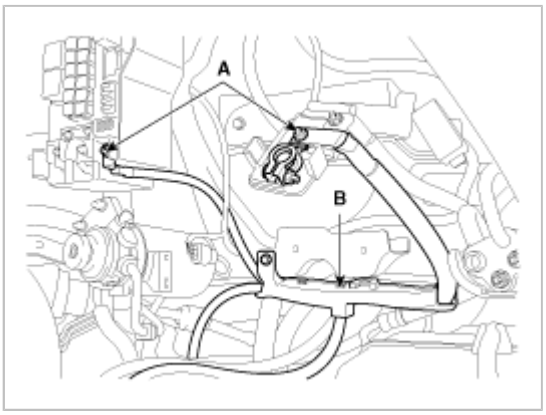
10. Disconnect the MAFS connector (A).
11. Remove the air cleaner hose (B), the breather hose (C) and the air cleaner assembly(D).



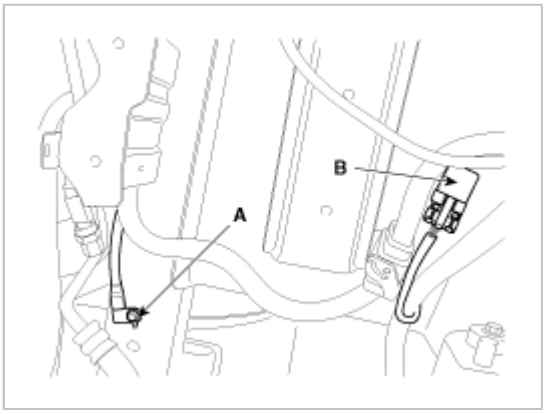
12. Disconnect the VGT (or WGT) actuator vacuum hoses (A).



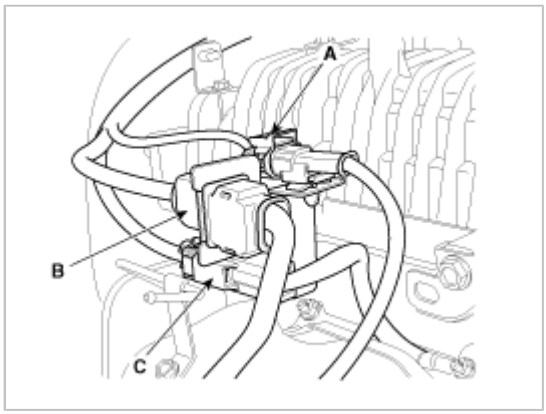
13. Disconnect the (+) cable (A) from the fuse/relay box and remove the wiring protector (B).



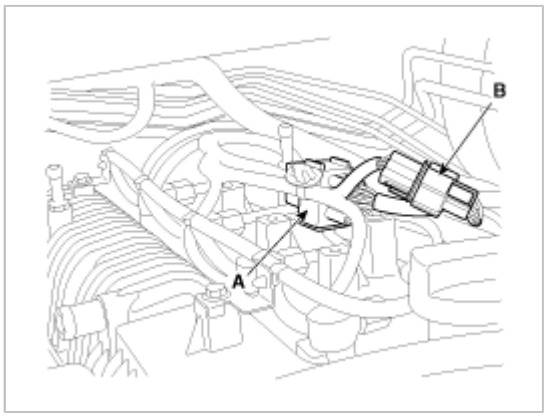
14. Disconnect the ground line (A) and the front connector (B).



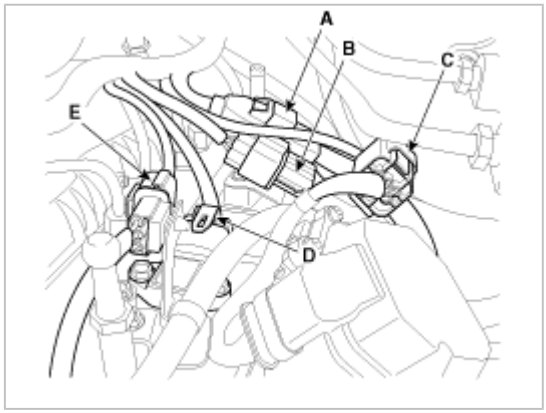
15. Disconnect the wiring connectors and harness clamps, and remove the wiring and protectors from the cylinder head and intake manifold.
    (1) Exhaust Gas Temperature Sensor (EGTS) connector (A)
    (2) Lambda sensor connector (B)
    (3) Glow plug connector (C)



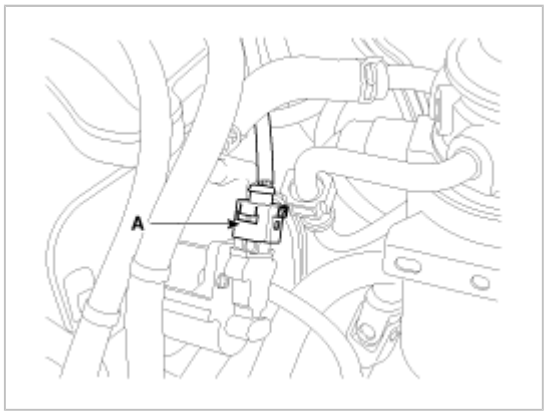
    (4) Injector extension connector (A)
    (5) Rail pressure sensor extension connector (B)



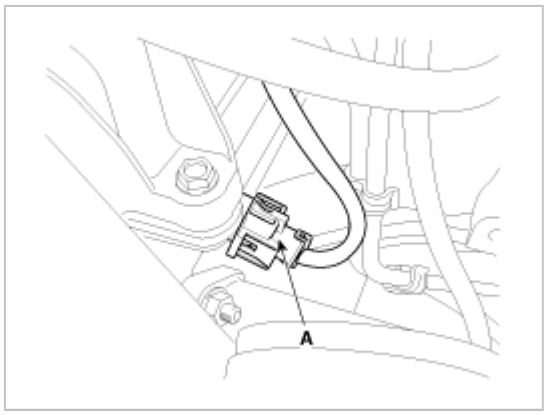
(6) Transmission connector (A)
(7) Battery extension connector (B)
(8) Air control valve connector (C)
(9) Booster pressure sensor connector (D)
(10) Water temperature sensor connector (E)



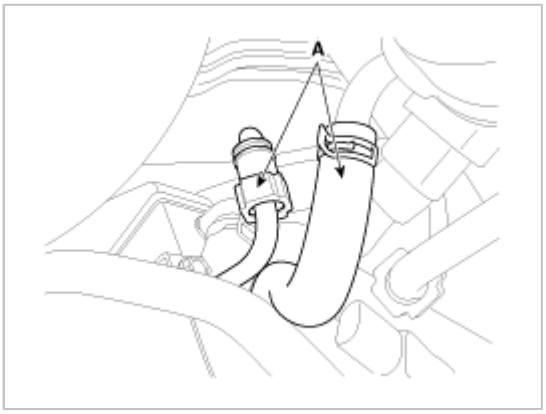
(11) EGR valve connector (A)



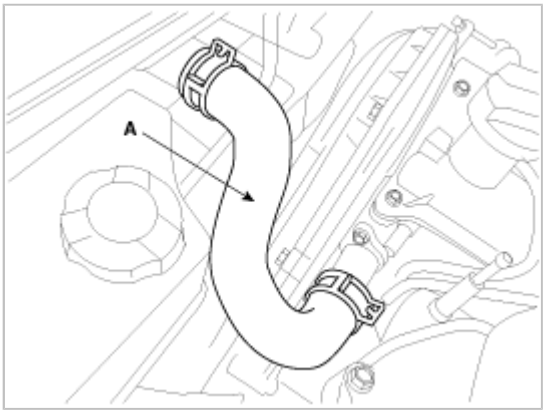
(12) Cam position sensor connector (A)



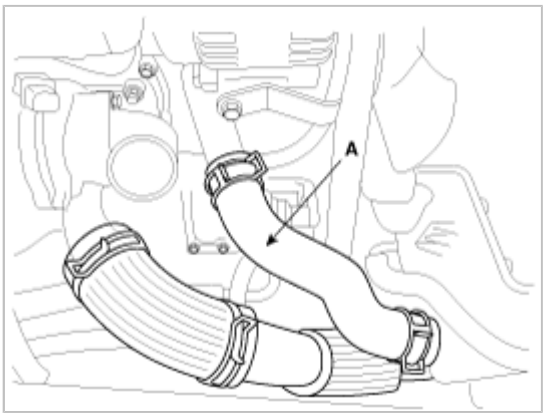
16. Disconnect the fuel hose (A).



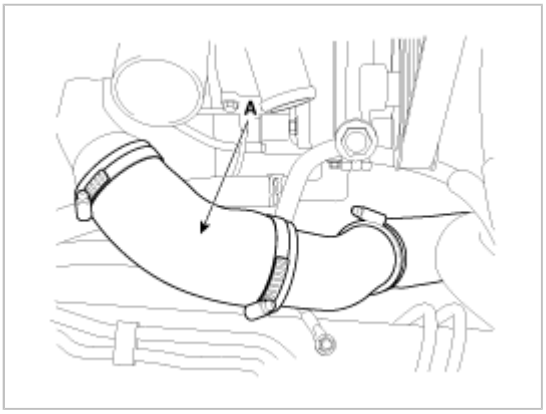
17. Disconnect the radiator upper hose (A).



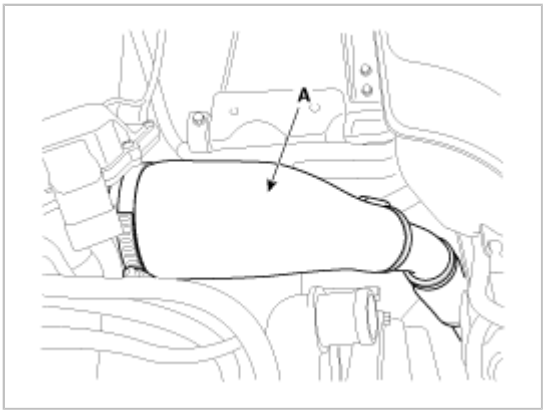
18. Disconnect the radiator lower hose (A).



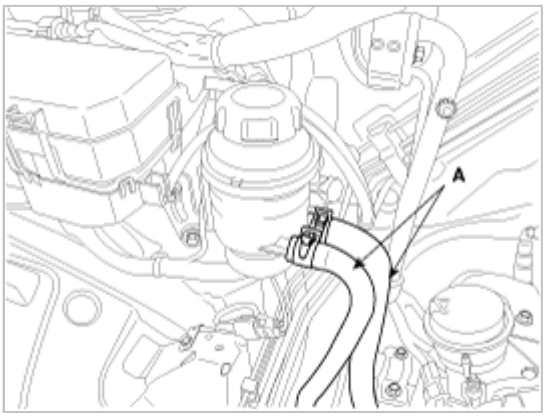
19. Disconnect the intercooler inlet hose (A) from the intake manifold.



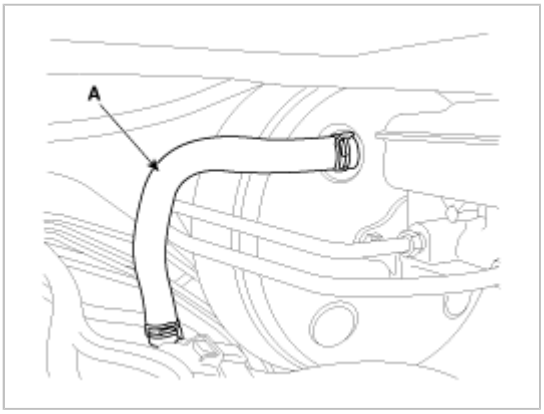
20. Disconnect the intercooler outlet hose(A) from the exhaust manifold.



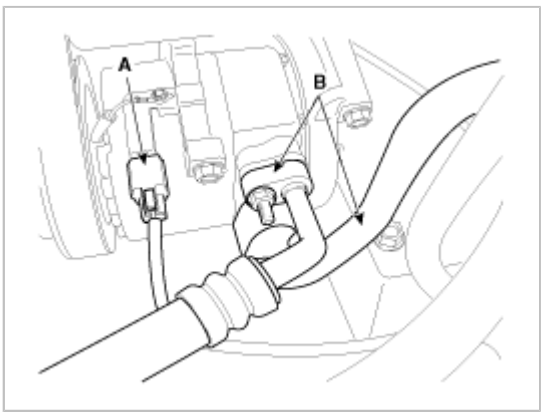
21. Disconnect the oil hose (A) from the power steering reservoir tank.



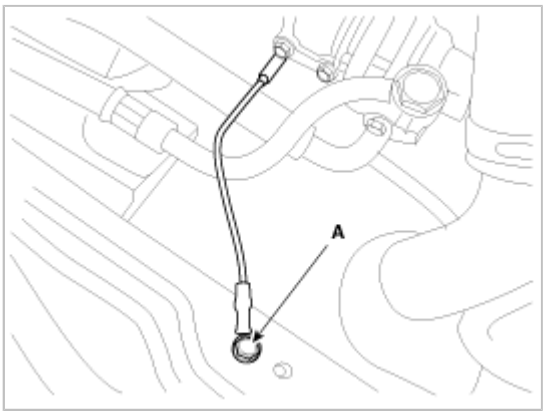
22. Disconnect the vacuum hose (A) from the brake booster.



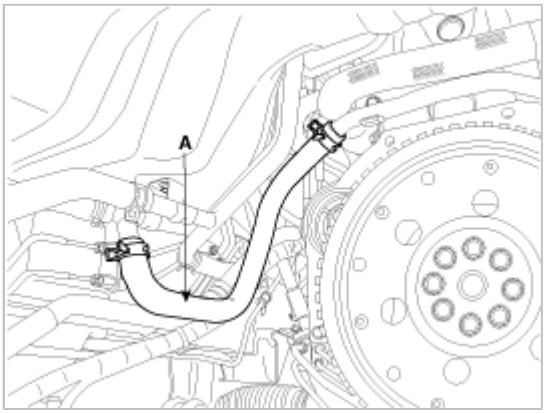
23. Disconnect the air conditioner compressor magnetic switch connector (A).
24. Remove the high Φ low pressure pipe (A). (Refer to Air conditioner compressor in HA Group)

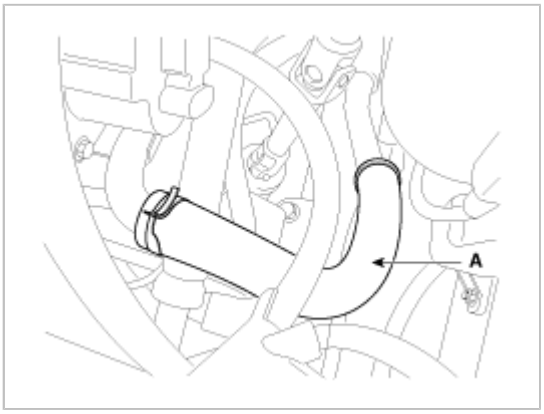


25. Disconnect the earth terminal(A) from the vehicle.

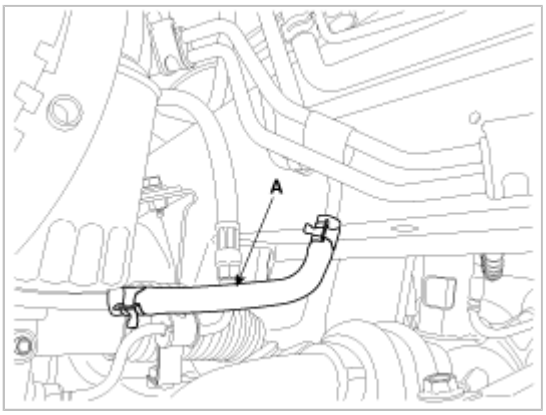


26. Disconnect the heater hoses (A).

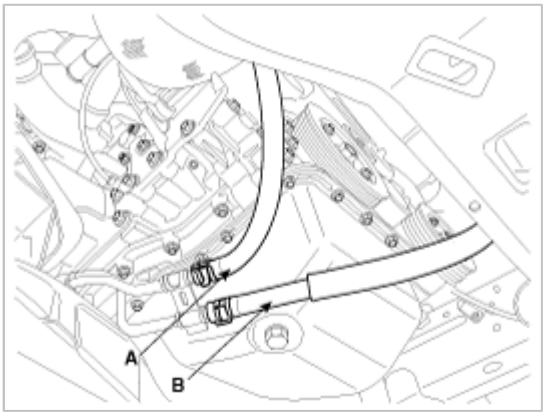




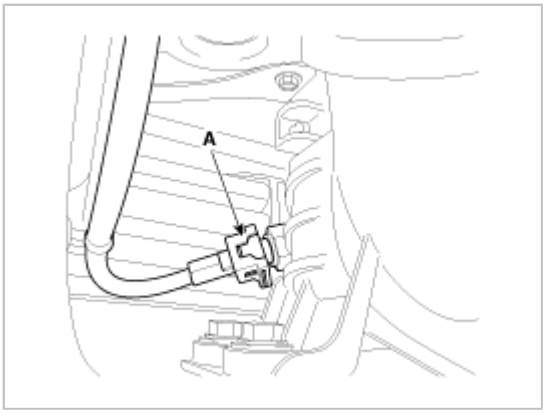
27. Disconnect the power steering oil return(A).



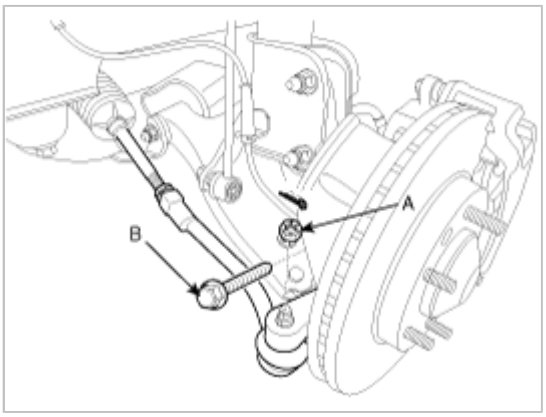
28. Disconnect the auto transmission oil cooler hose (A, B).



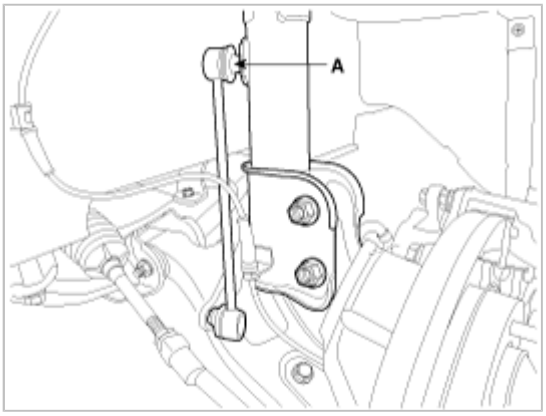
29. Disconnect the intercooler pressure sensor connector(A).



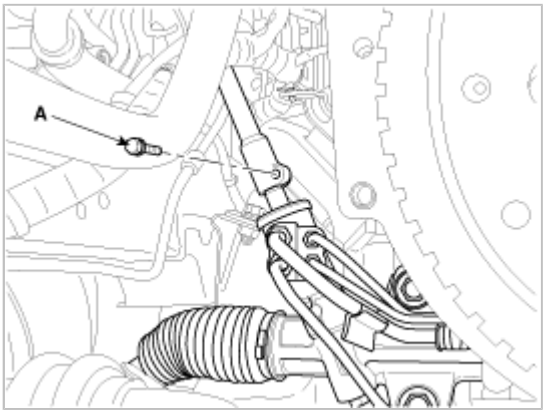
30. Remove the tie rod end fixing nut(A) and the lower arm mounting bolt(B). (Refer to SS,ST group)



31. Remove the stabilizer link mounting nut(A). (Refer to SS group)

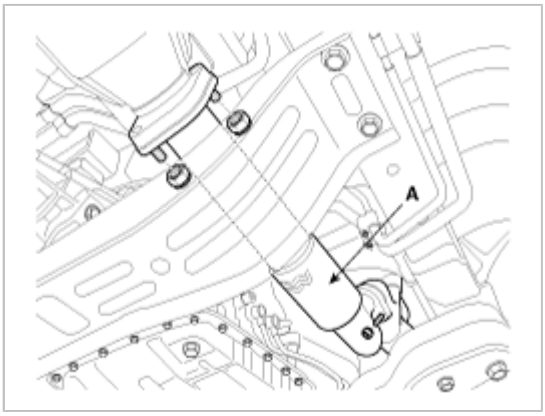


32. Disconnect the drive shafts. (Refer to DS group)
33. Remove the steering gear intermediate shaft mounting bolt(A). (Refer to ST group)



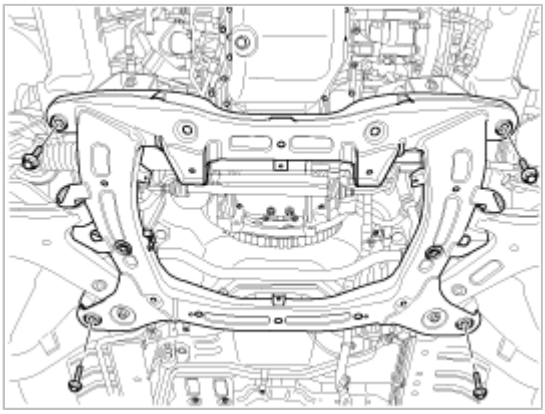
34. Remove the front muffler (A).

Tightening torque :
39.2 ~ 58.8N.m(4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)

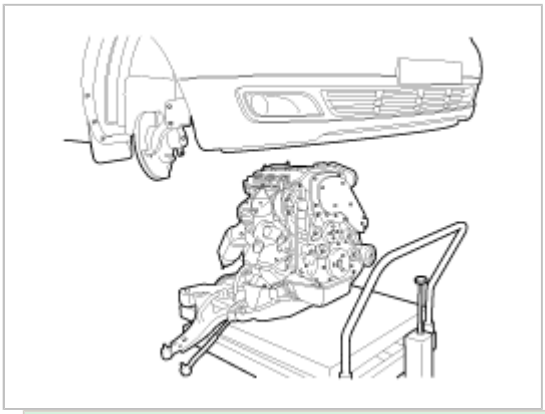


35. Supporting the sub frame (A) with a jack, remove the sub frame mounting bolts.

Tightening torque :
156.9~176.5 N.m (16.0~18.0 kgf.m, 115.7~130.2 lb-ft)



36. Remove the engine assembly by lifting vehicle.



When removing the engine and transaxle assembly,be careful not to damage any surrounding parts orbody components.

Installation

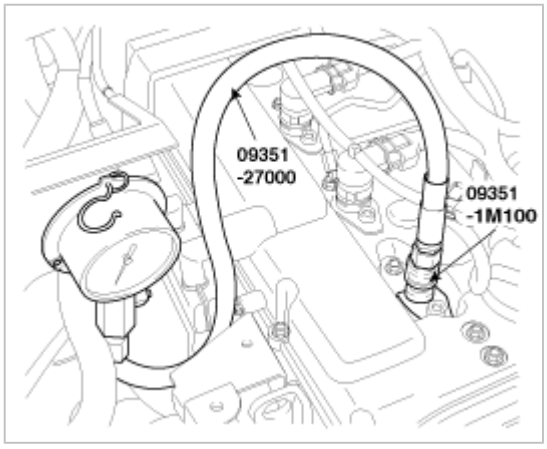
Installation is in the reverse order of removal.

Perform the following :

- Adjust the shift cable.
- Refill an engine with engine oil.
- Refill a transaxle with fluid.
- Refill a radiator with engine coolant.
- Bleed air from the cooling system.
  - Start engine and let it run until it warms up. (until the radiator fan operates 3 or 4 times.)
  - Turn Off the engine. Check the level in the radiator, add coolant if needed. This will allow trapped air to be removed from the cooling system.
  - Put radiator cap on tightly, then run the engine again and check for leaks.
- Clean the battery posts and cable terminals with sandpaper assemble them, then apply grease to prevent corrosion.
- Inspect for fuel leakage.
  - After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes.
  - Repeat this operation two or three times, then check for fuel leakage at any point in the fuel lines.

Compression Pressure

1. Before checking engine compression, check the engine oil level. Also check that the starter motor and battery are all in normal operating condition.
2. Start the engine and wait until the engine coolant temperature reaches 80-95℃ (176-205℉).
3. Turn "OFF" the engine and remove the aircleaner element.
4. Remove the Engine Control Module (ECM) fuse.
5. Remove the injectors.
6. Crank the engine to remove any foreign material in the cylinders.
7. Install the compression gauge (09351-27000) and adapter (09351-1M100).



8. Crank the engine and read the gauge.

Standard value :
2,452~2,745kPa (25~28kg/cm², 327~398psi) at 160rpm

9. Repeat steps 7 to 8 for all cylinders, ensuring that the pressure difference for each of the cylinders is within the specified limit.

Limit :
Max. 294.2 kPa (3.0 kg/cm², 14.22 psi) between cylinders

10. If a cylinder's compression or pressure differential is outside the specification, add a small amount of oil through the injector hole, and repeat steps 6 to 8.
    (1) If the addition of oil causes the compression to rise, it is likely that there may be wear between the piston ring and cylinder wall.
    (2) If compression remains the same, valve seizure, poor valve seating or a compression leak from the cylinder head gasket are all possible causes.

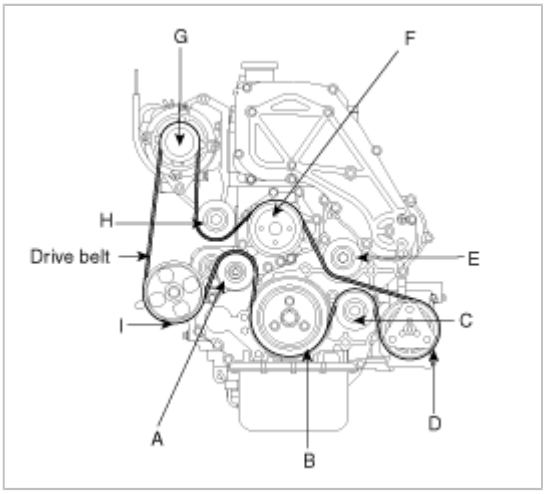
Drive Belt And Tensioner Adjustment

1. Check that the belts are not damaged and are properly placed for the pulley grooves.

- When installing the V-ribbed belt, check that the V-ribs are properly aligned.

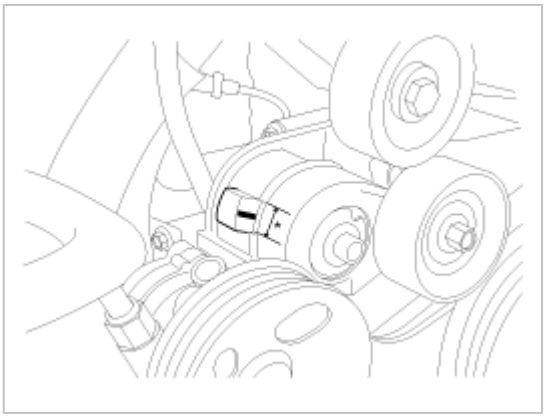
- If noise or slippage is detected, check the belt for wear, damage, or breakage on the pulley contact surface, and check the pulley for scoring. Also check the amount that the belt is deflected.

2. Install the belt in the following order.

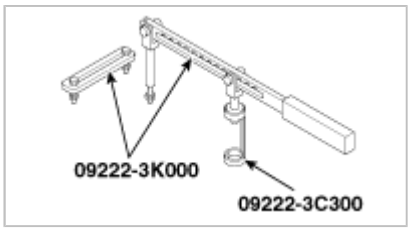
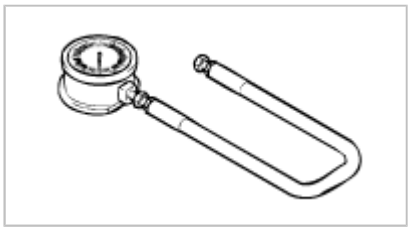
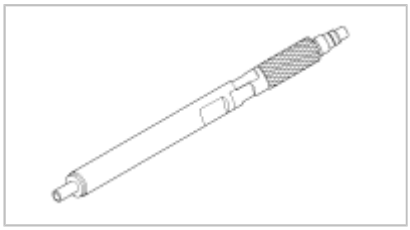
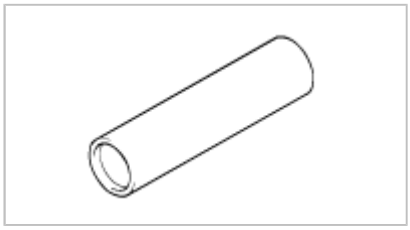
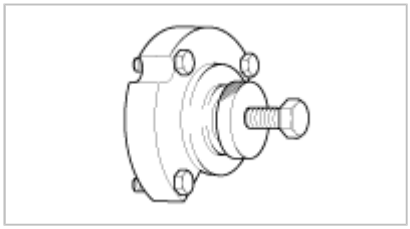


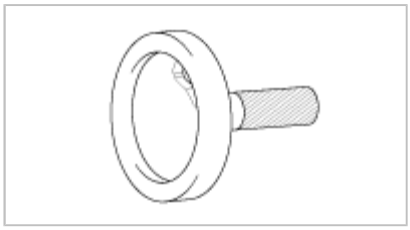
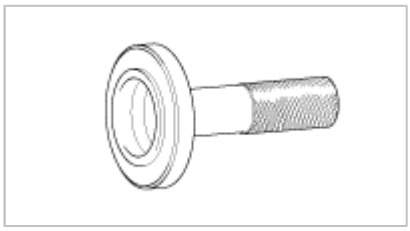
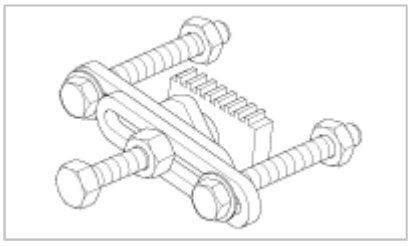
(1) Install the belt in RH side of the auto-tensioner pulley.
Auto-tensioner pulley (A) Φ Crankshaft pulley (B) Φ Idler (C) Φ Air conditioner compressor pulley (D) Φ Idler (E) Φ Water pump pulley (F)
(2) Install the belt in LH side of the auto-tensioner pulley.
Auto-tensioner pulley(A) Φ Power steering pump pulley(I) Φ Alternator pulley(G)
(3) Loosen the belt tension by turning the auto-tensioner clockwise (about 39°), and then install the belt on the idler between the alternator pulley and the water pump pulley.

3. The tensioner mark should be between the " * " position.
If not, replace the belt.



Special Service Tools

Tool (Number and Name)	Illustration	Use
Torque angle adapter (09221-4A000)		Installation of bolts →nuts needing an angular method
Valve spring compressor (09222-3K000) Valve spring compressor adapter (09222-3C300)		Removal and installation of intake and exhaust valves
Compression gauge (09351-27000)		Checking engine compression pressure
Compression adapter (09351-1M100)		Checking engine compression pressure
Valve stem seal installer (09222-4A000)		Installation of valve stem oil seals
High pressure pump sprocket remover (09331-4A000)		Removal of high pressure pump sprocket
Crank shaft rear oil seal installer		Installation of crank shaft rear oil seals

(09231-4A100)		
Timing chain lower front cover oil seal installer (09214-4A000)		Installation of timing chain lower front cover oil seal
Ring gear stopper (09231-2B100)		• Removal and installation of crankshaft pulley bolt • Removal and installation of flywheel bolt
Oil pan remover (09215-3C000)		Removal of oil pan

Specifications

Description	Specification	Limit
General		
Type	In-line, DOHC	
Number of cylinders	4	
Bore	91 mm (3.58 in)	
Stroke	96 mm (3.78 in)	
Total displacement	2497 cc (121.5 cu.in)	
Compression ratio	16.4 : 1	
Firing order	1-3-4-2	
Valve timing		
Intake valve		
Opens (BTDC)	8°	
Closes (ABDC)	38°	
Exhaust valve		
Opens (BBDC)	52°	
Closes (ATDC)	8°	
Cylinder head		
Flatness of gasket surface	0.05 mm (0.0020 in)	
Flatness of manifold mounting surface	0.15 mm (0.0059 in)	
Camshaft		
Cam height (LH)		
Intake	40.163 mm (1.5812 in)	
Exhaust	40.043 mm (1.5765 in)	
Cam height (RH)		
Intake	39.782 mm (1.5662 in)	
Exhaust	40.456 mm (1.5928 in)	
Journal outer diameter	29.964 ~ 29.980 mm (1.1797 ~ 1.1803 in)	
End play	0.10 ~ 0.20 mm (0.0039 ~ 0.0079 in)	

Valve		
Valve length		
Intake	110.55 mm (4.352 in)	
Exhaust	110.55 mm (4.352 in)	
Stem outer diameter		
Intake	6.965 ~ 6.980 mm (0.2742 ~ 0.2748 in)	
Exhaust	6.935 ~ 6.950 mm (0.2730 ~ 0.2736 in)	
Face angle	45°	
Thickness of valve head (margin)		
Intake	1.8 ~ 2.0 mm (0.071 ~ 0.079 in)	
Exhaust	1.8 ~ 2.0 mm (0.071 ~ 0.079 in)	
Valve stem to valve guide clearance		
Intake	0.020 ~ 0.050 mm (0.0008 ~ 0.0020 in)	0.10mm (0.0039in)
Exhaust	0.050 ~ 0.080 mm (0.0020 ~ 0.0031 in)	0.15mm (0.0059in)
Valve guide		
Length		
Intake	43.3 mm (1.705 in)	
Exhaust	39.4 mm (1.551 in)	
Inner diameter		
Intake	7.000 ~ 7.015 mm (0.2756 ~ 0.2762 in)	
Exhaust	7.000 ~ 7.015 mm (0.2756 ~ 0.2762 in)	
Valve seat		
Width of seat contact		
Intake	1.3 ~ 1.7 mm (0.0512 ~ 0.669 in)	
Exhaust	1.5 ~ 1.9 mm (0.0591 ~ 0.0748 in)	
Seat angle		
Intake	45°	
Exhaust	45°	
Valve spring		
Free length	48.2 mm (1.898 in)	

Load	258 ± 12 N/38 mm (26.3 ± 1.2 kg/38 mm, 569 ± 26 lb/1.496 in) 505.5 ± 24 N/28.8 mm (51.5 ± 2.4 kg /28.8 mm, 1114.4 ± 53 lb/1.134 in)	
Cylinder block		
Cylinder bore	91.000 ~ 91.030 mm (3.5827 ~ 3.5839 in)	
Flatness of gasket surface	0.05 mm (0.0020 in)	
Piston		
Piston outer diameter	90.910 ~ 90.940 mm (3.5791 ~ 3.5803 in)	
Piston to cylinder clearance	0.080 ~ 0.100 mm (0.0031 ~ 0.0039 in)	
Ring groove width		
No. 1 ring groove	2.378 ~ 2.398 mm (0.0936 ~ 0.0944 in)	
No. 2 ring groove	2.06 ~ 2.08 mm (0.0811 ~ 0.0819 in)	
Oil ring groove	3.03 ~ 3.05 mm (0.1193 ~ 0.1201 in)	
Piston ring		
Side clearance		
No. 1 ring	0.08 ~ 0.12 mm (0.0031 ~ 0.0047 in)	
No. 2 ring	0.07 ~ 0.11 mm (0.0028 ~ 0.0043 in)	
Oil ring	0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)	
End gap		
No. 1 ring	0.20 ~ 0.35 mm (0.0079 ~ 0.0138 in)	
No. 2 ring	0.70 ~ 0.90 mm (0.0276 ~ 0.0354 in)	
Oil ring	0.20 ~ 0.40 mm (0.0079 ~ 0.0157 in)	
Piston pin		
Piston pin outer diameter	32.993 ~ 32.998 mm (1.2989 ~ 1.2991 in)	
Piston pin hole inner diameter	33.014 ~ 33.019 mm (1.2998 ~ 1.3000 in)	
Piston pin hole clearance	0.016 ~ 0.026 mm (0.0006 ~ 0.0010 in)	
Connecting rod small end hole inner diameter	33.020 ~ 33.033 mm (1.3000 ~ 1.3005 in)	

Connecting rod small end hole clearance		0.022 ~ 0.040 mm (0.0009 ~ 0.0016 in)	
Connecting rod			
Connecting rod big end inner diameter		60.000 ~ 60.018 mm (2.3622 ~ 2.3629 in)	
Connecting rod bearing oil clearance		0.024 ~ 0.042 mm (0.0009 ~ 0.0017 in)	0.1mm(0.0039in)
Side clearance		0.05 ~ 0.25 mm (0.0020 ~ 0.0098 in)	
Crankshaft			
Main journal outer diameter		66.982 ~ 67.000 mm (2.6371 ~ 2.6378 in)	
Pin journal outer diameter		56.982 ~ 57.000 mm (2.2434 ~ 2.2441 in)	
Main bearing oil clearance		0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in)	0.1mm(0.0039in)
End play		0.05 ~ 0.25 mm (0.0020 ~ 0.0098 in)	
Flywheel			
Runout		0.45 mm (0.0177 in)	
Oil pump			
Side clearance			
Inner rotor		0.040 ~ 0.085 mm (0.0016 ~ 0.0033 in)	
Outer rotor		0.050 ~ 0.100 mm (0.0020 ~ 0.0039 in)	
Relief valve opening pressure		600 ± 60 kPa (6.1 ± 0.6 kgf/cm, 87.0 ± 8.7psi)	
Balance shaft			
Front journal outer diameter		48.975 ~ 49.000 mm (1.9281 ~ 1.9291 in)	
Rear journal outer diameter		47.965 ~ 47.990 mm (1.8884 ~ 1.8894 in)	
Front bush inner diameter		49.050 ~ 49.080 mm (1.9311 ~ 1.9323 in)	
Rear bush inner diameter		48.050 ~ 48.080 mm (1.8917 ~ 1.8929 in)	
Fornt bush oil clearance		0.050 ~ 0.105 mm (0.0020 ~ 0.0041 in)	
Rear bush oil clearance		0.060 ~ 0.115 mm (0.0024 ~ 0.0045 in)	
Engine oil			
Oil quantity	Total	7.8 L (8.24 US qt, 6.86 Imp qt)	When replacing a short engine or a block assembly

	Oil pan	6.6 L (6.97 US qt, 5.81 Imp qt)	
	Drain and refill	7.4 L (7.82 US qt, 6.51 Imp qt)	Including oil filter
Oil grade	Classification	ACEA C3 (with DPF) ACEA B4 (without DPF)	
	SAE viscosity grade	Recommended SAE viscosity number	Refer to the "Lubrication System"
Oil pressure (at idle)		78.45kPa (0.8kg/cm², 11.38psi) or above	Oil temperature in oil pan : 80℃ (176°F)
Cooling system			
Cooling method		Forced circulation with cooling fan	
Coolant quantity	Wagon	About 13L (13.74 Us qt, 11.44 Imp qt)	
	Van	About 10L (10.57 Us qt, 8.80 Imp qt)	
Thermostat			
Type		Wax pellet type	
Opening temperature		88℃ (190.4℉)	
Closing temperature		83℃ (181.4℉)	
Pull opening temperature		97℃ (206.6℉)	
Radiator cap			
Main valve opening pressure		107.9 ± 14.7 (1.1 ± 0.15 kgf/cm, 15.6 ± 2.1 psi)	

Tightening Torques

* Bolt size = Diameter x Length

Item	Quantity	Tightening torque		
		N.m	kgf.m	lb-ft
Main bearing cap bolt	10	127.5 ~ 137.3	13.0 ~ 14.0	94.0 ~ 101.3
Connecting rod cap nut	8	58.8 → Loosen → (32.4~36.3) + (60~64°)	6.0 → Loosen → (3.3~3.7) + (60~64°)	43.4 → Loosen → (23.9~26.8) + (60~64°)
Oil jet bolt	4	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Crankshaft pulley bolt	1	274.6 ~ 294.2	28.0 ~ 30.0	202.5 ~ 217.0

Rear oil seal case bolt	5	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Rear plate bolt	1	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Flywheel/drive plate bolt	8	127.5 ~ 137.3	13.0 ~ 14.0	94.0 ~ 101.3
Water pump bolt	7	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil cooler element bolt	8	8.8 ~ 12.7	0.9 ~ 1.3	6.5 ~ 9.4
Oil cooler cover bolt	11	19.6 ~ 25.5	2.0 ~ 2.6	14.5 ~ 18.8
Oil pump compoete bolt (6 x 18)	3	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil pump compoete bolt (6 x 30)	13	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil pump compoete bolt (8 x 45)	8	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil screen bolt	2	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil filter assembly	1	21.6 ~ 24.5	2.2 ~ 2.5	15.9 ~ 18.1
Oil pan bolt	22	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil level gauge bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Oil pump cover bolt	4	8.8 ~ 12.7	0.9 ~ 1.3	6.5 ~ 9.4
Oil pump cover screw	1	5.9 ~ 8.8	0.6 ~ 0.9	4.3 ~ 6.5
Bell housing cover bolt	3	42.2 ~ 53.9	4.3 ~ 5.5	31.1 ~ 39.8
Oil pressure switch	1	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Cylinder head cover bolt	WGT : 16 VGT : 17	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Camshaft cap bolt	22	13.7 ~ 15.7	1.4 ~ 1.6	10.1 ~ 11.6
Cylinder head bolt	18	49.0+120°+90°	5.0 + 120°+90°	36.2+120°+90°
Glow plug	4	15.0 ~ 20.0	1.5 ~ 2.0	11.1 ~ 14.7
Glow plug plate nut	4	1.3 ~ 2.0	0.14 ~ 0.20	1.0 ~ 1.4
Engine hanger bolt	4	18.6 ~ 28.4	1.9 ~ 2.9	13.7 ~ 21.0
Thermostat housing bolt	3	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Water inlet fitting bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Exhaust manifold lock nut	7	27.5 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Exhaust manifold lock bolt	1	27.5 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
Exhaust manifold heat protector bolt	3	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9

Turbo charger fitting nut	3	49.0 ~ 68.6	5.0 ~ 7.0	36.2 ~ 50.6
Turbo charger oil return pipe bolt	2	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Turbo charger oil inlet pipe bolt	2	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Turbo charger heat protector bolt	3	14.7 ~ 21.6	1.5 ~ 2.2	10.8 ~ 15.9
Intake manifold bolt and nut	10	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
EGR cooler bolt (M8)	Euro 4/5:2 Euro 3:1	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
EGR cooler bolt (M6)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
EGR pipe nut	2	27.5 ~ 31.4	2.8 ~ 3.2	20.3 ~ 23.1
EGR pipe bolt (6 x 14) - Euro 5	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
EGR pipe bolt (8 x 20) - Euro 5	2	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
EGR pipe bolt - Euro 4	4	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
EGR pipe bolt (6 x 22) - Euro 3	2	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
EGR pipe bolt (8 x 16) - Euro 3	2	19.6 ~ 23.5	2.0 ~ 2.4	14.5 ~ 17.4
Timing chain lower under cover bolt (6 x 14)	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain lower under cover bolt (8 x 22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower under cover bolt (8 x 30)	3	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower under cover bolt (8 x 40)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
LH balance shaft driven gear bolt	1	33.3 ~ 39.2	3.4 ~ 4.0	24.6 ~ 28.9
LH balance shaft sprocket nut	1	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
RH balance shaft sprocket bolt	1	33.3 ~ 39.2	3.4 ~ 4.0	24.6 ~ 28.9
Timing chain guide "A" bolt (upper)	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide "A" bolt (lower)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lever "A" bolt	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain auto tensioner "A" bolt	2	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain guide "B" (1) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide "B" (2) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7

Timing chain auto tensioner "B" bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain lower front cover bolt (8 x 22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 40)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 50)	6	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 70)	6	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain lower front cover bolt (8 x 80)	4	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain upper under cover bolt (6 x 14)	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain upper under cover bolt (6 x 22)	9	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain upper under cover bolt (8 x 22)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain upper under cover bolt (8 x 40)	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain upper under cover nut	1	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain guide "C" (1) bolt	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain guide "C" (2) bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Timing chain lever "C" bolt	1	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Timing chain auto tensioner "C" bolt	2	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
High pressure pump sprocket nut	1	64.7 ~ 74.5	6.6 ~ 7.6	47.7 ~ 55.0
Camshaft sprocket bolt	2	93.2 ~ 117.7	9.5 ~ 12.0	68.7 ~ 86.8
Timing chain upper front cover bolt	9	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
High pressure pump bracket bolt	4	19.6 ~ 25.5	2.0 ~ 2.6	14.5 ~ 18.8
Water pump pulley bolt	4	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Alternator bracket bolt	4	18.6 ~ 27.4	1.9 ~ 2.8	13.7 ~ 20.3
Alternator fixing bolt and nut	2	38.2 ~ 58.8	3.9 ~ 6.0	28.2 ~ 43.4
Power steering pump bracket bolt	6	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5

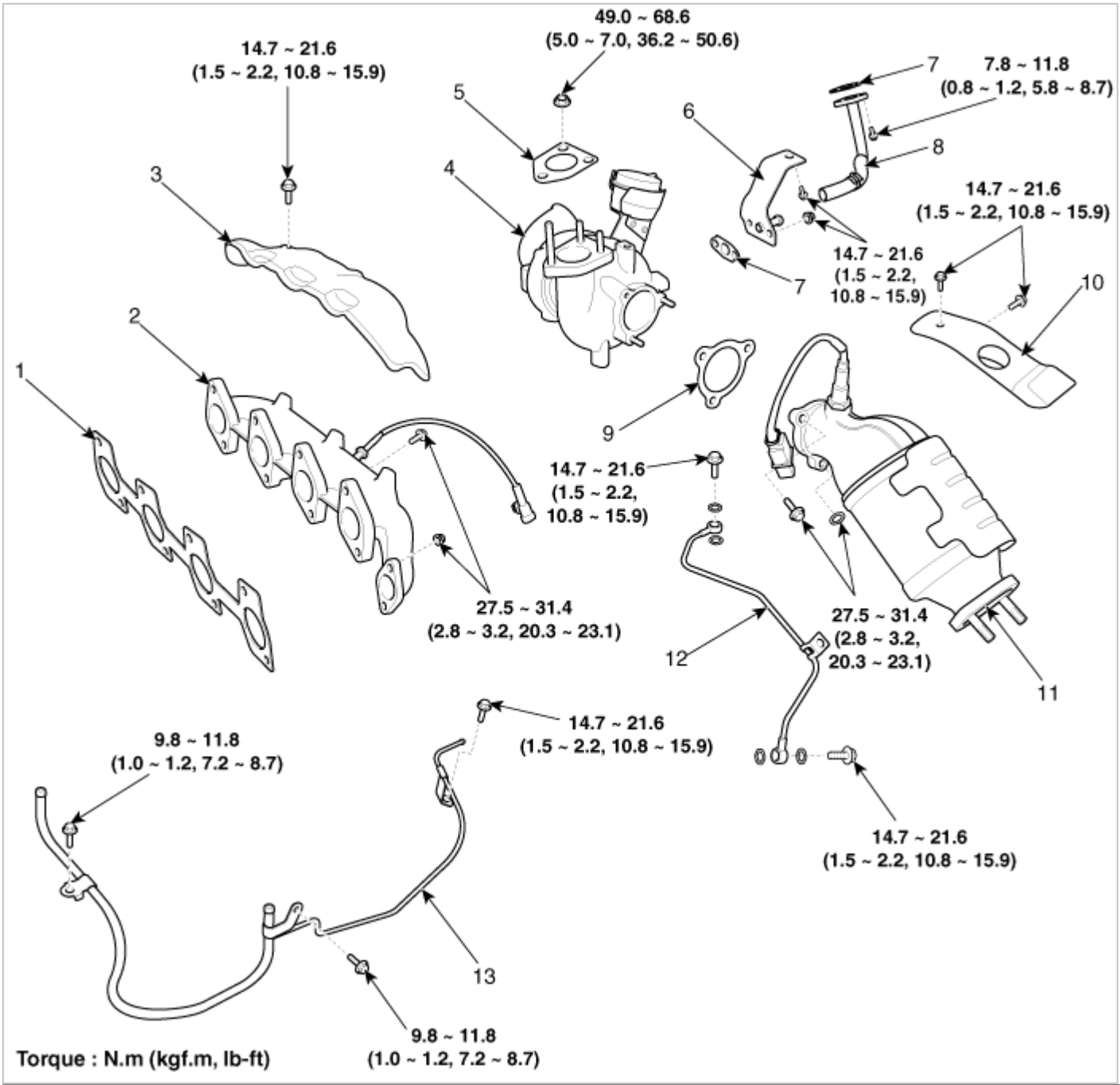
Drive belt idler fixing bolt	3	47.1 ~ 53.0	4.8 ~ 5.4	34.7 ~ 39.1
Drive belt auto tensioner fixing bolt	1	47.1 ~ 53.0	4.8 ~ 5.4	34.7 ~ 39.1
Starter fixing bolt	2	49.0 ~ 63.7	5.0 ~ 6.5	36.2 ~ 47.0

Troubleshooting

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 vibration	Loose engine mounting bolt	Retighten
	Loose transmission mounting bolt	Retighten
	Loose cross member bolt	Retighten
	Broken transmission mounting rubber	Replace
	Broken engine mounting rubber	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
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
Abnormally high coolant temperature	Faulty thermostat	Replace
	Faulty radiator cap	Replace
	Restricted of flow in cooling system	Replace
	Loose or missing drive belt	Adjust or replace
	Faulty engine coolant pump	Replace
	Faulty temperature sensor wiring	Repair or replace
	Faulty electric fan	Repair or replace
	Faulty thermo-sensor on radiator	Replace
	Insufficient coolant	Refill coolant
Abnormally low coolant temperature	Faulty thermostat	Replace
	Faulty temperature sensor wiring	Repair or replace
Leakage from oil cooling system	Loose hose and pipe connection	Retighten
	Blocked or collapsed hose and pipe	Replace
Inoperative electrical cooling fan	Damaged, fuse	Replace or repair
Exhaust gas leakage	Loose connections	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Detached baffle plate in muffler	Replace
	Broken rubber hanger	Replace
	Pipe or muffler contacting vehicle body	Correct
	Broken pipe or muffler	Repair or replace

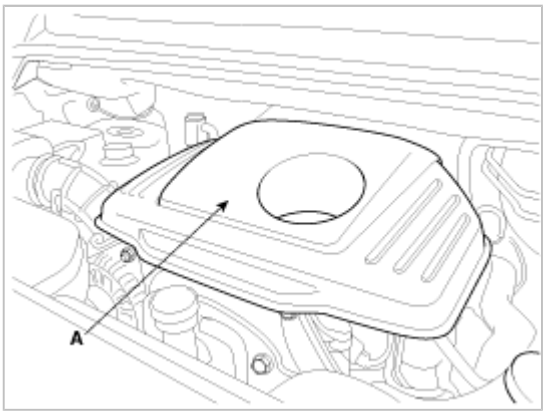
Components



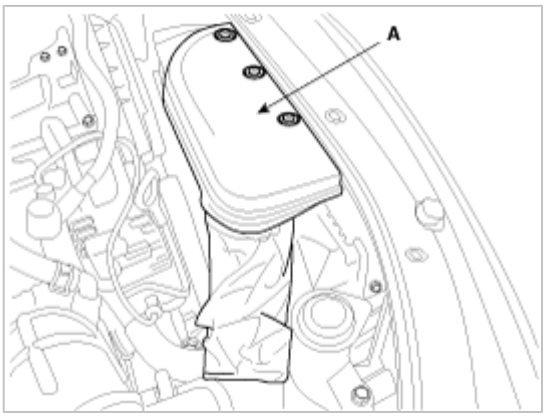
1. Exhaust manifold gasket	7. Oil return pipe gasket
2. Exhaust manifold	8. Oil return pipe & hose assembly
3. Exhaust manifold heat protector	9. Catalytic coverter gasket
4. Turbo charger	10. Turbo charger heat protector
5. Turbo charger gasket	11. Catalytic converter
6. Turbo charger stay	12. Oil feed pipe

Removal

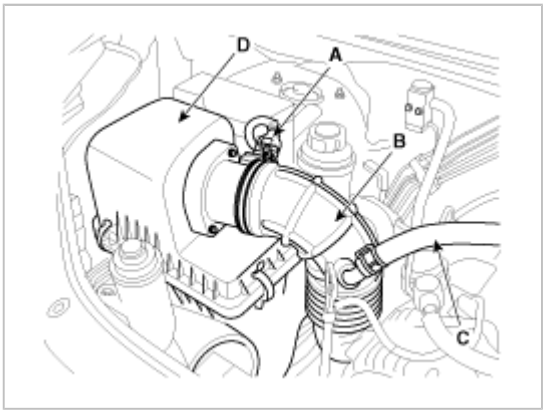
1. Remove the engine cover(A).



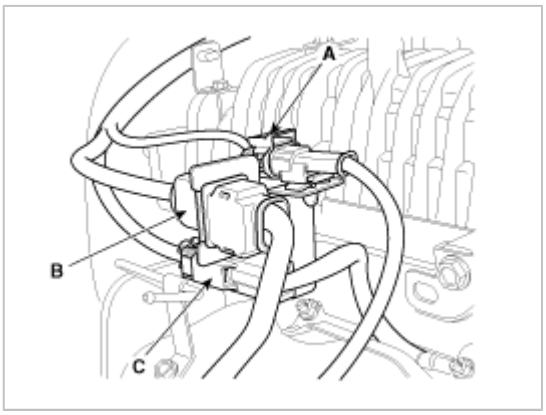
2. Remove the air duct(A).



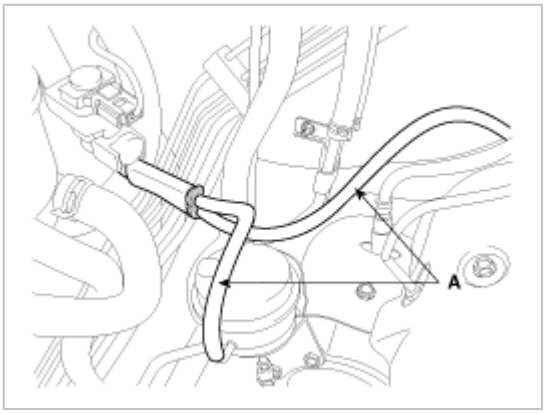
3. Disconnect the MAFS connector (A).
4. Remove the air cleaner hose (B), the breather hose (C) and the air cleaner assembly(D).



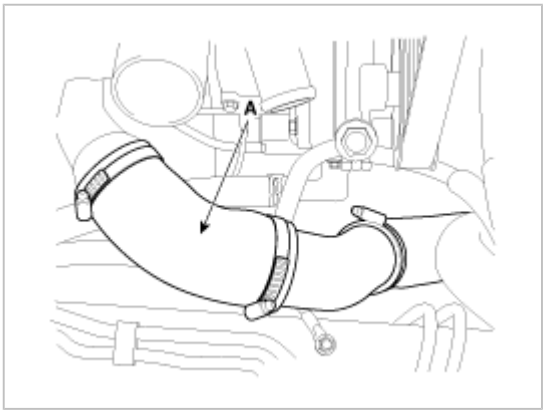
5. Disconnect the EGTS connector (A), the lambda sensor connector(B) and the glow plug connector(C).



6. Disconnect the VGT (or WGT) actuator vacuum hose(A).

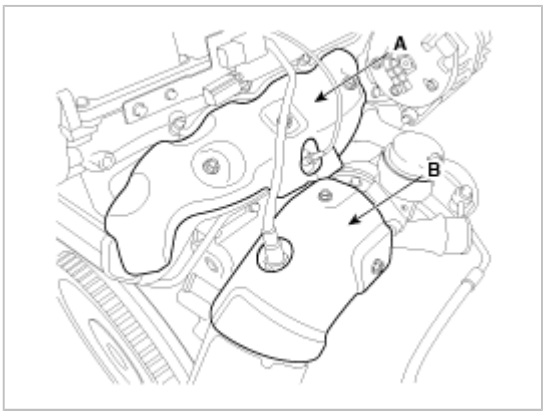


7. Disconnect the inter cooler inlet hose (A) from the exhaust manifold.



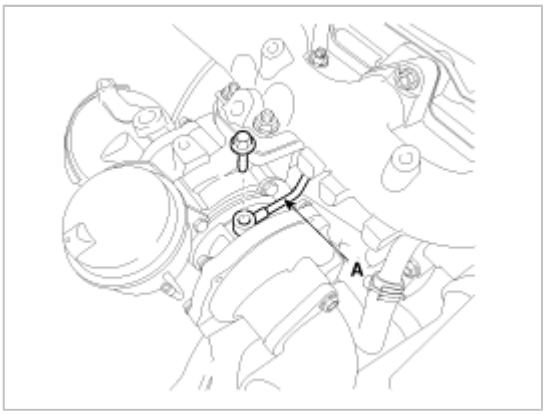
8. Remove the exhaust manifold heat protector and turbo charger heat protector (B).

Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



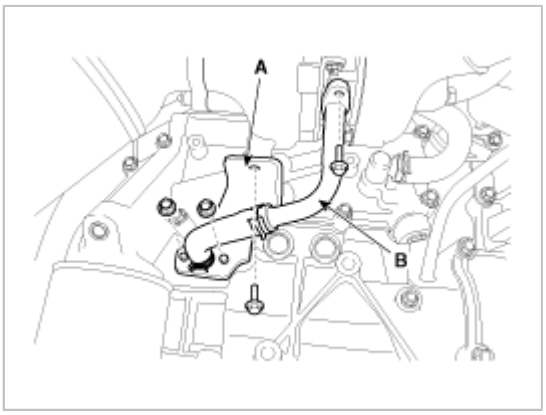
9. Remove the oil feed pipe (A) from the turbo charger.

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



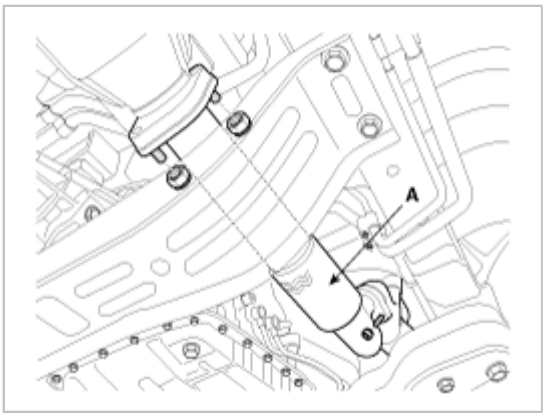
10. Remove the turbo charger stay(A) and oil return hose & pipe (B).

Tightening torque
Stay (A) :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)
Pipe (B) :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)



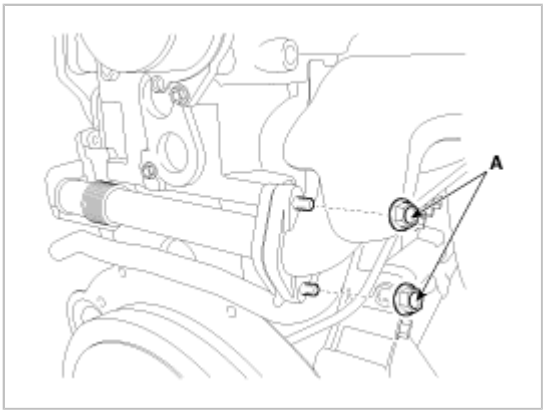
11. Remove the front muffler(A).

Tightening torque :
39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



12. Unfasten the EGR cooler pipe mounting nuts (A).

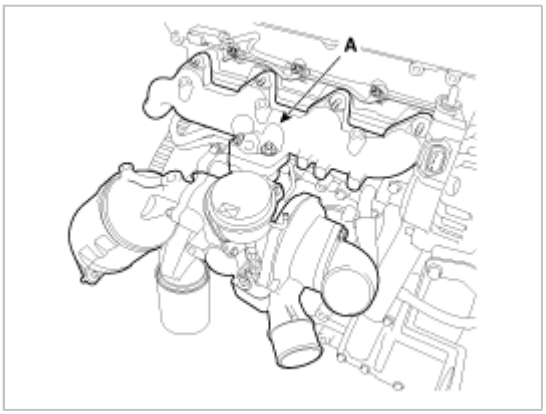
Tightening torque :
27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)



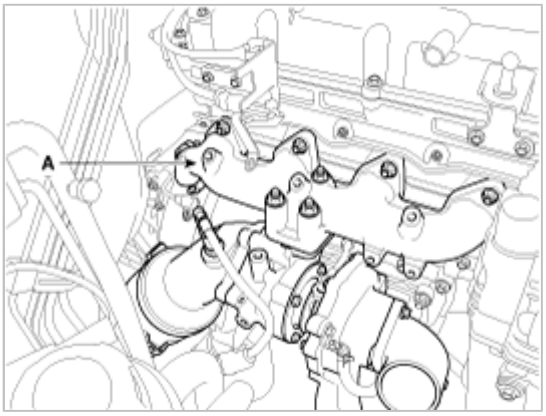
13. Remove the exhaust manifold assembly(A).

Tightening torque :
27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)

[VGT]



[WGT]



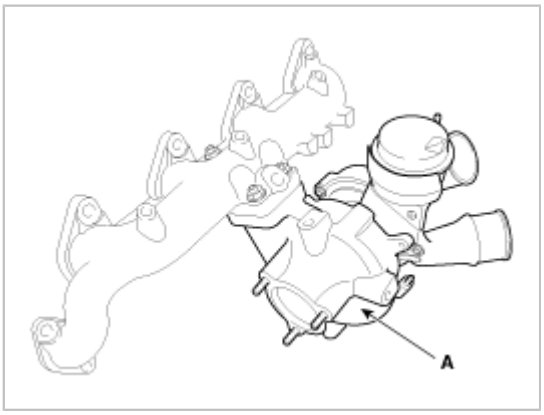
14. Remove the catalytic coverter (A).

Tightening torque :
27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)

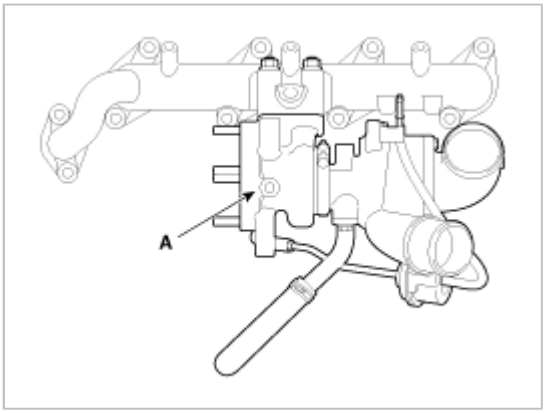
15. Remove the turbo charger (A).

Tightening torque :
49.0 ~ 68.6N.m (5.0 ~ 7.0kgf.m, 36.2 ~ 50.6lb-ft)

[VGT]

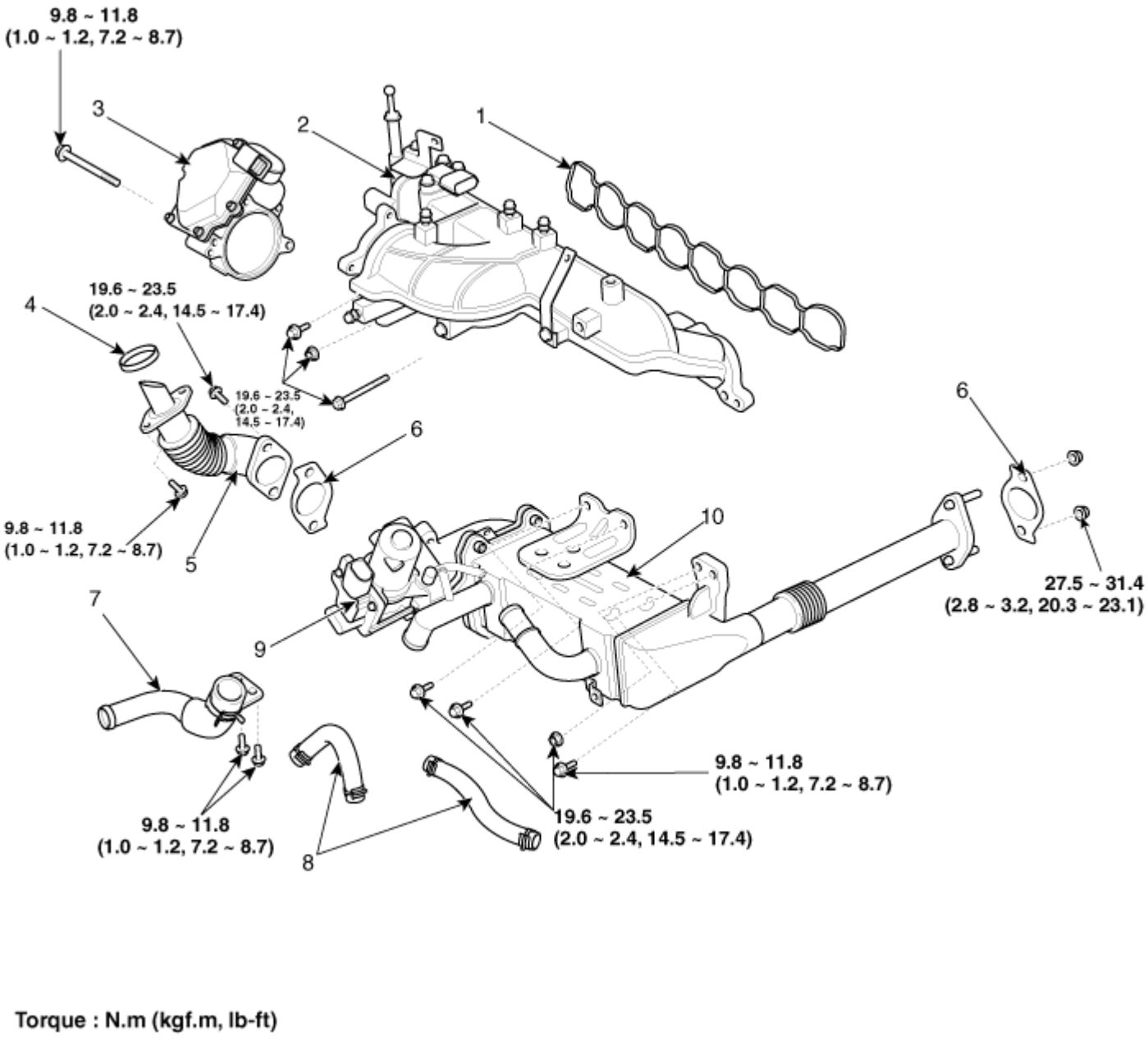


[WGT]



16. Installation is reverse order of removal, with a new gasket.

Components

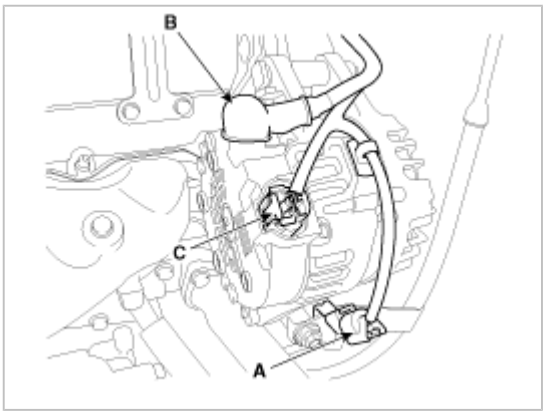


Torque : N.m (kgf.m, lb-ft)

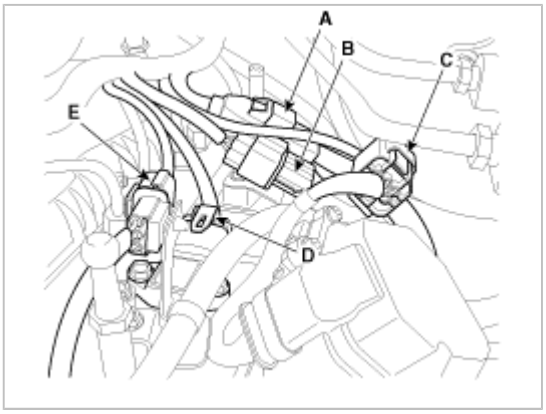
1. Intake manifold gasket	6. EGR pipe gasket
2. Intake manifold	7. EGR cooler hose & pipe assembly.
3. Air control valve (Euro 5 only)	8. EGR cooler hoses.
4. O-ring	9. EGR solenoid valve
5. EGR pipe	10. EGR cooler and pipe assembly

Removal

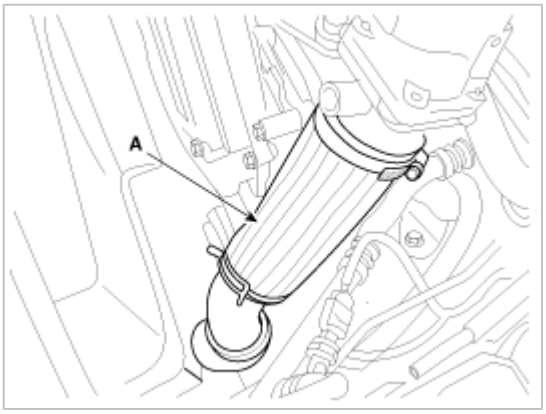
1. Disconnect the negative terminal from the battery and remove the battery.
2. Remove the battery tray.
3. Disconnect the oil pressure switch connector(A).
4. Disconnect the alternator B terminal(B) and the connector(C).



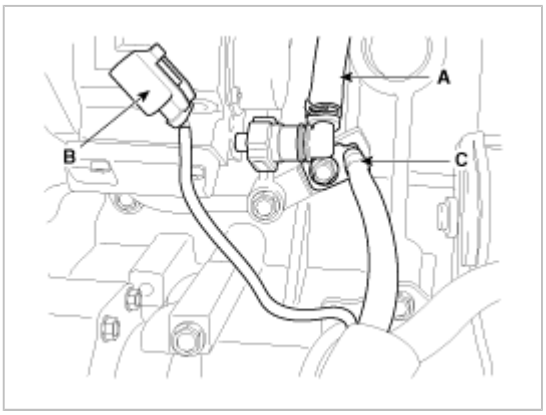
5. Disconnect the transmission connector (A), battery extension connector (B), air control valve connector (C), booster pressure sensor connector (D) and water temperature sensor connector (E).



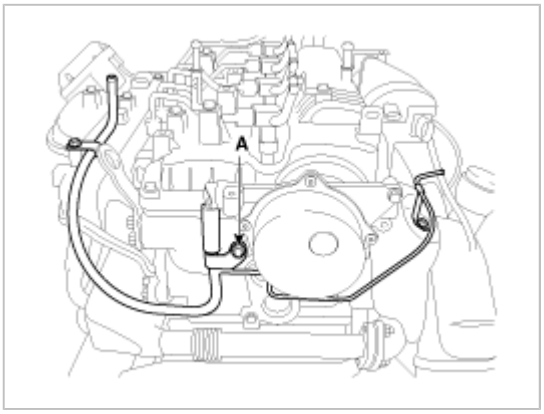
6. Disconnect the inter cooler outlet hose(A) from the intake manifold.



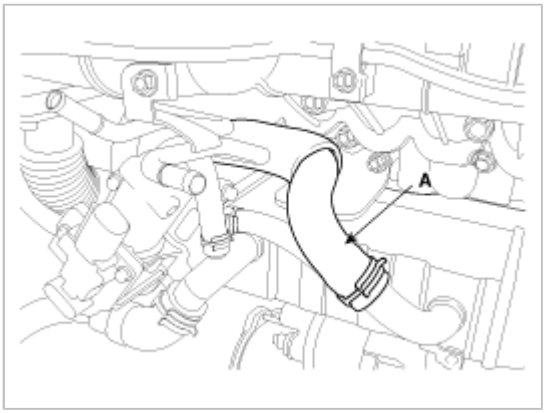
7. Disconnect the fuel hose(A).
8. Disconnect the fuel temperature sensor connector(B) and the ground line (C).



9. Remove the vacuum pipe(A).



10. Remove the EGR cooler coolant hose and pipe (A).



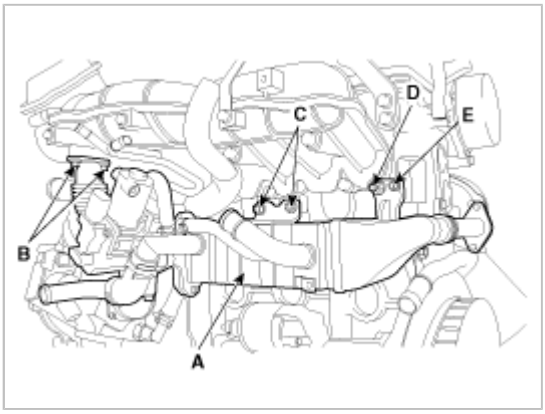
11. Remove the EGR cooler assembly (A).

Tightening torque

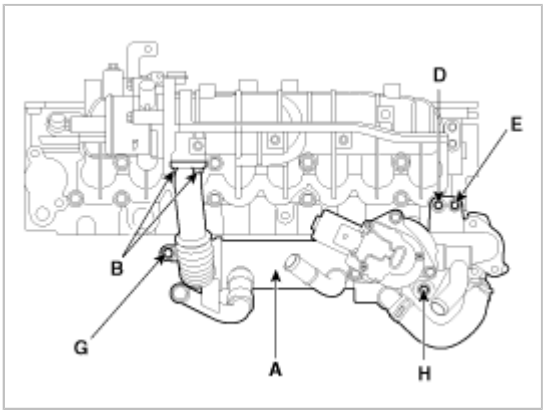
Bolts (B,E) :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
Bolts (C, G, H) :
19.6 ~ 23.5N.m (2.0 ~ 2.4kgf.m, 14.5 ~ 17.4lb-ft)
Nut (D) :
19.6 ~ 23.5N.m (2.0 ~ 2.4kgf.m, 14.5 ~ 17.4lb-ft)
Nuts (F) :

27.5 ~ 31.4N.m (2.8 ~ 3.2kgf.m, 20.3 ~ 23.1lb-ft)

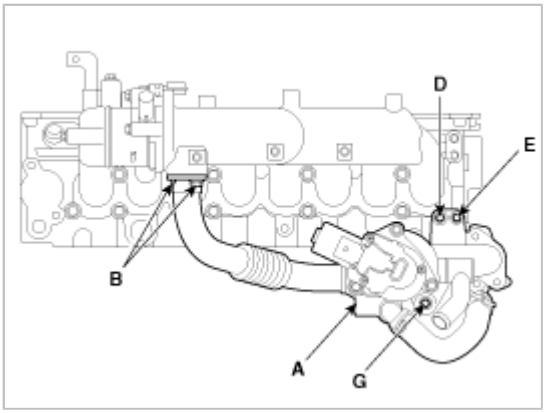
[Euro 5]

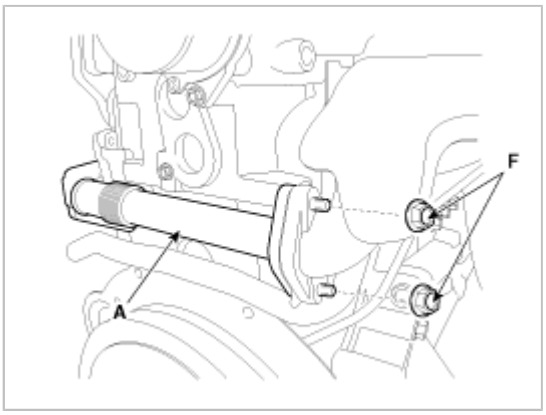


[Euro 4]

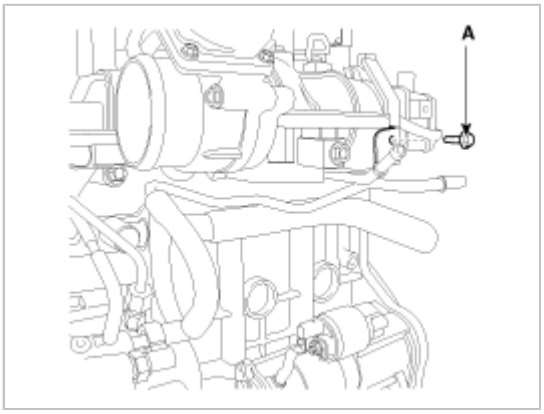


[Euro 3]

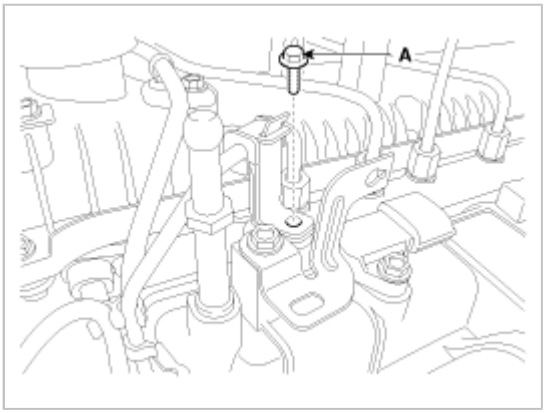




12. Remove the fuel pipe bracket mounting bolt (A).

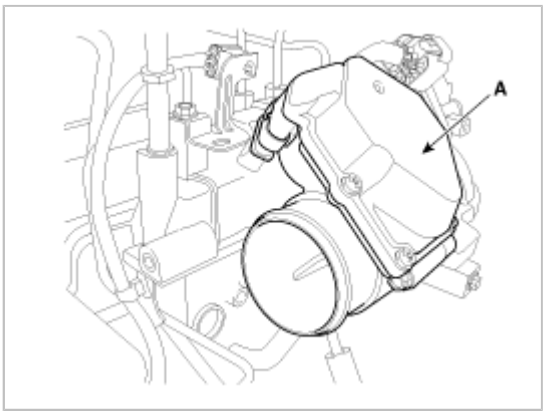


13. Remove the high pressure pipe bracket mounting bolts (A).



14. Remove the air control valve (A). (Euro 5 only)

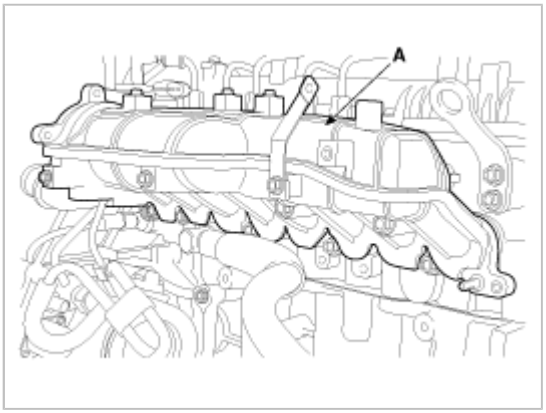
Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



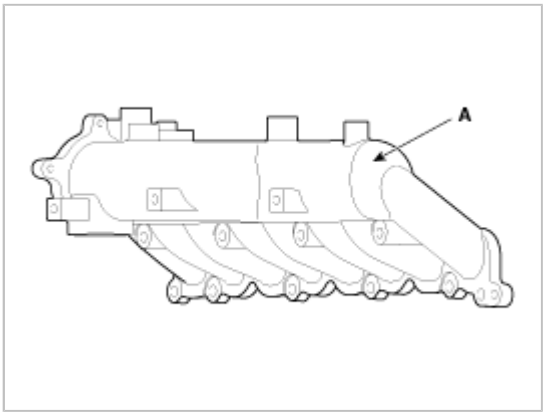
15. Remove the intake manifold (A).

Tightening torque :
19.6 ~ 23.5N.m (2.0 ~ 2.4kgf.m, 14.5 ~ 17.4lb-ft)

[Euro 4/5]

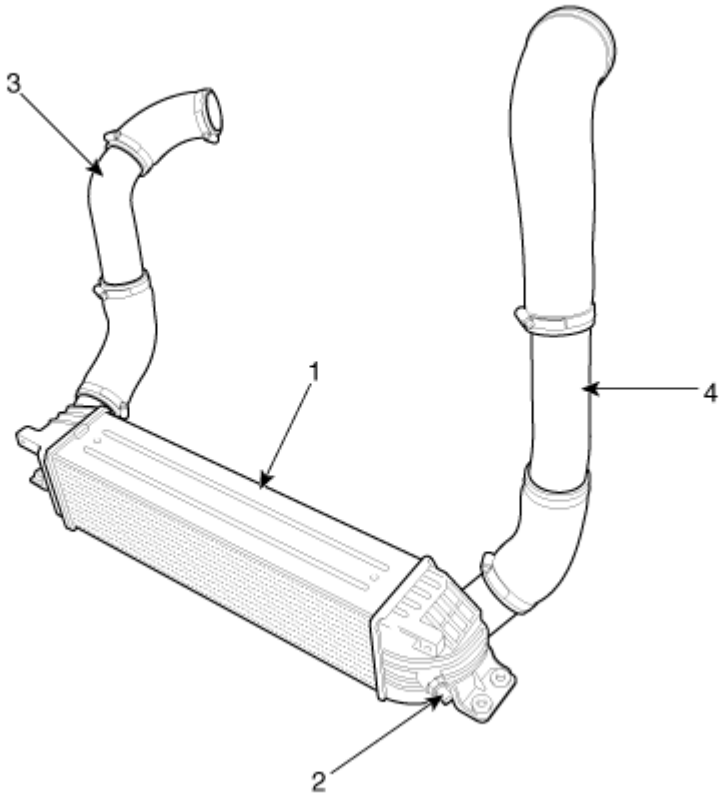


[Euro 3]



16. Installation is reverse order of removal, with a new gasket.

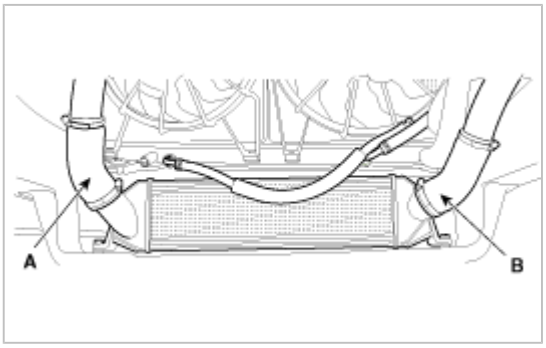
Components



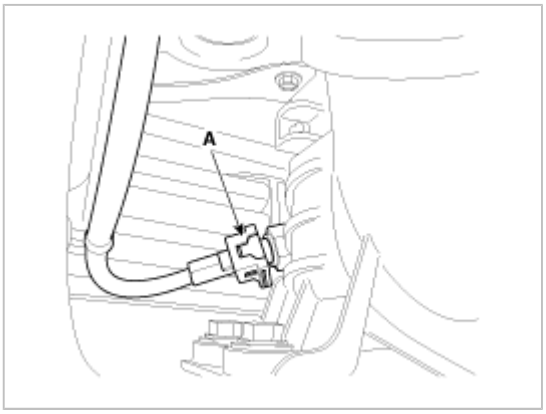
1. Intercooler 2. Booster pressure sensor	3. Intercooler inlet hose and pipe assembly 4. Intercooler outlet hose and pipe assembly

Removal

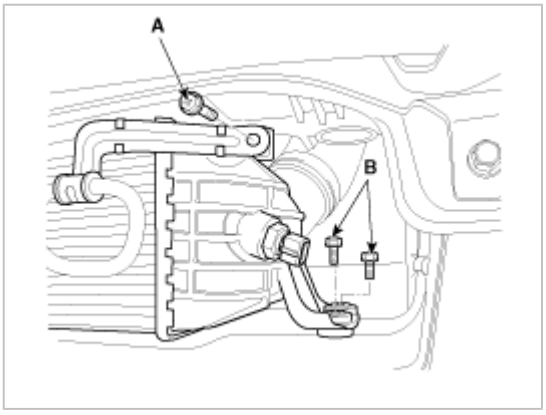
1. Remove the front bumper. (Refer to BD group)
2. Remove the intercooler hoses(A, B).

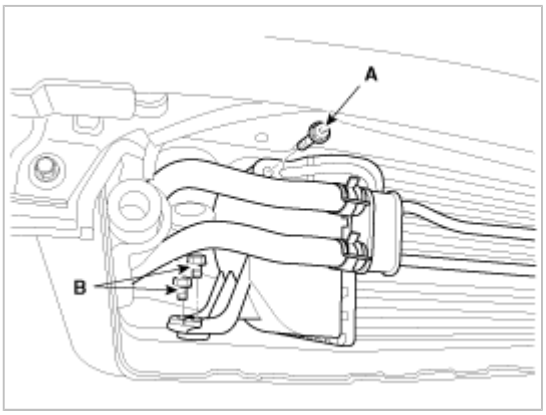


3. Disconnect the intercooler pressure sensor connector (A).



4. Remove the mounting bolt (A) of the power steering oil cooler tube bracket.
5. Remove the mounting bolt (B) of the intercooler.





6. Remove the intercooler from the vehicle.

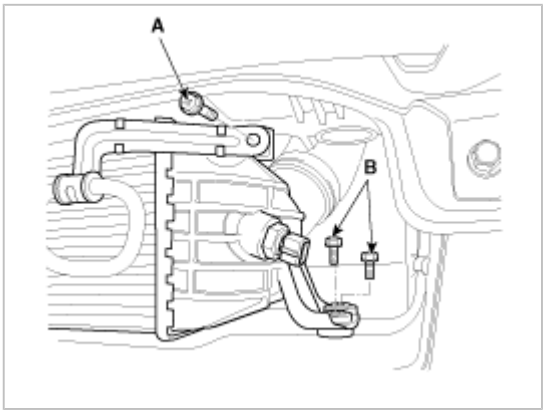
Installation

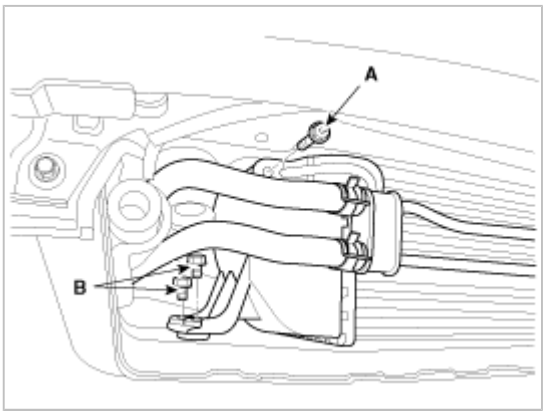
1. Install the intercooler to the vehicle.
2. Install the mounting bolt (B) of the intercooler.

Tightening torque :
21.6 ~ 25.5N.m (2.2 ~ 2.6kgf.m, 15.9 ~ 18.8lb-ft)

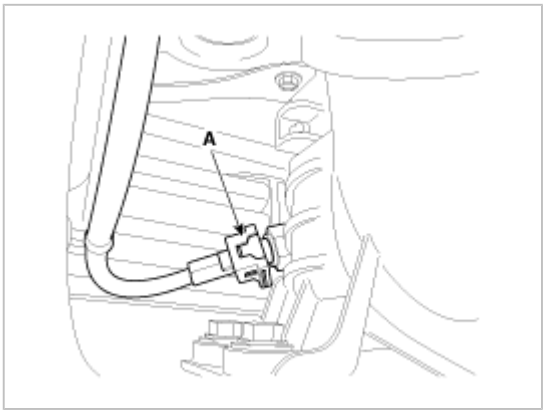
3. Install the mounting bolt (A) of the power steering oil cooler tube bracket.

Tightening torque :
6.9 ~ 10.8N.m (0.7 ~ 1.1kgf.m, 5.1 ~ 8.0lb-ft)

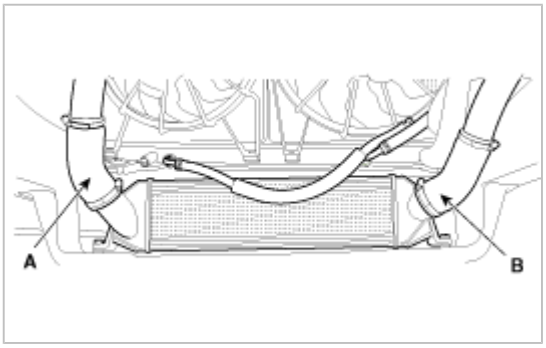




4. Reconnect the intercooler pressure sensor connector (A).

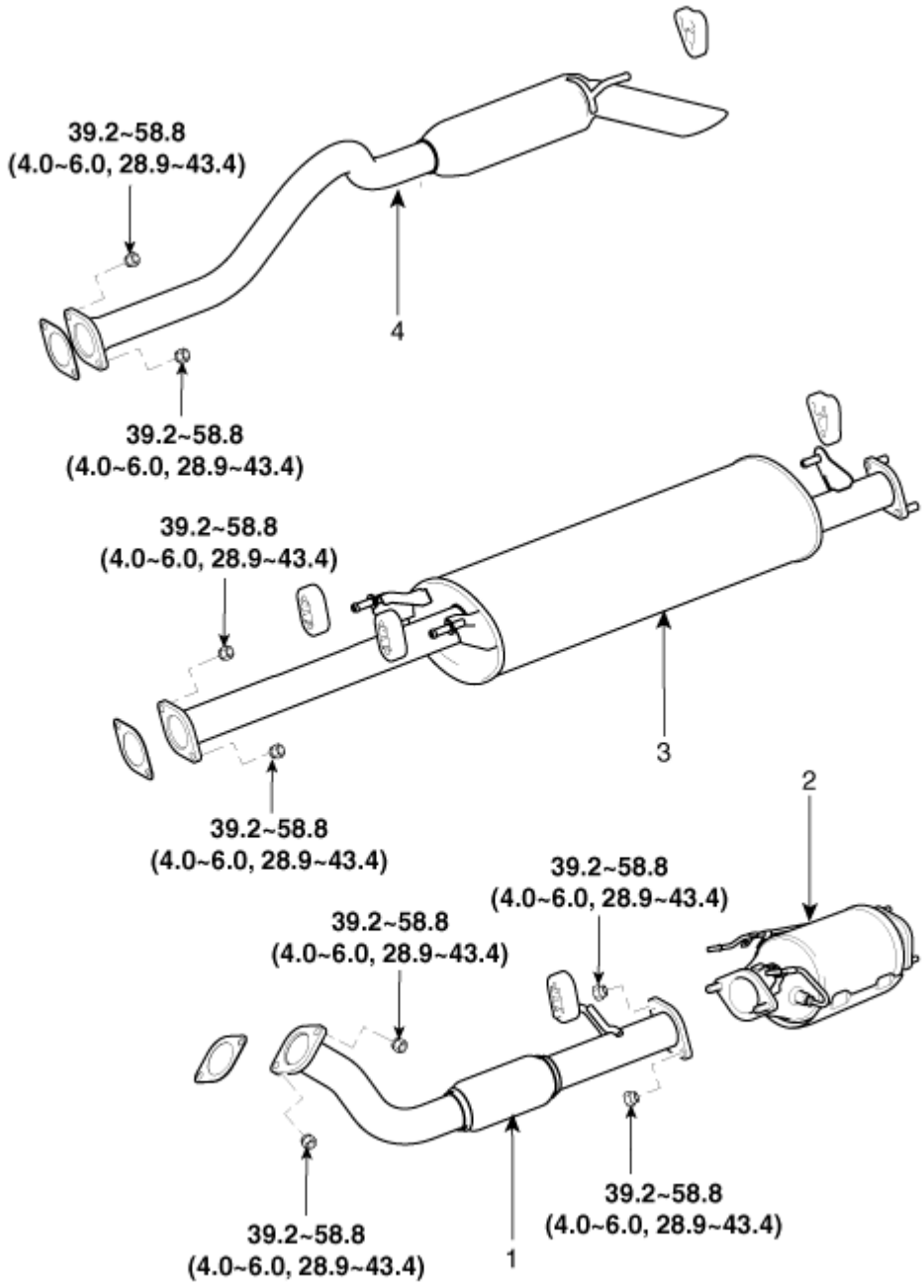


5. Install the intercooler hoses(A, B).



6. Install the front bumper. (Refer to BD group)

Components

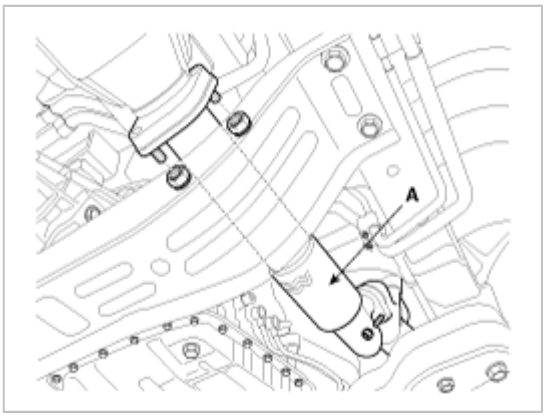


Torque : N.m (kgf.m, lb-ft)

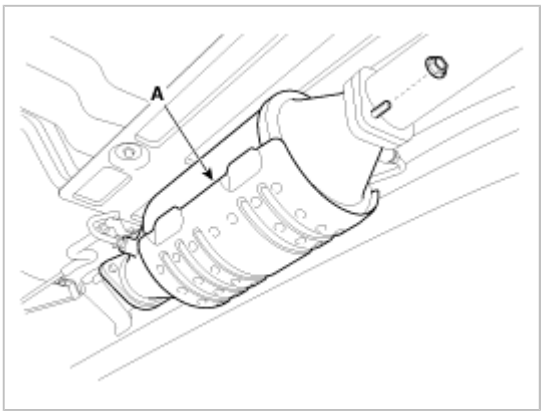
1. Front muffler 2. Catalytic converter	3. Center muffler 4. Main muffler

Removal

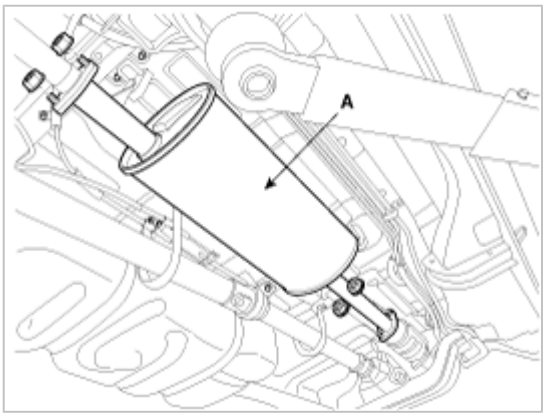
1. Remove the front muffler (A).



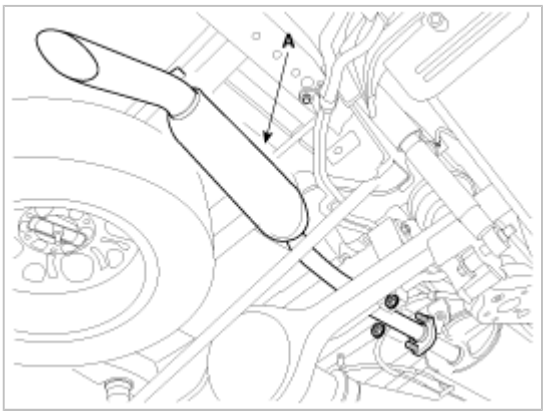
2. Remove the catalytic converter (A). (Refer to FL group)



3. Remove the center muffler (A).



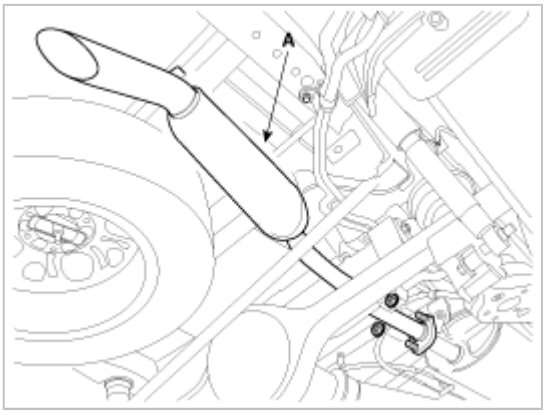
4. Remove the rear muffler (A).



Installation

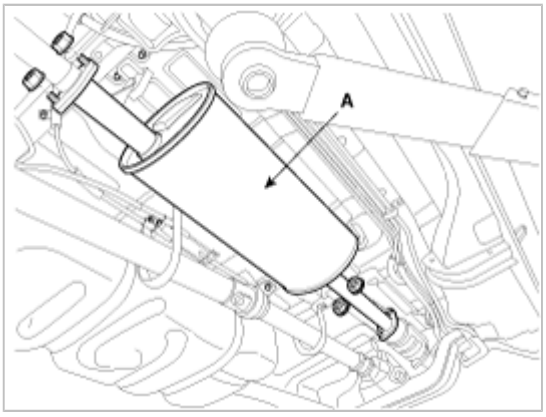
1. Install the rear muffler (A) with new gasket.

Tightening torque :
39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



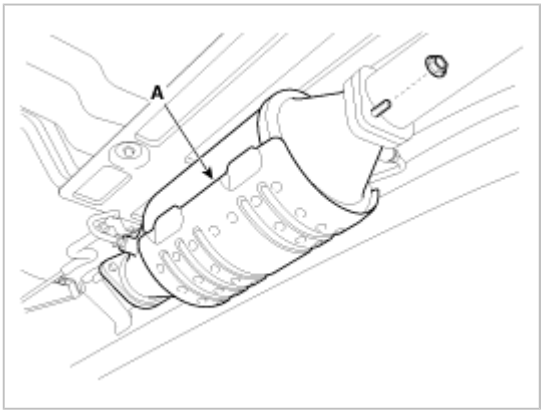
2. Install the center muffler (A) with new gasket.

Tightening torque :
39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



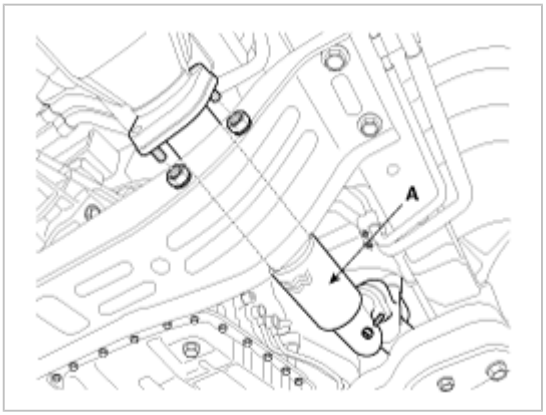
3. Install the catalytic converter (A) with new gasket. (Refer to FL group)

Tightening torque :
39.2 ~ 58.8N.m (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



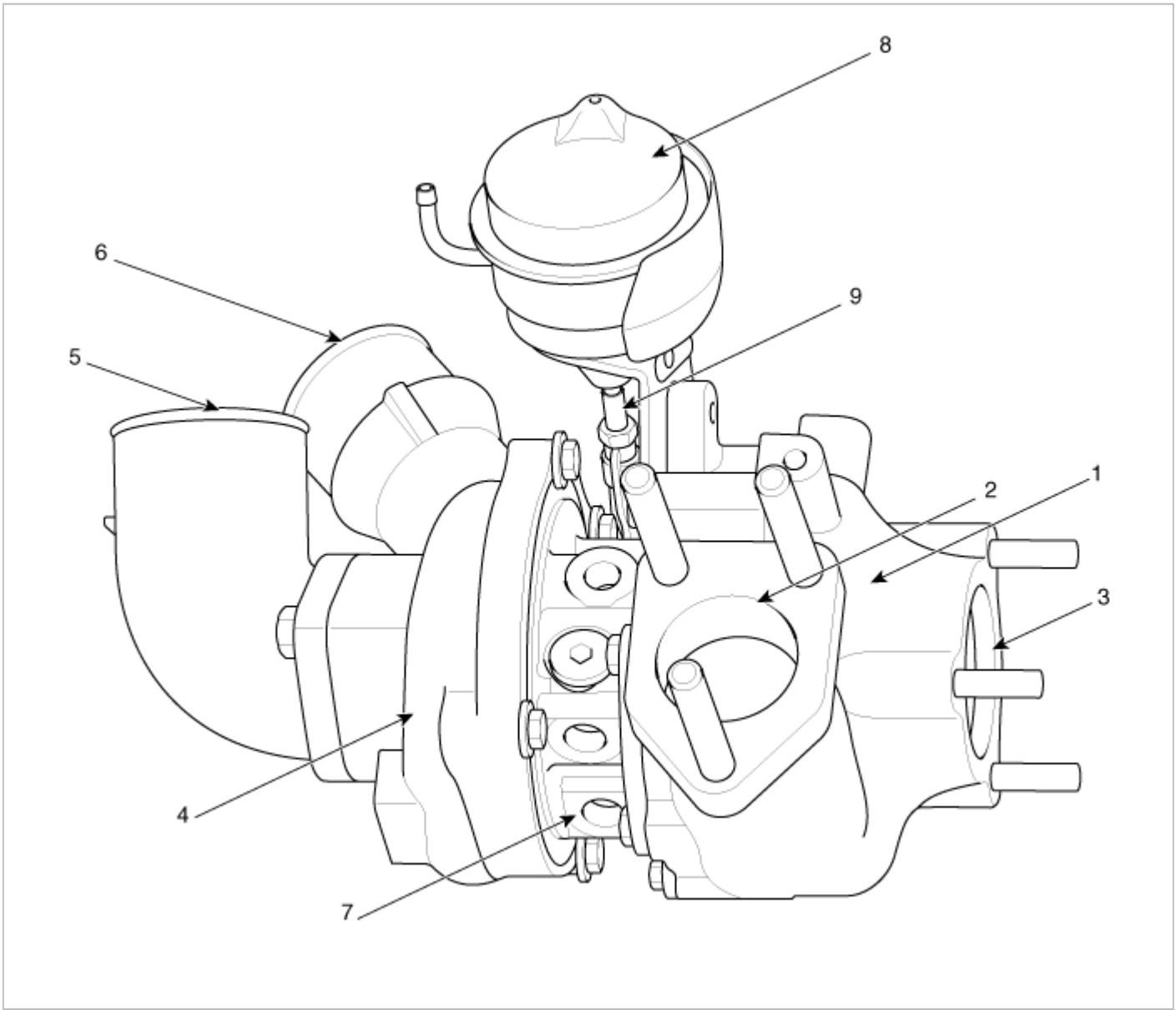
4. Install the front muffler (A) with new gasket.

Tightening torque :
39.2 ~ 58.8Nm (4.0 ~ 6.0kgf.m, 28.9 ~ 43.4lb-ft)



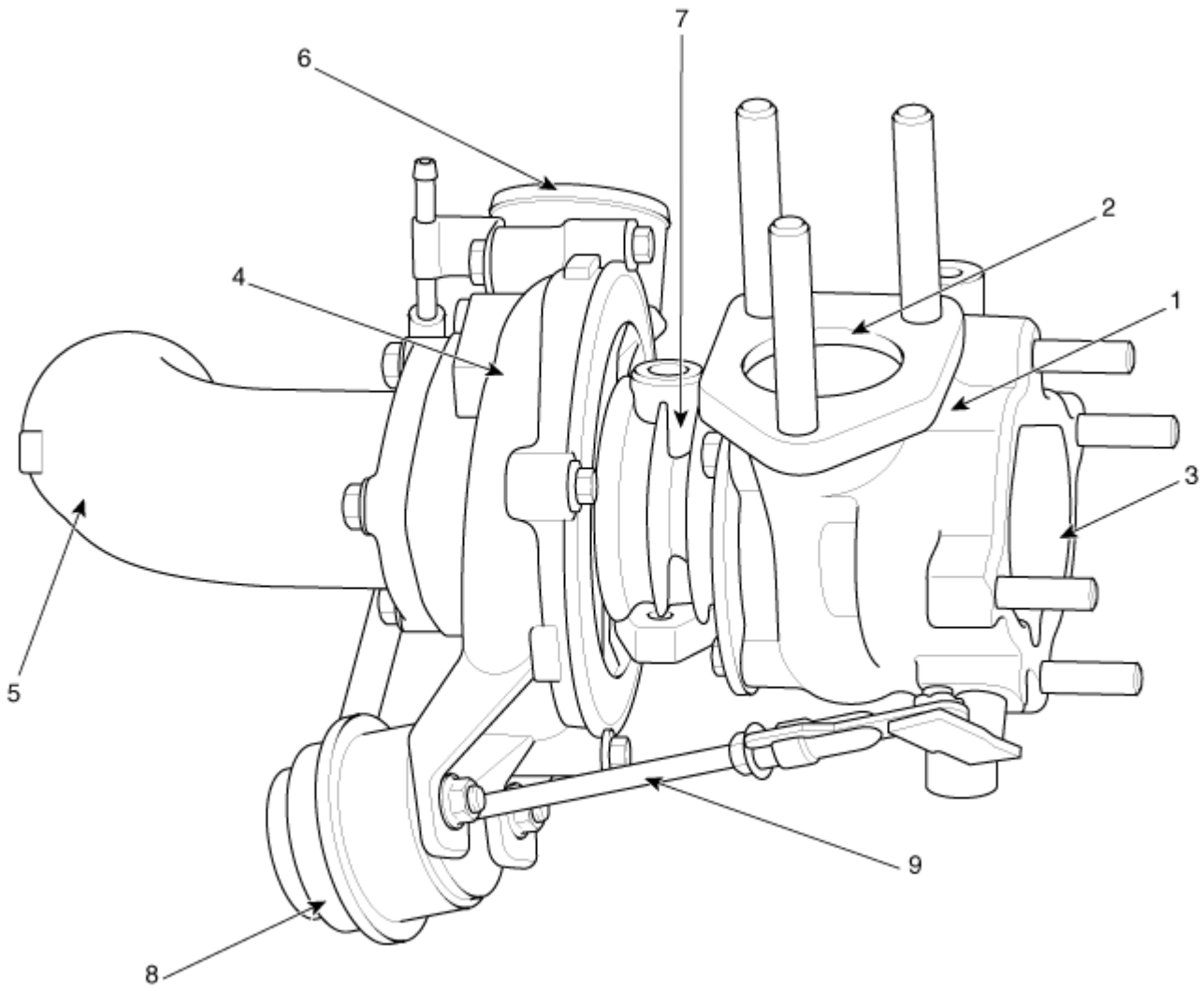
Components

[VGT]



1. Turbine housing	6. Compressor outlet
2. Turbine inlet	7. Center housing
3. Turbine outlet	8. Actuator
4. Compressor housing	9. Actuator rod
5. Compressor inlet	

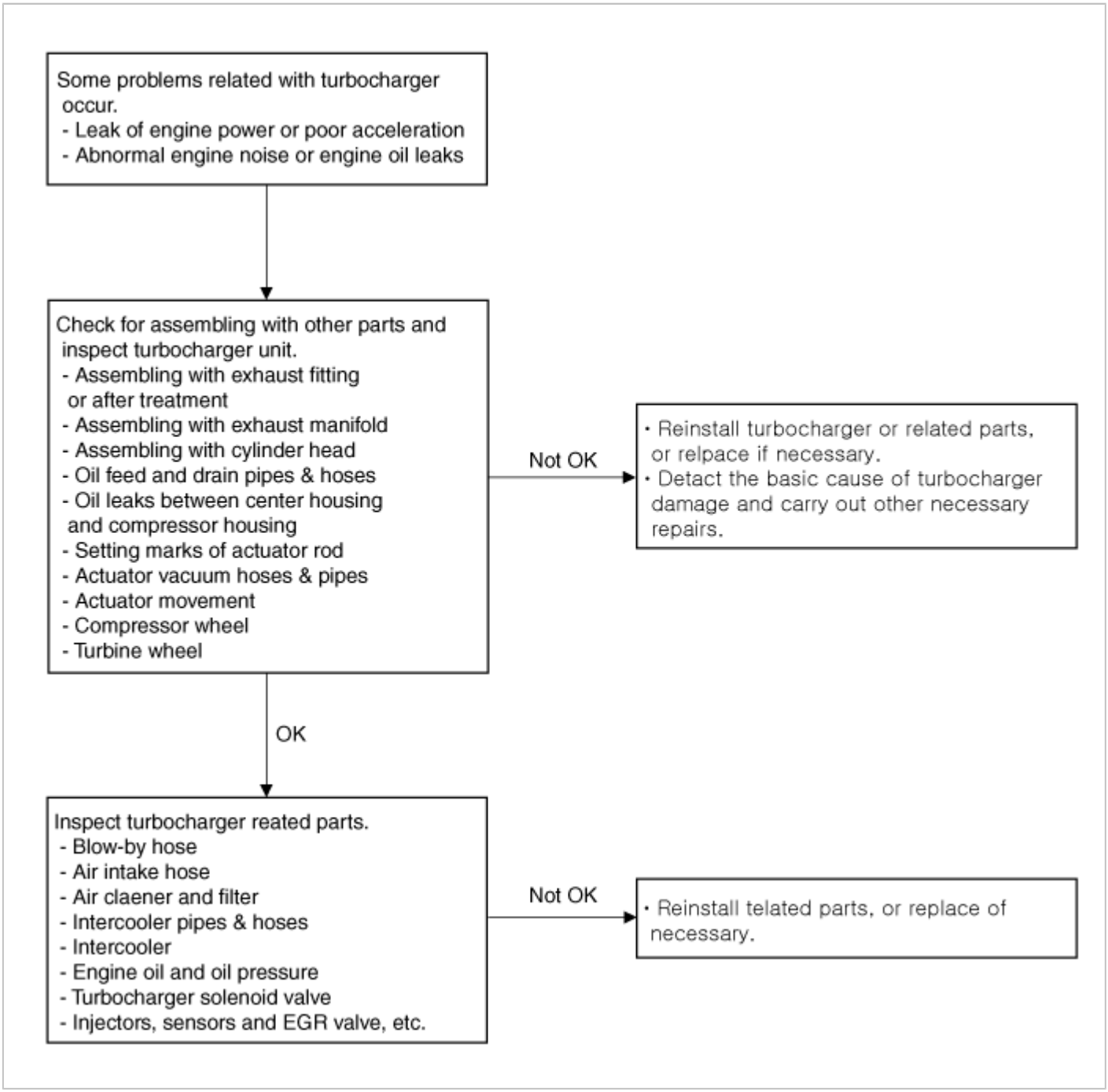
[WGT]



1. Turbine housing	6. Compressor outlet
2. Turbine inlet	7. Center housing
3. Turbine outlet	8. Actuator
4. Compressor housing	9. Actuator rod
5. Compressor inlet	

On-vehicle Inspection

Turbocharger Diagnostic Flow



If any problem related with turbocharger, such as lack of engine power, poor acceleration, abnormal engine noise or oil leaks, may occur, check the turbocharger according to the procedure as follows.

1. Check for assembling of the turbocharger and the exhaust fitting (or the after treatment).
   A. Check if a gasket is installed.

A. Check if mounting bolts (or nuts) are tightened properly.
A. Check if there is a gas leak.
A. Check if there is any damage, such as crack, on the parts.

If a gas leak occur as a gasket was not installed or mounting bolts (or nuts) were tightened inadequately, it may cause abnormal engine noise.
If the cause of the problem is detected, retighten the mounting bolts (or nuts) as the specified torque or replace the gasket or damaged parts with new ones if necessary.

2. Check for assembling of the turbocharger and the exhaust manifold.
   A. Check if a gasket is installed.
   B. Check if the mounting bolts (or nuts) are tightened properly.
   C. Check if there is a gas leak.
   D. Check if there is any damage, such as crack, on the parts.

   If a gas leak occur as a gasket was not installed or mounting bolts (or nuts) were tightened inadequately, it may cause abnormal engine noise.
   If the cause of the problem is detected, retighten the mounting bolts (or nuts) as the specified torque or replace the gasket or damaged parts with new ones if necessary.
3. Check for assembling of the exhaust manifold and the cylinder head.
   A. Check if a gasket is installed.
   B. Check if the mounting bolts (or nuts) are tightened properly.
   C. Check if there is a gas leak.

   If a gas leak occur as a gasket was not installed or mounting bolts (or nuts) were tightened inadequately, it may cause abnormal engine noise.
   If the cause of the problem is detected, retighten the mounting bolts (or nuts) as the specified torque or install a new gasket if necessary.
4. Check the turbocharger oil feed pipe & hose and oil drain pipe & hose.
   A. Check if a gasket is installed.
   B. Check if the mounting bolts are tightened properly.
   C. Check if the clamps are positioned in place.
   D. Check if the oil pipes & hoses are damaged (bent, crushed, torn or cracked).

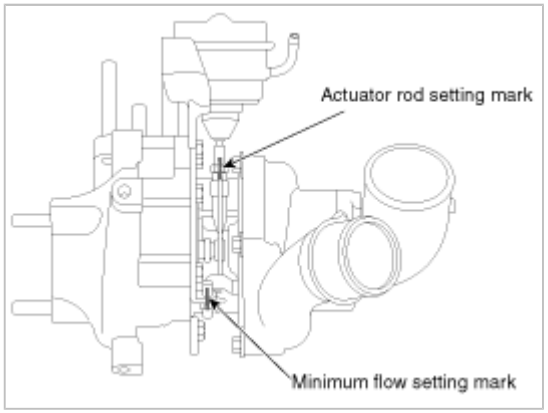
   If a gas leak occur as a gasket was not installed or mounting bolts were tightened inadequately, it may cause oil leaks.
   If the oil feed pipe & hose is damaged, engine oil is not supplied sufficiently to the turbocharger then it may damage the turbocharger. If the oil drain pipe & hose is damaged and clogged, engine oil is not drained smoothly then it may cause oil leaks from the turbocharger.
   If the cause of the problem is detected, retighten the mounting bolts (or nuts) as the specified torque or replace the gasket or damaged parts with new ones if necessary.
5. Check for oil leaks between center housing and compressor housing.
   A. Check if the mounting bolts are tightened properly.
   B. Check if there is an oil leak.

If the O-ring (gasket) between the center housing and the compressor housing is damaged, it may cause oil leaks.

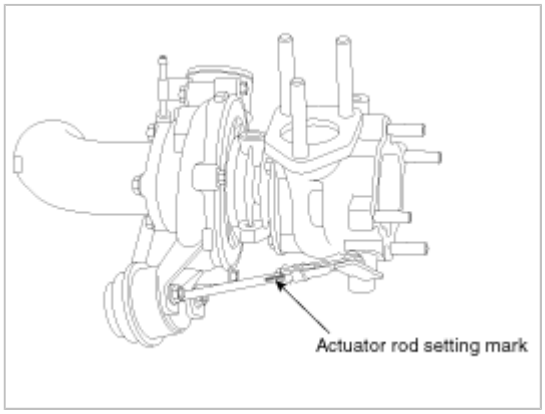
If an oil leak is detected, replace the turbocharger with a new one.

6. Check the setting marks of the turbocharger actuator rod.
   A. Check if the actuator rod setting mark is aligned in line.
   B. Check if the minimum flow setting mark is aligned in line.

   [VGT]



   [WGT]



If the setting marks are not aligned in line, the engine performance is changed by an arbitrary tune-up of the turbocharger after delivery.

If the setting marks are not aligned in line, replace the turbocharger with a new one.

7. Check the turbocharger actuator vacuum hoses & pipes.
   A. Check if the vacuum hose is connected to the actuator properly.
   B. Check if the vacuum hoses & pipes are damaged (bent, detached or torn).
   C. Check if there is any damage, such as crack, on the vacuum pipes.
   D. Check if the vacuum hoses are connected to inlet or outlet of the solenoid valve correctly.

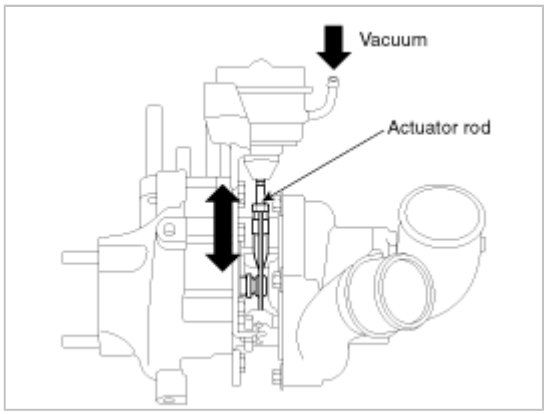
If the vacuum pipes & hoses are damaged or disconnected, the actuator does not work properly then it may cause lack of engine power and poor acceleration.

If the vacuum hoses & pipes are damaged, replace them with new ones.

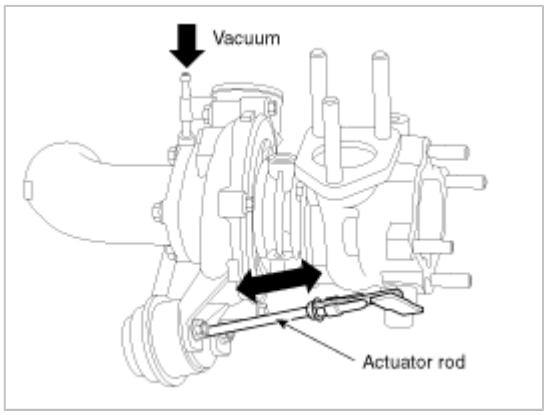
8. Check the turbocharger actuator.
   A.

Vacuum type actuator: Check for movement of the actuator rod when a vacuum of 60kPa (450mmHg, 8.7psi) is applied to the actuator or a forced actuator operating mode is performed by GDS. (Refer to DTC guide)

[VGT]



[WGT]

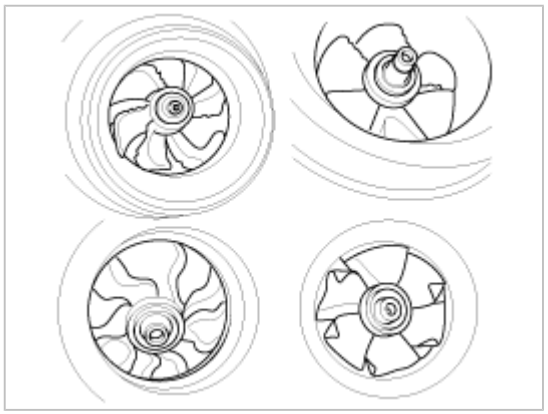


If the turbocharger actuator is damaged, it may cause lack of engine power and poor acceleration.

If the actuator rod does not move, replace the turbocharger with a new one.

9. Check the turbocharger compressor wheel.
   A. Check if the compressor wheel is damaged (bent or deformed).
   B. Check if the compressor wheel rotates smoothly.

   EX)

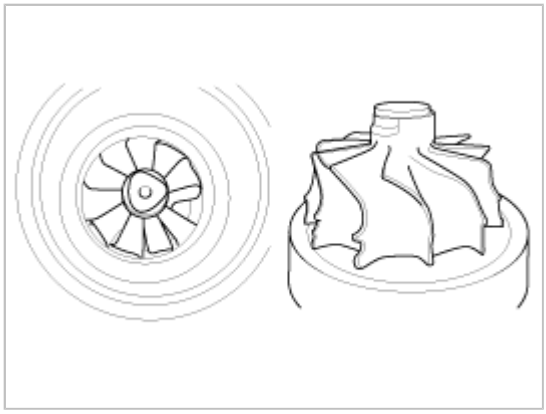


If the compressor wheel are damaged, it may cause abnormal noise from the turbocharger and poor acceleration.

If the compressor wheel are damaged or deformed, replace the turbocharger with new ones.

10. Check the turbocharger turbine wheel.
    A. Check if the turbine wheel is damaged.
    B. Check if the turbine wheel rotates smoothly.

EX)



If the turbine wheel are damaged, it may cause abnormal noise from the turbocharger and poor acceleration.

If the turbine wheel are damaged or deformed, replace the turbocharger with new ones.

If any problem is not detected in the turbocharger, check the turbocharger-related parts according to the procedure as follows.

1. Check the blow-by hose. (Refer to FL group)
    A. Check if the breather hose is damaged (bent, clogged).
    B. Check if the positive crankcase ventilation (PCV) valve is clogged.

If the breather hose is bent or clogged, the internal pressure in the engine increases then engine oil is not supplied smoothly to the turbocharger. So it may cause damage of the turbocharger and oil leaks.

If the cause of the problem is detected, replace the breather hose or the related parts with new ones.

2. Check the air intake hose connected to the turbocharger.
    A. Check if the air intake hose is damaged (bent, crushed, detached or torn).

If a cross-section of the hose diminishes as the air intake hose is bent or crushed, intake air to the turbocharger reduces and the pressure in front of turbocharger drops. So it may cause damage of the turbocharger and oil leaks. If the air intake hose is detached or torn, a foreign substance goes into the turbocharger and causes damage of it.

If the air intake hose is damaged, replace it with a new one.

3. Check the air cleaner.
    A. Check the air cleaner filter for pollution state.
    B. Check the air cleaner filter for water influx.
    C. Check the air cleaner cover for dirtiness.
    D. Check if the air cleaner filter is a genuine part..

If the air cleaner filter is moistened or polluted excessively or a non-genuine part is used, intake air to the turbocharger reduces and the pressure in front of turbocharger drops. So it may cause damage of the turbocharger and oil leaks. .
If the air cleaner filter is moistened or polluted excessively, replace it with a new one.

> Replace the air cleaner filter according to the maintenance schedule.

4. Check the intercooler hoses & pipes.
   A. Check if the intercooler hoses & pipes are connected properly.
   B. Check if the intercooler hoses & pipes are damaged (bent, detached or torn).
   C. Check if there is any damage, such as crack, on the intercooler pipes.
   D. Check if the clamps are positioned in place.

   If the intercooler hoses & pipes are damaged or disconnected, oil leaks may occur from the hoses & pipes and the turbocharger may exceed the permissible speed then it may cause damage of the turbocharger.
   If the intercooler hoses & pipes are damaged, replace them with new ones.

   > Use new clamps when replacing the hoses & pipes.

5. Check the intercooler.
   A. Check if the intercooler tubes and tanks are damaged (oil leak or crack).

   If the intercooler is damaged, the turbocharger may exceed the permissible speed then it may cause damage of the turbocharger.
   If the intercooler is damaged, replace them with a new one.

   > Use new clamps when replacing the intercooler.

6. Check the engine oil.
   A. Check the engine oil level.
   B. Check the engine oil for discoloration, water influx and viscosity degradation.
   C. Check the engine oil grade.

   If the engine oil level is low, amount of engine oil fed to turbocharger reduces then the bearings in the turbocharger may adhere due to insufficient lubrication and cooling.
   If the cause of the problem is detected, add or change engine oil.

   > Change the engine oil according to the maintenance schedule.

7. Check the engine oil pressure.
   A. Engine oil pressure: Check the oil pressure using an oil pressure gauge after removing the oil pressure switch on the cylinder block.

B. Check the engine oil screen in the oil pan if the engine oil level is low. Then check the injectors for gas leaks if foreign substances are accumulated on the oil screen.

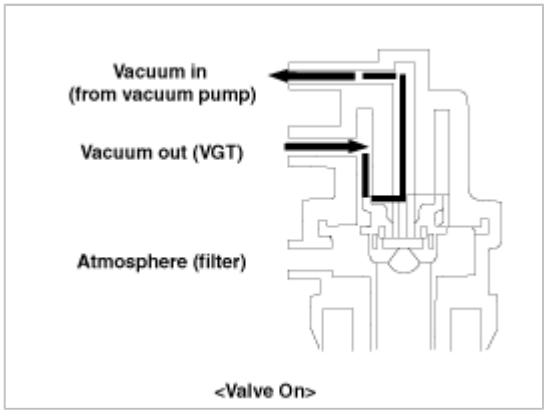
If the engine oil level is low, amount of engine oil fed to turbocharger reduces then the bearings in the turbocharger may adhere due to insufficient lubrication and cooling.
If the cause of the problem is detected, add or change engine oil. If foreign substances are accumulated on the oil screen, wash the oil screen and replace the injector's washer with a new one after checking the injectors for gas leaks. Check the engine oil-related parts, such as oil pump, if necessary.

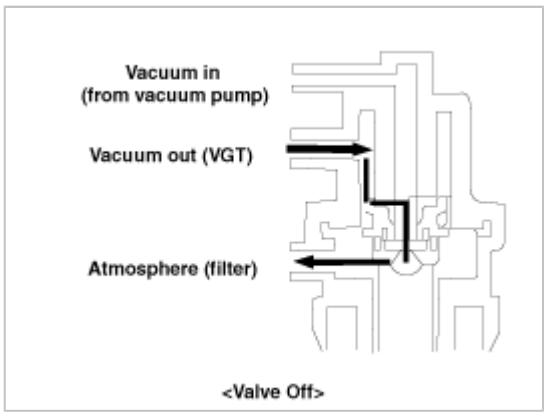
As the turbocharger rotates at high speed of 100,000 rpm or above, deterioration of engine oil can cause damage of the turbocharger bearings. Check engine oil for discoloration, water influx, viscosity degradation and oil pressure lowering.

8. Check the solenoid valve of turbocharger. (Refer to DTC guide)

A. Damage of the solenoid valve: Check if vacuum is generated at the disconnected vacuum hose from the actuator when a forced actuator operating mode is performed by GDS..

B. Clog of the solenoid valve filter: Check if vacuum is released when a forced actuator operating mode is performed from max. duty (95%) to min. duty (5%) by GDS. (If the solenoid valve filter is clogged, the vacuum won't be released or it will take a long time to be released.)





If the solenoid valve is damaged, the actuator does not work properly then it may cause lack of engine power and poor acceleration. If the solenoid valve filter is clogged, vacuum is not released then it may cause damage of the turbocharger by overrunning.

If the solenoid valve is damaged, replace it with a new one.

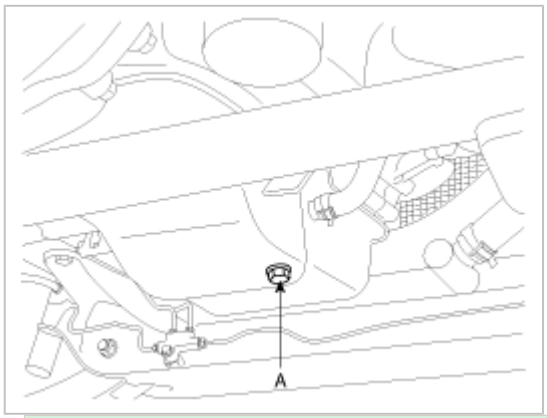
9. Check the injectors, sensors, EGR valve, etc. (Refer to FL group)
   A. Check if the injectors operate properly.
   B. Check if the sensors, such as the mass air flow sensor (MAFS), intake air temperature sensor (IATS), boost pressure sensor (BPS), operate properly.
   C. Check if the exhaust gas recirculation (EGR) valve operates properly.

   If the injectors, sensors, EGR valve and etc. don't work properly, it may cause lack of engine power.
   If the cause of the problem is detected, replace the related parts with new ones.

Engine Oil And Filter Replacement

1. Run the engine until it reaches normal operating temperature.
2. Turn off the engine.
3. Remove the oil filler cap and the drain plug. Drain the engine oil.
4. Tighten the drain plug (A) to the specified torque.

Tightening torque
Oil pan drain plug :
35 ~ 45N.m (3.5 ~ 4.5kgf.m, 25 ~ 33lb-ft)



Whenever tightening the oil drain plug, use a new drain plug gasket.

5. Fill new engine oil through the oil filler cap opening.

Capacity :
Total : 7.8L (8.24 US qt, 6.86 Imp qt)
Oil pan : 6.6L (6.97 US qt, 5.81 Imp qt)
Drain and refill including oil filter :
7.4L(7.82 US qt, 6.51 Imp qt)

Do not overfill. This will cause oil aeration and loss of oil pressure.

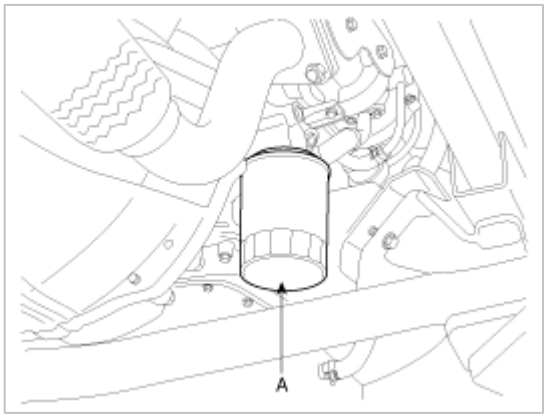
6. Install the oil filler cap.
7. Start and run the engine.
8. Turn off the engine and then check the oil level. Add oil if necessary.

Oil Filter

1. Use a filter wrench to remove the oil filter.
2. Before installing the new oil filter on the engine, apply clean engine oil of the surface of the rubber gasket.

3. Tighten the oil filter (A) of the specified torque.

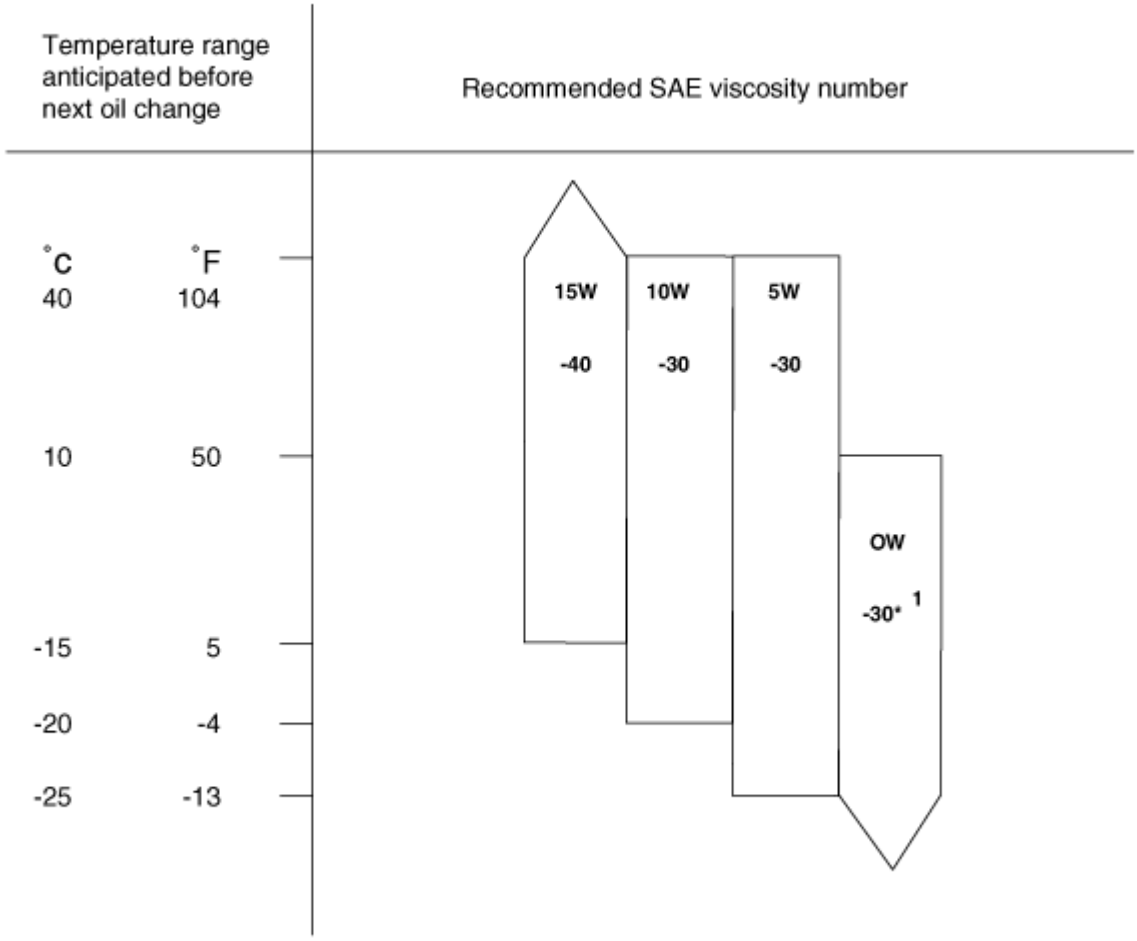
Oil filter :
21.6 ~ 24.5N.m (2.2 ~ 2.5kgf.m, 15.9 ~ 18.1lb-ft)



4. Start and run the engine and check for engine oil leaks.
5. After stopping the engine, check the oil level and add oil as necessary.

Selection Of Engine Oil

ACEA classification : C3 (with DPF), B4 (without DPF)
SAE viscosity grades : Refer to the recommended SAE viscosity number



*1 Restricted by driving condition and environment.
Not recommended for sustained high speed vehicle operation.

For best performance and maximum protection of all types of operation, select only those lubricants which :

1. Satisfy the requirement of the ACEA classification.
2. Have proper SAE grade number for expected ambient temperature range.

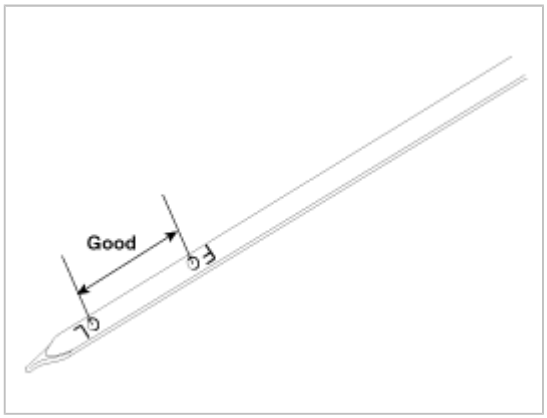
- Lubricants that do not have both an SAE grade number and ACEA service classification on the container should not be used.
- The ACEA certified engine oil is required as a service engine oil. Only in case that ACEA certified engine oil is not available, the API certified engine oil (API CH-4 or above) is allowed restrictively.
- For the vehicle equipped with DPF, the service engine oil quality should meet the ACEA C3 grade. However, oil refill with small amount of ACEA B4 grade between oil change intervals is possible.

Inspection

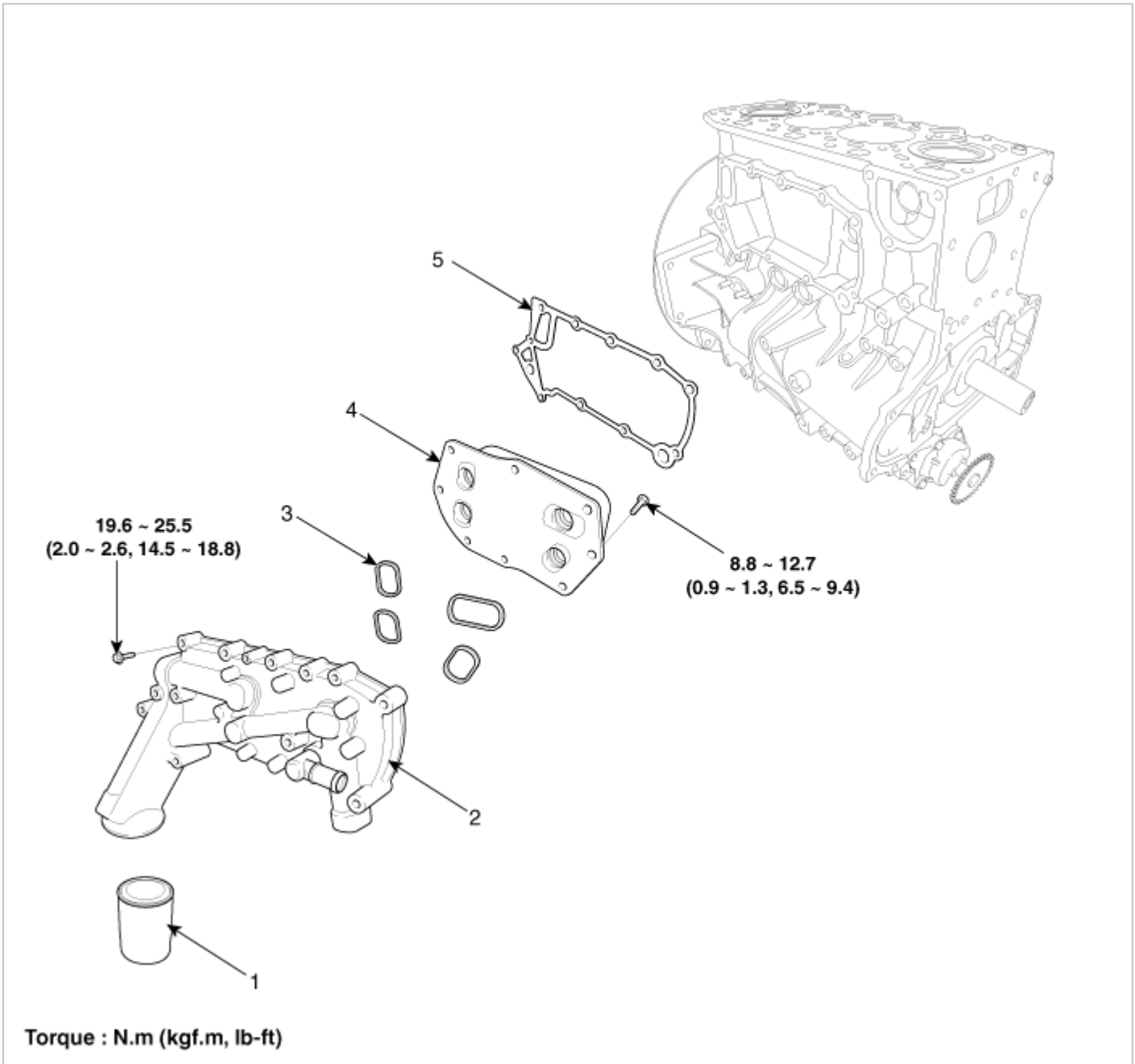
1. Position a vehicle on a level surface.
2. Turn off the engine.

> If a vehicle that has not been used for a prolonged period, run the engine for several minutes. Turn off the engine and wait for 5 minutes at least, and then check the oil level.

3. Check that the engine oil level is within the level range indicated on the oil dipstick. If the oil level is found to have fallen to the lower limit (the "L" mark), refill to the "F" mark.
4. Check that the oil is not dirty or mixed with coolant or gasoline and it has the proper viscosity.



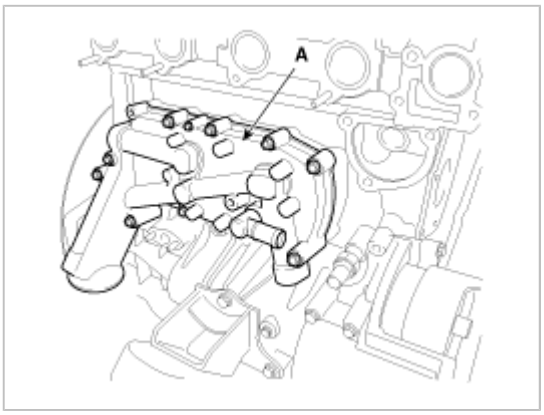
Components



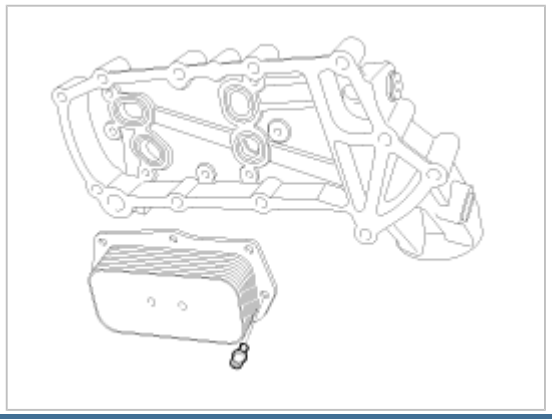
1. Oil filter 2. Oil cooler cover 3. O-ring	4. Oil cooler element 5. Gasket

Removal

1. Drain engine coolant and engine oil.
2. Remove the engine oil filter.
3. Remove the oil cooler assembly (A) from the cylinder block.



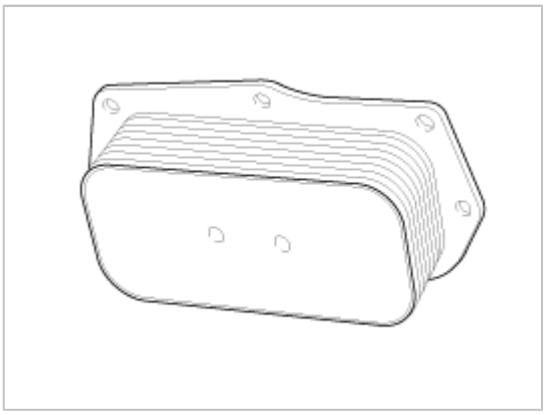
4. Remove the oil cooler(B) from the oil cooler cover(A).



Inspection

Oil Cooler

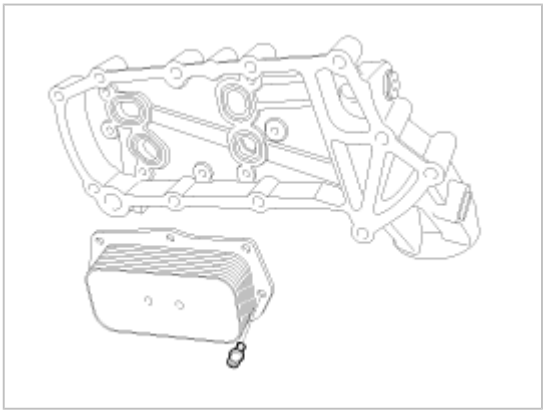
1. Inspect visually the core for clogging or damage, and replace it if a problem is found.



Installation

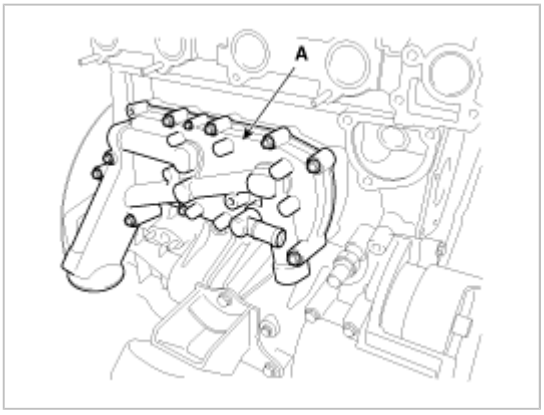
1. Install the oil cooler (B) to oil cooler cover (A).

Tightening torque
8.8 ~ 12.7N.m (0.9 ~ 1.3kgf.m, 6.5 ~ 9.4lb-ft)



2. Install the oil cooler assembly (A) to the cylinder block with new gasket.

Tightening torque :
19.6 ~ 25.5N.m (2.0 ~ 2.6kgf.m, 14.5 ~ 18.8lb-ft)



3. Install the engine oil filter.

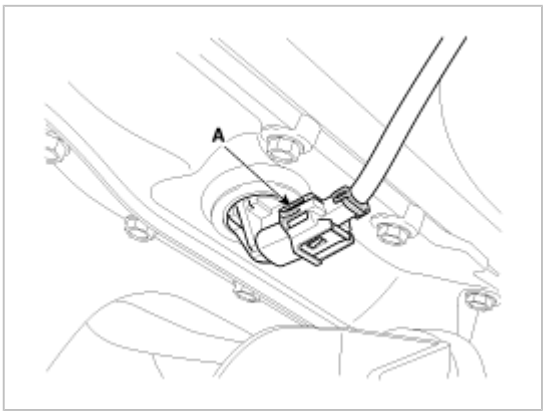
Tightening torque :
21.6 ~ 24.5N.m (2.2 ~ 2.5kgf.m, 15.9 ~ 18.1lb-ft)

4. Refill the engine oil and engine coolant.
5. Check for oil and coolant leak.

Removal and Installation

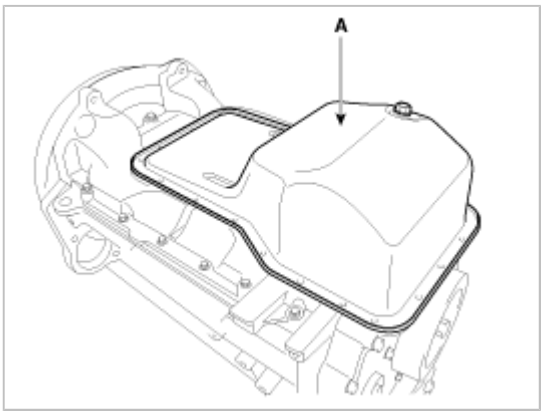
When the oil sensor signal fault occurs, refer to the DTC guide.

1. Drain the engine oil.
2. Disconnect the oil level sensor connector (A).

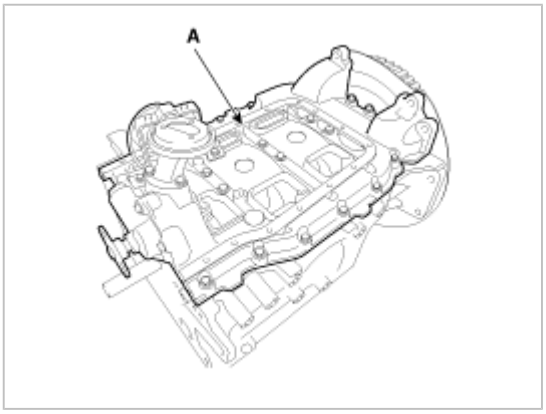


3. Remove the oil pan (A).

Tightening torque:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

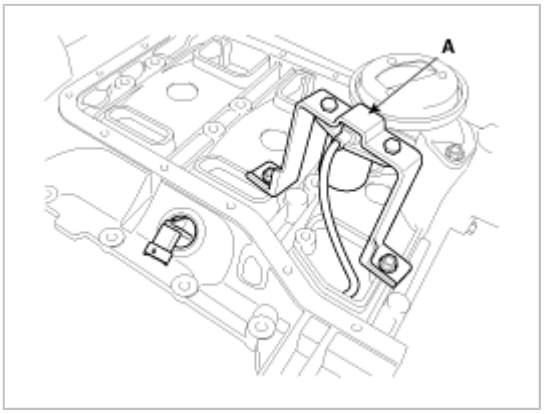


4. Remove the timing system. (Refer to Timing System)
5. Remove the oil pump complete (A). (Refer to Cylinder block in this group)



6. Remove the oil level sensor (A) from the oil pump complete.

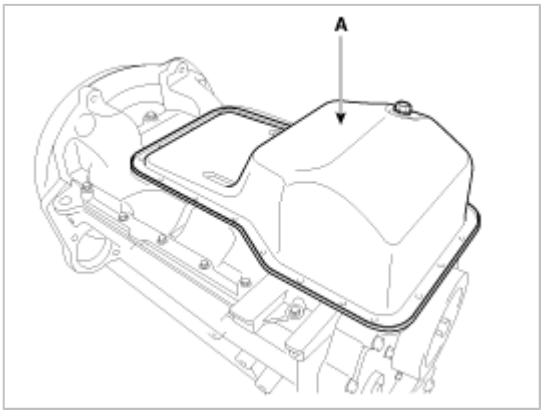
Tightening torque:
8.8 ~ 9.8N.m (0.9 ~ 1.0kgf.m, 6.5 ~ 7.2lb-ft)



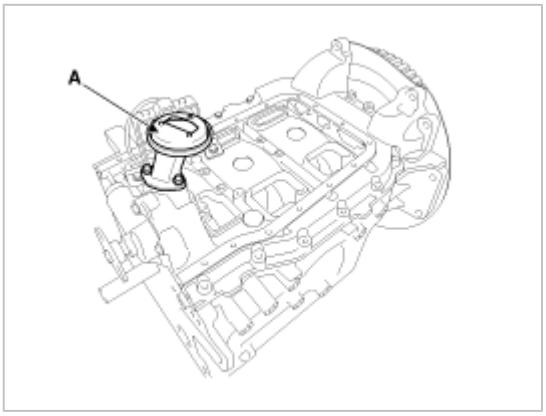
7. Installation is reverse order of removal.

Removal

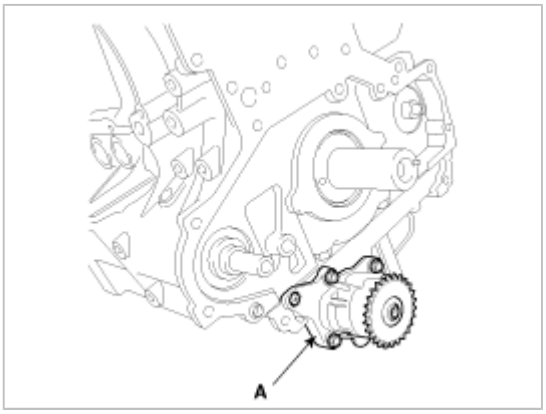
1. Drain engine oil.
2. Remove the oil pan (A).



3. Remove the oil screen (A) from the oil pump.



4. Remove the timing system. (Refer to Timing System)
5. Remove the oil pump cover (A).



Inspection

1. Make sure the outer rotor and inner rotor turn smoothly with no excessive play between them.
2. Check the side clearance.

Side clearance :

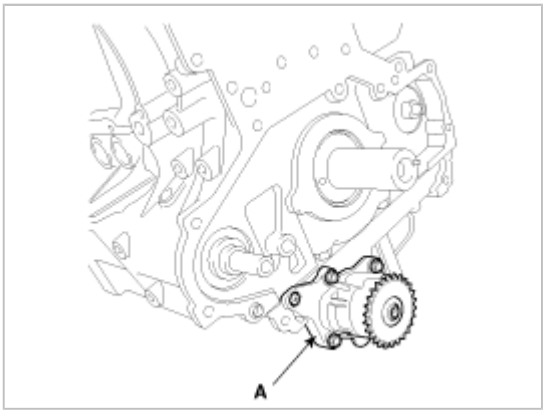
Inner rotor : 0.040 ~ 0.085 mm (0.0016 ~ 0.0033 in)
Outer rotor : 0.050 ~ 0.100 mm (0.0020 ~ 0.0039 in)

3. If clearance is excessive, replace the oil pump.

Installation

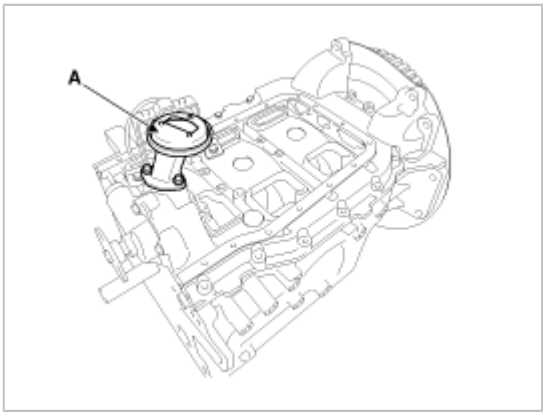
1. Install the oil pump cover.

Tightening torque
Bolts :
8.8 ~ 12.7N.m (0.9 ~ 1.3kgf.m, 6.5 ~ 9.4lb-ft)
Screw :
5.9 ~ 8.8N.m (0.6 ~ 0.9kgf.m, 4.3 ~ 6.5lb-ft)



2. Install the timing system. (Refer to Timing System)
3. Install the oil screen (A) to the oil pump.

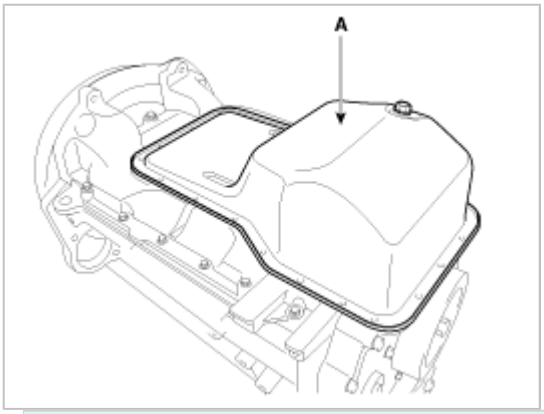
Tightening torque :
7.8 ~ 11.8N.m (0.8 ~ 1.2kgf.m, 5.8 ~ 8.7lb-ft)



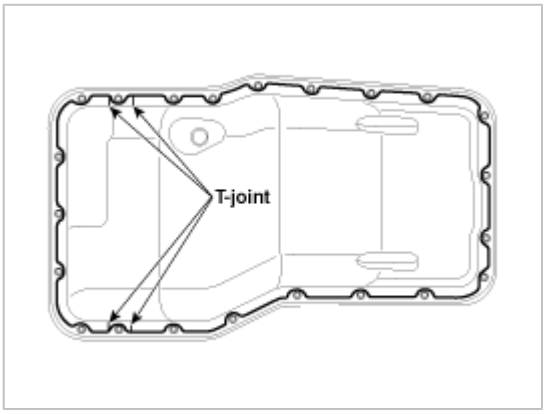
4. Install the oil pan (A).

Tightening torque :

9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

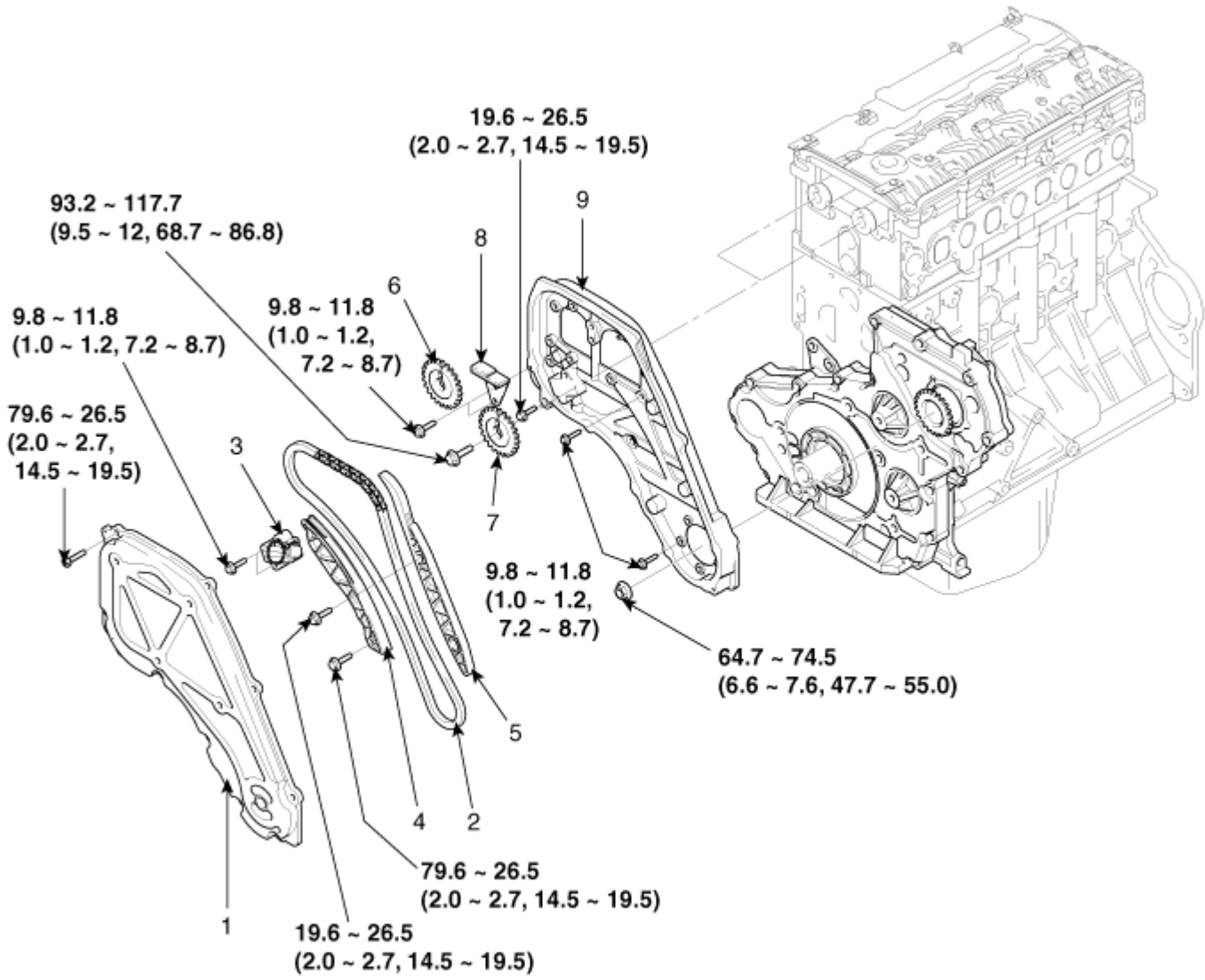


Then apply the sealant additionally to prevent the oil leak to the overlapping part (T-joint : 4 points right and left of the engine), where bed plate timing chain lower under cover, timing chain lower front cover and oil pan overlap.



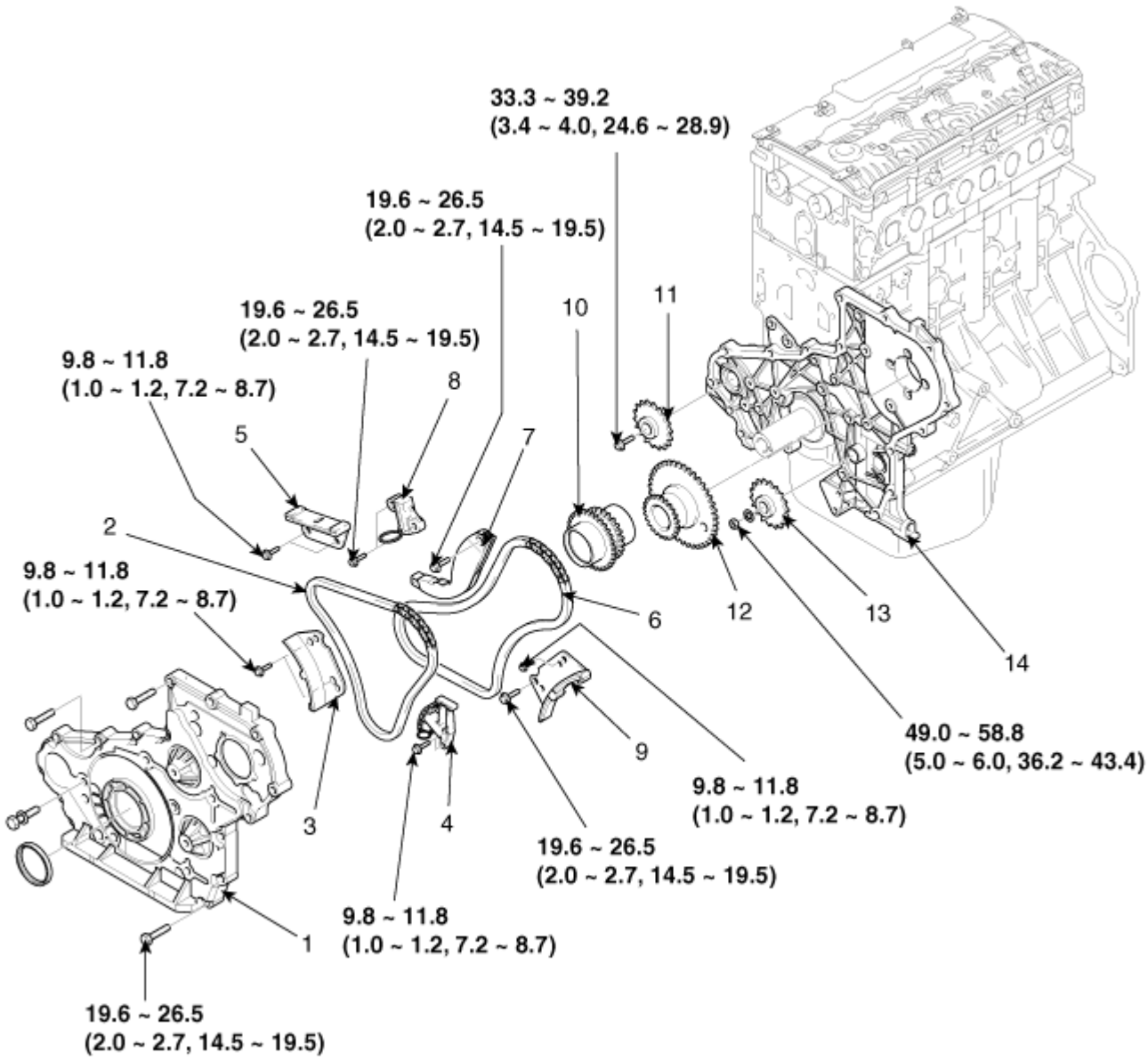
5. Refill engine oil and check for oil leak.

Components



Torque : N.m (kgf.m, lb-ft)

1. Timing chain upper front cover	6. RH Camshaft sprocket
2. Timing chain "C"	7. LH Camshaft sprocket
3. Auto-tensioner "C"	8. Guide "C2"
4. Lever "C"	9. Timing chain upper under cover
5. Guide "C1"	



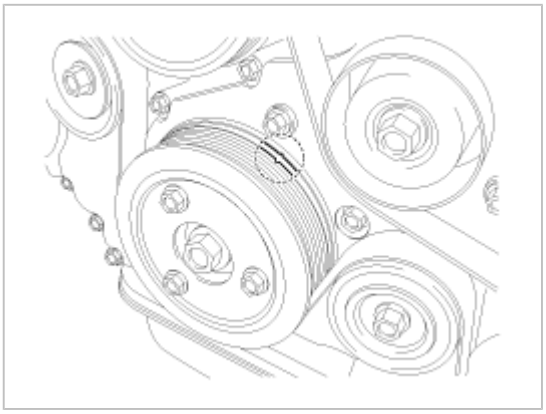
Torque : N.m (kgf.m, lb-ft)

1. Timing chain lower front cover	8. Auto tensioner "A"
2. Timing chain "B"	9. Guide "A"
3. Guide "B2"	10. Crankshaft sprocket
4. Auto tensioner "B"	11. RH Balance shaft sprocket
5. Guide "B1"	12. High pressure pump sprocket
6. Timing chain "A"	13. LH Balance shaft sprocket
7. Lever "A"	14. Timing chain lower under cover

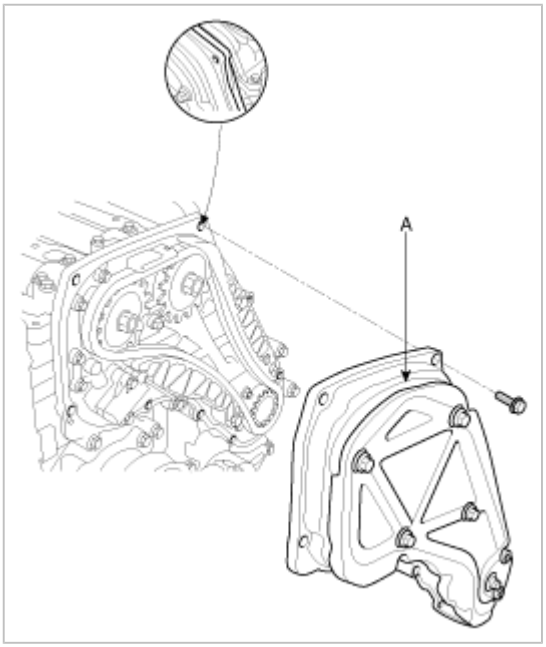
Removal

Timing Chain "C"

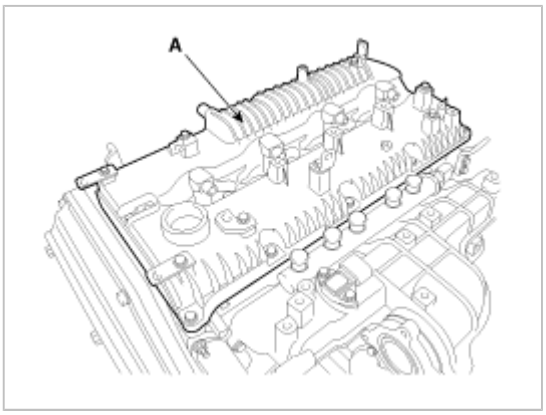
1. Rotate the crankshaft pulley to align the timing mark with TDC mark, in which No.1 piston locates at the top dead center of compression stroke.



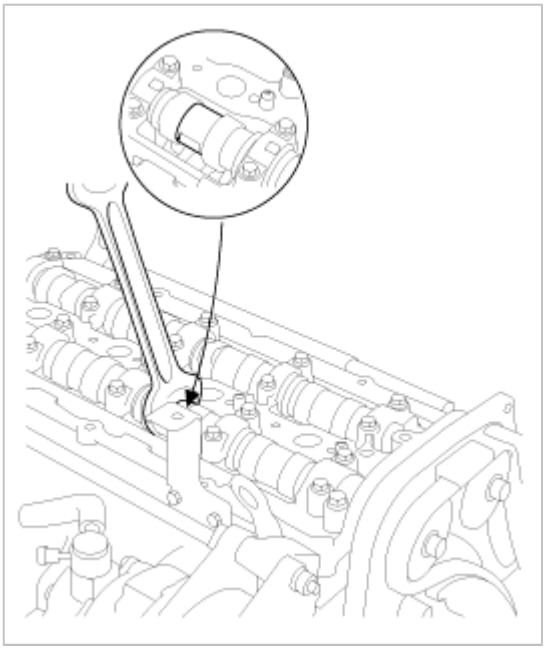
2. Remove the timing chain upper front cover(A).



3. Remove the cylinder head cover (A).

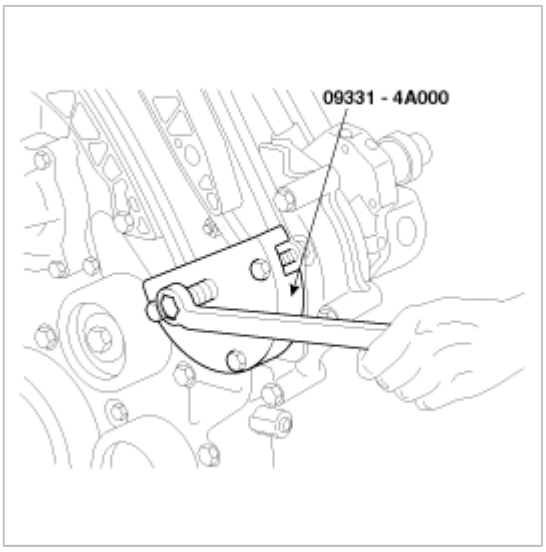


4. Holding the slot of the camshaft with the spanner, loosen the bolts for the high-pressure pump sprocket and camshaft sprocket.

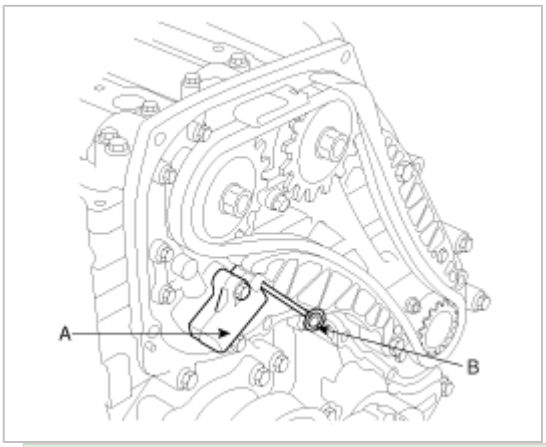


5. Insert the SST(09311-4A00) into timing chain upper cover.
   And then remove the high pressure pump and sprocket.

> Loosen the high pressure pump fixing bolts first working.

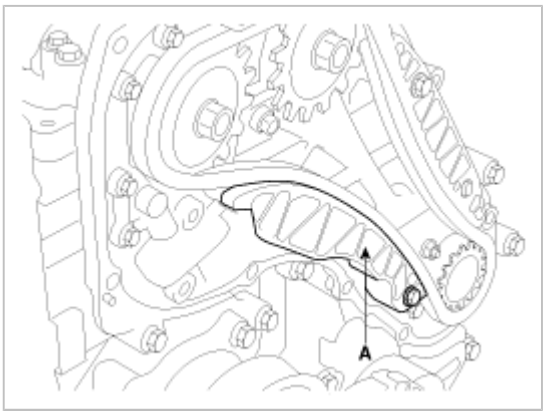


6. Remove the timing chain auto-tensioner "C"(A).

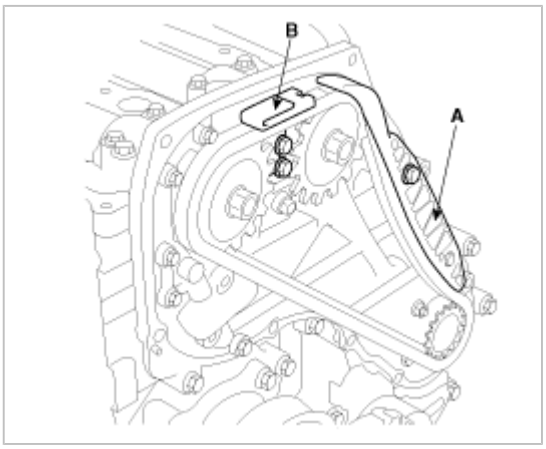


Before removing auto-tensioner "C", install a set pin (B) (Ø2.5mm steel wire) after compressing the tensioner so that inner parts are not missing during disassembly.

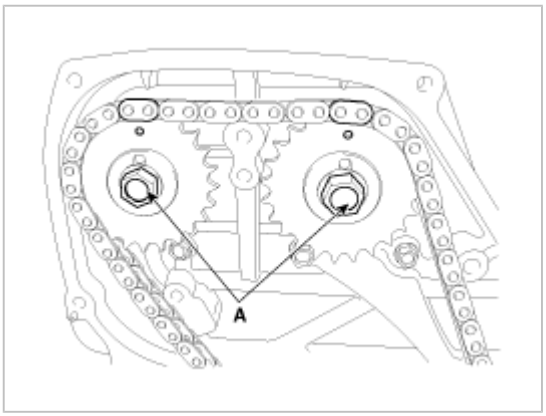
7. Remove the timing chain lever "C" (A).



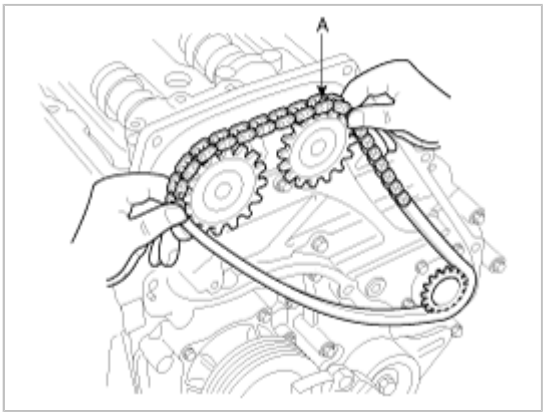
8. Remove the timing chain guide "C(1)(A), C(2)(B)".



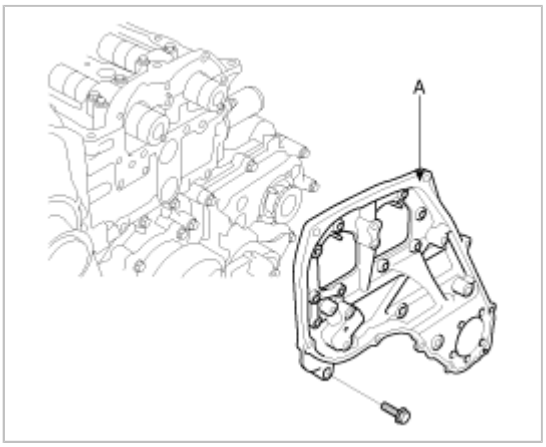
9. Remove the LH and RH camshaft sprocket bolts (A).



10. Remove the timing chain "C" (A) with the camshaft sprocket.

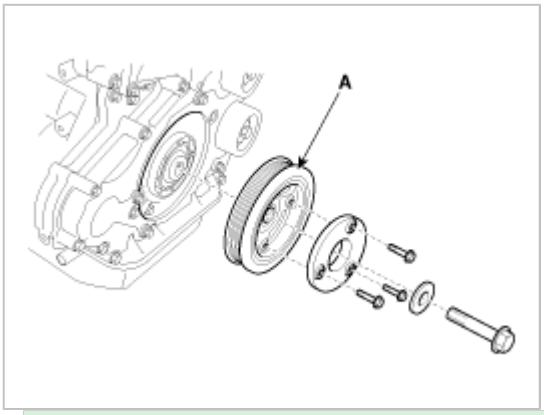


11. Remove the timing chain upper under cover (A).



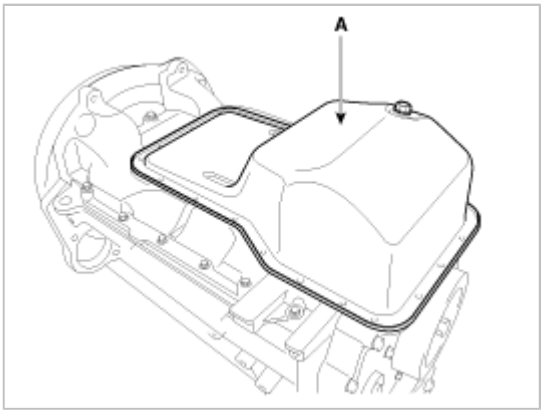
Timing Chain "B"

1. Remove the timing chain "C".
2. Remove the crankshaft pulley (A).

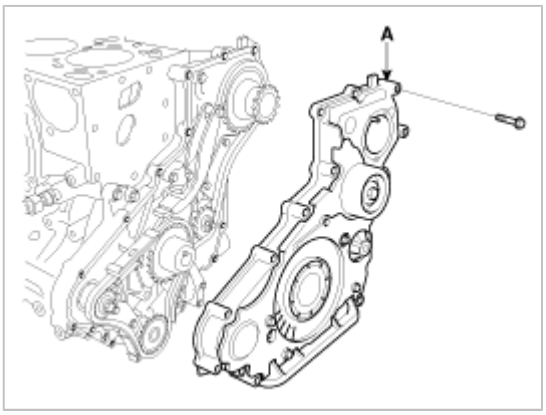


Use the SST (09231-2B100) to remove the crankshaft pulley bolt, after remove the starter.

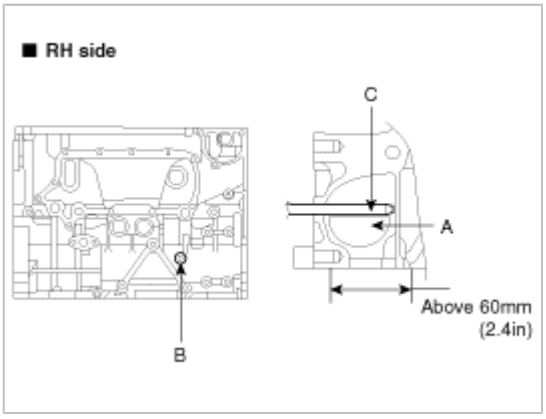
3. Remove the oil pan (A).



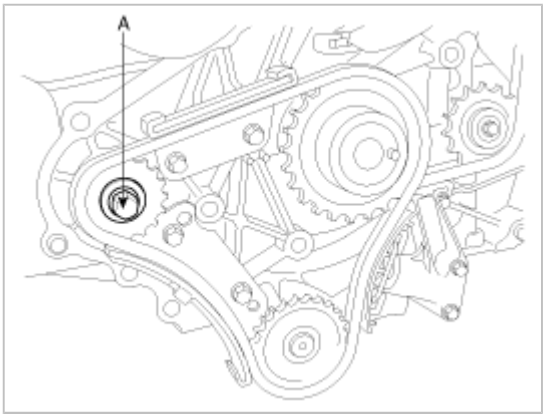
4. Remove the timing chain lower front cover (A).



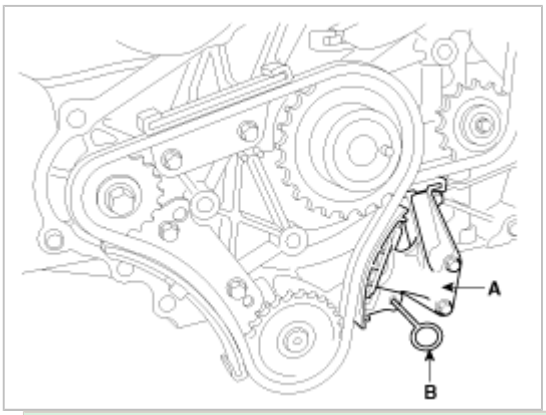
5. To prevent the rotation of RH balance shaft (A), remove the plug (B) at the side of cylinder block and insert the screwdriver (C) (or bolt) with an 8 mm(0.32in) diameter into the plughole more than 60 mm (2.4in).



6. Loosen the RH balance shaft sprocket bolt (A).

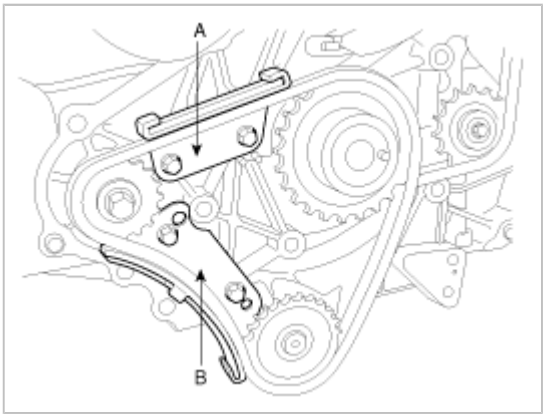


7. Remove the timing chain auto-tensioner "B" (A).

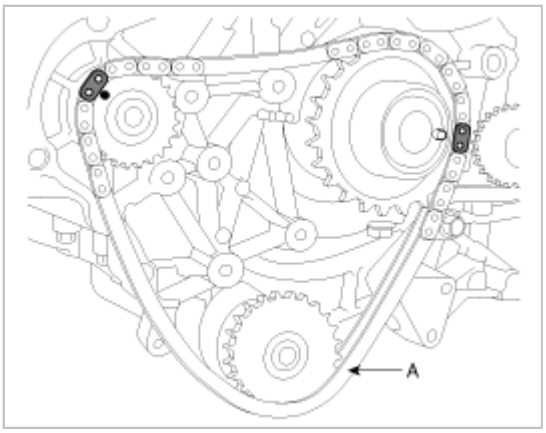


Before removing auto-tensioner "B", install a set pin (Ø2.5mm wire) after compressing the tensioner.

8. Remove the timing chain guide "B(1)(A), B(2)(B)".

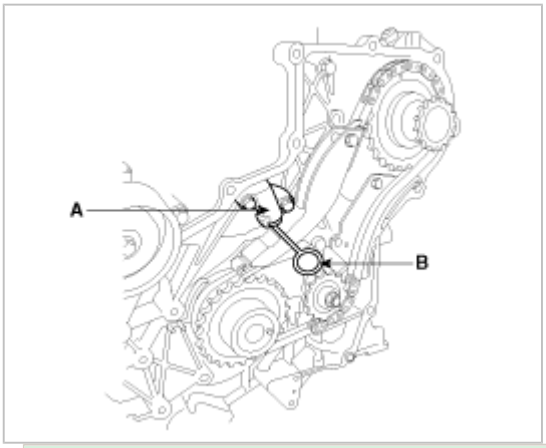


9. Remove the RH balance shaft sprocket bolt.
10. Remove the timing chain "B"(A) with the RH balance shaft sprocket.



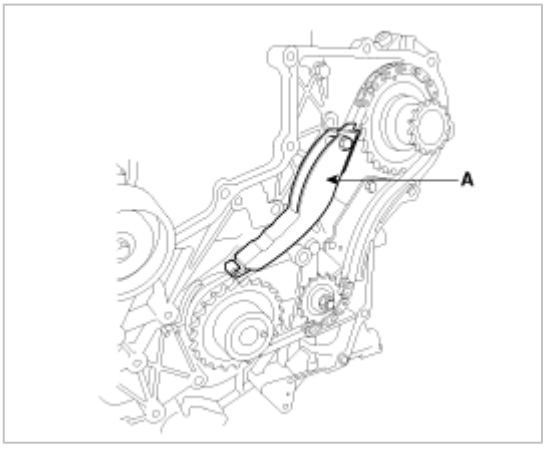
Timing Chain "A"

1. Remove the timing chain "C" and "B".
2. Loosen the high-pressure pump sprocket.
3. Remove the timing chain auto-tensioner "A" (A).

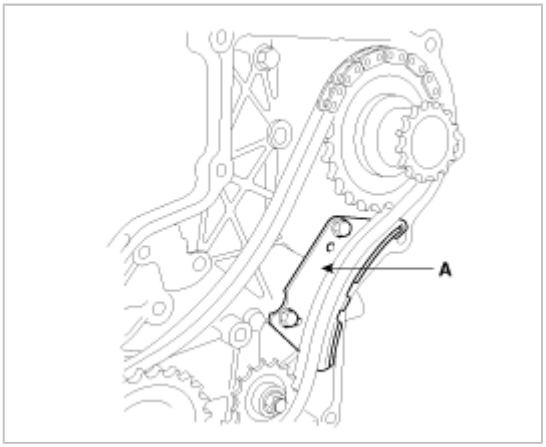


Before removing auto-tensioner "A", install a set pin (Ø2.5mm wire) after compressing the tensioner.

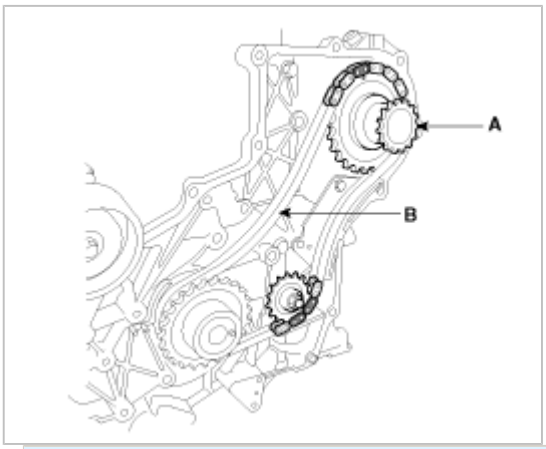
4. Remove the timing chain lever "A" (A).



5. Remove the timing chain guide "A" (A).



6. Remove the timing chain "A" (B) with the high-pressure pump sprocket (A).

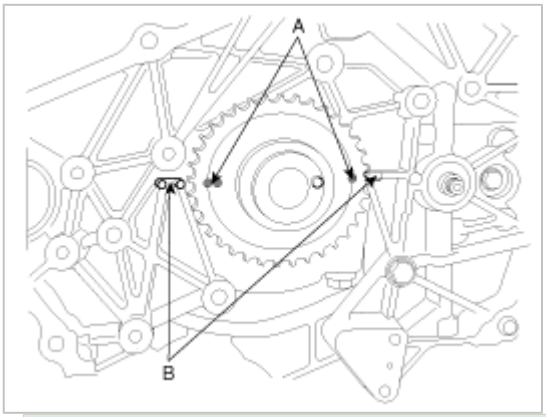


Remove thoroughly sealant and oil etc left at the sealing surface after remove the chain cover and oil pan. (If any impurities are left at the sealing face, oil may leak after reassembly even with the sealant application.)

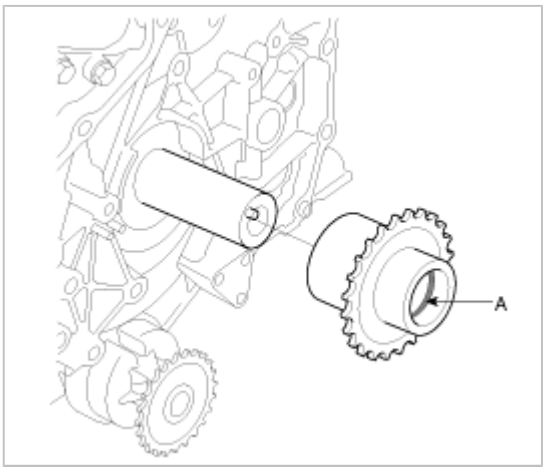
Installation

Timing Chain "A"

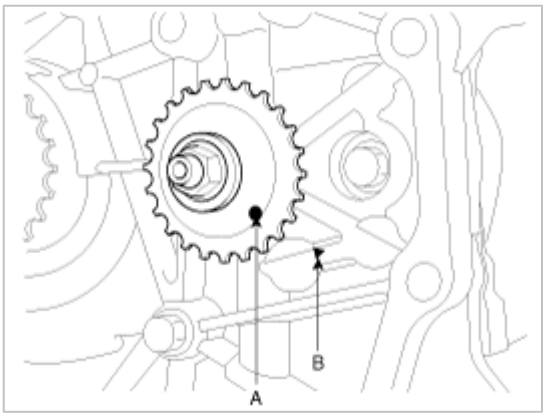
1. Check the worn of timing chain, lever, guide and sprocket and replace them if necessary.
2. Install the crankshaft sprocket as the timing mark of crankshaft sprocket aligns with the timing mark(A) of lower under cover(B), at which No.1 piston locates at the top dead center of compression stroke.



In installing crankshaft sprocket, apply oil to the O ring inside the sprocket.

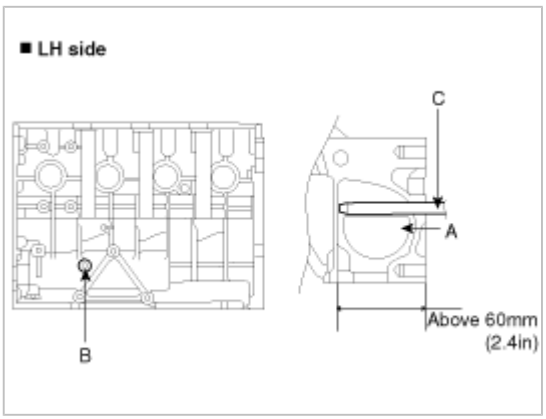


3. Align the timing mark of LH balance sprocket(A) with the timing mark of timing chain lower under cover (B).



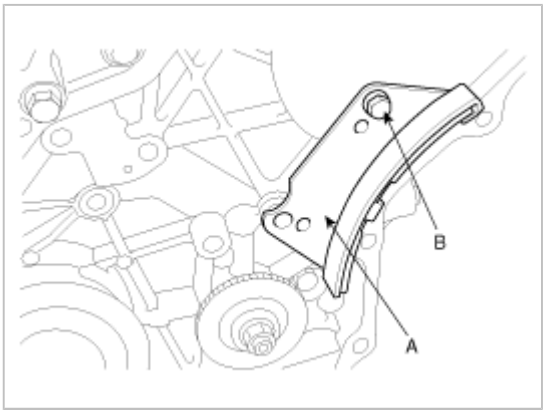
4. Check the LH balance shaft (A) whether it is located at the right position. To prevent the rotation of balance shaft, remove plug (B) at the side of cylinder block. Insert screwdriver (C) (or bolt) with an 8 mm (0.32in) diameter into the plughole and check whether it slides more than 60 mm (2.4in).

When the screwdriver (or bolt) depth is about 25~30mm(1~1.2in), rotate LH balance shaft sprocket 1 revolution. And insert the screwdriver (or bolt) again to check whether it slides more than 60mm(2.4in).

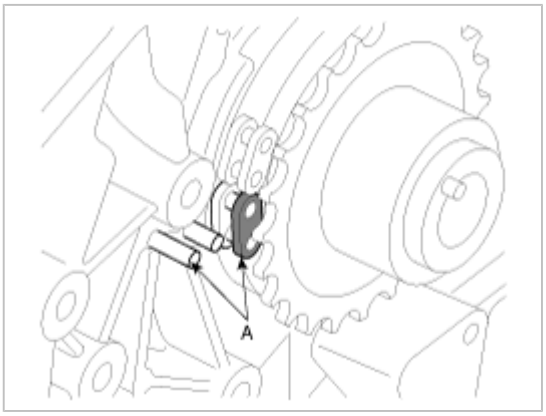


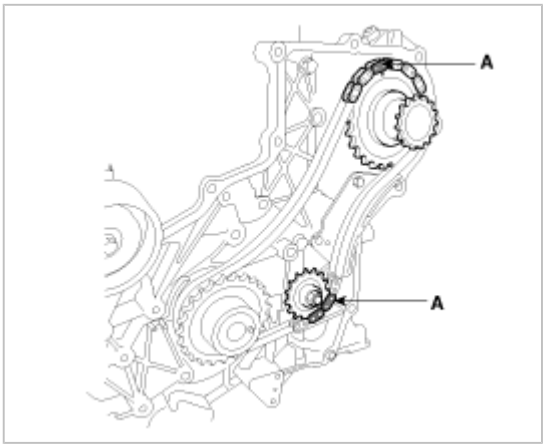
5. Assemble the upper bolt (B) of timing chain guide "A"(A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



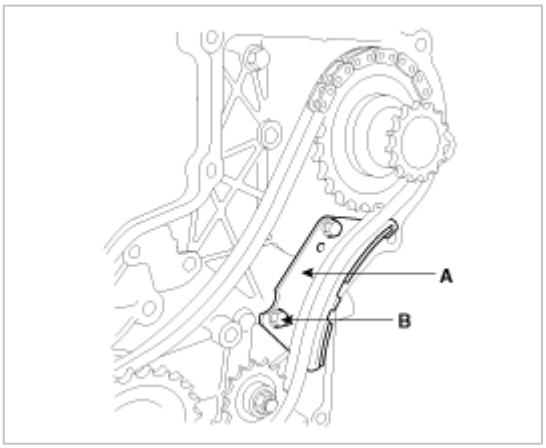
6. Align the timing marks of sprocket and chain when high-pressure pump sprocket is not installed to pump.
7. Using the chain connected to the high-pressure pump sprocket, install as the timing marks of LH balance shaft sprocket(A) and crankshaft sprocket align with each other.





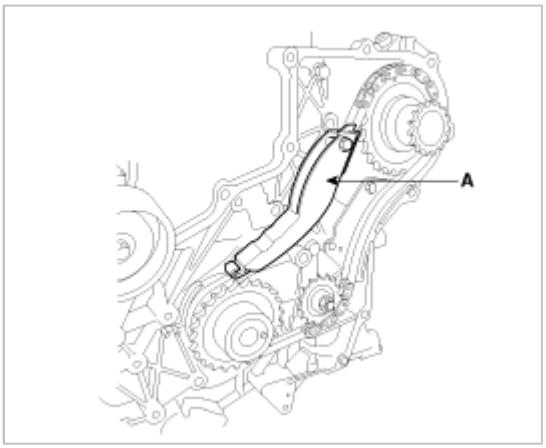
8. Assemble the high-pressure pump sprocket to the high-pressure pump tentatively.
9. Install the other bolt (B) of the timing chain guide "A" (A) at the lower side and tighten it.

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



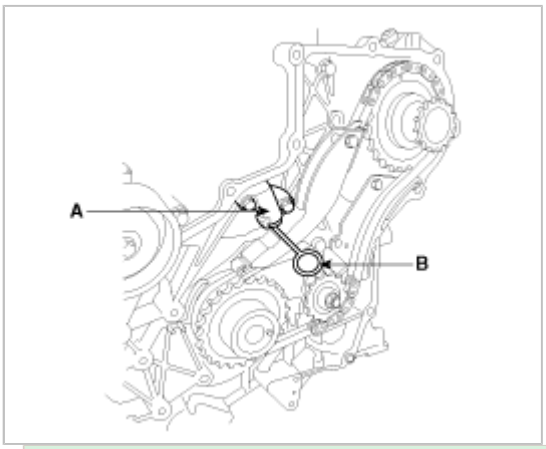
10. Install the timing chain lever "A" (A).

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



11. Install the timing chain auto-tensioner "A" (A), and remove a set pin (B) from the auto-tensioner.

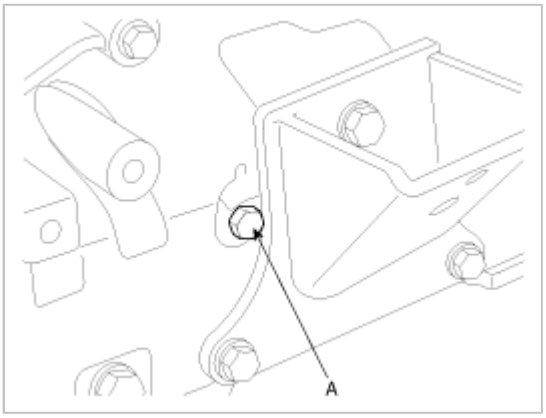
Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



After assembling timing chain, check whether chain is assembled within the rail at both sides.

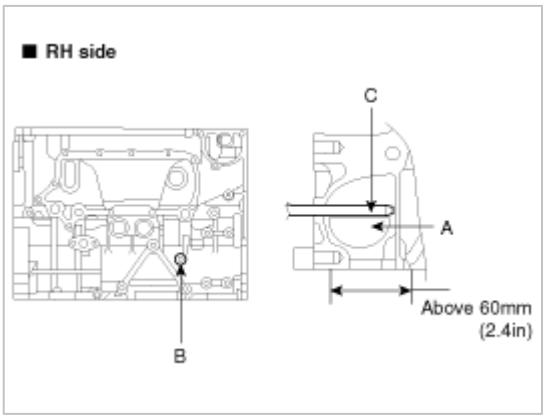
12. Remove the screwdriver (or bolt) from the plughole and install the plug(A).

Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)

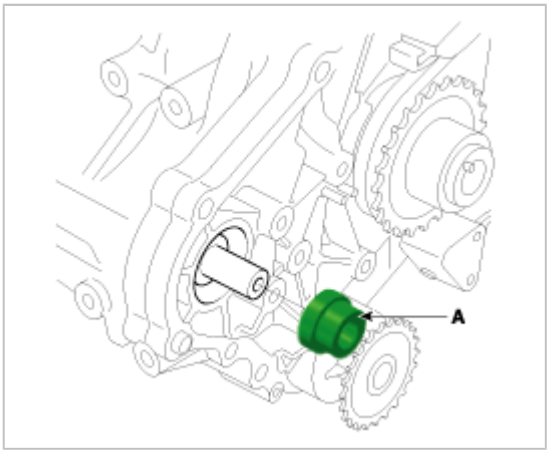


Timing Chain "B"

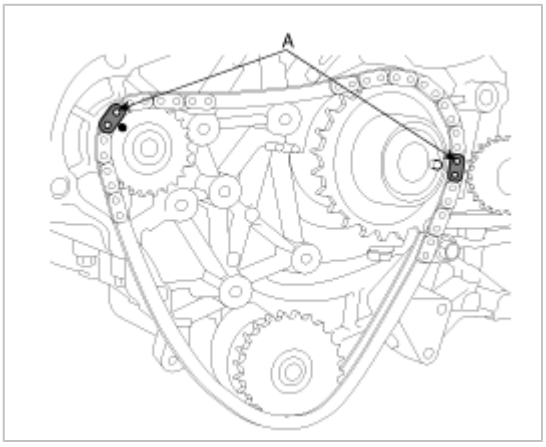
1. Check the worn of timing chain, lever, guide and sprocket and replace them if necessary.
2. Install the timing chain "A".
3. Check the RH balance shaft(A) whether it is located at the right position. To prevent the rotation of balance shaft, insertthe screwdriver(C) (or bolt) into the plughole(B) at the side of cylinder block and check whether it slides more than 60 mm(2.4in).



4. Install the space washer(A) from RH balance shaft.

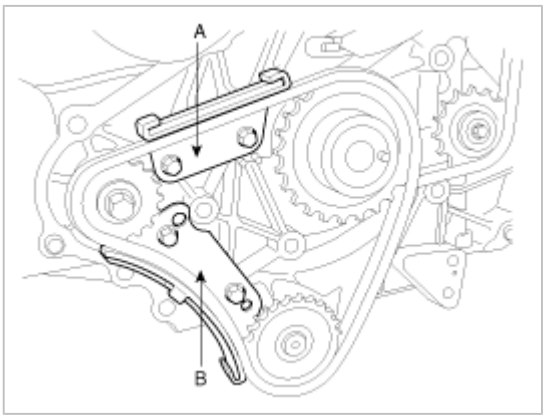


5. Using the chain connected to RH balance shaft sprocket, install as the timing marks(A) of crankshaft sprocket and oil pump sprocket align with each other.



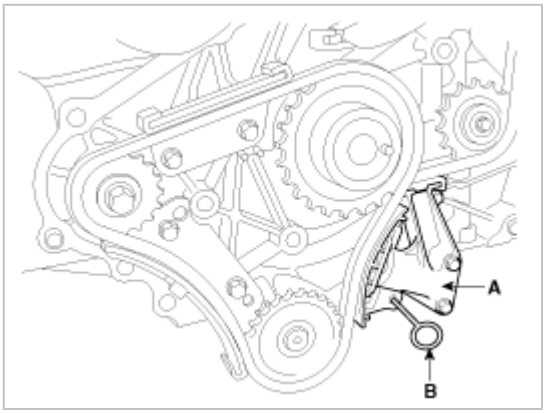
6. Assemble the RH balance shaft sprocket to the balance shaft tentatively.
7. Install the timing chain guide "B(1)(A), B(2)(B)".

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



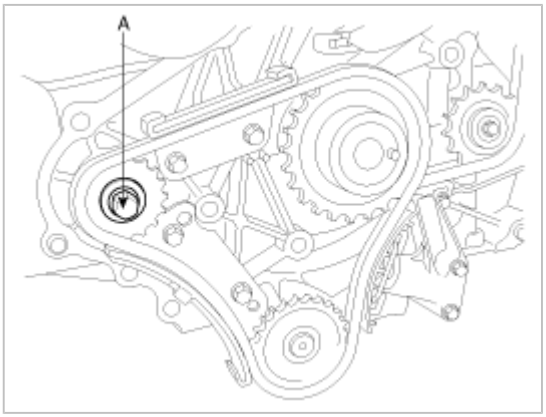
8. Install the timing chain auto-tensioner "B" (A), and remove the set pin (B) from the auto-tensioner.

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)



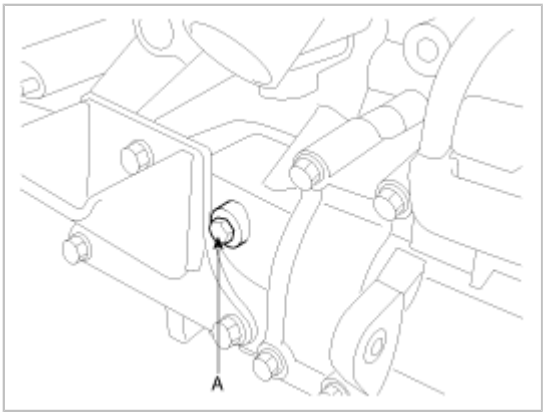
9. Assemble the RH balance shaft sprocket bolt(A).

Tightening torque :
33.3 ~ 39.2N.m (3.4 ~ 4.0kgf.m, 24.6 ~ 28.9lb-ft)



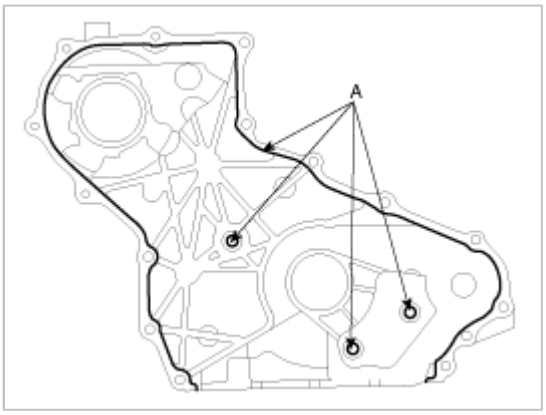
10. Remove the screwdriver(or bolt) from the plughole(A) and install the plug.

Tightening torque :
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.8 ~ 15.9lb-ft)



11. Apply the sealant (A) at the timing chain lower front cover.

Sealant type : Lotite #5902
Bead width : 2 ~ 4 mm(0.08 ~ 0.16 in)

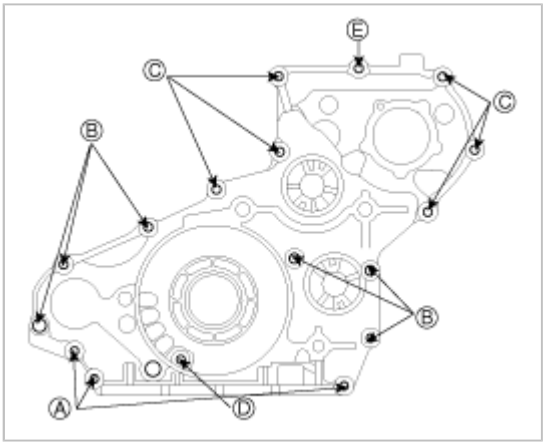


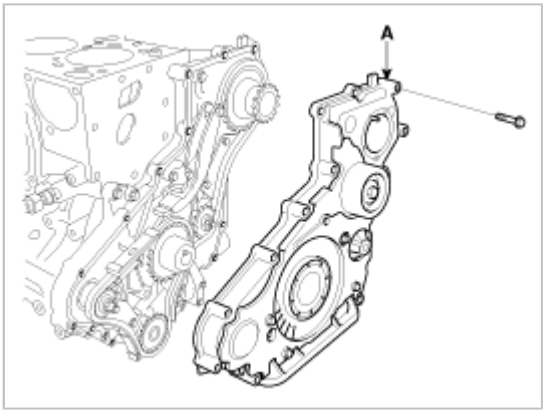
12. Install the timing chain lower front cover(A).

Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)
A	8 x 80	4 EA	19.6 ~ 26.5 (2.0 ~ 2.7, 14.5 ~ 19.5)
B	8 x 70	6 EA	19.6 ~ 26.5 (2.0 ~ 2.7, 14.5 ~ 19.5)
C	8 x 50	6 EA	19.6 ~ 26.5 (2.0 ~ 2.7, 14.5 ~ 19.5)
D	8 x 40	1 EA	19.6 ~ 26.5 (2.0 ~ 2.7, 14.5 ~ 19.5)

E	8 x 22	1 EA	19.6 ~ 26.5 (2.0 ~ 2.7, 14.5 ~ 19.5)

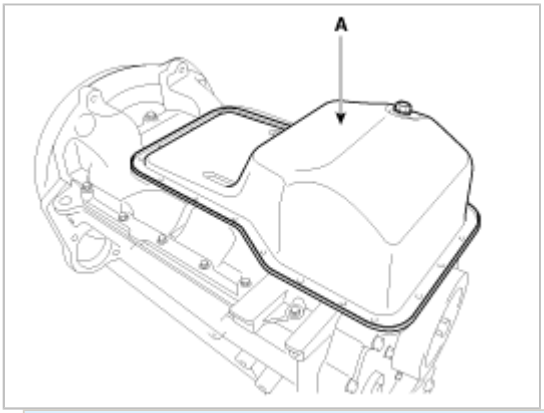
* Bolt Size = Diameter x Length



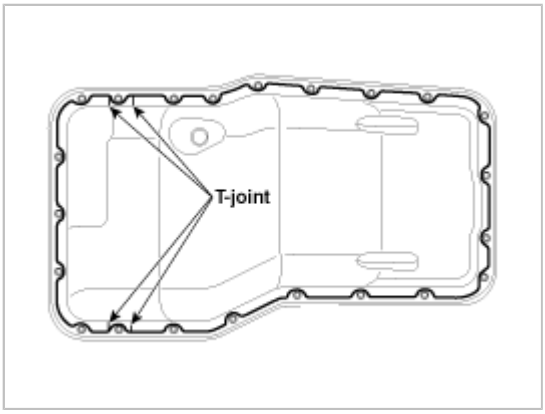


13. Install the oil pan (A).

Tightening torque :
9.8 ~ 11.8 N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

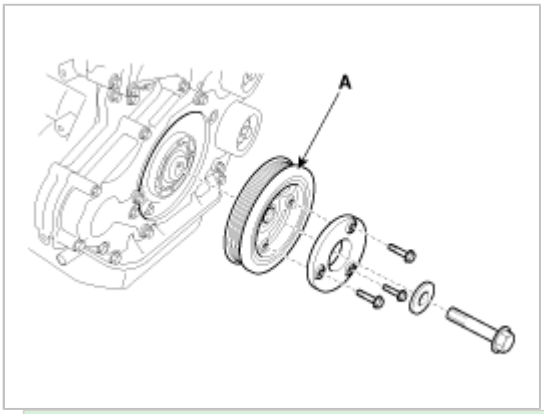


Then apply the sealant additionally to prevent the oil leak to the overlapping part (T-joint: 4 points right and left of the engine), where bed plate, timing chain lower under cover, timing chain lower front cover and oil pan overlap.



14. Install the crankshaft pulley (A) and tighten the crankshaft pulley bolt.

Tightening torque :
274.6 ~ 294.2N.m (28 ~ 30kgf.m, 202.5 ~ 217.0lb-ft)



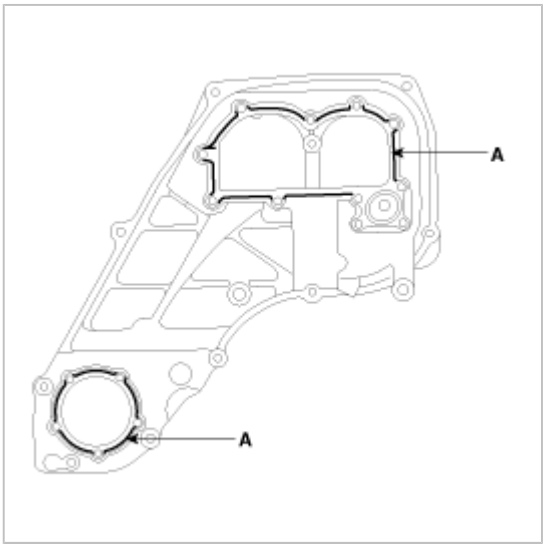
Use the SST (09231-2B100) to remove the crankshaft pulley bolt, after remove the starter.

Timing Chain "C"

1. Check the worn of the timing chain, lever, guide and sprocket and replace them if necessary.
2. Install the timing chain "A" and "B".
3. Apply the sealant(A) at the timing chain upper under cover.

Sealant type : Lotite #5902
Bead width : 2 ~ 4mm (0.08 ~ 0.16in)

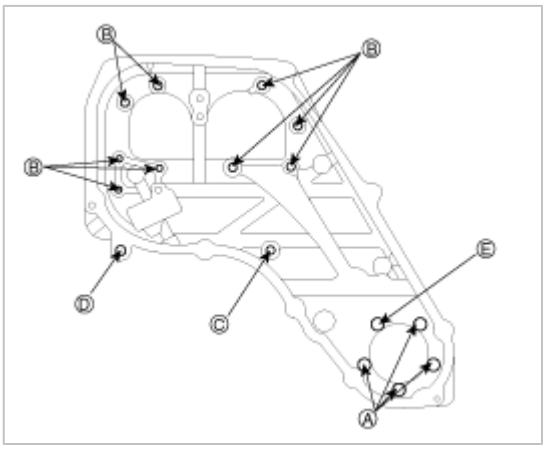
Then apply the sealant additionally to prevent the oil leak to the overlapping part (T-joint : 2 points right and left of the engine), where cylinder head, timing chain cover plate and timing chain upper under cover overlap.

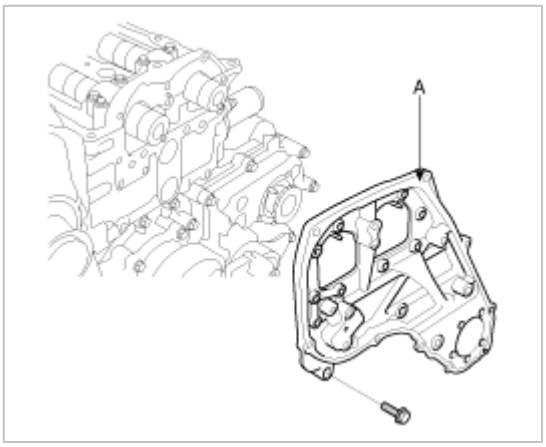


4. Install the timing chain upper under cover(A).

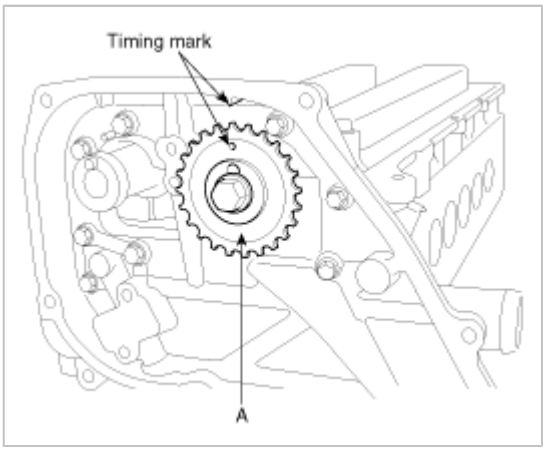
Bolt	Size	Quantity	Tightening torque N.m (kgf.m, lb-ft)
A	6 x 14	4 EA	9.8 ~ 11.8 (1.0 ~ 1.2, 7.2 ~ 8.7)
B	6 x 22	9 EA	9.8 ~ 11.8 (1.0 ~ 1.2, 7.2 ~ 8.7)
C	8 x 22	1 EA	19.6 ~ 26.5 (2.0 ~ 2.7, 14.5 ~ 19.5)
D	8 x 40	1 EA	19.6 ~ 26.5 (2.0 ~ 2.7, 14.5 ~ 19.5)
E	Nut	1 EA	9.8 ~ 11.8 (1.0 ~ 1.2, 7.2 ~ 8.7)

* Bolt Size = Diameter x Length

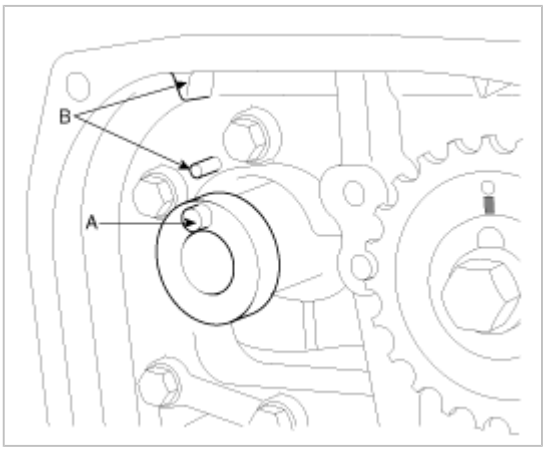




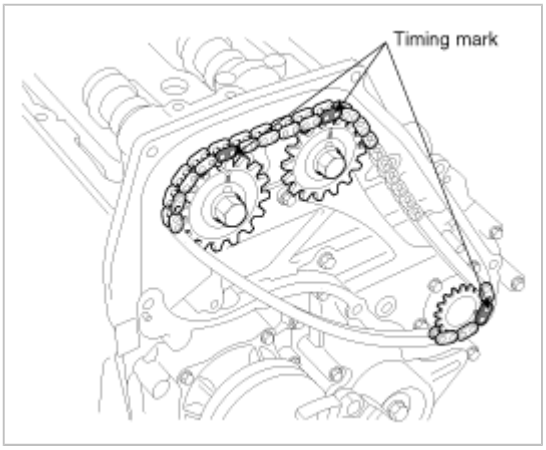
5. Assemble the LH camshaft sprocket(A) tentatively, and align the timing mark with that of timing chain upper under cover.



6. Align the RH camshaft dowel pin(A) with the timing mark(B) of the timing chain upper under cover.

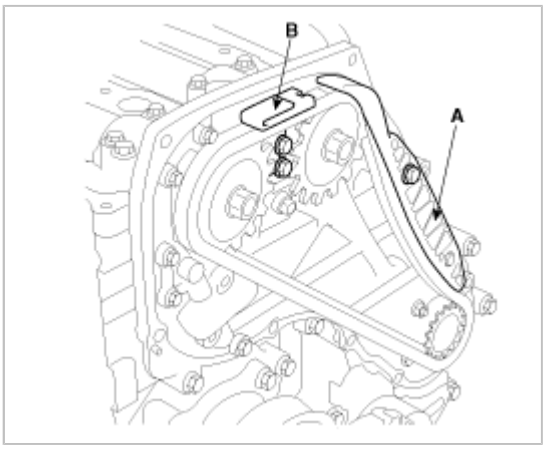


7. Align the timing marks of sprocket and chain when RH camshaft sprocket is not installed to the camshaft.
8. Using the chain connected to the RH camshaft sprocket, install as the timing marks of high-pressure pump sprocket and LH camshaft sprocket align with each other.



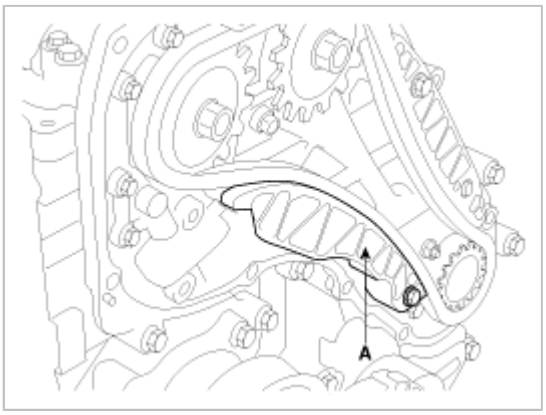
9. Assemble the RH camshaft sprocket to the RH camshaft tentatively.
10. Install the timing chain guide "C(1)(A), C(2)(B)".

Tightening torque :
A : 19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)
B : 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



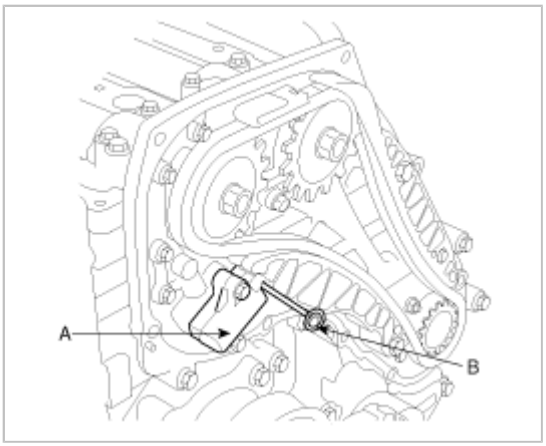
11. Install the timing chain lever "C"(A).

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)



12. Install the timing chain auto-tensioner "C"(A), and remove the set pin(B) from the auto-tensioner.

Tightening torque :
9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

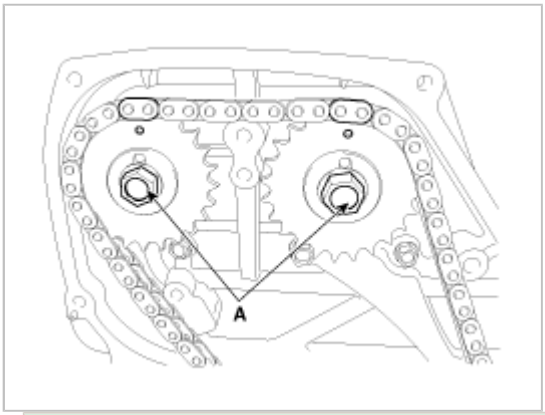


13. Assemble the high-pressure pump sprocket bolt.

Tightening torque :
64.7 ~ 74.5N.m (6.6 ~ 7.6kgf.m, 47.7 ~ 55.0lb-ft)

14. Assemble camshaft sprocket bolt.

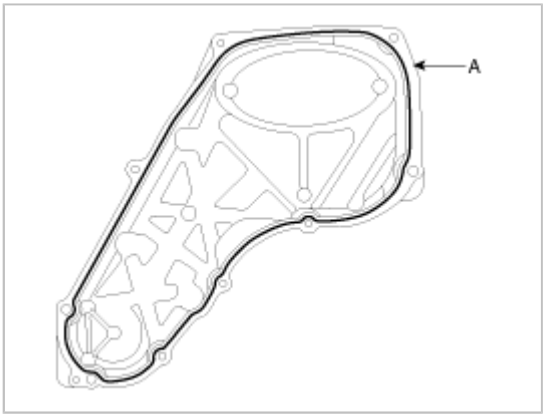
Tightening torque :
93.2 ~ 117.7N.m (9.5 ~ 12kgf.m, 68.7 ~ 86.8lb-ft)



Then assemble the damper pulley to the crankshaft tentatively and align the timing mark of the damper pulley to that of chain cover. And check whether timing mark of the camshaft positions at the right place finally.

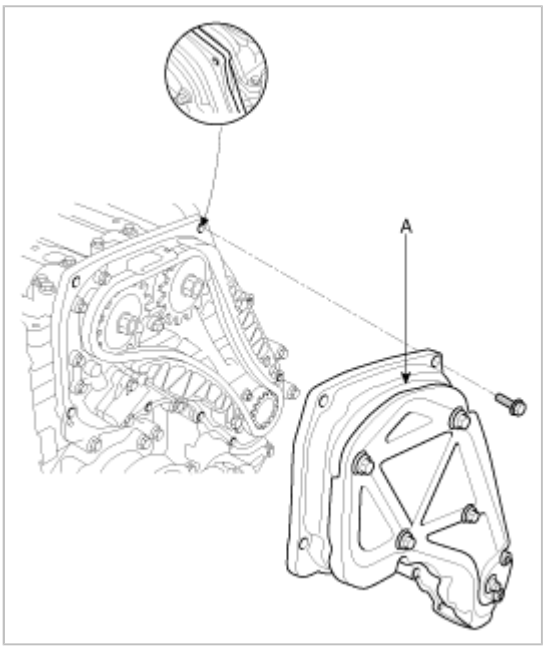
15. Apply the sealant (A) at the timing chain upper front cover.

Sealant type : Lotite #5902
Bead width : 2 ~ 4 mm (0.08 ~ 0.16 in)



16. Install the timing chain upper front cover(A).

Tightening torque :
19.6 ~ 26.5N.m (2.0 ~ 2.7kgf.m, 14.5 ~ 19.5lb-ft)

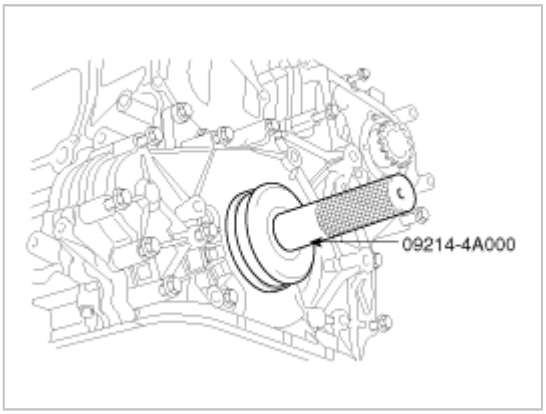


Replacement

Timing Chain Lower Front Cover Oil Seal

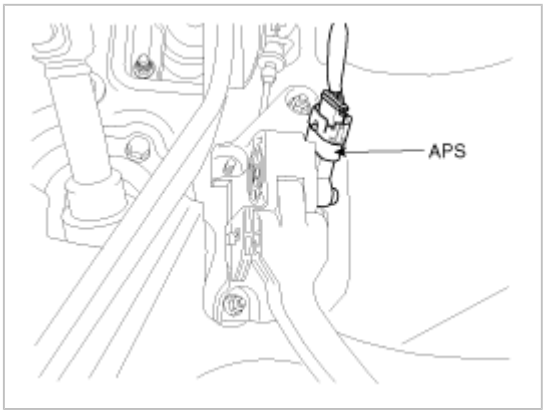
1. With the timing chain lower front cover oil seal installed, install the oil seal using the special service tool (09214-4A000).

Apply engine fluid to the circumference of oil seal lip.



Description

On electronic injection systems, there is no longer a load lever that mechanically controls the fuelling. The flow is caculated by the ECM depending on a number of parameters, including pedal position, which is measured using a potentiometer. The pedal sensor has two potentio-meters whoses slides are mechanically solid. The two potentiometers are supplied from distinct and different power sources so there is built in redundancy of information giving reliable driver's request information. A voltage is generated across the potentiometer in the acceleration position sensor as a function of the accelerator-pedal setting. Using a peogrammed characteristic curve, the pedal's position is then calculated from this voltage.



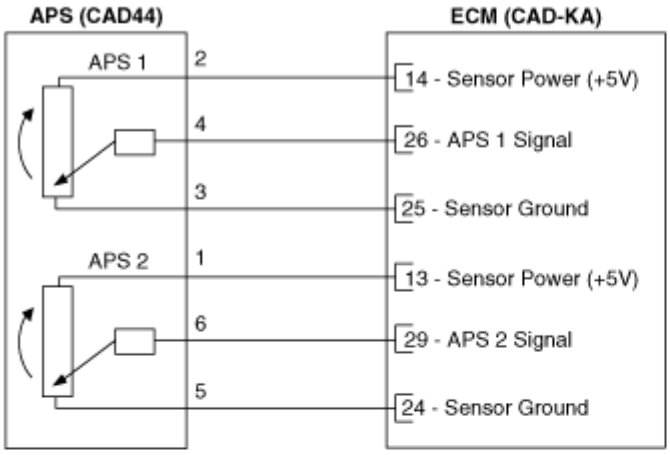
Inspection

1. Turn ignition switch OFF.
2. Disconnect the accelerator position sensor connector.
3. Measure resistance between voltage supply terminal and ground terminal of APS1.
4. Measure resistance between voltage supply terminal and ground terminal of APS2.
5. Check that the resistance is within the specification.

Specification: Refer to Specification section.

Circuit Diagram

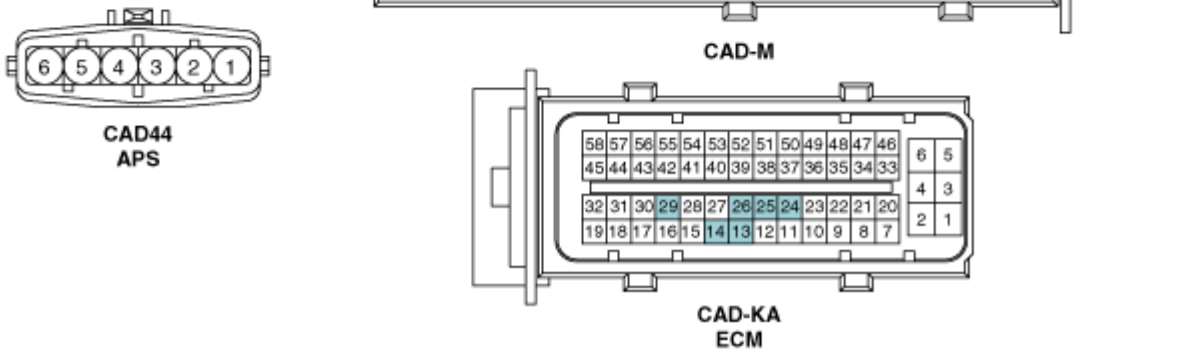
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM CAD-KA (13)	APS 2 Sensor Power (+5V)
2	ECM CAD-KA (14)	APS 1 Sensor Power (+5V)
3	ECM CAD-KA (25)	APS 1 Ground
4	ECM CAD-KA (26)	APS 1 Signal
5	ECM CAD-KA (24)	APS 2 Ground
6	ECM CAD-KA (29)	APS 2 Signal

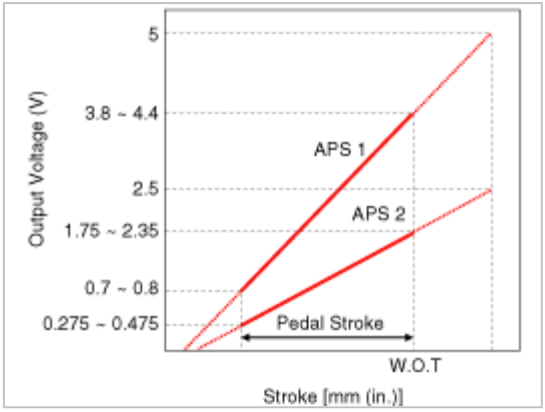
[Harness Connector]



Specification

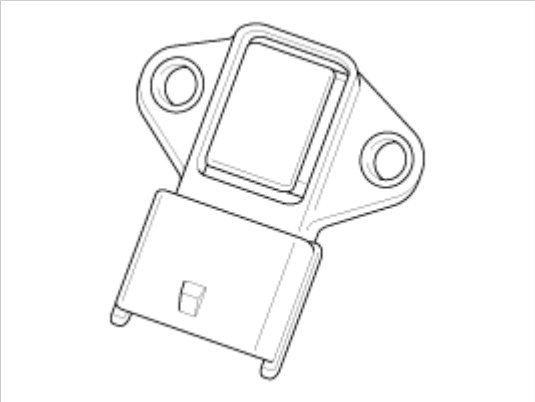
Test Condition	Output Voltage (V) [Vref=5V]	
	APS 1	APS 2
Idle	0.7 ~ 0.8	0.275 ~ 0.475
Fully depressed	3.8 ~ 4.4	1.75 ~ 2.35

Items	Specification	
	APS 1	APS 2
Potentiometer Resistance (□)	0.7 ~ 1.3	1.4 ~ 2.6



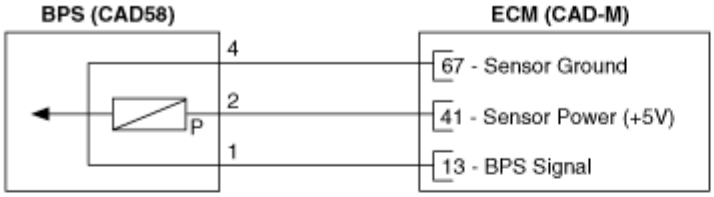
Description

Boost pressure sensor (BPS) is installed on surge tank to measure the absolute intake manifold pressure. BPS input voltage is changed in proportion with absolute pressure in manifold. This information is used to control Variable Geometery Turbocharger (VGT) by ECM.



Circuit Diagram

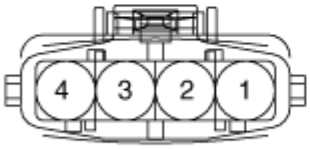
[Circuit Diagram]



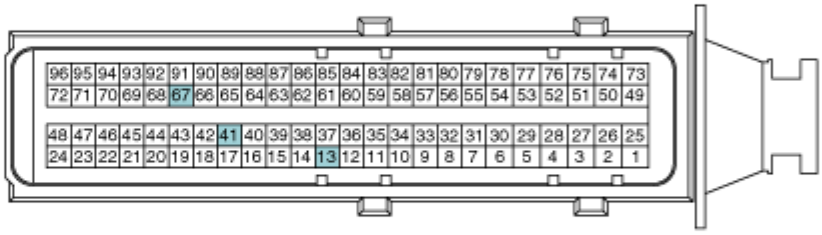
[Connection Information]

Terminal	Connected to	Function
1	ECM CAD-M (13)	BPS Signal
2	ECM CAD-M (41)	Sensor Power
3	-	-
4	ECM CAD-M (67)	Sensor ground

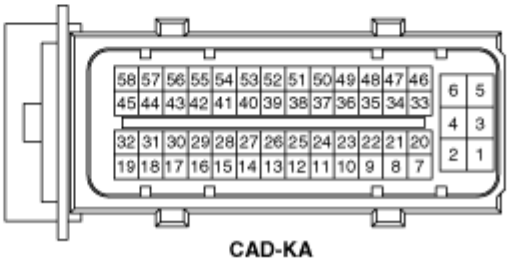
[Harness Connector]



CAD58
BPS



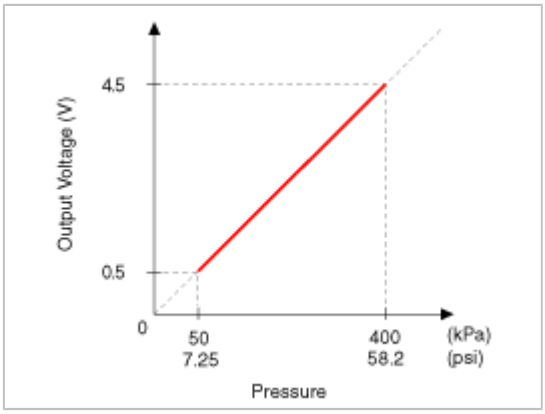
CAD-M



CAD-KA
ECM

Specification

Pressure[kPa (kg/cm² / psi)]	Output Voltage (V)
50 (0.51 / 7.25)	0.5
100 (1.02 / 14.50)	1.00 ~ 1.14
300 (3.06 / 43.51)	3.29 ~ 3.43
400 (4.08 / 58.02)	4.41 ~ 4.59



Signal Waveform

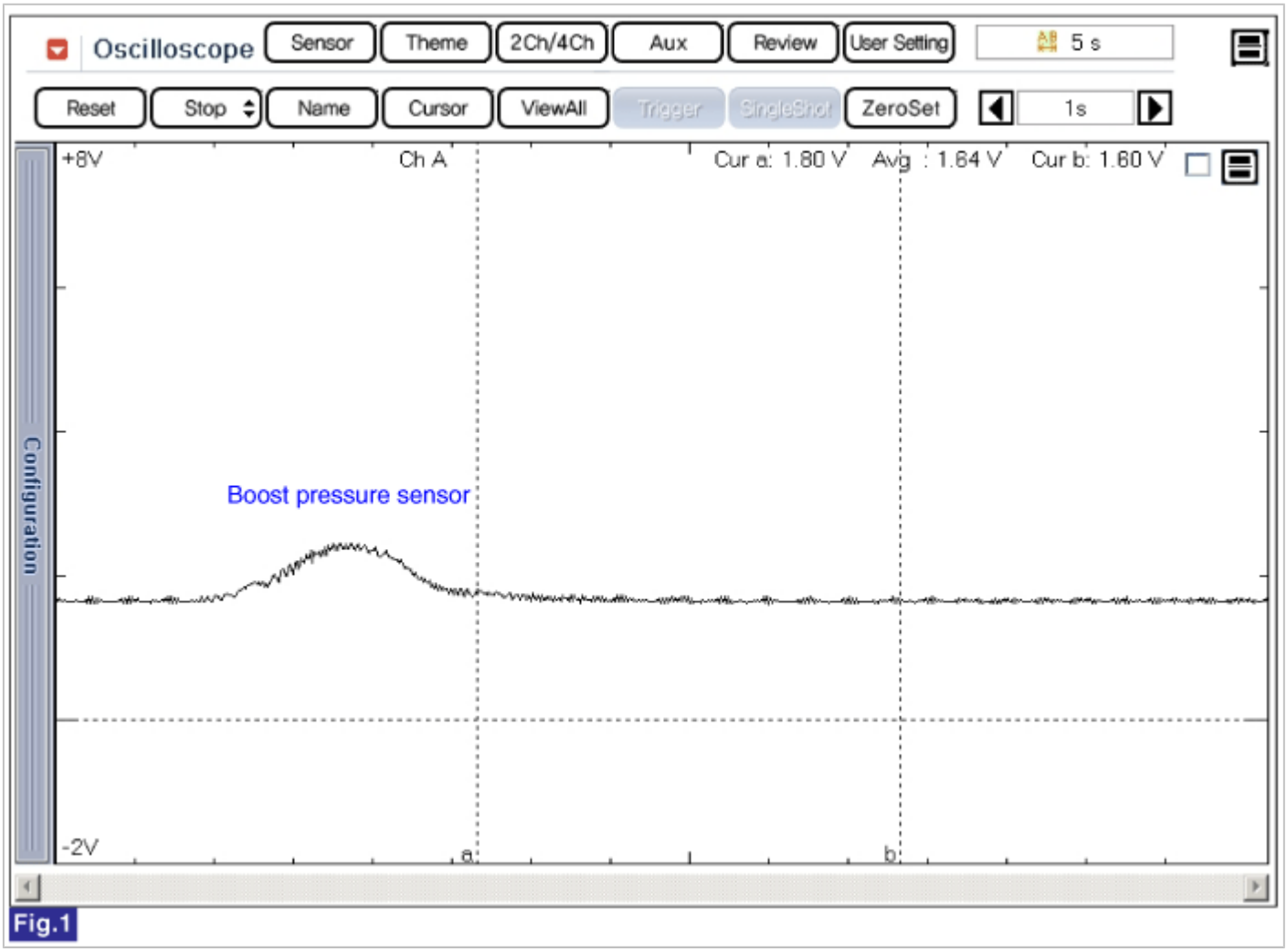
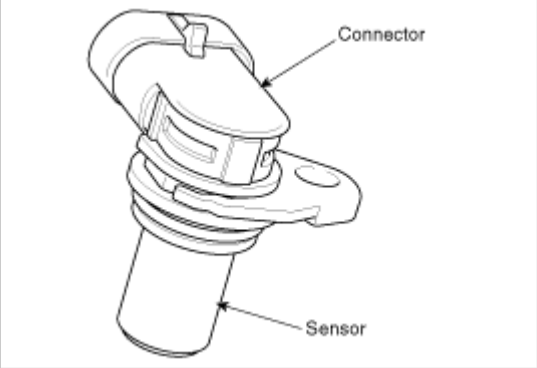


Fig.1

This is the waveform of BPS as accelerating at idle.
Signal voltage rises as accelerating.

Description

Camshaft Position Sensor (CMPS) a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can't detect. The CMPS are installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. So the sequential injection of the 4 cylinders is impossible without CMPS signal.



Inspection

1. Check signal waveform of CMPS and CKPS using a scan tool.

Specification: Refer ro "Signal Waveform"

Circuit Diagram

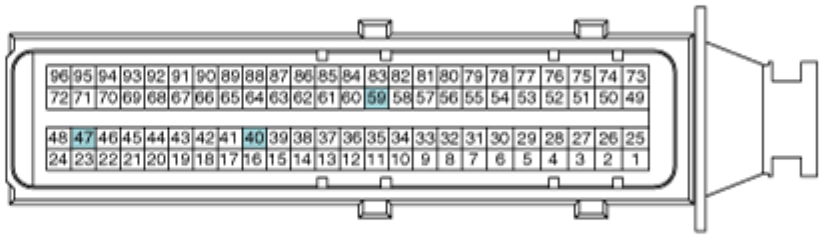
[Circuit Diagram]

[Connection Information]

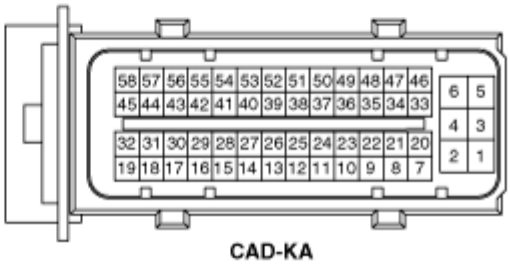
Terminal	Connected to	Function
1	ECM CAD-M (40)	Power Supply
2	ECM CAD-M (59)	CMPS Signal
3	ECM CAD-M (47)	Sensor Ground

[Harness Connector]

CAD30
CMPS



CAD-M



CAD-KA
ECM

Specification

Level	Output Pulse (V)
High	5
Low	0

Items	Specification
Air Gap [mm (in.)]	0.5 ~ 1.5 (0.019 ~ 0.059)

Signal Waveform

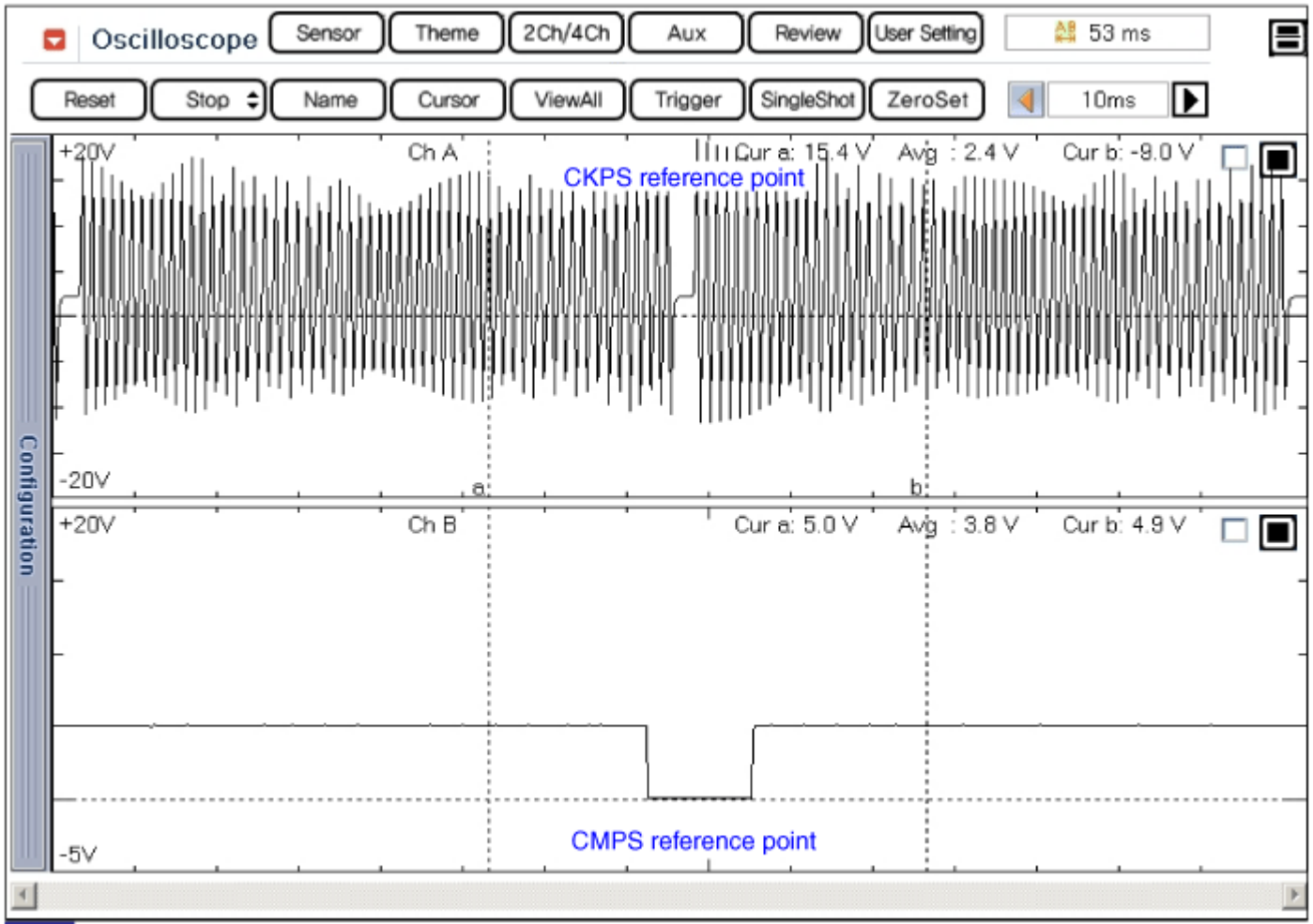


Fig.1

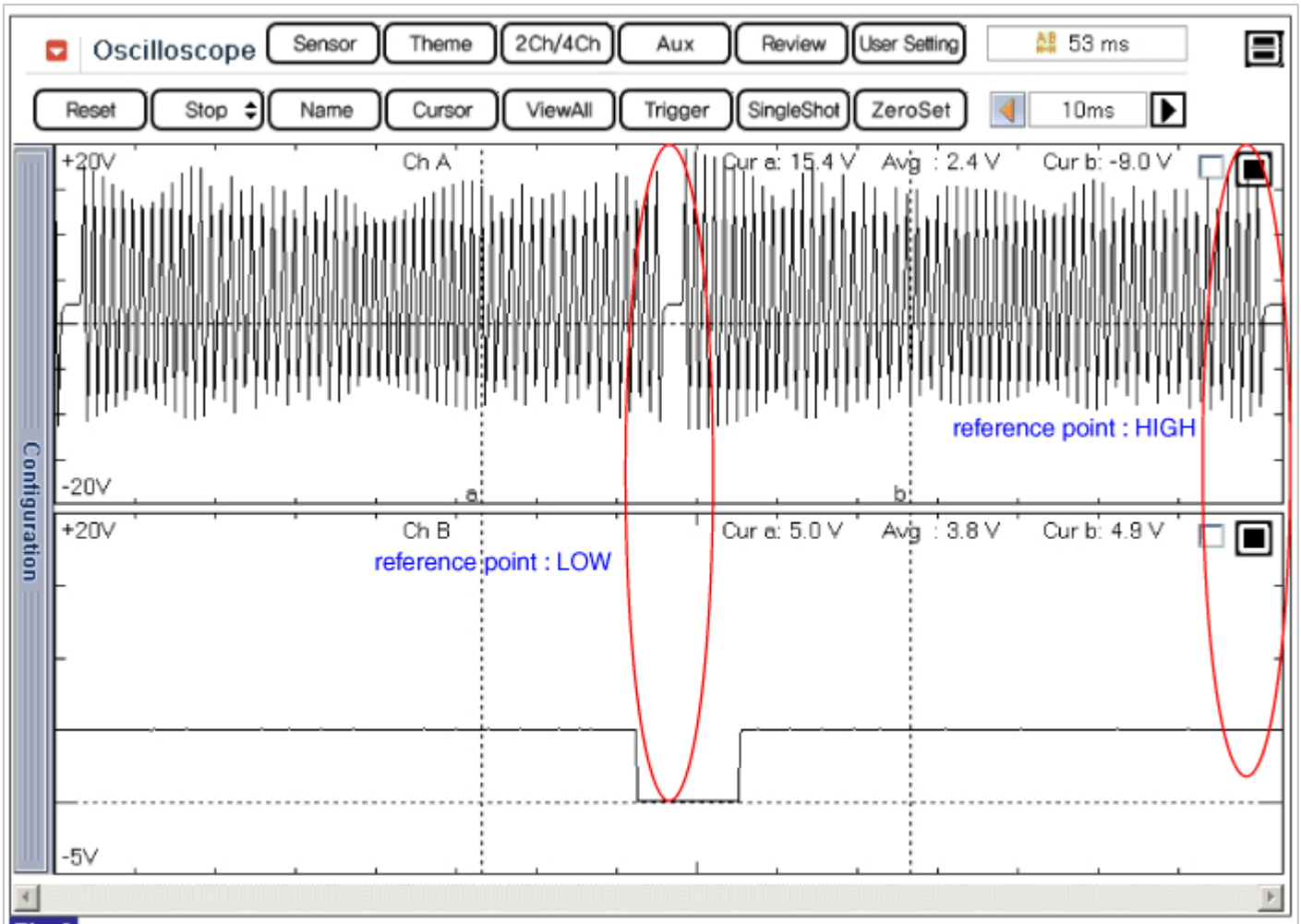


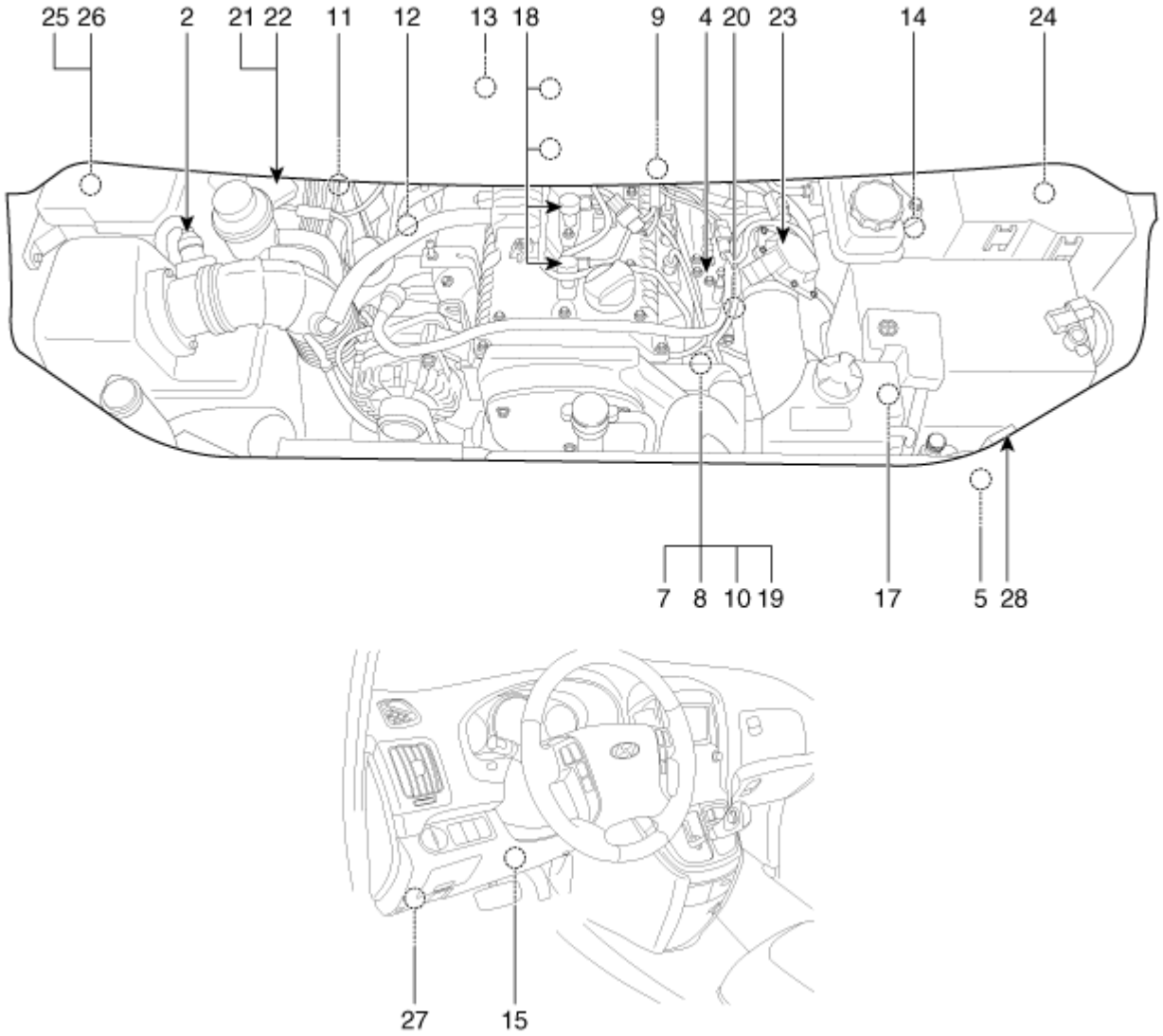
Fig.2

Fig.1) This shows waveform of Crank Shaft Position Sensor and Cam Shaft Position Sensor simulatneously. The middle area indicates reference points of Crank Shaft Position Sensor and Cam Shaft Position Sensor.

Fig.2) Crank Shaft Position Sensor and Cam Shaft Position Sensor signal are measured simultaneously. Cam Shaft Position Sensor signal is outputted once when Crank Shaft Position sensor signal is outputted twice. LOW and HIGH output of Cam Shaft Position sensor reference point is detected at Crank Shaft Position sensor reference point.

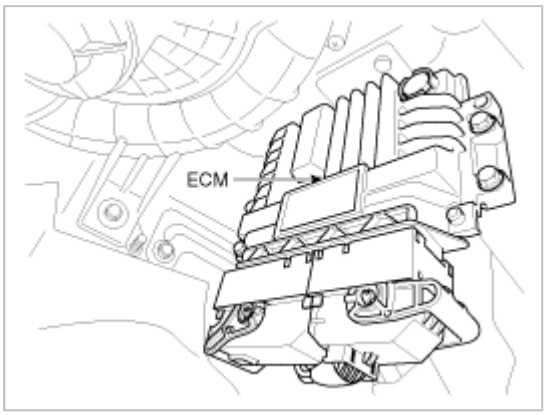
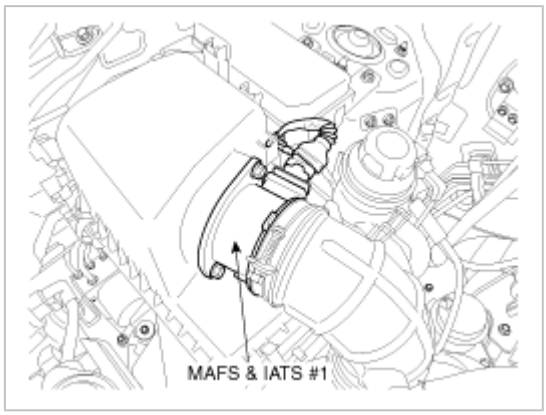
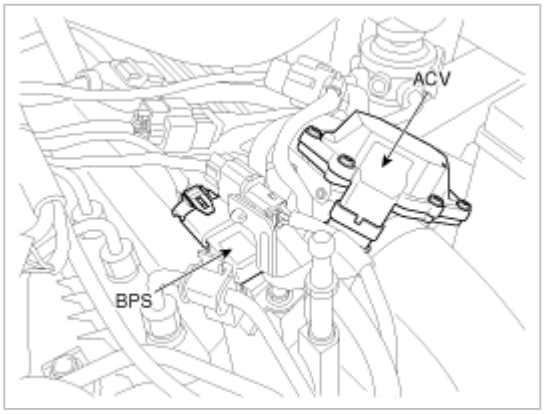
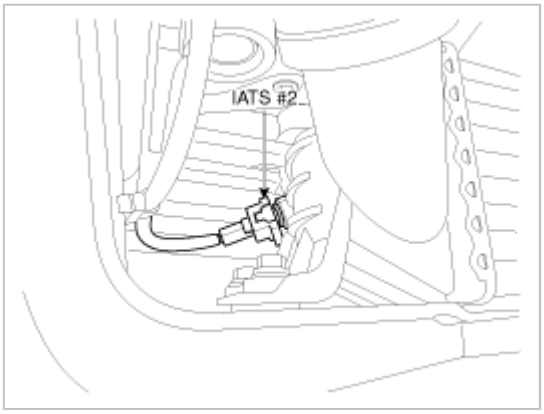
(Injection sequence is determined based on LOW and HIGH signal of Cam Shaft Position Sensor reference point as detecting cylinder position.)

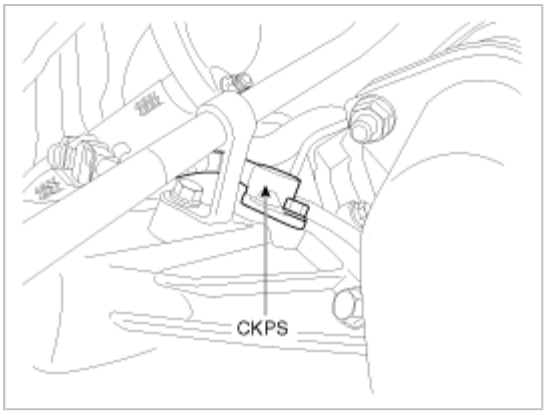
Component Location



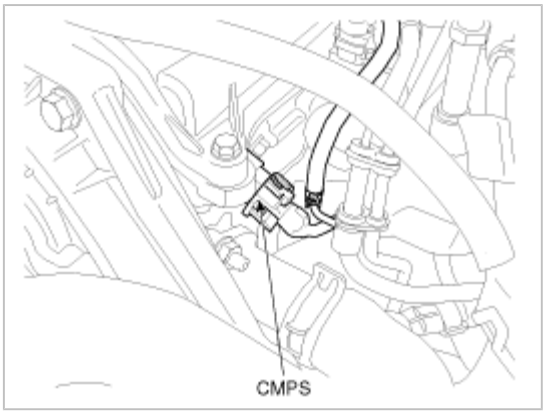
1. ECM (Engine Control Module)	15. Accelerator Position Sensor (APS)
2. Mass Air Flow Sensor (MAFS)	16. Vehicle Speed Sensor (VSS)
3. Intake Air Temperature Sensor (IATS) #1 built in MAFS	17. A/C Pressure Transducer (APT)
4. Boost Pressure Sensor (BPS)	18. Injector
5. Intake Air Temperature Sensor (IATS) #2	19. Fuel Pressure Regulator Valve (FPRV)
6. Crankshaft Position Sensor (CKPS)	20. Electric EGR Control Valve
7. Camshaft Position Sensor (CMPS)	21. VGT Control Solenoid Valve [With VGT]
8. Engine Coolant Temperature Sensor (ECTS)	22. WGT Control Solenoid Valve [With WGT]
9. Rail Pressure Sensor (RPS)	23. Air cotrol valve (ACV)
	24. Main Relay

10. Fuel Temperature Sensor (FTS) 11. Differential Pressure Sensor (DPS) 12. Exhaust Gas Temperature Sensor (EGTS) #1 for VGT 13. Exhaust Gas Temperature Sensor (EGTS) #2 for DPF 14. Water Sensor (Included in Fuel Filter)	25. Glow Relay 26. PTC Heater Relay 27. Data Link Connector (DLC) [16 pin] 28. Multi-Purpose Check Connector [20 pin]

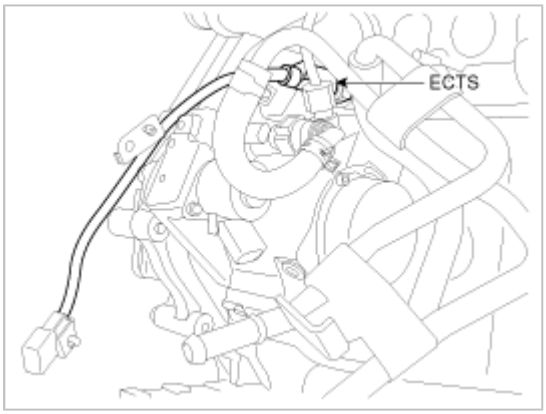
1. ECM (Engine Control Module)	2. Mass Air Flow Sensor (MAFS) 3. Intake Air Temperature Sensor (IATS) #1 built in MAFS
	
4. Boost Pressure Sensor (BPS) 23. Air cotrol valve (ACV)	5. Intake Air Temperature Sensor (IATS) #2
	
6. Crankshaft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS)



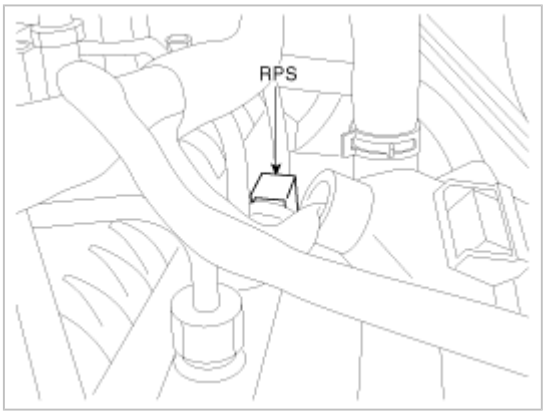
8. Engine Coolant Temperature Sensor (ECTS)



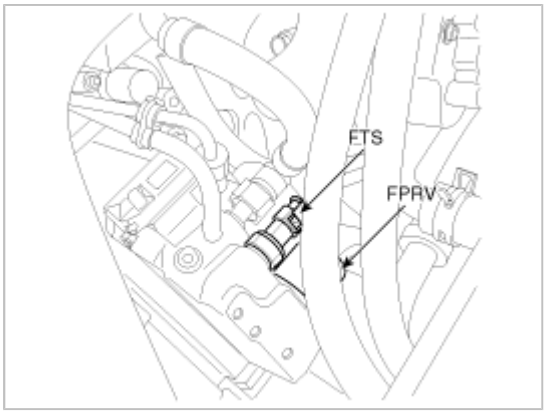
9. Rail Pressure Sensor (RPS)



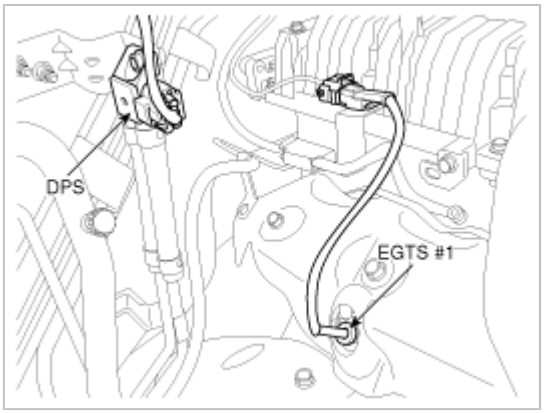
10. Fuel Temperature Sensor (FTS)
19. Fuel Pressure Regulator Valve (FPRV)



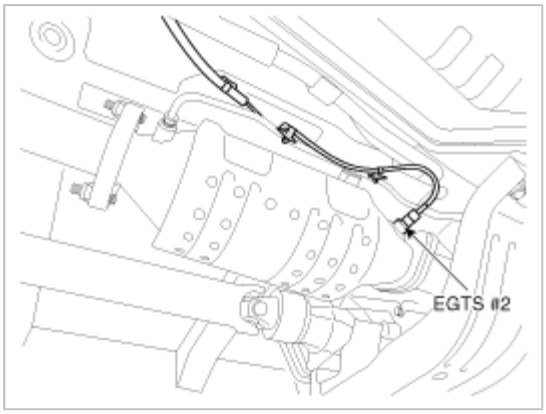
11. Differential Pressure Sensor (DPS)
12. Exhaust Gas Temperature Sensor (EGTS) #1 for VGT



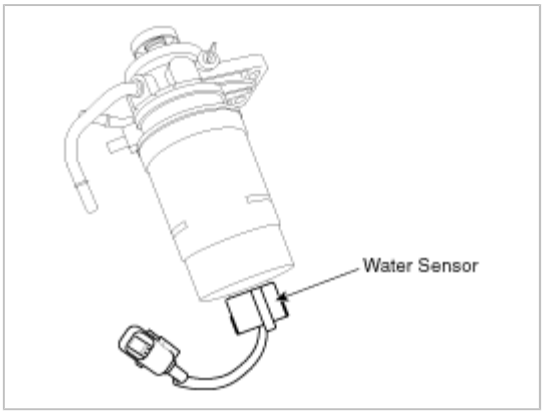
13. Exhaust Gas Temperature Sensor (EGTS) #2 for DPF



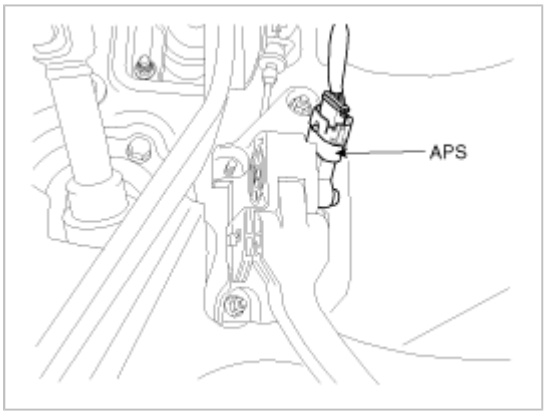
14. Water Sensor (Included in Fuel Filter)



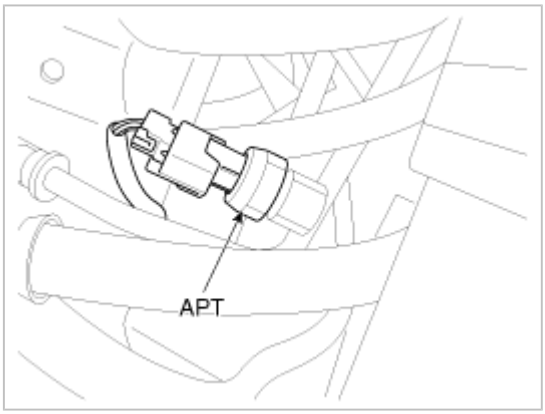
15. Accelerator Position Sensor (APS)



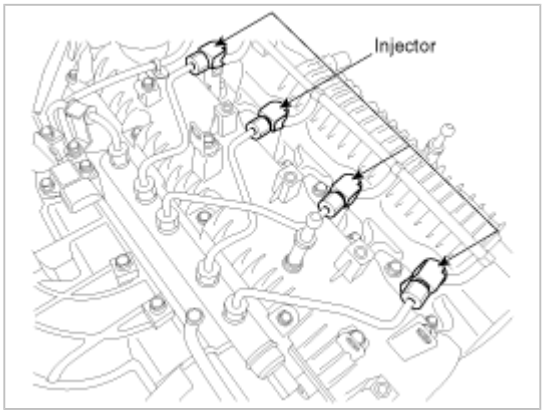
17. A/C Pressure Transducer (APT)



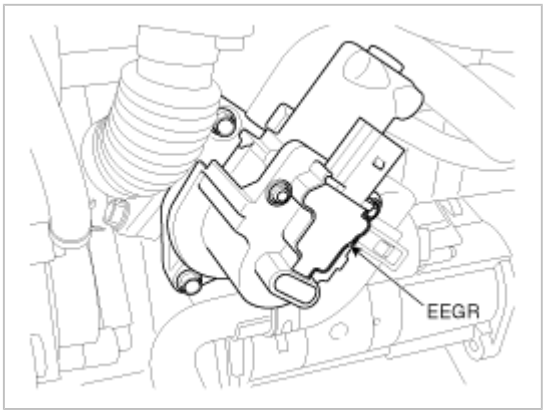
18. Injector



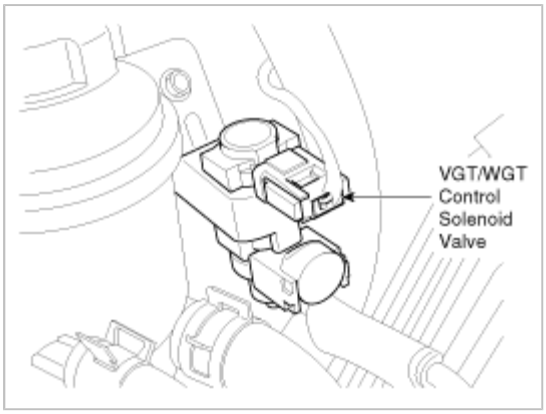
20. Electric EGR Control Valve

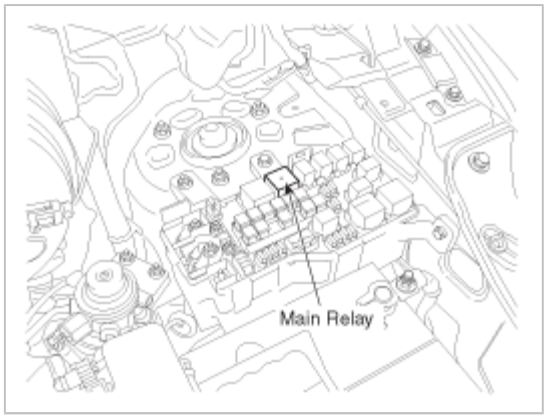


21. VGT Control Solenoid Valve [With VGT]
22. WGT Control Solenoid Valve [With WGT]



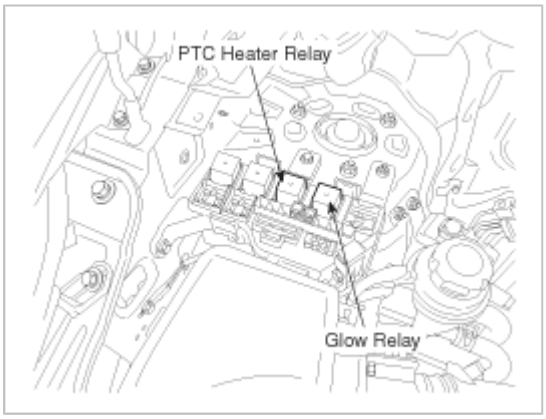
24. Main Relay

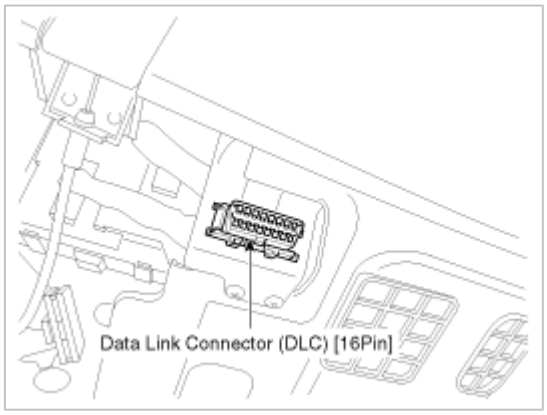




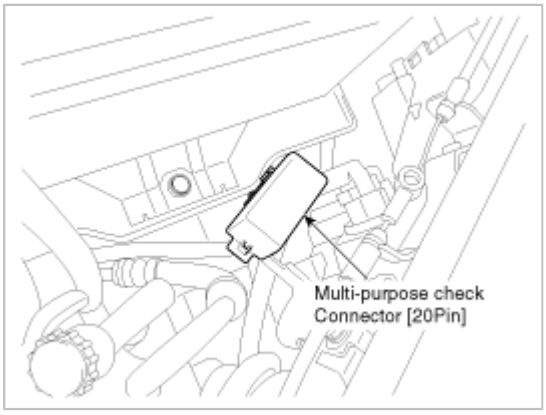
25. Glow Relay
26. PTC Heater Relay

27. Data Link Connector (DLC) [16 pin]





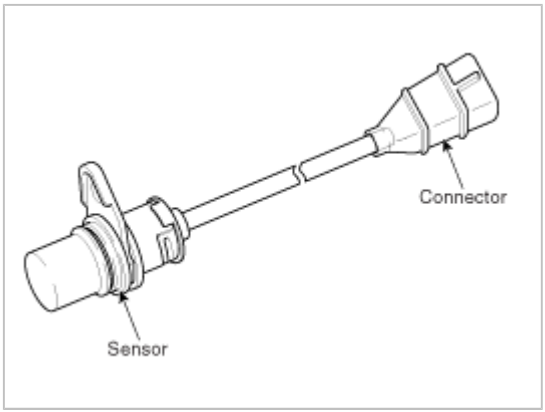
28. Multi-Purpose Check Connector [20 pin]



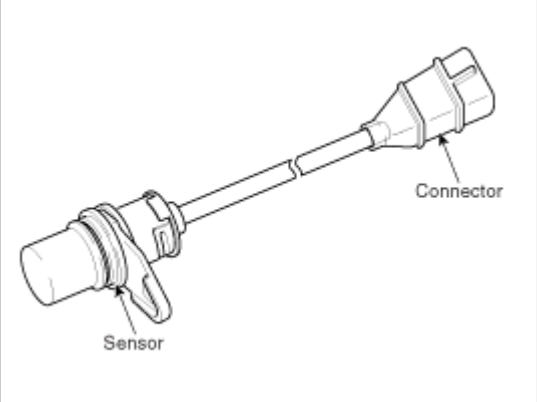
Description

Piston position on combustion chamber is the substantial to define the starting of injection timing. All engine pistons are connected to crankshaft by connecting rod. Sensor on crankshaft can supply the informations concerning all piston positions, revolution speed is defined by revolution perminute of crankshaft. Prior input variable is determined at ECM by using signal induced from crankshaft position sensor.

[A/T]



[M/T]



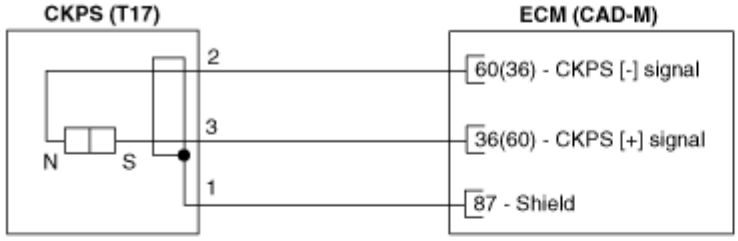
Inspection

1. Check signal waveform of CMPS and CKPS using a scan tool.

Specification: Refer ro "Signal Waveform"

Circuit Diagram

[Circuit Diagram]



* ( ): A/T

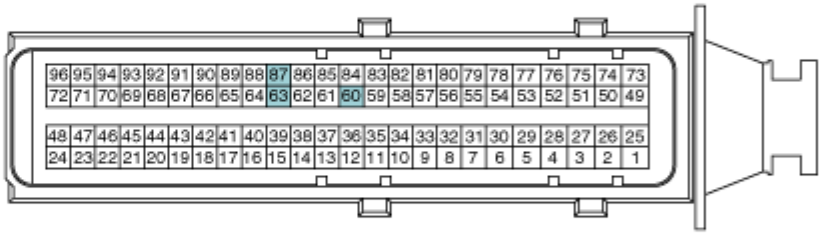
[Connection Information]

Terminal	Connected to	Function
1	ECM CAD-M (87)	Sensor Shield
2	ECM CAD-M [60](36)	CKPS [-] Signal
3	ECM CAD-M [36](60)	CKPS [+] Signal

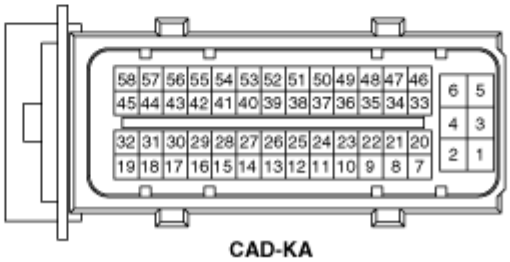
* [ ]: M/T
* ( ): A/T

[Harness Connector]

T17
CKPS



CAD-M



CAD-KA
ECM

Specification

Items	Specification
Coil Resistance (Ω)	774 ~ 946 [20Ω(68Ω)]

Signal Waveform

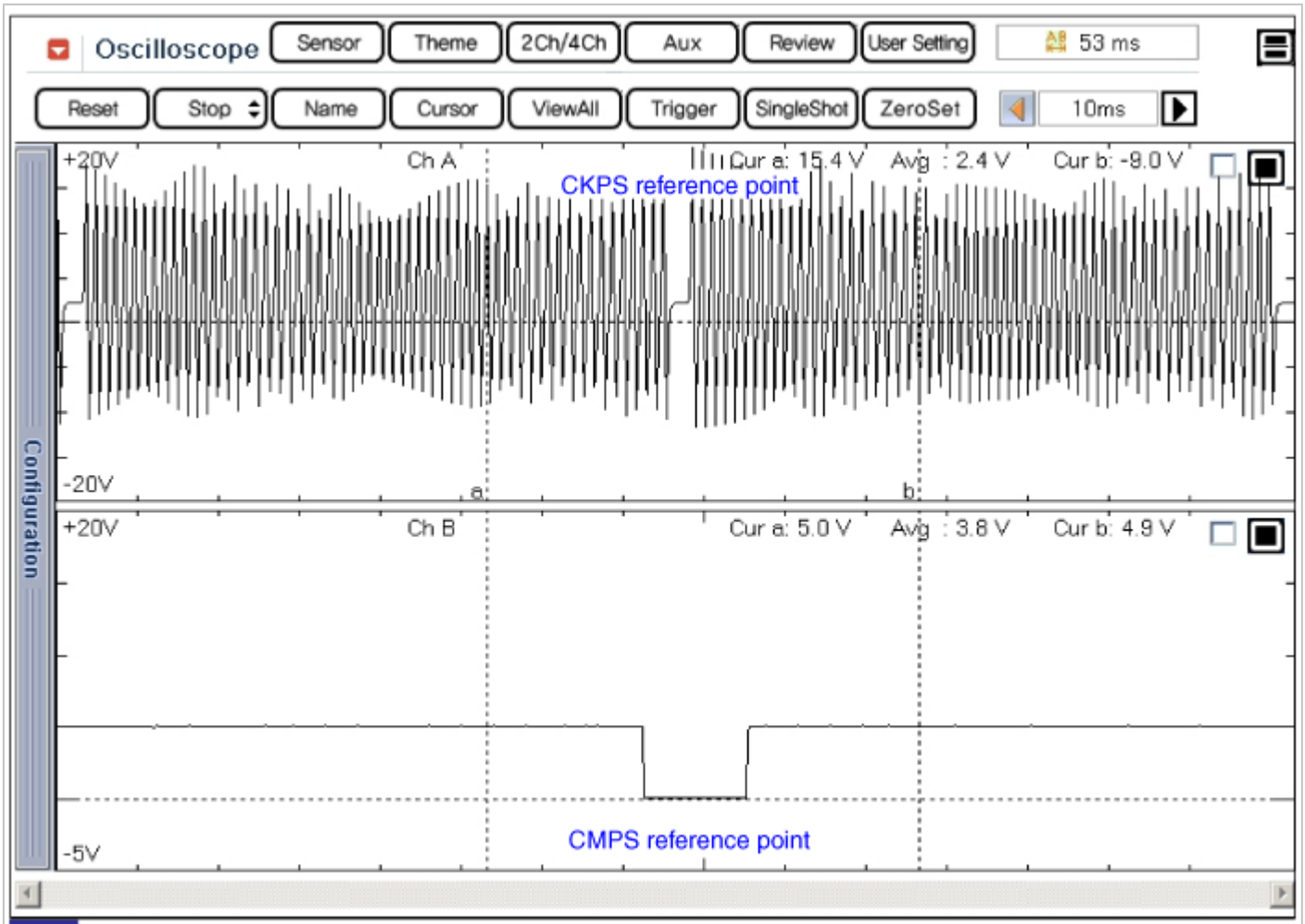


Fig.1

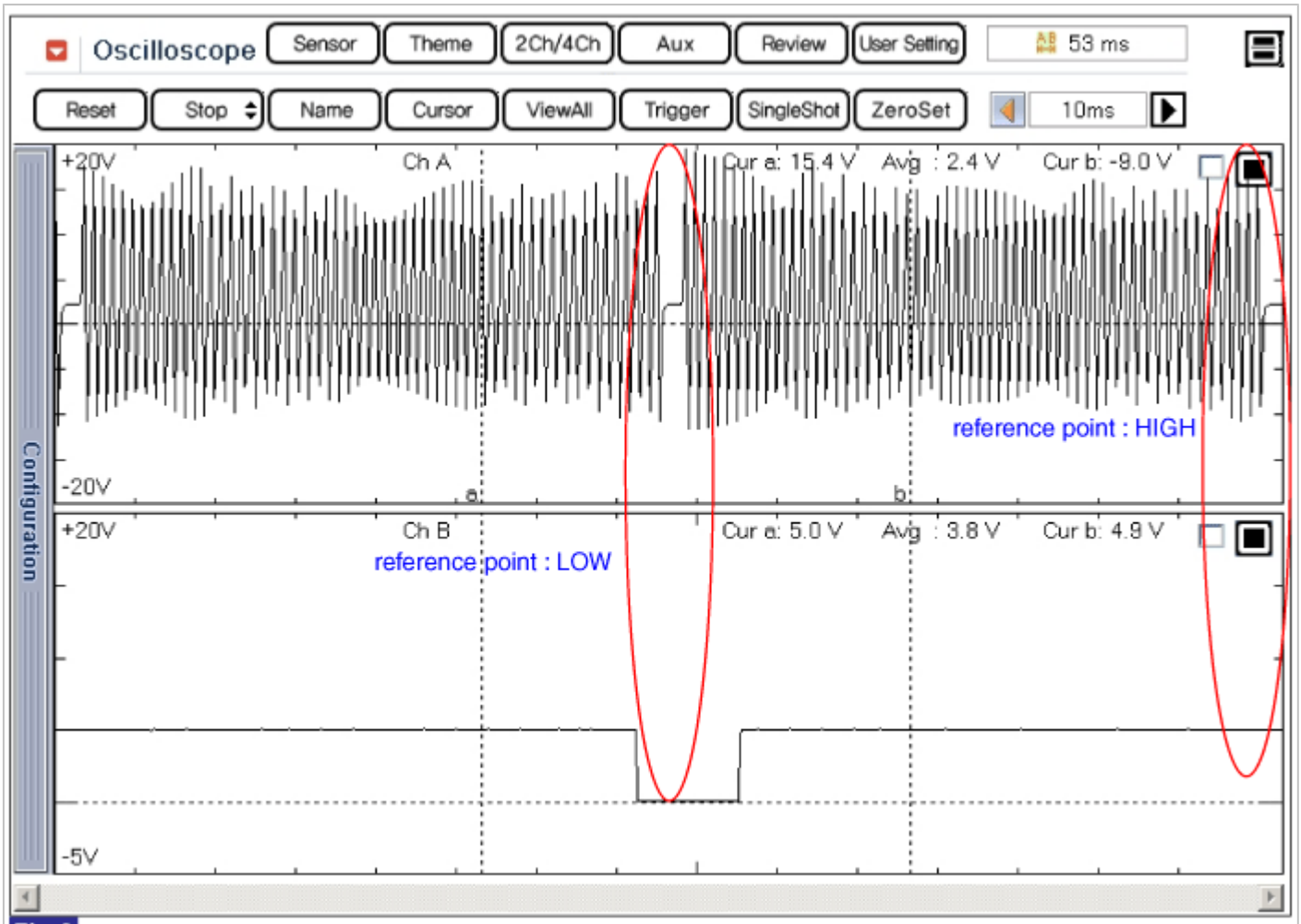


Fig.1) This shows waveform of Crank Shaft Position Sensor and Cam Shaft Position Sensor simulatneously. The middle area indicates reference points of Crank Shaft Position Sensor and Cam Shaft Position Sensor.

Fig.2) Crank Shaft Position Sensor and Cam Shaft Position Sensor signal are measured simultaneously. Cam Shaft Position Sensor signal is outputted once when Crank Shaft Position sensor signal is outputted twice. LOW and HIGH output of Cam Shaft Position sensor reference point is detected at Crank Shaft Position sensor reference point.

(Injection sequence is determined based on LOW and HIGH signal of Cam Shaft Position Sensor reference point as detecting cylinder position.)

Description

If the disel control system components (sensors, ECM, injector, etc.) fail, interruption to the fuel supply or failure to supply the proper amount of fuel for variousengine operating conditions will result. The following situations may be encountered

1. Engine is hard to start or does not start at all.
2. Nstable idle.
3. Poor driveability.

If any of the above conditions are noted, first perform a routine diagnosis that includes basic engine checks (ignition system malfunction, incorrectengine adjustment, etc.). Then, inspect the disel contorl system components with a scan tool.

- Before removing or installing any part, read the diagnostic trouble codesand then disconnect the battery negative (-) terminal.
- Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operationor while the ignition switch is ON could cause damage to the ECM.
- Wchecking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.
- Wcharging the battery with the external charger, disconnect the vehicleside battery terminals to prevent damage to the ECM.

Self-Diagnosis

The ECM monitors the input/output signals (some signals at all times and theothers under specified conditions). When the ECM detects an irregularity, it records the diagnostic trouble code, and outputs the signal to the Data Link connector. The diagnosis results can be read with the MIL or scan tool. Diagnostic Trouble Code(DTC) will remain in the ECM and may be deleted by the scan tool.

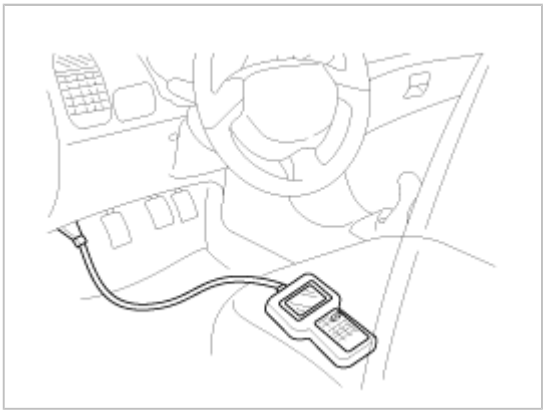
If a sensor connector is disconnected with the ignition switch turned on, the diagnostic trouble code (DTC) is recorded. In this case, disconnect the battery negative terminal (-) for 15 seconds or more, and the diagnosis memory will be erased.

Checking Procedure (Self-Diagnosis)

- When attery voltage is excessively low, diagnostic trouble codes can not be read. Be sure to check the battery for voltage and the charging system before starting the test
- 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 scan tool to check the diagnostic trouble code.
5. Repair the faulty part from the diagnosis chart.
6. Erase the diagnostic trouble code.
7. Disconnect the scan tool.

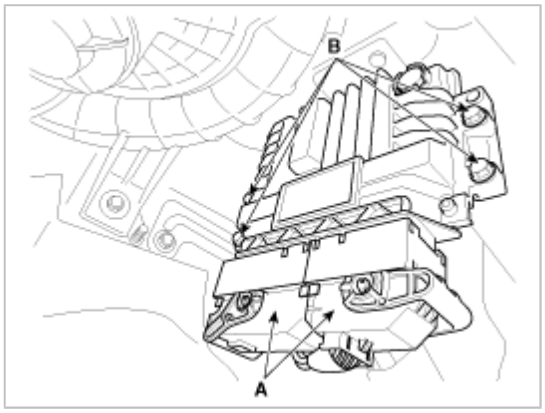
When deleting diagnostic trouble code, use scan tool as possible.

Replacement

When replacing the ECM, the vehicle equipped with the immobilizer must be performed procedure as below.
[In the case of installing used ECM]
1) Perform "ECM Neutral mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2) After finishing "ECM Neutral mode", perform "Key teaching" procedure with GDS. (Refer to "Immobilizer" in BE group)
[In the case of installing new ECM]
Perform "Key teaching" procedure with GDS. (Refer to "Immobilizer" in BE group)

When replacing the ECM, the vehicle equipped with the smart key system (Button start) must be performed procedure as below.
[In the case of installing used ECM]
1) Perform "ECM Neutral mode" procedure with GDS. (Refer to "Smart key" in BE group)
2) After finishing "ECM Neutral mode", insert the key (or press the start button) and turn it to the IGN ON and OFF position. Then the ECM learns the smart key information automatically.
[In the case of installing new ECM]
Insert the key (or press the start button) and turn it to the IGN ON and OFF position.
Then the ECM learns the smart key information automatically.

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the ECM connector (A).
3. Unscrew the ECM mounting bolts (B) and remove the ECM.

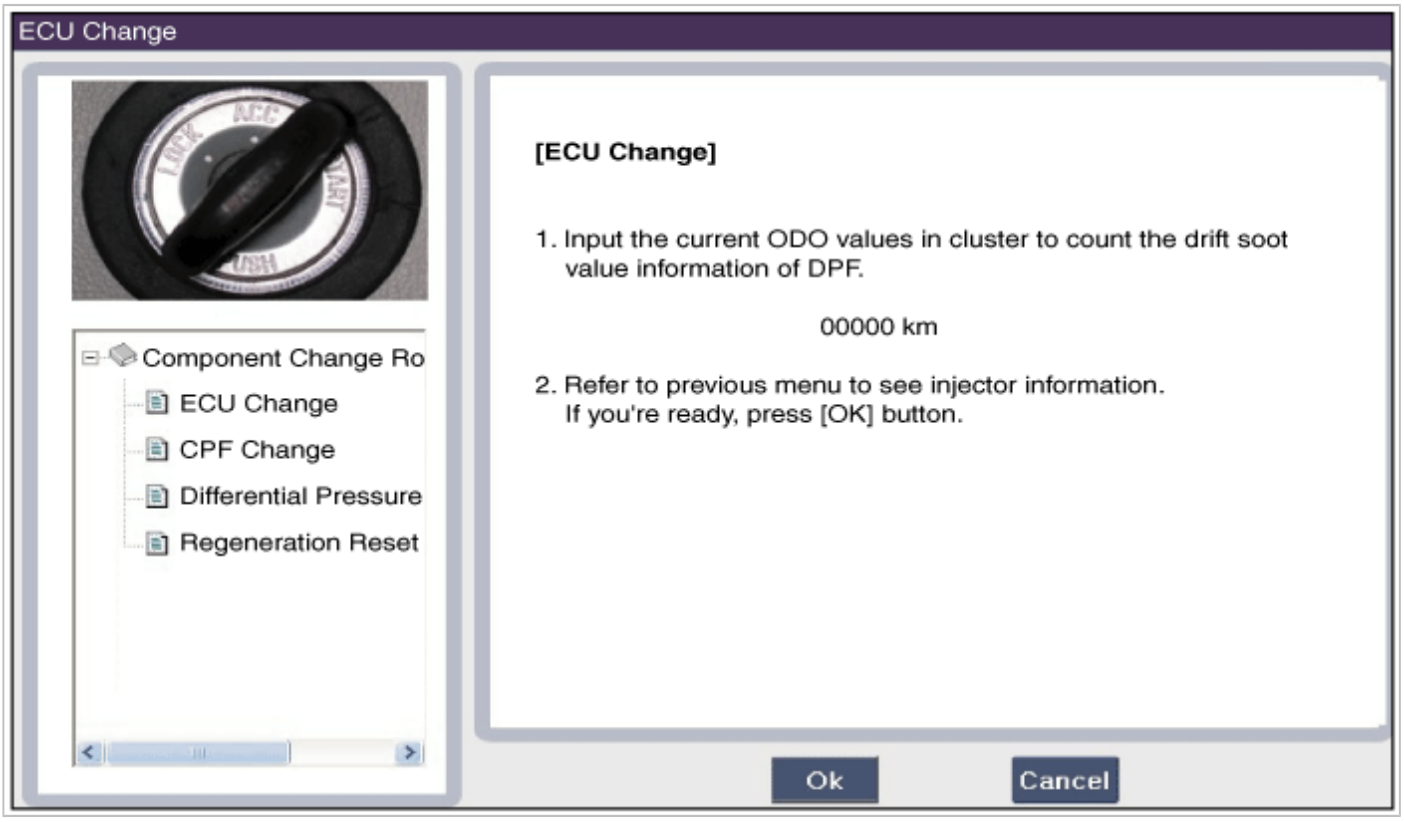


4. Install a new ECM.

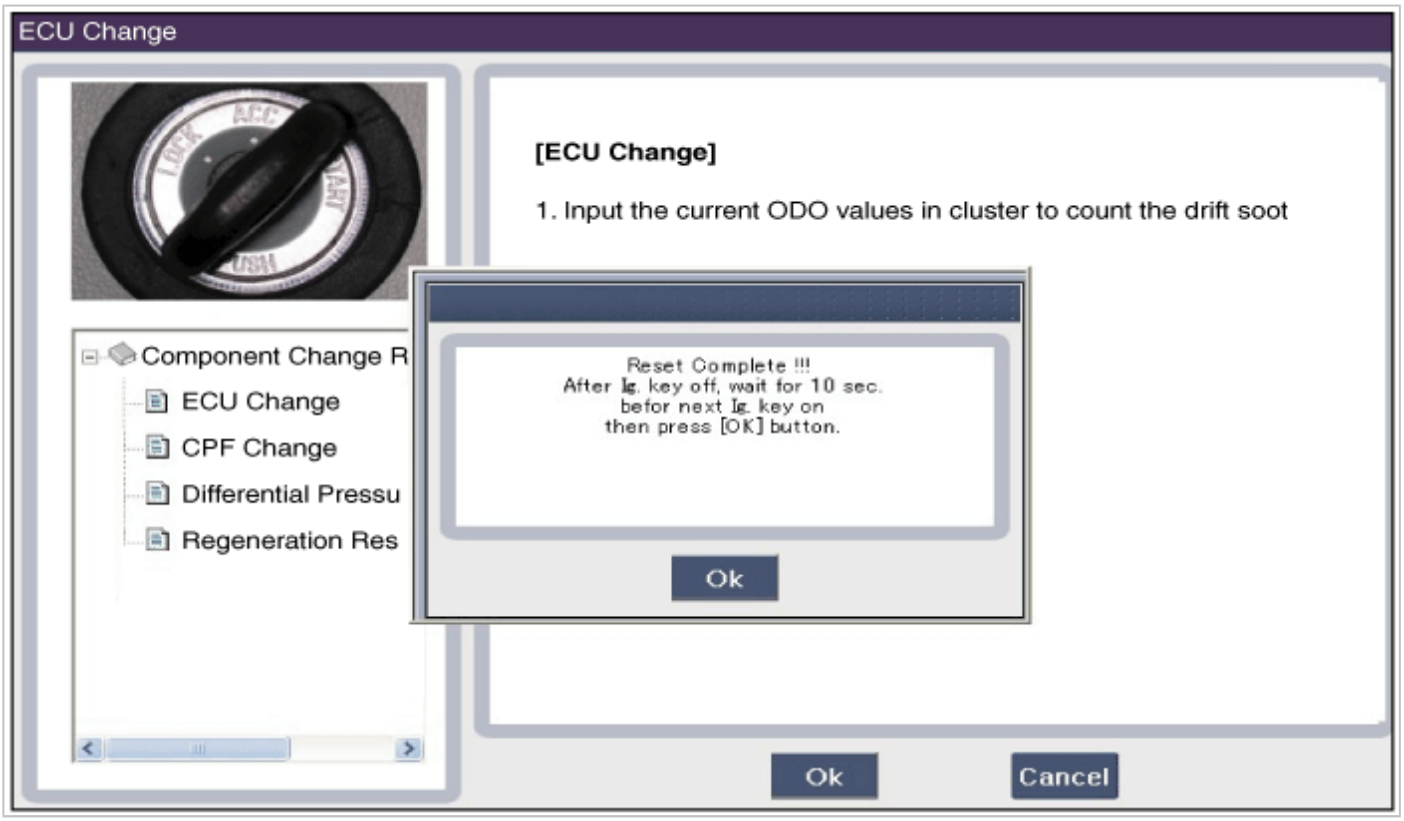
ECM installation nut:
8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)

5. Connect the negative(-) battery cable.
6. Perform "ECM Change" procedure [With DPF].

(1) Turn ignition switch OFF.
(2) Connect a GDS Data Link Connector (DLC).
(3) Turn ignition switch ON.
(4) Select "Vehicle, Model year, Engine, System".
(5) Select "Vehicle S/W Management".
(6) Select "Component Change Routine".
(7) Select "ECU Change".
(8) Input the mileage in odometer.



(9) Confirm the "Complete" message and then turn ignition switch OFF.



(10) Wait for more than 10 seconds, and then turn ignition switch ON.

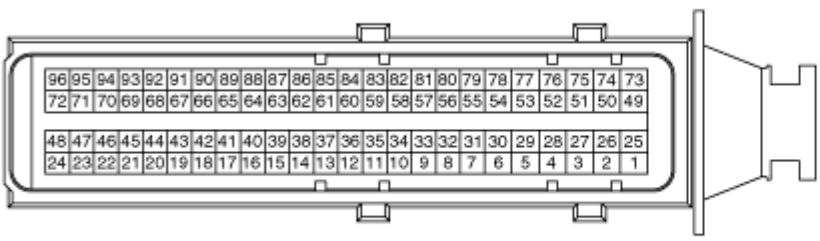
7. Perform "Injector Specific Data Input" procedure (Refer to "Injector" in this group).
8. Perform "Key Teaching" procedure (Refer to "Immobilizer" in BE group).

ECM Problem Inspection Procedure

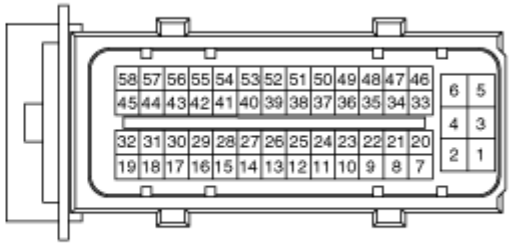
1. TEST ECM GROUND CIRCUIT: Measure resistance between ECM and chassis ground using the backside of ECM harness connector as ECM side check point. If the problem is found, repair it.
2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle again. If the vehicle operates normally then the problem was likely with the ECM.
4. RE-TEST THE ORIGINAL ECM : Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem does not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE)

ECM (Engine Control Module)

1. ECM Harness connector



Connector [CAD-M]



Connector [CAD-KA]

2. ECM Terminal function

Connector [CAD-M]

Pin	Description	Connected to
1	-	
2	-	
3	Injector (Cylinder #4) [High] control output	Injector (Cylinder #4)
4	Intake Air Temperature Sensor (IATS) #1 signal input	Intake Air Temperature Sensor (IATS) #1 [MAFS]
5	Exhaust Gas Temperature Sensor (EGTS) #1 signal input	Exhaust Gas Temperature Sensor (EGTS) #1
6	Exhaust Gas Temperature Sensor (EGTS) #2 signal input	Exhaust Gas Temperature Sensor (EGTS) #2
7	-	
8	Differential Pressure Sensor (DPS) signal input	Differential Pressure Sensor (DPS)
9	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)
10	Fuel Temperature Sensor (FTS) signal input	Fuel Temperature Sensor (FTS)
11	-	
12	-	
13	Boost Pressure Sensor (BPS) signal input	Boost Pressure Sensor (BPS)
14	-	
15	Sensor ground	Position Sensor in Air Control Valve (ACV)
16	Position sensor signal input	Position Senor in Electric EGR Control Valve

17	Wiper motor signal input	Wiper motor
18	-	
19	Sensor ground	Rail Pressure Sensor (RPS)
20	Sensor ground	Position Senor in Electric EGR Control Valve
21	Sensor ground	Intake Air Temperature Sensor (IATS) #2
22	Sensor ground	Exhaust Gas Temperature Sensor (EGTS) #1
23	Sensor ground	Exhaust Gas Temperature Sensor (EGTS) #2
24	-	
25	Injector (Cylinder #4) [Low] control output	Injector (Cylinder #4)
26	Injector (Cylinder #1) [Low] control output	Injector (Cylinder #1)
27	Injector (Cylinder #1) [High] control output	Injector (Cylinder #1)
28	-	
29	-	
30	-	
31	-	
32	-	
33	-	
34	Intake Air Temperature Sensor (IATS) #2 signal input	Intake Air Temperature Sensor (IATS) #2
35	Rail Pressure Sensor (RPS) signal input	Rail Pressure Sensor (RPS)
36	Crankshaft Position Sensor (CKPS) [-] signal input	Crankshaft Position Sensor (CKPS) [M/T]
	Crankshaft Position Sensor (CKPS) [+] signal input	Crankshaft Position Sensor (CKPS) [A/T]
37	-	
38	Sensor power (+5V)	Rail Pressure Sensor (RPS)
39	-	
40	Sensor power (+5V)	Camshaft Position Sensor (CMPS)
41	Sensor power (+5V)	Boost Pressure Sensor (BPS)
42	-	
43	-	

44	Sensor ground	Differential Pressure Sensor (DPS) [With DPF]
45	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
46	Sensor ground	Fuel Temperature Sensor (FTS)
47	Sensor ground	Camshaft Position Sensor (CMPS)
48	-	□
49	-	□
50	Injector (Cylinder #2) [High] control output	Injector (Cylinder #2)
51	Injector (Cylinder #3) [High] control output	Injector (Cylinder #3)
52	Neutral Switch signal input [M/T]	Neutral Switch [M/T]
53	Reference frequency	Mass Air Flow Sensor (MAFS)
54	-	□
55	-	□
56	-	□
57	-	□
58	Mass Air Flow Sensor (MAFS) signal input	Mass Air Flow Sensor (MAFS)
59	Camshaft Position Sensor (CMPS) signal input	Camshaft Position Sensor (CMPS)
60	Crankshaft Position Sensor (CKPS) [+] signal input	Crankshaft Position Sensor (CKPS) [M/T]
	Crankshaft Position Sensor (CKPS) [-] signal input	Crankshaft Position Sensor (CKPS) [A/T]
61	-	□
62	-	□
63	-	□
64	Sensor power (+5V)	Position Sensor in Air Control Valve (ACV)
65	Sensor power (+5V)	Position Senor in Electric EGR Control Valve
66	Sensor power (+5V)	Differential Pressure Sensor (DPS) [With DPF]
67	Sensor ground	Boost Pressure Sensor (BPS)
68	-	
69	-	□
70	-	□

71	Sensor ground	Mass Air Flow Sensor (MAFS)
72	Position sensor ground	Position Sensor in Air Control Valve (ACV)
73	-	□
74	Injector (Cylinder #4) [Low] control output	Injector (Cylinder #4)
75	Injector (Cylinder #2) [Low] control output	Injector (Cylinder #2)
76	-	□
77	Fuel Pressure Regulator Valve control output	Fuel Pressure Regulator Valve
78	Oil level switch signal input	Oil level switch
79	Start Switch Input	Ignition swich
80	-	□
81	-	□
82	-	□
83	Motor [-] control output	Electric EGR Control Valve
84	Motor [+] control output	Electric EGR Control Valve
85	Glow Relay control output	Glow Relay
86	-	□
87	Sensor shield	Crankshaft Position Sensor (CKPS)
88	VGT/WGT Control Solenoid Valve control output	VGT/WGT Control Solenoid Valve
89	-	
90	-	□
91	-	□
92	Motor [+] control output	Air Control Valve (ACV)
93	Motor [-] control output	Air Control Valve (ACV)
94	Blower Max. switch input	A/C control module
95	Water Sensor signal input	Water Sensor [Fuel filter]
96	Head Lamp detection switch	Multi function switch

Connector [CAD-KA]

Pin	Description	Connected to
1	Battery power	Main Relay

2	Power ground	Chassis ground
3	Battery power	Main Relay
4	Power ground	Chassis ground
5	Battery power	Main Relay
6	Power ground	Chassis ground
7	-	
8	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)
9	-	□
10	-	□
11	-	□
12	-	□
13	Accelerator Position Sensor (APS) #2 signal input	Accelerator Position Sensor (APS) #2
14	Sensor ground	Accelerator Position Sensor (APS) #2
15	-	
16	Blower Switch signal input	A/C control module
17	Clutch Switch signal input	Clutch switch [M/T]
18	-	
19	Battery power	Ignition Switch
20	Sensor ground	A/C Pressure Transducer (APT)
21	-	□
22	Sensor power (+5V)	A/C Pressure Transducer (APT)
23	-	□
24	Sensor power (+5V)	Accelerator Position Sensor (APS) #1
25	Accelerator Position Sensor (APS) #1 signal input	Accelerator Position Sensor (APS) #1
26	Sensor ground	Accelerator Position Sensor (APS) #1
27	Vehicle Speed Sensor (VSS) signal input	Vehicle Speed Sensor (VSS)
28	A/C thermo switch signal input	A/C thermo switch
29	Sensor power (+5V)	Accelerator Position Sensor (APS) #2

30	Brake [Redundant] switch signal input	Brake switch
31	Immobilizer signal	Immobilizer Control Module
32	Brake [Main] switch signal input	Brake switch
33	-	
34	-	□
35	-	
36	Starter relay control output	Starter relay
37	Cooling Fan Relay [Low] control output	Cooling Fan Relay [Low]
38	Immobilizer Lamp control output	Cluster
39	Ground	Immobilizer Control Module
40	Alternator Regulator Feedback [FR]	Alternator
41	Glow Plug Lamp	Cluster
42	-	
43	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
44	-	□
45	Battery power	Main Relay
46	-	
47	CAN 1 [Low]	Other control module
48	CAN 1 [High]	Other control module
49	Alternator Regulator Output [PWM]	Alternator
50	-	
51	A/C Compressor Relay control output	A/C Compressor Relay
52	LIN communication (K-Line)	Battery Sensor
53	-	
54	-	
55	Malfuntion Indicator Lamp (MIL) control output	Cluster
56	PTC Heater Relay output	PTC Heater Relay
57	-	□
58	A/C ON Switch signal input	A/C ON Switch

3. ECM Terminal input / Output signal

Connector [CAD-M]

Pin	Pin description	Vehicle state	Signal type	Reference level	Test result
1	-	□	□	□	□
2	-	□	□	□	□
3	Injector (Cylinder #4) [High] control output	Idle	Pulse	Battery Voltage ~ 75V	□
4	Intake Air Temperature Sensor (IATS) #1 signal input	Idle	Analog	0.244 ~ 4.760V	2.11V / 33.5degC
5	Exhaust Gas Temperature Sensor (EGTS) #1 signal input	Idle	Analog	0.409 ~ 4.987V	4.98V / 130degC
6	Exhaust Gas Temperature Sensor (EGTS) #2 signal input	Idle	Analog	0.409 ~ 4.987V	4.98V / 130degC
7	Ground	Ignition ON	DC	0 ~ 0.3V	0V
8	Differential Pressure Sensor (DPS) signal input	Idle	Analog	1 ~ 4.5V	1.007V / 0.31kPa
9	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.195 ~ 4.849V	2.72V / 28.5degC
10	Fuel Temperature Sensor (FTS) signal input	Idle	Analog	0.132 ~ 4.995V	3.03V / 24.5degC
11	Air heater diagnosis	□	□	□	□
12	-				
13	Boost Pressure Sensor (BPS) signal input	Idle	Analog	0.5 ~ 4.5V	1.60V / 1.01Bar
14	-	Ignition ON	DC	0.2273 V +/-0.1V 4.5 V +/-0.1V	□
15	Sensor ground	Idle	Analog	0.15 ~ 4.9V	4.37V / 100%
16	Position sensor signal input	Idle	Analog	0.15 ~ 4.9V	0.78V / 42.31%
17	Wiper motor signal input	□	□	□	□
18	-	□	□	□	□
19	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
20	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
21	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V

22	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
23	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
24	-	□	□	□	□
25	Injector (Cylinder #4) [Low] control output	Idle	Pulse	"High : Battery Voltage ~ 75V Low : Max. 1.0V"	□
26	Injector (Cylinder #1) [Low] control output	Idle	Pulse	"High : Battery Voltage ~ 75V Low : Max. 1.0V"	□
27	Injector (Cylinder #1) [High] control output	Idle	Pulse	Battery Voltage ~ 75V	□
28	-				
29	-	□	□	□	□
30	-		□	□	□
31	-		□	□	□
32	-	□	□	□	□
33	-	□	□	□	□
34	Intake Air Temperature Sensor (IATS) #2 signal input	Idle	Analog	0.391 ~ 4.907V	3.3V / 25degC
35	Rail Pressure Sensor (RPS) signal input	Idle	Analog	0.5 ~ 4.5V	0.505V / 7bar
36	Crankshaft Position Sensor (CKPS) [-] signal input [M/T] Crankshaft Position Sensor (CKPS) [+] signal input [A/T]	Idle	Sine Wave	Vp_p : Min. 1.0V Max. 360V	□
37	-	□	□	□	□
38	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
39	-	□	□	□	□
40	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
41	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
42	-				
43	-				

44	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
45	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
46	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
47	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
48	-	□	□	□	□
49	-	□	□	□	□
50	Injector (Cylinder #2) [High] control output	Idle	Pulse	Battery Voltage ~ 75V	□
51	Injector (Cylinder #3) [High] control output	Idle	Pulse	Battery Voltage ~ 75V	□
52	Neutral Switch signal input	Neural Gear engaged	DC	Vbatt Max 0.3 V	10.8V 0.006V
53	Reference frequency	Idle	Pulse	16.7~25Hz High : Vcc Low : Max 0.7V	19.08Hz / 52ms
54	-	□	□	□	□
55	-	□	□	□	□
56	-	□	□	□	□
57	-	□	□	□	□
58	Mass Air Flow Sensor (MAFS) signal input	Idle	Pulse	1.2~14kHz High : Vcc Low : Max 0.7V	2273Hz/7.0g/s
59	Camshaft Position Sensor (CMPS) signal input	Idle	Pulse	High : Battery voltage - 0.8V (Max. 24V) Low : Max. 0.5V	□
60	Crankshaft Position Sensor (CKPS) [+] signal input [M/T] Crankshaft Position Sensor (CKPS) [-] signal input [A/T]	Idle	Sine Wave	Vp_p : Min. 1.0V Max. 360V	□
61	-	□	□	□	□
62	-	Ignition ON	DC	4.7 ~ 5.1 V	□
63	-	□	□	□	□

64	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
65	Sensor power (+5V)	Ignition ON	DC	0 ~ 0.3 V	0.007V
66	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
67	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
68	-				
69	-				□
70	-	□	□	□	□
71	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.12V
72	Position sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.007V
73	-	□	□	□	□
74	Injector (Cylinder #4) [Low] control output	Idle	Pulse	"High : Battery Voltage ~ 75V Low : Max. 1.0V"	□
75	Injector (Cylinder #2) [Low] control output	Idle	Pulse	"High : Battery Voltage ~ 75V Low : Max. 1.0V"	□
76	-	□	□	□	□
77	Fuel Pressure Regulator Valve control output	Idle	Pulse	Vbatt Ground : Max. 0.3V	350Hz / 40%
78	-				□
79	Start Switch Input	Key On Key Start	DC	Max 0.3 V Vbatt	0.005V 12.8V
80	-	□	□	□	□
81	-				□
82	-	□	□	□	□
83	Motor [-] control output	Engine Running	Pulse	High : Battery Voltage	
				Low : Max. 1.0V	
				Low : Max. 1.0V	
84	Motor [+] control output	Active	Pulse	Hi: Battery Voltage	
				Low: Max. 1.0V	
				Frequency: 1,000Hz	

85	Glow Relay control output	Relay OFF Relay ON	DC	Vbatt Max 0.7 V	12.12V 0.1V
86	-	□	□	□	□
87	Sensor shield	Ignition ON	DC	0 ~ 0.3 V	0.004V
88	VGT/WGT Control Solenoid Valve control output	Idle	Pulse	Vbatt Ground : Max. 0.3V	300Hz / 28%
89	-				
90	-	□	□	□	□
91	-	□	□	□	□
92	Motor [+] control output	Idle	Pulse	Vbatt Ground : Max. 0.3V	1000Hz / 16% (neg)
93	Motor [-] control output				
94	Blower Max. Switch input	Max blower OFF Max blower ON	Analog	Vbatt Max 0.3 V	10.11 V 0.0005V
95	Water Sensor signal input	Water in Fuel No water	DC	Vbatt Max 0.3 V	- 0.005V
96	Head Lamp detection switch	Lamp OFF Lamp ON	DC	Vbatt Max 0.3 V	10.86 V 0.05 V

Connector [CAD-KA]

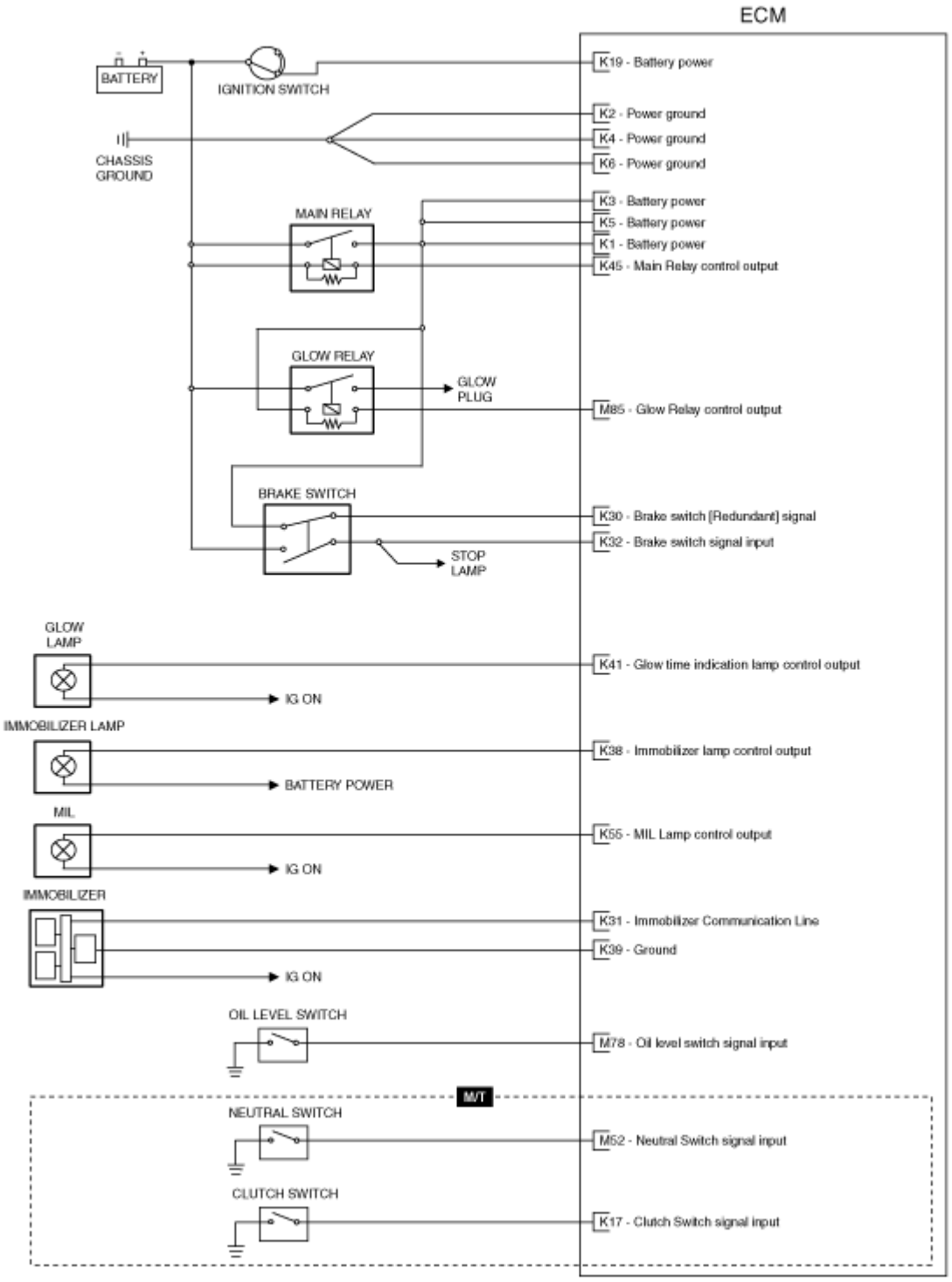
Pin	Pin description	Vehicle state	Signal type	Reference level	Test result
1	Battery power	Ignition ON	DC	Vbatt	12.05V
2	Power ground	Ignition ON	DC (Engine)	0 ~ 0.3 V	0V
3	Battery power	Ignition ON	DC	Vbatt	12.05V
4	Power ground	Ignition ON	DC (Engine)	0 ~ 0.3 V	0V
5	Battery power	Ignition ON	DC	Vbatt	12.05V
6	Power ground	Ignition ON	DC (Engine)	0 ~ 0.3 V	0V
7	-	□	□	□	□
	A/C Pressure Transducer				

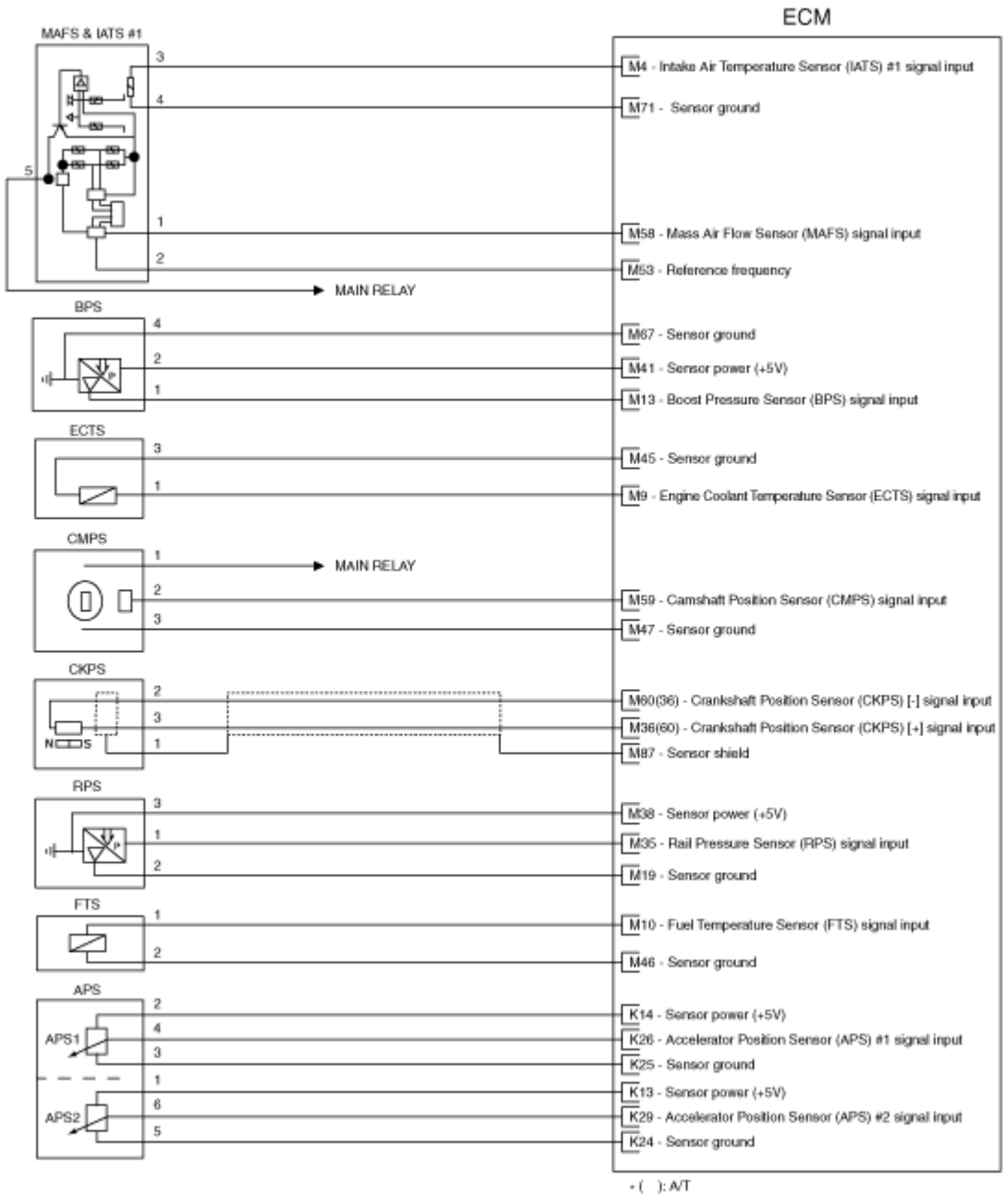
8	(APT) signal input	Idle	Analog	0.5 ~ 4.5V	1.23 V / 5.75bar
9	-	□	□	□	□
10	-	□	□	□	□
11	-	□	□	□	□
12	-	□	□	□	□
13	Accelerator Position Sensor (APS) #2 signal input	C.T W.O.T	Analog	0.275 ~ 0.475 V 1.9 ~ 2.2 V	0.373V / 0% 2.04V / 100%
14	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.008V
15	-				□
16	Blower Switch Signal	Blower OFF Blower ON	DC	Vbatt Max 1.5 V	11.16V 1.05V
17	Clutch Top Switch signal input	Push Release	DC	Vbatt Max 1.5 V	11.21V 0.002V
18	-				
19	Battery power	Key OFF Key ON	DC	Max 2 V Vbatt	0.23V 12.02V
20	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.008V
21	-	□	□	□	□
22	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
23	-	□	□	□	□
24	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
25	Accelerator Position Sensor (APS) #1 signal input	C.T W.O.T	Analog	0.7 ~ 0.85 V 3.95 ~ 4.25 V	0.737V 4.04V
26	Sensor ground	Ignition ON	DC	0 ~ 0.3 V	0.009V
27	Vehicle Speed Sensor (VSS) signal input	Vehicle Run	Pulse	High: Vcc Low: Max 0.5V	□
28	A/C thermo switch signal input	A/C OFF A/C ON	DC	Max 1.5 V Vbatt	0.002V 10.42V
29	Sensor power (+5V)	Ignition ON	DC	4.7 ~ 5.1 V	5V
30	Brake [Redundant] switch signal input	Push Release	DC	Max 1.5 V Vbatt	0.005V 12.2V
31	Immobilizer signal	Ignition ON	□	□	OK

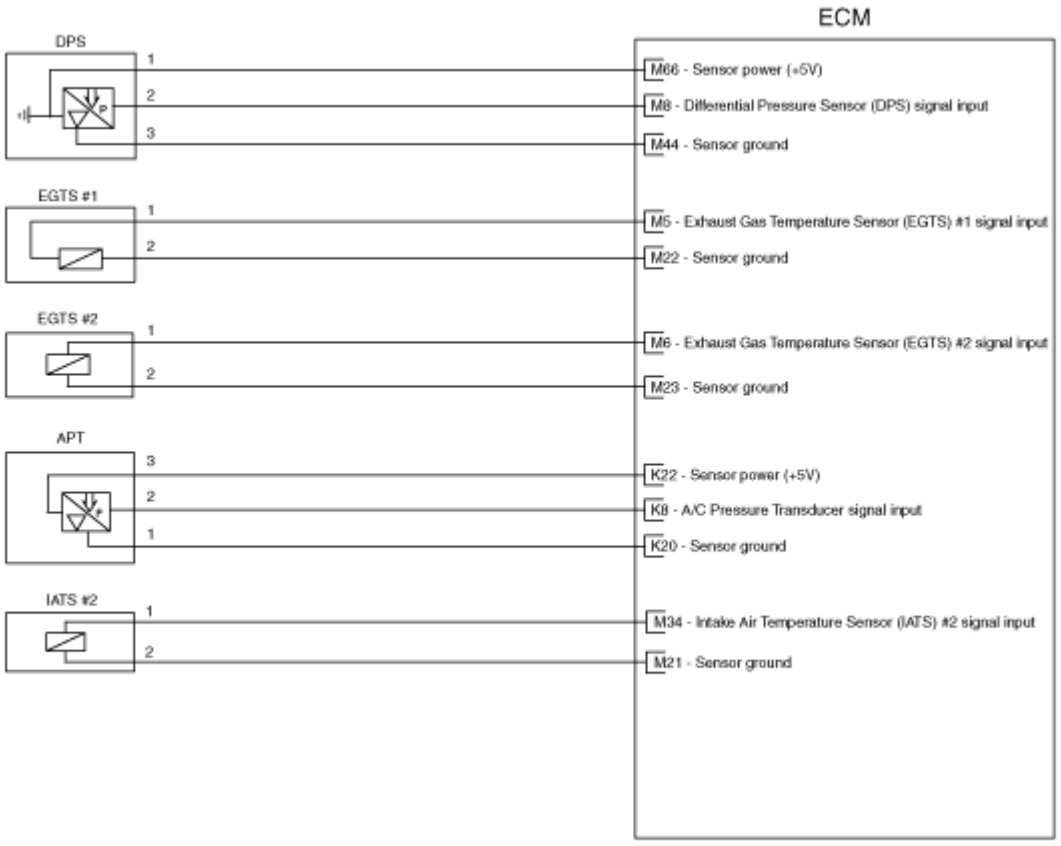
32	Brake [Main] switch signal input	Push Release	DC	Vbatt Max 1.5 V	11.62V 0.005V
33	-				□
34	-	□	□	□	□
35	-				
36	Starter relay control output	Relay OFF Relay ON	DC	Vbatt Max 1.5 V	12V 0.002V
37	Cooling Fan Relay [Low] control output	Relay OFF Relay ON	DC	Vbatt Max 0.7 V	12V 0.018V
38	Immobilizer Lamp control output				
39	Ground	Ignition ON	DC	0 ~ 0.3 V	0V
40	Alternator Regulator Feedback	Idle	Pulse	High : Min 3V Low : Max 1.5V	□
41	Glow Plug Lamp	Lamp OFF Lamp ON	DC	Vbatt Max 0.4 V	10.5V 0.002V
42	-	□	□	□	□
43	Cooling Fan Relay [High] control output	Relay OFF Relay ON	DC	Vbatt Max 0.7 V	12V 0.02V
44	-	□	□	□	□
45	Battery power	Relay OFF Relay ON	DC	Max 1.2 V Vbatt	0.9V 12V
46	-	Idle	Pulse	High : Vbatt Low : Max 0.3V	□
47	CAN 1 [Low]	RECESSIVE DOMINANT	Pulse	2.0 ~ 3.0V 0.5 □ 2.25V	□
48	CAN 1 [High]	RECESSIVE DOMINANT	Pulse	2.0 ~ 3.0V 2.75 □ 4.5V	□
49	Alternator Regulator Output [PWM]	Idle	Pulse	High : Min 4V Low : Max 2V	□
50	-	□	□	□	□
51	A/C Compressor Relay control output	A/C OFF A/C ON	DC	Vbatt Max 1.5 V	12V 0.02V

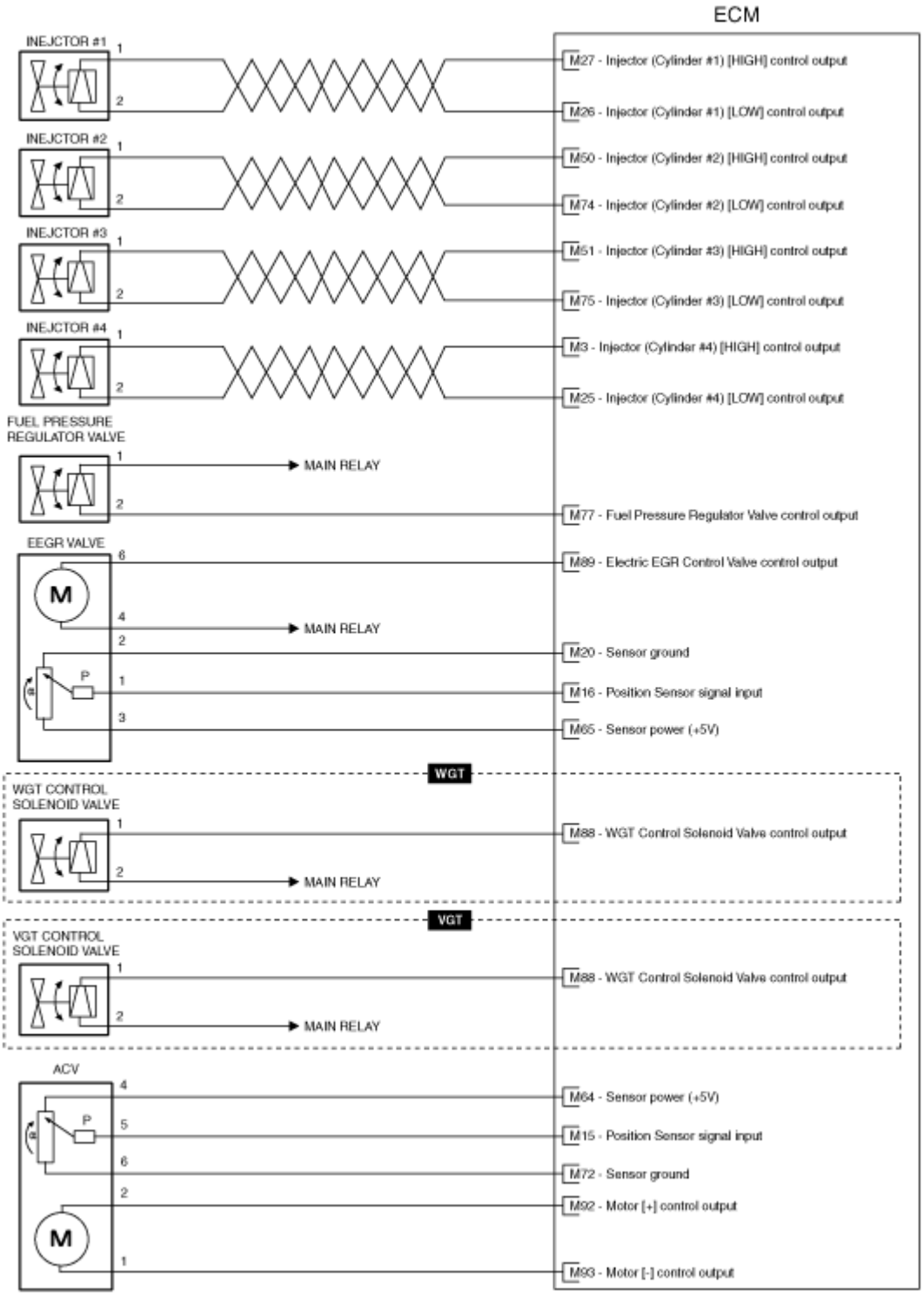
52	LIN communication (K-Line)	Ignition ON	□	□	OK
53	-	□	□	□	□
54	-	□	□	□	□
55	Malfuntion Indicator Lamp (MIL) control output				
56	PTC Heater Relay output	Relay OFF Relay ON	DC	Vbatt Max 0.4 V	12V 0.02V
57	-	□	□	□	□
58	A/C ON Switch signal input	A/C OFF A/C ON	DC	Max 1.5 V Vbatt	0.002V 10.46V

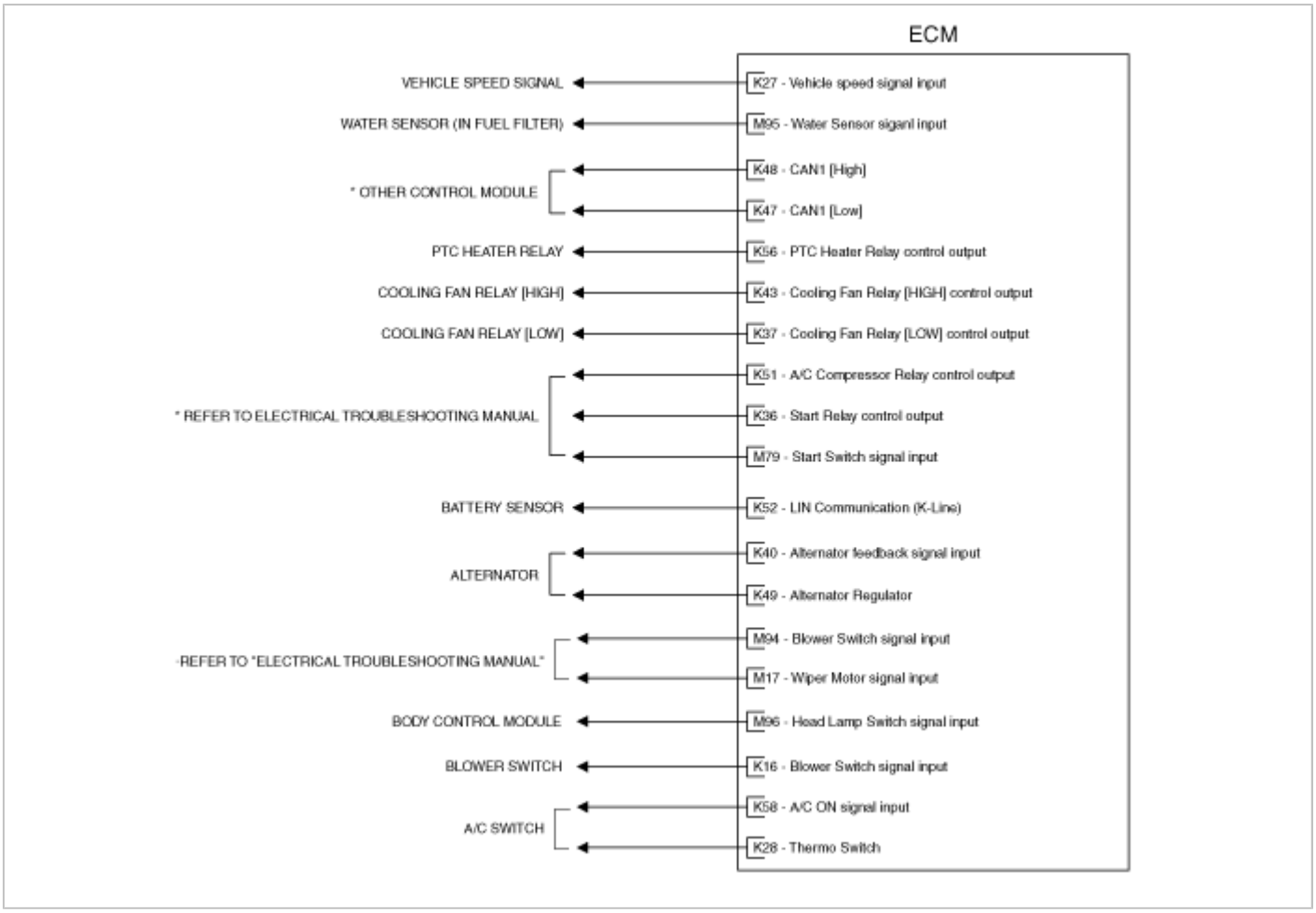
Circuit Diagram


ECM
BATTERY
IGNITION SWITCH
K19 - Battery power
CHASSIS GROUND
K2 - Power ground
K4 - Power ground
K6 - Power ground
MAIN RELAY
K3 - Battery power
K5 - Battery power
K1 - Battery power
K45 - Main Relay control output
GLOW RELAY
GLOW PLUG
M85 - Glow Relay control output
BRAKE SWITCH
K30 - Brake switch [Redundant] signal
K32 - Brake switch signal input
STOP LAMP
GLOW LAMP
K41 - Glow time indication lamp control output
IG ON
IMMOBILIZER LAMP
K38 - Immobilizer lamp control output
BATTERY POWER
MIL
K55 - MIL Lamp control output
IG ON
IMMOBILIZER
K31 - Immobilizer Communication Line
K39 - Ground
IG ON
OIL LEVEL SWITCH
M78 - Oil level switch signal input
M/T
NEUTRAL SWITCH
M52 - Neutral Switch signal input
CLUTCH SWITCH
K17 - Clutch Switch signal input


ECM
MAFS & IATS #1
3
4
5
1
2
MAIN RELAY
M4 - Intake Air Temperature Sensor (IATS) #1 signal input
M71 - Sensor ground
M58 - Mass Air Flow Sensor (MAFS) signal input
M53 - Reference frequency
BPS
4
2
1
M67 - Sensor ground
M41 - Sensor power (+5V)
M13 - Boost Pressure Sensor (BPS) signal input
ECTS
3
1
M45 - Sensor ground
M9 - Engine Coolant Temperature Sensor (ECTS) signal input
CMPS
1
MAIN RELAY
2
3
M59 - Camshaft Position Sensor (CMPS) signal input
M47 - Sensor ground
CKPS
2
3
1
N
S
M60(36) - Crankshaft Position Sensor (CKPS) [-] signal input
M36(60) - Crankshaft Position Sensor (CKPS) [+] signal input
M87 - Sensor shield
RPS
3
1
2
M38 - Sensor power (+5V)
M35 - Rail Pressure Sensor (RPS) signal input
M19 - Sensor ground
FTS
1
2
M10 - Fuel Temperature Sensor (FTS) signal input
M46 - Sensor ground
APS
APS1
APS2
2
4
3
1
6
5
K14 - Sensor power (+5V)
K26 - Accelerator Position Sensor (APS) #1 signal input
K25 - Sensor ground
K13 - Sensor power (+5V)
K29 - Accelerator Position Sensor (APS) #2 signal input
K24 - Sensor ground
- ( ): A/T


ECM
DPS
1
2
3
M66 - Sensor power (+5V)
M8 - Differential Pressure Sensor (DPS) signal input
M44 - Sensor ground
EGTS #1
1
2
M5 - Exhaust Gas Temperature Sensor (EGTS) #1 signal input
M22 - Sensor ground
EGTS #2
1
2
M6 - Exhaust Gas Temperature Sensor (EGTS) #2 signal input
M23 - Sensor ground
APT
3
2
1
K22 - Sensor power (+5V)
K8 - A/C Pressure Transducer signal input
K20 - Sensor ground
IATS #2
1
2
M34 - Intake Air Temperature Sensor (IATS) #2 signal input
M21 - Sensor ground

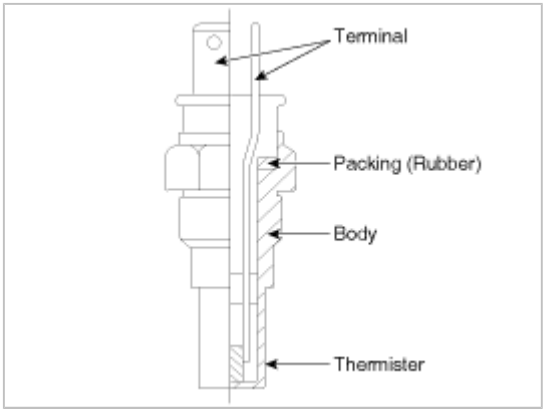

ECM
INEJCTOR #1
1
2
M27 - Injector (Cylinder #1) [HIGH] control output
M26 - Injector (Cylinder #1) [LOW] control output
INEJCTOR #2
1
2
M50 - Injector (Cylinder #2) [HIGH] control output
M74 - Injector (Cylinder #2) [LOW] control output
INEJCTOR #3
1
2
M51 - Injector (Cylinder #3) [HIGH] control output
M75 - Injector (Cylinder #3) [LOW] control output
INEJCTOR #4
1
2
M3 - Injector (Cylinder #4) [HIGH] control output
M25 - Injector (Cylinder #4) [LOW] control output
FUEL PRESSURE REGULATOR VALVE
1
MAIN RELAY
2
M77 - Fuel Pressure Regulator Valve control output
EEGR VALVE
6
M89 - Electric EGR Control Valve control output
M
4
MAIN RELAY
2
M20 - Sensor ground
P
1
M16 - Position Sensor signal input
3
M65 - Sensor power (+5V)
WGT
WGT CONTROL SOLENOID VALVE
1
M88 - WGT Control Solenoid Valve control output
2
MAIN RELAY
VGT
VGT CONTROL SOLENOID VALVE
1
M88 - WGT Control Solenoid Valve control output
2
MAIN RELAY
ACV
4
M64 - Sensor power (+5V)
P
5
M15 - Position Sensor signal input
6
M72 - Sensor ground
2
M92 - Motor [+] control output
M
1
M93 - Motor [-] control output


ECM
VEHICLE SPEED SIGNAL
K27 - Vehicle speed signal input
WATER SENSOR (IN FUEL FILTER)
M95 - Water Sensor siganl input
* OTHER CONTROL MODULE
K48 - CAN1 [High]
K47 - CAN1 [Low]
PTC HEATER RELAY
K56 - PTC Heater Relay control output
COOLING FAN RELAY [HIGH]
K43 - Cooling Fan Relay [HIGH] control output
COOLING FAN RELAY [LOW]
K37 - Cooling Fan Relay [LOW] control output
* REFER TO ELECTRICAL TROUBLESHOOTING MANUAL
K51 - A/C Compressor Relay control output
K36 - Start Relay control output
M79 - Start Switch signal input
BATTERY SENSOR
K52 - LIN Communication (K-Line)
ALTERNATOR
K40 - Alternator feedback signal input
K49 - Alternator Regulator
REFER TO "ELECTRICAL TROUBLESHOOTING MANUAL"
M94 - Blower Switch signal input
M17 - Wiper Motor signal input
BODY CONTROL MODULE
M96 - Head Lamp Switch signal input
BLOWER SWITCH
K16 - Blower Switch signal input
A/C SWITCH
K58 - A/C ON signal input
K28 - Thermo Switch

Description

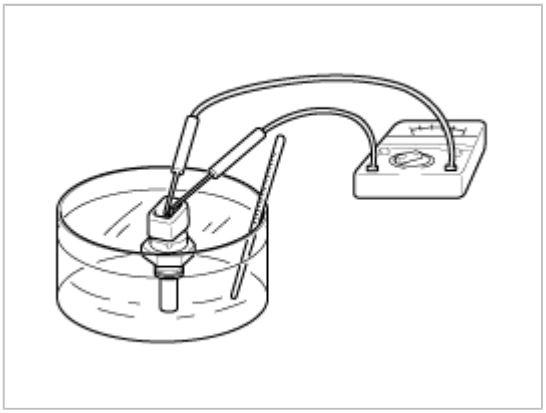
Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5V in the ECM is supplied to the ECTS via a resistor in the ECM.

That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.



Inspection

1. Turn ignition switch OFF.
2. Disconnect the engine coolant temperature sensor connector.
3. Remove the sensor.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS signal terminal and ground terminal.



5. Check that the resistance is within the specification.

Specification: Refer to Specification section.

Specification

Temperature [□(□)]	Resistance(□)
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83
0(32)	5.79
20(68)	2.31 ~ 2.59
40(104)	1.15
60(140)	0.59
80(176)	0.32

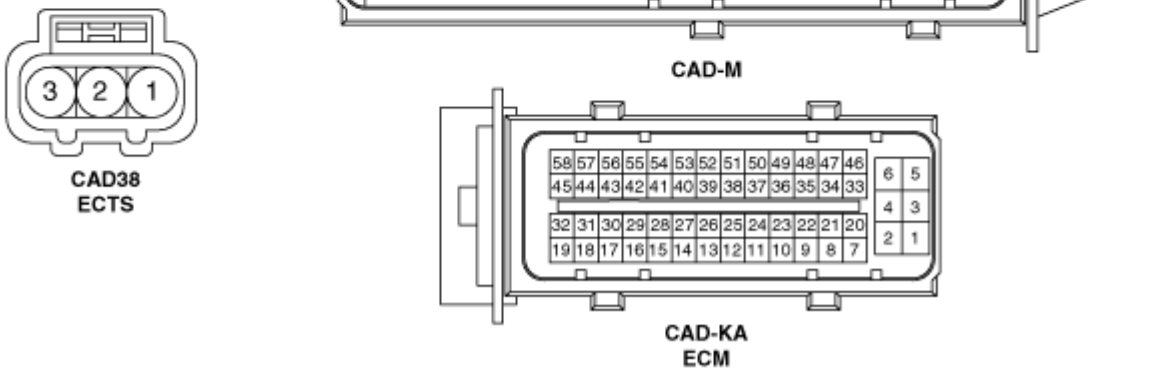
Circuit Diagram

[Circuit Diagram]

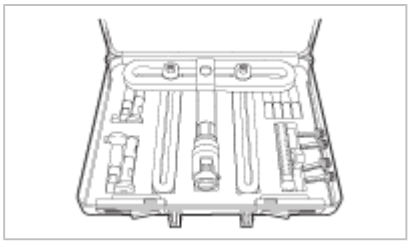
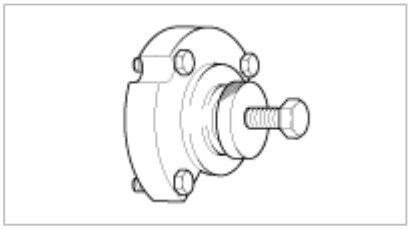
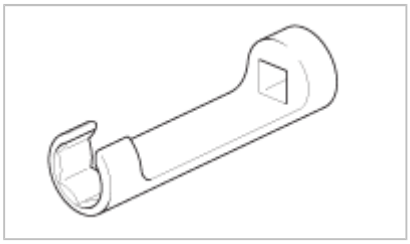
[Connection Information]

Terminal	Connected to	Function
1	ECM CAD-M (9)	ECTS Signal
2	-	-
3	ECM CAD-M (45)	Sensor ground

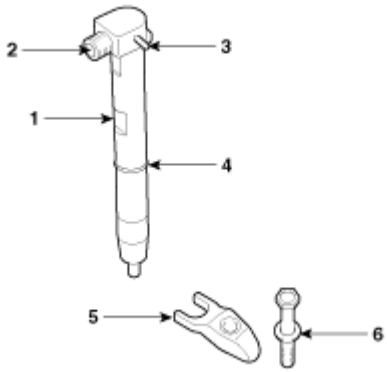
[Harness Connector]



Special Service Tools

Tool (Number and name)	Illustration	Application
Injector Remover (09351-4A300)		Removing the injector
Injector Remover Adaptor (09351-4A310)		Removing the stuck injector
High Pressure Fuel Pump Sprocket Remover (09331-4A000)		Removing the high pressure fuel pump sprocket
Torque Wrench Socket (17mm) (09314-27120)		Installing the high pressure fuel pipe
Fuel Pump Plate Cover Wrench (09310-2B100)		Removing or installing fuel pump (or fuel sender) plate cover

Components



1. Injector
2. Fuel inlet
3. Return nipple
4. O-ring
5. Clamp
6. Clamp bolt

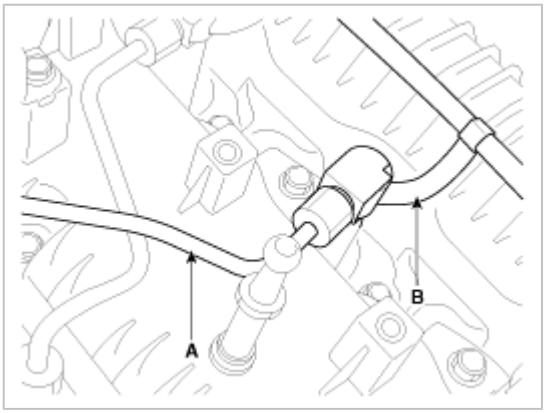
Description

The start of injection and the injected fuel quantity are adjusted by electrically triggered injectors. These injectors supersede the nozzle-and-holder assembly (nozzle and nozzle-holder). Similar to the already existing nozzle-holder assemblies in direct-injection (DI) diesel engines, clamps are preferably used for installing the injectors in the cylinder head. This means that the Common Rail injectors can be installed in already existing DI diesel engines without major modifications to the cylinder head.

Removal

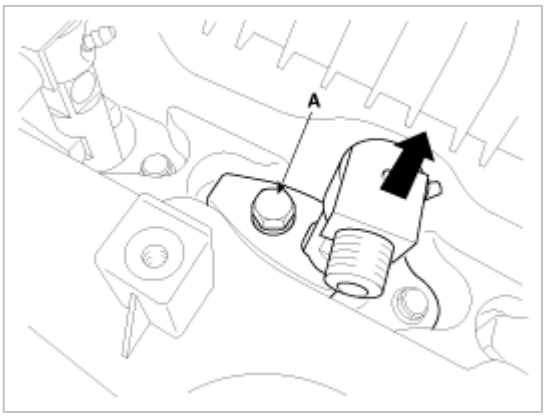
- Common Rail Fuel Injection System operates with extremely high pressure [approximately 1,800 bar (180 MPa / 26,106 psi)], so never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Keep cleanly the parts and the working area.
- Pay attention to a foreign substance.
- Just before installing injector, tube or hose, remove the protect-cap attached on them.
- Do not remove injector except for special case.
- When installing Injector
  - Wash the contact area of the injector and replace the O-ring with a new one.
  - Spread oil on the injector O-ring.
  - To protect damage caused by shock, vertically insert the injector into the cylinder head.
- When installing High Pressure Fuel Pipe
  - Do not use again the used high pressure fuel pipe.
  - Install the flange nut correctly.

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the injector connector.
3. Disconnect the high pressure fuel pipe (A) connecting the injectors with the common rail.
4. Disconnect the retun hose (B) from the injectors.



5. Unscrew the clamp tightening bolt (A) and pull the injector upward.

If the injector adheres to the cylinder head, use the special Service Tool [SST No. : 09351-4A300 & 09351-4A310]



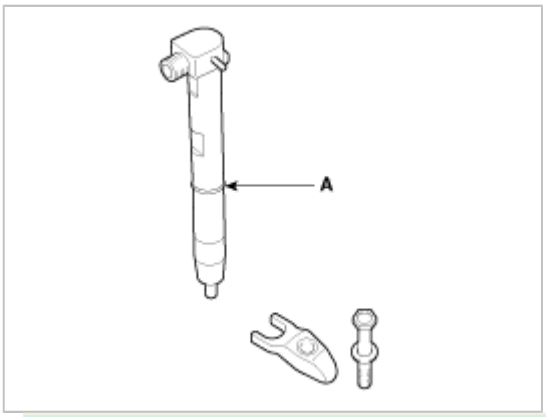
Installation

1. Installation is reverse of removal.

After removing or replacing fuel system below, must perform fuel leakage test procedure. (Refer to "Fuel leak test" in this group.)

- Fuel tank
- Fuel sender
- Fuel filter
- High pressure fuel pump
- Injector
- Common rail
- Low pressure fuel line

When installing the injector, MUST REPLACE the O-ring (A) and apply a grease to that.



When installing the high pressure fuel pipe, apply the specified tightening torques with the special service tool (SST No.: 09314-27120/09314-27110).

Injector clamp installation bolt:
24.5 ~ 28.4 N.m (2.5 ~ 2.9 kgf.m, 18.1 ~ 20.1 lb-ft)
High pressure fuel pipe installation nut:
24.5 ~ 28.4 N.m (2.5 ~ 2.9 kgf.m, 18.1 ~ 20.1 lb-ft)

Replacement

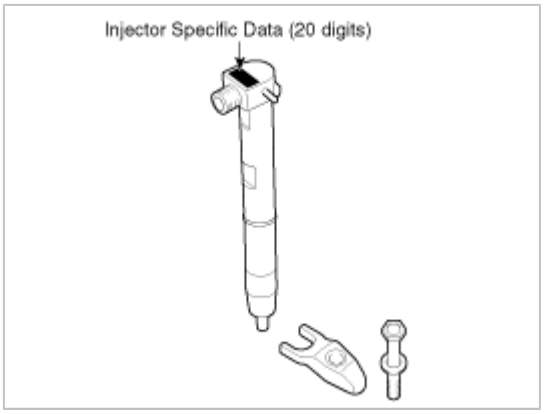
- Common Rail Fuel Injection System operates with extremely high pressure [approximately 1,800 bar (180 MPa / 26,106 psi)], so never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Keep cleanly the parts and the working area.
- Pay attention to a foreign substance.
- Just before installing injector, tube or hose, remove the protect-cap attached on them.
- Do not remove injector except for special case.
- When installing Injector
  - Wash the contact area of the injector and replace the O-ring with a new one.
  - Spread oil on the injector O-ring.
  - To protect damage caused by shock, vertically insert the injector into the cylinder head.
- When installing High Pressure Fuel Pipe
  - Do not use again the used high pressure fuel pipe.
  - Install the flange nut correctly.

After replacing injector, MUST input the injector specific data (20 digits) of each cylinder into ECM with scan tool.

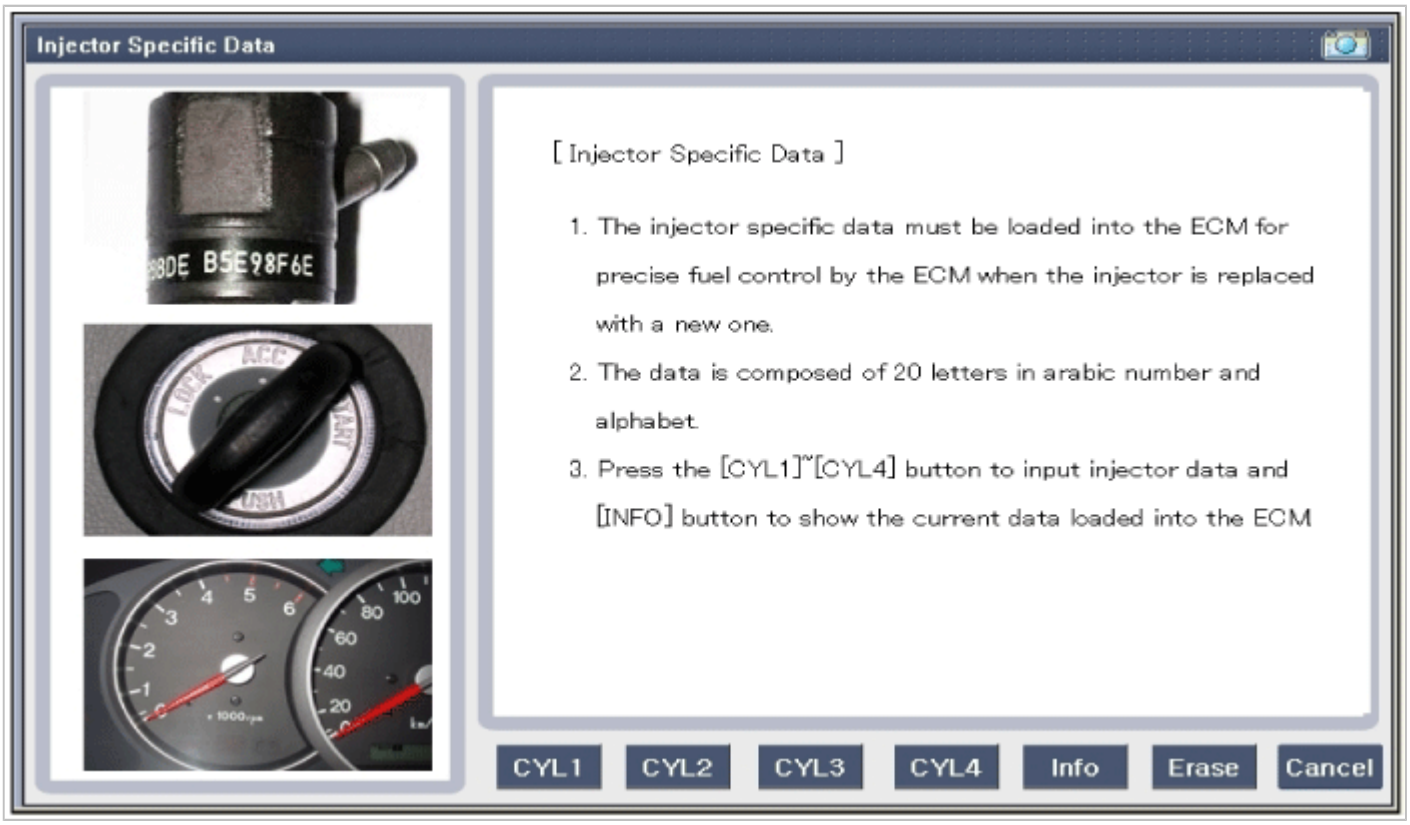
1. Remove the injector (Refer to "Removal" procedure).
2. Install the injector (Refer to "Installation" procedure).
3. Perform "Injector Specific Data Input" procedure (Refer to "Injector Specific Data Input" procedure).

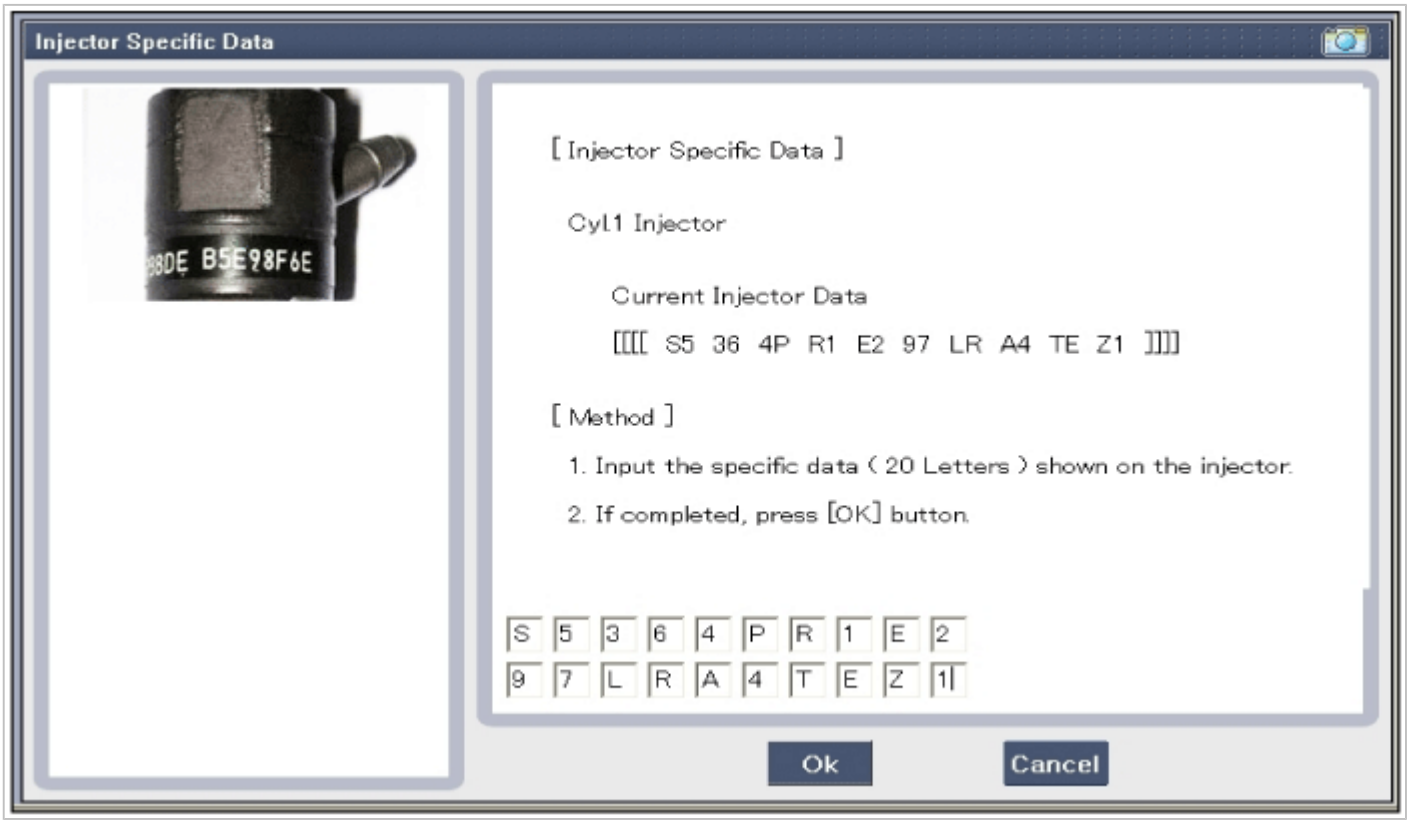
Injector Specific Data Input

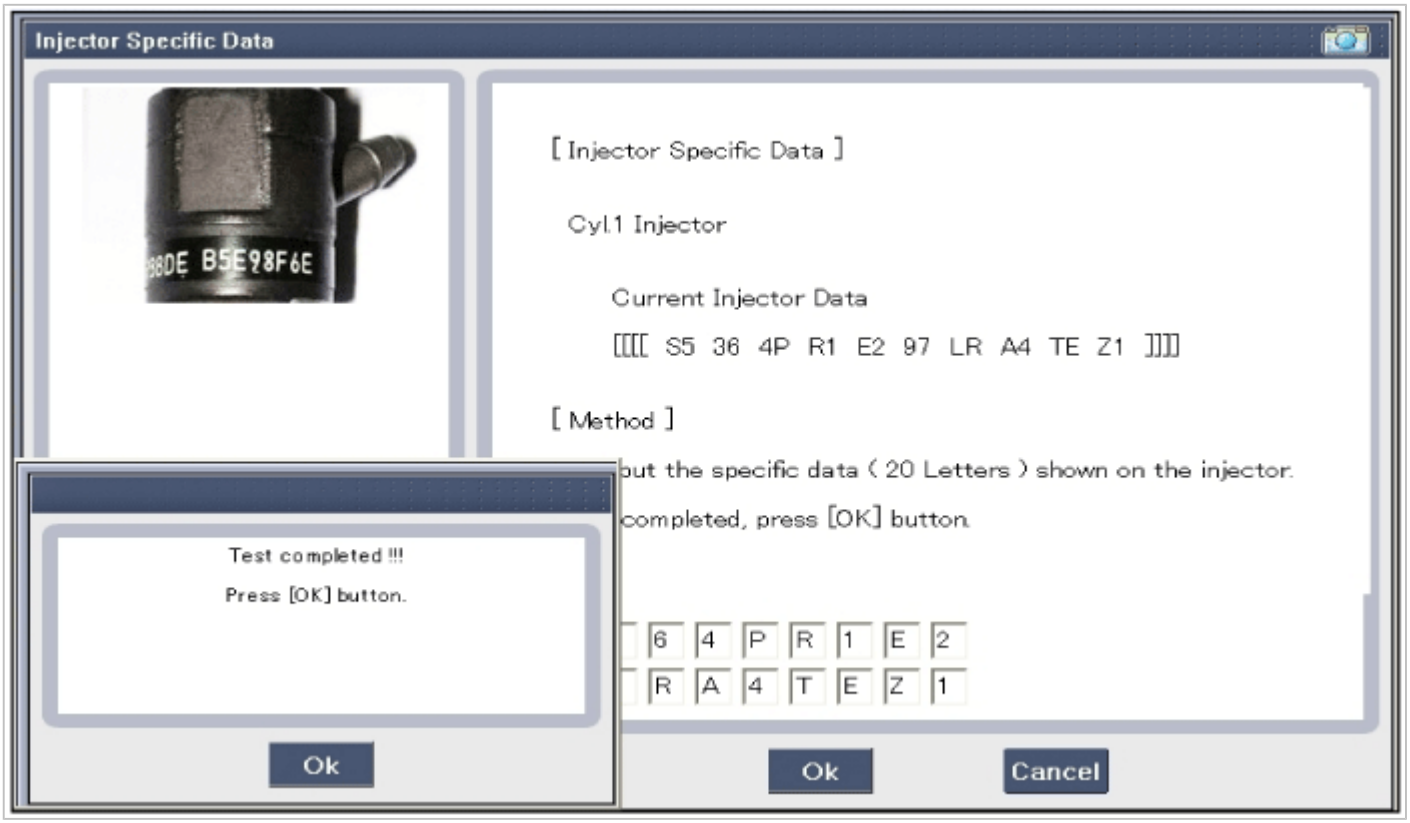
After replacing injector, MUST input the injector specific data (20 digit) of each cylinder into ECM with scan tool.



1. Turn ignition switch OFF.
2. Connect a GDS to Data Link Connector (DLC).
3. Turn ignition switch ON.
4. Select "Vehicle, Model year, Engine, System".
5. Select "Vehicle S/W Management".
6. Select "injector Specific Data".
7. Perform the procedure in accordance with the message.

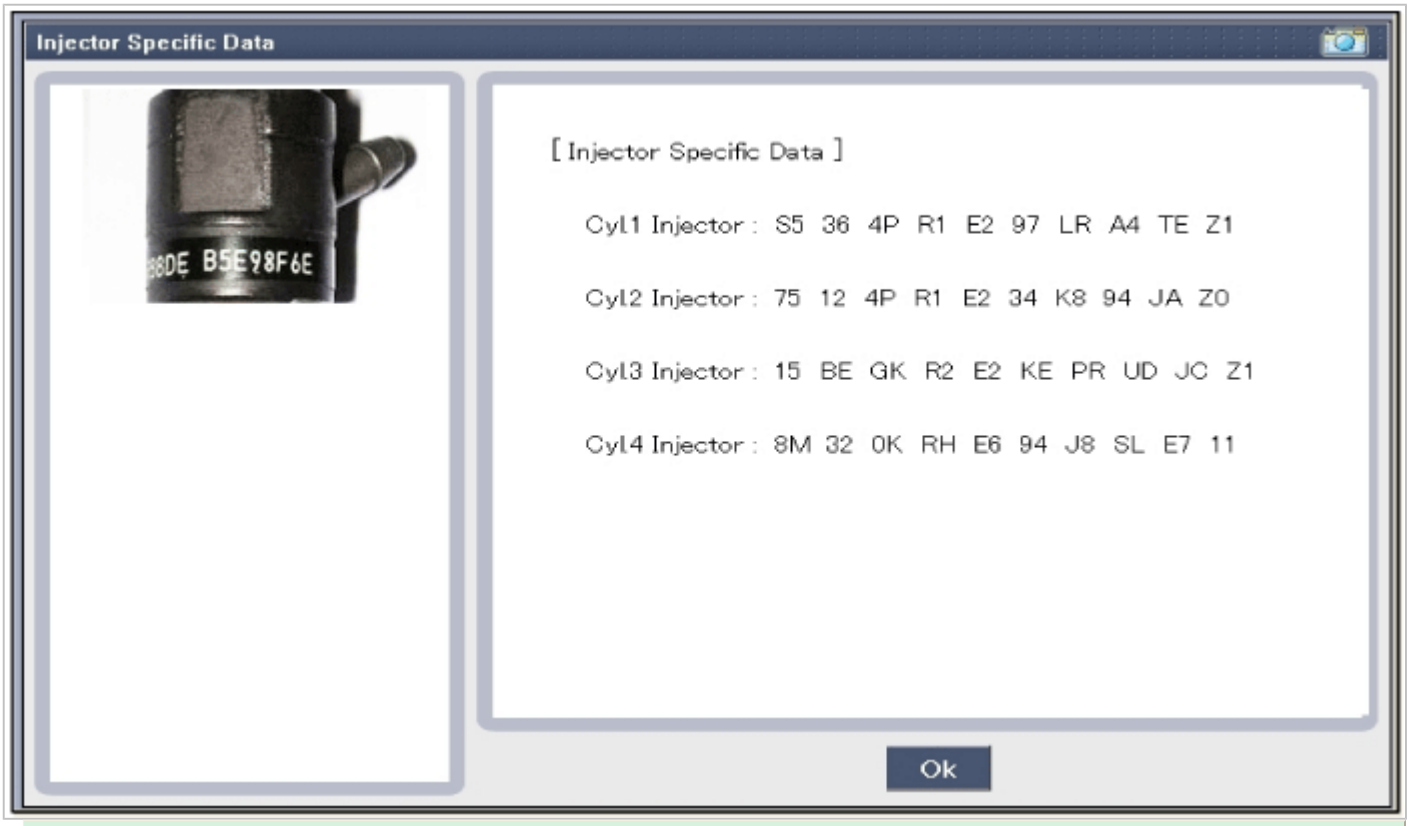






8. After selecting "OK" on the "Test competed" message, turn ignition switch OFF.
9. In about 10 seconds, turn ignition switch ON and recheck the injector specific data memorized in the

ECM.

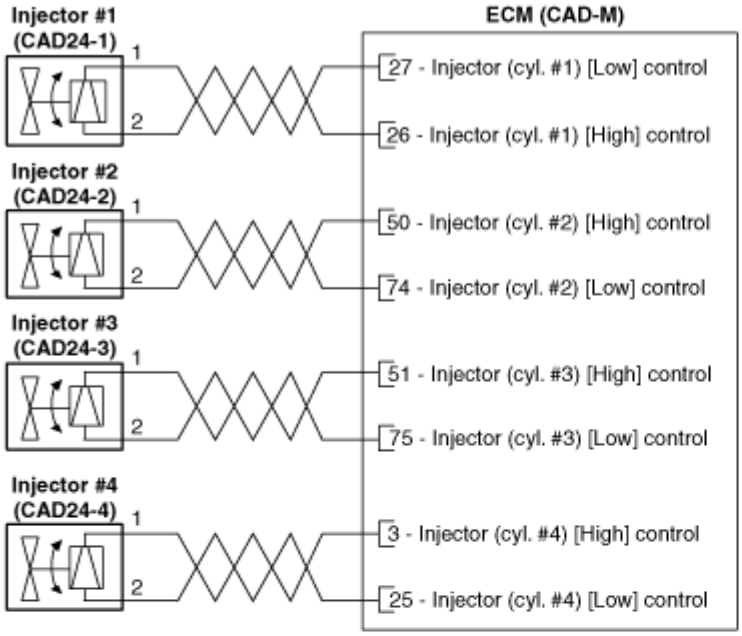


In case of failure, input the injector specific data (20 digits) into ECM again.

10. Perform "Fuel leakage test" procedure. (Refer to "Fuel leakage test" in this manual)

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Injector #1 (CAD24-1)

Terminal	Connected to	Function
1	ECM CAD-M (27)	Injector (cyl. #1) [Low]
2	ECM CAD-M (26)	Injector (cyl. #1) [High]

Injector #2 (CAD24-2)

Terminal	Connected to	Function
1	ECM CAD-M (50)	Injector (cyl. #2) [High]
2	ECM CAD-M (74)	Injector (cyl. #2) [Low]

Injector #3 (CAD24-3)

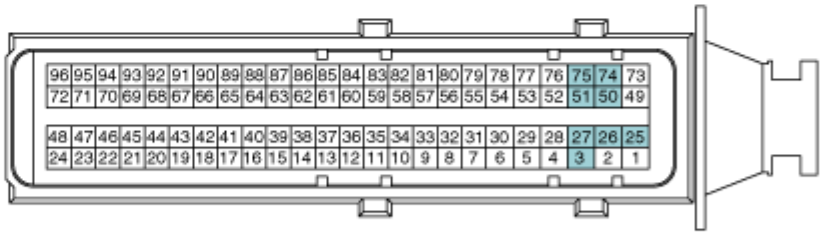
Terminal	Connected to	Function
1	ECM CAD-M (51)	Injector (cyl. #3) [High]
2	ECM CAD-M (75)	Injector (cyl. #3) [Low]

Injector #4 (CAD24-4)

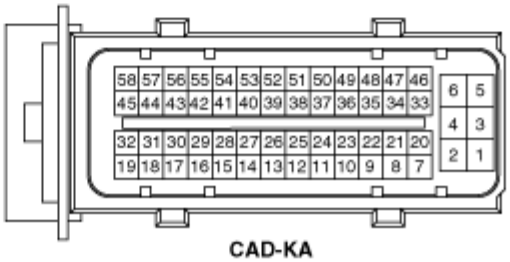
Terminal	Connected to	Function
1	ECM CAD-M (3)	Injector (cyl. #4) [High]
2	ECM CAD-M (25)	Injector (cyl. #4) [Low]

[Harness Connector]

CAD24-1,2,3,4
Injector #1,2,3,4



CAD-M



CAD-KA
ECM

Specification

Items	Specification
Coil Resistance (Ω)	0.164 ~ 0.195 [20Ω(68Ω)]

Signal waveform

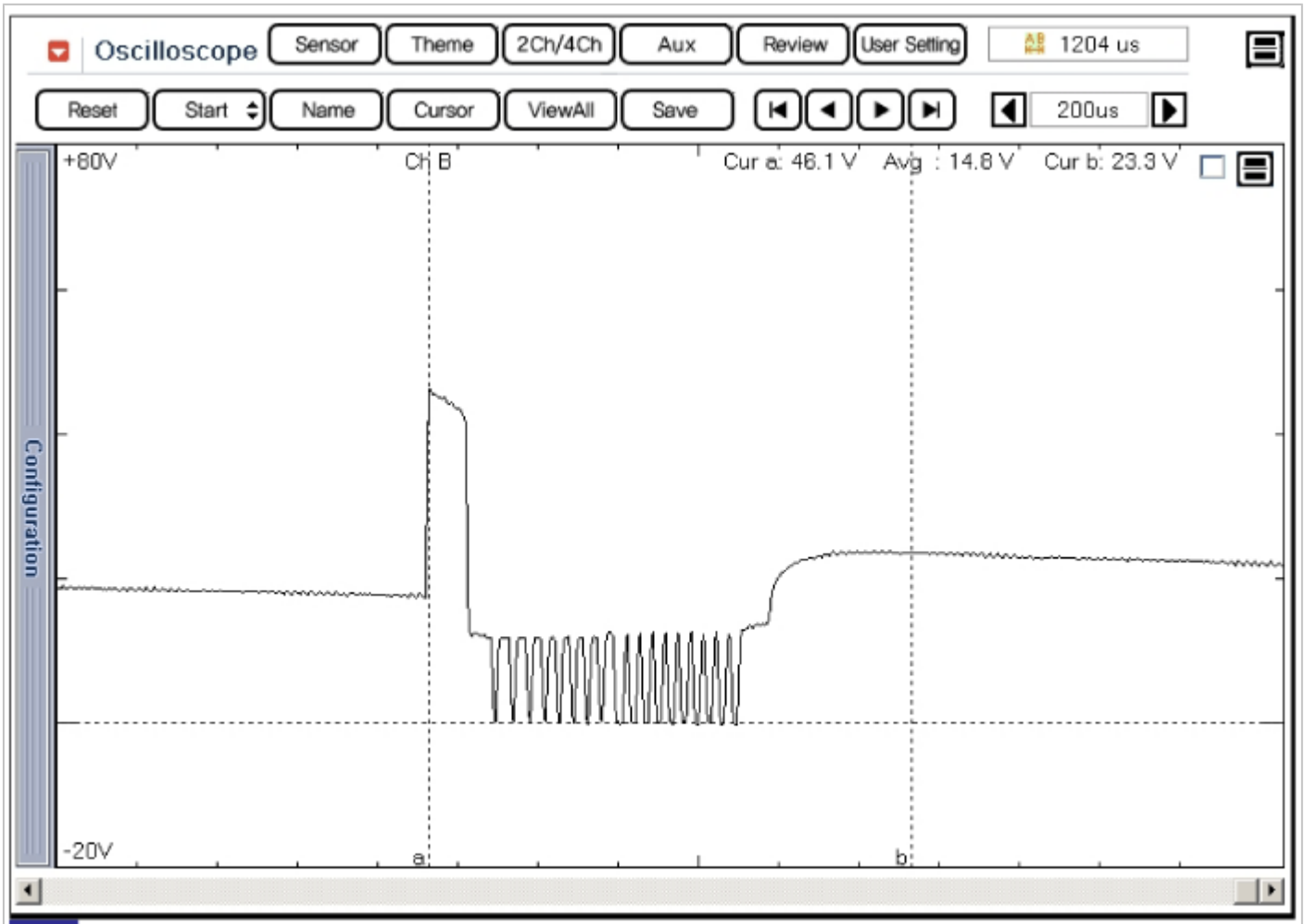
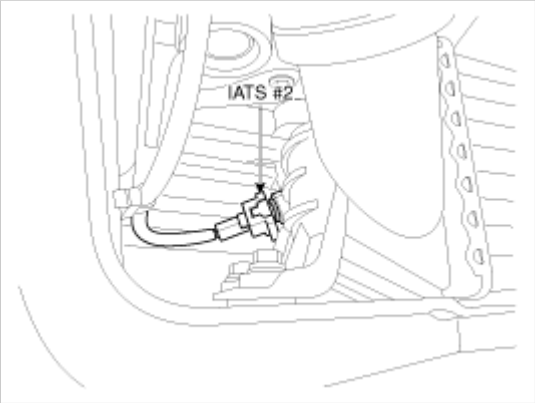


Fig.1) Magnified waveform of main injection at idle

Description

Intake Air Temperature Sensor (IATS) uses a Negative Temperature Characteristics (NTC) thermistor and senses intake air temperature. Two intake air temperature sensors are installed in this engine.
IATS #1 in Mass Air Flow Sensor (MAFS) and IATS #2 installed at intercooler pipe are located in front of and behind turbo-charger respectively. IATS #1 senses air temperature entering turbo-charger and the other (IATS #2) does air temperature coming out from the turbo-charger.
Comparing these air temperature values from both sensors, more accurate sensing of intake air temperature is possible. ECM uses these air temperature signals to perform EGR control correction and fuel injection quantity correction.



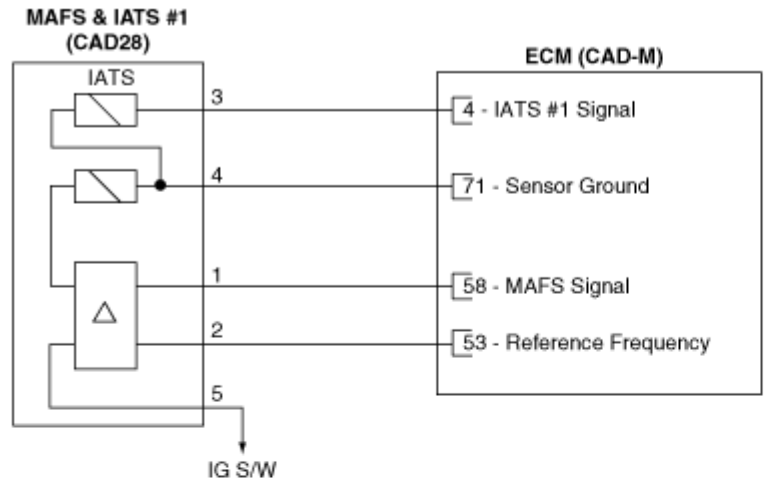
Inspection

1. Turn ignition switch OFF.
2. Disconnect the MAFS (for IATS #1) or BPS (for IATS #2) connector.
3. Measure resistance between IATS signal terminal and sensor ground terminal.
4. Check that the resistance is within the specification.

Specification: Refer to Specification section.

Circuit Diagram

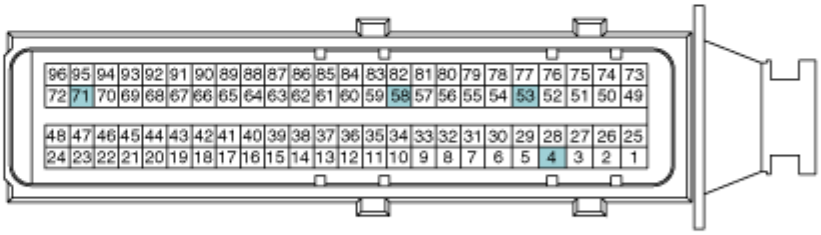
[Circuit Diagram]

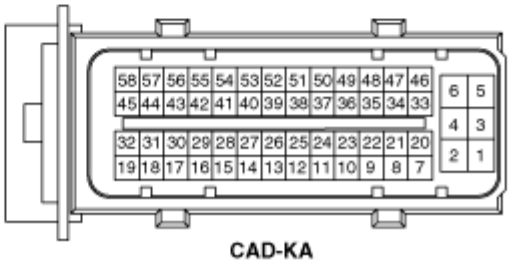


[Connection Information]

Terminal	Connected to	Function
1	ECM CAD-M (58)	MAFS Signal
2	ECM CAD-M (53)	Reference Frequency
3	ECM CAD-M (4)	IATS #1 Signal
4	ECM CAD-M (71)	Sensor Ground
5	IG S/W	Power Supply (B+)

[Harness Connector]





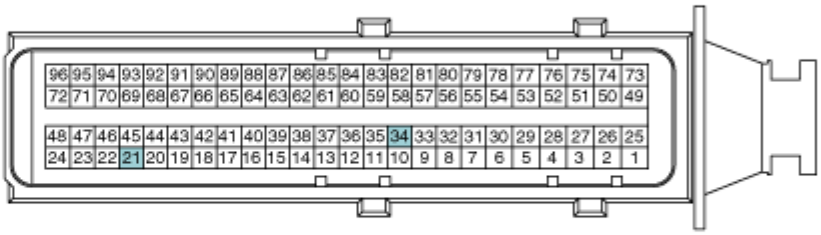
[Circuit Diagram]

[Connection Information]

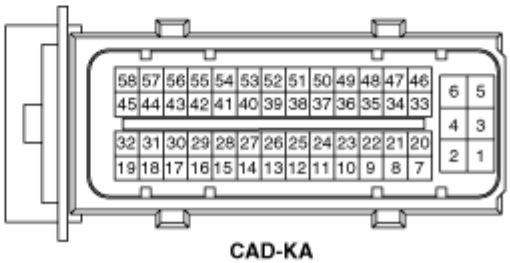
Terminal	Connected to	Function
1	ECM CAD-M (34)	IATS #2 Signal
2	ECM CAD-M (21)	Sensor Power

[Harness Connector]

T29
IATS #2



CAD-M



CAD-KA
ECM

Specification

IATS #1 in MAFS

Temperature [□(□)]	Resistance(□)
-40(-40)	35.14 ~ 43.76
-20(-4)	12.66 ~ 15.12
0(32)	5.12 ~ 5.89
20(68)	2.29 ~ 2.55
40(104)	1.10 ~ 1.24
60(140)	0.57 ~ 0.65
80(176)	0.31 ~ 0.37

IATS #2

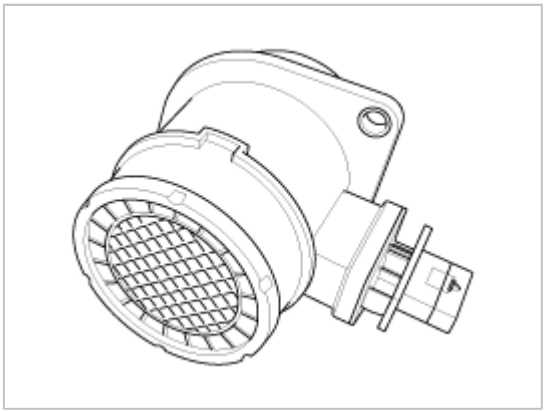
Temperature [□(□)]	Resistance(□)
-40(-40)	40.93 ~ 48.35
-20(-4)	13.89 ~ 16.03
0(32)	5.38 ~ 6.09
20(68)	2.31 ~ 2.57
40(104)	1.08 ~ 1.21
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

Description

MAFS uses a hot-film type sensing element to measure the mass of intake air entering the engine, and send the signal to ECM.

A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle.

The ECM uses this information to control the EGR solenoid valve and correct the fuel amount.

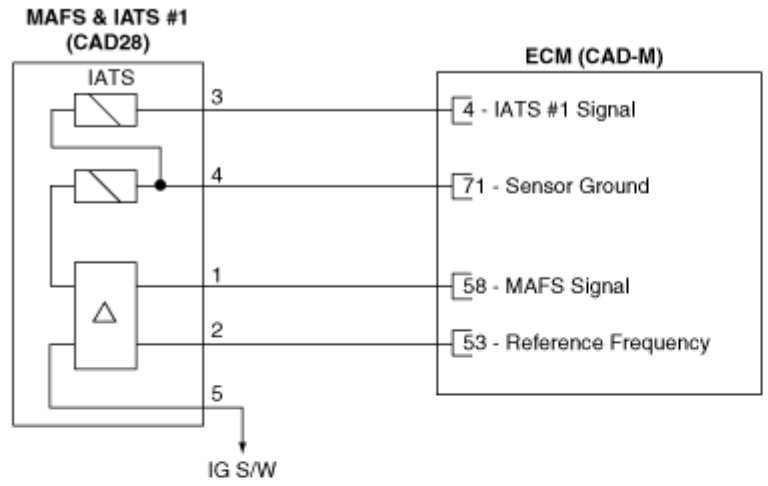


Inspection

1. Check the MAFS visually.
   A. Mounting direction correct.
   B. Any contamination, corrosion or damage on connector.
   C. Air cleaner's clogging or wet.
   D. MAFS cylinder's deforming or blocking by any foreign material.
2. Check any leakage on intake system and intercooler system.

Circuit Diagram

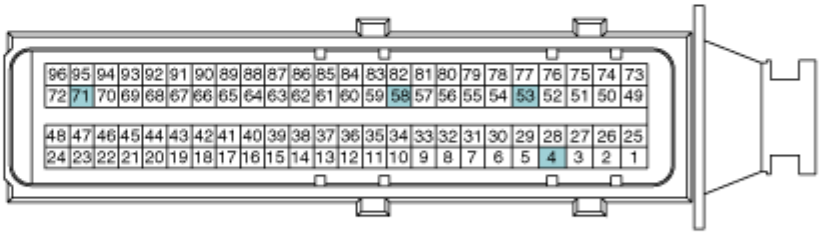
[Circuit Diagram]

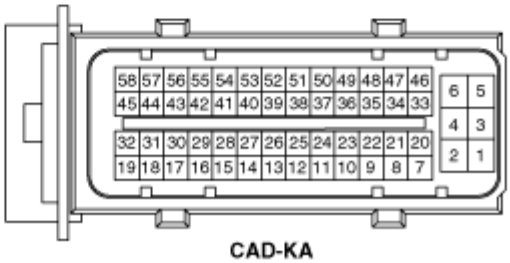


[Connection Information]

Terminal	Connected to	Function
1	ECM CAD-M (58)	MAFS Signal
2	ECM CAD-M (53)	Reference Frequency
3	ECM CAD-M (4)	IATS #1 Signal
4	ECM CAD-M (71)	Sensor Ground
5	IG S/W	Power Supply (B+)

[Harness Connector]





Specification

***At intake air temperature = 20□(68□)**

Air Flow (kg/h)	Frequency (kHz)
8	1.96 ~ 1.97
10	2.01 ~ 2.02
40	2.50 ~ 2.52
105	3.18 ~ 3.23
220	4.26 ~ 4.35
480	7.59 ~ 7.94
560	9.08 ~ 9.89

***At intake air temperature = -15□(5□) or 80□(176□)**

Air Flow (kg/h)	Frequency (kHz)
10	2.00 ~ 2.01
40	2.49 ~ 2.53
105	3.16 ~ 3.25
480	7.42 ~ 8.12

Monitor GDS Data

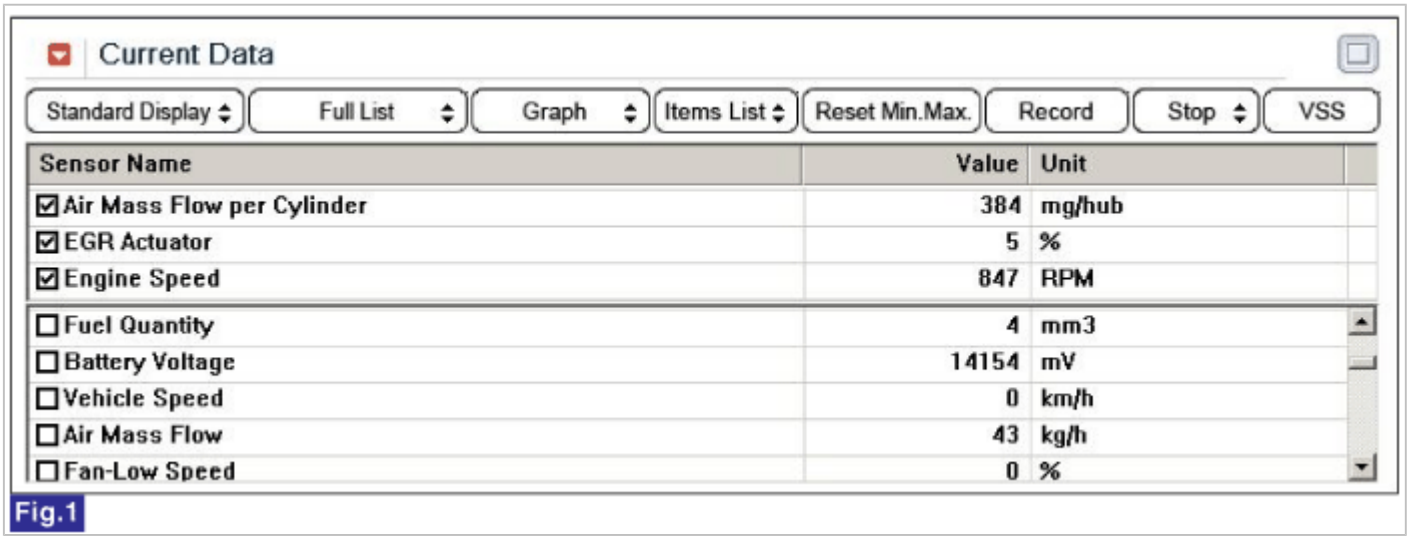


Fig.1

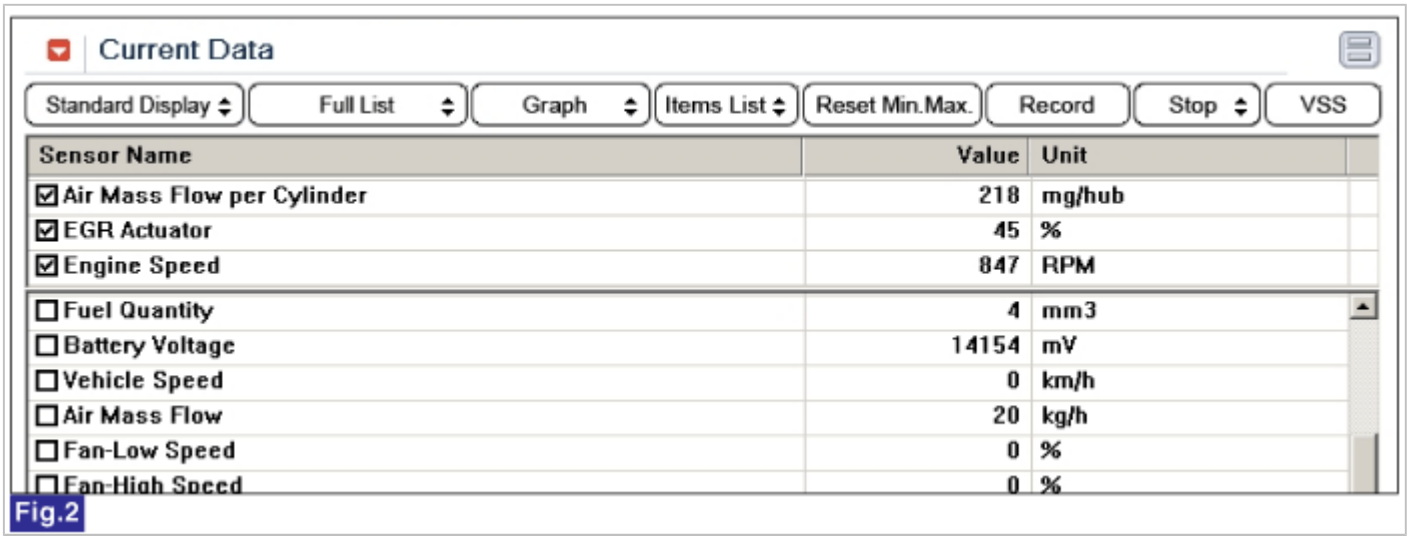
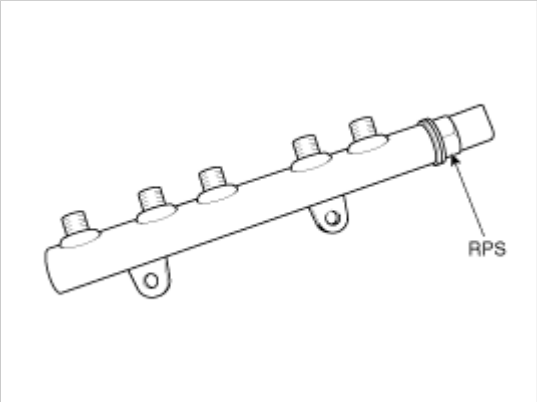


Fig.2

Fig 1) Check if "Air Mass Per Cylinder" is 340mg/st ± 50mg/st without EEGR operation at warm idle (Electric EGR control valve 5% duty)
Fig 2) Check if "Air Mass Per Cylinder" is 200mg/st ± 50mg/st with EEGR operation at warm idle (Electric EGR control valve approx. 45% duty)

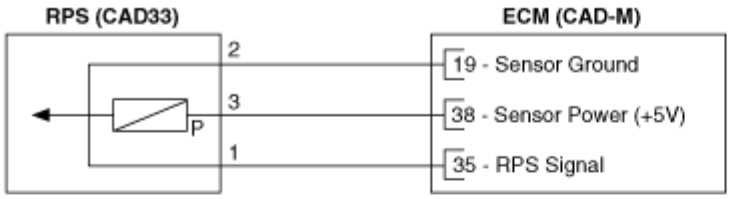
Description

Rail Pressure Sensor (RPS) is installed at the end of the common rail and measures the instantaneous fuel pressure in the common rail by using its diaphragm. Its sensing element (semiconductor device) mounted on the diaphragm converts the fuel pressure to an electric signal.



Circuit Diagram

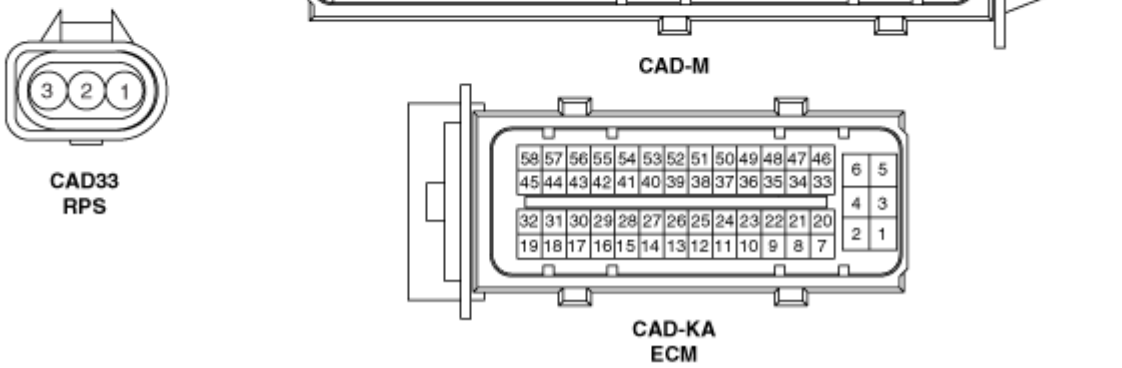
[Circuit Diagram]



[Connection Information]

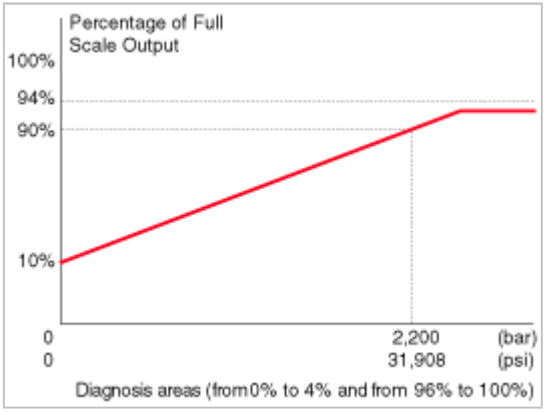
Terminal	Connected to	Function
1	ECM CAD-M (35)	RPS Signal
2	ECM CAD-M (19)	Sensor Ground
3	ECM CAD-M (38)	Sensor Power (+5V)

[Harness Connector]



Specification

Test Condition	Rail pressure [bar (MPa / psi)]	Output Voltage (V)
Idle	230 (23 / 3,335)	Approx. 0.92
Fully depressed	1,800 (180 / 26,106)	Approx. 3.7



Signal Waveform

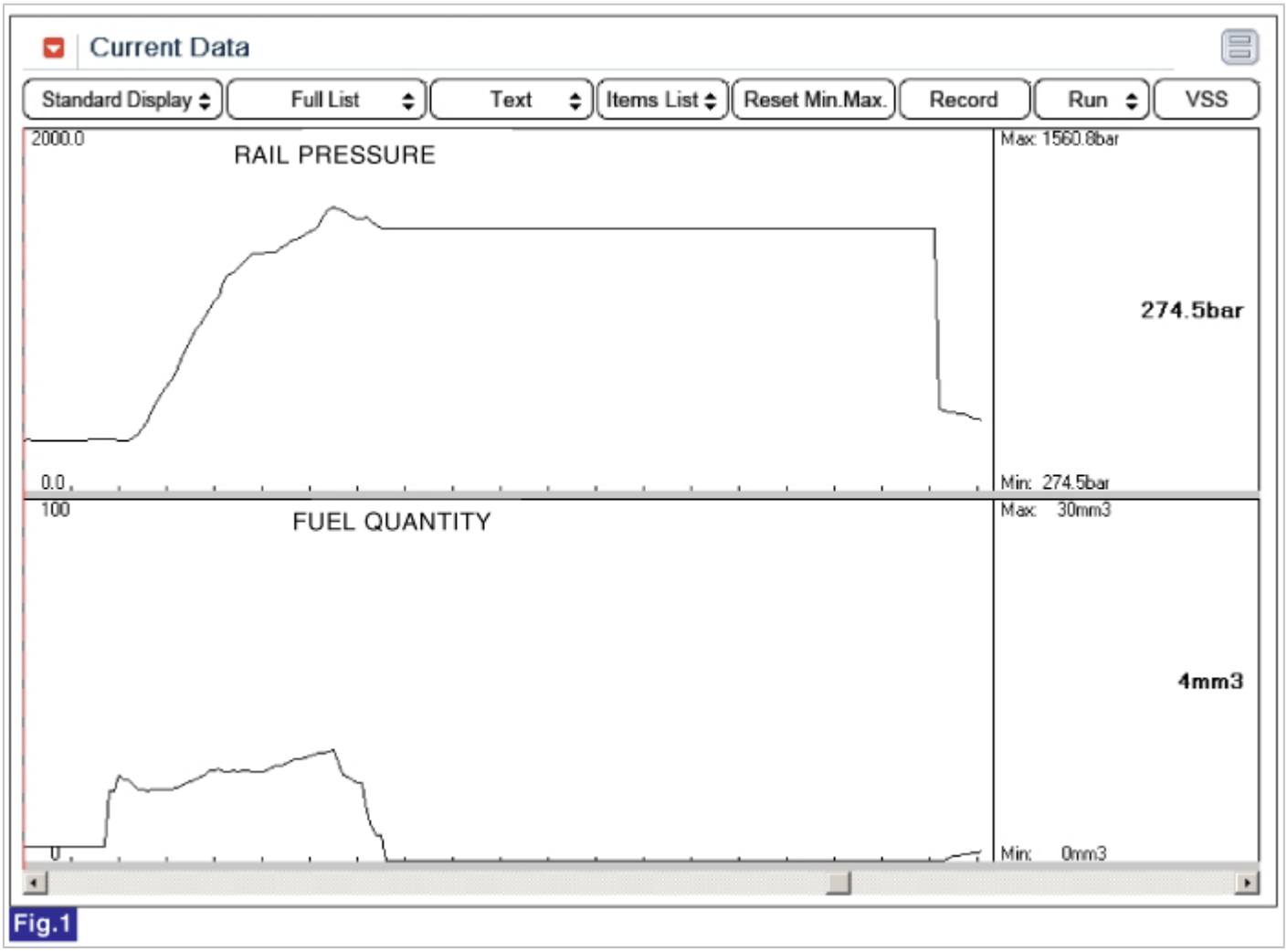
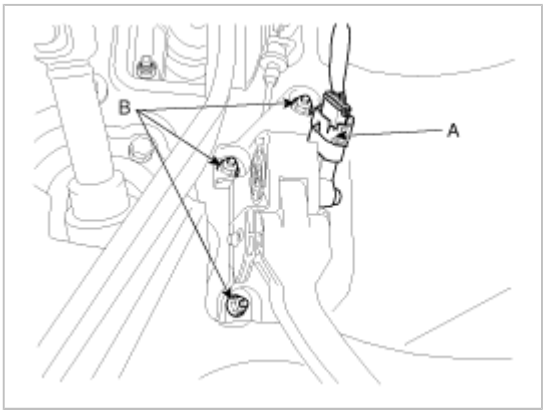


Fig.1

This waveform shows the rise of RPS output voltage at rapid acceleration

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the accelerator pedal position sensor connector (A).



3. Remove the accelerator pedal assembly from the vehicle after unscrewing the mounting nut (B).

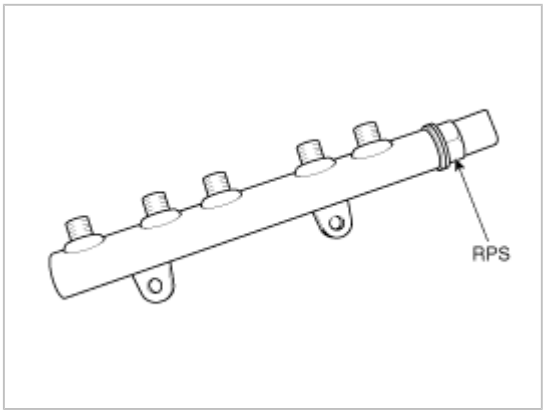
Installation

1. Installation is reverse of removal.

Accelerator pedal module installation nuts:
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)

Description

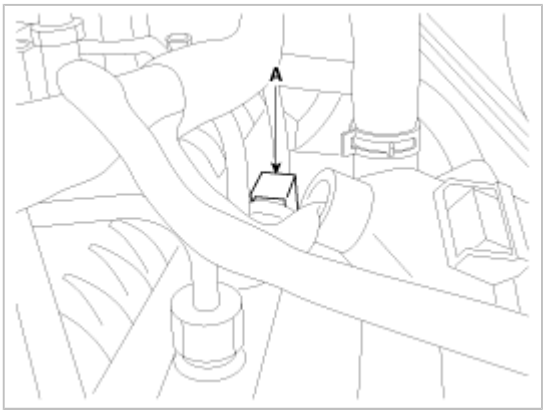
In order to comply with the wide variety of engine installation conditions, the common rail with its flow limiters and the provistions for attaching rail pressure sensor, fuel pressure control valve, and pressure limiter valve is available in a number of different designs.
The available common rail volume is permanently filled with pressurized fuel. The compressibility of the fuel resulting from the high pressure is utilized to achieve the accumulator effect. When fuel leaves the rail for injection, the pressure variations resulting from the pulsating fuel supply from the high-pressure pump are compensated for.



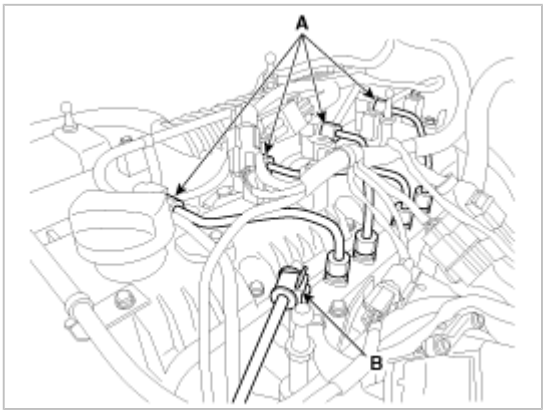
Removal

- Common Rail Fuel Injection System operates with extremely high pressure (approximately 1,800bar), so never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Keep cleanly the parts and the working area.
- Pay attention to a foreign substance.
- Just before installing injector, tube or hose, remove the protect-cap attached on them.
- Do not remove injector except for special case.
- When installing Injector
  - Wash the contact area of the injector and replace the O-ring with a new one.
  - Spread oil on the injector O-ring.
  - To protect damage caused by shock, vertically insert the injector into the cylinder head.
- When installing High Pressure Fuel Pipe
  - Do not use again the used high pressure fuel pipe.
  - Install the flange nut correctly.

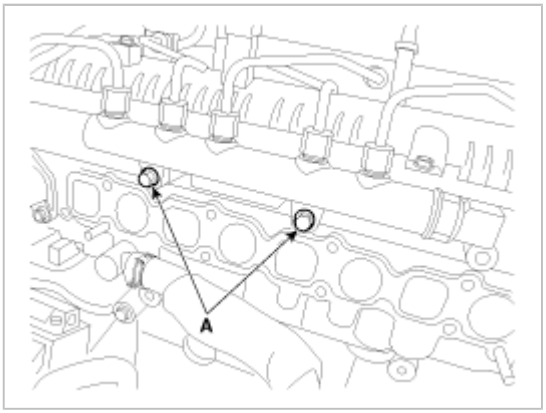
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the rail pressure sensor connector (A).



3. Remove the high pressure fuel pipes (A,B).



4. Remove the intake manifold (Refer to "INTAKE AND EXHAUST SYSTEM" in EM group).
5. Remove the common rail after unscrewing the mounting bolts (A).



Installation

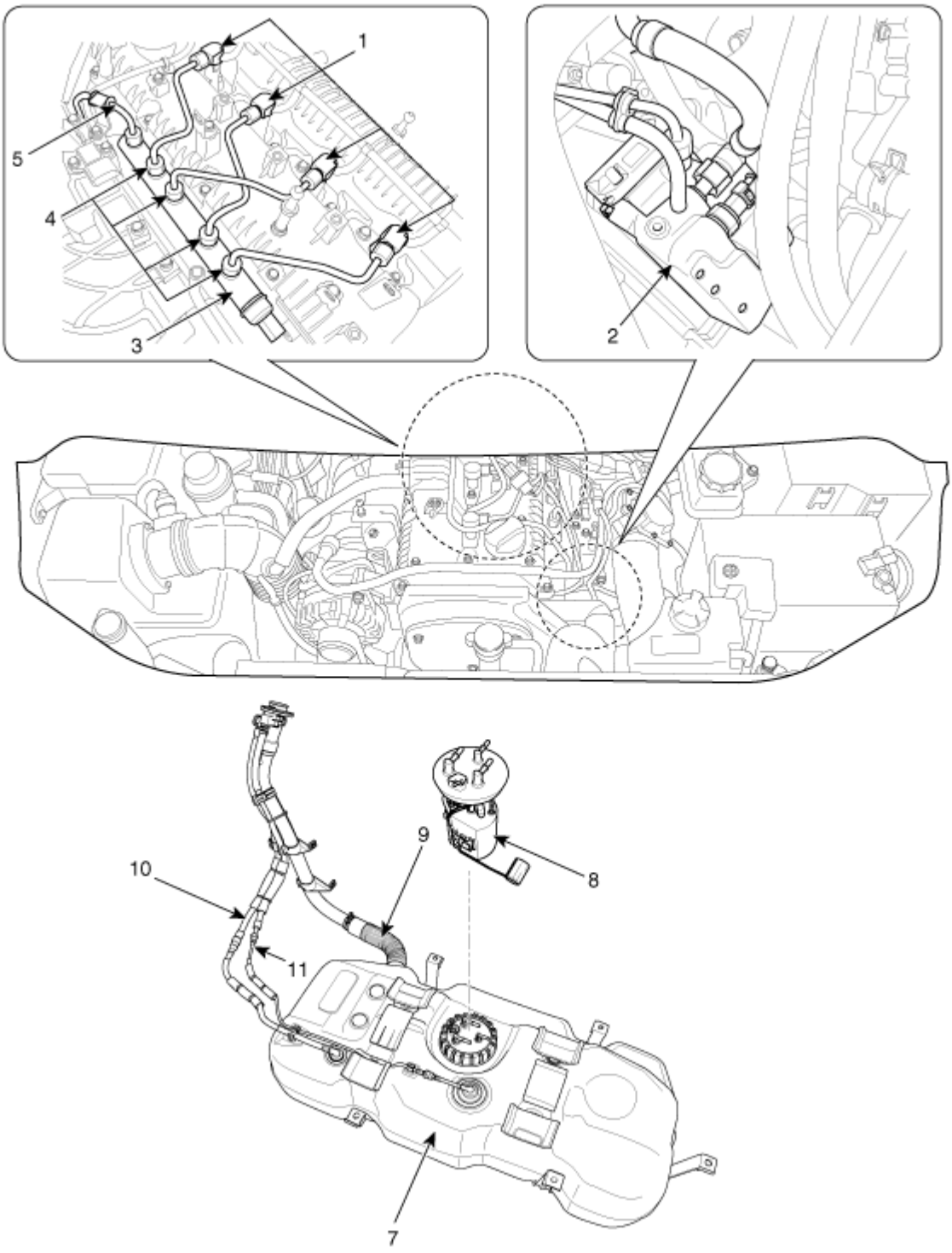
1. Installation is reverse of removal.

When installing the high pressure fuel pipe, apply the specified tightening torques with the special service tool (Refer to below table).

Item	Dimension	SST No.
Flange Nut (Injector Side)	17mm (0.669in)	09314-27120
Flange Nut (HP Pump Side)		
Flange Nut (Common Rail Side)	17mm (0.669in)	09314-27120

· **Common rail installation bolts:**
14.7 ~ 21.6N.m (1.5 ~ 2.2kgf.m, 10.9 ~ 15.9lb-ft)
·**High pressure fuel pipe installation nut:**
24.5 ~ 28.4N.m (2.5 ~ 2.9kgf.m, 18.1 ~ 20.1lb-ft)

Component Location

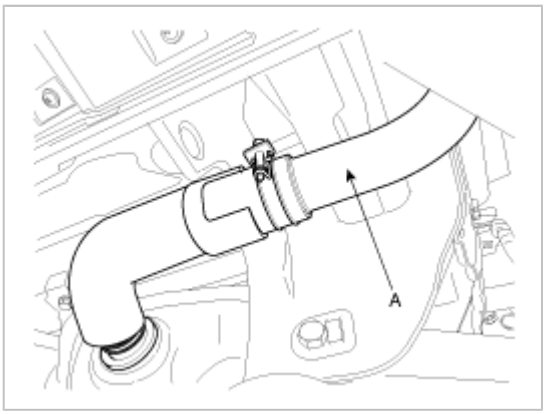


1. Injector	6. Fuel Filter
2. High Pressure Fuel Pump	7. Fuel Tank
3. Common Rail	8. Fuel Sender

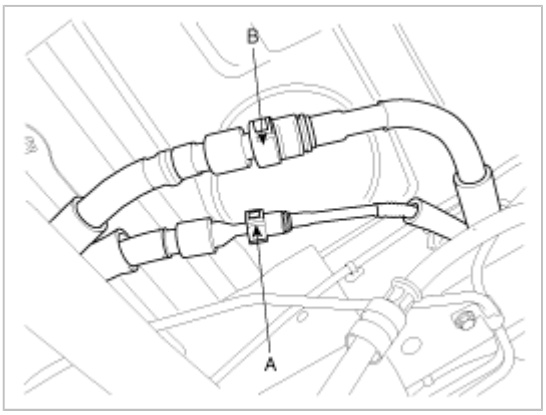
4. High Pressure Fuel Pipe (Common Rail → Injector) 5. High Pressure Fuel Pipe (High Pressure Fuel Pump → Common Rail)	9. Fuel Filler Hose 10. Breather Hose 11. Ventilation Hose

Removal

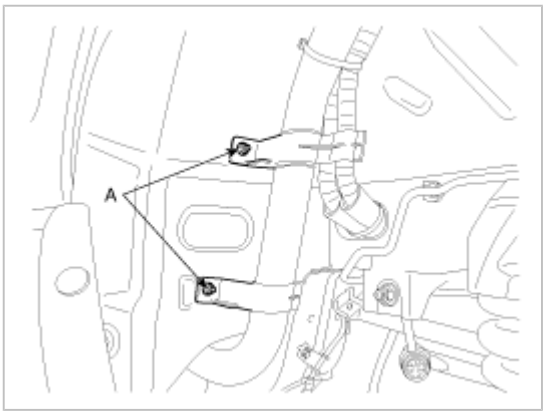
1. Disconnect the fuel filler hose (A).



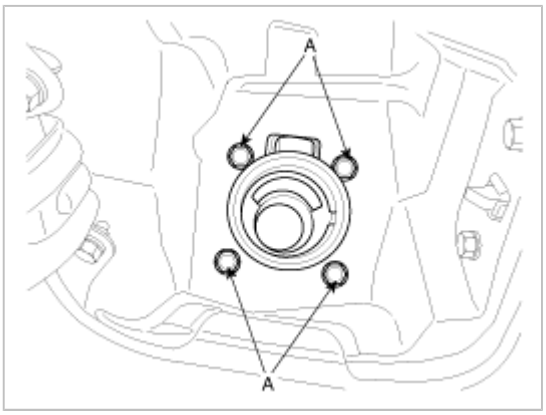
2. Disconnect the ventilation hose quick-connector (A) and the breather hose quick-connector (B).



3. Remove the left - rear wheel □ tire and the wheel house.
4. Unscrew the bracket mounting nuts (A).



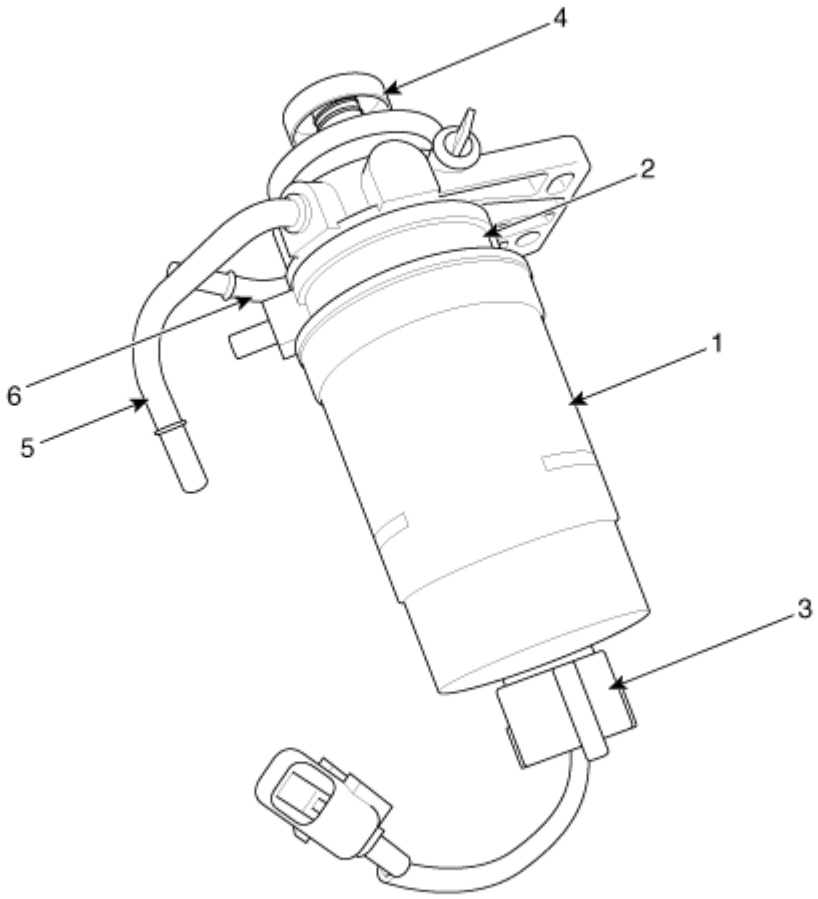
5. Remove the fuel filler neck assembly after unscrewing the mounting bolts (A).



Installation

1. Installation is reverse of removal.

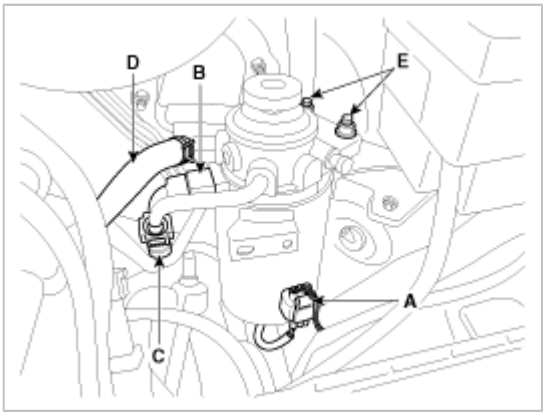
Components



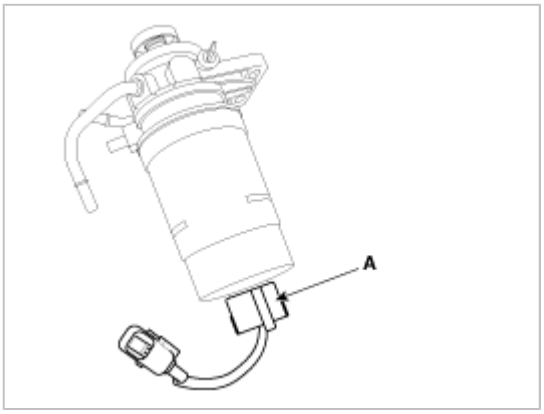
1. Fuel Filter	4. Priming Pump
2. Heater	5. Nipple (↔ Fuel Tank)
3. Water Sensor	6. Nipple (↔ High Pressure Fuel Pump)

Replacement

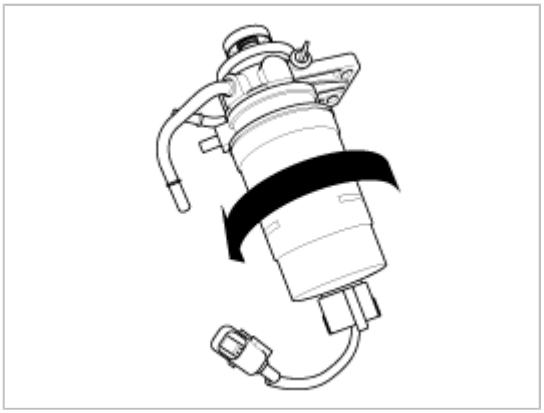
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the water sensor connector (A).
3. Disconnect the heater connector (B).
4. Disconnect the fuel inlet tube quick-connector (C) and the fuel outlet tube hose (D).
5. Unscrew the fuel filter bracket installation nuts (E), and then remove the fuel filter from the vehicle.

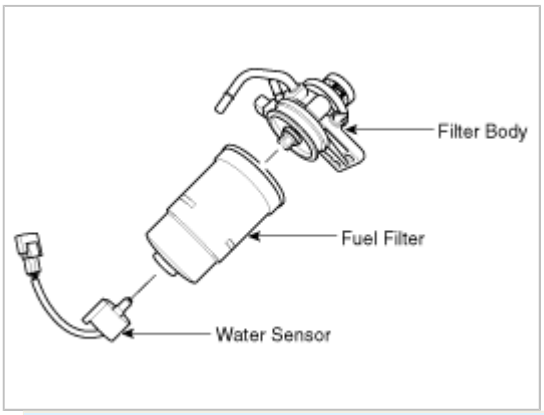


6. Remove the water sensor (A).



7. After removing the fuel filter (A) from the fuel filter assembly, replace it with a new one, and then install the fuel filter assembly in accordance with reverse of above steps.



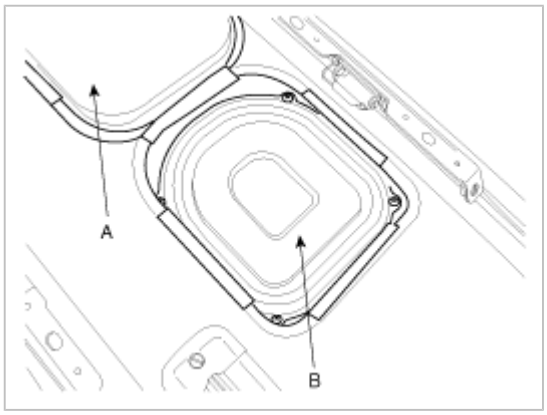


When replacing the fuel filter, must replace the O-ring.

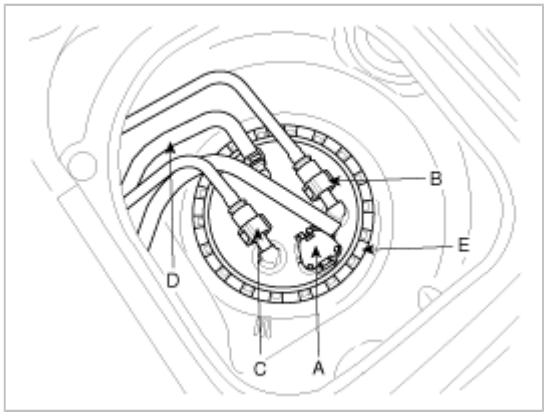
8. Bleed air in low pressure fuel circuit (Refer to "Bleeding Air In Low Pressure Fuel Circuit").
9. Start the engine and check that there is any leak on the low pressure fuel circuit including the fuel filter.

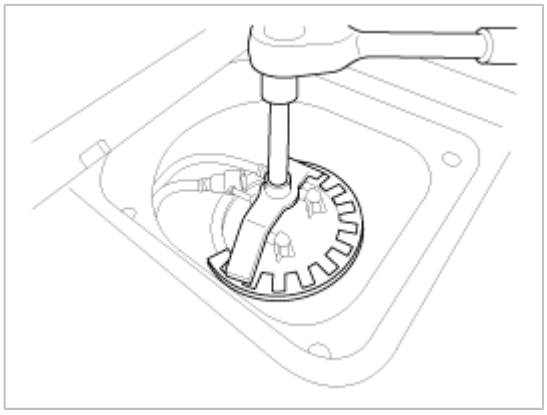
Removal

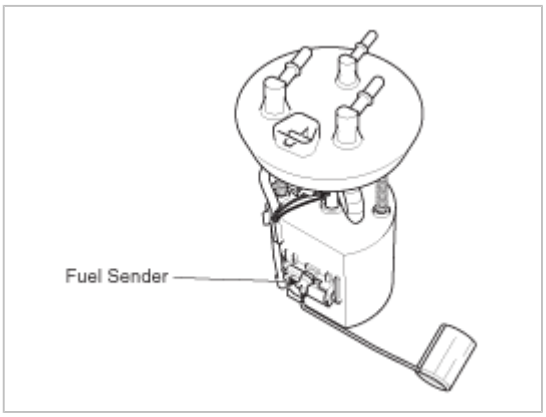
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove or slide the 2nd seat (Refer to "SEAT" in BD group).
3. Open the carpet of the fuel sender (A).
4. Remove the service cover(B).



5. Disconnect the fuel pump connector (A).
6. Disconnect the fuel feed tube quick-connector (B), the fuel return tube quick-connector (C), and the fuel feed hose (D) for the fuel fire heater.
7. Remove th plate cover (E) with the special service tool (SST No.:09310-2B100), and then remove the fuel sender from the fuel tank.







Installation

1. Installation is reverse of removal.

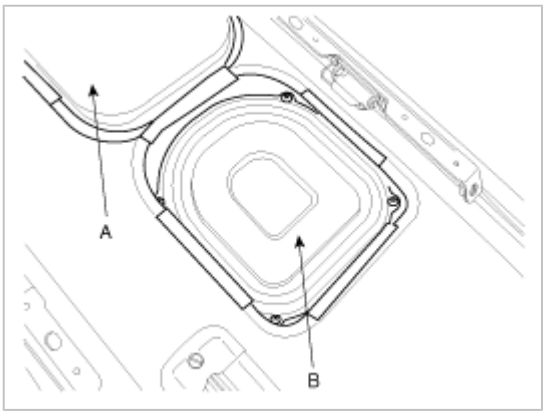
Fuel sender plate cover installation:
58.9 ~ 68.7N.m (6.0 ~ 7.0kgf.m, 43.4 ~ 50.6lb-ft)

After removing or replacing the part below, bleed air in low pressure fuel circuit (Refer to "Bleeding Air In Low Pressure Fuel Circuit" in this group).

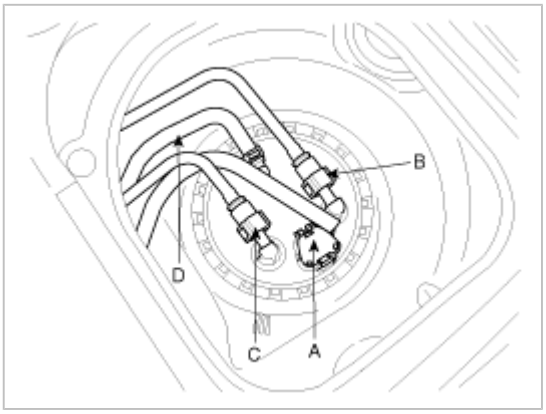
- Fuel Tank
- Fuel Sender
- Fuel Filter
- High Pressure Fuel Pump
- Low Pressure Fuel Lines

Removal

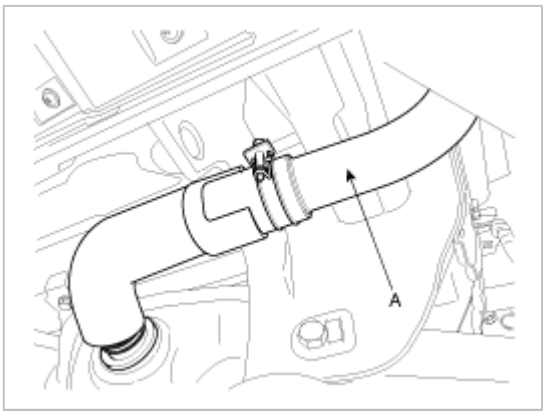
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove or slide the 2nd seat (Refer to "SEAT" in BD group).
3. Open the carpet of the fuel sender (A).
4. Remove the service cover(B).



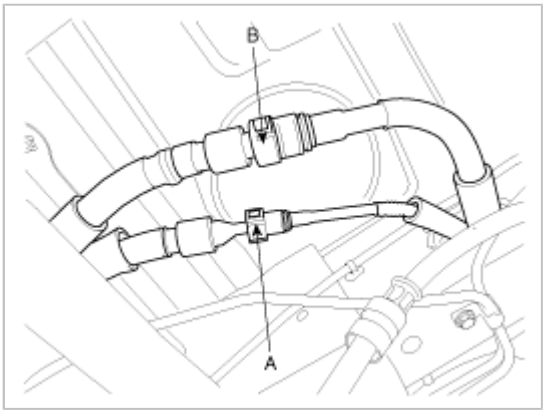
5. Disconnect the fuel pump connector (A).
6. Disconnect the fuel feed tube quick-connector (B), the fuel return tube quick-connector (C), and the fuel feed hose (D) for the fuel fire heater.



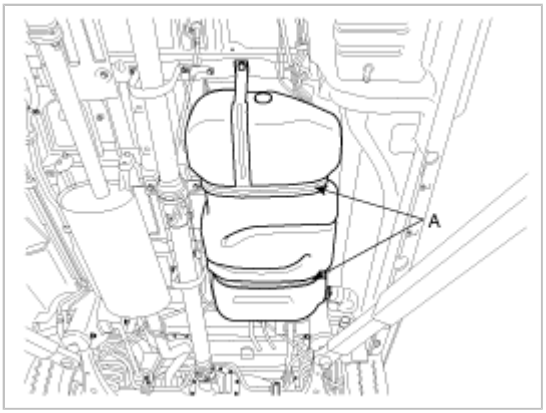
7. Lift the vehicle.
8. Support the fuel tank with a jack.
9. Disconnect the fuel filler hose (A).



10. Disconnect the ventilation hose quick-connector (A) and the breather hose quick-connector (B).



11. Unscrew the fuel tank band (A) installation bolts/nuts, and then remove the fuel tank from the vehicle.



Installation

1. Installation is reverse of removal.

Fuel tank band installation nuts:
39.2 ~ 54.0N.m (4.0 ~ 5.5kgf.m, 28.9 ~ 39.8lb-ft)

After removing or replacing the part below, bleed air in low pressure fuel circuit (Refer to "BLEEDING AIR IN LOW PRESSURE FUEL CIRCUIT" in this group).

- Fuel Tank
- Fuel Sender
- Fuel Filter
- High Pressure Fuel Pump
- Low Pressure Fuel Lines

General Safety Information and Caution

- Common Rail Fuel Injection System operates with extremely high pressure (approximately 1,600bar), so never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Keep cleanly the parts and the working area.
- Pay attention to a foreign substance.
- Just before installing injector, tube or hose, remove the protect-cap attached on them.
- Do not remove injector except for special case.
- When installing Injector
  - Wash the contact area of the injector and replace the O-ring with a new one.
  - Spread oil on the injector O-ring.
  - To protect damage caused by shock, vertically insert the injector into the cylinder head.
- When installing High Pressure Fuel Pipe
  - Do not use again the used high pressure fuel pipe.
  - Install the flange nut correctly.

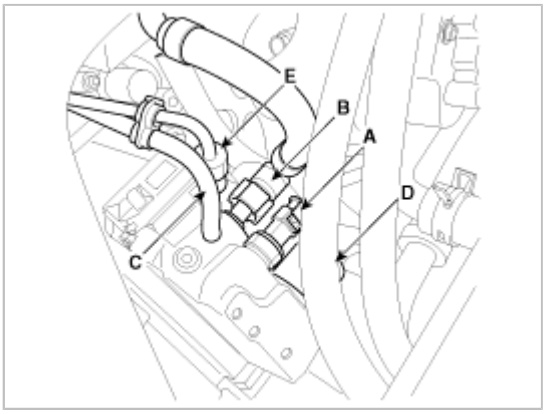
Description

The high pressure fuel pump is the interface between the low pressure and the high pressure stages. Under all operating conditions, it is responsible for providing adequate high pressure fuel through out the vehicle's complete service life. This also includes the provision of extra as needed for rapid starting and for rapid build-up of pressure in the rail. The high pressure pump continually generates the system pressure as needed in the high-pressure accumulator (common rail). This means therefore, that in contrast to conventional systems, the fuel does not have to be specially compressed for each individual injection process.

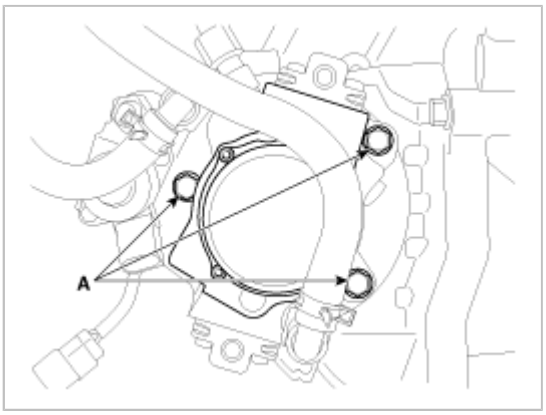
Removal

- Common Rail Fuel Injection System operates with extremely high pressure (approximately 1,800bar), so never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Keep cleanly the parts and the working area.
- Pay attention to a foreign substance.
- Just before installing injector, tube or hose, remove the protect-cap attached on them.
- Do not remove injector except for special case.
- When installing Injector
  - Wash the contact area of the injector and replace the O-ring with a new one.
  - Spread oil on the injector O-ring.
  - To protect damage caused by shock, vertically insert the injector into the cylinder head.
- When installing High Pressure Fuel Pipe
  - Do not use again the used high pressure fuel pipe.
  - Install the flange nut correctly.

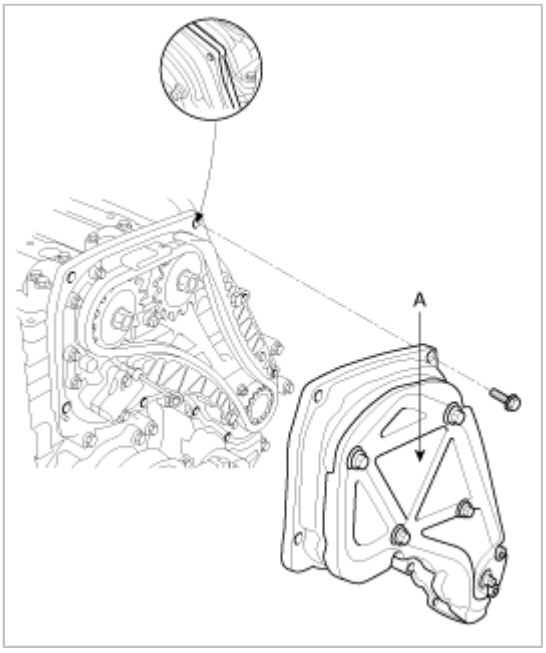
1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the battery (Refer to "CHARGING SYSTEM" in EE group).
3. Remove the throttle body (Refer to "INTAKE AND EXHAUST SYSTEM" in EM group).
4. Remove the cooling fan (Refer to "COOLING SYSTEM" in EM group).
5. Disconnect the fuel temperature sensor connector (A).
6. Disconnect the fuel feed tube quick-connector and the fuel return tube quick-connector (B).
7. Remove the function block installation bolts.
8. Disconnect the injector return hose (C).
9. Disconnect the fuel pressure regulator valve connector (D).
10. Remove the high pressure fuel pipe (E).



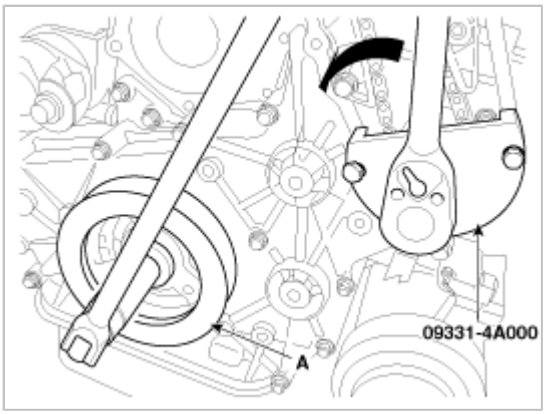
11. Unscrew the 3 mounting bolts (A).



12. Remove the timing chain upper-front cover (A) (Refer to "TIMING SYSTEM" in EM group).



13. Install the crankshaft pulley (A) and then hold the pulley.
14. Install the SST (SST No.:09331-4A000) to the under cover of the upper timing chain, and then remove the high pressure fuel pump from the sprocket.



Installation

1. Installation is reverse of removal.

When installing the high pressure fuel pipe, apply the specified tightening torques with the special service tool (Refer to below table).

Item	Dimension	SST No.
Flange Nut (HP Pump Side)	17mm (0.669 in)	09314-27120
Flange Nut (Common Rail Side)	17mm (0.669 in)	09314-27120

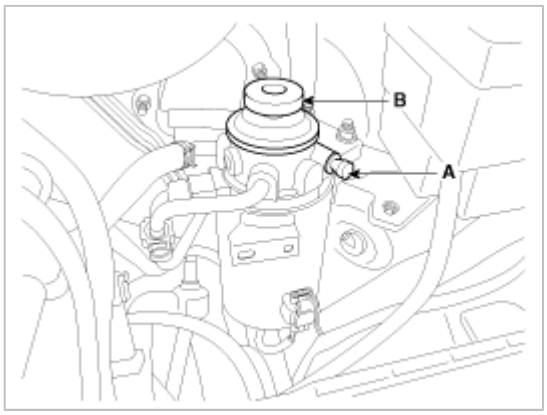
High pressure pump sprocket nut:
64.7 ~ 74.5N.m (6.6 ~ 7.6kgf.m, 47.7 ~ 55.0lb-ft)
High pressure fuel pump installation bolts:
19.6 ~ 25.5N.m (2.0 ~ 2.6kgf.m, 14.5 ~ 18.8lb-ft)
High pressure fuel pipe installation nut:
24.5 ~ 28.4N.m (2.5 ~ 2.9kgf.m, 18.1 ~ 20.1lb-ft)

After removing or replacing the part below, bleed air in low pressure fuel circuit (Refer to "BLEEDING AIR IN LOW PRESSURE FUEL CIRCUIT" in this group).

- Fuel Tank
- Fuel Sender
- Fuel Filter
- High Pressure Fuel Pump
- Low Pressure Fuel Lines

Bleeding Air In Low Pressure Fuel Circuit

1. After removing the air plug (A), press the priming pump (B) several times until fuel comes out of the outlet port.



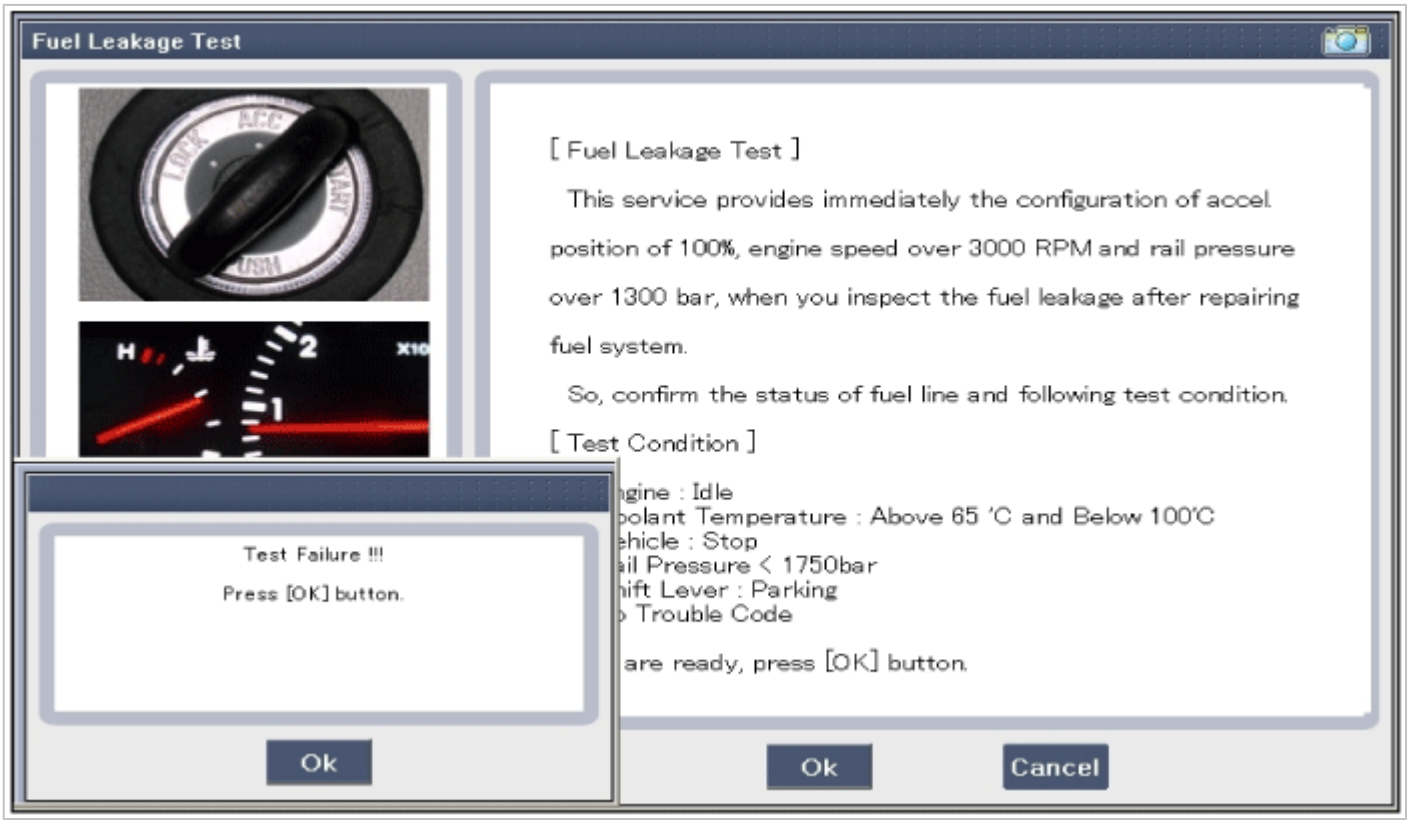
2. Install the air plug (A).

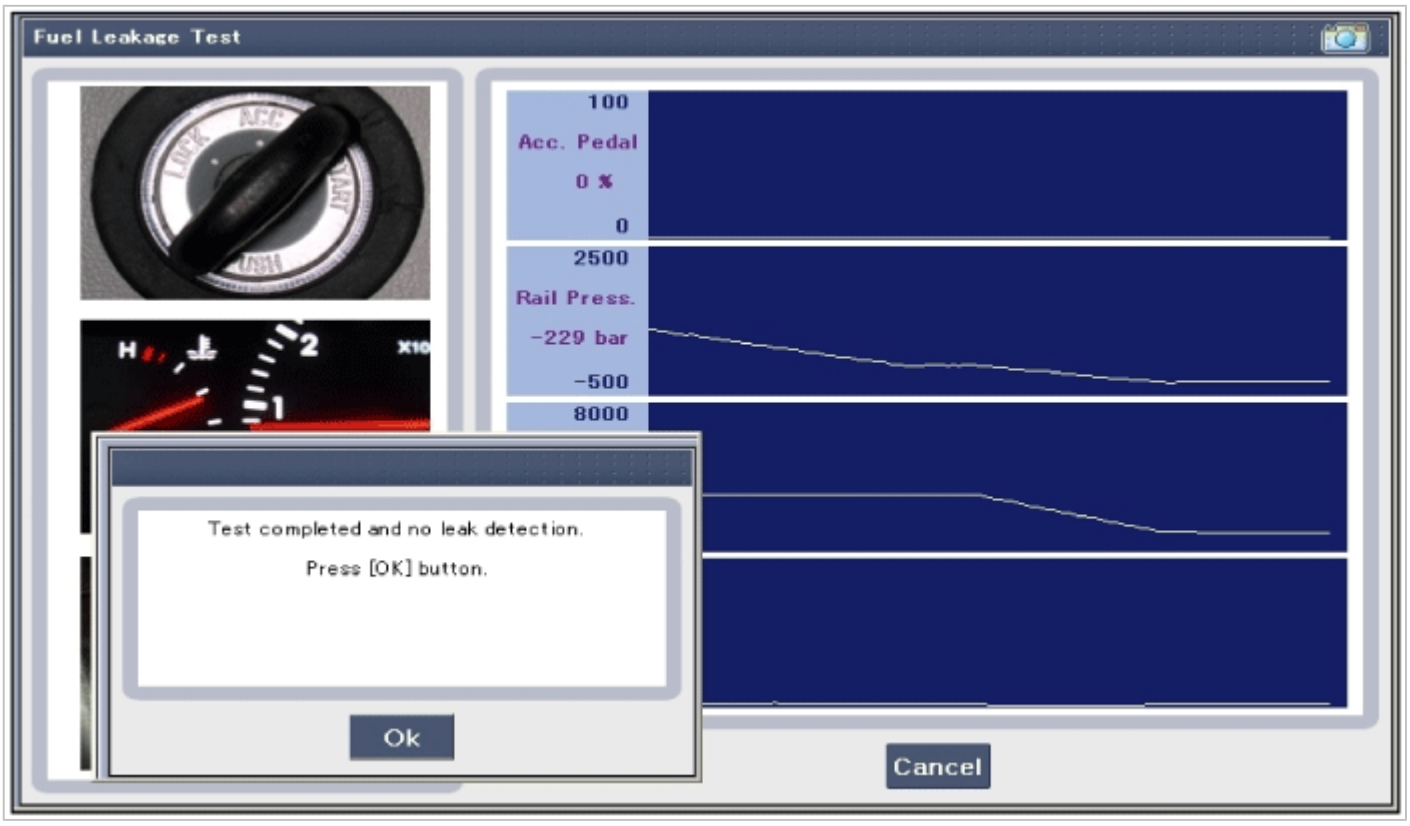
After removing or replacing the part below, bleed air in low pressure fuel circuit.
- Fuel Tank
- Fuel Sender
- Fuel Filter
- High Pressure Fuel Pump
- Low Pressure Fuel Lines

Fuel Leakage Test

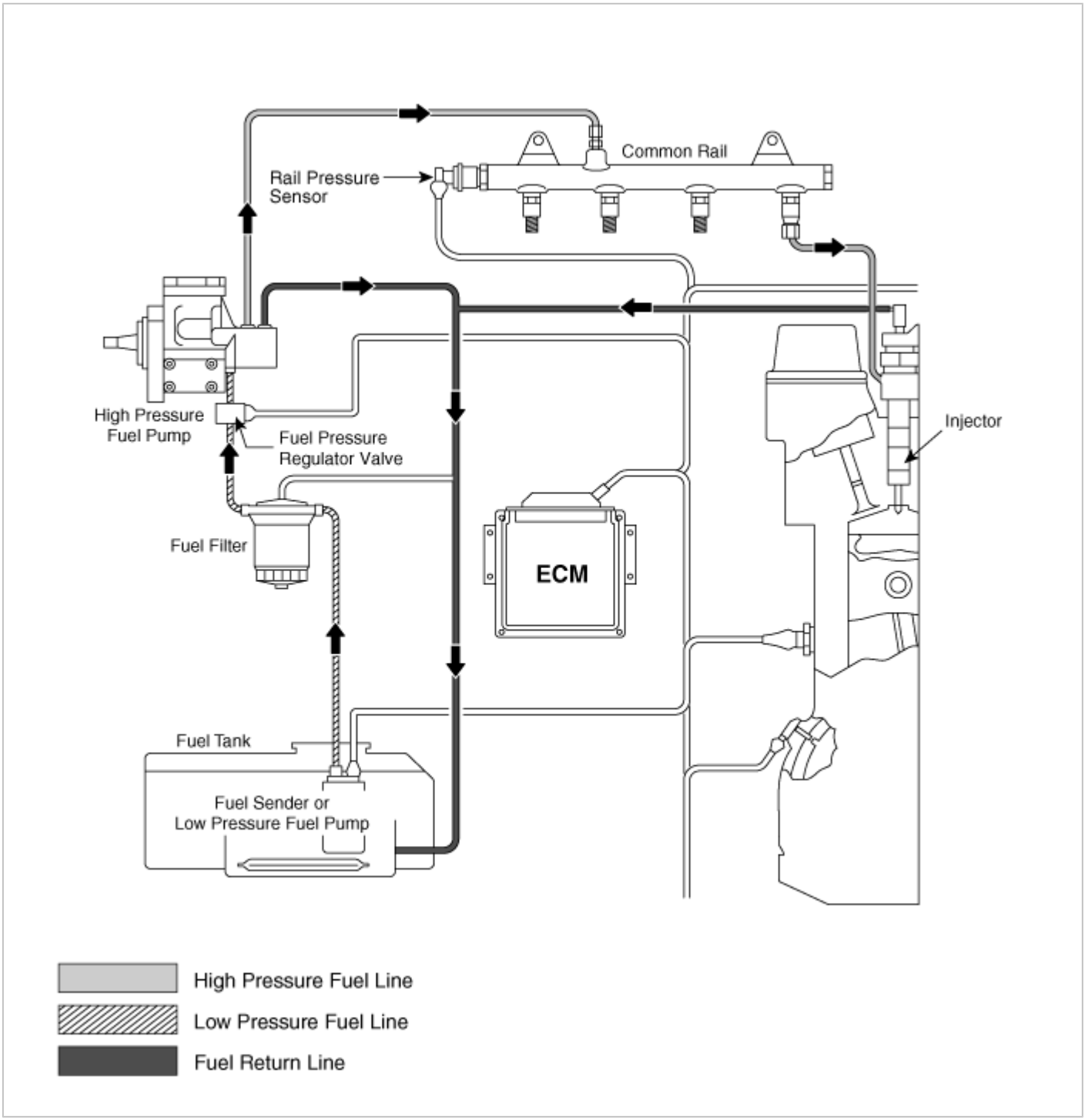
After removing or replacing fuel system below, must perform fuel leakage test procedure.
- Fuel tank
- Fuel sender
- Fuel filter
- High pressure fuel pump
- Injector
- Common rail
- Low pressure fuel line

1. Turn ignition switch OFF.
2. Connect a GDS to Data Link Connector (DLC).
3. Turn ignition switch ON.
4. Select "Vehicle, Model year, Engine, System".
5. Select "Vehicle S/W Management".
6. Select "Fuel leakage test".
7. Perform the procedure in accordance with the message.


Fuel Leakage Test
[Fuel Leakage Test]
This service provides immediately the configuration of accel. position of 100%, engine speed over 3000 RPM and rail pressure over 1300 bar, when you inspect the fuel leakage after repairing fuel system.
So, confirm the status of fuel line and following test condition.
[Test Condition]
ngine : Idle
olant Temperature : Above 65 'C and Below 100'C
ehicle : Stop
il Pressure < 1750bar
hift Lever : Parking
Trouble Code
are ready, press [OK] button.
Ok
Cancel
Test Failure !!!
Press [OK] button.
Ok


Fuel Leakage Test
100
Acc. Pedal
0 %
0
2500
Rail Press.
-229 bar
-500
8000
Cancel
Test completed and no leak detection.
Press [OK] button.
Ok

Common Rail Direct Injection(CRDI) System



• Low Pressure Fuel Circuit

Low Pressure Fuel Pump

The low pressure fuel pump is either an electric fuel pump with pre-filter, or a gear-type fuel pump. The pump draws the fuel from the fuel tank and continually delivers the required quantity of fuel in the direction

of the high pressure fuel pump (via fuel filter).

Fuel Sender

The fuel sender is located into the fuel tank and measures amount of fuel contained in fuel tank.

Fuel Filter

The fuel filter is located in between the low pressure fuel pump and the high pressure fuel pump and filters the fuel delivered from the fuel tank.

- **High Pressure Fuel Circuit**

High Pressure Fuel Pump

The high pressure fuel pump compresses fuel up to 1,600 bar and delivers the compressed fuel to the common rail.

Common Rail

The common rail is connected with the high pressure fuel pump and the injectors by the high pressure fuel pipes. This rail stores the fuel compressed in the high pressure fuel pump. The ECM controls the fuel pressure of the common rail by using the rail pressure sensor and the rail pressure regulator valve installed on the common rail.

Injector

The injector injects the high pressure fuel stored in the common rail into the cylinder by the ECM control signal.

High Pressure Fuel Pipe

The high pressure fuel pipe is a channel in high pressure fuel circuit consisting of the high pressure fuel pump, common rails, and injectors. It is a steel tube which can withstand high frequency generated when the fuel pressure reaches the maximum pressure or fuel injection stops.
The differences in length between the common rail and the individual injectors are compensated for by using slight or pronounced bends in the individual lengths of tubing. Nevertheless, the injection lines should be kept as short as possible.

Specifications

Fuel Delivery System

Items	Specification	
Fuel Injection System	Type	Common Rail Direct Injection (CRDI)
Fuel Return System	Type	Return type
Fuel Pressure	Max. Pressure	1,800 bar (180 MPa / 26,106 psi)
Fuel Tank	Capacity	75 lit. (19.8 U.S.gal., 79.3 U.S.qt., 66.0 Imp.qt.)
Fuel Filter	Type	High pressure type (Built in engine room)
High Pressure Fuel Pump	Type	Mechanical, Plunger Pumping Type
	Driven by	Drive Belt
Low Pressure Fuel Pump	Type	Mechanical, Gear Pumping Type
	Driven by	Involved in High Pressure Fuel Pump

Sensors

Mass Air Flow Sensor (MAFS)

□ Type: Hot-Film Type

□ Specification

* At intake air temperature = 20□(68□)

Air Flow (kg/h)	Frequency (kHz)
8	1.96 ~ 1.97
10	2.01 ~ 2.02
40	2.50 ~ 2.52
105	3.18 ~ 3.23
220	4.26 ~ 4.35
480	7.59 ~ 7.94
560	9.08 ~ 9.89

* At intake air temperature = -15□(5□) or 80□(176□)

Air Flow (kg/h)	Frequency (kHz)
10	2.00 ~ 2.01
40	2.49 ~ 2.53
105	3.16 ~ 3.25

480	7.42 ~ 8.12

Intake Air Temperature Sensor (IATS) #1 [BUILT IN MAFS]

□ Type: Thermistor type

□ Specification

Temperature [□(□)]	Resistance(□)
-40(-40)	35.14 ~ 43.76
-20(-4)	12.66 ~ 15.12
0(32)	5.12 ~ 5.89
20(68)	2.29 ~ 2.55
40(104)	1.10 ~ 1.24
60(140)	0.57 ~ 0.65
80(176)	0.31 ~ 0.37

Boost Pressure Sensor (BPS)

□ Type: Piezo-resistive pressure sensor type

□ Specification

Pressure[kPa (kg/cm² / psi)]	Output Voltage (V)
50 (0.51 / 7.25)	0.5
100 (1.02 / 14.50)	1.00 ~ 1.14
300 (3.06 / 43.51)	3.29 ~ 3.43
400 (4.08 / 58.02)	4.41 ~ 4.59

Intake Air Temperature Sensor (IATS) #2

□ Type: Thermistor type

□ Specification

Temperature [□(□)]	Resistance(□)
-40(-40)	40.93 ~ 48.35
-20(-4)	13.89 ~ 16.03
0(32)	5.38 ~ 6.09
20(68)	2.31 ~ 2.57
40(104)	1.08 ~ 1.21
60(140)	0.54 ~ 0.62

80(176)	0.29 ~ 0.34

Engine Coolant Temperature Sensor (ECTS)
□ Type: Thermistor type
□ Specification

Temperature [□(□)]	Resistance(□)
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83
0(32)	5.79
20(68)	2.31 ~ 2.59
40(104)	1.15
60(140)	0.59
80(176)	0.32

Camshaft Position Sensor (CMPS)
□ Type: Hall effect type
□ Specification

Level	Output Pulse (V)
High	5
Low	0

Items	Specification
Air Gap [mm (in.)]	0.2 ~ 2.0 (0.008 ~ 0.079)

Crankshaft Position Sensor (CKPS)
□ Type: Variable reluctance type
□ Output Voltage (V): 0 ~ 5V

Items	Specification
Coil Resistance (Ω)	774 ~ 946 [20□(68□)]

Accelerator Position Sensor (APS)
□ Type: Potentiometer type
□ Specification

Test Condition	Output Voltage (V) [Vref=5V]	
	APS 1	APS 2

Idle	0.7 ~ 0.8	0.275 ~ 0.475
Fully depressed	3.8 ~ 4.4	1.75 ~ 2.35

Items	Specification	
	APS 1	APS 2
Potentiometer Resistance (□)	0.8 ~ 1.6	0.9 ~ 2.5

Fuel Temperature Sensor (FTS)
□ Type: Thermistor type
□ Specification

Temperature [□(□)]	Resistance(□)
-30(-22)	35.6 ~ 44.2
-20(-4)	19.7 ~ 24.0
-10(14)	11.3 ~ 13.6
0(32)	6.7 ~ 8.0
20(68)	2.6 ~ 3.0
40(104)	1.1 ~ 1.3
50(122)	0.8 ~ 0.9
60(140)	0.5 ~ 0.6
70(158)	0.4
80(176)	0.3

Rail Pressure Sensor (RPS)
□ Type: Piezo-electricity type
□ Specification

Test Condition	Rail pressure [bar (MPa / psi)]	Output Voltage(V)
Idle	230 (23 / 3,335)	Approx. 0.92
Fully depressed	1,800 (180 / 26,106)	Approx. 3.7

Exhaust Gas Temperature Sensor (EGTS) #1 FOR VGT
□ Type: Thermistor type
□ Specification

Temperature [□(□)]	Resistance(□)
100(212)	289.0 ~ 481.0

300(572)	5.30 ~ 6.61
600(1,112)	0.35 ~ 0.38
900(1,652)	0.08 ~ 0.09

Exhaust Gas Temperature Sensor (EGTS) #2 for DPF

□ Type: Thermistor type

□ Specification

Temperature [□(□)]	Resistance(□)
100(212)	289.0 ~ 481.0
300(572)	5.30 ~ 6.61
600(1,112)	0.35 ~ 0.38
900(1,652)	0.08 ~ 0.09

Differential Pressure Sensor (DPS) [With DPF]

□ Type: Piezo-electricity type

□ Specification: Vout = (4.5 - 1.0) / 100 * □P + 1.0 (V)

Differential Pressure [□P] [kPa (kg/cm² / psi)]	Output Voltage (V)
0	1.00
10 (0.1 / 1.45)	1.35
20 (0.2 / 2.90)	1.70
30 (0.3 / 4.35)	2.05
40 (0.4 / 5.80)	2.40
50 (0.5 / 7.25)	2.75
60 (0.6 / 8.70)	3.10
70 (0.7 / 10.10)	3.45
80 (0.8 / 11.60)	3.80
90 (0.9 / 13.00)	4.15
100 (1.0 / 14.50)	4.50

Water Sensor

□ Specification

Item	Specification
Warning Level (cc)	40 ~ 60

Vehicle Speed Sensor (VSS)

- Type: Inductive type

Actuators

Injector

- Number: 4
- Specification

Items	Specification
Coil Resistance (Ω)	0.164 ~ 0.195 [20□(68□)]

Fuel Pressure Regulator Valve

- Specification

Items	Specification
Coil Resistance (Ω)	4.77 ~ 5.83 [20□(68□)]

Air Control Valve

- Type : Duty control motor type
- Specification

Duty (%)	Throttle Valve Position
5	Open
5 ~ 94	Normal operation (Partially open in proportion to duty value)
94	Closed
94 ~ 95	Maintaining the last valid position
95 ~ 97	Fully closed

Electric EGR Control Valve

- Type: Hall effect type
- Specification

Position sensor

Items	Specification
1st Voltage (V) [Valve Close - 0.66mm]	4.67
2nd Voltage (V) [2.00mm]	4.00
3rd Voltage (V) [3.66mm]	3.17
4th Voltage (V) [Open - 6.00mm]	2.00
Supply Voltage (V)	5.00

□ Type: DC Motor
□ Specification

Motor

Items	Specification
Coil Resistance (kΩ)	2.2 ~ 2.6 [20□(68□)]
Supply Voltage (V)	13.5 (Battery Voltage)

VGT/WGT Control Solenoid Valve

□ Specification

Items	Specification
Coil Resistance (Ω)	14.7 ~ 16.1 [20□(68□)]

Service Standard

Item	Specification		
Basic Idle rpm (After warm up)	A/C OFF	Neutral,N,P-range	780 ± 100 rpm
		D-range	780 ± 100 rpm
	A/C ON	Neutral,N,P-range	780 ± 100 rpm
		D-range	780 ± 100 rpm

Tightening Torques

Engine Control System

Item	Kgf.m	N.m	lb-ft
ECM installation bolts	0.9 ~ 1.4	8.8 ~ 13.7	6.5 ~ 10.1
Mass air flow sensor clamp installation bolt	0.3 ~ 0.5	2.9 ~ 4.9	2.2 ~ 3.6
Mass air flow sensor installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Boost pressure sensor installation bolts	0.7 ~ 1.1	6.9 ~ 10.8	5.1 ~ 8.0
Intake Air Temperature Sensor installation	2.0 ~ 3.0	19.6 ~ 29.4	14.5 ~ 21.7
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Crankshaft position sensor installation bolt	0.7 ~ 1.1	6.9 ~ 10.8	5.1 ~ 8.0
Camshaft position sensor installation bolt	0.7 ~ 1.1	6.9 ~ 10.8	5.1 ~ 8.0
Electric EGR control valve installation bolts	2.2 ~ 2.8	21.6 ~ 27.5	15.9 ~ 20.3
Exhaust gas temperature sensor installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Differential pressure sensor bracket installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

Air control valve installation bolts	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

Fuel Delivery System

Item	Kgf.m	N.m	lb-ft
Injector clamp installation bolt	2.5 ~ 2.9	24.5 ~ 28.4	18.1 ~ 20.1
Common rail installation bolt	1.5 ~ 2.2	14.7 ~ 21.6	10.9 ~ 15.9
High pressure fuel pump installation bolt	2.0 ~ 2.6	19.6 ~ 25.5	14.5 ~ 18.8
High pressure pump sprocket nut	6.6 ~ 7.6	64.7 ~ 74.5	47.7 ~ 55.0
High pressure fuel pipe (Injector ↔ Common Rail) installation nut	2.5 ~ 2.9	24.5 ~ 28.4	18.1 ~ 21.0
High pressure fuel pipe (Common Rail ↔ High Pressure Fuel Pump) installation nut	2.5 ~ 2.9	24.5 ~ 28.4	18.1 ~ 21.0
Fuel tank installation bolt/nut	4.0 ~ 5.5	39.2 ~ 54.0	28.9 ~ 39.8
Fuel sender plate cover installation	6.0 ~ 7.0	58.9 ~ 68.7	43.4 ~ 50.6
Accelerator pedal module installation nuts	1.7 ~ 2.6	16.7 ~ 25.5	12.3 ~ 18.8
Fuel filler installation bolts	0.6 ~ 0.7	5.9 ~ 6.9	4.3 ~ 5.1

Basic Troubleshooting

Basic Troubleshooting Guide

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**

- Ask the customer about the conditions and environment relative to the issue. (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**

- Connect the GDS to Diagnostic Link Connector (DLC).
- Record the DTC and Freeze Frame Data.

Information

To erase DTC and Freeze Frame Data, refer to Step 5.

4	**Confirm the Inspection Procedure for the System or Part**

- Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**

NOTICE

NEVER erase DTC and Freeze Frame Data before completing Step 2 : MIL/DTC in CUSTOMER PROBLEM ANALYSIS SHEET.

6	**Inspect Vehicle Visually**

- Go to Step 11, if you recognize the problem.

7	**Recreate (Simulate) Symptoms of the DTC**

- Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.
- If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.

8	**Confirm Symptoms of Problem**

- If DTC(s) is/are not displayed, go to Step 9.
- If DTC(s) is/are displayed, go to Step 11.

9	**Recreate (Simulate) Symptom**

- Try to recreate or simulate the condition of the malfunction as described by the customer.

10	**Check the DTC**

- If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.
- If DTC(s) occur(s), go to Step 11.

11	**Perform Troubleshooting Procedure for DTC**

12	**Adjust or repair the vehicle**

13	**Confirm test**

14	**END**

Customer Problem Analysis Sheet

1. VEHICLE INFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐ CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile	DPF (Diesel Engine)	☐ With DPF ☐ Without DPF

2. SYMPTOMS

☐ Unable to start	☐ Engine does not turn over ☐ Incomplete combustion ☐ Initial combustion does not occur
☐ Difficult to start	☐ Engine turns over slowly ☐ Other_____
☐ Poor idling	☐ Rough idling ☐ Incorrect idling ☐ Unstable idling (High:_____ rpm, Low:_____rpm) ☐ Other
☐ Engine stall	☐ Soon after starting ☐ After accelerator pedal depressed ☐ After accelerator pedal released ☐ During A/C ON ☐ Shifting from N to D-range ☐ Other_____
☐ Others	☐ Poor driving (Surge) ☐ Knocking ☐ Poor fuel economy ☐ Back fire ☐ After fire ☐ Other_____

3. ENVIRONMENT

Problem frequency	☐ Constant ☐ Sometimes (_____) ☐ Once only ☐ Other_____
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other_____
Outdoor temperature	Approx. _____ °C/°F
Place	☐ Highway ☐ Suburbs ☐ Inner City ☐ Uphill ☐ Downhill ☐ Rough road ☐ Other_____
Engine temperature	☐ Cold ☐ Warming up ☐ After warming up ☐ Any temperature
Engine operation	☐ Starting ☐ Just after starting (____min) ☐ Idling ☐ Racing ☐ Driving ☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ A/C switch ON/OFF ☐ Other_____

4. MIL/DTC

MIL (Malfunction Indicator Lamp)		☐ Remains ON ☐ Sometimes lights up ☐ Does not light
DTC	Normal check (Pre-check)	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data
	Check mode	☐ Normal ☐ DTC (_____) ☐ Freeze Frame Data

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

Basic Inspection Procedure

Measuring Condition Of Electronic Parts' Resistance

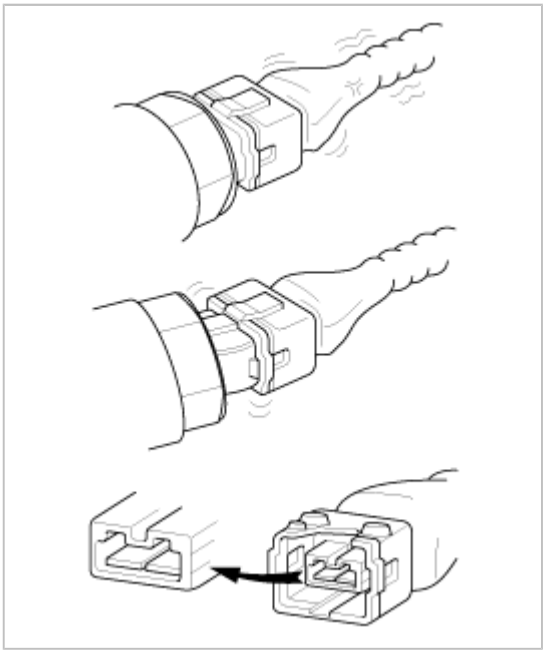
The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature (20→, 68→), unless stated otherwise.

> The measured resistance in except for ambient temperature (20→, 68→) is reference value.

Intermittent Problem Inspection Procedure

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, the technician should thoroughly make out a "CUSTOMER PROBLEM ANALYSIS SHEET" and recreate (simulate) the environment and condition which occurred when the vehicle was having the issue.

1. Clear Diagnostic Trouble Code (DTC).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



3. Slightly shake the connector and wiring harness vertically and horizontally.
4. Repair or replace the component that has a problem.
5. Verify that the problem has disappeared with the road test.

● SIMULATING VIBRATION

1) Sensors and Actuators

: Slightly vibrate sensors, actuators or relays with finger.

> Strong vibration may break sensors, actuators or relays

2) Connectors and Harness
: Lightly shake the connector and wiring harness vertically and then horizontally.

- SIMULATING HEAT

1) Heat components suspected of causing the malfunction with a hair dryer or other heat source.

- DO NOT heat components to the point where they may be damaged.
- DO NOT heat the ECM directly.

- SIMULATING WATER SPRINKLING

1) Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

DO NOT sprinkle water directly into the engine compartment or electronic components.

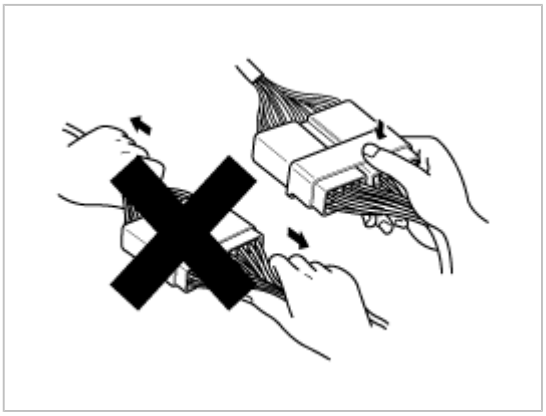
- SIMULATING ELECTRICAL LOAD

1) Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, rear window defogger, etc.).

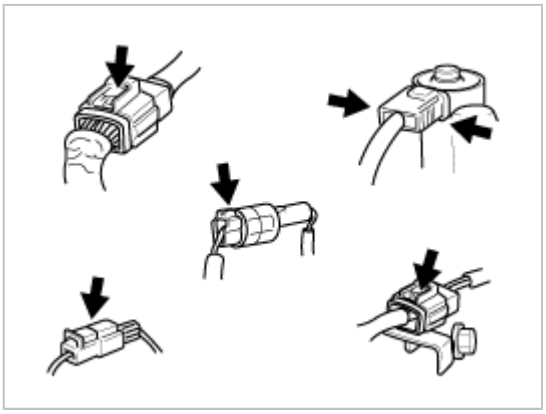
Connector Inspection Procedure

1. Handling of Connector

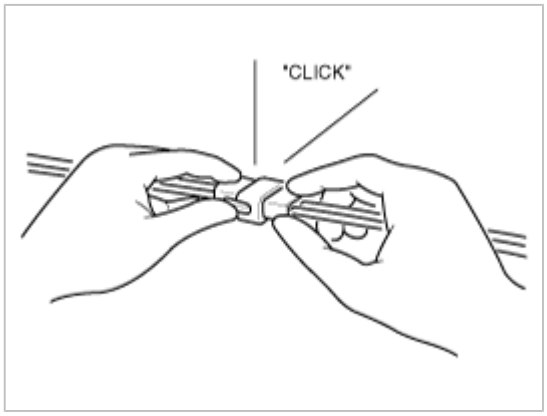
A. Never pull on the wiring harness when disconnecting connectors.



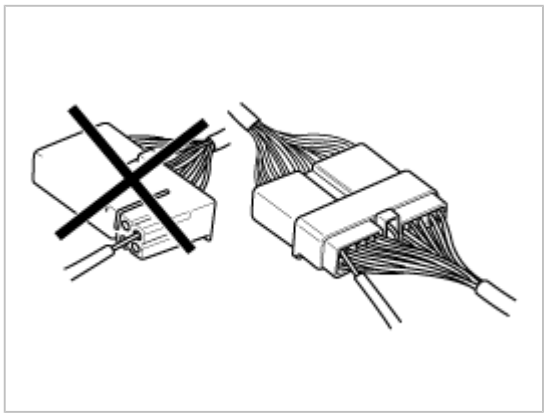
B. When removing the connector with a lock, press or pull locking lever.



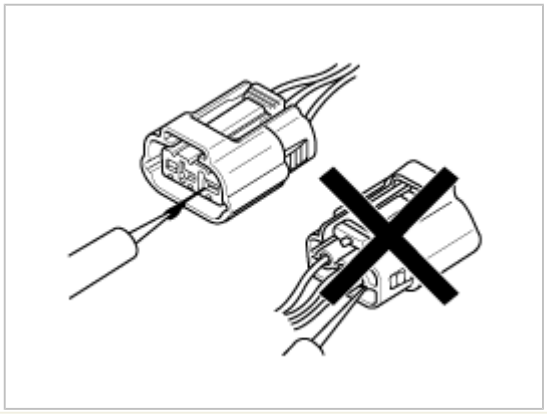
C. Listen for a click when locking connectors. This sound indicates that they are securely locked.



D. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



E. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.

2. Checking Point for Connector

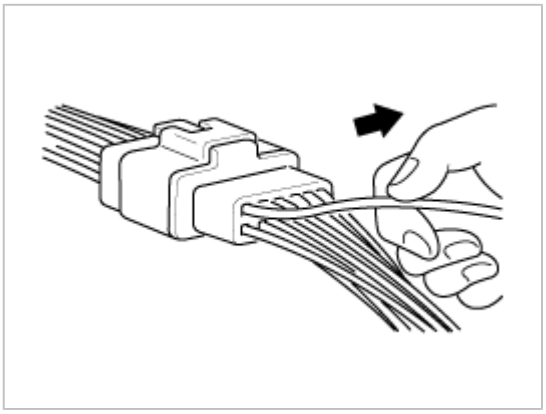
A.

While the connector is connected:
Hold the connector, check connecting condition and locking efficiency.

B. When the connector is disconnected:
Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.
Visually check for rust, contamination, deformation and bend.

C. Check terminal tightening condition:
Insert a spare male terminal into a female terminal, and then check terminal tightening conditions.

D. Pull lightly on individual wires to ensure that each wire is secured in the terminal.



3. Repair Method of Connector Terminal
   A. Clean the contact points using air gun and/or shop rag.

> Never use sand paper when polishing the contact points, otherwise the contact point may be damaged.

   B. In case of abnormal contact pressure, replace the female terminal.

Wire Harness Inspection Procedure

1. Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
2. Check whether the wire harness is twisted, pulled or loosened.
3. Check whether the temperature of the wire harness is abnormally high.
4. Check whether the wire harness is rotating, moving or vibrating against the sharp edge of a part.
5. Check the connection between the wire harness and any installed part.
6. If the covering of wire harness is damaged; secure, repair or replace the harness.

Electrical Circuit Inspection Procedure

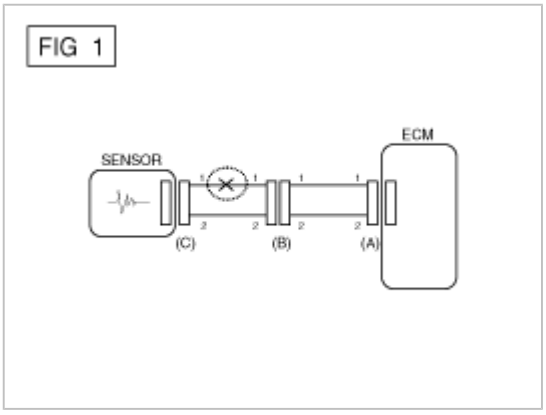
• Check Open Circuit

1. Procedures for Open Circuit
   A. Continuity Check
   B. Voltage Check

If an open circuit occurs (as seen in [FIG. 1]), it can be found by performing Step 2 (Continuity Check

Method) or Step 3 (Voltage Check Method) as shown below.

FIG 1



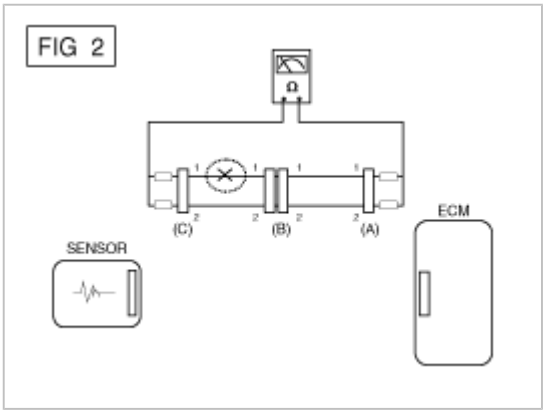
2. Continuity Check Method

When measuring for resistance, lightly shake the wire harness above and below or from side to side.

Specification (Resistance)
1Ω or less → Normal Circuit
1→or Higher → Open Circuit

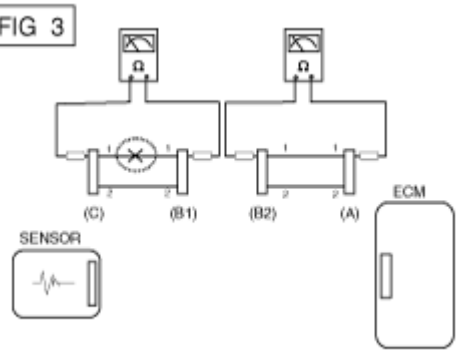
A. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].
In [FIG.2.] the measured resistance of line 1 and 2 is higher than 1→and below 1 Ω respectively. Specifically the open circuit is line 1 (Line 2 is normal). To find exact break point, check sub line of line 1 as described in next step.

FIG 2



B. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].
In this case the measured resistance between connector (C) and (B1) is higher than 1→and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

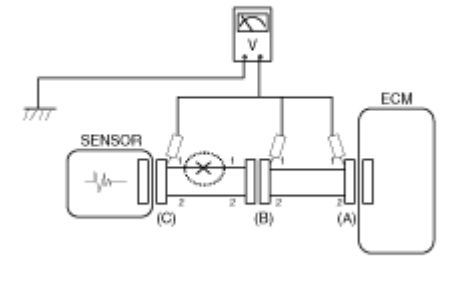
FIG 3



3. Voltage Check Method

A. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].
The measured voltage of each connector is 5V, 5V and 0V respectively. So the open circuit is between connector (C) and (B).

FIG 4



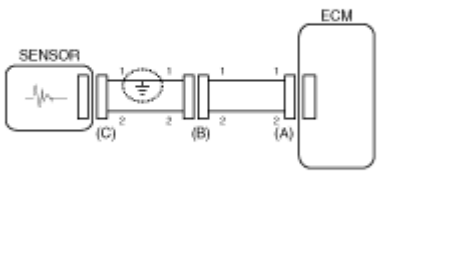
• Check Short Circuit

1. Test Method for Short to Ground Circuit

A. Continuity Check with Chassis Ground

If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5

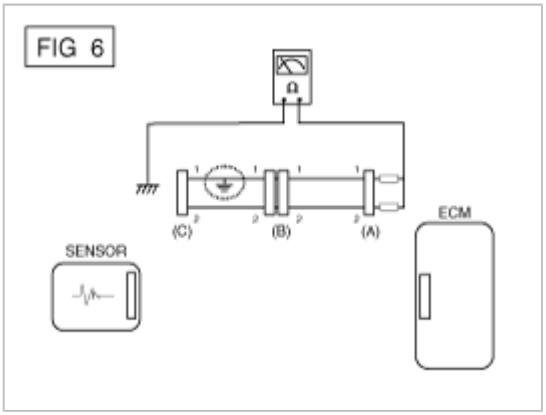


2. Continuity Check Method (with Chassis Ground)

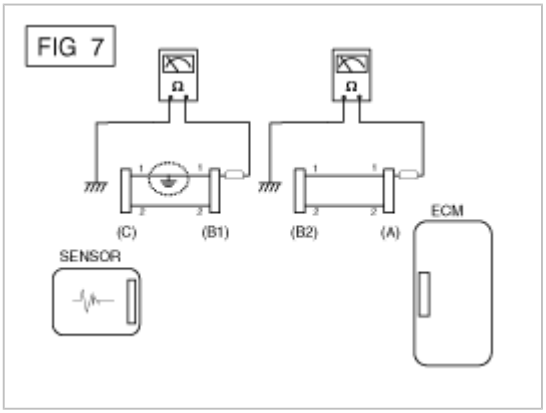
Lightly shake the wire harness above and below, or from side to side when measuring the resistance.

Specification (Resistance)
1Ω or less → Short to Ground Circuit
1MΩ or Higher → Normal Circuit

A. Disconnect connectors (A), (C) and measure for resistance between connector (A) and Chassis Ground as shown in [FIG. 6].
The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1MΩ respectively. Specifically the short to ground circuit is line 1 (Line 2 is normal). To find exact broken point, check the sub line of line 1 as described in the following step.



B. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].
The measured resistance between connector (B1) and chassis ground is 1Ω or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



Symptom Troubleshooting Guide Table
(Symptom 1) Engine Does Not Start

Possible Cause	

• Run out of fuel • Faulty starter • Not connected fuel feed line • Leakage in high pressure fuel circuit • Fuse out of order • Drift of the rail pressure sensor • Cam and crank signals missing simultaneously • Low battery voltage • Faulty immobilizer • Fuel pressure regulator valve contaminated, stuck, jammed • Rail pressure regulator valve contaminated, stuck, jammed • Bad fuel quality or water ingress in fuel	• Inversion of fuel connections (feed □ return) • Faulty fuel filter • Clogged low pressure fuel circuit • Clogged fuel filter • Intermittent faulty fuel line connection • Air ingress in the low pressure fuel circuit • Clogged return line of high pressure fuel pump • Low compression pressure • Leakage at the injector • Faulty low pressure fuel pump • Faulty high pressure fuel pump • Injector jammed open • ECM program error or hardware fault • Faulty glow system

(Symptom 2) Engine Starts With Difficulty Or Starts And Stalls

Possible Cause	
• Not connected fuel return line at injector • Leakage in high pressure fuel circuit • Fuse out of order • Clogged air filter • Faulty alternator or voltage regulator • Compensation of individual injector not adapted • No engine coolant temperature sensor signal • No rail pressure sensor signal • Low battery voltage • Electric EGR control valve blocked open • Fuel pressure regulator valve contaminated, stuck, jammed • Rail pressure regulator valve contaminated, stuck, jammed • Bad fuel quality or water ingress in fuel • Inversion of fuel connections (feed □ return)	• Clogged low pressure fuel circuit • Clogged fuel filter • Oil level too high or too low • Sealed or damaged catalytic converter • Intermittent faulty fuel line connection • Air ingress in the low pressure fuel circuit • Clogged return line of high pressure fuel pump • Faulty glow system • Low compression pressure • Clogged injector return line • Carbon deposit on the injector (sealed holes) • Injector needle stuck (injection possible over a certain pressure) • Gasoline in fuel • ECM program error or hardware fault

(Symptom 3) Poor Starting When Hot

Possible Cause	
• Compensation of individual injector not adapted	

• No rail pressure sensor signal • Electric EGR control valve blocked open • Fuel pressure regulator valve contaminated, stuck, jammed • Rail pressure regulator valve contaminated, stuck, jammed • Clogged air filter • Air ingress in the low pressure fuel circuit • Bad fuel quality or water ingress in fuel	• Clogged return line of high pressure fuel pump • Clogged fuel filter • Low compression pressure • Intermittent faulty fuel line connection • Carbon deposit on the injector (sealed holes) • Injector needle stuck (injection possible over a certain pressure) • Gasoline in fuel • ECM program error or hardware fault

(Symptom 4) Unstable Idling

Possible Cause	
• Not connected fuel return line at injector • Compensation of individual injector not adapted • No rail pressure sensor signal • Wiring harness open or poor connection • Air ingress in the low pressure fuel circuit • Bad fuel quality or water ingress in fuel • Clogged fuel filter • Clogged air filter • Clogged injector return line • Leakage in high pressure fuel circuit	• Faulty glow system • Low compression pressure • Poor tightening of injector clamp • Faulty high pressure fuel pump • Injector not adapted • Carbon deposit on the injector (sealed holes) • Injector needle stuck (injection possible over a certain pressure) • Injector jammed open • Electric EGR control valve blocked open

(Symptom 5) Idle Speed Too High Or Too Low

Possible Cause	
• No engine coolant temperature sensor signal • Incorrect state of the electrical pack devices • Faulty alternator or voltage regulator • ECM program error or hardware fault	• Electric EGR control valve blocked open • Faulty accelerator pedal

(Symptom 6) Blue, White, Or Black Smokes

Possible Cause	
• Compensation of individual injector not adapted • No engine coolant temperature sensor signal • No rail pressure sensor signal • Electric EGR control valve blocked open	• Clogged air filter • Oil suction (engine racing) • Faulty glow system • Low compression pressure

• Fuel pressure regulator valve contaminated, stuck, jammed • Rail pressure regulator valve contaminated, stuck, jammed • Oil level too high or too low • Bad fuel quality or water ingress in fuel • Sealed or damaged catalytic converter	• Poor tightening of injector clamp • Poor injector O-ring, no O-ring or two O-ring installed • Injector not adapted • Carbon deposit on the injector (sealed holes) • Injector jammed open • Gasoline in fuel

(Symptom 7) Engine Rattling, Noisy Engine

Possible Cause	
• Compensation of individual injector not adapted • Electric EGR control valve blocked open • Electric EGR control valve blocked open • No engine coolant temperature sensor signal • Faulty glow system • Low compression pressure • Clogged injector return line • No rail pressure sensor signal	• Poor injector O-ring, no O-ring or two O-ring installed • Injector not adapted • Carbon deposit on the injector (sealed holes) • Injector needle stuck (injection possible over a certain pressure) • Injector jammed open • No engine coolant temperature sensor signal

(Symptom 8) Nurst Noise

Possible Cause	
• Compensation of individual injector not adapted • Intermittent faulty fuel line connection • Clogged exhaust system • No rail pressure sensor signal	• Fuel pressure regulator valve contaminated, stuck, jammed • Rail pressure regulator valve contaminated, stuck, jammed • ECM program error or hardware fault

(Symptom 9) Untimely Acceleration/deceleration And Engine Racing

Possible Cause	
• Blocked accelerator pedal position sensor • Electric EGR control valve blocked open • Intermittent faulty fuel line connection	• Oil suction (engine racing) • No rail pressure sensor signal • ECM program error or hardware fault

(Symptom 10) Gap When Accelerating And At Re-coupling (Response Time)

Possible Cause	
• Leakage in intake system • Incorrect state of the electrical pack devices	• Fuel pressure regulator valve contaminated,

• Blocked accelerator pedal position sensor • Electric EGR control valve blocked open • Damaged turbocharger or leakage in vacuum line • Clogged fuel filter • Low compression pressure • Leakage in high pressure fuel circuit	stuck, jammed • Rail pressure regulator valve contaminated, stuck, jammed • Injector needle stuck (injection possible over a certain pressure) • ECM program error or hardware fault

(Symptom 11) Engine Stop

Possible Cause	
• Run out of fuel • Not connected fuel feed line • Leakage in high pressure fuel circuit • Fuse out of order • Bad fuel quality or water ingress in fuel • Clogged low pressure fuel circuit • Clogged fuel filter • Crank signals missing • Electric EGR control valve blocked open • Fuel pressure regulator valve contaminated, stuck, jammed	• Rail pressure regulator valve contaminated, stuck, jammed • Faulty alternator or voltage regulator • Intermittent faulty fuel line connection • Sealed or damaged catalytic converter • Faulty low pressure fuel pump • Faulty high pressure fuel pump • Gasoline in fuel • ECM program error or hardware fault

(Symptom 12) Engine Judder

Possible Cause	
• Run out of fuel • Not connected fuel return line at injector • Incorrect state of the electrical pack devices • Compensation of individual injector not adapted • Electric EGR control valve blocked open • Faulty fuel filter • Air ingress in the low pressure fuel circuit • Bad fuel quality or water ingress in fuel • Clogged fuel filter • Intermittent faulty fuel line connection • Wiring harness open or poor connection • Faulty glow system	• Low compression pressure • Clogged injector return line • Poor valve clearance • Faulty low pressure fuel pump • Poor injector O-ring, no O-ring or two O-ring installed • Carbon deposit on the injector (sealed holes) • Injector needle stuck (injection possible over a certain pressure) • Injector jammed open • Gasoline in fuel • ECM program error or hardware fault

(Symptom 13) Lack Of Power

Possible Cause	
• Compensation of individual injector not adapted • Blocked accelerator pedal position sensor • Incorrect state of the electrical pack devices • Electric EGR control valve blocked open • Leakage in intake system • Clogged air filter • Oil level too high or too low • Sealed or damaged catalytic converter • Damaged turbocharger or leakage in vacuum line • Damaged turbocharger	• Clogged fuel filter • Leakage at the injector • Clogged return line of high pressure fuel pump • Clogged injector return line • Low compression pressure • Injector not adapted • Carbon deposit on the injector (sealed holes) • Poor valve clearance • Engine coolant temperature too high • Fuel temperature too high

(Symptom 14) Too Much Power

Possible Cause	
• Compensation of individual injector not adapted • Oil suction (engine racing)	• ECM program error or hardware fault

(Symptom 15) Excessive Fuel Consumption

Possible Cause	
• Not connected fuel return line at injector • Leakage at the Fuel pressure regulator valve • Leakage at fuel temperature sensor • Leakage in high pressure fuel circuit • Leakage in intake system • Clogged air filter • Compensation of individual injector not adapted • Electric EGR control valve blocked open	• Incorrect state of the electrical pack devices • Oil level too high or too low • Bad fuel quality or water ingress in fuel • Sealed or damaged catalytic converter • Damaged turbocharger • Low compression pressure • Injector not adapted • ECM program error or hardware fault

(Symptom 16) Over Speed Engine When Changing The Gear Box Ratio

Possible Cause	
• Blocked accelerator pedal position sensor • Compensation of individual injector not adapted • Intermittent faulty fuel line connection • Clutch not well set (optional)	• Oil suction (engine racing) • Damaged turbocharger • Injector not adapted • ECM program error or hardware fault

(Symptom 17) Exhaust Smells

Possible Cause	
• Leakage at electric EGR control valve • Oil suction (engine racing) • Damaged turbocharger • Oil level too high or too low • Compensation of individual injector not adapted • Sealed or damaged catalytic converter • Poor tightening of injector clamp	• Poor injector O-ring, no O-ring or two O-ring installed • Injector not adapted • Carbon deposit on the injector (sealed holes) • Injector needle stuck (injection possible over a certain pressure) • Injector jammed open • ECM program error or hardware fault

(Symptom 18) Smokes (Black, White, Blue) When Accelerating

Possible Cause	
• Compensation of individual injector not adapted • Electric EGR control valve blocked open • Clogged air filter • Bad fuel quality or water ingress in fuel • Oil level too high or too low • Damaged turbocharger • Sealed or damaged catalytic converter • Oil suction (engine racing) • Faulty air heater • Low compression pressure • Leakage in high pressure fuel circuit	• Intermittent faulty fuel line connection • Poor tightening of injector clamp • Poor injector O-ring, no O-ring or two O-ring installed • Injector not adapted • Carbon deposit on the injector (sealed holes) • Injector needle stuck (injection possible over a certain pressure) • Injector jammed open • Gasoline in fuel • ECM program error or hardware fault • Catalyzed Particulate Filter (DPF) fail

(Symptom 19) Fuel Smells

Possible Cause	
• Not connected fuel feed line • Not connected fuel return line at injector • Leakage at the Fuel pressure regulator valve	• Leakage at fuel temperature sensor • Leakage in high pressure fuel circuit

(Symptom 20) The Engine Collapses At Take Off

Possible Cause	
• Blocked accelerator pedal position sensor • Incorrect state of the electrical pack devices • Clogged air filter	• Intermittent faulty fuel line connection • No rail pressure sensor signal • Fuel pressure regulator valve contaminated,

• Inversion of fuel connections (feed □ return) • Faulty fuel filter • Bad fuel quality or water ingress in fuel • Air ingress in the low pressure fuel circuit • Clogged fuel filter • Sealed or damaged catalytic converter	stuck, jammed • Rail pressure regulator valve contaminated, stuck, jammed • Gasoline in fuel • ECM program error or hardware fault • Faulty accelerator pedal position sensor

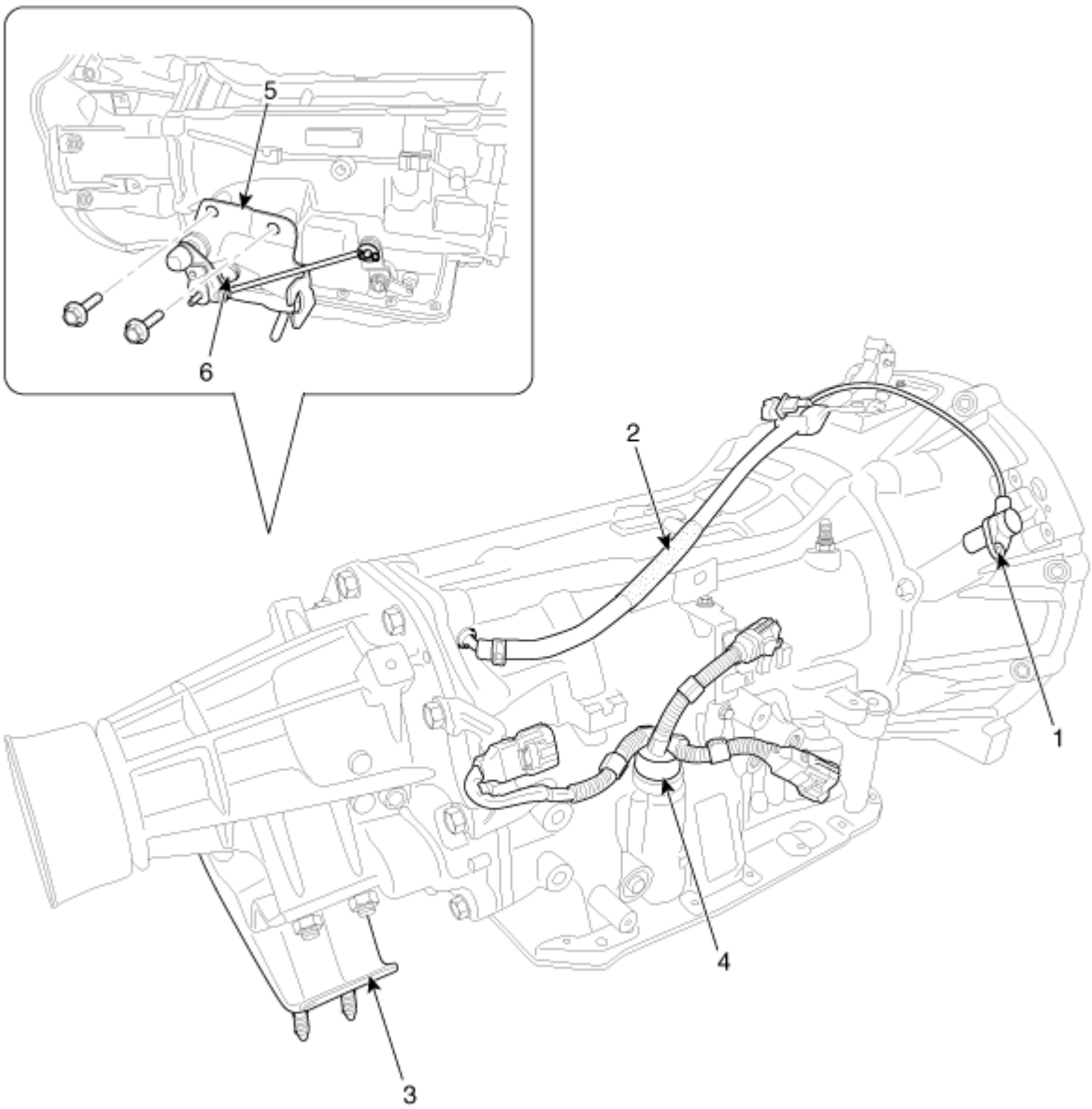
(Symptom 21) Engine Does Not Stop

Possible Cause	
• Stuck or worn lubrication circuit of turbocharger • Too much engine oil	• Leakage at vacuum hose • ECM program error or hardware fault

(Symptom 22) Different Mechanical Noises

Possible Cause	
• Buzzer noise (discharge by the injectors) • Broken clip (vibrations, resonance, noises) • Incorrect state of the electrical pack devices • Sealed or damaged catalytic converter	• Leakage in intake system • Poor tightening of injector clamp • Damaged turbocharger • Poor valve clearance

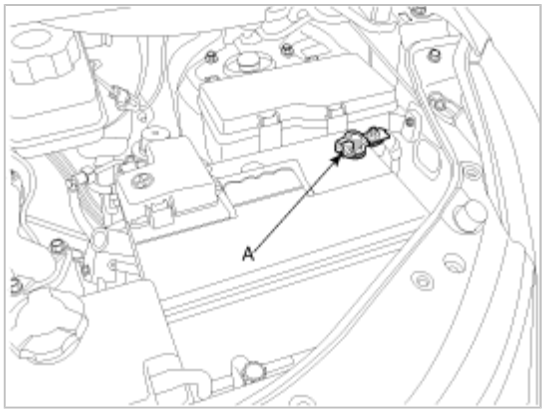
Components



1. CKP sensor	4. Transmission wiring connector
2. Air breather hose	5. Shift cable bracket
3. Transmission mounting bracket	6. Oil filler plug

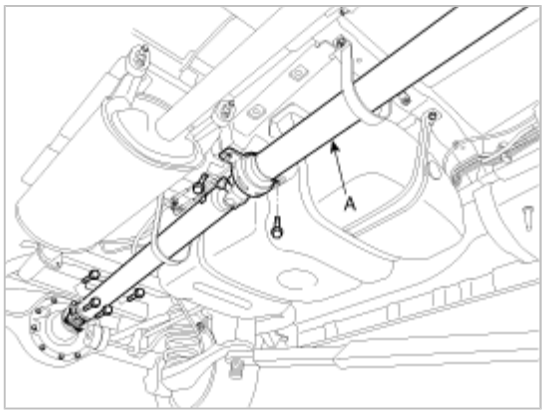
Removal

1. Remove the battery (-) terminal (A).

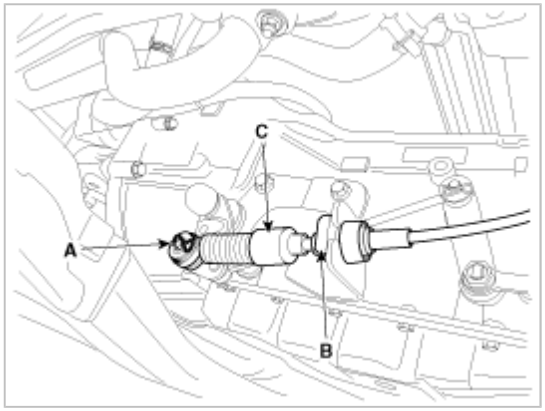


2. Remove the propeller shaft (A).

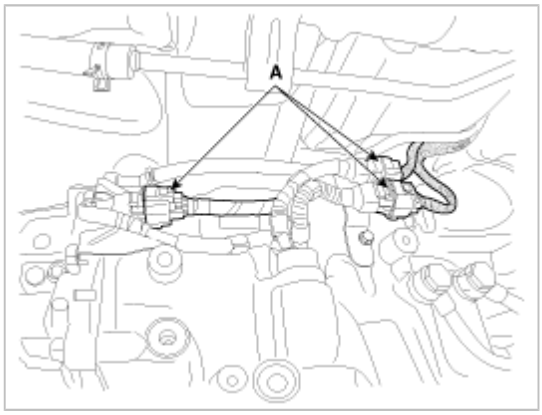
Tightening torque
Propeller shaft :
58.9 ~ 68.7 N.m (6.0 ~ 7.0 kgf.m, 43.4 ~ 50.6 lb-ft)
Rear steel bends :
39.2 ~ 49.1 N.m (4.0 ~ 5.0 kgf.m, 28.9 ~ 36.2 lb-ft)



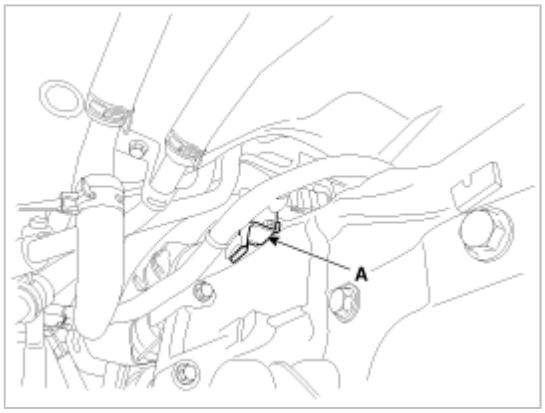
3. Remove the shift cable (C) by removing pin (A) and clip (B).



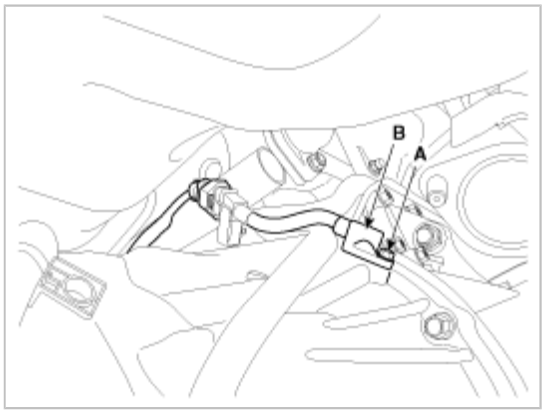
4. Remove the main connector (A).



5. Remove the wire bracket (A).

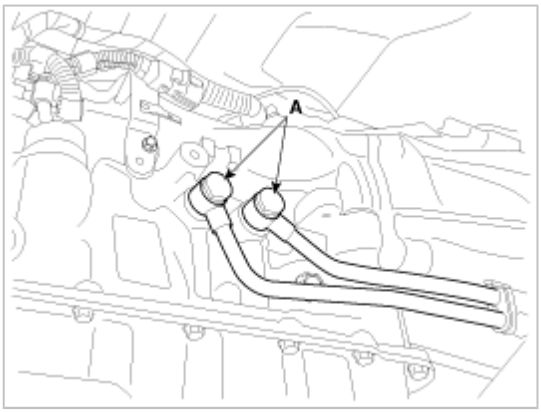


6. Remove the CKP sensor (B) by removing a bolt (A-1ea).



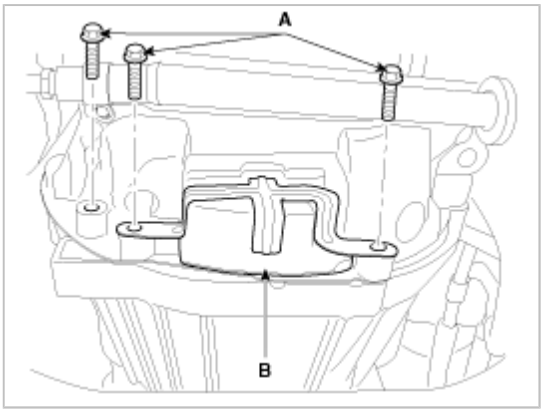
7. Remove the oil cooler pipes (A).

Tightening torque :
39.2 ~ 49.1 N.m (4.0 ~ 5.0 kgf.m, 28.9 ~ 36.2 lb-ft)



8. Remove the transmission lower mounting bolts (A) and the dust cover (B).

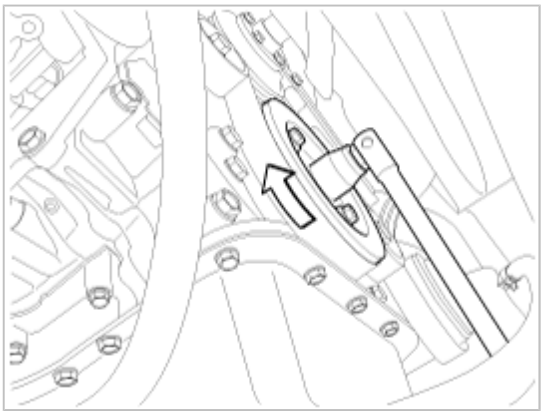
Tightening torque :
42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)

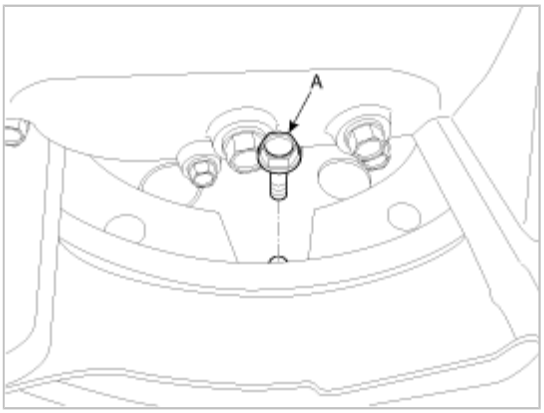


9. Remove the tstorque converter mounting bolts (A).

Tightening torque :
45.1 ~ 52.0 N.m (4.6 ~ 5.3 kgf.m, 33.3 ~ 38.3 lb-ft)

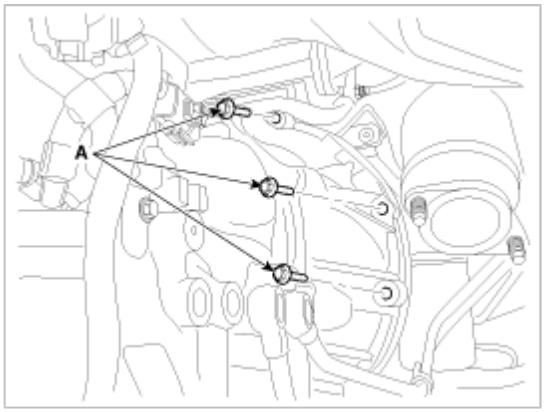
Remove the bolts(A-6ea) while rotating the crankshaft clockwise.

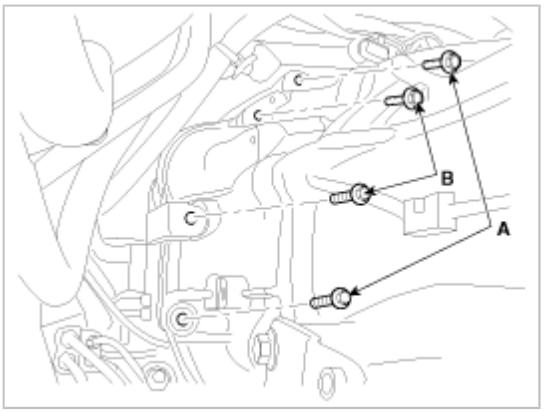




10. Remove the transmission upper mounting bolts (A-5ea) and the starter motor mounting bolts (B-2ea).

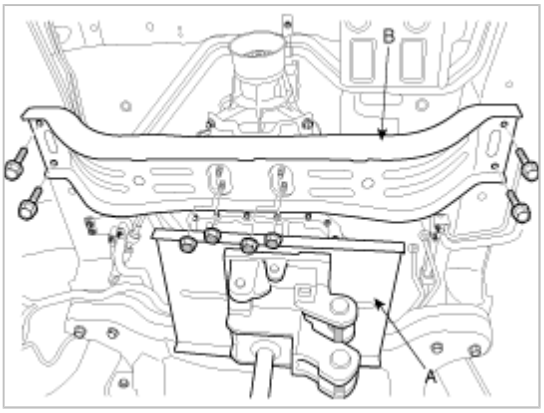
Tightening torque :
(A) 42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)
(B) 49.1 ~ 63.8 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47 lb-ft)





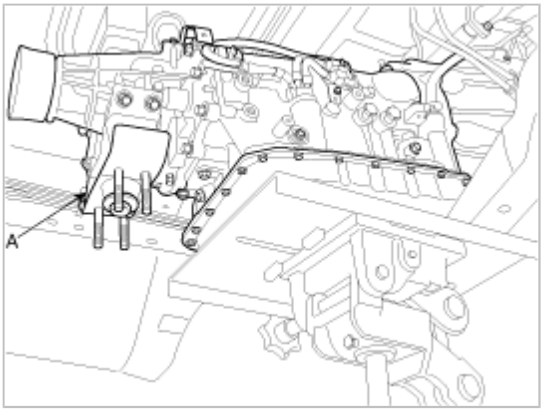
11. Remove the crossmember (B) mounting bolts while supporting the transmission with a jack (A).

Tightening torque :
137.3 ~ 166.8 N.m (14.0 ~ 17.0 kgf.m, 101.3 ~ 123 lb-ft)



12. Lowering the jack slowly, remove the transmission.

When removing the transaxle assembly, be careful not to damage any surrounding parts or body components.



Installation

1. Install in the reverse order of removal.

Follow the separated each procedure as below according to reinstallation or replacing with a new automatic transmission.

2. In case of the reinstallation.
   (1) Check the ATF level after refilling the automatic transmission with fluid. (Refer to Automatic Transmission System - "Repair procedures")
   (2) Clear the diagnostic trouble codes (DTC) using the GDS.

Even though disconnecting the battery negative terminal, the DTCs will not be cleared. So, be sure to clear the DTCs using the GDS.

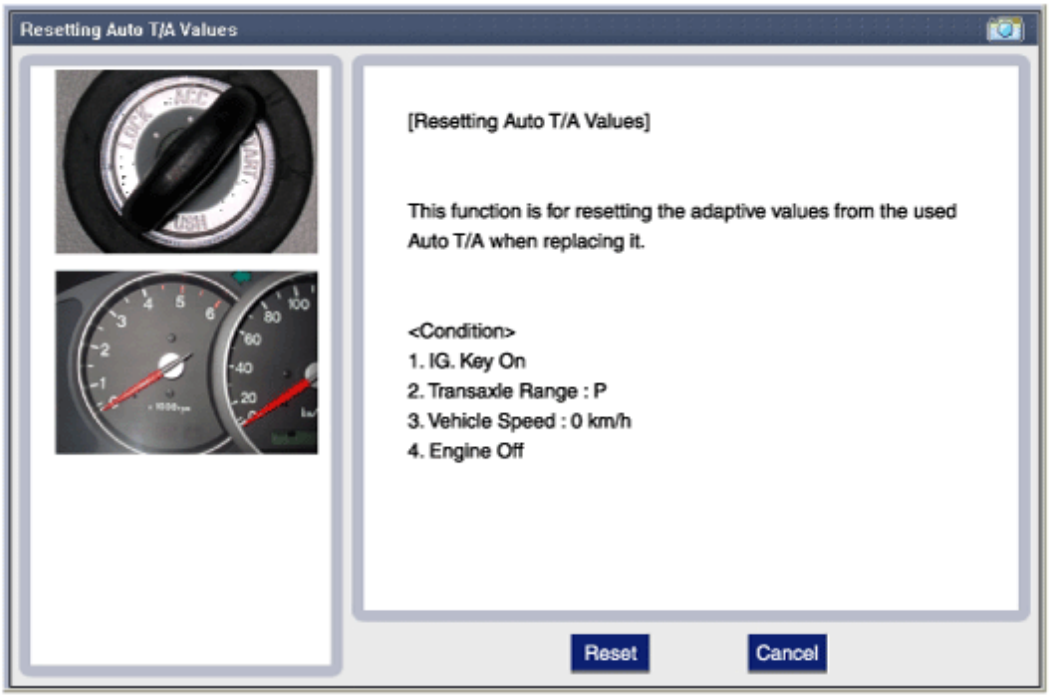
3. In case of the replacing with a new automatic transmission.

New automatic transmission is already filled with specified quantity ATF.
For that reason, it does not necessary to refill and check the ATF but the remaining ATF inside of ATF cooler have to be removed.

   (1) Clear the diagnostic trouble codes (DTC) using the GDS.

Even though disconnecting the battery negative terminal, the DTCs will not be cleared. So, be sure to clear the DTCs using the GDS.

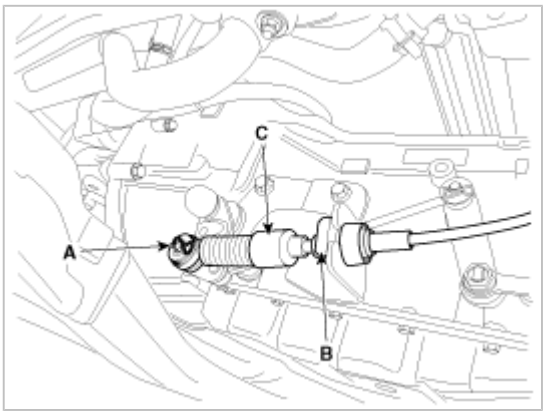
   (2) Reset the automatic transmission adaptive values using the GDS.



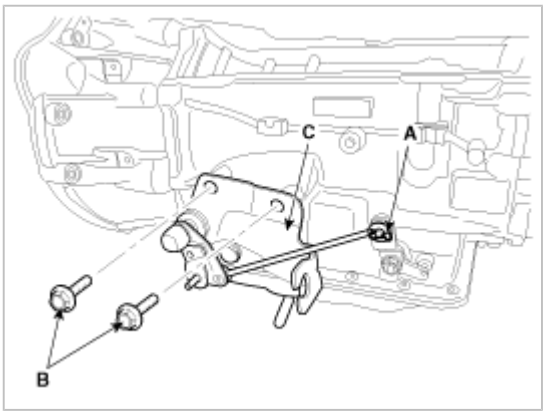
(3) Perform the TCM adaptive values learning procedure.

Procedure of ATF level adjusting

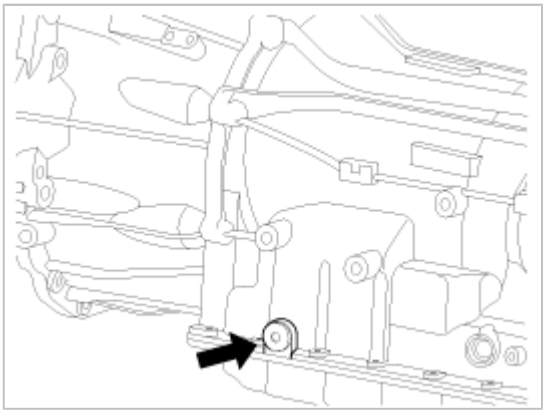
1. Park the vehicle on a flat road and lock the tires.
2. Shift the shift lever to the "P" range.
3. Remove the shift cable (C) by removing pin (A) and clip (B).



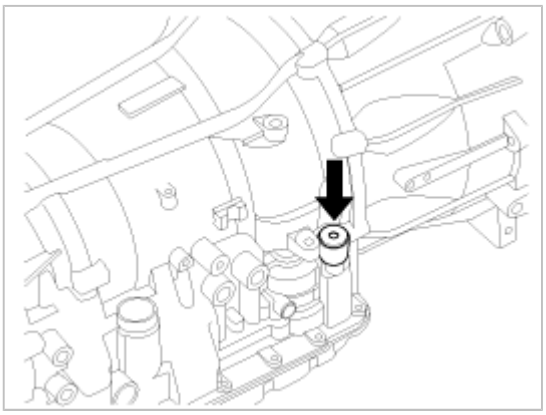
4. Remove the shift cable bracket (C) by removing bolt (B-2ea) and snap pin (A).



5. Remove the overflow plug by using a torx wrench.



6. Remove the filler plug by using a torx wrench.



7. Check if ATF flows out of the overflow hole. If ATF does not drop, add ATF until it drops.
8. Fix the overflow plug by using Torx wrench.
9. Add 1400cc(A5SR1),1200cc(A5SR2) of ATF from the oil filling hole.
10. Install it to the filler plug with a new gasket.
11. Tighten the filler plug by using Torx wrench with the specified torque.

Tightening torque :
23.5 ~ 54.9 N.m (2.4 ~ 5.6 kgf.m, 17.4 ~ 40.5 lb-ft)

12. Start the engine.
13. Raise ATF temperatirue on CAN signal up to 50~60℃ at stabilized idle speed condition.
14. Shift from "P" to "D", then from "D" to "P", keeping each shift position "N","R" more than 2 seconds with foot braking.
15. Repeat 2 times above procedure "3".
16. Remove the overflow plug and the O-ring by using Torx wrench.
17. Check If the thin oil stream becomes drop by drop when ATF temperatirue on CAN signal is at 54~60° C.
18. Install it to the overflow plug with a new gasket.
19. Tighten the overflow plug by using Torx wrench with the specified torque.

Tightening torque :
5.9 ~ 8.8 N.m (0.6 ~ 0.9 kgf.m, 4.3 ~ 6.5 lb-ft)

Be sure to wipe off spilled ATF completely after tightening the overflow plug.

Specifications

Type			A5SR2
Driving system			2WD
T/CON	Type		3 elements, 1 stage, 2 phase
	Identification inscription [Nominal diameter (mm)]		8 (Φ250)
	Stall torque ratio		1.76
Transmission	Manipulating system		Remote control flow transmission (Cable method)
	Gear ratio	1st	3.767
		2nd	2.331
		3rd	1.534
		4th	1.000
		5th	0.838
		Reverse	2.767
	Oil pump	Type	Trochoid oil pump
		Driving system	Engine drive

Tightening Torques

Items	N.m	kgf.m	lb-ft
Vehicle speed sensor	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Rear steel bends	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Propeller shaft	58.9 ~ 68.7	6.0 ~ 7.0	43.4 ~ 50.6
Cross member	137.3 ~ 166.8	14.0 ~ 17.0	101.3 ~ 123
Automatic transmission oil cooler pipes	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Automatic transmission oil pan	6.9 ~ 8.8	0.7 ~ 0.9	5.1 ~ 6.5
Transmission mounting bolt	42.2 ~ 54.0	4.3 ~ 5.5	31.1 ~ 39.8
Starter motor mounting bolt	49.1 ~ 63.8	5.0 ~ 6.5	36.2 ~ 47
Torque converter mounting bolt	45.1 ~ 52.0	4.6 ~ 5.3	33.3 ~ 38.3
Shift lever assembly mounting bolt	8.8 ~ 13.7	0.9 ~ 1.4	6.5 ~ 10.1
Shift lock cable	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7

Control cable	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Oil filler plug	58.9 ~ 63.8	6.0 ~ 6.5	43.4 ~ 47
Oil drain plug	58.9 ~ 63.8	6.0 ~ 6.5	43.4 ~ 47

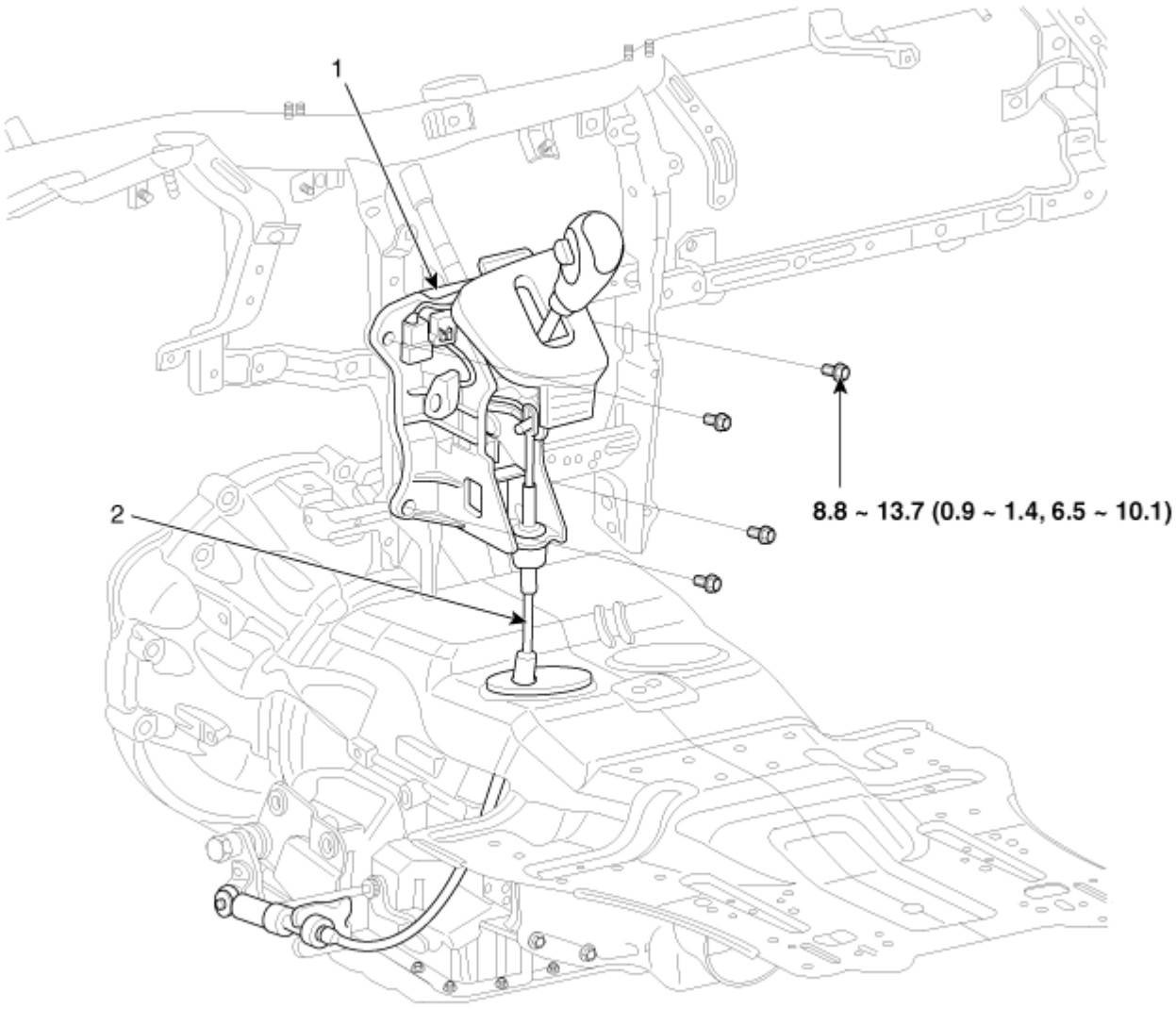
Lubricants

Items	Recommnend lubricant	Quantity
Automatic transmission oil	APOLLOIL ATF RED-1K	10 L (2.64 U.S gal., 10.57 U.S.qt., 8.80 Imp.qt.)

Sealant

Items	Specified sealant
Rear cover Torque converter housing Valve body	LOCTITE FMD-546

Components

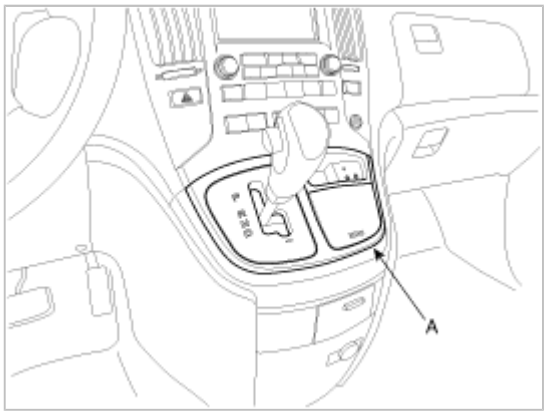


Torque : N.m (kgf.m, lb-ft)

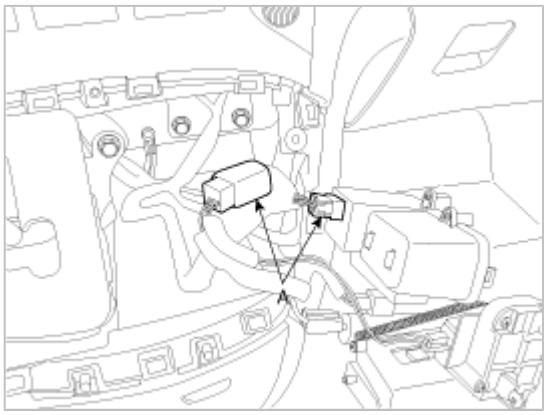
1. Shift lever assembly
2. Control cable assembly

Removal

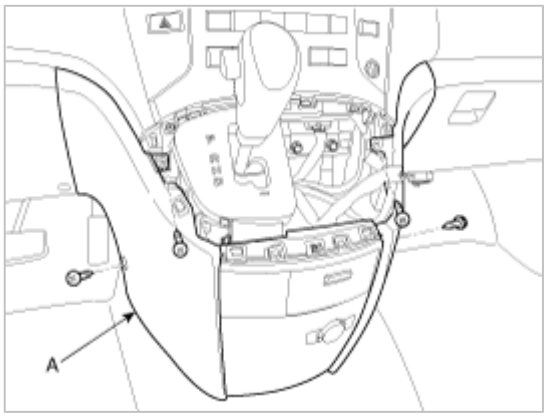
1. Remove the front console under cover (A).



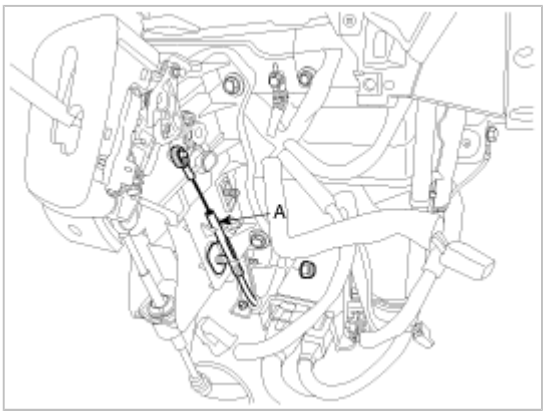
2. Remove the connector (A-2).



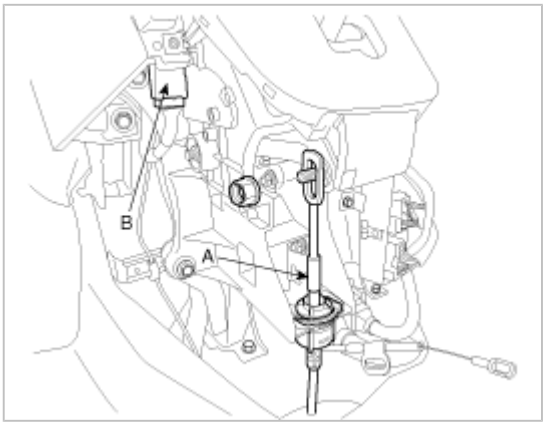
3. Remove the front console (A).



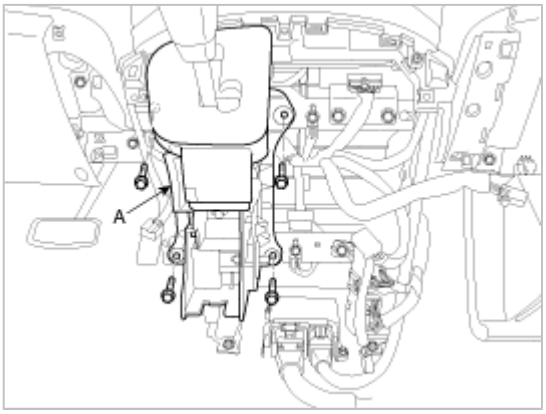
4. Remove the shift lock cable (A).



5. Remove the control cable assembly (A) and the connector (B).



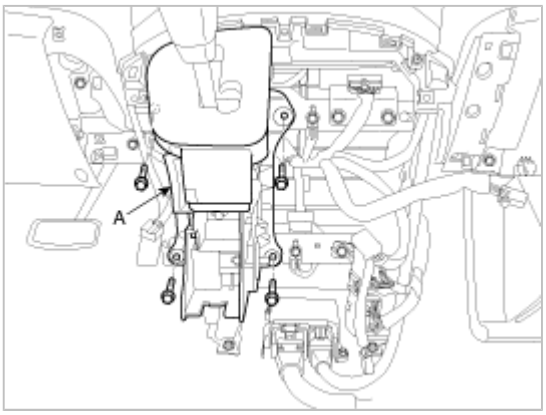
6. Remove the shift lever assembly (A).



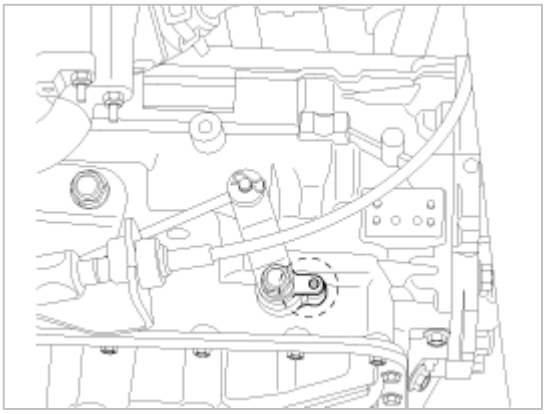
Installation

1. Install the shift lever assembly (A).

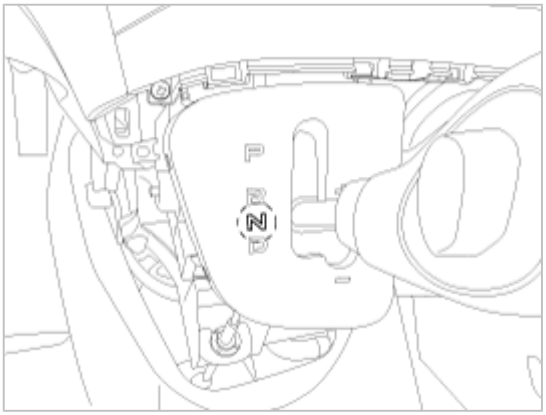
Tightening torque :
9 ~ 14 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)



2. Place the manual lever to N position as show in the illustration.



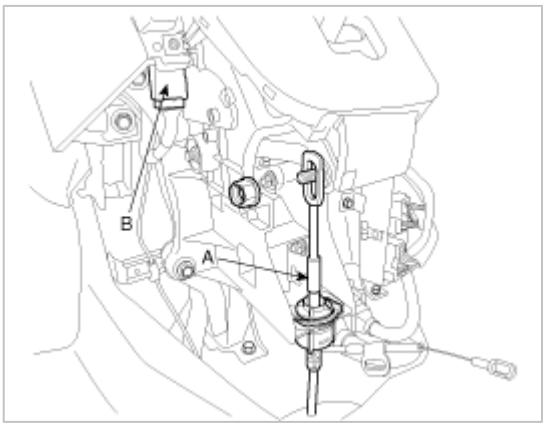
3. Move the shift lever to N position.



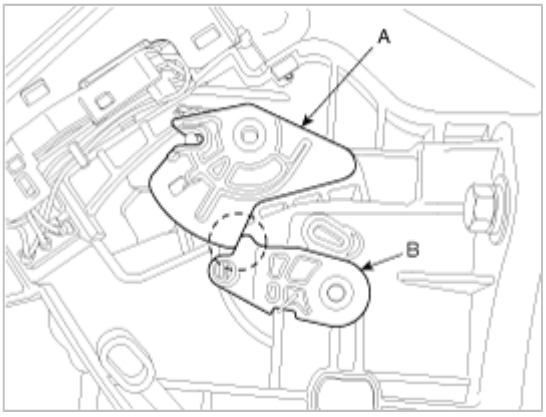
4. Install the control cable assembly (A) and the connector (B).

Tightening torque :
8 ~ 12 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

Make sure that the lever can be shifted to each position.



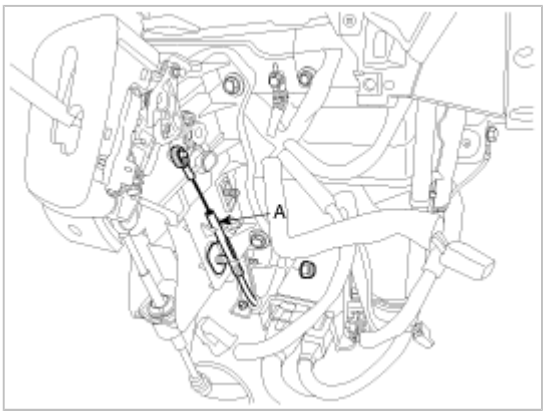
5. Shift the lever to P and place the shift locking cam (B) and shift cam (A) as shown in the illustration.



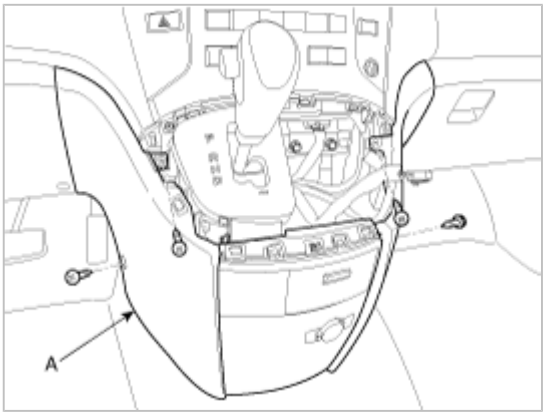
6. Install the shift lock cable (A).

Tightening torque :
8 ~ 12 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

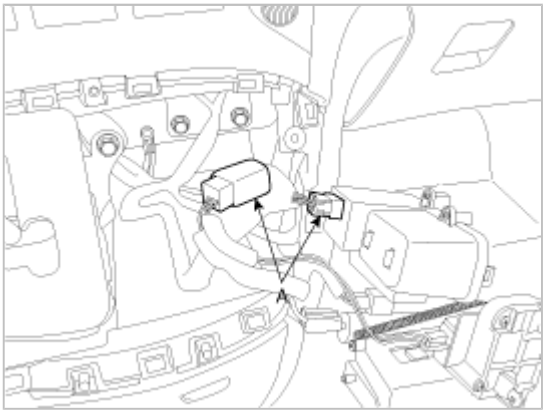
- After installing the shift locking cable, the shift locking cam can move when stepping on the brake.
- Check if the lever can shift to each position by pushing the shift lock button when stepping on the brake.
- The shift lock button can't move when the lever is shifted to P and releasing the brake.



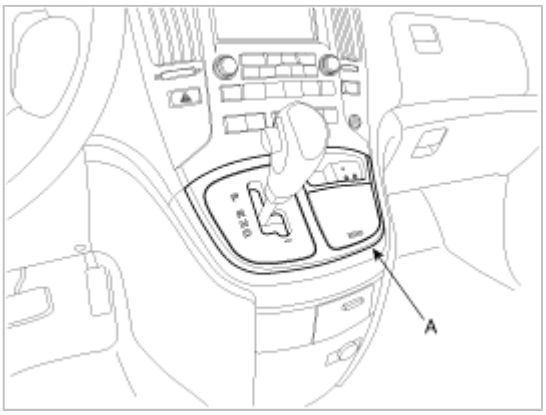
7. Install the front console (A).



8. Install the connector (A-2).



9. Install the front console under cover (A).

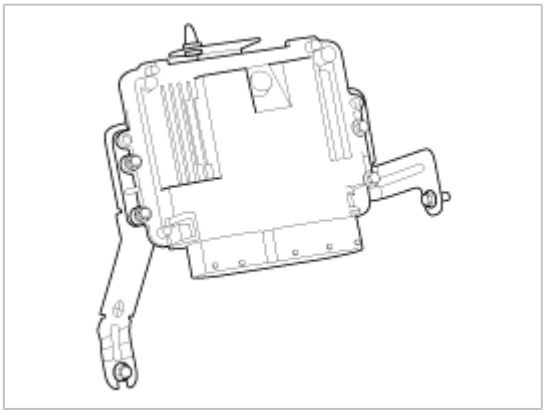

A

Description

Transaxle Control Module (TCM) is the automatic transaxle's brain. The module receives and processes signals from various sensors and implements a wide range of transaxle controls to ensure optimal driving conditions for the driver. TCM is programmed for

Functions

- Monitors the vehicle's operating conditions to determine the optimal gear setting.
- Performs a gear change if the current gear setting differs from the identified optimal gear setting.
- Determines the need for damper clutch (D/C) activation and engages the clutch accordingly.
- Calculates the optimal line pressure level by constantly monitoring the torque level and adjusts the pressure accordingly.
- Diagnoses the automatic transaxle for faults and failures.



Inspection

TCM Problem Inspection Procedure

1. TEST TCM GROUND CIRCUIT: Measure resistance between TCM and chassis ground using the backside of TCM harness connector as TCM side check point. If the problem is found, repair it.

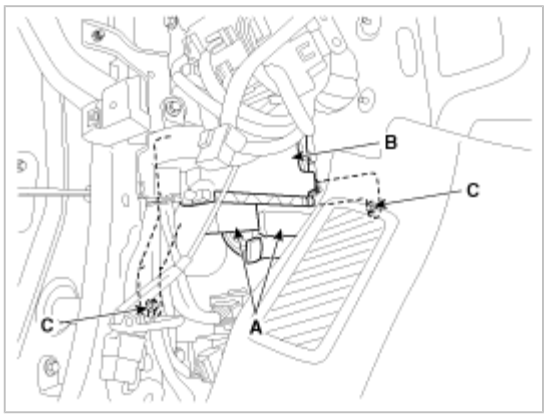
   Specification : Below 1Ω

2. TEST TCM CONNECTOR: Disconnect the TCM connector and visually check the ground terminals on TCM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the TCM could be faulty. If so, make sure there were no DTC's before swapping the TCM with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping TCM.
4. RE-TEST THE ORIGINAL TCM: Install the original TCM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original TCM with a new one. If problem does not occur, this is intermittent problem (Refer to “Intermittent Problem Inspection Procedure” in Basic Inspection Procedure).

Replacement

1. Turn ignition switch OFF.
2. Disconnect the negative (-) battery cable.
3. Remove the junction box.
   (Refer to "Fuses And Relay (Relay Box)" in BE group.)
4. Disconnect the TCM connector (A).
5. Remove the TCM (B) after removing the mounting bolts (C-2ea).

TCM installation bolt/nut :
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

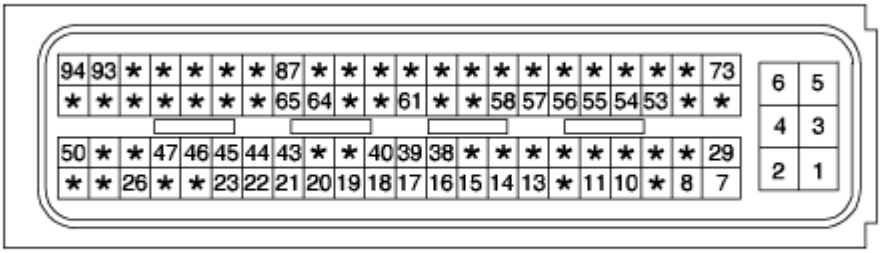


Installation

1. Installation is reverse of removal.

In the case of the vehicle equipped with immobilizer or button engine start system, perform "Key Teaching" procedure together (Refer to "Immobilizer" or "Button Engine Start System in BE group).

1. TCM Connector and Terminal Function



[E35A]

2. TCM Terminal Function

[E35A]

Terminal No.	Terms	Descriptions
1	Battery	Main power supply
2	Battery	Main power supply
3	ON/START	ON/START
4	GND-P	Ground
5	GND-P	Ground
6	GND-C	Ground
7	STARTER RELEY	Starter relay control
8	B3-ON/OFF SOL	LC/B(Low Coast Brake) Solenoid actuation output signal
10	STOP LAMP SW	Stop lamp switch
11	INH SW3-MON	Inhibiter switch-3 break monitoring input signal
13	INH SW1	Inhibiter switch-1 input signal
14	ATF1	Oil temperature sensor-1 (Oil pan)
15	ATF2	Oil temperature sensor-2 (Torque converter outlet)
16	Manual-up shift SW	Sport mode up shift switch input signal
17	Manual-down shift SW	Sport mode down shift switch input signal
18	PSC2	H□LR/C(High&Low Reverse Clutch) Oil pressure switch input signal
19	PSB2	Fr/B(Front Brake) Oil pressure switch input signal
20	K-LINE	K-Line Communication

21	INH SW-2	Inhibiter switch-2 input signal
22	INH SW-4	Inhibiter switch-4 input signal
23	INH SW-3	Inhibiter switch-3 input signal
28	SELECTED GEAR DISPLAY	Selected gear output
29	SOLENOID SUPPLY	Solenoid power supply
38	GND-A	Ground
39	GND-A1	Ground
40	GND-C	Ground
43	C1-SOL	I/C(Input Clutch) Solenoid actuation output signal
44	L/U-SOL	L/U(Lock UP) Solenoid actuation output signal
45	C2-SOL	H□LR/C(High&Low Reverse Clutch) Solenoid actuation output signal
46	B2-SOL	Fr/B(Front Brake) Solenoid actuation output signal
47	PL-SOL	PL(Line Pressure Control) Solenoid actuation output signal
50	C3-SOL	D/C(Direct Clutch) Solenoid actuation output signal
53	REV-LAMP RELAY	Back up lamp relay control
54	TURBIN 2	Turbine sensor-2 input signal (1,2,3,5th speed)
55	TURBIN1	Turbine sensor-1 input signal (4th speed)
56	VSP1	Vehicle speed sensor-1 (Output speed sonsor) input signal
57	SEL2	D/C(Direct Clutch) Oil pressure switch signal and System clock signal in Sub-ROM communication
58	SEL3	I/C(Input Clutch) Oil pressure switch signal and System clock signal in Sub-ROM communication
61	Manual Mode select SW	Sport mode select switch input signal
64	SEL1	LC/B(Low Coast Brake) Oil pressure switch signal and System clock signal in Sub-ROM communication
65	CAN-L	CAN Low
73	SOLENOID SUPPLY	Solenoid power supply
87	CAN-H	CAN High
88	R range LAMP	R range lamp output signal
89	N range LAMP	N range lamp output signal

91	D range LAMP	D range lamp output signal
92	P range LAMP	P range lamp output signal
93	VIGN-OUT	Control valve power supply
94	DATABIT 1	Control valve communication line

3. TCM Terminal Input/ Output Signal

[E35A]

Pin	Description	Condition	Input/output value	
			Type	Level
1	Battery power (B+)	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
2	Battery power (B+)	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
4	Ground (Power 1)	□	Ground	0V
5	Ground (Power 2)	□	Ground	0V
8	LowCoast Brake solenoid valve (ON/OFF) (LC/B SOL)	High	Output	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
13	Inhibitor switch signal "S1"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
14	Oil temperature sensor (-)	□	Ground	0V
15	Oil temperature sensor (+)	ON	Input	0V/3.3V
		OFF		
16	Sports mode up switch	Up ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
17	Sports mode down switch	Down ON	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
21	Inhibitor switch signal "S2"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
22	Inhibitor switch signal "S4"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V

23	Inhibitor switch signal "S3"	High	Input	0V/Battery voltage level
		Low		9V < Battery voltage level < 16V
29	Solenoid supply power 1	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
43	Input Clutch control solenoid valve	□	Output	0V/Battery voltage level
	(I/C SOL)			9V < Battery voltage level < 16V
44	Lock Up control solenoid valve	□	Output	0V/Battery voltage level
	(LU SOL)			9V < Battery voltage level < 16V
45	High&LowReverse clutch control solenoid valve	□	Output	0V/Battery voltage level
	(H&LR/C_VFS)			9V < Battery voltage level < 16V
46	Front Rear brake control solenoid valve	□	Output	0V/Battery voltage level
	(FR/B SOL)			9V < Battery voltage level < 16V
47	Pressure Line control solenoid valve	□	Output	0V/Battery voltage level
	(PL SOL)			9V < Battery voltage level < 16V
50	Direct Clutch control solenoid valve	□	Output	0V/Battery voltage level
	(D/C SOL)			9V < Battery voltage level < 16V
61	Sports mode select switch	Sport mode	Input	0V/Battery voltage level
		Other		9V < Battery voltage level < 16V
73	Solenoid supply power 2	ON	Power	0V/Battery voltage level
		OFF		9V < Battery voltage level < 16V
93	Vspeed sensor signal	High	Input	0.7V/1.4V
		Low		

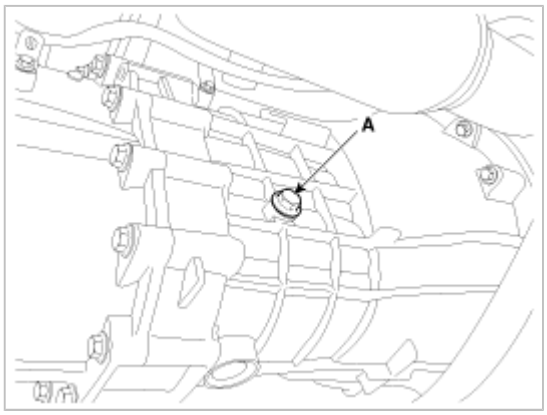
Service Adjustment Procedure

Transaxle Gear Oil Level

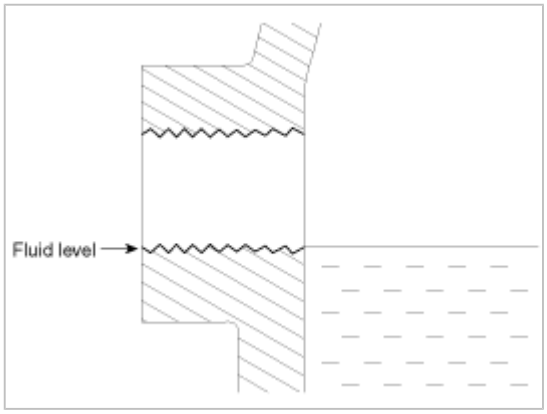
Inspection

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 (A).



2. Check level with finger.
   Oil level must be up to fill the hole, add oil until it runs over.

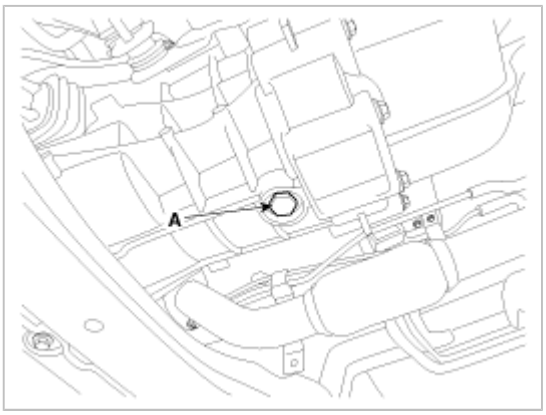


3. Install filler plug.

Tightening torque :
60~80Nm (6.0~8.0kgf.m, 43.4~57.9lb-ft)

Replacement

1. With the vehicle parked on a level surface, remove the drain plug.
2. Drain the transaxle oil after loosening the drain plug (A).



3. Install the drain plug with new washer.

Tightening torque :
60~80Nm (6.0~8.0kgf.m, 43.4~57.9lb-ft)

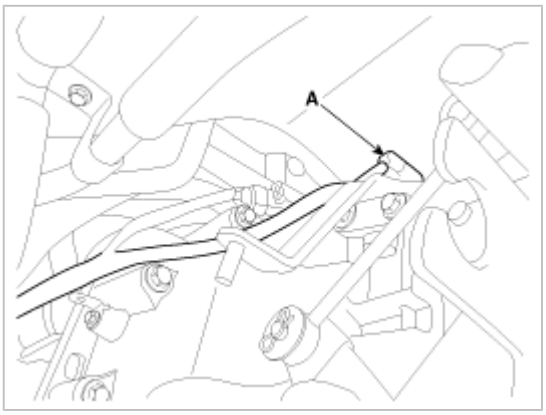
4. Add new oil through the fille plug hole and, fill it just below the plug opening.

Standard oil SAE 75W/85, API GL-4
Oil capacity: 3.2 L(3.381US qt, 2.815Imp qt)

Backup Lamp Switch

Inspection

1. Disconnect the backup lamp switch (A).

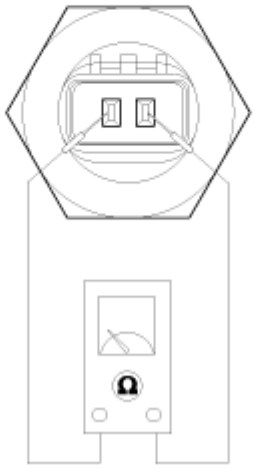


2. Check the continuity between no. 1 and 2 terminals of backup lamp switch.
When the shift lever is in reverse, there should be contunuity.

Backup lamp switch :
30~35Nm (3.0~3.5kgf.m, 21.7~25.3lb-ft)

Condition	1	2
Reverse Range	●	●
Other Range		

*The back up Lamp "ON" shall keep over 0.5mm(0.02in) From ON-OFF poinrt.



3. If necessary, repair or replace the backup lamp switch.

Specifications

Transaxle type		M6VR2
Engine type		Diesel 2.5
Gear ratio	1st	4.489
	2nd	2.337
	3rd	1.350
	4th	1.000
	5th	0.784
	6th	0.679
	Reverse	4.253
Final gear ratio		3.692

Tightening Torques

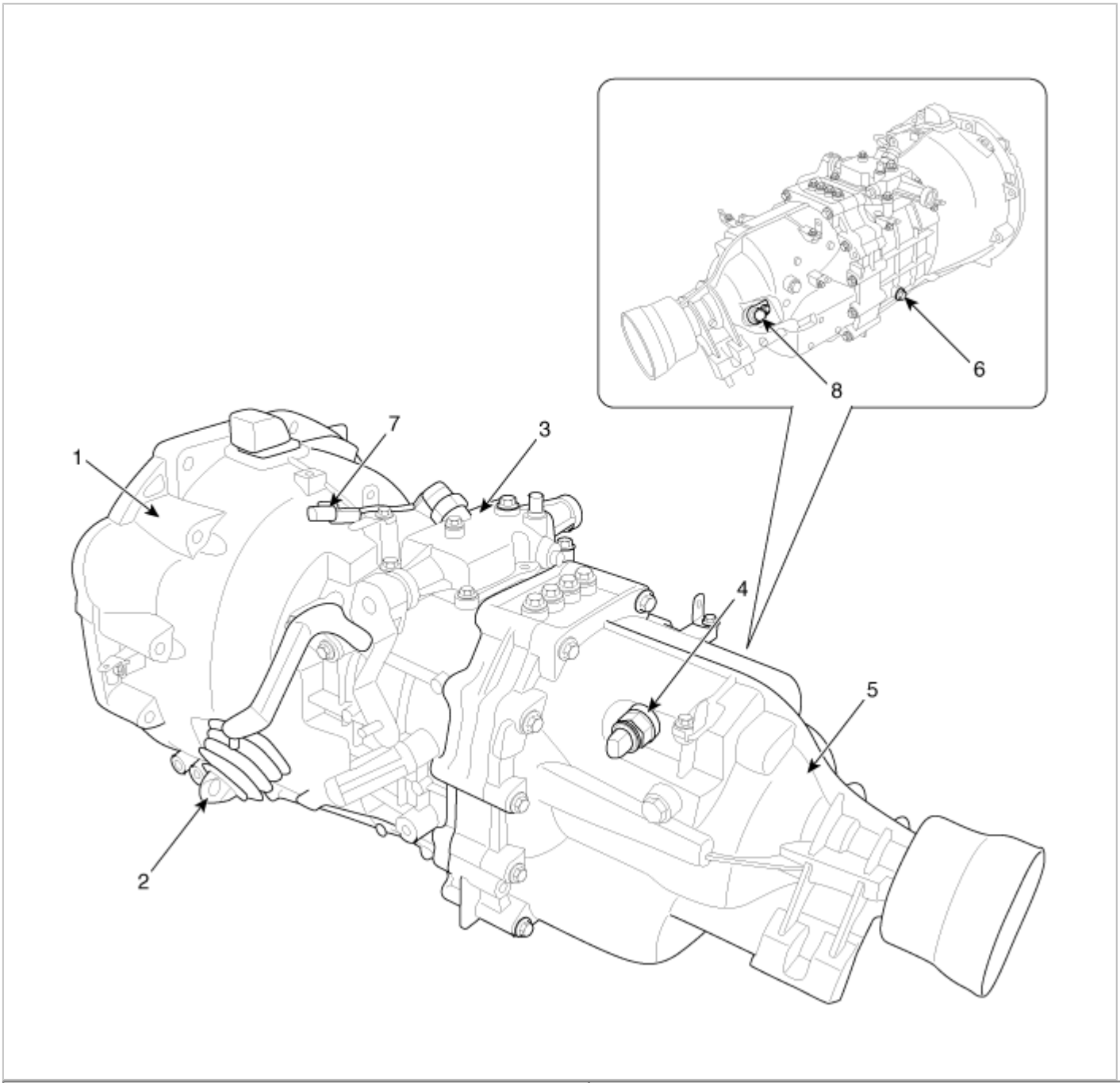
Items	N.m	kgf.m	lb-ft
Vehicle speed sensor	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Oil drain plug	58.9 ~ 78.5	6.0 ~ 8.0	43.4 ~ 57.8
Rear steel bends	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Propeller shaft	58.9 ~ 68.7	6.0 ~ 7.0	43.4 ~ 50.6
Cross member	137.3 ~ 166.8	14.0 ~ 17.0	101.3 ~ 123
Starter motor mounting bolt	49.1 ~ 63.8	5.0 ~ 6.5	36.2 ~ 47
Shift lever assembly mounting bolt	8.8 ~ 13.7	0.9 ~ 1.4	6.5 ~ 10.1
Oil filler plug	58.9 ~ 63.8	6.0 ~ 6.5	43.4 ~ 47
Oil drain plug	58.9 ~ 63.8	6.0 ~ 6.5	43.4 ~ 47
Transmission upper mounting bolt (TM=>ENG)	42.2 ~ 54.0	4.3 ~ 5.5	31.1 ~ 39.8
Transmission lower mounting bolt (ENG=>TM)	42.2 ~ 54.0	4.3 ~ 5.5	31.1 ~ 39.8

Lubricants

Items	Recommnend lubricant	Quantity
Transaxle gear oil	SAE 75W/85 API GL-4 TGO-7(MS517-14)	2.2L (0.58 U.S.gal., 2.32 U.S. qt., 1.93 Imp qt.)

Surface of release fork and bearing	Grease (CASMOLY L9508)	As requried

Components



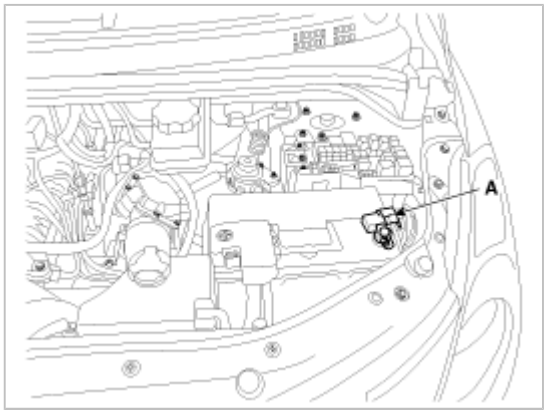
1. Transmission case assembly	5. Extension housing assembly
2. Release fork	6. Oil filler plug
3. Control housing assembly	7. Back up lamp switch
4. Neutral Switch	8. Vehicle speed sensor

Removal

- Use fender covers to avoid damaging painted surfaces.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

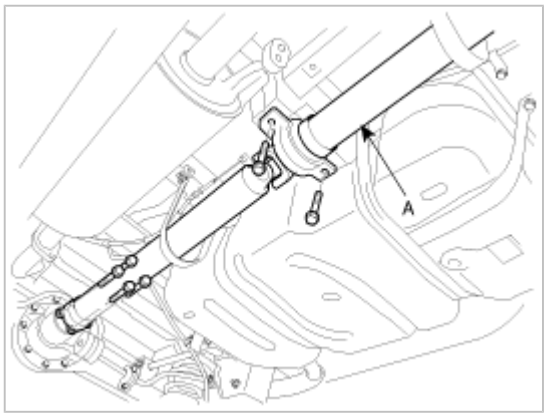
- Mark all wiring and hoses to avoid misconnection.

1. Remove the battery (-) terminal (A).

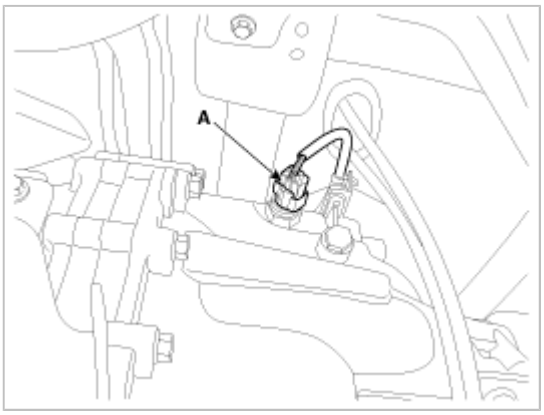


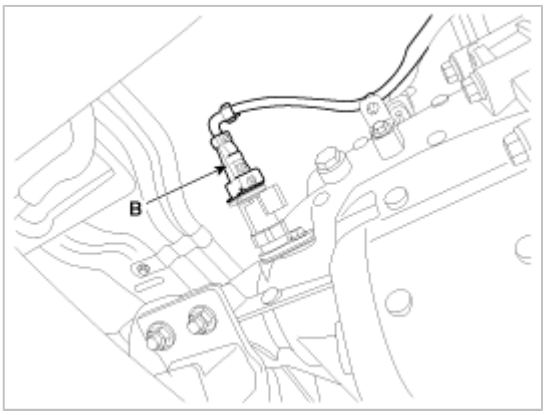
2. Remove the propeller shaft (A).

Tightening torque :
[Propeller shaft]
58.9 ~ 68.7 N.m (6.0 ~ 7.0 kgf.m, 43.4 ~ 50.6 lb-ft)
[Rear steel bends]
39.2 ~ 49.1 N.m (4.0 ~ 5.0 kgf.m, 28.9 ~ 36.2 lb-ft)

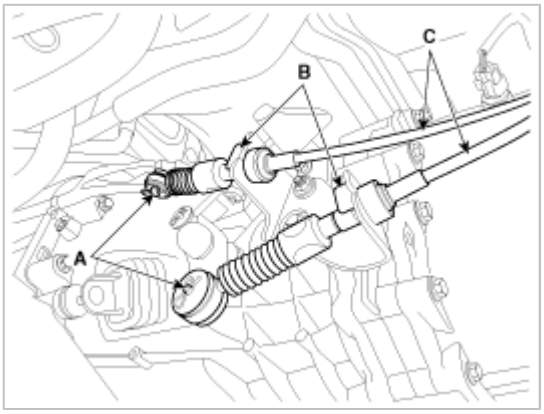


3. Disconnect the neutral switch connector (A) and the vehicle speed sensor connector (B).

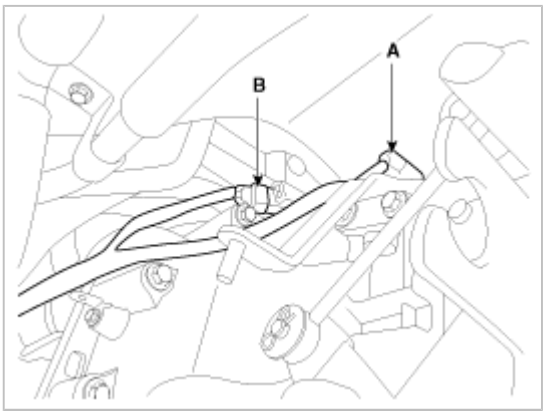




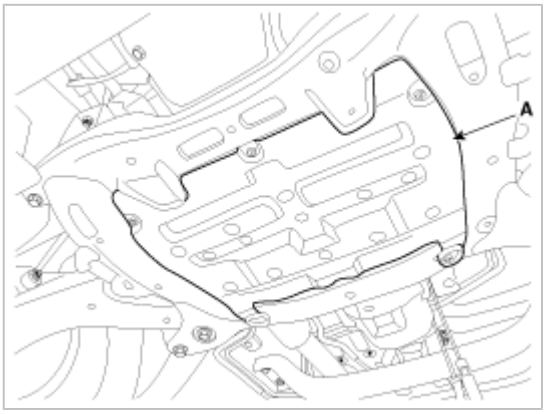
4. Remove the control cable assembly (C) after removing pins (A) and clips (B).



5. Disconnect the back lamp switch connector (A), and the CKP sensor connector (B).

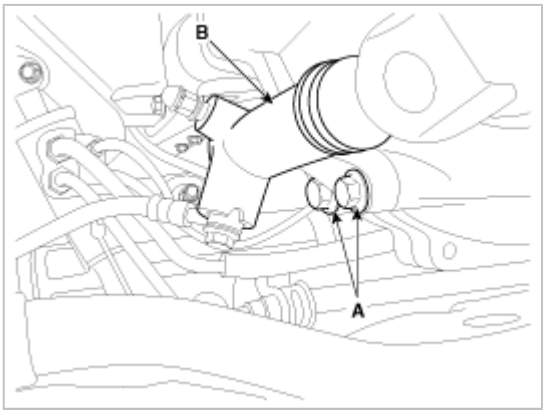


6. Remove the under cover (A).



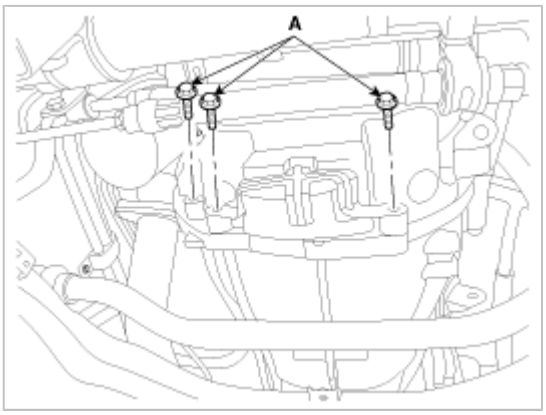
7. Remove the clutch release cylinder assembly (B) after removing the bolts (A-2ea).

Tightening torque :
31.4 ~ 41.2 N.m (3.2 ~ 4.2 kgf.m, 23.1 ~ 30.4 lb-ft)



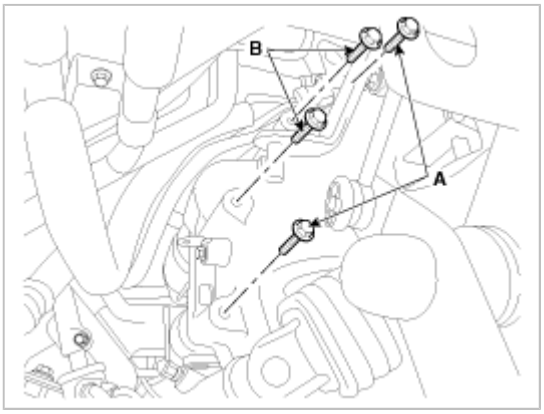
8. Remove the transmission lower mounting bolt (A-3ea).

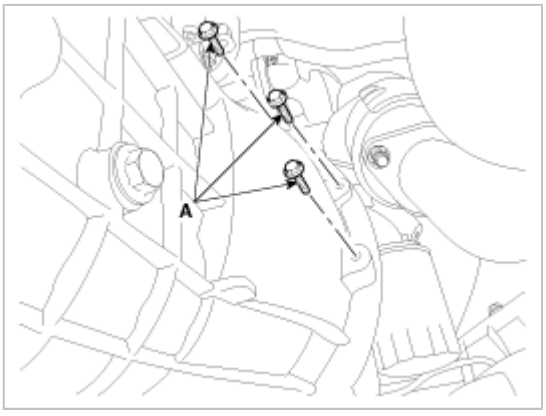
Tightening torque :
42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)



9. Remove the transmission upper mounting bolt (A-5ea) and the starter motor mounting bolt (B-2ea).

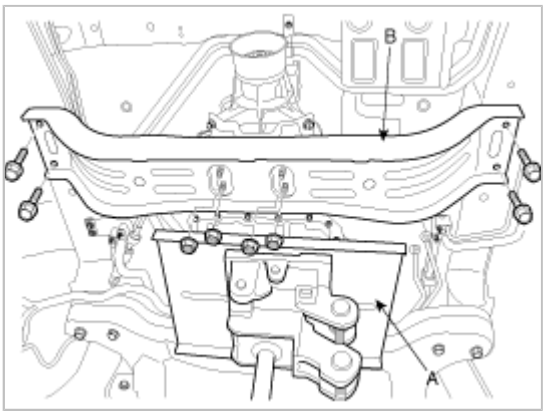
Tightening torque :
(A) 42.2 ~ 54.0 N.m (4.3 ~ 5.5 kgf.m, 31.1 ~ 39.8 lb-ft)
(B) 49.1 ~ 63.8 N.m (5.0 ~ 6.5 kgf.m, 36.2 ~ 47 lb-ft)





10. Remove the cross member (B) the transmission with a jack (A).

Tightening torque :
137.3 ~ 166.8 N.m (14.0 ~ 17.0 kgf.m, 101.3~123 lb-ft)



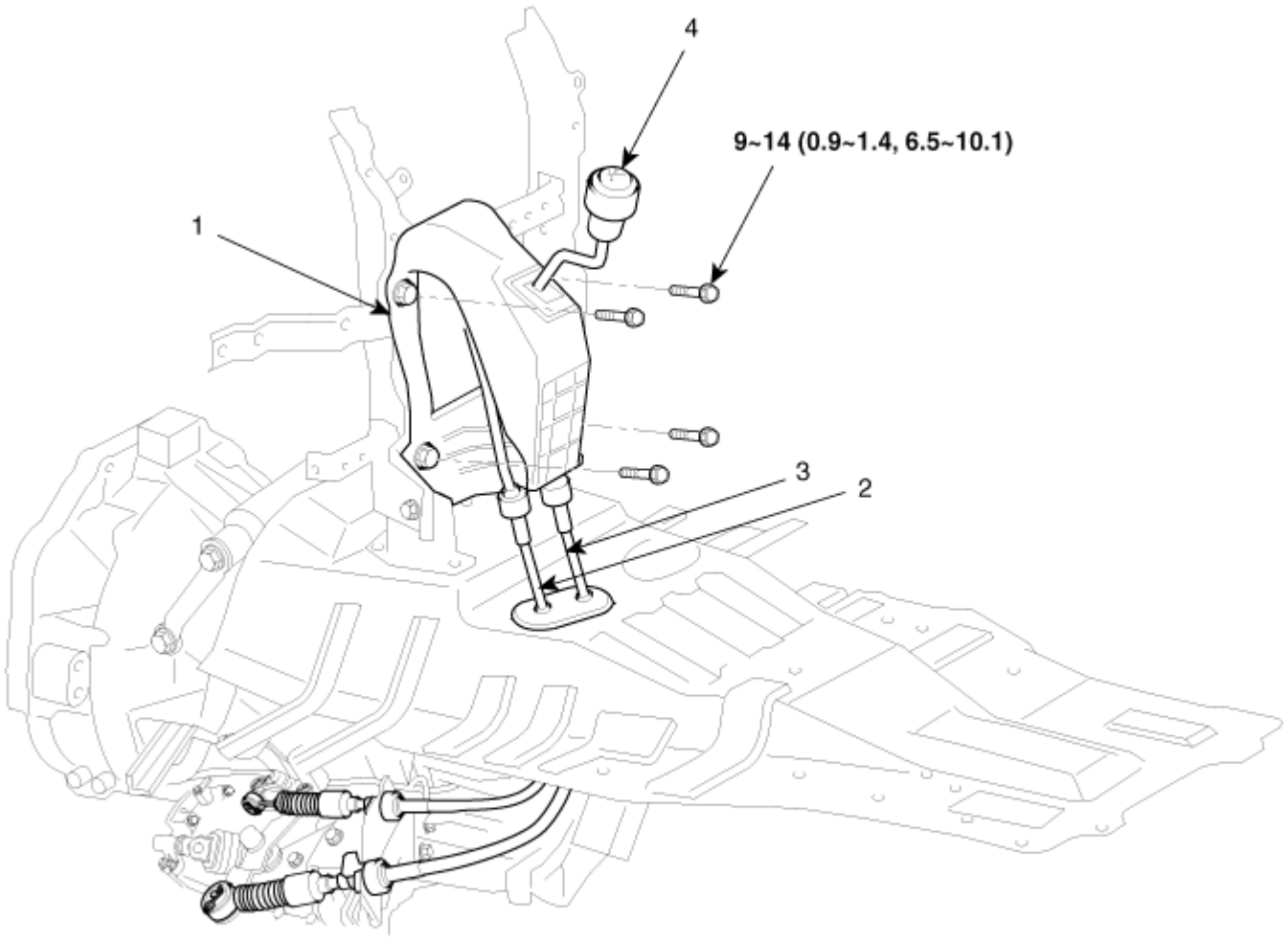
11. Lowering the jack slowly, remove the transaxle.

Installation

1. Installation is the reverse of removal.

- Adding Manual transaxle fluid.
  (Refer to "Manual transaxle system" in this group.)

Components

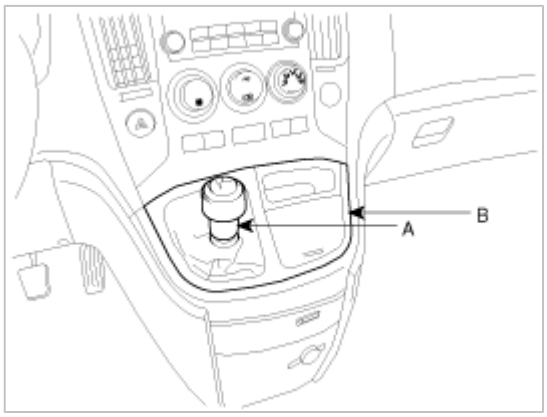


Torque : Nm (kgf.m, lb-ft)

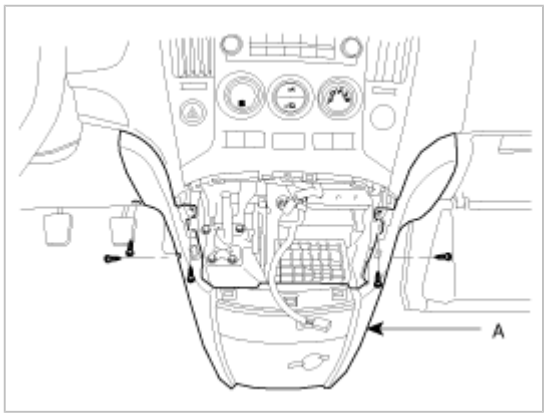
1. Shift lever assembly	3. Select cable assembly
2. Shift cable assembly	4. Shift lever knob

Removal

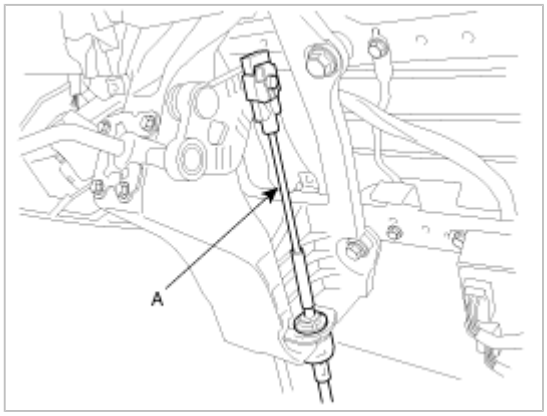
1. Remove the shift lever knob (A) by rotating counterclockwise and remove the front console under cover (B).



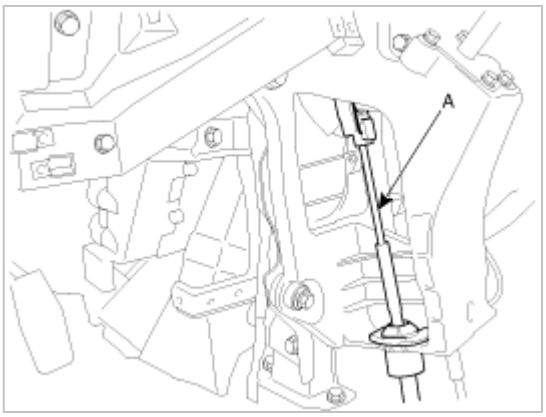
2. Remove the front console (A).



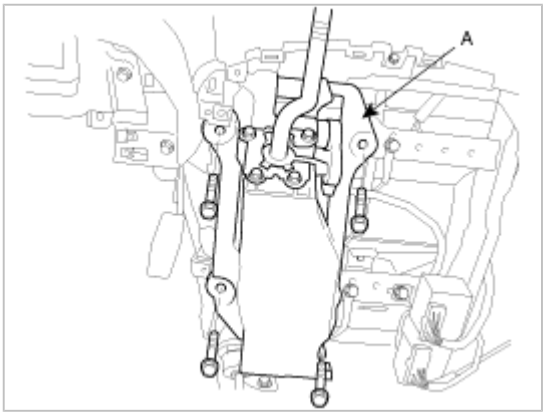
3. Remove the select cable (A).



4. Remove the shift cable (A).



5. Remove the shift lever assembly (A).



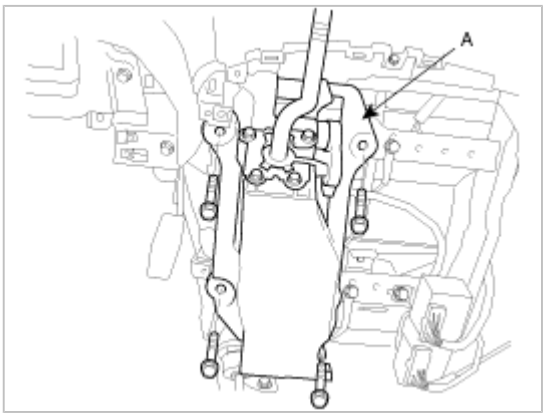
Inspection

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 boots for damage.
4. Check the boots for wear, abrasion, sticking, restricted movement or damage.
5. Check for the weak or damaged spring.

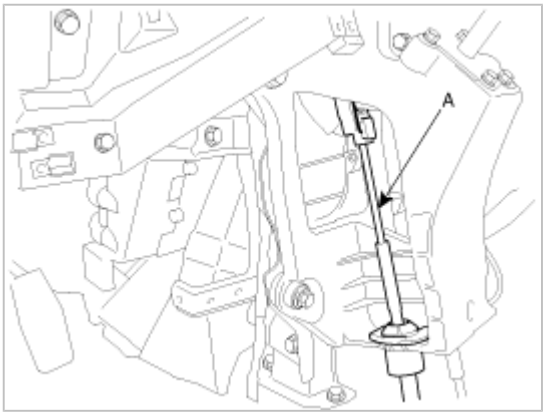
Installation

1. Install the shift lever assembly (A).

Tightening torque :
9~14Nm (0.9~1.4kgf.m, 6.5~10.1lb-ft)

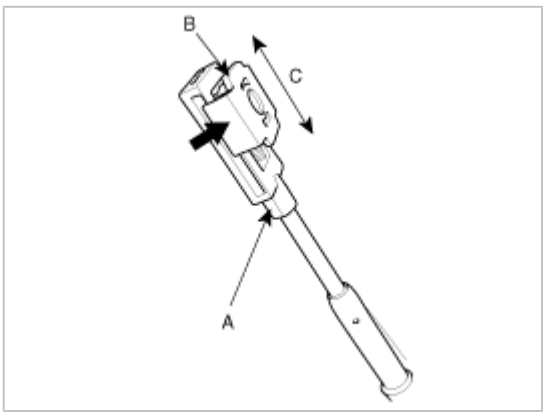


2. Install the shift cable (A).

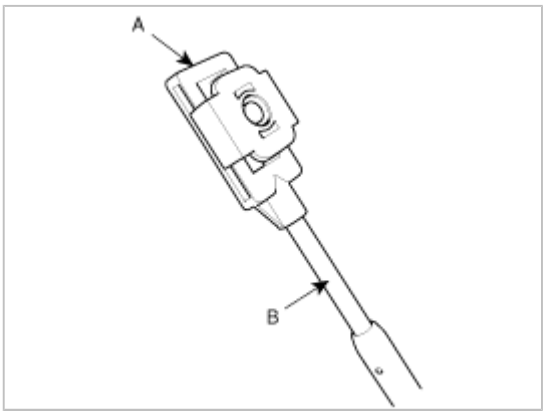


3. Move the slide clip (B) of guide member (A) in the direction as shown in the illustration.

Adjust the slide clip fit into the select lever moving the slide clip in the direction (C).

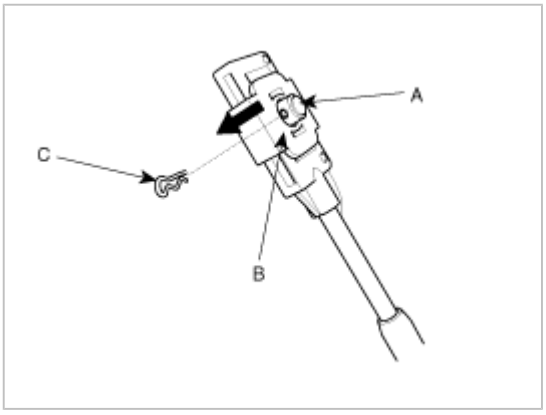


4. Install the guide member (A) of the select cable (B).

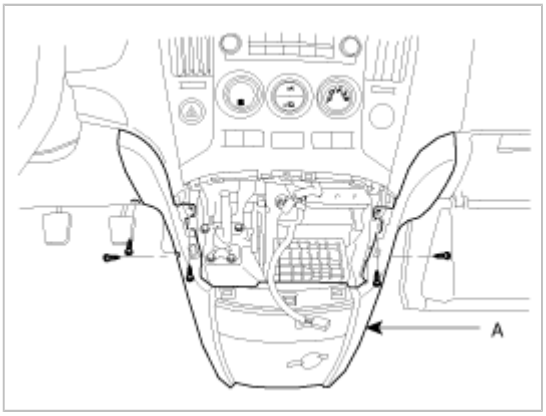


5. Adjust the slide clip (B) to fit it into the select lever pin (A) and install the snap pin (C).

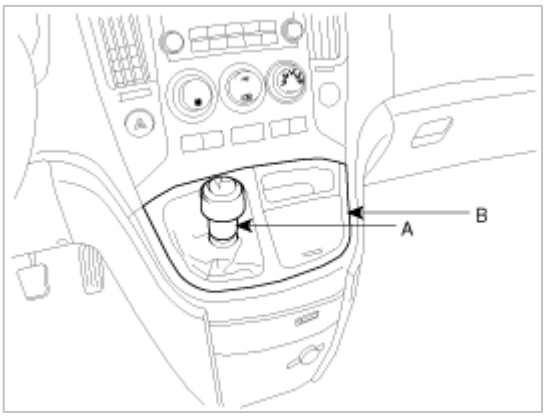
Insert the slide clip in the direction as shown in the illustration.



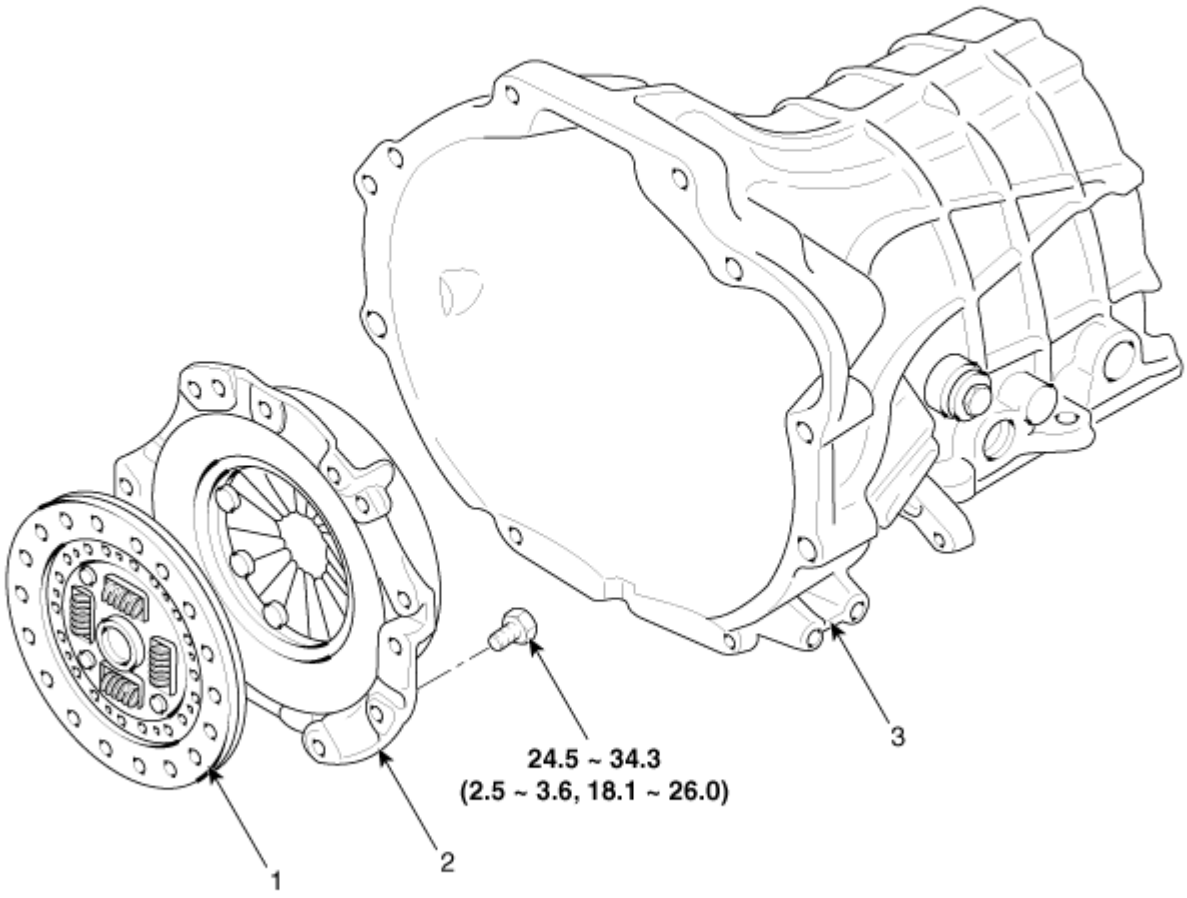
6. Install the front console (A).



7. Install the shift lever knob (A) by rotating to right and remove the front console under cover (B).


B
A

Components

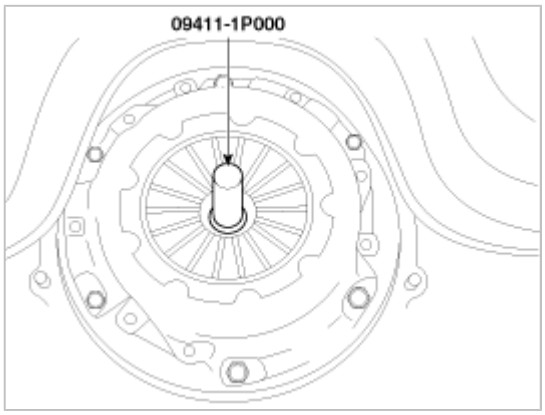


Torque : N.m (kgf.m, lb-ft)

1. Clutch disc 2. Clutch disc cover	3. Transmission

Removal

1. Remove the transmission assembly.
   (Refer to Manual transmission removal in MT group)
2. Insert the special tool (09411-1P000) in the clutch disc to prevent the disc from shifting.



3. Loosen the bolts(6ea) which attach the clutch cover to the flywheel in a star pattern.
   Loosen the bolts in succession, one or two turns at atime, to avoid bending the cover.

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

Inspection

Clutch Disc Cover Assembly

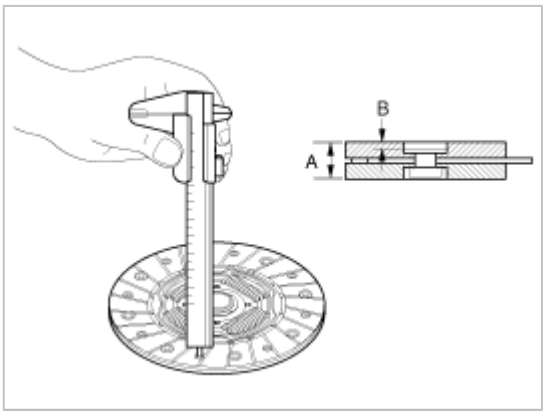
1. Check the diaphragm spring end for wear and uneven height.
2. Check the pressure plate surface for wear, cracks and color change.
3. Check the rivets for looseness and replace the clutch cover assembly if necessary.

Clutch Disc

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

Standard value

Clutch disc thickness (A) [when free] :
8.4 ± 0.3mm [0.33 ±0.012in]
Limit :
Clutch disc rivet depth (B) : 0.3mm [0.0118 in.]



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

Clutch Release Bearing

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

Standard grease : CASMOLY L9508

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

Clutch Release Fork

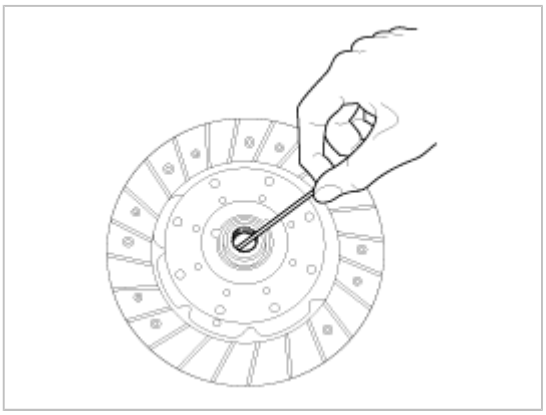
If there is abnormal wear at the point of contact with the bearing, replace the release fork assembly.

Installation

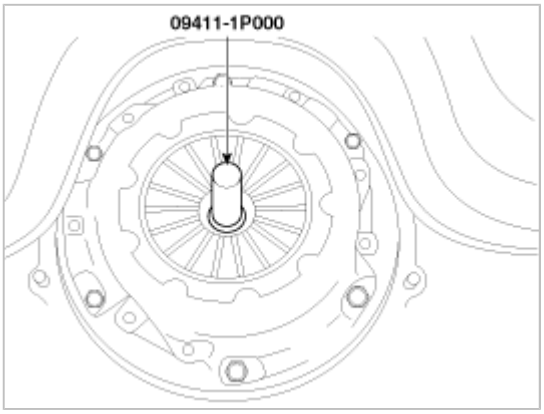
1. Apply multipurpose grease to the spline of the disc.

   Grease : CASMOLY L 9508

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

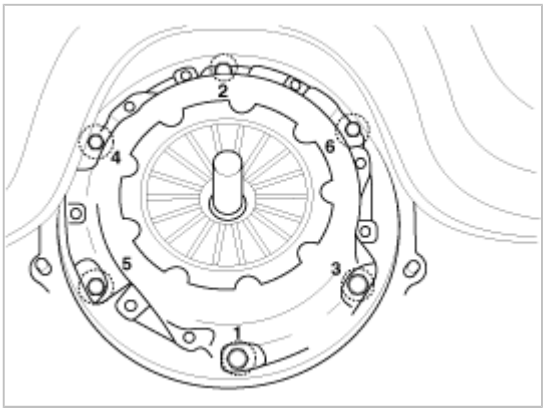


2. Install the clutch disc assembly to the flywheel usingthe special tool (09411-1P000).



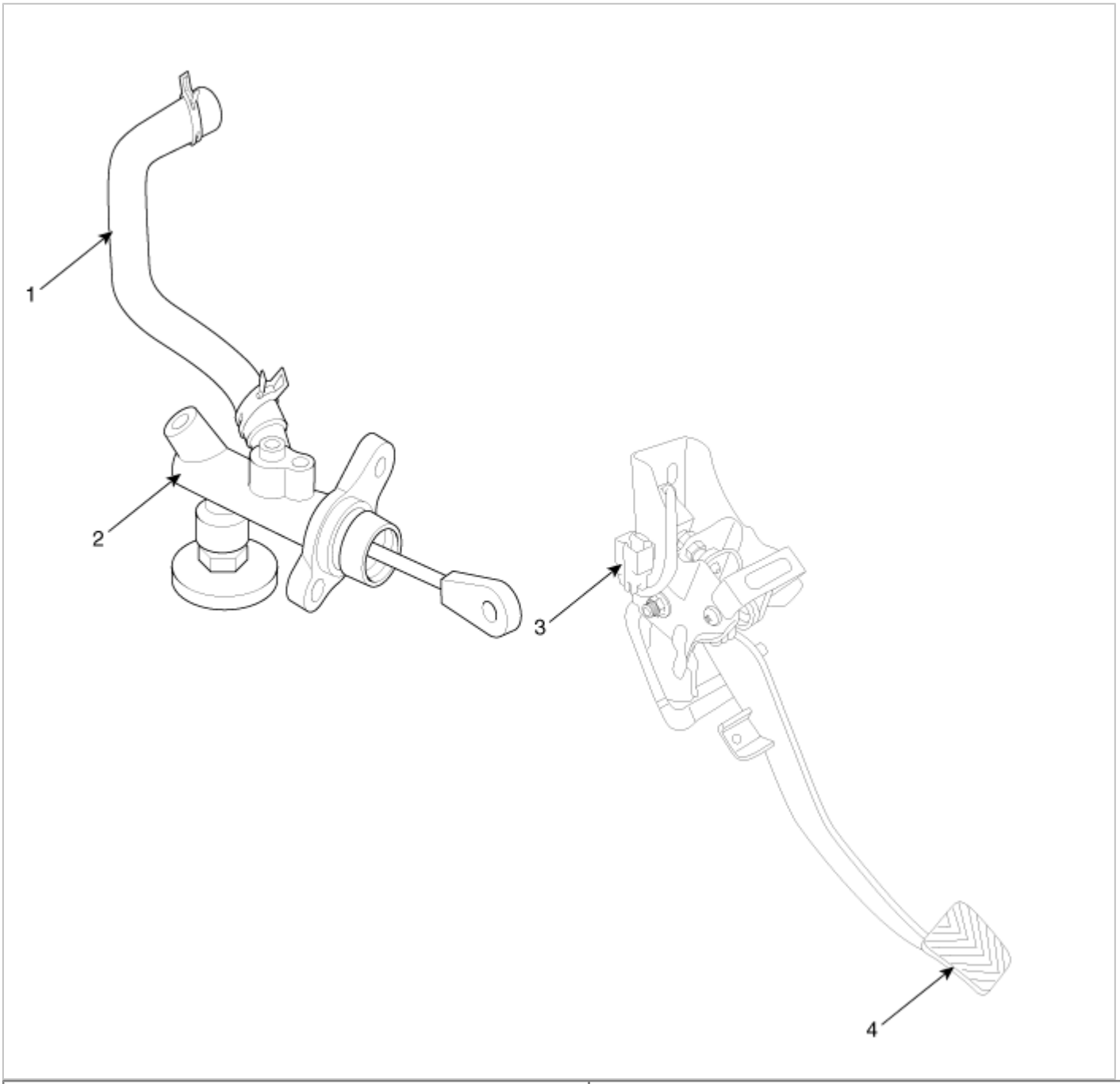
3. Install the clutch cover assembly to the flywheel and temporarily tighten the bolts one or two steps at a time in a star pattern.

Tightening torque :
24.5 ~ 35.3 N.m (2.5 ~ 3.6 kgf.m, 18.1 ~ 26.0 lb-ft)



4. Remove the clutch disc guide (09411-1P000).
5. Install the transmission assembly to the engine.
   (Refer to Manual transmission installation in MT group)

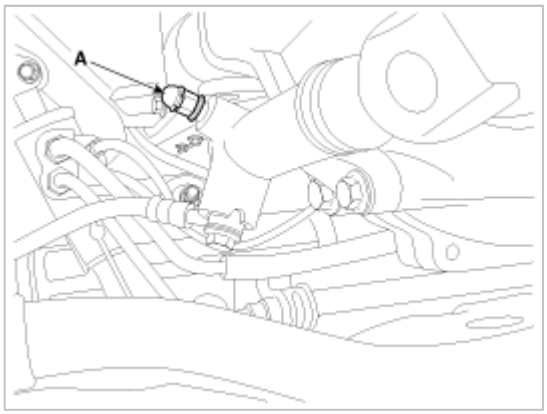
Components



1. Reservoir hose 2. Master cylinder	3. Ignition lock switch 4. Pedal pad

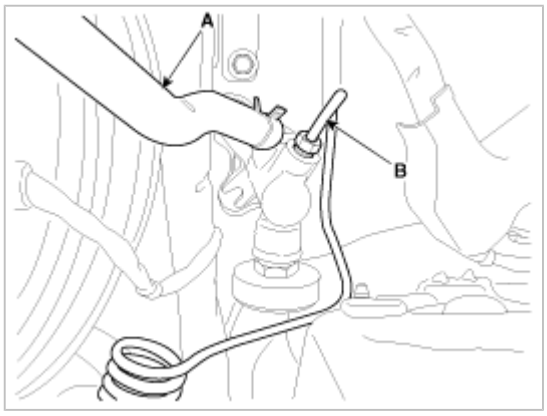
Removal

1. Drain the brake fluid through the bleeding plug (A).

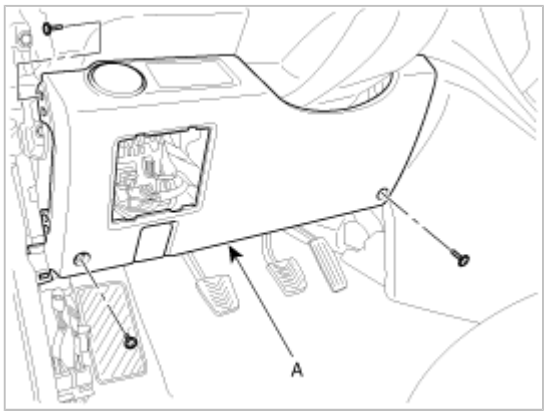


2. Disconnect the clutch tube (B) and reservoir hose (A) from the clutch master cylinder.

Tightening torque :
14.7 ~ 19.6 N.m (1.5 ~ 2.0 kgf.m, 10.8 ~ 14.5 lb-ft)



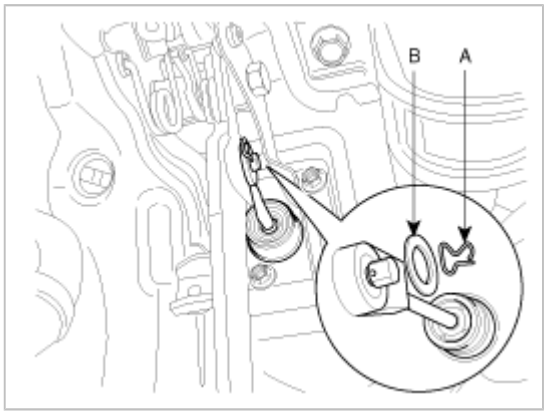
3. Remove the lower cover (A).
(Refer to "Interior(Crash Pad)" in BD group.)



4. Disconnect the push rod from the master cylinder by removing the snap pin (A) and washer (B).

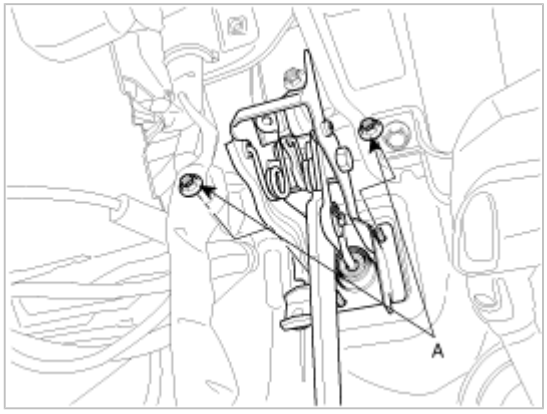
Apply the specified grease to the snap pin (A) and washer (B).

Wheel bearing grease : SAE J310, NLGI No.2



5. Remove the clutch pedal mounting nuts (A-2ea).

Tightening torque :
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



6. Remove the master cylinder.

Inspection

1. Check the inside of the cylinder body for rust, pitting or scoring.
2. Check the piston cup for wear or distortion.
3. Check the piston for rust, pitting or scoring.
4. Check to make sure the clutch line tube is not clogged or restricted in any way.
5. Measure the master cylinder inside diameter and the piston outside diameter with a cylinder gaugemicrometer.

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

perpendicular direction.

6. If the master cylinder-to-piston clearance exceeds the limit, replace the master cylinder and/or piston assembly.

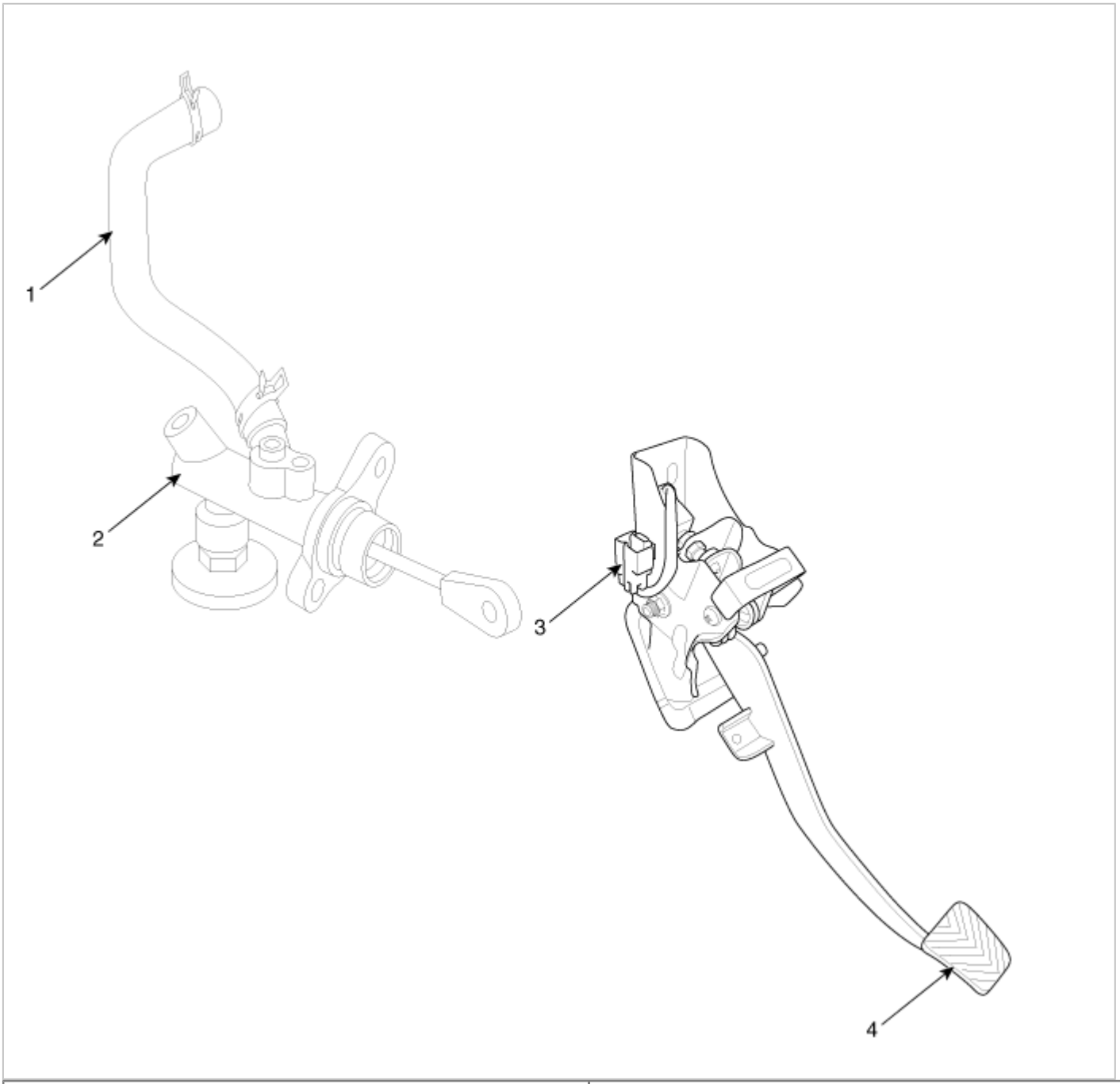
Limit : 0.15 mm (0.0059 in.)

Installation

1. Installation is the reverse of removal.

- Perform bleeding air procedure in clutch release cylinder after pouring the brake fluid. (Refer to "Clutch release cylinder" in CH group.)

Components



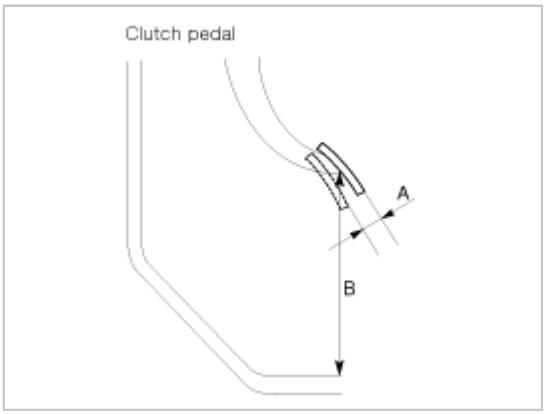
1. Reservoir hose 2. Master cylinder	3. Ignition lock switch 4. Pedal pad

Inspection

Clutch Pedal Assembly

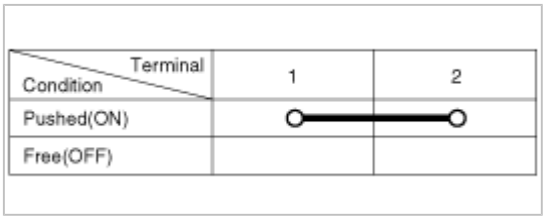
1. Check the pedal shaft and bushing for wear.
2. Check the clutch pedal for bending or torsion.
3. Check the return spring for damage or deterioration.
4. Check the pedal pad for damage or wear.
5. Adjust the clutch pedal within the standard value, thensecure by tightening the lock nut.

Standard value :
Free play (A)
6 ~ 13mm (0.2362 ~ 0.5118 in.)
Height (B)
150.7mm (5.933 in)

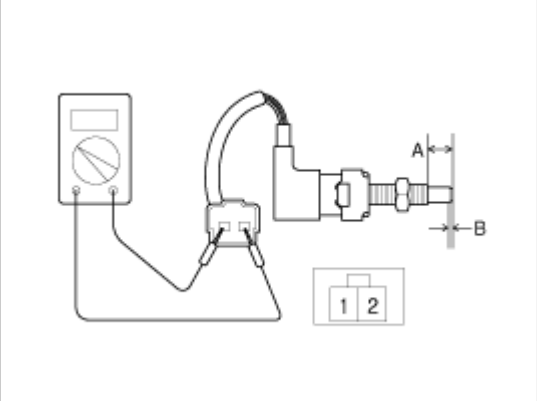


Ignition Lock Switch Inspection

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

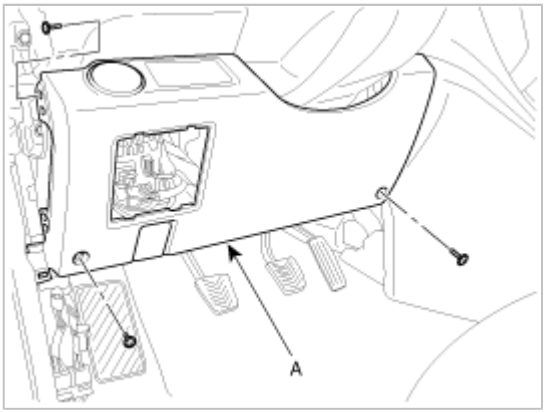


Standard value
Full stroke (A) : 12.0 ± 0.3mm (0.472 ± 0.012 in.)
ON-OFF point (B) : 2.0 ± 0.3mm (0.078 ± 0.012 in)



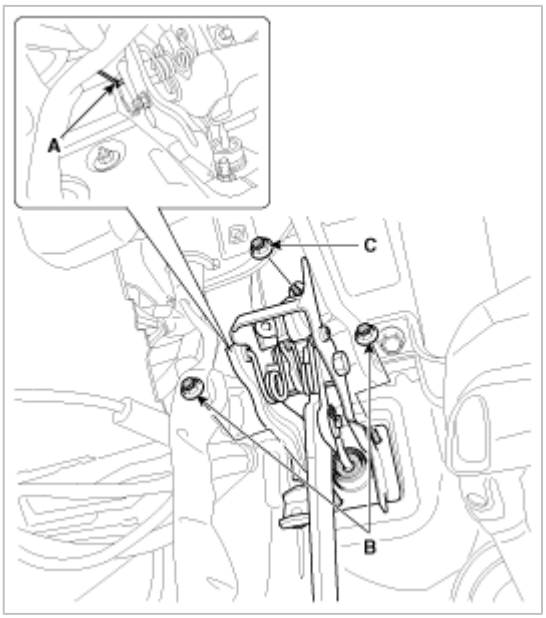
Removal

1. Remove the lower cover (A).
   (Refer to "Interior(Crash Pad)" in BD group.)



2. Remove the Ignition lock switch connector (A).
3. Remove the clutch pedal mounting nuts (B-2ea) andthe bracket mounting nut (C).

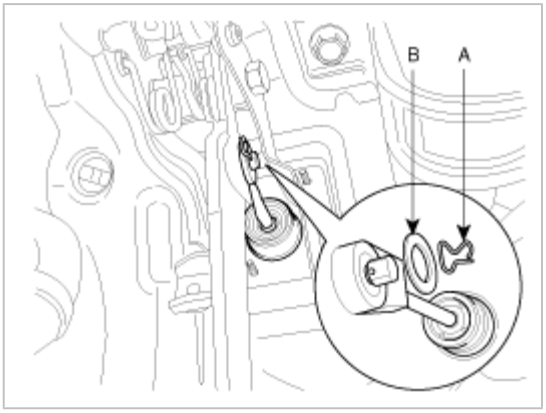
Tightening torque :
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)



4. Disconnect the push rod from the master cylinder byremoving the snap pin (A) and washer (B).

Apply the specified grease to the snap pin (A) and washer (B).

Wheel bearing grease : SAE J310, NLGI No.2



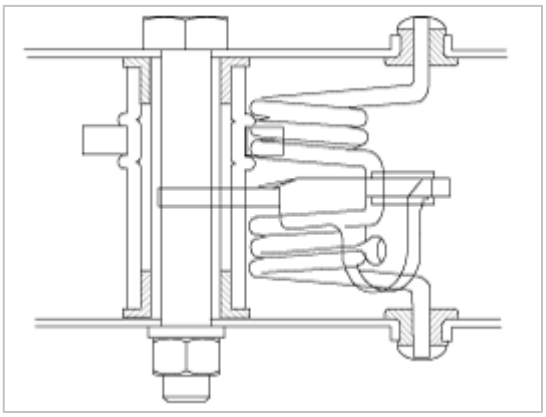
5. Remove the clutch pedal assembly.

Installation

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

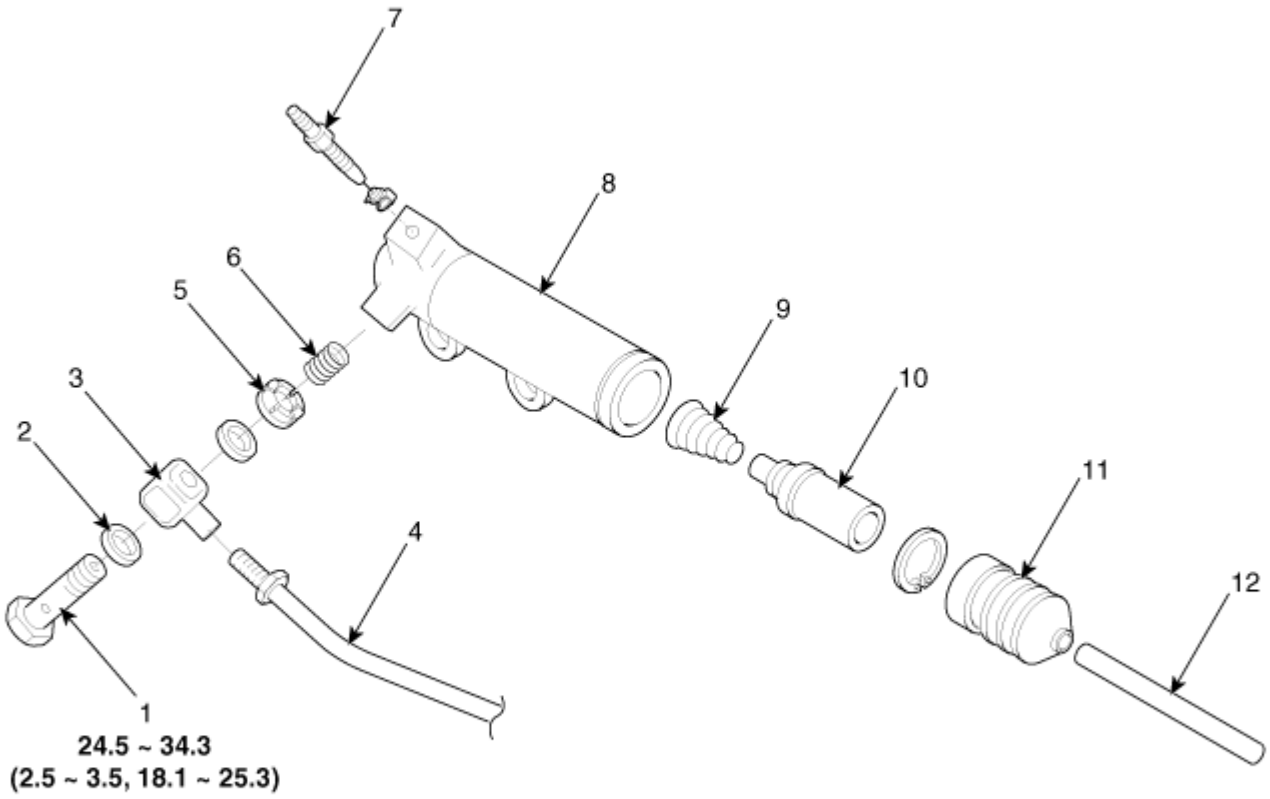
- Apply the specified grease to the clutch pedal andbushings.

Chassis grease : SAE J310a, NLGI No.1



2. Installation is the reverse of removal.

Components



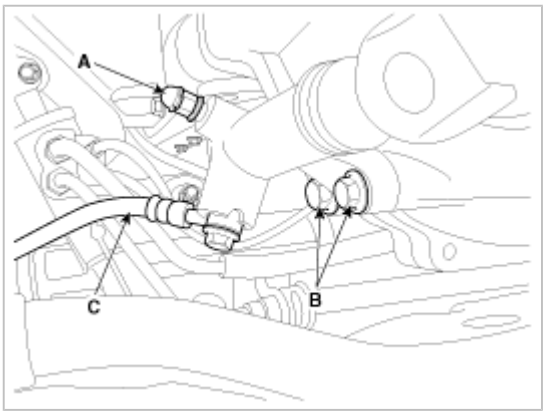
Torque : N.m (kgf.m, lb-ft)

1. Union bolt	7. Bleeder screw
2. Gasket	8. Release cylinder
3. Tube joint	9. Return spring
4. Clutch tube	10. Piston
5. Valve plate	11. Boot
6. Valve spring	12. Push rod

Removal

1. Drain the brake fluid through the bleed plug (A).
2. Remove the clutch release cylinder assembly after removing thd tube (C) and botls (B-2ea).

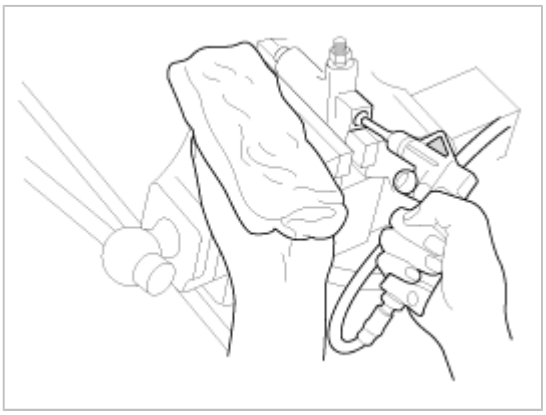
Tightening torque :
31.4 ~ 41.2 N.m (3.2 ~ 4.2 kgf.m, 23.1 ~ 30.4 lb-ft)



Disassembly

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.

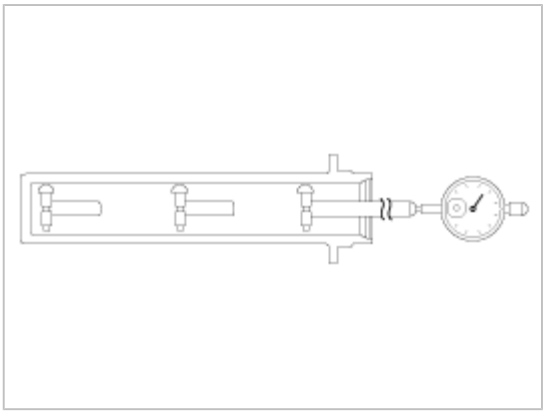
- Use rags to prevent the piston from popping out and causing injury.
- Apply compressed air slowly. Keep the fluid from splashing in your eyes or on your skin.



Inspection

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

Limit clearance to piston : 0.25mm (0.0098in)



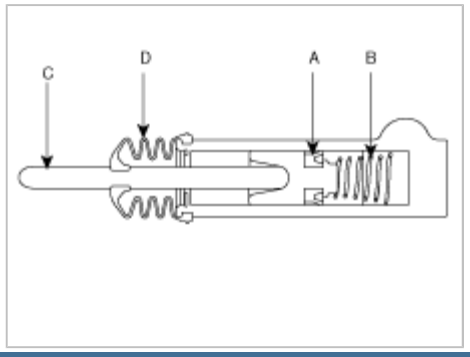
3. Check the clutch release cylinder for fluid leakage.
4. Check the clutch release cylinder boots for damage.

Reassembly

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

Specified fluid : Brake fluid DOT 3 or DOT 4

2. Install the valve plate (A), spring (B), push rod (C) and boot (D).

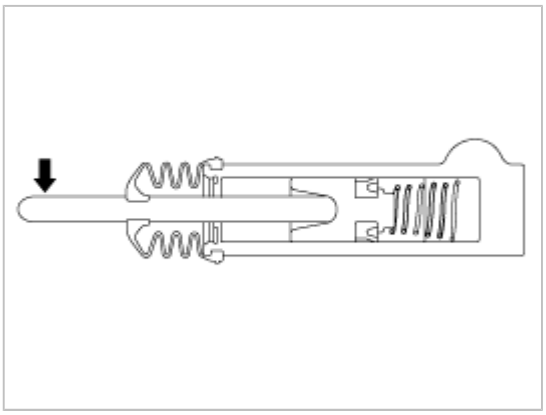


Installation

1. Coat the clutch clevis push rod specified grease.

Coat the clutch clevis push rod specified grease.

Specified grease : CASMOLY L9508

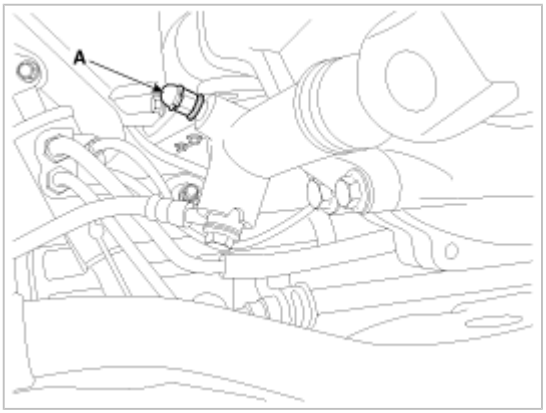


Bleeding

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

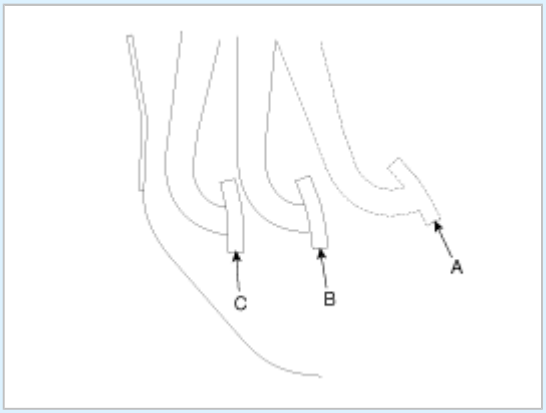
- Use the specified fluid. Avoid mixing different brands of fluid.
- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid.
- Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.
  Specified fluid: SAE J1703 (DOT 3 or DOT 4)

1. Make sure the brake fluid in the reservoir is at the MAX (upper) level line.
2. Loosen the bleeder screw (A) at the clutch release cylinder.



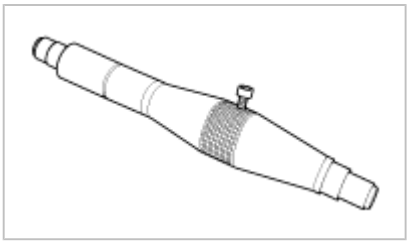
3. Depress the clutch pedal slowly until all air is expelled.
4. Hold the clutch pedal down until the bleeder is retightened.
5. Refill the clutch master cylinder with the specified fluid.

The rapidly-repeated operation of the clutch pedalin B-C range may disrupt the release cylinder' sposition. During the bleeding operation, press theclutch pedal to the floor after it returns to the "A" point.



6. Refill the master cylinder reservoir to MAX (upper) level line.

Special Service Tools

Tool (Number and name)	Illustration	Use
09411-1P000 Clutch disc guide		Installation of the clutch disc.

Specifications

Item		Specification
Engine type		Diesel 2.5
transmission type		M6VR2
Clutch operation method		Hydraulic type
Clutch disc	Type	Single dry with diaphragm
	Facing diameter (outside x inside)mm (in)	258 ± 1 × 160 +1.5/-1.0 (10.1575±0.0394×6.2992 +0.05991/-0.0394)
Clutch cover assembly Type		Diaphragm spring strap
Clutch release cylinder * I.D. mm (in)		20.64 mm(0.8126)
Clutch master cylinder * I.D. mm (in)		15.87 mm(0.6248)

* I.D: Inside diameter

Service Standard

Item	Standard value
Clutch pedal height [Without carpet]	150.7 mm(5.9331 in.)
Clutch pedal free play	6 ~ 13 mm(0.2362~0.5118 in.)
Clutch disc thickness[When free]	8.4 ± 0.3(0.3307 in.±0.0118 in.)
Clutch pedal stroke	160 mm(6.2992 in.)
Clutch disc rivet sink	0.3 mm(0.0118 in.)
Diaphragm spring end height difference	0.5 mm(0.0197 in.)
Clutch master cylinder clearance to piston	0.15 mm(0.0059 in.)

Tightening Torques

Item	N.m	kgf.m	lb-ft
Clutch pedal assembly	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Clutch release cylinder mounting bolt	31.4 ~ 41.2	3.2 ~ 4.2	23.1 ~ 30.4
Clutch master cylinder clutch tube	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Clutch release cylinder union bolt	24.5 ~ 34.3	2.5 ~ 3.5	18.1 ~ 25.3
Clutch release cylinder air bleeder screw	11.8 ~ 19.6	1.2 ~ 2.0	8.7 ~ 14.5

Clutch disc cover assembly	24.5 ~ 34.3	2.5 ~ 3.6	18.1 ~ 26.0

Lubricants

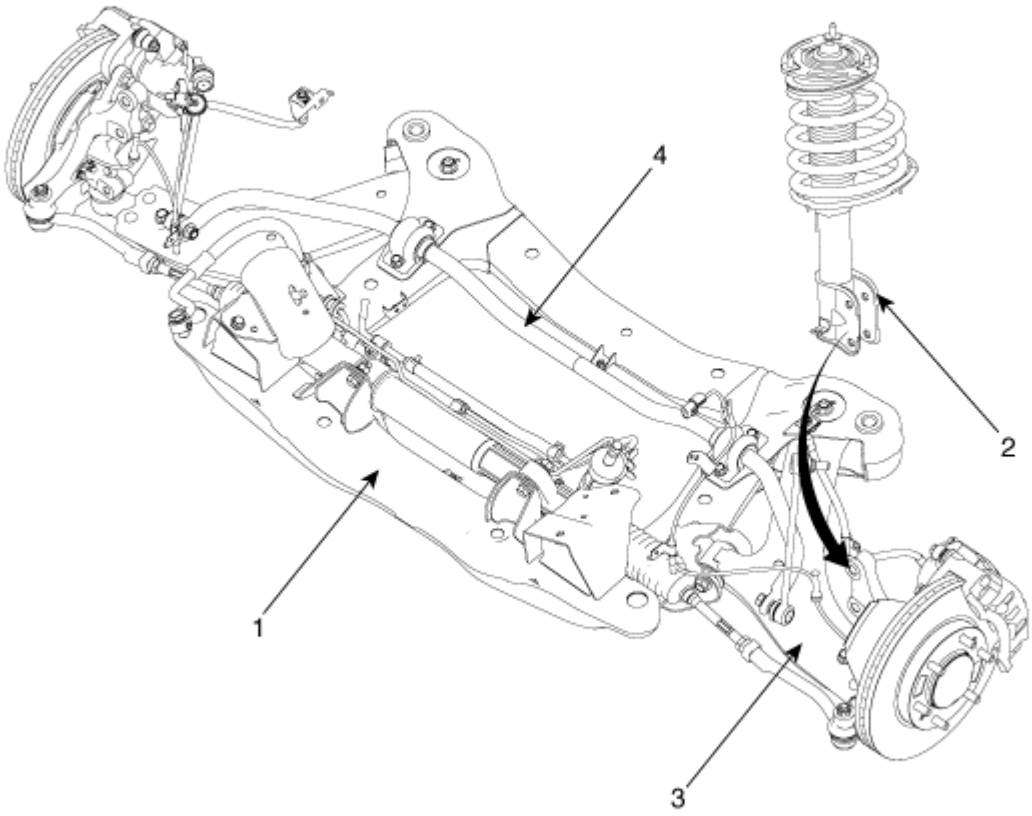
Items	Specified lubricants	Quantity
Contact surface of release bearing and fulcrum of clutch release fork	CASMOLY L9508	As required
Inner surface of clutch release bearing	CASMOLY L9508	As required
Inner surface of clutch release cylinder and outer circumference of piston and cup	Brake fluid DOT 3 or DOT 4	As required
Inner surface of clutch disc spline	CASMOLY L9508	As required
Inner surface of clutch master cylinder and outer circumference of piston assembly	Brake fluid DOT 3 or DOT 4	As required
Clutch master cylinder push rod, clevis pin and washer	Wheel bearing grease SAE J310, NLGI No.2V	As required
Clutch pedal shaft and bushings	Chassis grease SAE J310a, NLGI No.1	As required
Contact portion of release fork to release cylinder push rod	CASMOLY L9508	As required
Input shaft spline	CASMOLY L9508	As required

Troubleshooting

Trouble symptom		Suspect area	Remedy
Clutch slipping • Car will not respond to engine speed during acceleration • Insufficient vehicle 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 the clutch disc spline	Replace
		Excessive vibration (distortion) of the clutch disc	Replace
Clutch noisy	When the clutch is not used	Insufficient play of the clutch pedal	Adjust
		Excessive wear of the clutch disc facing	Replace
	A noise is heard after the clutch is disengaged	Unusual wear and/ or damage of the release bearing	Replace
	A noise is heard when the clutch is disengaged	Insufficient grease on the sliding surface of the bearing sleeve	Repair
		Improperly installed clutch assembly or bearing	Repair
	A noise is heard when the car suddenly rolled up with the clutch partially engaged	Damaged pilot bushing	Replace
Hard pedal effort		Insufficient lubrication of the clutch pedal	Repair
		Insufficient lubrication of the spline part of clutch disc	Repair
		Insufficient lubrication of the clutch release lever shaft	Repair

Hard to shift or will not shift	Excessive clutch pedal free play	Adjust the pedal free play
	Faulty of the clutch release cylinder	Repair the release cylinder
	Clutch disc out of place, runout is excessive or lining broken	Inspect the clutch disc
	Spline on the input shaft or clutch disc dirty or burned	Repair as necessary
	Faulty of the clutch pressure plate	Replace the clutch cover
Clutch slips	Insufficient clutch pedal free play	Adjust the pedal free play
	Clogged of the hydraulic system	Repair or replace parts
	Clutch disc lining oily or worn out	Inspect the clutch disc
	Faulty pressure plate	Replace the clutch cover
	Binding of the release fork	Inspect the release fork
Clutch grabs/chatters	Clutch disc lining oily or worn out	Inspect the clutch disc
	Faulty the pressure plate	Replace the clutch cover
	Bent clutch diaphragm spring	Replace the clutch cover
	Worn or broken torsion spring	Replace the clutch disc
	Engine mounts loose	Repair as necessary
Clutch noisy	Damaged the clutch pedal bushing	Replace the clutch pedal bushing
	Loose part inside housing	Repair as necessary
	Worn or dirty release bearing	Replace the replease bearing
	Sticking release fork or linkage	Repair as necessary

Components



1. Sub-frame 2. Front strut assembly	3. Front lower arm 4. Front stabilizer

Replacement

1. Remove the front wheel & tire.

Tightening torque:
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

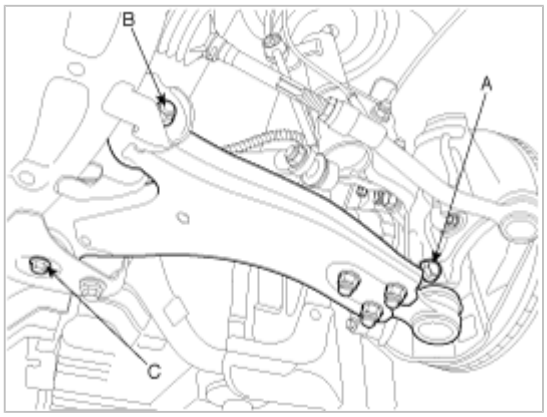
2. Remove the split pin and bolt & nut (A) and then disconnect the front lower arm with the knuckle.

Tightening torque:
90 ~ 120N.m (9.0 ~ 12.0kgf.m, 65 ~ 87lb-ft)

Be careful not to damage the lower arm ball joint boot when removing or installing the lower arm.

3. Loosen the bolt & nut (B, C) and then remove the front lower arm from the sub-frame.

Tightening torque
B: 140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)
C: 160 ~ 180N.m (16.0 ~ 18.0kgf.m, 116 ~ 130lb-ft)



4. Installation is the reverse of the removal.

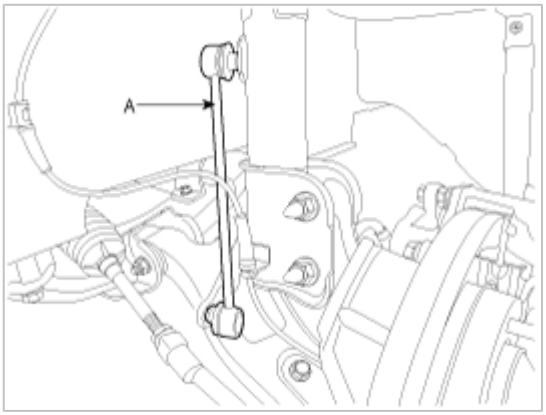
Inspection

1. Check the lower arm ball joint boot for wear or damage and replace the lower arm assembly if necessary.
2. Check the lower arm bushing for wear or damage and replace the lower arm assembly if necessary.

Replacement

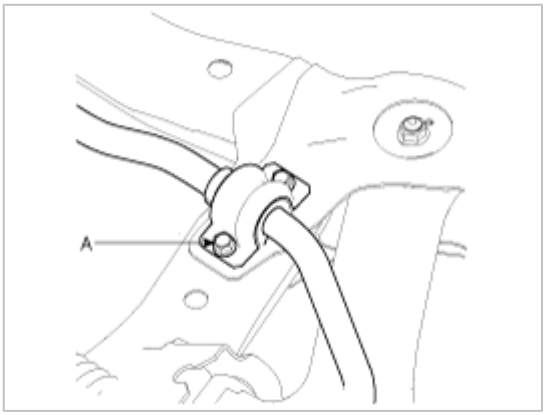
1. Remove both stabilizer links(A) by loosening the nuts.

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



2. Remove the stabilizer bar from the sub-frame by loosening the mounting bolts (A).

Tightening torque:
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)

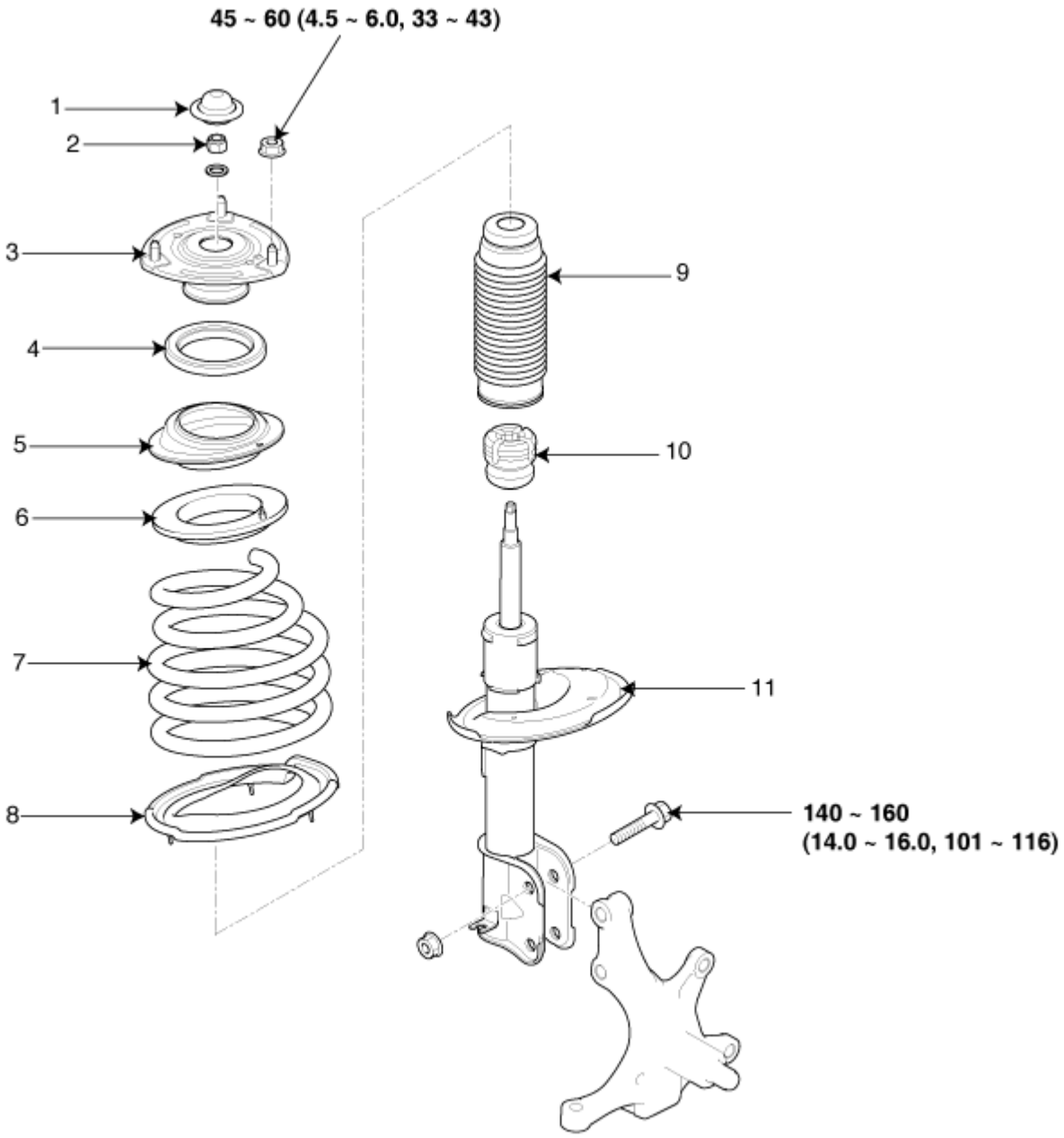


3. Installation is the reverse of the removal.

Inspection

1. Check the stabilizer bar bushing for wear or damage and replace it if necessary.
2. Check the stabilizer bar link ball joint for damage and replace the stabilizer link if necessary.

Components



Torque : N.m (kgf.m, lb-ft)

1. Insulator cap	7. Coil spring
2. Lock nut	8. Spring lower pad
3. Insulator assembly	9. Dust cover
4. Strut bearing	10. Bumper rubber
5. Spring upper seat	11. Shock absorber
6. Spring upper pad	

Replacement

1. Remove the front wheel & tire.

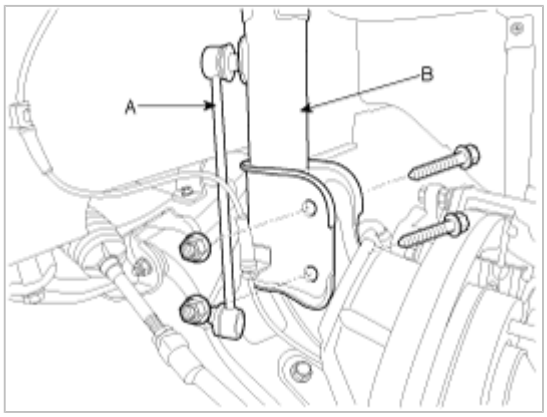
Tightening torque:
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Remove the wheel speed sensor cable and brake hose from the front strut assembly.
3. Disconnect the stabilizer link (A) with the front strut assembly.

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

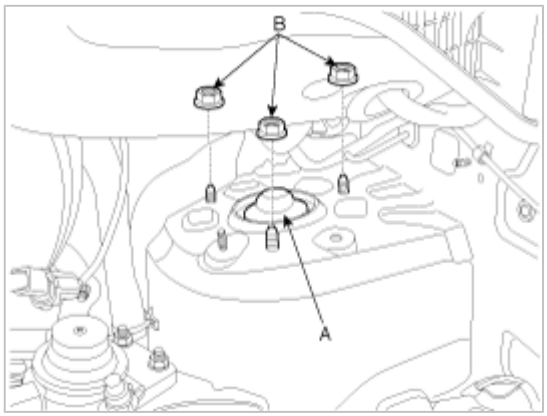
4. Disconnect the front strut assembly (B) with the knuckle by loosening the bolts & nuts.

Tightening torque:
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)



5. Remove the insulator cap (A).
6. Remove the front strut assembly from the wheel housing panel by loosening the mounting bolts (B).

Tightening torque:
45 ~ 60N.m (4.5 ~ 6.0kgf.m, 33 ~ 43lb-ft)



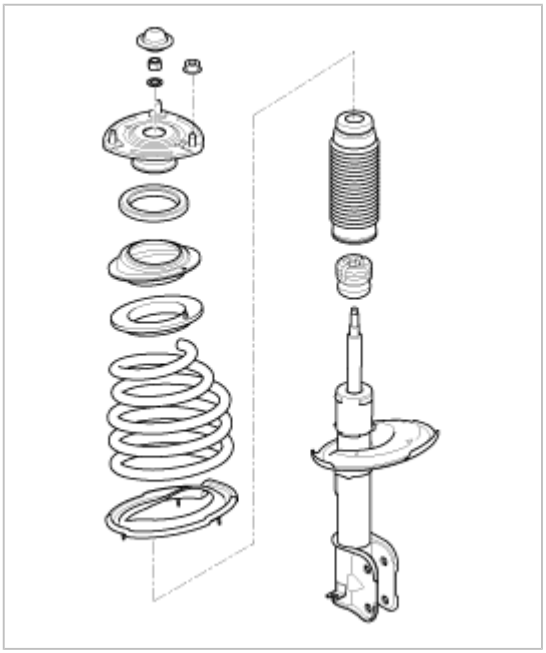
7. Installation is the reverse of the removal.

Disassembly and Reassembly

1. Compress the coil spring with a strut spring compressor.
   Do not compress the spring more than necessary.
2. Loosen the lock nut.

Tightening torque:
45 ~ 60N.m (4.5 ~ 6.0kgf.m, 33 ~ 43lb-ft)

3. Disassemble the components of front strut assembly in sequence. (Refer to Front strut assembly components.)

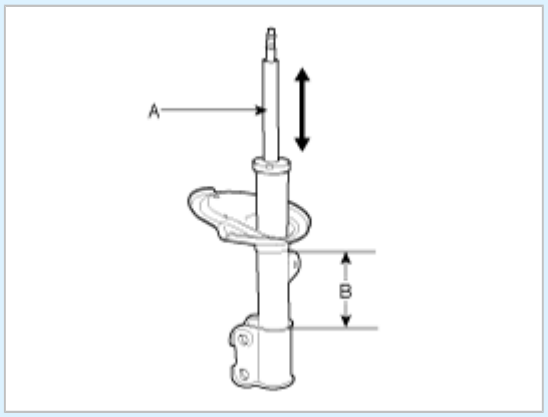


4. Reassembly is the reverse of the disassembly.

Inspection

1. Check the components for damage or deformation.
2. Compress and extend the piston rod (A) and check that there is no abnormal resistance or unusual sound during operation.
3. When disposing the shock absorber, fully extend the piston rod (A) and then drill a hole on the (B) section to discharge gas from the cylinder.

The gas coming out is harmless, but be careful of chips that may fly when drilling. Be sure to wear safety goggles or eye protection when performing this task.


A
B

Adjustment

When using a commercially available computerized wheel alignment equipment to inspect the wheel alignment, always position the vehicle on a level surface with front wheels facing straight ahead. Prior to inspection, make sure that the suspension and steering system are in normal operating condition and that the tires are inflated to the specified pressure.

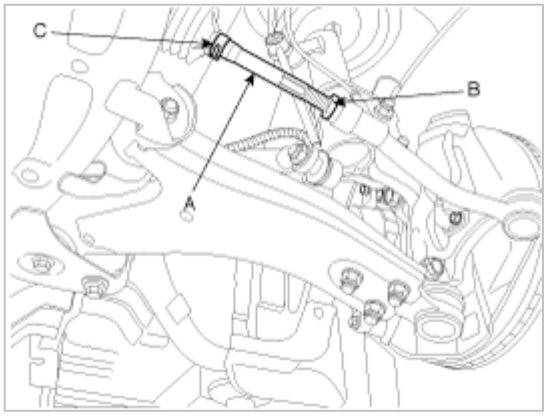
Front wheel alignment

Toe

1. Loosen the tie rod end lock nut (B).
2. Loosen the bellows clip (C) to prevent the bellows from being twisted.
3. Adjust the toe by screwing or unscrewing the tie rod (A). Toe adjustment should be made by turning the tie rods right and left by the same amount.

Standard value

Toe: 0±2mm (0±0.079in.)



4. When the toe adjustment is completed, tighten the lock nut with the tie-rod held stationary and reinstall the bellow clip.

Camber and Caster

Camber and Caster are pre-set at factory, so they do not need to be adjusted. If the camber or caster value is not within the standard value, replace or repair the damaged parts and then inspect again.

Standard value

Camber: -0.5±0.5°
Caster: 4.27±0.5°

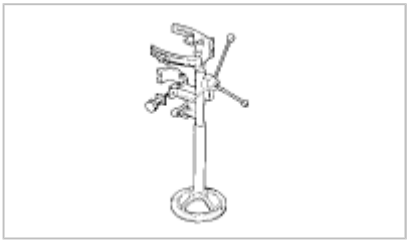
Rear wheel alignment

Rear wheel alignment factors (Toe and camber) are pre-set at factory, so they do not need to be adjusted. If the rear toe or camber is not within the standard value, replace or repair the damaged parts and then inspect again.

Standard value

Toe: 0±2mm (0±0.079in.)
Camber: 0±0.5°

Special Service Tools

Tool (Number and Name)	Illustration	Use
09546-26000 Strut spring compressor		Compression of coil spring

Specifications~2013-10-28

Front Suspension

Item			Specification
Suspension Type			MacPherson strut
Shock absorber	Type		Gas pressurized
	Stroke		172.2 (6.7795in.)
	I.D. color	Wagon	LH:Orange, RH: Black
		Van	LH: Red, RH: Yellow
Coil spring	Free height [I.D. color]		319.4mm (12.5748in.) [Green – Blue]
			356.3mm (14.0275in.) [Green – Pink]
			320.0mm (12.5984in.) [Green – Green]

Rear Suspension

Item		Specification	
		Wagon	Van
Suspension type		5-Link coil spring	Leaf spring
Shock absorber	Type	Oil	Oil
	Stroke	173mm (6.8110in.)	182mm (7.1653in.)
	I.D. color	Yellow	Blue
Coil spring	Free height [I.D. color]	329.3mm (12.9645in.) [Green – White]	
		325.5mm (12.8149in.) [Green – Red]	

Wheel and Tire

Item			Specification
Wheel size	Steel		6.5J × 16
	Alloy		6.5J × 16
Tire size			215/70 R16C
Tire Pressure	Front		2.90kg/cm, (42psi)
	Rear	Wagon	3.25kg/cm, (47psi)
		Van	3.50kg/cm, (51psi)

Wheel Alignment

Item		Specification	
		Front	Rear
Toe-in	Total	0°±0.2°	0°±0.2°
	Individual	0°±0.1°	0°±0.1°
Camber		-0.5°±0.5°	0°±0.5°
Caster		4.27°±0.5°	-
King-pin		11.84°±0.5°	-
Ride height		421.5 mm (16.5945in.)	437±10 mm (17.2047± 0.3937in.)

Tightening Torques

Front Suspension

Item	Tightening torque		
	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Front strut assembly to wheel housing panel	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4
Front strut assembly to knuckle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Front strut assembly to stabilizer link	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Front lower arm to sub frame (Front)	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Front lower arm to sub frame (Rear)	156.9 ~ 176.5	16.0 ~ 18.0	115.7 ~ 130.2
Front lower arm to knuckle	88.3 ~ 117.7	9.0 ~ 12.0	65.1 ~ 86.8
Front stabilizer bar to sub frame	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Front stabilizer bar to stabilizer link	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8

Rear Suspension

Item	Tightening torque		
	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Rear shock absorber to body	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Rear shock absorber to rear axle	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3

Rear upper arm to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Rear upper arm to rear axle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Rear stabilizer bar link to body	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Rear stabilizer bar to rear axle	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Rear stabilizer bar to stabilizer link	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Rear lower arm to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Rear lower arm to rear axle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Lateral rod to body	176.5 ~ 205.9	18.0 ~ 21.0	130.2 ~ 151.9
Lateral rod to rear axle	176.5 ~ 205.9	18.0 ~ 21.0	130.2 ~ 151.9
Rear shock absorber to spring seat	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Leaf spring assembly to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Leaf spring assembly to shackle	58.8 ~ 74.5	6.0 ~ 7.6	43.4 ~ 55.0
Leaf spring assembly U-bolt to nut	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8

Specifications2013-10-29~

Front Suspension

Item			Specification
Suspension Type			MacPherson strut
Shock absorber	Type		Gas pressurized
	Stroke		172.2 (6.7795in.)
	I.D. color	Wagon	LH:Orange, RH: Black
		Van	LH: Red, RH: Yellow
Coil spring	Free height [I.D. color]		319.4mm (12.5748in.) [Green – Blue]
			356.3mm (14.0275in.) [Green – Pink]
			320.0mm (12.5984in.) [Green – Green]

Rear Suspension

Item		Specification	
		Wagon	Van
Suspension type		5-Link coil spring	Leaf spring
	Type	Oil	Oil

Shock absorber	Stroke	173mm (6.8110in.)	182mm (7.1653in.)
	I.D. color	Yellow	Blue
Coil spring	Free height [I.D. color]	329.3mm (12.9645in.) [Green – White]	
		325.5mm (12.8149in.) [Green – Red]	

Wheel and Tire

Item			Specification
Wheel size	Steel		6.5J × 16
	Alloy		6.5J × 16
Tire size			215/70 R16C
Tire Pressure	Front		2.90kg/cm, (42psi)
	Rear	Wagon	3.25kg/cm, (47psi)
		Van	3.50kg/cm, (51psi)

Wheel Alignment

Item		Specification	
		Front	Rear
Toe-in	Total	0.1°±0.2°	0°±0.2°
	Individual	0.05°±0.1°	0°±0.1°
Camber		-0.5°±0.5°	0°±0.5°
Caster		4.27°±0.5°	-
King-pin		11.84°±0.5°	-
Ride height		421.5 mm (16.5945in.)	437±10 mm (17.2047± 0.3937in.)

Tightening Torques
Front Suspension

Item	Tightening torque		
	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Front strut assembly to wheel housing panel	44.1 ~ 58.8	4.5 ~ 6.0	32.5 ~ 43.4

Front strut assembly to knuckle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Front strut assembly to stabilizer link	98.1 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Front lower arm to sub frame (Front)	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Front lower arm to sub frame (Rear)	156.9 ~ 176.5	16.0 ~ 18.0	115.7 ~ 130.2
Front lower arm to knuckle	88.3 ~ 117.7	9.0 ~ 12.0	65.1 ~ 86.8
Front stabilizer bar to sub frame	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Front stabilizer bar to stabilizer link	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8

Rear Suspension

Item	Tightening torque		
	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Rear shock absorber to body	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Rear shock absorber to rear axle	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Rear upper arm to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Rear upper arm to rear axle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Rear stabilizer bar link to body	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Rear stabilizer bar to rear axle	44.1 ~ 53.9	4.5 ~ 5.5	32.5 ~ 39.8
Rear stabilizer bar to stabilizer link	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8
Rear lower arm to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Rear lower arm to rear axle	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Lateral rod to body	176.5 ~ 205.9	18.0 ~ 21.0	130.2 ~ 151.9
Lateral rod to rear axle	176.5 ~ 205.9	18.0 ~ 21.0	130.2 ~ 151.9
Rear shock absorber to spring seat	117.7 ~ 137.3	12.0 ~ 14.0	86.8 ~ 101.3
Leaf spring assembly to body	137.3 ~ 156.9	14.0 ~ 16.0	101.3 ~ 115.7
Leaf spring assembly to shackle	58.8 ~ 74.5	6.0 ~ 7.6	43.4 ~ 55.0
Leaf spring assembly U-bolt to nut	98.7 ~ 117.7	10.0 ~ 12.0	72.3 ~ 86.8

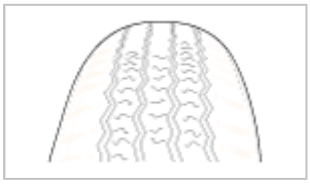
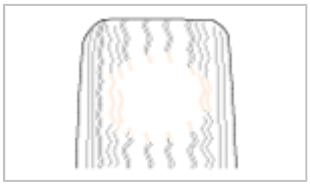
Troubleshooting

Symptom	Possible cause	Remedy
Hard steering	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Low tire pressure No power assist	Correct Replace Adjust Repair and replace
Poor return of steering wheel to center	Improper front wheel alignment	Correct
Poor or rough ride	Improper front wheel alignment Malfunctioning shock absorber Broken or worn stabilizer Broken or worn coil spring Worn lower arm bushing	Correct Repair or replace Replace Replace Replace the lower arm assembly
Abnormal tire wear	Improper front wheel alignment Improper tire pressure Malfunctioning shock absorber	Correct Adjust Replace
Wandering	Improper front wheel alignment Poor turning resistance of lower arm ball joint Loose or worn lower arm bushing	Correct Repair Retighten or replace
Vehicle pulls to one side	Improper front wheel alignment Excessive turning resistance of lower arm ball joint Broken or worn coil spring Bent lower arm	Correct Replace Replace Repair
Steering wheel shimmy	Improper front wheel alignment Poor turning resistance of lower arm ball joint Broken or worn stabilizer Worn lower arm bushing Malfunctioning shock absorber Broken or worn coil spring	Correct Replace Replace Replace Replace Replace
Bottoming	Broken or worn coil spring Malfunctioning shock absorber	Replace Replace

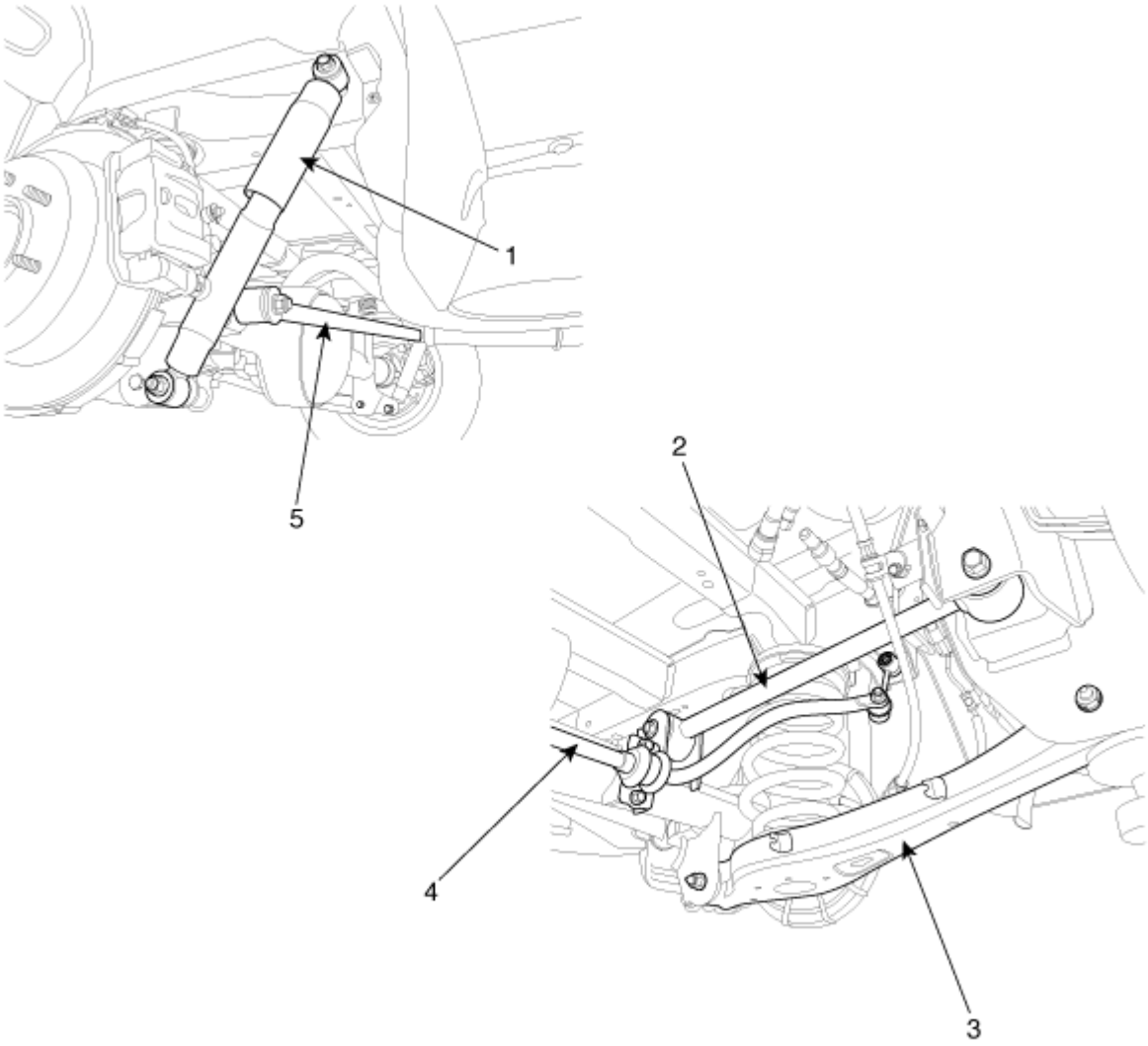
Wheel /tire noise, vibration and harshness concerns are directly related to vehicle speed and are not generally affected by acceleration, coasting or decelerating. Also, out-of-balance wheel and tires can vibrate at more than one speed. A vibration that is affected by the engine rpm, or is eliminated by placing the transmission in Neutral is not related to the tire and wheel. As a general rule, tire and wheel vibrations

felt in the steering wheel are related to the front tire and wheel assemblies. Vibrations felt in the seat or floor are related to the rear tire and wheel assemblies. This can initially isolate a concern to the front or rear.

Careful attention must be paid to the tire and wheels. There are several symptoms that can be caused by damaged or worn tire and wheels. Perform a careful visual inspection of the tires and wheel assemblies. Spin the tires slowly and watch for signs of lateral or radial runout. Refer to the tire wear chart to determine the tire wear conditions and actions.

Wheel and tire diagnosis		
Rapid wear at the center	Rapid wear at both shoulders	Wear at one shoulder
		
• Center-tread down to fabric due to excessive over inflated tires • Lack of rotation • Excessive toe on drive wheels • Heavy acceleration on drive	• Under-inflated tires • Worn suspension components • Excessive cornering speeds • Lack of rotation	• Toe adjustment out of specification • Camber out of specification • Damaged strut • Damaged lower arm
Partial wear	Feathered edge	Wear pattern
		
• Caused by irregular burrs on brake drums	• Toe adjustment out of specification • Damaged or worn tie rods • Damaged knuckle	• Excessive toe on non-drive wheels • Lack of rotation

Components

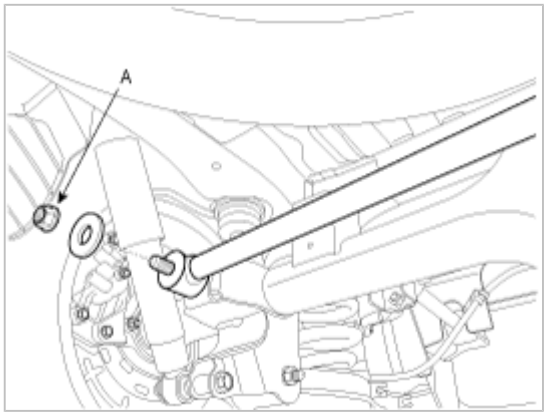


1. Rear shock absorber 2. Rear upper arm 3. Rear lower arm	4. Rear stabilizer 5. Lateral rod

Replacement

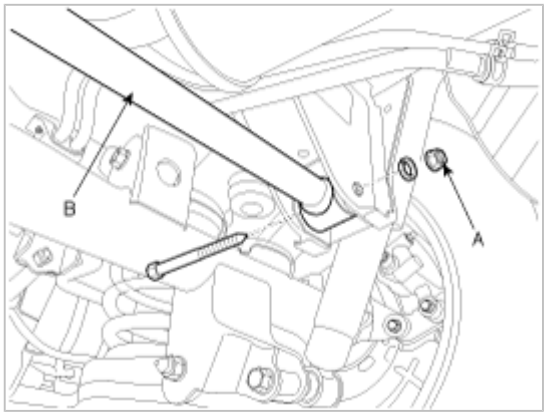
1. Disconnect the lateral rod from the rear axle by loosening the nut (A).

Tightening torque:
180 ~ 210N.m (18.0 ~ 21.0kgf.m, 130 ~ 152lb-ft)



2. Disconnect the lateral rod (B) from the body by loosening the bolt and nut (A).

Tightening torque:
180 ~ 210N.m (18.0 ~ 21.0kgf.m, 130 ~ 152lb-ft)



3. Installation is the reverse of the removal.

Inspection

Check the lateral rod bushing for wear or damage and replace lateral rod assembly if necessary.

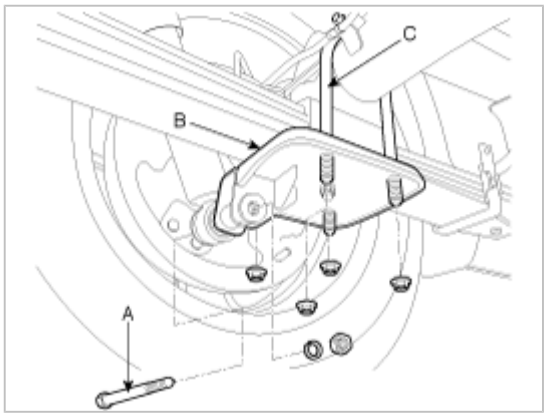
Replacement

1. Remove the wheel speed sensor bracket from the leaf spring assembly.
2. Support the lower portion of the rear axle with a jack securely.
3. Remove the bolt and nut (A).

Tightening torque:
120 ~ 140N.m (12.0 ~ 14.0, 87 ~ 101lb-ft)

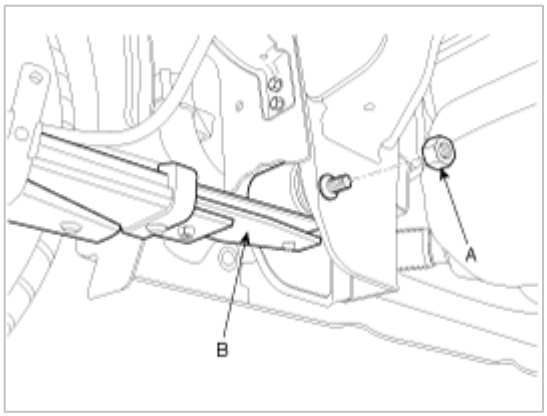
4. Loosen the nuts and then remove the spring seat (B) and U-bolts (C).

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



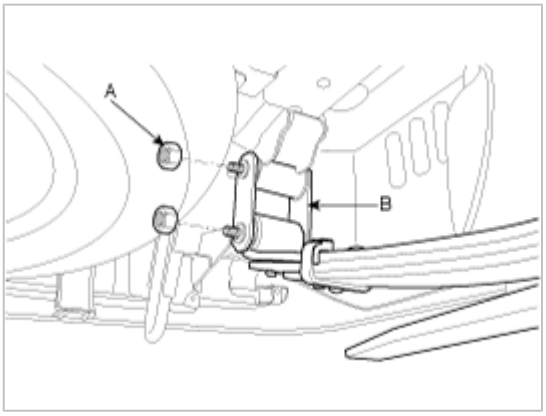
5. Disconnect the leaf spring assembly (B) from the body by loosening the bolt and nut (A).

Tightening torque:
140 ~ 160N.m, (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)



6. Disconnect the leaf spring assembly with the shackle (B) by loosening the nuts (A).

Tightening torque:
60 ~ 76N.m, (6.0 ~ 7.6kgf.m, 43 ~ 55lb-ft)



7. Installation is the reverse of the removal.

Inspection

1. Check the U-bolt for deformation or damage and replace it if necessary.
2. Check the shackle bushing for wear or damage and replace it if necessary.

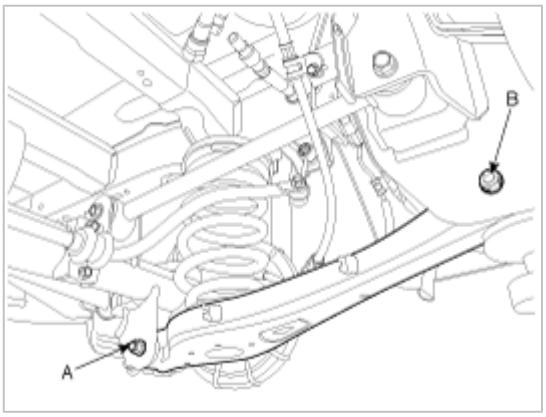
Replacement

1. Remove the wheel speed sensor cable and parking brake cable from the rear lower arm.
2. Support the lower portion of the rear lower arm with a jack securely.
3. Remove the bolt and nut (A).

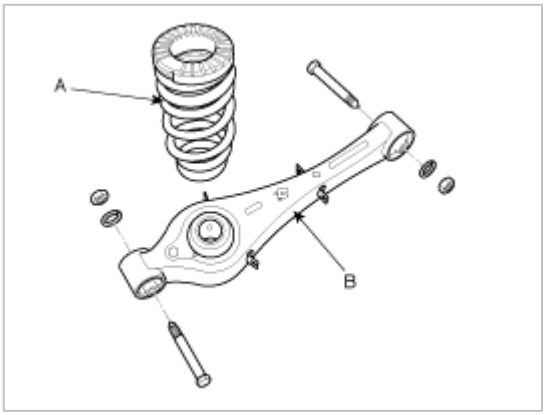
Tightening torque:
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)

4. Loosen the nut (B) and do not remove the bolt holding the body to rear lower arm.

Tightening torque:
140 ~ 160N.m (14.0 ~ 16.0kgf.m, 101 ~ 116lb-ft)

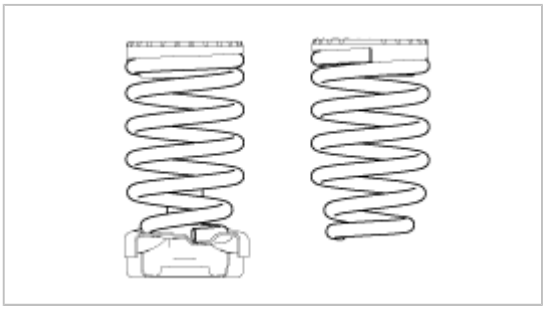


5. Lower the jack and then remove the coil spring (A), spring pad, and seat.
6. Remove the lower arm by pulling out the bolt holding body to rear lower arm.



7. Installation is the reverse of the removal.

When installing the rear coil spring, align the spring ends with the grooves of the spring pad and seat correctly as shown in the illustration below.



Inspection

1. Check the rear lower arm bushing for wear or damage and replace rear lower arm if necessary.
2. Check the spring pad and seat for wear or damage and replace it if necessary.

Replacement

1. Remove the rear wheel & tire.

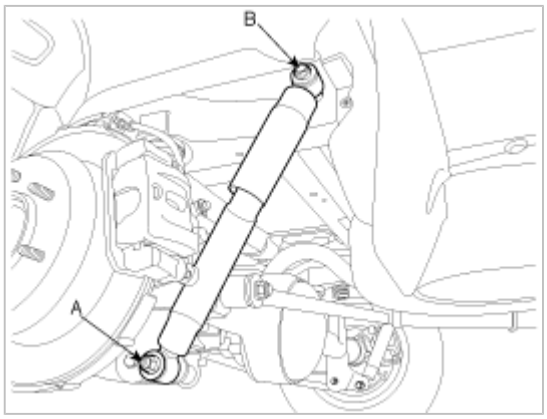
Tightening torque:
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)

2. Support the lower portion of the rear axle with a jack securely.
3. Disconnect the rear shock absorber with the rear axle by loosening the bolt and nut (A).

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72~ 87lb-ft)

4. Remove the rear shock absorber by loosening the bolt (B).

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

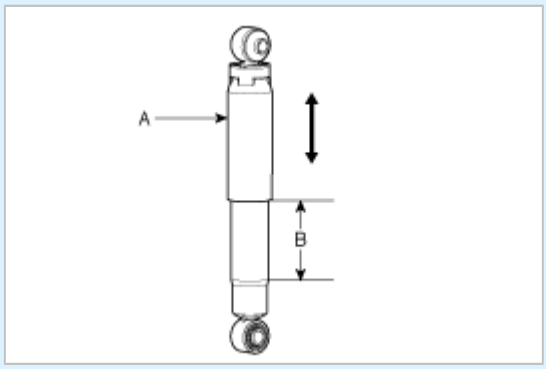


5. Installation is the reverse of the removal.

Inspection

1. Check the components for damage or deformation.
2. Compress and extend the piston (A) and check that there is no abnormal resistance or unusual sound during operation.
3. When disposing the shock absorber, fully extend the piston (A) and then drill a hole on the (B) section to discharge gas from the cylinder.

The gas coming out is harmless, but be careful of chips that may fly when drilling. Be sure to wear safety goggles or eye protection when performing this task.


A
B

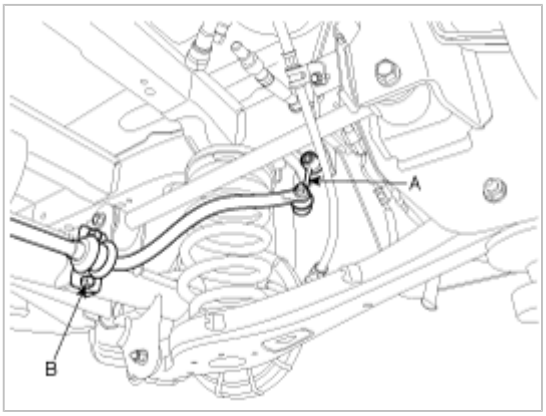
Replacement

1. Remove both rear stabilizer links (A) by loosening the nuts.

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

2. Remove the rear stabilizer bar from the rear axle by loosening mounting bolts.

Tightening torque:
45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)



3. Installation is the reverse of the removal.

Inspection

1. Check the stabilizer bar bushing for wear or damage and replace it if necessary.
2. Check the stabilizer bar link ball joint for damage and replace the stabilizer link if necessary.

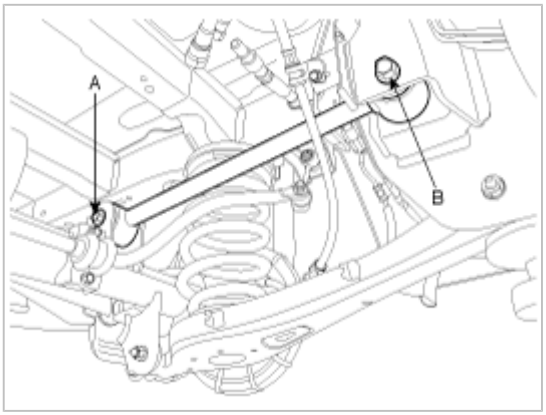
Replacement

1. Support the lower portion of the rear axle securely.
2. Remove the bolt and nut (A).

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)

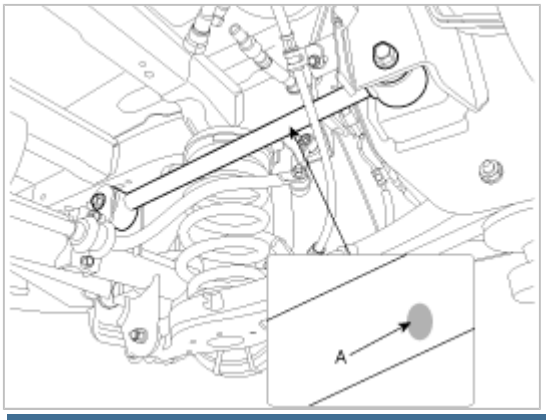
3. Remove the rear upper arm by loosening the bolt (B).

Tightening torque:
100 ~ 120N.m (10.0 ~ 12.0kgf.m, 72 ~ 87lb-ft)



4. Installation is the reverse of the removal.

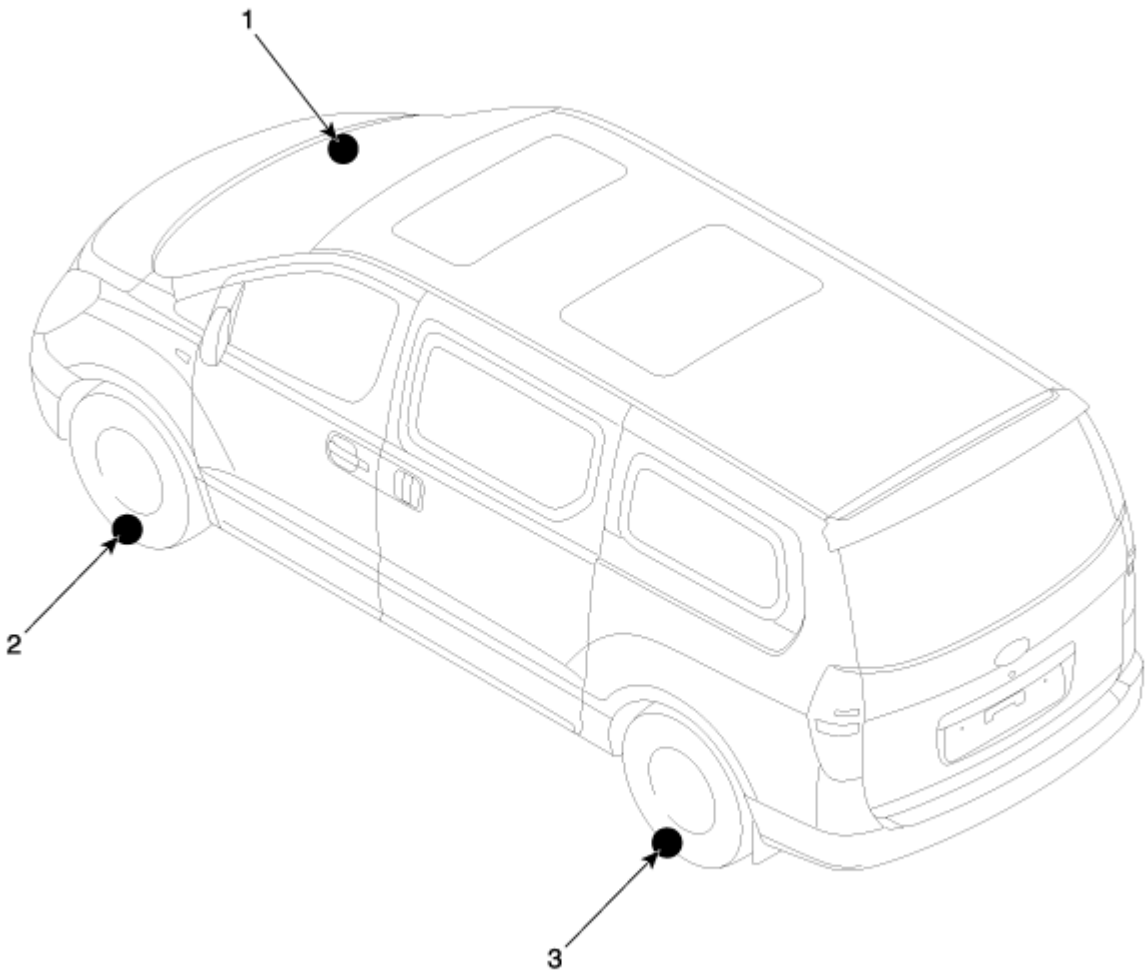
Install the rear upper arm so that identification mark (A) can face the front of the vehicle.



Inspection

Check the rear upper arm bushing for wear or damage and then replace the rear upper arm assembly if necessary.

Components



1. Receiver 2. TPMS Sensor (Front)	3. TPMS Sensor (Rear)

Description

TREAD Lamp

- Tire Under Inflation / Leak Warning.

1. Turn on condition
   A. When tire pressure is below allowed threshold
   B. Indicates that tire needs to be re-inflated to placard pressure / repaired.
2. Turn off condition
   A. Under-inflation ; When tire pressure is above (warning threshold + hysteresis).
   B. Rapid Leak ; When tire pressure is above (leak warning threshold).

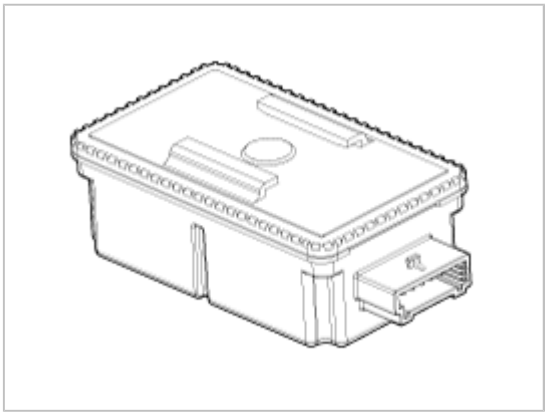
DTC Warning

1. Turn on condition
   A. When the system detects a fault that is external to the receiver/ sensor.
   B. When the system detects a receiver fault.
   C. When the system detects a sensor fault.
2. Turn off condition
   A. If the fault is considered as 'critical', then the lamp is held on throughout the current Ignition cycle (even if the DTC has been demoted). This is because it is important to bring the problem to the drivers attention. On the following Ignition cycle, the demotion conditions will be re-checked. If the demotion conditions occur, the lamp will be turned off. It will be held on until DTC demotion checking is completed.
   B. 'Non critical' faults are those that can occur temporarily e.g. vehicle battery under voltage. The lamp is therefore turned off when the DTC demotion condition occurs.

System Fault

1. General Function
   A. The system monitors a number of inputs across time in order to determine that a fault exists.
   B. Faults are prioritized according to which has the most likely cause.
   C. Certain faults are not covered through DTC. The main ones are:
      1. Ignition Line stuck ; requires observation of lamps at Ignition ON to diagnose

Description



1. **Mode**
   (1) Virgin State
      A. The receiver as a sole part is shipped in this state. Replacement parts should therefore arrive in this state.
      B. In this state, there is no sensor monitoring and no DTC monitoring.
      C. The state indicates that platform specific parameters must be written to the receiver and that sensors are un-learned.
   (2) Normal State
      A. In order for tire inflation state and DTC monitoring to occur, the receiver must be in this state.
      B. In this state, automatic sensor learning is enabled.
   (3) Test State
      A. This state is only used in manufacturing plant to check RF transmission between sensor and receiver.
2. **Overview**
   A. Receives RF data from sensor.
   B. Uses sensor data to decide whether to turn on TREAD Lamp.
   C. Learn TPM sensor for under inflation monitoring automatically.
   D. Uses sensor information, distance travelled, background noise levels, Auto-learn status, short / open circuit output status, vehicle battery level, internal receiver states to determine if there is a system or a vehicle fault.

Operation

1. General Function
   A. auto-learn take place when driving 19 minute after stopping.
   B. On successful completion, 4 road wheel sensor ID's are latched into memory for monitoring.
   C. Until Auto-learn completes, previously learned sensors are monitored for under inflation / leak warnings.
2. General Conditions to Learn New Sensors:
   A. Receiver must determine that it is confident that sensor is not temporary:

1) Uses vehicle speed.
2) Uses confidence reduction of previously learned sensors.

B. Typical time at driving continuously over 15.5 mph(25 kph) to learn a new sensor is up to 10 minutes.

3. General Conditions to Un-Learn a sensor that is removed:

A. It takes less than 10 minutes at 15.5 mph(25 mph).

B. Confidence reduction is dependent on time which vehicle is driven at speed greater than or equal to 12.4 mph(20 kph).

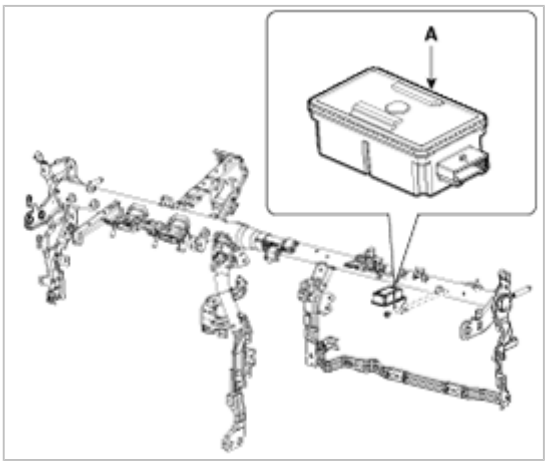
Replacement

When the receiver first arrives for replacement:

1) It will be in Virgin State.
2) It will not be configured for any specific platform.
3) It will not have any sensor ID's memorized.

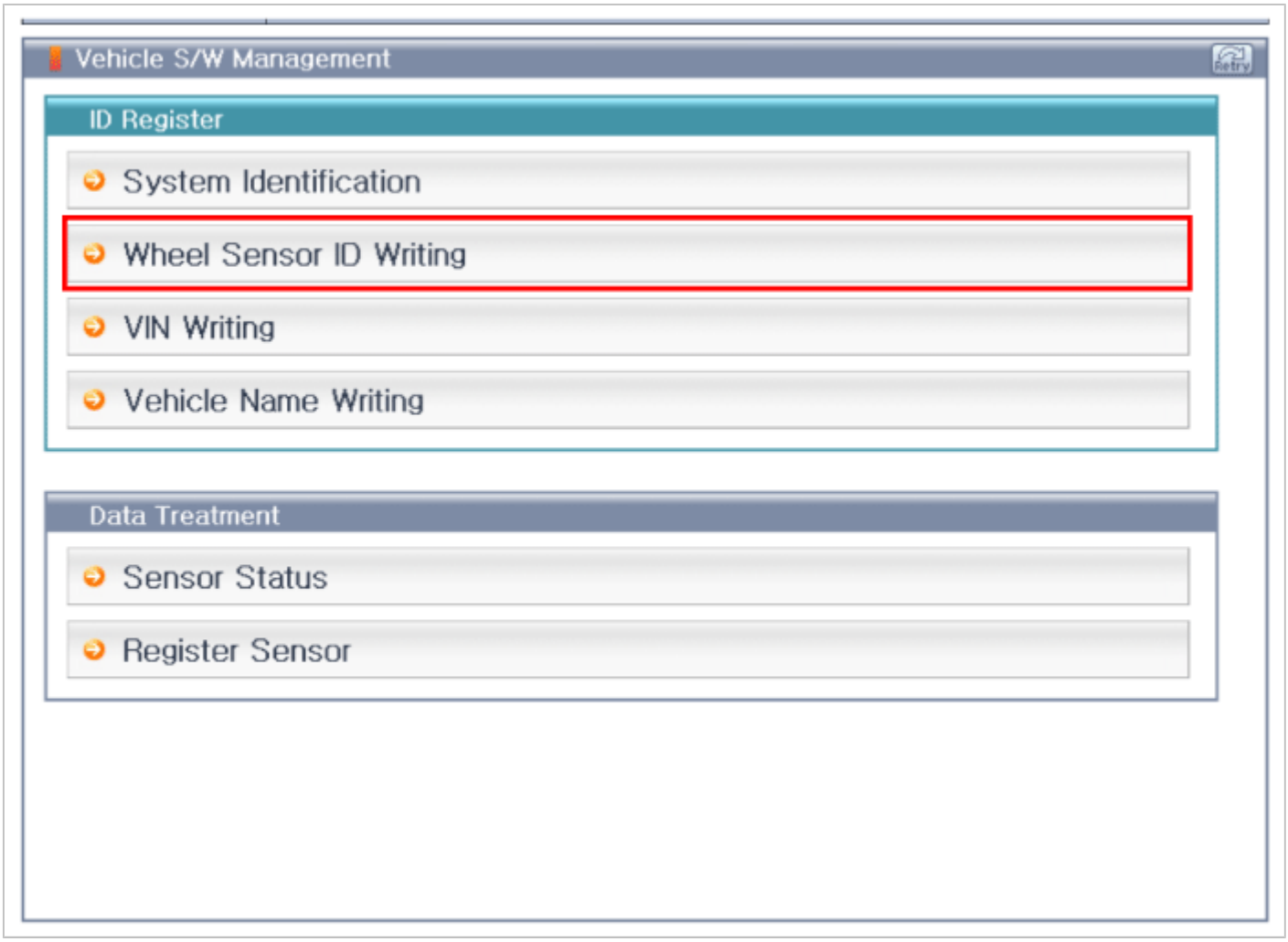
It is important to make sure that the correct receiver is used to replace the faulty part i.e. it must be Low Line and not High Line in order to have the correct inflation warning thresholds set.

1. Disconnect the negative (-) battery cable.
2. Remove the bracket and receiver (A) as loosen the nut.

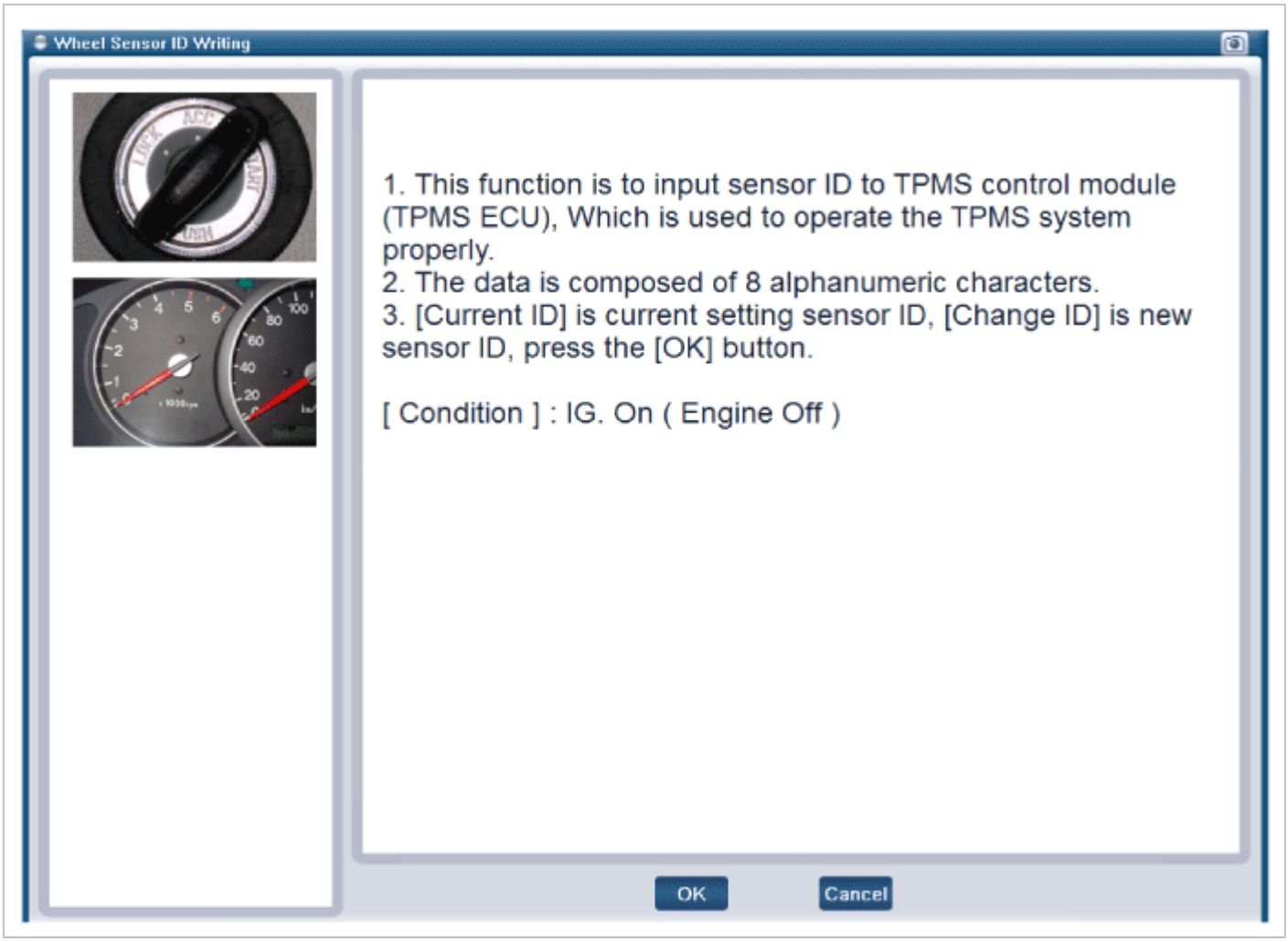


3. Install in the reverse order of removal.
4. Re-connect battery and turn Ignition on.
5. After replacing the receiver, learn by using self-diagnosis device(GDS).

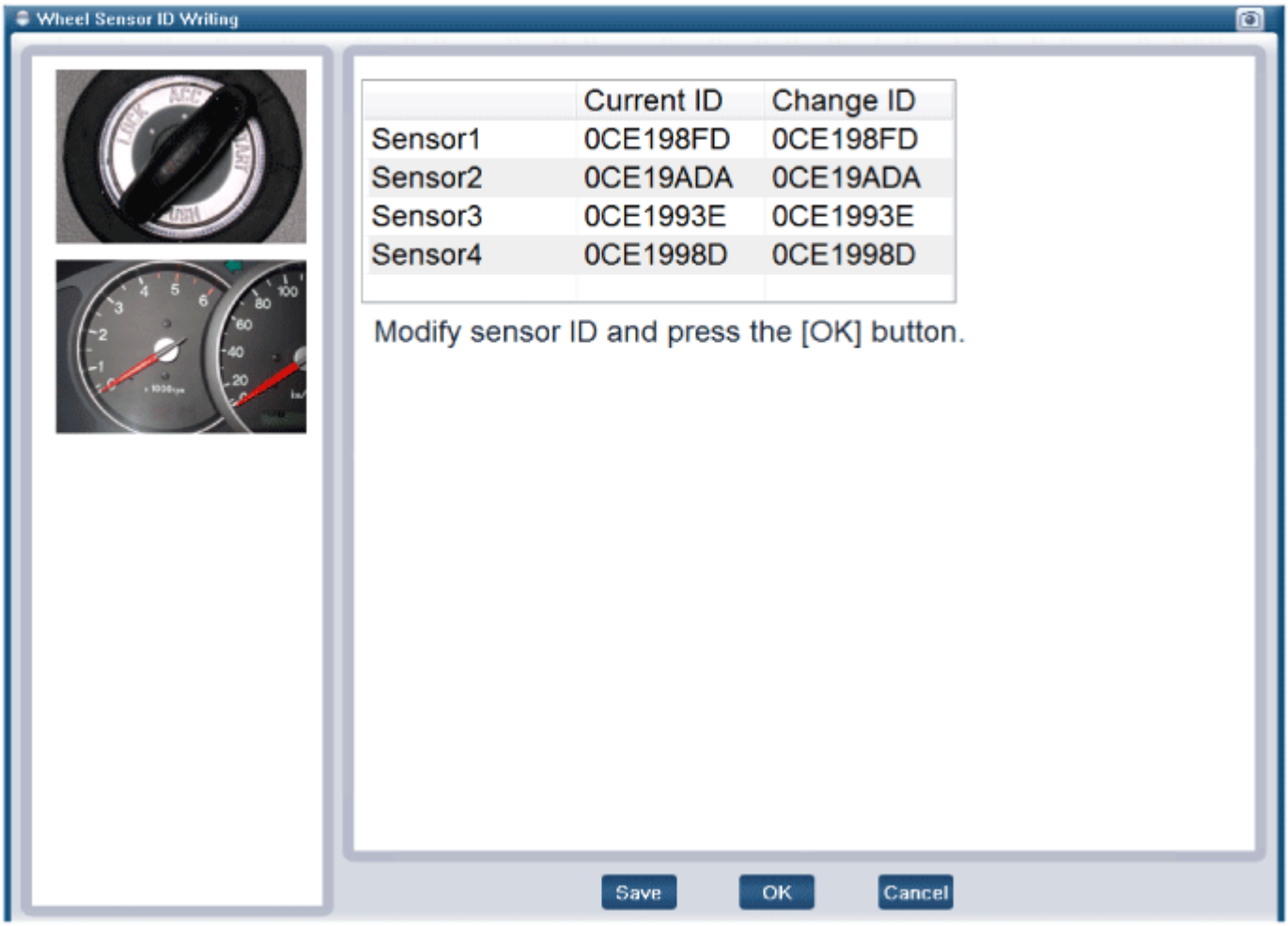
[Wheel Sensor ID Writing (Wireless) initialization]



[Wheel Sensor ID Writing (Wireless) 1]



[Wheel Sensor ID Writing (Wireless) 2]

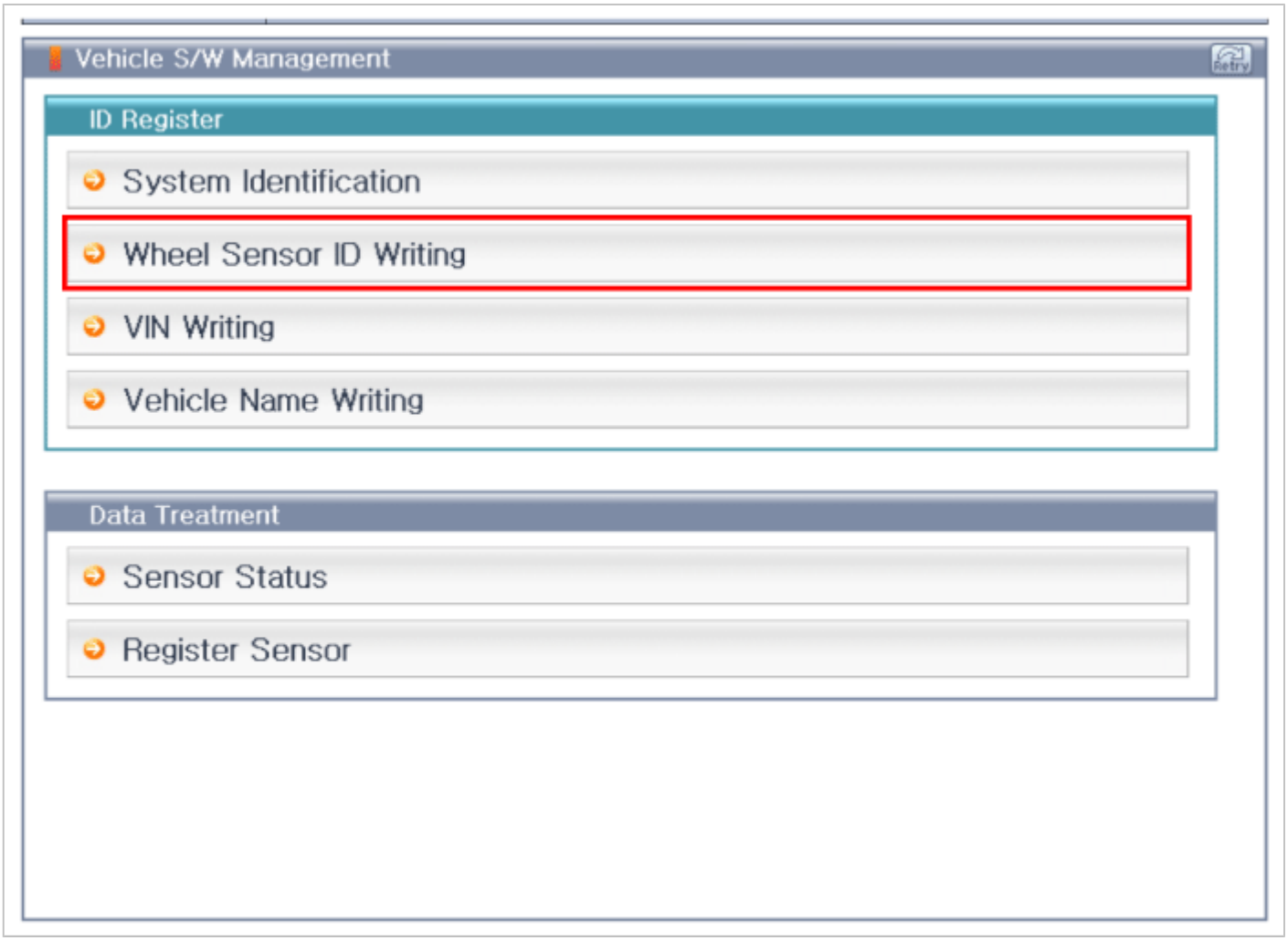


Diagnosis procedure by using diagnostic device

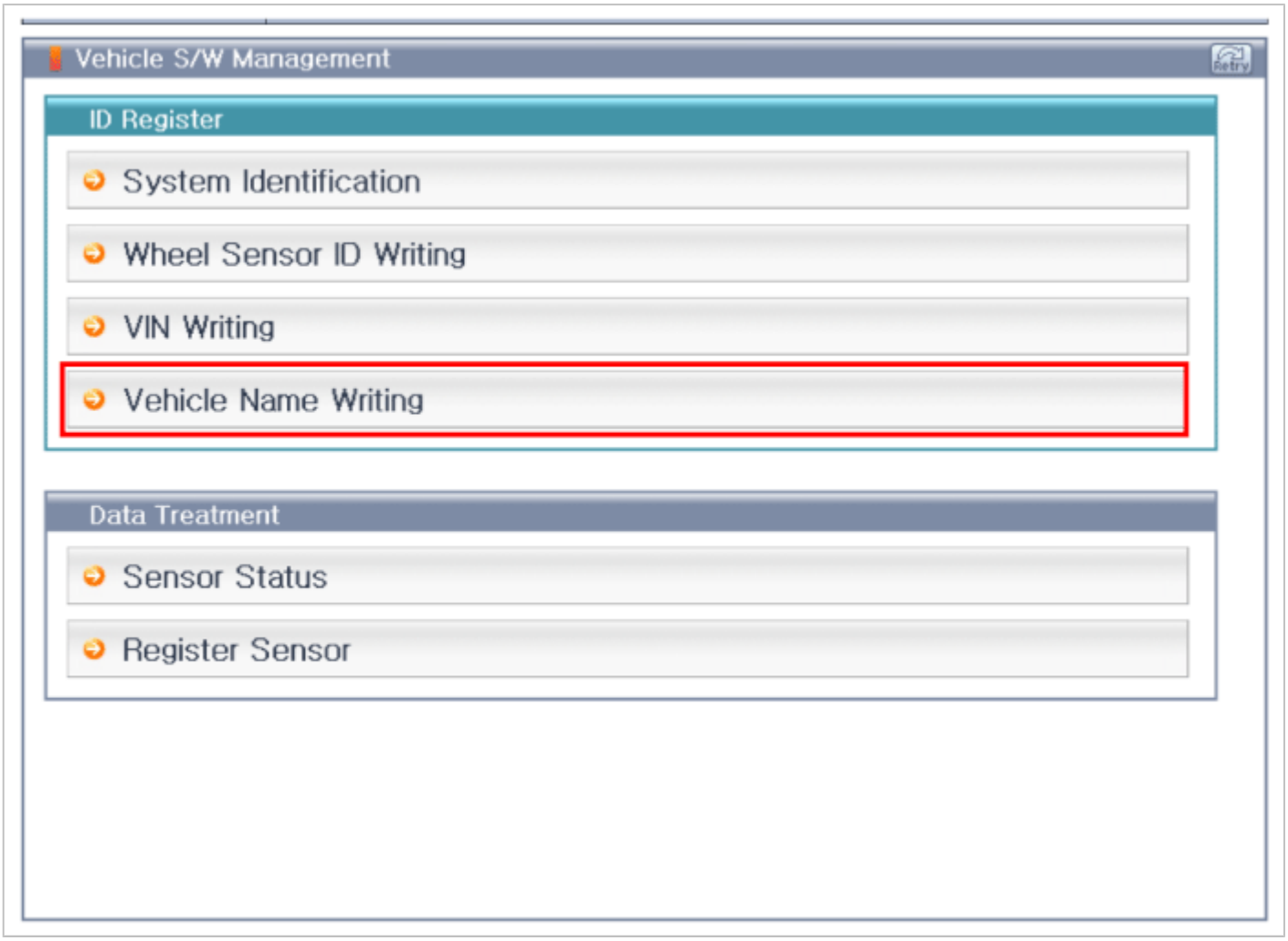
As manual for diagnosis methods by using diagnosis device, the main contents are as follows:

1. Connect self-diagnosis connector(16pins) located in the lower of driver side crash pad to self-diagnosis device, and then turn the self-diagnosis device after key is ON.
2. Select the "vehicle model" and "TPMS" on GDS vehicle selection screen, then select OK.

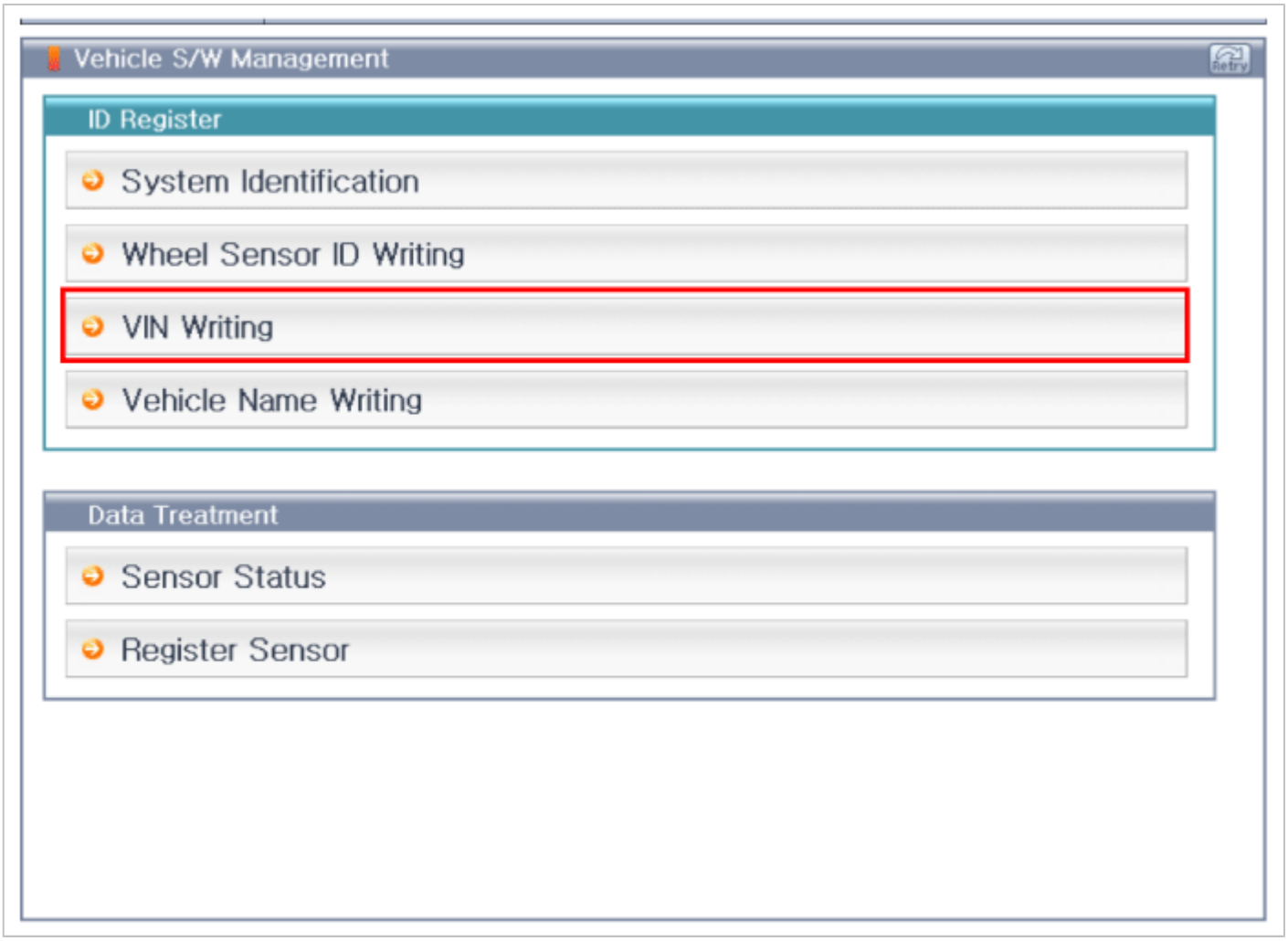
[Wheel Sensor ID Writing (Wireless) initialization]



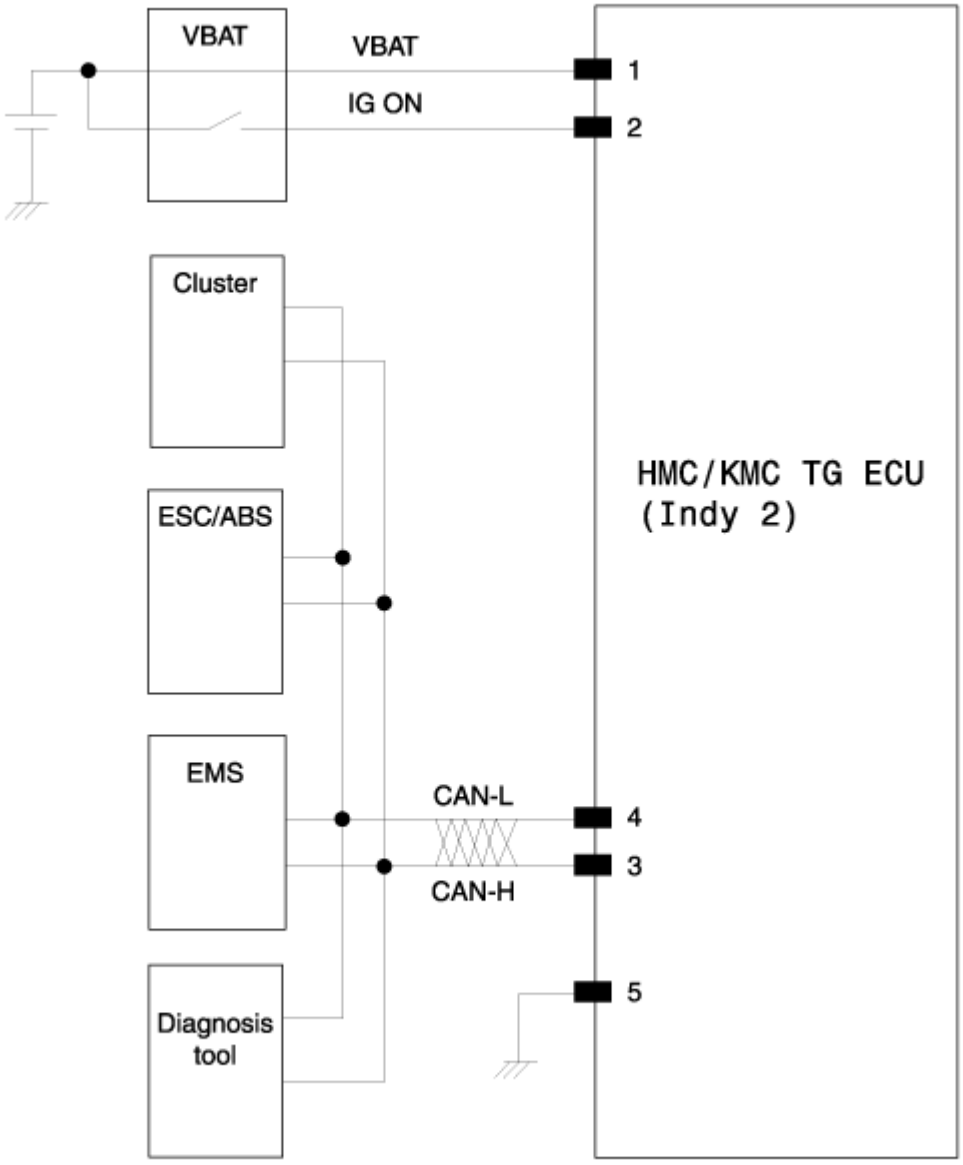
[Vehicle name input initialization]



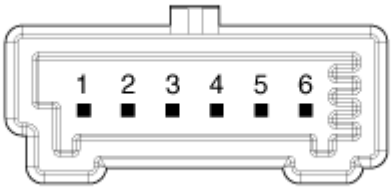
[VIN input initialization]


Vehicle S/W Management
ID Register
System Identification
Wheel Sensor ID Writing
VIN Writing
Vehicle Name Writing
Data Treatment
Sensor Status
Register Sensor

Circuit Diagram



Terminal Function



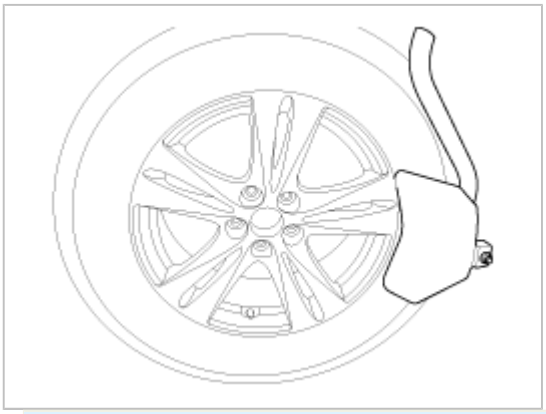
Pin No.	Description
1	V_BAT_ECU
2	IG_ON
3	CAN High
4	CAN_Low
5	GND
6	NA

Description

1. General description
   WU is a sensor placed in the tire that reports pressure and temperature.
   The WU is mounted inside the wheels, fixed to the valve. The angle between the valve and the housing of the WU is variable.
   This allows adaptation to various types of rims.
   The Wheel Unit is made of a PCB supporting the electronic hardware and encapsulated inside a housing which is potted with polyurethane.
   It is self-powered by a battery and includes all systems for parameter measurement (pressure, temperature and centrifugal acceleration and optionally rotation direction), RF transmission and LF detection.
   To achieve the specified battery lifetime, the WU supports various measurement and transmission timings, depending on WU operation mode.
   For RF transmission, WU uses an internal antenna.
2. First Block Mode
   : When vehicle start driving, Sensor enter Mode First Block.
   Typical period of RF emissions is 16 sec. for 40 times for Auto-learning and Auto-location function.
3. Driving Mode
   : After 19 min. parking and then finishing Mode First Block mode, WU enter Driving mode.
   Typical period of RF emissions are 64 sec above 4g vehicle speed.
4. Parking Mode
   : at below 3g Vehicle speed, enter Parking mode.
   Typical periodicities of RF emissions are 13 hours.

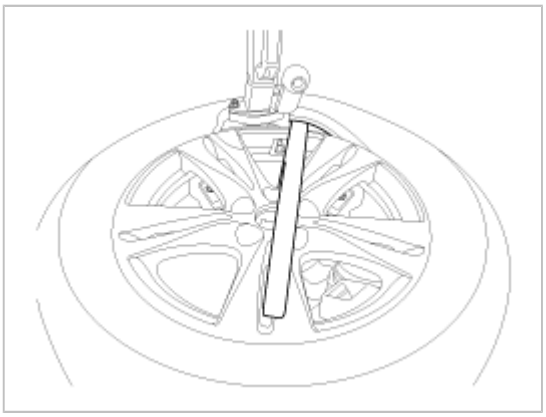
Replacement

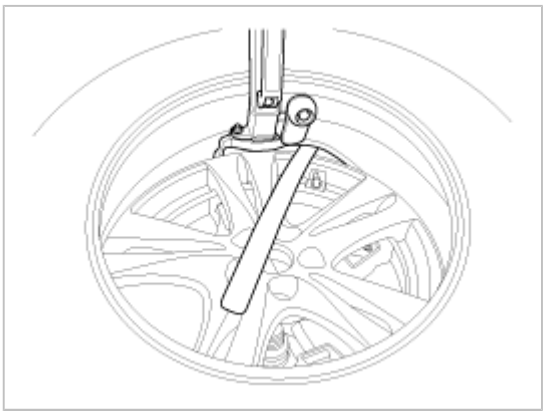
1. Remove the valve core and deflate the tire.
2. Remove the side of the tire bead area from the wheel using tire changing machine .



- The tire bead should be broken approx. 90° from the valve side of the wheel. The bead breaker should not be set too deep.
- Avoid tire/tool contact with the valve on dismount.
- Dismount should end near the valve.

3. Rotate the wheel clockwise.





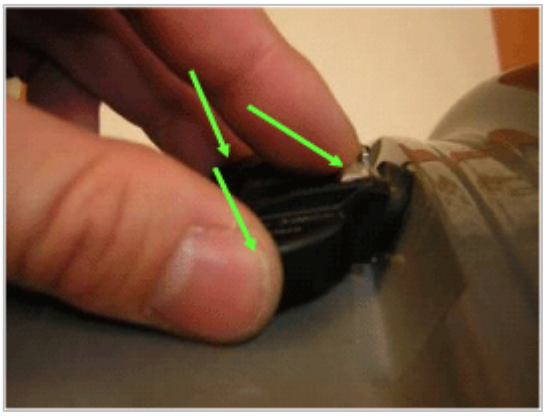
4. The valve during transportation (air inlet portion of the silver) deviated from its original location be sure

to check whether the original position of the valve (metal brackets) are assembled in indented state.

5. While tightening the nut on the valve as not to deviate from the fixed position while rotating the valve to a fixed location (metal brackets to fit inside) and push. The specified torque (8Nm) to tighten the nut does not reuse.
6. Contact with the rim so that the valve washer seals the valve hole put into.

7. Housing with two fingers holding the valve in the axial direction with one finger and push the valve.

8. Housing, the state must be visible laser marking.

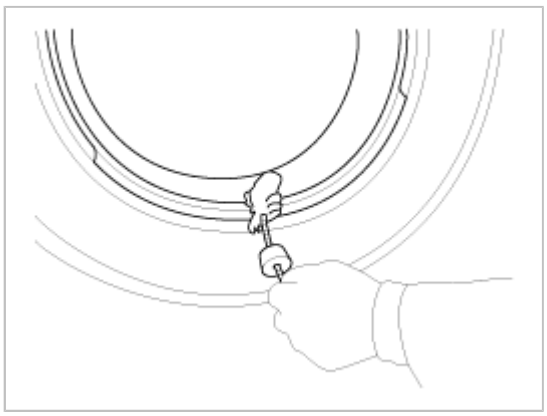


9. When the valve is fully inserted so that the contact between the sensor and the rim while keeping hands on the wheel nut tightening will start Wed.

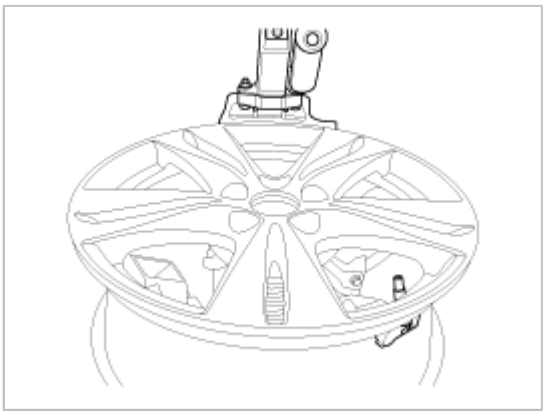
10. While maintaining the position of the valve and the sensor is mounted nut.

Tightening torque :
7.0 ~ 9.0 N.m (0.7 ~ 0.9 kgf.m, 5.1~6.5 lb-ft)

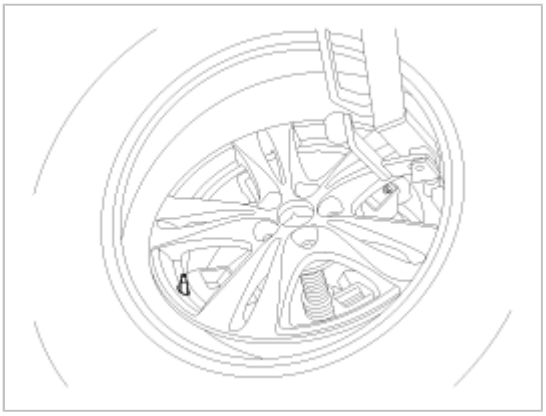
11. Apply tire soap or lubrication to the top and bottom tire beads.



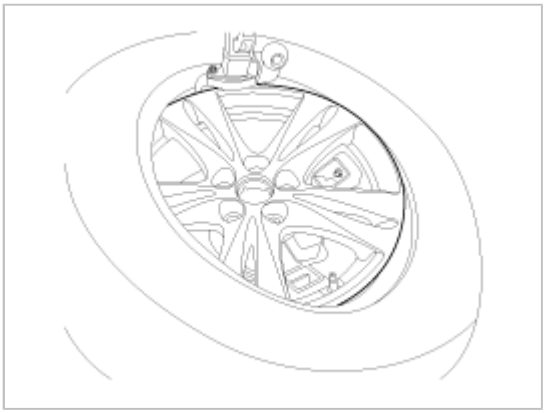
12. To fit the bottom bead, position the sensor at the 5 o'clock position relative to the head on the tire changing machine



13. Place the tire on the rim so the bottom bead touches the edge of the rim after the sensor (@6 o'clock). Rotate the rim clockwise, and push down on the tire at the 3 o'clock position to fit bottom bead.

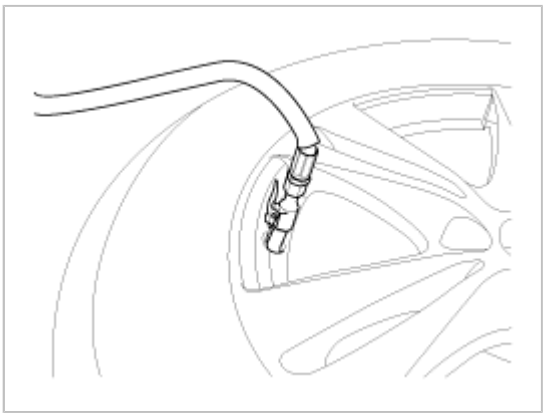


14. After bottom bead is on tire, rotate the rim until the sensor is at the 5 o'clock position relative to the head on the tire changing machine. Push down on the tire at the 3 o'clock position and rotate the rim clockwise to fit the top bead.



15. Inflate the tire until both beads seat.

Tire pressure
Front : 290 kPa (42 psi)
Rear : Wagon 325 Kpa (47 pis) / Van 350 Kpa (51 pis)

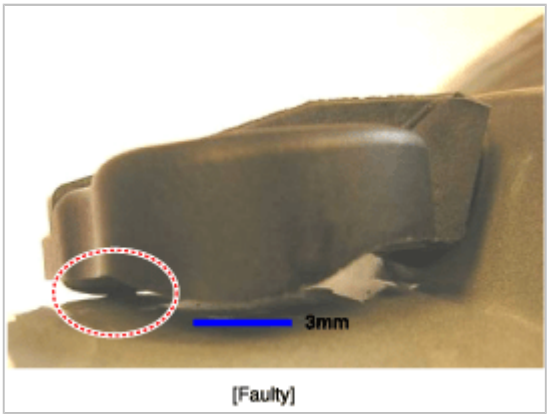


16. In the case of TPMS sensor failure, TPMS sensor needs learning. Faulty sensor is replaced new units, conduct learning of TPMS sensors.

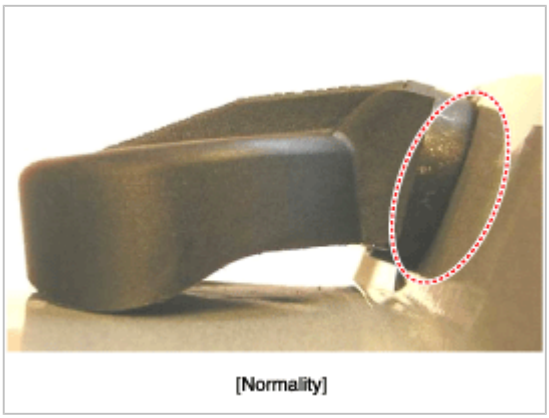
Inspection

After installing TPMS sensor test methods Thai

1. Sealing washer on the outside rim of hole to be compressed.
2. The lower part of the valve housing, a fixed place (no metal brackets) should be located.
3. Housing is at least one or more points on the surface of the rim should contact.
4. The rim of the housing mounting height shall not exceed the height of the chin.



[Faulty]



[Normality]

Diagnosis procedure by using diagnostic device

As manual for diagnosis methods by using diagnosis device, the main contents are as follows:

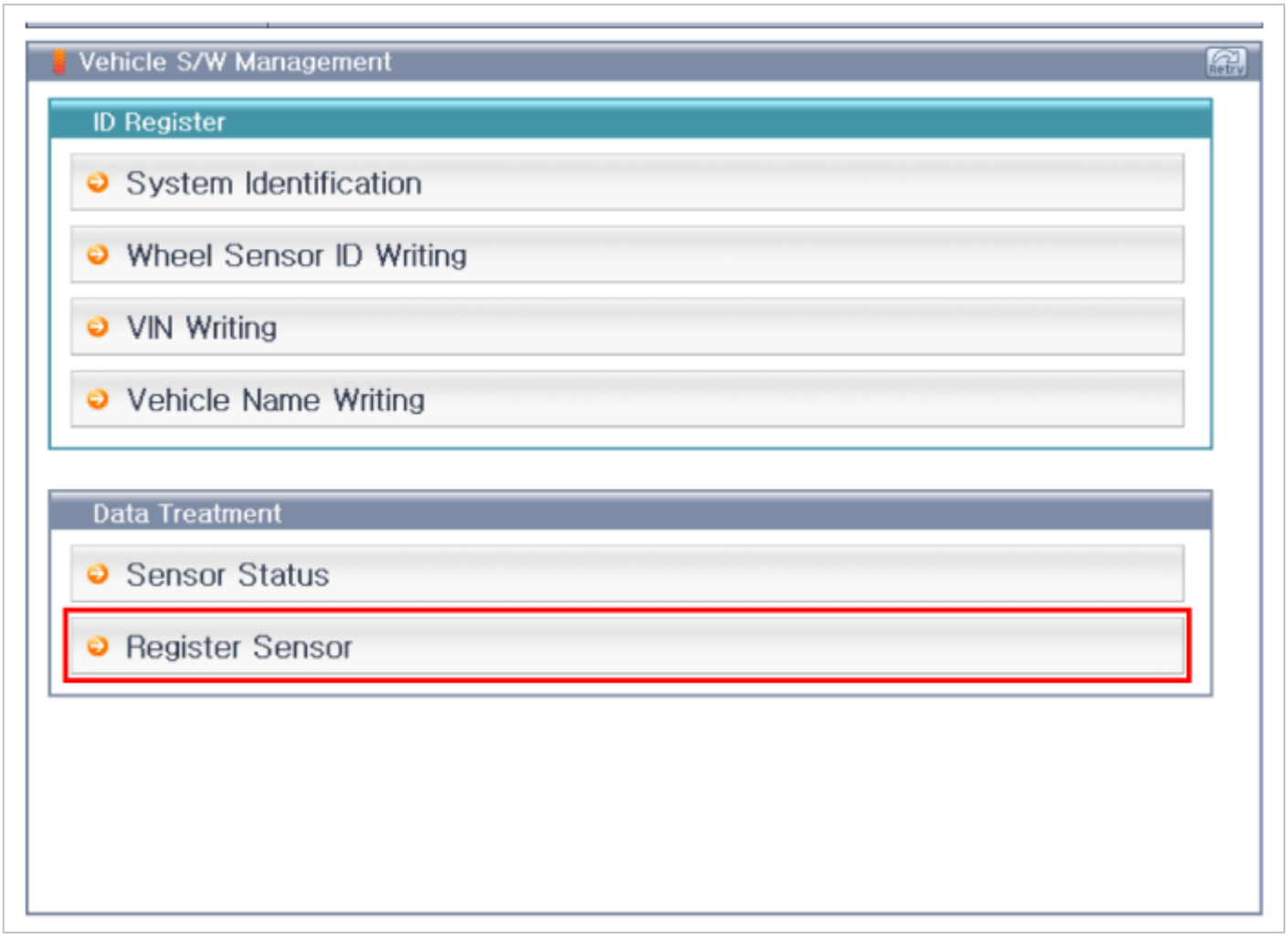
1. Connect self-diagnosis connector(16pins) located in the lower of driver side crash pad to self-diagnosis device, and then turn the self-diagnosis device after key is ON.
2. Select the "vehicle model" and "TPMS" on GDS vehicle selection screen, then select OK.

Diagnostic Procedure Using a Diagnostic Instrument

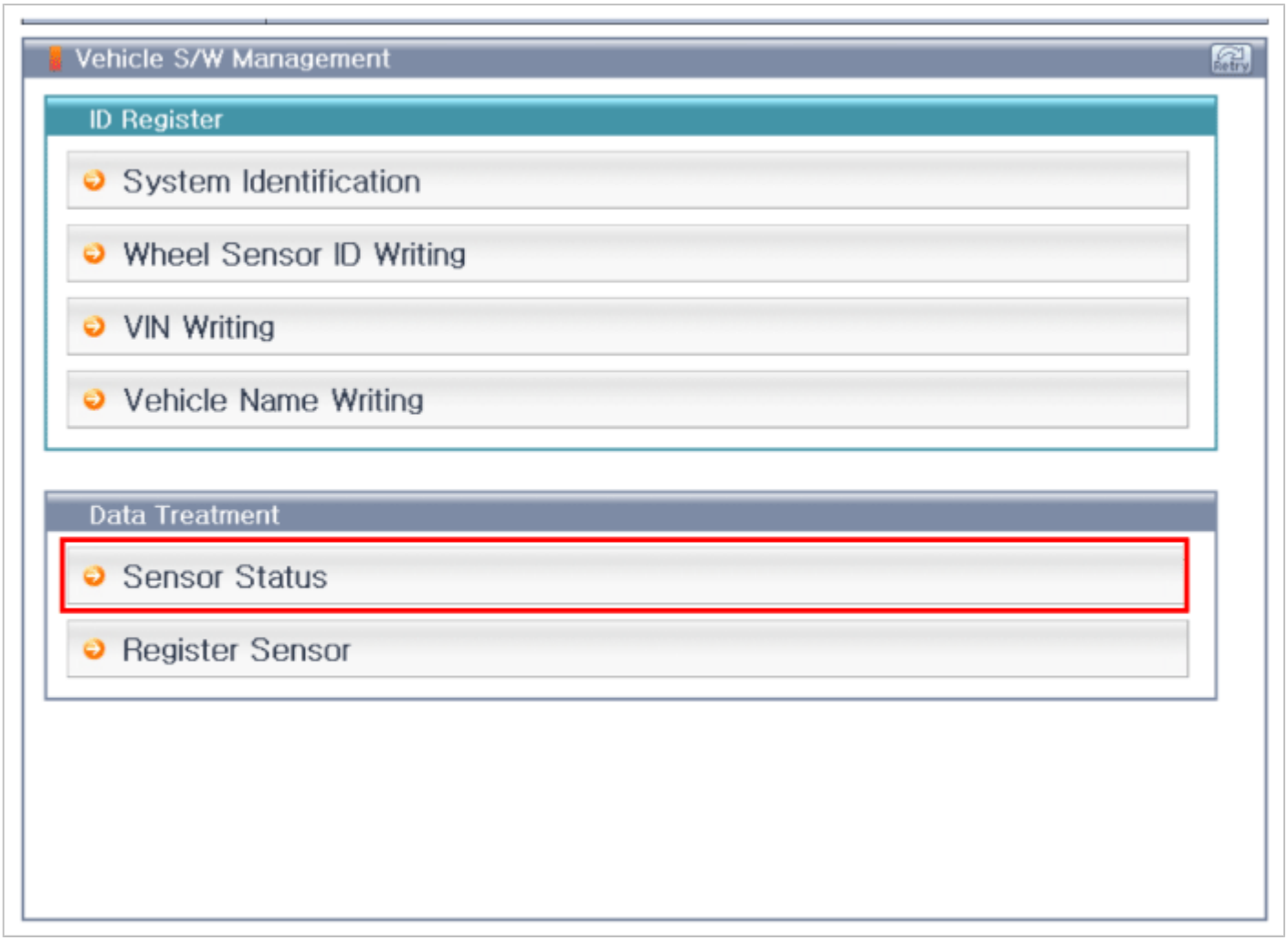
As manual for diagnosis methods by using diagnosis device, the main contents are as follows:

1. Connect self-diagnosis connector(16pins) located in the lower of driver side crash pad to self-diagnosis device, and then turn the self-diagnosis device after key is ON.
2. Select the "vehicle model" and "TPMS" on GDS vehicle selection screen, then select OK.

[Register Sensor initialization]



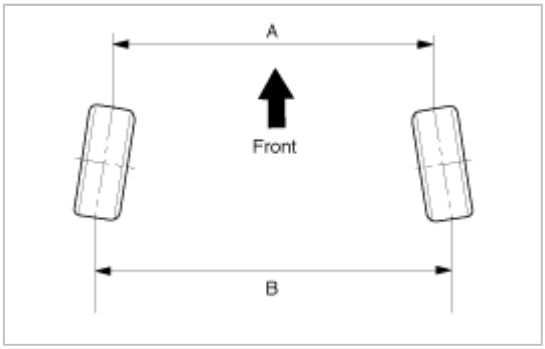
[Sensor Status initialization]


Vehicle S/W Management
ID Register
System Identification
Wheel Sensor ID Writing
VIN Writing
Vehicle Name Writing
Data Treatment
Sensor Status
Register Sensor

Front Wheel Alignment~2013-10-28

1. Replace the damaged suspension assembly before measuring the front wheel alignment.
2. If the camber or caster is not within the standard value, replace the damaged parts.

TOE-IN

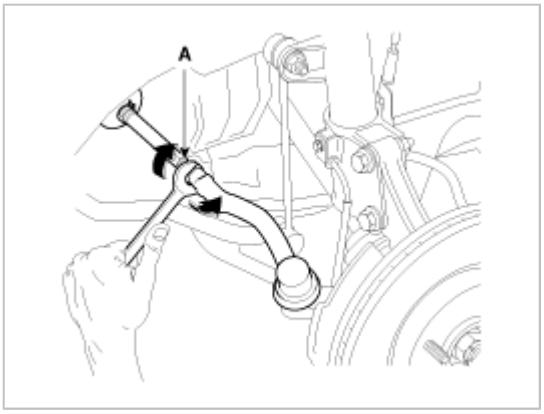


B - A →0: Toe in
B - A →0: Toe out

Adjustment

1. Loosen the tie rod end lock nut.
2. Remove the bellows clip to prevent the bellows from being twisted.
3. Adjust the toe by screwing or unscrewing the tie rod. Toe adjustment should be made by turning the right and left tie rods by the same amount.

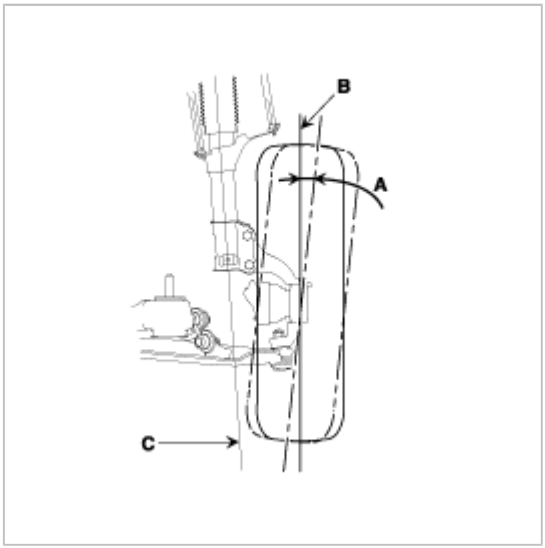
Total : 0.0˚±0.2˚
Individual : 0.0˚±0.1˚



CAMBER

When the wheel tilts out at the top, then the camber is positive (+).
When the wheel tilts in at the top, then the camber is negative (-).

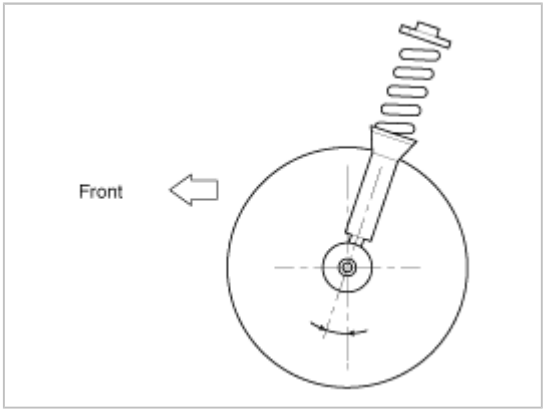
Camber and Caster are pre-set at the factory, so they do not need to be adjusted. If the camber and caster are not within the standard value, replace or repair the damaged parts and then inspect again.



Camber angle : -0.5˚±0.5˚

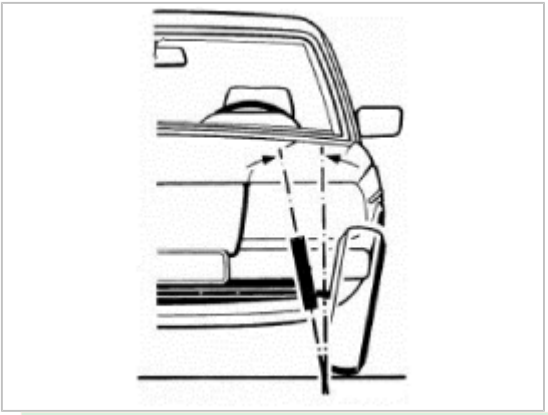
Caster is the tilting of the strut axis either forward or backward from vertical. A backward tilt is positive (+) and a forward tilt is negative (-).
Caster is pre-set at the factory and doesn't need to be adjusted. If the caster is not within the standard value, replace the bent or damaged parts.

Caster : 4.68˚±0.5˚



King-pin angle

King-pin angle : 11.84˚±0.5˚

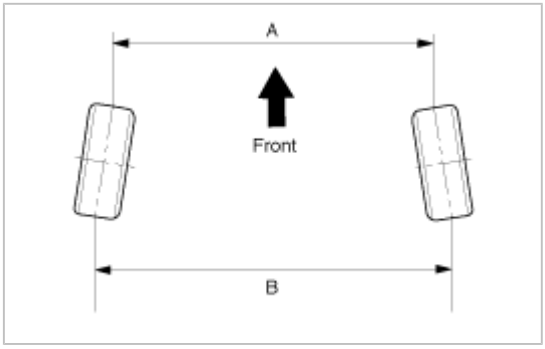


- The worn loose or damaged parts of the front suspension assembly must be replaced prior to measuring front wheel alignment.
- Caster are pre-set to the specified value at the factory and don't need to be adjusted.
- If the caster are not within specifications, replace bent or damaged parts.
- The difference of left and right wheels about the the caster must be within the range of 0° ± 0.5°.

Front Wheel Alignment2013-10-29~

1. Replace the damaged suspension assembly before measuring the front wheel alignment.
2. If the camber or caster is not within the standard value, replace the damaged parts.

TOE-IN

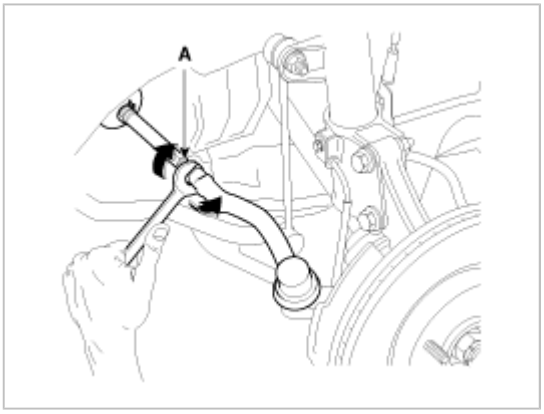


B - A →0: Toe in
B - A →0: Toe out

Adjustment

1. Loosen the tie rod end lock nut.
2. Remove the bellows clip to prevent the bellows from being twisted.
3. Adjust the toe by screwing or unscrewing the tie rod. Toe adjustment should be made by turning the right and left tie rods by the same amount.

Total : 0.1˚±0.2˚
Individual : 0.05˚±0.1˚



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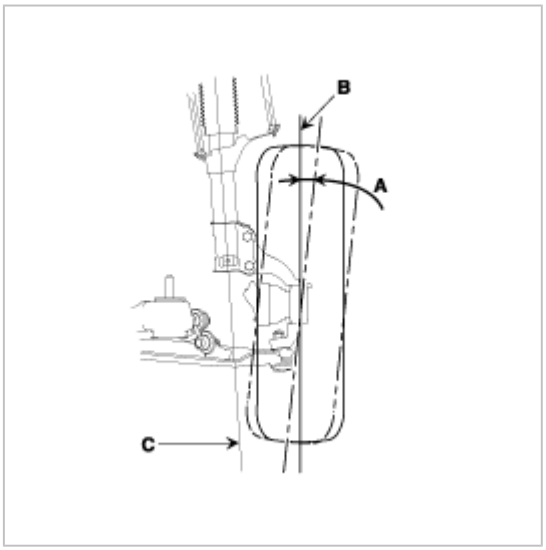

Camber angle : -0.5˚±0.5˚

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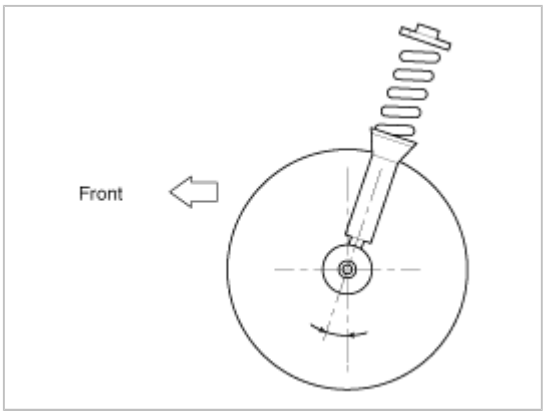
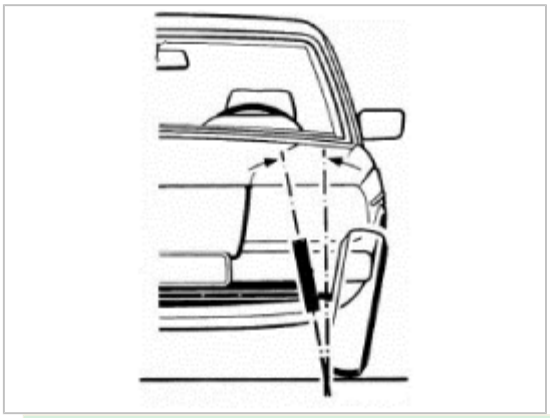
Caster : 4.68˚±0.5˚



King-pin angle

King-pin angle : 11.84˚±0.5˚



- The worn loose or damaged parts of the front suspension assembly must be replaced prior to measuring front wheel alignment.
- Caster are pre-set to the specified value at the factory and don't need to be adjusted.
- If the caster are not within specifications, replace bent or damaged parts.
- The difference of left and right wheels about the the caster must be within the range of 0° ± 0.5°.

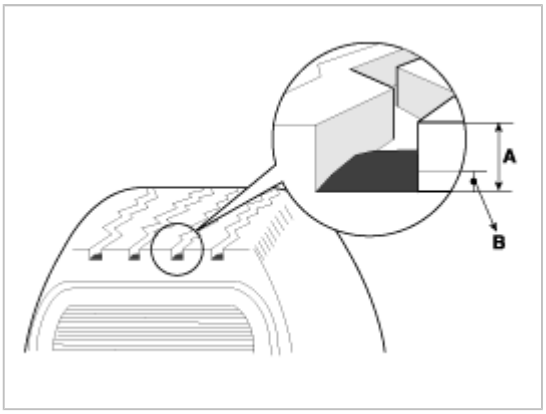
Tire Wear

1. Measure the tread depth of the tires.

   Tread depth [limit] : 1.6 mm (0.063 in)

2. If the remaining tread depth (A) is less than the limit, replace the tire.

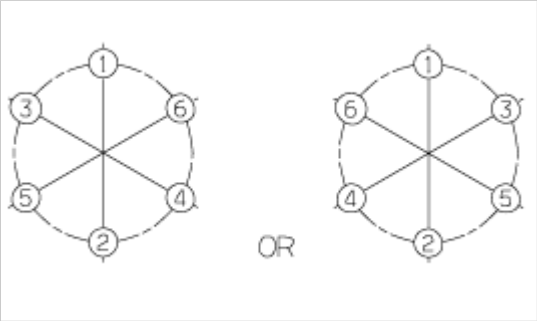
   When the tread depth of the tires is less than 1.6mm(0.063 in), the wear indicators (B) will appear.



Hub Nut Tightening Sequence

Tighten the hub nuts as follows.

Tightening torque :
90 ~ 110N.m (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)



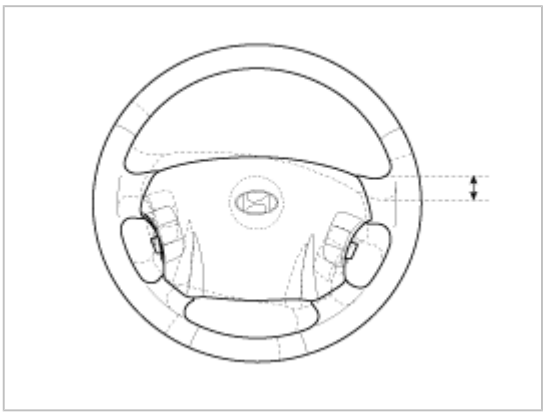
When using an impact gun , final tighteningtorque should be checked using a torque wrench.

Inspection

Steering wheel play inspection

1. Turn the steering wheel so that the front wheels can face straight ahead.
2. Measure the distance the steering wheel can be turned without moving the front wheels.

Standard value: 30mm (1.18in.) or less

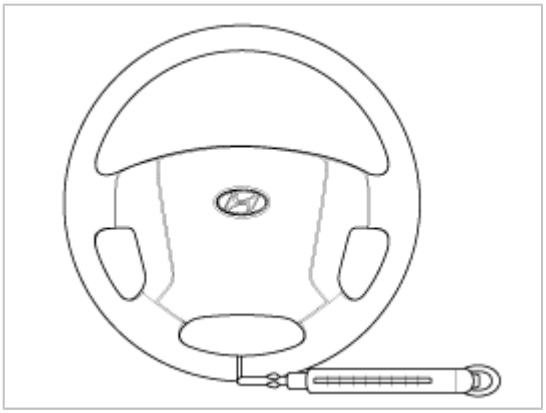


3. If the play exceeds standard value, inspect the steering column, shaft, and linkages.

Checking stationary steering effort

1. Position the vehicle on a level surface and place the steering wheel in the straight ahead position.
2. Start the engine and turn the steering wheel from lock to lock several times to warm up the power steering fluid.
3. Attach a spring scale to the steering wheel. With the engine speed 900 ~ 1100rpm, pull the scale and read it as soon as the tires begin to turn.

Standard value: 3.5kgf or less



4. If the measured value exceeds standard value, inspect the power steering gear box and pump.

Power steering fluid replacement

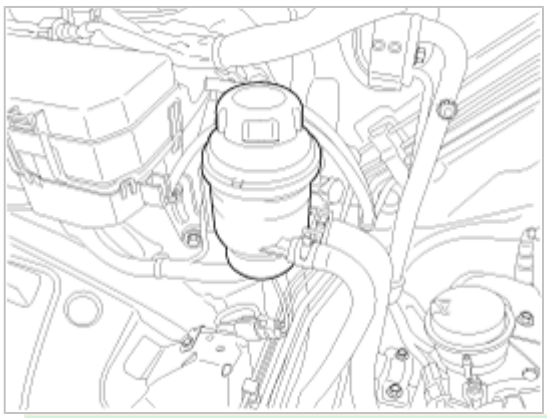
Always use genuine power steering fluid. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.

1. Raise the reservoir and then disconnect the return hose to drain the reservoir. Take care not to spill the fluid on the body and parts. Wipe off any spilled fluid at once.
2. Connect a tube of suitable diameter to the disconnected return hose, and put the hose end in a suitable container.
3. Jack up the front wheels and turn the steering wheel from the lock to lock until fluid stops running out of the tube.
4. Reconnect the return hose to reservoir.
5. Fill the reservoir with the power steering fluid and then bleed the power steering system.

Air bleeding

Always use genuine power steering fluid. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.

1. Fill the reservoir with the power steering fluid up to the level of 'COLD MAX' marked on the reservoir.



While conducting the following operations, keep replenishing the reservoir so that the fluid level can be always between the 'COLD MAX' and the 'COLD MIN' marked on the reservoir.

2. Jack up the front wheels.
3. Crank the engine 1 ~ 2times by turning the ignition key very quickly from the 'On' position to the 'Start' position, but do not start the engine.

Be careful not to start the engine. If starting the engine before performing the steps 3 through 4, it may cause an abnormal noise during power steering pump operation.

4. Turn the steering wheel from lock to lock 5 ~ 6 times for 15 ~ 20 seconds.
5. Start the engine and keep turning the steering wheel from lock to lock until air bubbles stop appearing in

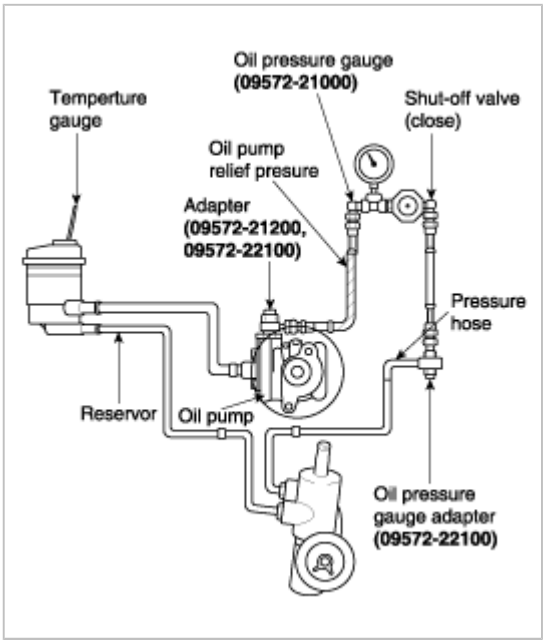
the reservoir with the engine idle.

6. Check the color and level of the power steering fluid in the reservoir and then replenish the reservoir up to the 'COLD MAX' level as required.

> If the fluid level moves up and down when turning the steering wheel, the fluid overflows out of the reservoir when the turning off the engine or the fluid has white color, it indicates that air bubbles have not been removed sufficiently from the power steering system. Therefore, repeat the steps 5 through 6 as required.

Oil pump relief pressure test

1. Disconnect the pressure tube from the power steering pump and then install the special tools between the pump and the pressure tube as illustration below.



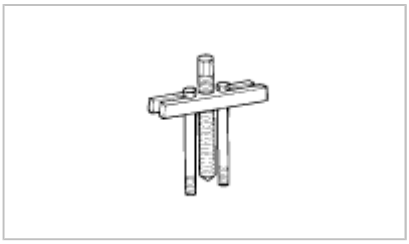
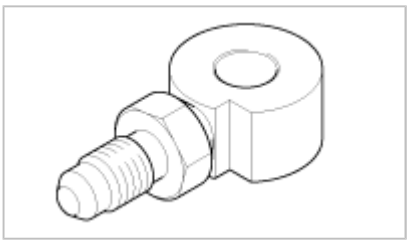
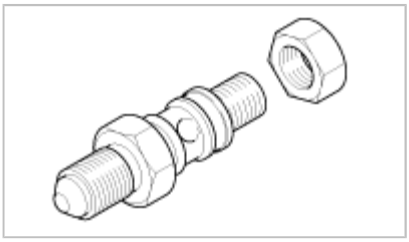
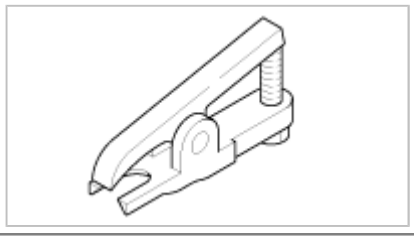
2. Start the engine and turn the steering wheel several times so that the fluid temperature can rise to approx. 50 ~ 60 ℃ (122 ℉).
3. Set the engine speed to approx. 1000rpm.
4. Close the shut-off valve of the special tools and measure the fluid pressure.

Relief pressure:
90 ~ 95kgf/cm (1280 ~ 1351psi, 8.8 ~ 9.3Mpa)

> Do not keep the shut-off valve on the pressure gauge closed for longer than 10 seconds.

5. Remove the special tools, and than connect the pressure tube to the pump by tightening the eye bolt.
6. Bleed the power steering system.

Special Service Tools

Tool (Number and Name)	Illustration	Use
09561-11001 Steering wheel puller		Removal of steering wheel
09572-21000 Oil pressure gauge		Measurement of oil pressure (Use with 09572-22100, 09572-21200)
09572-22100 Oil pressure gauge adaptor		Measurement of oil pressure (Use with 09572-21000, 09572-21200)
09572-21200 Oil pressure gauge adaptor		Measurement of oil pressure (Use with 09572-22100, 09572-22100)
09568-34000 Ball joint puller		Separation of tie-rod end ball joint

Specifications

Items		Specifications
Type		Hydraulic power assist
Steering gear	Type	Rack & Pinion
	Rack stroke	166 ~ 168mm (6.5354 ~ 6.6142 in.)
Oil pump	Type	Vane
	Relief pressure	90 ~ 95kgf/cm (1280 ~ 1351psi, 8.8 ~ 9.3Mpa)
Max. steering angle	Inner	44.67°±1°30'
	Outer	37.74°
Power steering fluid		PSF-3

Tightening Torques

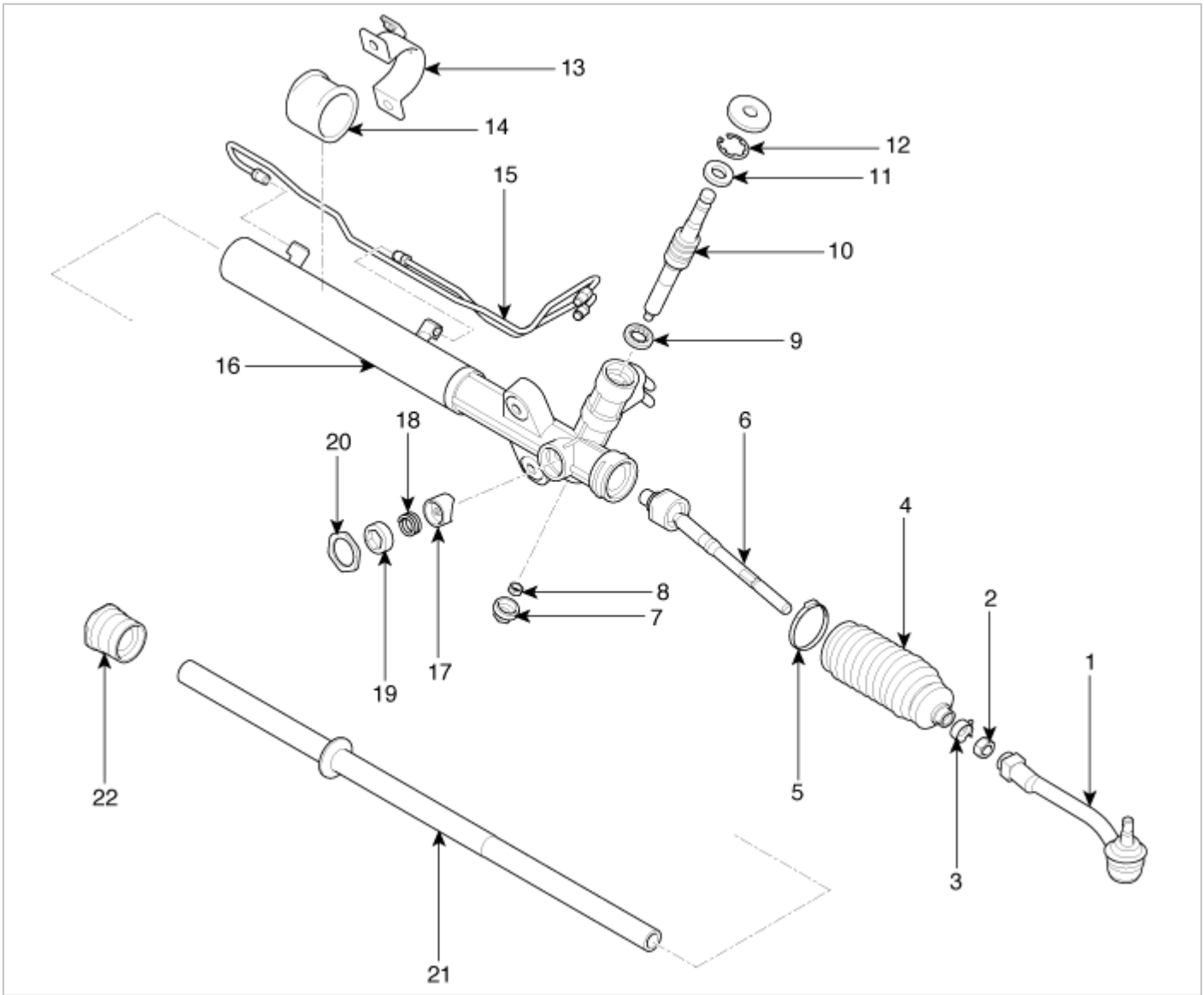
Items	Tightening torque		
	N.m	Kgf.m	Lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Steering wheel to column shaft	39.2 ~ 49.0	4.0 ~ 5.0	28.9 ~ 36.2
Steering column mounting bolts & nuts	12.7 ~ 17.7	1.3 ~ 1.8	9.4 ~ 13.0
Steering column to universal joint	14.7 ~ 19.6	1.5 ~ 2.0	10.8 ~ 14.5
Universal joint to steering gear	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Tie-rod end to knuckle	34.3 ~ 44.1	3.5 ~ 4.5	25.3 ~ 32.5
Steering gear box to sub-frame	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Pressure hose to oil pump	53.9 ~ 63.7	5.5 ~ 6.5	39.8 ~ 47.0
Oil pump to pump bracket	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5

Troubleshooting

Symptom	Probable cause	Remedy
Excessive play in steering	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage	Readjust
	Damaged V-belt	Replace
	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Twisted or damaged hoses	Correct the routing or replace
	Insufficient oil pump pressure	Repair or replace the oil pump
	Sticky flow control valve	Replace
	Excessive internal oil pump leakage	Replace the damaged parts
	Excessive oil leaks from rack and pinion in gear box	Replace the damaged parts
	Distorted or damaged gear box or valve body seals	Replace
Steering wheel does not return properly	Excessive turning resistance of tierod end	Replace
	Yoke plug excessively tight	Adjust
	Tie rod and/or ball joint cannot turn smoothly	Replace
	Loose mounting of gear box mounting bracket Worn steering shaft joint and/or	Retighten
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace
	Twisted or damaged hoses	Reposition or replace
	Damaged oil pressure control valve	Replace
	Damaged oil pump input shaft bearing	Replace
	Hissing Noise in Steering GearThere is some noise with all power steering systems.	

Noise	One of the most common is a hissing sound when the steering wheel is turned and the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition.	
Rattling or chucking noise in the rack and pinion	Interference with hoses from vehicle body	Reposition
	Loose gear box bracket	Retighten
	Loose tie rod end and/or ball joint	Retighten
	Worn tie rod and/or ball joint	Replace
Noise in the oil pump	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Loose pump mounting bolts	Retighten

Components

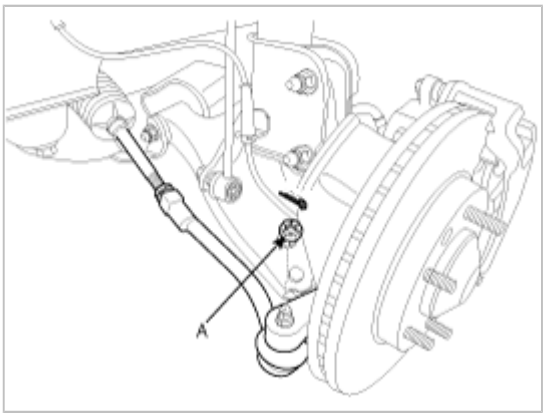


1. Tie-rod end	9. Roller bearing	16. Rack housing assembly
2. Lock nut	10. Valve assembly	17. Support yoke assembly
3. Bellows clip	11. Oil seal	18. Yoke spring
4. Bellows	12. Snap ring	19. Yoke plug
5. Bellows band	13. Mounting clamp	20. Lock nut
6. Tie-rod	14. Mounting rubber	21. Rack bar
7. Pinion plug	15. Feed tube	22. Rack bush
8. Pinion lock nut		

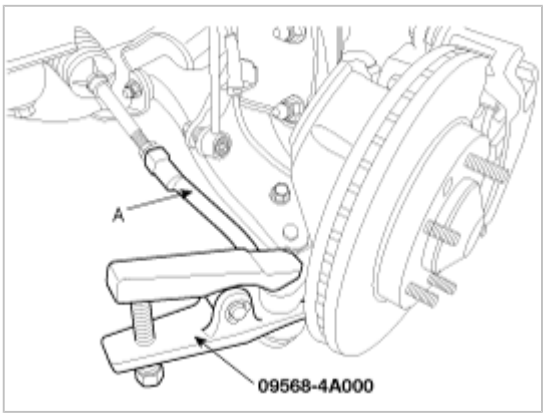
Replacement

1. Drain the power steering fluid.
2. Remove the both front wheels.
3. Remove the split pin and castle nut (A).

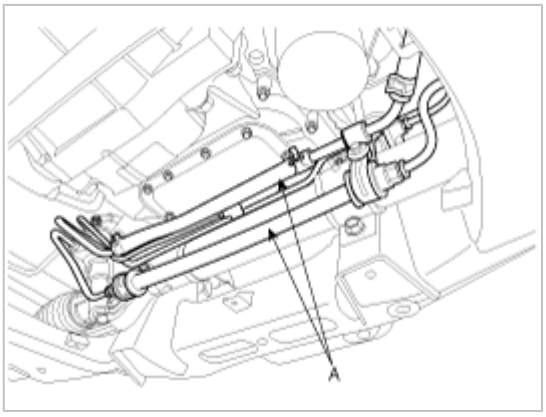
Tightening torque:
35 ~ 45N.m (3.5 ~ 4.5kgf.m, 25 ~ 32lb-ft)



4. Disconnect the tie-rod end (A) with the knuckle using a SST (09568-4A000).

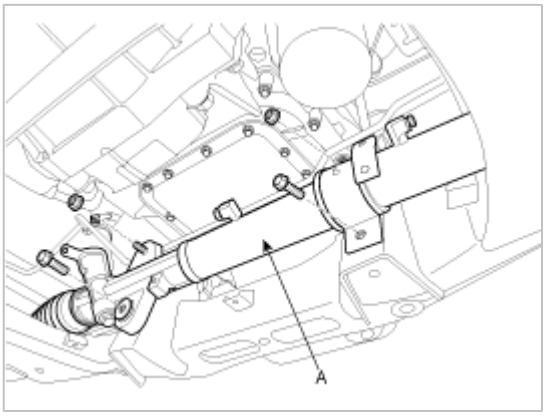


5. Loosen the tube bracket bolts and then disconnect the pressure and return tube (A) with the power steering gear box by loosening the flare nuts.



6. Remove the steering gear box (A) by loosening the mounting bolts and nuts.

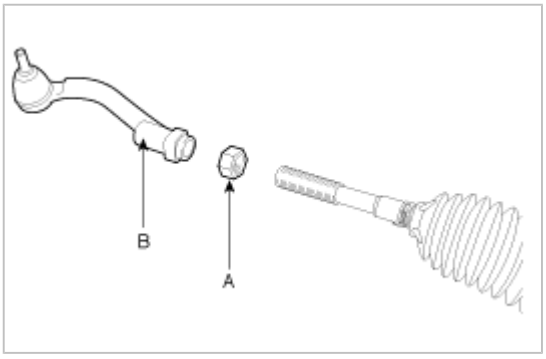
Tightening torque:
90 ~ 110N.m, (9.0 ~ 11.0kgf.m, 65 ~ 80lb-ft)



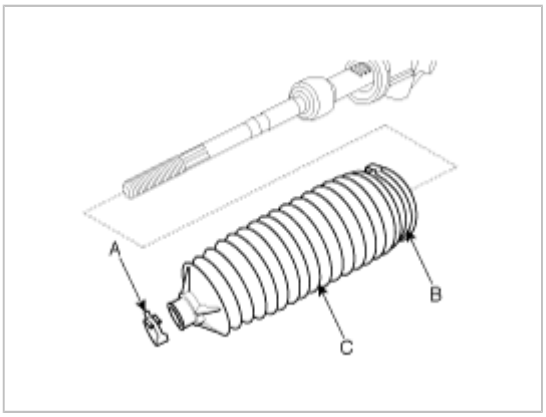
7. Installation is the reverse of the removal.
8. Fill the reservoir with the power steering fluid and then bleed the power steering system.
9. Inspect the front wheel alignment and adjust it if necessary.

Disassembly

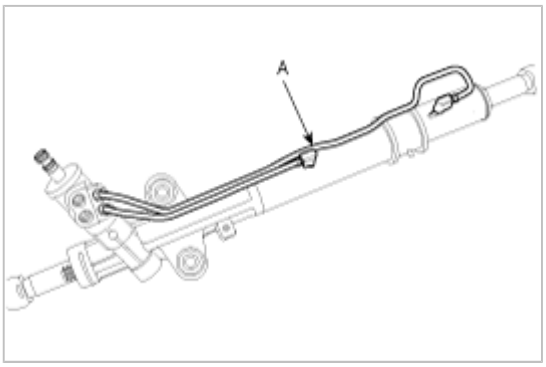
1. Loosen the lock nut (A) and then unscrew the tie-rod end (B) and lock nut from the tie-rod.



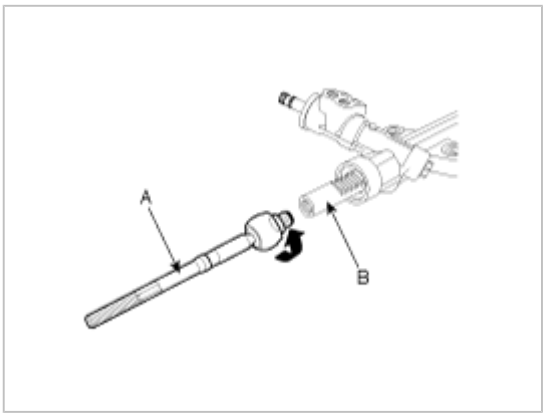
2. Loosen the lock nut (A) and then unscrew the tie-rod end (B) and lock nut from the tie-rod.



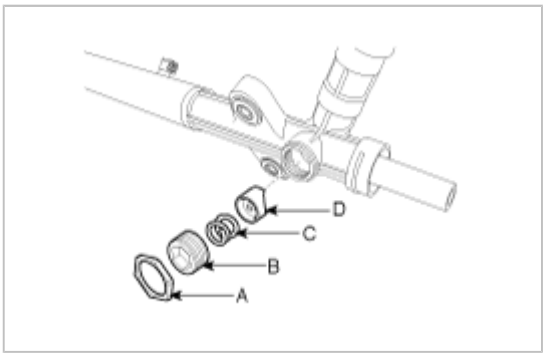
3. Remove the feed tubes (A) from the steering gear box.



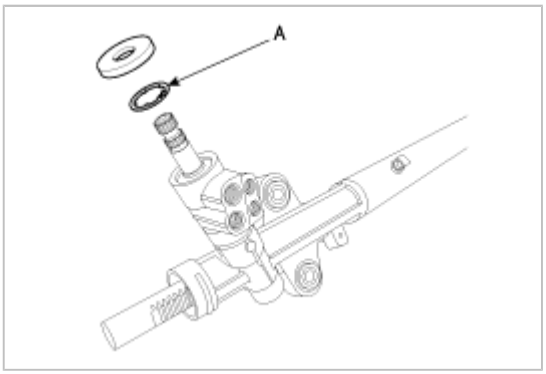
4. Unscrew the tie-rod (B) from the rack bar (A).



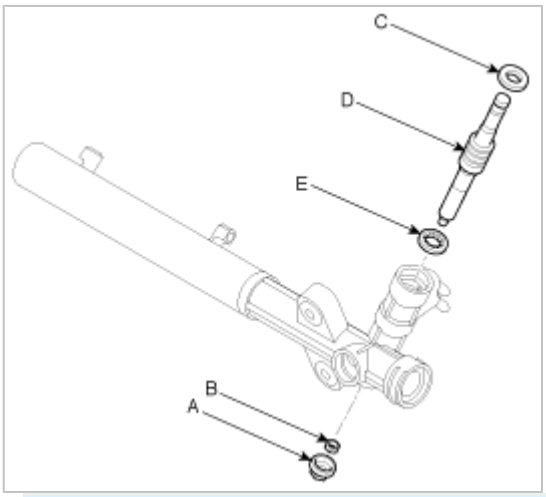
5. Remove the lock nut (A) and yoke plug (B) and then pull out the yoke spring (C) and support yoke (D).



6. Remove the snap ring (A).

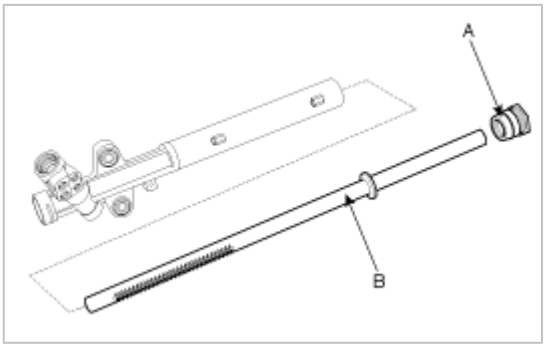


7. Remove the pinion plug (A) and lock nut (B).
8. Remove the oil seal (C), valve assembly (D), and bearing (E).



Do not allow dust, dirt, or foreign materials to contact the disassembled parts and inside of the valve assembly housing.

9. Unscrew the rack bush (A) and pull the rack bar (B) out of the rack housing.



Inspection

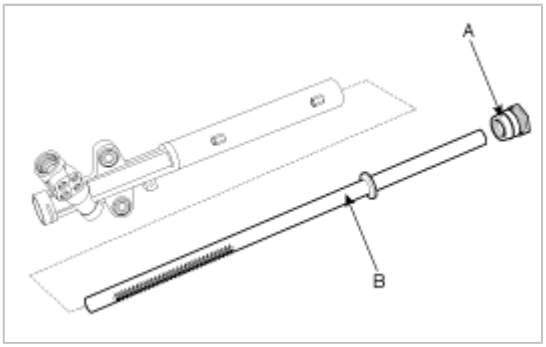
1. Rack bar
   A. Check the rack gear for damage.
   B. Check the rack bar for bend and deformation.
2. Valve assembly
   A. Check the valve assembly for wear, burr, and damage.

Reassembly

- Clean the disassembled parts with a solvent and then dry them with compressed air. Do not dip the rubber parts in a solvent.
- Always replace the O-ring and the oil seal with new ones before reassembly.

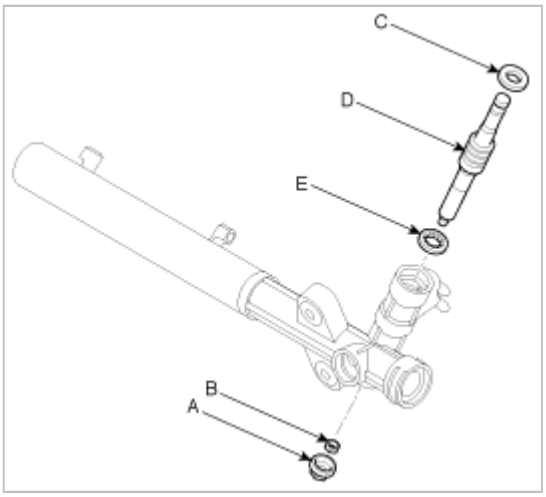
1. Apply the grease to the rack gear teeth and then insert the rack bar (A) into the rack hosing.
2. Assemble the rack bush (A) to the rack hosing end.

Tightening torque:
110 ~ 130N.m (11.0 ~ 13.0kgf.m, 80 ~ 94lb-ft)

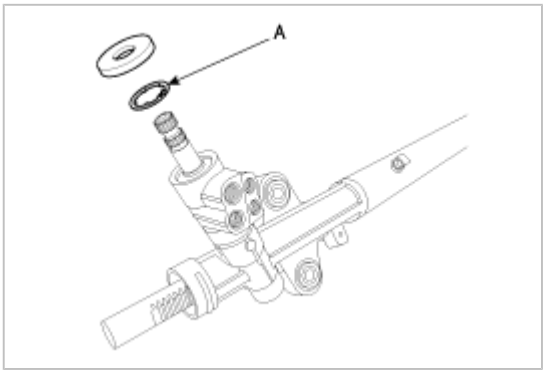


3. Assemble the bearing (E), valve assembly (D), and oil seal (C) and then tighten the lock nut (B) and pinion plug (A).

Tightening torque
Lock nut: 40 ~ 50N.m (4.0 ~ 5.0kgf.m, 29 ~ 36lb-ft)
Pinion plug: 45 ~ 55N.m (4.5 ~ 5.5kgf.m, 33 ~ 40lb-ft)



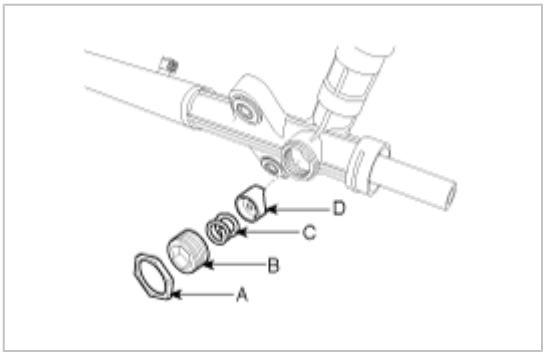
4. Assembly the snap ring (A) and dust cap.



5. Insert the support yoke (D) and yoke spring (C) into the housing.

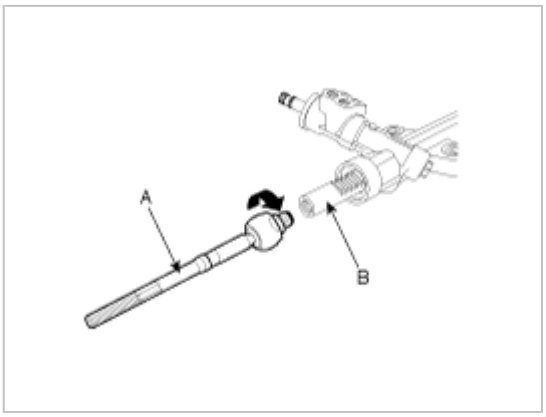
6. Torque the yoke plug to 70 ~ 120N.m(7.0 ~ 12.0kgf.m, 51 ~ 87lb-ft) and then loosen it completely. Torque the yoke plug to 60 ~ 65 N.m (6.0 ~ 65kgf.m, 43 ~ 47) again and then loosen it by approx. 15°.
7. Tighten the lock nut (A) while holding the yoke plug.

Tightening torque:
50 ~ 60N.m (5.0 ~ 6.0kgf.m, 36 ~ 43kgf.m)

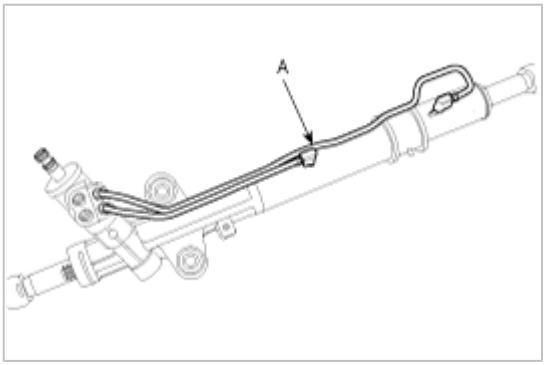


8. Assemble tie-rod (A) to rack bar (B).

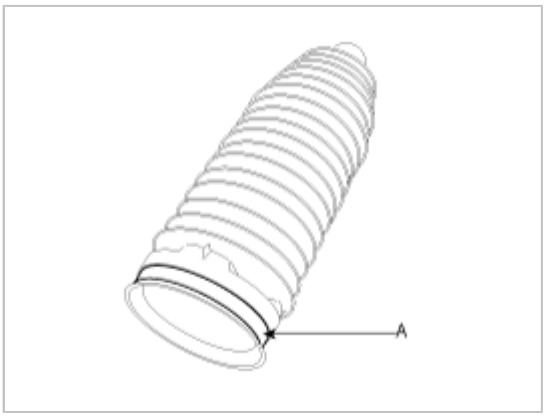
Tightening torque:
120 ~ 140 N.m (12.0 ~ 14.0kgf.m, 87 ~ 101lb-ft)



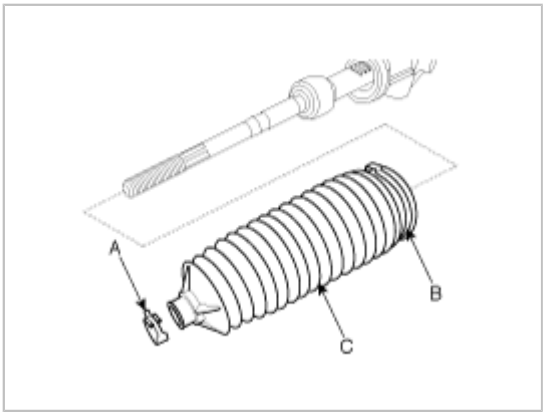
9. Install the feed tubes (A) to the steering gear box.



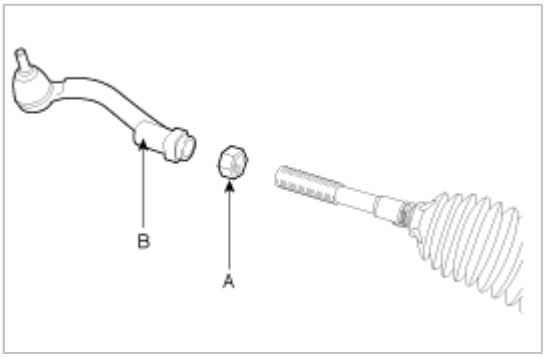
10. Assemble new bellows band (A) to the bellows.



11. Apply the sealant to the bellows mating surface of the rack housing. Assemble the bellows (C) to rack housing and then tighten the bellows clip (A) and band (B).

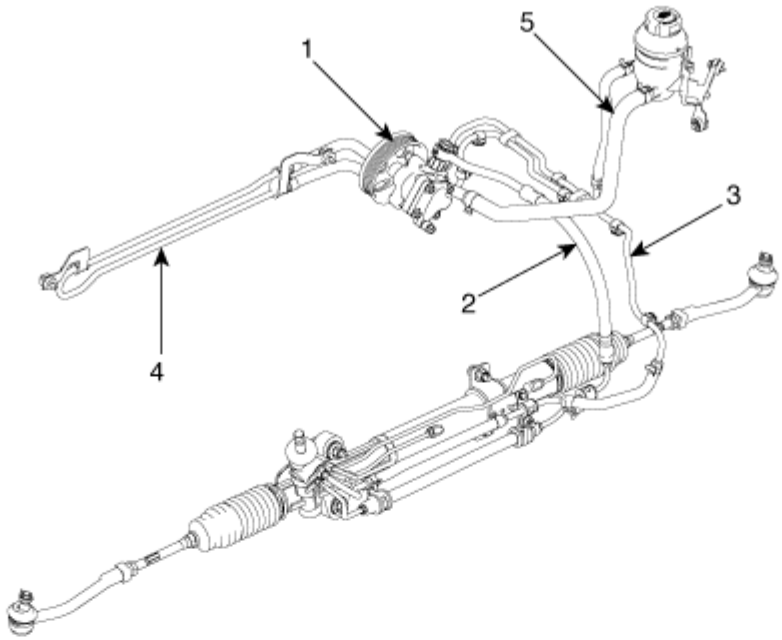


12. Assemble the lock nut (A) and tie rod end (B) to tie- rod.

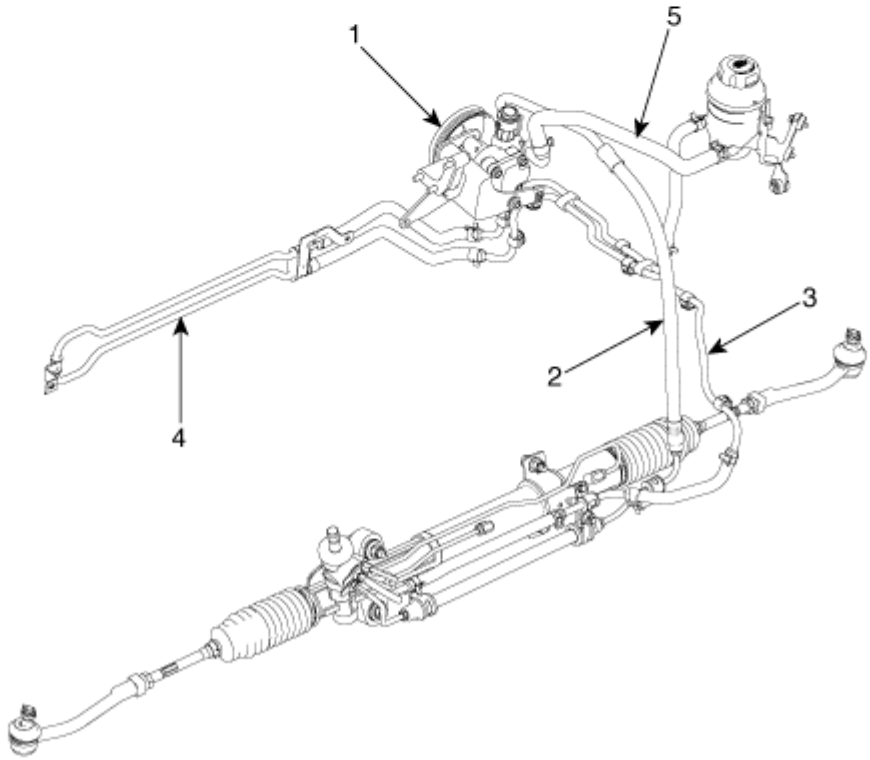


Components

[CRDI]

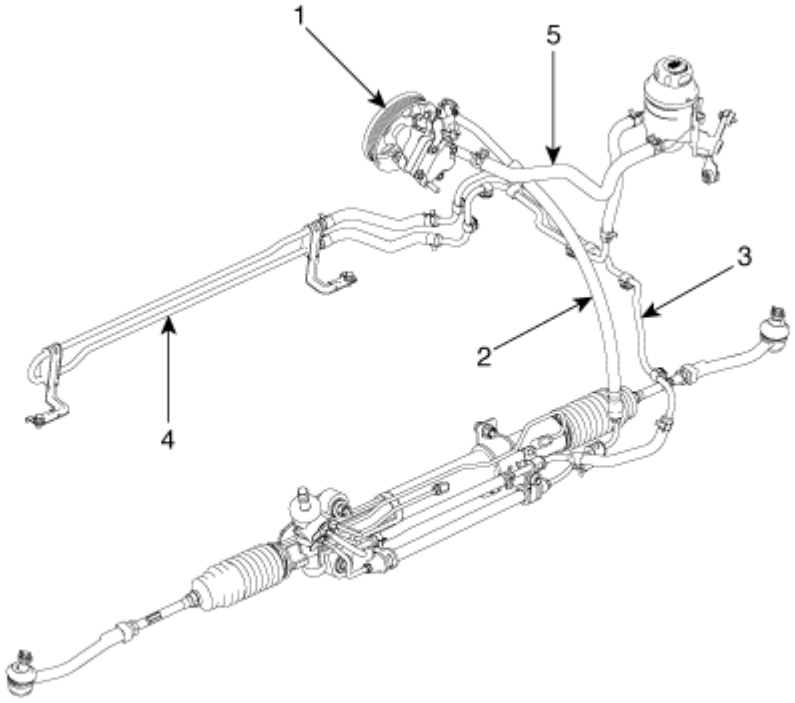


[TCI]



1. Oil pump 2. Pressure hose 3. Return hose & tube	4. Cooler tube 5. Suction hose

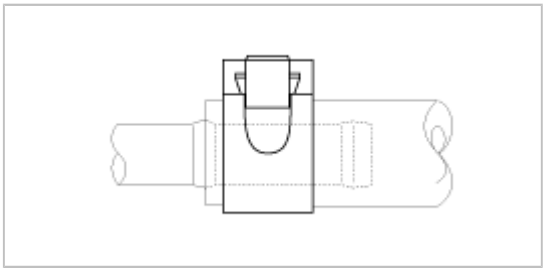
[MPI]



1. Oil pump 2. Pressure hose 3. Return hose & tube	4. Cooler tube 5. Suction hose

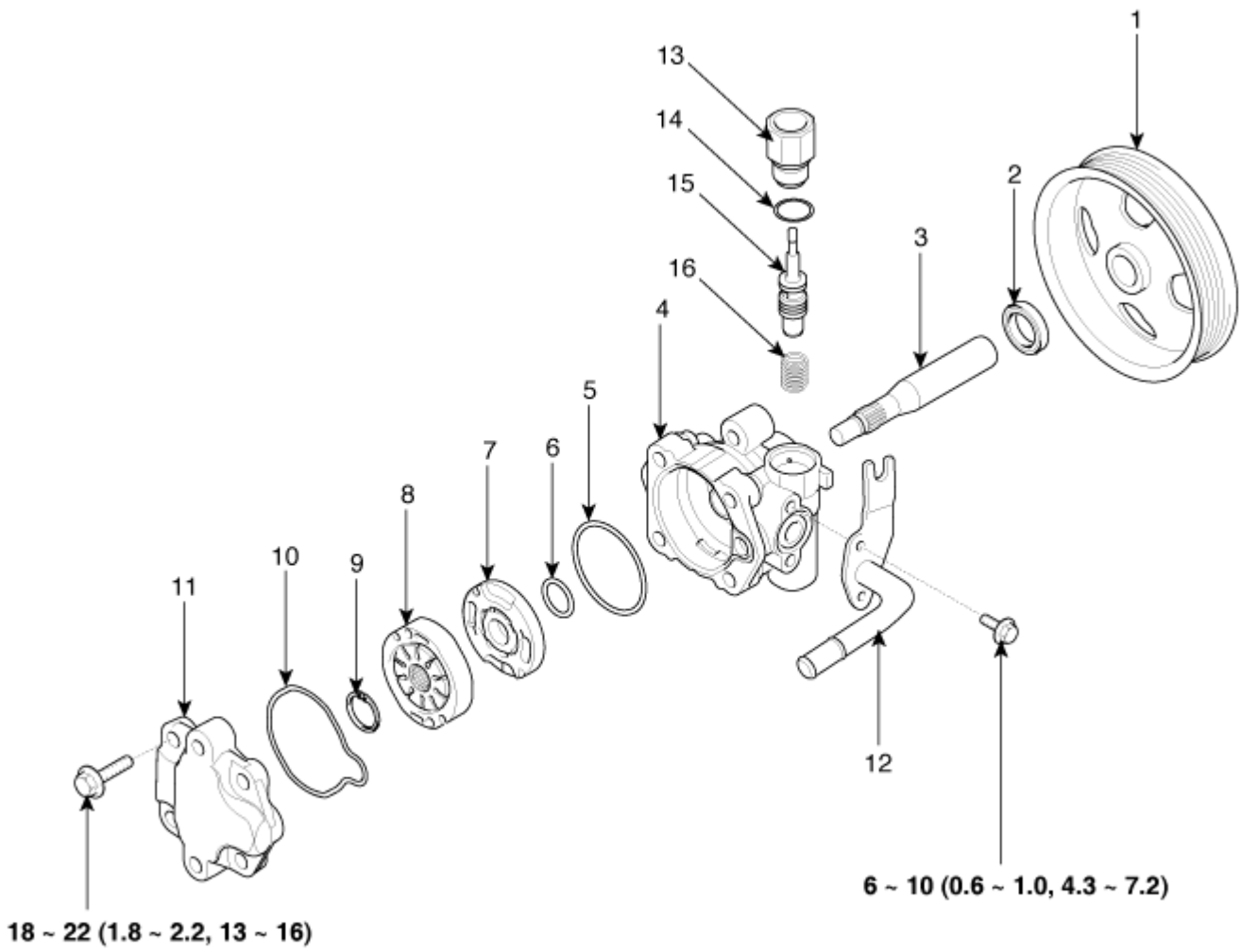
Replacement

- Refer to the components illustration during removal or installation.
- When installing, be sure to connect the between hose to tube using a clamp as shown in the illustration.



- Check all clamps for deterioration or deformation; replace the clamp with a new one if necessary.
- Add the recommended power steering fluid and bleed the power steering system. (Refer to the Air bleeding)

Components



Torque : Nm (Kgf.m, lb-ft)

1. Drive pulley	9. Snap ring
2. Oil seal	10. O-ring
3. Drive shaft	11. Rear cover assembly
4. Casing assembly	12. Suction pipe
5. O-ring	13. Connector assembly
6. O-ring	14. O-ring
7. Side plate	15. Relief valve assembly
8. Rotor & Vane	16. Spring

Replacement

1. Drain the power steering fluid.
2. Disconnect the oil pressure switch. (Gasoline 2.4L only)
3. Remove the drive belt.
4. Disconnect the pressure tube from the oil pump by loosening the eye-bolt.

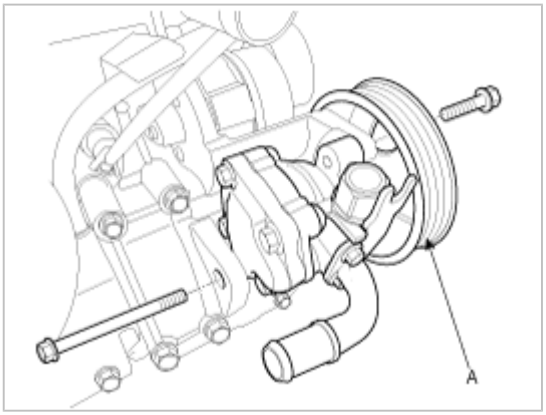
Tightening torque:
55 ~ 65N.m (5.5 ~ 6.5kgf.m, 40 ~ 47lb-ft)

5. Remove the oil pump (A) by loosening the mounting bolts.

Tightening torque
CRDI: 20 ~ 27N.m (2.0 ~ 2.7kgf.m, 14 ~ 20lb-ft)

TCI:
Long bolt: 20 ~ 27N.m (2.0 ~ 2.7kgf.m, 14 ~ 20lb-ft)
Short bolt: 25 ~ 33N.m (2.5 ~ 3.3kgf.m, 18 ~ 24lb-ft)

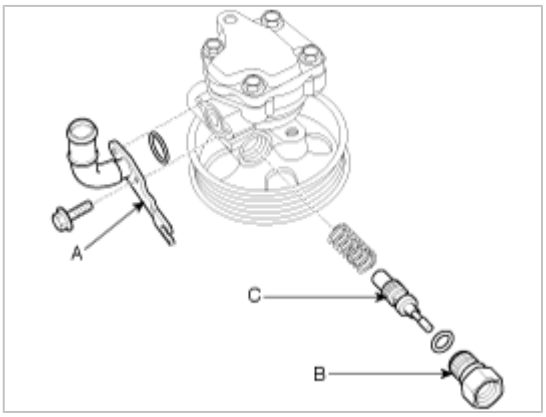
MPI: 17 ~ 26Nm (1.7 ~ 2.6kgf.m, 12 ~ 19lb-ft)



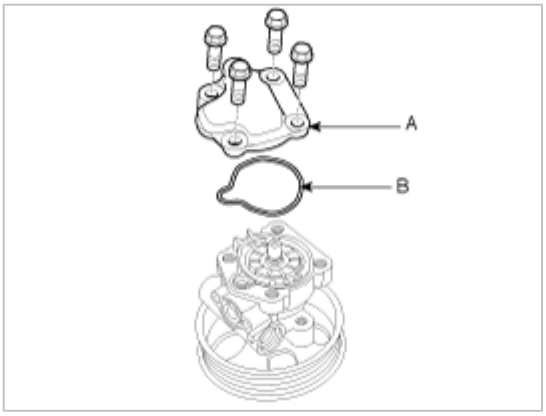
6. Installation is the reverse of the removal.
7. Add the recommended power steering fluid and bleed the power steering system. (Refer to the Air bleeding)

Disassembly

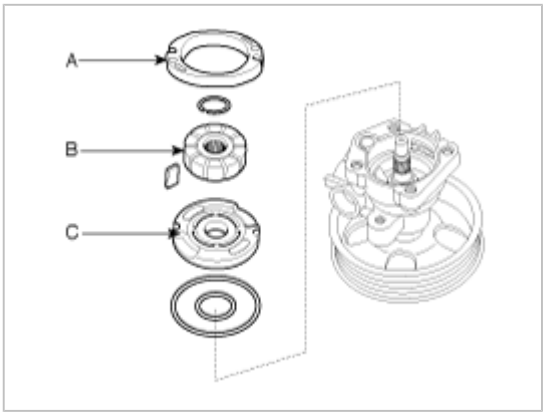
1. Remove the suction pipe (A) and O-ring.
2. Unscrew the connector assembly (B) and then pull the flow control valve (C) and spring out of the pump body.



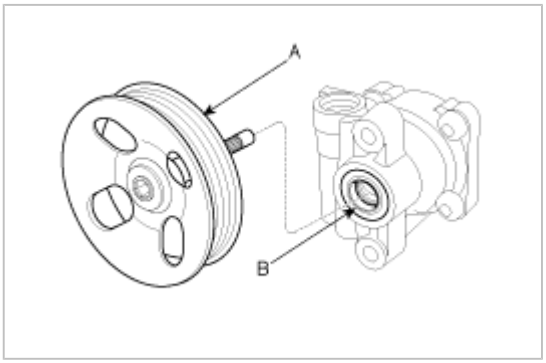
3. Remove the pump cover (A) and the O-ring (B).



4. Remove the cam ring (A).
5. Remove the snap ring and then pull the rotor & vane (B), side plate (C), and O-ring out of the pump body.



6. Remove the pump pulley & shaft (A) and the oil seal (B).



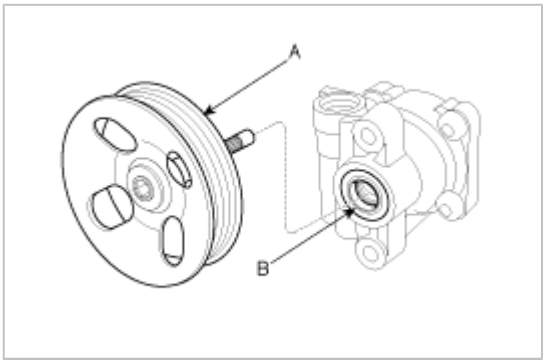
Inspection

1. Check that the flow control valve is not bent.
2. Check the shaft for wear and damage.
3. Check the V belt for wear and deterioration.
4. Check the grooves of the rotor and vanes for stratified abrasion.
5. Check the contact surface of the cam ring and vanes for stratified abrasion.
6. Check vanes for damage.
7. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

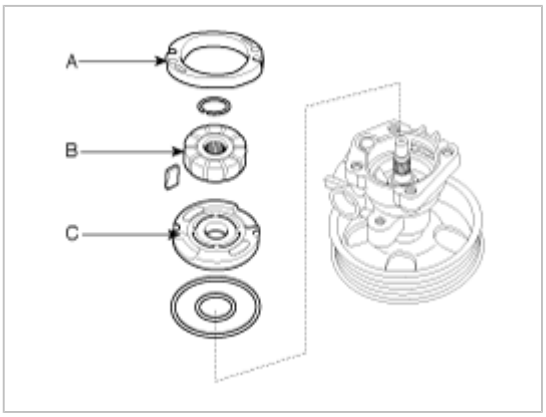
Reassembly

- Clean the disassembled parts with a solvent and then dry them with compressed air. Do not dip the rubber parts in a solvent.
- Always replace the O-ring and the oil seal with new ones before reassembly.

1. Assemble the new oil seal (B) and pulley & shaft (A) to the pump body.



2. Assemble the O-rings, side plate (C), and rotor & vane (B) to the pump body.
3. Assemble the cam ring (A) to pump body.



4. Assemble the O-ring (B) and pump rear cover (A) to the pump body.

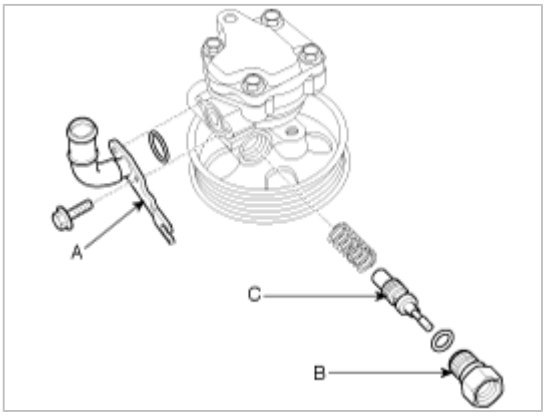
Tightening torque:
18 ~ 22N.m (1.8 ~ 2.2kgf.m, 13 ~ 16lb-ft)

5. Assemble a new O-ring to the connector assembly (B).
6. Insert the spring and flow control valve (C) into the pump body and then tighten the connector assembly (B).

Tightening torque:
70 ~ 80N.m (7.0 ~ 8.0kgf.m, 51 ~ 58lb-ft)

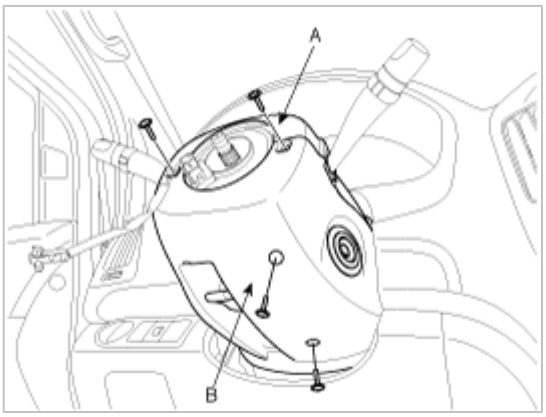
7. Assemble a new O-ring and suction pipe (A) to the pump body.

Tightening torque:
6 ~ 10N.m (0.6 ~ 1.0kgf.m, 4.3 ~ 7.2lb-ft)

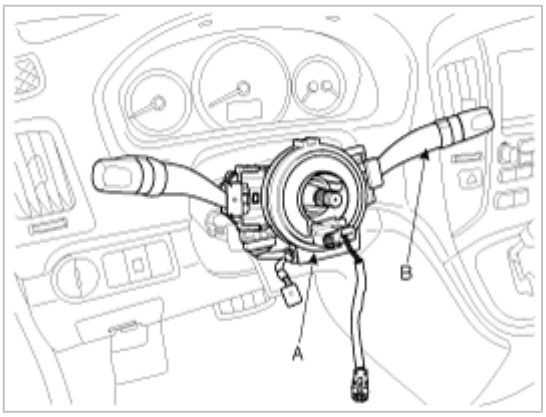


Replacement

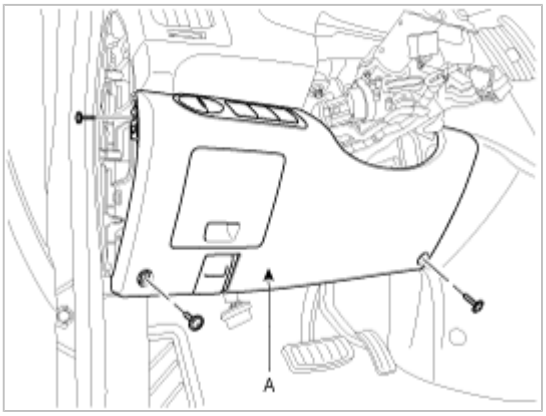
1. Remove the steering wheel. (Refer to steering wheel)
2. Remove the steering column upper and lower shroud (A, B).



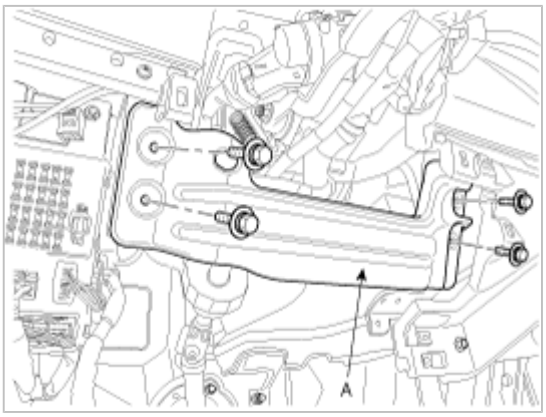
3. Remove the clock spring (A) and multifunction switch (B).



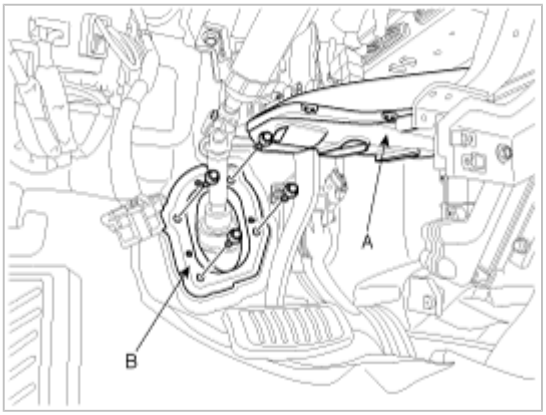
4. Remove the lower crash pad (A).



5. Remove the reinforce panel (A) by loosening the mounting bolts.

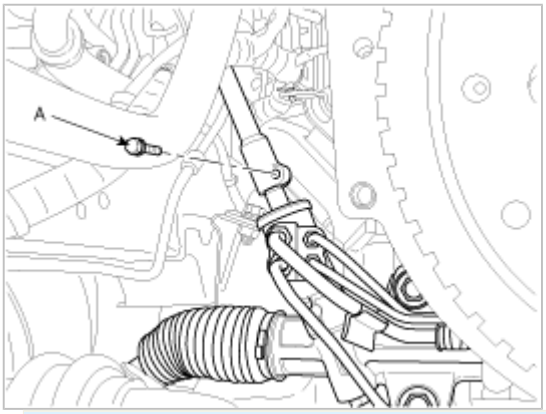


6. Remove the shower duct (A) and steering column dust cover (B) bolts.



7. Loosen the bolt (A) and then disconnect the universal joint assembly with the steering column assembly.

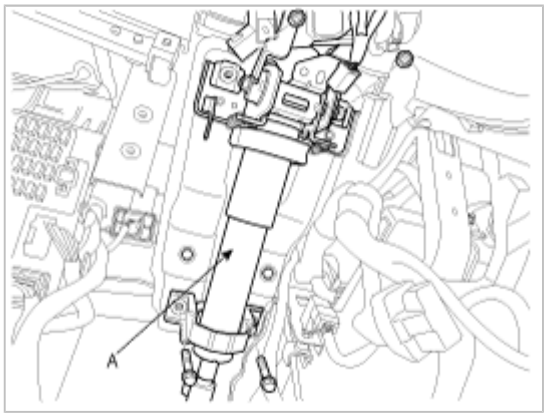
Tightening torque:
30 ~ 35N.m (3.0 ~ 3.5kgf.m, 22 ~ 25lb-ft)



Keep the neutral-range to prevent the damage of the clock spring inner cable when you handlethe steering wheel.

8. Disconnect all connectors connected to the steering column assembly.
9. Remove the steering column assembly (A) by loosening the mounting bolts and nuts.

Tightening torque Nm:
13 ~ 18N.m (1.3 ~ 1.8kgf.m, 9 ~ 13lb-ft)

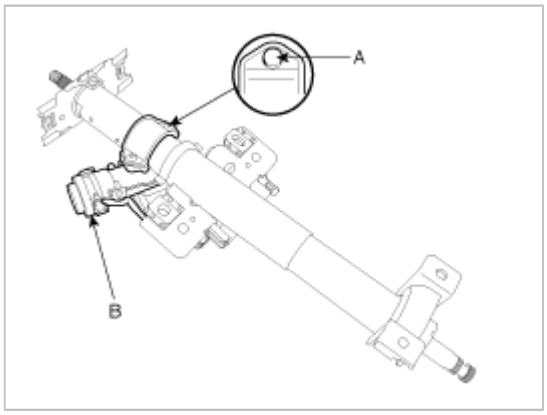


10. Installation is the reverse of removal.

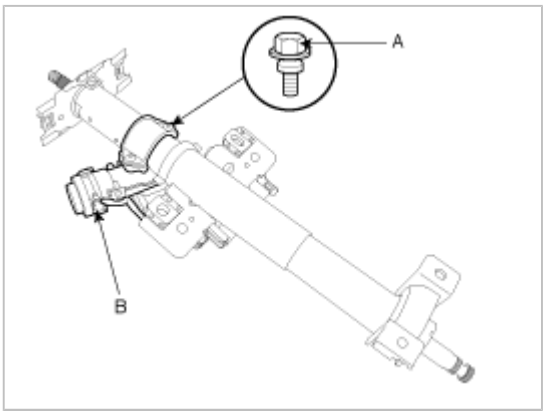
> When installing the clock spring, refer the RT group to prevent the damage of clock spring inner cable.

Disassembly And Reassembly

1. Make a groove on the head of special bolts (A) by a punch.
2. Loosen the special bolt using a screw driver and then remove the key lock assembly (B) from the steering column assembly.



3. Reassembly is the reverse of the disassembly. When reassembling the key lock assembly, install the key lock assembly to the steering column and then tighten the new special bolts until its head (A) is cut off.

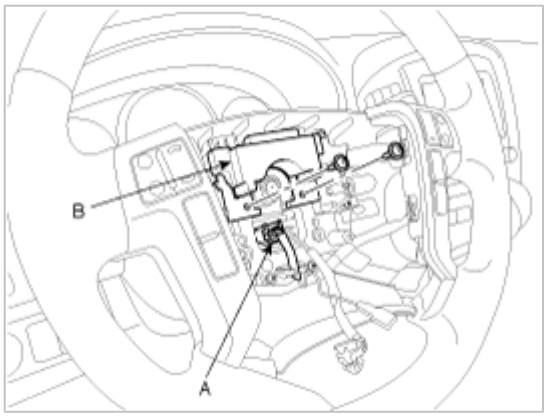


Inspection

1. Check the steering column and universal joint for play, damage, and smooth operation.
2. Check the key lock assembly for proper operation and replace it if necessary.

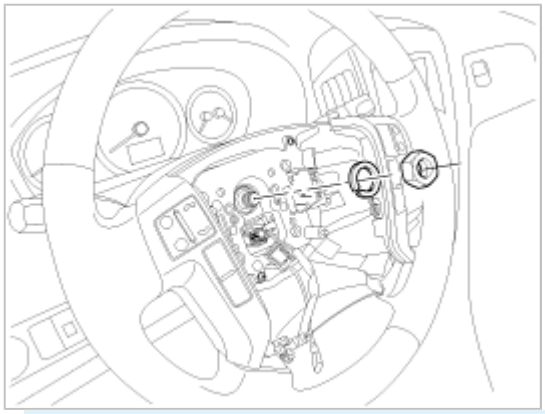
Replacement

1. Disconnect the negative cable from the battery and then wait for at least 30 seconds.
2. Turn the steering wheel so that the front wheels can face straight ahead.
3. Remove the DAB module (or Horn pad). (Refer to RT group)
4. Disconnect the remote switch connector (A) and remove the dynamic damper (B) by loosening the bolts.

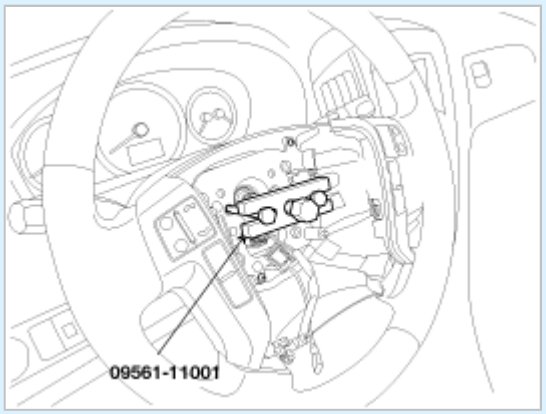


5. Loosen the lock nut and then remove the steering wheel using a SST (09561-4H000).

Tightening torque:
40 ~ 50N.m (4.0 ~ 5.0kgf.m, 29 ~ 36lb-ft)



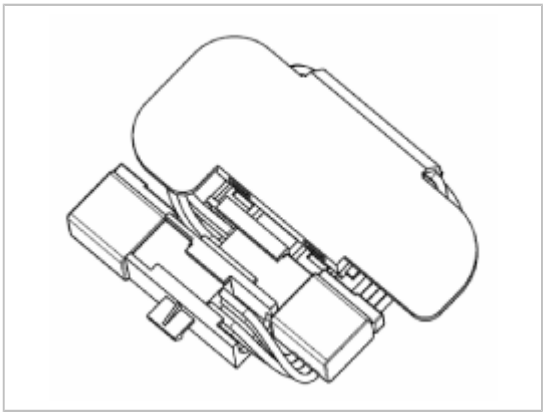
Do not hammer on the steering wheel to remove it; it may damage the steering column.



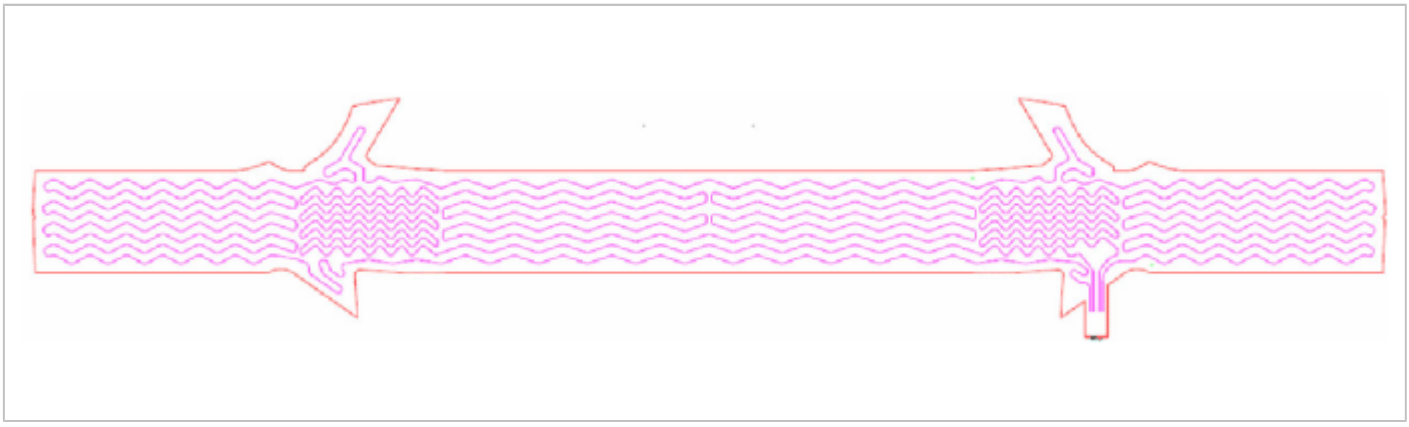
6. Installation is the reverse of the removal.

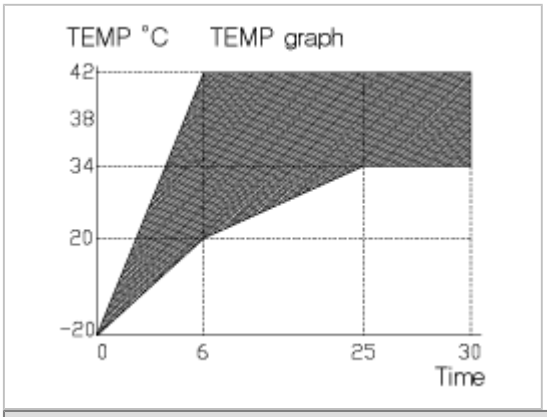
Description

1. Heated control unit



Heated pad

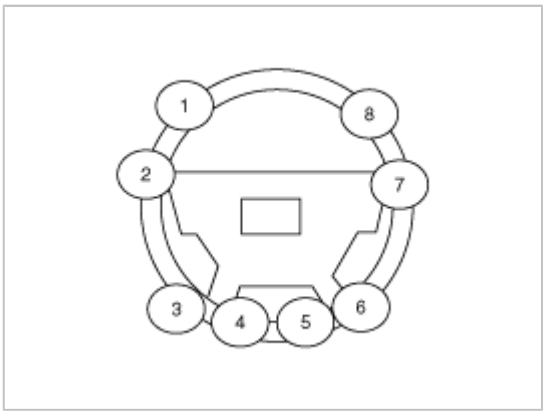




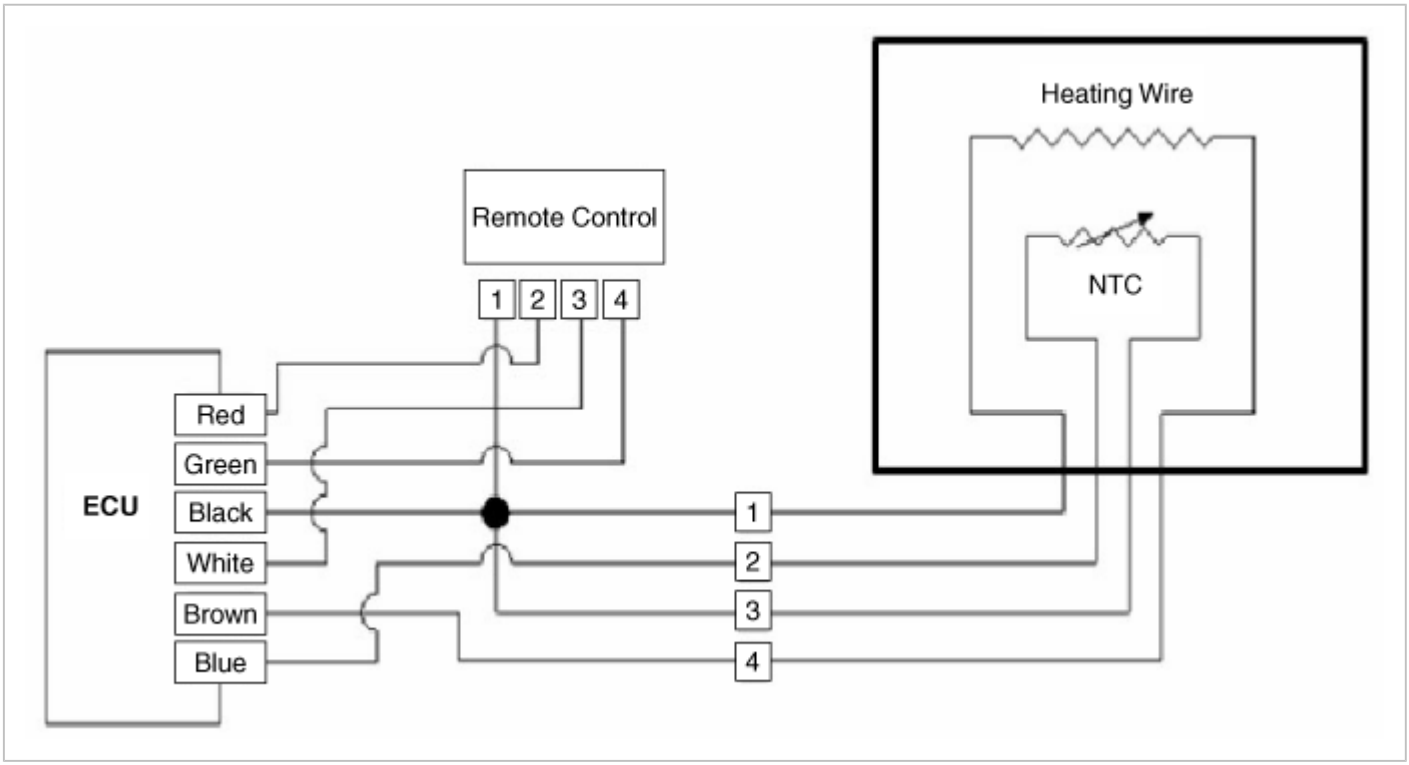
Item	Specification
Voltage	13.5 V
Heated pad resistance	1.6 ~ 2.0 Ω ± 10%
NTC resistance	10.0 kΩ ± 10% (25℃)

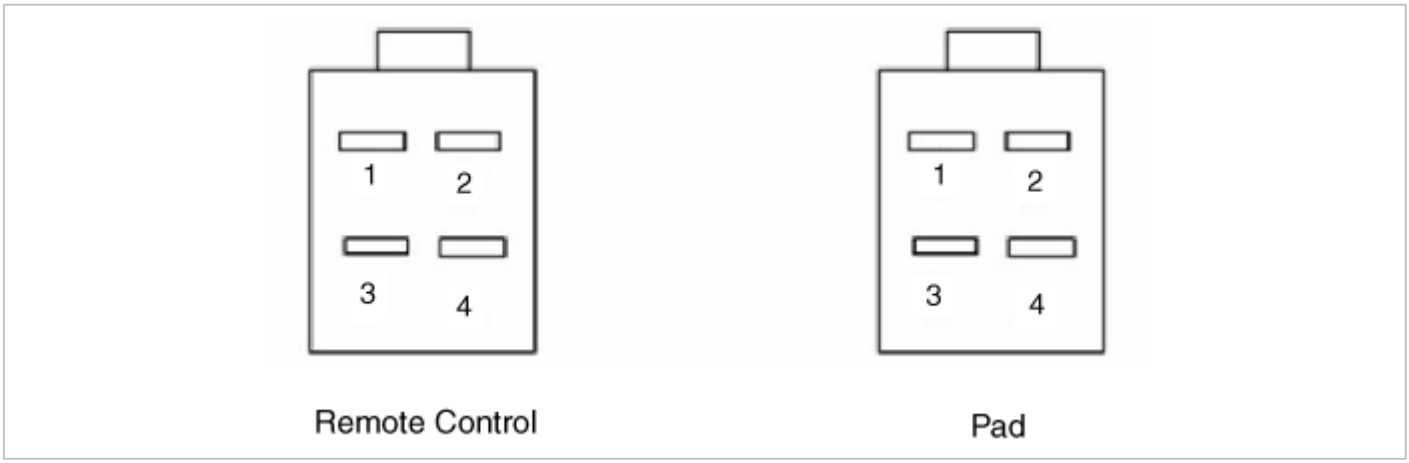
Inspection

1. Measure a resistance of NTC and Heated pad.
   A. NTC resistance(Black / Yellow, Black) - 10.0 kΩ ± 10% (25℃)
   B. Heated pad resistance (Yellow, Black) - 1.5 ~ 2.1 Ω ± 10%
2. Measure a temperature.
   A. The temperature of wheel surface grip must rise from -20℃ to 20℃ within 6 minute
   B. The temperature of wheel surface grip must keep 38℃ ± 4℃ after 25 minute
   C. At that time switch on, all measure point (1~8)



System Circuit Diagram



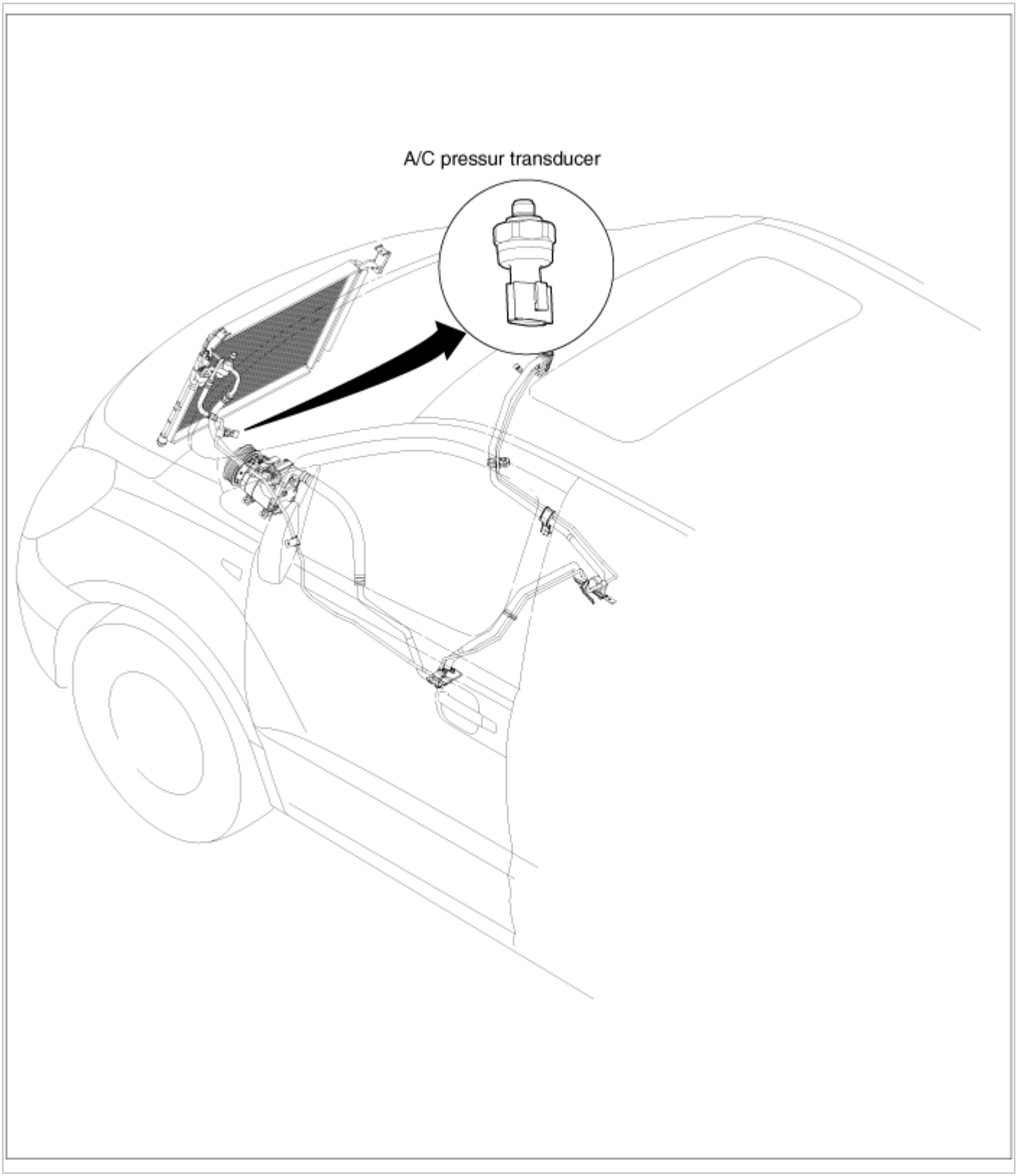


Terminal Function

Housing	Pin	Function	Wire color
Pad	A	GND	Back
	B	HEATER	Blue
	C	NTC-	Back
	D	NTC+	Brown
	A	GND	Back

Remote Control	B	BAT	Red
	C	SWITCH	Green
	D	LED	White

Component Location

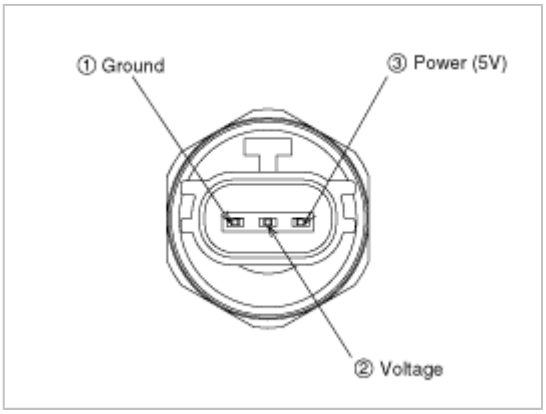


Description

A/C pressure transducer convert the pressure value of high pressure line into voltage value after measure it. By converted voltage value, engine ECU controls cooling fan by operating it high speed or low speed. Engine ECU stop the operation of compressor when the temperature of refrigerant line is so high or so low irregularly to optimize air conditioning system.

Inspection

1. Measure the pressure of high pressure line by measuring voltage output between NO.1 and NO.2 terminals.



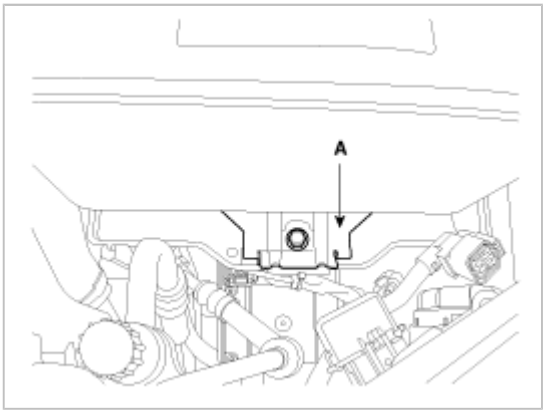
2. Inspect the voltage value whether it is sufficient to be regular value or not.

0.00878835 * Pressure + 0.37081095 [PSIA]

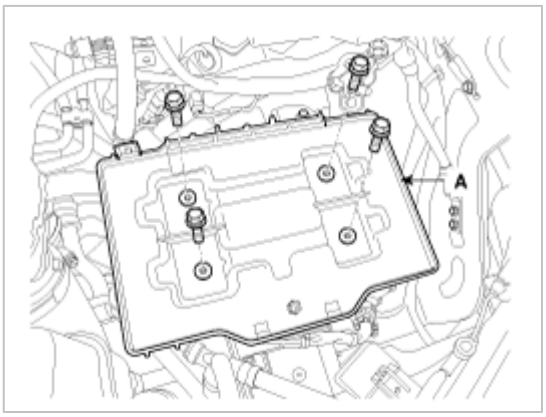
3. If the measured voltage value is not specification, replace the A/C pressure transducer.

Replacement

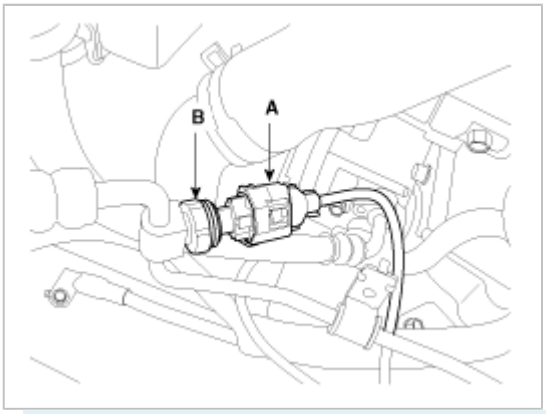
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/charging station.
3. Removr the battery mounting bracket (A), After loosen the mounting bolts.



4. Remove the battery tray (A), After loosen the mounting bolts.



5. Disconnect A/C pressure transducer connector (3P) (A).
   Remove the A/C pressure transducer (B).



Take care that liquid & suction pipe are not bent.

6. Installation is the reverse order of removal.

10~12 N.m (1.0~1. 2kgf.m, 7.4~8.8 lbf-ft)

Refrigerant System Service Basics

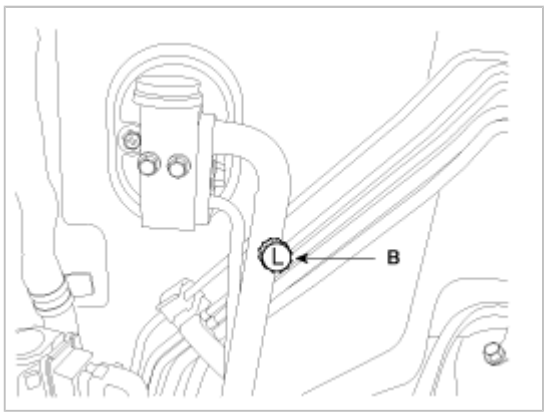
Refrigerant Recovery

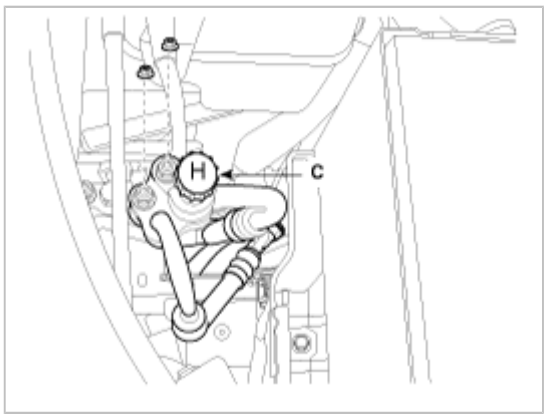
Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

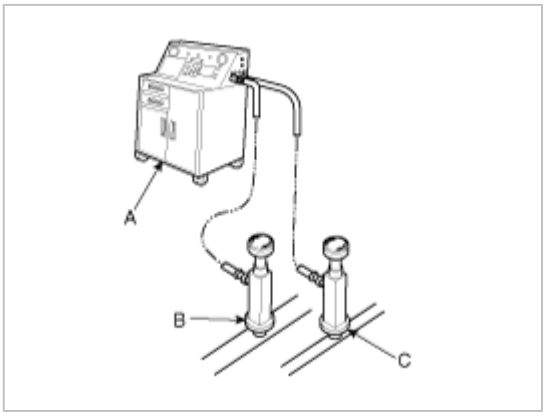
- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the low-pressure service port (B) and the high-pressure service port (C) as shown, following the equipment manufacturer's instructions.







2. Measure the amount of refrigerant oil removed from the A/C system after the recovery process is completed. Be sure to install the same amount of new refrigerant oil back into the A/C system before charging.

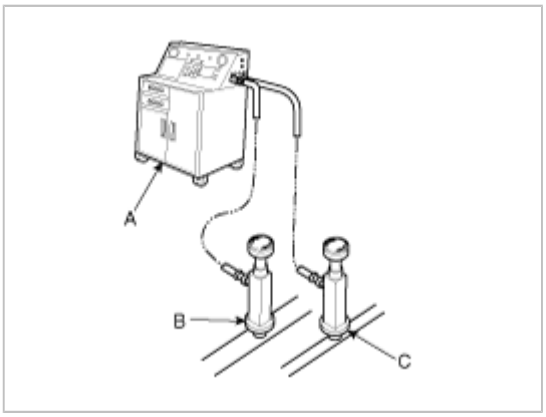
System Evacuation

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. When an A/C System has been opened to the atmosphere, such as during installation or repair, it must be evacuated using an R-134a refrigerant Recovery/Recycling/Charging System. (If the system has been open for several days, the receiver/dryer should be replaced, and the system should be evacuated for several hours.)
2. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) and the low-pressure service port (C) as shown, following the equipment manufacturer's instructions.



3. If the low-pressure does not reach more than 93.3 kPa (700 mmHg, 27.6 in.Hg) in 10 minutes, there is

probably a leak in the system. Partially charge the system, and check for leaks (see Leak Test.).
4. Remove the low pressure valve from the low-pressure service port.

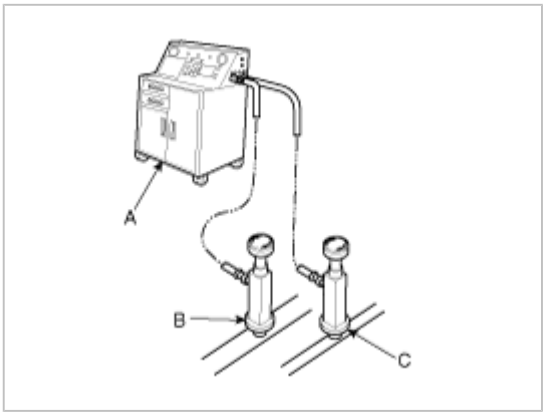
System Chargine

Use only service equipment that is U.L-listed and is certified to meet the requirements of SAE J2210 to remove HFC-134a(R-134a) from the air conditioning system.

- Air conditioning refrigerant or lubricant vapor can irritate your eyes, nose, or throat.
- Be careful when connecting service equipment.
- Do not breathe refrigerant or vapor.

If accidental system discharge occurs, ventilate work area before resuming service.
Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

1. Connect an R-134a refrigerant Recovery/Recycling/Charging System (A) to the high-pressure service port (B) as shown, following the equipment manufacturer's instructions.



2. Add the same amount of new refrigerant oil to system that was removed during recovery. Use only specified refrigerant oil. Charge the system with 29.88 ± 0.88 oz. (850 ± 25g) of R-134a refrigerant. Do not overcharge the system the compressor will be damaged.

Refrigerant Leak Test

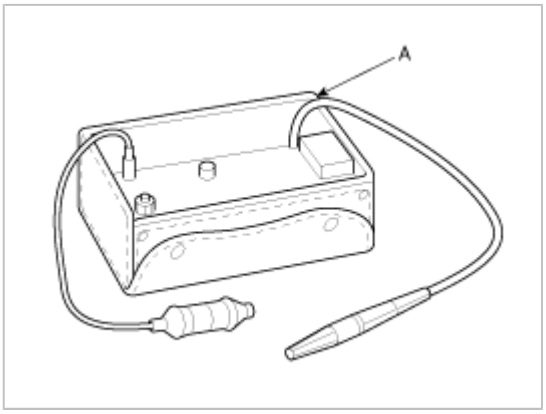
Always conduct a leak test with an electronic leak detector whenever leakage or refrigerant is suspected and when conducting service operations which are accompanied by disassembly or loosening or connection fittings.

In order to use the leak detector properly, read the manual supplied by the manufacturer.

If a gas leak is detected, proceed as follows:

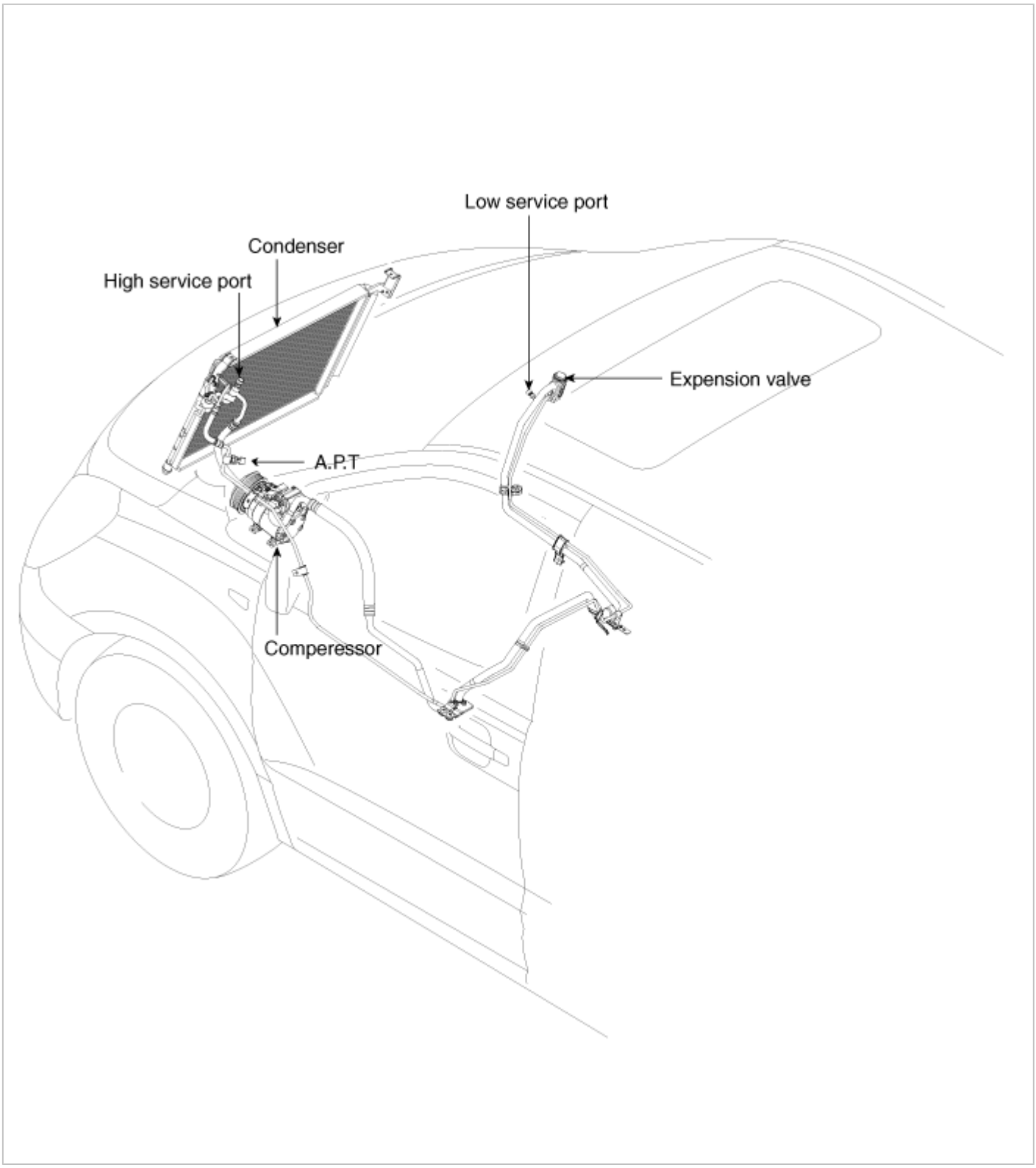
1. Check the torque on the connection fittings and, if too loose, tighten to the proper torque. Check for gas leakage with a leak detector (A).
2. If leakage continues even after the fitting has been tightened, discharge the refrigerant from the system, disconnect the fittings, and check their seating faces for damage. Always replace, even if the damage is slight.

3. Check the compressor oil and add oil if required.
4. Charge the system and recheck for gas leaks. If no leaks are found, evacuate and charge the system again.

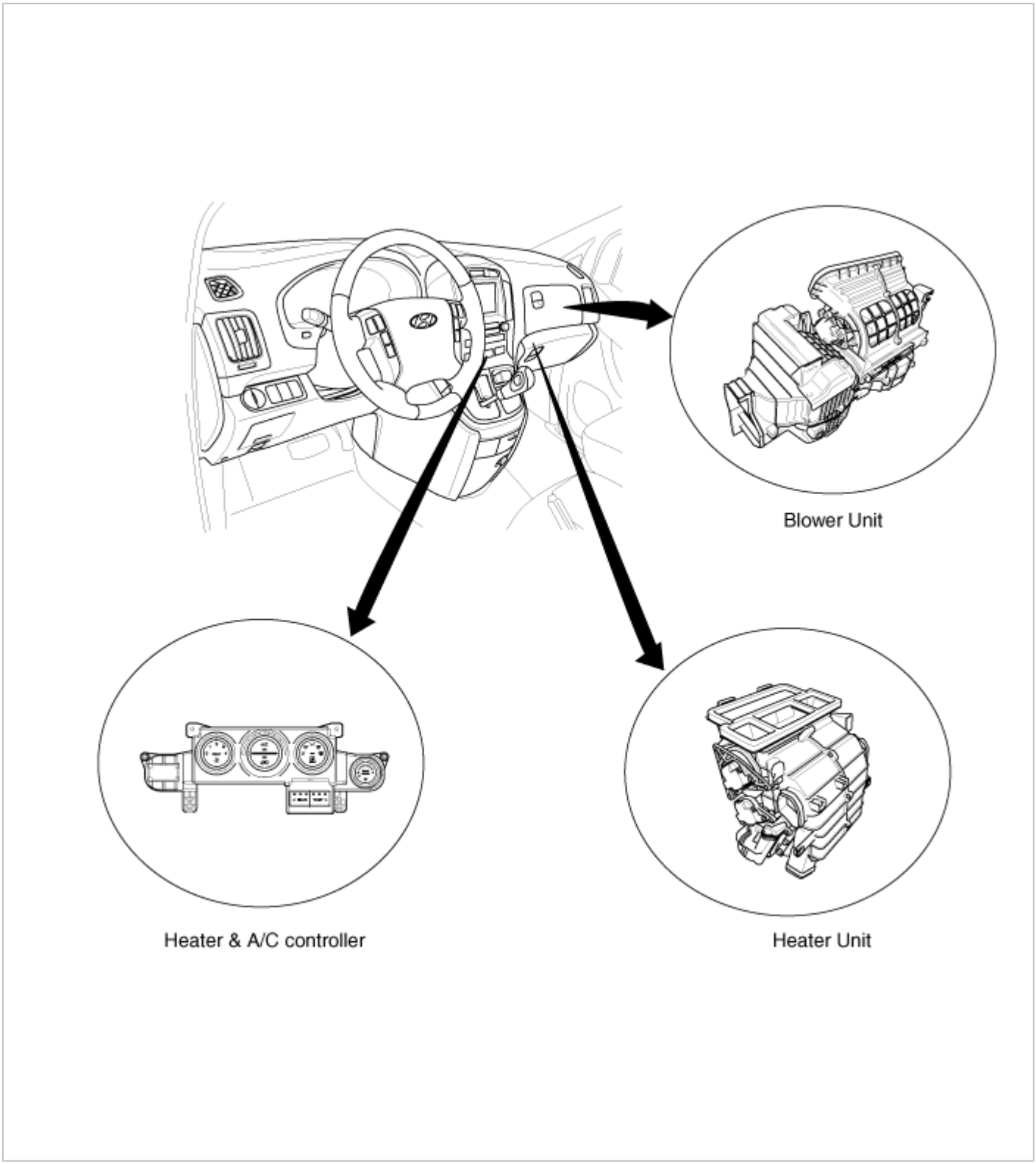


Component Location Index

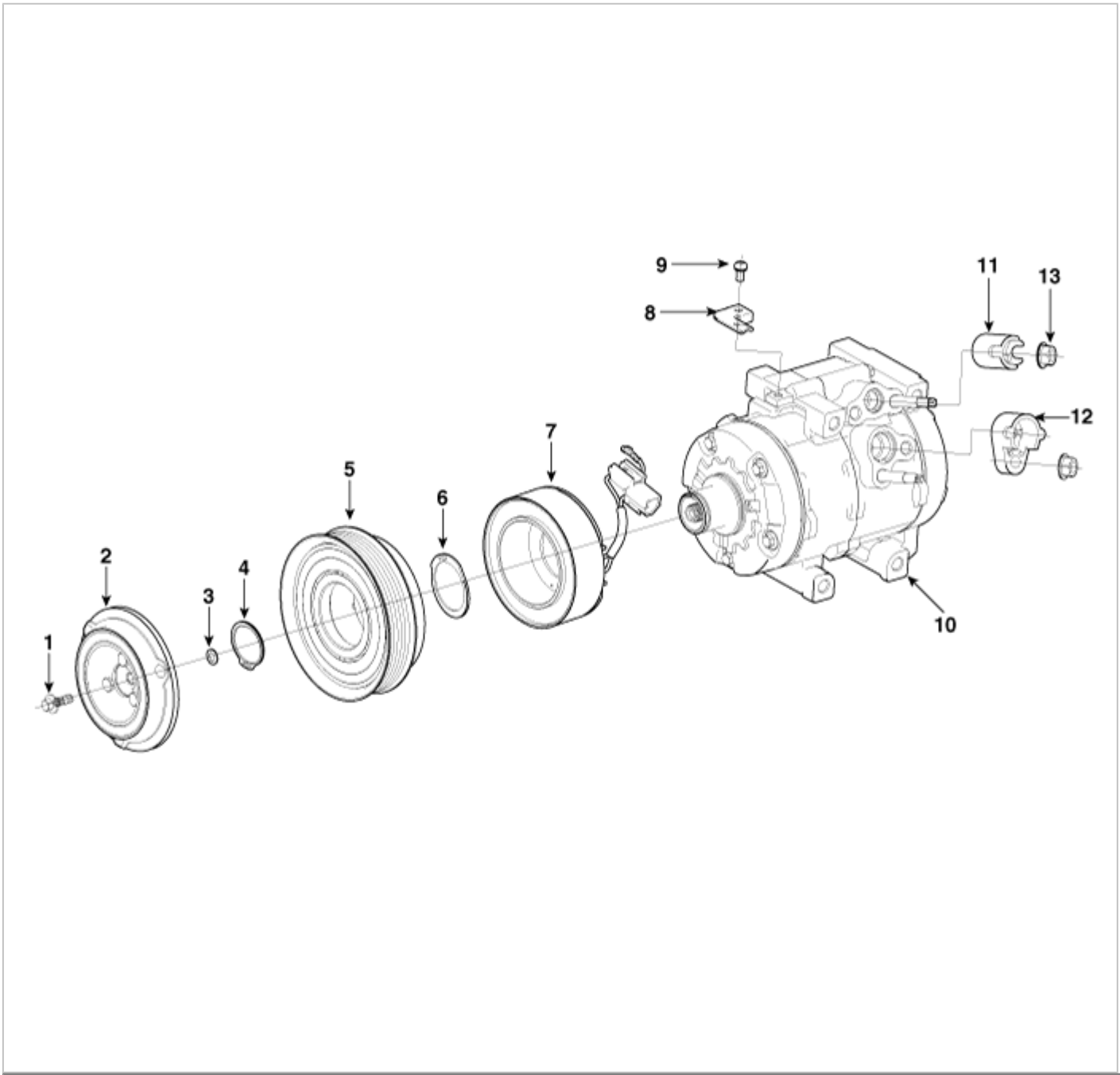
Engine Room



Interior



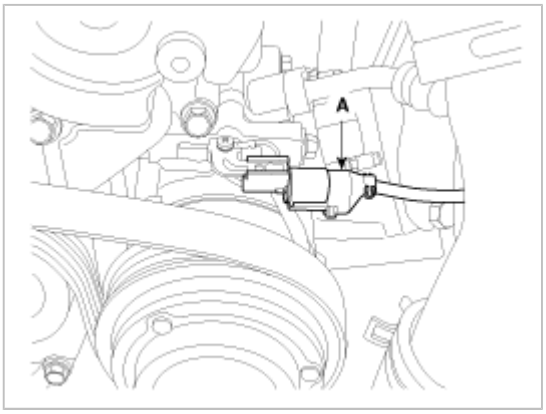
Components



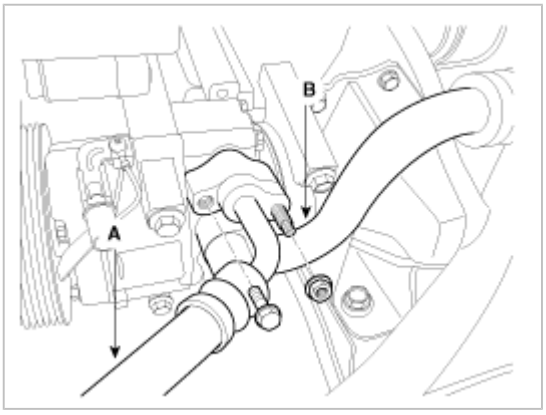
1. Bolt	5. Pully	9. Screw
2. Disc & Hub assembly	6. Retainer ring (Field coil)	10. Compressor assembly
3. Shim (Gap washer)	8. Field coil	11. Cap (out)
4. Retainer ring (pully)	9. Connector bracket	12. Cap (in)
		13. Nut

Removal

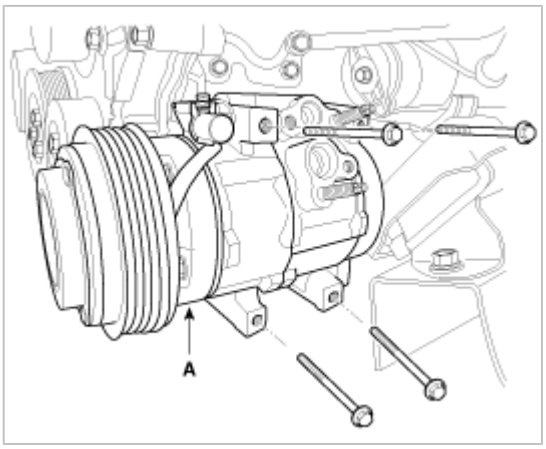
1. If the compressor is marginally operable, run the engine at idle speed, and let the air conditioning work for a few minutes, then shut the engine off.
2. Disconnect the negative cable from the battery.
3. Recover the refrigerant with a recovery/charging station.
4. Loosen the drive belt.
5. Disconnect the compressor connector (A).



6. Remove the bolts, then disconnect the suction line (A) and discharge line (B) from the compressor. Plug (C) or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

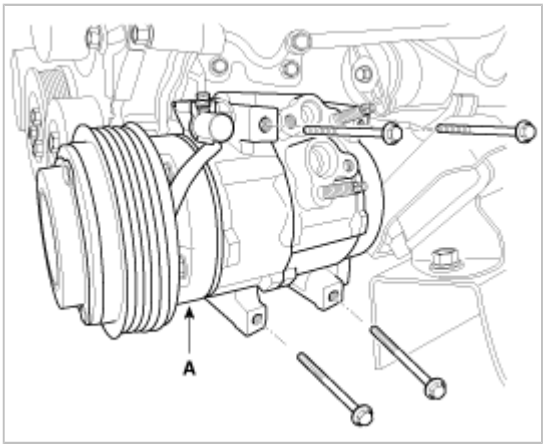


7. Disconnect the compressor clutch connector (A), and then remove 4 mounting bolts and the compressor.



Installation

1. Make sure of the length of compressor mounting bolts, and then tighten it A→B→C→D order.

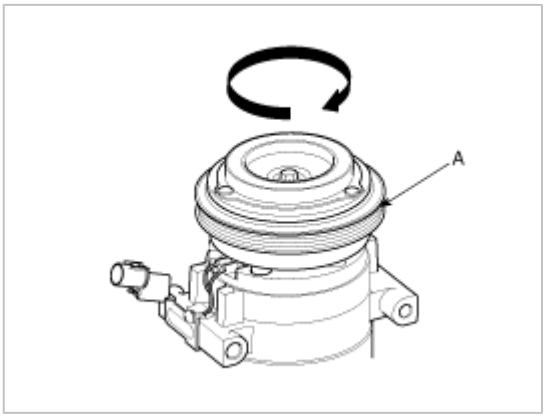


: 2.04~3.36Kg/f

2. Install in the reverse order of removal, and note these items.
   A. If you're installing a new compressor, drain all the refrigerant oil from the removed compressor, and measure its volume, Subtract the volume of drained oil from 210cc(7.40 oz.) the result is the amount of oil you should drain from the new compressor (through the suction fitting).
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. To avoid contamination, do not return the oil to the container once dispensed, and never mix it with other refrigerant oils.
   D. Immediately after using the oil, replace the cap on the container and seal it to avoid moisture absorption.
   E. Do not spill the refrigerant oil on the vehicle; it may damage the paint; if the refrigerant oil contacts the paint, wash it off immediately.
   F. Adjust the drive belt.
   G. Charge the system and test its performance.

Inspection

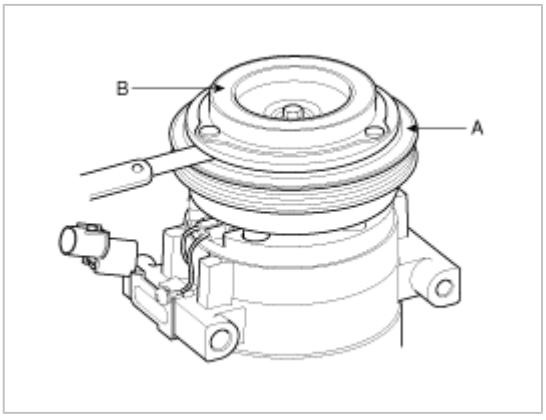
1. Check the plated parts of the disc & hub assembly (A) for color changes, peeling or other damage. If there is damage, replace the clutch set.
2. Check the pulley (B) bearing play and drag by rotating the pulley by hand. Replace the clutch set with a new one if it is noisy or has excessive play/drag.



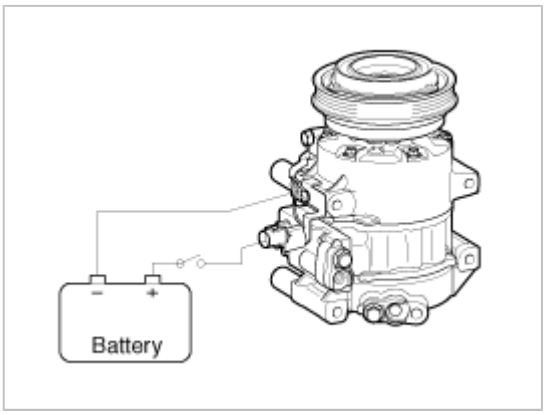
3. Measure the clearance between the pulley (B) and the disc & hub assembly (A) all the way around. If the clearance is not within specified limits, remove the disc & hub assembly and add or remove shim (gap washer) as needed to increase or decrease clearance.

0.45 ± 0.1mm (0.018 ± 0.004 in.)

The shims (gap washers) are available in seven thicknesses: 0.7mm, 0.8mm, 0.9mm, 1.0mm, 1.1mm, 1.2mm and 1.3mm.



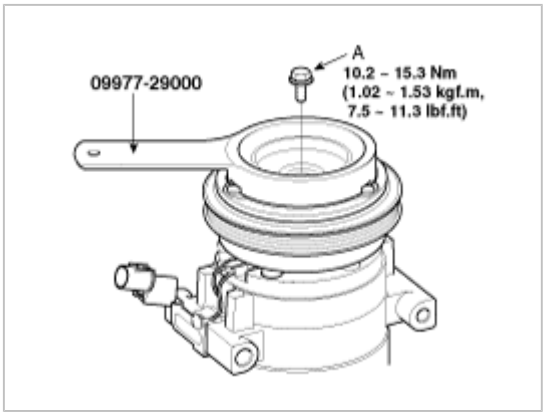
4. Check operation of the magnetic clutch.
   Connect the compressor side terminals to the battery (+) terminal and the ground battery (-) terminal to the compressor body.
   Check the magnetic clutch operating noise to determine the condition.



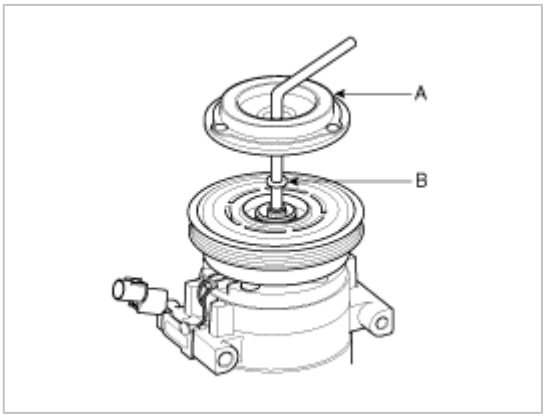
Disassembly

1. Remove the center bolt (A) while holding the disc & hub assembly with a commercially available disc & hub assembly bolt remover; Special tool number 09977-29000.

: 10~15N.m (1.02~1.53kgf.m, 7.37~11lbf.ft)

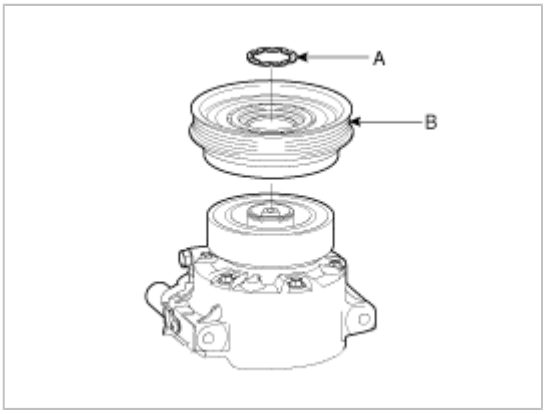


1. Remove the disc & hub assembly (A) and shim (gap washer) (B), taking care not to lose the shims. If the clutch needs adjustment, increase or decrease the number and thickness of shims as necessary, then reinstall the disc & hub assembly, and recheck its clearance.

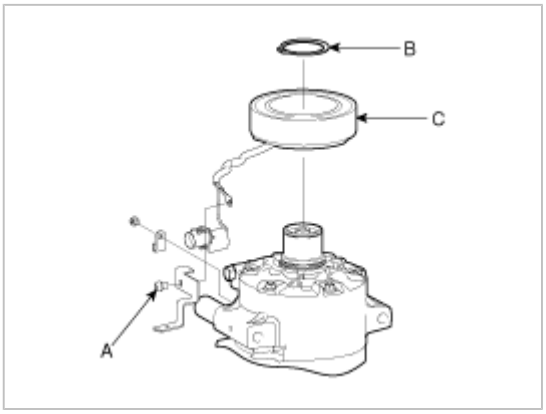


2. If you removal the field coil, remove retainer ring (A) with retainer ring pliers.

- Be careful not to damage the pulley (B) and compressor during removal/installation.
- Once retainer ring (A) is removed, replace it with a new one.



3. Remove the screw (A) from the field coil ground terminal. Remove the retainer ring (B) and then remove the field coil (C) from the shaft with a puller. Be careful not to damage the coil and compressor.



4. Reassemble the compressor clutch in the reverse order of disassembly, and note these items :
   A. Clean the pulley and compressor sliding surfaces with non-petroleum solvent.
   B. Install new retainer rings, and make sure they are fully seated in the groove.
   C. Make sure that the pulley turns smoothly after its reassembled.

Oil Specification

1. The HFC-134a system requires synthetic (PAG) compressor oil whereas the R-12 system requires mineral compressor oil. The two oils must never be mixed.
2. Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.

Handling of Oil

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

Compressor oil check

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

Oil total volume in system:
SINGLE A/C : 150±10cc (5.29±0.34 fl.oz)
DUAL A/C : 210±10cc (7.40±0.34 fl.oz)

Oil Return Operation

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

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

Replacement of Component Parts

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

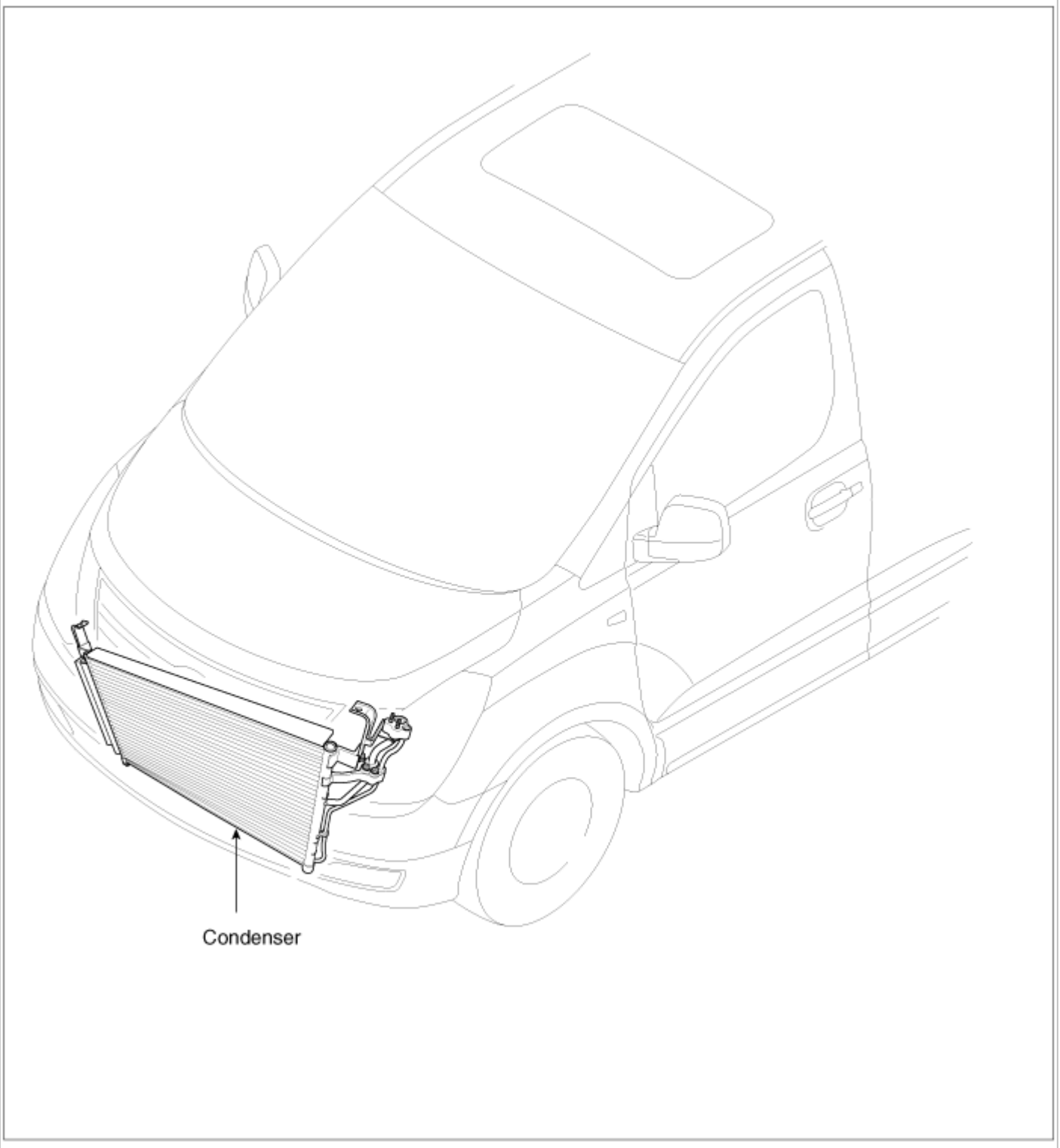
Component parts to be installed	Amount of Oil
Evaporator	50 cc (1.70 fl.oz)
Condenser	30 cc (1.02 fl.oz)
Receiver/dryer	30 cc (1.02 fl.oz)

Refrigerant line (One piece)	10 cc (0.34 fl.oz)

For compressor replacement, subtract the volume of oil drained from the removed compressor from the specified volume, and drain the calculated volume of oil from the new compressor:
The specified volume - volume of removed compressor = volume to drain from the new compressor.

Even if no oil is drained from the removed compressor, don't drain more than 50cc from new compressor.

Component Location



Inspection

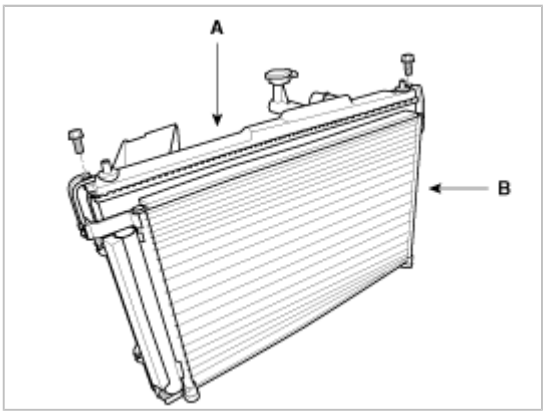
1. Check the condenser fins for clogging and damage. If clogged, clean them with water, and blow them with compressed air. If bent, gently bend them using a screwdriver or pliers.
2. Check the condenser connections for leakage, and repair or replace it, if required.

Replacement

1. Recover the refrigerant with a recovery/ recycling/ charging station.
2. Disconnect the negative (-) battery terminal.
3. Remove 2 nuts (A), and then disconnect the discharge line and liquid line from the condenser.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.

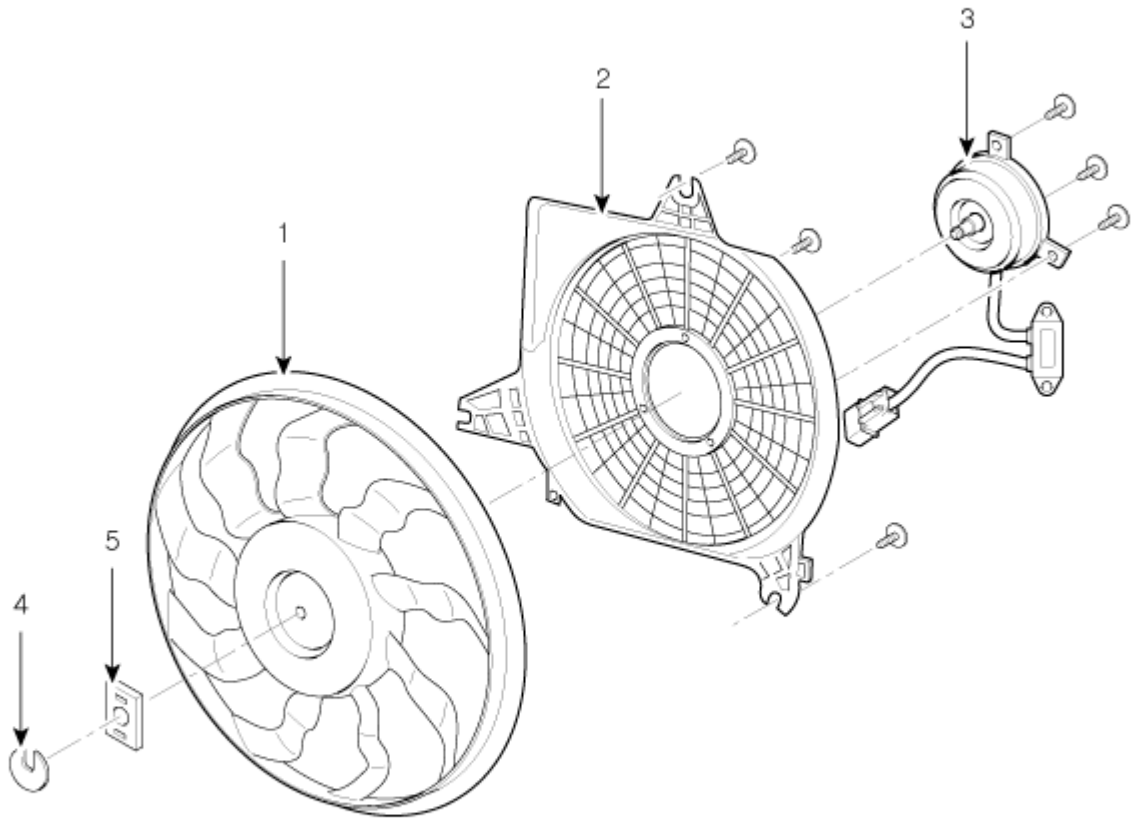
   : 7.8~11.7N.m(0.8~1.2kgf.m, 5.9~8.7lb.ft)

4. Remove the radiator (A).
   (Refer to EM group - "Radiator")
5. Remove 2 bolts, and then remove the condenser by lifting it up. Be careful not to damage the radiator and condenser fins when removing the condenser (B).



6. Install in the reverse order of removal, and note these items :
   A. If you're installing a new condenser, add refrigerant oil ND-OIL8.
   B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
   C. Be careful not to damage the radiator and condenser fins when installing the condenser.
   D. Be sure to install the lower mount cushions of condenser securely into the holes.
   E. Charge the system, and test its performance.

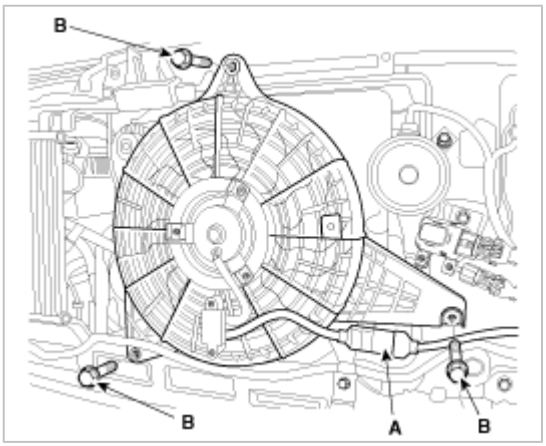
Component Location



1. Cooling fan 2. Cooling fan motor assembly 3. Cooling fan shround	4. Retainer 5. Torque washer

Replacement

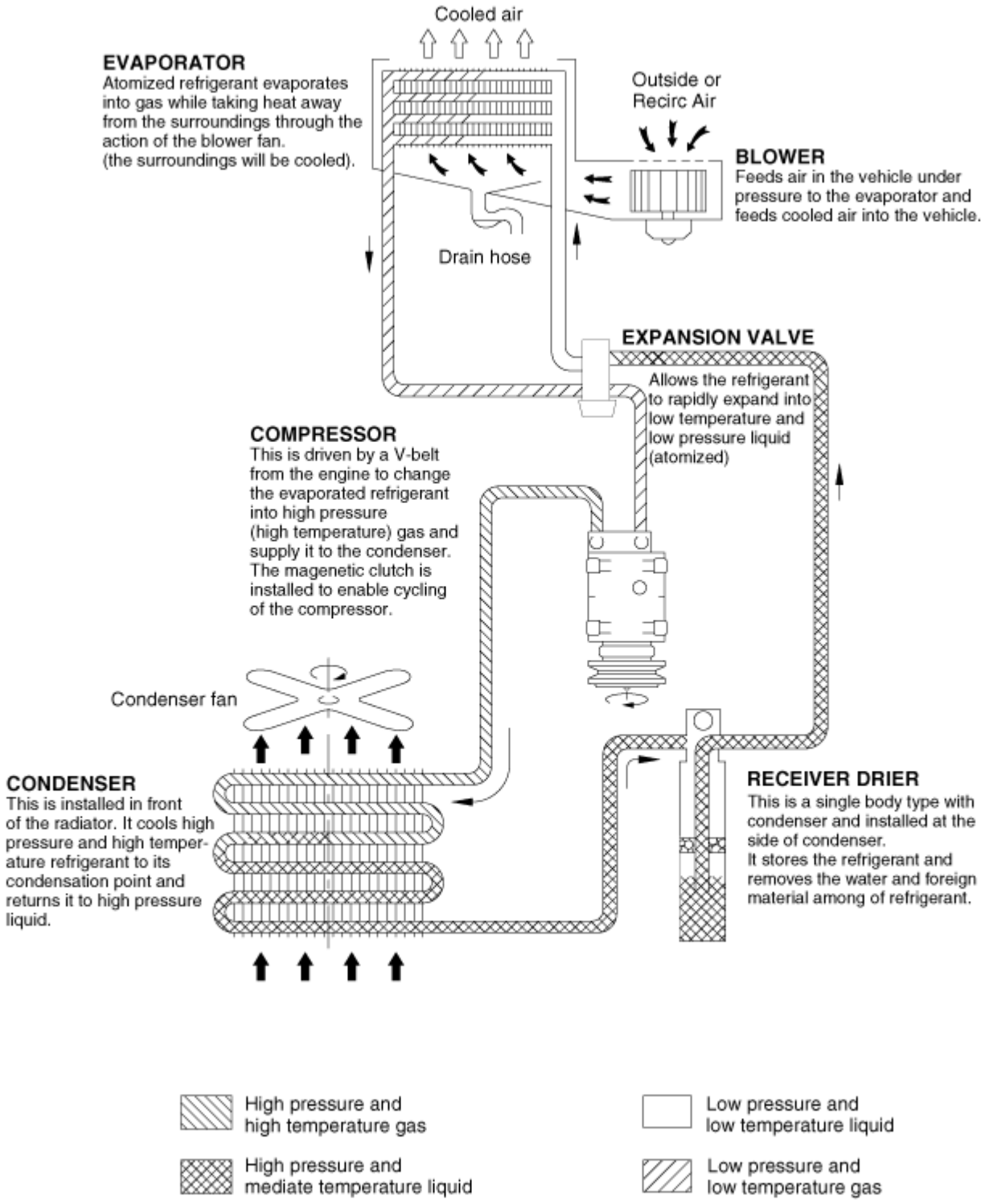
1. Rmove the front bumper.
   (Refer to BD group - "Front Bumper")
2. Disconnect the condenser fan connector (A).
3. Remove the condenser fan (B).



0.9 ~ 1.1 Kgf.m

4. Installation is the reverse order of removal.

Refrigeration Cycle



Description

The evaporator temperature sensor will detect the evaporator core temperature and interrupt compressor relay power in order to prevent evaporator freezing by excessive cooling.It is a negative type thermistor whose resistance is inversely proportional to temperature.

Inspection

1. Ignition "OFF"
2. Disconnect evaporator temperature sensor.
3. Using the multi-tester, Measure resistance between terminal "1" and "2" of evaporator temperature sensor.

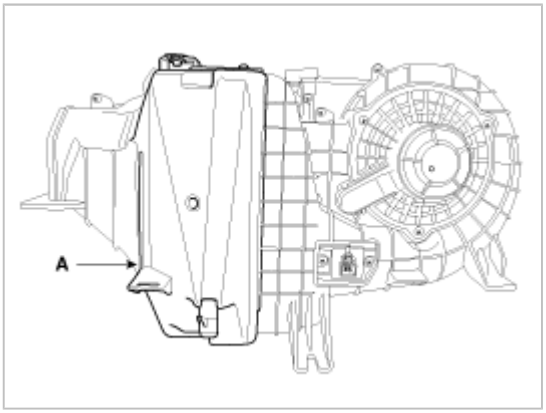
Specification

Evaporator core temperature [℃(□)]	Resistance [□]	Voltage [V]
-20 (-4)	70.04	3.50
-10 (14)	43.35	2.96
0 (32)	27.62	2.40
10 (50)	18.07	1.88
20 (68)	12.11	1.44
30 (86)	8.30	1.08
40 (104)	5.81	0.81
50 (122)	4.15	0.61

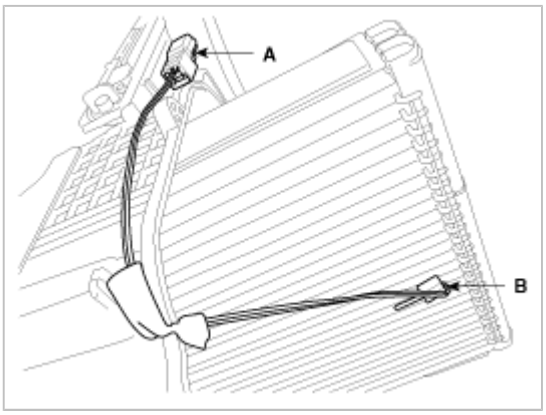
4. If the measured resistance is not specification, substitute with a known-good evaporator temperature sensor and check for proper operation.
5. If the problem is corrected, replace the evaporator temperature sensor.

Replacement

1. Remove the crash pad.
   (Refer to BD group - "Crash Pad")
2. Remove the blower unit.
   (Refer to BD group - "Blower Unit")
3. Remove the blower unit lower cover (A).



4. Disconnect the evaporator sensor (B), After disconnect the connector (A).

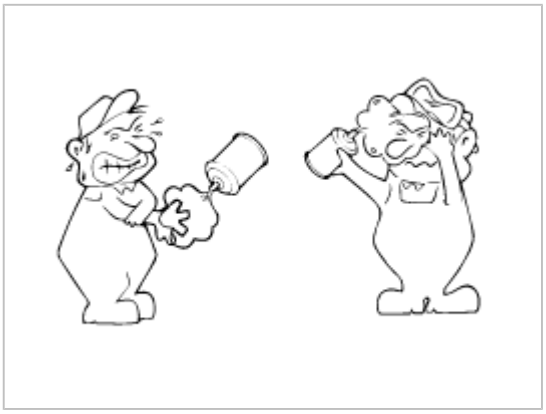


5. Installation is the reverse order of removal

Instructions

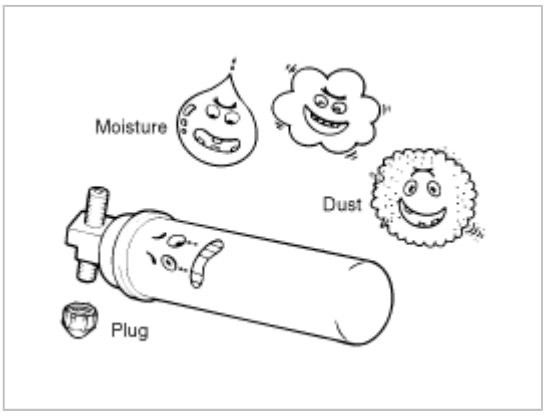
When Handling Refrigerant

1. R-134a liquid refrigerant is highly volatile. A drop on the skin of your hand could result in localized frostbite. When handling the refrigerant, be sure to wear gloves.
2. It is standard practice to wear goggles or glasses to protect your eyes, and gloves to protect your hands. If the refrigerant splashes into your eyes, wash them with clean water immediately.
3. The R-134a container is highly pressurized. Never leave it in a hot place, and check that the storage temperature is below 52□ (126□)
4. An electronic leak detector should be used to check the system for refrigerant leakage. Bear in mind that the R-134a, upon coming into contact with flame, produces phosgene, a highly toxic gas.
5. Use only recommended the lubricant for R-134a systems. If lubricants other than the recommended one used, system failure may occur.
6. PAG lubricant absorbs moisture from the atmosphere at a rapid rate, therefore the following precautions must be observed:
   A. When removing refrigerant components from a vehicle, cap immediately the components to prevent from the entry of moisture.
   B. When installing refrigerant components to a vehicle, do not remove the cap until just before connecting the components.
   C. Complete the connection of all refrigerant tubes and hoses without delay to prevent the A/C system from taking on moisture.
   D. 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.



When Replacing Parts ON A/C System

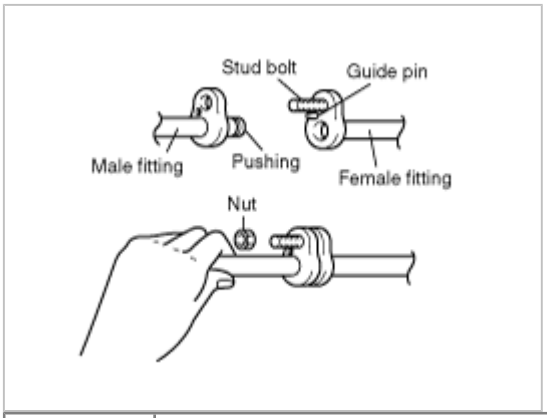
1. Never open or loosen a connection before discharging the system.
2. Seal the open fittings of components with a cap or plug immediately to prevent intrusion of moisture or dust.
3. Do not remove the sealing caps from a replacement component until it is ready to be installed.
4. Before connecting an open fitting, always install a new sealing ring. Coat the fitting and seal with refrigerant oil before making the connection.



When Installing Connecting Parts

Flange With Guide Pin

Check the new O-ring for damage (use only the specified) and lubricate it using compressor oil. Tighten the nut to specified torque.



Size	Tightening torque [N.m (kg.m, lbf.ft)]	
	General bolt, nut	
	4T	7T
M6	5 - 6(0.5 - 0.6, 3.6 - 4.3)	9 - 11(0.9 - 1.1, 6.5 - 7.9)
M8	12 - 14(1.2 - 1.4, 8.7 - 10)	20 - 26(2.0 - 2.6, 14 - 18)
M10	25 - 28(2.5 - 2.8, 18 - 20)	45 - 55(4.5 - 5.5, 32 - 39)
Size	Flange bolt, nut	
	4T	7T
M6	5 - 7(0.5 - 0.7, 3.6 - 5.0)	8 - 12(0.8 - 1.2, 5.8 - 8.6)
M8	10 - 15(1.0 - 1.5, 7 - 10)	19 - 28(1.9 - 2.8, 14 - 20)
M10	21 - 31(2.1 - 3.1, 15 - 22)	39 - 60(3.9 - 6.0, 28 - 43)

T means tensile intensity, which is stamped on the head of bolt only numeral.

Handling Tubing And Fittings

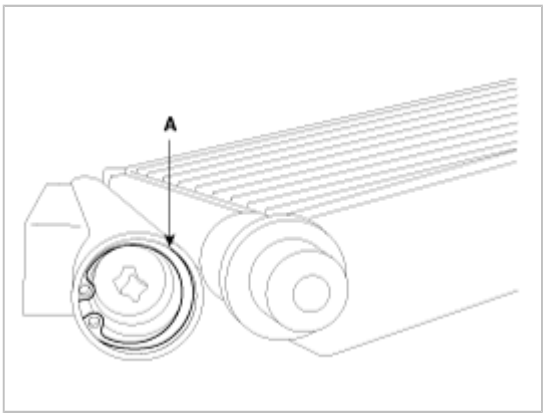
The internal parts of the refrigeration system will remain in a state of chemical stability as long as pure moisture- free refrigerant and refrigerant oil are used. Abnormal amounts of dirt, moisture or air can upset the chemical stability and cause problems or serious damage.

The Following Precautions Must Be Observed

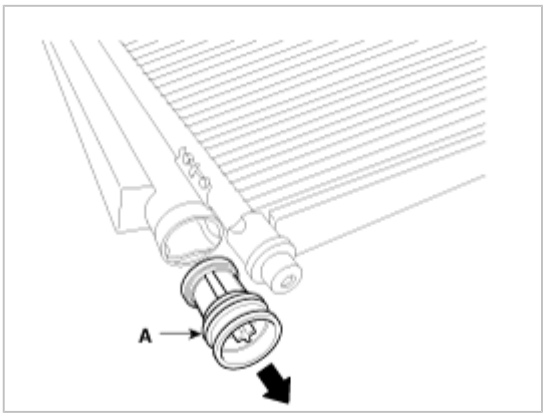
1. When it is necessary to open the refrigeration system, have everything you will need to service the system ready so the system will not be left open any longer than necessary.
2. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture.
3. All lines and components in parts stock should be capped or sealed until they are ready to be used.
4. Never attempt to rebind 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.

Replacement

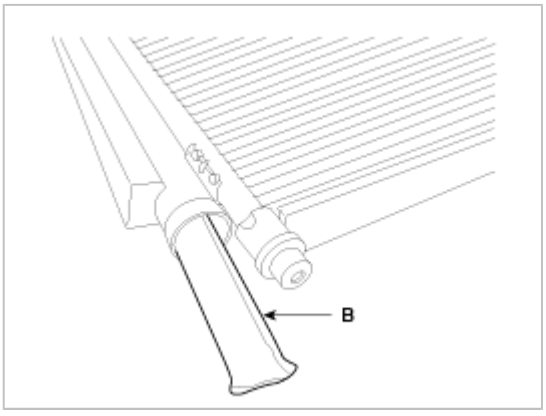
1. Disconnect the snapring (A).



2. Remove the receiver drier cap (A).



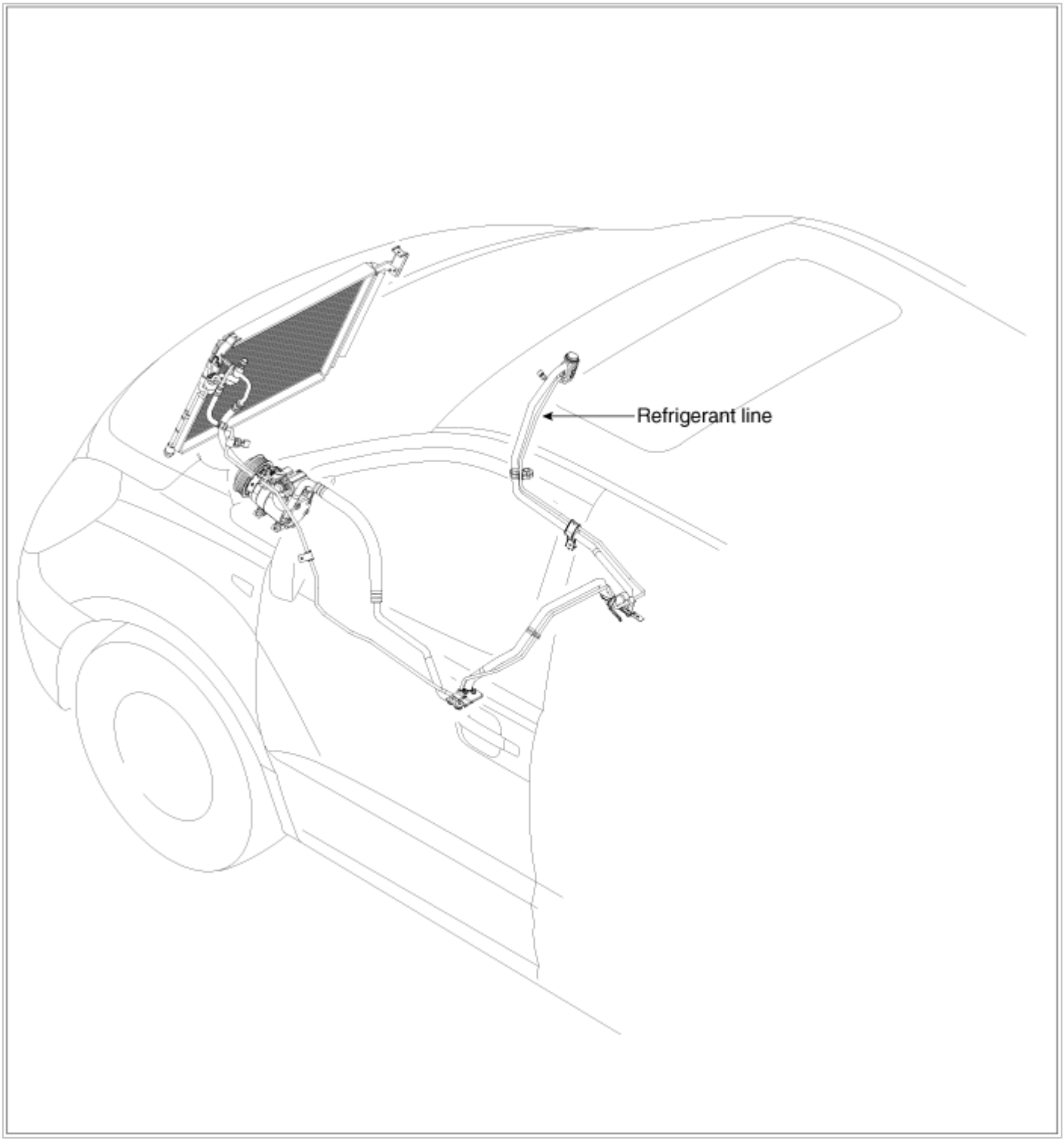
3. Remove the desiccant (A) from condenser using a long nose plier. Check for crumbled desiccant and clogged bottom cap filter.



4. Apply air conditioning compressor oil along the O-rings and threads of the new bottom cap.
5. Insert the new desiccant into the receiver drier tank. The desiccant must be sealed in vacuum before it is exposed to air for use.
6. Install the new bottom cap to the condenser.

- Always replace the desiccant and bottom cap at the same time.
- Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them.
  Be sure to use the right O-rings for R-134a to avoid leakage.
- Be careful not to damage the radiator and condenser fins when installing the condenser.
- Be sure to install the lower mount cushions of condenser securely into the holes.
- Charge the system, and test its performance.

Component Location



Relpacement

1. Discharge refrigerant from refrigeration system.
2. Replace faulty tube or hose.

> Cap the open fittings immediately to keep moisture or dirt out of the system.

3. Tighten joint of bolt or nut to specified torque.

> Connections should not be torque tighter than the specified torque.

Part tightened	Kgf.m (N.m, lbf-ft)
Condenser - Discharge hose	0.5~0.6
Condenser - Liquid tube	
Compressor - Discharge hose	0.5~0.6
Compressor - Suction hose	
Expansion valve - Evaporator	1.2~1.5

4. Evacuate air in refrigeration system and charge system with refrigerant.

Specified amount:
SINGLE A/C : 650 ± 25g
DUAL A/C : 850 ± 25

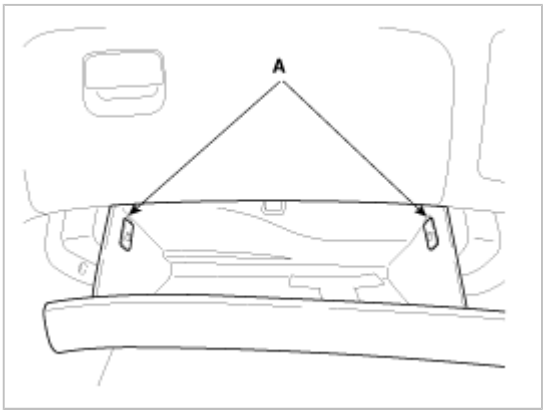
5. Inspect for leakage of refrigerant.
   Using a gas leak detector, check for leakage of refrigerant
6. Inspect A/C operation.

Description

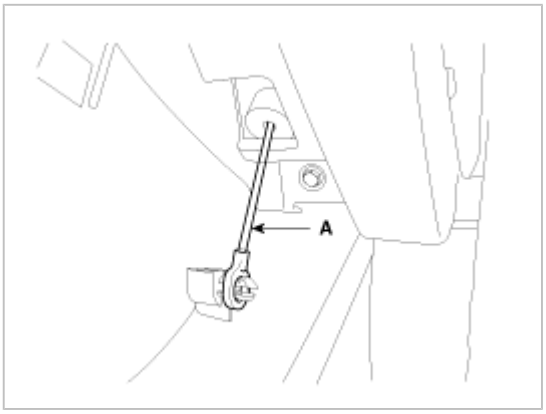
This has particle filter which eliminates foreign materials and odor. The particle filter includes odor filter as well as conventional dust filter to ensure comfortable interior environment.

Replacement

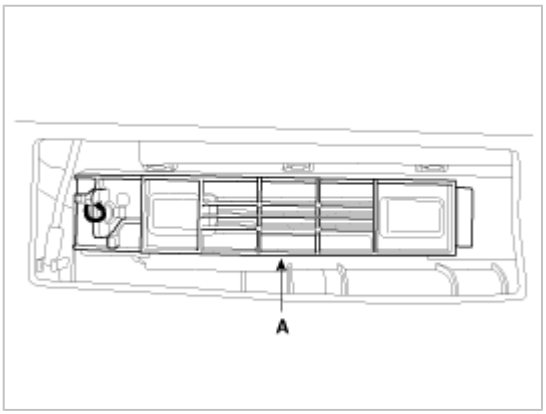
1. Open the glove box (B). Lower the glove box down completely by removing the glove box stopper (A) to the glove box.

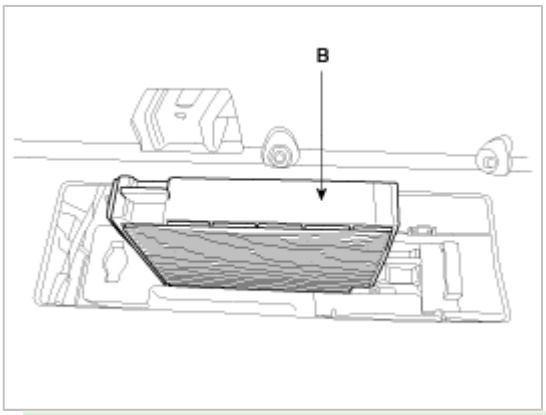


2. Remove the glove box (B) from the left (A).



3. Replace the air filter (B), install it after making sure of the direction of air filter.



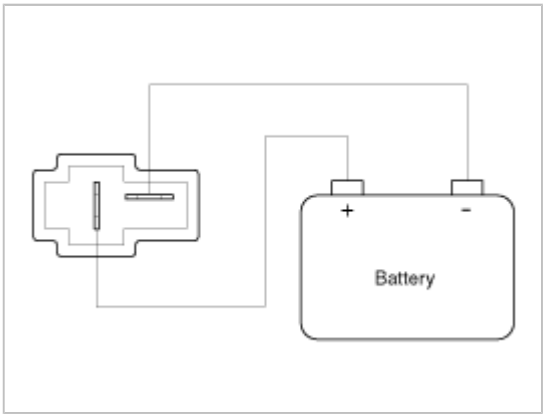


In case of driving in an air-polluted area or rugged terrain, check and replace the air filter as frequently as possible.

4. Installation is the reverse order of removal.

Inspection

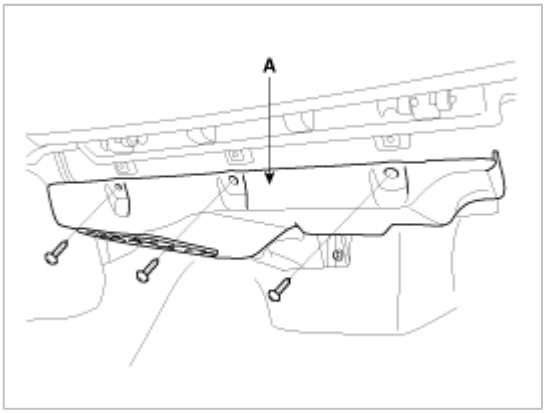
1. Connect the battery voltage and check the blower motor rotation.



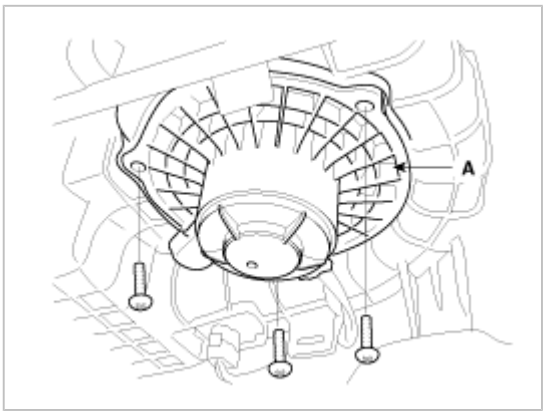
2. If the blower motor voltage is not operated well, substitute with a known-good blower motor and check for proper operation.
3. If the problem is corrected, replace the blower motor.

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the crashpad lower cover (A).



3. Disconnect the connector (A) of the blower motor and then remove the blower motor (A) after loosening the mounting screws.

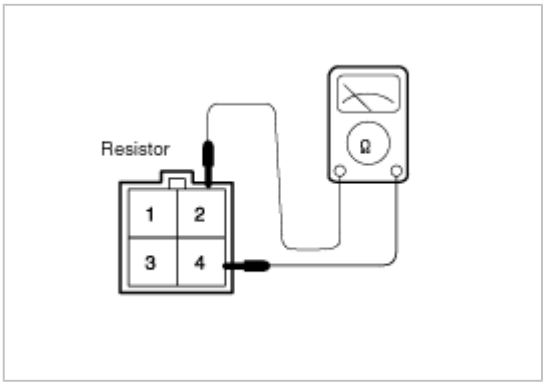


4. Installation is the reverse order of removal.

Inspection

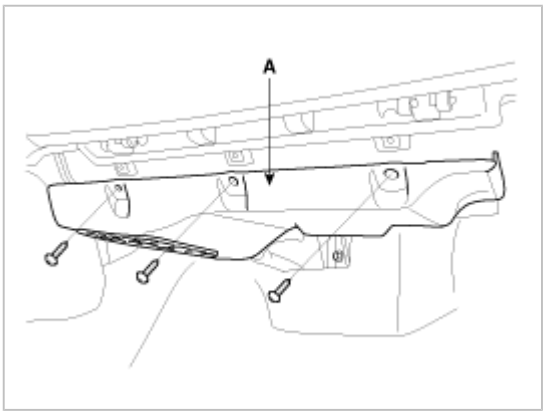
1. Measure terminal - to - terminal resistance of blower resistor.
2. If measure resistance isnot within specification, the blower resistor must be replaced.

Terminal / Resistance ohmmeter / Speed	2	1	4	3	Resistance (Ω)
	MH	ML	HI	LO	
Measurement of resistance between each terminal			○—○	○—○	2.30 ± 5%
		○—○	○—○		1.0 ± 5%
	○—○		○—○		0.35 ± 5%

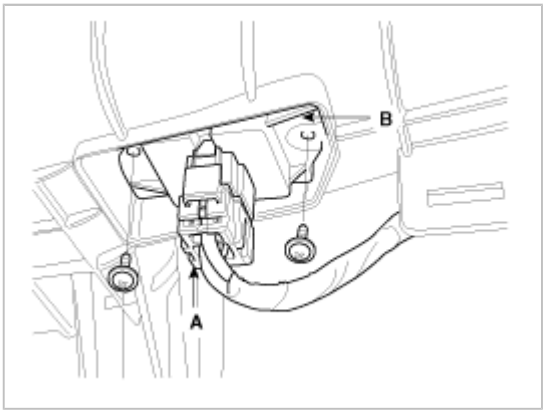


Replacement

1. Disconnect the negative (-) battry teminal.
2. Remove the crash pad lower cover (A).

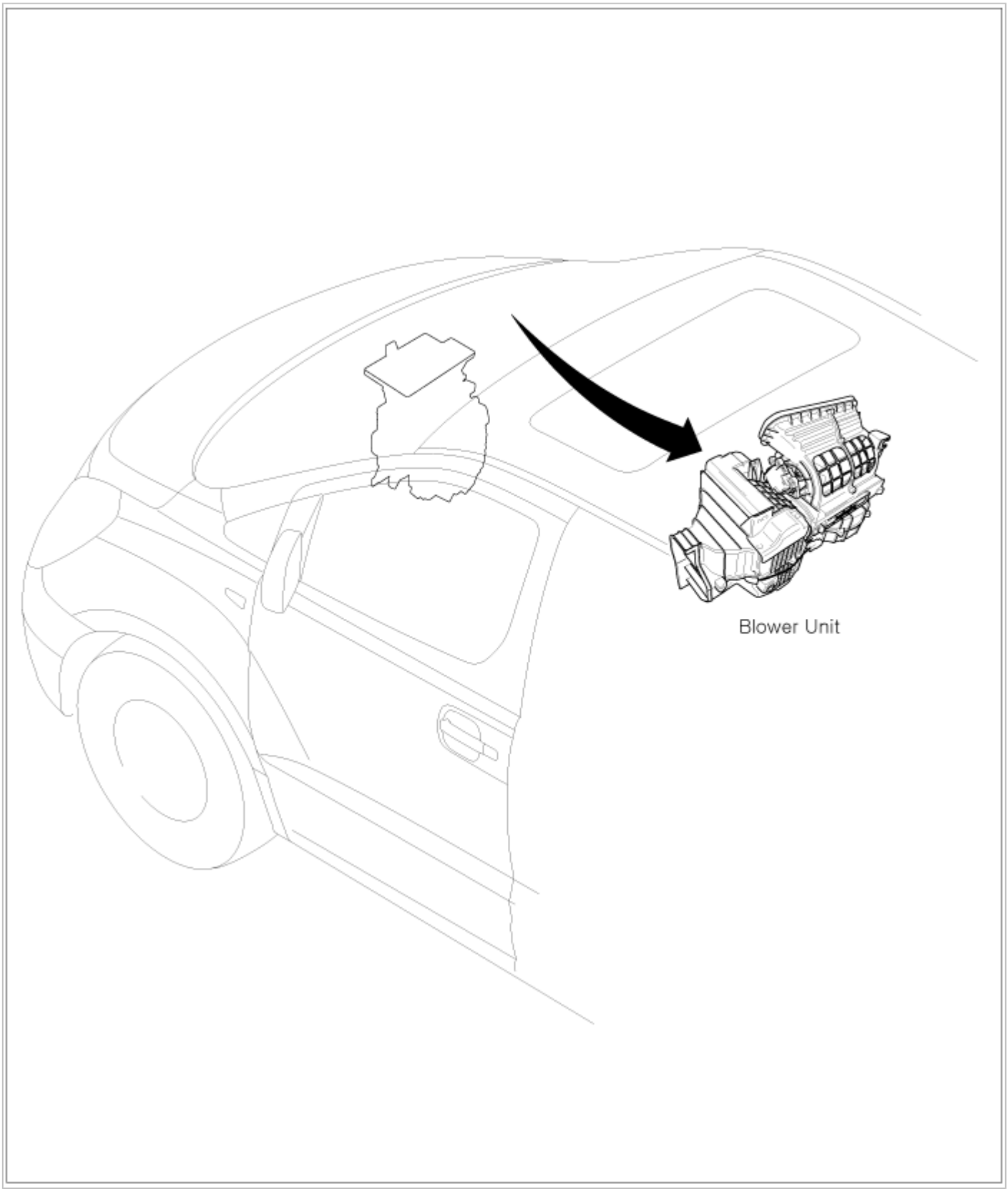


3. Disconnect the blower resistor connector (A) at the connecting part blower unit.

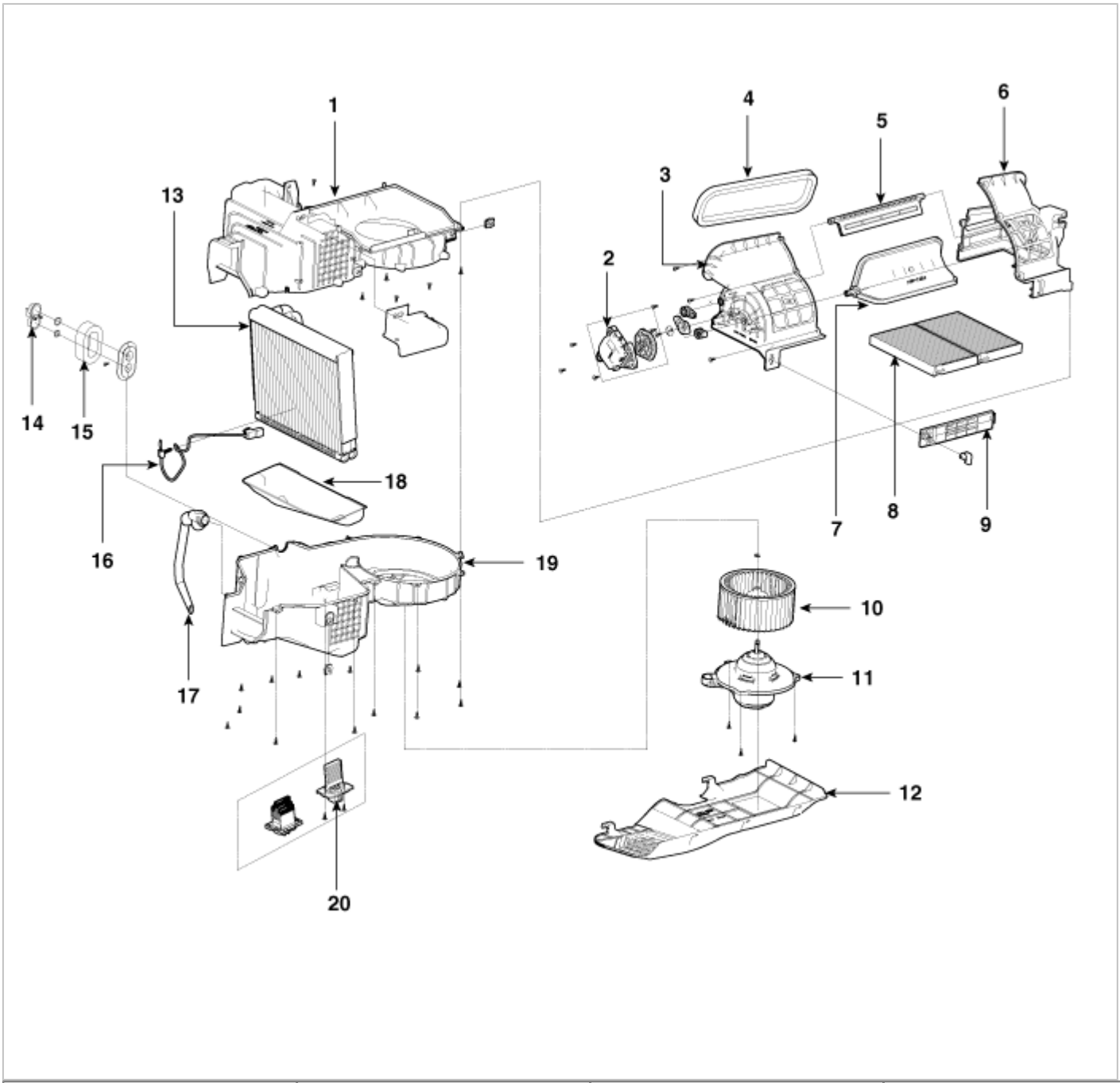


4. Installation is the reverse order of removal.

Component Location



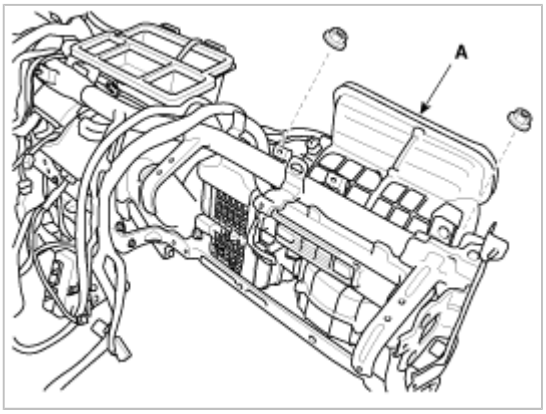
Components



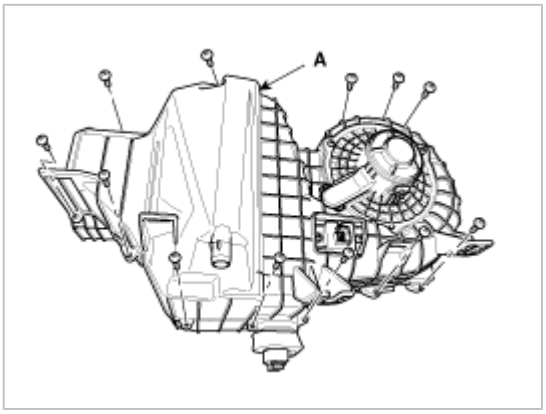
1.Case (upper) 2. Intake actuator 3. Intake duct (R) 4. Cowl seal 5. Sub door	6. Intake acuct (L) 7. Intake door 8. Climate control air filter 9. Climate control air filter 10. Fan	11. Motor 12. Crash pad lower 13. Evaporator core 14. Flange cap 15. Evaporator flange seal 16. Evaporator sensor	17. Drain hose 18. Lower insulation 19. Case (lower) 20. Power mosfet (auto) 21. Blower resistor (manual)

Replacement

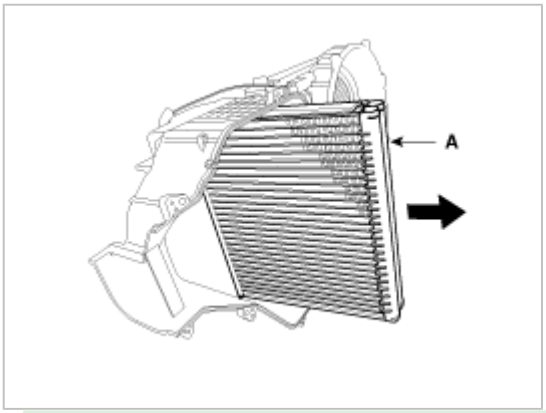
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad.
   (Refer to BD group - "Crash Pad")
3. Remove the cowl cross bar assembly.
   (Refer to BD group - "Cowl Cross Bar")
4. Remove the blower unit (A) from the cowl cross bar.



5. After loosening the mounting screw, then remove the blower unit lower cover (A).



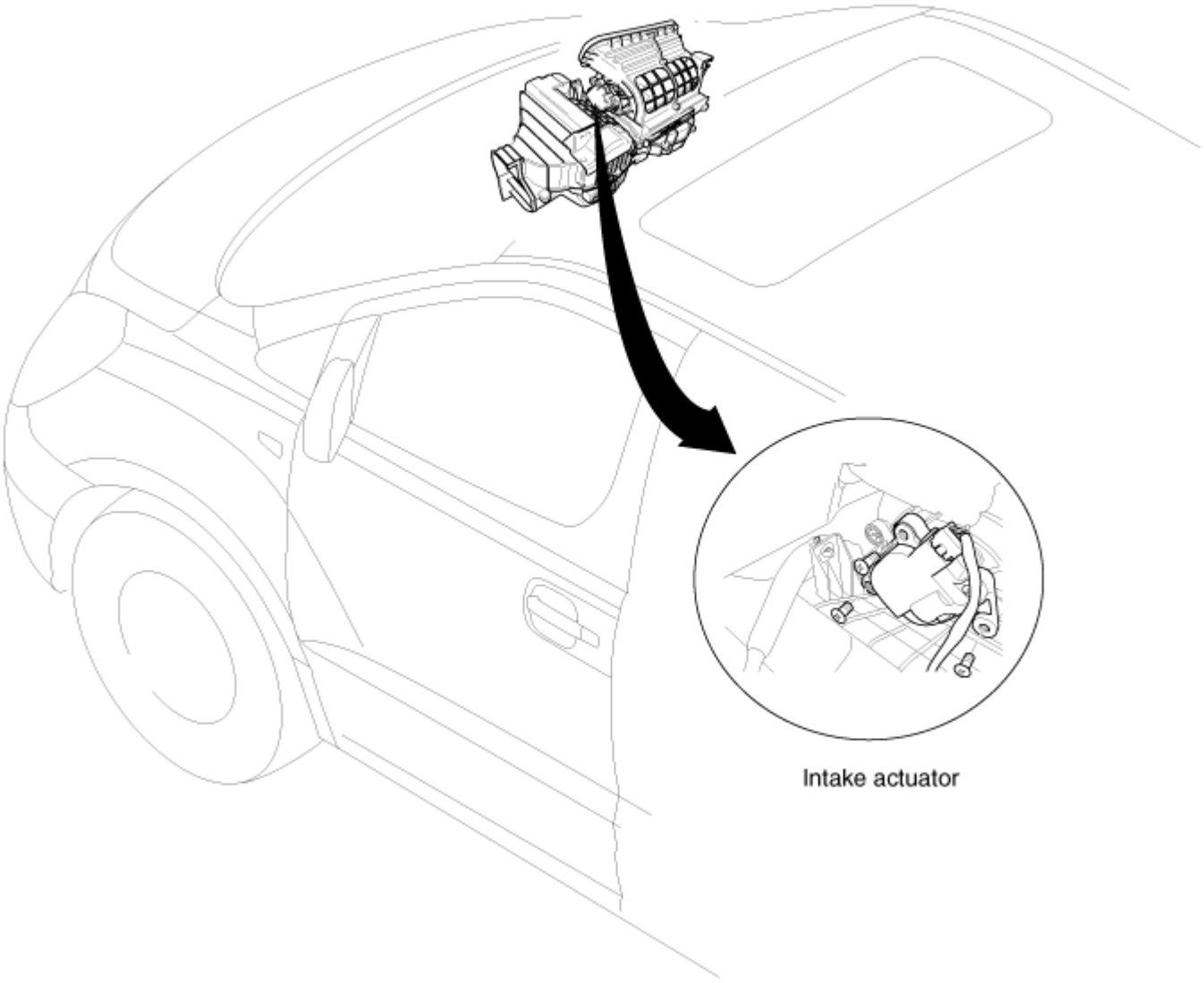
6. Remove the evaporator core (A).



Make sure that there is no air leaking out of the blower and duct joints.

7. Installation is the reverse order of removal.

Component Location

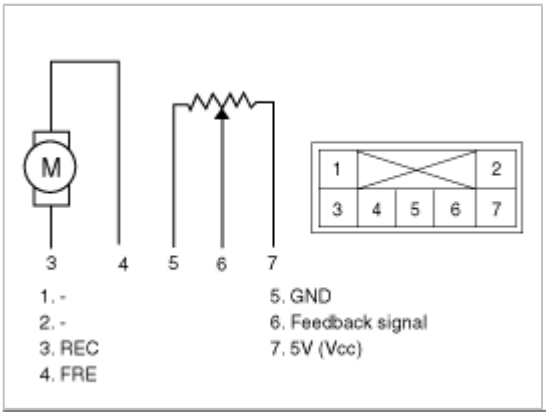


Description

1. The intake actuator is located at the blower unit.
2. It regulates the intake door by signal from control unit.
3. Pressing the intake selection switch will shift between recirculation and fresh air modes.

Inspection

1. Ignition "OFF"
2. Disconnect the intake actuator connector.
3. Verify that the actuator operates to the recirculation position when connecting 12V to the terminal 3 and grounding terminal 3.
4. Verify that the intake actuator operates to the fresh position when connecting in the reverse.

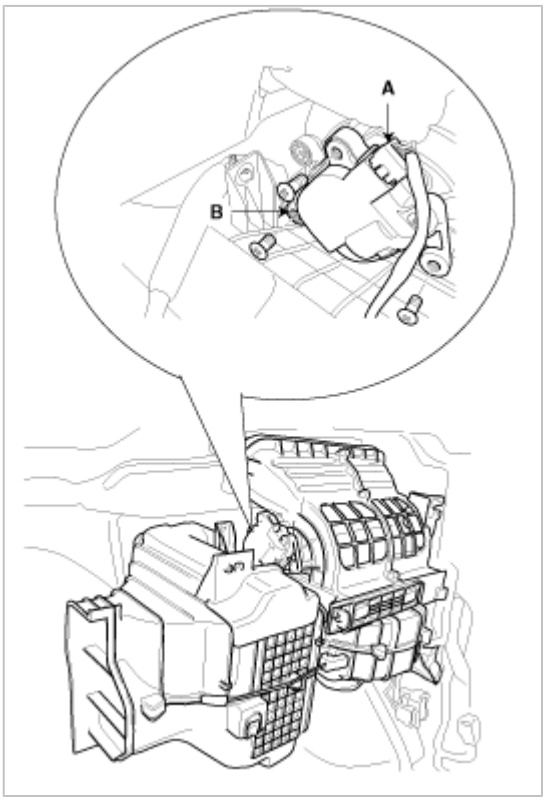


Door position	Voltage (5-6)	Error detecting
Fresh	0.3 ± 0.15V	Low voltage :0.1V or less High voltage :4.9V or more
	1.8 ± 0.15V	
Recirculation	4.7 ± 0.15V	

5. If the intake actuator is not operated well, substitute with a known-good intake actuator and check for proper operation.
6. If the problem is corrected, replace the intake actuator.

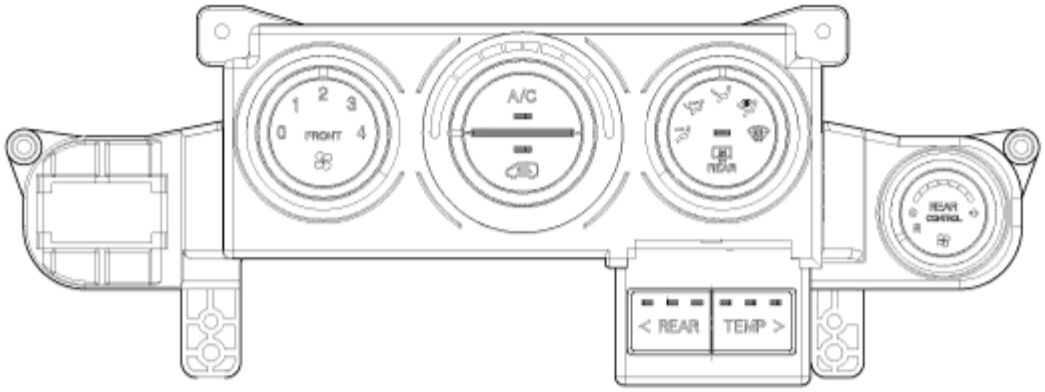
Replacement

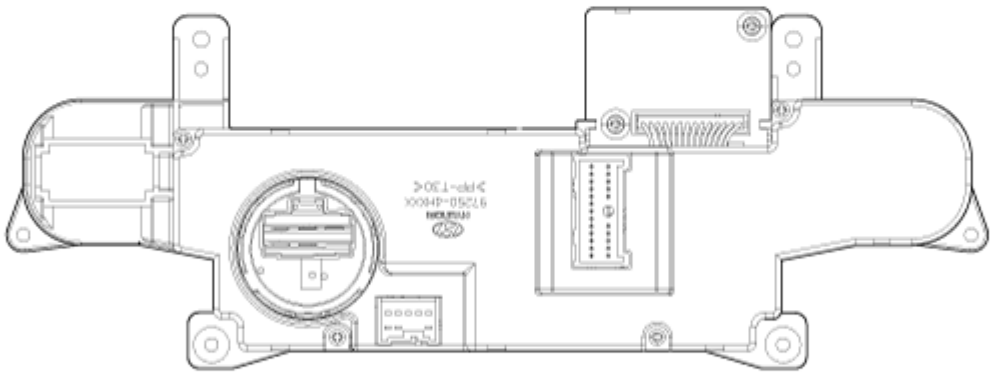
1. Disconnect the negative (-) battery terminal.
2. Remove the glove box. (Refer to BD group)
3. Disconnect the intake actuator connector.
4. Loosen the mounting screw and then remove the intake actuator (A) from the blower unit.

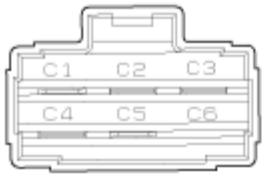


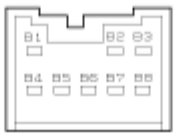
5. Installation is the reverse order of removal.

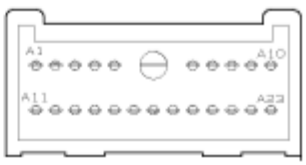
Components











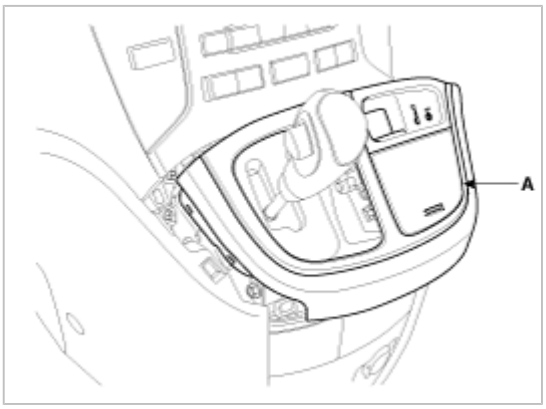
Connector Pin Function

	PIN			PIN	

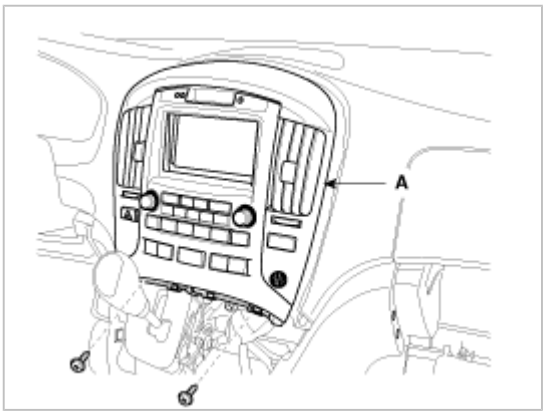
Connector	NO.	Function	Connector	NO	Function
Connector (A)	1	BATTERY	Connector (B)	1	BLOWER VOLTAGE F/B
	2	IGN2		2	MODE ACTUATOR(DEF)
	3	FET (G) - RR		3	TEMP ACTUATOR(COOL)
	4	SENSOR REF(+5V)		4	TEMP ACTUATOR(WARM)
	5	A/C SELECT SIGNAL		5	INTAKE ACTUATOR(FRE)
	6	A/C OUTPUT(THERMO)		6	INTAKE ACTUATOR(REC)
	7	PTC RELAY2		7	FET (D) - RR
	8	PTC RELAY3		8	RR BLOWER MOTOR (+)
	9	SENSOR GND	Connector (C)	1	GND
	10	GND		2	M/HIGH
	11	MODE ACTUATOR (VENT)		3	M/LOW
	12	TAIL LAMP(ILL+)		4	HIGH
	13	REAR C-LINE		5	LOW
	14	PTC ON SIGNAL		6	-
	15	BLOWER ON SIGNAL TO ECU			
	16	MODE ACTUATOR F/B			
	17	TEMP ACTUATOR F/B			
	18	INTAKE ACTUATOR F/B			
	19	HTD			
	20	REAR DEFOG SW			
	21	EVAPORATOR SENSOR(+)			
	22	BLOWER ON SIGNAL (ILL-)			
	23	RHEOSTAT(ILL)			

Replacement

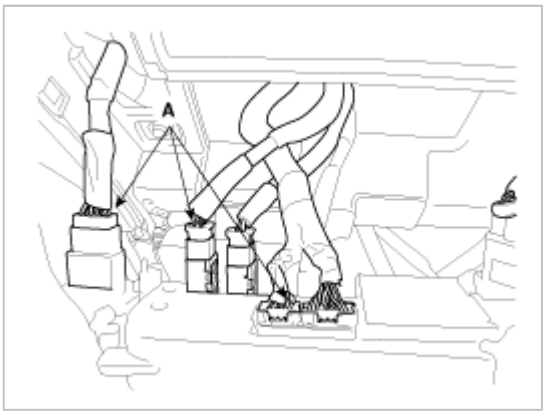
1. Disconnect the negative (-) battery terminal.
2. Remove the front console under cover (A).



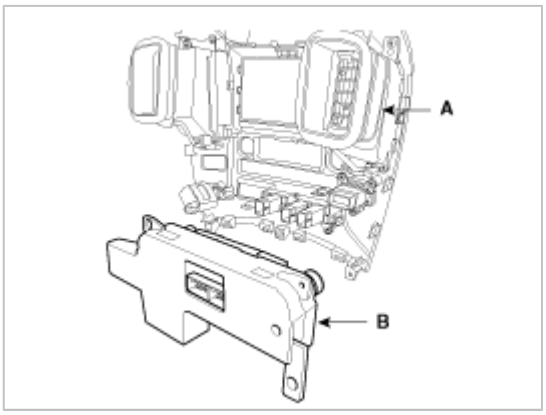
3. After loosening the mounting screws, then remove the fascia panel (A).



4. Disconnect the connectors (A).

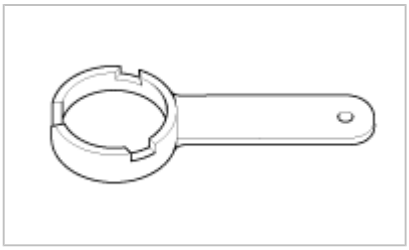


5. Remove the heater □ A/C controller (A) after loosening 4 screws.



6. Installation is the reverse order of removal.

Special tools

Tool(Number and name)	Illustration	Use
09977-29000Disc □ hub assembly bolt remover		Removal and installation of the disc □ hub assembly bolt

Air conditioner

Item		Specification	
		DAUL A/C	SINGLE A/C
Compressor	Type	HS-20	HS-15
	Oil type □ Capacity	FD46XG(PAG) 210±10	FD46XG(PAG) 150±10
	Pulley type	7PK-TYPE	
	Displacement	214cc/rev	154cc/rev
Condenser	Heat rejection	18,000 ±5% kcal/hr	
APT(A/C pressure transducer)	The method to measure the pressure	Voltage = 0.00878835 * Pressure + 0.37081095 [PSIA]	
Expansion valve	Type	Block	
Refrigerant	Type	HFC-134a(R-134a)	
	Capacity	850 ± 25g (29.98 ± 0.88oz.)	650 ± 25g (22.92 ± 0.88oz.)

Blower unit

Item		Specification
Fresh and recirculation	Operating method	Actuator
Blower	Type	Sirocco
	Speed step	1-16 speed (Manual)
	Speed control	Resistor (Manual)
Air filter	Type	Particle filter

Heater and evaporator unit

Item		Specification
Heater	Type	Pin □ Tube type
	Heating capacity	4,700 ± 5% kcal/hr
	Mode operating method	Actuator
	Temperature operating method	Actuator (Automatic)

Evaporator	Temperature control type	Evaporator temperature sensor
	A/C ON/OFF [□(□)]	ON : 4.0 ± 0.3 (39.2 ± 32.54), OFF: 2.5± 0.3 (36.5 ± 32.54)

PROBLEM SYMPTOMS TABLE

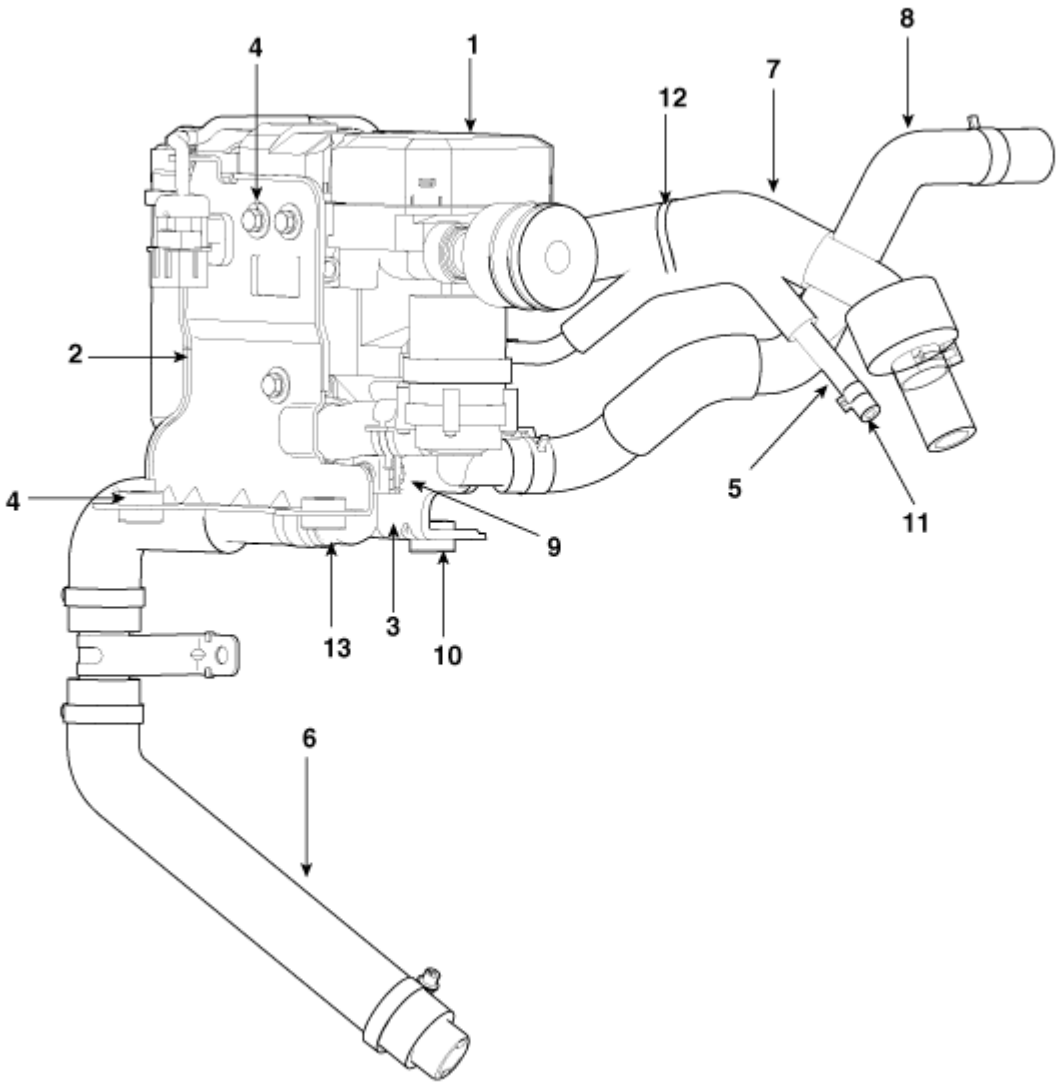
Before replacing or repairing air conditioning components, first determine if the malfunction is due to the refrigerant charge, air flow or compressor.
Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order.
If necessary, replace these parts.
After correcting the malfunction, check the complete system to ensure that performance is satisfactory.

STANDARD :

Symptom	Suspect Area
No blower operation	1. Blower fuse
	2. Blower relay
	3. Blower motor
	4. Blower resistor
	5. Blower speed control switch
	6. Wire harness
No air temperature control	1. Engine coolant capacity
	2. Heater control assembly
No compressor operation	1. Refrigerant capacity
	2. A/C Fuse
	3. Magnetic clutch
	4. Compressor
	5. A/C pressure transducer
	6. A/C switch
	7. Evaporator temperature sensor
	8. Wire harness
No cool comes out	1. Refrigerant capacity
	2. Refrigerant pressure
	3. Drive belt
	4. Magnetic clutch
	5. Compressor
	6. A/C pressure transducer
	7. Evaporator temperature sensor

	8. A/C switch
	9. Heater control assembly
	10. Wire harness
Insufficient cooling	1. Refrigerant capacity
	2. Drive belt
	3. Magnetic clutch
	4. Compressor
	5. Condenser
	6. Expansion valve
	7. Evaporator
	8. Refrigerant lines
	9. A/C pressure transducer
	10. Heater control assembly
No engine idle-up when A/C switch ON	1. Engine ECM
	2. Wire harness
No air inlet control	1. Heater control assembly
No mode control	1. Heater control assembly
	2. Mode actuator
No cooling fan operation	1. Cooling fan fuse
	2. Fan motor
	3. Engine ECM
	4. Wire harness

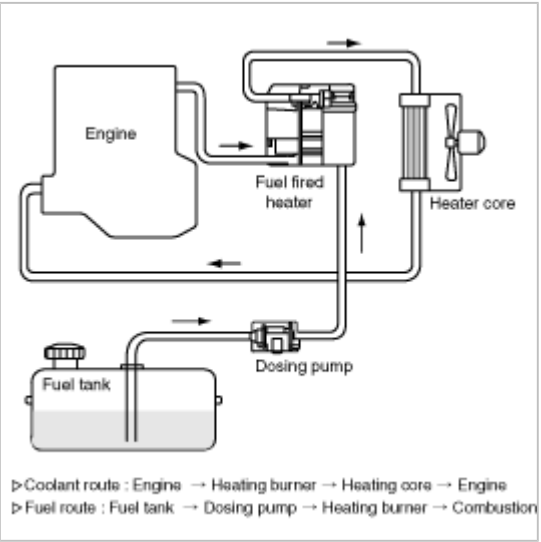
Components



1. Fuel fired heater assembly	5. Fuel hose	10. Rubber
2. Fuel fired heater bracket (A)	6. Exhaust pipe	11. Bush
3. Fuel fired heater bracket (B)	7. Hose - outlet	12. Clamp
4. Bolt	8. Hose - inlet	13. Exhaust pipe
	9. Clamp	

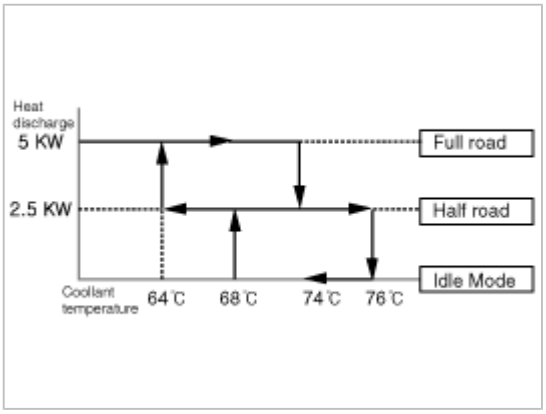
Description

The fuel fired heater has been applied to the diesel engine (CRDi) to increase heating capability by using diesel only in cold weather



Overview

1. This fuel fired heater supplies additional heat to the interior compartment with a low fuel consumption to compensate the heat provided by engine alone.
2. The fuel fired heater has been adopted to warm up the interior compartment in a short time.
3. The two coolant temperature sensors are installed to the heater inner. The sensor valves determine heater operation.
4. One of the temperature sensors functions to prevent the heater from overheating.
   If the sensor temperature valve exceeds 125℃, the fuel will be cut and the heater will be deactivated by the determination of the overheating of the heater.
   The other temperature sensor determines the operation mode of the fuel fired heater.The temperature of this sensor enables to activate the heater at full load (5kw) or half load(2.5kw).
   The coolant temperature shown on the above Figure is the value of the inner sensor and the actual coolant temperature is higher about 5℃ ~7℃ than the above value.



Operation

Switch on/ Operation start

The fuel fired heater is operated when the coolant temperature is below 68℃ and the ambient temperature is below 2℃ after starting the engine.
At this time, the glow plug and combustion air fan are operated first and after 30 seconds, the dosing pump is operated with stopping the combustion fan for 3 seconds.
After that, the operation of the fan increases continuously until it approaches to full load within 56 seconds.
If fuel supply reaches to full load the glow plug does not operate and the operation of the fan reaches to full load.
After that the glow plug monitors ignition condition as a flame sensor for 45 seconds.
The above operation procedure is done automatically and in case the ignition fails, the above operation will be done again automatically.
If the condition of ignition failure sustains continuously, fuel supply and fan operation will be stopped and error codes will be stored to find cause of failurGenerally, the cause of ignition failure during combustion is caused by the automatic re-operation of the above procedure.

Operation for heating

The fuel fired heater operates at full load when the coolant temperature is below 68℃ and the ambient temperature is below 2℃ after starting the engine.
It operates at half load when the coolant temperature is 74℃ and it operates at idle mode when the coolant temperature is 78℃.
The fuel fired heater during the transformation process does a cleaning function from the half mode to the idle mod.
At idle mode, all components do not work.
The fuel fired heater operating at idle mode turns into the half load when the coolant temperature is 74℃.
At this time, if the coolant temperature drops again below 68℃, the heater operates with full load and turns into the idle mode if the temperature is 78℃.
This serial operating process is performed automatically.

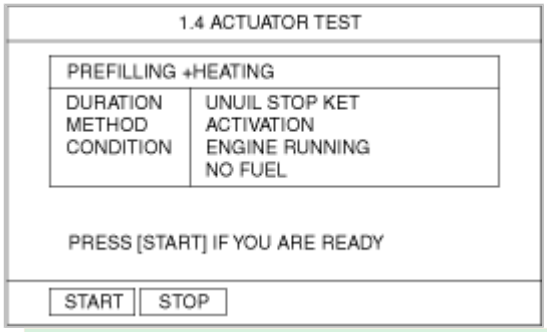
Key switch off / Operation stop

The fuel fired heater ECU stops the operation of the fuel pump and cuts fuel supply when shutting off the engine during the heater operation.
The heater conducts cleaning operation at this time.
This is a process of burning the fuel completely supplied in the heater inner.
In this process, the glow plug and combustion air fan are operated.
When the cleaning process is over, the operation of the heater is stopped.
The time for cleaning when the engine is turned off during the operation of the heater at full load is about 175 second
About 100 seconds are required to conduct the cleaning of the heater at half load condition.
The operating sound of cleaning the heater is heard from the outside of the heater after turning the engine off and this is a normal process of operation

Operation Test

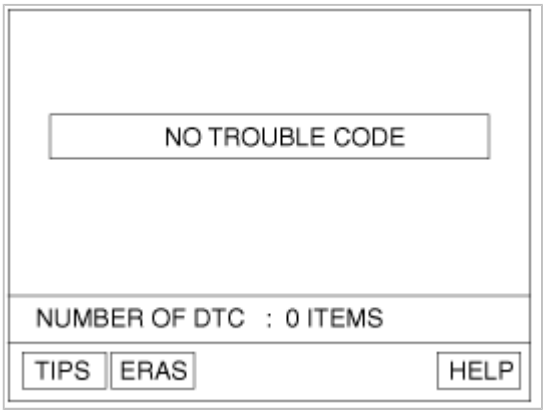
Fuel-fired heater operation test by force using Hi-Scan

1. Start the engine.
2. Connect the Hi-Scan to the vehicle.
3. Select "GRAND STAREX" and then select "FUEL FIRED HEATER".
4. Select "04. ACTUATION TEST" mode.
5. Select "PREFILLING + HEATING" to conduct the performance test after replacing the fuel fired heater system.
   Fuel supply and heating will be initiated if the "F1 key STRT" is pressed.
   However, a repair or replacement of the components related to the fuel line system in the fuel-fired heater were not done, operate the component by force after selecting the appropriate item from the menu screen.

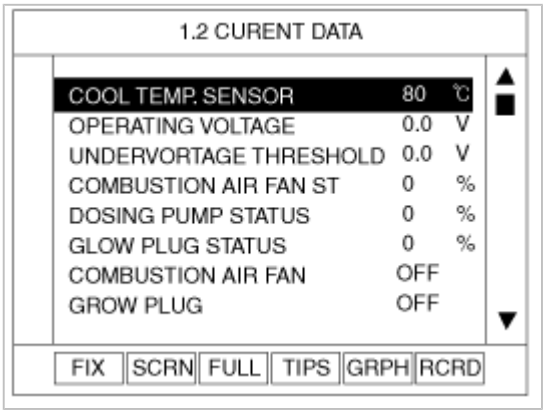


Do not operate the system by force with selecting the " PREFILLING + HEATING " option if no repair for the fuel line relating components has been done.
This means the fuel is in the fuel line.If an excessive fuel is supplied, it may cause smoke and abnormal "Banging" noise when the fuel is burned.
If the "F2 KEY STOP" is pressed, operation test is stopped.For self-diagnosis test and sensors outputs during compulsory operation test, press "ESC KEY".
When a self-diagnosis test is completed, disconnect the self-diagnosis connector or press "F2 KEY STOP" from the "PREFILLING + HEATING" menu to stop the compulsory operation.
In case of selecting the individual part (ex. Combustion air fan, water pump,), press "ESC KEY" to stop the test.
In case of selecting the "PREFILLING + HEATING" option, about 2 minutes are required to conduct cleaning process after pressing the "F2 KEY STOP".
It is a normal process to burn the fuel left in the fuel line.

6. To conduct self diagnosis test, press "ESC" and then "01. DIAGNOSTIC TROUBLE CODES" option.



7. Select "02. CURRENT DATA" to view the current status of the components.



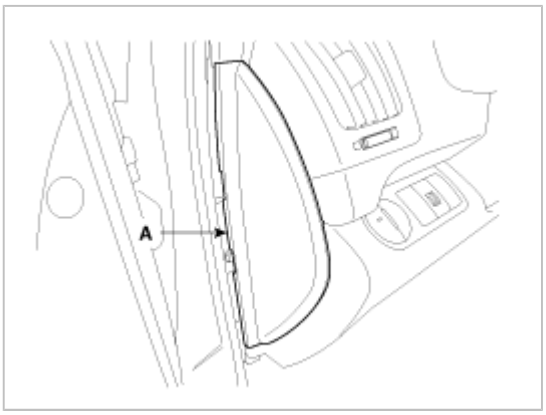
Component test

1. Using the Hi-Scan, conduct component test after selecting "FUEL FIRED HEATER" and "ACTUATION TEST" mode.
2. After conducting component test, perform self-diagnosis test.
3. It is recommended to conduct the fuel fired heater system test after completing the component test.
4. Test values for glow plug.

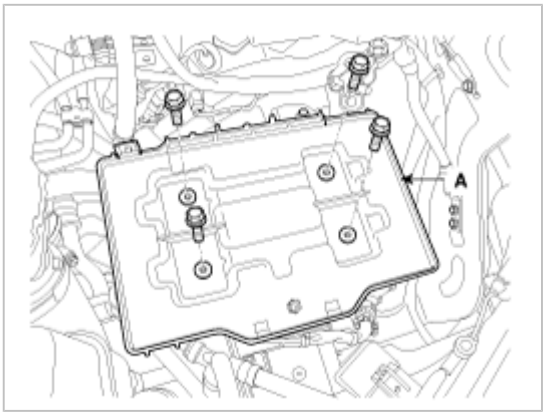
0.324 W ~ 0.360 W
Below 5mA

Replacement

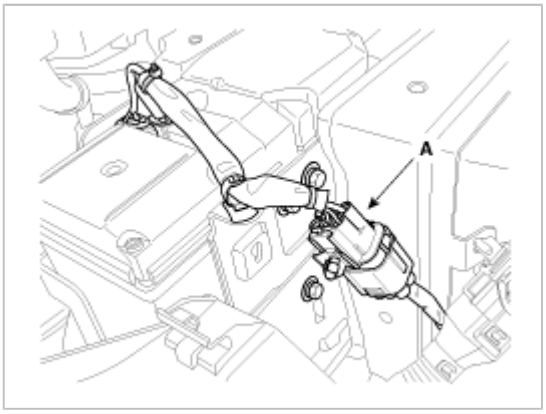
1. Disconnect the negative (-) battery terminal.
2. Removr the battery mounting bracket (A), After loosen the mounting bolts.



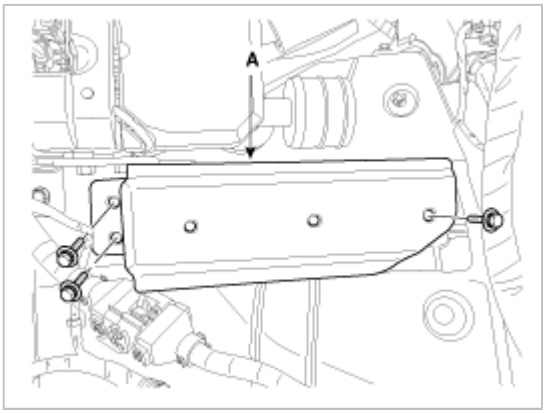
3. Remove the battery tray (A), After loosen the mounting bolts.



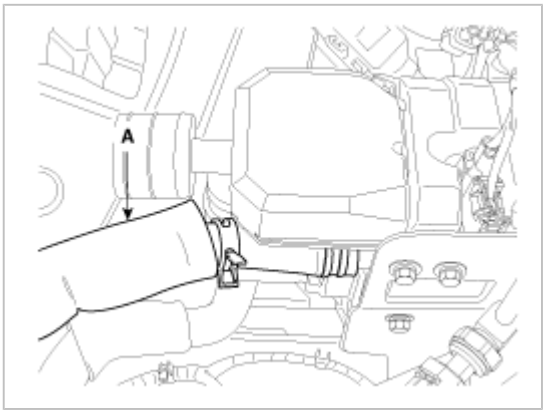
4. Disconnect the fuel fired heater main connector (A).

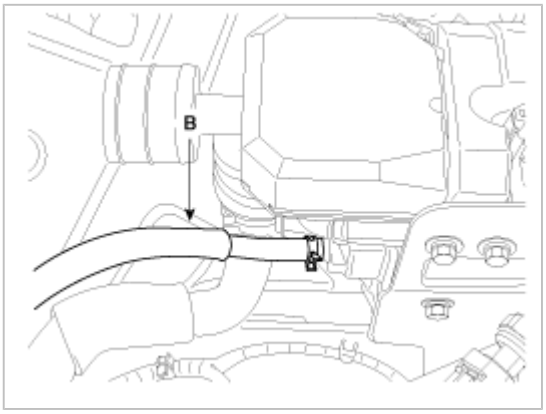


5. Remove the battery tray mount bracket (A), After loosen the mounting bolts.

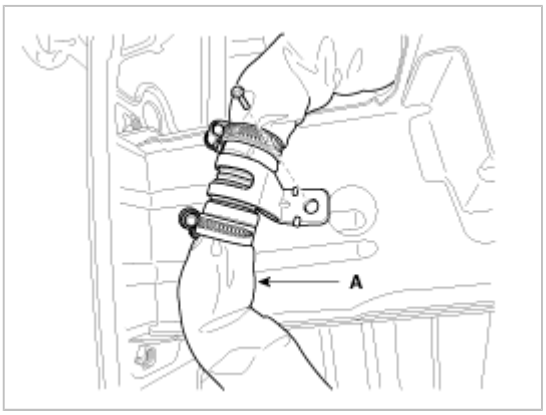


6. Disconnect the water hose (A), fuel hose (B).

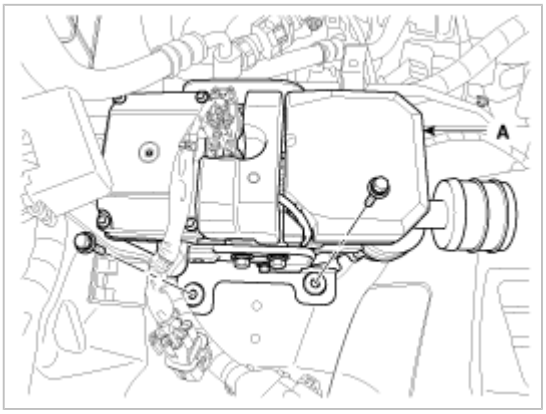




7. Loosen the exhaust pipe (A) mount bolt.

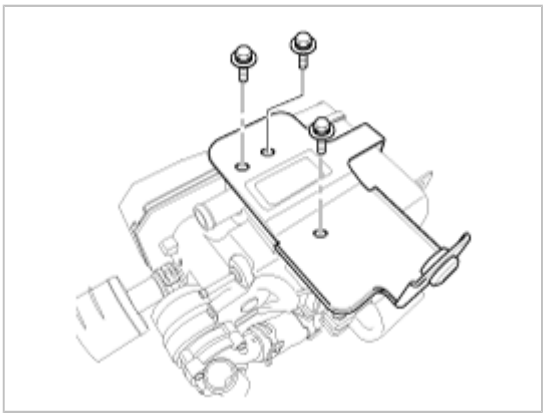


8. Remove the fuel fired heater assemble (A).



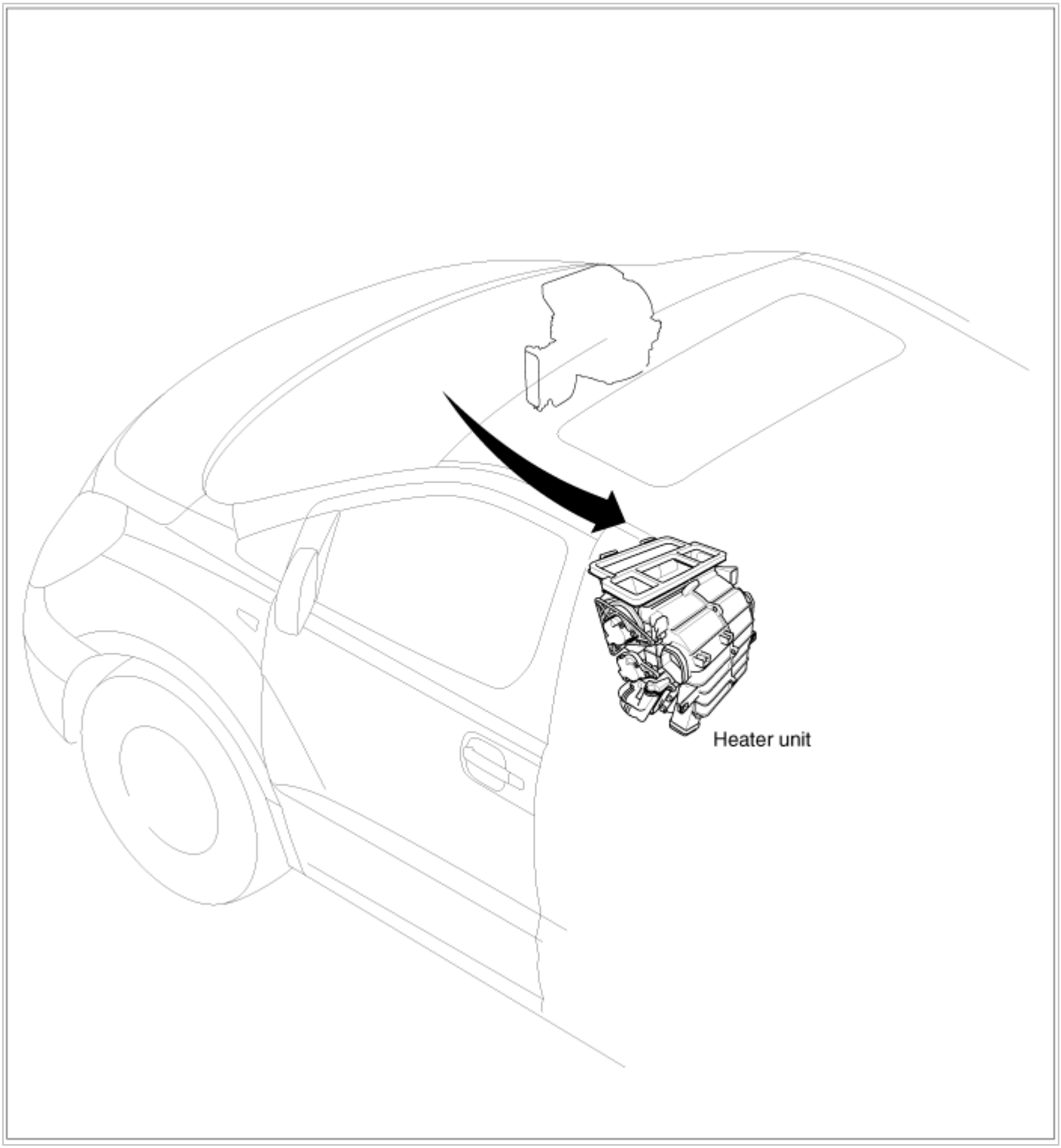
: 0.9~1.4kg/f

9. Disconnect the fuel fired heater mounting bracket (A).

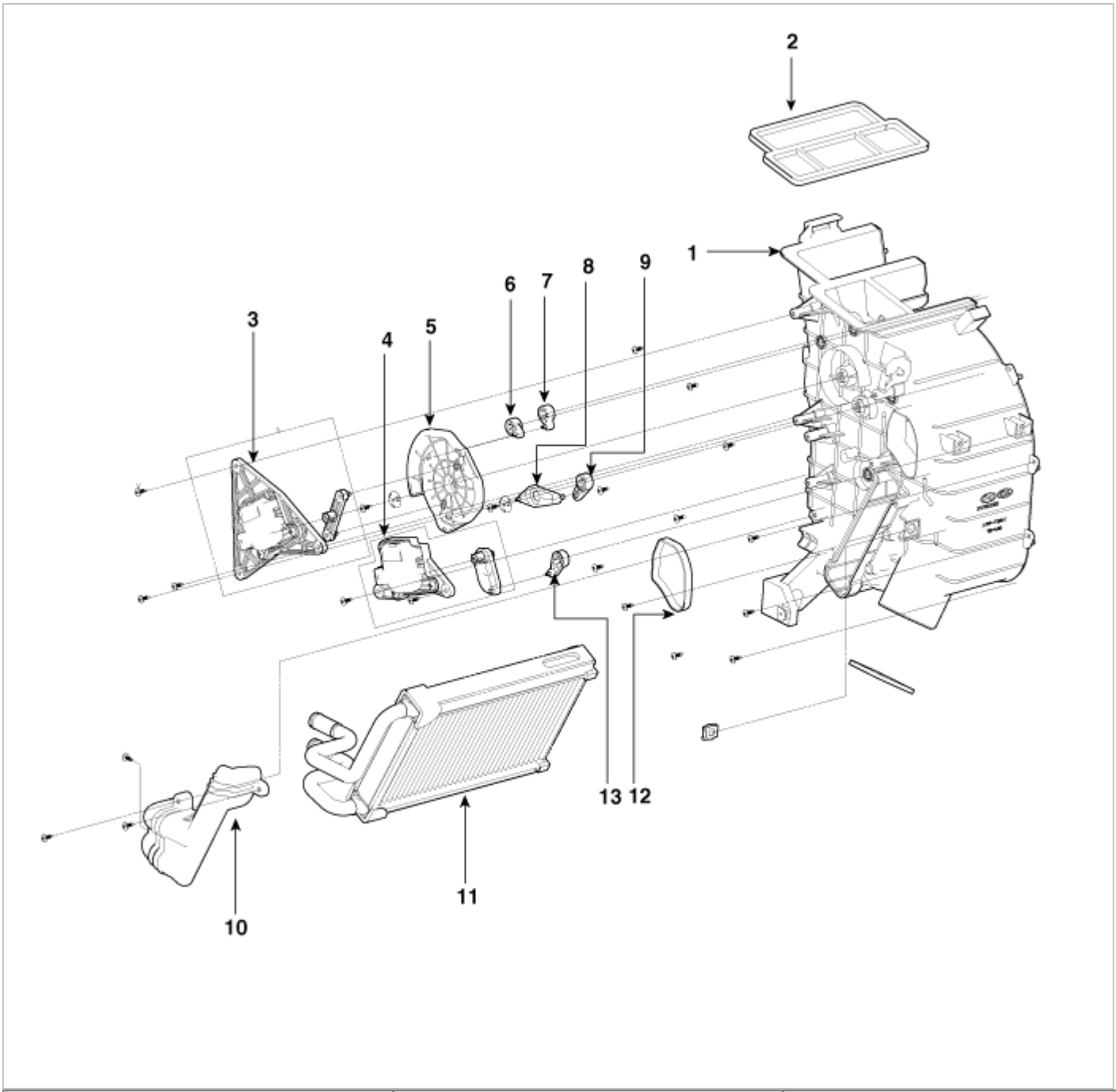


10. Installation is the reverse order of removal.

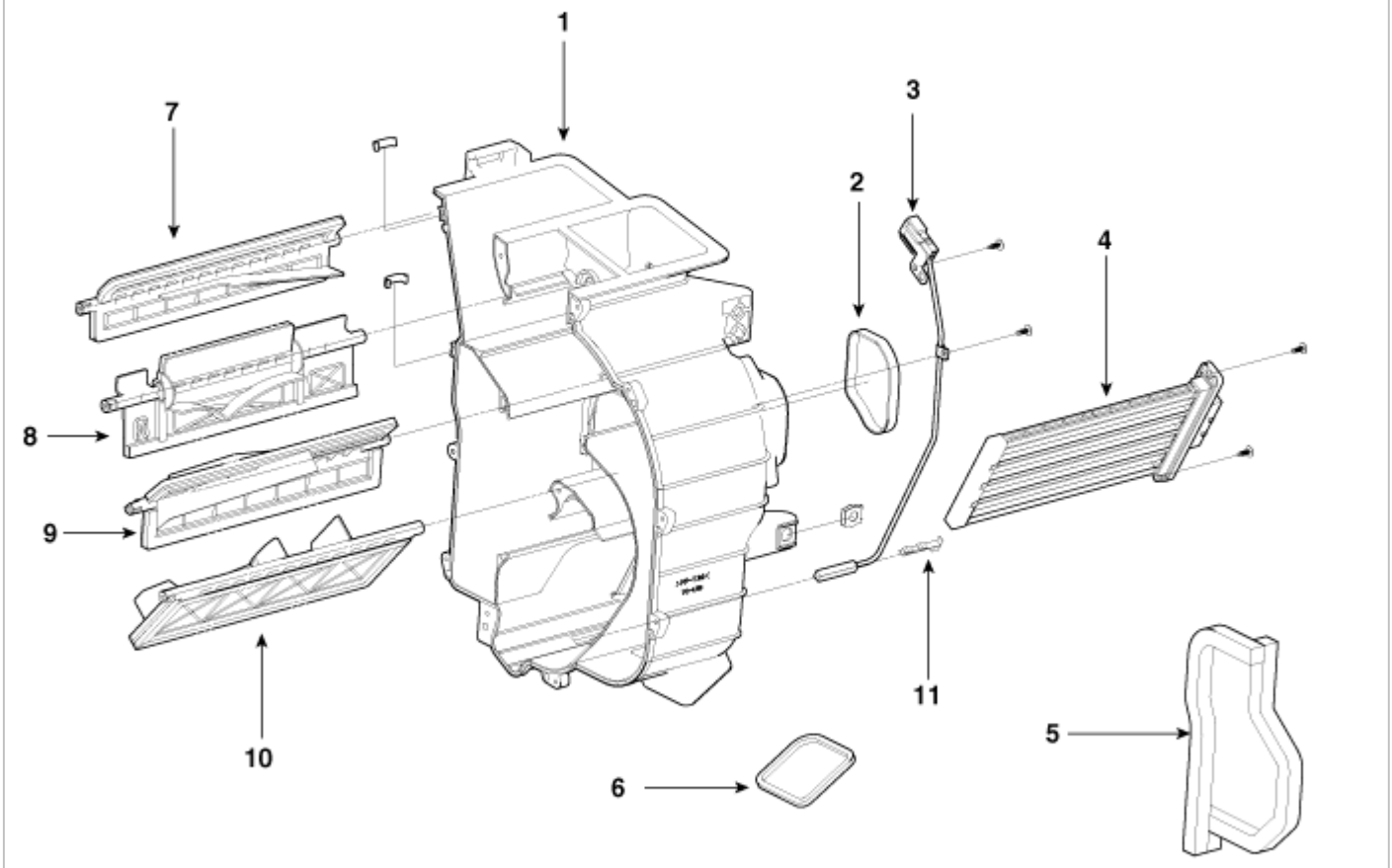
Components Location



Components



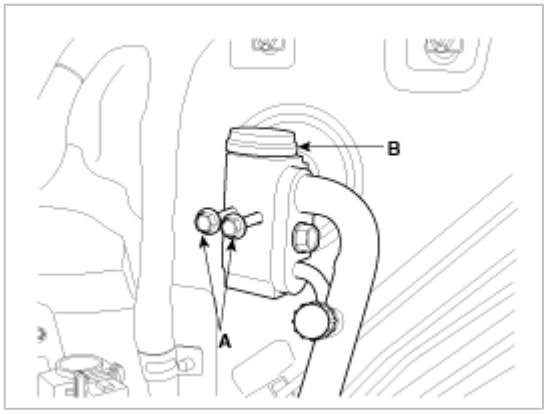
1. Heater case (L)	5. Mode cam	9. Foot lever
2. Seal	6. Def lever	10. Heater pipe cover
3. Mode actuator	7. Vent lever	11. Heater core
4. Temp actuator	8. Foot link	12. Foot seal
		13. Temp lever



1. Heater case (R)	6. Rear duct seal
2. Foot seal	7. Def door
3. Water temperature sensor	8. Vent door
4. PTCcore	9. Foot door
5. Evaporator seal	10. Temp dooor
	11. Sensor clip

Replacement

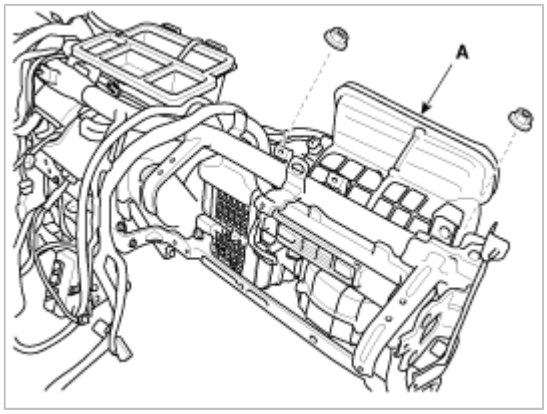
1. Disconnect the negative (-) battery terminal.
2. Recover the refrigerant with a recovery/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.
4. Remove the bolts (A) and the expansion valve (B) from the evaporator core.
   Plug or cap the lines immediately after disconnecting them to avoid moisture and dust contamination.



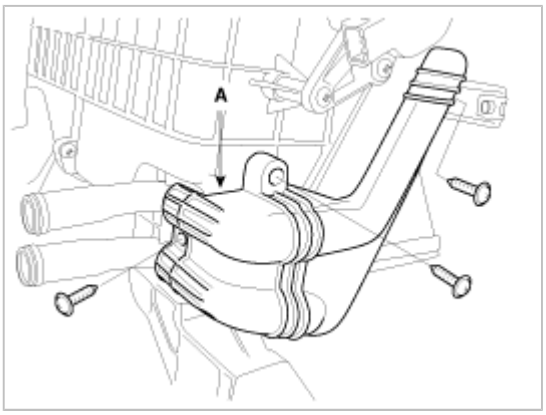
5. Disconnect the inlet and outlet heater hoses from the heater unit.

   Engine coolant will run out when the hoses are disconnected; drain it into a clean drip pan. Be sure not to let coolant spill on electrical parts or painted surfaces. If any coolant spills, rinse it off immediately.

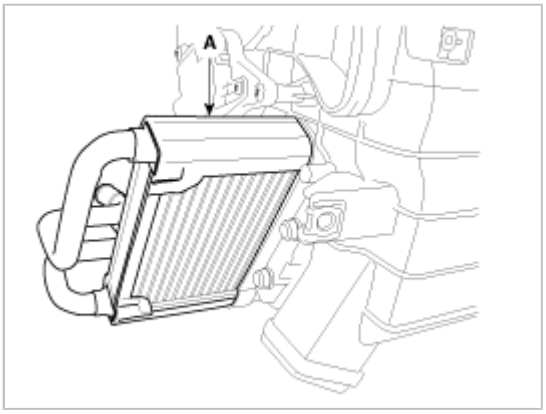
6. Remove the crash pad.
   (Refer to BD group - "Crash Pad")
7. Remove the cowl cross bar assembly.
   (Refer to BD group - "Crash Pad")
8. Disconnect the blower unit (A) from cowl cross bar.



9. Remove the heater core (B) after remove the cover (A).

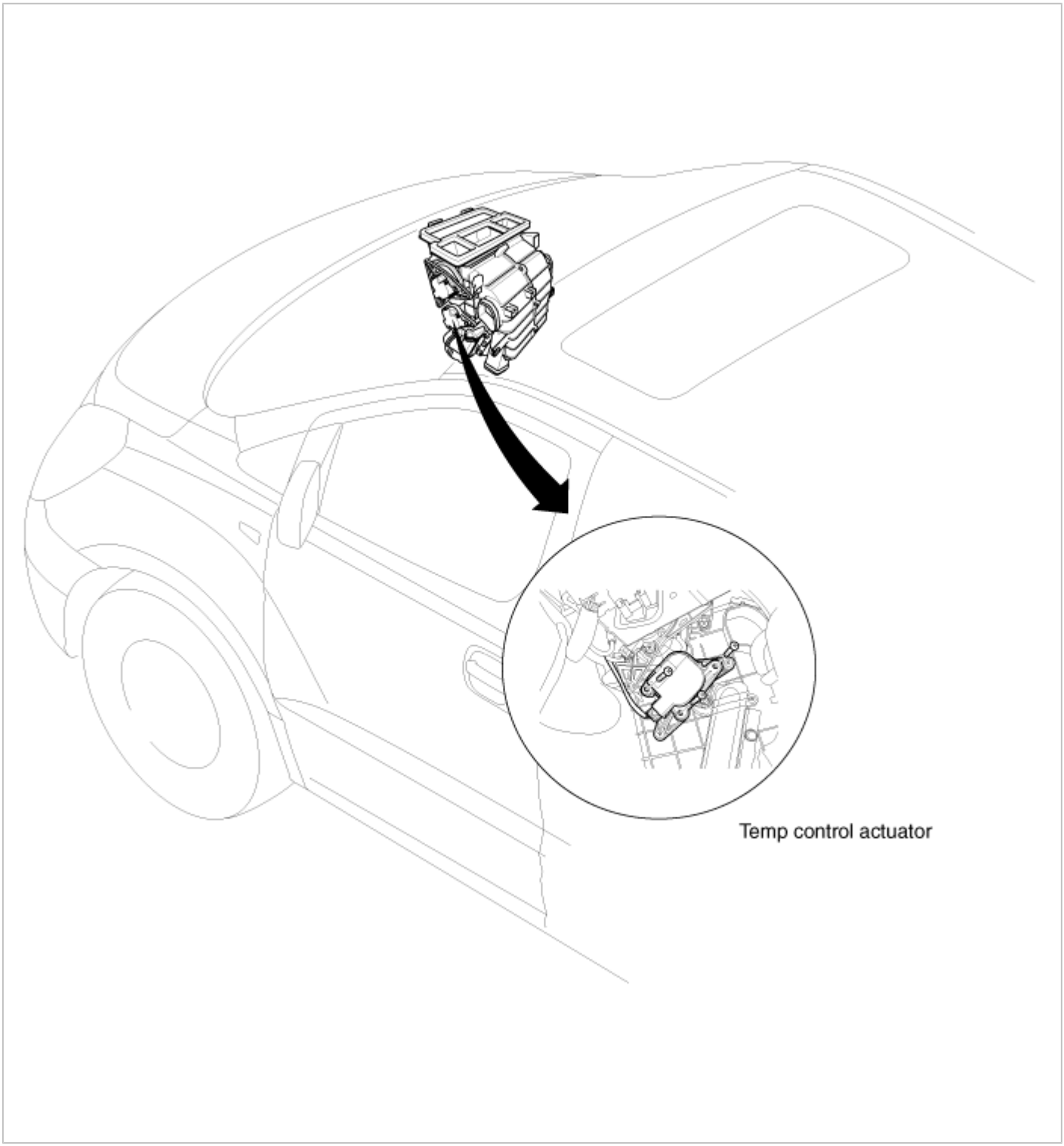


10. Be careful that the inlet and outlet pipe are not bent during heater core removal, and pull out the heater core.



11. Installation is the reverse order of removal, and note these items :
    A. If you're installing a new evaporator, add refrigerant oil (ND-OIL8).
    B. Replace the O-rings with new ones at each fitting, and apply a thin coat of refrigerant oil before installing them. Be sure to use the right O-rings for R-134a to avoid leakage.
    C. Immediately after using the oil, replace the cap on the container, and seal it to avoid moisture absorption.
    D. Do not spill the refrigerant oil on the vehicle ; it may damage the paint ; if the refrigerant oil contacts the paint, wash it off immediately
    E. Apply sealant to the grommets.
    F. Make sure that there is no air leakage.
    G. Charge the system and test its performance.
    H. Do not interchange the inlet and outlet heater hoses and install the hose clamps securely.
    I. Refill the cooling system with engine coolant

Component Location

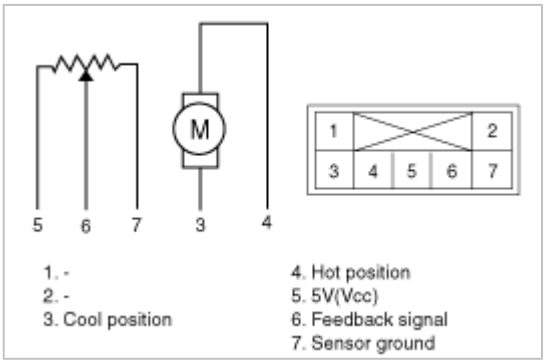


Description

1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. It regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio decided by position of temperature door.

Inspection

1. Ignition "OFF"
2. Disconnect the connector of temperature control actuator.
3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.
   Verify that the temperature control actuator operates to the cool position when connecting in the reverse.



4. Check the voltage between terminals 6 and 7.Specification

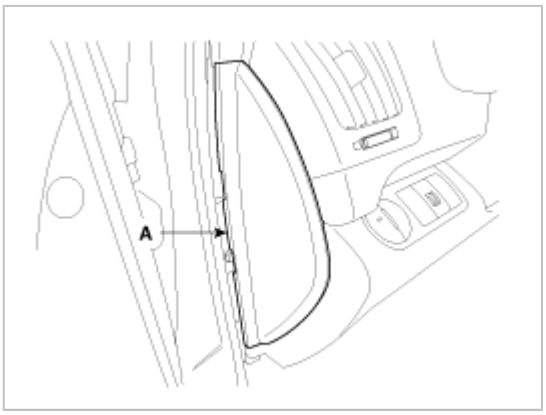
Specification

Door position	Voltage (6-7)	Error detecting
Max. cooling	0.3 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.7 ± 0.15V	High voltage : 4.9V or more

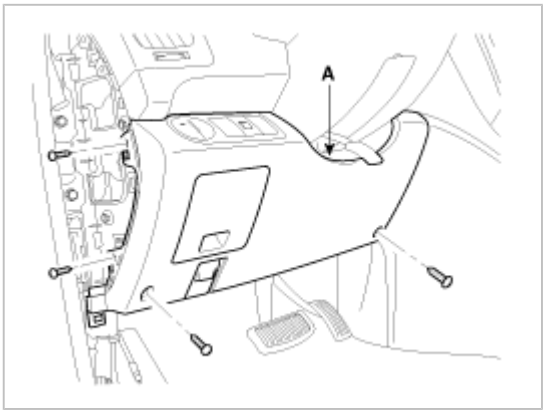
   It will feedback current position of actuator to controls.
5. If the measured voltage is not specification, substitute with a known-good temperature control actuator and check for proper operation.
6. If the problem is corrected, replace the temperature control actuator.

Replacement

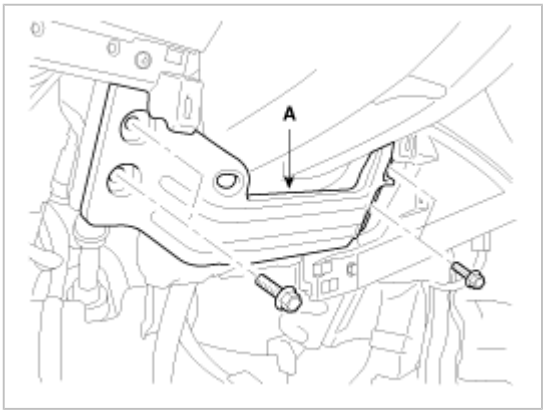
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



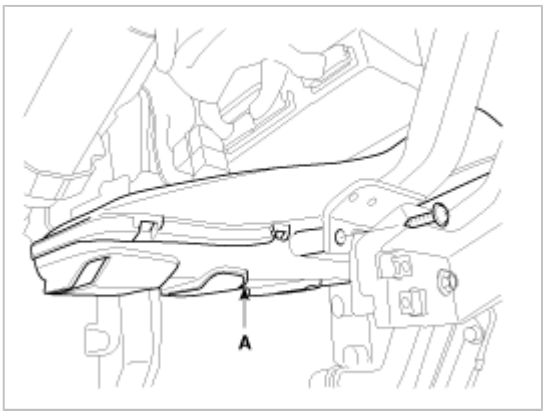
3. After loosening the crash pad lower panel mounting screw, then remove the lower panel (A).



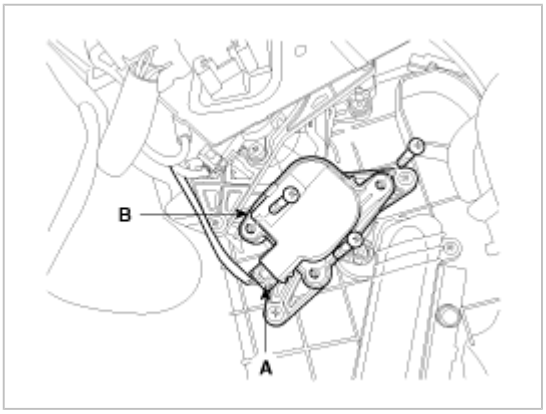
4. After loosening the mounting bolts, then remove the reinforcing panel (A).



5. Remove the shower duct (A).

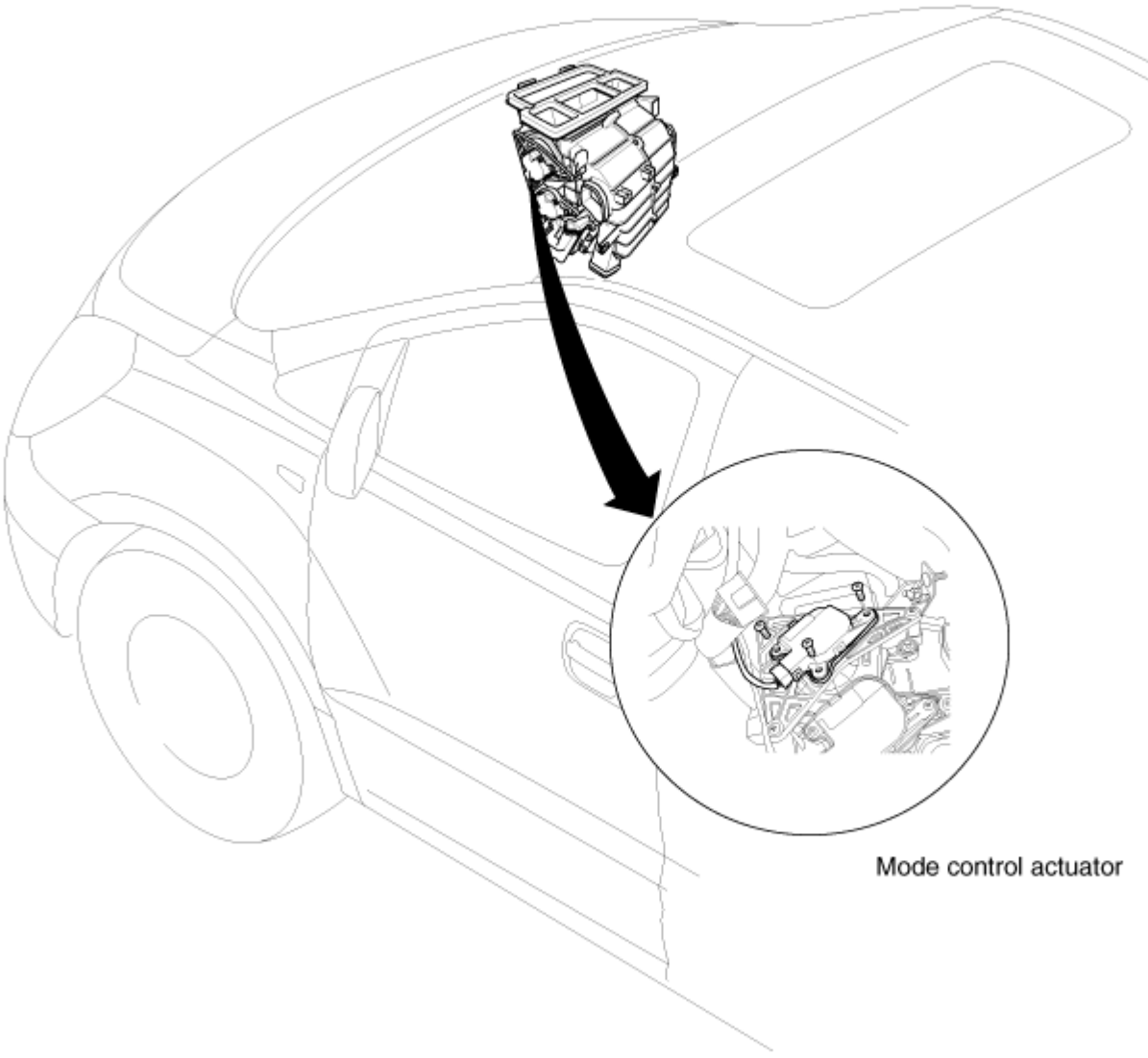


6. Remove the BCM. (Refer to BE group - "BCM")
7. Loosen the mounting screw and then remove the temperature control actuator (B).



8. Installation is the reverse order of removal.

Component Location



Description

The mode control actuator is located at the heater unit.It adjusts position of mode door by operating mode control actuator based on signal of A/C control unit. Pressing mode select switch makes the mode control actuator shift in order of vent→ B/L → floor → mix.

Inspection

1. Ignition "OFF"
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the defrost mode when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.
5. Check the voltage between terminals 5 and 6.

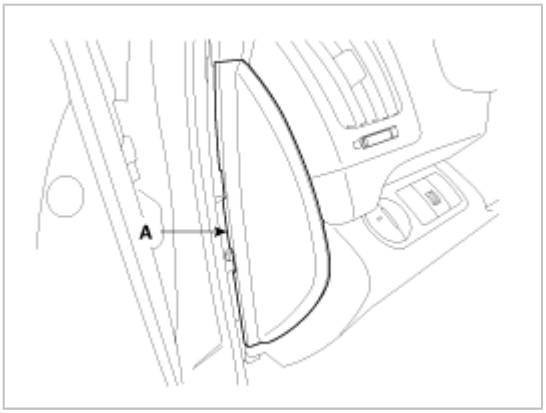
Door position	Voltage (5-6)	Error detecting
Vent	0.3 ± 0.15V	Low voltage : 0.1V or less
Defrost	4.7 ± 0.15V	High voltage : 4.9V or more

It will feedback current position of actuator to controls.

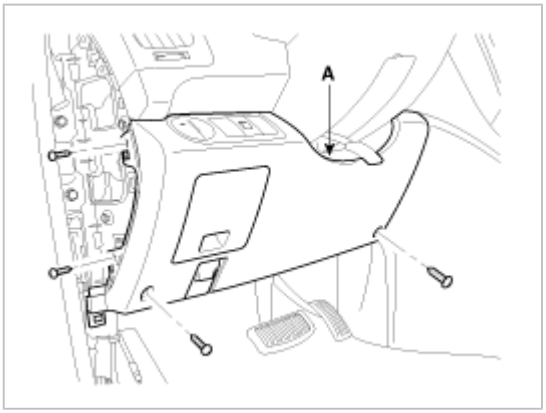
6. If the measured voltage is not specification, substitute with a known-good mode control actuator and check for proper operation.
7. If the problem is corrected, replace the mode control actuator.

Replacement

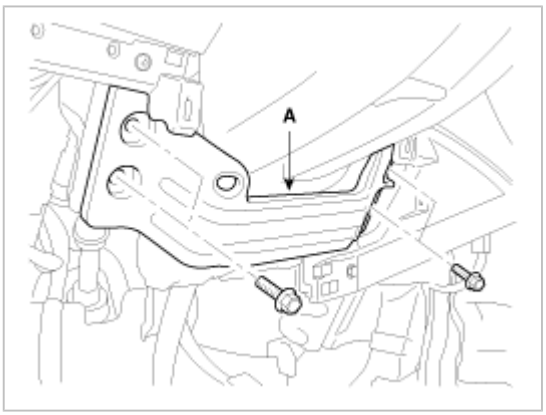
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad side cover (A).



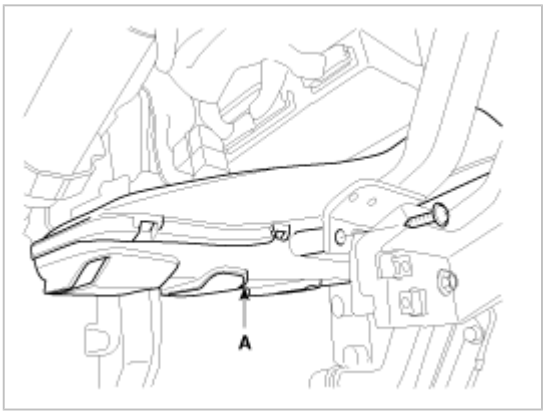
3. After loosening the crash pad lower panel mounting screw, then remove the lower panel (A).



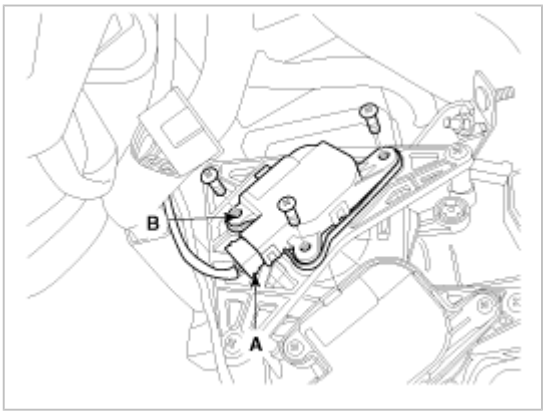
4. After loosening the mounting bolts, then remove the reinforcing panel (A).



5. Remove the shower duct (A).



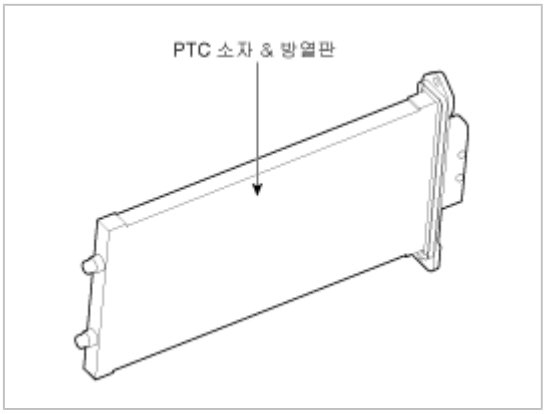
6. Remove the BCM. (Refer to BE group - "BCM")
7. Loosen the mounting screws and then remove the mode control actuator (B).



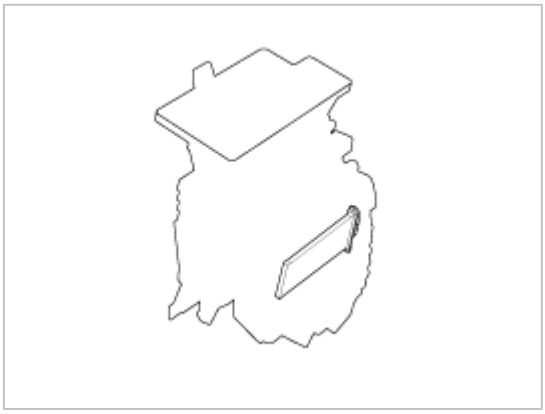
8. Installation is the reverse order of removal.

Description

PTC (Positive Temperature Coefficient) heater (A) is an electric heater using a PTC element as an auxiliary heating device that supplements deficiency of interior heat source in highly effective diesel engine.



An electric heater heats up the interior by directly heating the air that passes through the heater.
PTC = positive Temperature Coefficient
The name itself implies that the element has a proportional resistance change sensitive to temperature.
PTC heater is installed at the exit or the backside of heater core.



Operation Principle

ECM outputs a PTC on signal. Operate PTC from 1st setting to 3rd setting with an interval of 15 seconds.
Heat up the air, which passes through a heater core.

(Connector Spec)

PIN	WIRE	COLOR	FUNCTION
E1	4.0	-	PTC RLY 2
E2	5.0	-	GND
E3	4.0	-	PTC RLY 1
E4	5.0	-	GND
E5	4.0	-	PTC RLY 3

OPERATION CONDITION

Judge the condition by ambient temperature is below 5℃, coolant temperature is below 70℃, and battery voltage is above 11V and engine RPM is above 700RPM.

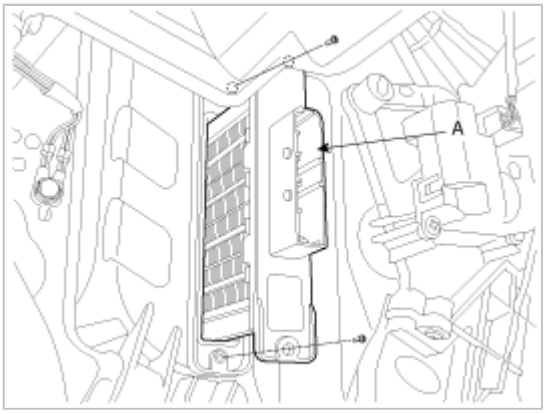
INSPECTION

Inspect the PTC operation by confirmation logic as below.

1. Entering method
   (1) Set the floor mode, maximum heating.
   (2) Turn off the blower switch.
   (3) Press the intake button more than 5 times.
   (4) Indicator of entire button is flashed with an interval of 0.5 seconds continuously (Manual).
   Graphics of the entire LCD display switch on and off with an interval of 0.5 seconds continuously (Automatic)
   (5) Confirm the PTC operation by operating the blower switchManual: 1~4 step, Automatic: 1~8step.
   (6) Each PTC relay is operated with an interval of 3 seconds.
   (7) Execute the PTC operation by confirmation logic for 30 seconds.
2. Cancellation method
   (1) Select the A/C button or intake button.
   (2) IG “OFF”
   (3) Cancel the logic after 30 seconds automatically.
3. If the PTC operation is not operated, substitute with a known-good PTC and check for proper operation. If the problem is corrected, replace the PTC.

Replacement

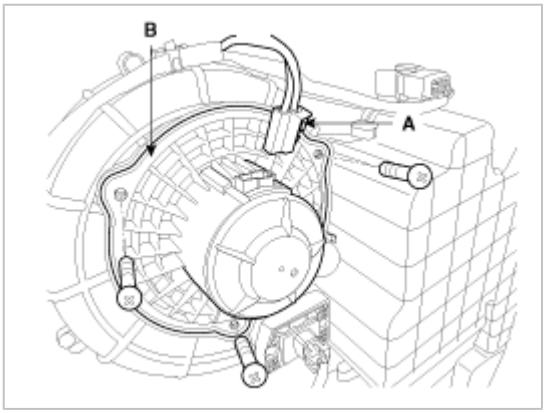
1. Remove the lower under cover.
   (Refer to BD group - "Console")
2. Rempve the PTC heater After disconnect the connector.



3. Installation is the reverse order of removal.

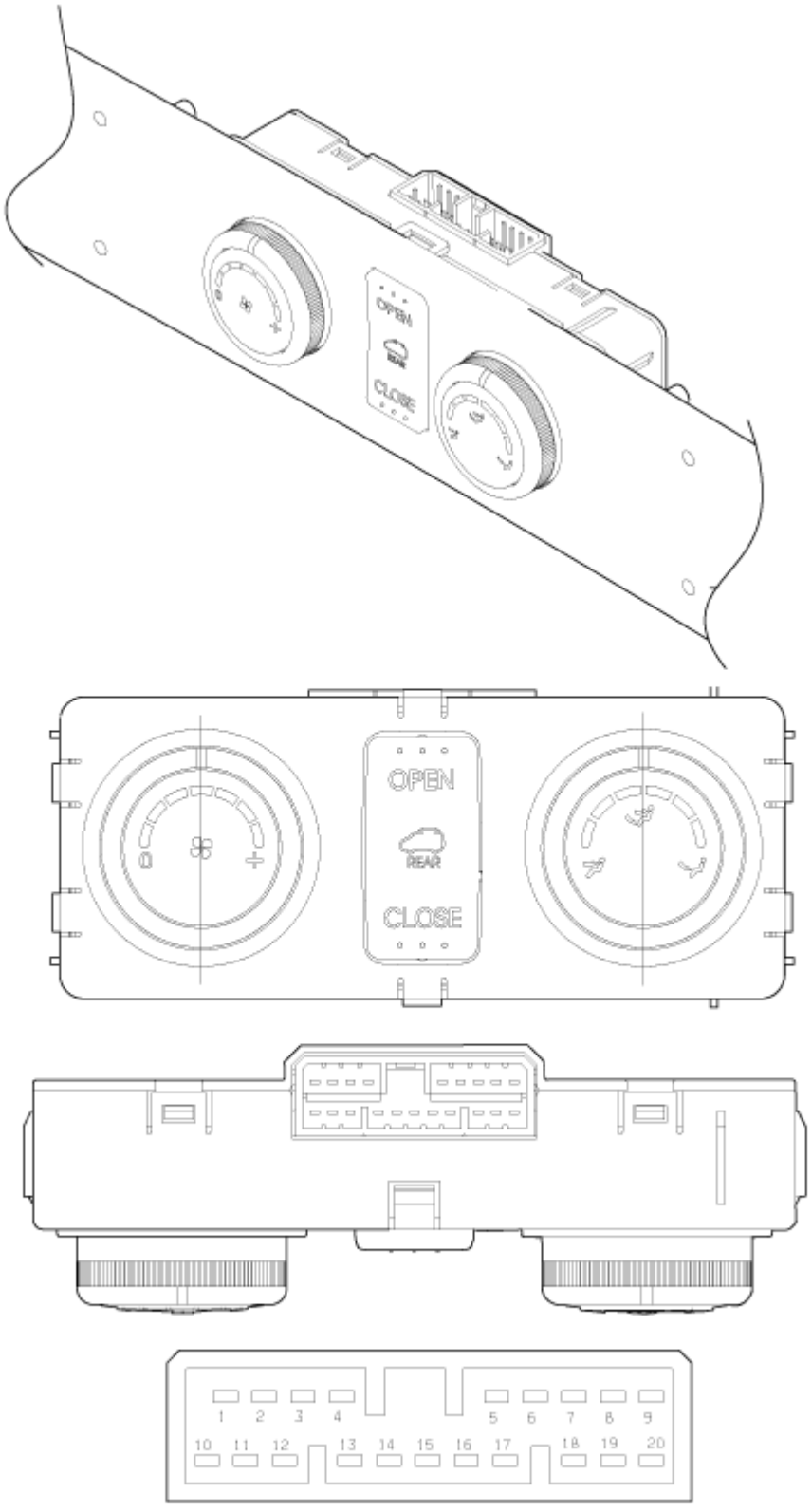
Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove luggage side trim.
3. Disconnect the connector (A) of the blower motor.
4. Remove the blower motor (A) after loosening the mounting screws.



5. Installation is the reverse order of removal.

Component

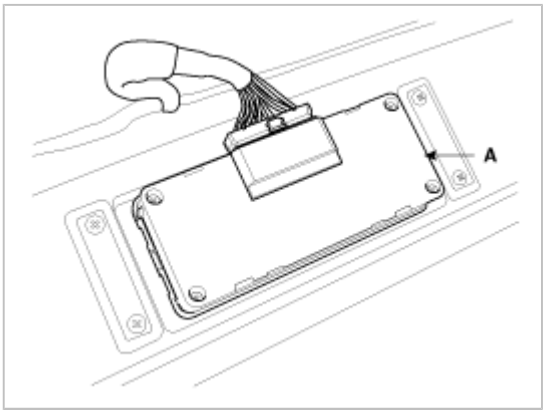


Connector Pin Function

Connector	Pin NO.	Function
Connector (A)	1	IG2
	2	TAIL (ILL+)
	3	REAR C-LINE
	4	-
	5	RR TEMP ACTUATOR (COOL)
	6	RR TEMP ACTUATOR (WARM)
	7	RR TEMP ACTUATOR F/B
	8	SENSOR REF (+5V)
	9	SENSOR GND
	10	RR BLOWER MOTOR (+)
	11	FET (D)
	12	FET (G)
	13	SHIELD WIRE GND
	14	OPEN / TILT DOWN
	15	CLOSE / TILT UP
	16	RR MODE ACTUATOR (VENT)
	17	RR MODE ACTUATOR (FLOOR)
	18	RR MODE ACTUATOR F/B
	19	GND
	20	RHEOSTAT (ILL-)

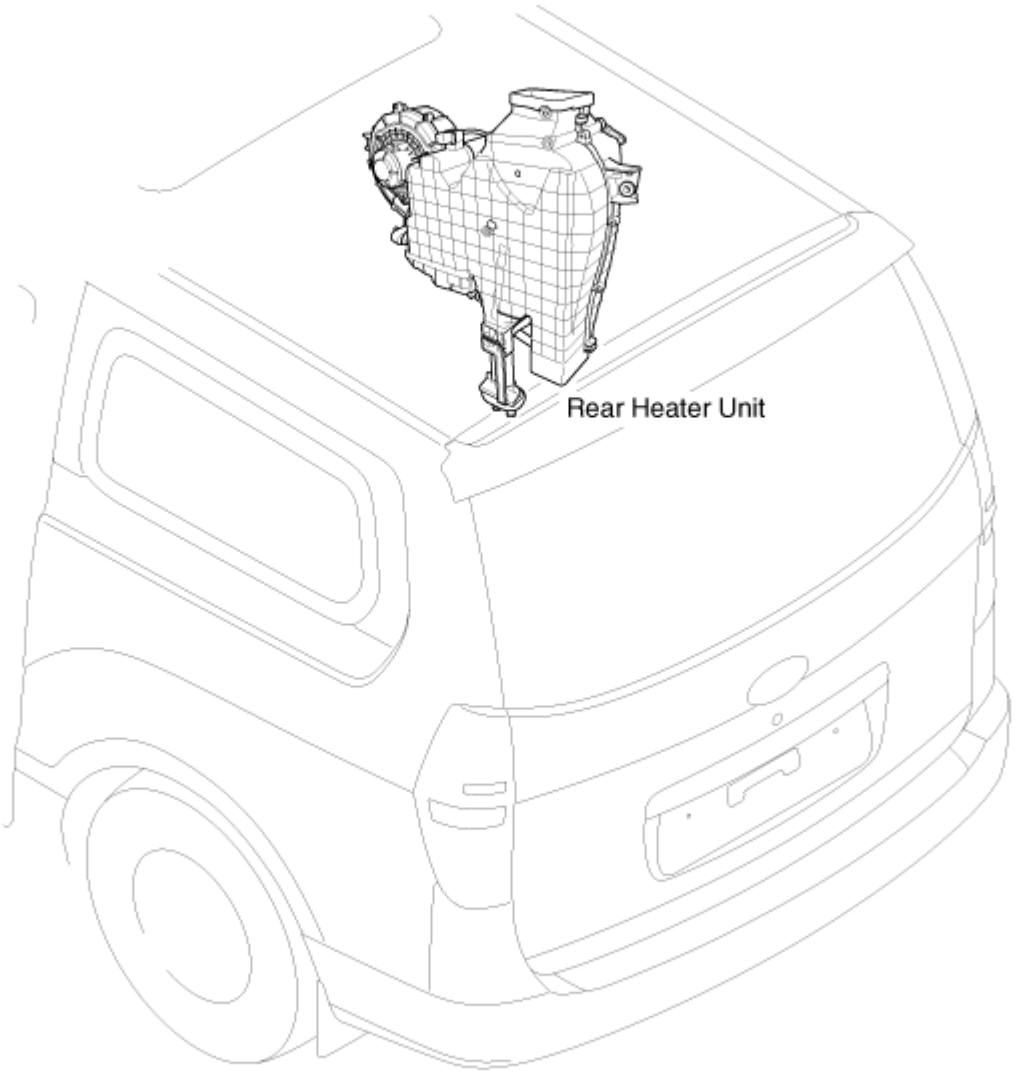
Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the pillar trim.
   (Refer to BD group - "Interior Trim")
3. Remove the roof trim.
   (Refer to BD group - Interior Trim")
4. Remove the rear control panel (A) and then dissconnect the rear control panel connector (B).

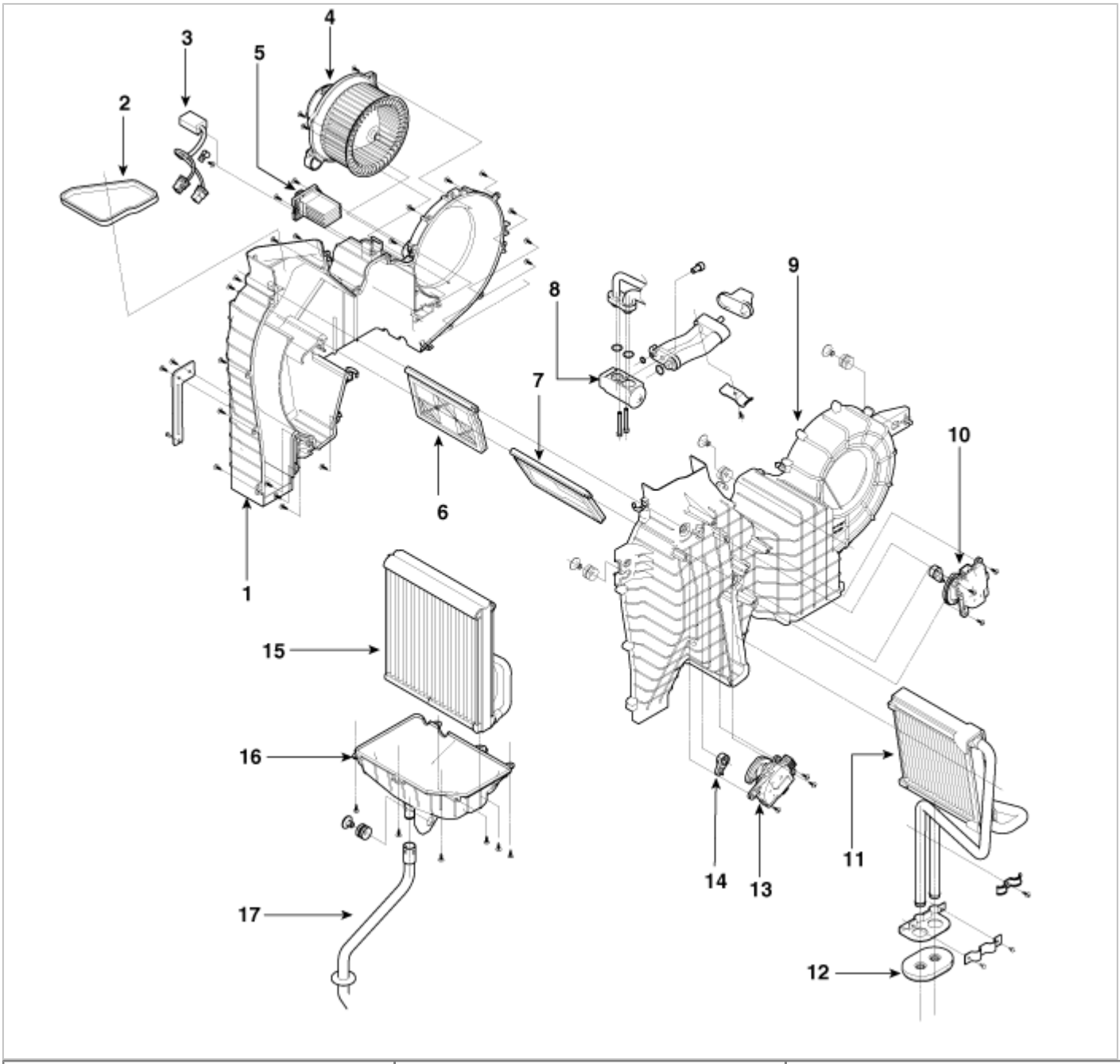


5. Installation is the reverse order of removal.

Component Location



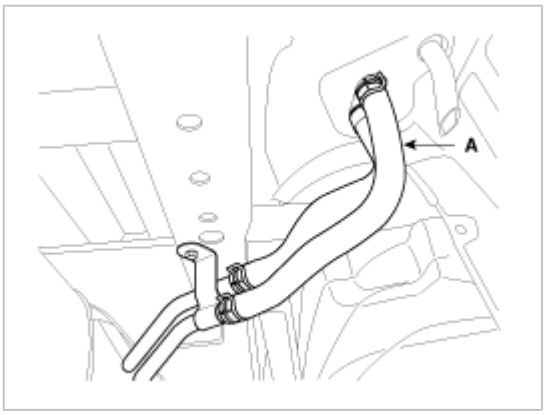
Components



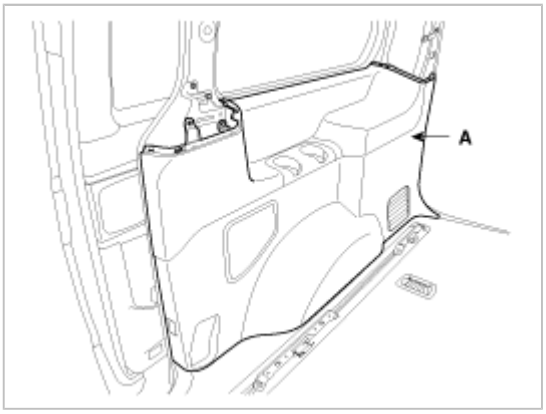
1. Case (L)	7. Temp door	13. Mode actuator
2. Roof seal	8. Expension valve	14. Mode door lever
3. Wireing	9. Case (R)	15. Evaporator core
4. Blower motor	10. Temp actuator	16. Lower case
5. Power mosfet	11. Heater core	17. Drain hose
6. Mode door	12. Heater pipe guide	

Replacement

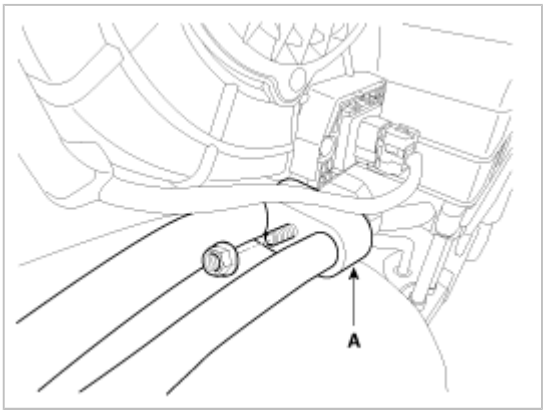
1. Disconnect the negative(-) battery terminal.
2. Recover the refrigerant with a recover/ recycling/ charging station.
3. When the engine is cool, drain the engine coolant from the radiator.
4. Remove the rear heater hose (A), After disconnect the clip.



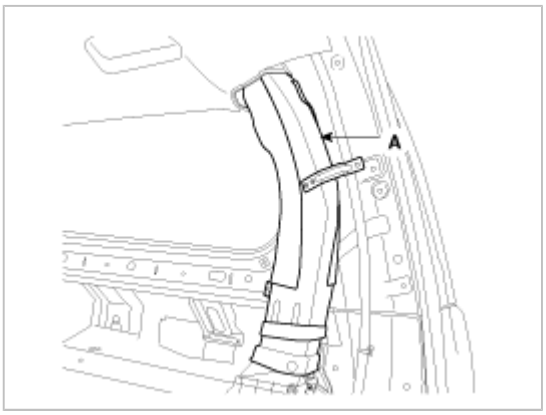
5. Remove luggage side trim(Refer to BD-interior trim).



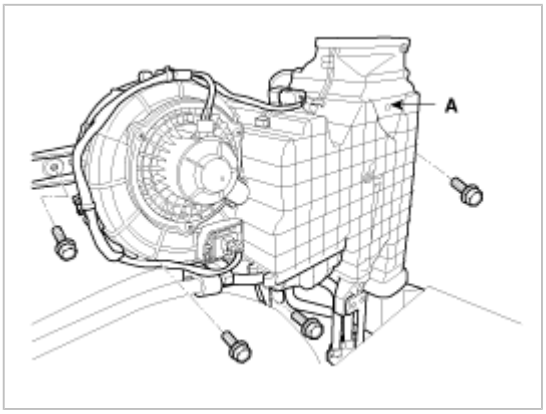
6. Loosen the refrigerant line mounting bolt, and then remove the rear refrigerant line (A).



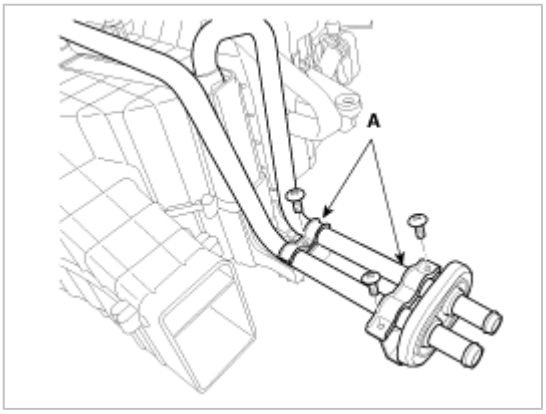
7. Loosen the air duct mounting screw, and then remove the air duct (A).



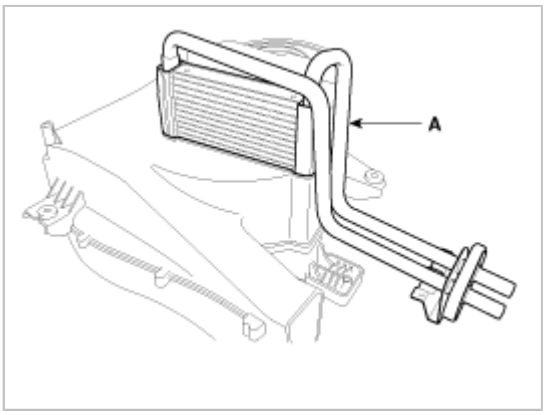
8. Disconnect the connectors and then remove the rear heater unit (A).



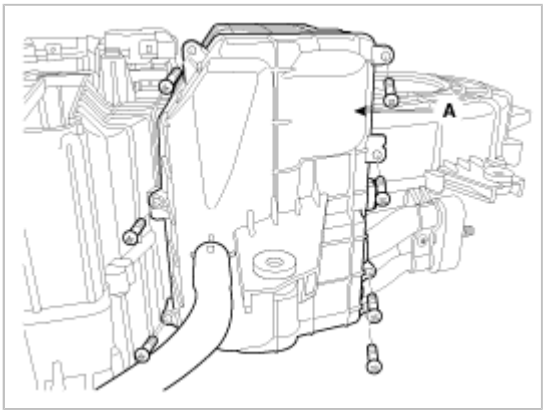
9. Rear heater core mounting bracket (A)



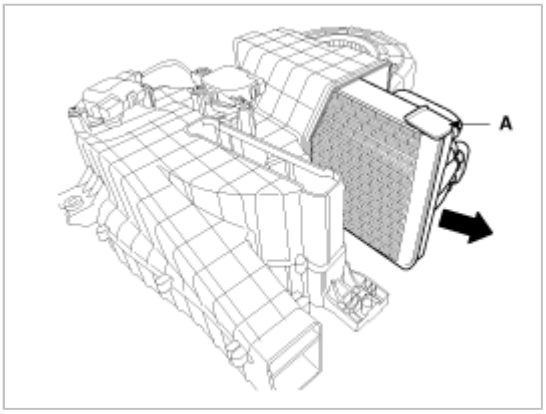
10. Remove the rear heater core (A).



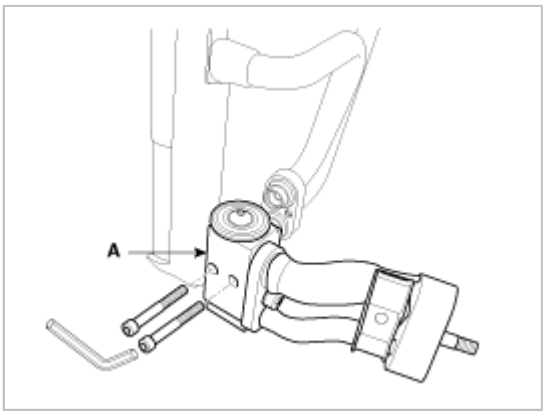
11. Remove the evaporator core cover (A).



12. Remove the evaoirator core (A).



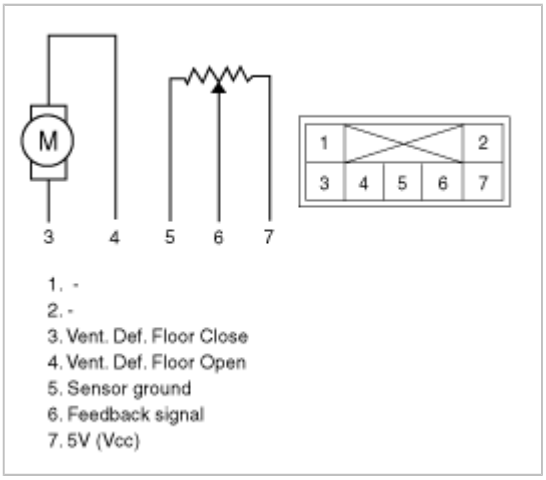
13. Disconnect the rear expension valve (A).



14. Installation is the reverse order of removal.

Inspection

1. Ignition "OFF".
2. Disconnect the connector of mode control actuator.
3. Verify that the mode control actuator operates to the defrost mode when connecting 12V to the terminal 3 and grounding terminal 4.
4. Verify that the mode control actuator operates to the vent mode when connecting in the reverse.

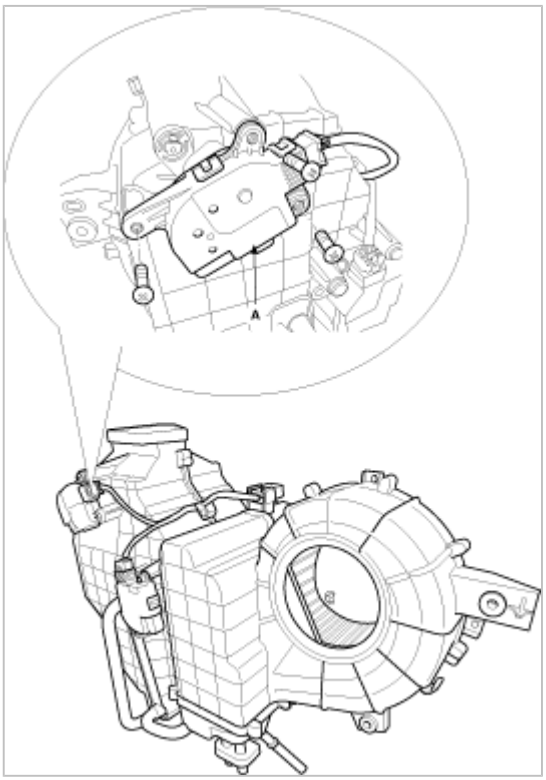


5. Check the voltage between terminals 5 and 6.

Door position	Voltage (5-6)	Error detecting
Vent	0.3 ± 0.15V	Low voltage : 0.1V or less
Defrost	4.7 ± 0.15V	High voltage : 4.9V or more

Replacement

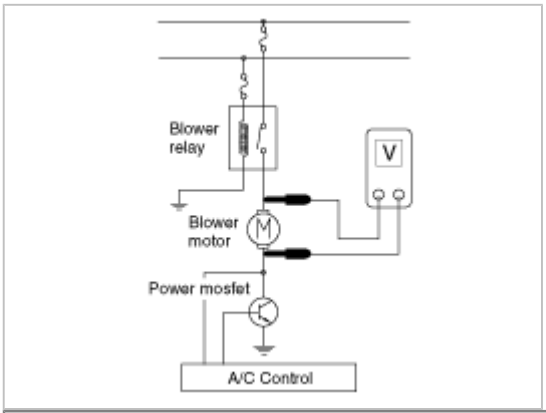
1. Disconnect the negative (-) battery terminal.
2. Remove the luggage side trim.
3. Remove the rear heater unit.
4. Disconnect the mode control actuator connector.
5. Loosen the mounting screw and then remove the mode control actuator (B).



6. Installation is the reverse order of removal.

Inspection

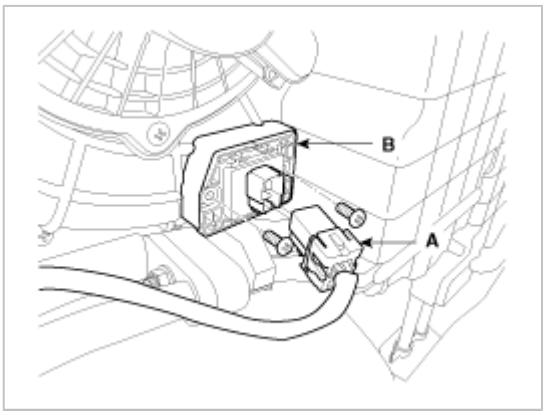
1. Ignition "ON".
2. Manually operate the control switch and measure the voltage of blower motor between pin 1 and 2.
3. Select the control switch to raise voltage until high speed.



Fan	Voltage
	Manual
1 STEP	4.5 ± 0.5
2 STEP	5.7 ± 0.5
3 STEP	6.9 ± 0.5
4 STEP	8.1 ± 0.5
5 STEP	9.3 ± 0.5
6 STEP	10.5 ± 0.5
7 STEP	Battary (+)

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the luggage side trim.
3. Disconnect the power mosfet connector (A).
4. Remove the power mosfet (B) after loosening the mounting screws.



5. Installation is the reverse order of removal.

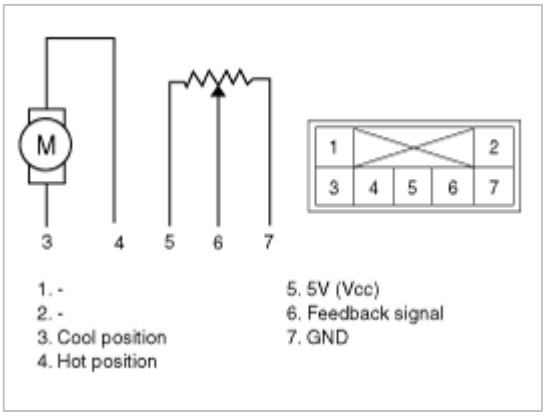
1.

Description

1. Heater unit includes mode control actuator and temperature control actuator.
2. Temperature control actuator is located at the heater unit. It regulates the temperature by the procedure as follows. Signal from control unit adjusts position of temperature door by operating temperature switch and then temperature will be regulated by the hot/cold air ratio decided by position of temperature door.

Inspection

1. Ignition "OFF".
2. Disconnect the connector of temperature control actuator.
3. Verify that the temperature control actuator operates to the hot position when connecting 12V to the terminal 3 and grounding terminal 4.
   Verify that the temperature control actuator operates to the cool position when connecting in the reverse.

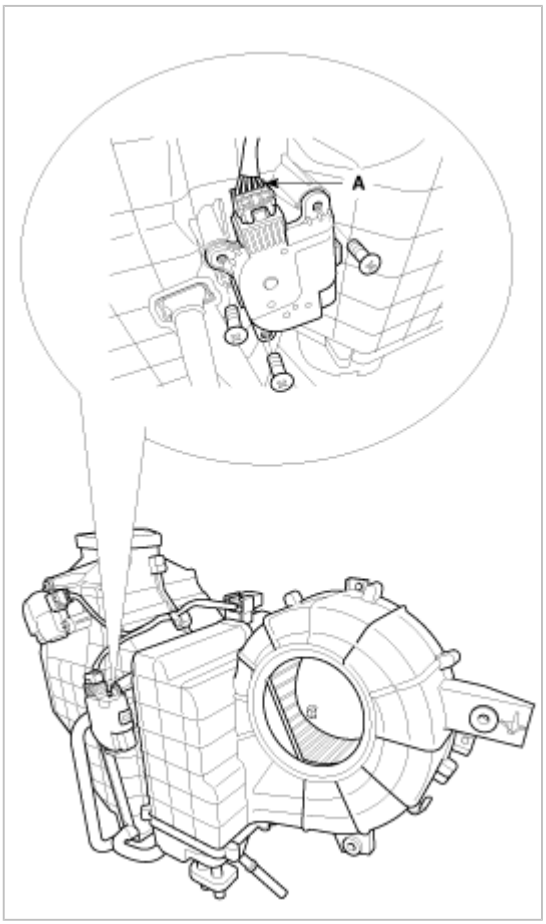


4. Check the voltage between terminals 6 and 7.

Door position	Voltage (6-7)	Error detecting
Max. cooling	0.3 ± 0.15V	Low voltage : 0.1V or less
Max. heating	4.7 ± 0.15V	High voltage : 4.9V or more

Replacement

1. Disconnect the negative (-) battery terminal.
2. Remove the luggage side trim.
3. Remove the rear heater unit.
4. Disconnect the temperature control actuator connector.
5. Loosen the mounting screw and then remove the temperature control actuator (B).

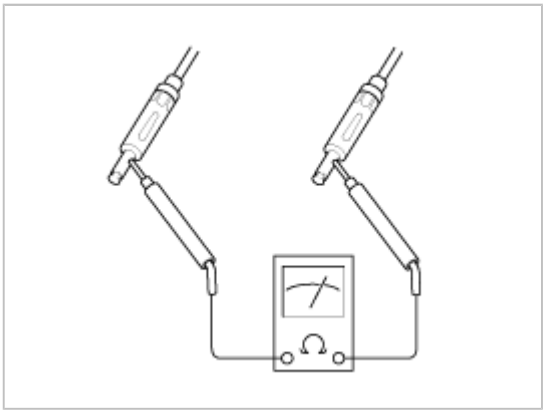


6. Installation is the reverse order of removal.

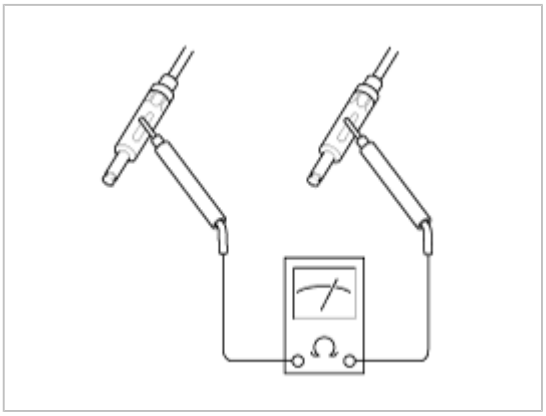
Inspection

Antenna Cable

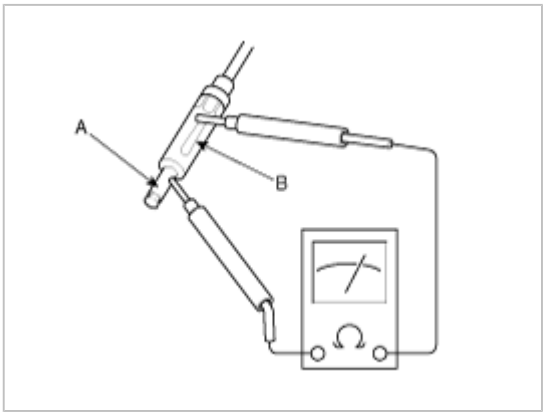
1. Remove the antenna jack from the audio unit and antenna.
2. Check for continuity between the center poles of antenna cable.



3. Check for continuity between the outer poles of antenna cable. There should be continuity.



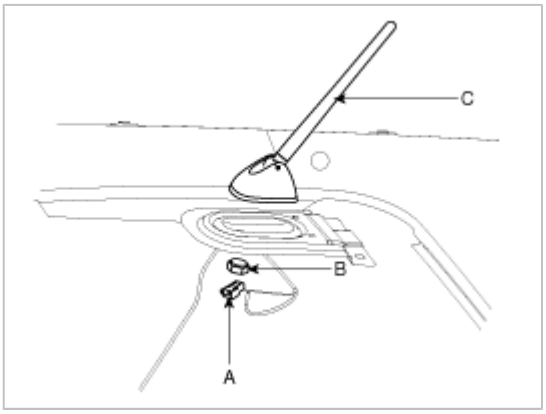
4. If there is no continuity, replace the antenna cable.
5. Check for continuity between the center pole (A) and outer pole (B) of antenna cable. There should be no continuity.



6. If there is continuity, replace the antenna cable.

Replacement

1. Remove the rear roof trim.
   (Refer to the Body group - Roof trim).
2. Disconnect the 1P power connector (A) from the roof antenna.

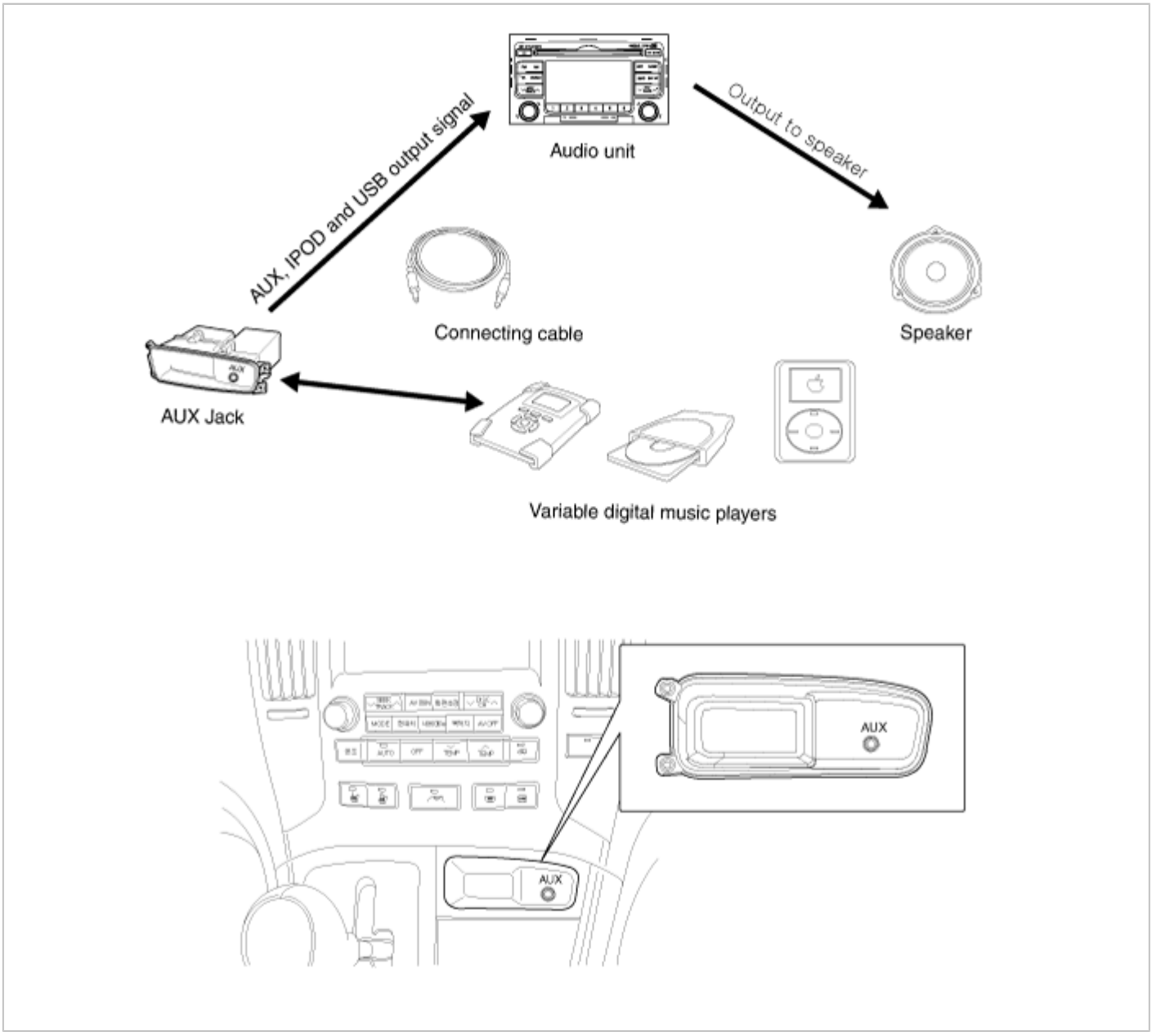


3. Remove the roof antenna(C) after removing a nut(B).
4. Installation is the reverse of removal.

Description

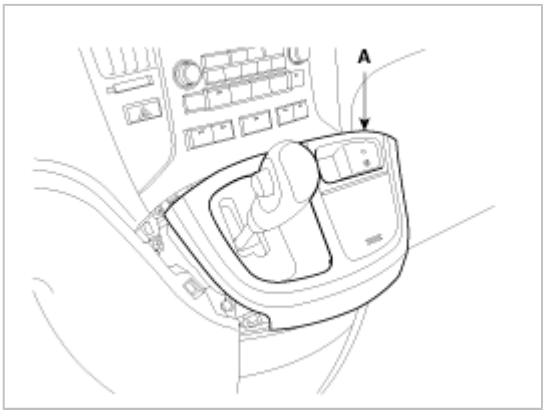
The AUX, JACK on the center console is for customers who like to listen to external portable music players like the MP3, iPOD, earphone, CD player and etc., through the vehicle's sound system when it is linked to this jack. The customer has this added option.

In case of distortions from media connected to the AUX source, the audio unit may not be defect but the output level of the used media does not match the specification of the AUX input.

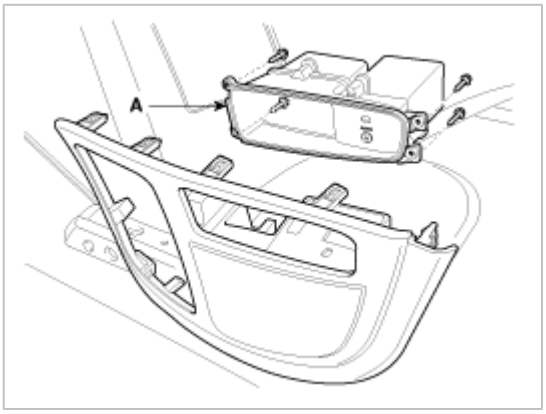


Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the front console under cover and disconnect the connector (A).



3. Remove the AUX Jack assembly (A) from the floor console under cover after loosening 4 screws.

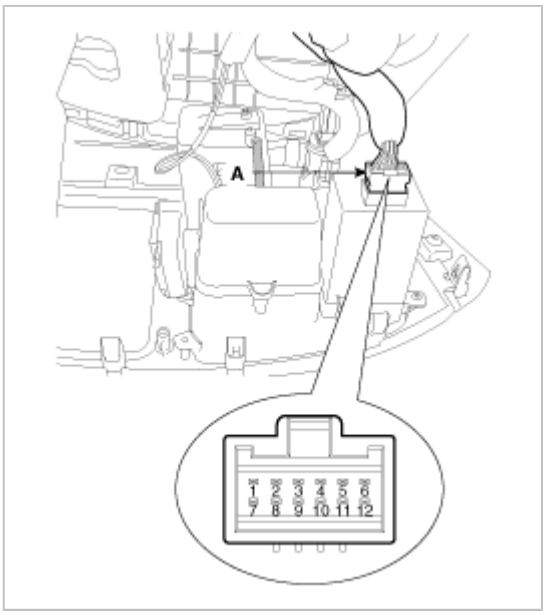


Installation

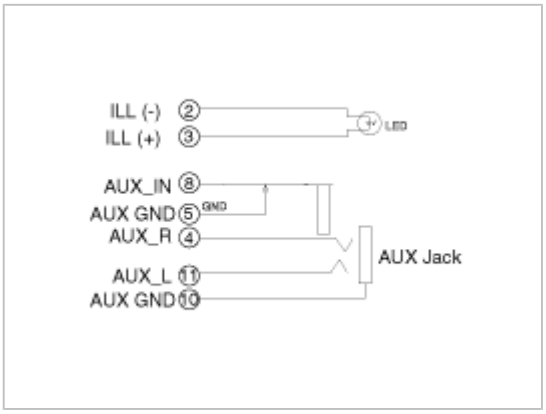
1. Install the AUX Jack.
2. Connect the AUX connector.
3. Install the front console under cover.

Inspection

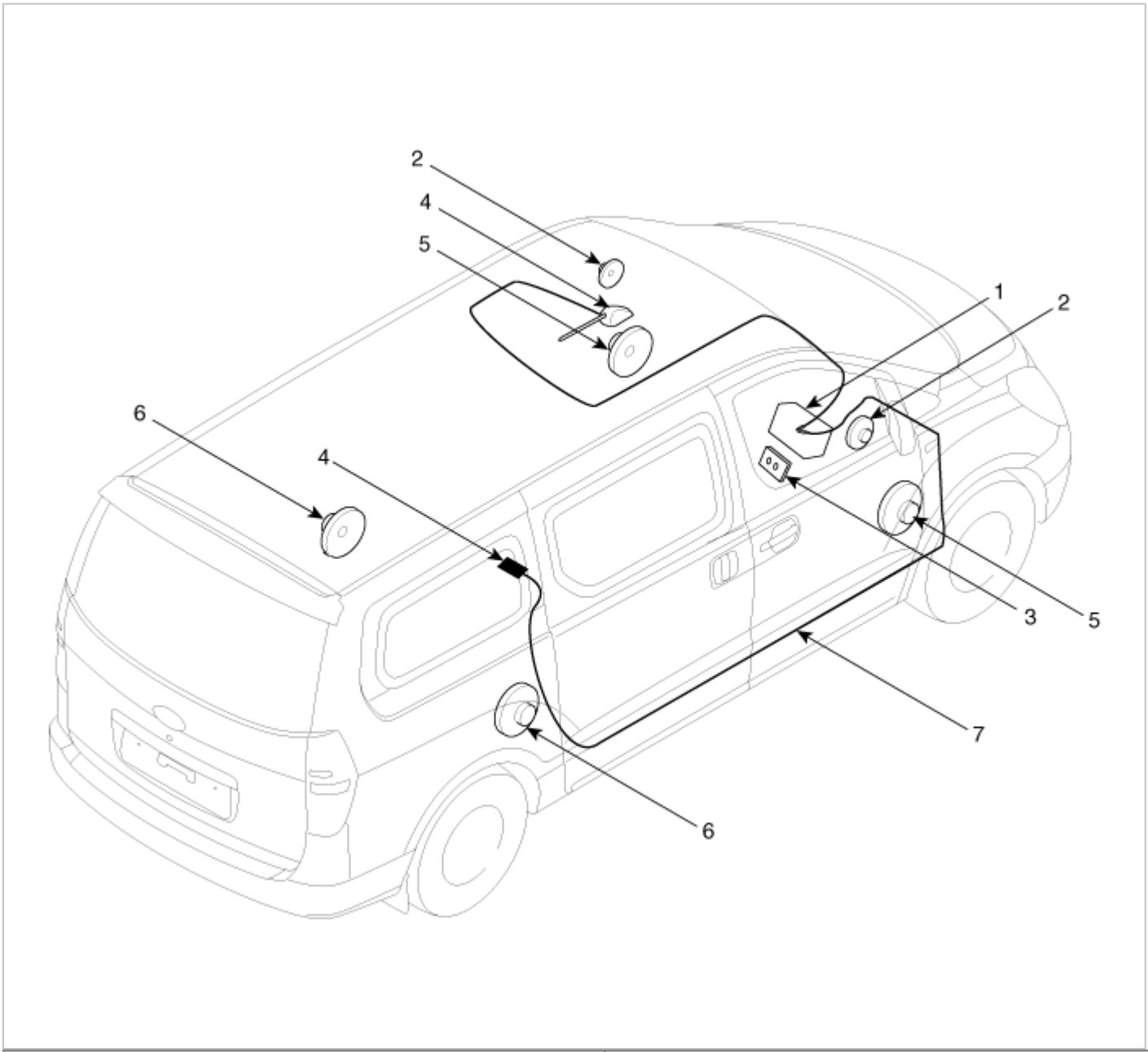
1. Disconnect the negative(-) battery terminal.
2. Disconnect the Aux Jack connector after from the front console under cover.
   To inspect USB/IPOD port, check the voltage between NO.1 and 4 terminal of.



3. Using an ohmmeter, check for continuity between the terminal of Aux Jack connector.



Component Location



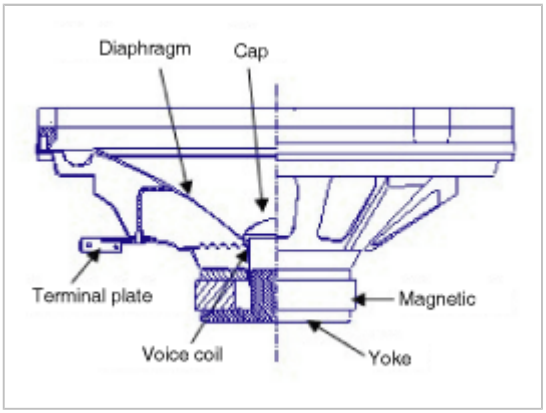
1. Audio unit	5. Front door speaker
2. Tweeter speaker	6. Rear door speaker
3. AUX jack	7. Antenna feeder cable
4. Roof antenna	

Inspection

1. Troubleshooting for Speaker

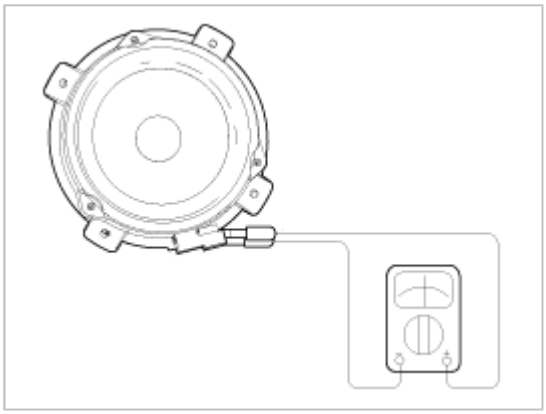
(1) Basic inspection of speaker

Inspect the sound from speaker after verifying that the speaker mounting screws is removed and the wiring connector is connected precisely to remove vibration transmitted from body trims and surrounding parts.



(2) Case Troubleshooting

No.	Case	Inspection/Remedy
1	Trembling sound	1. Before replacing the speaker, inspect that the mounting screw is installed normally. 2. After re-installing the speaker, verify that no trembling sound is heard. 3. When hearing a trembling sound again, replace the speaker with new one.
2	Noise	1. Check if the wiring connector is connected normally. If not, reconnect the wiring connector. 2. In case of radio static, check if there is a noise from cassette. 3. When a noise is heard on turning radio, cassette and CD on, replace the speaker with new one. In case there is only radio static, this causes from poor radio reception. Thus the speaker needs no repair and replacement.
		Inspection of the wiring connection between the battery and the speaker 1. Before replacing the speaker, inspect the wiring connection between the battery and the speaker is normal. 2. Check the supplying power to the speaker and the resistance, then inspect the sound quality. ■ Specified impedance : 2 ~ 4Ω

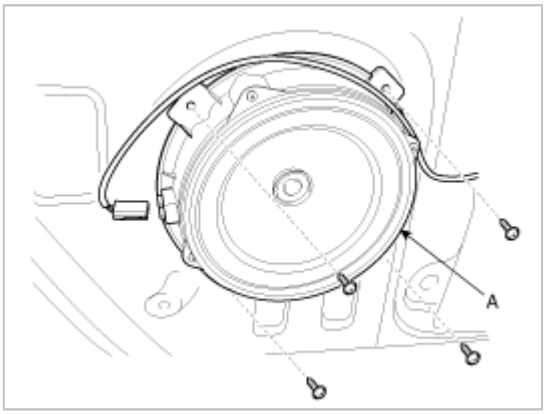
3	Poor working	 3. If the speaker works poorly, replace it with new one.

- During dealing of speaker
- Do not damage the speaker with impact as like a drop and a throw.
- Be careful not to cover water and oil over the speaker.
- Caution during dealing of speaker because the material of diaphragm is paper which is easy to be torn by impact and external force.
- When modifying audio system as customer pleases, this does electric damage to speaker.
- And, in this case the speakers are not covered by the manufacturer's warranty.

Removal

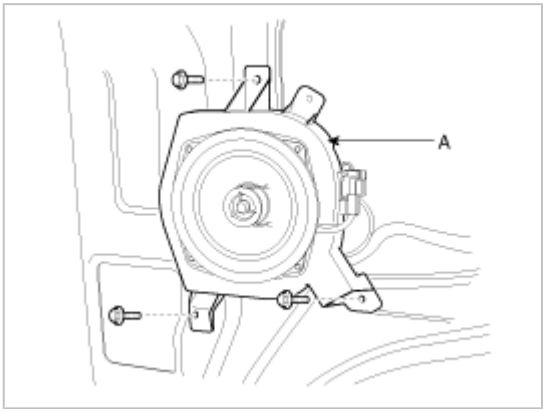
Front Speaker

1. Remove the front door trim.
   (Refer to the Body group - Front door).
2. Remove the front speaker (A) after removing 4 screws.



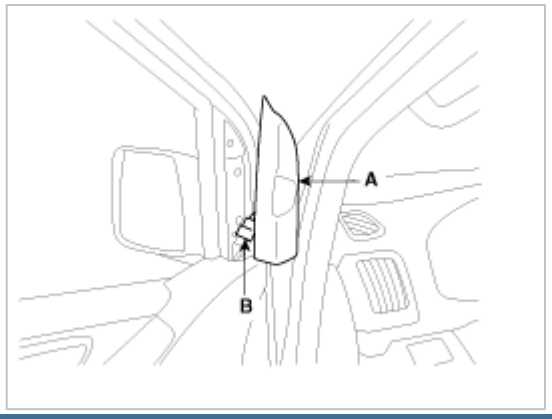
Rear Side Speaker

1. Remove the rear guarter side trim.
   (Refer to the Body group - Rear door).
2. Remove the rear speaker (A) after removing 3 bolts.



Tweeter Speaker

1. Remove the guadrant inner cover.
   (Refer to the Body group - Front door).
2. Remove the tweeter speaker (A) after disconnecting the connector (B).



Installation

Front Speaker

1. Install the front speaker.
2. Install the front door trim.

Rear Speaker

1. Install the rear side speaker.
2. Install the rear guarter side trim.

Tweeter Speaker

1. Install the tweeter speaker after connecting the tweeter speaker connector.
2. Install the guadrant inner cover.

Specification

Audio

Item		Specification	
Model		RADIO/CD (M420)	RADIO/CD/MP3 (M445)
Power supply		DC 14.4V	
Rated output		Max 43W x 4	
Antenna		80PF 75Ω	
Tuning type		PLL SYNTHESIZED TUNING	
Frequency range / Channel space	FM	87.5 ~ 108.0 MHz/100 KHz (for General)	
	AM	531 ~ 1602 KHz/9 KHz (for General)	
	FM	87.5 ~ 108.0 MHz/50 KHz (for Europe)	
	MW	522 ~ 1620 KHz/9 KHz (for Europe)	
	LW	153 ~ 279 KHz/1 KHz (for Europe)	

Speaker

Item		M420	M445
Input Power (W)	Front	Max. 40	
	Rear	Max. 40	
	Tweeter	Max. 40	
Speaker Impedance (Ω)	Front	4.0 ± 0.6	
	Rear	4.0 ± 0.6	
	Tweeter	3.4 ± 0.5	
Speaker Number		4	6

Troubleshooting

Customer Complaint Analysis Check Sheet

Trouble In	☐ ALL ☐ AM ☐ FM ☐ TAPE ☐ CD ☐ MP3 ☐ CD changer ☐ AMP ☐ Others
Trouble Occurs	☐ Always ☐ Engine start ☐ Engine Running ☐ Cold ☐ Warm ☐ Sometimes ☐ Most of the time ☐ Engine off
Type Of Trouble	☐ Will not play ☐ Tape speed not proper ☐ Weak ☐ Squealing noise ☐ Eats tape ☐ Display/illumination poor ☐ CD skips & jumps ☐ Tape/CD will not eject or insert ☐ Others (Describe) :
Others	▶ Customer complaint contents : ▶ Have you checked customer's defects :
★ Using the customer complaint analysis check sheet for reference, ask the customer for as much detail as possible about the problem.	

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

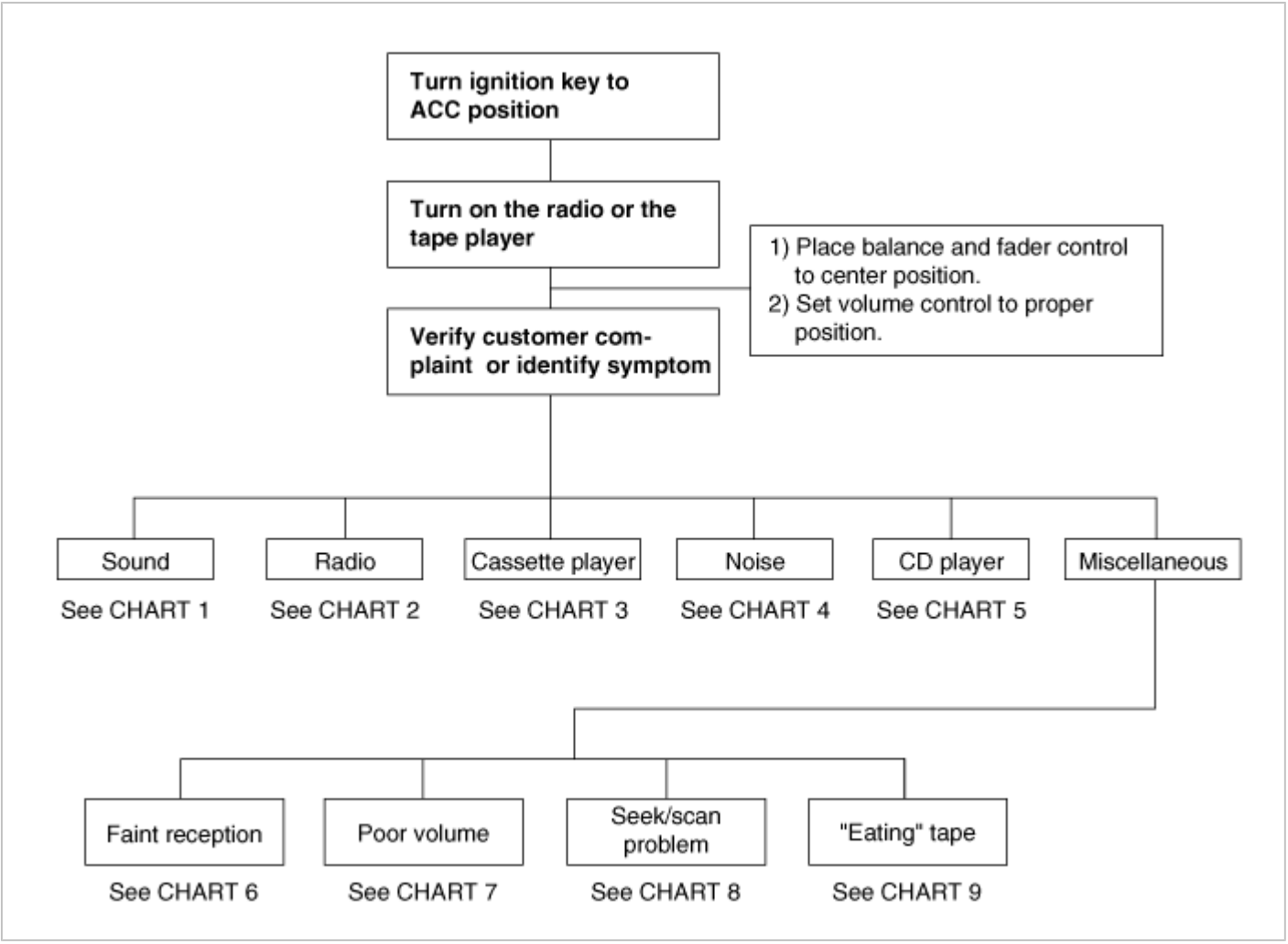
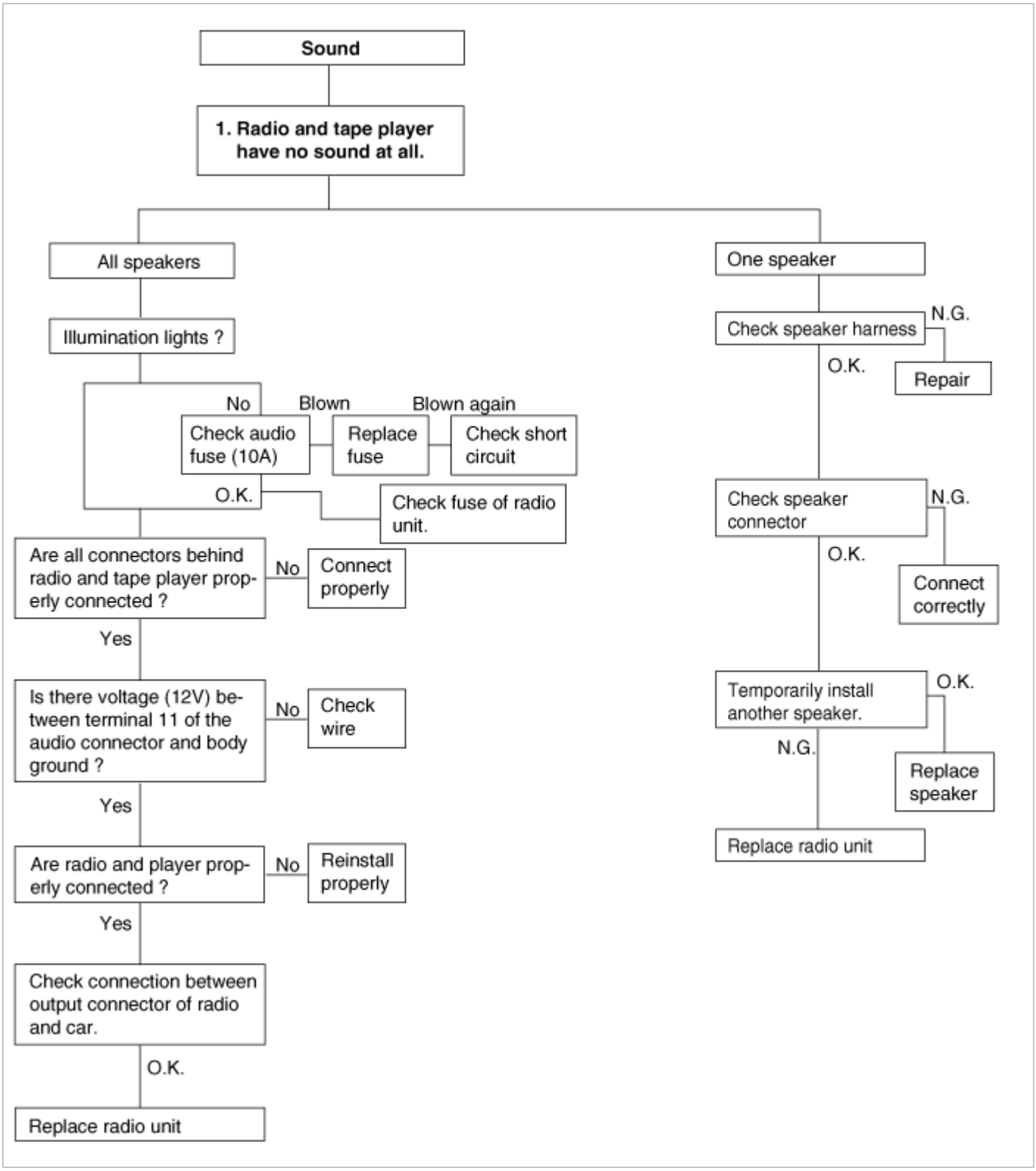

Turn ignition key to ACC position
Turn on the radio or the tape player
1) Place balance and fader control to center position.
2) Set volume control to proper position.
Verify customer com-plaint or identify symptom
Sound
See CHART 1
Radio
See CHART 2
Cassette player
See CHART 3
Noise
See CHART 4
CD player
See CHART 5
Miscellaneous
Faint reception
See CHART 6
Poor volume
See CHART 7
Seek/scan problem
See CHART 8
"Eating" tape
See CHART 9

Chart 1


Sound
1. Radio and tape player have no sound at all.
All speakers
Illumination lights ?
No
Blown
Blown again
Check audio fuse (10A)
Replace fuse
Check short circuit
O.K.
Check fuse of radio unit.
Are all connectors behind radio and tape player properly connected ?
No
Connect properly
Yes
Is there voltage (12V) between terminal 11 of the audio connector and body ground ?
No
Check wire
Yes
Are radio and player properly connected ?
No
Reinstall properly
Yes
Check connection between output connector of radio and car.
O.K.
Replace radio unit
One speaker
Check speaker harness
N.G.
O.K.
Repair
Check speaker connector
N.G.
O.K.
Connect correctly
Temporarily install another speaker.
O.K.
N.G.
Replace speaker
Replace radio unit

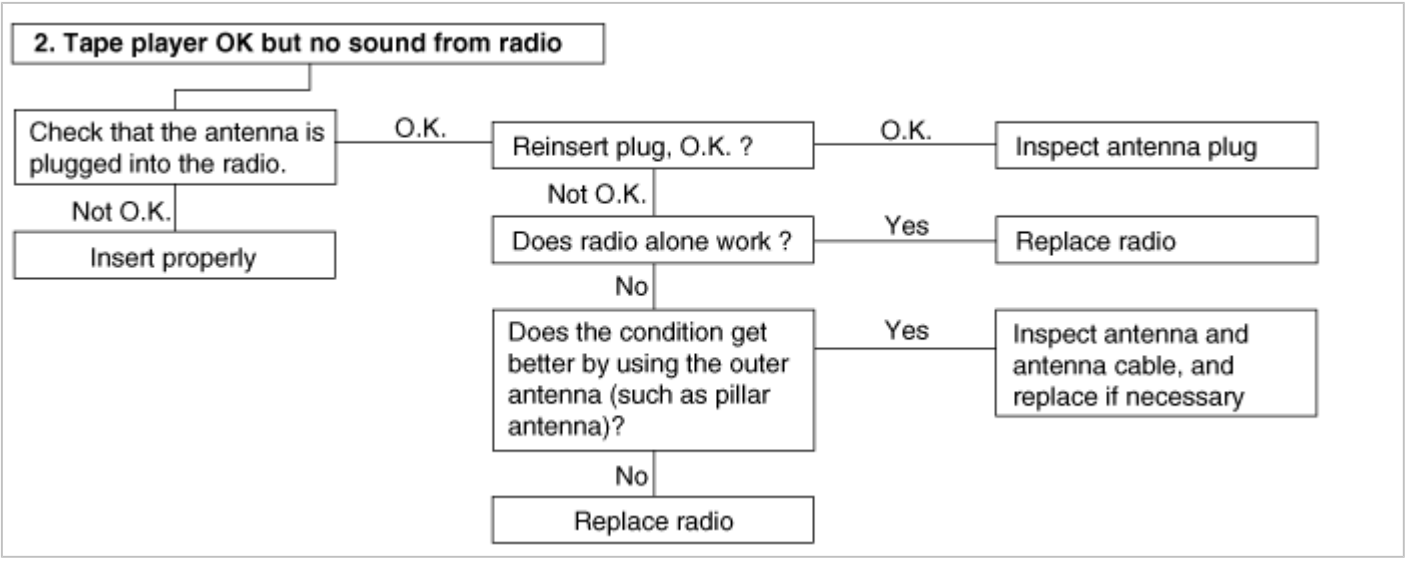


Chart 2

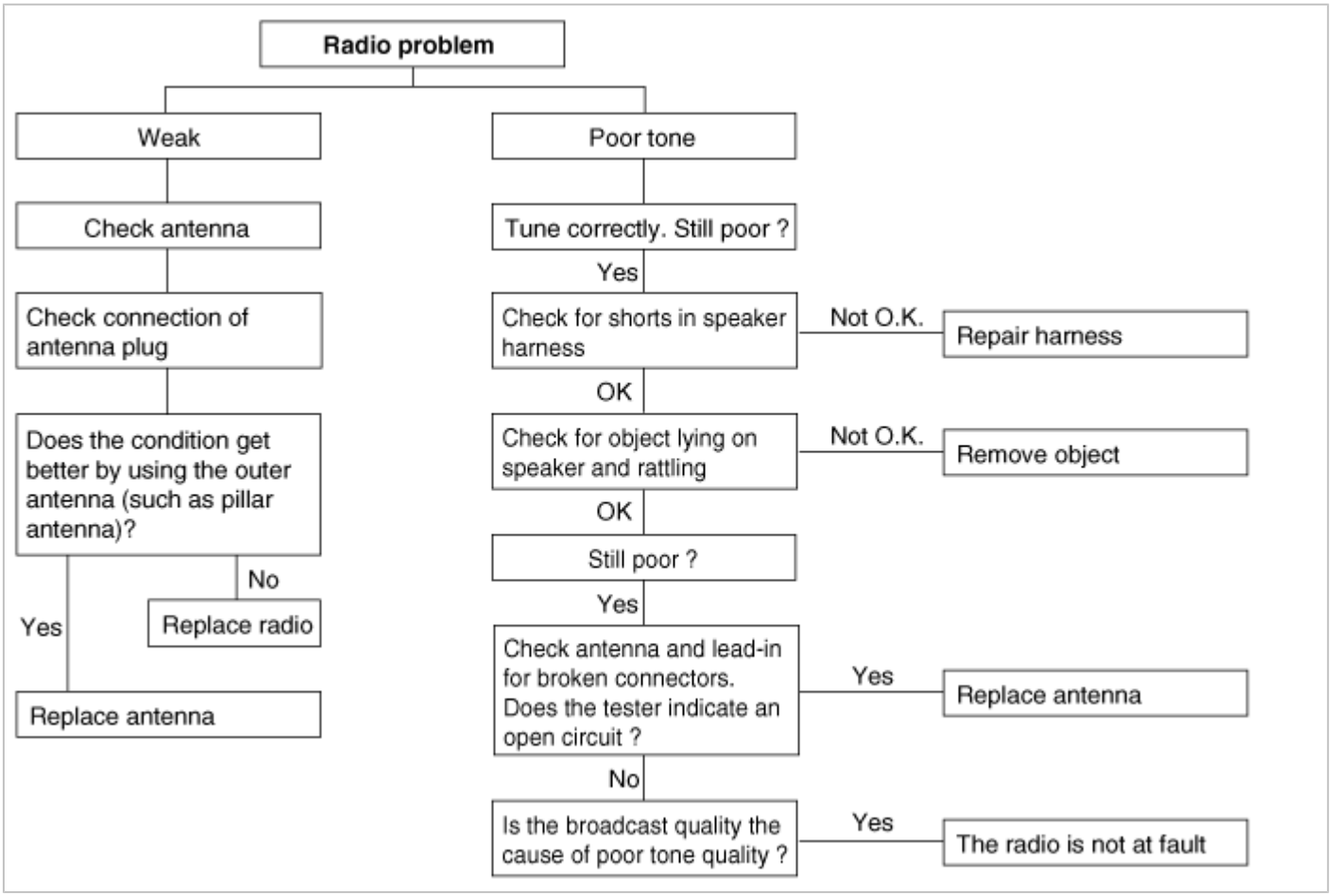


Chart 3

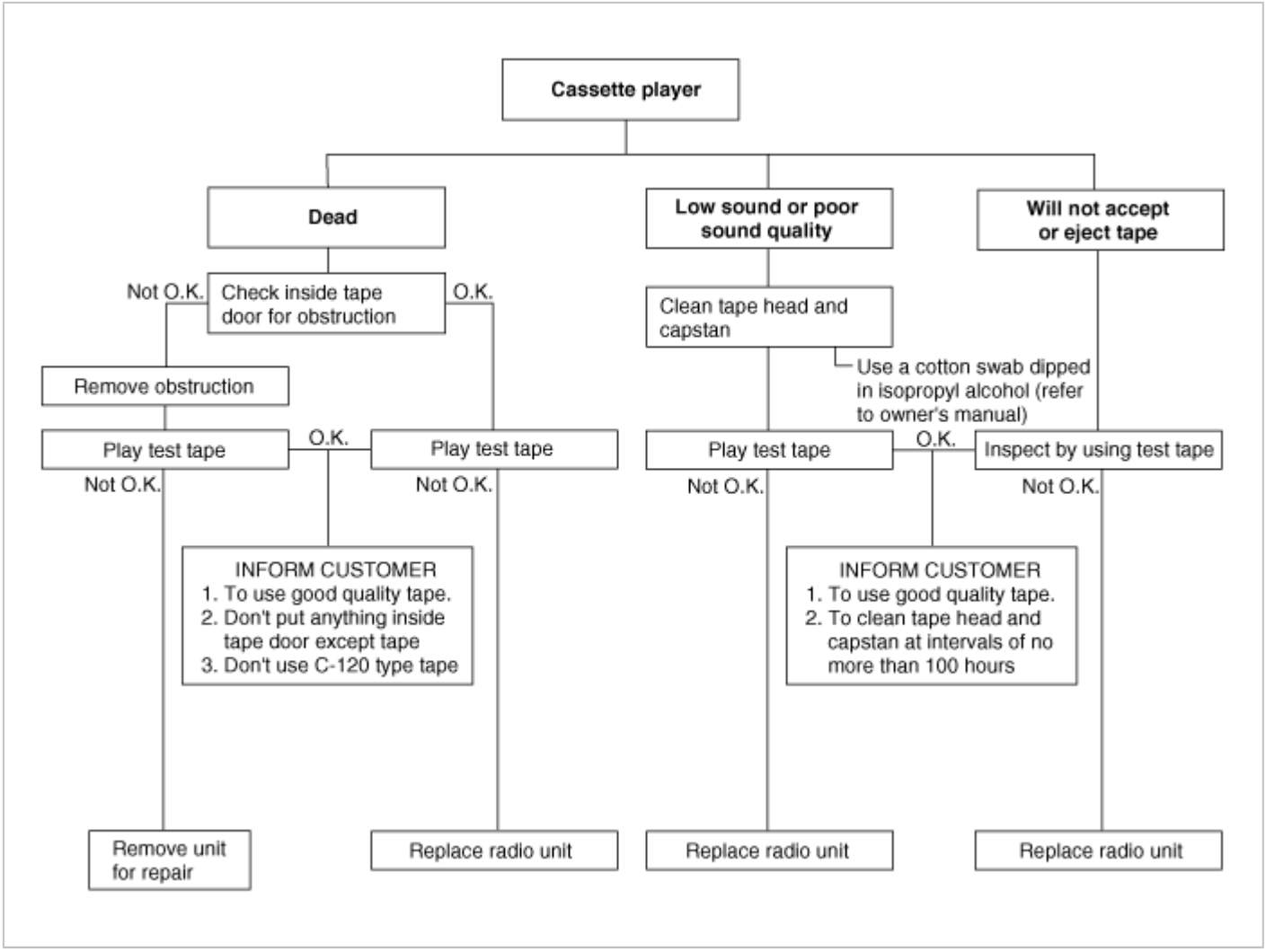
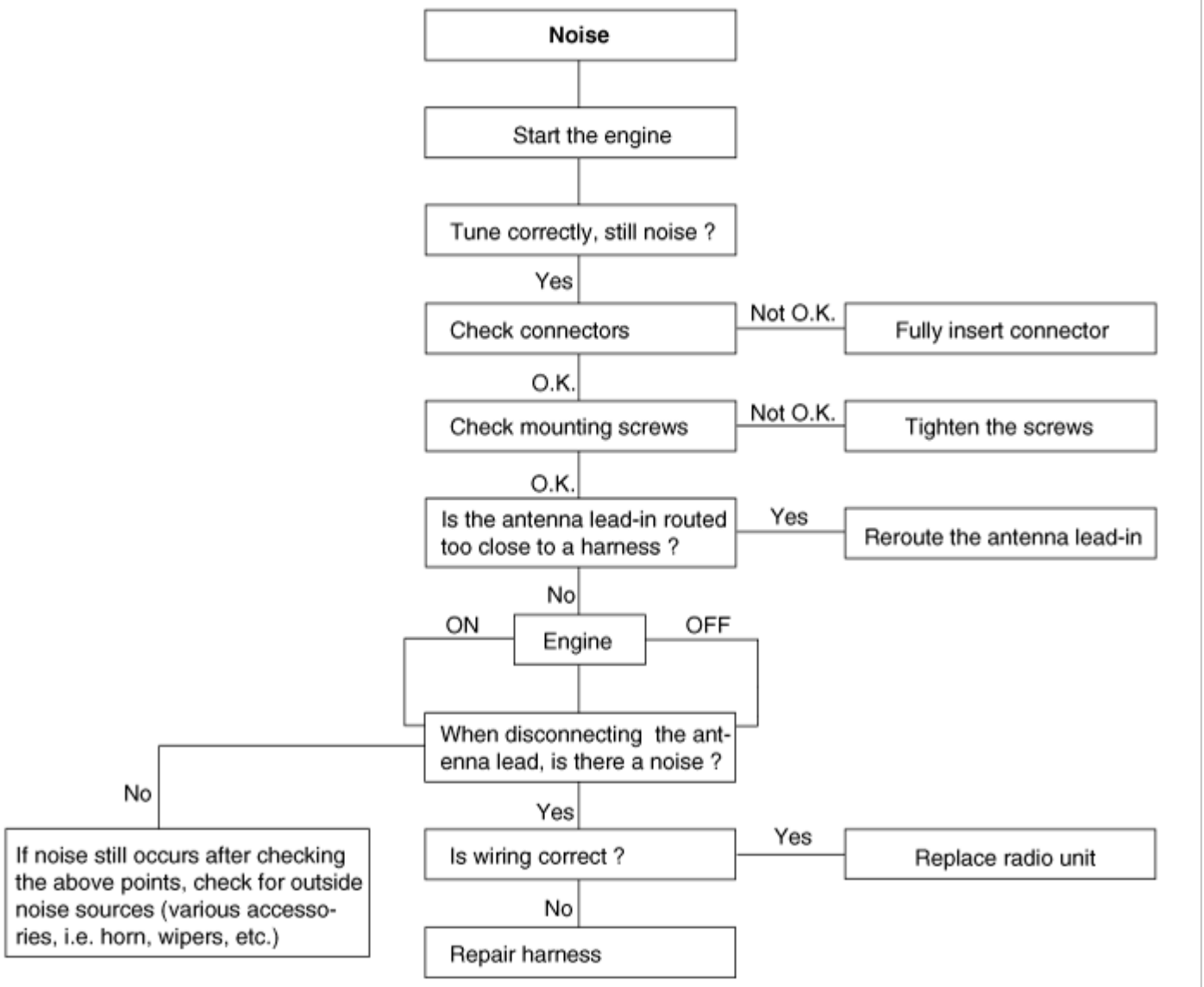

Cassette player
Dead
Low sound or poor sound quality
Will not accept or eject tape
Not O.K.
Check inside tape door for obstruction
O.K.
Clean tape head and capstan
Use a cotton swab dipped in isopropyl alcohol (refer to owner's manual)
Remove obstruction
Play test tape
O.K.
Play test tape
Play test tape
O.K.
Inspect by using test tape
Not O.K.
Not O.K.
Not O.K.
Not O.K.
INFORM CUSTOMER
1. To use good quality tape.
2. Don't put anything inside tape door except tape
3. Don't use C-120 type tape
INFORM CUSTOMER
1. To use good quality tape.
2. To clean tape head and capstan at intervals of no more than 100 hours
Remove unit for repair
Replace radio unit
Replace radio unit
Replace radio unit

Chart 4

1. RADIO


Noise
Start the engine
Tune correctly, still noise ?
Yes
Check connectors
Not O.K.
Fully insert connector
O.K.
Check mounting screws
Not O.K.
Tighten the screws
O.K.
Is the antenna lead-in routed too close to a harness ?
Yes
Reroute the antenna lead-in
No
ON
Engine
OFF
When disconnecting the antenna lead, is there a noise ?
No
If noise still occurs after checking the above points, check for outside noise sources (various accessories, i.e. horn, wipers, etc.)
Yes
Is wiring correct ?
Yes
Replace radio unit
No
Repair harness

2. TAPE

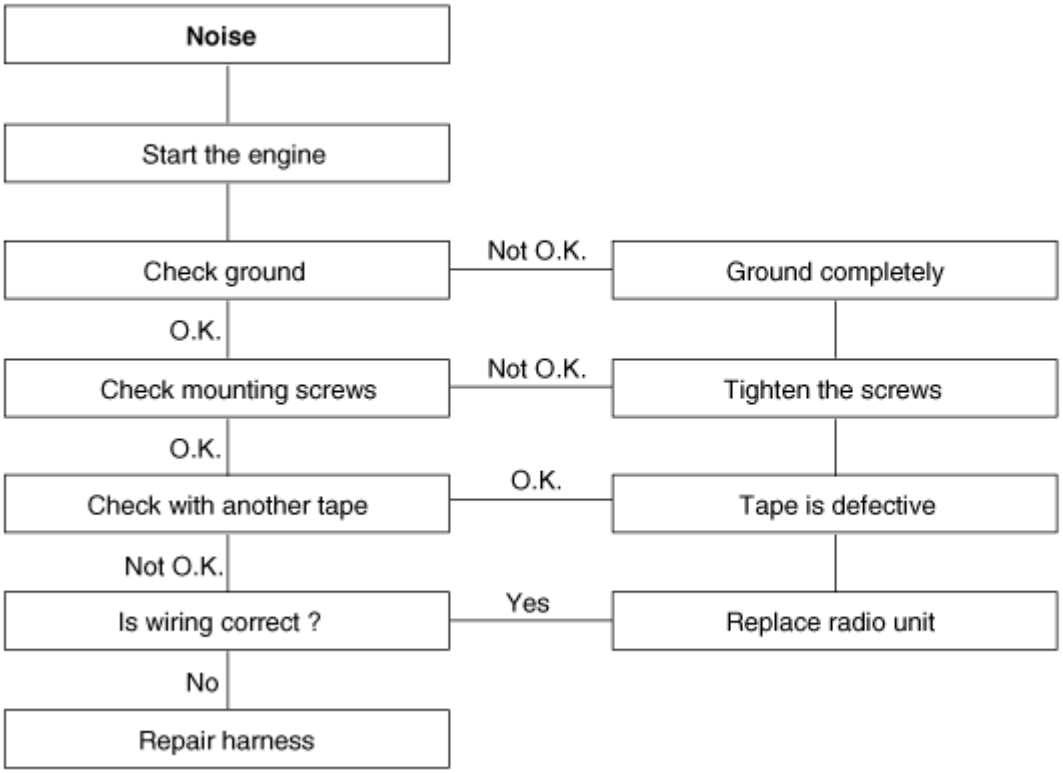
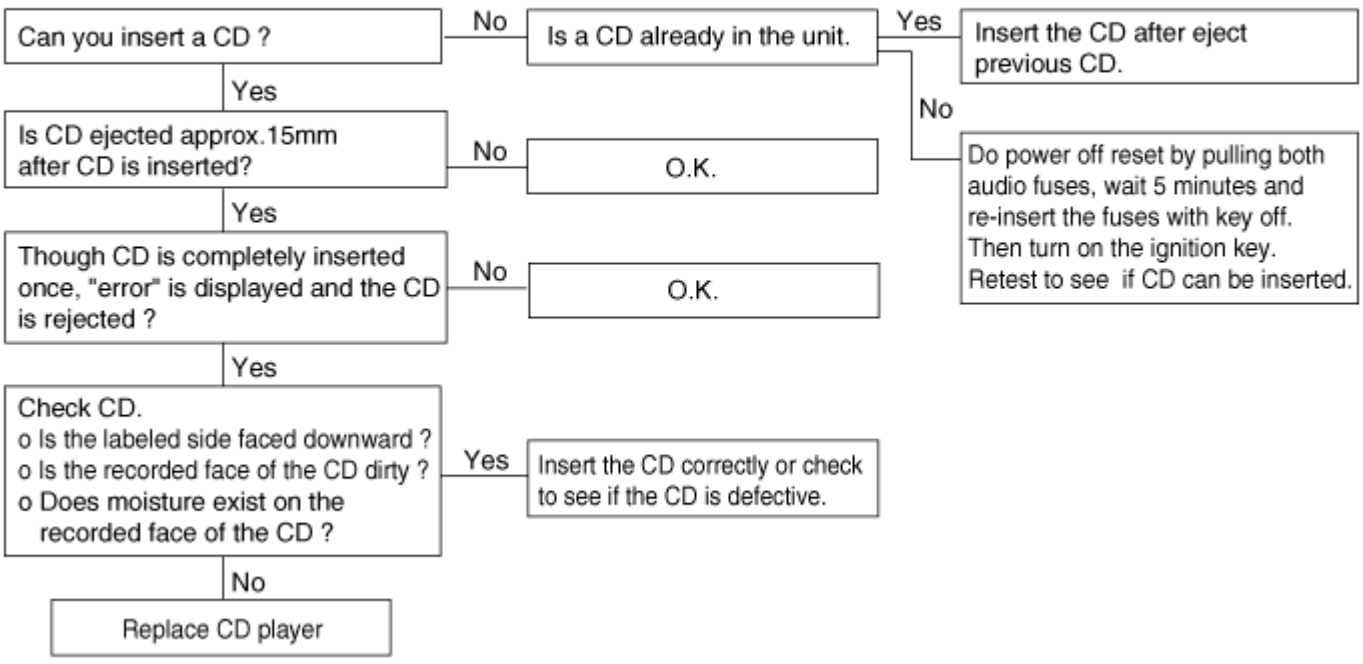
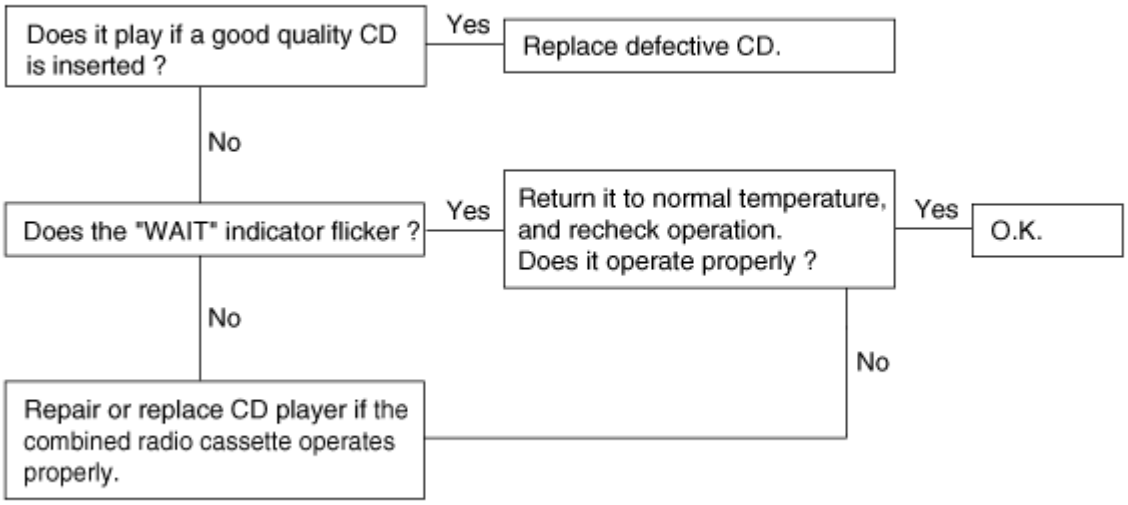


Chart 5

1. CD WILL NOT BE ACCEPTED

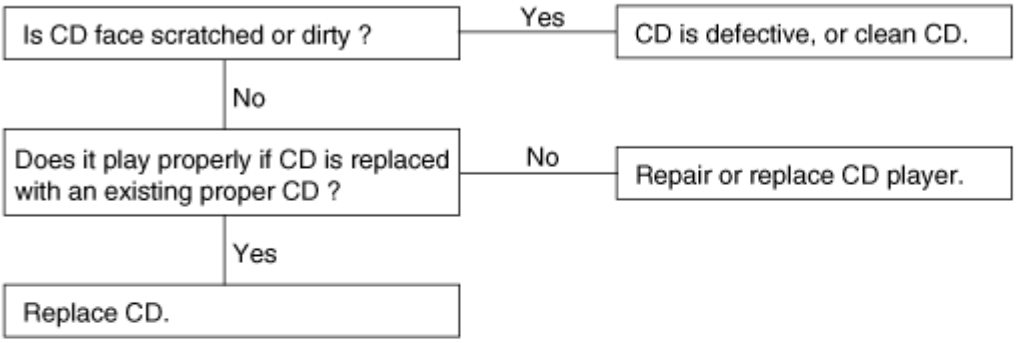


2. NO SOUND

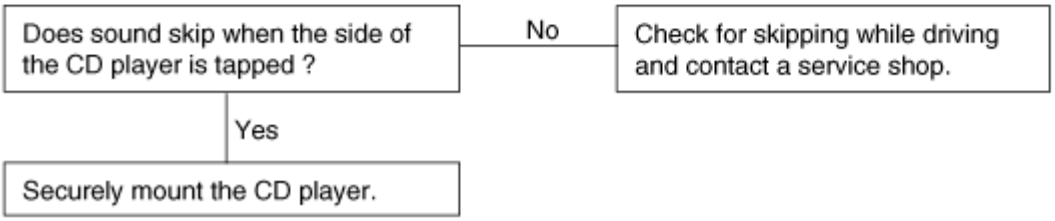


3. CD SOUND SKIPS

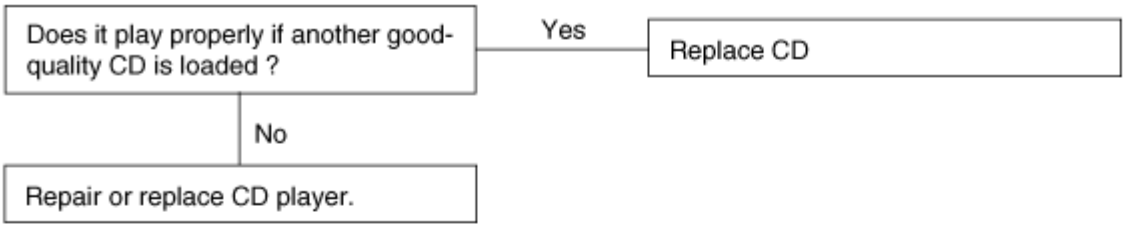
1) Sound sometimes skips when parking.



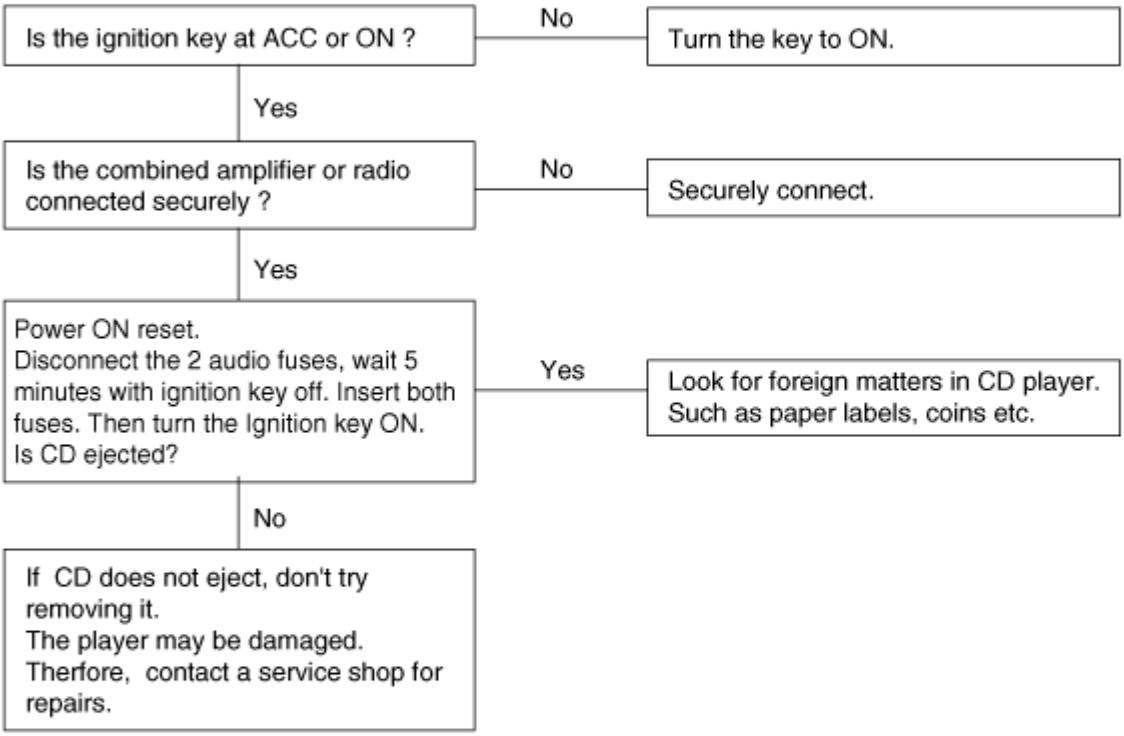
2) Sound sometimes skips when driving.
(Stop vehicle, and check it.)
(Check by using a CD which is free of scratches, dirt or other damage.)



4. SOUND QUALITY IS POOR



5. CD WILL NOT EJECT



6. NO SOUND FROM ONE SPEAKER

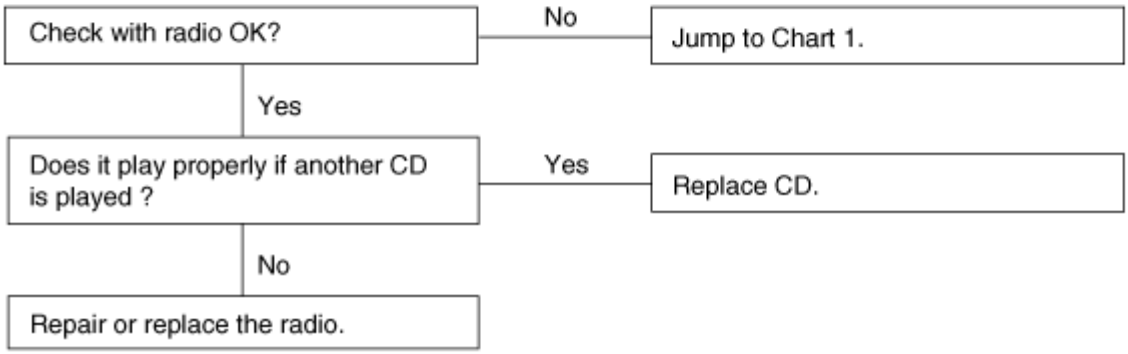


Chart 6

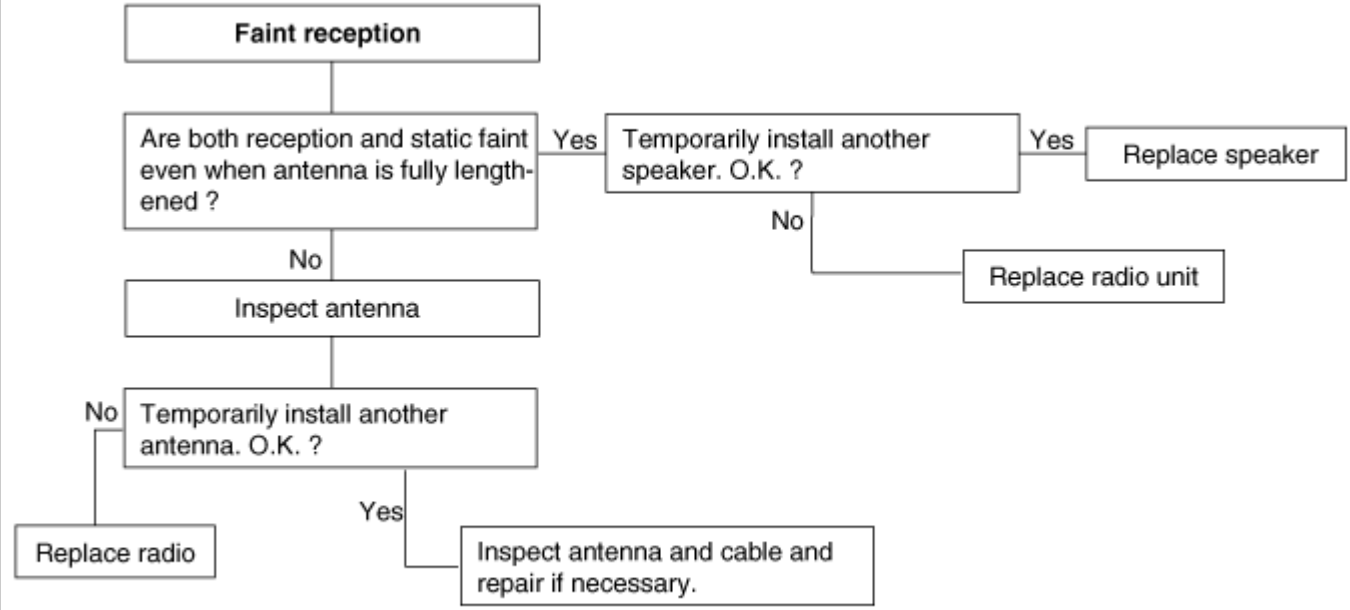


Chart 7

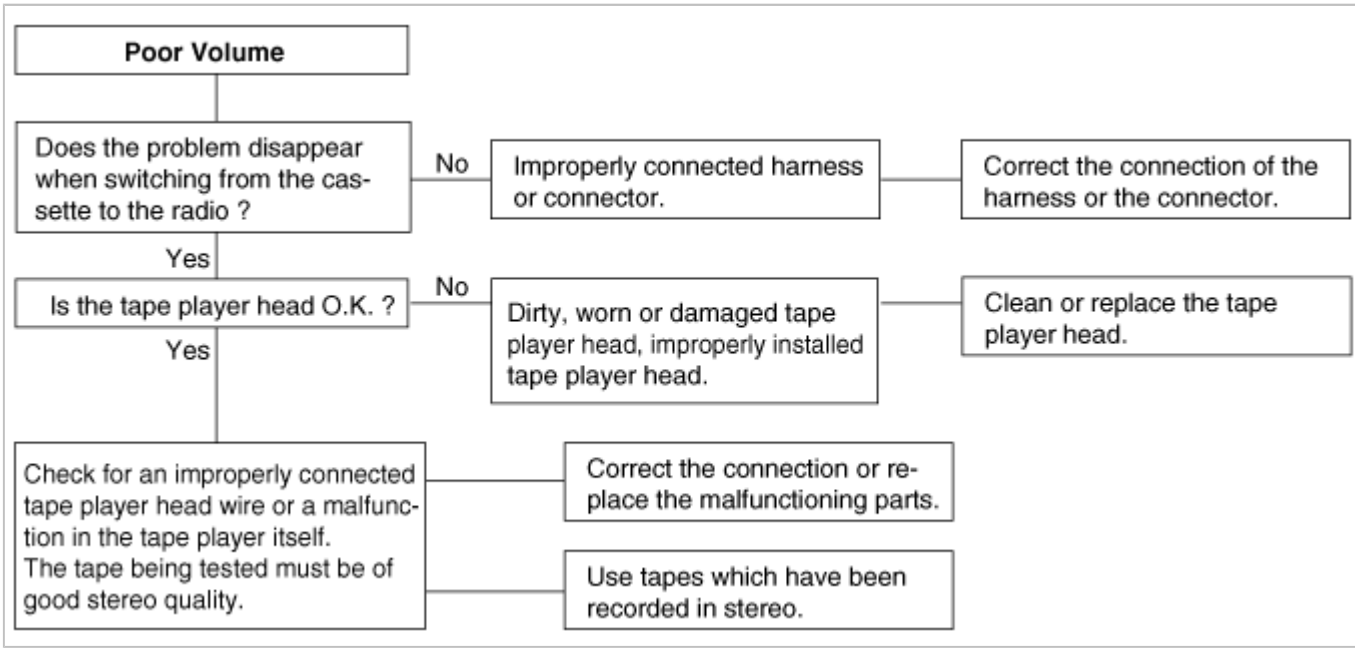


Chart 8

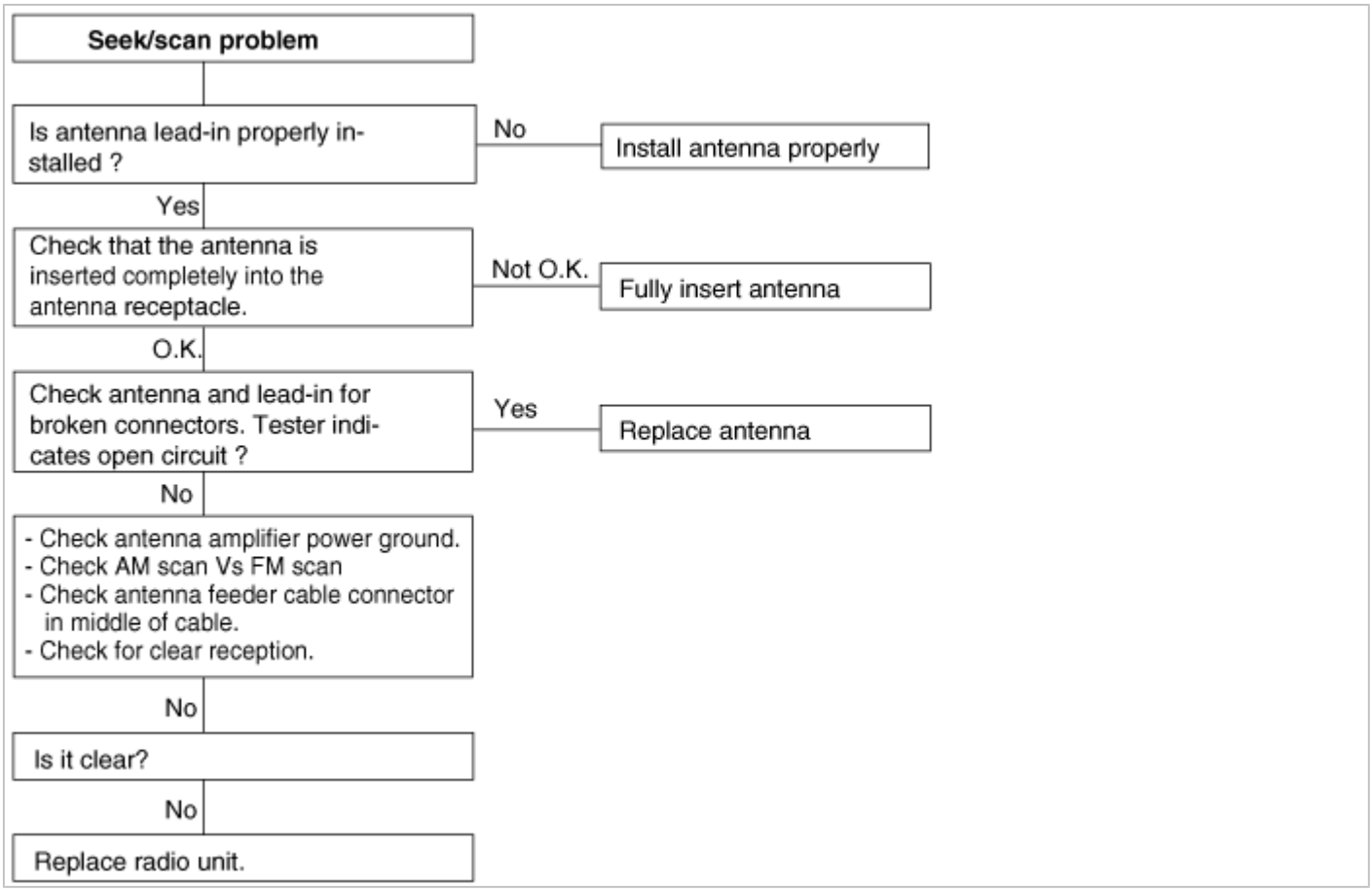
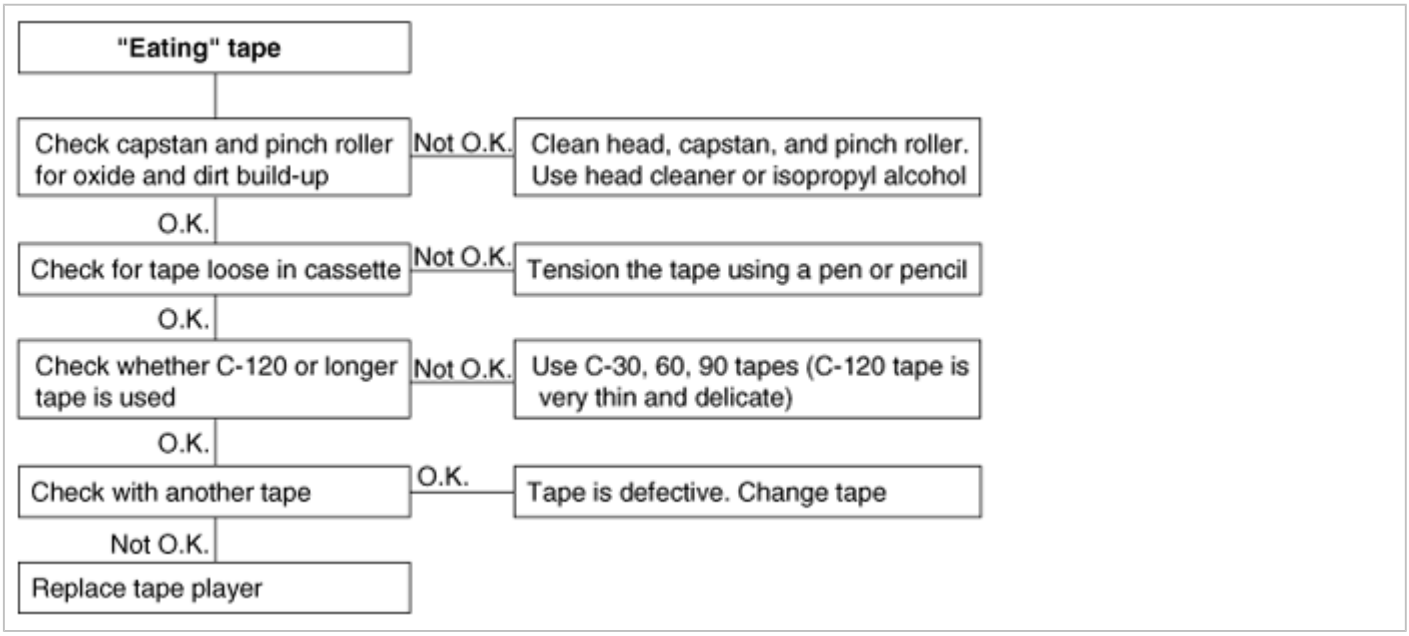
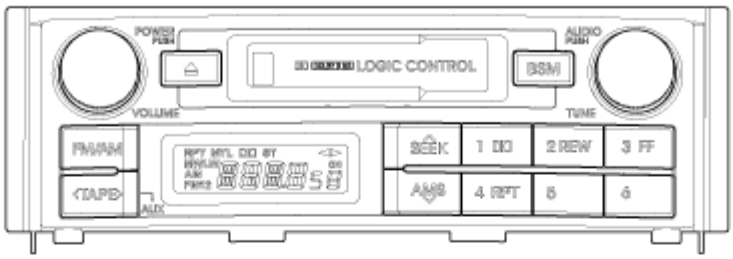

Seek/scan problem
Is antenna lead-in properly installed ?
No
Install antenna properly
Yes
Check that the antenna is inserted completely into the antenna receptacle.
Not O.K.
Fully insert antenna
O.K.
Check antenna and lead-in for broken connectors. Tester indicates open circuit ?
Yes
Replace antenna
No
- Check antenna amplifier power ground.
- Check AM scan Vs FM scan
- Check antenna feeder cable connector in middle of cable.
- Check for clear reception.
No
Is it clear?
No
Replace radio unit.

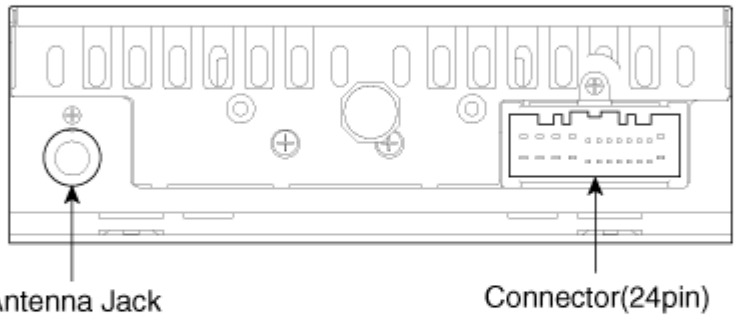
Chart 9

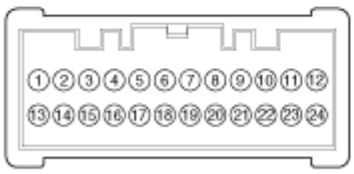

"Eating" tape
Check capstan and pinch roller for oxide and dirt build-up
Not O.K.
Clean head, capstan, and pinch roller. Use head cleaner or isopropyl alcohol
O.K.
Check for tape loose in cassette
Not O.K.
Tension the tape using a pen or pencil
O.K.
Check whether C-120 or longer tape is used
Not O.K.
Use C-30, 60, 90 tapes (C-120 tape is very thin and delicate)
O.K.
Check with another tape
O.K.
Tape is defective. Change tape
Not O.K.
Replace tape player

Components

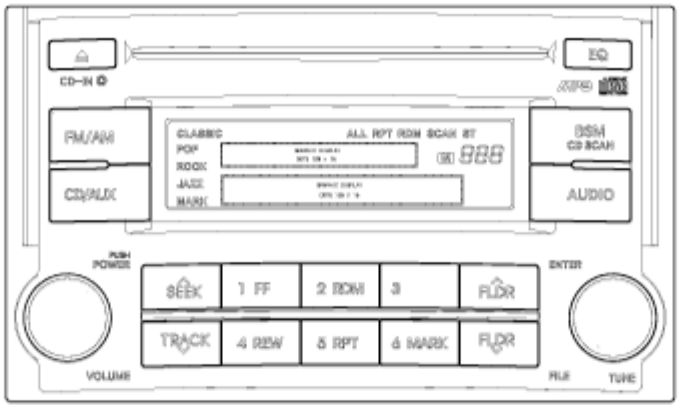
[RADIO / TAPE (M420)]

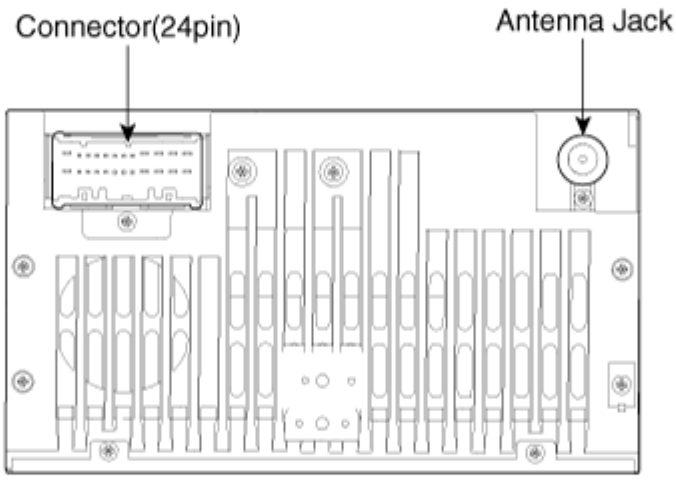


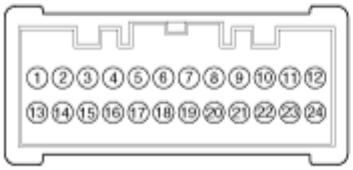


Connector	Pin	Name	Pin	Name
	1	Front Left Speaker(+)	13	Front Left Speaker(-)
	2	Front Right Speaker(+)	14	Front Right Speaker(-)
	3	Rear Right Speaker(+)	15	Rear Right Speaker(-)
	4	Rear Left Speaker(+)	16	Rear Left Speaker(-)
	5	Illumination +	17	Illumination -
	6	Steering Remote Control	18	Remote Control Ground
	7	-	19	Tel Mute
	8	Aux Ground	20	Aux Detect
	9	Aux In(l)	21	Aux In (R)
	10	-	22	Auto Volume Control
	11	Acc	23	Antenna B+
	12	Battery	24	Ground

[RADIO / CD / MP3 (M445)]

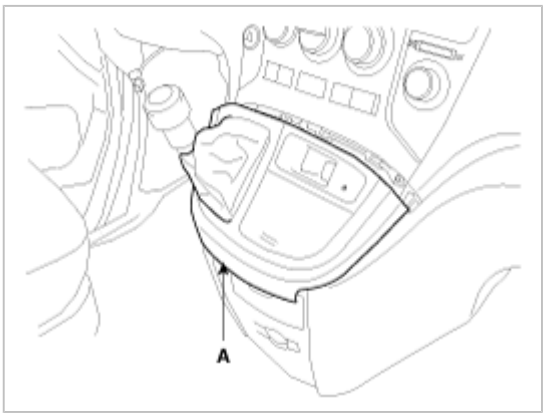




Connector	Pin	Name	Pin	Name
	1	Front Left Speaker(+)	13	Front Left Speaker(-)
	2	Front Right Speaker(+)	14	Front Right Speaker(-)
	3	Rear Right Speaker(+)	15	Rear Right Speaker(-)
	4	Rear Left Speaker(+)	16	Rear Left Speaker(-)
	5	Illumination +	17	Illumination -
	6	Steering Remote Control	18	Remote Control Ground
	7	-	19	Tel Mute
	8	Aux Ground	20	Aux Detect
	9	Aux In(l)	21	Aux In (R)
	10	-	22	Auto Volume Control
	11	Acc	23	Antenna B+
	12	Battery	24	Ground

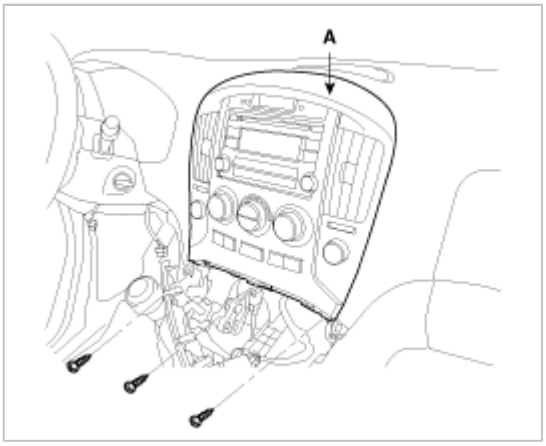
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front console under cover (A).

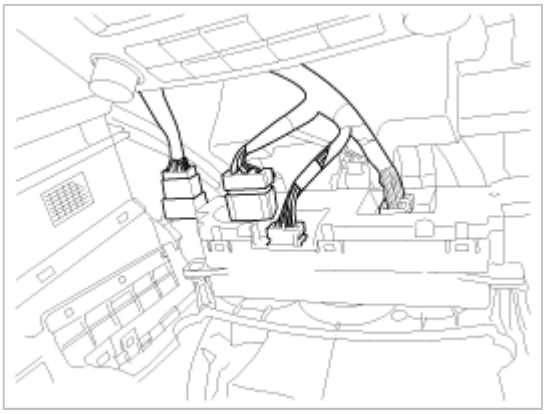


3. Remove the crash pad center facia panel (A).

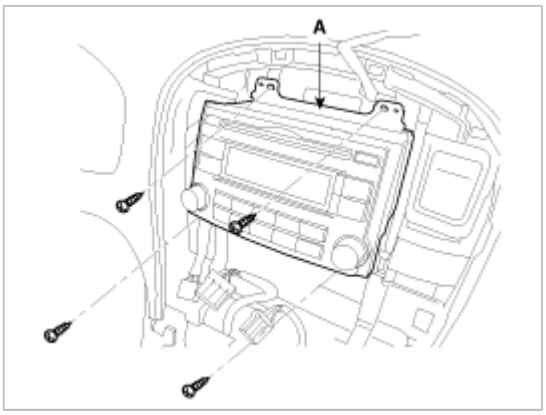
Take care not to scratch the crash pad and related parts.



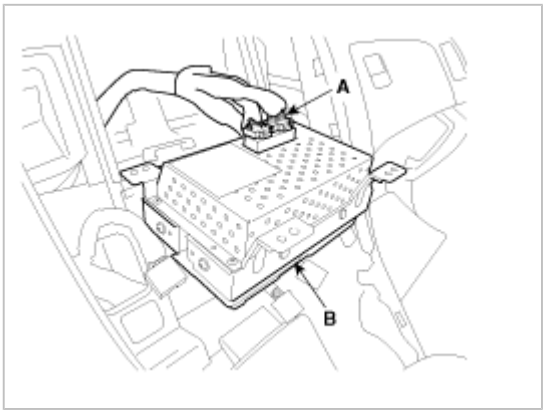
4. Disconnect the connectors from the crash pad center facia panel.



5. Remove the mounting screws then remove the audio unit(A).



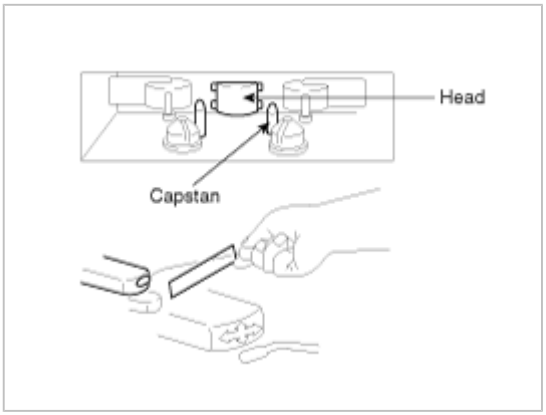
6. Disconnect the audio connectors and cable(A).



Inspection

Tape Head And Capstan Cleaning

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



Installation

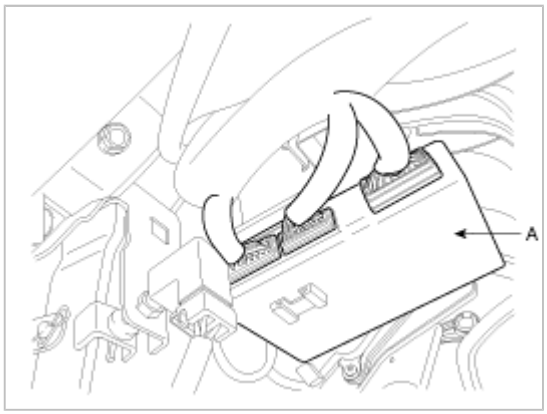
1. Connect the audio unit connectors and cable.

- Make sure the audio head unit connectors are plugged in properly, and the antenna cable is connected properly.

2. Install the audio unit.
3. Install the crash pad center facia panel.
4. Install the front console under cover.
5. Check the audio system.

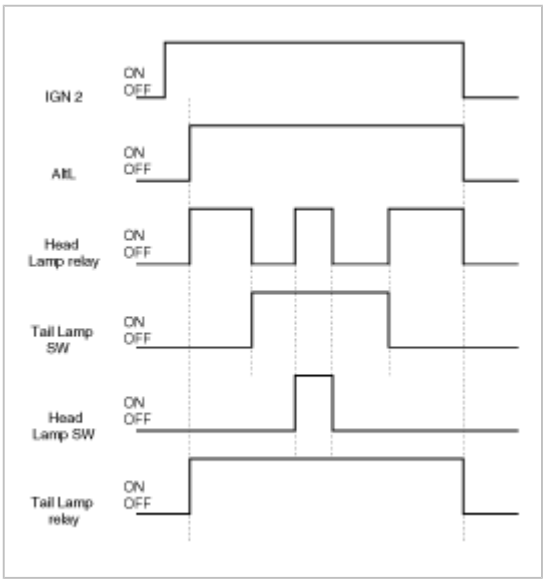
Inspection

1. The daytime running unit is integrated in the BCM (A).

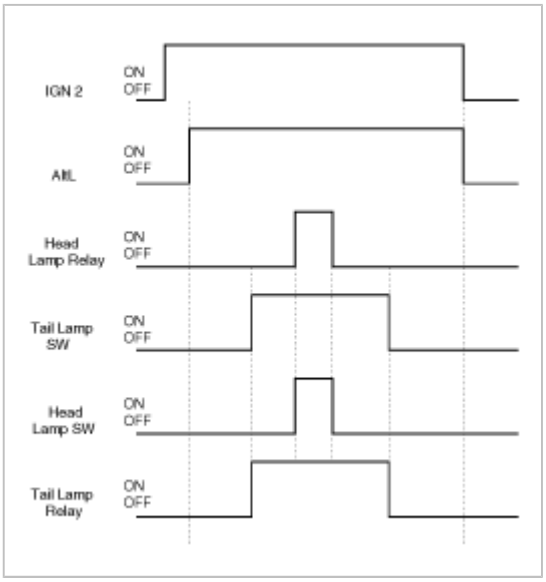


2. Check that the light operate according to the following timing chart.
   (1) TAIL LAMP RELAY and HEAD LAMP RELAY SIGNAL are TURNED ON If IGN2 is ON, ALT "L" is ON, DRLL Activation INPUT is ON, Head LAMP SW is OFF and Tail LAMP SW is OFF.
   (2) HEAD LAMP RELAY SIGNAL IS TURNED OFF at TAIL LAMP SW ON after operation in 1).
   (3) HEAD LAMP RELAY SIGNAL IS TURNED ON at HEAD LAMP SW ON again after operation in 2).
   (4) TAIL LAMP RELAY is turned ON when DRL Activation INPUT is ON, TAIL LAMP SW is ON and IGN2 and ALT "L" is turned from OFF to ON
   (5) Function of DRL is stopped at DRL Activation INPUT OFF(LOW) during Function of DRL.

DRL Activation INPUT ON(HIGH)



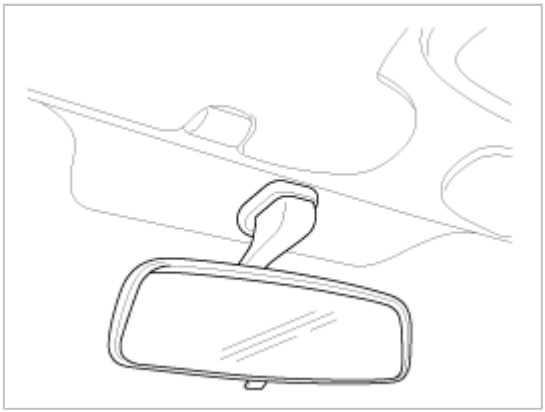
DRL Activation INPUT OFF(LOW)



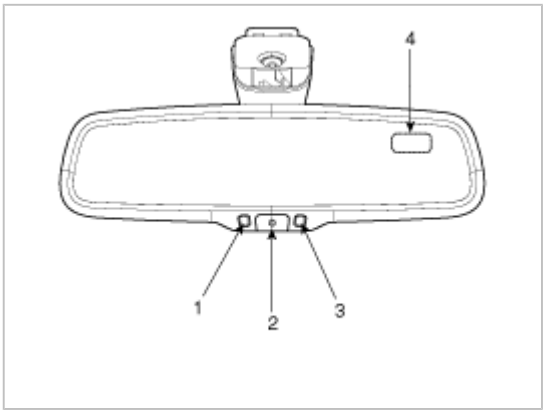
3. If the daytime running light is not operated well, Inspect the connector and terminals to be sure they are all making good contact.
   If the terminals are bent, loose or corroded, repair them as necessary, and recheck the system.
   If the terminals look OK, go to step 4.
4. Make these input tests at the connector by using ETM.
   If any test indicates a problem, find and correct the cause, then recheck the system.
   If all the input tests prove OK, the BCM must be faulty; replace it.

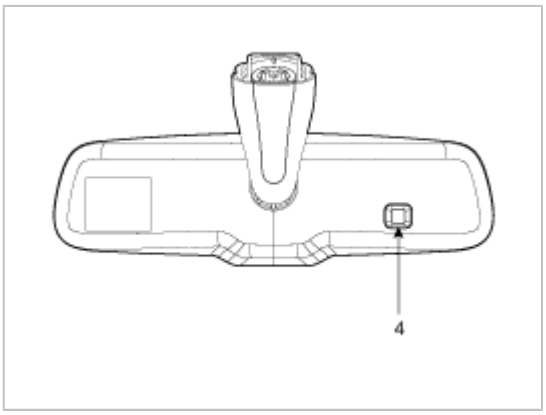
Description

The ECM (Electro Chromic inside rear view Mirror) is for dimming the reflecting light from a vehicle behind at night, in order the user not to be dazzled by the light. The front looking sensor detects brightness of the surroundings, while the rearward looking sensor the strength of the reflecting light so that adjusts the reflexibility of the mirror in the range of 10~70%. But, when the reverse gear is engaged, it stops functioning.



1. The front looking sensor sees if the brightness of the surroundings is low enough for the mirror to operate its function.
2. The rearward looking sensor detects glaring of the reflecting light from a vehicle behind.
3. The ECM is darkened to the level as determined by the rearward looking sensor. When the glaring is no longer detected, the mirror stops functioning.
   (1. Status indicator LED, 2. Buttom, 3. Rear indicator, 4. Front light sensor)





Automatic-dimming Function

To protect your vision during nighttime driving, your mirror will automatically dim upon detecting glare from the vehicles traveling behind you. The auto-dimming function can be controlled by the Dimming ON/OFF Button :

1. Pressing and holding the Feature Control button for more than 3 but less than 6 seconds turns the auto-dimming function OFF which is indicated by the green Status Indicator LED turning off.
2. Pressing and holding the Feature Control button again for more than 3 but less than 6 seconds turns the auto-dimming function ON which is indicated by the green Status Indicator LED turning on.

The mirror defaults to the "ON" position each time the vehicle is started.

Inspection

Check it by the procedure below to see if the function of the ECM is normal.

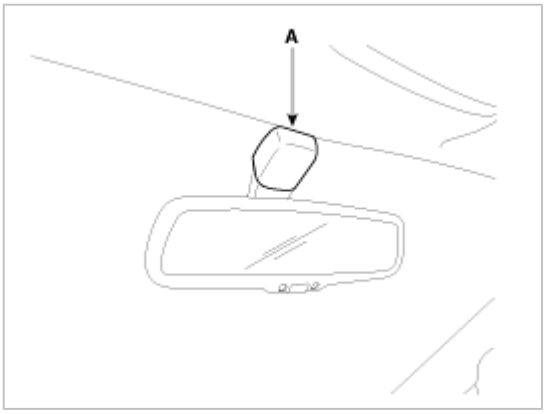
1. Turn the ignition key to the "ON" position.
2. Cover the foreward looking sensor to stop functioning.
3. Head a light to the rearward looking sensor.
4. The ECM should be darkened as soon as the rearward looking sensor detects the light.

> If this test is performed in daytime, the ECM may be darkened as soon as the foreward looking sensor is covered.

5. When the reverse gear is engaged, the ECM should not be darkened.
   When heading lights to both the foreward looking and rearward looking sensors, the ECM should not be darkened.

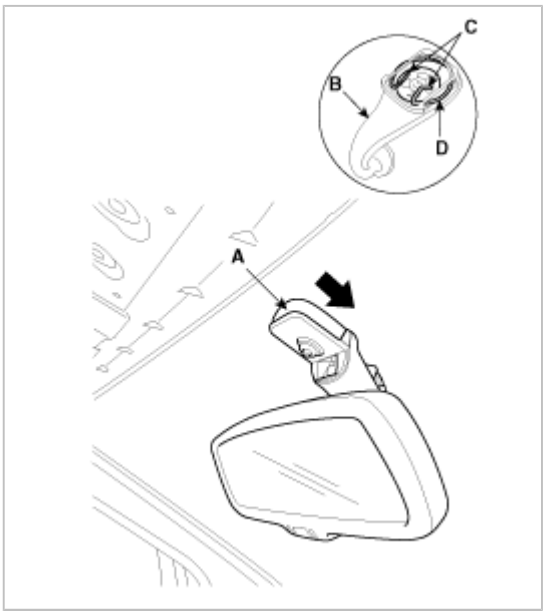
Removal

1. Remove the mirror wire cover(A).



2. Disconnect the inside rear view mirror connector.
3. Remove the inside rear view mirror pulling it upside carefully.

> Mirror it adheres closely in the mirror base (A) and it separates while removing the mirror (B).
> Make sure the spring(D) mounting bracket (C) of the mirror not to be damaged.

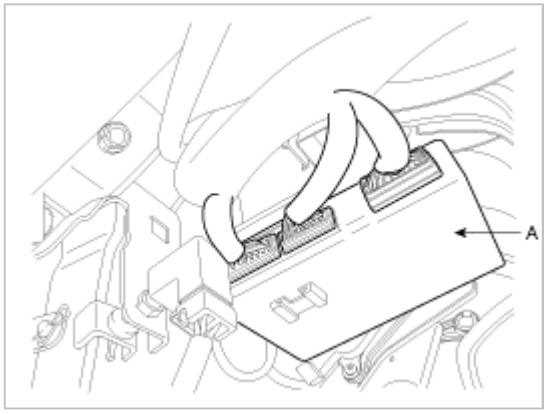


Installation

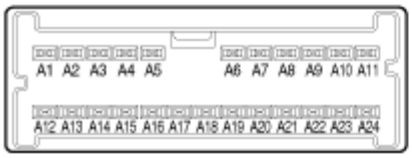
1. Install the inside rear view mirror.
2. Connect the inside rear view mirror connector.
3. Install the mirror wire cover.

Description

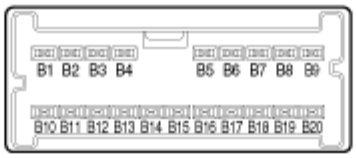
Body control module (A) receives various input switch signals controlling time and alarm functions for tail lamp, rear fog lamp, wiper control, front deicer timer, tail lamp, central door lock, seat belt warning, key operated warning, over speed warning, ignition key hole illumination, room lamp control, power window timer, keyless entry control, burgular alarm control, crash door unlock, key reminder.



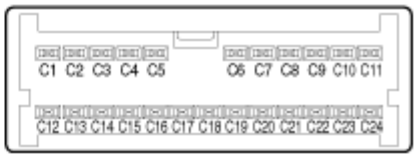
Bcm Connectors



Connector A



Connector B



Connector C

Pin NO.	Connector A	Connector B	Connector C
1	B+	Driver Door Key Lock SW	Room Lamp Relay
2	IGN1	Driver Door Key Unlock SW	Front Deicer Relay
3	ALT "L"	Central Door Lock SW	Power Window Relay
4	Key In SW	Tail SW	Head Lamp Low Relay
5	ACC	Wiper Int Volume SW	Wiper Relay
6	Over Speed Signal (Middle East Only)	Speed Sensor	Lock Relay
7	Crash Input	-	Unlock Relay
8	Driver Door Unlock SW	Door Seat Belt SW	Alarm Horn Relay
9	Passenger Unlock SW	Head Lamp Low SW	Hazard Relay
10	Slider Door LH Unlock SW	Rear Wiper SW	Key Hole Illumination
11	Slider Door RH Unlock SW	Central Door Unlock SW	Door Seat Belt IND
12	GND	DRL Activation input	GND(Power)
13	IGN2	Parking Brake SW	-

14	Washer SW	Tailgate Unlock SW	-
15	Wiper Int SW	Slider Door LH SW	-
16	Code Save Unit	Slider Door RH SW	Step Lamp LH Relay
17	-	Front Deicer SW	Step Lamp RH Relay
18	-	Rear Defogger SW	Flasher Relay
19	Over Speed IND (Middle East Only)	Rear Fog SW	Rear Fog Relay
20	Driver Door SW	Front Fog SW	Rear Defogger Relay
21	Passenger Door SW		Tail Lamp Relay
22	MIST SW		Start Inhibitor Relay
23	Tailgate SW		-
24	Hood SW		Hi-Scan

Terminal Voltage

No	Input signal name	Logic state	ON/OFF LEVEL(V)	Remarks
A1	B+	ON = BAT	9V~16V	
A2	IGN1	ON = BAT (IGN KEYisONorSTARTposition)	7Vor more/4Vor less	BAT=BATTERY
A3	Alt L	ON = BAT (starting state st ate)	7Vor more/4Vor less	
A4	Key In SW	IN = BAT (KEYinsertion st ate)	7Vor more/4Vor less	
A5	ACC	ON = BAT	7Vor more/4Vor less	
A7	Crash Input	ON = GND (at crash detec tion)	1Vor less/OPEN(Reference value:4 Vor more)	
A8	Driver Door Unlock SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4 Vor more)	
A9	Passenger Door Unlock SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4 Vor more)	
A10	SILDE DOOR_LH UNLO	LOCK = OPEN, UNLOCK =	1Vor less/OPEN(Reference value:4	

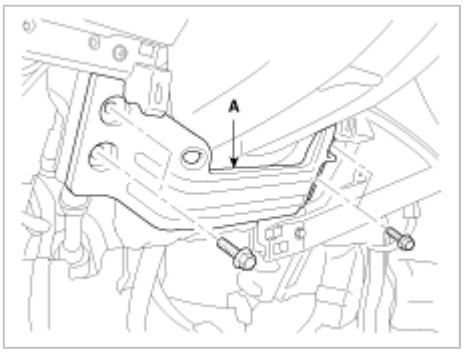
	CK SW	GND	Vor more)	
A11	SLIDE DOOR_RH UNLO CK SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4 Vor more)	
A13	IGN2	ON = BAT (IGN KEYisON position)	7Vor more/4Vor less	
A14	Washer SW	ON = BAT	7Vor more/4Vor less	
A15	Wiper Int SW	ON = BAT	7Vor more/4Vor less	
A16	CODE SAVE UNIT	ON = GND	1Vor less/4Vor more	
A20	Driver Door SW	OPEN = GND	1Vor less/OPEN(Reference value:4 Vor more)	
A21	Passenger Door SW	OPEN = GND	1Vor less/OPEN(Reference value:4 Vor more)	
A22	Mist SW	ON = BAT	7Vor more/4Vor less	
A23	TAIL GATE SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
A24	HOOD SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
BA	Driver Door key Lock SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B2	Driver Door key Unlock SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B3	Power window Door Lock SW(Driver)	ON=GND	1Vor less/OPEN(Reference value:4 Vor more)	
B04	Tail SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	

B5	Wiper Int Volume SW	0V ~ 2.5V	-	0Ω~ 50KΩ
B6	Speed Sensor	Speed input= PULSE (0~5 V)	1Vor less/4Vor more	Open Collector
B8	Seat Belt SW	Fasten= OPEN,Unfasten = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B9	Head Lamp SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B11	Power Window Door Unlo ck SW(Driver)	ON=GND	1Vor less/OPEN(Reference value:4 Vor more)	
B12	DRL Activation INPUT	ON = BAT	7Vor more/4Vor less	
B13	PARKING BRAKE SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B14	TAILGATE UNLOCK SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B15	SILDE DOOR_LH SW	OPEN = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B16	SLIDE DOOR_RH SW	OPEN = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B17	Front DEICER SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B18	Rear Defogger SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
B19	Rear Fog SW	ON = GND	1Vor less/OPEN(Reference value:4 Vor more)	
			1Vor less/OPEN(Reference	

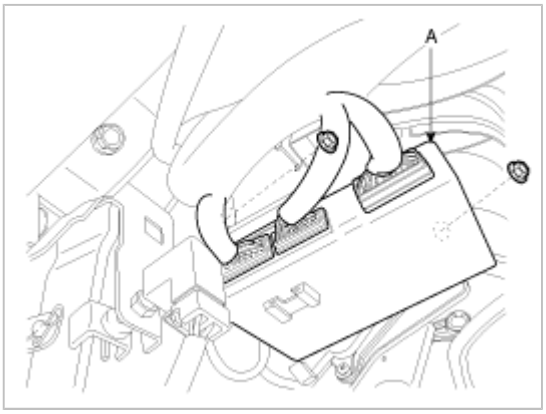
B20	Front Fog SW	ON = GND	value:4 Vor more)	

REMOVAL

1. Disconnect the negative (-) battery terminal.
2. Remove the driver side crash pad lower panel.
   (Refer to the Body group - Crash pad)
3. Remove the reinforce panel (A).



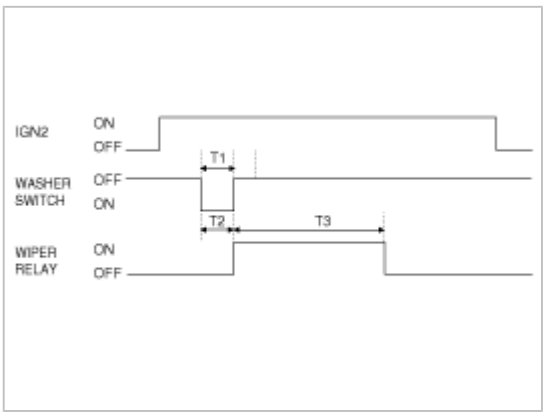
4. Remove the body control module (A) after loosening 2 nuts and disconnecting connector.



INSPECTION

WIPER Control

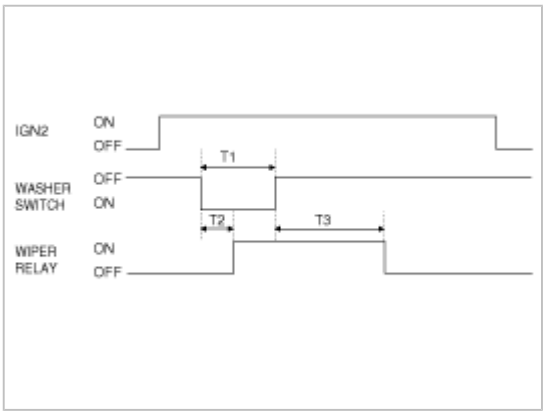
1. WIPER Control coupled with Washer
   (1) Under IGN2 SW ON, WIPER RELAY is turned ON after T2 from WASHER SW ON if WASHER SW is ON for T1 and WIPER RELAY is turned OFF after T3.



YHGHJGHJ

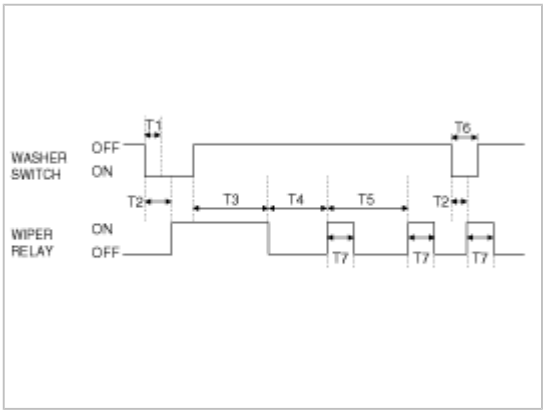
T1 < 0.2s, T2 = 0.3s ±0.03s,
T3 = 0.7s ±0.1s

(2) Under IGN2 SW ON, WIPER RELAY is turned ON after T2 from WASHER SW ON if WASHER SW is ON for at least T1, and WIPER RELAY is turned OFF after T3 from the moment that WASHER SW is turned OFF.



T1≥0.2s, T2 = 0.3s ±0.03s,
T3 = 3.0s±0.3s (2~3 TURN)

(3) Operation in Item 1) is performed if WASHER SW is ON for T6 during WIPER operation with Wiper INT SW. Operation in Item 2) is performed if WASHER SW is ON for more than T1.

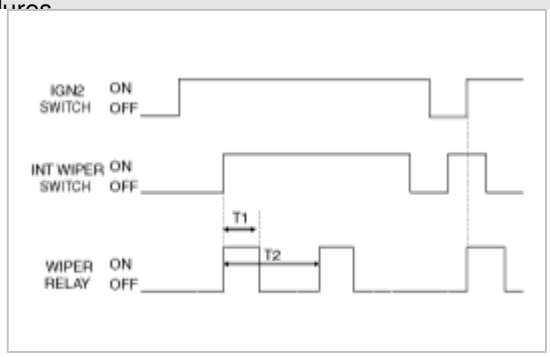


T1 ≥ 0.2s, T2 = 0.3s ± 0.03s, T3 = 3.0s ± 0.3s (2~3 TURN)
T4○ T5 - 0.7s, T5 ○ INT TIME, T6 < 0.2s, T7 = 0.7s ±0.1s

A. Operation is cancelled in case of IGN2 OFF during T3.
B. Give priority to WASHER interlocking WIPER than VARIABLE INT WIPER function.
C. WASHER SW signal input shall be ignored at start-up (IGN1 ON& IGN2 OFF states).

2. VARIABLE INT WIPER

(1) Under IGN2 SW ON and INT SW ON states, then INT WIPER RELAY is turned ON during intermittent time. And intermittent time is according to INPUT STEP.

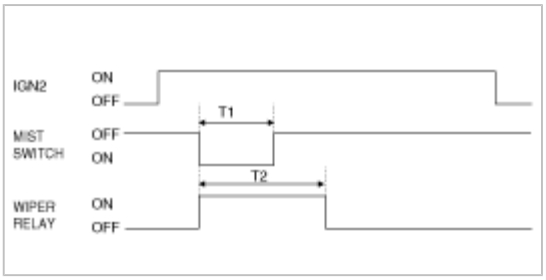


* T1 = 0.7s±0.1s, T2 = 2.2s(±10%) ~ 10.0s(±10%)

INPUT TEP	Intermittent time (sec)±10%	REMARK (M/F R value±10%)
	Speed is fixed	
1step (0°)	2.2 sec	0~1 Kohm
2step (22.5°)	3.9 sec	13 Kohm
3step (45°)	6.1 sec	24 Kohm
4step (67.5°)	8.3 sec	38 Kohm
5step (90°)	10.0 sec	50 Kohm

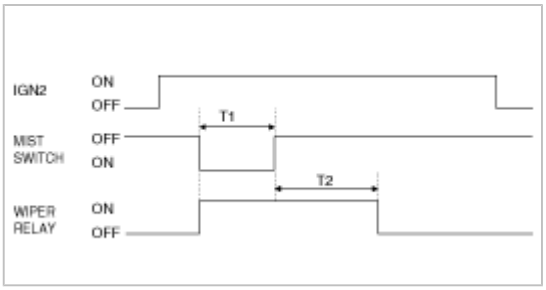
3. MIST coupled with WIPER

(1) Under IGN2 ON, WIPER RELAY is turned ON directly from MIST SW ON if MIST SW is ON for T1 and WIPER RELAY is turned OFF after T2.



T1 < 0.7s, T2 = 0.7s±0.1s

(2) Under IGN2 SW ON, WIPER RELAY is turned ON directly from MIST SW ON if MIST SW is ON for at least T1, and WIPER RELAY is turned OFF after T3 from the moment that MIST SW is turned OFF.

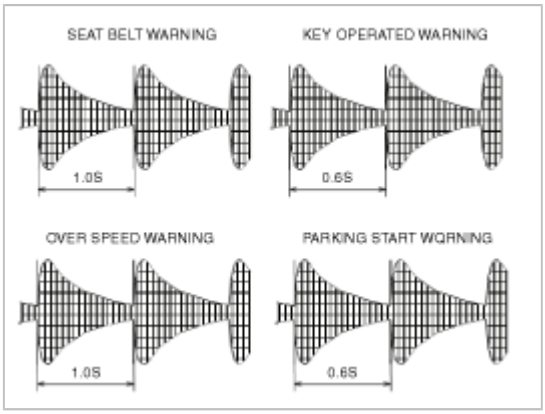


T1 ≥ 0.7s, T2 = 0.7s±0.1s

Chime Warning

* BUZZER Control(BUZZER sound option)

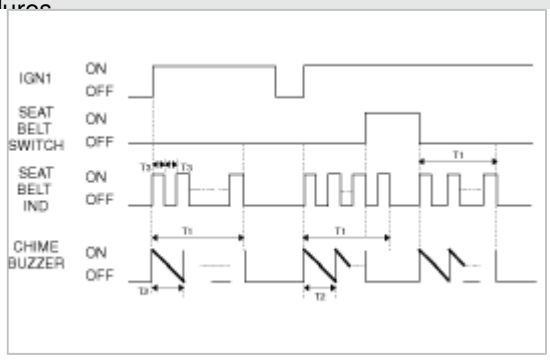
	freqency	freqency DUTY	cycle	Sound pressure	remark
SEAT BELTWARNING	800Hz	50%	1.0s	70±10dB	Decrease sound
KEY OPERATEDWARNING	800Hz	50%	0.6s	70±10dB	Decrease sound
OVER SPEEDWARNING	800Hz	50%	1.0s	70±10dB	Decrease sound
PARKING START WARNING	800Hz	50%	0.6s	70±10dB	Decrease sound



* Priority of warning : S/BELT WARNING > OVER SPEED WARNING > KEY OPERATED or PARKING START WARNING
* Output continues up to OFF cycle when output is OFF
* Sound pressure measurement distance: 1.0 m

Seat Belt Warning

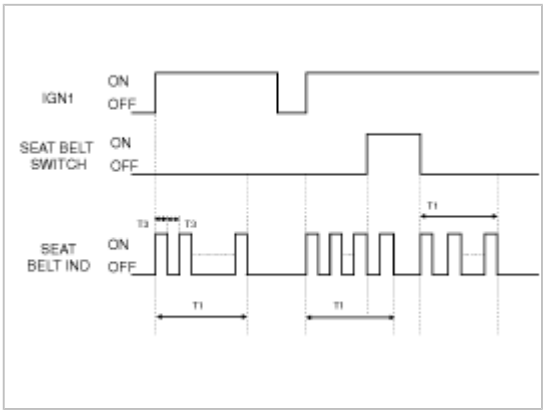
1. Middle East
   (1) In state that Seat Belt is unfastened, Seat Belt IND is turned ON for T1 on T3/T3(ON/OFF) Cycle and Chime Buzzer output for T1 on T2.
   (2) Seat Belt IND & Chime Buzzer stopped output at IGN1 OFF within T1.
   (3) Chime Buzzer stopped output and Seat Belt IND output for residual time at Seat Belt SW ON Within T1.
   (4) In state of IGN1 ON, Seat Belt IND & Chime Buzzer output for 6s when seat belt is unfastened after fastened.
   (5) In state that Seat Belt is fastened, Chime Buzzer is off & Seat Belt IND is turned ON for 6sec then off at IGN1 OFF ○ ON.



T1 = 6s±1s, T2 = 1s±0.1s, T3 = 0.5s±0.1s

2. OTHERS

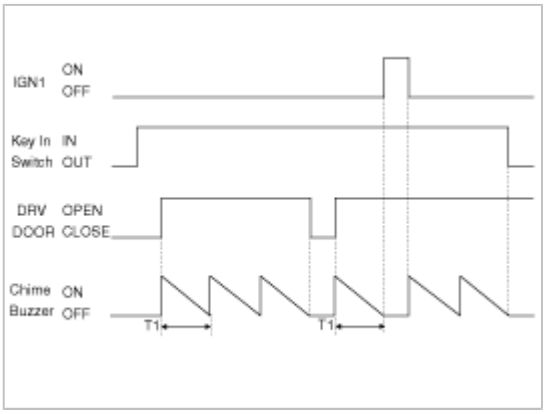
(1) In state that Seat Belt is unfastened, 0_SeatBeltIND is turned ON for T1 on T3/T3(ON/OFF) Cycle.
(2) Seat Belt IND is turned off at IGN1 OFF within T1.
(3) Seat Belt IND output for residual time at Seat Belt SW ON Within T1.
(4) In state of IGN1 ON, Seat Belt IND output always when seat belt is unfastened after fastened
(5) In state that Seat Belt is fastened, Seat Belt IND is turned ON for 6sec then off at IGN1 OFF ○ ON.



T1 = 6s±1s, T3 = 0.5s±0.1s

Key Operated Warning (Except Ec)

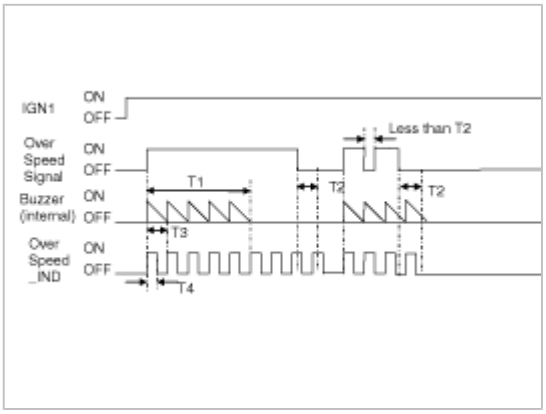
1. Buzzer sounds every 0.6sec when DRVDR is opened under Key In SW IN.
2. Buzzer stops sounding if Key In SW OUT or DRVDR CLOSE during Chime Buzzer output.
3. Buzzer stops sounds if IGN1 ON state during Chime Buzzer output



T1, = 0.6s ±0.1s

Over Speed Warning/ind (Middle East Only)

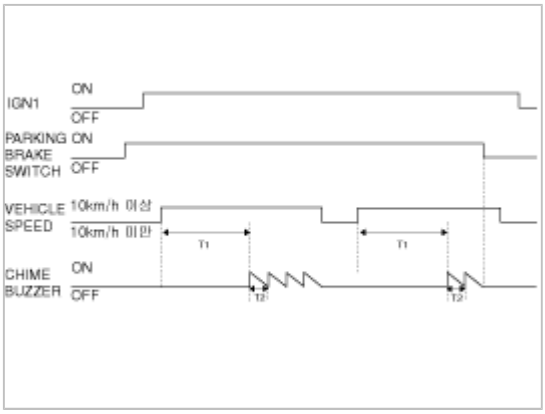
1. Under IGN1 ON, Buzzer is output for T1 on T3 cycle when Over Speed Signal of CLUSTER is ON and Over Speed IND output is ON for more than T2 until Over Speed Signal OFF on T4/T4 ON/OFF cycle.
2. Chime Buzzer & Over Speed IND output is off within T1 when Over Speed Signal is off for more than T2.
3. IF Over Speed Signal is changed (ON-->OFF-->ON) within T2, Chime Buzzer is output for the rest time, Over Speed IND is output for more than T2 until Over Speed Signal OFF.
4. IF Over Speed Signal is changed (ON-->OFF-->ON) more than T2, the output Operate repeatedly above 1).
5. IF IGN1 OFF, Chime Buzzer & Over Speed IND output are OFF.



T1 = 5±0.1s, T2 = 1±0.1s,
T3 = 1±0.1s, T4 = 0.5±0.1s

Parking Start Warning

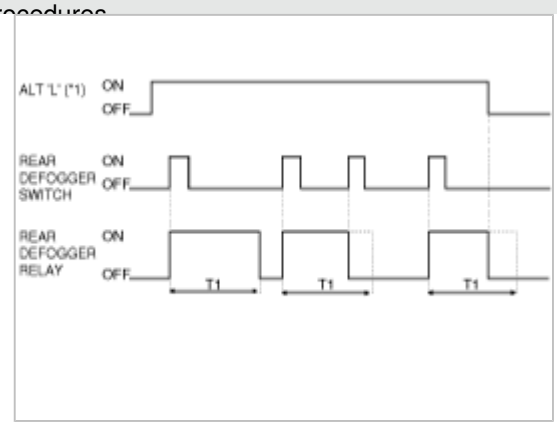
In the state that IGN1 ON & Parking Brake is operating, Chime Buzzer is output on T2 cycle continuously if vehicle speed(≥10 Km/h) is remainded more than 2~3s.



T1 = 2.5s ± 0.5s, T2 = 0.6s ± 0.1s

Rear Defogger Timer

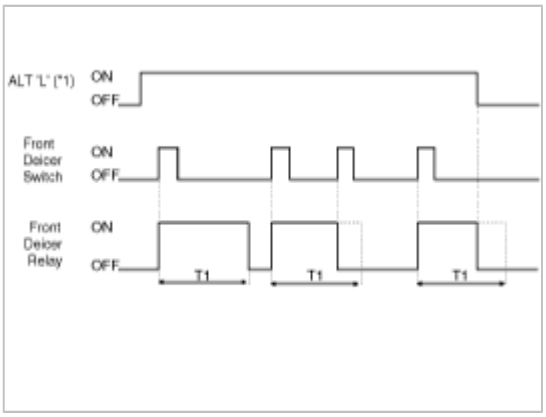
1. In state of Alt L ON, Defogger Relay is output for T1 if Rear Defogger SW is turned ON.
2. Defogger Relay output is OFF if Rear Defogger SW is turned ON again under output ON or ALT"L" OFF



T1 = 20min±1min

Front Deicer Timer

1. Front Deicer Relay is turned for T1 if Front Deicer SW is turned ON under Alt L ON.
2. Front Deicer Relay is turned OFF if Front Deicer SW is turned ON again under output ON or Alt L OFF.

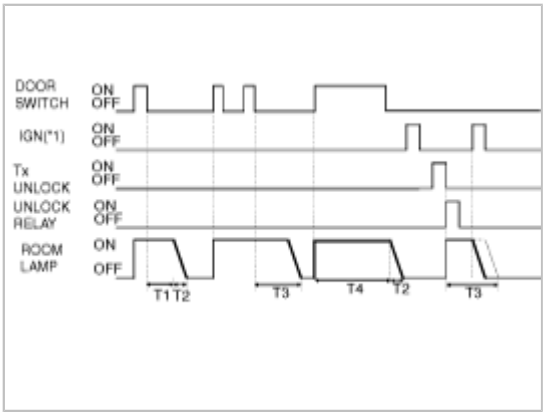


T1○ 20min±1min

Decayed Room Lamp

1. Room Lamp lights 100% at D00R OPEN (Driver, Passenger, Slide LH/RH DOOR SW ON).
2. Room Lamp phases out lighting up to 0% in T2 after lighting 100% for T1.
   [But, if DOOR is opened (Driver, Passenger, Slide LH/RH DOOR SW ON) continuously, Room Lamp is lighting up 100% for T4 then Room Lamp phases out lighting up to 0% in T2.]
3. Resolution is 32 STEP or more.
4. Room Lamp is immediately turned OFF at All Door Locked or IGN ON during T1.(phasing out lighting for T2)
5. Shall be no flashing during Phasing out lighting.
6. Shall be no flashing under D00R OPEN (Driver, Passenger, Slide LH/RH DOOR SW ON) & Room Lamp ON at IGN1 ON.
7. Room Lamp is turned ON for T3 when Tx UNLOCK signal is received under DOOR CLOSE (Driver, Passenger, Slide LH/RH DOOR SW OFF).
8. Under ON state, Room Lamp signal output is extended for T3 if Tx UNLOCK signal is received again.
9. Under T3 ON, Room Lamp lights for T4 continuously at D00R OPEN (Driver, Passenger, Slide LH/RH DOOR SW ON) and operation in 2) is performed at DOOR CLOSE.

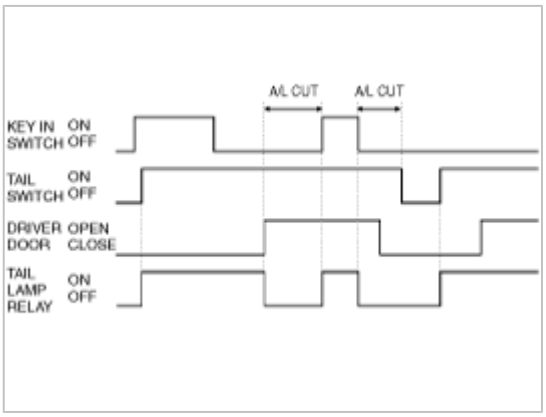
10. Room Lamp is turned off (phasing out for T2) at All Door Locked during Room Lamp ON.
11. Room Lamp does not coupled with TailGate SW.



T1 : 30sec ± 3sec, T2 : 2sec ±0.2sec,
T3 : 32sec ± 3.2sec, T4 : Max. 20min ± 2min

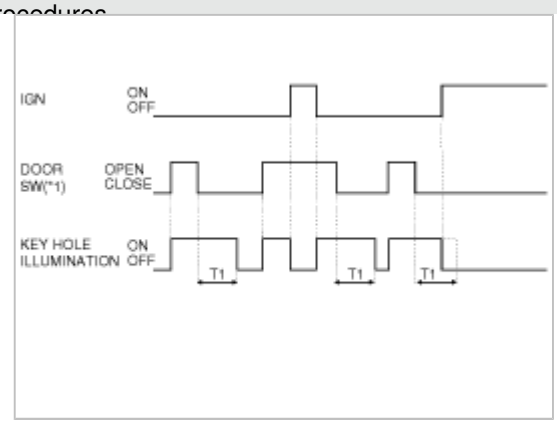
Tail Lamp Auto Cut

1. Tail Lamp Relay is turned ON at Tail SW OFF ○ ON.
2. Tail Lamp Relay is turned OFF at Tail SW OFF.
3. Tail Lamp Relay is turned OFF if the state is changed from Key In SW ON & Tail SW ON to Key In SW OFF & Tail SW ON & DRVDR OPEN.(automatic light out)
4. Tail Lamp Relay is turned ON at Key In SW ON after the operation in 3).
5. Tail Lamp Relay is not turned at DRVDR○ OPEN ○ CLOSE after the operation in 3).
6. The previous MODE is remained at A_B+ ON/OFF after the operation in 3).



IGN KEY HOLE ILLUMINATION

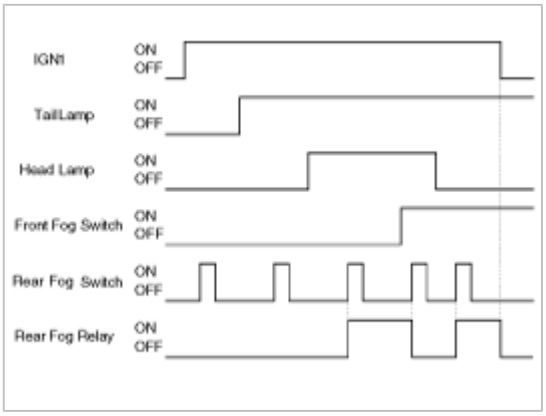
1. Key Hole Illumination lamp is turned ON at IGN OFF & DOOR OPEN.
2. Key Hole Illumination lamp is turned ON at DOOR CLOSE after the operation in 1).
3. Key Hole Illumination lamp is turned OFF immediately at IGN ON during output.
4. Key Hole Illumination lamp is turned OFF immediately at transition to ARMWAIT MODE during output.



T1 = 30s ±1s

REAR FOG LAMP CONTROL

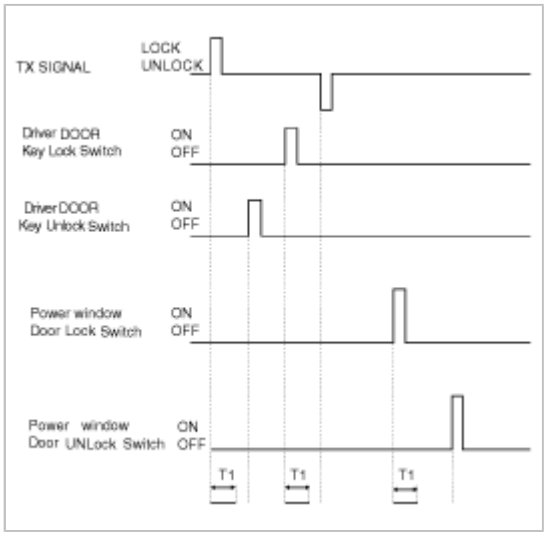
1. Under IGN1 ON & Tail Lamp Relay ON & (Head Lamp Relay ON or Front Fog SW ON), Rear Fog Relay is turned ON if pushing Rear Fog SW.
2. Under Rear Fog Relay ON, Rear Fog Relay is turned OFF if pushing Rear Fog SW again.
3. Rear Fog Relay output is OFF unless the condition that IGN1 ON & Tail Lamp Relay ON & (Head Lamp Relay ON or Front Fog SW ON) is met.

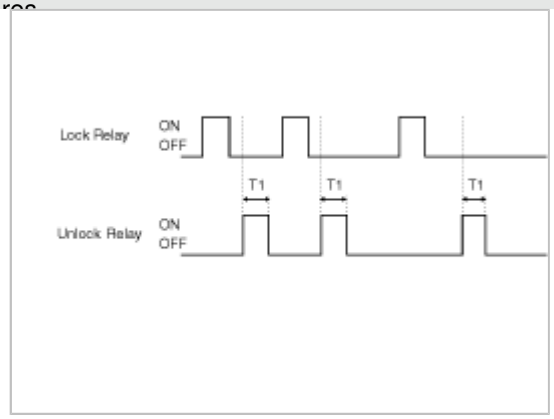


DOOR LOCK/UNLOCK CONTROL

1. CENTRAL DOOR LOCK/UNLOCK
   (1) All Door Lock RELAY signal is output for T1(0.5s) if DRV DOOR UNLOCK SW OFF within 3sec after DRV Door Key Lock SW ON.
   (But, under IGN 1 ON, LOCK OUTPUT by DOOR KEY LOCK SW is OFF.)
   (2) All Door Lock RELAY signal is output for T1(0.5s) if DRV DOOR UNLOCK SW ON within 3sec after DRV Door Key Lock SW ON.
   (3) All Door Lock RELAY signal is output for T1 if Driver Door Unlock SW is unlocked when Tx signal is received.
   (4) All Door Lock RELAY signal is output for T1 if Driver Door Unlock SW is locked when Tx signal is received.
   (5) All Door Lock Relay signal is output for T1 if Driver/Passenger Lock SW(Power window) is locked.
   (6) All Door Unlock Relay signal is output for T1 if Driver/Passenger Lock SW(Power window) is unlocked.

(7) LOCK/UNLOCK by SAFETY KNOB is not interlocked.(mechanical operation.)
(8) Shall be no malfunction when A_B+ connected.(even at KEY IN position.)
(9) Inputs which are 40msec or less not received.(Door Key Lock/Unlock SW)
(10) Always, ALL DOOR LOCK signal is output for T1 when LOCK signal received.
  ○ LOCK signal: LOCK, Driver/Passenger Lock SW(Power window) LOCK
(11) Always, ALL DOOR UNLOCK signal (UNLOCK RELAY signal) is output for T! when UNLOCK signal received.
  [○ UNLOCK signal : UNLOCK, Driver/Passenger Lock SW(Power window) UNLOCK]
(12) Under SLIDE DOOR (LH/RH) is OPEN, All Door Lock RELAY signal is output for T1(0.5s) when Driver DOOR is locked by Tx or DRV DOOR KEY LOCK SW or Central Door Lock SW and SLIDING DOOR(LH/RH) is CLOSED.
(13) Under SLIDE DOOR (LH/RH) is OPEN, All Door UnLock RELAY signal is output for T1 (0.5s) when Driver DOOR is unlocked by Tx or DRV DOOR KEY UNLOCK SW or Central Door UnLock SW and SLIDING DOOR(LH/RH) is CLOSED.
(14) Above 12) and 13), All Door Lock/Unlock RELAY output is CANCELED when the mechanical changes of Driver Door Unlock SW are occurred prior to SLIDING DOOR(LH/RH) CLOSING.
(15) LOCK (UNLOCK) input is ignored by TX or KEY or Power window for T1.
  (EXCEPT: LOCK by 2nd_SLIDE DOOR CLOSE during 1st_SLIDE DOOR Closing-LOCK OUTPUT.)

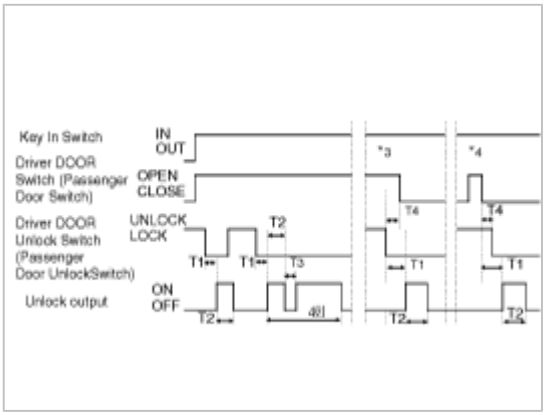




T1 = 0.5s±0.1s

IGN KEY REMINDER

1. This function is not performed when vehicle speed is 3km/h or more.
2. All Door Unlock Relay output for 1s after 0.5s when Key In SW IN & Driver Door SW OPEN & DRV Driver Lock SW LOCK.
3. All Door Unlock Relay output for 1s after 0.5s when Key In SW IN & Passenger Door SW OPEN & Passenger Door Lock SW LOCK
4. Even though UNLOCK signal output for 1s Unlock Relay signal output for 3times maximum(except 1s) in case of locking state. (3times output cycle: 0.5s/0.5s ON/OFF○
5. All Door Unlock Relay output for 1s in case of DOOR LOCKING state at DOOR CLOSED after operatioin in 4).



T1,T3 = 0.5s ±0.1s, T2 = 1s ±0.1s,
T4 = 0.5s or less

A. Under Key In SW IN, Unlock Relay output for 1s one time if Door is CLOSED within 0.5s from the change of Driver Door Unlock SW(Passenger Door Unlock SW) UNLOCK -> LOCK
B. Under Key In SW IN, Unlock Relay output for 1s one time if Driver Door Unlock SW (Passenger Door Unlock SW) is locked within 0.5s from the change of Driver Door SW(Passenger Door SW)OPEN -> CLOSE
C. Under Key In SW IN, All Door Unlock Relay signal is output when DR LOCK(Power window)SW ON after Driver Door or Passenger Door OPEN
D. Judgement of RETRY OUTPUT is performed at RELAY signal start.(after 1.5s at First Unlock Relay

OUTPUT)

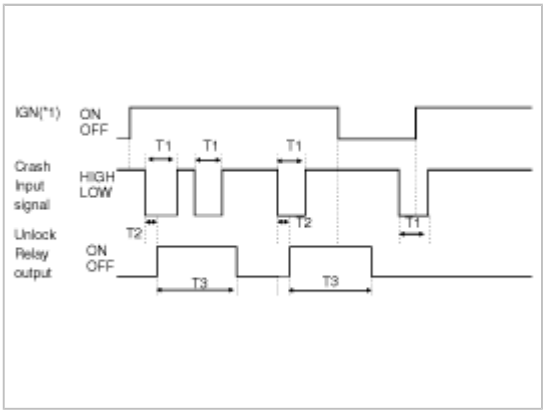
E. Unlock Relay signal is output even though the condition is not met for 0.5s after UNLOCK condition is met. (But, Unlock Relay signal is not output if Key IN SW is OUT at 0.5s after condition is met by the change of Driver Door Unlock SW(Passenger Door Unlock SW) UNLOCK○ LOCK.)

F. Above Time Chart is not displayed about OUTPUT by function of Door LOCK/UNLOCK.

CRASH DOOR UNLOCK

1. Unlock Relay signal is always output when Crash signal is input under IGN1 ON.
2. Unlock Relay signal is output for the remaining time even when IGN1 ON turned to OFF during Unlock Relay output.
3. Unlock Relay signal is not output when IGN1 OFF turned to ON after Crash Input signal is input in advance.
4. Unlock Relay signal is output for T3 when Driver or Passenger Door Lock SW UNLOCK○ LOCK After Unlock Relay signal is output.
5. AUTO Door LOCK function is not performed when the condition of CRASH UNLOCK is met.
6. Central Door LOCK function is not performed during or after CRASH UNLOCK signal output. (But, Central Door LOCK function is performed normally if CRASH UNLOCK function is reset after IGN1 OFF.)

A. T1 is the time of Crash Input signal output.



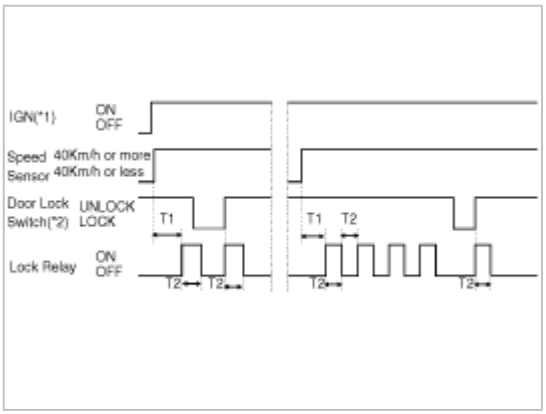
T1 = 0.2s, T2 = 40ms, T35s ±0.5s

- Notice at DOOR LOCK/UNLOCK control
- Output at that time is immediately stopped when there is reverse direction output request during output and 100ms is extended then the reverse direction output is performed. But, output is performed for the last received output request when there is output request during extending 100ms.
- LOCK signal output is performed and UNLOCK signal output is ignored when LOCK signal output and UNLOCK signal output are performed at the same time.
- CRASH DOOR UNLOCK function is given priority than LOCK/UNLOCK control by other functions.
- LOCK/UNLOCK signal request by other functions is ignored during and after CRASH DOOR UNLOCK signal output. But, LOCK/UNLOCK signal control by other functions are performed in case of IGN1 SW OFF & IGN2 SW OFF.

- All Driver LOCK(UNLOCK) RELAY is output if the change of Driver DOOR KNOB correspond to INPUT occures within 3sec after Driver KEY LOCK(UNLOCK) INPUT.
- LOCK signal by DOOR KEY LOCK SW is not output at IGN 1 ON.

AUTO DOOR LOCK(CHINA ONLY)

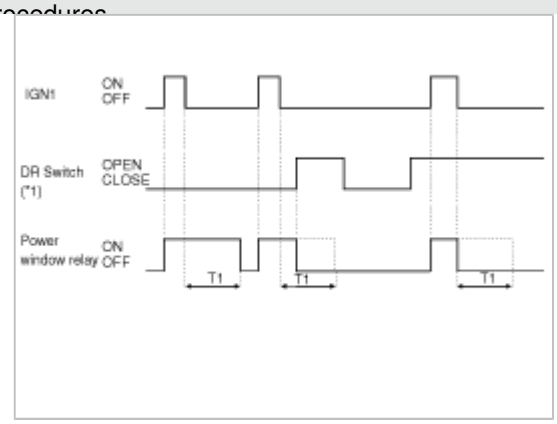
1. This is not performed when vehicle speed is less than 40km/h.
2. Lock Relay signal is output if vehicle speed is 40km/h or more for at least 1s under ALT"L" ON, IGN SW ON.
   But, LOCK signal is not output if all DOORs are locked or all DOORs are FAIL in advance.
3. Lock Relay signal is output 3 times as Max ((2) is ignored) if either one door is unlocked After LOCK signal output in (2).(1s cycle)
   But, DOOR, which is locked from UNLOCK state during 3-time output, is ignored.
4. Relevant DOOR is FAIL if the state is UNLOCK after 3-time output in above 3).
5. LOCK Relay signal is output one time when FAIL DOOR'S change(UNLOCK○ LOCK○ UNLOCK) or NOT FAILED DOOR's change(LOCK○ UNLOCK) happened after FAIL in above 4).
6. Lock Relay signal is output in above 2) again when the change(LOCK○ UNLOCK) happened in the state of ALL DOOR LOCK after Lock Relay OUTPUT in above 2) or 3).
7. FAIL DOOR is cleared at IGN1 OFF or Alt L OFF
8. AUTO DOOR LOCK function is not performed when CRASH UNLOCK condition is met.



T1○ 1s ±0.1s, T2○ 0.5s ±0.1s
*1 ON : Alt L & ING1 ON
OFF : Alt L & ING1 OFF
*2 LOCK : Driver ○ Passenger ○ SLIDE DOOR LH/RH & TAILGATE Unlock SW LOCK
UNLOCK : Driver or Passenger or SLIDE DOOR LH/RH or TAILGATE Unlock SW UNLOCK

POWER WINDOW TIMER

1. Power window relay is turned ON at IGN ON and turned ON for T1 at IGN OFF
2. Power window relay is immediately turned OFF when Door is opened under Power window relay ON for T1.
3. Power window relay is immediately turned OFF at IGN ON ○ OFF under Door OPEN.

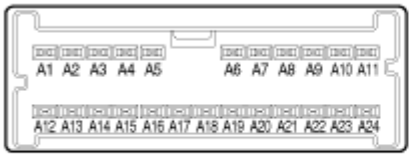


T1 = 30s ±3s

*1 OPEN : Driver or Passenger Door OPEN,
CLOSE : Driver & Passenger Door CLOSE

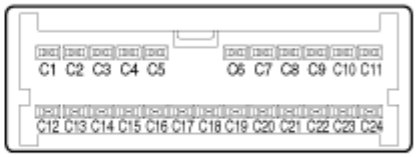
INSPECTION

BCM CONNECTORS



Connector A

Connector B



Connector C

Pin NO.	Connector A	Connector B	Connector C
1	B+	Driver Door Key Lock SW	Room Lamp Relay
2	IGN1	Driver Door Key Unlock SW	Front Deicer Relay
3	ALT "L"	Central Door Lock SW	Power Window Relay
4	Key In SW	Tail SW	Head Lamp Low Relay
5	ACC	Wiper Int Volume SW	Wiper Relay
6	Over Speed Signal (Middle East Only)	Speed Sensor	Lock Relay
7	Crash Input	-	Unlock Relay
8	Driver Door Unlock SW	Door Seat Belt SW	Alarm Horn Relay
9	Passenger Unlock SW	Head Lamp Low SW	Hazard Relay
10	Slider Door LH Unlock SW	Rear Wiper SW	Key Hole Illumination

11	Slider Door RH Unlock SW	Central Door Unlock SW	Door Seat Belt IND
12	GND	DRL Activation input	GND(Power)
13	IGN2	Parking Brake SW	-
14	Washer SW	Tailgate Unlock SW	-
15	Wiper Int SW	Slider Door LH SW	-
16	Code Save Unit	Slider Door RH SW	Step Lamp LH Relay
17	-	Front Deicer SW	Step Lamp RH Relay
18	-	Rear Defogger SW	Flasher Relay
19	Over Speed IND (Middle East Only)	Rear Fog SW	Rear Fog Relay
20	Driver Door SW	Front Fog SW	Rear Defogger Relay
21	Passenger Door SW		Tail Lamp Relay
22	MIST SW		Start Inhibitor Relay
23	Tailgate SW		-
24	Hood SW		Hi-Scan

TERMINAL VOLTAGE

No	Input signal name	Logic state	ON/OFF LEVEL(V)	Remarks
A1	B+	ON = BAT	9V~16V	
A2	IGN1	ON = BAT (IGN KEYisONorSTARTposition)	7Vor more/4Vor less	BAT=BATTERY
A13	IGN2	ON = BAT (IGN KEYisONposition)	7Vor more/4Vor less	
A5	ACC	ON = BAT	7Vor more/4Vor less	
A3	Alt L	ON = BAT (starting state state)	7Vor more/4Vor less	
A4	Key In SW	IN = BAT (KEYinsertion state)	7Vor more/4Vor less	
A20	Driver Door SW	OPEN = GND	1Vor less/OPEN(Reference value:4Vor more)	
A21	Passenger Door SW	OPEN = GND	1Vor less/OPEN(Reference value:4Vor more	

B16	SLIDE DOOR_RH SW	OPEN = GND	1Vor less/OPEN(Reference value:4Vor more	
B15	SILDE DOOR_LH SW	OPEN = GND	1Vor less/OPEN(Reference value:4Vor more	
A8	Driver Door Unlock SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4Vor more	
A9	Passenger Door Unlock SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4Vor more	
A11	SLIDE DOOR_RH UNLOCK SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4Vor more	
A10	SILDE DOOR_LH UNLOCK SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4Vor more	
B11	Power Window Door Unlock SW(Driver)	ON=GND	1Vor less/OPEN(Reference value:4Vor more	
BA	Driver Door key Lock SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B2	Driver Door key Unlock SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B3	Power window Door Lock SW(Driver)	ON=GND	1Vor less/OPEN(Reference value:4Vor more	
A14	Washer SW	ON = BAT	7Vor more/4Vor less	
A15	Wiper Int SW	ON = BAT	7Vor more/4Vor less	
A22	Mist SW	ON = BAT	7Vor more/4Vor less	
B5	Wiper Int Volume SW	0V ~ 2.5V	-	0Ω~ 50KΩ
B18	Rear Defogger SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
A23	TAIL GATE SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B04	Tail SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
A24	HOOD SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B14	TAILGATE UNLOCK SW	LOCK = OPEN, UNLOCK = GND	1Vor less/OPEN(Reference value:4Vor more	

B8	Seat Belt SW	Fasten= OPEN,Unfasten = GND	1Vor less/OPEN(Reference value:4Vor more	
A7	Crash Input	ON = GND (at crash detection)	1Vor less/OPEN(Reference value:4Vor more	
B6	Speed Sensor	Speed input= PULSE (0~5V)	1Vor less/4Vor more	OPEN COLLECTOR
B9	Head Lamp SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B17	Front DEICER SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B20	Front Fog SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B19	Rear Fog SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
B13	PARKING BRAKE SW	ON = GND	1Vor less/OPEN(Reference value:4Vor more	
A16	CODE SAVE UNIT	ON = GND	1Vor less/4Vor more	
B12	DRL Activation INPUT	ON = BAT	7Vor more/4Vor less	

BCM ACTUATOR OPERATION

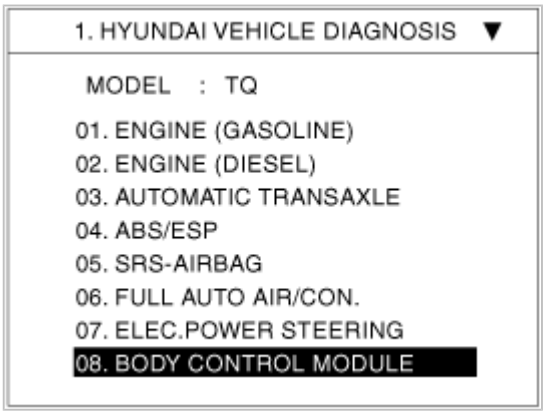
SCAN tool can operates all actuators controlled by BCM by force.

NO.	BCM DISPLAY
1	DOOR LOCK RELAY
2	DOOR UNLOCK RELAY
3	TAILGATE RELEASE RELAY
4	POWER WINDOW RELAY
5	WIPER RELAY
6	HAZARD RELAY (+RK)
7	BURGLAR HORN RELAY (+RK)
8	STARTER INHIBIT RELAY (+RK)
9	TAIL LAMP RELAY/DRL UNIT
10	HEAD LAMP RELAY
11	REAR FOG RELAY

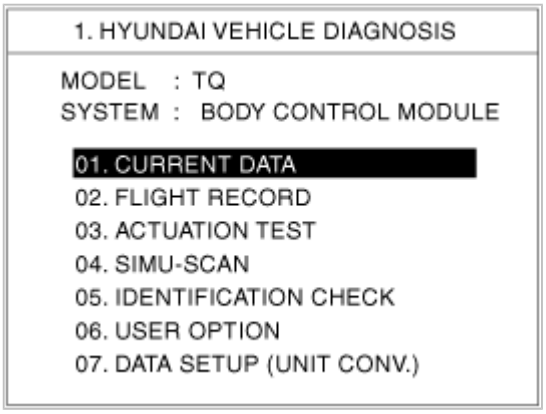
12	FRONT DEICER RELAY
13	REAR DEFOGGER RELAY
14	DRIVER SEAT BELT INDICATOR
15	IGN KEY HOLE ILLUMINATION
16	ROOM LAMP

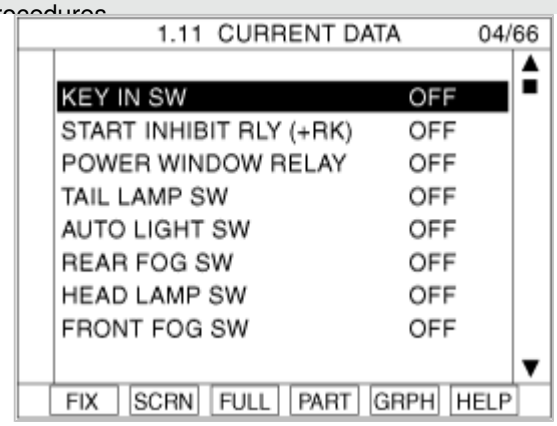
BCM DIAGNOSIS WITH SCAN TOOL

1. It will be able to diagnose defects of BCM with scan tool quickly. Scan tool can operates actuator forcefully, input/output value monitoring and self diagnosis.
2. Select model and menu.

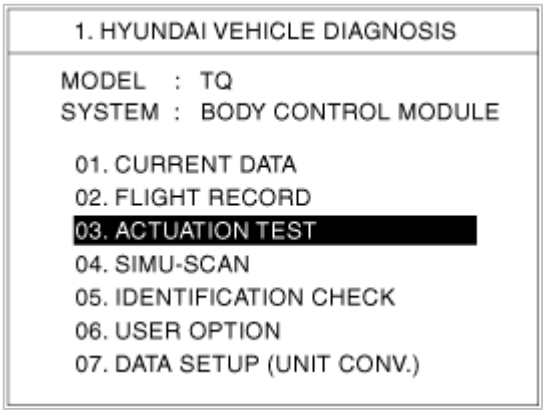


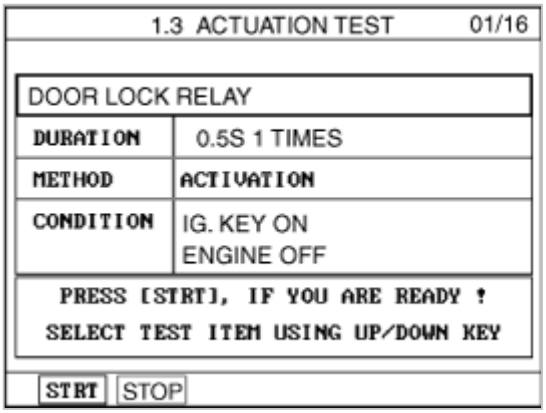
3. Select "Current data", if you will check current data of BCM. It provides power supply status, multi function status, lamp status, door status, lock system status, wiper, auto light status and so on.





4. If you will check BCM data operation forcefully, select "Actuation test".





5. You can turn ON/OFF as below option function with the user option program.
   (1) LOCK / UNLOCK comfirming alarm: Alarm sound ON/OFF control when you LOCK/UNLOCK doors with transmitter.
   (2) Mechanical LOCKING system: Arm/Disarm ON/OFF when you lock the door with the mechanical key.
   (3) AUTO DOOR LOCK/UNLOCK system ON/OFF.
      A. Vehicle speed gearing AUTO DOOR LOCK (more than 20km/h)
      B. AUTO DOOR LOCK non application
      C. Shift lever gearing AUTO DOOR LOCK
      D. Driver seat AUTO DOOR LOCK

E. AUTO DOOR UNLOCK non application
F. All doors UNLOCK in the case of driver door UNLOCK
G. All doors UNLOCK in the case of IGN key seperation.

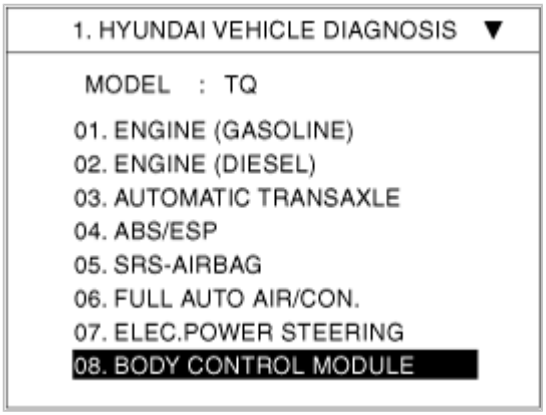
(4) Riding ○ Getting off gearing
A. Seat installation state ON/OFF
B. Seat riding ○ getting off gearing ON/OFF
C. Column installation state ON/OFF
D. Column riding ○ getting off gearing ON/OFF

USER OPTION MODE

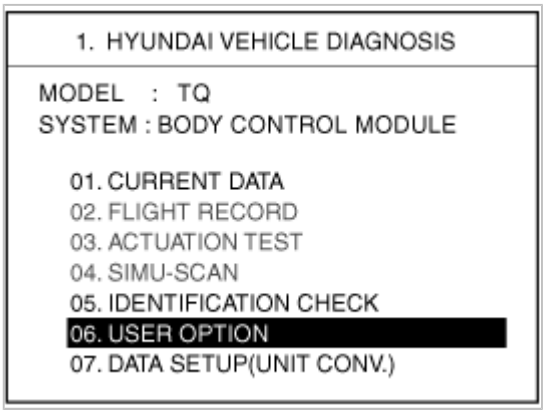
The BCM offers 3 items user option mode for a user convenience (AUTO DOOR LOCK/UNLOCK, DOOR KEY ARM/DISARM

- It is able to set up the enable or disable of AUTO DOOR LOCK function or AUTO DOOR LOCK operation when using it.
- It is able to set up the enable or disable of AUTO DOOR UNLOCK function or AUTO DOOR LOCK operation when using it.
- It is able to set up the enable or disable of burglar alarm mode when using door lock by the key.

1. Select option "TQ" and press ENTER.
2. Select option "BODY CONTROL MODULE" and press ENTER.

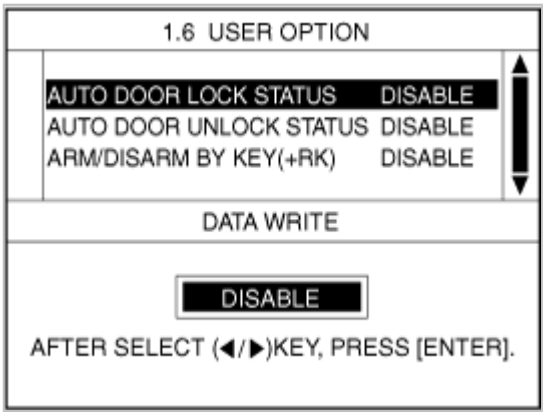


3. Select option "USER OPTION" and press ENTER.



4. Select option "AUTO DOOR LOCK STATUS by using the direction button(▲ / ▼).

5. Select the parameter by using the direction button(○ / ○) and press ENTER to save it.
   (Disable / FIXING)

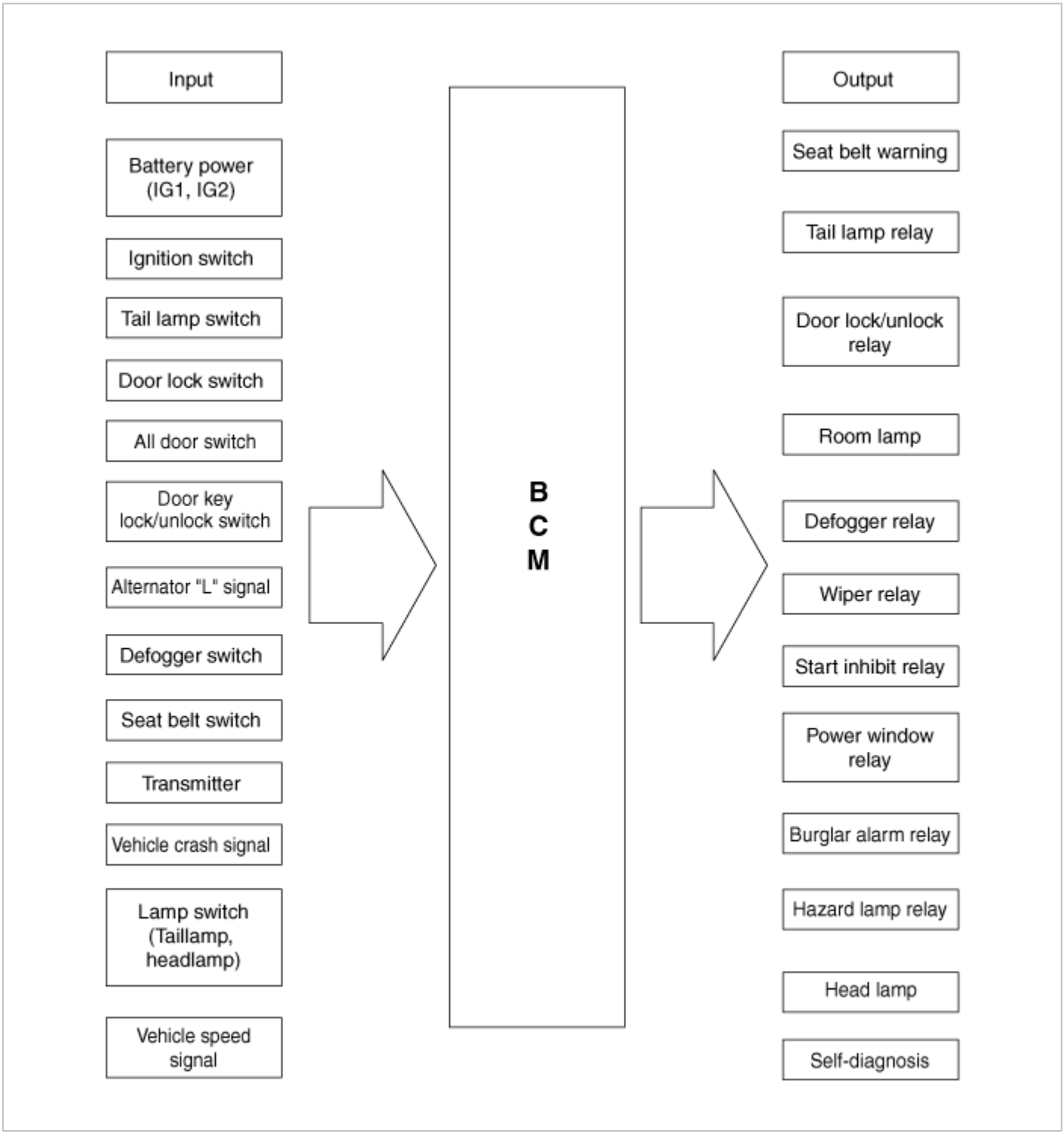


6. Select option "AUTO DOOR UNLOCK STATUS" by using the direction button(▲ / ▼).
7. Select the parameter by using the direction button(○ / ○) and press ENTER to save it.
   (Disable / Enable)
8. Select option "DOOR KEY ARM/DISARM" by using the direction button(▲ / ▼).
9. Select the parameter by using the direction button (▲ / ▼) and press ENTER to save it (Disable/Enable)

Installation

1. Install the body control module.
2. Install the reinforce panel.
3. Install the driver side crash pad lower panel.

Schematic Diagram



Specifications

Item	Requirement	Remark
Rated voltage	DC 12V	Shall activate normally in these range.
Operating voltage range	DC 9 ~ 16V	
Operating temperature range	-30℃ ~ +80℃	
Storage temperature range	-40℃ ~ +85℃	
Max humidity in use	95%	
High voltage resistance	24V	
Insulation resistance	100Mohm or more (measured with 500V MEGGER)	
Dark Current	Max 4mA (KEYLESS) Max 3mA (NON-KEYLESS)	
Voltage drop	1.2V or less	

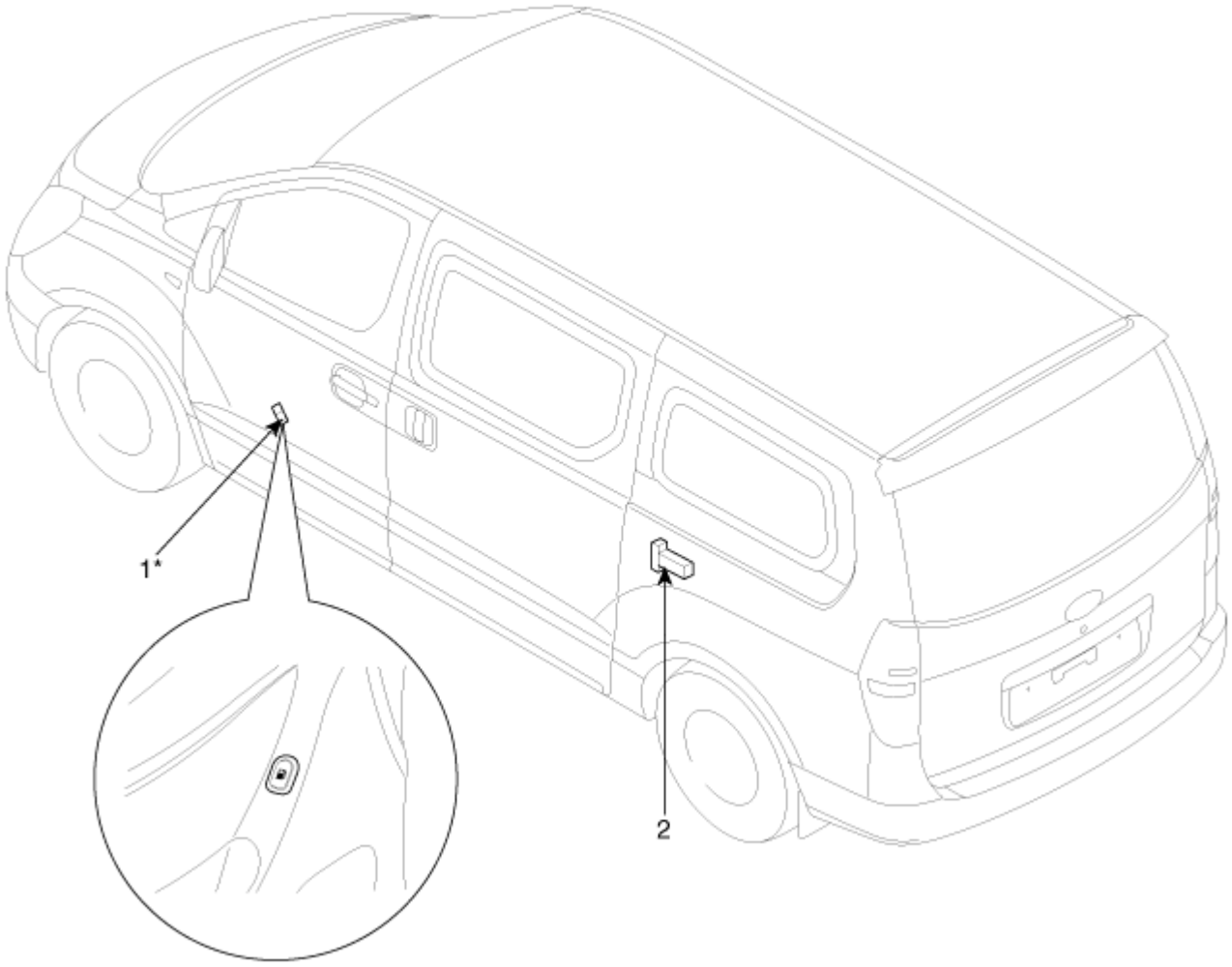
Rated Load

Item	Rated load
Room lamp	DC 12V 21W (LAMP load)
Key hole illumination	DC 12V 2W (LAMP load)
Seat belt indicator	DC 12V 0.5W (LED load)
Hazard relay	DC 12V 360mA (Inductive load)
Wiper relay	DC 12V 150 ~ 170mA (Inductive load)
Defogger relay	DC 12V 200mA (Inductive load)
Tail lamp relay	DC 12V 160mA (Inductive load)
Head lamp relay	DC 12V 160mA (Inductive load)
Front deicer relay	DC 12V 160mA (Inductive load)
Front fog relay	DC 12V 180mA (Inductive load)
Rear fog relay	DC 12V 180mA (Inductive load)
Horn relay	DC 12V 180mA (Inductive load)

Start inhibit Relay	DC 12V 180mA (Inductive load)
Central door unlock relay	DC 12V 180mA (Inductive load)
Central door lock relay	DC 12V 180mA (Inductive load)
Power window relay	DC 12V 53.3mA (Inductive load)
Tailgate unlock relay	DC 12V 160mA (Inductive load)

Component location

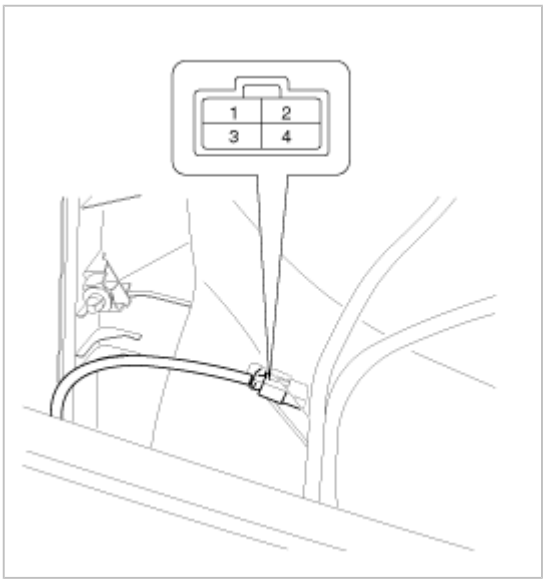
The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.



1. Fuel filler door open switch	2. Fuel filler door release actuator

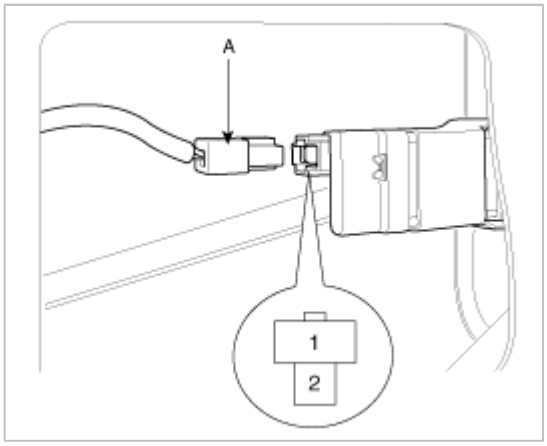
Inspection

1. Remove the front door trim panel. (Refer to the Body group-front door)
2. Disconnect the fuel filler door open switch connector.
3. Check the switch for continuity between the No. 1 and No. 2 terminals.
4. If the continuity is not as specified, replace the switch.



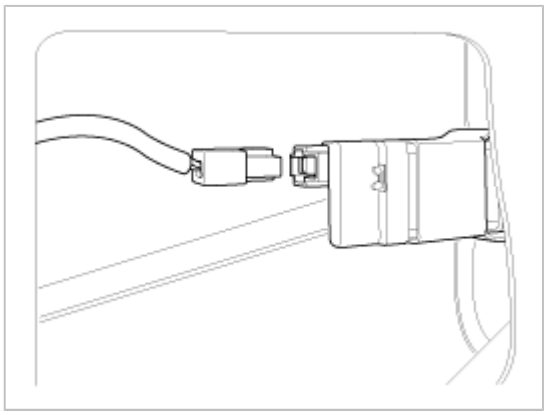
Inspection

1. Remove the rear guarter side.
   (Refer to Body group - "Interior Trim")
2. Disconnect the fuel filler door release actuator connector.
3. Check for continuity between terminal No. 1 and No. 2. If there is no continuity replace the fuel filler door opener.

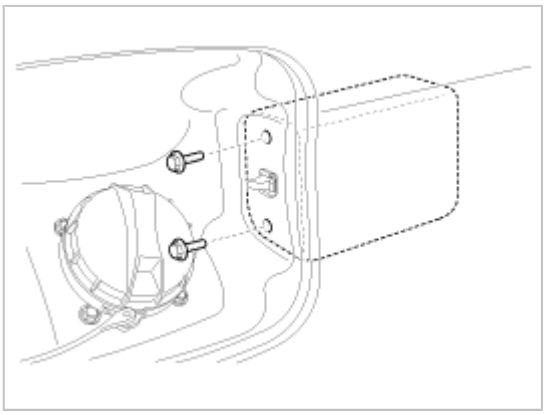


Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the rear guarter side trim.
   (Refer to Body group - "Interior Trim")
3. Disconnect the fuel filler door release actuator connector



4. Remove the fuel filler door release actuator after loosening 2 bolts.

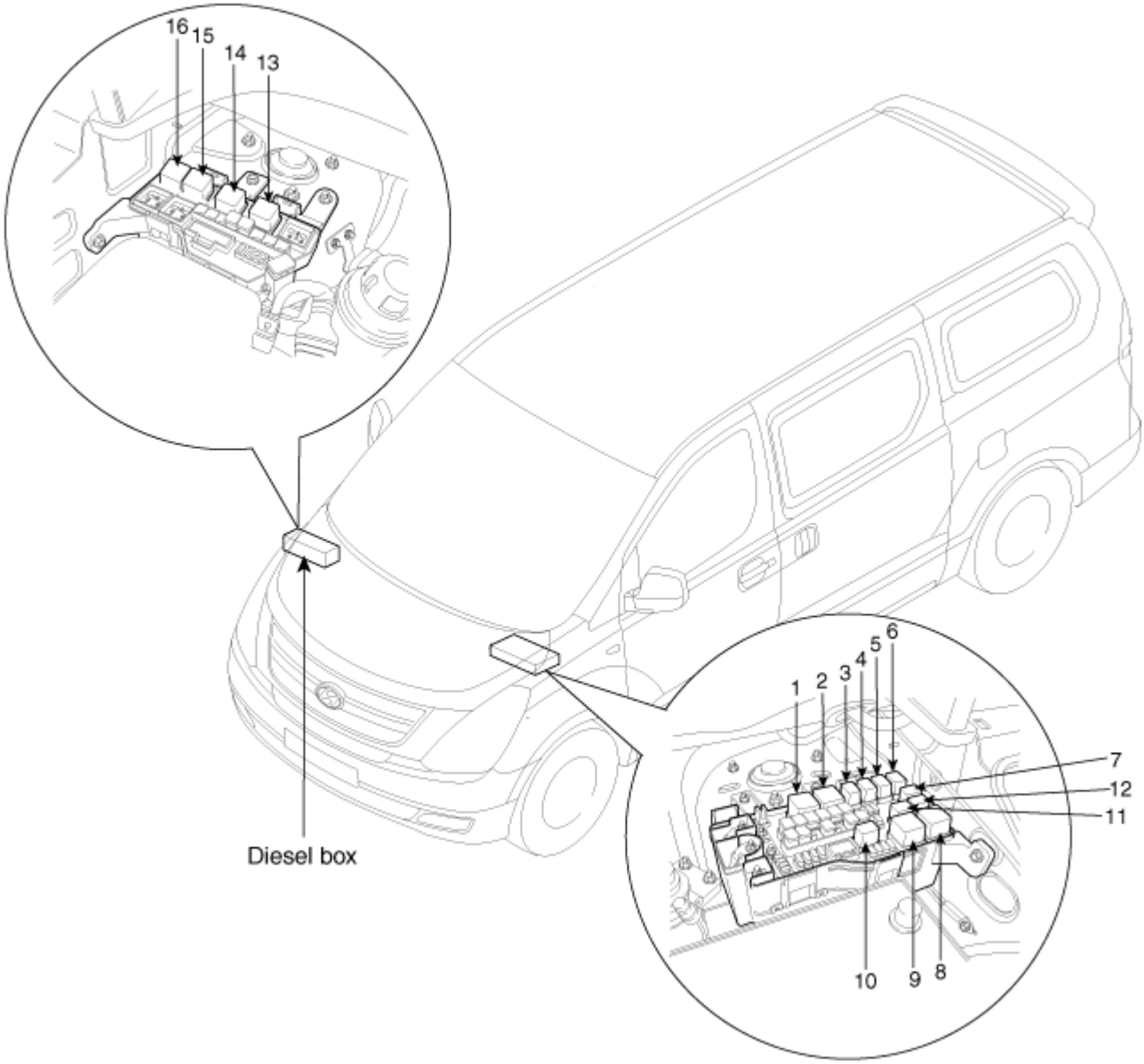


Installation

1. Install the fuel filler door release actuator.
2. Install the fuel filler door release actuator connector.
3. Install the rear guarter side trim.

Component Location

[Engine room relay box]

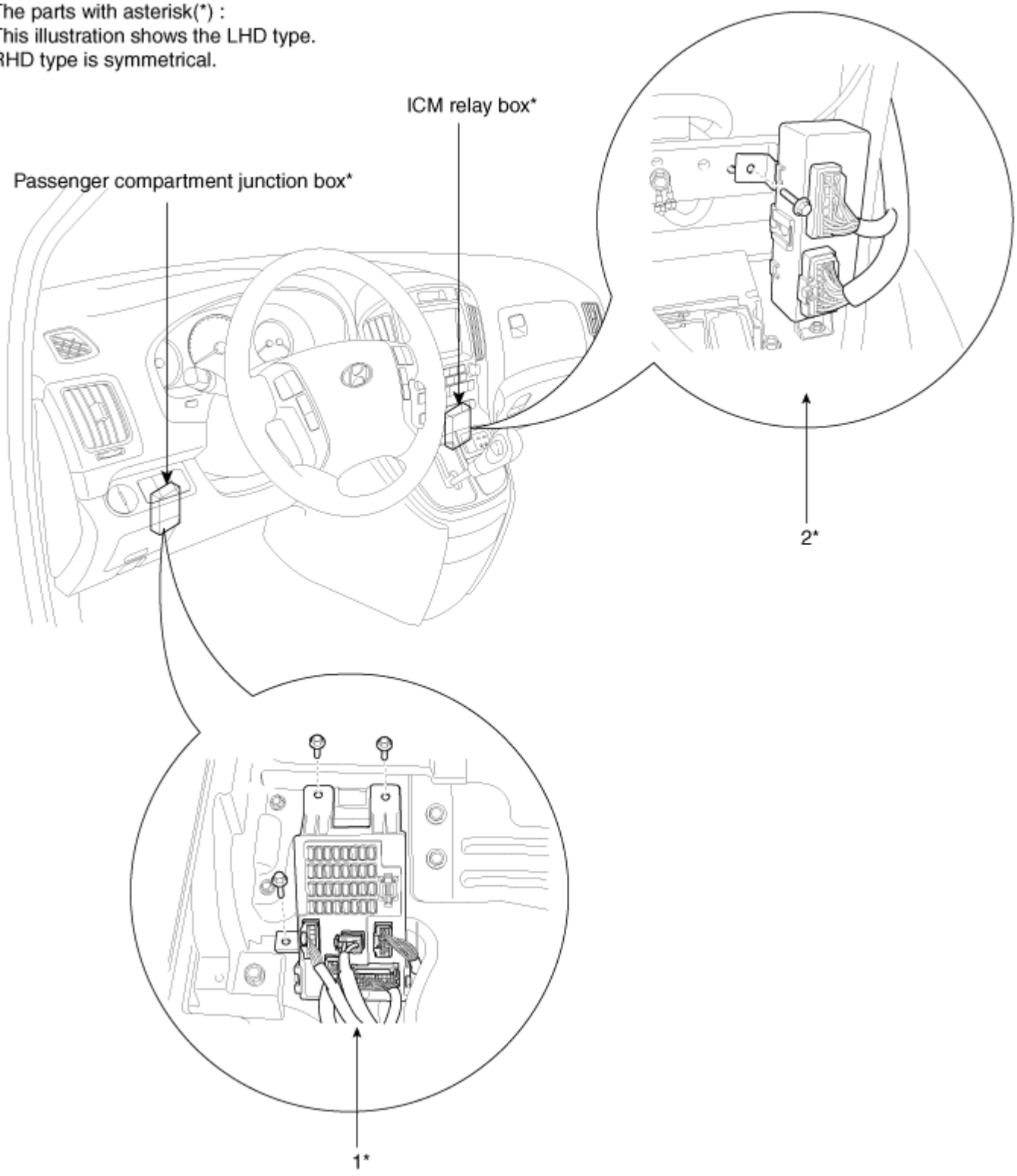


1. Start relay	9. Condenser fan 1 relay
2. Main relay	10. A/C relay
3. Horn relay	11. Condenser fan 2 relay
4. Head lamp relay (High)	12. Fuel pump relay
5. Tail lamp relay	13. Glow plug relay
6. Wiper relay	14. PTC Heater relay #1
7. Head lamp relay (Low)	15. PTC Heater relay #2

8. Fuel filter heater relay	16. PTC Heater relay #3

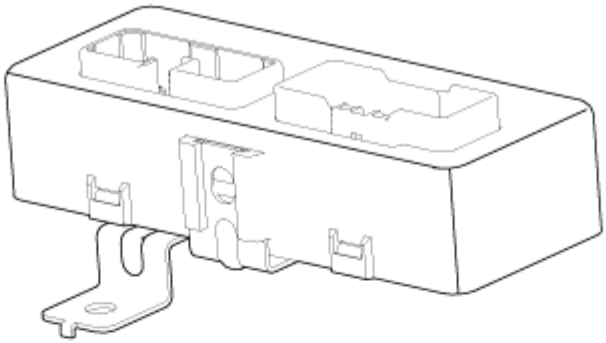
[Passenger compartment relay]

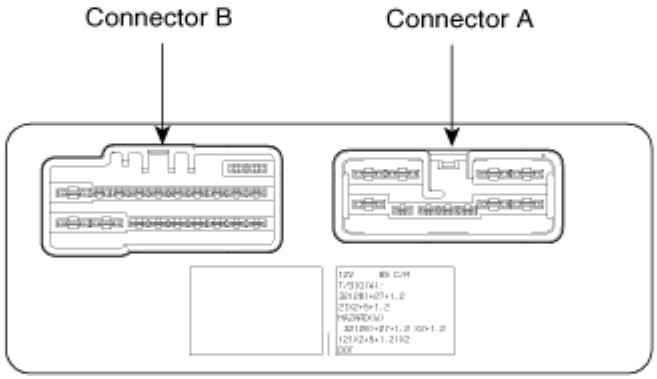
The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.

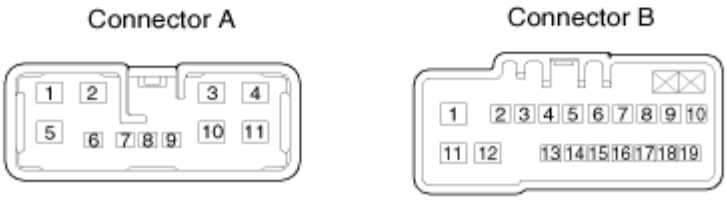


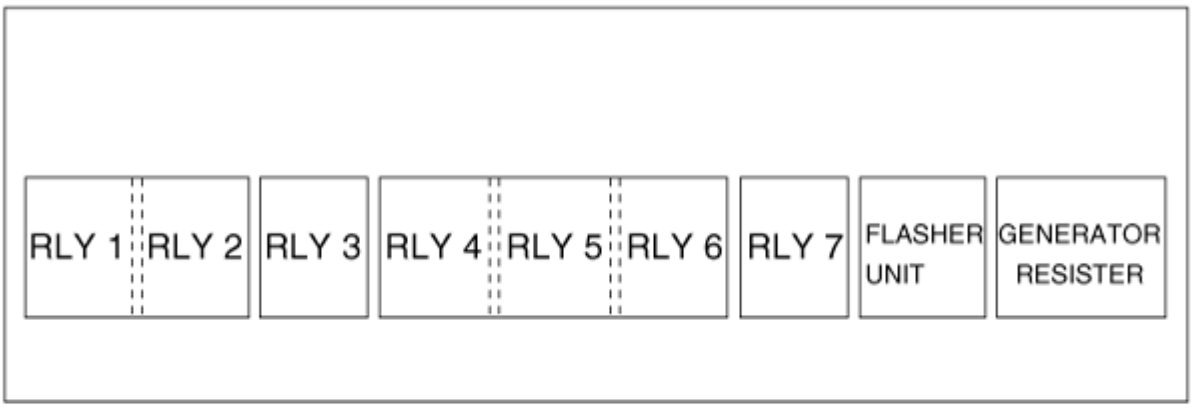
1. Power window relay, Rear heater relay, Fuel filter relay, Back-up relay (Built-in-Junction box)
2. Door unlock relay, Door lock relay, Front fog relay, Rear fog relay, Buglar alarm horn relay, Buglar alarm relay, Hazard relay (Built-in-ICM relay Box)

Component




Connector B
Connector A


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



RELAY NAME

NO	NAME
1	Door lock relay
2	Door unlock relay
3	Rear fog lamp relay

NO	NAME
4	Burglar alarm horn relay
5	Burglar alarm relay
6	Hazard relay
7	Front fog lamp relay

Description

The ICM is united with many kinds of relays and installed over the instrument panel box.

Inspection

1. Disconnect the negative(-) battery terminal.
2. Remove the ICM relay box.

Door Lock

Check for continuity between the terminals.

1. There should be continuity between the No.11 and No.13 terminals when power and ground are connected to the No.1 and No.2 in the ICM-B.
2. There should be no continuity between the No.11 and No.13 terminals when power is disconnected.

Door Unlock

Check for continuity between the terminals.

1. There should be no continuity between the No.12 and No.13 terminals when power and ground are connected to the No.1 and No.3 in the ICM-B.
2. There should be continuity between the No.12 and No.13 terminals when power is disconnected.

Burglar Alarm Horn

Check for continuity between the terminals.

1. There should be continuity between the No.6 and No.8 terminals when power and ground are connected to the No.6 and No.7 in the ICM-A.
2. There should be no continuity between the No.6 and No.8 terminals when power is disconnected.

Burglar Alarm (Start Inhibit)

Check for continuity between the terminals.

1. There should be continuity between the No.3 and No.10 terminals when power and ground are connected to the No.9 and No.10 terminals in the ICM-A.
2. There should be no continuity between the No.3 and No.10 terminals when power is disconnected.

Front Fog Lamp

Check for continuity between the terminals.

1. There should be continuity between the No.18 and No.19 terminals when power and ground are connected to the No.9 and No.10 terminals in the ICM-B.
2. There should be no continuity between the No.18 and No.19 terminals when power is disconnected.

Hazard Lamp

Check for continuity between the terminals.

1. There should be continuity between the No.5 (or 14) and No.15 terminals when power and ground are connected to the No.6 and No.15 terminals in the ICM-B.
2. There should be no continuity between the No.5 (or 14) and No.15 terminals when power is disconnected.

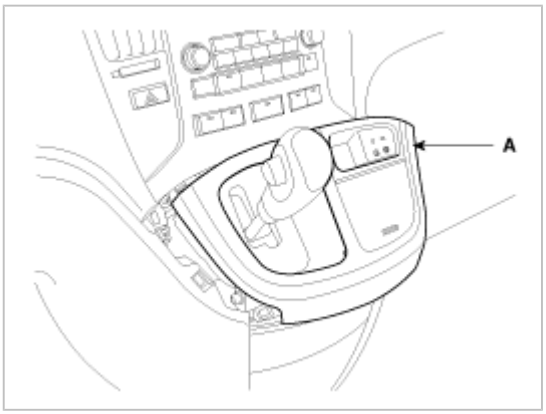
Rear Fog Lamp

Check for continuity between the terminals.

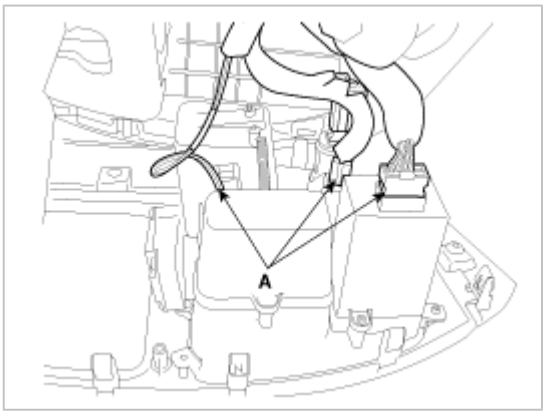
1. There should be continuity between the No.7 and No.16 terminals when power and ground are connected to the No.8 and No.17 terminals in the ICM-B.
2. There should be no continuity between the No.7 and No.16 terminals when power is disconnected.

Removal

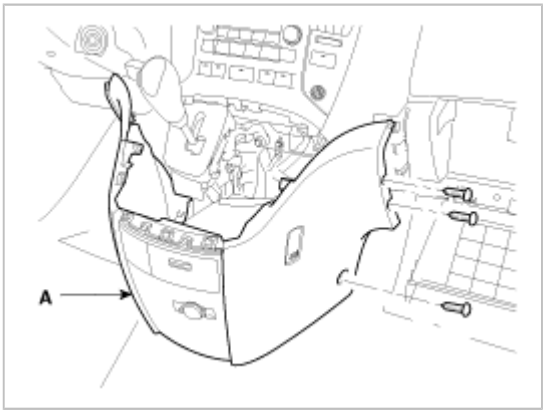
1. Disconnect the negative(-) battery terminal.
2. Remove the front console under cover (A).
   (Refer to the Body group - "Console")



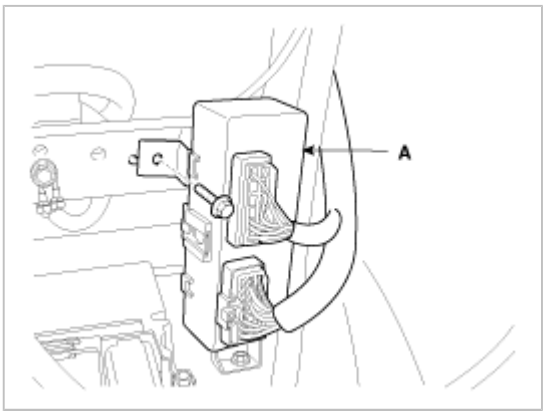
3. Disconnect the connector (A) from console under cover.



4. Remove the front console (A) after loosening screws (8) and disconnecting the connector.



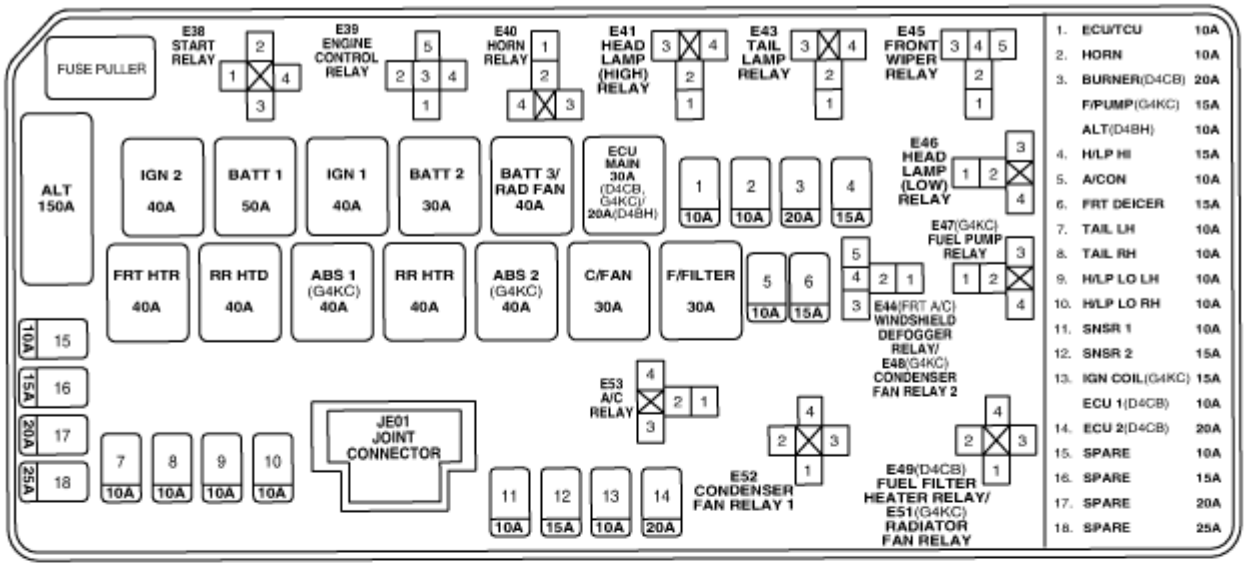
5. Remove the ICM relay box (A) after loosening bolt (1) and disconnecting the connector.



Installation

1. Install the ICM relay box.
2. Install the front console.
3. Install the front console under cover.

Component Location



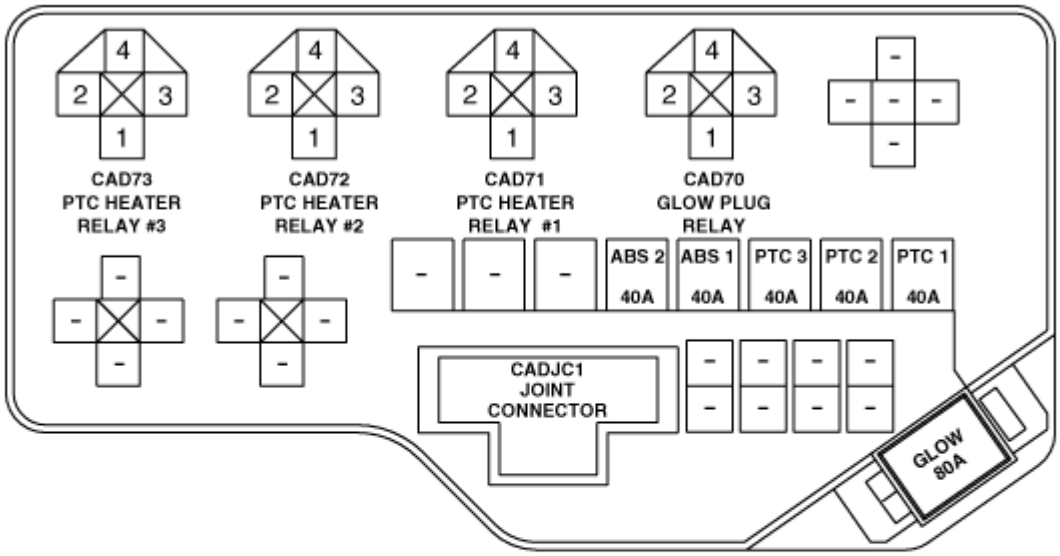
CIRCUIT

FUSIBLE LINK	(A)	Circuit Protected
ALT	150A	Fuse(A/CON, FRT DEICER), Fusible link(FRT HTR, RR HTR, RR HTD, C/FAN, F/FILTER, ABS 1/2), Generator, E/R fuse & relay box RH
BATT 1	50A	Fuse(DR LOCK, FRT FOG LP, B/ALARM, Power connector(AUDIO-1, ROOM LP))
BATT 2	30A	Fuse(FUEL LID, P/WDW LH/RH, HAZARD), Multipurpose check connector
BATT 3/RAD FAN	40A	Fuse(STOP LP, BWS), Radiator fan relay(G4KC)
IGN 1	40A	Ignition switch(IG2, START), Start relay
IGN 2	40A	Ignition switch(ACC, IG1)
ECU MAIN	30A/20A	Engine control relay
FRT HTR	40A	Front blower relay
RR HTD	40A	Rear defogger relay
RR HTR	40A	Rear blower relay
ABS 1	40A	ABS control module(G4KC)
ABS 2	40A	ABS control module(G4KC)
C/FAN	30A	Condenser fan relay 1
F/FILTER	30A	Fuel filter heater relay(D4CB)

FUSE	(A)	Circuit Protected
ECU/TCU	10A	TCM
HORN	10A	Horn relay
BURNER	20A	Fuel fired heater control module(D4CB)
F/PUMP	15A	Fuel pump relay(G4KC)
ALT	10A	Generator(D4BH)
H/LP HI	15A	Head lamp(HIGH) relay, Head lamp(LOW) relay
A/CON	10A	A/C relay
FRT DEICER	15A	Windshield defogger relay
TAIL LH	10A	Head lamp LH(Position lamp), Rear combi lamp LH, License lamp LH
TAIL RH	10A	Head lamp RH(Position lamp), Rear combi lamp RH, License lamp RH
H/LP LO LH	10A	Head lamp LH
H/LP LO RH	10A	Head lamp RH
SNSR 1	10A	A/C relay, Condenser fan relay(D4CB), Lambda sensor(D4CB), PTC heater relay #1(D4CB), Stop lamp switch(D4CB)
SNSR 2	15A	D4CB:Camshaft position sensor, Glow plug relay, EGR actuator, VGT control valve, Immobilizer control module G4KC:Fuel pump relay, Canister purge solenoid valve, Oil control valve, Crankshaft position sensor, Oxygen sensor, Immobilizer control module, Idle speed control actuator
IGN COIL	15A	Ignition coil #1~#4(G4KC), Condenser(G4KC)
ECU 1	10A	ECM(D4CB)
ECU 2	20A	ECM(D4CB, G4KC), Injector #1~#4(G4KC)

※USE THE DESIGNATED FUSE ONLY

LAYOUT



CIRCUIT

FUSIBLE LINK	(A)	Circuit Protected
GLOW	80A	Glow plug relay
PTC 1	40A	PTC heater relay #1
PTC 2	40A	PTC heater relay #2
PTC 3	40A	PTC heater relay #3
ABS 1	40A	ABS/ESP control module
ABS 2	40A	ABS/ESP control module

※ **USE THE DESIGNATED FUSE ONLY**

Inspection

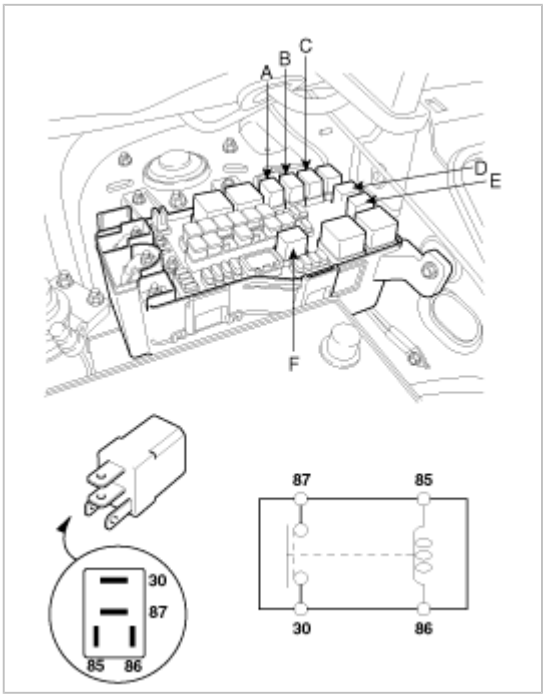
1. Disconnect the negative (-) battery terminal.
2. Pull out the relay from the engine compartment relay box.

Power Relay (Type A)

Check for continuity between the terminals.

A : Horn relay
B : Head lamp relay (High)
C : Tail lamp relay
D : Head lamp relay (Low)
E : Fuel pump relay
F : A/C relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

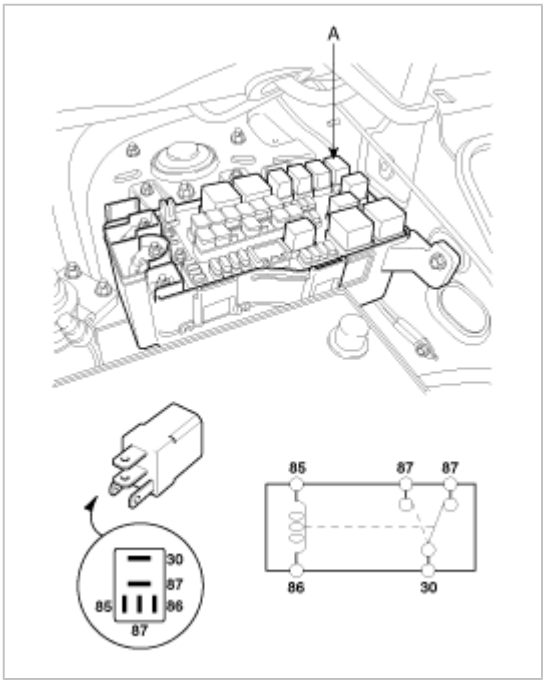
Power Relay (Type B)

Check for continuity between the terminals.

A : Wiper relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.

2. There should be continuity between the No.30 and No.87 terminals when power is disconnected.



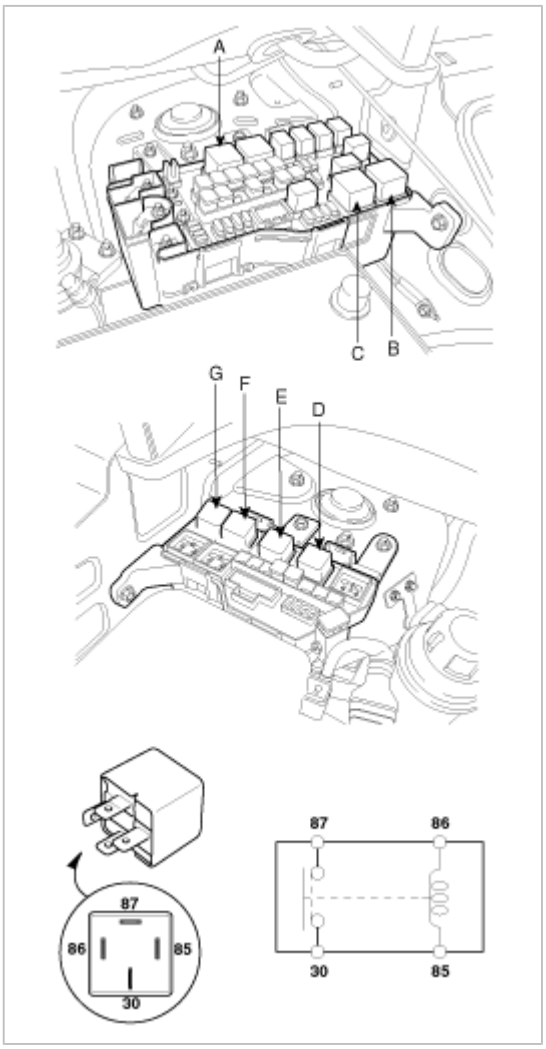
Terminal / Power	85	86	30	87	87
Disconnected			○		○
Connected	⊖	⊕	○	○	

Power Relay (Type C)

Check for continuity between the terminals.

A : Start relay
B : Fuel filter relay
C : Condenser pan relay
D : Glow relay
E : DTC heater relay #1
F : DTC heater relay #2
G : DTC heater relay #3

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



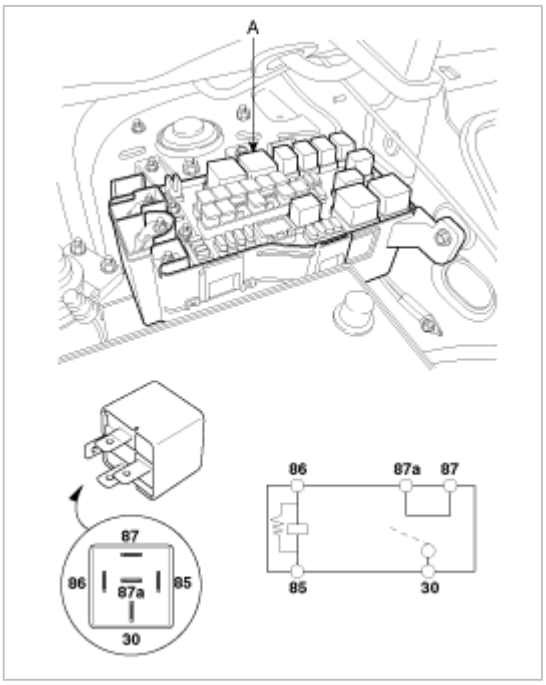
Terminal / Power	86	85	87	30
Disconnected	○	○		
Connected	⊖	⊕	○	○

Power Relay (Type D)

Check for continuity between the terminals.

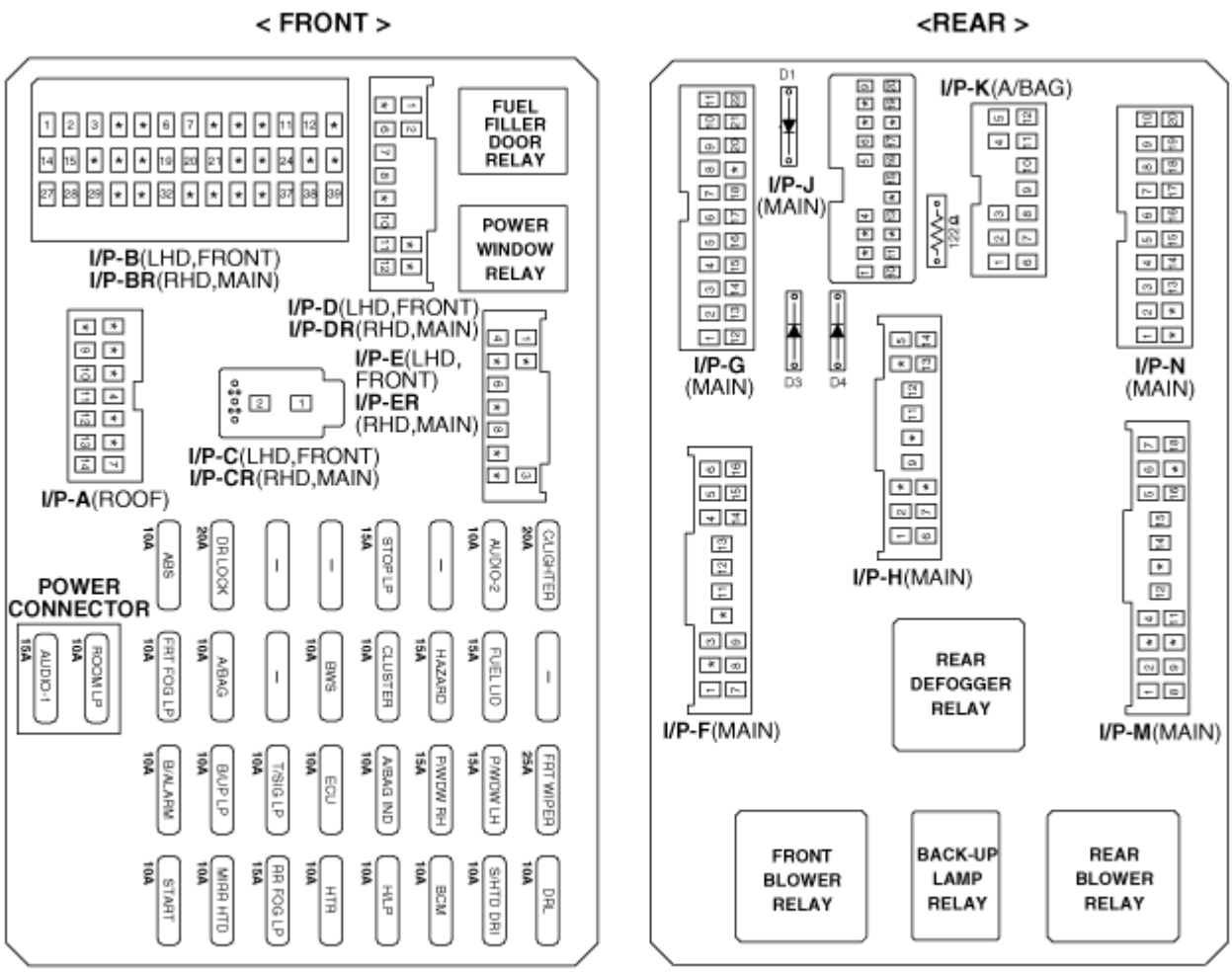
A : Main relay

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be continuity between the No.30 and No.87 terminals when power is disconnected.



Terminal / Power	86	85	87	87a	30
Disconnected	○—○				
Connected	⊖—⊕		○—○—○		

Component Location



CIRCUIT

FUSE	(A)	Circuit Protected
AUDIO-2	10A	Audio, Digital clock, BCM, Power outside mirror switch
C/LIGHTER	20A	Cigarette lighter, Front power outlet
S/HTD DRI	10A	Driver seat warmer switch
DRL	10A	BCM
RR FOG LP	15A	Rear fog lamp relay
H/LP	10A	Head lamp High/Low relay
FRT WIPER	25A	Front wiper relay, Front wiper motor
BCM	10A	BCM
HTR	10A	Front/Rear blower relay, Front/Rear A/C control module, Condenser fan relay, Electro chromic mirror, Thermo switch, PTC heater relay(D4CB), EGR solenoid valve(D4BH)
B/UP LP	10A	Back-up lamp relay, Back-up lamp switch, Transaxle range switch
ABS	10A	ABS/ESP control module, ESP switch(D4CB)
T/SIG LP	10A	Hazard switch
A/BAG	10A	SRS control module
A/BAG IND	10A	Instrument cluster
CLUSTER	10A	Instrument cluster, BCM, Immobilizer control module(D4BH), A/C relay(D4BH), Generator resister
ECU	10A	Vehicle speed sensor, ECM, Air flow sensor(D4CB), Injection pump(D4BH), TCM, Fuel filter warning sensor

FUSE	(A)	Circuit Protected
START	10A	Start relay, Burglar alarm relay
MIRR HTD	10A	Front A/C control module, Power outside mirror & defogger LH/RH
STOP LP	15A	Stop lamp switch
BWS	10A	Buzzer
DR LOCK	20A	Door lock/unlock relay
FRT FOG LP	10A	Front fog lamp relay
B/ALARM	10A	Burglar alarm horn relay
AUDIO-1 (POWER CONNECTOR)	15A	Audio
ROOM LP (POWER CONNECTOR)	10A	Digital clock, Instrument cluster, Courtesy lamp LH/RH, Step lamp LH/RH, Cargo lamp, Room lamp switch, Door warning switch, Data link connector, BCM, Vanity lamp switch LH/RH, Overhead console lamp
HAZARD	15A	Hazard relay, Hazard switch
FUEL LID	15A	Fuel filler door relay
P/WDW LH	15A	Power window main switch, Power window switch LH
P/WDW RH	15A	Power window main switch, Power window switch RH

※ USE THE DESIGNATED FUSE ONLY

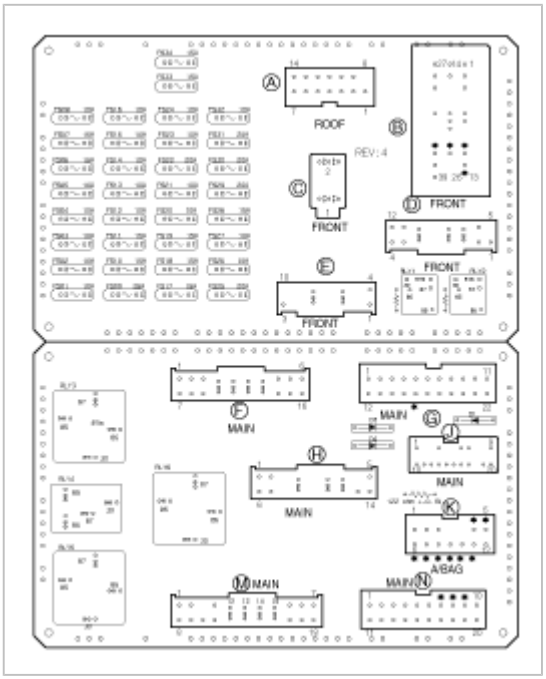
Inspection

Fuse

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

Passenger Compartment Relay

1. Disconnect the negative(-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to the Body group - "Crash pad")
3. Remove the junction box.



Power Window

Check for continuity between the terminals.

1. There should be continuity between the No.10 terminal in the I/P-D and the No.13 or 9 terminal in the I/P-F when power and ground are connected to the No.10 terminal in the I/P-D and the No.7 terminal in the I/P-G.
2. There should be no continuity between the No.10 terminal in the I/P-D and the No.13 or 9 terminal in the I/P-F when power and ground are connected to the No.10 terminal in the I/P-D and the No.7 terminal in the I/P-G.

Back up lamp

Check for continuity between the terminals.

1. There should be continuity between the No.15 terminal in the I/P-M and the No.7 terminal in the I/P-H

when power and ground are connected to the No.15 terminal in the I/P-M and the No.3 terminal in the I/P-B.
2. There should be no continuity between the No.15 terminal in the I/P-M and the No.7 terminal in the I/P-H when power and ground are connected to the No.15 terminal in the I/P-M and the No.3 terminal in the I/P-B.

Fuel filter

Check for continuity between the terminals.

1. There should be continuity between the No.21 terminal in the I/P-G and the No.10 terminal in the I/P-D when power and ground are connected to the No.10 terminal in the I/P-D and the No.22 terminal in the I/P-G.
2. There should be no continuity between the No.21 terminal in the I/P-H and the No.10 terminal in the I/P-D when power and ground are connected to the No.10 terminal in the I/P-D and the No.22 terminal in the I/P-G.

Rear Heater

Check for continuity between the terminals.

1. There should be continuity between the No.7 terminal in the I/P-H and the No.14 or 15 terminal in the I/P-N when power and ground are connected to the No.7 terminal in the I/P-D and the No.6 terminal in the I/P-H.
2. There should be no continuity between the No.7 terminal in the I/P-H and the No.14 or 15 terminal in the I/P-N when power and ground are connected to the No.7 terminal in the I/P-D and the No.6 terminal in the I/P-H.

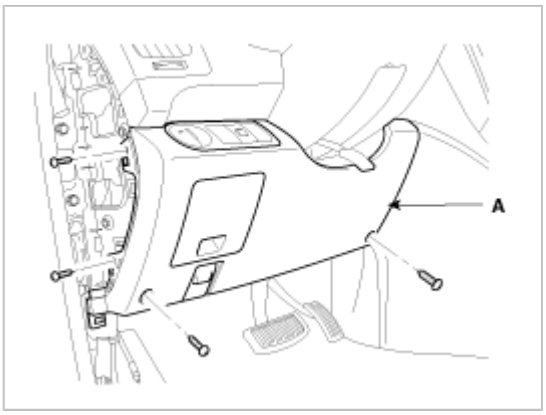
Front Blower

Check for continuity between the terminals.

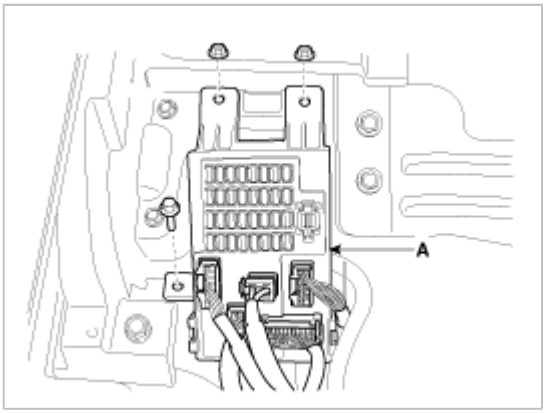
1. There should be continuity between the No.9 terminal in the I/P-H and the No.11 terminal in the I/P-H when power and ground are connected to the No.9 terminal in the I/P-H and the No.4 terminal in the I/P-F.
2. There should be no continuity between the No.9 terminal in the I/P-H and the No.11 terminal in the I/P-H when power and ground are connected to the No.9 terminal in the I/P-H and the No.4 terminal in the I/P-F.

Removal

1. Disconnect the negative(-) battery terminal.
2. Remove the driver crash pad lower panel (A).
   (Refer to the Body group - "Crash pad")



3. Remove the driver reinforce panel (A).
4. Disconnect the connector from junction box.
5. Remove the instrument panel junction box (A) after 2 nuts and 1 bolt.



Installation

1. Install the instrument panel junction box.
2. Install the driver reinforce panel.
3. Install the driver crash pad lower panel.

General Troubleshooting Information

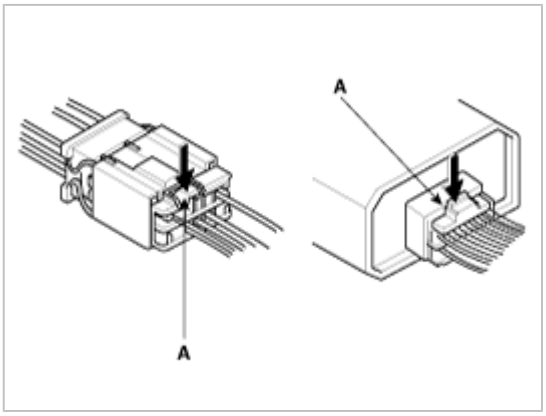
Before Troubleshooting

1. Check applicable fuses in the appropriate fuse/relay box.
2. Using the battery checker (MCR-570 KIT), check the battery for damage, state of charge, and clean and tight connections.
   (Refer to the Engine Electrical System - Battery)

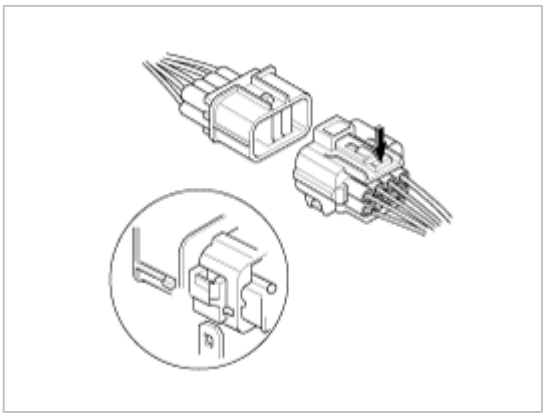
   - Do not quick-charge a battery unless the battery ground cable has been disconnected, otherwise you will damage the alternator diodes.
   - Do not attempt to crank the engine with the battery ground cable loosely connected or you will severely damage the wiring.
3. Check the alternator belt tension.

Handling Connectors

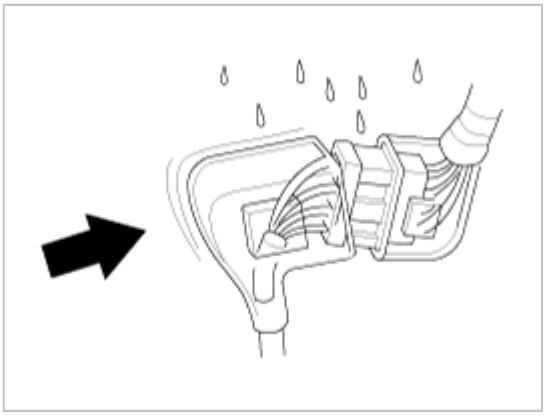
1. Make sure the connectors are clean and have no loose wire terminals.
2. Make sure multiple cavity connectors are packed with grease (except watertight connectors).
3. All connectors have push-down release type locks (A).



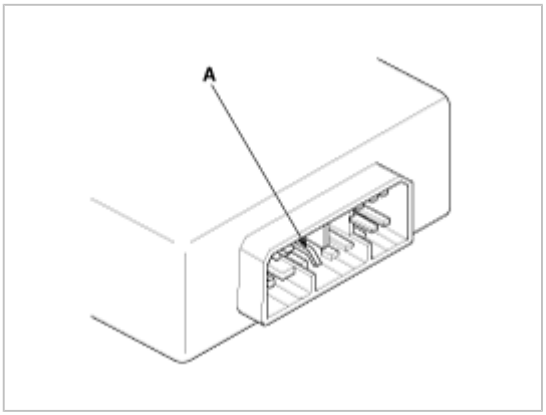
4. Some connectors have a clip on their side used to attach them to a mount bracket on the body or on another component. This clip has a pull type lock.
5. Some mounted connectors cannot be disconnected unless you first release the lock and remove the connector from its mount bracket (A).



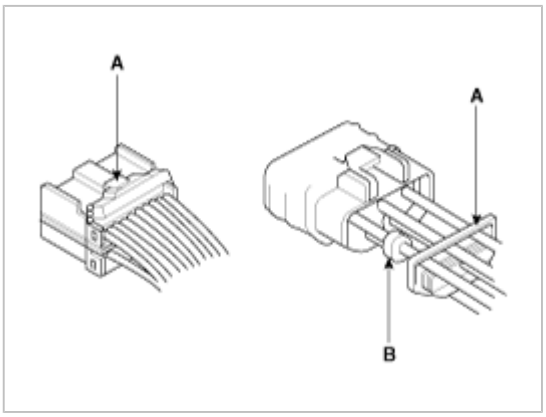
6. Never try to disconnect connectors by pulling on their wires; pull on the connector halves instead.
7. Always reinstall plastic covers.



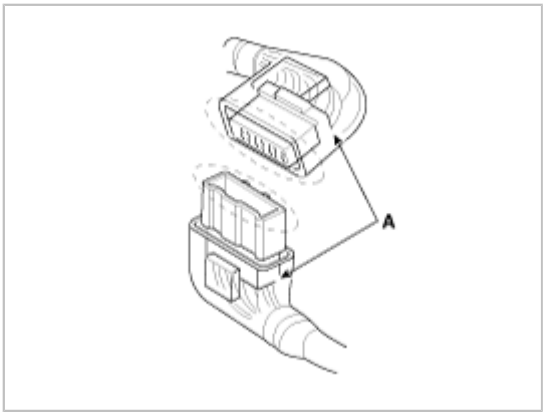
8. Before connecting connectors, make sure the terminals (A) are in place and not bent.



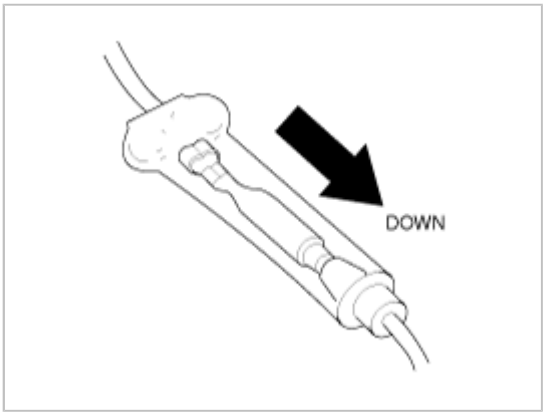
9. Check for loose retainer (A) and rubber seals (B).



10. The backs of some connectors are packed with grease. Add grease if necessary. If the grease (A) is contaminated, replace it.

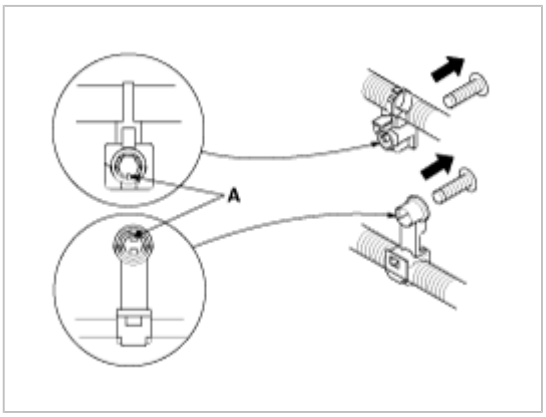


11. Insert the connector all the way and make sure it is securely locked.
12. Position wires so that the open end of the cover faces down.

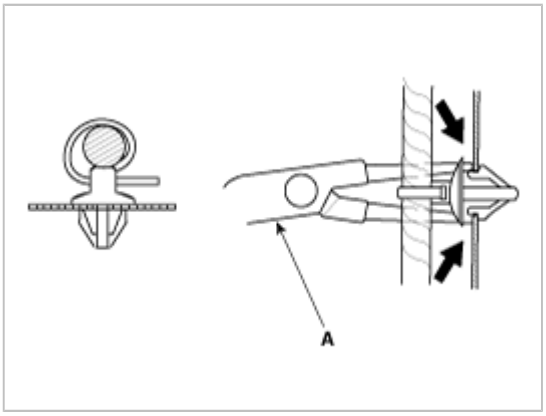


Handling Wires And Harnesses

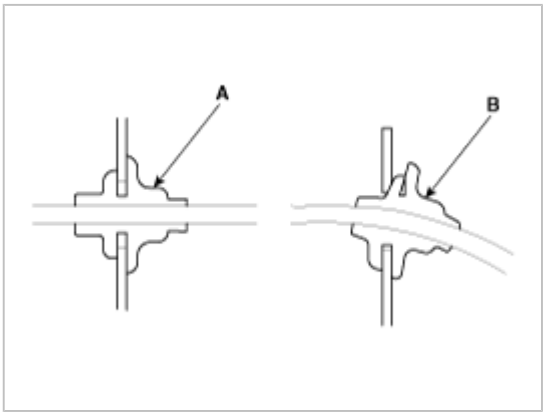
1. Secure wires and wire harnesses to the frame with their respective wire ties at the designated locations.
2. Remove clips carefully; don't damage their locks (A).



3. Slip pliers (A) under the clip base and through the hole at an angle, and then squeeze the expansion tabs to release the clip.



4. After installing harness clips, make sure the harness doesn't interfere with any moving parts.
5. Keep wire harnesses away from exhaust pipes and other hot parts, from sharp edges of brackets and holes, and from exposed screws and bolts.
6. Seat grommets in their grooves properly (A). Do not leave grommets distorted (B).

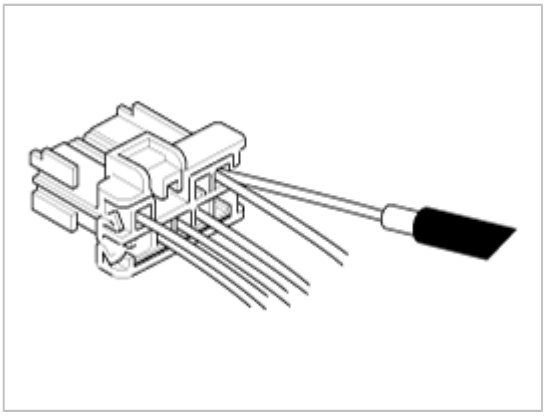


Testing And Repairs

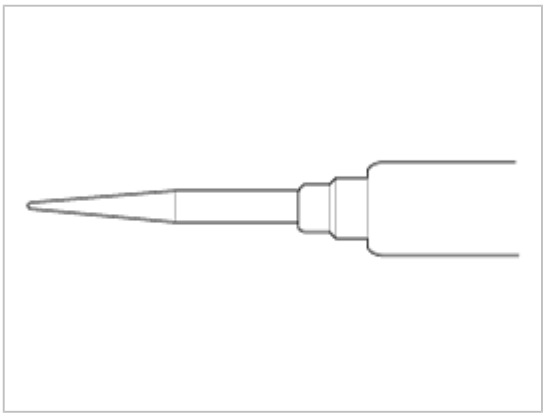
1. Do not use wires or harnesses with broken insulation.
   Replace them or repair them by wrapping the break with electrical tape.
2. After installing parts, make sure that no wires are pinched under them.
3. When using electrical test equipment, follow the manufacturer's instructions and those described in this

manual.

4. If possible, insert the remover tool from the wire side (except waterproof connector).



5. Use a probe with a tapered tip.
   Refer to the user's guide in the wiring repair kit (Pub No. : TRK 015.)



Five-step Troubleshooting

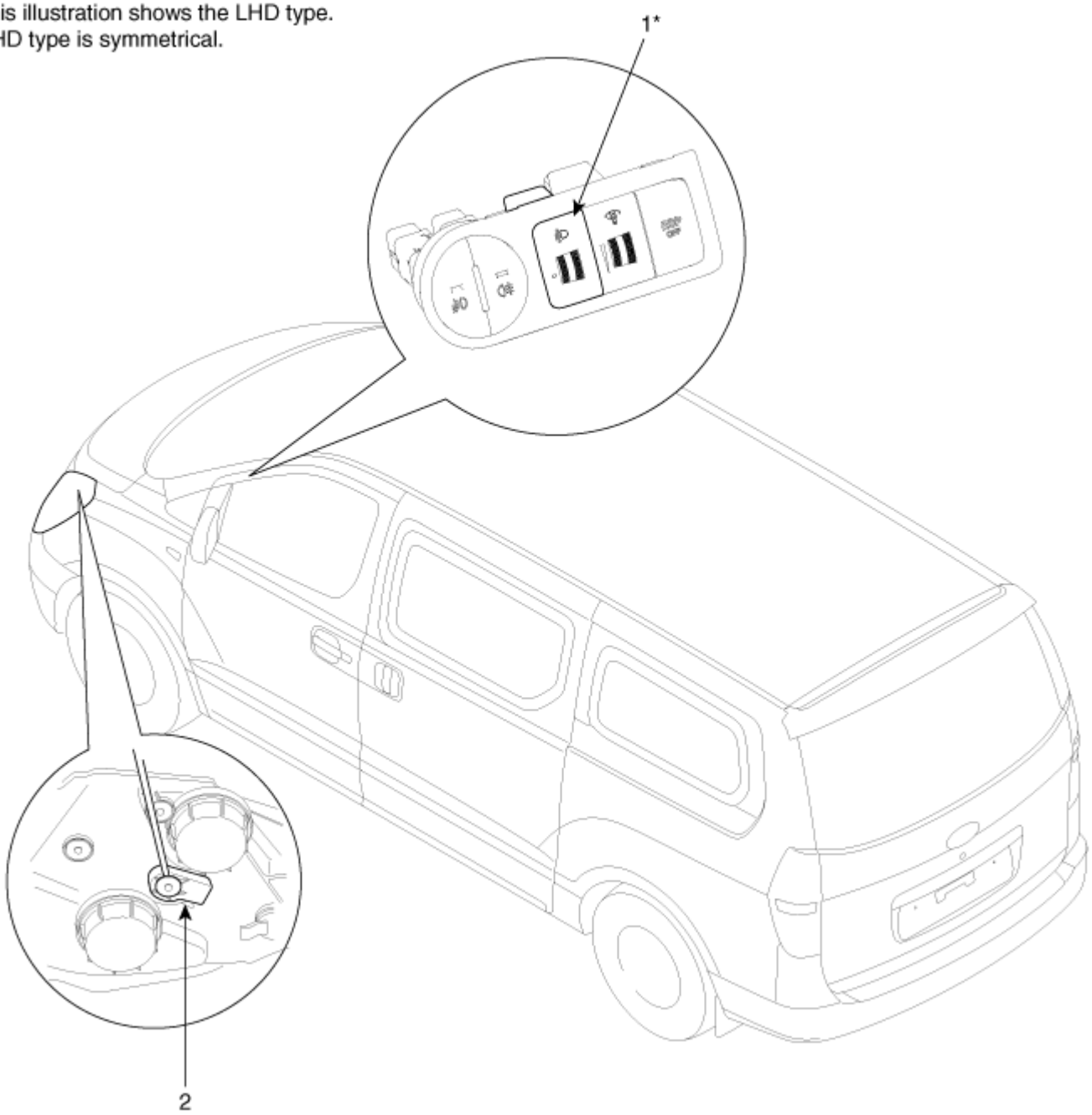
1. Verify the complaint
   Turn on all the components in the problem circuit to verify the customer complaint. Note the symptoms. Do not begin disassembly or testing until you have narrowed down the problem area.
2. Analyze the schematic
   Look up the schematic for the problem circuit.
   Determine how the circuit is supposed to work by tracing the current paths from the power feed through the circuit components to ground. If several circuits fail at the same time, the fuse or ground is a likely cause.
   Based on the symptoms and your understanding of the circuit operation, identify one or more possible causes of the problem.
3. Isolate the problem by testing the circuit.
   Make circuit tests to check the diagnosis you made in step 2. Keep in mind that a logical, simple procedure is the key to efficient troubleshooting.
   Test for the most likely cause of failure first. Try to make tests at points that are easily accessible.
4. Fix the problem
   Once the specific problem is identified, make the repair. Be sure to use proper tools and safe

procedures.

5. Make sure the circuit works
   Turn on all components in the repaired circuit in all modes to make sure you've fixed the entire problem. If the problem was a blown fuse, be sure to test all of the circuits on the fuse. Make sure no new problems turn up and the original problem does not recur.

Component Location

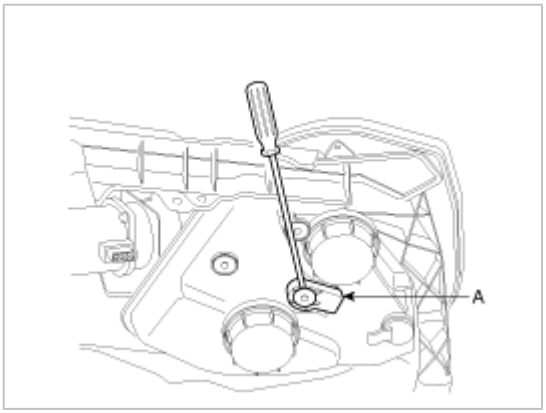
The parts with asterisk (*) :
This illustration shows the LHD type.
RHD type is symmetrical.



1. Headlamp leveling switch	2. Headlamp leveling actuator

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the head lamp assembly (Refer to the head lamp).
3. Remove the head lamp leveling actuator (A) by turning the adjusting gear in the hole using the adjusting wheel or screwdriver.



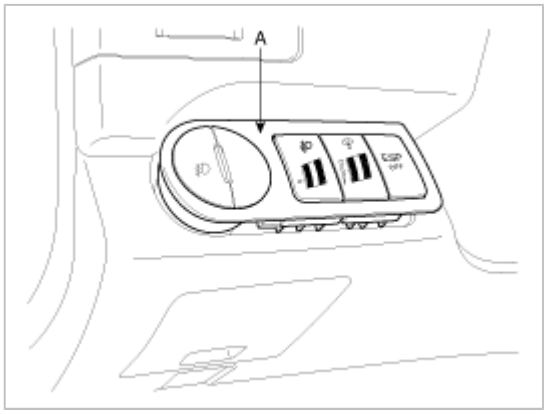
Installation

1. Install the head lamp leveling actuator by turning the adjusting gear.
2. Install the head lamp assembly.
3. Adjust the head lamp in accordance with the head lamp aiming instructions.

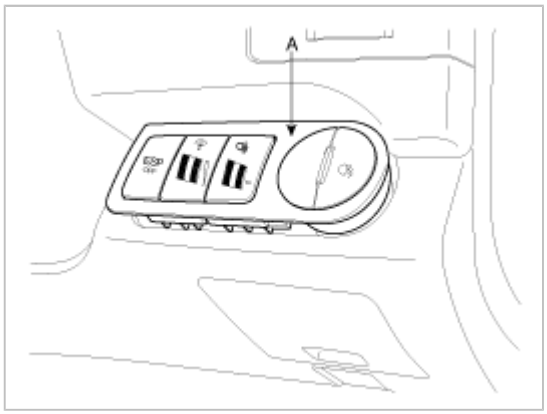
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad switch (A) from the side crash pad cover by using the trim removal tool.

[LHD]

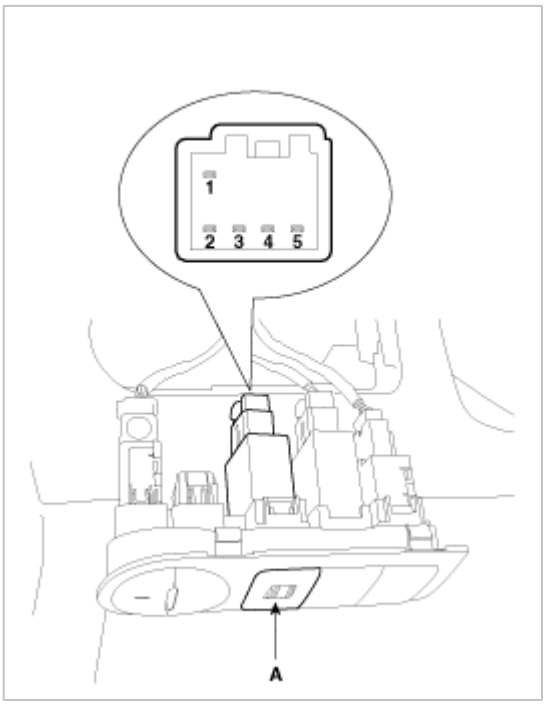


[RHD]

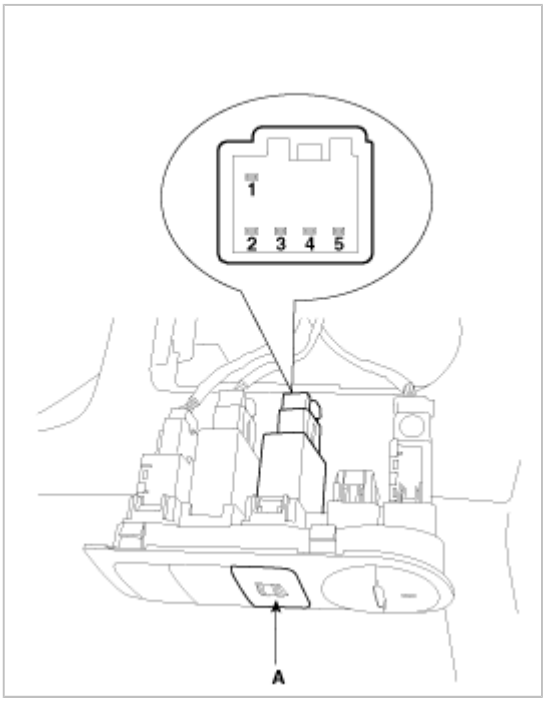


3. Remove the head lamp leveling switch connector from the lower crash pad switch.

[LHD]



[RHD]



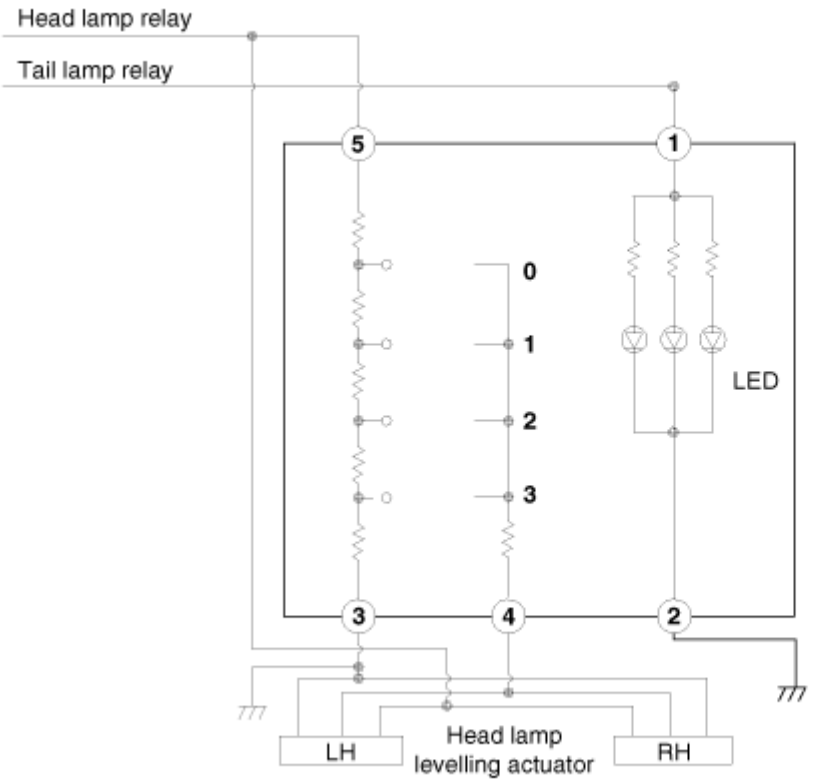
4. Connect the battery voltage between terminals 3 and 5.
5. Measure the voltage between terminals 4 and 5 at each position.

Position No.	Rotation	Voltage (V) (±5%)
0	0°	11.55
1	20°	10.2

2	40°	8.9
3	60°	8.2

6. If the voltage is not as specified, replace the head lamp leveling switch.

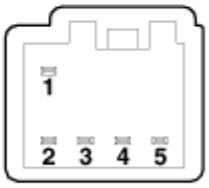
Circuit Diagram



PIN CONNECTION

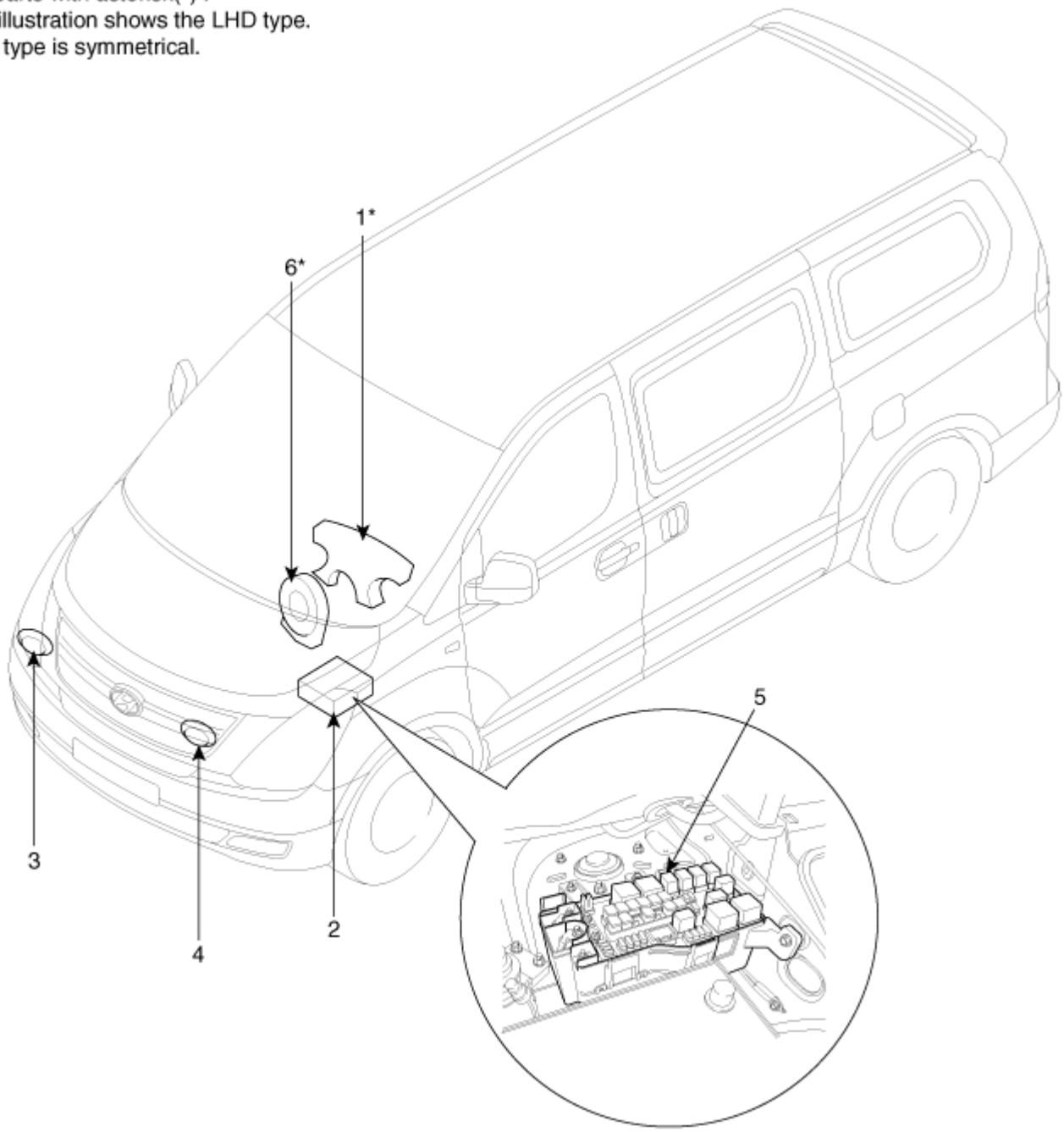
PIN NO	Description
1	Tail(+)
2	GND
3	GND
4	GATE
5	IGN

Head lamp leveling SW connector



Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.



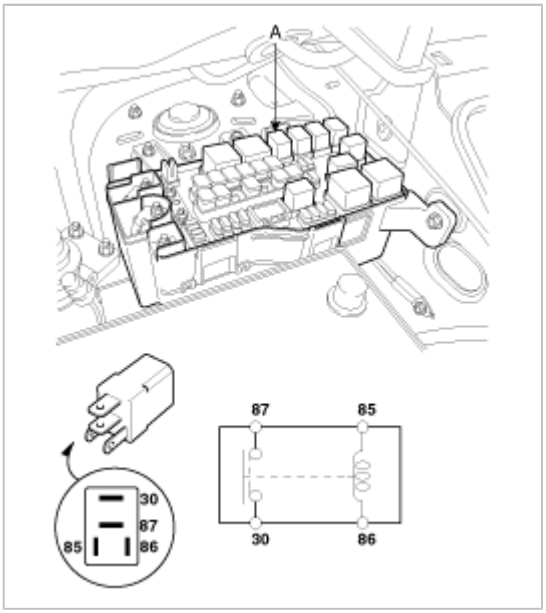
1. Horn switch	4. Horn (High pitch)
2. Relay box (Engine room compartment)	5. Horn relay
3. Horn (Low pitch - Single)	6. Clock spring

Inspection

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

Horn Relay Inspection

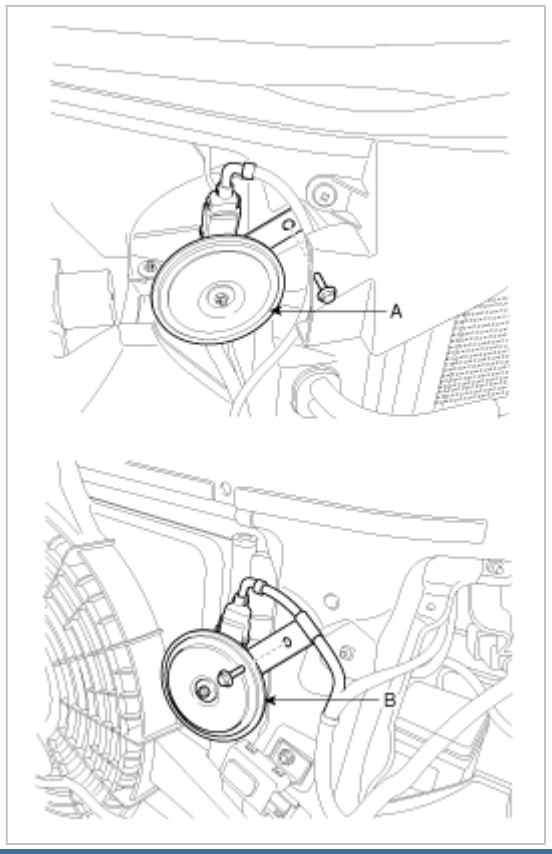
1. Remove the horn relay (A) from the engine room relay box.
2. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
3. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.



Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Removal

1. Remove the front bumper. (Refer to the Body group - front bumper).
2. Remove the bolts and disconnect the horn connectors, then remove the low pitch horn (A) and high pitch (B).



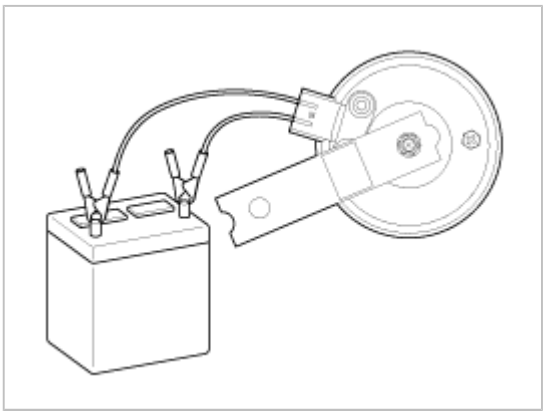
Installation

1. Install the horns after connecting the horn connectors.
2. Install the front bumper.
   (Refer to the Body group - Front bumper).

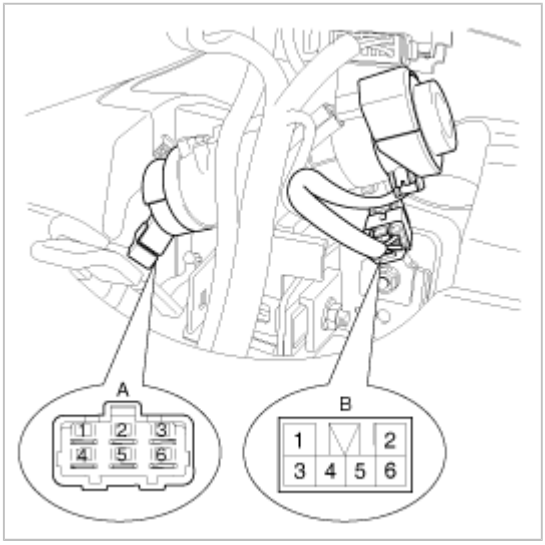
Adjustment

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

After adjustment, apply a small amount of paint around the screw head to keep it from loosening.



Inspection

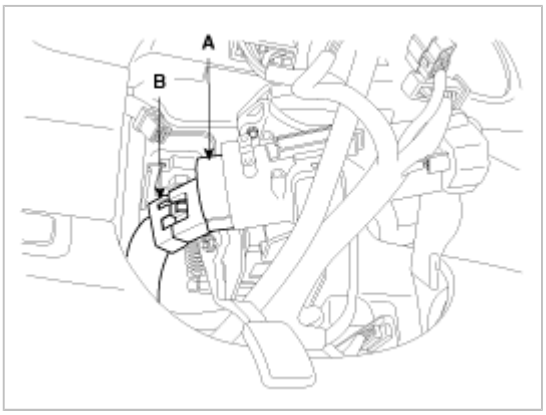


1. Disconnect the ignition switch connector (A) and key warning switch connector (B) from under the steering column.
2. Check for continuity between the terminals.
3. If continuity is not specified, replace the switch.

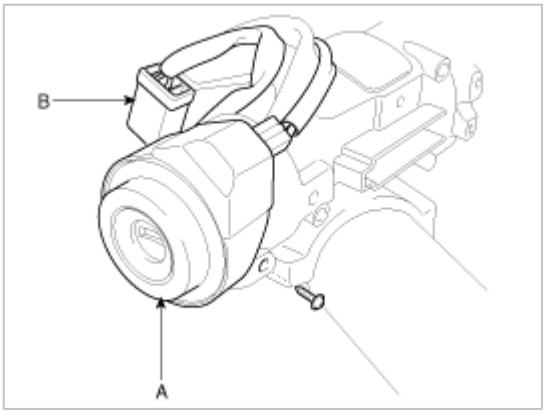
Position \ Terminal	Key	Ignition Switch (A) 2	4	6	5	3	1	Steering Travel	Travel	Key Warning Switch (B) 5	6	Key Hole Illumination (B) 3	4
Lock	Removal							Lock					
	Insert							Lock	Unlock				
ACC		○	○					Unlock		○	○	○	○
ON		○	○	○	○	○							
Start		○	○	○	○	○	○						

Removal

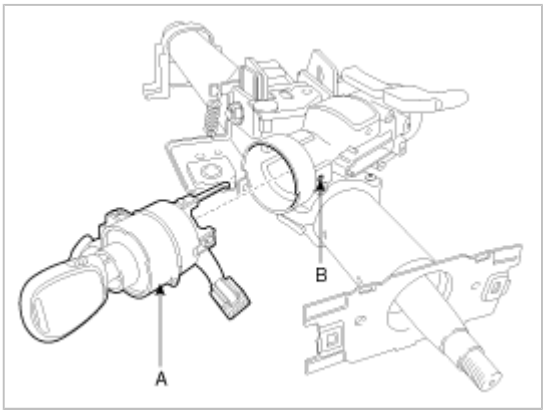
1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (Refer to ST group - "Steering columin and shaft").
3. Remove the ignition switch (A) after loosening the screw with IG ON and disconnecting the 6P connector (A).



4. Remove the door warning switch and key illumination lamp (A) after loosening the screw and disconnecting the 6P connector (B).



5. If it is necessary to remove the key lock cylinder (A), Remove the key lock cylinder after pushing lock pin (B) with key ACC.

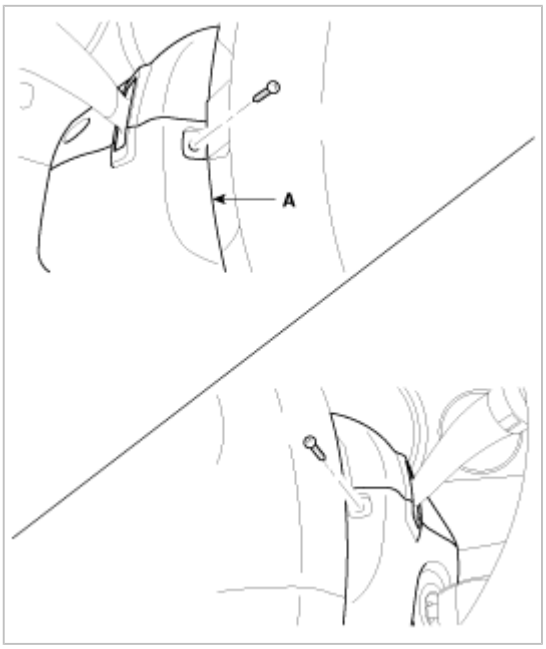


Installation

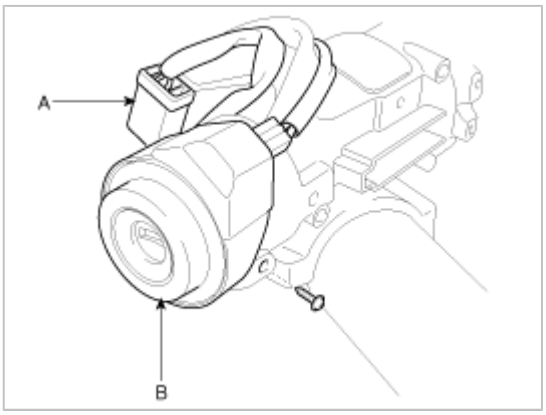
1. Install the key lock cylinder.
2. Install the door warning switch and key illumination lamp.
3. Install the ignition switch.
4. Install the steering column cover.

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering clumn upper and lower shrouds (A). (Refer to the ST group - "Steering column and shaft").



3. Disconnect the 6P connector (A) of the coil antenna and then remove the coil antenna (B) after loosening the screw.



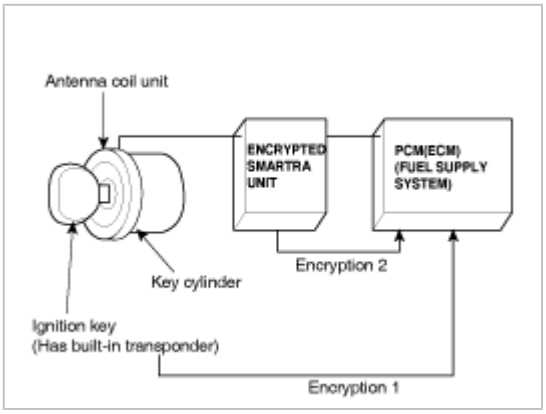
Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the steering column upper and lower shrouds.

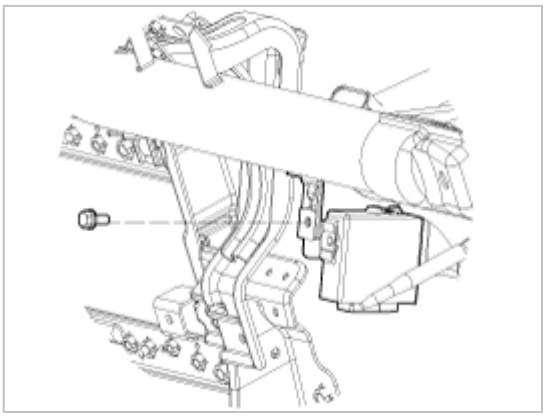
Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. Encrypted SMARTRA type immobilizer
   A. The SMARTRA system consists of a passivie challenge - response (mutual authentication) transponder located in the ignition key, an antenna coil, a encoded SMARTRA unit, an indicator light and the PCM(ECM).
   B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
   C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the PCM(ECM).
   D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the SMARTRA unit has recognized the code sent by the transponder.
   E. If the wrong key has been used and the code was not received or recognized by the PCM(ECM) the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
   F. If it is necessary to rewrite the PCM(ECM) to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
   G. The immobilizer system can store up to eight key codes.
   H. If the customer has lost his key, and cannot start the engine, contact Hyundai motor service station.



2. Shinchang type immobilizer for 4D56 Engine.
   A. The " Shinchang " type immobilizer system is applied to the 4D56 engine.
   B. The shinchang system consists of a transponder located in left side cowl cross bar, a coil antenna, an ICM (Immobilizer control module) , an indicator light and the ECM.



C. When the key is inserted in the ignition and turned to the ON position, the coil antenna sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the coil antenna to the ICM.

D. If the ID code transmitted from the key does not match the pre-registered code in the ICM, injection is not performed by the engine ECM. Hence, each vehicle has a set of keys containing a unique ID code which are registered on the ICM. This signal is captured by the coil antenna located in the front section of the steering handle lock and transmitted to the ICM. The ICM analyses and verifies the signal to determine if the signal matches the pre-registered code.If the signal is verified, the ICM transmits a message to the engine ECM to allow injection. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the ICM has recognized the code sent by the transponder.If the signal is not verified by the ICM, fuel injection is not performed by the engine ECM. The indicator light will continue blinking for five seconds until the ignition switch is turned OFF. Communication between ICM and ECM communicates through the K-line of ECM. K-line is also used for the communication between ECM and scan tool. there is a regal inside of ICM to switch the communication.

E. If it is necessary to rewrite the ICM to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.

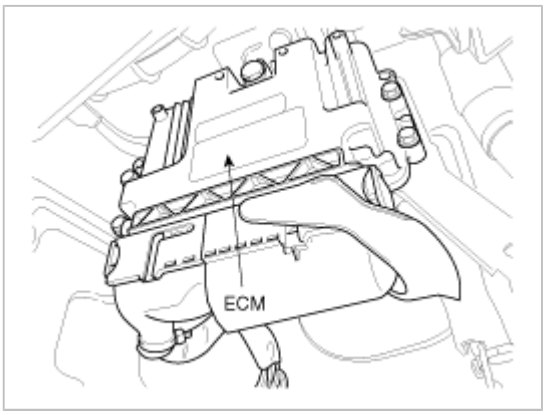
F. The immobilizer system can store up to four key codes.

G. If the customer has lost his key, and cannot start the engine, contact HMC motor service station.

Components Operations

Pcm (Power Train Control Module)

1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM(ECM).
   ERN (Encrypted Randorn Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.

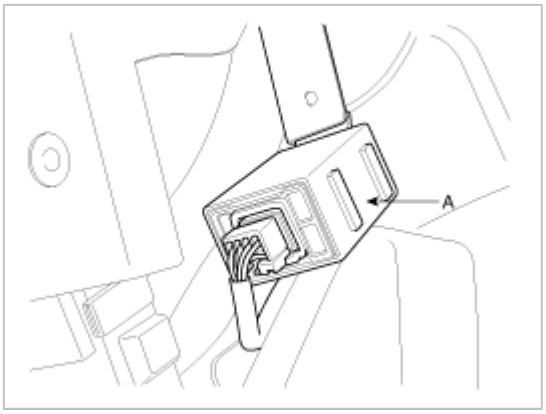


Encrypted Smartra Unit (A)

The SMARTRA carries out communication with the built- in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar.

The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.

The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.

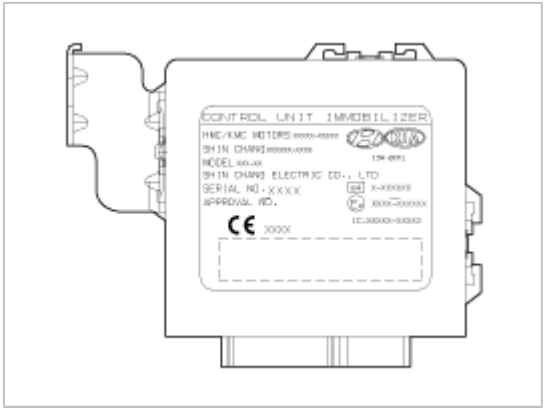


ICM (Immobilizer Control Module)

The ICM carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The IC M is mounted at the behind of the crush pad under panel close to the antenna coil for RF transmission and receiving.

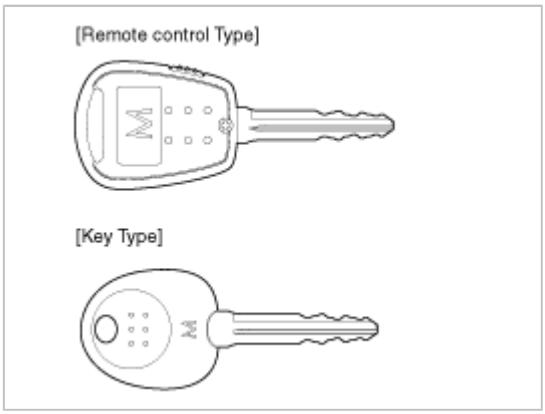
The ICM carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the ICM simultaneously. Only if the results are equal, transmits the signal to the ECM to permits injection. The data of all transponders, which are valid for the vehicle, are stored in the ICM.

[Shinchang Type]



Transponder (Built-in Keys)

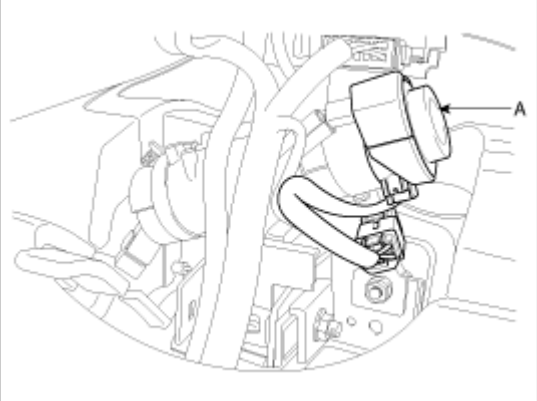
The transponder has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.



Antenna coil

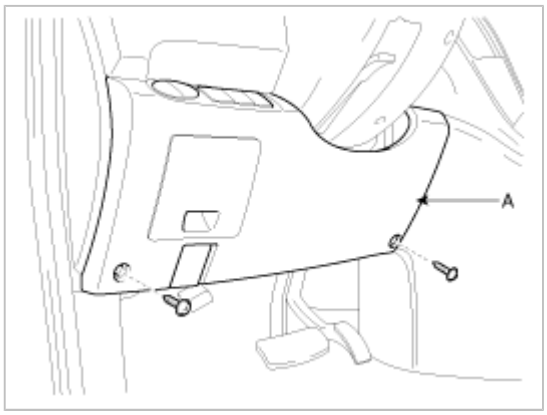
The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.
  It is located directly in front of the steering handle lock.

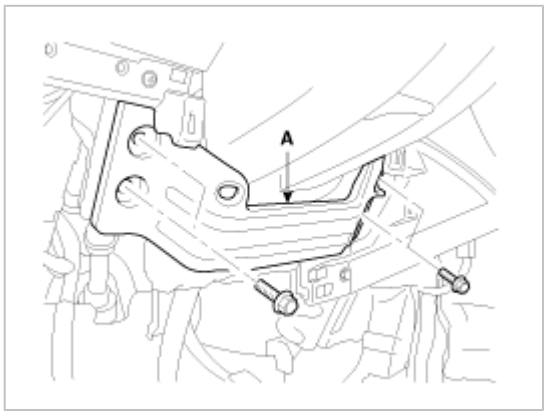

A

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A). (Refer to the Body group - "Crash pad").

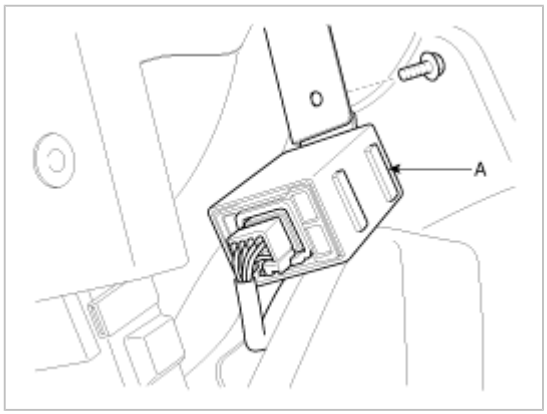


3. Remove the driver reinforce panel (A) after loosening bolts.

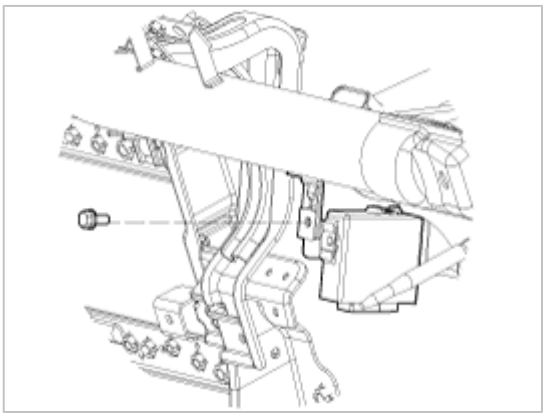


4. Disconnect the 5P connector of the SMARTRA unit and then remove the Immobilizer control unit (A) after loosening a bolt.

[Smartra Type]



[Shinchang Type]



Installation

1. Install the immobilizer control unit after connecting the unit connector.
2. Install the driver reinforce panel.
3. Install the crash pad lower panel.

Teaching Procedures

1. Key Teaching Procedure

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

The procedure starts with an ECM(ICM) request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" ECM(ICM) stores the vehicle specific data and the key teaching can be started. The "learnt" ECM(ICM) compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.

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

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

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

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

The ECM(ICM) rejects invalid keys, which are presented for teaching. A message is sent to the tester.

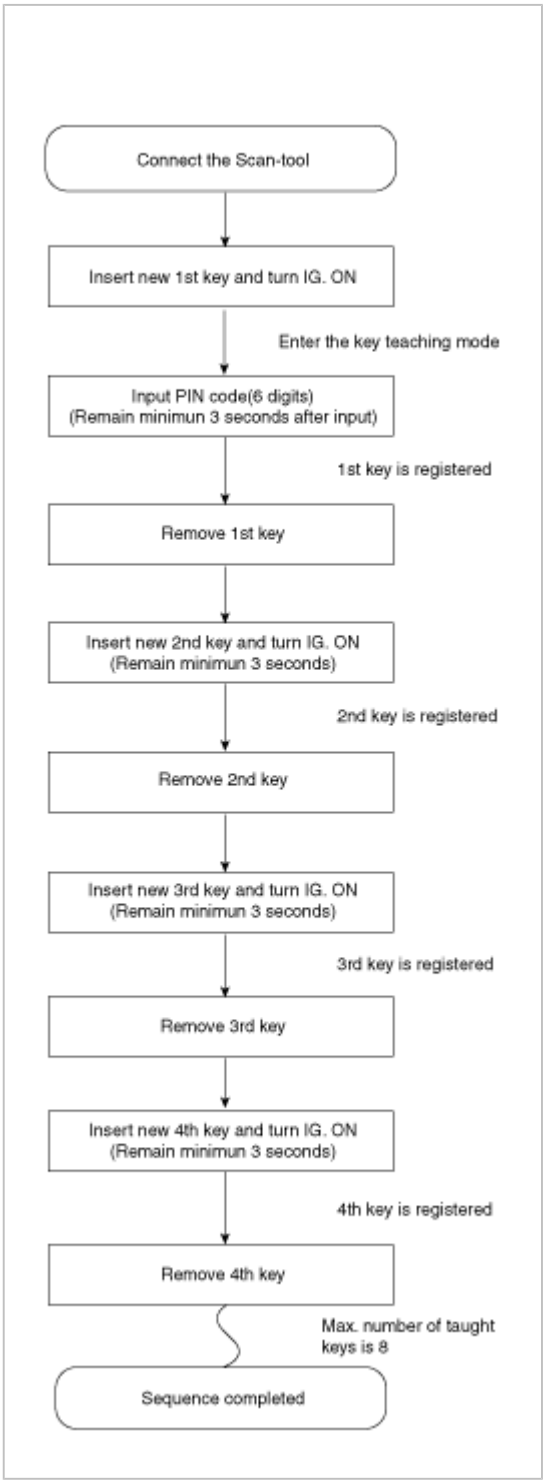
The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the ECM(ICM) detects different authenticators of a transponder and an ECM (ICM), the key is considered to be invalid.

The maximum number of taught keys is 8

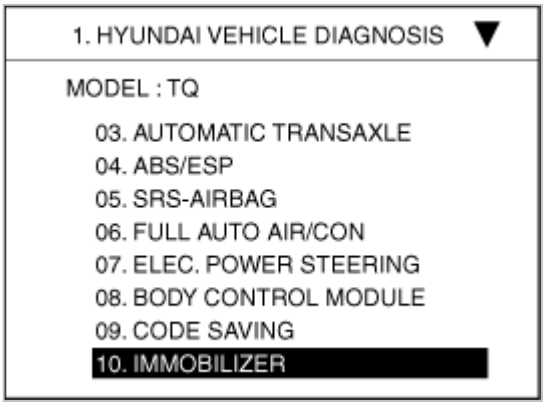
If an error occurs during the Immobilizer Service Menu, the ECM(ICM) status remains unchanged and a specific fault code is stored.

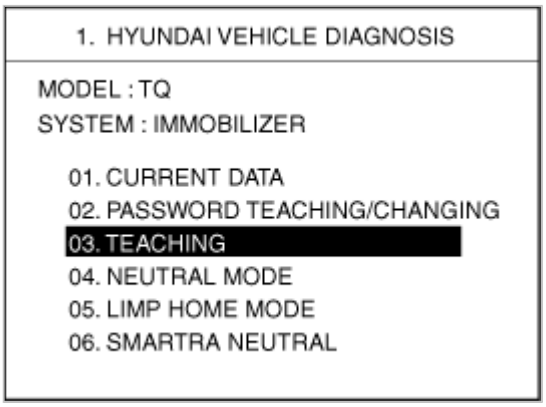
If the ECM(ICM) status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at ECM(ICM).

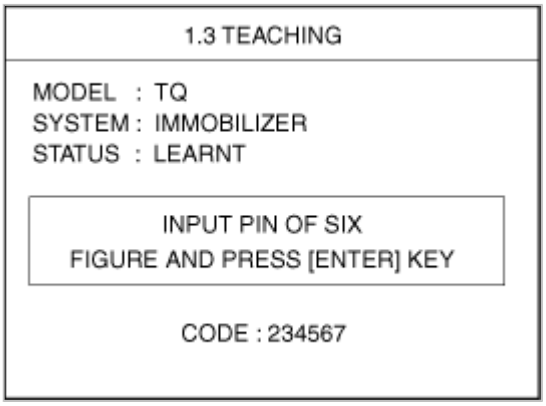
When teaching the 1st key, Smartra regists at the same time.

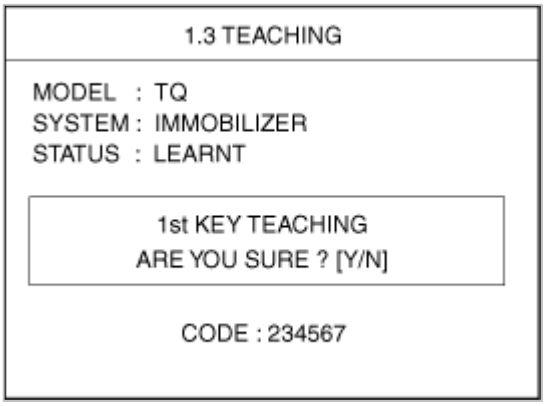


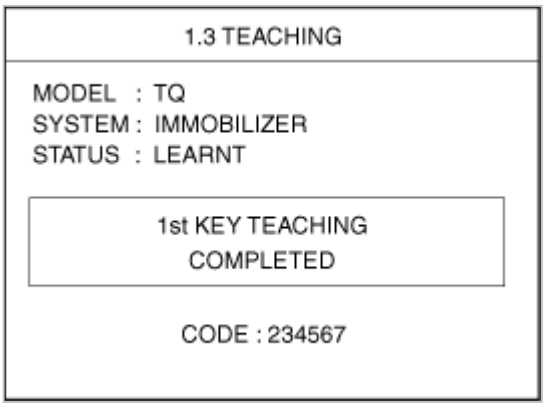
(1) ECM(ICM) learnt status.

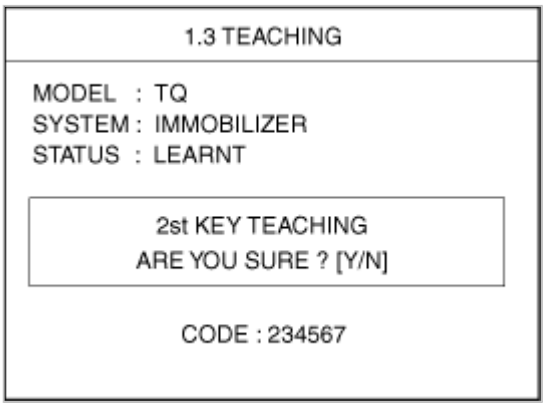

1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : TQ
03. AUTOMATIC TRANSAXLE
04. ABS/ESP
05. SRS-AIRBAG
06. FULL AUTO AIR/CON
07. ELEC. POWER STEERING
08. BODY CONTROL MODULE
09. CODE SAVING
10. IMMOBILIZER

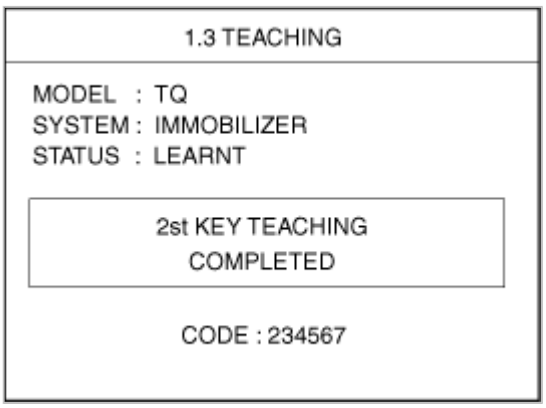

1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : TQ
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL


1.3 TEACHING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567


1.3 TEACHING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567



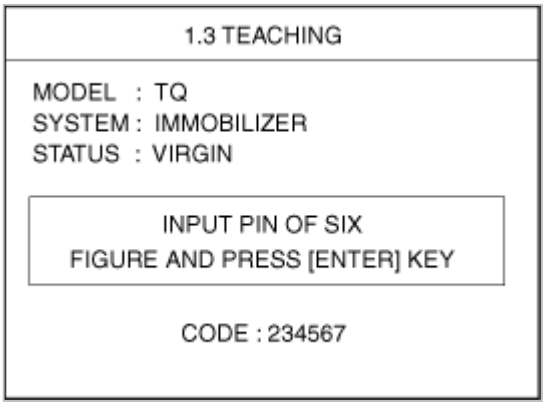


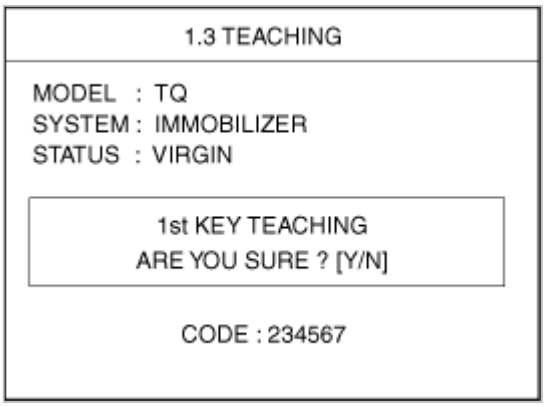


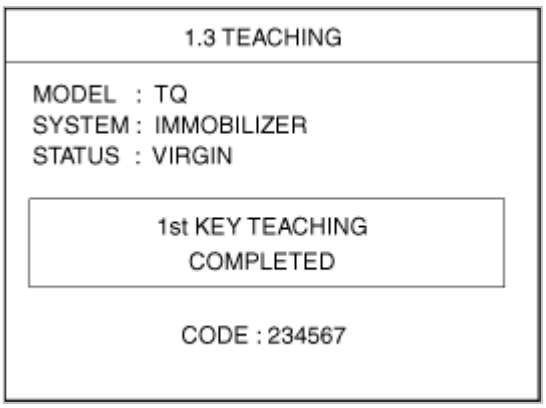
(2) ECM(ICM) virgin status.

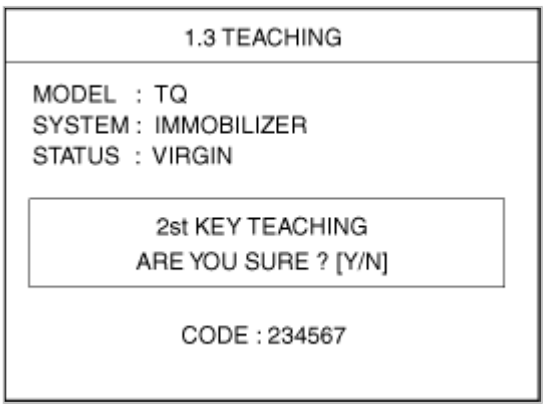
After replacing new "ECM(ICM)" scantool displays that ECM(ICM) is virgin status in Key Teaching mode.

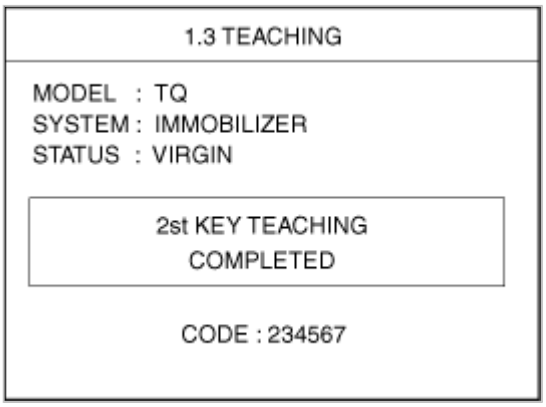
"VIRGIN" status means that ECM(ICM) has not matched any PIN code before.


1.3 TEACHING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567


1.3 TEACHING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
1st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567


1.3 TEACHING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
1st KEY TEACHING
COMPLETED
CODE : 234567


1.3 TEACHING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
2st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567



2. User Password Teaching Procedure

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

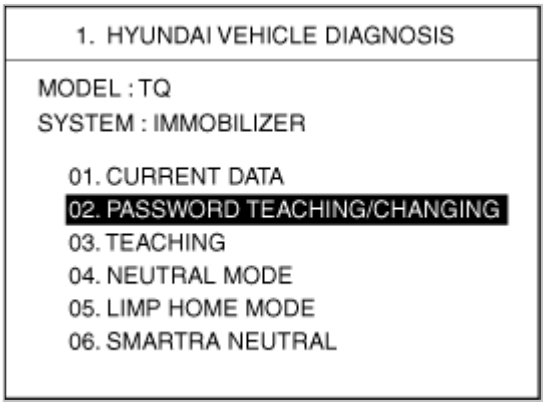
The user password teaching is only accepted by a "learnt" ECM(ICM). Before first teaching of user password to an ECM(ICM), the status of the password is "virgin" No limp home function is possible.

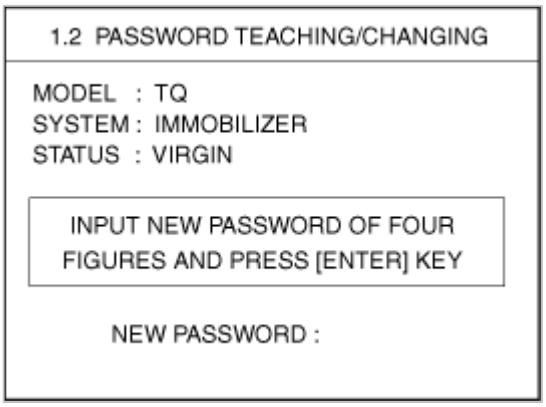
The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

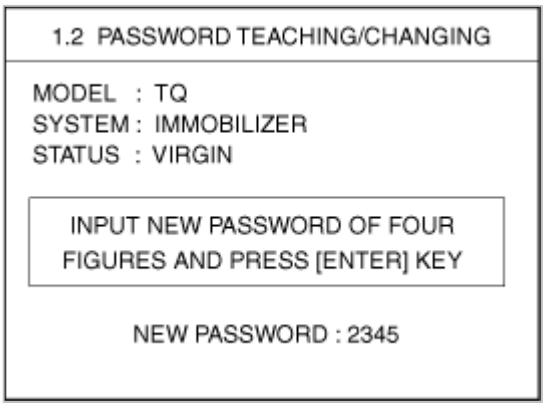
The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the ECM(ICM) requests the new user password. The status remains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

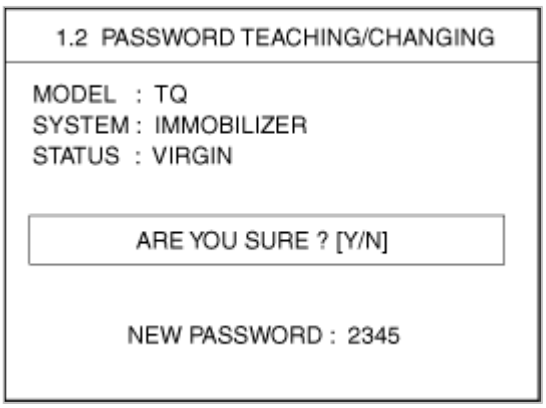
If wrong user passwords or wrong vehicle specific data have been sent to the ECM(ICM) three times continuously or intermittently, the ECM(ICM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting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

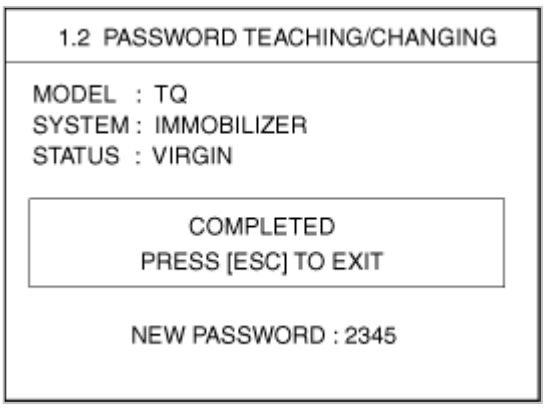
(1) User password teaching





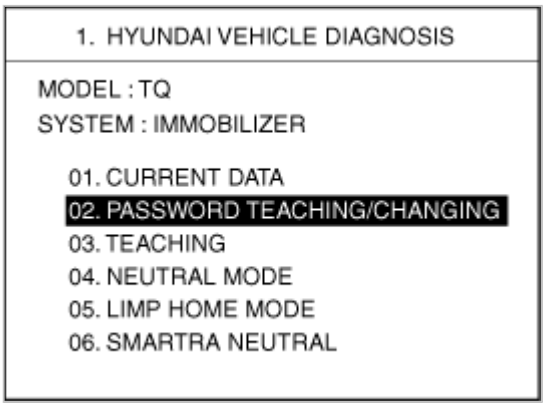


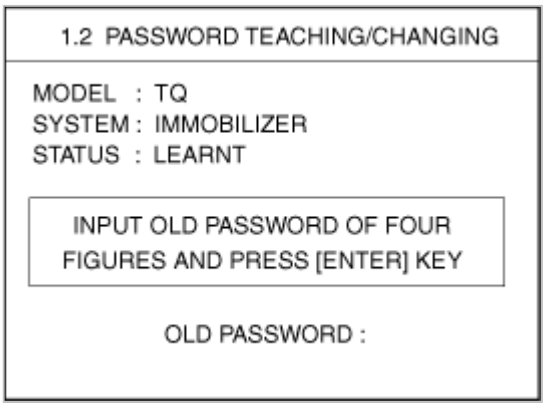


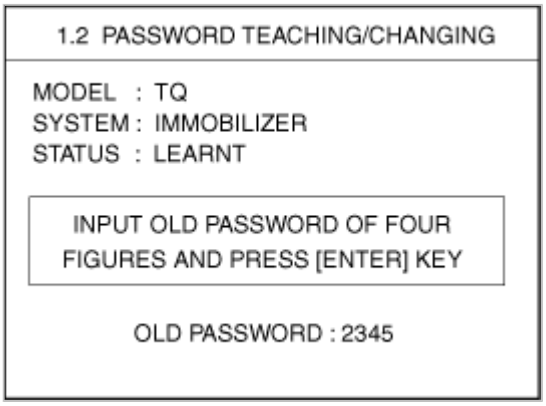


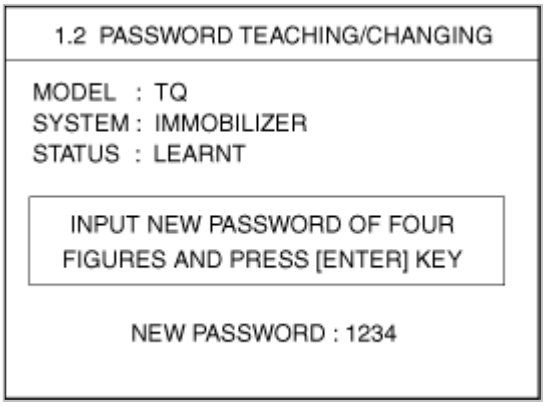
→In case of putting wrong password, retry from first step after 10 seconds.

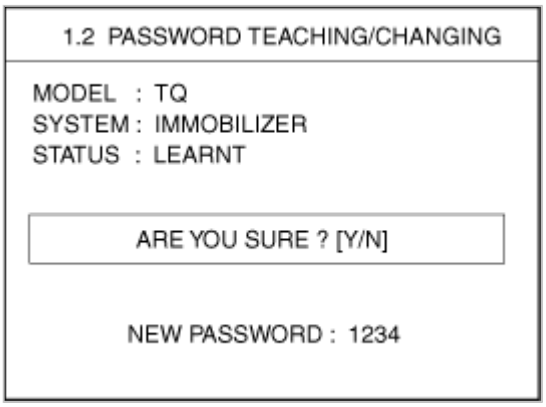
(2) User password changing

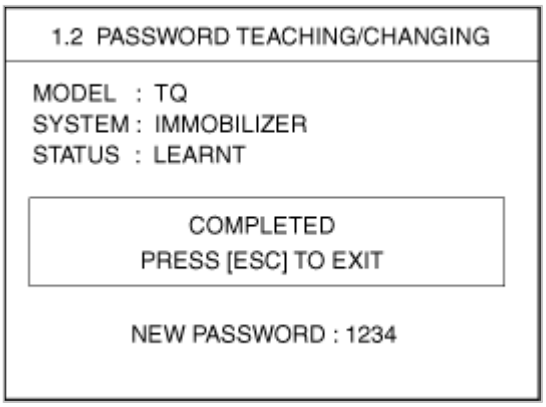

1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : TQ
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL


1.2 PASSWORD TEACHING/CHANGING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT OLD PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
OLD PASSWORD :


1.2 PASSWORD TEACHING/CHANGING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT OLD PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
OLD PASSWORD : 2345


1.2 PASSWORD TEACHING/CHANGING
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
NEW PASSWORD : 1234





Replacement

Problems And Replacement Parts:

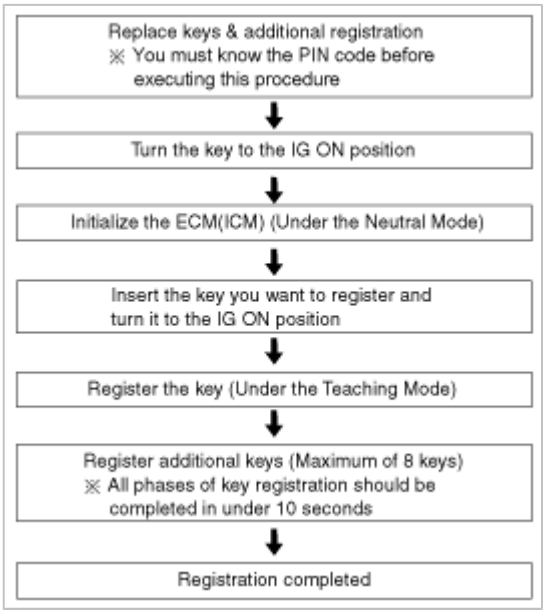
Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM(ICM) does not work	ECM(ICM)	YES
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, ECM(ICM)	YES
SMARTRA unit does not work	SMARTRA unit	YES

Replacement Of ECM(ICM) And Smartra

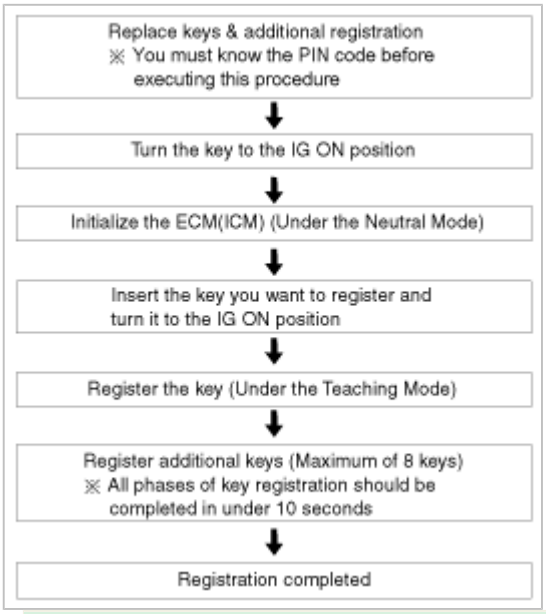
In case of a defective ECM(ICM), the unit has to be replaced with a "virgin" or "neutral" ECM(ICM). All keys have to be taught to the new ECM(ICM). Keys, which are not taught to the ECM(ICM), are invalid for the new ECM(ICM) (Refer to key teaching procedure). The vehicle specific data have to be left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

In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (ECM(ICM))



2. Things to remember before a replacement (Keys →Additional registration)



1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2. (Note that key #2 must be used within 10 seconds of removing key #1)
3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
   The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.

Always remember the 10 seconds zone.

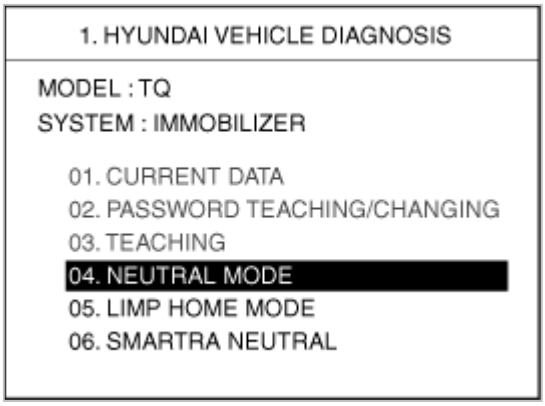
5. If the pin code →password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

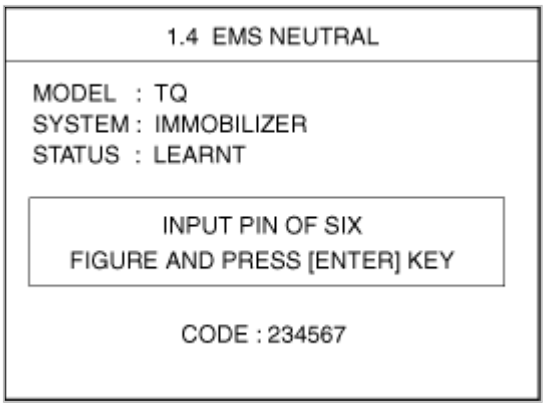
Neutralising Of ECM(ICM)

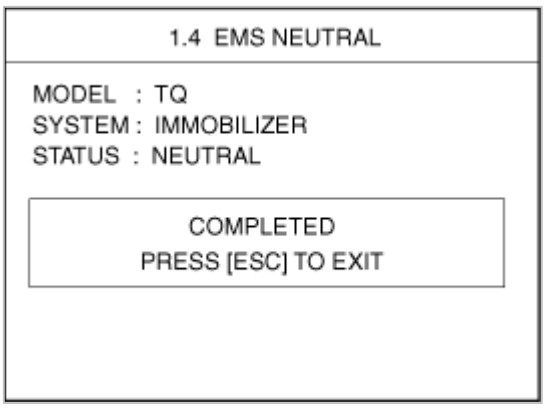
The ECM(ICM) can be set to the "neutral" status by a tester.
A valid ignition key is inserted and after ignition on is recorded, the ECM(ICM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the ECM(ICM) is neutralized.
The ECM(ICM) remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the ECM(ICM).
The teaching of keys follows the procedure described for the virgin ECM(ICM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.
This function is for neutralizing the ECM(ICM) and Key. Ex) when lost key, Neutralize the ECM(ICM) then teach keys.
(Refer to the Things to do when Key →PIN Code the ECM(ICM) can be set to the "neutral" status by a scanner.If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

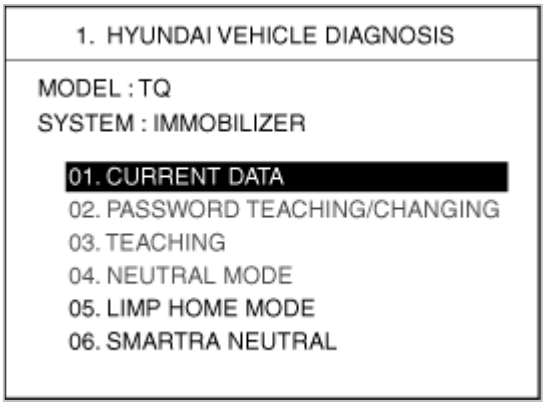
- Neutralizing setting condition
  - In case of ECM(ICM) status "Learnt" regardless of user password "Virgin or Learnt"
  - Input correct PIN code by scanner.
  - Neutralizing meaning .
    : PIN code (6) →user password (4) deletion.
    : Locking of ECM(ICM) (except key teaching permission)
- Neutralizing meaning:
  - PIN Code(6) →User P/Word(4) deletion
  - Locking of EMS(except Key Learning permission)

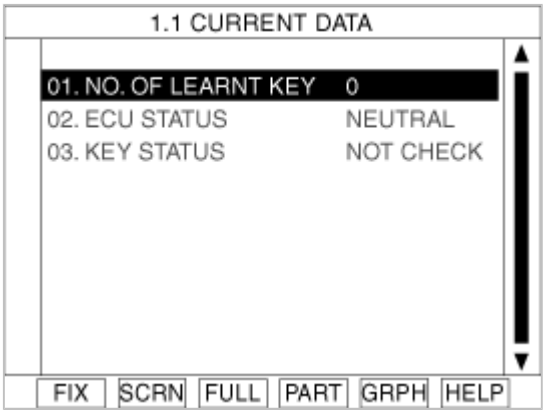
Function / EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No


1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : TQ
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL


1.4 EMS NEUTRAL
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : LEARNT
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567


1.4 EMS NEUTRAL
MODEL : TQ
SYSTEM : IMMOBILIZER
STATUS : NEUTRAL
COMPLETED
PRESS [ESC] TO EXIT


1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : TQ
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL



NEUTRALISING OF SMARTRA

The EMS can be set to the status "neutral" by tester

Ignition key (regardlss of key status) is inserted and after IGN ON.If receiving the correct vehicle password from GST, SMARTRA can be neutralized.The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST.

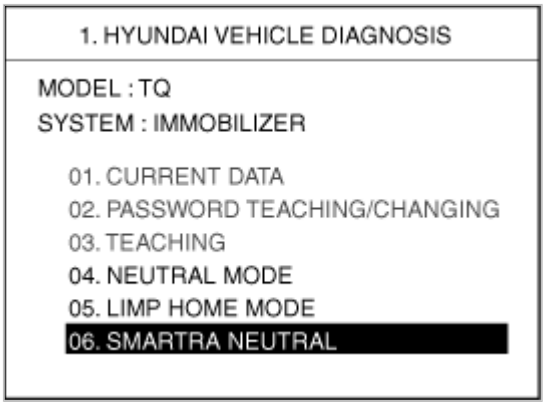
In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".

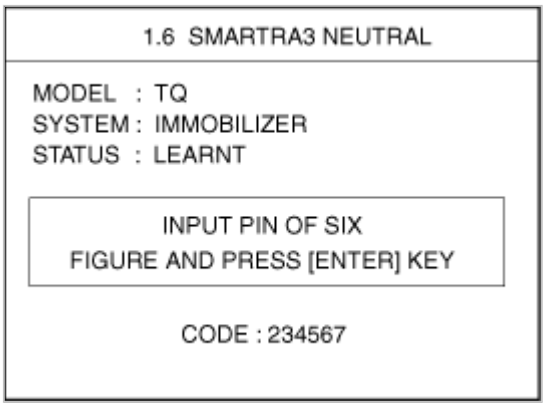
In case of chaging the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning the key of vehicle password, it can be used.

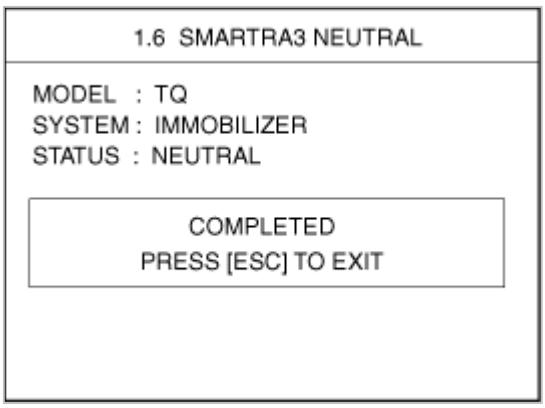
If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

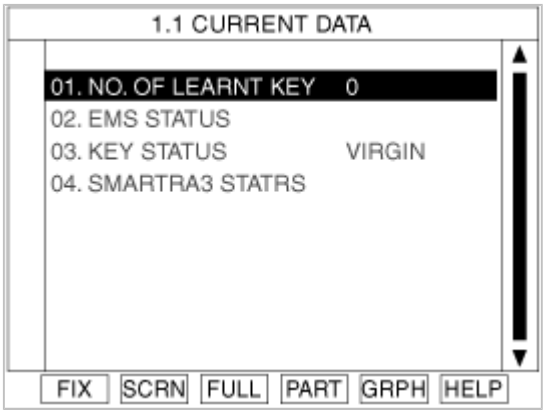
- Neutralizing Setting condition :
  - In case of "SMARTRA status", "Learnt"
  - Input correct Pin code by tester
- Neutralizing meaning :
  - Vehicle password(DPN Code) →SEK Code deletion.
  - Permission of New DPN Learning.

Function / SMARTRA	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS learnt)	No	Yes	No





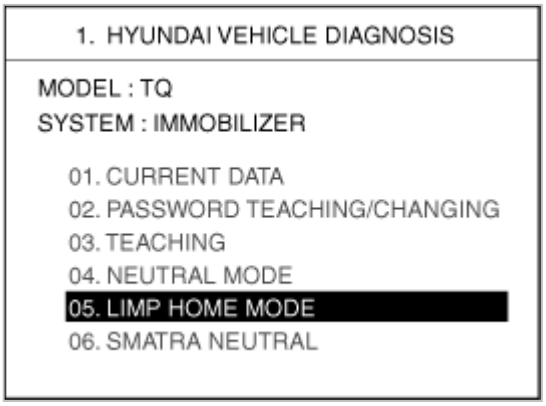


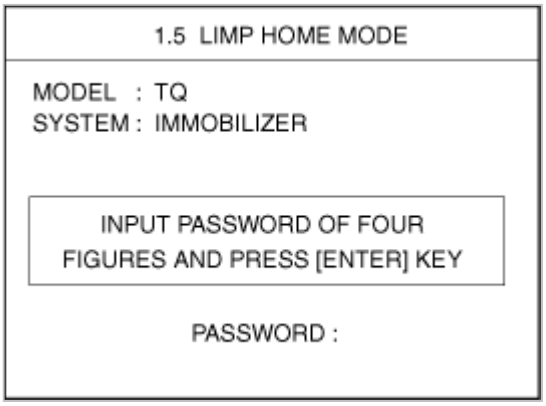


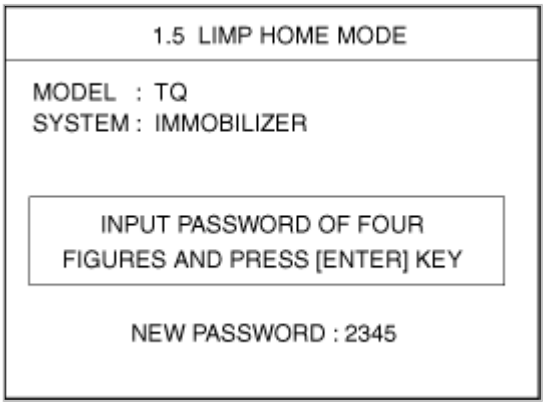
Limp Home Function

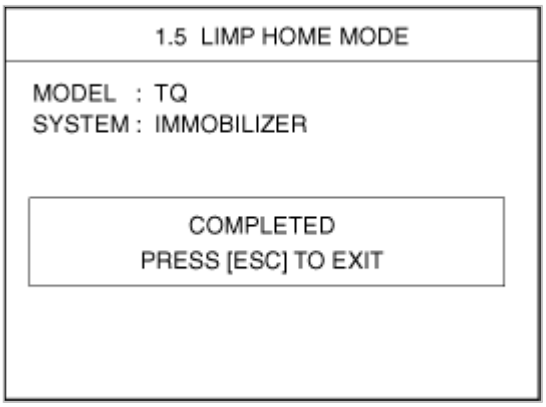
1. LIMP HOME BY TESTER

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









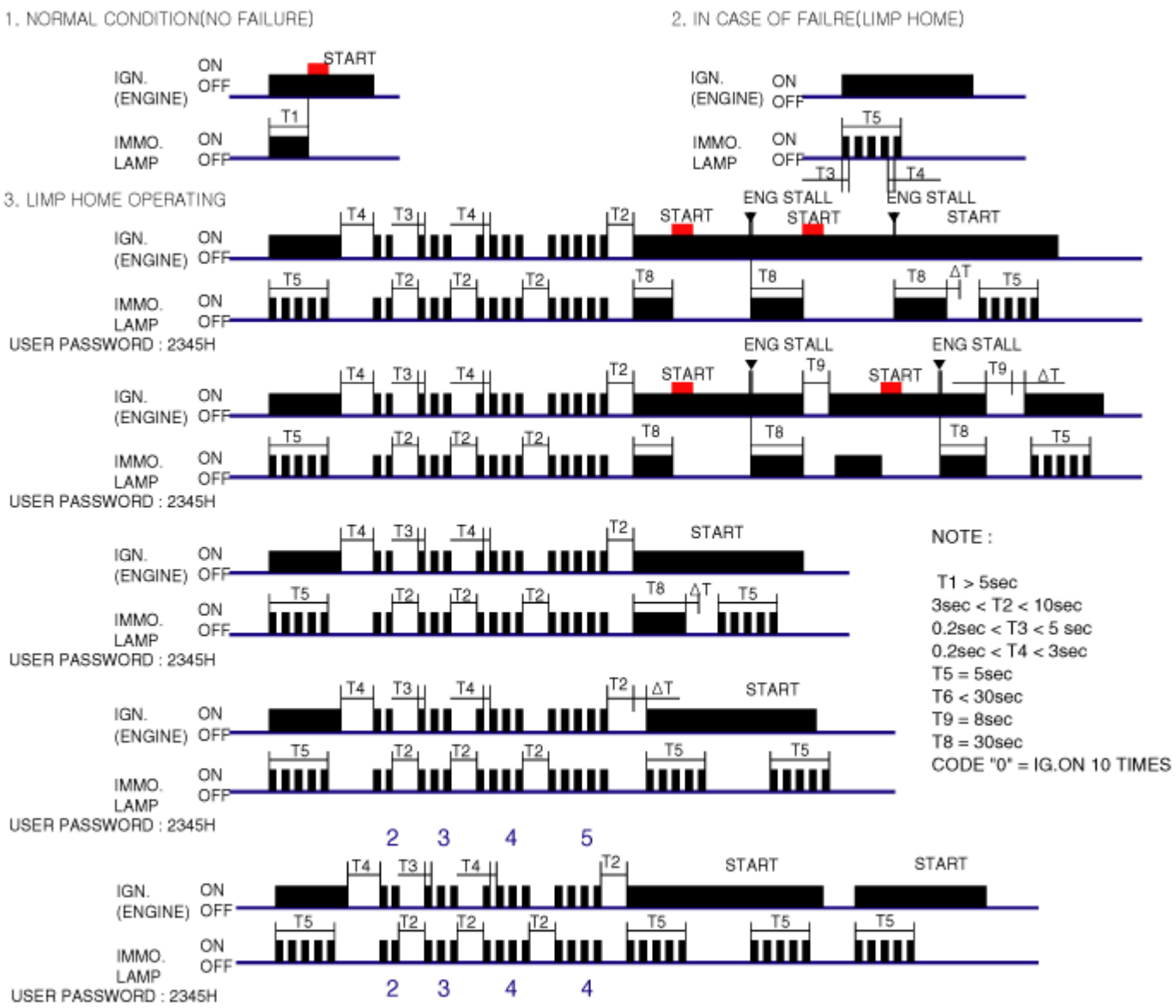
2. LIMP HOME BY IGNITION KEY

   The limp home can be activated also by the ignition key. The user password can be input to the ECM (ICM) by a special sequence of ignition on/off.

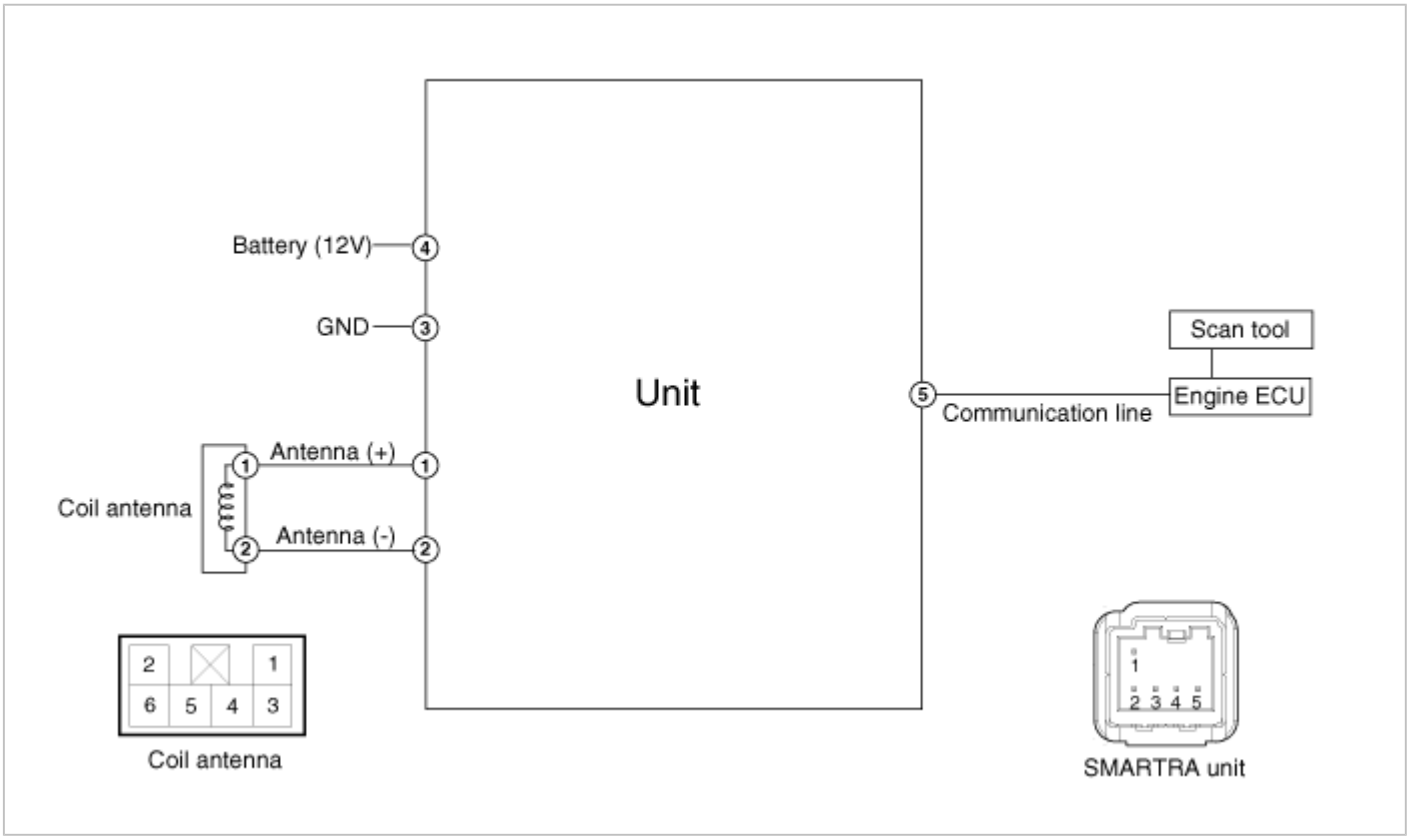
   Only if the ECM(ICM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the ECM(ICM) will be unlocked for a period of time (30 sec.).

   The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

   After ignition off, the ECM(ICM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.


1. NORMAL CONDITION(NO FAILURE)
IGN. (ENGINE) ON OFF
IMMO. LAMP ON OFF
START
T1
2. IN CASE OF FAILRE(LIMP HOME)
T5
T3
T4
3. LIMP HOME OPERATING
ENG STALL
START
T2
T4
T3
T5
T8
ΔT
USER PASSWORD : 2345H
T9
NOTE :
T1 > 5sec
3sec < T2 < 10sec
0.2sec < T3 < 5 sec
0.2sec < T4 < 3sec
T5 = 5sec
T6 < 30sec
T9 = 8sec
T8 = 30sec
CODE "0" = IG.ON 10 TIMES
2 3 4 5
2 3 4 4

Circuit Diagram



Diagnosis Of Immobilizer Faults

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

The following table shows the assignment of immobilizer related faults to each type:

[Smartar Type]

Immobilizer Related Faults	Fault types	Diagnostic codes
PCM(ECM) fault	1. Non-Immobilizer-EMS connected to an Immobilizer	P1610
Transponder key fault	1. Transponder not in password mode 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programming error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA message error)
SMARTRA fault	1. Virgin SMARTRA at learnt EMS 2. Neutral SMARTRA at learnt EMS 3. Incorect the Authentication of EMS and SMARTRA 4. Locking of SMARTRA	P169A (SMARTRA Authentication fail)
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error 3. Communication line error (Open/Short etc.) 4. Invalid message from SMARTRA to PCM(ECM)	P1690 (SMARTRA no response)
Antenna coil fault	1. Antenna coil open/short circuit	P1691 (Antenna coil error)
Immobilizer indicator lamp fault	1. Immobilizer indicator lamp error (Cluster)	P1692 (Immobilizer lamp error)
Transponder key fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the	P1693 (Transponder no response error/invalid

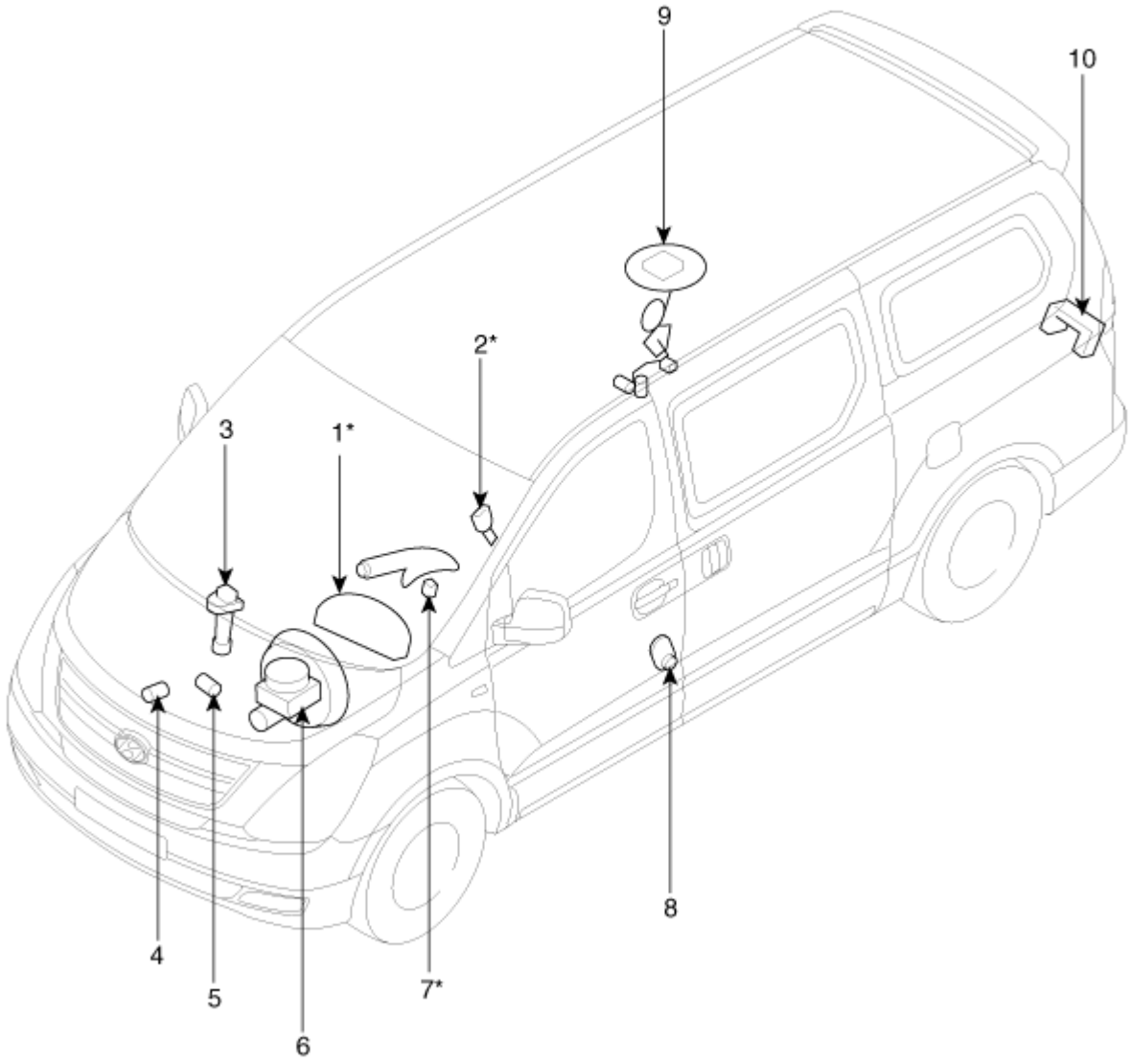
	magnetic field (Antenna coil)	response)
PCM(ECM) fault	1. Request from PCM(ECM) is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1694 (PCM(ECM) message error)
PCM(ECM) internal permanent memory (EEPROM) fault	1. PCM(ECM) internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1695 (PCM(ECM) memory error)
Invalid key fault	1. Virgin transponder at PCM(ECM) status "Learnt"Learnt (Invalid) Transponder at PCM (ECM) status "Learnt"(Authentication fail)	P1696 (Authentication fail)
Locked by timer	1. Exceeding the maximum limit of Twice IGN ON (□ 32 times)	P1699 (Twice IG ON over trial)

[Shinchang Type - 4D56 ENG.]

Immobilizer Related Faults	**Fault types**	**Diagnostic codes**
Transponder fault	1. Corrupted data from transponder 2. More than one transponder in the magnetic field (Antenna coil) 3. No transponder (Key without transponder) in the magnetic field (Antenna coil) 4. Transponder not in the password mode 5. Transponder transport data has been changed 6. Transponder programming error	P1693 Transponder no response error/transponder invalid response, Transponder status error, Transponder programming error
SMARTRA/ECM fault	1. Antenna coil error	P1691 (4D56) Antenna coil error
	1. Communication line error (Open/Short etc.) 2. Invalid message from SMARTRA/ICM to ECM	P1678 (4D56) ECM no response message error
ECM internal permanent memory(EEPROM) fault	1. ECM internal permanent memory (EEPROM) fault 2. Invalid write operation to permanent memory (EEPROM)	P1677 (4D56) ECM has different VIN
ECM fault	1. Request from ECM is invalid (Protocol layer violation- Invalid request, check sum error etc.)	P1679 (4D56) ECM message error
Invalid TP	TP has different PIN	P1698 (4D56)

Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.

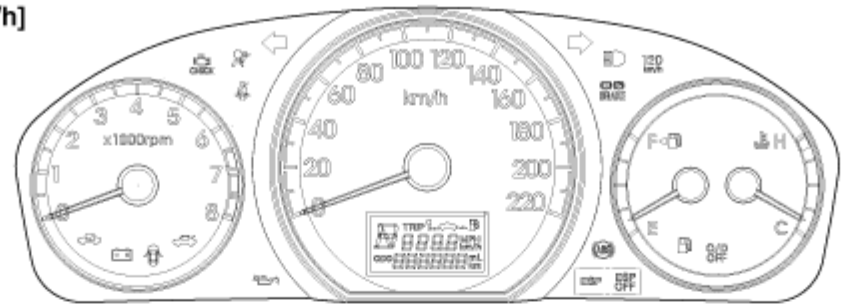


1. Cluster assembly	6. Brake fluid level warning switch
2. Seat belt switch	7. Parking brake switch
3. Vehicle speed sensor	8. Door switch
4. Engine coolant temperature sender	9. Fuel gauge sender
5. Oil pressure switch	10. Tailgate switch

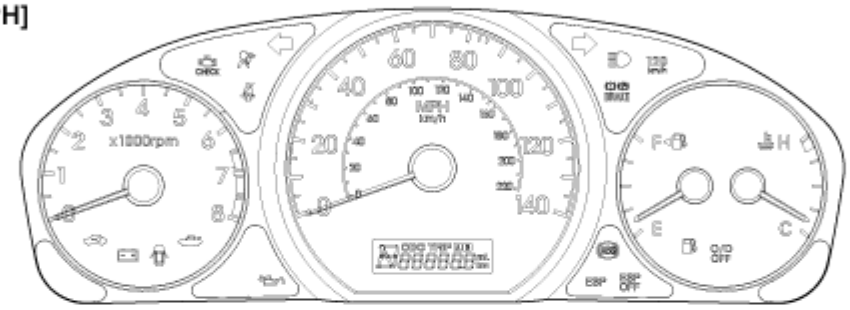
Components

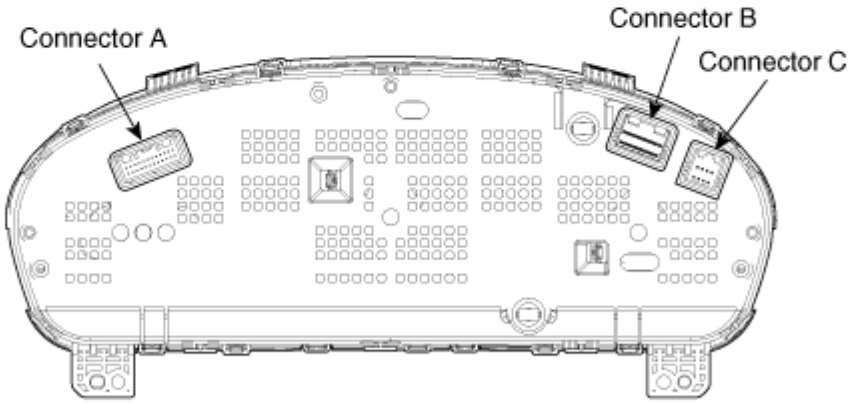
[GASOLINE]

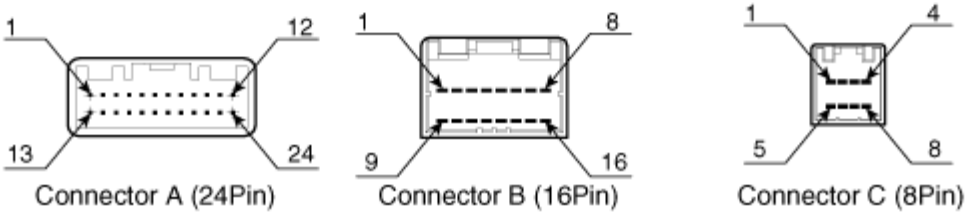
[km/h]



[MPH]

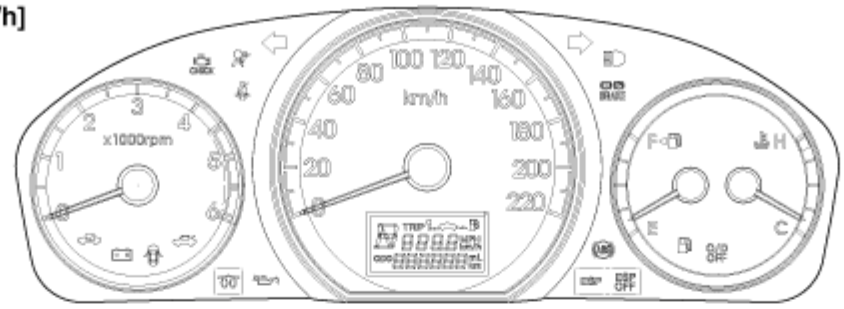




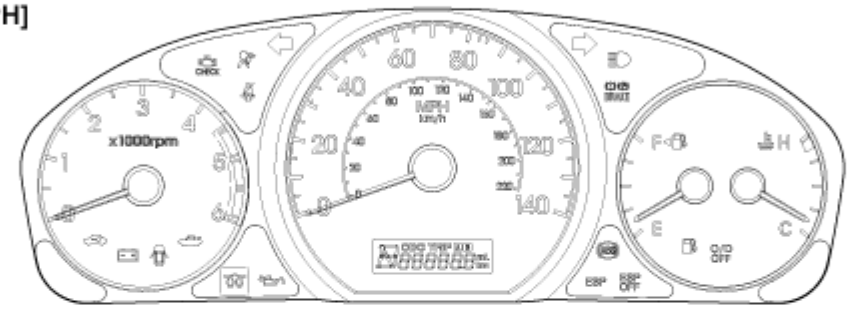


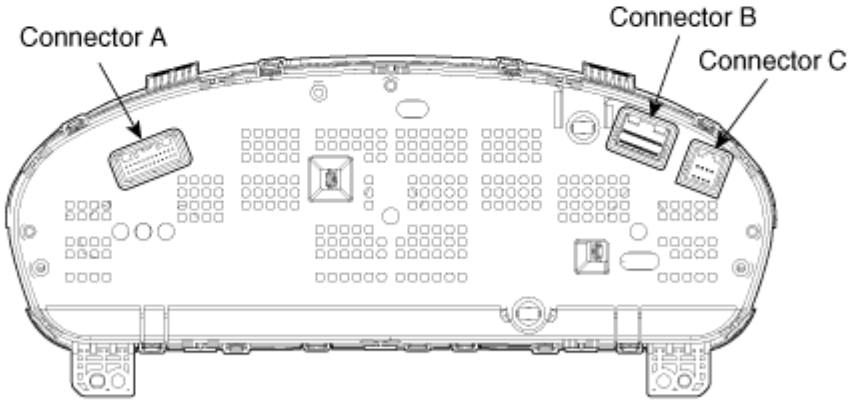
[DIESEL]

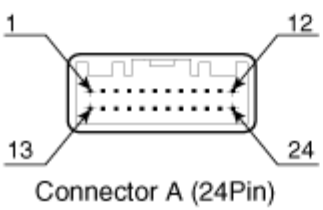
[km/h]



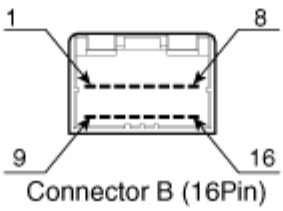
[MPH]



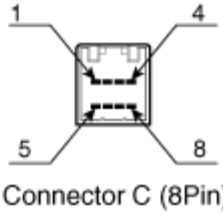




Connector A (24Pin)



Connector B (16Pin)



Connector C (8Pin)

Instrument Cluster

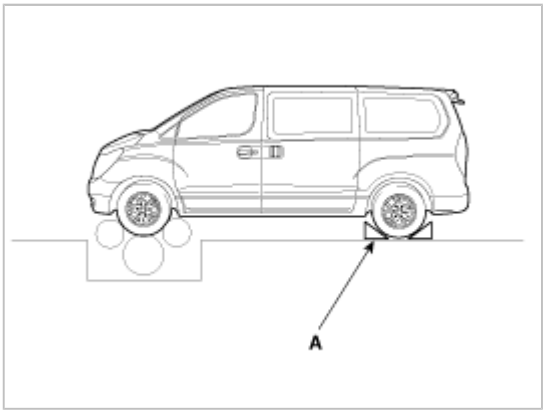
No	Connector A	Connector B	Connector C

1	Brake	Check engine	N
2	Feul Signal	Seat Belt	R
3	Fuel GND	Air bag (-)	P
4	ABS/EBD signal	Air bag (+)	-
5	Trip mode SW	Turn L	D
6	Trip SW GND	Glow	2-
7	-	Tailgate open	L
8	ILL (+)	Door	PWM
9	ILL (-)	B (+)	
10	Over speed signal	Tacho signal	
11	Oil press	IGN1 (+)	
12	-	Speed signal	
13	Over speed IND	Micom GND (-)	
14	High beam (+)	Injection signal	
15	High beam (-)	Immobilizer	
16	Trun R	Charge	
17	Power GND (-)		
18	-		
19	Temp signal		
20	-		
21	ESP OFF		
22	ESP OFF		
23	O/D OFF		
24	Water seperator		

Inspection

Speedometer

1. Adjust the pressure of the tires to the specified level.
2. Drive the vehicle onto a speedometer tester. Use wheel chocks(A) as appropriate.



3. Check if the speedometer indicator range is within the standard values.

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

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

[km/h - Except Australia]

Velocity (km/h)	20	40	60	80	100	
Tolerance (km/h)	+3.8 +0.8	+4.6 +1.6	+5.3 +2.3	+6.1 +3.1	+6.9 +3.9	AT
Tolerance (km/h)	+4.0 +1.0	+5.0 +2.0	+5.9 +2.9	+6.9 +3.9	+7.9 +4.9	MT
Velocity (km/h)	120	140	160	180	220	
Tolerance (km/h)	+7.7 +4.7	+8.4 +5.4	+9.2 +6.2	+10.0 +7.0	+11.5 +8.5	AT
Tolerance (km/h)	+8.9 +5.9	+9.9 +6.9	+10.8 +7.8	+11.8 +8.8	+13.8 +10.8	MT

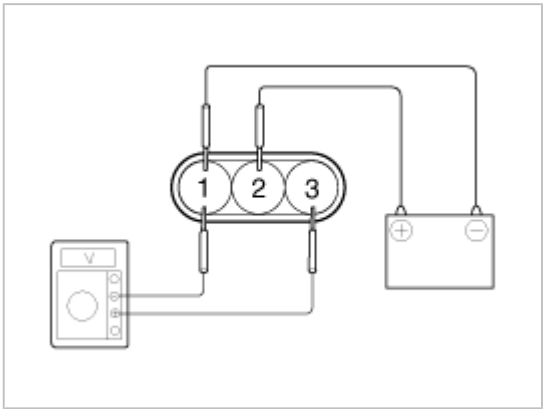
[Mph]

Velocity (MPH)	20	40	60	80	

Tolerance (MPH)	+2.8 +0.8	+3.5 +1.5	+4.3 +2.3	+5.1 +3.1	AT
Tolerance (MPH)	+3.0 +1.0	+4.0 +2.0	+4.9 +2.9	+5.9 +3.9	MT
Velocity (MPH)	100	120	140	-	
Tolerance (MPH)	+5.9 +3.9	+6.6 +4.6	+7.4 +5.4	-	AT
Tolerance (MPH)	+6.9 +4.9	+7.9 +5.9	+8.8 +6.8	-	MT

Vehicle Speed Sensor

1. Connect the positive (+) lead from battery to terminal 2 and negative (-) lead to terminal 1.
2. Connect the positive (+) lead from tester to terminal 3 and the negative (-) lead to terminal 1.
3. Rotate the shaft.
4. Check that there is voltage change from approx. 0V to 11V or more between terminals 3 and 1.
5. The voltage change should be 4 times for every revolution of the speed sensor shaft.
   If operation is not as specified, replace the sensor.



Tachometer

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

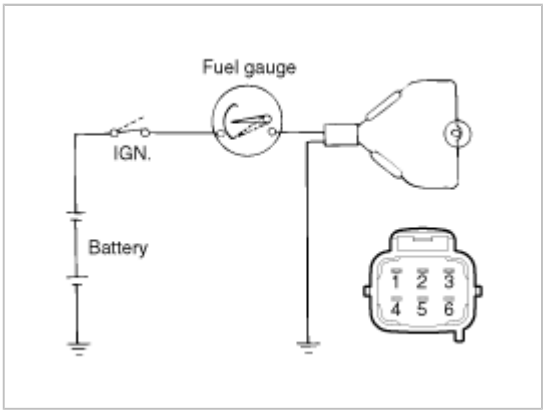
1) Reversing the connections of the tachometer will damage the transistor and diodes inside.
2) When removing or installing the tachometer, be careful not to drop it or subject it to severe shock.

Revolution	1,000	2,000	3,000	4,000	Remark

(rpm)					
Tolerance (rpm)	±100	±125	±150	±150	Gasoline
Tolerance (rpm)	±100	±125	±150	±170	Diesel
Revolution (rpm)	5,000	6,000	7,000	-	Remark
Tolerance (rpm)	±150	±180	±210	-	Gasoline
Tolerance (rpm)	±150	±180	-	-	Diesel

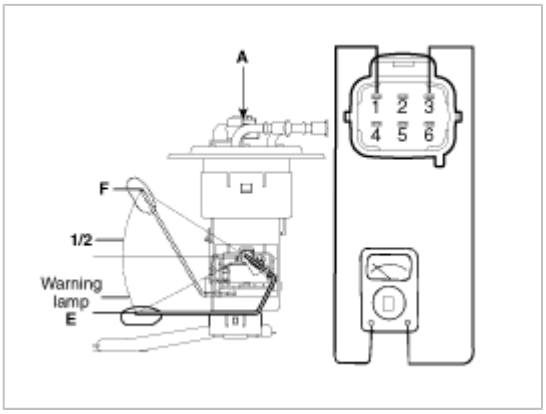
Fuel Gauge

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



Fuel Gauge Sender

1. Using an ohmmeter, measure the resistance between terminals 1 and 3 of sender connector (A) at each float level.



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

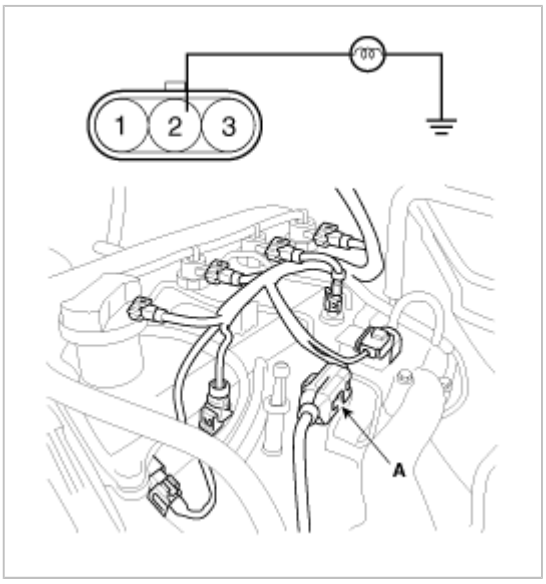
Position	Resistance(Ω)
E	183 ± 1Ω
Warning lamp	175 ± 1Ω
1/2	99 ± 1Ω
Sender (F)	15 ± 1Ω

3. If the height resistance is unsatisfied, replace the fuel sender as an assembly.

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

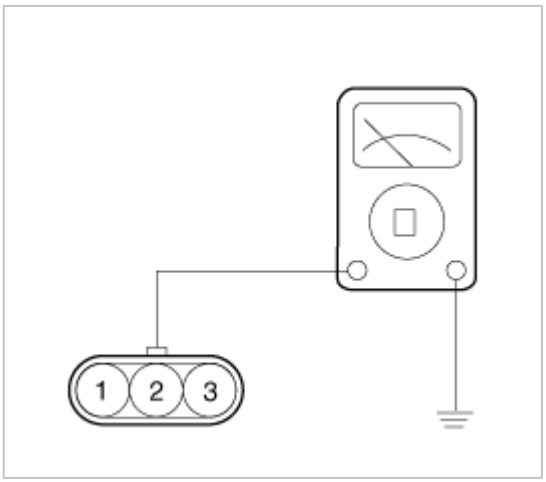
Engine Coolant Temperature Gauge

1. Disconnect the wiring connector (A) from the engine coolant temperature sender in the engine compartment.
2. Connect a 12V, 3.4 wattages test bulb between the harness side connector 2 terminal and ground.
3. Turn the ignition switch ON.
4. Verify that the test bulb flashes and that the indicator moves to HOT position.
   If operation is not as specified, replace the cluster (Engine coolant temperature gauge). Then recheck the system.



Engine Coolant Temperature Sender

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



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

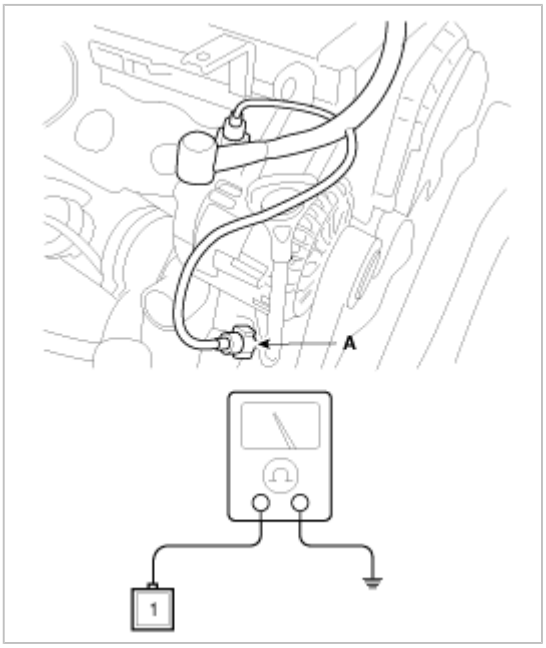
Temp ℉(℃)	122 (50)	185 (85)	230 (110)	261 (127.4)	E/G
Resistance (Ω)	140.5	53.8	22.5	17.1	Gasoline
Temp ℉(℃)	120 (49)	160 (71)	230 (110)	261 (127.4)	E/G
Resistance (Ω)	195	80.5	22.5	17.1	Diesel

Oil Pressure Switch

1. Check that there is continuity between the oil pressure switch (A) terminal and ground with the engine

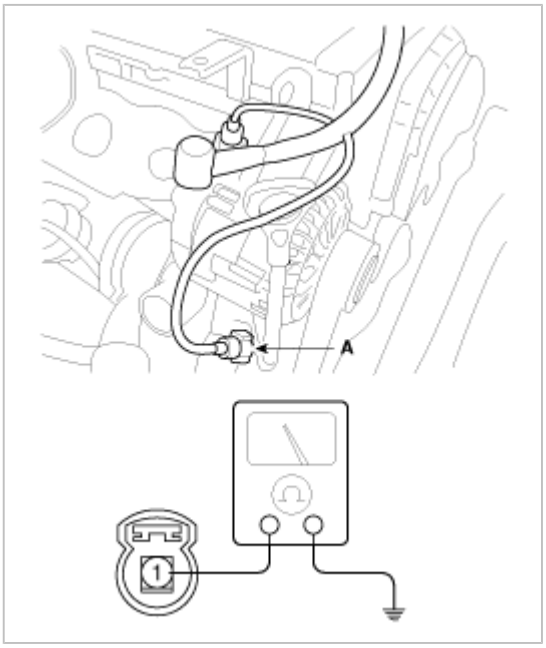
off.

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



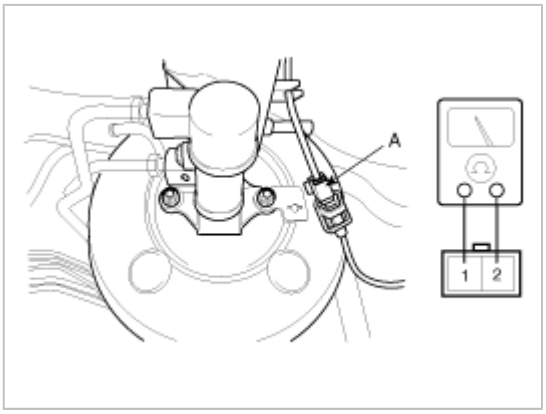
Oil Pressure Warning Lamp

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



Brake Fluid Level Warning Switch

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



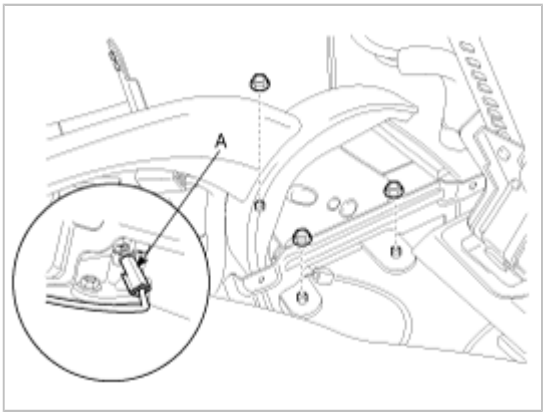
Brake Fluid Level Warning Lamp

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

Parking Brake Switch

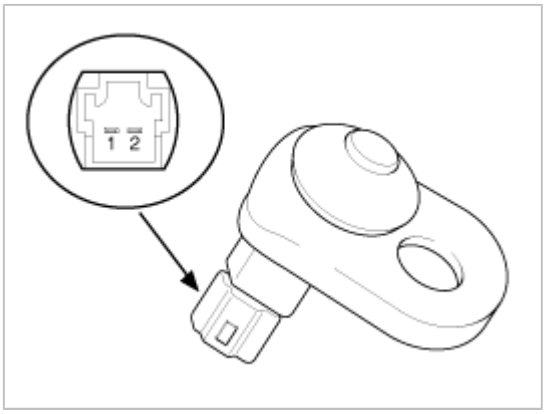
The parking brake switch is a pull type. It is located at the side of the parking brake lever.

1. Check that there is continuity between the terminal and switch body with the switch (A) ON.
2. Check that there is no continuity between the terminal and switch body with the switch OFF.
   If continuity is not as specified, replace the switch or inspect its ground connection.



Door Switch

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

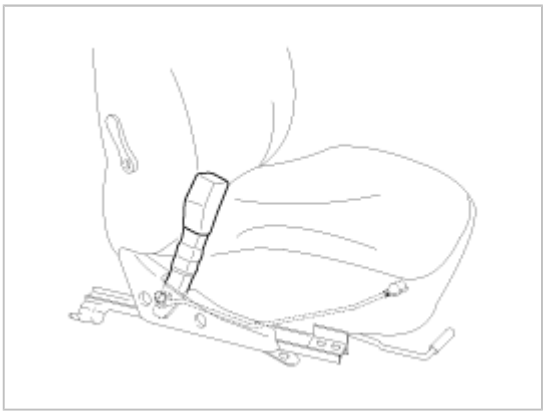


Terminal / Position	1	2	Body (Ground)
Free(Door open)	○	○	○
Push(Door close)			

Seat Belt Switch

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

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



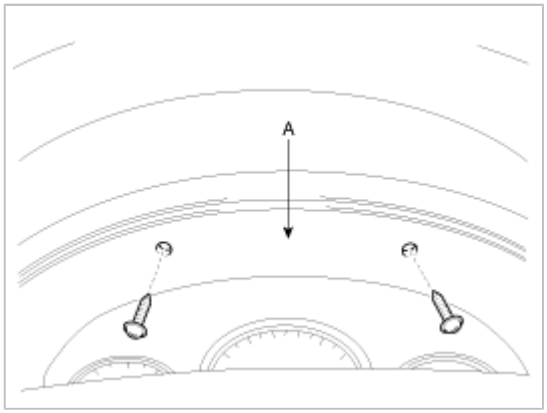
Seat Belt Warning Lamp

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

Seat belt condition	Warning lamp
Fastened	OFF
Not fastened	ON

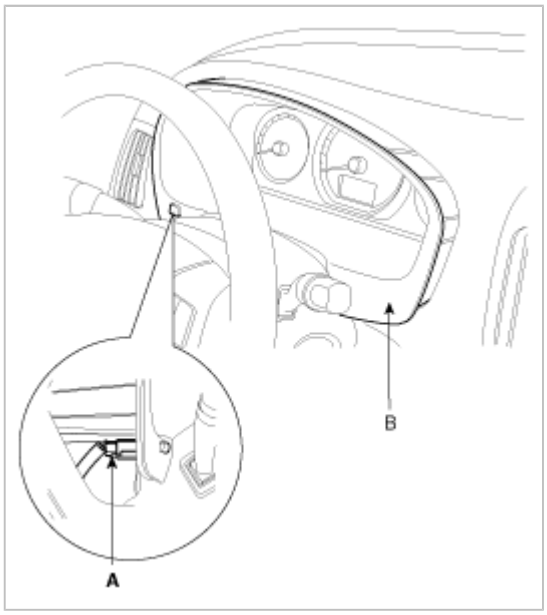
Trip Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel (A) after loosening 2 screws.(Refer to the Body group - " Crash pad")

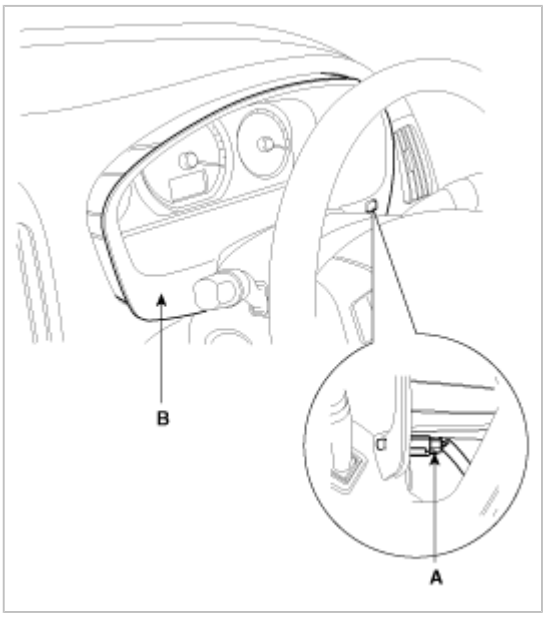


3. Remove the trip switch (A) from the cluster facia panel (B).

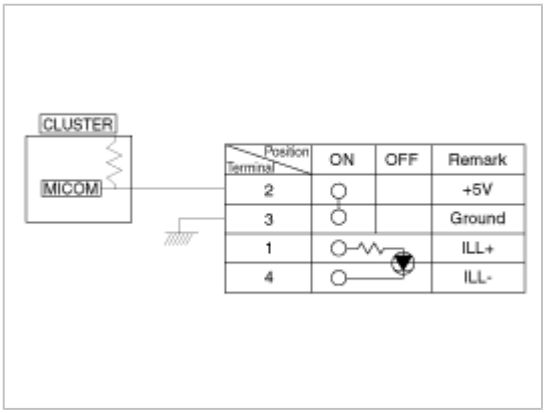
[LHD]



[RHD]



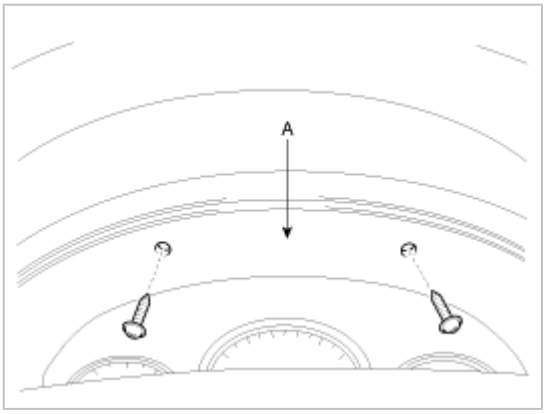
4. Check for continuity between the terminals in each switch position according to the table.



Position / Terminal	ON	OFF	Remark
2	○		+5V
3	○		Ground
1	○—∿—●		ILL+
4	○——●		ILL-

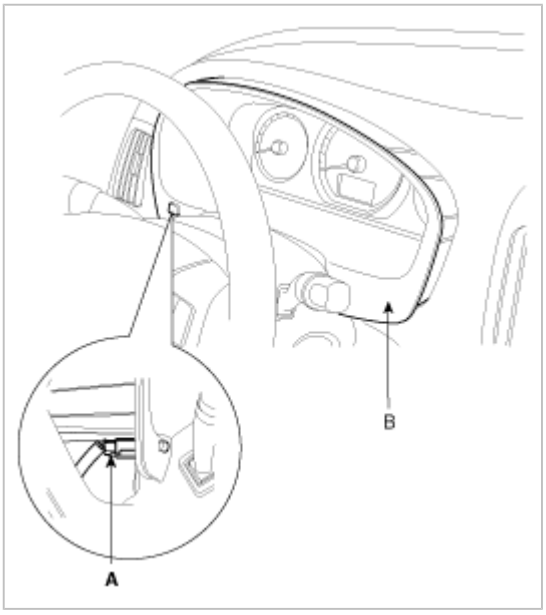
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster fascia panel (A) after loosening 2 screws.
   (Refer to the Body group - "Crash pad")

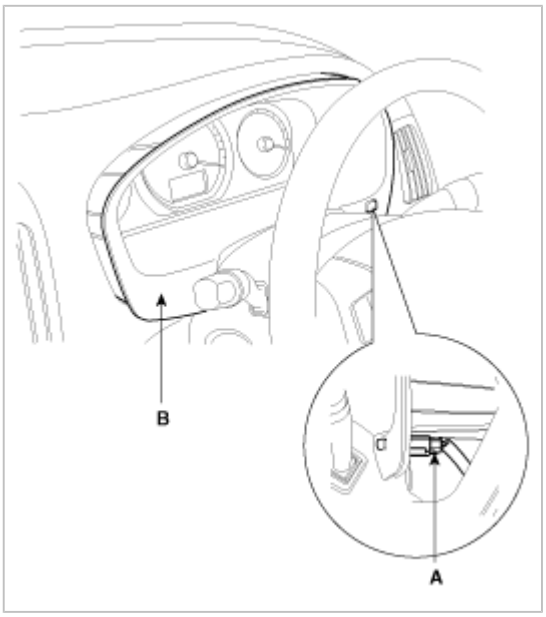


3. Disconnect the trip computer switch connector (A) from the cluster fascia panel (B).

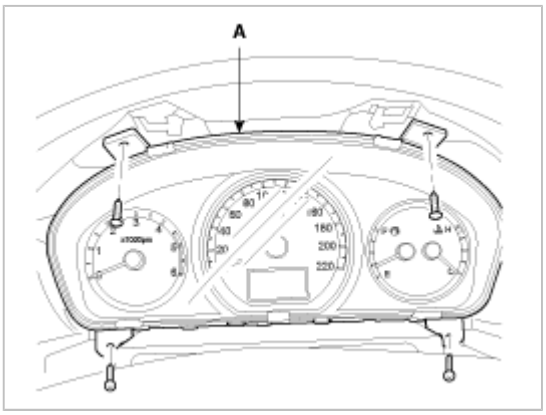
[LHD]



[RHD]



4. Remove the cluster fascia (A) from the housing after removing 4 screws.



5. Disconnect the cluster fascia connecters and then remove the cluster.

Installation

1. Connect the cluster connector.
2. Install the cluster assembly.
3. Connect the trip switch connector.
4. Install the center facia panel.

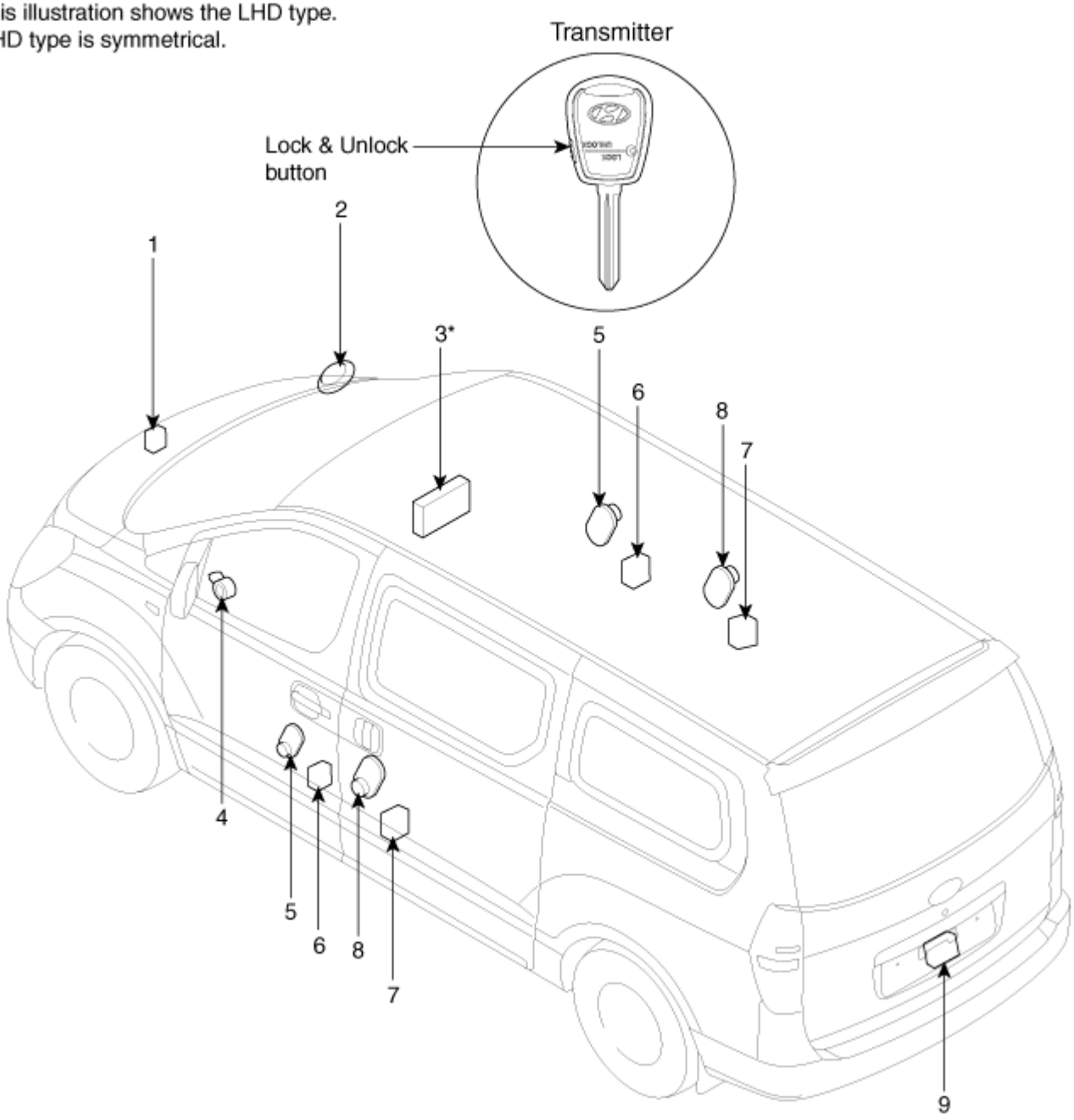
Troubleshooting

Symptom	Possible cause	Remedy
Speedometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Speedometer faulty	Check speedometer
	Vehicle speed sensor faulty	Check vehicle speed sensor
	Wiring or ground faulty	Repair if necessary
Tachometer does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Tachometer faulty	Check tachometer
	Wiring or ground faulty	Repair if necessary
Fuel gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Fuel gauge faulty	Check gauge
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Low fuel warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Fuel sender faulty	Check fuel sender
	Wiring or ground faulty	Repair if necessary
Water temperature gauge does not operate	Cluster fuse (10A) blown	Check for short and replace fuse
	Water temperature gauge faulty	Check gauge
	Water temperature sender faulty	Check sender
	Wiring or ground faulty	Repair if necessary
Oil pressure warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Oil pressure switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Parking brake warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Brake fluid level warning switch faulty	Check switch
	Parking brake switch faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Open door warning lamp and tailgate warning lamp do not light up	Memory fuse (15A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Door switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Seat belt warning lamp does not light up	Cluster fuse (10A) blown	Check for short and replace fuse
	Bulb burned out	Replace bulb
	Seat belt switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.



1. Hood switch	6. Front door lock actuator & switch
2. Burglar horn	7. Rear door lock actuator & switch
3. Body control module	8. Rear door switch
4. Key warning switch	9. Trunk Lid actuator & switch

5. Front door switch	

Description

Burglar Alarm System

The burglar alarm system is armed automatically after the doors, hood, and tailgate are closed and locked. The system is set off when any of these things occur :

- A door is forced open.
- The tailgate is opened.
- The hood is opened.

When the system is set off, the alarm sounds and the hazard lamp flash for about 30 seconds or until the system is disarmed by unlocking the transmitter or door key.

For the system to arm, the ignition switch must be off and the key removed. Then, the body control module must receive signals that the doors, hood, and tailgate are closed and locked. When everything is closed and locked, none of the control unit inputs are grounded.

The door switches, hood switch and tailgate switch are all close and lock the doors with the remote transmitter and then the system arms after 30s.

If anything is opened after the system is armed, the body control module gets a ground signal from that switch, and the system is set off.

If one of the switches is misadjusted or there is a short in the system, the system will not arm. As long as the body control module continues to get a ground signal, it thinks the vehicle is not closed and locked and will not arm.

Keyless Entry System

The burglar alarm system is integrated with the keyless entry system. The keyless entry system allows you to lock and unlock the vehicle with the remote transmitter. When you push the LOCK button, all doors lock. When you push the UNLOCK button again, all doors unlock.

The room lamp, if its switch is in the center position, will come on when you press the UNLOCK button. If you do not open a door, the light will go off in about 30 seconds, the doors will automatically relock, and the burglar alarm system will rearm. If you relock the doors with the remote transmitter within 30 seconds, the light will go off immediately.

You cannot lock or unlock the doors with the remote transmitter if the key is in the ignition switch.

The system will signal you when the doors lock and unlock by flashing the hazard lamp once when they lock and closed, and twice when they unlock.

Function

Keyless Entry Function

DOOR LOCK / UNLOCK are performed with remocon

1. Keyless entry function is performed in a state that key in SW is eliminated from key cylinder
2. LOCK / UNLOCK signals are received from the transmitter and DOOR LOCK / UNLOCK signals are output.

Transmitter(tx) Spec

1. Transmission Distance : 30m or more from outside of the car
2. Registration procedure of the transmitter

(1) In registration mode, it shall be possible to register up to Max 4EA (Scan tool) / Max.2EA (Code saving unit).

(2) At re-registration, data are registered newly after deleting the previous TX DATA

No.	Saved CODE	CODE to change	Changed CODE
1	-	A	A
2	A	B	B (A is deleted)
3	A, B	C	C
4	A, B	C, D	C, D
5	A, B	C, C, D	C, D (Using scan tool) C (Using code saving unit)
6	A, B, C, D	A	A (Using scan tool)
7	A, B, C, D	B	B (Using scan tool)

(3) For the registration procedures by using Hi-scan tool, refer to "TRANSMITTER CODE REGISTRATION".

3. Transmitter signal Φ Receiver Spec

(1) Transmission signal

A. Transmit relevant transmission DATA (Transmission frame) twice by pushing TX SW.

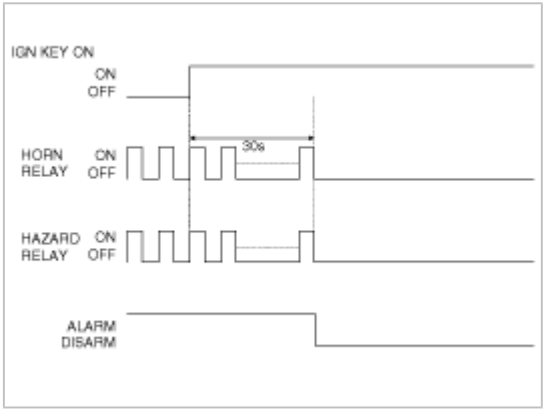
B. Only LOCK signal is output when pushing TX LOCK SW and UNLOCK SW at the same time.

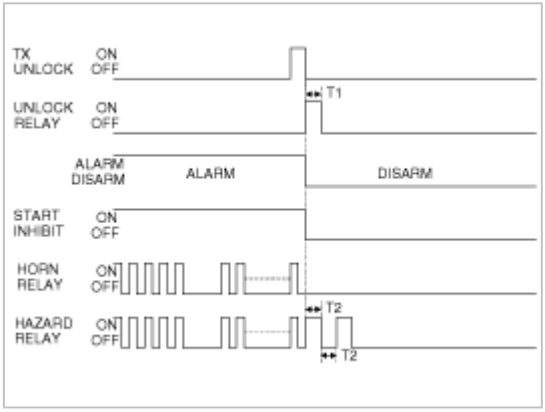
Inspection

Disarm

Condition 1

State	Description
InitialCondition	ALARM state
Event	• IGN KEY ON during 30sec(EXCEPTCHINA) • IGN KEY ON & ALT"L"ON during 3sec(EXCEPTCHINA) • TX Unlock & Any Door open(4DOORSW ON) • TX Lock & Lock confirm Failed
Action	• The state goes to DISARM state • Hazard Relay off, Horn Relay off, Start INH Relay off • TX Unlock-Unlock - Relay on for 0.5sec - Hazard Relay on (2 times)





T1,T2 : 0.5s ± _0.1s

Condition 2

State	Description

Initial Condition	DISARM state & (IGN KEY OUT) & Any Door open
Event	• TX Unlock
Action	• No state change • TX UNLOCK - Unlock Relay on for 0.5sec - Hazard Relay on (2 times)

Condition 3

State	Description
Initial Condition	ARMWAIT state
Event	• At least one entrance opened • Any door is unlocked • Key In SW on
Action	• The state goes to DISARM state

Condition 4

State	Description
Initial Condition	AUTOLOCKTIMER1 state
Event	• At least one entrance opened • Key In SW on • Lock by AUTOLOCK, but Lock confirmation failure • Tx Lock, but Lock confirmation failure
Action	• The state goes to DISARM state

Condition 5

State	Description
Initial Condition	AUTOLOCKTIMER2 state
Event	• Any Door open • Key In SW on • Lock by AUTOLOCK, but Lock confirmation failure • Tx Lock, but Lock confirmation failure
Action	• The state goes to DISARM state

Condition 6

State	Description
Initial Condition	ARM state
Event	• IGN KEY ON(EXCEPT CHINA)
Action	• The state goes to DISARM state

Condition 7

State	Description
Initial Condition	REARM state
Event	• IGN KEY ON during 30sec(EXCEPT CHINA) • IGN KEY ON & ALT "L" ON during 3sec(EXCEPT CHINA) • Tx Lock, but Lock confirmation failure
Action	• The state goes to DISARM state • Start INH Relay off

Condition 8

State	Description
Initial Condition	PREARM state
Event	• Key In SW on • All entrance closed & Any Door is unlocked • Any Door open & Tx Unlock
Action	• The state goes to DISARM state • TX UNLOCK - Unlock Relay on for 0.5sec • Hazard Relay on (2 times)

Condition 9

State	Description
Initial Condition	3S TIMER state
Event	• Key In SW on • Any Door open & Tx Unlock
Action	• The state goes to DISARM state • TX UNLOCK - Unlock Relay on for 0.5sec • Hazard Relay on (2 times)

Arm

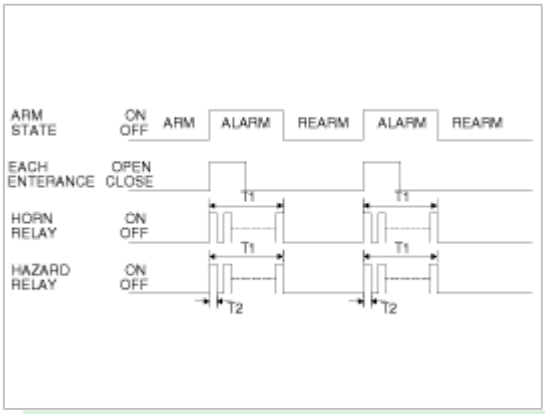
Condition 1

State	Description
Initial Condition	ARMWAIT state
Event	• ARMWAITTIMER is expired
Action	• The state goes to ARM state

Alarm

Condition 1

State	Description
Initial Condition	ARM state
Event	• Any entrance open(4DOOR or HOOD) • IGN KEY IN, IGN1 ON, IGN2 ON(CHINA ONLY)
Action	• The state goes to ALARM state - The horn is ON one time for 27sec(±2sec) • The hazard is driven also (During Horn driving) • Engine Start Inhibit is ON

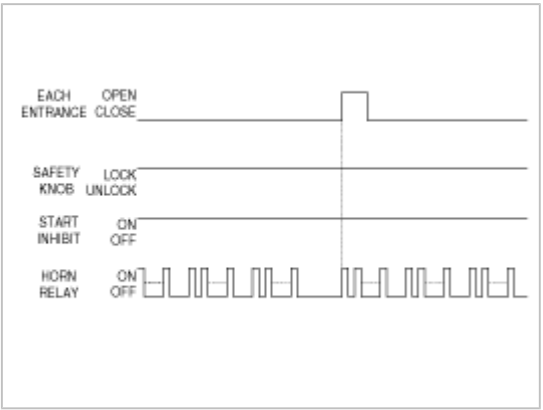


Horn Output : Period : 1sec(Can be calibrated Horn Period), 50% Duty

Condition 2

State	Description
Initial Condition	REARM state
Event	• Any door open or Hood open or Tailgate open

Action	• The state goes to ALARM state - The horn is ON one time for 27sec(±2sec) • The hazard is driven also (During Horn driving)



Armwait Mode

Condition 1

State	Description
Initial Condition	DISARM state & IGN KEY OUT & All entrances closed(4DOOR and HOOD)
Event	• Tx Lock & locked confirmed
Action	• The state goes to ARMWAIT State • Start ARMWAITTIMER • Hazard Relay 1 time on(1sec)

Condition 2

State	Description
Initial Condition	ALARM state & All entrances closed(4DOOR and HOOD)
Event	• Tx Lock & locked confirmed
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Horn Relay off • Start INH Relay off • Hazard Relay 1time on(1sec)

Condition 3

State	Description
Initial Condition	AUTOLOCKTIMER1 state

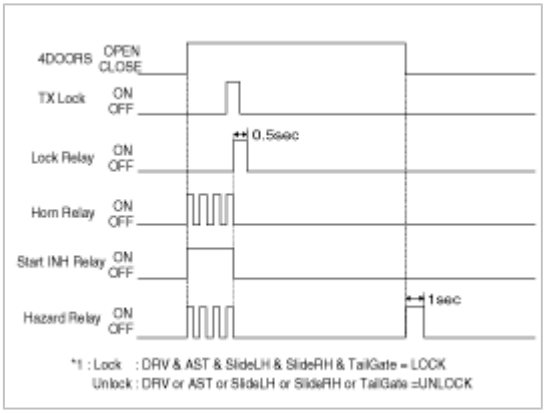
Event	• AUTO LOCK confirmed • Tx Lock & locked confirmed
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Hazard Relay 1time on(1sec)

Condition 4

State	Description
Initial Condition	PREARM state
Event	Hood and 4door are closed & 4doors locked
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Hazard Relay 1time on(1sec)

Condition 5

State	Description
Initial Condition	REARM state
Event	• Tx Lock & locked confirmed
Action	• The state goes to ARMWAIT state • Start ARMWAITTIMER • Start INH Relay off • Hazard Relay 1time on(1sec) -EXCEPT M_LOCK



Rearm Mode

Condition 1

State	Description

Initial Condition	ALARM state
Event	All entrance is closed & Alarm Patten finished
Action	The state goes to REARM state

Autolock Timer1 Mode

Condition 1

State	Description
Initial Condition	ARM state
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard Relay 2 times on(0.5s ON/0.5s OFF)

Condition 2

State	Description
Initial Condition	AUTOLOCKTIMER1 state
Event	• Timer is expired
Action	• The state goes to State • Tx Unlock - Hazard Relay 2 times on(0.5s ON/0.5s OFF) - Restart AUTOLOCKTIMER1 • Expire AUTOLOCKTIMER1 - AUTOLOCK

Condition 3

State	Description
Initial Condition	ARMWAIT state
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazrd Relay 2 times on(0.5s ON/0.5s OFF)

Condition 4

State	Description

Initial Condition	DISARM state & All entrances closed(DOORS, HOOD & TRUNK) & IGN KEY OUT
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazard Relay 2 times on(0.5s ON/0.5s OFF)

Condition 5

State	Description
Initial Condition	ALARM state & All entrances are closed(DOORS, HOOD & TRUNK)
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Hazrd Relay 2 times on(0.5s ON/0.5s OFF) • Start INH Relay off • Horn Relay off

Condition 6

State	Description
Initial Condition	REARM state
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER1 state • Start AUTOLOCKTIMER1 • Start INH Relay off • Hazrd Relay 2 times on(0.5s ON/0.5s OFF)

Autolock Timer2 Mode
Condition 1

State	Description
Initial Condition	3S TIMER
Event	• CONDITION2 & UNLOCK
Action	• The state goes to AUTOLOCKTIMER2 state • Start AUTOLOCKTIMER2 • Hazard Relay 2 times on(0.5s ON/0.5s OFF)

Condition 2

State	Description
Initial Condition	AUTOLOCKTIMER2 state
Event	• Timer is expired • Tx Unlock
Action	• No State change • Tx Unlock - Hazard Relay 2 times on(0.5s ON/0.5s OFF) - The timer restart • Expire AUTOLOCKTIMER2 - AUTOLOCK

Condition 3

State	Description
Initial Condition	DISARM state & 4Doors are closed & HOOD is opened) & IGN KEY OUT
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER2 state • Start AUTOLOCKTIMER2 • Hazrd Relay 2 times on(0.5s ON/0.5s OFF)

Condition 4

State	Description
Initial Condition	ALARM state & All Door are closed & (HOOD or TRUNK is opened)
Event	• Tx Unlock
Action	• The state goes to AUTOLOCKTIMER2 state • Start AUTOLOCKTIMER2 • Start INH Relay off • Horn Relay off • Hazrd Relay 2 times on(0.5s ON/0.5s OFF)

Condition 5

State	Description
Initial Condition	PREARM state All Doors are closed & (HOOD or TailGate is opened)
Event	• Tx Unlock
	•

Action	The state goes to AUTOLOCKTIMER2 state • Start AUTOLOCKTIMER2 • Hazard Relay 2 times on(0.5s ON/0.5s OFF)

3S Timer Mode
Condition 1

State	Description
Initial Condition	PREARM state & FINAL SLIDING DOOR OPEN
Event	• FINAL SLIDING DOOR CLOSED
Action	• The state goes to 3S TIMER state • 3S TIMER START

Prearm Mode
Condition 1

State	Description
Initial Condition	AUTOLOCKTIMER2 state
Event	• AUTOLOCK confirmed • Tx Lock & locked confirmed
Action	• The state goes to PREARM state

Condition 2

State	Description
Initial Condition	DISARM state & IGN KEY OUT
Event	• ((4Door Not Closed ON) or (Hood SW ON)) & Tx Lock & Locked confirmed
Action	• The state goes to PREARM state

Condition 3

State	Description
Initial Condition	ALARM state & At least one entrance opened
Event	• Tx Lock & Locked confirmed
Action	• The state goes to PREARM state • Start INH Relay off • Horn Relay off • Hazrd Relay 1 times on(1sec)

Condition 4

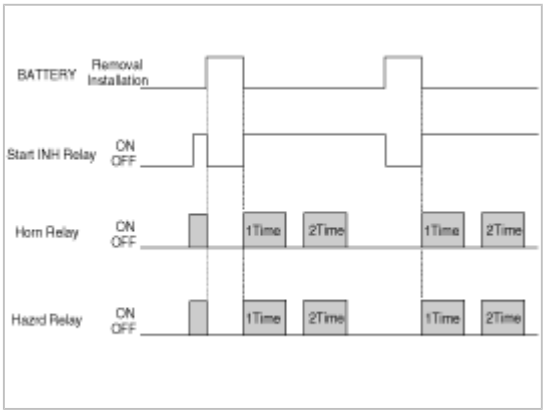
State	Description
Initial Condition	3S TIMER state
Event	• ALL DOORS LOCKED • 3S TIMER EXPIRED
Action	• The state goes to PREARM state

Reset

1. In case of removing Battery at the state of ALARM

Condition

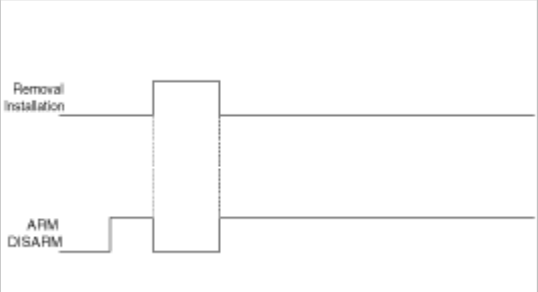
State	Description
Initial Condition	During ALARM, REARM
Event	• BATTERY removal(Cold or Warm RESET)
Action	• The state goes to ALARM mode • Horn Relay ON (No remained time of warning signal) • Hazard Relay ON (Same time with Horn Relay ON)



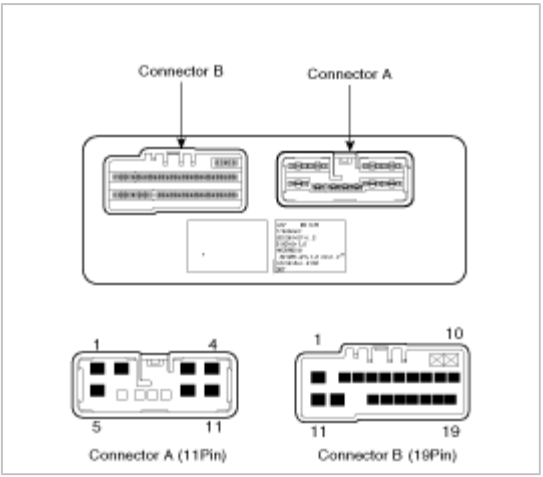
1. In case of removing Battery at the state of ARM

Condition

State	Description
Initial Condition	ARM state
Event	• BATTERY removal(Cold or Warm RESET)
Action	• The state goes to ARM mode • Keep the state of ARM



Inspection



Burglar Alarm Horn Relay

Check for continuity between the terminals.

1. There should be continuity between the No.6 and No.8 terminals when power and ground are connected to the No.6 and No.7 in the ICM-A.
2. There should be no continuity between the No.6 and No.8 terminals when power is disconnected.

Burglar Alarm Relay

Check for continuity between the terminals.

1. There should be continuity between the No.3 and No.10 terminals when power and ground are connected to the No.9 and No.10 terminals in the ICM-A.
2. There should be no continuity between the No.3 and No.10 terminals when power is disconnected.

Hazard Lamp Relay

Check for continuity between the terminals.

1. There should be continuity between the No.5 (or 14) and No.15 terminals when power and ground are connected to the No.6 and No.15 terminals in the ICM-B.
2. There should be no continuity between the No.5 (or 14) and No.15 terminals when power is disconnected.

Door Lock/unlock Relay

Check for continuity between the terminals.

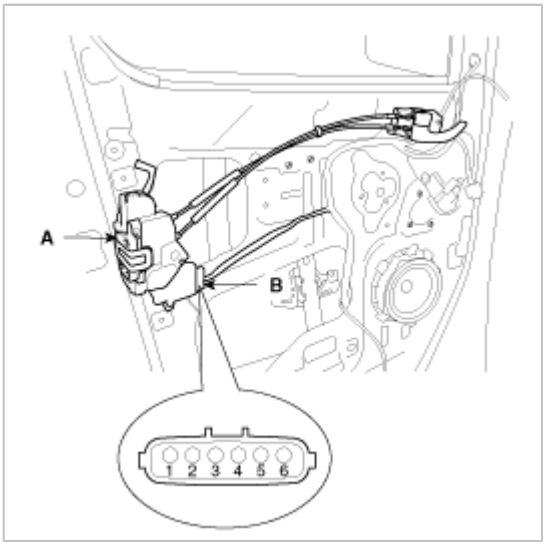
1. There should be continuity between the No.1 and No.11 terminals when power and ground are connected to the No.1 and No.2 terminals in the ICM-B.

2. There should be no continuity between the No.1 and No.11 terminals when power is disconnected.

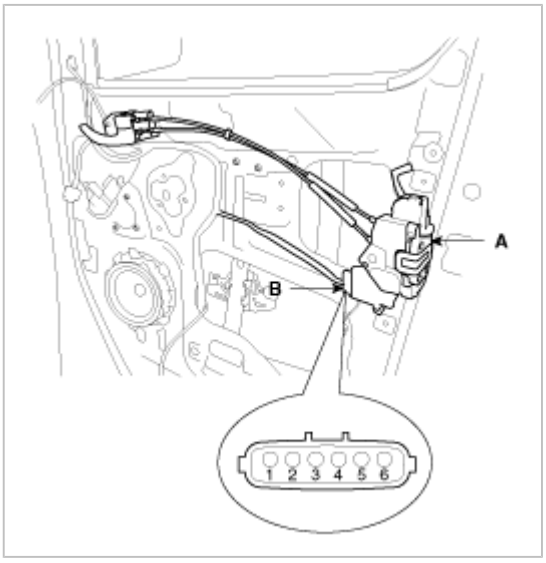
Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



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

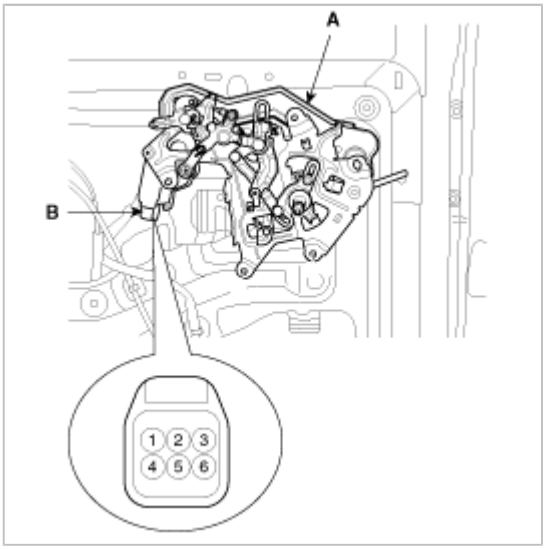
( ) : RHD

Position \ Terminal		5(2)	6(1)
Front left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		2(5)	1(6)
Front right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

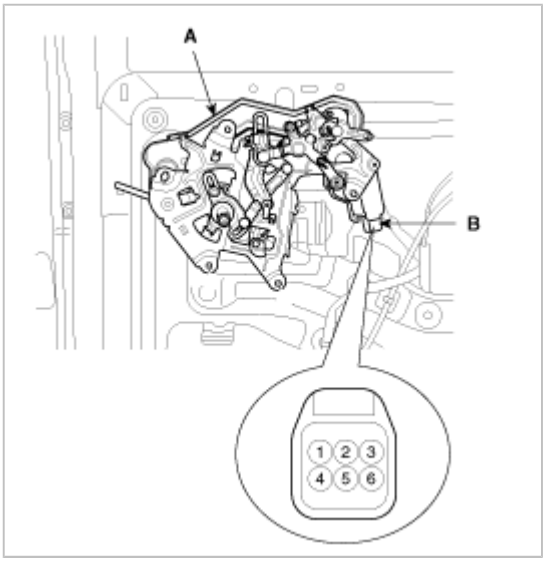
Rear Slide Door Lock Actuator

1. Remove the rear door trim.
   (Refer to the Body group - Rear door)
2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



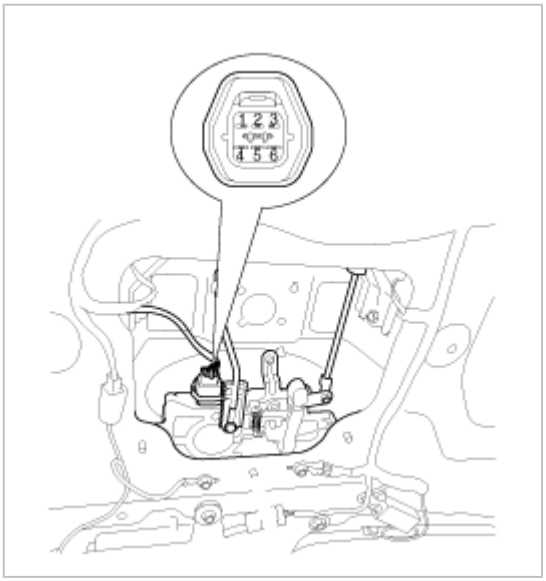
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

( ) : RHD

Position \ Terminal		1(3)	2(2)
Rear left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		3(1)	2(2)
Rear right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.



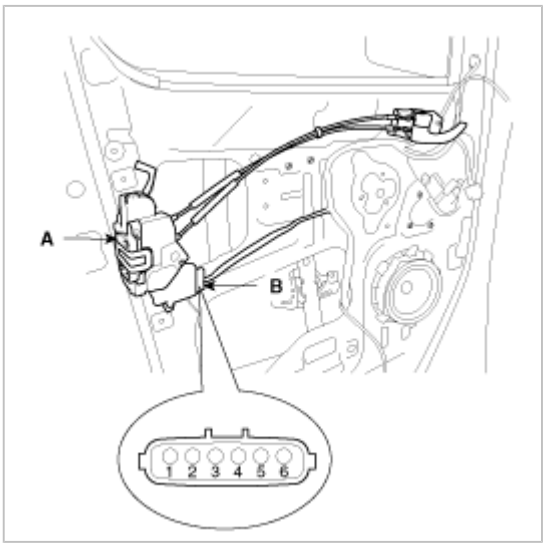
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	4	6
Unlock	⊕	⊖
Lock	⊖	⊕

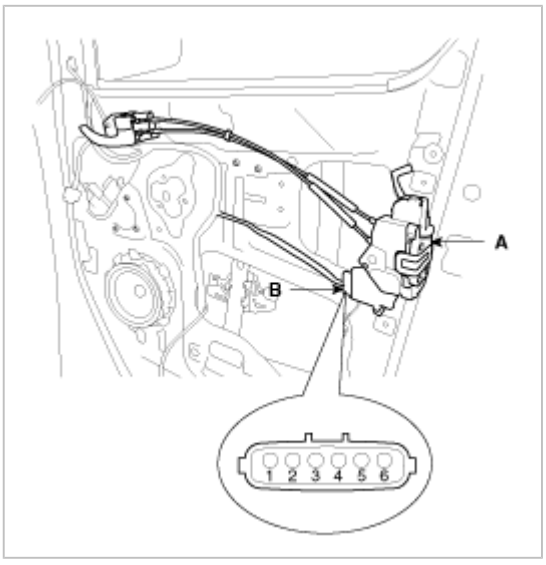
Front Door Lock Switch

1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



3. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

( ) : RHD

Position \ Terminal		4(3)	3(4)	2(5)
Front left	UNLOCK	○	○	
	LOCK		○	○
Position \ Terminal		**3(4)**	**4(3)**	**5(2)**
Front right	UNLOCK	○	○	
	LOCK		○	○

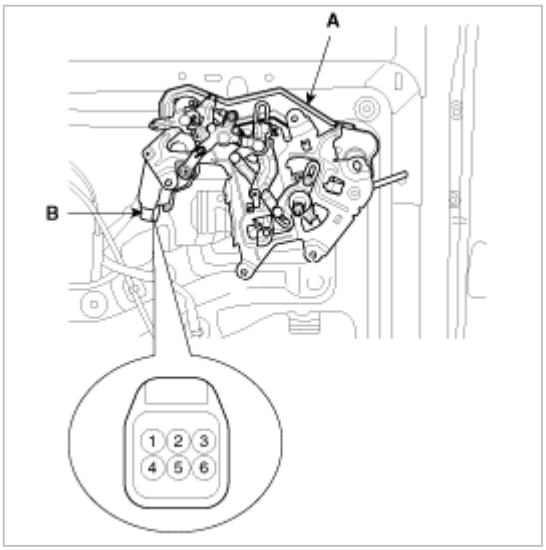
Rear Slide Door Lock Switch

1. Remove the rear door trim.

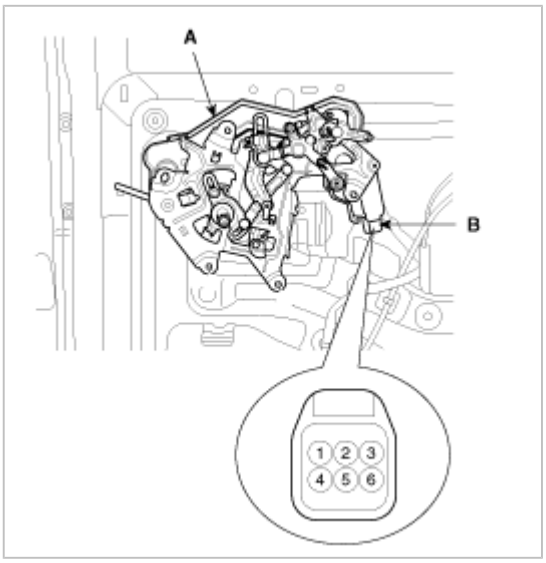
(Refer to the Body group - Rear door)

2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



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

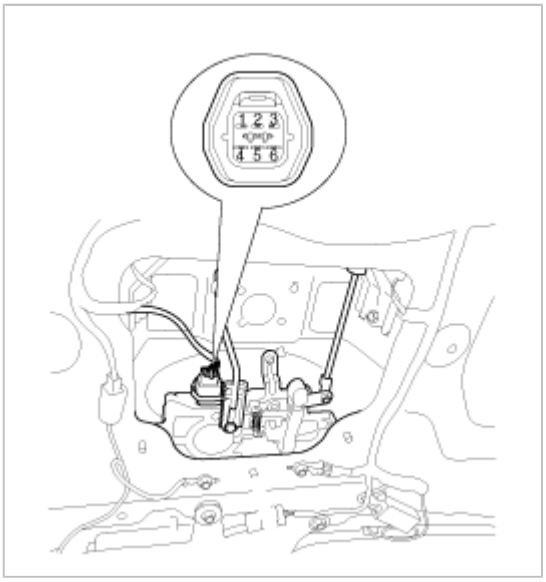
( ) : RHD

Position \ Terminal		5(5)	6(4)
Rear left	Lock		
	Unlock	○———	———○

Position \ Terminal		5(5)	4(6)
Rear right	Lock		
	Unlock	○———	———○

Tailgate Switch

1. Remove the tailgate trim. (Refer to the Body group - Tailgate)
2. Disconnect the 6P connector from the actuator.

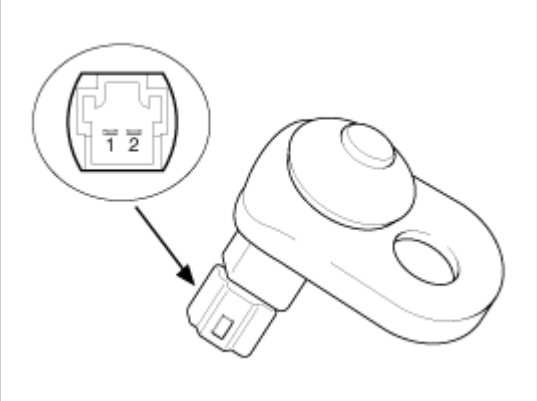


3. Check for continuity between the terminals in each switch position according to the table.

Position \ Terminal	1	2	3
Lock		○———	———○
Unlock	○———	———○	

Door Switch

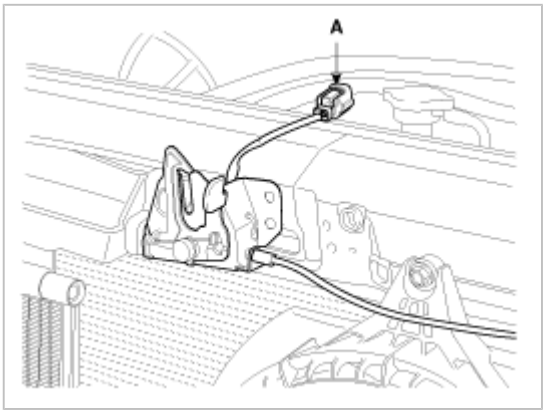
Remove the door switch and check for continuity between the terminals.



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

Hood Switch

1. Disconnect the connector from the hood switch (A).

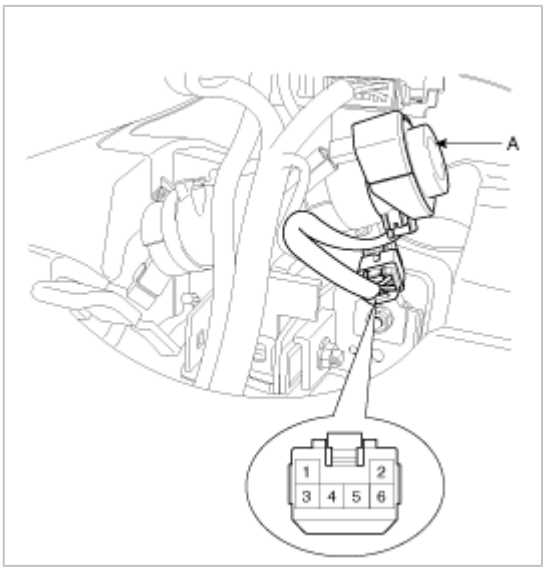


2. Check for continuity between the terminals and ground according to the table.

Terminal / Position	1	2
Hood open (Free)	○	○
Hood close (Push)		

Key In Switch

1. Remove the crash pad lower panel. (Refer to Body group-Crash pad)
2. Disconnect the 6P connector from the key warning switch (A).

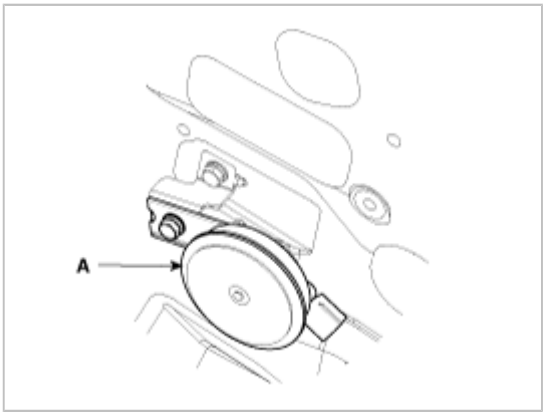


3. Check for continuity between the terminals in each position according to the table.

Terminal / Key position	5	6
Insert	○	○
Removal		

Burglar Horn

1. Remove the burglar horn(A) after removing 1 bolt and disconnect the 2P connector from the burglar horn.



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

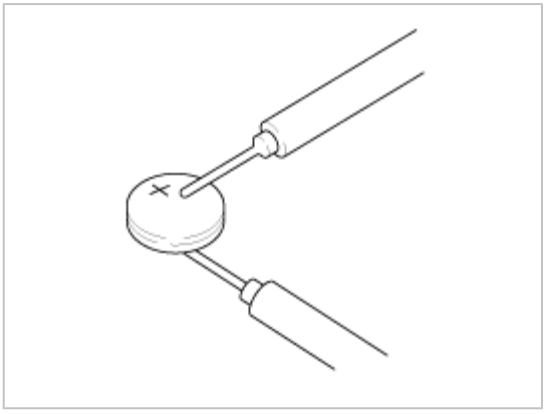
Specifications

Item	Specification
Rated voltage	DC 3V
Service voltage range	DC 2.7V ~ 3.5V
Temperature range	-4℉ ~ 140℉ (-20℃ ~ +60℃)
Storage temperature range	-40℉ ~ 185℉ (-40℃ ~ +85℃)
Modulation method	FSK (Freguency Shift Keying)
Keyless entry transmitterPower source	Lithium 3V battery (1EA)_CR1620
Transmissible distance	30m or more
Life of battery	2 years or more (at 20 times per day)
Button	1 (Door lock, unlock)
Transmission frequency	433.92 MHz

Inspection

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

Standard voltage : 3V



3. Replace the transmitter battery with a new one, if voltage is below 3V then try to lock and unlock the doors with the transmitter by pressing the lock or unlock button five or six times.
4. If the doors lock and unlock, the transmitter is O.K, but if the doors don't lock and unlock, register the transmitter code, then try to lock and unlock the doors.
5. If the transmitter is fails, replace only the transmitter.

Adjustment

Code Saving Procedure (Scan Tool)

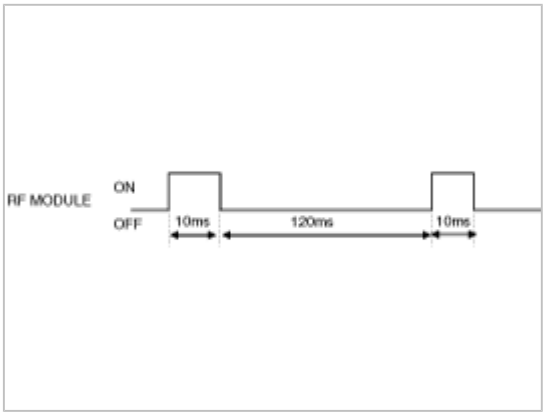
* Registration procedure of the transmitter

1. In registration mode with High Scan, it shall be possible to register up to Max 4EA.
   In registration mode with Code Saving Unit, it shall be possible to register up to Max 2EA.
2. At re-registration, data are registered newly after deleting the previous TX DATA

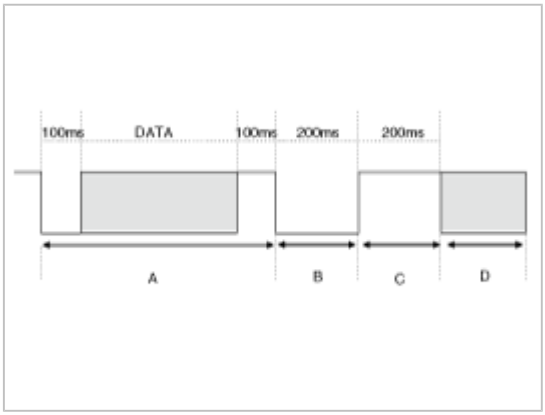
NO.	Saved CODE	CODE to change	Changed CODE
1	-	A	A
2	A	B	B(DeleteA)
3	A, B	C	C
4	A, B	C, D	C,D
5	A, B	C, C, D	C, D (with High Scan) C (with Code Saving Unit)
6	A, B, C, D	A	A(with High Scan)
7	A, B, C, D	B	B (with High Scan)

Receiver Spec

1. Reception RF MODULE control
   A. intermittent control as below to decrease dark current



1. CODE registration method
   (1) Registration with CODE SAVING machine
      A. CODE of TX can be registered up to 2 as max.
      B. CODE registration of TX is possible in case the below condition is input to CODE SAVING



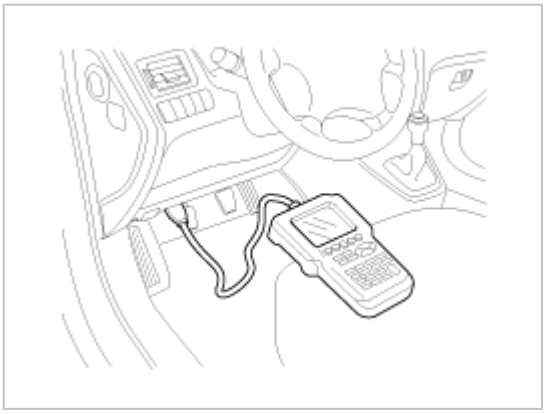
A,C : CODE input device → BCM
B : BCM → CODE input device
D : CODE input is possible

1. Connect CONNECTOR of CODE input device to power line and communication line.
2. Red LED flashes and power is supplied to power line at the same time when connection stathas no problem.
3. DATA registered in CODE input device is output when pushing SW of CODE input device.
4. BCM outputs SAVE MODE conversion signals with CODE input device when recognizing DATA.
5. CODE input device received conversion signals, GREEN LED is turned ON and BCM enters SAVE MODE.
6. 1 Transmitter is registered by pushing LOCK OR UNLOCK OR TRUNK BUTTON of the transmitter to be registered (TX1) for 1sec.(HAZARD is output once for 1sec at CODE input)
7. Perform 6) during SAVE MODE after 0.5sec from completion of registration for the first transmitter if there are 2 transmitted to be registered.

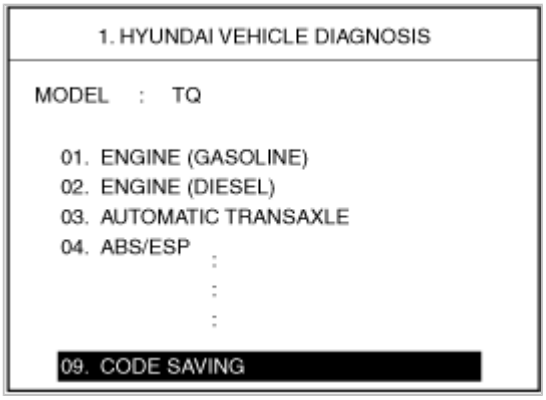
8. It is Completed by pulling out CONNECTOR of SAVING machine or SW OFF.

Transmitter Code Registration

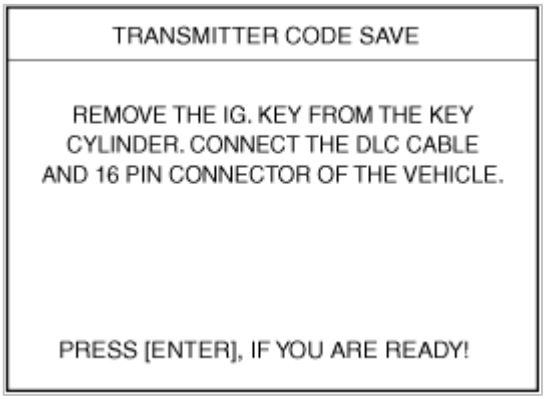
1. Connect the DLC cable of scan tool to the data link connector (16 pins) in driver side crash pad lower panel, turn the power on scan tool.



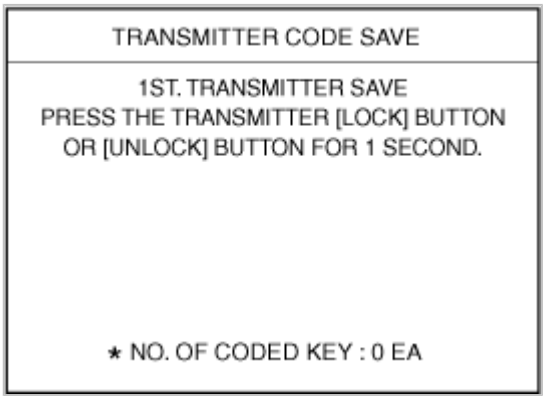
2. Select the vehicle model and then do "CODE SAVING".



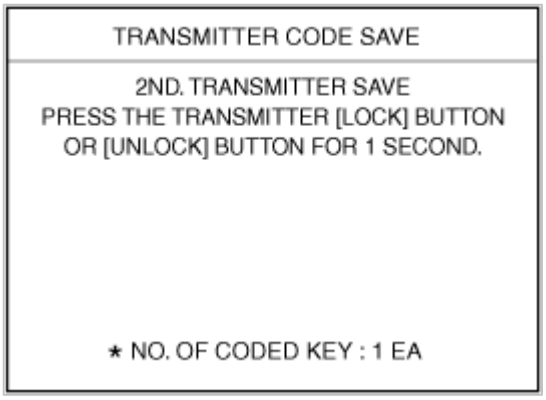
3. After selecting "CODE SAVING" menu, push "ENTER" key, then the screen will be shown as below.



4. After removing the ignition key from key cylinder, push "ENTER" key to proceed to the next mode for code saving. Follow steps 1 to 4 and then code saving is completed.


TRANSMITTER CODE SAVE
1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.
* NO. OF CODED KEY : 0 EA

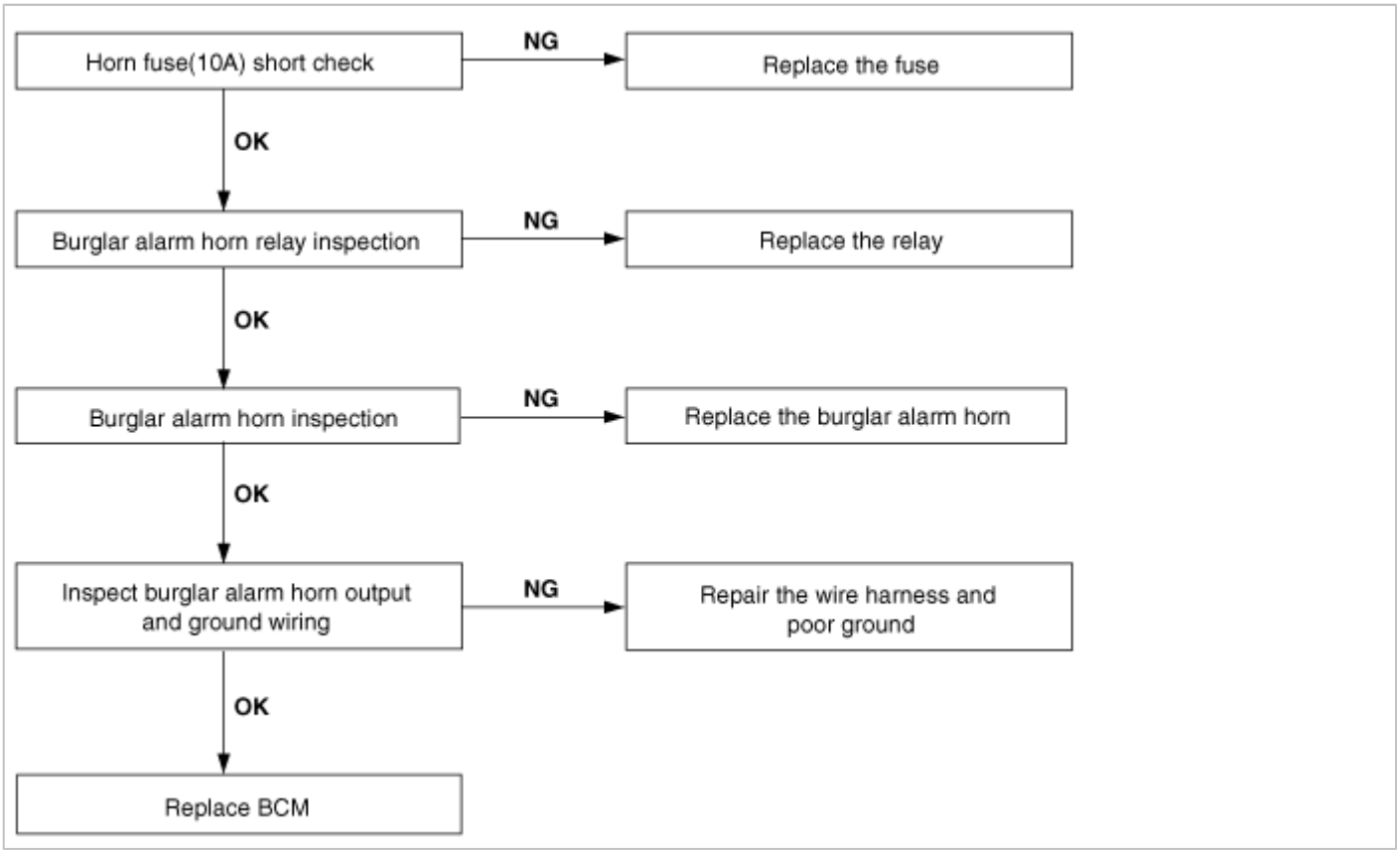
TRANSMITTER CODE SAVE
1ST. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.
1ST. TRANSMITTER SAVE SUCCESS!
IF YOU WANT TO SAVE THE 2ND KEY
PRESS [YES], OR NOT PRESS [NO]
* NO. OF CODED KEY : 1 EA


TRANSMITTER CODE SAVE
2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.
* NO. OF CODED KEY : 1 EA

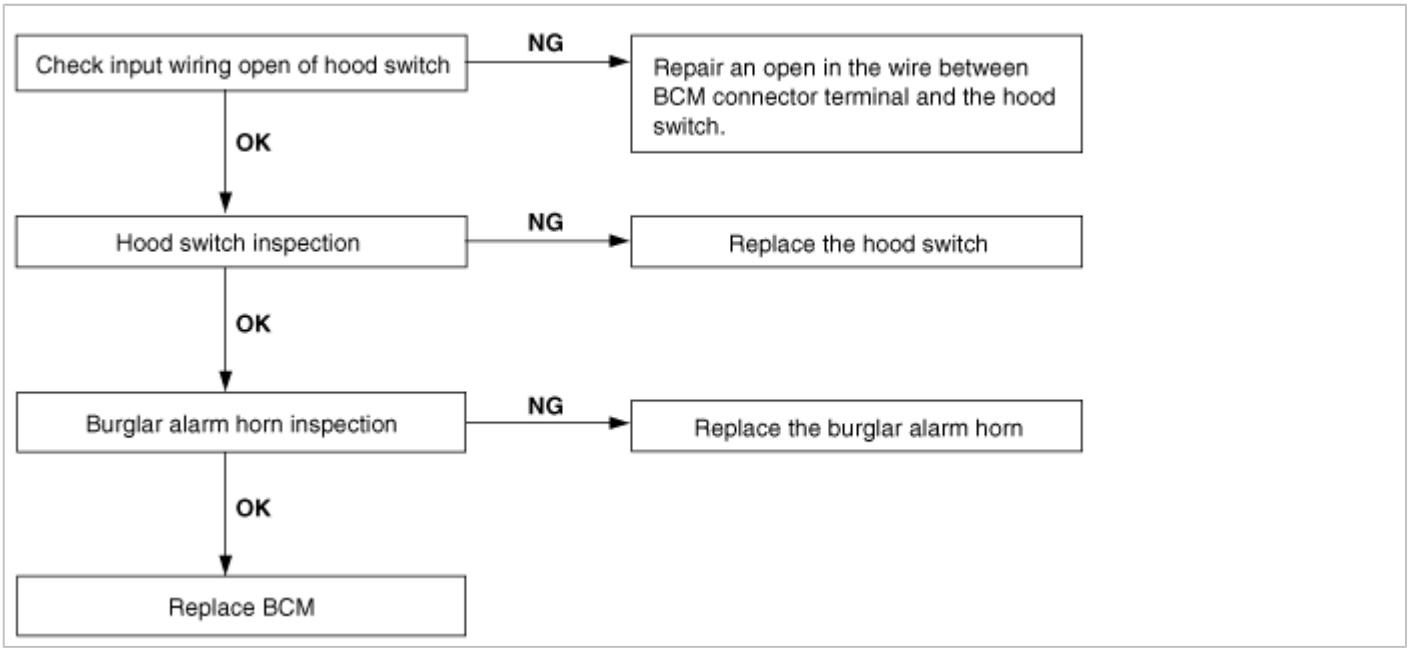
TRANSMITTER CODE SAVE
2ND. TRANSMITTER SAVE
PRESS THE TRANSMITTER [LOCK] BUTTON
OR [UNLOCK] BUTTON FOR 1 SECOND.
2ND. TRANSMITTER SAVE SUCCESS!
CODE SAVING IS COMPLETED!
IF YOU STOP, PRESS [ESC] KEY!!!
* NO. OF CODED KEY : 2 EA

Troubleshooting

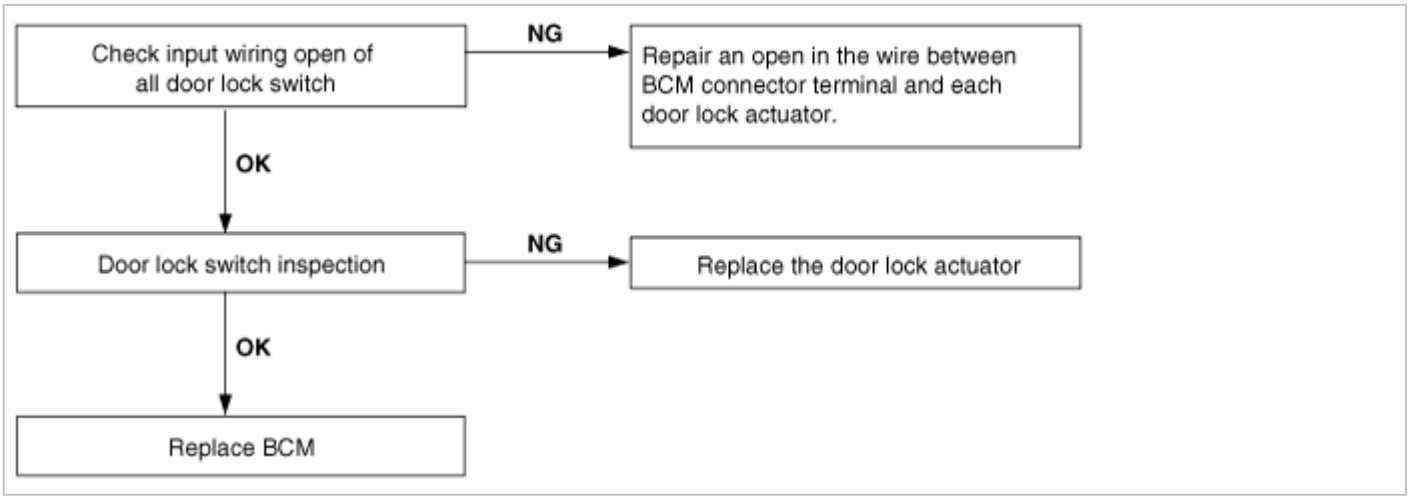
1. Alarm does not work. (Hazard lamps work)



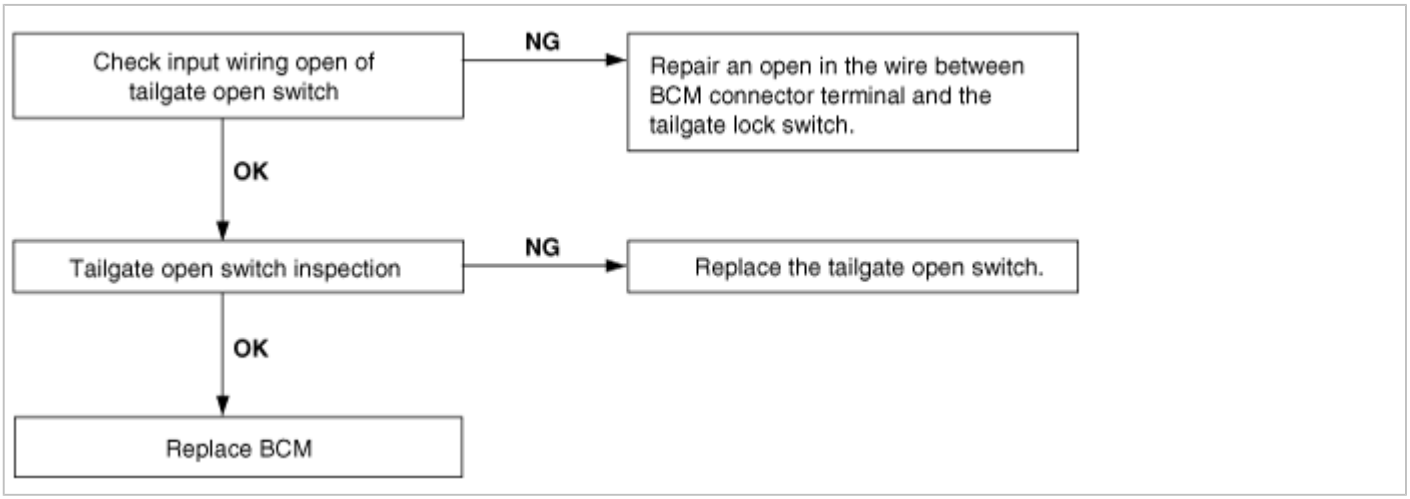
2. When hood is opened in ARM mode, burglar alarm does not work.



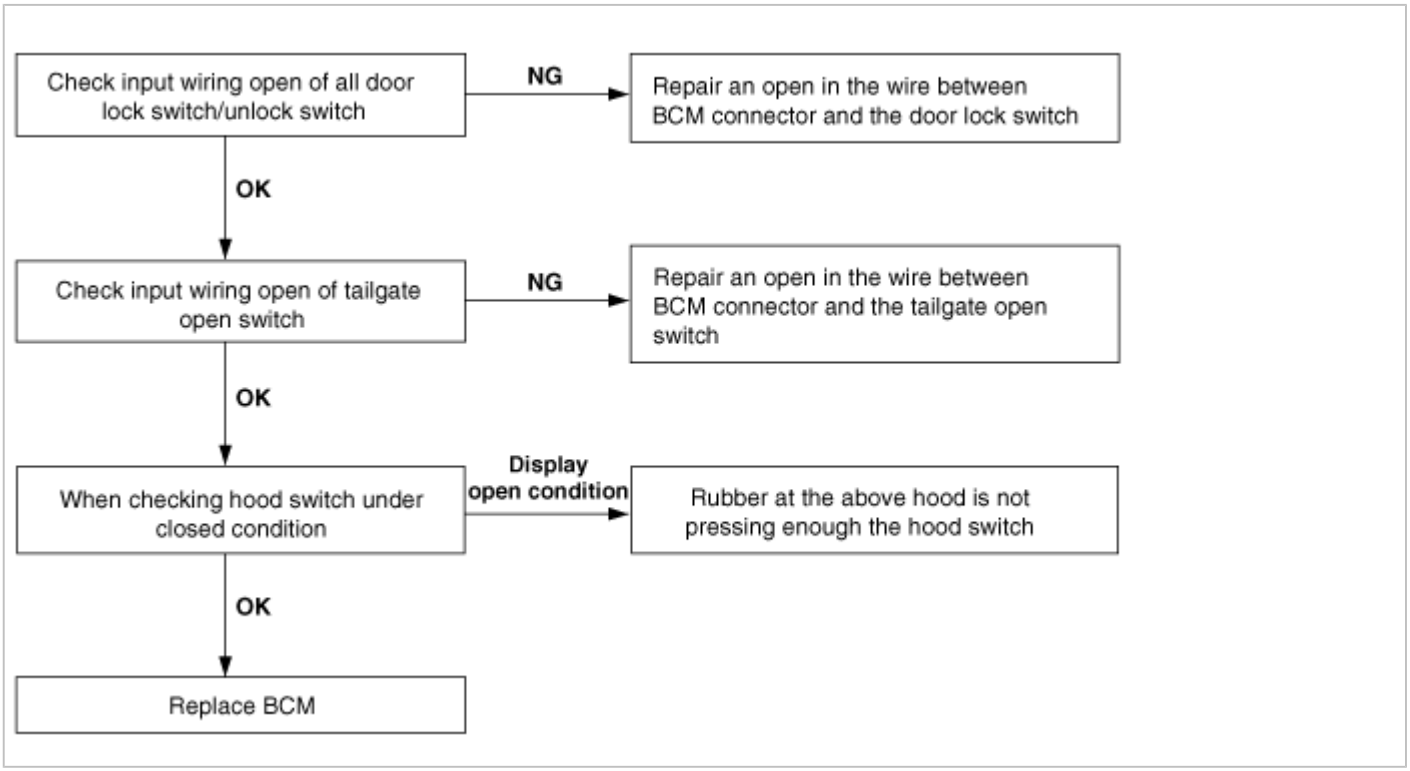
3. When door is opened, burglar alarm does not work. (If tailgate and hood is opened, alarm works)



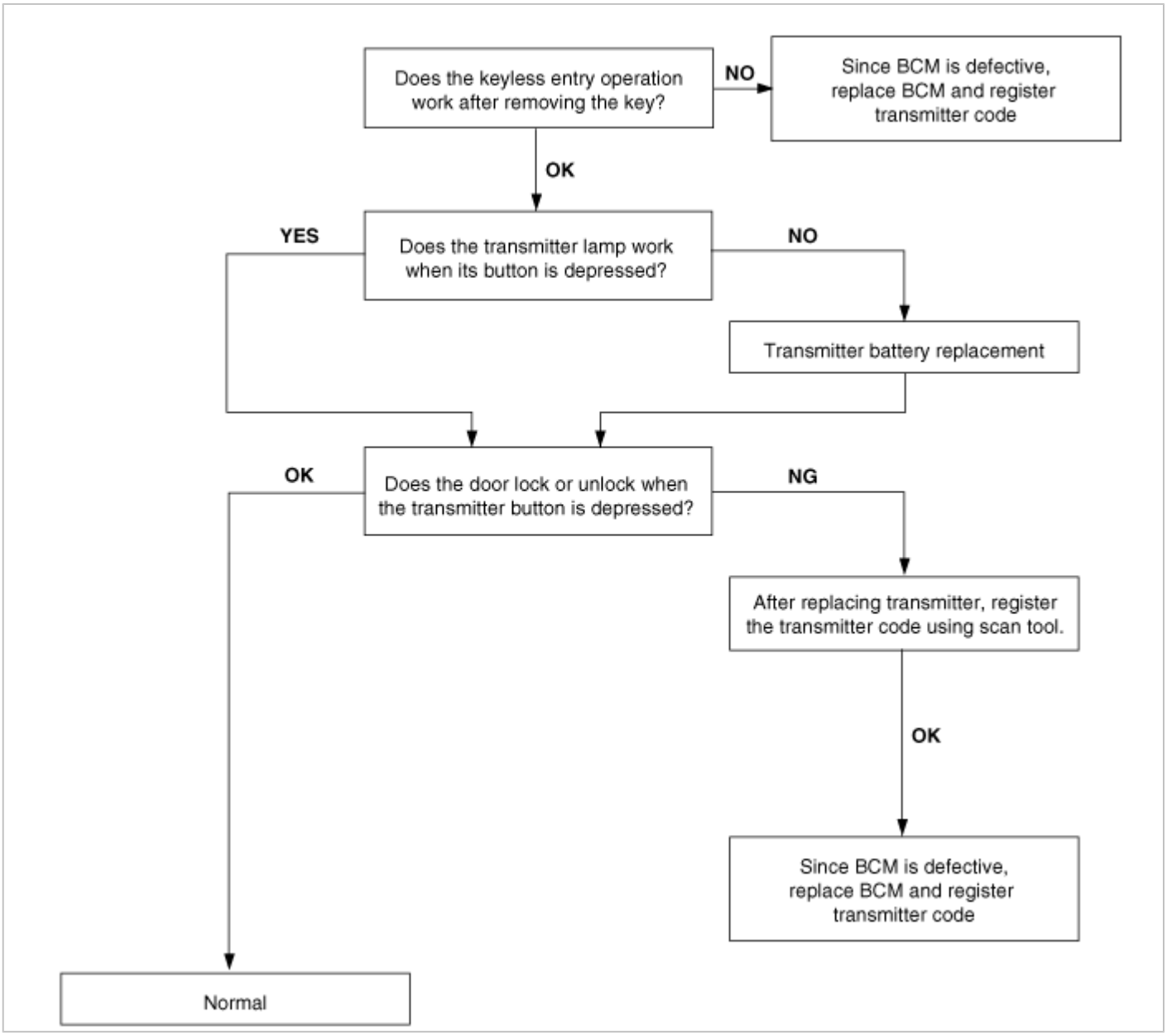
4. When tailgate is opened in ARM mode, burglar alarm does not work.



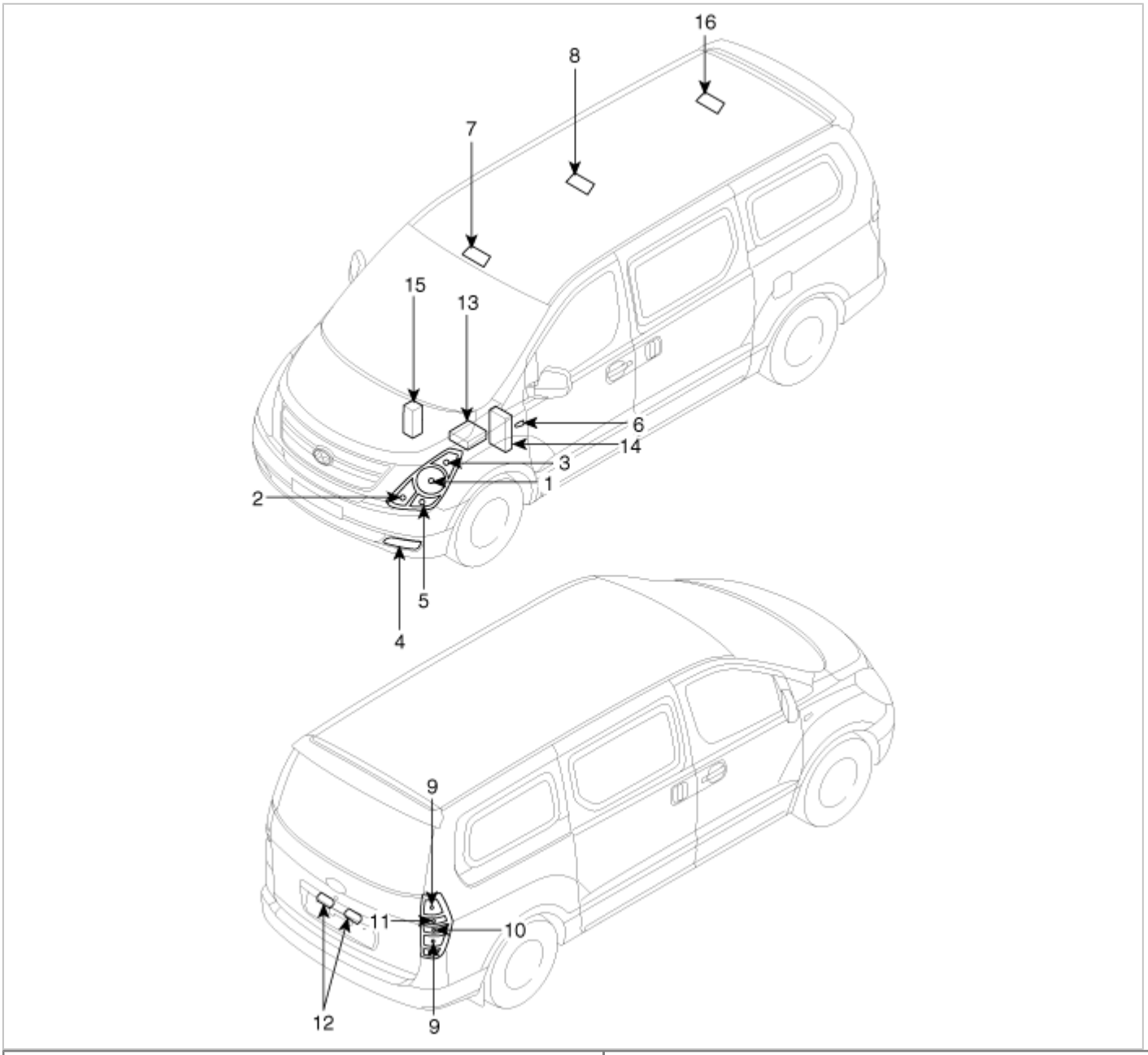
5. When the vehicle is locked by the transmitter, central door lock function works but hazard lamp doesn't blink.



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


Does the keyless entry operation work after removing the key?
NO
Since BCM is defective, replace BCM and register transmitter code
OK
YES
Does the transmitter lamp work when its button is depressed?
NO
Transmitter battery replacement
OK
Does the door lock or unlock when the transmitter button is depressed?
NG
After replacing transmitter, register the transmitter code using scan tool.
OK
Since BCM is defective, replace BCM and register transmitter code
Normal

Component Location



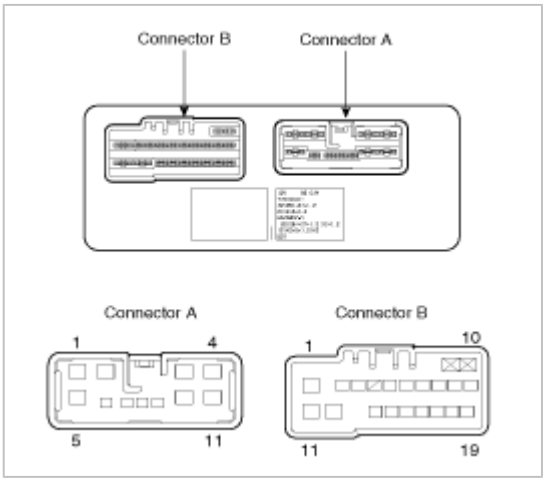
1. Head lamp (Low)	10. Rear turn signal lamp
2. Head lamp (High)	11. Back up lamp
3. Position lamp	12. License plate lamp
4. Front fog lamp	13. Engine room junction box (Head lamp Low/High, tail lamp relay)
5. Front turn signal lamp	14. Passinger compartment junction box (Back up lamp relay)
6. Side repeater	15. ICM relay box (Fog lamp relay)
7. Front room lamp	
8. Room lamp(Center)	

9. Tail/Stop lamp (GEN) / Rear fog lamp (EUR)	16. Rear room lamp

Inspection

Front Fog Lamp Relay

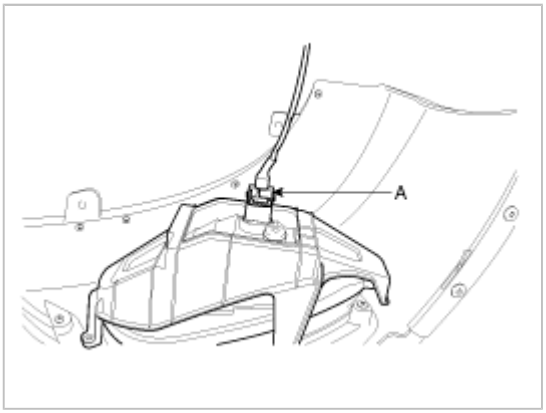
1. Disconnect the negative(-) battery terminal.
2. Pull out the front fog lamp relay(A) from the ICM box.
3. Check for continuity between terminals. There should be continuity between the No.18 and No.19 of terminals in the ICM-A when power and ground are connected to the No.9 and No.10 of terminals in the ICM-A.
4. There should be no continuity between the No.18 and No.19 of terminals in the ICM-A when power is disconnected.



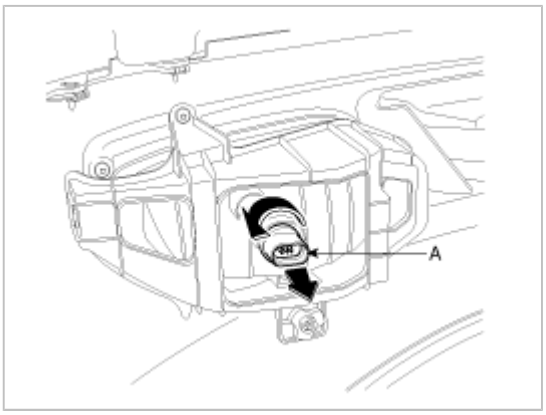
Terminal / Power	A18	A19	A9	A10
Disconnected			○ ○	
Connected	○ ○		⊖ ⊕	

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the front wheel house cover screw.
3. Remove the front fog lamp assembly connector (A).



4. Remove the front fog lamp bulb (A) turning in the counter clock-wise direction.

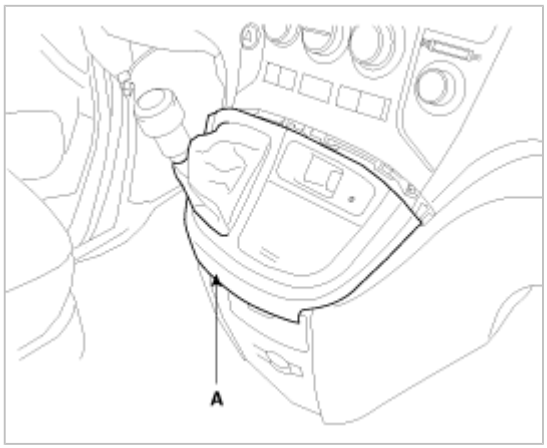


Installation

1. Install the front fog lamp bulb.
2. Connect the front fog lamp connector.
3. Install the front side cover.

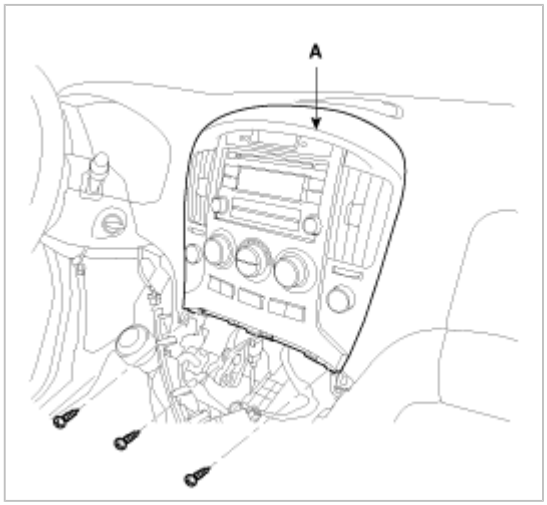
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front under cover (A).
   (Refer to the Body group - Crash pad)

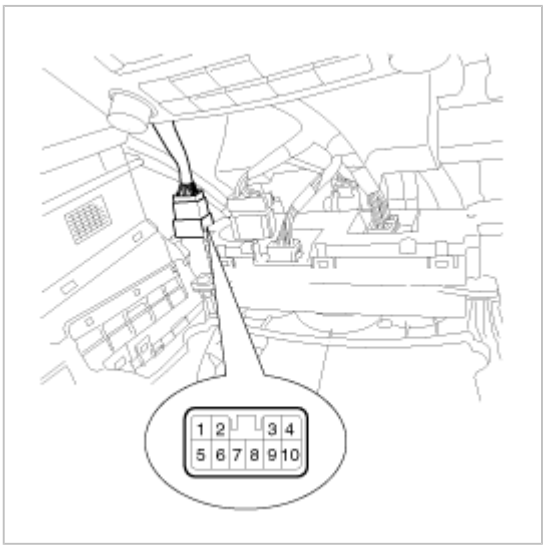


3. Remove the crash pad center facia panel (A) after loosening 3 screws.

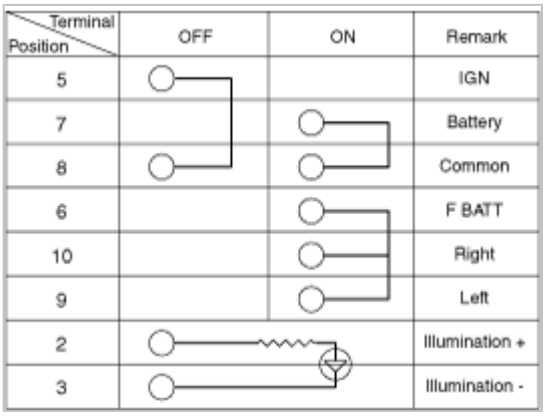
> Take care not to scratch the crash pad and related parts.



4. Disconnect the hazard lamp switch conector.

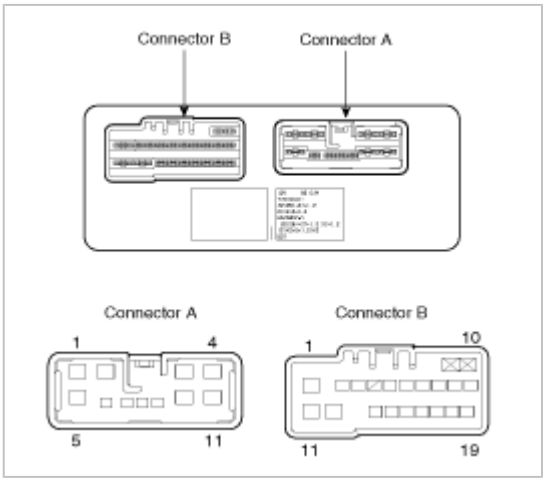


5. Operate the switch and check for continuity between terminals with an ohmmeter.



Hazard Lamp Relay

1. Disconnect the negative (-) battery terminal.
2. Disconnect the ICM relay box connector.
3. Check for continuity between terminals. There should be continuity between the No.15 and No.5 or No.14 of ICM-B terminals when power and ground are connected to the No.5 and No.6 of ICM-B terminals.
4. There should be no continuity between the No.15 and No.5 or No.14 of ICM-B terminals when power is disconnected to the No.6 and No.15 of ICM-B terminals.

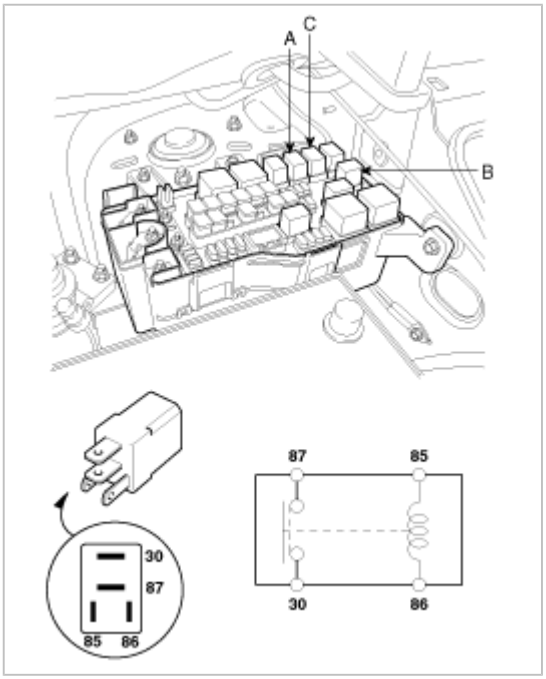


Terminal / Position	ICM-B (15)	ICM-B (5 or 14)	ICM-B (15)	ICM-B (6)
Power off			○	○
Power on	○	○	⊖	⊕

Inspection

Head Lamp Relay / Tail Lamp Relay

1. Disconnect the negative(-) battery terminal.
2. Pull out the relay from the engine compartment relay box.
   A : Head lamp(High) relay
   B : Head lamp (Low) relay
   C : Tail lamp

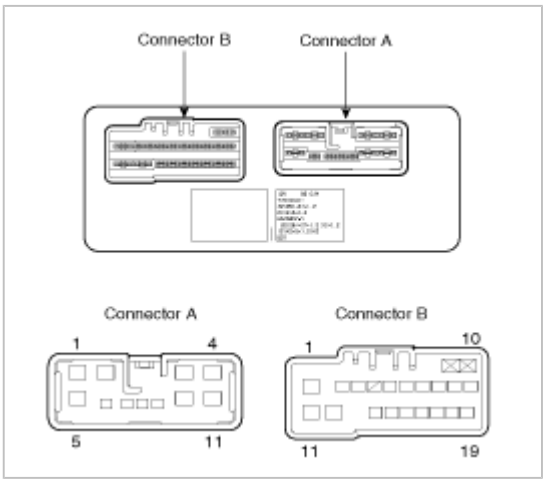


3. Check for continuity between terminals. There should be continuity between the No.87 and No.30 terminals when power and ground are connected to the No.86 and No.85 terminals.
4. There should be no continuity between the No.87 and No.30 terminals when power is disconnected.

Terminal / Power	30	87	85	86
Disconnected			○	○
Connected	○	○	⊖	⊕

Fog Lamp Relay

1. Disconnect the negative(-) battery terminal.
2. Remove the ICM relay box.
   (Refer to "Fuse and relay / ICM relay box")
3. Remove the ICM relay box.



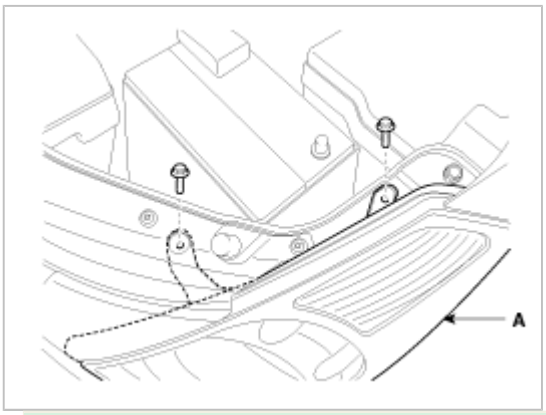
4. Check for continuity between the terminals.
   (1) There should be continuity between the No.18 terminal and the No.19 terminal in the ICM-A when power and ground are connected to the No.9 terminal and the No.10 terminal in the ICM-A.
   (2) There should be no continuity between the No.18 terminal and the No.19 terminal in the ICM-A when power and ground are connected to the No.9 terminal and the No.10 terminal in the ICM-A.

Removal

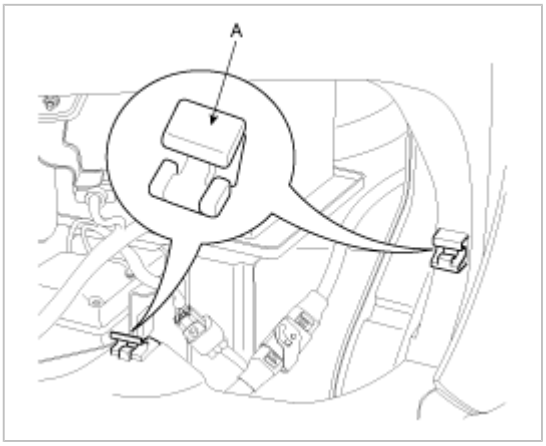
Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

The headlamp bulb should not be removed from the headlamp assembly until just before a new bulb is installed.
Removing bulb for an extended period of time may affect headlamp bulb performance.
Contaminants may enter the headlamp assembly where they can settle on the lens and reflector.
Never turn on the head lamps with the bulb removed from the headlamp assembly.

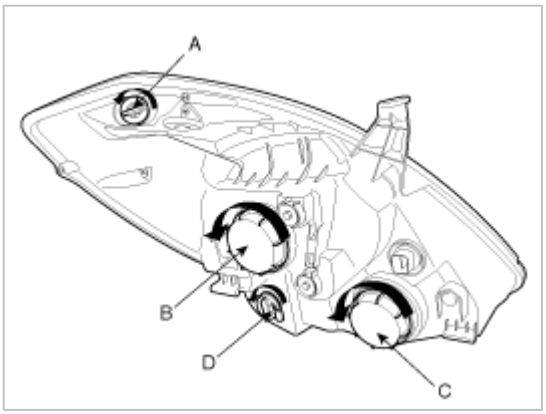
1. Disconnect the negative (-) battery terminal.
2. Remove the front bumper.
   (Refer to the Body group - "Bumper")
3. Loosen the mounting bolts (2EA) of head lamp. Remove the head lamp assembly (A) after disconnecting the lamp connectors.



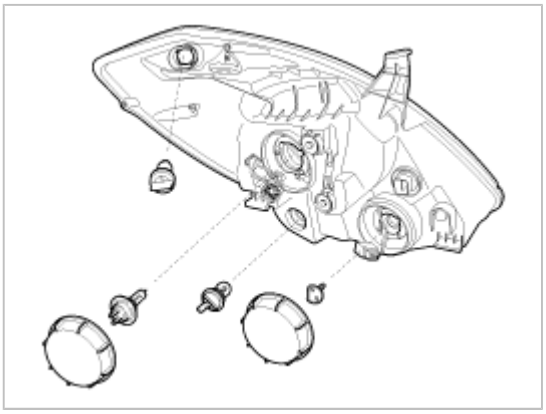
Take care that retaining clip (A) is not to be damaged.



4. Remove the bulb caps from the head lamp assembly after turning in the counter clock-wise direction.
   A : Tail lamp cab
   B : Head lamp low bulb cab
   C : Head lamp high bulb
   D : Turn signal bulb cab



5. Remove the head lamp bulbs after releasing the lock of the set spring.
   A : Head lamp high bulb, B : Head lamp low bulb.



Installation

1. Install the head lamp bulbs.
2. Install the head lamp bulb caps.
3. Install the head lamp assembly after connecting the lamp connector.

Adjustment

Head Lamp Aiming Instructions

Head lamps become very hot during use; do not touch them or any attaching hardware immediately after they have been turned off.

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

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

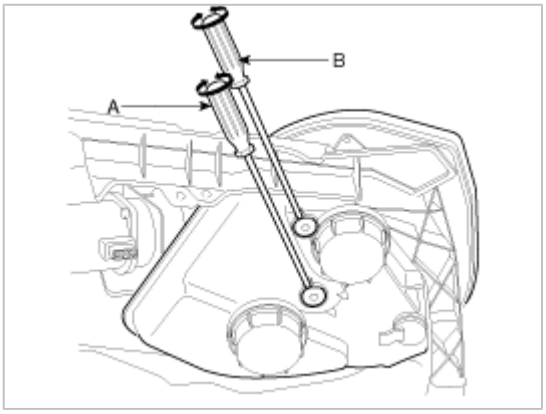
Alternately turn the adjusting gear to adjust the head lamp aiming. If beam-setting equipment is not available, proceed as follows :

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

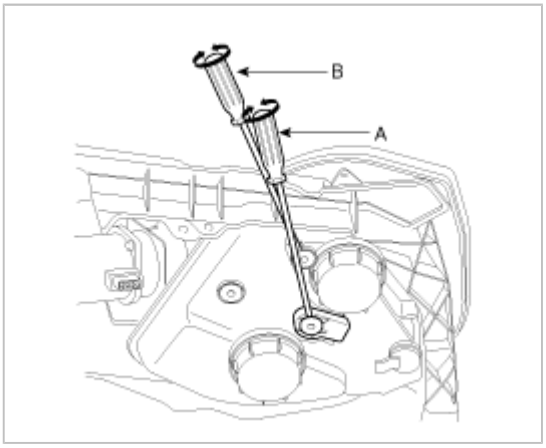
Condition	Aiming Direction		
	A	B	
Turning Clockwise	up	left	right

		down	down
Turning Counter clockwise	down	right up	left up

[Standard Type]



[Leveling Device Type]

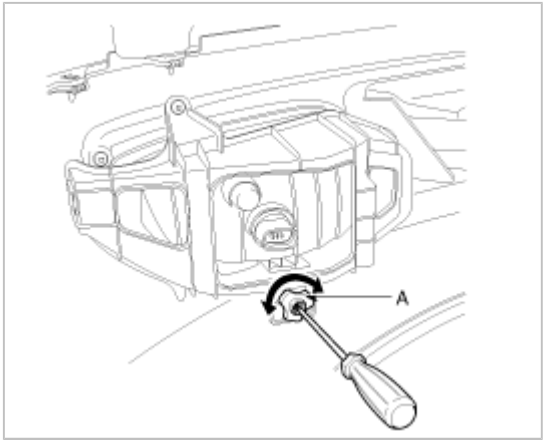


Front Fog Lamp Aiming

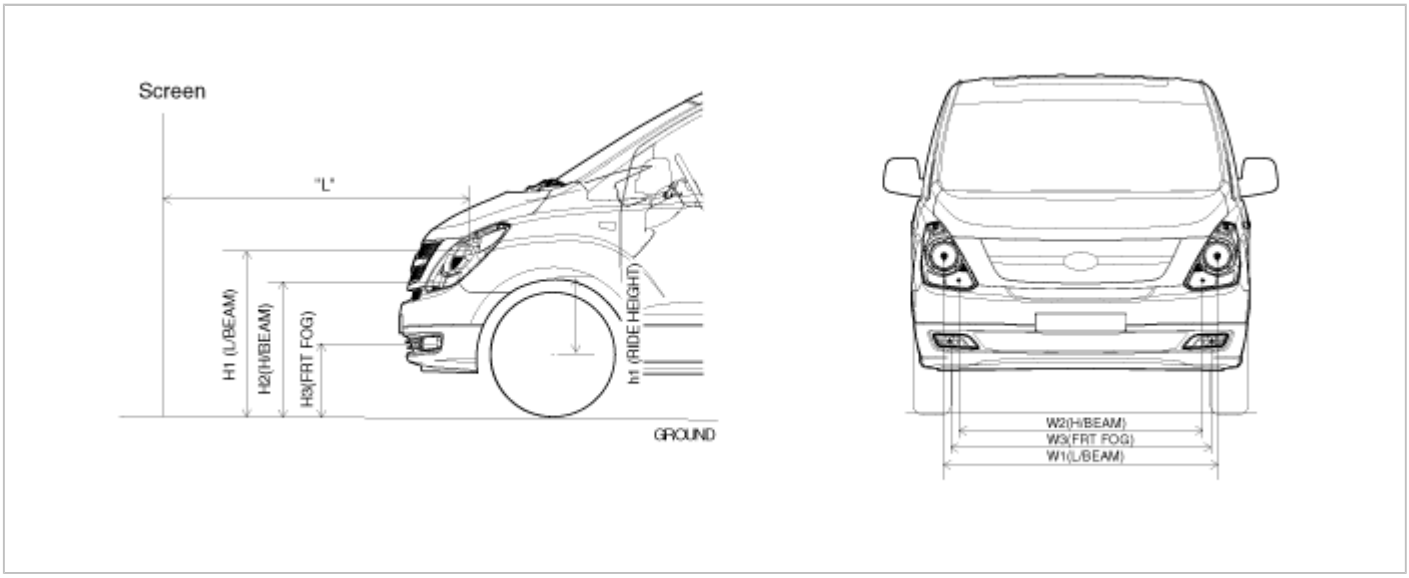
The front fog lamps should be aimed as the same manner of the head lamps aiming.

With the front fog lamps and battery normal condition, aim the front fog lamps by turning the adjusting gear (A).

Condition	Aiming Direction
Turning Clockwise	DOWN
Turning Counter clockwise	UP



Head Lamp And Fog Lamp Aiming Point



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 two head lamp bulbs centers (Low beam)
W2 : Distance between the two head lamp bulbs centers (High beam)
W3 : Distance between the two fog lamp bulbs centers
L : Distance between the head lamp bulb center and screen

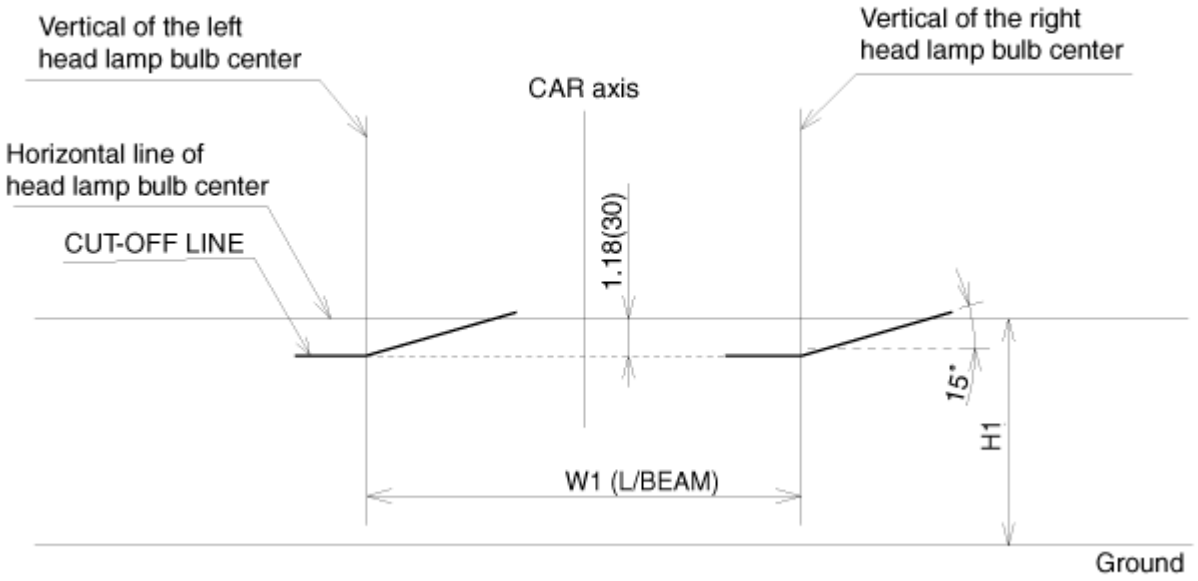
Unit : in (mm)

Vehicle condition	H1	H2	H3	W1	W2	W3	L
Without driver	34.3(871.7)	28.8(731.7)	15.2(385.3)	60.9(1,548)	54.5(1,384)	58.5(1,486)	118(3,000)
With driver	33.9(860.6)	28.4(720.4)	14.7(373.8)				

1. Turn the low beam on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.
   In case of equipping with the manual leveling device, set the leveling device switch on the "O" position.

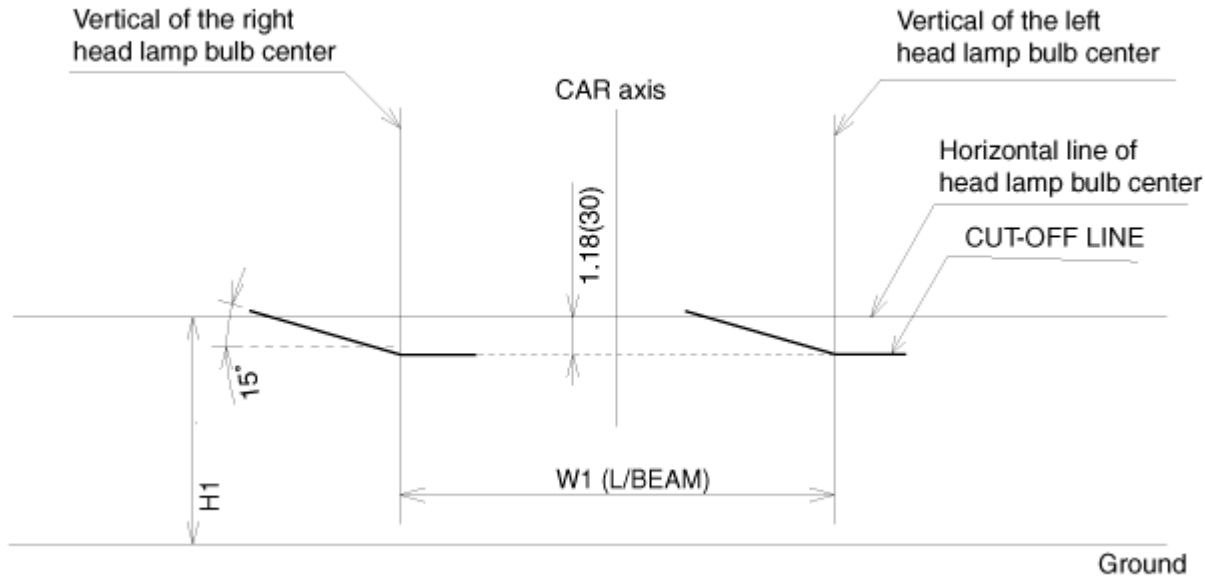
In case of equipping with the auto leveling device, set the initialization by using the diagnostic tool before aiming.

[LHD]



Unit : in.(mm)

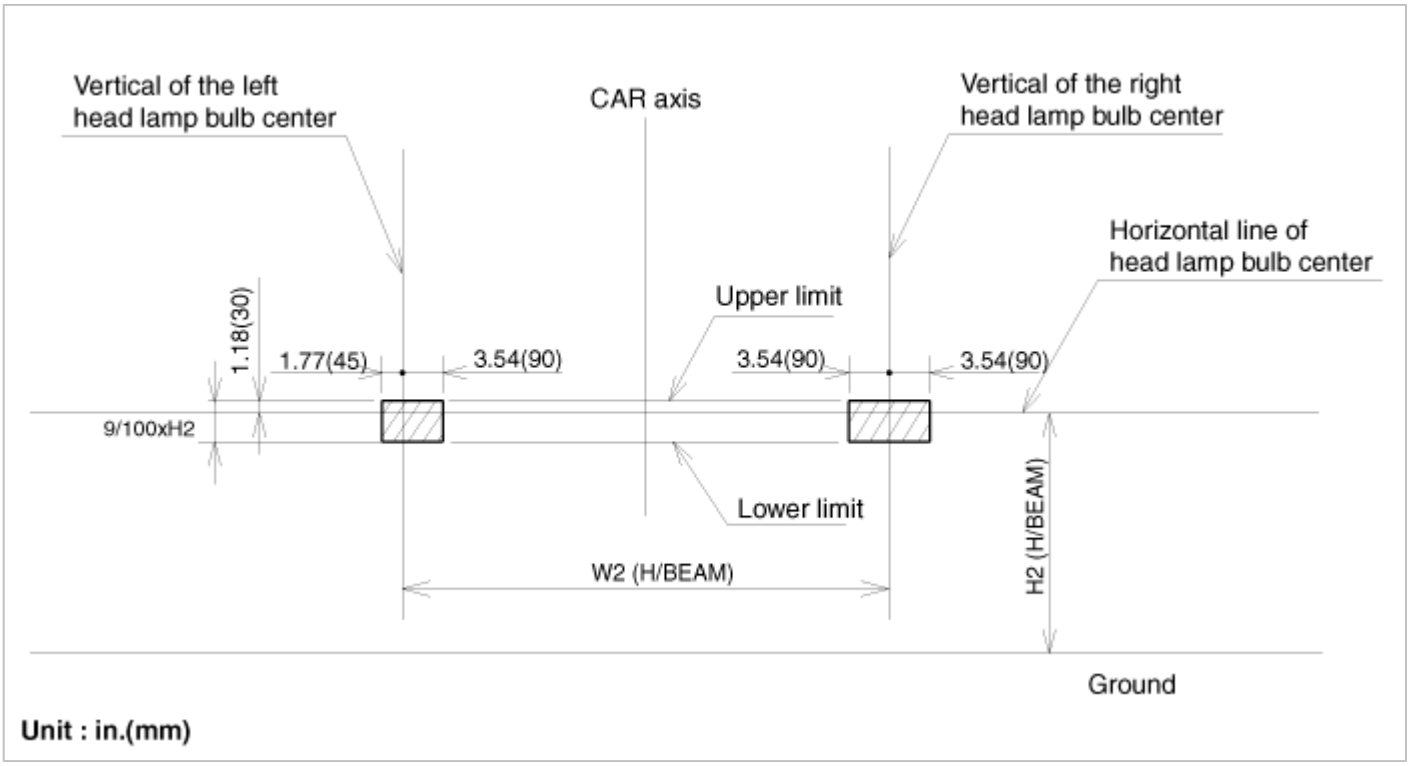
[RHD]



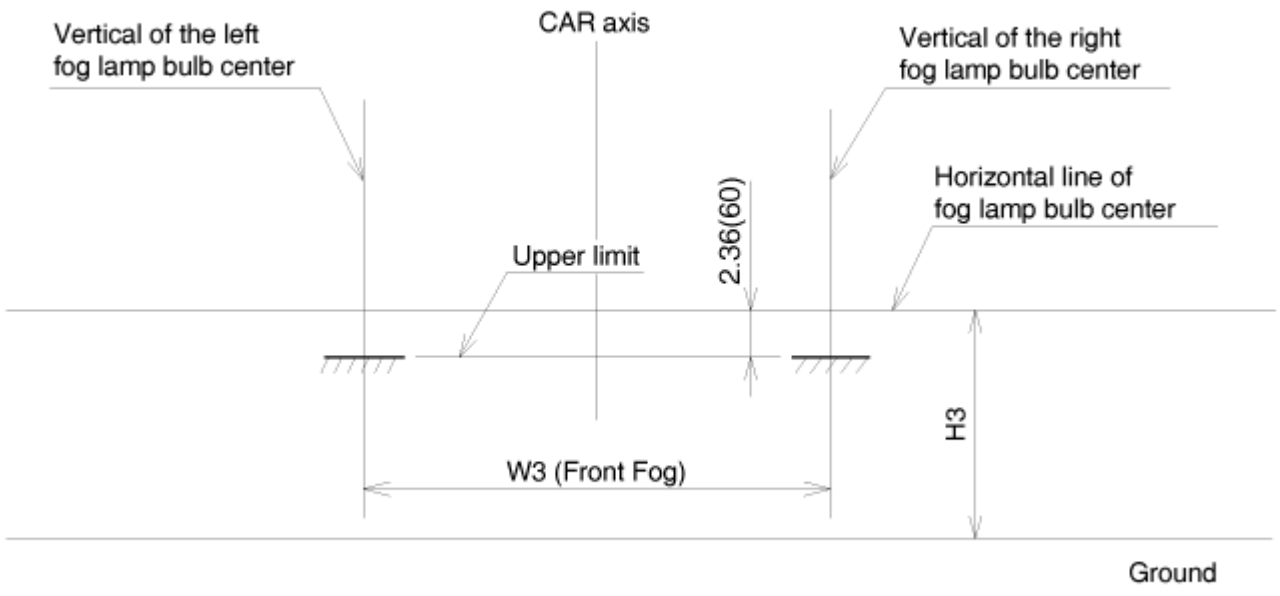
Unit : in.(mm)

2. Turn the high beam on with driver.
   The hot zone should be projected in the allowable range shown in the picture.

The hot zone should be projected in the allowable range in the condition of High beam on after aiming the low beam first.



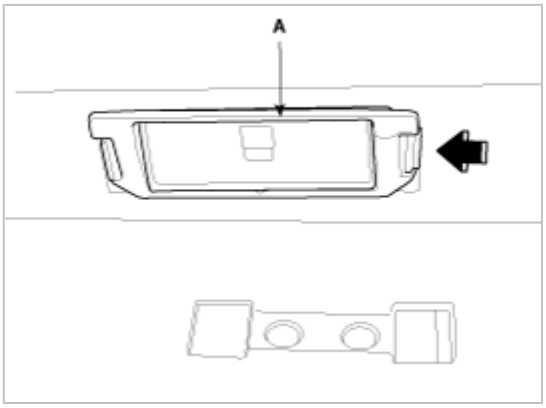
3. Turn the front fog lamp on with driver.
   The cut-off line should be projected in the allowable range shown in the picture.


Vertical of the left
fog lamp bulb center
CAR axis
Vertical of the right
fog lamp bulb center
Horizontal line of
fog lamp bulb center
Upper limit
2.36(60)
H3
W3 (Front Fog)
Ground

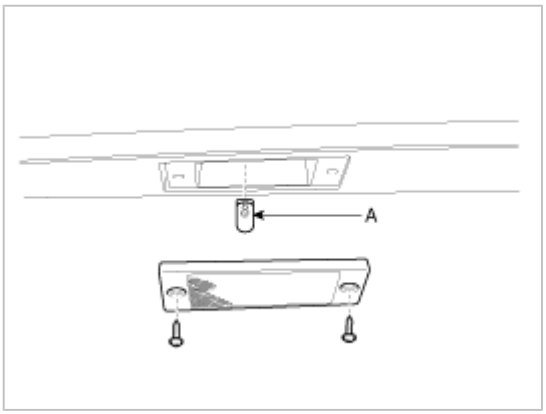
Unit : in.(mm)

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the license lamp lens (A) after loosening 2 screws.



3. Replace the bulb (A).

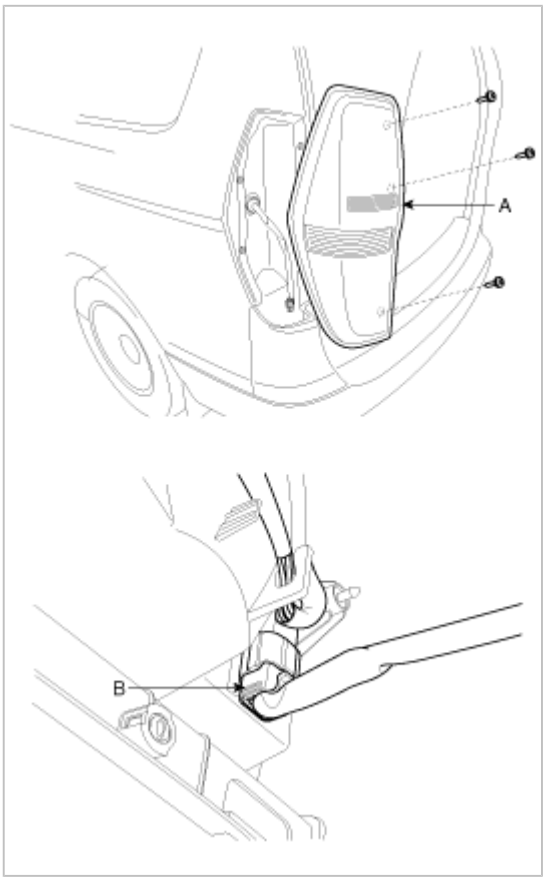


Installation

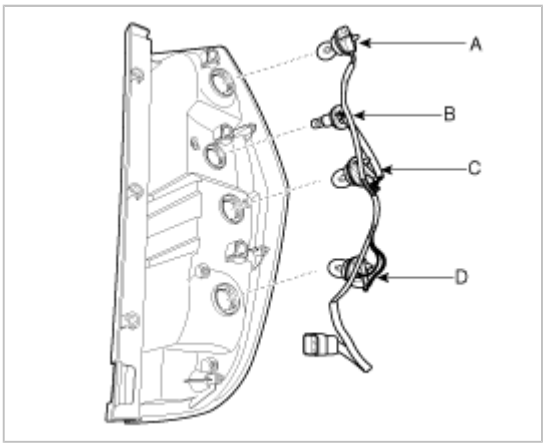
1. Install the bulb.
2. Install the license lamp lens.

Removal

1. Disconnect the negative (-) battery terminal.
2. Loose the screws (3EA) holding the rear combination lamp then disconnect the connector (B) then remove the rear combination lamp (A).



3. Replace the bulbs (4EA) turning in the counter clockwise direction.
   A : Tail / Stop lamp
   B : Rear turn signal lamp
   C : Back up lamp
   D : Rear fog lamp (Europe) / Stop lamp (General)

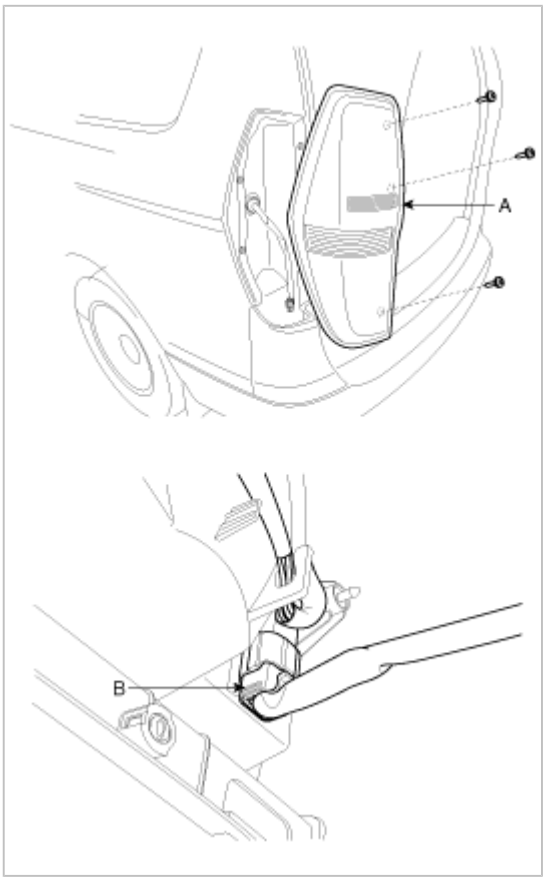


Installation

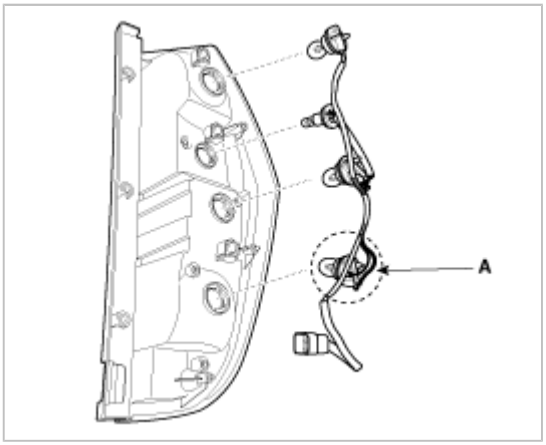
1. Connect the lamp connector after assembling the bulb.
2. Install the rear combination lamp assembly.

Removal

1. Disconnect the negative (-) battery terminal.
2. Loose the screws (3EA) holding the rear combination lamp then disconnect the connector (A) then remove the rear combination lamp.



3. Replace the rear fog lamp bulb(A) turning in the counter clockwise direction.



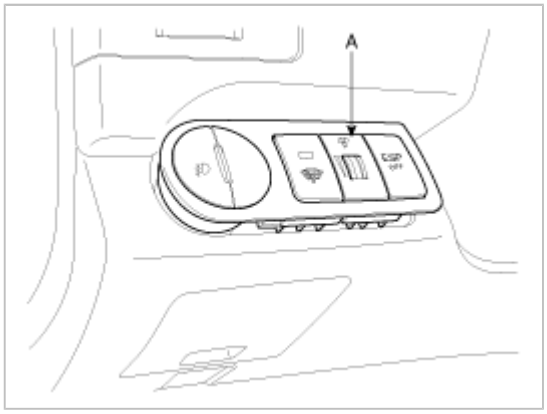
Installation

1. Connect the lamp connector after assembling the rear fog lamp bulb.
2. Install the rear combination lamp assembly.

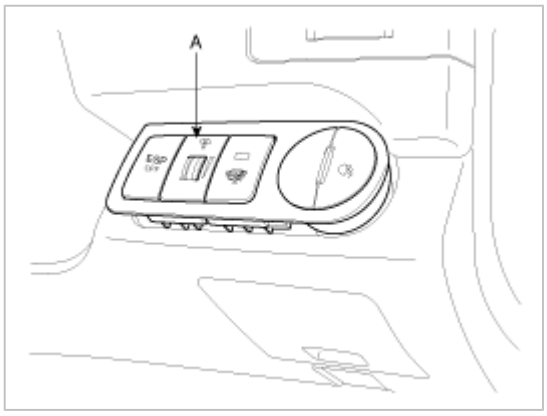
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad switch assembly (A) by using the trim remover tool.

[LHD]

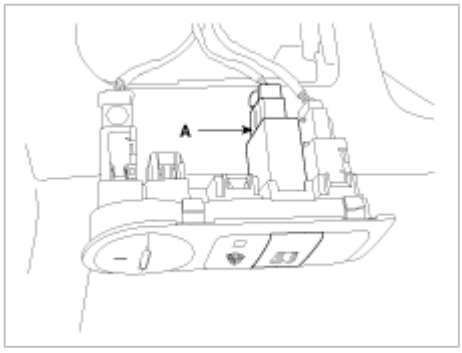


[RHD]

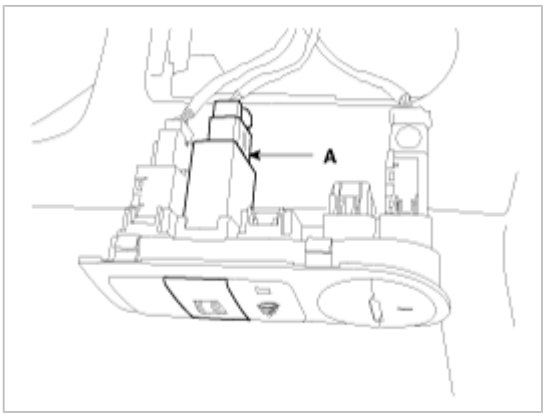


3. Disconnect the rheostat switch connector (A).

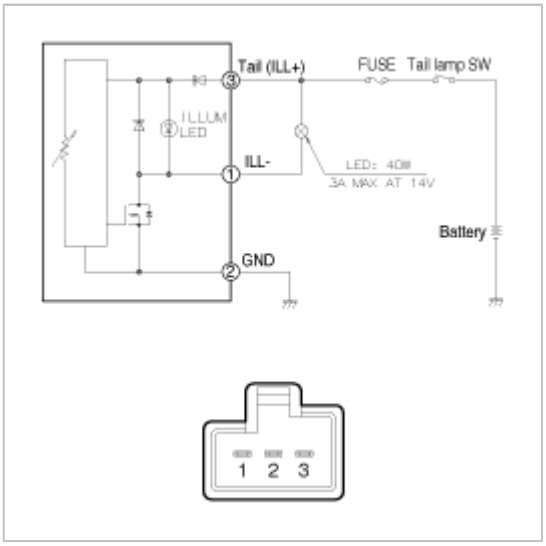
[LHD]



[RHD]



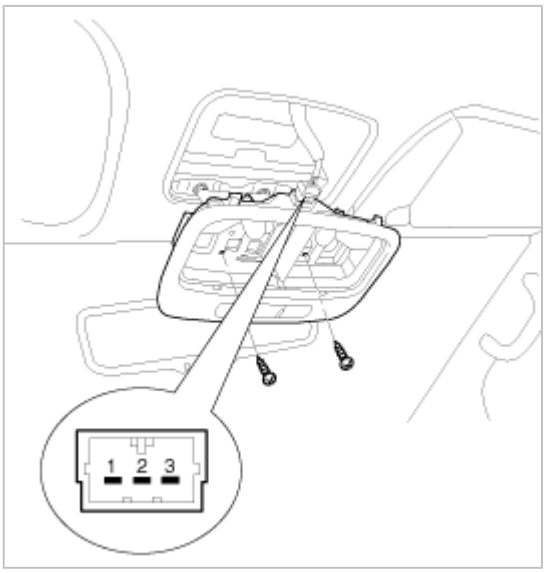
4. Check for intensity of new rheostat switch. If the light intensity of the lamps changes smoothly without any flickering when the rheostat is turned, it can be assumed that the rheostat is normal.



Inspection

Front Room & Map Lamp

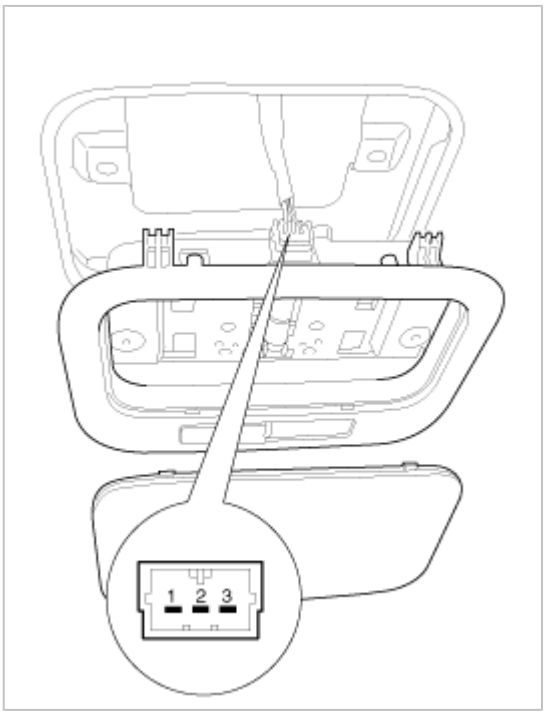
1. Remove the room lamp assembly then check for continuity between terminals.



Terminal / Position	1	3	2
ROOM		●	●
DOOR	●	●	●
OFF			

Rear Room Lamp

1. Remove the rear room lamp assembly then check for continuity between terminals.



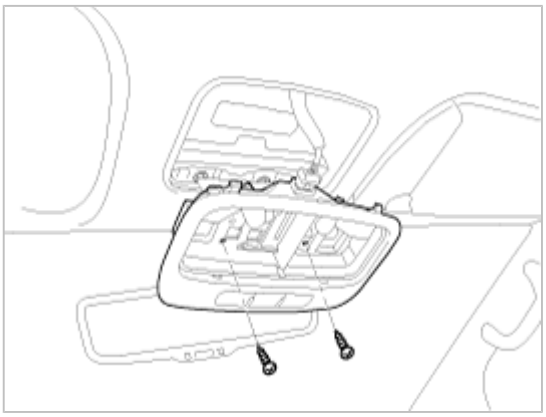
Terminal / Position	1	3	2
ROOM		○	○
DOOR	○	○	○
OFF			

Removal

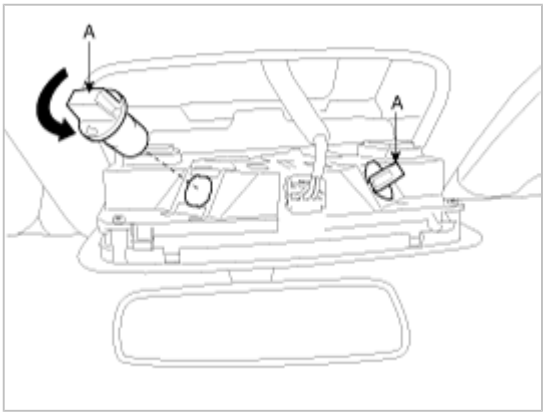
Front Room & Map Lamp

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

3. Remove the room lamp assembly (A) after loosening 2 screws. And then disconnect the 3P connector.

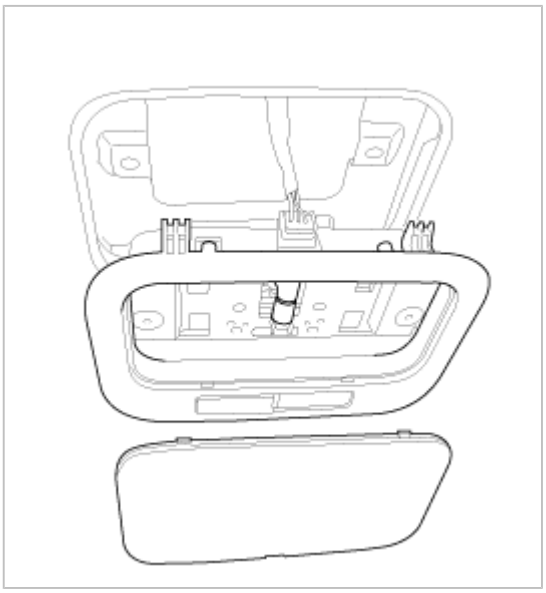


4. If it is necessary to replace the bulb, replace the bulb (A) turning in the counter - clockwise direction.



Rear Room Lamp

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



3. Disconnect the 3P connector.

Installation

Front Room & Map Lamp

1. Install the bulbs.
2. Install the room lamp assembly after connecting the lamp connector.
3. Install the lamp lens.

Rear Room Lamp

1. Install the room lamp assembly.
2. Install the lamp lens.

Specification

Items	Bulb Wattage (W)
Head lamp (High)	55
Head lamp (Low)	60 / 55
Front turn signal lamp	21
Front position lamp	5
Interior lamp	10
Cargo lamp (Van)	10
Step lamp	5
Front fog lamp	27
Rear stop/tail lamp	21/5
Back up lamp	16
Rear turn signal lamp	21
Rear fog lamp - Europe	21
License plate lamp	5
Side repeater	5
Room lamp	10
High mounted stop lamp	5

Troubleshooting

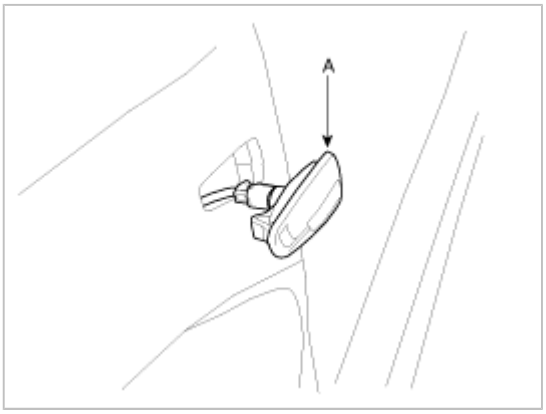
Symptom	Possible cause	Remedy
One lamp does not light (all exterior)	Bulb burned out	Replace bulb
	Socket, wiring or ground faulty	Repair if necessary
Head lamps do not light	Bulb burned out	Replace bulb
	Head lamp fuse (LOW:10A, HIGH:10A) blown	Check for short and replace fuse
	Head lamp fuse (10A) blown	Check for short and replace fuse
	Head lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tail lamps and license plate lamps do not light	Bulb burned out	Replace bulb
	Tail lamp fuse (10A) blown	Check for short and replace fuse
	Tail lamp relay faulty	Check relay
	Lighting switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not light	Bulb burned out	Replace bulb
	Stop lamp fuse (10A) blown	Check for short and replace fuse
	Stop lamp switch faulty	Adjust or replace switch
	Wiring or ground faulty	Repair if necessary
Stop lamps do not turn off	Stop lamp switch faulty	Repair or replace switch
Instrument lamps do not light (Tail lamps 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 lamps do not light	Bulb burned out	Replace bulb
	Turn signal lamp fuse (10A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Turn signal switch faulty	Check switch

	Wiring or ground faulty	Repair if necessary
Hazard warning lamps do not light	Bulb burned out	Replace bulb
	Hazard warning lamp fuse (15A) blown	Check for short and replace fuse
	Flasher unit faulty	Check flasher unit
	Hazard switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Flasher unit faulty	Check flasher unit	
Back up lamps do not light	Bulb burned out	Replace bulb
	Back up lamp fuse (10A) blown	Check for short and replace fuse
	Back up lamp switch (M/T) faulty	Check switch
	Transaxle range switch (A/T) faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (15A) blown	Check for short and replace fuse
	Room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Front fog lamps do not light	Bulb burned out	Replace bulb
	Front fog lamp fuse (10A) blown	Check for short and replace fuse
	Front fog lamp relay faulty	Check relay
	Front fog lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Rear fog lamps do not light	Bulb burned out	Replace bulb
	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp fuse (10A) blown	Check for short and replace fuse
	Rear fog lamp switch faulty	Check switch
	Rear fog lamp relay faulty	Check relay
	Wiring or ground faulty	Repair if necessary
Room lamp does not light	Bulb burned out	Replace bulb

	Room lamp fuse (10A) blown	Check for short and replace fuse
	Map lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary
Tailgate room lamp does not light	Bulb burned out	Replace bulb
	Room lamp fuse (10A) blown	Check for short and replace fuse
	Tailgate room lamp switch faulty	Check switch
	Wiring or ground faulty	Repair if necessary

Removal

1. Disconnect the negative(-)battery terminal.
2. Remove the fender side repeater lamp (A).



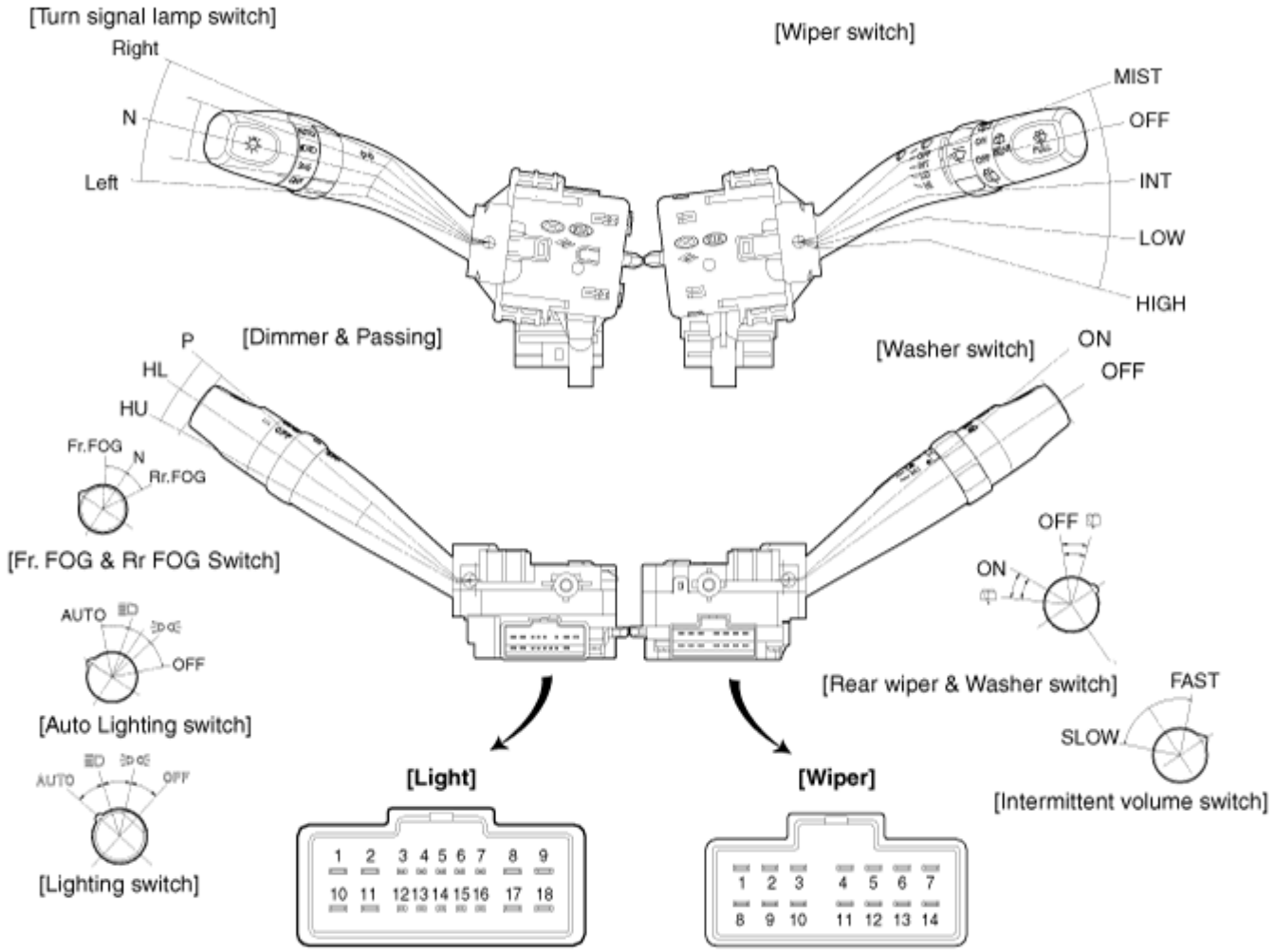
3. Disconnect the connector then remove the bulb.

Installation

1. Install the bulb.
2. Reconnect the lamp connector.
3. Install the side repeater lamp.

Component

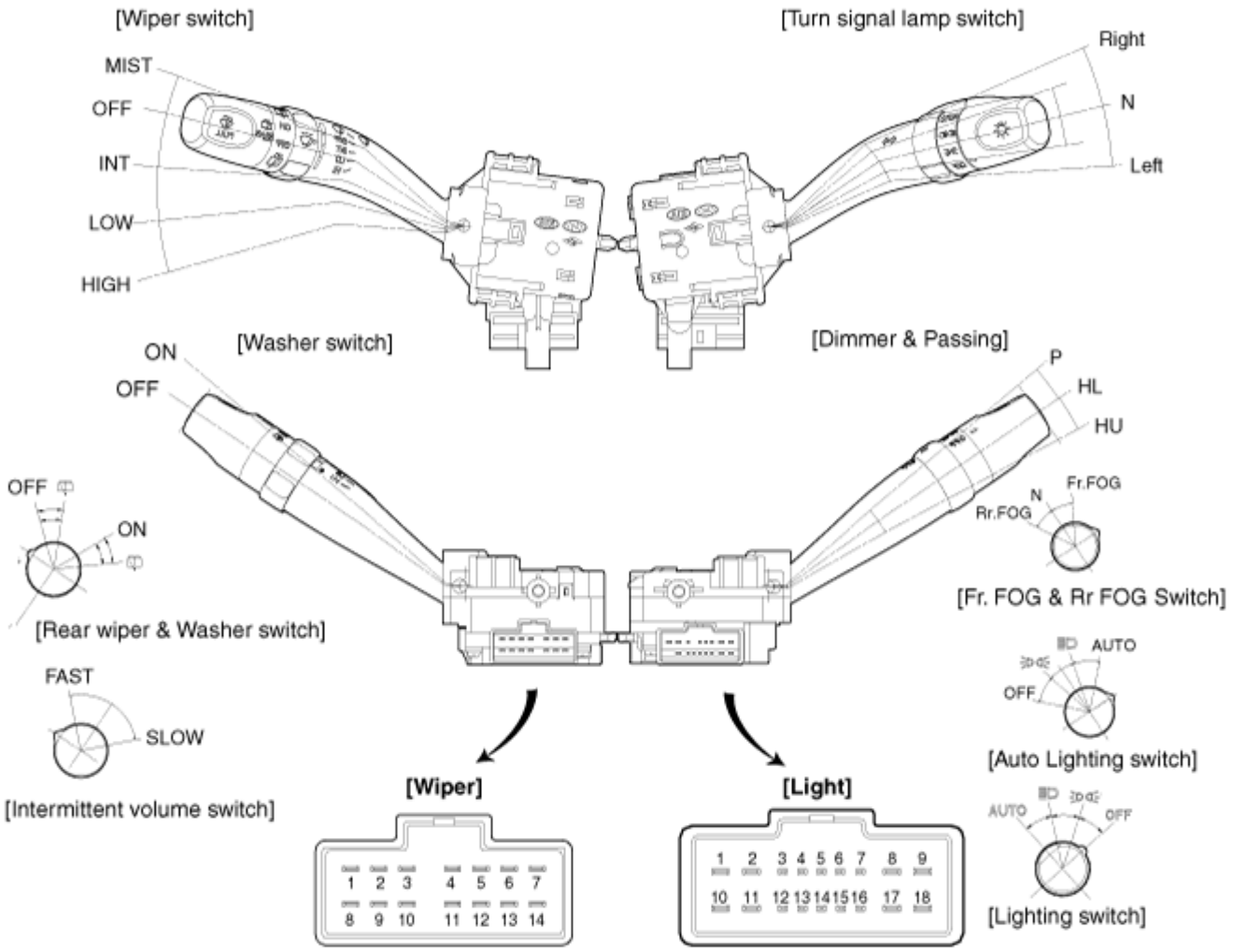
[LHD]



Circuit connection

Connector Name	Terminal No.	Description	Connector Name	Terminal No.	Description
Light (18Pin)	1	Head lamp passing switch	**Wiper (14Pin)**	1	Wiper high speed
	2	Head lamp upper beam power		2	Wiper low speed
	3	-		3	Wiper parking
	4	-		4	Mist switch
	5	-		5	IGN2
	6	-		6	Intermittent wiper
	7	Turn signal (RH) lamp switch		7	Front washer sw
	8	Flash unit power		8	-
	9	Turn signal (LH) lamp switch		9	Rear wiper & washer
	10	Head lamp lower beam power		10	Rear wiper
	11	Dimmer & Passing ground		11	-
	12	-		12	Rear wiper ground
	13	-		13	Intermittent wiper
	14	Tail lamp switch		14	Intermittent wiper ground
	15	Head lamp switch			
	16	Rear fog lamp/Auto light switch			
	17	Lighting switch ground			
	18	-			

[RHD]



Circuit connection

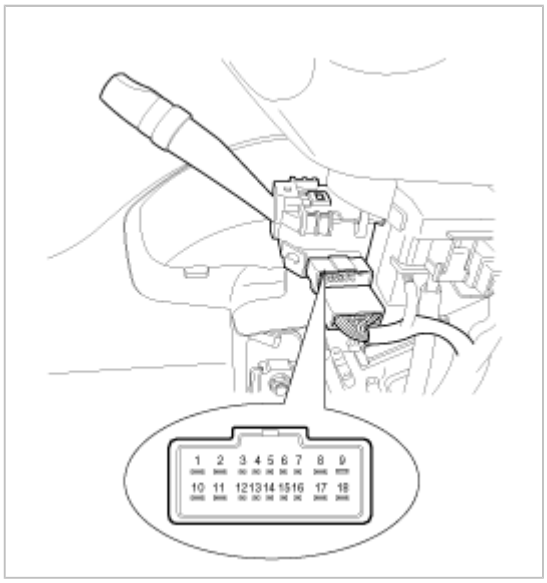
Connector Name	Terminal No.	Description	Connector Name	Terminal No.	Description
Light (18Pin)	1	Turn signal RH lamp switch	**Wiper (14Pin)**	1	Front washer sw
	2	Flash unit power		2	Intermittent wiper
	3	-		3	IGN2
	4	-		4	Mist switch
	5	-		5	Wiper parking
	6	-		6	Wiper low speed
	7	-		7	Wiper high speed
	8	Lead lamp upper beam power		8	-
	9	Head lamp passing switch		9	Rear wiper & washer
	10	-		10	Rear wiper
	11	-		11	-
	12	-		12	Rear wiper ground
	13	Tail lamp switch		13	Intermittent wiper
	14	Head lamp switch		14	Intermittent wiper ground
	15	Rear fog lamp/Auto light switch			
	16	Lighting switch ground			
	17	Dimmer & passing ground			
	18	Head lamp lower beam power			

Inspection

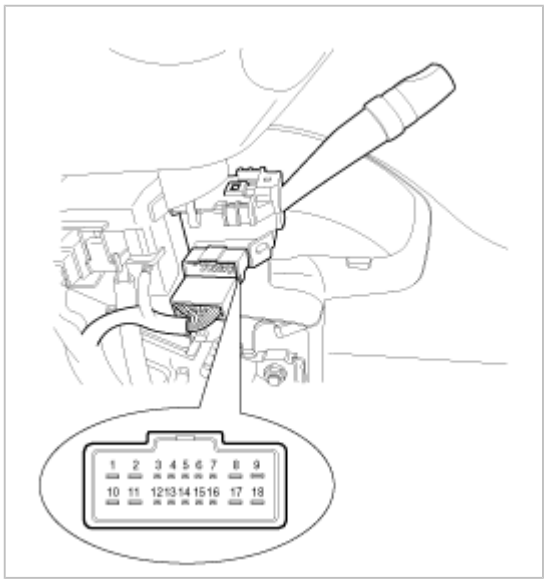
Lighting Switch Inspection

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

[LHD]



[RHD]



Lighting Switch (Auto Light)

( ) : RHD

Terminal / Position	14(13)	15(14)	16(15)	17(16)
OFF				
I	○			○
II	○	○		○
AUTO			○	○

Lighting Switch (General)

( ) : RHD

Terminal / Position	14(13)	15(14)	16(15)	17(16)
OFF				
I	○			○
II	○	○	○	○

Dimmer And Passing Switch

( ) : RHD

Terminal / Position	1(9)	2(8)	10(18)	11(17)
HU		○		○
HL			○	○
P	○	○		○

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

Turn Signal Switch

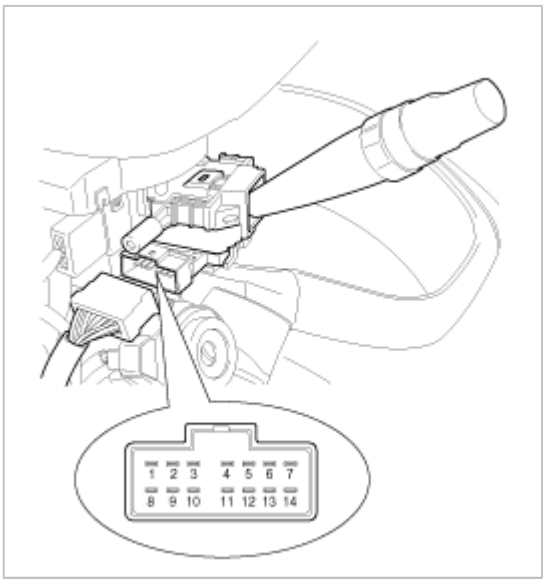
( ) : RHD

Hazard switch / Turn signal switch		7(1)	8(2)	9(3)
OFF	L		○	○
	N			
	R	○		○

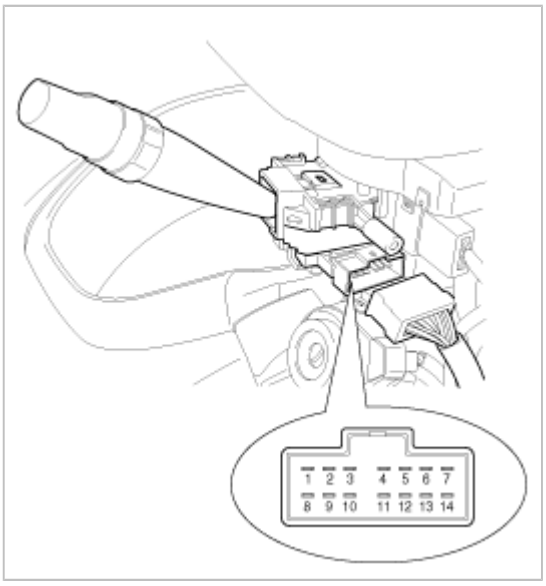
Wiper And Washer Switch Inspection

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

[LHD]



[RHD]



Wiper Switch

( ) : RHD

Terminal / Position	2 (6)	1 (7)	3 (5)	6 (2)	5 (3)	4 (4)	14 (14)	13 (13)
MIST	○		○		○	○		
OFF	○		○					
INT	○		○	○	○		○	○
LOW	○				○			
HI		○			○			

Washer Switch

( ) : RHD

Terminal / Position	7(1)	5(3)
OFF		
ON	○	○

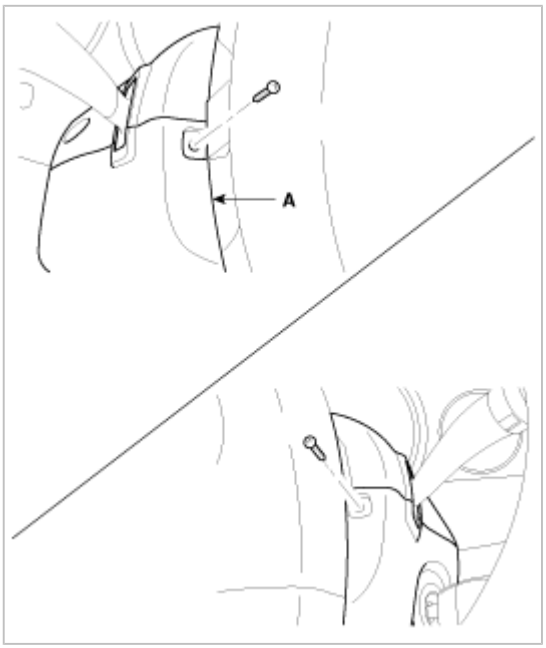
Rear Wiper □ Washer Switch

( ) : RHD

Terminal / Position	12(12)	10(10)	9(9)
OFF			
ON	○	○	
WASHER	○		○

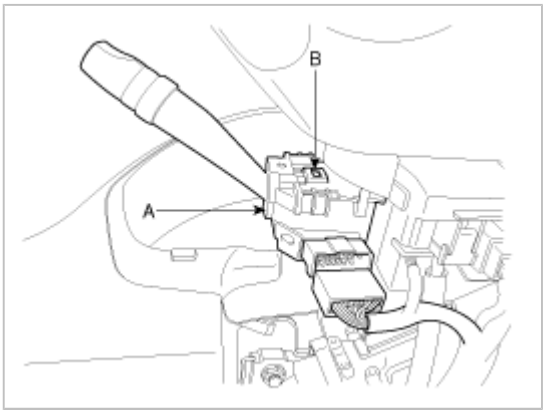
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after removing 4 screws.
   (Refer to ST group - Steering column and shaft).

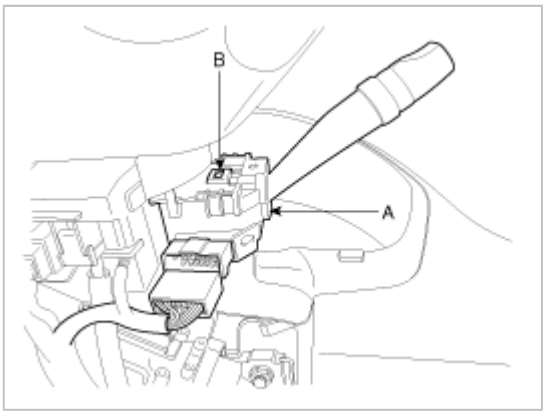


3. Remove the lighting switch (A) by pushing the lock pin (B).

[LHD]

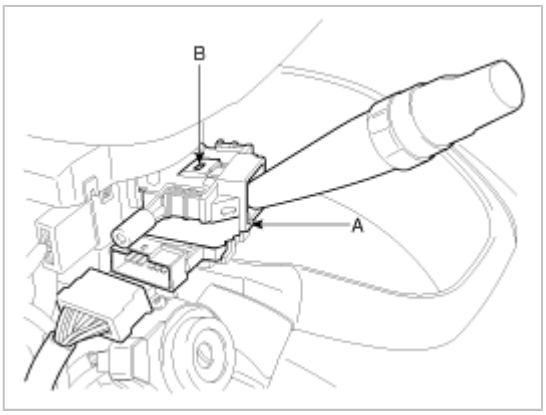


[RHD]

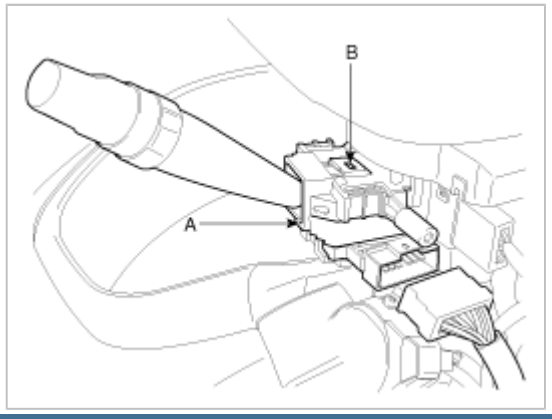


4. Remove the wiper switch (A) by pushing the lock pin (B).

[LHD]



[RHD]



Installation

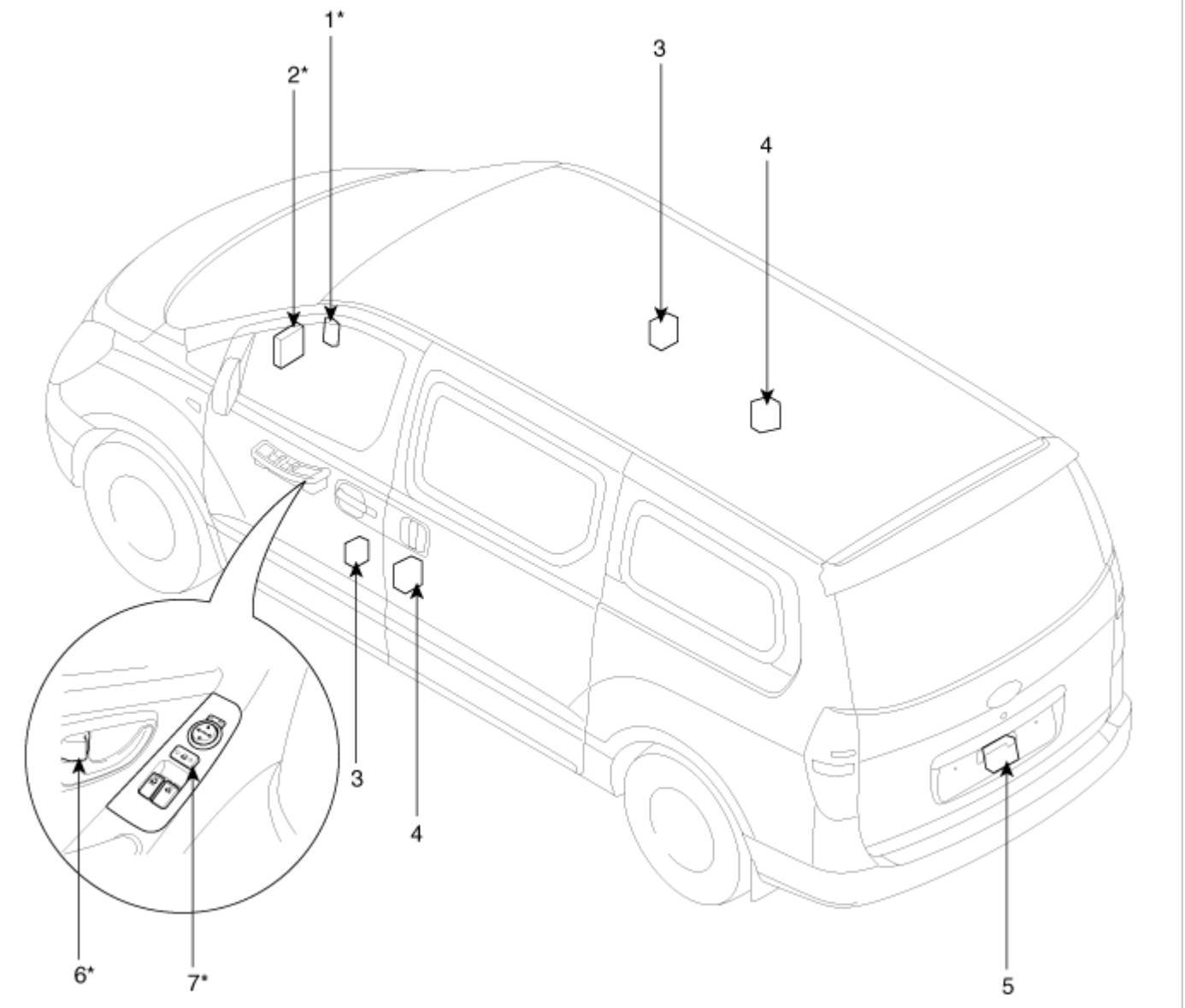
1. Install the wiper switch then connect the lighting switch connector.
2. Install the lighting switch then connect the wiper switch connector.
3. Install the steering column upper and lower shrouds.

Specifications

Items		Specifications
Rated voltage		DC 12V
Operating temperature range		-30℃ ~ +80℃ (-22 ~ +176℉)
Lever end play		0.098 in (2.5 mm)
Rated load	Dimmer □ passing switch	High : 1A (Relay load) Low : 1A (Relay load) Passing : 1A (Relay load)
	Lighting switch	Lighting : 1A (Relay load)
	Turn signal switch	6.6 ± 0.5A (Lamp load)
	Wiper □ mist switch	High : 4.5A (Motor load) Low : 4.5 A (Motor load) Intermittent : 0.22±0.05A(Relay Load) Lock : Max. 28A (Motor load) Mist : 1A (Relay load)
	Washer switch	4A (Motor load)
	Rear wiper □ Washer	Wiper : 1A (Relay load) Washer : 4A (Motor load)

Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.



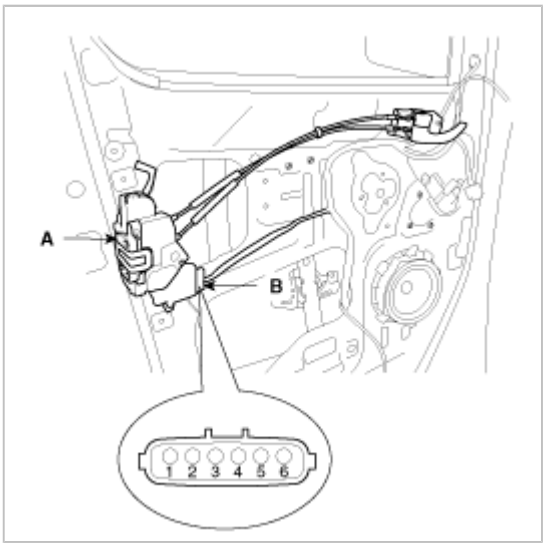
1. ICM relay box (Door lock/unlock relay) 2. Body control module (BCM) 3. Front door lock actuator & switch 4. Rear slide door lock actuator & switch	5. Tailgate actuator & switch 6. Door lock knob 7. Door lock switch

Inspection

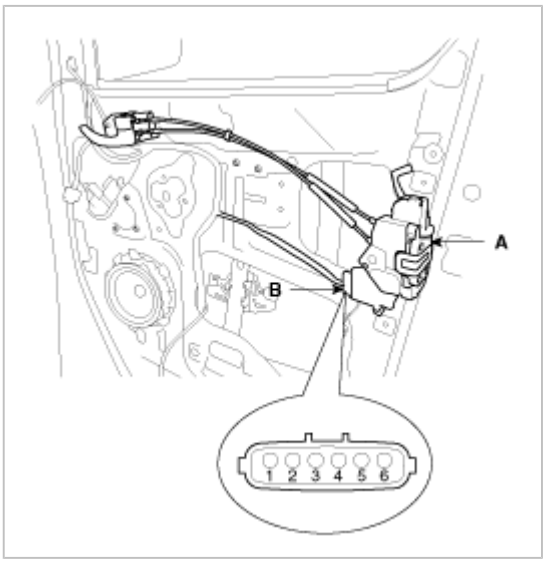
Front Door Lock Actuator

1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



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

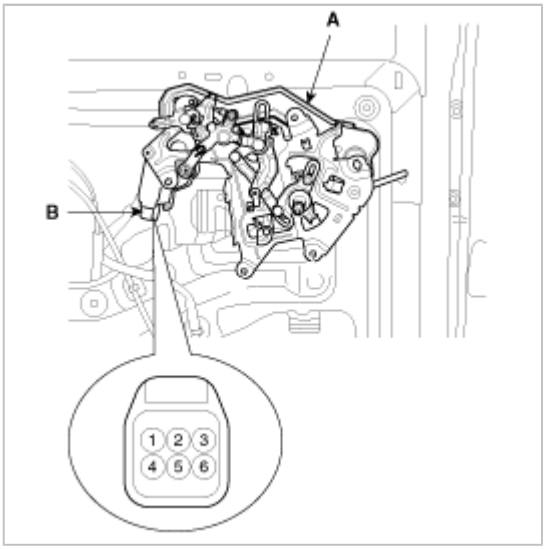
( ) : RHD

Position \ Terminal		5(2)	6(1)
Front left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		2(5)	1(6)
Front right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

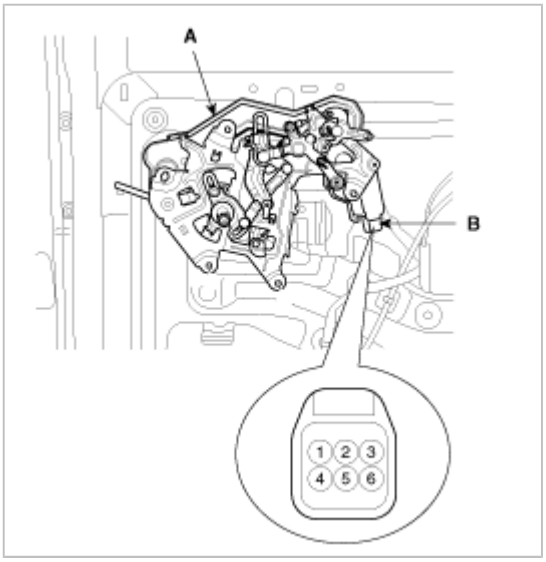
Rear Slide Door Lock Actuator

1. Remove the rear door trim.
   (Refer to the Body group - Rear door)
2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



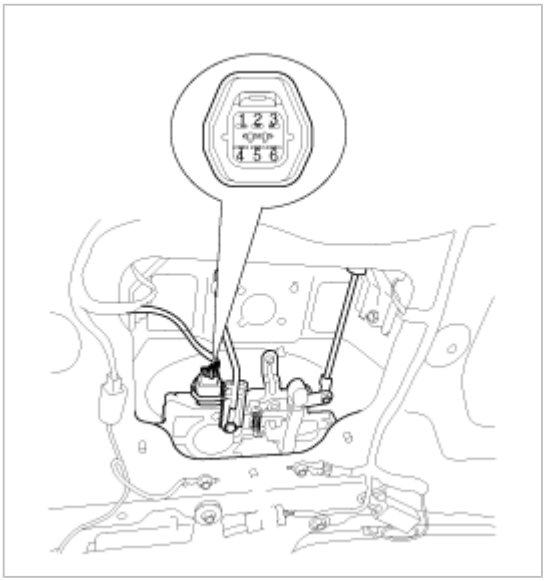
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

( ) : RHD

Position \ Terminal		1(3)	2(2)
Rear left	Central Lock	⊕	⊖
	Central Unlock	⊖	⊕
Position \ Terminal		3(1)	2(2)
Rear right	Central Lock	⊖	⊕
	Central Unlock	⊕	⊖

Tailgate Lock Actuator Inspection

1. Remove the tailgate trim. (Refer to the Body group - tailgate)
2. Disconnect the 6P connector from the actuator.



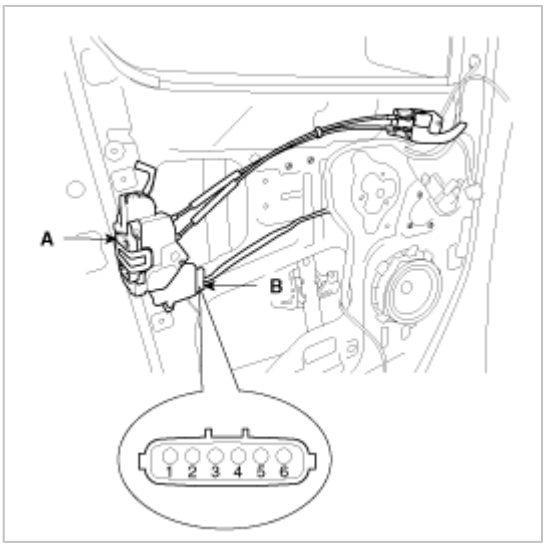
3. Check actuator operation by connecting power and ground according to the table. To prevent damage to the actuator, apply battery voltage only momentarily.

Position \ Terminal	4	6
Unlock	⊕	⊖
Lock	⊖	⊕

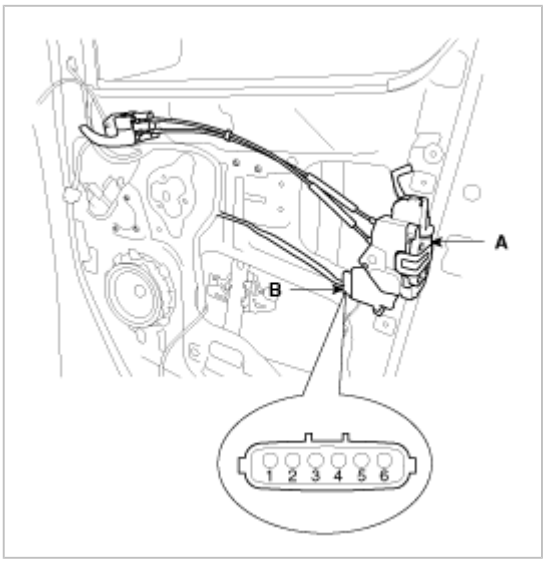
Front Door Lock Switch

1. Remove the front door trim.
   (Refer to the Body group - Front door)
2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



3. Check for continuity between the terminals in each switch position when inserting the key into the door according to the table.

( ) : RHD

Position \ Terminal		4(3)	3(4)	2(5)
Front left	UNLOCK	○——	——○	
	LOCK		○——	——○
Position \ Terminal		3(4)	4(3)	5(2)
Front right	UNLOCK	○——	——○	
	LOCK		○——	——○

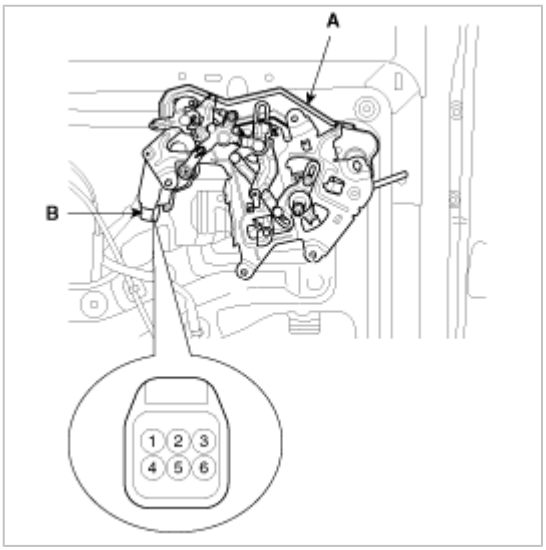
Rear Slide Door Lock Switch

1. Remove the rear door trim.

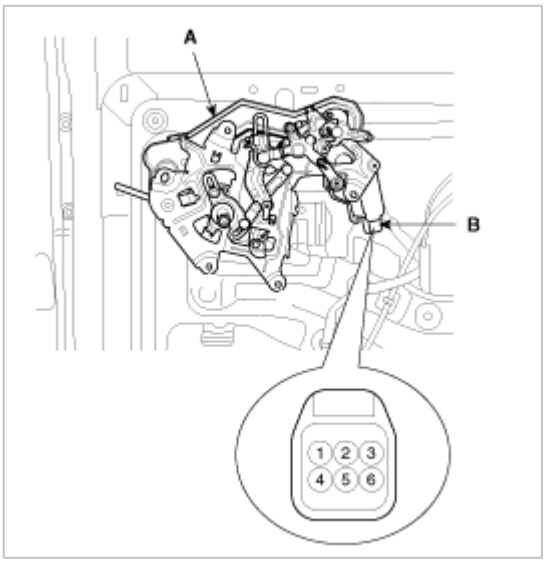
(Refer to the Body group - Rear door)

2. Disconnect the connectors (B) from the actuator (A).

[LHD]



[RHD]



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

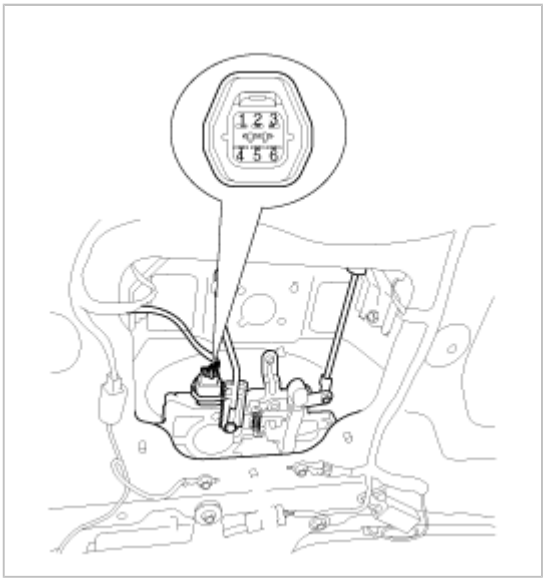
( ) : RHD

Position \ Terminal		5(5)	6(4)
Rear left	Lock		
	Unlock	○———	———○

Position \ Terminal		5(5)	4(6)
Rear right	Lock		
	Unlock	○———	———○

Tailgate Switch

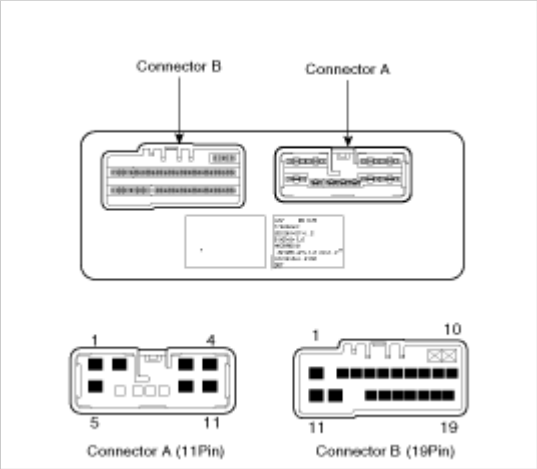
1. Remove the tailgate trim. (Refer to the Body group - Tailgate)
2. Disconnect the 6P connector from the actuator.



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

Position \ Terminal	1	2	3
Lock		○———	———○
Unlock	○———	———○	

Inspection



Door Lock

1. Disconnect the negative (-) battery terminal.
2. Remove the ICM relay box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.11 terminal and No.13 terminals in the ICM-B when power and ground are connected to the No.1 terminal and No.2 terminal in the ICM-B.
5. There should be no continuity between the No.5 terminal and No.14 terminal in the ICM-B when power is disconnected.

Terminal / Power	ICM-B (11)	ICM-B (13)	ICM-B (1)	ICM-B (2)
Disconnected			○	○
Connected	○	○	⊖	⊕

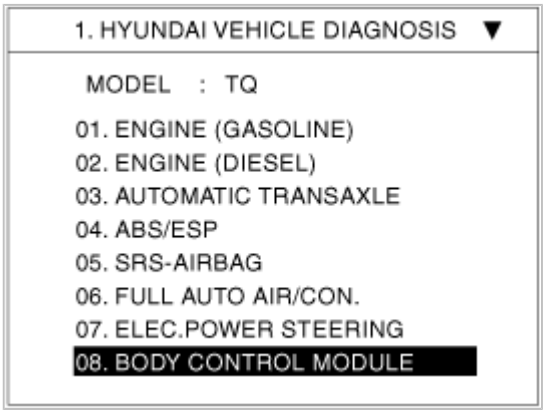
Door Unlock

1. Disconnect the negative (-) battery terminal.
2. Remove the ICM relay box.
3. Check for continuity between the terminals.
4. There should be continuity between the No.12 terminal and No.13 terminal in the ICM-B when power and ground are connected to the No.1 terminal and No.3 terminal in the ICM-B.
5. There should be no continuity between the No.12 terminal and No.13 terminal in the ICM-B when power is disconnected.

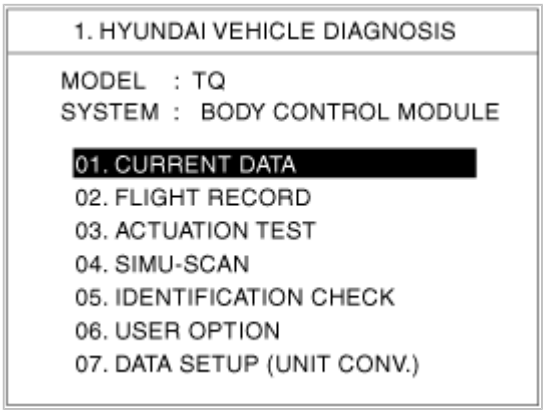
Terminal / Power	ICM-B (12)	ICM-B (13)	ICM-B (1)	ICM-B (3)
Disconnected			○	○
Connected	○	○	⊖	⊕

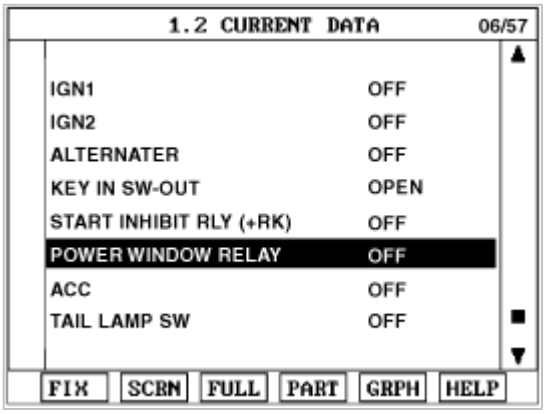
Inspection

1. The DDM inputs can be checked using the scan tool.
2. To check the input value of door lock switch, select option "BODY CONTROL MODULE".

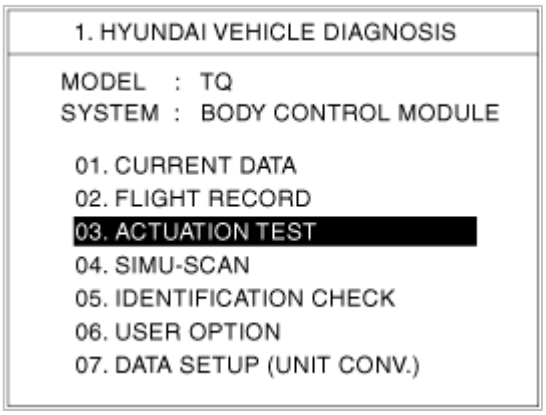


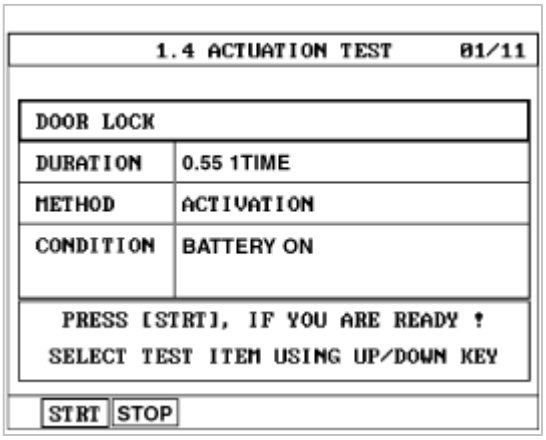
3. Select option "CURRENT DATA".





4. To check the input value of door lock switch in force mode, select option "ACTUATION TEST".

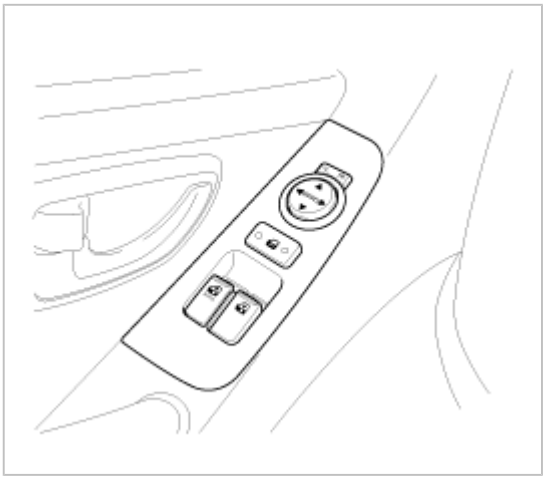




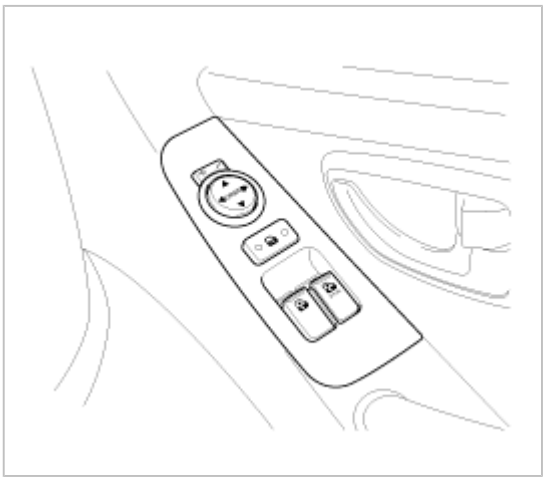
Driver Door Lock Switch

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch. (Refer to the Body group - "front door")

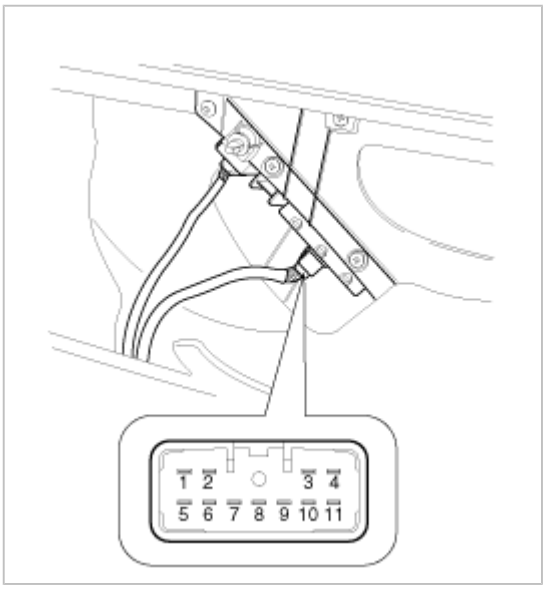
[LHD]



[RHD]



3. Disconnect the connector from the switch.



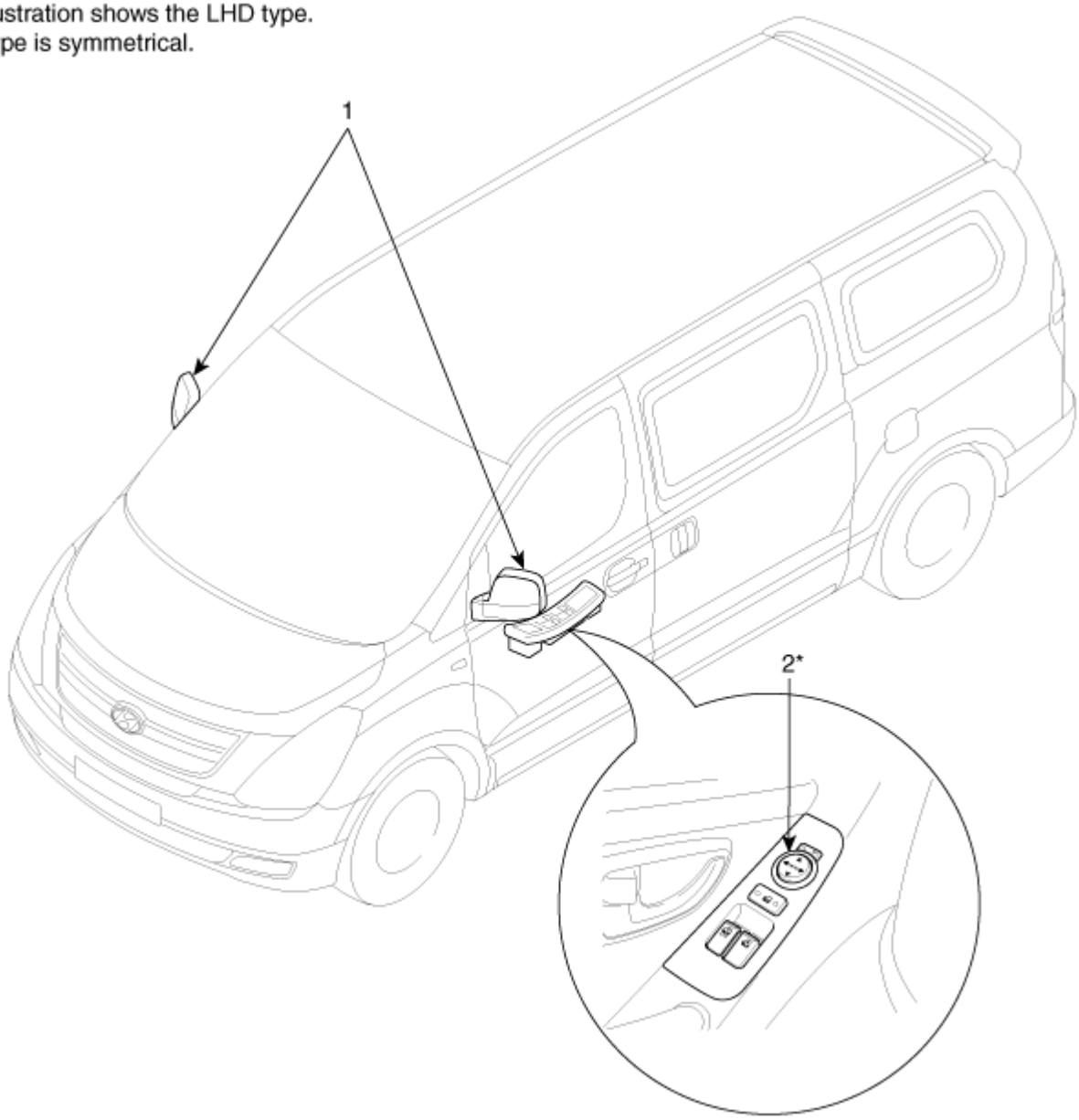
4. Check for continuity between the terminals in each switch position according to the table.

( ) : RHD

Position \ Terminal	2(2)	3(3)	8(8)
LOCK		○——○	
UNLOCK	○———		○

Component Location

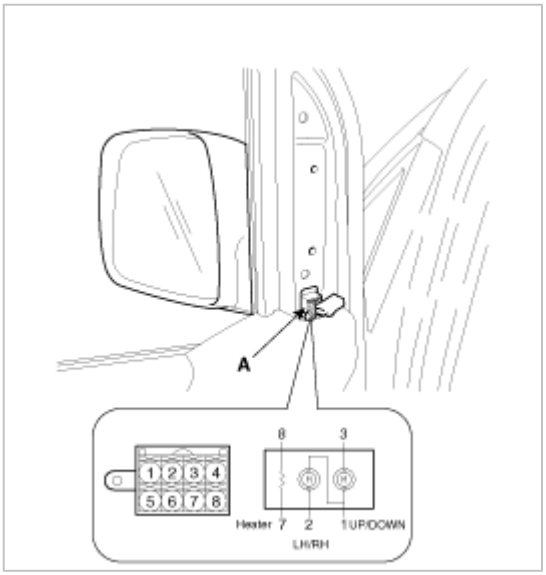
The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.



1. Power door mirror	2. Power door mirror switch

Inspection

1. Remove the front door quadrant inner cover (A). Take care not to damage fixing clips. (Refer to the Body group - front door)
2. Disconnect the power door mirror connector from the harness.
3. Apply battery voltage to each terminal as shown in the table and verify that the mirror operates properly.



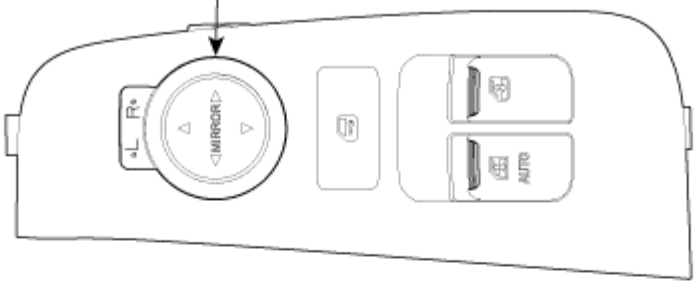
Terminal / Position	1	2	3	B+	GND
UP	○	○		○	
			○		○
DOWN			○	○	
	○	○			○
OFF	○	○		○	
RIGHT	○		○	○	
		○			○
LEFT		○		○	
	○		○		○

Mirror Heater

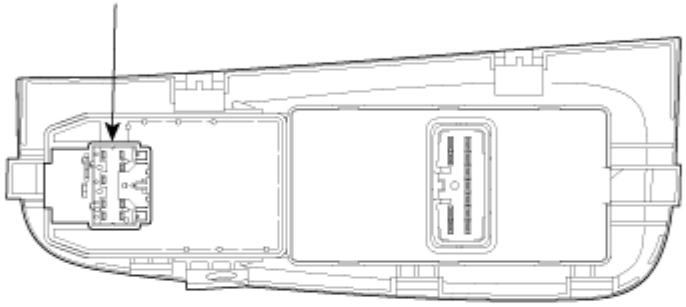
Terminal / Position	7	8
Heater	○	○

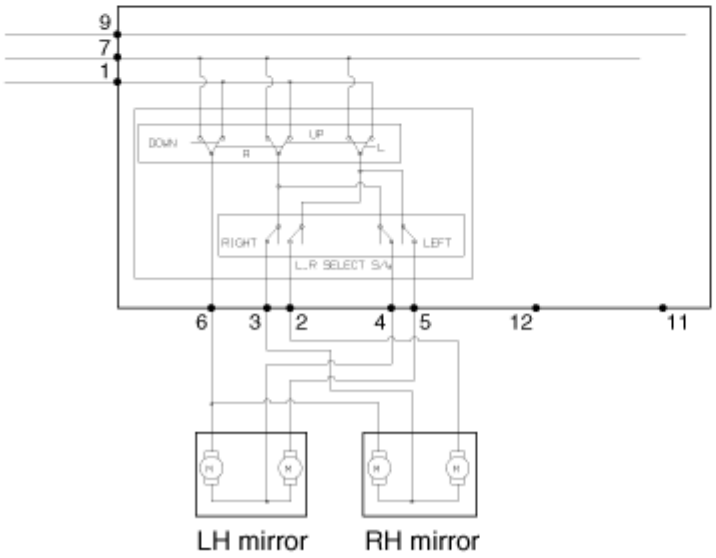
Components

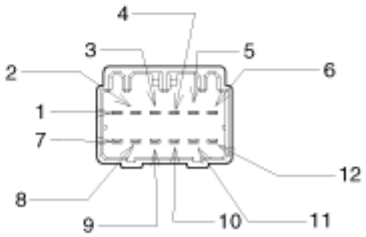
Power outside mirror switch (12Pins)



Power outside mirror switch connector (12Pins)



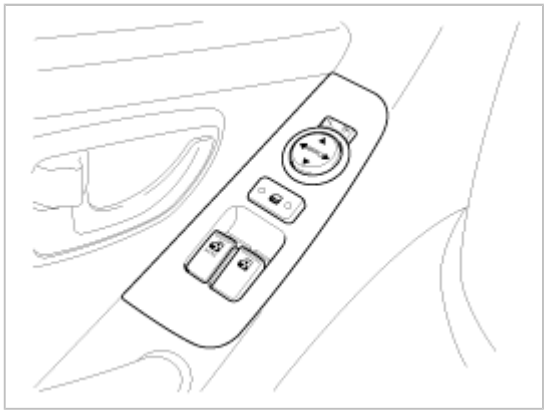




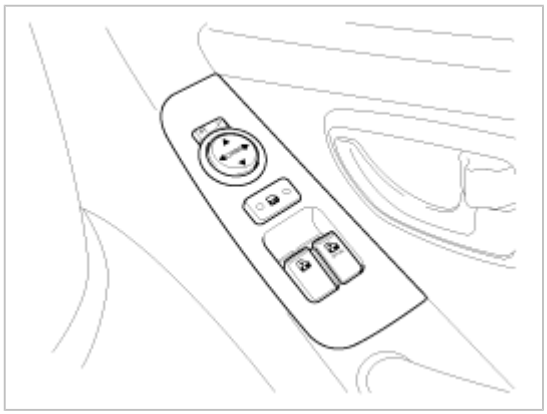
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim and power window switch module. (Refer to the Body group-front door)

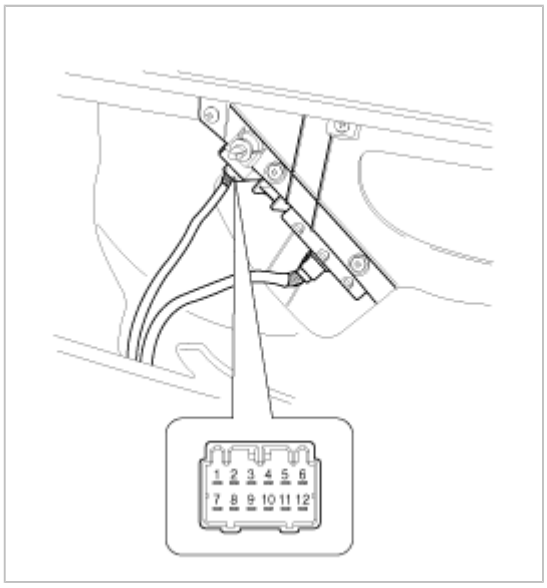
[LHD]



[RHD]



3. Check for the continuity between terminals of power door mirror switch according to the table.

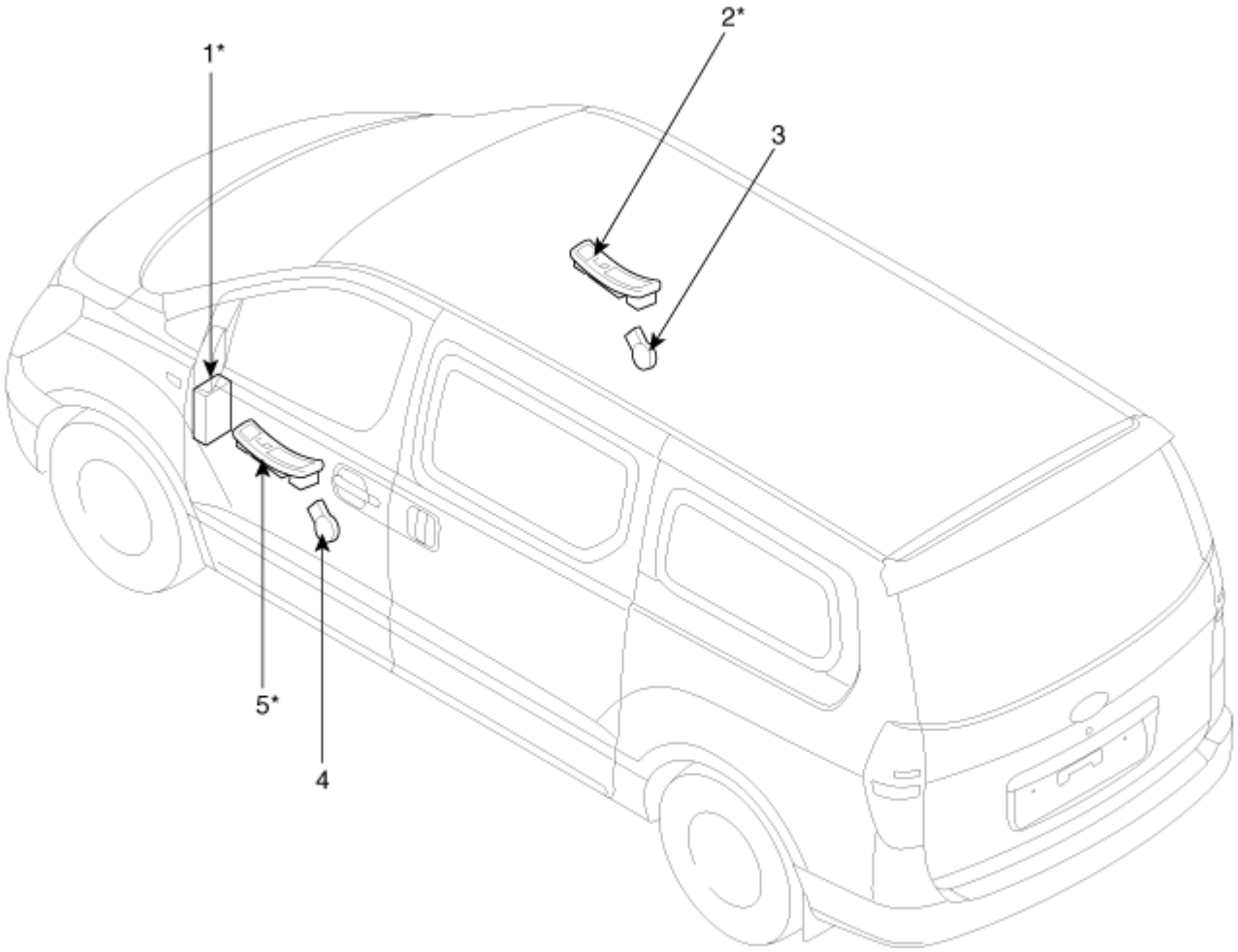


( ) : RHD

Item	Terminal / Direction	4 (3)	5 (2)	3 (4)	2 (5)	6 (1)	1 (6)	7 (12)	9 (10)
Left	UP	○	○			○	○	○	
	DOWN	○	○			○	○	○	
	OFF	○	○			○		○	
	LEFT	○				○	○	○	
	RIGHT		○			○	○	○	
Right	UP			○	○	○	○	○	
	DOWN			○	○	○	○	○	
	OFF			○	○	○		○	
	LEFT			○		○	○	○	
	RIGHT				○	○	○	○	

Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.



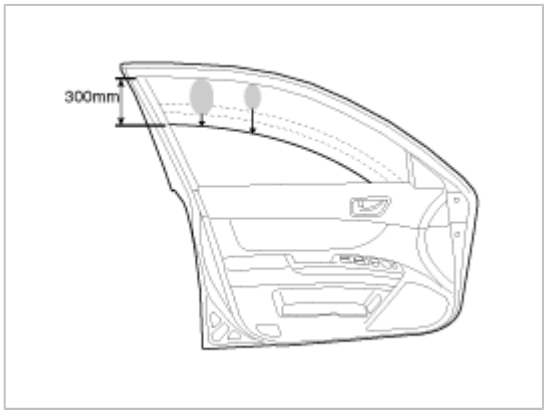
1. Instrument panel junction box (Power window relay) 2. Passenger window switch 3. Front window motor (Passenger)	4. Front window motor (Driver) 5. Driver power window main switch

Operation

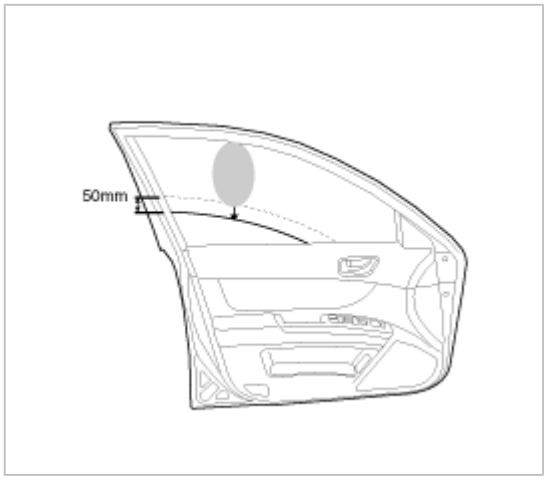
Function Of Safety Power Window

When all door (Front, Rear) power window auto-up switch is operated, safety function is activated.

1. Safety function condition
   When detect the force of 100N during the window rising, window is reversed.
2. Length of window reversing (except holding the auto-up switch)
   A. When detect the jamming during the 4mm ~ 250mm from top of the door.
   → Window is reversed until 300mm from top of the door.



   B. When detect the jamming over the 250mm from top of the door.
   → Window is reversed until 50mm from jamming position.
   → Window is reversed 50mm or bottom position in case of 50mm reversing distance.

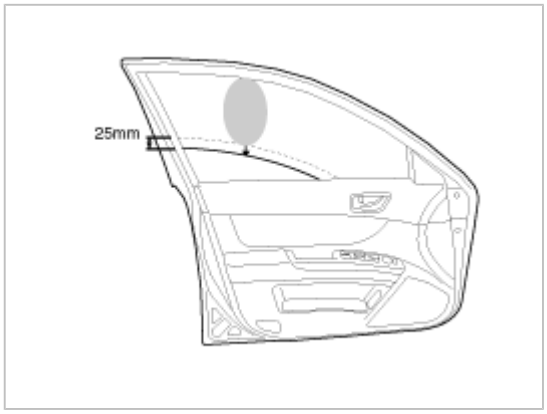


   C. When detect the jamming over 250mm from top of the door.
   → Window stops at reverse point.
3. Length of window reversing (holding the auto-up switch)
   A. When detect the jamming during holding the auto-up switch.
   → Window is reversed until 25mm from jamming position.
   B. Auto-up function is not available during the 5 seconds from above condition.
   → When holding the auto-up switch, window is operated as a manual-up function. (Safety function is

not activated.)

C.

D.



4. Safety function is not available area
   Safety function is not available during the 4mm from top of the door.

B+ and Power Window Enable

ECU power ought to be supplied from B+ in order to secure the RAM and its memory. ECU observes the level of power window enable to decide the state (normal mode, sleep mode). The ECU is allowed to operate the motor with power window enable On and stop the motor as well as change to the sleep mode with power window enable Off. However, the reverse by anti-pinch function ought to be completed regardless of the EN on/off.

Self Diagnosis

1. Checksum error of RAM after Wake-Up
   A. S/W reset, De-normalization
2. Low voltage (Ubat<5V)
   A. S/W reset, De-normalization
3. Hall sensor direction error except speed hall sensor error(Hardware error, No plausibility between the switch command and rotational direction of the motor)
   A. De-normalization, No auto up is allowed.
4. Normalized and the position value of closing window is 3cm above the previous “0” position
   A. Stop the movement, De-normalization
5. Normalized and the position value of opening window is 5cm above the entire travel
   A. Stop the movement, De-normalization
6. Abnormal behavior of ECU
   A. H/W reset by the watch dog control, No movement
7. No plausibility of Flash ROM data after wake-up
   A. Stop the movement, De-normalization

Thermal Protection

Software provides an algorithm in order to prevent the motor from thermal overheating under the specified conditions like the valid Flash ROM Data.

After power on reset, the software thermal counter starts to count from the initial value. In case of motor running, software increases the thermal counter by using the motor heating characteristic, otherwise the thermal counter decreases by using the motor cooling characteristic.
There exist 2 thermal protection limits. If the software thermal counter is over the first limit, the motor movement stops until the software thermal counter decrease to the release limit temperature value, but still allows the current movement to finish. If the software thermal counter is over the second limit (while motor running), the movement stops at once until the release temperature value is reached (reversing will not be interrupted by software thermal protection).

Voltage supply : 13.5V
Load : 3N.m
Temperature : 23˚C ± 5□

The motor is able to continue to operate at least “15” cycles without a break under the above conditions and after thermal protection is activated, the motor turns to the operational condition within “35 ± 5” seconds.
Test starts with SW-thermal counter at the initial value.
Cycle : Full closed → 1sec. rest → Full opened → 1sec. rest

2nd heating limit > 1st heating limit

Normalization
After power on reset or an error detection, the motor has to be normalized at the fully closed position.
How to be normalized :

- Move the window upwards into the fully closed position. As the window reaches the fully closed position, hold the power window switch in auto for t tblock. If the block is recognized, the system state turns to normalized.

Block Control
“tblock” time is defined as the time duration that the system does not receive the valid hall sensor pulse while motor ON. When the system doesn’t detect the hall sensor pulse for tblock = 200ms 10ms the software recognizes the window state as a block and terminates the motor or carries out the reverse operation by anti-pinch function.

In case of the block detection within the anti-pinch function range, the system will act on the anti-pinch function.

Position Control
To detect the window position and direction of motor rotation, hall sensors are employed. ECU recognizes the fully closed position of the window and sets this relative window position value as “0”. When the window goes downwards, based on the information from the hall sensor, the relative position value

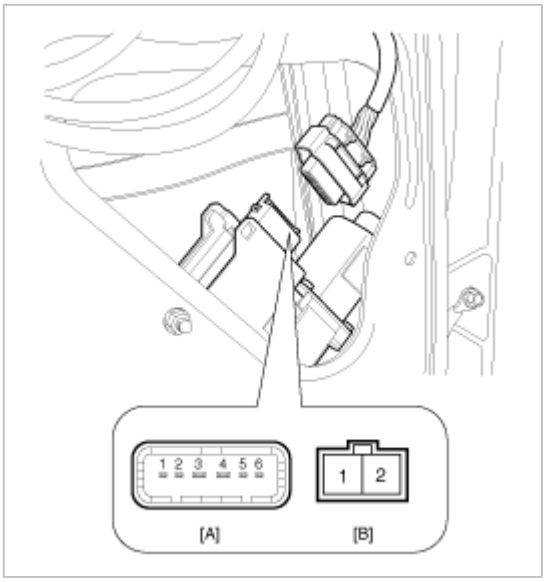
increments. On the contrary, when the window goes upwards, it decrements.

motor position is only valid if the system stays in normalized state. (see initialization force limitation).

Inspection

Front Power Window Motor

1. Remove (-) negative battery terminal.
2. Remove the front door trim. (Refer to the Body group-front door)
3. Disconnect the connector from the motor.
   (A : Safety, B : Standard)



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

[STANDARD]

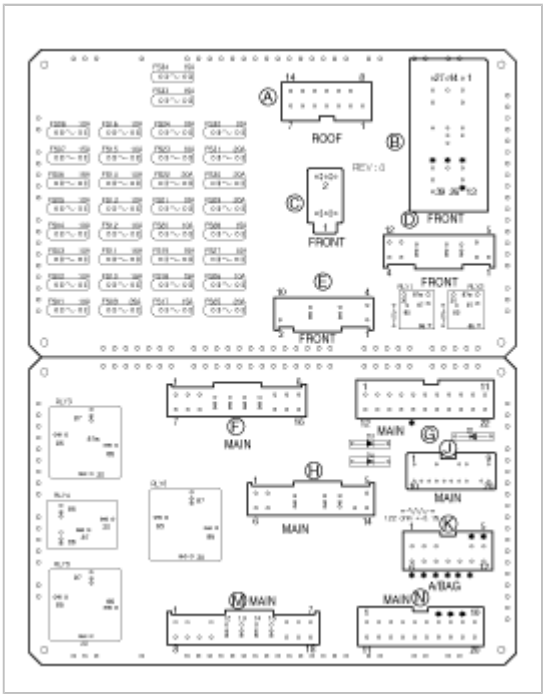
Position \ Terminal			1	2
Left	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖
Right	DOWN	Clockwise	⊖	⊕
	UP	Counter-clockwise	⊕	⊖

[SAFETY]

Position \ Terminal			1	6
Left	UP	Clockwise	⊖	⊕
	DOWN	Counter-clockwise	⊕	⊖

Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel.
   (Refer to Body group - "Crash pad")
3. Remove the junction box.
4. Check for continuity between the terminals.
5. There should be continuity between the No.10 in the I/P-D and No.13(RH) or 9(LH) terminal in the I/P-F when power and ground are connected to the No.10 terminal in the I/P-D and No.7 terminal in the I/P-G.
6. There should be no continuity between the No.10 terminal in the I/P-D and No.13(RH) or 9(LH) terminal in the I/P-F when power is disconnected.

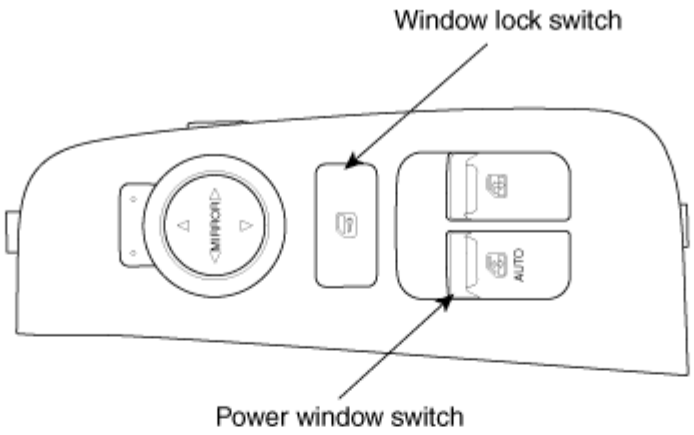


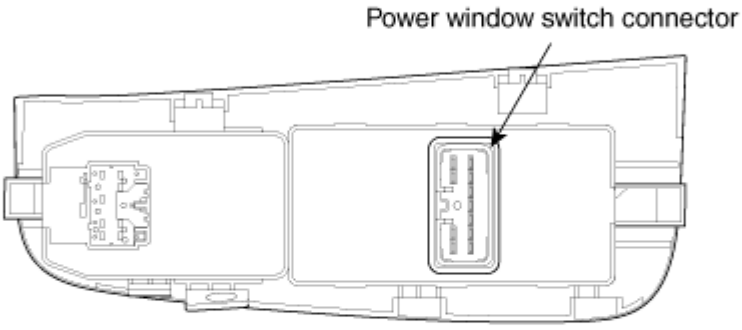
Terminal / Power	I/P-D (10)	I/P-F (9 or 13)	I/P-H (10)	I/P-G (7)
Disconnected			○	○
Connected	○	○	⊕	⊖

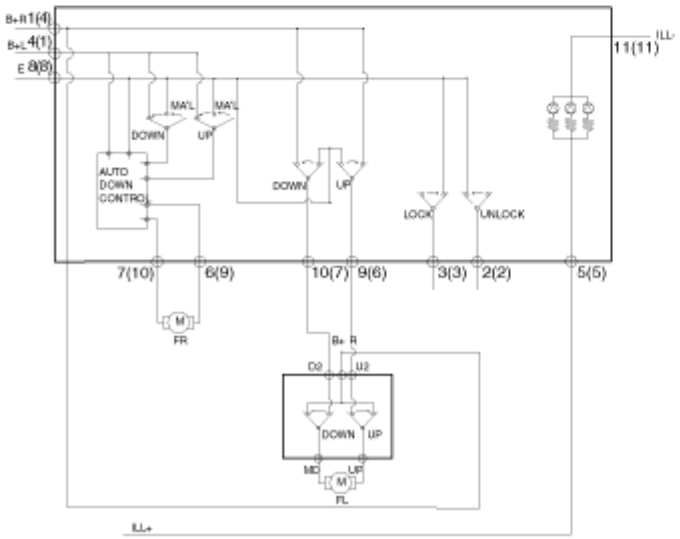
Components

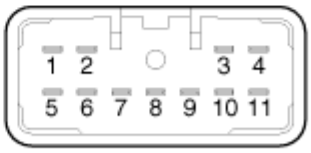
Power Window Main Switch

[POWER WINDOW]

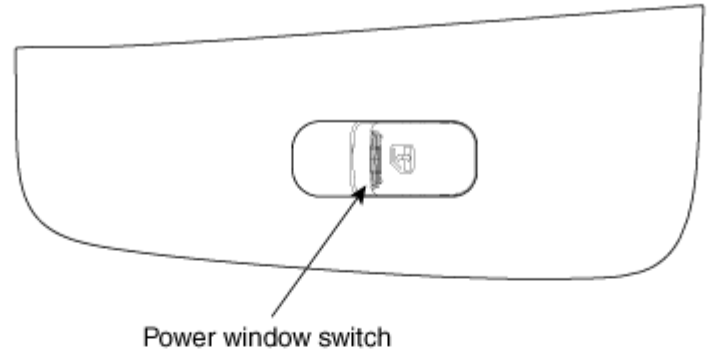


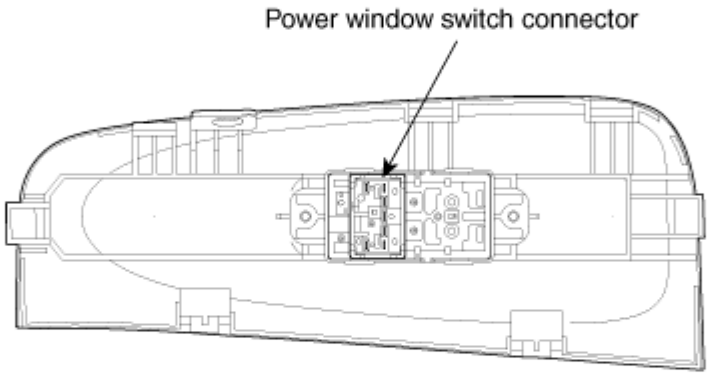


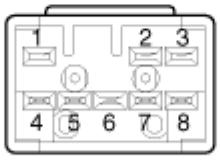


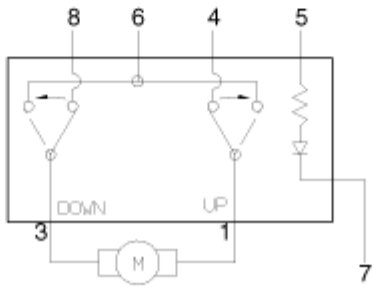


Passenger/rear Power Window Switch





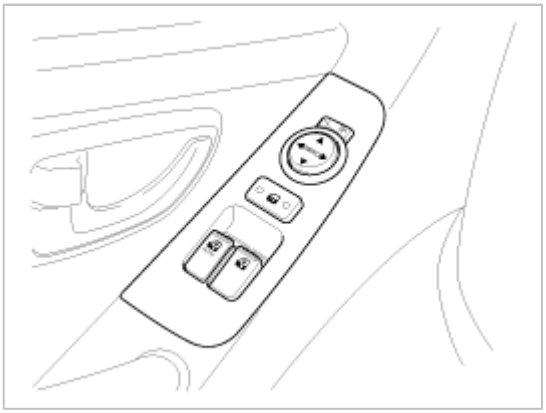




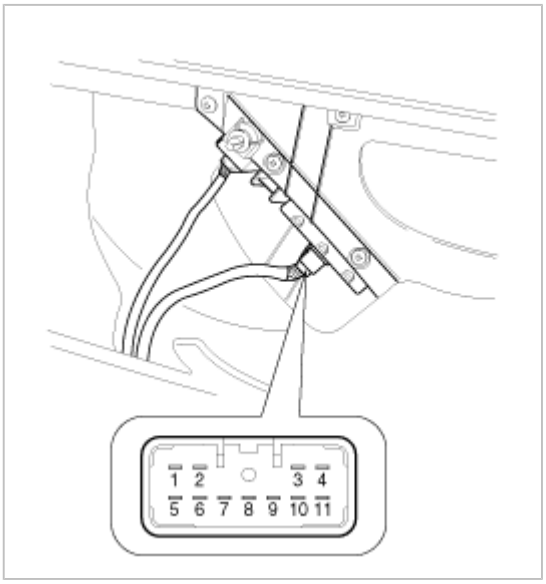
Inspection

Power Window Main Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim. (Refer to the Body group - front door)



3. Disconnect the connector from the switch.



4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

( ) : RHD

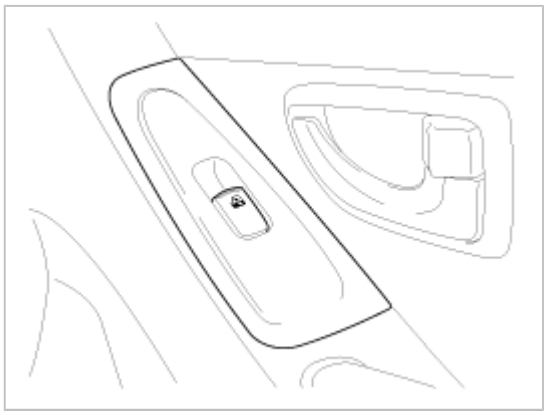
Terminal / Position	3(3)	8(8)	2(2)
Lock	○	○	
Unlock		○	○

( ) : RHD

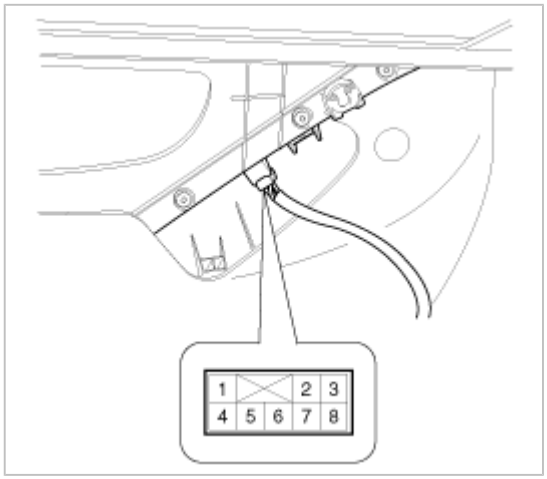
Terminal / Position	Front left				Front right			
	4(1)	9(6)	10(7)	8(8)	1(4)	6(9)	7(10)	8(8)
UP	○—○		○—○	○—○	○—○		○—○	○—○
OFF		○—○	○—○	○—○		○—○	○—○	○—○
DOWN	○—○	○—○		○—○	○—○	○—○		○—○

Passenger Power Window Switch Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the front door trim. (Refer to the Body group - front door)



3. Disconnect the 8P connector from the switch.

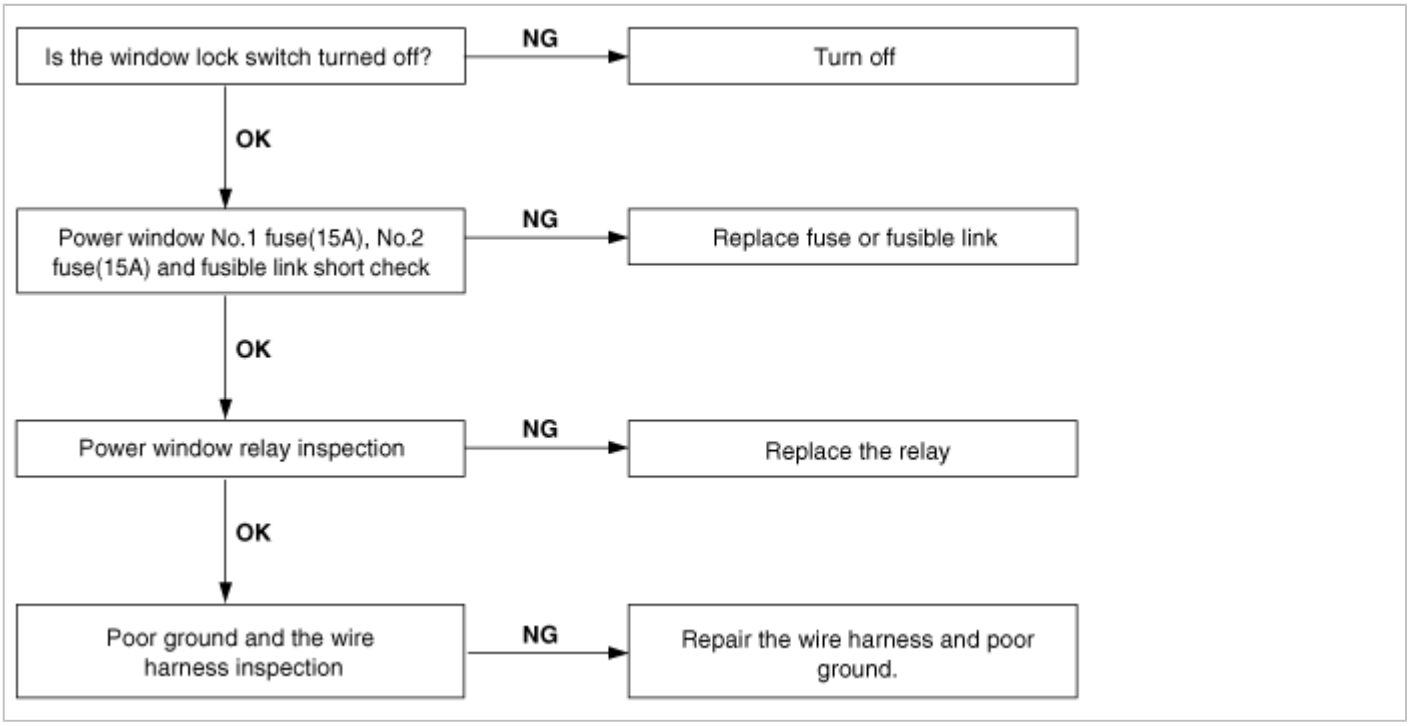


4. Check for continuity between the terminals in each switch position according to the table. If the continuity condition is not normal, replace the switch.

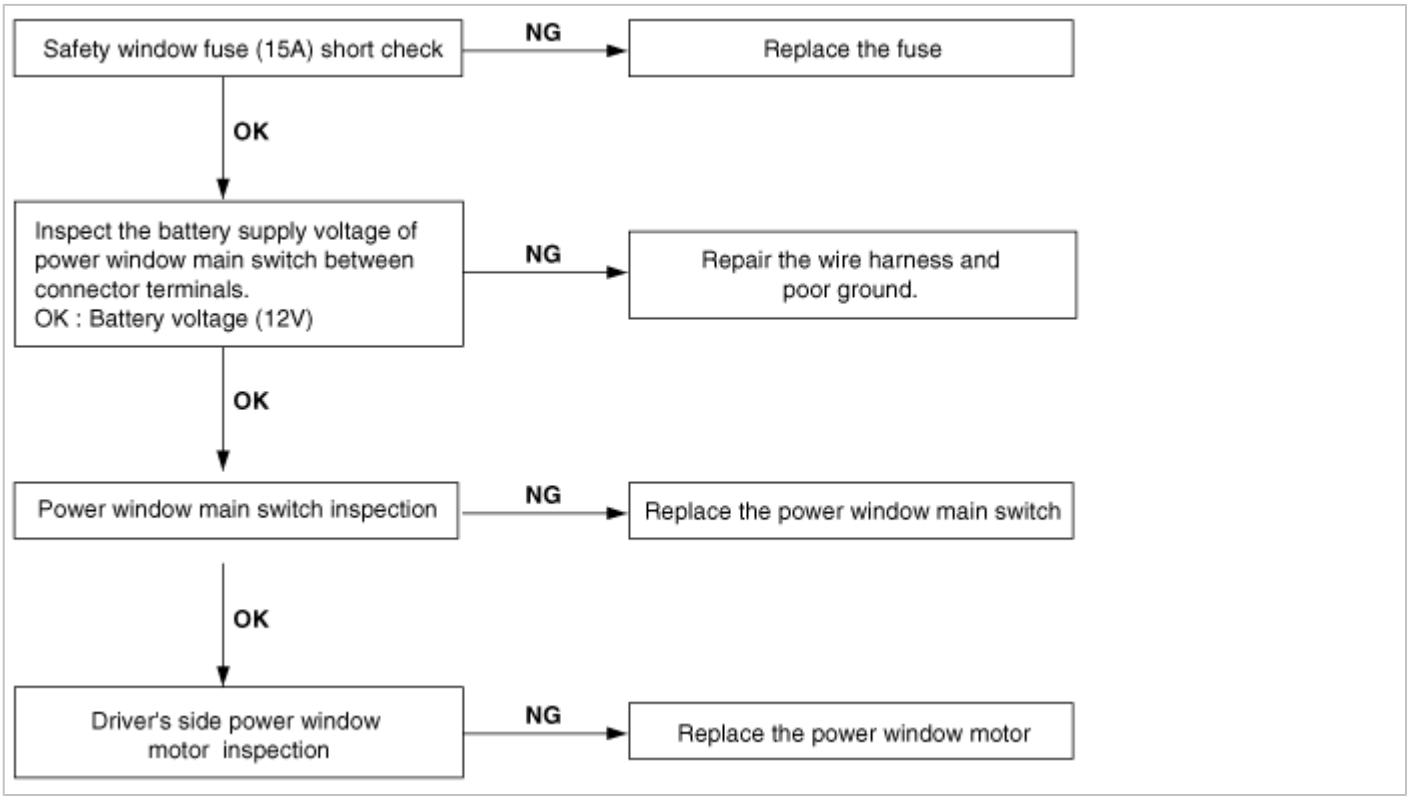
Terminal / Position	6	1	4	8	3
UP	○—○			○—○	○—○
OFF		○—○	○—○	○—○	○—○
DOWN	○—○	○—○			○—○

Troubleshooting

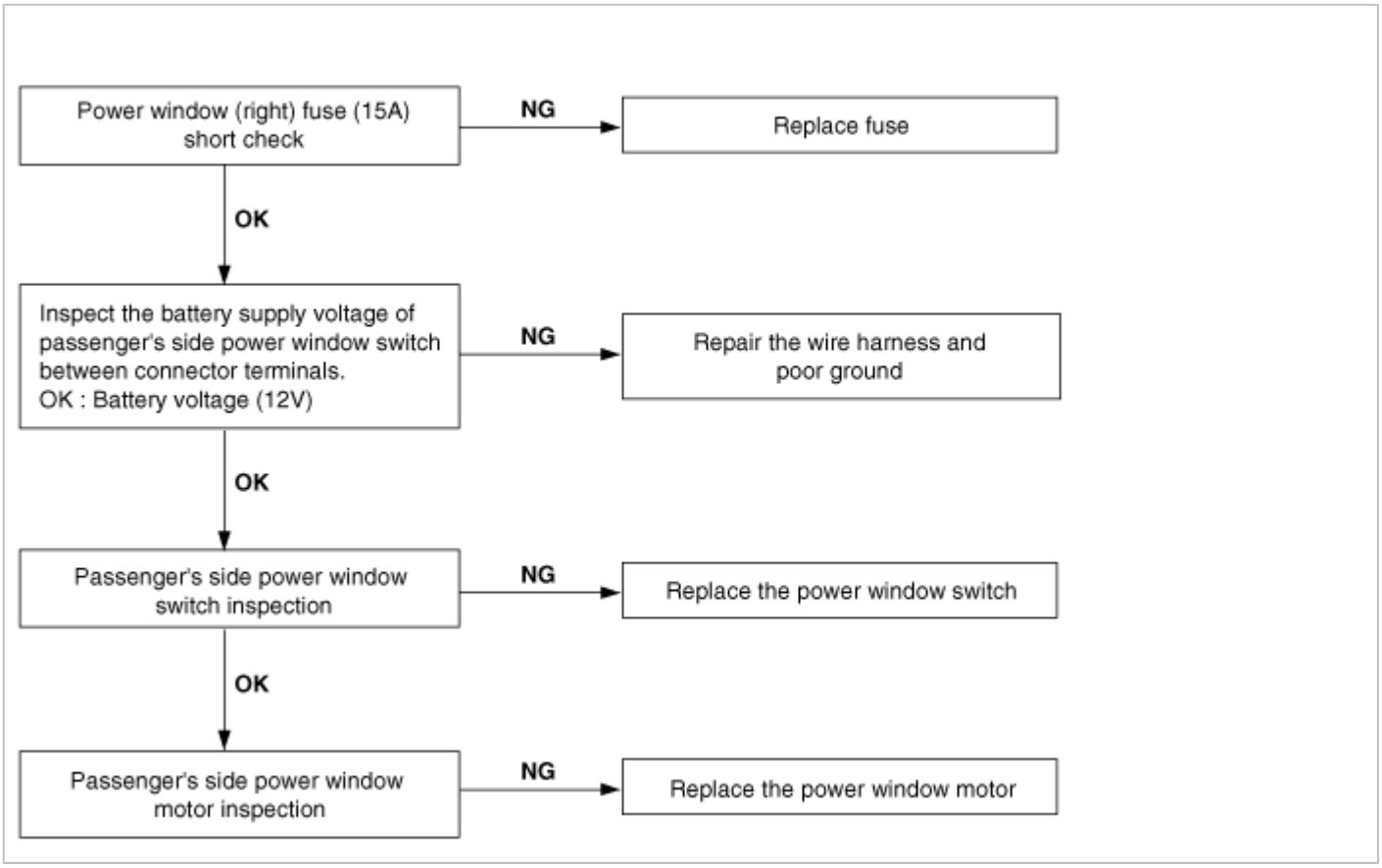
1. No windows operate from the main switch on the driver's door.



2. Driver's side window does not operate.



3. Passenger's side window does not operate.

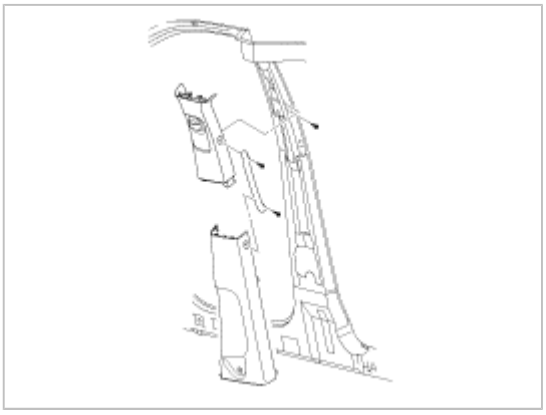

Power window (right) fuse (15A) short check
NG
Replace fuse
OK
Inspect the battery supply voltage of passenger's side power window switch between connector terminals.
OK : Battery voltage (12V)
NG
Repair the wire harness and poor ground
OK
Passenger's side power window switch inspection
NG
Replace the power window switch
OK
Passenger's side power window motor inspection
NG
Replace the power window motor

Inspection

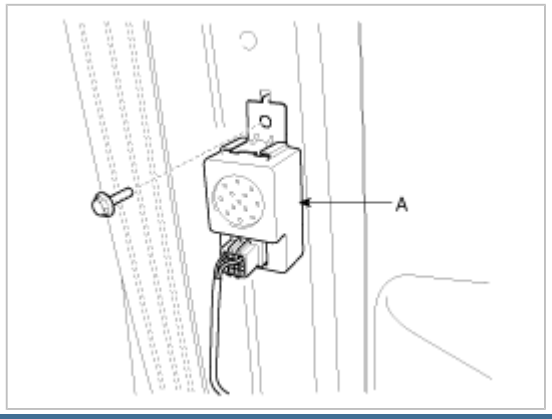
Test the buzzer by connecting battery voltage to the 1 terminal and ground the 2 terminal.
The buzzer should make a sound. If the buzzer fails to make a sound, replace it.

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the driver side center filler trim (A).
   (Refer to the Body group - "Interior trim")



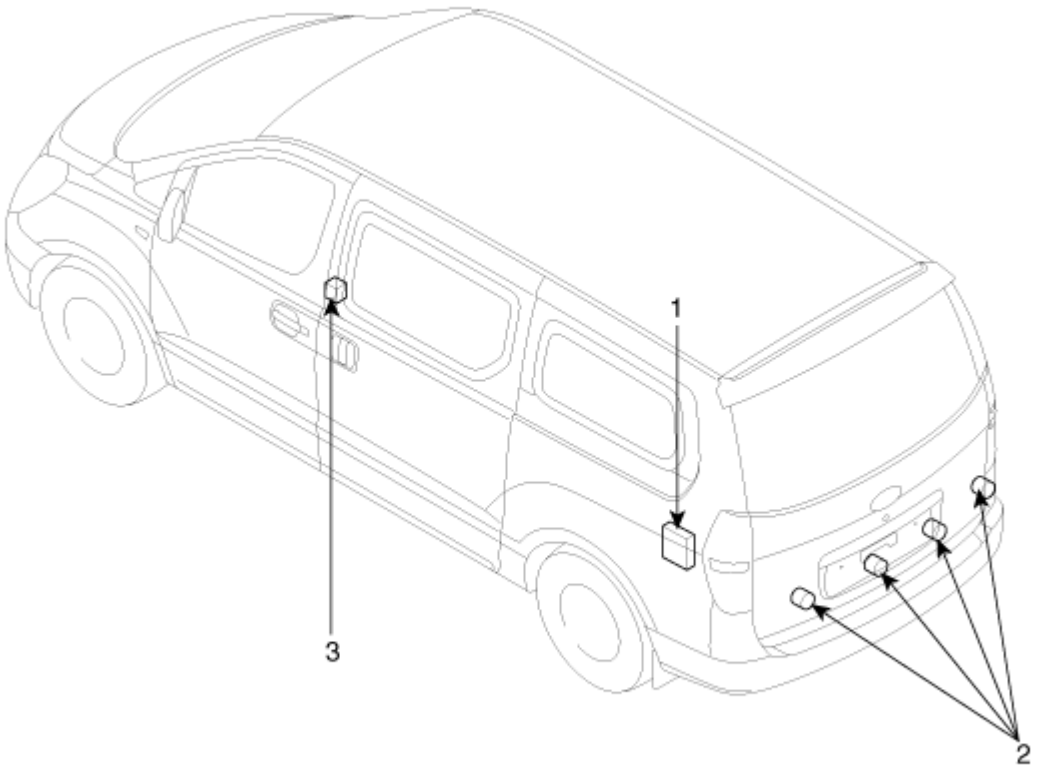
3. Remove the buzzer (A) after loosening the bolt and disconnecting the connector.



Installation

1. Install the buzzer.
2. Install the driver side center filler trim.

Component Location



1. Rear parking assist system control unit 2. Ultrasonic sensor	3. Buzzer

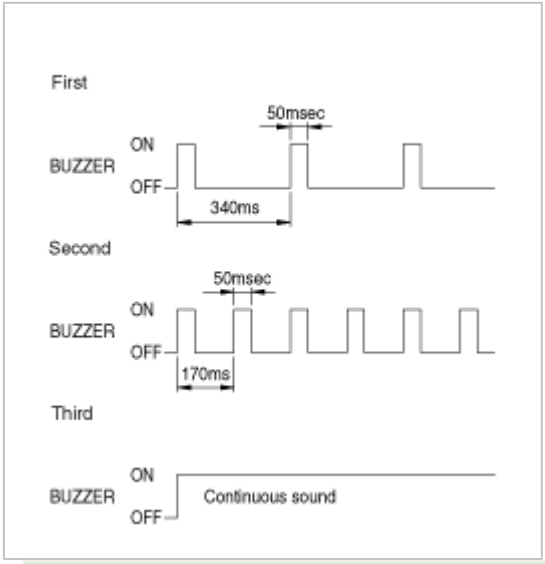
Description

When reversing, the driver is not easy to find objects in the blind spots and to determine the distance from the object. In order to provide the driver safety and convenience, rear parking assist system will operate upon shifting to "R" Ultrasonic sensor will emit ultrasonic wave rearward and detect the reflected wave. Control unit will calculate distance to the object using the sensor signal input and output buzzer alarm in three steps (first, second and third alarm).

Alarm Range

Upon detecting an object at each range out of 3 ranges as stated below within the operation range, it will generate alarm.

First alarm : Object comes near to the sensor located at the rear of vehicle, within 81-120cm ± 15cm
Second alarm : Object comes near to the sensor located at the rear of vehicle, within 41-80cm ± 10cm
Third alarm : Object comes near to the sensor located at the rear of vehicle, within 40cm ± 10cm

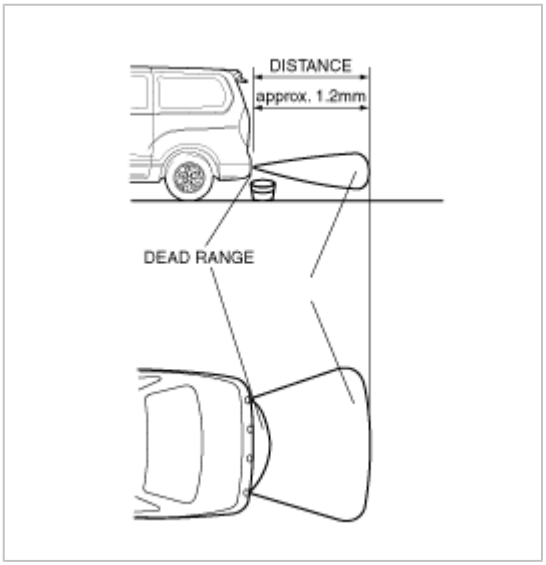


1. Time tolerance of the above waveform : Time ± 10%
2. At nearer distance than 40cm, detection may not occur.
3. Alarm will be generated with vehicle reversing speed 10km/h or less.
   For moving target, maximum operation speed shall be target approach speed of 10km/h.
4. When the vehicle or the target is moving, sequential alarm generation or effective alarm may be failed.
5. Misalarm may occur in the following conditions.
   - Irregular road surface, gravel road, reversing toward grass.
   - Horn, motor cycle engine noise, large vehicle air brake, or other object generating ultrasonic wave is near.
   - When a wireless transmitter is used near to the sensor.
   - Dirt on the sensor.

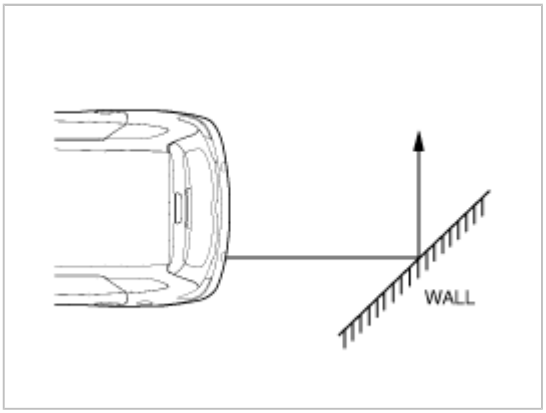
- Sequential alarm may not occur due to the reversing speed or the target shape.

Warning

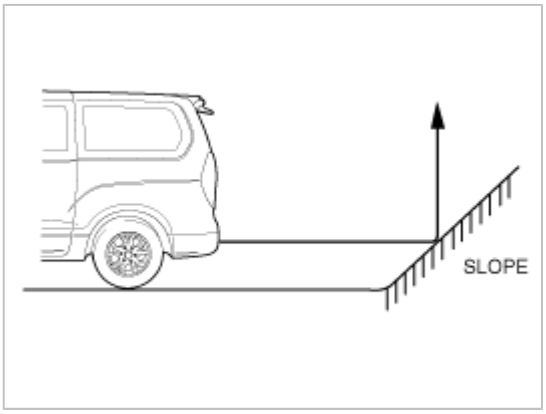
1. Range detected by back sensors is limited.
   Watch back before reversing.
2. There is a blind spot below the bumper. Low objects (for example boundary barrier) may be detected from minimum 1.5m away unable to detect at nearer.
3. Besides there are some materials unable to be detected even in detection range as follows.
   (1) Needles, ropes, rods, or other thin objects.
   (2) Cotton, snow and other material absorbing ultrasonic wave(for example, fire extinguisher device covered with snow)



4. Reversing toward the sloped walls.



5. Reversing toward the sloped terrain.

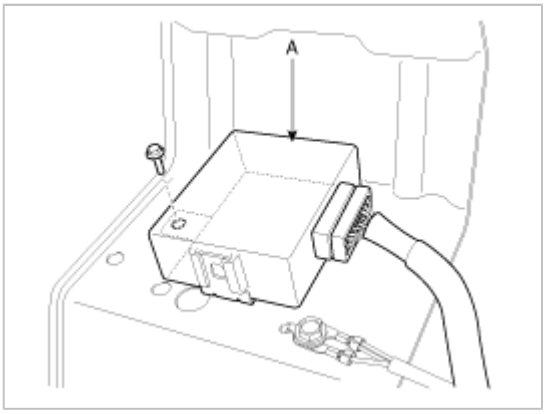


6. False alarm may operate in the following condition: irregular road surface, gravel road, sloped road and grass. Upon alarm generation by grass the alarm may be generated by rock behind grass. Be sure to check for the safety.
   Ultrasonic sensor cannot discriminate among glass, stake, and rock.
7. Sensors may not operate correctly in the below conditions.
   Ensure sensors clean from mud or dirt.
   (1) When spraying the bumper, the sensor opening is covered with something in order not to be contaminated. If sensor opening is contaminated with mud, snow, or dirt, detection range will be reduced and alarm may not be generated under the crash condition. Dirt accumulated on the sensor opening shall be removed with water.
   Do not wipe or scrape sensor with a rod or a hard object.
   (2) If the sensor is frozen, alarm may not operate until sensor thaws.
   (3) If a vehicle stays under extremely hot or cold environment, the detection range may be reduced. It will be restored at the normal temperature.
   (4) When heavy cargo is loaded in tailgate, it changes the vehicle balance, which reduces the detection range.
   (5) When other vehicle's horn, motor cycle engine noise, or other ultra-sonic wave sources are near.
   (6) Under heavy rain.
   (7) When reversing towards a vertical wall and the gap between the vehicle and the wall is 15cm. (Alarm may sound despite of no barrier)
   (8) If radio antenna is installed at the rear.
   (9) If the vehicle rear wiring is re-routed or electrical component is added at the rear part.
   (10) Vehicle balance is changed due to the replacement of the rear spring.
   (11) The unit will operate normally when the vehicle speed is 5km/h or less. Above the speed, the unit may not operate normally.
8. Check the rear bumper for installation condition and deformation. If installed improperly or the sensor orientation is deviated, it may cause malfunction.
9. Be careful not to apply shock during sensor installation on the transmission or reception unit.
10. When adding electrical devices or modifying harness at the rear body of the vehicle, ensure not the change the transmission and reception unit wiring. Tagging the transmission side and reception side, it may cause malfunction.

11. High power radio transmitter (above 10W) may cause malfunction. Do not install it on the vehicle.
12. Be careful that heating or sharp objects shall not touch ultrasonic sensor surface.
    Besides do not cover the sensor opening or press the sensor.

Removal

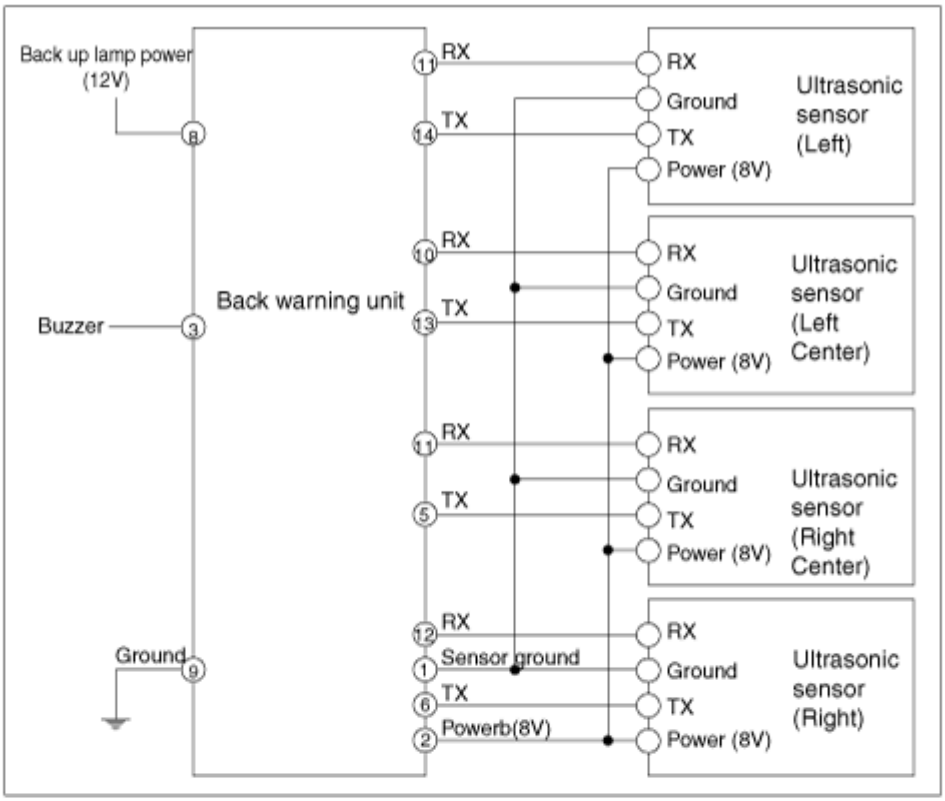
1. Disconnect the negative (-) battery terminal.
2. Remove the rear left guarter trim.
   (Refer to the Body group - "Interior trim")
3. Loosen a mounting 1bolt and disconnect the connector.
4. Remove the rear parking assist system control unit (A).

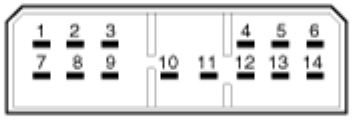


Installation

1. Install the rear parking assist system control unit.
2. Install the rear left trim.

Circuit Diagram





(Rear parking assist system control unit connector)

Pin configuration

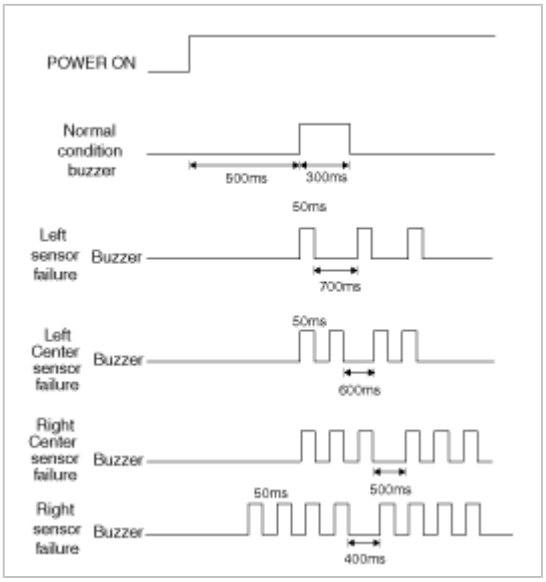
Pin No.	Signal	Test : Desired result
1	Sensor ground	0V
2	Sensor power	8V (While operating)
3	Buzzer	0V (While operating)
4	RX - Sensor(Left)	0~1V voltage change (Inspect waveform)
5	TX - Sensor(Right center)	0~3V voltage change (Inspect waveform)
6	TX - Sensor(Right)	0~3V voltage change (Inspect waveform)
7	Back up lamp power	12V (While shifting to "R")
8	Ground	0V
10	RX - Sensor(Left center)	0~1V voltage change (Inspect waveform)
11	RX - Sensor(Right Center)	0~1V voltage change (Inspect waveform)
12	RX - Sensor(Right)	0~1V voltage change (Inspect waveform)
13	TX - Sensor(Left center)	0~3V voltage change (Inspect waveform)
14	TX - Sensor(Left)	0~3V voltage change (Inspect waveform)

Specification

Item		Specification
Rear parking assist system control unit	Voltage rating	DC 12V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30℃ ~ + 80℃
	Operation current	MAX 600 mA
	Operation frequency	48 ± 5 KHz
	Detective method	Direct and indirect detection
Ultrasonic sensor	Voltage rating	DC 8 V
	Detecting range	40 cm ~ 120 cm
	Operation voltage	DC 7.5 ~ 8.5 V
	Operation current	MAX 20 mA
	Operation temperature	-30℃ ~ + 80℃
	Number of sensors	4 (Right, Right center, Left center, Left)
Piezo buzzer	Voltage rating	DC 12 V
	Operation voltage	DC 9 ~ 16 V
	Operation temperature	-30℃ ~ + 80℃
	Operation current	MAX 60 mA
	Sound, tone	Oscillation frequency : 2.2±0.5 KHz
		Sound level : MIN 70 dB (DC 13V /m)

Diagnosis

1. Operate with ignition switch on and shift the lever to position "R"
2. Then it checks the system condition.
   If no trouble, it generates buzzer alarm sound for 0.3 seconds after 0.5 seconds from power approval. In case of system failure, then it indicates the failed point as follows.
   A. Left sensor failure : beep-beep-beep
   B. Center sensor failure : beep beep-beep beep-beep beep
   C. Right sensor failure: beep beep beep-beep beep beep-beep beep beep
3. Alarm is generated 3 times sequentially.
4. Effective operation range is 10km/h or less for the vehicle speed.



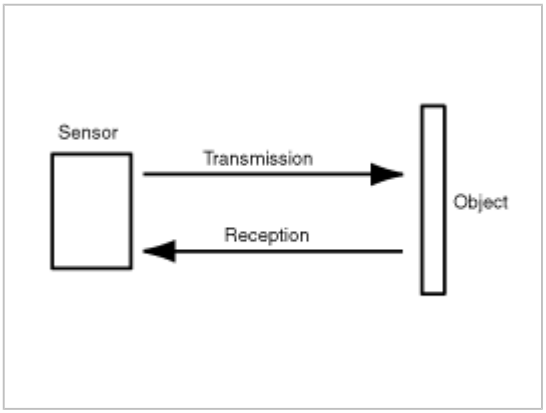
Operation Principle

The sensor emits ultrasonic wave to the objects, and it measures the time until reflected wave returns, and calculates the distance to the object.

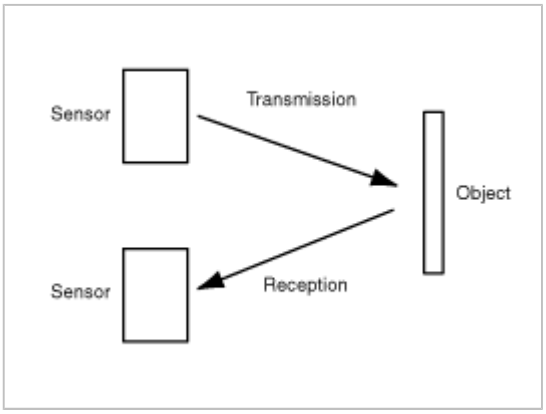
Distance Detection Type

Direct detection type and indirect detection type are used together for improving effectiveness of the detection.

1. Direct detection type: One sensor transmits and receives signals to measure the distance.



2. Indirect detection type: One sensor transmits signals and the other sensor receives the signals to measure the distance.



Measurement Principle

Rear parking assist system is a complementary device for reversing. Rear parking assist system detects objects behind vehicle and provides the driver with buzzer alarm finding objects in a certain area, using ultrasonic wave propagation speed and time.

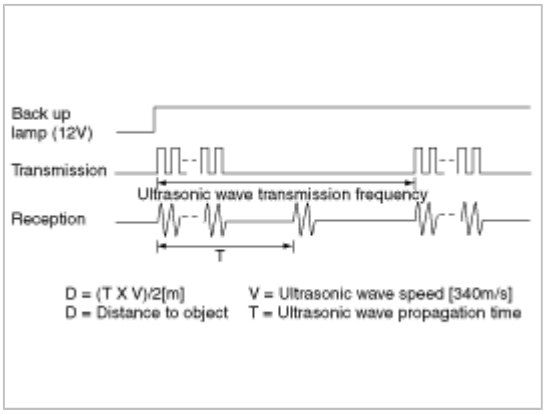
The propagation speed formula of ultrasonic wave in air is following :

$v=331.5 + 0.6t$ (m/s)

v=ultrasonic wave propagation speed

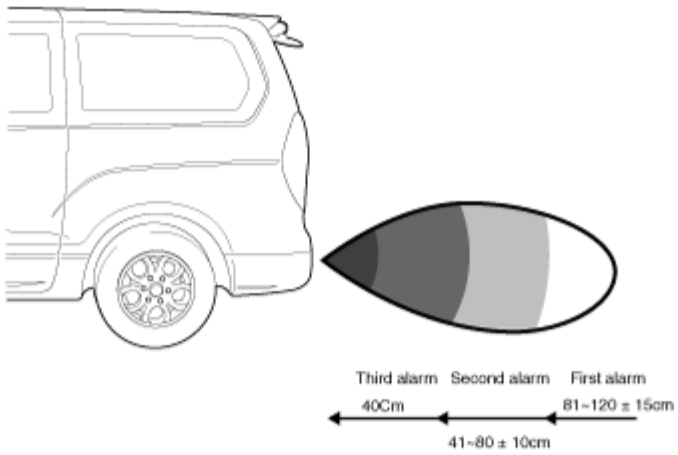
t=ambient temperature

The basic principle of distance measurement using ultrasonic wave is :



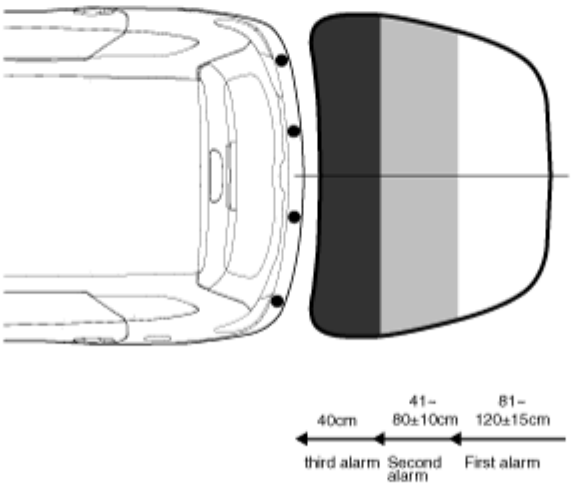
Sensor Detection Range

[Vertical range]



1. Distance tolerance(Messured at the front of sensor)
   - 81~120cm : ±15cm
   - 41~80cm : ±10cm
   - 40cm : ±10Cm
2. Detection tolerance
   - At 40cm :45° ± 15°
   - At 80cm : 30° ± 15°
   - At 120cm : 20° ± 15°
3. At nearer distance than 40cm detection may occur.
4. Measurement condition : Room temperature (20℃), 90mm diameter, 3m length rod.

[Horizontal range]

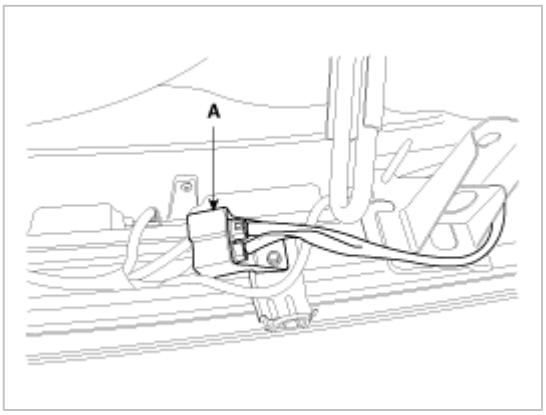


1. Distance tolerance(Messured at the front of sensor)
   - 81~120cm : ±15cm
   - 41~80cm : ±10cm
   - 40cm : ±10cm
2. Detection tolerance
   - At 80cm : 90° ± 20°
   - At 120cm : 10° ± 20°
3. At nearer distance than 40Cm detection may occur.
4. Measurement condition : Room temperature (20℃), 90mm diameter, 3m length rod.

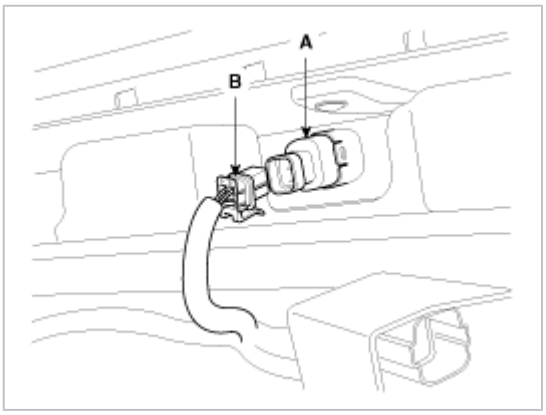
1. 14cm (dia.) plastic rod is used for the test target.
2. The test result may differ by a different target object.
3. Detection range may be reduced by dirt accumulated on sensor, and extremely hot or cold weather.
4. The following object may not be detected.
   - Sharp object or thin object like rope.
   - Cotton sponge, snow or other materials absorbing sonic wave.
   - Smaller objects than 14cm (dia.), 1m length.

Removal

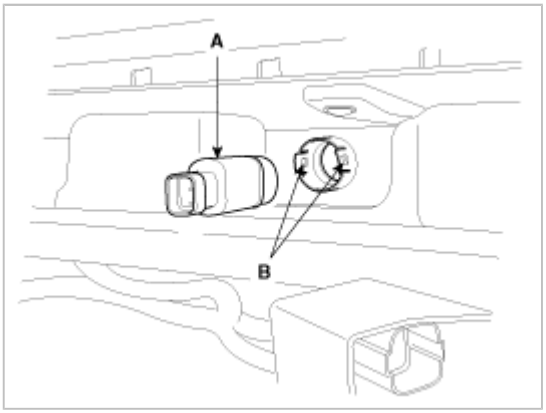
1. Disconnect the negative (-) battery terminal.
2. Remove the rear bumper (Refer to the Body group - "Rear bumper")
3. Disconnect the wiring harness connector (A) at the inside of the rear bumper.



4. Disconnect the sensor (A) connector (B).



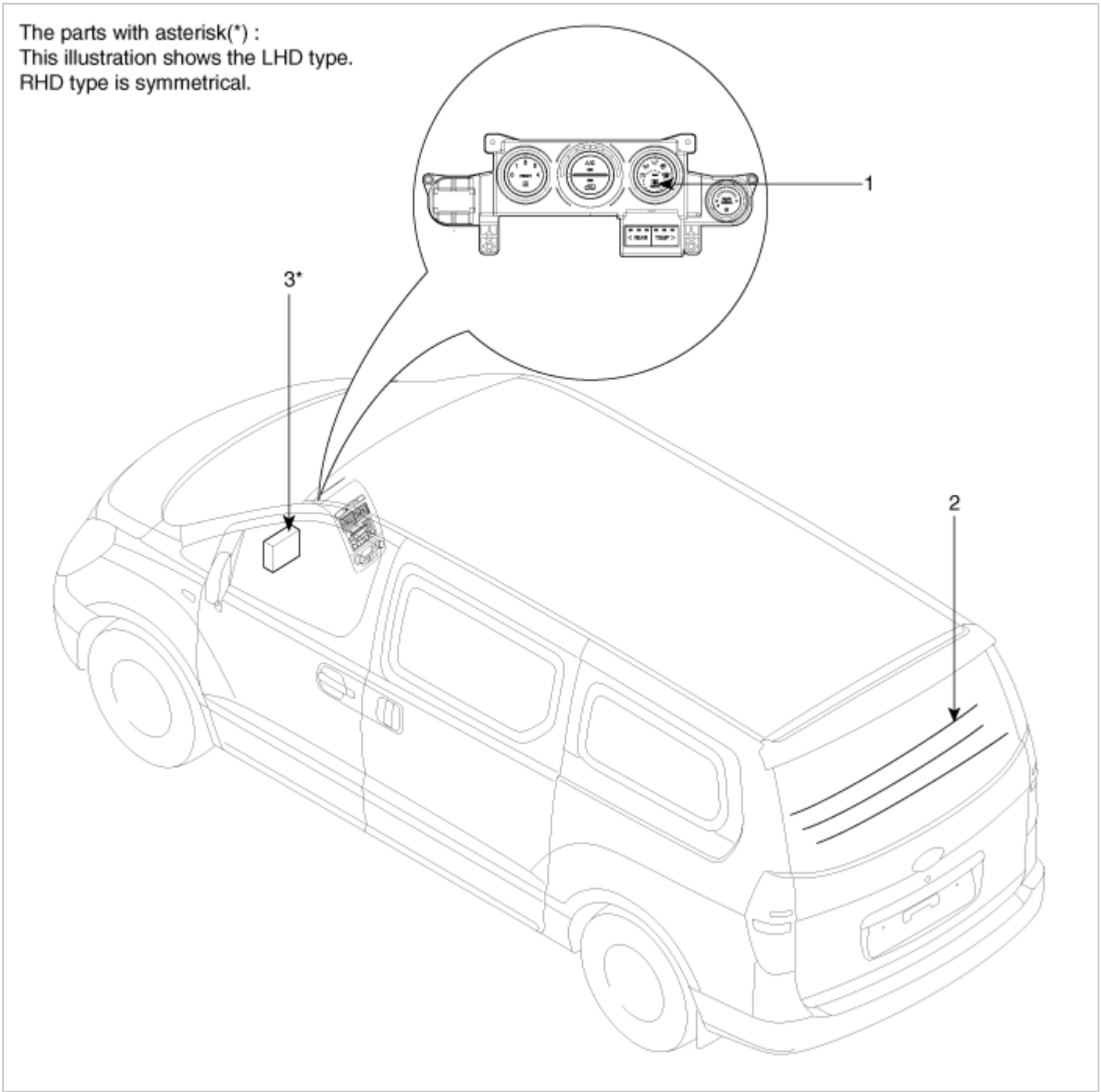
5. Pull out the sensor (A) by opening the sensor holder (B) out.



Installation

1. Install the sensor to the rear bumper
2. Connect the sensor connector and harness connector.
3. Install the rear bumper.

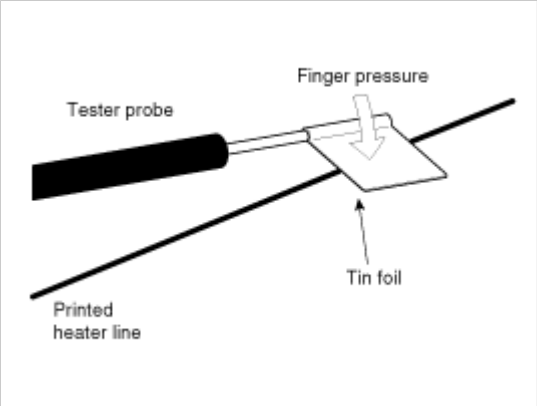
Component Location



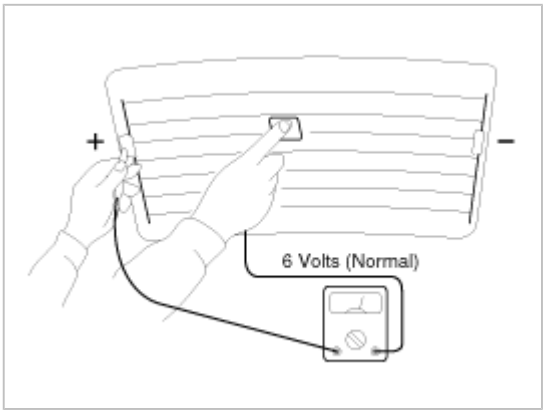
1. Rear window defogger switch 2. Rear window defogger	3. Body control module

Inspection

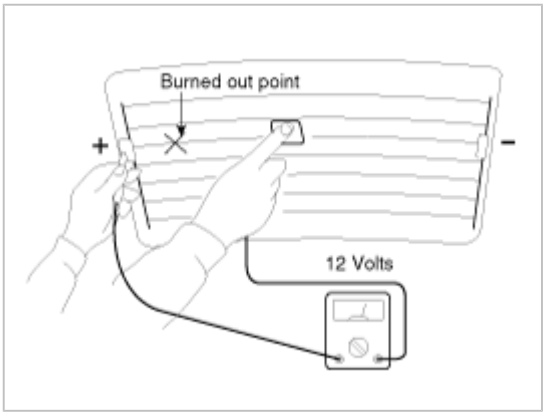
Wrap tin foil around the end of the voltmeter test lead to prevent damaging the heater line. Apply finger pressure on the tin foil, moving the tin foil along the grid line to check for open circuits.



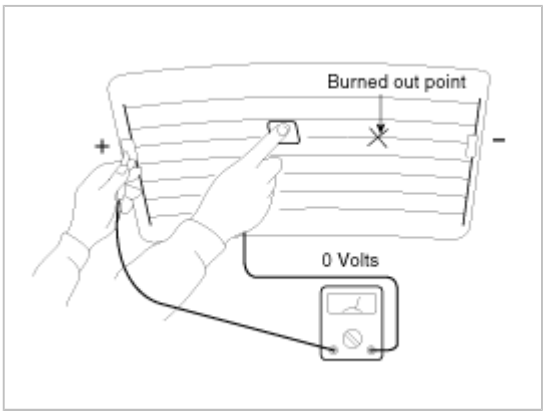
1. Turn on the defogger switch and use a voltmeter to measure the voltage of each heater line at the glass center point. If a voltage of approximately 6V is indicated by the voltmeter, the heater line of the rear window is considered satisfactory.



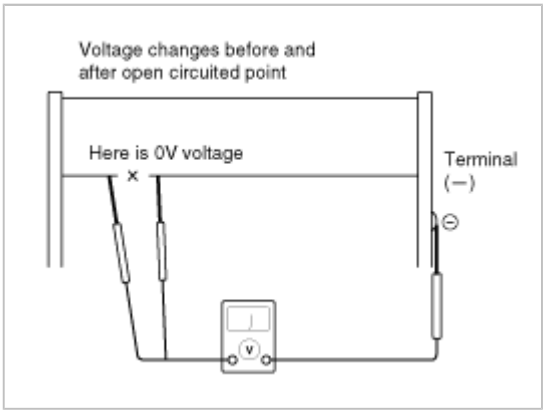
2. If a heater line is burned out between the center point and (+) terminal, the voltmeter will indicate 12V.



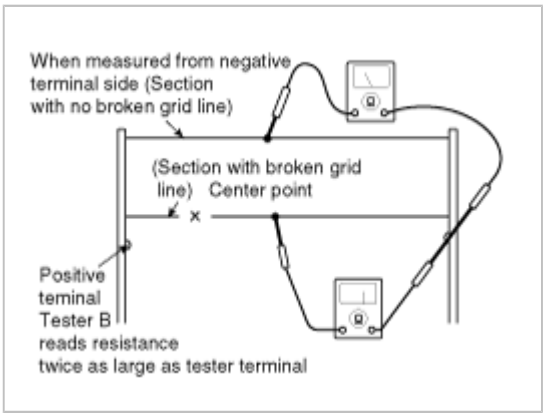
3. If a heater line is burned out between the center point and (-) terminal, the voltmeter will indicate 0V.



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



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

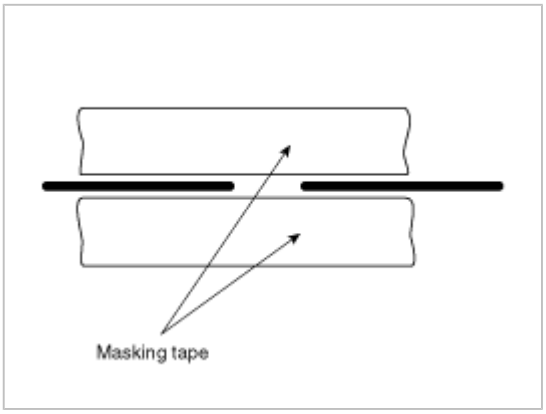


Repair Of Broken Heater Line

Prepare the following items :

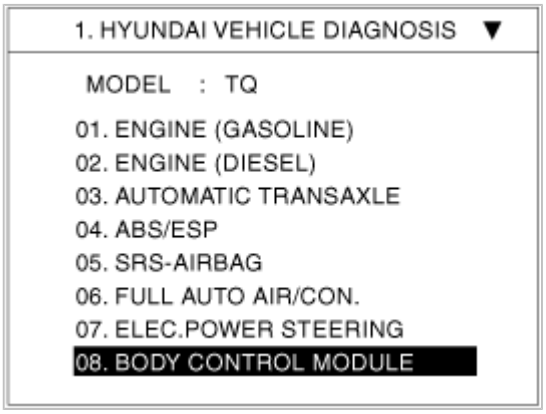
1. Conductive paint.
2. Paint thinner.

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

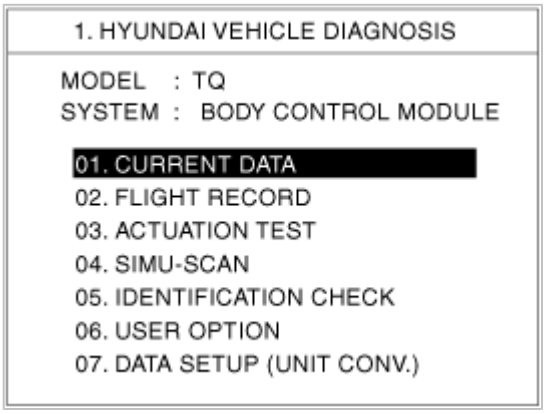


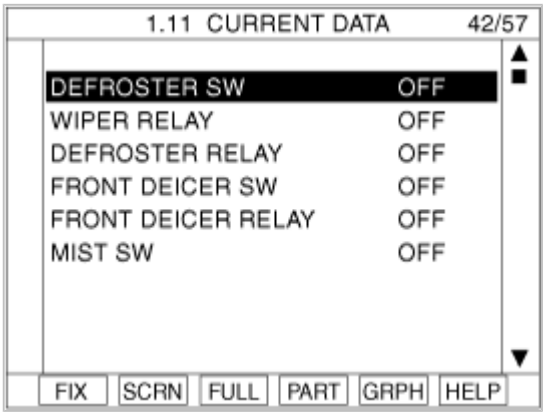
Inspection

1. The rear window defogger switch inputs can be checked using the scan tool.
2. To check the input value of rear window defogger switch, select option "BODY CONTROL MODULE".

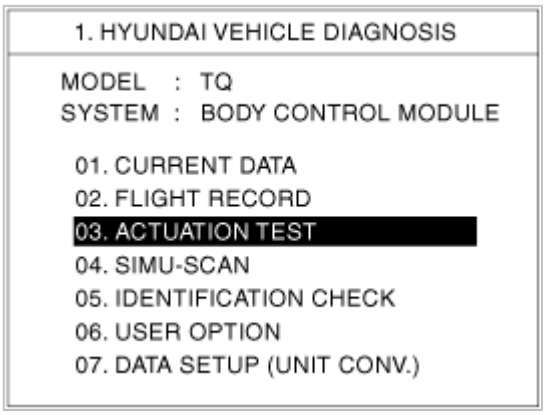


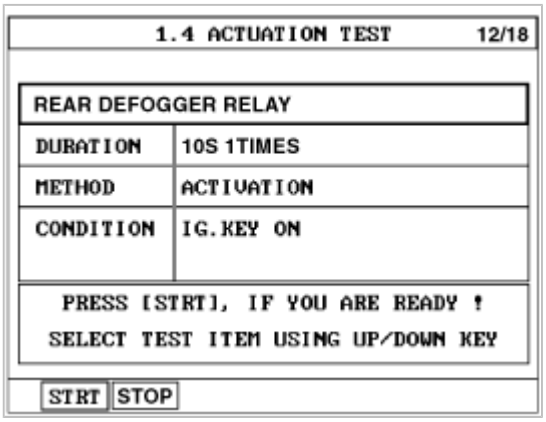
3. Select option "CURRENT DATA".



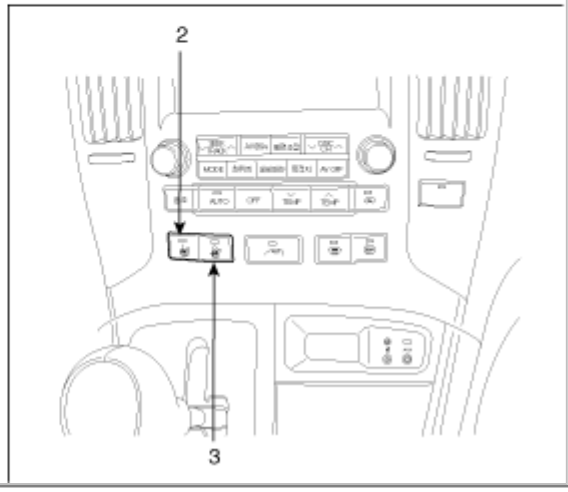


4. To check the input value of rear window defogger switch in force mode, select option "ACTUATION TEST".


1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : TQ
SYSTEM : BODY CONTROL MODULE
01. CURRENT DATA
02. FLIGHT RECORD
03. ACTUATION TEST
04. SIMU-SCAN
05. IDENTIFICATION CHECK
06. USER OPTION
07. DATA SETUP (UNIT CONV.)

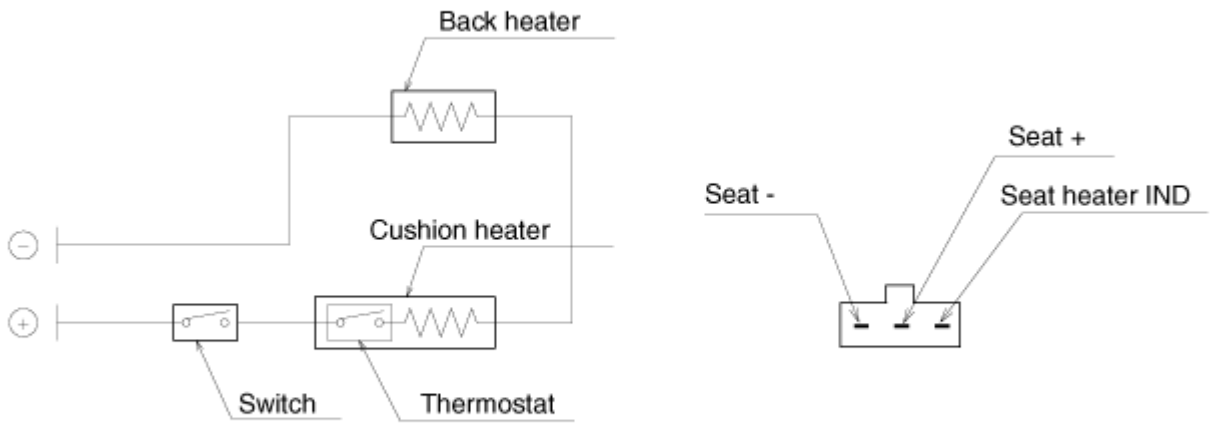

1.4 ACTUATION TEST 12/18
REAR DEFOGGER RELAY
DURATION 10S 1TIMES
METHOD ACTIVATION
CONDITION IG.KEY ON
PRESS [STRT], IF YOU ARE READY !
SELECT TEST ITEM USING UP/DOWN KEY
STRT STOP

Component Location



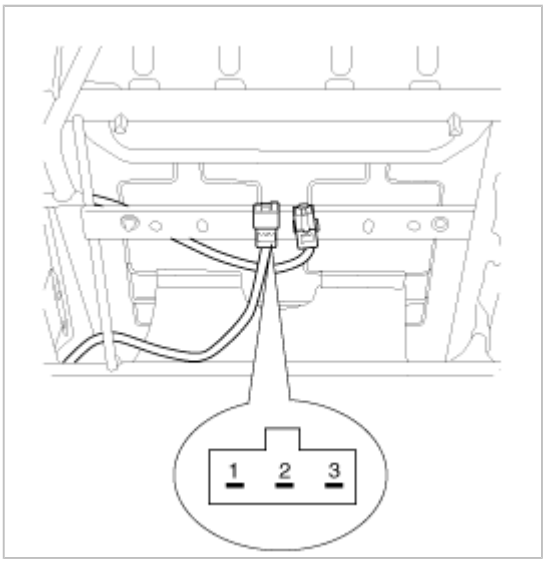
1. Seat heater 2. Seat heater switch (LH)	3. Seat heater switch (RH) 4. Control unit

Circuit Diagram



Inspection

1. Check for continuity and measure the resistance between No.1 terminal and No.2 terminal.



Srandard Value : 12.5Ω ± 10% / SET

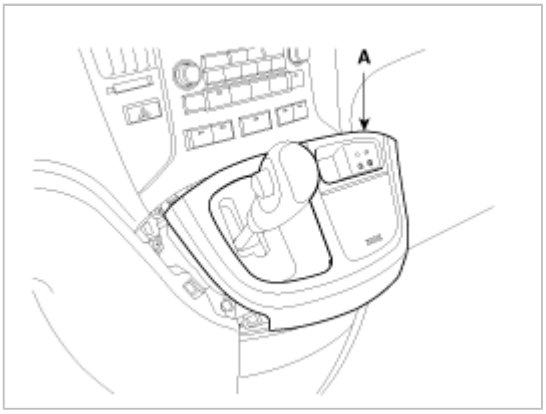
2. Operate the seat warmer after connecting the connectors, and then check the NTC(Negative Temperature Coefficient) thermostat by measuring the temperature of seat surface.

Srandard Value :
ON : 82 ± 28℉ (28 ± 3.5℃)
OFF : 98 ± 37℉ (37 ± 3℃)

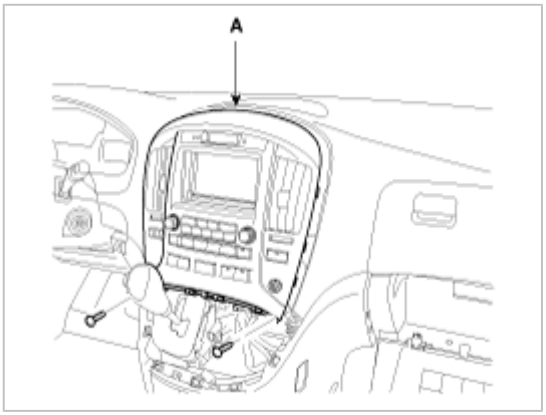
Inspection

Front Seat Heater Switch

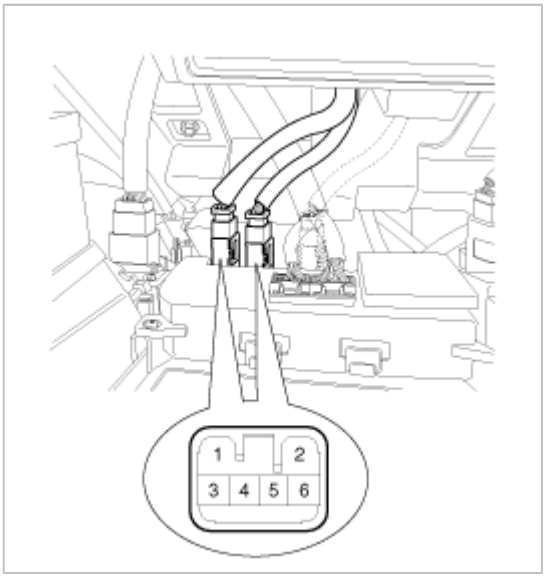
1. Disconnect the negative (-) battery terminal.
2. Remove the front console under cover (A).



3. Remove the center fascia panel(A).
   (Refer to the Body group - "Crash pad")



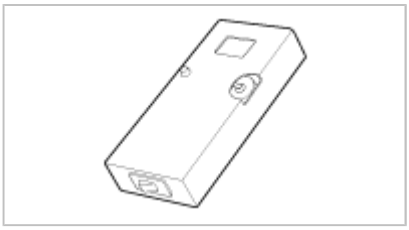
4. Disconnect the seat heater switch connector.



5. Check that continuity exists between the terminals.

Position / Terminal	ON (PUSH)	OFF (FREE)	Remark
1			
3			IND +
4			
5			IND -
6			ILL +
2			ILL -

Special Service Tools

Tool (Number and Name)	Illustration	Application
RKE Battery Checker (09954-2P100)		Measuring the RKE battery voltage

Description

The trip computer displays information related to driving, including distance to empty, average speed and Trip on this display.

To change the function as described below, push the mode button less than 2 second.

Operation

Function

Item	Function	Detection	Remark
Distance to empty	The estimated distance indication to empty	Fuel sender	1Km(1mile)
Trip	The amount of driving distance	Fuel sender	1Km(1mile)
Average speed	The average speed indication since the last driving time reset	Speed sensor	1Km/h(1MPH)

Distance To Empty Mode

1. Description
   This mode indicates the estimated distance to empty based on the current fuel in the fuel thank and the amount of fuel delivered to the engine.
2. Indication range : 50Km ~ 999Km(30miles ~ 999miles)
3. Indication division : 1Km(mile)
   During 64seconds the distance to empty (DTE) remaiming amount which is continued less than 5ℓ, a blinking "---"symbol will be displayed.
4. Data clear : at battery + off

Average speed mode

1. Description
   This mode indicates the estimated speed by the driving distance to the indication timing after

reconnecting the batter or resetting the data.
2. Indication range : 0 Km/h(MPH) ~ 999 Km/h(MPH)
3. Indication division : 1Km/h(MPH)
   When the battery is reconnected or the data are reset, "---" symbol will be displayed until display timing (10sec).
4. Indication interval : 10 sec.
5. Data clear: press the reset button for more than 1 sec. or Battery + on

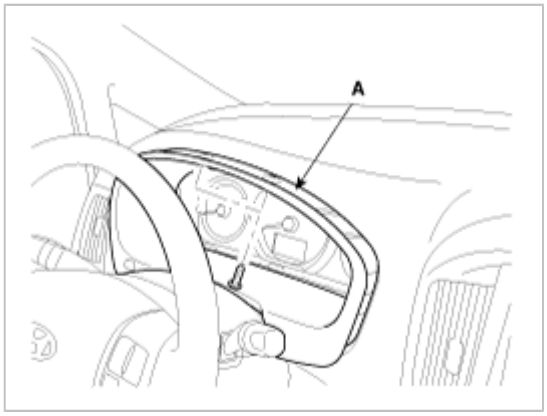
Trip Mode

1. Description
   This mode calculates the amount driving distance unit resetting the data again after reconneting the battery or resetting the data.
2. Indication range : 0Km(mile) ~ 999.9Km(mile)
3. Indication division : 1Km(mile)

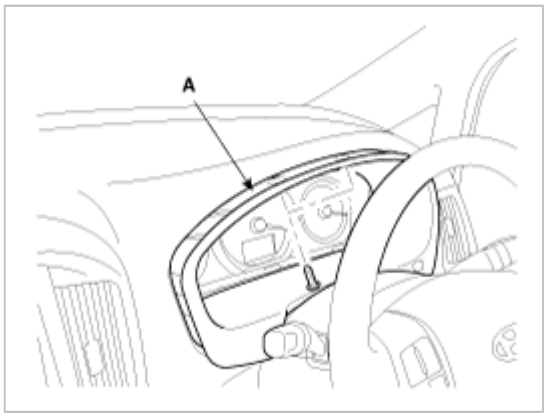
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the cluster facia panel (A) after loosening 2 screws.

[LHD]

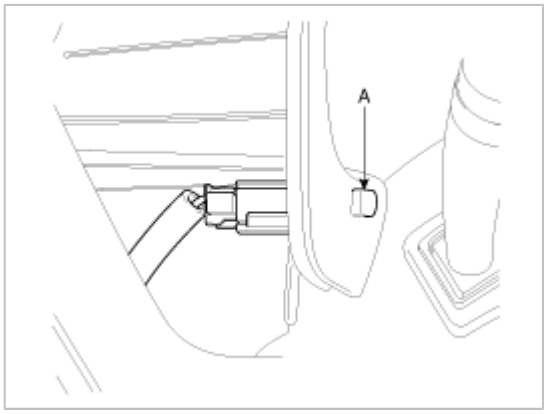


[RHD]

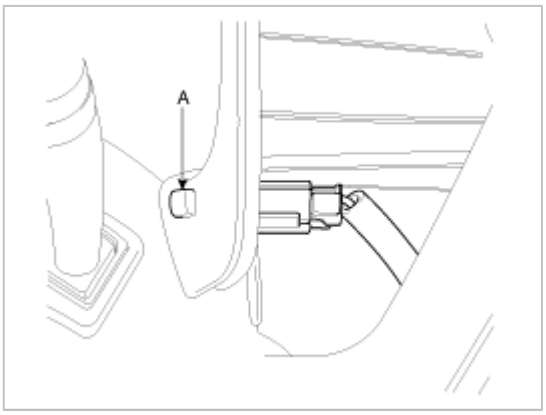


3. Disconnect the trip computer connector (A).

[LHD]



[RHD]



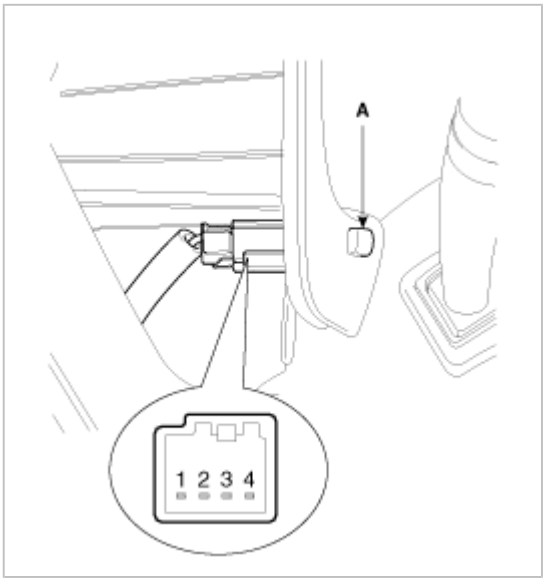
Installation

1. Install the trip computer to the cluster facia panel.
2. Install the cluster facia panel.

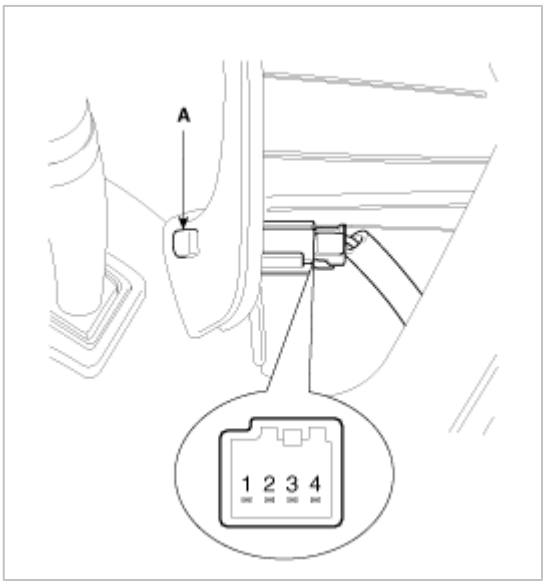
Inspection

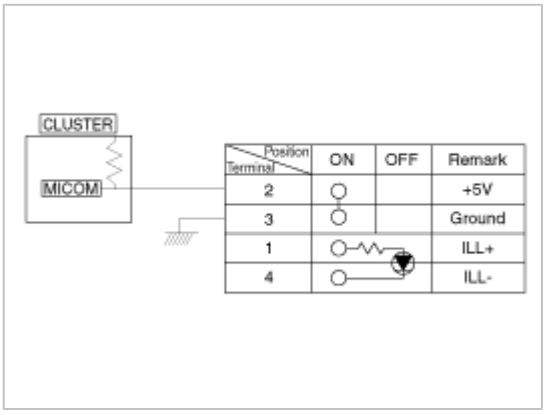
1. Remove the cluster facia panel.
2. Operate the switch (A) and check for continuity between terminals with an ohmmeter.

[LHD]



[RHD]

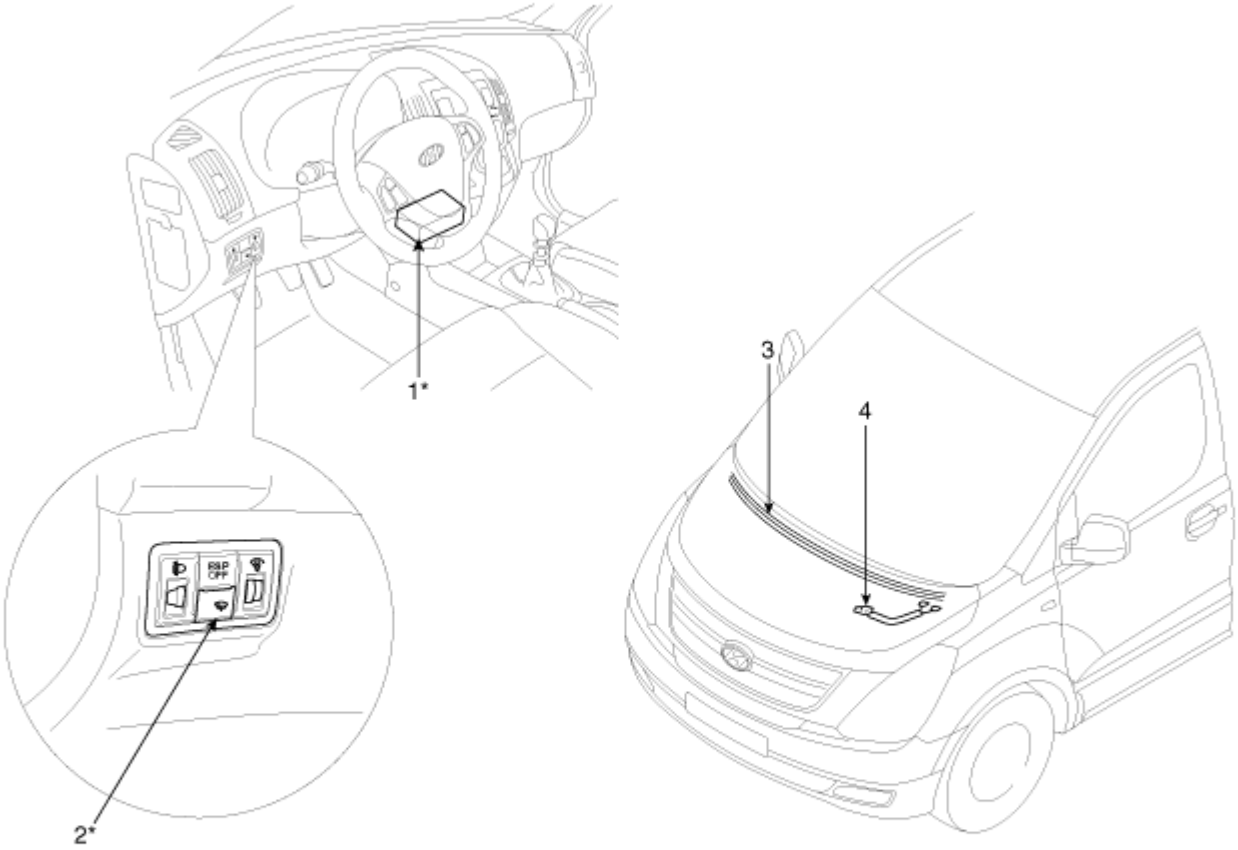




Position / Terminal	ON	OFF	Remark
2	○		+5V
3	○		Ground
1	○–∿–●		ILL+
4	○——		ILL-

Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.



LHD	RHD

1. Body control module 2. Windshield deicer switch	3. Windshield deicer 4. Deicer connector

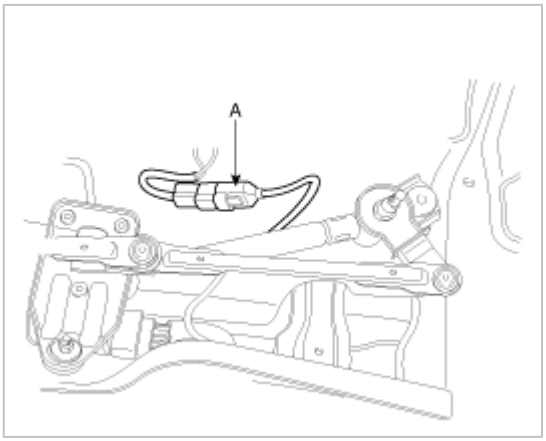
Description

Windshield deicer system prevent windshield wiper from freezing in the winter season. It consists of deicer in the lower part of windshield, switch and relay. Body control module receives an input signal from the deicer switch , then controls relay.

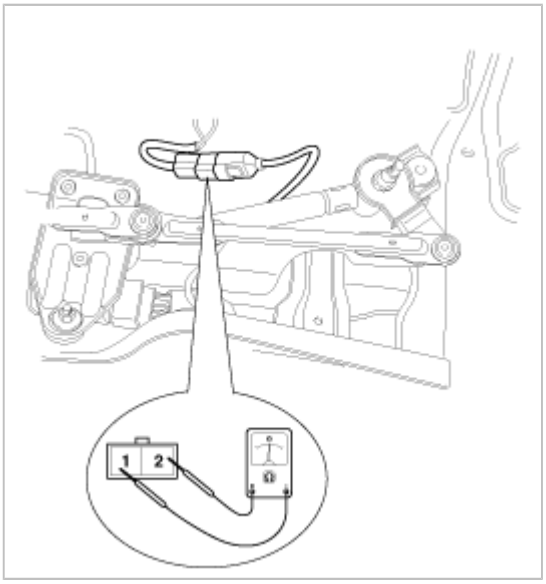
Since the generator "L" is switched ON, if the deicer switch is ON, then deicer output is ON for 20 minutes.

Inspection

1. Remove the cowl top cover.(Refer to the wiper)
2. Disconnect the windshield deicer connector (A) from the wiper motor linkage.

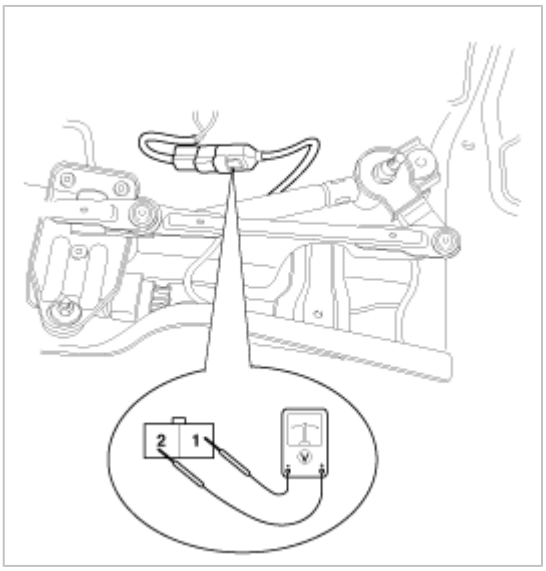


3. Check for continuity between the terminals of deicer lines.



4. Turn the ignition switch ON and the windshield deicer switch ON, then measure the voltage between the terminals of harness side deicer connector.

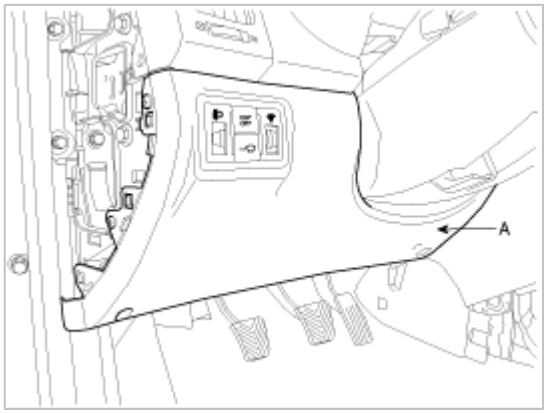
Battery voltage : Approx. 12V


2
1

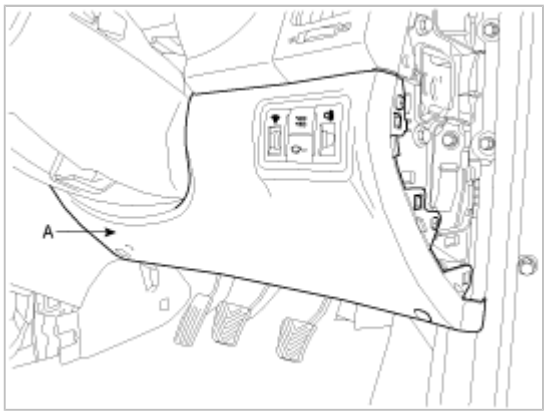
Inspection

1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A).
   (Refer to the Body group - "Crash pad")

[LHD]

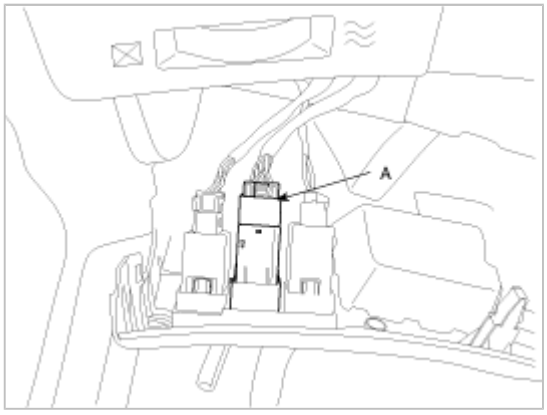


[RHD]

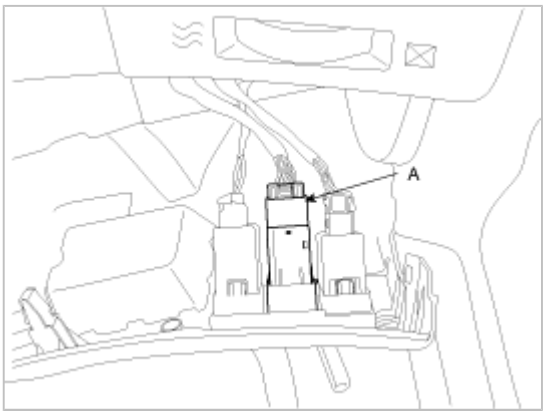


3. Disconnect deicer switch connectors.

[LHD]

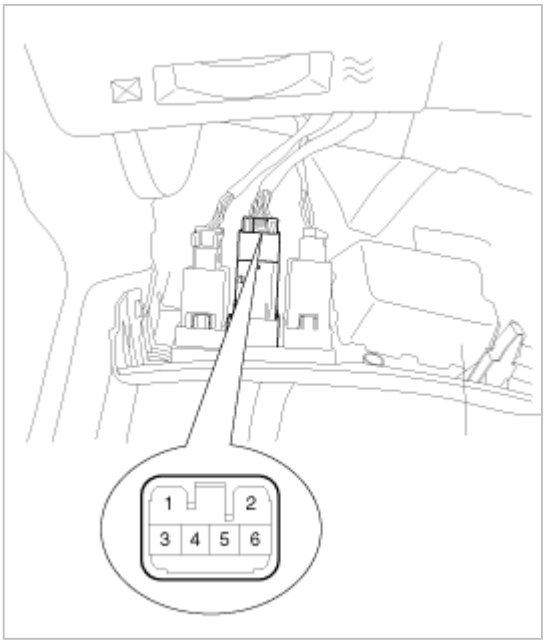


[RHD]

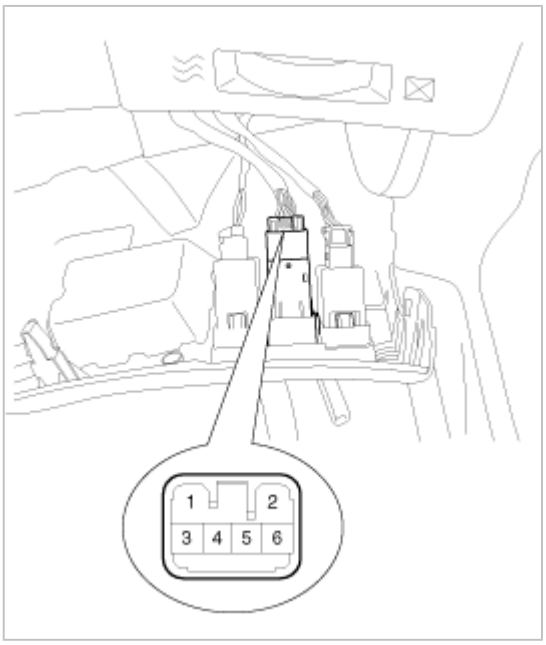


4. Using an ohmmeter, inspect the continuity between the terminals.

[LHD]



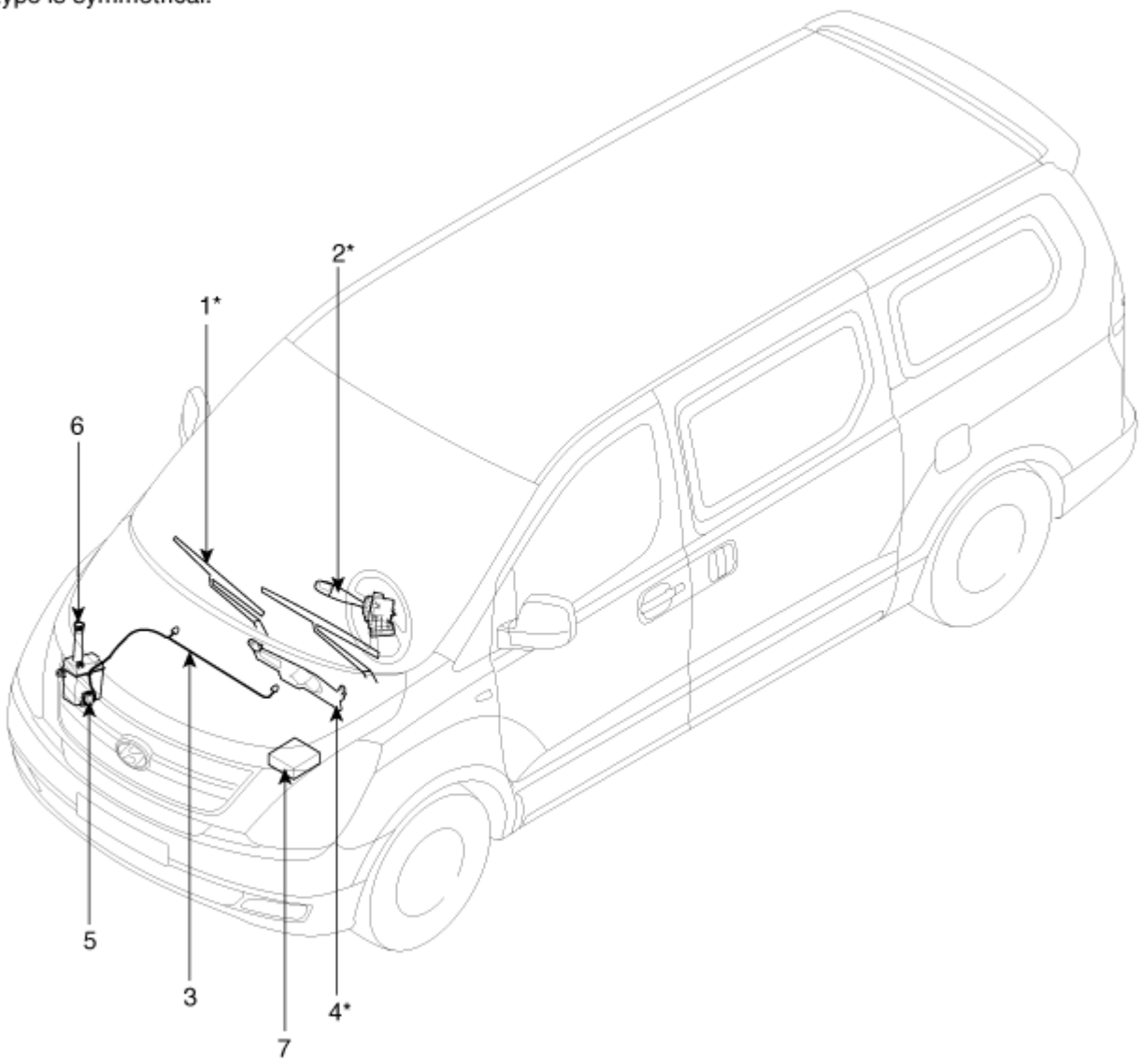
[RHD]



Position / Terminal	ON(PUSH)	OFF(FREE)	Remark
3			GND
6			BCM
4			
1			IND+
5			ILL-
2			ILL+

Component Location

The parts with asterisk(*) :
This illustration shows the LHD type.
RHD type is symmetrical.

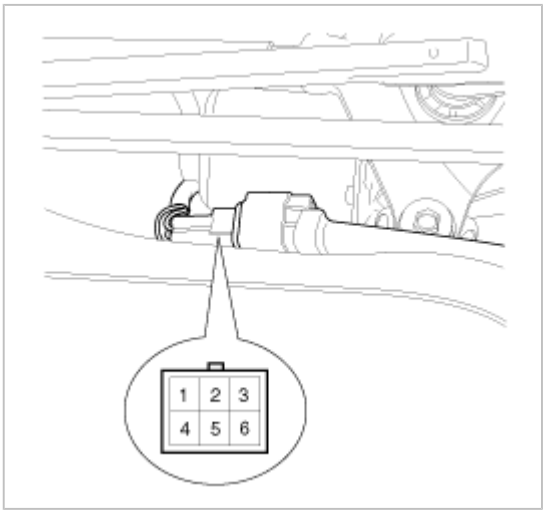


1. Windshield wiper arm & blade	5. Washer motor
2. Wiper & washer switch	6. Washer reservoir
3. Windshield washer hose	7. Wiper relay (Engine room relay box)
4. Windshield wiper motor & linkage	

Inspection

Speed Operation Check

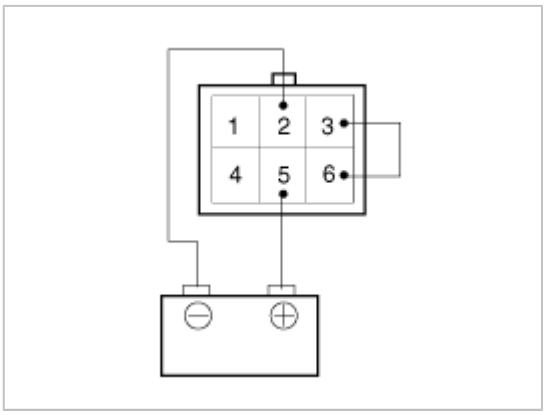
1. Remove the connector(A) from the wiper motor.
   1. Bacnk
   2. Battery
   3. Parking
   4. High
   5. Ground
   6. Low



2. Attach the positive (+) lead from the battery to terminal 6 and the negative (-) lead to terminal 5.
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 5.
5. Check that the motor operates at high speed.

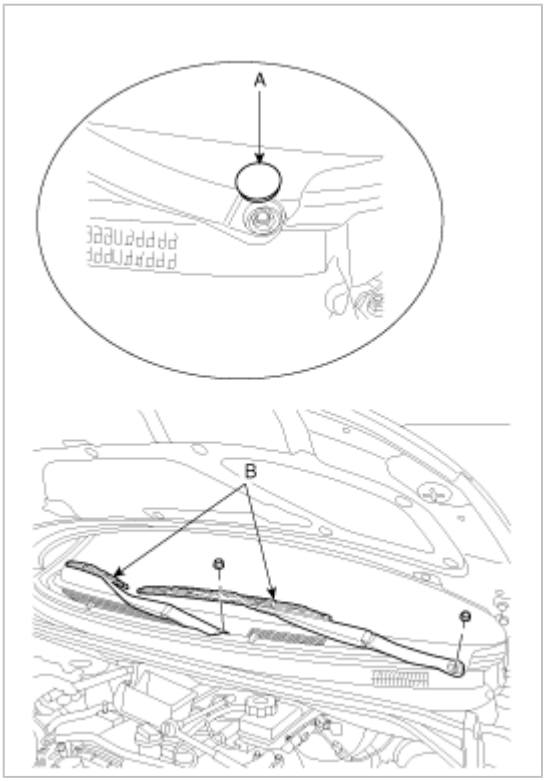
Automatic Stop Operation Check

1. Operate the motor at low speed using the stalk control.
2. Stop the motor operation anywhere except at the off position by disconnecting terminal 6.
3. Connect terminals 6 and 3.
4. Connect the positive (+) lead from the battery to terminal 2 and the negative (-) lead to terminal 5.
5. Check that the motor stops running at the off position.

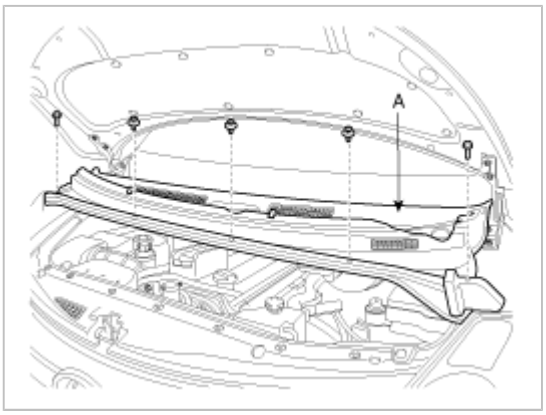


Removal

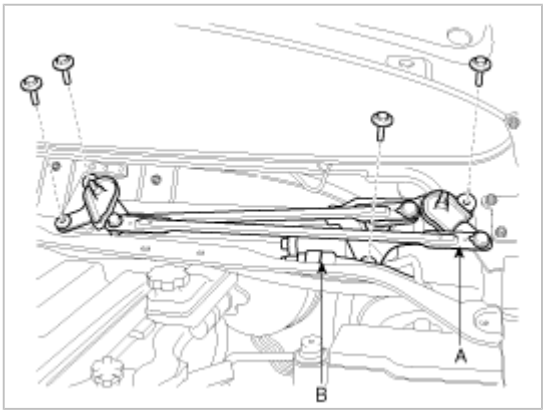
1. Remove the windshield wiper arm (B) and blade after removing a cap (A) and loosening a nut.



2. Remove the weather strip and the cowl top cover (A) after removing 3 rivets and 2 bolt.



3. Remove the windshield wiper motor and linkage assembly(A) after removing 4 bolts. Disconnect the wiper motor connector (B) from the wiper motor □ linkage assembly.



Installation

1. Install the wiper motor and linkage assembly and then connect the wiper motor connector.

Tightening torque :
7-11N.m (0.7-1.1, kgf.m, 5.0-7.9lbf-ft)

2. Install the cowl top cover.
3. Install the windshield wiper arm and blade.

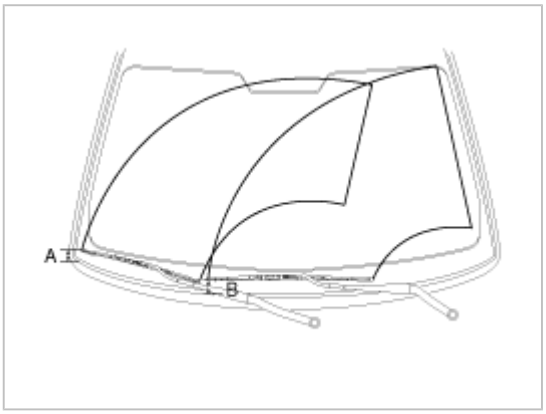
Tightening torque
28~33N.m (2.8~3.3 kgf.m, 20~23.1lbf-ft)

- The windshield wiper motor must be cycled to make sure that it is in the park position. If necessary, adjust the wiper arm and blade.

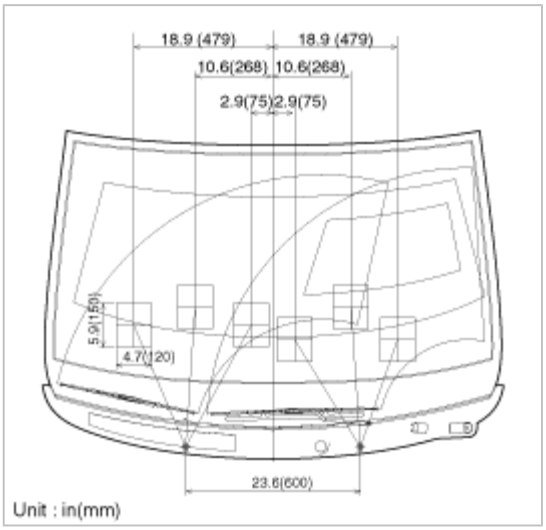
4. Install the wiper arm and blade to the specified position.

Specified position	A	B
Distance	(1.30)	(1.42)

[in (mm)]	33	36



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

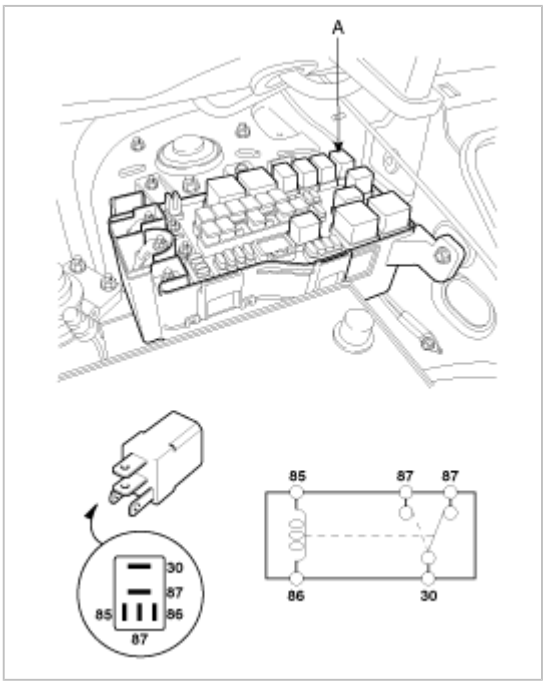


Wiper Relay Inspection

Check for continuity between the terminals.

1. There should be continuity between the No.30 and No.87 terminals when power and ground are connected to the No.85 and No.86 terminals.
2. There should be no continuity between the No.30 and No.87 terminals when power is disconnected.

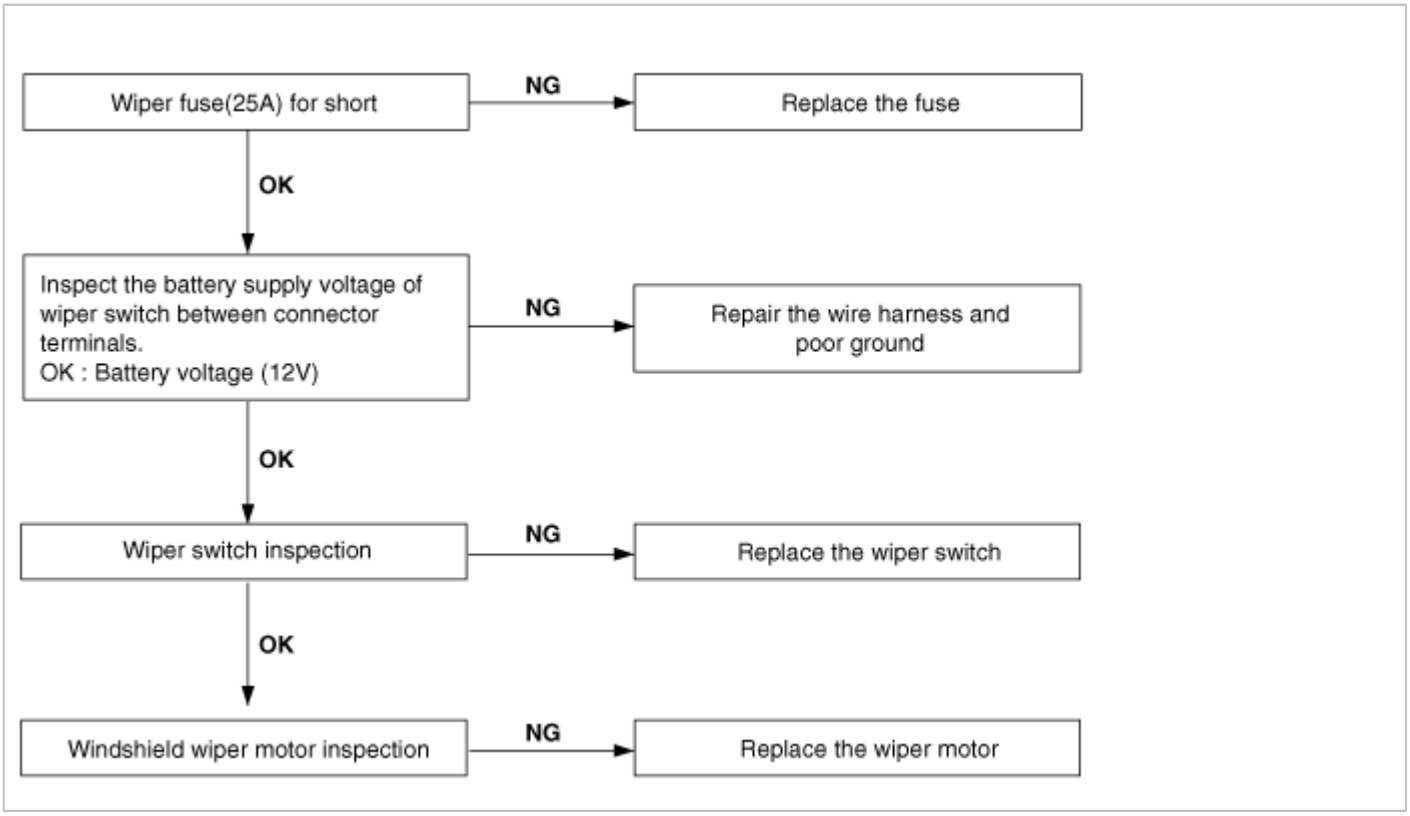
A : Front wiper relay



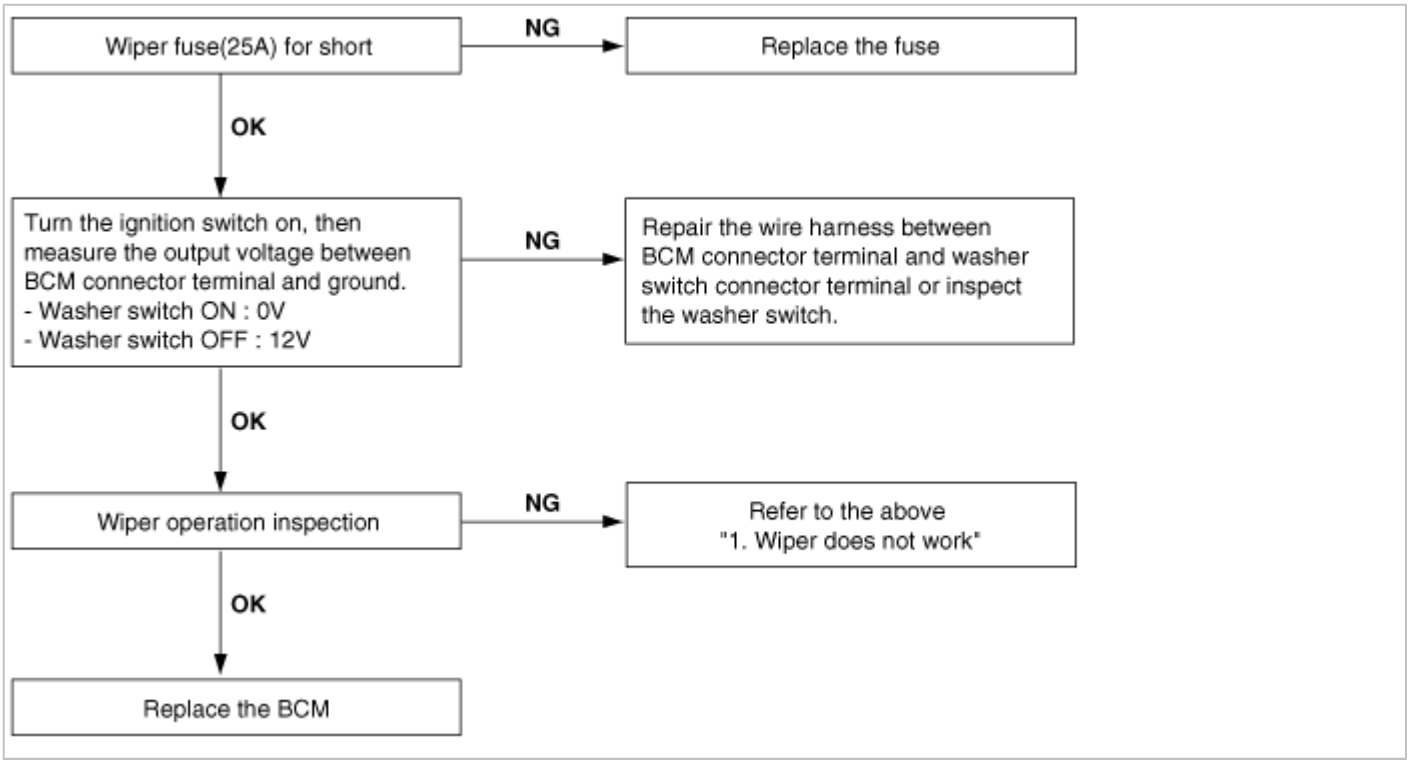
Terminal / Power	85	86	30	87	87
Disconnected			○	—	○
Connected	⊖	⊕	○	○	

Troubleshooting

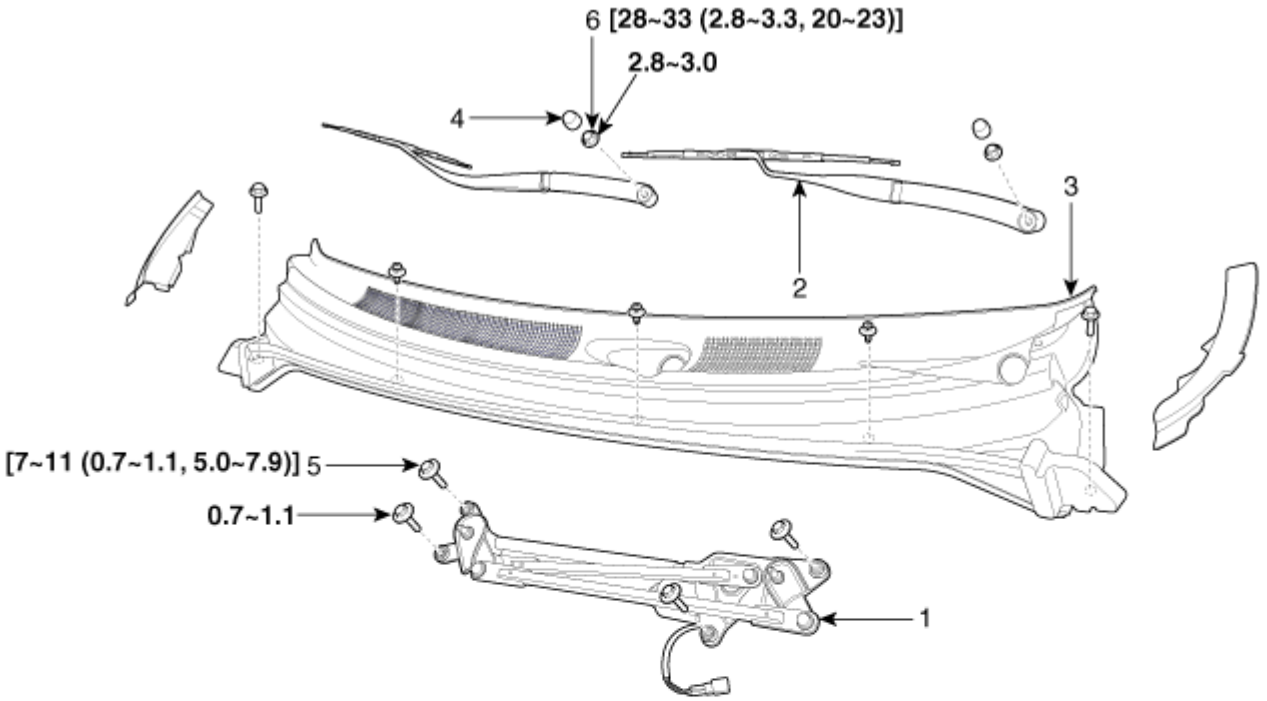
1. Wiper low and wiper high do not work.

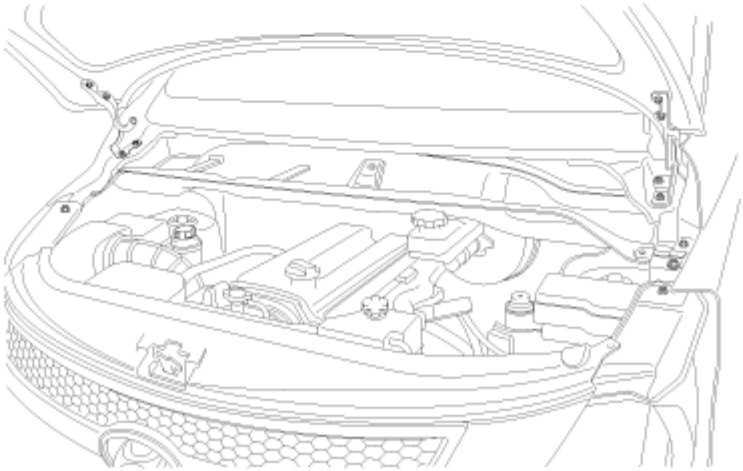


2. When washer switch is on, wiper does not work.



Component Location





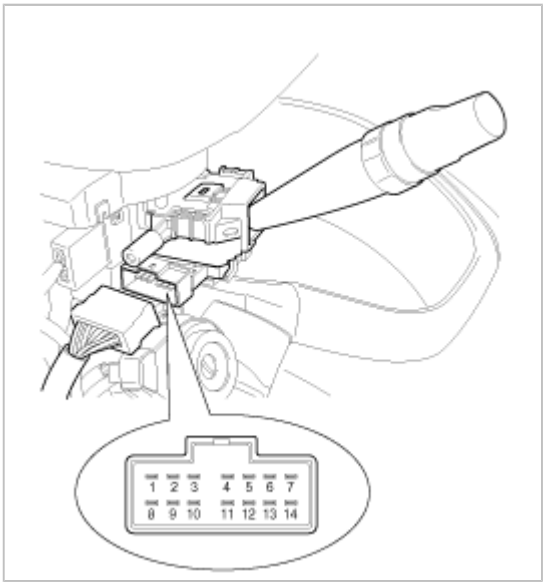
Torque : N.m (kgf.m, lb-ft)

1. Wiper motor & linkage assembly	4. Cap
2. Wiper arm & blade	5. Bolt
3. Cowl top cover	6. Nut

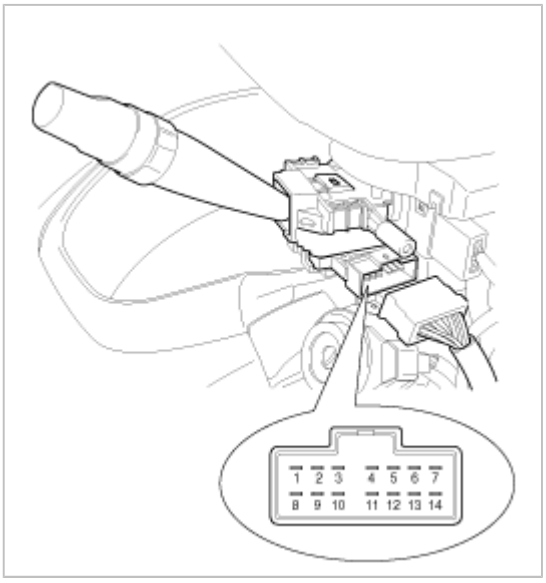
Inspection

1. Check for continuity between the terminals while operating the wiper and washer switch. If it is not normal condition, replace wiper and wiper switch.

[LHD]



[RHD]



Wiper Switch

( ) : RHD

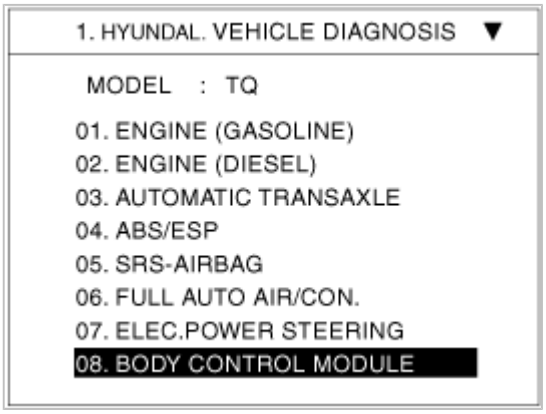
Position \ Terminal	2 (6)	1 (7)	3 (5)	6 (2)	5 (3)	4 (4)	14 (14)	13 (13)
MIST	○	○	○		○	○		
OFF	○	○	○					
INT	○	○	○	○	○		○	○
LOW	○				○			
HI		○			○			

Washer Switch

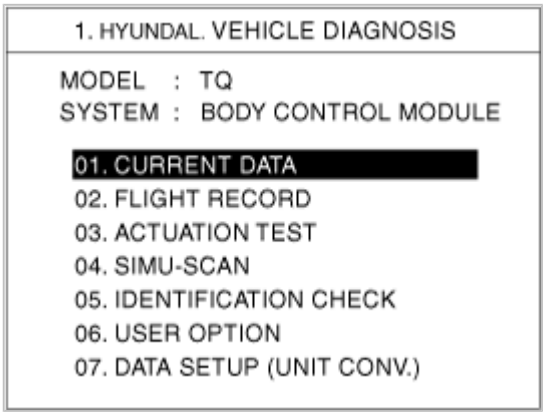
( ) : RHD

Position \ Terminal	7(1)	5(3)
OFF		
ON	○	○

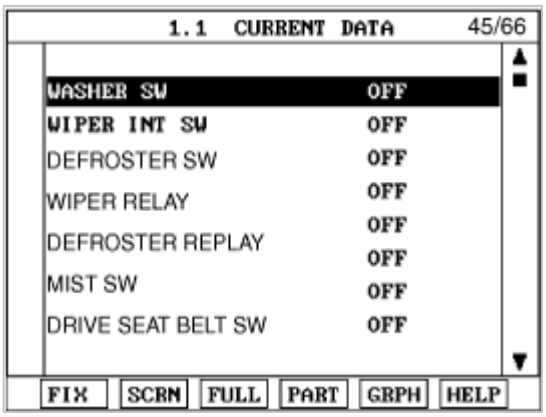
2. Multifunction switch operates head lamps and wiper by communicating with BCM through LIN communication.
3. Check BCM input/output value of each position of multifunction switch when you inspect the module whether faulty or not.
4. Select model and BCM menu.



5. Select "Current data" and wiper.

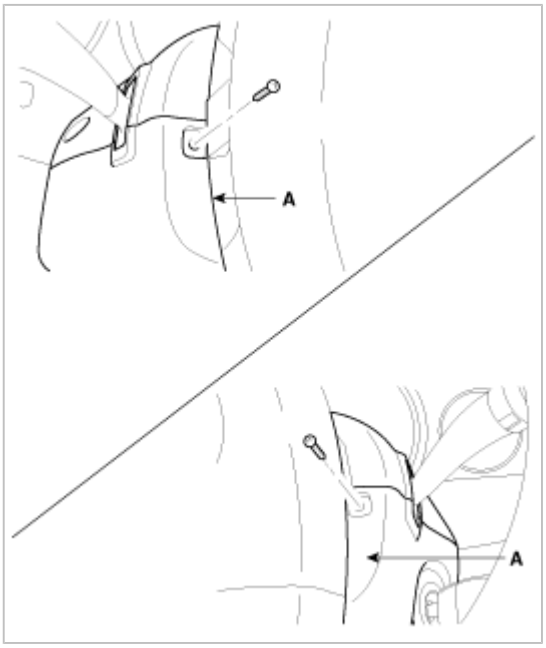


6. Check input/output value of washer □ wiper switch.



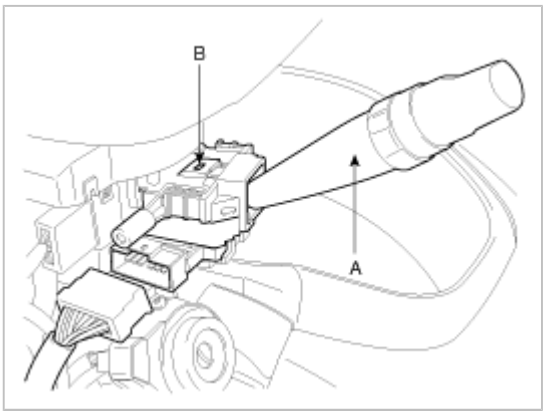
Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper and lower shrouds (A) after loosening 4 screws.

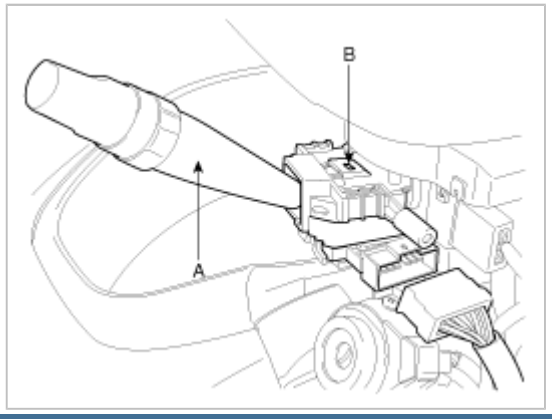


3. Remove the wiper switch (A) after disconnecting the connector with pushing the lock pin (B).

[LHD]

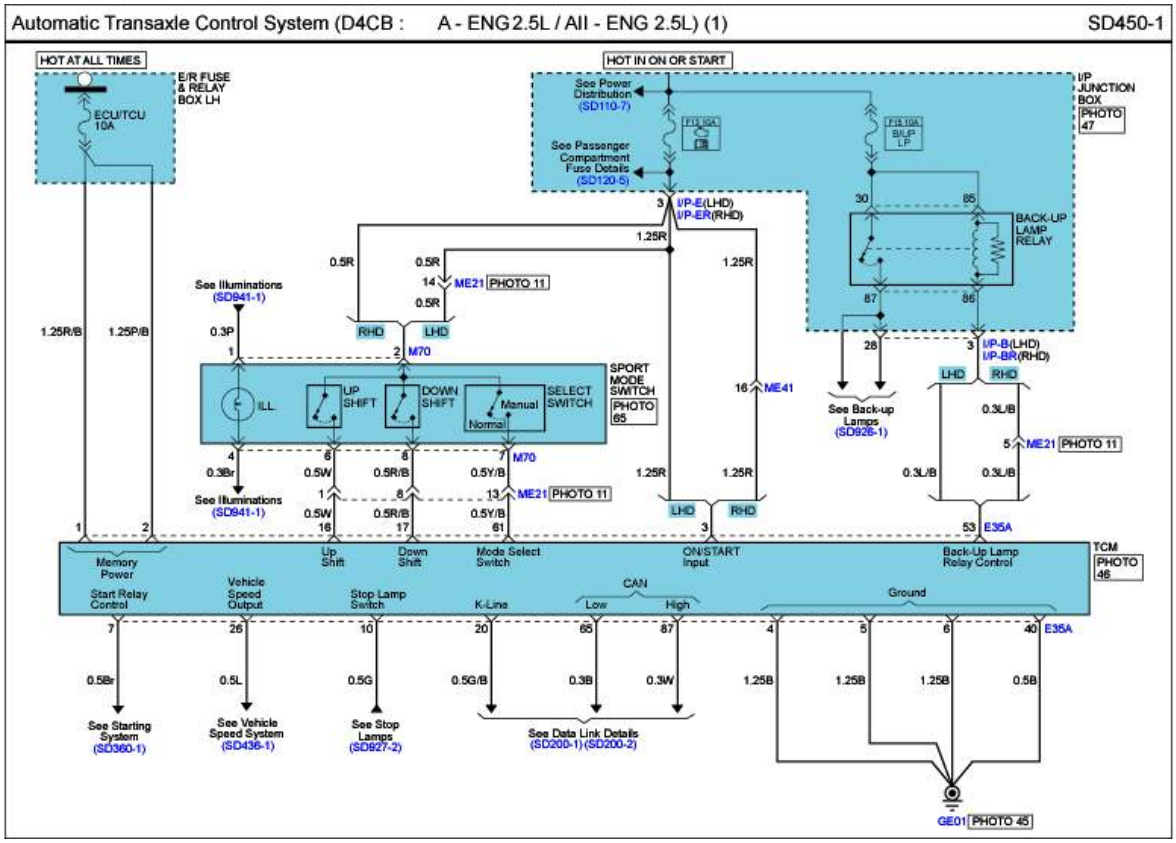


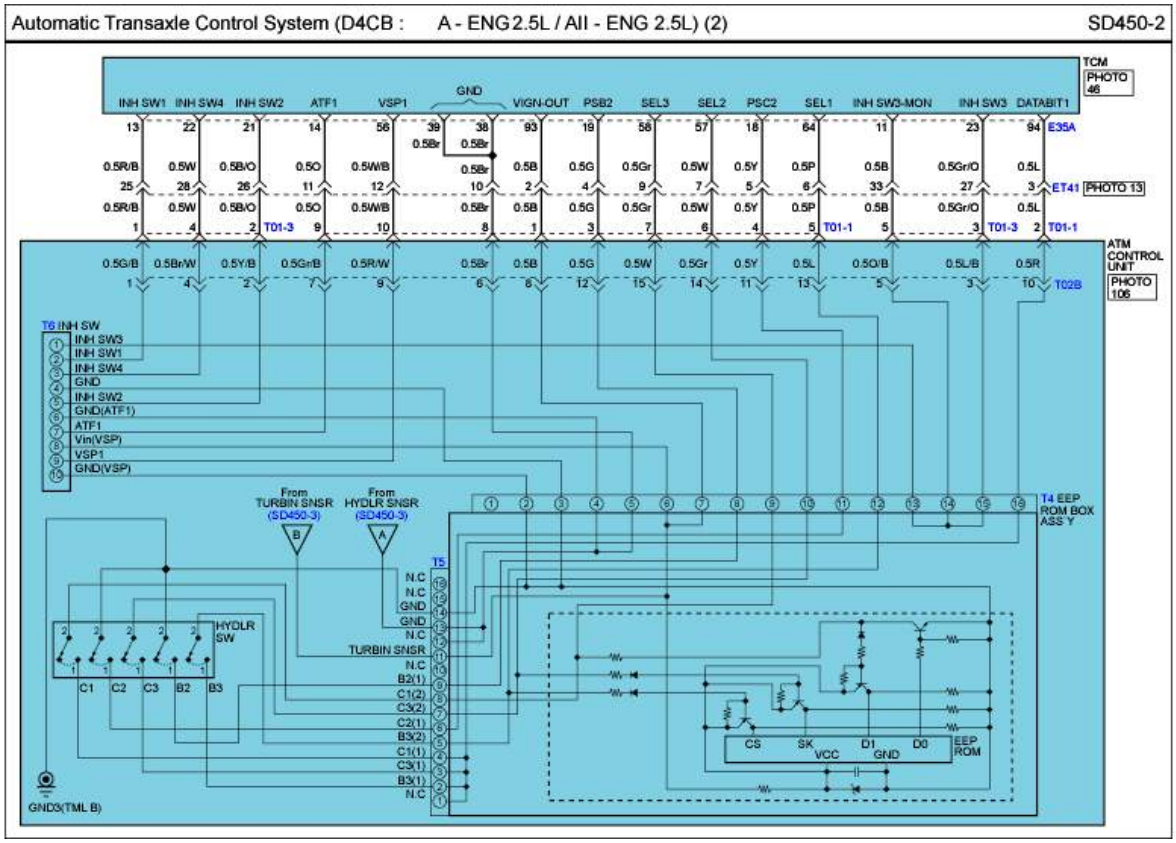
[RHD]

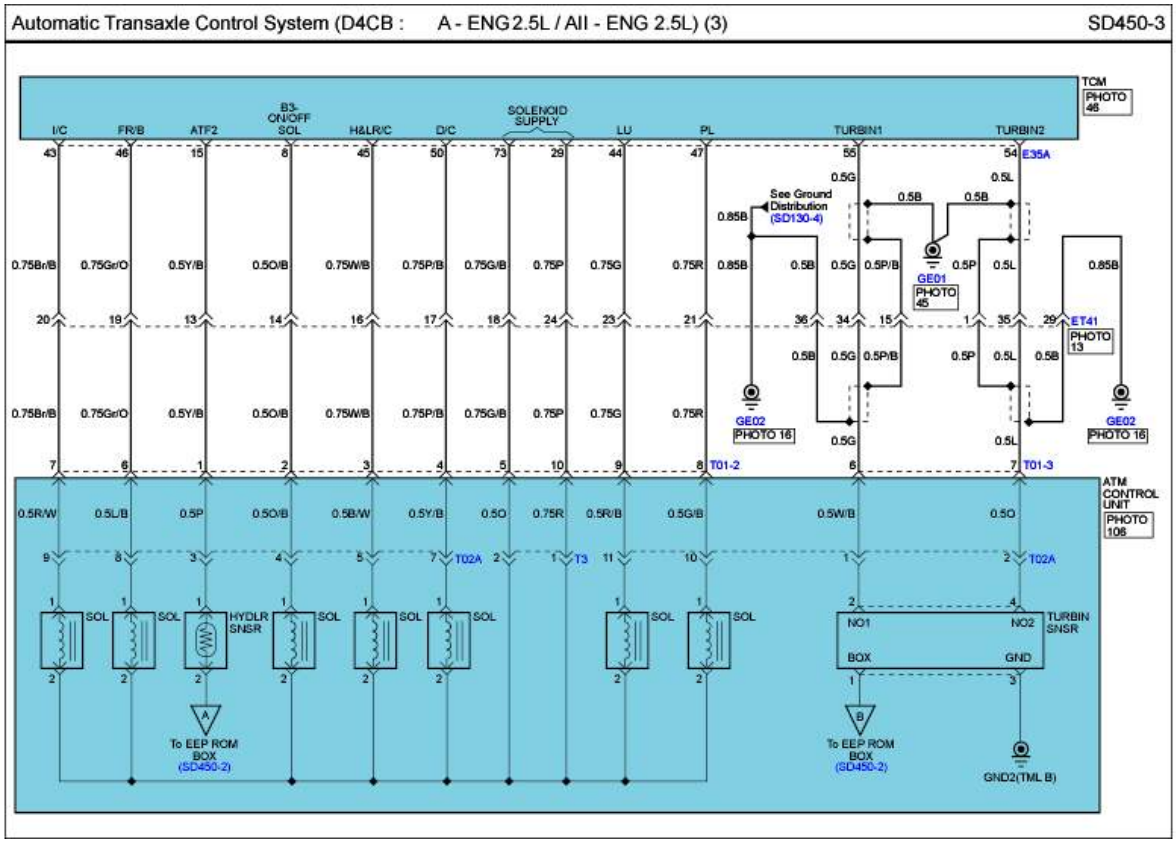


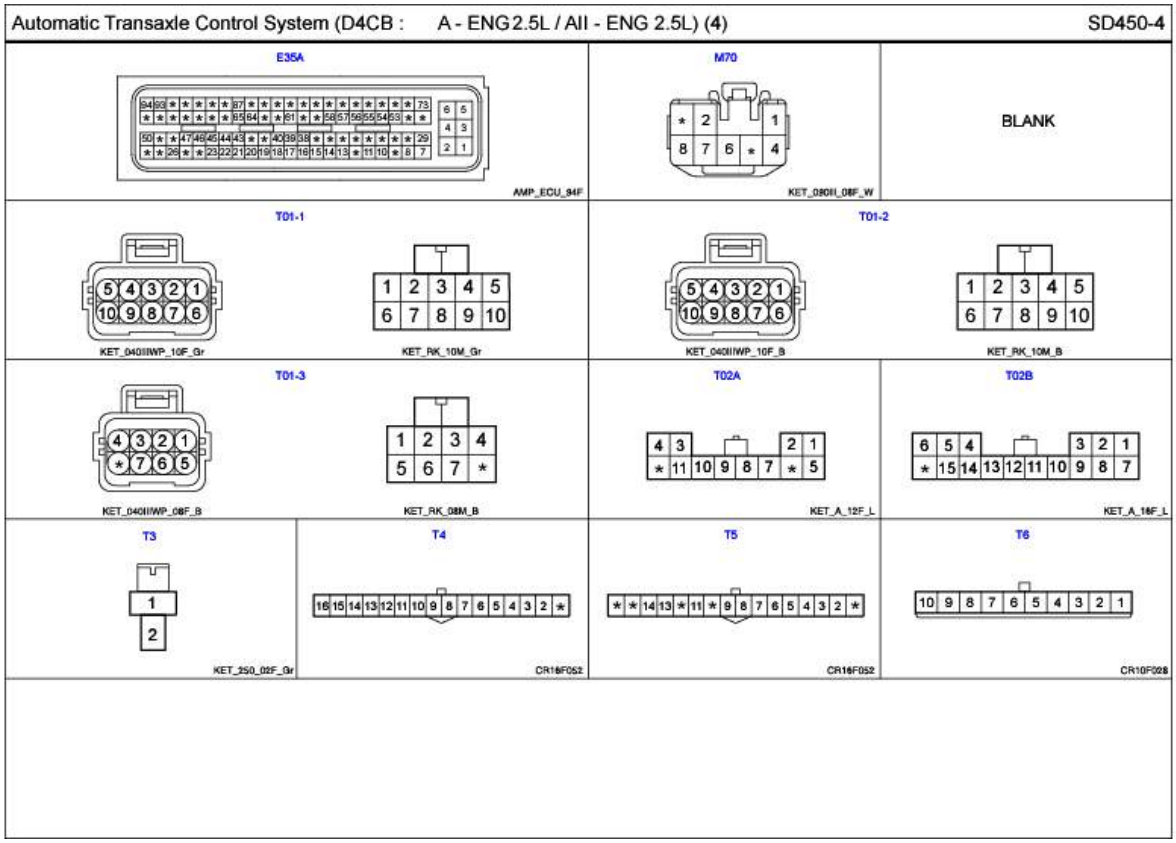
Installation

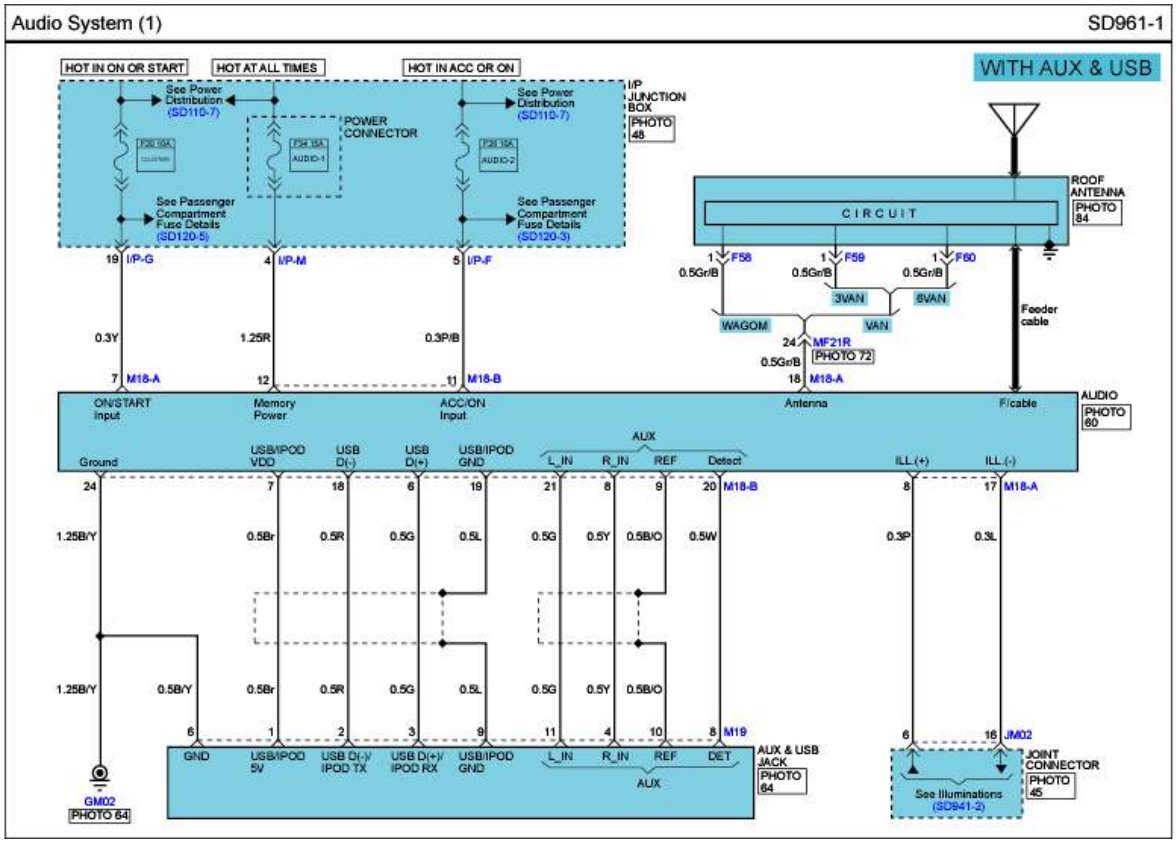
1. Install the windshield wiper switch.
2. Connect the wiper switch connector.
3. Install the steering column upper and lower shrouds.

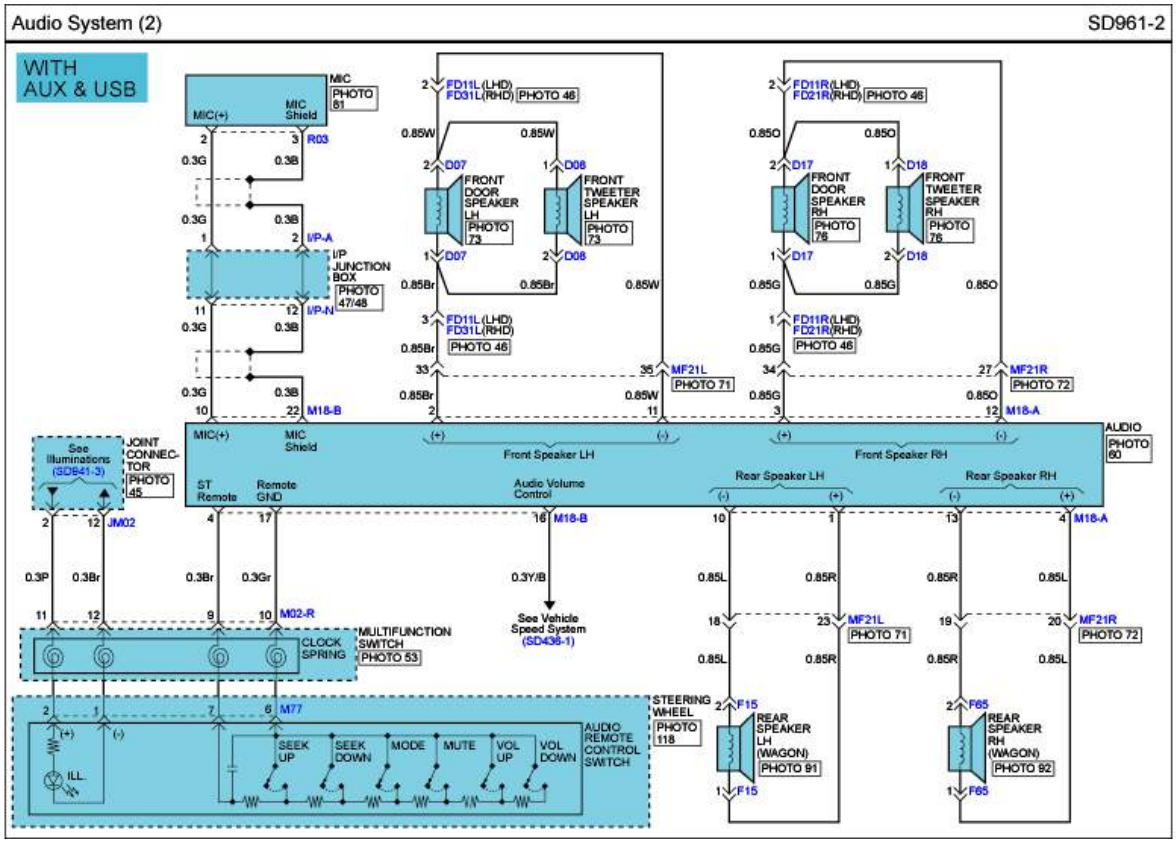

Automatic Transaxle Control System (D4CB : A - ENG 2.5L / AII - ENG 2.5L) (1)
SD450-1
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
ECU/TCU 10A
HOT IN ON OR START
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-5)
I/P JUNCTION BOX PHOTO 47
BACK-UP LAMP RELAY
I/P-E(LHD) I/P-ER(RHD)
I/P-B(LHD) I/P-BR(RHD)
See Illuminations (SD841-1)
SPORT MODE SWITCH PHOTO 65
UP SHIFT
DOWN SHIFT
SELECT SWITCH
Manual
Normal
ILL
See Back-up Lamps (SD928-1)
ME21 PHOTO 11
M70
ME41
E35A
TCM PHOTO 46
Memory Power
Start Relay Control
Vehicle Speed Output
Up Shift
Down Shift
Stop Lamp Switch
Mode Select Switch
K-Line
CAN
Low
High
ON/START Input
Ground
Back-Up Lamp Relay Control
See Starting System (SD360-1)
See Vehicle Speed System (SD436-1)
See Stop Lamps (SD927-2)
See Data Link Details (SD200-1) (SD200-2)
GE01 PHOTO 45

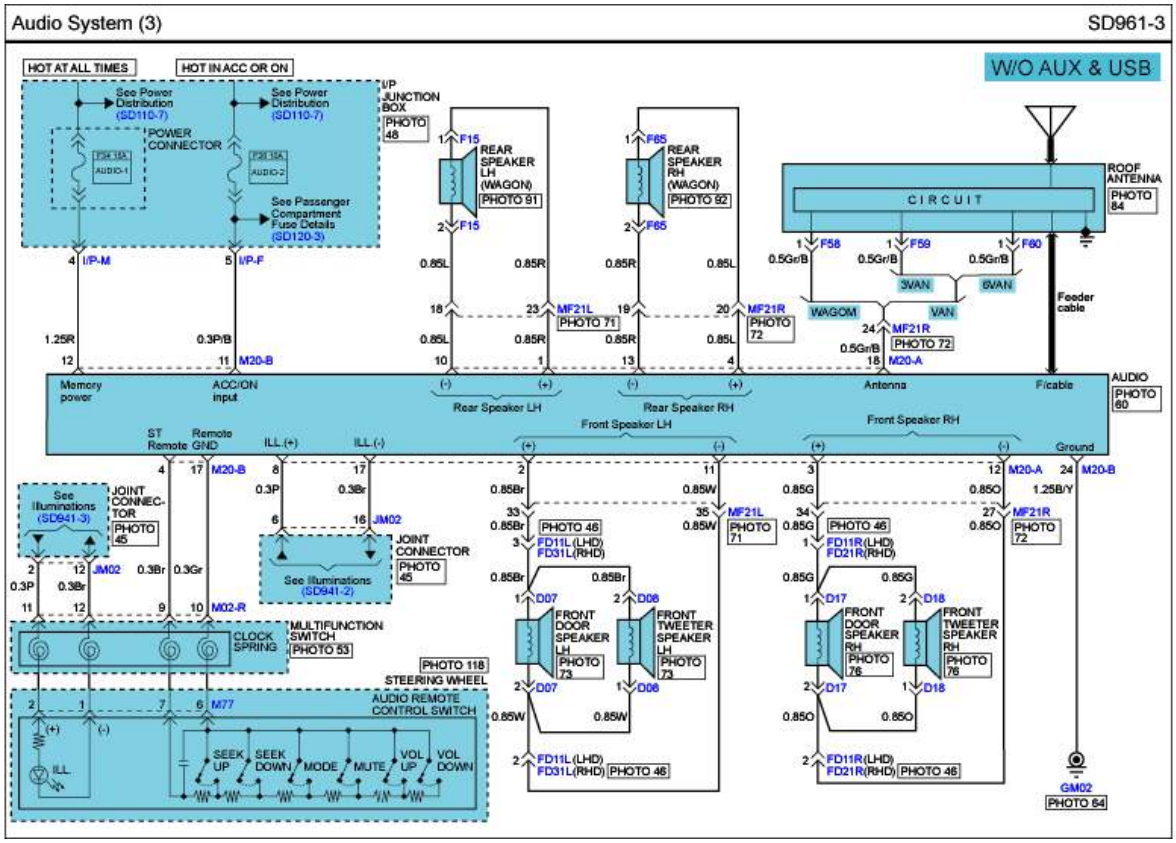

Automatic Transaxle Control System (D4CB : A - ENG 2.5L / AII - ENG 2.5L) (2)
SD450-2
TCM
PHOTO 46
INH SW1
INH SW4
INH SW2
ATF1
VSP1
GND
VIGN-OUT
PSB2
SEL3
SEL2
PSC2
SEL1
INH SW3-MON
INH SW3
DATABIT1
E35A
ET41
PHOTO 13
T01-3
T01-1
ATM CONTROL UNIT
PHOTO 106
T02B
T6 INH SW
INH SW3
INH SW1
INH SW4
GND
INH SW2
GND(ATF1)
ATF1
Vin(VSP)
VSP1
GND(VSP)
From TURBIN SNSR (SD450-3)
From HYDLR SNSR (SD450-3)
T4 EEP ROM BOX ASS'Y
T5
N.C
GND
TURBIN SNSR
B2(1)
C1(2)
C3(2)
C2(1)
B3(2)
C1(1)
C3(1)
B3(1)
HYDLR SW
C1
C2
C3
B2
B3
CS
SK
VCC
D1
GND
D0
EEP ROM
GND3(TML B)

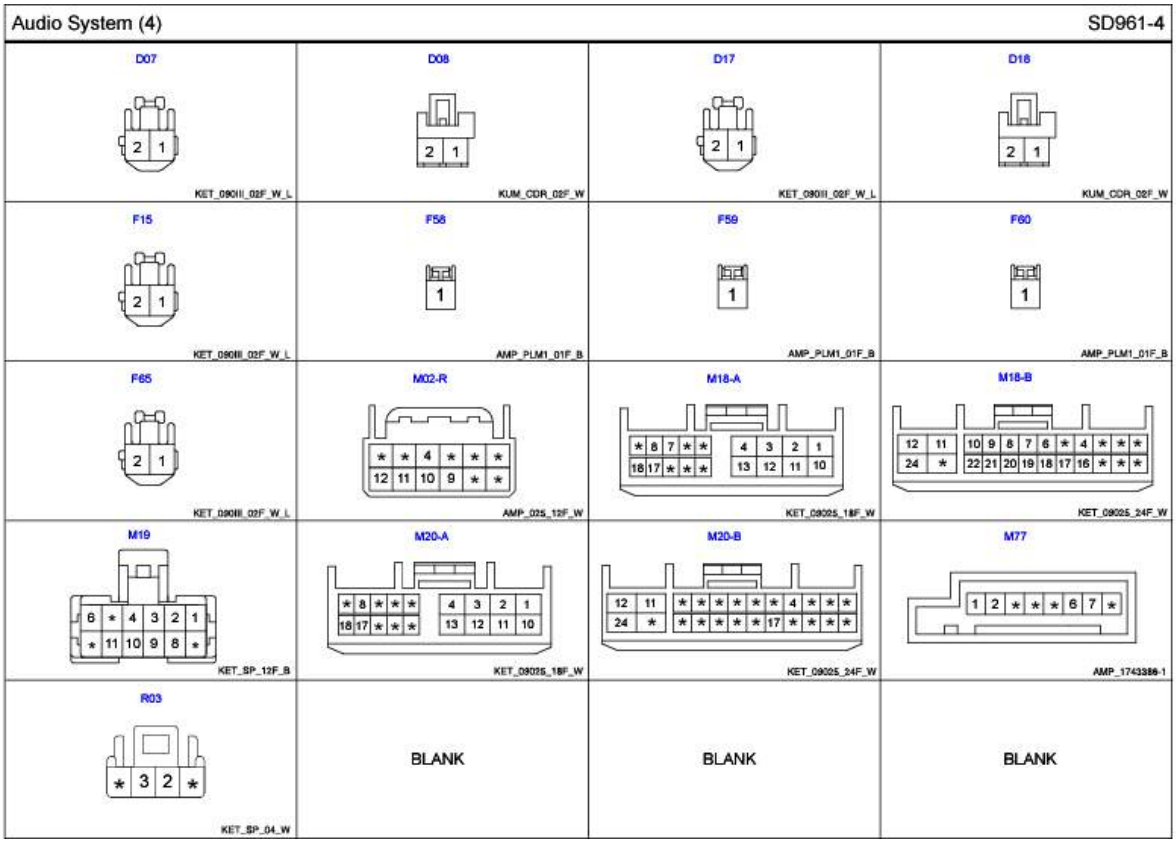

Automatic Transaxle Control System (D4CB : A - ENG 2.5L / AII - ENG 2.5L) (3)
SD450-3
TCM
PHOTO 46
I/C
FR/B
ATF2
B3-ON/OFF SOL
H&LR/C
D/C
SOLENOID SUPPLY
LU
PL
TURBIN1
TURBIN2
See Ground Distribution (SD130-4)
GE01
PHOTO 45
GE02
PHOTO 16
ET41
PHOTO 13
E35A
T01-2
T01-3
T02A
T3
ATM CONTROL UNIT
PHOTO 106
SOL
HYDLR SNSR
NO1
NO2
BOX
GND
TURBIN SNSR
To EEP ROM BOX (SD450-2)
GND2(TML B)

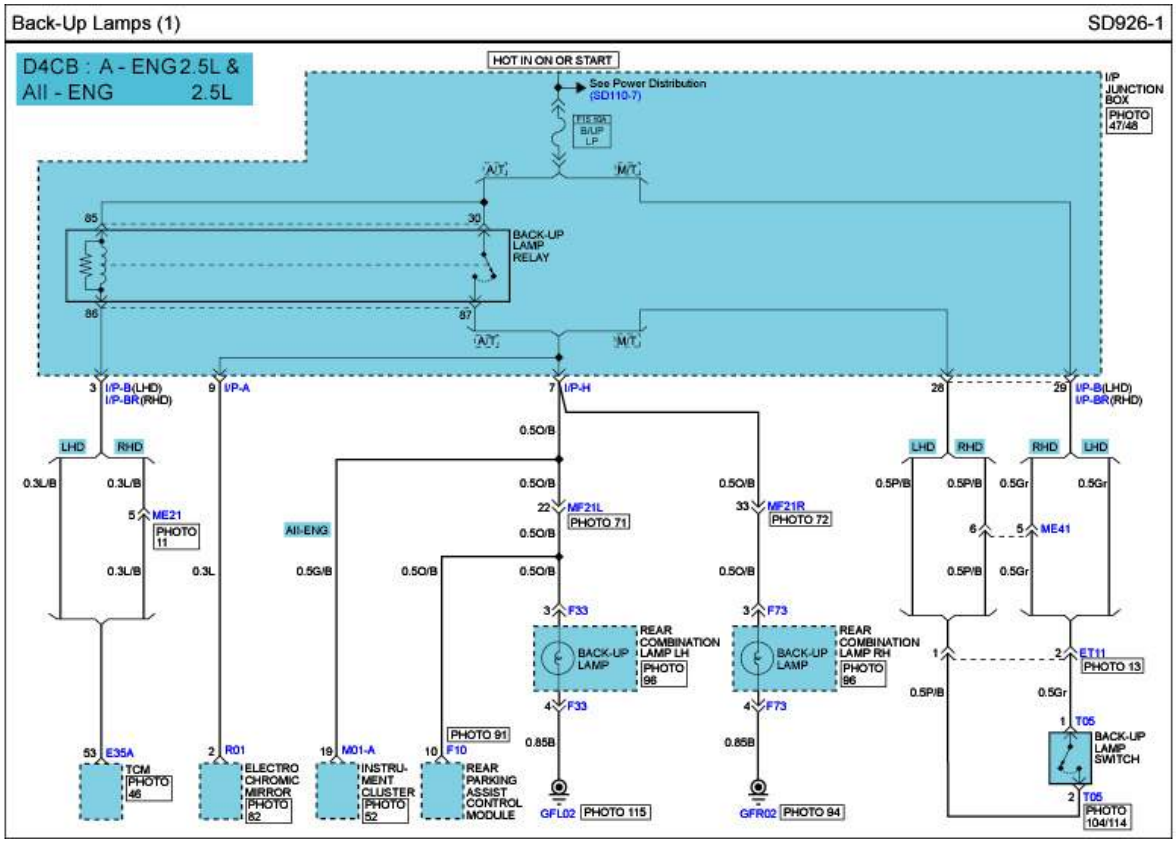

Automatic Transaxle Control System (D4CB : A - ENG 2.5L / AII - ENG 2.5L) (4)
SD450-4
E35A
AMP_ECU_84F
M70
KET_080II_08F_W
BLANK
T01-1
KET_040IIWP_10F_Gr
KET_RK_10M_Gr
T01-2
KET_040IIWP_10F_B
KET_RK_10M_B
T01-3
KET_040IIWP_08F_B
KET_RK_08M_B
T02A
KET_A_12F_L
T02B
KET_A_16F_L
T3
KET_2S0_02F_Gr
T4
CR16F052
T5
CR16F052
T6
CR10F028


Audio System (1)
SD961-1
WITH AUX & USB
HOT IN ON OR START
HOT AT ALL TIMES
HOT IN ACC OR ON
See Power Distribution (SD110-7)
POWER CONNECTOR
I/P JUNCTION BOX
PHOTO 48
See Passenger Compartment Fuse Details (SD120-5)
See Passenger Compartment Fuse Details (SD120-3)
ROOF ANTENNA
PHOTO 84
CIRCUIT
F58
F59
F60
0.5Gr/B
3VAN
8VAN
WAGOM
VAN
MF21R
PHOTO 72
Feeder cable
19 I/P-G
4 I/P-M
5 I/P-F
0.3Y
1.25R
0.3P/B
7 M18-A
12
11 M18-B
18 M18-A
ON/START Input
Memory Power
ACC/ON Input
Antenna
F/cable
AUDIO
PHOTO 60
AUX
Ground
USB/IPOD VDD
USB D(-)
USB D(+)
USB/IPOD GND
L_IN
R_IN
REF
Detect
ILL (+)
ILL (-)
24
7
18
6
19
21
8
9
20 M18-B
8
17 M18-A
1.25B/Y
0.5Br
0.5R
0.5G
0.5L
0.5Y
0.5B/O
0.5W
0.3P
0.3L
0.5B/Y
6
1
2
3
9
11
4
10
8 M19
16 JM02
GND
USB/IPOD 5V
USB D(-)/ IPOD TX
USB D(+)/ IPOD RX
USB/IPOD GND
DET
AUX & USB JACK
PHOTO 64
JOINT CONNECTOR
PHOTO 45
GM02
PHOTO 64
See Illuminations (SD941-2)

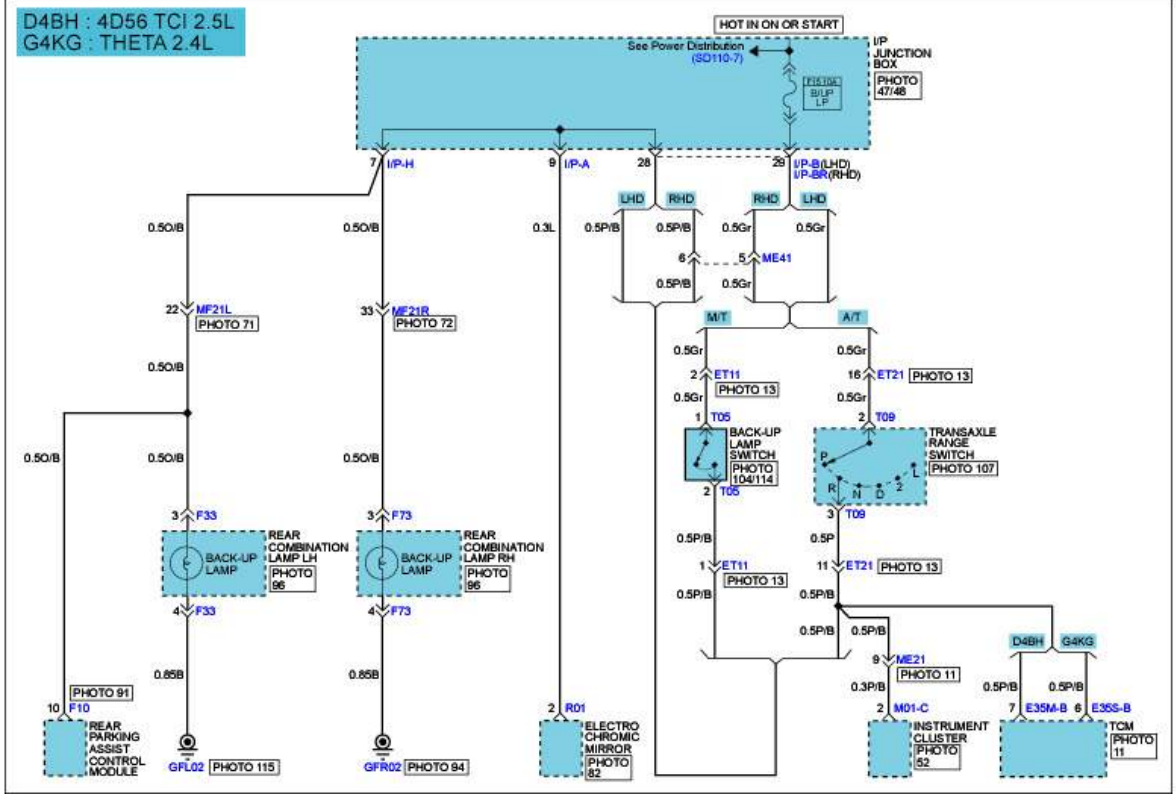

Audio System (2)
SD961-2
WITH AUX & USB
MIC
PHOTO 61
MIC(+)
MIC Shield
R03
I/P JUNCTION BOX
PHOTO 47/48
I/P-A
I/P-N
M18-B
FD11L (LHD) FD31L(RHD) PHOTO 46
D07
FRONT DOOR SPEAKER LH
PHOTO 73
D08
FRONT TWEETER SPEAKER LH
PHOTO 73
MF21L
PHOTO 71
FD11R(LHD) FD21R(RHD) PHOTO 46
D17
FRONT DOOR SPEAKER RH
PHOTO 76
D18
FRONT TWEETER SPEAKER RH
PHOTO 76
MF21R
PHOTO 72
M18-A
AUDIO
PHOTO 60
Front Speaker LH
Front Speaker RH
Rear Speaker LH
Rear Speaker RH
Audio Volume Control
ST Remote
Remote GND
See Illuminations (SD841-3)
JOINT CONNEC-TOR
PHOTO 45
JM02
M18-B
See Vehicle Speed System (SD438-1)
M02-R
CLOCK SPRING
MULTIFUNCTION SWITCH
PHOTO 53
M77
SEEK UP
SEEK DOWN
MODE
MUTE
VOL UP
VOL DOWN
ILL.
AUDIO REMOTE CONTROL SWITCH
STEERING WHEEL
PHOTO 118
F15
REAR SPEAKER LH (WAGON)
PHOTO 91
F65
REAR SPEAKER RH (WAGON)
PHOTO 92


Audio System (3)
SD961-3
W/O AUX & USB
HOT AT ALL TIMES
HOT IN ACC OR ON
See Power Distribution (SD110-7)
POWER CONNECTOR
See Passenger Compartment Fuse Details (SD120-3)
I/P JUNCTION BOX
PHOTO 48
REAR SPEAKER LH (WAGON)
PHOTO 91
REAR SPEAKER RH (WAGON)
PHOTO 92
CIRCUIT
ROOF ANTENNA
PHOTO 84
Feeder cable
MF21L
PHOTO 71
MF21R
PHOTO 72
Memory power
ACC/ON input
Rear Speaker LH
Rear Speaker RH
Front Speaker LH
Front Speaker RH
Antenna
Ficable
AUDIO
PHOTO 60
ST Remote
Remote GND
ILL.(+)
ILL.(-)
Ground
See Illuminations (SD941-3)
JOINT CONNEC-TOR
PHOTO 45
See Illuminations (SD941-2)
JOINT CONNECTOR
PHOTO 45
CLOCK SPRING
MULTIFUNCTION SWITCH
PHOTO 53
PHOTO 118
STEERING WHEEL
AUDIO REMOTE CONTROL SWITCH
SEEK UP
SEEK DOWN
MODE
MUTE
VOL UP
VOL DOWN
ILL.
FRONT DOOR SPEAKER LH
PHOTO 73
FRONT TWEETER SPEAKER LH
PHOTO 73
FRONT DOOR SPEAKER RH
PHOTO 76
FRONT TWEETER SPEAKER RH
PHOTO 76
PHOTO 46
GM02
PHOTO 54

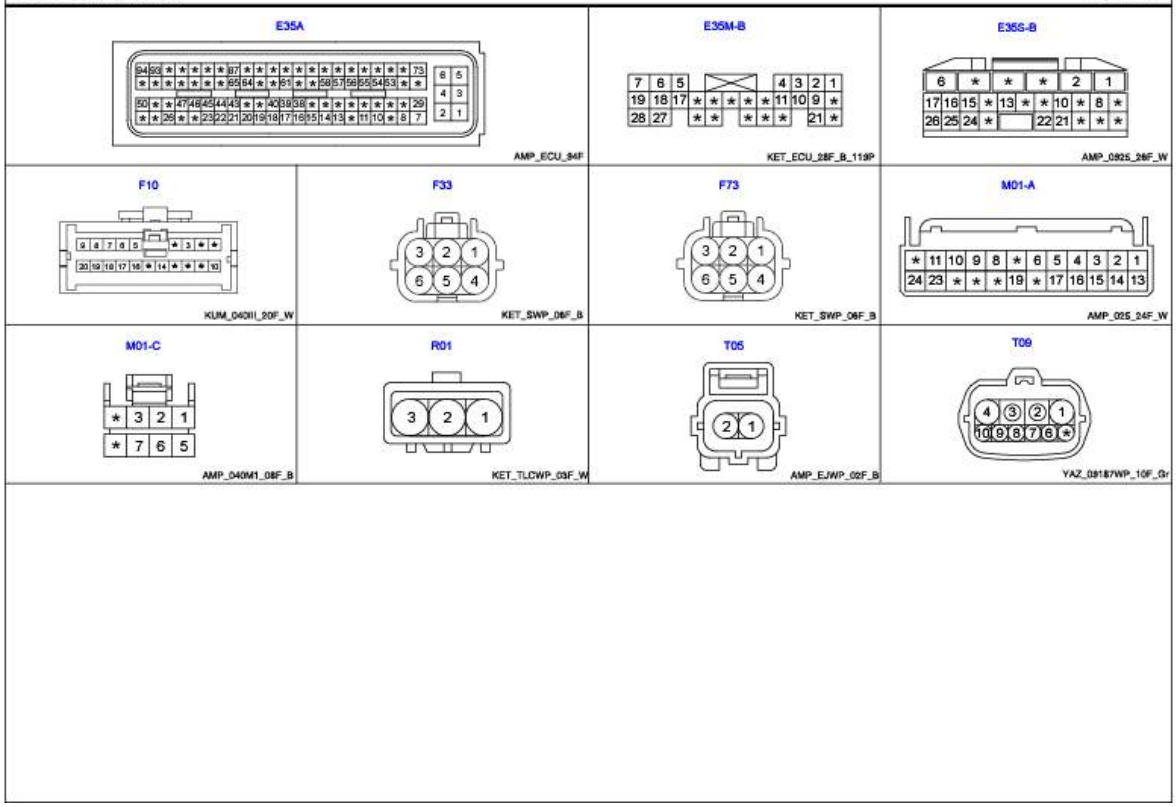

Audio System (4)
SD961-4
D07
KET_090III_02F_W_L
D08
KUM_CDR_02F_W
D17
KET_090III_02F_W_L
D18
KUM_CDR_02F_W
F15
KET_090III_02F_W_L
F58
AMP_PLM1_01F_B
F59
AMP_PLM1_01F_B
F60
AMP_PLM1_01F_B
F65
KET_090III_02F_W_L
M02-R
AMP_025_12F_W
M18-A
KET_09025_18F_W
M18-B
KET_09025_24F_W
M19
KET_SP_12F_B
M20-A
KET_09025_18F_W
M20-B
KET_09025_24F_W
M77
AMP_1743386-1
R03
KET_SP_04_W
BLANK
BLANK
BLANK


Back-Up Lamps (1)
SD926-1
D4CB : A - ENG 2.5L &
All - ENG 2.5L
HOT IN ON OR START
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47/48
BACK-UP LAMP RELAY
A/T
M/T
I/P-B(LHD) I/P-BR(RHD)
I/P-A
I/P-H
LHD
RHD
ME21
PHOTO 11
All-ENG
MF21L
PHOTO 71
MF21R
PHOTO 72
ME41
F33
F73
REAR COMBINATION LAMP LH
REAR COMBINATION LAMP RH
BACK-UP LAMP
PHOTO 98
PHOTO 96
ET11
PHOTO 13
T05
BACK-UP LAMP SWITCH
PHOTO 104/114
E35A
TCM
PHOTO 46
R01
ELECTRO CHROMIC MIRROR
PHOTO 82
M01-A
INSTRU-MENT CLUSTER
PHOTO 52
F10
REAR PARKING ASSIST CONTROL MODULE
PHOTO 91
GFL02
PHOTO 115
GFR02
PHOTO 94

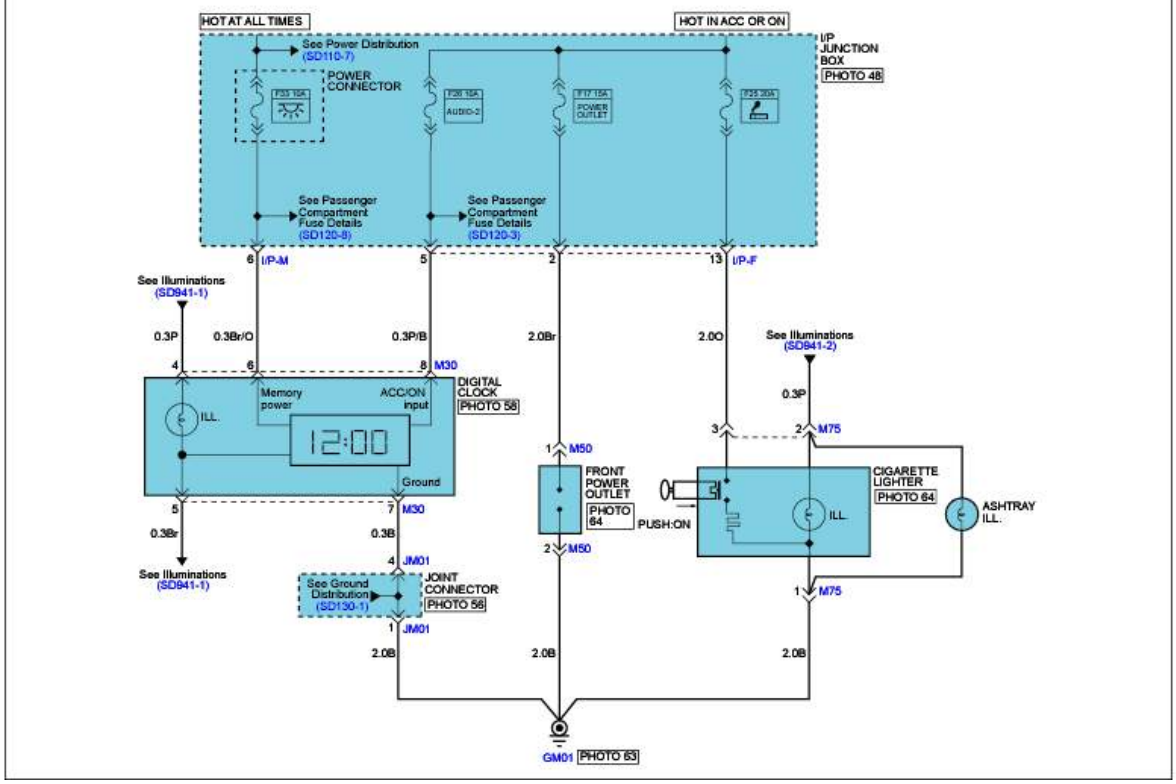
Back-Up Lamps (2) SD926-2



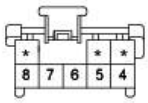
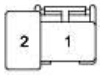
Back-Up Lamps (3) SD926-3

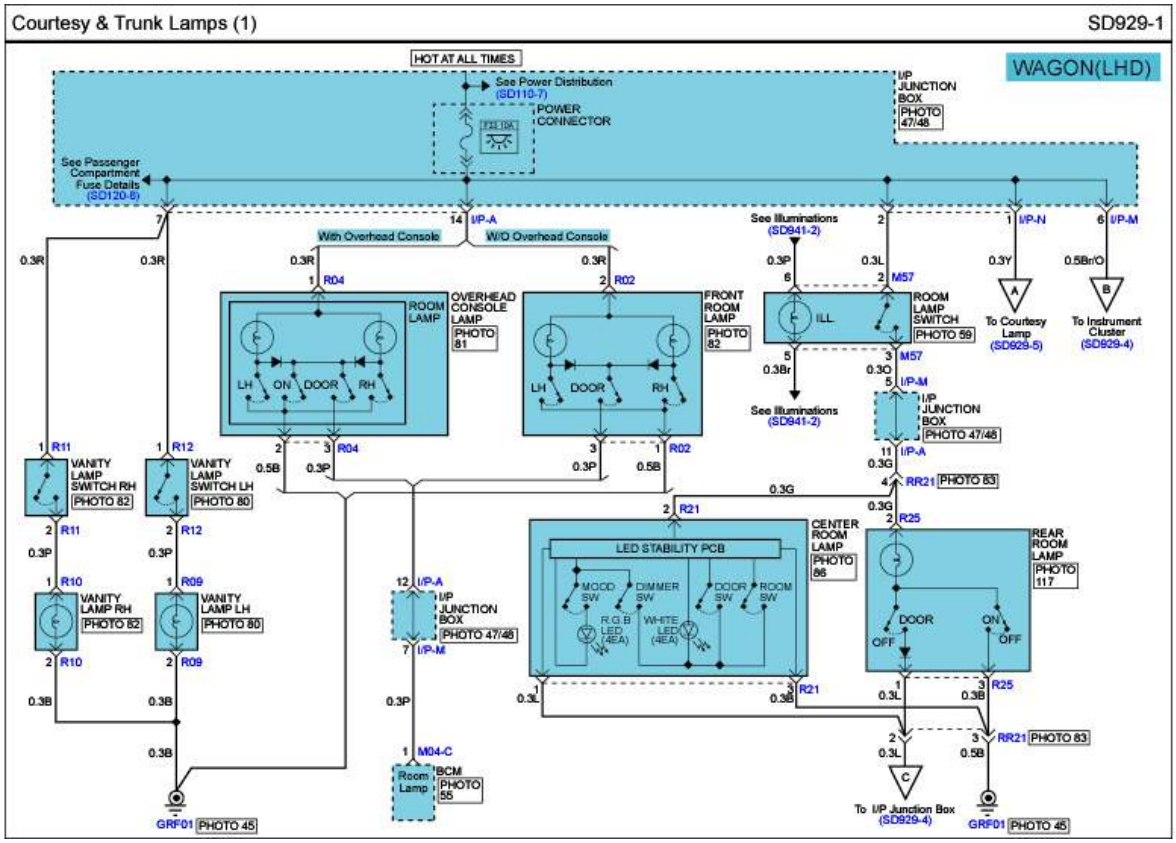


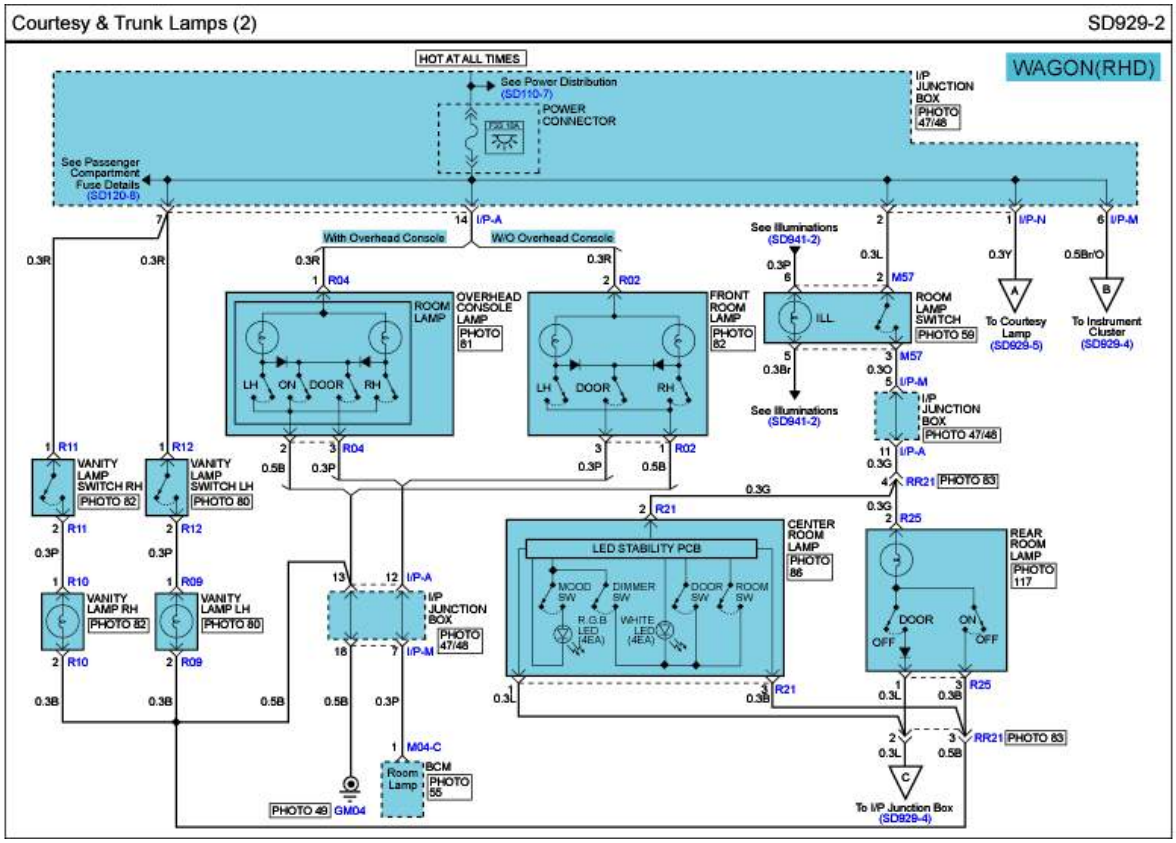
Clock & Cigarette Lighter (Power Outlet) System (1) SD945-1

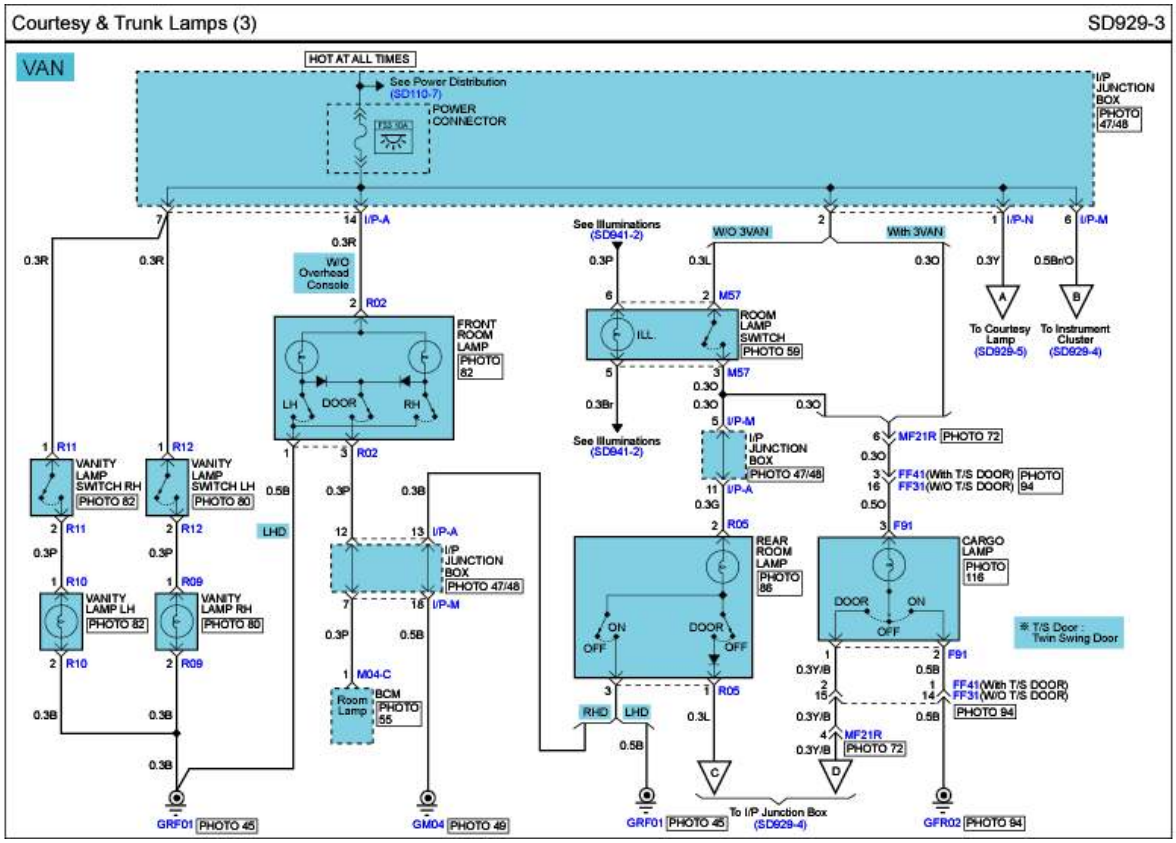


Clock & Cigarette Lighter (Power Outlet) System (2) SD945-2

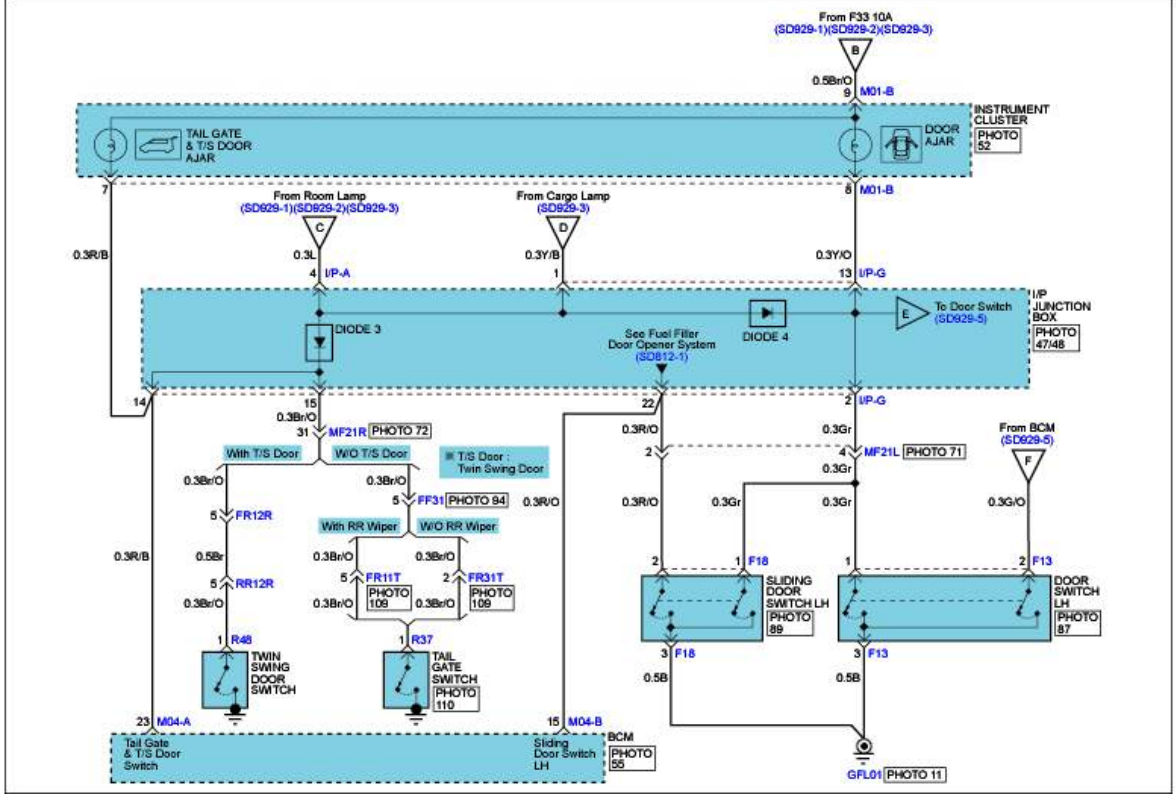
M30	M50	M75	
 KUM_AR_08F_W	 AMP_PLM2_02F_B	KET_090II_03F_W	BLANK

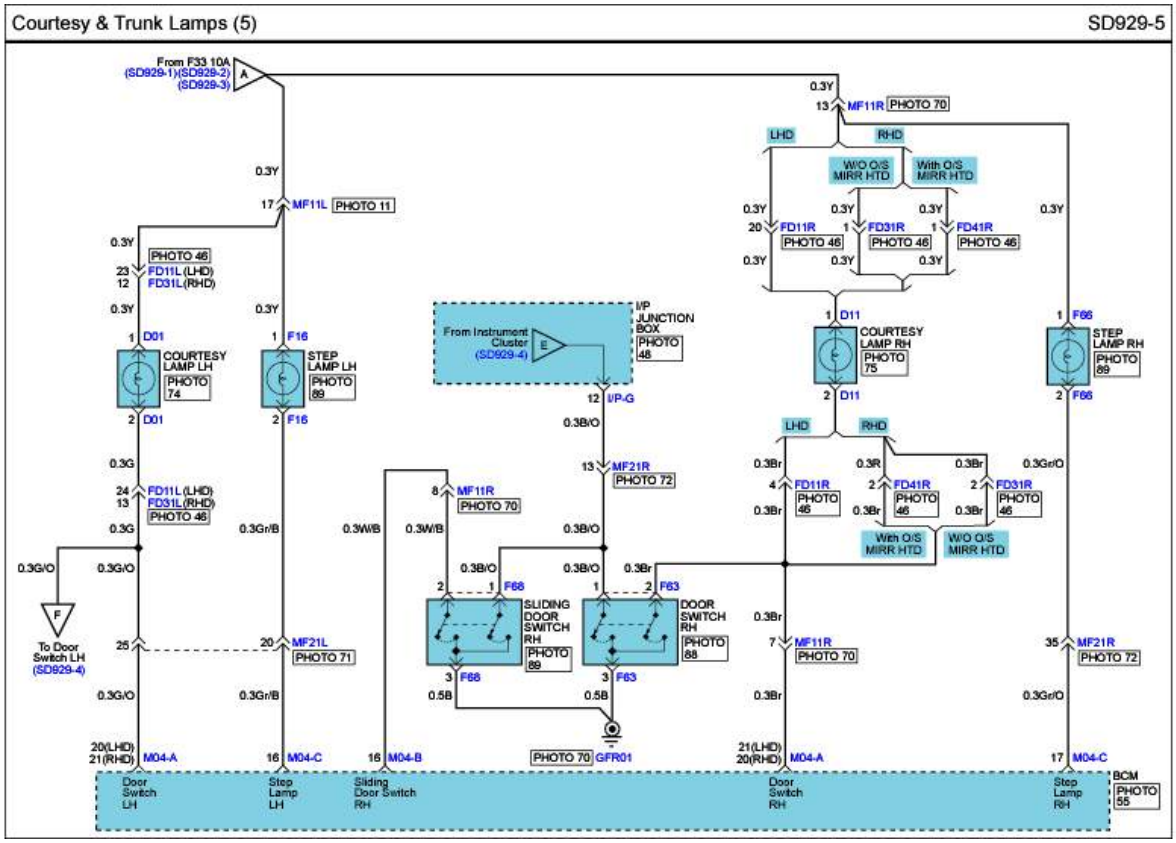

Courtesy & Trunk Lamps (1)
SD929-1
WAGON(LHD)
HOT AT ALL TIMES
See Power Distribution (SD110-7)
POWER CONNECTOR
I/P JUNCTION BOX PHOTO 47/48
See Passenger Compartment Fuse Details (SD120-8)
With Overhead Console
W/O Overhead Console
ROOM LAMP OVERHEAD CONSOLE LAMP PHOTO 81
FRONT ROOM LAMP PHOTO 82
See Illuminations (SD941-2)
ROOM LAMP SWITCH PHOTO 59
To Courtesy Lamp (SD929-5)
To Instrument Cluster (SD929-4)
VANITY LAMP SWITCH RH PHOTO 82
VANITY LAMP SWITCH LH PHOTO 80
VANITY LAMP RH PHOTO 82
VANITY LAMP LH PHOTO 80
LED STABILITY PCB
MOOD SW
DIMMER SW
DOOR SW
ROOM SW
R.G.B LED (4EA)
WHITE LED (4EA)
CENTER ROOM LAMP PHOTO 86
REAR ROOM LAMP PHOTO 117
DOOR
ON
OFF
BCM Room Lamp PHOTO 55
To I/P Junction Box (SD929-4)
GRF01 PHOTO 45


Courtesy & Trunk Lamps (2)
SD929-2
WAGON(RHD)
HOT AT ALL TIMES
See Power Distribution (SD110-7)
POWER CONNECTOR
I/P JUNCTION BOX PHOTO 47/48
See Passenger Compartment Fuse Details (SD120-8)
With Overhead Console
W/O Overhead Console
ROOM LAMP OVERHEAD CONSOLE LAMP PHOTO 81
FRONT ROOM LAMP PHOTO 82
ILL
ROOM LAMP SWITCH PHOTO 59
See Illuminations (SD941-2)
To Courtesy Lamp (SD929-5)
To Instrument Cluster (SD929-4)
VANITY LAMP SWITCH RH PHOTO 82
VANITY LAMP SWITCH LH PHOTO 80
VANITY LAMP RH PHOTO 82
VANITY LAMP LH PHOTO 80
LED STABILITY PCB
MOOD SW
DIMMER SW
DOOR SW
ROOM SW
R.G.B LED (4EA)
WHITE LED (4EA)
CENTER ROOM LAMP PHOTO 86
REAR ROOM LAMP PHOTO 117
DOOR
ON
OFF
BCM PHOTO 55
Room Lamp
PHOTO 49 GM04
To I/P Junction Box (SD929-4)

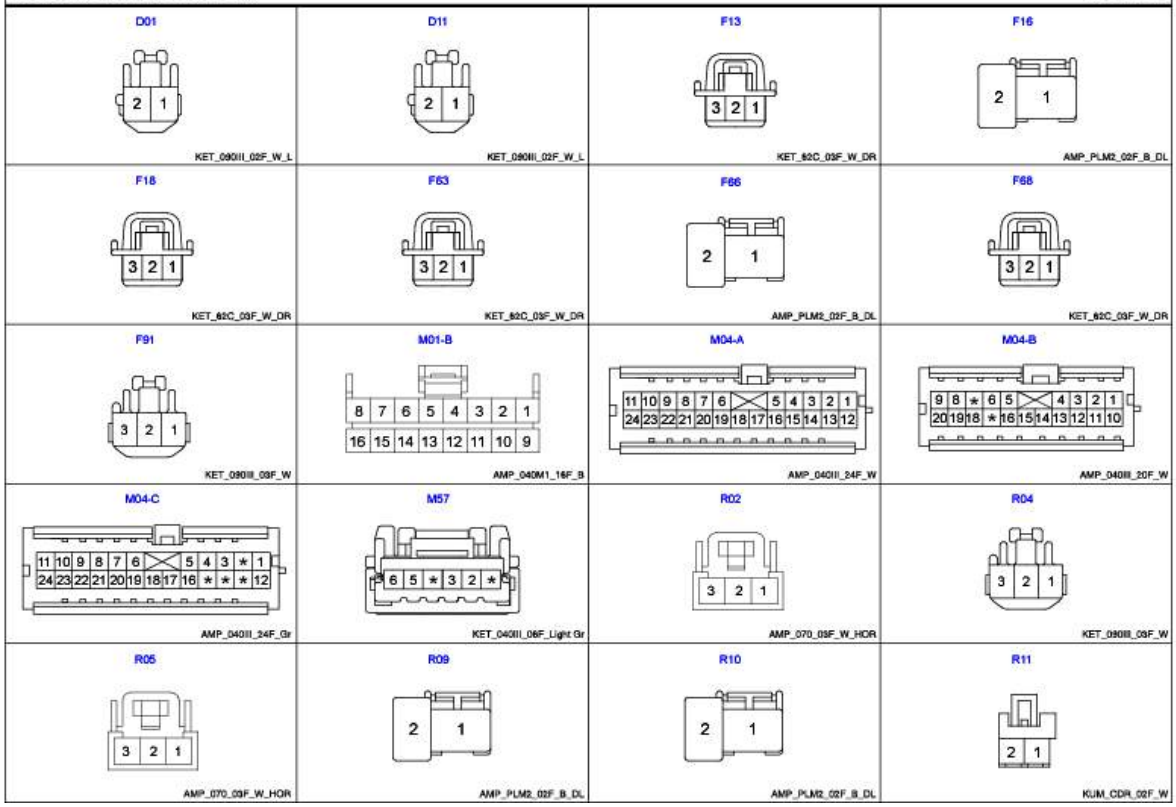

Courtesy & Trunk Lamps (3)
SD929-3
VAN
HOT AT ALL TIMES
See Power Distribution (SD110-7)
POWER CONNECTOR
I/P JUNCTION BOX PHOTO 47/48
W/O Overhead Console
FRONT ROOM LAMP PHOTO 82
LH
DOOR
RH
VANITY LAMP SWITCH RH PHOTO 82
VANITY LAMP SWITCH LH PHOTO 80
LHD
VANITY LAMP LH PHOTO 82
VANITY LAMP RH PHOTO 80
I/P JUNCTION BOX PHOTO 47/48
BCM PHOTO 55
Room Lamp
GRF01 PHOTO 45
GM04 PHOTO 49
See Illuminations (SD941-2)
W/O 3VAN
With 3VAN
ROOM LAMP SWITCH PHOTO 59
ILL.
REAR ROOM LAMP PHOTO 86
ON
OFF
DOOR
RHD
LHD
To I/P Junction Box (SD929-4)
GRF01 PHOTO 45
MF21R PHOTO 72
FF41(With T/S DOOR) FF31(W/O T/S DOOR) PHOTO 94
CARGO LAMP PHOTO 116
* T/S Door : Twin Swing Door
GFR02 PHOTO 94
To Courtesy Lamp (SD929-5)
To Instrument Cluster (SD929-4)

Courtesy & Trunk Lamps (4) SD929-4

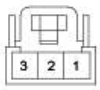


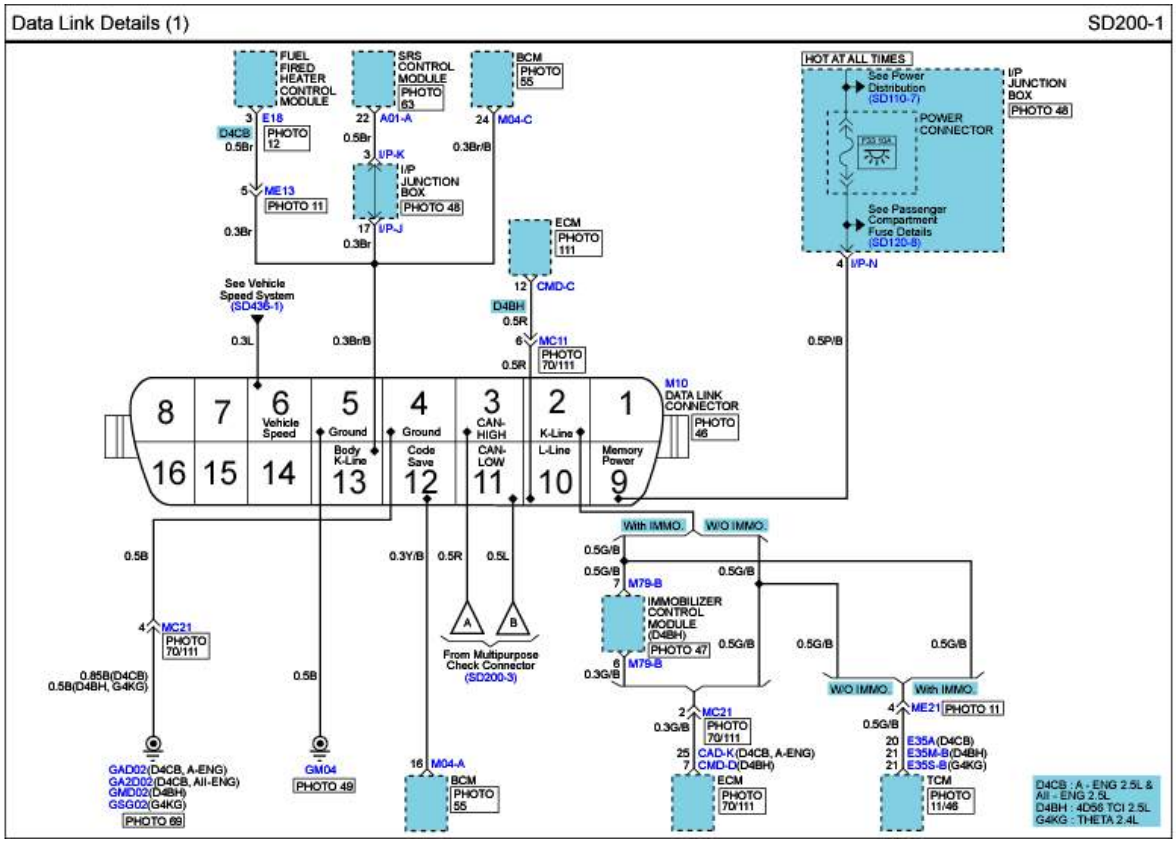

Courtesy & Trunk Lamps (5)
SD929-5
From F33 10A (SD929-1)(SD929-2) (SD929-3)
A
0.3Y
17 MF11L PHOTO 11
0.3Y
PHOTO 46
23 FD11L (LHD)
12 FD31L (RHD)
0.3Y
1 D01
COURTESY LAMP LH
PHOTO 74
2 D01
0.3G
24 FD11L (LHD)
13 FD31L (RHD)
PHOTO 46
0.3G
0.3G/O
F
To Door Switch LH (SD929-4)
25
0.3G/O
20(LHD) 21(RHD) M04-A
Door Switch LH
0.3Y
1 F16
STEP LAMP LH
PHOTO 89
2 F16
0.3G/B
20 MF21L PHOTO 71
0.3G/B
16 M04-C
Step Lamp LH
From Instrument Cluster (SD929-4)
E
I/P JUNCTION BOX
PHOTO 48
12 I/P-G
0.3B/O
13 MF21R PHOTO 72
0.3B/O
0.3B/O
2 1 F68
SLIDING DOOR SWITCH RH
PHOTO 89
3 F68
0.5B
0.3W/B
8 MF11R PHOTO 70
0.3W/B
16 M04-B
Sliding Door Switch RH
0.3B/O
0.3B/O
1 2 F63
DOOR SWITCH RH
PHOTO 88
3 F63
0.5B
PHOTO 70 GFR01
0.3Y
13 MF11R PHOTO 70
LHD
RHD
W/O O/S MIRR HTD
With O/S MIRR HTD
0.3Y
20 FD11R PHOTO 46
0.3Y
1 FD31R PHOTO 46
0.3Y
1 FD41R PHOTO 46
0.3Y
0.3Y
1 D11
COURTESY LAMP RH
PHOTO 75
2 D11
LHD
RHD
0.3Br
4 FD11R PHOTO 46
0.3Br
0.3R
2 FD41R PHOTO 46
0.3Br
0.3Br
2 FD31R PHOTO 46
0.3Br
With O/S MIRR HTD
W/O O/S MIRR HTD
0.3Br
7 MF11R PHOTO 70
0.3Br
21(LHD) 20(RHD) M04-A
Door Switch RH
0.3Y
1 F66
STEP LAMP RH
PHOTO 89
2 F66
0.3Gr/O
35 MF21R PHOTO 72
0.3Gr/O
17 M04-C
Step Lamp RH
BCM PHOTO 55

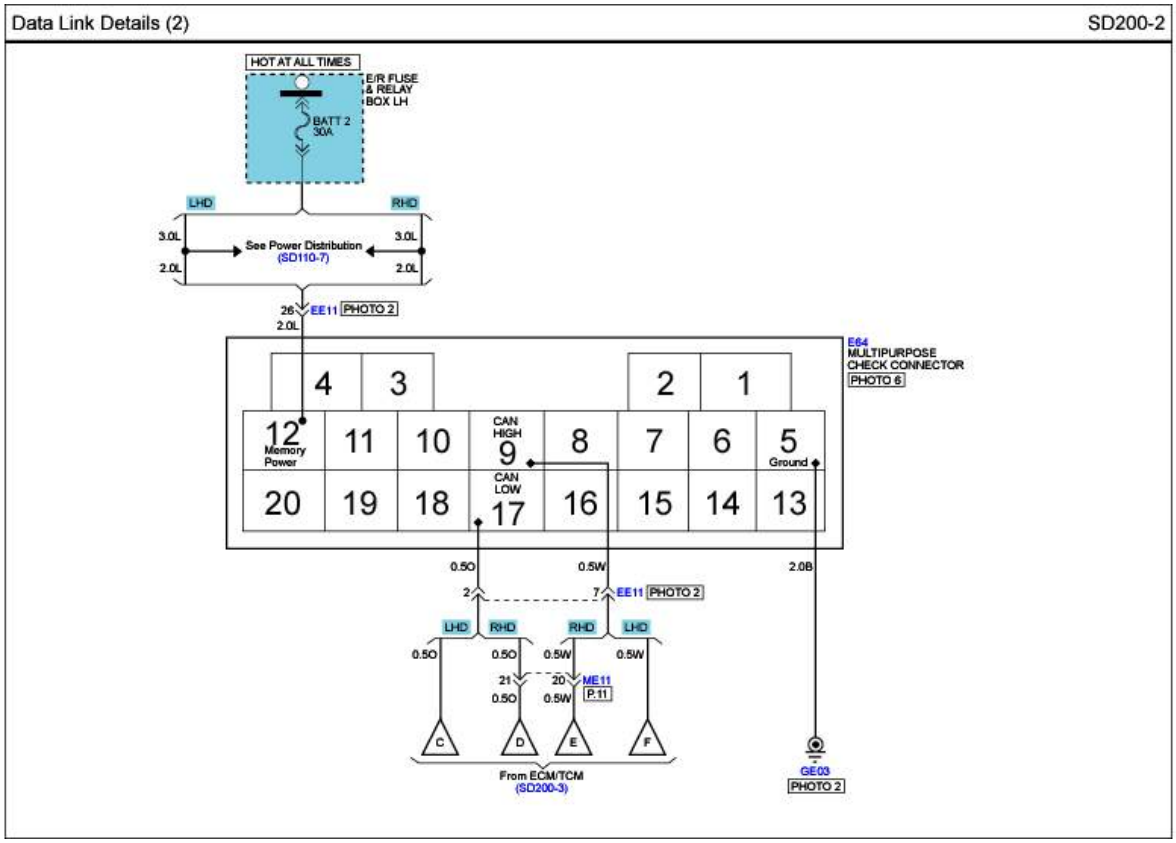
Courtesy & Trunk Lamps (6) SD929-6



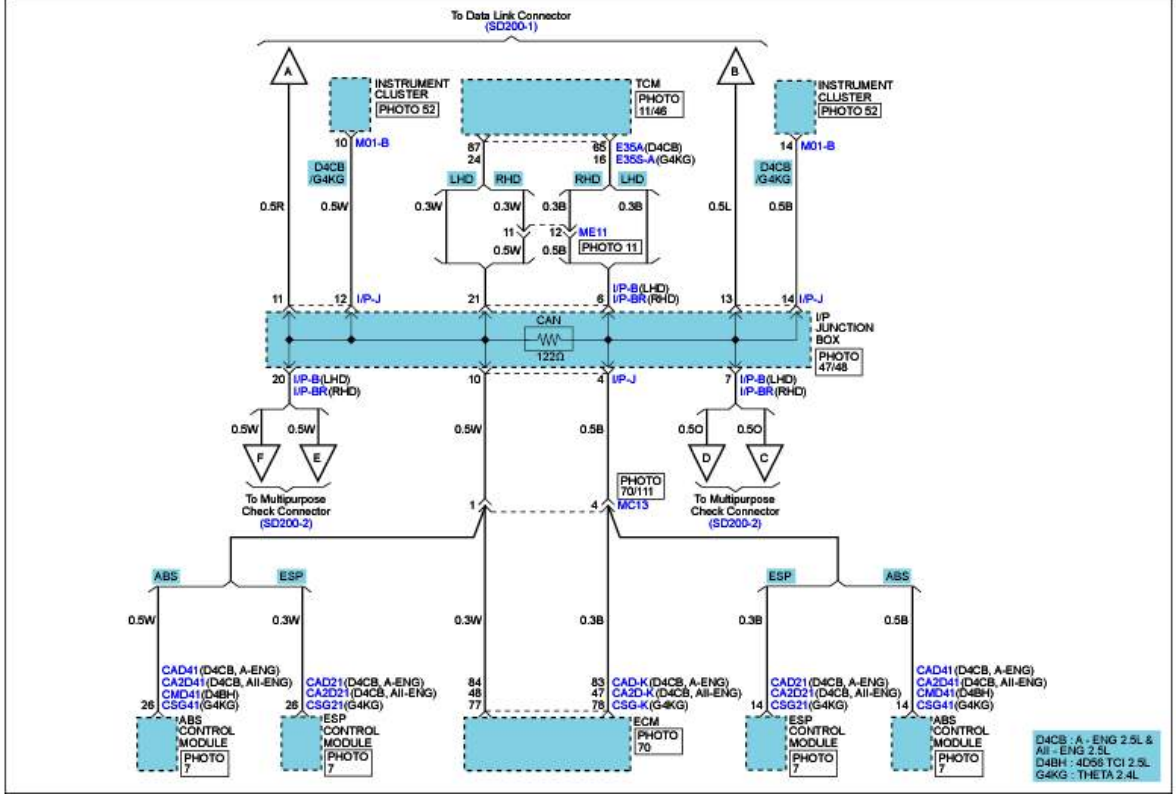
Courtesy & Trunk Lamps (7) SD929-7

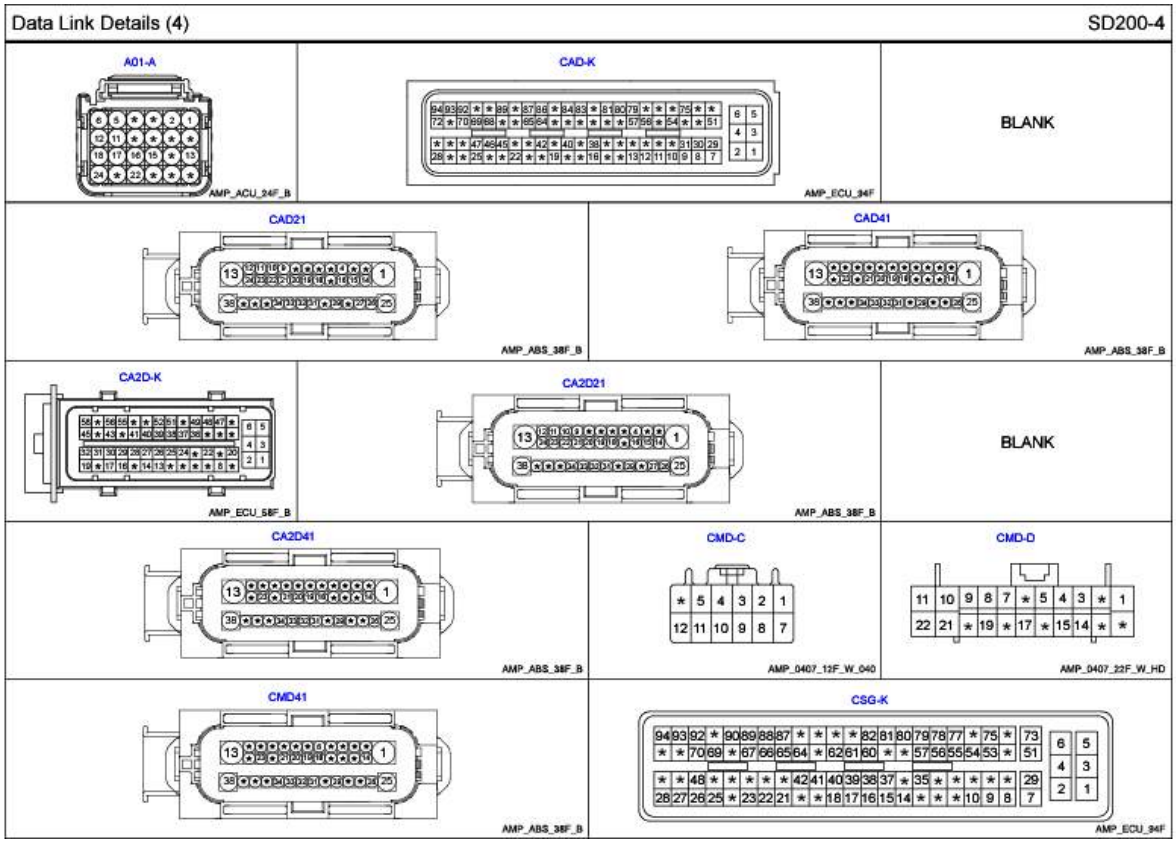
R12 KUM_CDR_02F_W	R21 AMP_070_03F_W_HOR	R25  AMP_070_03F_W_HOR	R37 CR01F050
R48 CR01F050	BLANK	BLANK	BLANK

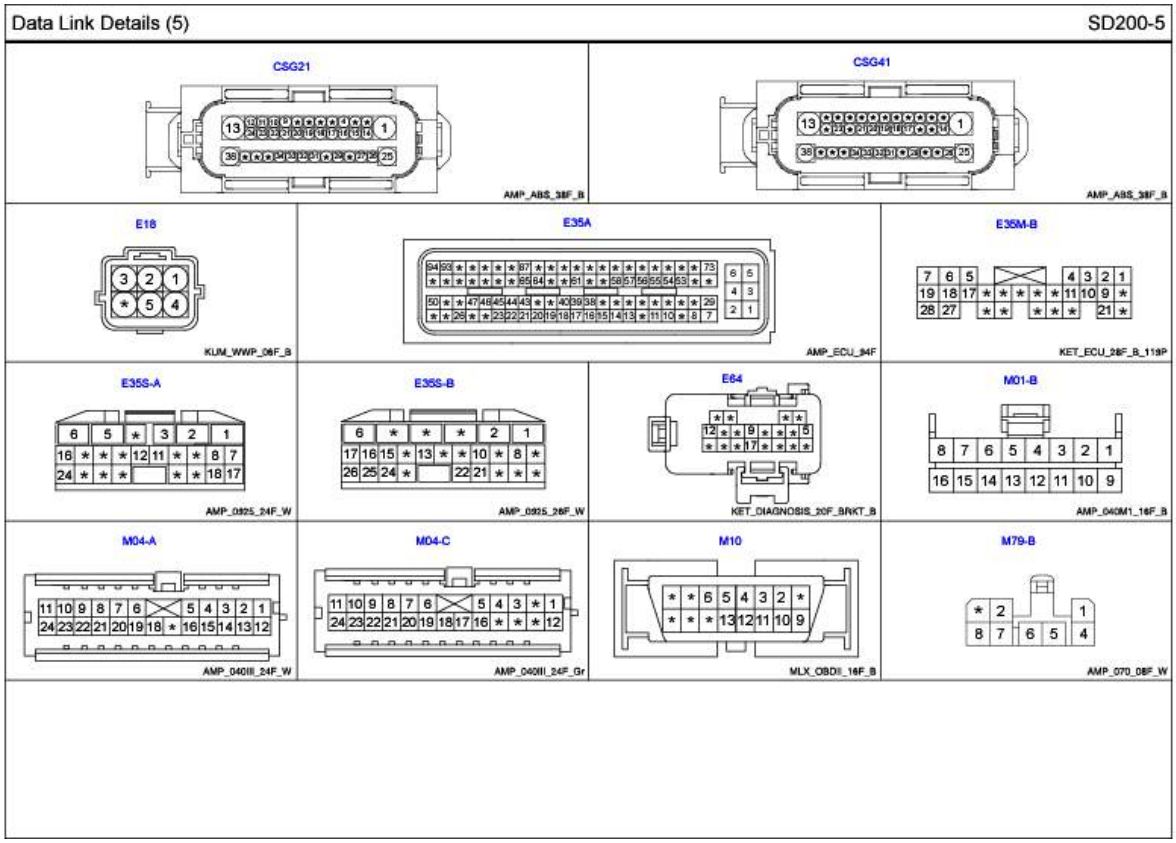

Data Link Details (1)
SD200-1
FUEL FIRED HEATER CONTROL MODULE
SRS CONTROL MODULE
BCM
HOT AT ALL TIMES
I/P JUNCTION BOX
POWER CONNECTOR
ECM
M10 DATA LINK CONNECTOR
Vehicle Speed
Ground
CAN-HIGH
K-Line
Body K-Line
Code Save
CAN-LOW
L-Line
Memory Power
With IMMO.
W/O IMMO.
IMMOBILIZER CONTROL MODULE (D4BH)
From Multipurpose Check Connector (SD200-3)
GAD02(D4CB, A-ENG)
GA2D02(D4CB, All-ENG)
GMD02(D4BH)
GSG02(G4KG)
GM04
D4CB : A - ENG 2.5L & All - ENG 2.5L
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L

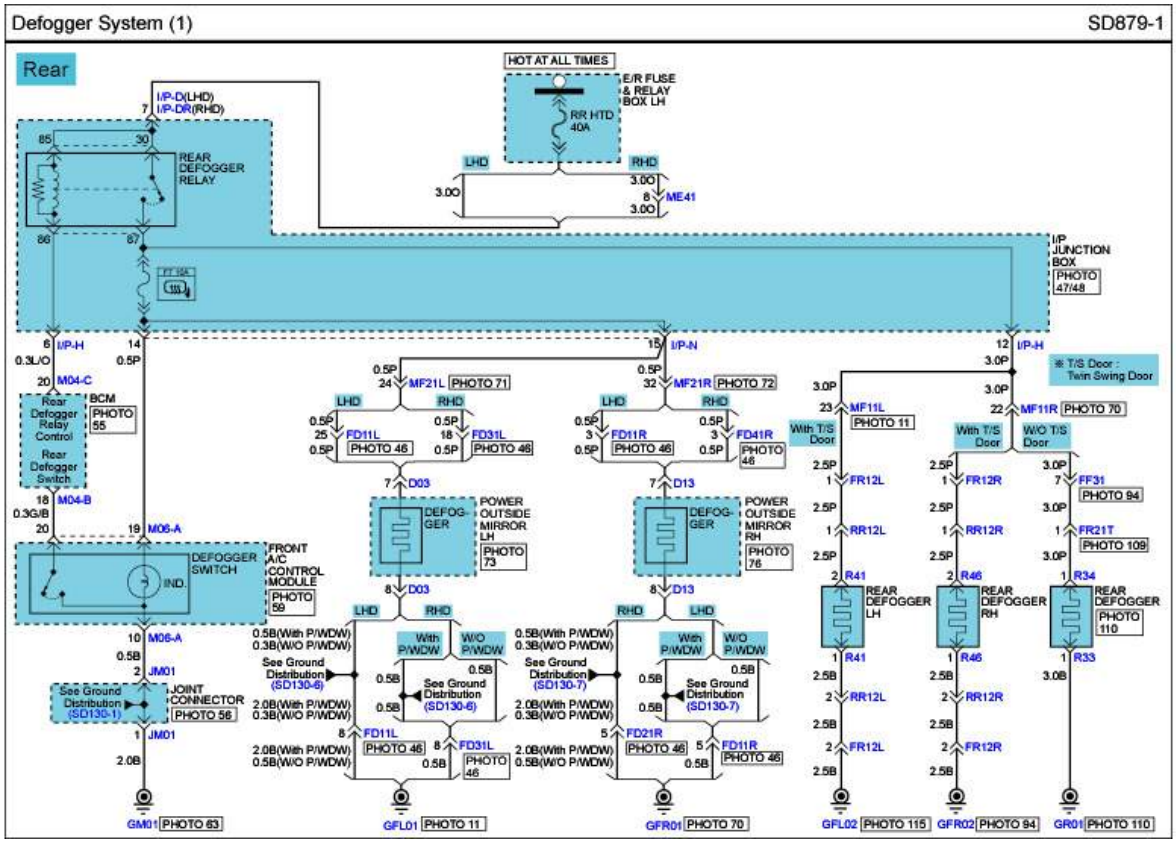

Data Link Details (2)
SD200-2
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
BATT 2 30A
LHD
RHD
3.0L
2.0L
See Power Distribution (SD110-7)
26
EE11 PHOTO 2
E64 MULTIPURPOSE CHECK CONNECTOR PHOTO 6
4 3 2 1
12 Memory Power
11 10
CAN HIGH 9
8 7 6
5 Ground
20 19 18
CAN LOW 17
16 15 14 13
0.5O
0.5W
2.0B
2
7
EE11 PHOTO 2
0.5O
0.5W
21
20
ME11 P.11
C D E F
From ECM/TCM (SD200-3)
GE03 PHOTO 2

Data Link Details (3) SD200-3

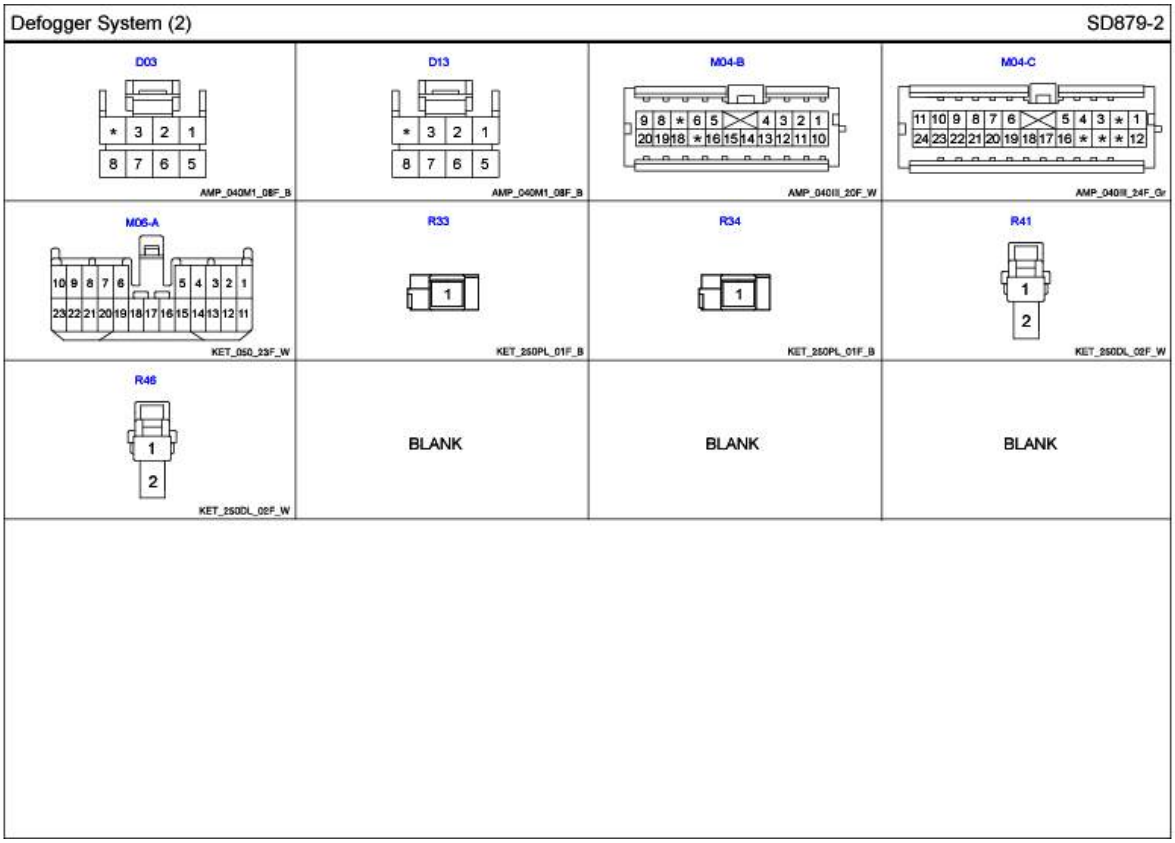



Data Link Details (4)
SD200-4
A01-A
AMP_ACU_24F_B
CAD-K
AMP_ECU_94F
BLANK
CAD21
AMP_ABS_38F_B
CAD41
AMP_ABS_38F_B
CA2D-K
AMP_ECU_58F_B
CA2D21
AMP_ABS_38F_B
BLANK
CA2D41
AMP_ABS_38F_B
CMD-C
AMP_0407_12F_W_040
CMD-D
AMP_0407_22F_W_HD
CMD41
AMP_ABS_38F_B
CSG-K
AMP_ECU_94F

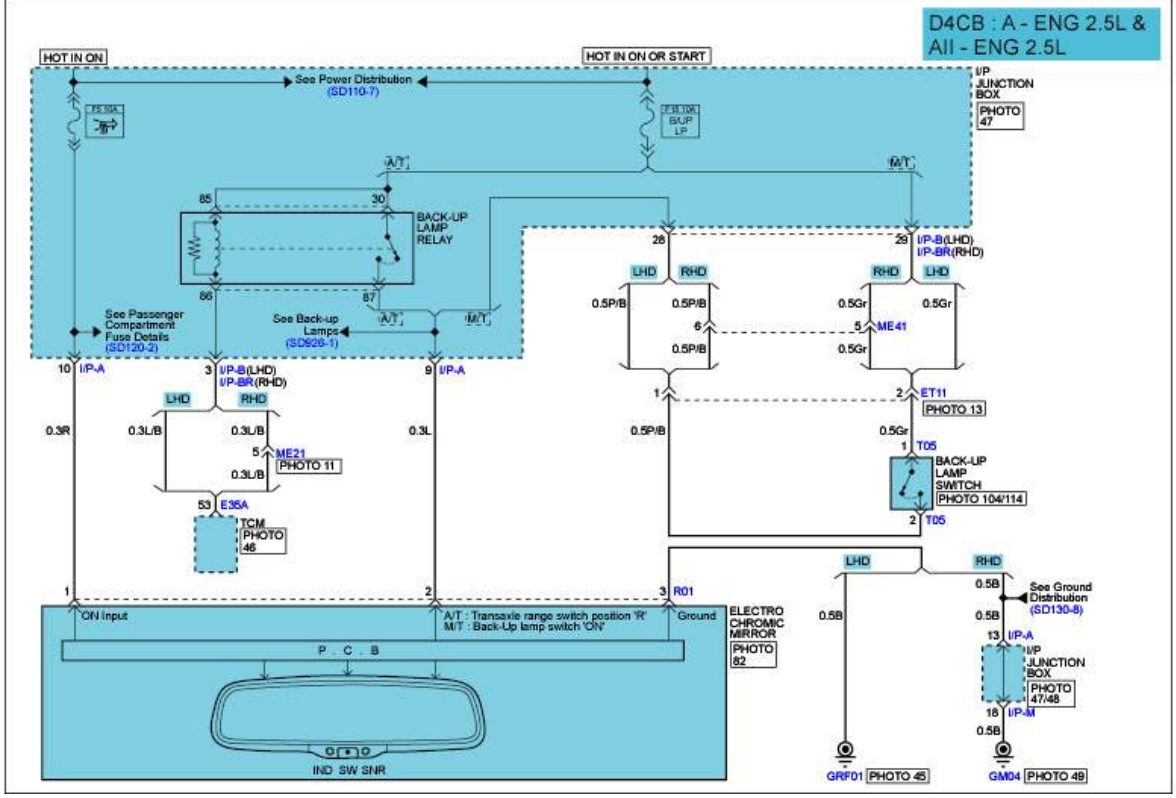

Data Link Details (5)
SD200-5
CSG21
AMP_ABS_38F_B
CSG41
AMP_ABS_38F_B
E18
KUM_WWP_06F_B
E35A
AMP_ECU_94F
E35M-B
KET_ECU_28F_B_119P
E35S-A
AMP_0925_24F_W
E35S-B
AMP_0925_26F_W
E64
KET_DIAGNOSIS_20F_BRKT_B
M01-B
AMP_040M1_16F_B
M04-A
AMP_040III_24F_W
M04-C
AMP_040III_24F_Gr
M10
MLX_OBDII_16F_B
M79-B
AMP_070_08F_W

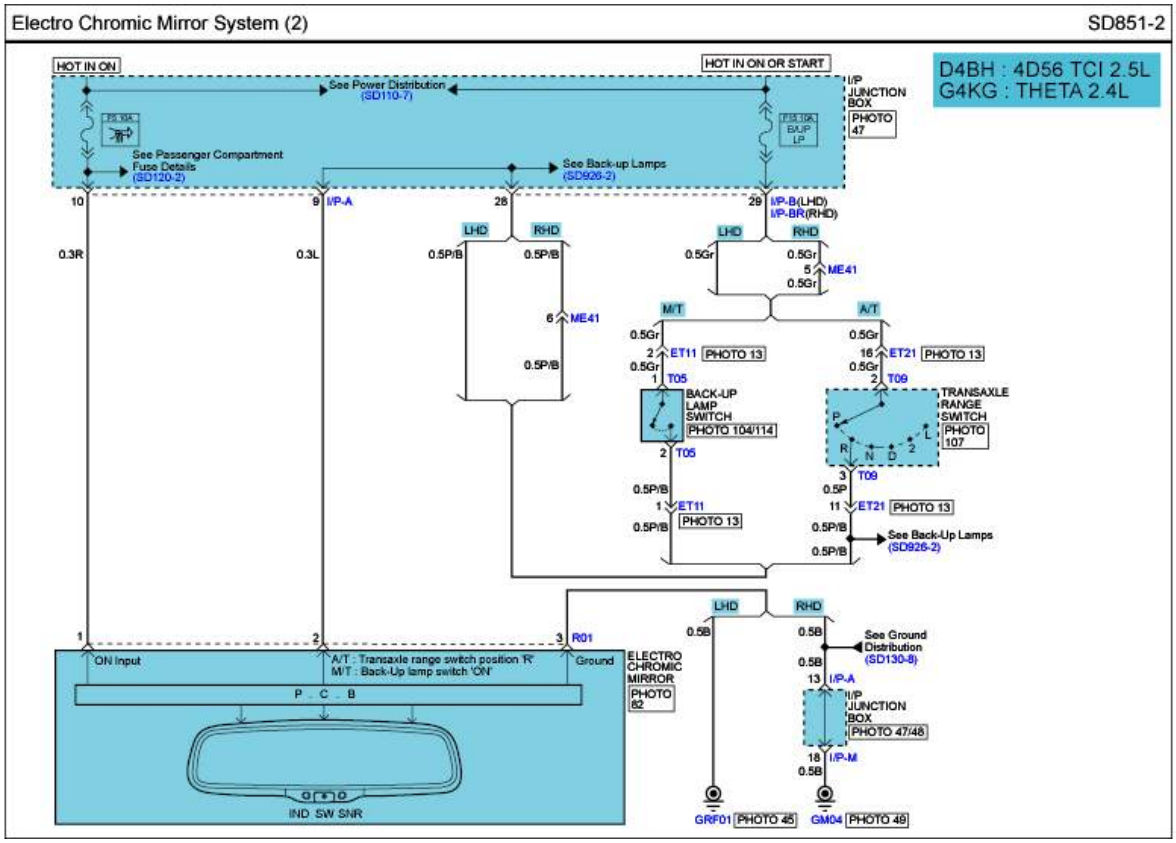

Defogger System (1)
SD879-1
Rear
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
RR HTD 40A
REAR DEFOGGER RELAY
I/P-D(LHD)
I/P-DR(RHD)
I/P JUNCTION BOX
PHOTO 47/48
I/P-H
I/P-N
M04-C
BCM
PHOTO 55
Rear Defogger Relay Control
Rear Defogger Switch
M04-B
M06-A
DEFOGGER SWITCH
IND.
FRONT A/C CONTROL MODULE
PHOTO 59
JM01
JOINT CONNECTOR
PHOTO 56
See Ground Distribution (SD130-1)
GM01 PHOTO 63
ME41
MF21L PHOTO 71
MF21R PHOTO 72
FD11L PHOTO 46
FD31L PHOTO 46
FD11R PHOTO 46
FD41R PHOTO 46
D03
D13
DEFOG-GER
POWER OUTSIDE MIRROR LH
PHOTO 73
POWER OUTSIDE MIRROR RH
PHOTO 76
LHD
RHD
With P/WDW
W/O P/WDW
See Ground Distribution (SD130-6)
See Ground Distribution (SD130-7)
FD21R PHOTO 46
FD11R PHOTO 46
FD31L PHOTO 46
GFL01 PHOTO 11
GFR01 PHOTO 70
MF11L PHOTO 11
MF11R PHOTO 70
With T/S Door
W/O T/S Door
FR12L
RR12L
R41
REAR DEFOGGER LH
FR12R
RR12R
R46
REAR DEFOGGER RH
FF31 PHOTO 94
FR21T PHOTO 109
R34
R33
REAR DEFOGGER PHOTO 110
※ T/S Door : Twin Swing Door
GFL02 PHOTO 115
GFR02 PHOTO 94
GR01 PHOTO 110

Defogger System (2) SD879-2

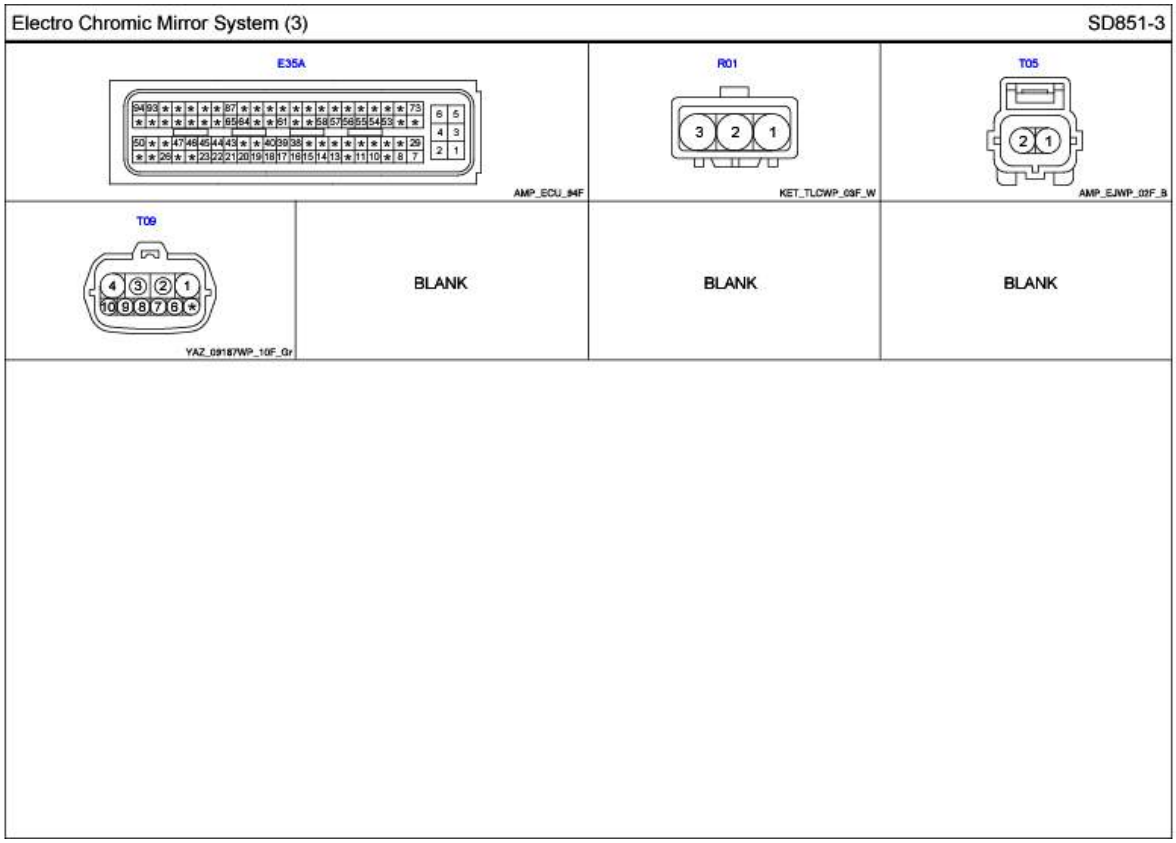


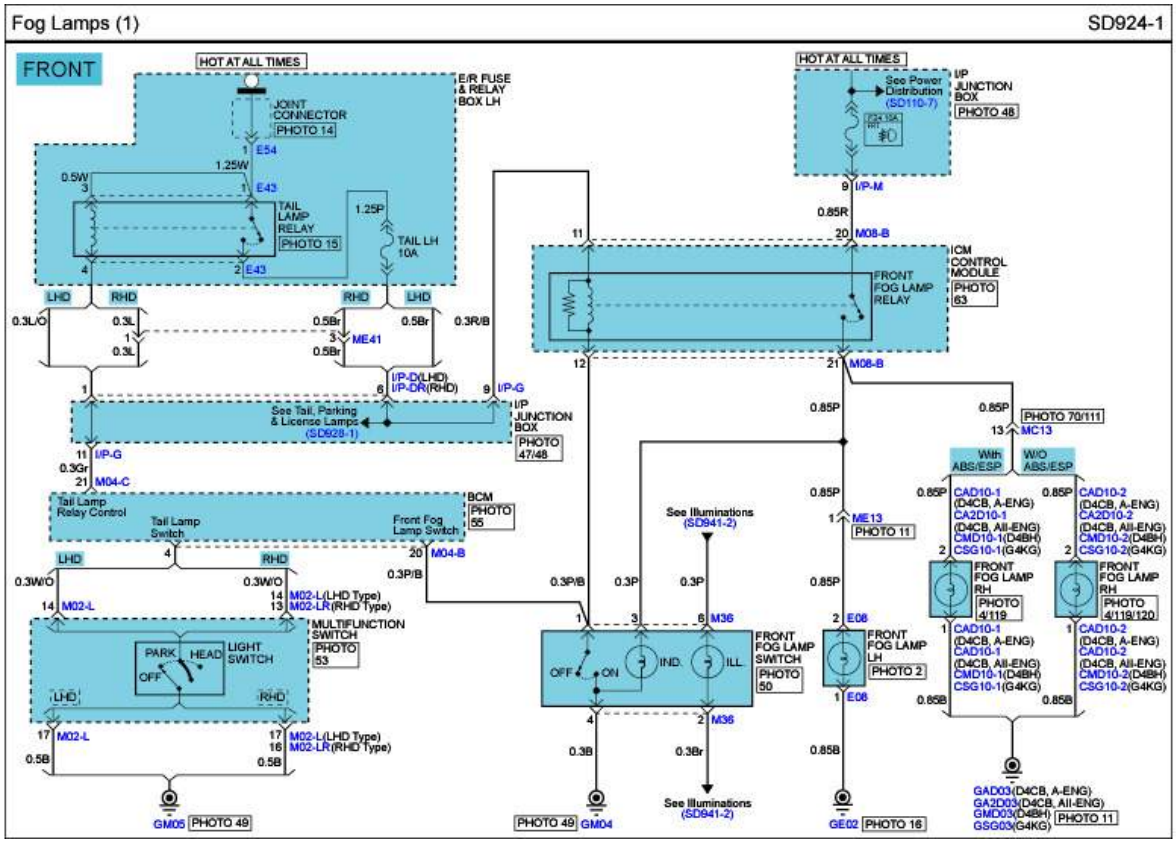
Electro Chromic Mirror System (1) SD851-1



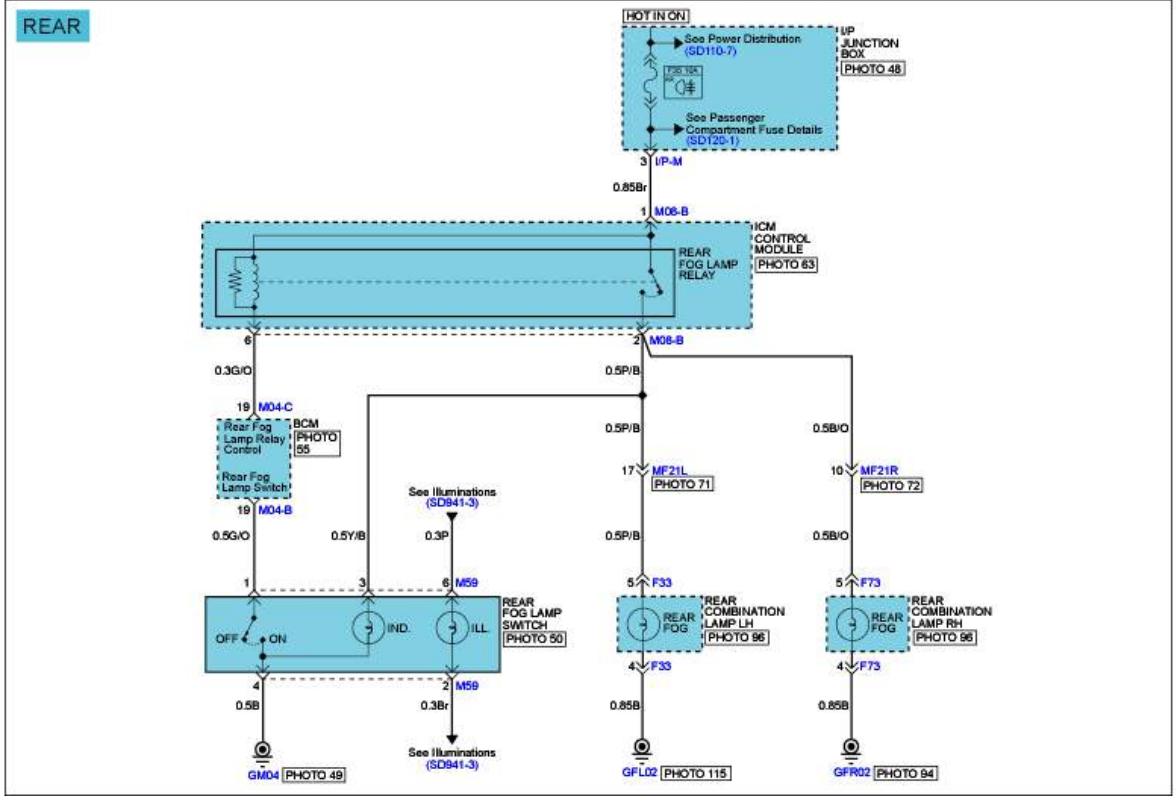

Electro Chromic Mirror System (2)
SD851-2
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L
HOT IN ON
HOT IN ON OR START
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-2)
See Back-up Lamps (SD926-2)
I/P JUNCTION BOX
PHOTO 47
I/P-A
I/P-B(LHD)
I/P-BR(RHD)
LHD
RHD
M/T
A/T
ME41
ET11
ET21
PHOTO 13
T05
T09
BACK-UP LAMP SWITCH
PHOTO 104/114
TRANSAXLE RANGE SWITCH
PHOTO 107
See Back-Up Lamps (SD926-2)
R01
ON Input
A/T : Transaxle range switch position 'R'
M/T : Back-Up lamp switch 'ON'
Ground
ELECTRO CHROMIC MIRROR
PHOTO 82
P . C . B
IND SW SNR
See Ground Distribution (SD130-8)
I/P-M
GRF01
PHOTO 45
GM04
PHOTO 49
PHOTO 47/48

Electro Chromic Mirror System (3) SD851-3




Fog Lamps (1)
SD924-1
FRONT
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
JOINT CONNECTOR
PHOTO 14
E54
E43
TAIL LAMP RELAY
PHOTO 15
TAIL LH 10A
1.25P
1.25W
0.5W
0.3L/O
0.3L
0.5Br
0.3R/B
ME41
I/P-D(LHD)
I/P-DR(RHD)
I/P-G
See Tail, Parking & License Lamps (SD928-1)
I/P JUNCTION BOX
PHOTO 47/48
M04-C
Tail Lamp Relay Control
Tail Lamp Switch
Front Fog Lamp Switch
BCM
PHOTO 55
M04-B
0.3P/B
0.3W/O
M02-L
M02-L(LHD Type)
M02-LR(RHD Type)
MULTIFUNCTION SWITCH
PHOTO 53
PARK
HEAD
LIGHT SWITCH
OFF
LHD
RHD
0.5B
GM05
PHOTO 49
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 48
I/P-M
0.85R
M08-B
ICM CONTROL MODULE
PHOTO 63
FRONT FOG LAMP RELAY
0.85P
PHOTO 70/111
MC13
With ABS/ESP
W/O ABS/ESP
ME13
PHOTO 11
See Illuminations (SD941-2)
0.3P
M36
FRONT FOG LAMP SWITCH
PHOTO 50
OFF
ON
IND.
ILL
E08
FRONT FOG LAMP LH
PHOTO 2
FRONT FOG LAMP RH
PHOTO 4/119
PHOTO 4/119/120
CAD10-1
CAD10-2
(D4CB, A-ENG)
CA2D10-1
CA2D10-2
(D4CB, A2-ENG)
CMD10-1(D4BH)
CMD10-2(D4BH)
CSG10-1(G4KG)
CSG10-2(G4KG)
0.85B
0.3B
0.3Br
PHOTO 49
GM04
GE02
PHOTO 16
GA03(D4CB, A-ENG)
GA2D03(D4CB, A2-ENG)
GMD03(D4BH)
GSG03(G4KG)
PHOTO 11

Fog Lamps (2) SD924-2



Fog Lamps (3) SD924-3

CAD10-1 /CAD10-2

KET_FOG(880)_02F_B

CA2D10-1 /CA2D10-2

KET_FOG(880)_02F_B

CMD10-1 /CMD10-2

KET_FOG(880)_02F_B

CSG10-1 /CSG10-2

KET_FOG(880)_02F_B

E08

KET_FOG(880)_02F_B

E43

CR04F036

E54

KET_090II_02F_W_BOTTOM

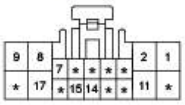
F33

KET_SWP_06F_B

F73

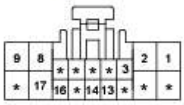
KET_SWP_06F_B

M02-L



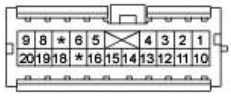
KET_0508_18F_W

M02-LR



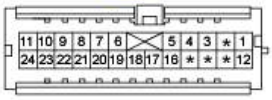
KET_0508_18F_W

M04-B



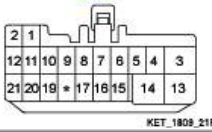
AMP_040III_20F_W

M04-C



AMP_040III_24F_Gr

M08-B



KET_1809_21F_W_A

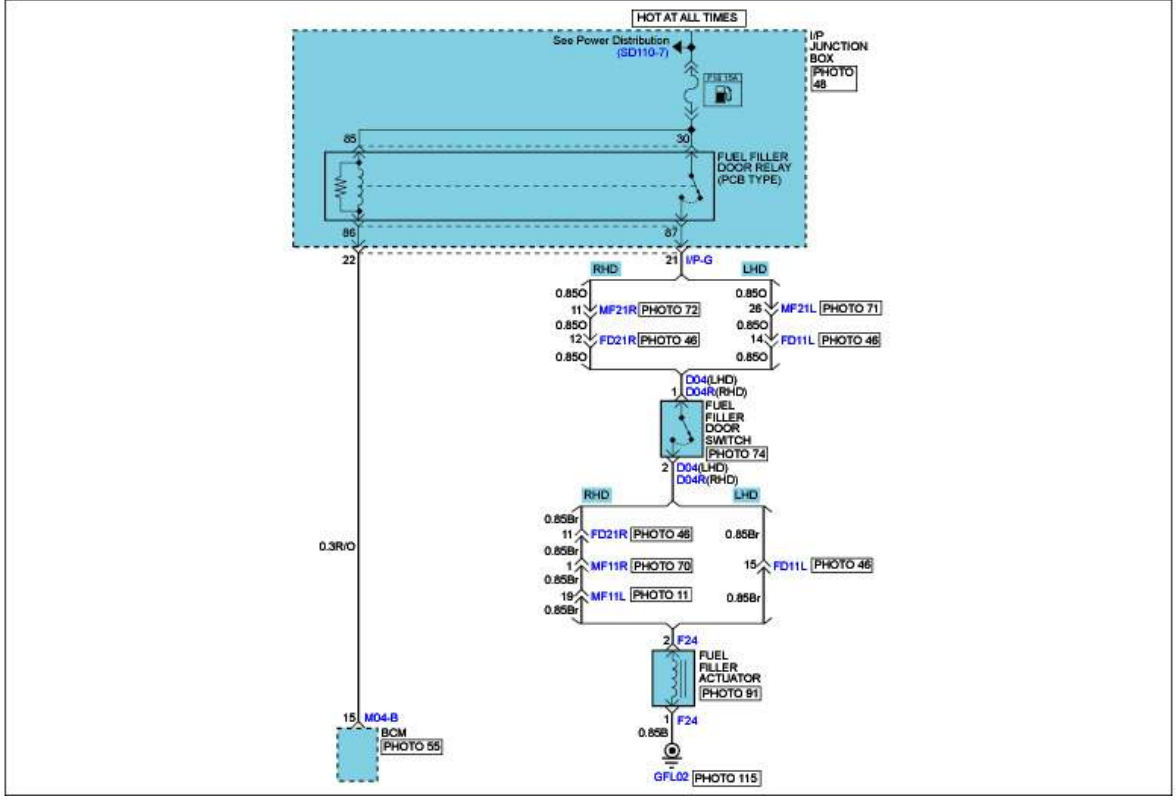
M36

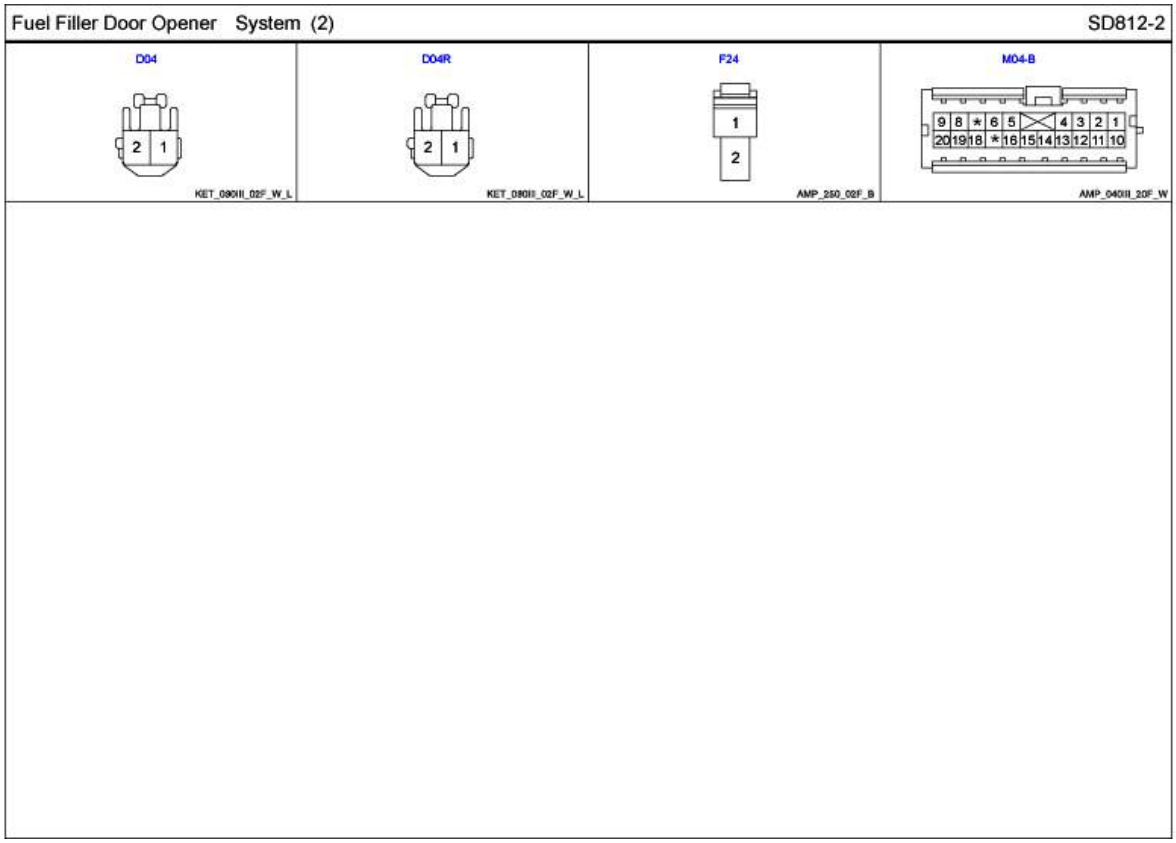
AMP_080III_06F_W_S1

M59

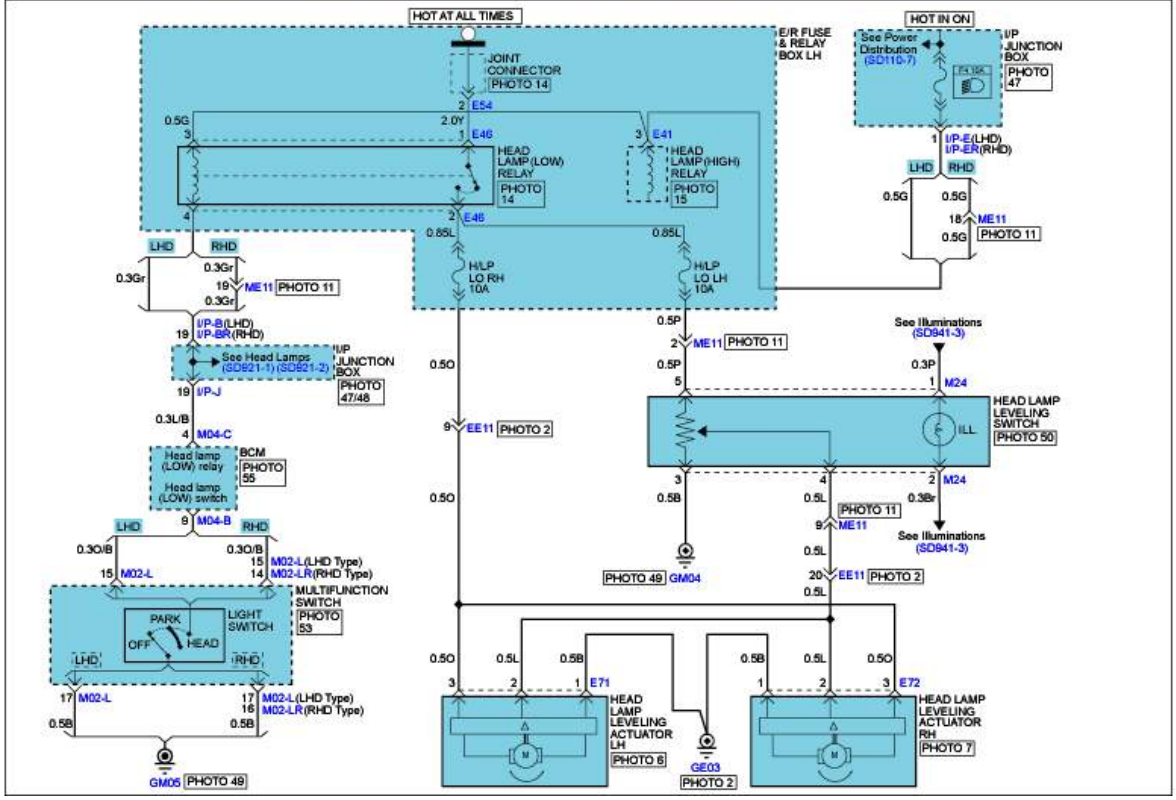
AMP_080III_06F_Y

Fuel Filler Door Opener System (1) SD812-1

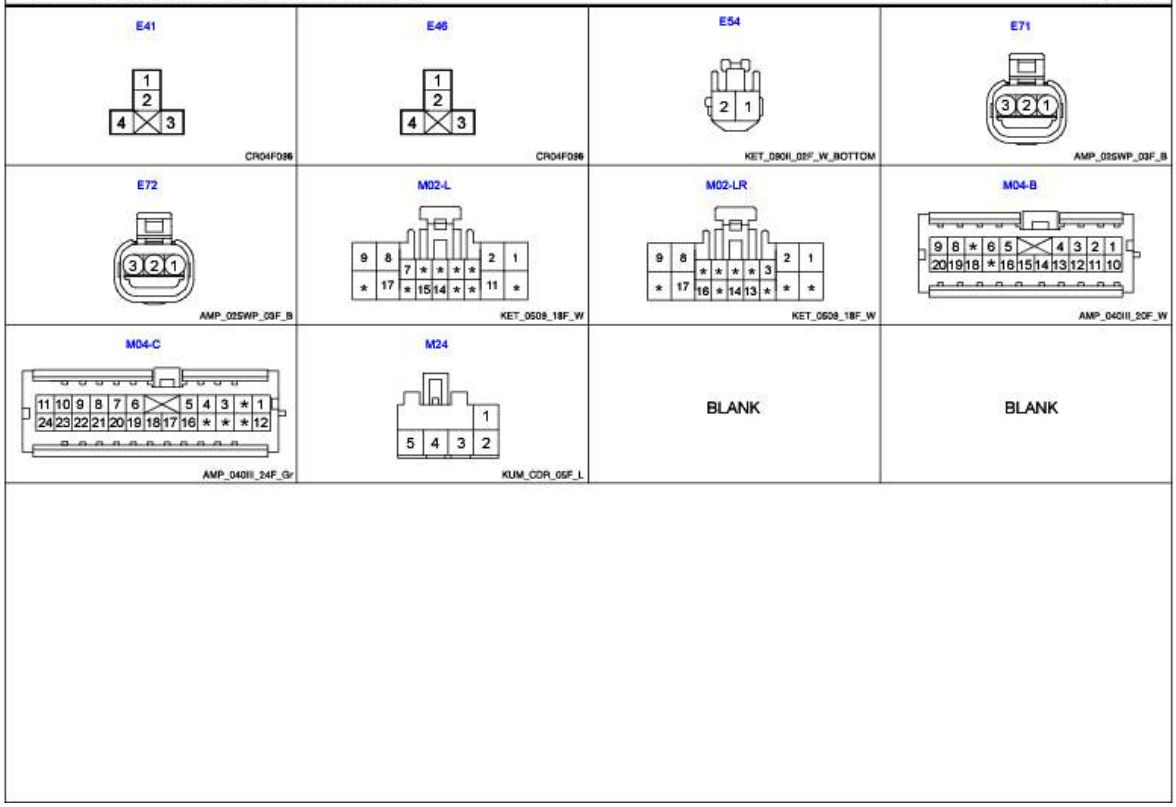


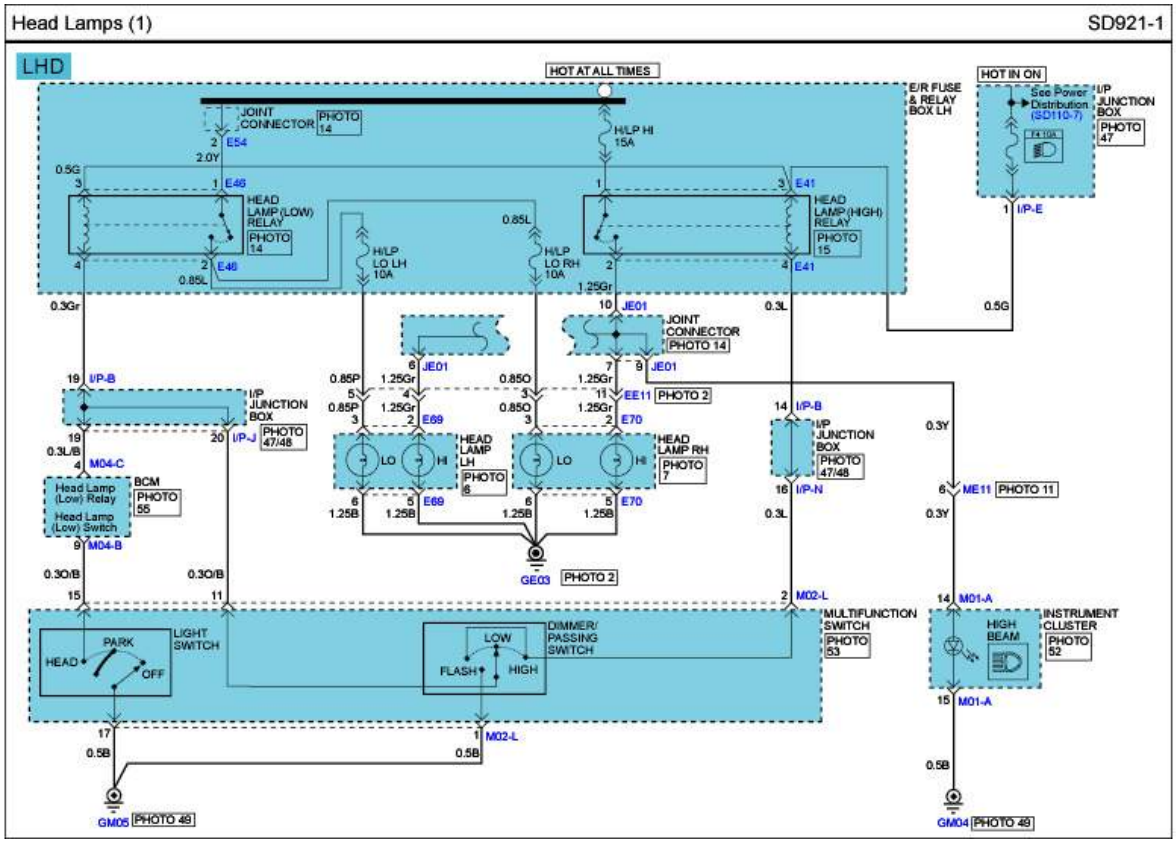

Fuel Filler Door Opener System (2)
SD812-2
D04
2 1
KET_080III_02F_W_L
D04R
2 1
KET_080III_02F_W_L
F24
1
2
AMP_250_02F_B
M04-B
9 8 * 6 5 4 3 2 1
20 19 18 * 16 15 14 13 12 11 10
AMP_040III_20F_W

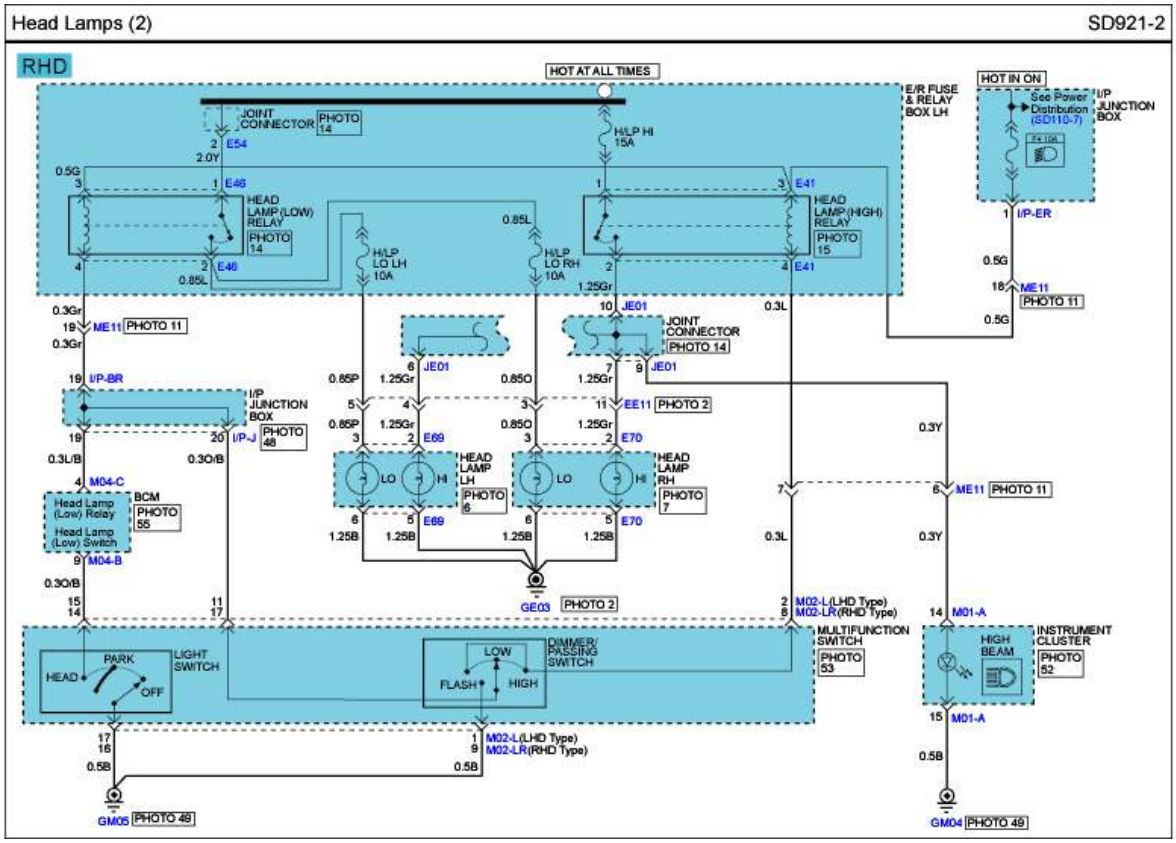
Head Lamp Leveling Device (HLLD) System (1) SD922-1



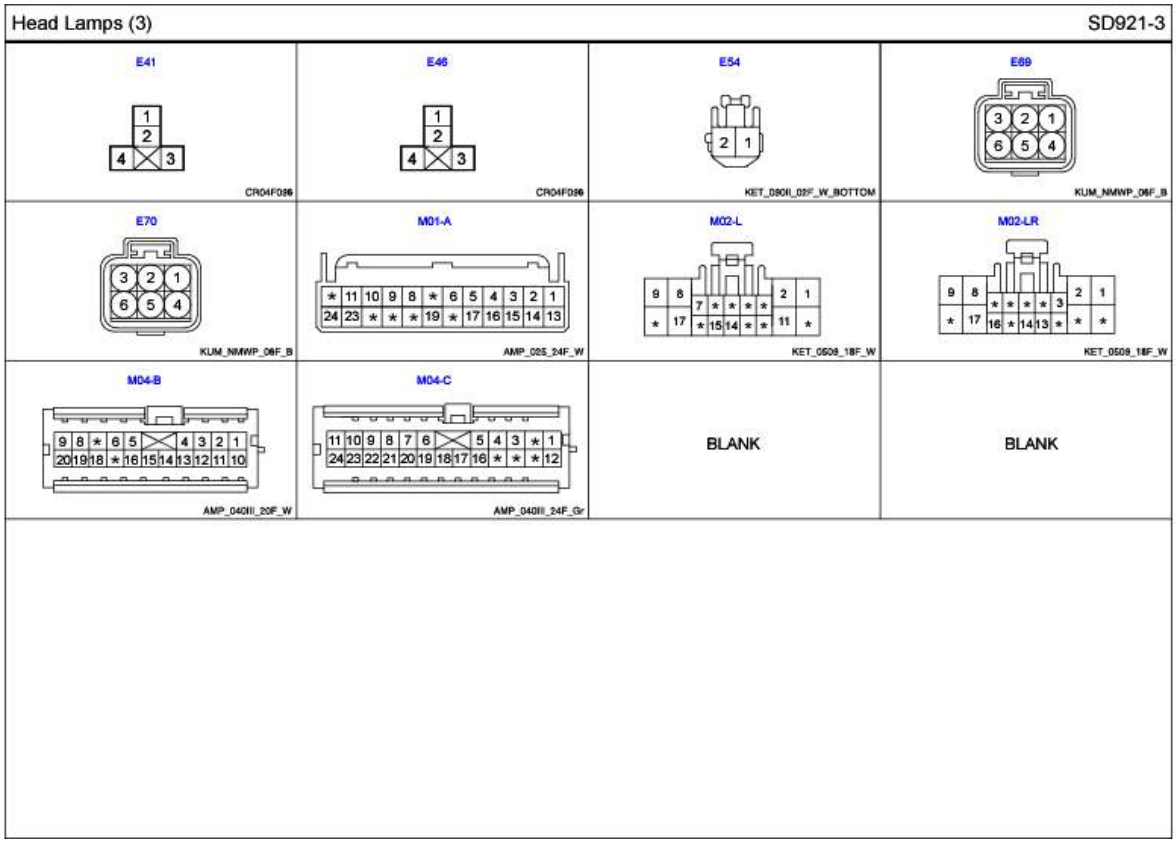
Head Lamp Leveling Device (HLLD) System (2) SD922-2



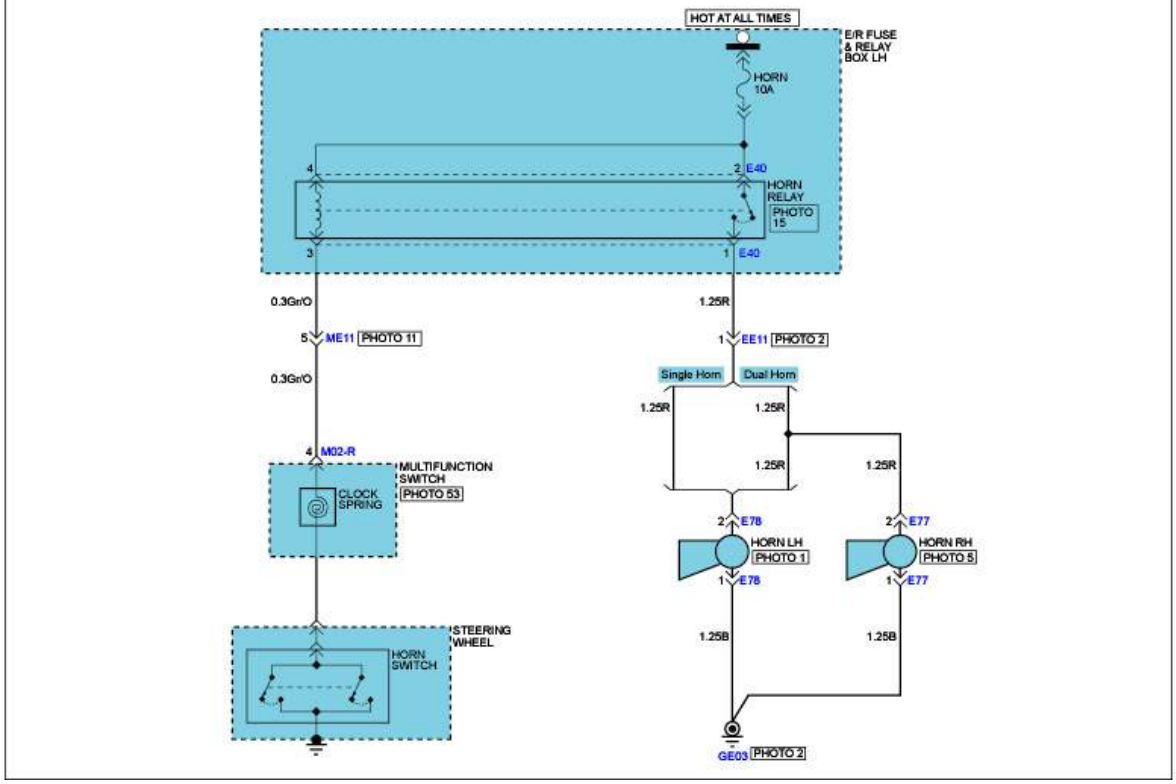

Head Lamps (1)
SD921-1
LHD
HOT AT ALL TIMES
HOT IN ON
E/R FUSE & RELAY BOX LH
JOINT CONNECTOR
PHOTO 14
E54
H/LP HI 15A
HEAD LAMP (LOW) RELAY
HEAD LAMP (HIGH) RELAY
H/LP LO LH 10A
H/LP LO RH 10A
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47
I/P-E
JE01
EE11
PHOTO 2
I/P-B
I/P-J
I/P-N
M04-C
M04-B
Head Lamp (Low) Relay
Head Lamp (Low) Switch
BCM
PHOTO 55
HEAD LAMP LH
HEAD LAMP RH
PHOTO 6
PHOTO 7
E69
E70
GE03
M02-L
ME11
PHOTO 11
LIGHT SWITCH
PARK
HEAD
OFF
DIMMER/ PASSING SWITCH
LOW
FLASH
HIGH
MULTIFUNCTION SWITCH
PHOTO 53
M01-A
INSTRUMENT CLUSTER
HIGH BEAM
PHOTO 52
GM05
GM04
PHOTO 49


Head Lamps (2)
SD921-2
RHD
HOT AT ALL TIMES
HOT IN ON
E/R FUSE & RELAY BOX LH
I/P JUNCTION BOX
See Power Distribution (SD110-7)
JOINT CONNECTOR PHOTO 14
H/LP HI 15A
HEAD LAMP (LOW) RELAY
HEAD LAMP (HIGH) RELAY
H/LP LO LH 10A
H/LP LO RH 10A
JOINT CONNECTOR
I/P JUNCTION BOX
BCM
Head Lamp (Low) Relay
Head Lamp (Low) Switch
HEAD LAMP LH
HEAD LAMP RH
LIGHT SWITCH
PARK
HEAD
OFF
DIMMER/ PASSING SWITCH
LOW
FLASH
HIGH
MULTIFUNCTION SWITCH
INSTRUMENT CLUSTER
HIGH BEAM
M02-L(LHD Type)
M02-LR(RHD Type)
GE03
GM05
GM04

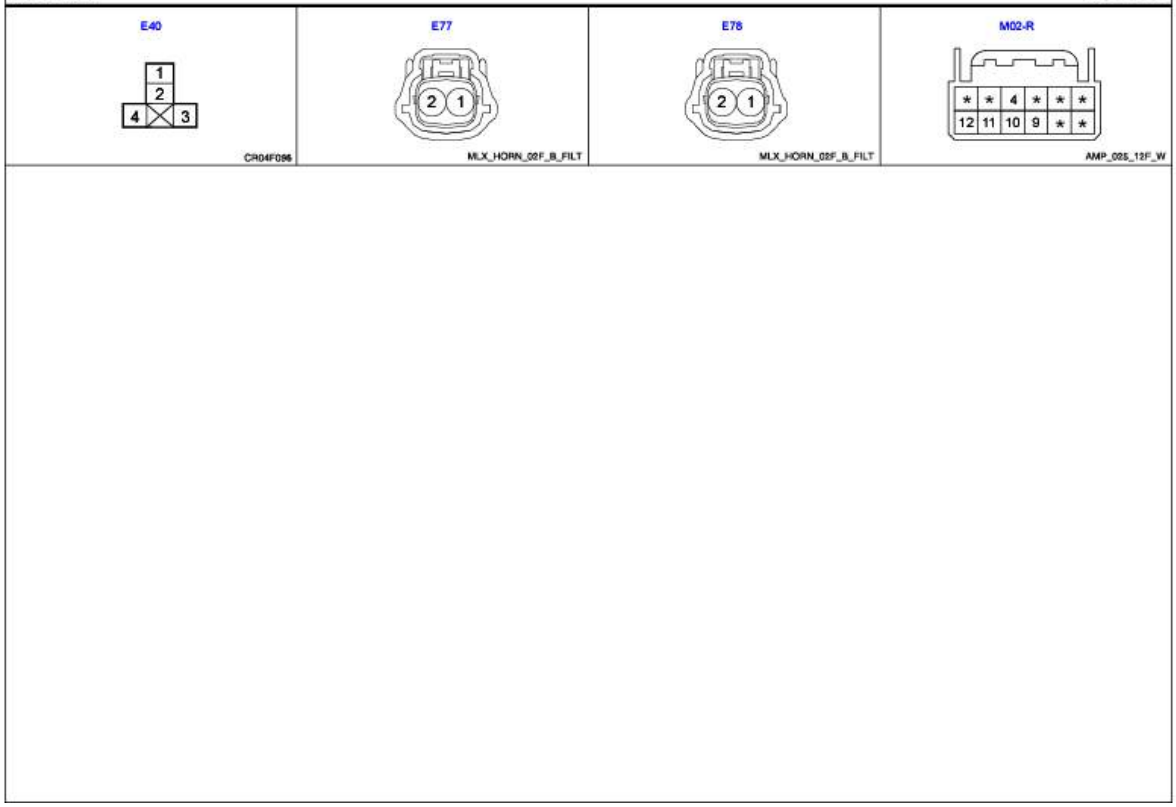
Head Lamps (3) SD921-3

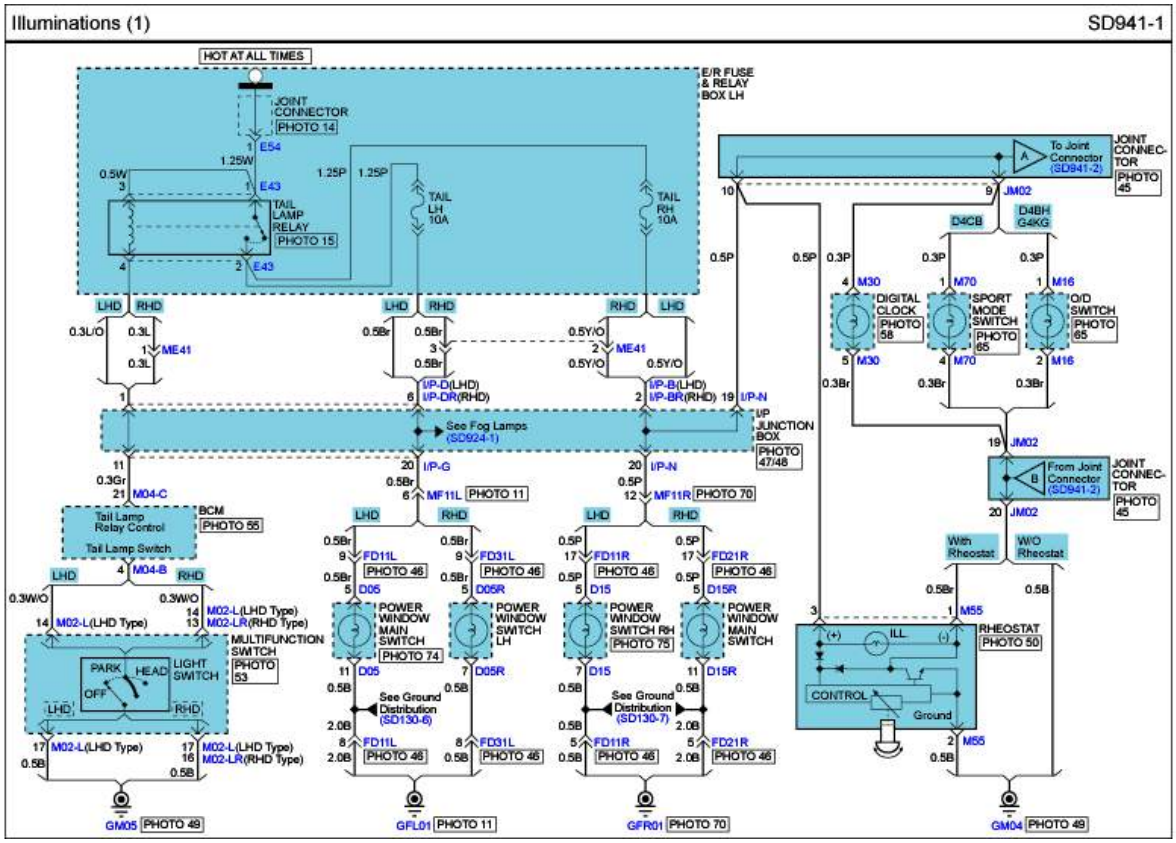


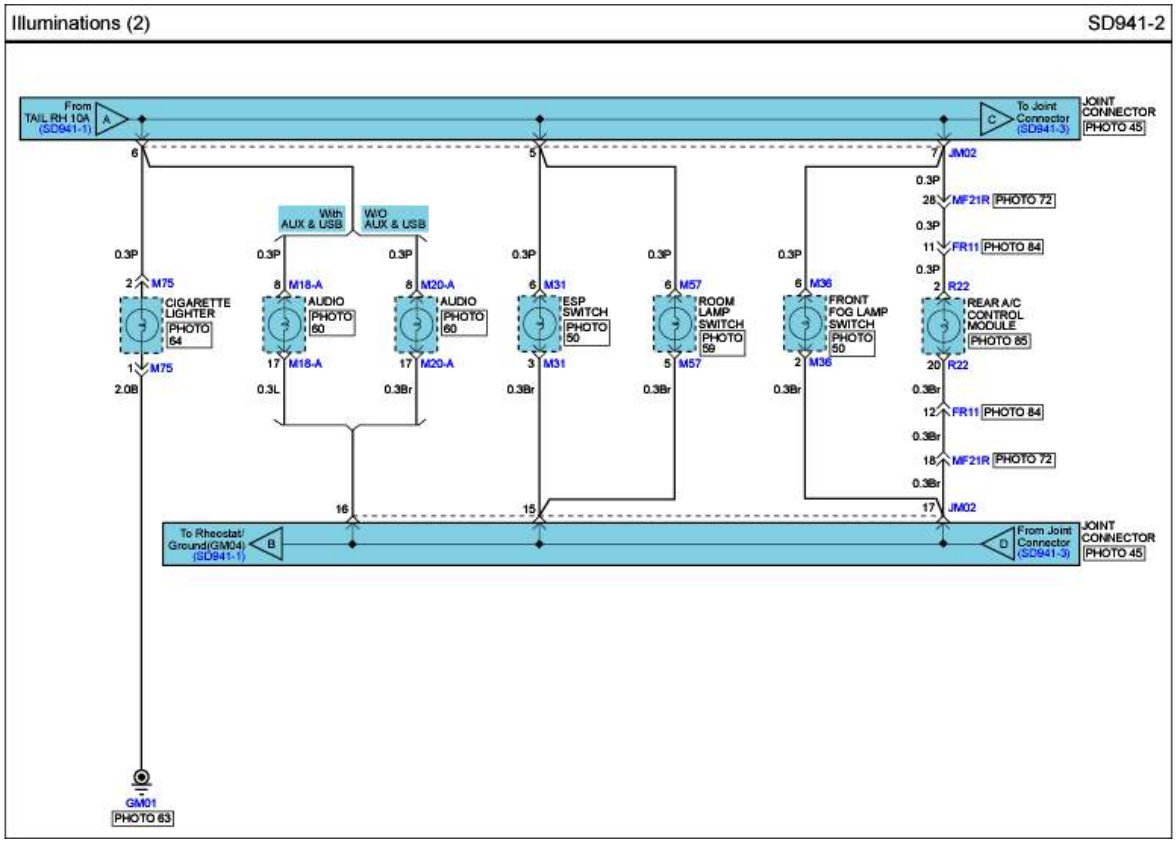
Horns (1) SD968-1



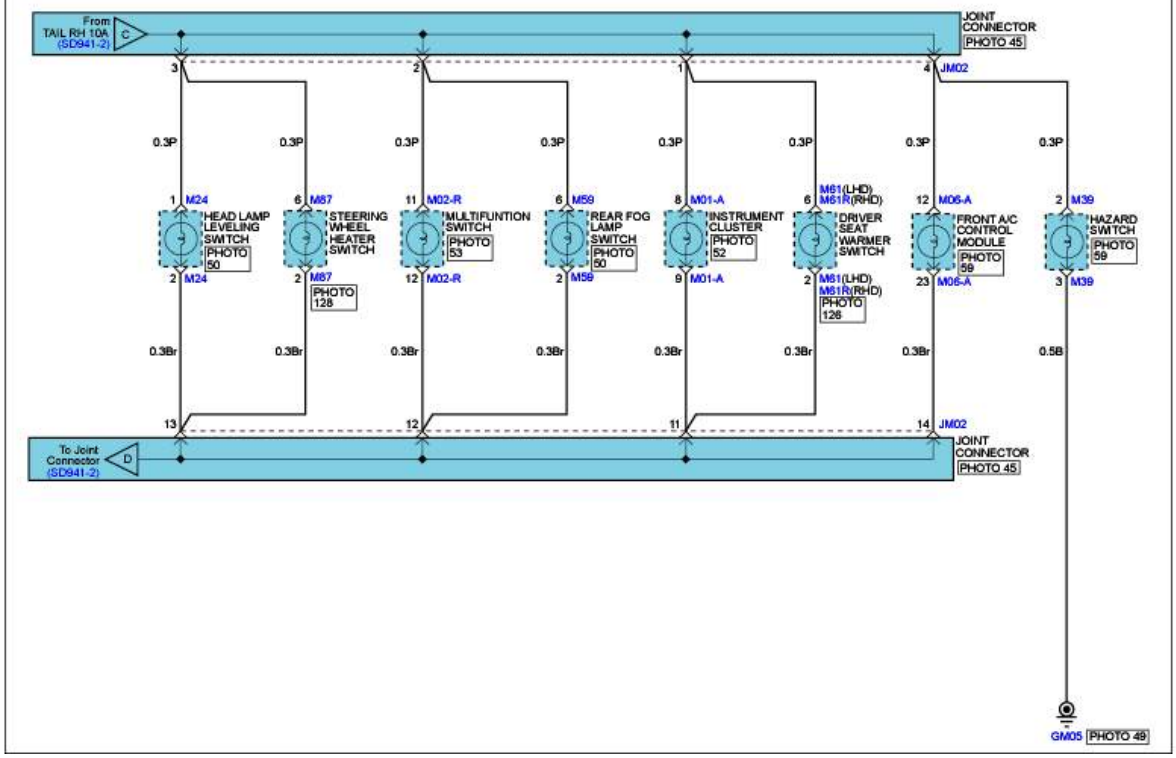
Horns (2) SD968-2

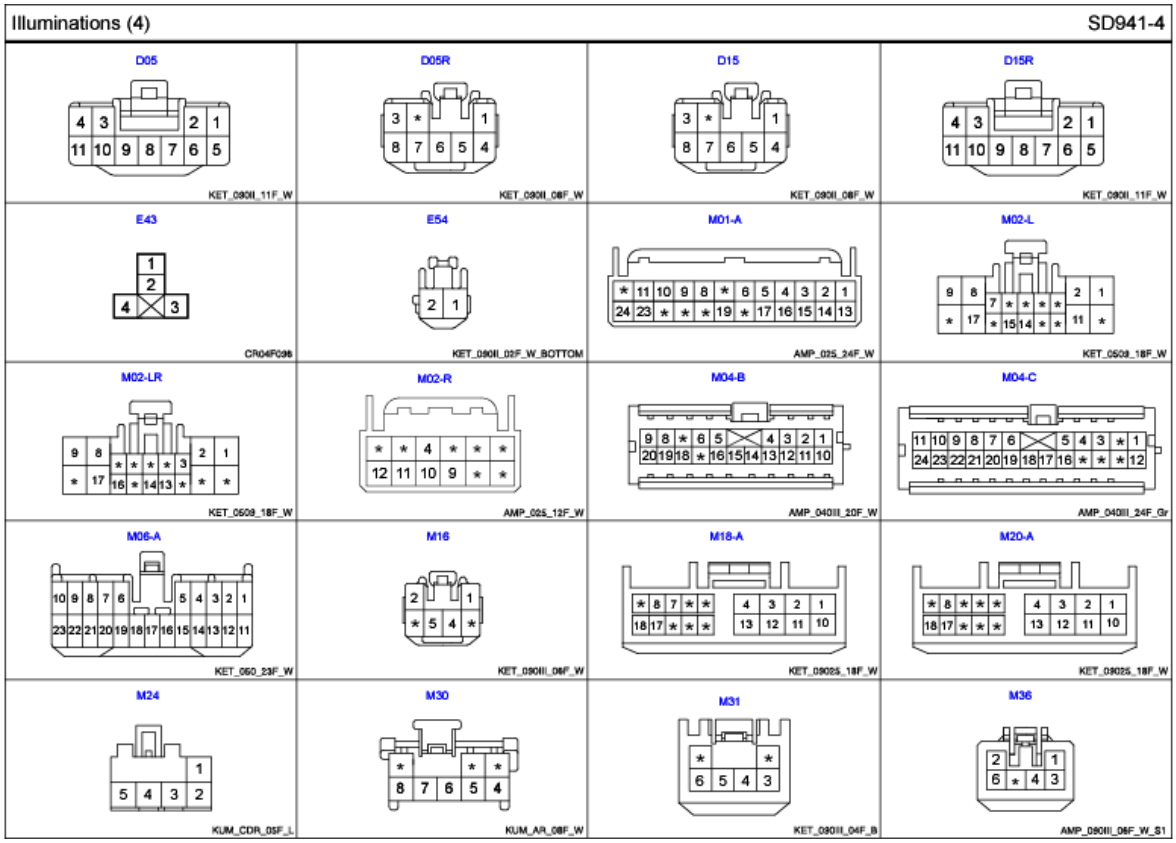



Illuminations (1)
SD941-1
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
JOINT CONNECTOR
PHOTO 14
E54
E43
TAIL LAMP RELAY
PHOTO 15
TAIL LH 10A
TAIL RH 10A
To Joint Connector (SD941-2)
JOINT CONNEC-TOR
PHOTO 45
JM02
D4CB
D4BH G4KG
M30
DIGITAL CLOCK
PHOTO 58
M70
SPORT MODE SWITCH
PHOTO 65
M16
O/D SWITCH
PHOTO 65
ME41
I/P-D(LHD) I/P-DR(RHD)
I/P-B(LHD) I/P-BR(RHD)
I/P-N
I/P JUNCTION BOX
PHOTO 47/48
See Fog Lamps (SD924-1)
I/P-G
I/P-N
MF11L PHOTO 11
MF11R PHOTO 70
From Joint Connector (SD941-2)
M04-C
M04-B
BCM
PHOTO 55
Tail Lamp Relay Control
Tail Lamp Switch
With Rheostat
W/O Rheostat
M02-L(LHD Type)
M02-LR(RHD Type)
MULTIFUNCTION SWITCH
PHOTO 53
PARK
HEAD LIGHT SWITCH
OFF
LHD
RHD
FD11L PHOTO 46
FD31L PHOTO 46
FD11R PHOTO 46
FD21R PHOTO 46
D05
D05R
D15
D15R
POWER WINDOW MAIN SWITCH
PHOTO 74
POWER WINDOW SWITCH LH
POWER WINDOW SWITCH RH
PHOTO 75
POWER WINDOW MAIN SWITCH
See Ground Distribution (SD130-6)
See Ground Distribution (SD130-7)
M55
RHEOSTAT
PHOTO 50
ILL.
CONTROL
Ground
GM05 PHOTO 49
GFL01 PHOTO 11
GFR01 PHOTO 70
GM04 PHOTO 49

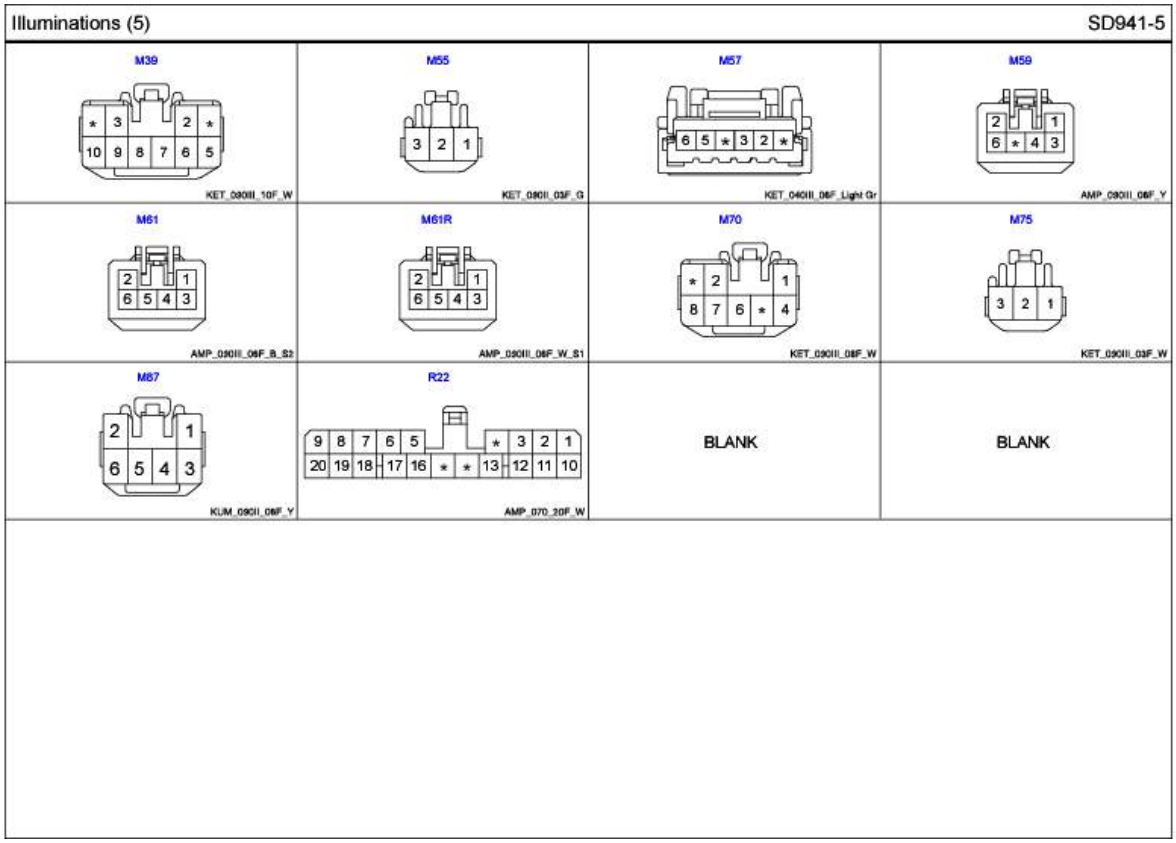

Illuminations (2)
SD941-2
From TAIL RH 10A (SD941-1)
To Joint Connector (SD941-3)
JOINT CONNECTOR PHOTO 45
With AUX & USB
W/O AUX & USB
M75
CIGARETTE LIGHTER PHOTO 64
M18-A
AUDIO PHOTO 60
M20-A
AUDIO PHOTO 60
M31
ESP SWITCH PHOTO 50
M57
ROOM LAMP SWITCH PHOTO 59
M36
FRONT FOG LAMP SWITCH PHOTO 50
R22
REAR A/C CONTROL MODULE PHOTO 85
JM02
MF21R PHOTO 72
FR11 PHOTO 84
To Rheostat/ Ground(GM04) (SD941-1)
From Joint Connector (SD941-3)
GM01 PHOTO 63

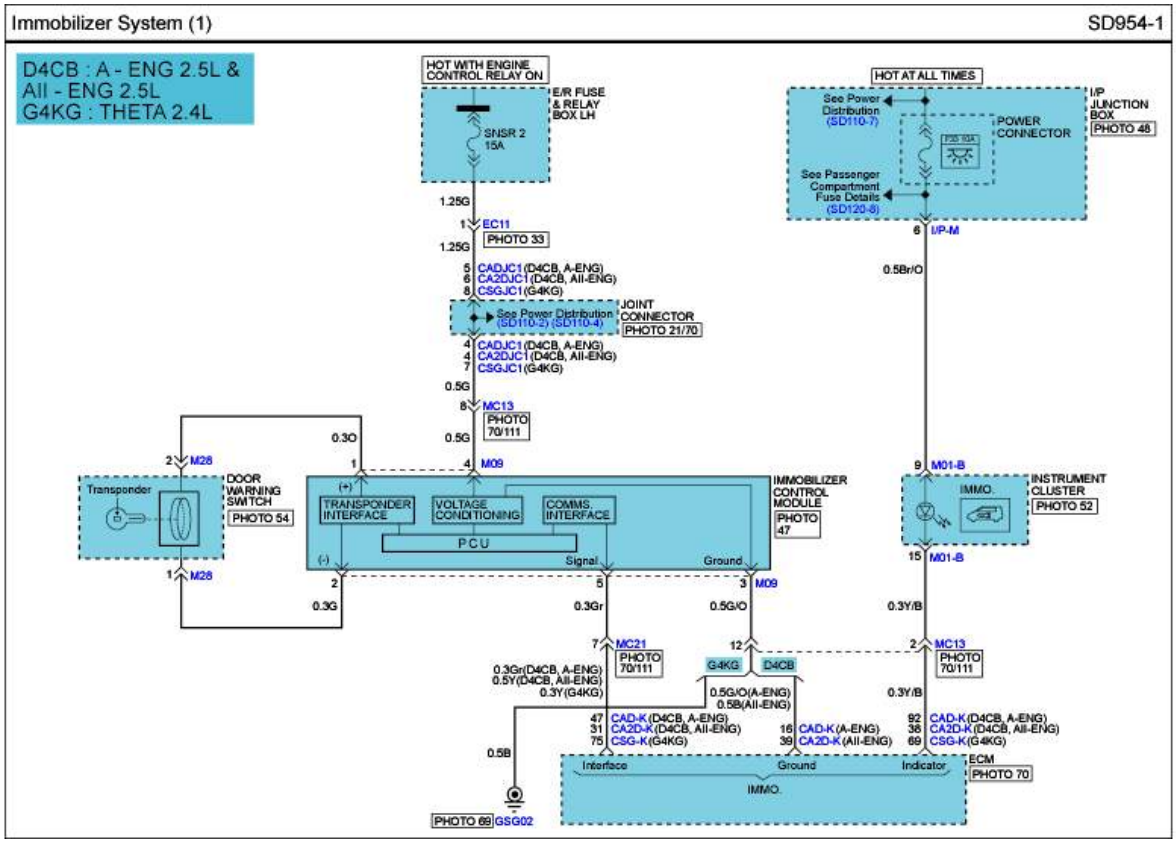
Illuminations (3) SD941-3




Illuminations (4)
SD941-4
D05
KET_090II_11F_W
D05R
KET_090II_08F_W
D15
KET_090II_08F_W
D15R
KET_090II_11F_W
E43
CR04FC036
E54
KET_090II_02F_W_BOTTOM
M01-A
AMP_025_24F_W
M02-L
KET_0509_18F_W
M02-LR
KET_0509_18F_W
M02-R
AMP_025_12F_W
M04-B
AMP_040III_20F_W
M04-C
AMP_040III_24F_Gr
M06-A
KET_050_23F_W
M16
KET_090III_06F_W
M16-A
KET_09025_18F_W
M20-A
KET_09025_18F_W
M24
KUM_CDR_05F_L
M30
KUM_AR_08F_W
M31
KET_090III_04F_B
M36
AMP_090III_06F_W_S1

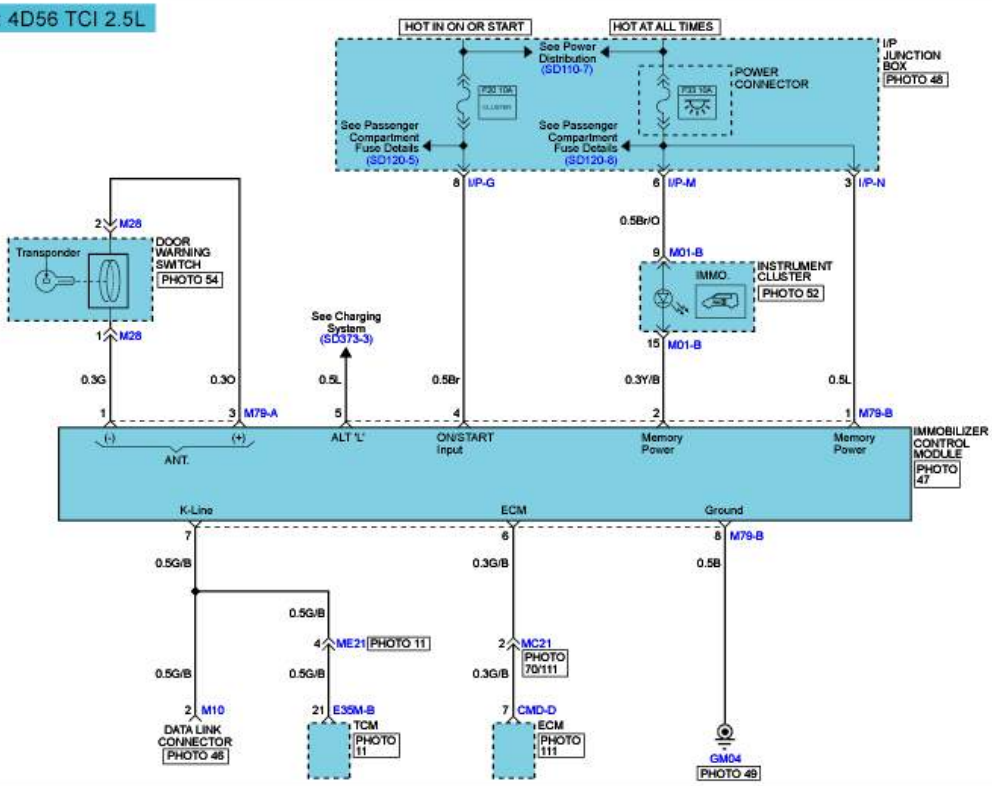
Illuminations (5) SD941-5

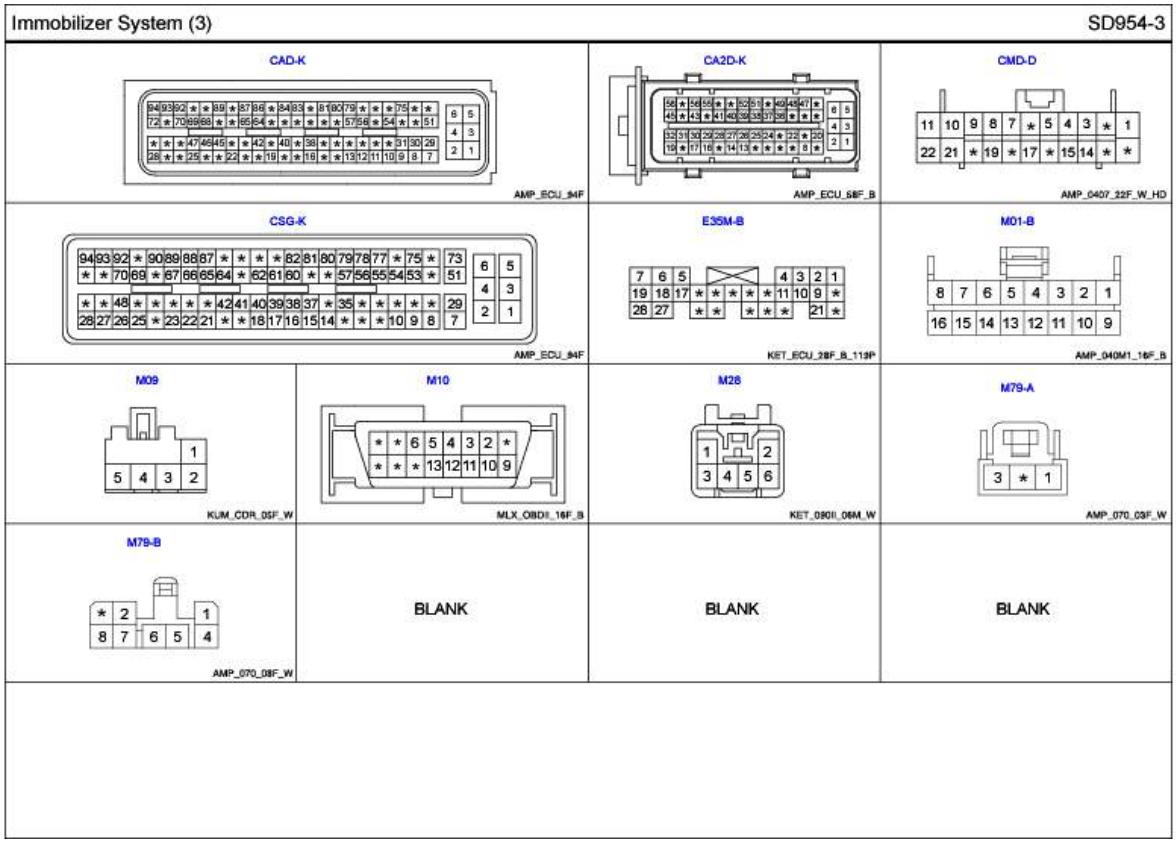


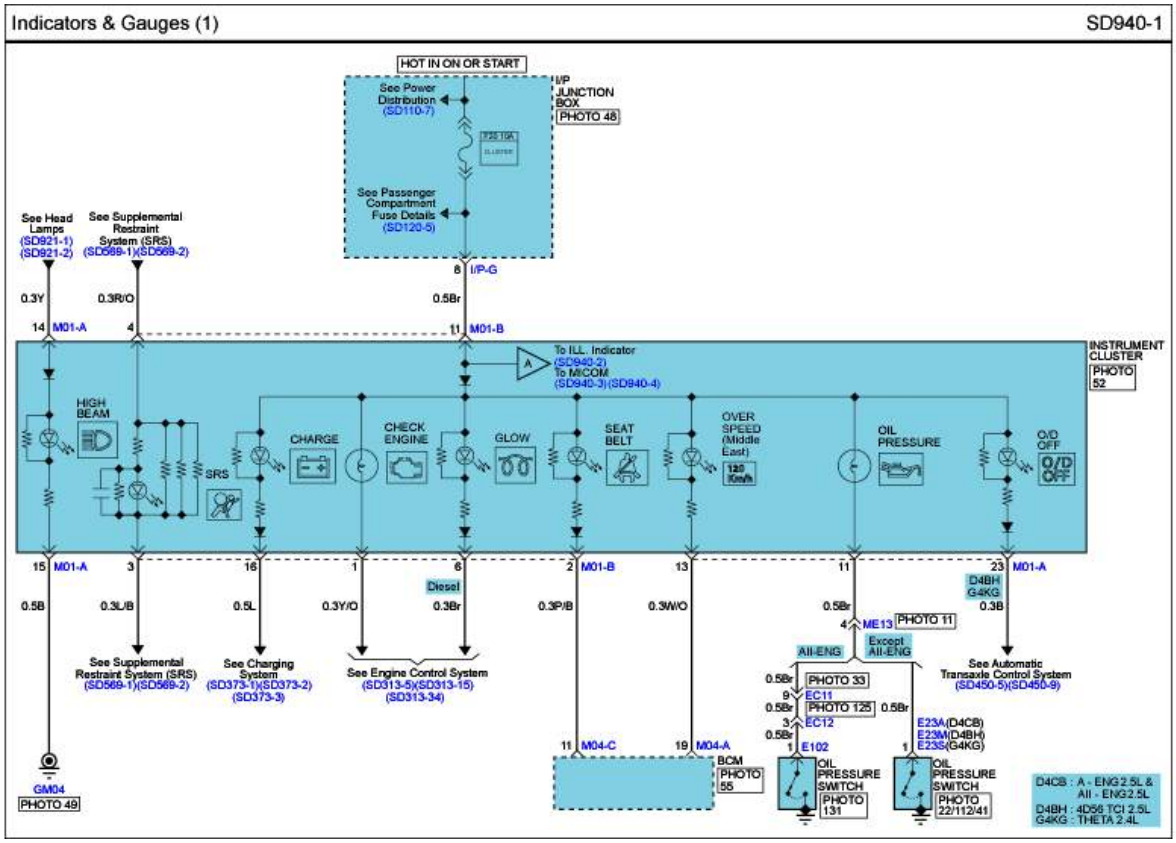

Immobilizer System (1)
SD954-1
D4CB : A - ENG 2.5L &
AII - ENG 2.5L
G4KG : THETA 2.4L
HOT WITH ENGINE CONTROL RELAY ON
E/R FUSE & RELAY BOX LH
SNSR 2 15A
1.25G
EC11
PHOTO 33
CADJC1 (D4CB, A-ENG)
CA2DJC1 (D4CB, AII-ENG)
CSGJC1 (G4KG)
See Power Distribution (SD110-2) (SD110-4)
JOINT CONNECTOR
PHOTO 21/70
0.5G
MC13
PHOTO 70/111
0.3O
M09
M28
DOOR WARNING SWITCH
PHOTO 54
Transponder
TRANSPONDER INTERFACE
VOLTAGE CONDITIONING
COMMS. INTERFACE
PCU
Signal
Ground
IMMOBILIZER CONTROL MODULE
PHOTO 47
0.3G
0.3Gr
0.5G/O
HOT AT ALL TIMES
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-8)
POWER CONNECTOR
I/P JUNCTION BOX
PHOTO 48
I/P-M
0.5Br/O
M01-B
IMMO.
INSTRUMENT CLUSTER
PHOTO 52
0.3Y/B
MC21
PHOTO 70/111
0.3Gr(D4CB, A-ENG)
0.5Y(D4CB, AII-ENG)
0.3Y(G4KG)
G4KG
D4CB
0.5G/O(A-ENG)
0.5B(AII-ENG)
CAD-K (D4CB, A-ENG)
CA2D-K (D4CB, AII-ENG)
CSG-K (G4KG)
CAD-K (A-ENG)
CA2D-K (AII-ENG)
0.5B
Interface
Ground
Indicator
IMMO.
ECM
PHOTO 70
PHOTO 69
GSG02

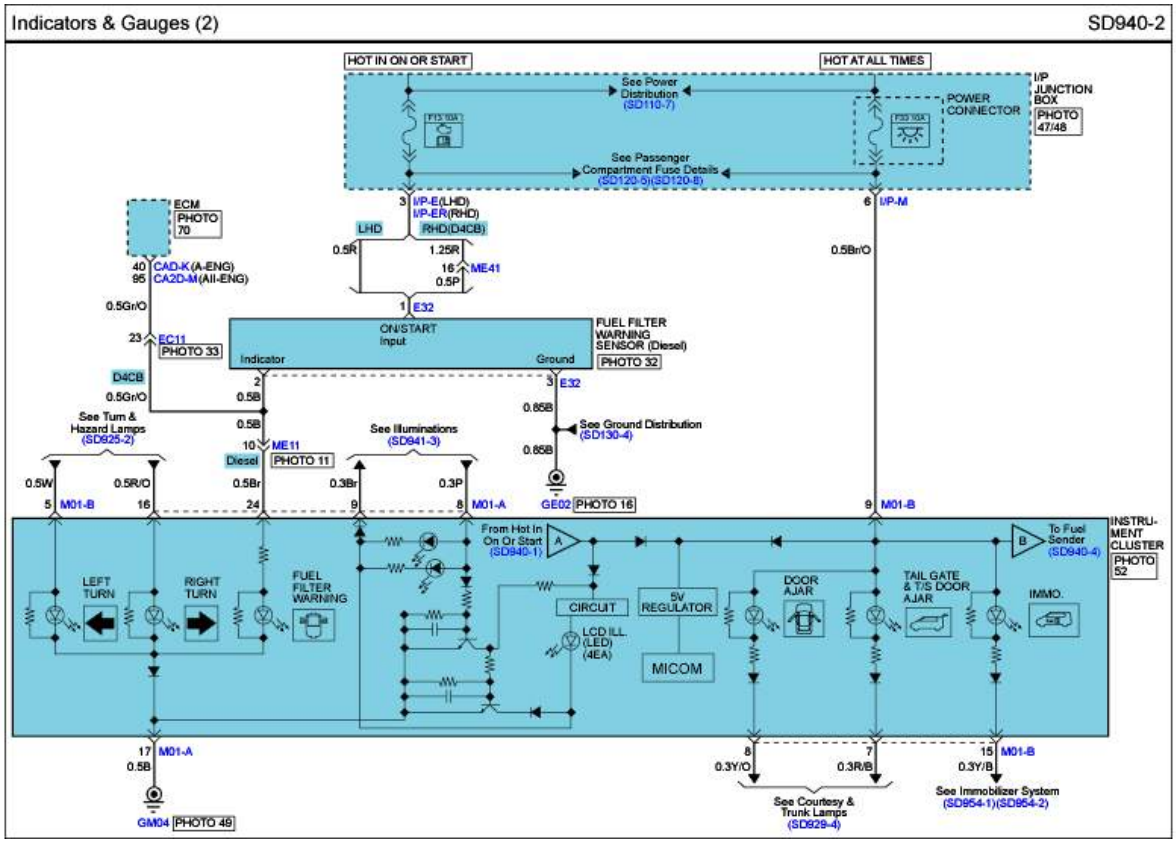
Immobilizer System (2) SD954-2

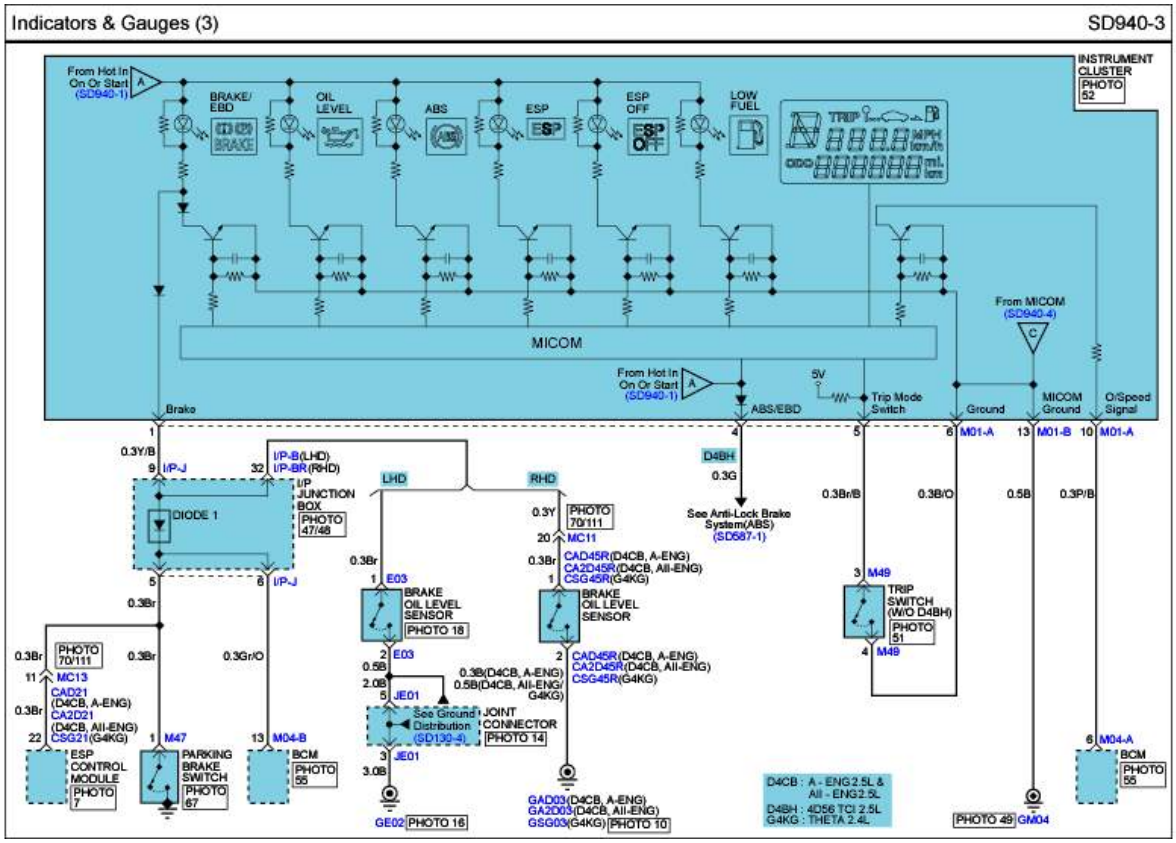
D4BH : 4D56 TCI 2.5L

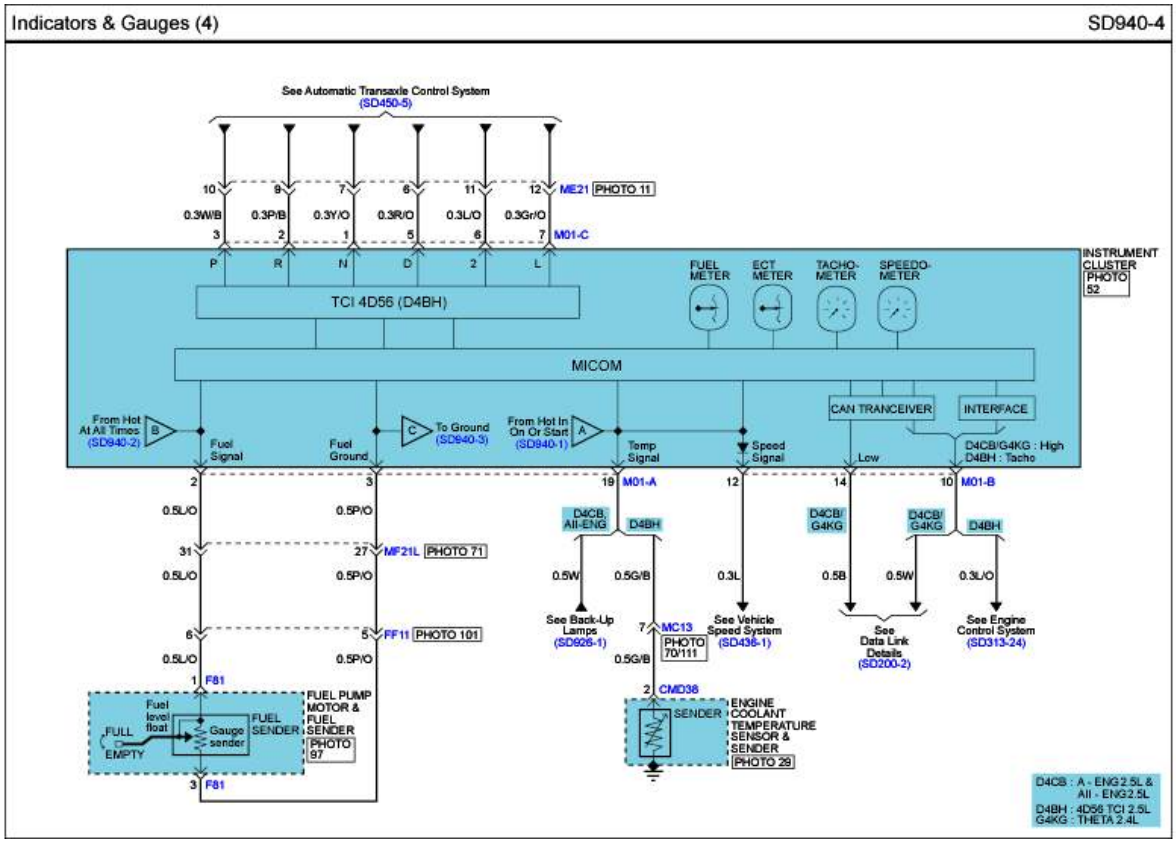


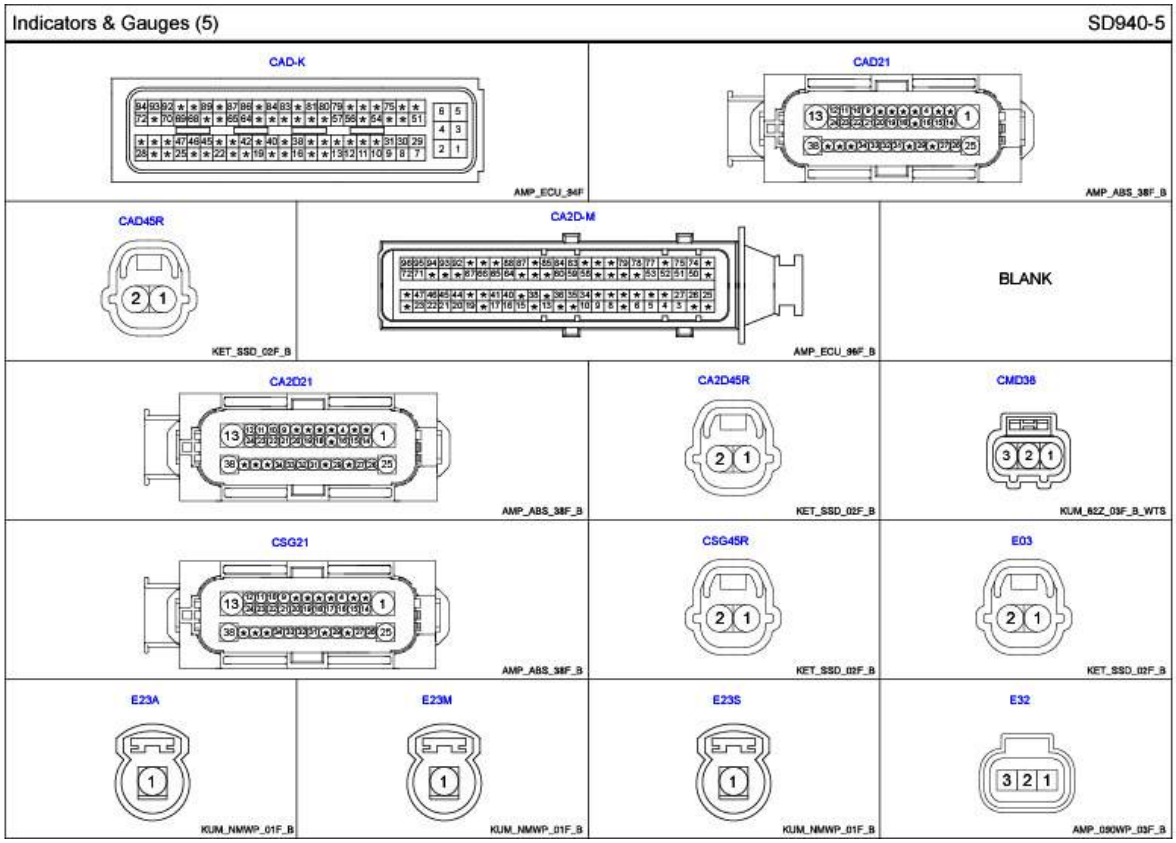

Immobilizer System (3)
SD954-3
CAD-K
AMP_ECU_94F
CA2D-K
AMP_ECU_58F_B
CMD-D
AMP_0407_22F_W_HD
CSG-K
AMP_ECU_94F
E35M-B
KET_ECU_28F_B_113P
M01-B
AMP_040M1_16F_B
M09
KUM_CDR_05F_W
M10
MLX_OBDII_16F_B
M28
KET_090II_06M_W
M79-A
AMP_070_03F_W
M79-B
AMP_070_08F_W
BLANK
BLANK
BLANK


Indicators & Gauges (1)
SD940-1
HOT IN ON OR START
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 48
See Passenger Compartment Fuse Details (SD120-5)
See Head Lamps (SD921-1) (SD921-2)
See Supplemental Restraint System (SRS) (SD569-1)(SD569-2)
I/P-G
0.3Y
0.3R/O
0.5Br
14 M01-A
4
11 M01-B
To ILL. Indicator (SD940-2)
To MICOM (SD940-3)(SD940-4)
INSTRUMENT CLUSTER
PHOTO 52
HIGH BEAM
SRS
CHARGE
CHECK ENGINE
GLOW
SEAT BELT
OVER SPEED (Middle East)
OIL PRESSURE
O/D OFF
15 M01-A
3
16
1
6
Diesel
2 M01-B
13
11
23 M01-A
D4BH G-4KG
0.5B
0.3L/B
0.5L
0.3Y/O
0.3Br
0.3P/B
0.3W/O
0.5Br
0.3B
4 ME13 PHOTO 11
All-ENG
Except All-ENG
See Supplemental Restraint System (SRS) (SD569-1)(SD569-2)
See Charging System (SD373-1)(SD373-2) (SD373-3)
See Engine Control System (SD313-5)(SD313-15) (SD313-34)
See Automatic Transaxle Control System (SD450-5)(SD450-9)
0.5Br
PHOTO 33
9 EC11
0.5Br
PHOTO 125
0.5Br
3 EC12
0.5Br
1 E102
E23A(D4CB)
E23M(D4BH)
E23S(G4KG)
11 M04-C
19 M04-A
BCM
PHOTO 55
OIL PRESSURE SWITCH
PHOTO 131
OIL PRESSURE SWITCH
PHOTO 22/112/41
GM04
PHOTO 49
D4CB : A - ENG 2.5L & All - ENG 2.5L
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L

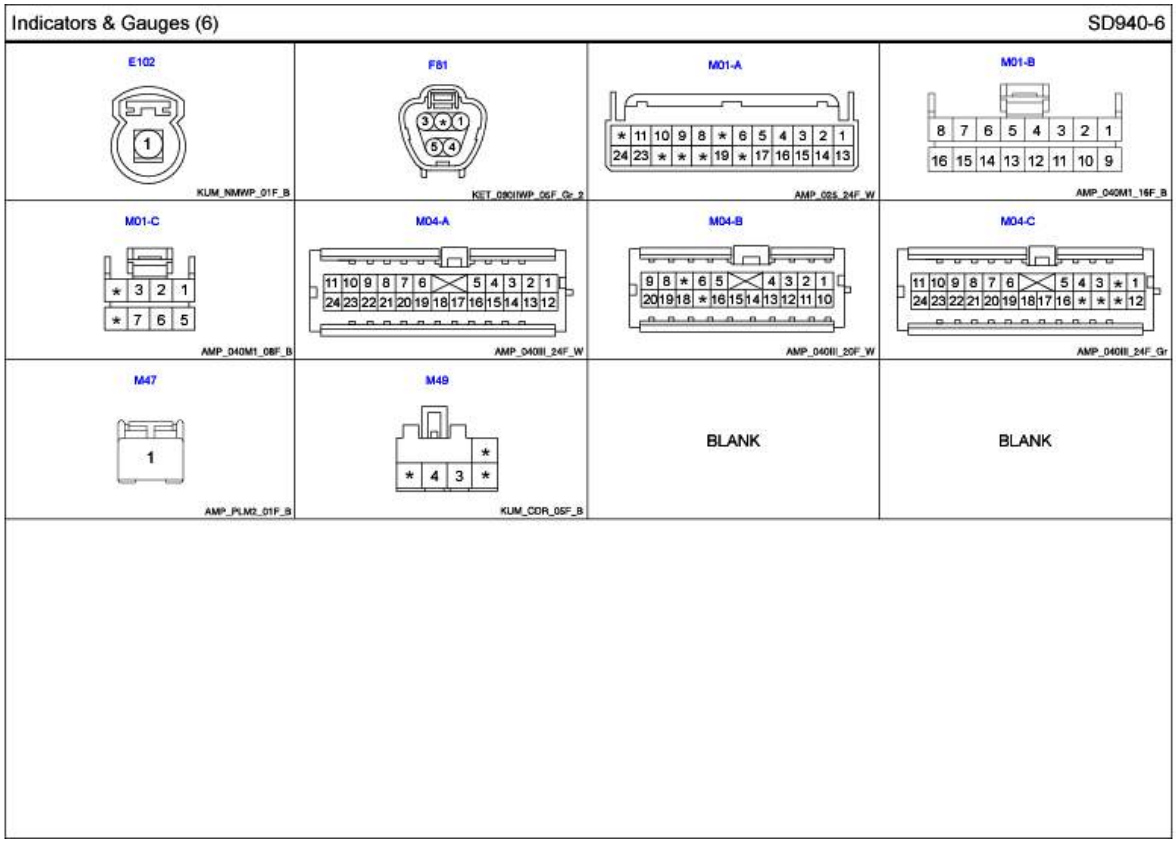

Indicators & Gauges (2)
SD940-2
HOT IN ON OR START
HOT AT ALL TIMES
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-5)(SD120-8)
I/P JUNCTION BOX
PHOTO 47/48
POWER CONNECTOR
ECM
PHOTO 70
I/P-E(LHD) I/P-ER(RHD)
RHD(D4CB)
LHD
I/P-M
CAD-K(A-ENG)
CA2D-M(All-ENG)
ME41
E32
ON/START Input
FUEL FILTER WARNING SENSOR (Diesel)
PHOTO 32
Indicator
Ground
EC11
PHOTO 33
D4CB
See Turn & Hazard Lamps (SD925-2)
See Illuminations (SD941-3)
See Ground Distribution (SD130-4)
Diesel
ME11
PHOTO 11
GE02
PHOTO 16
M01-B
M01-A
From Hot In On Or Start (SD940-1)
To Fuel Sender (SD940-4)
INSTRU-MENT CLUSTER
PHOTO 52
LEFT TURN
RIGHT TURN
FUEL FILTER WARNING
CIRCUIT
LCD ILL. (LED) (4EA)
5V REGULATOR
MICOM
DOOR AJAR
TAIL GATE & T/S DOOR AJAR
IMMO.
GM04
PHOTO 49
See Courtesy & Trunk Lamps (SD929-4)
See Immobilizer System (SD954-1)(SD954-2)

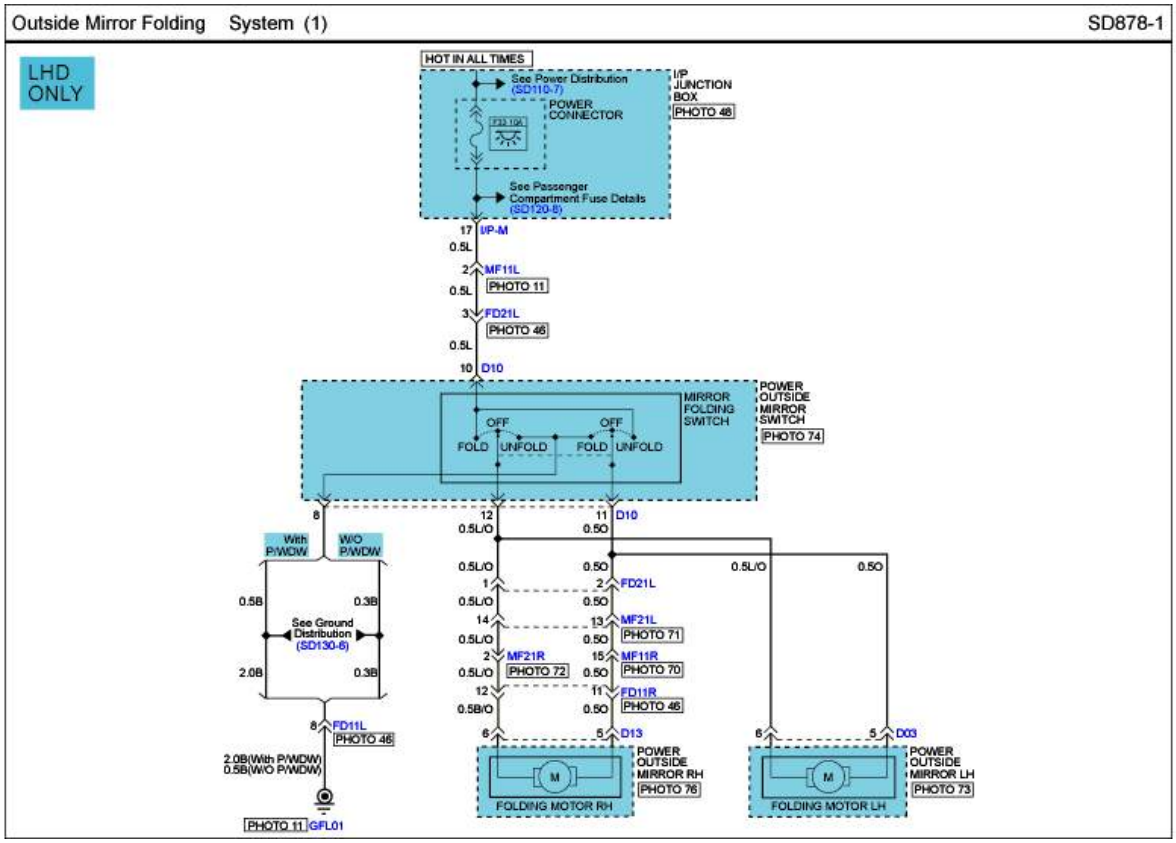

Indicators & Gauges (3)
SD940-3
INSTRUMENT CLUSTER
PHOTO 52
From Hot In On Or Start (SD940-1)
BRAKE/ EBD
OIL LEVEL
ABS
ESP
ESP OFF
LOW FUEL
TRIP
ODO
MICOM
From MICOM (SD940-4)
From Hot In On Or Start (SD940-1)
5V
Brake
ABS/EBD
Trip Mode Switch
Ground
MICOM Ground
O/Speed Signal
I/P-B(LHD) I/P-BR(RHD)
I/P JUNCTION BOX
PHOTO 47/48
DIODE 1
I/P-J
LHD
RHD
D4BH
See Anti-Lock Brake System(ABS) (SD587-1)
PHOTO 70/111
MC11
CAD45R(D4CB, A-ENG)
CA2D45R(D4CB, AII-ENG)
CSG45R(G4KG)
E03
BRAKE OIL LEVEL SENSOR
PHOTO 18
M49
TRIP SWITCH (W/O D4BH)
PHOTO 51
MC13
CAD21 (D4CB, A-ENG)
CA2D21 (D4CB, AII-ENG)
CSG21(G4KG)
ESP CONTROL MODULE
PHOTO 7
M47
PARKING BRAKE SWITCH
PHOTO 67
M04-B
BCM
PHOTO 55
JE01
See Ground Distribution (SD130-4)
JOINT CONNECTOR
PHOTO 14
GE02 PHOTO 16
GAD03(D4CB, A-ENG)
GA2D03(D4CB, AII-ENG)
GSG03(G4KG) PHOTO 10
D4CB : A - ENG 2.5L & AII - ENG 2.5L
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L
PHOTO 49 GM04
M01-A
M01-B
M04-A


Indicators & Gauges (4)
SD940-4
See Automatic Transaxle Control System (SD450-5)
ME21 PHOTO 11
M01-C
P
R
N
D
2
L
TCI 4D56 (D4BH)
MICOM
FUEL METER
ECT METER
TACHO-METER
SPEEDO-METER
INSTRUMENT CLUSTER PHOTO 52
CAN TRANCEIVER
INTERFACE
From Hot At All Times (SD940-2)
Fuel Signal
Fuel Ground
To Ground (SD940-3)
From Hot In On Or Start (SD940-1)
Temp Signal
Speed Signal
Low
D4CB/G4KG : High
D4BH : Tacho
M01-A
M01-B
D4CB, All-ENG
D4BH
D4CB/ G4KG
MF21L PHOTO 71
FF11 PHOTO 101
F81
FUEL PUMP MOTOR & FUEL SENDER PHOTO 97
Fuel level float
FULL
EMPTY
Gauge sender
FUEL SENDER
See Back-Up Lamps (SD926-1)
MC13 PHOTO 70/111
See Vehicle Speed System (SD436-1)
See Data Link Details (SD200-2)
See Engine Control System (SD313-24)
CMD38
SENDER
ENGINE COOLANT TEMPERATURE SENSOR & SENDER PHOTO 29
D4CB : A - ENG 2.5L & All - ENG 2.5L
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L

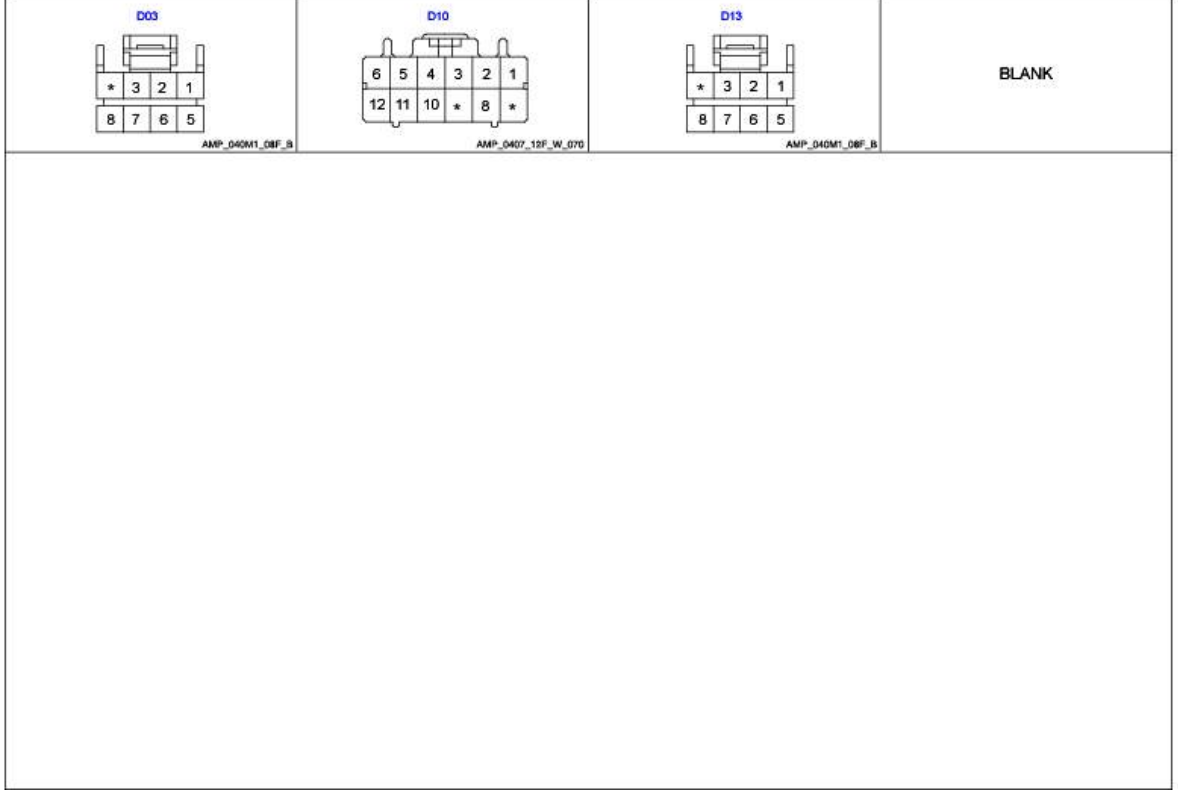

Indicators & Gauges (5)
SD940-5
CAD-K
AMP_ECU_94F
CAD21
AMP_ABS_38F_B
CAD45R
KET_SSD_02F_B
CA2D-M
AMP_ECU_96F_B
BLANK
CA2D21
AMP_ABS_38F_B
CA2D45R
KET_SSD_02F_B
CMD38
KUM_62Z_03F_B_WTS
CSG21
AMP_ABS_38F_B
CSG45R
KET_SSD_02F_B
E03
KET_SSD_02F_B
E23A
KUM_NMWP_01F_B
E23M
KUM_NMWP_01F_B
E23S
KUM_NMWP_01F_B
E32
AMP_090WP_03F_B

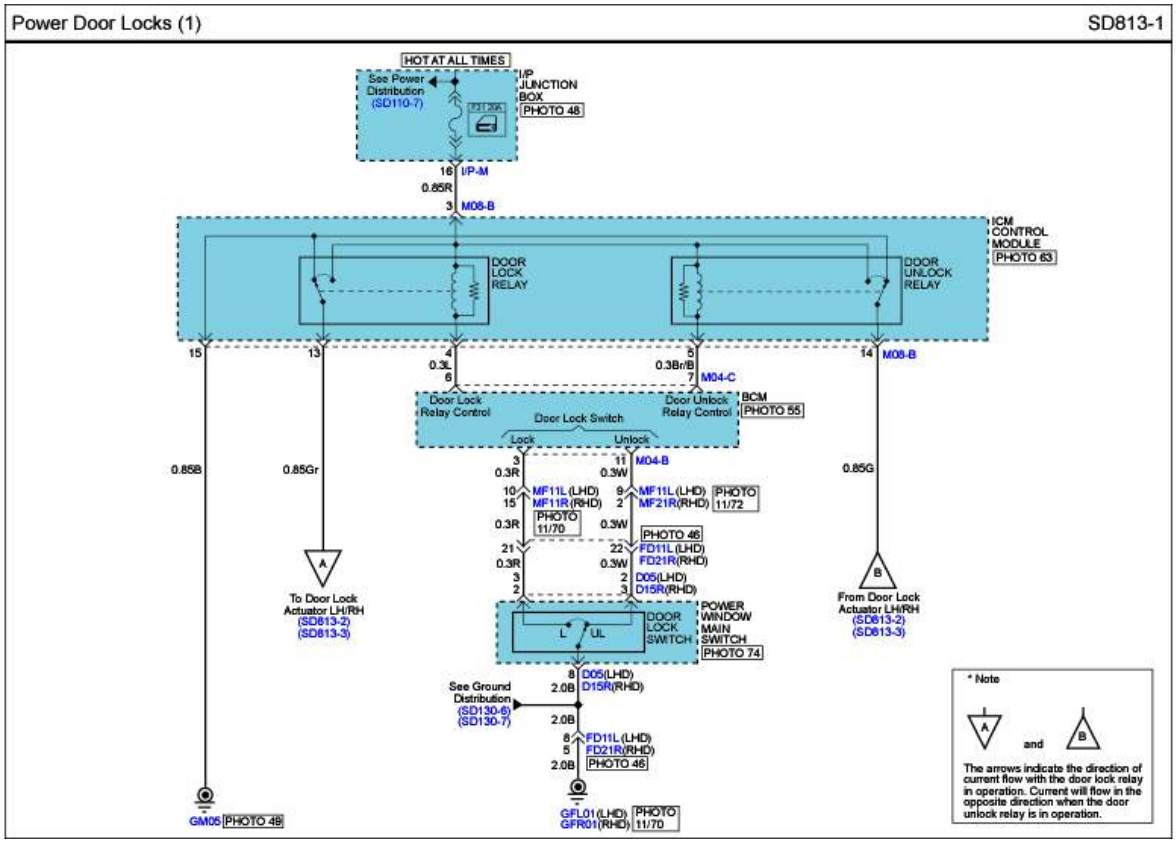
Indicators & Gauges (6) SD940-6

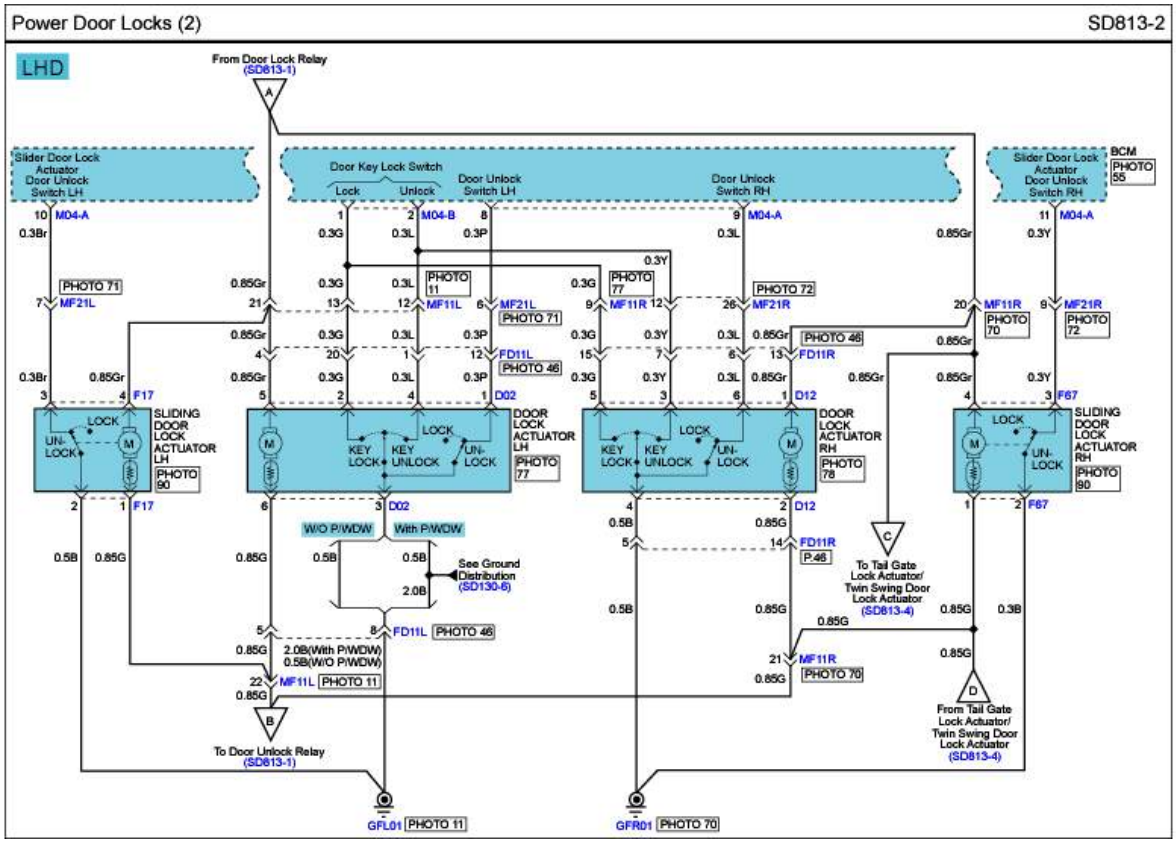


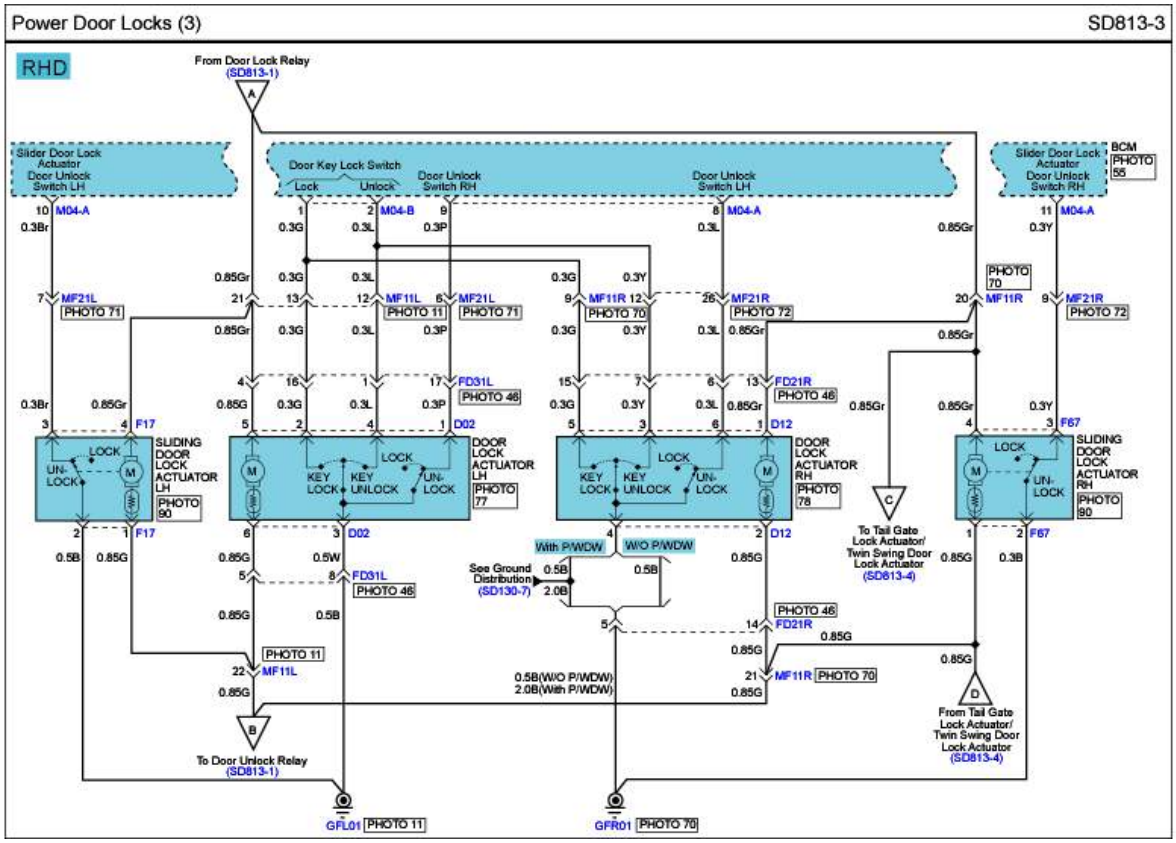

Outside Mirror Folding System (1)
SD878-1
LHD ONLY
HOT IN ALL TIMES
See Power Distribution (SD110-7)
POWER CONNECTOR
I/P JUNCTION BOX
PHOTO 48
See Passenger Compartment Fuse Details (SD120-8)
17 I/P-M 0.5L
2 MF11L PHOTO 11 0.5L
3 FD21L PHOTO 46 0.5L
10 D10
MIRROR FOLDING SWITCH
POWER OUTSIDE MIRROR SWITCH
PHOTO 74
OFF FOLD UNFOLD
OFF FOLD UNFOLD
With P/WDW
W/O P/WDW
See Ground Distribution (SD130-6)
0.5B 0.3B
2.0B 0.3B
8 FD11L PHOTO 46
2.0B(With P/WDW)
0.5B(W/O P/WDW)
PHOTO 11 GFL01
12 0.5L/O
11 D10 0.5O
1 FD21L
14 MF21L PHOTO 71
2 MF21R PHOTO 72
15 MF11R PHOTO 70
12 FD11R PHOTO 46
6 5 D13
FOLDING MOTOR RH
POWER OUTSIDE MIRROR RH PHOTO 76
6 5 D03
FOLDING MOTOR LH
POWER OUTSIDE MIRROR LH PHOTO 73

Outside Mirror Folding System (2) SD878-2

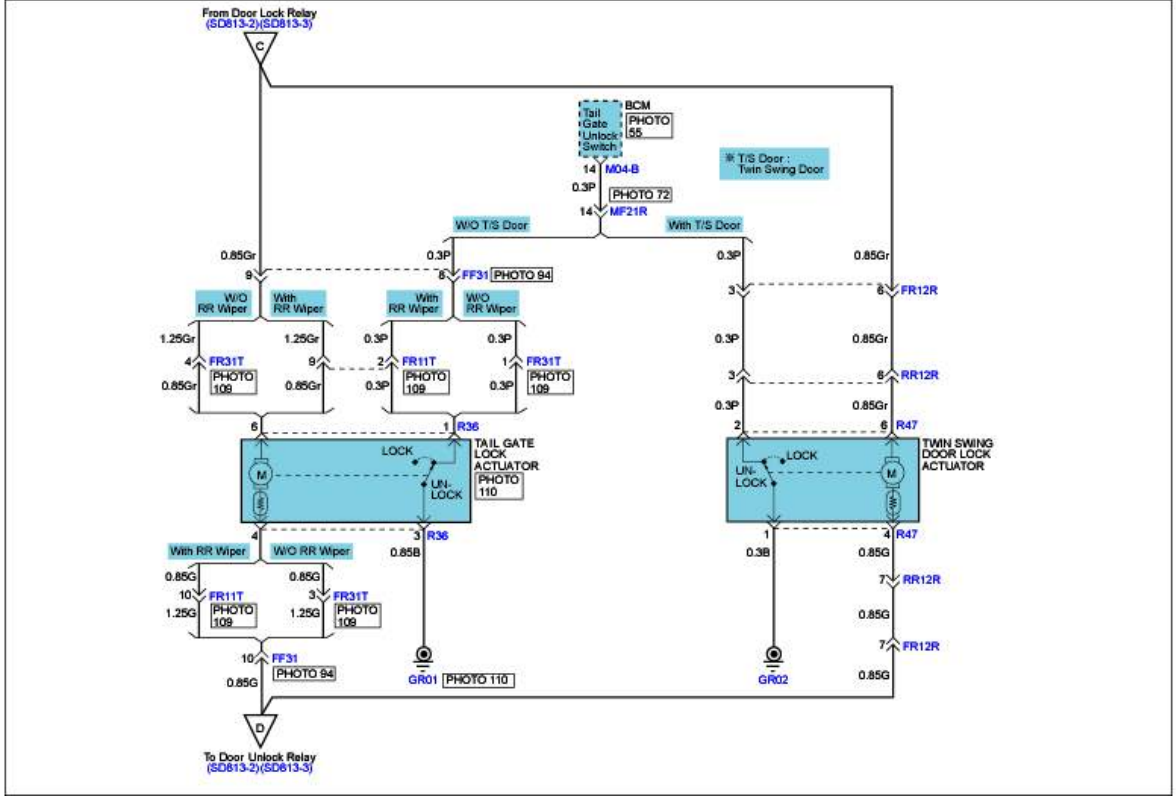



Power Door Locks (1)
SD813-1
HOT AT ALL TIMES
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 48
16 I/P-M
0.85R
3 M08-B
ICM CONTROL MODULE
PHOTO 63
DOOR LOCK RELAY
DOOR UNLOCK RELAY
15
13
4
0.3L
6
5
0.3Br/B
7 M04-C
14 M08-B
Door Lock Relay Control
Door Lock Switch
Door Unlock Relay Control
BCM
PHOTO 55
Lock
Unlock
3
0.3R
11
0.3W
M04-B
10
15
MF11L (LHD)
MF11R (RHD)
PHOTO 11/70
9
2
MF11L (LHD)
MF21R (RHD)
PHOTO 11/72
0.3R
0.3W
PHOTO 46
21
0.3R
22
0.3W
FD11L (LHD)
FD21R (RHD)
3
2
D05 (LHD)
D15R (RHD)
2
3
POWER WINDOW MAIN SWITCH
PHOTO 74
DOOR LOCK SWITCH
L
UL
0.85B
0.85Gr
0.85G
A
To Door Lock Actuator LH/RH
(SD813-2)
(SD813-3)
B
From Door Lock Actuator LH/RH
(SD813-2)
(SD813-3)
8
D05 (LHD)
D15R (RHD)
2.0B
See Ground Distribution
(SD130-6)
(SD130-7)
2.0B
8
5
FD11L (LHD)
FD21R (RHD)
2.0B
PHOTO 46
GM05 PHOTO 48
GFL01 (LHD)
GFR01 (RHD)
PHOTO 11/70
* Note
A
and
B
The arrows indicate the direction of current flow with the door lock relay in operation. Current will flow in the opposite direction when the door unlock relay is in operation.

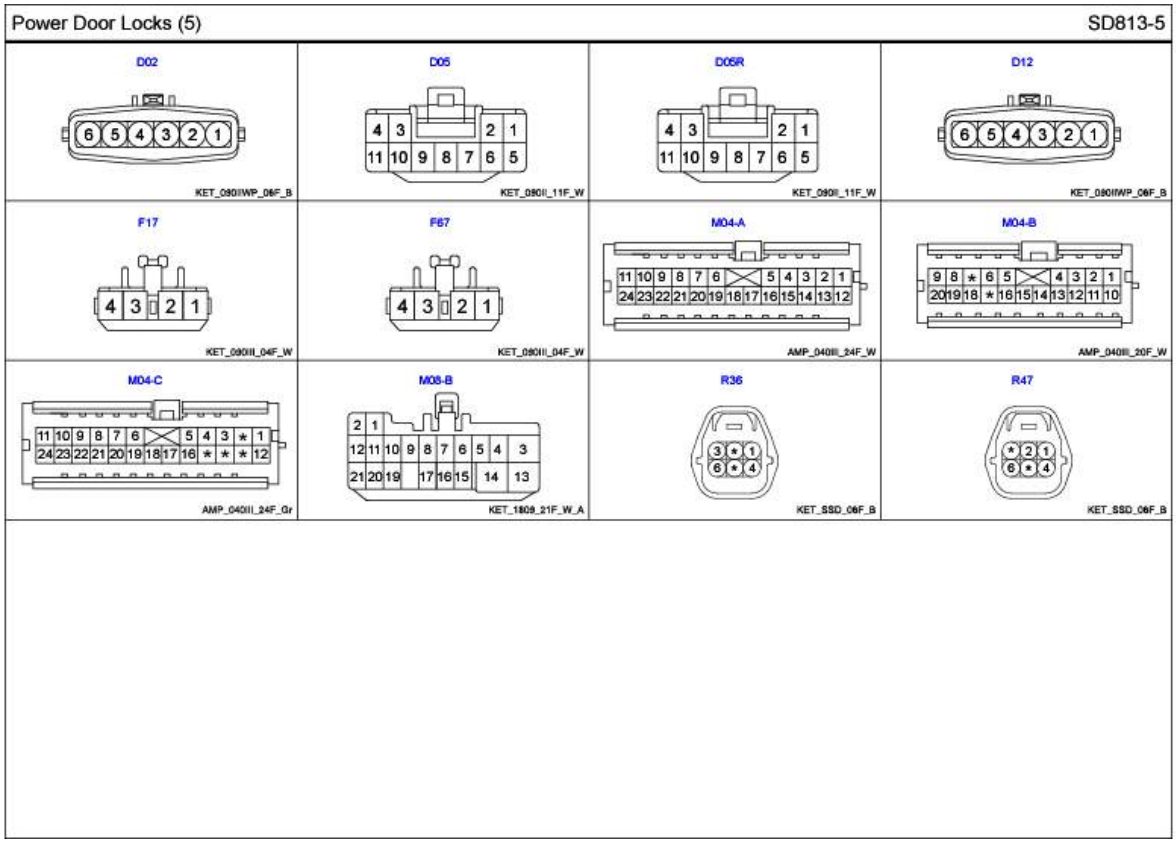

Power Door Locks (2)
SD813-2
LHD
From Door Lock Relay (SD813-1)
Slider Door Lock Actuator Door Unlock Switch LH
Door Key Lock Switch
Lock
Unlock
Door Unlock Switch LH
Door Unlock Switch RH
Slider Door Lock Actuator Door Unlock Switch RH
BCM
PHOTO 55
M04-A
M04-B
PHOTO 71
MF21L
MF11L
PHOTO 11
PHOTO 77
MF11R
PHOTO 72
MF21R
PHOTO 70
PHOTO 46
FD11L
FD11R
F17
D02
D12
F67
SLIDING DOOR LOCK ACTUATOR LH
PHOTO 90
DOOR LOCK ACTUATOR LH
PHOTO 77
DOOR LOCK ACTUATOR RH
PHOTO 78
SLIDING DOOR LOCK ACTUATOR RH
LOCK
UN-LOCK
KEY LOCK
KEY UNLOCK
W/O P/WDW
With P/WDW
See Ground Distribution (SD130-6)
2.0B(With P/WDW)
0.5B(W/O P/WDW)
To Door Unlock Relay (SD813-1)
To Tail Gate Lock Actuator/ Twin Swing Door Lock Actuator (SD813-4)
From Tail Gate Lock Actuator/ Twin Swing Door Lock Actuator (SD813-4)
GFL01
GFR01

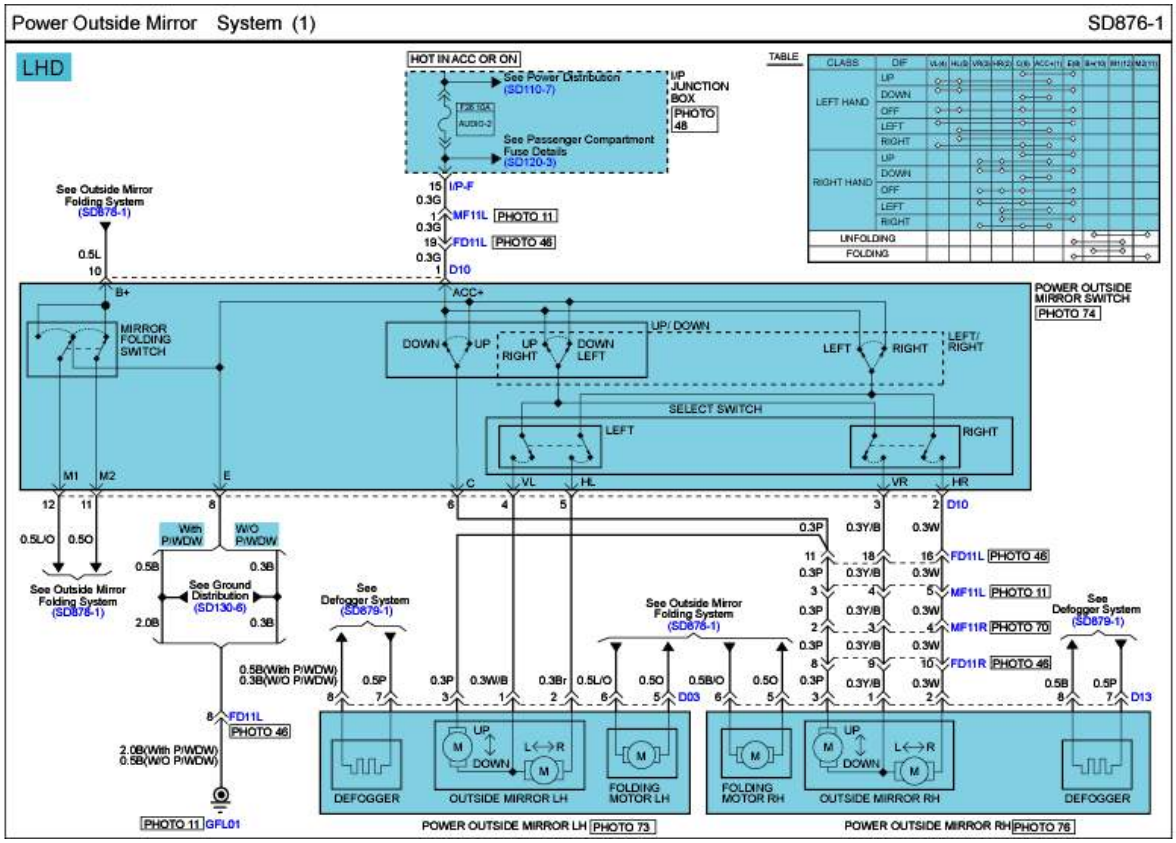

Power Door Locks (3)
SD813-3
RHD
From Door Lock Relay (SD813-1)
Slider Door Lock Actuator Door Unlock Switch LH
Door Key Lock Switch
Lock
Unlock
Door Unlock Switch RH
Door Unlock Switch LH
Slider Door Lock Actuator Door Unlock Switch RH
BCM PHOTO 55
M04-A
M04-B
MF21L
MF11L
MF11R
MF21R
FD31L
FD21R
F17
F67
D02
D12
SLIDING DOOR LOCK ACTUATOR LH
SLIDING DOOR LOCK ACTUATOR RH
DOOR LOCK ACTUATOR LH
DOOR LOCK ACTUATOR RH
LOCK
UN-LOCK
KEY LOCK
KEY UNLOCK
PHOTO 90
PHOTO 77
PHOTO 78
PHOTO 71
PHOTO 72
PHOTO 70
PHOTO 11
PHOTO 46
With P/WDW
W/O P/WDW
See Ground Distribution (SD130-7)
0.5B(W/O P/WDW)
2.0B(With P/WDW)
To Tail Gate Lock Actuator/ Twin Swing Door Lock Actuator (SD813-4)
From Tail Gate Lock Actuator/ Twin Swing Door Lock Actuator (SD813-4)
To Door Unlock Relay (SD813-1)
GFL01 PHOTO 11
GFR01 PHOTO 70

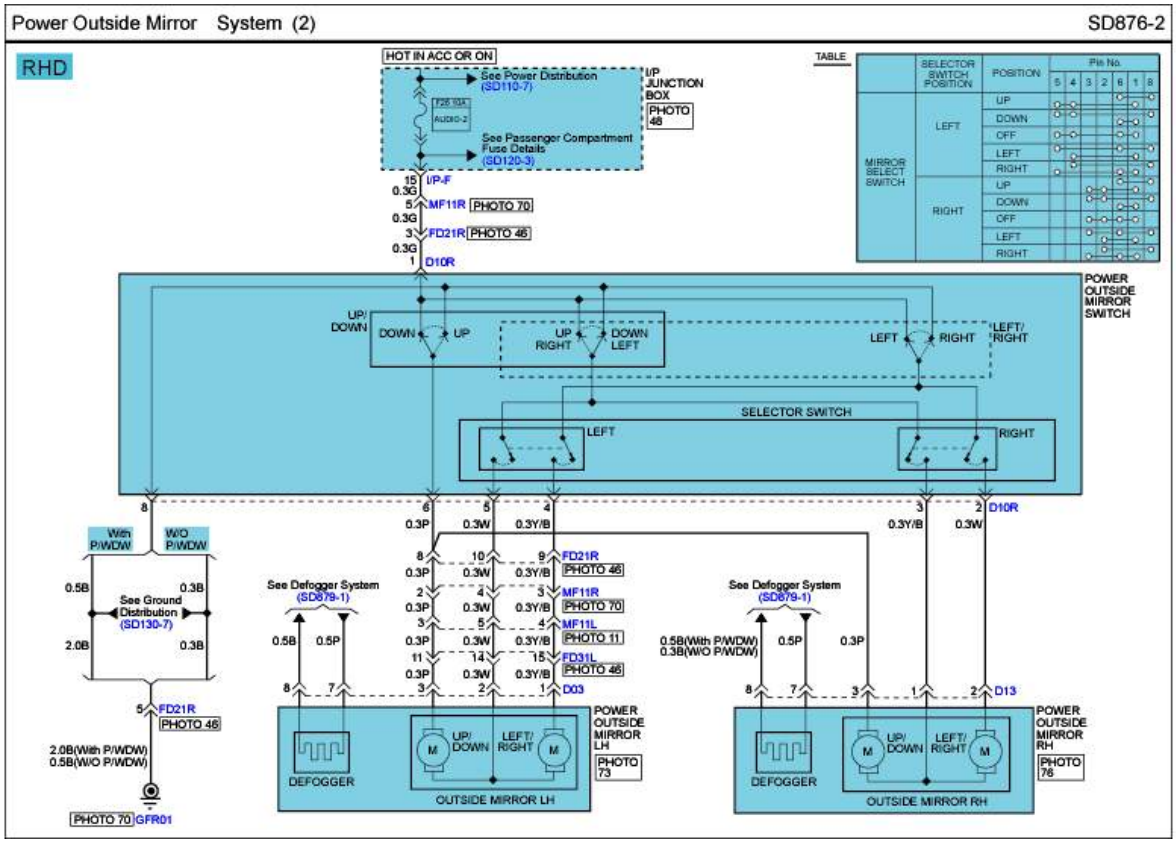
Power Door Locks (4) SD813-4

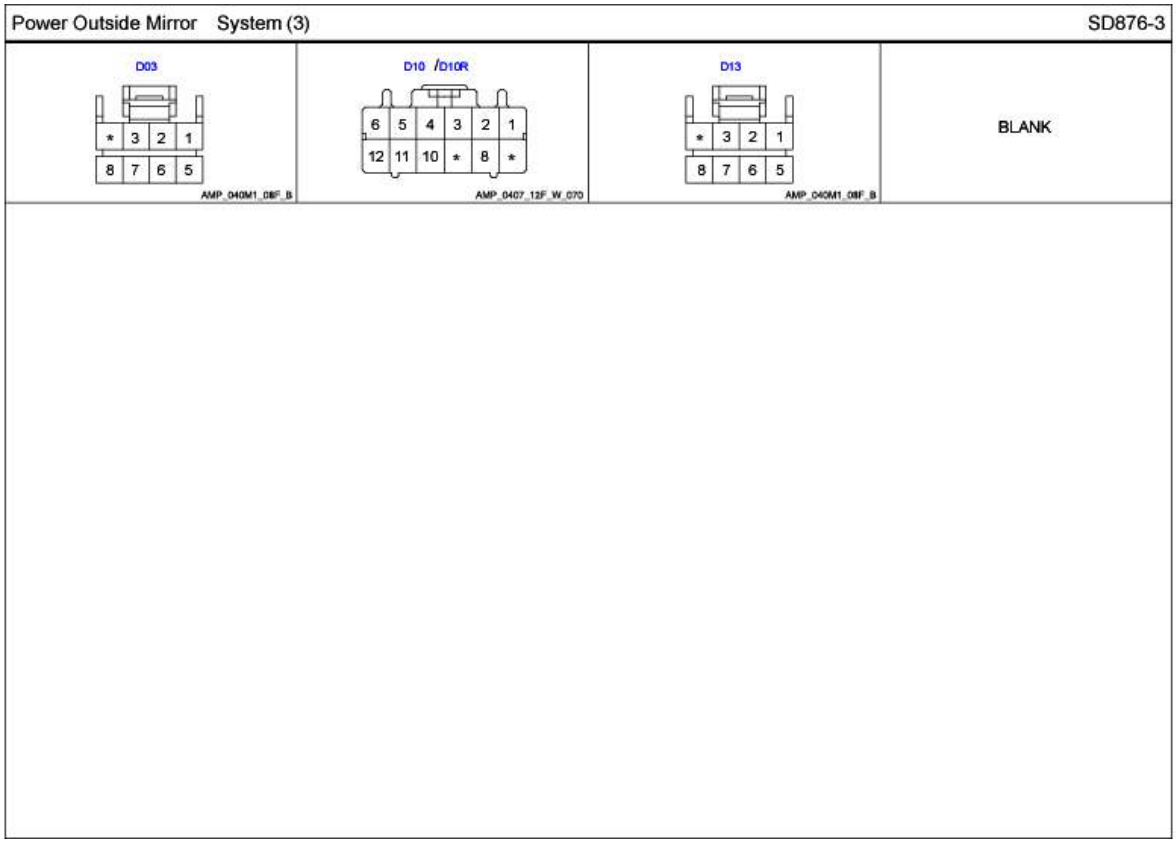


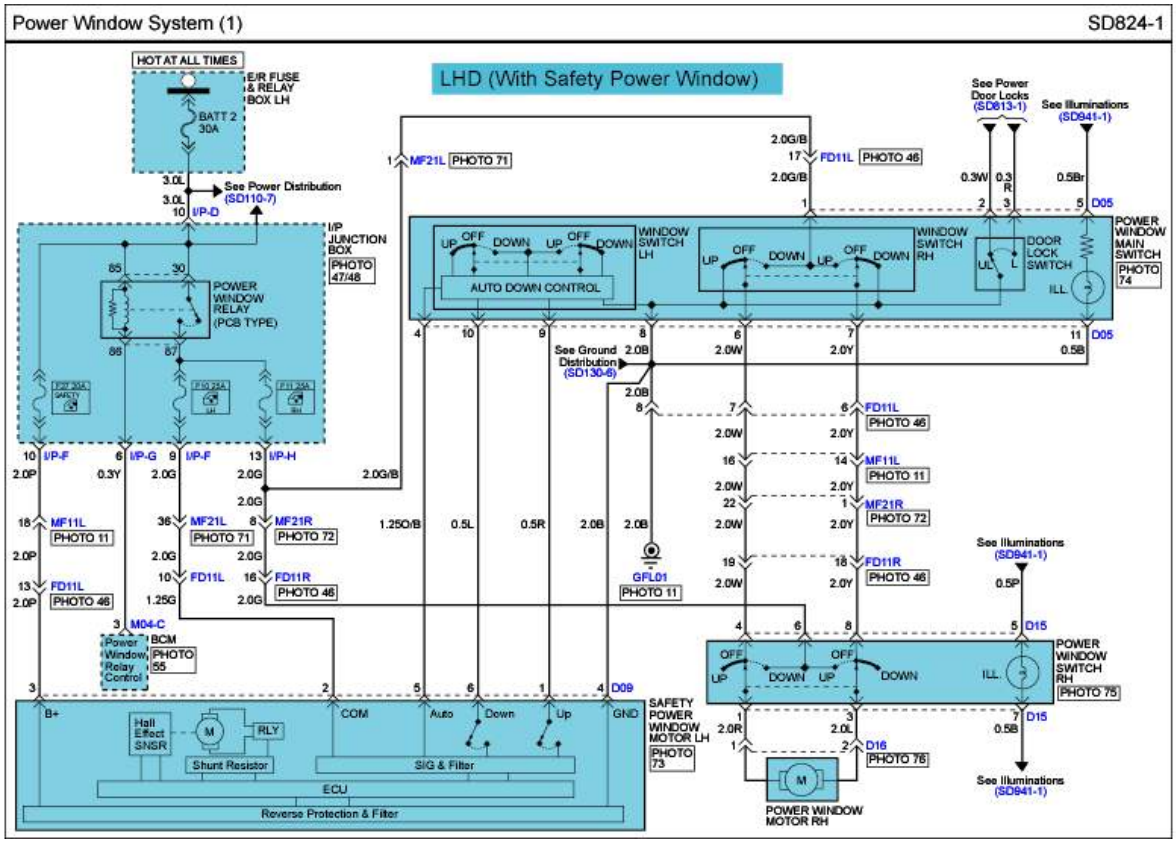
Power Door Locks (5) SD813-5

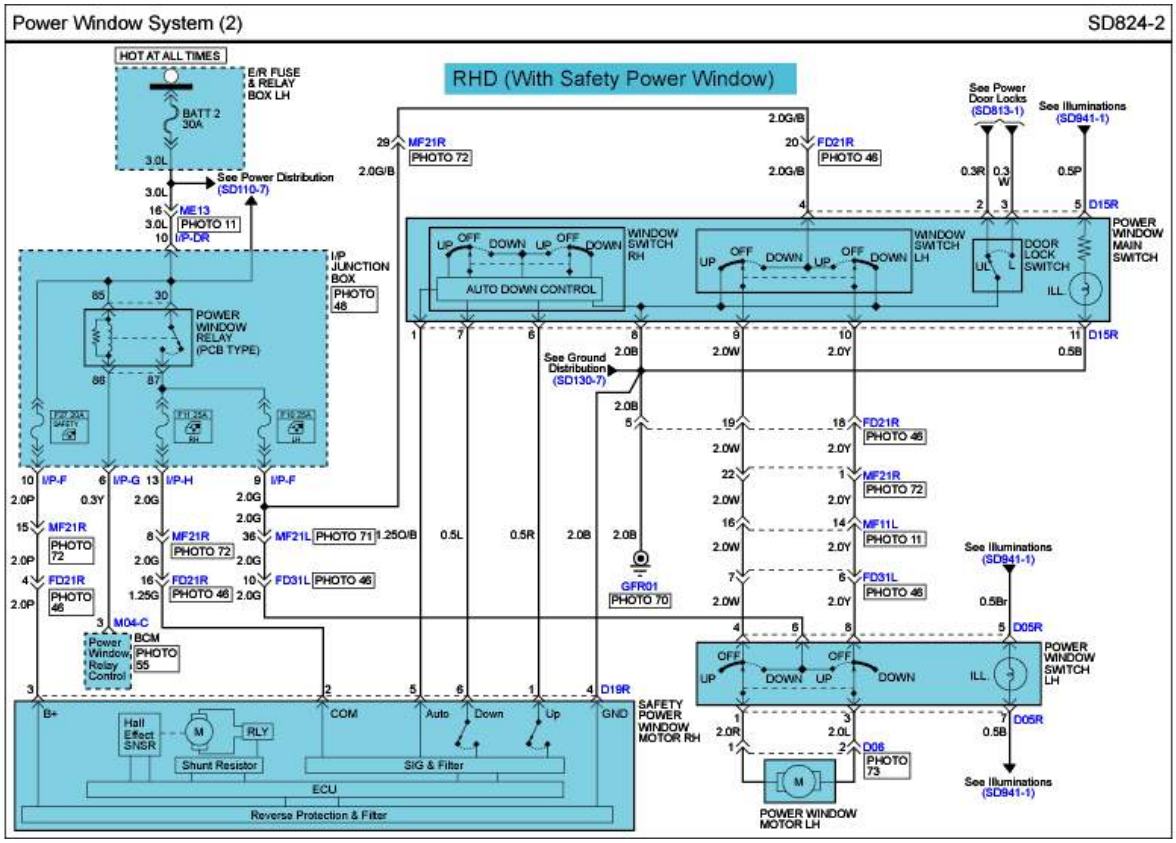


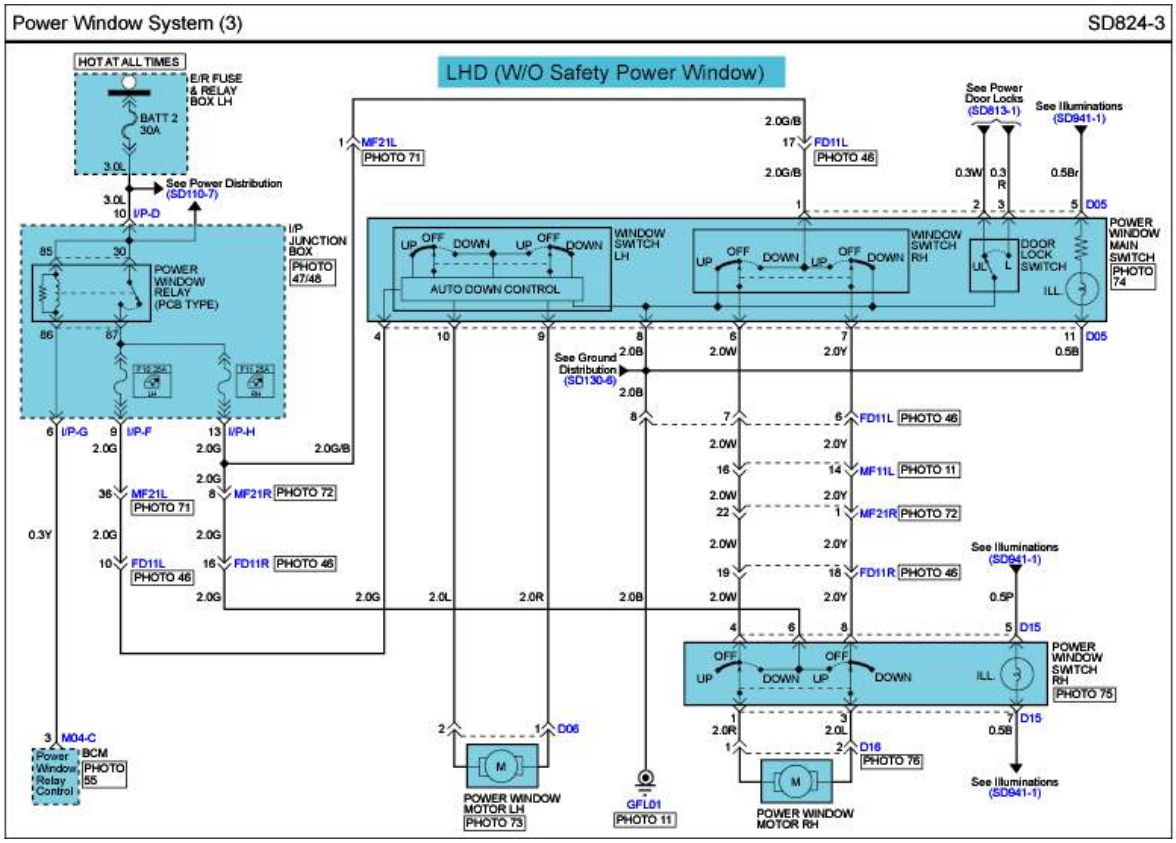

Power Outside Mirror System (1)
SD876-1
LHD
HOT IN ACC OR ON
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 48
See Passenger Compartment Fuse Details (SD120-3)
TABLE
CLASS
DIF
LEFT HAND
RIGHT HAND
UP
DOWN
OFF
LEFT
RIGHT
LINFOLDING
FOLDING
See Outside Mirror Folding System (SD878-1)
I/P-F
MF11L PHOTO 11
FD11L PHOTO 46
D10
POWER OUTSIDE MIRROR SWITCH
PHOTO 74
B+
ACC+
MIRROR FOLDING SWITCH
UP/ DOWN
LEFT/ RIGHT
SELECT SWITCH
M1
M2
E
C
VL
HL
VR
HR
With P/WDW
W/O P/WDW
See Ground Distribution (SD130-6)
See Defogger System (SD879-1)
FD11R PHOTO 46
MF11R PHOTO 70
D03
D13
DEFOGGER
OUTSIDE MIRROR LH
FOLDING MOTOR LH
FOLDING MOTOR RH
OUTSIDE MIRROR RH
GFL01
POWER OUTSIDE MIRROR LH PHOTO 73
POWER OUTSIDE MIRROR RH PHOTO 76

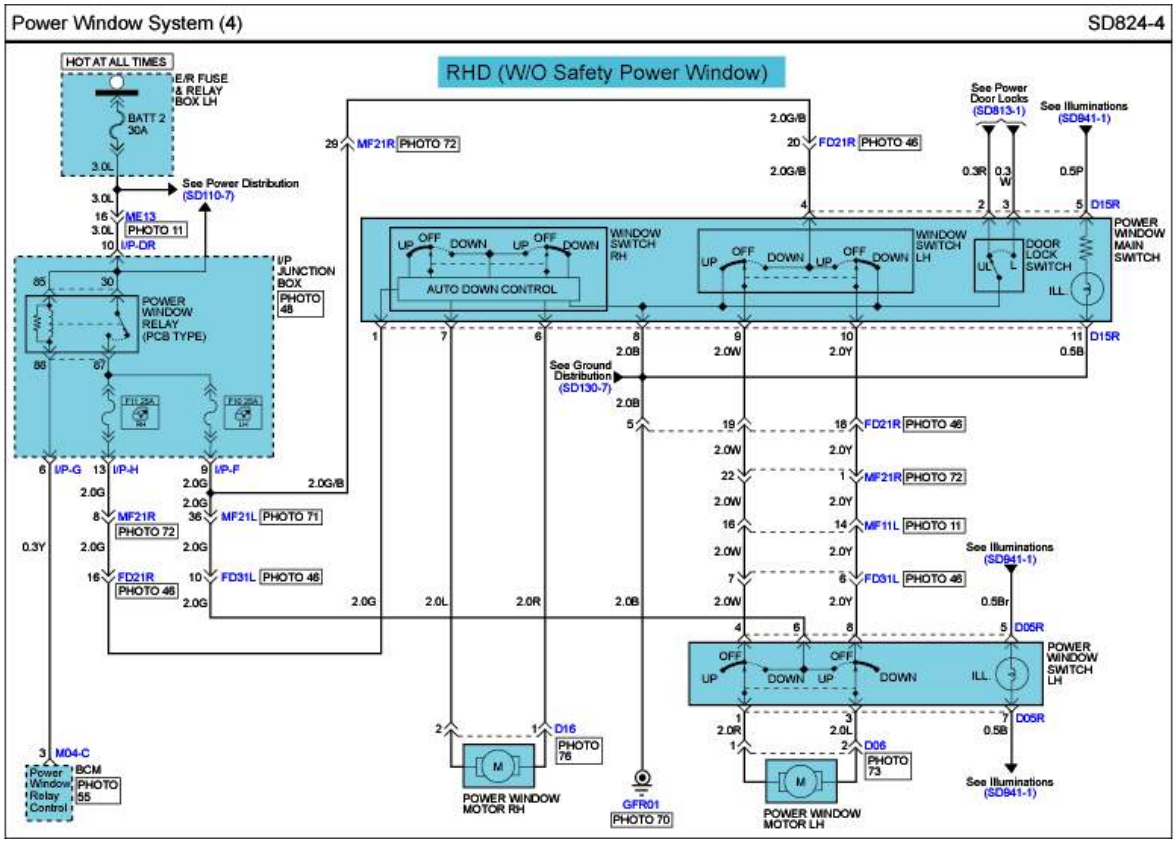

Power Outside Mirror System (2)
SD876-2
RHD
HOT IN ACC OR ON
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-3)
I/P JUNCTION BOX
PHOTO 48
I/P-F
MF11R PHOTO 70
FD21R PHOTO 46
D10R
TABLE
SELECTOR SWITCH POSITION
POSITION
Pin No.
MIRROR SELECT SWITCH
LEFT
RIGHT
UP
DOWN
OFF
POWER OUTSIDE MIRROR SWITCH
UP/ DOWN
LEFT/ RIGHT
SELECTOR SWITCH
With P/WDW
W/O P/WDW
See Ground Distribution (SD130-7)
FD21R PHOTO 46
PHOTO 70 GFR01
See Defogger System (SD879-1)
MF11L PHOTO 11
FD31L PHOTO 46
D03
D13
DEFOGGER
OUTSIDE MIRROR LH
OUTSIDE MIRROR RH
POWER OUTSIDE MIRROR LH PHOTO 73
POWER OUTSIDE MIRROR RH PHOTO 76


Power Outside Mirror System (3)
SD876-3
D03
* 3 2 1
8 7 6 5
AMP_040M1_08F_B
D10 /D10R
6 5 4 3 2 1
12 11 10 * 8 *
AMP_0407_12F_W_070
D13
* 3 2 1
8 7 6 5
AMP_040M1_08F_B
BLANK

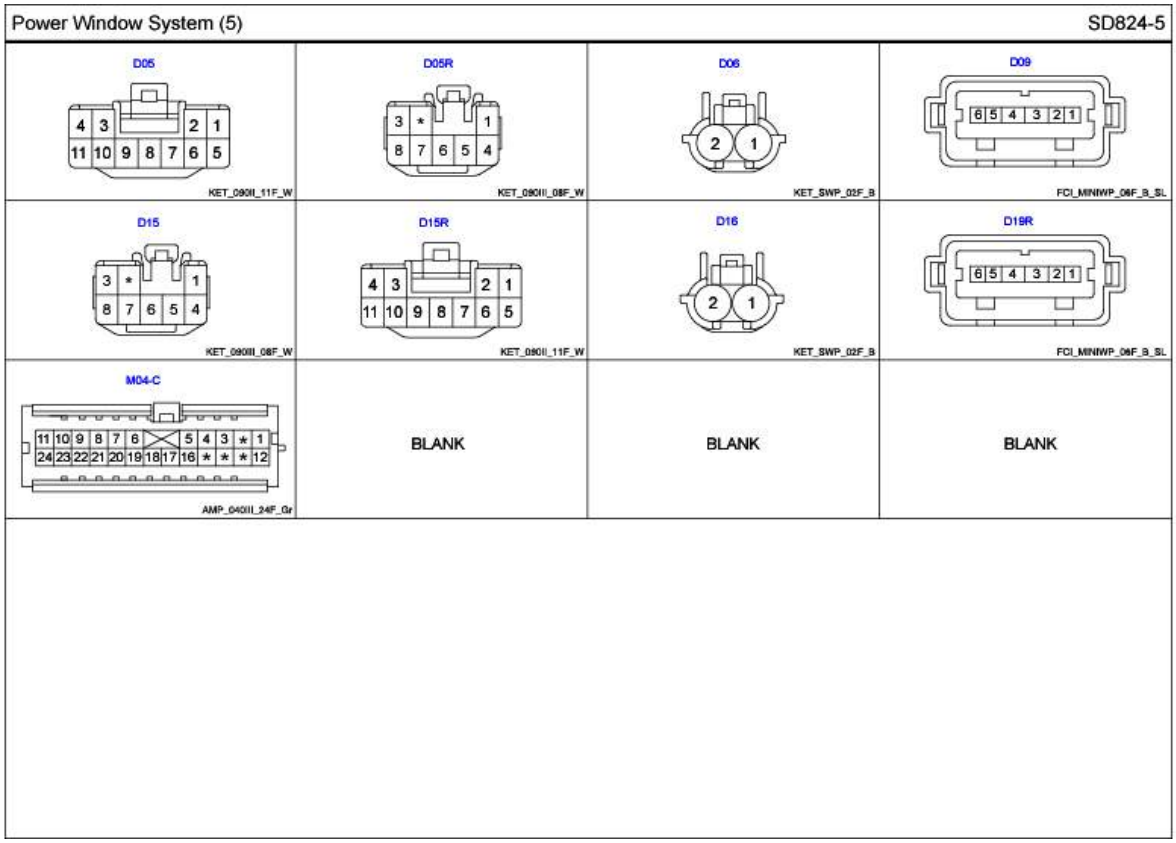

Power Window System (1)
SD824-1
LHD (With Safety Power Window)
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
BATT 2 30A
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47/48
POWER WINDOW RELAY (PCB TYPE)
AUTO DOWN CONTROL
WINDOW SWITCH LH
WINDOW SWITCH RH
DOOR LOCK SWITCH
POWER WINDOW MAIN SWITCH
PHOTO 74
See Power Door Locks (SD813-1)
See Illuminations (SD941-1)
See Ground Distribution (SD130-6)
POWER WINDOW SWITCH RH
PHOTO 75
SAFETY POWER WINDOW MOTOR LH
PHOTO 73
POWER WINDOW MOTOR RH
PHOTO 76
BCM
PHOTO 55
Hall Effect SNSR
Shunt Resistor
RLY
SIG & Filter
ECU
Reverse Protection & Filter
B+
COM
Auto
Down
Up
GND


Power Window System (2)
SD824-2
RHD (With Safety Power Window)
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
BATT 2 30A
See Power Distribution (SD110-7)
ME13
PHOTO 11
I/P-DR
I/P JUNCTION BOX
PHOTO 48
POWER WINDOW RELAY (PCB TYPE)
MF21R
PHOTO 72
FD21R
PHOTO 46
See Power Door Locks (SD813-1)
See Illuminations (SD941-1)
D15R
POWER WINDOW MAIN SWITCH
WINDOW SWITCH RH
WINDOW SWITCH LH
AUTO DOWN CONTROL
DOOR LOCK SWITCH
See Ground Distribution (SD130-7)
MF11L
PHOTO 11
MF31L
PHOTO 71
FD31L
PHOTO 46
GFR01
PHOTO 70
D05R
POWER WINDOW SWITCH LH
M04-C
BCM
Power Window Relay Control
PHOTO 55
D19R
SAFETY POWER WINDOW MOTOR RH
Hall Effect SNSR
RLY
Shunt Resistor
SIG & Filter
ECU
Reverse Protection & Filter
D06
PHOTO 73
POWER WINDOW MOTOR LH

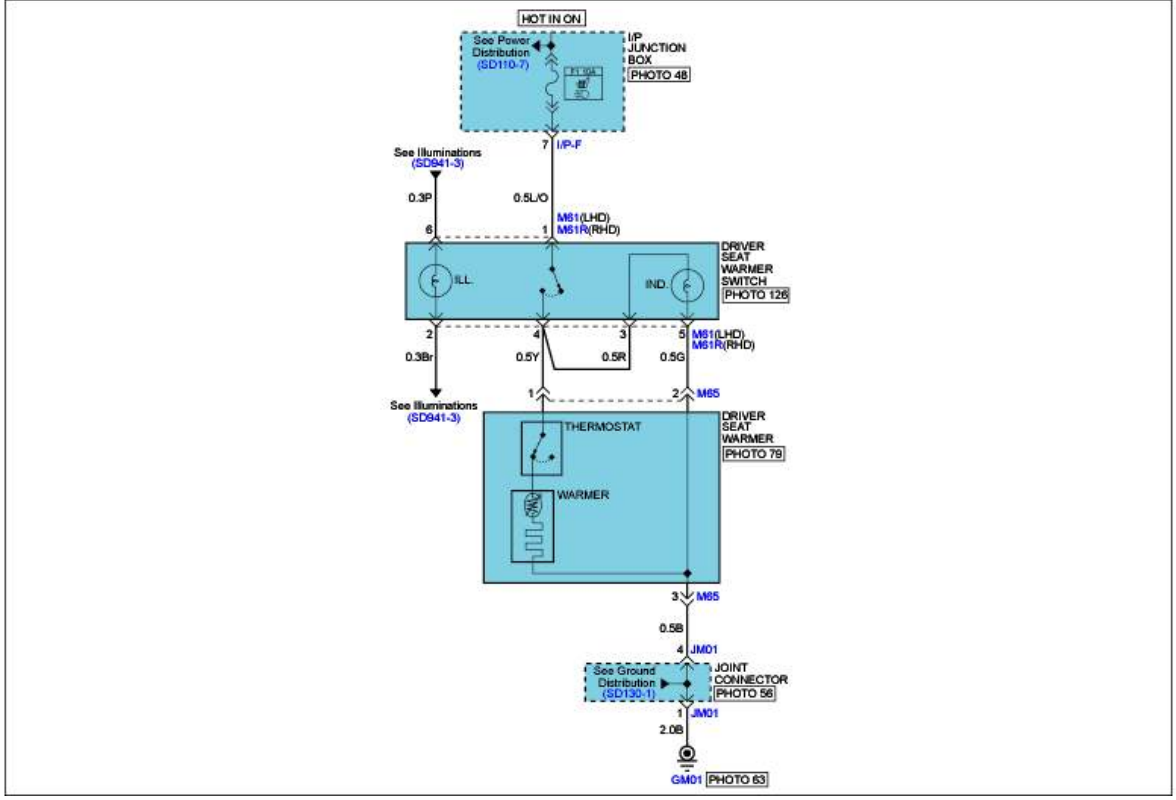

Power Window System (3)
SD824-3
LHD (W/O Safety Power Window)
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
BATT 2 30A
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47/48
POWER WINDOW RELAY (PCB TYPE)
WINDOW SWITCH LH
WINDOW SWITCH RH
AUTO DOWN CONTROL
DOOR LOCK SWITCH
POWER WINDOW MAIN SWITCH
PHOTO 74
See Power Door Locks (SD813-1)
See Illuminations (SD941-1)
See Ground Distribution (SD130-6)
POWER WINDOW SWITCH RH
PHOTO 75
POWER WINDOW MOTOR LH
PHOTO 73
POWER WINDOW MOTOR RH
PHOTO 76
GFL01
PHOTO 11
BCM
PHOTO 55
Power Window Relay Control


Power Window System (4)
SD824-4
RHD (W/O Safety Power Window)
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
BATT 2 30A
See Power Distribution (SD110-7)
ME13
PHOTO 11
I/P-DR
I/P JUNCTION BOX
PHOTO 48
POWER WINDOW RELAY (PCB TYPE)
F11 25A
F12 20A
I/P-G
I/P-H
I/P-F
MF21R PHOTO 72
MF21L PHOTO 71
FD21R PHOTO 46
FD31L PHOTO 46
M04-C
BCM
PHOTO 55
Power Window Relay Control
WINDOW SWITCH RH
AUTO DOWN CONTROL
WINDOW SWITCH LH
DOOR LOCK SWITCH
POWER WINDOW MAIN SWITCH
D15R
See Ground Distribution (SD130-7)
See Power Door Locks (SD813-1)
See Illuminations (SD841-1)
POWER WINDOW SWITCH LH
D05R
D16
PHOTO 76
D06
PHOTO 73
POWER WINDOW MOTOR RH
POWER WINDOW MOTOR LH
GFR01
PHOTO 70

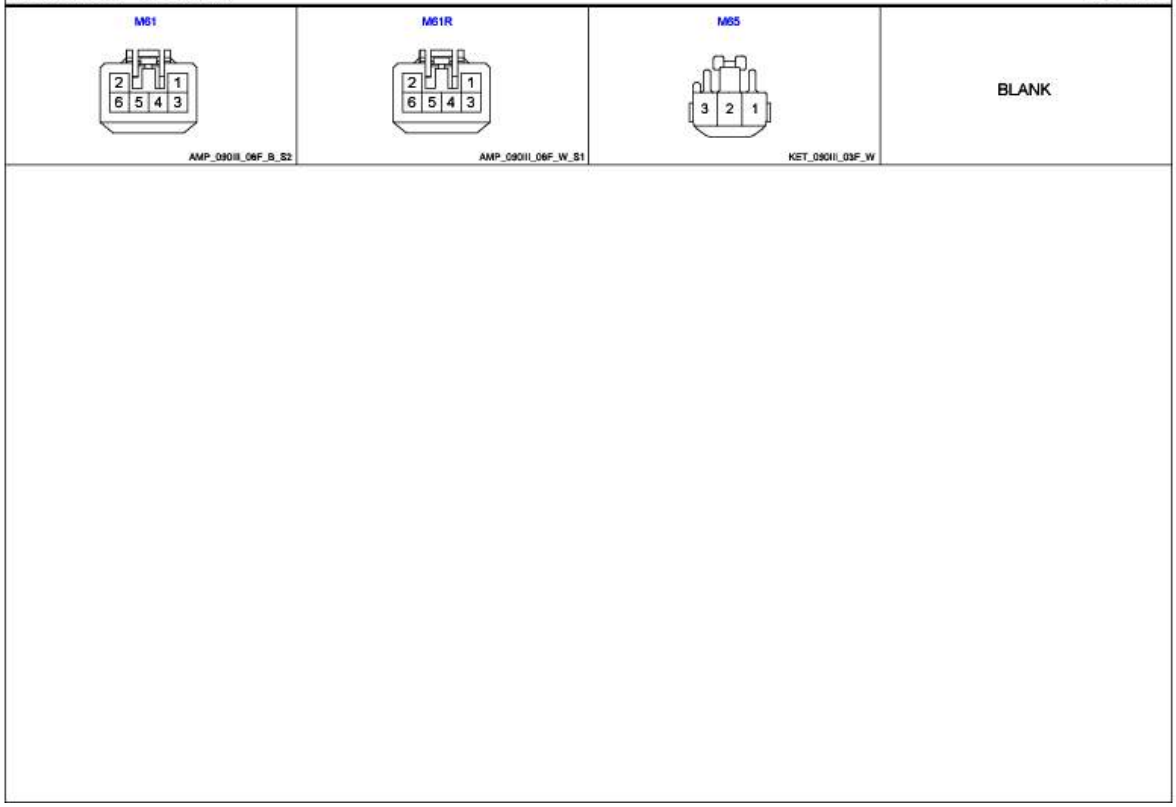
Power Window System (5) SD824-5

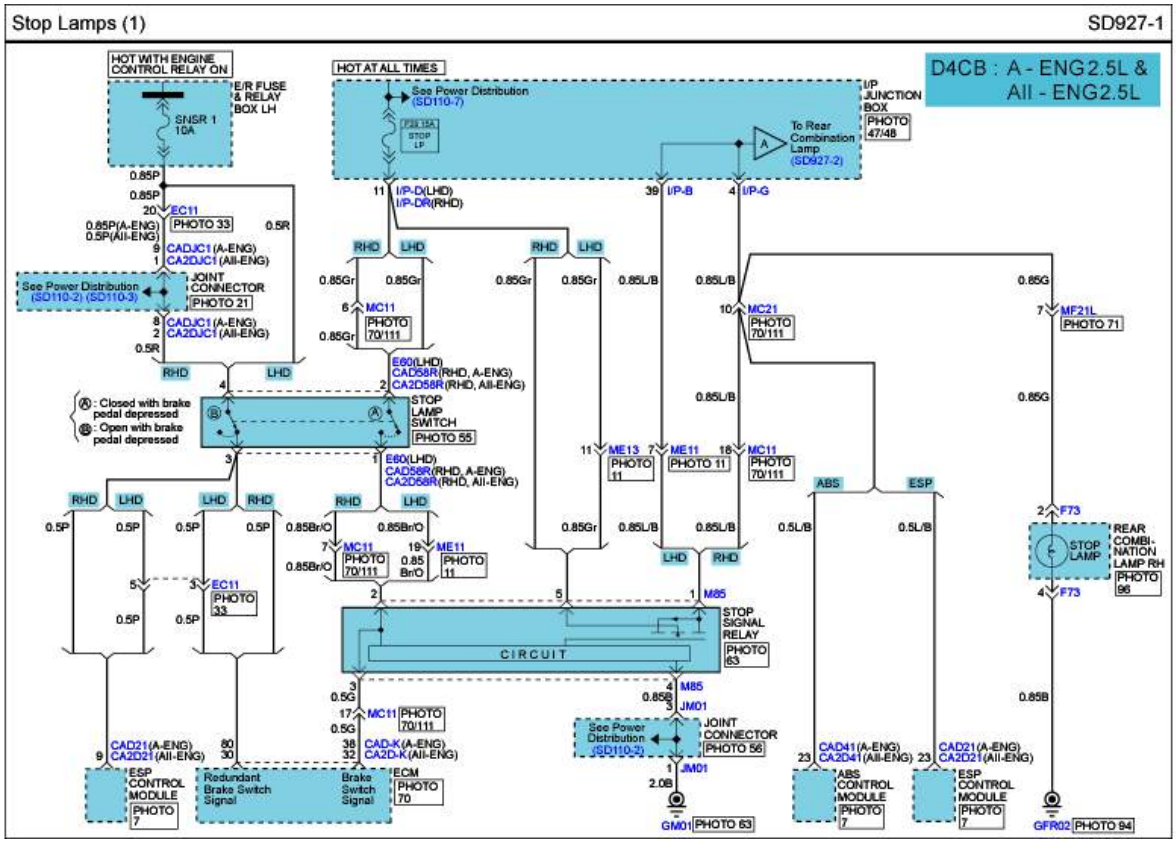


Seat Warmer System (1) SD889-1



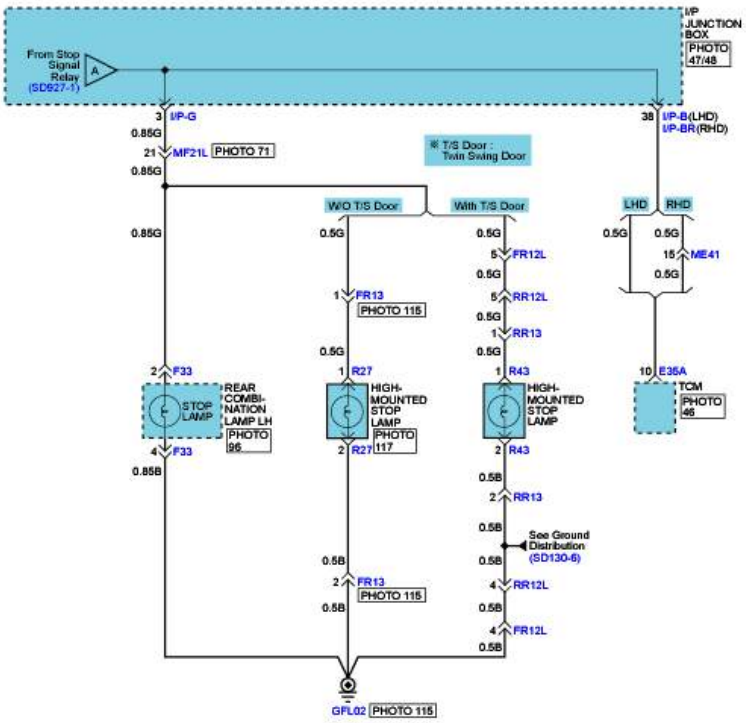
Seat Warmer System (2) SD889-2

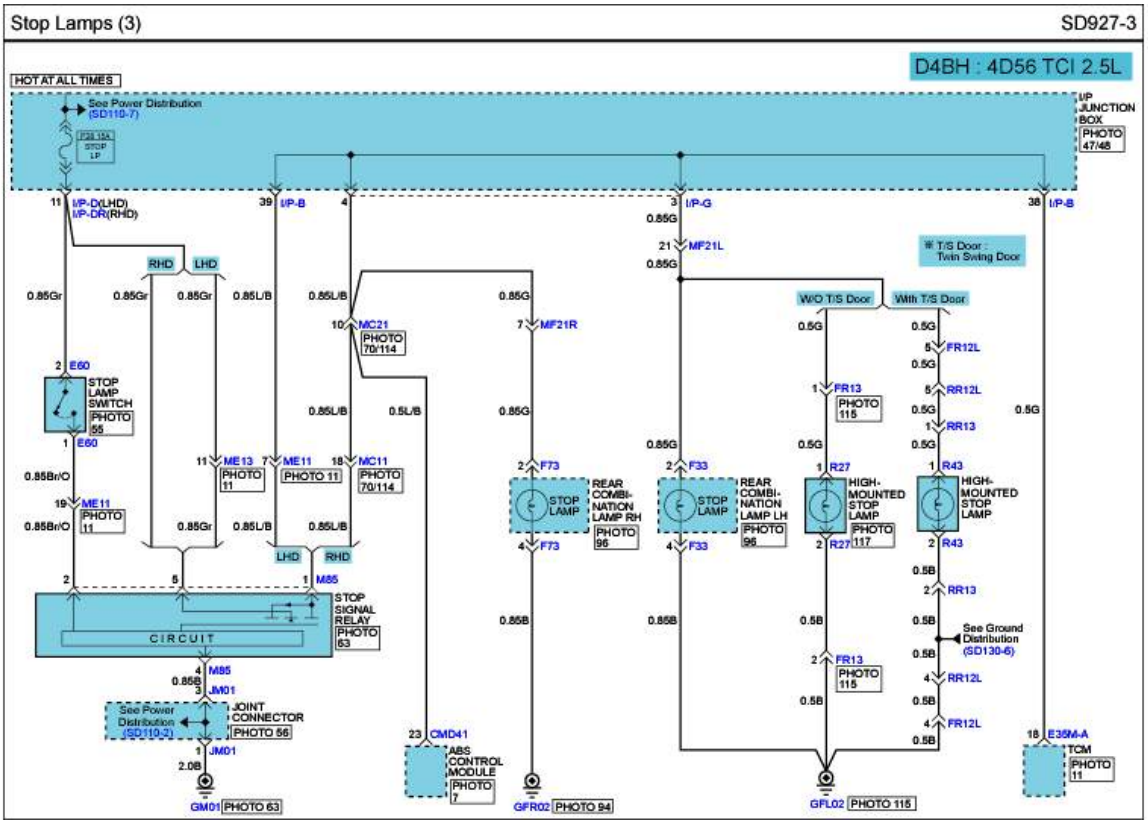


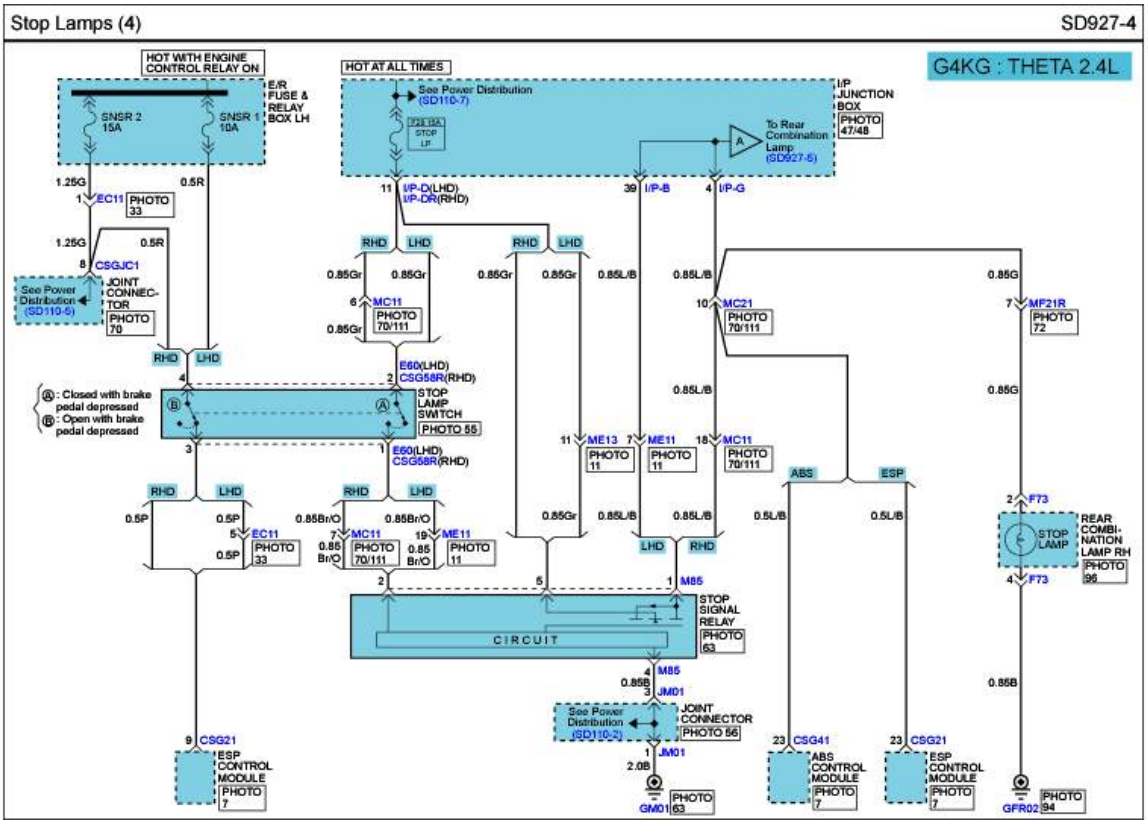

Stop Lamps (1)
SD927-1
D4CB : A - ENG2.5L & All - ENG2.5L
HOT WITH ENGINE CONTROL RELAY ON
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
SNSR 1 10A
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47/48
To Rear Combination Lamp (SD927-2)
I/P-D(LHD) I/P-DR(RHD)
I/P-B
I/P-G
EC11
PHOTO 33
CADJC1 (A-ENG) CA2DJC1 (All-ENG)
See Power Distribution (SD110-2) (SD110-3)
JOINT CONNECTOR
PHOTO 21
MC11
PHOTO 70/111
E60(LHD) CAD58R(RHD, A-ENG) CA2D58R(RHD, All-ENG)
STOP LAMP SWITCH
PHOTO 55
Ⓐ : Closed with brake pedal depressed
Ⓑ : Open with brake pedal depressed
ME13
PHOTO 11
ME11
PHOTO 11
MC21
PHOTO 70/111
MF21L
PHOTO 71
ABS
ESP
F73
REAR COMBI-NATION LAMP RH
PHOTO 96
STOP LAMP
M85
STOP SIGNAL RELAY
PHOTO 63
CIRCUIT
JM01
JOINT CONNECTOR
PHOTO 56
CAD-K(A-ENG) CA2D-K(All-ENG)
ECM
PHOTO 70
CAD21(A-ENG) CA2D21(All-ENG)
ESP CONTROL MODULE
PHOTO 7
Redundant Brake Switch Signal
Brake Switch Signal
CAD41(A-ENG) CA2D41(All-ENG)
ABS CONTROL MODULE
PHOTO 7
GM01
PHOTO 63
GFR02
PHOTO 94

Stop Lamps (2) SD927-2

D4CB : A - ENG2.5L &
AII - ENG2.5L

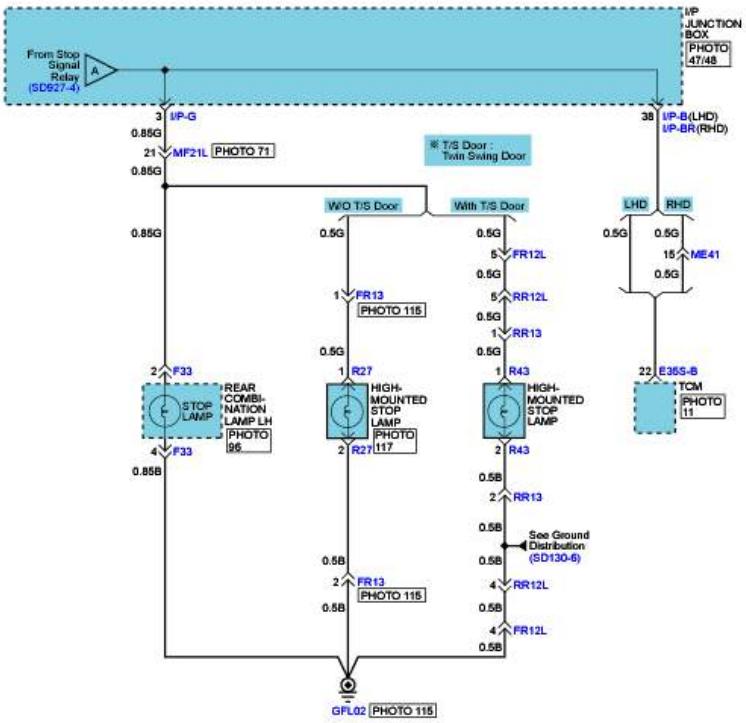



Stop Lamps (3)
SD927-3
D4BH : 4D56 TCI 2.5L
HOT AT ALL TIMES
See Power Distribution (SD110-7)
F28 15A STOP LP
I/P JUNCTION BOX PHOTO 47/48
I/P-D(LHD) I/P-DR(RHD)
I/P-B
I/P-G
RHD
LHD
E60 STOP LAMP SWITCH PHOTO 55
ME13 PHOTO 11
ME11 PHOTO 11
MC11 PHOTO 70/114
MC21 PHOTO 70/114
MF21R
MF21L
W/O T/S Door
With T/S Door
* T/S Door : Twin Swing Door
FR13 PHOTO 115
FR12L
RR12L
RR13
F73 STOP LAMP REAR COMBI-NATION LAMP RH PHOTO 96
F33 STOP LAMP REAR COMBI-NATION LAMP LH PHOTO 96
R27 HIGH-MOUNTED STOP LAMP PHOTO 117
R43 HIGH-MOUNTED STOP LAMP
M85 STOP SIGNAL RELAY PHOTO 63
CIRCUIT
JM01 JOINT CONNECTOR PHOTO 56
See Power Distribution (SD110-2)
See Ground Distribution (SD130-6)
CMD41 ABS CONTROL MODULE PHOTO 7
E35M-A TCM PHOTO 11
GM01 PHOTO 63
GFR02 PHOTO 94
GFL02 PHOTO 115

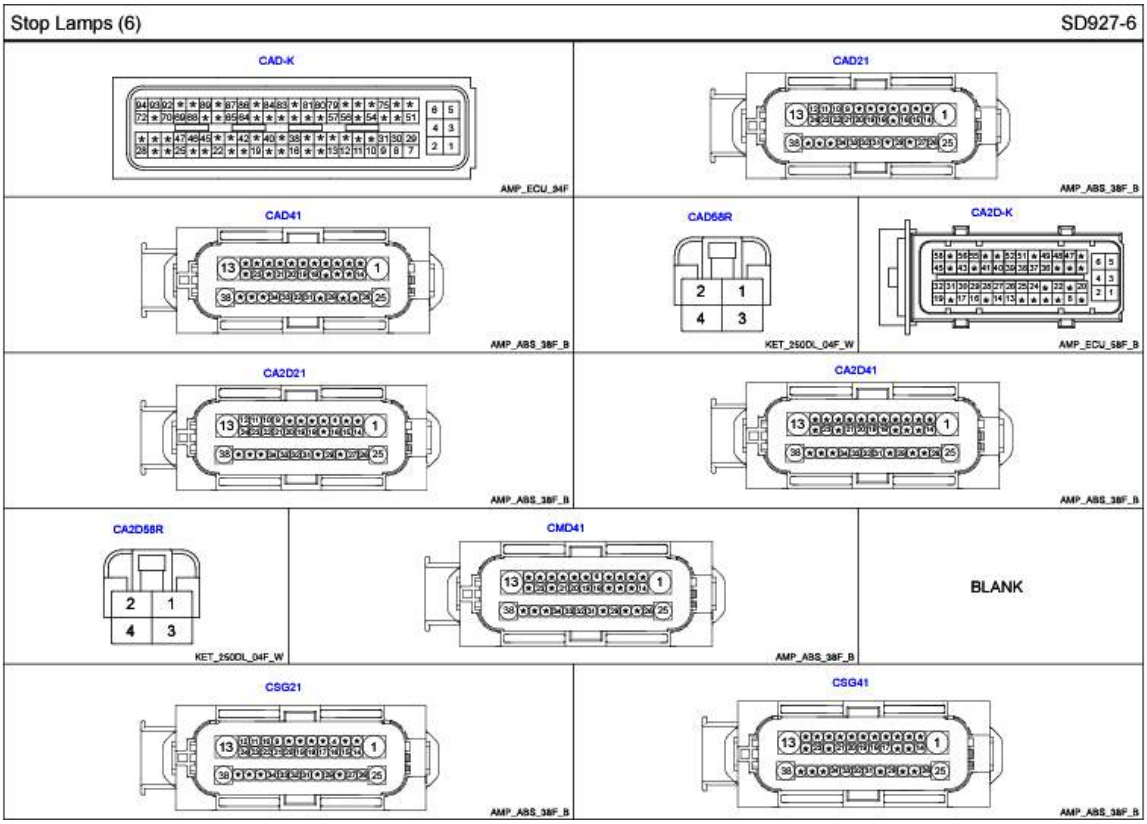

Stop Lamps (4)
SD927-4
G4KG : THETA 2.4L
HOT WITH ENGINE CONTROL RELAY ON
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
SNSR 2 15A
SNSR 1 10A
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47/48
To Rear Combination Lamp (SD927-5)
EC11
CSGJC1
JOINT CONNEC-TOR
PHOTO 70
MC11
MC21
MF21R
PHOTO 72
E60(LHD) CSG58R(RHD)
STOP LAMP SWITCH
PHOTO 55
Ⓐ : Closed with brake pedal depressed
Ⓑ : Open with brake pedal depressed
E60(LHD) CSG58R(RHD)
ME13
ME11
MC11
PHOTO 11
PHOTO 70/111
ABS
ESP
F73
STOP LAMP
REAR COMBI-NATION LAMP RH
PHOTO 96
M85
STOP SIGNAL RELAY
PHOTO 63
CIRCUIT
JM01
JOINT CONNECTOR
PHOTO 56
CSG21
ESP CONTROL MODULE
CSG41
ABS CONTROL MODULE
GM01
GFR02
PHOTO 94

Stop Lamps (5) SD927-5

G4KG : THETA 2.4L

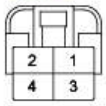


Stop Lamps (6) SD927-6



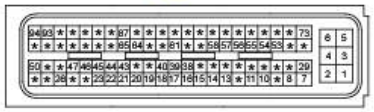
Stop Lamps (7) SD927-7

CSG58R



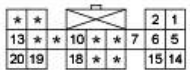
KET_250DL_02F_W

E35A



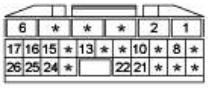
AMP_ECU_94F

E35M-A



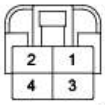
KET_025_20F_B

E35S-B



AMP_0925_26F_W

E60



KET_250DL_02F_W

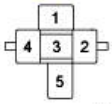
F33

KET_SWP_06F_B

F73

KET_SWP_06F_B

M65



KET_250_05F_B_RLY

R27

KET_090_02F_W

R43

KET_090_02F_W

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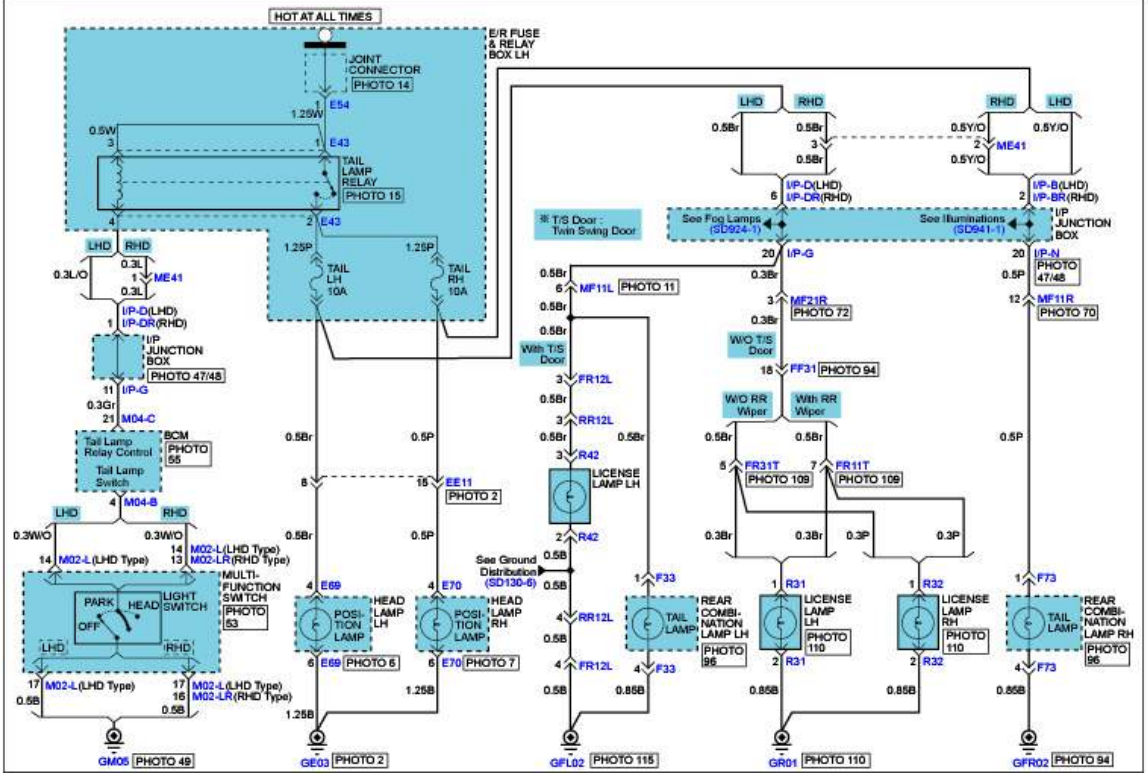
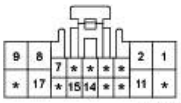
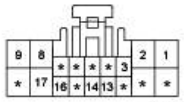
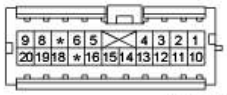
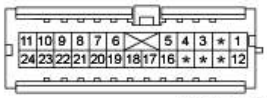
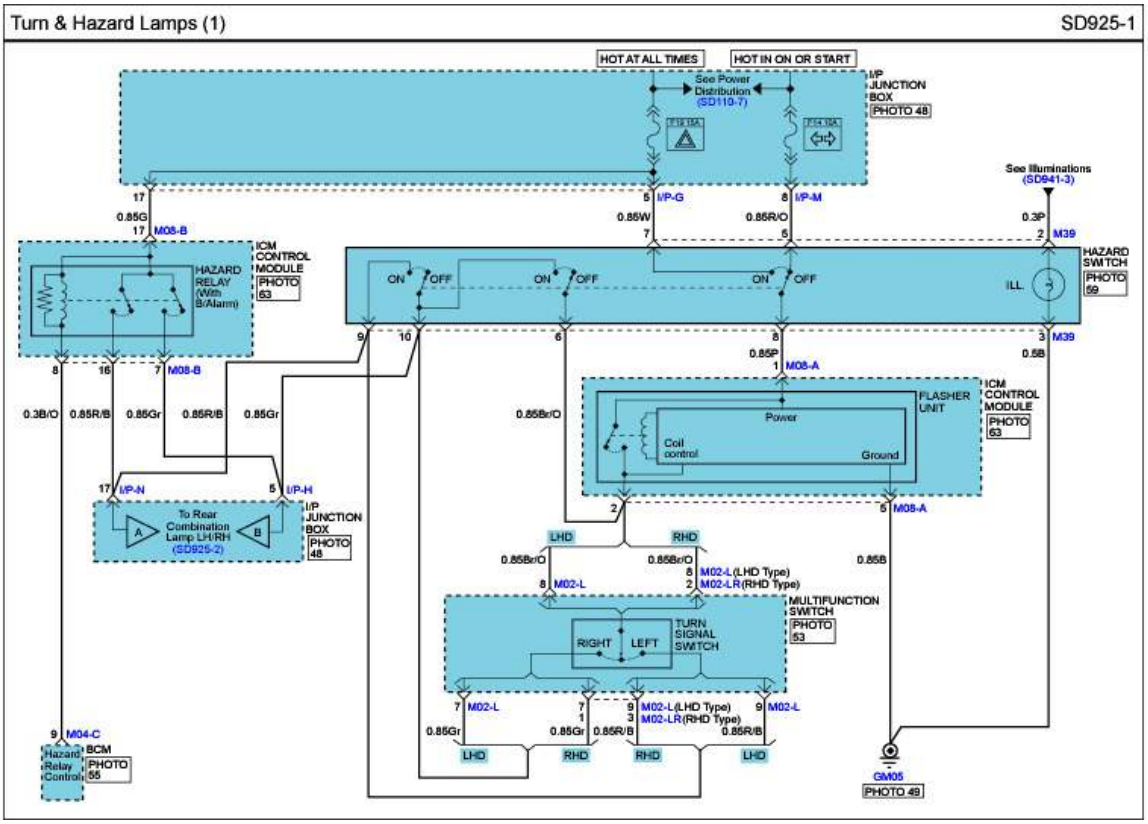
Tail, Parking & License Lamps (1) SD928-1

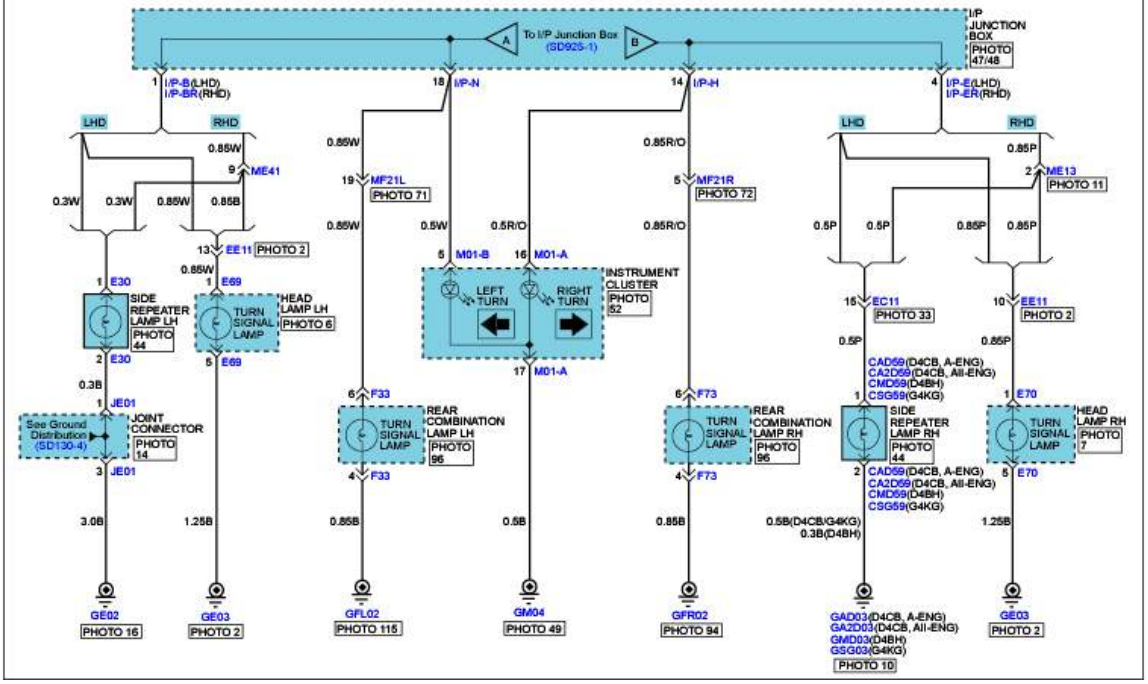


Tail, Parking & License Lamps (2) SD928-2

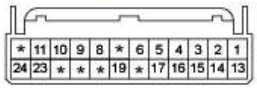
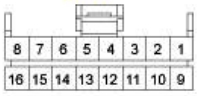
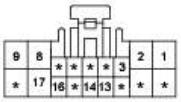
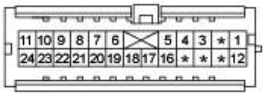
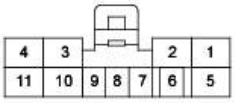
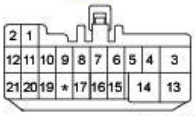
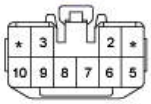
E43 CR04F096	E54 KET_0901I_02F_W_BOTTOM	E69 KUM_NMWP_06F_B	E70 KUM_NMWP_06F_B
M02-L  KET_0508_18F_W	M02-LR  KET_0508_18F_W	M04-B  AMP_04038_20F_W	M04-C  AMP_04038_24F_Gr
F33 KET_SWP_06F_B	F73 KET_SWP_06F_B	R31 KET_050_02F_W	R32 KET_050_02F_W
R42 KUM_CDR_03M_W	BLANK	BLANK	BLANK

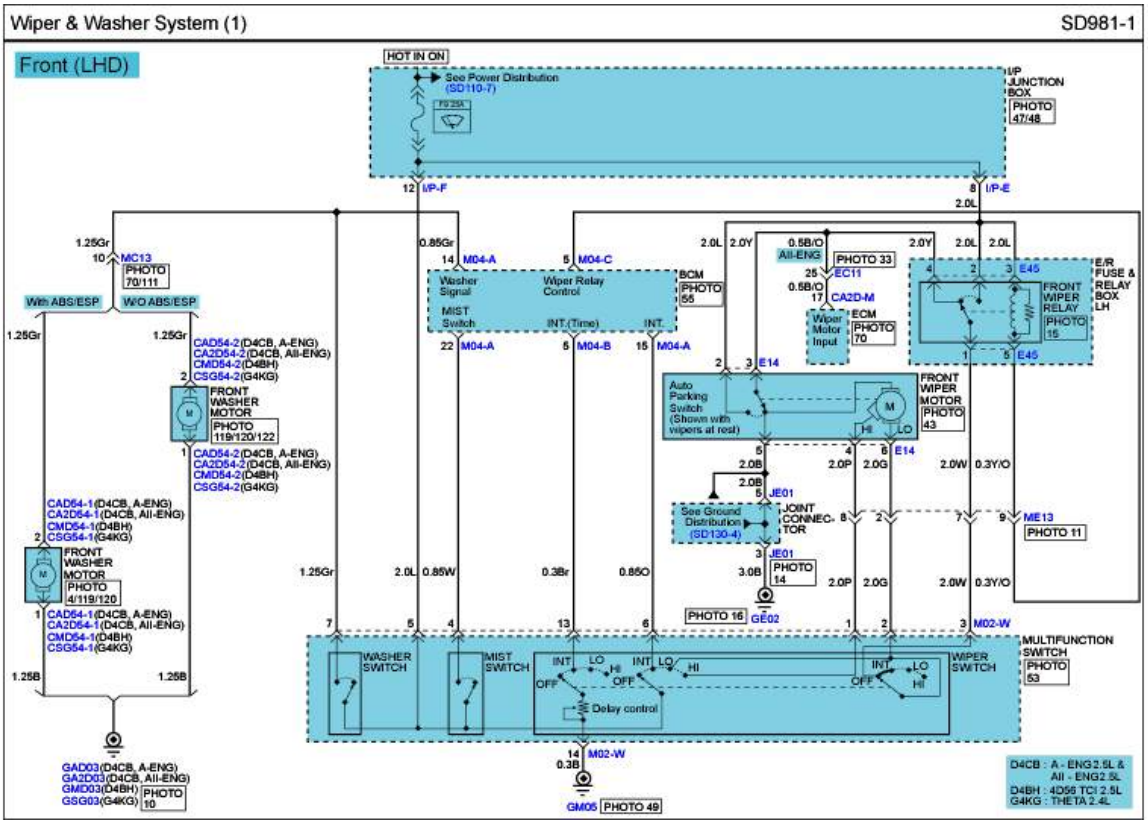

Turn & Hazard Lamps (1)
SD925-1
HOT AT ALL TIMES
HOT IN ON OR START
See Power Distribution (SD110-7)
I/P JUNCTION BOX PHOTO 48
See Illuminations (SD941-3)
HAZARD RELAY (With B/Alarm)
ICM CONTROL MODULE PHOTO 63
HAZARD SWITCH PHOTO 59
ON OFF
ILL
FLASHER UNIT
Power
Coil control
Ground
To Rear Combination Lamp LH/RH (SD925-2)
LHD
RHD
M02-L (LHD Type)
M02-LR (RHD Type)
MULTIFUNCTION SWITCH PHOTO 53
TURN SIGNAL SWITCH
RIGHT
LEFT
BCM PHOTO 55
Hazard Relay Control
GM05 PHOTO 49

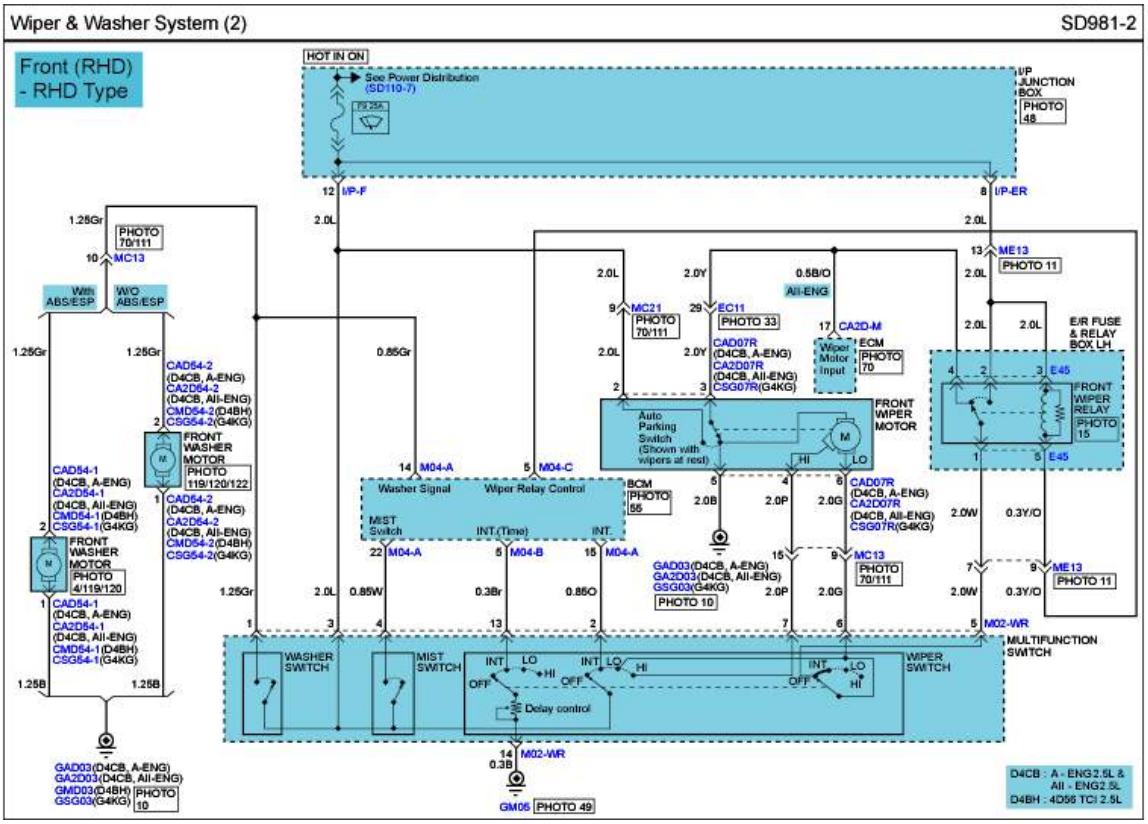
Turn & Hazard Lamps (2) SD925-2

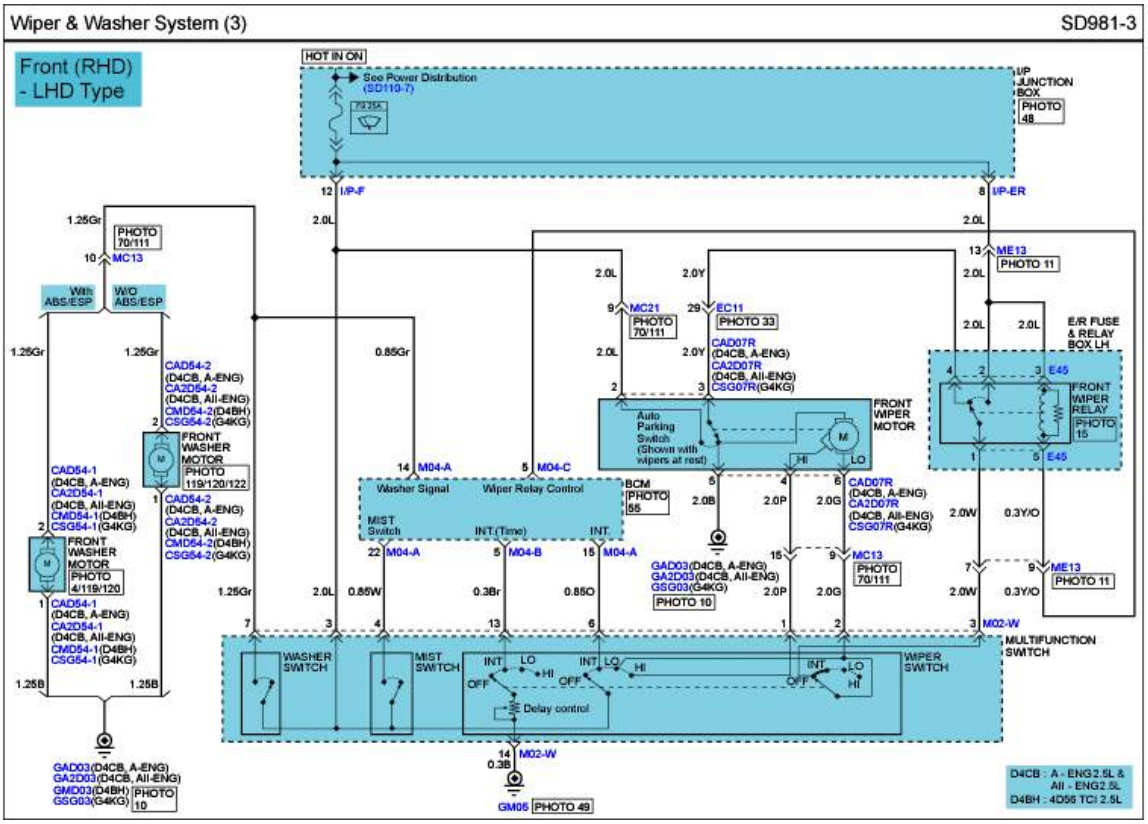


Turn & Hazard Lamps (3) — SD925-3

CAD69 KUM_62Z_02F_GR	CA2D69 KUM_62Z_02F_GR	CMD69 KUM_62Z_02F_GR	CSG69 KUM_62Z_02F_GR
E30 KUM_62Z_02F_GR	E69 KUM_NMWP_06F_B	E70 KUM_NMWP_06F_B	F33 KET_SWP_06F_B
F73 KET_SWP_06F_B	M01-A  AMP_025_24F_W	M01-B  AMP_040M1_16F_B	M02-L KET_0509_18F_W
M02-LR  KET_0509_18F_W	M04-C  AMP_040III_24F_Gr	M08-A  KET_1809_11F_W_UNIT	M08-B  KET_1809_21F_W_A
M39  KET_090III_10F_W	BLANK	BLANK	BLANK


Wiper & Washer System (1)
SD981-1
Front (LHD)
HOT IN ON
See Power Distribution (SD110-7)
F9 25A
I/P JUNCTION BOX PHOTO 47/48
12 I/P-F
8 I/P-E
2.0L
1.25Gr
10 MC13
PHOTO 70/111
With ABS/ESP
W/O ABS/ESP
CAD54-2(D4CB, A-ENG)
CA2D54-2(D4CB, AII-ENG)
CMD54-2(D4BH)
CSG54-2(G4KG)
FRONT WASHER MOTOR
PHOTO 119/120/122
CAD64-1(D4CB, A-ENG)
CA2D64-1(D4CB, AII-ENG)
CMD64-1(D4BH)
CSG64-1(G4KG)
FRONT WASHER MOTOR
PHOTO 4/119/120
1.25B
GAD03(D4CB, A-ENG)
GA2D03(D4CB, AII-ENG)
GMD03(D4BH)
GSG03(G4KG)
PHOTO 10
0.85Gr
14 M04-A
5 M04-C
Washer Signal
Wiper Relay Control
MIST Switch
INT.(Time)
INT.
BCM PHOTO 55
22 M04-A
5 M04-B
15 M04-A
2.0Y
0.5B/O
All-ENG
PHOTO 33
25 EC11
0.5B/O
17 CA2D-M
Wiper Motor Input
ECM PHOTO 70
E/R FUSE & RELAY BOX LH
FRONT WIPER RELAY PHOTO 15
E45
2 3 E14
Auto Parking Switch (Shown with wipers at rest)
FRONT WIPER MOTOR PHOTO 43
HI
LO
5 4 6 E14
2.0B
2.0P
2.0G
2.0W
0.3Y/O
5 JE01
See Ground Distribution (SD130-4)
JOINT CONNEC- TOR
8 2 7 9 ME13
PHOTO 11
3 JE01
3.0B
PHOTO 14
PHOTO 16 GE02
1.25Gr
2.0L
0.85W
0.3Br
0.85O
7 5 4 13 6 1 2 3 M02-W
MULTIFUNCTION SWITCH PHOTO 53
WASHER SWITCH
MIST SWITCH
INT
LO
HI
OFF
Delay control
WIPER SWITCH
14 M02-W
0.3B
GM05 PHOTO 49
D4CB : A - ENG 2.5L & AII - ENG 2.5L
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L


Wiper & Washer System (2)
SD981-2
Front (RHD)
- RHD Type
HOT IN ON
See Power Distribution (SD110-7)
F9 25A
I/P JUNCTION BOX
PHOTO 48
I/P-F
I/P-ER
PHOTO 70/111
MC13
With ABS/ESP
W/O ABS/ESP
CAD54-2 (D4CB, A-ENG)
CA2D54-2 (D4CB, AII-ENG)
CMD54-2(D4BH)
CSG54-2(G4KG)
FRONT WASHER MOTOR
PHOTO 119/120/122
CAD54-1 (D4CB, A-ENG)
CA2D54-1 (D4CB, AII-ENG)
CMD54-1(D4BH)
CSG54-1(G4KG)
FRONT WASHER MOTOR
PHOTO 4/119/120
GAD03(D4CB, A-ENG)
GA2D03(D4CB, AII-ENG)
GMD03(D4BH)
GSG03(G4KG)
PHOTO 10
M04-A
M04-C
Washer Signal
Wiper Relay Control
MIST Switch
INT.(Time)
INT.
BCM
PHOTO 55
M04-B
GAD03(D4CB, A-ENG)
GA2D03(D4CB, AII-ENG)
GSG03(G4KG)
PHOTO 10
MC21
PHOTO 70/111
EC11
PHOTO 33
All-ENG
CA2D-M
Wiper Motor Input
ECM
PHOTO 70
CAD07R (D4CB, A-ENG)
CA2D07R (D4CB, AII-ENG)
CSG07R(G4KG)
Auto Parking Switch (Shown with wipers at rest)
FRONT WIPER MOTOR
HI
LO
MC13
PHOTO 70/111
ME13
PHOTO 11
E/R FUSE & RELAY BOX LH
E45
FRONT WIPER RELAY
PHOTO 15
M02-WR
MULTIFUNCTION SWITCH
WASHER SWITCH
MIST SWITCH
WIPER SWITCH
INT
LO
HI
OFF
Delay control
GM06
PHOTO 49
D4CB : A - ENG2.5L & AII - ENG2.5L
D4BH : 4D56 TCI 2.5L


Wiper & Washer System (3)
SD981-3
Front (RHD)
- LHD Type
HOT IN ON
See Power Distribution (SD110-7)
F9 25A
I/P JUNCTION BOX
PHOTO 48
12 I/P-F
8 I/P-ER
1.25Gr
PHOTO 70/111
10 MC13
With ABS/ESP
W/O ABS/ESP
CAD54-2 (D4CB, A-ENG) CA2D54-2 (D4CB, AII-ENG) CMD54-2(D4BH) CSG54-2(G4KG)
FRONT WASHER MOTOR
PHOTO 119/120/122
CAD54-1 (D4CB, A-ENG) CA2D54-1 (D4CB, AII-ENG) CMD54-1(D4BH) CSG54-1(G4KG)
FRONT WASHER MOTOR
PHOTO 4/119/120
1.25B
GAD03(D4CB, A-ENG) GA2D03(D4CB, AII-ENG) GMD03(D4BH) GSG03(G4KG) PHOTO 10
2.0L
0.85Gr
14 M04-A
5 M04-C
Washer Signal
Wiper Relay Control
MIST Switch
INT.(Time)
INT.
BCM PHOTO 55
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29 EC11 PHOTO 33
CAD07R (D4CB, A-ENG) CA2D07R (D4CB, AII-ENG) CSG07R(G4KG)
Auto Parking Switch (Shown with wipers at rest)
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LO
2.0B
2.0P
2.0G
15 9 MC13 PHOTO 70/111
13 ME13 PHOTO 11
E/R FUSE & RELAY BOX LH
E45
FRONT WIPER RELAY PHOTO 15
2.0W
0.3Y/O
7 9 ME13 PHOTO 11
M02-W
MULTIFUNCTION SWITCH
WASHER SWITCH
MIST SWITCH
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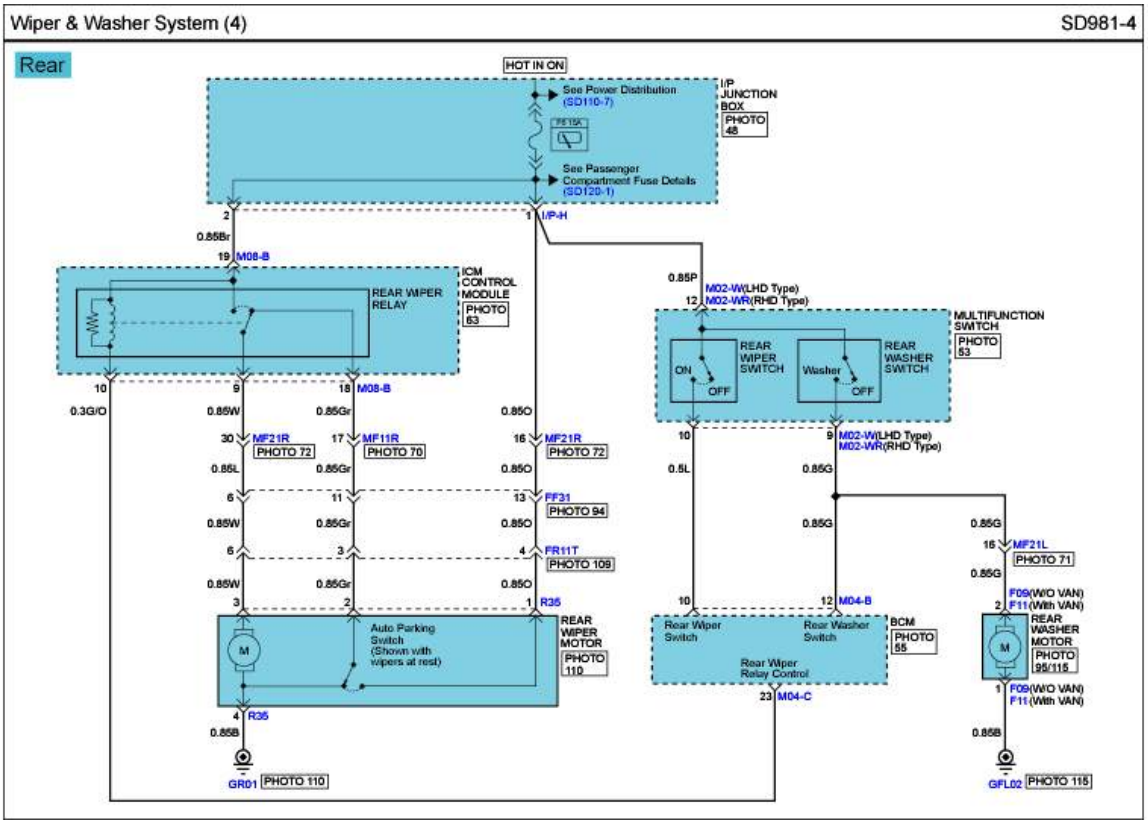
14 M02-W
0.3B
GM05 PHOTO 49
D4CB : A - ENG2.5L & AII - ENG2.5L
D4BH : 4D56 TCI 2.5L


Wiper & Washer System (4)
SD981-4
Rear
HOT IN ON
See Power Distribution (SD110-7)
I/P JUNCTION BOX
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See Passenger Compartment Fuse Details (SD120-1)
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PHOTO 53
REAR WIPER RELAY
M02-W(LHD Type)
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REAR WIPER SWITCH
REAR WASHER SWITCH
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OFF
Washer
MF21R
PHOTO 72
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R35
REAR WIPER MOTOR
PHOTO 110
Auto Parking Switch (Shown with wipers at rest)
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Rear Wiper Switch
Rear Washer Switch
Rear Wiper Relay Control
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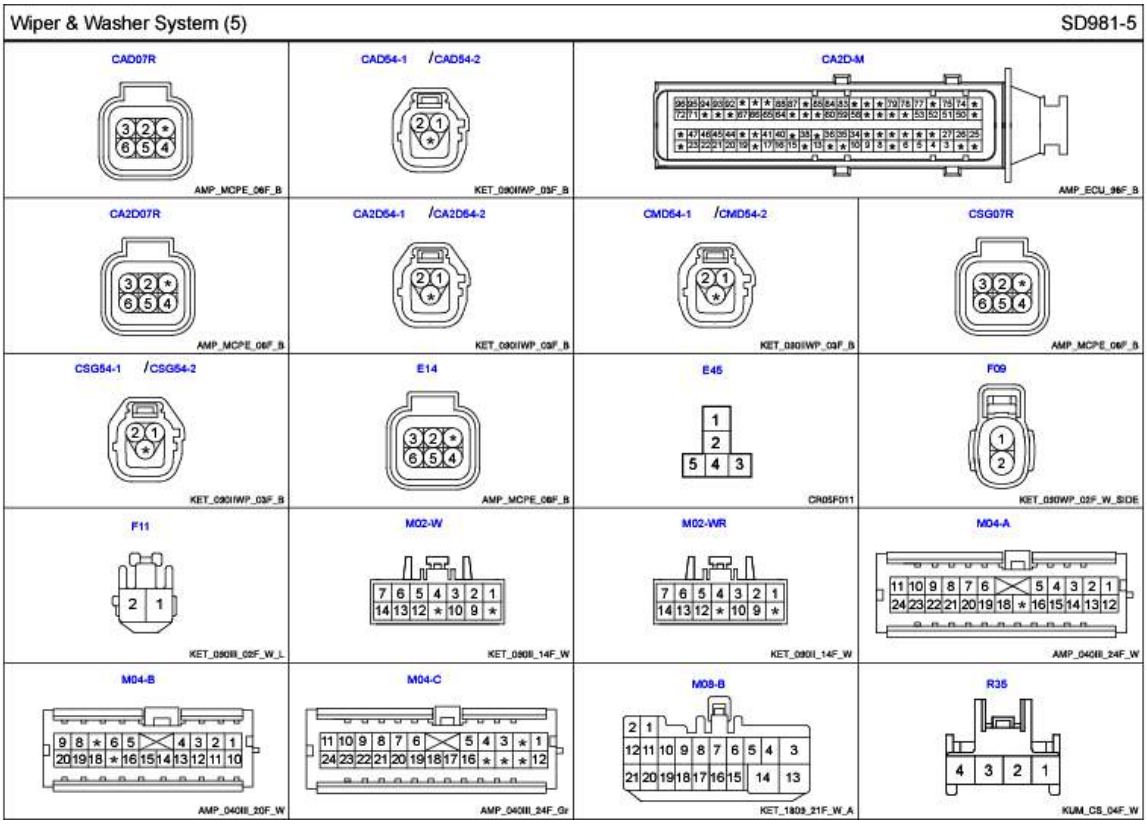
M04-C
MF21L
PHOTO 71
F09(W/O VAN)
F11(With VAN)
REAR WASHER MOTOR
PHOTO 95/115
GFL02
PHOTO 115


Wiper & Washer System (5)
SD981-5
CAD07R
AMP_MCPE_06F_B
CAD54-1 /CAD54-2
KET_090IWP_03F_B
CA2D-M
AMP_ECU_96F_B
CA2D07R
AMP_MCPE_06F_B
CA2D54-1 /CA2D54-2
KET_090IWP_03F_B
CMD64-1 /CMD54-2
KET_090IWP_03F_B
CSG07R
AMP_MCPE_06F_B
CSG54-1 /CSG54-2
KET_090IWP_03F_B
E14
AMP_MCPE_06F_B
E45
CR05F011
F09
KET_090WP_02F_W_SIDE
F11
KET_090III_02F_W_L
M02-W
KET_090II_14F_W
M02-WR
KET_090II_14F_W
M04-A
AMP_040III_24F_W
M04-B
AMP_040III_20F_W
M04-C
AMP_040III_24F_Gr
M08-B
KET_180II_21F_W_A
R35
KUM_CS_04F_W

HYUNDAI

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H-1

Body Repair Manual

FOREWORD

This Body Repair Manual provides detailed repair procedures for repair of commonly damaged structural panels on the 2008 H-1(TQ). To aid in the information of the damaged vehicle, body construction, body dimensions, Body Panel Repair Procedure, Body Sealing Locations, Corrosion Protection, Body Modification Tools and Plastic Parts are contained herein.

The repair procedures specify locations where body members may be structurally sectioned.

All of the repair procedures have been performed on H-1(TQ) body shells and that is currently available in most auto body repair shops.

The repair procedures illustrated in this manual were developed to simplify body repair in order to reduce insurance costs, and indirectly, cost of ownership.

The vehicle should not be sectioned in locations other than those illustrated in this repair manual. Furthermore, these repair procedures DO NOT apply to any other vehicle. The individuals performing the work must assume full responsibility for the quality of their workmanship.

We believe this manual to be helpful for Hyundai dealers, and anticipate it to be effectively used for Hyundai vehicle bodies.

For the services of other than collision-damaged body parts of the H-1(TQ), refer to the H-1(TQ) shop manual.

The illustrations and descriptive text in this manual were corrected at the time of printing.

It is the policy of HYUNDAI MOTOR COMPANY to continuously improve its products.

Specifications and procedures are subject to change at any time without notice.

August 2007, Printed in Korea

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General Information	GI
Body Construction	BC
Body Dimensions	BD
Body Panel Repair Procedure	BP
Body Sealing Locations	BS
Corrosion Protection	CP
Body Modification Tools	BT
Plastic Parts	PP

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IMPORTANT SAFETY NOTICE

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

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

IN THIS MANUAL

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

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

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

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

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

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GENERAL GUIDE LINES AND PRECAUTIONS

The H-1 is a completely new vehicle design. During its development, close attention has been given to safety, stability, weight and corrosion protection. Typical of unit body design, the H-1 is designed so that the front and rear compartments will absorb much of the collision energy so that the passengers are better protected. During collisions, these front and rear energy absorbing systems may be severely damaged. During repair, these damaged areas must be returned to their original strength and geometry. If this is not properly done, the vehicle will not provide the intended level of protection to its occupants in the event of another collision.

The repairs described in this manual were performed on H-1 body shells. In some instances special fixtures were welded in place to support the structure. During the repair of an actual vehicle, the interior would be fully disassembled and standard jack screws or portable braces may be used for temporary support.

During the repair of an accident involved vehicle, the vehicle must first be returned to pre-impact dimensions prior to beginning the sectioning repair procedures. The extent of damage that must be repaired should then be evaluated to determine the appropriate repair procedures. This manual provides locations and procedures where structural sectioning may be employed. It is the responsibility of the repair technician, based upon the extent of damage, to determine which location and procedure is suitable for the particular damaged vehicle.

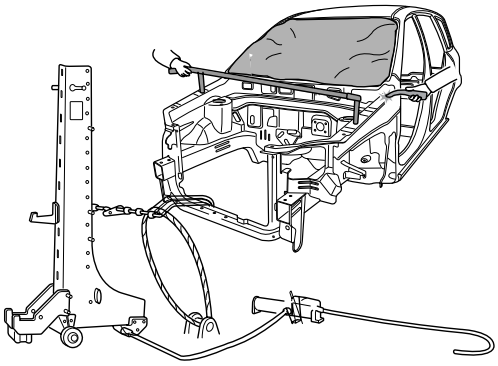
During the repair of a collision damaged automobile, it is impossible to fully duplicate the methods used in the factory during the vehicle manufacture. Therefore, auto body repair techniques have been developed to provide a repair that has strength properties equivalent to those of the original design and manufacture.

FUNDAMENTAL PROCEDURES

VEHICLE PROTECTION

1. Cover the seats before performing any procedure to keep them from getting dirty.

2. Cover all glasses, seats and mats with a heat resistant cover when welding.



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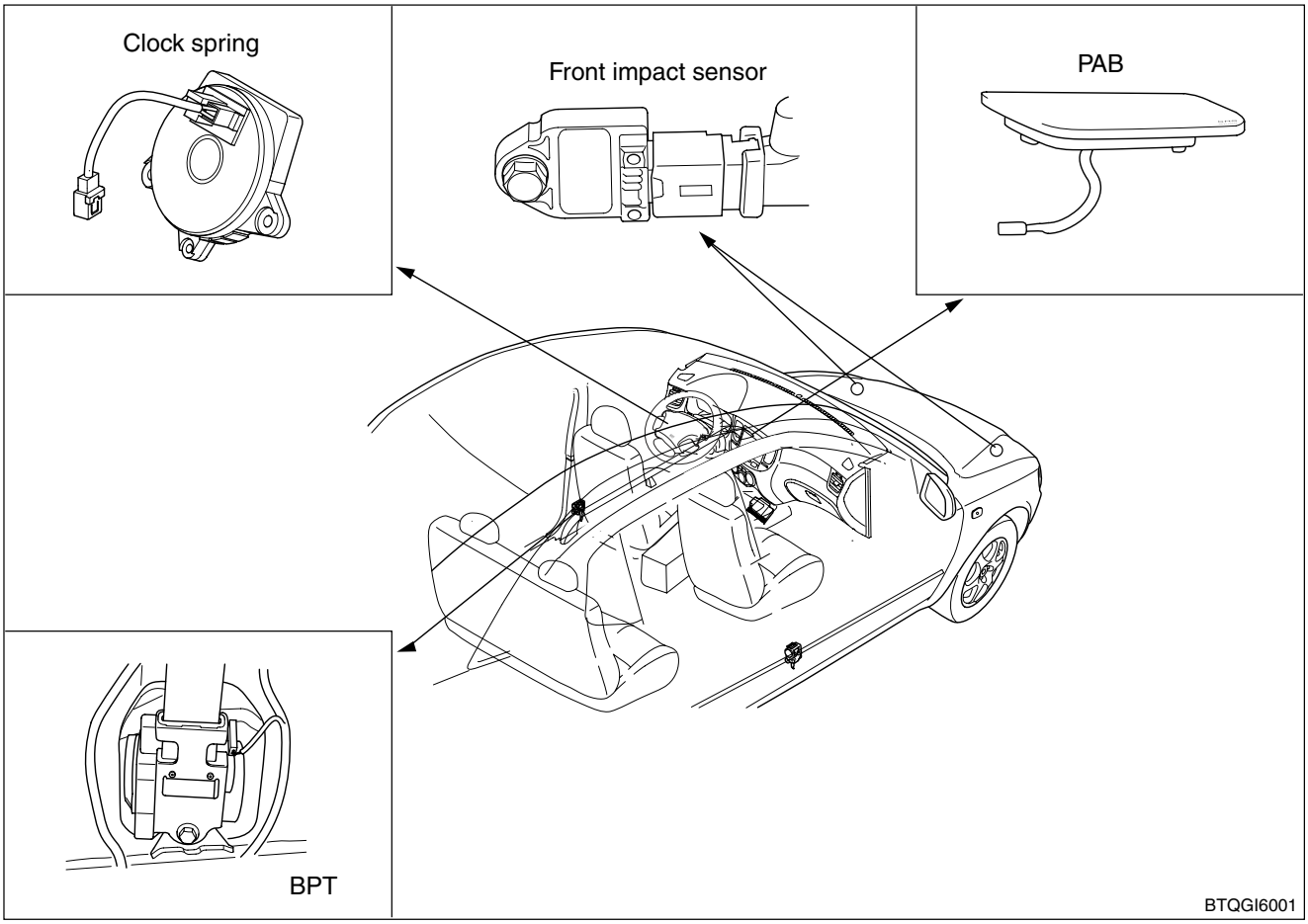
3. Protect moldings, garnishes and ornaments.

SAFETY FACTORS

1. Disconnect the negative(-) battery cable before performing any work on the vehicle.
2. Protect yourself by wearing goggles, earplugs, respirators, gloves, safety shoes, caps, etc. when working on a vehicle.
3. Safely support the vehicle before any work is done. Block the front or rear wheels if the vehicle is not lifted off of the ground.
4. When welding or performing other procedures that require the use of an open flame near the fuel tank, disconnect and remove the tank and fuel pipe, and cap the pipe to prevent fuel leakage.
5. Insure proper ventilation of your working area. Some paint and sealant can generate toxic gases when heated. Use an air chisel or saw to remove damaged panels instead of a gas torch.
6. Observe all local and national safety regulations when performing any work.
7. Cover interior with heat-resistant cover to insure safety when welding.
8. Take care when using gas or cutting torches so as not to burn body sealer or interior. Extinguish immediately if they should catch fire.

SRS AIR-BAG



The H-1 is equipped with a Supplemental Restraint System AIR-BAG to provide the vehicle's driver and/or the front passenger with additional protection than that offered by the seat-belt system alone, in case of a frontal impact of sufficient severity.

When handling airbag components (removal, installation or inspection, etc.), always follow the directions given in the repair manual for the relevant model to prevent the occurrence of accidents and airbag malfunction.

Also take the following precautions when repairing the body:

1. Work must be started after approximately 30 seconds or longer from the time 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 of disconnecting the negative (-) terminal cable of the battery, the airbag may be deployed.)
   When the negative(-) terminal cable is disconnected from the battery, memory of the clock and audio systems will be cancelled. So before starting work, make a record of the contents memorized by the audio memory system. Then when work is finished, reset the audio system as before and adjust the clock.
2. When using electric welding, first disconnect the air-bag connectors under the steering column near the MULTI-FUNCTION SWITCH and the passenger's side crash pad before starting work.
3. Store the air-bag modules where the ambient temperature remains below 93 C°(200 F°), without high humidity and away from electrical noise.
4. WARNING/CAUTION labels are attached to the periphery of the air-bag components.
   Refer to the H-1 SHOP MANUAL.

WELDING

All repairs in this manual require the use of a Metal-Inert Gas (MIG) welder, Gas (oxyacetylene) welding must not be used. Both high strength steel and mild steel can be welded using the MIG welder. The I-CAR recommendations for welding should be followed. The shielding gas should be 75% Argon and 25% CO_2.
The recommended welding wire size is 0.23" and the wire should satisfy the American Welding Society standard code AWSER70S-6.

During the repair process, plug welds are used to duplicate original factory spot welds. All plug welds should be done with the MIG welder. An 8 mm (5/16") hole is placed in the top (welding side) sheetmetal.

You then begin welding along the edges and the spiral towards the center (see illustration). This is important so that weld penetration between the two metal pieces takes place along the circumference of the circle.

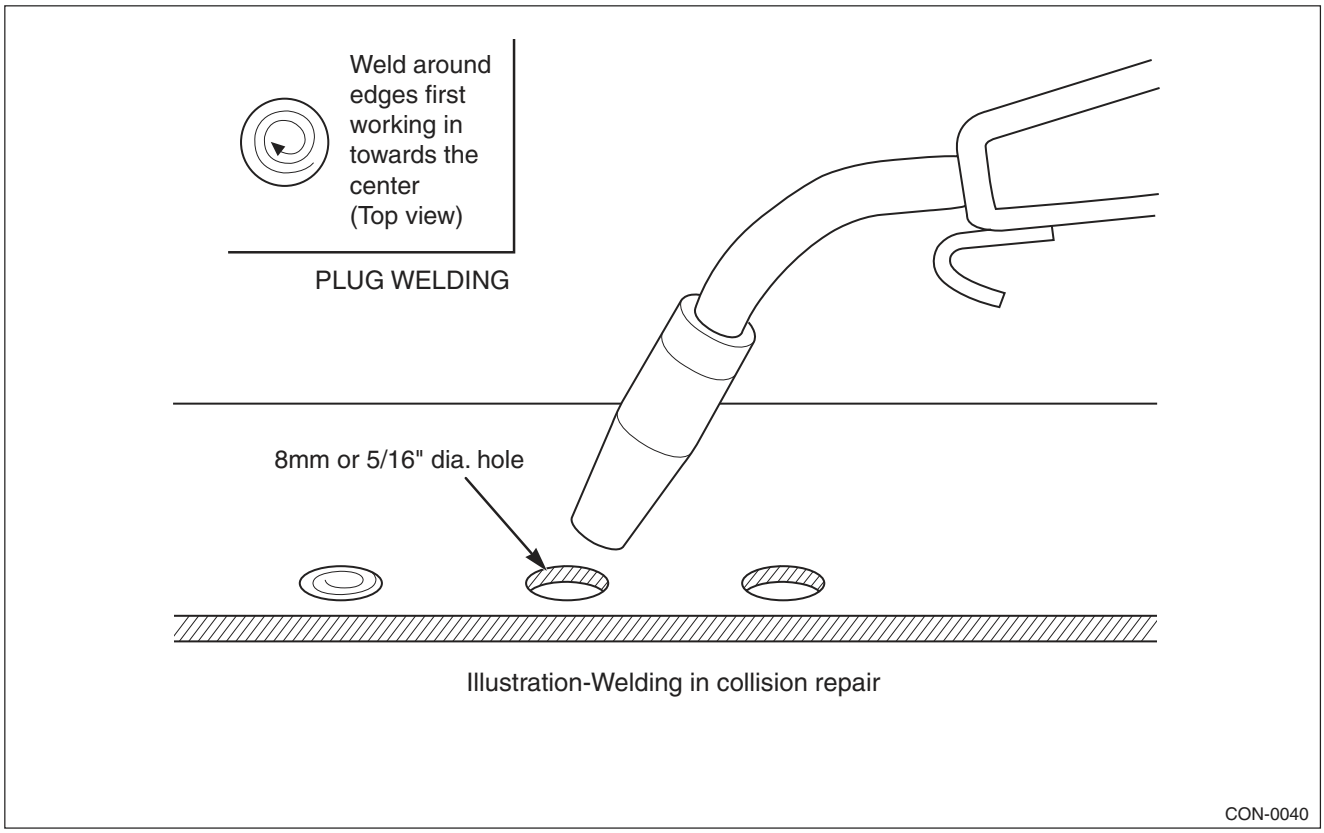


Illustration-Welding in collision repair

Observe the following tips when welding.
1. Wear appropriate eye protection.

2. Carefully follow the manufacturers operating instructions for the welding machine you are using.

3. Do not weld, smoke or allow open flames around volatile chemicals, cleaners or solvents or in any area where they have just been used.

BODY FRAME STRAIGHTENER

When using a frame straightener, do not enter the area where the body is being straightened by the chain.

ELECTRONIC PARTS

Vehicles today include a great many electronic parts and components, and these are in general very susceptible to adverse effects caused by overcurrent, reverse current, electromagnetic waves, high temperature, high humidity impacts, etc.
In particular such electronic components can be damaged if there is a large current flow during welding from the body side.
Therefore, take the following precautions during body repair to prevent damage to the CONTROL MODULES (ECM, TCM, ABS CM, SRS CM, etc.)

1. Before removing and inspecting the electrical parts or before starting electric welding operations, disconnect the negative (-) terminal cable from the battery.
2. Do not expose the CONTROL MODULES to ambient temperatures above 80°C (176°F).

   NOTE

   If it is possible the ambient temperatures may reach 80°C (176°F) or more, remove the CONTROL MODULES from the vehicle before starting work.

3. Be careful not to drop the CONTROL MODULES and not to apply physical shocks to them.

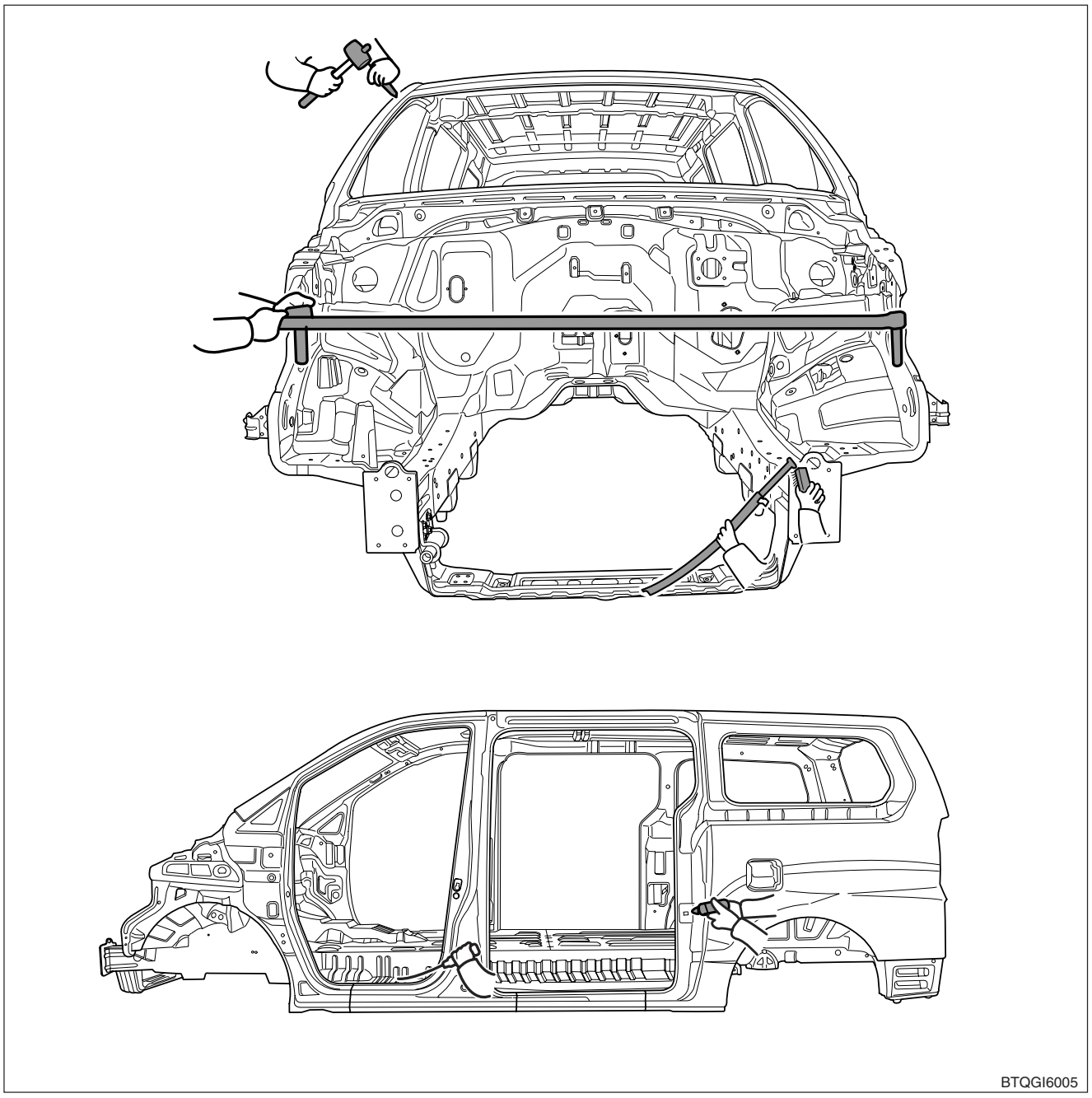
FOR BEST RESULTS

REMOVAL

Measuring dimensions before beginning
Measure the dimensions of the damaged area according to the body dimension drawings before removing and repairing. Adjust dimensions with body frame adjuster if deformed.

Selecting cutting area
Select a cutting area that is easily accessible and that is prone to the least amount of distortion when welding. Select an area that would allow the new part to overlap repair area by 30~50 mm (1.2~2.0 in) .

Protecting body from damage
Secure the body with clamps and jacks to prevent damage to the body when working on it.

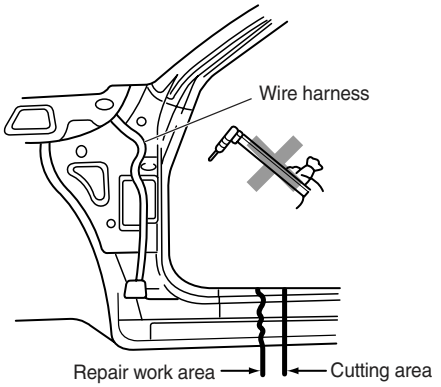


Removing

Use caution when removing body molding and trim from the area to be worked.

Apply masking tape where needed to prevent damage to the part being removed or to the vehicle body.

Before starting repairs, check if pipes, hoses or electrical components are present near damaged area.



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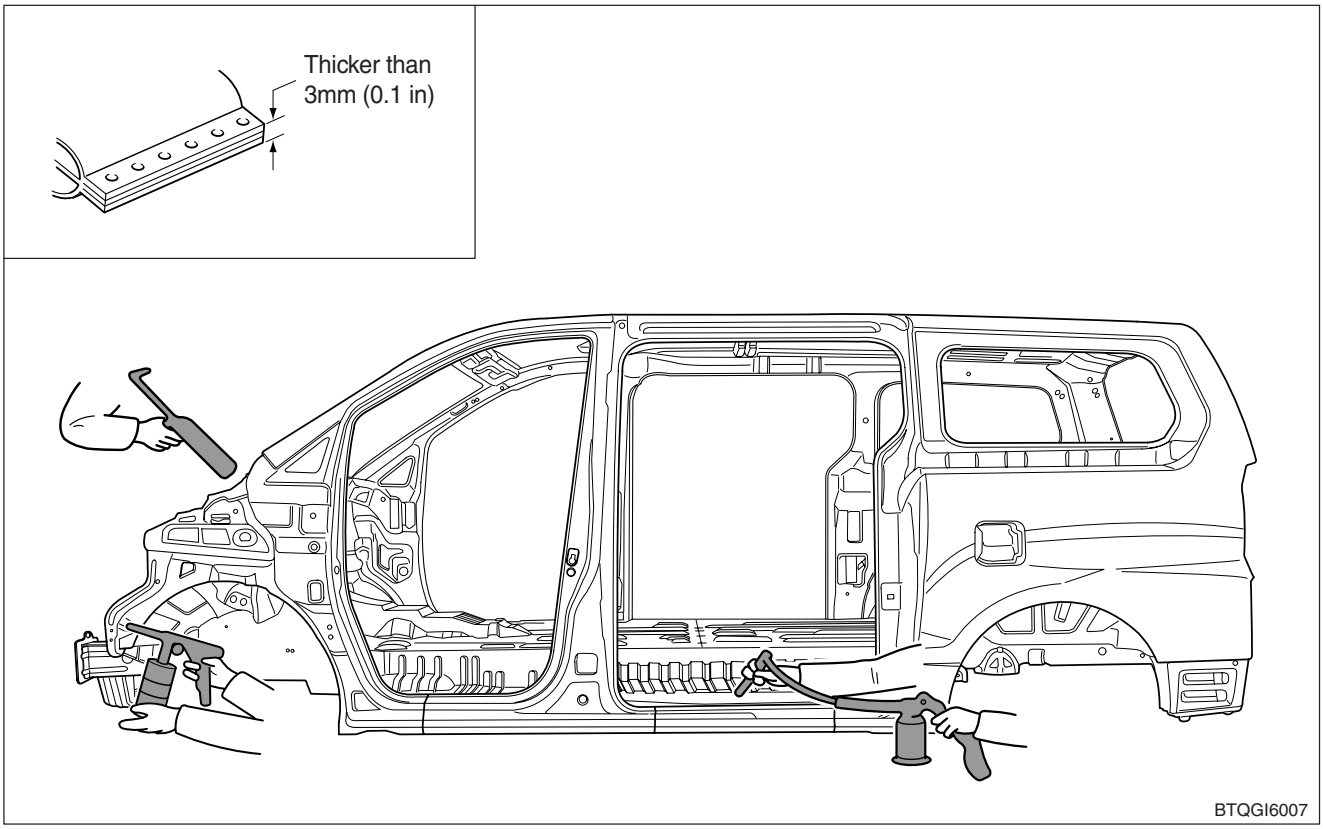
PREPARATION OF INSTALLATION

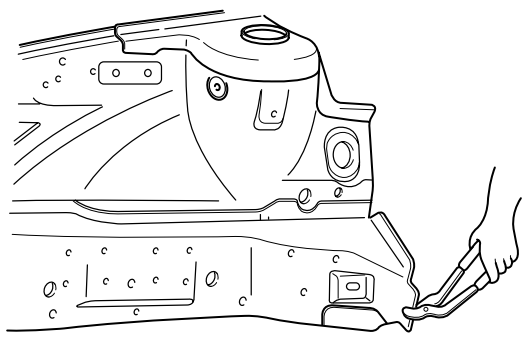
Applying spot sealer
Remove paint from the surface of new parts and body to be spot welded, and apply spot sealer for rustproofing.

Selecting a welding method
If the thickness of the area to be welded with the panels overlapped is greater than 3 mm (0.1 in), do plug welding using a carbon arc welding machine.

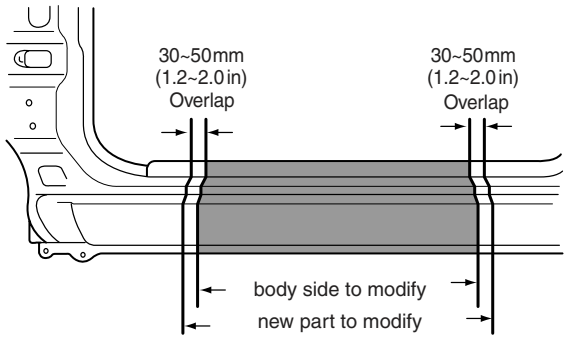
Protecting body from damage
Secure the body with clamps and jacks to prevent damage to the body when working on it.



Machining holes for plug welding
Drill a hole of approximately 5~6 mm (0.2~0.24 in) in diameter in those areas which are not suitable for spot welding.



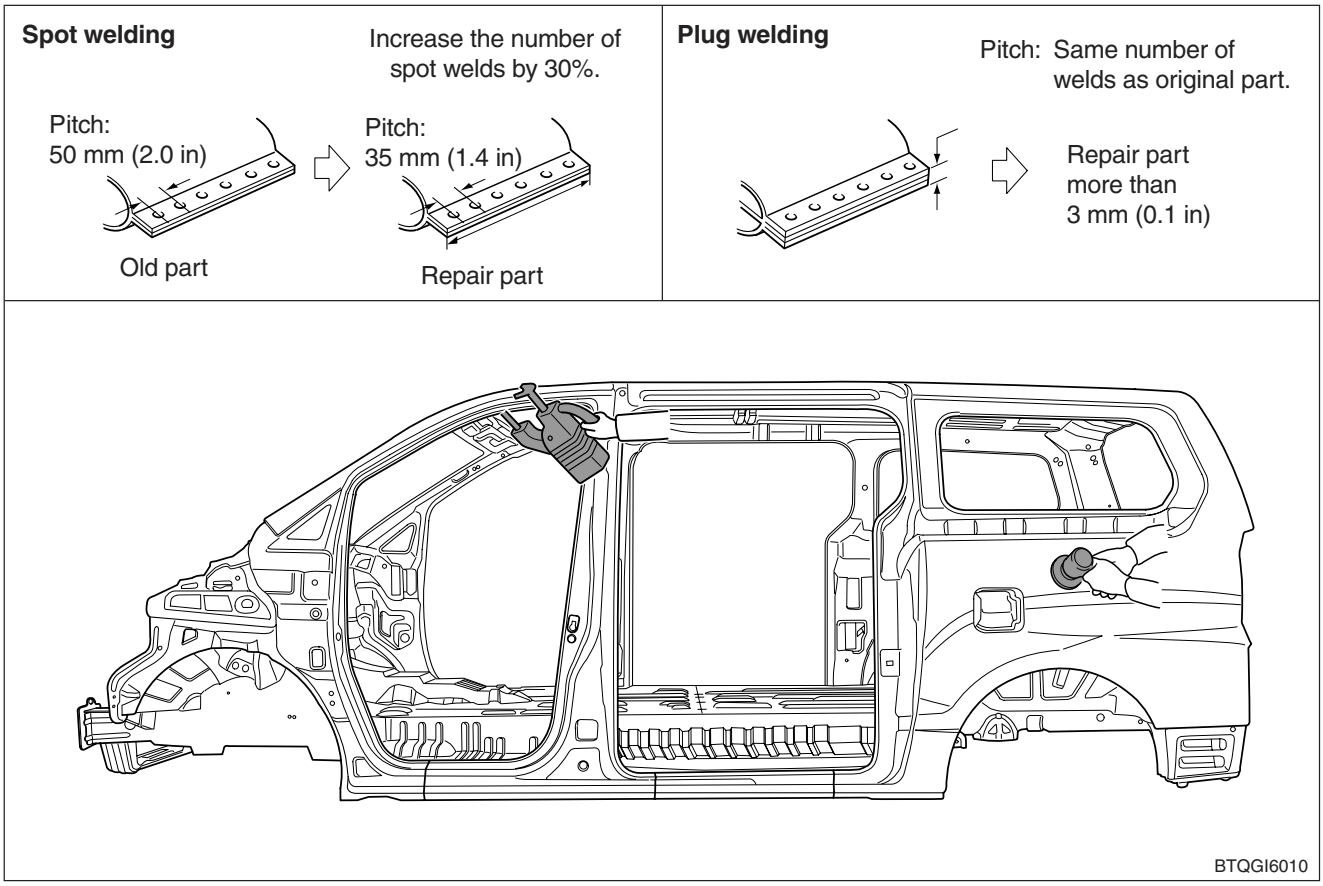
Adjusting a new part
The new part should be cut larger than the repair area, overlapping the repair area by 30~50 mm (1.2~2.0 in).



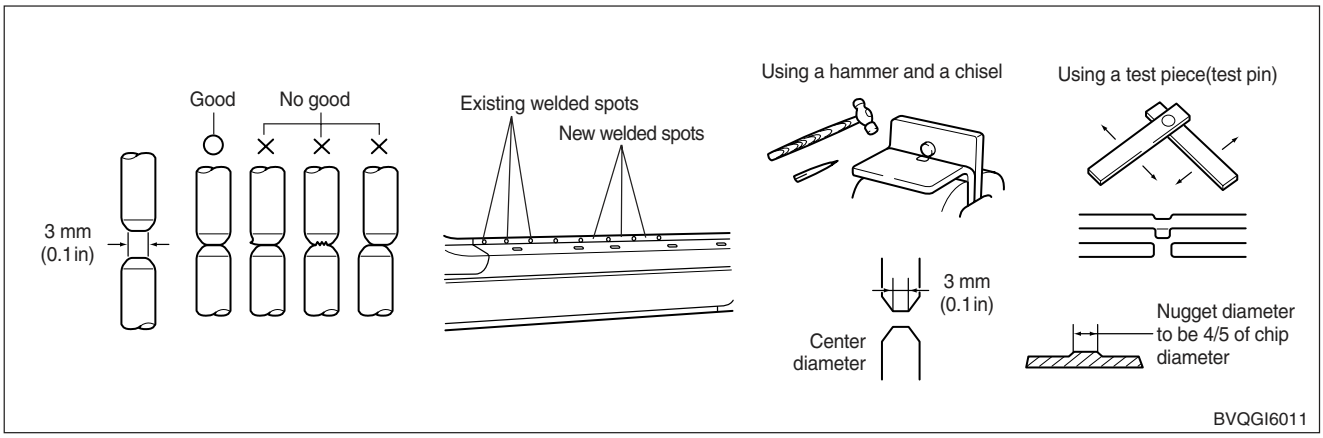
INSTALLATION

Measuring dimensions before welding
When installing a new part, assemble it according to the body dimensions given in Section BD, and start welding after checking the gaps with nearby parts.

Caution when welding
The number of welding points should be determined based on the criteria below:



Caution when spot welding
The tip of the spot welding machine should be maintained to a minimum of 3 mm (0.1 in) because it greatly affects welding strength. When possible, spot welding should be done between the existing spot welded points.
Before and after spot welding, weld a test piece(test pin) of the same material as the body panel, and check the welding strength.



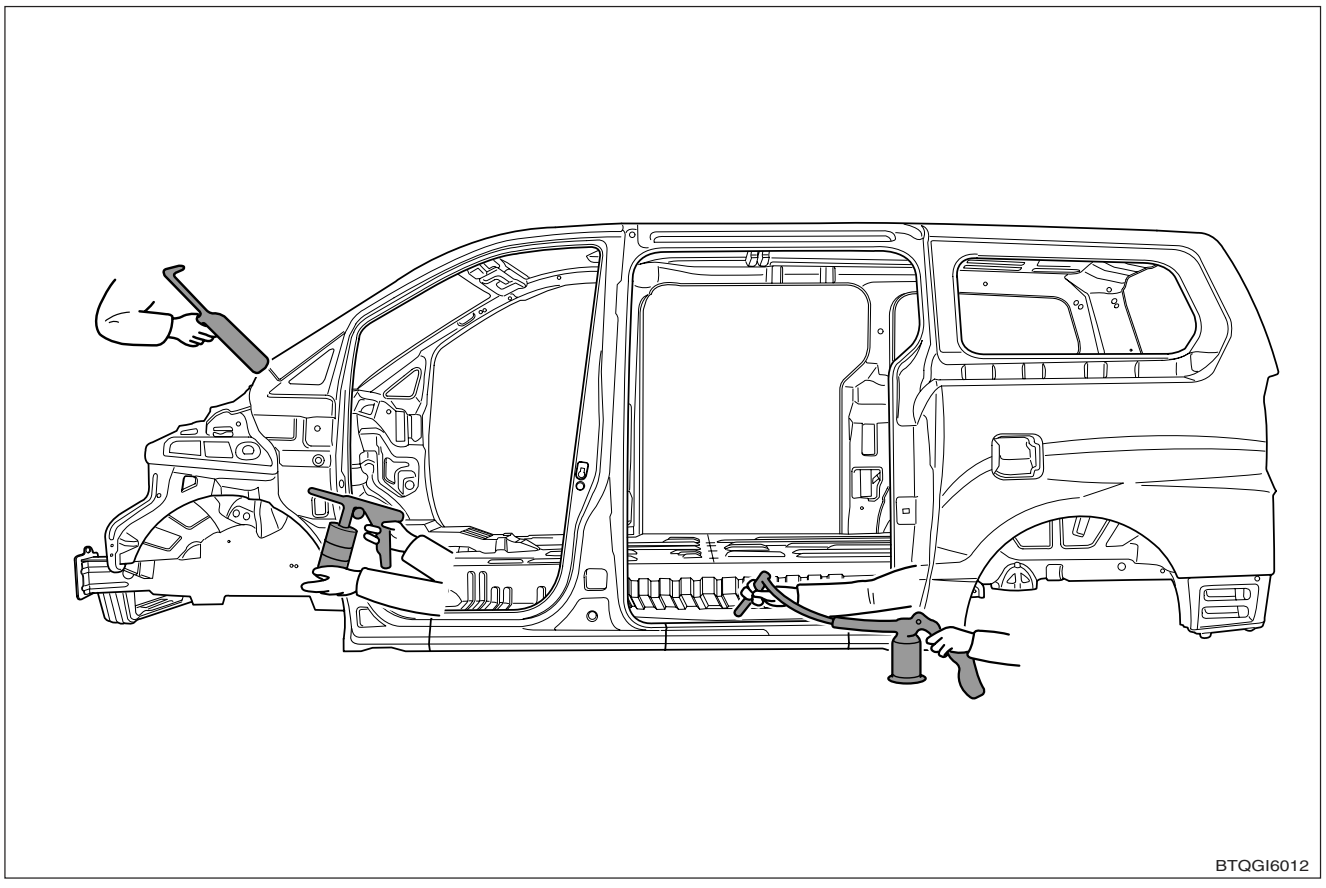
CORROSION PROTECTION AND SEALING

Proper corrosion protection and sealing is an important part of any repair. When reviewing these repair procedures, it is important to recognize the need for corrosion restoration to provide for long term strength of the repaired member.

A two part epoxy primer was applied to the metal surfaces during the latter part of the repair. For closed sections, such as front and rear rails, rocker panels and pillars, the primer is applied without applying the metal conditioner and the conversion coating. These steps are omitted to insure that no rinse water is trapped in the closed sections. The primer application in followed by an application of an oil or wax based rust proofing material.

After the corrosion restoration process for the closed sections are completed, then the process can be applied to all exterior sections. For exterior surfaces, both metal conditioner and conversion coating treatments are applied to the exterior surface prior to application of the epoxy primer. The procedure in applying the corrosion restoration process is important order to insure that moisture, due to the water rinsing of the metal conditioner and conversion coating is not inadvertently trapped inside any closed section before the epoxy primer and rust proofing materials have been applied.

Appropriate seam sealers are then applied to all joints. Follow manufacturer's recommendations for the appropriate type of seam sealer to be used at each seam or joint.



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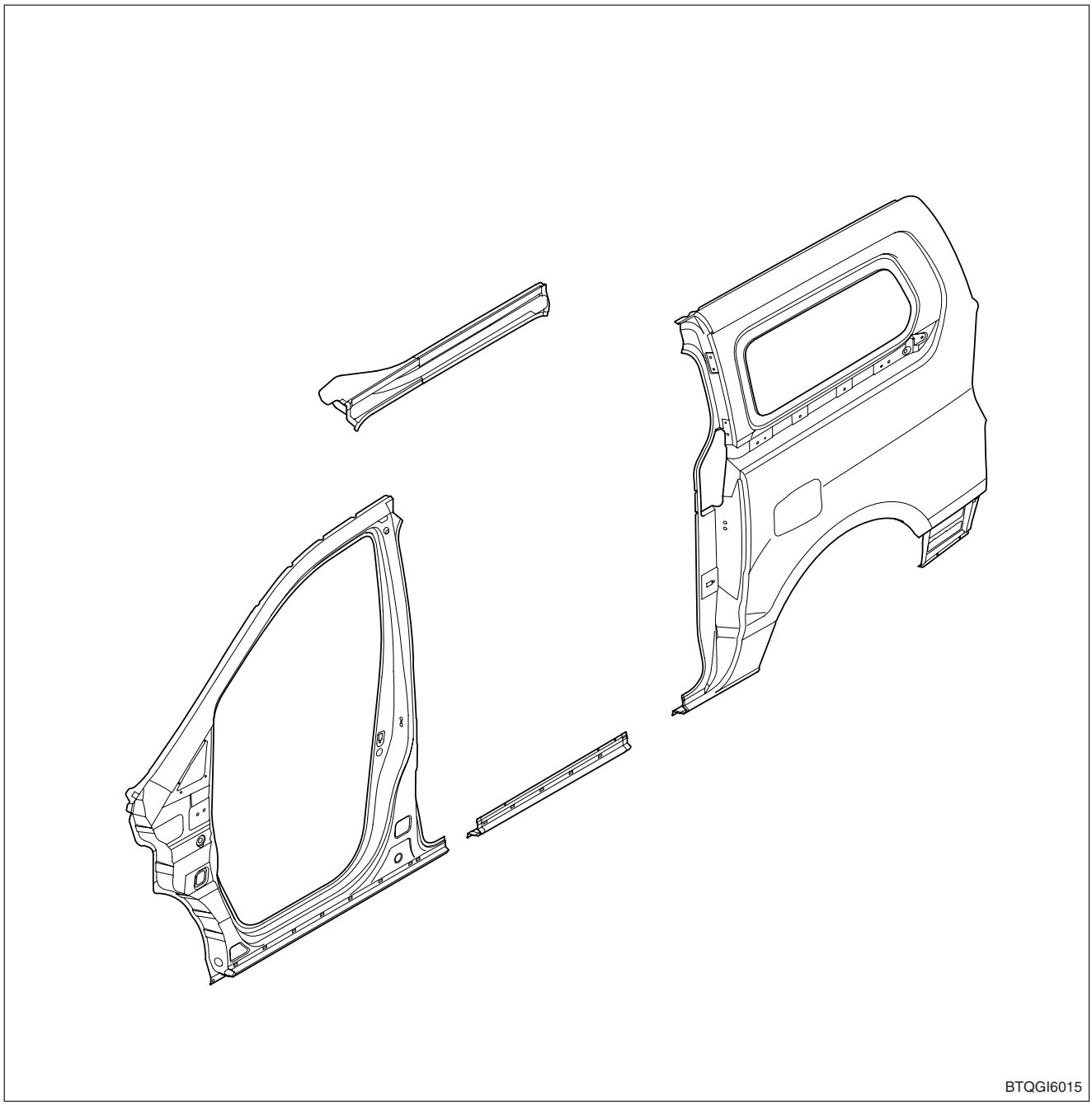
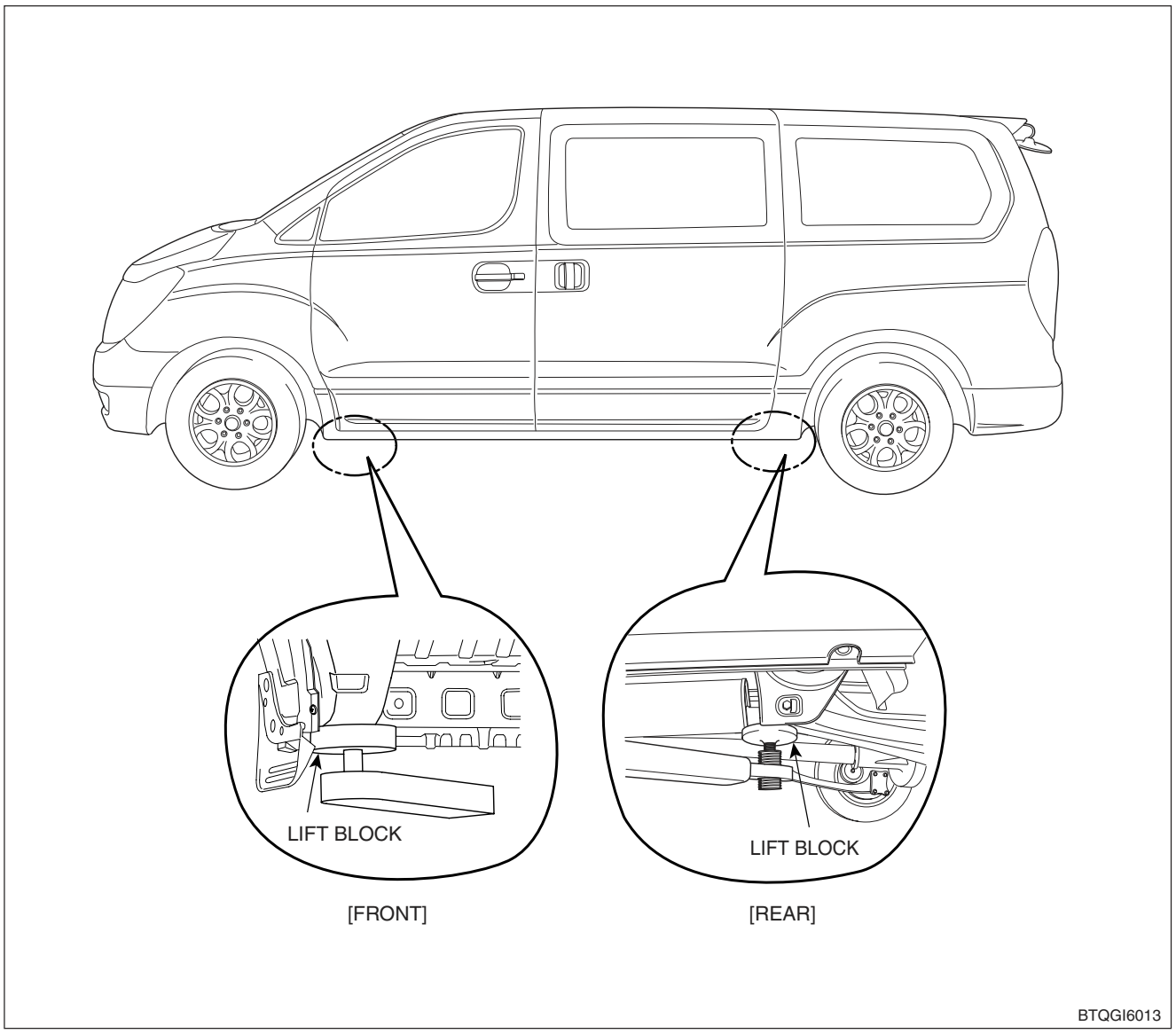
SIDE BODY PANELS

The side body panel for H-1 S is designed and stamped from a single piece of sheet metal in factory as shown in the figure. While the entire side panel is available for service, the partial panels sectioned by several damaged areas are also available. Therefore when repairing side body, refer to "Replacement parts section" of this manual to select and use the appropriate part.



VEHICLE LIFT (2-SUPPORT TYPE) AND SAFETY STAND POSITIONS

1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height to inspect the lift points for secure support.



Body Construction

FRONT SIDE MEMBER ..... BC - 2

REAR SIDE MEMBER ..... BC - 5

FENDER APRON PANEL(RH) ..... BC - 9

FENDER APRON PANEL(LH) ..... BC -11

DASH PANEL ..... BC -13

SIDE BODY PANEL ..... BC -17

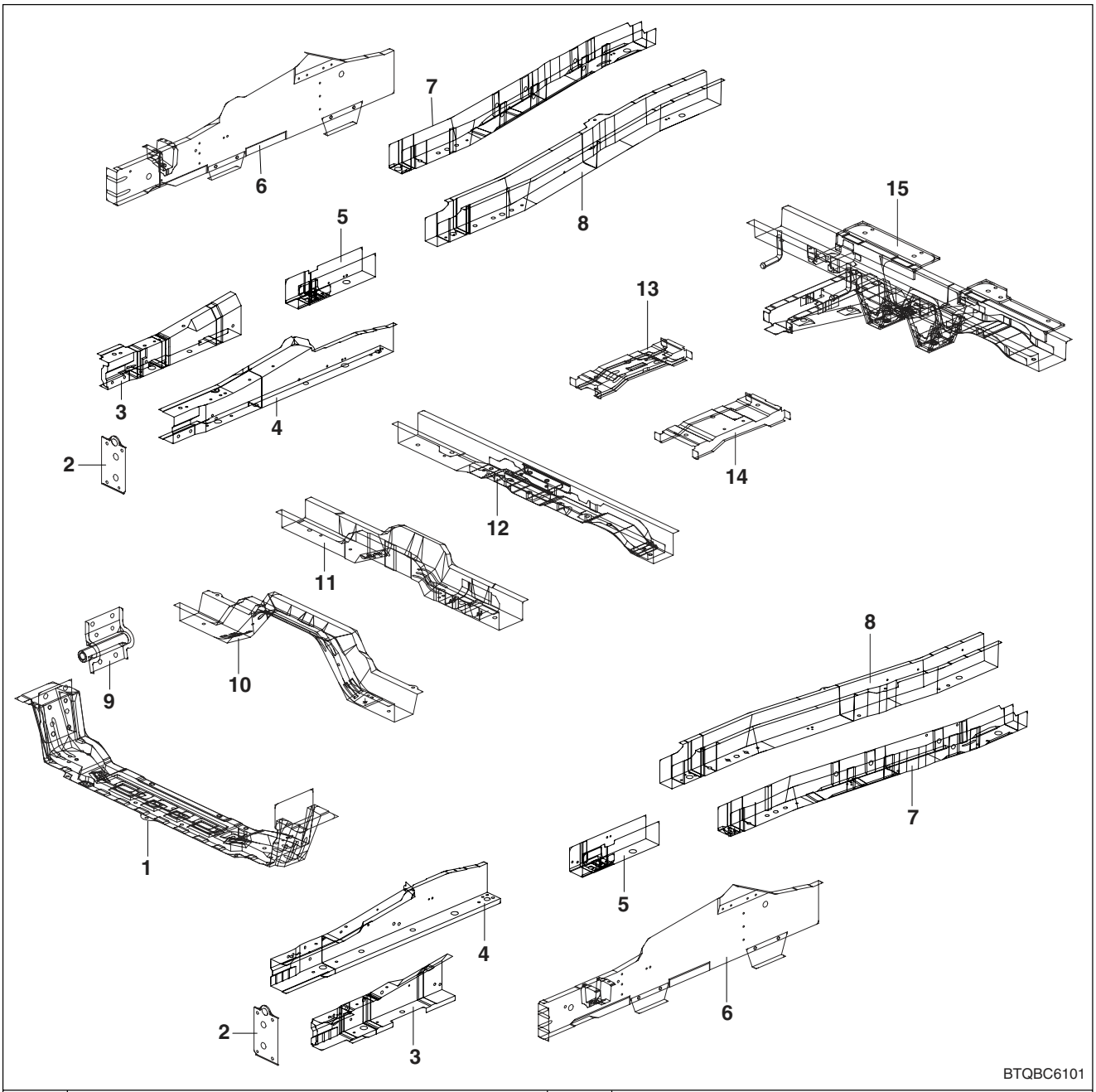
FLOOR PANEL ..... BC -20

ROOF PANEL ..... BC -24

SIDE BODY DIMENSIONS ..... BC -27

REAR BODY DIMENSIONS ..... BC -31

FRONT SIDE MEMBER



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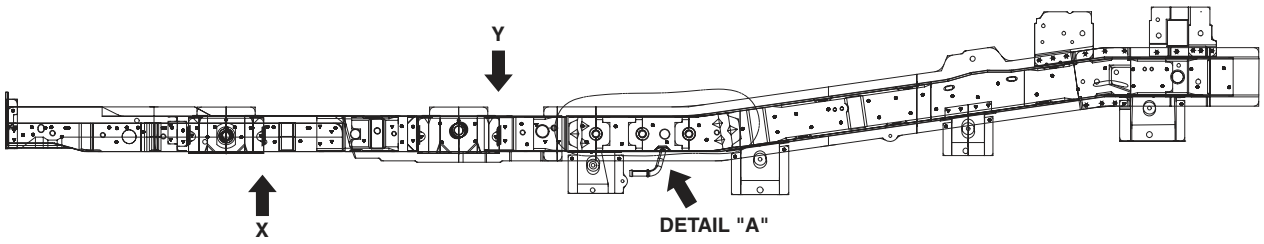
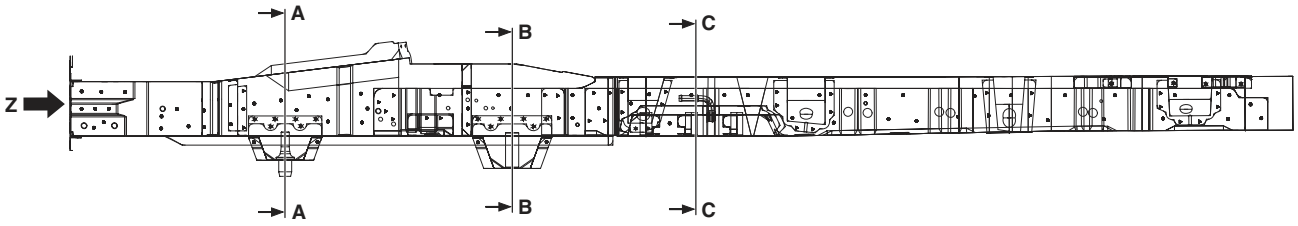
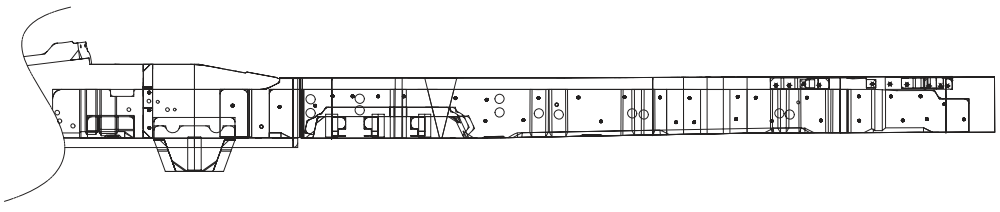
No.	PART NAME	No.	PART NAME
1	Front end cross member	9	Towing hook bracket
2	Front end module mounting bracket	10	No.1 Cross member
3	Member front side reinforcement	11	No.2 Cross member
4	Front side inner member	12	No.3 Cross member
5	Member front side reinforcement	13	Rear slide mounting member
6	Front side outer member	14	Rear slide mounting member
7	Center side member reinforcement	15	No.4 Cross member
8	Center side member		

< Cross-Sectional Views >





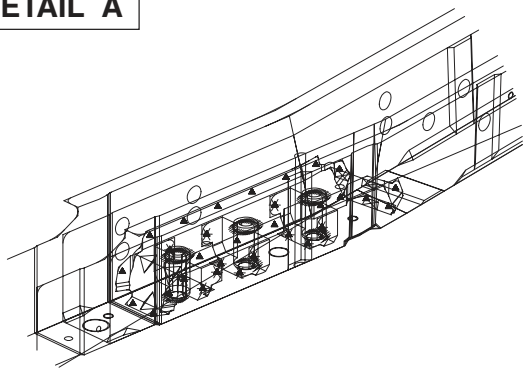
[VIEW "X"]



[VIEW "Y"]

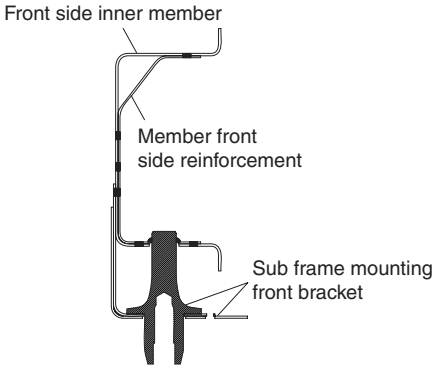
BTQBC6104

DETAIL A



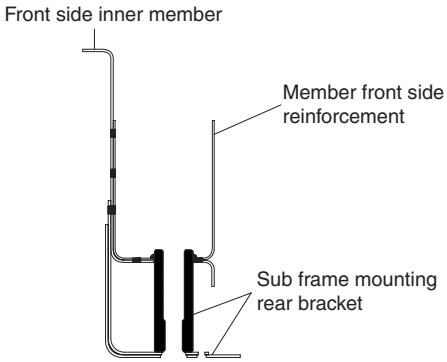
BTQBC6105

A - A



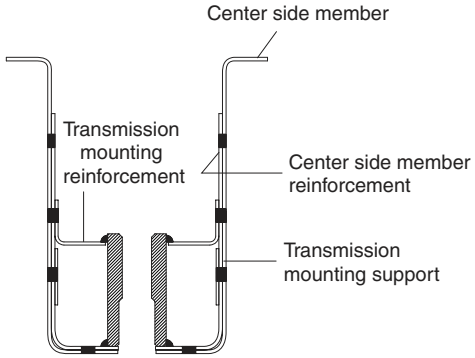
BTQBC6106

B - B



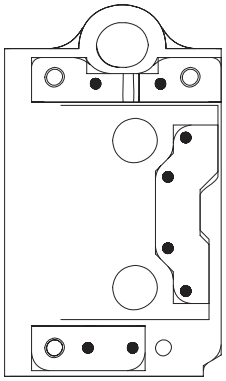
BTQBC6107

C - C



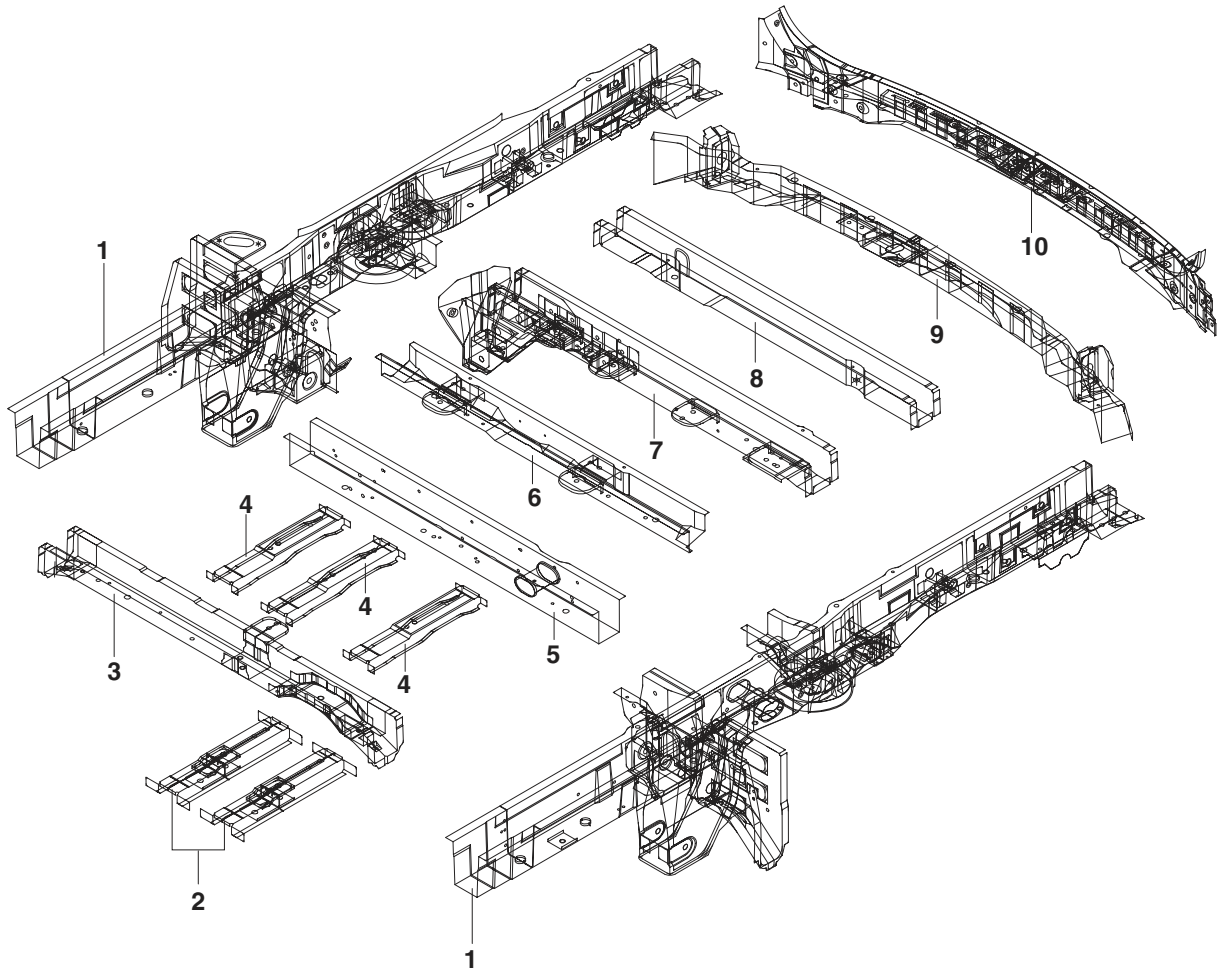
BTQBC6108

VIEW Z



BTQBC6109

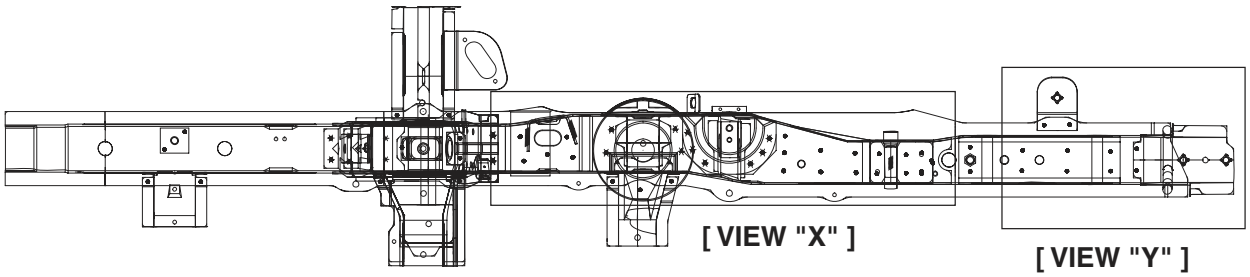
REAR SIDE MEMBER

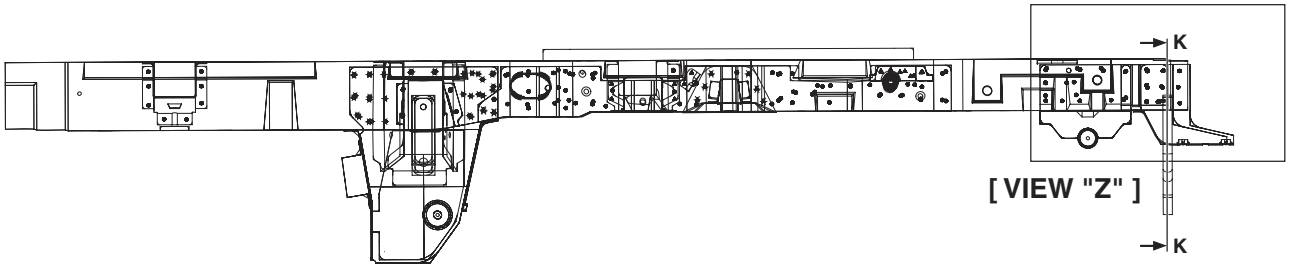


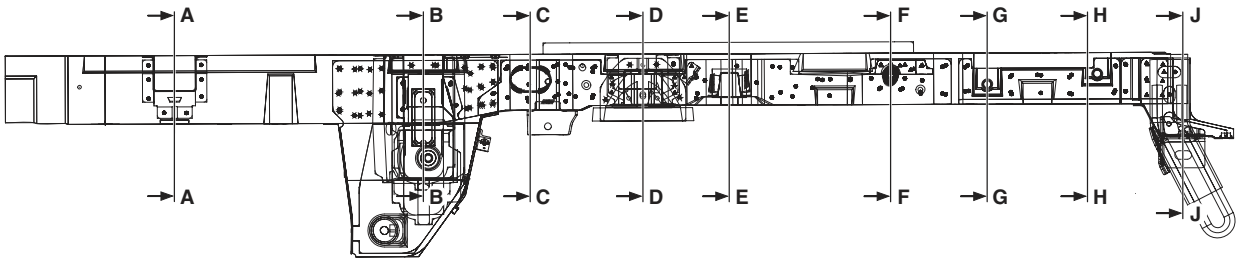
BTQBC6196

No.	PART NAME	No.	PART NAME
1	Rear side member	6	No.7 Cross member
2	Seat anchor reinforcement	7	No.8 Cross member
3	No.5 Cross member	8	No.9 Cross member
4	Seat anchor reinforcement	9	Rear end cross inner member
5	No.6 Cross member	10	Rear end cross outer upper member

< Cross-Sectional Views >

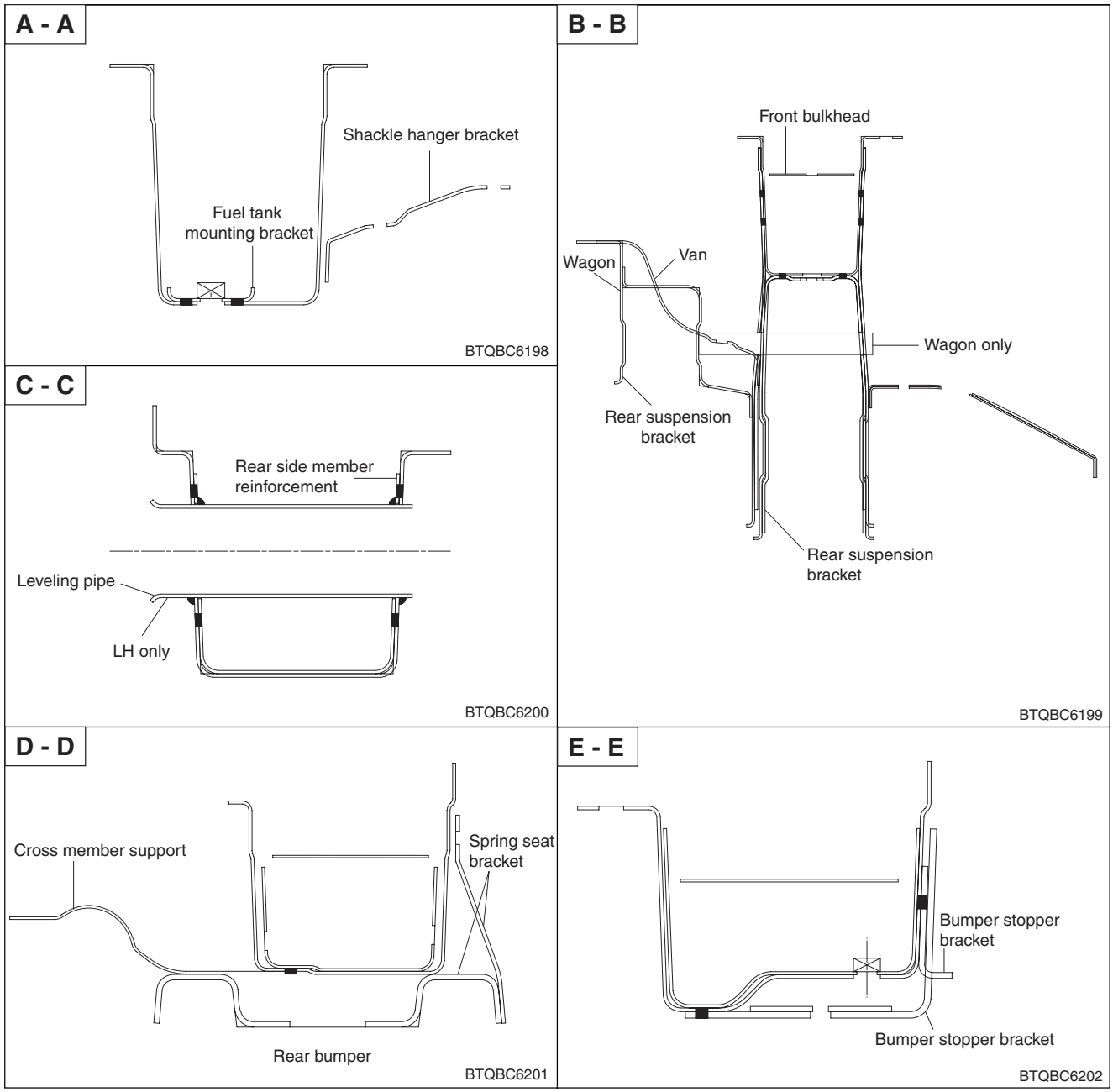




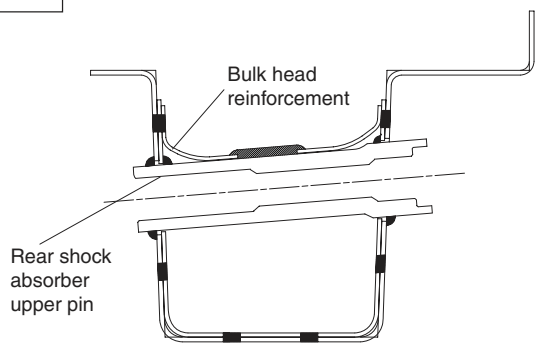


[Wagon]

BTQBC6197

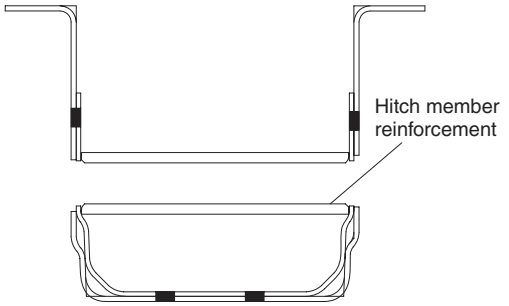

A - A
Shackle hanger bracket
Fuel tank
mounting bracket
BTQBC6198
B - B
Front bulkhead
Wagon
Van
Wagon only
Rear suspension
bracket
Rear suspension
bracket
BTQBC6199
C - C
Rear side member
reinforcement
Leveling pipe
LH only
BTQBC6200
D - D
Cross member support
Spring seat
bracket
Rear bumper
BTQBC6201
E - E
Bumper stopper
bracket
Bumper stopper bracket
BTQBC6202

F - F



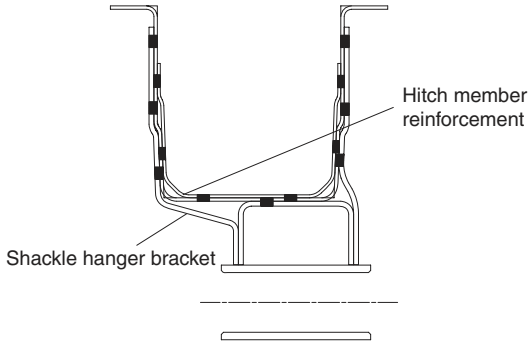
BTQBC6169

G - G



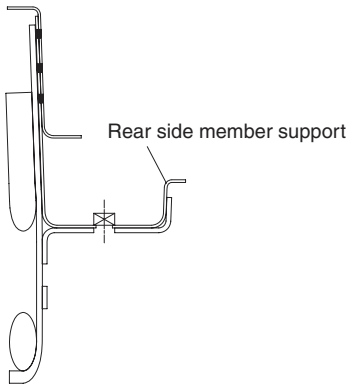
BTQBC6170

H - H



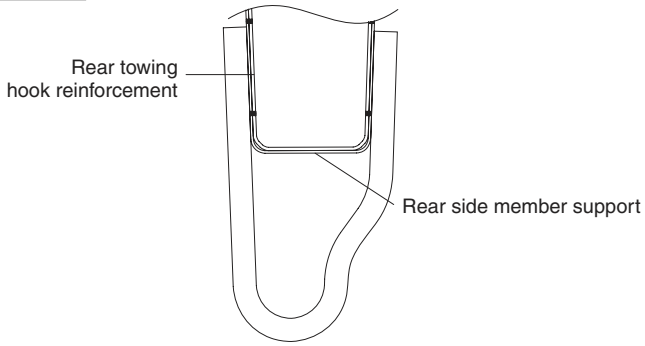
BTQBC6171

J -J



BTQBC6172

K - K



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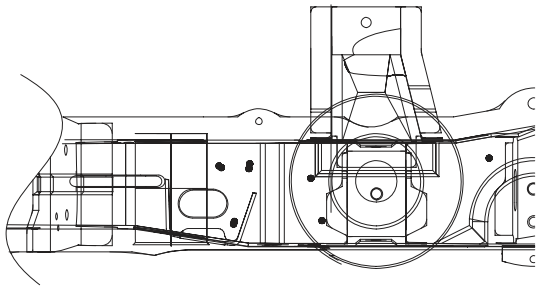
X



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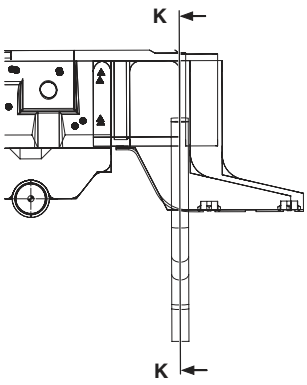

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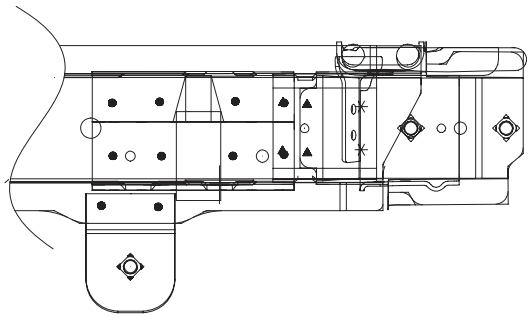
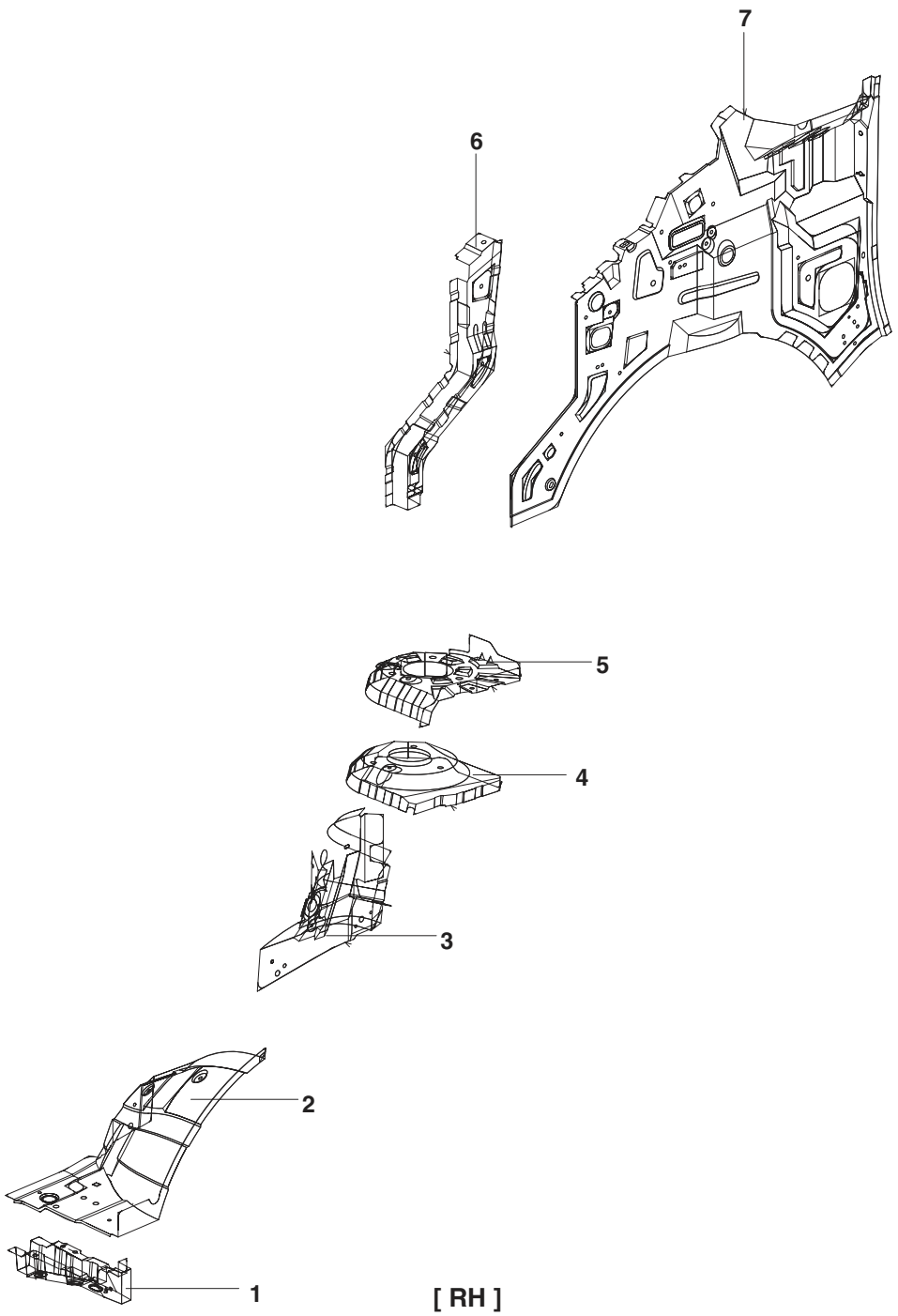


BTQBC6176

FENDER APRON PANEL (RH)

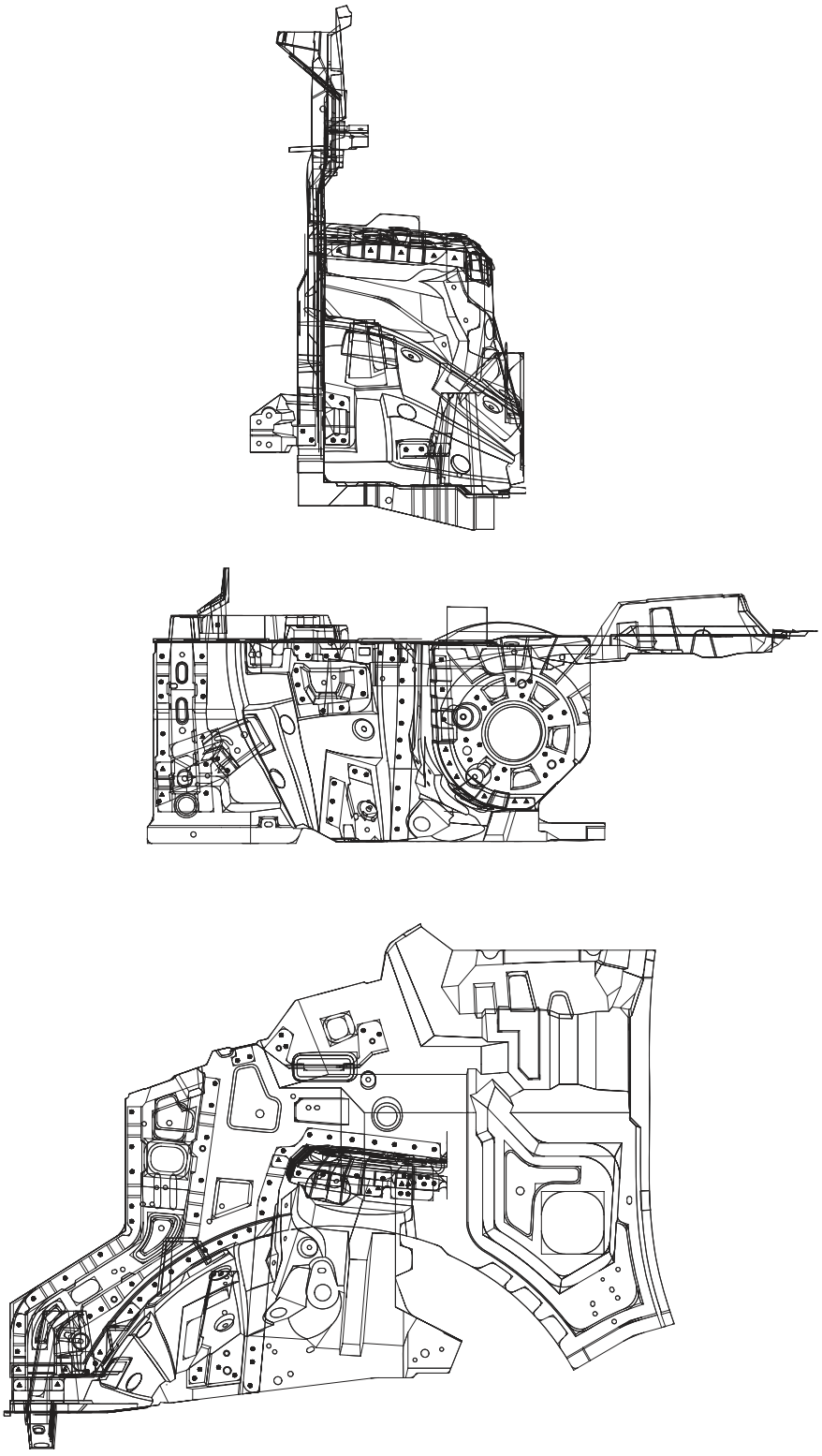


[RH]

BTQBC6111

No.	PART NAME	No.	PART NAME
1	Front wheel housing support	5	Shock absorber housing reinforcement
2	Front wheel housing panel	6	Fender apron inner support
3	Shock absorber housing panel	7	Fender apron inner panel
4	Shock absorber housing cover		

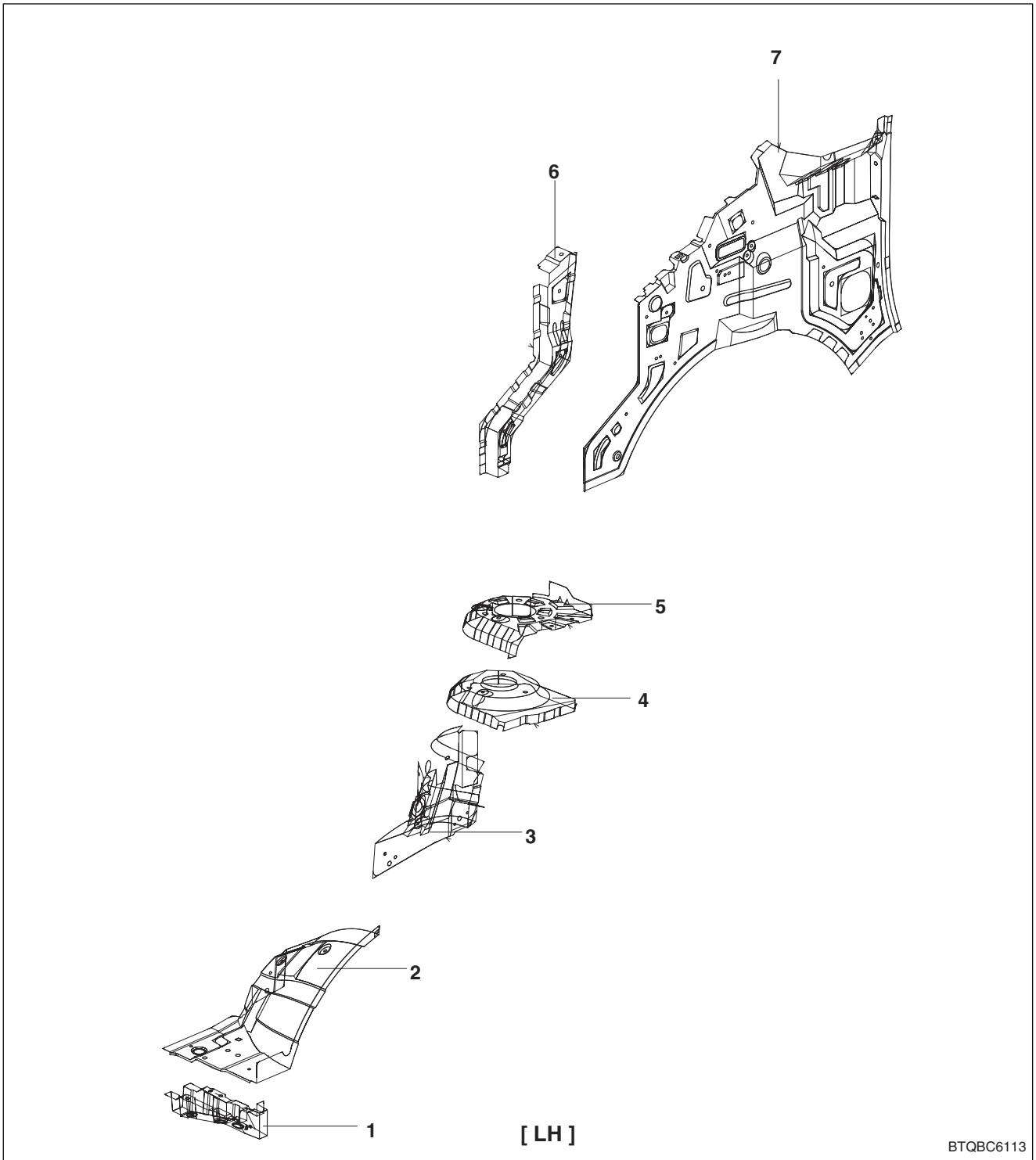
< Cross-Sectional Views >



[VIEW RH]

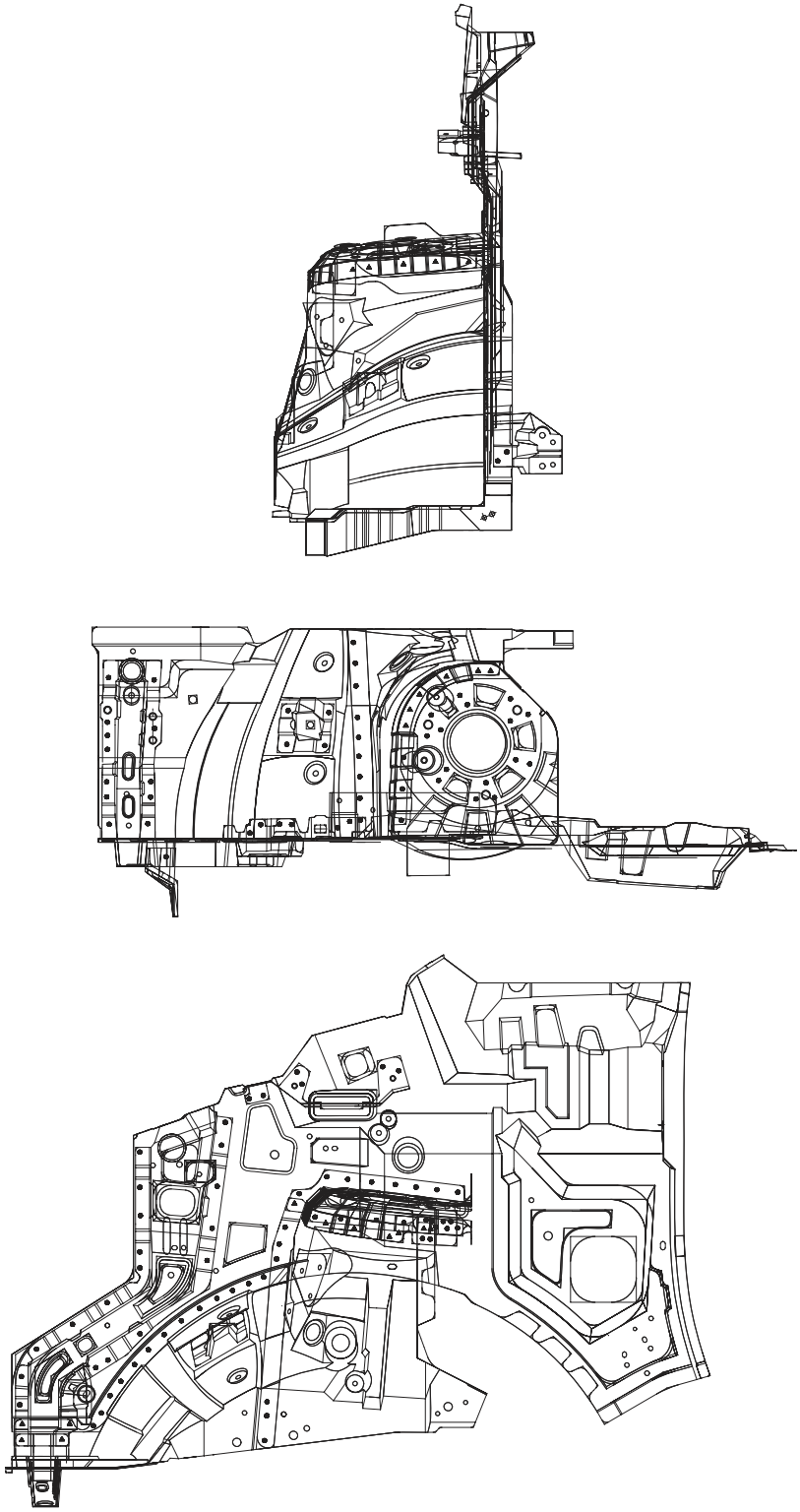
BTQBC6112

FENDER APRON PANEL (LH)



No.	PART NAME	No.	PART NAME
1	Front wheel housing support	5	Shock absorber housing reinforcement
2	Front wheel housing panel	6	Fender apron inner support
3	Shock absorber housing panel	7	Fender apron inner panel
4	Shock absorber housing cover		

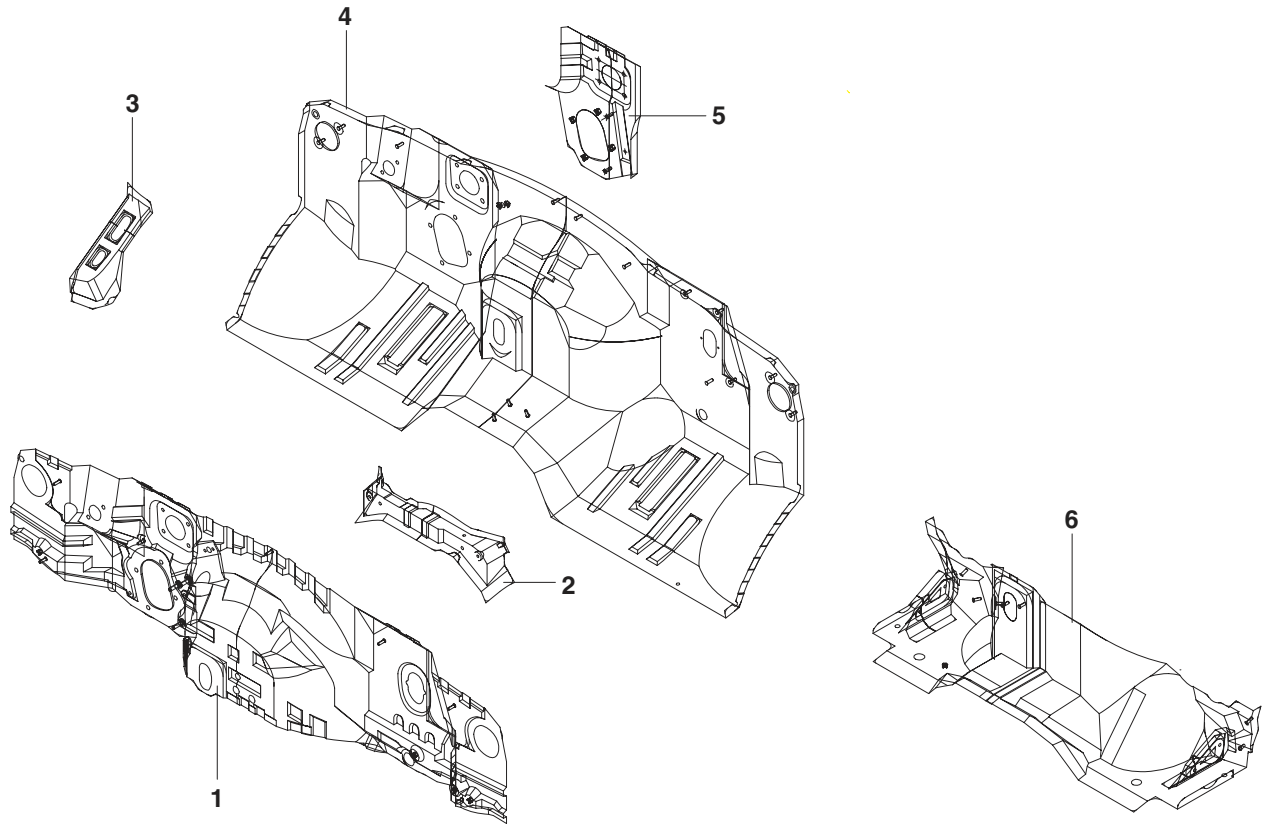
< Cross-Sectional Views >



[VIEW LH]

BTQBC6115

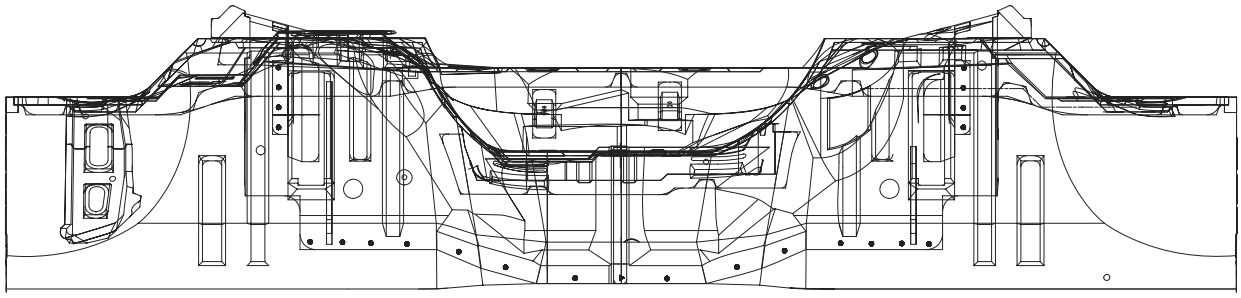
DASH PANEL

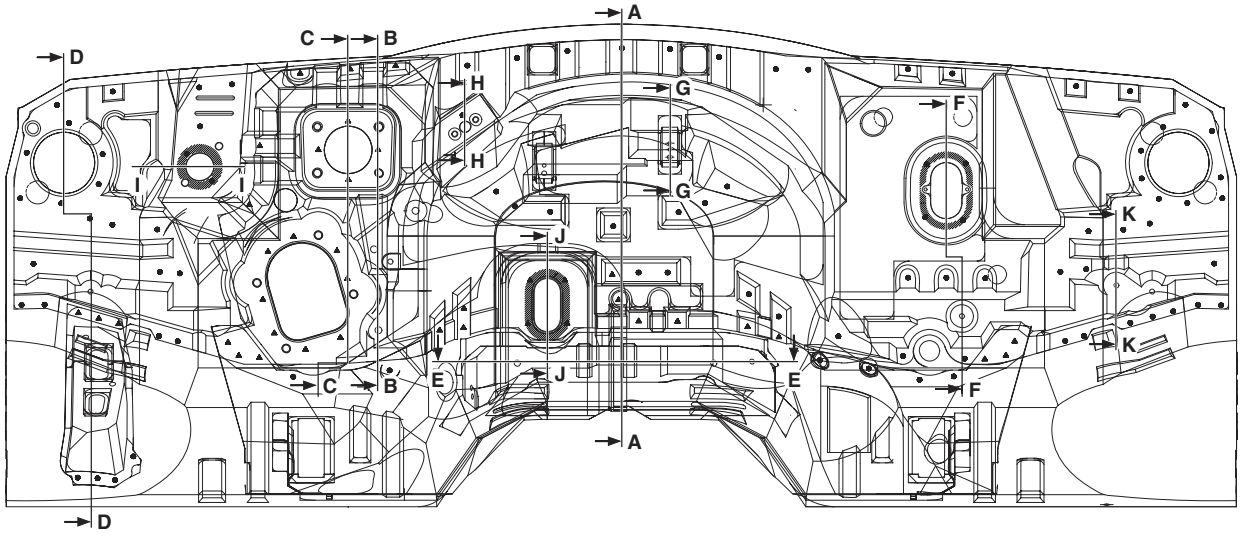


BTQBC6116

No.	PART NAME	No.	PART NAME
1	Dash panel reinforcement	4	Dash panel
2	Heater mounting bracket	5	Brake booster mounting reinforcement
3	Foot rest bracket	6	Dash lower member

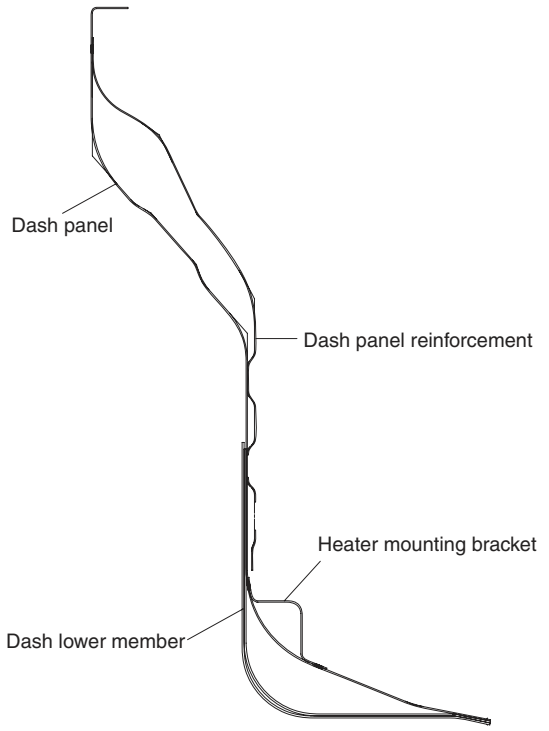
< Cross-Sectional Views >





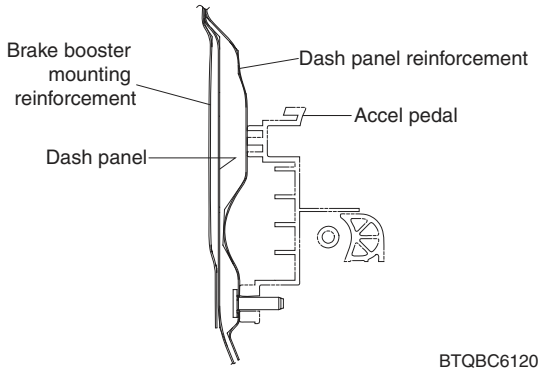
BTQBC6118

A - A



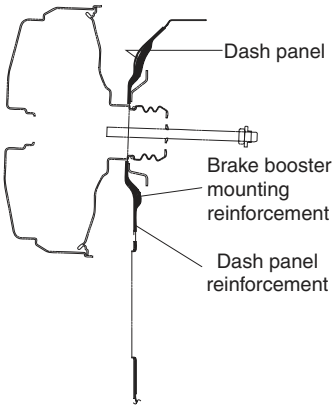
BTQBC6119

B - B



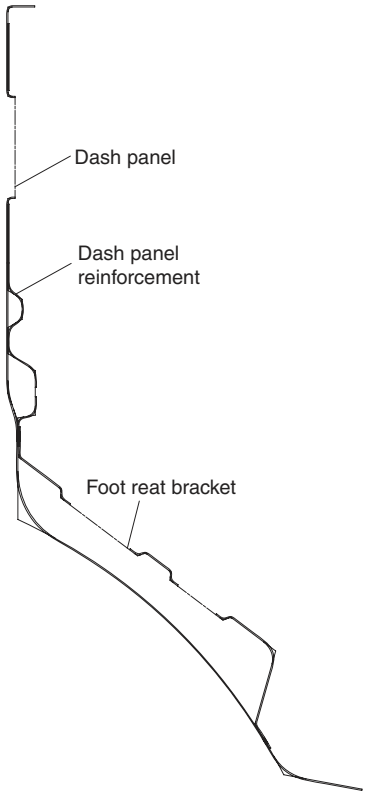
BTQBC6120

C - C



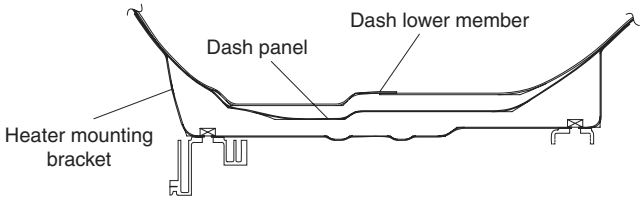
BTQBC6121

D - D



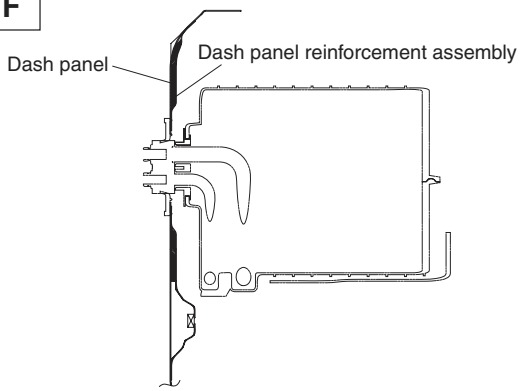
BTQBC6122

E - E

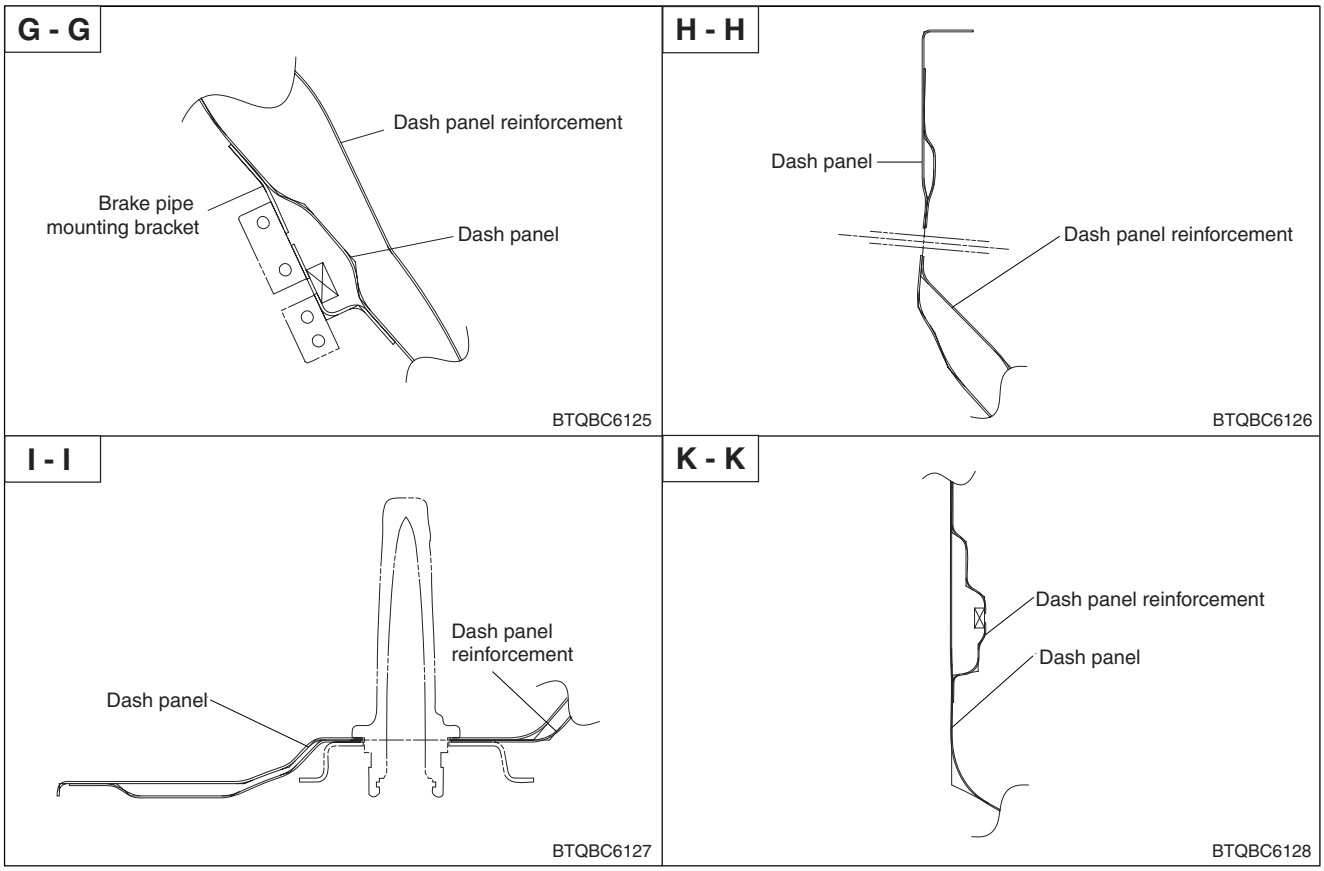


BTQBC6123

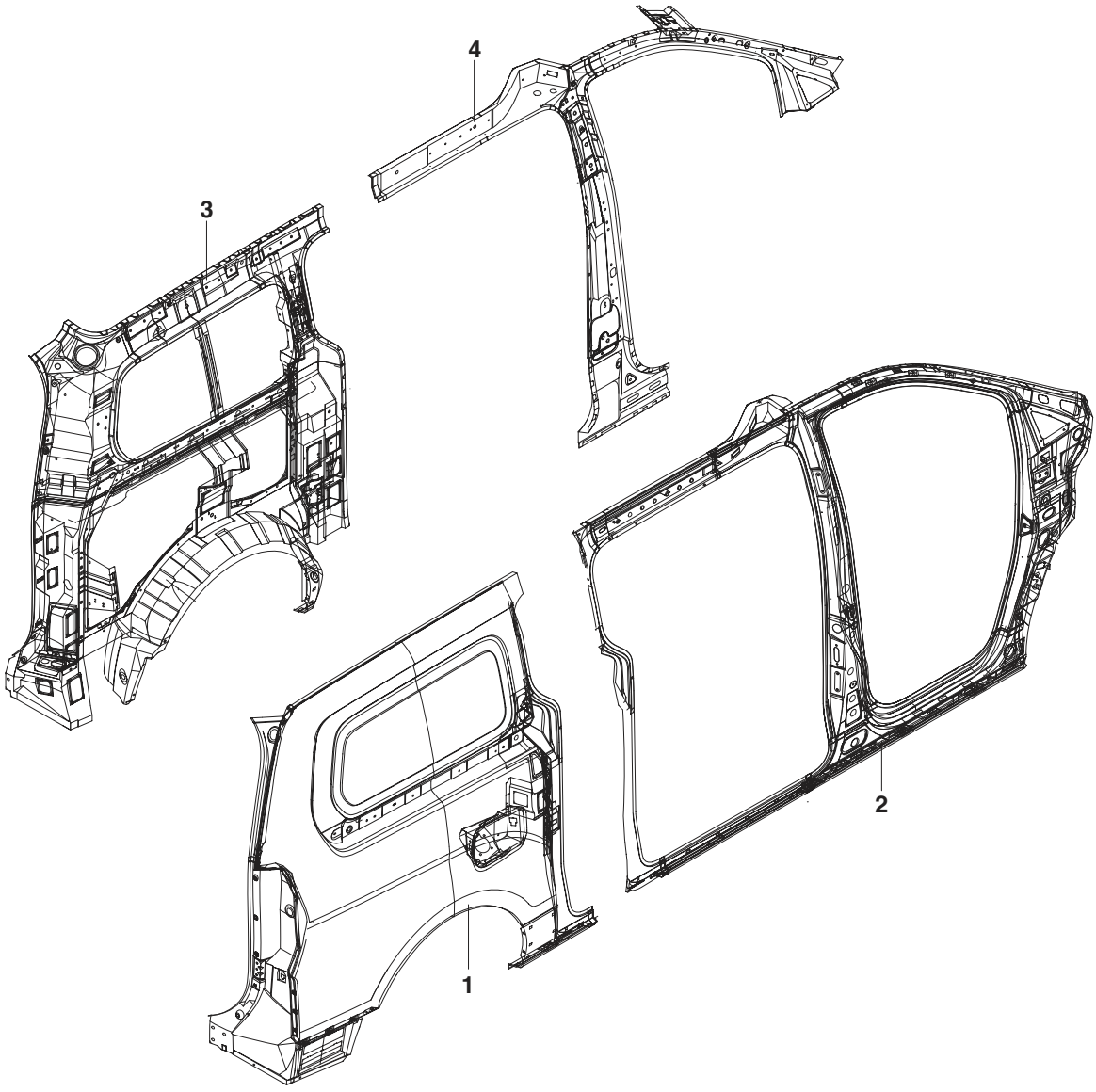
F - F



BTQBC6124


G - G
Dash panel reinforcement
Brake pipe
mounting bracket
Dash panel
BTQBC6125
H - H
Dash panel
Dash panel reinforcement
BTQBC6126
I - I
Dash panel
reinforcement
Dash panel
BTQBC6127
K - K
Dash panel reinforcement
Dash panel
BTQBC6128

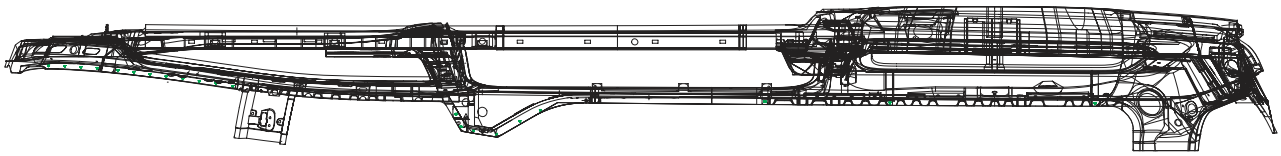
SIDE BODY PANEL

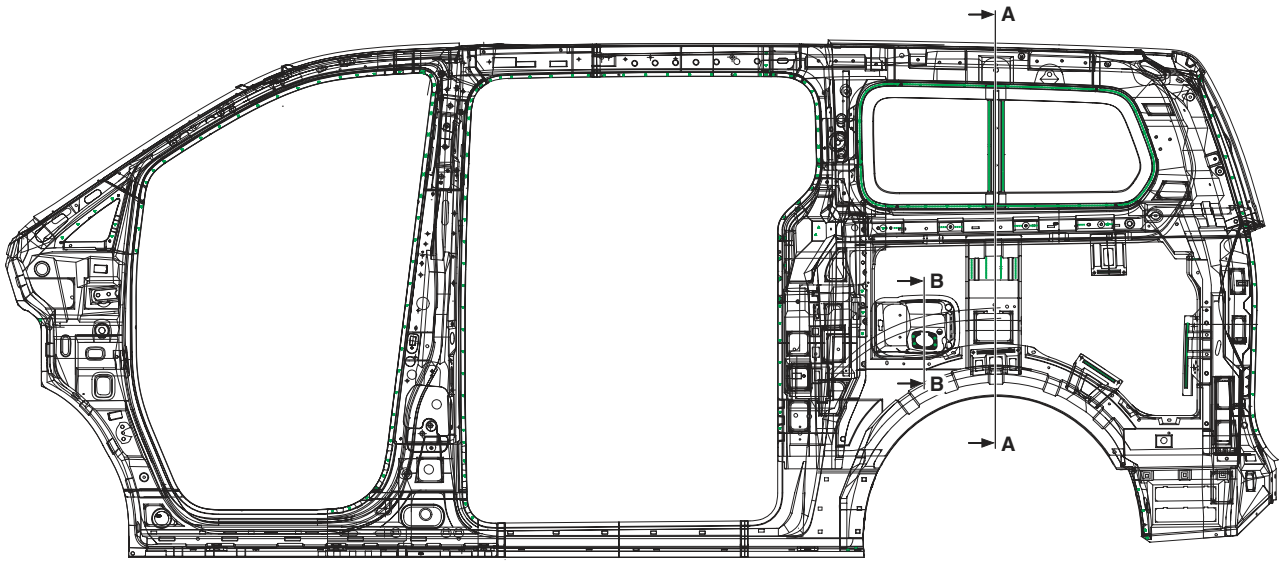


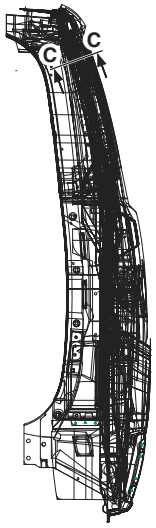
BTQBC6129

No.	PART NAME	No.	PART NAME
1	Quarter outer panel	3	Quarter inner panel
2	Side outer panel	4	Side inner panel

< Cross-Sectional Views >

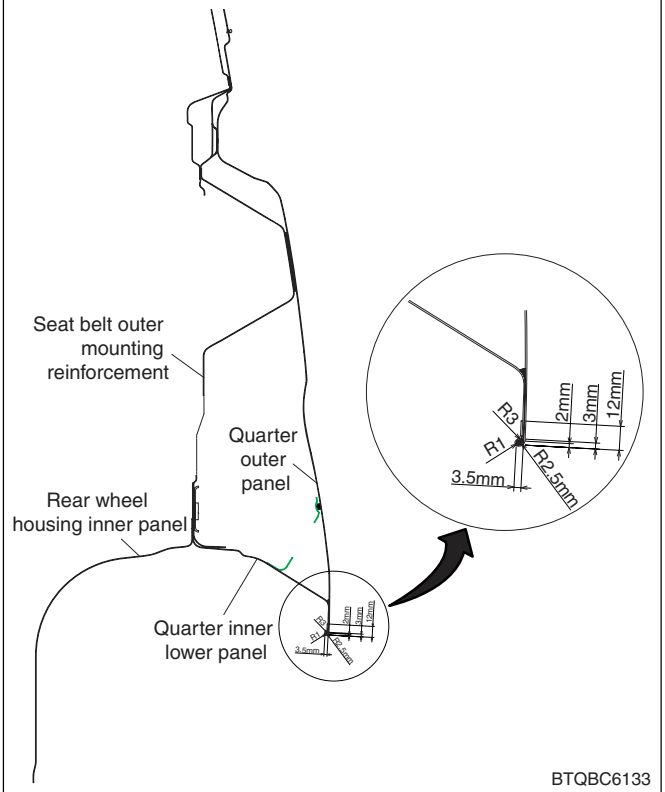






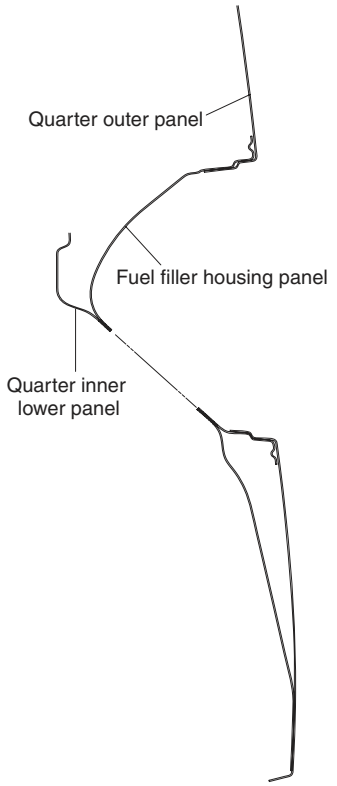
BTQBC6132

A - A



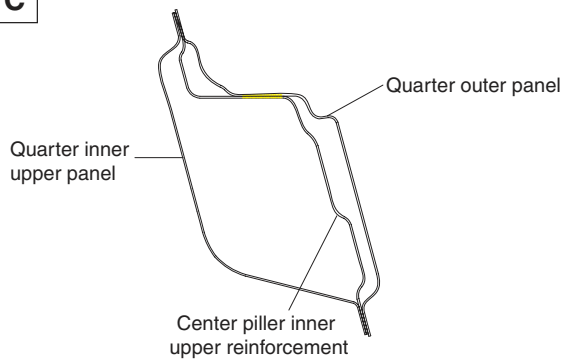
BTQBC6133

B - B



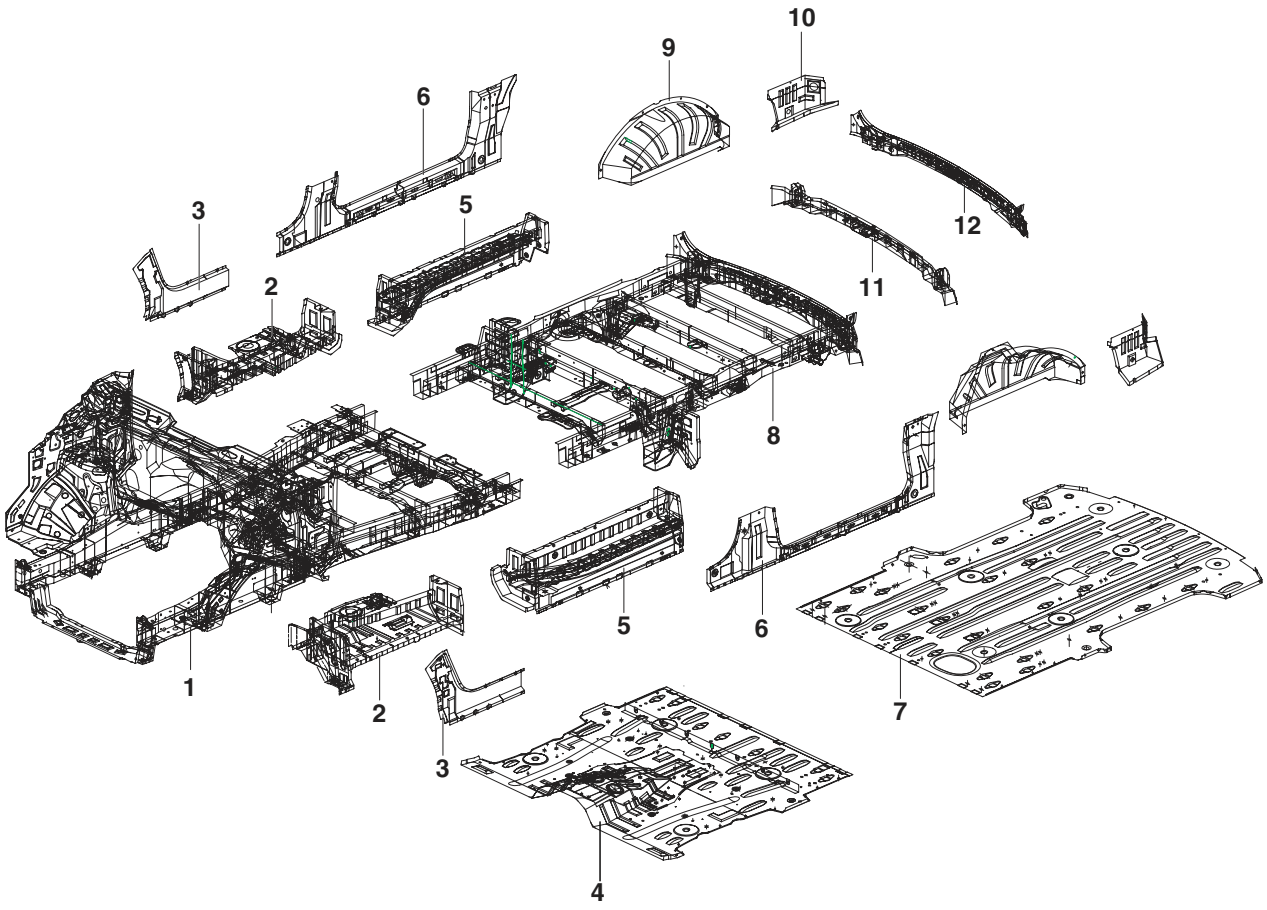
BTQBC6134

C - C



BTQBC6135

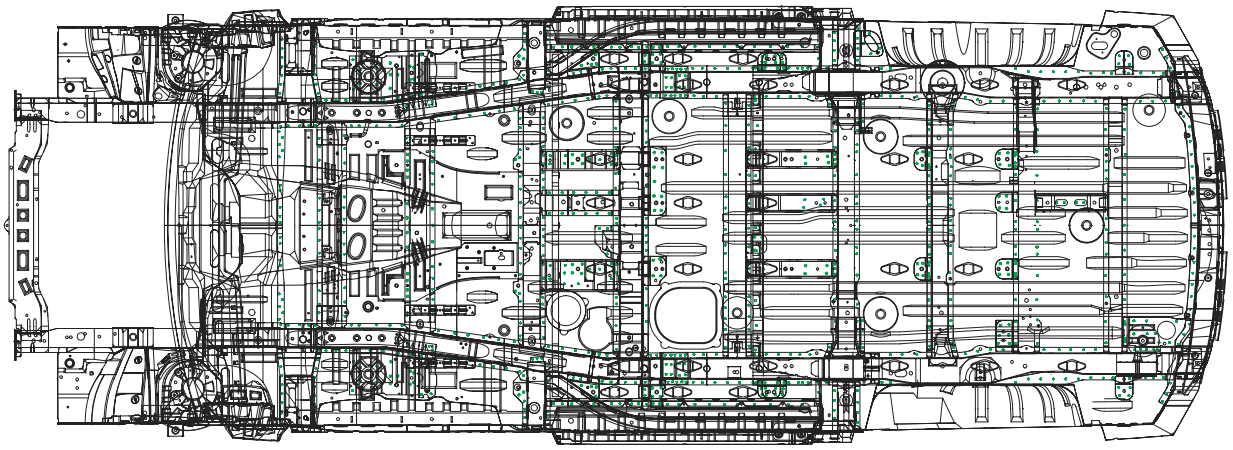
FLOOR PANEL

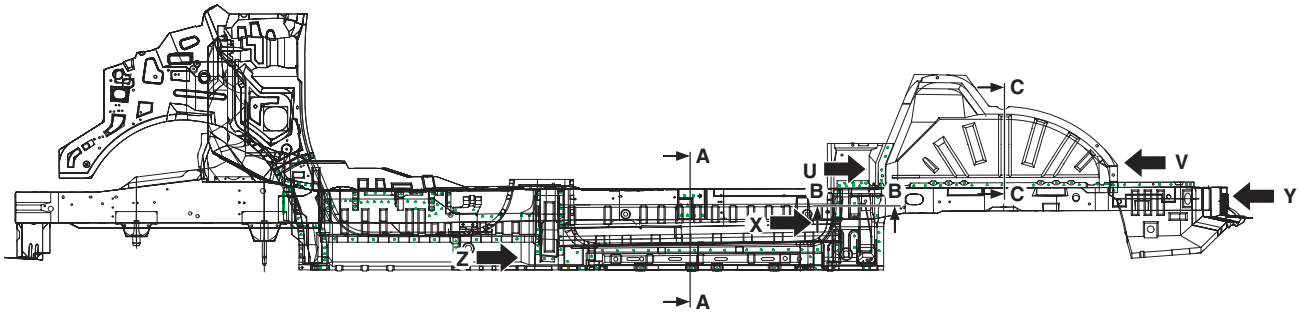


BFDBC6136

No.	PART NAME	No.	PART NAME
1	Front frame	7	Rear floor panel
2	Front step panel	8	Rear frame
3	Front side sil inner panel	9	Rear wheel housing inner panel
4	Center floor panel	10	Quarter inner lower rear panel
5	Rear step panel	11	Rear end cross inner member
6	Quarter inner lower panel	12	Rear end cross outer upper member

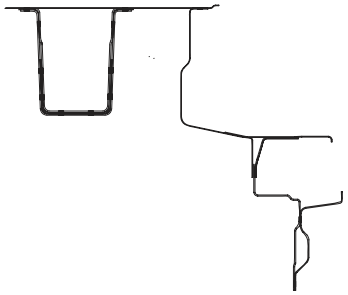
< Cross-Sectional Views >





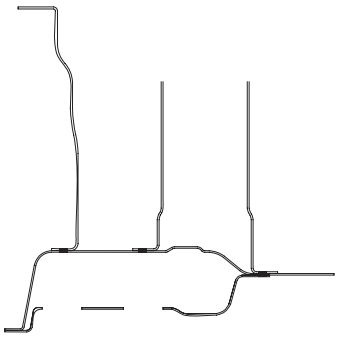
BTQBC6138

A - A



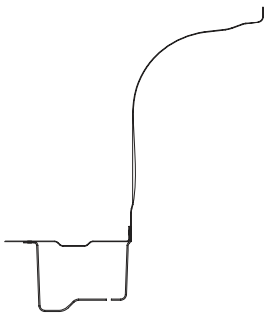
BTQBC6139

B - B



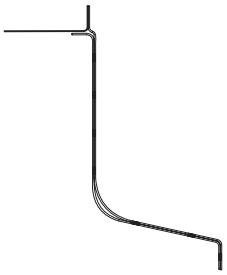
BTQBC6140

C - C



BTQBC6141

D - D



BTQBC6142

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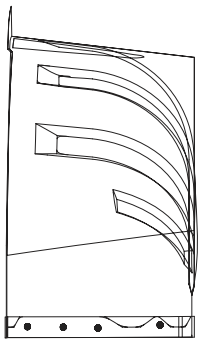
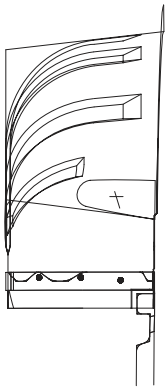


BTQBC6143

V



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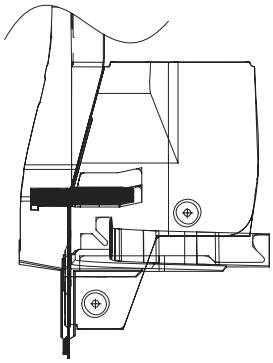

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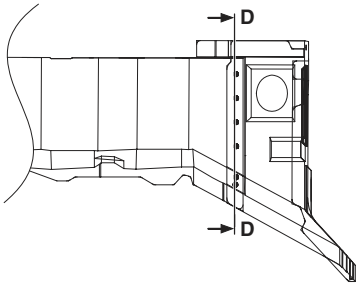

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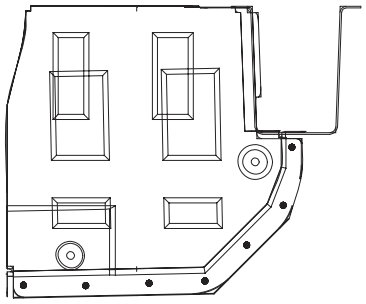

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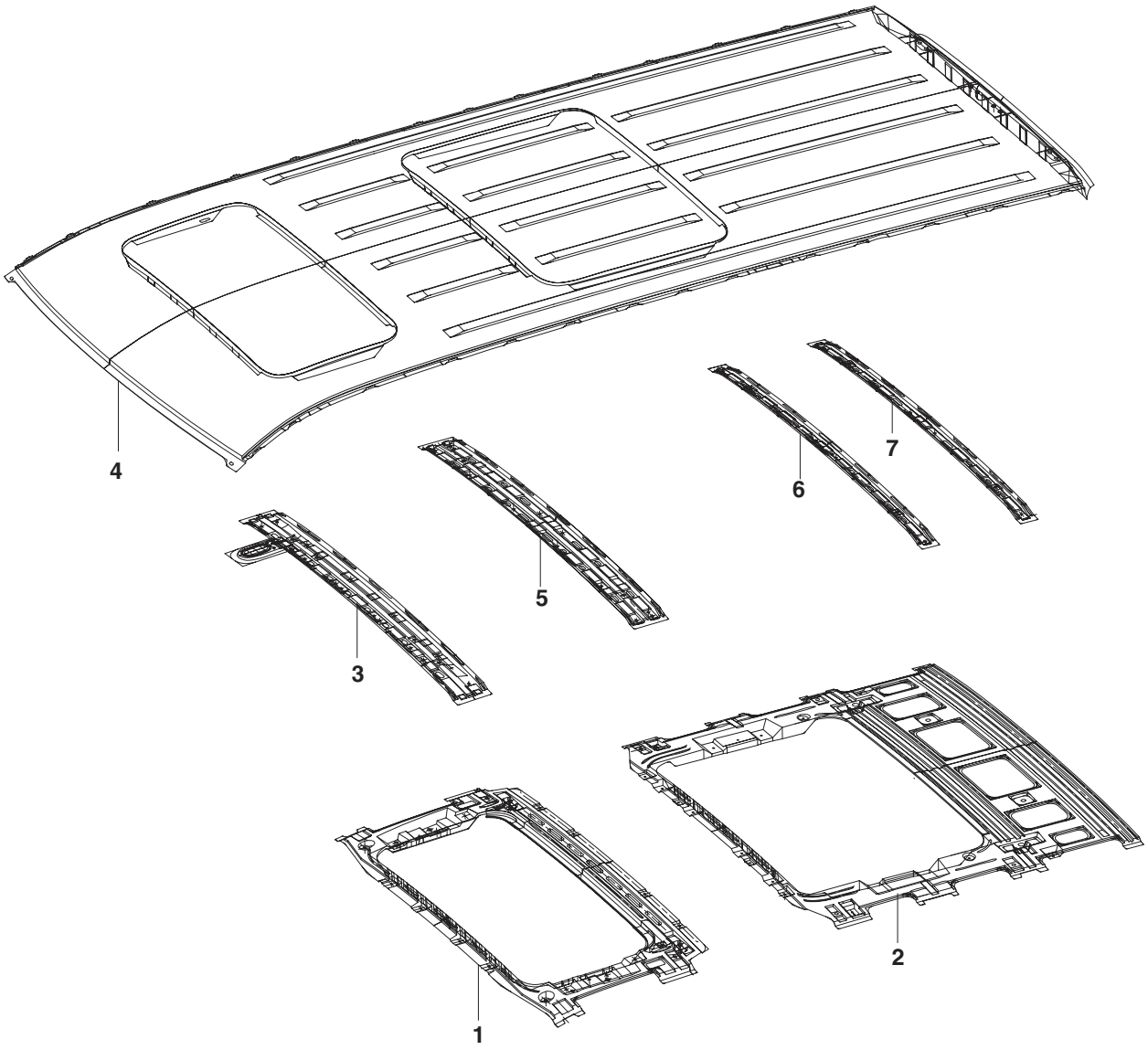
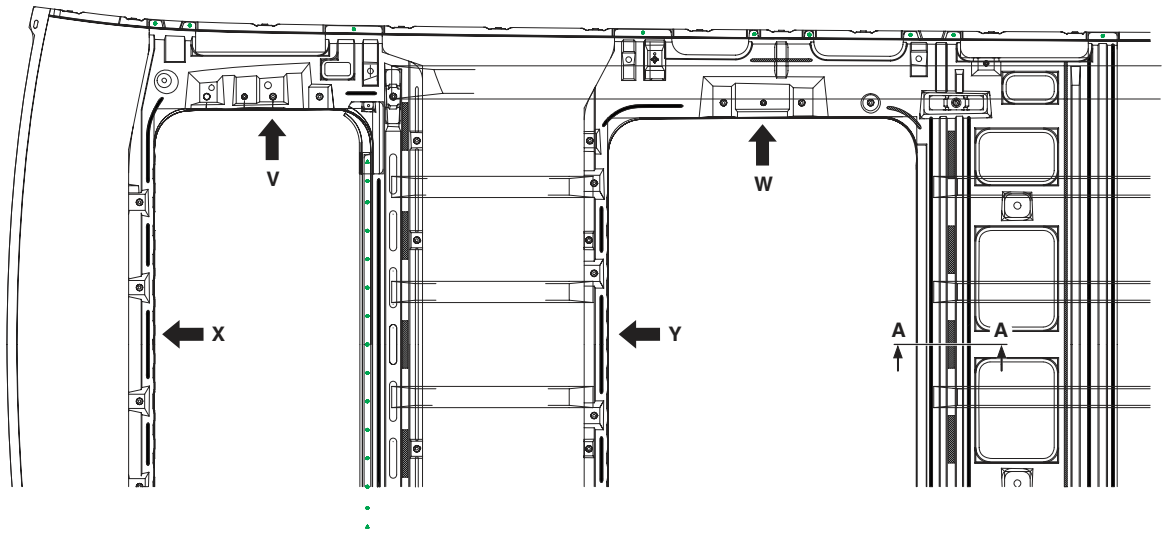
ROOF PANEL



BTQBC6148

No.	PART NAME	No.	PART NAME
1	Sunroof front reinforcement	5	Roof B bow
2	Sunroof rear reinforcement	6	Roof D bow
3	Roof A bow	7	Roof E bow
4	Roof panel		

< Cross-Sectional Views >



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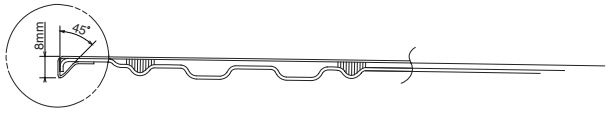
BTQBC6153

A - A



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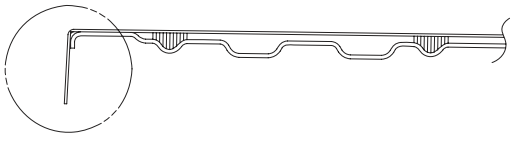

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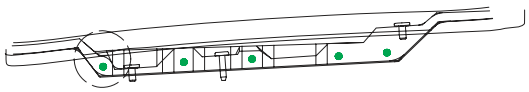

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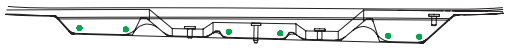

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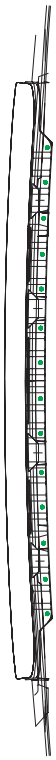

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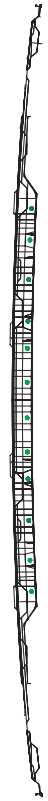
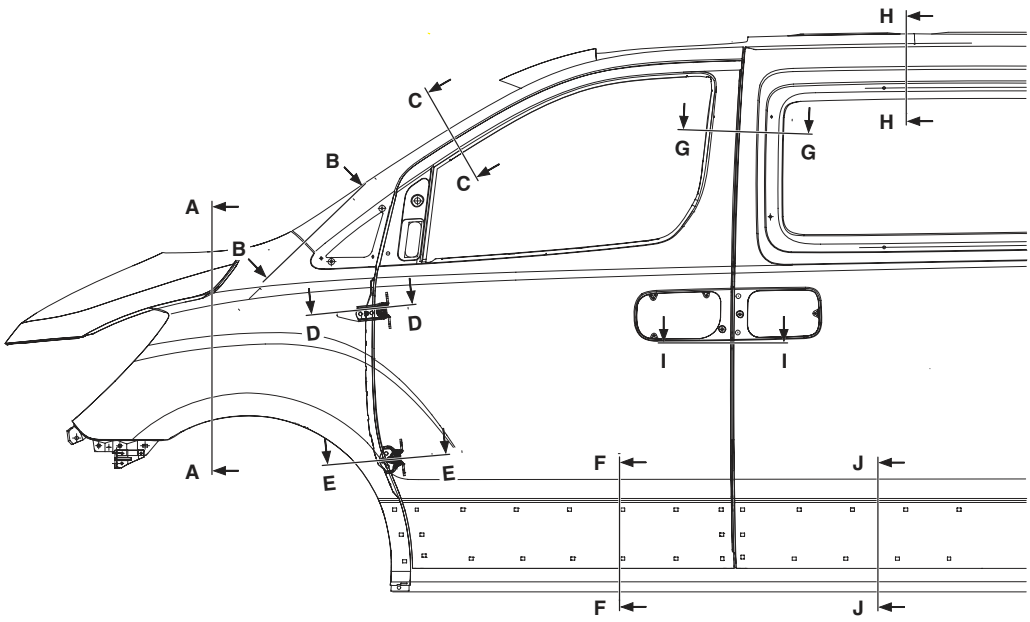
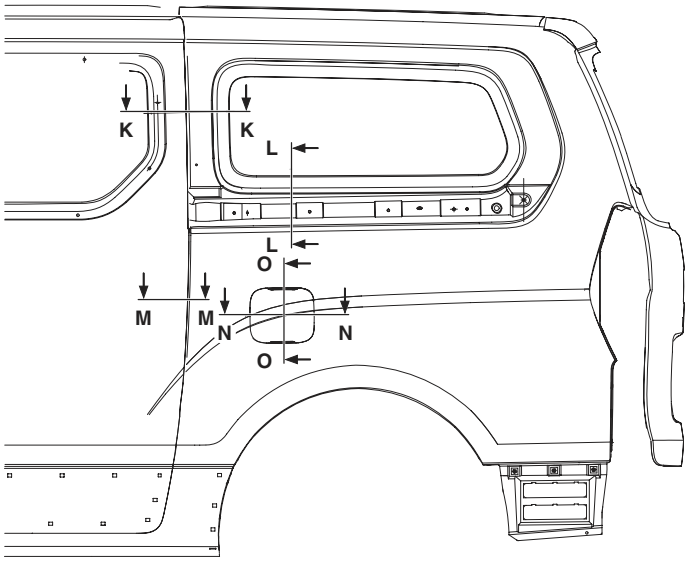


BTQBC6159

SIDE BODY DIMENSIONS

< Cross-Sectional Views >





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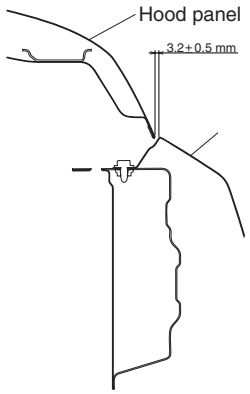

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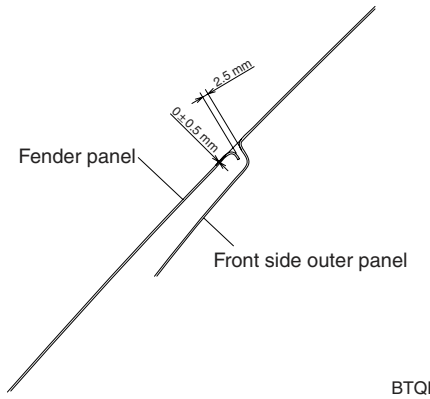

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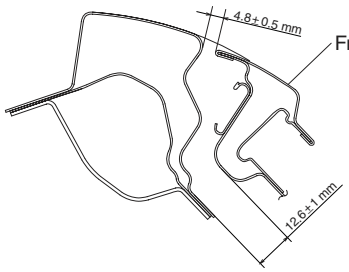

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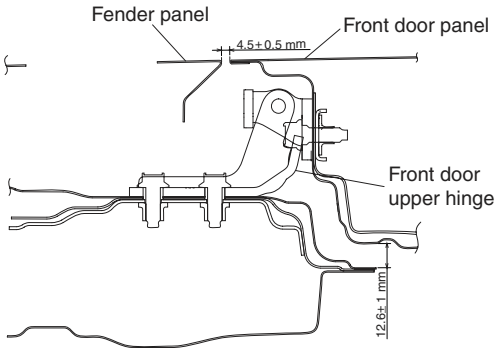

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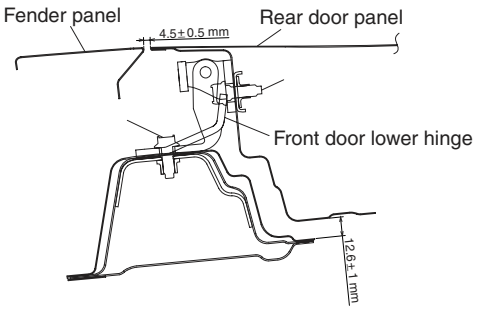

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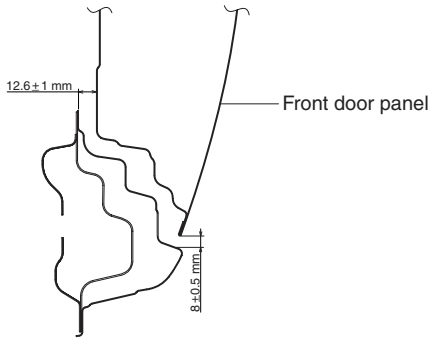

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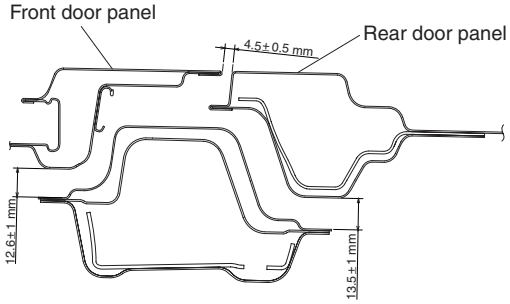

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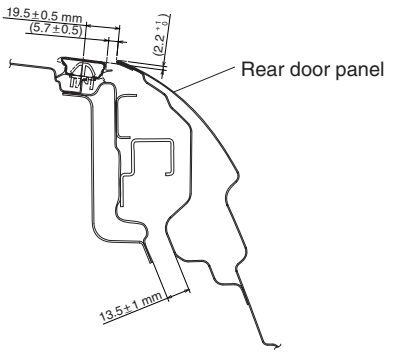

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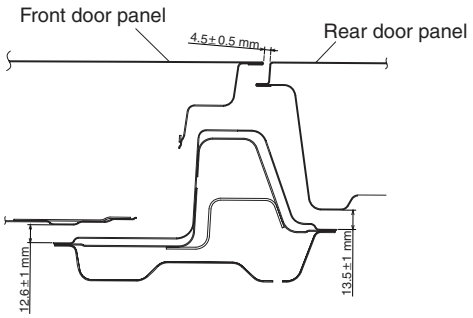

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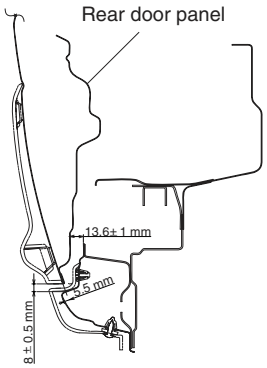

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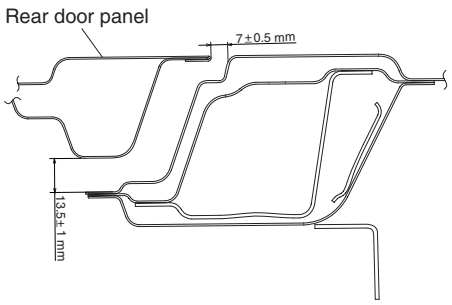

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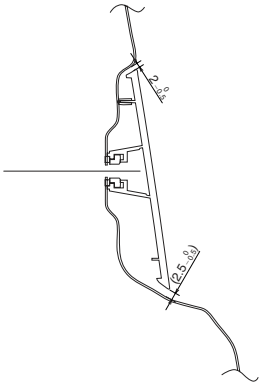

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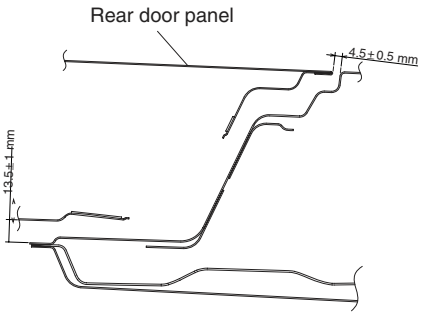

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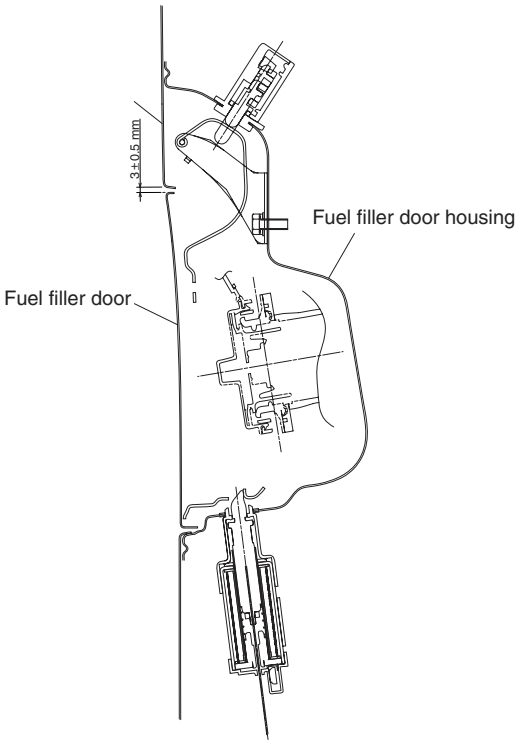

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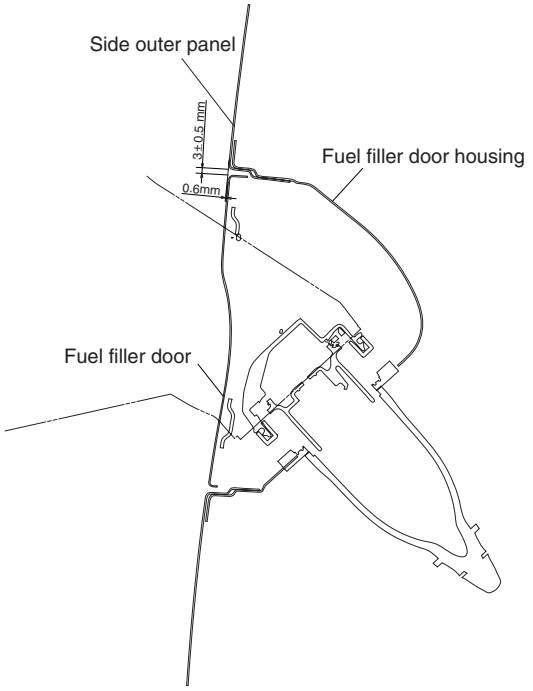
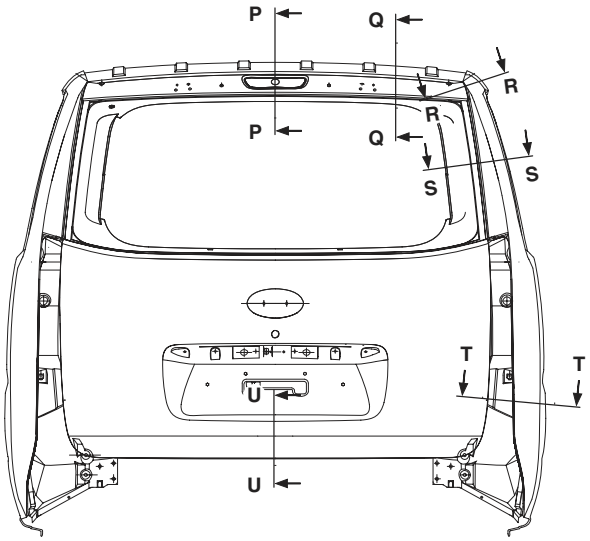
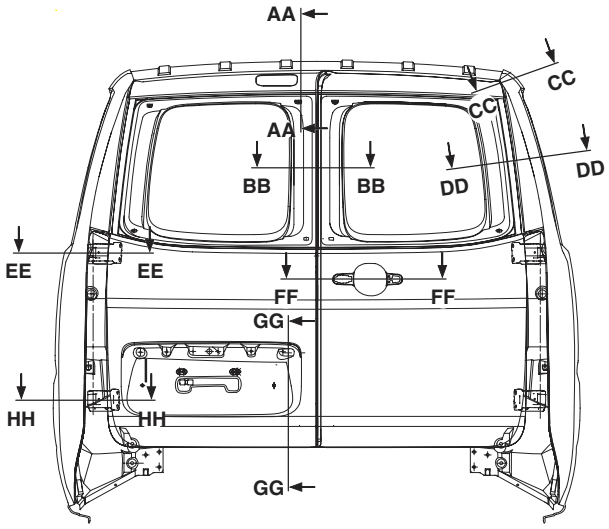


BTQBC6175

REAR BODY DIMENSIONS

< Cross-Sectional Views >





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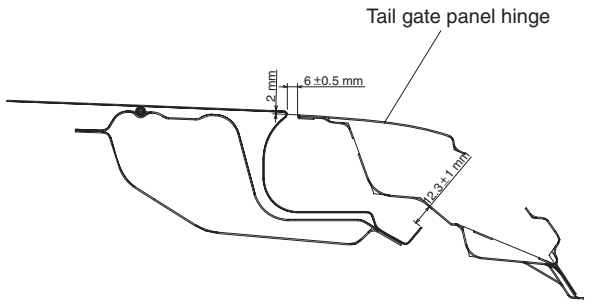

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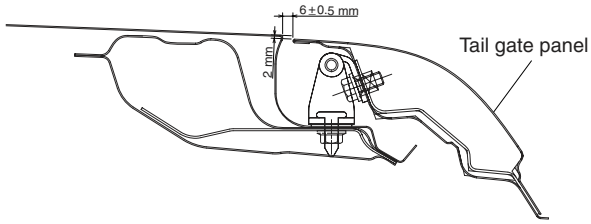

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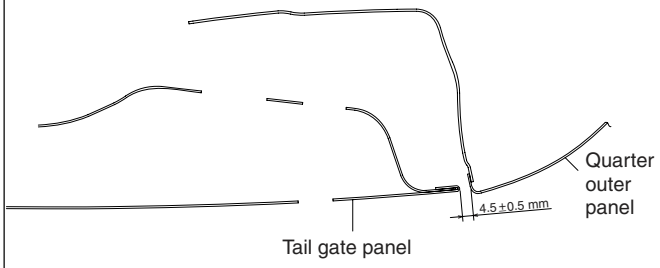

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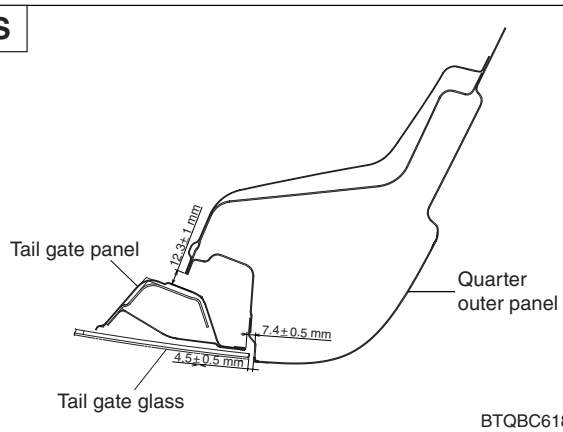

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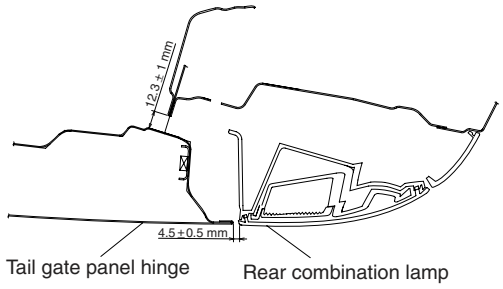

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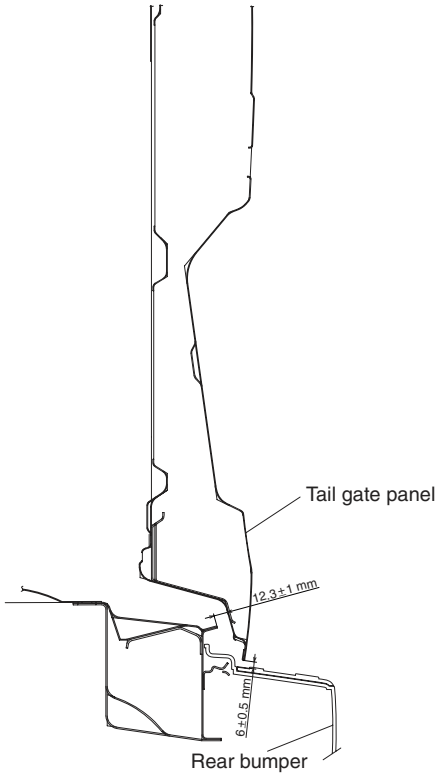

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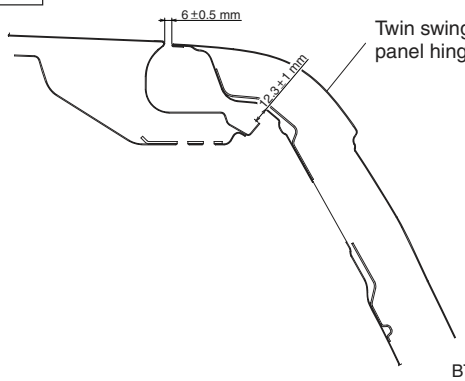

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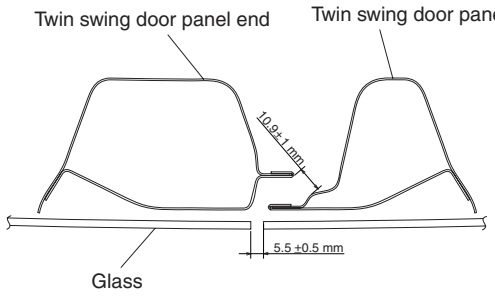

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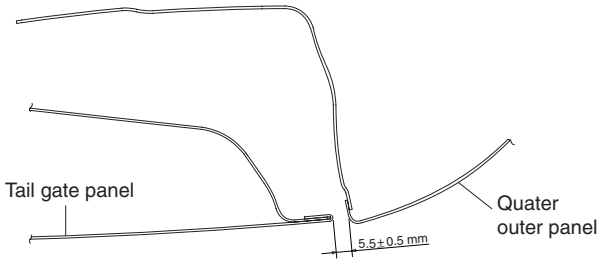

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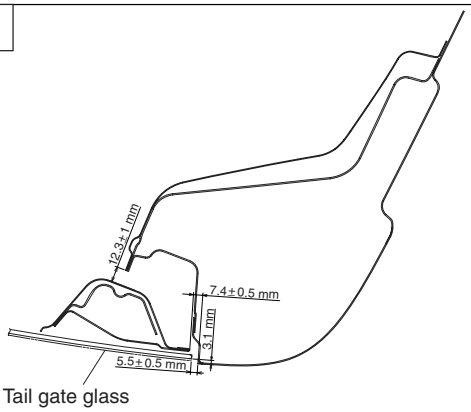

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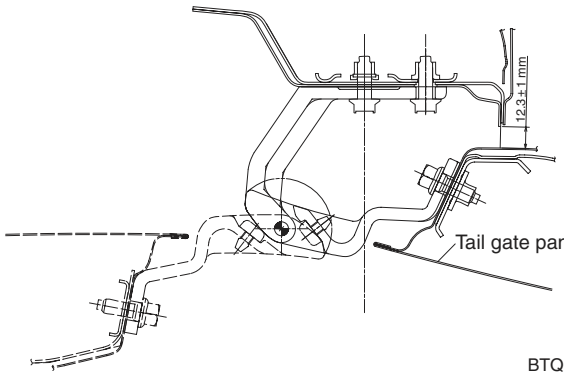

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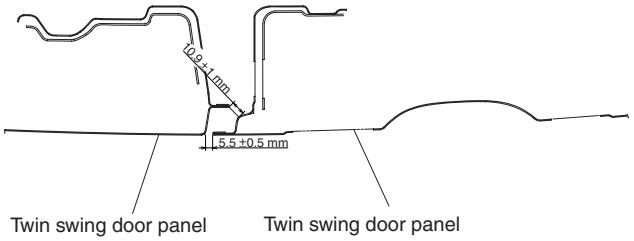

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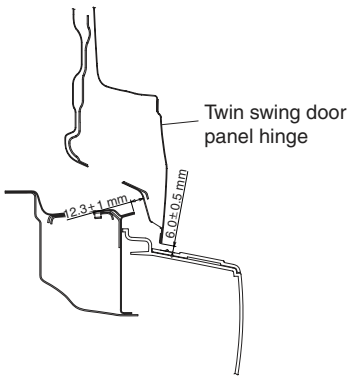


BTQBC6195

Body Dimensions

GENERAL ..... BD - 2

MEASUREMENT METHOD ..... BD - 2
- PROJECTED DIMENSIONS ..... BD - 2
- ACTUAL-MEASUREMENT DIMENSIONS ..... BD - 2
- MEASUREMENT POINT ..... BD - 2

FRONT BODY A ..... BD - 3

FRONT BODY B ..... BD - 5

SIDE BODY A ..... BD - 7

SIDE BODY B ..... BD - 9

SIDE BODY C ..... BD - 11

SIDE BODY D ..... BD - 13

INTERIOR A ..... BD - 15

INTERIOR B ..... BD - 17

INTERIOR C ..... BD - 20

INTERIOR D ..... BD - 22

REAR BODY ..... BD - 24

UNDER BODY (PROJECTED DIMENSIONS) ..... BD - 26

UNDER BODY (ACTUAL-MEASUREMENT DIMENSIONS) ..... BD - 29

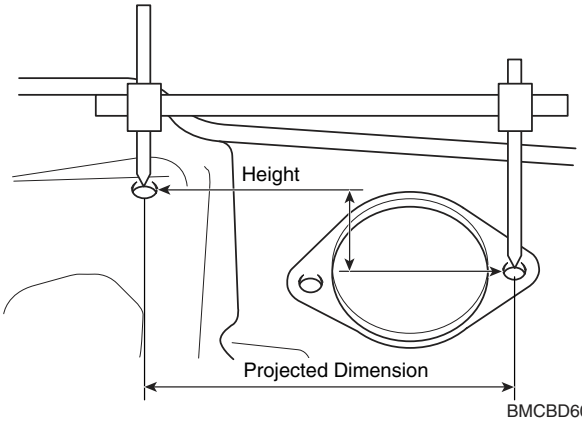
GENERAL

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.

MEASUREMENT METHOD

PROJECTED DIMENSIONS

1. These are the dimensions measured when the measurement points are projected into the reference plane, and are the reference dimensions used for body alterations.
2. If the length of the tracking gauge probes are adjustable, make the measurement by lengthening one probe by the amount equivalent to the difference in height of the two surfaces.

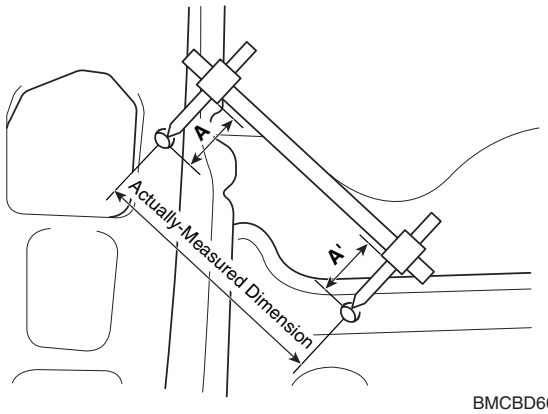


BMCBD6001

ACTUAL-MEASUREMENT DIMENSIONS

1. These dimensions indicate the actual linear distance between measurement points, and are the reference dimensions for use if a tracking gauge is used for measurement.
2. Measure by first adjusting both probes to the same length (A=A')

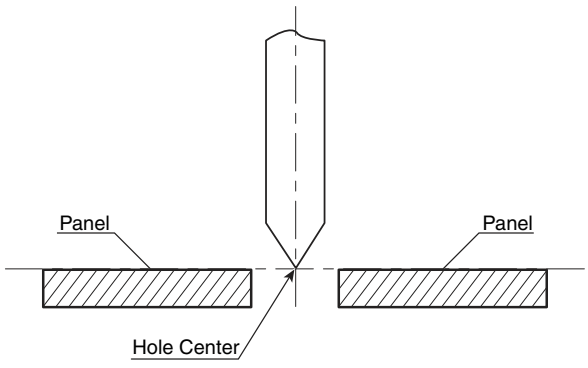
CAUTION
Check the probes and gauge itself to make sure there is no free play.



BMCBD6002

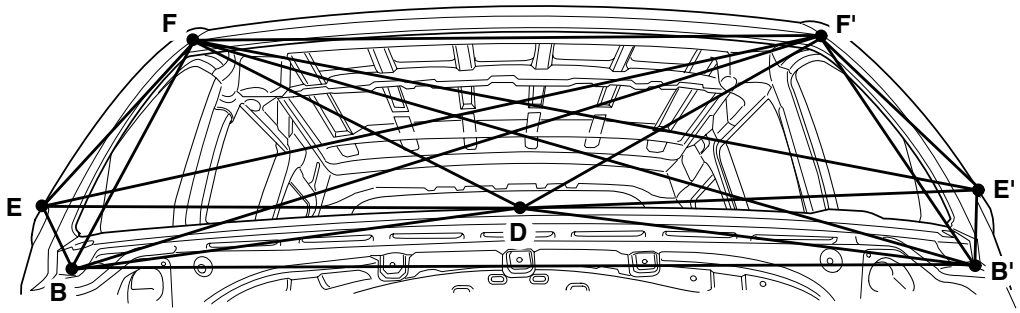
MEASUREMENT POINT

1. Measurements should be taken at the hole center.



BMCBD6003

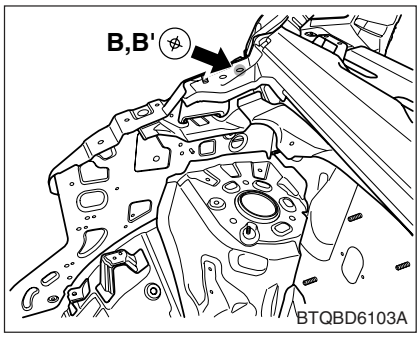
FRONT BODY A



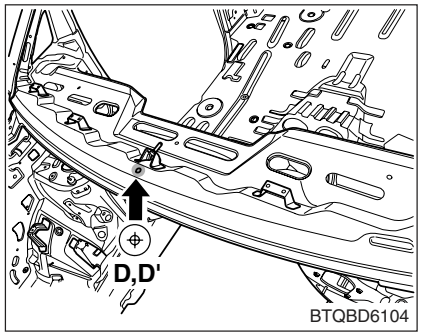
BTQBD6101

* These dimensions indicated in this figure are actual-measurement dimensions.

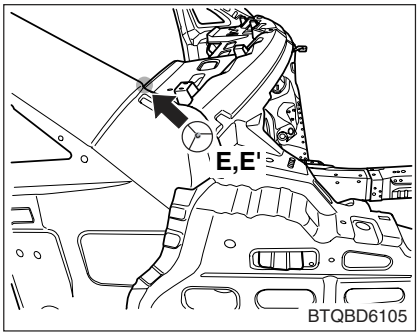
Point symbol	B-B'	B-D	B-E	B-F	B-F'	D-E	D-F	E-E'
Length(mm)	1477	745	201	1012	1701	757	1171	1419
Point symbol	**E-F**	**E-F'**	**F-F'**					
Length(mm)	892	1610	1266					



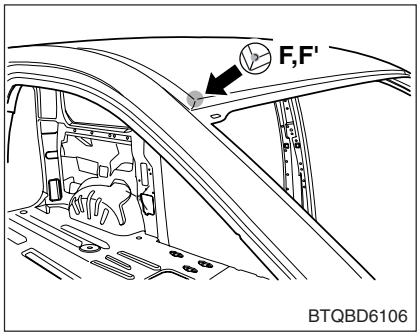
Hood hinge mounting hole (ø12)



Cowl panel hole (ø12)

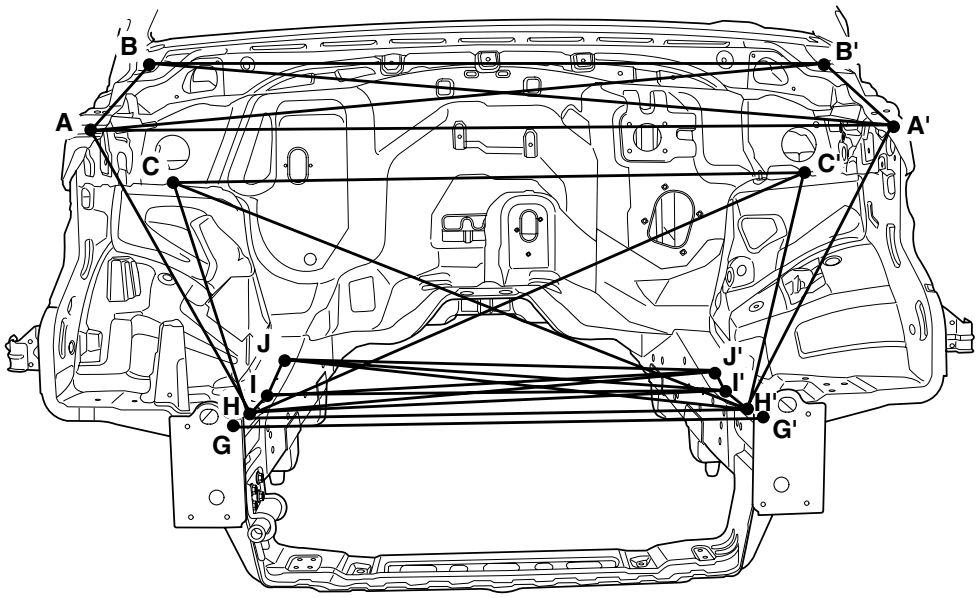


Front pillar outer panel corner



Roof panel front corner

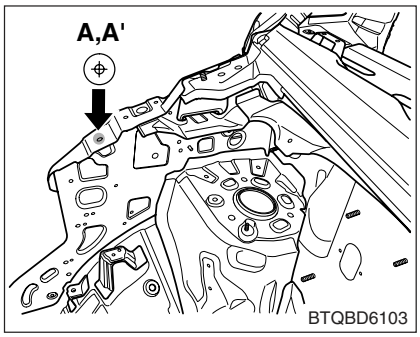
FRONT BODY B



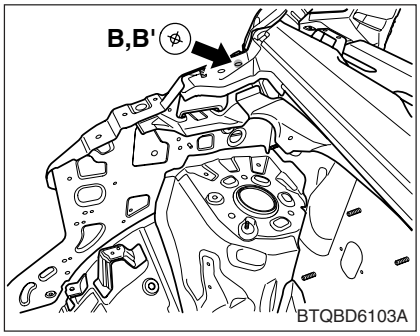
BTQBD6101A

* These dimensions indicated in this figure are actual-measurement dimensions.

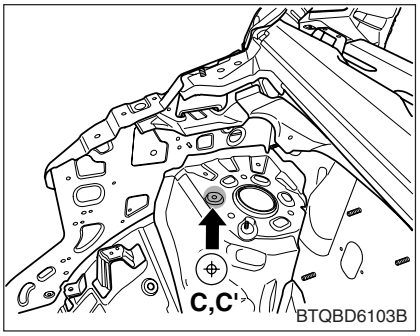
Point symbol	A-A'	A-B	A-B'	A-H	B-B'	C-C'	C-H	C-H'
Length(mm)	1582	284	1554	711	1477	1357	719	1331
Point symbol	G-G'	H-H'	H-I	H-I'	H-J'	I-H'	I-I'	I-J
Length(mm)	1024	924	220	919	953	922	867	264
Point symbol	I-J'	J-H'	J-I'	J-J'	H'-I'	I'-J'		
Length(mm)	874	1017	910	867	207	120		



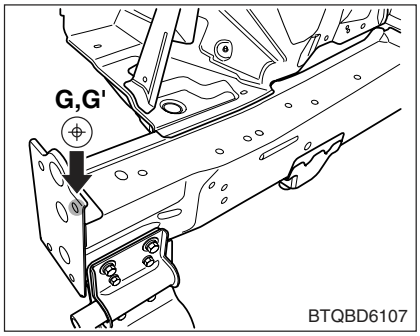
Fender panel mounting hole
(ø11)



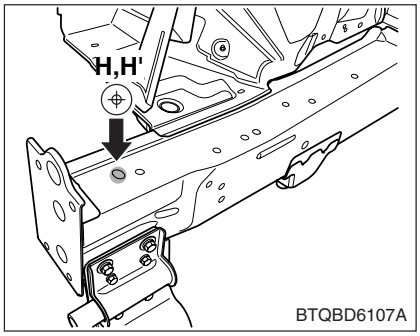
Hood hinge monting hole
(ø12)



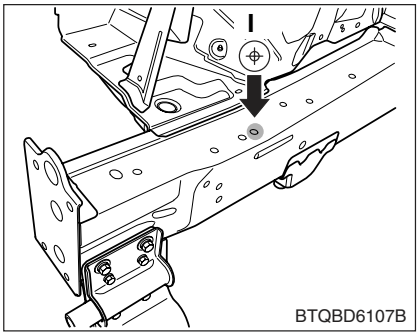
Front suspension mounting hole
(ø6.6)



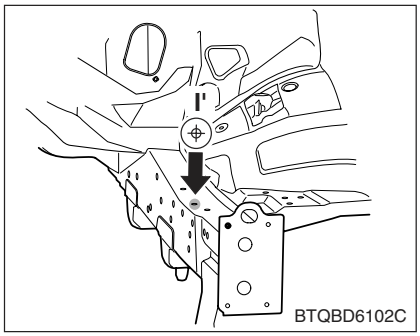
Front end module mounting hole
(ø11)



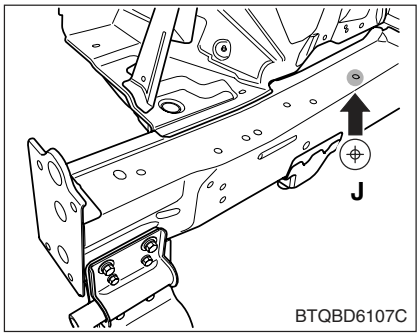
Front side member tooling hole
(6X12)



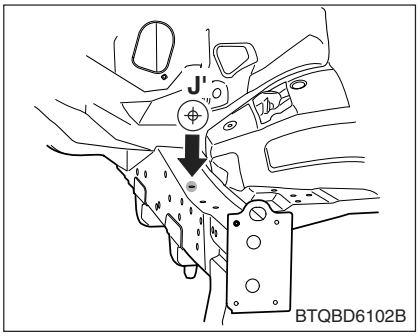
Front side member tooling hole
(ø9)



Front side member tooling hole
(ø11)

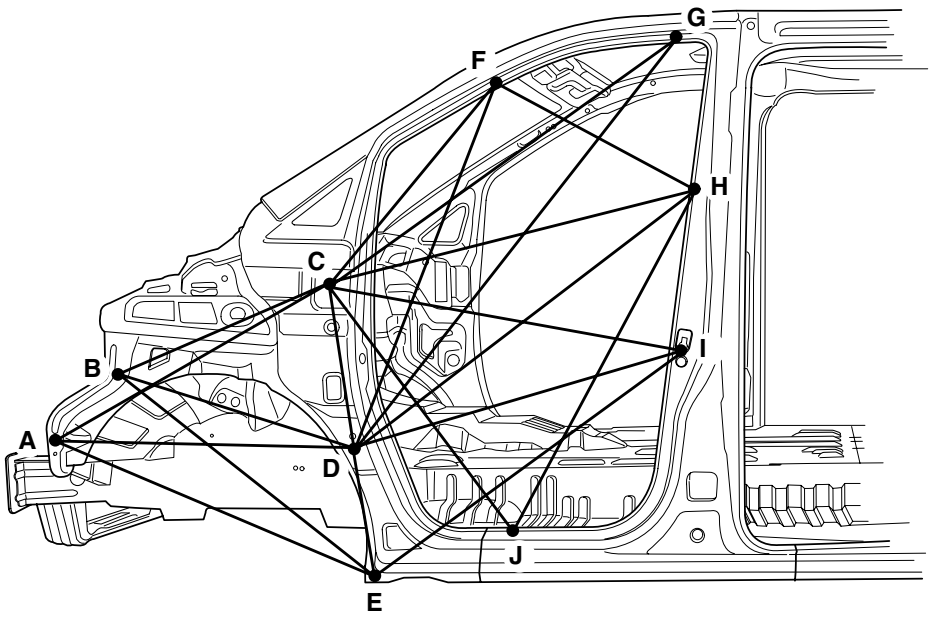


Front side member tooling hole
(ø10)



Front side member tooling hole
(ø11)

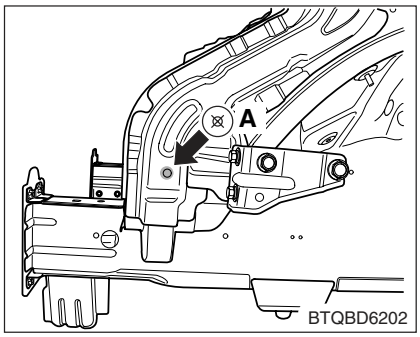
SIDE BODY A



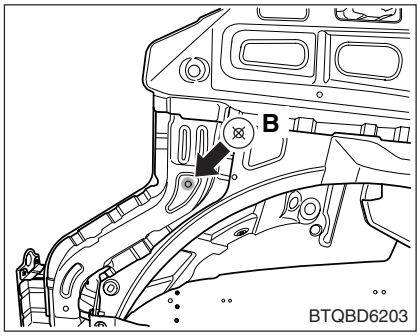
BTQBD6201

* These dimensions indicated in this figure are actual-measurement dimensions.

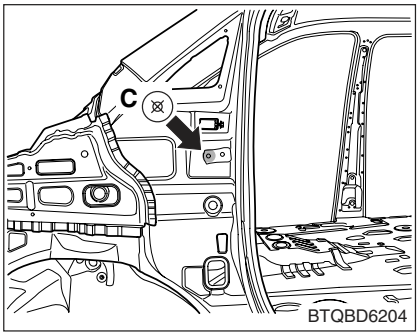
Point symbol	A-C	A-D	A-E	B-C	B-D	B-E	C-D	C-F
Length(mm)	914	871	980	699	722	922	471	622
Point symbol	C-G	C-H	C-I	C-J	D-E	D-F	D-G	D-H
Length(mm)	1105	1055	1008	827	370	1016	1404	1209
Point symbol	D-I	E-I	F-H	H-J				
Length(mm)	967	1103	699	1132				



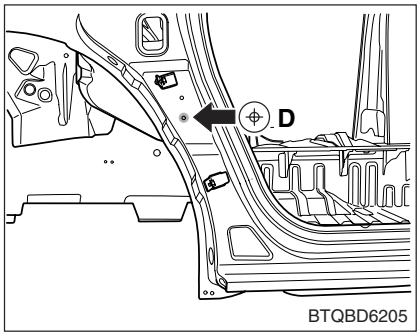
Fender apron inner support tooling hole (ø8)



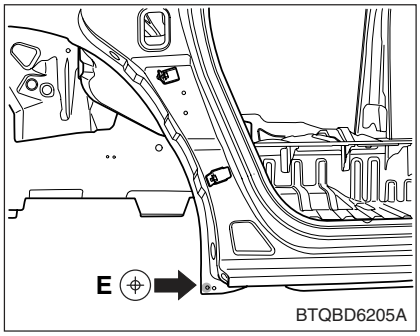
Fender apron inner support tooling hole (ø8)



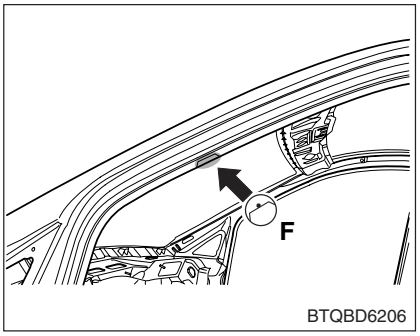
Front door hinge upper mounting hole (ø11)



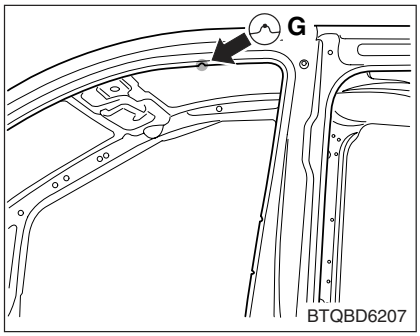
Front door hinge lower mounting hole (ø11)



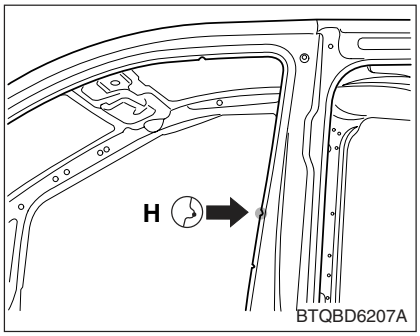
Front fender panel mounting hole (ø11)



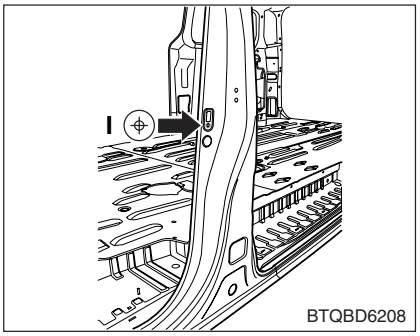
Front pillar outer panel notch



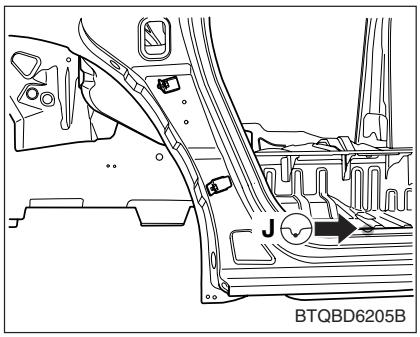
Side outer panel notch



Center pillar outer panel notch

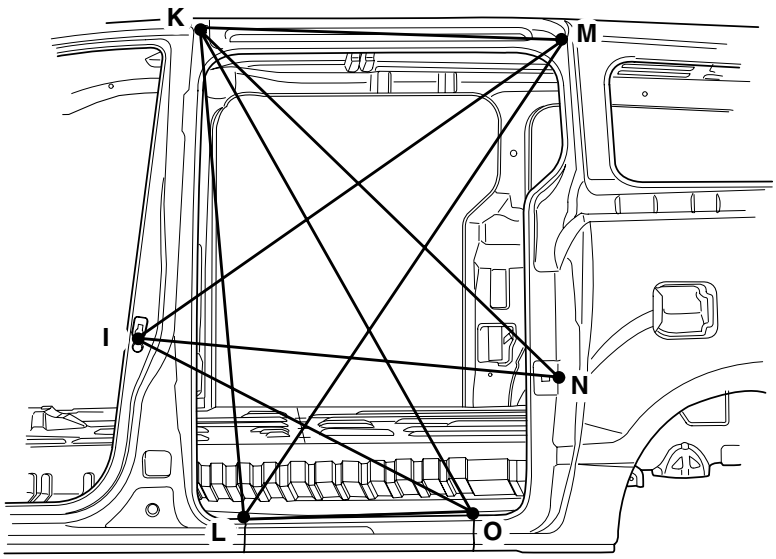


Front door switch mounting hole (ø7)



Side sill outer panel notch

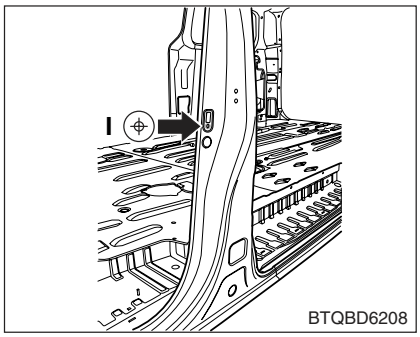
SIDE BODY B



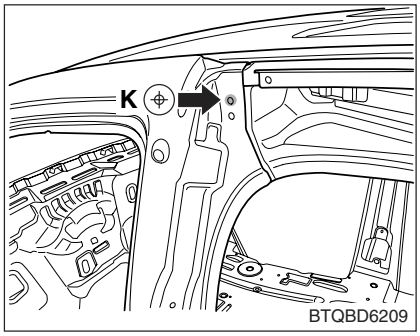
BTQBD6201A

* These dimensions indicated in this figure are actual-measurement dimensions.

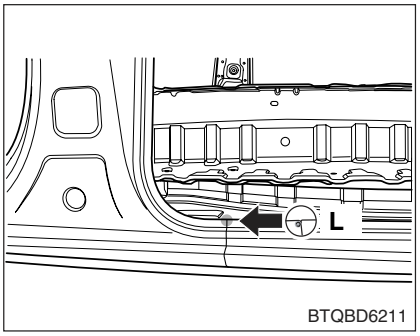
Point symbol	I-M	I-N	I-O	K-L	K-M	K-N	K-O	L-M
Length(mm)	1622	1255	1188	1495	1121	1511	1720	1831
Point symbol	L-O							
Length(mm)	758							



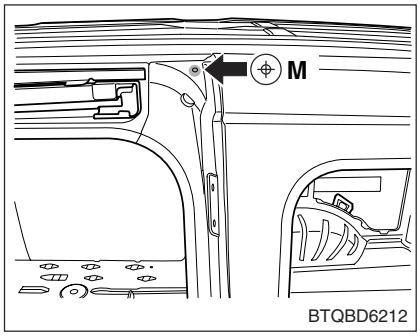
Front door switch mounting hole (ø7)



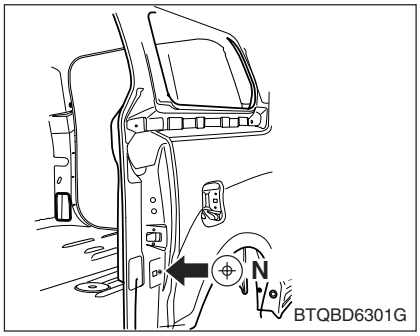
Center pillar outer panel hole (ø8)



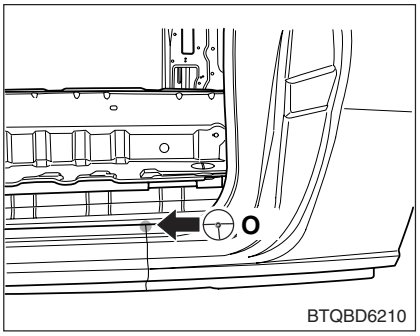
Center pillar outer panel end corner



Quarter outer panel hole (ø6.8)

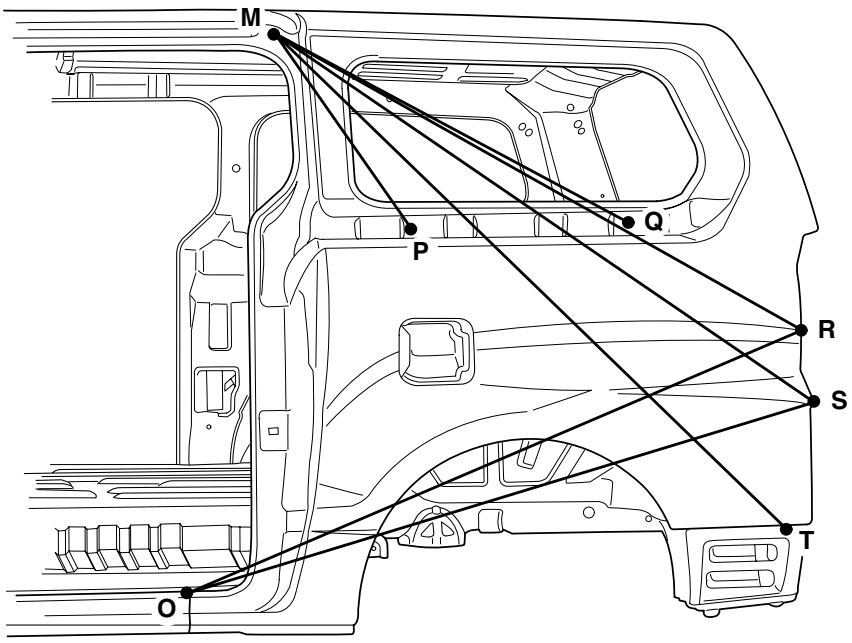


Rear door switch mounting hole (ø10)



Quarter outer panel lower front end corner

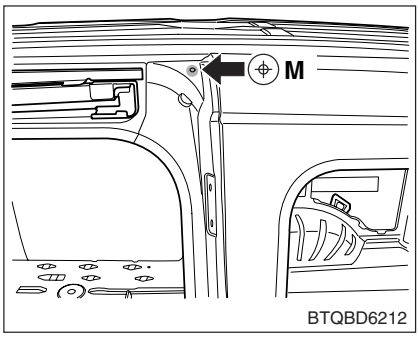
SIDE BODY C



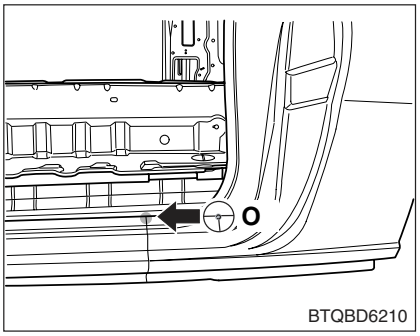
BTQBD6201B

* These dimensions indicated in this figure are actual-measurement dimensions.

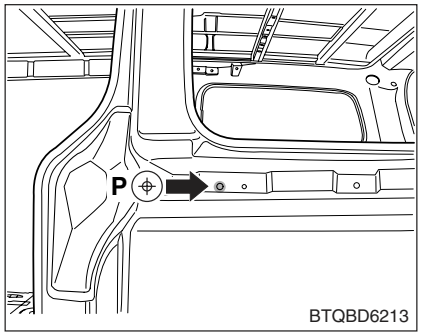
Point symbol	M-P	M-Q	M-R	M-S	M-T	O-R	O-S	
Length(mm)	624	1065	1515	1701	1876	1668	1664	



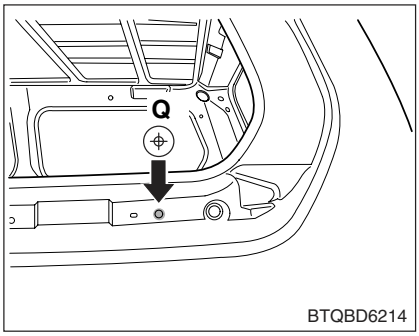
Quarter outer panel hole (ø6.8)



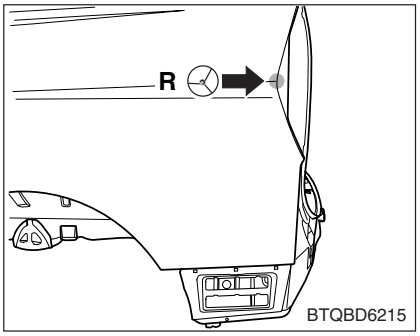
Quarter outer panel lower front end corner



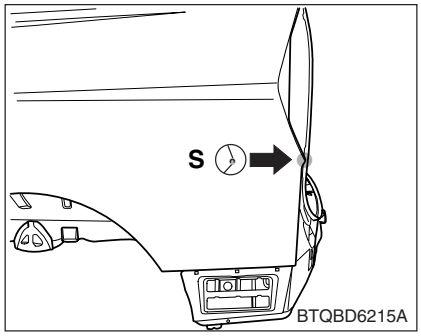
Rear door center rail mounting hole (ø8)



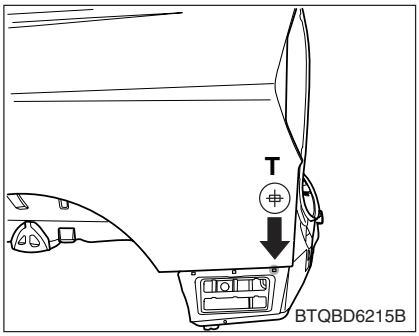
Rear door center rail mounting hole (ø8)



Quarter outer panel rear corner

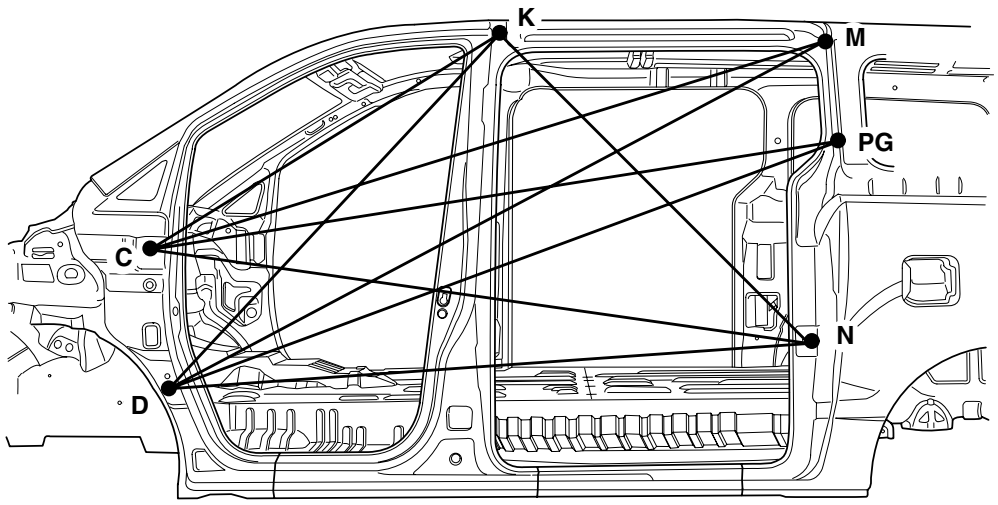


Quarter outer panel rear corner



Rear bumper mounting hole (8.5X8.5)

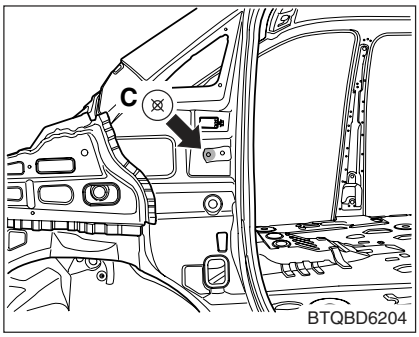
SIDE BODY D



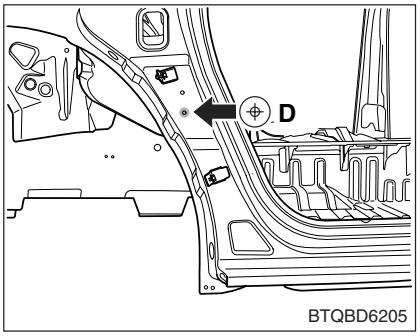
BTQBD6201D

* These dimensions indicated in this figure are actual-measurement dimensions.

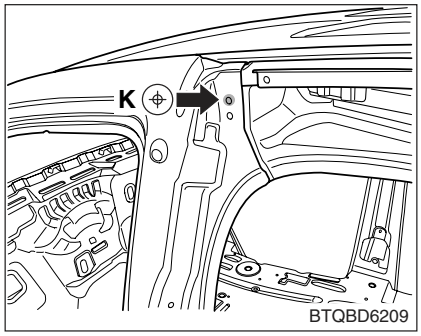
Point symbol	C-K	C-M	C-PG	C-N	D-K	D-M	D-PG	D-N
Length(mm)	1400	2430	2346	2261	1648	2556	2384	2173
Point symbol	K-M	K-N						
Length(mm)	1121	1511						



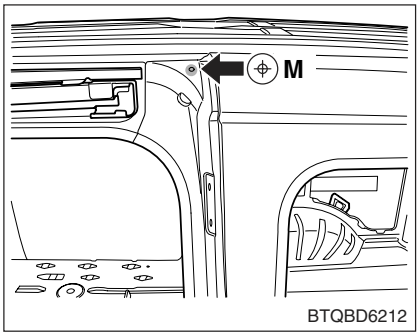
Front door hinge upper mounting hole (ø11)



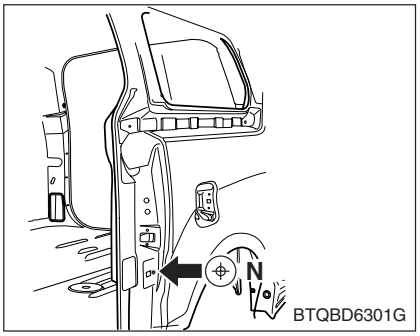
Front door hinge lower mounting hole (ø11)



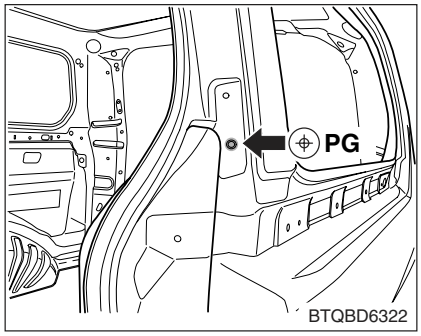
Center pillar outer panel hole (ø8)



Quarter outer panel hole (ø6.8)

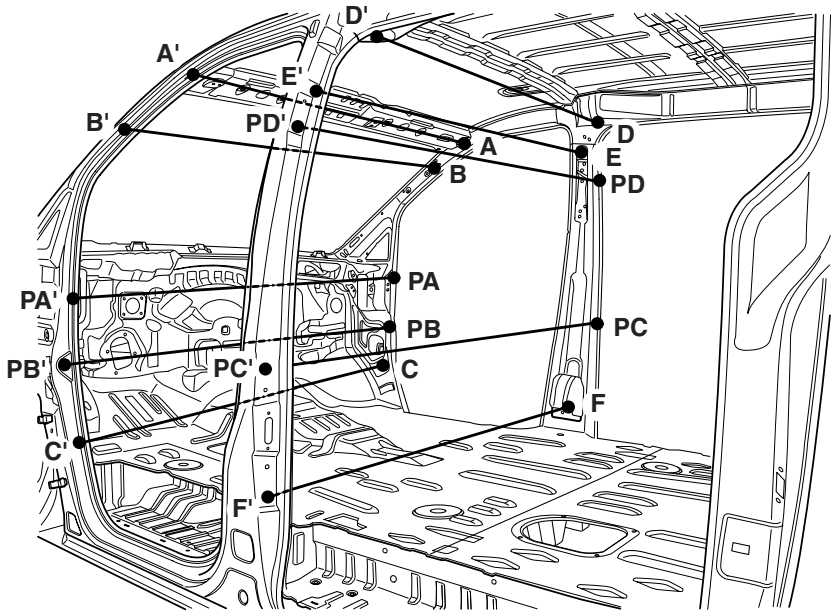


Rear door switch mounting hole (ø10)



Quarter window glass mounting hole (ø9)

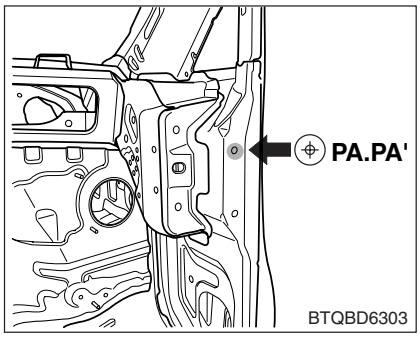
INTERIOR A



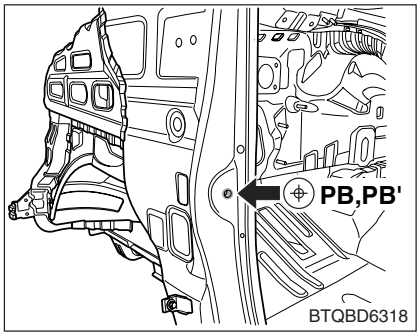
BTQBD6301H

* These dimensions indicated in this figure are actual-measurement dimensions.

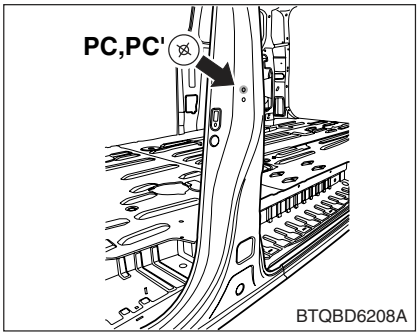
Point symbol	PA-PA'	PB-PB'	PC-PC'	PD-PD'	A-A'	B-B'	C-C'	D-D'
Length(mm)	1585	1657	1736	1603	1384	1441	1602	1250
Point symbol	E-E'	F-F'						
Length(mm)	1435	1605						



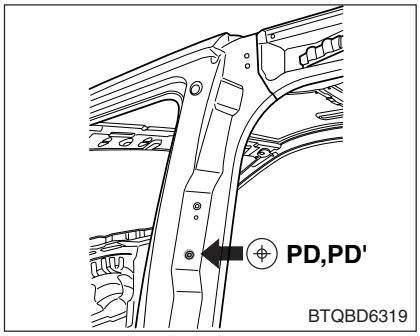
Crash pad mounting guide hole (ø9)



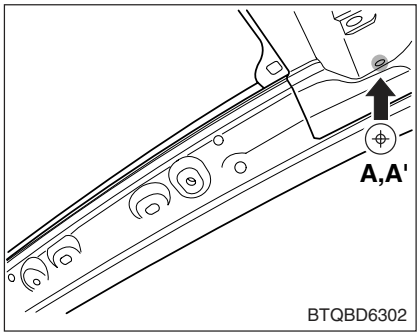
Front door checker mounting hole (ø11)



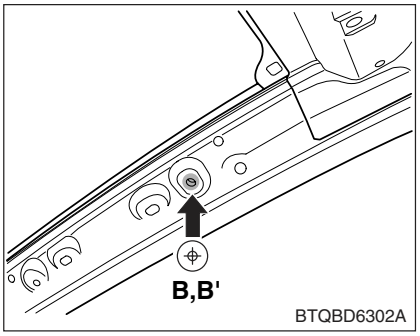
Front door striker mounting hole (ø13)



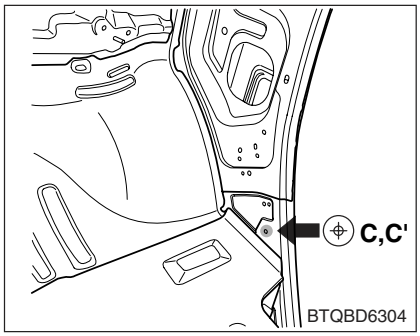
Rear door stopper mounting hole (ø9)



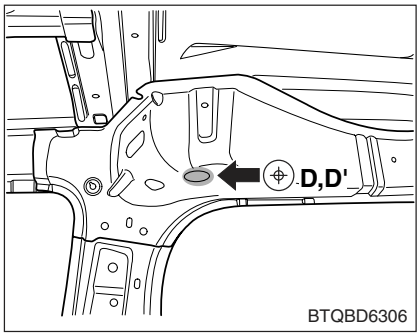
Roof front rail tooling hole (ø7)



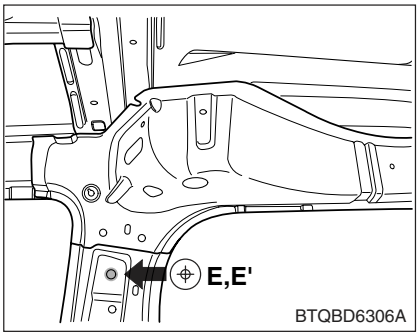
Front pillar trim mounting hole (ø6.6)



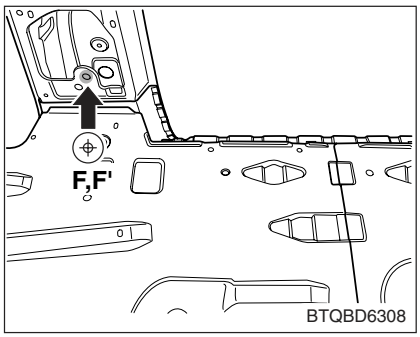
Front pillar inner panel tooling hole (ø6.6)



Roof side inner rail tooling hole (ø30)

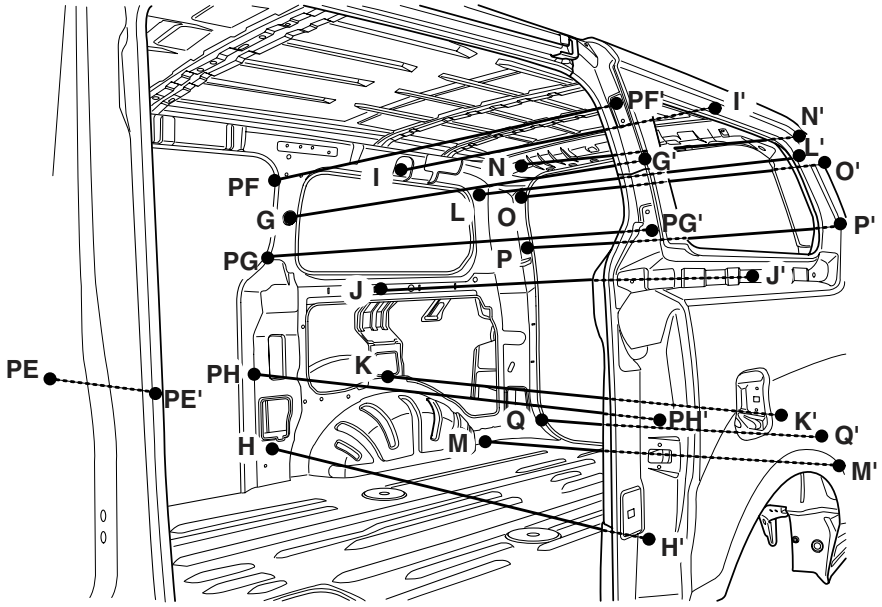


Front seat belt upper anchor mounting hole



Front seat belt retractor mounting hole (ø16)

INTERIOR B



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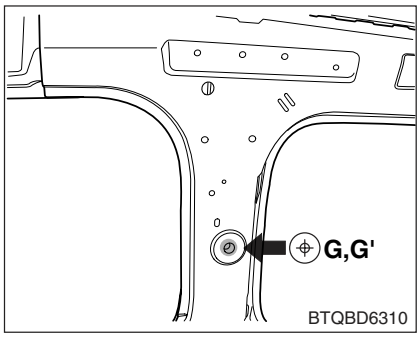
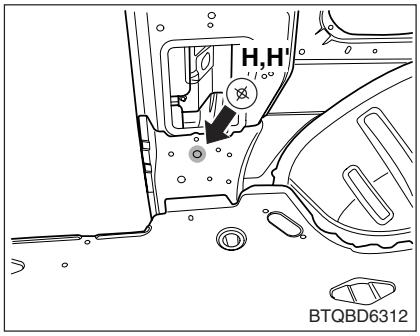
* These dimensions indicated in this figure are actual-measurement dimensions.

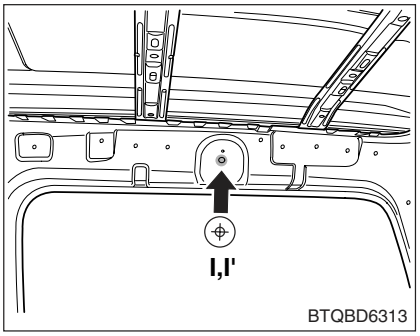
Point symbol	G-G'	H-H'	I-I'	J-J'	K-K'	L-L'	M-M'	N-N'
Length(mm)	1513	1569	1376	1622	1625	1456	1596	973
Point symbol	**O-O'**	**P-P'**	**Q-Q'**	**PE-PE'**	**PF-PF'**	**PG-PG'**	**PH-PH'**	
Length(mm)	1211	1338	1332	1742	1498	1670	1750	



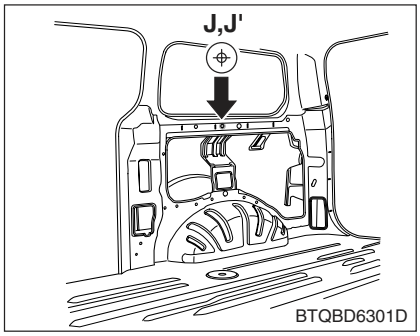
Quarter inner panel tooling hole (ø19)



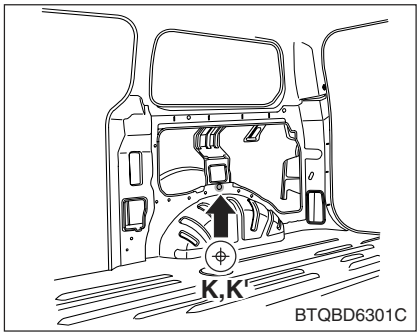
Quarter inner panel tooling hole (ø15)



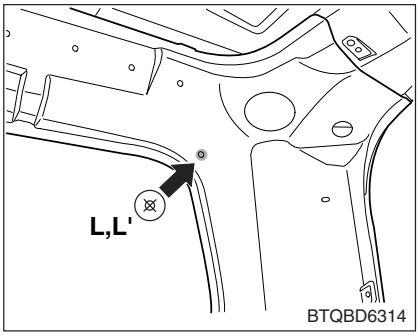
Quarter inner panel tooling hole (ø17.2)



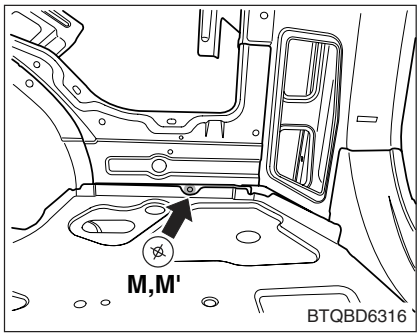
Quarter inner panel tooling hole (ø8.5)



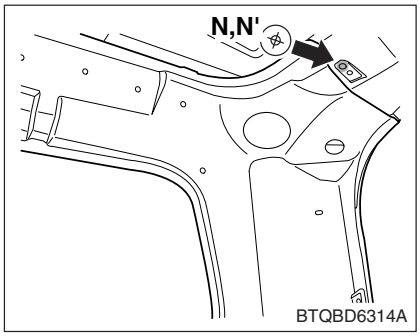
Quarter inner panel tooling hole (ø16)



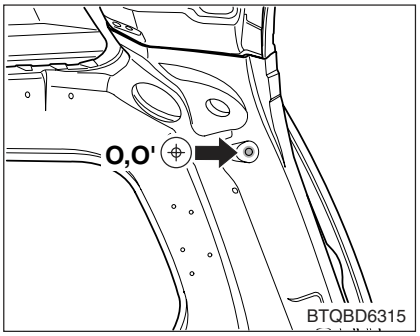
Quarter inner panel tooling hole (ø8.5)



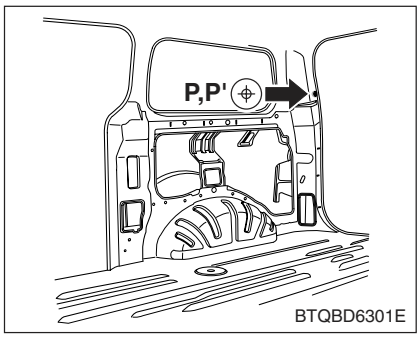
Quarter inner panel tooling hole (ø7)



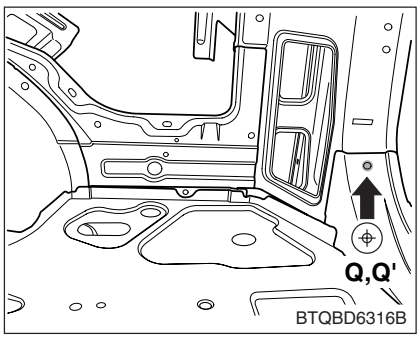
Roof rear rail tooling hole (ø8.5)



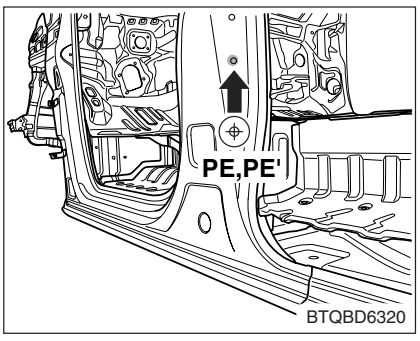
Quarter inner panel tooling hole (ø8.5)



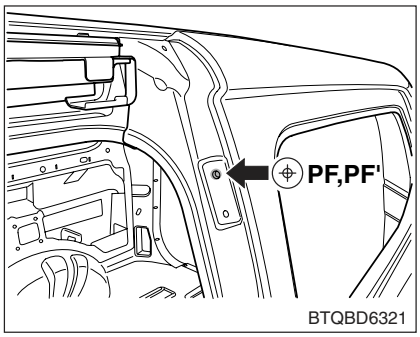
Quarter inner panel tooling hole (ø6.6)



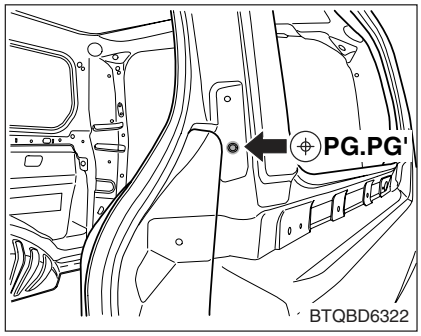
Quarter inner lower rear extension tooling hole (ø7)



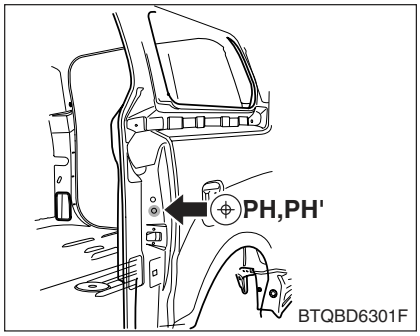
Rear door stopper mounting hole (ø6.6)



Quarter outer panel tooling hole (ø9)

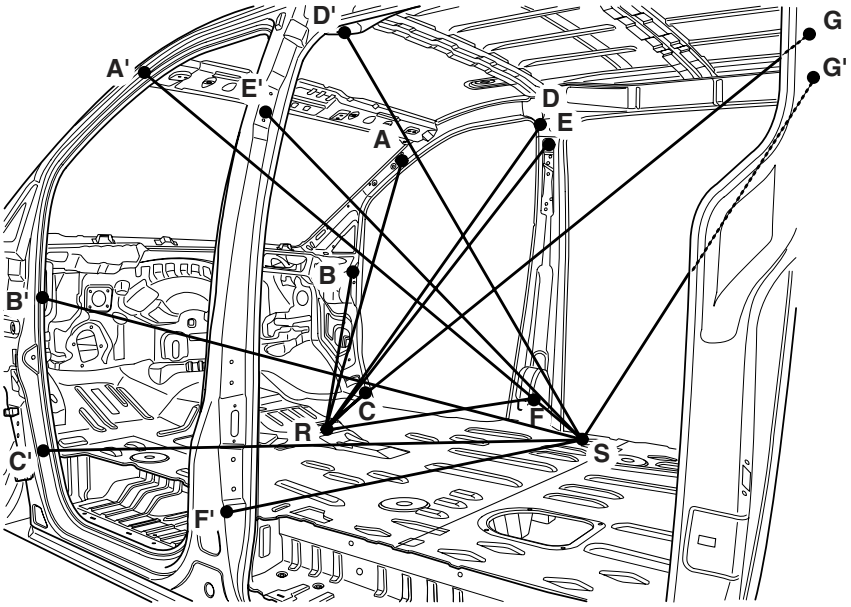


Quarter outer panel tooling hole (ø9)



Quarter outer panel tooling hole (ø13)

INTERIOR C



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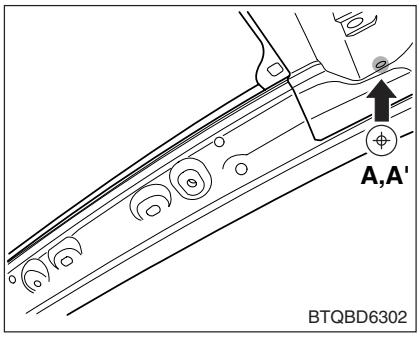
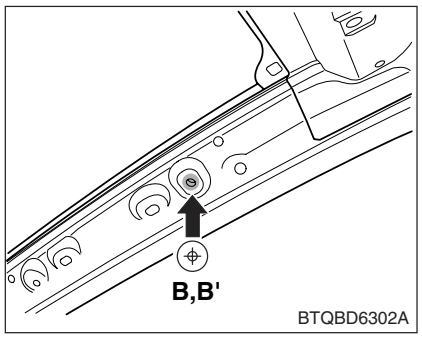
* These dimensions indicated in this figure are actual-measurement dimensions.

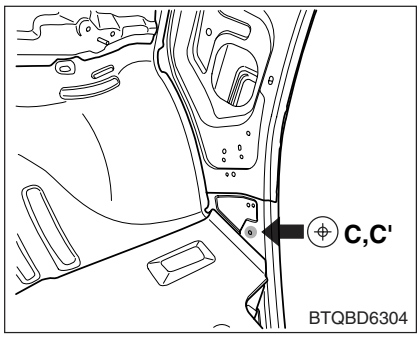
Point symbol	R-A	R-B	R-C	R-D	R-E	R-F	R-G	S-A'
Length(mm)	1324	1286	926	1467	1390	925	2136	1410
Point symbol	**S-B'**	**S-C'**	**S-D'**	**S-E'**	**S-F'**	**S-G'**		
Length(mm)	1426	1179	1220	1134	301	1454		



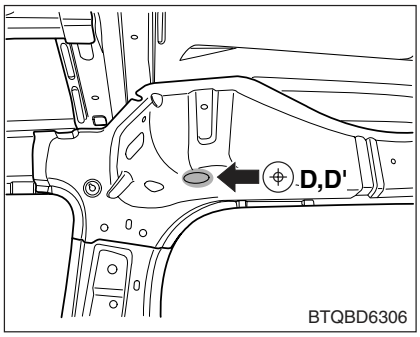
Roof front rail tooling hole (ø7)



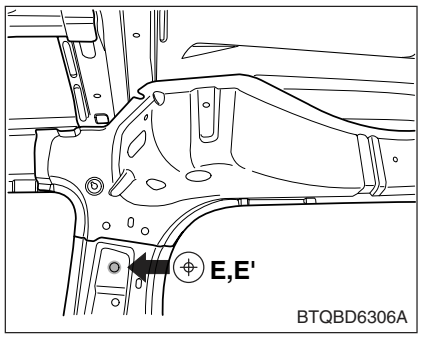
Front pillar trim mounting hole (ø6.6)



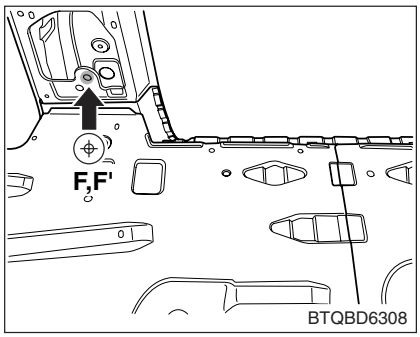
Front pillar inner panel tooling hole (ø6.6)



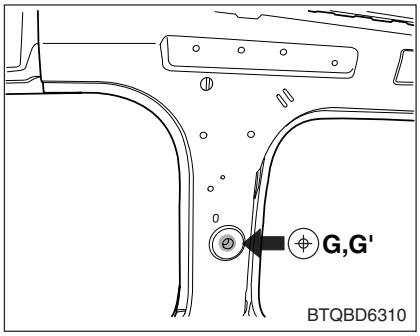
Side inner panel tooling hole (ø30)



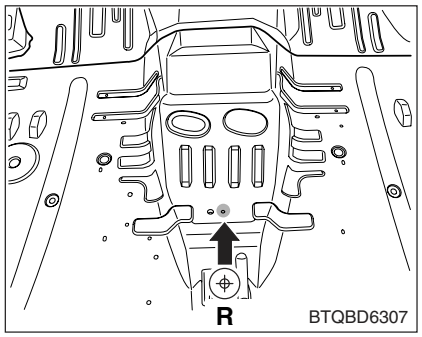
Front seat belt upper anchor mounting hole



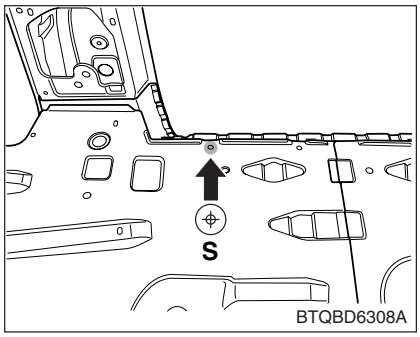
Front seat belt retractor mounting hole (ø16)



Quarter inner panel tooling hole (ø19)

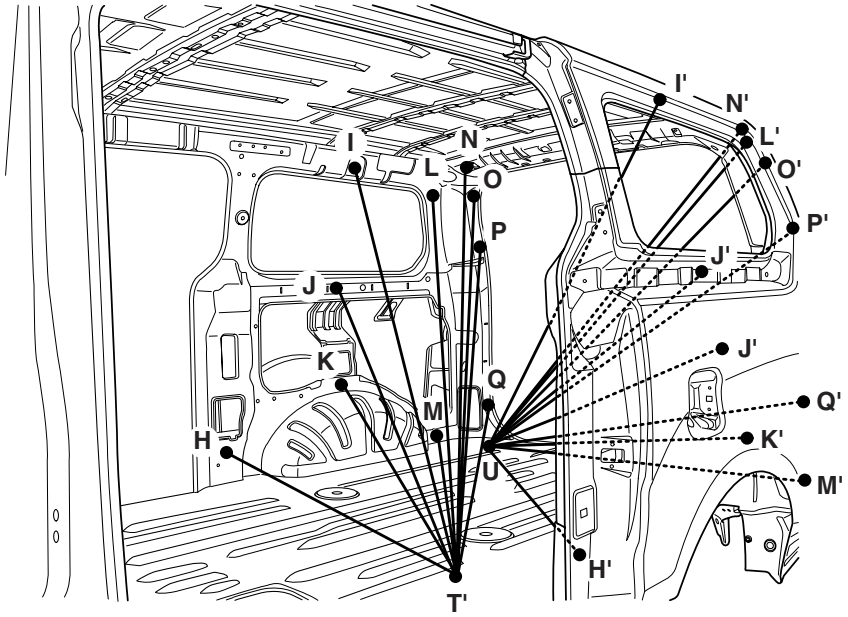


Center floor front rainforcement tooling hole (ø11)



Center floor panel tooling hole (ø11)

INTERIOR D



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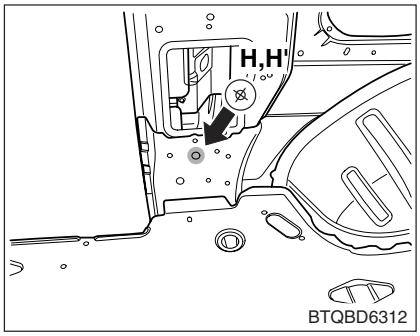
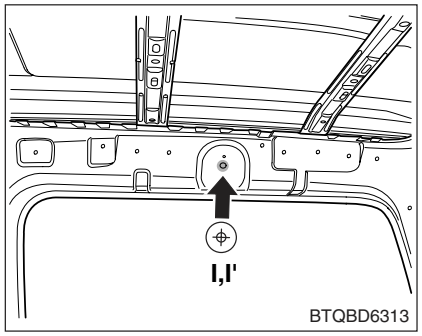
* These dimensions indicated in this figure are actual-measument dimensions.

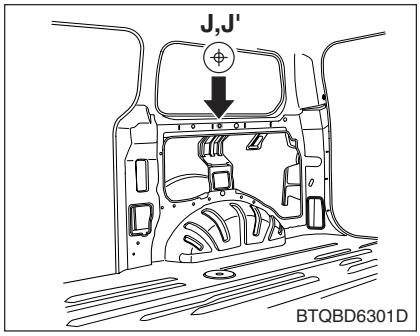
Point symbol	T'-H	T'-I	T'-J	T'-K	T'-L	T'-M	T'-N	T'-O
Length(mm)	1481	2022	1866	1739	2236	2054	2175	2260
Point symbol	**T'-P**	**T'-Q**	**U-H'**	**U-I'**	**U-J'**	**U-K'**	**U-L'**	**U-M'**
Length(mm)	2231	2124	1800	1848	1657	1536	1726	1361
Point symbol	**U-N'**	**U-O'**	**U-P'**	**U-Q'**				
Length(mm)	1640	1632	1449	1249				



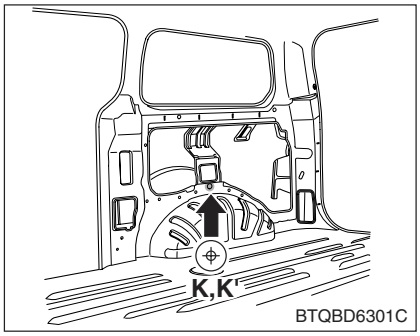
Quarter inner panel tooling hole (ø15)



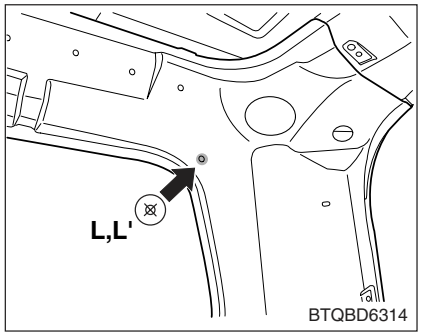
Quarter inner panel tooling hole (ø17.2)



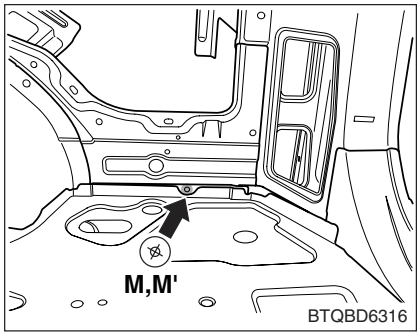
Quarter inner panel tooling hole (ø8.5)



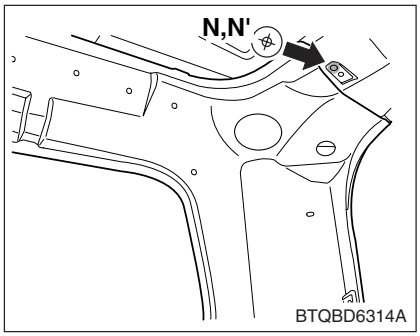
Quarter inner panel tooling hole (ø16)



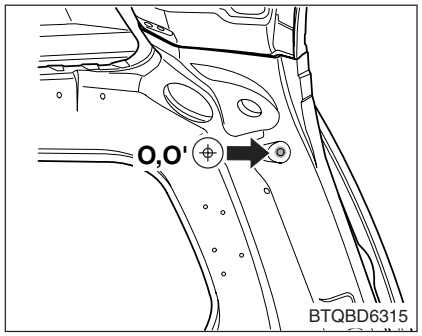
Quarter inner panel tooling hole (ø8.5)



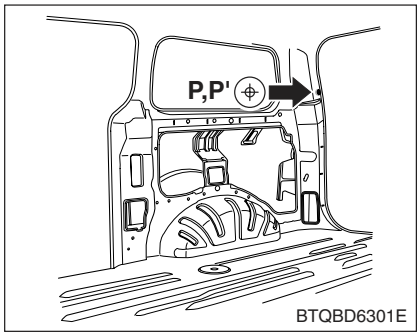
Quarter inner panel tooling hole (ø7)



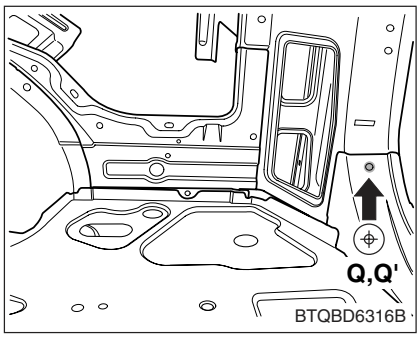
Roof rear rail tooling hole (ø8.5)



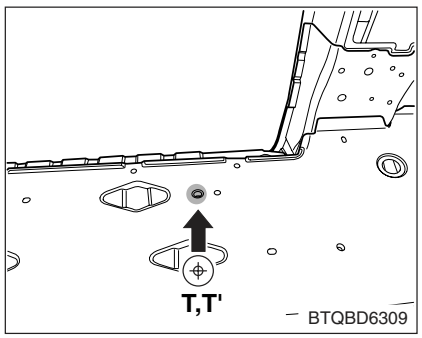
Quarter inner panel tooling hole (ø8.5)



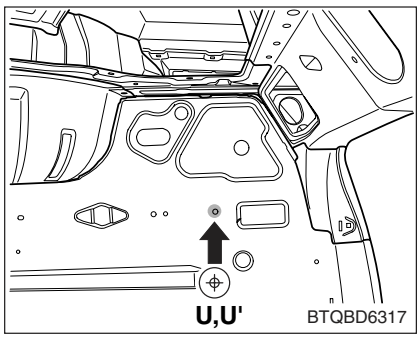
Quarter inner panel tooling hole (ø6.6)



Quarter inner lower rear extension tooling hole (ø7)

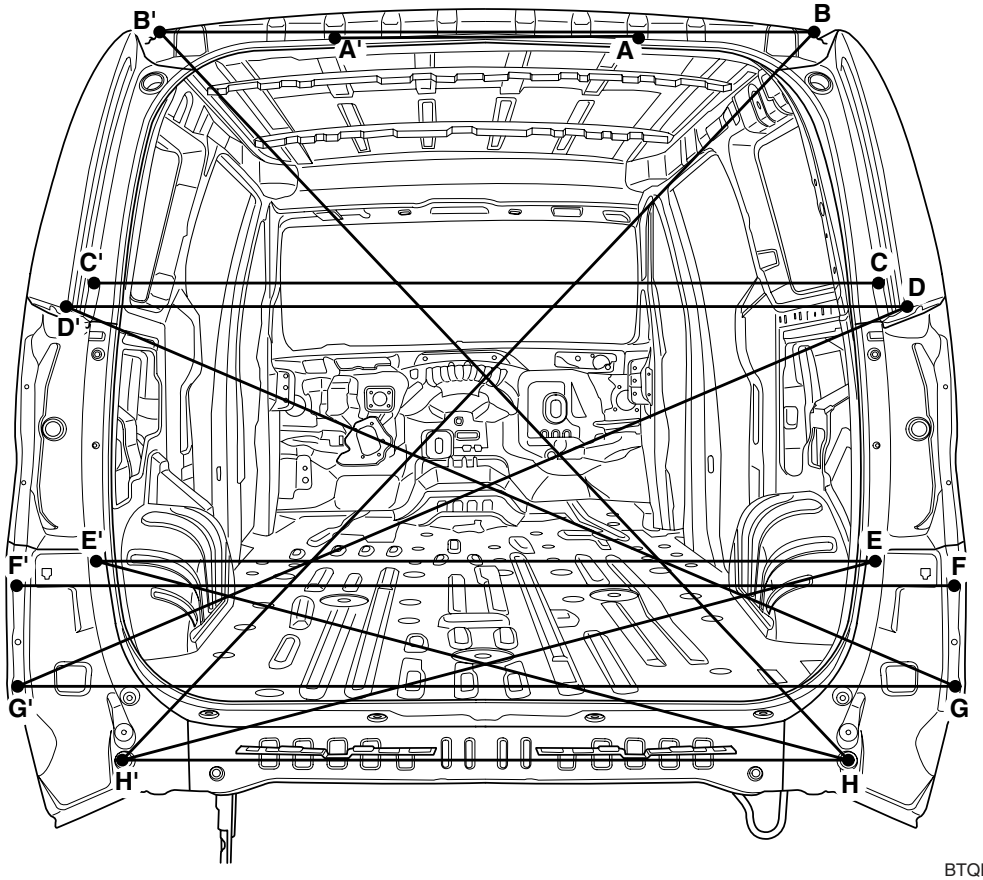


Rear floor panel tooling hole (ø15)



Rear floor panel tooling hole (ø15)

REAR BODY



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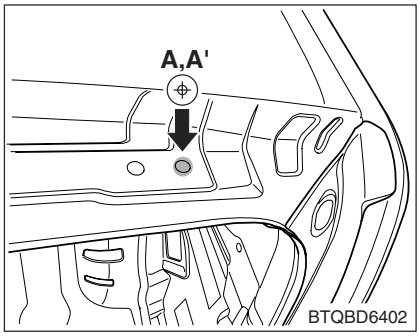
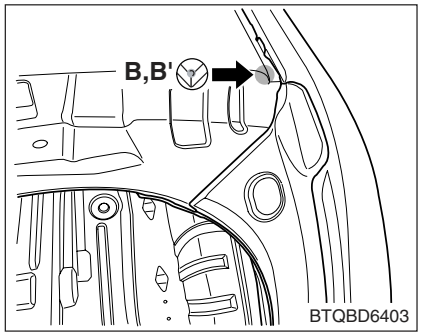
* These dimensions indicated in this figure are actual-measurement dimensions.

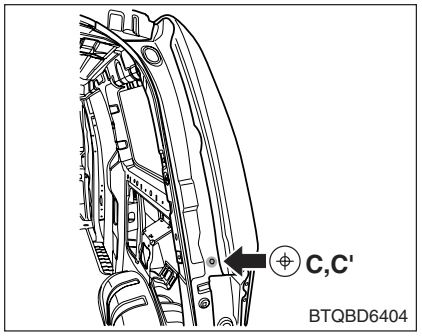
Point symbol	A-A'	B-B'	B-H'	C-C'	D-D'	D-G'	E-E'	E-H'
Length(mm)	840	1272	1933	1455	1514	1797	1447	1450
Point symbol	**F-F'**	**G-G'**	**H-H'**					
Length(mm)	1769	1789	1360					



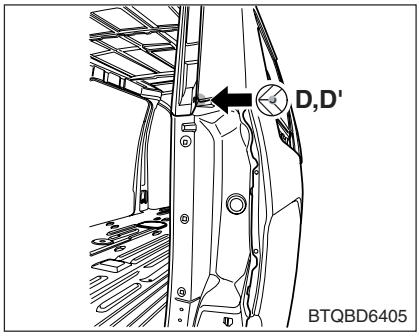
Tailgate hinge mounting hole (ø12)



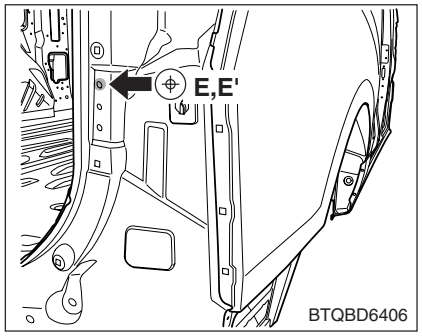
Roof panel rear corner



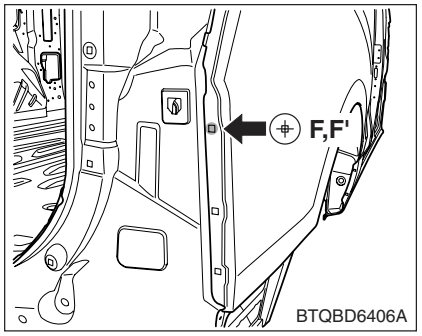
Quarter outer panel rear tooling hole (ø12)



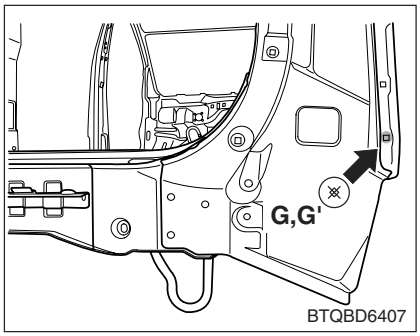
Quarter outer panel rear corner



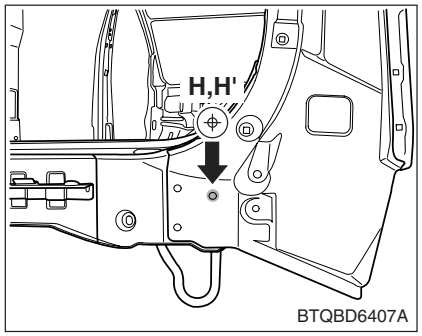
Quarter outer rear extension tooling hole (ø6.6)



Quarter outer panel rear tooling hole (8.5 X 8.5)

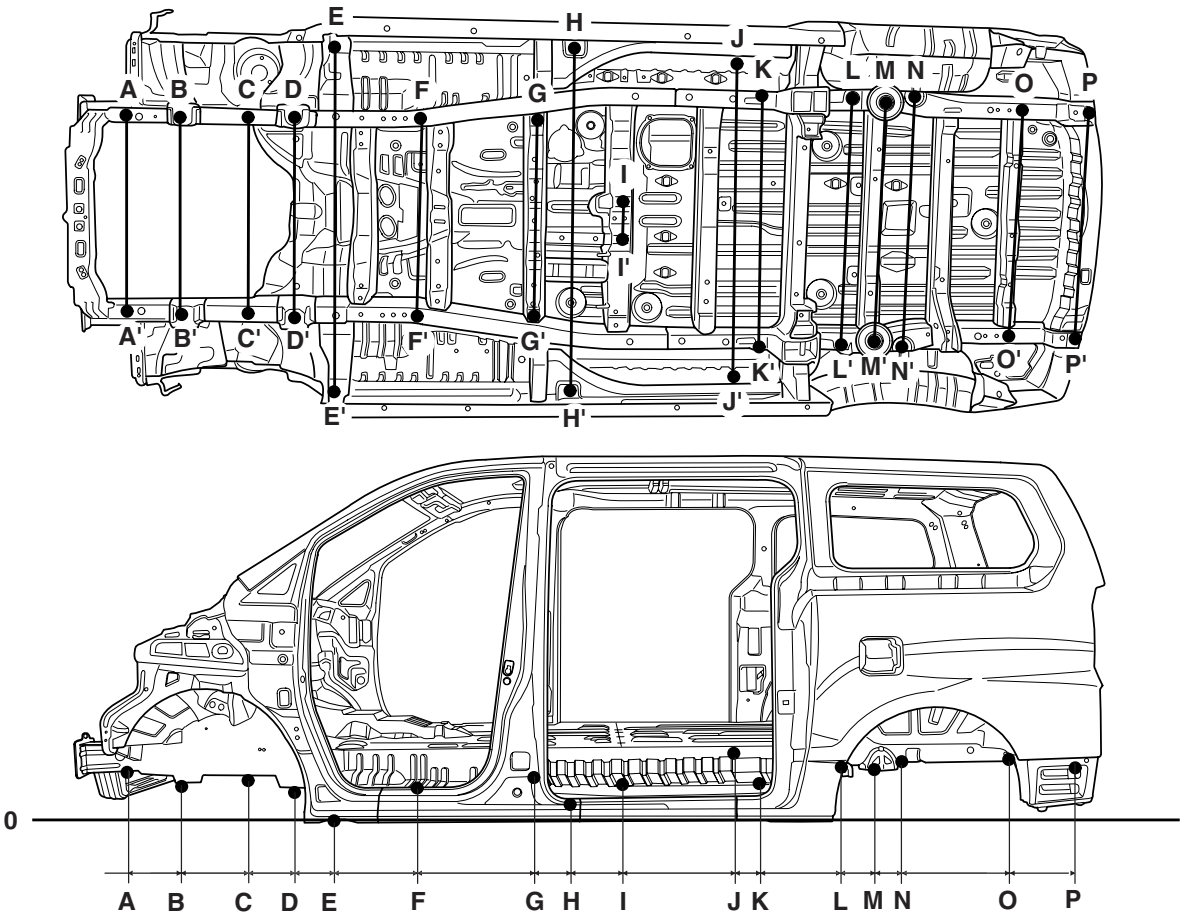


Quarter outer panel rear tooling hole (8.5 X 8.5)



Rear end cross member tooling hole (ø13)

UNDER BODY (PROJECTED)



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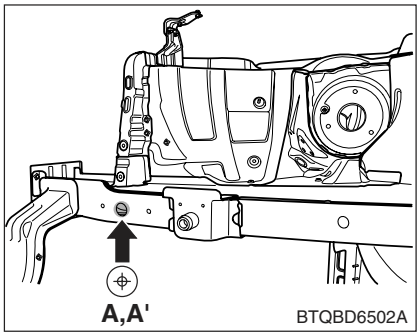
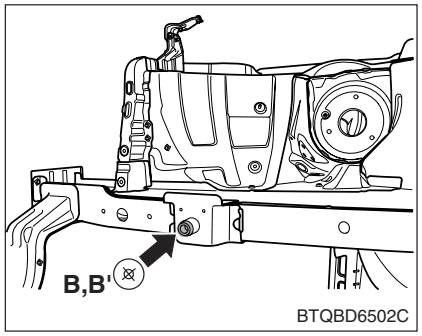
* These dimensions indicated in this figure are projected dimensions.

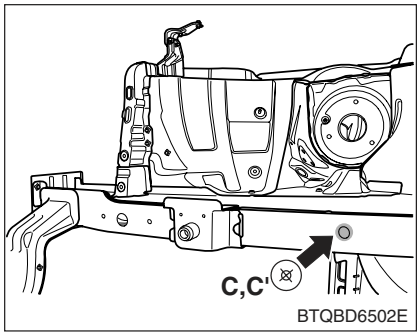
Point symbol	A-A'	B-B'	C-C'	D-D'	E-E'	F-F'	G-G'	H-H'
Length(mm)	896	893	900	916	1540	907	923	1563
Point symbol	I-I'	J-J'	K-K'	L-L'	M-M'	N-N'	O-O'	P-P'
Length(mm)	170	1334	1180	1183	1140	1218	1106	1106
Point symbol	0-A	0-B	0-C	0-D	0-E	0-F	0-G	0-H
Length(mm)	155	102	155	84	-2.9	155	195	56
Point symbol	0-I	0-J	0-K	0-L	0-M	0-N	0-O	0-P
Length(mm)	144	289	169	193	172	217	204	145
Point symbol	A-B	B-C	C-D	D-E	E-F	F-G	G-H	H-I
Length(mm)	265	278	222	190	365	540	156	243
Point symbol	I-J	J-K	K-L	L-M	M-N	N-O	O-P	
Length(mm)	540	60	477	167	151	544	327	



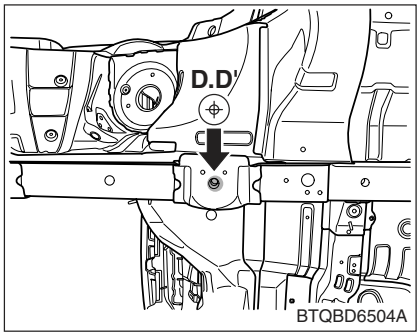
Front side member tooling hole (ø11)



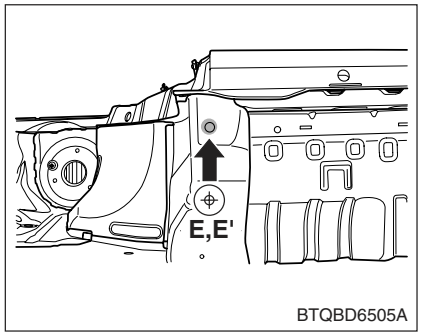
Sub frame front mounting pipe (ø30)



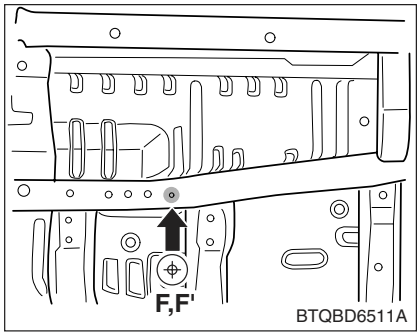
Front side member tooling hole (ø20)



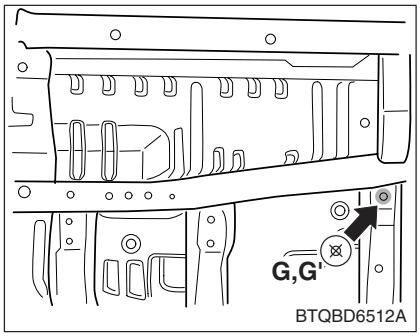
Front side member tooling hole (ø18)



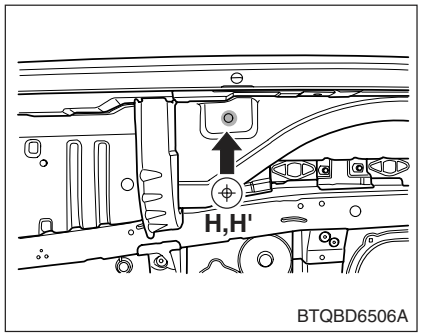
Dash panel tooling hole (ø15)



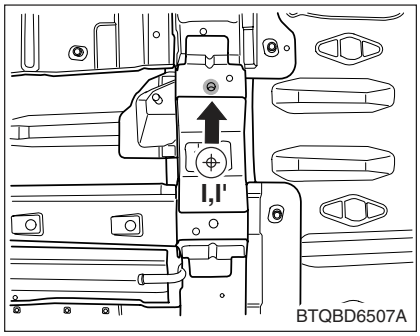
Front side member tooling hole (ø11)



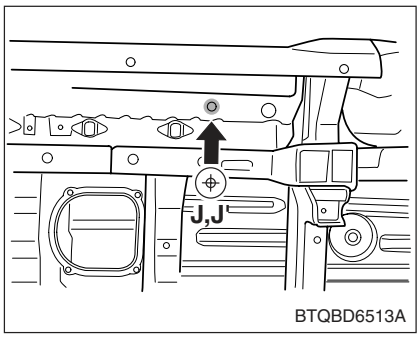
Cross member tooling hole (ø8)



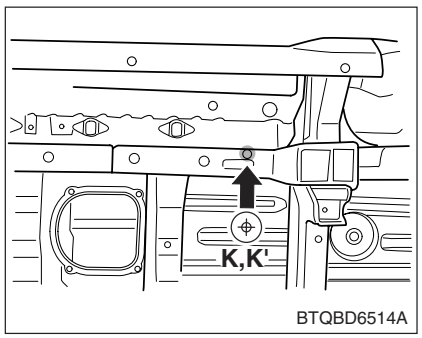
Center floor panel tooling hole (ø16)



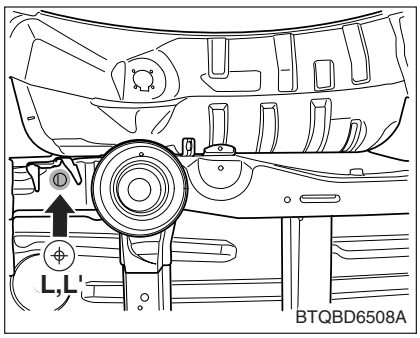
Cross member tooling hole (ø15)



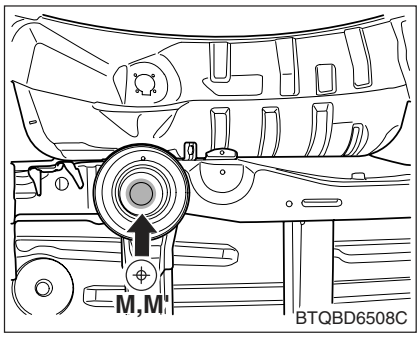
Rear floor panel tooling hole (ø15)



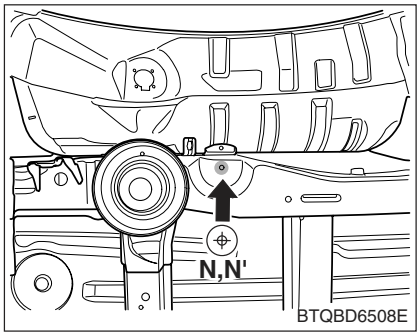
Rear side member tooling hole (ø6.6)



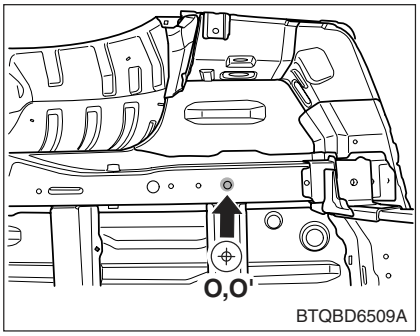
Rear side member tooling hole



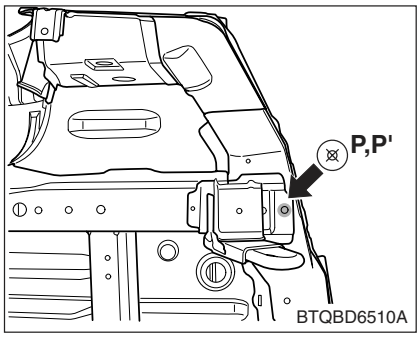
Spring mounting hole
(ø40)



Rear side member tooling hole
(ø9)

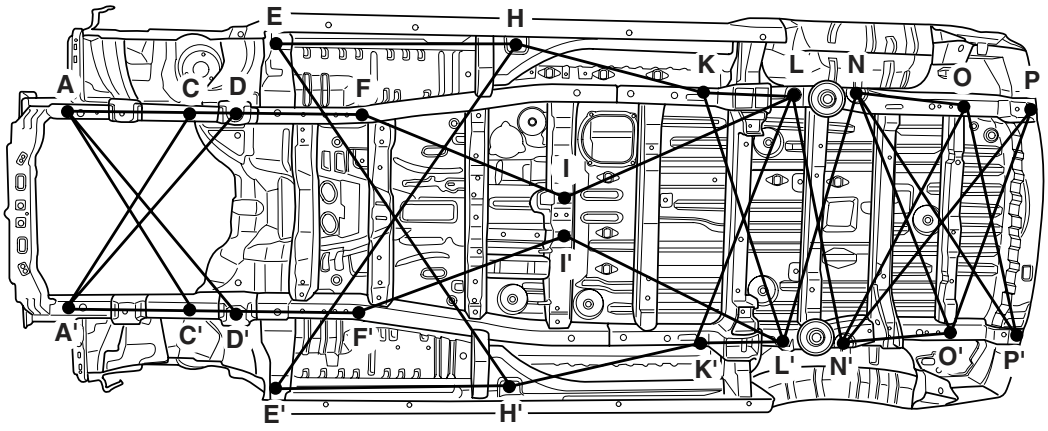


Rear side member tooling hole
(ø16)



Rear side member tooling hole
(ø11)

UNDER BODY (ACTUAL-MEASUREMENT DIMENSIONS)



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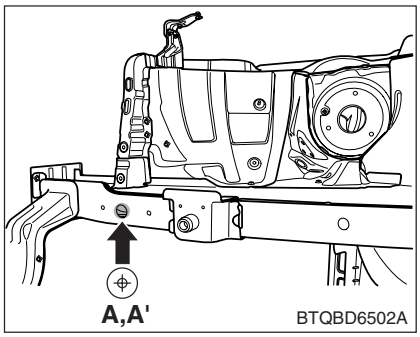
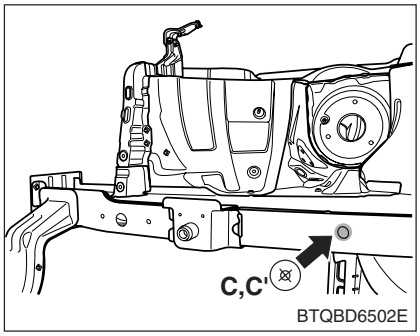
* These dimensions indicated in this figure are actual-measurement dimensions.

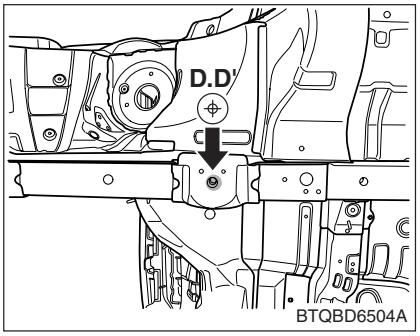
Point symbol	A-C'	A-D	A-D'	D-F	E-H	E-H'	F-I	H-K'
Length(mm)	1049	768	1188	560	1063	1881	1010	1614
Point symbol	**I-L**	**K-L'**	**L-N'**	**N-O**	**N-O'**	**N-P'**	**O-P'**	
Length(mm)	1191	1274	1242	547	1283	1454	1155	



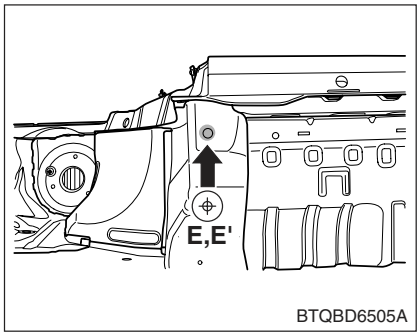
Front side member tooling hole (ø11)



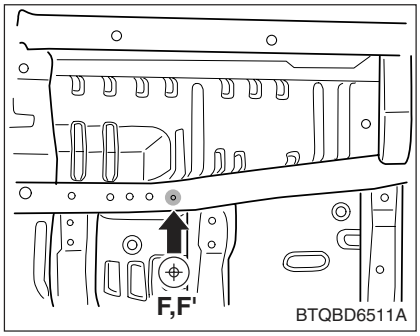
Front side member tooling hole (ø20)



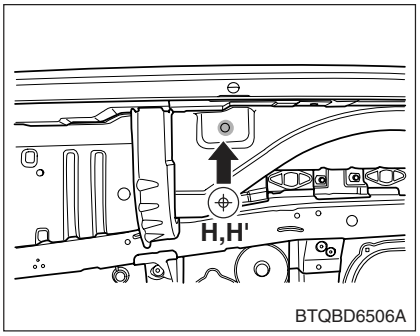
Front side member tooling hole (ø18)



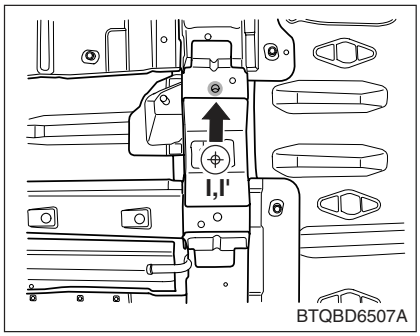
Dash panel tooling hole (ø15)



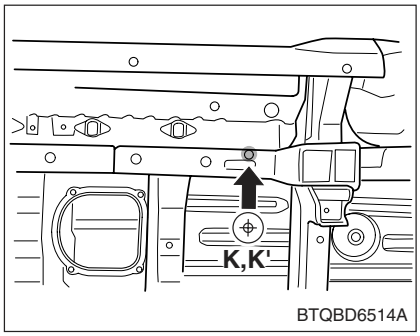
Front side member tooling hole (ø11)



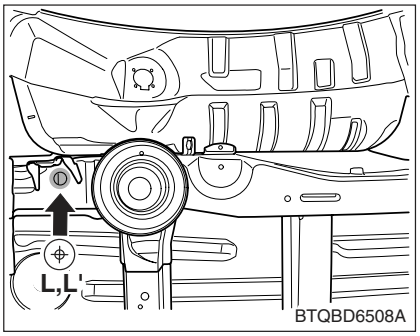
Center floor panel tooling hole (ø16)



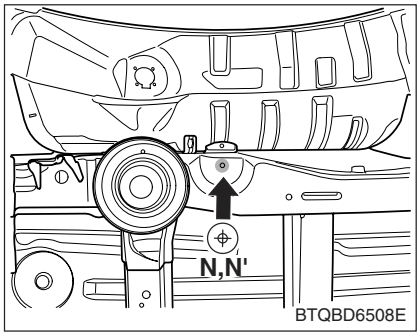
Cross member tooling hole (ø15)



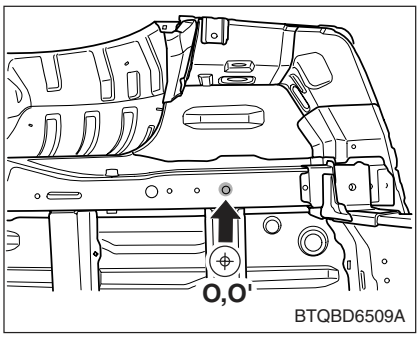
Rear side member tooling hole (ø6.6)



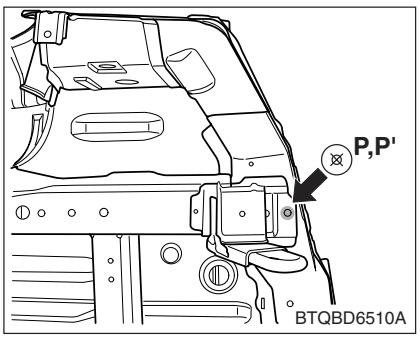
Rear side member tooling hole



Rear side member tooling hole (ø9)



Rear side member tooling hole (ø16)



Rear side member tooling hole (ø11)

Body Panel Repair Procedure

REPLACING BODY PANELS
- CODES FOR REMOVING AND INSTALLING BODY PANELS ..... BP - 2

NOTES WHEN WELDING BODY
- REMOVING SPOT WELDED AREA ..... BP - 3
- INSTALLING A NEW BODY FRAME ..... BP - 5
- DETERMINING A WELDING METHOD ..... BP - 5
- SPOT WELDING ..... BP - 5
- CARBON ARC WELDING ..... BP - 6
- REPLACING BODY PANEL
  - REMOVAL ..... BP - 7
  - PREPARATION FOR INSTALLATION ..... BP - 9
  - INSTALLATION ..... BP - 10

FENDER APRON PANEL ..... BP - 12
- REMOVAL ..... BP - 13
- INSTALLATION ..... BP - 14

FRONT SIDE MEMBER ..... BP - 17
- REMOVAL ..... BP - 18
- INSTALLATION ..... BP - 21

FRONT PILLAR ..... BP - 23
- REMOVAL ..... BP - 24
- INSTALLATION ..... BP - 28

CENTER PILLAR ..... BP - 31
- REMOVAL ..... BP - 32
- INSTALLATION ..... BP - 35

FRONT SIDE SILL PANEL ..... BP - 37
- REMOVAL ..... BP - 38
- INSTALLATION ..... BP - 39

REAR SIDE SILL PANEL ..... BP - 40
- REMOVAL ..... BP - 41
- INSTALLATION ..... BP - 41

QUARTER PANEL ..... BP - 43
- REMOVAL ..... BP - 44
- INSTALLATION ..... BP - 45

LOWER QUARTER PANEL ..... BP - 47
- REMOVAL ..... BP - 48
- INSTALLATION ..... BP - 49

QUARTER OUTER REAR EXTENSION ..... BP - 50
- REMOVAL ..... BP - 51
- INSTALLATION ..... BP - 51

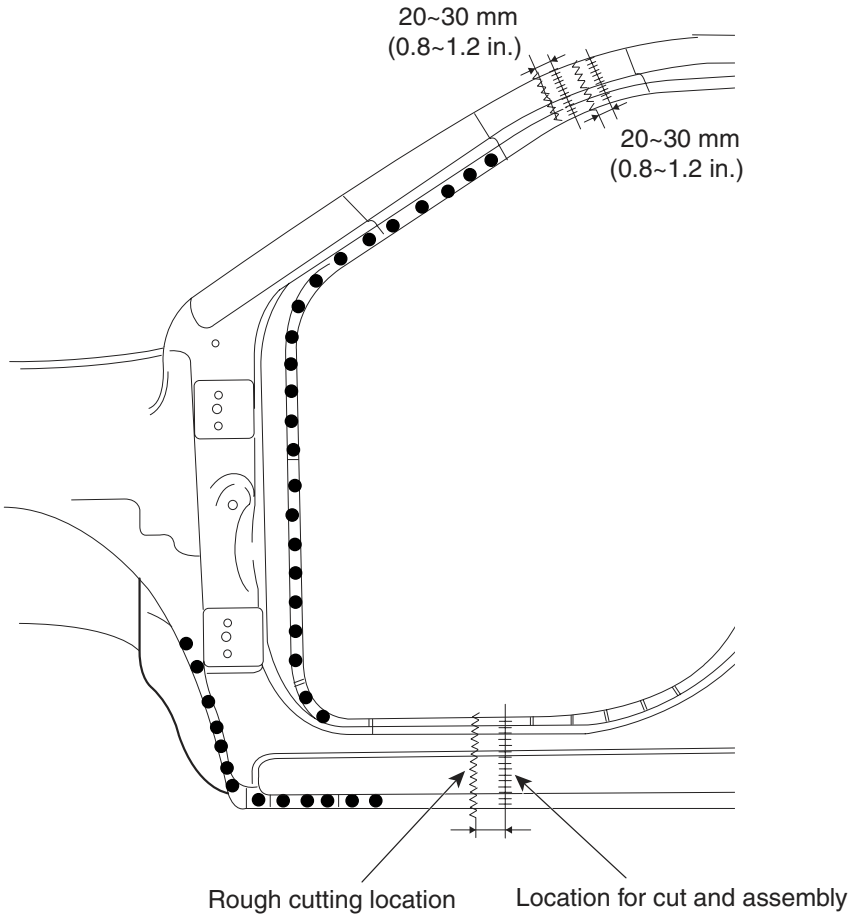
REAR END CROSS MEMBER ..... BP - 53
- REMOVAL ..... BP - 54
- INSTALLATION ..... BP - 55

REAR END CROSS OUTER LOWER MEMBER ..... BP - 58
- REMOVAL ..... BP - 59
- INSTALLATION ..... BP - 60

REAR SIDE MEMBER ..... BP - 62
- REMOVAL ..... BP - 63
- INSTALLATION ..... BP - 64

REPLACING BODY PANELS

CODES FOR REMOVING AND INSTALLING BODY PANELS



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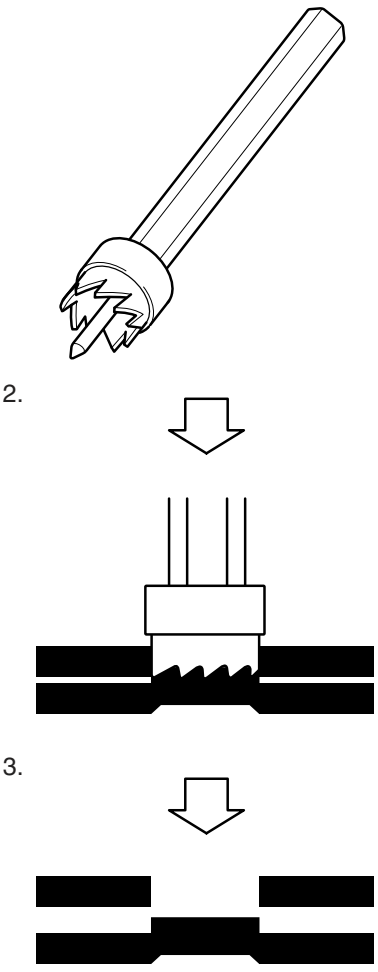
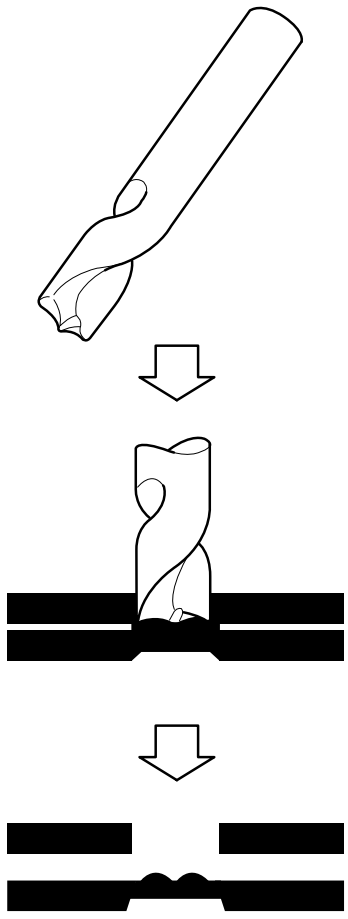
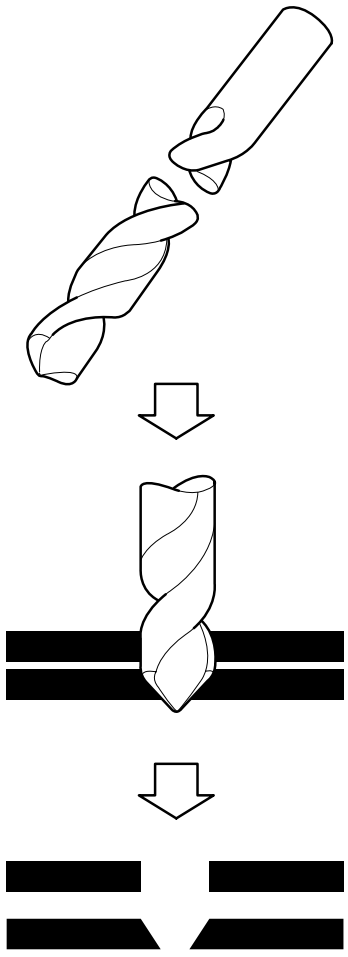
NOTES WHEN WELDING BODY

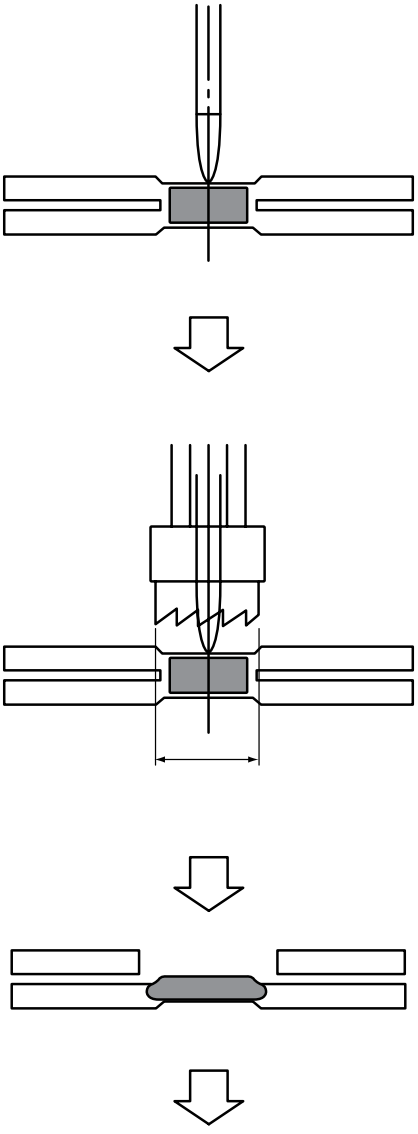
REMOVING SPOT WELDED AREA

Most body parts are spot welded. In order to remove the damaged area, it is best to remove the spot welded area from the body frame using a spot cutter or candle type edge drill bit.
Do not use a drill bit with a tapered edge. Center punch middle of spot weld to insure the entire spot weld will be removed.

1. Spot cutter	1. Drill(candle type edge)	1. Drill(taper edge)
		
Correct	Correct	Not correct

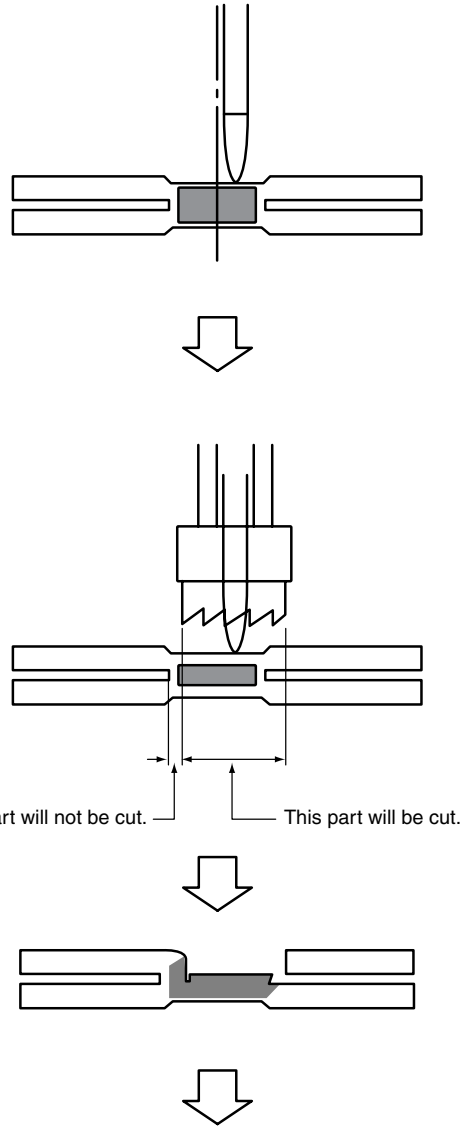
BVQBP6002

Center punch the middle(nugget) of the spot weld.



Spot welded area can be removed from the body frame.

Otherwise,



Spot welded area cannot be removed from the body frame.

BVQBP6003

INSTALLING A NEW BODY FRAME

The efficiency of the transmission and load distribution are determined by many complicated factors such as thickness of plate, shape and size of a cross section, damage of parts, variance of joints, welding method, and/or welding locations. Therefore, a new part should be fitted to the body frame using the proper procedures to avoid reducing the strength of the body.

DETERMINING A WELDING METHOD

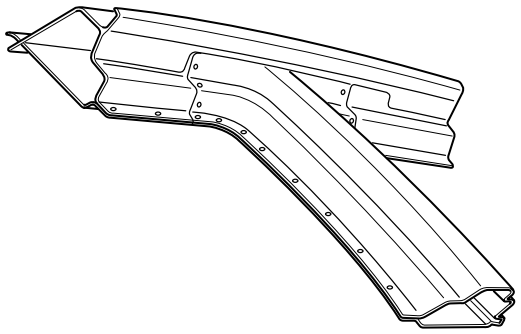
It is extremely important that appropriate welding methods, which don't reduce the original strength and durability of the body be used when making repairs. Try to use either spot welding or carbon arc(plug) welding. Do not braze any body components other than the ones brazed at the factory. Do not use an oxy-acetylene torch for welding.

Welding	Symbol	Details
Spot welding	●	The most reliable welding method (provides high efficiency and quality of assembled part.)
Carbon arc welding (Plug welding)	■	Use when spot welding cannot be done or spot welding is not necessary.
Oxygen-acetylene welding	✖	Not used

BVQBP6004

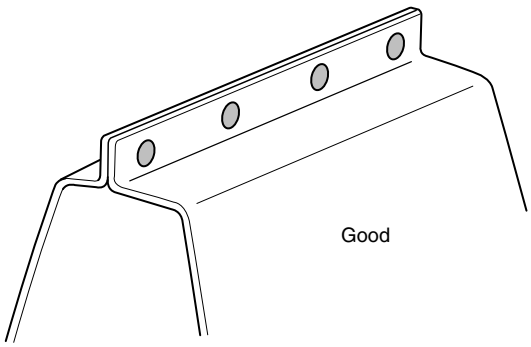
SPOT WELDING

1. Commercial spot welding machines do not perform as well as the machines used in the manufacturing process. When spot welding, increase the number of spot welds by 30% (1.3 times the original number of welds).



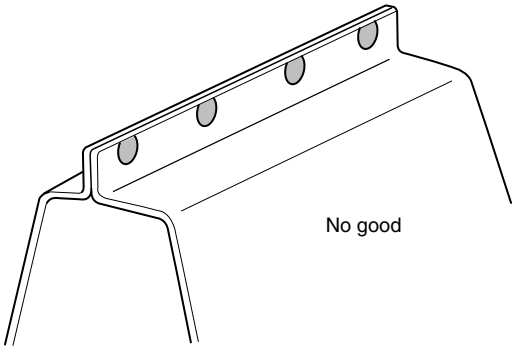
BVQBP6005

2. When spot welding, weld in the middle of the joint.



BVQBP6006

- Spot welding on the edge of the joint will reduce welding strength.

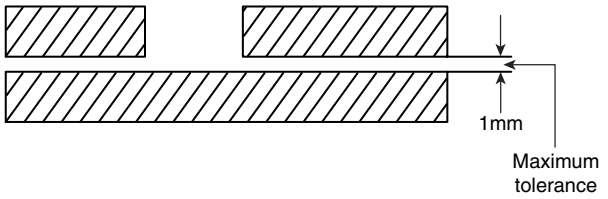


BVQBP6007

CARBON ARC WELDING

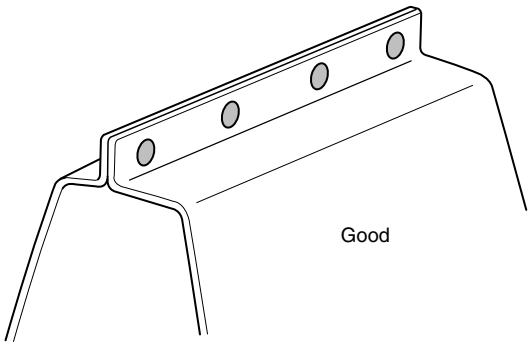
In areas where spot welding is not suitable, do plug welding using a carbon welding machine.

1. Clamp the parts to be welded together tightly. Do not exceed 1 mm of space between parts. A tolerance greater than 1 mm will reduce the strength of the welded area.



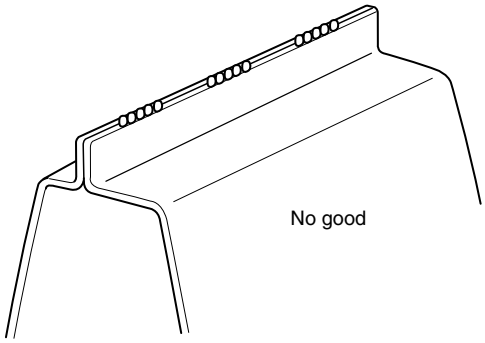
BVQBP6008

2. Weld in the middle of the flange joint.
   a) Drill a hole 5~6 mm on one side of the flange only, and weld within the hole.



BVQBP6006

   b) Do not weld on the edge of the flange joint.

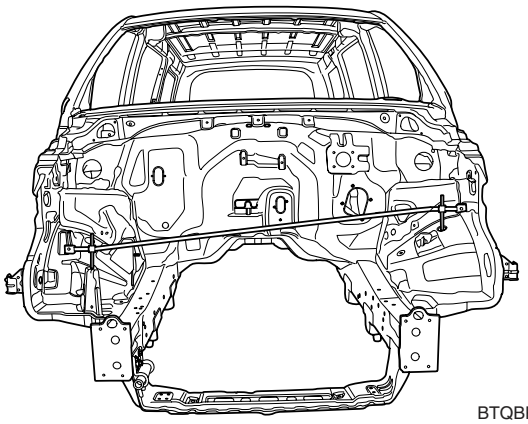


BVQBP6009

REPLACING BODY PANEL

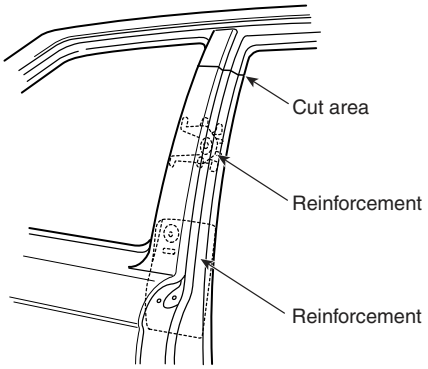
REMOVAL

1. **Body measurement**
   a) Before removing, measure the damaged area according to the dimensions supplied in Body Dimension, section BD. If deformation is present, use a frame straightener to adjust.
   b) When removing a panel, apply clamps to prevent damage of each part, and support the lower end of the frame to prevent deformation during the procedure.



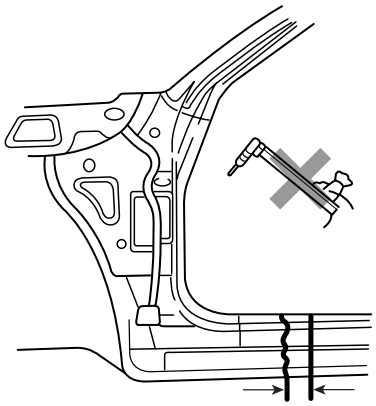
BTQBP6104

2. **Cut and welding point selection**
   Cutting, if necessary, should not be done in a reinforcement area. Select an area which will result in the least amount of deformation after welding.



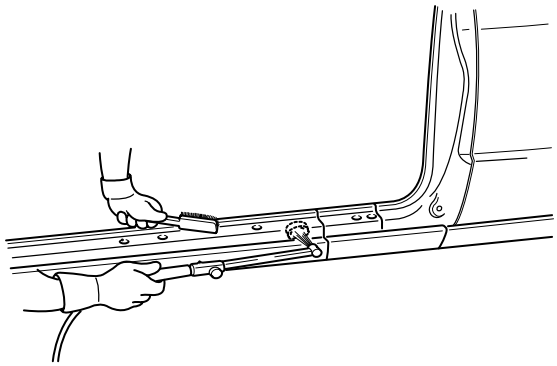
BVQBP6011

3. **Cutting rough area for replacement part**
   Cutting should be done according to the following steps to make removal easy:
   a) Use care when cutting an area close to a pipe or wiring harness.
   b) Cut an area leaving 30~50 mm of tolerance.



BVQBP6012

4. **Removing paint from an area to be spot welded**
   Using a torch and wire brush, remove paint completely before beginning welding.

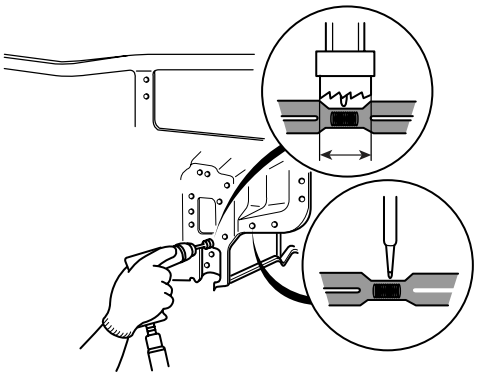


BVQBP6013

5. Determine a cutting method

a) Cutting a spot welded area

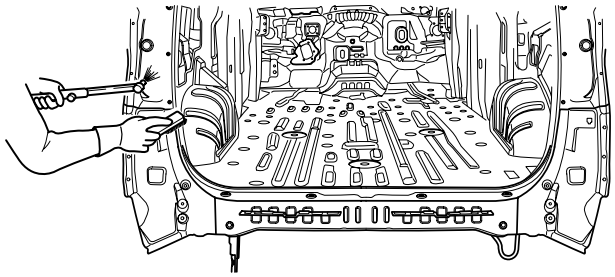
Make a hole in the middle of spot welded area with a punch, remove welded area using a spot cutter and remove using a chisel.



BVQBP6014

b) Removing brazed area

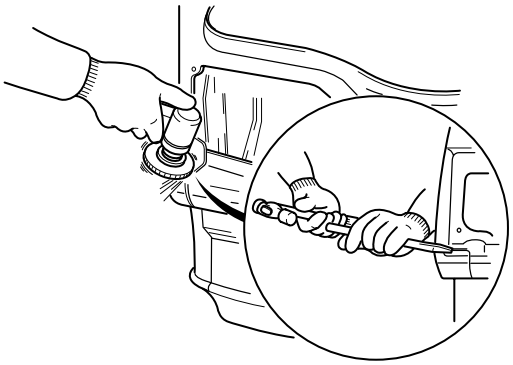
Remove brazed area using a torch and wire brush, and chisel.



BTQBP6401D

c) Removing plug welded area

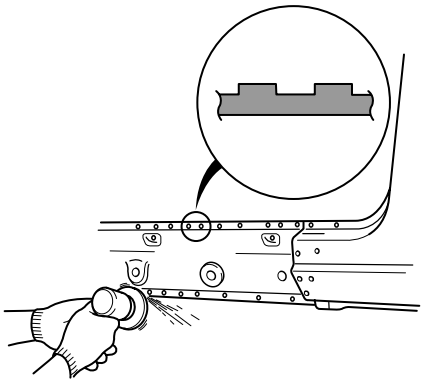
Remove plug welded area using a disk grinder and chisel.



BVQBP6016

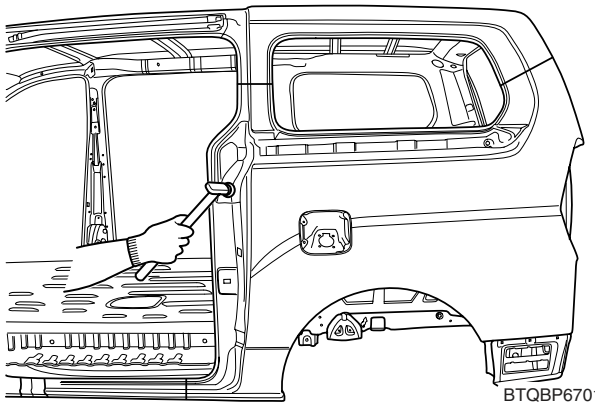
PREPARATION FOR INSTALLATION

1. **Spot weld finish**
   Use a disk grinder or similar tool to finish spot weld mark. Do not grind more than necessary to smooth surface.



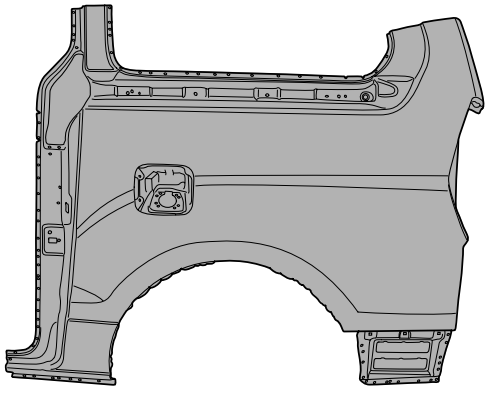
BVQBP6017

2. **Panel preparation**
   Repair any bent or uneven areas with a hammer to improve the installation process.



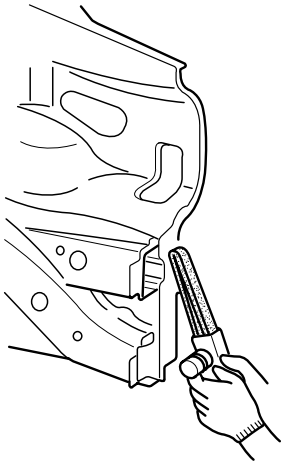
BTQBP6701B

3. **Cutting a rough area for a new part**
   When cutting an rough area for a new part, leave a tolerance of 30~50 mm.



BTQBP6707A

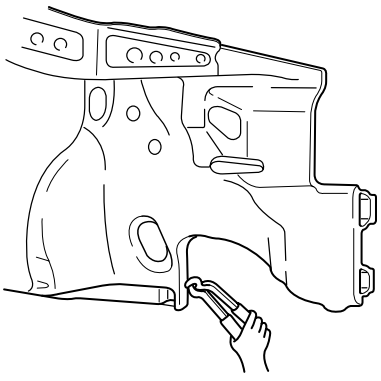
4. **Preparation for spot welding**
   Remove paint on spot welded area and on the area overlapped by the new part using a belt sander or similar tool.



BVQBP6020

5. **Drilling a hole for plug welding**
   If the thickness of the part to be welded is less than 3 mm, drill a 5~6 mm diameter hole. If the thickness of the part to be welded is greater than 3 mm, drill a hole using a 7 mm diameter drill.

NOTE
Do not spot weld where thickness is greater than 3 mm.

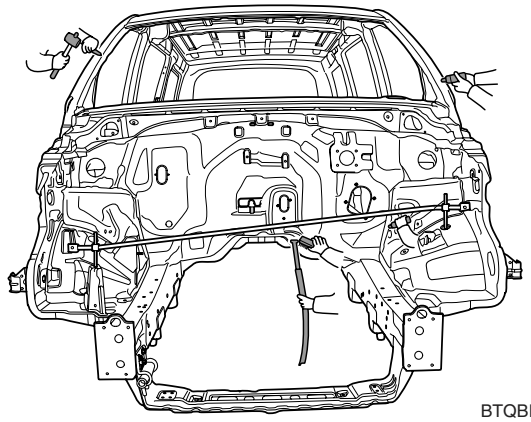


BVQBP6021

INSTALLATION

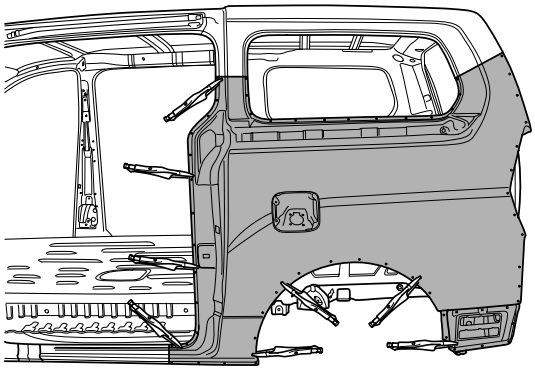
1. Checking welding and fitting in advance

a) When installing a new part, measure the dimensions of each part according to the body dimensions given in Section BD, and set part to the reference dimensions.



BTQBP6104

b) Prior to final welding, check the fit of all related parts.



BTQBP6701G

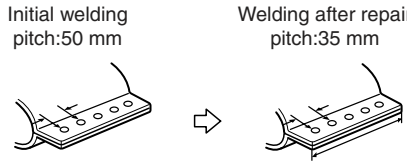
2. Selecting number of welding points

Spot welding : Multiply the original number of factory welds by 1.3 times

Plug welding : Same number as original number of factory welds

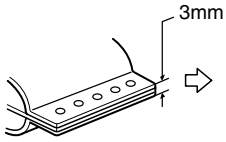
NOTE

- *Plug welding should be done using a carbon arc welding machine.*
- *Brazing should be done only on areas that were originally brazed at the factory.*



Spot welding:initial number of welds x1.3

Welding points-same number as original number of factory welds.



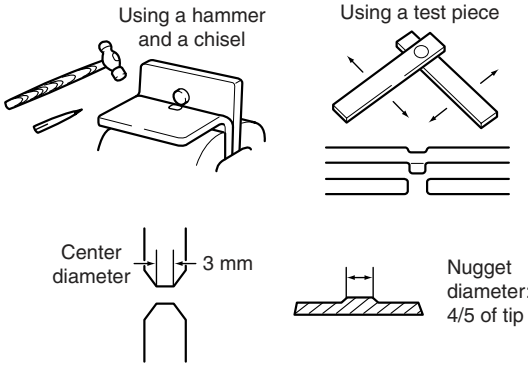
Plug welding-used when spot welding is not feasible or material is thicker than 3 mm.

BVQBP6024A

3. Caution when spot welding

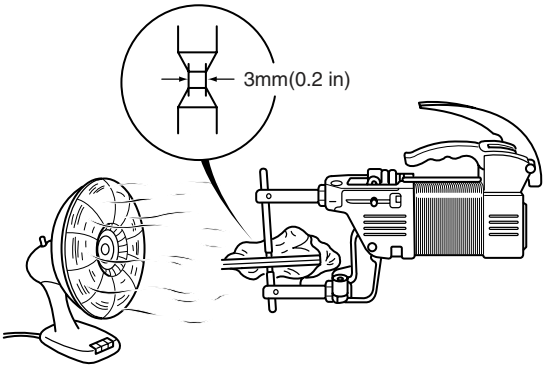
a) Do a test welding on a piece of material of the same type and thickness as the part to be welded and proceed if test weld is good.

b) Before spot welding, check if welding debris, oil or paint is present on the area where surfaces meet.
Clean or sand as necessary.



BVQBP6025

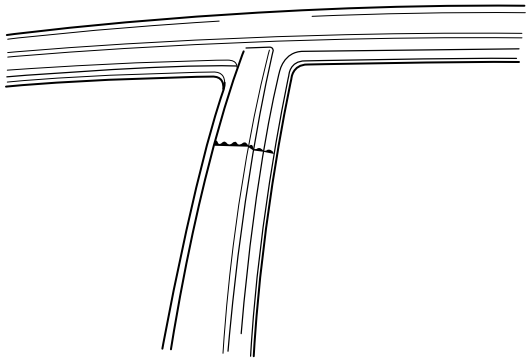
c) The tip of the spot welding machine should be maintained to a minimum tolerance of 3 mm. Also let area cool after 5 or 6 welds to minimize problems caused by excessive heat.



BVQBP6026

4. Cutting and welding an removed area

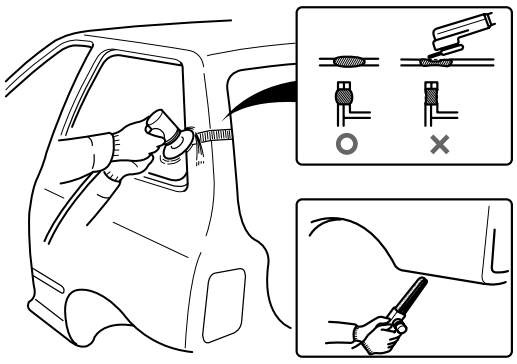
To align a roof panel and a center pillar together for butt welding, temporarily fasten a steel flange to the roof panel and then apply the new center pillar panel. Remove the flange when final welding is done.



BVQBP6027

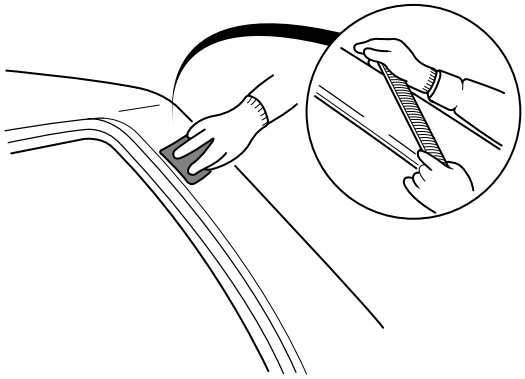
5. Finishing after welding

a) Grind any areas that were plug welded or butt welded using a disk grinder. Grind carefully to avoid removing too much material. This degrades the strength of the weld.



BVQBP6028

b) Finish areas that have been brazed by applying body filler then smooth the area with a flexible file and sander.



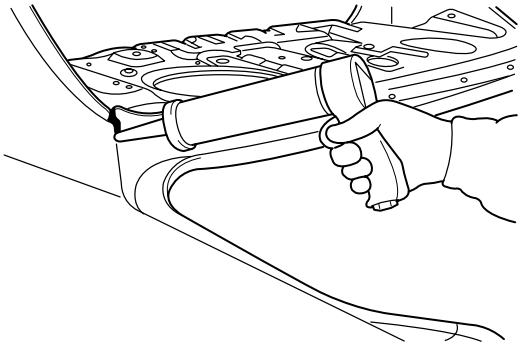
BVQBP6029

6. Applying anti-rust agent and body sealer

After coating the surface with anti-rust agent, apply body sealer where necessary.

NOTE

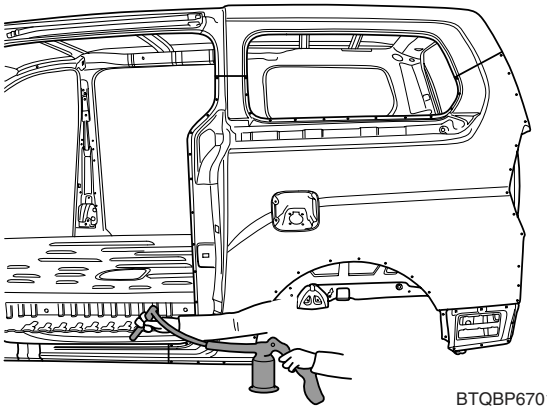
Apply body sealer before assembly.



BVQBP6030

7. Anti-rust treatment

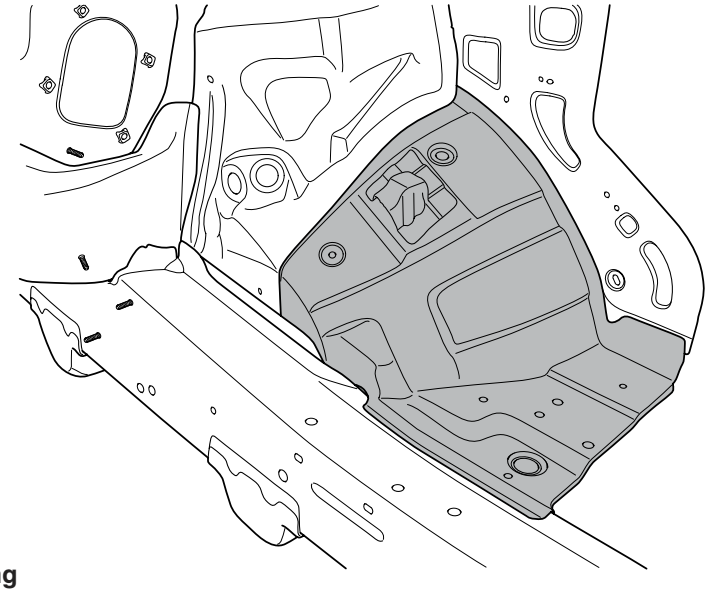
Apply anti-rust agent to inside of doors and sills by spraying through access holes provided.



BTQBP6701H

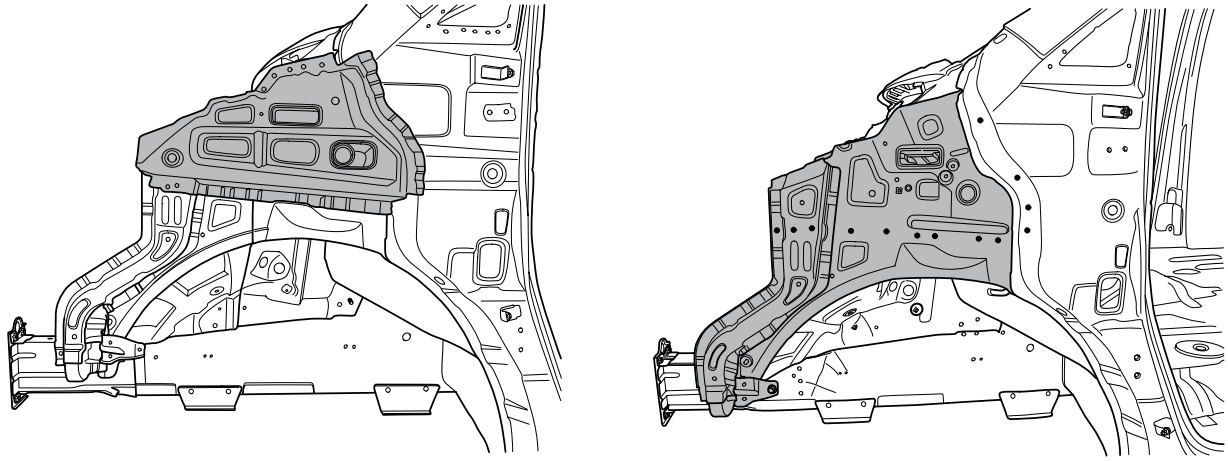
FENDER APRON PANEL

WELDING POINTS



- ● MIG plug welding
- ⫲ MIG butt welding
- ⤫ MIG lap welding

BFDBP6102



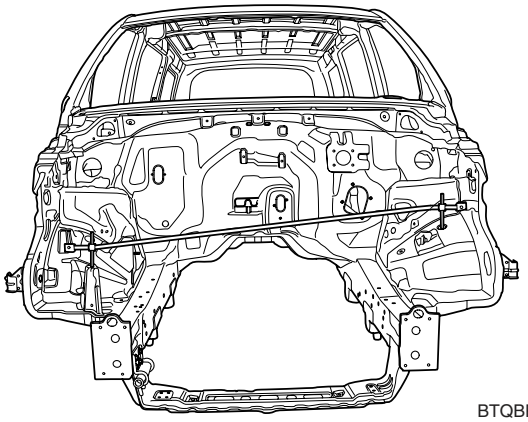
- ● MIG plug welding
- ⫲ MIG butt welding
- ⤫ MIG lap welding

BTQBP6103

REMOVAL

NOTE

Before repairing, remove Engine and Suspension Components.
Refer to the body dimension charts and measure the vehicle to determine straightening and alignment requirements. The body must be returned to its original dimension before begining the repair procedure.

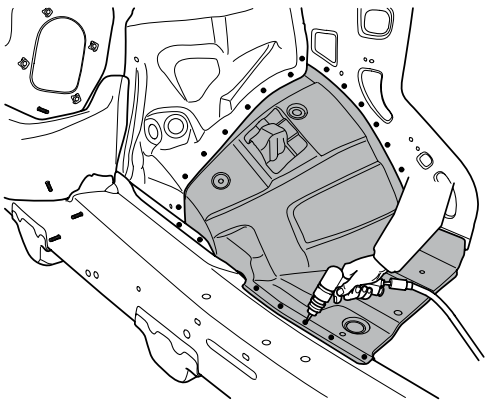


BTQBP6104

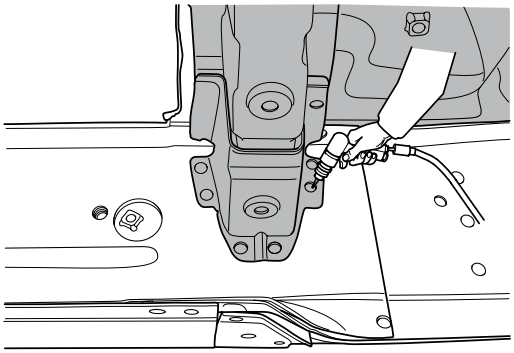
1. 1. Drill out all the spotwelds(47) to separate front wheel housing panel from shock absorber housing panel, fender apron inner panel and front side member.

NOTE

When spotwelded portions are not apparent, remove paint with a rotary wire brush.

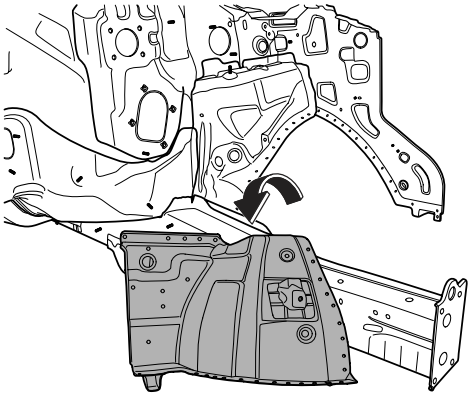


BTQBP6101A



BTQBP6105

2. Remove the front wheel housing panel.

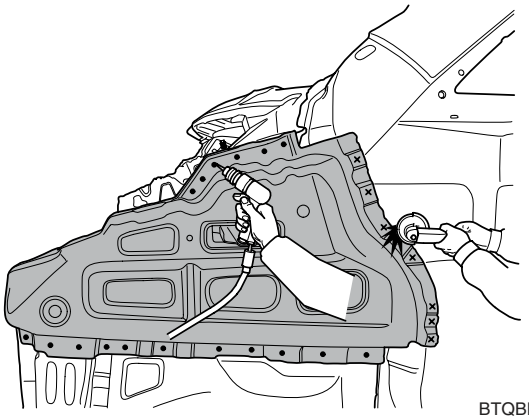


BTQBP6106

3. Drill out and grind away all spotwelds(23) and MIG lap welds(6) attaching the fender apron outer panel.

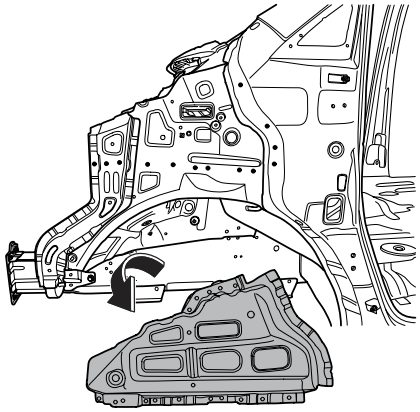
NOTE

If it is possible that the fender apron outer panel is reusable, be careful not to damage it while removing.



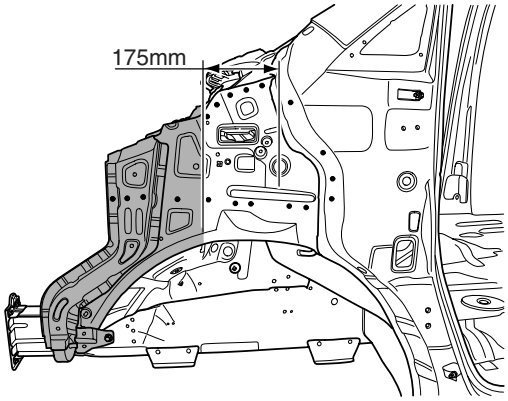
BTQBP6107

4. Remove the fender apron outer panel.



BTQBP6108

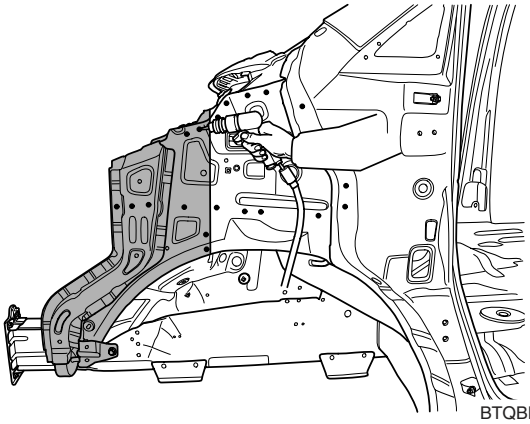
5. Measure and mark the vertical cutline on the fender apron inner panel 175mm from the fender apron inner panel tooling hole center.



BTQBP6108A

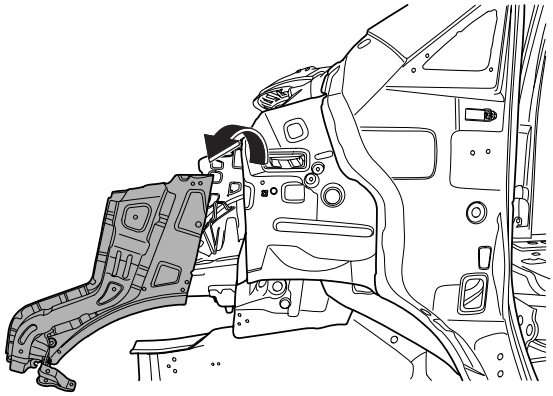
6. Cut the fender apron inner panel along the cutline.

7. Drill out and grind away all spotwelds(5) attaching the fender apron inner panel and fender apron support.



BTQBP6108B

8. Remove the fender apron inner panel.



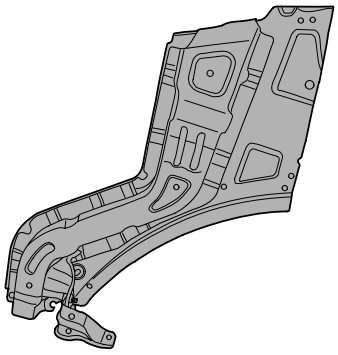
BTQBP6109A

9. Prepare all surfaces to be welded.

10. After removing, apply the welding primer.

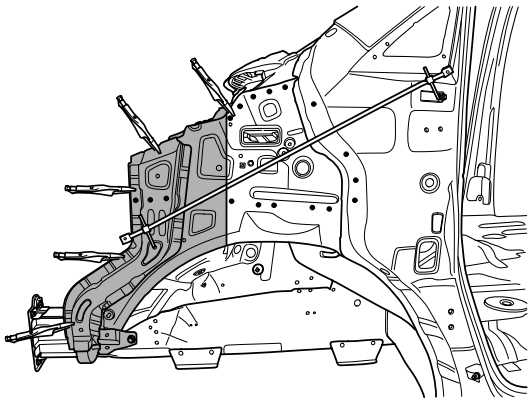
INSTALLATION

1. Transcribe the fender apron inner panel cutline to the new fender apron inner panel, cut to length and chamfer butt end to improve weld surface.



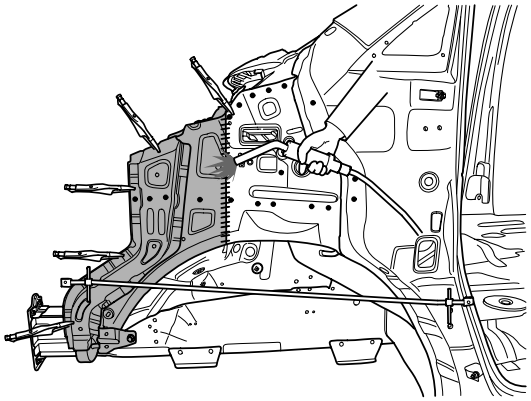
BTQBP6109A

2. Fit and clamp the fender apron upper inner panel in place.
3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



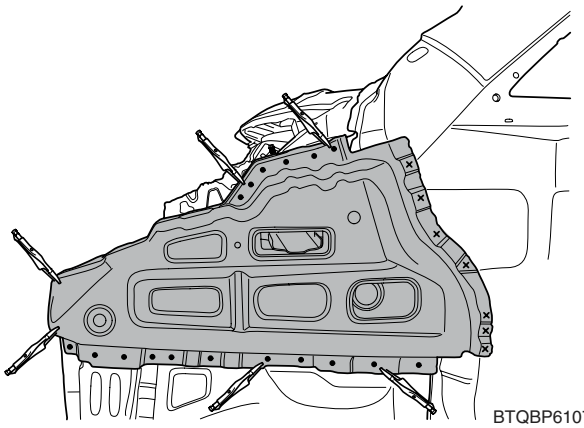
BTQBP6108C

4. MIG plug weld all holes and MIG butt weld all seams.



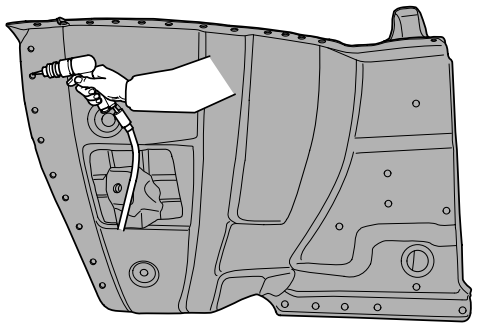
BTQBP6108D

5. Clean and prepare all welds, and remove all residue.
6. After removing, apply the welding primer.
7. Fit and clamp the fender apron outer panel in place.
8. MIG plug weld all holes and MIG lap weld all seams.



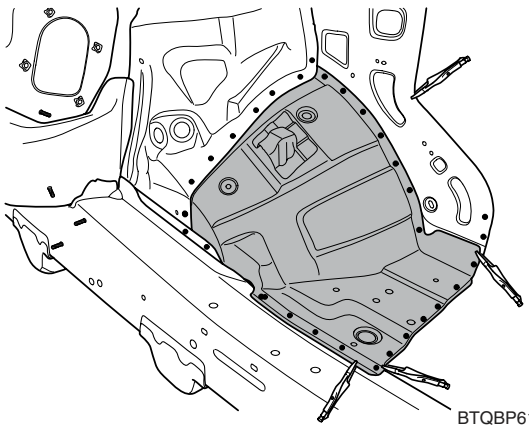
BTQBP6107A

9. Drill 8mm holes in the new wheel housing panel for MIG plug welding.



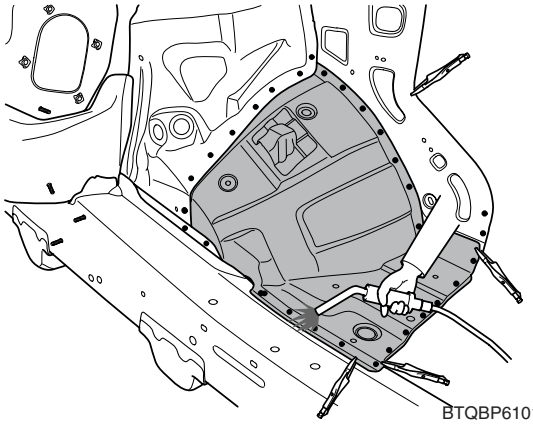
BTQBP6109B

10. Fit and clamp the wheel housing panel in place.
11. Measure each measurement point and correct the installation position.

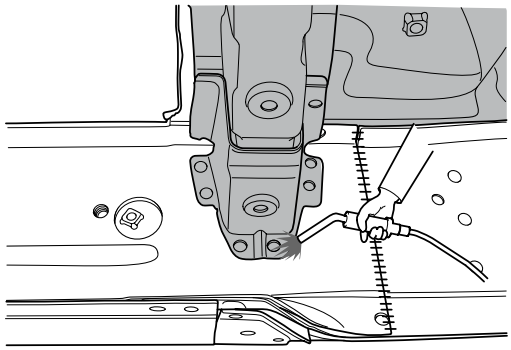


BTQBP6101B

12. MIG plug weld all holes.



BTQBP6101C



BTQBP6105A

13. Clean and prepare all welds, and remove all residue.

14. Apply the two-part epoxy primer to the interior of each panel.

15. Apply an anti-corrosion agent as required. (Refer to the BODY CORROSION PROTECTION)

16. Prepare the exterior surfaces for priming using wax and grease remover.

17. Apply metal conditioner and water rinse.

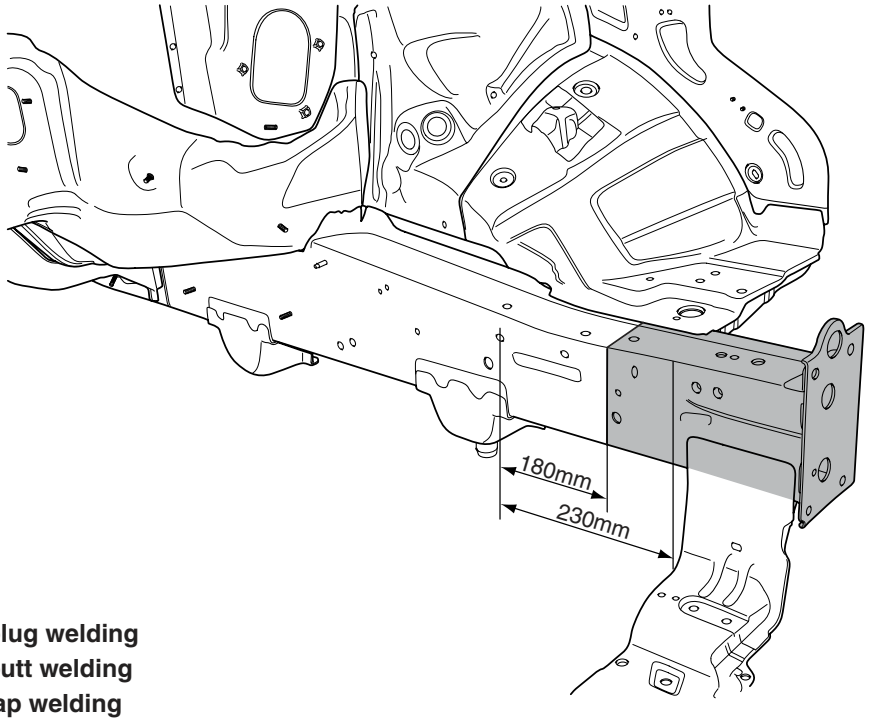
18. Apply conversion coating and water rinse.

19. Apply the two-part epoxy primer.

20. Apply the correct seam sealer to all joints carefully. (Refer to the BODY SEALING LOCATION)

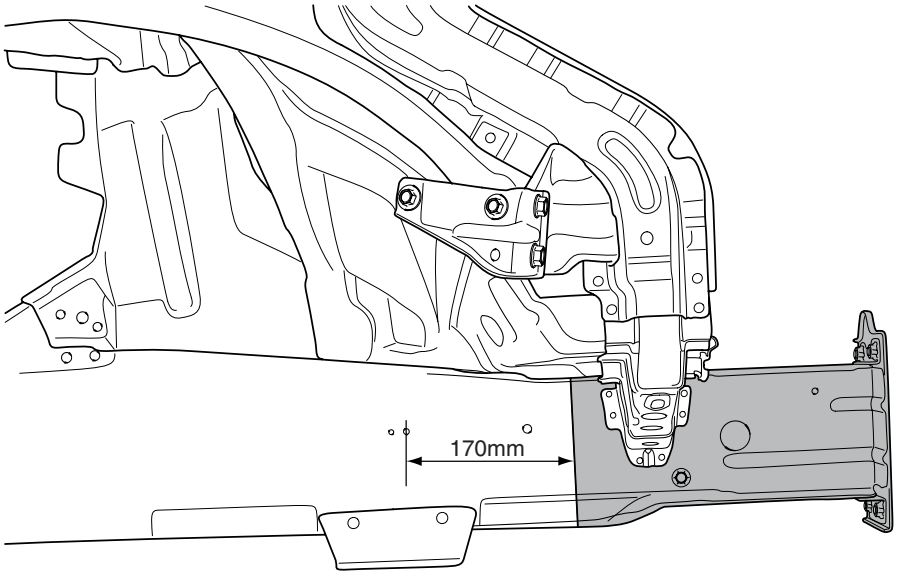
FRONT SIDE MEMBER

WELDING POINTS



● MIG plug welding
MIG butt welding
MIG lap welding

BTQBP6201



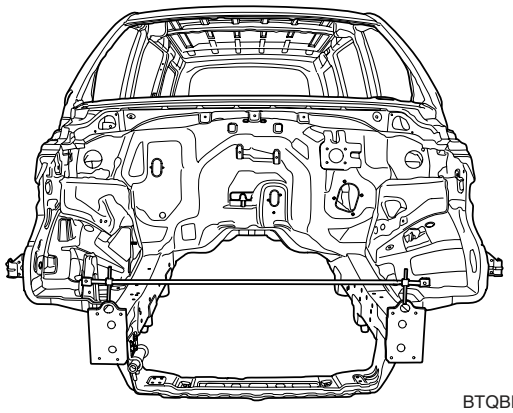
● MIG plug welding
MIG butt welding
MIG lap welding

BTQBP6202

REMOVAL

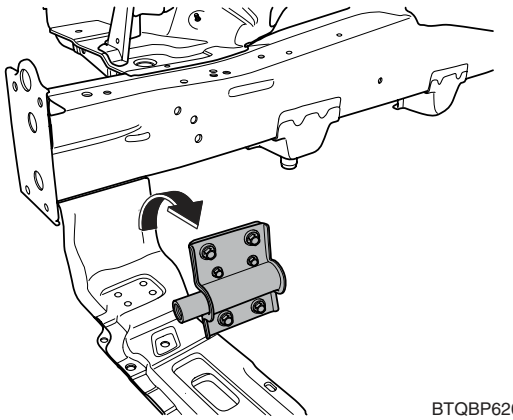
NOTE

Before repairing, remove Engine and Suspension Components.
Refer to the body dimension charts and measure the vehicle to determine straightening and alignment requirements. The body must be returned to its original dimension before begining the repair procedure.



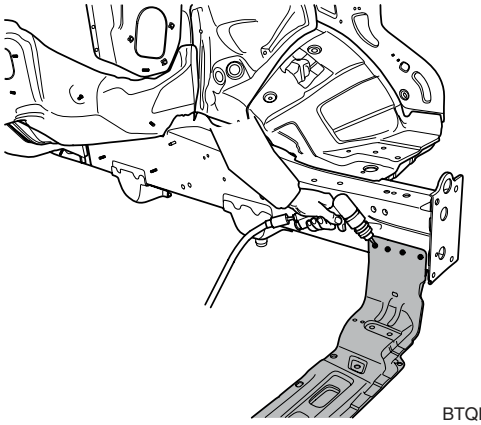
BTQBP6104A

1. Before cutting the front side member, remove the towing hook bracket.



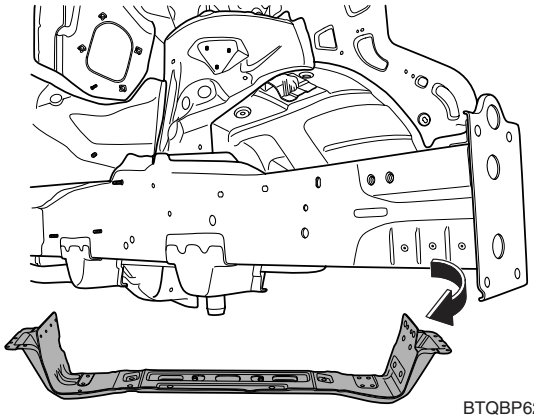
BTQBP6203A

2. Drill out the sportwelds(18) to separate front end cross member.



BTQBP6201A

3. Remove front end cross member.

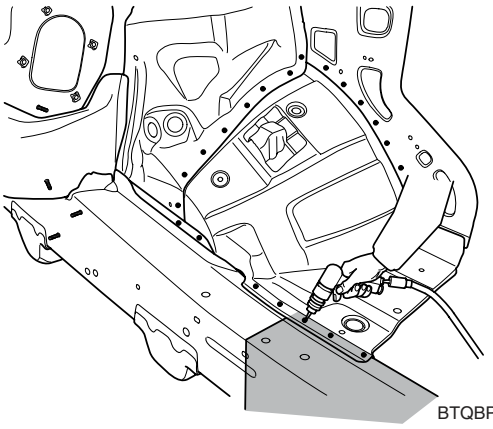


BTQBP6204

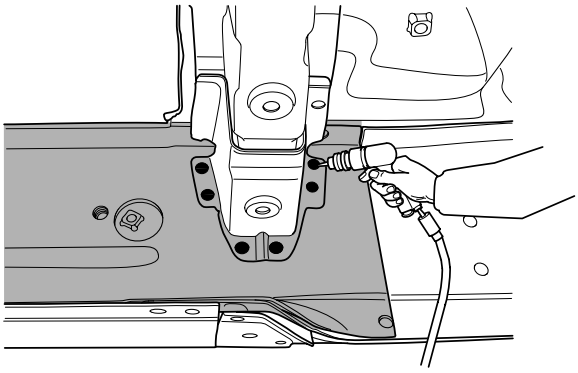
4. Drill out all the spotwelds(12) attaching the front side member.

NOTE

When spotwelded portions are not apparent, remove paint with a rotary wire brush.

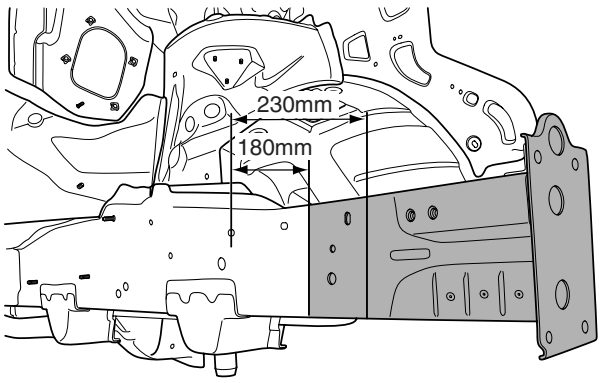


BTQBP6101E



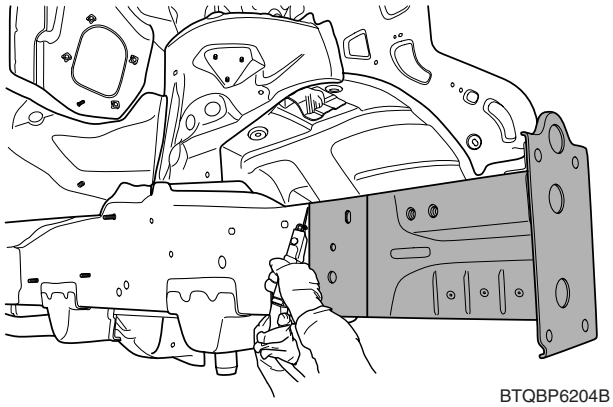
BTQBP6105C

5. Measure and mark the vertical cutlines on front side inner member 180mm and 230mm from the front side inner member tooling hole center.



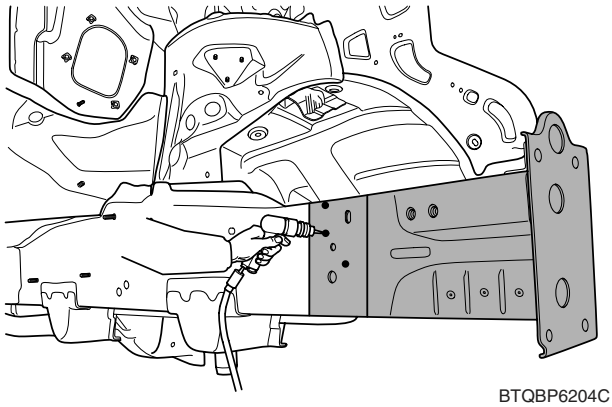
BTQBP6204A

6. Cut the front side inner member along the cutlines.



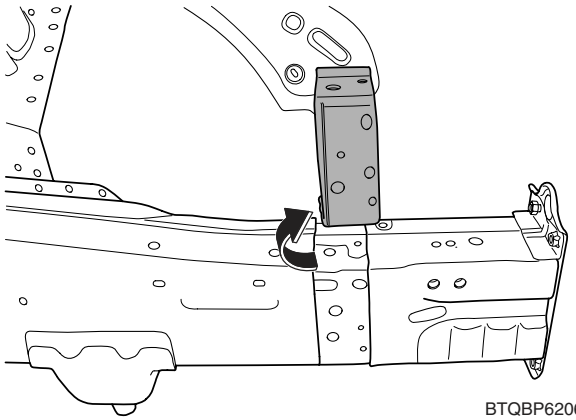
BTQBP6204B

7. Drill out all the spotwelds(7) to front side inner member section.



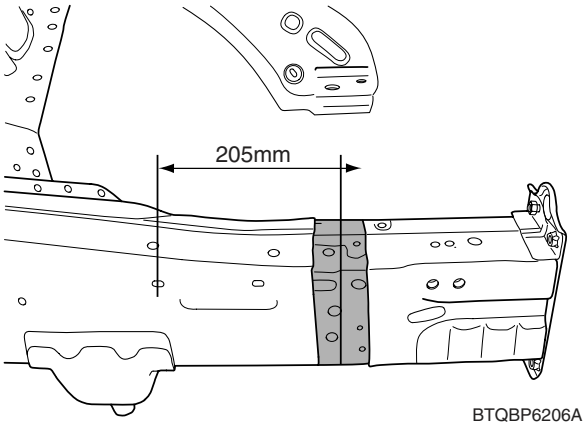
BTQBP6204C

8. Remove the front side inner member section.



BTQBP6206

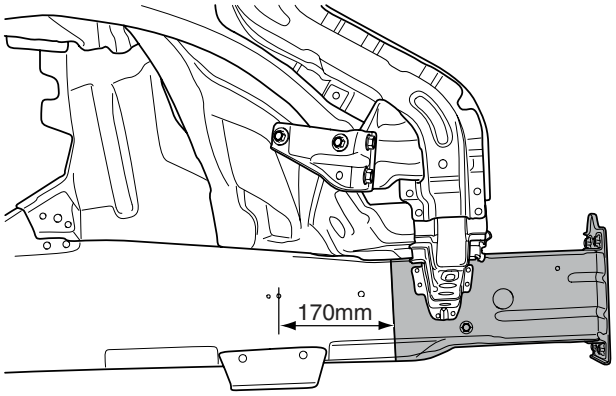
9. Measure and mark the vertical cutline on front side inner member reinforcement 205mm from front side inner member tooling hole center.



BTQBP6206A

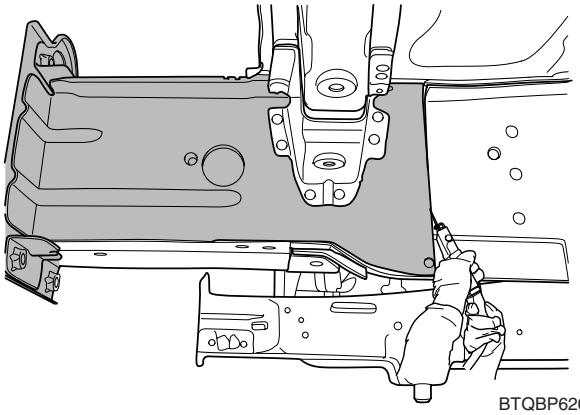
10. Cut the front side member reinforcement along the cutline.

11. Measure and mark the vertical cutline on the front side outer member 170mm from front side outer member tooling hole center.



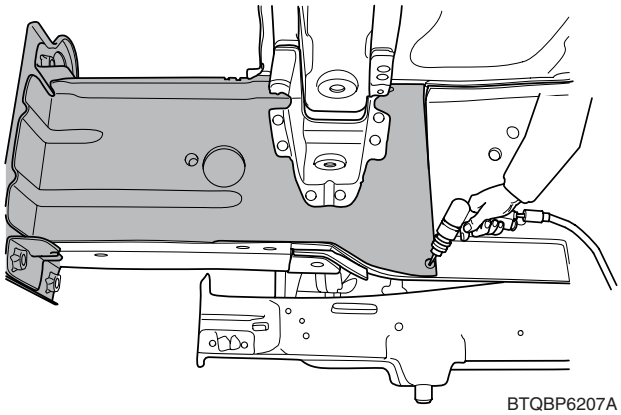
BTQBP6202A

12. Cut the front side outer member along the cutline.



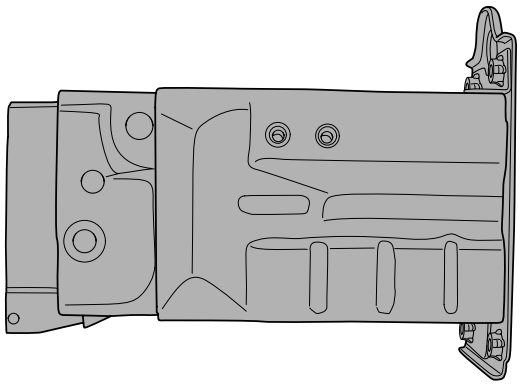
BTQBP6207

13. Drill out all the spotwelds(2) to front side outer member.



BTQBP6207A

14. Remove the front side member.



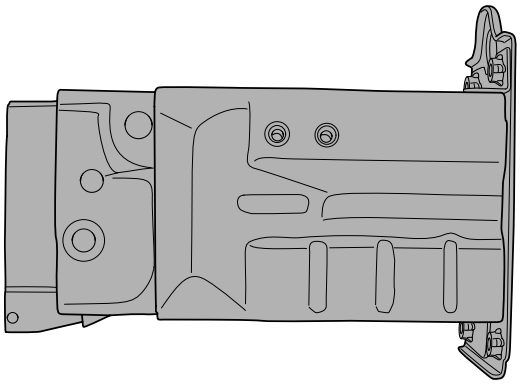
BTQBP6208

15. Prepare all surfaces to be welded.

16. After removing, apply the welding primer.

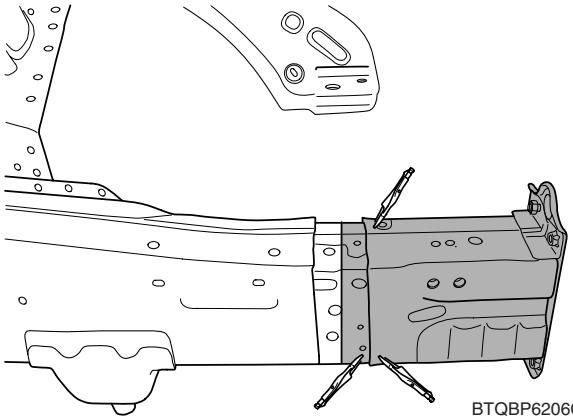
INSTALLATION

1. Transcribe the front side member inner and outer cutline to the new front side member, cut to length and chamfer butt end to improve weld surface.



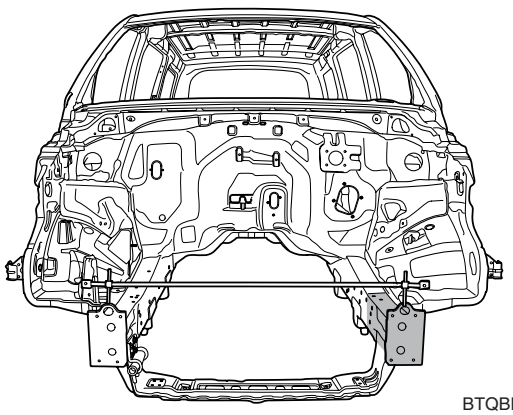
BTQBP6208

2. Fit and clamp the front side member in place.



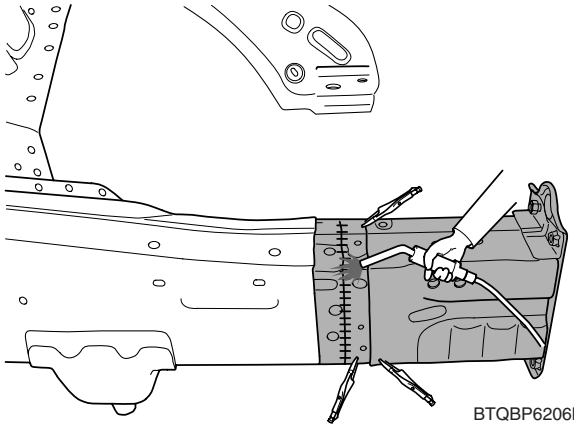
BTQBP6206C

3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

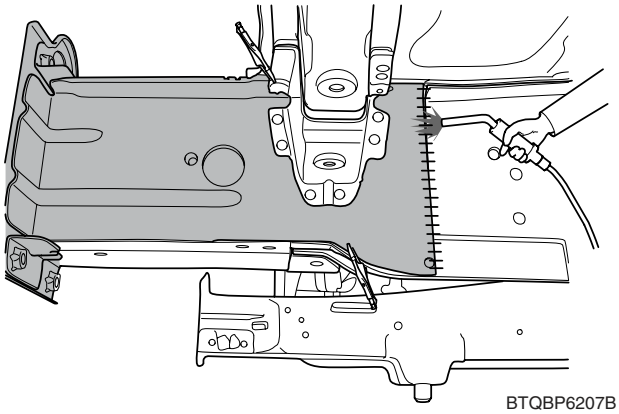


BTQBP6104B

4. MIG plug weld all holes and MIG butt weld all seams.

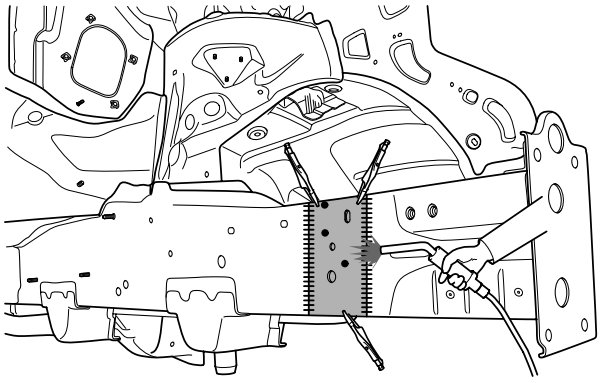


BTQBP6206B



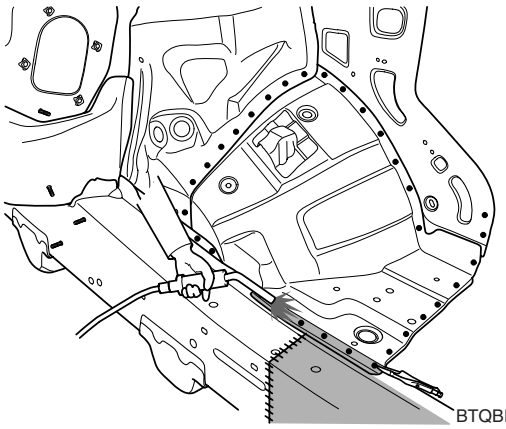
BTQBP6207B

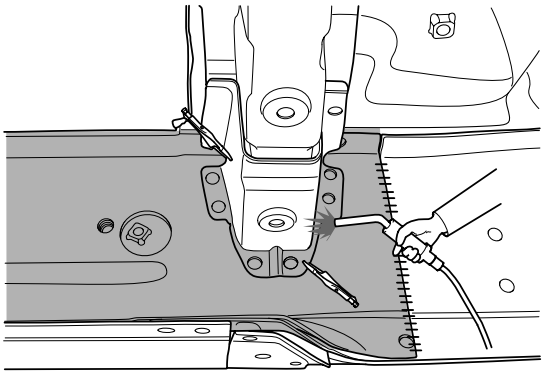
5. Clean and prepare all welds, and remove all residue.
6. After removing, apply the welding primer.
7. Reattach the cut front side inner member section, then MIG plug weld all holes and MIG butt weld seams.



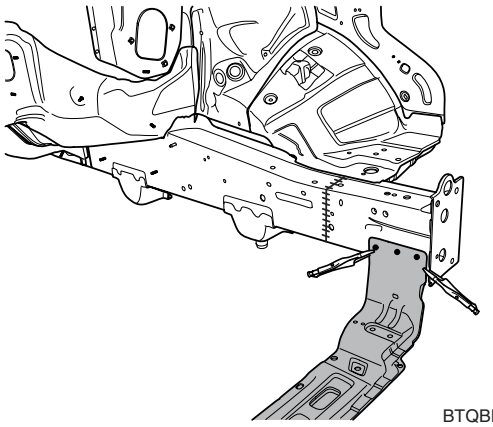
BTQBP6204E

8. MIG plug weld all holes.


BTQBP6101D

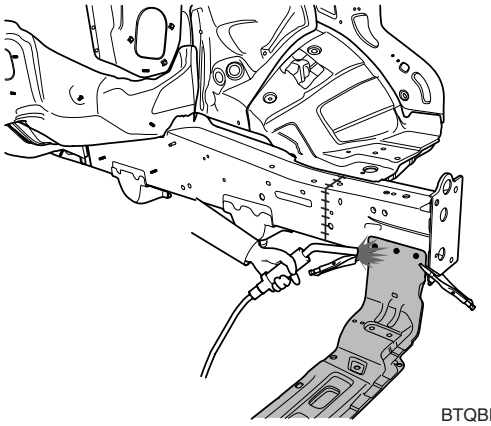

BTQBP6105D

9. Fit and clamp the front end cross member in place.


BTQBP6201B

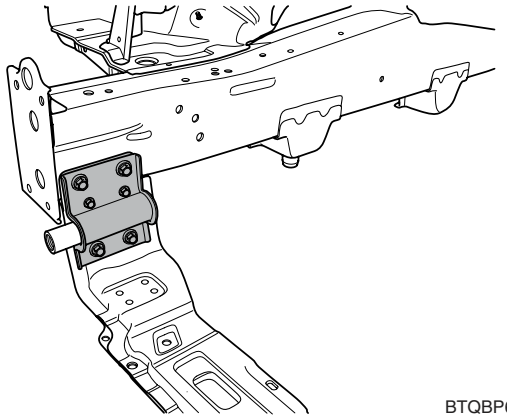
10. Measure each measurement point and correct the installation position.

11. MIG plug weld all holes.


BTQBP6201C

12. Clean and prepare all welds, and remove all residue.

13. Install the towing hook bracket.


BTQBP6203

14. Apply the two-part epoxy primer to the interior of each panel.

15. Apply an anti-corrosion agent as required. (Refer to the BODY CORROSION PROTECTION)

16. Prepare the exterior surfaces for priming using wax and grease remover.

17. Apply metal conditioner and water rinse.

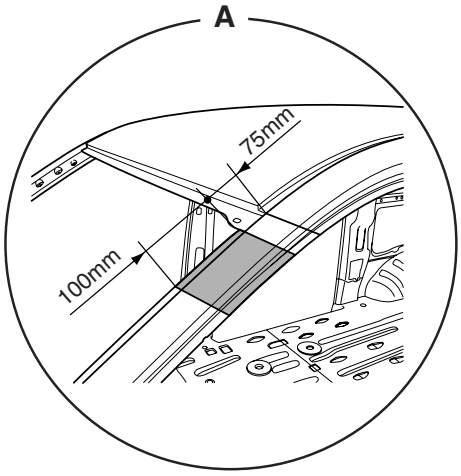
18. Apply conversion coating and water rinse.

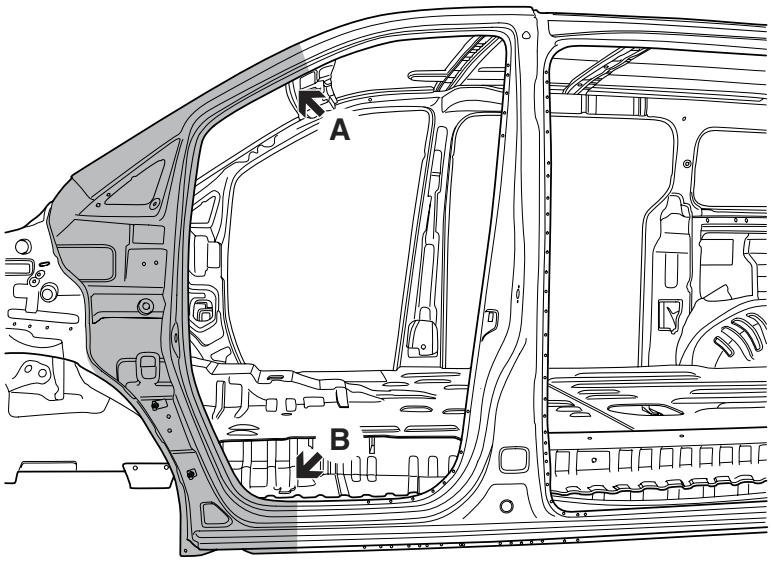
19. Apply the two-part epoxy primer.

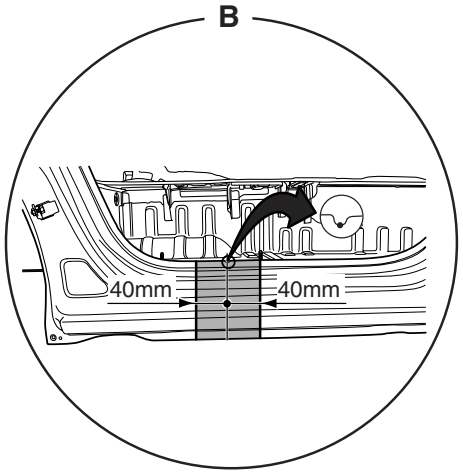
20. Apply the correct seam sealer to all joints carefully. (Refer to the BODY SEALING LOCATION)

FRONT PILLAR

WELDING POINTS







- ● MIG plug welding
- ⫲ MIG butt welding
- ⫘ MIG lap welding

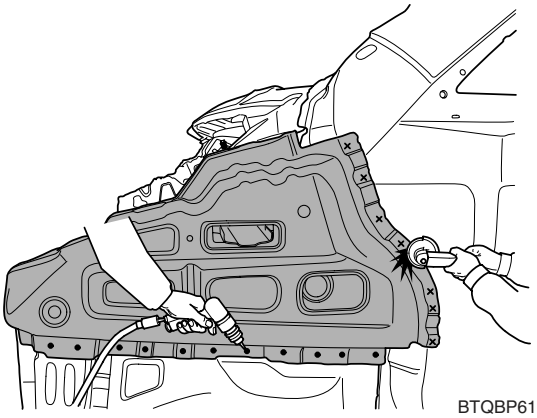
BTQBP6303

REMOVAL

1. To remove the front pillar, drill out and grind away all spotwelds(23) and MIG lap welds(6) attaching the fender apron outer panel.

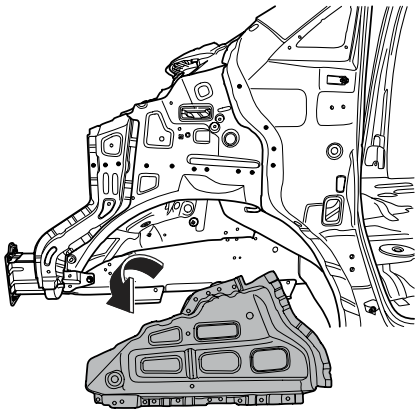
NOTE

If it is possible that the fender apron outer panel is reusable, be careful not to damage it while removing.



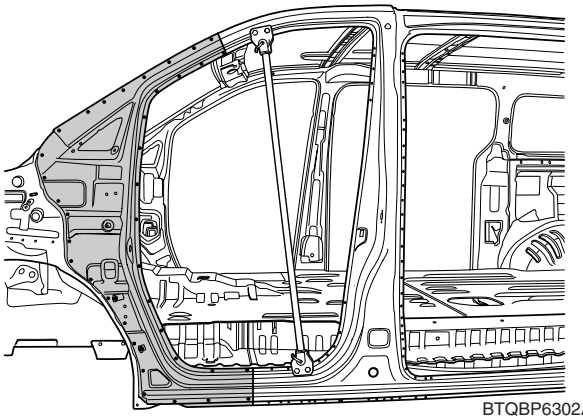
BTQBP6107B

2. Remove the fender apron outer panel.



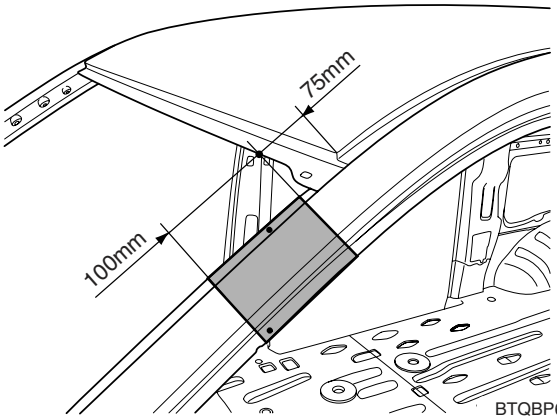
BTQBP6108

3. Before cutting front pillar, be sure to support roof panel.



BTQBP6302A

4. Measure and mark each cutline on the front pillar outer panel 75mm and 175mm from the roof panel front corner as indicated in the illustration.

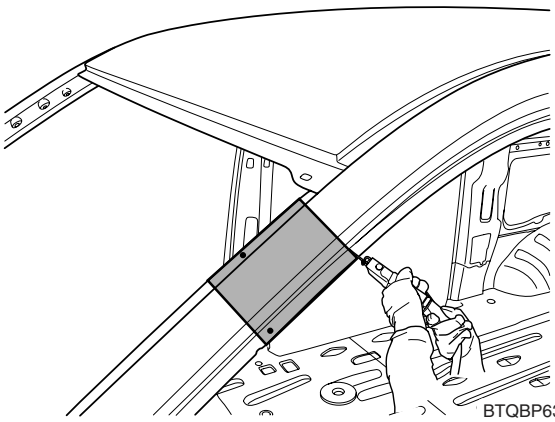


BTQBP6301

5. Cut the front pillar outer panel along the cutlines.

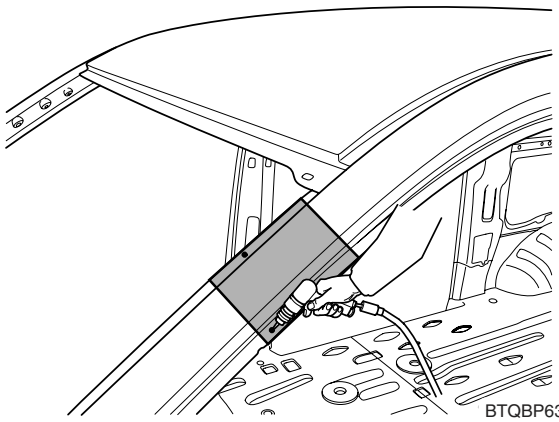
NOTE

When cutting the front pillar outer panel, take care not to cut through mating flanges or front pillar outer reinforcement.



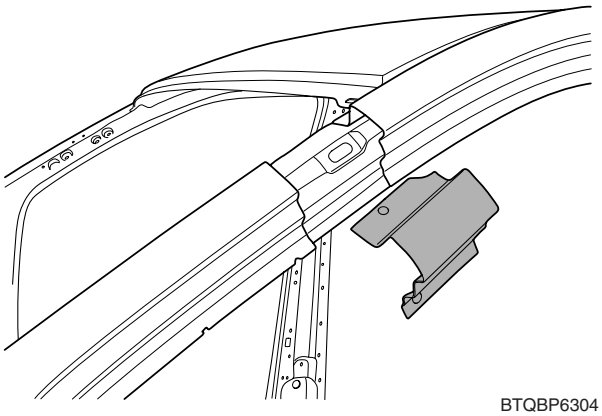
BTQBP6301A

6. Drill out all the spotwelds(2) attaching the front pillar outer panel section.



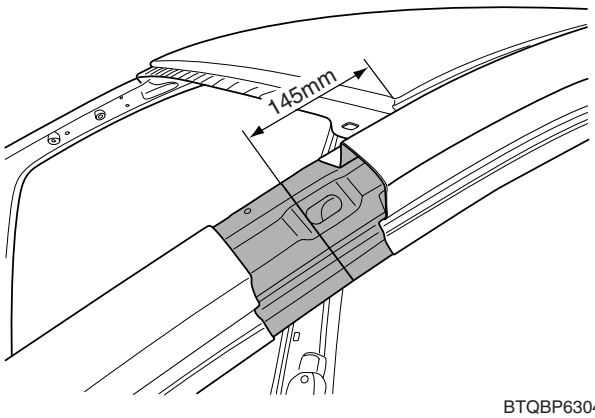
BTQBP6301B

7. Remove the front pillar outer panel section.



BTQBP6304

8. Measure and mark the cutline on the front pillar outer reinforcement 145mm from the roof panel front corner as shown in the illustration.

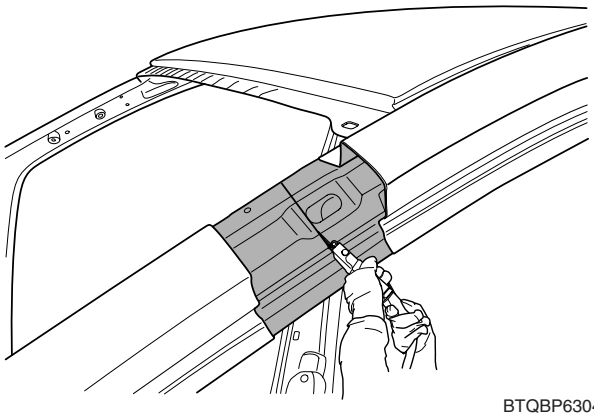


BTQBP6304A

9. Cut the front pillar outer panel reinforcement along the cutline.

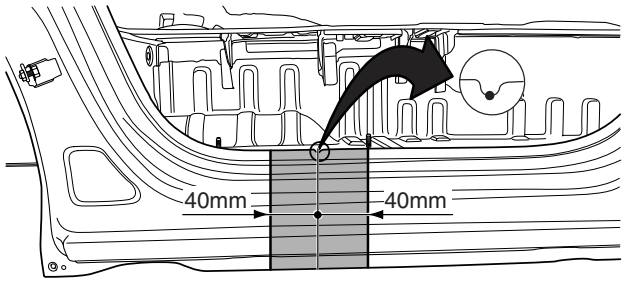
NOTE

When cutting the front pillar outer panel reinforcement, be careful not to cut front pillar inner panel.



BTQBP6304B

10. Measure and mark each cutline on the side sill outer panel as indicated in the illustration.

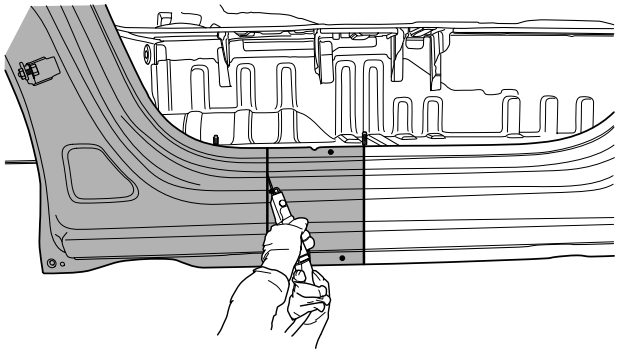


BTQBP6305

11. Cut the side sill outer panel along the cutlines.

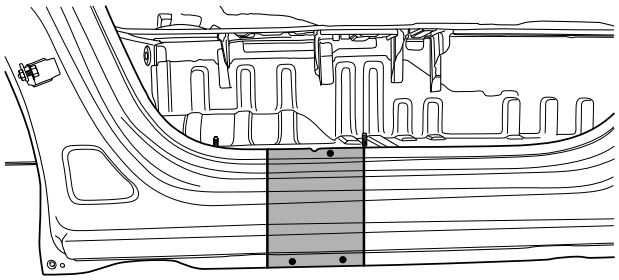
NOTE

When cutting the side sill outer panel, take care not to cut through mating flanges or side sill outer reinforcement.



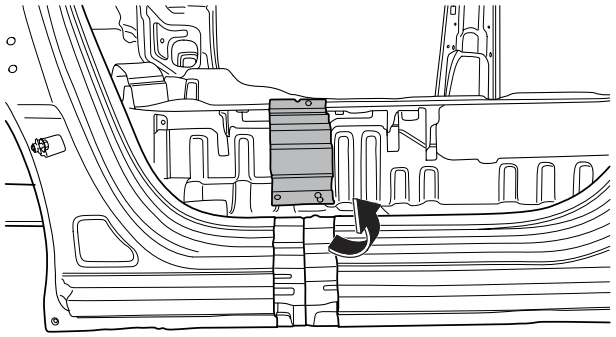
BTQBP6305A

12. Drill out all the spotwelds(3) attaching the side sill outer panel section.



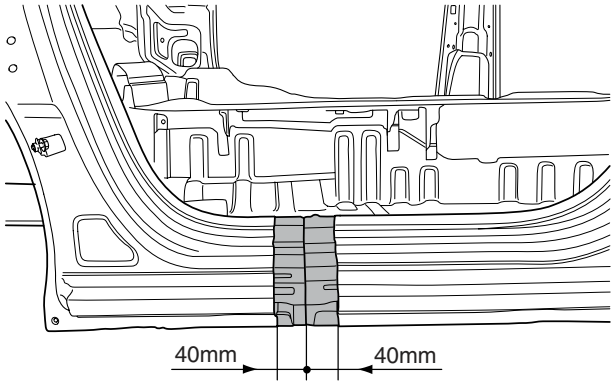
BTQBP6305B

13. Remove the side sill outer panel section.



BTQBP6306

14. Measure and mark the cutline on side sill outer reinforcement as shown in the illustration.

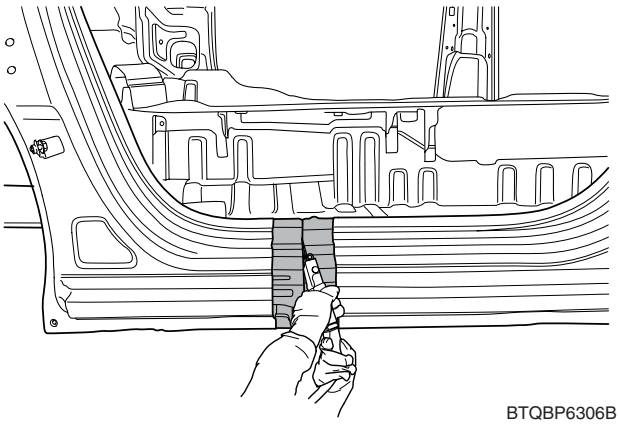


BTQBP6306A

15. Cut the side sill outer reinforcement along the cutline.

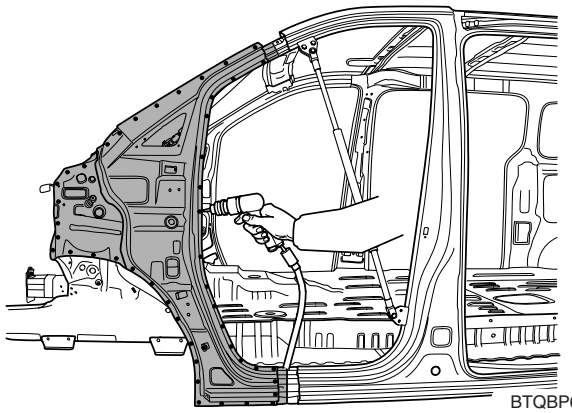
NOTE

When cutting the side sill outer reinforcement, be careful not to cut side sill inner panel.

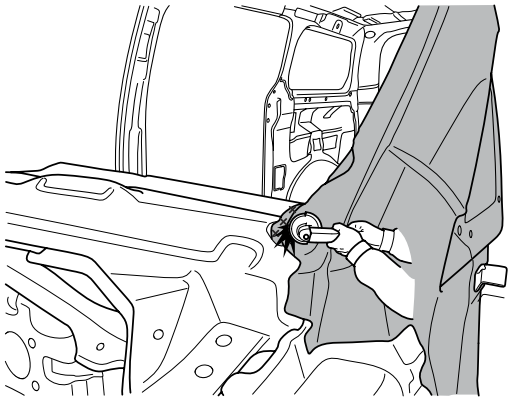


BTQBP6306B

16. To remove the front pillar outer panel, drill out all spotwelds(83).

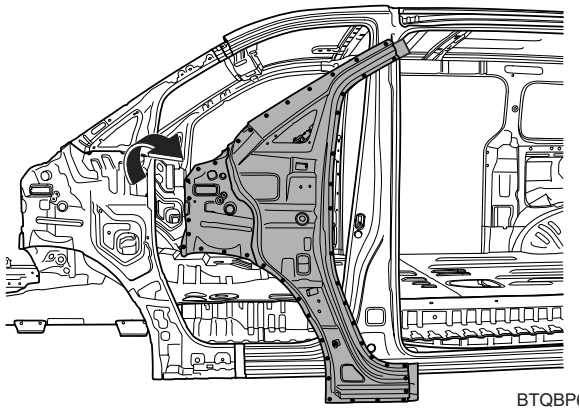


BTQBP6307



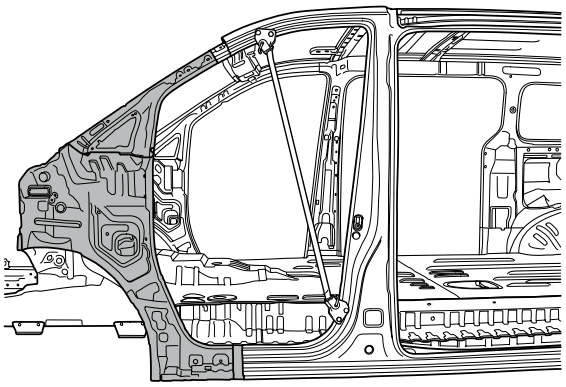
BTQBP6308

17. Remove the front pillar outer panel.

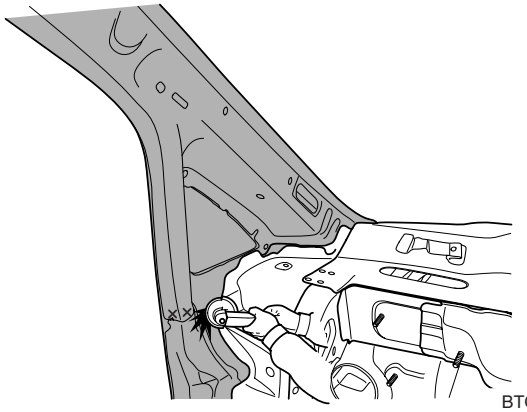


BTQBP6309

18. To remove the front pillar inner panel, drill out and grind away all spotwelds(37) and lap welds(2).

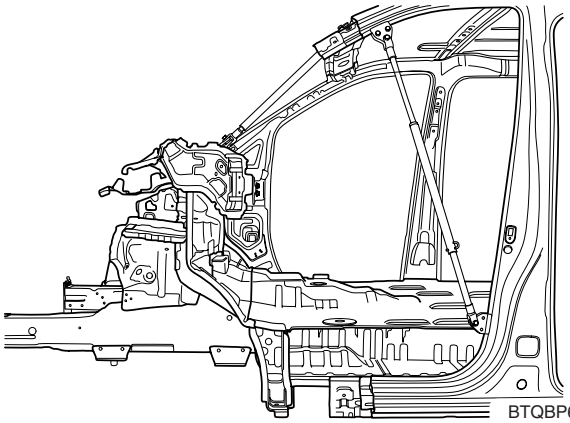


BTQBP6309A

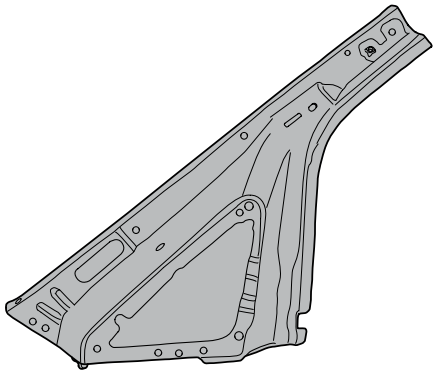


BTQBP6310

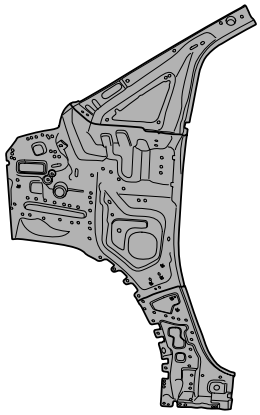
19. Remove the front pillar inner panel.



BTQBP6313



BTQBP6311



BTQBP6312

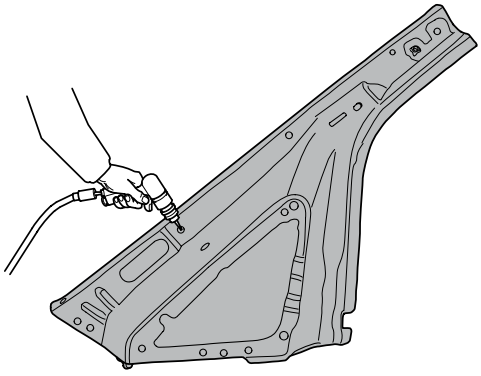
20. Straighten all flanges as necessary, prepare all surfaces to be welded.

21. Clean and prepare all welds, and remove all residue.

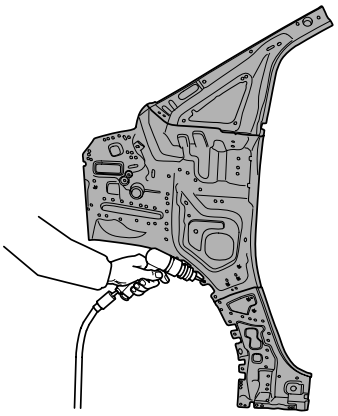
22. After removing, apply the welding primer.

INSTALLATION

1. Drill 8mm holes in the new front pillar inner panel for MIG plug welding.



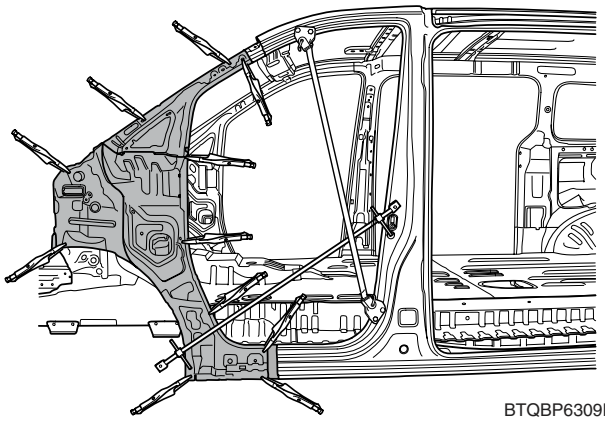
BTQBP6311A



BTQBP6312A

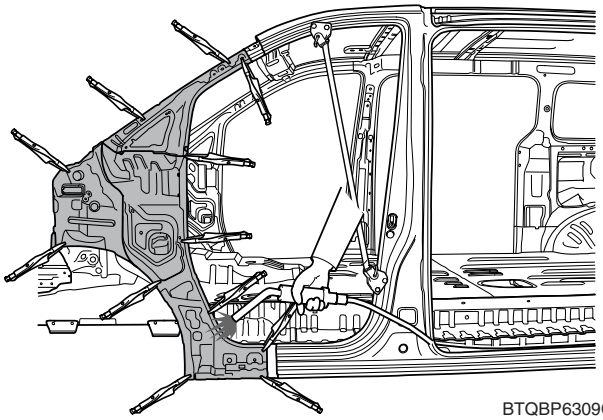
2. Fit and clamp the new front pillar inner panel in place.

3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6309B

4. MIG plug weld all holes and MIG lap weld seams.



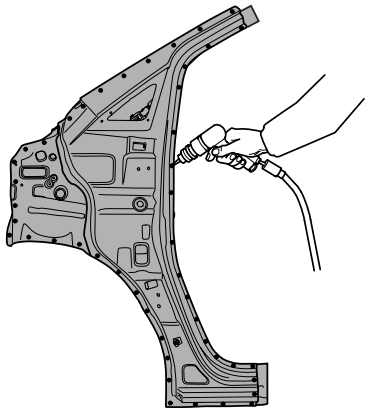
BTQBP6309C

5. Clean and prepare all welds, and remove all residue.

6. After removing, apply the welding primer.

7. Transcribe the cutlines to the new front pillar outer panel, adding 30mm overlap to each end and cut to length.

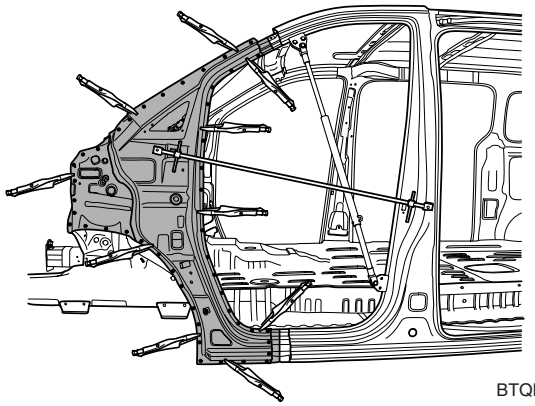
8. Drill 8mm holes along new front pillar outer panel flanges for MIG plug welding.



BTQBP6309D

9. Fit and clamp the new front pillar outer panel in place.

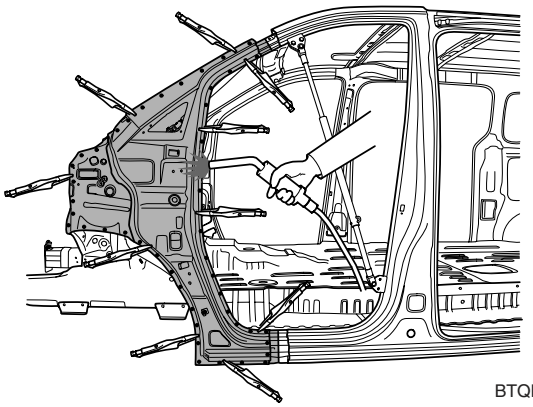
10. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6307A

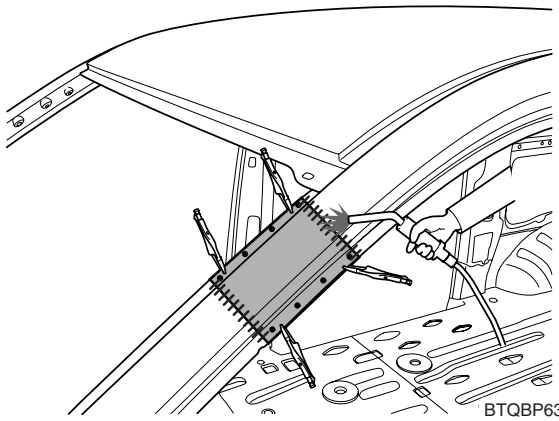
11. If necessary, make temporary welds, and then check to confirm that the closing and fit for windshield glass, door and fender are correct.

12. MIG butt weld front pillar outer reinforcement and side sill outer reinforcement.



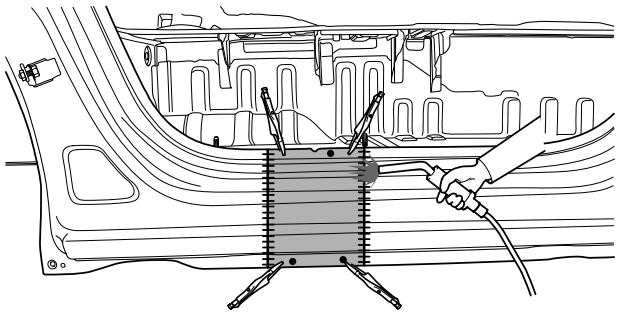
BTQBP6307B

13. Reattach the cut front pillar outer panel section, then MIG plug weld all holes and MIG butt weld seams.



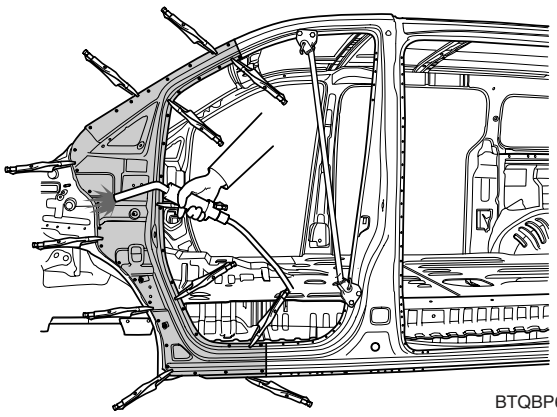
BTQBP6301C

14. Reattach the cut side sill outer panel section, then MIG plug weld all holes and MIG butt weld seams.



BTQBP6305C

15. MIG plug weld all holes.



BTQBP6302B

16. Clean and prepare all welds, and remove all residue.

17. Apply body filler to joints and sand as need.

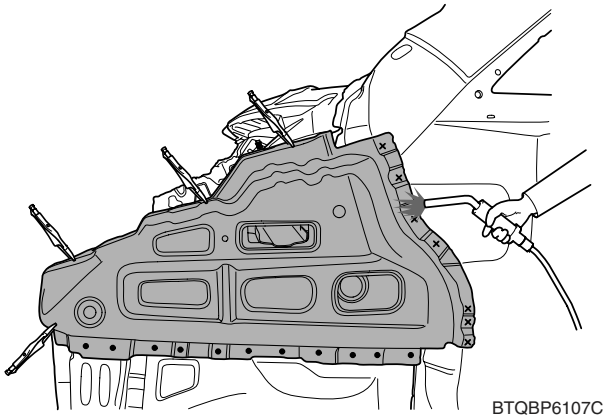
18. Apply the two-part epoxy primer to the interior of the front pillar.

19. Clean all welds with a disc grinder.

20. Before welding the fender apron outer panel, apply the two-part epoxy primer and anti-corrosion agent to the interior of the fender apron panel.

21. Install the fender apron outer panel in place.

22. MIG plug weld all holes and MIG lap weld seams.



BTQBP6107C

23. Clean and prepare all welds, remove all residue.

24. Apply an anti-corrosion agent to the welded parts and inside of front pillar (Refer to the CORROSION PROTECTION).

25. Prepare exterior surfaces for priming, using wax and grease remover.

26. Apply metal conditioner and water rinse.

27. Apply conversion coating and water rinse.

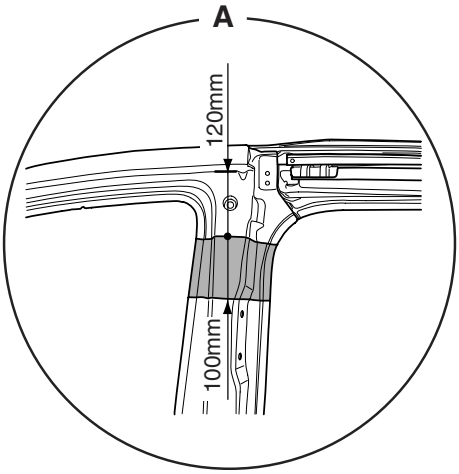
28. Apply the two-part epoxy primer.

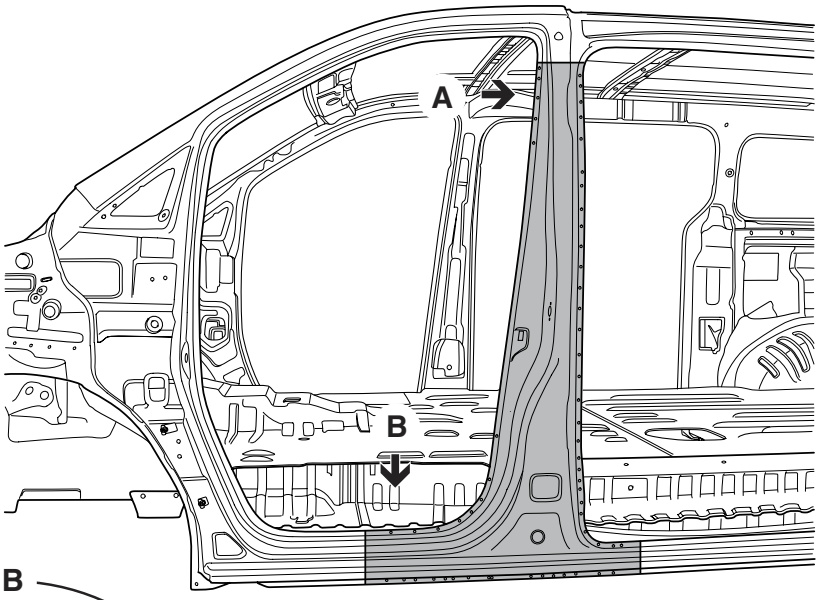
29. Apply the correct seam sealer to all joints carefully (Refer to the BODY SEALING LOCATIONS).

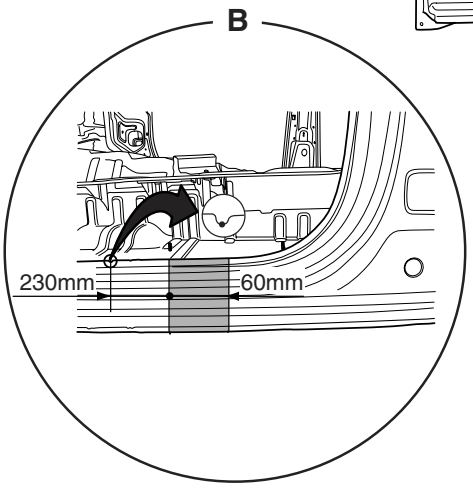
30. Reprime over the seam sealer to complete the repair.

CENTER PILLAR

WELDING POINTS





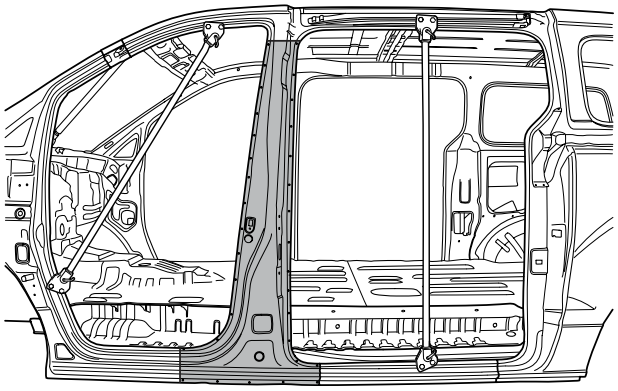


- ● MIG plug welding
- ⫲ MIG butt welding
- ⫘ MIG lap welding

BTQBP6501

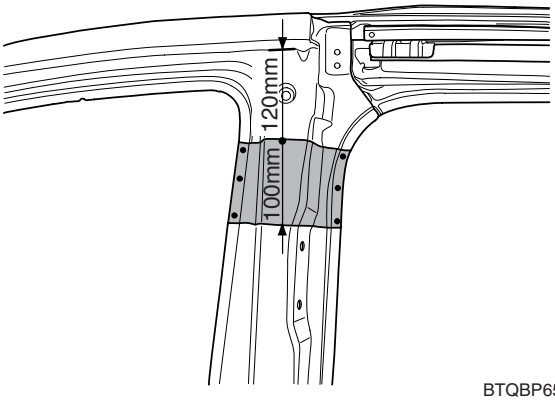
REMOVAL

1. Before cutting center pillar, be sure to support roof panel.



BTQBP6503

2. Measure and mark the horizontal cutlines on center pillar outer panel as indicated in the illustration.

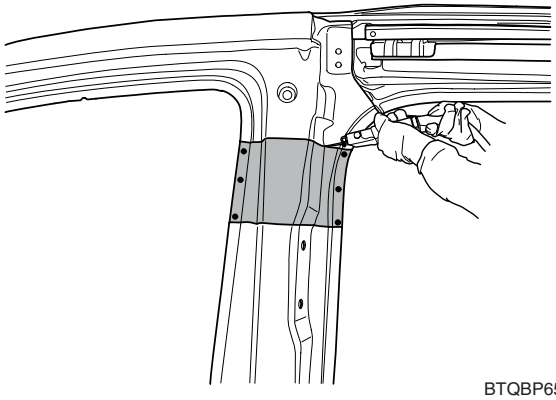


BTQBP6501A

3. Cut center pillar outer panel along the cutlines.

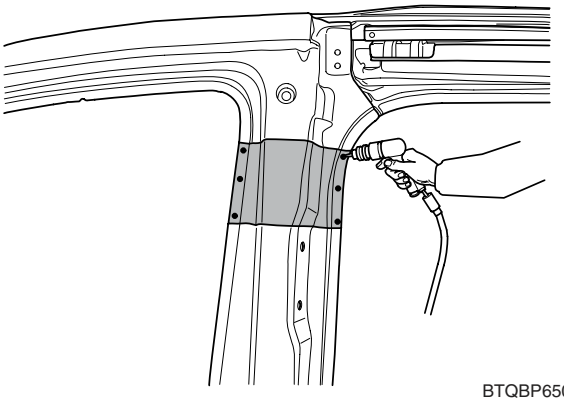
NOTE

When cutting center pillar outer panel, take care not to cut through mating flanges or center pillar outer reinforcement.



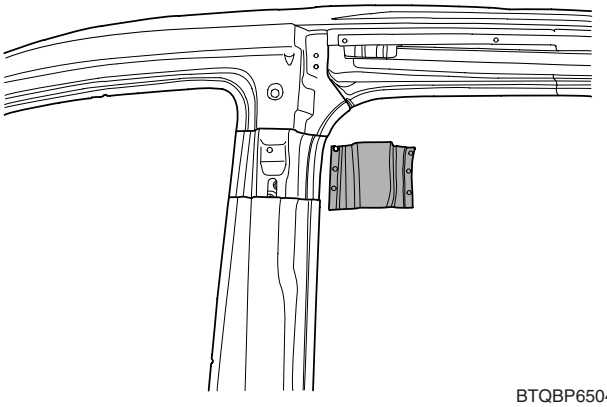
BTQBP6501B

4. Drill out all spotwelds(6), attaching the center pillar outer panel section.



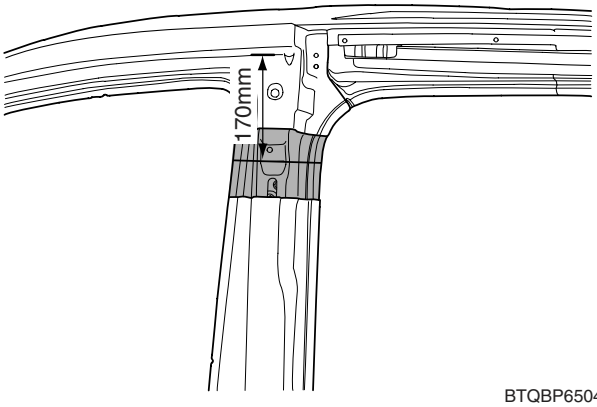
BTQBP6501C

5. Remove the center pillar outer panel section.



BTQBP6504

6. Measure and mark the horizontal cutline on center pillar outer reinforcement as indicated in the illustration.

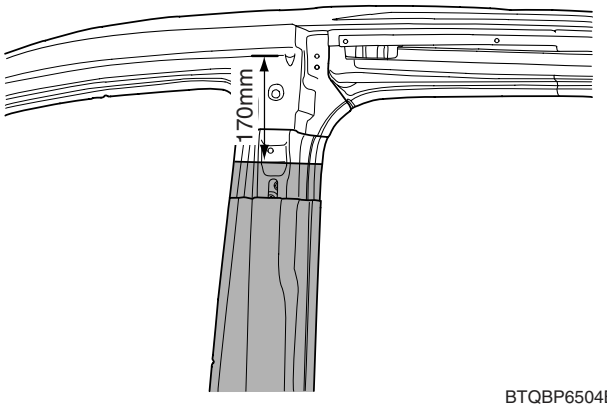


BTQBP6504A

7. Cut the center pillar outer reinforcement along the cutline.

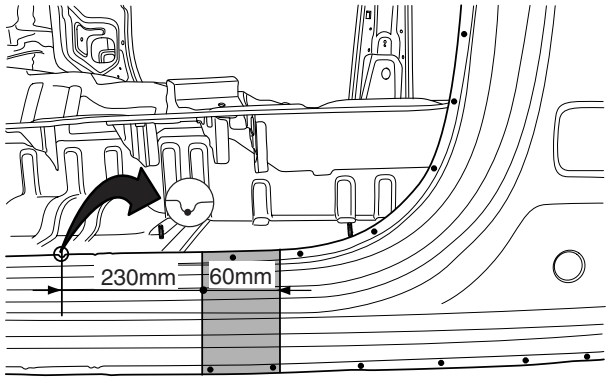
NOTE

When cutting center pillar outer reinforcement, take care not to cut through mating flanges or front seat belt mounting upper bracket.



BTQBP6504B

8. Measure and mark the vertical cutlines on front side sill outer panel 230mm and 290mm from the side sill outer panel notch center.

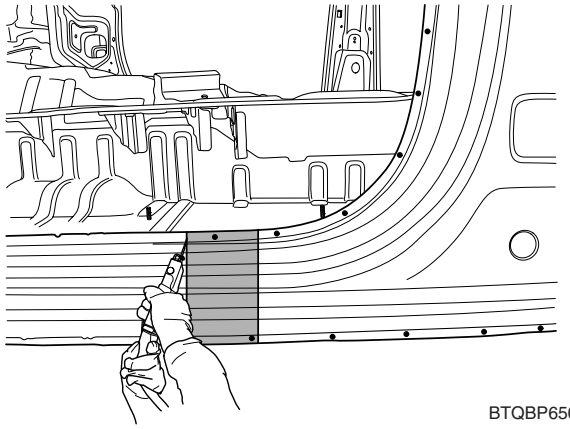


BTQBP6502A

9. Cut the front side sill outer panel along the cutlines.

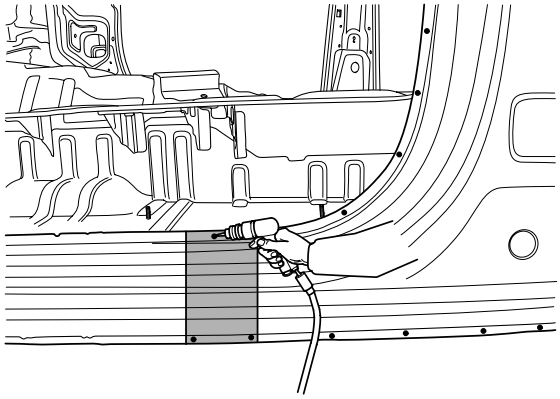
NOTE

When cutting front side sill outer panel, take care not to cut through mating flanges or side sill outer reinforcement.



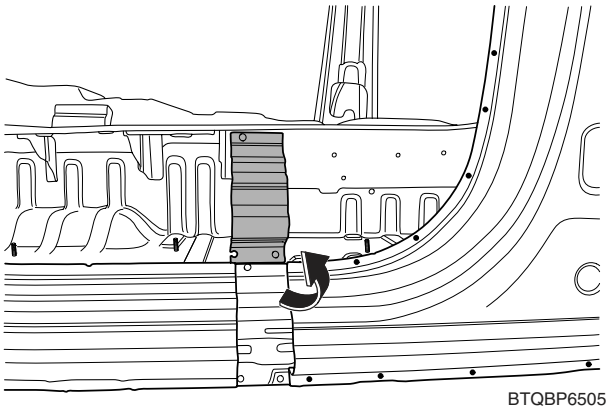
BTQBP6502B

10. Drill out all spotwelds (3) attaching the front side sill outer panel section.



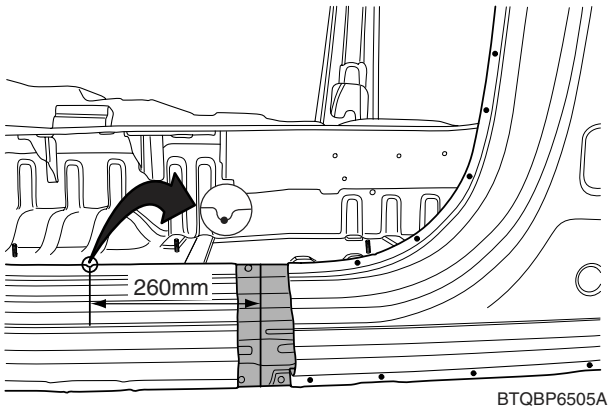
BTQBP6502C

11. Remove the front side sill outer panel section.



BTQBP6505

12. Measure and mark the vertical cutline on front side sill outer reinforcement 260mm from the side sill outer panel notch center as indicated in the illustration.

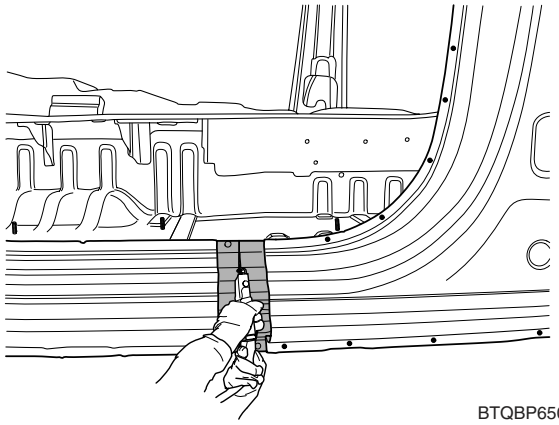


BTQBP6505A

13. Cut the front side sill outer reinforcement aiong the cutline.

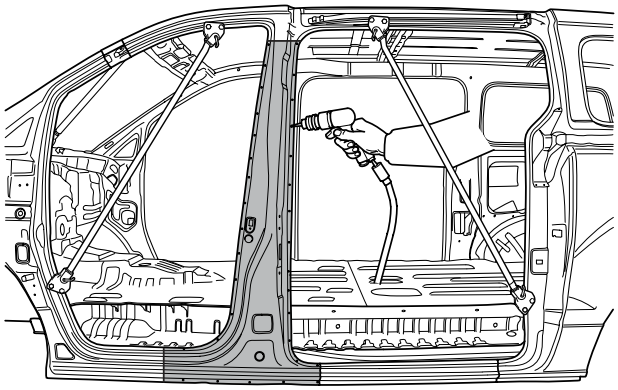
NOTE

When cutting front side sill outer reinforcement, take care not to cut through mating flanges.



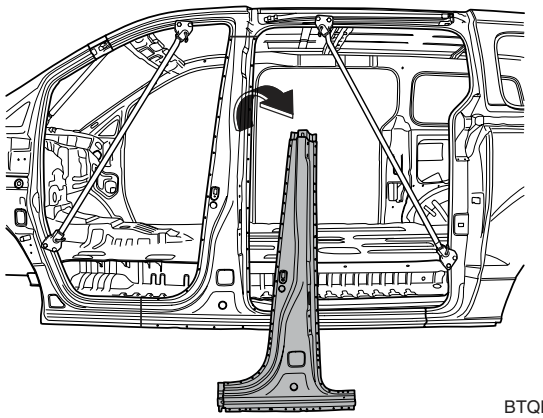
BTQBP6505B

14. Drill out all spotwelds(70), attaching the center pillar outer panel.



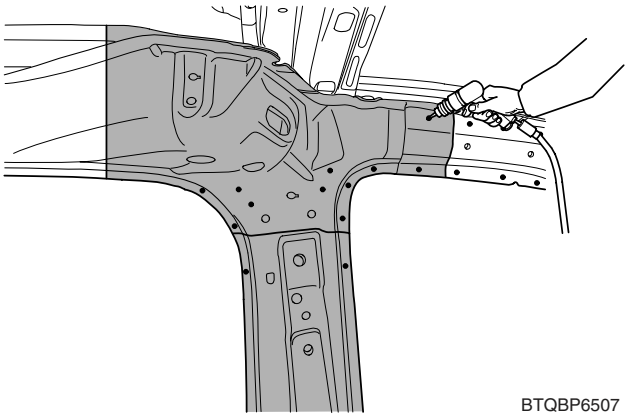
BTQBP6503A

15. Remove the center pillar outer panel.

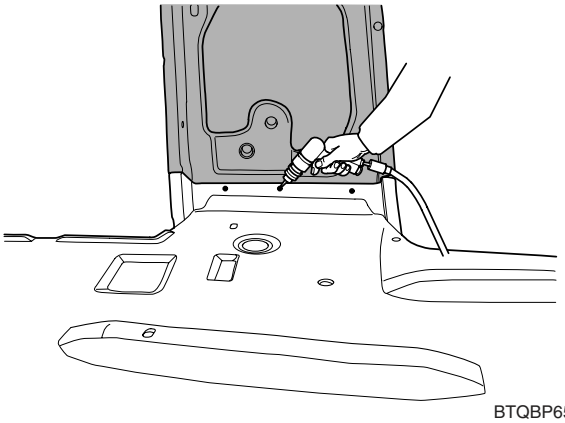


BTQBP6506

16. Drill out all spotwelds(30), attaching the center pillar inner panel.

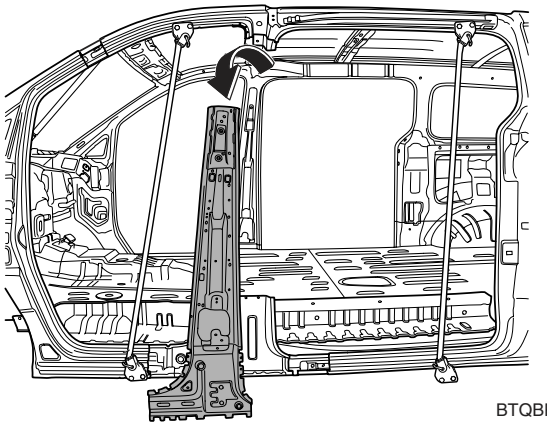


BTQBP6507



BTQBP6508

17. Remove the center pillar inner panel.

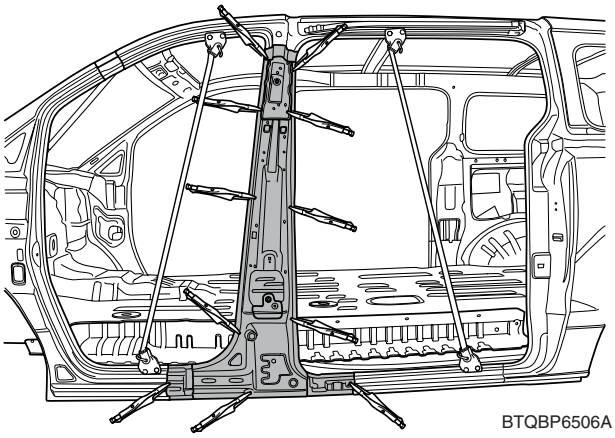


BTQBP6509

18. Prepare all surfaces to be welded.
19. After removing, apply the welding primer.

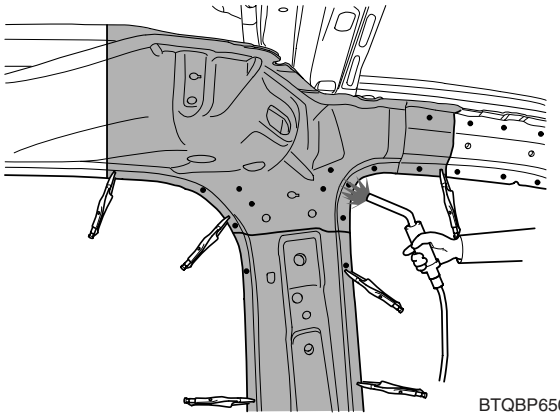
INSTALLATION

1. Fit and clamp the new center pillar inner panel in place.
2. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

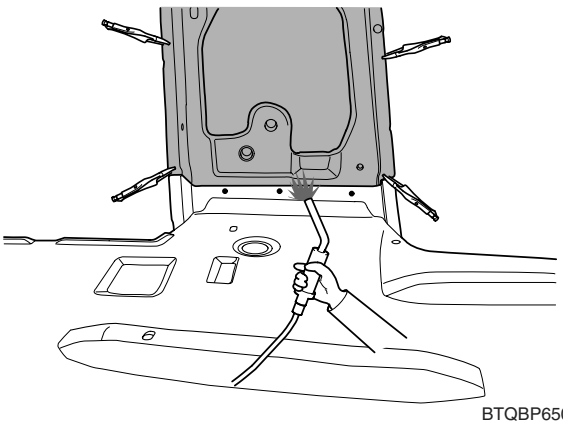


BTQBP6506A

3. MIG plug weld all holes.



BTQBP6507A



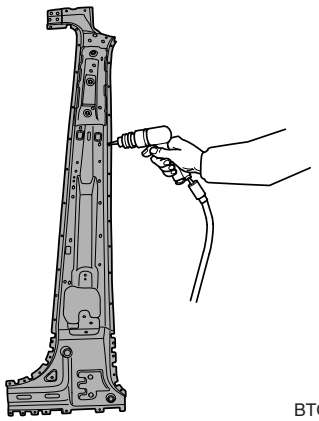
BTQBP6508A

4. Clean and prepare all welds, and remove all residue.

5. After removing, apply the welding primer.

6. Transcribe the cutlines to the new center pillar outer panel, adding 30mm overlap to each end and cut to length.

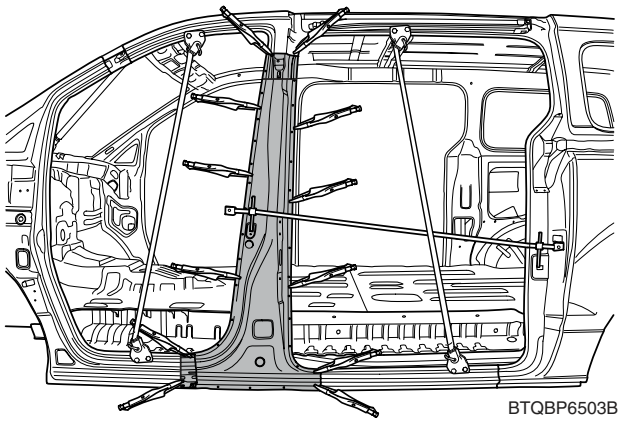
7. Drill 8mm holes in overlap areas along center pillar outer panel flanges.



BTQBP6509A

8. Fit and clamp the new center pillar outer panel in place.

9. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



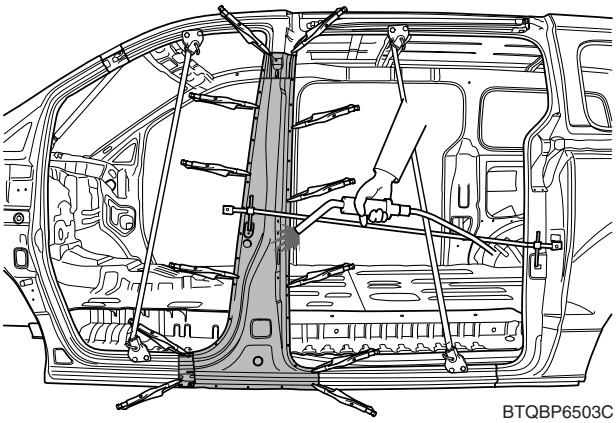
BTQBP6503B

10. Check the fit of the front and rear doors.

11. Reinstall center pillar outer panel.

12. Apply body filler to the outer center pillar seam. Sand and finish.

13. MIG plug weld all holes and MIG butt weld seams.

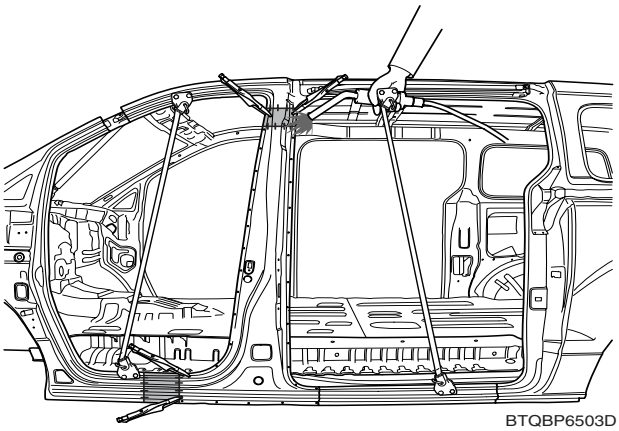


BTQBP6503C

14. Clean and prepare all welds, and remove all residue.

15. After removing, apply the welding primer.

16. Reattach the cut center pillar outer panel section, then MIG plug weld all holes and MIG butt weld seams.



BTQBP6503D

17. Clean all welds with a disc grinder.

18. Apply the two-part epoxy primer to the interior of the center pillar.

19. Apply an anti-corrosion agent to the welded parts and interior of the center pillar (Refer to the CORROSION PROTECTION).

20. Prepare exterior surfaces for priming, using wax and grease remover.

21. Apply metal conditioner and water rinse.

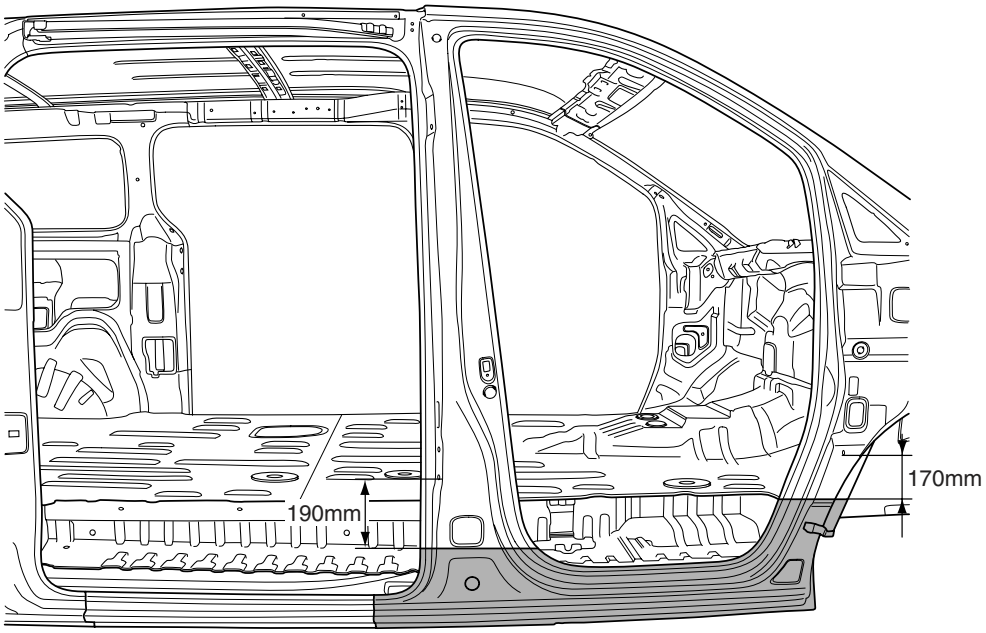
22. Apply conversion coating and water rinse.

23. Apply the two-part epoxy primer.

24. Apply the correct seam sealer to all joints carefully (Refer to the BODY SEALING LOCATIONS).

FRONT SIDE SILL PANEL

WELDING POINTS

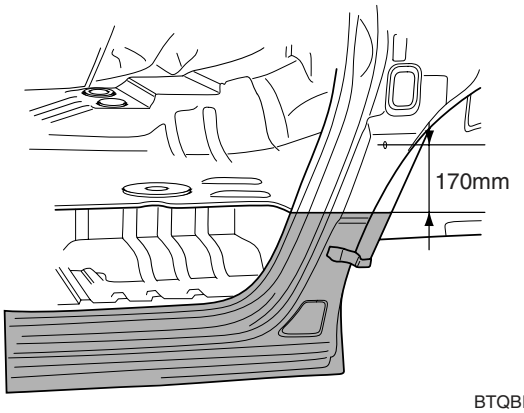


- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

BTQBP6601

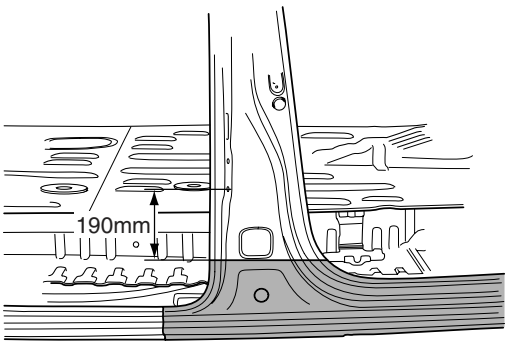
REMOVAL

1. Measure and mark the horizontal cutline on front side sill outer panel 170mm from front door lower hinge mounting hole center as indicated in the illustration.



BTQBP6601A

2. Measure and mark the horizontal cutline on front side sill outer panel 190mm from rear lower stopper mounting hole center as indicated in the illustration.

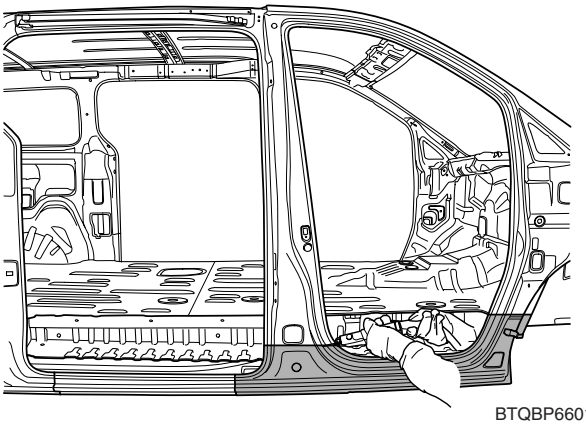


BTQBP6601L

3. Cut the front side sill outer panel along the cutlines.

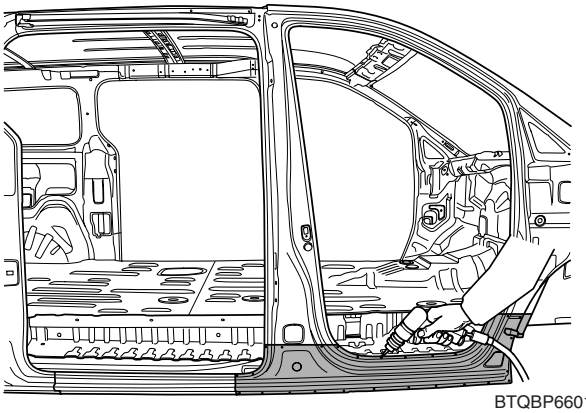
NOTE

When cutting the front side sill outer panel, take care not to cut through mating flanges or front and center pillar outer reinforcement.



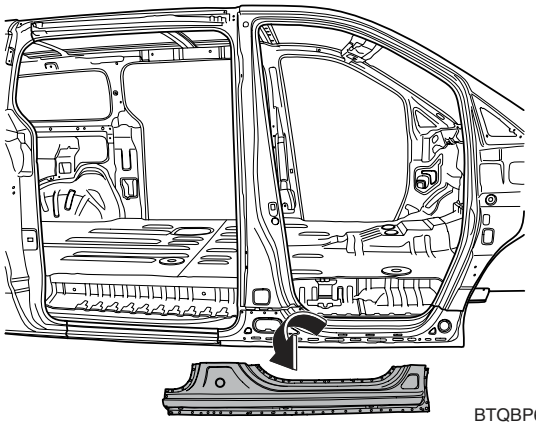
BTQBP6601B

4. Drill out all spotwelds(56), attaching the front side sill outer panel.



BTQBP6601C

5. Remove the front side sill outer panel.



BTQBP6602

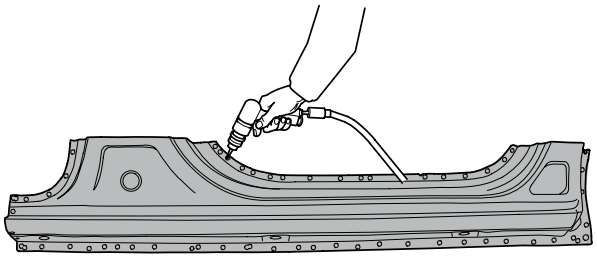
6. Clean cut portions with a grinder.

7. After removing, apply the welding primer.

INSTALLATION

1. Transcribe the cutlines to the new front side sill outer panel, adding 30mm overlap to each end and cut to length.

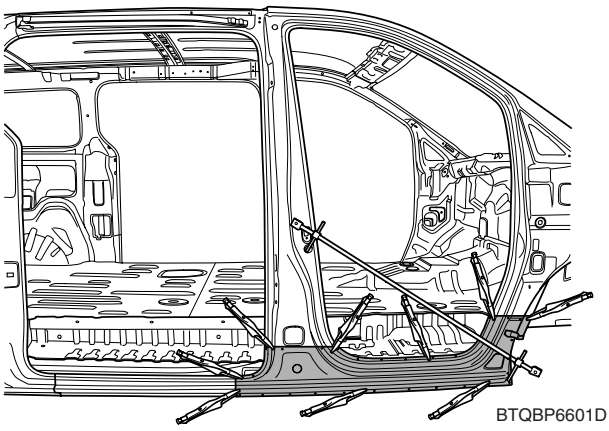
2. Using service panel for replacement of front side sill outer panel, drill 8mm holes in overlap areas along upper and lower flanges.



BTQBP6603

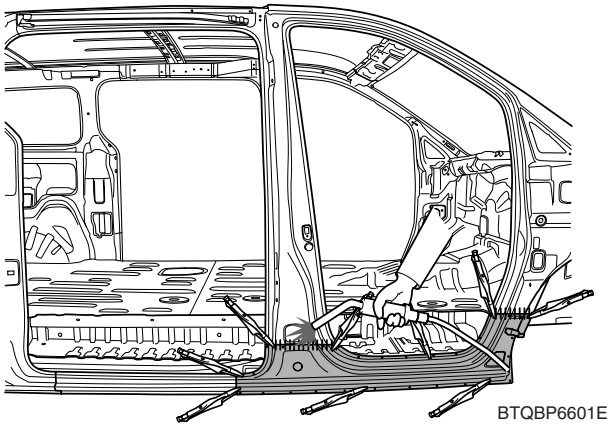
3. Fit and clamp the front side sill outer reinforcement in place.

4. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6601D

5. MIG plug weld all holes and MIG butt weld seams.



BTQBP6601E

6. Clean and prepare all welds and remove all residue.

7. Apply body filler to the side sill outer panel seams.

8. Apply the two-part epoxy primer to the interior of the side sill outer panel.

9. Apply an anti-corrosion agent to welded parts and interior of the side sill outer panel (Refer to the CORROSION PROTECTION).

10. Prepare the exterior surfaces for priming, using wax and grease remover.

11. Apply metal conditioner and water rinse.

12. Apply conversion coating and water rinse.

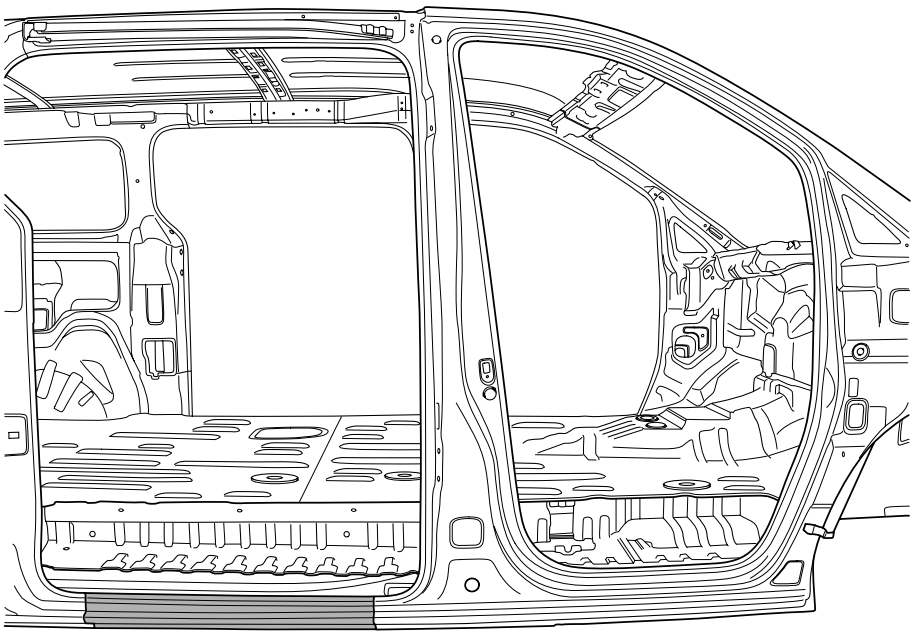
13. Apply the two-part epoxy primer.

14. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

15. Reprime over the seam sealer.

REAR SIDE SILL PANEL

WELDING POINTS

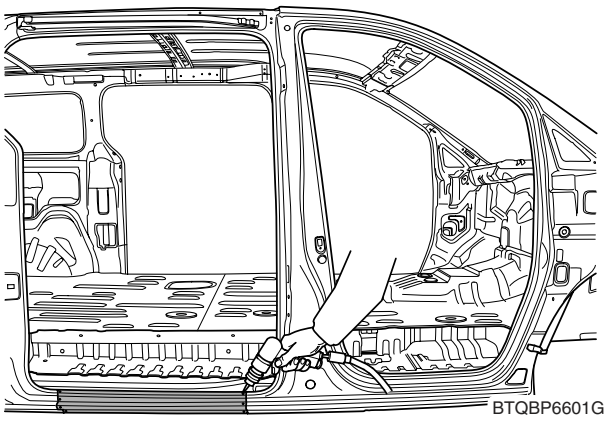


Laser welding
MIG plug welding
MIG butt welding
MIG lap welding

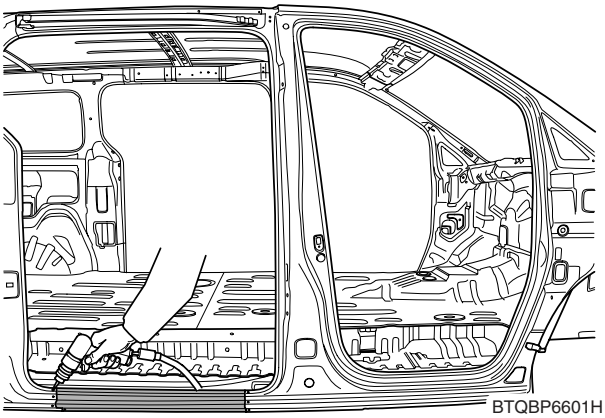
BTQBP6601F

REMOVAL

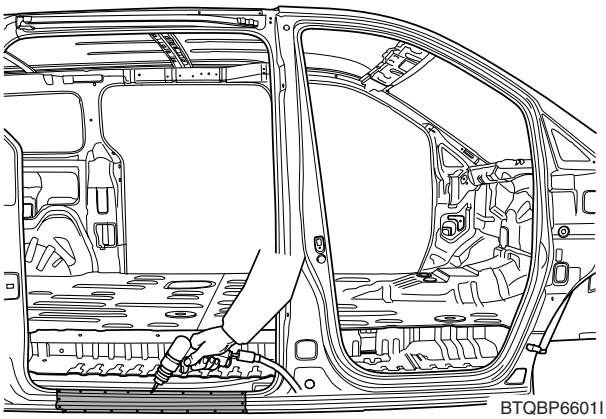
1. Drill out all spotwelds(7), attaching the rear side sill outer panel to the front side sill outer panel.


BTQBP6601G

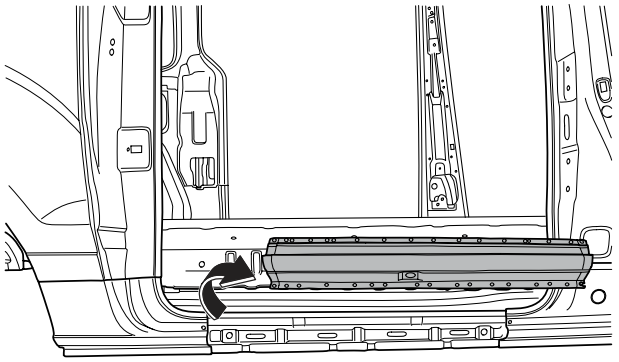
2. Drill out all spotwelds(6), attaching the rear side sill outer panel.


BTQBP6601H

3. Drill out all spotwelds(32), attaching the rear side sill outer panel.


BTQBP6601I

4. Remove the rear side sill outer panel.

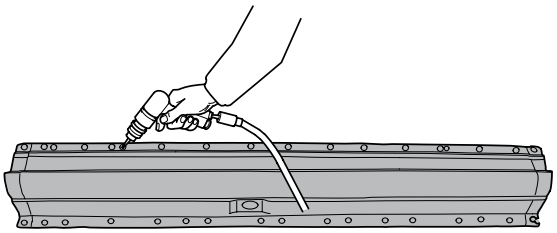

BTQBP6604

5. Clean cut portions with a grinder.

6. After removing, apply the welding primer.

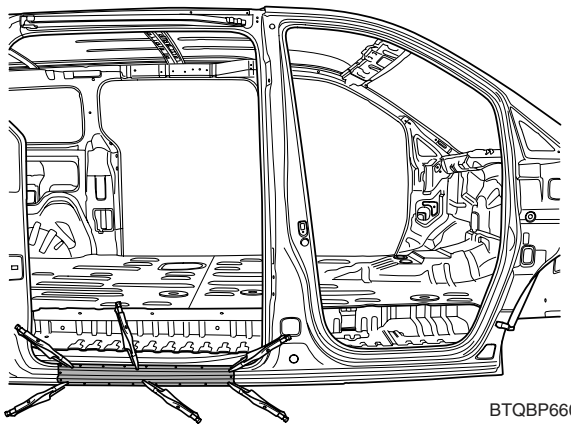
INSTALLATION

1. Using service panel for replacement of new rear side sill outer panel, drill 8mm holes in overlap areas along upper and lower flanges.


BTQBP6605

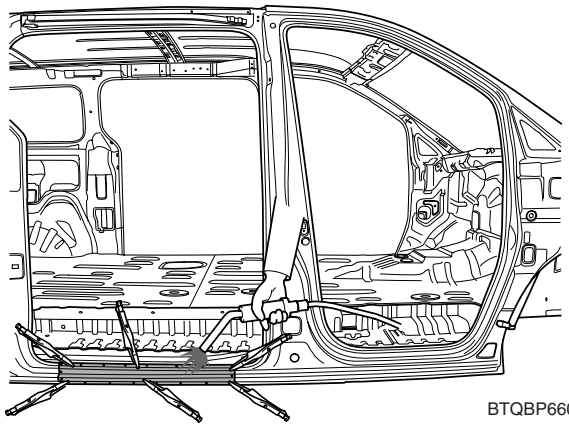
2. Fit and clamp the new rear side sill outer panel in place.

3. Measure each measurement point and correct the installation position.



BTQBP6601J

4. MIG plug weld all holes.



BTQBP6601K

5. Clean and prepare all welds and remove all residue.

6. Apply body filler to the side sill outer panel seams.

7. Apply the two-part epoxy primer to the interior of the side sill outer panel.

8. Apply an anti-corrosion agent to welded parts and interior of the side sill outer panel(Refer to the CORROSION PROTECTION).

9. Prepare the exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

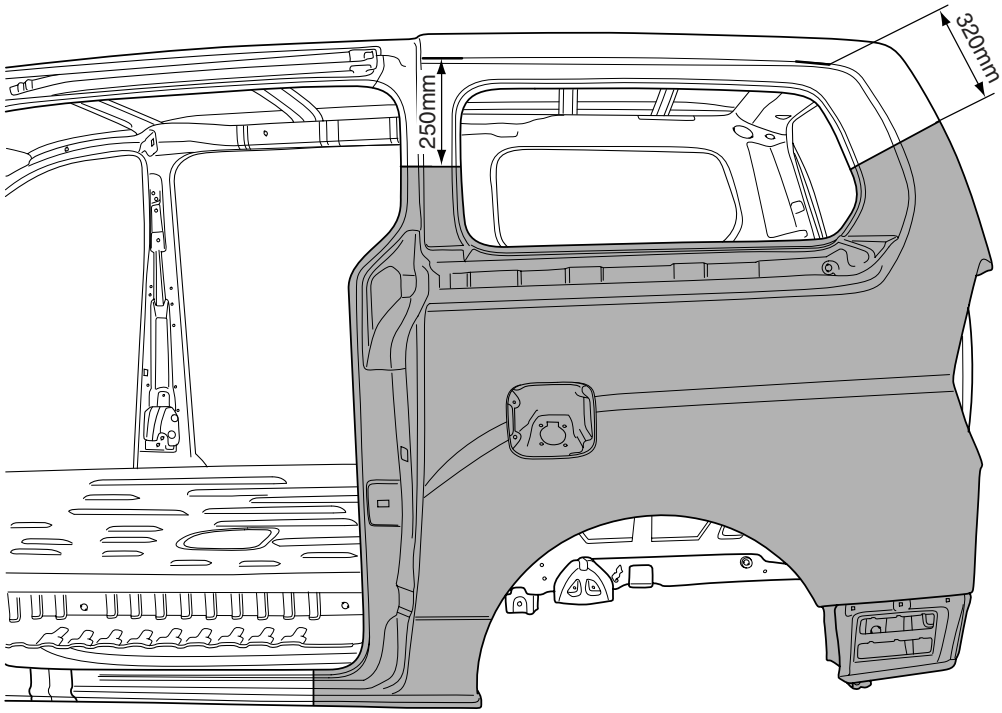
12. Apply the two-part epoxy primer.

13. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

14. Reprime over the seam sealer.

QUARTER PANEL

WELDING POINTS

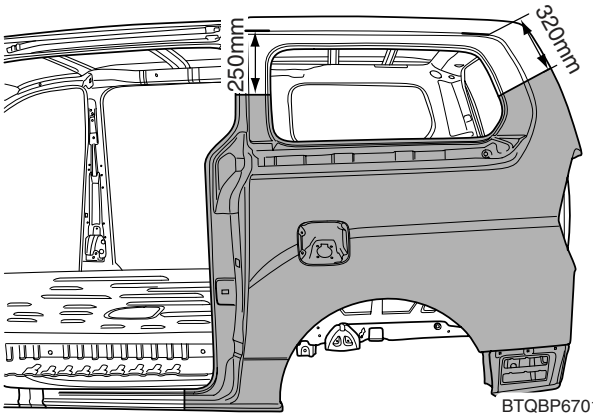


- ● MIG plug welding
- ⫼ MIG butt welding
- ⫘ MIG lap welding

BTQBP6701

REMOVAL

1. Measure and mark the cutlines on the quarter outer panel as indicated in the illustration.

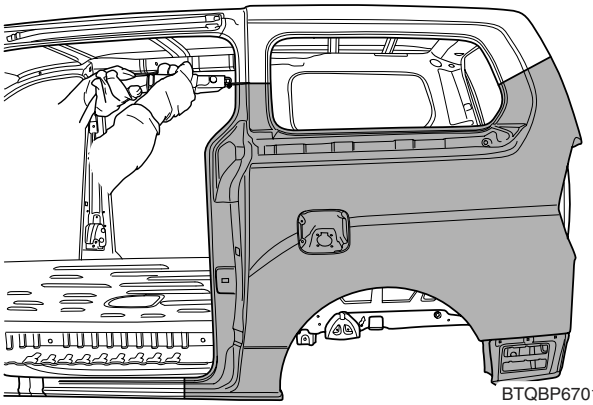


BTQBP6701A

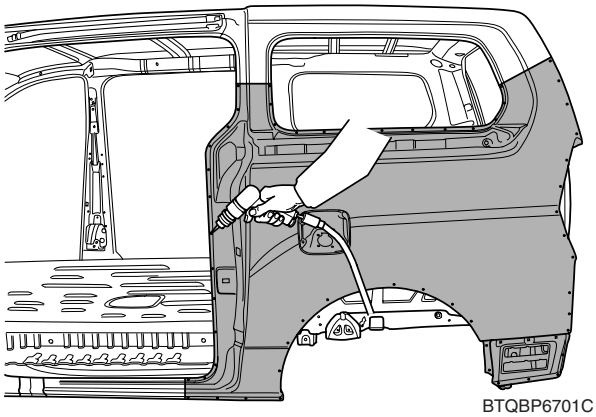
2. Cut the quarter outer panel along the cutlines.

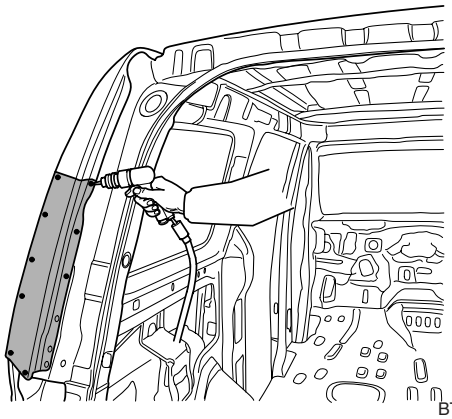
NOTE

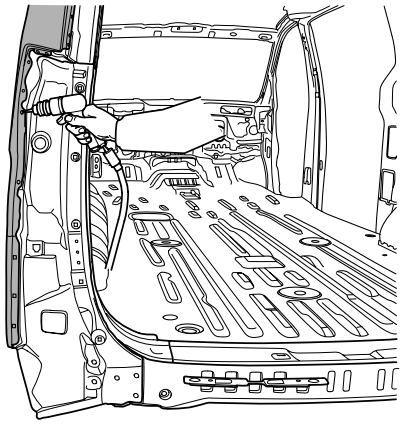
When cutting the quarter outer panel, be careful not to cut quarter inner panel.

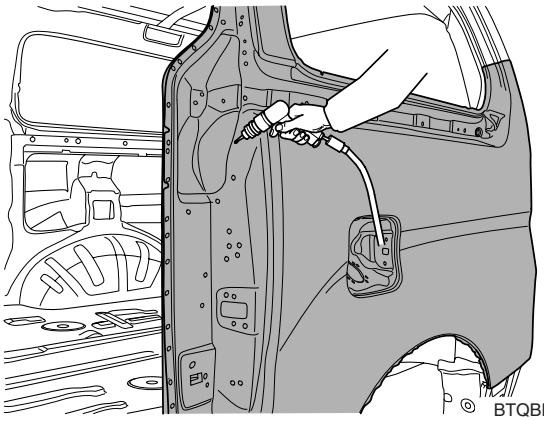

BTQBP6701B

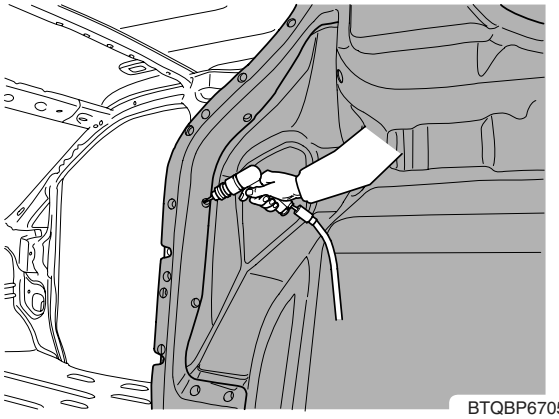
3. Drill out all spotwelds(142), attaching on the quarter outer paneal.

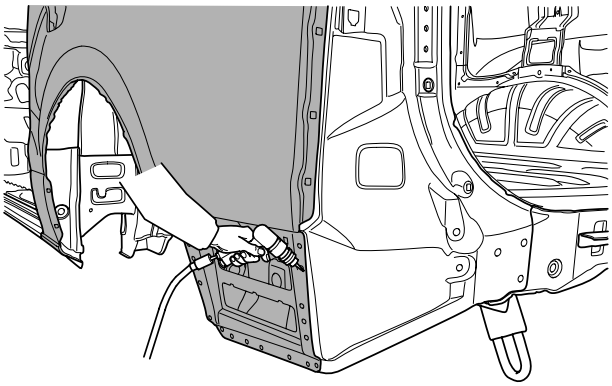

BTQBP6701C


BTQBP6702

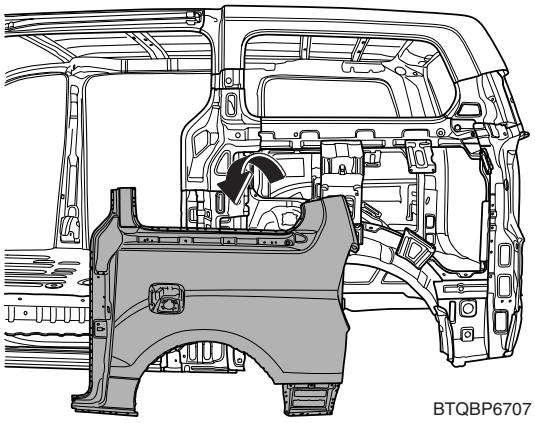

BTQBP6703


BTQBP6704


BTQBP6705


BTQBP6706

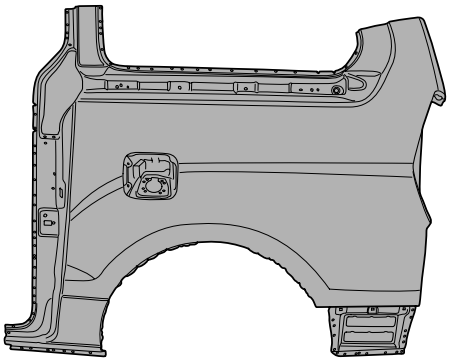
4. Remove the quarter outer panel.


BTQBP6707

5. Clean cut portions with a disc grinder.
6. Prepare all surfaces to be welded.
7. After removing, apply the welding primer.

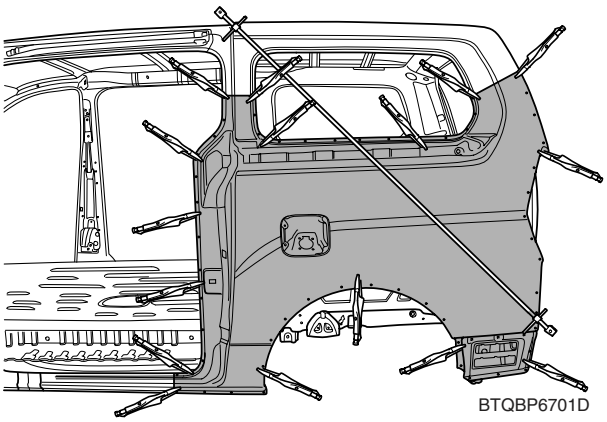
INSTALLATION

1. Transcribe the cutlines to the new quarter outer panel, adding 30 mm overlap each end.
2. Drill 8 mm holes in overlap areas along upper and lower flanges of the new quarter outer panel for MIG plug welding.

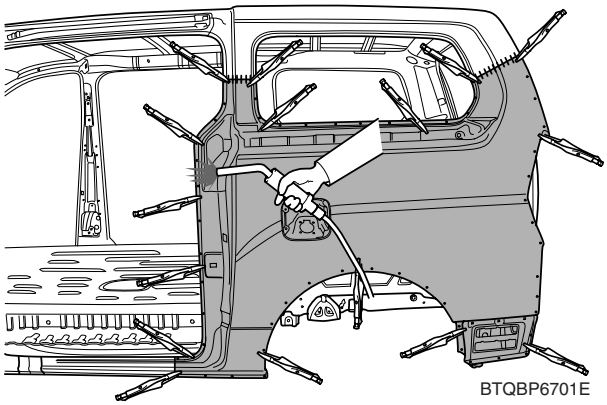

BTQBP6708

3. Apply body filler to the welded seam. Sand and finish. Apply the two-part epoxy primer to the interior of the quarter outer panel.
4. Fit and clamp the quarter outer panel in place.

5. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.


BTQBP6701D

6. MIG plug weld all holes and MIG butt weld seams.


BTQBP6701E

7. Clean and prepare all welds, remove all residue.

8. Apply an anti-corrosion agent to the welded parts and interior of the quarter outer panel (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

12. Apply the two-part epoxy primer.

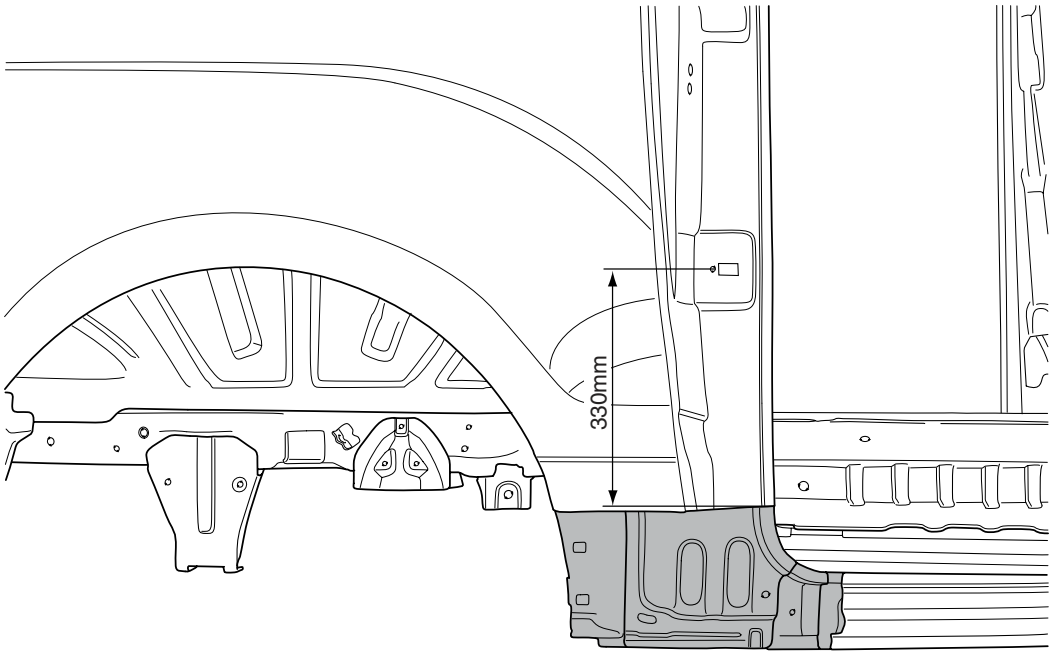
13. Apply the correct seam sealers to all joints.

14. Reprime over the seam sealer to complete the repair.

15. In order to improve corrosion resistance, if necessary, apply an under body anti-corrosion agent to the wheel well (Refer to the CORROSION PROTECTION).

LOWER QUARTER PANEL

WELDING POINTS

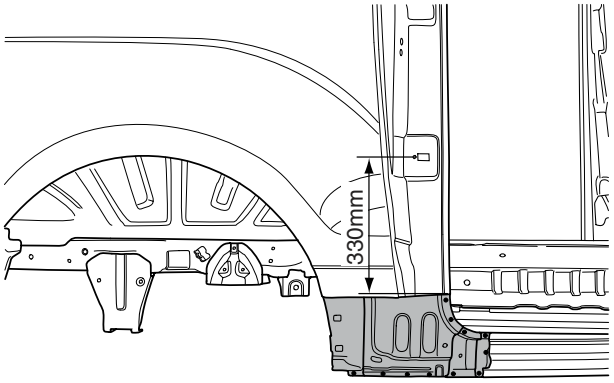


- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

BTQBP6709

REMOVAL

1. Measure and mark cutline on the lower quarter outer panel 330mm from door switch mounting hole center as indicated in the illustration.

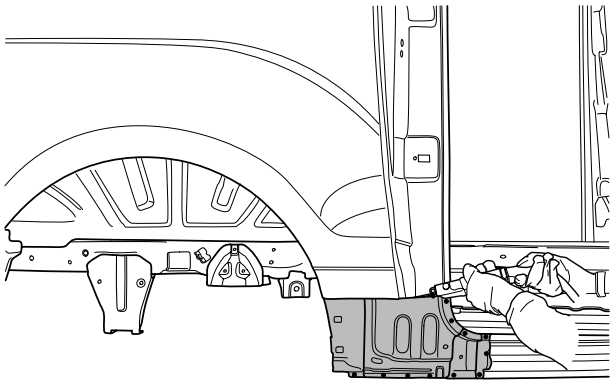


BTQBP6709A

2. Cut the lower quarter outer panel along the cutline.

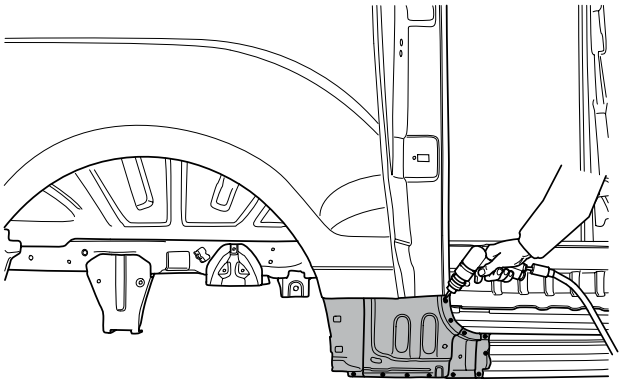
NOTE

When cutting the lower quarter outer panel, be careful not to cut quarter inner panel.



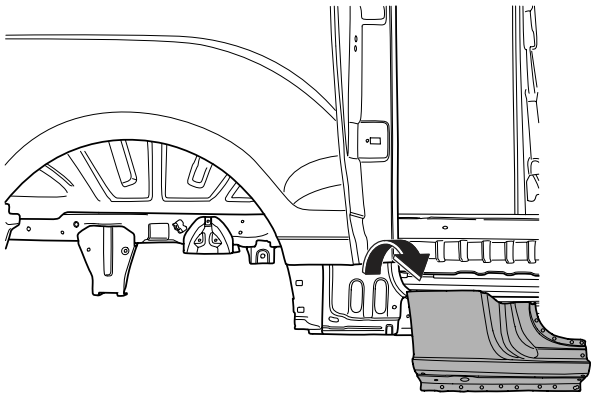
BTQBP6709B

3. Drill out all spotwelds(21), attaching on the lower quarter outer panel.



BTQBP6709C

4. Remove the lower quarter outer panel.



BTQBP6710

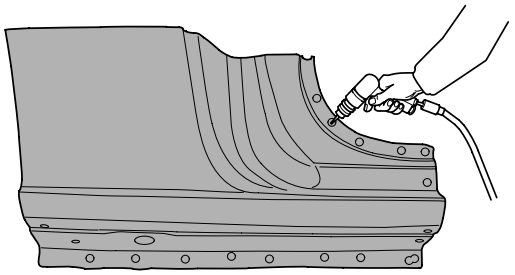
5. Prepare all surfaces to be welded.

6. After removing, apply the welding primer.

INSTALLATION

1. Transcribe the cutline to the new lower quarter outer panel, adding 30 mm overlap each end.

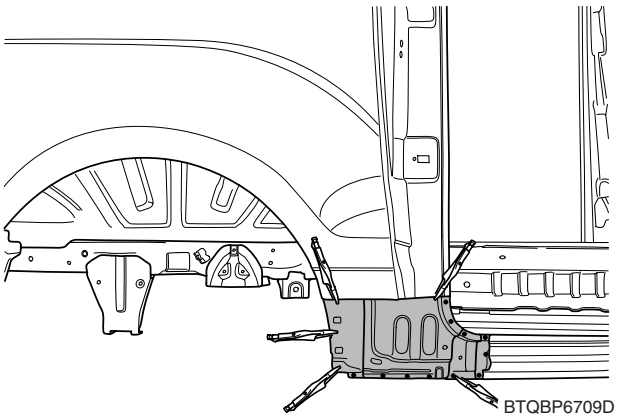
2. Drill 8 mm holes in overlap areas along upper and lower flanges of the new lower quarter outer panel for MIG plug welding.



BTQBP6710B

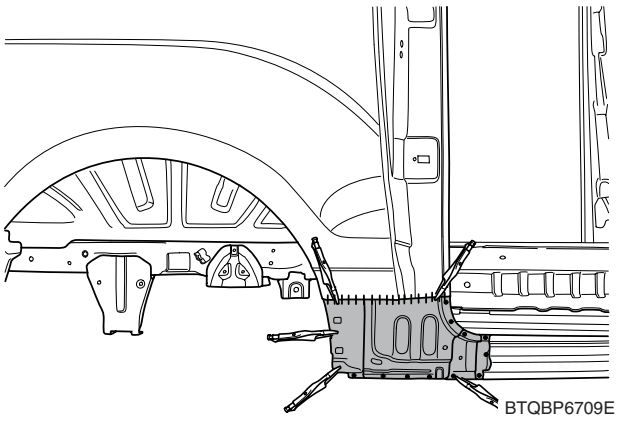
3. Fit and clamp the lower quarter outer panel in place.

4. Measure each measurement point and correct the installation position.



BTQBP6709D

5. MIG plug weld all holes and MIG butt weld seams.



BTQBP6709E

6. Clean and prepare all welds, remove all residue.

7. Apply body filler to the welded seam. Sand and finish. Apply the two-part epoxy primer to the interior of the lower quarter outer panel.

8. Apply an anti-corrosion agent to the welded parts and interior of the lower quarter outer panel (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

12. Apply the two-part epoxy primer.

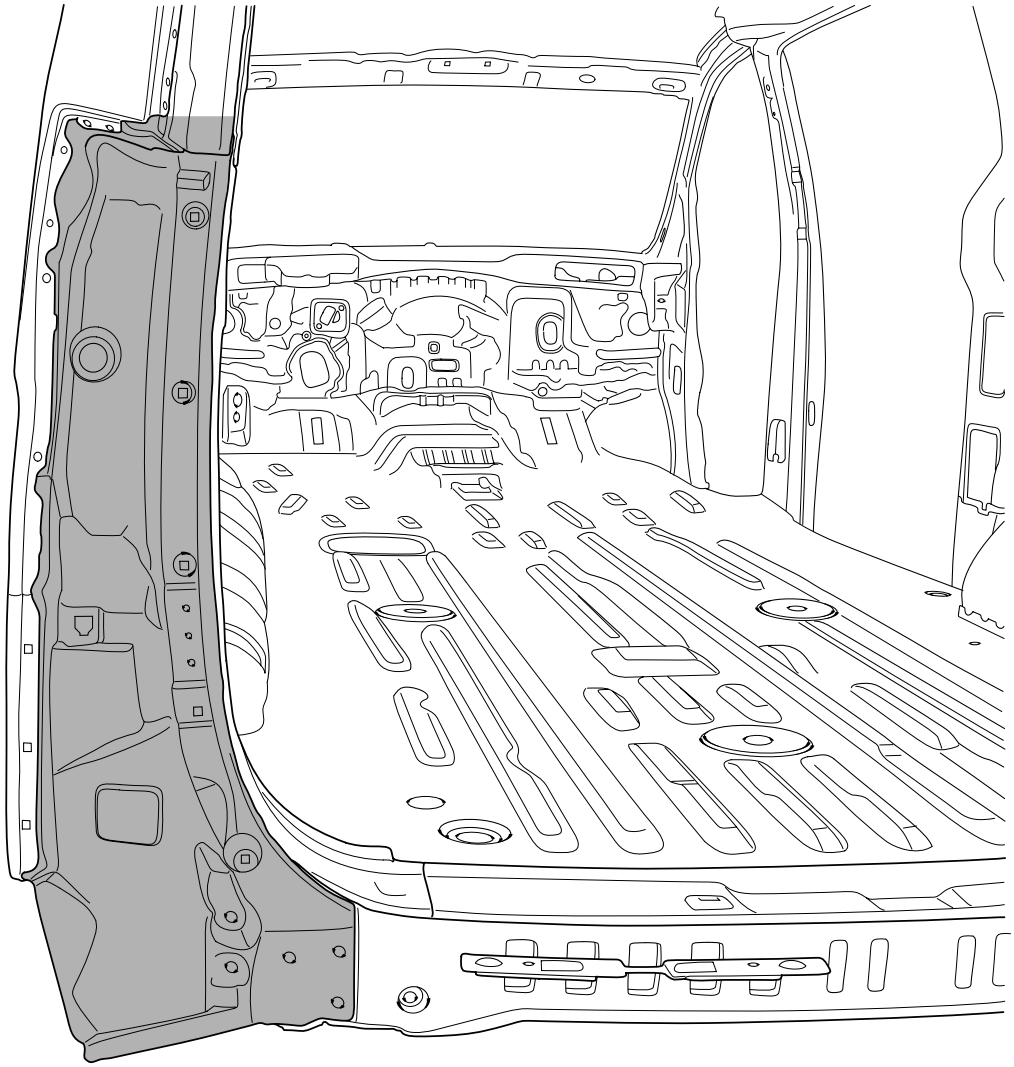
13. Apply the correct seam sealers to all joints.

14. Reprime over the seam sealer to complete the repair.

15. In order to improve corrosion resistance, if necessary, apply an under body anti-corrosion agent to the wheel well (Refer to the CORROSION PROTECTION).

QUARTER OUTER REAR EXTENSION

WELDING POINTS

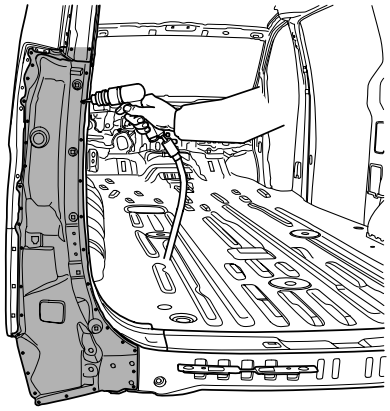


- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

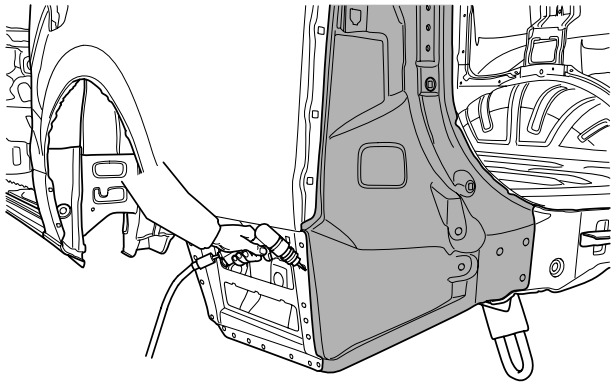
BTQBP6703A

REMOVAL

1. Drill out all spotwelds(46), attaching the quarter outer rear extension.

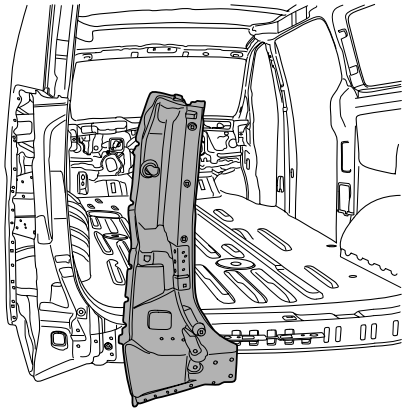


BTQBP6703B



BTQBP6706A

2. Remove the quarter outer rear extension.



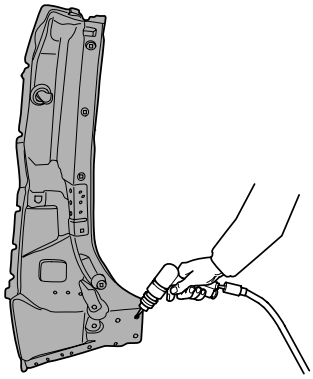
BTQBP6801

3. Prepare all surfaces to be welded.

4. After removing, apply the welding primer.

INSTALLATION

1. Drill 8 mm holes in overlap areas along upper and lower flanges of the new quarter outer rear extension for MIG plug welding.

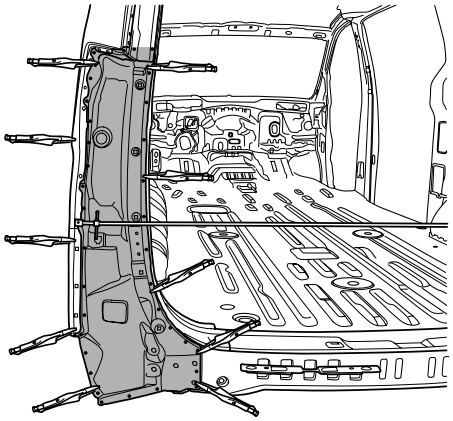


BTQBP6802

3. Apply body filler to the welded seam. Sand and finish. Apply the two-part epoxy primer to the interior of the quarter outer panel.

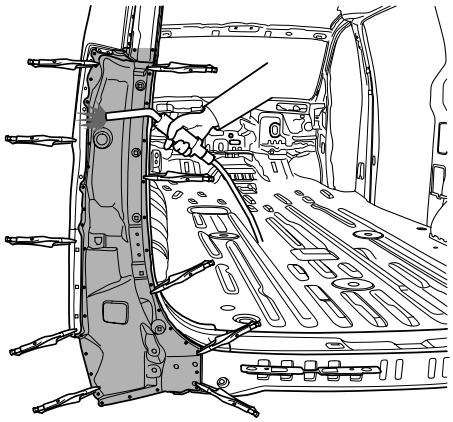
4. Fit and clamp the quarter outer rear extension in place.

5. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

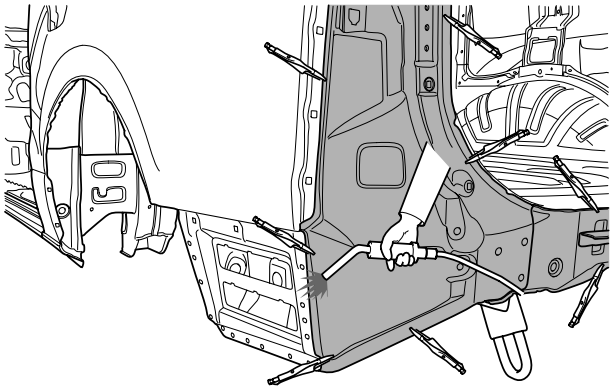


BTQBP6703C

6. MIG plug weld all holes.



BTQBP6703D



BTQBP6706B

7. Clean and prepare all welds, remove all residue.

8. Apply an anti-corrosion agent to the welded parts and interior of the quarter outer rear extension (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

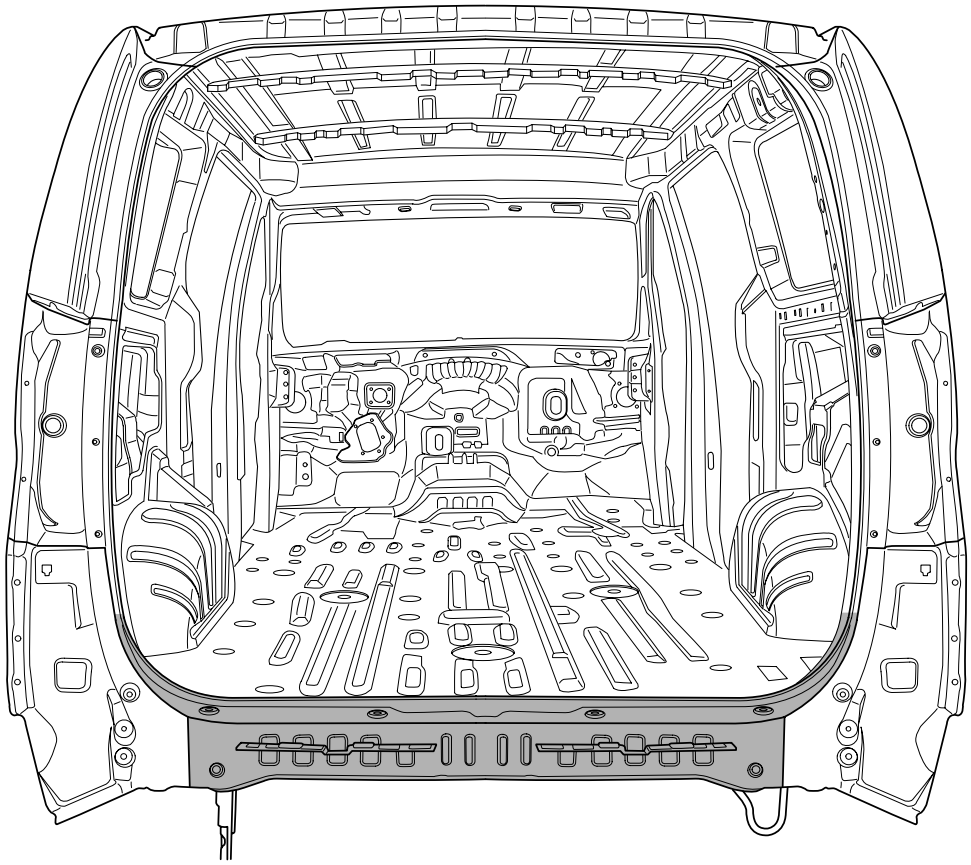
12. Apply the two-part epoxy primer.

13. Apply the correct seam sealers to all joints.

14. Reprime over the seam sealer to complete the repair.

REAR END CROSS MEMBER

WELDING POINTS

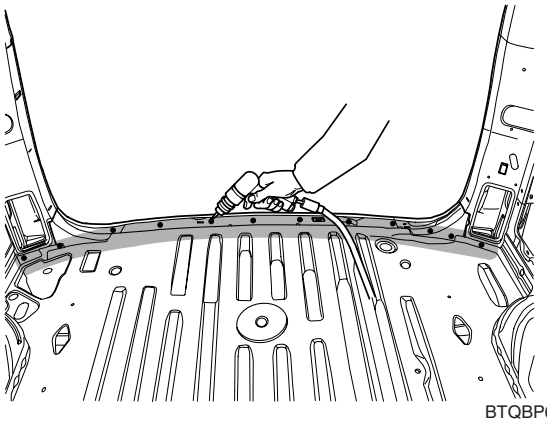


● MIG plug welding
MIG butt welding
MIG lap welding

BTQBP6401

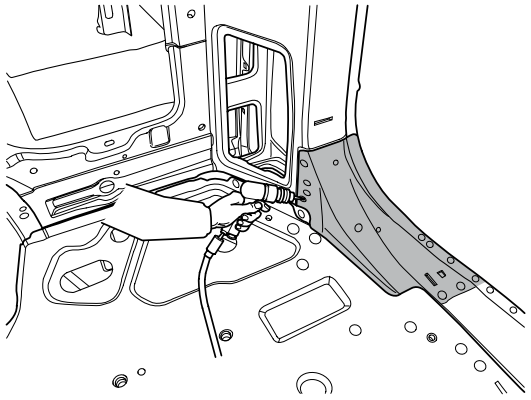
REMOVAL

1. Drill out all the spotwelds(36) attaching the rear end cross outer upper member to the rear floor panel.



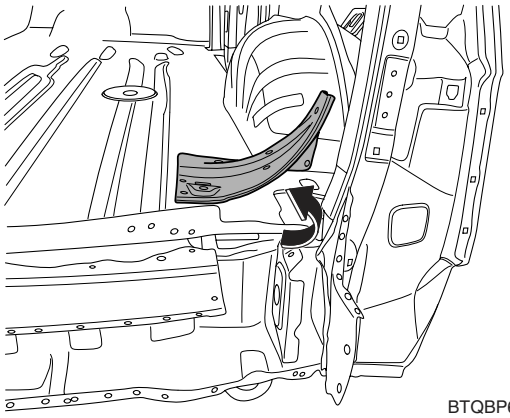
BTQBP6803

2. Drill out all the spotwelds(23) attaching the quarter inner lower rear extension.



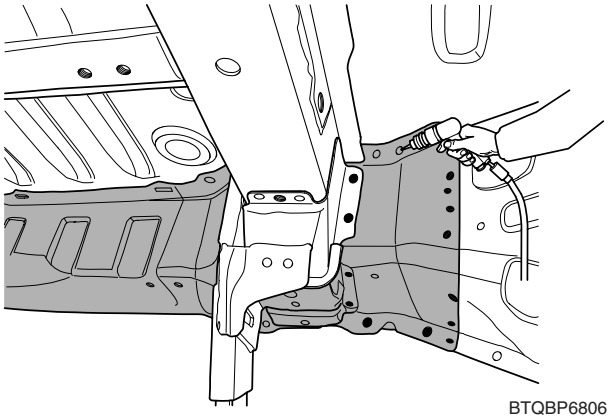
BTQBP6804

3. Remove the quarter inner lower rear extension.

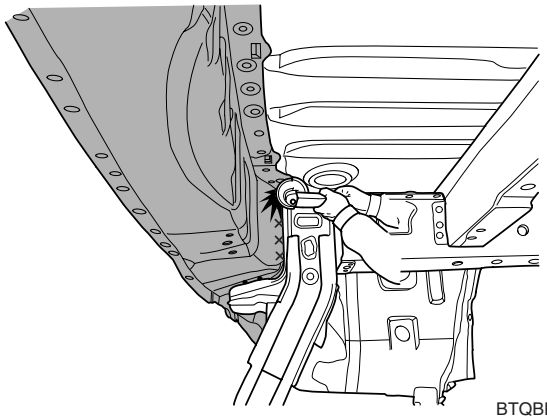


BTQBP6805

4. Drill out and grind away all the spotwelds(18) and lap weld attaching the rear end cross inner member to the rear side member (LH side).

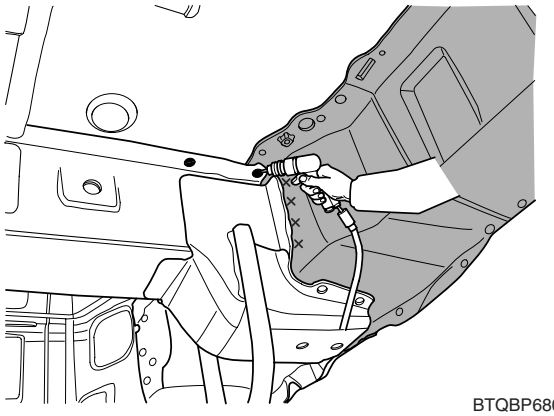


BTQBP6806

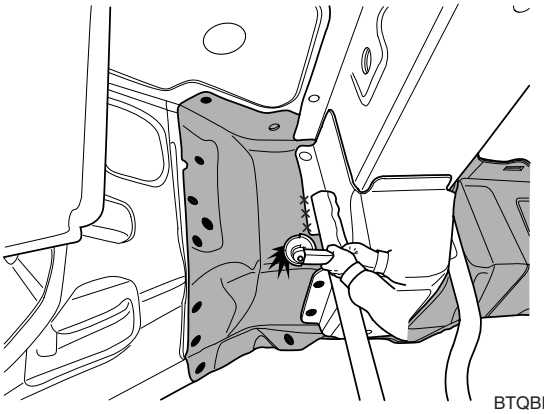


BTQBP6807

5. Drill out and grind away all the spotwelds(18) and lap welds(2) attaching the rear end cross inner member to the rear side member (RH side).

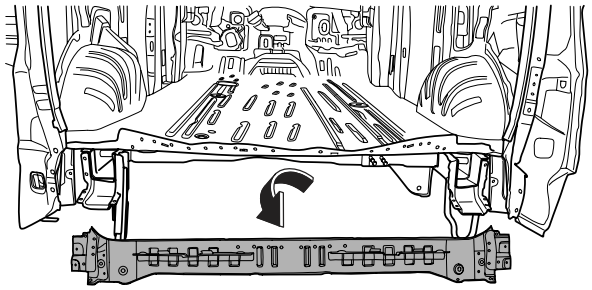


BTQBP6808



BTQBP6809

6. Remove the rear end cross member.



BTQBP6810

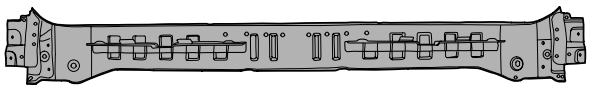
7. Straighten all flanges as necessary, p
repare
all surfaces to be welded.

8. Prepare all surfaces to be welded.

9. After removing, apply the welding primer.

INSTALLATION

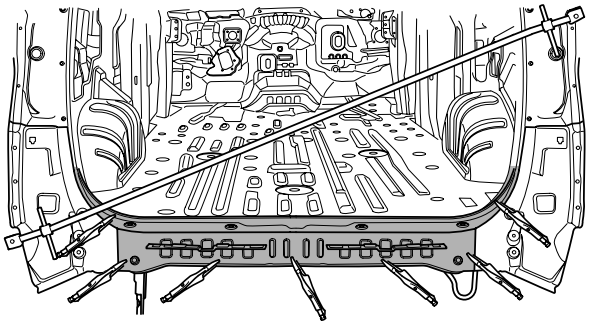
1. Drill 8 mm holes in rear end cross member for MIG plug welding.



BTQBP6811

2. Fit and clamp the rear end cross member in place.

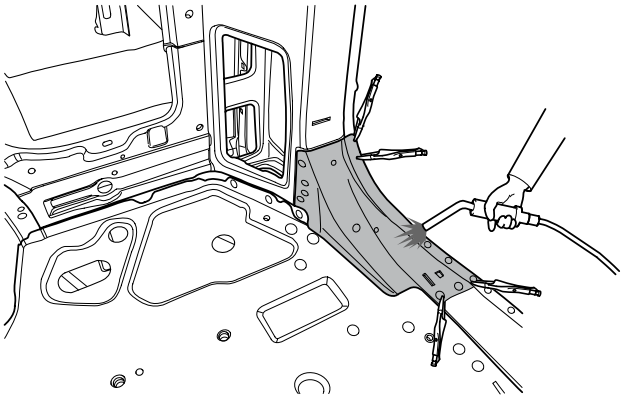
3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.



BTQBP6401A

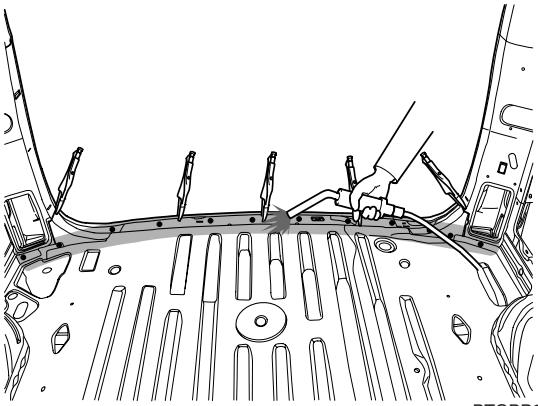
4. Fit and clamp the quarter inner lower rear extension in place.

5. MIG plug weld all holes and MIG lap weld seams.



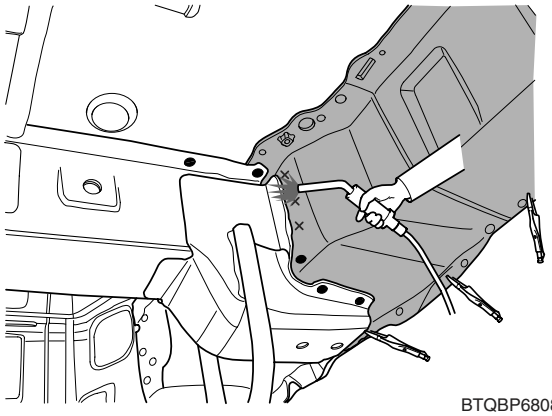
BTQBP6804A

6. MIG plug weld all holes and MIG lap weld seams.

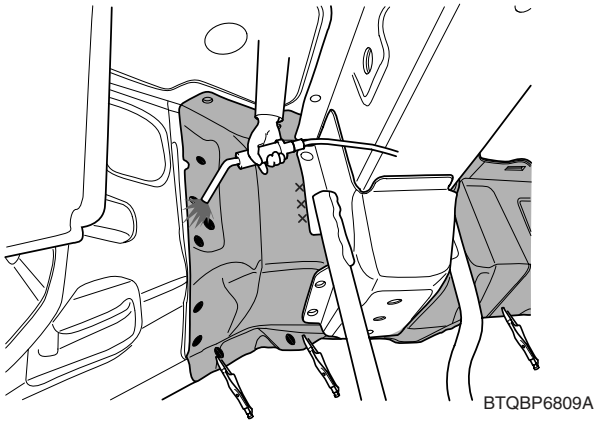


BTQBP6803A

7. MIG plug weld all holes and MIG lap weld seams.

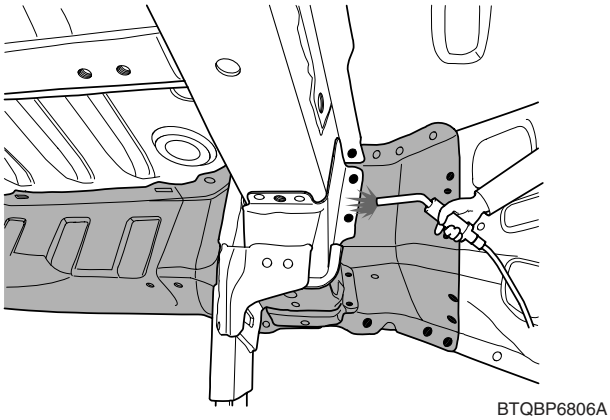


BTQBP6808A

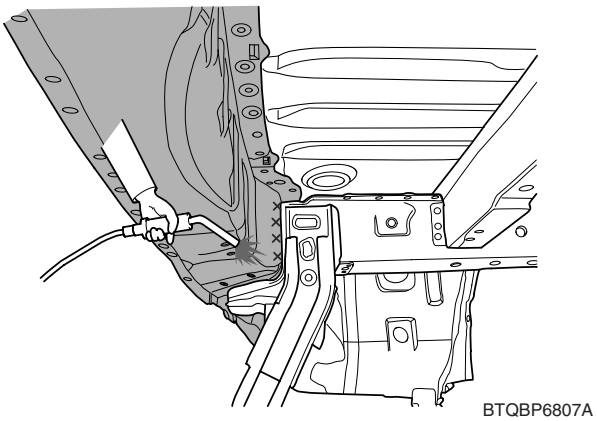


BTQBP6809A

8. MIG plug weld all holes and MIG lap weld seams.



BTQBP6806A



BTQBP6807A

9. Clean and prepare all welds, remove all residue.

10. Apply the two-part epoxy primer to the interior of the rear end cross member.

11. Apply an anti-corrosion to the interior of the rear end cross member (Refer to the CORROSION PROTECTION).

12. Prepare exterior surfaces for priming, using wax and grease remover.

13. Apply metal conditioner and water rinse.

14. Apply conversion coating and water rinse.

15. Apply the two-part epoxy primer.

16. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

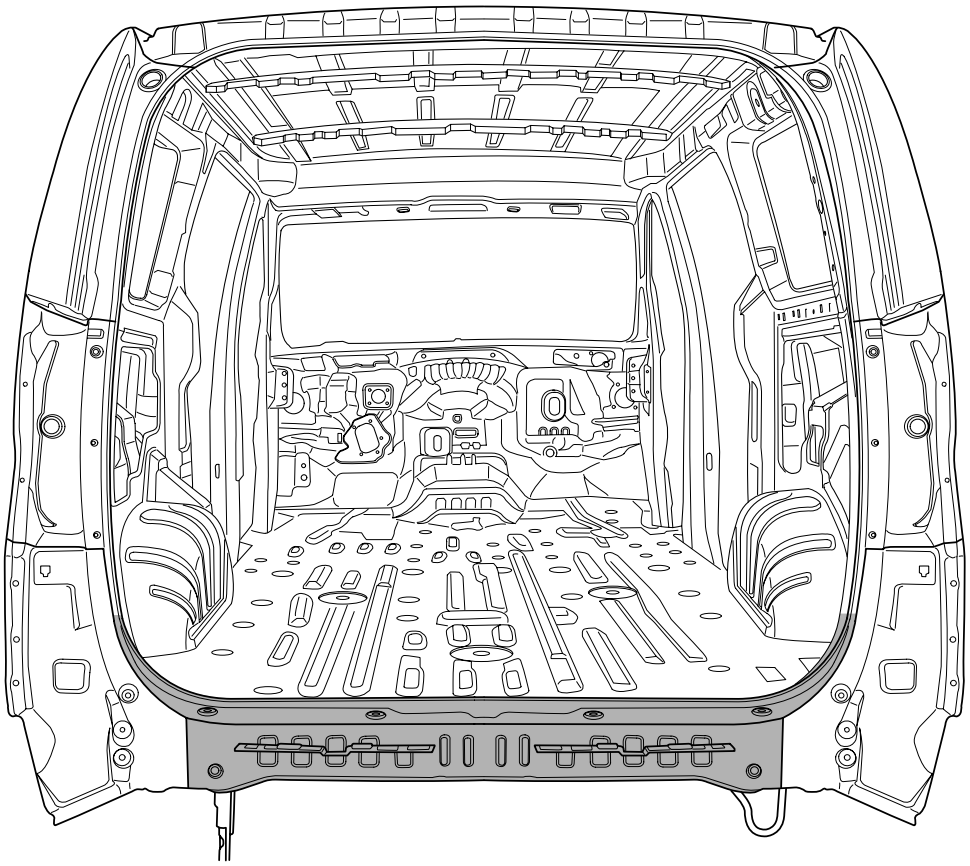
17. Reprime over the seam sealer to complete the repair.

18. After completing body repairs, carefully apply Under coating to the Under body (Refer to the CORROSION PROTECTION).

19. In order to improve corrosion resistance, if necessary, apply an Under body anti-corrosion agent to the panel which is repaired or replaced (Refer to the CORROSION PROTECTION).

REAR END CROSS OUTER LOWER MEMBER

WELDING POINTS

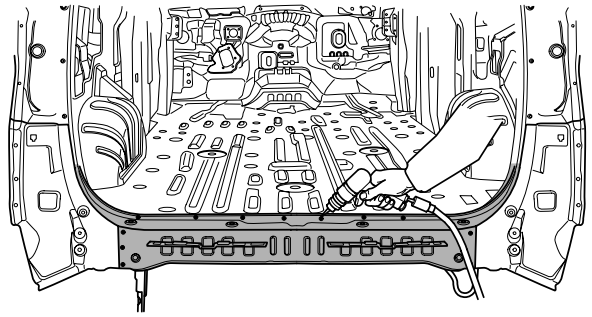


● MIG plug welding
⫫ MIG butt welding
⤫ MIG lap welding

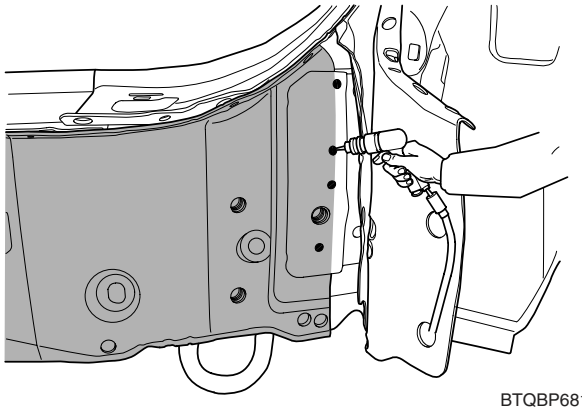
BTQBP6401

REMOVAL

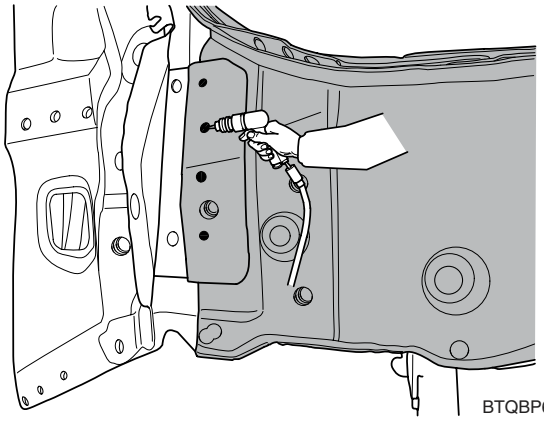
1. Drill out and grind away all the spotwelds(43) and lap weld all seams attaching the rear end cross outer lower member.



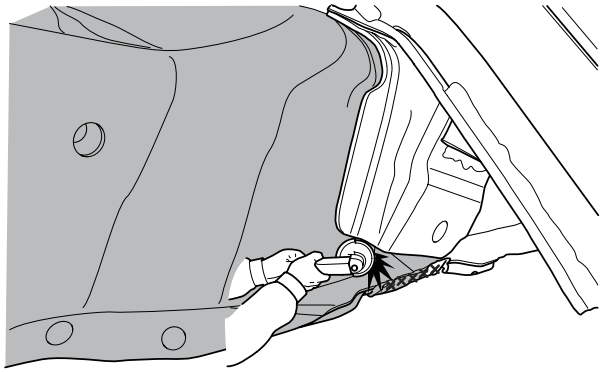
BTQBP6401B



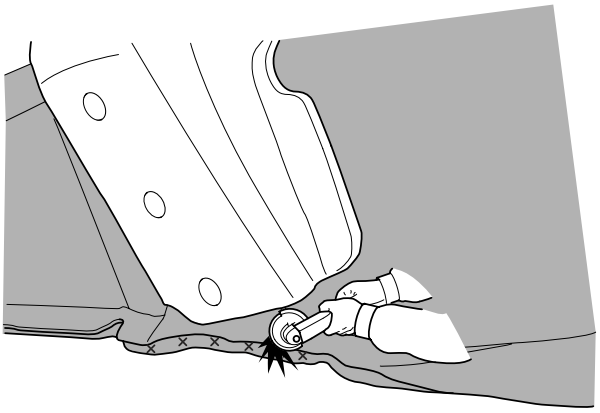
BTQBP6812



BTQBP6813

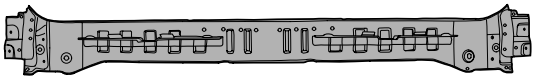


BTQBP6814



BTQBP6815

2. Remove the rear end cross outer lower member.



BTQBP6816

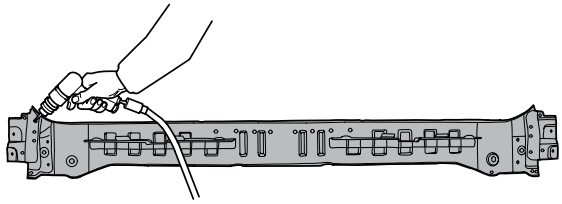
3. Straighten all flanges as necessary, Prepare all surfaces to be welded.

4. Prepare all surfaces to be welded.

5. After removing, apply the welding primer.

INSTALLATION

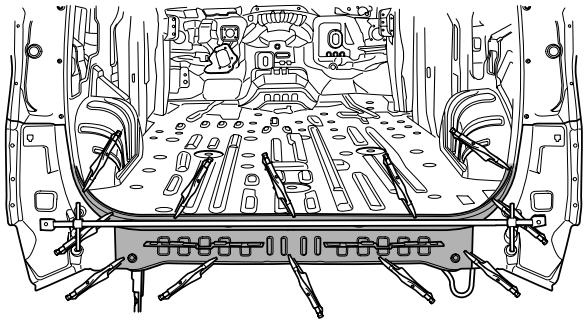
1. Drill 8 mm holes in new rear end cross outer lower member for MIG plug welding.



BTQBP6817

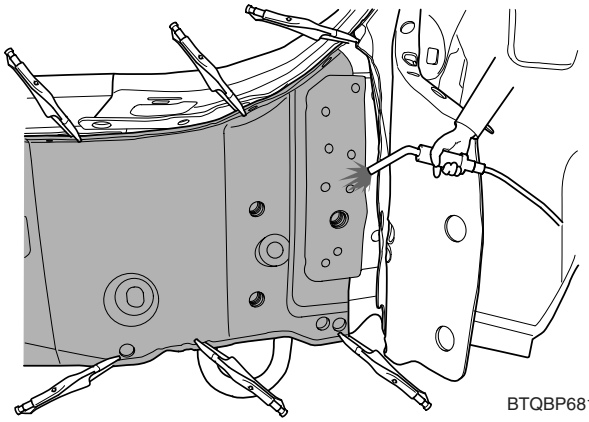
2. Fit and clamp the rear end cross outer lower member in place.

3. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.

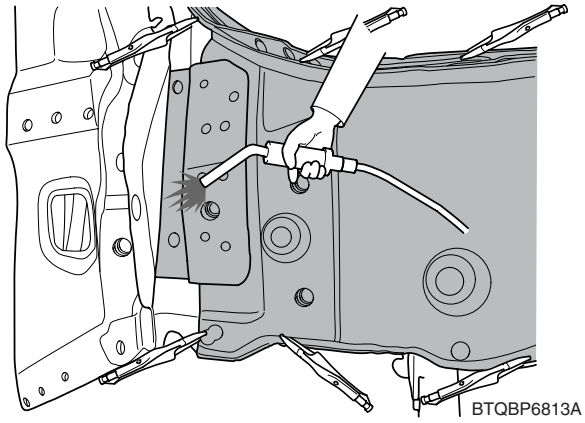


BTQBP6401C

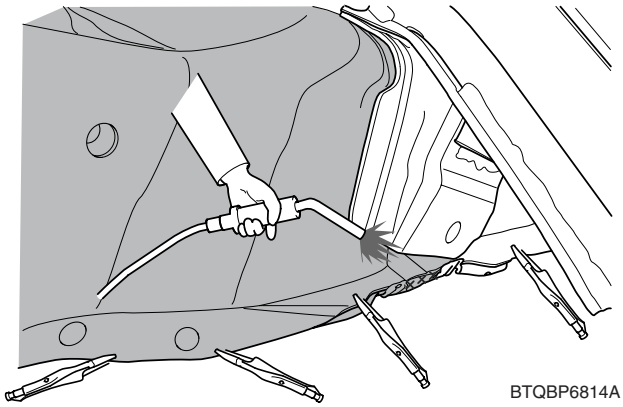
4. MIG plug weld all holes and MIG butt weld seams.



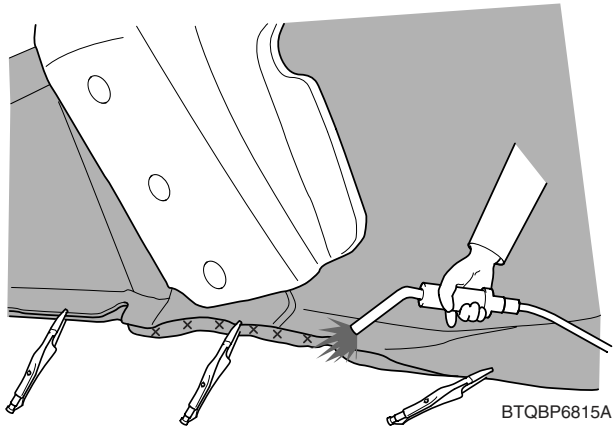
BTQBP6812A



BTQBP6813A



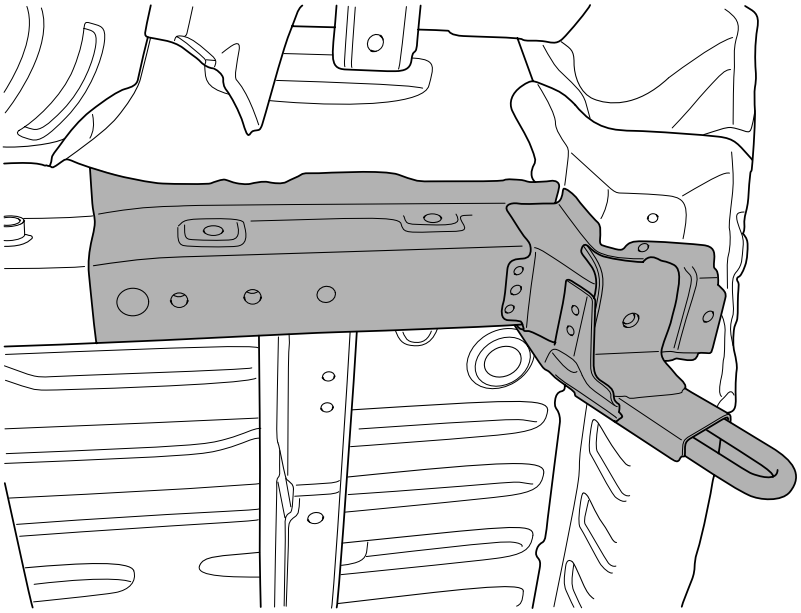
BTQBP6814A

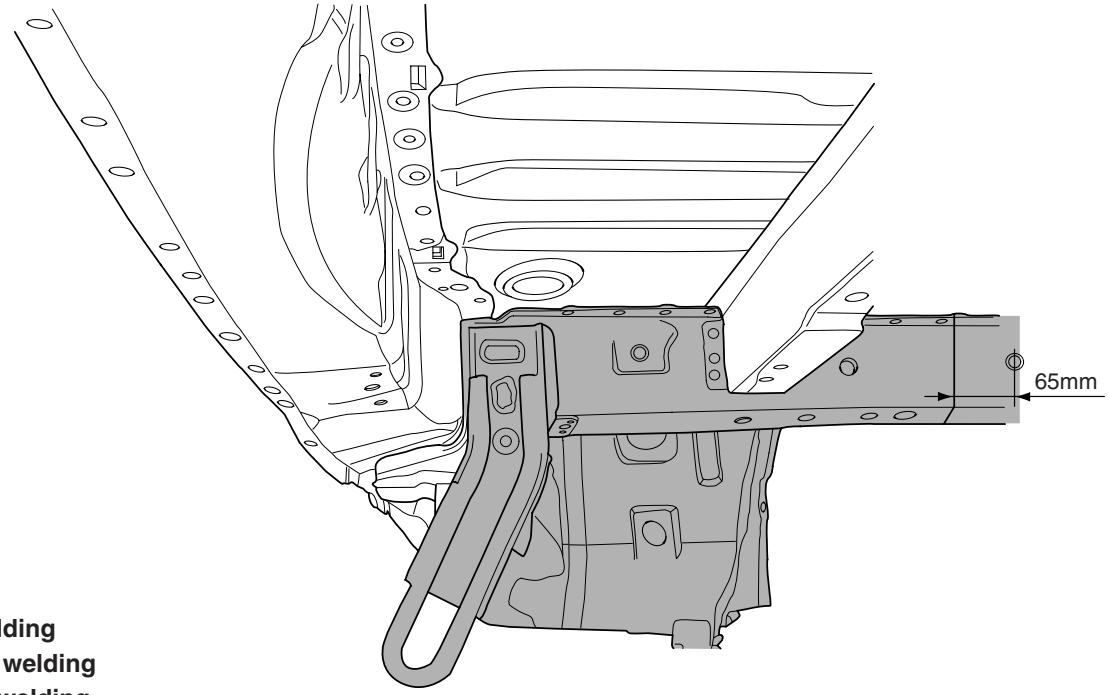

BTQBP6815A

5. Clean and prepare all welds, remove all residue.
6. Apply the two-part epoxy primer to the interior of the rear end cross member.
7. Apply an anti-corrosion to the interior of the rear end cross member (Refer to the CORROSION PROTECTION).
8. Prepare exterior surfaces for priming, using wax and grease remover.
9. Apply metal conditioner and water rinse.
10. Apply conversion coating and water rinse.
11. Apply the two-part epoxy primer.
12. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).
13. Reprime over the seam sealer to complete the repair.
14. After completing body repairs, carefully apply Under coating to the Under body (Refer to the CORROSION PROTECTION).
15. In order to improve corrosion resistance, if necessary, apply an Under body anti-corrosion agent to the panel which is repaired or replaced (Refer to the CORROSION PROTECTION).

REAR SIDE MEMBER

WELDING POINTS





- Laser welding
- MIG plug welding
- MIG butt welding
- MIG lap welding

BTQBP6902

REMOVAL

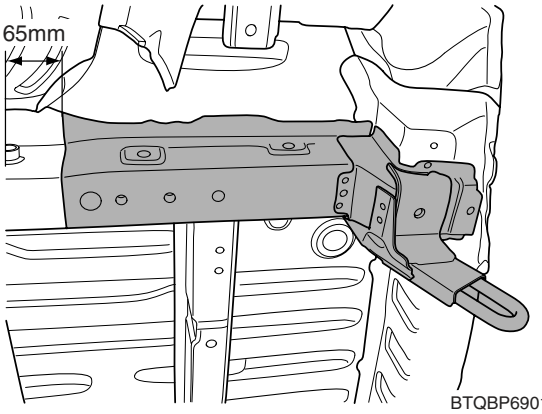
NOTE

Because the rear side members are designed to absorb energy during a rear collision, care must be used when deciding to use this repair method. This repair is recommended only for moderate damage to the vehicle, where distortions do not extend forward of the luggage region. If the damage is more severe, then the entire side member assembly should be replaced at the factory seams without employing this sectioning procedure.

The following procedure applys when only one rear side member needs to be replaced. If both side members are damaged and need to be replaced, then the procedure of rear side members and rear floor section should be followed.

Refer to the body dimension charts and measure the vehicle to determine straightening and alignment requirements.
The body must be returned to its original dimensions before beginning the repair procedure.

1. Measure and mark cutline on the rear side member as indicated in the illustration.

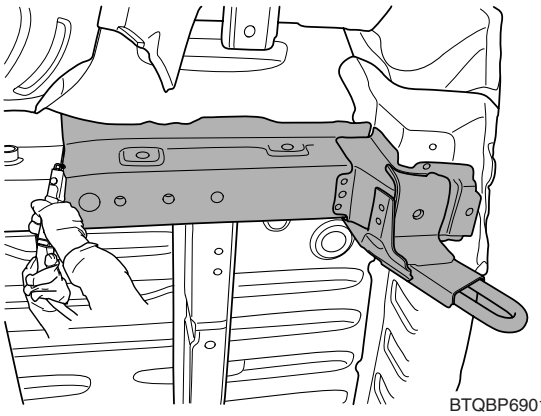


BTQBP6901A

2. Cut the rear side member along the cutline.

NOTE

When cutting the rear side member, be careful not to cut rear side member reinforcement.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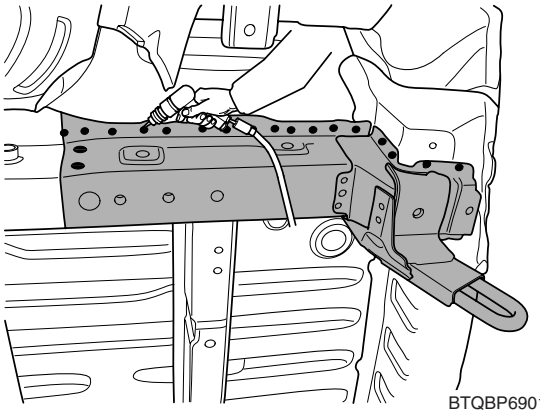
3. Drill out all the spotwelds(29) and lap weld attaching the rear side member.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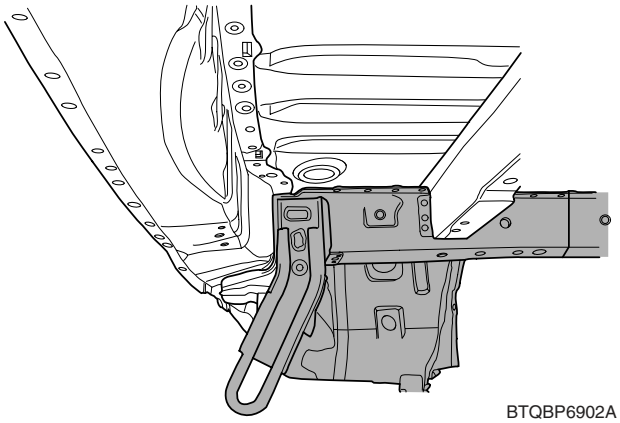
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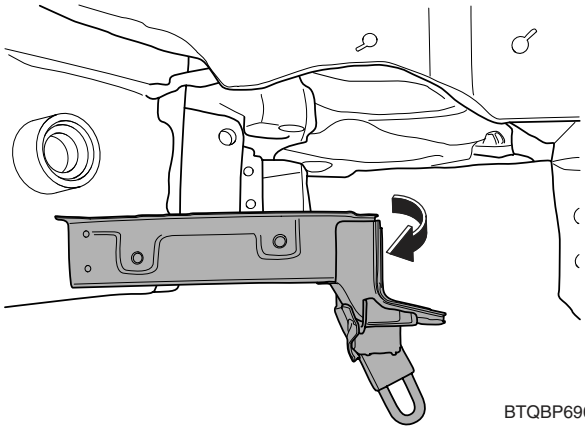
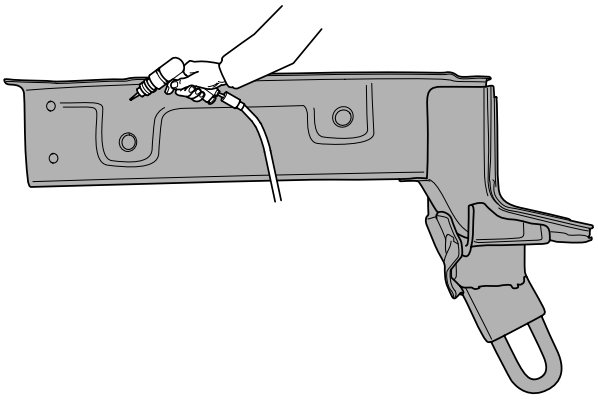
4. Remove the rear side member.


BTQBP6904

5. Clean cut portions with a disc grinder.
6. Prepare all surfaces to be welded.
7. After removing, apply the welding primer.

INSTALLATION

1. Transcribe the cutline to the new rear side member, adding 30 mm overlap to the rear end.
2. Drill 8 mm holes in new rear side member for MIG plug welding.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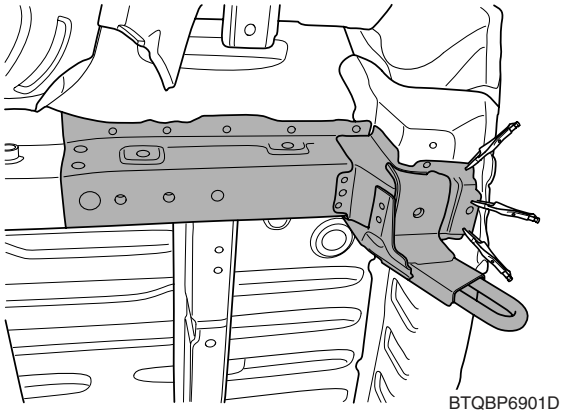
3. Fit and clamp the rear side member in place.
4. Measure each measurement point (Refer to the BODY DIMENSIONS) and correct the installation position.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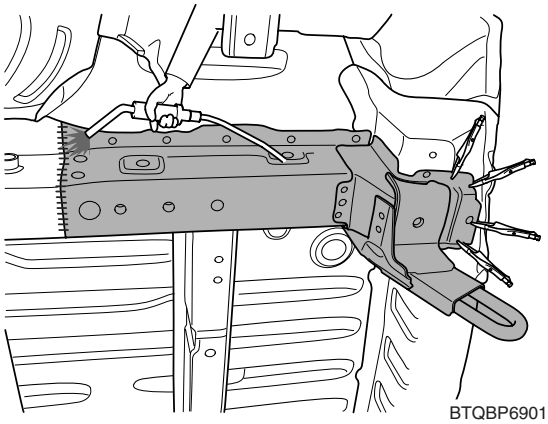
5. MIG plug weld all holes and MIG butt weld seams.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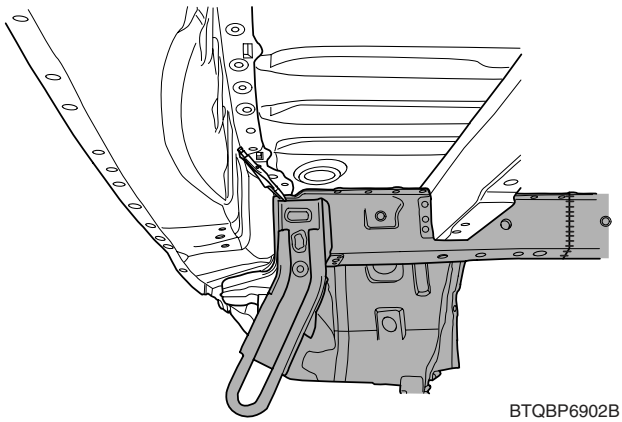
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6. Clean and prepare all welds, remove all residue.

7. Apply the two-part epoxy primer to the interior of the rear side member.

8. Apply an anti-corrosion to the interior of the rear side member (Refer to the CORROSION PROTECTION).

9. Prepare exterior surfaces for priming, using wax and grease remover.

10. Apply metal conditioner and water rinse.

11. Apply conversion coating and water rinse.

12. Apply the two-part epoxy primer.

13. Apply the correct seam sealer to all joints (Refer to the BODY SEALING LOCATIONS).

14. Reprime over the seam sealer to complete the repair.

15. After completing body repairs, carefully apply Under coating to the Under body (Refer to the CORROSION PROTECTION).

16. In order to improve corrosion resistance, if necessary, apply an Under body anti-corrosion agent to the panel which is repaired or replaced (Refer to the CORROSION PROTECTION).

Body Sealing Locations

FRONT BODY & INTERIOR ..... BS - 2

EXTERIOR ..... BS - 5

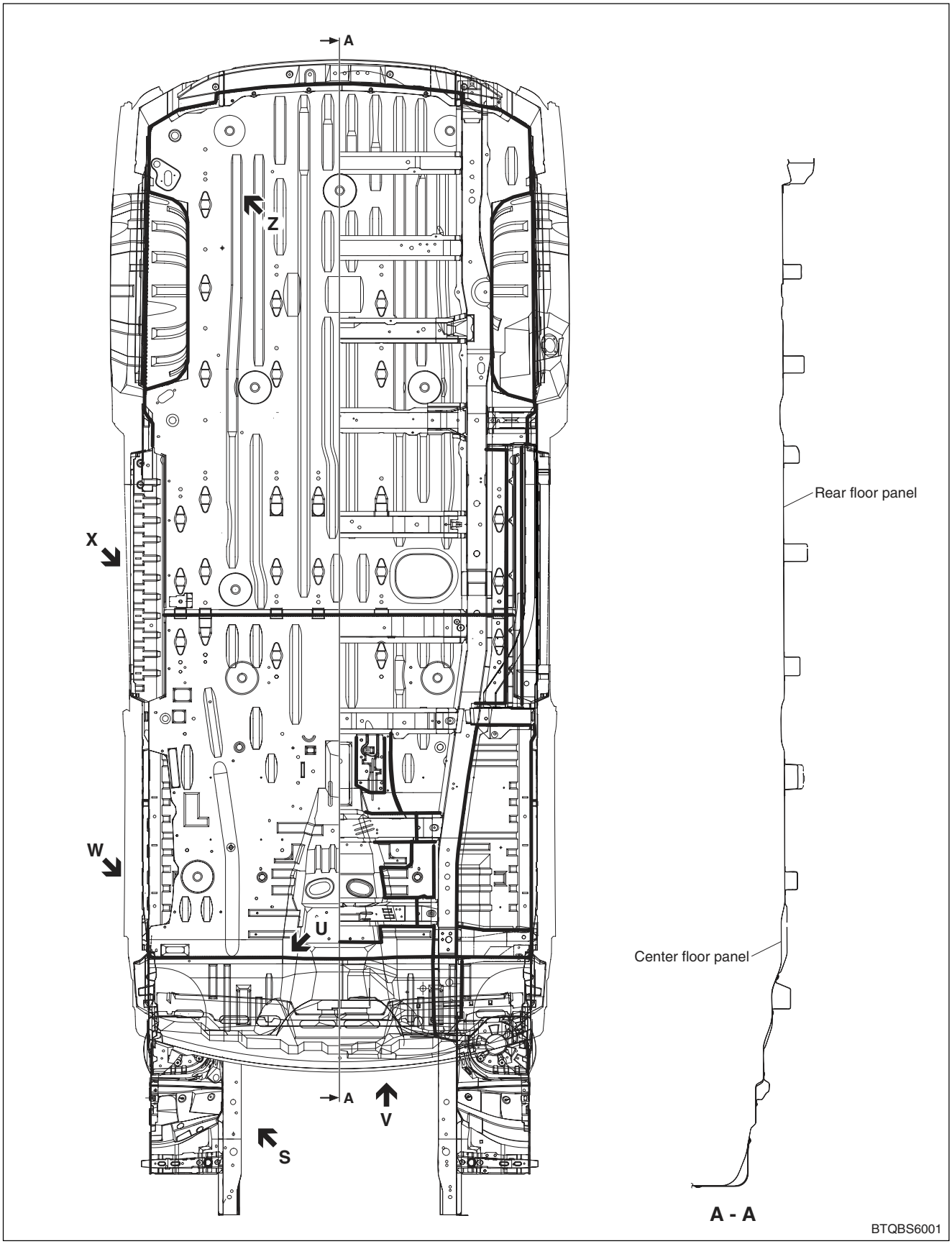
ROOF PANEL ..... BS - 8

HOOD ..... BS - 10

FRONT & REAR DOOR ..... BS - 12

TAIL GATE ..... BS - 14

FRONT BODY & INTERIOR



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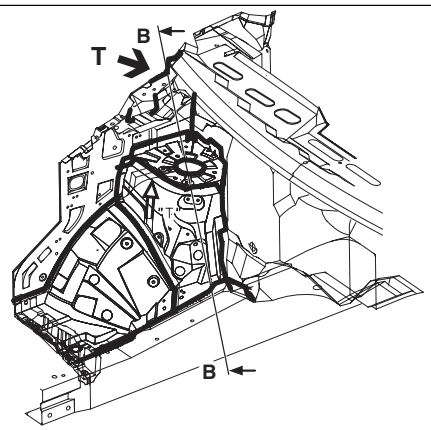

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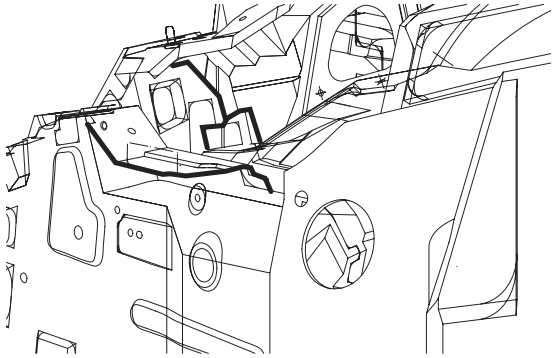

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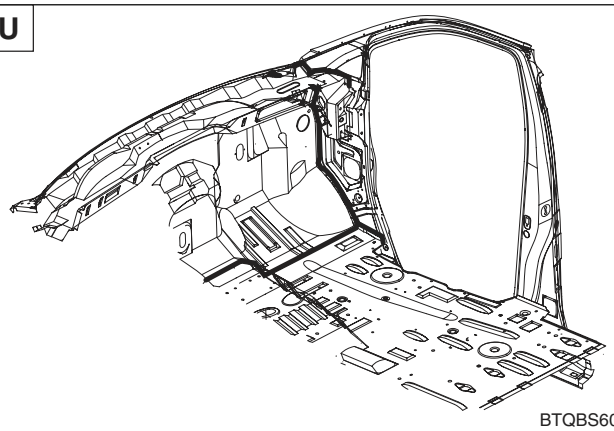

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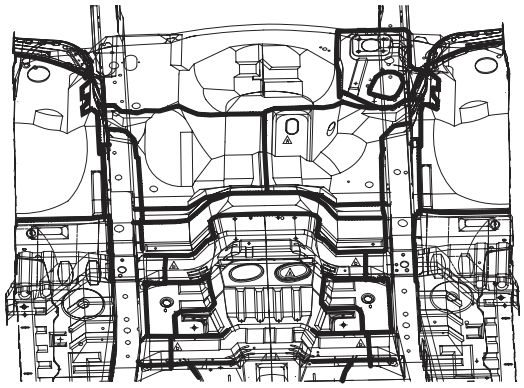

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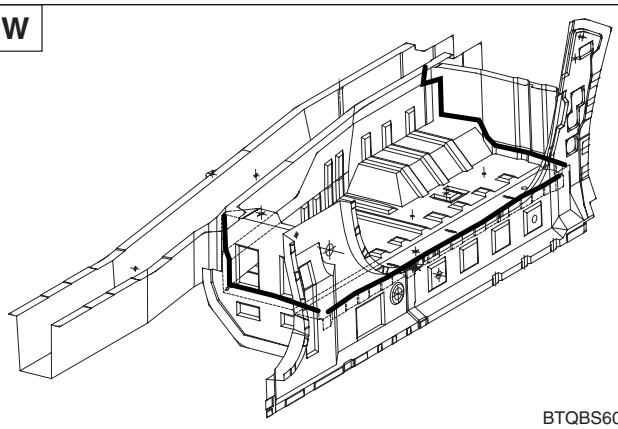

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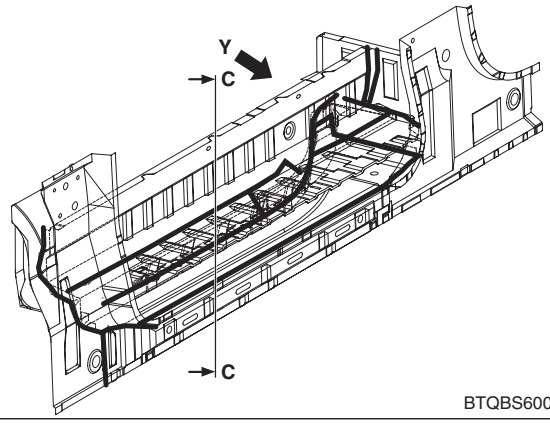

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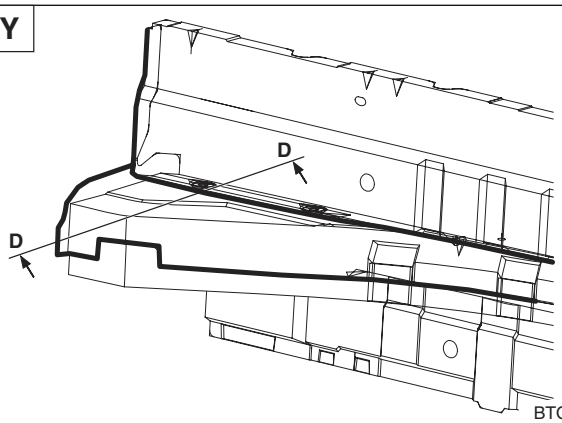

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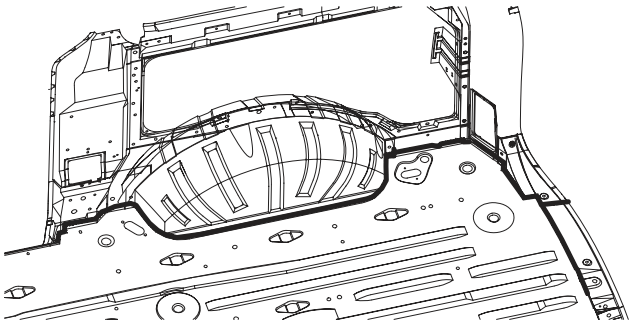

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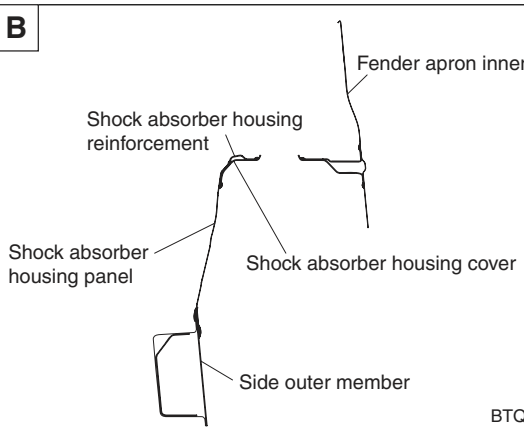

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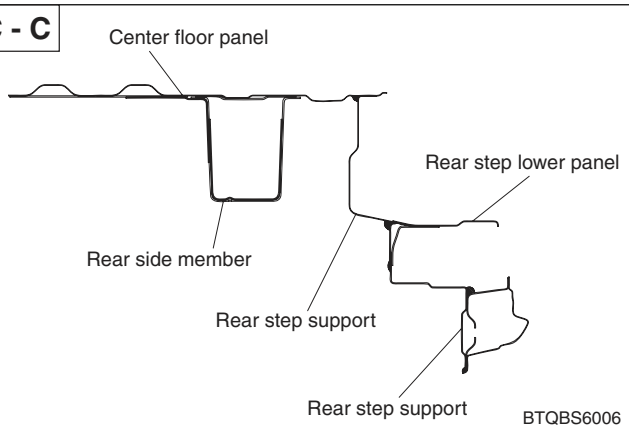

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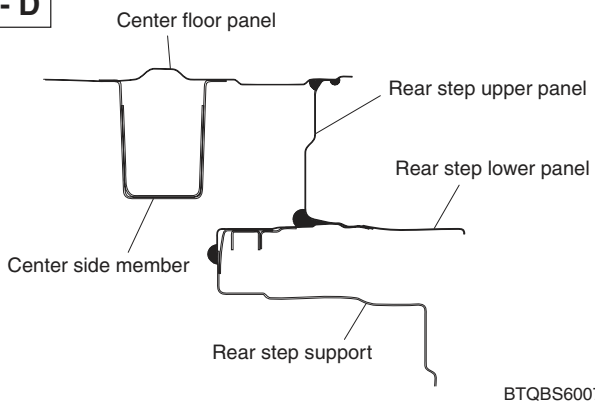

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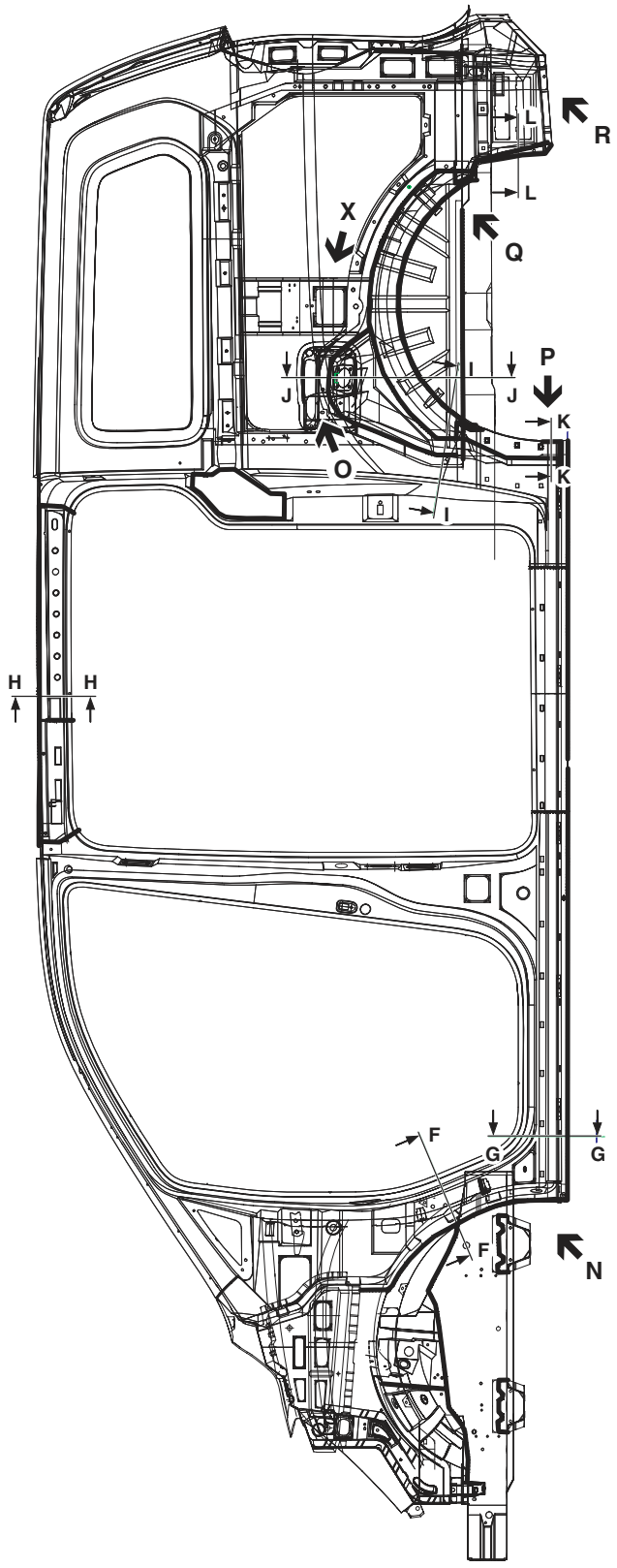

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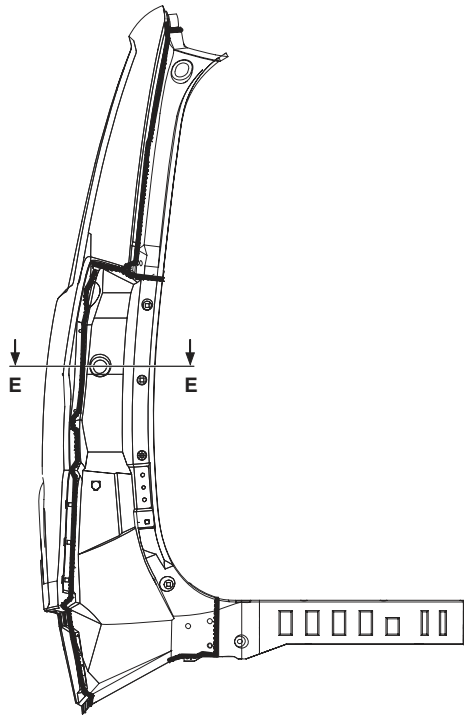

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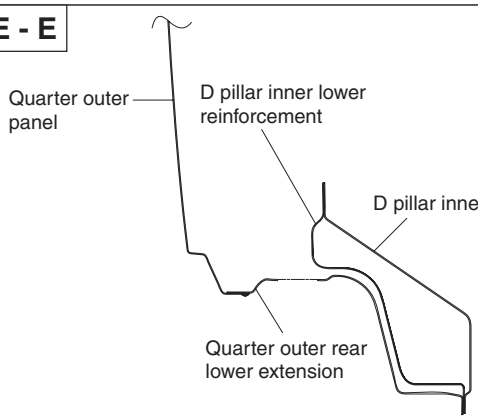

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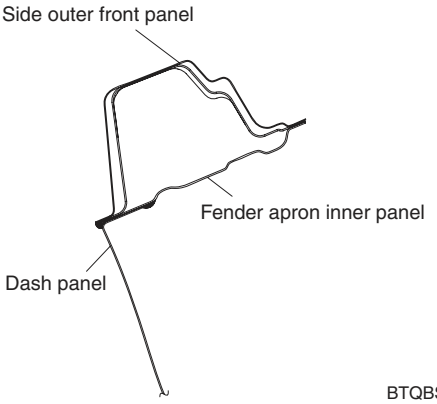

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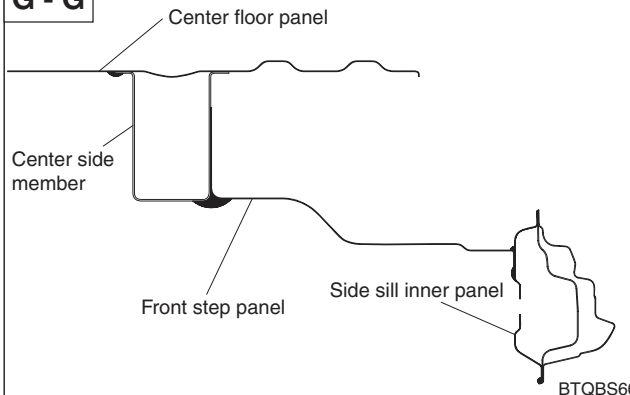

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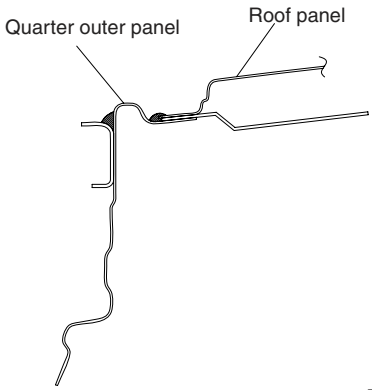

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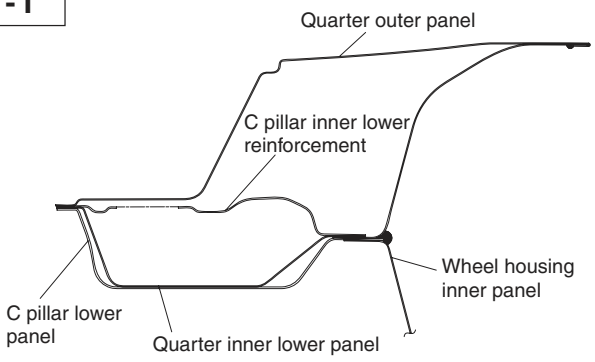

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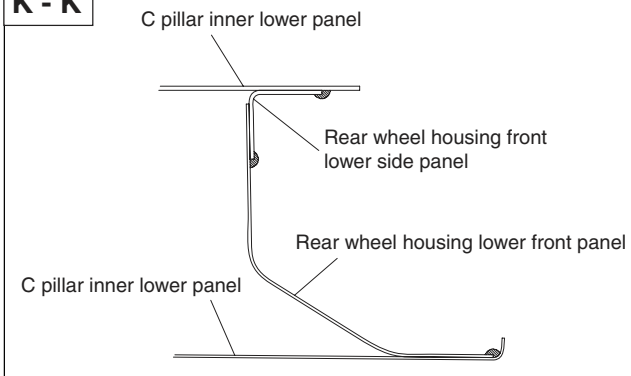

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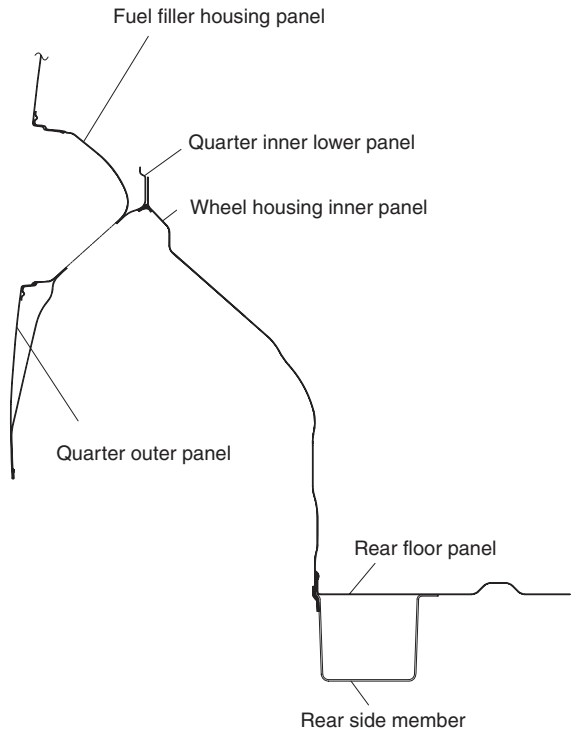

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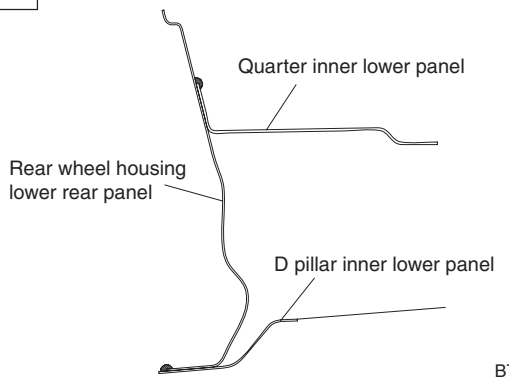

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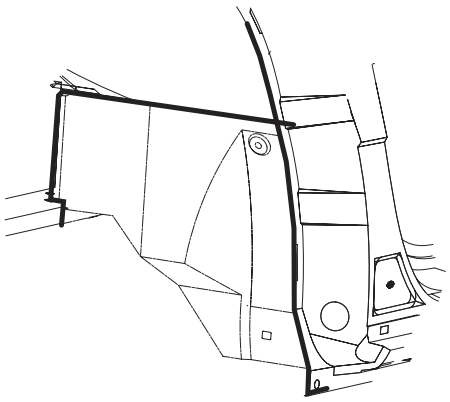

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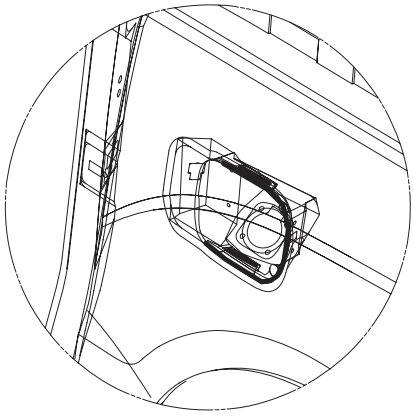

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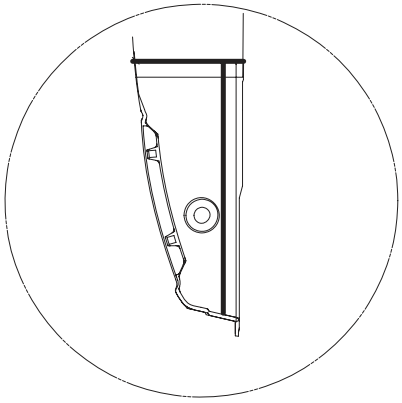

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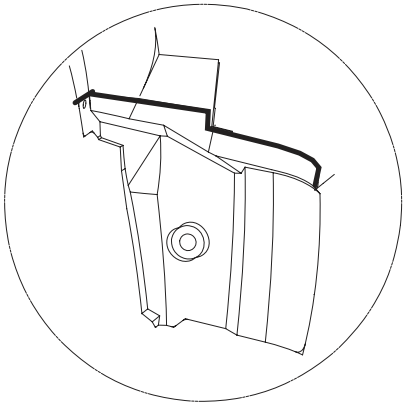

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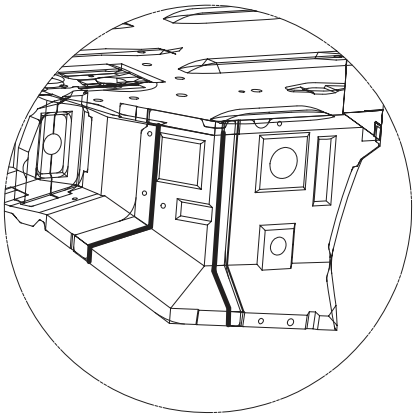

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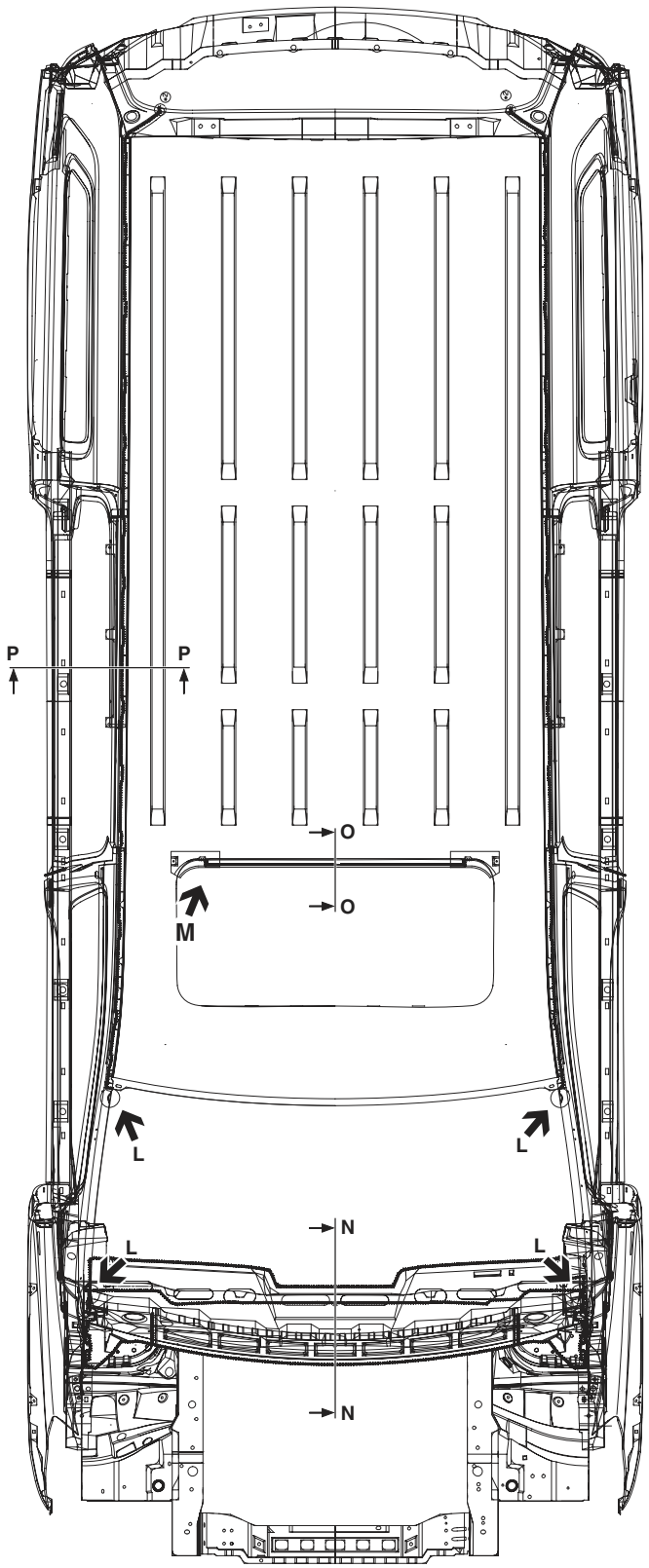
ROOF PANEL



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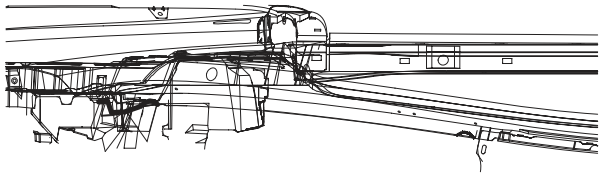

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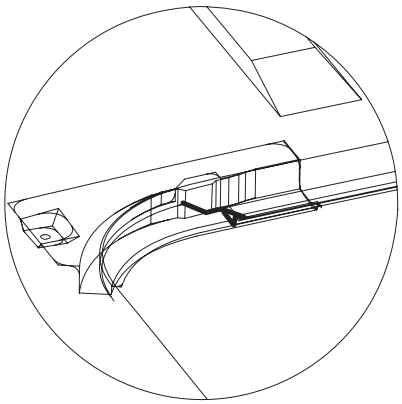

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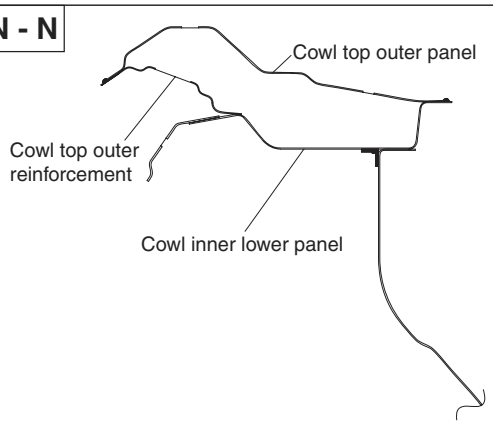

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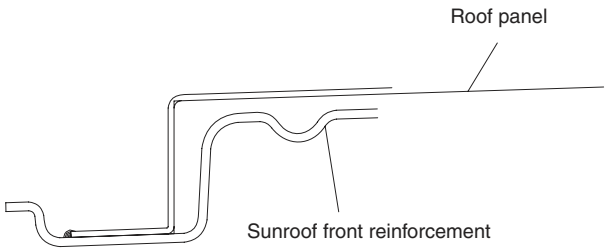

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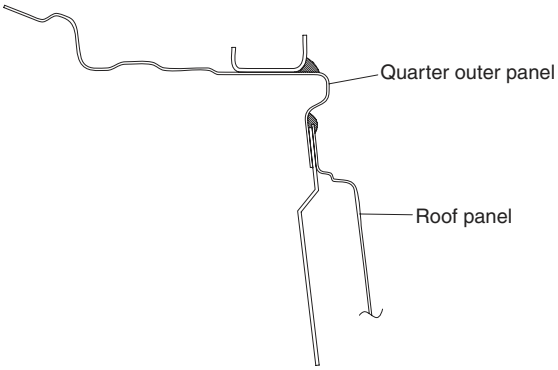

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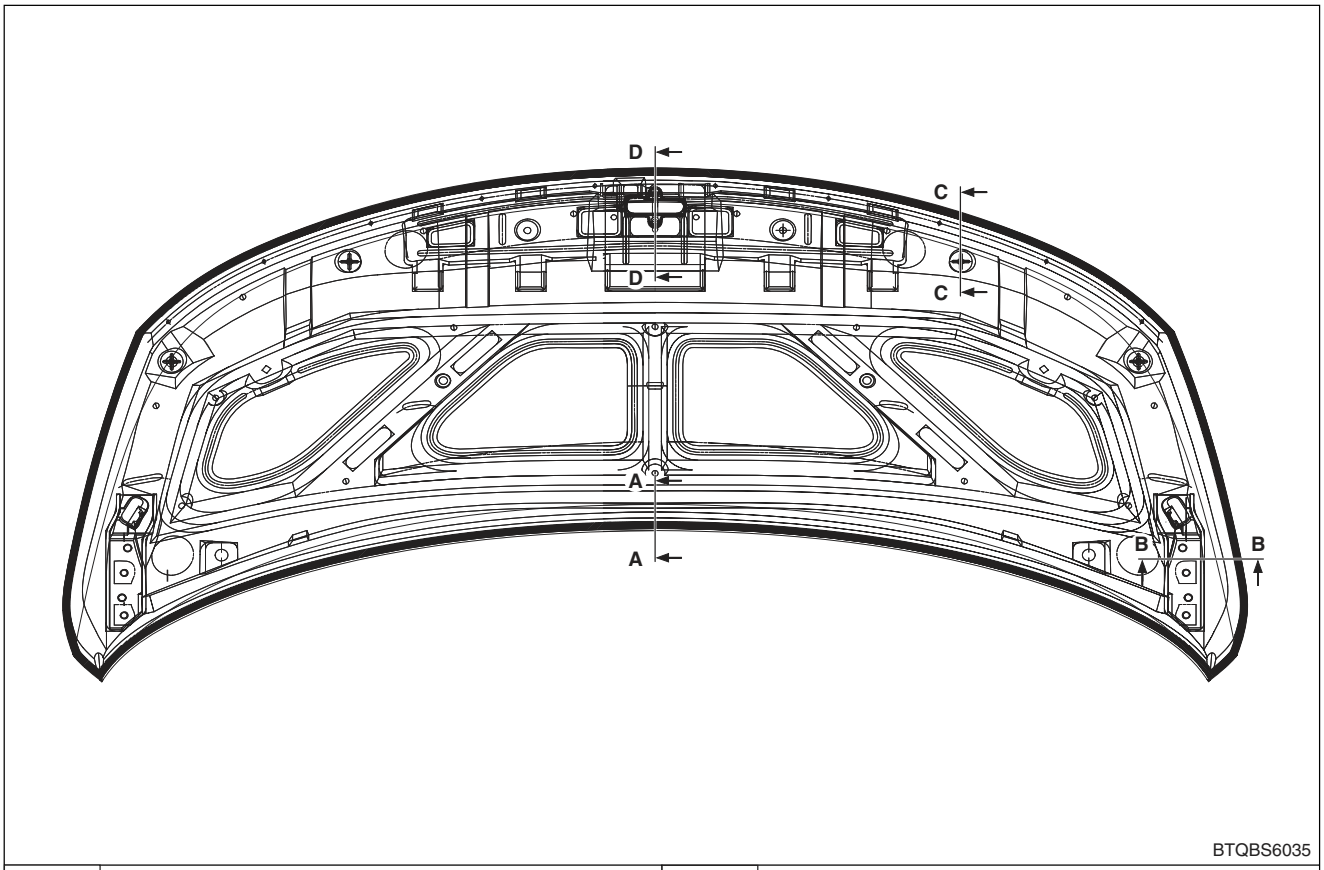

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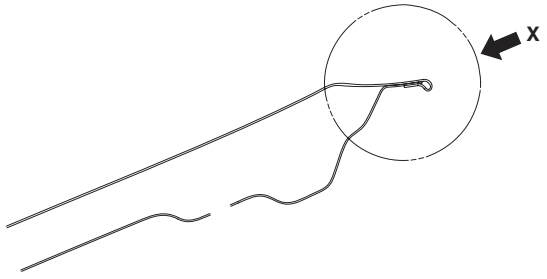

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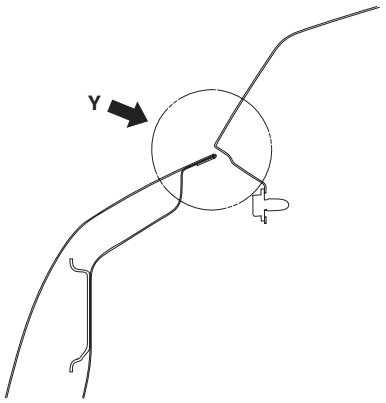

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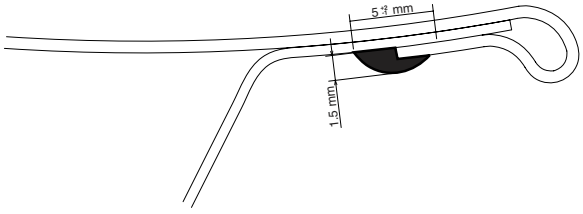

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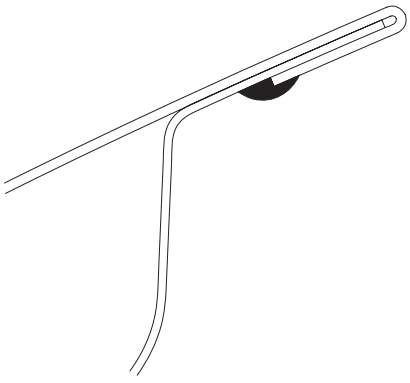

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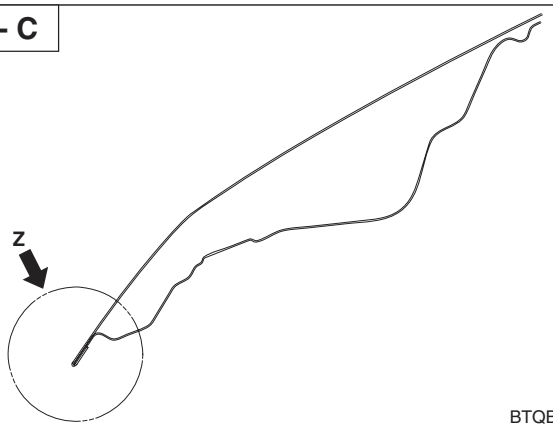

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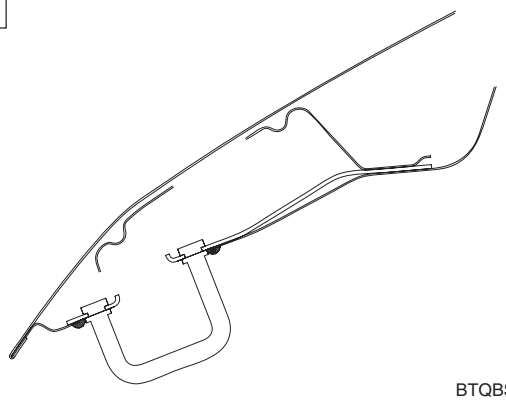

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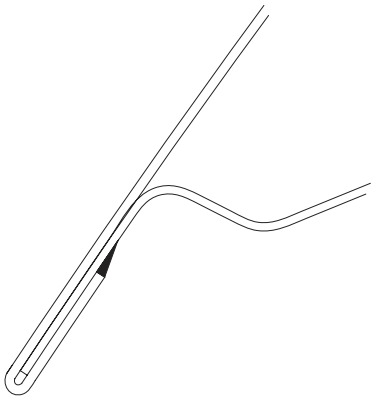
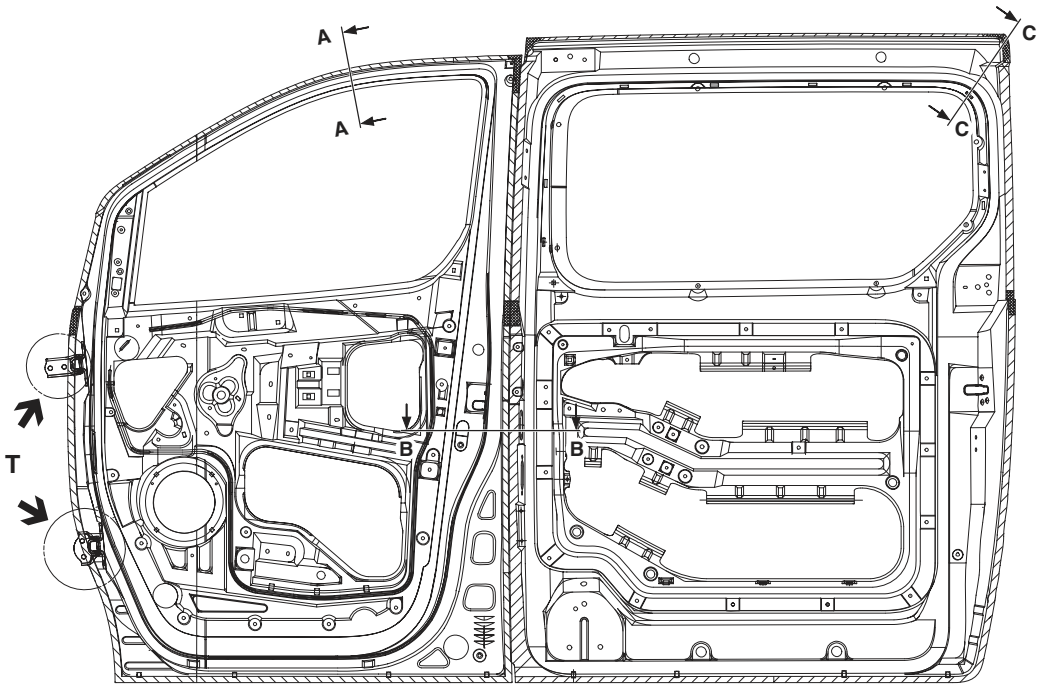


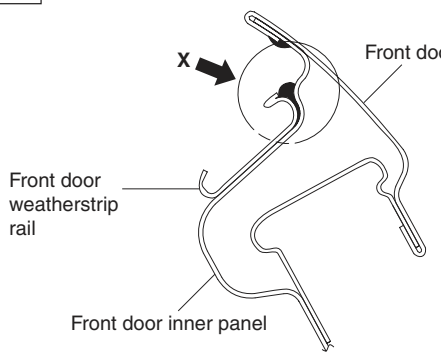
BTQBS6042

FRONT & REAR DOOR



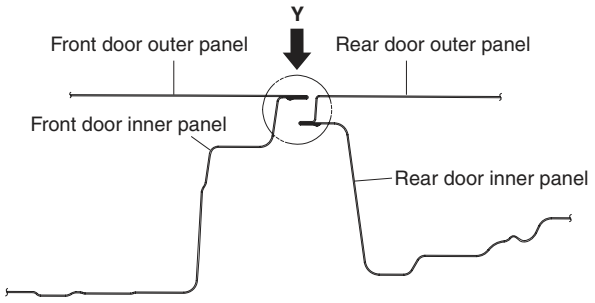
BTQBS6042

A - A



BTQBS6043

B - B



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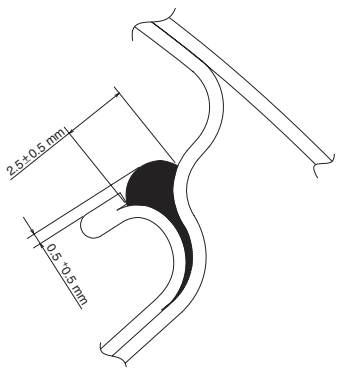

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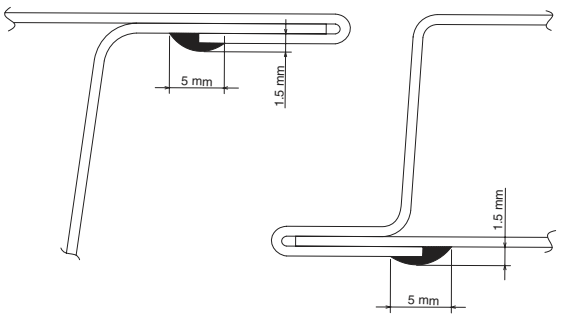
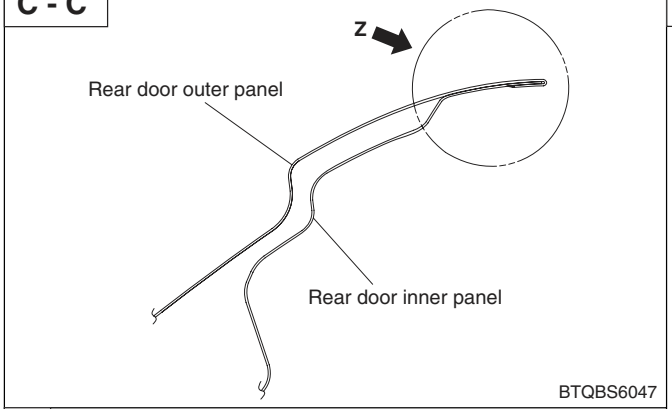


BEDBS6046

C - C



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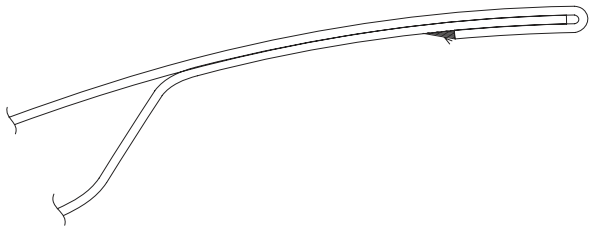

BTQBS6049

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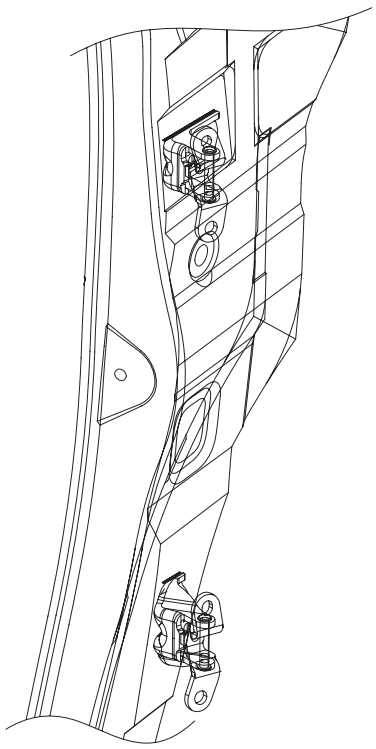
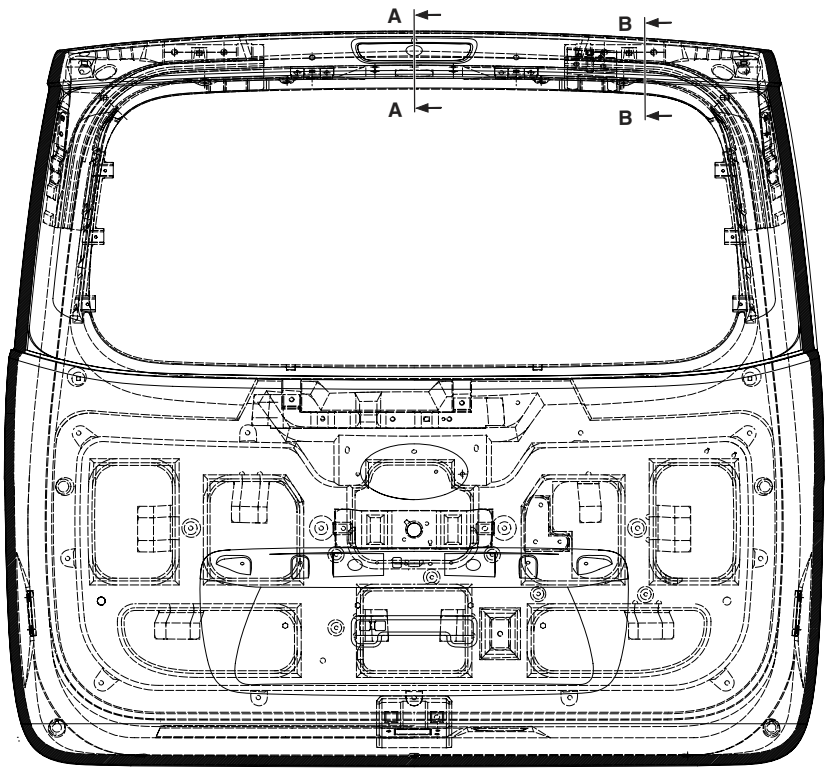


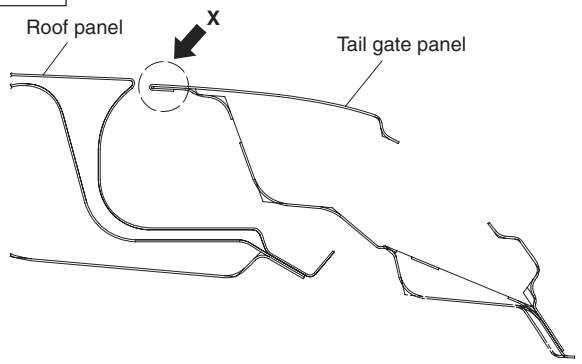
BTQBS6048

TAIL GATE



BTQBS6050

A - A



BTQBS6051

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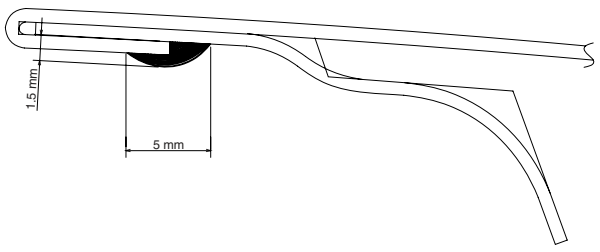
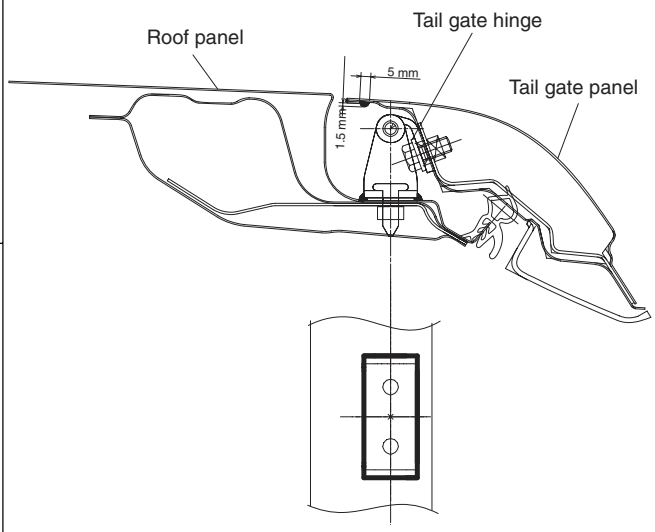


BTQBS6052

B - B



BEDBS6053

Corrosion protection

ZINC-PHOSPHATE COAT & CATIONIC ELECTRODEPOSITION PRIMER ..... CP - 2

ATTACHMENT OF ANTIVIBRATION PADS ..... CP - 3

ANTIVIBRATION PADS-LOCATION & SECTION ..... CP - 4

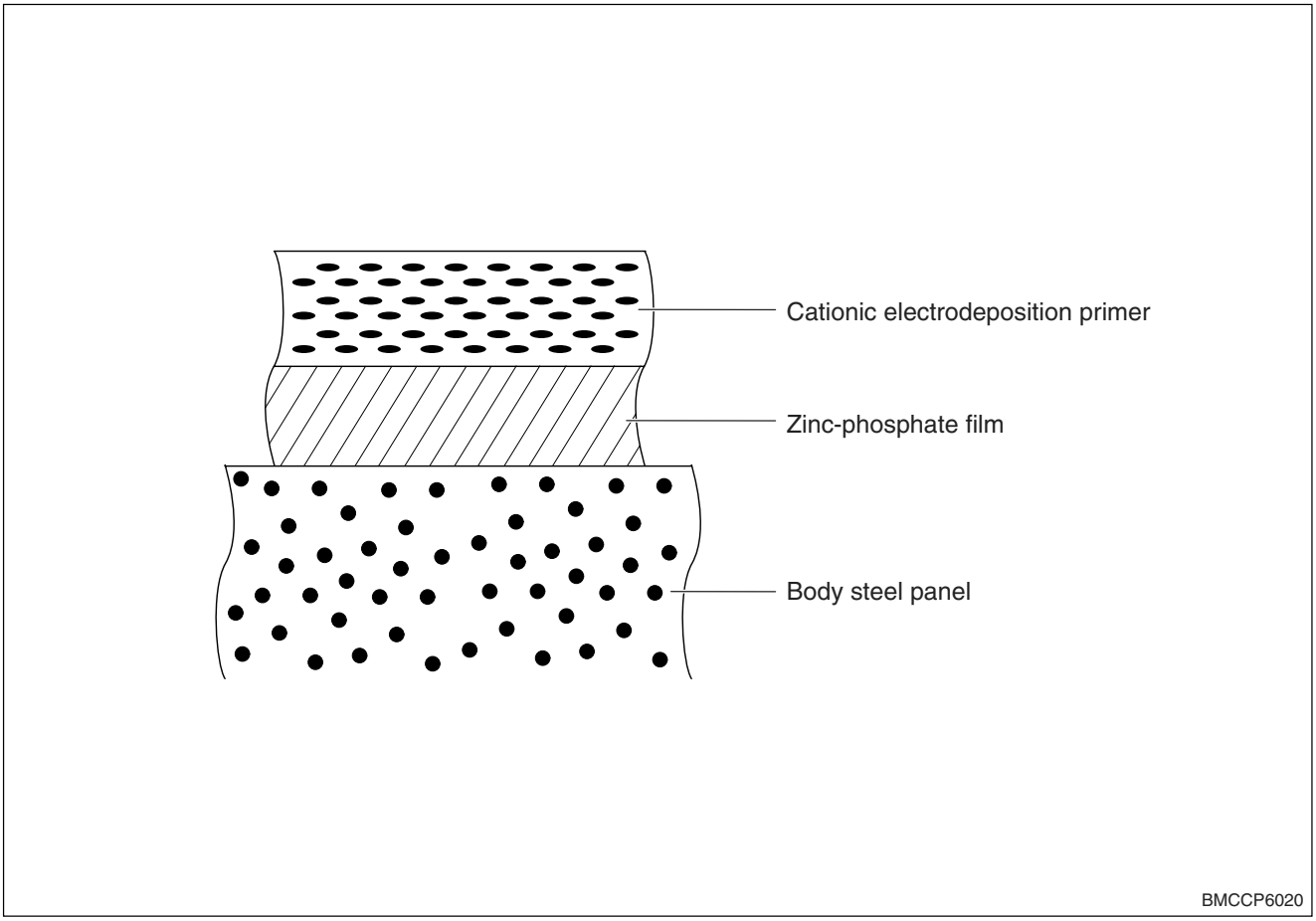
UNDER BODY ..... CP - 7

CAVITY WAX INJECTION ..... CP - 10
- HOOD ..... CP - 10
- SIDE BODY ..... CP - 11
- FRONT & REAR DOOR ..... CP - 12
- TAIL GATE ..... CP - 13
- TWIN SWING DOOR ..... CP - 14
- UNDER FLOOR ..... CP - 15

UNDER BODY ANTI-CORROSION AGENT ..... CP - 17

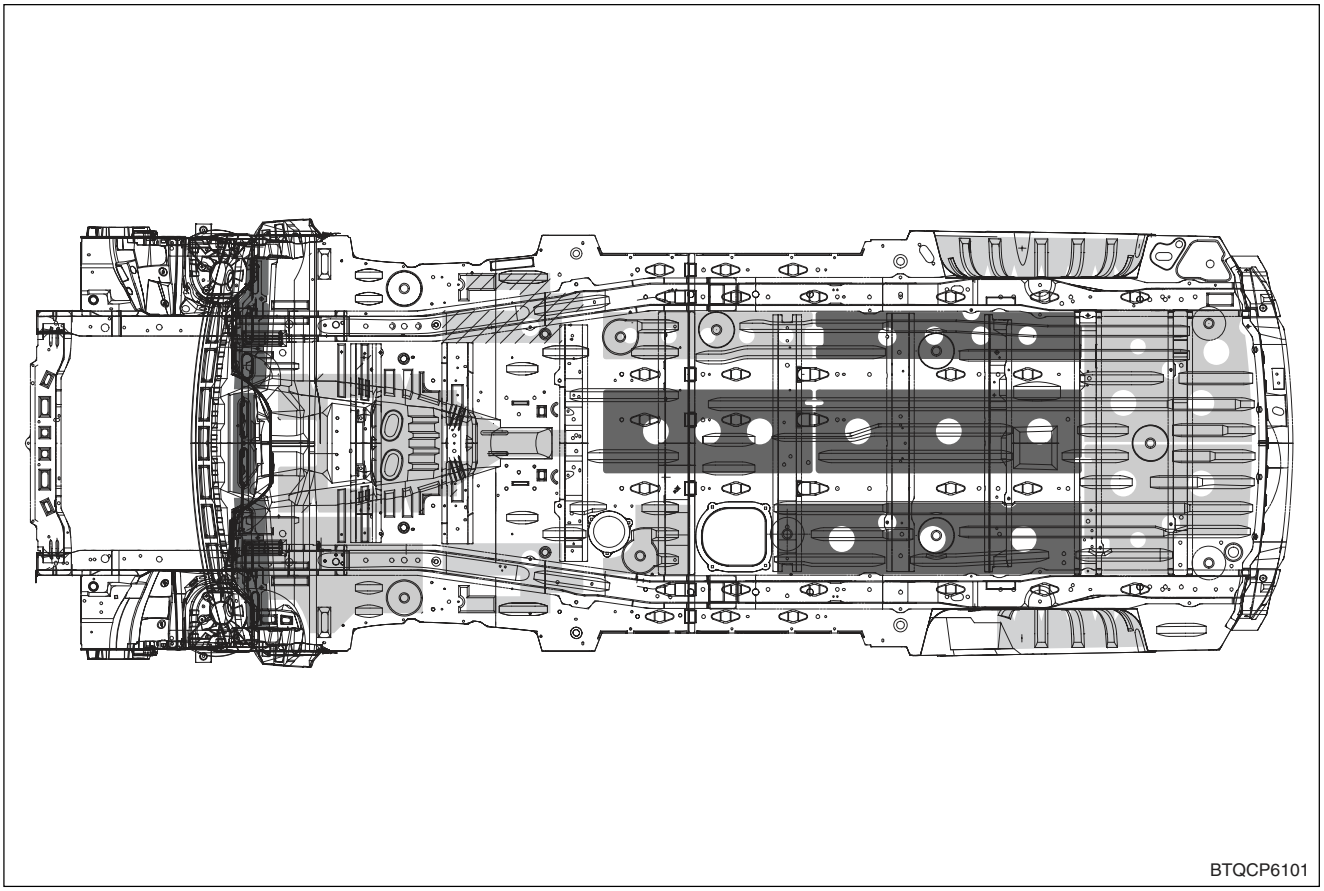
ZINC-PHOSPHATE COAT & CATIONIC ELECTRODEPOSITION PRIMER

In order to improve the adhesion of the paint coat on the steel panel, and also to improve the corrosion resistance, the entire body is coated with a film of Zinc-phosphate and a cationic electrodeposition primer.



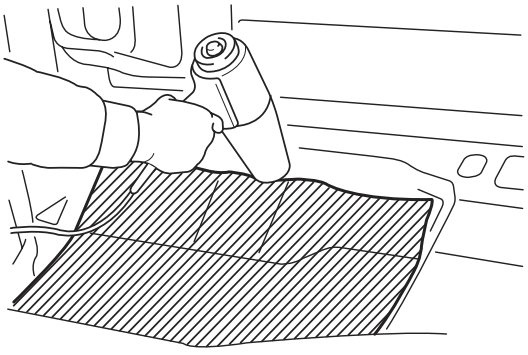
ATTACHMENT OF ANTIVIBRATION PADS

Antivibration pads are attached to the upper surface of the floor and at the interior side of the dash panel in order to absorb vibrations and shut out exhaust gas heat. If these antivibration pads are peeled off in the course of replacement or repair of a welded panel, cut and attach replacement material (in the shape shown in the figure).



BTQCP6101

1. Heat the "antivibration pad" with a blow drier to soften it.



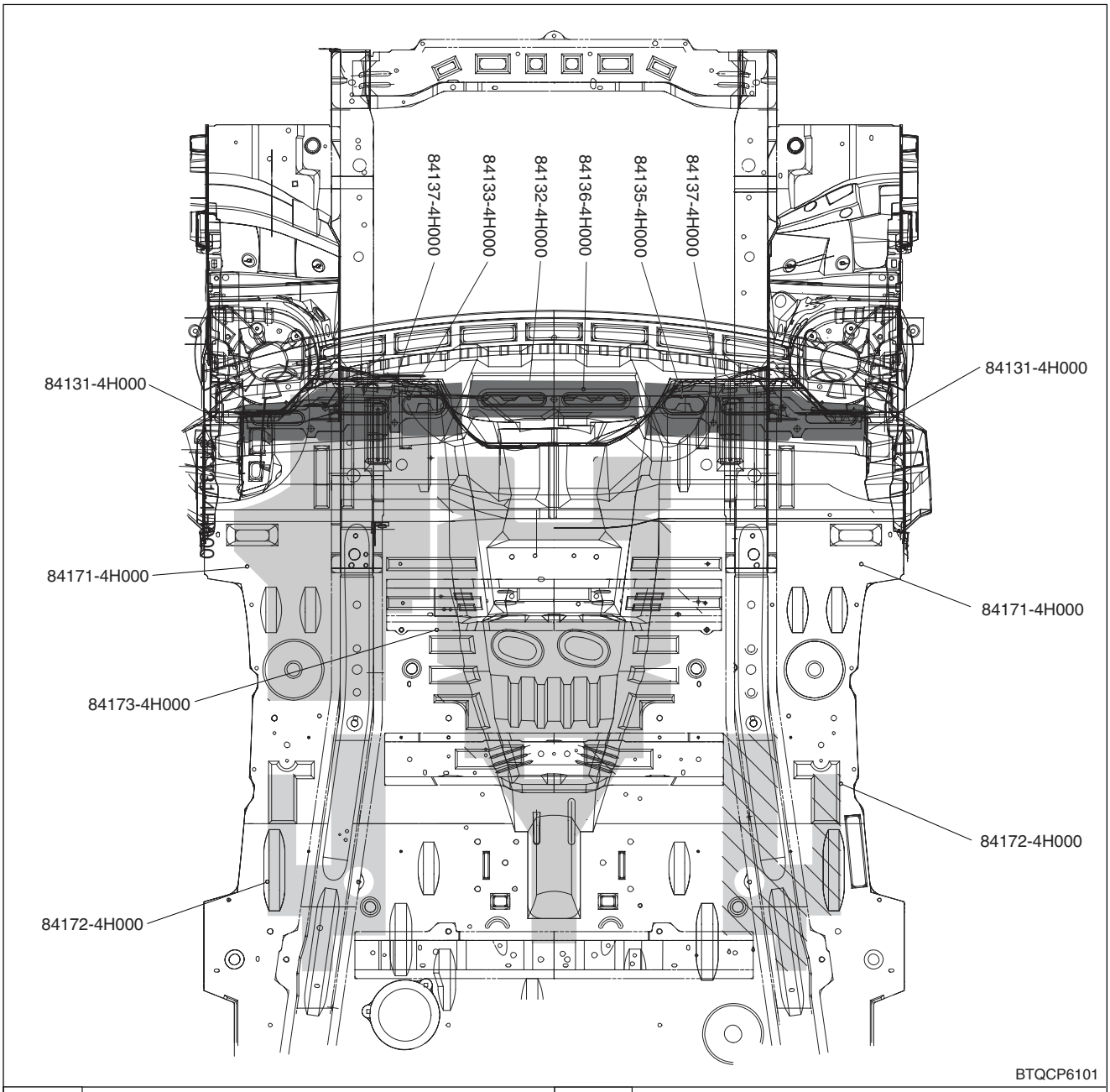
BMCCP6041

2. Align the antivibration pad layer in the position where it is to be installed, and then press it down with a roller or a block of wood so that it adheres well.

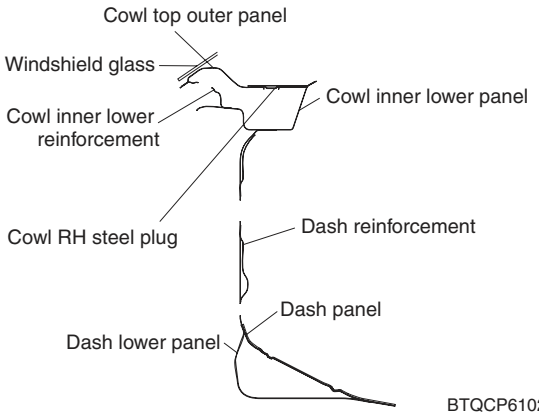
NOTE

An infrared lamp can also be used to heat both the antivibration pad layer and the body panels(be sure to wear gloves).

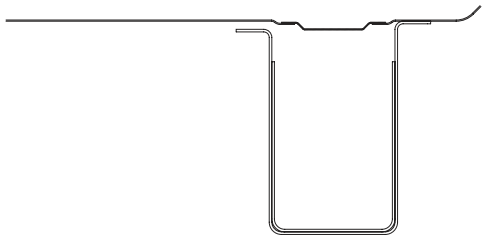
ANTIVIBRATION PADS-LOCATION & SECTION

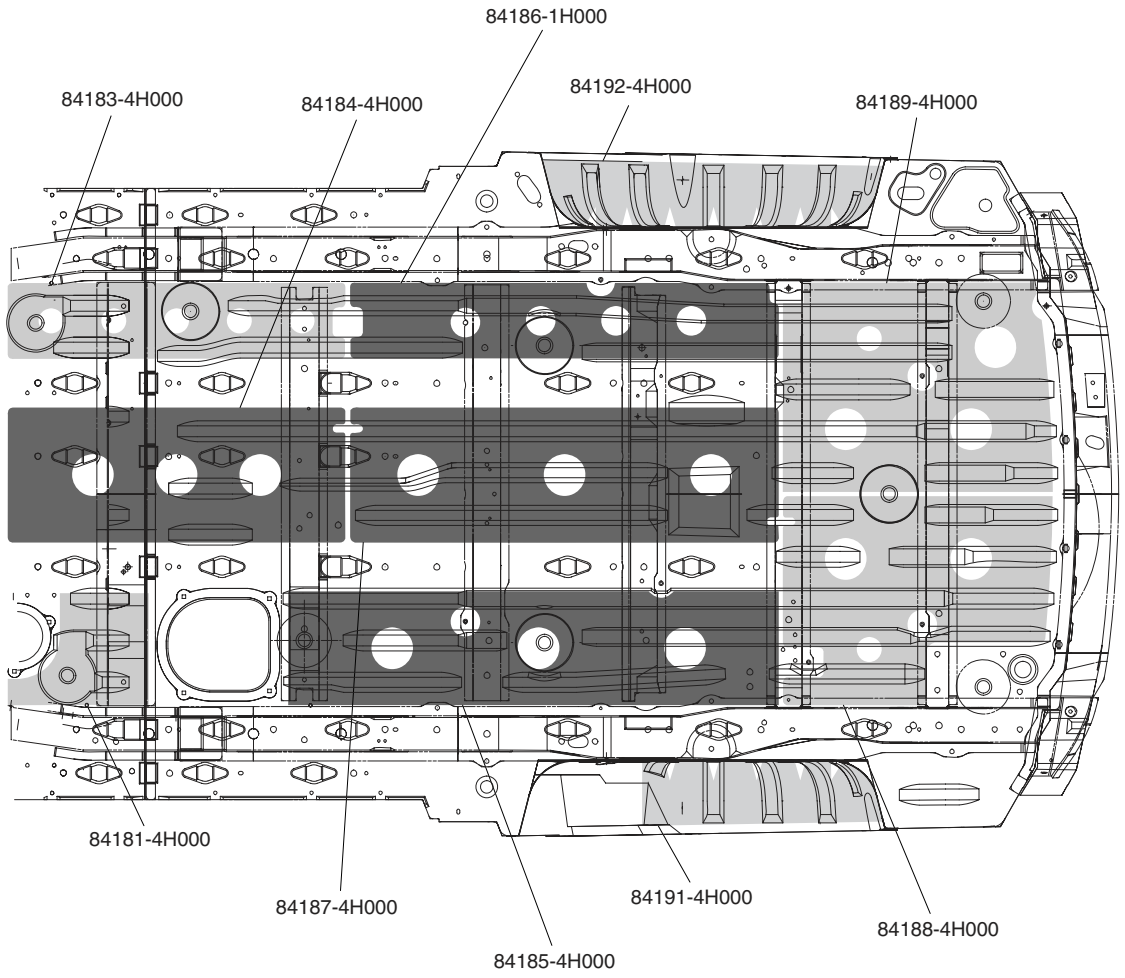


A - A



B - B




84186-1H000
84183-4H000
84184-4H000
84192-4H000
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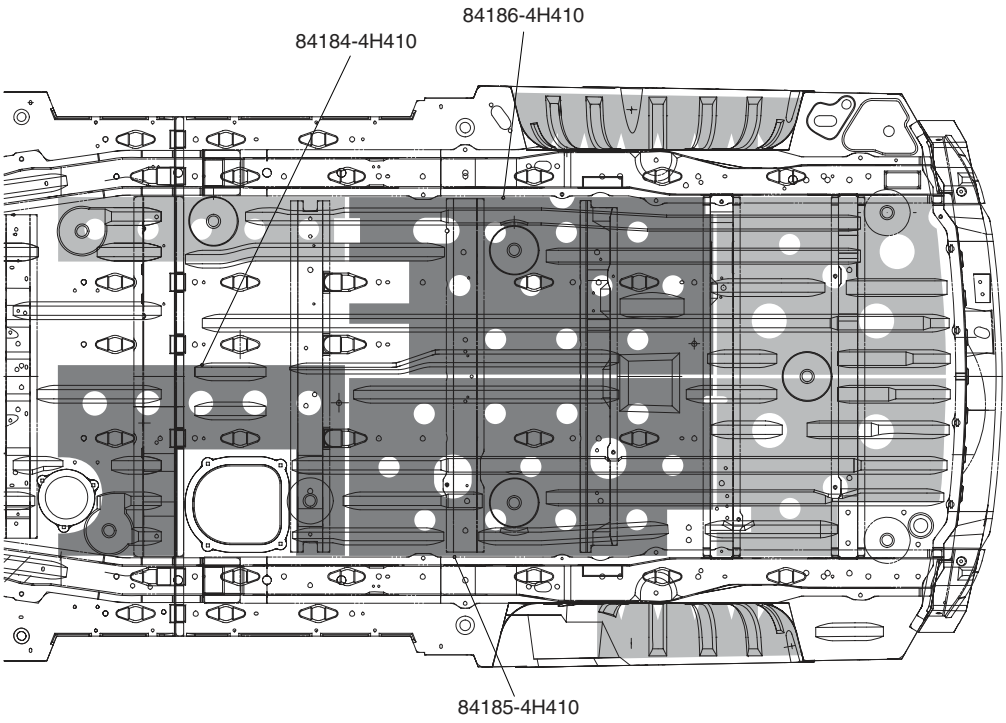
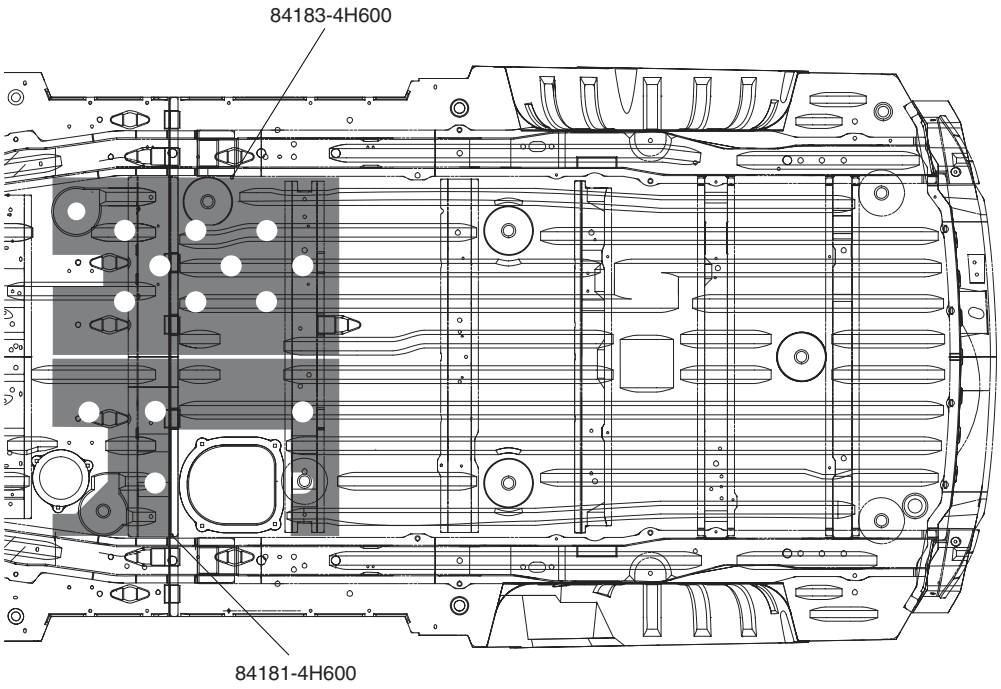
84191-4H000
84188-4H000
84185-4H000

BTQCP6133



[Wagon]

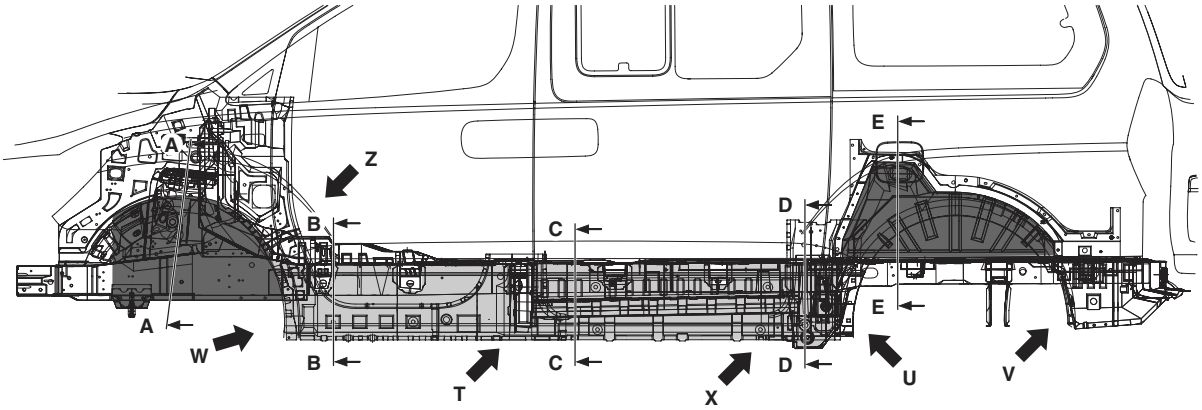


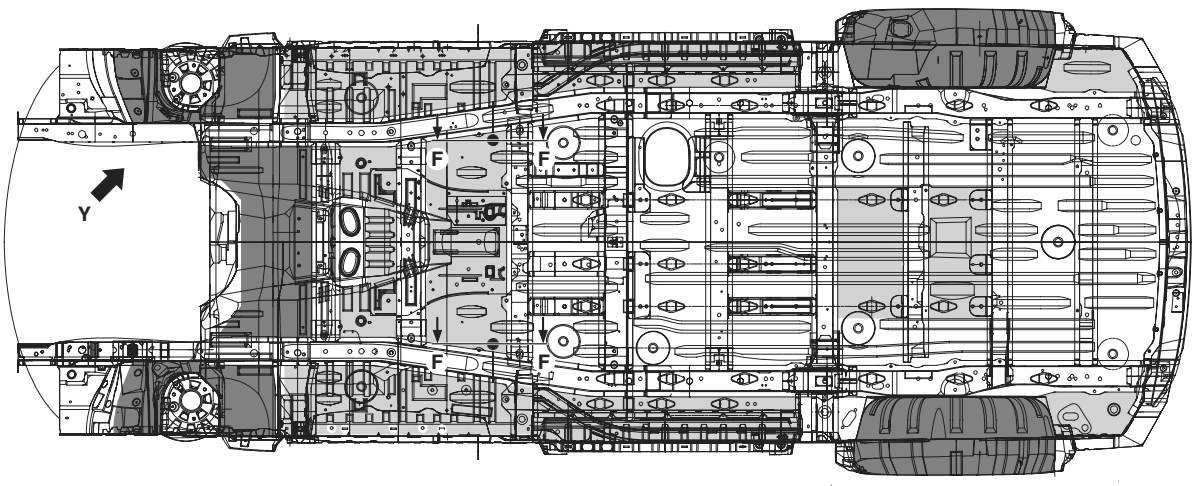
[VAN]

BTQCP6105

UNDER BODY COAT

In order to provide corrosion, stone chipping and vibration resistance, under body coat is applied to the under sides of the floor and wheel house.
Therefore, when such panel is replaced or repaired, apply under body coat to that part.

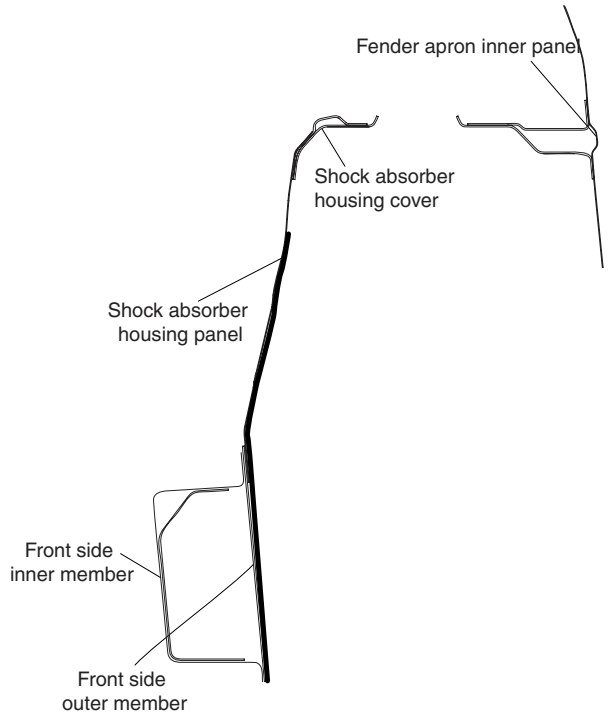




Under body coating (Thickness : 1.0 mm , :2.0 mm)

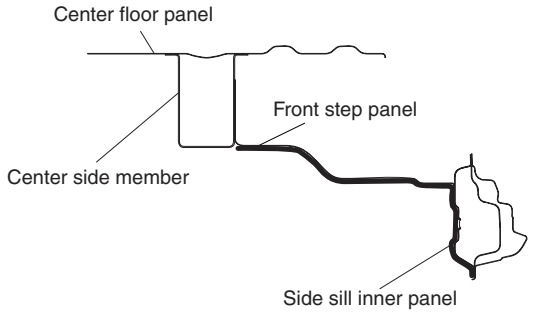
BTQCP6107

A - A



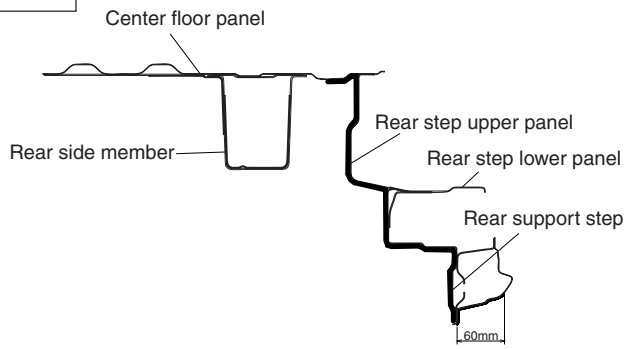
BTQCP6108

B - B



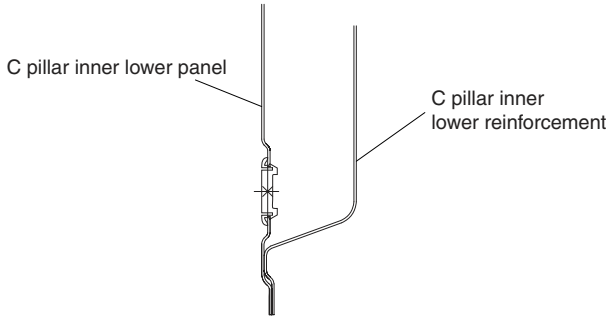
BTQCP6109

C - C



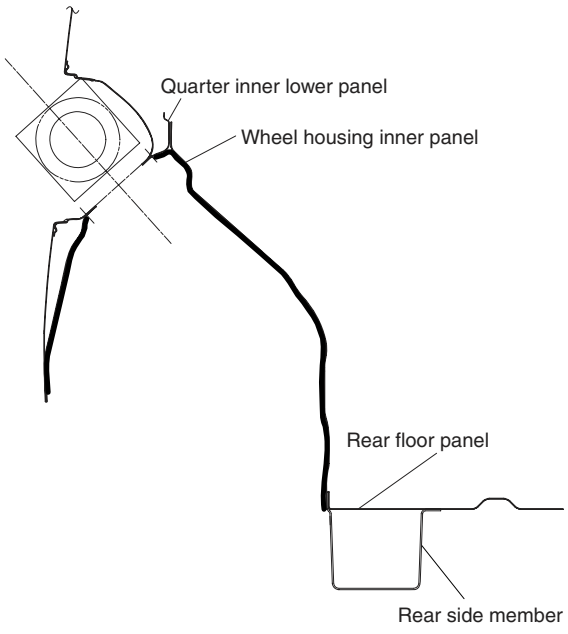
BTQCP6110

D - D



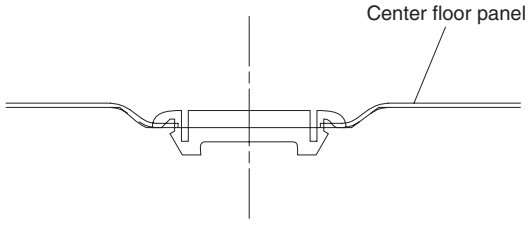
BTQCP6111

E - E



BTQCP6112

F - F



BTQCP6113

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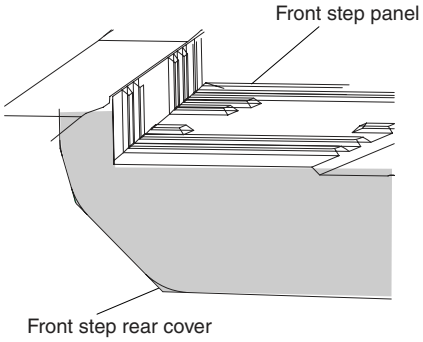

BTQCP6114

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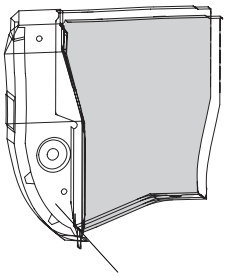

BTQCP6115

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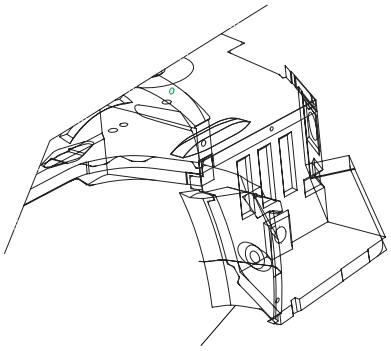

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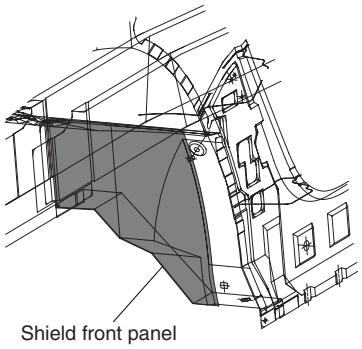

BTQCP6117

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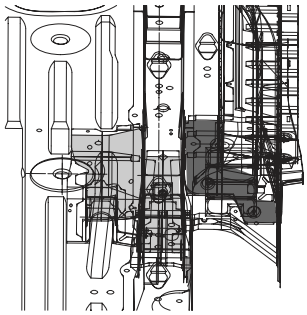

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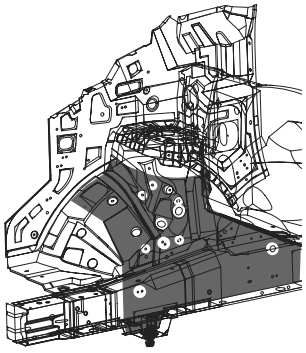
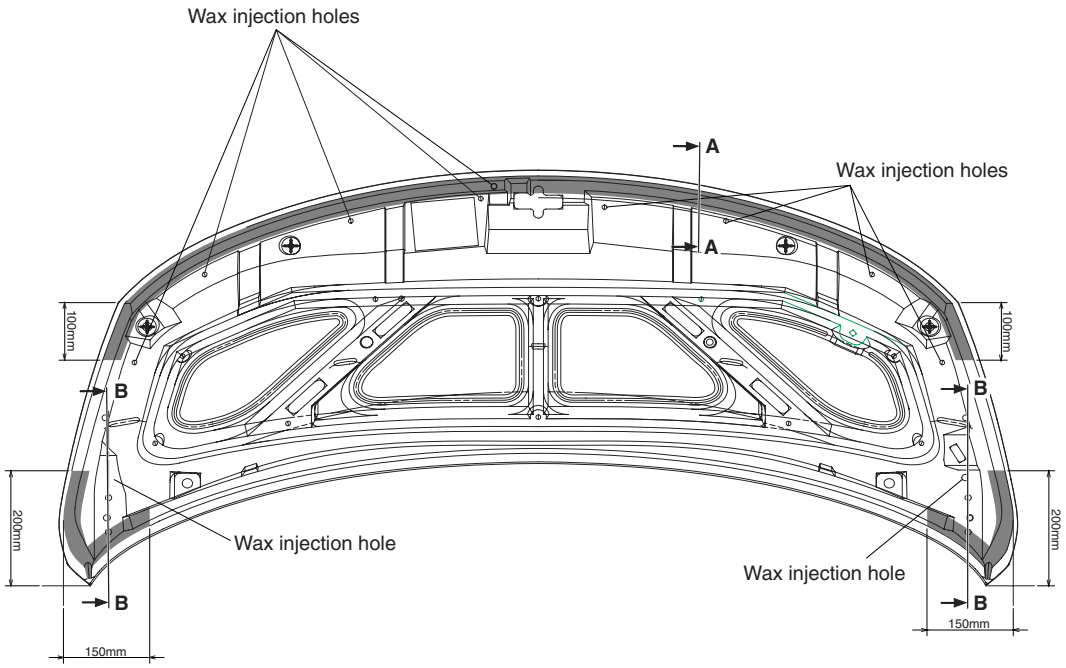


BTQCP6119

CAVITY WAX INJECTION

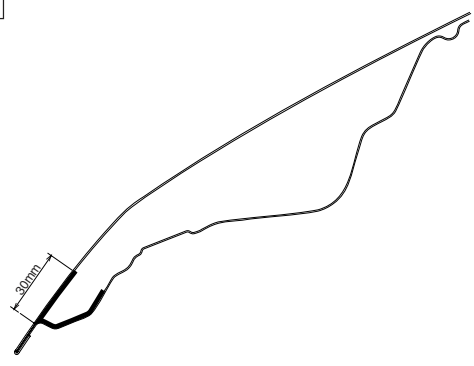
In order to provide greater corrosion resistance, cavity wax injection has been performed for the lower areas of the vehicle, such as the sidemember, the side sill and the inside of other panels which are a hollow construction.
When replacing these parts, be sure to apply cavity wax to the appropriate areas of the new parts.

HOOD



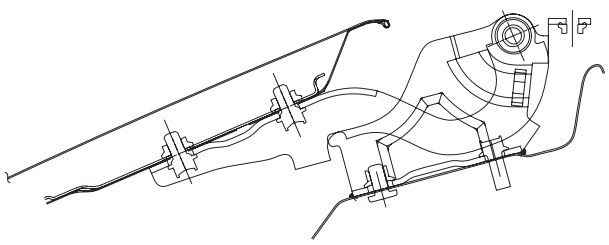
BTQCP6122

A - A



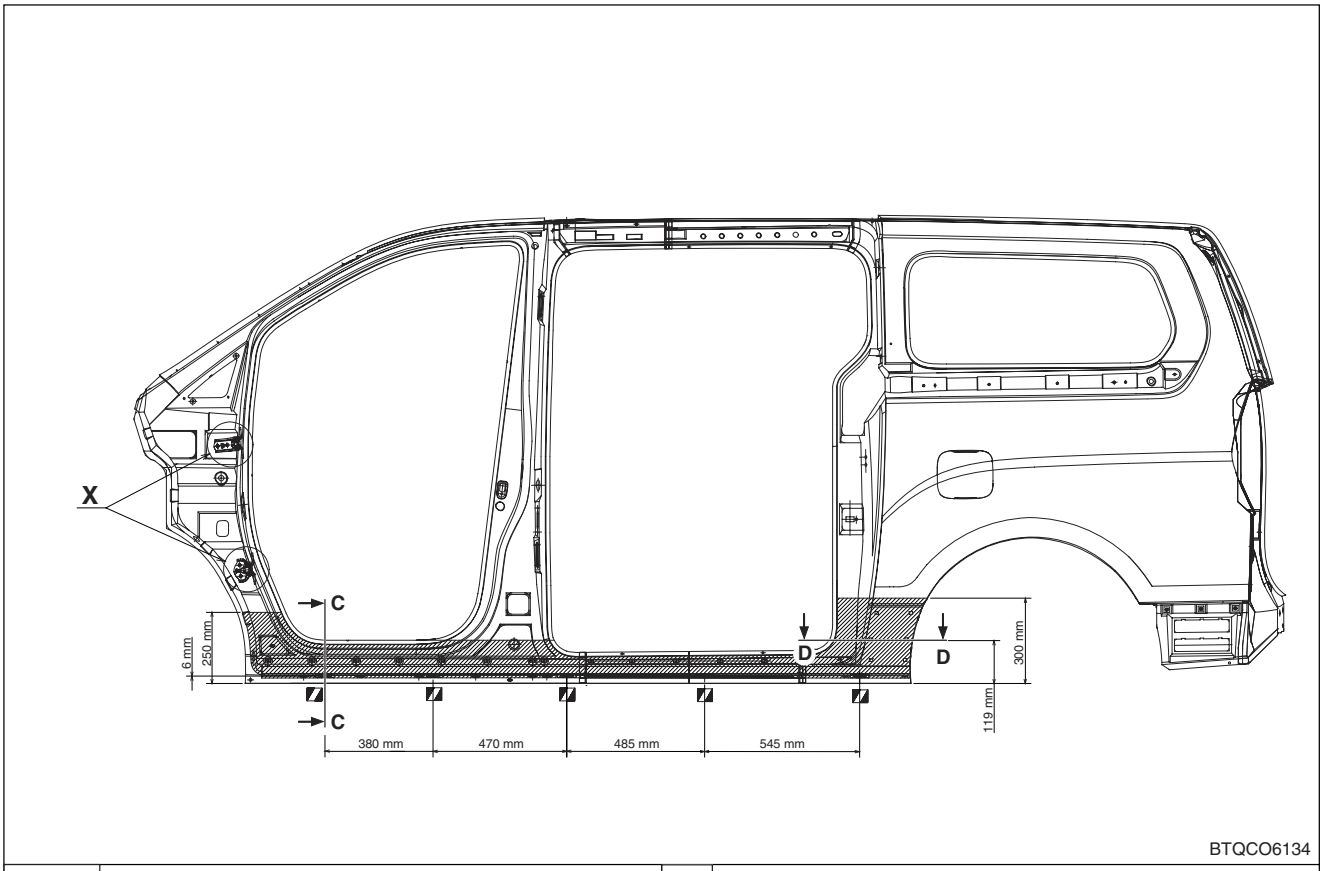
BTQCP6123

B - B



BTQCP6124

SIDE BODY



BTQCO6134

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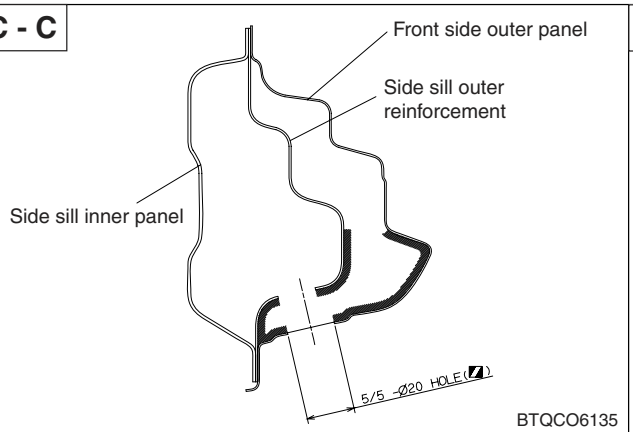
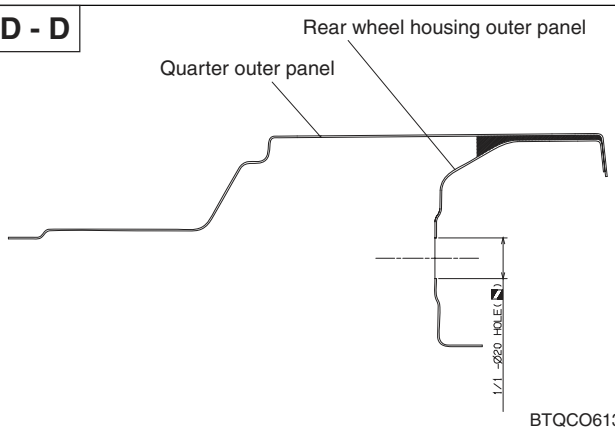


BTQCO6135

D - D



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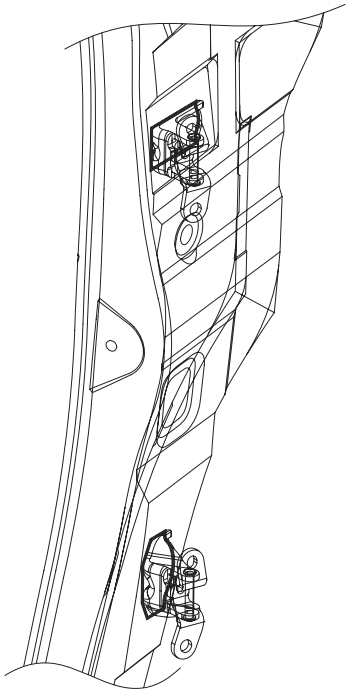
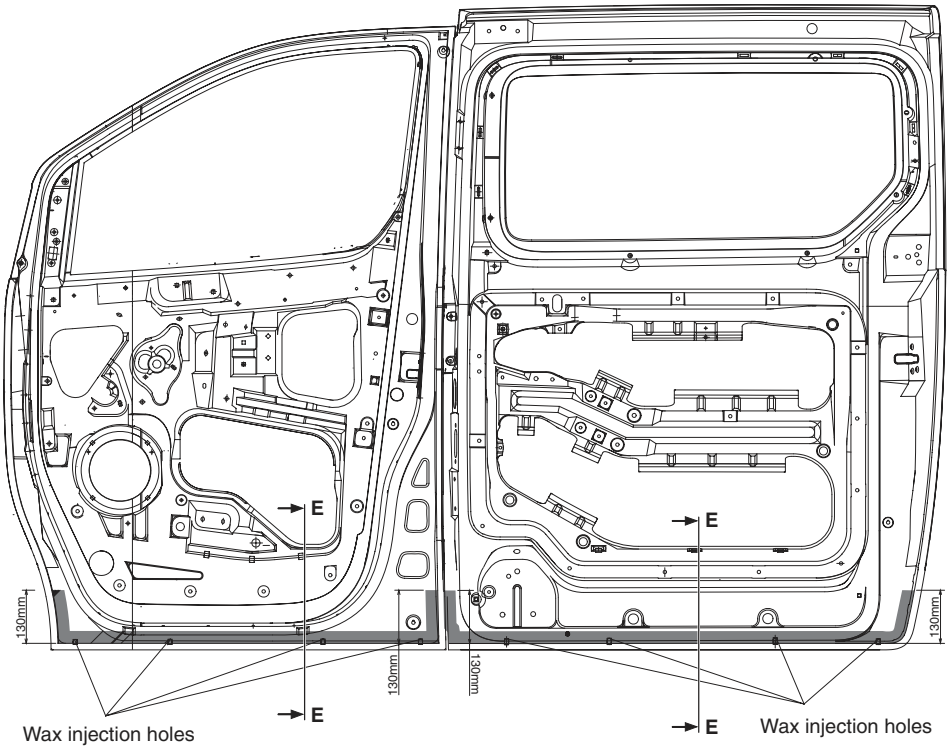


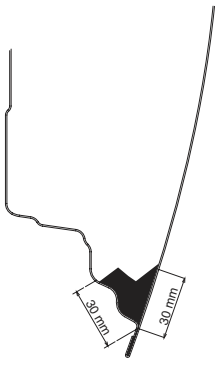
BTQCO6137

FRONT & REAR DOOR



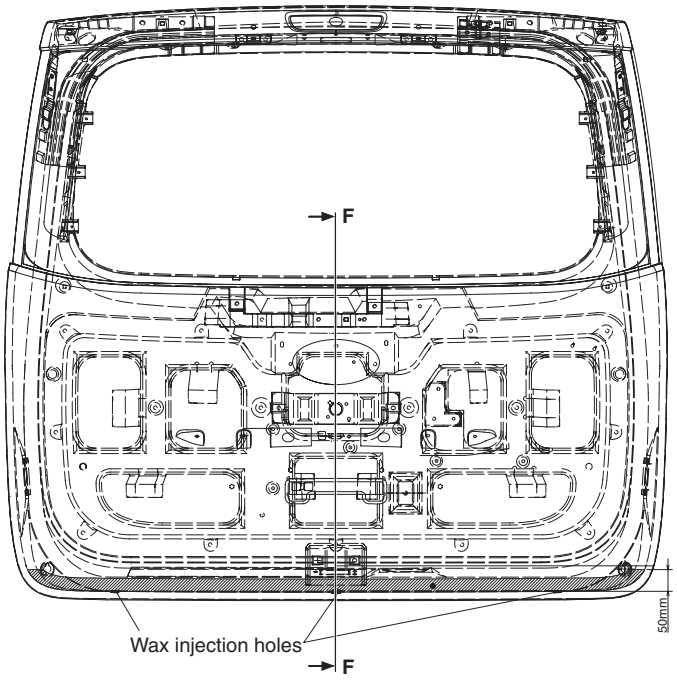
BTQCP6131

E - E



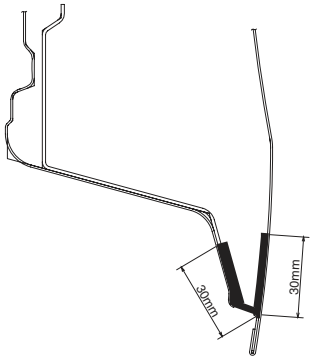
BTQCP6132

TAIL GATE



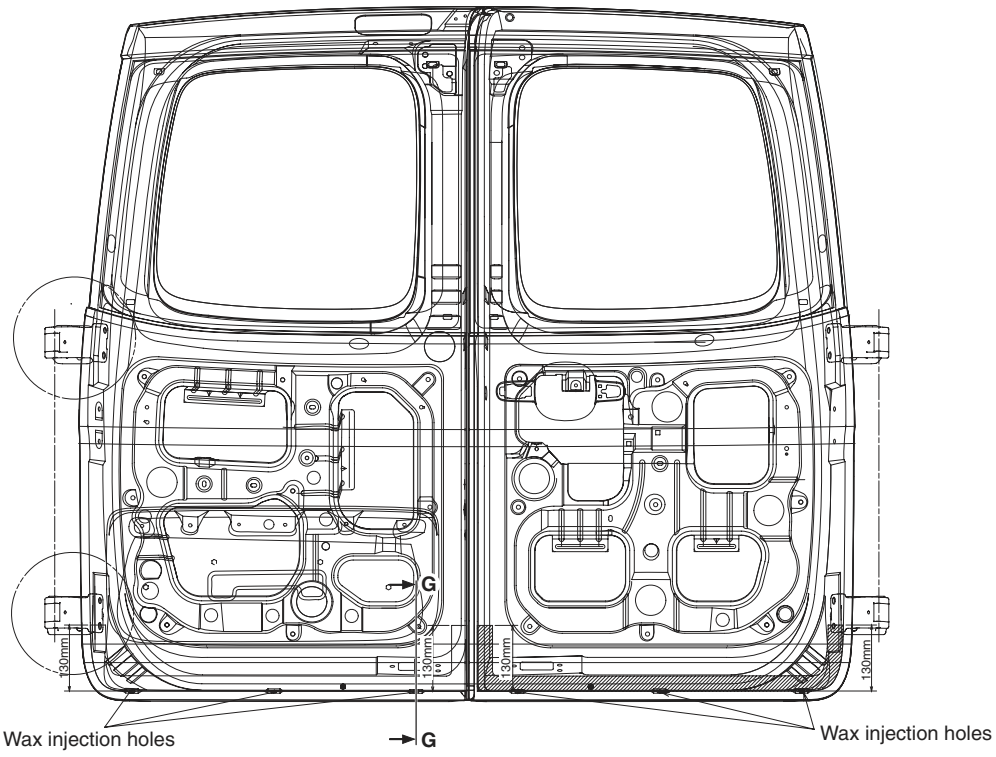
BTQCP6125

F - F



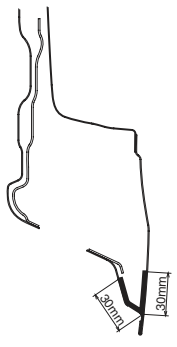
BTQCP6126

TWIN SWING DOOR



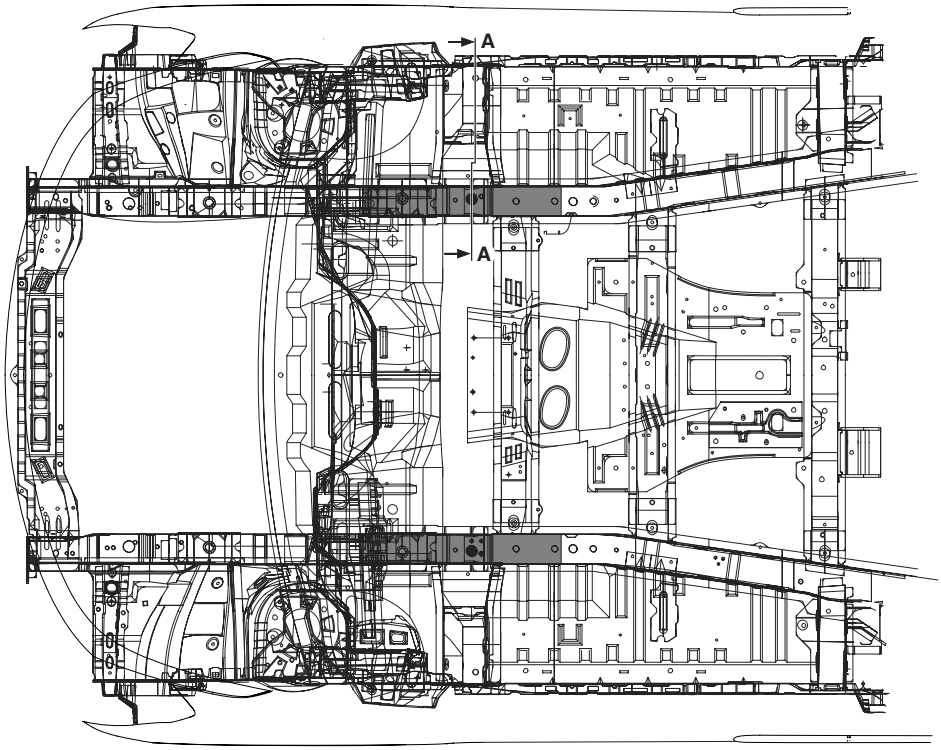
BTQCP6128

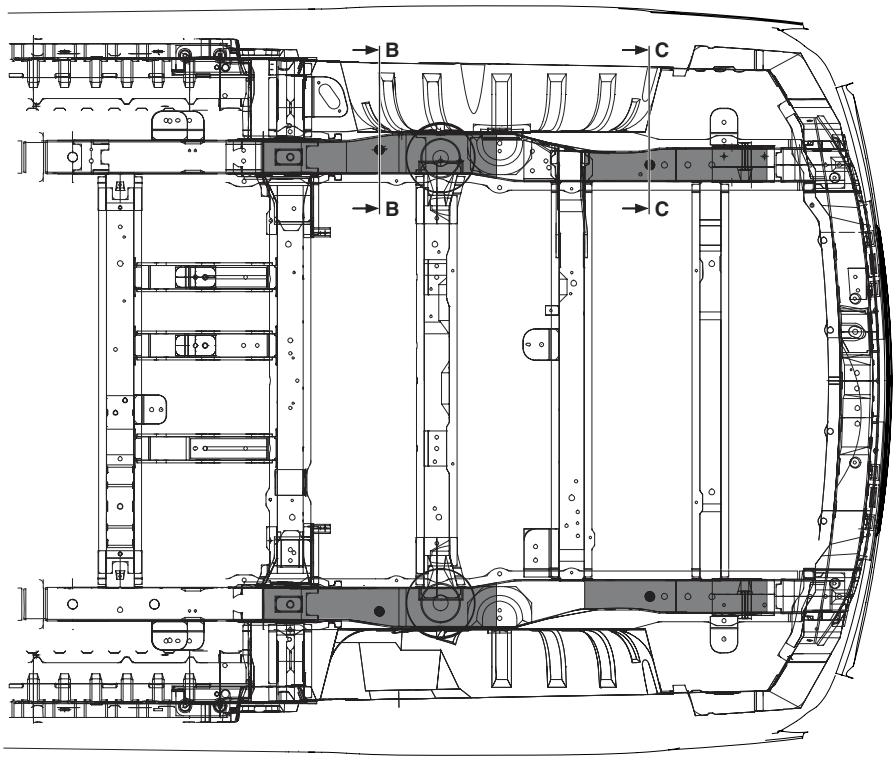
G - G



BTQCP6129

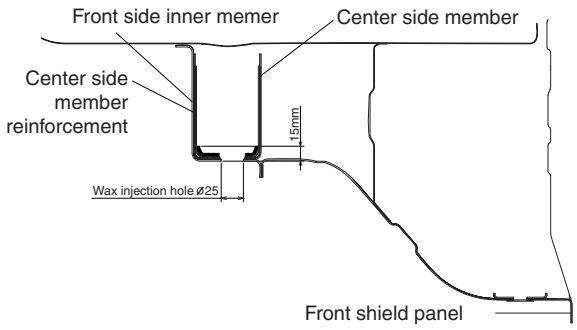
UNDER BODY





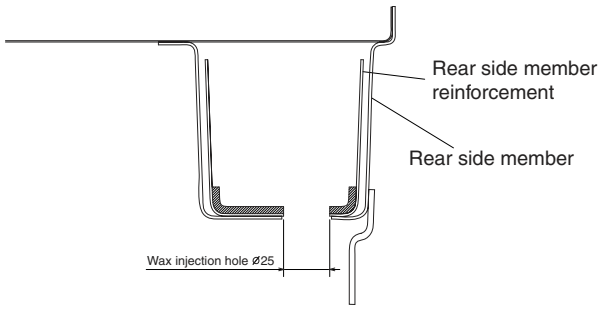
BTQCP6138

A - A



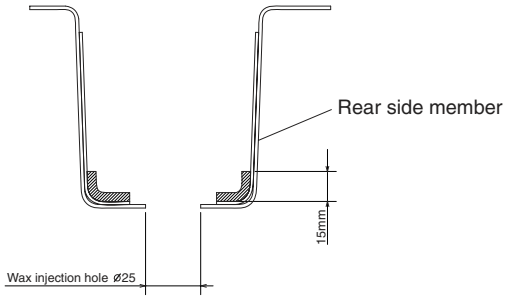
BTQCP6139

B - B



BTQCP6140

C - C



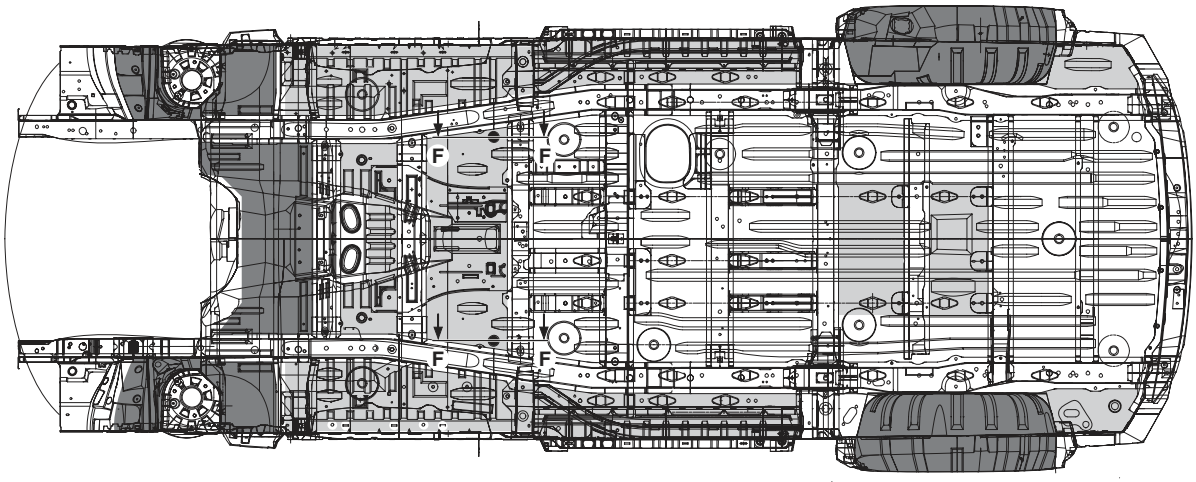
BTQCP6141

UNDER BODY ANTI-CORROSION AGENT

The undersides of the floor and wheel house are undercoated to provide greater corrosion resistance. Therefore, when such panel is replaced or repaired, apply under body anti-corrosion agent to that part.

NOTE

Do not apply the under body anti-corrosion agent to come in contact with tires, muffler and exhaust pipe.



Under body coating (Thickness : 1.0mm , :2.0 mm)

BTQCP6107A

Body Modification Tools

MODIFICATION TOOLS ..... BT - 2

CUT AND DISASSEMBLY TOOLS ..... BT - 3

ASSEMBLY TOOLS ..... BT - 4

MEASUREMENT TOOLS ..... BT - 4

WELDING MACHINE ..... BT - 5

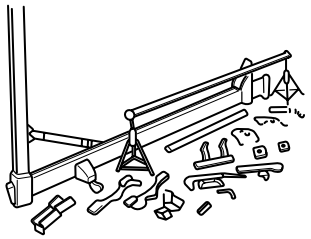
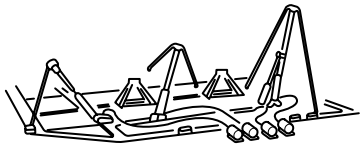
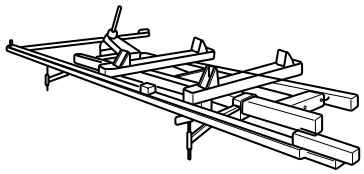
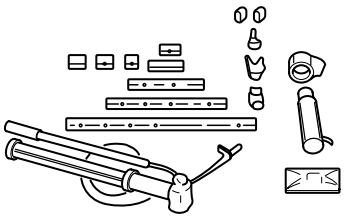
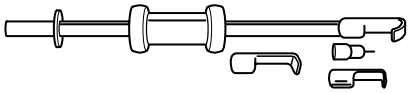
BUFFING AND GRINDING TOOLS ..... BT - 6

HANDHELD TOOLS ..... BT - 8

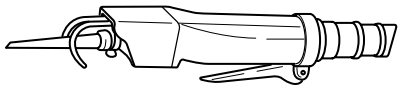
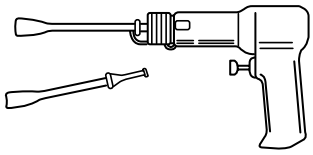
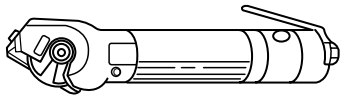
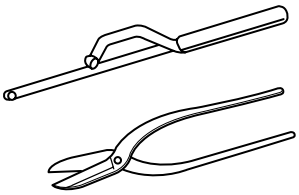
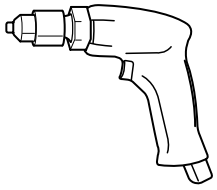
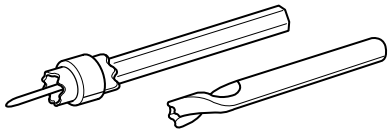
REPAIR TOOLS SET ..... BT - 9

BODY MODIFICATION TOOLS

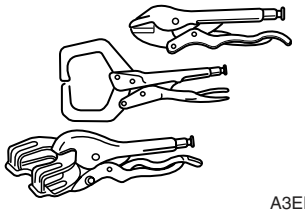
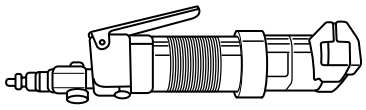
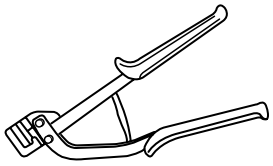
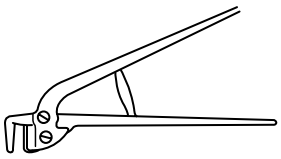
MODIFICATION TOOLS

Name	Used for	Figure
Frame straightener	Modify twisted or bent body	 A3EB3501
		 A3EB3502
		 A3EB3503
Port power	Push out, stretch, pull in damaged area	 A3EB3504
Body puller	Stretch damaged area	 A3EB3505

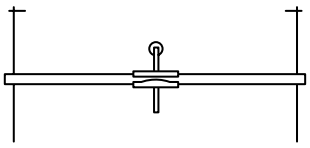
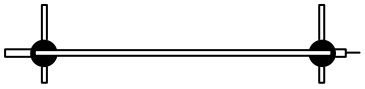
CUT AND DISASSEMBLY TOOLS

Name	Used for	Figure
Air saw	Cut a panel	 A3EB3506
Air chisel	Cut or bend a panel, cut and disassemble spot welded area	 A3EB3507
Rotary cutter	Cut a panel	 A3EB3508
Hand saw and metal scissors	Cut a panel	 A3EB3509
Air drill	Fix a spot cutter or drill to cut or disassembly spot welding area, to finish a hole	 A3EB3510
Spot cutter	Cut and disassemble spot welded area	 A3EB3511

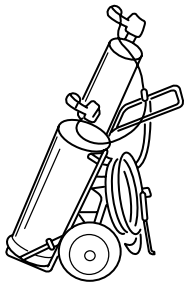
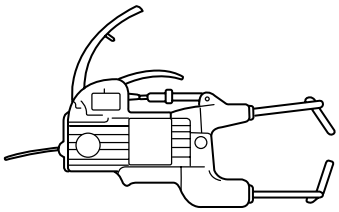
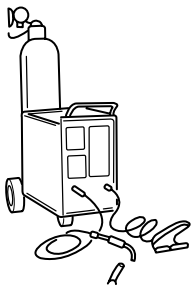
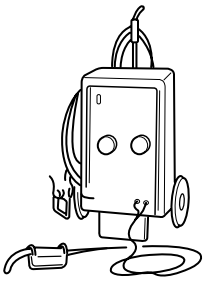
ASSEMBLY TOOLS

Name	Used for	Figure
Vice pliers	Fix a panel or area to weld	 A3EB3512
Air bench	Finish contact area of flange and finish a hole for plug welding	 A3EB3513
Quick bench	Finish a hole for plug welding	 A3EB3514
Flanging tool	Finish contact area of flange	 A3EB3515

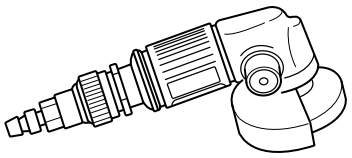
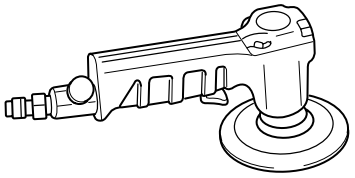
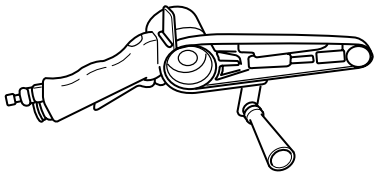
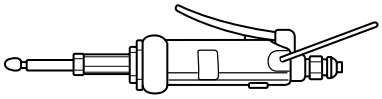
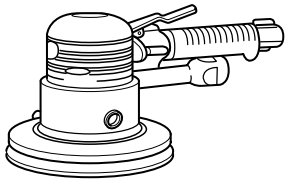
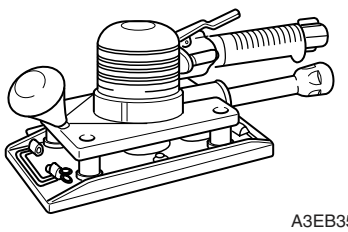
MEASUREMENT TOOLS

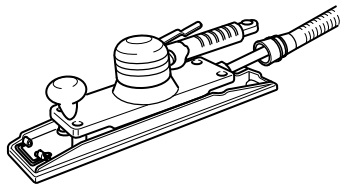
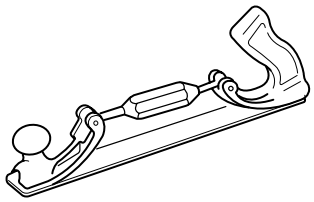
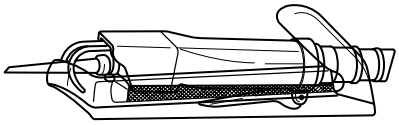
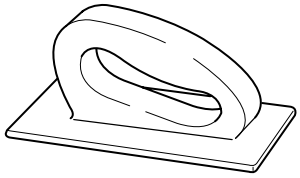
Name	Used for	Figure
Centering gauge	Measure distortion of body and frame	 A3EB3516
Tracking gauge	Measure body and frame	 A3EB3517

WELDING MACHINE

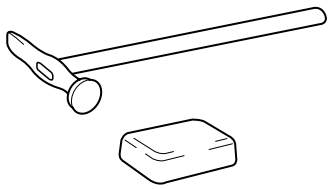
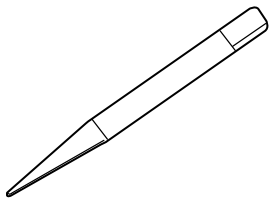
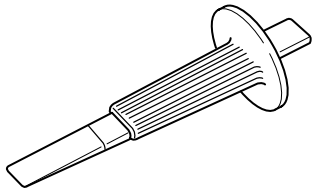
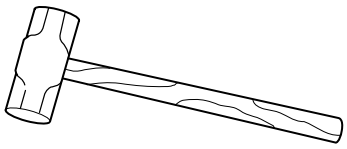
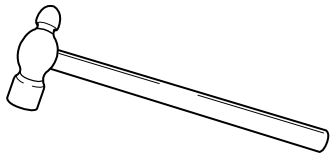
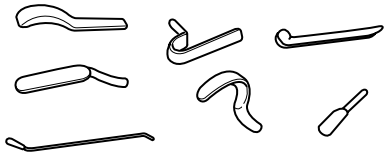
Name	Used for	Figure
Gas welding machine	Cut a panel	 A3EB3518
Spot welding machine	Weld a panel	 A3EB3519
Carbon arc welding machine	Weld a panel	 A3EB3520
Stud welding machine	Stretch a panel, weld a stud bolt to fix front window mold clip	 A3EB3521

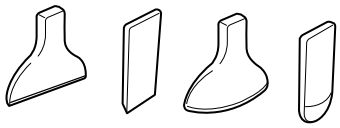
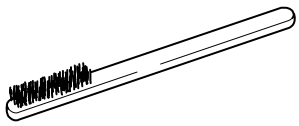
BUFFING AND GRINDING TOOLS

Name	Used for	Figure
Disk grinder	Buff	 A3EB3522
Disk sander	Buff	 A3EB3523
Belt sander	Buff paints	 A3EB3524
Small sized grinder	Buff paints or smooth finishing	 A3EB3525
Double action sander	Grind rough area of puttee assembled area	 A3EB3526
Orbital sander(short)	Grind rough area of puttee assembled area	 A3EB3527

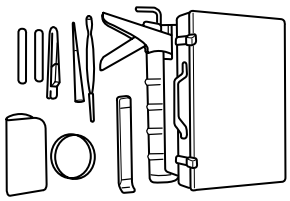
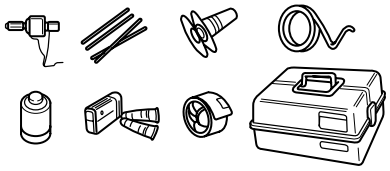
Name	Used for	Figure
Orbital sander(long)	Used for puttee grinding of wide area	 A3EB3528
Flexible file	Grind touch up area, uneven area of a panel	 A3EB3529
Surform tool	Buff rough area of puttee area	 A3EB3530
Hand file	Grind body puttee, pulley, finish puttee	 A3EB3531

HANDHELD TOOLS

Name	Used for	Figure
Body hammer and dolly	-	 A3EB3532
Center punch	Punch a hole in the middle of a spot welding area	 A3EB3533
Plane chisel	Cut and disassemble a panel	 A3EB3534
Weight hammer	Used when greater force is required	 A3EB3535
Bowl pin hammer	Used when smaller force is required	 A3EB3536
Spoon	Used for an area where not reached by hand	 A3EB3537

Name	Used for	Figure
Body chisel	Bend rough body line damaged or sheet metal etc.	 A3EB3538
Wire brush	Remove paints, rust, slag on welded area which are hard to recognize	 A3EB3539

REPAIR TOOLS SET

Name	Used for	Figure
Window tool set	Repair window collar	 A3EB3540
Repair tool set for plastics	Repair plastic parts	 A3EB3541

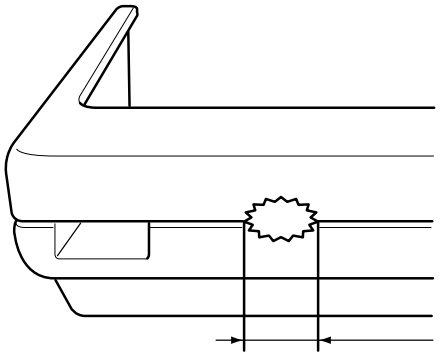
Plastic Parts

POLYPROPYLENE(PP) BUMPER REPAIRABILITY ..... PP - 2
BUMPER REPAIR PROCEDURE ..... PP - 3
REPAIR METHOD FOR PP BUMPER ..... PP - 4

POLYPROPYLENE(PP) BUMPER REPAIRABILITY

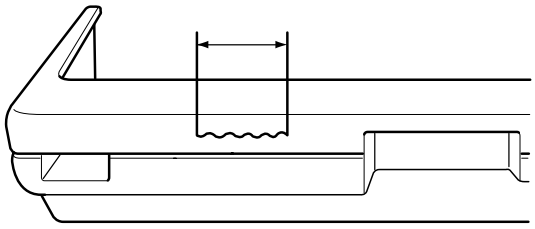
The three types of damaged bumpers shown below can be repaired. Because of cost and quality considerations, bumpers with more damage may be repaired, but replacing the bumper is encouraged.

1. If a hole on a bumper is less than 2 in.(50 mm).



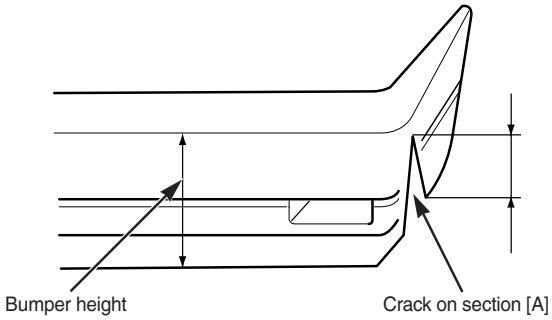
A3EB3601

2. If a crack on a bumper is less than 100 mm(4 in).



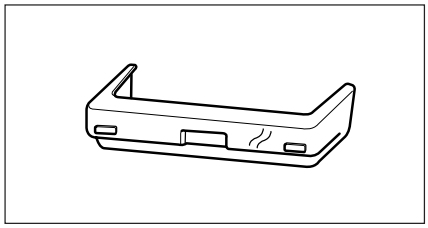
A3EB3602

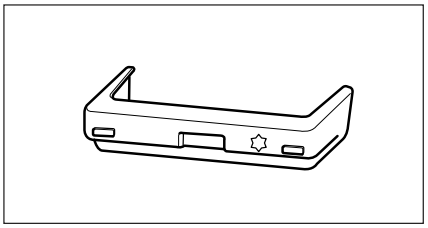
3. If a crack on bumper sectionis [A] is less than 100 mm (4 in) (less than half of the bumper height).

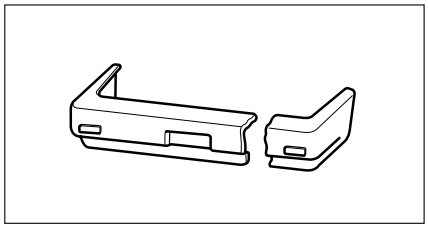


A3EB3603

BUMPER REPAIR PROCEDURE







Surface of bumper is not visible.

Surface of bumper is visible.

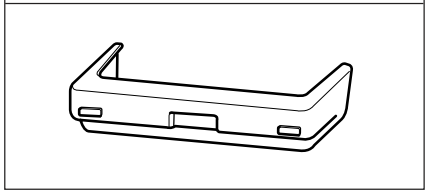
Remove paint.

Sand damaged area smooth.

Apply aluminum tape on the rear side of bumper.

Weld damaged area.

- Replace damaged bumper with a new bumper.
- Apply primer for polypropylene over bumper surface.



Sand damaged area with a rough sandpaper.

Clean and degrease damaged area(use TCE de-oil material).

Apply primer for polypropylene over damaged area.

Apply solvent over damaged area.

Spray primer surface over bumper and let dry.

Sand surface of bumper with sandpaper.

Clean and degrease with TCE de-oil material.

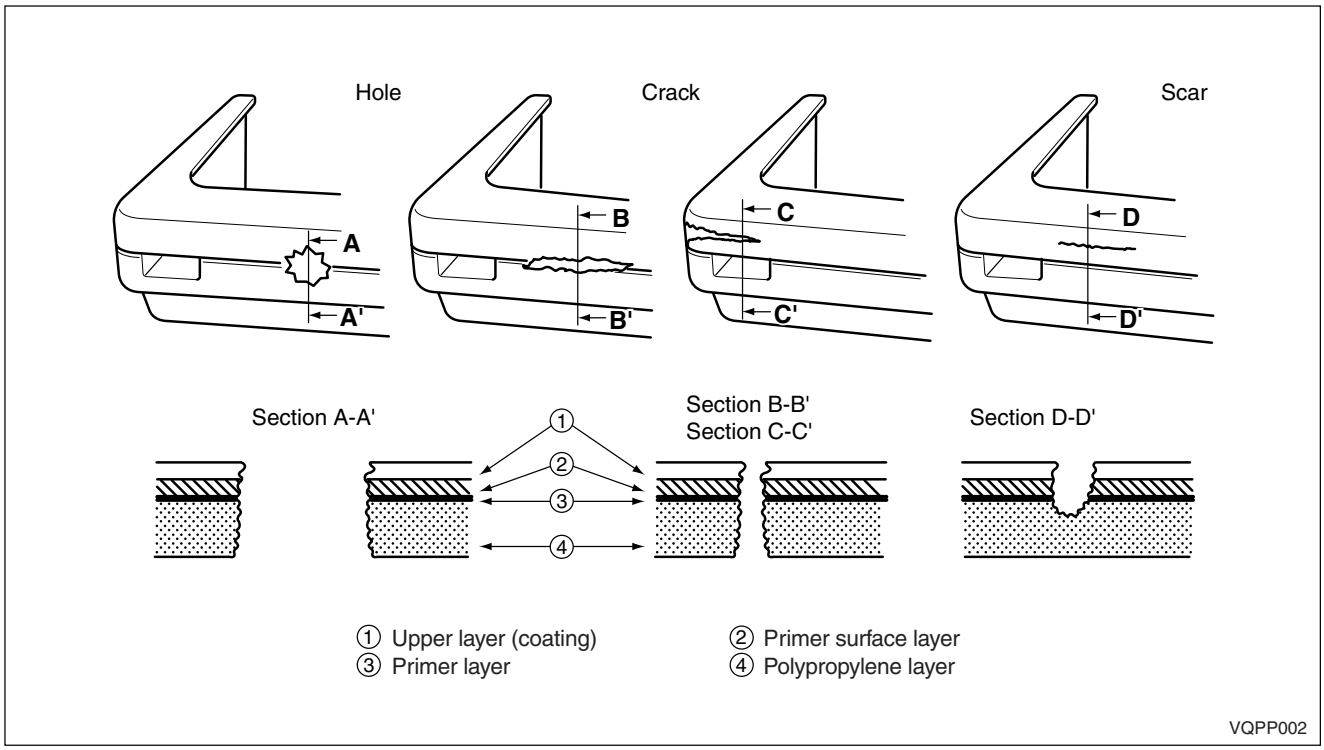
Wipe the surface of bumper with a tack cloth.

Paint bumper with a paint of the same color and let dry.

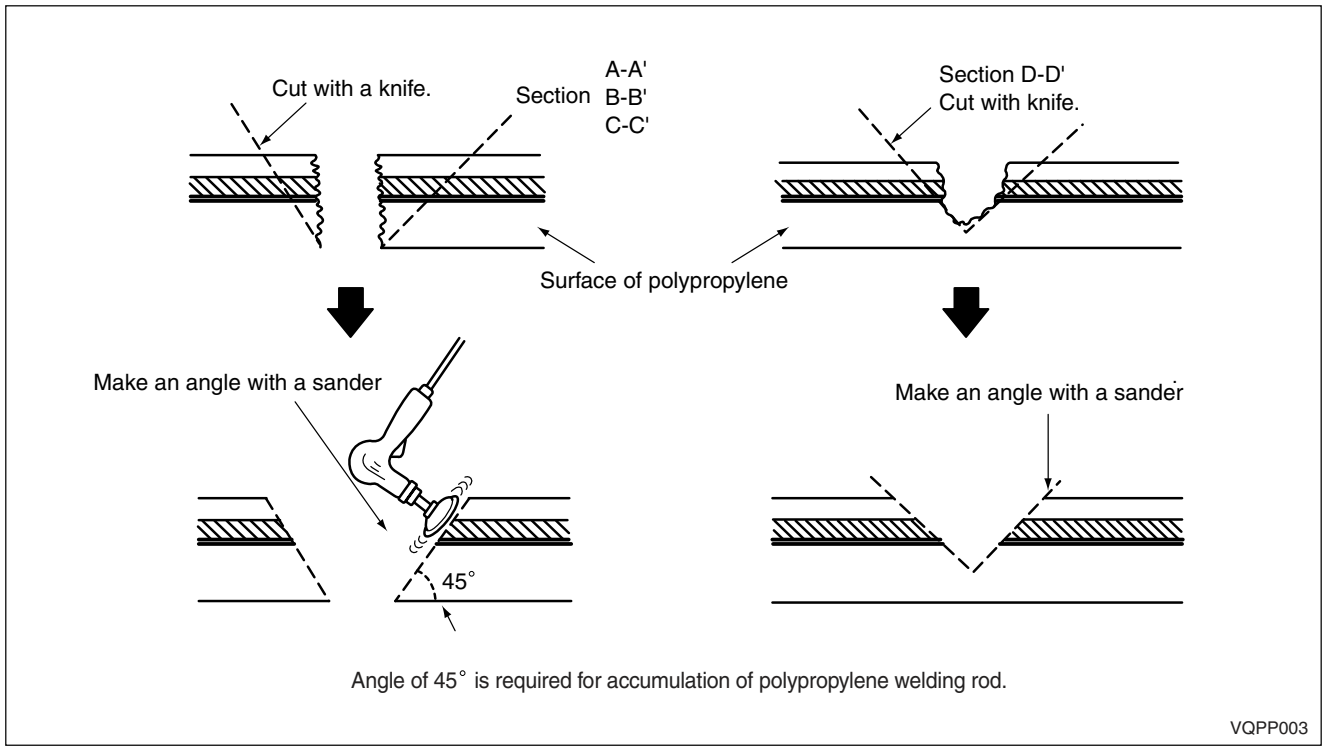
VQPP001

REPAIR METHOD FOR PP BUMPER

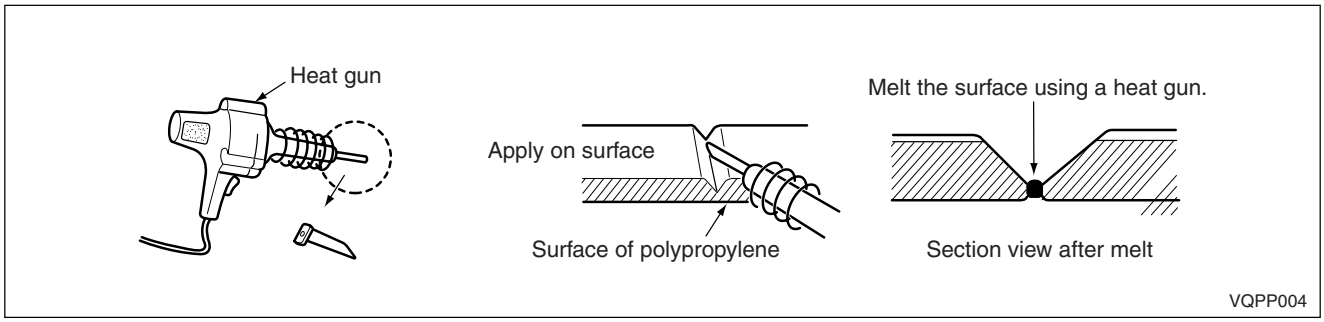
Damage to the bumper that reaches the surface of the polyporpylene cannot be fixed just by painting. Use the repair methods shown below to repair damage that reaches the surface of the polypropylene.



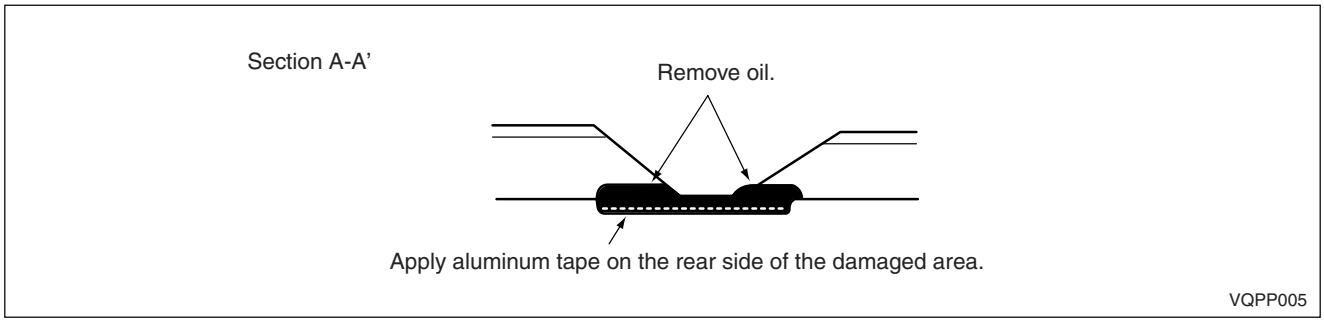
1. Rough cut the damaged area 45° using a knife and then sand the angle smooth.



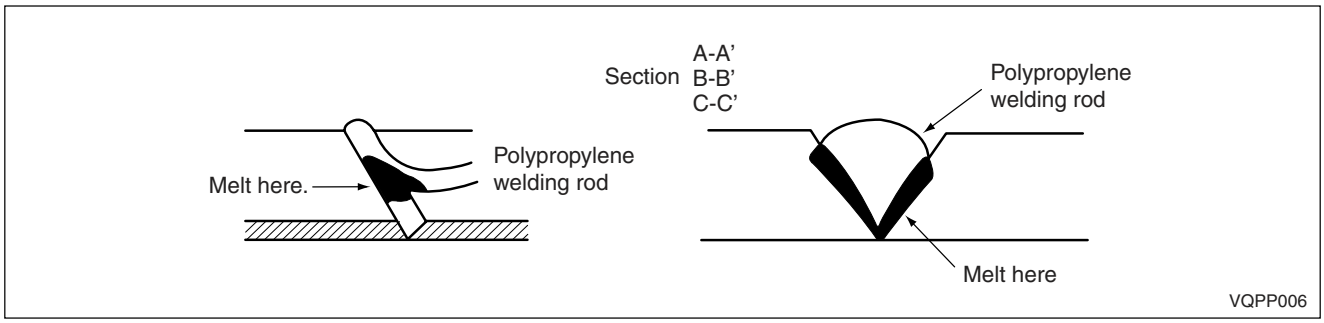
2. Welding damaged area
   a) To repair cracked area, melt the area using a heat gun and attachment.



   b) To repair a hole, remove oil from the damaged area and apply aluminum tape to the rear side of the damaged area.

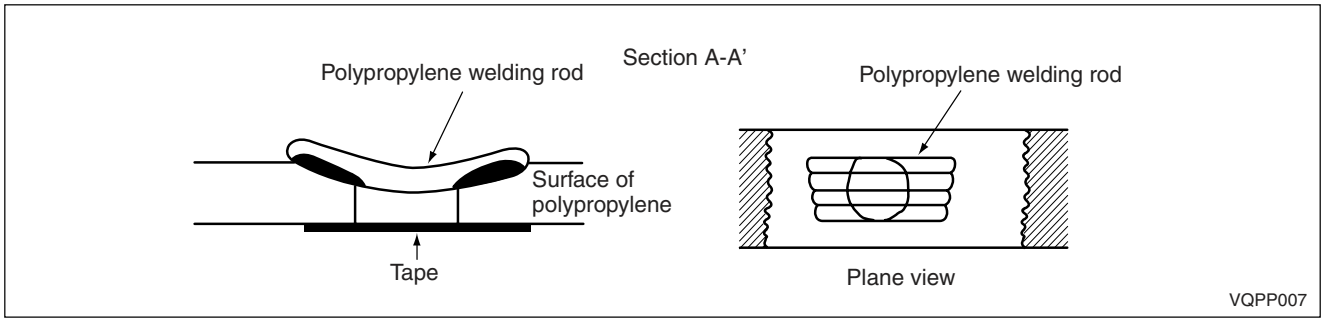


3. Melt polypropylene welding rod using a heat gun and fill in the cracked area.

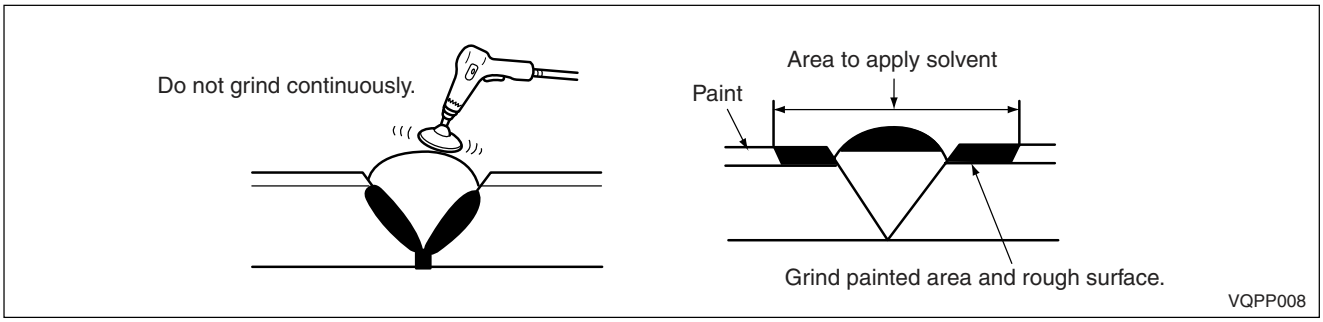


NOTE

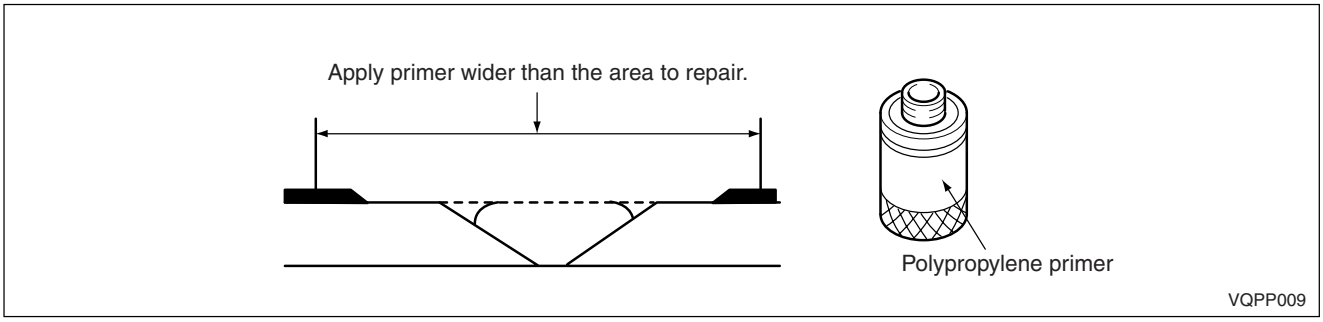
- *Heat and melt the area indicated.*
- *Melt the welding rod carefully so that it does not over-melt. If the welding rod over-melts like jelly, the welding strength will deteriorate.*
- *Use the heat gun 10~20 mm(0.4~0.8 in) away from the repair area to be welded. Welding rod should not move until the welded area is cooled.*



4. Grind polypropylene surface carefully. It melts easily due to the heat generated by friction. If melted, remove that area. Also, grind the area where solvent is to be applied.



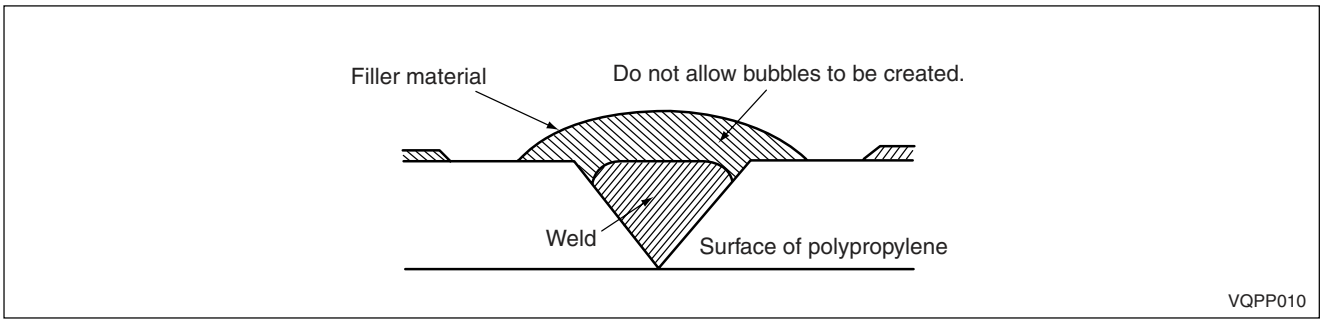
5. Apply polypropylene primer evenly with a brush over an area wider than the area to be repaired. Dry it at 20°C (68°F) for more than 10 minutes.



6. Mix main filler material and hardener at a ratio depending on paint specifications. Mix filler material and apply over the damaged area.

NOTE

- *Mix main filler material and hardener so that no bubbles are made.*
- *Work immediately after mixing filler material because the filler material hardens quickly(in about 5 minutes).*
- *Dry it at 20°C (68°F) for about 30 minutes before sanding.*

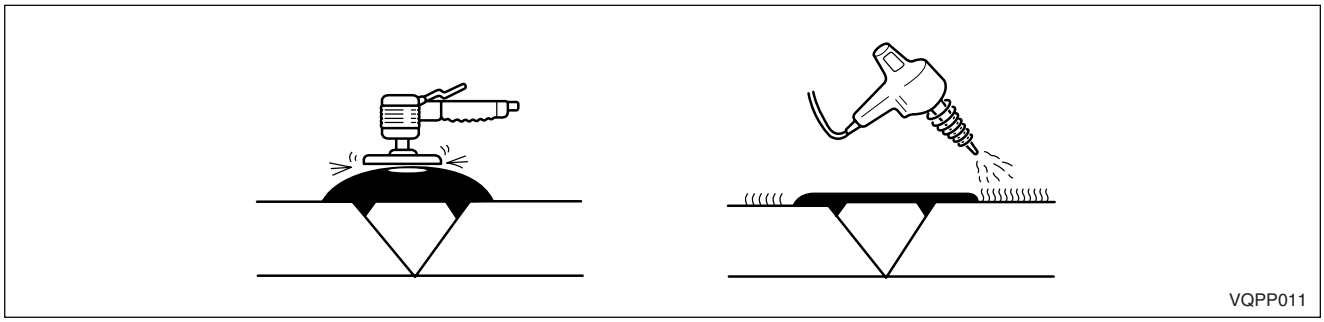


- *Filler material consists of two types of epoxy.*
  When the filler material hardens, you will have a desirable finish with flexibility like polypropylene.
- *Use only filler material designed for use on polypropylene bumpers.*

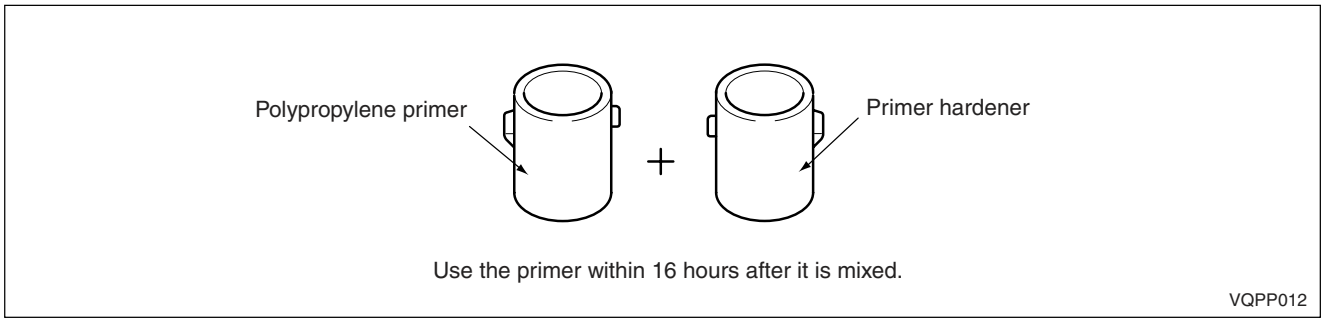
7. Sand the damaged area with sandpaper using #180~#240 grit paper.

NOTE
- *The surface will not be even if excessive force is applied during sanding.*
- *If there is fuzz in the damaged area, heat it a little bit with a heater gun and melt it.*

8. Degrease the painted surface.



9. Mix polypropylene primer and hardener at a ratio depending on paint specifications.
Spray polypropylene primer on the surface of the damaged area and the bumper.



10. Apply polypropylene primer.

NOTE
Use only water to clean after applying polypropylene primer. Solvent, if used, will melt the primer.

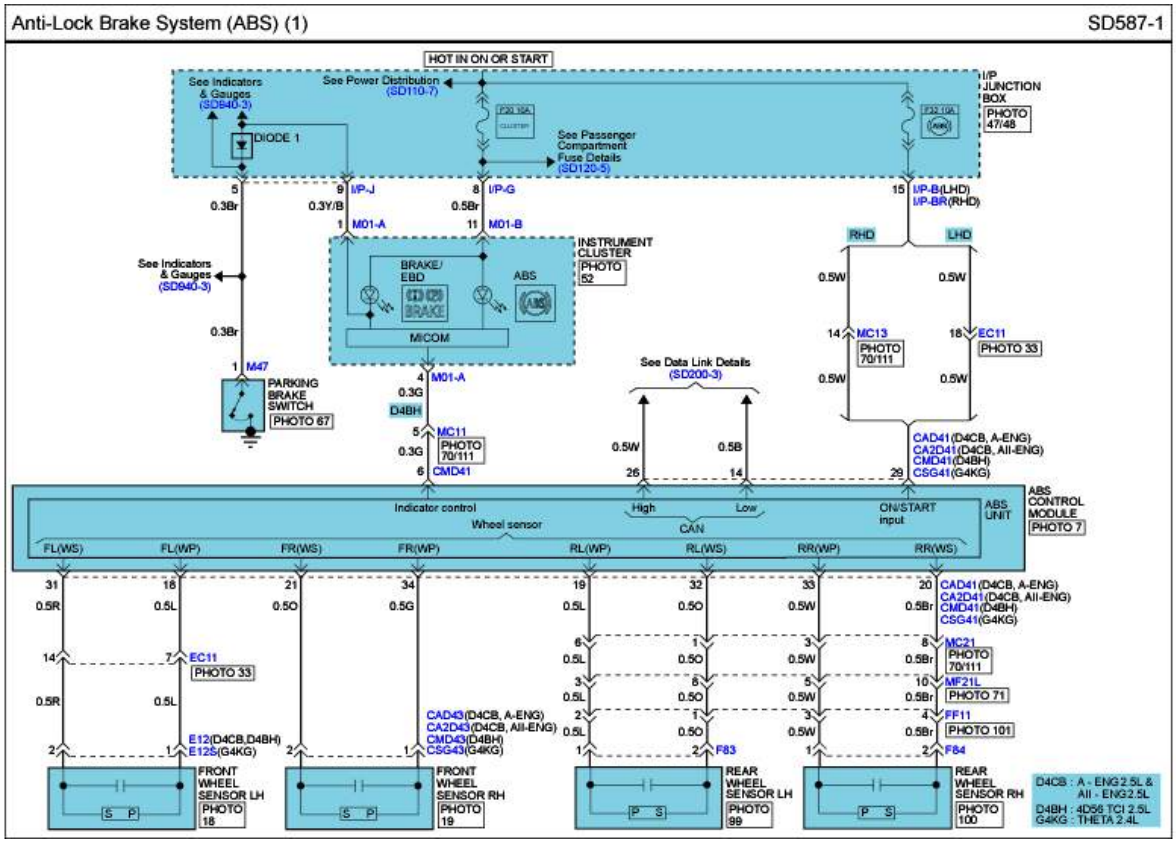
11. Lightly sand the sprayed area using a primer a sandpaper(#400~#600).
The polypropylene surface should not be exposed.(Either wet sanding or dry sanding is all right.)

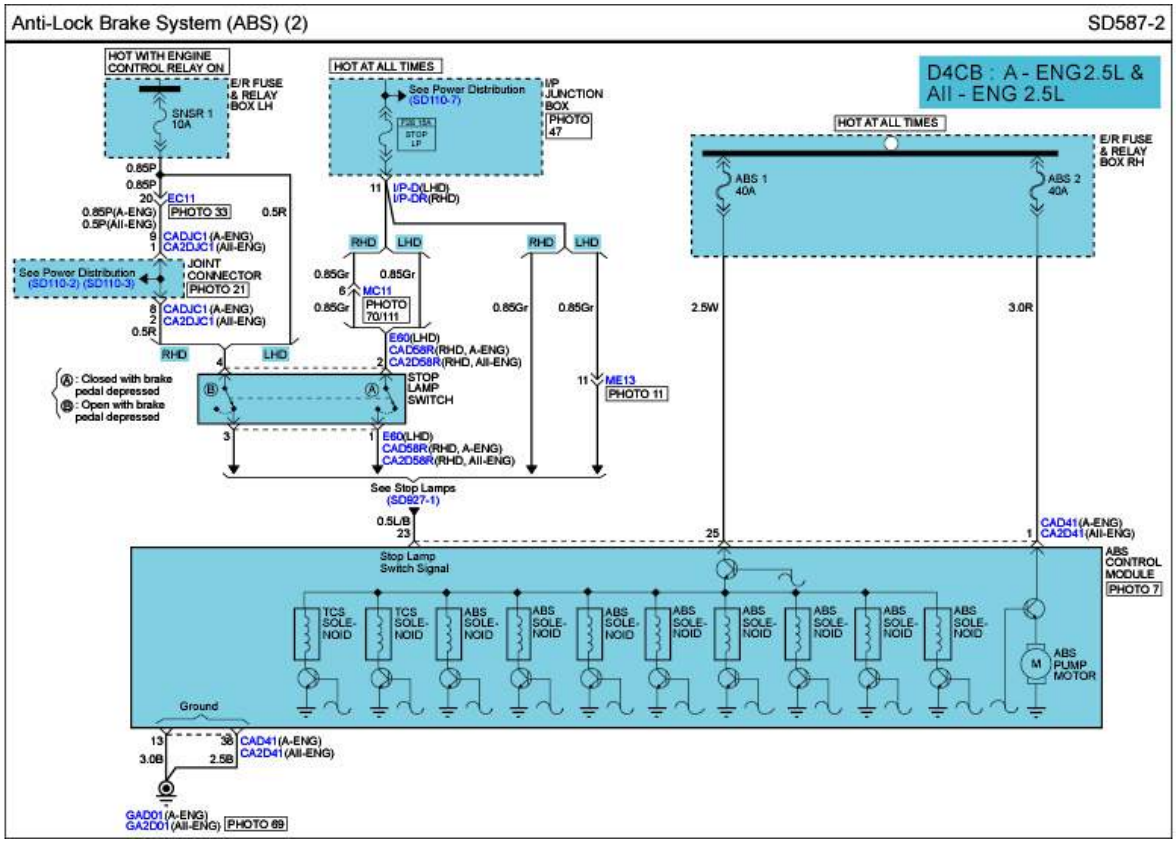
12. Use agent(TCE(Tri Chloro Ethane) degreasing material) to remove any grease or oil, and wipe the finished surface of the bumper quickly with a clean cloth.

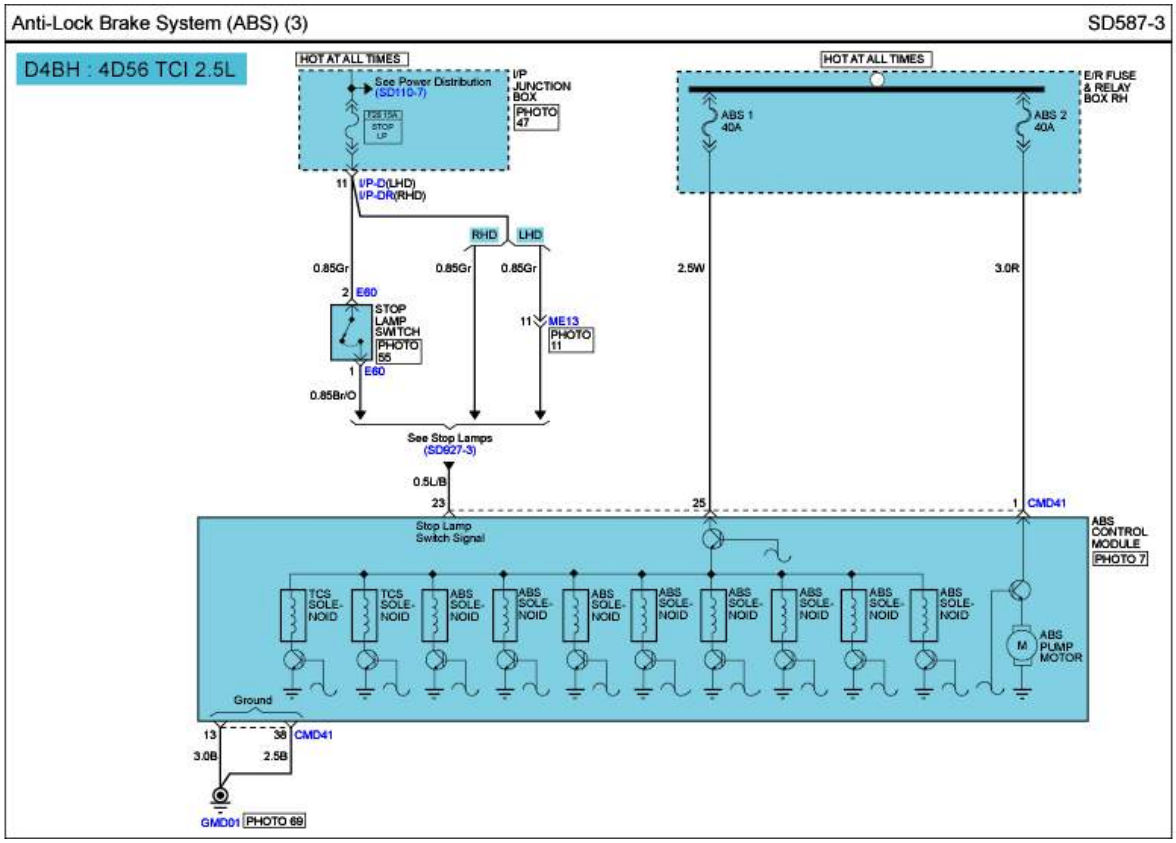
NOTE
- *The painting method for the polypropylene bumper is the same used to paint the urethane bumper.*
- *Therefore, use urethane primer only on urethane bumpers and polypropylene primer on polypropylene bumpers.*

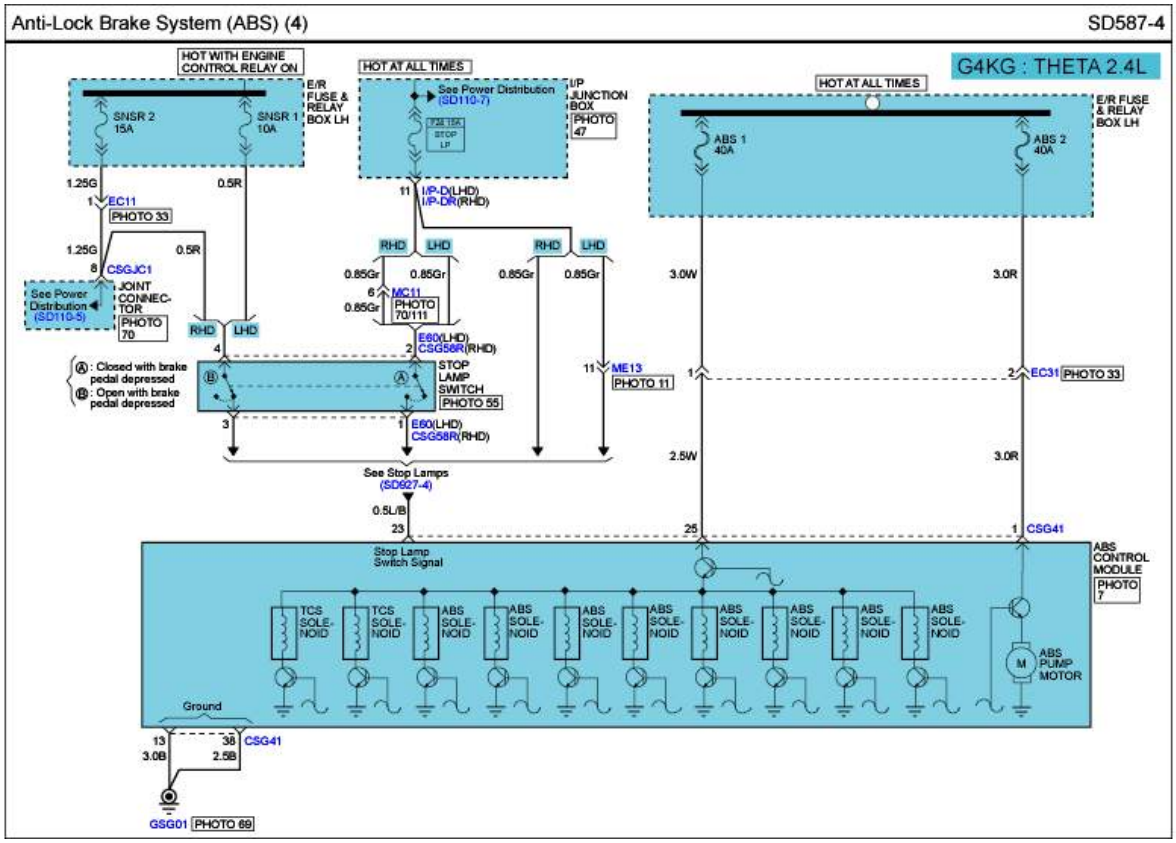
13. Air dry at 20°C(68°F) for about 8 hours, or dry in 60°C(140°F) for about 2 hours.
(Since drying time varies according to the type of paint used, follow paint manufacturers directions for drying times.)

NOTE
Air dry if possible. Forced drying may create air bubbles on the top layer.

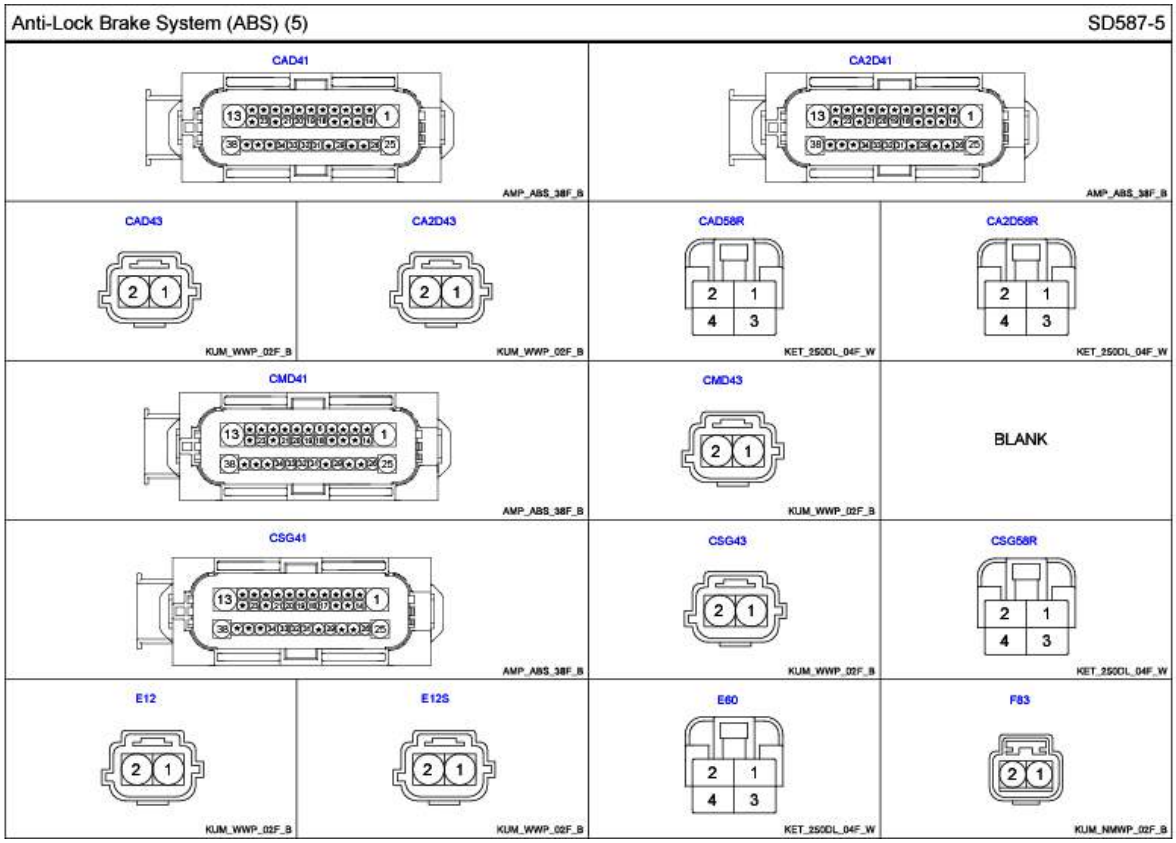

Anti-Lock Brake System (ABS) (1)
SD587-1
HOT IN ON OR START
See Indicators & Gauges (SD640-3)
See Power Distribution (SD110-7)
DIODE 1
See Passenger Compartment Fuse Details (SD120-5)
I/P JUNCTION BOX
PHOTO 47/48
I/P-J
I/P-G
I/P-B(LHD)
I/P-BR(RHD)
M01-A
M01-B
INSTRUMENT CLUSTER
PHOTO 52
BRAKE/ EBD
ABS
MICOM
RHD
LHD
MC13
PHOTO 70/111
EC11
PHOTO 33
M47
PARKING BRAKE SWITCH
PHOTO 67
MC11
CMD41
See Data Link Details (SD200-3)
CAD41(D4CB, A-ENG)
CA2D41(D4CB, AII-ENG)
CMD41(D4BH)
CSG41(G4KG)
Indicator control
Wheel sensor
High
Low
CAN
ON/START input
ABS UNIT
ABS CONTROL MODULE
PHOTO 7
FL(WS)
FL(WP)
FR(WS)
FR(WP)
RL(WP)
RL(WS)
RR(WP)
RR(WS)
E12(D4CB,D4BH)
E12S(G4KG)
CAD43(D4CB, A-ENG)
CA2D43(D4CB, AII-ENG)
CMD43(D4BH)
CSG43(G4KG)
MC21
PHOTO 70/111
MF21L
PHOTO 71
FF11
PHOTO 101
F83
F84
FRONT WHEEL SENSOR LH
PHOTO 18
FRONT WHEEL SENSOR RH
PHOTO 19
REAR WHEEL SENSOR LH
PHOTO 99
REAR WHEEL SENSOR RH
PHOTO 100
D4CB : A - ENG 2.5L & AII - ENG 2.5L
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L

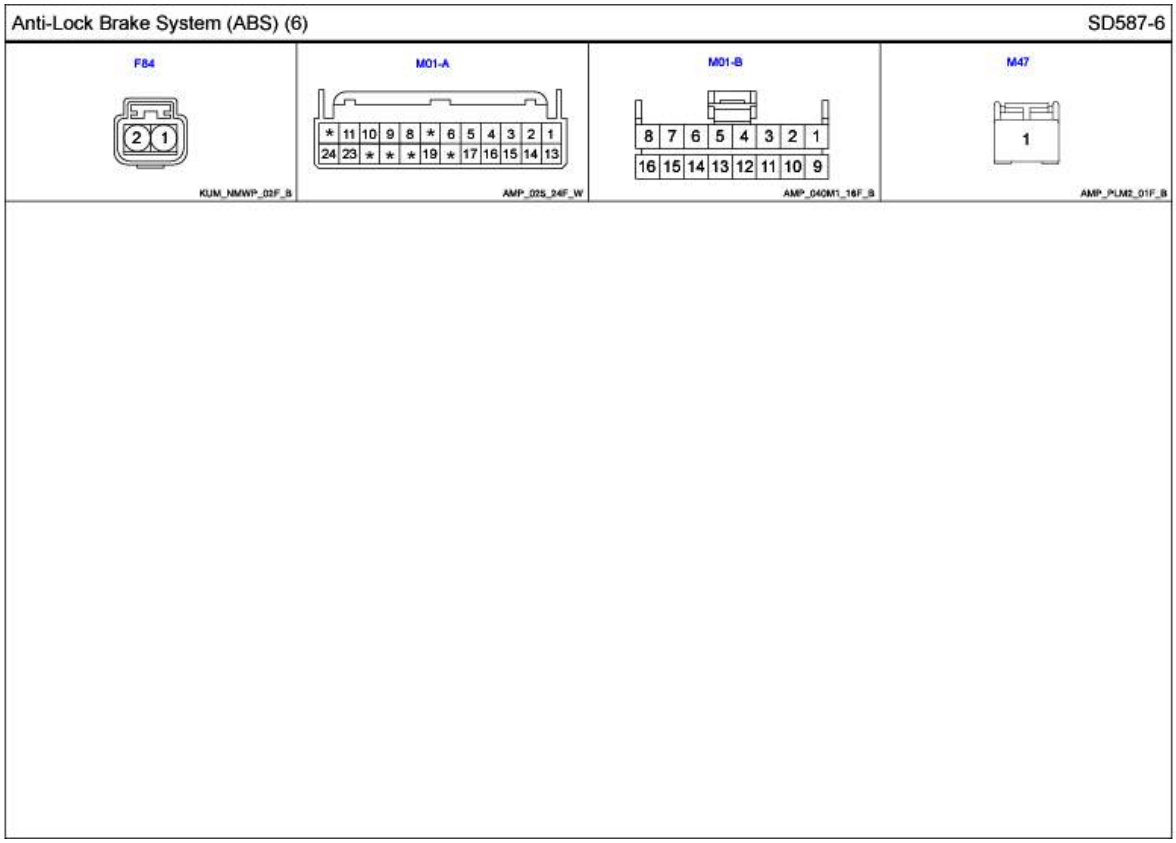

Anti-Lock Brake System (ABS) (2)
SD587-2
D4CB : A - ENG2.5L & All - ENG 2.5L
HOT WITH ENGINE CONTROL RELAY ON
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
E/R FUSE & RELAY BOX RH
I/P JUNCTION BOX
See Power Distribution (SD110-7)
SNSR 1 10A
ABS 1 40A
ABS 2 40A
EC11
PHOTO 33
CADJC1 (A-ENG)
CA2DJC1 (All-ENG)
JOINT CONNECTOR
PHOTO 21
See Power Distribution (SD110-2) (SD110-3)
I/P-D(LHD)
I/P-DR(RHD)
MC11
PHOTO 70/111
E60(LHD)
CAD58R(RHD, A-ENG)
CA2D58R(RHD, All-ENG)
ME13
PHOTO 11
STOP LAMP SWITCH
Ⓐ : Closed with brake pedal depressed
Ⓑ : Open with brake pedal depressed
See Stop Lamps (SD927-1)
Stop Lamp Switch Signal
CAD41(A-ENG)
CA2D41(All-ENG)
ABS CONTROL MODULE
PHOTO 7
TCS SOLE-NOID
ABS SOLE-NOID
ABS PUMP MOTOR
Ground
GAD01(A-ENG)
GA2D01(All-ENG)
PHOTO 69

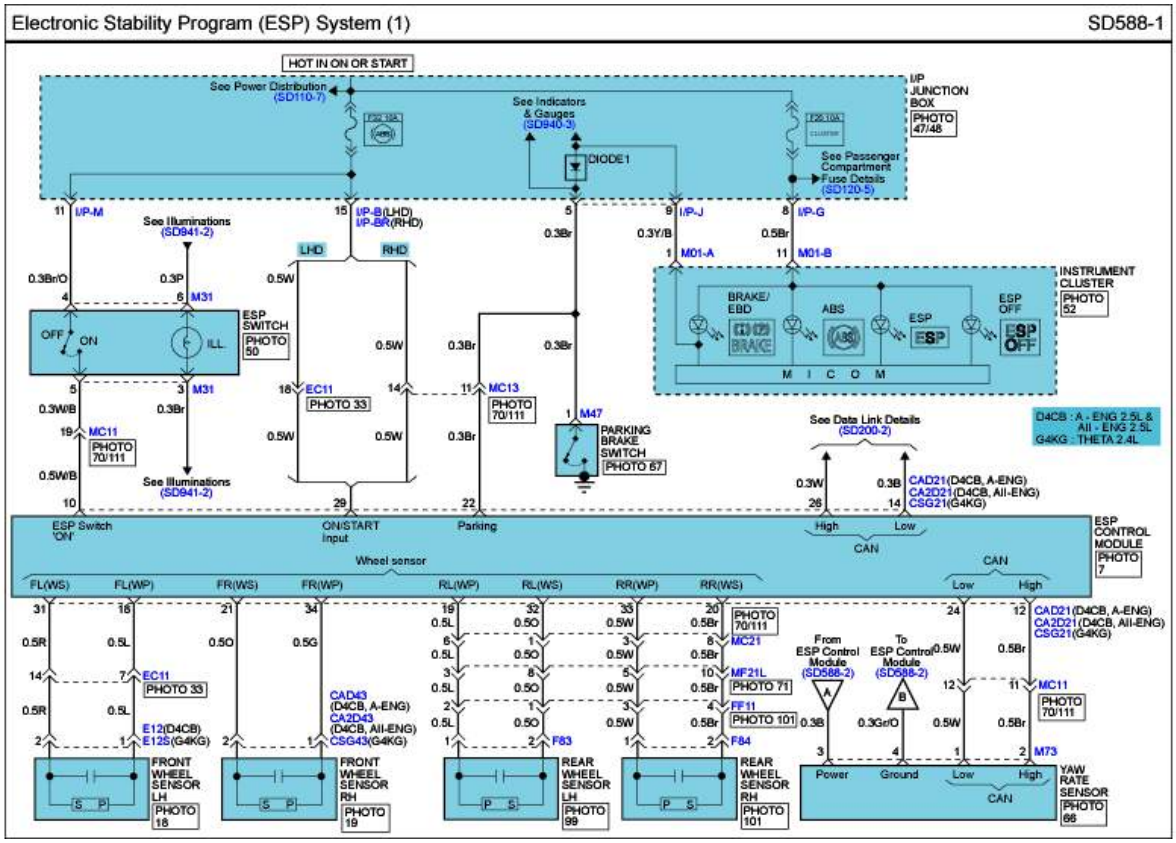

Anti-Lock Brake System (ABS) (3)
SD587-3
D4BH : 4D56 TCI 2.5L
HOT AT ALL TIMES
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47
HOT AT ALL TIMES
E/R FUSE & RELAY BOX RH
ABS 1 40A
ABS 2 40A
11
I/P-D(LHD)
I/P-DR(RHD)
RHD
LHD
0.85Gr
0.85Gr
0.85Gr
2.5W
3.0R
2
E60
STOP LAMP SWITCH
PHOTO 55
1
E60
11
ME13
PHOTO 11
0.85Br/O
See Stop Lamps (SD627-3)
0.5L/B
23
Stop Lamp Switch Signal
25
1
CMD41
ABS CONTROL MODULE
PHOTO 7
TCS SOLE-NOID
TCS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
M
ABS PUMP MOTOR
Ground
13
3.0B
38
2.5B
CMD41
GMD01
PHOTO 69

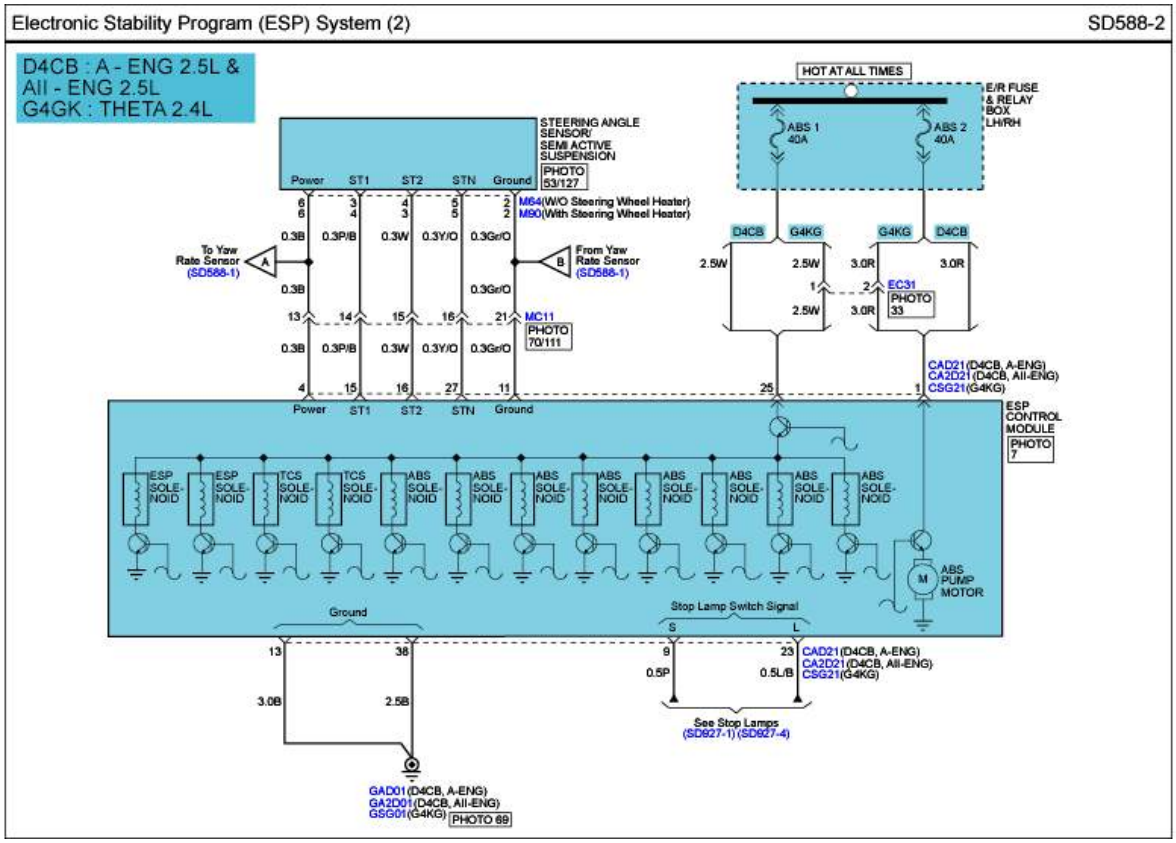

Anti-Lock Brake System (ABS) (4)
SD587-4
G4KG : THETA 2.4L
HOT WITH ENGINE CONTROL RELAY ON
HOT AT ALL TIMES
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
SNSR 2 15A
SNSR 1 10A
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47
ABS 1 40A
ABS 2 40A
E/R FUSE & RELAY BOX LH
1.25G
0.5R
EC11
PHOTO 33
I/P-D(LHD)
I/P-DR(RHD)
RHD
LHD
RHD
LHD
1.25G
0.5R
CSGJC1
JOINT CONNEC-TOR
PHOTO 70
See Power Distribution (SD110-5)
0.85Gr
0.85Gr
0.85Gr
0.85Gr
3.0W
3.0R
MC11
PHOTO 70/111
E60(LHD)
CSG58R(RHD)
STOP LAMP SWITCH
PHOTO 55
ME13
PHOTO 11
EC31
PHOTO 33
Ⓐ : Closed with brake pedal depressed
Ⓑ : Open with brake pedal depressed
E60(LHD)
CSG58R(RHD)
See Stop Lamps (SD627-4)
2.5W
3.0R
0.5L/B
Stop Lamp Switch Signal
CSG41
ABS CONTROL MODULE
PHOTO 7
TCS SOLE-NOID
TCS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS SOLE-NOID
ABS PUMP MOTOR
Ground
3.0B
2.5B
CSG41
GSG01
PHOTO 69

Anti-Lock Brake System (ABS) (5) SD587-5

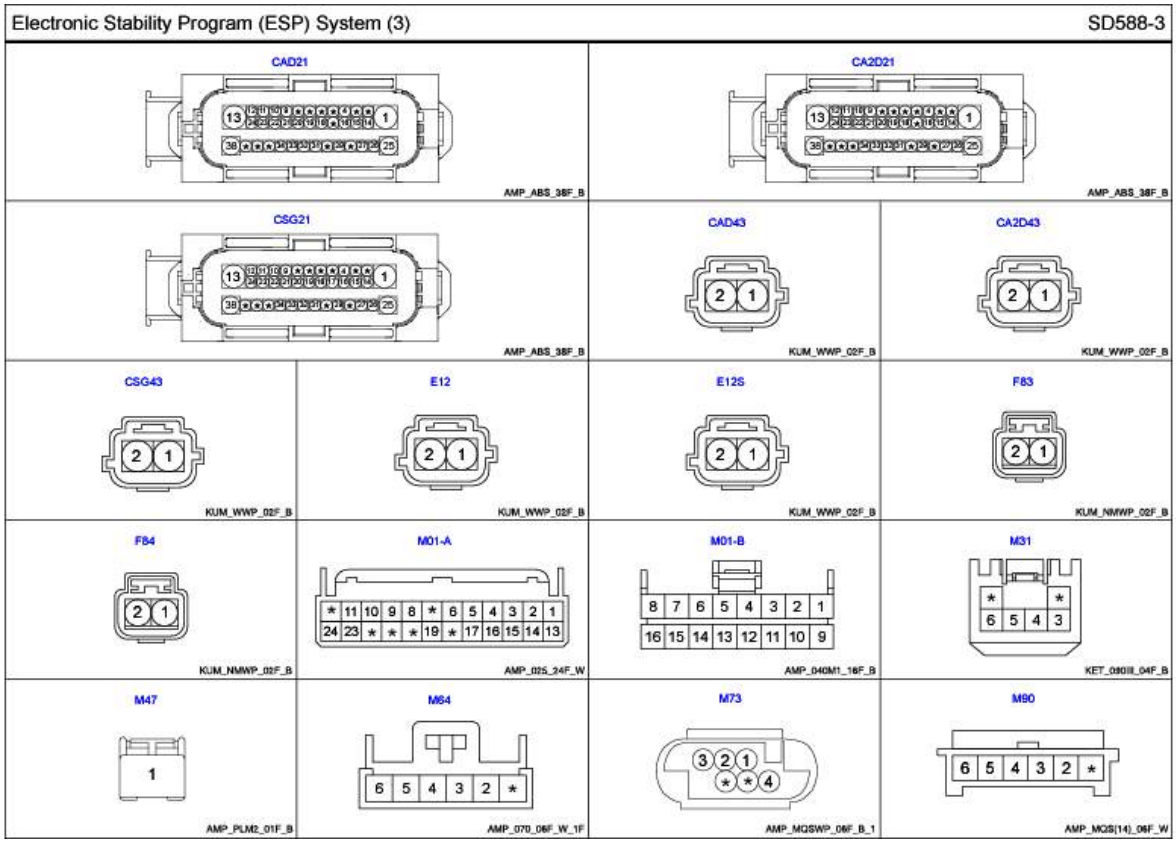


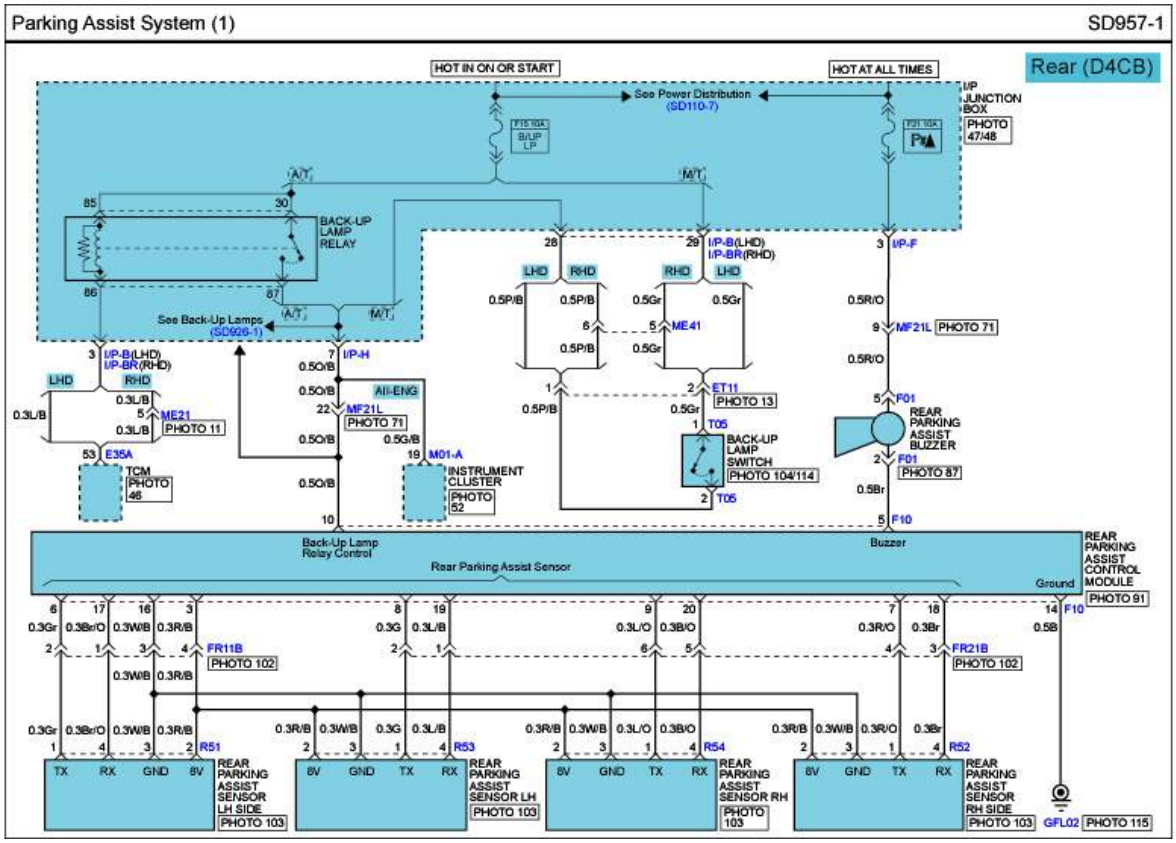

Anti-Lock Brake System (ABS) (6)
SD587-6
F84
2 1
KUM_NMWP_02F_B
M01-A
* 11 10 9 8 * 6 5 4 3 2 1
24 23 * * * 19 * 17 16 15 14 13
AMP_025_24F_W
M01-B
8 7 6 5 4 3 2 1
16 15 14 13 12 11 10 9
AMP_040M1_16F_B
M47
1
AMP_PLM2_01F_B

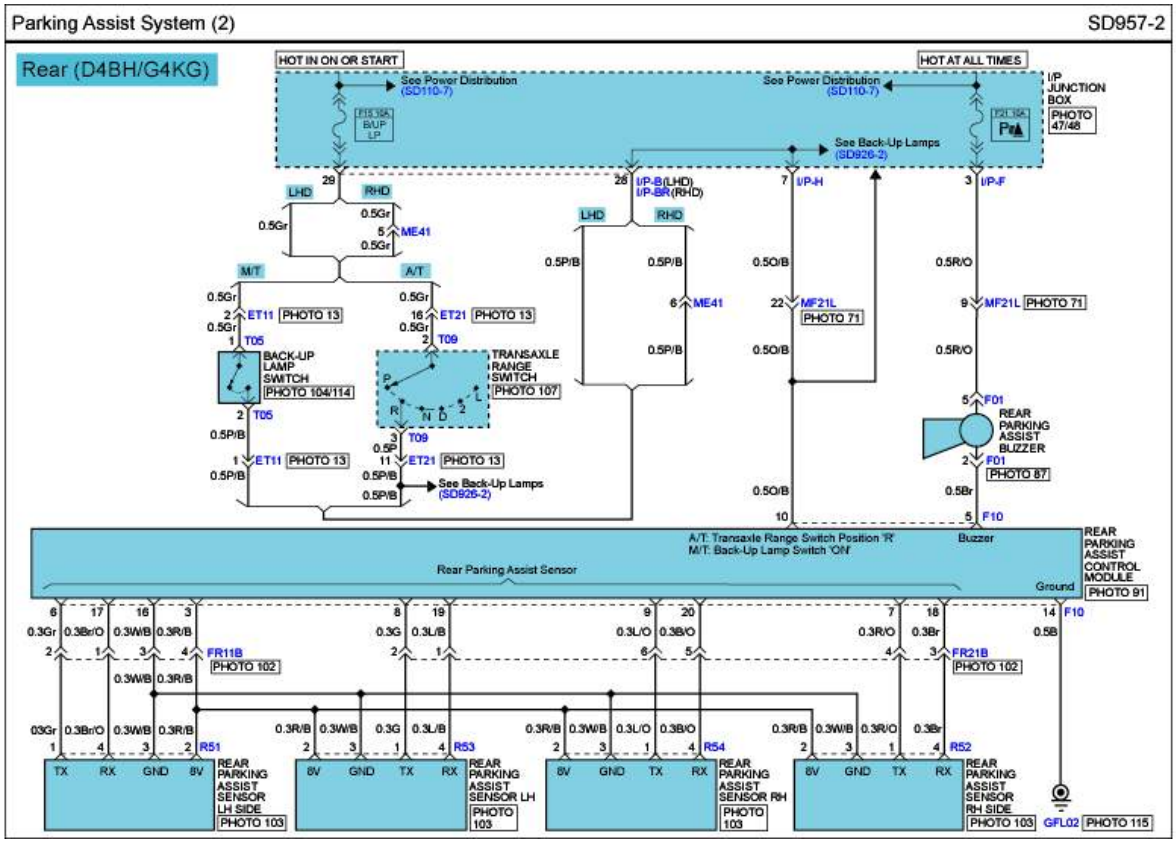

Electronic Stability Program (ESP) System (1)
SD588-1
HOT IN ON OR START
See Power Distribution (SD110-7)
See Indicators & Gauges (SD940-3)
DIODE1
See Passenger Compartment Fuse Details (SD120-5)
I/P JUNCTION BOX
PHOTO 47/48
I/P-M
See Illuminations (SD941-2)
I/P-B(LHD) I/P-BR(RHD)
LHD
RHD
I/P-J
I/P-G
M01-A
M01-B
INSTRUMENT CLUSTER
PHOTO 52
BRAKE/ EBD
ABS
ESP
ESP OFF
M I C O M
ESP SWITCH
PHOTO 50
OFF
ON
ILL
M31
MC11
PHOTO 70/111
EC11
PHOTO 33
MC13
PHOTO 70/111
M47
PARKING BRAKE SWITCH
PHOTO 67
See Data Link Details (SD200-2)
D4CB : A - ENG 2.5L & All - ENG 2.5L
G4KG : THETA 2.4L
CAD21(D4CB, A-ENG)
CA2D21(D4CB, All-ENG)
CSG21(G4KG)
ESP Switch 'ON'
ON/START Input
Parking
High
Low
CAN
ESP CONTROL MODULE
PHOTO 7
Wheel sensor
FL(WS)
FL(WP)
FR(WS)
FR(WP)
RL(WP)
RL(WS)
RR(WP)
RR(WS)
PHOTO 70/111
MC21
MF21L
PHOTO 71
FF11
PHOTO 101
F83
F84
From ESP Control Module (SD588-2)
To ESP Control Module (SD588-2)
MC11
PHOTO 70/111
M73
Power
Ground
YAW RATE SENSOR
PHOTO 66
E12(D4CB)
E125(G4KG)
CAD43 (D4CB, A-ENG)
CA2D43 (D4CB, All-ENG)
CSG43(G4KG)
FRONT WHEEL SENSOR LH
PHOTO 18
FRONT WHEEL SENSOR RH
PHOTO 19
REAR WHEEL SENSOR LH
PHOTO 99
REAR WHEEL SENSOR RH
PHOTO 101


Electronic Stability Program (ESP) System (2)
SD588-2
D4CB : A - ENG 2.5L &
AII - ENG 2.5L
G4GK : THETA 2.4L
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH/RH
ABS 1 40A
ABS 2 40A
STEERING ANGLE SENSOR/ SEMI ACTIVE SUSPENSION
PHOTO 53/127
Power ST1 ST2 STN Ground
M64(W/O Steering Wheel Heater)
M90(With Steering Wheel Heater)
To Yaw Rate Sensor (SD588-1)
From Yaw Rate Sensor (SD588-1)
MC11
PHOTO 70/111
EC31
PHOTO 33
CAD21(D4CB, A-ENG)
CA2D21(D4CB, AII-ENG)
CSG21(G4KG)
ESP CONTROL MODULE
PHOTO 7
ESP SOLE-NOID
TCS SOLE-NOID
ABS SOLE-NOID
ABS PUMP MOTOR
Ground
Stop Lamp Switch Signal
See Stop Lamps (SD927-1) (SD927-4)
GAD01(D4CB, A-ENG)
GA2D01(D4CB, AII-ENG)
GSG01(G4KG)
PHOTO 69

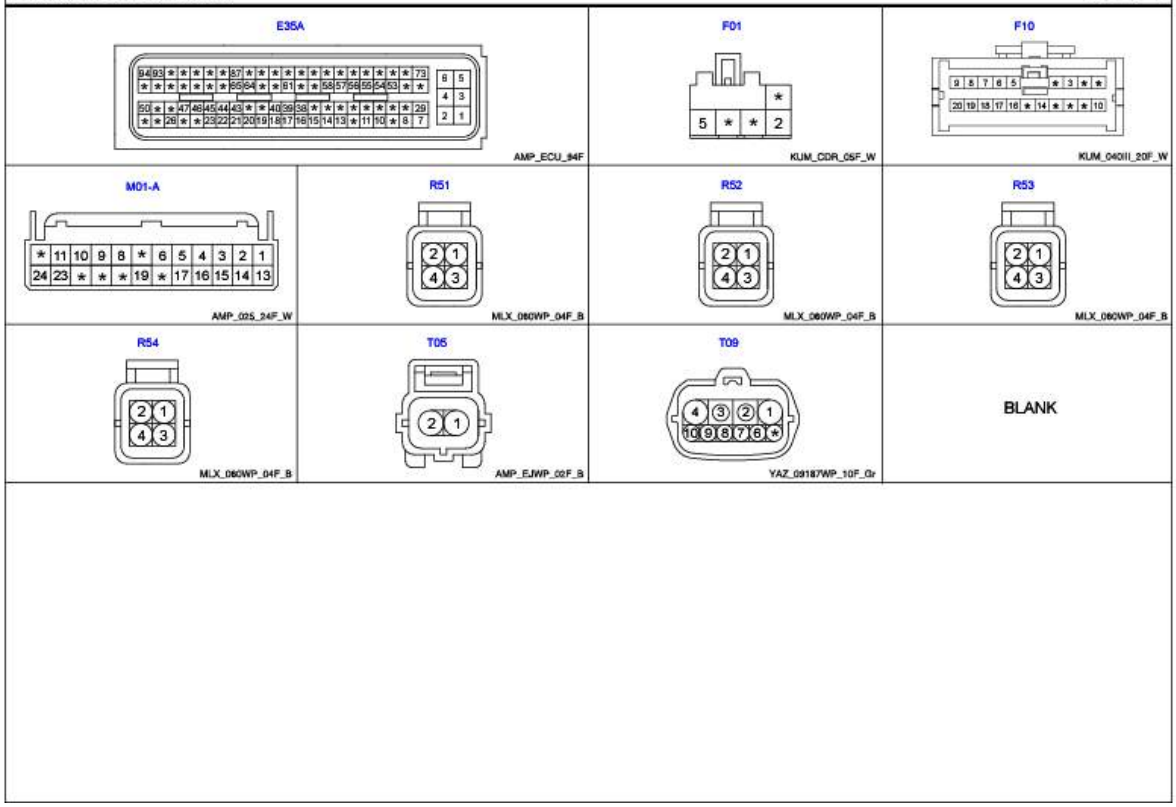
Electronic Stability Program (ESP) System (3) SD588-3




Parking Assist System (1)
SD957-1
Rear (D4CB)
HOT IN ON OR START
HOT AT ALL TIMES
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47/48
BACK-UP LAMP RELAY
See Back-Up Lamps (SD926-1)
I/P-B(LHD) I/P-BR(RHD)
I/P-H
I/P-F
ME21
PHOTO 11
E35A
TCM
PHOTO 46
All-ENG
MF21L
PHOTO 71
M01-A
INSTRUMENT CLUSTER
PHOTO 52
ME41
ET11
PHOTO 13
T05
BACK-UP LAMP SWITCH
PHOTO 104/114
F01
REAR PARKING ASSIST BUZZER
PHOTO 87
F10
Back-Up Lamp Relay Control
Rear Parking Assist Sensor
Buzzer
Ground
REAR PARKING ASSIST CONTROL MODULE
PHOTO 91
FR11B
FR21B
PHOTO 102
R51
R52
R53
R54
REAR PARKING ASSIST SENSOR LH SIDE
REAR PARKING ASSIST SENSOR RH SIDE
REAR PARKING ASSIST SENSOR LH
REAR PARKING ASSIST SENSOR RH
PHOTO 103
GFL02
PHOTO 115


Parking Assist System (2)
SD957-2
Rear (D4BH/G4KG)
HOT IN ON OR START
HOT AT ALL TIMES
See Power Distribution (SD110-7)
See Back-Up Lamps (SD926-2)
I/P JUNCTION BOX
PHOTO 47/48
LHD
RHD
M/T
A/T
ET11 PHOTO 13
ET21 PHOTO 13
BACK-UP LAMP SWITCH
PHOTO 104/114
TRANSAXLE RANGE SWITCH
PHOTO 107
I/P-B(LHD) I/P-BR(RHD)
I/P-H
I/P-F
MF21L PHOTO 71
REAR PARKING ASSIST BUZZER
PHOTO 87
A/T: Transaxle Range Switch Position 'R'
M/T: Back-Up Lamp Switch 'ON'
Buzzer
Rear Parking Assist Sensor
Ground
REAR PARKING ASSIST CONTROL MODULE
PHOTO 91
FR11B PHOTO 102
FR21B PHOTO 102
R51 REAR PARKING ASSIST SENSOR LH SIDE PHOTO 103
R53 REAR PARKING ASSIST SENSOR LH PHOTO 103
R54 REAR PARKING ASSIST SENSOR RH PHOTO 103
R52 REAR PARKING ASSIST SENSOR RH SIDE PHOTO 103
GFL02 PHOTO 115

Parking Assist System (3) SD957-3



Component Locations (1) CL-1

PHOTO.1

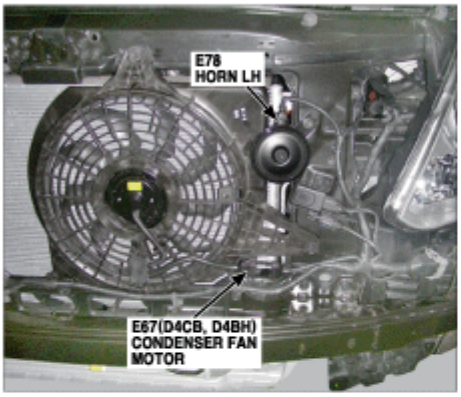


PHOTO.2

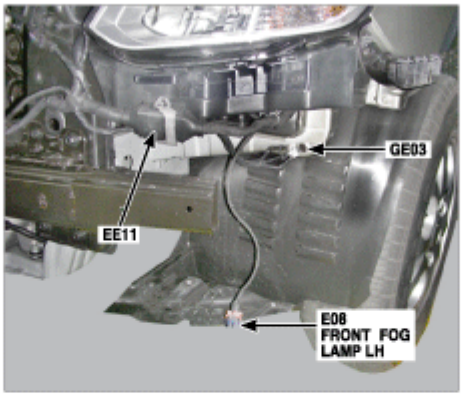


PHOTO.3

PHOTO.4

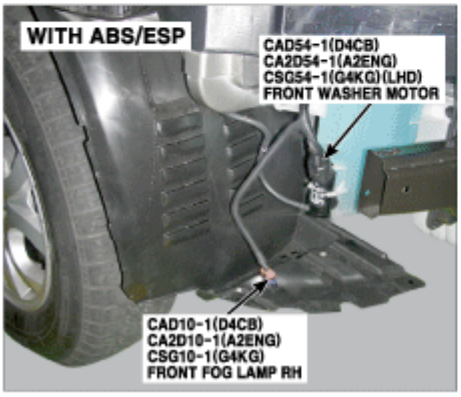


PHOTO.5

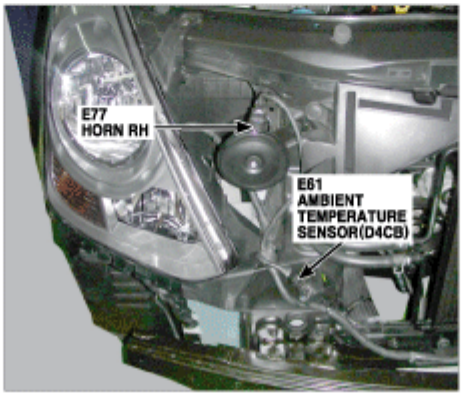
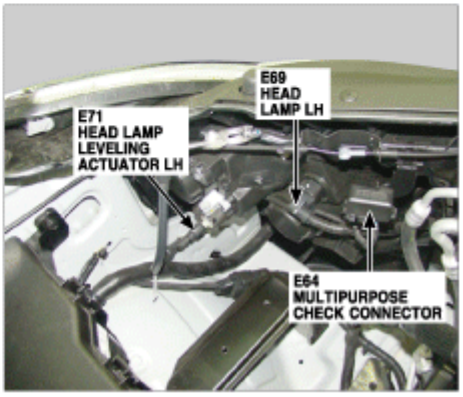


PHOTO.6



Component Locations (2) CL-2

PHOTO.7

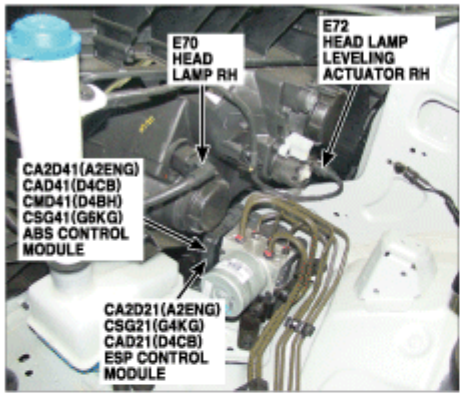


PHOTO.8

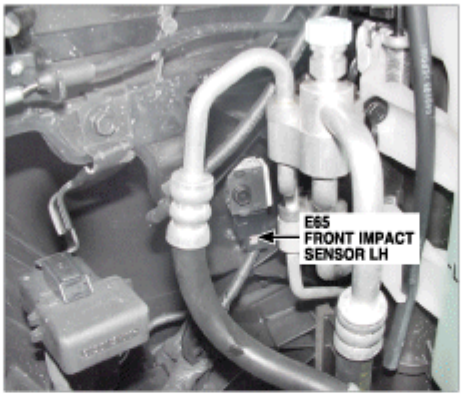


PHOTO.9

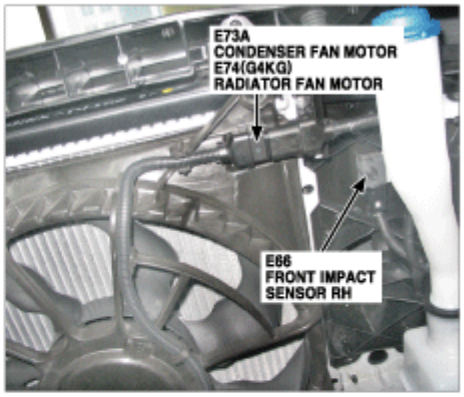


PHOTO.10

PHOTO.11

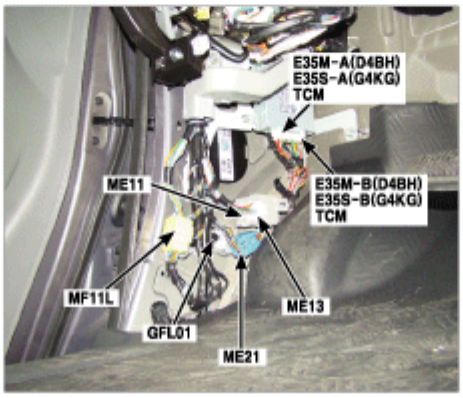


PHOTO.12

Component Locations (3) CL-3

PHOTO.13

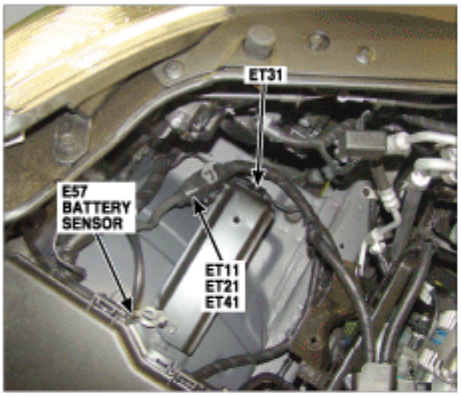


PHOTO.14

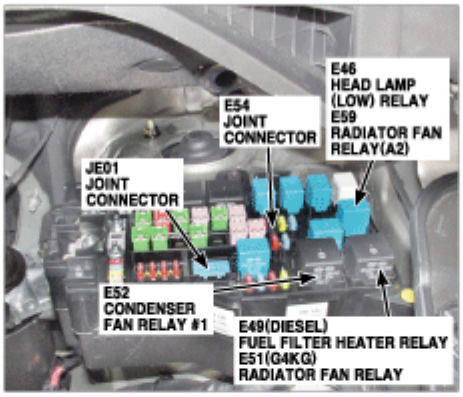


PHOTO.15

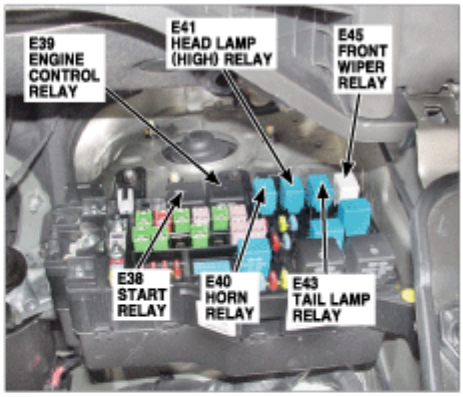


PHOTO.16

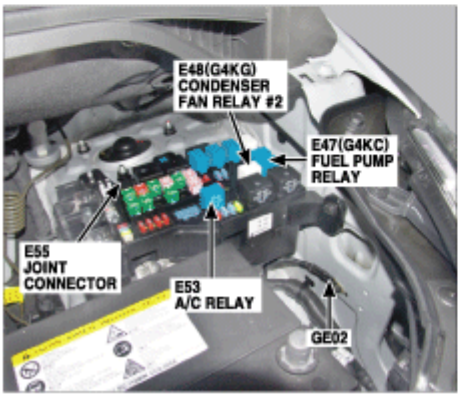


PHOTO.17

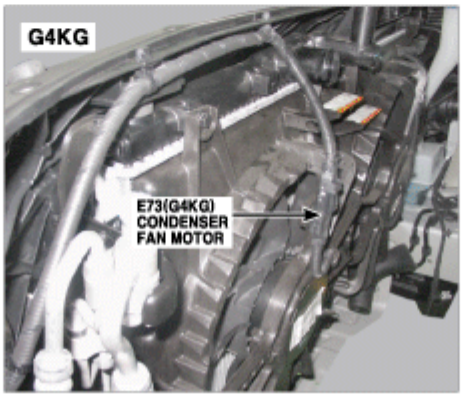
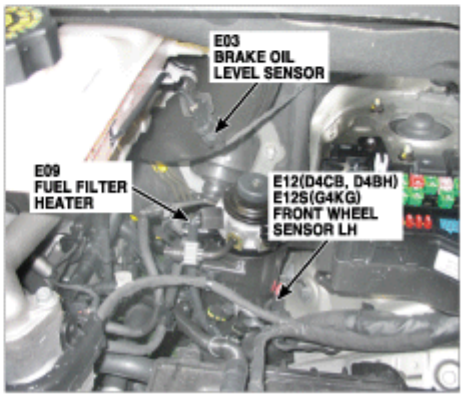


PHOTO.18



Component Locations (4) CL-4

PHOTO.19

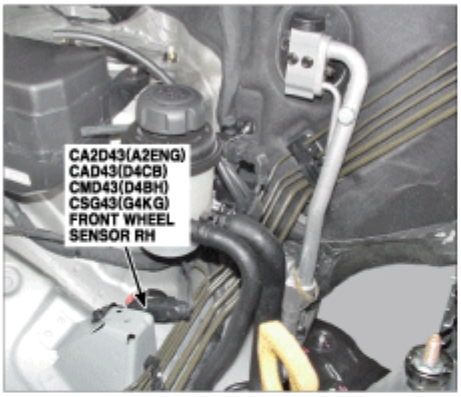


PHOTO.20

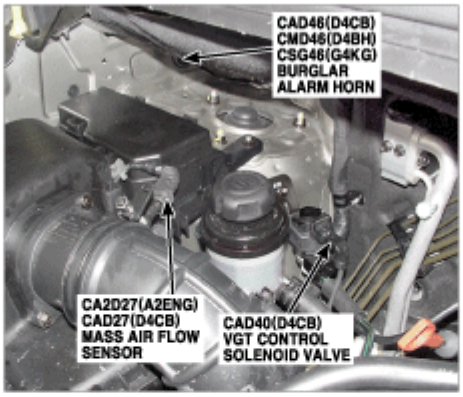


PHOTO.21

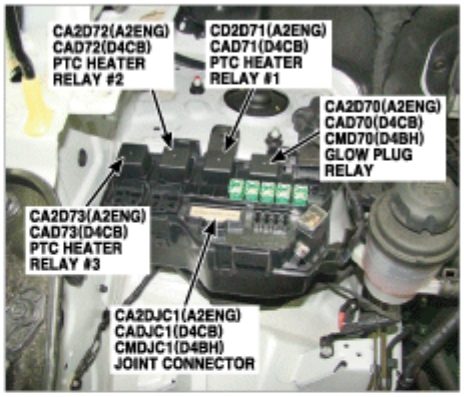


PHOTO.22

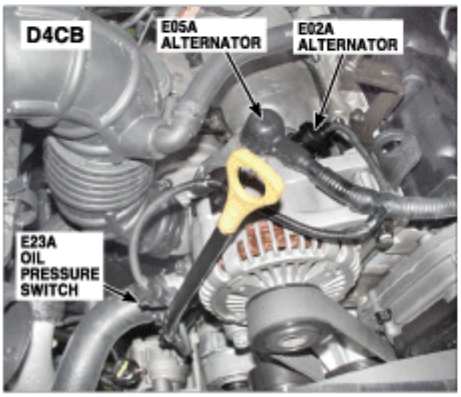


PHOTO.23

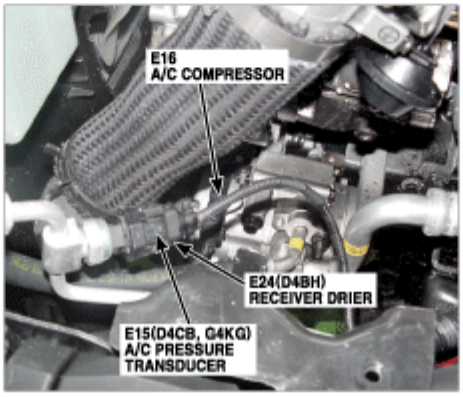
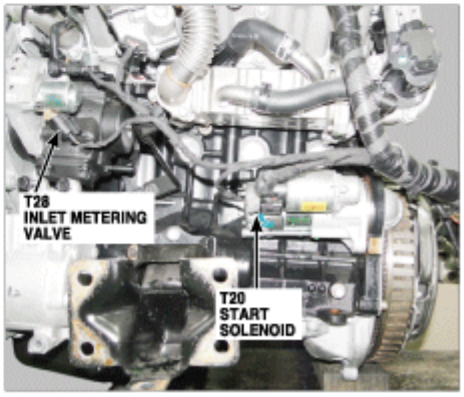


PHOTO.24



Component Locations (5) CL-5

PHOTO.25

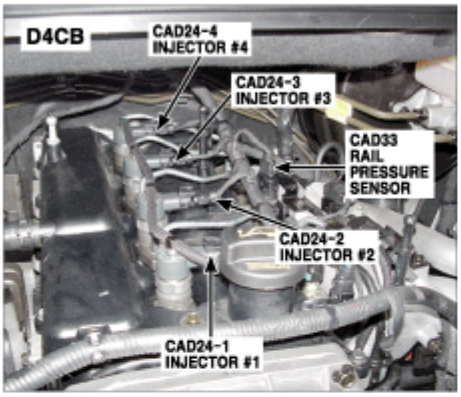


PHOTO.26

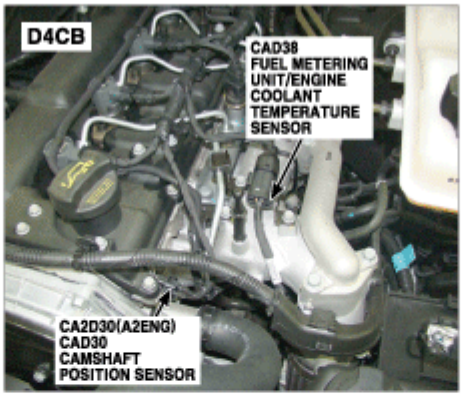


PHOTO.27

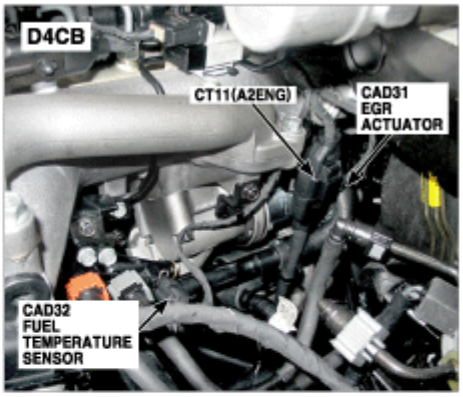


PHOTO.28

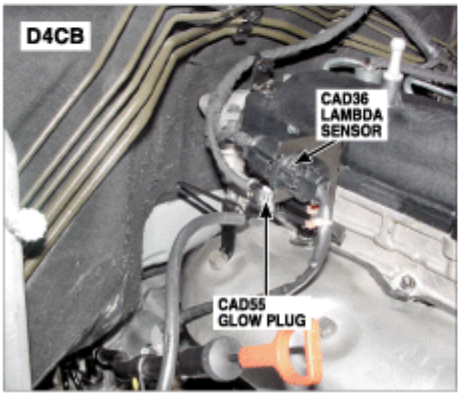


PHOTO.29

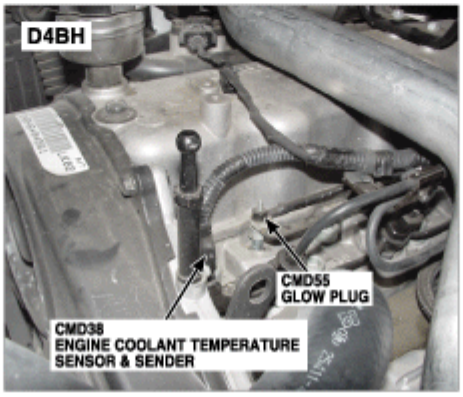
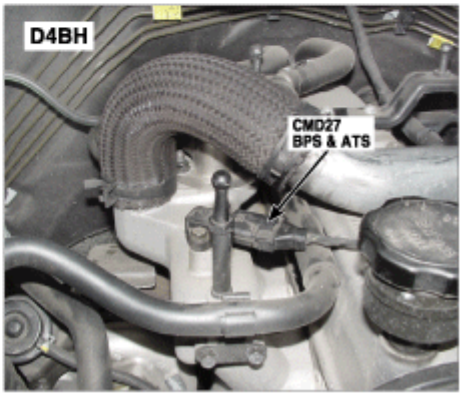


PHOTO.30



Component Locations (6) CL-6

PHOTO.31

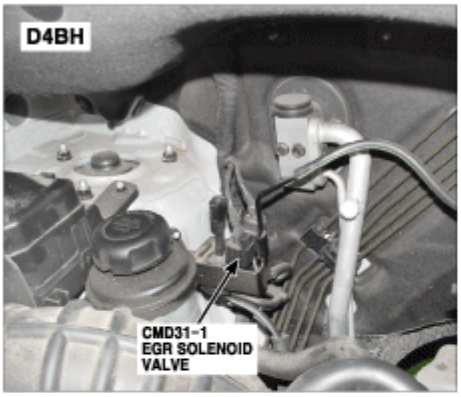


PHOTO.32

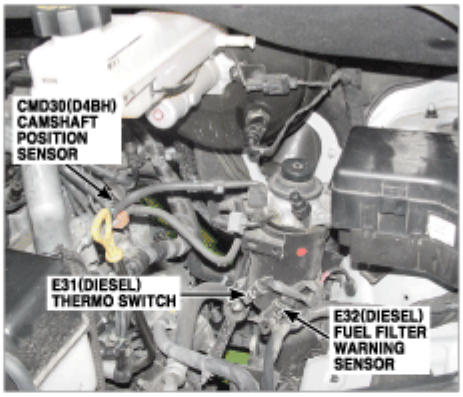


PHOTO.33

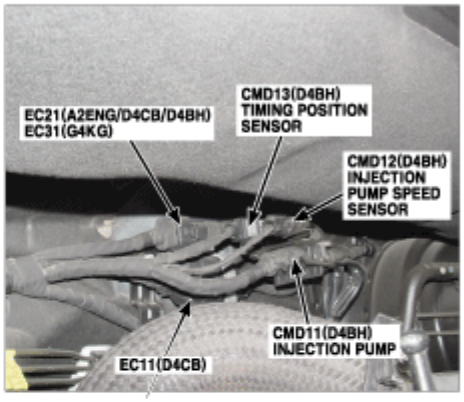


PHOTO.34

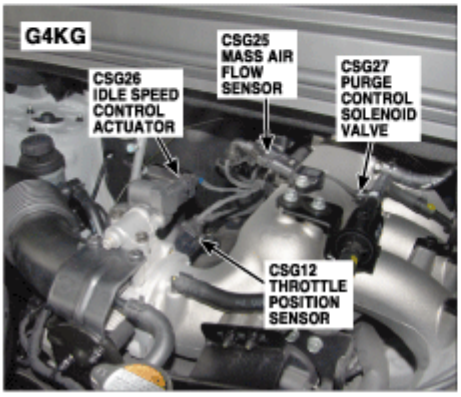


PHOTO.35

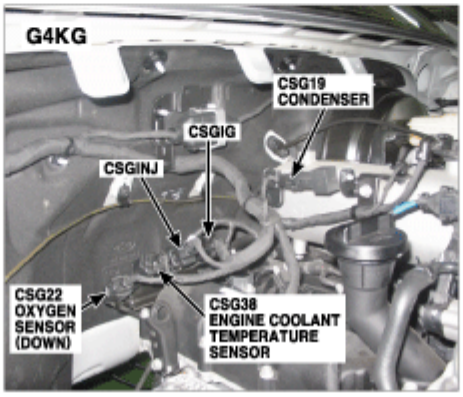
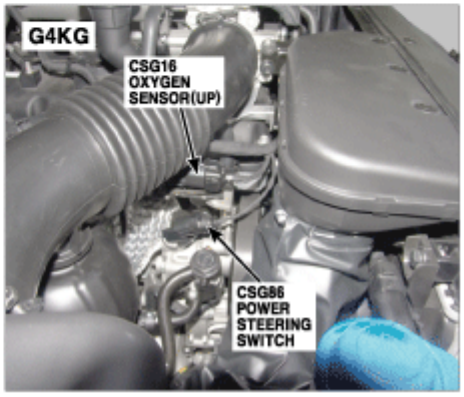


PHOTO.36



Component Locations (7)

PHOTO.37

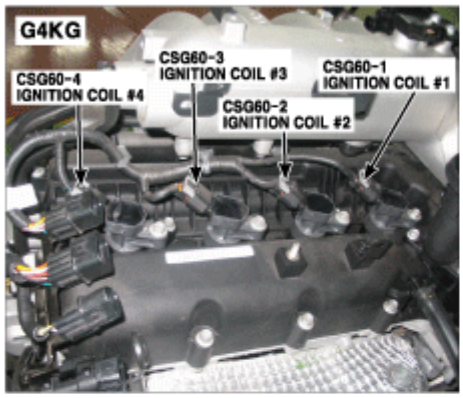


PHOTO.38

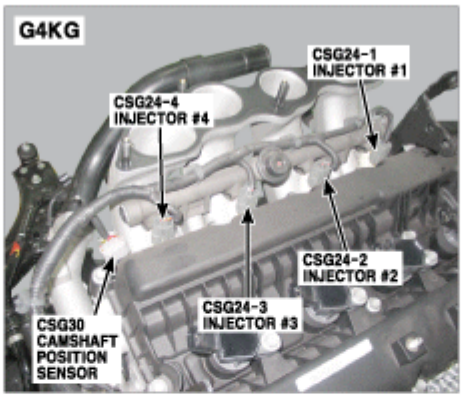


PHOTO.39

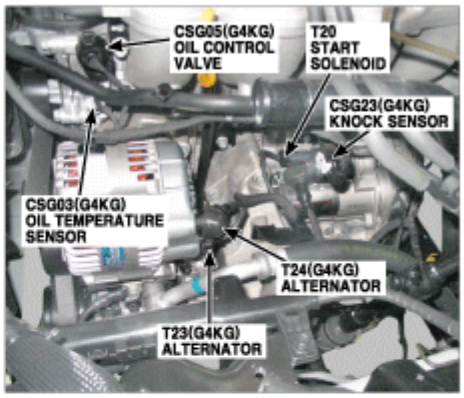


PHOTO.40

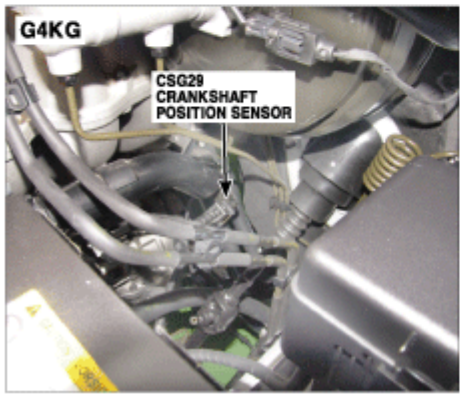


PHOTO.41

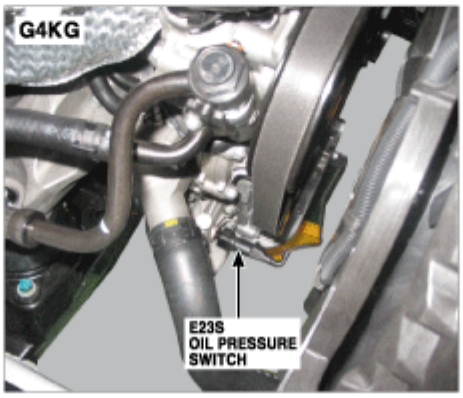
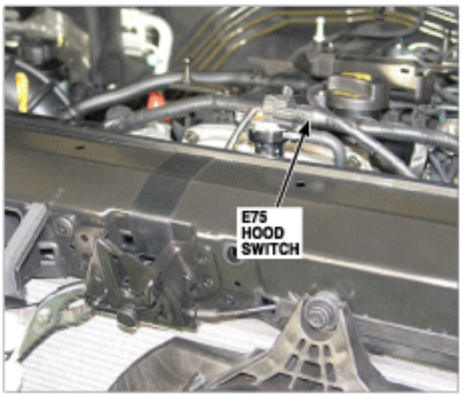


PHOTO.42



Component Locations (8) CL-8

PHOTO.43

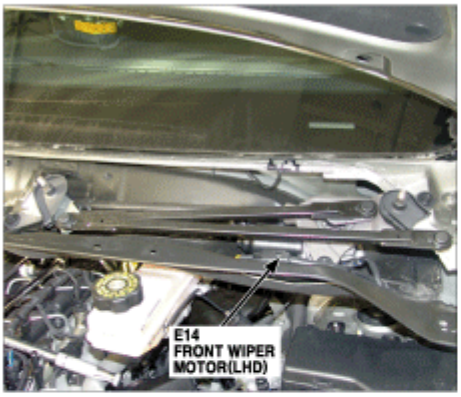


PHOTO.44

PHOTO.45

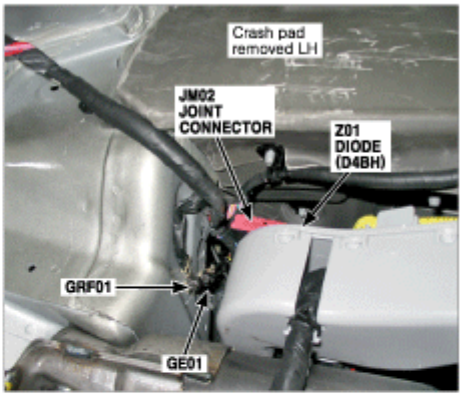


PHOTO.46

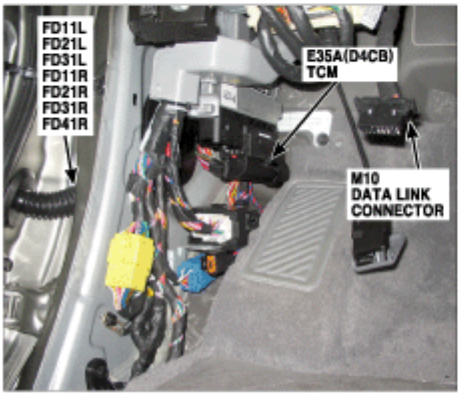


PHOTO.47

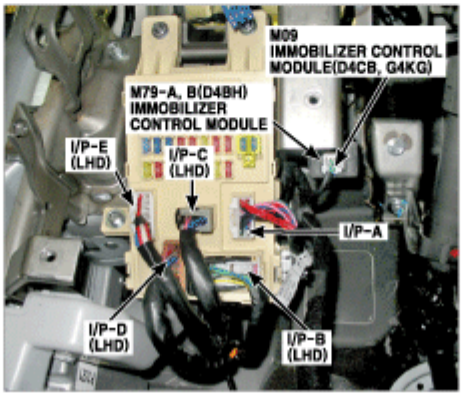
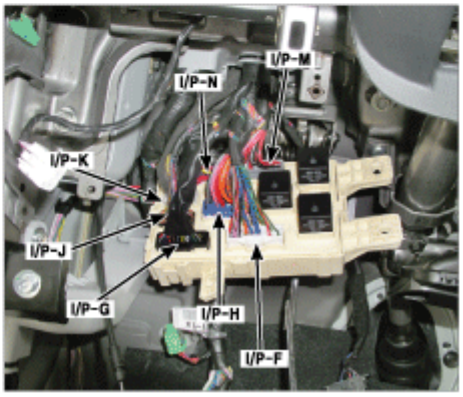


PHOTO.48



Component Locations (9) CL-9

PHOTO.49

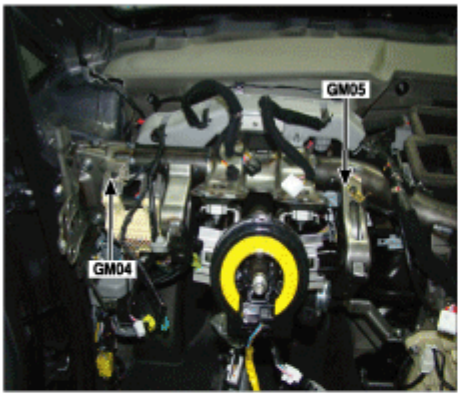


PHOTO.50

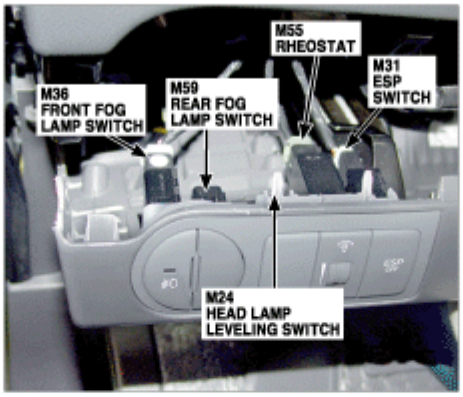


PHOTO.51

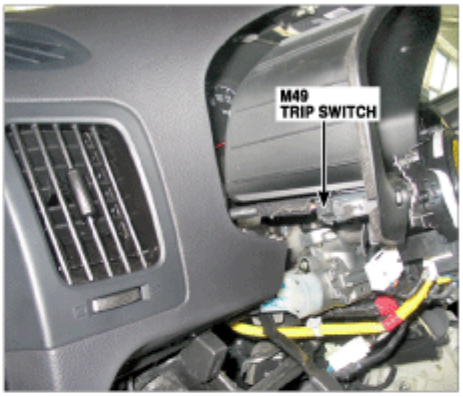


PHOTO.52

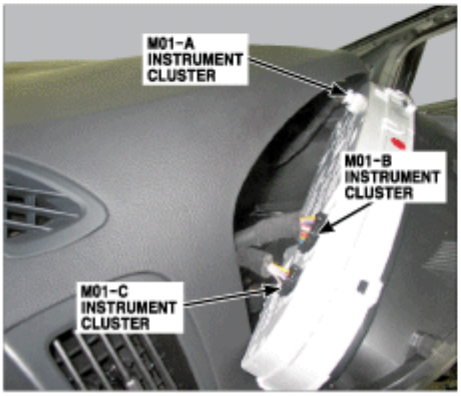


PHOTO.53

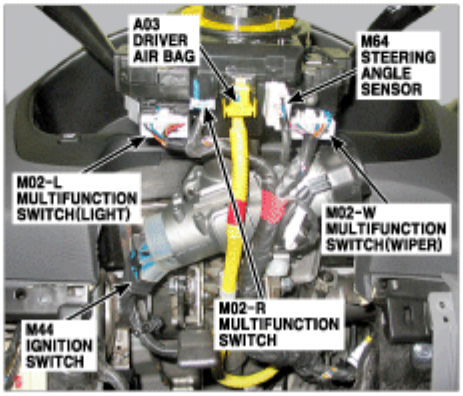
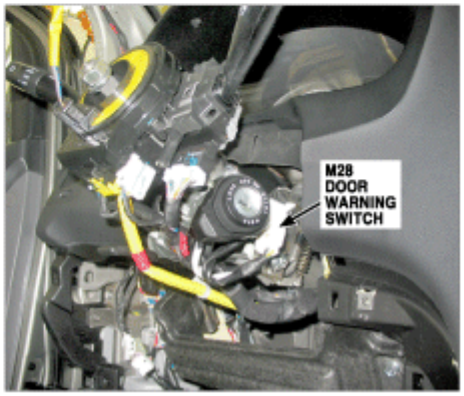


PHOTO.54



Component Locations (10) CL-10

PHOTO.55

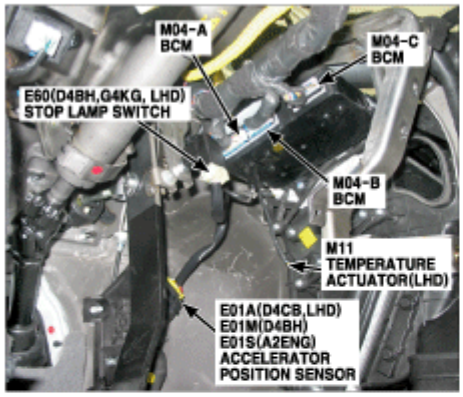


PHOTO.56

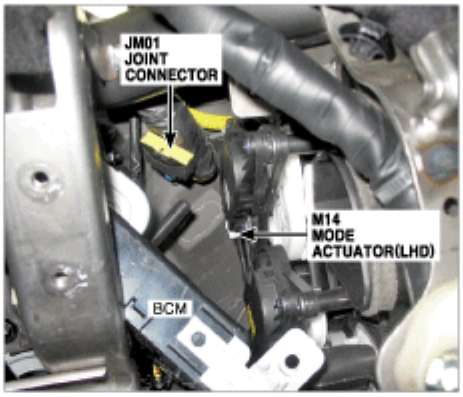


PHOTO.57

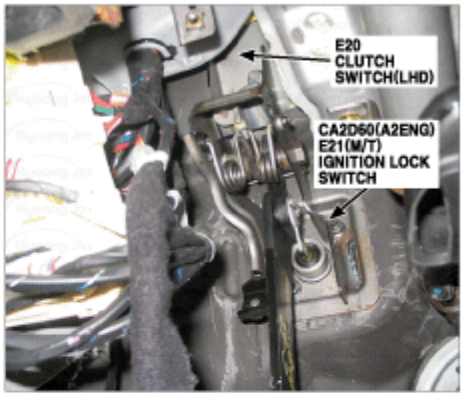


PHOTO.58

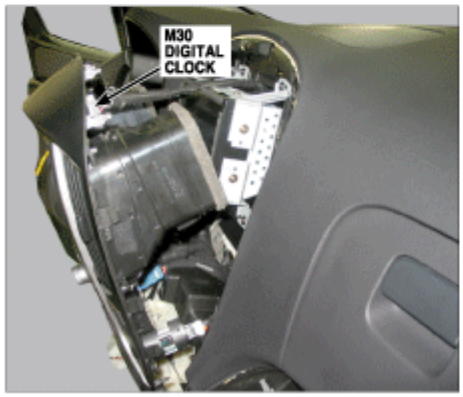


PHOTO.59

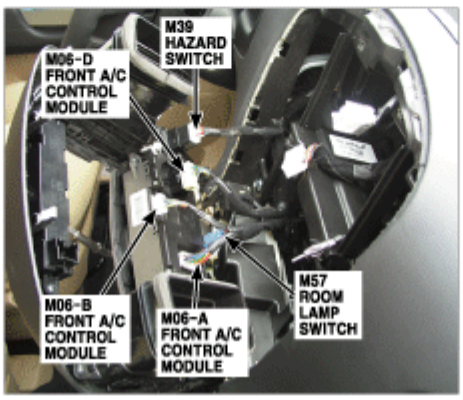
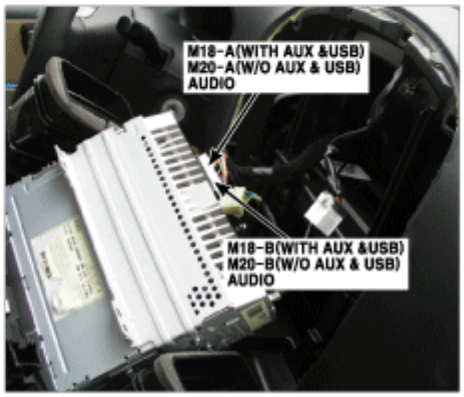


PHOTO.60



Component Locations (11) CL-11

PHOTO.61

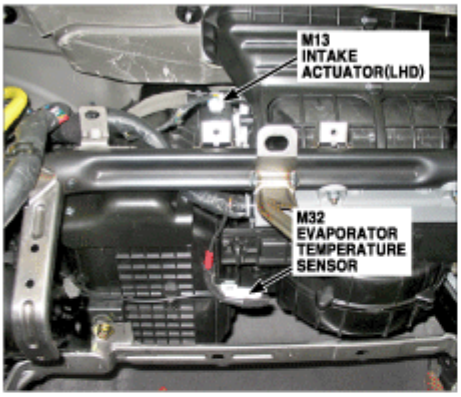


PHOTO.62

PHOTO.63

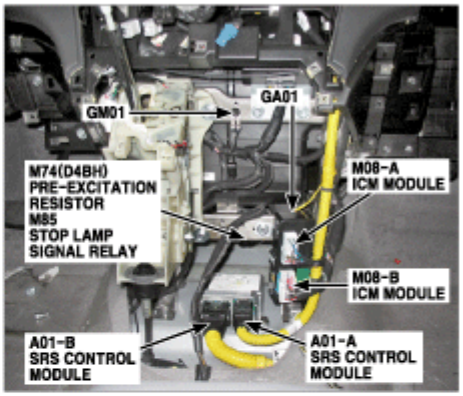


PHOTO.64

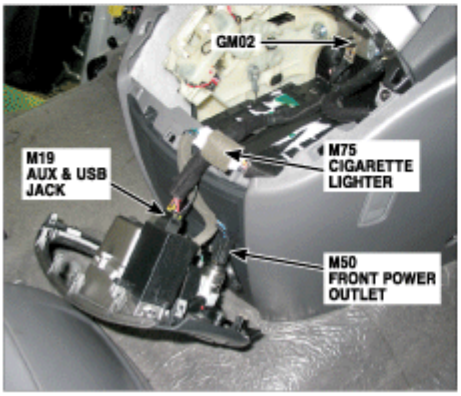


PHOTO.65

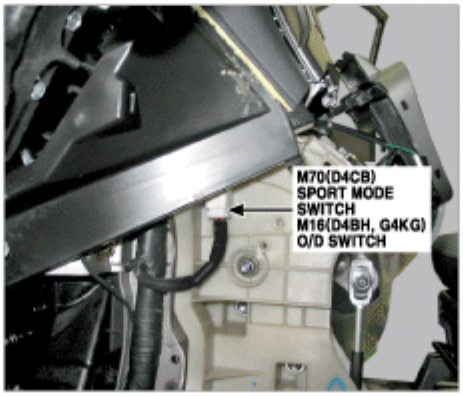
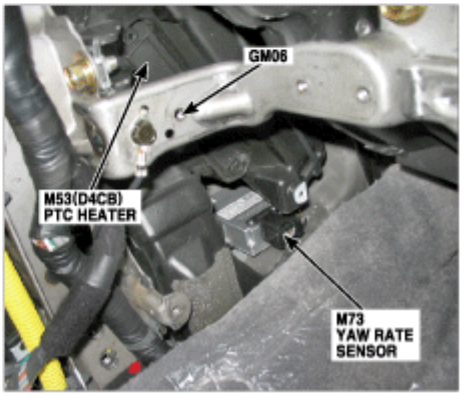


PHOTO.66



Component Locations (12) CL-12

PHOTO.67

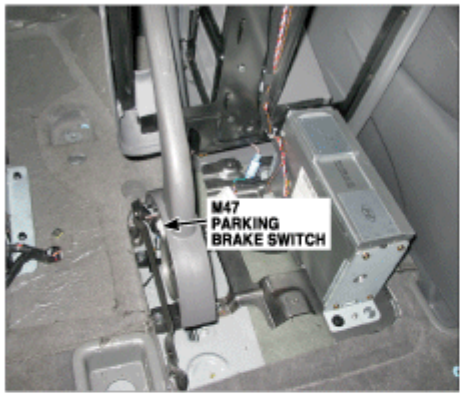


PHOTO.68

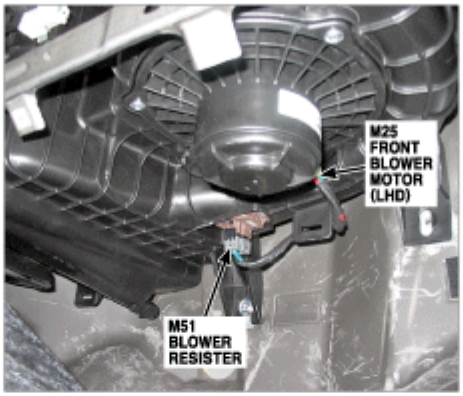


PHOTO.69

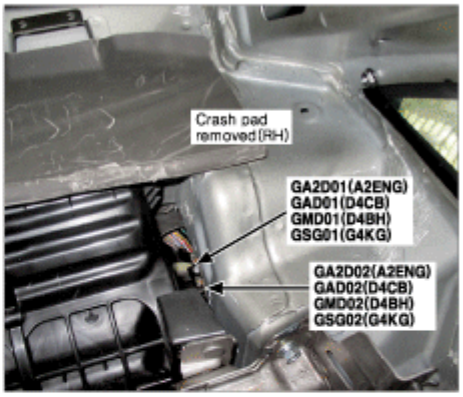


PHOTO.70

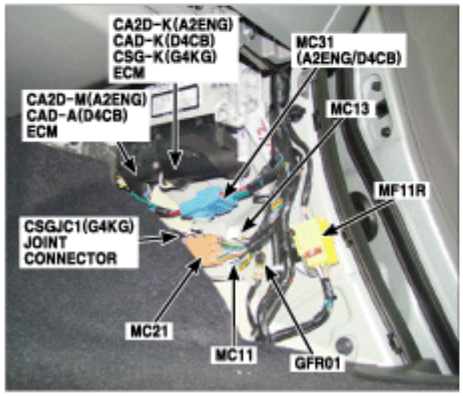


PHOTO.71

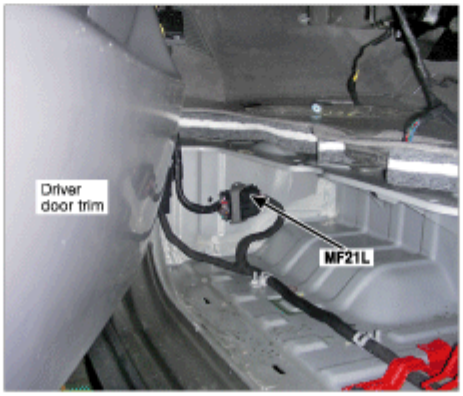
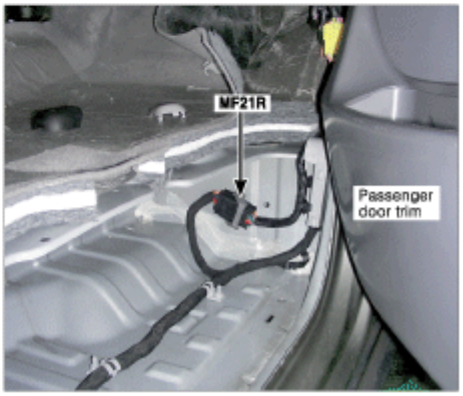


PHOTO.72



Component Locations (13) CL-13

PHOTO.73

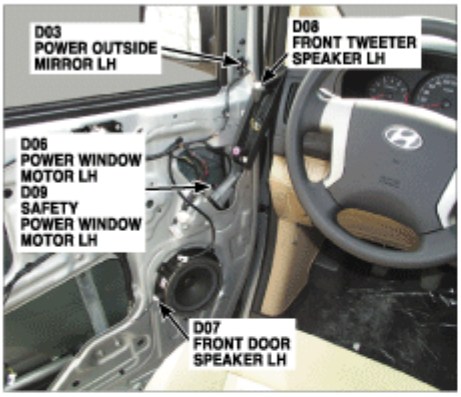


PHOTO.74

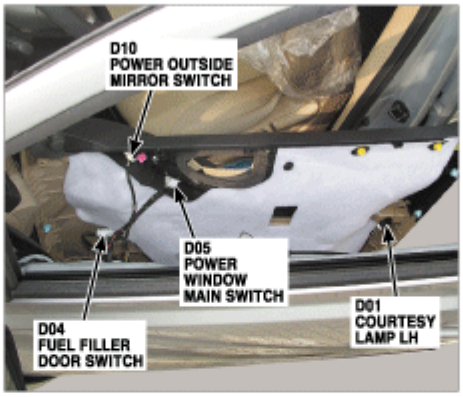


PHOTO.75

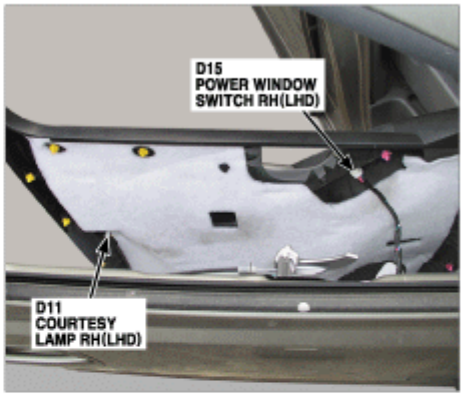


PHOTO.76

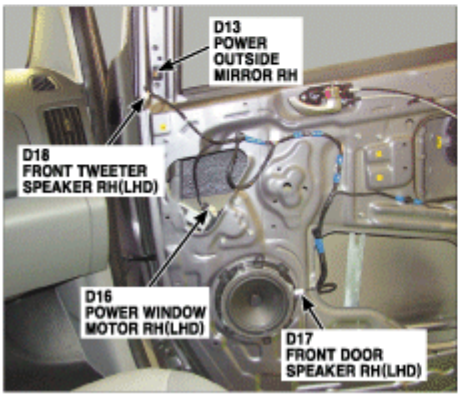


PHOTO.77

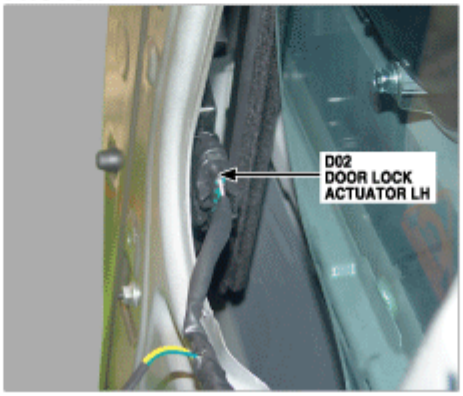
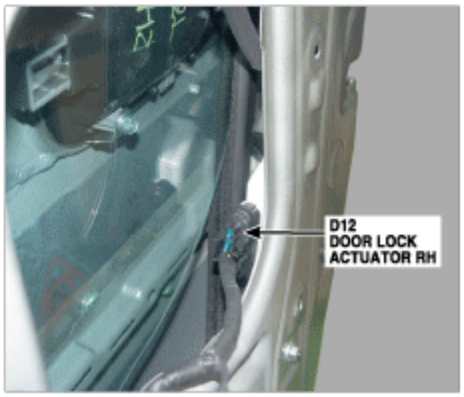


PHOTO.78



Component Locations (14)

PHOTO.79

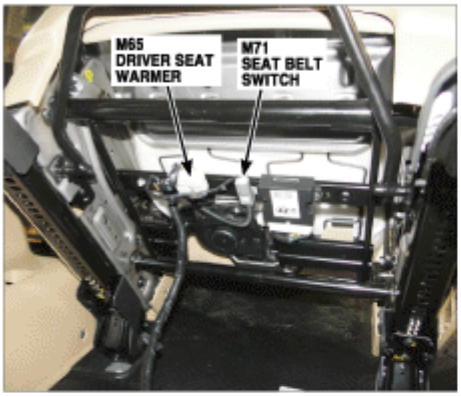


PHOTO.80

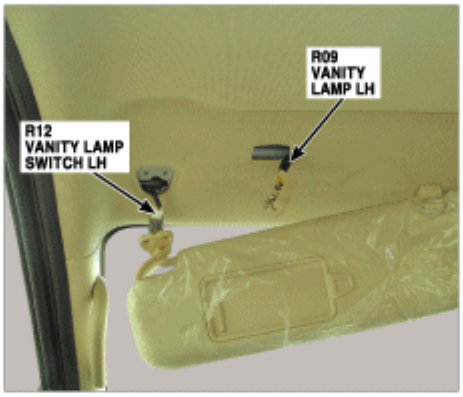


PHOTO.81

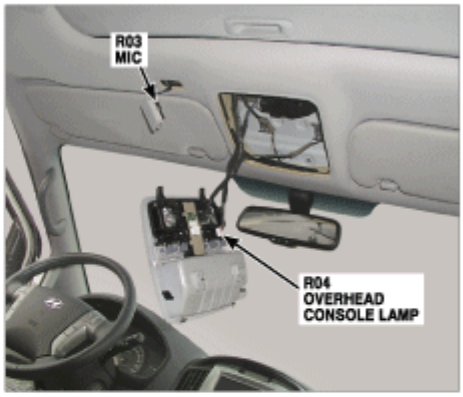


PHOTO.82

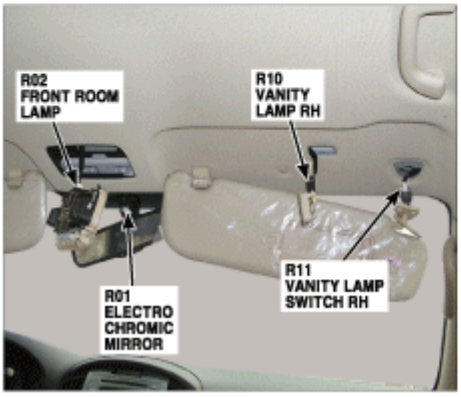


PHOTO.83

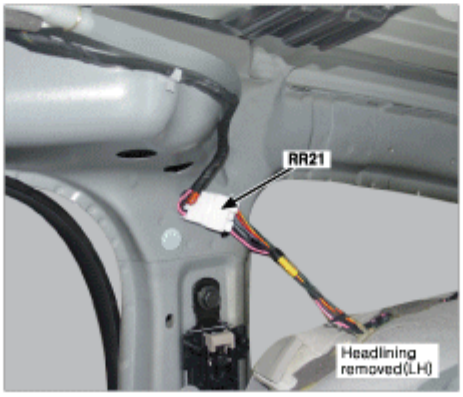
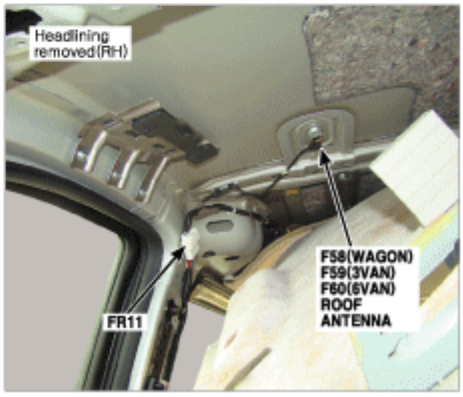


PHOTO.84



Component Locations (15) CL-15

PHOTO.85

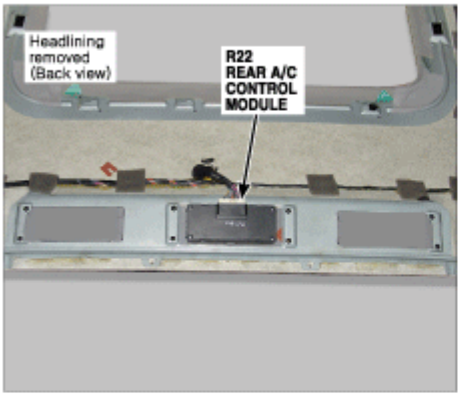


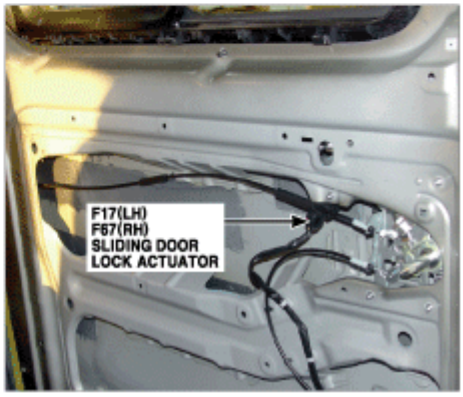
PHOTO.86

PHOTO.87

PHOTO.88

PHOTO.89

PHOTO.90



Component Locations (16) CL-16

PHOTO.91

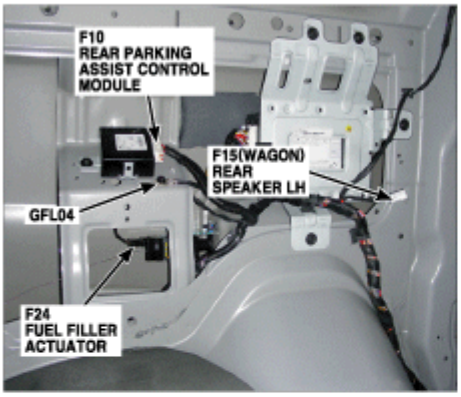


PHOTO.92

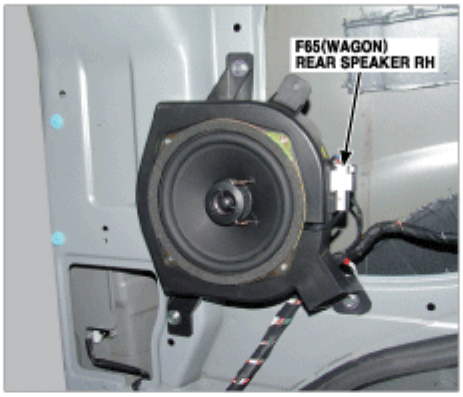


PHOTO.93

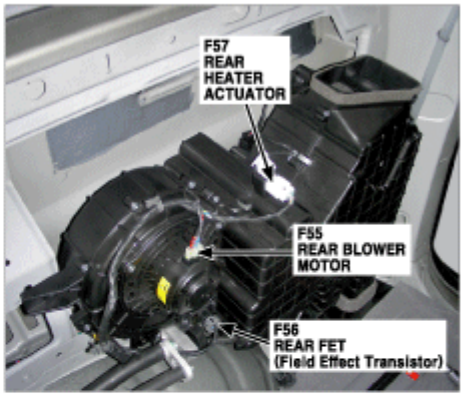


PHOTO.94

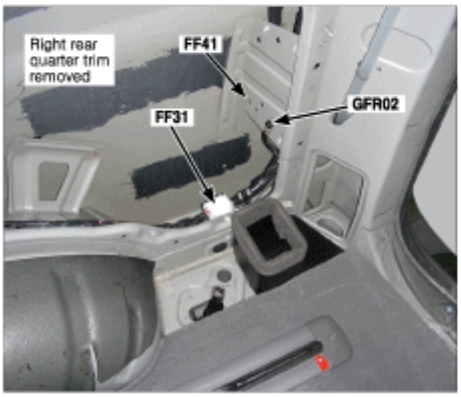
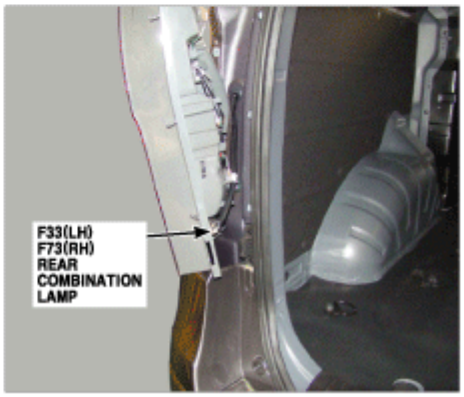


PHOTO.95

PHOTO.96



Component Locations (17) CL-17

PHOTO.97

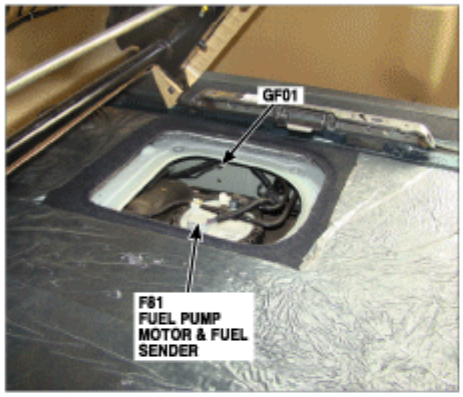


PHOTO.98

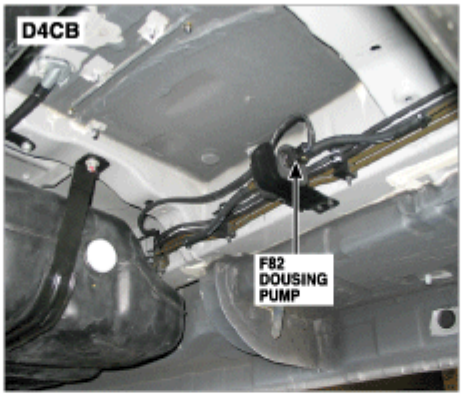


PHOTO.99

PHOTO.100

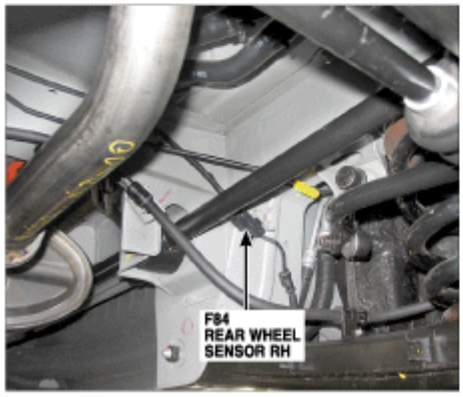
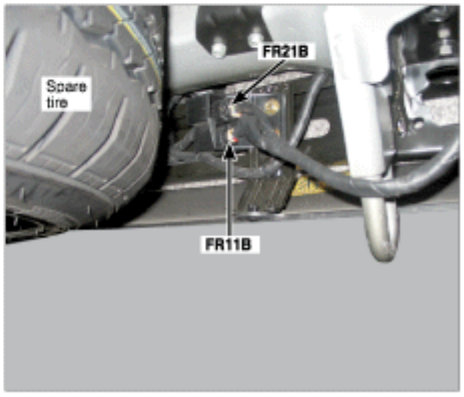


PHOTO.101

PHOTO.102



Component Locations (18) CL-18

PHOTO.103

PHOTO.104

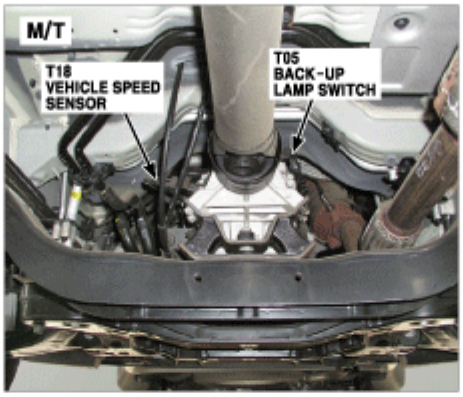


PHOTO.105

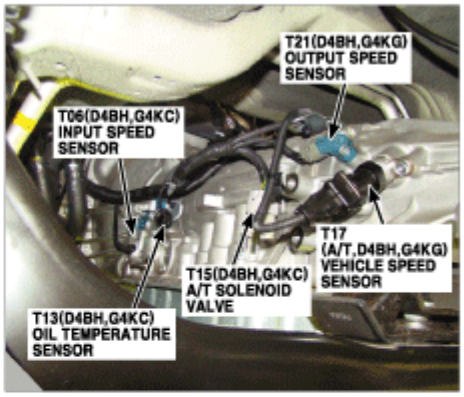


PHOTO.106

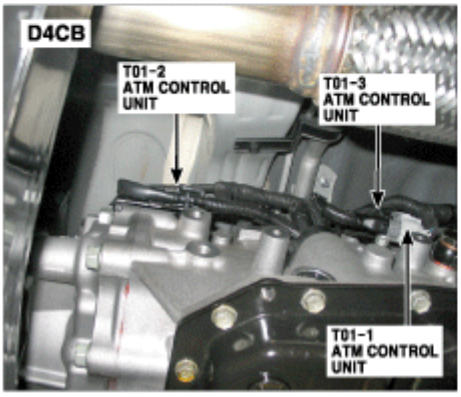


PHOTO.107

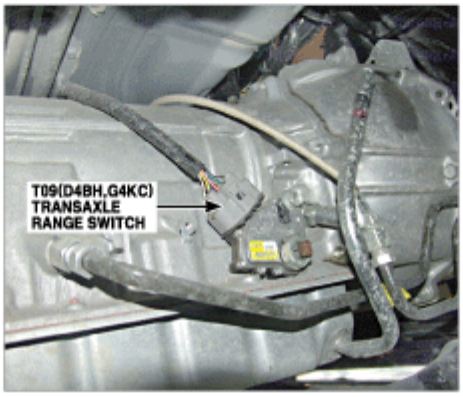
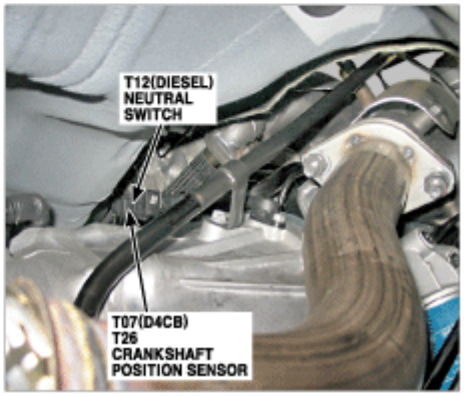


PHOTO.108



Component Locations (19) CL-19

PHOTO.109

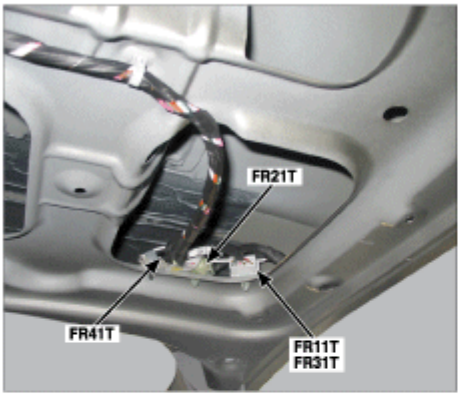


PHOTO.110

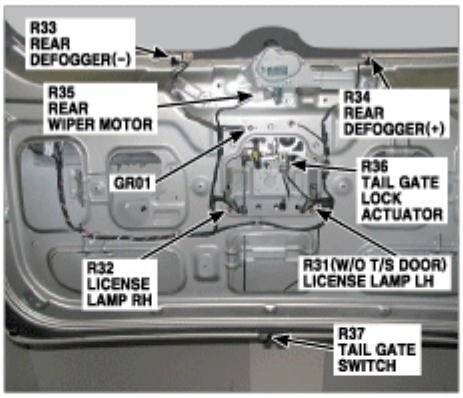


PHOTO.111

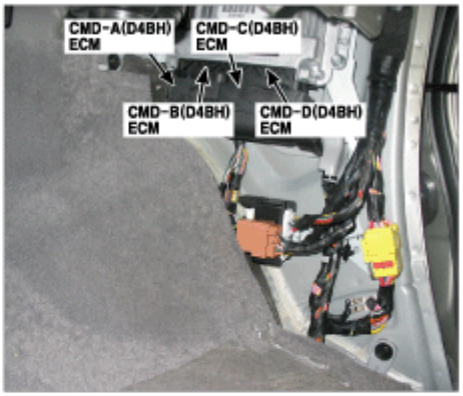


PHOTO.112

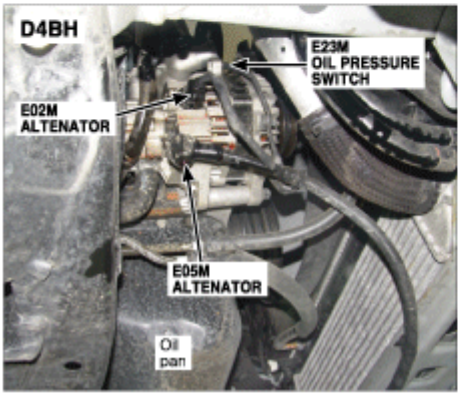


PHOTO.113

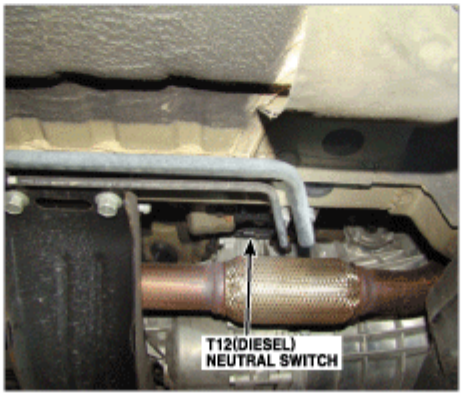
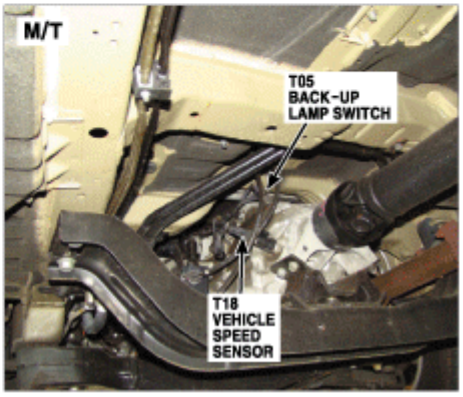


PHOTO.114



Component Locations (20) CL-20

PHOTO.115

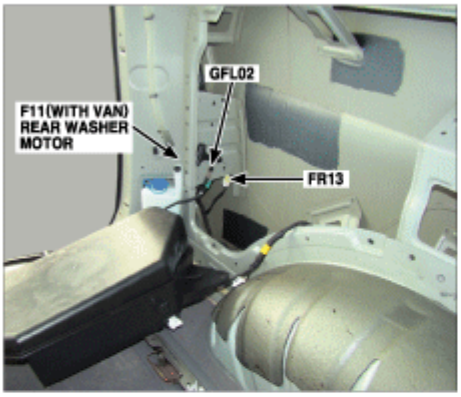


PHOTO.116

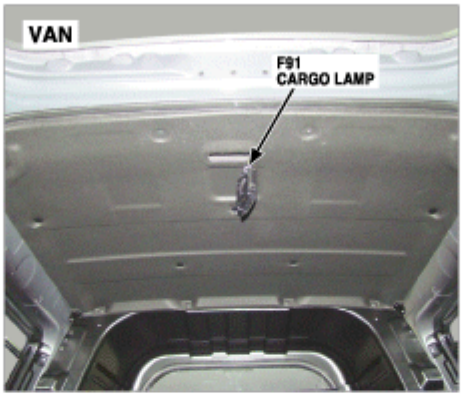


PHOTO.117

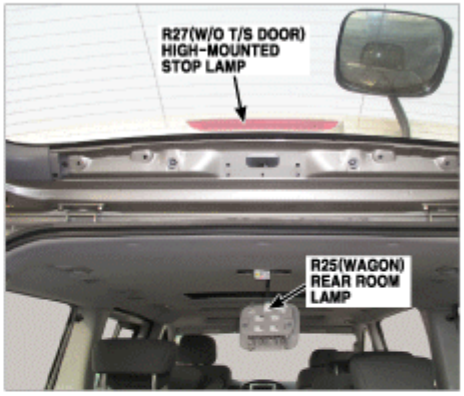


PHOTO.118

PHOTO.119

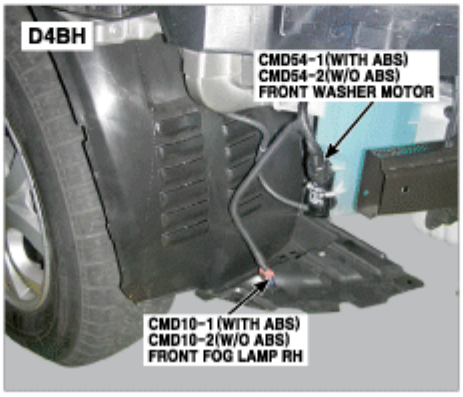
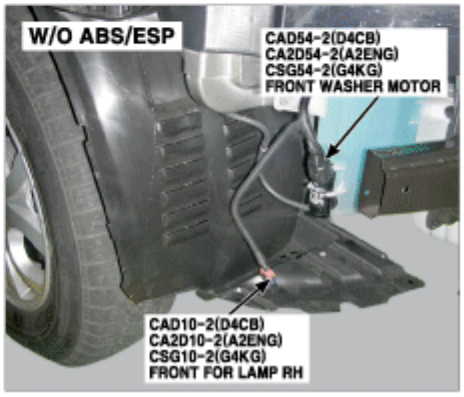


PHOTO.120



Component Locations (21) CL-21

PHOTO.121

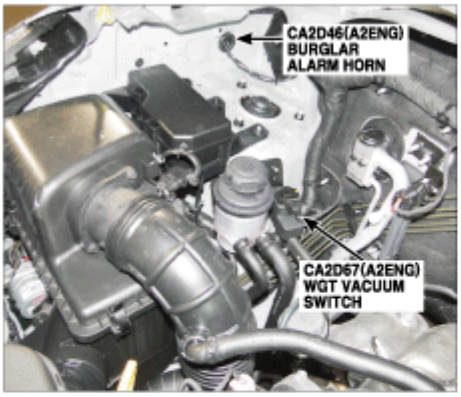


PHOTO.122

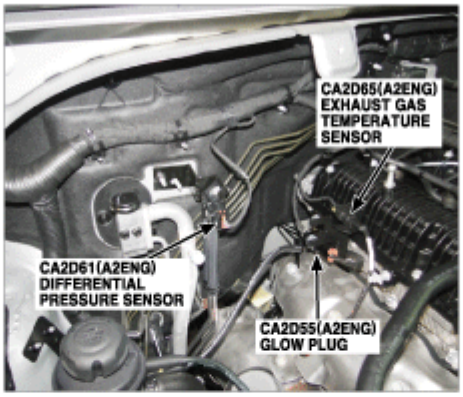


PHOTO.123

PHOTO.124

PHOTO.125

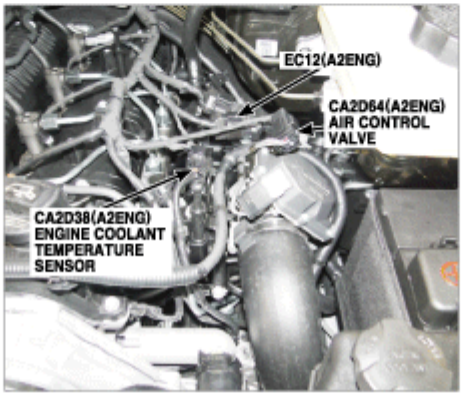


PHOTO.126

Component Locations (22) CL-22

PHOTO.127

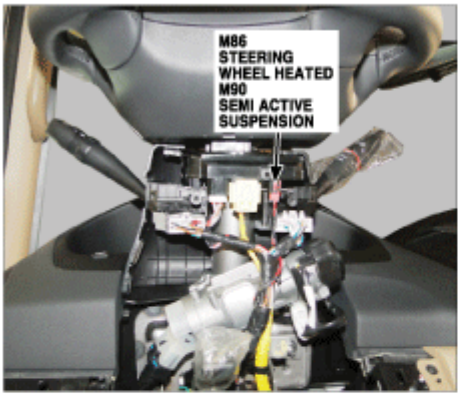


PHOTO.128

PHOTO.129

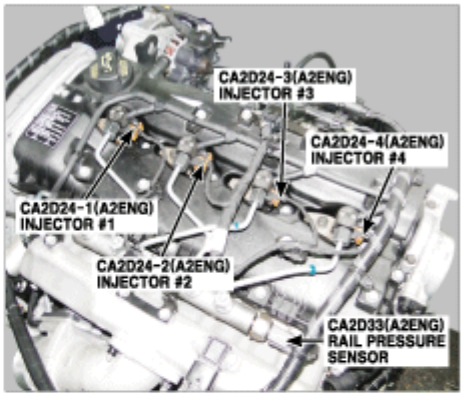


PHOTO.130

PHOTO.131

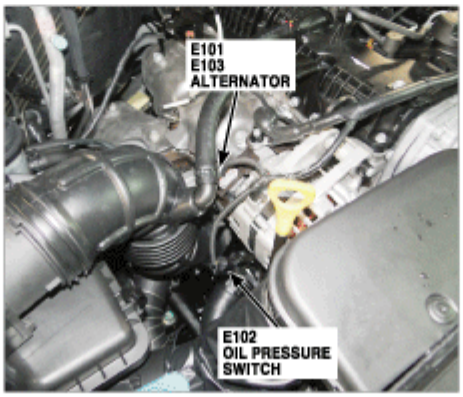
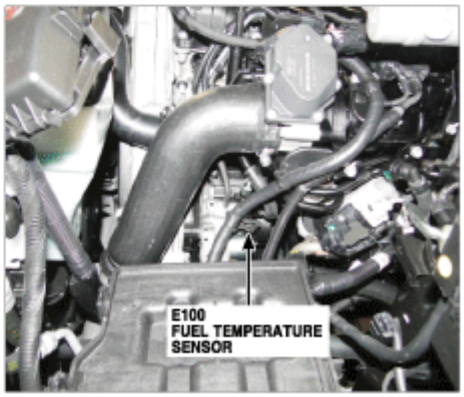
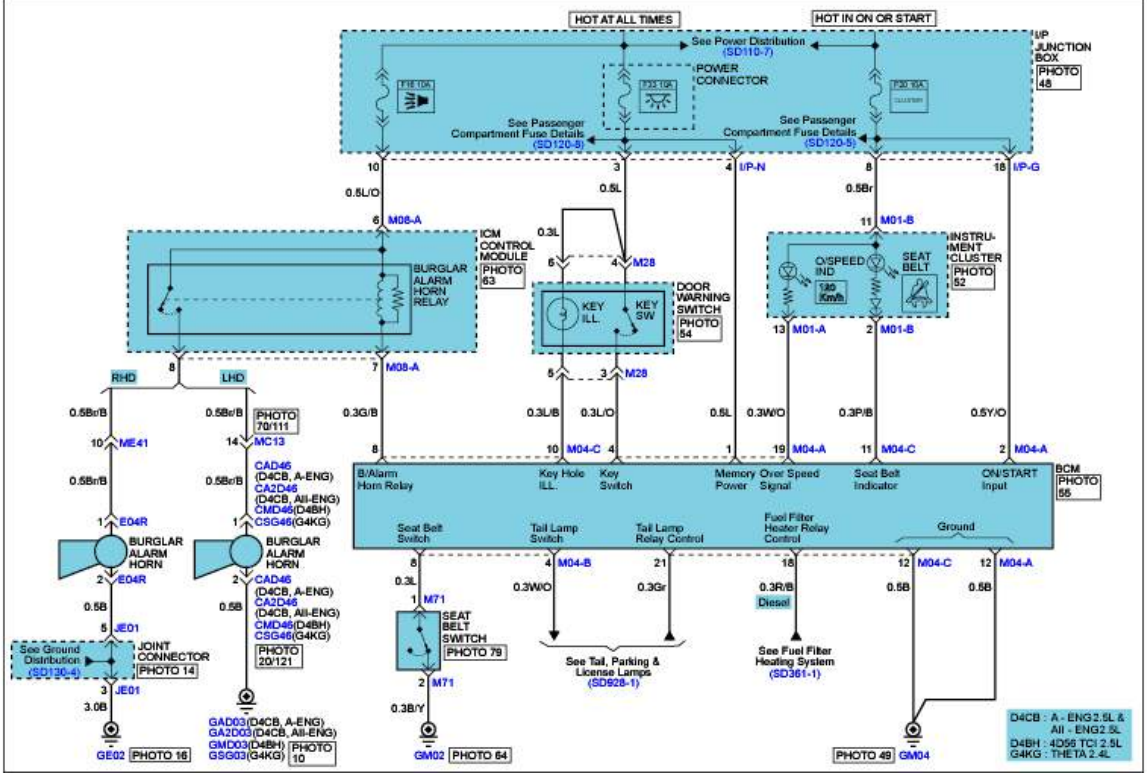


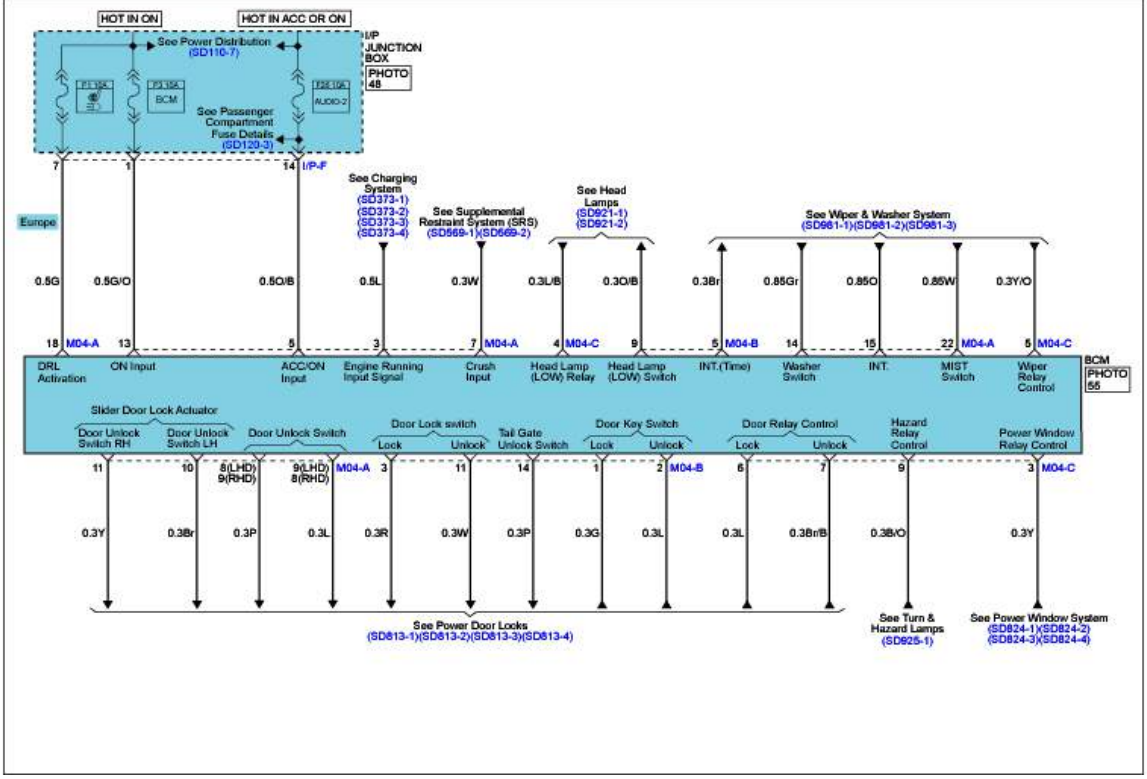
PHOTO.132



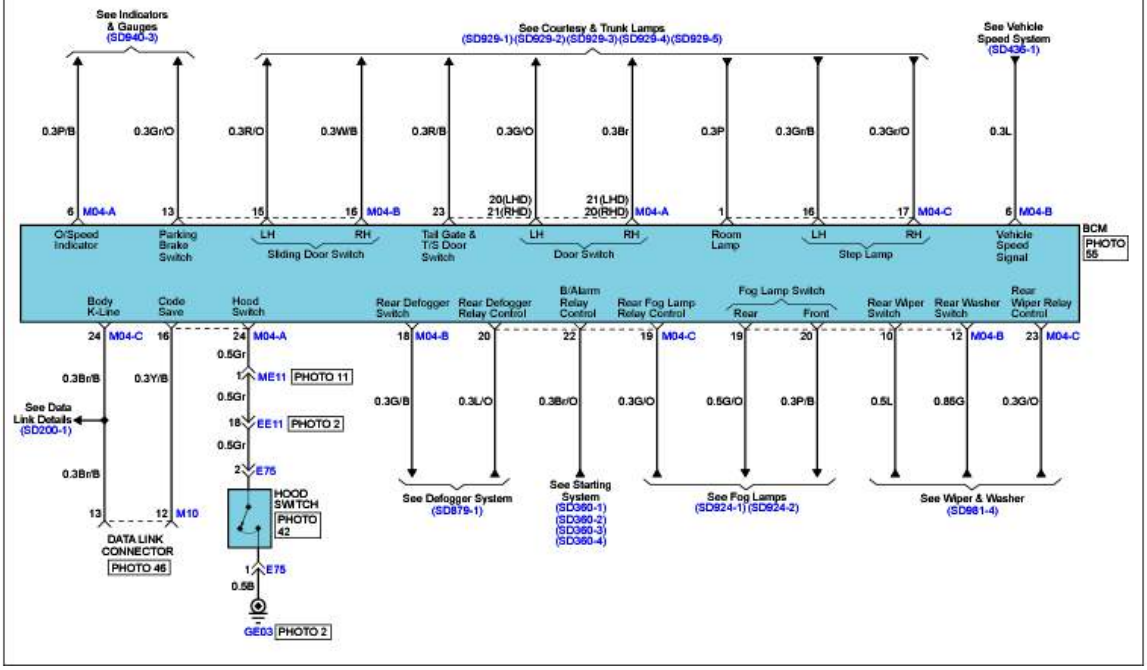
Body Control Module (BCM) System (1) SD952-1



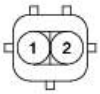
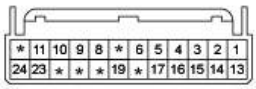
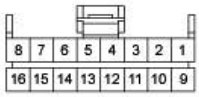
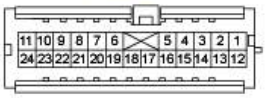
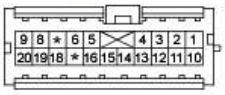
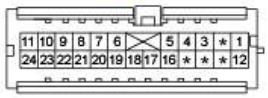
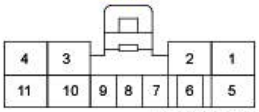
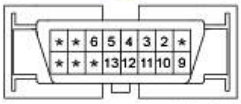
Body Control Module (BCM) System (2) SD952-2



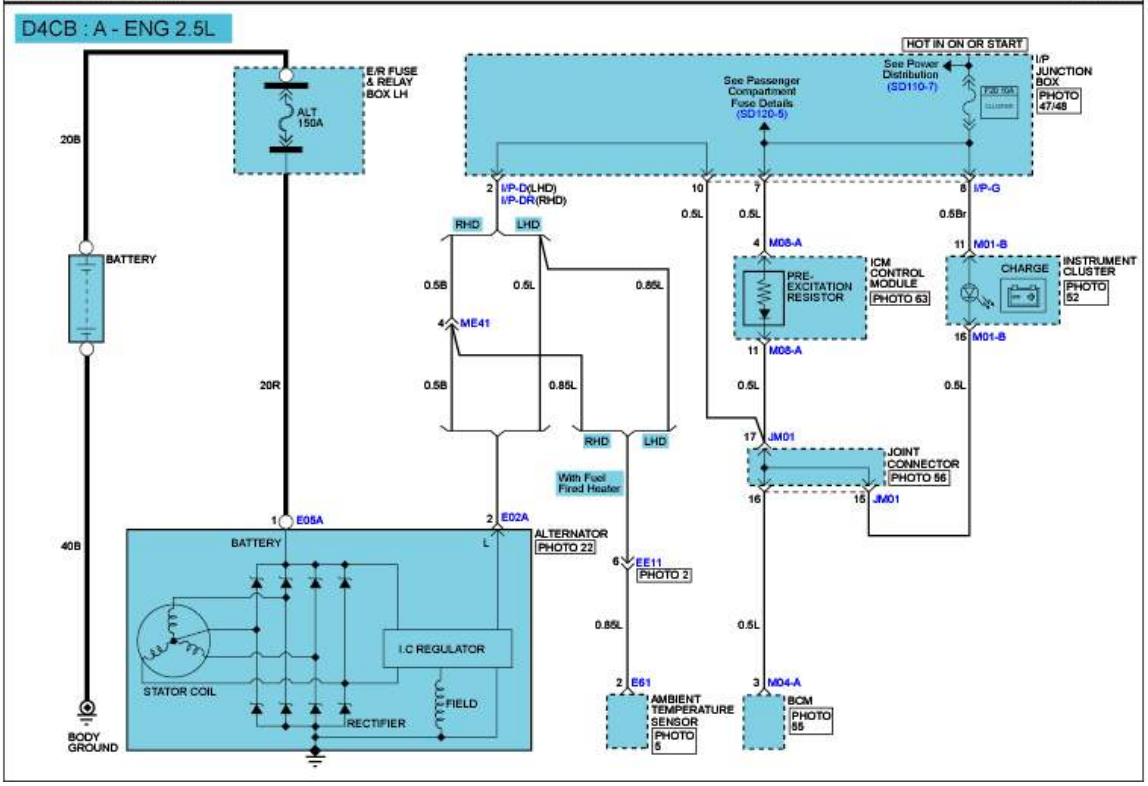
Body Control Module (BCM) System (3) SD952-3

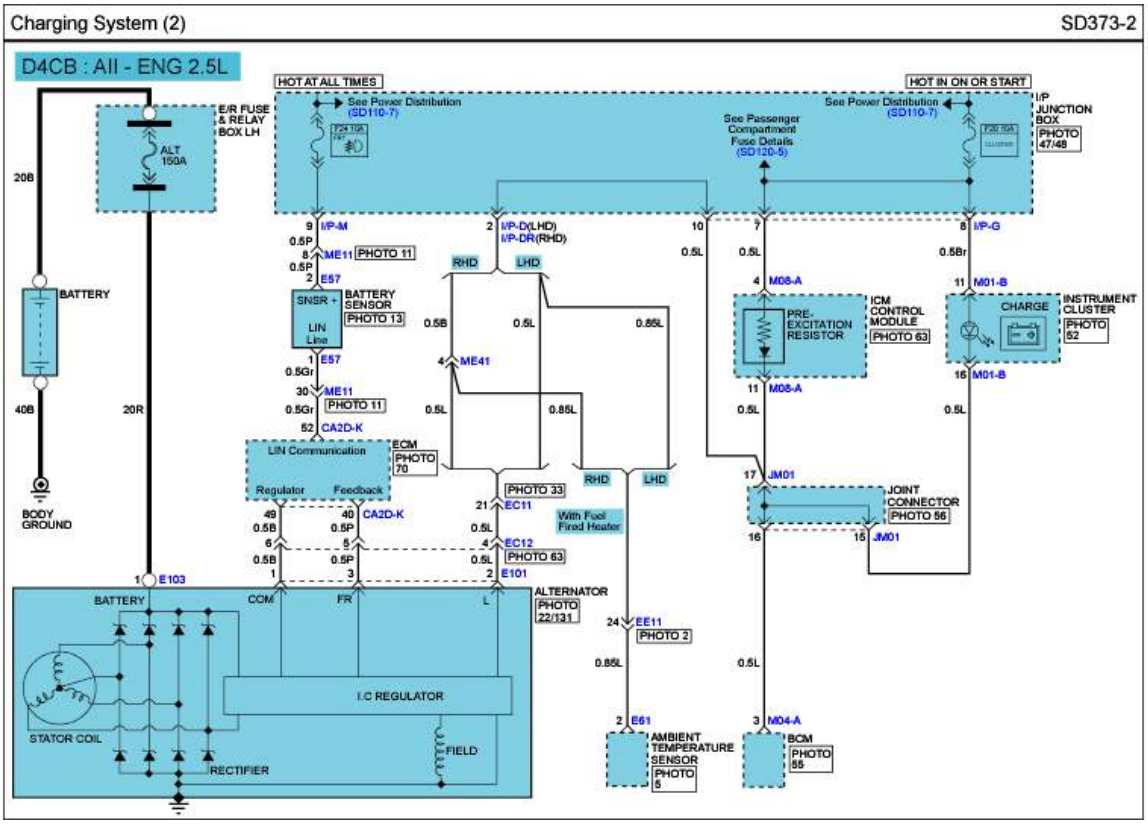


Body Control Module (BCM) System (4) — SD952-4

CAD46 MLX_HORN_02F_B_FILT	CA2D46 MLX_HORN_02F_B_FILT	CMD46 MLX_HORN_02F_B_FILT	CSG46 MLX_HORN_02F_B_FILT
E04R MLX_HORN_02F_B_FILT	E75  AMP_EJWP_02M_B	M01-A  AMP_025_24F_W	M01-B  AMP_040M1_16F_B
M04-A  AMP_040II_24F_W	M04-B  AMP_040II_20F_W	M04-C  AMP_040III_24F_Gr	M08-A  KET_1808_11F_W_UNIT
M10  MLX_OBDII_16F_B	M28 KET_080II_06M_W	M71 KET_080III_2F_W_BOTTOM	BLANK

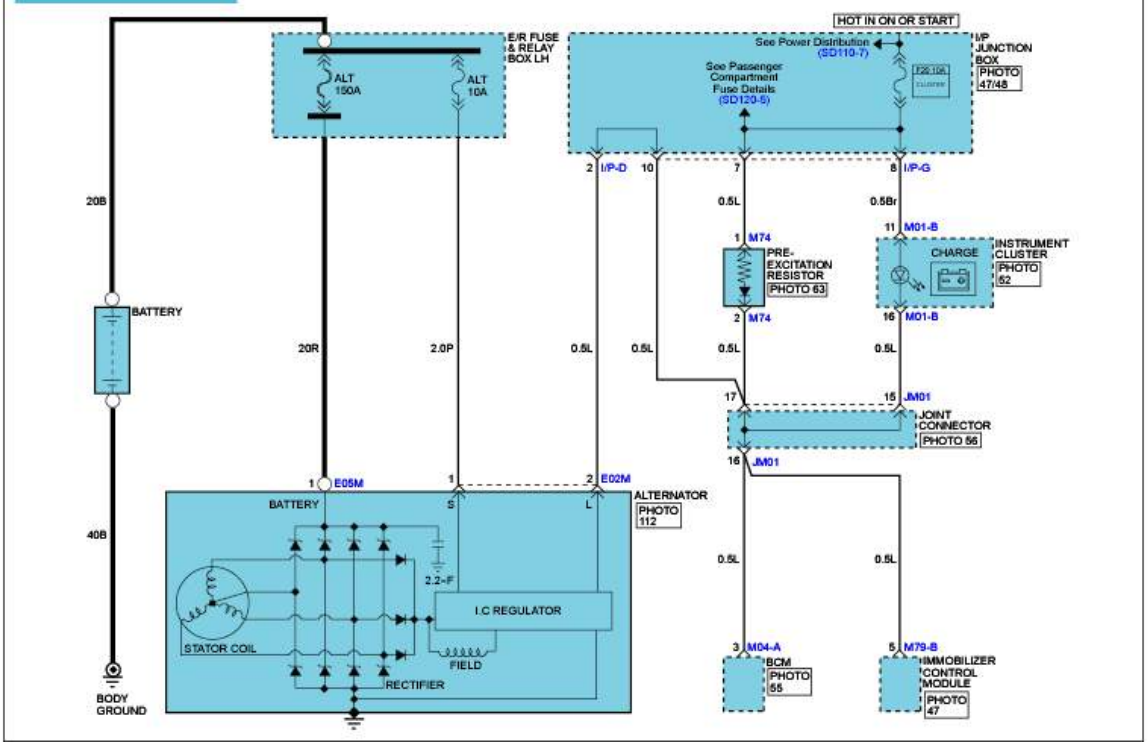
Charging System (1) SD373-1



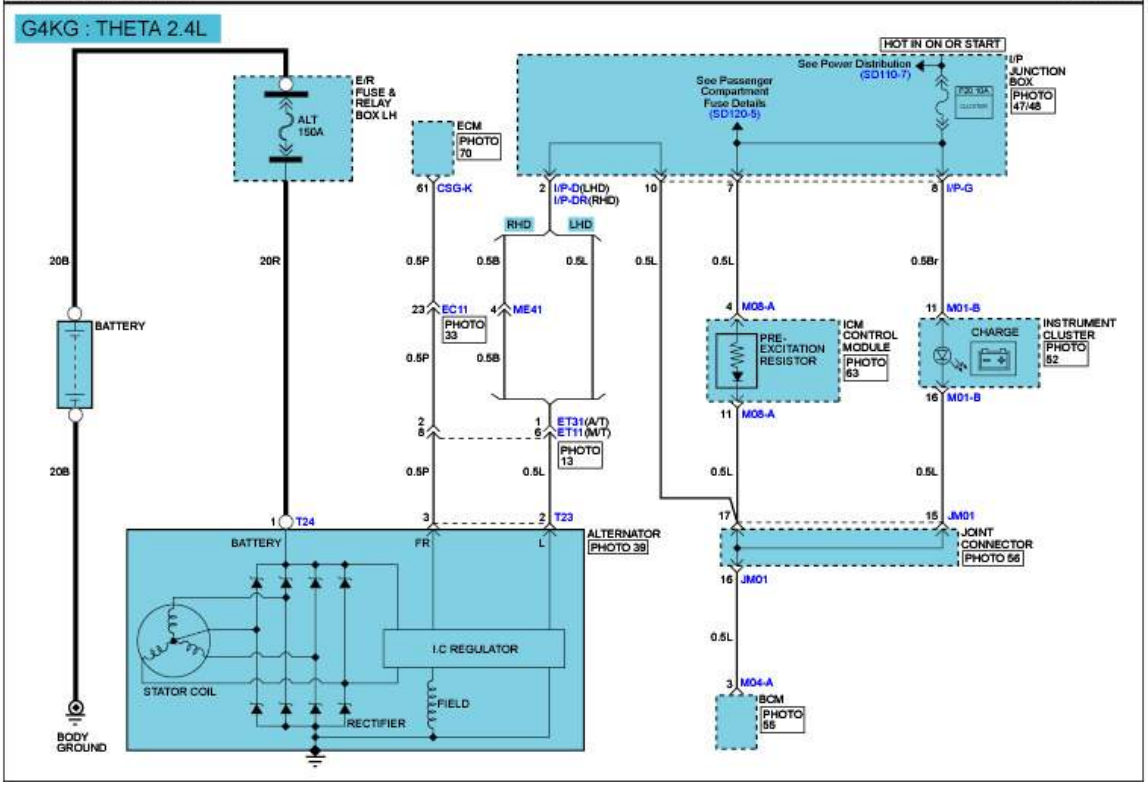

Charging System (2)
SD373-2
D4CB : All - ENG 2.5L
HOT AT ALL TIMES
HOT IN ON OR START
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-5)
I/P JUNCTION BOX
PHOTO 47/48
E/R FUSE & RELAY BOX LH
ALT 150A
BATTERY
BODY GROUND
I/P-M
I/P-D(LHD) I/P-DR(RHD)
I/P-G
ME11
PHOTO 11
E57
BATTERY SENSOR
PHOTO 13
RHD
LHD
ME41
M08-A
PRE-EXCITATION RESISTOR
ICM CONTROL MODULE
PHOTO 63
M01-B
CHARGE
INSTRUMENT CLUSTER
PHOTO 52
CA2D-K
LIN Communication
ECM
PHOTO 70
Regulator
Feedback
PHOTO 33
EC11
EC12
With Fuel Fired Heater
JM01
JOINT CONNECTOR
PHOTO 56
E103
E101
BATTERY
COM
FR
L
ALTERNATOR
PHOTO 22/131
I.C REGULATOR
STATOR COIL
FIELD
RECTIFIER
EE11
PHOTO 2
E61
AMBIENT TEMPERATURE SENSOR
PHOTO 5
M04-A
BCM
PHOTO 55

Charging System (3) SD373-3

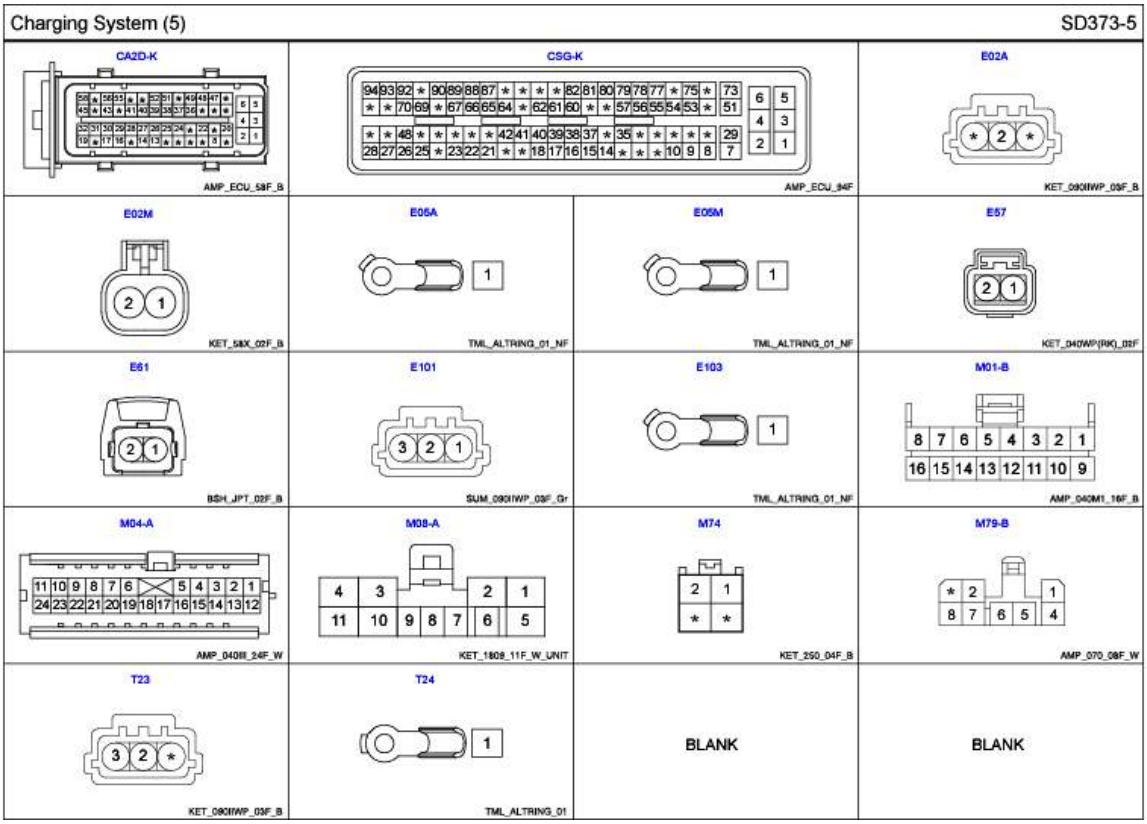
D4BH : 4D56 TCI 2.5L



Charging System (4) SD373-4

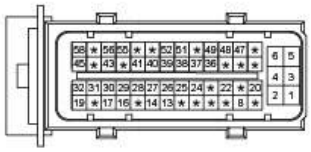


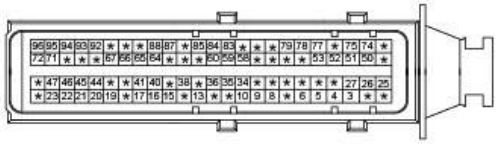
Charging System (5) SD373-5



Engine Control System (D4CB : All - ENG 2.5L) (1) SD313-11

ECM Terminal Information



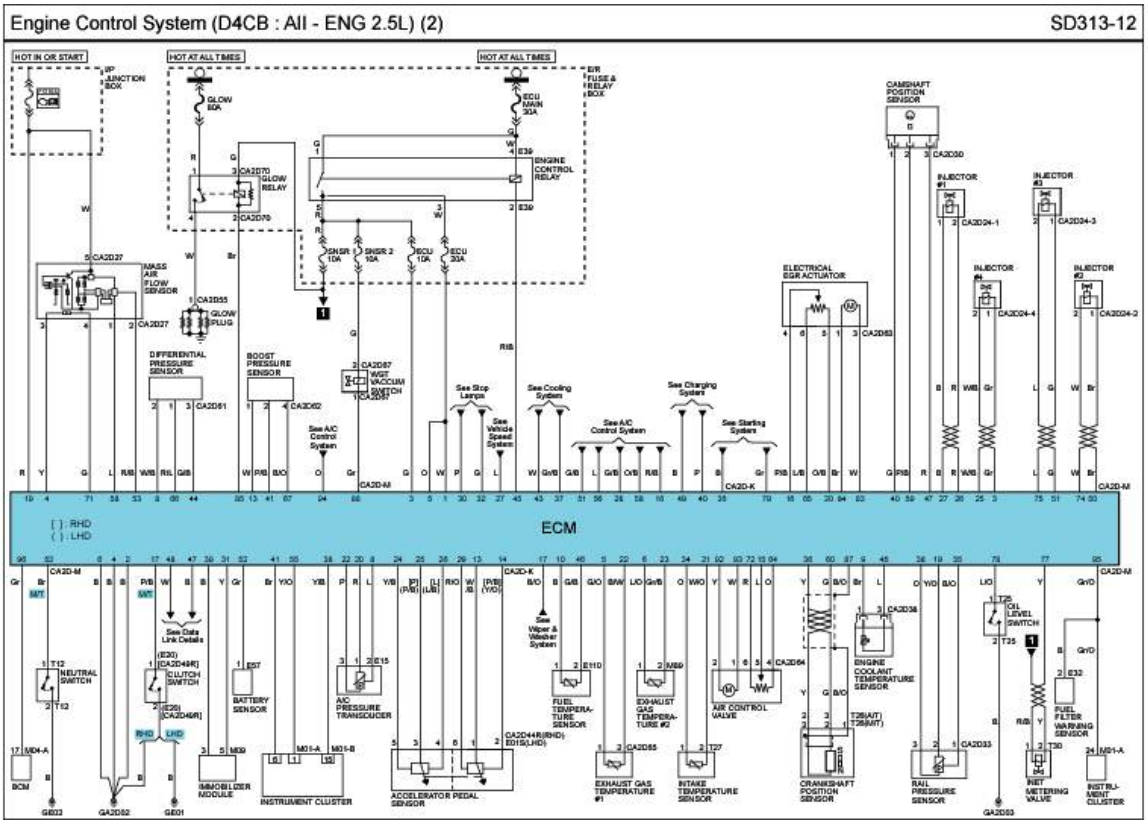


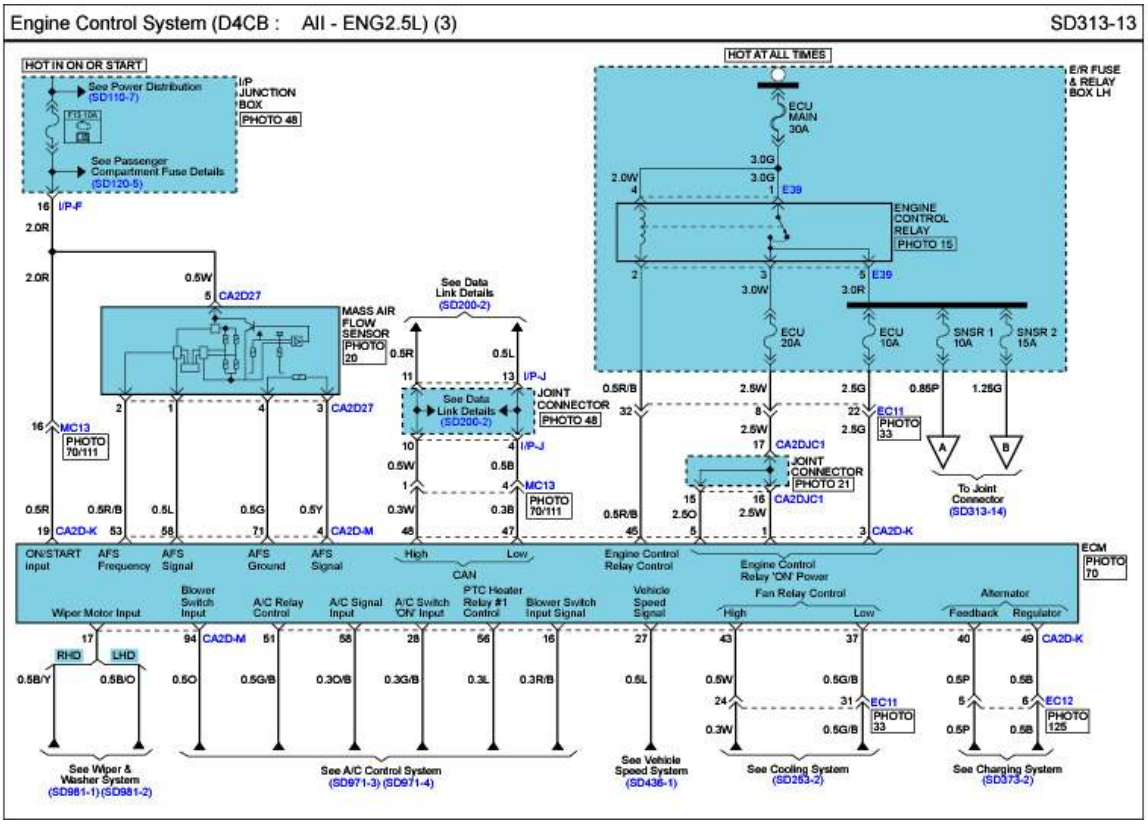
CA2D-K

PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION
1	W	Engine Control Relay 'ON' Input	28	G/B	Thermo Switch
2	B	Ground	29	R/O	APS Supply #2
3	G	Engine Control Relay 'ON' Input	30	P	Redundant Brake Switch
4	B	Ground	31	Y	IMMO. Interface
5	O	Engine Control Relay 'ON' Input	32	G	Brake Switch Signal
6	B	Ground	33	*	-
7	-	-	34	*	-
8	L	APT Signal	35	*	-
9	-	-	36	B	Start Relay Control
10	-	-	37	G/B	Fan Relay Control Low
11	-	-	38	Y/B	IMMO IND.
12	-	-	39	B	IMMO. Ground
13	W/B	APS Signal #2	40	P	Alternator Feedback
14	Y/O	APS Ground #2(LHD)	41	Br	GLOW
	P/B	APS Ground #2(RHD)	42	*	-
15	-	-	43	W	Fan Relay Control High
16	R/B	Blower Switch Input Signal	44	*	-
17	P/B	Clutch Switch Signal	45	R/B	Engine Control Relay Control
18	-	-	46	*	-
19	R	ON/START Input Signal	47	B	CAN - Low
20	R	APT Ground	48	W	CAN - High
21	-	-	49	B	Alternator Regulator
22	P	APT Supply	50	*	-
23	-	-	51	G/B	A/C Relay Control
24	Y/B	APS Supply #1(LHD)	52	Gr	LIN Communication
	Y/B	APS Supply #1(RHD)	53	*	-
25	P/B	APS Signal #1(LHD)	54	*	-
	P	APS Signal #1(RHD)	55	Y/O	Check Engine
26	L/B	APS Return #1(LHD)	56	L	PTC Heater Relay #1 Control
	L	APS Return #1(RHD)	57	*	-
27	L	Vehicle Speed Signal	58	O/B	A/C Signal Input

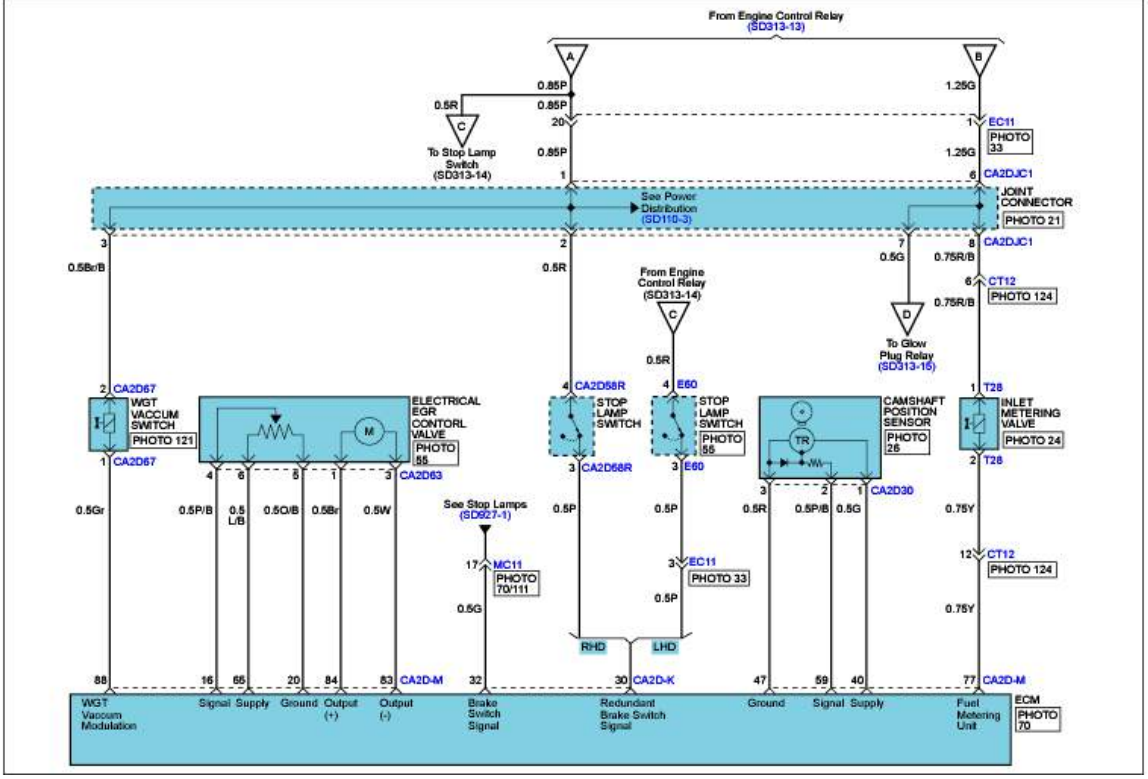
CA2D-M

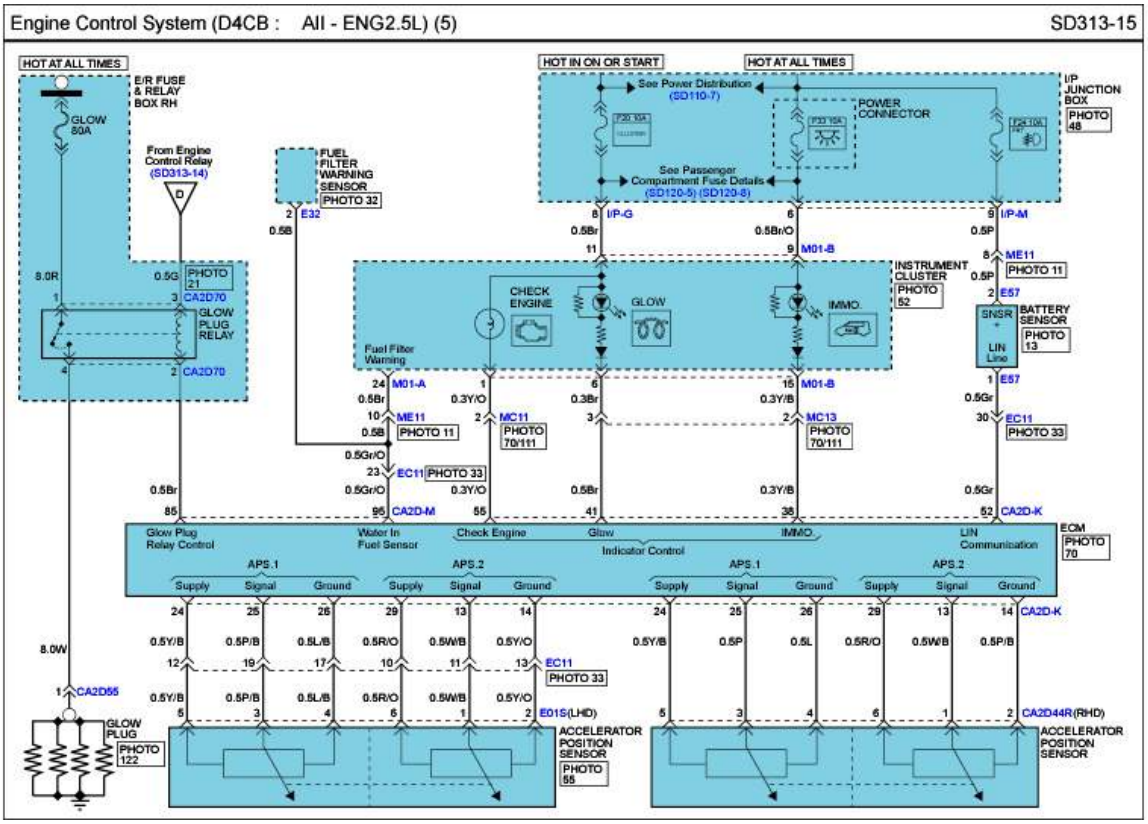
PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION	PIN	COLOR	DESCRIPTION
1	-	-	33	-	-	66	R/L	DPS Power
2	-	-	34	P	Intake Temperature Sensor Signal	67	B/O	BPS Ground
3	Gr	Injector #4 Control High	35	B/O	Rail Pressure Sensor Signal	68	-	-
4	Y	Air Temp Signal	36	Y	CPS Sensor (+) (A/T), (-) (M/T)	69	-	-
5	G/O	Gas Temp #1 Signal	37	-	-	70	-	-
6	L/O	Gas Temp #2 Signal	38	O	Rail Pressure Sensor Supply	71	G	AFS Ground
7	-	-	39	-	-	72	R	ACV Ground
8	W/B	DPS Signal	40	G	CMP Sensor Supply	73	-	-
9	Br	ECT Sensor Signal	41	P/B	BPS Supply	74	W	Injector #2 Control Low
10	B	Fuel Temperature Sensor Signal	42	-	-	75	L	Injector #3 Control Low
11	-	-	43	-	-	76	-	-
12	-	-	44	G/B	DPS Ground	77	Y	Fuel Metering Unit
13	W	BPS Signal	45	L	ECT Sensor Return	78	L/O	Oil Level Switch Signal
14	-	-	46	G/B	Fuel Temp Sensor Ground	79	Gr	Start Switch Input
15	L	ACV Signal	47	R	CMP Sensor Ground	80	-	-
16	P/B	EGR Signal	48	-	-	81	-	-
17	B/O	Wiper Motor Input (LHD)	49	-	-	82	-	-
	B/Y	Wiper Motor Input (RHD)	50	Br	Injector #2 Control High	83	W	EGR Out Put (-)
18	-	-	51	G	Injector #3 Control High	84	Br	EGR Out Put (+)
19	Y/O	Rail Pressure Sensor Ground	52	Br	Neutral Switch Signal	85	Br	Glow Plug Relay Control
20	O/B	EGR Ground	53	R/B	AFS Frequency	86	-	-
21	W/O	Intake Temp sensor ground	54	-	-	87	B/O	CPS Shield
22	B/W	Gas Temp #1 Ground	55	-	-	88	Gr	WGT Vacuum Modulation
23	Gr/B	Gas Temp #2 Ground	56	-	-	89	-	-
24	-	-	57	-	-	90	-	-
25	W/B	Injector #4 Control Low	58	L	AFS Signal	91	-	-
26	R	Injector #1 Control Low	59	P/B	CMP Sensor Signal	92	Y	ACV Motor (+)
27	B	Injector #1 Control High	60	G	CPS Sensor (-) (A/T), (+) (M/T)	93	W	ACV Motor (-)
28	-	-	61	-	-	94	O	Blower Switch Input
29	-	-	62	-	-	95	Gr/O	Water In Fuel Sensor
30	-	-	63	-	-	96	Gr	Load Detection(Head Lamp)
31	-	-	64	O	ACV Supply			
32	-	-	65	L/B	EGR Supply			


Engine Control System (D4CB : All - ENG 2.5L) (2)
SD313-12
ECM
[ ] : RHD
( ) : LHD

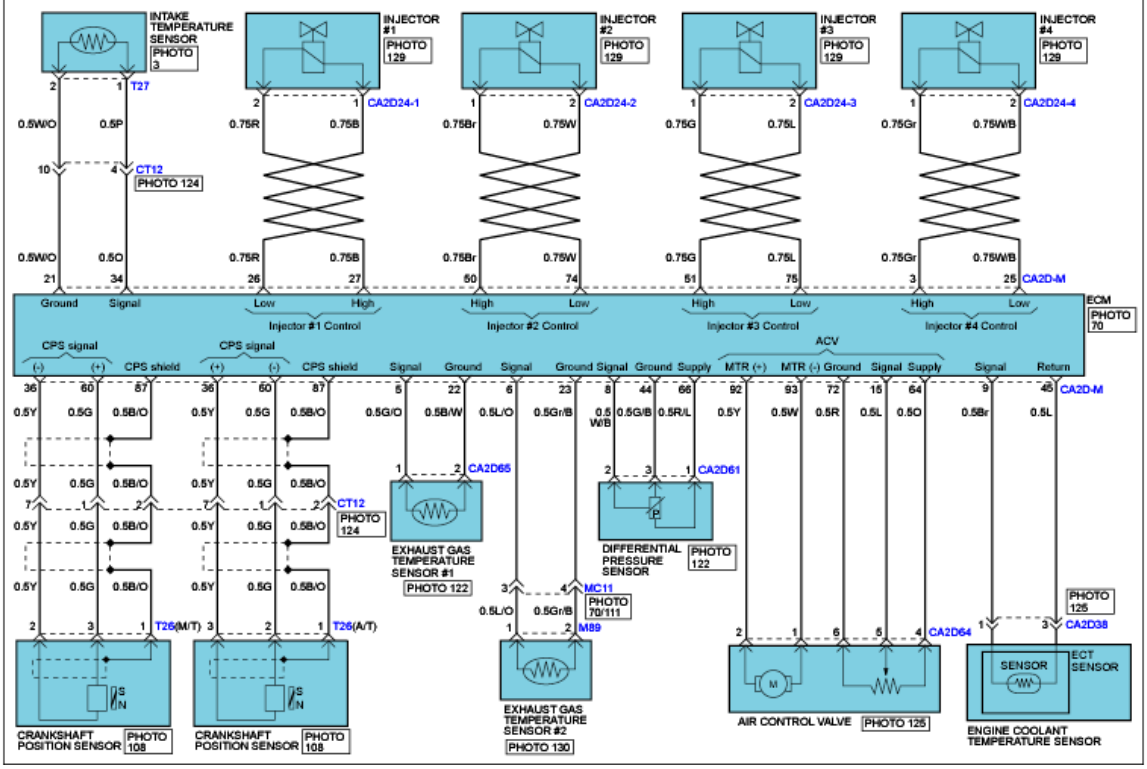

Engine Control System (D4CB : All - ENG2.5L) (3)
SD313-13
HOT IN ON OR START
HOT AT ALL TIMES
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-5)
I/P JUNCTION BOX
PHOTO 48
E/R FUSE & RELAY BOX LH
ECU MAIN 30A
ENGINE CONTROL RELAY
PHOTO 15
ECU 20A
ECU 10A
SNSR 1 10A
SNSR 2 15A
MASS AIR FLOW SENSOR
PHOTO 20
See Data Link Details (SD200-2)
JOINT CONNECTOR
PHOTO 48
JOINT CONNECTOR
PHOTO 21
EC11
PHOTO 33
To Joint Connector (SD313-14)
MC13
PHOTO 70/111
ECM
PHOTO 70
ON/START input
AFS Frequency
AFS Signal
AFS Ground
AFS Signal
CAN
Engine Control Relay Control
Engine Control Relay 'ON' Power
Wiper Motor Input
Blower Switch Input
A/C Relay Control
A/C Signal Input
A/C Switch 'ON' Input
PTC Heater Relay #1 Control
Blower Switch Input Signal
Vehicle Speed Signal
Fan Relay Control
Alternator
Feedback
Regulator
RHD
LHD
See Wiper & Washer System (SD981-1) (SD981-2)
See A/C Control System (SD971-3) (SD971-4)
See Vehicle Speed System (SD436-1)
See Cooling System (SD263-2)
See Charging System (SD373-2)

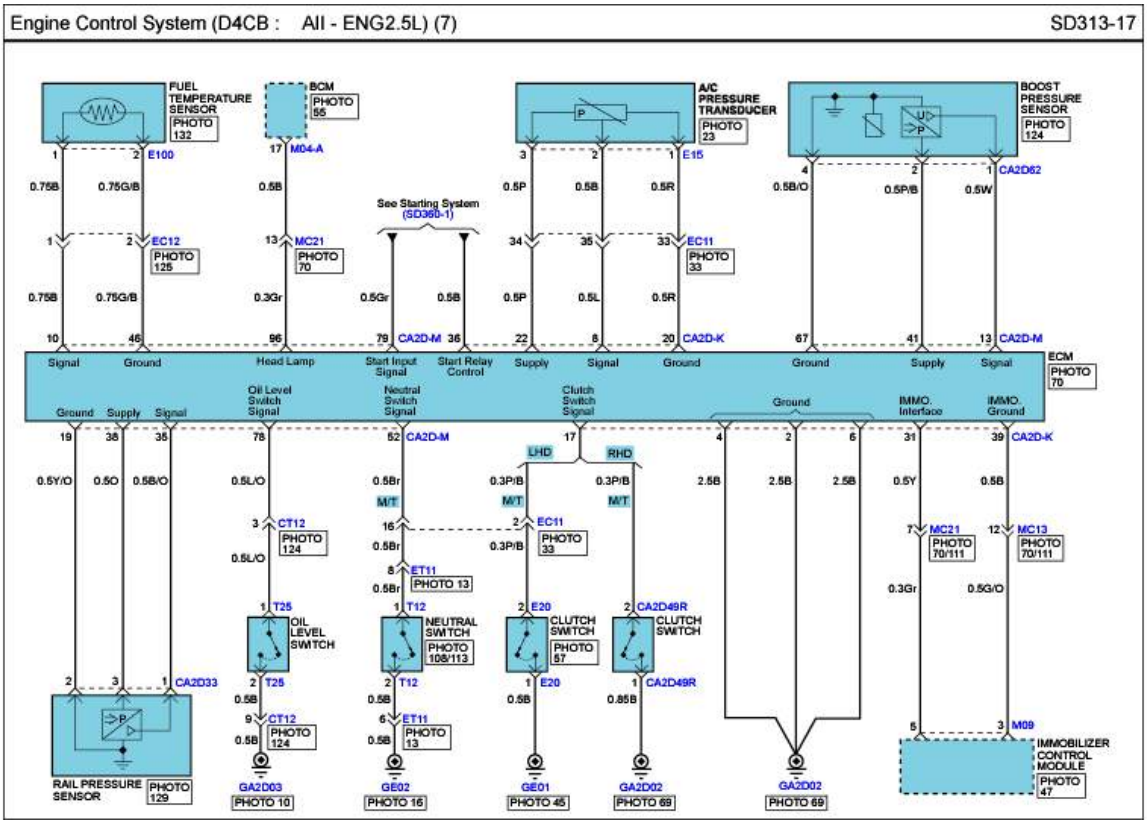
Engine Control System (D4CB : All - ENG2.5L) (4) SD313-14



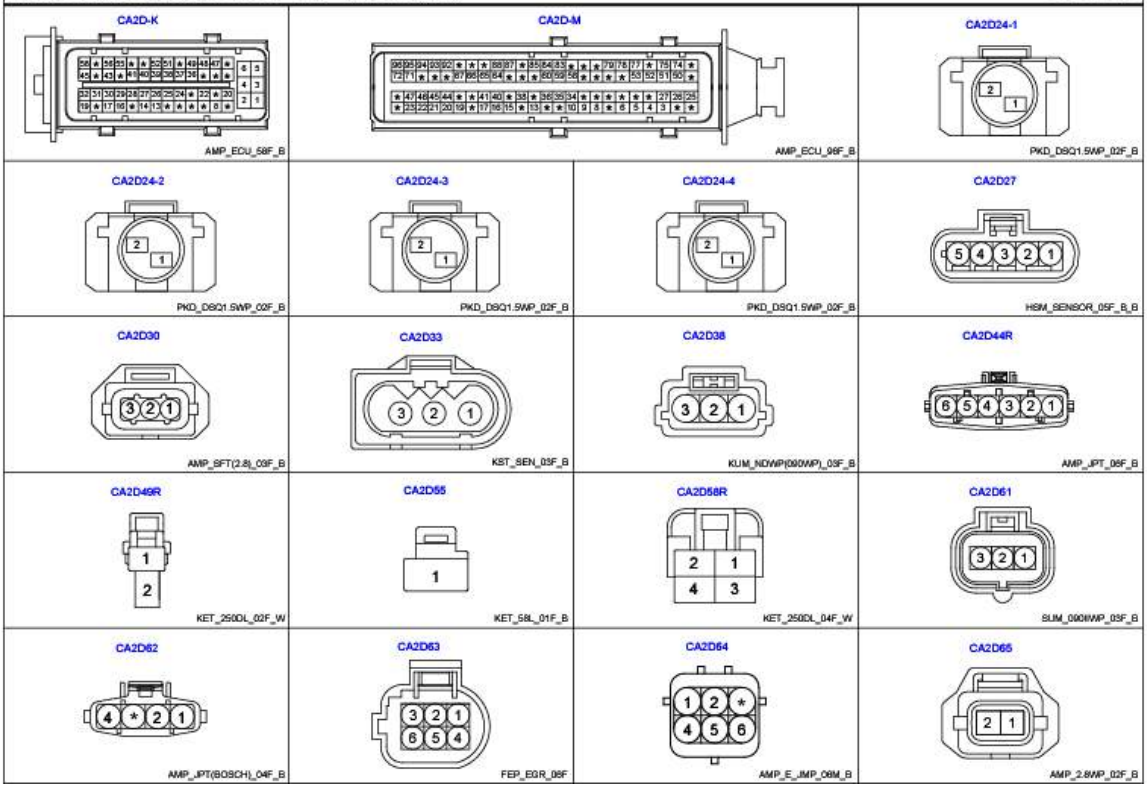

Engine Control System (D4CB : All - ENG2.5L) (5)
SD313-15
HOT AT ALL TIMES
E/R FUSE & RELAY BOX RH
GLOW 80A
From Engine Control Relay (SD313-14)
GLOW PLUG RELAY
FUEL FILTER WARNING SENSOR
PHOTO 32
HOT IN ON OR START
HOT AT ALL TIMES
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-5) (SD120-8)
POWER CONNECTOR
I/P JUNCTION BOX
PHOTO 48
INSTRUMENT CLUSTER
PHOTO 52
CHECK ENGINE
GLOW
IMMO.
Fuel Filter Warning
BATTERY SENSOR
PHOTO 13
ECM
PHOTO 70
Glow Plug Relay Control
Water In Fuel Sensor
Check Engine
Glow Indicator Control
IMMO.
LIN Communication
APS.1
APS.2
Supply
Signal
Ground
GLOW PLUG
PHOTO 122
ACCELERATOR POSITION SENSOR
PHOTO 55
ACCELERATOR POSITION SENSOR

Engine Control System (D4CB : All - ENG2.5L) (6) SD313-16




Engine Control System (D4CB : All - ENG2.5L) (7)
SD313-17
FUEL TEMPERATURE SENSOR
PHOTO 132
BCM
PHOTO 55
A/C PRESSURE TRANSDUCER
PHOTO 23
BOOST PRESSURE SENSOR
PHOTO 124
E100
M04-A
E15
CA2D62
EC12
PHOTO 125
MC21
PHOTO 70
See Starting System (SD360-1)
EC11
PHOTO 33
CA2D-M
CA2D-K
Signal
Ground
Head Lamp
Start Input Signal
Start Relay Control
Supply
Signal
Ground
Ground
Supply
Signal
ECM
PHOTO 70
Oil Level Switch Signal
Neutral Switch Signal
Clutch Switch Signal
IMMO. Interface
IMMO. Ground
LHD
RHD
M/T
CT12
PHOTO 124
ET11
PHOTO 13
MC13
PHOTO 70/111
T25
OIL LEVEL SWITCH
T12
NEUTRAL SWITCH
PHOTO 108/113
E20
CLUTCH SWITCH
PHOTO 57
CA2D49R
CLUTCH SWITCH
CA2D33
RAIL PRESSURE SENSOR
PHOTO 129
M09
IMMOBILIZER CONTROL MODULE
PHOTO 47
GA2D03
PHOTO 10
GE02
PHOTO 16
GE01
PHOTO 45
GA2D02
PHOTO 69
GA2D02
PHOTO 69

Engine Control System (D4CB : All - ENG2.5L) (8) SD313-18



Engine Control System (D4CB : All - ENG2.5L) (9) SD313-19

CA2D67

AMP_JPT2F_SHORT_B

CA2D70

CR04F101

E01S

AMP_JPT_06F_B

E15

KET_040WP_03F_B

E20

KET_250DL_02F_W

E32

AMP_090WP_09F_B

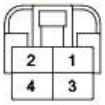
E39

CR05F012

E57

KET_040WP(RK)_02F

E60

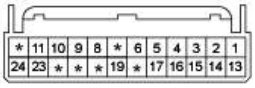


KET_250DL_04F_W

E100

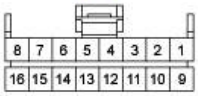
HIR_MLK1.2_2F_B

M01-A



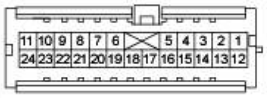
AMP_025_24F_W

M01-B



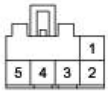
AMP_040M1_16F_B

M04-A



AMP_040III_24F_W

M09



KUM_CDR_05F_W

M89

SUN_MT090WP_02M_W

T12

KUM_NMWP_02F_B

T25

AMP_2.8WP_02F_B

T26

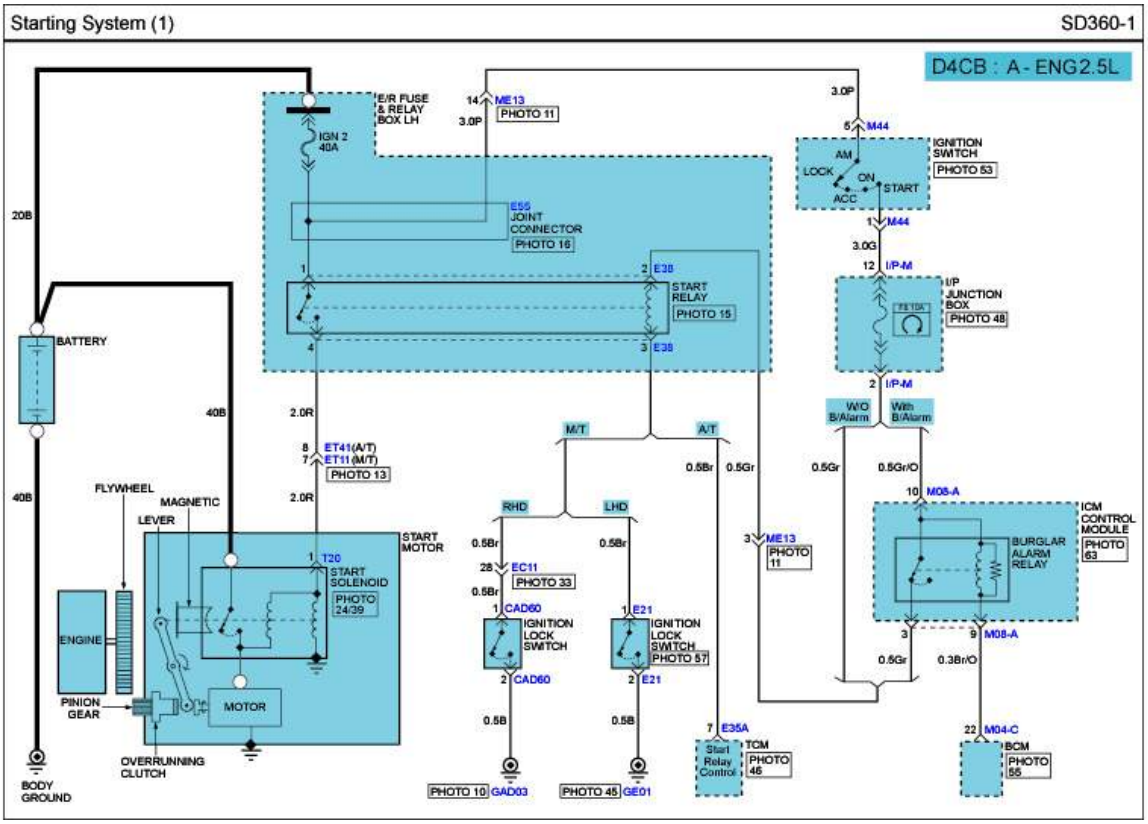
AMP_JPT_03F_B_BSH3

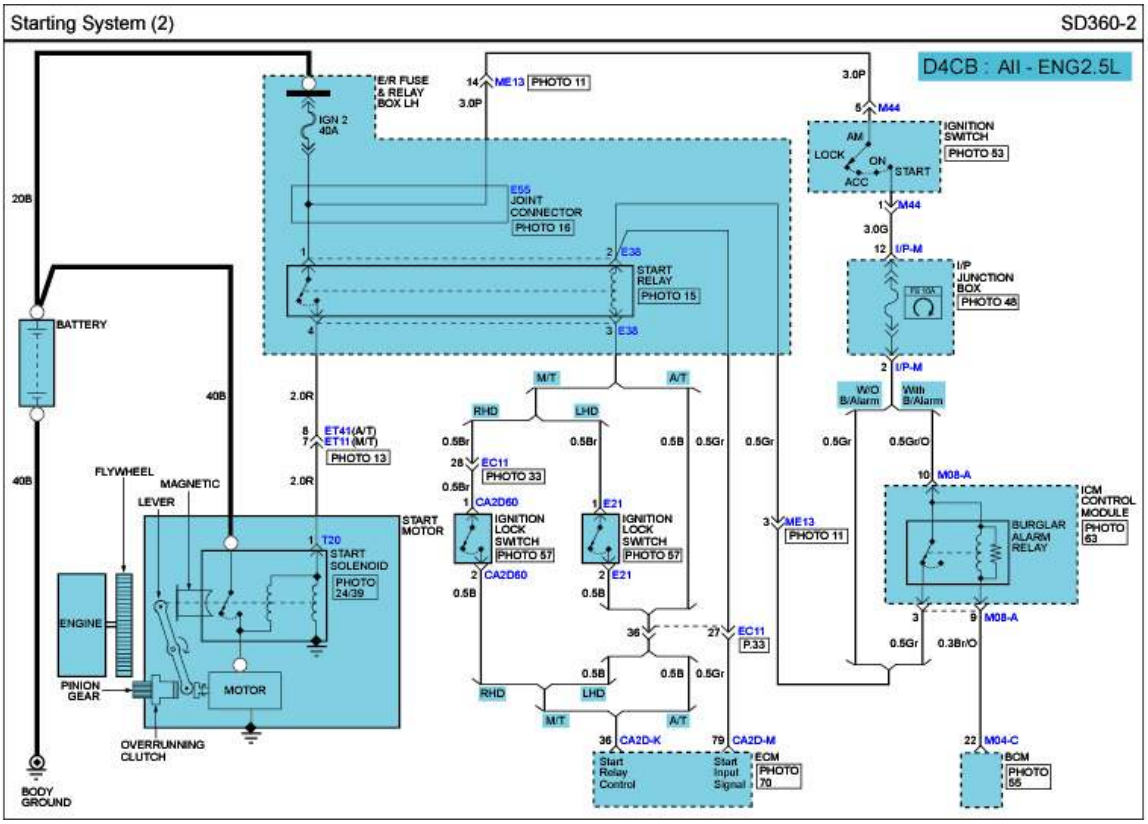
T27

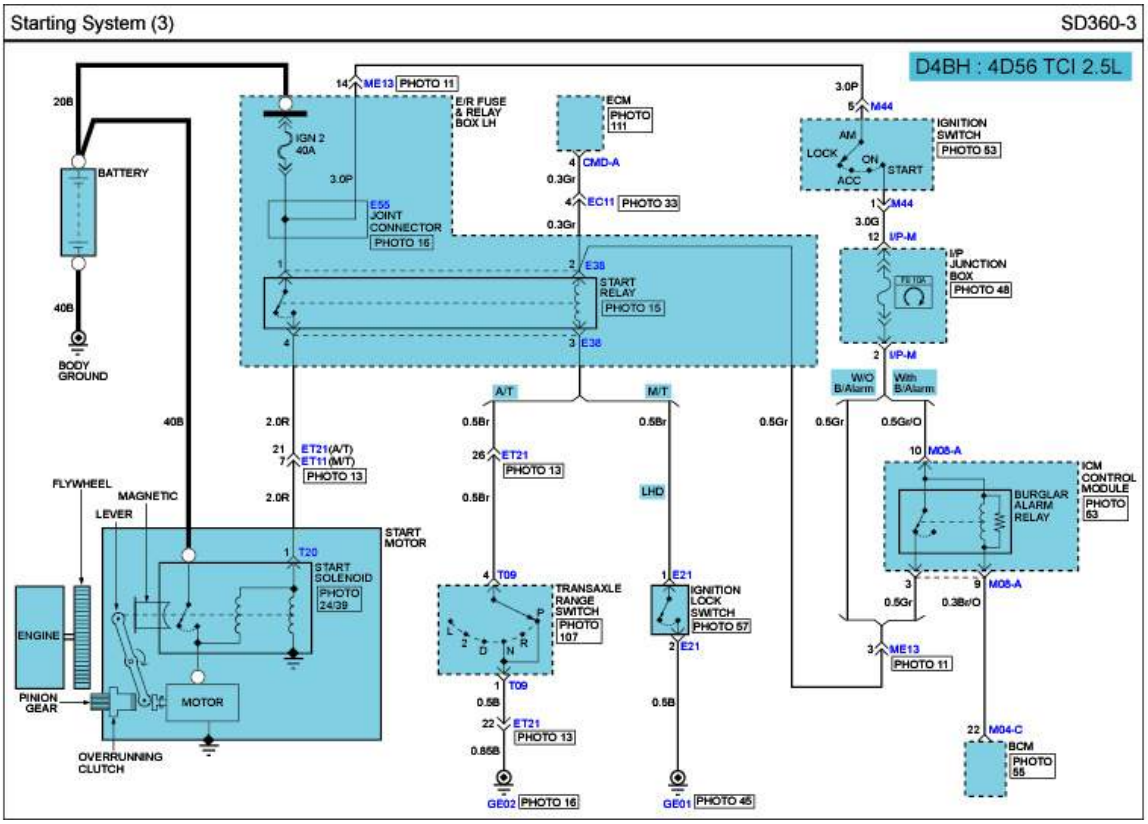
AMP_JPT_02F_B

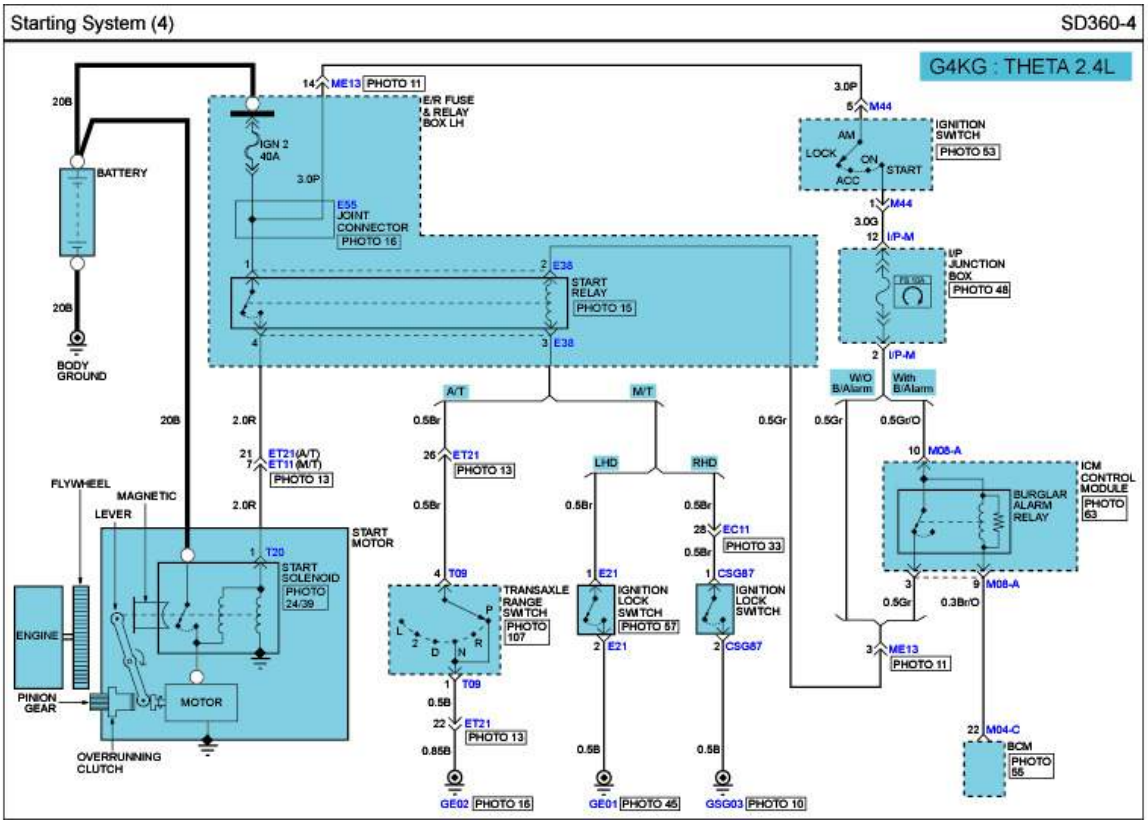
T28

KOSTAL(SLK2.8)02F_B


Starting System (1)
SD360-1
D4CB : A - ENG2.5L
E/R FUSE & RELAY BOX LH
IGN 2 40A
ME13
PHOTO 11
3.0P
M44
IGNITION SWITCH
PHOTO 53
AM
LOCK
ON
START
ACC
E55
JOINT CONNECTOR
PHOTO 16
E38
START RELAY
PHOTO 15
3.0G
I/P-M
I/P JUNCTION BOX
PHOTO 48
FE 15A
BATTERY
20B
40B
2.0R
ET41(A/T)
ET11(M/T)
PHOTO 13
W/O B/Alarm
With B/Alarm
M/T
A/T
0.5Br
0.5Gr
0.5Gr/O
M08-A
ICM CONTROL MODULE
PHOTO 63
BURGLAR ALARM RELAY
FLYWHEEL
MAGNETIC
LEVER
START MOTOR
T20
START SOLENOID
PHOTO 24/39
RHD
LHD
EC11
PHOTO 33
CAD60
IGNITION LOCK SWITCH
E21
PHOTO 57
ENGINE
PINION GEAR
MOTOR
OVERRUNNING CLUTCH
BODY GROUND
PHOTO 10
GAD03
PHOTO 45
GE01
E35A
Start Relay Control
TCM
PHOTO 46
0.3Br/O
M04-C
BCM
PHOTO 55

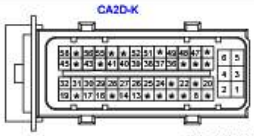

Starting System (2)
SD360-2
D4CB : All - ENG2.5L
E/R FUSE & RELAY BOX LH
IGN 2 40A
ME13 PHOTO 11
3.0P
M44
IGNITION SWITCH
PHOTO 53
AM
LOCK
ON
START
ACC
E55 JOINT CONNECTOR PHOTO 16
E36
START RELAY PHOTO 15
I/P-M
I/P JUNCTION BOX PHOTO 48
BATTERY
20B
40B
2.0R
ET41(A/T) ET11(M/T) PHOTO 13
M/T
A/T
RHD
LHD
W/O B/Alarm
With B/Alarm
EC11 PHOTO 33
CA2D60
E21
IGNITION LOCK SWITCH PHOTO 57
M08-A
ICM CONTROL MODULE PHOTO 63
BURGLAR ALARM RELAY
FLYWHEEL
MAGNETIC
LEVER
START MOTOR
T20
START SOLENOID PHOTO 24/39
ENGINE
PINION GEAR
MOTOR
OVERRUNNING CLUTCH
EC11 P.33
CA2D-K
CA2D-M
Start Relay Control
Start Input Signal
ECM PHOTO 70
M04-C
BCM PHOTO 55
BODY GROUND


Starting System (3)
SD360-3
D4BH : 4D56 TCI 2.5L
BATTERY
BODY GROUND
E/R FUSE & RELAY BOX LH
IGN 2 40A
E55 JOINT CONNECTOR
START RELAY
ECM
IGNITION SWITCH
I/P JUNCTION BOX
START MOTOR
START SOLENOID
FLYWHEEL
MAGNETIC LEVER
ENGINE
PINION GEAR
MOTOR
OVERRUNNING CLUTCH
TRANSAXLE RANGE SWITCH
IGNITION LOCK SWITCH
A/T
M/T
LHD
W/O B/Alarm
With B/Alarm
ICM CONTROL MODULE
BURGLAR ALARM RELAY
BCM


Starting System (4)
SD360-4
G4KG : THETA 2.4L
BATTERY
BODY GROUND
E/R FUSE & RELAY BOX LH
IGN 2 40A
JOINT CONNECTOR
START RELAY
START MOTOR
START SOLENOID
FLYWHEEL
MAGNETIC
LEVER
ENGINE
PINION GEAR
MOTOR
OVERRUNNING CLUTCH
IGNITION SWITCH
I/P JUNCTION BOX
A/T
M/T
LHD
RHD
TRANSAXLE RANGE SWITCH
IGNITION LOCK SWITCH
W/O B/Alarm
With B/Alarm
ICM CONTROL MODULE
BURGLAR ALARM RELAY
BCM
GE02
GE01
GSG03

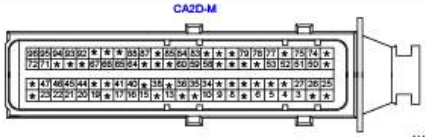
Starting System (5) SD360-5

CA2D-K



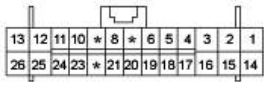
AMP_ECU_58F_B

CA2D-M



AMP_ECU_96F_B

CMD-A



AMP_0407_26F_W_HD

CAD60

KET_090II_02F_W_L

CA2D60

KET_090II_02F_W_L

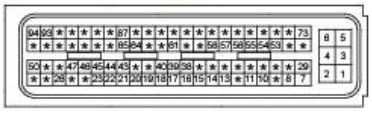
CSG87

KET_090II_02F_W_L

E21

KET_090II_02F_W_L

E35A



AMP_ECU_94F

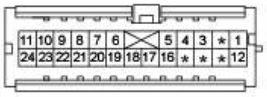
E38

CR04F077

E55

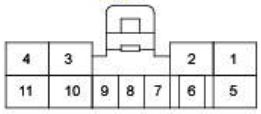
KET_58L(375)_01F_W

M04-C



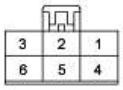
AMP_040II_24F_Gr

M08-A



KET_180S_11F_W_UNIT

M44



KUM_DSD_06F_B/L

T09

YAZ_03187WP_10F_Gr

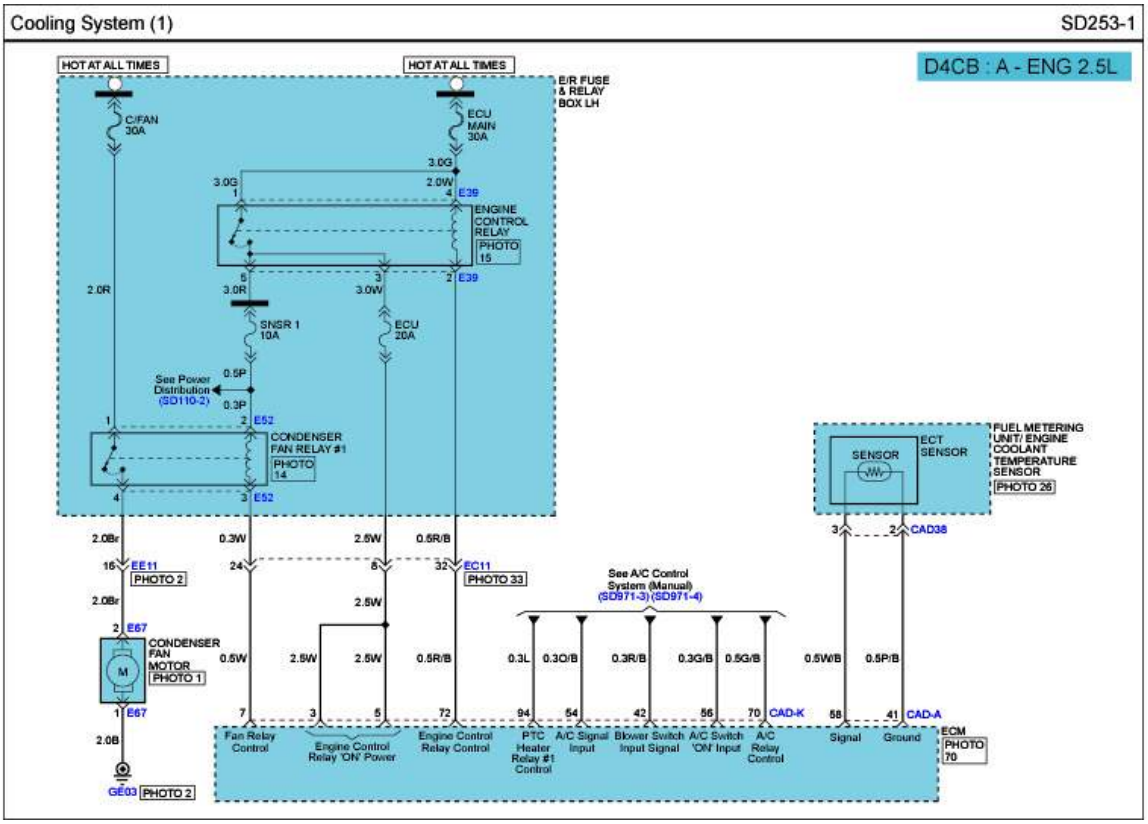
T20

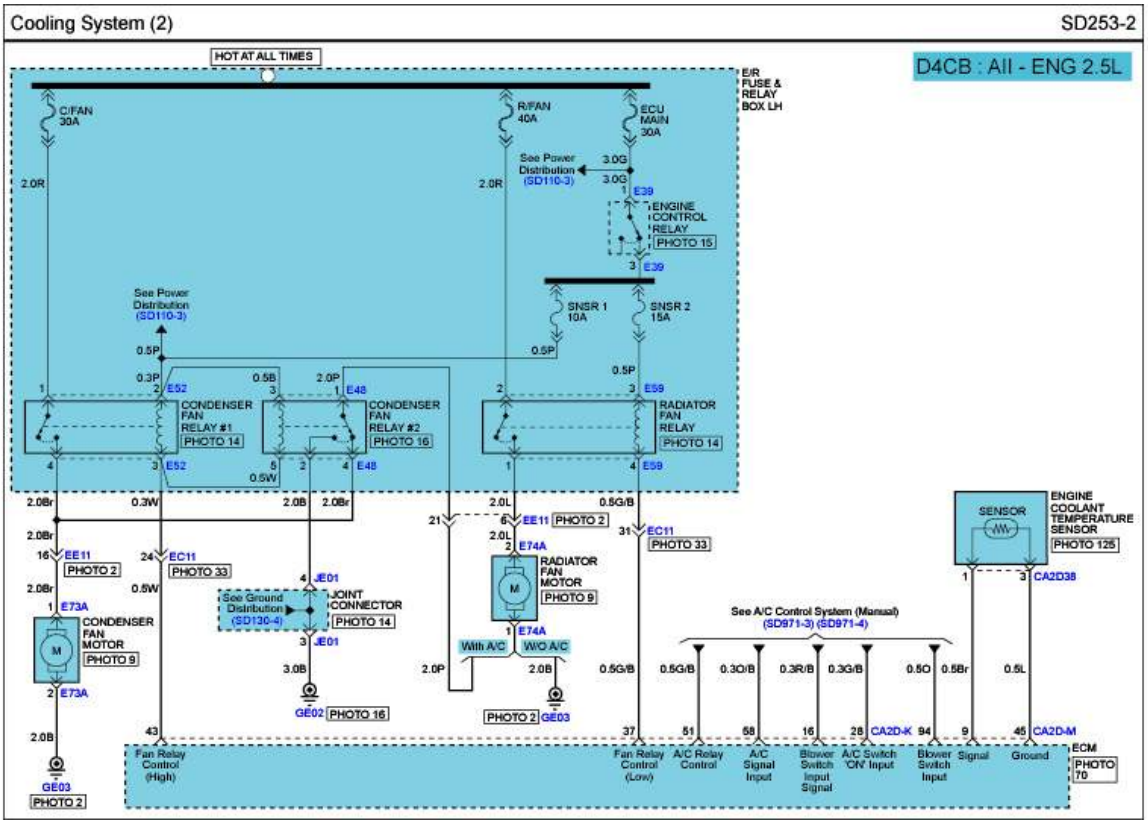
KET_250WP_01F_B

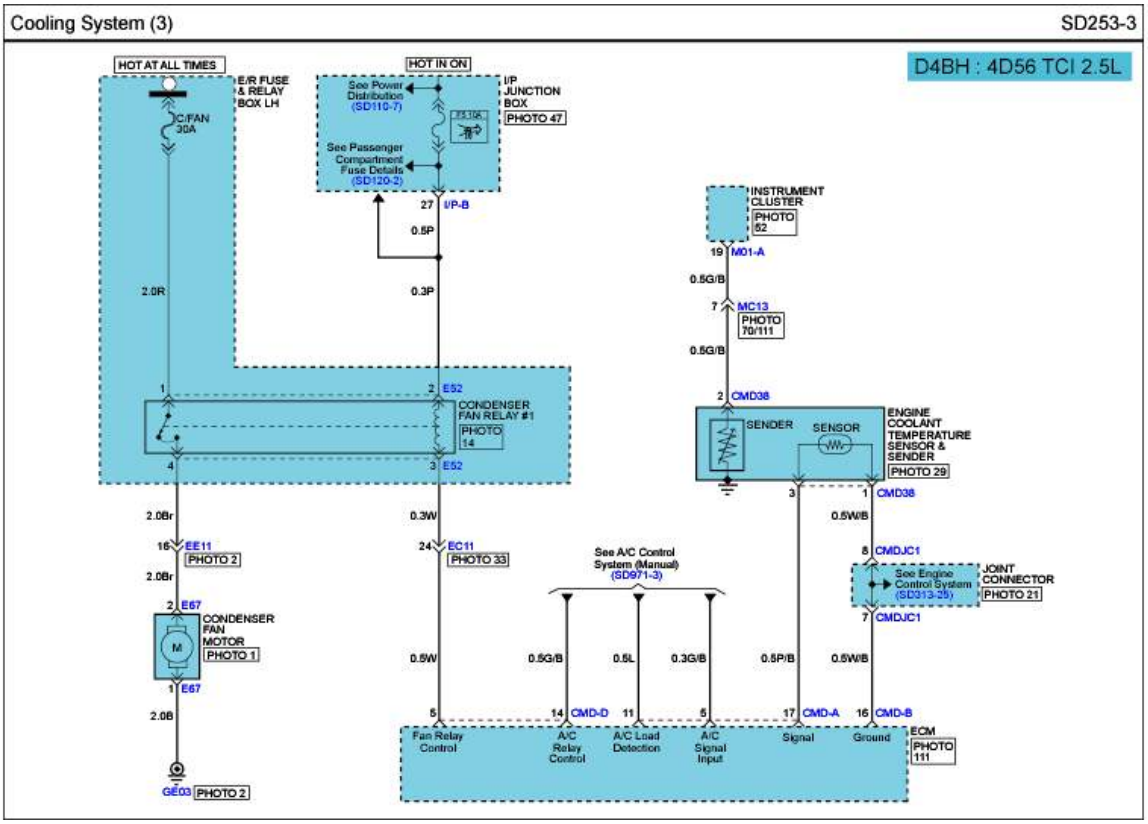
BLANK

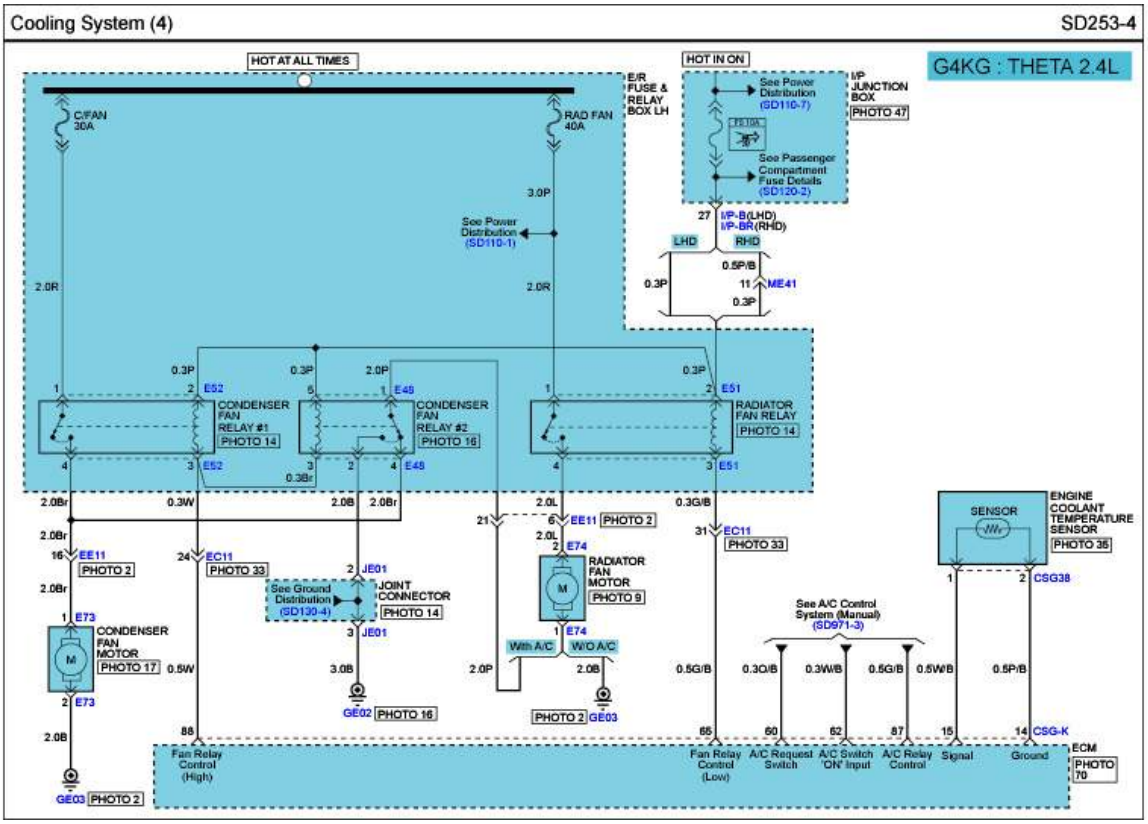
BLANK

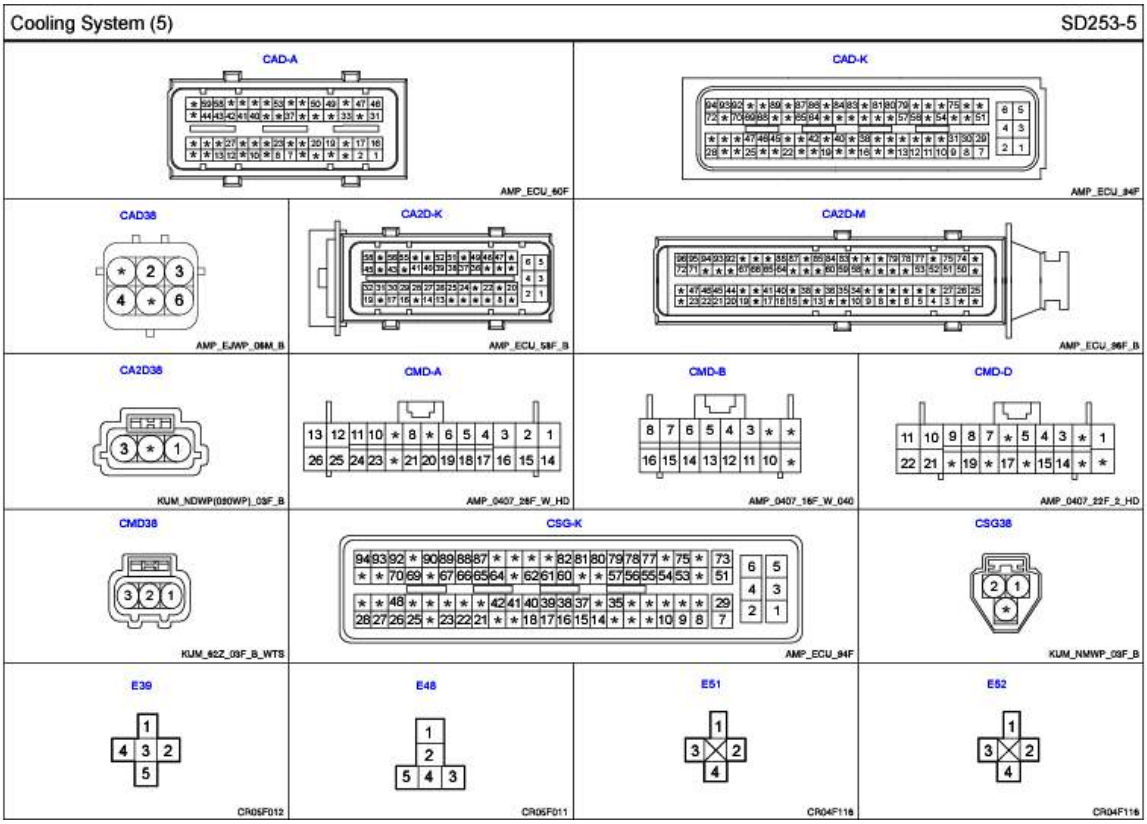
BLANK


Cooling System (1)
SD253-1
D4CB : A - ENG 2.5L
HOT AT ALL TIMES
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
C/FAN 30A
ECU MAIN 30A
ENGINE CONTROL RELAY
PHOTO 15
SNSR 1 10A
ECU 20A
See Power Distribution (SD110-2)
CONDENSER FAN RELAY #1
PHOTO 14
CONDENSER FAN MOTOR
PHOTO 1
PHOTO 2
GE03
SENSOR
ECT SENSOR
FUEL METERING UNIT/ ENGINE COOLANT TEMPERATURE SENSOR
PHOTO 26
CAD38
See A/C Control System (Manual) (SD971-3) (SD971-4)
EE11
EC11
PHOTO 33
CAD-K
CAD-A
Fan Relay Control
Engine Control Relay 'ON' Power
Engine Control Relay Control
PTC Heater Relay #1 Control
A/C Signal Input
Blower Switch Input Signal
A/C Switch 'ON' Input
A/C Relay Control
Signal
Ground
ECM
PHOTO 70

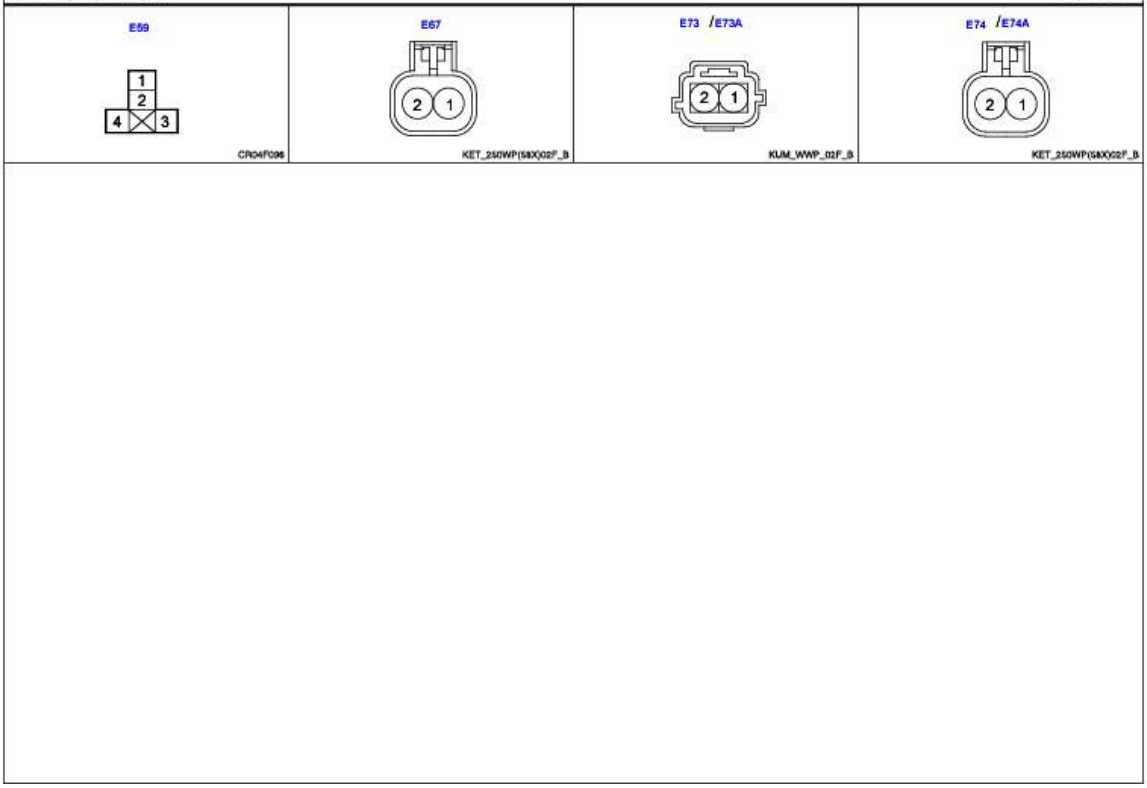

Cooling System (2)
SD253-2
D4CB : All - ENG 2.5L
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
C/FAN 30A
R/FAN 40A
ECU MAIN 30A
See Power Distribution (SD110-3)
ENGINE CONTROL RELAY
PHOTO 15
SNSR 1 10A
SNSR 2 15A
CONDENSER FAN RELAY #1
PHOTO 14
CONDENSER FAN RELAY #2
PHOTO 16
RADIATOR FAN RELAY
PHOTO 14
RADIATOR FAN MOTOR
PHOTO 9
CONDENSER FAN MOTOR
PHOTO 9
See Ground Distribution (SD130-4)
JOINT CONNECTOR
PHOTO 14
ENGINE COOLANT TEMPERATURE SENSOR
PHOTO 125
See A/C Control System (Manual) (SD971-3) (SD971-4)
With A/C
W/O A/C
Fan Relay Control (High)
Fan Relay Control (Low)
A/C Relay Control
A/C Signal Input
Blower Switch Input Signal
A/C Switch 'ON' Input
Blower Switch Input
Signal
Ground
ECM
PHOTO 70


Cooling System (3)
SD253-3
D4BH : 4D56 TCI 2.5L
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
C/FAN 30A
HOT IN ON
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-2)
I/P JUNCTION BOX
PHOTO 47
27 I/P-B
0.5P
0.3P
2.0R
INSTRUMENT CLUSTER
PHOTO 52
19 M01-A
0.5G/B
7 MC13
PHOTO 70/111
1
2 E52
CONDENSER FAN RELAY #1
PHOTO 14
4
3 E52
2 CMD38
SENDER
SENSOR
ENGINE COOLANT TEMPERATURE SENSOR & SENDER
PHOTO 29
3
1 CMD38
2.0Br
16 EE11
PHOTO 2
0.3W
24 EC11
PHOTO 33
0.5W/B
8 CMDJC1
See A/C Control System (Manual) (SD971-3)
See Engine Control System (SD313-25)
JOINT CONNECTOR
PHOTO 21
7 CMDJC1
2.0Br
2 E67
CONDENSER FAN MOTOR
PHOTO 1
1 E67
0.5W
0.5G/B
0.5L
0.3G/B
0.5P/B
0.5W/B
2.0B
5
14 CMD-D
11
5
17 CMD-A
16 CMD-B
Fan Relay Control
A/C Relay Control
A/C Load Detection
A/C Signal Input
Signal
Ground
ECM
PHOTO 111
GE03 PHOTO 2

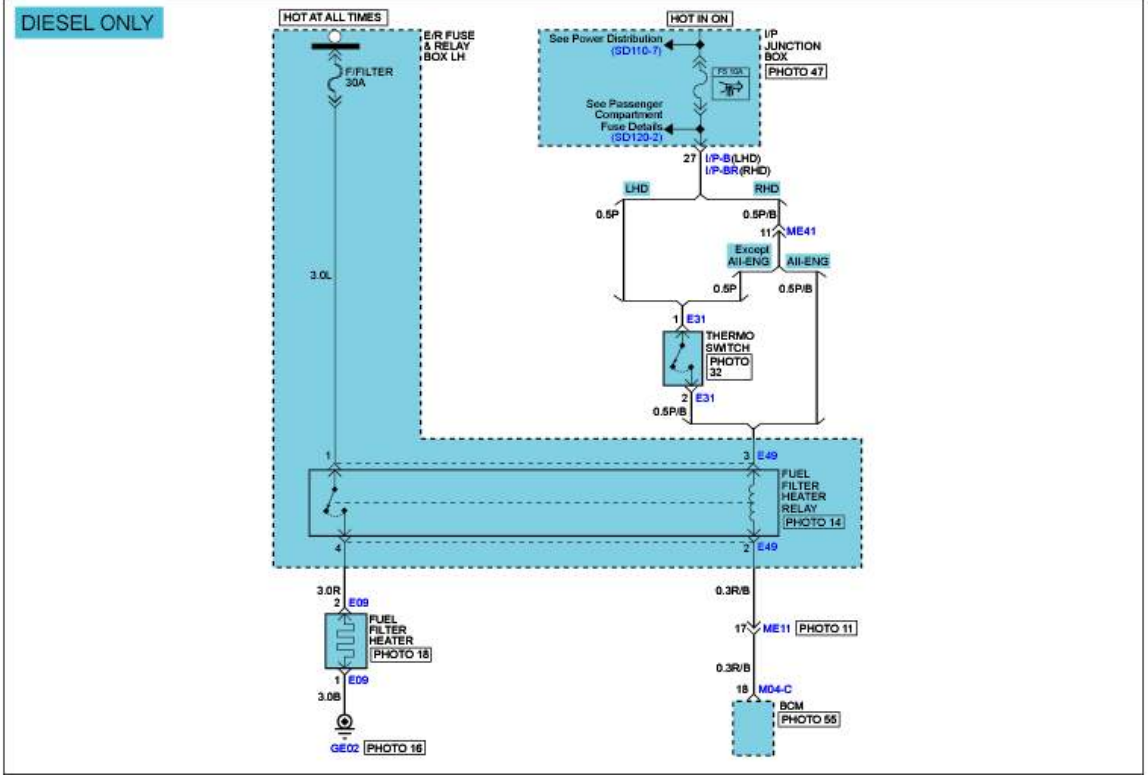

Cooling System (4)
SD253-4
G4KG : THETA 2.4L
HOT AT ALL TIMES
HOT IN ON
E/R FUSE & RELAY BOX LH
I/P JUNCTION BOX
PHOTO 47
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-2)
See Power Distribution (SD110-1)
C/FAN 30A
RAD FAN 40A
I/P-B(LHD) I/P-BR(RHD)
LHD
RHD
ME41
CONDENSER FAN RELAY #1
PHOTO 14
CONDENSER FAN RELAY #2
PHOTO 16
RADIATOR FAN RELAY
PHOTO 14
E52
E48
E51
RADIATOR FAN MOTOR
PHOTO 9
CONDENSER FAN MOTOR
PHOTO 17
See Ground Distribution (SD130-4)
JOINT CONNECTOR
PHOTO 14
JE01
EE11
PHOTO 2
EC11
PHOTO 33
E73
E74
GE02
PHOTO 16
GE03
With A/C
W/O A/C
See A/C Control System (Manual) (SD971-3)
SENSOR
ENGINE COOLANT TEMPERATURE SENSOR
PHOTO 35
CSG38
CSG-K
ECM
PHOTO 70
Fan Relay Control (High)
Fan Relay Control (Low)
A/C Request Switch
A/C Switch 'ON' Input
A/C Relay Control
Signal
Ground


Cooling System (5)
SD253-5
CAD-A
AMP_ECU_60F
CAD-K
AMP_ECU_94F
CAD38
AMP_EJWP_06M_B
CA2D-K
AMP_ECU_58F_B
CA2D-M
AMP_ECU_86F_B
CA2D38
KUM_NDWP(080WP)_03F_B
CMD-A
AMP_0407_26F_W_HD
CMD-B
AMP_0407_16F_W_040
CMD-D
AMP_0407_22F_2_HD
CMD38
KUM_62Z_03F_B_WTS
CSG-K
AMP_ECU_94F
CSG38
KUM_NMWP_03F_B
E39
CR05F012
E48
CR05F011
E51
CR04F116
E52
CR04F116

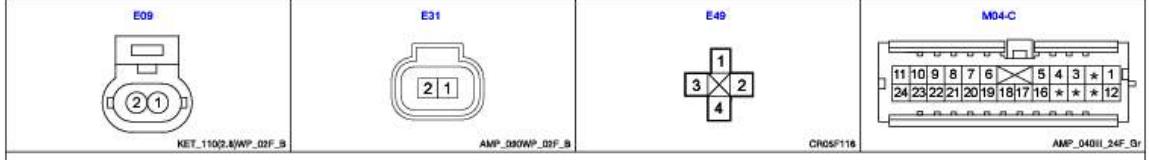
Cooling System (6) SD253-6



Fuel Filter Heating System (1) SD361-1

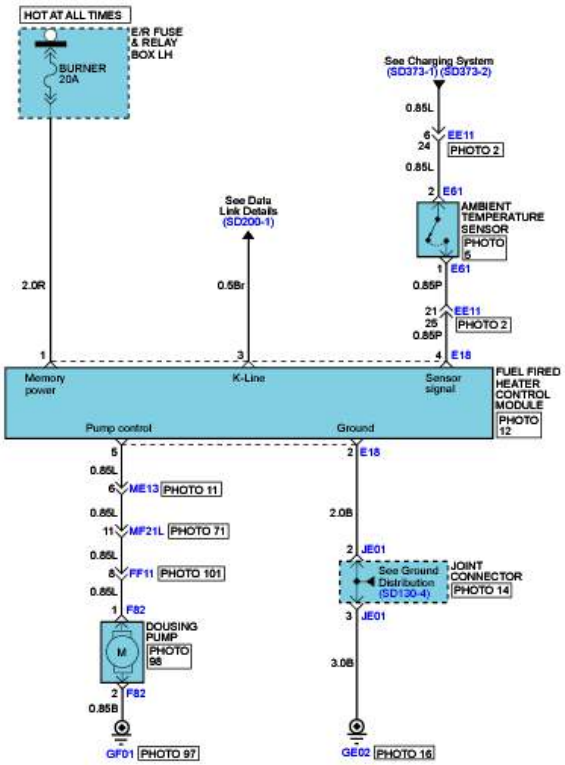


Fuel Filter Heating System (2) SD361-2



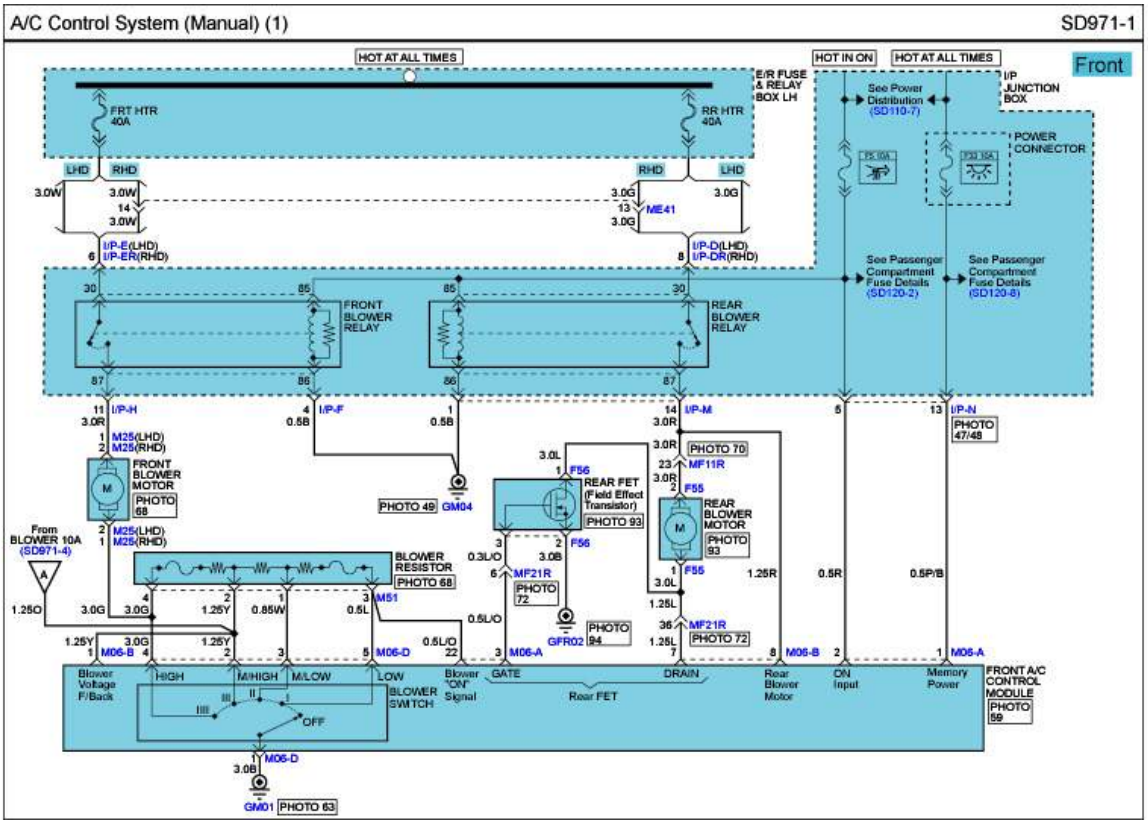
Fuel Fired Heater System (1) SD972-1

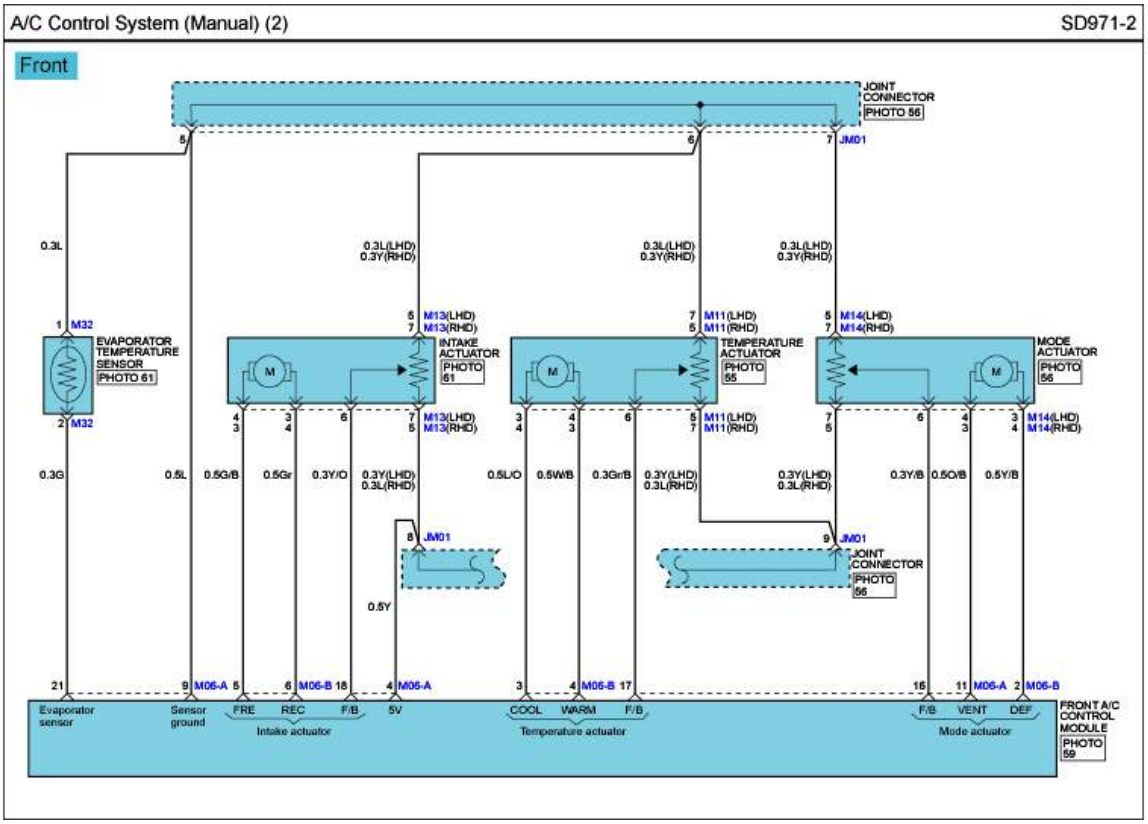
D4CB : A - ENG 2.5L & AII - ENG 2.5L (W/O PTC HEATER)

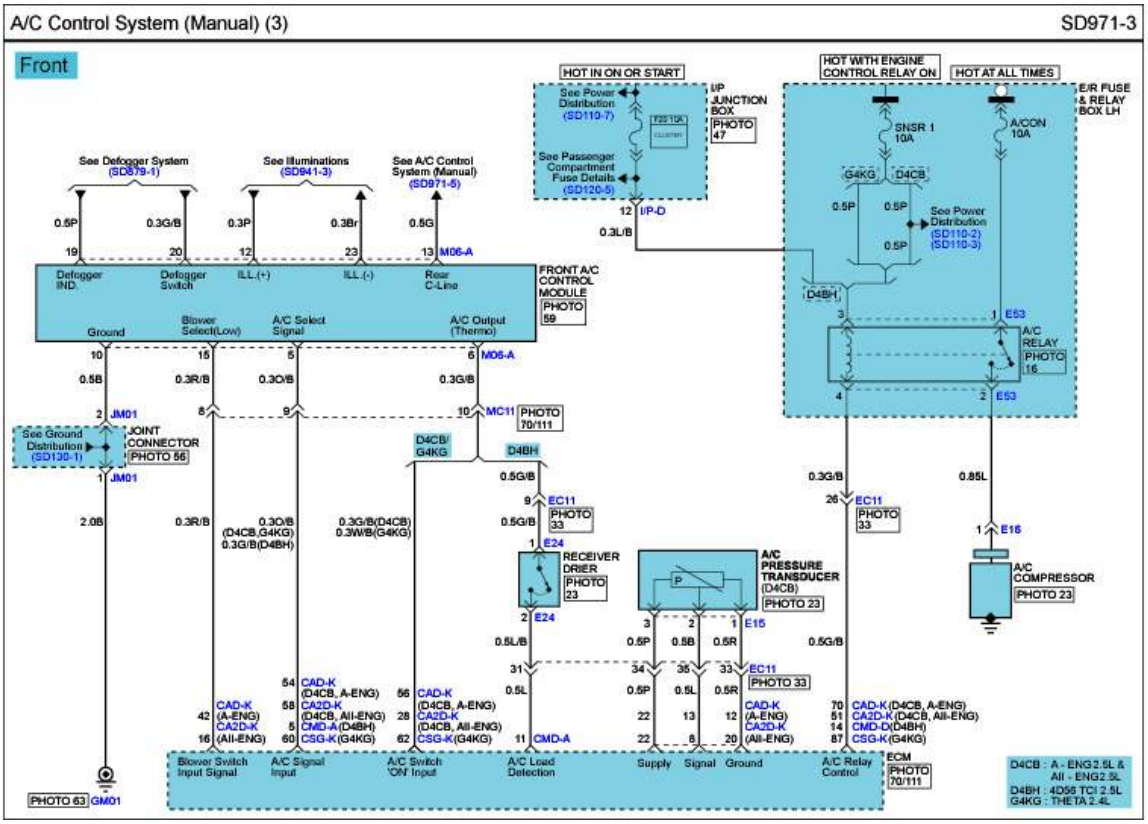


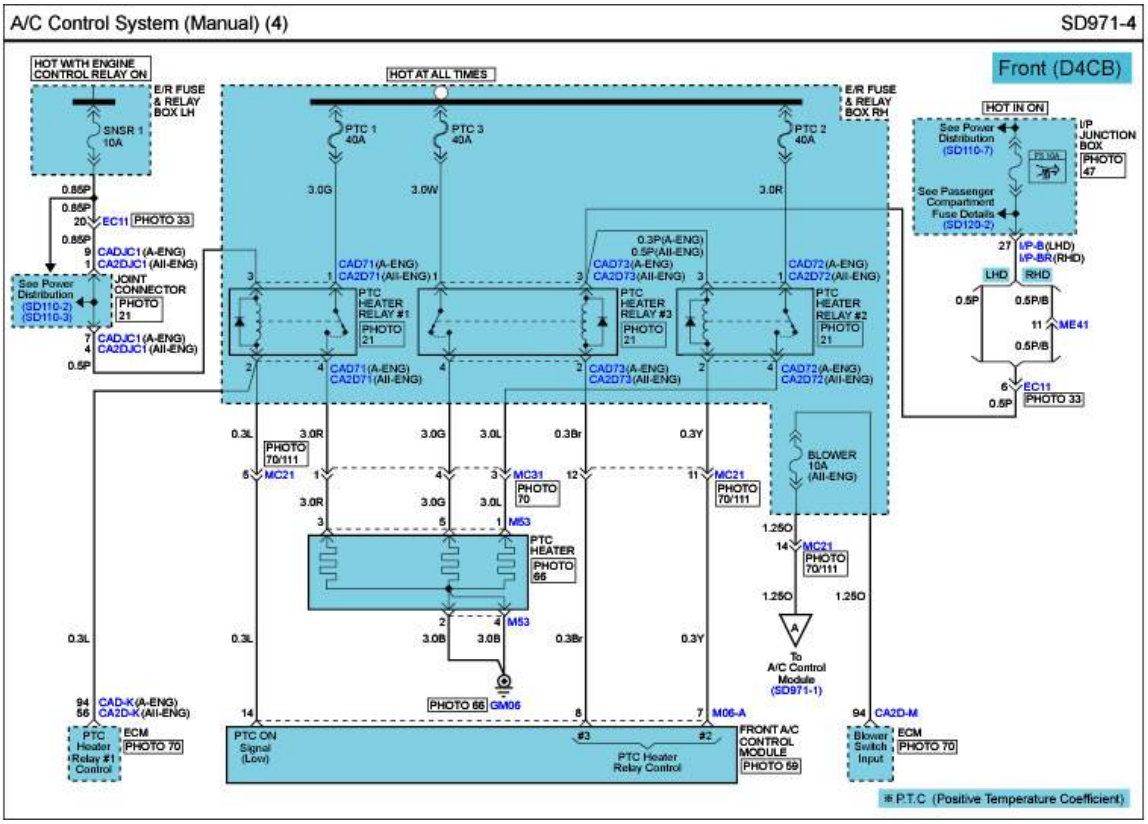
Fuel Fired Heater System (2) SD972-2

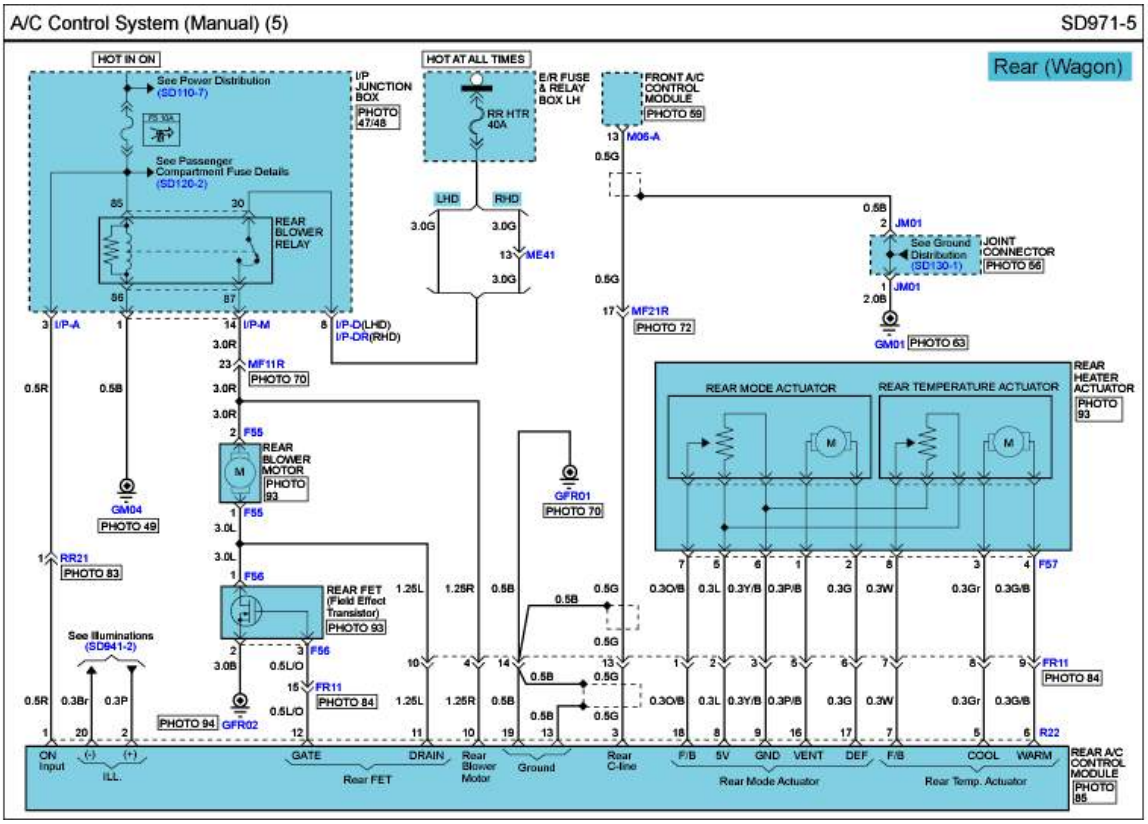
E18	E61	F82	
KUM_WWP_06F_B	BSH_JPT_02F_B	BSH_JPT_02F_B	BLANK


A/C Control System (Manual) (1)
SD971-1
Front
HOT AT ALL TIMES
HOT IN ON
HOT AT ALL TIMES
E/R FUSE & RELAY BOX LH
I/P JUNCTION BOX
See Power Distribution (SD110-7)
POWER CONNECTOR
FRT HTR 40A
RR HTR 40A
FRONT BLOWER RELAY
REAR BLOWER RELAY
See Passenger Compartment Fuse Details (SD120-2)
See Passenger Compartment Fuse Details (SD120-8)
FRONT BLOWER MOTOR
PHOTO 68
REAR FET (Field Effect Transistor)
PHOTO 93
REAR BLOWER MOTOR
PHOTO 93
BLOWER RESISTOR
PHOTO 68
From BLOWER 10A (SD971-4)
PHOTO 49
GM04
PHOTO 70
PHOTO 72
PHOTO 94
GFR02
PHOTO 47/48
Blower Voltage F/Back
HIGH
M/HIGH
M/LOW
LOW
BLOWER SWITCH
OFF
Blower "ON" Signal
GATE
DRAIN
Rear FET
Rear Blower Motor
ON Input
Memory Power
FRONT A/C CONTROL MODULE
PHOTO 59
GM01
PHOTO 63


A/C Control System (Manual) (2)
SD971-2
Front
JOINT CONNECTOR PHOTO 56
JM01
EVAPORATOR TEMPERATURE SENSOR PHOTO 61
M32
INTAKE ACTUATOR PHOTO 61
TEMPERATURE ACTUATOR PHOTO 55
MODE ACTUATOR PHOTO 56
M13(LHD) M13(RHD)
M11(LHD) M11(RHD)
M14(LHD) M14(RHD)
0.3L
0.3L(LHD) 0.3Y(RHD)
0.3G
0.5L
0.5G/B
0.5Gr
0.3Y/O
0.3Y(LHD) 0.3L(RHD)
0.5L/O
0.5W/B
0.3Gr/B
0.3Y/B
0.5O/B
0.5Y/B
0.5Y
JOINT CONNECTOR PHOTO 56
M06-A
M06-B
Evaporator sensor
Sensor ground
FRE
REC
F/B
5V
Intake actuator
COOL
WARM
F/B
Temperature actuator
F/B
VENT
DEF
Mode actuator
FRONT A/C CONTROL MODULE PHOTO 59

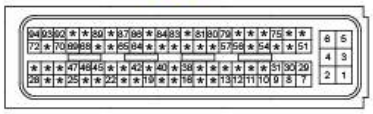

A/C Control System (Manual) (3)
SD971-3
Front
HOT IN ON OR START
HOT WITH ENGINE CONTROL RELAY ON
HOT AT ALL TIMES
See Power Distribution (SD110-7)
I/P JUNCTION BOX
PHOTO 47
See Passenger Compartment Fuse Details (SD120-5)
E/R FUSE & RELAY BOX LH
SNSR 1 10A
A/CON 10A
G4KG
D4CB
See Power Distribution (SD110-2) (SD110-3)
See Defogger System (SD879-1)
See Illuminations (SD941-3)
See A/C Control System (Manual) (SD971-5)
I/P-D
M06-A
FRONT A/C CONTROL MODULE
PHOTO 59
Defogger IND.
Defogger Switch
ILL.(+)
ILL.(-)
Rear C-Line
Ground
Blower Select(Low)
A/C Select Signal
A/C Output (Thermo)
D4BH
E53
A/C RELAY
PHOTO 16
JM01
JOINT CONNECTOR
PHOTO 56
See Ground Distribution (SD130-1)
MC11
PHOTO 70/111
D4CB/ G4KG
EC11
PHOTO 33
E24
RECEIVER DRIER
PHOTO 23
A/C PRESSURE TRANSDUCER (D4CB)
PHOTO 23
E15
E16
A/C COMPRESSOR
PHOTO 23
CAD-K (D4CB, A-ENG)
CA2D-K (D4CB, All-ENG)
CMD-A (D4BH)
CSG-K (G4KG)
CAD-K (A-ENG)
CA2D-K (All-ENG)
CMD-D (D4BH)
Blower Switch Input Signal
A/C Signal Input
A/C Switch 'ON' Input
A/C Load Detection
Supply
Signal
Ground
A/C Relay Control
ECM
PHOTO 70/111
PHOTO 63
GM01
D4CB : A - ENG 2.5L & All - ENG 2.5L
D4BH : 4D56 TCI 2.5L
G4KG : THETA 2.4L


A/C Control System (Manual) (4)
SD971-4
Front (D4CB)
HOT WITH ENGINE CONTROL RELAY ON
HOT AT ALL TIMES
HOT IN ON
E/R FUSE & RELAY BOX LH
E/R FUSE & RELAY BOX RH
SNSR 1 10A
PTC 1 40A
PTC 3 40A
PTC 2 40A
I/P JUNCTION BOX
PHOTO 47
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-2)
See Power Distribution (SD110-2) (SD110-3)
JOINT CONNECTOR
PHOTO 21
PTC HEATER RELAY #1
PTC HEATER RELAY #3
PTC HEATER RELAY #2
PHOTO 33
PHOTO 70/111
PHOTO 70
PHOTO 66
BLOWER 10A (All-ENG)
To A/C Control Module (SD971-1)
PTC Heater Relay #1 Control
ECM
PHOTO 70
PTC ON Signal (Low)
PTC Heater Relay Control
FRONT A/C CONTROL MODULE
PHOTO 59
Blower Switch Input
LHD
RHD
* P.T.C (Positive Temperature Coefficient)


A/C Control System (Manual) (5)
SD971-5
Rear (Wagon)
HOT IN ON
HOT AT ALL TIMES
See Power Distribution (SD110-7)
See Passenger Compartment Fuse Details (SD120-2)
I/P JUNCTION BOX
PHOTO 47/48
E/R FUSE & RELAY BOX LH
RR HTR 40A
FRONT A/C CONTROL MODULE
PHOTO 69
M06-A
REAR BLOWER RELAY
LHD
RHD
ME41
JM01
See Ground Distribution (SD130-1)
JOINT CONNECTOR
PHOTO 56
GM01
PHOTO 63
MF21R
PHOTO 72
I/P-A
I/P-M
I/P-D(LHD)
I/P-DR(RHD)
MF11R
PHOTO 70
REAR MODE ACTUATOR
REAR TEMPERATURE ACTUATOR
REAR HEATER ACTUATOR
PHOTO 93
F55
REAR BLOWER MOTOR
PHOTO 93
GM04
PHOTO 49
GFR01
PHOTO 70
RR21
PHOTO 83
F56
REAR FET (Field Effect Transistor)
PHOTO 93
F57
See Illuminations (SD941-2)
FR11
PHOTO 84
PHOTO 94
GFR02
R22
REAR A/C CONTROL MODULE
PHOTO 85
ON Input
ILL.
GATE
DRAIN
Rear FET
Rear Blower Motor
Ground
Rear C-line
F/B
5V
GND
VENT
DEF
Rear Mode Actuator
F/B
COOL
WARM
Rear Temp. Actuator

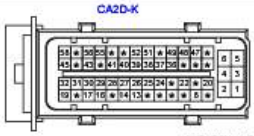
A/C Control System (Manual) (6) SD971-6

CAD-K



AMP_ECU_94F

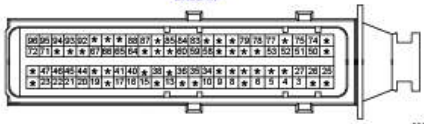
CA2D-K



AMP_ECU_58F_B

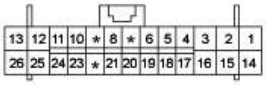
BLANK

CA2D-M



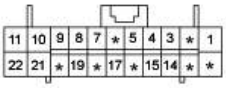
AMP_ECU_96F_B

CMD-A



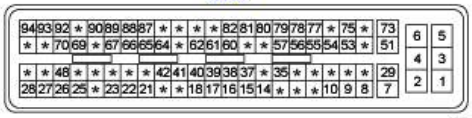
AMP_0407_26F_W_HD

CMD-D



AMP_0407_22F_W_HD

CSG-K



AMP_ECU_84F

CAD71 /CA2D71

CR04F101

CAD72 /CA2D72

CR04F101

CAD73 /CA2D73

CR04F101

E15

KET_040WP_03F_B

E16

KUM_NMWP(A)_01F_B

E24

KET_080WP_02F_B_RD

E53

CR04F056

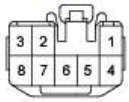
F55

KET_250_02F_W

F56

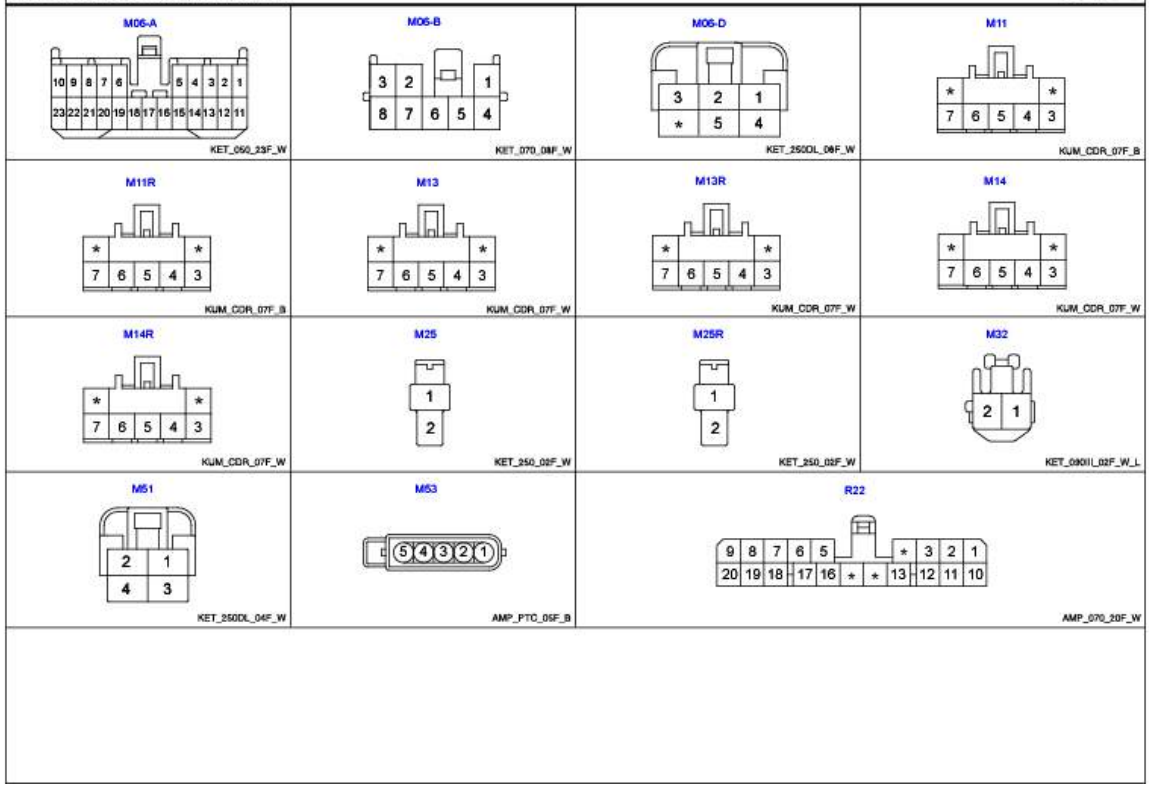
KUM_DSD_03F_B

F57

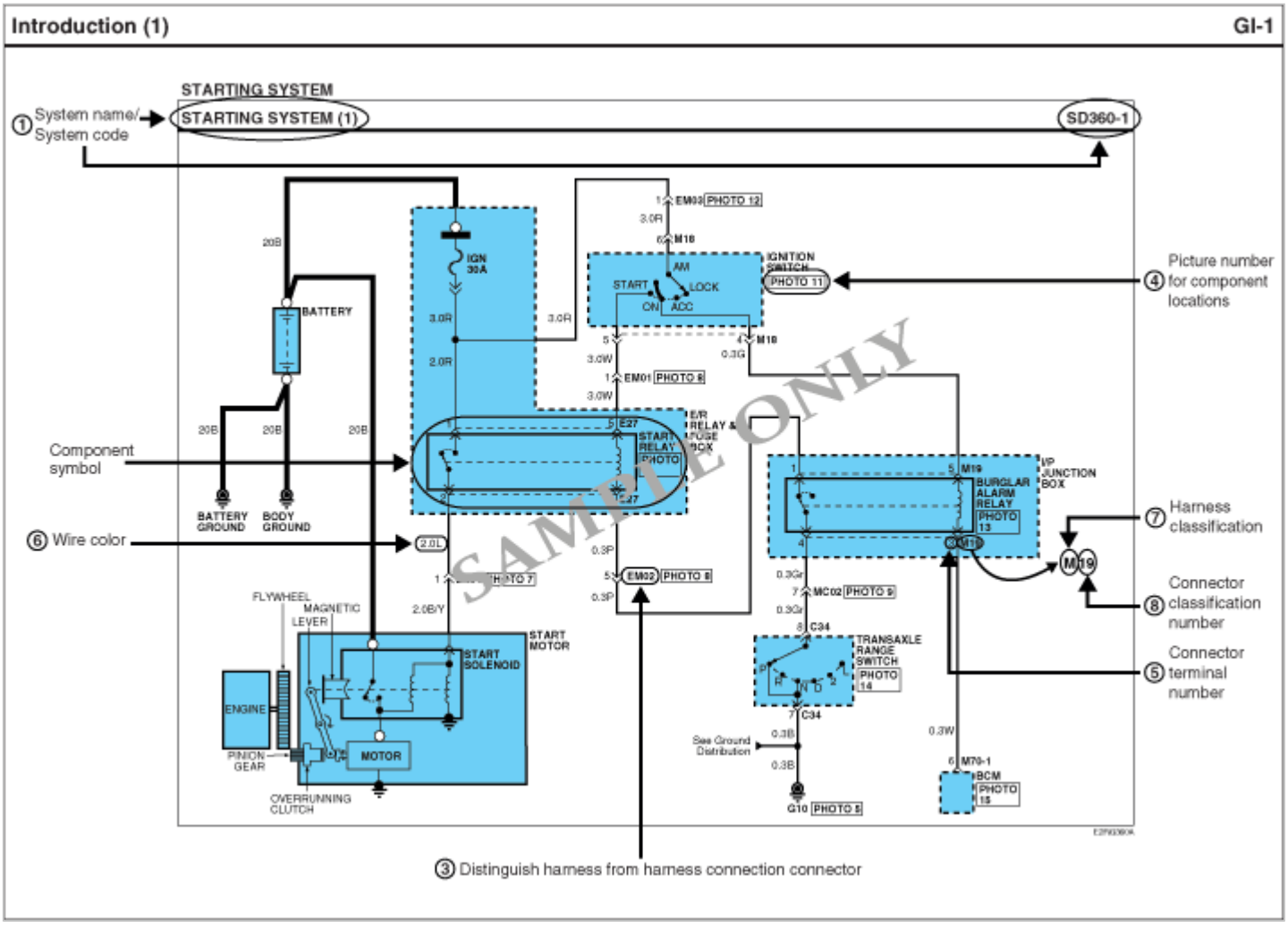


KET_080II_08F_W

A/C Control System (Manual) (7) SD971-7



Introduction

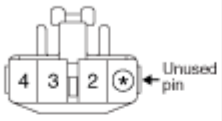
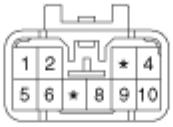
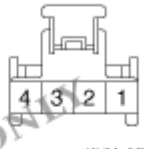
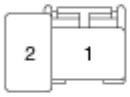


Introduction (2) GI-2

STARTING SYSTEM

STARTING SYSTEM (2) SD360-2

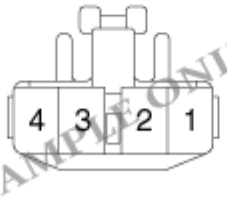
Connector configurations (components) ②

M05	M06	M11	M13
 KET_090II_04F_W	 KET_090II_10M_W	 KUM_AR_04F_W	KET_090IL_10F_W
M67	**M81**	**BLANK**	**BLANK**
 AMP_PLM2_02F_B	KET_090II_06M_W		

E2903B0E

Explanation of connector code

M05



KET_090II_04F_W

a b c d e

a : Connector manufacturer
b : Terminal series number
c : The number of connector terminals
d : Connector distinguishing → Female Pin : F / Male Pin : M
e : Connector color abbreviations
- B (Black)
- Br (Brown)
- G (Green)
- Gr (Gray)
- L (Blue)
- R (Red)
- W (White)
- Y (Yellow)

SAMPLE ONLY

Introduction (3) GI-3

① Pages by system/ Name of Schematic diagram

- Each page is consisted of circuits by system. This schematic diagram includes the path of electricity flow, connection condition for each switch, and the function of other relevant circuits at once. It is applicable to real service work.
- It is very important to understand relevant circuits exactly before troubleshooting diagnosis.
- Circuits by system depends upon part number and are indicated on schematic diagram index.

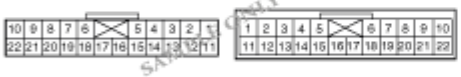
② Connector configuration (components)

- The connector figure of components in the schematic diagram by system is indicated on the last page of schematic diagram.
- It shows the front of the connector on the harness side when not to the harness connector. The terminal number on each connector can be obtained by following the pattern used in ⑤ connector view and numbering order. Unused terminals are marked with an asterisk (*).

③ Connector configurations (connection between harnesses)

- When connecting the harness with connector between harnesses, it shows female and male connectors and indicates them on the connector configurations group.

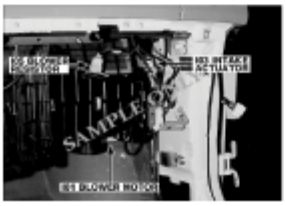
EM02



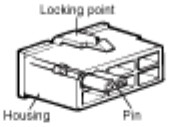
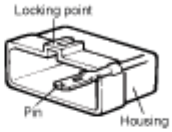
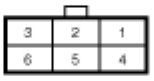
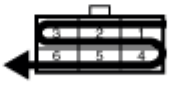
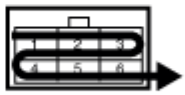
④ Component locations

- To find the components easily, a component locations diagram is indicated with "PHOTO NO" on the lower portion of the component name.
- To make it easy to distinguish connectors, the connector in the picture is indicated being installed in the vehicle.

PHOTO 03



⑤ CONNECTOR VIEW AND NUMBERING ORDER

Female	Male	Remarks
		It is not the shape of the connector housing, but the connector pin that distinguishes between male or female connectors. When numbering female and male connectors, refer to the numbering order in the following table. Some connectors may not follow this method of numbering order. For individual detailed numbering, refer to the CONNECTOR CONFIGURATIONS.
		
		Numbered in order from upper right to lower left Numbered in order from upper left to lower right

NOTE

UNLESS OTHERWISE STATED, ALL CONNECTOR VIEWS ARE FROM THE TERMINAL SIDE OF THE CONNECTOR.

Introduction (4) GI-4

⑥ WIRE COLOR ABBREVIATIONS

The following abbreviations are used to identify wire colors in the circuit schematics.

Symbol	Color of wire	Symbol	Color of wire
B	Black	O	Orange
Br	Brown	P	Pink
G	Green	R	Red
Gr	Gray	W	White
L	Blue	Y	Yellow
Lg	Light Green	LI	Light Blue

* Ⓨ/Ⓑ: Yellow wire with black stripe (2 colors)

the color of wire — the color of stripe

⑦ HARNESS CLASSIFICATION

Electrical wiring connectors are classified according to the wiring parts in the Harness Layouts.

Symbol	Harness name	Location
A	Air bag harness	Under crash pad and Floor
C	Control, Injector, Ignition coil	Engine compartment,

⑧ CONNECTOR IDENTIFICATION

A connector identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector.
These connector locations can be found in the HARNESS LAYOUTS.

For example:

E 10 -1
- -1: Number corresponding to sub-connector (Serial Number)
- 10: Number corresponding to main connector (Serial Number)
- E: Symbol indicating wiring harness (Engine wiring harness)

NOTE

Connectors which connect each wiring harness are represented by the following symbols.

For example:

M R 01
- 01: Number corresponding to main connector (Serial Number)
- R: Rear wiring harness
- M: Main wiring harness

	harness	Passenger compartment
D	Door harness	Door
E	Front, Front end EXT. harness	Engine compartment
F	Floor, Frame, Front EXT. harness	Floor
M	Main harness	Passenger compartment
R	Roof, Tail gate, Twin Swing Door, HMSL, Back Waring harness	Roof, Tail gate
T	TM harness	Engine Acompartment

* Depending on the vehicle, it is necessary to check the harness name symbol on the harness layouts for detailed symbol.

JUNCTION BLOCK IDENTIFICATION

A junction block identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector in the junction block.

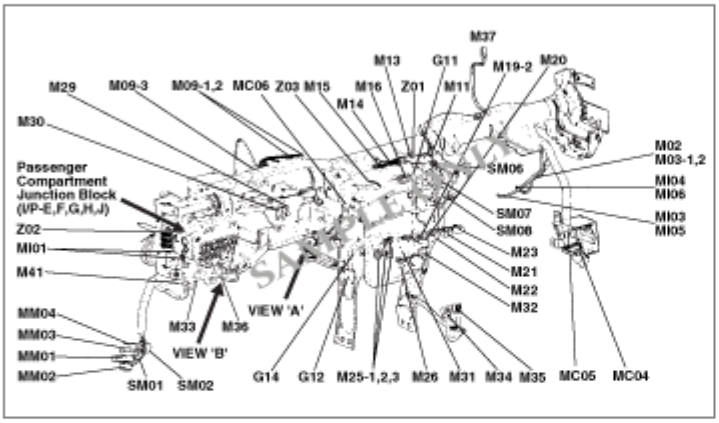
For example:

I/P- A
- A: Connector name
- I/P: Abbreviation of the word "Passenger compartment junction block"

Symbol	Harness name	Location
A	Air Bag, Air Bag EXT. harness	Floor and under crash pad
C	Control, Injector, Ignition Coil, Oil Control Valve harness	Engine compartment, Passenger compartment
D	Door, Door EXT. harness	Door
E	Front, Front Warning EXT., Front End Module, Battery Cable, Generator EXT. harness	Engine compartment, Battery
F	Floor, EPB EXT. harness	Floor
M	Main, Console EXT. harness	Passenger compartment
R	Trunk Lid, Roof, BWS EXT. harness	Roof, Trunk
S	Seat harness	Seat

HARNESS LAYOUTS

Harness layouts show the routing of the major wiring harnesses, the in-line connectors and the splices between the major harnesses. These layouts will make electrical troubleshooting easier.

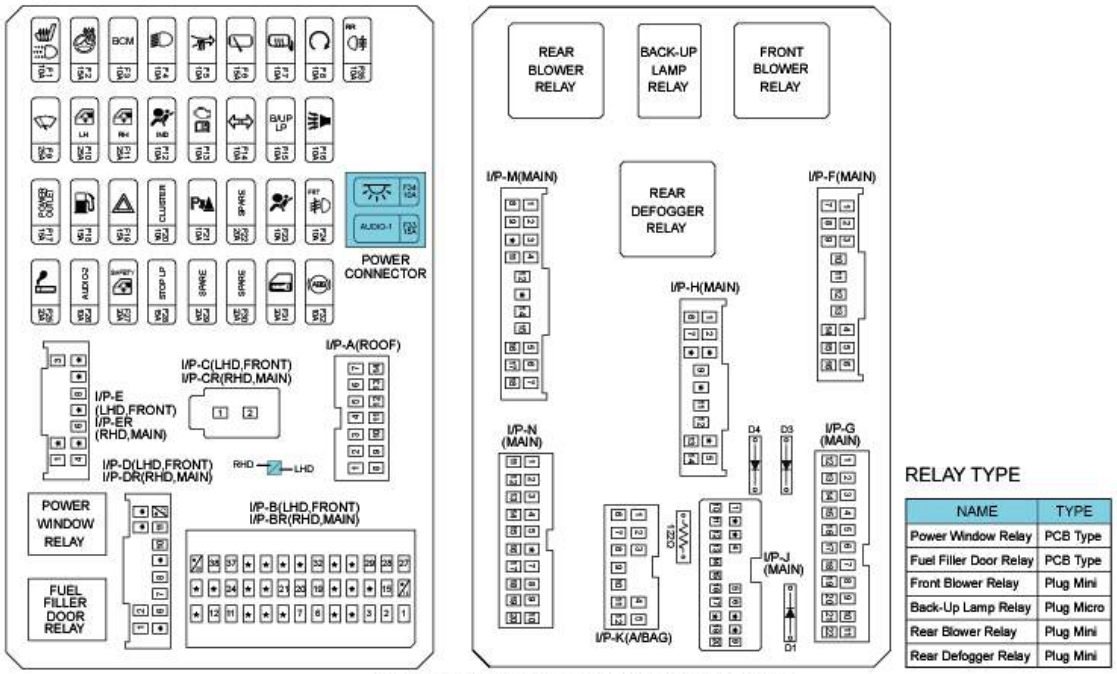


MAIN HARNESS

M01-1	Multifunction switch	MH10	Driver door unlock relay
M01-2	Multifunction switch	MH11	Cast lites lock
M01-3	Multifunction switch (CANADA)	MH12	Auto light control module
M01-4	Multifunction switch (USA)	MH15	Power outlet
M04	Ignition switch	MH16	Pre-oscillation resistor
M05	Ignition key ILL. & Door warning switch	LP-E	Connection with PASSENGER COMPARTMENT JUNCTION BLOCK
M06	Multipurpose check connector	LP-F	Connection with PASSENGER COMPARTMENT JUNCTION BLOCK
M07	Data link connector	LP-G	Connection with PASSENGER COMPARTMENT JUNCTION BLOCK
M08	Joint connector	LP-H	Connection with PASSENGER COMPARTMENT JUNCTION BLOCK
M09-1	Instrument cluster (M/O Trip)	LP-J	Connection with PASSENGER COMPARTMENT JUNCTION BLOCK
M09-2	Instrument cluster (M/O Trip)	EM04	Connection with ENGINE harness
M09-3	Instrument cluster (M/O Trip)	EM02	Connection with ENGINE harness
M10-1	Instrument cluster (With Trip)	EM03	Connection with ENGINE harness
M10-2	Instrument cluster (With Trip)	MC04	Connection with CONTROL harness (SULEV)
M10-3	Instrument cluster (With Trip)	MC05	Connection with CONTROL harness (SULEV)
M12	Immobilizer control module	MC06	Connection with CONTROL harness (SULEV)
M16	Audio	MC07	Connection with CONTROL harness (CVVT)
M19-1	A/C control module (Auto A/C)	MC08	Connection with CONTROL harness (CVVT)
M19-2	A/C control module (Auto A/C)	MC09	Connection with CONTROL harness (CVVT)
M20	A/C control module (Manual A/C)	MM03	Connection with SWITCH EXT. harness
M21	Blower switch (Manual A/C)	MM03	Connection with A/C harness (Manual A/C)
M25-1	E TACM	MM04	Connection with A/C harness (Manual A/C)
M25-2	E TACM	MM05	Connection with A/C harness (Auto A/C)
M25-3	E TACM	MM06	Connection with A/C harness (Auto A/C)
M27	Joint connector	MM01	Connection with FLOOR harness
M30	Chime bell	MM02	Connection with FLOOR harness
M31	Cigarette lighter	MM03	Connection with FLOOR harness
M32	Door lock control module	MM07	Connection with HAZARD EXT. harness
M33	Joint connector	MM11	Connection with GLOVE BOX harness
M34	Left front seat warmer switch	G11	Ground
M35	Right front seat warmer switch	G12	Ground
M36	Joint connector	G13	Ground
M37	Photo sensor	Z01	Diode
M38	Flasher unit	Z02	Diode
M39	Hazard relay	Z03	Diode
M41	Burglar alarm relay		

Fuse & Relay Information (1) SD100-1

I/P JUNCTION BOX LAYOUT



RELAY TYPE

NAME	TYPE
Power Window Relay	PCB Type
Fuel Filler Door Relay	PCB Type
Front Blower Relay	Plug Mini
Back-Up Lamp Relay	Plug Micro
Rear Blower Relay	Plug Mini
Rear Defogger Relay	Plug Mini

※ USE THE DESIGNATED FUSE ONLY

Fuse & Relay Information (2) SD100-2

Circuit

Fuse No.	(A)	Symbol	Fuse Name	Circuit Protected
F1	10A		DRL	BCM (Europe), Driver Seat Warmer Switch
F2	15A		S/HTD DRI	Steering Wheel Heater
F3	10A	BCM	BCM	BCM
F4	10A		H/LP	E/R Fuse & Relay Box LH (Head Lamp (High/Low) Relay)
F5	10A		HTR	Front/Rear Blower Relay, Front/Rear A/C Control Module, Electro Chromic Mirror, Thermo Switch E/R Fuse & Relay Box RH(PTC Heater Relay #2/#3(D4CB)), Condenser Fan Relay #1(D4BH, G4KG) E/R Fuse & Relay Box LH(Radiator Fan Relay(G4KG), EGR Solenoid Valve(D4BH), Condenser Fan Relay #2 (G4KG))
F6	15A		RR WIPER	ICM Control Module (Rear Wiper Relay), Rear Wiper Motor, Multifunction Switch
F7	10A		MIRR HTD	Front A/C Control module, Power Outside Mirror LH/RH
F8	10A		START	E/R Fuse & Relay Box LH (Start Relay), ECM, ICM Control Module (Burglar Alarm Relay)
F9	25A		FRT WIPER	E/R Fuse & Relay Box LH (Front Wiper Relay), Front Wiper Motor, Multifunction Switch
F10	25A		P/WDW LH	Power Window Main Switch, Power Window Switch LH, Safety Power Window Motor LH
F11	25A		P/WDW RH	Power Window Main Switch, Power Window Switch RH, Safety Power Window Motor RH
F12	10A		A/BAG IND	Instrument Cluster
F13	10A		ECU	Vehicle Speed Sensor, ECM, Mass Air Flow Sensor(D4CB), Injection Pump(D4BH), TCM, Fuel Filter Warning Sensor, Neutral Switch(D4BH), Sport Mode Switch
F14	10A		T/SIG	Hazard Switch
F15	10A	B/UP LP	B/UP LP	Back-Up Lamp Switch, Transaxle Range Switch, Back-Up Lamp Relay (D4CB&A/T)
F16	10A		B/ALARM	ICM Control Module (Burglar Alarm Horn Relay)
F17	15A	POWER OUTLET	POWER OUTLET	Front Power Outlet
F18	15A		FUEL LID	Fuel Filler Door Relay (PCB Type)
F19	15A		HAZARD	ICM Control Module (Hazard Relay (With B/Alarm))
F20	10A	CLUSTER	CLUSTER	Instrument Cluster, BCM, Immobilizer Control Module(D4BH), E/R Fuse & Relay Box LH(A/C Relay(D4BH)), Pre-Excitation Resistor(D4CB), ICM Control Module (Pre-Excitation Resistor (D4CB/G4KG)), Audio

※ USE THE DESIGNATED FUSE ONLY

Fuse & Relay Information (3) SD100-3

Circuit

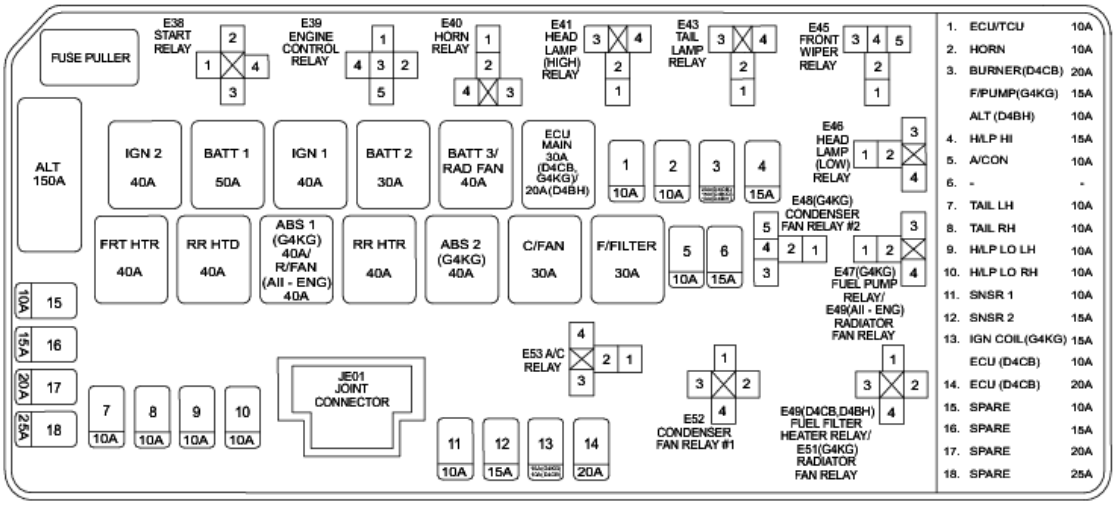
Fuse No.		(A)	Symbol	Fuse Name	Circuit Protected
F21		20A		BWS	Rear Parking Assist Buzzer
F22		25A	SPARE	-	-
F23		25A		A/BAG	SRS Control Module
F24		15A	RRT	FRT FOG	ICM Control Module (Front Fog Lamp Relay), Battery Sensor (D4CB, All - ENG)
F25		15A		C/LIGHTER	Cigarette Lighter
F26		15A	AUDIO-2	AUDIO-2	Audio, Digital Clock, BCM, Power Outside Mirror Switch
F27		10A	SAFETY	SAFETY P/WDW	Safety Power Window Motor LH/RH
F28		10A	STOP LP	STOP LP	Stop Lamp Switch, Stop Signal Relay
F29		20A	SPARE	-	-
F30		20A	SPARE	-	-
F31		20A		DR LOCK	ICM Control Module (Door Lock/Unlock Relay)
F32		20A	ABS	ABS	ABS/ESP Control Module, ESP Switch
POWER CONNEC-TOR	F33	10A		ROOM LP	Digital clock, Instrument Cluster, Courtesy Lamp LH/RH, Step Lamp LH/RH, Cargo Lamp, Door Warning Switch, Data Link Connector, BCM, Power Outside Mirror Switch, Vanity Lamp Switch LH/RH, Overhead Console Lamp, Immobilizer Control Module(D4BH), Front A/C Control Module, Front Room Lamp, Room Lamp Switch
	F34	20A	AUDIO-1	AUDIO-1	Audio
F35		30A	RR	RR FOG	ICM Control Module (Rear Fog Lamp Relay)

※ USE THE DESIGNATED FUSE ONLY

Fuse & Relay Information (4) SD100-4

E/R FUSE & RELAY BOX LH

LAYOUT



RELAY TYPE

NO.	NAME	TYPE	NO.	NAME	TYPE	NO.	NAME	TYPE
E38	Start Relay	Plug Mini	E45	Front Wiper Relay	Plug Micro	E51	Radiator Fan Relay	Plug Mini
E39	Engine Control Relay	Plug Mini	E46	Head Lamp(Low) Relay	Plug Micro	E52	Condenser Fan Relay #1	Plug Mini
E40	Horn Relay	Plug Micro	E47	Fuel Pump Relay	Plug Micro	E53	A/C Relay	Plug Micro
E41	Head Lamp(High) Relay	Plug Micro	E48	Condenser Fan Relay #2	Plug Micro	E59	Radiator Fan Relay	Plug Micro
E43	Tail Lamp Relay	Plug Micro	E49	Fuel Filter Heater Relay	Plug Mini			

※ USE THE DESIGNATED FUSE AND RELAY ONLY

Fuse & Relay Information (5) SD100-5

CIRCUIT

FUSIBLE LINK	(A)	Circuit Protected
ALT	150A	Fuse(A/CON 10A, R/FAN 40A, FRT HTR 40A, RR HTR 40A, RR HTD 40A, C/FAN 30A, F/FILTER 30A, ABS 1/2 40A), Alternator, E/R Fuse & Relay Box RH
BATT 1	50A	Fuse(DR LOCK 20A, FRT FOG 10A, B/ALARM 10A, Power Connector(AUDIO-1 15A, ROOM LP 10A))
BATT 2	30A	Fuse(FUEL LID 15A, HAZARD 15A, SAFETY P/WDW 20A), Multipurpose Check Connector, Power Window Relay(PCB TYPE)
BATT 3/RAD FAN	40A	Fuse(STOP LP 15A, BWS 10A), Radiator Fan Relay(G4KG)
IGN 1	40A	Ignition Switch(ACC, IG1)
IGN 2	40A	Ignition Switch(IG2, START), Start Relay
ECU MAIN	30A/20A	Engine Control Relay
FRT HTR	40A	Front Blower Relay
RR HTD	40A	Rear Defogger Relay
RR HTR	40A	Rear Blower Relay
ABS 1 / R/FAN	40A	ABS/ESP Control Module(G4KG), Radiator Fan Relay (All - ENG)
ABS 2	40A	ABS/ESP Control Module(G4KG)
C/FAN	30A	Condenser Fan Relay #1
F/FILTER	30A	Fuel Filter Heater Relay(Diesel)

	FUSE	(A)	Circuit Protected
1	ECU/TCU	10A	TCM(A - ENG, G4KG), ECM(G4KG)
2	HORN	10A	Horn Relay
3	BURNER	20A	Fuel Fired Heater Control Module(D4CB)
	F/PUMP	15A	Fuel Pump Relay(G4KG)
	ALT	10A	Alternator(D4BH)
4	H/LP HI	15A	Head Lamp(HIGH) Relay
5	A/CON	10A	A/C Relay
6	-	-	-
7	TAIL LH	10A	Head Lamp LH(Position lamp), Rear Combination Lamp LH, License Lamp LH/RH
8	TAIL RH	10A	Head lamp RH(Position lamp), Rear combination lamp RH
9	H/LP LO LH	10A	Head lamp LH, Head lamp Leveling Switch
10	H/LP LO RH	10A	Head lamp RH, Head lamp Leveling Actuator LH/RH
11	SNSR 1	10A	A/C relay, Condenser Fan Relay #1(D4CB), Lambda Sensor(A - ENG), PTC Heater Relay #1(D4CB), Stop Lamp Switch, Immobilizer Control Module (All - ENG), WGT Vaccum Switch (All - ENG)
12	SNSR 2	15A	A - ENG : Camshaft Position Sensor, Glow Plug Relay, EGR Actuator, VGT Control Solenoid Valve, Immobilizer Control Module All - ENG : Radiator Fan Relay, Inlet Metering Valve, Glow Plug Relay G4KG:Fuel Pump Relay, Purge Control Solenoid Valve, Oil Control Valve, Crankshaft Position Sensor, Oxygen Sensor(UP/DOWN) Stop Lamp Switch (RHD), Immobilizer Control Module, Idle Speed Control Actuator, Camshaft Position Sensor
13	IGN COIL	15A	Ignition Coil #1~#4(G4KG), Condenser(G4KG)
	ECU	10A	ECM(D4CB)
14	ECU	20A	ECM(D4CB, G4KG), Injector #1~#4(G4KG)

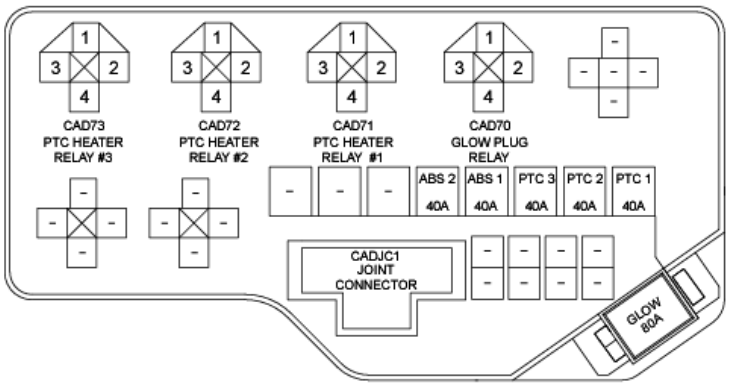
※ USE THE DESIGNATED FUSE ONLY

Fuse & Relay Information (6) SD100-6

E/R FUSE & RELAY BOX RH

D4CB : A - ENG 2.5L &
AII - ENG 2.5L

LAYOUT



CIRCUIT

FUSIBLE LINK	(A)	Circuit Protected
GLOW	80A	Glow plug relay
PTC 1	40A	PTC heater relay #1
PTC 2	40A	PTC heater relay #2
PTC 3	40A	PTC heater relay #3
ABS 1	40A	ABS/ESP control module
ABS 2	40A	ABS/ESP control module

RELAY TYPE

NO.	NAME	TYPE
CAD70	Glow Plug Relay	Plug Mini
CAD71	PTC Heater Relay #1	Plug Mini
CAD72	PTC Heater Relay #2	Plug Mini
CAD73	PTC Heater Relay #3	Plug Mini

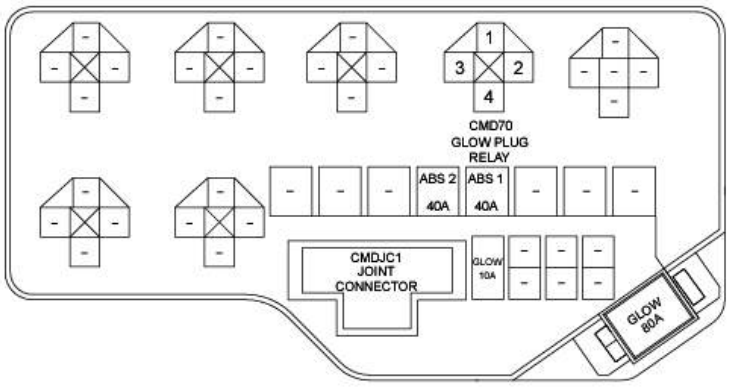
※ USE THE DESIGNATED FUSE ONLY

Fuse & Relay Information (7) SD100-7

E/R FUSE & RELAY BOX RH

D4BH : 4D56 TCI 2.5L

LAYOUT



CIRCUIT

Description		(A)	Circuit Protected
FUSIBLE LINK	GLOW	80A	Glow plug relay
	ABS 1	40A	ABS control module
	ABS 2	40A	ABS control module
FUSE	GLOW	10A	ECM

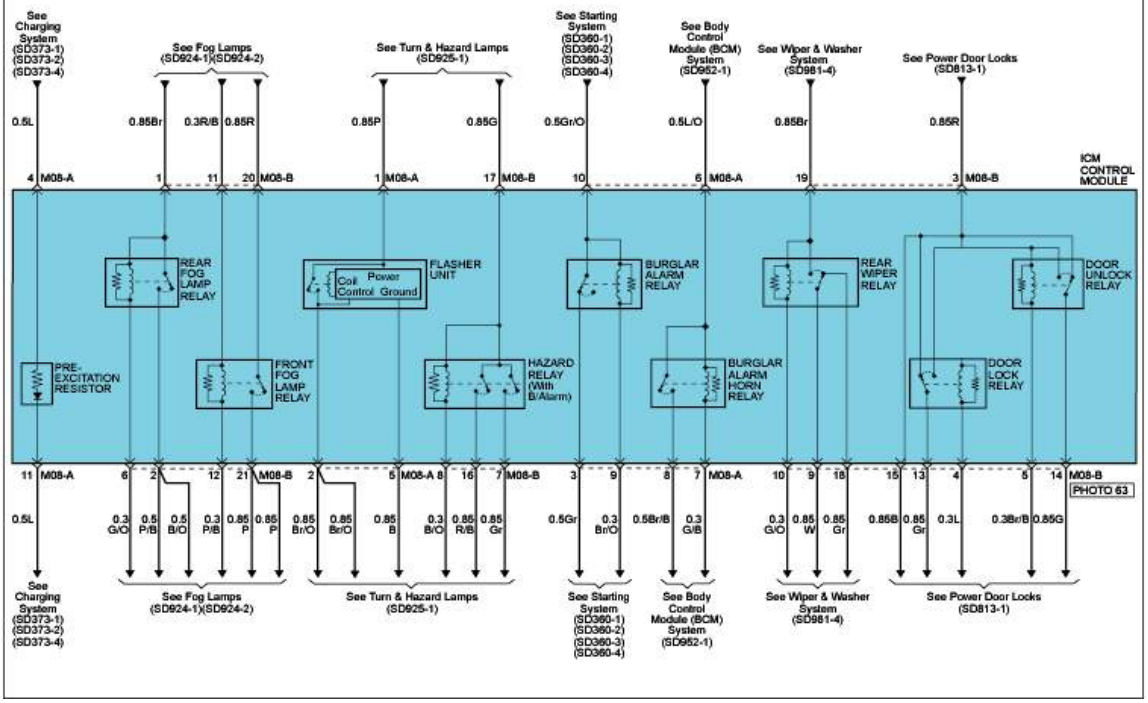
RELAY TYPE

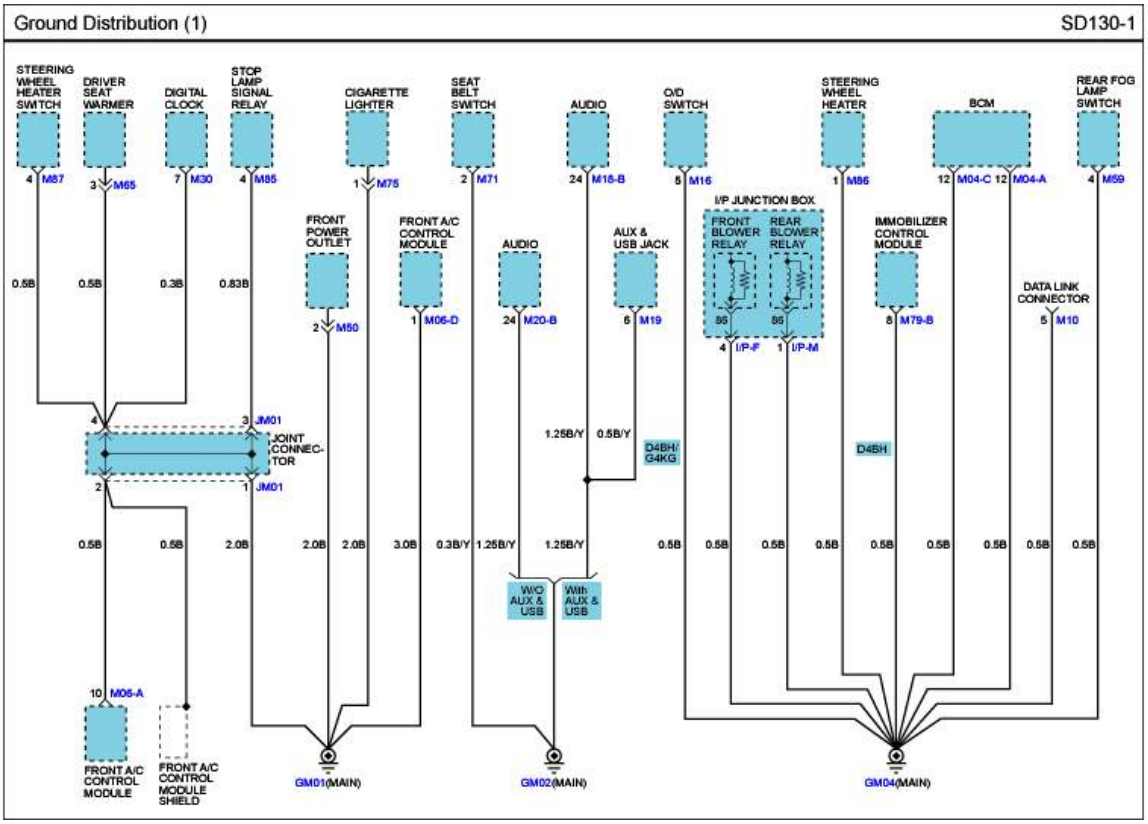
NO.	NAME	TYPE
CMD70	Glow Plug Relay	Plug Mini

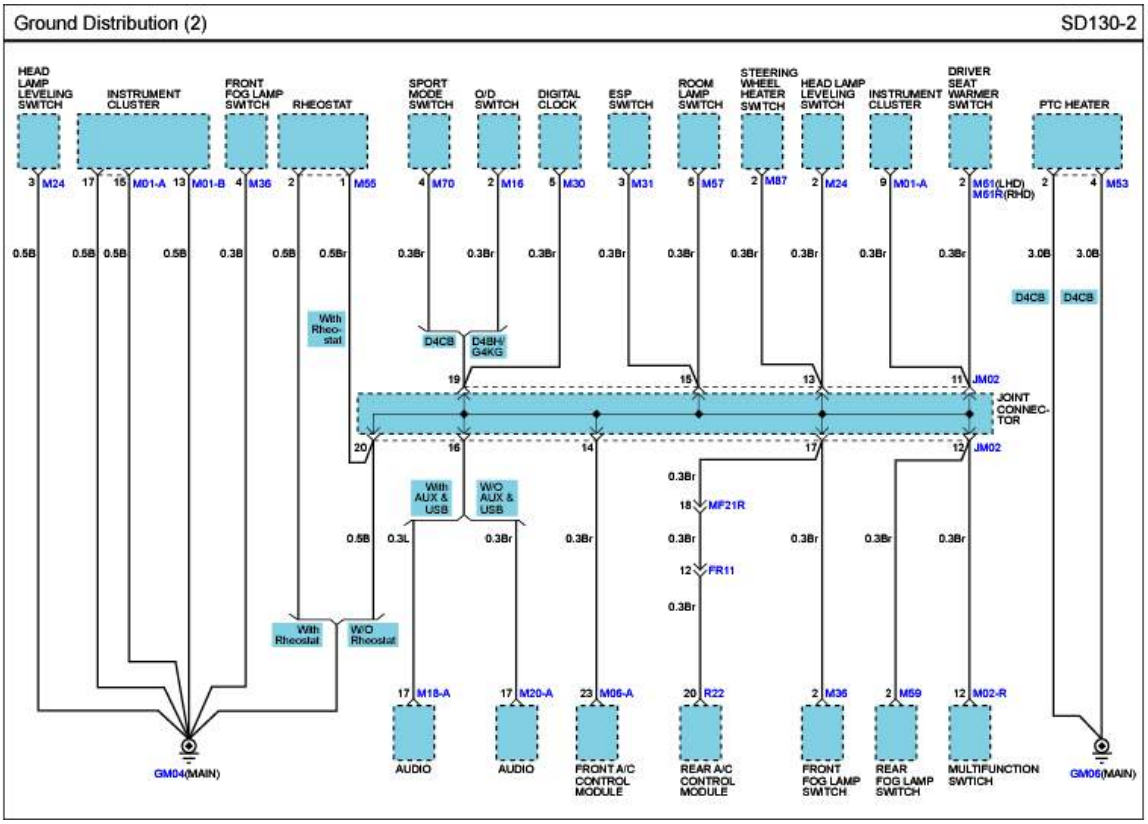
※ USE THE DESIGNATED FUSE AND RELAY ONLY

Fuse & Relay Information (8) SD100-8

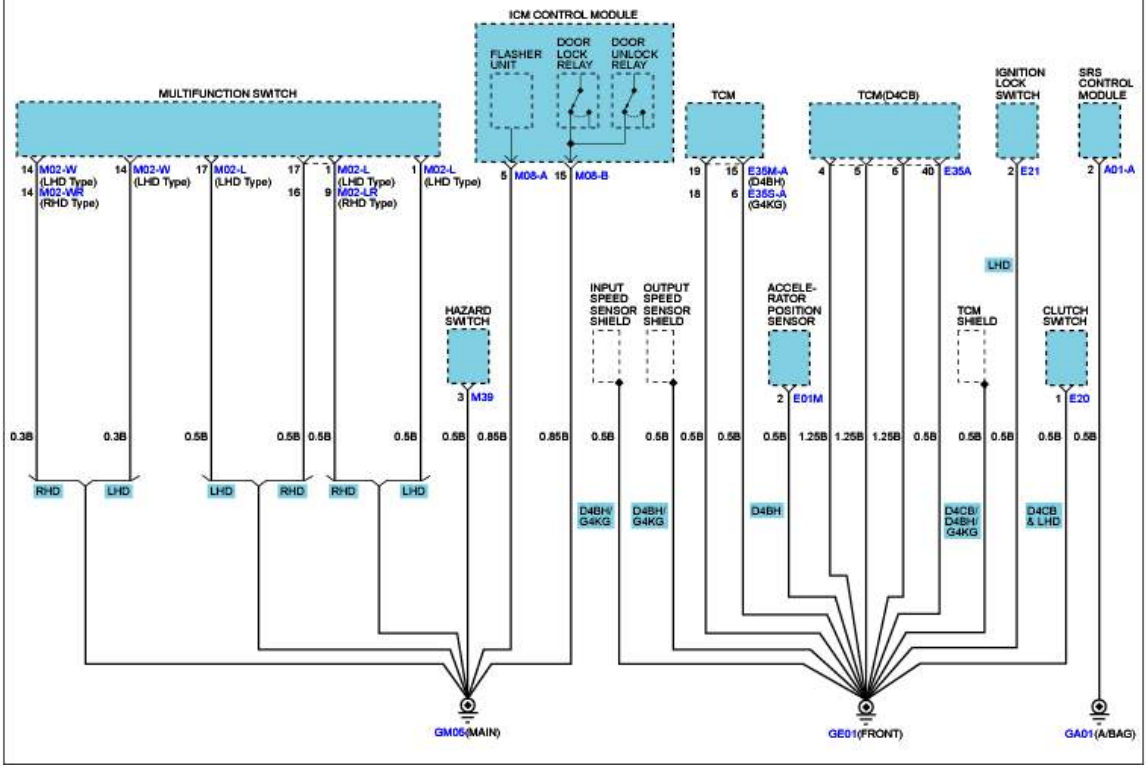
ICM CONTROL MODULE (CIRCUIT DIAGRAM)

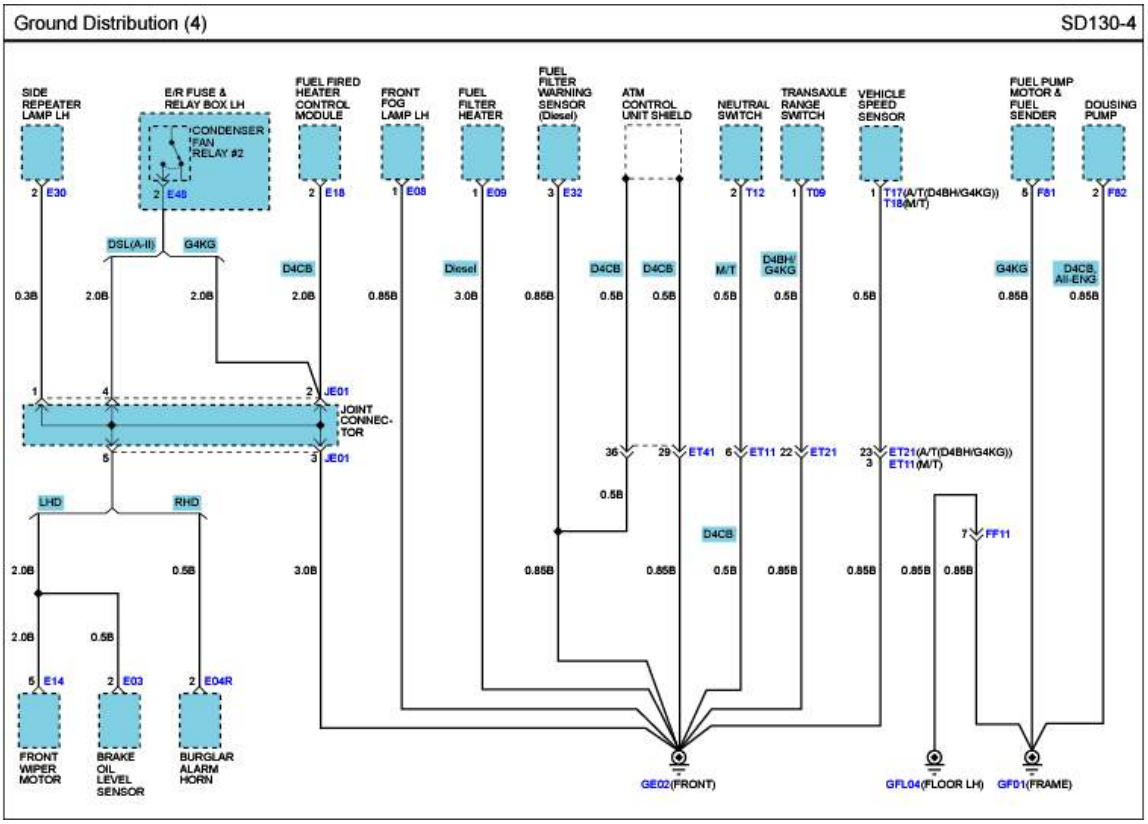


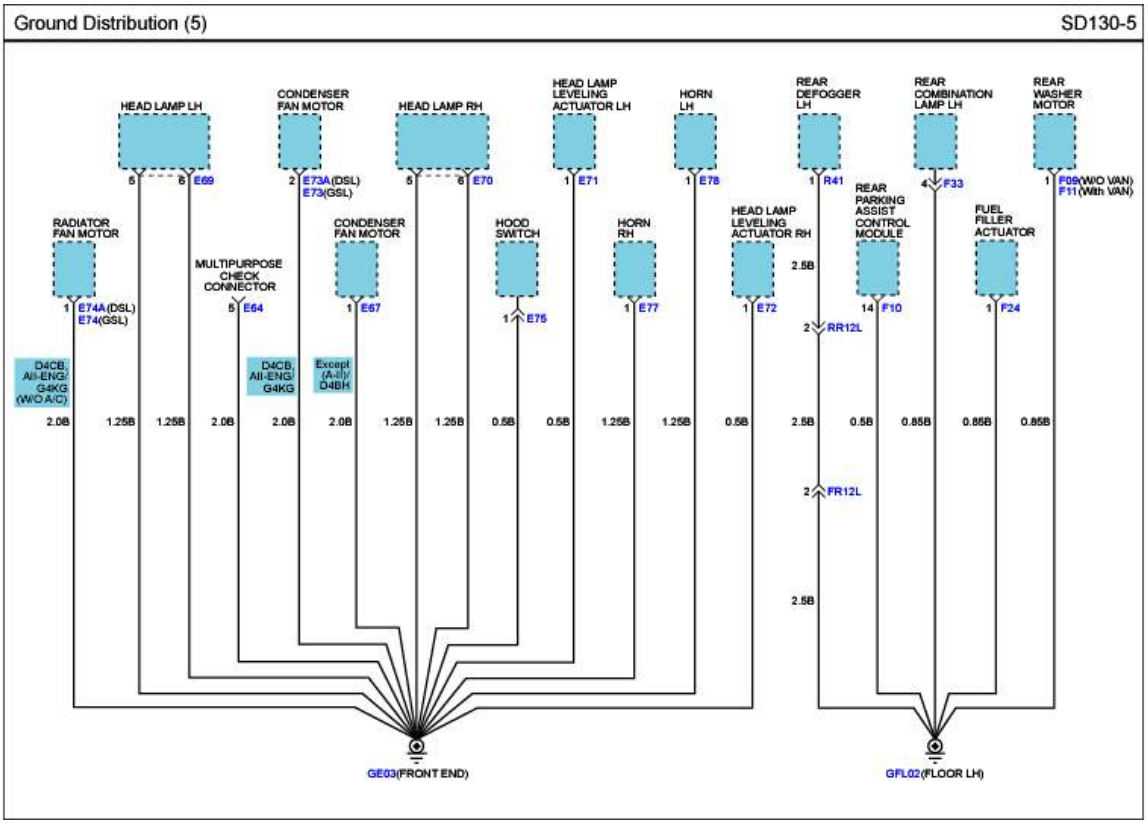

Ground Distribution (1)
SD130-1
STEERING WHEEL HEATER SWITCH
DRIVER SEAT WARMER
DIGITAL CLOCK
STOP LAMP SIGNAL RELAY
CIGARETTE LIGHTER
SEAT BELT SWITCH
AUDIO
O/D SWITCH
STEERING WHEEL HEATER
BCM
REAR FOG LAMP SWITCH
I/P JUNCTION BOX
FRONT BLOWER RELAY
REAR BLOWER RELAY
FRONT POWER OUTLET
FRONT A/C CONTROL MODULE
AUDIO
AUX & USB JACK
IMMOBILIZER CONTROL MODULE
DATA LINK CONNECTOR
JOINT CONNEC-TOR
W/O AUX & USB
With AUX & USB
FRONT A/C CONTROL MODULE
FRONT A/C CONTROL MODULE SHIELD
GM01(MAIN)
GM02(MAIN)
GM04(MAIN)


Ground Distribution (2)
SD130-2
HEAD LAMP LEVELING SWITCH
INSTRUMENT CLUSTER
FRONT FOG LAMP SWITCH
RHEOSTAT
SPORT MODE SWITCH
O/D SWITCH
DIGITAL CLOCK
ESP SWITCH
ROOM LAMP SWITCH
STEERING WHEEL HEATER SWITCH
HEAD LAMP LEVELING SWITCH
INSTRUMENT CLUSTER
DRIVER SEAT WARMER SWITCH
PTC HEATER
M24
M01-A
M01-B
M36
M55
M70
M16
M30
M31
M57
M87
M24
M01-A
M61(LHD)
M61R(RHD)
M53
D4CB
D4BH/ G4KG
With Rheo-stat
JM02
JOINT CONNEC-TOR
With AUX & USB
W/O AUX & USB
MF21R
FR11
With Rheostat
W/O Rheostat
M18-A
M20-A
M06-A
R22
M36
M59
M02-R
GM04(MAIN)
AUDIO
AUDIO
FRONT A/C CONTROL MODULE
REAR A/C CONTROL MODULE
FRONT FOG LAMP SWITCH
REAR FOG LAMP SWITCH
MULTIFUNCTION SWITCH
GM06(MAIN)

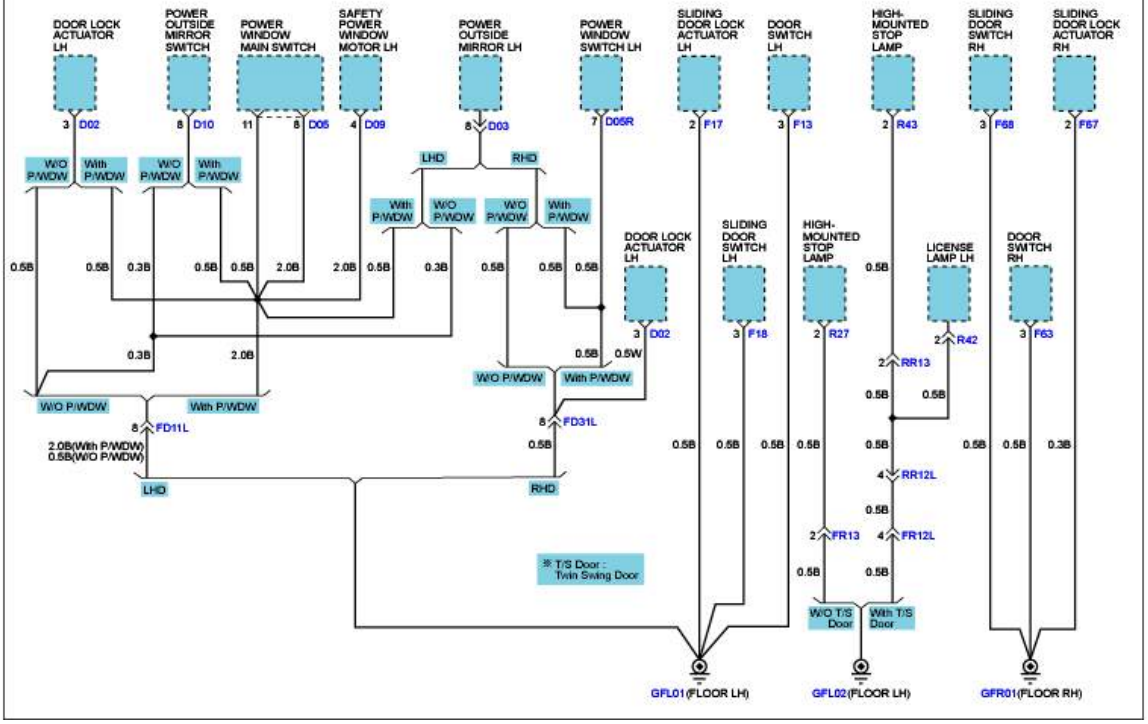
Ground Distribution (3) SD130-3

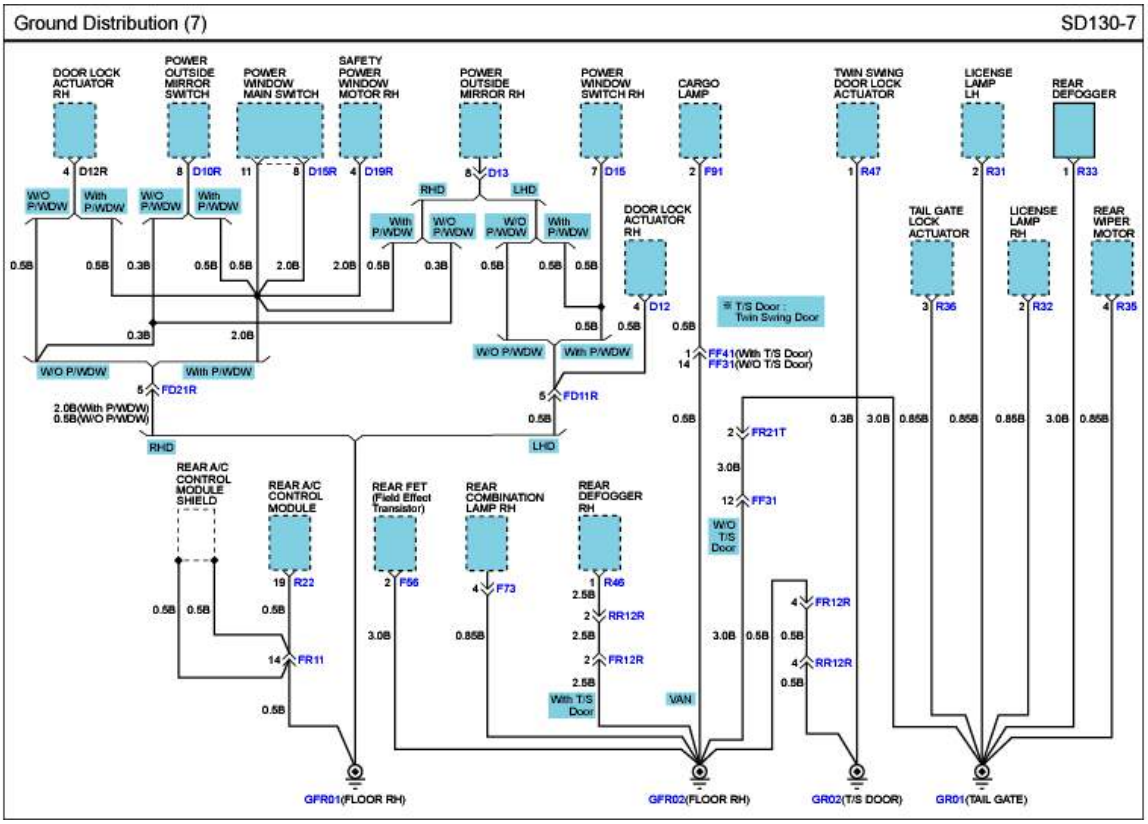



Ground Distribution (4)
SD130-4
SIDE REPEATER LAMP LH
E/R FUSE & RELAY BOX LH
CONDENSER FAN RELAY #2
FUEL FIRED HEATER CONTROL MODULE
FRONT FOG LAMP LH
FUEL FILTER HEATER
FUEL FILTER WARNING SENSOR (Diesel)
ATM CONTROL UNIT SHIELD
NEUTRAL SWITCH
TRANSAXLE RANGE SWITCH
VEHICLE SPEED SENSOR
FUEL PUMP MOTOR & FUEL SENDER
DOUSING PUMP
JOINT CONNEC-TOR
LHD
RHD
FRONT WIPER MOTOR
BRAKE OIL LEVEL SENSOR
BURGLAR ALARM HORN
GE02(FRONT)
GFL04(FLOOR LH)
GFD1(FRAME)

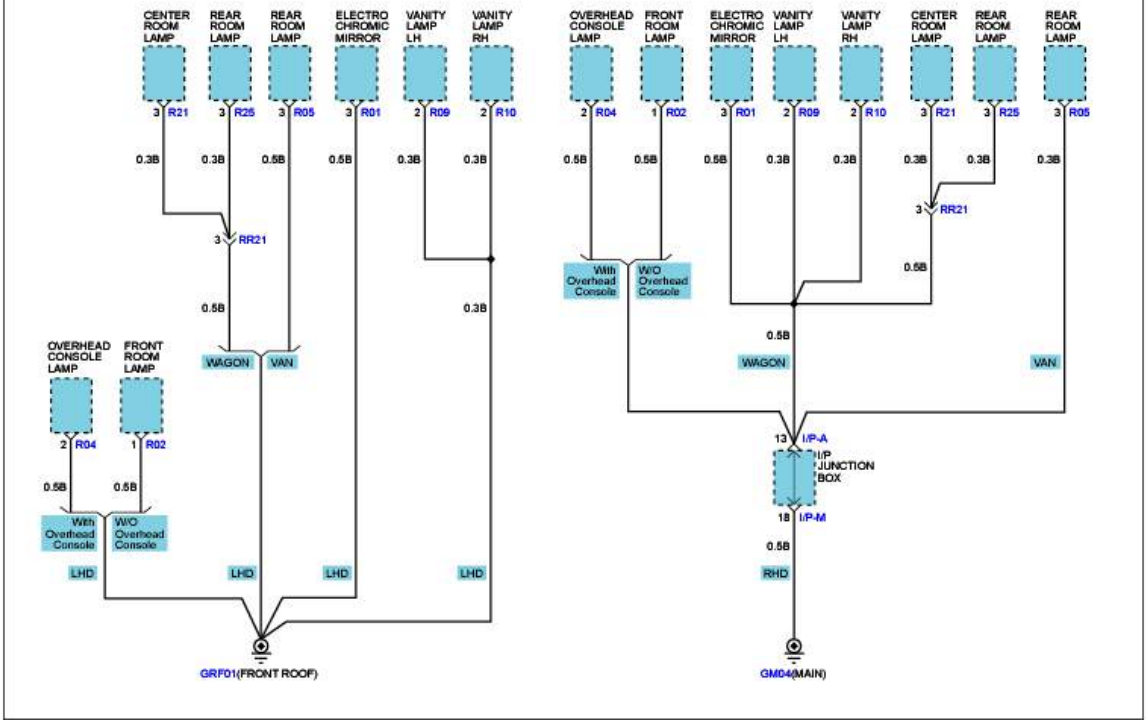

Ground Distribution (5)
SD130-5
HEAD LAMP LH
CONDENSER FAN MOTOR
HEAD LAMP RH
HEAD LAMP LEVELING ACTUATOR LH
HORN LH
REAR DEFOGGER LH
REAR COMBINATION LAMP LH
REAR WASHER MOTOR
RADIATOR FAN MOTOR
MULTIPURPOSE CHECK CONNECTOR
CONDENSER FAN MOTOR
HOOD SWITCH
HORN RH
HEAD LAMP LEVELING ACTUATOR RH
REAR PARKING ASSIST CONTROL MODULE
FUEL FILLER ACTUATOR
E69
E73A(DSL) E73(GSL)
E70
E71
E78
R41
F33
F09(W/O VAN) F11(With VAN)
E74A(DSL) E74(GSL)
E64
E67
E75
E77
E72
RR12L
F10
F24
FR12L
D4CB All-ENG G4KG (W/O A/C)
D4CB All-ENG G4KG
Except (A-II) D4BH
2.0B
1.25B
0.5B
2.5B
0.85B
GE03(FRONT END)
GFL02(FLOOR LH)

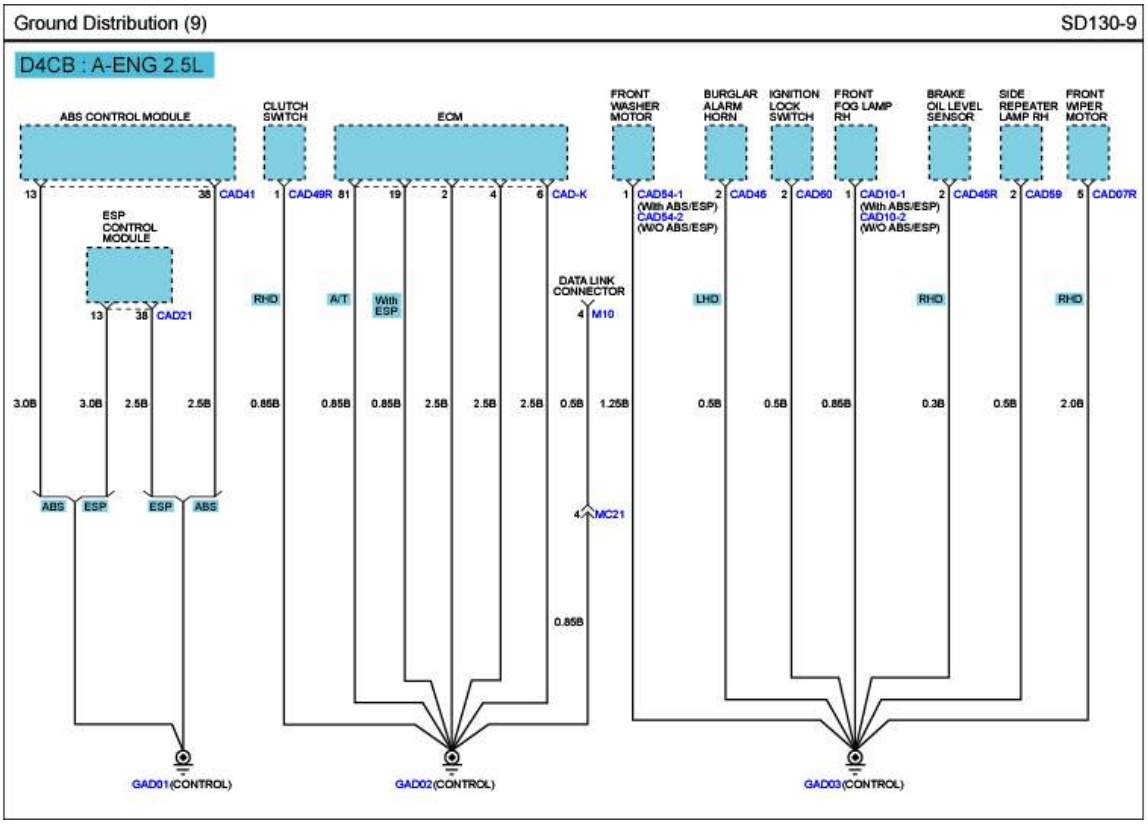
Ground Distribution (6) SD130-6

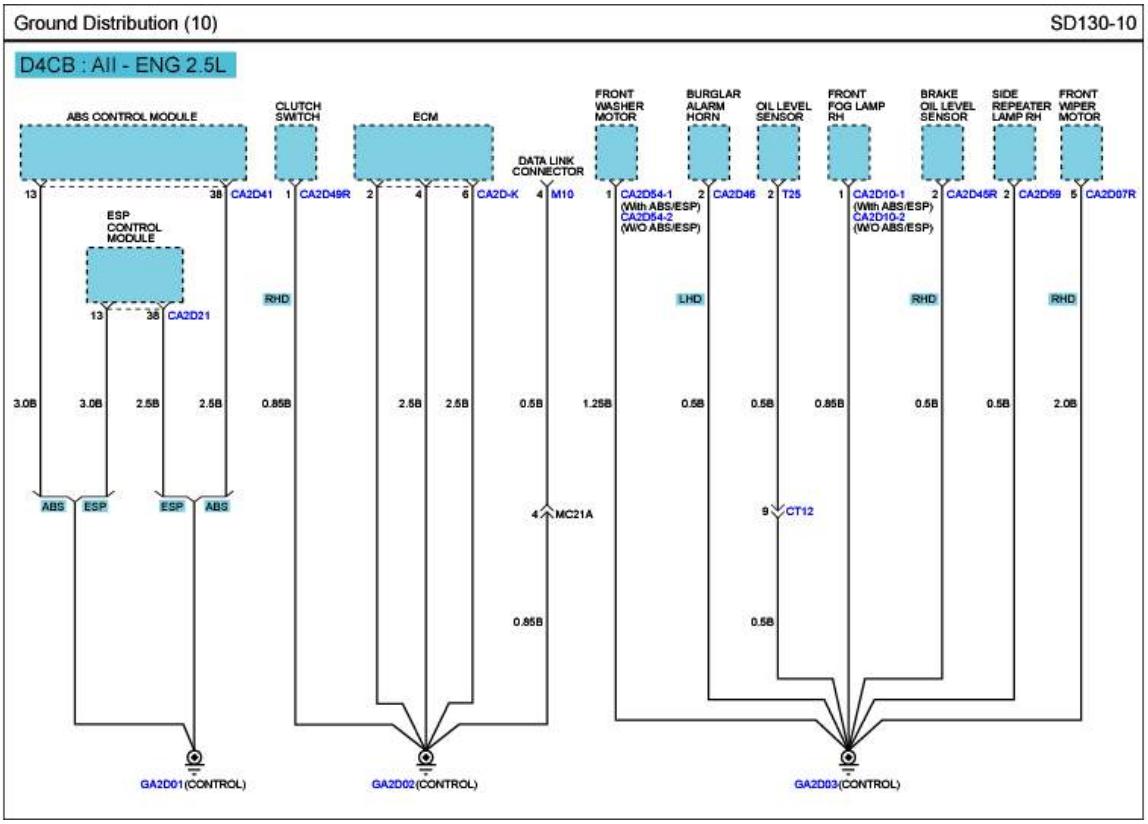


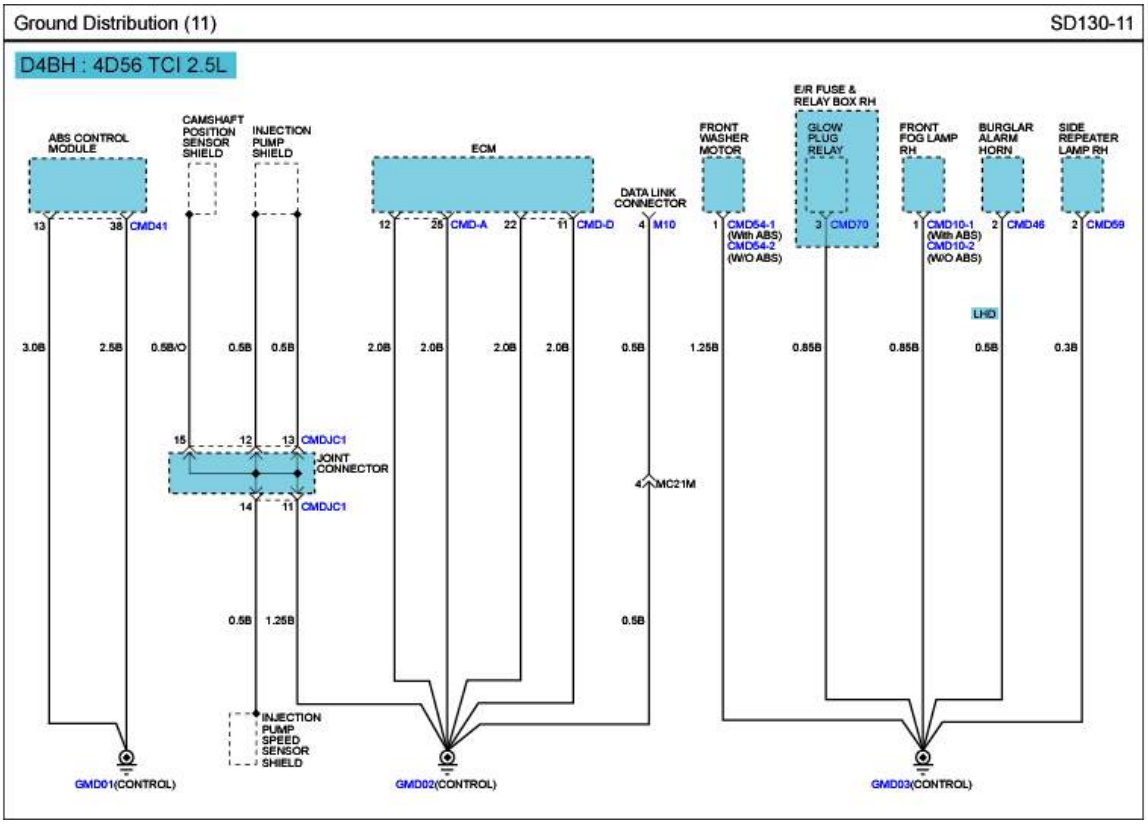

Ground Distribution (7)
SD130-7
DOOR LOCK ACTUATOR RH
POWER OUTSIDE MIRROR SWITCH
POWER WINDOW MAIN SWITCH
SAFETY POWER WINDOW MOTOR RH
POWER OUTSIDE MIRROR RH
POWER WINDOW SWITCH RH
CARGO LAMP
TWIN SWING DOOR LOCK ACTUATOR
LICENSE LAMP LH
REAR DEFOGGER
TAIL GATE LOCK ACTUATOR
LICENSE LAMP RH
REAR WIPER MOTOR
REAR A/C CONTROL MODULE SHIELD
REAR A/C CONTROL MODULE
REAR FET (Field Effect Transistor)
REAR COMBINATION LAMP RH
REAR DEFOGGER RH
※ T/S Door : Twin Swing Door
GFR01(FLOOR RH)
GFR02(FLOOR RH)
GR02(T/S DOOR)
GR01(TAIL GATE)

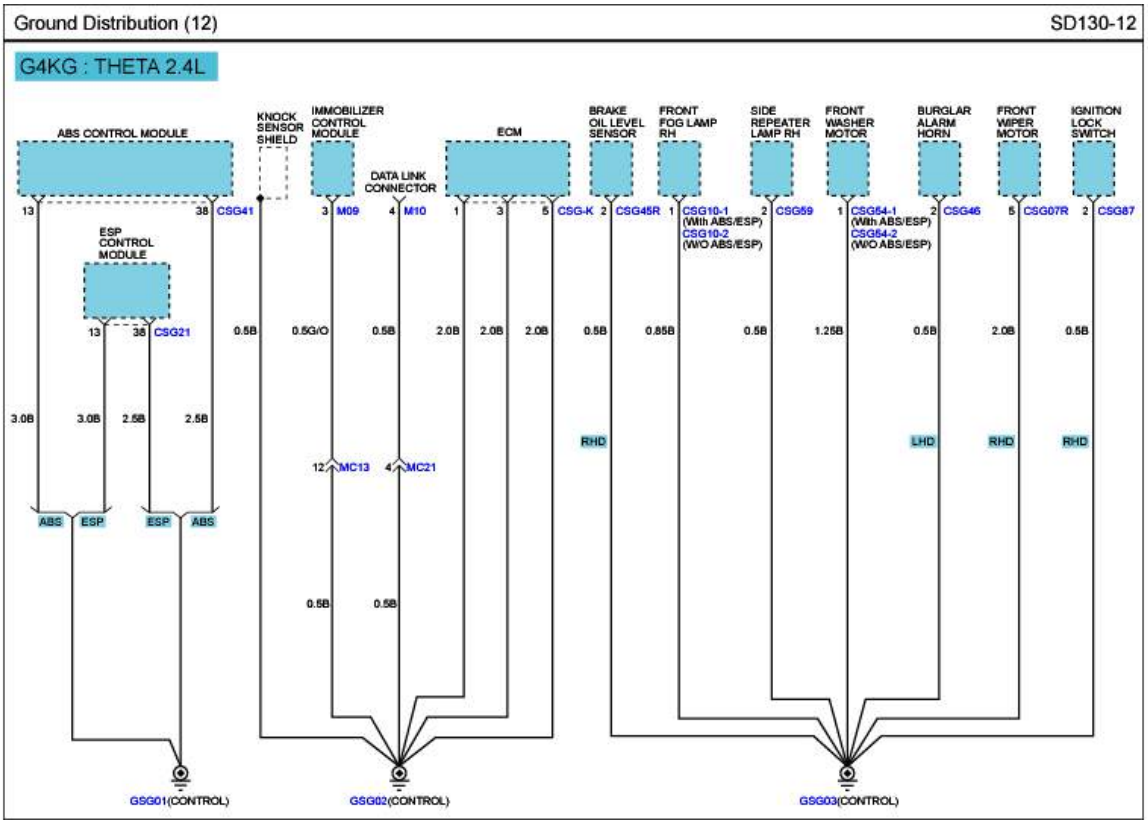
Ground Distribution (8) SD130-8

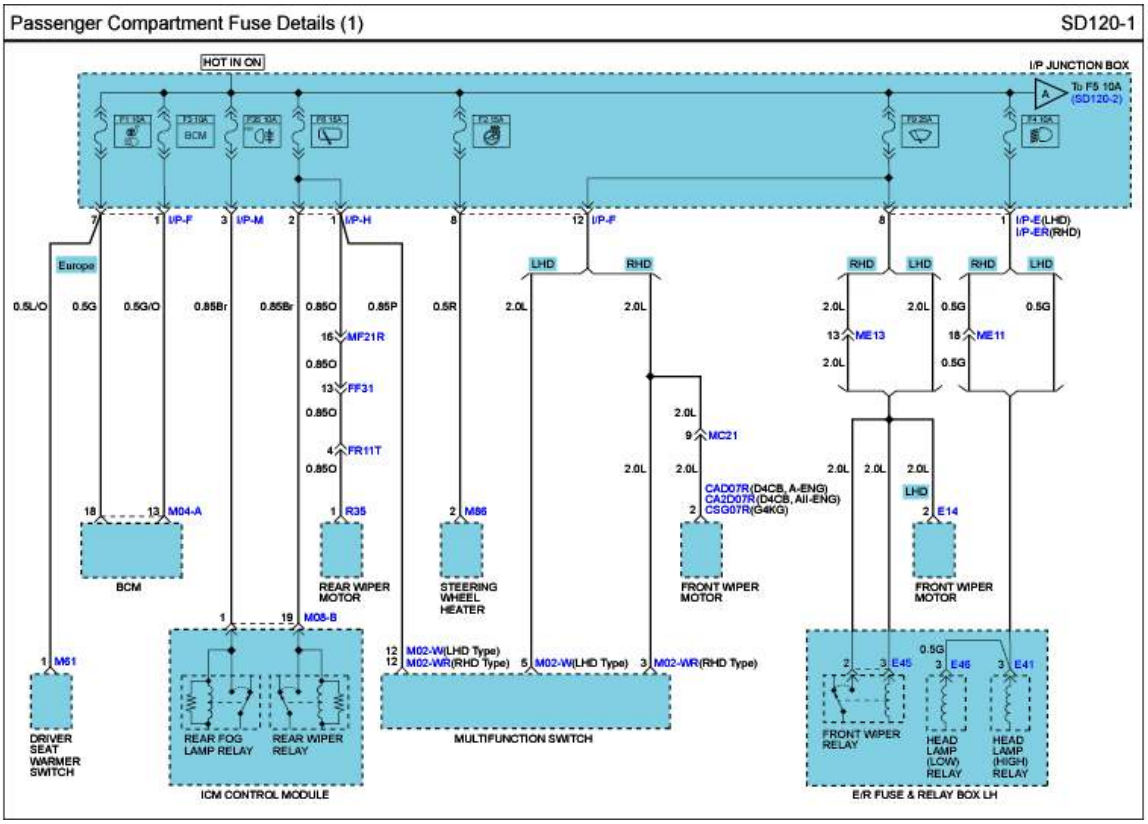



Ground Distribution (9)
SD130-9
D4CB : A-ENG 2.5L
ABS CONTROL MODULE
CLUTCH SWITCH
ECM
FRONT WASHER MOTOR
BURGLAR ALARM HORN
IGNITION LOCK SWITCH
FRONT FOG LAMP RH
BRAKE OIL LEVEL SENSOR
SIDE REPEATER LAMP RH
FRONT WIPER MOTOR
ESP CONTROL MODULE
DATA LINK CONNECTOR
CAD41
CAD49R
CAD-K
CAD54-1
(With ABS/ESP)
CAD54-2
(W/O ABS/ESP)
CAD46
CAD60
CAD10-1
(With ABS/ESP)
CAD10-2
(W/O ABS/ESP)
CAD45R
CAD59
CAD07R
CAD21
M10
MC21
RHD
A/T
With ESP
LHD
GAD01(CONTROL)
GAD02(CONTROL)
GAD03(CONTROL)

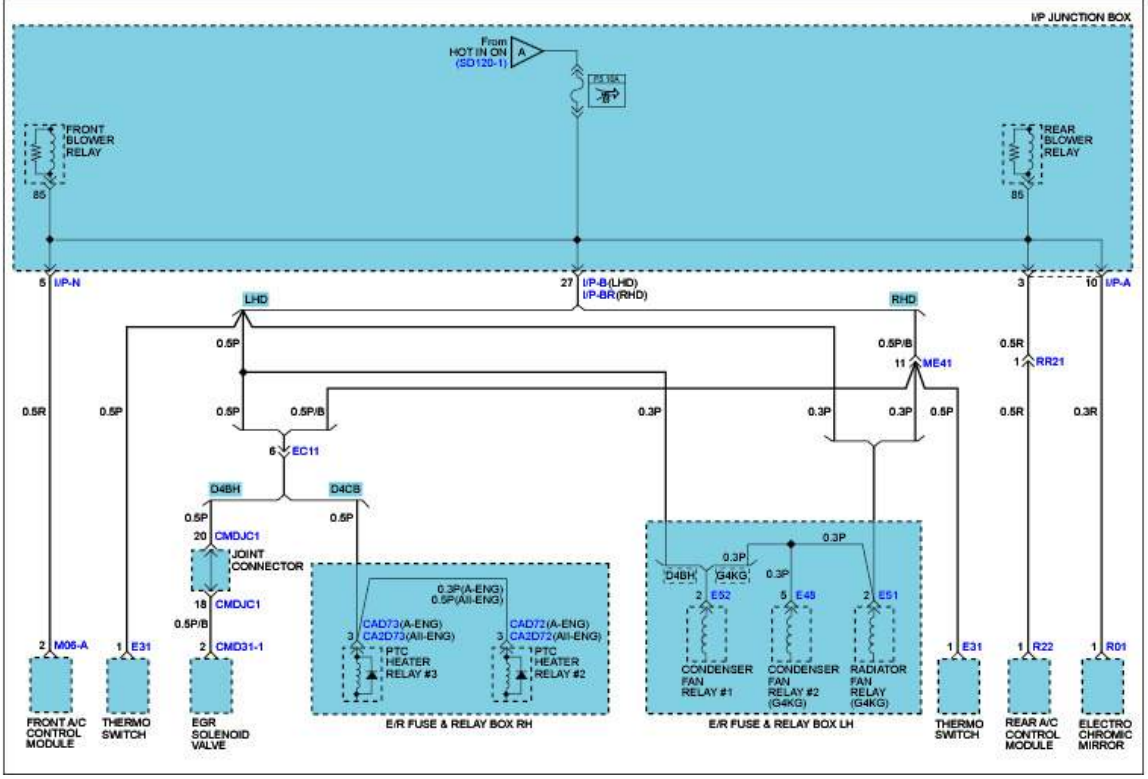

Ground Distribution (10)
SD130-10
D4CB : All - ENG 2.5L
ABS CONTROL MODULE
CLUTCH SWITCH
ECM
DATA LINK CONNECTOR
FRONT WASHER MOTOR
BURGLAR ALARM HORN
OIL LEVEL SENSOR
FRONT FOG LAMP RH
BRAKE OIL LEVEL SENSOR
SIDE REPEATER LAMP RH
FRONT WIPER MOTOR
ESP CONTROL MODULE
CA2D41
CA2D49R
CA2D-K
M10
CA2D54-1 (With ABS/ESP)
CA2D54-2 (W/O ABS/ESP)
CA2D46
T25
CA2D10-1 (With ABS/ESP)
CA2D10-2 (W/O ABS/ESP)
CA2D45R
CA2D59
CA2D07R
CA2D21
RHD
LHD
3.0B
2.5B
0.85B
0.5B
1.25B
MC21A
CT12
ABS
ESP
GA2D01 (CONTROL)
GA2D02 (CONTROL)
GA2D03 (CONTROL)


Ground Distribution (11)
SD130-11
D4BH : 4D56 TCI 2.5L
ABS CONTROL MODULE
CAMSHAFT POSITION SENSOR SHIELD
INJECTION PUMP SHIELD
ECM
DATA LINK CONNECTOR
FRONT WASHER MOTOR
E/R FUSE & RELAY BOX RH
GLOW PLUG RELAY
FRONT FOG LAMP RH
BURGLAR ALARM HORN
SIDE REPEATER LAMP RH
13
38
CMD41
12
26
CMD-A
22
11
CMD-D
4
M10
1
CMD54-1
(With ABS)
CMD54-2
(W/O ABS)
3
CMD70
1
CMD10-1
(With ABS)
CMD10-2
(W/O ABS)
2
CMD46
2
CMD69
LHD
3.0B
2.5B
0.5B/O
0.5B
0.5B
2.0B
2.0B
2.0B
2.0B
0.5B
1.25B
0.85B
0.85B
0.5B
0.3B
15
12
13
CMDJC1
JOINT CONNECTOR
14
11
CMDJC1
4
MC21M
0.5B
1.25B
0.5B
INJECTION PUMP SPEED SENSOR SHIELD
GMD01(CONTROL)
GMD02(CONTROL)
GMD03(CONTROL)

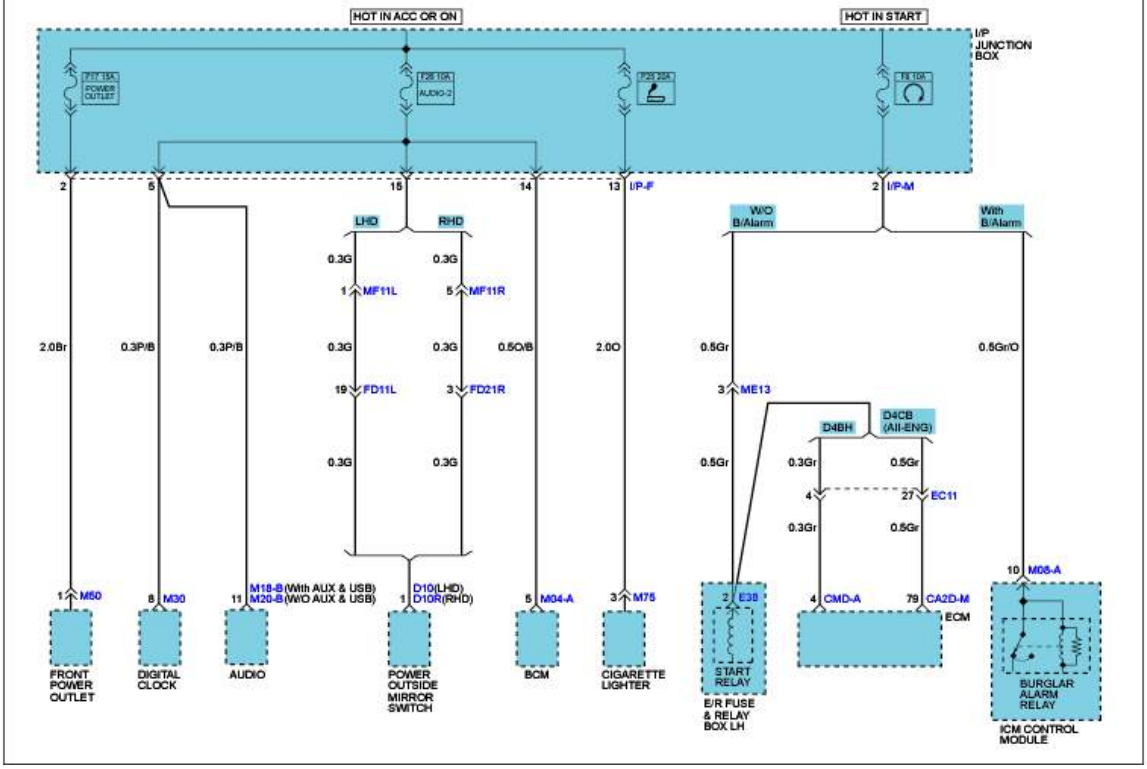

Ground Distribution (12)
SD130-12
G4KG : THETA 2.4L
ABS CONTROL MODULE
KNOCK SENSOR SHIELD
IMMOBILIZER CONTROL MODULE
DATA LINK CONNECTOR
ECM
BRAKE OIL LEVEL SENSOR
FRONT FOG LAMP RH
SIDE REPEATER LAMP RH
FRONT WASHER MOTOR
BURGLAR ALARM HORN
FRONT WIPER MOTOR
IGNITION LOCK SWITCH
ESP CONTROL MODULE
CSG41
CSG21
M09
M10
CSG-K
CSG45R
CSG10-1 (With ABS/ESP)
CSG10-2 (W/O ABS/ESP)
CSG59
CSG54-1 (With ABS/ESP)
CSG54-2 (W/O ABS/ESP)
CSG46
CSG07R
CSG87
MC13
MC21
RHD
LHD
ABS
ESP
GSG01(CONTROL)
GSG02(CONTROL)
GSG03(CONTROL)

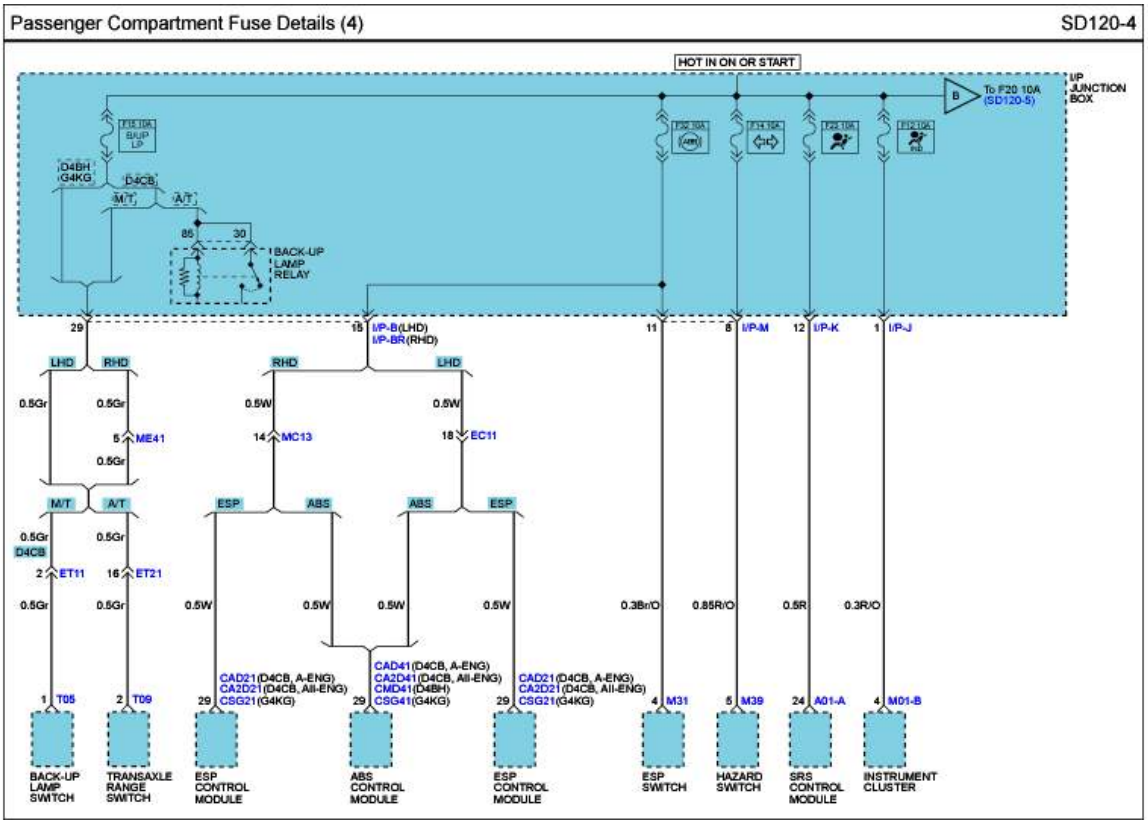

Passenger Compartment Fuse Details (1)
SD120-1
HOT IN ON
I/P JUNCTION BOX
To F5 10A (SD120-2)
F1 15A
F2 10A BCM
F3 30A
F5 10A
F6 10A
F9 20A
F4 10A
I/P-F
I/P-M
I/P-H
I/P-F
I/P-E(LHD)
I/P-ER(RHD)
Europe
LHD
RHD
0.5L/O
0.5G
0.5G/O
0.85Br
0.85O
0.85P
0.5R
2.0L
MF21R
FF31
FR11T
MC21
ME13
ME11
M04-A
BCM
R35
REAR WIPER MOTOR
M86
STEERING WHEEL HEATER
CAD07R(D4CB, A-ENG)
CA2D07R(D4CB, AII-ENG)
CSG07R(G4KG)
FRONT WIPER MOTOR
E14
FRONT WIPER MOTOR
M61
DRIVER SEAT WARMER SWITCH
M08-B
REAR FOG LAMP RELAY
REAR WIPER RELAY
ICM CONTROL MODULE
M02-W(LHD Type)
M02-WR(RHD Type)
MULTIFUNCTION SWITCH
E45
E46
E41
FRONT WIPER RELAY
HEAD LAMP (LOW) RELAY
HEAD LAMP (HIGH) RELAY
E/R FUSE & RELAY BOX LH

Passenger Compartment Fuse Details (2) SD120-2

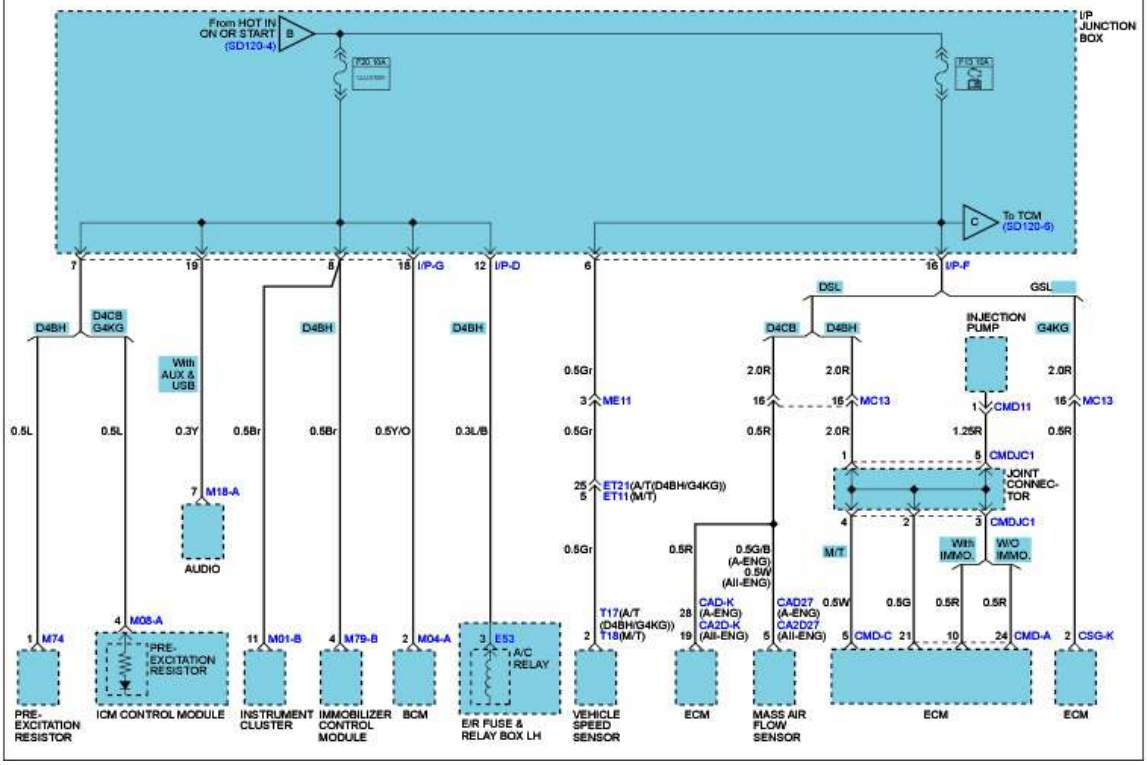


Passenger Compartment Fuse Details (3) SD120-3

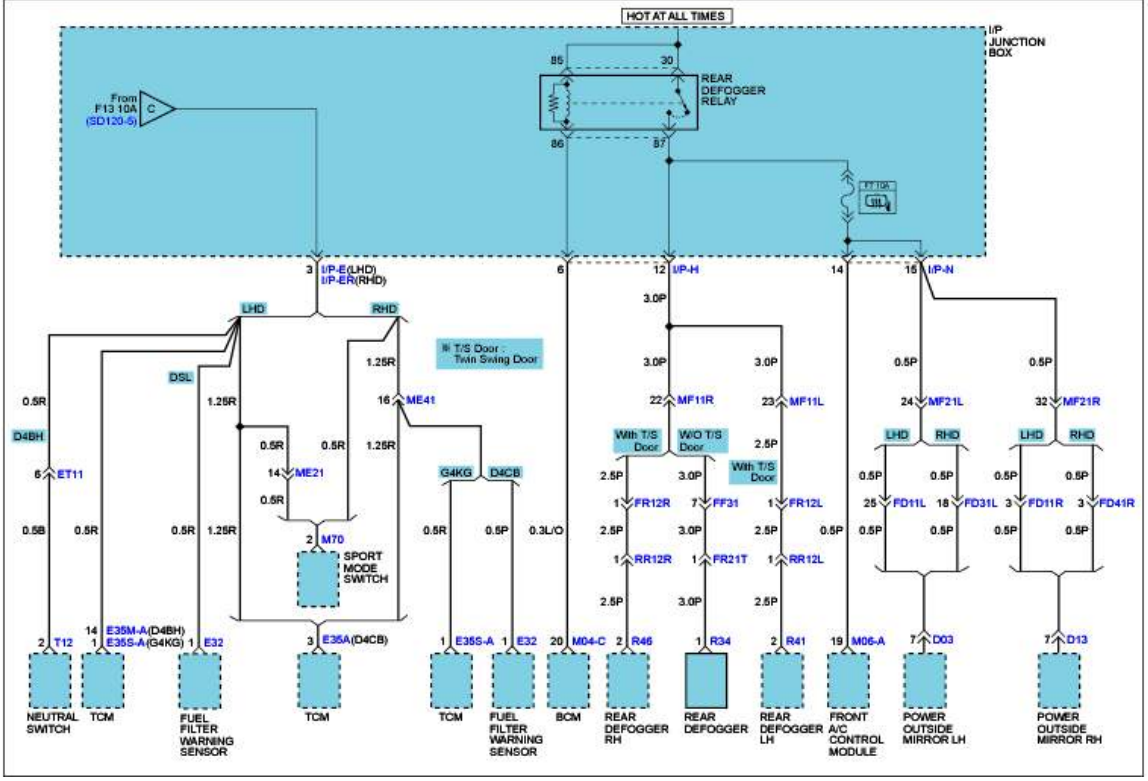


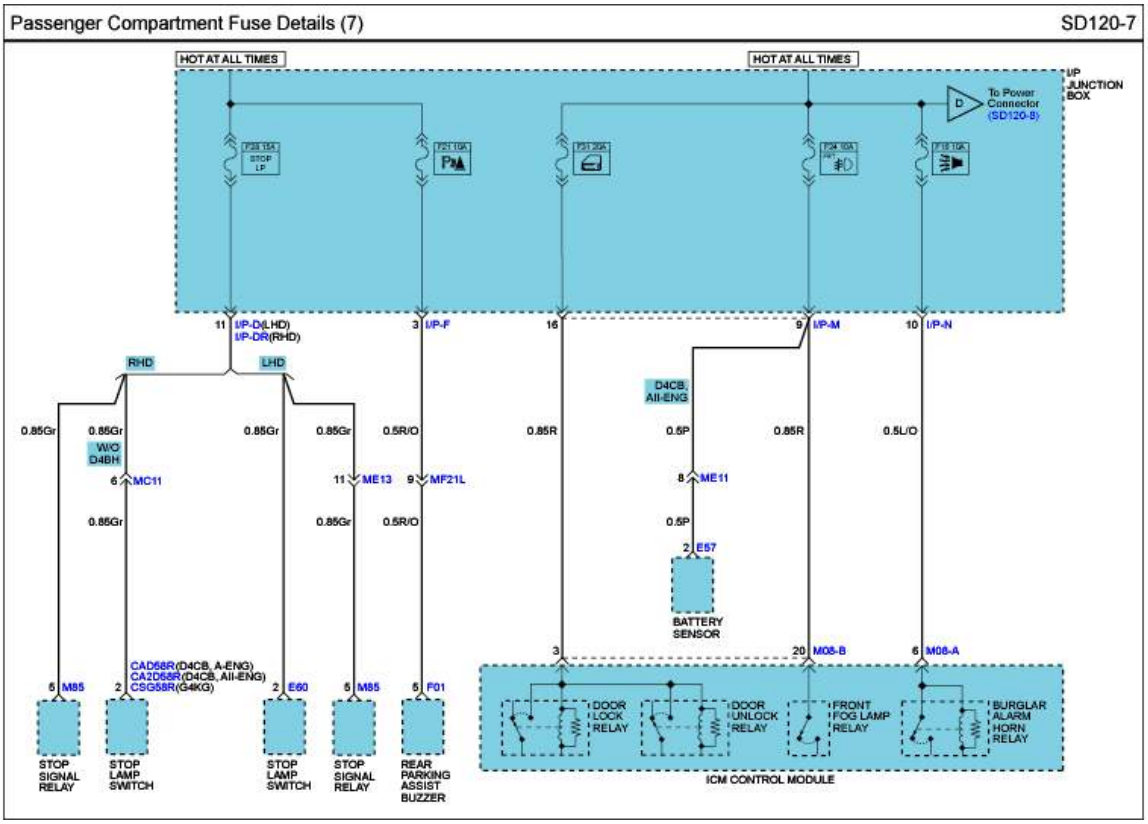

Passenger Compartment Fuse Details (4)
SD120-4
HOT IN ON OR START
I/P JUNCTION BOX
To F20 10A (SD120-5)
F15 10A B/UP LP
F20 10A
F14 10A
F22 10A
F12 10A
D4BH G4KG
D4CB
M/T
A/T
86
30
BACK-UP LAMP RELAY
I/P-B(LHD) I/P-BR(RHD)
I/P-M
I/P-K
I/P-J
LHD
RHD
0.5Gr
0.5W
ME41
MC13
EC11
ESP
ABS
ET11
ET21
0.3Br/O
0.85R/O
0.5R
0.3R/O
CAD21(D4CB, A-ENG)
CA2D21(D4CB, A/T-ENG)
CSG21(G4KG)
CAD41(D4CB, A-ENG)
CA2D41(D4CB, A/T-ENG)
CMD41(D4BH)
CSG41(G4KG)
T05
T09
M31
M39
A01-A
M01-B
BACK-UP LAMP SWITCH
TRANSAXLE RANGE SWITCH
ESP CONTROL MODULE
ABS CONTROL MODULE
ESP CONTROL MODULE
ESP SWITCH
HAZARD SWITCH
SRS CONTROL MODULE
INSTRUMENT CLUSTER

Passenger Compartment Fuse Details (5) SD120-5

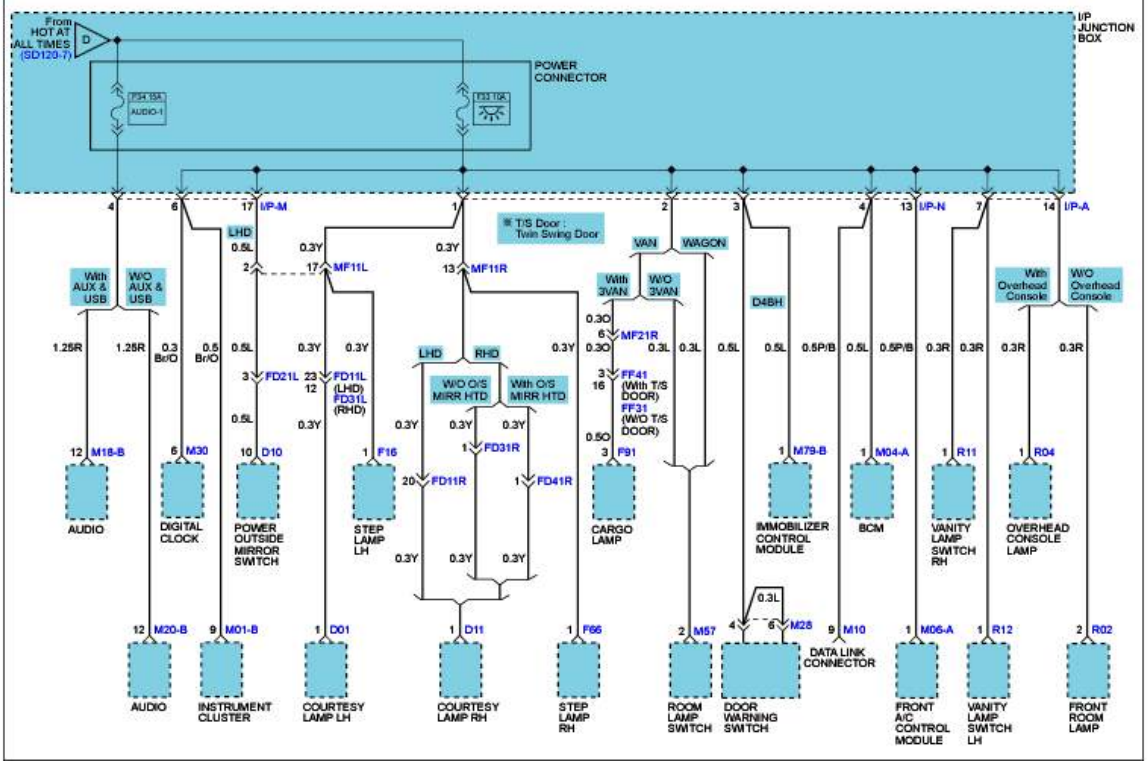


Passenger Compartment Fuse Details (6) SD120-6

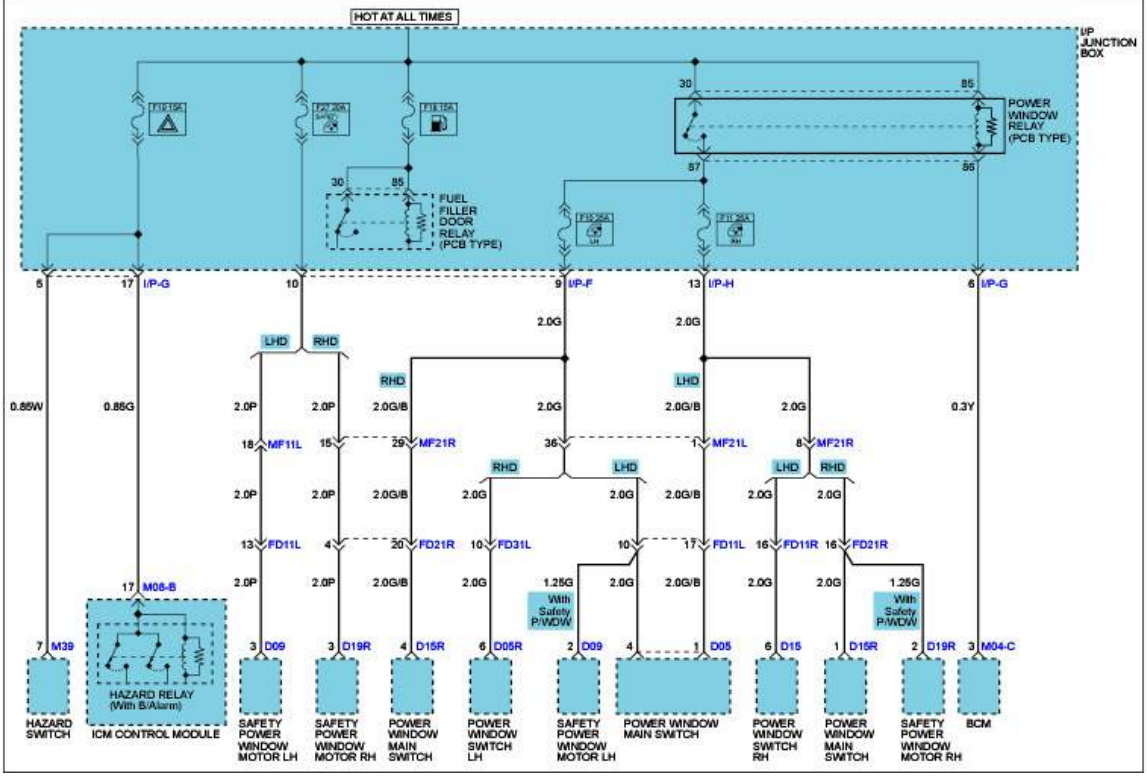


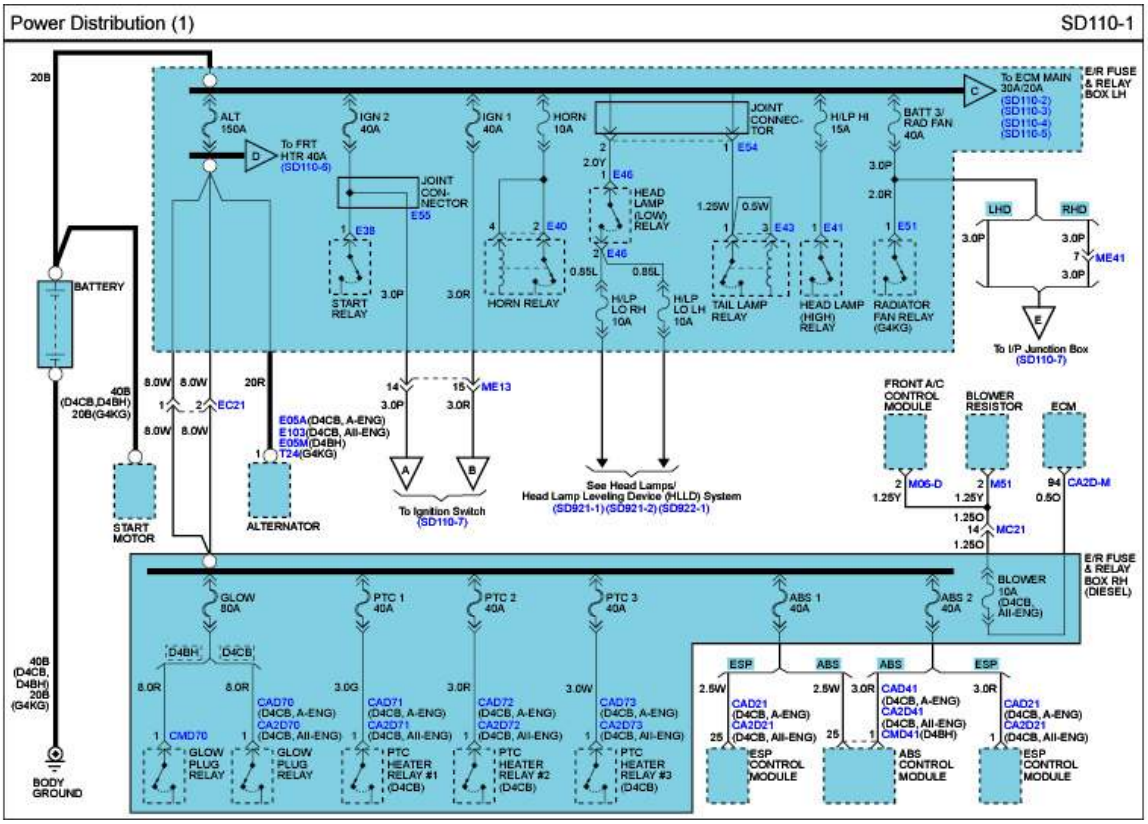

Passenger Compartment Fuse Details (7)
SD120-7
HOT AT ALL TIMES
HOT AT ALL TIMES
I/P JUNCTION BOX
To Power Connector (SD120-8)
F28 15A STOP LP
F21 10A
F21 20A
F24 10A
F18 10A
11 I/P-D(LHD) I/P-DR(RHD)
3 I/P-F
16
9 I/P-M
10 I/P-N
RHD
LHD
D4CB, AII-ENG
0.85Gr
0.85Gr
0.85Gr
0.85Gr
0.5R/O
0.85R
0.5P
0.85R
0.5L/O
W/O D4BH
6 MC11
11 ME13
9 MF21L
8 ME11
0.85Gr
0.85Gr
0.5R/O
0.5P
2 E57
BATTERY SENSOR
3
20 M08-B
6 M08-A
CAD58R(D4CB, A-ENG)
CA2D58R(D4CB, AII-ENG)
CSG58R(G4KG)
5 M85
2
2 E60
5 M85
5 F01
DOOR LOCK RELAY
DOOR UNLOCK RELAY
FRONT FOG LAMP RELAY
BURGLAR ALARM HORN RELAY
STOP SIGNAL RELAY
STOP LAMP SWITCH
STOP LAMP SWITCH
STOP SIGNAL RELAY
REAR PARKING ASSIST BUZZER
ICM CONTROL MODULE

Passenger Compartment Fuse Details (8) SD120-8



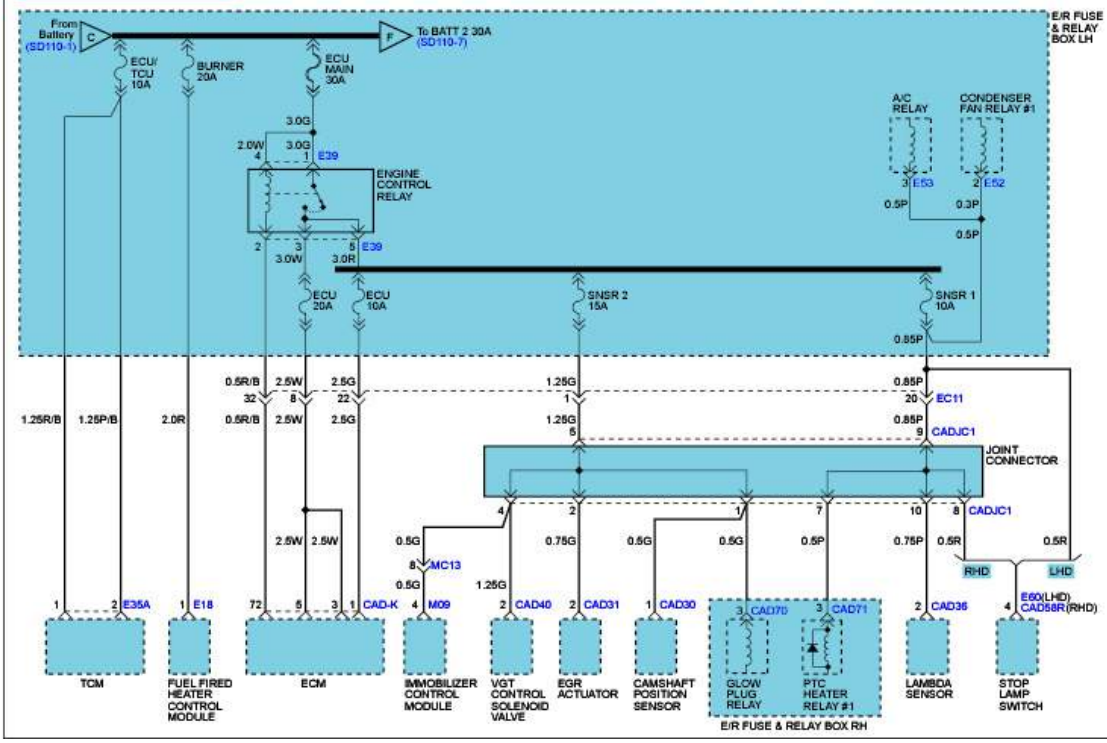
Passenger Compartment Fuse Details (9) SD120-9




Power Distribution (1)
SD110-1
20B
BATTERY
40B (D4CB,D4BH) 20B(G4KG)
START MOTOR
ALTERNATOR
BODY GROUND
E/R FUSE & RELAY BOX LH
To ECM MAIN 30A/20A (SD110-2) (SD110-3) (SD110-4) (SD110-5)
ALT 150A
To FRT HTR 40A (SD110-9)
IGN 2 40A
IGN 1 40A
HORN 10A
JOINT CONNECTOR
H/LP HI 15A
BATT 3/ RAD FAN 40A
JOINT CON-NECTOR E55
E38
E40
E46
E54
E41
E43
E51
START RELAY
HORN RELAY
HEAD LAMP (LOW) RELAY
TAIL LAMP RELAY
HEAD LAMP (HIGH) RELAY
RADIATOR FAN RELAY (G4KG)
H/LP LO RH 10A
H/LP LO LH 10A
LHD
RHD
ME41
To I/P Junction Box (SD110-7)
EC21
E05A(D4CB, A-ENG)
E103(D4CB, All-ENG)
E05M(D4BH)
T24(G4KG)
ME13
To Ignition Switch (SD110-7)
See Head Lamps/ Head Lamp Leveling Device (HLLD) System (SD921-1) (SD921-2) (SD922-1)
FRONT A/C CONTROL MODULE
BLOWER RESISTOR
ECM
M06-D
M51
MC21
CA2D-M
E/R FUSE & RELAY BOX RH (DIESEL)
BLOWER 10A (D4CB, All-ENG)
GLOW 80A
PTC 1 40A
PTC 2 40A
PTC 3 40A
ABS 1 40A
ABS 2 40A
D4BH
D4CB
CMD70
CAD70 (D4CB, A-ENG) CA2D70 (D4CB, All-ENG)
CAD71 (D4CB, A-ENG) CA2D71 (D4CB, All-ENG)
CAD72 (D4CB, A-ENG) CA2D72 (D4CB, All-ENG)
CAD73 (D4CB, A-ENG) CA2D73 (D4CB, All-ENG)
GLOW PLUG RELAY
PTC HEATER RELAY #1 (D4CB)
PTC HEATER RELAY #2 (D4CB)
PTC HEATER RELAY #3 (D4CB)
ESP
ABS
CAD21 (D4CB, A-ENG) CA2D21 (D4CB, All-ENG)
CAD41 (D4CB, A-ENG) CA2D41 (D4CB, All-ENG) CMD41(D4BH)
ESP CONTROL MODULE
ABS CONTROL MODULE

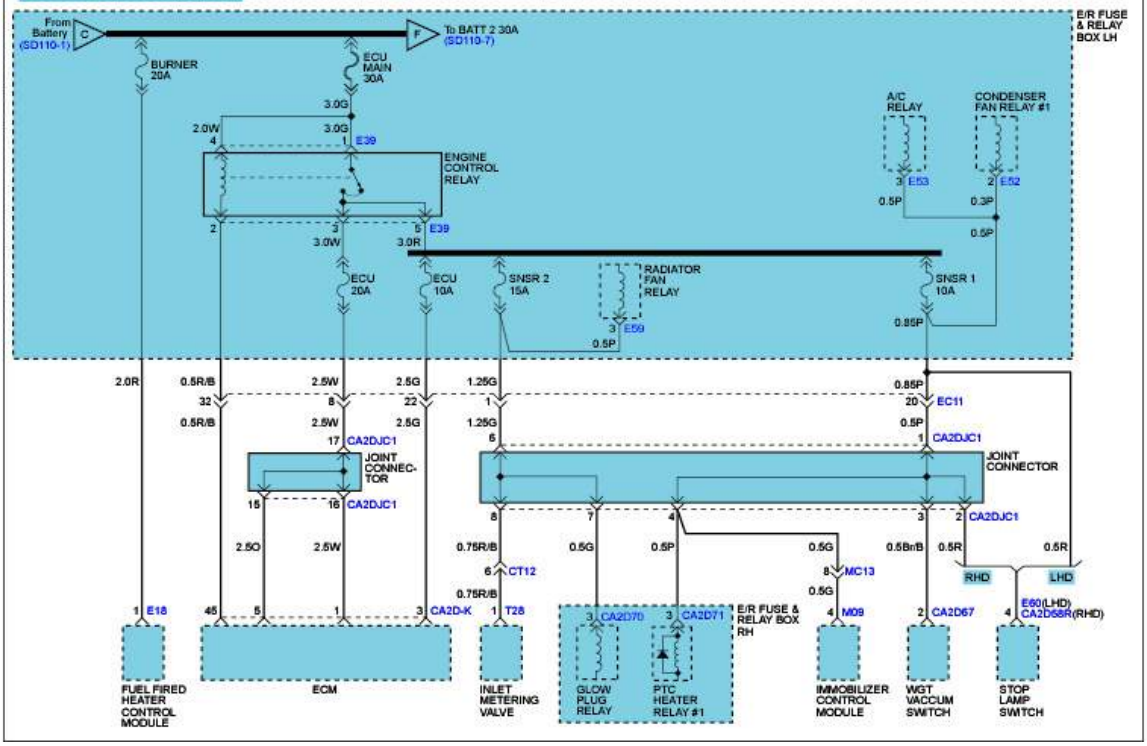
Power Distribution (2) SD110-2

D4CB : A - ENG 2.5L

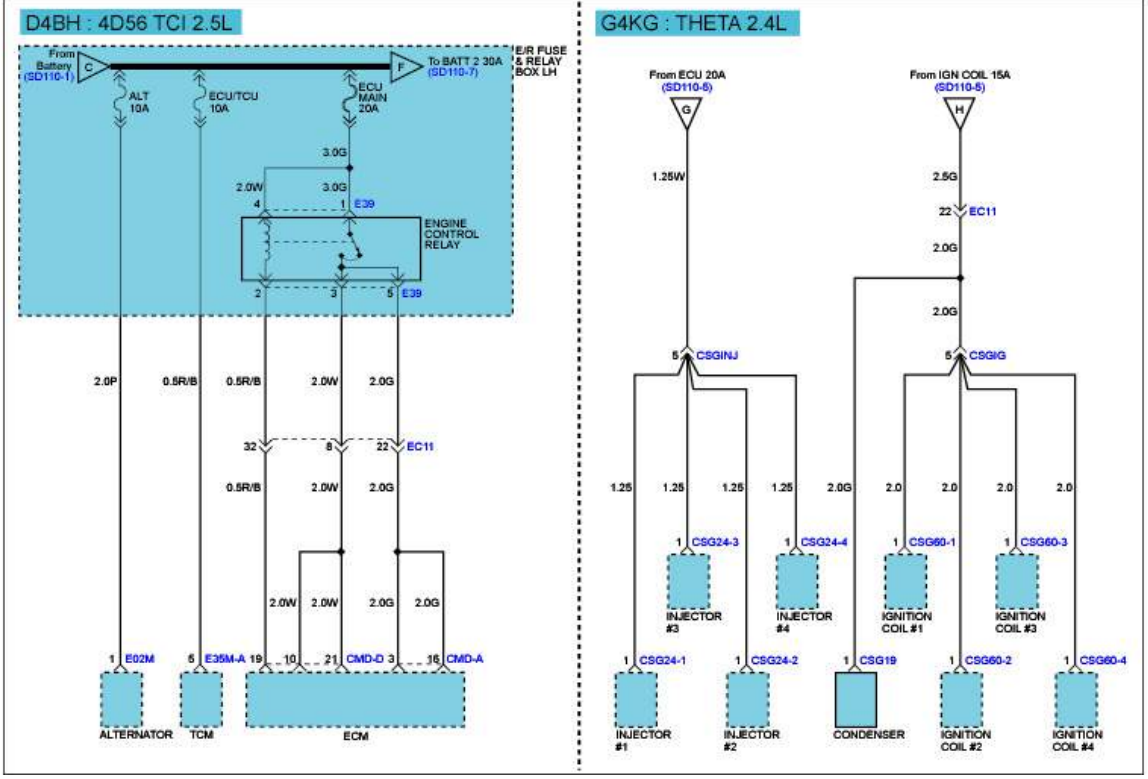


Power Distribution (3) SD110-3

D4CB : All - ENG 2.5L

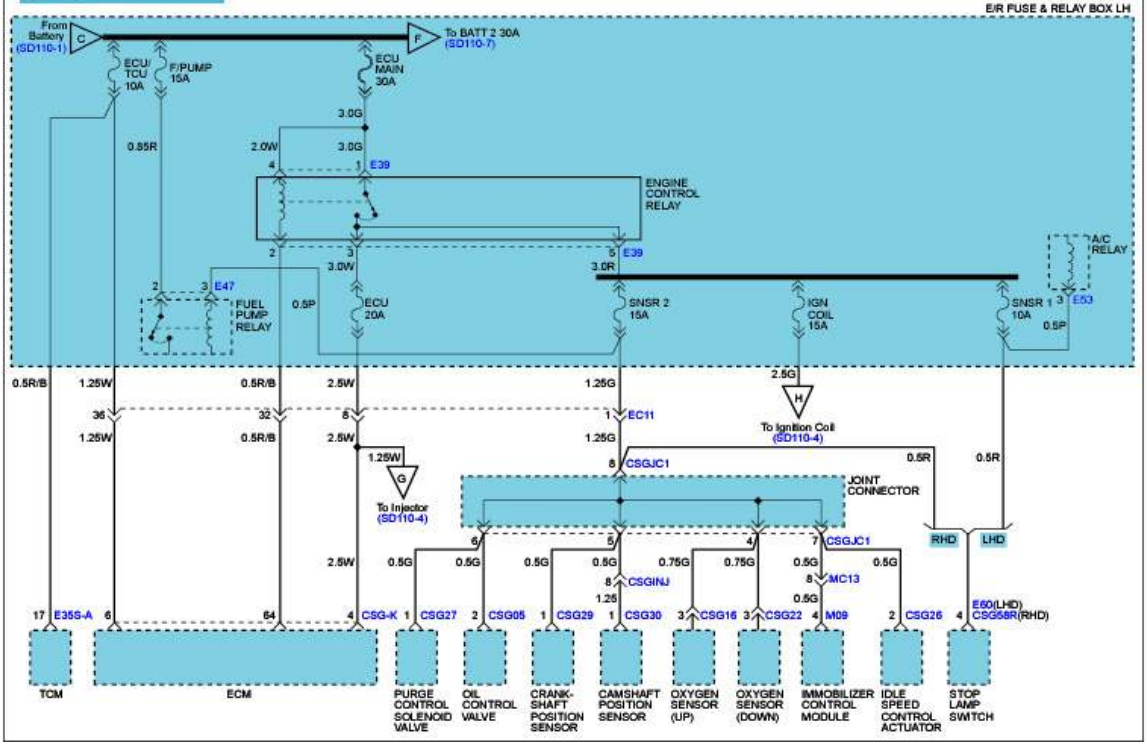


Power Distribution (4) SD110-4

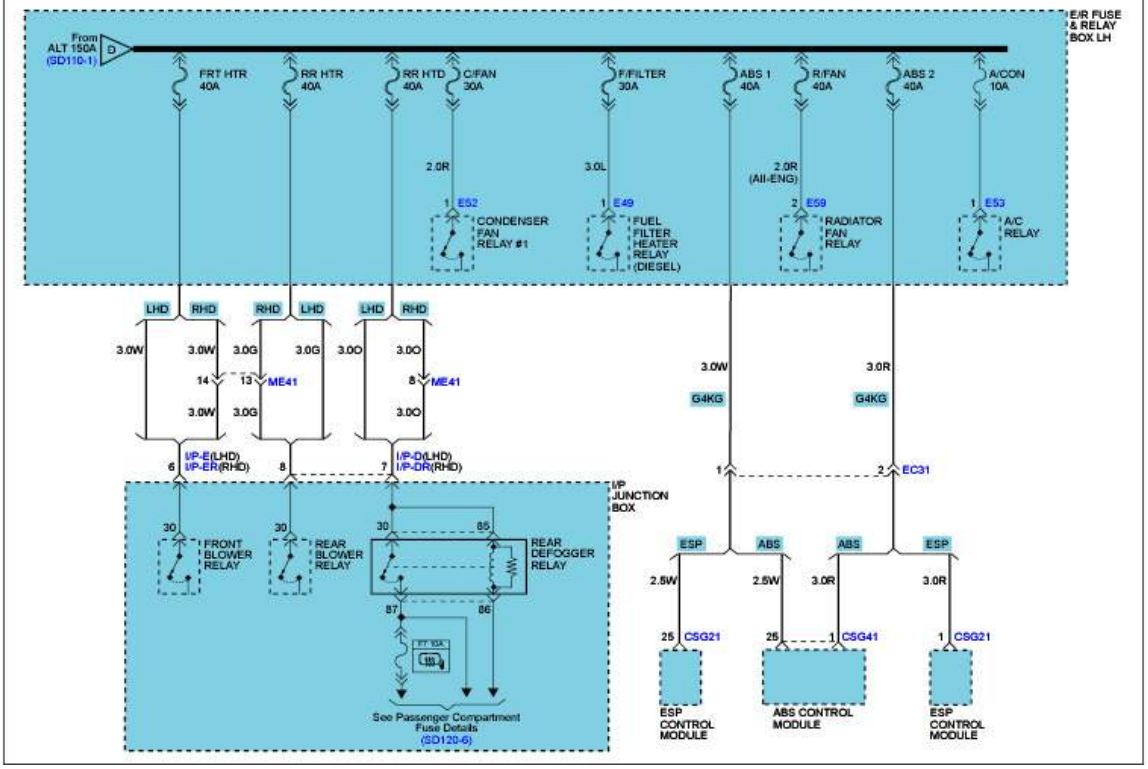


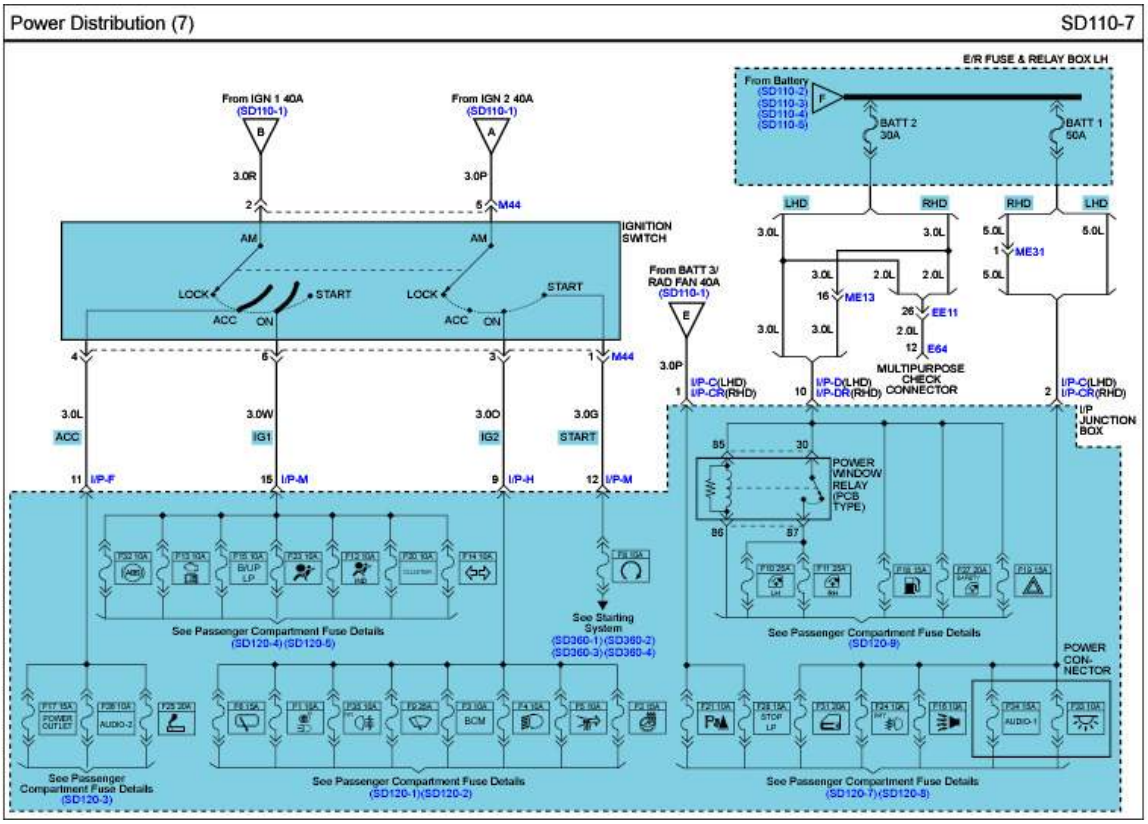
Power Distribution (5) SD110-5

G4KG : THETA 2.4L

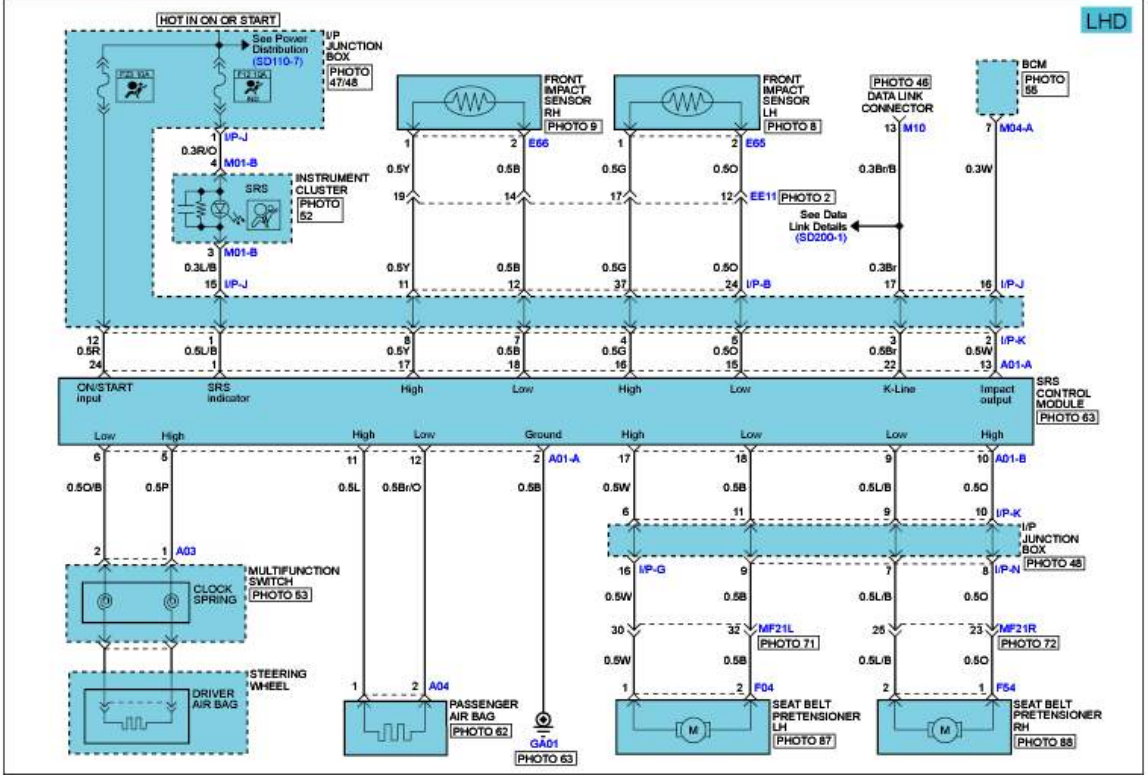


Power Distribution (6) SD110-6

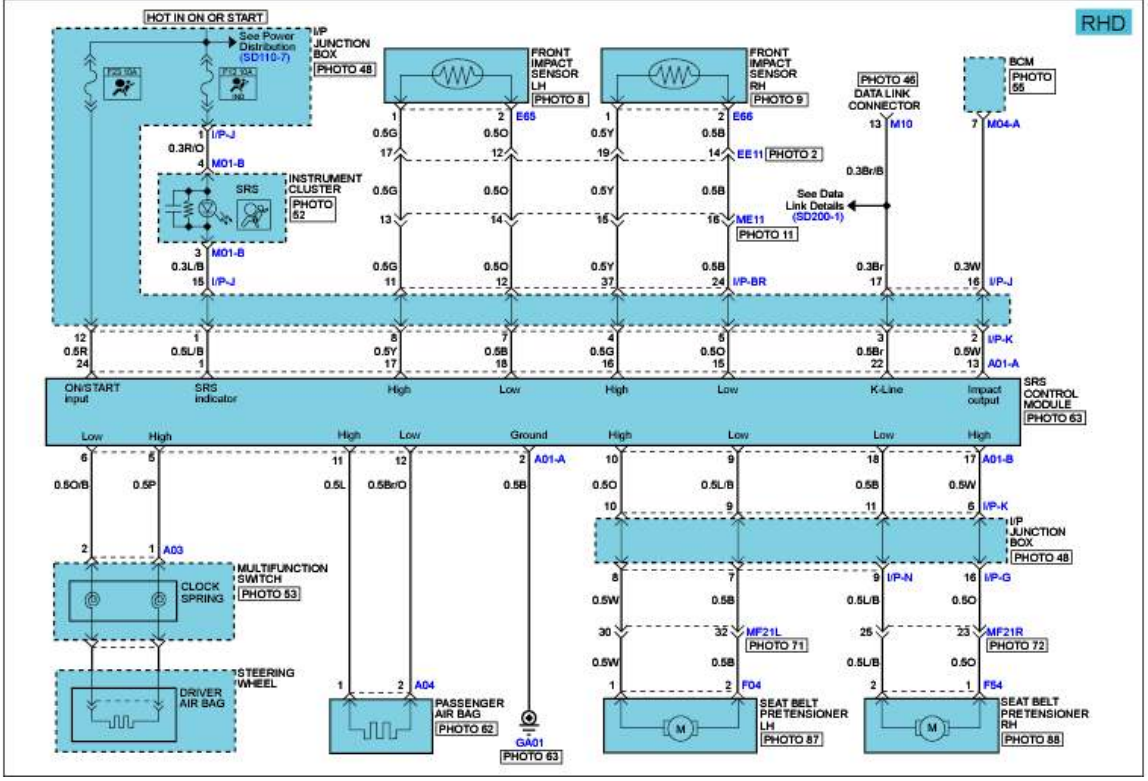



Power Distribution (7)
SD110-7
E/R FUSE & RELAY BOX LH
From Battery
(SD110-2)
(SD110-3)
(SD110-4)
(SD110-5)
BATT 2
30A
BATT 1
50A
From IGN 1 40A
(SD110-1)
From IGN 2 40A
(SD110-1)
IGNITION SWITCH
From BATT 3/
RAD FAN 40A
(SD110-1)
LHD
RHD
ME31
ME13
EE11
E64
MULTIPURPOSE CHECK CONNECTOR
I/P-C(LHD)
I/P-CR(RHD)
I/P-D(LHD)
I/P-DR(RHD)
I/P JUNCTION BOX
POWER WINDOW RELAY (PCB TYPE)
ACC
IG1
IG2
START
I/P-F
I/P-M
I/P-H
See Passenger Compartment Fuse Details
(SD120-4)(SD129-5)
See Starting System
(SD360-1)(SD360-2)
(SD360-3)(SD360-4)
See Passenger Compartment Fuse Details
(SD120-9)
POWER CONNECTOR
See Passenger Compartment Fuse Details
(SD120-3)
See Passenger Compartment Fuse Details
(SD120-1)(SD120-2)
See Passenger Compartment Fuse Details
(SD120-7)(SD120-8)

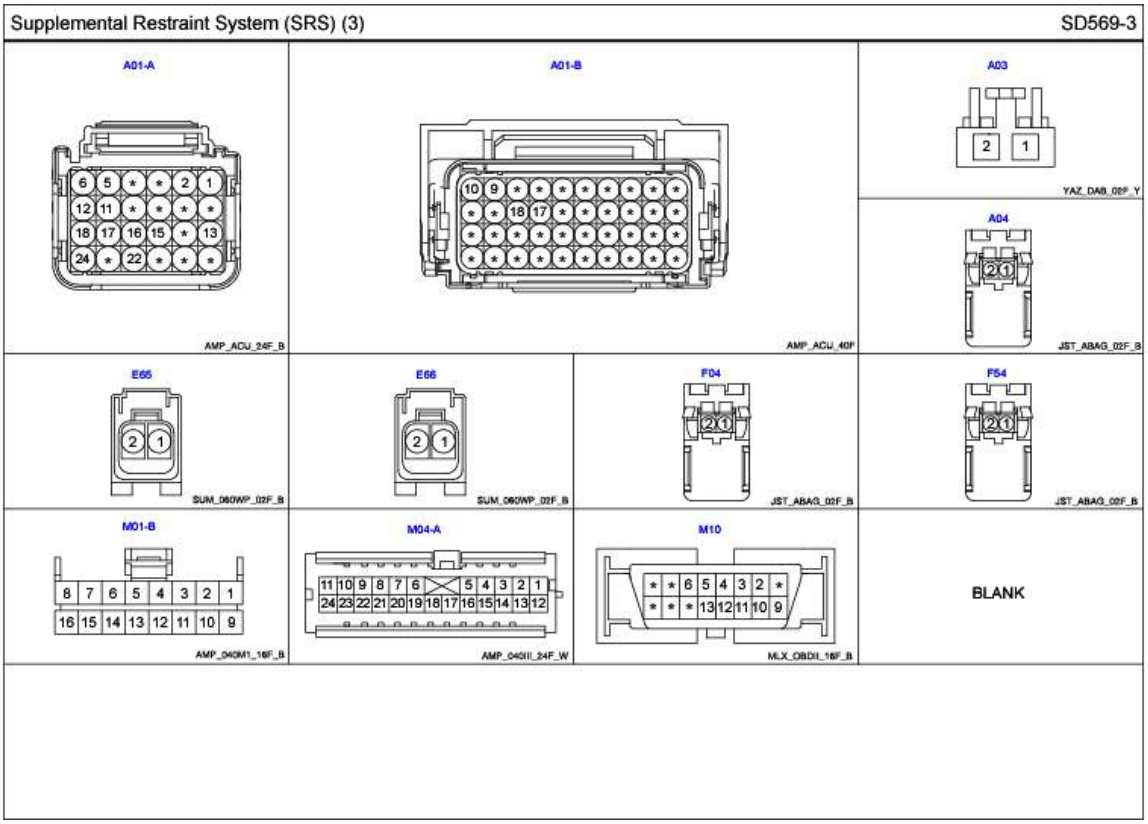
Supplemental Restraint System (SRS) (1) SD569-1



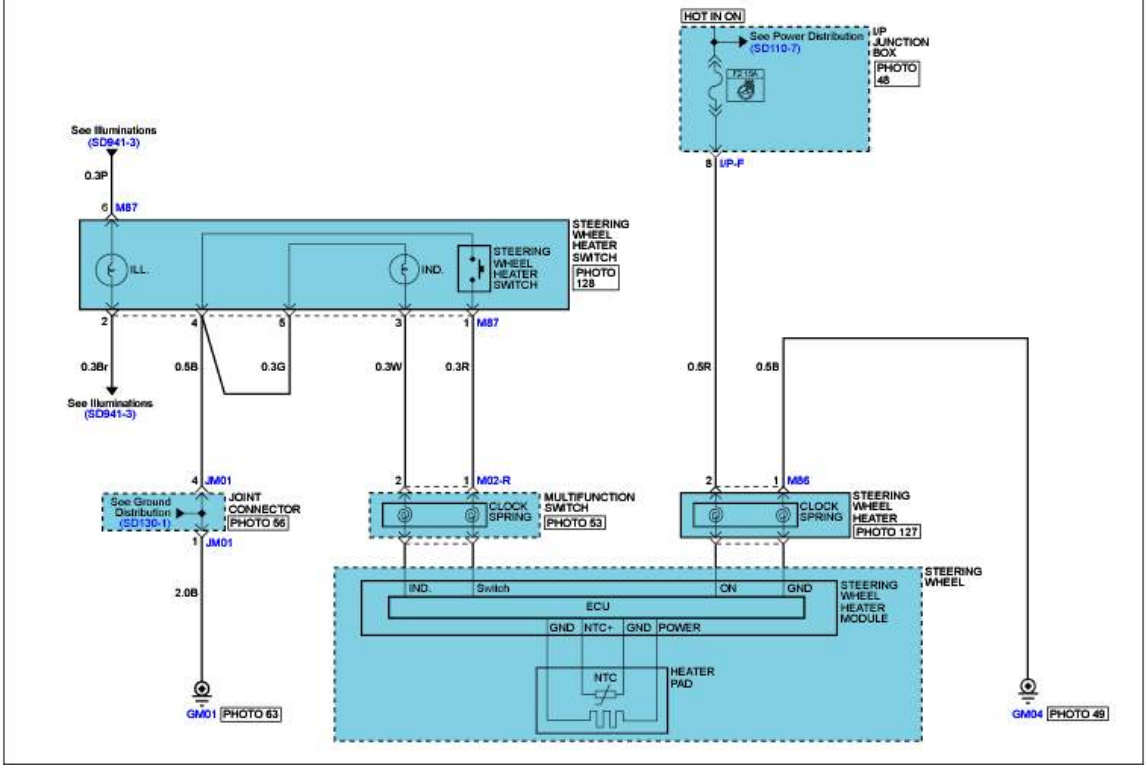
Supplemental Restraint System (SRS) (2) SD569-2



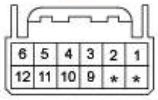
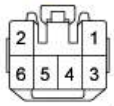
Supplemental Restraint System (SRS) (3) SD569-3



Steering Wheel Heating System (1) SD879-3



Steering Wheel Heating System (2) SD879-4

M02-R	M86	M87	
 AMP_025_12F_W	PKD_MP150_02F_R	 KUM_090II_06F_Y	BLANK

Symbols

Symbols (1)

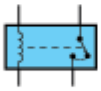
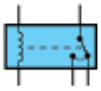
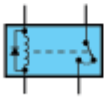
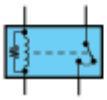
GI-6

Section	Symbol	Meaning
COMPONENT		A solid line means the entire component is shown.
		A broken line indicates only part of the component is shown.
		This means the connector connects directly to the component.
		This indicates the connector connects to a lead (pigtail), wired directly to the component.
		This indicates a screw terminal on the component.
		This ground symbol (dot and 3 lines overlapping the component) means the housing of the component is attached to a metal part of the vehicle.
	STOP LAMP SWITCH PHOTO-83	The name of the component appears next to its upper right corner. Shows the number of pictures for component location.
CONNECTOR	Male connector / Female connector	Shows the name of each connector on the component location index for reference. Indicates the number of corresponding terminal. (Only relevant terminal on the corresponding schematic diagram).
		The dashed-line means each of two wires connect with same connector(E35)
WIRE		A wavy line means the wire is broken but is to be continued.
		Wire insulation is yellow with a red strip.
		Current path is continued on the same page or another page.The arrow shows the direction of current flow. You should look for the "A" in the marked position.
	Name of Circuit	A wire connects to another circuit. The wire is shown again on that circuit which the arrow is pointing.
		Wire choices for options or different models are labeled and shown with a "choice" bracket like this.
SPLICES		Splices are numbered and shown as a dot with circle. The exact location and connection of these splices may vary among vehicles.
GROUND	G06	This symbol means the end of the wire is attached to a metal part of the vehicle.

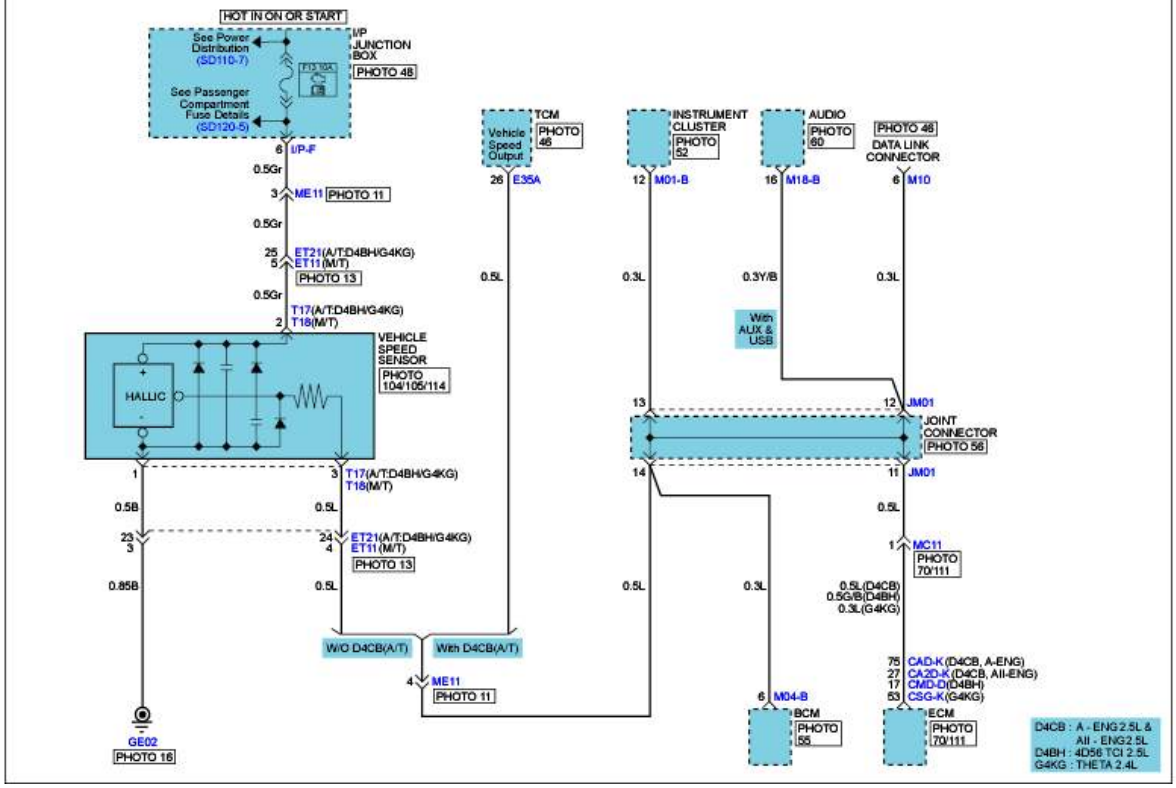
Section	Symbol	Meaning
SHIELD WIRE		This represents RFI (Radio Frequency Interference) Shielding around a wire. The shielding is always connected to ground.
JOINT CONNECTOR		This is a connector showing the joining wires.
FUSE		Power supplied at all times. Name Capacity
		This means power is supplied with the ignition on position. This means the short bar connects to other fuses. Identification Current rating
POWER CONNECTOR		Control battery power at all times

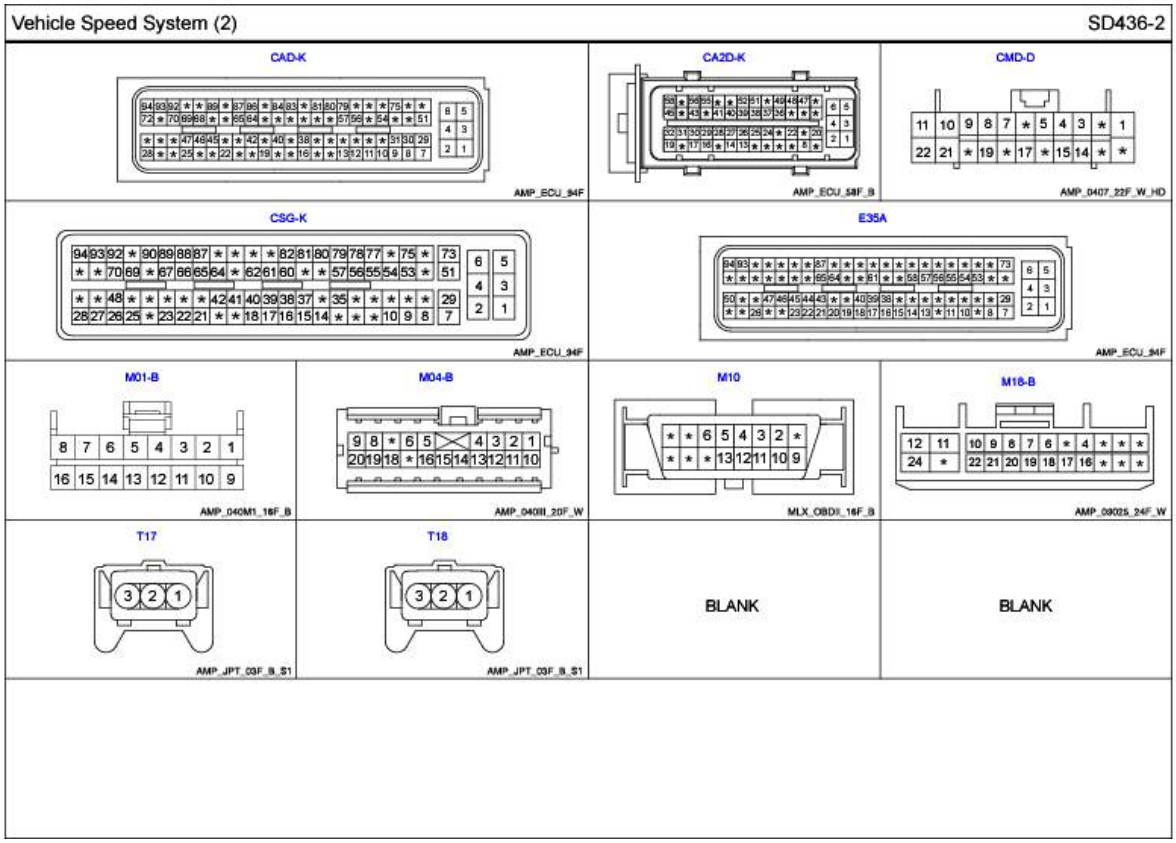
Section	Symbol	Meaning
LAMP		Double filament
		Single filament
DIODE		Diode
		Led diode
		Zener diode
TR	NPN	NPN
	PNP	PNP
GENERAL COMPONENT SYMBOL		These switches move together: a dashed line shows a mechanical connection between them.
		Switch (1 contact point)
		Heater

Symbols (2)

Section	Symbol	Meaning	Section	Symbol	Meaning
GENERAL COMPONENTS SYMBOL		Sensor	GENERAL COMPONENTS SYMBOL		Condenser
		Sender			Speaker
		Injector			Horn, Buzzer, Siren, Chime Bell
		Solenoid	RELAY		Normally open contact
		Motor			This is a relay shown with no current flowing through its coil. When a current flows through coil, contact will toggle.
					Diode interior relay
		Battery			Resistance interior relay

Vehicle Speed System (1) SD436-1




Vehicle Speed System (2)
SD436-2
CAD-K
AMP_ECU_94F
CA2D-K
AMP_ECU_58F_B
CMD-D
AMP_0407_22F_W_HD
CSG-K
AMP_ECU_94F
E35A
AMP_ECU_94F
M01-B
AMP_040M1_16F_B
M04-B
AMP_040III_20F_W
M10
MLX_OBDII_16F_B
M18-B
AMP_03025_24F_W
T17
AMP_JPT_03F_B_S1
T18
AMP_JPT_03F_B_S1
BLANK
BLANK

Troubleshooting Instructions

TROUBLESHOOTING INSTRUCTIONS

TROUBLESHOOTING PROCEDURES

The following five-step troubleshooting procedure is recommended.

1. Verify the customer's complaints

Turn on all the components in the problem circuit to check the accuracy of the customer's complaints. Note the symptoms.
Do not begin disassembly or testing until you have narrowed down the probable causes.

2. Read and analyze the schematic diagram

Locate the schematic for the problem circuit. Determine how the circuit is supposed to work by tracing the current paths from the power source through the system components to ground. If you do not understand how the circuit should work, read the circuit operation text. Also check other circuits that share with the problem circuit. The name of circuits that share the same fuse, ground, or switch, for example, are referred to on each diagram. Try to operate any shared circuits you did not check in step 1. If the shared circuit works, the shared wiring is okay, and the cause must be within the wiring used only by the problem circuit.
If several circuits fail at the same time, the fuse or ground is a likely cause.

3. Inspect the circuit/ component with the problem isolated

Make a circuit test to check the diagnosis you made in step 2. Remember that a logical, simple procedure is the key to efficient troubleshooting. Narrow down the probable causes using the troubleshooting hints and system diagnosis charts.
Test for the most likely cause of failure first.
Try to make tests at points that are easily accessible.

4. Repair the problem

Once the problem is found, make the necessary repairs.

5. Make sure the circuit works

Repeat the system check to be sure you have repaired the problem. If the problem was a blown fuse, be sure to test all of the circuits on that fuse.

TROUBLESHOOTING EQUIPMENT

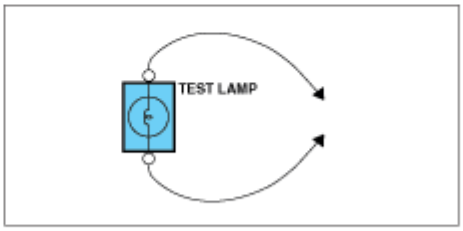
VOLTMETER AND TEST LAMP

Use a test lamp or a voltmeter on circuits without solidstate units and use a test lamp to check for voltage. A test lamp is made up of a 12-volt light bulb with a pair of leads attached. After grounding one lead, touch the other lead to various points along the circuit where voltage should be present.
When the bulb goes on, there is voltage at the point being tested.

CAUTION

A number of circuits include solid-state modules, such as the Engine Control Module(ECM), used with computer command control injection. Voltage in these circuits should be tested only with a 10-megaohm or higher impedance digital multimeter. Never use a test lamp on circuits that contain solid state modules. Damage to the modules may result.

A voltmeter can be used in place of a test lamp. While a test lamp shows whether the voltage is present or not, a voltmeter indicates how much voltage is present.



SELF-POWERED TEST LAMP AND OHMMETER

Use a self-powered test lamp or an ohmmeter to check for continuity.
The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

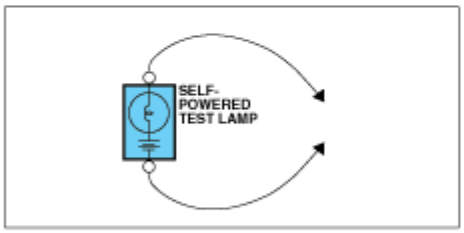
Troubleshooting Instructions (2) GI-9

CAUTION

Never use a self-powered test lamp on circuits that contain solid state modules. Damage to these modules may result.

An ohmmeter can be used in place of a self-powered test lamp.
The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

Circuits which include any solid-state devices should be tested only with a 10-megaohm or higher impedance digital multimeter. When measuring resistance with a digital multimeter, the battery negative terminal should be disconnected. Otherwise, there may be incorrect readings. Diodes and solid-state devices in a circuit can make an ohmmeter give a false reading. To find out if a component is affecting a measurement, take one reading, reverse the leads and take a second reading.
If different the solid-state device is affecting the measurement.



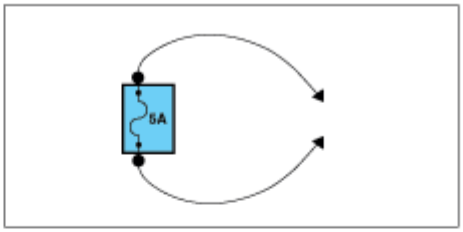
JUMPER WIRE WITH FUSE

Use a jumper wire with a fuse to by-pass an open circuit.

A jumper wire is made up of an in-line fuse holder connected to a set of test leads. This tool is available with small clamp connectors providing adaption to most connectors without damage.

CAUTION

Do not use a fuse with a higher rating than the specified fuse that protects the circuit being tested. Do not use this tool in any situation to substitute an input or output at the solid-state control module, such as ECM, TCM, etc.



SHORT FINDER

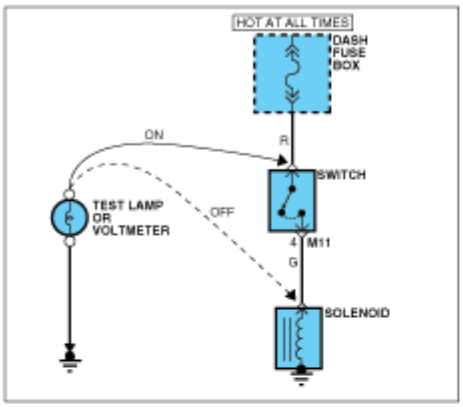
A short finder is available to locate a short to ground. The short finder creates a pulsing magnetic field in the shorted circuit and shows you the location of the short through body trim or sheet metal.

TROUBLESHOOTING TEST

1. TESTING FOR VOLTAGE

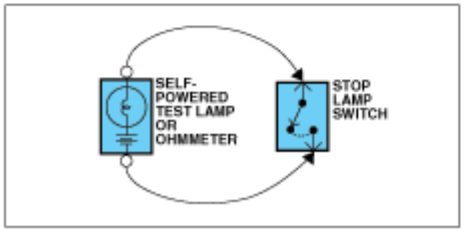
This test measures voltage in a circuit. When testing for voltage at a connector, you do not have to separate the two halves of the connector. Instead, probe the connector from the back(backprobe). Always check both sides of the connector because dirt and corrosion between its contact surfaces can cause electrical problems.

A. Connect one lead of a test lamp or voltmeter to a ground. If you are using a voltmeter, be sure it is the voltmeter's negative test lead you have connected to ground.
B. Connect the other lead of the test lamp or voltmeter to a selected test point(connector or terminal).
C. If the test lamp glows, there is voltage present. If you are using a voltmeter, note the voltage reading. A loss of more than 1 volt from specification indicates a problem.



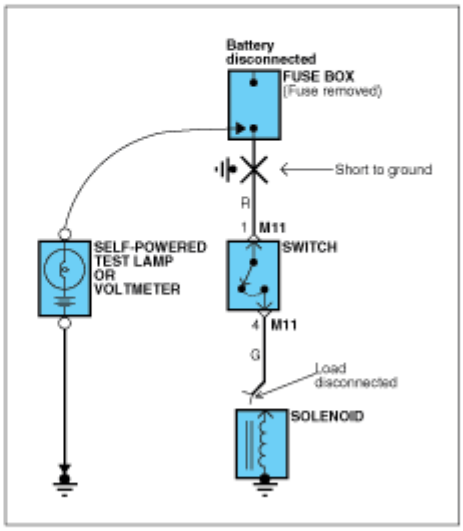
2. TESTING FOR CONTINUITY

A. Disconnect the battery negative terminal.
B. Connect one lead of a self-powered test lamp or ohmmeter to one end of the part of the circuit you wish to test. If you are using an ohmmeter, hold the leads together and adjust the ohmmeter to read zero ohms.
C. Connect the other lead to the other end.
D. If the self-power test lamp glows, there is continuity. If you are using an ohmmeter, low or zero resistance means good continuity.



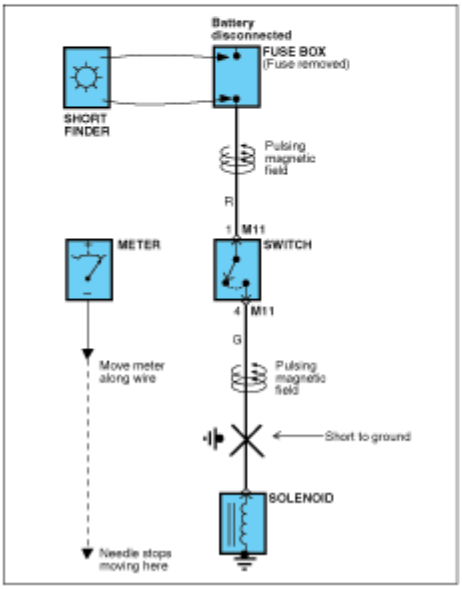
3. TESTING FOR SHORT TO GROUND

A. Disconnect the battery negative terminal.
B. Connect one lead of a self-powered test lamp or an ohmmeter to the fuse terminal on the load side.
C. Connect the other lead to a ground.
D. Beginning near the fuse block move the harness from side to side. Continue this proceedure(about six inches apart) while watching the self-powered test lamp or ohmmeter.
E. When the self-powered test lamp glows, or ohmmeter registers, there is a short to a ground in the wiring near that point.



4. TESTING FOR A SHORT WITH A SHORT FINDER

A. Remove the blown fuse. Leave the battery connected.
B. Connect the short finder across the fuse terminals.
C. Close all switches in series in the circuit that is being testing.
D. Turn on the short circuit locator. It sends pulses of current to the short. This creates a pulsing magnetic field around the wiring between the fuse box and the short.
E. Beginning at the fuse box, slowly move the short finder along the circuit wiring. The meter will show current pulses through sheet metal and body trim. As long as the meter is between the fuse and the short, the needle will move with each current pulse. Once the meter is moved past the point of the short, the needle will stop moving. Check around this area to locate the cause of the short circuit.



Wiring Repair

Wiring Repair (1)

*** WRK II Standardd Kit "GHWRK2"**
Total 117 connectors well designed to repair automotive wiring harness instead of whole parts with wiring harness replacement (1 set of connector = 5 connectors each)

* Effective to save the labor & parts cost and reduce time to complete the service on vehicle

WRK II Tool Set (GHWRK2T)

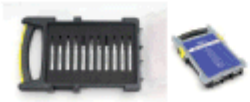
No.	Part No.	Part Name	Q'ty
1	GHWRK2T-MPC01	Multi Purpose Crimper	1
2	GHWRK2T-WRS01	Wire Stripper	1
3	GHWRK2T-STS03	Shrink Tube Set	5
4	GHWRK2T-STS05		5
5	GHWRK2T-STS09		5
6	GHWRK2T-STS12		5
7	GHWRK2T-SDR01	Solder	1
8	GHWRK2T-SHT01	Shield Tape	1
9	GHWRK2T-TLB01	Tool Box	1

Multi Purpose Crimper

Wire Stripper

WRK II Reference Service Tools

WRK II Tool Set



WRK II Removable Tools

WRK II Cabinet Set

WRK II Removable Tools (WRKRT10000)

- Total 11 Removable Tools cover all 117 connectors

Removable Tool			
WRKRT00001	WRKRT00002	WRKRT00003	WRKRT00004
WRKRT00005	WRKRT00006	WRKRT00007	WRKRT00008
WRKRT00009	WRKRT00010	WRKRT00011	

WRK II Cabinet Set (WRKCB60000)

- Twelve drawer cabinets X 6 EA with WRK all connectors Numbers

- Total 72 slots with enough space for 10 connectors in each slot except big size connectors

REWORK PROCEDURE

1. Use of WRKII Tool Set (GHWRK2T)

1) Disconnect the battery cable.

2) Choose the correct clamping slot for the wire and strip off the wire coat.

◉ If the incorrect crimping slot is used, the terminal may be damaged and may not fitt into the connector.

2. Use of In-line solder (GHWRK2T-SDR01) and Shrink tube set (GHWRK2T-STS03, 05, 09, 12)

1) Strip off about 5mm of the wire coat at the end of the wires.

2) Insert each wire into the opposite ends of the in-line solder and crimp using a wire stripper.

3) Put the shrink tube over the connection area and shrink the tube using an electrical hot gun.

4) The shrink tube should be securely wrapped around the soldering area and exposed wiring.

3. Use of WRKII Removable Tool (WRKRT10000)

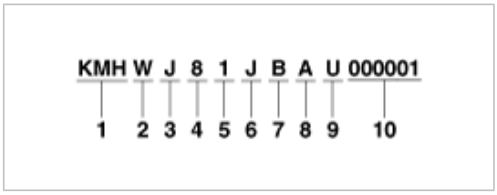
▶ **Flat tip type** : Removal of single locking male/ female terminal from the connector

1) Remove the front or rear retainer (holder, stopper) of the connector.

2) Ensure that the tip of the tool is inserted into the gap between the elastic arm of key and terminal.

3) Remove the terminal and check the terminal condition, if it is damaged, replace it with a new terminal

▶ **Double tip type** : Removal of double locking male/ female terminal from the connector.



1. World Manufacturer Identifier (WMI)
   A. KMF : Commercial vehicle (Van)
   B. KMH : : Passenger vehicle or MPV(Multipurpose Passenger Vehicle)/SUV(Sports Utility Vehicle)/RV (Recreational Vehicle)
   C. KMJ : Van
   D. KM8 : MPV/SUV/RV (For U.S.A, Canada, Mexico only)
2. Vehicle line
   A. W : H-1 BUS
3. Model ≥ Series
   A. F : Low grade (L)
   B. G : Middle-z`Low grade (GL)
   C. H : Middle grade (GLS, JSL, TAX)
   D. J : Middle-High grade (GDS)
   E. K : High grade (HGS, TOP)
4. Body/Cabin type, Gross Vehicle Weight Rating
   KMF (Commercial vehicle / Van)
   Except U.S.A, Canada, Mexico, Gulf Cooperation Council, China
   - X : Standard Cabin / Semi-Bonnet
   - Y : Double Cabin / Bonnet
   - Z : Super Cabin / Box
   For U.S.A, Canada, Mexico, Gulf Cooperation Council, China
   - 3 : Standard Cabin Class-E 4×2 / Semi-Bonnet Class-E 4×2
   - 4 : Standard Cabin Class-E 4×4 / Semi-Bonnet Class-E 4×4
   - 5 : Standard Cabin Class-F 4×2 / Semi-Bonnet Class-F 4×2
   - 6 : Standard Cabin Class-F 4×4 / Semi-Bonnet Class-F 4×4
   - 7 : Double Cabin Class-E 4×2 / Bonnet Class-E 4×2
   - 8 : Double Cabin Class-E 4×4 / Bonnet Class-E 4×4
   - 9 : Double Cabin Class-F 4×2 / Bonnet Class-F 4×2
   - 0 : Double Cabin Class-F 4×4 / Bonnet Class-F 4×4
   - A : Super Cabin Class-E 4×2 / Box Class-E 4×2
   - B : Super Cabin Class-E 4×4 / Box Class-E 4×4
   - C : Super Cabin Class-F 4×2 / Box Class-F 4×2
   - D : Super Cabin Class-F 4×4 / Box Class-F 4×4
   KMH
   - 1 : Limousine
   - 2 : Sedan - 2 door
   - 3 : Sedan - 3 door
   - 4 : Sedan - 4 door
   - 5 : Sedan - 5 door

- 6 : Coupe
- 7 : Convertible
- 8 : Wagon
- 9 : Commercial Van
- 0 : Pick-Up

KMJ

- 1 : Box
- 2 : Bonnet
- 3 : Semi-Bonnet

KM8

- 1 : Wagon 4×2 Class-A
- 2 : Wagon 4×2 Class-B
- 3 : Wagon 4×2 Class-C
- 4 : Wagon 4×2 Class-D
- 5 : Wagon 4×2 Class-E
- 6 : Wagon 4×2 Class-F
- 7 : Wagon 4×2 Class-G
- A : Wagon 4×4 Class-A
- B : Wagon 4×4 Class-B
- C : Wagon 4×4 Class-C
- D : Wagon 4×4 Class-D
- E : Wagon 4×4 Class-E
- F : Wagon 4×4 Class-F
- G : Wagon 4×4 Class-G

5. Restraint system, Brake system

KMH, KM8

Except U.S.A, Canada, Mexico

- 0 : Both side - None
- 1 : Both side - Active belt
- 2 : Both side - Passive belt

For U.S.A, Canada, Mexico

Code	Sea belt	Front air bag		Knee air bag		Side air bag			Curtain air bag		
		Driver's	Passenger's	Driver's	Passenger's	1st row	2nd row	3rd row	1st row	2nd row	3rd row
A	○	○	○	×	×	○	×	×	○	○	×
B	○	○	○	×	×	×	×	×	×	×	×
C	○	○	○	×	×	○	×	×	○	○	○
D	○	○	○	×	×	○	○	×	○	○	×
E	○	○	×	×	×	×	×	×	×	×	×
F	○	○	○	×	×	○	×	×	×	×	×
J	○	○	○	○	×	○	○	×	○	○	×

L	○	○	○	○	×	○	×	×	○	○	×
N	○	×	×	×	×	×	×	×	×	×	×

KMJ
Except U.S.A, Canada, Mexico
- 7 : Hydraulic brake system
- 8 : Pneumatic brake system
- 9 : Mixed brake system

For U.S.A, Canada, Mexico
- X : Hydraulic brake system
- Y : Pneumatic brake system
- Z : Mixed brake system

KMF
Except U.S.A, Canada, Mexico
- 7 : Hydraulic brake system
- 8 : Pneumatic brake system
- 9 : Mixed brake system

For U.S.A, Canada, Mexico

Code	Restraint system											Brake system		
	Sea belt	Front air bag		Knee air bag		Side air bag			Curtain air bag			Hydrauric	Pneumatic	Mixed
		Driver's	Passenger's	Driver's	Passenger's	1st row	2nd row	3rd row	1st row	2nd row	3rd row			
X	○	×	×	×	×	×	×	×	×	×	×	○	-	-
V	○	○	×	×	×	×	×	×	×	×	×	○	-	-
W	○	○	○	×	×	×	×	×	×	×	×	○	-	-

6. Engine type
   A. H : Diesel engine 2.5(4D56-TCI)
   B. J : Diesel engine 2.5(A-TCI)
   C. K : Diesel engine 2.5 (A-II TCI)
   D. R : Gasoline engine 2.4
7. Check digit or Driver's side & Transmission
   Except U.S.A, Canada, Mexico, Gulf Cooperation Council, China, Yemen
   - A : LHD & MT
   - B : LHD & AT
   - C : LHD & MT+Transfer
   - D : LHD & AT+Transfer
   - E : LHD & CVT
   - L : RHD & MT
   - M : RHD & AT

- N : RHD & MT+Transfer
- S : RHD & AT+Transfer
- T : RHD & CVT

For U.S.A, Canada, Mexico, Gulf Cooperation Council, China, Yemen

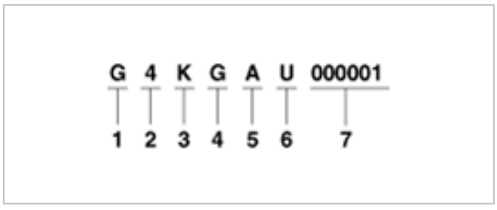
- Check digit : 0 ~ 9, ×

8. Model year
   A. A : 2010, B : 2011, C : 2012, D : 2013 ...
9. Plant of production
   A. A : Asan (Korea)
   B. B : Beijing (China)
   C. C : Cheonju (Korea)
   D. H : Alabama (U.S.A)
   E. M : Chennai (India)
   F. U : Ulsan (Korea)
   G. Z : Izmit (Turkey)
   H. J : Ostrava (Czech)
10. Vehicle production sequence number
    A. 000001 ~ 999999

Paint Code

Code	Color
KM	SLEEK SILER
EC	CRYSTAL WHITE
CJ	STONE BLACK
KB	INDIGO BLUE
MZ	SOFT ECRU
PV	SUNNY YELLOW
KH	SHINE RED
GX	CARBON GRAY
HN	MYSTIC BLUE
FQ	CRIMSON RED
VL	ICY BLUE

Engine Number



1. Engine fuel

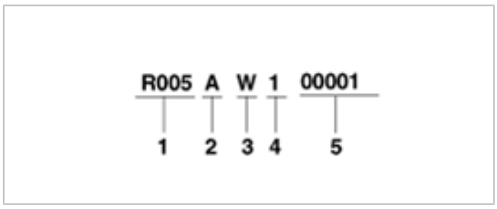
- G : Gasoline
- D : Diesel

2. Engine range
   - 4 : 4 cycle 4 cylinder
   - 6 : 4 cycle 6 cylinder
3. Engine development order and capacity
   - B : 4D56 (Diesel)
   - C : A engine (Diesel)
   - K : Theta engine (Gasoline)
4. Engine Capacity
   - H : 2476cc (4D56 engine)
   - B : 2497 cc (A engine)
   - G : 2359cc (Theta-II engine)
5. Model year
   - A : 2010, B : 2011, C : 2012, D : 2013...
6. Plant of production
   - A : Asan (Korea)
   - B : Beijing (China)
   - H : Hwasung (Korea)
   - K : Montgomery (U.S.A)
   - M : Chennai (India)
   - P : Poseung (Korea)
   - S : Sohari (Korea)
   - T : Izmit (Turkey)
   - U : Ulsan (Korea)
   - W : Shandong (China)
   - Z : Zilina (Slovakia)
   - 1 : Yancheng (China)
7. Engine production sequence number
   - 000001 ~ 999999

Transaxle Number

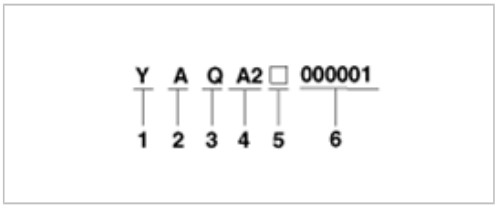
Manual

1. Model
   - T : M5SR1
2. Model year
   - A : 2010, B : 2011, C : 2012, D : 2013...
3. Transaxle production sequence number
   - 000001 ~ 999999

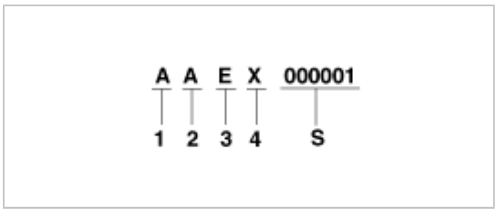


1. Assembly code
   - R005 : TQ A-II 2.5
2. Model year
   - A : 2010, B : 2011, C : 2012, D : 2013...
3. Plant of production
   W : HYUNDAI-WIA
4. Production month
   - A : January
   - B : February
   - C : March
   - D : April
   - E : May
   - F : June
   - G : July
   - H : August
   - I : September
   - J : October
   - K : November
   - L : December
5. Serial number
   - 00001 ~ 99999

Automatic

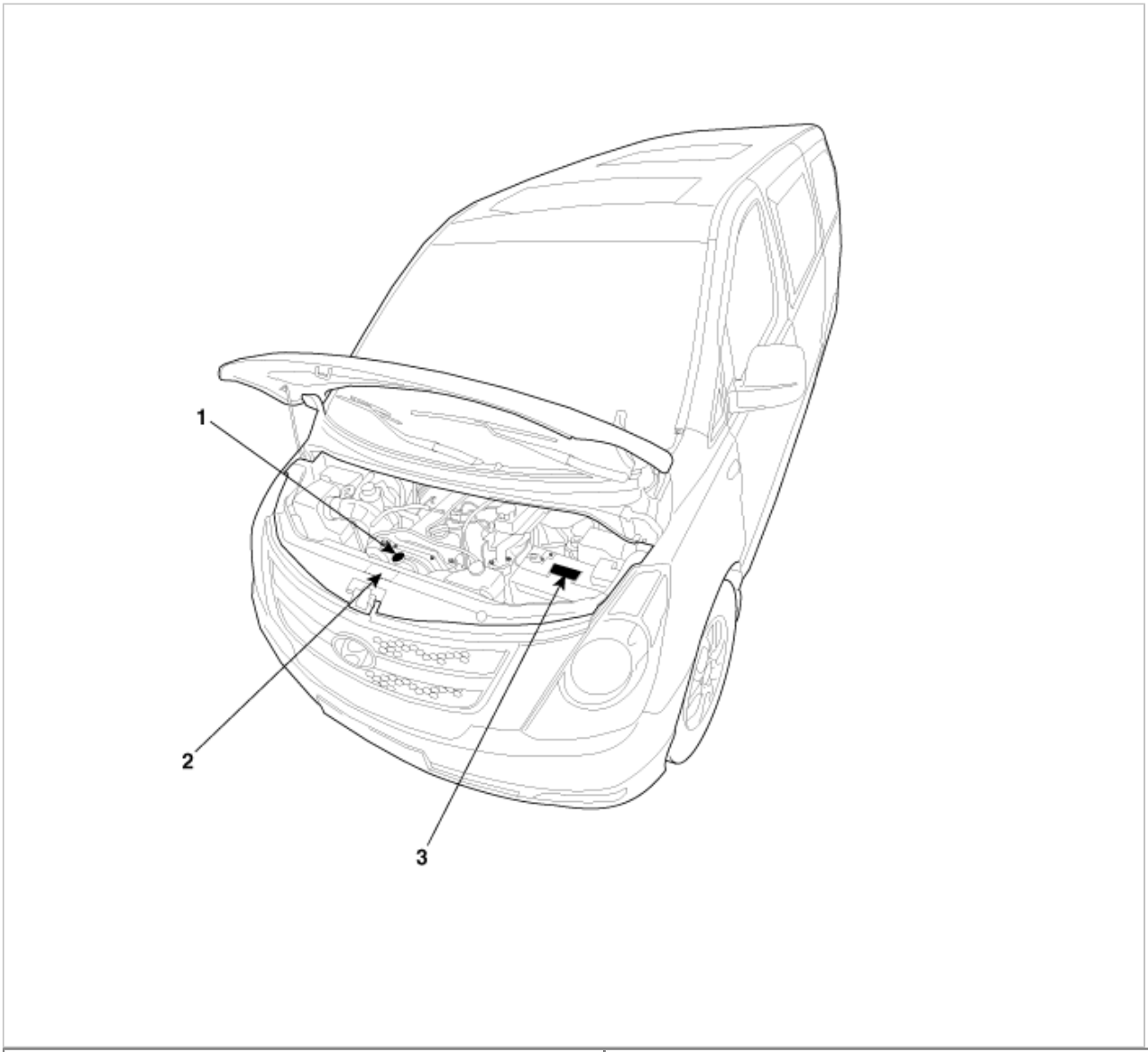


1. Model
   - Y : A5SR2
2. Model year
   - A : 2010, B : 2011, C : 2012, D : 2013...
3. Model
   - Q : TQ
4. Detailed chassification
   - A2 : A-2.5 VGT 2WD
5. Spare
6. Transaxle production sequence number
   - 000001 ~ 999999



1. Model year
   - A : 2010, B : 2011, C : 2012, D : 2013...
2. Production month
   - A : January
   - B : February
   - C : March
   - D : April
   - E : May
   - F : June
   - G : July
   - H : August
   - I : September
   - J : October
   - K : November
   - L : December
3. Production code
   - E : 30-43LE
   - R : 30-40LE
4. Production line No.

Warning / Caution Label Locations



1. Radiator cap caution 2. Fan caution	3. Battery caution

Battery Caution Label Describtion

Warning / Caution Label (Cont'd)

A.
Keep lighted cigarettes and all other flames or sparks away from the battery.

B.
Wear eye protection when charging or working near a battery. Always provide ventilation when working in an enclosed space.

- When lifting a plastic-cased battery, excesive pressure on acid to leak resulting in personal injury. Lift with a battery carrier or with your hands on opposite corners.
- Never attempt to change the battery when the battery cables are connected.
- The electrical ignition system works with high voltage.
  Never touch these components with the engine running or the ignition switched on.

C.
Keep batteries out of the reach of children because batteries contain highly corrosive SULFURIC ACID. Do not allow battery acid to contact your skin, eyes, clothing or paint finish.

D.
If any electrolyte gets into your eyes, flush your eyes with clean water for at least 15 minutes and get immediate medical attention. If possible, continue to apply water with a sponge or cloth until medical attention is received.
If electrolyte gets on your skin, throughly wash the contacted area. If you feel a pain or a burning sensation, get medical attention immediately.

E.

Always read the following instructions carefully when handing a battery.

F.
Hydrogen, which is a highly combustible gas, is always presents in battery cells and may explode if ignited.

G.
An improperly disposed battery can be harmful to the environment and human health.
Always confirm local regurations for battery disposal.

Handling And Storage The Battery

Battery Itself	• Batteries should be stored in cool, dry (27℃/80℉) places and out of direct sunlight. • MF batteries are tightly sealed to prevent acid leakage. However, tilting the battery to an angle of 45 degrees can cause acid to leak through the vents on the sides. Therefore, batteries should always be stored in their upright positions. Prevent placing any aqueous or solid (i.e. conductors) bodies on top of the battery. • It is extremely dangerous to use tools, such as hammers, on the battery terminals when connecting cables to the mounted battery.
Battery on Vehicle	• When storing the vehicle for long periods of time, make sure to remove the memory fuse at junction box to prevent natural discharging. • Also, run the engine for battery charging within 1 month if the memory fuse wasn't removed from the start of vehicle storing. If the memory fuse was removed, run the engine for battery charging within 3 months from the start of vehicle storing.

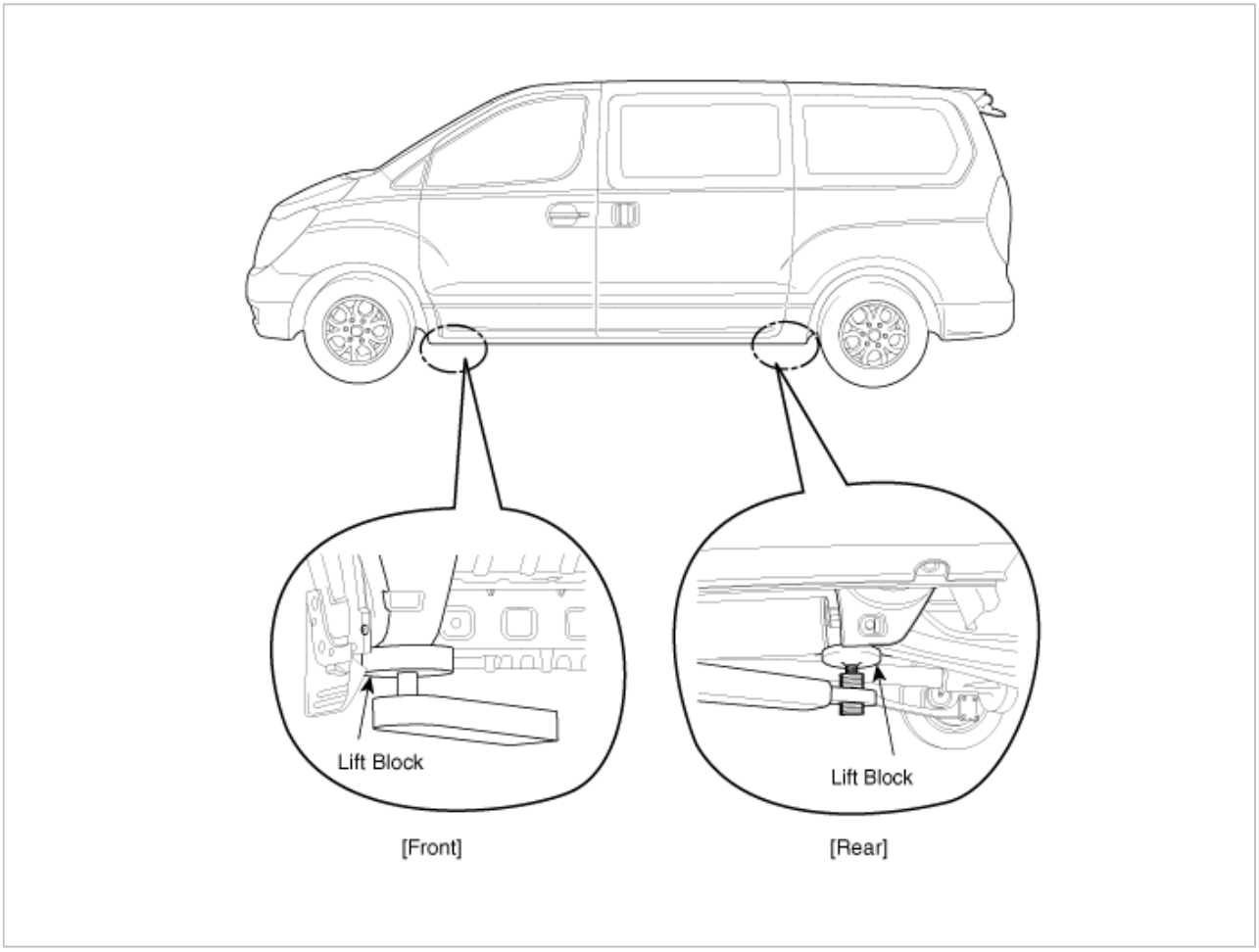
After reconnecting or recharging a discharged battery, the ESP OFF indicator may illuminate.
In this case, turn the handle half way to the left and right whilst the ignition switch is in the ON position.
Then, restart the engine after the ignition is OFF.
The ESP OFF indicator may turn OFF.
If the ESP OFF indicator does not turn OFF, have the system checked refering to DTC.

Lift And Support Points

When heavy rear components such as suspension, fuel tank, spare tire, tailgate and trunk lid are to be removed, place additional weight in the luggage area before hoisting. When substatial weight is removed from the rear of the vehicle, the center of gravity may change and can cause the vehicle to tip forward on the hoist.

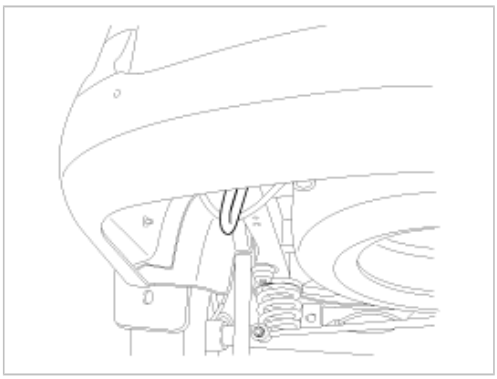
- Since each tire/wheel assembly weights approximately 30lbs (14kg), placing the front wheels in the luggage area can assist with the weight distribution.
- Use the same support points to support the vehicle on safety stands.

1. Place the lift blocks under the support points as shown in the illustration.
2. Raise the hoist a few inches (centimeters) and rock the vehicle to be sure it is firmly supported.
3. Raise the hoist to full height to inspect the lift points for secure support.



Towing

If the vehicle needs to be towed, call a professional towing service. Never tow vehicle with just a rope or chain. It is very dangerous.



Emergency Towing

There are three popular methods of towing a vehicle :

- The operator loads the vehicle on the back of truck. This is best way of transporting the vehicle.
- The tow truck uses two pivoting arms that go under the tires of the driving axle and lift them off the ground. The other two wheels remain on the ground.
- The tow truck uses metal cables with hooks on the ends. These hooks go around parts of the frame or suspension, and the cables lift that end of the vehicle off the ground. The vehicle's suspension and body can be seriously damaged if this method of towing is attempted.

If the vehicle cannot be transported by flat-bed, should be towed with the wheels of the drivig axle off the ground and do the following :

Manual Transaxle

- Release the parking brake.
- Shift the Transaxle to neutral

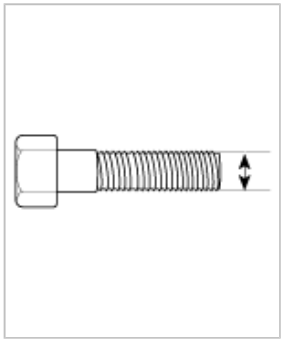
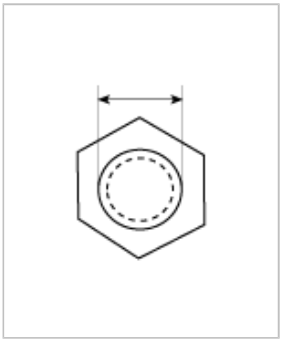
Automatic Transaxle

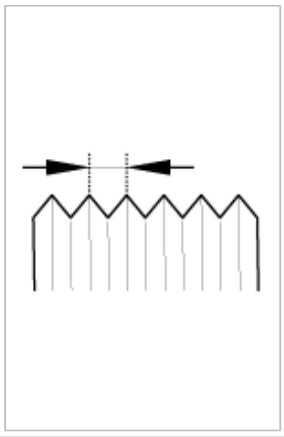
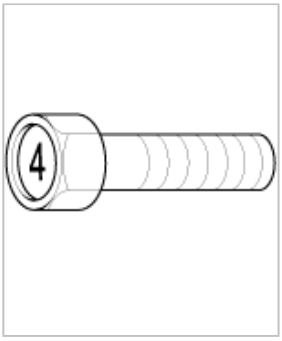
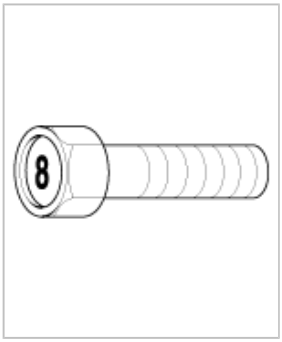
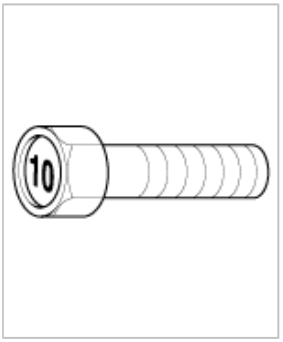
- Release the parking brake.
- Start the engine.
- Shift to [D] position, then [N] position.
- Turn off the engine.

- The vehicle equipped with full-time 4WD should be only transported on a flat-bed.
- Improper towing preparation will damage the transaxle. follow the above procedure exactly. If you cannot shift the transaxle or start the engine(automatic transaxle), your vehicle must be transported on a flatbed.

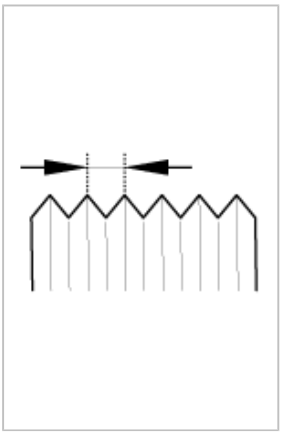
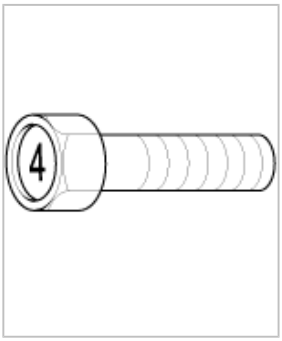
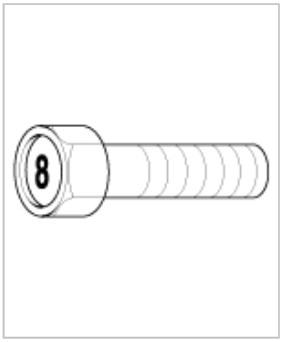
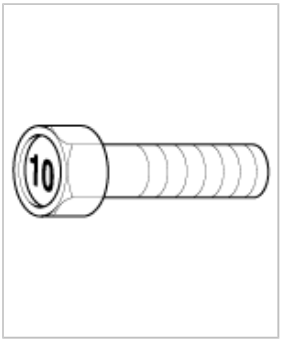
- It is the best to tow vehicle no farther than 30km (19miles), and keep the speed below 50km/h (30mph). (For the full-time 4WD vehicle, limit the towing to 1.5km (1mile) and 15km/h (10mph)
- Trying to lift or tow your vehicle by the bumpers will cause serious damage. The bumpers are not designed to support the vehicle's weight.

Tightening Torque Table Of Standard Parts

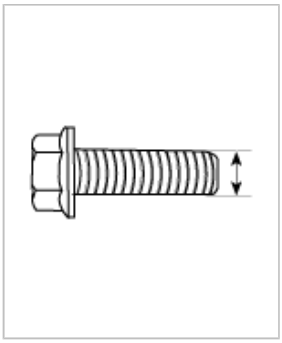
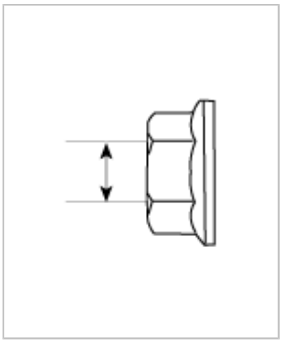
BOLT (Nominal diameter)	NUT (Nominal diameter)
	

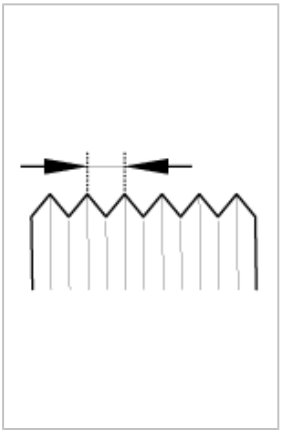
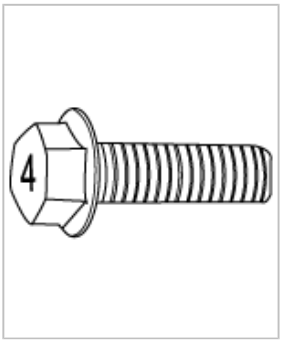
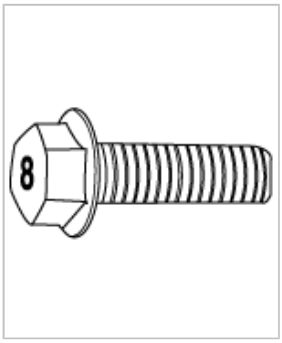
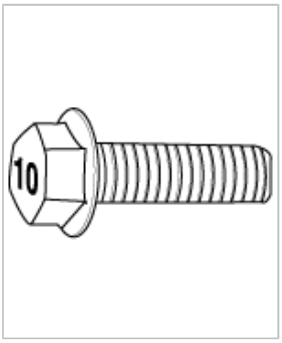
BOLT/NUT Thin screw		Torque Nm (kg.m, lb-ft)		
	Pitch [mm (in.)]	4T	8T	10T
Nominal diameter. (mm)				
M5	0.8 (0.031)	2.0 ~ 3.0 (0.2 ~ 0.3, 1.4 ~ 2.2)	4.9 ~ 6.9 (0.5 ~ 0.7, 3.6 ~ 5.1)	7.8 ~ 10.8 (0.8 ~ 1.1, 5.8 ~ 8.0)
M6	1 (0.039)	2.9 ~ 4.9 (0.3 ~ 0.5, 2.2 ~ 3.6)	8.8 ~ 12.7 (0.9 ~ 1.3, 6.5 ~ 9.4)	13.7 ~ 18.6 (1.4 ~ 1.9, 10.1 ~ 13.7)
M8	1.25 (0.049)	8.8 ~ 11.8 (0.9 ~ 1.2, 6.5 ~ 8.7)	22.6 ~ 30.4 (2.3 ~ 3.1, 16.6 ~ 22.4)	33.3 ~ 44.1 (3.4 ~ 4.5, 24.6 ~ 32.5)
M10	1.5 (0.059)	16.7 ~ 22.6 (1.7 ~ 2.3, 12.3 ~ 16.6)	45.1 ~ 60.8 (4.6 ~ 6.2, 33.3 ~ 44.8)	65.7 ~ 88.3 (6.7 ~ 9.0, 48.5 ~ 65.1)
M12	1.75 (0.068)	29.4 ~ 39.2 (3.0 ~ 4.0, 21.7 ~ 28.9)	78.5 ~ 105.9 (8.0 ~ 10.8, 57.9 ~ 78.1)	114.7 ~ 154.9 (11.7 ~ 15.8, 84.6 ~ 114.3)

M14	2 (0.078)	47.1 ~ 63.7 (4.8 ~ 6.5, 34.7 ~ 47.0)	125.5 ~ 169.7 (12.8 ~ 17.3, 92.6 ~ 125.1)	183.4 ~ 249.1 (18.7 ~ 25.4, 135.3 ~ 183.7)
M16	2 (0.078)	73.5 ~ 100.0 (7.5 ~ 10.2, 54.2 ~ 73.8)	197.1 ~ 266.7 (20.1 ~ 27.2, 145.4 ~ 196.7)	288.3 ~ 390.3 (29.4 ~ 39.8, 212.7 ~ 287.9)
M20	2.5 (0.098)	144.2 ~ 195.2 (14.7 ~ 19.9, 106.3 ~ 143.9)	396.2 ~ 535.4 (40.4 ~ 54.6, 292.2 ~ 394.9)	565.8 ~ 764.9 (57.7 ~ 78.0, 417.3 ~ 564.2)
M24	3 (0.118)	249.1 ~ 337.3 (25.4 ~ 34.4, 183.7 ~ 248.8)	687.4 ~ 929.7 (70.1 ~ 94.8, 507.0 ~ 685.7)	975.8 ~ 1320.0 (99.5 ~ 134.6, 719.7 ~ 973.6)
M30	3.5 (0.137)	499.2 ~ 674.7 (50.9 ~ 68.8, 368.2 ~ 497.6)	1372.9 ~ 1858.4 (140.0 ~ 189.5, 1012.6 ~ 1370.7)	1956.4 ~ 2647.8 (199.5 ~ 270.0, 1443.0 ~ 1952.9)

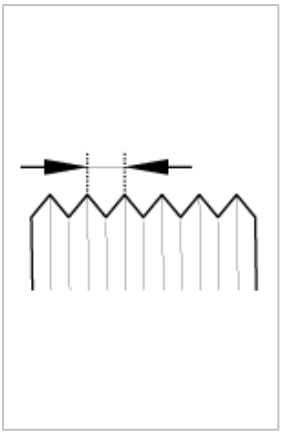
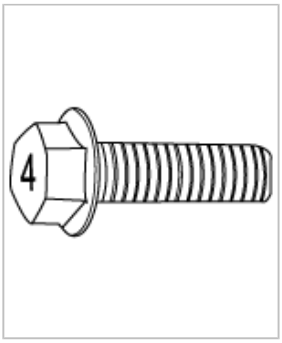
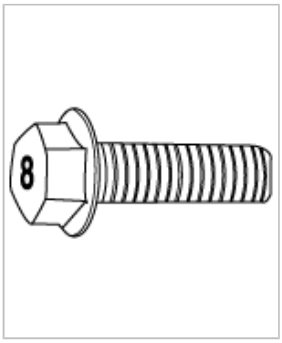
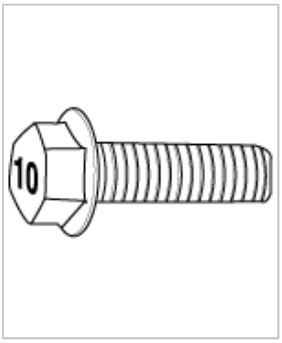
BOLT/NUT Thin screw		**Torque Nm (kg.m, lb-ft)**		
Nominal diameter. (mm)	Pitch [mm (in.)]	4T	8T	10T
				
M5	0.5 (0.019)	2.0 ~ 3.0 (0.2 ~ 0.3, 1.4 ~ 2.2)	5.9 ~ 8.8 (0.6 ~ 0.9, 4.3 ~ 6.5)	8.8 ~ 12.7 (0.9 ~ 1.3, 6.5 ~ 9.4)
M6	0.75 (0.029)	3.9 ~ 4.9 (0.4 ~ 0.5, 2.9 ~ 3.6)	9.8 ~ 13.7 (1.0 ~ 1.4, 7.2 ~ 10.1)	14.7 ~ 20.6 (1.5 ~ 2.1, 10.8 ~ 15.2)
M8	1 (0.039)	8.8 ~ 11.8 (0.9 ~ 1.2, 6.5 ~ 8.7)	24.5 ~ 32.4 (2.5 ~ 3.3, 18.1 ~ 23.9)	35.3 ~ 48.1 (3.6 ~ 4.9, 26.0 ~ 35.4)
M10	1.25 (0.049)	17.7 ~ 23.5 (1.8 ~ 2.4, 13.0 ~ 17.4)	47.1 ~ 63.7 (4.8 ~ 6.5, 34.7 ~ 47.0)	69.6 ~ 94.1 (7.1 ~ 9.6, 51.4 ~ 69.4)
M12	1.25 (0.049)	32.4 ~ 44.1 (3.3 ~ 4.5, 23.9 ~ 32.5)	86.3 ~ 117.7 (8.8 ~ 12.0, 63.7 ~ 86.8)	127.5 ~ 172.6 (13.0 ~ 17.6, 94.0 ~ 127.3)
M14	1.5 (0.059)	51.0 ~ 69.6 (5.2 ~ 7.1, 37.6 ~ 51.4)	136.3 ~ 185.3 (13.9 ~ 18.9, 100.5 ~ 136.7)	201.0 ~ 271.6 (20.5 ~ 27.7, 148.3 ~ 200.4)
M16	1.5 (0.059)	79.4 ~ 107.9 (8.1 ~	211.8 ~ 286.4 (21.6 ~	311.8 ~ 421.7 (31.8 ~

		11.0, 58.6 ~ 79.6)	29.2, 156.2 ~ 211.2)	43.0, 230.0 ~ 311.0)
M20	1.5 (0.059)	163.8 ~ 221.6 (16.7 ~ 22.6, 120.8 ~ 163.5)	448.2 ~ 607.0 (45.7 ~ 61.9, 330.5 ~ 447.7)	639.4 ~ 864.9 (65.2 ~ 88.2, 471.6 ~ 638.0)
M24	2 (0.078)	276.5 ~ 373.6 (28.2 ~ 38.1, 204.0 ~ 275.6)	759.0 ~ 1026.8 (77.4 ~ 104.7, 559.8 ~ 757.3)	1080.7 ~ 1462.2 (110.2 ~ 149.1, 797.1 ~ 1078.4)
M30	2 (0.078)	562.9 ~ 762.0 (57.4 ~ 77.7, 415.2 ~ 562.0)	1553.4 ~ 2102.5 (158.4 ~ 214.4, 1145.7 ~ 1550.8)	2210.4 ~ 2991.0 (225.4 ~ 305.0, 1630.3 ~ 2206.1)

Flange BOLT (Nominal diameter)	Flange NUT (Nominal diameter)
	

Flange BOLT/NUT Normal screw		Torque Nm (kg.m, lb-ft)		
Nominal diameter. (mm)	Pitch [mm (in.)]	4T	8T	10T
				
M5	0.8 (0.031)	2.0 ~ 2.9 (0.2 ~ 0.3, 1.4 ~ 2.2)	5.9 ~ 7.8 (0.6 ~ 0.8, 4.3 ~ 5.8)	8.8 ~ 11.8 (0.9 ~ 1.2, 6.5 ~ 8.7)
M6	1 (0.039)	3.9 ~ 4.9 (0.4 ~ 0.5, 2.9 ~ 3.6)	9.8 ~ 13.7 (1.0 ~ 1.4, 7.2 ~ 10.1)	14.7 ~ 19.6 (1.5 ~ 2.0, 10.8 ~ 14.5)
M8	1.25 (0.049)	8.8 ~ 11.8 (0.9 ~ 1.2, 6.5 ~ 8.7)	24.5 ~ 32.4 (2.5 ~ 3.3, 18.1 ~ 23.9)	35.3 ~ 48.1 (3.6 ~ 4.9, 26.0 ~ 35.4)

M10	1.5 (0.059)	17.7 ~ 24.5 (1.8 ~ 2.5, 13.0 ~ 18.1)	48.1 ~ 65.7 (4.9 ~ 6.7, 35.4 ~ 48.5)	70.6 ~ 96.1 (7.2 ~ 9.8, 52.1 ~ 70.9)
M12	1.75 (0.068)	31.4 ~ 43.1 (3.2 ~ 4.4, 23.1 ~ 31.8)	84.3 ~ 113.8 (8.6 ~ 11.6, 62.2 ~ 83.9)	123.6 ~ 167.7 (12.6 ~ 17.1, 91.1 ~ 123.7)
M14	2 (0.078)	51.0 ~ 68.6 (5.2 ~ 7.0, 37.6 ~ 50.6)	135.3 ~ 182.4 (13.8 ~ 18.6, 99.8 ~ 134.5)	198.1 ~ 268.7 (20.2 ~ 27.4, 146.1 ~ 198.2)
M16	2 (0.078)	79.4 ~ 107.9 (8.1 ~ 11.0, 58.6 ~ 79.6)	212.8 ~ 288.3 (21.7 ~ 29.4, 157.0 ~ 212.7)	311.8 ~ 421.7 (31.8 ~ 43.0, 230.0 ~ 311.0)

Flange BOLT/NUT Thin screw		**Torque Nm (kg.m, lb-ft)**		
Nominal diameter. (mm)	Pitch [mm (in.)]	4T	8T	10T
				
M5	0.5 (0.019)	2.9 ~ 2.9 (0.3 ~ 0.3, 2.2 ~ 2.2)	6.9 ~ 8.8 (0.7 ~ 0.9, 5.1 ~ 6.5)	9.8 ~ 13.7 (1.0 ~ 1.4, 7.2 ~ 10.1)
M6	0.75 (0.029)	3.9 ~ 5.9 (0.4 ~ 0.6, 2.9 ~ 4.3)	10.8 ~ 14.7 (1.1 ~ 1.5, 8.0 ~ 10.8)	16.7 ~ 21.6 (1.7 ~ 2.2, 12.3 ~ 15.9)
M8	1 (0.039)	9.8 ~ 12.7 (1.0 ~ 1.3, 7.2 ~ 9.4)	26.5 ~ 35.3 (2.7 ~ 3.6, 19.5 ~ 26.0)	38.2 ~ 52.0 (3.9 ~ 5.3, 28.2 ~ 38.3)
M10	1.25 (0.049)	19.6 ~ 25.5 (2.0 ~ 2.6, 14.5 ~ 18.8)	51.0 ~ 68.6 (5.2 ~ 7.0, 37.6 ~ 50.6)	75.5 ~ 102.0 (7.7 ~ 10.4, 55.7 ~ 75.2)
M12	1.25 (0.049)	35.3 ~ 48.1 (3.6 ~ 4.9, 26.0 ~ 35.4)	94.1 ~ 126.5 (9.6 ~ 12.9, 69.4 ~ 93.3)	138.3 ~ 186.3 (14.1 ~ 19.0, 102.0 ~ 137.4)
M14	1.5 (0.059)	55.9 ~ 75.5 (5.7 ~ 7.7, 41.2 ~ 55.7)	148.1 ~ 200.1 (15.1 ~ 20.4, 109.2 ~ 147.6)	216.7 ~ 293.2 (22.1 ~ 29.9, 159.8 ~ 216.3)
M16	1.5 (0.059)	86.3 ~ 116.7 (8.8 ~ 11.9, 63.7 ~ 86.1)	229.5 ~ 309.9 (23.4 ~ 31.6, 169.3 ~ 228.6)	336.4 ~ 455.0 (34.3 ~ 46.4, 248.1 ~ 335.6)

1. The torques shown in the table are standard values under the following conditions.

- Nuts and bolts are made of galvanized steel bar.
- Galvanized plain steel washers are inserted.
- All nuts, bolts and plain washers are dry.

2. The torques shown in the table are not applicable.

- When spring washers, toothed washers and the like are inserted.
- If plastic parts are fastened.
- If self-tapping screws or self-locking nuts are used.
- If threads and surfaces are coated with oil.

General Service Information

Protection Of The Vehicle

Always be sure to cover fenders, seats, and floor areas before starting work.

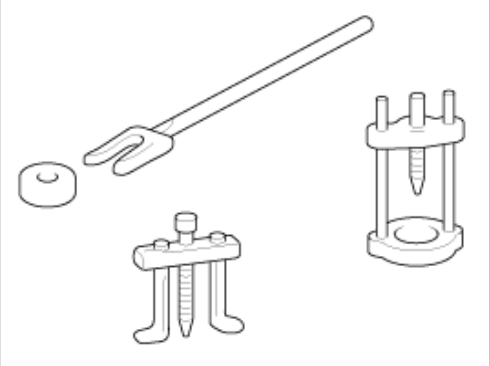
The support rod must be inserted into the hole near the edge of the hood whenever you inspect the engine compartment to prevent the hood from falling and causing possible injury.
Make sure that the support rod has been released prior to closing the hood. Always check to be sure the hood is firmly latched before driving the vehicle.

Preparation Of Tools And Mesuring Equipment

Be sure that all necessary tools and measuring equipment are available starting work.

Special Tools

Use special tools when they are required.



Removal Of Parts

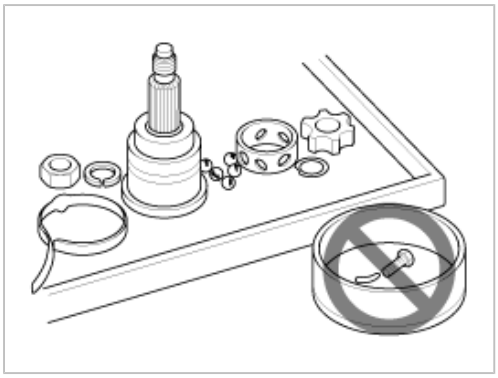
First find the cause of the problem and then determine whether removal or disassembly before starting the job.

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 on suspected for malfunction, deformation, damage, and other problems.

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.



3. **Cleaning parts for reuse**
   All parts to be used again should be carefully and thoroughly cleaned by an appropriate method.

Parts

When replacing parts, use HYUNDAI genuine parts.

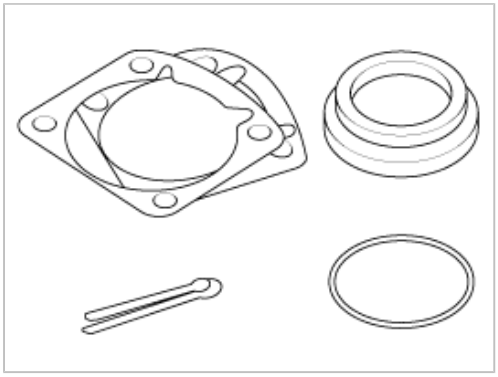
Replacement

Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.

If removed, the following parts should always be replaced with new ones.

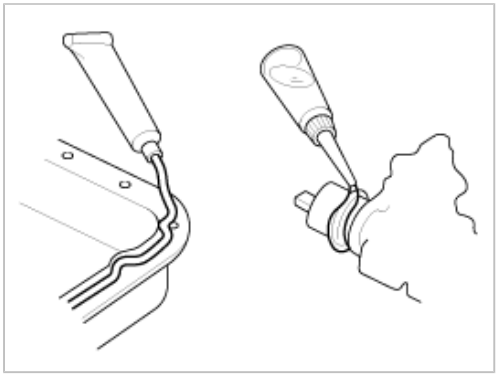
1. Oil seals

2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins (split pins)
6. Plastic nuts



Depending on their location.

7. Sealant should be applied to gaskets.
8. Oil should be applied to the moving components of parts.
9. Specified oil or grease should be applied to the prescribed locations (oil seals, etc) before assembly.

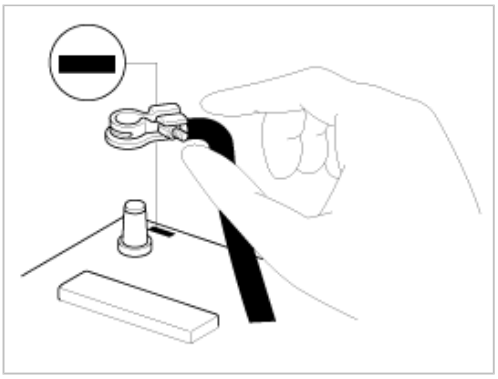


Adjustment

Use gauges and testers to adjust correctly the parts to standard values correctly.

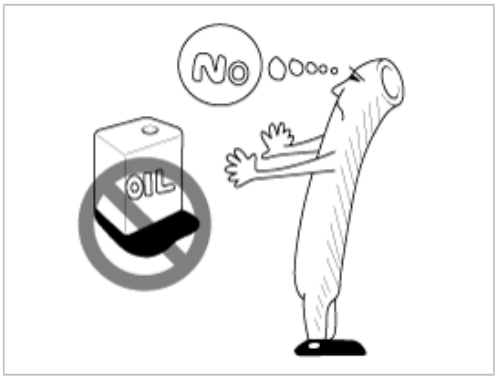
Electrical System

1. Be sure to disconnect the battery cable from the negative (-) terminal of the battery.
2. Never pull on the wires when disconnecting connectors.
3. Locking connectors will click when the connector is secure.
4. Handle sensors and relays carefully. Be careful not to drop them against other parts.



Ruber Parts And Tubes

Always prevent gasoline or from touching rubber parts or tubing.

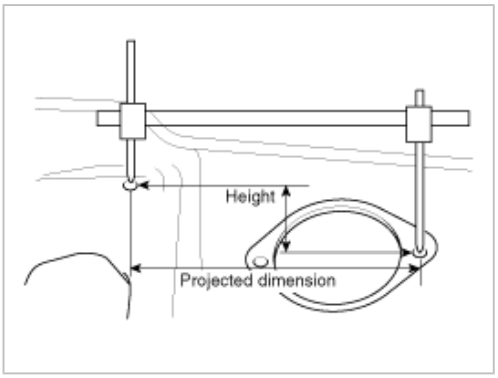


Measuring Body Dimensiongs

1. Basically, all measurements in this manual are taken with a tracking gauge.
2. When a measuring tape is used, check to be sure there is no elongation, twisting or bending.
3. For measuring dimensions, both projected dimensions and actual - measurement dimensions are used in this manual.

Dimensions Projected

1. These are the dimensions measured when the measurement points are projected from the vehicle's surface, and are the reference dimensions used for 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 surface.



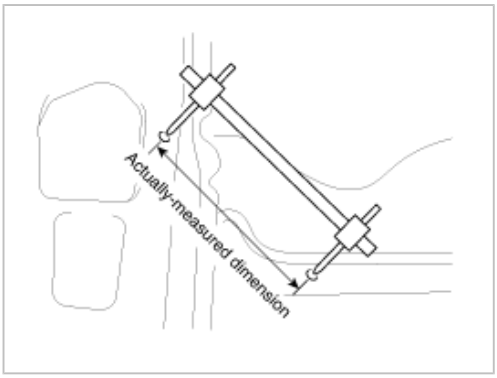
Measuring Actual Dimensions

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.

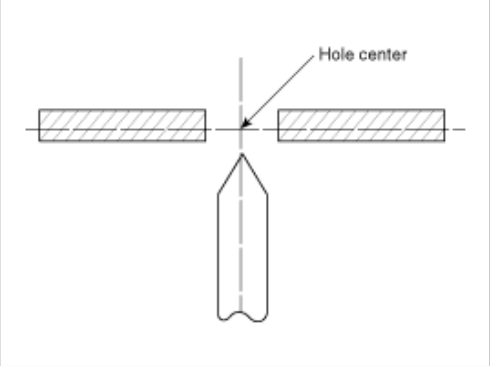
2. First adjust both probes to the same length (A=A') before measurement.

> Check the probes and gauge itself to make sure there is no free play.



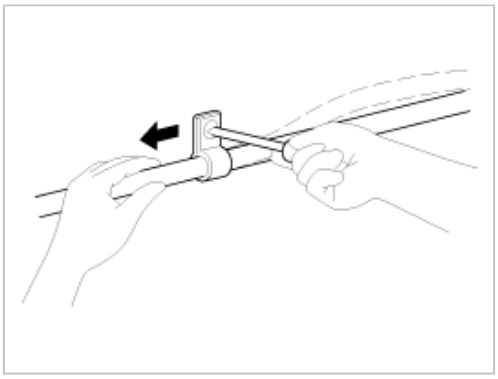
Measurement Point

Measurements should be taken at the center of the hole.



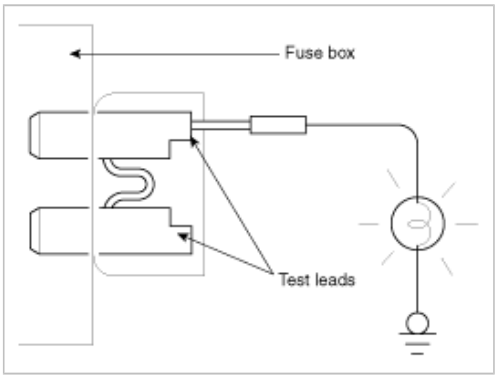
Checking Cables And Wires

1. Check the terminal for tightness.
2. Check terminals and wires for corrosion from battery electrolyte, etc.
3. Check terminals and wires for open circuits.
4. Check wire insulation and coating for damage, cracks and degrading.
5. Check the conductive parts of terminals for contact with other metallic parts (vehicle body and other parts).
6. Check grounded parts to verify that there is complete continuity between their attaching bolt(s) and the vehicle's body.
7. Check for incorrect wiring.
8. Check that the wiring is so clamped to the prevent contact with sharp corners of the vehicle body, etc. or hot parts (exhaust manifold, etc.)
9. Check that the wiring is clamped firmly to provide enough clearance from the fan pulley, fan belt and other rotating or moving parts.
10. Check that the wiring has a little space so that it can vibrate between fixed and moving parts such as the vehicle body and the engine.



Check Fuses

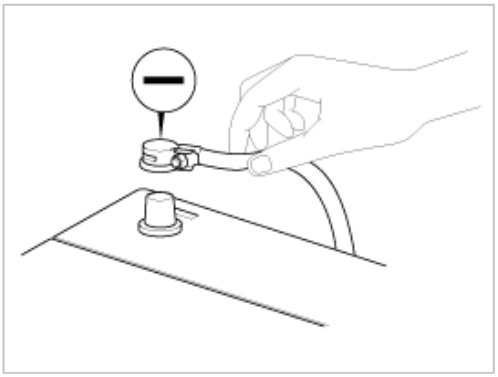
A blade type fuse test taps provided to allow checking the fuse itself without removing if from the fuse box. The fuse is good if the test lamp lights up when one lead is connected to the test taps (one at a time) and the other lead is grounded. (Turn the ignition switch so that the fuse circuit becomes operative)



Serivicing The Electrical System

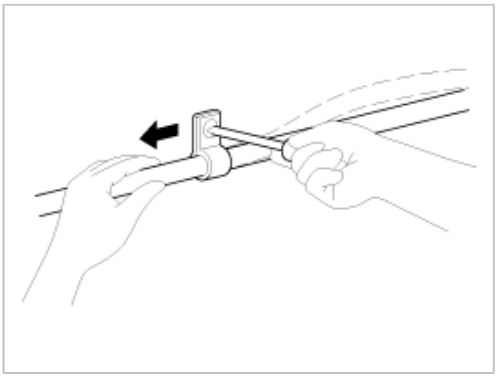
1. Prior to servicing the electrical system, be sure to turn off the ignition switch and disconnect the battery ground cable.

   In the course of MFI or ELC system diagnosis, when the battery cable is removed, any diagnostic trouble code retained by the computer will be cleared. There fore, if necessary, record the diagnostic data before removing the battery cable.

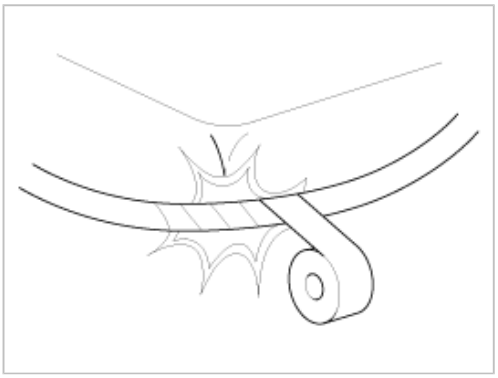


2. Attach the wiring harnesses with clamps so that there is no slack. However, for any harness which passes the engine or other vibrating parts of the vehicle, allow some slack within a range that does not allow the engine vibrations to cause the harness to come into contact with any of the surrounding parts

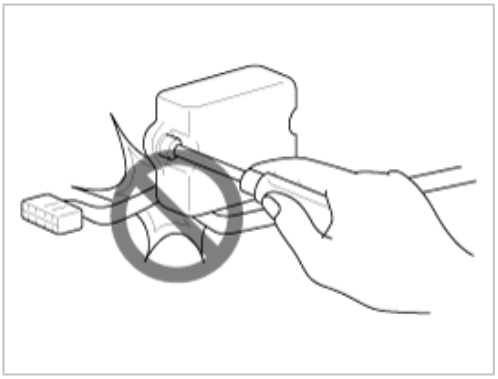
and then secure the harness by using a clamp.



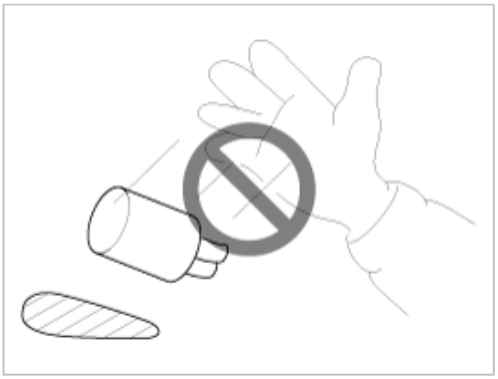
3. If any section of a wiring harness interferes with the edge of a parts, or a corner, wrap the section of the harness with tape or something similar in order to protect if from damage.



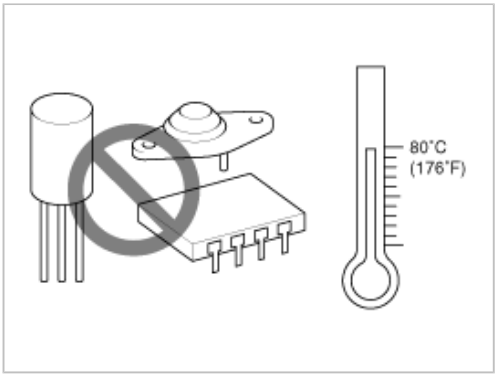
4. When installing any parts, be careful not to pinch or damage any of the wiring harness.



5. Never throw relays, sensors or electrical parts, or expose them to strong shock.

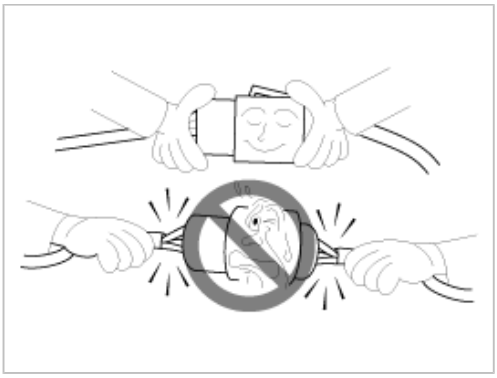


6. The electronic parts used in the computer, relays, etc. are readily damaged by heat. If there is a need for service operations that may cause the temperature to exceed 80℃ (176℉), remove the electronic parts before hand.

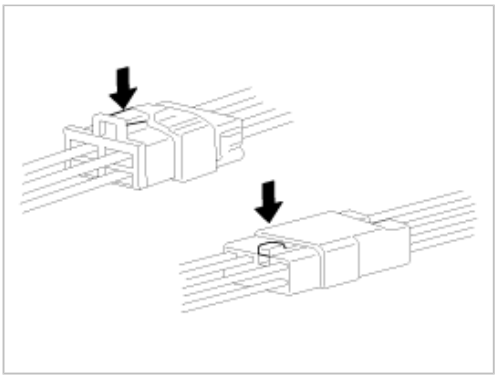


7. Loose connectors cause problems. Make sure that the connectors are always securely fastened.

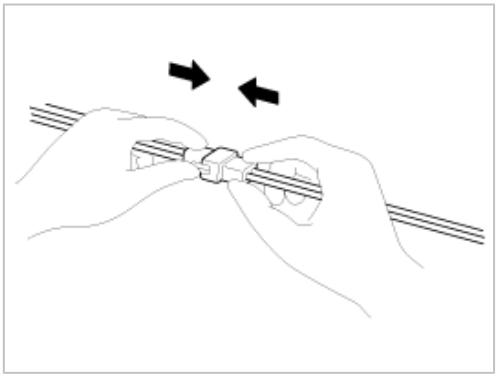
8. When disconnecting a connector, be sure to grip only the connector, not the wires.



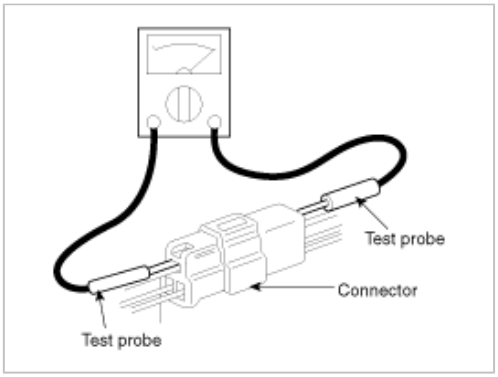
9. Disconnect connector which have catches by pressing in the direction of the arrows shown the illustration.



10. Connect connectors which have catches by inserting the connectors until they make a clicking sound.



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 until contacts the terminal, being careful not to damage the insulation of the wires.



12. To avoid overloading the wiring, take the electrical current load of the optional equipment into consideration, and determine the appropriate wire size.

Noeminal size	SAE gauge No.	Permissible current	
		In engine compartment	Other areas
0.3mm²	AWG 22	-	5A
0.5mm²	AWG 20	7A	13A
0.85mm²	AWG 18	9A	17A
1.25mm²	AWG 16	12A	22A

2.0mm²	AWG 14	16A	30A
3.0mm²	AWG 12	21A	40A
5.0mm²	AWG 10	31A	54A

Precautions For Catalytic Converter

If a large amount of unburned gasoline flows into the converter, it may overheat and create a fire hazard. To prevent this observe the following precations and explain them to your customer.

1. Use only unleaded gasoline.
2. Do not run the engine while the car is at rest for a long time. Avoid running the engine at fast idle for more than 10minutes and idle speed for more than 20 minutes.
3. Do not measure engine compression for an extended time. Engine compression tests must be made as rapidly as possible. Remove the fuel pump relay before performing a compression test.
4. Do not dispose of used catalytic converter together with parts contaminated with gasoline or oil.