General Information

General Precautions

Dangerous Substances

Modern vehicles contain many materials and liquids which if not handled with care can be hazardous to both personal health and the environment.

Warning: Many liquids and other substances used in vehicles are poisonous and should under no circumstances be consumed and should, as far as possible, be kept from contact with the skin. These liquids and substances include acid, anti-freeze, brake fluid, fuel, windscreen washer additives, lubricants, refrigerants and various adhesives.

Warning: Always read carefully the instructions printed on labels or stamped on components and obey them implicitly. Such instructions are included for reasons of your health and personal safety. Never disregard them.

Synthetic Rubber

Many O-rings, seals, hoses, flexible pipes and other similar items which appear to be natural rubber, are in fact, made of synthetic materials called Fluoroelastomers. Under normal operating conditions this material is safe and does not present a health hazard. However, if the material is damaged by fire or excessive heating, it can break down and produce highly corrosive Hydrofluoric acid.

Contact with Hydrofluoric acid can cause serious burns on contact with skin. If skin contact does occur

- Remove any contaminated clothing immediately.
- Irrigate affected area of skin with a copious amount of cold water or limewater for 15 to 60 minutes.
- Obtain medical assistance immediately.

Should any material be in a burnt or overheated condition, handle with extreme caution and wear protective clothing (seamless industrial gloves, protective apron etc.).

Decontaminate and dispose of gloves immediately after use.

Lubricating Oils

Avoid excessive skin contact with used lubricating oils and always adhere to the health protection precautions.

Warning: Avoid excessive skin contact with used engine oil. Used engine oil contains potentially harmful contaminants which may cause skin cancer or other serious skin disorders.

Warning: Avoid excessive skin contact with mineral oil. Mineral oils remove the natural fats from the skin, leading to dryness, irritation and dermatitis.

Health Protection Precautions

The following precautions should be observed at all times.

- Wear protective clothing, including impervious gloves where practicable.
- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Do not put oily rags in pockets.
- Avoid contaminating clothes (particularly those next to the skin) with oil.
- Overalls must be cleaned regularly. Discard heavily soiled clothing and oil impregnated footwear.
- First aid treatment should be obtained immediately for open cuts and wounds.
- Apply barrier creams before each work period to help prevent lubricating oil from contaminating the skin.
- Wash with soap and water to ensure all oil is removed (proprietary skin cleansers and nail brushes will help).
- Use moisturisers after cleaning; preparations containing lanolin help replace the skin's natural oils which have been removed.
- Do not use petrol/gasoline, kerosene, diesel fuel, oil, thinners or solvents for cleaning skin.
- Where practicable, degrease components prior to handling.
- If skin disorders develop, obtain medical advice without delay.
- Wear eye protection (e.g. goggles or face shield) if there is a risk of eye contamination. Eye wash facilities should be provided in close vicinity to the work area.

Flexible Pipes and Hoses

General

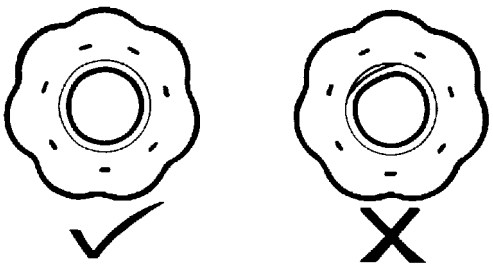
When removing and installing flexible hydraulic pipes and hoses, ensure that the following practices are observed to ensure component serviceability.

- Clean end fittings and the area surrounding them as thoroughly as possible.
- Obtain appropriate plugs or caps before detaching hose end fittings, so that the ports can be immediately covered to prevent the ingress of dirt.

  Clean hose externally and blow through with airline. Examine carefully for cracks, separation of plies, security of end fittings and external damage. Reject any faulty hoses.
- When refitting a hose, ensure that no unnecessary bends are introduced, and that hose is not twisted before or during tightening of union nuts.
- Fit a cap to seal a hydraulic union and a plug to its socket after removal to prevent ingress of dirt.
- Absolute cleanliness must be observed with hydraulic components at all times.

  After any work on hydraulic systems, carefully inspect for leaks underneath the vehicle while a second operator applies maximum brake pressure to the brakes (engine running) and operates the steering.

Fuel System Hoses



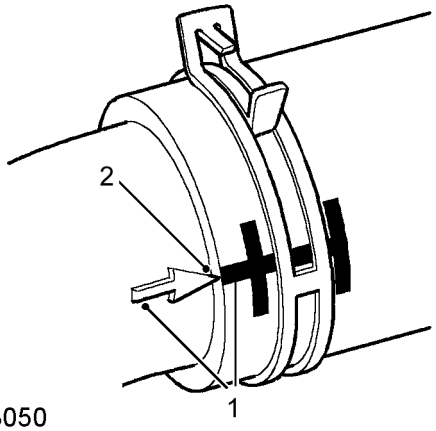
S003049

All fuel hoses are made up of two laminations, an armoured rubber outer sleeve and an inner viton core. If any of the fuel system hoses have been disconnected, it is imperative that the internal bore is inspected to ensure that the viton lining has not become separated from the armoured outer sleeve. A new hose must be fitted if separation is evident.

Cooling System Hoses

The following precautions MUST be followed to ensure that integrity of cooling hoses and their connections to system components are maintained.

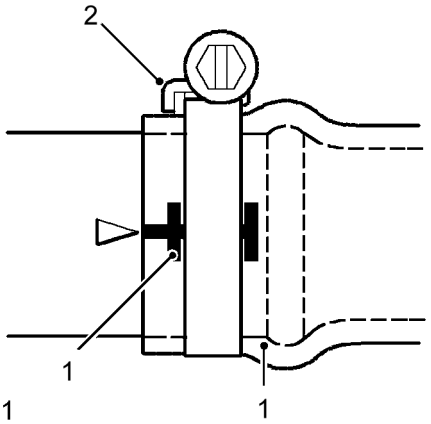
Hose orientation and connection



S003050

Correct orientation of cooling hoses is important in ensuring that the hose does not become fatigued or damaged through contact with adjacent components. Where 'timing' marks (1) are provided on the hose and corresponding connection, these must be used to ensure correct orientation. Hoses must be pushed fully onto their connection points. Usually, a moulded form (2) on the stub pipe provides a positive indicator.

hose clip



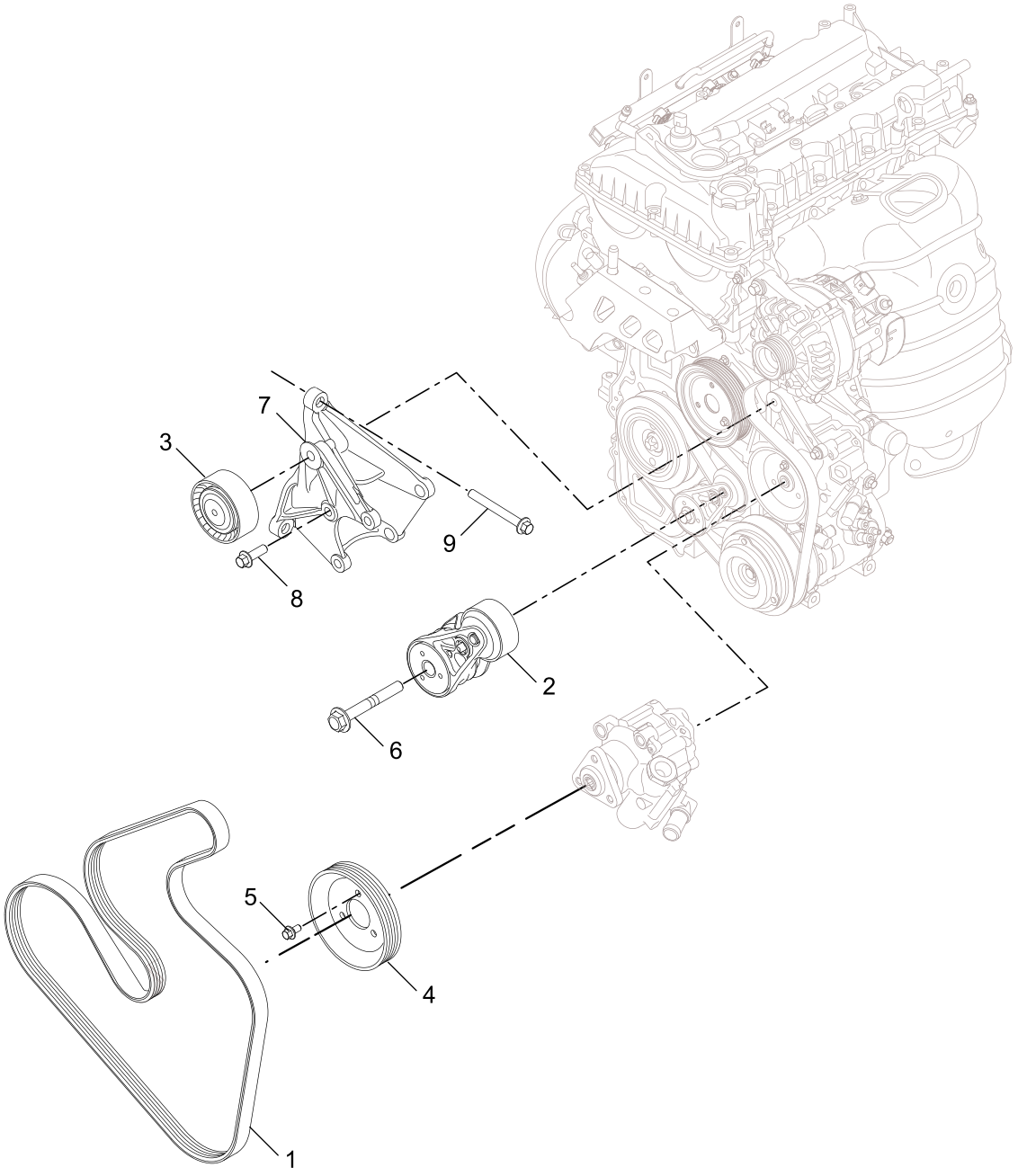
S003051

Markings (1) are usually provided on the hose to indicate the correct clip position. If no markings are provided, position the clip directly behind the retaining lip at the end of the stub as shown. Worm drive clips should be oriented with the crimped side of the drive housing (2) facing towards the end of the hose, or the hose may become pinched between the clip and the stub pipe retaining lip. Worm drive clips should be tightened to 3 Nm unless otherwise stated. Ensure that hose clips do not foul adjacent components.

Heat protection

Always ensure that heatshields and protective sheathing are in good condition. Replace if damage is evident. Particular care must be taken when routing hoses close to hot engine components, such as the exhaust manifold and the Exhaust Gas Recirculation (EGR) pipe. Hoses will relax and deflect slightly

Accessory Belt System



1. Accessory Belt
2. Accessory Belt Tensioner
3. PAS Pump Idler
4. Pulley - PAS Pump
5. Bolt - PAS Pump Pulley
6. Bolt - Tensioner

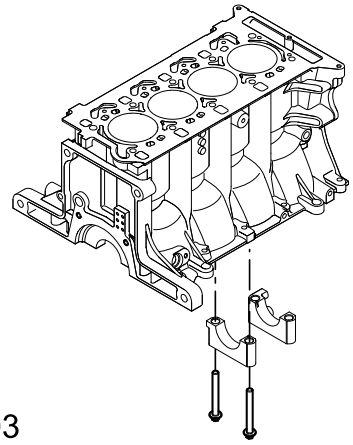
Piston Inspection

Removal

1. Remove the cylinder head assembly.

☞Cylinder Head Assembly Removal

2. Loosen the connecting rod bolts.



S111A403

3. Remove the connecting rod cap.
4. Remove the connecting rod bearing.
5. Push the piston to the top of the cylinder bore.

Caution: Remove the carbon deposits on the top of the cylinder bore first to avoid scratching the piston rings and the piston.

6. Make sure the connecting rod does not contact to the inner wall of the cylinder bore. Carefully push the piston assembly out of the cylinder bore.

Caution: Please carefully mark each piston and matched liner.

7. Fit the connecting rod big end cap to the connecting rod, and gently tighten the connecting rod bolts.
8. Remove the used piston rings with a expander (tool), and dispose of them.

Refit

1. Clean the ring grooves of the piston and dry the oil passage with air.
2. Position a new piston ring at 20 mm from the cylinder bore top surface, and measure the gap.

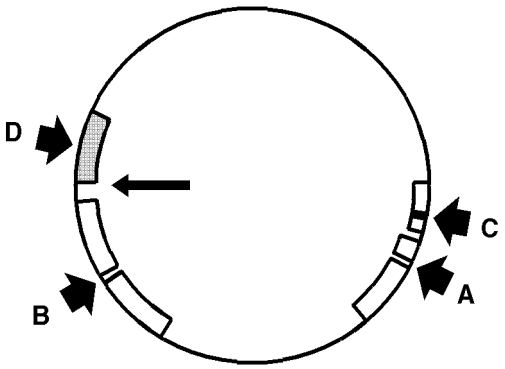
S111A405

3. Check if the piston is deformed or cracked.
4. At a right angle to the piston pin, measure the piston diameter at the measuring point 11 mm up from under the skirt portion (Refer to "Parameter").

☞Parameter

Caution: Pistons and connecting rods are only supplied as assemblies, and as the connecting rods are grouped according to weight, be sure that the piston connecting rod assemblies of the four cylinders are of the same weight.

5. Fit the oil ring spring.
6. Make the "TOP" mark face the piston top, and fit the oil ring side rail, 2nd compression ring and top compression ring in order with a expander.
7. Ensure that the piston rings can turn freely. The angle between the gaps A and B of the two compression rings should be 120°and away from the thrust side of the piston.
8. On both sides of the piston pin, the angle of the side rail gap C and spring gap D should be 30°.



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9. Check the gaps between the new piston rings and ring grooves (Refer to "Parameter").

☞Parameter

Radiator

Removal

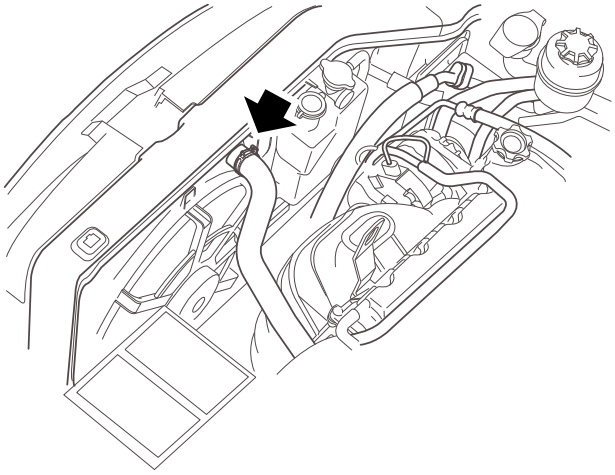
1. Disconnect the battery earth lead.
2. Drain the coolant.

☞Drain and Refill the Coolant

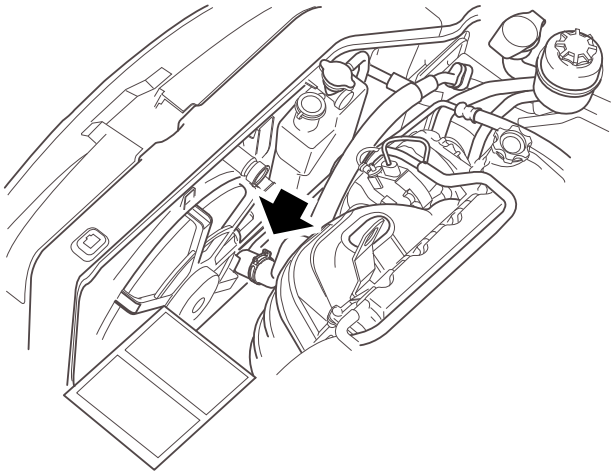
3. Remove the air cleaner inlet pipe.

☞Air Cleaner Inlet Pipe

4. Put an appropriate container under the automatic transmission fluid outlet on the radiator to collect the flowing automatic transmission fluid. (Only for the automatic transmission model)
5. Loosen the radiator hose inlet clamp with the clamp plier, and disconnect the radiator hose inlet from the radiator.



6. Remove the radiator hose outlet clamp with the clamp plier, and disconnect the radiator hose outlet from the radiator.



7. Disconnect the quick joints of the 2 automatic transmission fluid cooling hoses from the radiator pipe sleeve. (Only for the automatic transmission model)

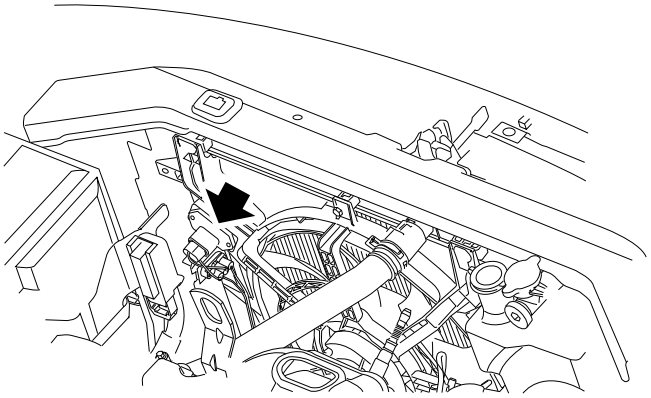
Warning: Take extra care, as the drained transmission fluid temperature is very high.

Caution: Plug the disconnected unions to prevent contamination entering.

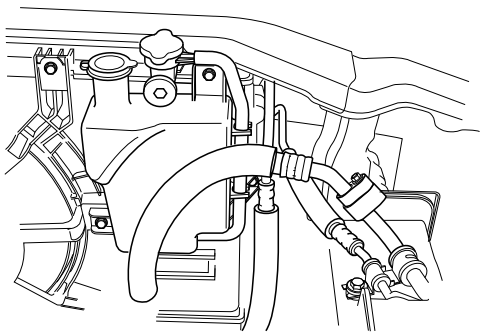
8. Remove the radiator upper crossmember.

☞Radiator Upper Crossmember

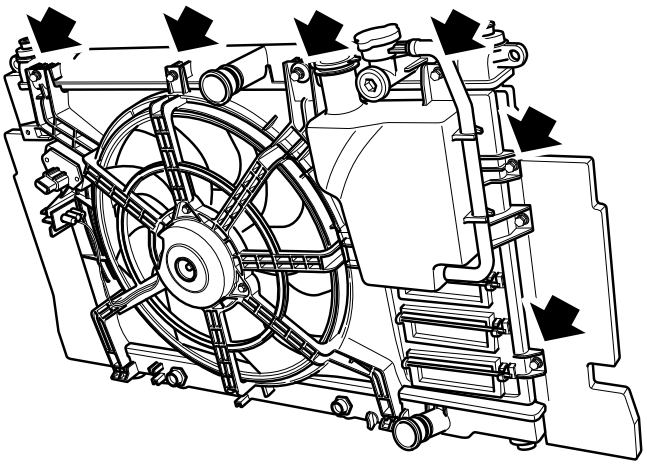
9. Disconnect the cooling fan electrical connector from the main wire.



10. Loosen the overflow hose clamp with the clamp plier, and disconnect the overflow hose.



11. Remove the radiator cooling fan assembly fastening screws.

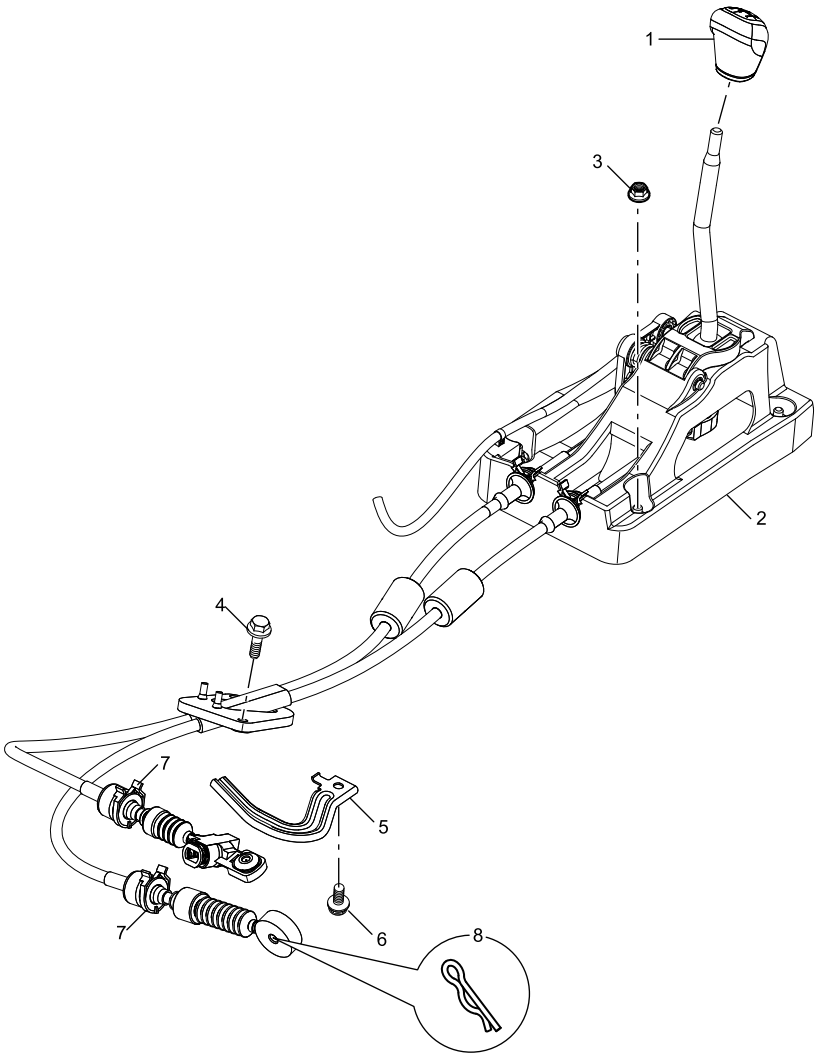


12. Remove the cooling fan together with the expansion tank from the top.
13. Lift the radiator up from the base, and move it towards the engine.

Description and Operation

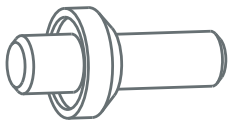
Description and Operation

System Component Layout



1. Shift Knob
2. Manual Shift Operating Unit and Gear Shift Cable
3. Nut - Shift Mechanism to Centre Path
4. Bolt - Gear Shift Cable to Body
5. Bracket - Gear Shift Cable
6. Screw - Cable Support Bracket
7. Snap Fit - Gear Shift Cable
8. Lock Pin - Shift Cable to Manual Transmission

Tool Number	Description	Picture
T24004	Drive Shaft Hole Oil Seal Hold-down	 T24004
T24005	st Gear Needle Roller Bearing Inner Race Hold-down	 T24005
T24006	2nd Gear Needle Roller Bearing Inner Race Hold-down	 T24006
T24007	Driven Shaft 4th Gear Hold-down	 T24007
T24008	Reverse Needle Roller Bearing Inner Race Hold-down	 T24008

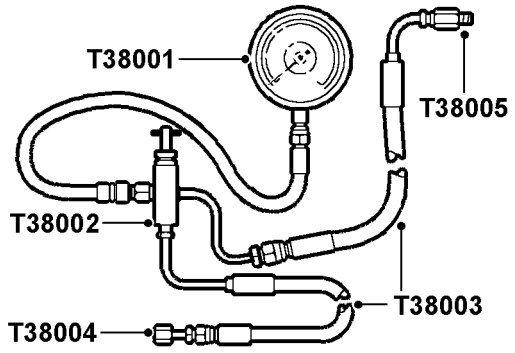
Tool Number	Description	Picture
T24009	Cone Bearing Inner Race Hold-down	 T24009
T24017		 T24017
T24024	Reverse Lock Block Shaft Drift	 T24024
T24016	Gear Shift Shaft Oil Seal Hold-down	 T24016

Service Procedures

Power Assisted Steering System - Pressure Test

Inspection

1. Test Device



S383003

   a. Fit the pressure gauge T38001 and hose to the valve assembly T38002 and tighten the union.

   b. Fit the 2 hoses T38003 to the valve assembly T38002 and tighten the union.

2. Disconnect the battery negative terminal.

Caution: Care must be taken to ensure that the oil or other fluid does not enter or contaminate the alternator.

3. Put a container to collect fluid which spills out from the**PAS** system.
4. Clean the power assisted steering pump, connector tube and tube joint.
5. Remove the butt bolt securing the steering gear inlet tube to the power assisted steering pump.
6. Fit the union T38005 and seal washer to the power assisted steering pump.
7. Fit the union T38004 to the power steering gear apply pipe with the butt bolt and seal washer.
8. Connect the hose T38003 to the T38004 and T38005.
9. Make sure all tubes and mountings DO NOT contact with rotation components.
10. Hang the pressure gauge to a safe place under the bonnet.
11. Connect the battery negative terminal.
12. Start the engine and bleed the power assisted steering system.

☞**Power Assisted Steering (PAS) System Bleeding**

13. Check the power assisted steering pump fluid level and fill it fully.
14. Test procedures:
   a. Make sure there are no leaks from the steering system and the fluid level is maximum when performing the test.
   b. Start the engine when the test device valve is open.
   c. When the engine is idling and in a normal operating temperature, turn the steering wheel slowly and hold it to the lock position.
   d. Repeat this pressure test in the opposite lock position.
   e. The test pressure should increase from 5 bar to 90 bar slowly, the pressure may increase to 90 bar according to road condition when steering is in the full lock position.
   f. When the engine is idling, release the steering wheel, the pressure reading should be 5 bar or less.
   g. There may be a malfunction if the pressure is out of the value above.

Adjustment

1. To determine if the steering pump or steering gear is defective, close the test valve for a maximum of 5 seconds. If the test valve is closed for an extended period of time, the pump will be damaged.
2. If the reading of pressure gauge is not between 85-95 bar (the maximum pump pressure), the pump is defective.
3. If the maximum pressure of the pump is correct, the steering gear may be defective.
4. Stop the engine after the test has been completed.
5. Loosen the battery negative terminal.
6. Remove the power steering oil reservoir and put it aside.
7. Remove the test device union.
8. Remove the union from the power assisted steering pump and power steering gear inlet tube.
9. Fit a new seal washer and fit the apply pipe to the power assisted steering pump, tighten the butt bolt to **35-40 Nm**.
10. Clean the chassis and surrounding area.
11. Fit the power steering oil reservoir.
12. Check the power assisted steering system fluid level.

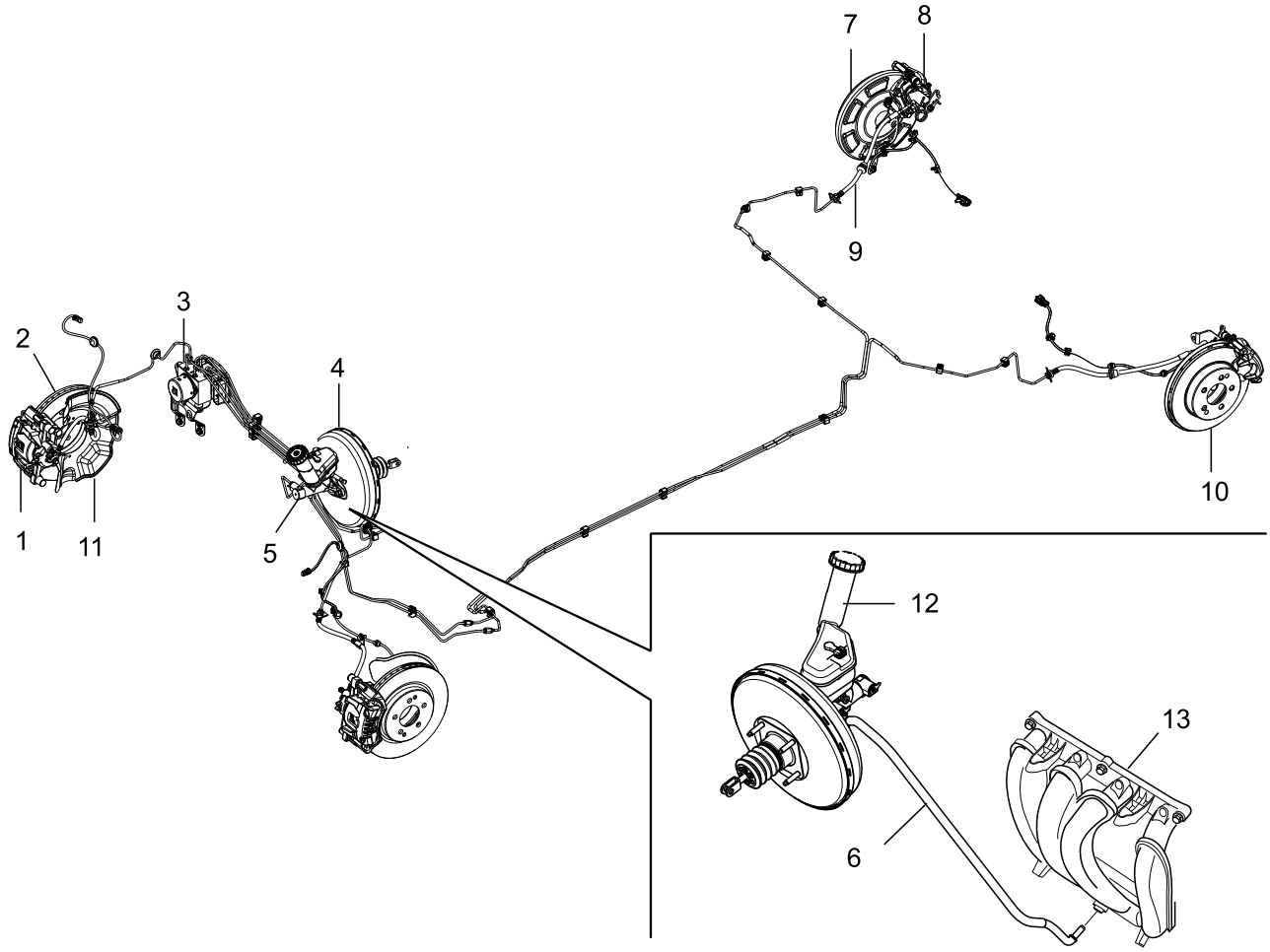
☞**Capacity**
☞**Fluid**

13. Connect the battery negative terminal.

Description and Operation

System Component Layout

Brake Fluid Pressure System Component Layout



1. Front Brake Caliper Assembly
2. Front Brake Ventilated Hole Disc
3. ABS Adjuster
4. Front Disc
5. Brake Booster Assembly
6. Booster Vacuum Pipe and Check Valve
7. Rear Brake Caliper Assembly
8. Rear Brake Disc Protector
9. Rear Brake Hose
10. Rear Brake Solid Disc
11. Front Brake Disc Protector
12. Brake Reservoir
13. Intake Manifold

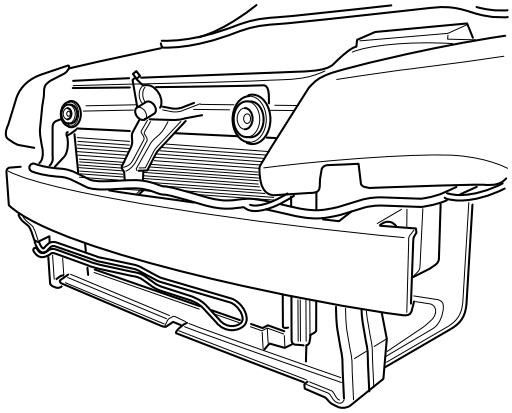
Front Armature

Removal

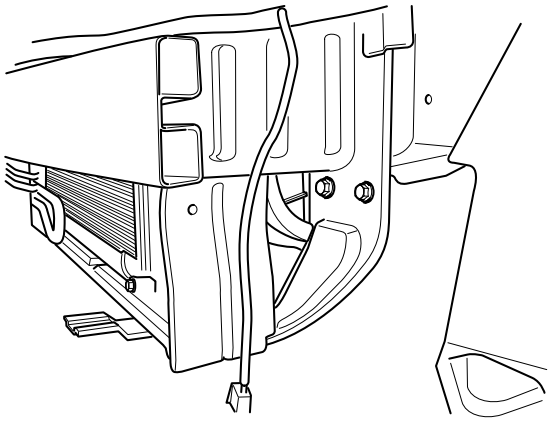
1. Disconnect the electrical connector.
2. Remove the front bumper.

☞**Front Bumper**

3. Unscrew the 6 bolts and the front bumper armature.



S920004



S920005

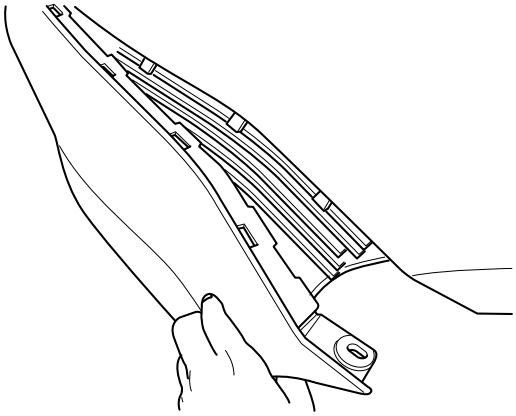
Refit

1. Hold the bolts to the front bumper armature, and tighten to **50-63 Nm**.
2. Fit the front bumper.
3. Connect the electrical connector.

Rear Bumper

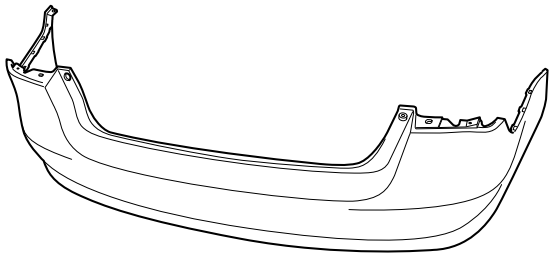
Removal

1. Disconnect the electrical connector.
2. Unscrew the screws and the splash shield.
3. Unscrew the 10 screws inside the wheel housing.



S920006

4. Unscrew the 3 screws at the lower side.



S920007

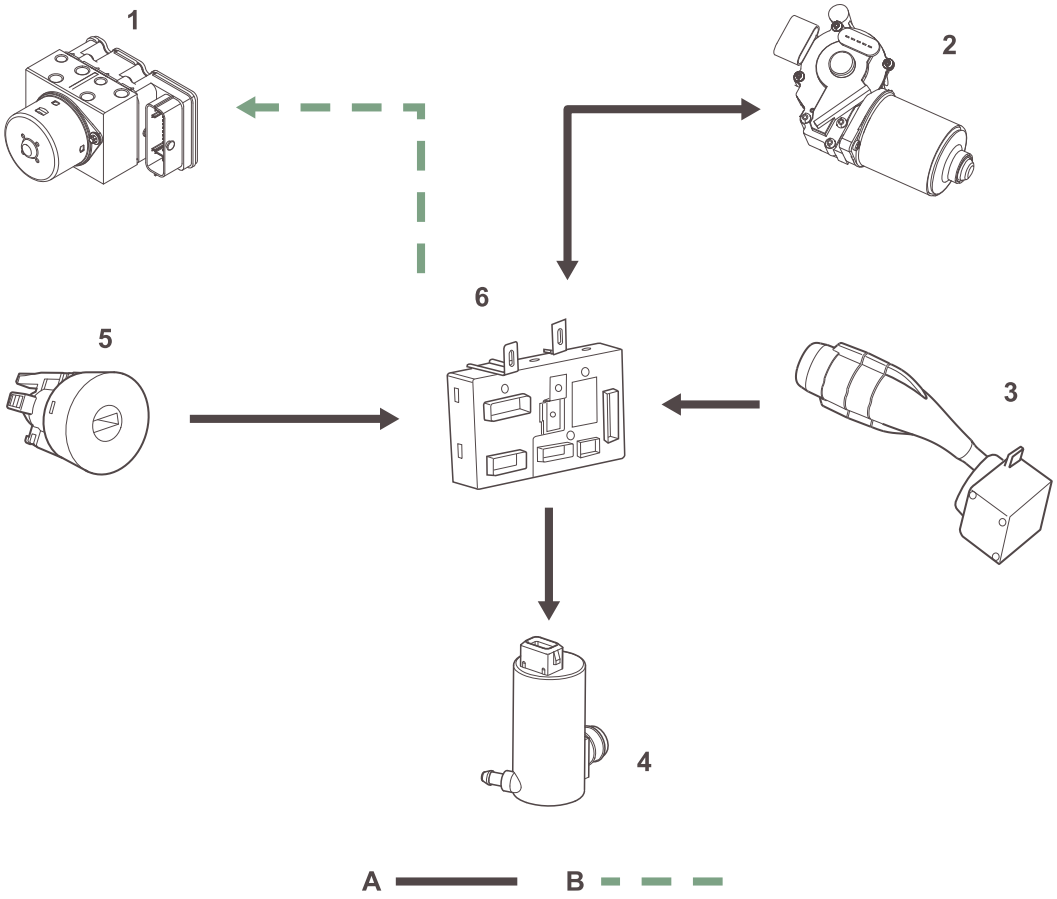
5. Unscrew the rear bumper bracket screws.
6. Remove the rear bumper.

Refit

1. Hold the screws to the rear bumper bracket, and tighten them to **2.7-3.3 Nm**.
2. The rear bumper is stuck to the rear bumper bracket through groove.
3. Fit the screws at the lower side.
4. Fit the screws inside the wheel housing.
5. Fit the screws and the splash shield.
6. Connect the electrical connector.

System Control Diagram

Wiper and Washer Control Diagram

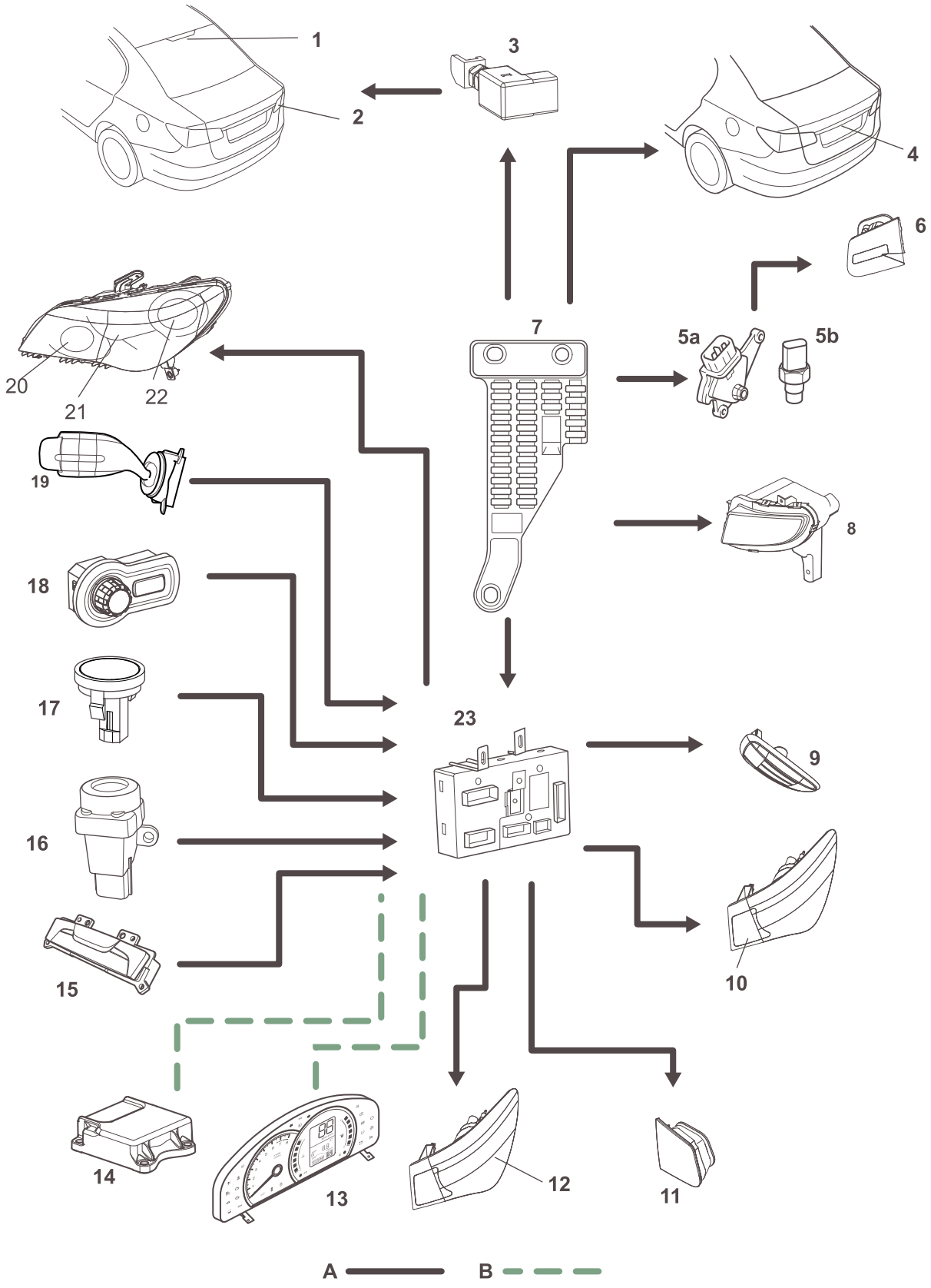


*A = Hard Wire; B =**CAN** High Speed Bus Line*

1. **ABS** Control Module
2. Wiper Motor
3. Wiper/Washer Lever Switch
4. Washer Pump
5. Ignition Switch
6. Body Controller Module (**BCM**)

System Control Diagram

Exterior Illumination Control Diagram



*A = Hard Wire; B = Medium Speed**CAN** Bus Line; C =**LIN** Bus Line*

Description

General Description

The exterior lighting system includes the various exterior lights which are controlled by the master light switch and the automatic light control sensor. The exterior lighting system includes:

- Side Marker Light
- Taillamp
- Dipped Beam Lamp
- Main Beam Lamp
- Rear License Plate Lamp
- Stop Lamp/High Mounted Stop Lamp
- Direction Indicator/Side Turn Signal Light
- Front Fog lamp
- Rear Fog Lamp
- Back-Up Light

Master Light Switch (MLS)

1. Illumination Mode Select Switch
2. Instrument Panel Back Light Dimming Thumbwheel

The master light switch back light is always on after inserting the wireless key or turning on the ignition switch. If the side marker light or headlight is turned on during nighttime driving, the instrument panel illumination dims automatically to prevent the driver from being dazzled.

Automatic Light Control Sensor

The automatic light control sensor is integrated in the rain sensor and fitted on the windshield behind the inner rear view mirror.

Headlight

The headlight is fitted on the modular front end panel with screws. The headlight assembly includes the dipped beam lamp, main beam lamp and side marker lights.

The bulbs of the dipped beam lamp and main beam lamp are halogen bulbs, and a smaller bulb near the main beam lamp bulb is used for the side marker light illumination. There is a light foot on each halogen bulb to ensure that the bulb is fitted correctly. The rear of the headlight assembly is covered with sealed rubber membrane to keep off water and dust.

Side Marker Light and Taillamp

The side marker light is fitted near the main beam lamp. The side marker light bulb is a single filament one. The taillamp bulb is fitted on the bulb clamp behind the taillamp lens.

Rear License Plate Lamp

The two rear license plate lamps are secured at the lower side of the trunklid garnish with screws.

Direction Indicator

The front direction indicator is located in the middle area of the headlight assembly, the rear direction indicator is located at the lower side of the taillamp assembly and near the inner side, and the side turn signal lights are fitted on the front fender. The direction indicators have semitransparent lens and single filament orange bulbs.

Direction Indicator/Main Beam Lamp Lever Switch

The direction indicator/main beam lamp lever switch is on the left side of the steering column, and is used to control the following components:

- Left Turn Signal Light
- Right Turn Signal Light
- Headlight Blinking
- Dipped Beam Lamp/Main Beam Lamp Change
- On-Board Computer

Stop Lamp, High Mounted Stop Lamp (CHMSL) and Stop Lamp Switch

The stop lamp bulb is located in the lower area outside the taillamp assembly. It is a double filament bayonet bulb. The bulb protrudes from the corresponding taillamp lens, illuminating the stop lamp area. The bulb clamp can be removed from the device by simply removing the inner garnish in the luggage room rear side cornering and pushing the adjusting plate.

The high mounted stop lamp is secured on the parcel shelf fixed on the body through the snap fit of the light body. The bulb of this light is 16 W.

The stop lamp switch is connected to the pedal fixing bracket behind the instrument panel. The stop lamp switch which is a Hall-effect proximity sensor is activated by the tang on the upper part of the brake pedal.

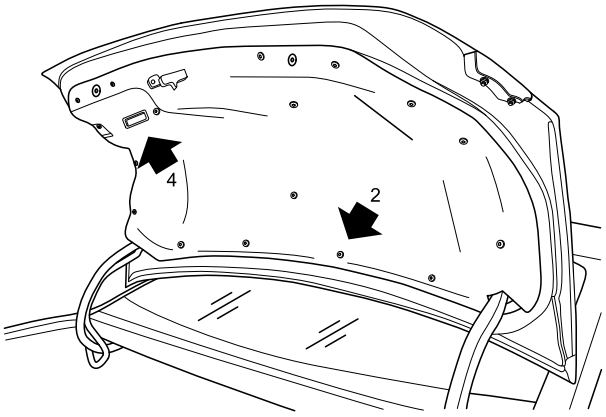
The brake pedal is fitted on the pivot of the engine bay baffle upper pedal fixing bracket. The vacuum booster input rod is connected to the brake pedal with the pin of the rod and clevis. The tang on the end of the brake pedal activates the "instantaneous disconnection" Hall-effect stop lamp switch of the pedal fixing bracket.

The brake light switch includes a built-in sensor located in the outer mounting spool. The sensor is connected to the mounting boot which is connected to the pedal mounting bracket to ensure the correct position. The built-in sensor stays in the right position in the spool due to the serration interacting between the mounting spool and the sensor. For the sake of security, the brake light switch includes two independent circuits, and one is normal open while the other is normal close. For the information of the two circuits, refer to the "Brake Main Signal" and "Brake Security Signal".

Trunklid Gasket

Removal

1. Open the trunklid.
2. Carefully pry up the 17 snap fits on the trunklid gasket as shown in the illustration (2).



3. Separate the gasket from the trunklid inner panel.
4. Carefully pry up the upper and lower bases of manual emergency cable to completely separate the manual emergency cable and the gasket as shown in the illustration (4).
5. Lastly, remove the gasket.

Refit

1. Fit the upper and lower bases of manual emergency cable to the gasket first.
2. And then secure the trunklid gasket to the trunklid inner panel with the snap fit.
3. Close the trunklid.

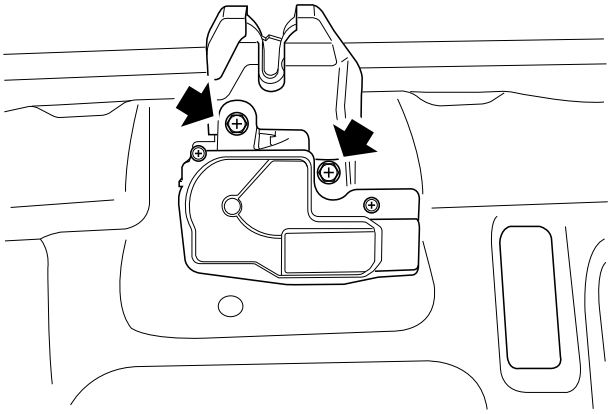
Trunklid Lock Body Assembly

Removal

1. Disconnect the battery earth lead.
2. Remove the trunklid gasket.

☞**Trunklid Gasket**

3. Unscrew the 2 bolts securing the trunklid lock body to the trunklid.



4. Carefully pry up the wire harness snap fits from the inner panel holes, and remove the connecting interface from the lock body assembly and disconnect it.
5. Remove the lock body assembly.

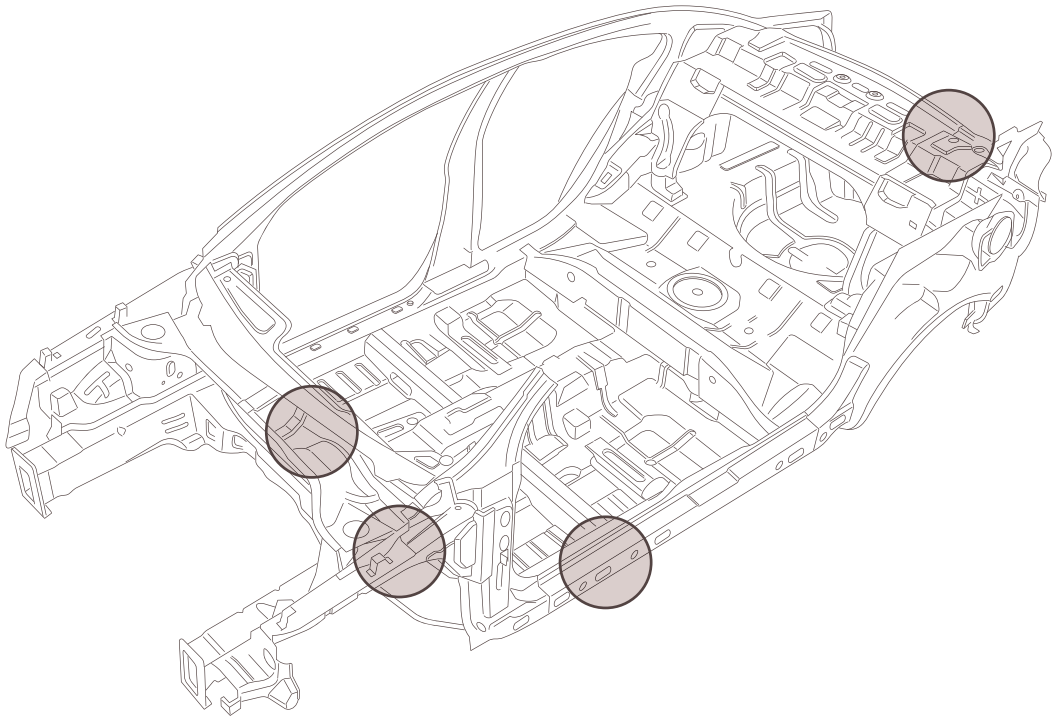
Refit

1. Carefully position the lock body assembly onto the trunklid inner panel, fit the bolts and tighten them to the rated torque **7-10 Nm**, and check the torque.
2. Connect the wire harness interface of the lock body assembly to the body wire harness, and position it to the trunklid inner panel with the snap fits.
3. Fit the trunklid gasket.

☞**Trunklid Gasket**

4. Close the trunklid.
5. Connect the battery earth lead.

Perfusion of Cavity Wax



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After repair is finished, always handle with the approved cavity wax. In addition, for all the inner surfaces which are damaged when repair, no matter whether they are handled or not during production process, handled with cavity wax is necessary. Among of them include all the cavities and inner of the doors. If necessary, other drills are allowed for easy to perfuse wax, but no drill should locate on the bearing parts. Make sure that all these drills handled with zinc rich primer properly and apply protection wax, finally seal with rubber ring.

Before perfusing wax, make sure that the cavity to be handled is free from contaminant and foreign objects. If necessary, clean the fragment inside with compressed air.

Make sure to perfuse the cavity wax after finishing all the finishing coat operations and before refitting other parts.

During applying, make sure that the cavity wax covers all the beams and seams and distributed to all the repairing areas which are new and have panel.

Underbody Protection Wax

After repairing the panel at the damaged wheel opening, always reapply the protection wax. The protection wax is also suitable for various finishing coat and underbody sealant.

The range that the old underbody protection wax removed is at least 200 mm larger than that of the new applied underbody sealant.

It should be noticed that this procedure of handling the perfused wax is not involved when assembling the new panel and the whole body case. This operation is carried out after repair.

The effective cavity wax protection measures are extremely important. Always observe the following points:

- Always finish the resurfacing of all the paint before perfusing wax;
- If necessary, clean the body panel area and blow the cavity clean before operating;
- During perfusing wax and drying, the temperature must be kept at 18℃ (64℉);
- Check the spraying mode of the perfusion device;
- Cover all the areas that need no protection wax, and the areas possibly are contaminated by applying the protection wax too much;
- In the condition that possibly are contaminated, remove the body devices, such as the seat belt retractor;