



2005 Sail (SGM7165, SGM7165 Series) Service Manual

The service manual has provided information on diagnostic, repair procedures, adjustment and specification about Sail SGM 7165 (SL, SE, SEAT) and SGM7166 (SL, SE, SXAT).

Titles in the service manual without A or B is adaptable to both SGM7165 and SGM7166 series. While those marked with A is only adaptable to SGM7165 series, and marked with B is only adaptable to SGM7166 series.

ASCs of Shanghai General Motors will be able to provide to owners of SGM7165 and SGM7166 with better services after they have the servicemen understand the manual as well as the service bulletins released by SGM.

When the manual refers to products, part number or special tools with registered marks, we strongly recommend you purchase such products, parts and special tools through Shanghai General Motors.

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If you find any error in the manual or you have any recommendations, we will appreciate if you will tell us.

You may give us your recommendations or report errors you find through mail or fax. The following are the contact information:

SGM Aftersales Engineering
3999 Longdong Avenue
Pudong New Area, Shanghai, PRC
Zip Code: 201201
Fax: (021)58583264

Please give us the following information.

- Your name
- Name of the ASC
- Phone and fax of the ASC
- Model year and model of the vehicle
- VIN of your vehicle
- Description of what you concern
- other necessary information (such as sample or page number)
- Any applicable electric info part identification number

SGM will reply your questions in the following ways:

- Transfer your concern to relevant service engineer;
- Consult service engineer to reply you;
- Provide you with solutions within 10 working days

Welcome owners of SGM7165 and SGM7166 to feedback your concerns to Customer Support Centers of SGM. Tel: (800) 820-2020 or (021) 50554580.

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Cautions and Notices

Definitions of Cautions, Notices and Notes

The diagnosis and service guidance in this service manual includes the information on cautions, notices and notes, which are designed to assist the technicians to carry out the normal operation in the diagnosis and service of the vehicles. Failure to operate in accordance by the recommended method, some procedures may be dangerous. Cautions, notices and notes are prepared to prevent the occurrence of any danger (but not all the dangers are predictable).

The information about the cautions, notices and notes are put in the prominent positions in the service manual. The said information is to prevent the following:

- Serious injury to the technician himself
- Damage to the vehicle
- Unnecessary service of the vehicle
- Unnecessary replacement of the parts
- Improper service or replacement of the components of the vehicle.

Caution and Note appearing in the normal information are cited from various service categories.

Definition of Caution

Caution requests you to adopt the necessary action or not to adopt any prohibited action. In case Caution is neglected, the following will be caused:

- Serious injury to the technician himself
- Serious injury to other technicians in the working area
- In case the vehicle is not properly repaired, the driver of the said vehicle will be seriously injured.
and/or passengers

Definition of Notice

Notice requires the special attention to be paid to the necessary or prohibiting measures. In case Notice is neglected, the following will be caused:

- Damage to the vehicle
- Unnecessary service of the vehicle
- Unnecessary replacement of the parts
- The operation or performance of the maintained system or component is abnormal.
- Damage to any system or component depending on the normal operation of the service system or part.
- The operation or performance of any system or part depending on the normal operation of the service system or component is abnormal.

- Damage to the fasteners, frequently used tools or special purpose tools.
- Leakage of the cooling liquids, lubrication oils or other main machine liquids;

Definition of Note

Note stresses the necessity of a certain diagnosis or service procedure. The purposes of the statement of the Note are in the following:

- Identification of the procedure;
- Provide the additional information for the performance of the procedure;
- Provide the internal cause for the operation in accordance with the recommended procedure;
- Provide the information helpful to the performance of the procedure more effectively;
- Provide the technicians with the past experiences and information, facilitating the easier performance of the procedure;

Caution on the treatment of the antilock brake system

Caution: It is impossible to maintain individually some components in the antilock brake system (ABS). Attempt to dismantle or detach some components of the system will cause injury to the people and/or improper operation of the system. Only those components with the approved procedure for the dismantling and installation can be maintained.

Caution on the bracing cable of the gear selector in the driving mechanism of the transmission

Caution: The bracing cable of the gear selector in the driving mechanism of the transmission consists of two sections. Don't detach the two metal hooks after the initial connection. The detachment of the two metal hooks will be detrimental to the integrity of the connection of the two metal hooks. When the driving mechanism of the transmission is to be maintained, the bracing cable is to be dismantled at the lever of the gear selector in the driving mechanism of the transmission and bracket of the bracing cable of the gear selector in the driving mechanism of the transmission. If it is necessary to replace any one section of the bracing cable, both sections must be replaced. Loss of integrity of the two metal hooks will cause the gear shifting of the driving mechanism of the transmission out of the control, resulting in injury to the people.

Caution on the explosive gas generated by the battery

Caution: Explosive gas may be generated by the battery. The battery contains the corrosive acid. The strength of the current generated by the battery is sufficient to cause burns. Therefore, the following guidelines must be abided by to reduce the dangers of injury to the people performing operation near the battery.

- Do wear the protective goggles.
- The human body is to be prevented from bending over the battery as far as possible.
- Do not place the battery near the open fire or sparks.
- Prevent the acid liquid of the battery from being in contact with the eye or skin.
 - Flush it thoroughly with the water. In case of being in contact with it, flush with water thoroughly. Seek the medical assistance.

Caution on the disconnection of the battery

Caution: Before the service of any electric part, the igniting key must be in the position of OFF or LOCK, with all the electric loads to be OFF, except it is otherwise specified in the operational procedure. If the tool or setup is easy to be in contact with the exposed electric terminal, the cable for the negative pole is to be disconnected. Violation of the safety notice will cause injury to the people and/or damage to the vehicle or components.

Caution on the dust of the brake

Caution: The following operations are to be avoided in the service of the braking parts of the wheels:

- Do not grind the frictional lining of the brake.
- Do not grind the frictional lining of the brake with the sand paper.
- Do not clean the braking parts of the wheels with the dry brush or compressed air.

The braking parts in some models or fitted additionally after the sales may contain certain asbestos fibres, possibly mixed in the dust. Intake of the dust containing asbestos will cause serious injury to the people. Please clean any dust on the parts of the brake with the wet cloth. There is the equipment for this kind of cleaning operation available in the market. The wet cleaning may prevent the fibres from mixing in the air.

Caution on the irritation of the braking liquids

Caution: The braking liquids are irritating to the eye and skin. Once being in contact, the following measures are to be taken:

- In case it is in contact with the eye, thorough cleaning is to be done with the flushing of water.

- In case it is in contact with the skin, it is to be washed with soap and water.
- In case it is swallowed, see the doctor immediately.

Caution on the replacement of the pipe of the brake

Caution: Do replace the pipe of the brake with the double walls steel pipe of the brake. It is not recommended to use the pipeline of any other type. Otherwise, it will cause the malfunction of the brake system. The replacement pipe of the brake is to be arranged and fixed carefully. Do use the correct fastener to replace the pipe of the brake in the original position. The improper arrangement and fixing of the pipe of the brake will damage the pipe of the brake and brake system, causing injury to the people.

Caution on the intake of R-134a.

Caution: Avoid the intake of the vapour or fog of the lubrication oil or coolant R-134a in the air conditioning system. Contact with them will irritate the eye, nose and throat. The operation should be carried out in an area with good ventilation. Use the service equipment validated under SAE J 2210 (R-134a recycling equipment) to eliminate R-134a from the air conditioning system. In case any accidental leakage occurred in the system, the working area must be ventilated before the service is to be continued. Information related to the health and safety is to be obtained from the coolant and lubrication oil producers.

Caution on the fan for the powered cooling liquids

Caution: The electric fan under the hood of engine will start and cause injury to the people even when the engine is idle. The hands, cloth and tools should be far away from any electric fan under the hood of the engine.

Caution on the fast dropping function of the windows

Caution: When the operation is carried out inside the door of the cabin, the switch of the powered window is to be turned on intermittently. In the operation, the fast dropping function enables the window to drop very fast with no stop, causing the injury to the people.

Caution on the fuel and evaporation discharge pipe

Caution: The following should be abided by to reduce the danger of fire or injury to the people:

- In the process of the installation, replace all the nylon fuel pipes that are cracked, scratched or damaged. It is prohibited to attempt the service of the nylon fuel pipe.

- *In the installation of the new fuel pipe, it is not permitted to strike the clamp of the bundle of the fuel pipes directly with the hammer. Damaged nylon pipe will lead to the leakage of the fuel.*
- *When operation is carried out with the blast burner near the nylon steam pipe, cover the steam pipe with the wet towel. Do not permit the vehicle to stay for more than one hour at the temperature above 115F or for a long time at the temperature above 90F.*
- *Before the connection of the joint of the fuel pipe, do apply a few drips of clean engine oil at the ends of the external pipe. Thus, it is to ensure the correct re-connection and prevent the leakage of fuel that might happen (in the normal operation, the O-ring in the joint of the internal pipe will expand. If no lubrication is applied, it will not be possible to reconnect correctly.*

Caution on the leakage of the fuel gauge

Caution: A piece of cotton towel is to be wrapped around the fuel pressure joint, to prevent the fire or injury to the people. The towel will absorb the fuel leaked when the fuel pressure gauge is connected. After the fuel pressure gauge is connected, the towel is to be put into an appropriate container.

Caution on the joint of the fuel pipe

Caution: Before the connection of the joint of the fuel pipe, do apply a few drips of clean engine oil to prevent the fire or injury to the people.

Thus, it is to ensure the correct reconnection and prevent the leakage of fuel that might occur.

In the normal operation, the O-ring seal in the joint of the internal pipe will expand. If no lubrication is applied, it will not be possible to make the correct reconnection.

Caution on the storage of the fuel;

Caution: It is not permitted to put the fuel into the open container. It is not permitted to store the fuel in the open container. Otherwise, fire or explosion will happen.

Caution on gasoline/vapours of the gasoline

Caution: The gasoline or vapour of gasoline is highly inflammable. If there is any fire source, it will burn. It is not permitted to use the open container to receive or store gasoline or some types of oil. Otherwise, it will cause fire or explosion. There shall be dry chemical fire extinguisher (grade B) at the side.

Caution on the halide lamp

Caution: There is pressure from the gas in the halide lamp. Any improper treatment will cause the lamp to be

exploded into broken glass. Avoid any injury to the people:

- *Before replacement of the lamp, the light is to be turned off and lamp to cool down.*
- *The switch of the light is to be maintained off until the replacement of the lamp is finished.*
- *When making replacement of the halide lamp, the protective goggles must be worn.*
- *The lamp is to be taken by holding the lamp holder. Avoid contact with the glass.*
- *The lamp is to be prevented from attached with dirt or moisture.*
- *Correct treatment of the used lamps*
- *The halide lamp is to be put away from the children.*

Caution on the dismantling of the lower O-ring seal

Caution: Examine the lower (small) O-ring seal of the respective oil atomizer. It is not to remain on the lower manifold, to reduce the danger of fire or injury to the people.

If O-ring seal is not to be dismantled together with the oil atomizer, when the oil atomizer is to be replaced with the new O-ring, it will be impossible to put correctly into the atomizer holder. Any improper placement will cause the leakage of oil.

Caution on the moving parts and hot surfaces.

Caution: During the operation of the engine, it is to avoid the contact with the moving parts and hot surfaces, to prevent the injury to the people.

Caution on the dismantling of the cover of the radiator

Caution: It is not permitted to dismantle the cover of the radiator or lid of the auxiliary water tank before the engine is cooled down to prevent any burn. If the engine and radiator have not been cooled down, open the cover of the radiator and lid of the auxiliary water tank, the cooling system shall discharge the very hot high pressure liquids and vapors.

Caution on the pressure relief of the fuel;

Caution: Before the service of the components of the fuel system, the pressure of the fuel system is to be relieved, to prevent the fire and injury to the people.

After the relief of the pressure in the system, there will be a few quantity of fuel overflowed in the service of the fuel piping or joint. In order to avoid any injury to the people, the joint of the fuel piping and adjuster shall be covered with the cotton towel before the disconnection. Thus the leaked fuel is to be adsorbed. After the

disconnection, the towel is to be put into an appropriate container.

Caution on the applicable road test

Caution: The vehicle is to be tested on the road in the safe conditions with the traffic statutes to be abided by. It is not permitted to attempt the operation hazardous to the control of the vehicle. Violation of the safety notice described above will cause the serious injury to the people.

Caution on the safety protection goggles and compressed air.

Caution: When the compressed air is to be used, the safety protection goggles are to be worn to prevent the injury to the eyes.

Caution on the fuel and safety protection goggles

Caution: In the treatment of fuel, the safety protection goggles must be worn to prevent the fuel from splashing into the eye.

Caution on the safety air bag system

Caution: This vehicle is equipped with the safety air bag system. Violation of the correct procedure for the operation will cause the following:

- Spreading of the safety air bag
- Injury to the people
- Service of the unnecessary air filling protective system attached;

The Safety rules of the air bag in the Safety air bag system must be abided by.

Caution on the scrapping of the safety air bag system

Caution: In order to prevent the safety air bag from accidental spreading, causing injury to the people, it is not permitted to treat the non spread air filled module as the ordinary rejects. The non spread air filling device module contains some materials. If the sealed container is damaged during the scrapping process, it will cause the serious disease or injury to the people. For the spread air filling system, it may be treated as the ordinary rejects.

Caution on the transportation and storage of the safety air bag system

Caution: When the non spread air filling module is transported:

- It is not permitted to handle by means of the wire or connector on the air filling device module.

- Make sure the opening of the air bag is not towards you.

When the non spread air filling module is to be stored, make sure the opening of the air bag is not oriented to the surface on which the air bag is placed. When the steering column is stored, the opening of the air bag is not permitted to be oriented downward and the steering column should not be vertical. There should be sufficient room around the safety air bag, to prevent the accidental spreading. Otherwise, it will cause the injury to the people.

Caution on the special purpose tools for the safety air bag system

Caution: In order to prevent the air bag from spreading when the defective of the safety air bag system is being eliminated, only the equipment stipulated and method designated in this manual are to be used. If the stipulated special purpose equipment is not used, it will cause the spreading of the safety air bag, injury to oneself, others or unnecessary service of the safety air bag.

Caution on the lifting of the vehicle

Caution: In order to prevent the damage to the vehicle, serious injury to the people or even death accident, the vehicle is to be supported with the jack on the side where the parts are to be dismantled when the main components are to be dismantled from the vehicle and the vehicle is supported by the lifting device.

Caution on the dismantling of the windows of the vehicle

Caution: When any type of the glass is processed, the approved safety protection goggles and gloves are to be used to prevent the injury to the people.

Caution on the fixing of the windows of the vehicle

Caution: When the static windows are to be replaced, if the ethyl carbamate adhesive assembly is not used, the fixing ability of the windows will be reduced. In that case the passenger without taking any protective measure will be popped out of the vehicle and injured.

Caution on the testing of the operation area

Caution: When the specific test required is being performed in the working area, one or more guidelines will be applicable:

- When the automobile is lifted with the jack while the test requires to rotate the driving wheels, the following safety notice is to be abided by:
 - When one driving wheel is rotated with the other being idle, the speed shall not be

more than 56 kilometers /hour. Under those conditions, as the tachometer indicates only half of the actual speed, the said restriction is essential. Too fast rotation of the wheel will cause injury to the people.

- *If all the driving wheels rotate at the same speed, the speed should not be more than 112 kilometers per hour. Too fast rotation of the wheel will cause injury to the people.*
- *All the personnel should be far away from the rotary parts and counterbalance locations, to avoid the injury to the people.*
- *When the engine is running for a long time in the working area, the operation must be very careful to prevent the engine or transmission from being overheated.*
- *When the test requires the vehicle to be lifted and run after the wheels and braked disc are dismantled, the following safety notice is to be abided by:*
 - *The suspension is to be supported at the height for the normal driving.*
 - *It is not permitted to use the brake after the braked disc is removed.*
 - *When the driving axle is rotating, it is not permitted to engage the transmission in the Idle gear position.*
 - *Turn off the igniting switch for the components of the power train to stop rotation.*

Notices for the air in the power steering system

Notice: In case the power steering system has been maintained, if the air were not released from the steering system, the reading of the liquid level will not be accurate. The air in the oil will cause the liquid pump to generate the gas corrosion noise and it will cause the damage to the liquid pump if running for a long time.

Notices regarding the anti rust materials

Notice: The inner face of some metal lining is applied with anti rust agent, to provide the protection against the rust. When the lining is maintained or new lining installed in the locations where the anti rust material is damaged, the anti rust agent is to be applied to prevent the damage caused by the rust corrosion.

Notices regarding rectification of the driving belt.

Notice: Do not rectify the driving belt. Rectification of the driving belt will cause the breakage of the texture of the belt. Violation of the said recommendation will cause damage to the driving belt.

Notices regarding the tightening of the fasteners of the components

Notice: The serial number of the replacement part must be correct. Those parts with the necessity to use the screw lock up glue, lubrication oil, anti rust agent or sealant should be indicated distinctly in the service procedure. Some replacement parts are coated. Unless it is specified individually, it is not permitted to apply those coatings on the components. The said coatings will affect the final torque, so to affect the operation of the components. In the installation of the components, the stipulated value of the correct torque is to be used to prevent any damage.

Notices regarding the malfunction diagnosis device

Notice: It is not permitted to use the malfunction diagnosis device that might indicate the erroneous data. The defectives of the malfunction diagnosis device should be reported to the manufacturer. Application of the defective malfunction diagnosis device will cause the erroneous diagnosis and unnecessary replacement of the parts.

Notices regarding the refitting of the exhaust.

Notice: The refitting of the following system will affect the control of the exhaust of the vehicle, with the possibility to turn on the malfunction indicator (MIL), engine examination indicator or engine immediate service indicator.

- Engine
- Transmission
- Exhaust system
- Fuel system

The replacement tyre not in compliance with the tyre performance condition installed originally will also affect the control of the exhaust of the vehicle. May lead to the malfunction indicator light, examine the engine or maintain the engine indicator light as soon as possible for starting and being lighted.

The service caused by the refitting of those systems or installation of the tyres with the tyre performance condition being incorrect is not covered by the warranty of the manufacturer. It will cause the vehicle not to pass the required examination of the exhaust/service test.

Notices regarding the engine exhaust.

Notice: The refitting of the engine or its parts will affect the exhaust control of the vehicle. It may cause the malfunction indicating light, examine the engine or immediate service of the engine indicator to be lighted. It will cause the vehicle not to pass the required examination of the exhaust/service test.

Notices specific to the fasteners

Notice: Use the correct fasteners in the correct positions. The part number of the replacement fastener must be correct. Those fasteners requiring the use of the screw lock up glue, lubrication oil, anti corrosion proof agent or sealant or fasteners requiring the replacement parts should be indicated distinctly in the service procedure. It is not permitted to use paint, lubricant or corrosion proof agent on the fasteners or connecting surface of the fasteners unless specified otherwise. The said coatings will affect the torque and binding force of the fasteners and damage the fasteners. In the installation of the fasteners, do use the correct tightening sequence and torque, to prevent the damage to the parts and systems.

Special cautions specific to the fuel pressure

Notice: The fuel pressure is not permitted to exceed the stipulated value. Otherwise, the fuel pressure regulator or manometer of the fuel will be damaged.

Notices specific to the fasteners of the fuel box yoke

Notice: Tighten gradually and alternatively the yoke fasteners until the stipulated torque is reached. If the yoke fastener failed to be tightened to the stipulated torque, the bottom of the fuel box will be curved upward. In this way, the fuel meter will indicate the availability of fuel even if there is no fuel in the fuel tank.

Note specific to the treatment of the parts sensitive to the electrostatic discharge

Notice: The electrostatic discharge (ESD) will damage a lot of solid state electric parts. The parts easily affected by the electrostatic discharge are not all indicated with the symbol of electrostatic discharge. All the electric parts are to be treated carefully. Abide by the following safety notice, to prevent the damage by the electrostatic discharge:

- Before the service of any electric part, first touch the metal grounding point to discharge the electrostatic electricity from the body, especially after sliding on the seat.
- Never touch the exposed terminal. The terminal may be connected with the circuit easily affected by the electrostatic discharge.
- When the joint is to be maintained, the tools are not permitted to be in contact with the exposed terminal.
- It is not permitted to dismantle any part from the protective case unless such operation is requested.

- Avoid the following operations unless it is specially required by the diagnostic procedure.
 - Bridge connection of the joint or part or grounding
 - Connect the probe of the test equipment to the part or joint. When the probe is to be tested, first the grounding line is to be connected.
- Before opening the protective case of the part, it is to be grounded first. It is not permitted to put the solid state parts on the metal operational bench, television set, radio or the top of other electric equipment.

Note specific to the treatment of the idle air control valve.

Notice: If the idle speed air control valve is being used, it is not permitted to push pull the pivot of the idle speed air control valve. The force required to shift the pivot will damage the threads on the worm drive. Additionally, the idle speed air control valve is not permitted to be immersed in any liquid cleaner or solvent. Otherwise, it will be damaged.

Note specific to the closing of the ignition switch when the battery is to be disconnected.

Notice: The ignition switch must be off when the cable of the battery, charger of the battery or the jumper cable is to be connected or disconnected. Otherwise, it will damage the control module of the power system or other electric parts.

Note specific to untwisted or bent installation of the hose

Notice: When the inlet or outlet hose is installed, no kink is permitted. It is not permitted to bend or kind the inlet or outlet hose for the convenience of installation. Violation of the said procedures will cause damage to the parts.

Special cautions specific to the nylon fuel pipe.

Notice: It is not permitted to attempt the straightening of the kink nylon fuel pipe. Any kink nylon oil inlet pipe or return pipe is to be replaced, to prevent the vehicle from being damaged.

Notices specific to the description of system II OBD (on board diagnosis)

Notice: The symbol of OBD II is used on the electric circuit diagram to remind the technicians that the said electric circuit is mainly used for the correct operation of the control circuit for OBD II exhaust. Any electric circuit for malfunction and causing the lighting of the

malfunction indicating light or causing the damage of the part relating to the exhaust is the OBD II circuit.

Remarks on the control module of the power system and electrostatic discharge

Notice: It is not permitted to touch the pin of the joint or welded parts on the circuit board, to prevent the electrostatic discharge from damaging the control module of the power system.

Notices specific to the silicone contamination of the heated oxygen sensor

Notice: The cause of the contamination of the oxygen sensor is the incorrect use of the hardening sealant at room temperature (not safe to the oxygen sensor) or excessive cooling liquid in the engine or consumption of machine oil. Dismantle the oxygen sensor and inspect the part of the sensor in the current of exhaust and examine if there is any contaminant. If contaminated, there will be a layer of white powder on the sensor exposed to the exhaust current. The silicone contamination will cause the voltage of the signal HO2 (indicating the concentration of the exhaust to be too dense) to be too high but not true. The control module will reduce the quantity of oil supplied to the engine, causing the serious worsening of the driving performance. The source for the contamination is to be

eliminated first, before the replacement of the oxygen sensor.

Special cautions specific to the simplex oil overflow

Notice: In order to prevent the simplex oil overflow and the possible damage of the engine, the fuel is to be released before the procedure of testing the coil of the fuel atomizer is carried out.

Note specific to the test probe

Notice: It is not permitted to insert the probe into any joint or terminal of the fuser box. The diameter of the probe will cause most of the terminals to be distorted. After the distortion of the terminal, poor contact will occur, causing the malfunction of the system. Do use the plug test adapter J35616 -A or plain wire probe joint unit J42675 to detect the terminal from the front. Avoid the use of the clip or other substitutes. Otherwise, it will cause damage to the terminal and error of measurement.

Note specific to the application of the appropriate power steering oil

Notice: Do use the appropriate power steering oil when the oil is replenished or replaced completely. The use of any inappropriate oil will cause the damage to the hose and sealant and leakage of oil.

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General Information

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0.1 General Information

0.1.1 Special Tools Ordering Information

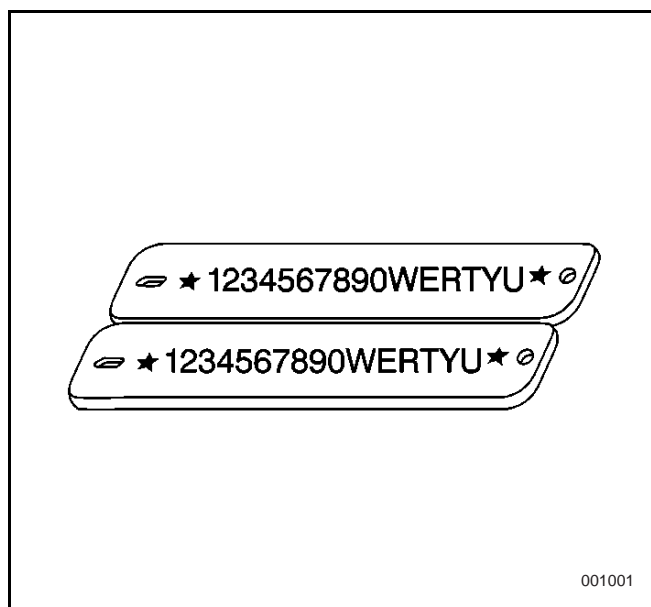
The special tools shown in this service manual are available through SPX Kent-Moore. The special tools of the codes started with KM are CORSA series. They are only suggested.

0.1.2 Diagnostic Work Sheets

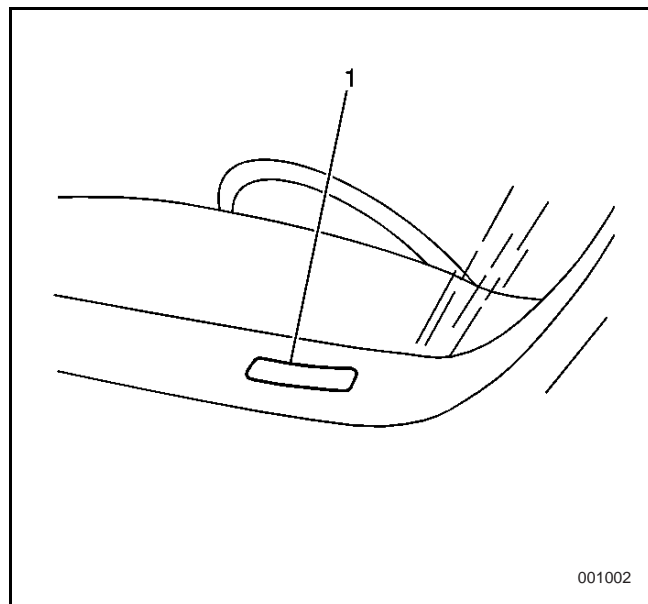
The GM diagnostic worksheet has been designed to improve communications between the service customer and the technician. The diagnostic worksheet can provide the technician with more information than the conventional repair order, since it is filled out by the service customer. GM service bulletin 58-01-01 has information on how to order this diagnostic worksheet.

0.1.3 Vehicle Identification Number

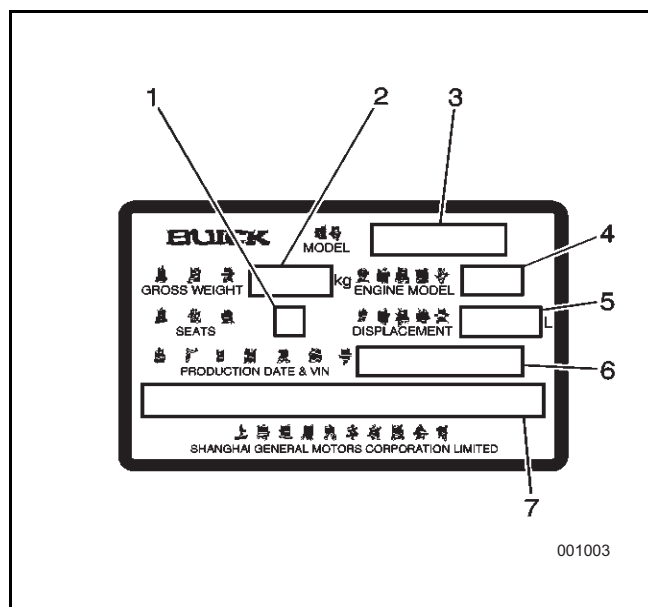
The VIN plate is the legal identifier of the vehicle.



The VIN plate (1) is located on the upper left corner of the instrument panel and can be seen through the windshield from the outside of the vehicle.



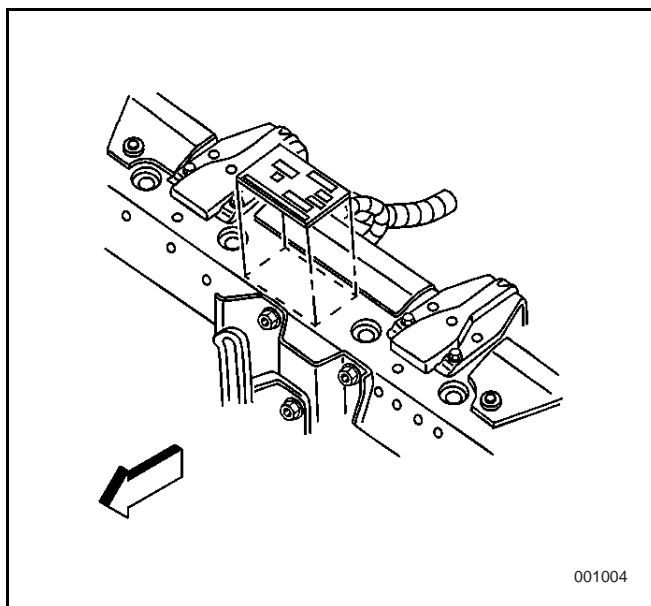
This vehicle contains a second VIN plate.



Legend:

- (1) Seats
- (2) Gross Vehicle Weight
- (3) Model
- (4) Engine Model
- (5) Engine Displacement
- (6) Date of Production
- (7) No. (VIN Number)

The second VIN plate is located on the radiator support.



Vehicle Identification Number (VIN) System

Location	Definition	Character	Description
1-3	Global Manufacture Identification	LSG	China
4-5	Vehicle Line and Series	SJ	1.6 L Engine
6	Body Style	5 8	4-Door Sedan 5-Door station wagon
7	Restraint System	2	Seat Belt and Driver & Passenger Seat Air Bag System
8	Engine types	N	4-cylinder multiple fuel injection 1.6L (Optional Code L01)
9	Verification figure	—	Verification figure
10	Model Year	3	2005
11	Plant Location	Y	Shanghai GM Dongyue Automobile Co., Ltd. (Yangtai)
12-17	Plant Code	—	—

0.1.4 Tire Placard

The tire placard is located on the lower part of the left front door.

The diagram shows a rectangular label titled "Tire Loading Information Label" with the "SHANGHAI GM" logo in the top left. It contains several sections: "Number of Occupants" with boxes for "Front", "Rear", and "Total" (callout 1); "Load Capacity" with boxes for "LBS" and "KG" (callout 2); a statement "The maximum load weight is equal to the load capacity"; a "Model:" field (callout 3); "Tire size" and "Speed level" fields for "Front tire" and "Rear tire" (callout 7); "Inflation Pressure (only effective to cold tire)" with three horizontal bars (callout 5); a reference to the "Owner's Manual for details"; and weight ratings for "Gross Vehicle Weight Rating", "Front Gross Axle Weight Rating", and "Rear Gross Axle Weight Rating" (callout 4). A "Date" field is also present (callout 9). A large box at the bottom contains the "Vehicle Identification Number" (callout 10). Callouts 6 and 8 point to the "Front Gross Axle Weight Rating" and "Rear Gross Axle Weight Rating" fields respectively.

Legend:

- (1) Total Occupant Seating
- (2) Vehicle Type Number
- (3) Maximum Vehicle Capacity Weight
- (4) Rated Loading, Rear Axle
- (5) Tire Pressure, Front & Rear
- (6) Rated Loading, Front Axle
- (7) Tire Speed Level, Front & Rear
- (8) Rated Gross Vehicle Weight
- (9) Rated Tire Dimension
- (10) Vehicle Identification Number

0.1.5 Service Parts Identification Label

The Service Parts Identification Label is attached on the vehicle in order to assist service and parts persons to make identifications.

Original Parts and Options on the vehicle

The diagram shows a rectangular label titled "Service Parts ID" with the "SHANGHAI GM" logo in the top left. It includes a large central box for identification. At the bottom, there are three fields: "Vehicle identification number" (callout 1), "Engineering Model Number (Vehicle Division, Vehicle Line and Body Style)" (callout 2), and "Interior Trim and Decor Level" (callout 3). A fourth callout (4) points to the "Vehicle Option Content (RPO code)" field. A note in the top right corner states "Removal of the label is prohibited". The number "001013" is printed in the bottom right corner.

Legend:

- (1) Vehicle identification number
- (2) Engineering Model Number (Vehicle Division, Vehicle Line and Body Style)
- (3) Interior Trim and Decor Level
- (4) Vehicle Option Content (RPO code)

0.1.6 RPO Code List

The following table provides the description of the Regular Production Option (RPO) codes that are available on the vehicle. The vehicle's RPO list is printed on the Service Parts Identification Label.

RPO	Description
12U	Metallic Bright Silver
16U	Bright White
24U	Space Blue
49U	Jasper Green
60U	Bright Metallic
64I	Interior Trim, Beige
70U	Maple-Leaf Red
8HU	Suspension Parts, Rear Left
9HU	Suspension Parts, Rear Right
A01	Shaded Windshield
A32	Power Window, FRT DR
A33	Power Window, RR DR
A51	Front Bucket Seat
A90	Power Door Lock, L/Gate
AG4	Height Adjuster, Driver 掙 Seat
AJ5	Split Headrest, Leather Covered, FRT Seat
AJ8	Rear Seat, Foldable
AK3	Split Headrest, Cloth Covered, FRT Seat
AK5	Dual Air bag
AK9	Three-Point Safety Belt, RR Seat, Central Lap-Strap
AQ4	Rear Seat
AR3	Split Headrest, Cloth Covered, Rear Seat
AU0	Door Lock, Remote Control
AU3	Central Door Locking System, Four-Door
AY7	Split Headrest, Leather Covered, Rear Seat
B52	Door Sill, Black
B86	Molding, Outside Door, Concolorous
AK9	Three-Point Safety Belt, RR Seat, Central Lap-Strap
BC0	Instrument Panel, Dual Color
BNN	Trunk Stowage
C1X	Central Console, Titanium Silver
C25	Rear Windscreen Wiper

RPO	Description
C49	Defogger, RR Window, Electric
C60	Air Conditioner, Manual
C72	Reading Lamp, Rear
CF5	Power Sunroof
D07	Instrument Console
D08	Paint, High Gloss Finish
D27	Roller Blind, Trunk
D32	Vanity Mirror, Right Sunshade
D41	Outside Mirror, Black
D67	Glove Box with Door, I/P Compartment
D6R	Instrument Cluster, Silver Grey
D72	Outside Door Handle, Black
D75	Outside Door Handle, Concolorous
D91	(Door) Handle, L/Gate R/CMPT, Concolorous
D98	Body Decals
DNB	Outside Mirror, Foldable, LH Manual, RH Electric, Concolorous
DR8	Outside Mirror, Manual, Concolorous
E22	Pull Handle, Roof, Rear Seat
FE2	Suspension System
FQ7	Drive Ratio 4.05 Drive Axle
FX1	Drive Ratio 3.94 Drive Axle
JM4	Hydraulic Brake System, Front Disc, Rear Drum, FRT & RR Anti-lock Brake
JVA	Brake System, Anti-lock Brake Disabled
K12	Air Filter
K60	100AMP Generator
L01	1.6 L Engine
M79	5 Gear Manual Transmission
ML4	4 Gear Auto Transmission
N34	3-Spoke Steering Wheel, Leather Wrapped
N40	Power steering
N45	3-Spoke Steering Wheel, Plastic Wrapped
N51	Manual Steering
NT3	Euro III Emission System
NV1	Oil Pan Guard
P08	Trim Cover, Steel Rim
PY4	14*5.5 Aluminum Rim
PY8	14*5.5 Steel Rim

RPO	Description
QIC	165/70R13-79T Tire
QUS	185/60HR14 Tire
T2F	ABS Module 5.4
T39	Turn Lamp, Aux.
T6G	Door Trim Panel, Inner, Coarse Cloth Covered
T79	Rear Fog Lamp
T84	Headlamp
T8B	Pull Handle, Roof, Front Seat
T96	Front Fog Lamp
T9N	Door Trim Panel, Inner, Punched Leather Covered
TD8	Radio/Cassette Player
TK0	46L Plastic Fuel Tank
TL6	Radiator Grille, Black
TN6	55AH Battery
TS6	High Mounted Brake Lamp
U0R	Engine Parts Package, Electronic Injection, Generation 2
U16	Engine Tachometer
U68	Driver Information Center
U76	Antenna Windshield, Radio
U95	2-Channel Speaker
UAK	CD/Radio
UOR	Component Assembly, Engine W/Direct Ignition System, Generation II
V35	Bumper FRT & RR, Body Color
UC5	6-Channel Speaker, Deluxe
UW4	4-Channel Speaker
V36	Wheelhouse, Concolorous
V44	Bumper FRT & RR, Dual Color
V54	Roof Luggage Rack
V9I	SL Vehicle Type
W5Z	Seat, Punched Leather Covered
W6G	Seat, Coarse Cloth Covered
W8X	Radio Wiring Harness
XM0	SXAT Vehicle Type
XN5	Trunk Lamp
Y7E	SE Vehicle Type

0.1.7 Key Coding

Key Identification and Usage

A single key is used to unlock and lock all of the locks on the vehicle. The key identification is obtained from the four-character key code located on the key tag. The four character key code should be recorded by the owner and the dealer. The mechanical key code can be determined through the use of a code cross-reference list which is available to the owner from the key cutting equipment suppliers.

Cutting Keys:

After the mechanical key code has been determined from the code list, perform the following steps:

1. Cut a blank key to the proper level (1) of each of the tumbler positions (2).
2. Inspect the key operation in the lock cylinder.

Replace Lock Cylinders

New lock cylinder cores are available from the service parts warehouses without tumblers and springs. The tumblers and springs are also available and must be assembled into the lock cylinder according to the key code. Other components are also available.

Lock Cylinder Tumbler Operation

All tumblers are shaped alike with the exception of slot position on them. As the key is inserted into the lock cylinder, it will set every tumbler slot to the same level as inner surface of cylinder bore, allowing the cylinder to turn inside the bore.

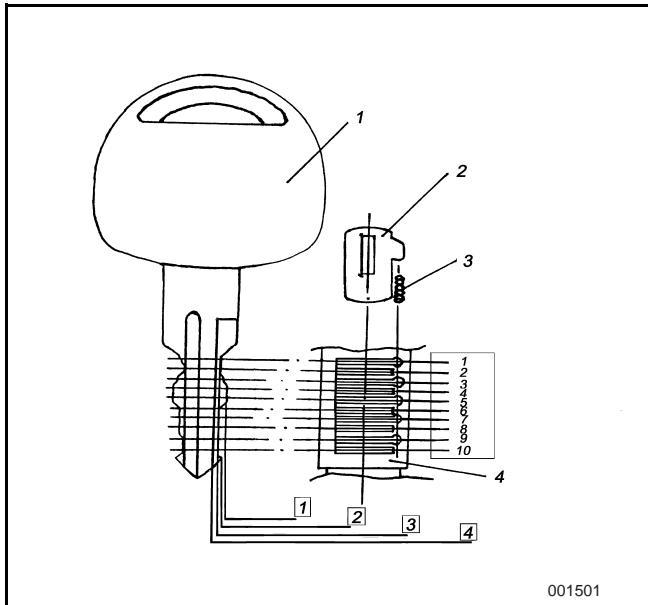
Lock Cylinder Coding

Note: If ignition cylinder does not work, it must be replaced with the new ignition cylinder.

Steps described as below:

1. Place the key directly over the illustrated key;
2. Starting with Position 1, find and record the lowest level (Tumbler number);
3. Repeat Step 2 for Positions 2-10;
4. Insert a spring into the cylinder core for each tumbler;
5. Starting with Position 1, insert tumbler into proper slot in coded order;
6. Repeat Step 2 for Positions 5-10; Be careful to put cylinder core in place without damaging the tumblers.

Note: Except the different amount of tumblers, use the same way to code other cylinders.



Legend:

- (1) Key
- (2) Tumbler
- (3) Spring
- (4) Key Cylinder

0.1.8 Lifting and Jacking the Vehicle

Caution: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed.

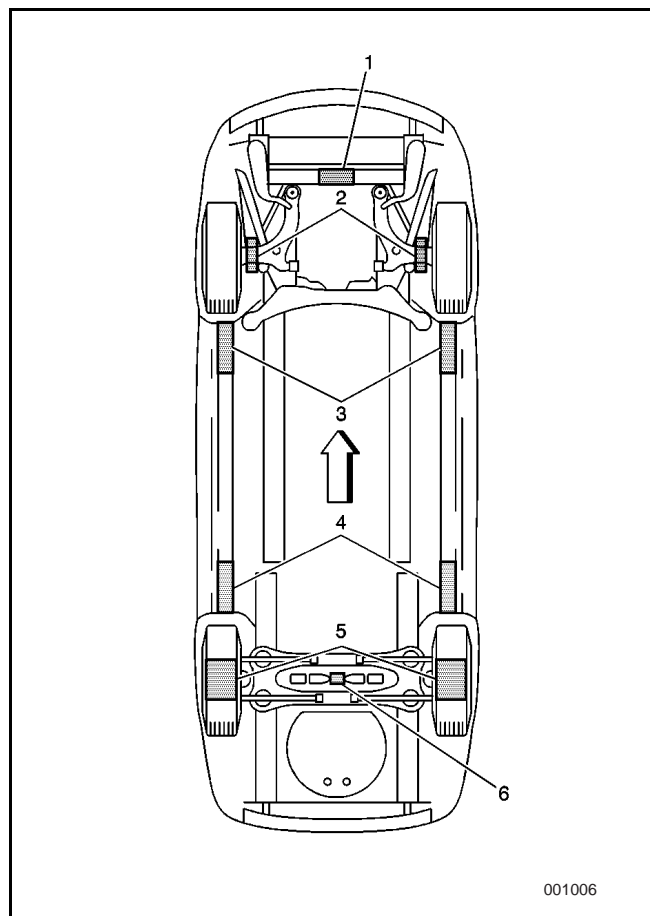
Caution: To avoid any vehicle damage, serious personal injury or death, always use the jack stands to support the vehicle when lifting the vehicle with a jack.

Notice: Perform the following steps before beginning any vehicle lifting or jacking procedure:

- Remove or secure all of the vehicle's contents in order to avoid any shifting or any movement that may occur during the vehicle lifting or jacking procedure.
- The lifting equipment or the jacking equipment weight rating must meet or exceed the weight of the vehicle and any vehicle contents.
- The lifting equipment or the jacking equipment weight rating must meet the operational standards of the lifting equipment or jacking equipment's manufacturer.
- Perform the vehicle lifting or jacking procedure on a clean, hard, dry, level surface.
- Perform the vehicle lifting or jacking procedure only at the identified lift points. Do not allow the lifting equipment or jacking equipment to contact any other vehicle components.

Failure to perform the previous steps could result in damage to the lifting equipment or jacking equipment, the vehicle, and/or the vehicle contents.

Automotive Lift and Floor Jack Contact Points



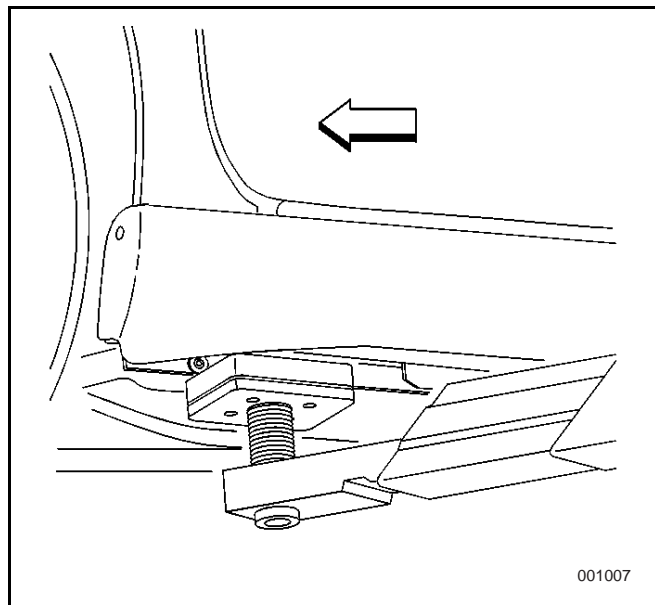
Legend:

- (1) Front Floor-Jacking Location
- (2) Front Suspension-Contact Lift Location
- (3) Front Frame-Contact Lift Location
- (4) Rear Frame-Contact Lift Location
- (5) Rear Suspension-Contact Lift Location
- (6) Rear Floor-Jacking Location

Vehicle Lifting-Frame Contact Lifter

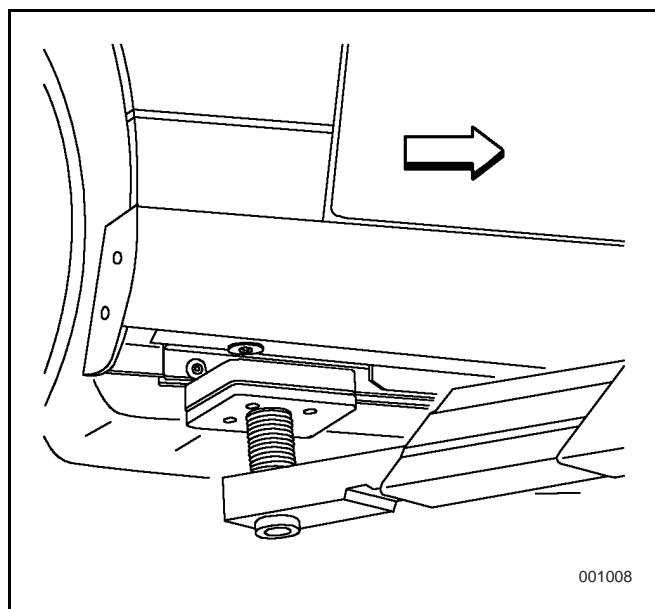
Front Lift Pads

When lifting the vehicle with a frame-contact lifter, place the front lift pads at the front pinch-weld flanges.



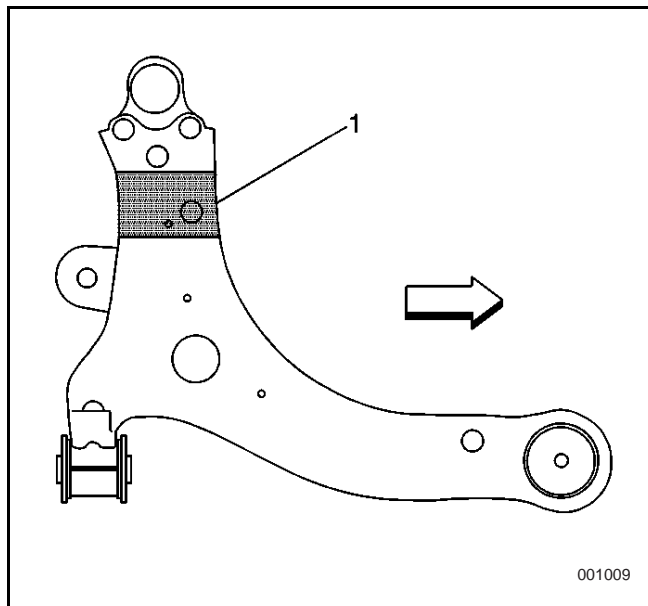
Rear Lift Pads

When lifting the vehicle with a frame-contact lifter, place the rear lift pads at the rear pinch-weld flanges.



Vehicle Lifting-Suspension Contact Lifter

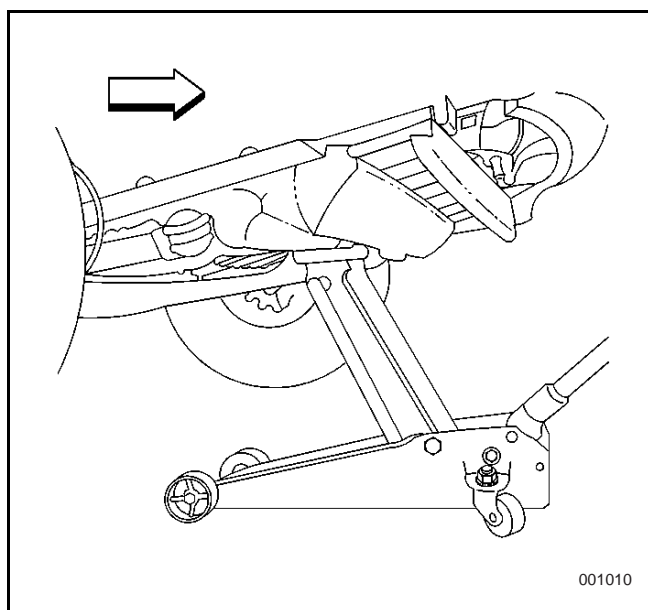
When lifting the vehicle with a suspension-contact lifter, place the front post lift points at the lower control arms (1). Lift the rear of the vehicle with the rear post lift point only under the rear wheels.



Vehicle Jacking

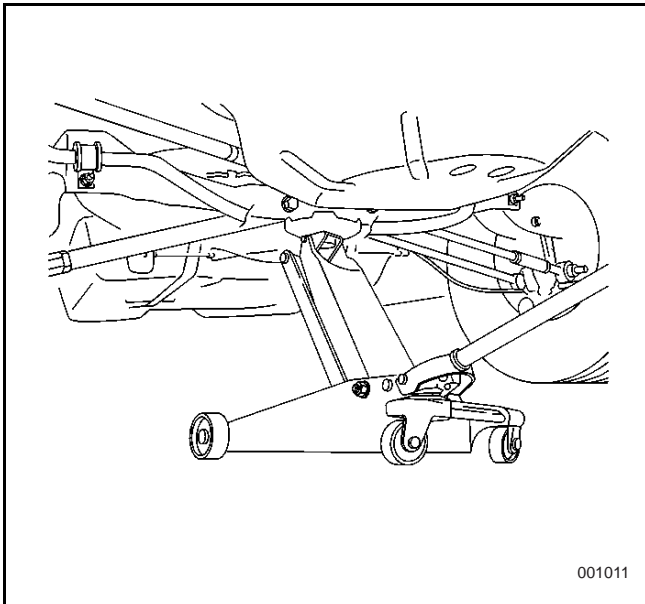
Under the Front Frame

When lifting the front of the vehicle with a floor jack, place the floor jack lift pad at the center of the front frame.



Under the Center of the Rear Suspension

Lift the rear of the vehicle by placing the floor jack lift pad at the center of the rear suspension.



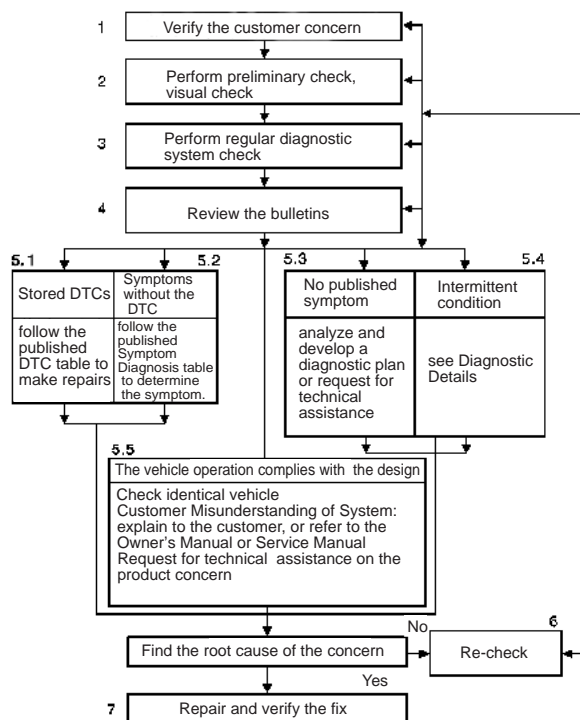
Supporting the Vehicle with Jack

Note: Place the jack only under strong and stable vehicle structures.

0.1.9 Diagnostic Strategy

The goal of diagnostic strategy is to provide guidance when you create a plan of action for each specific diagnosis situation. Following similar plan for each diagnostic situation, you will achieve maximum efficiency when you diagnose and repair vehicles. Although each of the strategy based

diagnostic boxes is numbered, you are not required to complete every box in order to diagnose a customer concern successfully. The last step of your diagnostic process should be, Repair and Verify the Fix. Refer to the following chart for the correct strategy based diagnostics.



001012

Legend:

- (1) Verify the customer concern: The first part of this step is to obtain as much information as possible from the customer. Are there after-market accessories on the vehicle? When does the condition occur? Where does the condition occur? How long does the condition last? How often does the condition occur? In order to verify the concern, the technician should be familiar with the normal operation of the system and refer to the owner or service manual for any information needed.
- (2) Preliminary Checks: Conduct a thorough visual inspection. Review the service history. Detect unusual sounds or odors. Gather diagnostic trouble code information in order to achieve an effective repair.
- (3) Perform regular diagnostic system checks: one or more DTCs may not support the conditions in

the system. System checks verify the proper operation of the system. This will lead the technician in an organized approach to diagnostics.

- (4) Check bulletins and other service information: Use newsletters.
- (5.1) Stored DTCs: Follow the designated DTC table exactly in order to make an effective repair.
- (5.2) Symptom has no DTC: select the symptom from the symptom tables. Follow the diagnostic steps or suggestions in order to complete the repair, or refer to the applicable components/system check.
- (5.3) No published diagnostics: Analyze the concern. Develop a plan for the diagnostics. The service manual schematics will help you to see system power, ground, input and output

circuits. You can also identify splices and other areas where multiple circuits are tied together. Look at component location to see if component, splices or harness exposed to extreme temperature, moisture, road salt or other corrosive. Utilize the wiring diagrams, system description and operation, and system circuit description.

- (5.4) Intermittent condition: an intermittent condition is one that does not occur continuously and will occur when certain conditions are met. Generally, intermittent conditions are caused by faulty electrical connections and wiring, malfunctioning components, electromagnetic/radio frequency interference, and after-market equipment. Combine technician knowledge with efficient use of the available service information. Evaluate the symptoms and conditions described by the customer. Use a check sheet or other method in order to identify the component. Follow the suggestions for intermittent diagnosis found in the service

manual. The Tech 1 and Tech 2 scan tools, and the J39200 (Fluke 87) have data capturing capabilities that can assist in detection of intermittence.

- (5.5) Vehicle operation as designed: The condition described by the customer exists when the vehicle is found to operate normally. It indicates that the condition may be normal. Verify against another like vehicle that is operating under the same conditions described by the customer. Explain your findings and the operation of that system to the customer.
- (6) Re-examine the concern: If a technician can not successfully find the concern, a re-evaluation is necessary. Re-verify the concern. The concern could be an intermittent or normal.
- (7) Repair and verify Fix: after isolating the cause, make the repairs and validate for proper operation. Verify that the symptom has been corrected, which may involve road testing of the vehicle.

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0.2 Maintenance and Lubrication

0.2.1 Specifications

0.2.1.1 Fuel Capacity (Approximation)

Application	Specification
Engine oil	
Filter replacement	3.5 L
Do not replace filter	3.25 L
Engine Cooling System	5.8 L
Transmission	
Auto	6.0 L
Manual	1.6 L
Brake fluid	0.45 L
Power steering fluid	0.9 L
Fuel tank	46 L
Windscreen cleaning agent	2.6 L
A/C system refrigerant	0.68 kg

0.2.1.2 Recommended Oil and lubricants

Usage	Fluid/lubricants
Transmission	
Auto	DEXRON III Auto Transmission Oil
Manual	CASTROL MTF0063 or SAE 75 W/85-APILGL4
Engine Coolant	DEX-COOL Coolant
Engine oil	The Society of Automotive Engineers certified SAE5W30
	If you are in an area where the temperature falls below -29 °C , use the Society of Automotive Engineers certified SAE 0W30
Engine hood	Multi-purpose lubricant
Door hinge	Lubricating Grease, No.: 09309859
Brake fluid	DOT 4 Brake fluid
Power steering system	DEXRON III Auto Transmission Oil
Key cylinder	Paraffin or graphite

0.2.1.3 Tire Inflation Pressure Specifications

Application	Specification (Full load)
Tire (185/60 R14-82H)	
Front tire	210 kpa.
Rear tire	250 kpa.

0.2.2 Maintenance Schedule

0.2.2.1 Normal Vehicle Use

The following schedule is used for the vehicle that meets the following conditions:

- Carry passengers and cargo within recommended limits. These limits are listed on the tire placard which is located on the driver's door.
- Vehicles that are driven on reasonable road surfaces within legal driving limits.
- Use the recommended fuel and oil.

Maintenance Schedule Intervals

The repair and inspection contents shown in this schedule up to 15,000 km (or one year) should be performed. The services shown in this schedule should be repaired and inspected after 15,000km (or one year) at an interval of 15,000km (or one year). The services shown in this schedule up to 200,000km (or 5 years) should be performed after 200,000km (or 5 years) at the same intervals. If the vehicle is not used frequently, the repair and inspection should be performed annually.

Maintenance Schedule

15,000 km

- Road test the vehicle before the services
- Inspect the engine emission.
- Replace the air filter.
- Replace the engine oil filter and the engine oil.
- Clean the positive crankcase ventilation of the engine.
- Inspect the engine cooling system hose and lines.
- Inspect the engine coolant level.
- Inspect the brake wears.
- Inspect the brake hose and lines.
- Inspect the electrical system, signal and lighting device for the possible conditions.
- Replace the wiper blade.
- Inspect the windshield washer fluid level.
- Inspect the headlamp aim
- Inspect the transmission lubricant
- Inspect the power steering system lubricant
- Inspect the absorber for leaks
- Inspect the power steering system lubricant
- Inspect the absorber for leaks
- Inspect the tires
- Inspect the engine drive belt.

- Inspect the A/C, and replace the air filter in the passenger compartment as required.
- Inspect the underbody and clean.
- Lubricate the door hinge, the engine hood release mechanism, the lock cylinder.
- Road test the vehicle after the services

30,000km

- Repeat the required performances at 15,000 km.
- Inspect the brake drum.
- Inspect the steering system.
- Replace the brake fluid.
- Replace the fuel filter
- Replace the spark plug

45,000km

- Repeat the required performances at 15,000 km.
- Replace the brake shoe.

60,000km

- Repeat the required performances at 30,000 km.

75,000km

- Repeat the required performances at 15,000 km.

90,000 km

- Repeat the required performances at 30,000 km.
- Replace the brake hose and the brake shoe
- Replace the drive axle
- Replace the transmission fluid
- Replace the parking brake cable

105,000 km

- Repeat the required performances at 15,000 km.

120,000 km

- Repeat the required performances at 30,000 km.

135,000 km

- Repeat the required performances at 45,000 km.

150,000 km

- Repeat the required performances at 30,000 km.

165,000 km

- Repeat the required performances at 45,000 km.

180,000 km

- Repeat the required performances at 90,000 km.

200,000 km

- Drain, flush and refill cooling system.
- Inspect radiator and heater hoses
- Clean radiator, condenser, pressure cap and journal. Perform a pressure test of the cooling system and pressure cap
- Repeat the required performances at 15,000 km.

0.2.2.2 Regular Service Description

For time and/or mileage intervals of scheduled maintenance items, refer to Maintenance Schedule.

For information on the proper fluids and lubricants to use, refer to Fluid and Lubricant Recommendations.

0.2.2.3 Owner Checks and Services

The following information covers the inspections and services required in order to retain the safety, dependability, and emission control performance of the vehicle.

Immediately complete all of the necessary repairs. Fill the vehicle with the recommended fluids or lubricants.

Before usage

- Inspect the engine oil level
- Inspect the fuel level
- Inspect the brake fluid level
- Inspect the power steering system fluid level
- Inspect the windshield washer fluid level
- Inspect the tire inflation
- Under the condition of vehicle speed less than 30km/h, try the steering and the braking.

If any problems found, always resume the vehicle to normal before the vehicle use.

At least once half a year

Restraint System Checks

Ensure the safety belt indicator and all the safety belt system operative normally. Inspect the safety belt system parts for any looseness or damage. Repair the loose or damaged safety belt system parts. Repair any torn or frayed safety belts.

Wiper Blade Checks

Inspect the wiper blades for wear or cracking.

Weather-strip Lubrication

Silicone grease on weather strips is helpful to make weather strips last longer, seal better, and not stick or squeak. Apply silicone grease on weather strips with a clean cloth.

Transmission Axle (Manual, Auto) Checks

Inspect the transmission axle fluid level. If necessary, add the fluid.

Door Hinge Lubrication Care

First clean the deposits inside and around the hinge pin, then fill appropriate designated grease on the hinge pin.

At least once a year

Key Cylinder Care

Use the recommended lubricants to lubricate the key cylinder.

Body Lubrication and Care

Lubricate all the following locations:

- Body hood, safety lever and drive rod pivot
- Fuel tank door
- Rear compartment hinge
- Rear compartment pin and lock
- Seat hardware

Underbody flush

At least every spring, use plain water to flush the underbody in order to remove any corrosive materials from the underbody.

Regular Maintenance Checks

At least twice a year, perform the following checks and repairs.

Steering mechanism, suspension and front drive axle boot seal checks

- Inspect front suspension and rear suspension system.
- Inspect the steering system for damage, looseness or part loss, frayed or insufficient lubrication. If necessary, repair the vehicle.
- Inspect the power steering system lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc. If necessary, repair the vehicle.
- Clean and inspect the drive axle boot seals for damage, tears, or leakage. If necessary, repair the vehicle.

Exhaust system checks

Inspect the entire system. If necessary, repair the vehicle.

Engine Cooling System Checks

Inspect the hoses. Replace the hoses if the hoses are cracked, swollen, or deteriorated.

Inspect all the lines, connectors and clamps. If necessary, repair the components.

Throttle linkage checks

Notice: Do not lubricate the accelerator cables.

Inspect the following contents, and replace if necessary:

- Parts lost
- Interference of linkage or cable conduit to critical components such as fuel lines, brake pipes or harness leads.
- Clearance of throttle system moving parts throughout travel from other stationary components.
- Damaged Parts

Brake system checks

Notice: A low brake fluid level can indicate disc brake pads are severely worn.

- Inspect the entire system.
- Inspect the brake lines and hose.

If necessary, repair the components.

Blank

0.3 Vibration Diagnosis and Correction

0.3.1 Specification

0.3.1.1 Tire and Radial Wheel Runout Specifications

Application	Specification
Aluminum Wheel	
Lateral	0.762mm
Radial	0.762mm
Steel Wheel	
Lateral	1.143mm
Radial	1.015mm
Wheel Assembly (Radial and Lateral)	
Off vehicle	1.27mm
On vehicle	1.52mm
Wheel Stud	0.25mm
Wheel hub	0.130mm

0.3.2 Diagnostic Information and Procedures

0.3.2.1 Diagnostic Information and Procedures

This section describes the techniques and procedures for correcting the following types of vibrations:

- Tire and Wheel Waddle
- Launch shudder
- Exhaust groan
- Engine ignition frequency
- Drive System Vibrations

Problem Identification

Note: DO NOT attempt to repair a normal condition, or the customer will probably be convinced that the vehicle has a problem. Customer satisfaction becomes extremely difficult after this point.

The first step in diagnosing a vibration concern is to identify the exact vibration that concerns the customer.

Test-drive the vehicle with customer, compare and explain the conditions before the customer.

Sometimes the vibration can be duplicated at a given speed. Other vibrations may not be as evident and may require further troubleshooting by performing a road test with the customer in the vehicle in order to determine the specific vibration complaints.

Ask the following questions when attempting to identify a vibration complaint:

- At what speed is the vibration the worst?
- Do you feel the vibration? If so, where is the vibration?
- Do you hear the vibration? If so, what does the noise sound like?
- Does the engine or the vehicle load affect the vibration?
- Does the vibration occur in more than one gear range?
- When did the vibration first appear?

The answers to these questions will help in duplicating and diagnosing the vibration.

If you suspect that the vibration is normal, compare the vibration with a vehicle that is equipped in the same way, including the following factors:

- Body Style
- Engine option
- Engine drive accessories
- Transmission type
- Tire size
- Suspension type
- Drive axle ratio

Removal Method

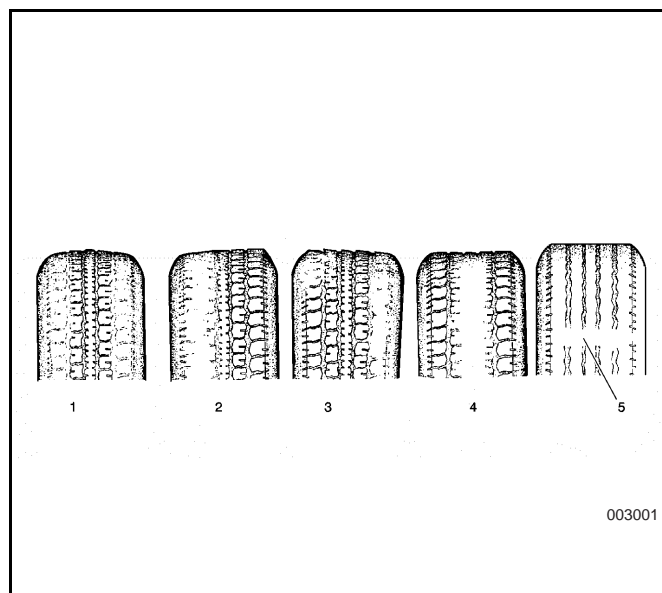
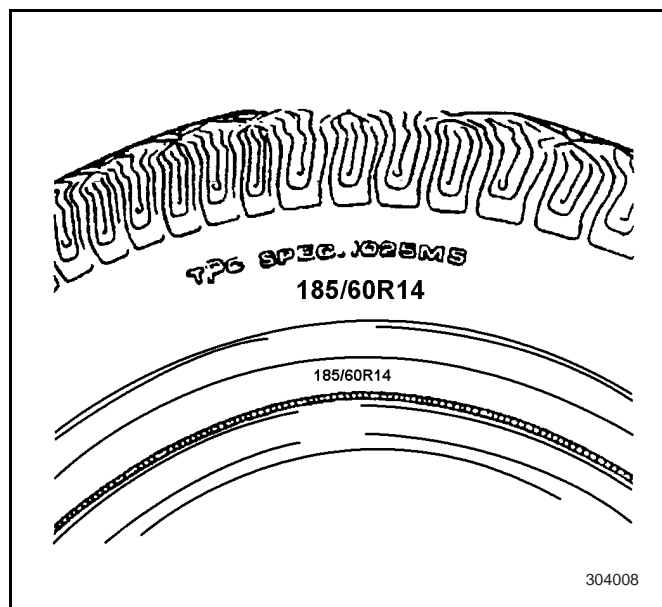
You must understand a few basic concepts before attempting to diagnose a vibration. As in any diagnostic process, you must perform the following steps:

- Gather the information
- Read the information
- Make your correction based on the results

Road test the vehicle and inspect the vehicle in a manner which systematically eliminates different components. This process supplements the information which you have received from the customer concerning the complaint. Focus on the non-eliminated part in order to speed up the repair work, and improve the efficiency.

0.3.2.2 Tire and Wheel Check

The tires on all new production models have a tire performance criteria (TPC) rating number molded on the sidewall. The TPC rating will appear as a 4-digit number preceded by the letters TPCSPEC on the tire wall near the tire size. A replacement tire should have the same TPC rating.



Tire Wear

Legend:

- (1) Hard steering/under inflation
- (2) Improper alignment/insufficient rotation
- (3) Improper alignment/unequal tire inflation
- (4) Heavy acceleration/over inflation
- (5) Wear Indicator

Inspect tire and wheel assembly for the following conditions:

- Abnormal wear, such as concave, flat spots and tire bead and tire edge wears
- Proper inflation pressure
- Bulges in the sidewalls
- Rim flange is bent

By inspecting these characteristics of the tire and wheel assemblies, you may discover the cause of the vibration. The inspection will also provide assurance that the vehicle is safe for road testing.

0.3.2.3 Road Test

Road test's purpose

Note: DO NOT attempt to repair a normal condition, or the customer will probably be convinced that the vehicle has a problem. Customer satisfaction becomes extremely difficult after this point.

The purpose of road testing is to duplicate the vibration. Most importantly, road testing will determine whether the vibration is related to the engine speed or to the vehicle speed.

In order to complete a quick and accurate road test, install an engine tachometer (such as a scan tool) and the Electronic Vibration Analyzer (EVA) in the vehicle. Place the EVA vibration sensor in a location where the customer's concern can be felt.

Determining the component group

After you have related a vibration to either the engine speed or to the vehicle speed, break the vibration down further in order to fit into one of the following groups of rotating components:

- Engine, clutch disc, transmission flywheel and transmission torque converter
- Transmission output shaft, propeller shaft, rear axle differential pinion
- Tire, wheel, wheel hub, brake drum and brake rotor

These three groups represent the major areas that can produce vibration complaints. The components in each group are related to each other because the components are either bolted or splined together. This means that each group of components rotates at the exact same speed.

These component groups can be broken down further in order to identify the exact component responsible for the disturbance. Focus on the testing in order to find the cause and avoid the unnecessary replacement of parts.

Perform a road test for all vibration complaints unless the disturbance occurs only with the vehicle at a standstill.

Types of road test procedures

Caution: Refer to Road Test Caution in Cautions and Notices.

Note: Before performing any road test, inspect the tires and wheels. Refer to Tire and Wheel Check

The following road test procedures are the most informative and the most used:

- Slow acceleration test
- Neutral coast-down test
- Downshift test
- Neutral run-up test
- Brake torque test
- Steering input test
- Standing start acceleration test

These road tests will help to pinpoint the vibration. Perform all of the tests on a smooth, level road.

Slow acceleration test

This test will be used to determine all the vibration conditions, unless the disturbance occurs with the vehicle at a stand still.

This road test can be used to identify the conditions related to the engine speed or the vehicle speed. Additional tests may be necessary in order to determine the exact cause of the vibration.

Caution: Refer to Road Test Caution in Cautions and Notices.

1. On a smooth, level road, slowly accelerate up to highway speed.
2. Verify the vibration that meets customer complaint.
3. Observe the following readings where the disturbance occurs:
 - Vehicle speed, km/h
 - Engine Speed (rev/min)
 - Frequency

Neutral coast-down test

Caution: Refer to Road Test Caution in Cautions and Notices.

1. This test will be used to determine all the vibration conditions, unless the disturbance occurs with the vehicle at a stand still.
2. Shift the vehicle into neutral and coast down through the vibration range.

Observe whether the vibration is present in NEUTRAL gear.

If the vibration still occurs in NEUTRAL gear, then the vibration is definitely sensitive to vehicle speed. At this point, the following components have been eliminated as a cause of the vibration:

- Engine
- Torque converter
- Transmission flywheel

Depending on the symptoms or the frequency, the repair will concentrate on one of the following components:

- Tire and wheel assembly
- Torque converter output shaft
- Rear axle differential pinion
- Rear drive axle or rear driven shaft

Downshift test

Caution: Refer to Road Test Caution in Cautions and Notices.

1. This test will be used to determine all the vibration conditions, unless the disturbance occurs with the vehicle at a stand still. On a smooth, level road, accelerate to the speed at which the concern vibration occurs. Observe the engine speed.
2. Decelerate and safely downshift to the next lower gear.
3. Operate the vehicle at original engine speed.

If the vibration returns at the same engine RPM, the following conditions are the most possible causes of the vibration:

- Engine driven accessories
- Engine
- Transmission flywheel
- Torque converter

Repeat this test in lower gears, and in NEUTRAL gear, in order to confirm the results.

In some cases, a vibration may also be sensitive to torque or engine load, as well as being related to a specific engine speed or vehicle speed. These vibrations can be most difficult to diagnose, and require additional testing. The system method can usually be used to find out the conditions.

Neutral run-up test

This test is designed to identify vibrations which are related to the speed of the engine. Use this test when the customer has a concern with vibration at idle, or as a follow-up to the downshift test. This test probably does not apply when the complaint is related to vehicle speed only (appearing at the same vehicle speed regardless of the engine speed).

Caution: Refer to Road Test Caution in Cautions and Notices.

1. Slowly increase the engine speed while looking for disturbances that match the customer's concern.
2. Observe the engine speed and the frequency where the vibration occurs.

Brake torque test

This test is designed to identify engine-related vibrations that were not uncovered with the Neutral Run-up test. This test also works for vibrations that are sensitive to engine load or to torque. This test will probably not apply to vibrations which are related only to the speed of the vehicle.

Caution: Refer to Road Test Caution in Cautions and Notices.

1. Apply parking brake.
2. Lift the front of vehicle, allowing front wheels away from the ground.
3. Start the engine and allow it to idle.
4. Depress the brake pedal, and apply the braking.
5. Place the transmission lever in DRIVE position.
6. Slowly increase the engine speed while looking for disturbances that match the customer's description.
7. Observe the engine speed and the frequency where the vibration occurs.

8. If necessary, place the vehicle in REVERSE gear and repeat Steps 5 and 6.

Additional Test

One or more of the following tests maybe necessary for some unique vibrations, which are the customer 担 concerns and are either torque/load sensitive in addition to vehicle speed or engine rpm sensitive.

- Steering input test
- Standing start acceleration test

Steering input test

This test is intended to determine how much the wheel bearings and other suspension components contribute to the vibration, especially a vibration relating to noise, such as growl, grinding, and roaring.

Caution: Refer to Road Test Caution in Cautions and Notices.

1. With the vehicle at the vibration speed, drive through slow sweeping turns, first in one direction and then in the other direction.
2. If the vibration gets worse or if the vibration goes away, inspect the following components as possible causes of the vibration:
 - Wheel bearing
 - Wheel hub
 - Tire tread
3. The CV joint angle increases when the vehicle is turning. On front wheel drive and four wheel drive vehicles, CV joint condition systems may appear when the angle increases. Putting a load on the CV joint may increase the vibration amplitude. The third order, tire speed related amplitude would remain the same.

Standing start acceleration test

The purpose of this test is to duplicate a vibration called launch shudder. In some cases, a powertrain mount or an exhaust ground-out may also be the cause of the vibration, depending upon the symptoms.

Caution: Refer to Road Test Caution in Cautions and Notices.

1. With the vehicle at a full stop and remaining at the gear, remove the foot from the brake pedal.
2. Accelerate to 48~64 km/h while looking for vibrations that match the customer's description.

Other possible causes of launch shudder include the following:

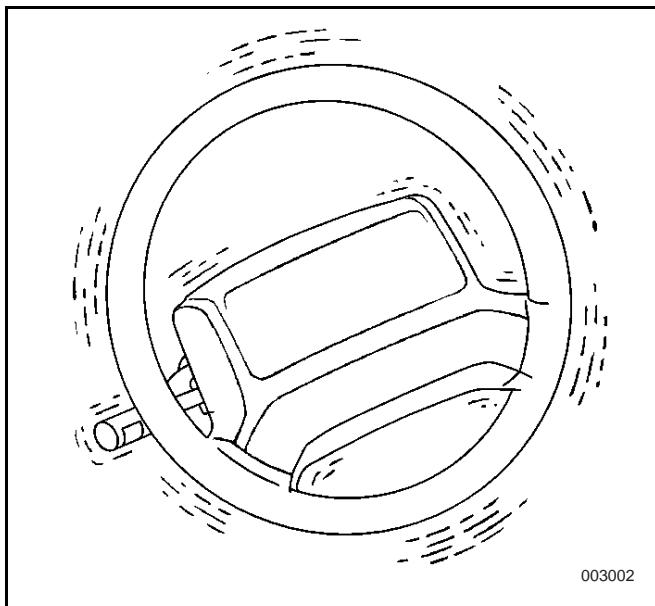
- A worn or damaged drive axle CV joint
- A rubber pad ground-out through the engine or transmission mounts
- A condition to exhaust pipe suspension hanger rods and mounts

0.3.2.4 Types of Vibration

The next step after road testing the vehicle is to identify the frequency of the duplicated and abnormal vibration. Use the EVA in order to measure the frequency. If the EVA is not available, observe how the vibration feels or sounds. Most of the vibrations belong to one of the following categories.

- Vibration that can be felt:
 - Shake
 - Vibration
 - Buzzing vibration
 - Tingle vibration
- Vibration that produces noise:
 - Boom
 - Groan
 - Yell
 - Whine

Vibration that can be felt with shake:



Shake is a low frequency vibration, typically 5-20 Hz. Shake is sometimes felt in the steering wheel, the seat, or the console. The best description is the feeling from an out-of-round or unbalanced tire. Customers may refer to a shake in one of the following terms:

- Shimmy
- Swing
- Tremble
- Wobble
- Hop

In most cases, shake is caused by damage or wear to the following components:

- Tire

- Wheel
- Brake rotor
- Tie rod end
- Suspension ball joint
- Engine

Jounce

The vibration frequency of jounce is slightly higher than shake, usually 25-50 Hz. Roughness of jounce is similar to the feeling you get from holding a jigsaw.

Surge

The surge frequency is slightly higher, usually 50-100 Hz. Vibration of surge is similar to the feeling you get from a electric shaver. You may feel it in your hands through the steering wheel, in your feet through the floor, or in the seat. Inspect the following components for possible condition causes:

- Exhaust system
- A/C Compressor
- Engine

Shimmy

This is the highest vibration frequency that you can feel. Shimmy sometimes may produce the feeling of acupuncture. Customers may say the vibration creates numbness in their hands or feet.

0.3.2.5 Vibration that produces noise

Boom

Boom is a low frequency interior noise of 20-60 Hz. Sometimes the customers complain of a pressure in their ears. The noise is similar to the noise of a bowling ball rolling down an alley, deep thunder, or a bass drum.

A customer may use the following words to describe boom:

- Droning
- Growling
- Moaning
- Roaring
- Rumbling
- Humming

Boom may be accompanied by a perceptible vibration.

Moaning or Droning

Moan or drone is a sustained tone at a low frequency of 60-120 Hz, somewhat higher than boom. The noise is similar to a bumble bee or blowing air across the top of a soda bottle. Examples of similar noises include the sound of a blowing air across the top of a carbonated

water bottle. A customer may use the following words to describe moan or drone:

- Humming
- Droning
- Resonance

Moan or drone may be accompanied by a perceptible buzzing vibration.

Inspect the following system:

- Powertrain mount
- Exhaust system

Howl

Howl is a noise at mid-range frequency of 120-300 Hz. The sound is similar to the sound of the wind howling

Whine

Whine is a prolonged, high-pitched sound in the 300-500 Hz range. Whine is usually related to the meshing gears or gear noise. Similar sounds include mosquitoes, turbine engines, and vacuum cleaners.

0.3.2.6 Matching Frequency to Component RPM

At this point in the diagnosis, the vibration has gone through the following analysis:

- The vibration has been duplicated.
- The vibration has been determined as unusual.
- The vibration is related to the engine speed or the vehicle speed.
- The vibration has been assigned a frequency from the Electronic Vibration Analyzer (EVA) or identified based on its feel or its sound.

Vehicle vibration is usually related to the component RPM. Calculate the speed of these components using either an engine speed method or a vehicle speed method. Use the engine to diagnose the vibrations that are sensitive to engine speed.

If the vibration is sensitive to vehicle speed, determine the rotational speed of the tires. As long as you operate the vehicle at a constant speed, the tires will operate at a constant speed. This speed is measured in rotations, or cycles per second. The reading is then compared to the frequency of the vibration, which is also measured in cycles per second.

Calculating Tire Rotation with the EVA.

The EVA program is designed to perform targeted frequency calculations on a suspected vibration source. The tire size, axle ratio, number of cylinders, vehicle speed and engine rpm are factored into a calculation that determines the predominant vibration frequency, amplitude and the suspected vehicle system producing the vibration.

1. Use the EVA to determine the speed at which the vibration occurs.
2. From the EVA main menu, select Auto Mode, then press enter; select Vehicle Speed, then press enter.
3. Enter the vehicle tire size information with one of three options:
 - RPS at 5 mph __ Refer to the Tire/Speed table below for the Hertz value at 8 km/h for that tire size.
 - Database __ Select the tire type and tire size from each selection screen. Hint: when browsing the tire size or axle ratio list, press a number key to go to a related point in the list; for example, press 1 to go to the top of the list; press 4 or 5 to go to the middle of the list; press 9 to go to the bottom of the list.
 - Enter the tire width (100-500 mm), aspect ratio (0.30-1.50) and rim diameter (10.00-25.00 in).
4. Enter the driveshaft configuration (skip Step 5 if vehicle is front wheel drive).
5. Enter the axle ratio, refer to the Axle Ratio screen or table below, (2.00-9.00) from the Axle Ratio selection screen. Axle Ratio is not applicable if front wheel drive (FWD) is selected.
6. The vehicle speed is chosen in kilometres per hour (km/h).
7. Enter the vehicle speed at which the vibration is felt.
8. As the test is run, the vehicle speed must be manually adjusted to match the actual vehicle speed:
 - Select the incremental step you want to increase/decrease vehicle speed, then press enter.
 - View the frequency ranges applicable for the speed selected, press enter to go to the active data screen or exit to go back one screen.
 - Press the arrow UP or DOWN key to adjust the on-screen RPM on the active data screen to match the actual engine RPM.
9. Data is displayed as average or instantaneous. Press average (avg) key to toggle. The amplitudes of the vibrations detected are displayed in descending order beginning with line 2. Repair the strongest vibration first. One to three sources of vibration are identified:
 - TIRE 1, 2, or 3 (1st, 2nd, or 3rd order tire/wheel system concern).

- Propeller Shaft 1 or 2 (Propeller shaft problem)
 - Overlap (overlap of Tire 3 and Prop 1 frequencies).
 - Unknown (vibration source is unknown).
10. Data is received through input A (A is displayed) or B (B is displayed). Press key 4 to toggle.
 11. The vehicle speed (V) is measured in mph or km/h for display. Press the down or up key to manually adjust this figure to match actual vehicle speed.
 12. An identification letter symbol displays during record or playback.
 13. During record or playback the event and frame numbers are displayed. If an event is not selected, a question mark (?) appears. During record or playback the frame number cycles from 0 to 9; for example, 0:0, 0:1, 0:2-0:9.
 14. Amplitude of the signal is displayed in number of G forces (G)

Tire/Speed

Tire size	Tread Type	Vehicle Usage	RPM 8km/h vehicle speed
185/60R14	ALS	S (China)	1.07

0.3.2.7 Steering and Suspension Assembly Vibrations

Steering and suspension assembly vibrations are the first level of testing for low-frequency vibrations that are sensitive to vehicle speed. The symptoms of a steering/suspension first-order vibration are a shimmy or a shake. This is usually felt in the steering wheel or in the seat. Inspect the following parts for wears or damage:

- Tie rod end
- Suspension ball joint
- Tire
- Wheel and engine

0.3.2.8 Brake Rotor/Drum Imbalance

There is not a set tolerance for brake rotor and brake drum. However, any brake rotor or drum imbalance which is over 21 g may have the potential to cause or contribute to a vibration. Inspect the rotor and the drum for imbalance using either the on-vehicle or the off-vehicle method.

Inspect the brake rotor/drum imbalance (on-vehicle).

1. Use the proper lifter to support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Remove the wheel assembly. Refer to Wheel Replacement in Tires and Wheels.

Caution: Refer to Stall Test Caution in Cautions and Notices.

3. Reinstall the wheel, and turn an angle.
4. Run the vehicle at the complaint speed while inspecting for the vibration.
5. If the vibration still exists, perform the following steps:
 - 5.1 Replace the brake rotor/drum.
 - 5.2 Resume to the complaint speed and run the vehicle.
6. If the vibration has been eliminated, perform the following steps:
 - 6.1 Remove a pair of brake rotor/drum at a time
 - 6.2 Perform the vibration test for each rotor/drum.
 - 6.3 Replace the rotor/drum that is causing the imbalance.
 - 6.4 Inspect the balance of the new rotor/drum.

Inspect the brake rotor/drum (off-vehicle).

1. Measure the diameter and the width of the rotor/drum.
2. Mount the rotor/drum on a balancer in the same manner as a wheel.

Note: Inspect the static balance of the rotor/drum only. Ignore the dynamic imbalance reading.

3. Inspect for static imbalance.
4. If the rotor/drum shows imbalance, replace the rotor/drum.
5. Before mounting the brake rotor/drum onto the vehicle, inspect the dynamic balance of the new brake rotor/drum.

0.3.2.9 Front Wheel Drive Vibrations

The front wheel propeller shaft has the following characteristics:

- Front wheel propeller shaft is short.
- Front wheel propeller shaft has a CV joint.
- The mass of front wheel propeller shaft is light.
- Front wheel propeller shaft turn or spin at a lower rate of speed than rear wheel propeller shaft.

Although front wheel drive runs more smoothly than rear wheel drive, the following conditions may occur, and need to be diagnosed and eliminated:

- Launch shudder
- Three vibrations related to the tire
- Growling noise
- Clicking noise or shudder during turns

Launch shudder

Launch shudder is a shaking sensation that is felt in the steering wheel and/or the front of the vehicle during moderate to heavy acceleration from a standing start. Launch shudder may also be a rocking back-and-forth motion in the vehicle during acceleration.

On the vehicle with manual transmission, launch shudder can be caused by the following conditions:

- Clutch disc performance is poor
- Clutch operating mechanism has not been adjusted well.
- The driver does not operate the clutch pedal correctly.

On front-wheel-drive vehicles, launch shudder can be caused by the following conditions:

- Inner tripod universal joint is worn or damaged.
- The inner universally jointed shaft angle is excessive.

Excessive inner tripod joint angle is usually caused by the over adjustment of front trim or suspension spring height, and the damaged or misaligned engine suspension may also produce the following conditions:

- The universal joint angle is excessive.
- Launch shudder

During fast acceleration, the front suspension height is raised by the high torque of the vehicle powertrain. When the front suspension height rises, the inner tri-pod angles increases and can cause a launch shudder condition if one of the following conditions are present.

- The joints are worn.
- The angles are already excessive before acceleration.

Because the inner tri-pot joint is usually the cause of launch shudder, the disturbance is typically related to third-order tire rotation frequency.

1. Identify the type of disturbance.
2. Visually inspect the drive axles for worn or damaged inner joints.
3. If you detect no obvious problem, measure the trim or spring height in order to determine if the suspension is causing an excessive joint angle.

Do not measure the body height. Body height measurements are not used because potential sheet metal variations could lead to mis-diagnosis of the

problem cause. For methods of measurement refer to the Suspension section in Service Manual.

4. If the spring height is out-of-specification, place sandbags under the following locations in order to lower the suspension: Under the hood or over the strut towers.

Caution: Refer to Road Test Cautions in Cautions and Notices.

5. Road test the vehicle, adding sandbags until you eliminate the disturbance.
6. In order to lower the suspension, measure the spring height in order to determine the required springs to install.

Each vehicle line has multiple spring options with different spring rates. You can achieve approximately 10 mm of suspension height change by dropping down one spring code. You can locate the spring codes in the following areas:

- On the springs
- On the SPID label in the vehicle

Note: Always replace the springs in matching sets in order to insure correct body levels and proper suspension performance. You can find the list of available springs in the parts catalog.

Third-Order Tire-Related Vibrations

Tri-pot joints are so named because of their design characteristics. Tri-pot or tri-potal joints have three trunnions (or a trilobal spider assembly) that fit into a race or a cup. The assembly moves in and out freely in order to compensate for drive axle length changes during suspension travel.

Although worn or damaged inner tri-pot joints can cause launch shudder, worn or damaged inner tri-pot joints may also cause vehicle speed-related, third-order tire vibrations. Third-order tire-related disturbances can occur if the following conditions are present:

- The joint becomes worn or damaged.
- The joint has excessive free-play or lash.

The worn joint creates three disturbances per revolution of the axle shaft. Because the axle shaft turns at the same rate as the wheel, third-order tire-related vibrations will result.

Growling (Wheel Bearing) Noise

Front-wheel-drive (FWD) hub and bearing assemblies can make a low, growling noise that increases with the vehicle speed. The tires and the bearings can make a similar noise. The tires and the bearings can make a similar noise.

In order to differentiate between tire noise and bearing noise, drive the vehicle in a straight line and perform several turning maneuvers side-to-side. If the noise level increases during a right-hand turn, then the left-hand wheel bearing generally is causing the

problem. The opposite is true for a left-hand turn. If a bearing and not the tires is the cause of the disturbance, the noise level increases when turning because an added load is applied to the bearing with the fault. The opposite is true for a left-hand turn. If a bearing and not the tires is the cause of the disturbance, the noise level increases when turning because an added load is applied to the bearing with the fault.

Clicking Noise or Shudder During Turns

A clicking noise or a shudder during vehicle turns is usually a symptom caused by one of the following conditions:

- A worn or damaged outer constant-velocity (CV) joint
- A worn or damaged outboard CV joint

During a visual inspection of the drive axle, look for a damaged boot on the outer CV joint. A damaged boot can allow water and other contaminants such as dust and dirt to compromise lubrication and prematurely destroy the joint. The CV joint will no longer function smoothly, causing the disturbance.

0.3.2.10 Tire and Wheel Vibration

Tire and wheel assembly vibrations are the next level of testing for low-frequency vibrations that are sensitive to vehicle speed. The tires, the wheels, the brake rotors, and the wheel hubs should be systematically tested, according to the symptoms.

First-Order Tire and Wheel Assembly Vibration

The following are symptoms of first-order vibrations caused by tire and wheel assemblies:

- The vibration is always related to the speed of the vehicle.

If the vibration is affected by the speed of the engine, or if the vibration is eliminated by placing the transmission in Neutral, the vibration is NOT related to the tire and wheel assemblies.

- The vibration will feel like a shake, usually in the steering wheel or the seat.
 - Tire and wheel vibrations that are felt in the steering wheel are most likely related to the front tire and wheel assemblies.
 - Tire and wheel vibrations that are felt in the seat or the floor are most likely related to the rear tire and wheel assemblies.

This may not always hold true, but this is a general rule that may serve to initially isolate a problem to the front or the rear of the vehicle.

- The customer may complain of a waddle at low speeds of 856 km/h (535 mph).

- The frequency on the EVA will correspond to the first-order of tire rotation. This frequency will usually be in the 10-20 Hz range, depending on the speed of the complaint and the size of the tire. The smaller the tire, the faster the tire will rotate at any given speed.
- The range of the human ear begins at 20 Hz. For this reason, first-order tire vibrations rarely produce noise. The exception is when the tires display an irregular tread pattern or flat spots. This causes a growling or a slapping noise.

Tire Runout Measurement

Correct the runout problem first, because the runout of a tire/wheel assembly will directly affect the amount of imbalance and radial force variation. As the amount of runout decreases, imbalance and force variation also decrease.

Note: Before measuring or attempting to correct excessive runout, carefully inspect the tire for an uneven bead seat. The distance from the edge of the ring to the concentric rim locating ring should be equal around the entire circumference. If the beads are not seated properly, remount the tire. Otherwise excessive runout and imbalance may result. You can correct radial and lateral runout at the same time. Two methods are available for measuring runout of the tire/wheel assemblies:

- On the vehicle
- On the vehicle

Make an initial on-car visual inspection prior to performing the off-car runout tests. Measuring the tire/wheel runout off the vehicle is the easier method for the following reasons:

- A dial indicator can be more easily mounted in the correct location.
- The chance of water, snow, dirt, or slush getting on the dial indicator is decreased.

Once you have measured and corrected the runout off the vehicle, a quick examination of runout on the vehicle will indicate if any further problems exist. If the off-vehicle measurement differs significantly from the on-vehicle measurement, the runout problem is due to one of the following:

- Stud circle runout
- Hub flange runout
- A mounting problem between the wheel and the vehicle. Proceed to Wheel Hub/Axle Flange Runout, and Wheel Stud (Stud Circle) Runout procedures.

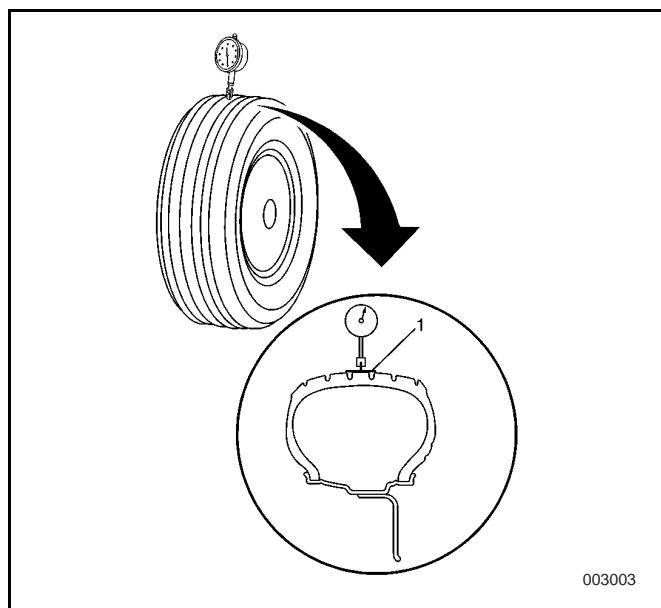
Measuring Tire Runout

If a vehicle sits in one place for an extended period of time, flat spots may develop at the point where the tires rest upon the ground. These flat spots will affect the

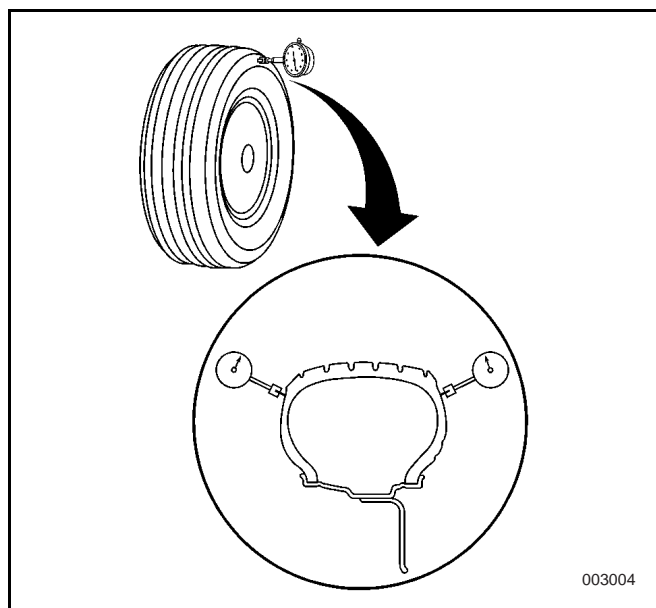
runout readings. Before you take any runout measurements, eliminate these flat spots by driving the vehicle long enough to warm up the tires.

1. Lift the vehicle on a hoist or support the vehicle with jackstands. Refer to Lifting and Jacking the Vehicle in General Information.
2. In order to get an initial indication of how much runout exists, spin each tire and wheel on the vehicle by hand. You may also use the engine at a slow speed in order to drive the wheels. Visually inspect the amount of runout from the front or the rear.
3. Mark the location of each tire/wheel assembly in relation to the wheel studs and to their position on the vehicle for future reference.
4. Remove the tire/wheel assemblies one at a time. Mount each assembly on a spin-type wheel balancer. Locate the tire/wheel assembly on the center pilot hole.
5. For lateral runout place the dial indicator in a smooth area on the tire sidewall as close to the tread as possible.

Radial Tire Runout



Lateral Tire Runout



Measure the tire/wheel assembly runout as shown in the figure.

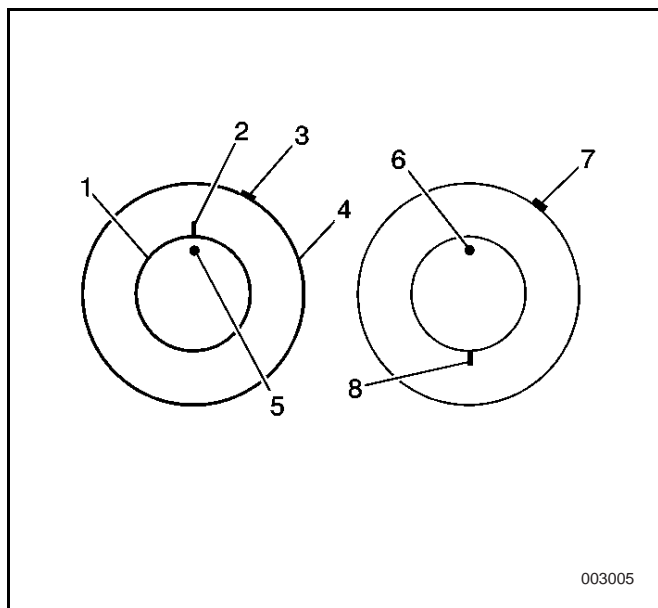
For radial runout, wrap the outer circumference with tape. This allows for a smooth reading from the dial indicator.

Ignore any jumps or dips due to sidewall splices. Use either of the following dial indicator sets with roller contact point J 23672 when applying this procedure:

J 23672

- J 8001 with a clamp-on base
 - J 7872 with a magnetic base
1. Load the indicator and slowly rotate the assembly one complete revolution.
 2. Set the indicator to zero on the low spot.
 3. Rotate the assembly one more complete revolution and note the total amount of runout indicated. The maximum allowable assembly radial and lateral runout is 1.27 mm (0.050 inch) when measured off the vehicle and 1.52 mm (0.060 inch) when measured on the vehicle.

Vectoring

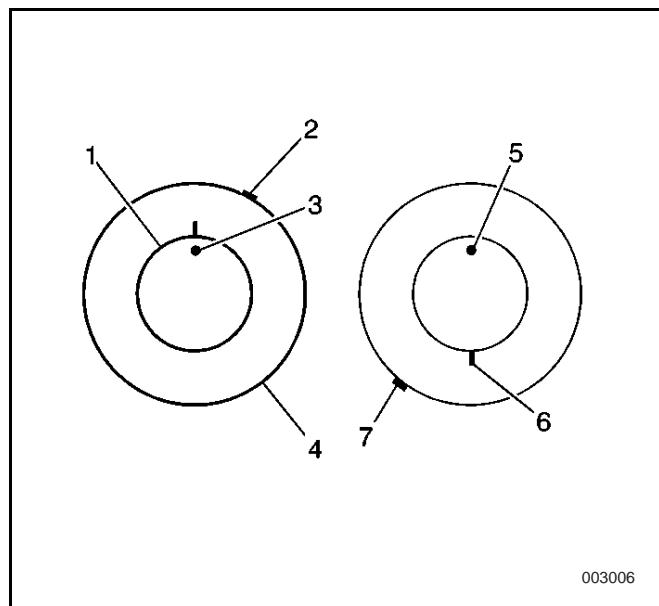


If the runout is excessive, mark the location of the high spot (3) and the low spot on the tire. Next, determine if the runout problem exists in the tire, the wheel, or a combination of both. Then, correct the problem. This procedure, called match-mounting or vectoring, uses the following steps:

Note: After replacing a tire or a wheel, remeasure the tire/wheel assembly runout in order to verify that the runout is within tolerance.

1. Place a mark (2) on the tire sidewall at the location of the valve stem (5). This mark is the 12 o'clock position. Always refer to the location of the high spot (3) in relation to its clock position on the wheel.
 2. Mount the tire/wheel assembly on a tire machine and break down the bead. Do not dismount the tire from the wheel at this time.
 3. Rotate the tire 180 degrees on the rim so that the valve stem reference mark (8) is now at the 6 o'clock position in relation to the valve stem (6) itself. You may need to lubricate the bead in order to easily rotate the tire on the wheel.
 4. Reinflate the tire and seat the bead properly.
 5. Mount the assembly on the tire balancer and remeasure the runout. Mark the new location of the runout high point on the tire.
 6. If runout is now within tolerance, no further steps are necessary. Balance and mount the tire on the vehicle. Refer to Balancing Tires and Wheels.
- If the clock location of the high spot remained at or near the clock location of the original high spot (7), the wheel is the major contributor to the

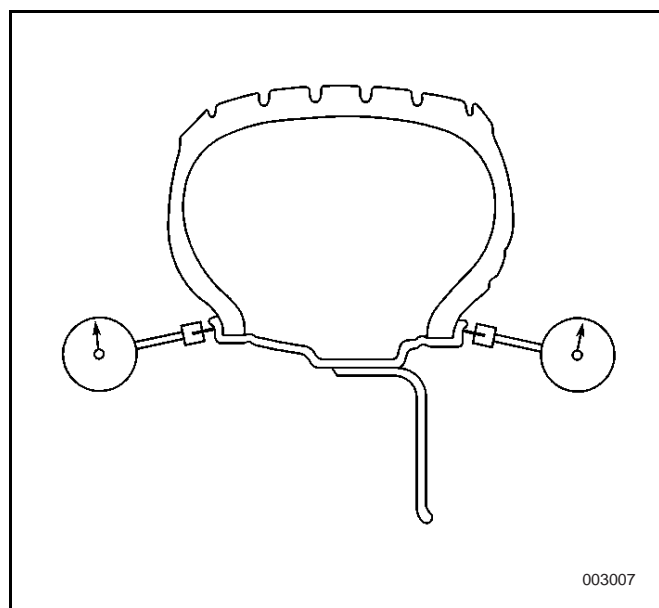
runout problem. Proceed to Wheel Runout Measurement.



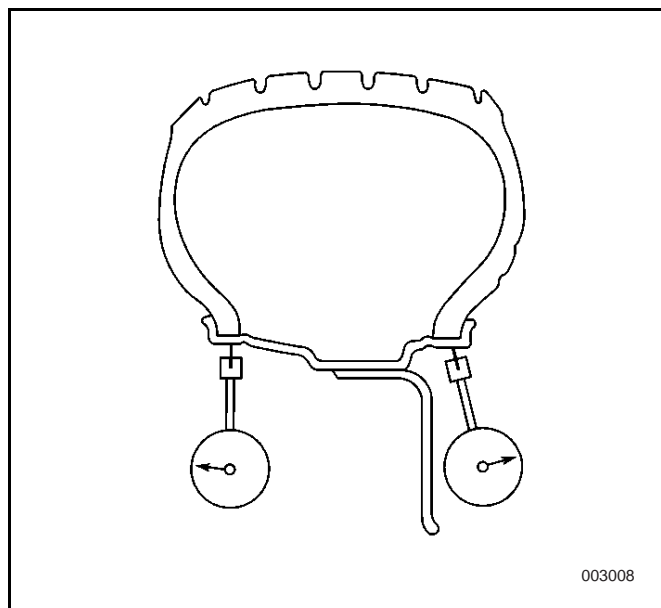
- If the high spot (7) is now at or near a position 180 degrees (6 hours) from the original high spot, the tire is the major contributor to the runout problem. Replace the tire.
- If the high spot is in between the two extremes, then both the tire and the wheel are contributing to the runout. Rotate the tire an additional 90 degrees (3 hours) in both the clockwise and the counterclockwise directions.

Wheel Runout Measurement

Lateral Wheel Runout



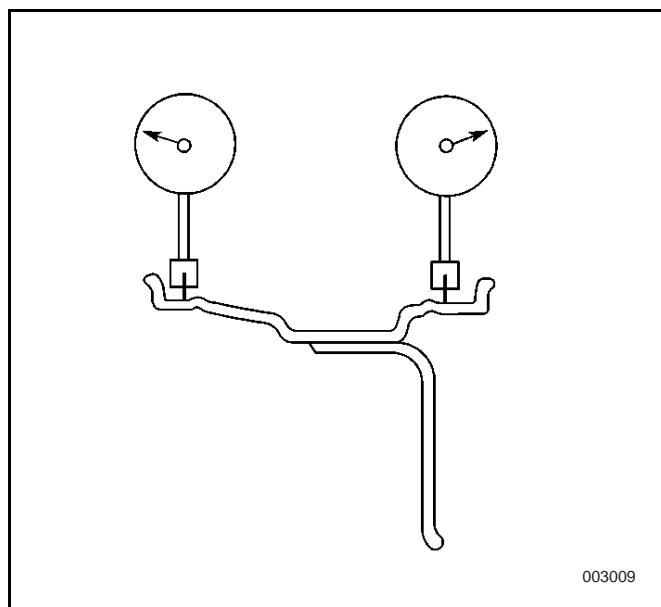
Radial Wheel Runout



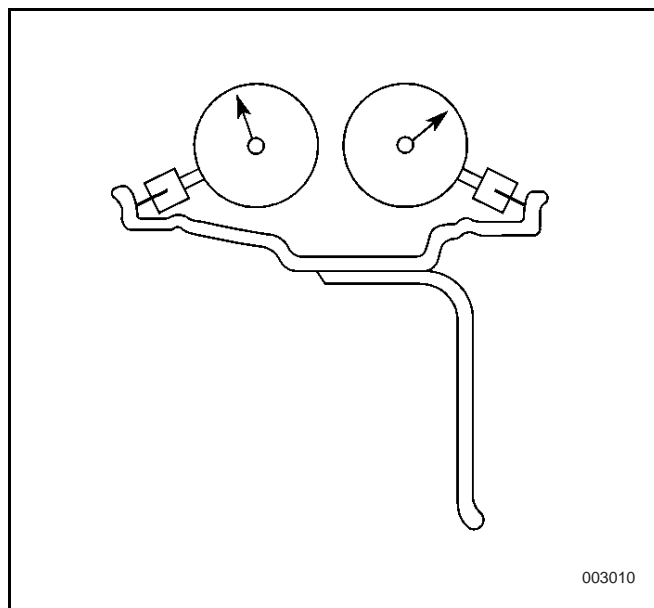
Complete the following steps if you cannot bring runout within tolerance by match-mounting:

1. Dismount the tire from the wheel.
2. Measure the radial wheel runout and the lateral wheel runout.

Radial Wheel Runout (Tire Removed)



Lateral Wheel Runout (Tire Removed)



You can measure rim runout more accurately on the inside bead area of the wheel. Measure wheel runout using the same procedure as tire runout. Ignore any jumps or dips due to paint drips, chips, or welds. Measure both the inboard flange and outboard flange as shown. The tolerances for wheel runout are as follows:

Steel Wheels

- Radial runout 1.015 mm
- Lateral runout 1.143 mm

Aluminum Wheels

- Radial runout .762 mm
- Lateral runout 1.143 mm

Note: Always measure the runout of new wheels. DO NOT assume that a new wheel is automatically good.

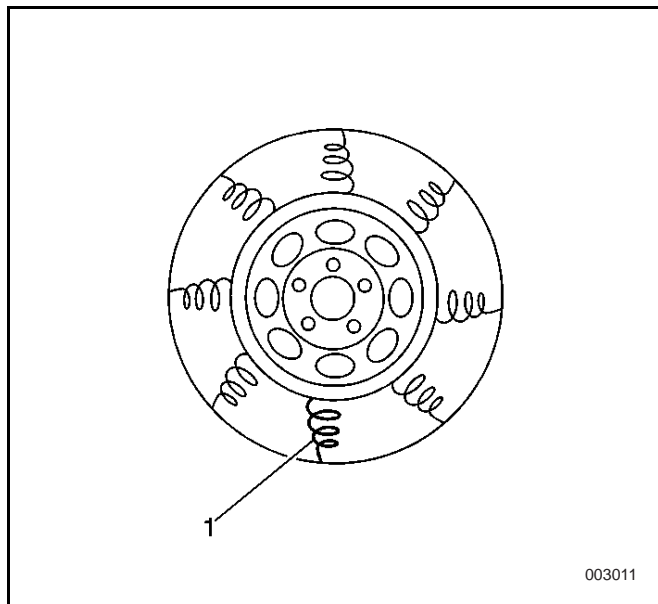
If the runout of the wheel is beyond the tolerance, replace the wheel. When replacing a wheel, refer to the wheel code that is stamped next to the valve stem. Cross-reference the letter code with the parts catalog. If the runout of the wheel is within tolerance, and the tire/wheel assembly runout cannot be reduced to an acceptable level by using the match-mounting technique, replace the tire.

Note: Always remeasure the tire/wheel assembly runout after you replace the tire. If you notice a large difference in runout measurements between on-vehicle testing and off-vehicle testing, the runout problem is due to one of the following:

- Stud circle runout
- Hub flange runout
- A mounting problem between the wheel and the vehicle.

The listed tolerances should serve only as a guideline. If runout measurements are within tolerance but are marginal, some sensitive vehicles may still be affected. Always reduce runout to as little as possible in order to attain optimum results under all conditions.

Radial Force Variation

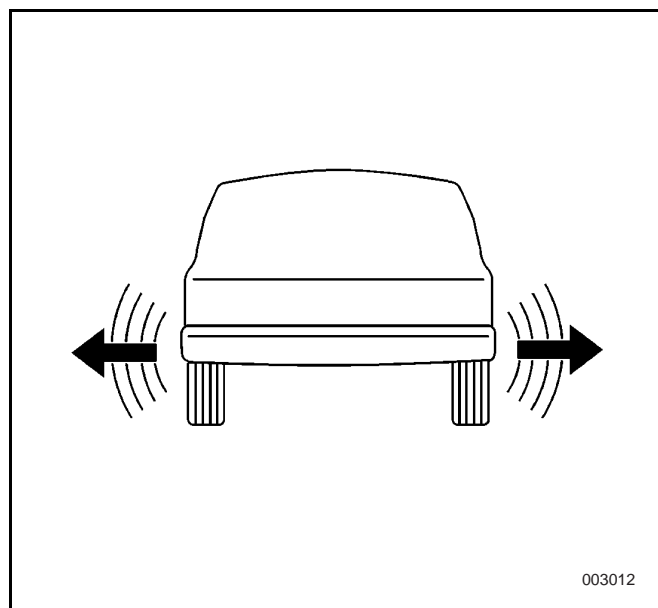


Radial force variation refers to the difference in the stiffness of a tire sidewall as the tire rotates and contacts the road. The tire and wheel assemblies have some variation due to splices in the tire plies. These splices do not cause a problem unless the force variation is excessive. These stiff spots in the tire can deflect the tire and wheel assembly upward as the assembly contacts the road.

If the tire has only one stiff spot, the spot will deflect the spindle once per each revolution of the tire and wheel assembly, thus causing a first-order tire/wheel vibration. If the tire has two stiff spots, the spots cause a second-order vibration. First-order and second-order tire/wheel vibrations are the most common as a result of radial force variation. Third-order, fourth-order, or higher are possible but rarely occur. Ensure that the tire and wheel assembly runout is at an absolute minimum. This is the most effective way to minimize the possibility of force variation as a factor in tire and wheel assembly vibrations. However, some tire and wheel assemblies exhibit vibration-causing force variation even though they are within runout and balance tolerances. These instances are becoming increasingly rare due to tighter tolerances and higher standards in manufacturing.

If you suspect force variation as a factor in tire and wheel assembly vibration complaints, substitute one or more known good tire and wheel assemblies.

Lateral Force Variation



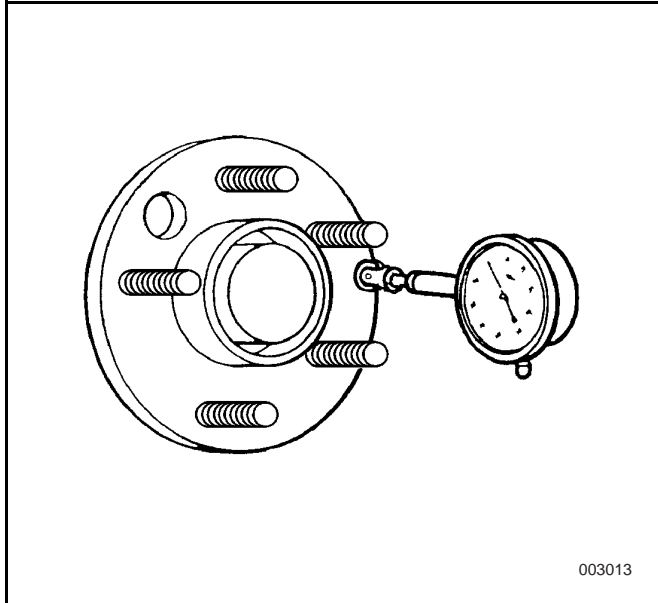
Lateral force variation tends to deflect the vehicle to the side, or laterally. Lateral force variation is based on the same concept as radial force variation. A snaky belt inside the tire may be the cause of lateral force. Test the vehicle with substitute tires before installing replacement tires.

A lateral force variation condition is rare. The best way to eliminate lateral force variation is to ensure that the lateral runout of the tire and wheel assemblies is at an absolute minimum.

The vehicle will wobble or waddle at slow speeds of 840 km/h (525 mph) when lateral force variation is excessive. This condition is usually related to the first-order of tire and wheel rotation.

Wheel Hub/Axle Flange Runout

When lateral runout occurs, inspect the wheel hub/axle flange runout if you are performing an on-vehicle test procedure, but not during off-vehicle testing. The tolerances provided are only guidelines.



1. Position the dial indicator on the machined surface of the hub, the axle flange, or the rotor outside of the wheel studs.
2. Rotate the hub in order to find the low spot.
3. Set the indicator to zero on the low spot.
4. Rotate the hub again and check the total amount of runout.

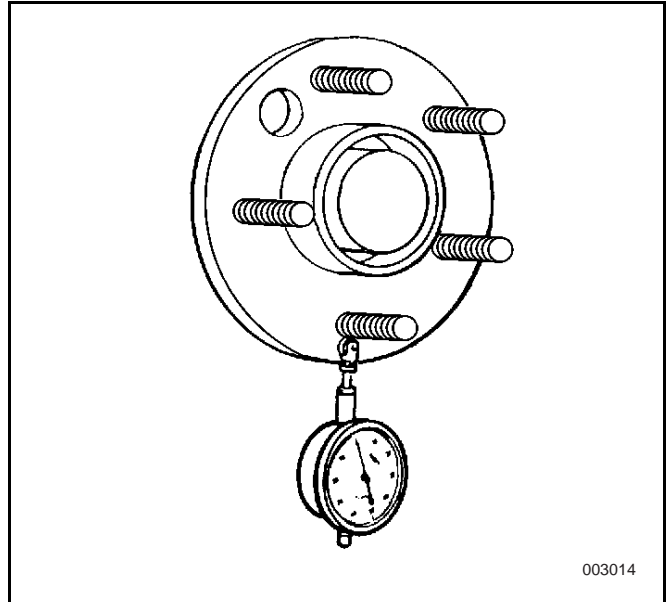
Specification (Guideline)

Runout tolerance: 0.127 mm

Wheel Stud Runout

Use the wheel stud runout procedure whenever the following conditions occur:

- The off-vehicle radial runout differs significantly from the on-vehicle radial runout
- Earlier attempts to correct the tire and wheel vibration condition have been unsuccessful



1. Position the dial indicator in order to contact the wheel mounting studs.
2. Turn the hub to register on each of the studs.
3. Zero the dial indicator on the lowest stud.
4. Rotate the hub again and check the total amount of runout.

Specification

Runout tolerance: 0.254 mm

0.3.3 Repair Instructions

0.3.3.1 Balancing Tires and Wheels

Caution: Failure to adhere to the following precautions before tire balancing can result in personal injury or damage to components:

- Clean away any dirt or deposits from the inside of the wheels.
- Remove any stones from the tread.
- Wear eye protection.
- Use coated weights on aluminum wheels.

Note: Use a known good, recently calibrated off-car two plane dynamic balancer. Use the finest balance mode available in order to perform a perfect balance of the assembly. The center pilot hole is the primary locator. Back cone mounting is recommended. If any assembly calls for more than 7.39 mm (1/4 ounce) on either rim flange, remove all balance weights and re-balance.

Tire and wheel balancers can drift out of calibration without warning, or can become inaccurate as a result of abuse. The balancer calibration should be inspected according to the manufacturer's requirements.

Tire Balancer Calibration Test

Note: Calibrate the tire balancer according to the manufacturer's recommendations, or use the following procedure.

1. Spin the balancer without a wheel or any of the adapters on the shaft.
2. Inspect the balancer readings.
3. Balance a tire and wheel assembly that is within radial and lateral tolerances to ZERO.
4. Add an 85 g (3 oz) test weight to the wheel at any location.
5. Spin the tire and wheel assembly again. Observe the readings.
 - In the static and dynamic modes, the balancer should call for 85 g (3 oz) of weight, 180 degrees opposite the test weight.
 - In the dynamic mode only, the weight should be called for on the flange of the wheel opposite the last weight.
6. With the assembly unbalanced to 85 g (3 oz), cycle the balancer five times.
7. Inspect the balancer readings.

Specification

Variation: 7 g or less

8. Index the tire and wheel assembly at four separate locations on the balancer shaft, 90 degrees apart.

9. Cycle the balancer with the assembly at each location.
10. Inspect the balancer readings.

Specification

Variation: 7 g or less

Tire Balancing Guidelines

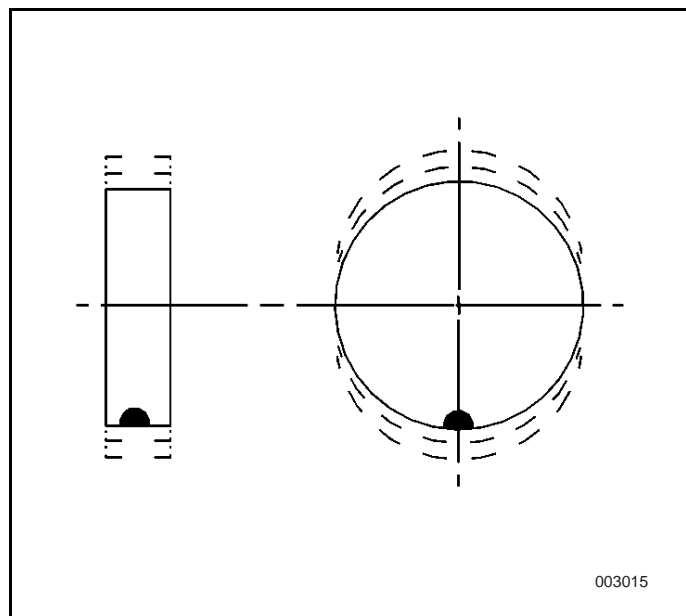
Static and dynamic balance are the two kinds of tire/wheel balance:

Static balance, also called single plane balance, affects the distribution of weights around the wheel circumference.

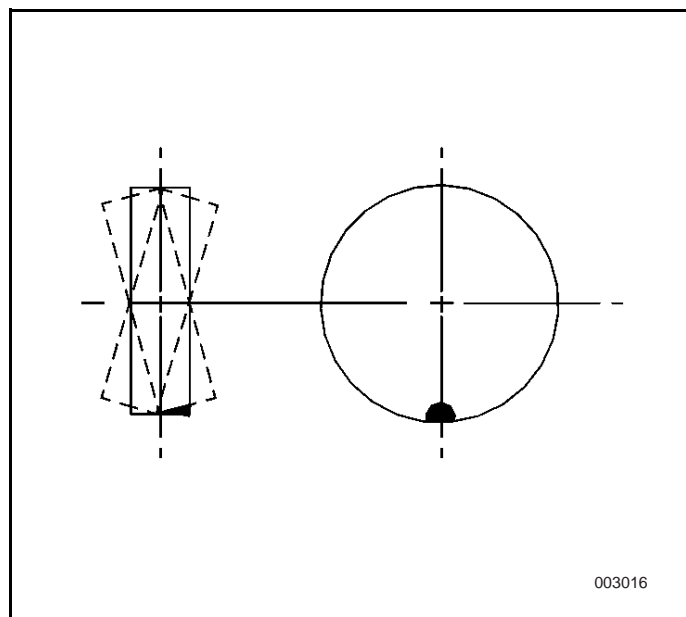
Dynamic balance, or two-plane balance, affects the distribution of weight on each side of the tire/wheel centerline.

Most off-vehicle balancers can check both types of balance simultaneously.

As a general rule, most vehicles are more sensitive to static imbalance than to dynamic imbalance. As little as 1421 g may induce a vibration in some vehicles. Vibration induced by static imbalance will cause a vertical, or bouncing, motion of the tire.



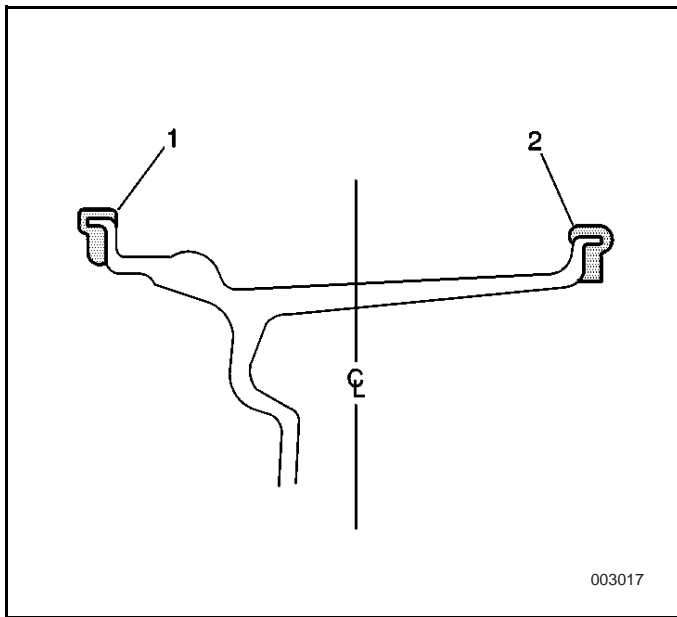
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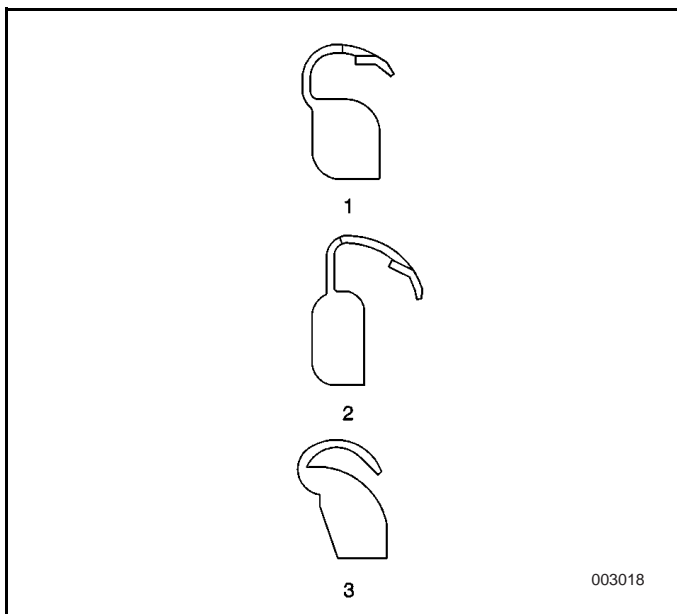
Dynamic imbalance results in a side-to-side motion of the tire, or shimmy.

- Balance all four tires as close to ZERO as possible.
- Carefully follow the wheel balancer manufacturer's instructions for proper mounting techniques for different types of wheels.
- Aftermarket wheels, especially those incorporating universal lug patterns, are potential sources of runout and mounting problems.
- Use the correct coated weights on aluminum wheels.
- Retest the tire and wheel assemblies for excessive runout after correction and installation.
- Evaluate the vehicle at the complaint speed and note if the vibration has been corrected.
- If the vibration is still present, or is reduced but still unacceptable, consider these possibilities:
 - On-vehicle imbalance
 - Radial or lateral force variation



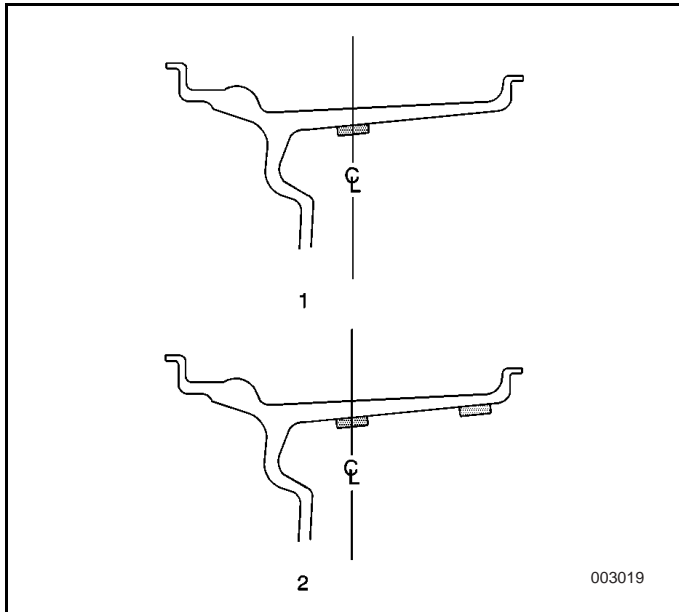
Wheel Weight Usage

Two methods for balancing wheels are the dynamic balancing method and the static balancing method. When using the dynamic balancing method, place the clip-on balance weights on the inboard rim flange (2) and the outboard rim flange (1) at the positions specified by the tire balancer. When using the static balancing method, place the weight on the inboard (2) flange if the weight is 28 grams (1 ounce) or less. If more than 28 grams (1 ounce) is required to balance the wheel, split the total weight required between the inboard rim flange (2) and the outboard rim flange (1).



Note: Special polyester-coated clip-on balance weights must be used on factory aluminum wheels. Polyester-coated wheel weights reduce the potential for corrosion and damage to aluminum wheels.

The two types of approved wheel weights are type MC(1) and type AW(2). Type P(3) wheel weights are for use on steel wheels and can not be used on aluminum wheels. The contour of the rim flange will determine which type of wheel weight should be used. The weight should follow the contour of the rim flange. Use a plastic-tipped hammer when installing polyester-coated wheel weights in order to avoid damaging the polyester coating.



Adhesive wheel weights (1,2) may also be used on aluminum wheels. Use the following procedure in order to install adhesive wheel weights.

1. Determine where the wheel weight is to be placed on the wheel.
2. Ensure that there is sufficient clearance between the wheel weights and the brake components.
3. Using a clean cloth or paper towel, wipe the area with a general purpose cleaner. Wipe the area again with a mixture of half isopropyl alcohol and half water in order to remove any remaining residue.
4. Dry the area with hot air until the wheel surface is warm to the touch.
5. Warm the adhesive backing on the wheel weight to room temperature.
6. Remove the protective covering in order to expose the adhesive tape on the wheel weight. Do not touch the adhesive tape.
7. Apply the wheel weight to the wheel. Press into place with hand pressure.
8. Secure the wheel weight to the wheel with a 90Newton (21 lb) force applied with a roller.

0.3.4 Description and Operation

0.3.4.1 Basic terminology:

Note: DO NOT attempt to repair a normal condition, or the customer will probably be convinced that the vehicle has a problem. Thereafter it is difficult to satisfy the customers.

The following are the two primary components of vibration diagnosis:

- The physical properties of objects
- The object's properties of conducting mechanical energy

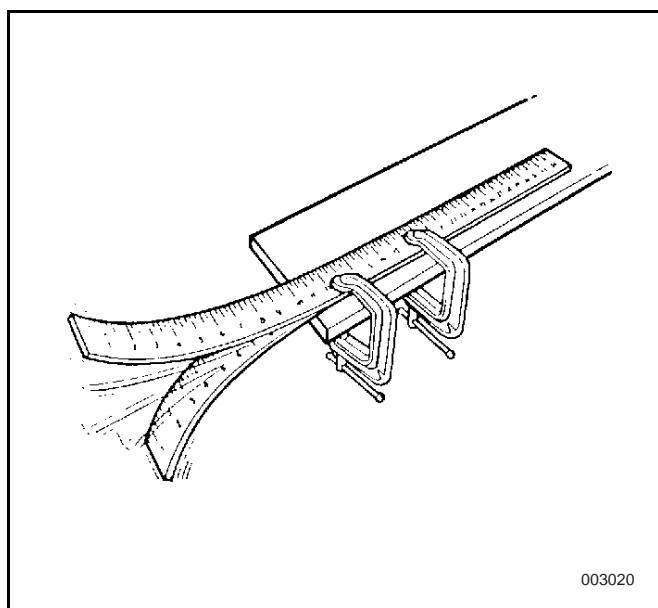
The repetitive up/down or back/forth movement of a component causes most customer vibration complaints. The following are the common components that vibrate:

- Steering Wheel
- The seat cushion
- Frame
- Dashboard

Vibration diagnosis involves the following steps:

1. Measure the repetitive motion and assign a value to the measurement in cycles per second or cycles per minute.
2. Relate the frequency to the rotational speed of a component that is operating at the same rate or speed.
3. Inspect and test the components for conditions that cause vibration.

For example, performing the following steps will help demonstrate the vibration theory:



1. Clamp a yardstick to the edge of a table, leaving approximately 50 cm (20 in) hanging over the edge of the table.
2. Pull down on the edge of the stick and release while observing the movement of the stick.

The motion of the stick occurs in repetitive cycles. The cycle begins at midpoint, continues through the lowest extreme of travel, then back past the midpoint, through the upper extreme of travel, and back to the midpoint where the cycle begins again.

The cycle occurs over and over again at the same rate, or frequency. In this case, approximately 10 cycles per second. If we measure the frequency to reflect the number of complete cycles that the yardstick made in one minute, the measure would be 10 cycles x 60 seconds = 600 cycles per minute (cpm). We have also found a specific amount of motion, or amplitude, in the total travel of the yardstick from the very top to the very bottom. Redo the experiment as follows:

1. Clamp the yardstick to the edge of a table, leaving approximately 25 cm (10 in) hanging over the edge of the table.
2. Pull down on the edge of the stick and release while observing the movement of the stick.

The stick vibrates at a much faster frequency: 30 cycles per second. The total travel, or amplitude, is less.

Vibration

Vibration is the repetitive motion of an object, back and forth, or up and down. The following conditions cause most vehicle vibrations:

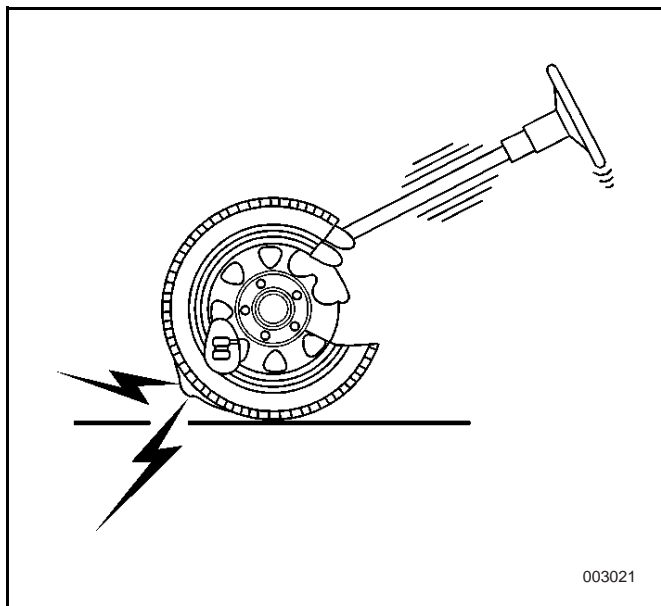
- A rotating component
- The engine combustion process firing impulses.

Rotating components will vibrate with excessive imbalance or runout. During vibration diagnosis, the amount of allowable imbalance or runout should be considered a tolerance and not a specification. In other words, the less imbalance or runout, the better. A vibration concern will occur when the firing impulses of the engine are not properly isolated from the passenger compartment.

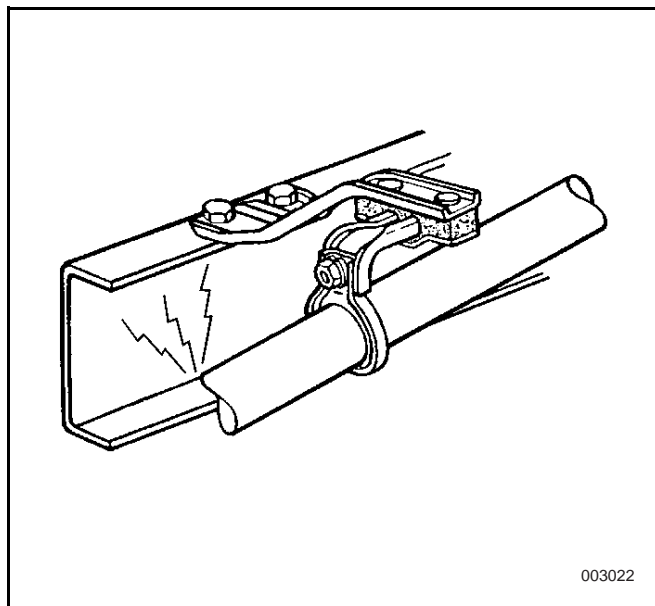
A vibrating component operates at a consistent rate. Measure the rate of vibration in question. When the rate/speed is determined, relate the vibration to a component that operates at an equal rate/speed in order to pinpoint the source. Vibrations also tend to transmit through the body structure to other components. Therefore, just because the seat vibrates does not mean the source of the vibration is in the seat.

Vibrations consist of the following three elements:

- The source - the cause of the vibration
- The transfer path - the path on which the vibration travels through the vehicle
- The responder - the component where the vibration is felt

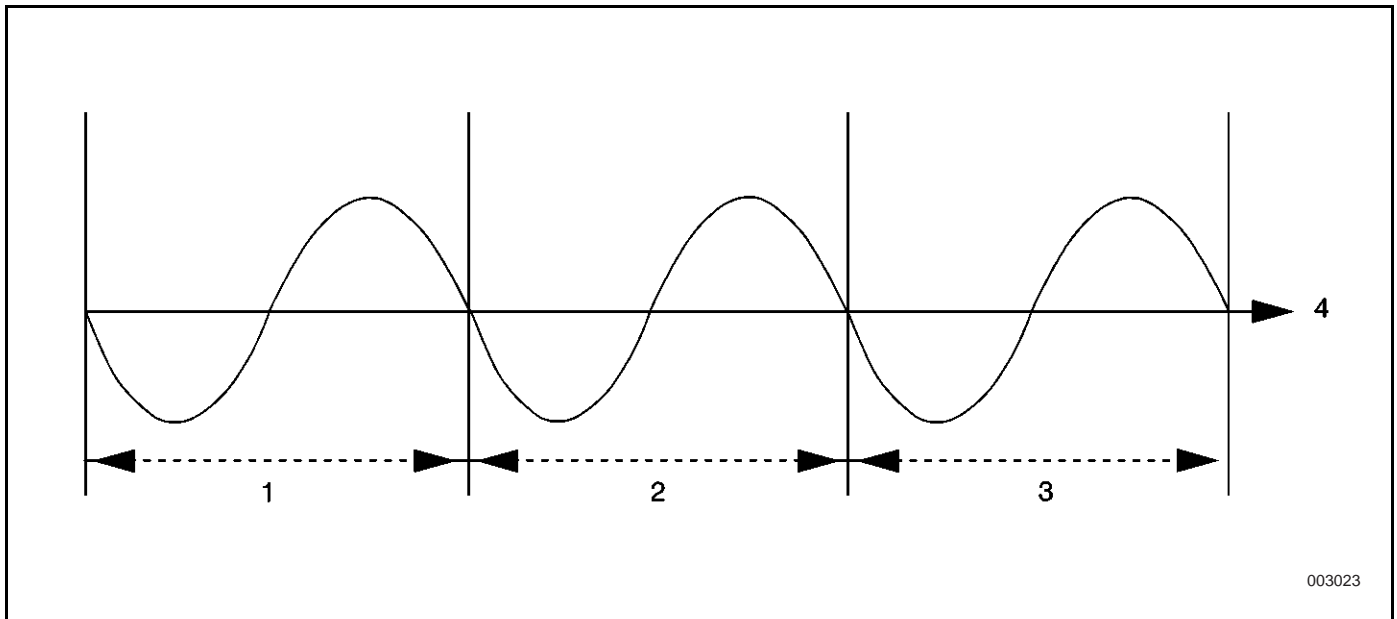


In the preceding figure, the source of the vibration is the unbalanced tire. The transfer path is the route the vibrations travel through the vehicle's suspension system into the steering column. The responder is the steering wheel, which the customer reports as vibrating. Eliminating any one of these three elements will usually correct the condition. From the gathered information, decide which element makes the most sense to repair. Adding a brace to the steering column may keep the steering wheel from vibrating, but adding a brace is not a practical solution. The most direct and effective repair would be to properly balance the tire.



Vibration can also produce noise. As an example, consider a vehicle that has an exhaust pipe which is grounded to the frame. The source of the vibration is the engine firing impulses traveling through the exhaust. The transfer path is a grounded or bound-up exhaust hanger. The responder is the frame. The floor panel vibrates, acting as a large speaker, which produces noise. The best repair would be to align the exhaust system and correct the grounded condition at the frame. This would eliminate the transfer path.

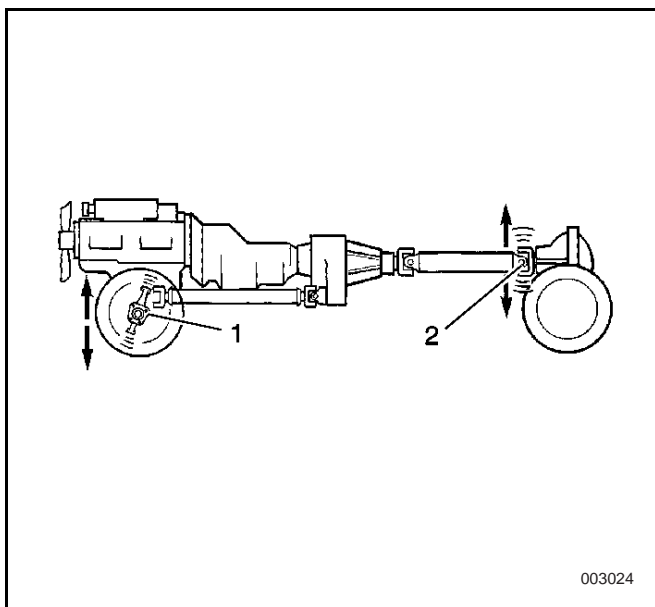
Cycle



Legend

- | | |
|---------------|---------------|
| (1) 1st Cycle | (3) 3rd Cycle |
| (2) 2nd Cycle | (4) Time |

Vibration Cycles in Powertrain Components



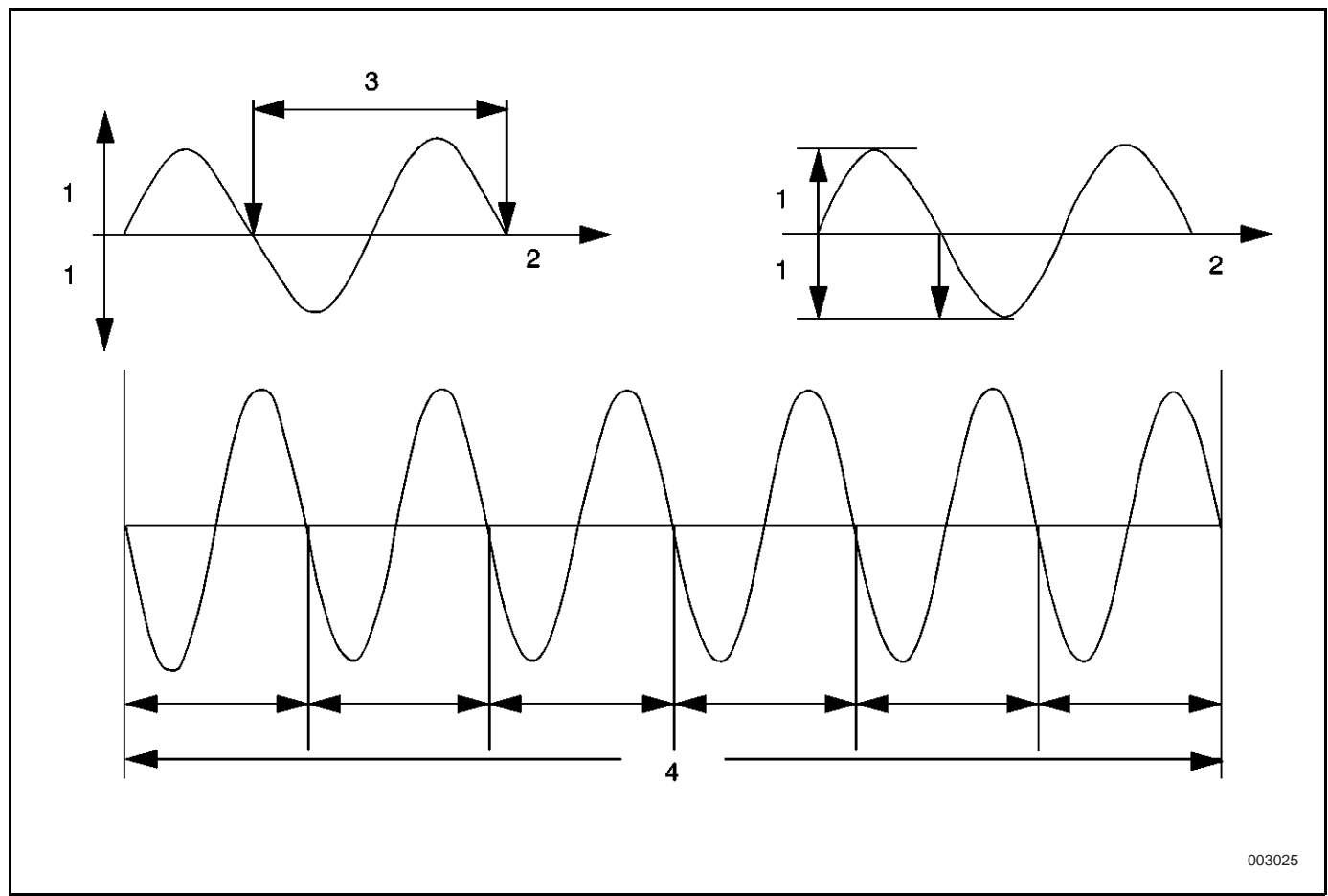
Legend

- | |
|-----------------|
| (1) Spindle |
| (2) Pinion Nose |

The word cycle comes from the same root as the word circle: both begin and end at the same point.

All vibrations consist of repetitive cycles.

Frequency



Legend

- (1)

Amplitude
- (2)

Reference
- (3)

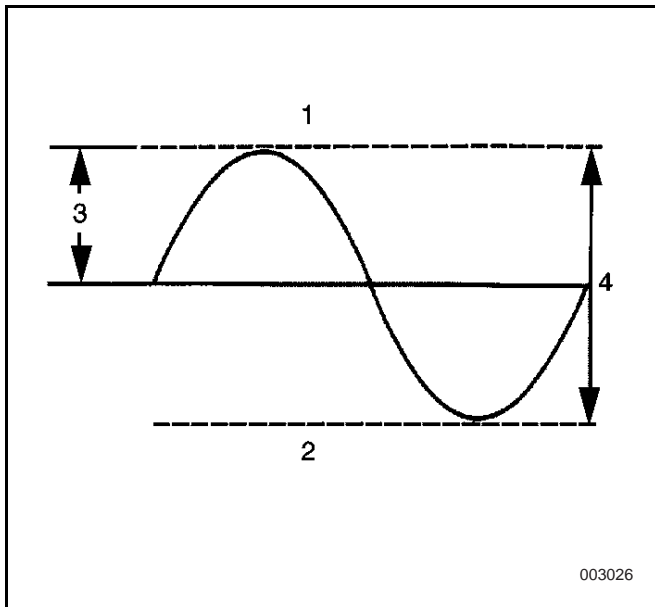
Time in Seconds
- (4)

1 second

Frequency is defined as the rate at which an event occurs during a given period of time. With a vibration, the event is a cycle, and the period of time is one

second. Thus, frequency is expressed in cycles per second, or Hertz (Hz). Multiply the Hertz by 60 to get the cycles, or revolutions per minute (RPM).

Amplitude



Legend

- (1) Large
- (2) Small
- (3) Zero-to-Peak Amplitude
- (4) Peak-to-Peak Amplitude

Amplitude is the maximum value of a periodically varying quantity. Used in vibration diagnostics, we are referring it to the magnitude of the disturbance. A severe disturbance would have a high amplitude; a minor disturbance would have a low amplitude. Amplitude is measured by the amount of actual movement, or the displacement. For example, consider the vibration caused by an out-of-balance wheel at 80 km/h (50 mph) as opposed to 40 km/h (25 mph). As the speed increases, the amplitude increases.

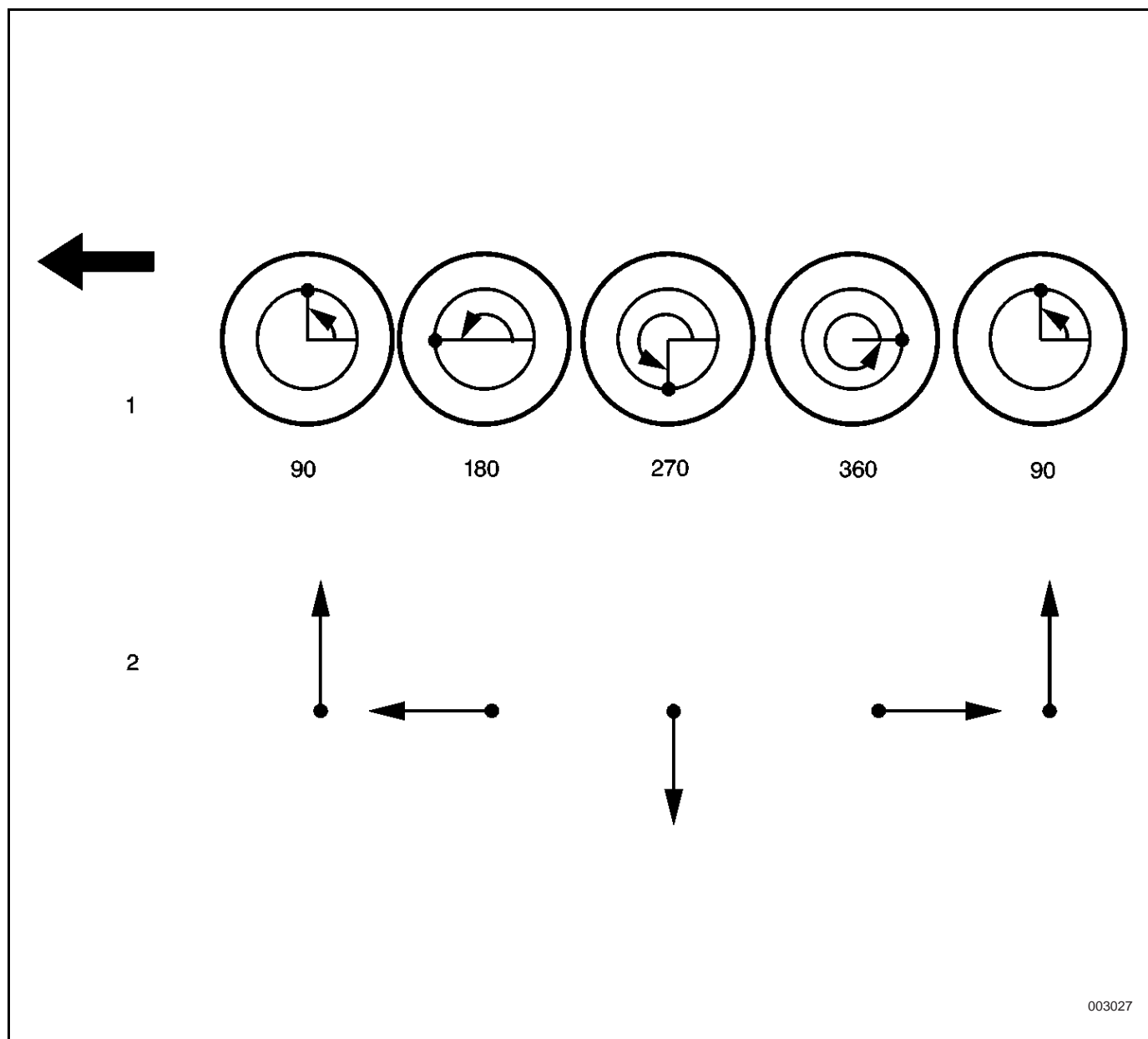
Free Vibration

Free vibration is the continued vibration in the absence of any outside force. In the yardstick example, the yardstick continued to vibrate even after the end was released.

Forced Vibration

Forced vibration is when an object is vibrating continuously as a result of an outside force.

Centrifugal Force Due to Imbalance



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Legend

- (1) Location of Imbalance
- (2) Centrifugal Force Acting on Spindle

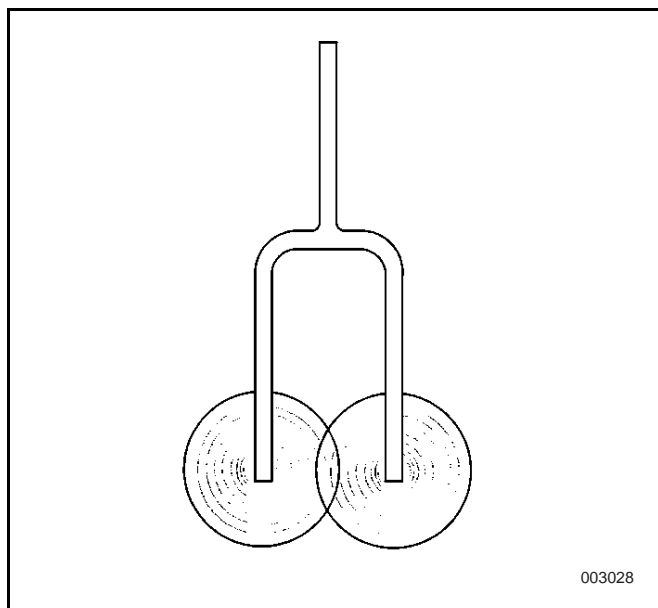
A spinning object with an imbalance generates a centrifugal force. Performing the following steps will help to demonstrate centrifugal force:

1. Tie a nut to a string.
2. Hold the string. The nut hangs vertically due to gravity.
3. Spin the string. The nut is the imbalance in the tire.

Centrifugal force is trying to make the nut fly outward, causing the pull you feel on your hand. An unbalanced

tire follows the same example. The nut represents the imbalance in the tire. The string represents the tire/wheel/suspension assembly. As the vehicle speed increases, you can feel the disturbing force of the unbalanced tire in the steering wheel, the seat, and the floor. This disturbance will be repetitive (Hz) and the amplitude will increase. At higher speeds, both the frequency and the amplitude will increase. As the tire revolves, the imbalance, or the centrifugal force, will alternately lift the tire up and force the tire downward, along with the spindle, once for each revolution of the tire.

Natural or Resonant Frequency

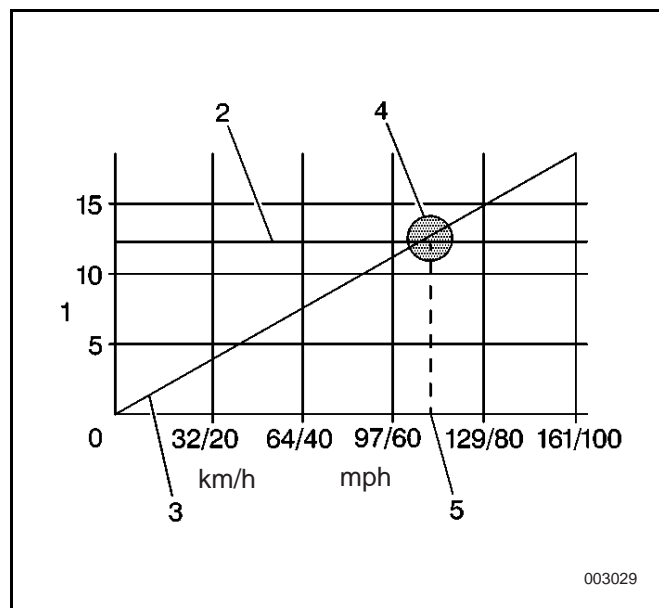


The natural frequency is the frequency at which an object tends to vibrate. Bells, guitar strings, and tuning forks are all examples of objects that tend to vibrate at specific frequencies when excited by an external force.

Suspension systems, and even engines within the mounts, have a tendency to vibrate at certain frequencies. This is why some vibration complaints occur only at specific vehicle speeds or engine RPM.

The stiffness and the natural frequency of a material have a relationship. Generally, the stiffer the material, the higher the natural frequency. The opposite is also true. The softer a material, the lower the natural frequency. Conversely, the greater the mass, the lower the frequency.

Resonance



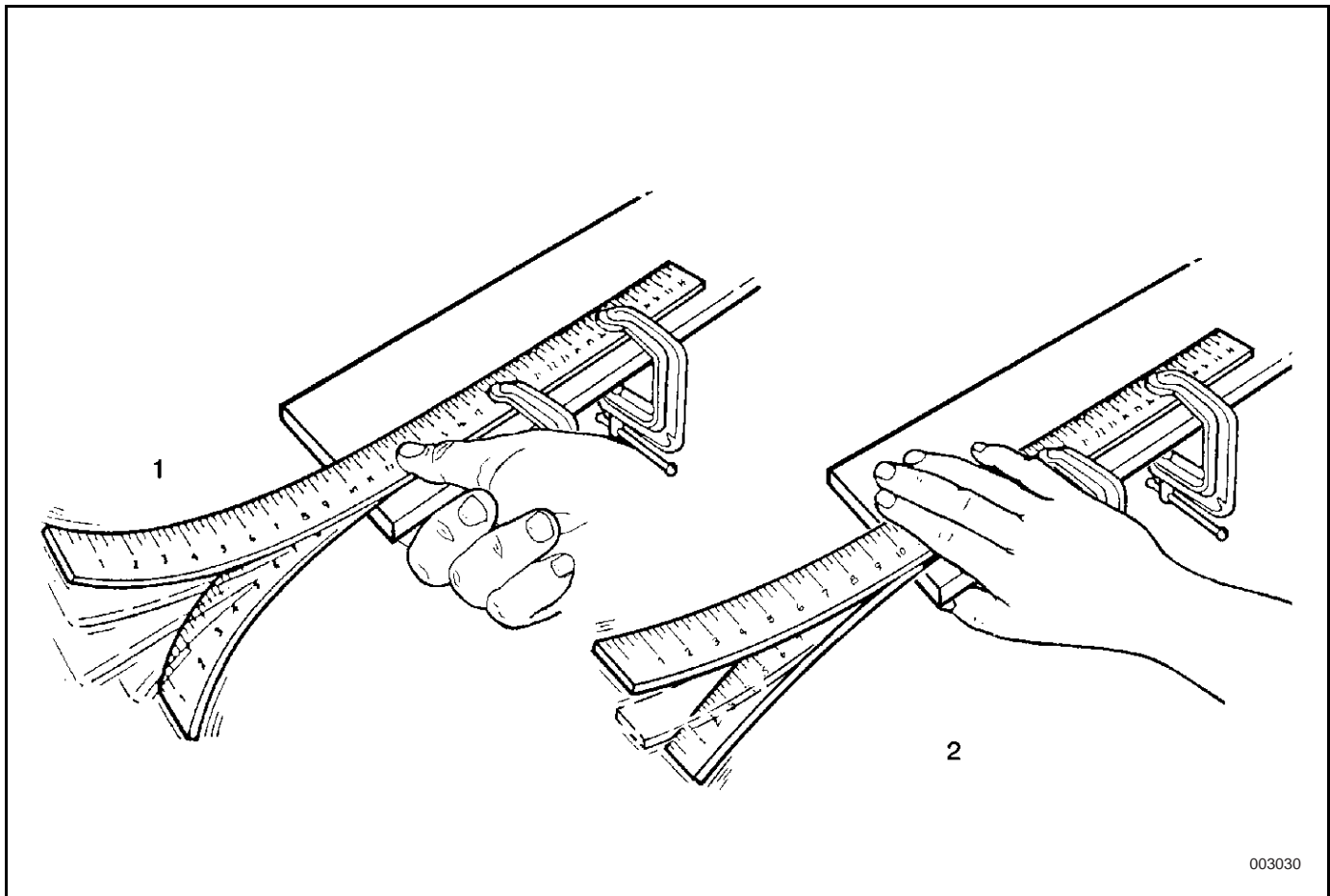
Legend

- (1) Frequency-cps
- (2) Suspension Frequency
- (3) Unbalanced Excitation
- (4) Point of Resonance
- (5) Problem Speed

All objects have natural frequencies. The natural frequency of a typical automotive front suspension is in the 1015 Hz range. This natural frequency is the result of the suspension design. The suspension's natural frequency is the same at all vehicle speeds. As the tire speed increases along with the vehicle speed, the disturbance created by the tire increases in frequency. Eventually, the frequency of the unbalanced tire will intersect with the natural frequency of the suspension. This causes the suspension to vibrate. The intersecting point is called the resonance.

The amplitude of a vibration will be greatest at the point of resonance. While the vibration may be felt above and below the problem speed, the vibration may be felt the most at the point of resonance.

Damping



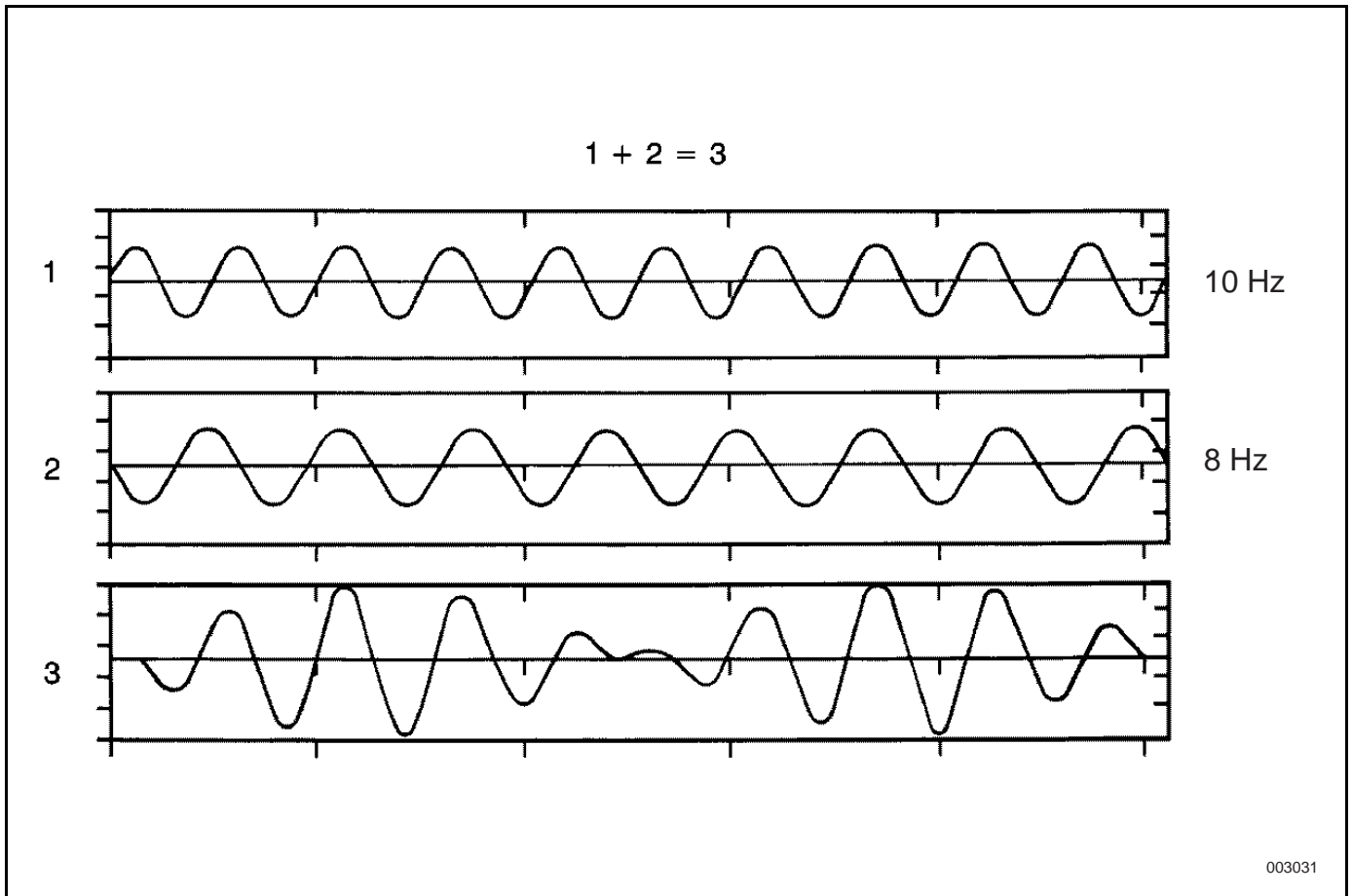
Legend

(1) Low Damping

(2) High Damping

Damping is the ability of an object or material to dissipate or absorb vibration. The automotive shock absorber is a good example. The function of the shock absorber is to absorb or dampen the oscillations of the suspension system.

Beating (Phasing)

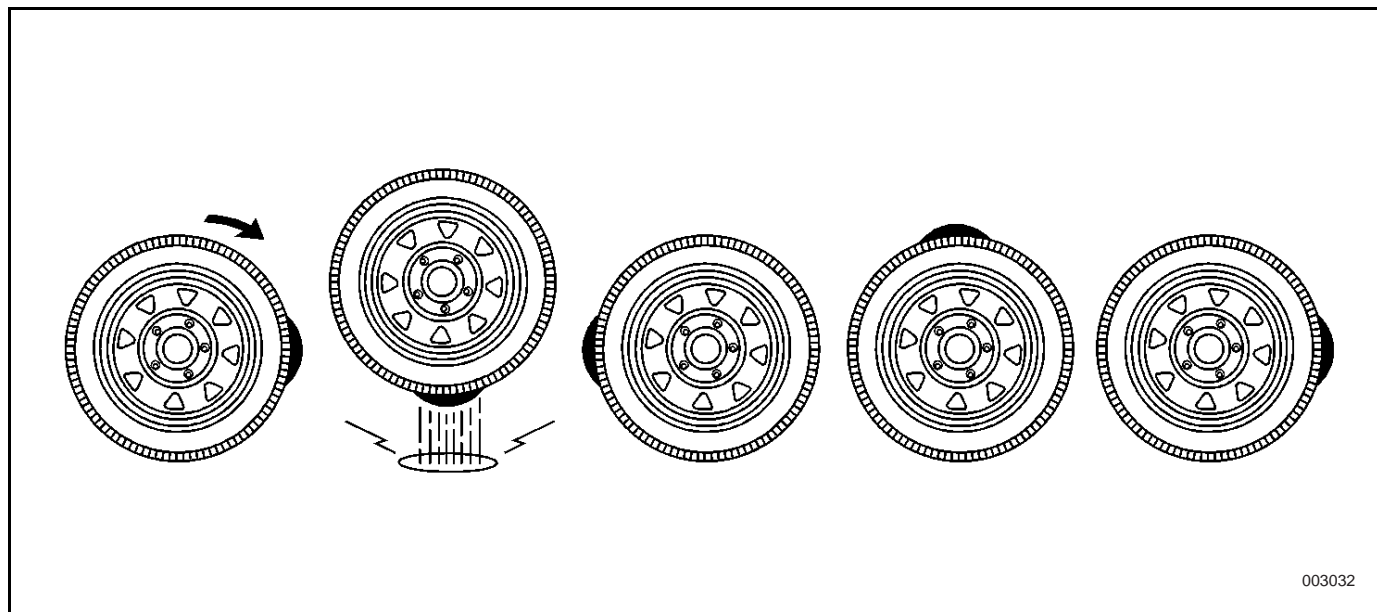


Two separate disturbances that are relatively close together in frequency will lead to a condition called beating, or phasing. Beating occurs when two vibrating forces are adding to, or subtracting from, each other's amplitude. A beating vibration condition will increase in

intensity or amplitude in a repetitive fashion as the vehicle travels at a steady speed. This beating vibration can produce the familiar droning noise heard in some vehicles. In many cases, eliminating either one of the disturbances can correct the condition.

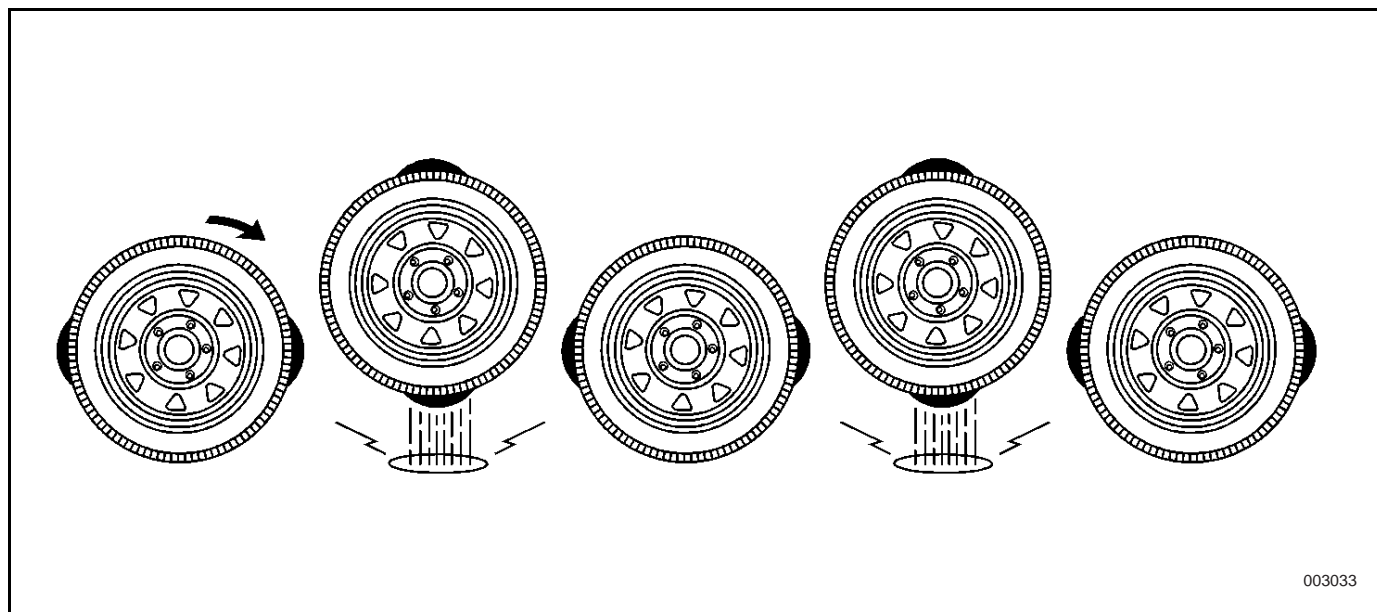
Order

Order refers to how many times an event occurs during one revolution of a rotating component.



For example, a tire with one high spot would create a disturbance once for every revolution of the tire.

This is called first-order vibration.

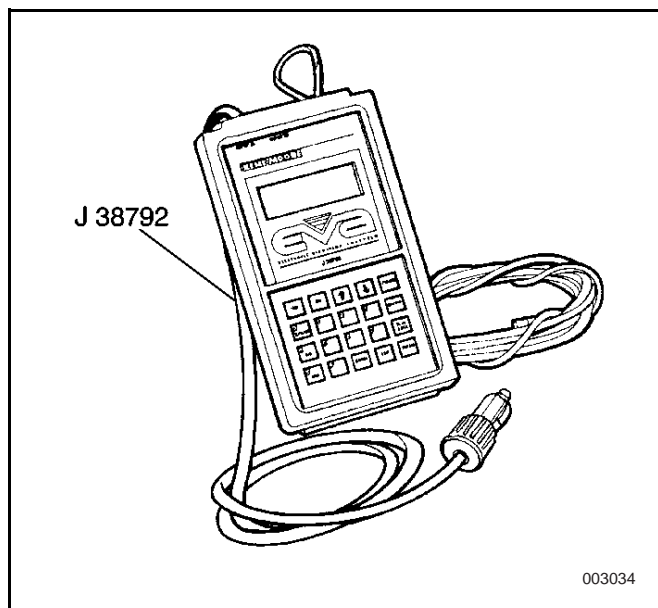


An oval-shaped tire with two high spots would create a disturbance twice for every revolution. This is called second-order vibration. Two first-order vibrations may add or subtract from the overall amplitude of the

disturbance, but that is all. Two first-order vibrations do not equal a second-order vibration. Due to centrifugal force, an unbalanced component will always create a first-order vibration, at minimum.

0.3.4.2 Electronic Vibration Analyzer (EVA)

EVA Sensor Placement



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J 38792 Electronic Vibration Analyzer (EVA) is specifically designed to diagnose vibrations. This handheld device is similar to a scan tool. A standard 12-volt power feed supplies the power. The vibration sensor, or the accelerometer, is at the end of a 6 m (20 ft) cord, and the vibration sensor can be mounted virtually anywhere on the vehicle where a vibration is felt.

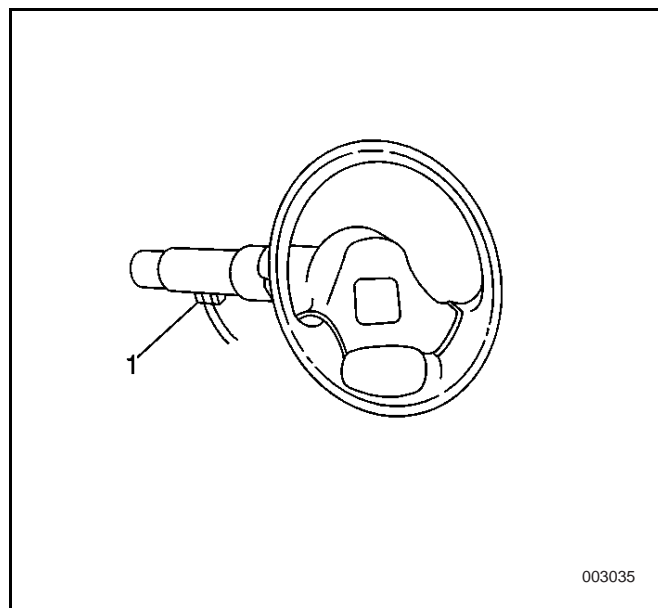
EVA Basic Hookup

1. Verify that the software cartridge is correctly inserted at the bottom of the unit.
2. Connect the vibration sensor cord into either input A or B.
3. Line up the connector so that the release button is at the bottom.

Note: Do not twist the connector. The sensor should remain plugged into the unit at all times.

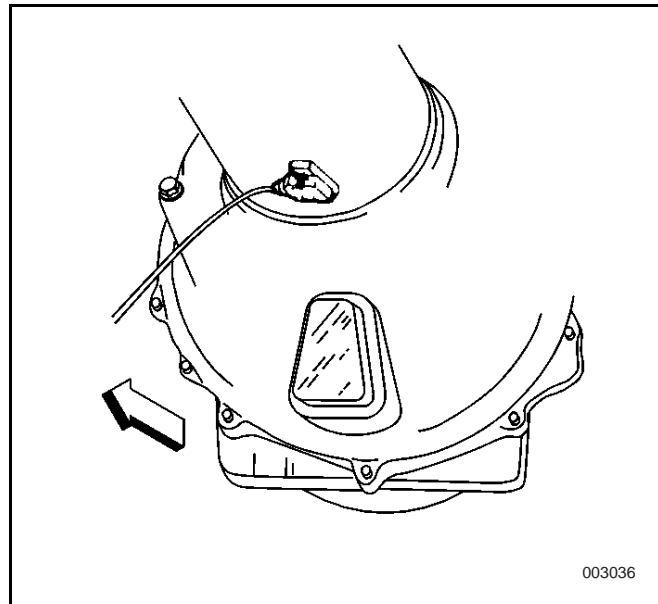
4. Push the connector into the input until the connector clicks and locks in place.
5. Plug the power cord into a 12-volt power feed in order to turn the EVA on.

To disconnect the sensor, press the release button and gently pull the connector straight out.



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Proper EVA sensor placement is critical in order to take proper vibration readings. You can place the sensor anywhere on the vehicle where vibrations are felt. Use putty or a hook and loop fastener in order to hold the sensor in place on non-ferrous surfaces, such as the surface of the steering column.



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A magnet holds the sensor to ferrous surfaces.

Vibrations are typically felt in an up-and-down direction. The sensor is directionally sensitive. Therefore, place the sensor as flat as possible with the side marked UP facing upward. Place the UP side of the sensor in the exact position every time for consistent results when repeating the tests or making a comparison.

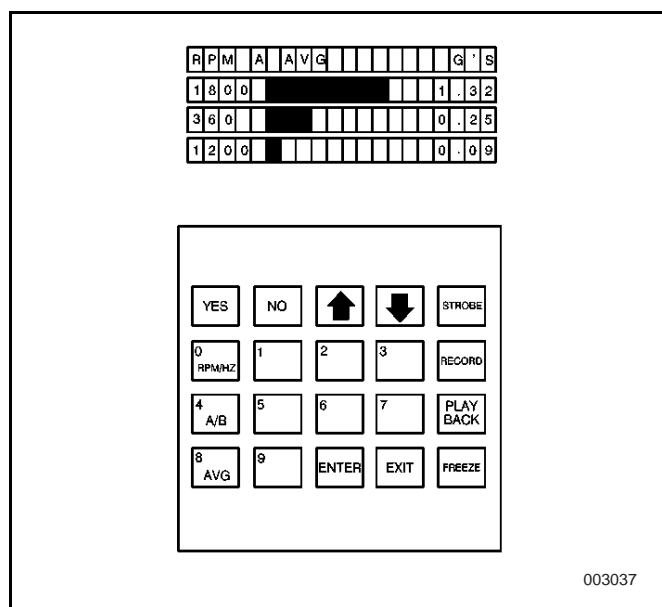
EVA Display

Up to 3 dominant vibration frequencies are displayed on the EVA's liquid crystal screen. On the left is the frequency reading, followed by a bar graph representation of the vibration's relative strength. At the right side of the screen, the actual strength, or amplitude, is shown in acceleration force (G's).

Frequencies can be displayed in revolutions per minute (RPM) or in Hertz (Hz). Switch between the two readings by pressing the RPM/Hz button on the keypad.

Next to the frequency data on the top line of the screen is the letter A or B. This letter indicates which input is activated. Press the A/B button on the keypad in order to switch between the two inputs.

Note: Verify that the letter on the display matches the correct sensor input.



The EVA offers the following main display features, all of which are described below:

- Freeze
- Record/Playback
- Averaging/Non-averaging modes
- Strobe Balancing

Freeze

Pressing the FREEZE button on the keypad activates the freeze function, which locks the display of data. The display shows FRZ at the top. The freeze function is useful when conducting an acceleration/deceleration test in which the significant amount of vibration registers only for a very short time. Pressing EXIT or the FREEZE button again deactivates the freeze function.

Record/Playback

The displayed vibration information can be recorded for later playback. The EVA retains stored data for

approximately 70 hours after the unit has been unplugged from a power source. Data is recorded as snapshots of vibration information. Each snapshot consists of 10 different frames. Up to 10 snapshots can be recorded.

Press the RECORD button in order to record a snapshot. The screen will display R? in order to request a tag number between 09. These tag numbers are the individual frames of the snapshot recording. New data will replace the existing data when a number is chosen that has already been used in order to tag a snapshot.

Pressing the PLAYBACK button plays back the recorded data. The screen shows P? in order to request the tag number for the wanted snapshot. Once the number is entered, the snapshot data displays the letter P followed by the tag number.

Then the screen displays the letter F followed by 09 in order to indicate which frame of the snapshot is being displayed.

Use the freeze function in order to freeze the display at any point in the sequence during playback. You can view individual frames in a forward or backward sequence using the up and down arrow keys. The display returns to the active screen when the recording or playback of a snapshot is finished, or when EXIT is pressed.

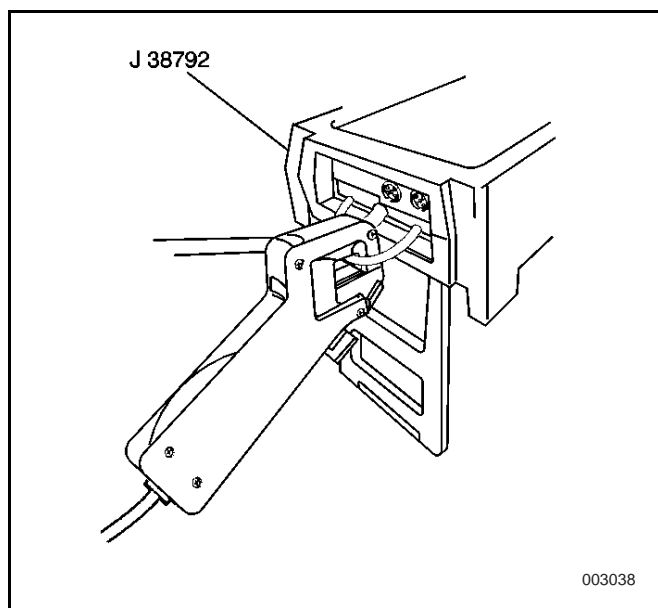
Averaging/Non-averaging modes

The EVA normally operates in an averaging mode that averages multiple vibration samples over a period of time. The averaging mode minimizes the effects of a sudden vibration that is not related to the problem. Most tests use the averaging mode.

The EVA is more sensitive to vibrations in the non-averaging mode. The display is more instantaneous and not averaged over a period of time. The non-averaging mode is used when measuring a vibration that exists for only a short period of time, and during acceleration/deceleration tests.

Pressing the AVG button switches between the averaging and non-averaging modes. During averaging mode, the screen will display AVG.

Strobe Balancing



The EVA can strobe balance a rotating component. A trigger wire is located on the top of the EVA, which is used with an inductive pick-up light strobe. The EVA triggers the strobe light at the same frequency as the vibration. The timing light clips on to the trigger wire. The vibration sensor must be attached to input A. Input B does not provide the strobe function.

Pressing the STROBE button starts the strobe balancing function. The EVA will ask a series of questions in order to determine the correct filter range: full, low, or high. The low and high ranges prevent other vibrations from interfering with the operation of the strobe light.

Use the full range as a last resort only. Press YES in order to select a range. Press NO in order to go on to the next range. The vibration/strobe frequency must fall within the selected range. The EVA is now ready to begin the strobe balance procedure. The EVA is now ready to begin the strobe balance procedure.

EVA Calibration

The EVA features the following two built-in calibration procedures:

- Sensor calibration
- Phase shift calibration

Calibrate a replaced or an added sensor in order to function properly with the EVA unit. The phase shift calibration is performed at the factory. Do NOT repeat this calibration under normal use.

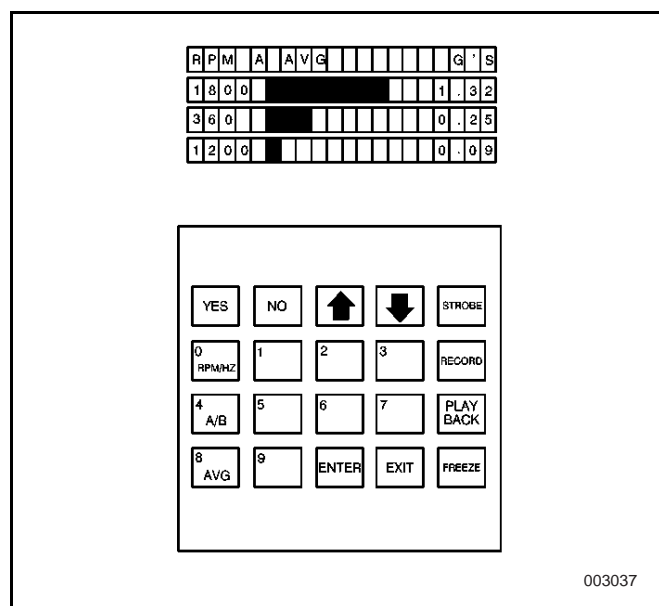
Sensor calibration

1. Lay the sensor on a flat stationary surface with the UP side facing upward.
2. Plug the sensor into either input A or B.
3. Plug the EVA into a 12-volt power supply.

4. After the display initializes, select the proper input.
5. Press the up arrow key on the EVA keypad.
6. Press the number 2 three times on the keypad. The message BURNING will appear, followed by a request to turn the sensor over.
7. Turn the sensor over.
8. Press any key in order to commence calibration:
 - Calibration will take approximately 20 seconds.
 - The display will return to the active mode when calibration is complete.

Phase shift calibration

1. Plug the EVA into a 12-volt power supply.
2. Press the down arrow key on the EVA keypad.
3. Press the number 2 on the keypad 3 times in order to begin calibration:
 - Do not press any key until the message ANY KEY TO CONTINUE appears. Pressing a key will cancel the calibration process.
 - The display will flash numbers for 56 minutes.
 - The message BURNING PHASE SHIFT CONSTANTS will appear for one minute.
 - The BURNING CENTER FREQUENCIES LOW=39 HIGH=48 message will appear.
 - The ANY KEY TO CONTINUE message should appear.
4. Press any key in order to return to the active mode.



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Keypad Reference

A/B: Switches the display between the A input and the B input. You must use Input A when strobe balancing.

AVG: Switches the display between the non-averaging mode and the averaging mode. The non-averaging mode is more sensitive to sudden vibration variations. When in the averaging mode, the word AVG appears at the top of the display.

RPM/HZ: Switches the frequency display between RPM and Hz.

FREEZ: Locks the display on the data at that moment and displays the word FRZ at the top of the screen. This key operates in the active display or during playback. Pressing the FREEZE key again or pressing the EXIT key unlocks the display.

RECORD: Places the EVA in the record mode. Pressing the EXIT key will return the screen to the active display.

PLAYBACK: Places the EVA in the playback mode in order to view vibration information that was previously

recorded. Pressing the EXIT key will return the key screen to the active display.

: The numbered keys are used in order to select one of 10 snapshot tag numbers (09) when recording or playing back information.

: The arrow keys are used in order to move through the individual frames of a snapshot during a freeze in the playback mode. Pressing the UP arrow moves forward one frame and pressing the DOWN arrow moves backward one frame.

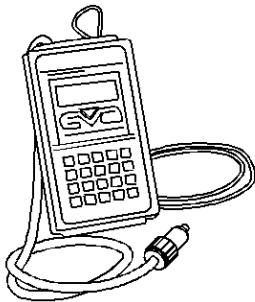
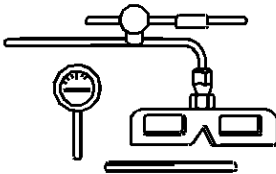
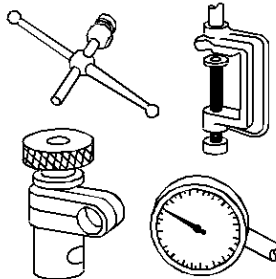
ENTER: Once the EVA is in the record mode and you have selected a snapshot tag number, press ENTER in order to start recording.

STROBE: Places the EVA in the strobe mode for driveshaft balancing and diagnosis. Pressing the EXIT key will return the key screen to the active display.

YES or NO: Used in order to select a filter range when in the strobe balancing mode.

EXIT: Returns the screen to the active display when the EVA is in the freeze mode, the record mode, the playback mode, or the strobe mode.

0.3.5 Special tools and devices

Legend	Tool Number/Name
 J38792	J -38792 Electronic Vibration Analyzer (EVA)
 J7872	J -7872 Magnetic Base Dial Indicator Set
 J-8001	J -8001 Dial Indicator Set

Blank

1

Heating, Ventilation and Air Conditioning System

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1.1 Heating, Ventilation and Air Conditioning System

1.1.1 Specifications

1.1.1.1 Fasteners Tightening Torque

Application	Specification
Bolts on the liquid container bracket	4.0-6.0 N•m
Air duct screw	1.5-2.5 N•m
Screw on the housing of strainer	3.0-3.5 N•m
Blower motor bolts	2.0 N•m
Blower motor resistor bolts	2.0 N•m
Compressor hose assembly to compressor bolt	33 N•m
Compressor hose assembly to condenser bolt	16 N•m
Bolt on the front of compressor	30-40 N•m
Bolt on the back of compressor	30-40 N•m
Compressor pressure relief valve	6-10 N•m
Drive belt tensioner bolt	22-30 N•m
Collar nuts of liquid pipe lines connected to condenser	16 N•m
Bolts on the liquid pipelines of expansion valve	16 N•m
Refrigerant pressure switch	11-14 N•m
Compressor hose at the evaporator hose assembly	36 N•m
Bolts on the upper bracket of condenser assembly	4-6 N•m
Fan of condenser assembly	2 N•m
Oil screw plug of compressor	15-20 N•m
Bolts on the rocker arm of air conditioner case	2.0-4.0 N•m
Bolts of fresh air door actuator	2.0-4.0 N•m
Screws on the plate of air inlet grill	1.0-1.5 N•m

1.1.1.2 Refrigerant and refrigerant oil

Specification and capacity

Specification	Capacity	GM Part Number
PAG synthetic refrigeration lubricant	220 ml.	12345923
R-134a refrigerant of air conditioning system	0.680 kg	12345922
Mineral base 525 viscosity mineral oil (lubricant for O-rings and accessories)	—	12301108

Addition of refrigerant oil

Components replaced	Oil to be added
Note: If refrigerant oil leaks from air conditioning system in the process of recovery or part replacement, replenishment of it should be made. Add refrigerant oil as specified.	
A/C compressor	If the refrigerant oil that has been discharged is less than 30ml, add 60ml. If the refrigerant oil that has been discharged is more than 30ml, add the same amount of it.
Condenser assembly	30 ml.
The evaporator	90 ml.
Reservoir of the container	The amount discharged plus 30ml.
If there is a sudden loss of engine oil caused by mass leakage of refrigerant,	the amount of refrigerant added to the replaced component (as a result of mass leakage) should be 90ml more than the required volume.

1.1.2 Schematic and Wiring Diagram

1.1.2.1 Wiring diagram of air conditioning system

Refer to 8.20.2.21.

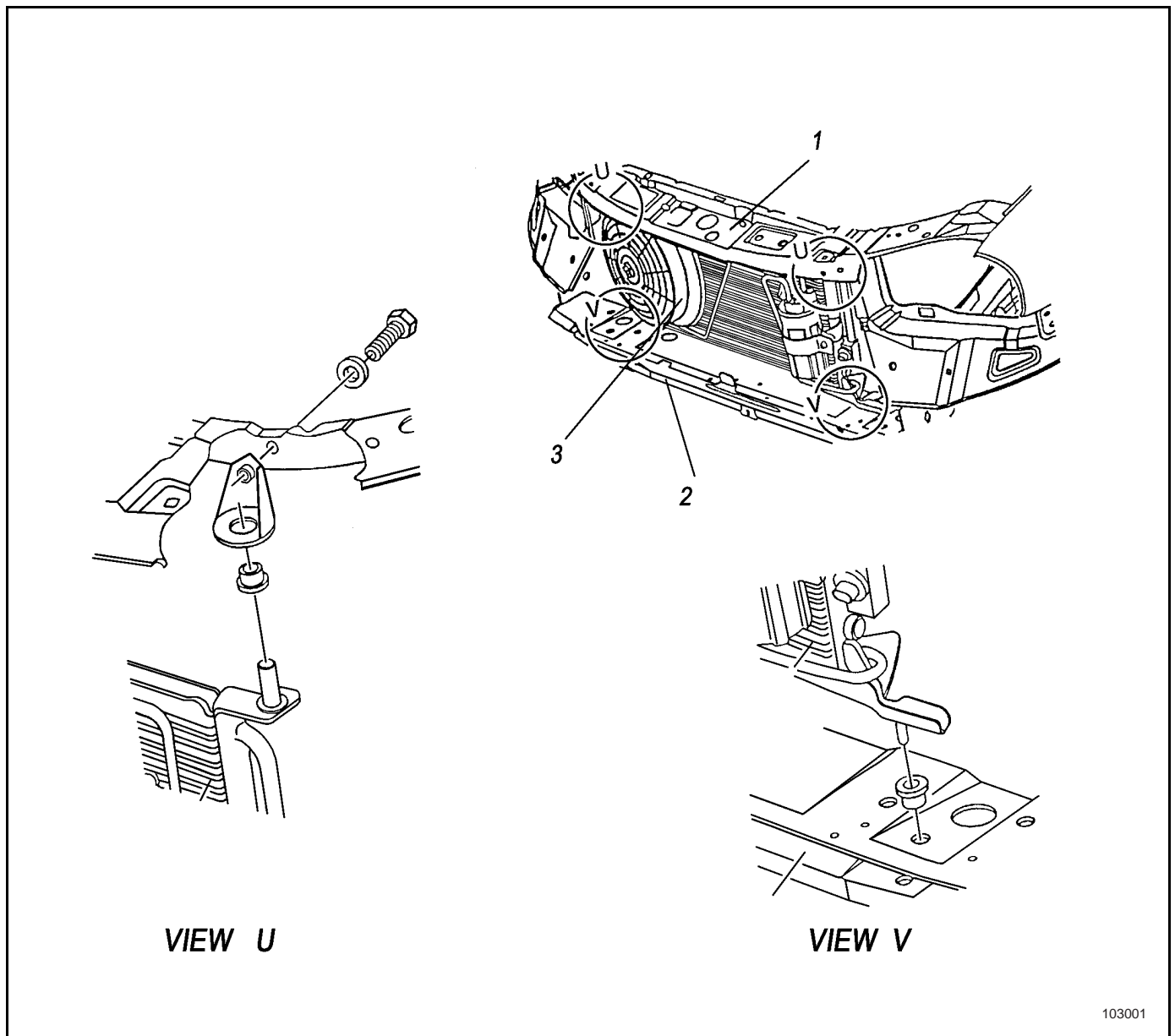
1.1.3 Component Locator

1.1.3.1 HVAC System Component Locator

Name	Location	Component Views	Connector End Views
A/C Compressor Clutch Coil	A part of A/C compressor, located at LR of the front side of engine.	—	HVAC Connector End Views
Blower motor	LR of IP, and the right side of the heater-air conditioner module.	—	HVAC Connector End Views
Blower motor resistor	Inside IP, and on top of the heater-air conditioner module	—	HVAC Connector End Views
Temperature actuator	On the left side of heater module	—	—
Fuse box	Left side of IP	Wiring Systems Component Views	—
A/C Controller	Center of IP	HVAC Component Views	—
Rear window defogger grid line	On rear window	—	—
Rear window defogger relay	Behind IP chamber, connecting to the underside of the cross member	Wiring Systems Component Views	—

1.1.3.2 HVAC Component Views

Condenser Assembly Component Views

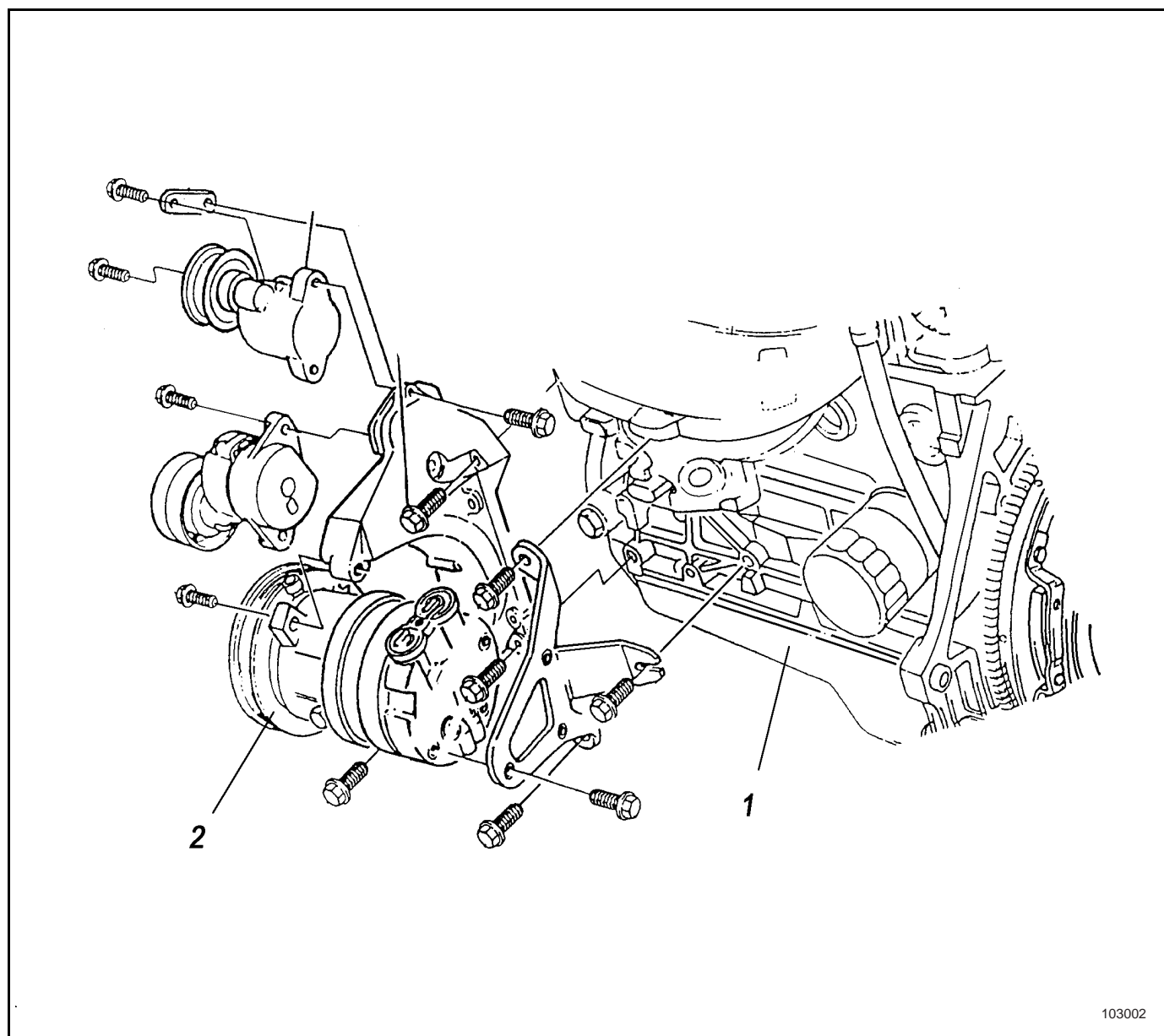


103001

Legend

- | | |
|------------------------------|---|
| (1) Front bumper assembly | (3) Condenser assembly (with the fan and the reservoir) |
| (2) Front lower cross member | |

Compressor Assembly Component Views

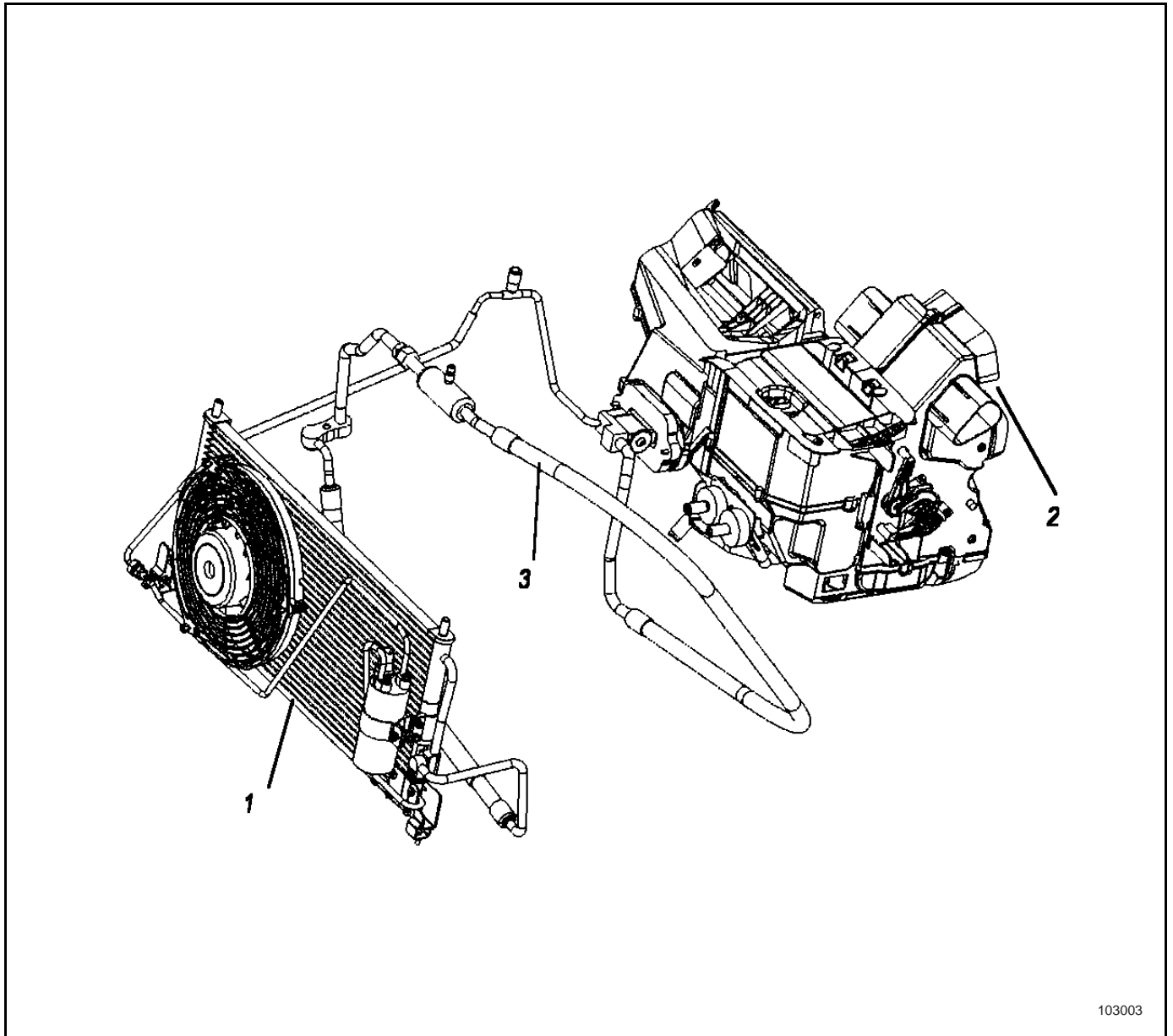


Legend

(1) Engine

(2) Compressor Assembly

HVAC Component Views (except for compressor)

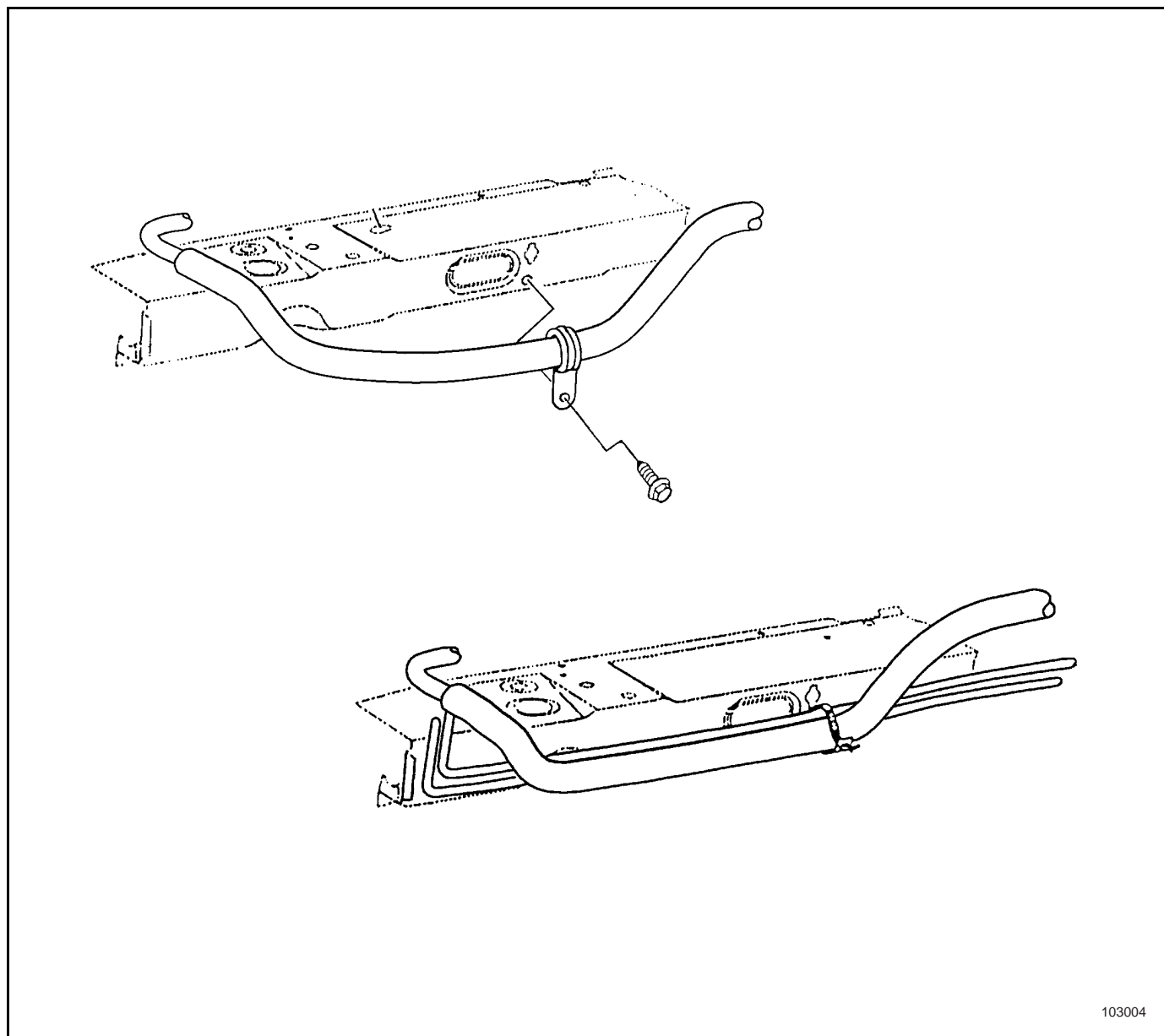


103003

Legend

- | | |
|---|-------------------|
| (1) Condenser assembly | (3) The A/C ducts |
| (2) Heating, Ventilation and Air Conditioning Subassemblies | |

Compressor Hose Component Views



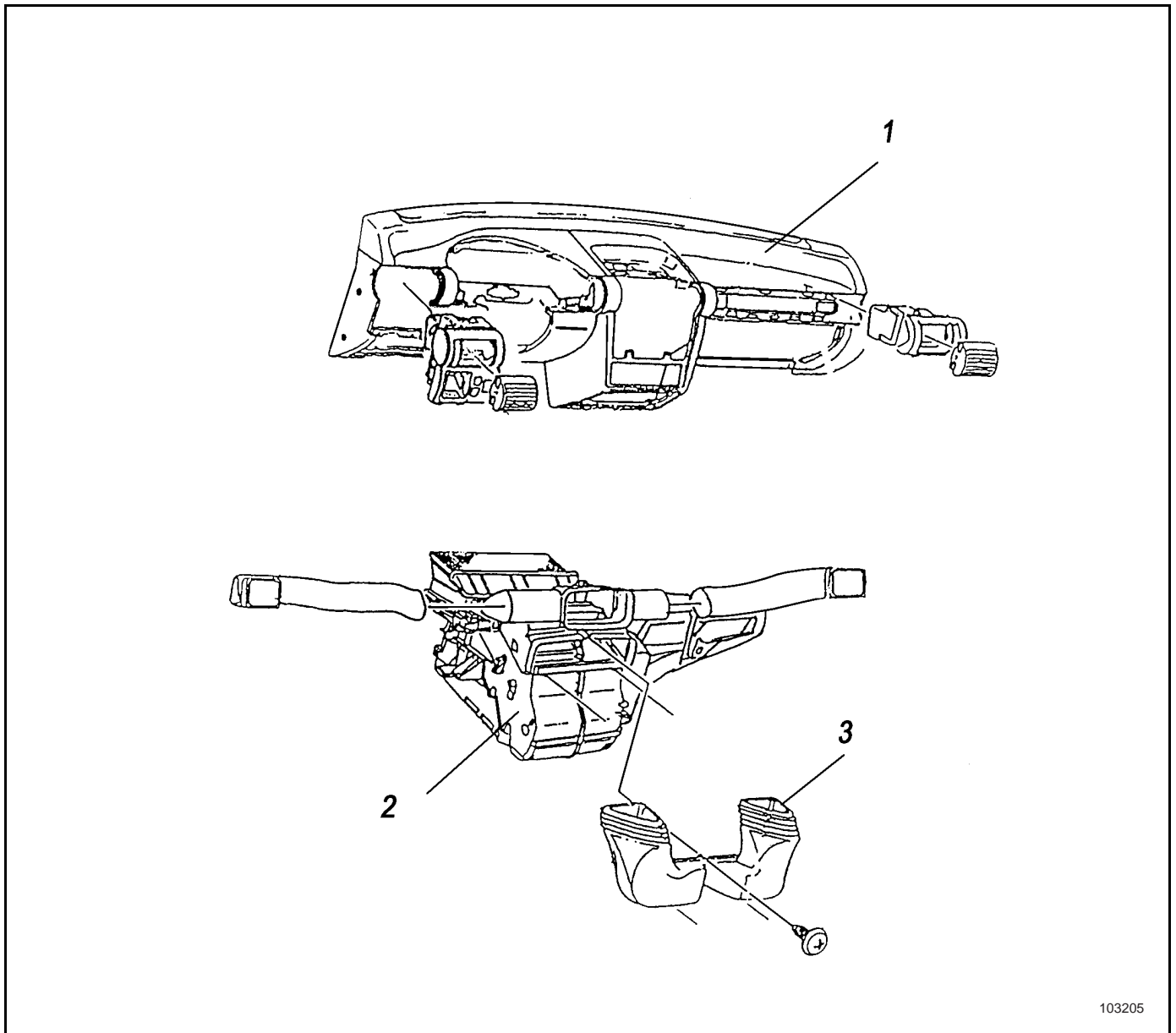
103004

Legend

(1) The fixing of compressor hose - without power steering system

(2) The fixing of compressor hose - with power steering system

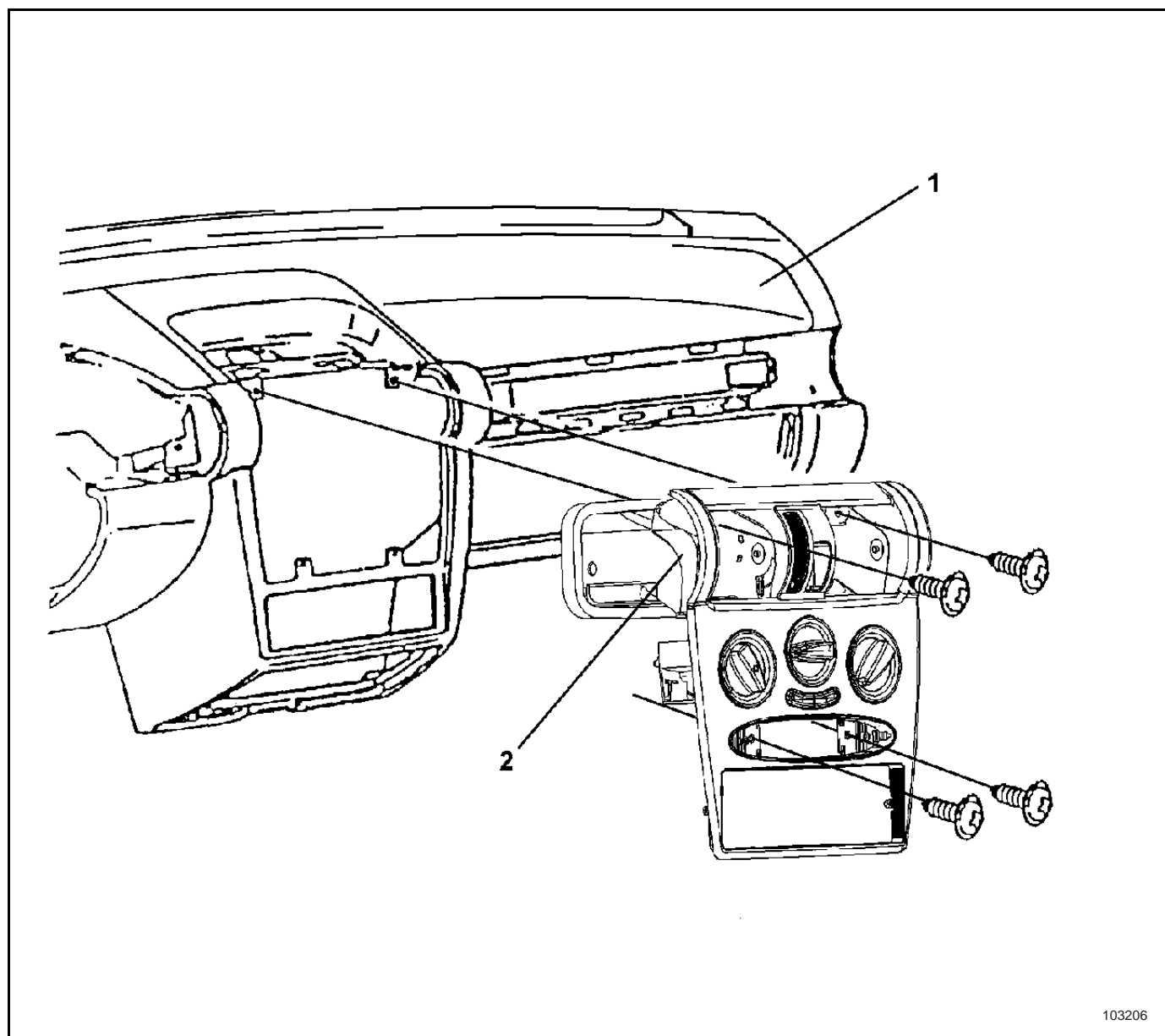
Component views of the air distribution duct and the air port



Legend

- (1) Instrument Panel (3) Air distribution duct
- (2) Air conditioner case

Component view of HVAC control assembly (at the center of instrument panel)

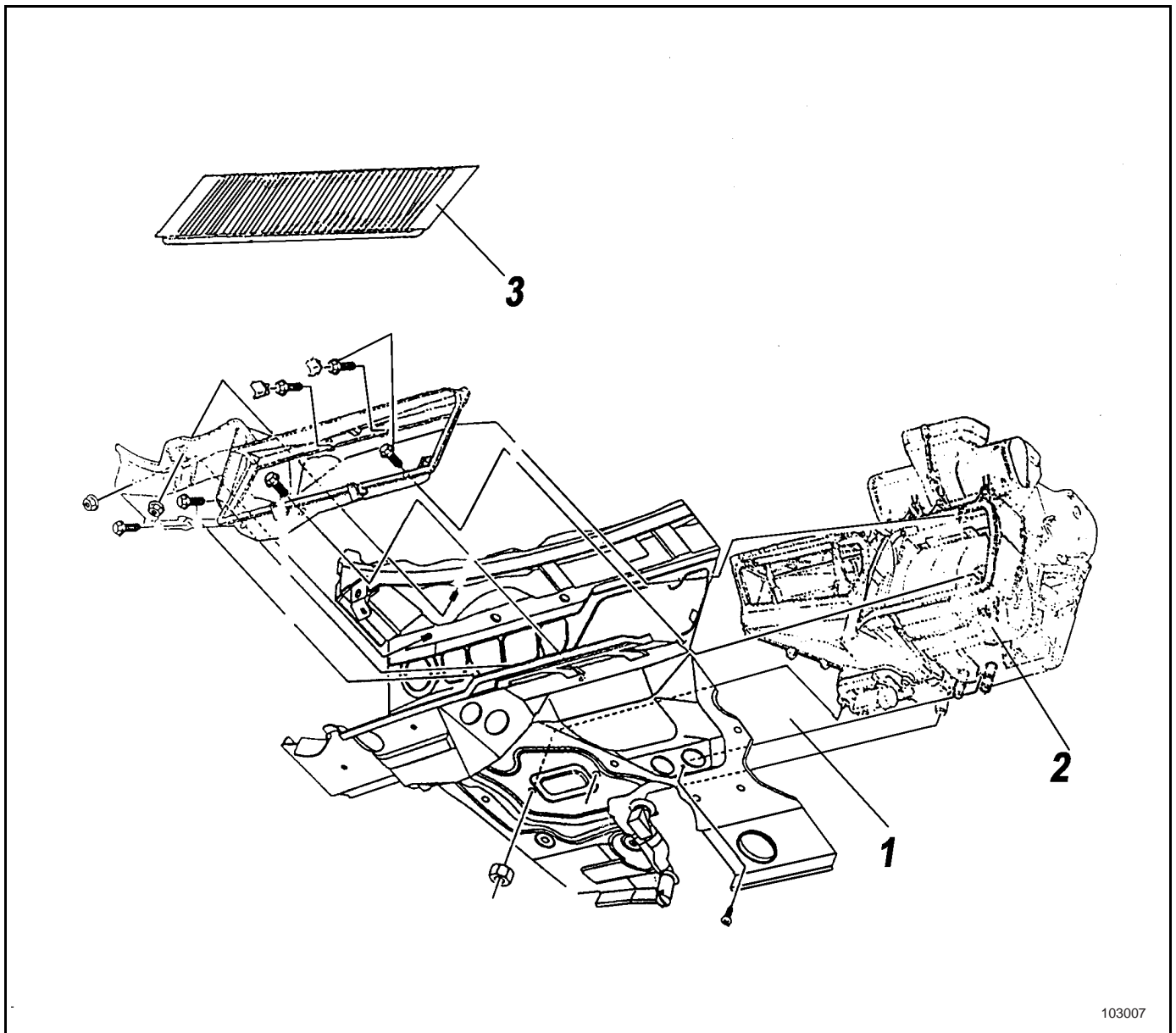


Legend

(1) Instrument Panel

(2) The Controller of HVAC system

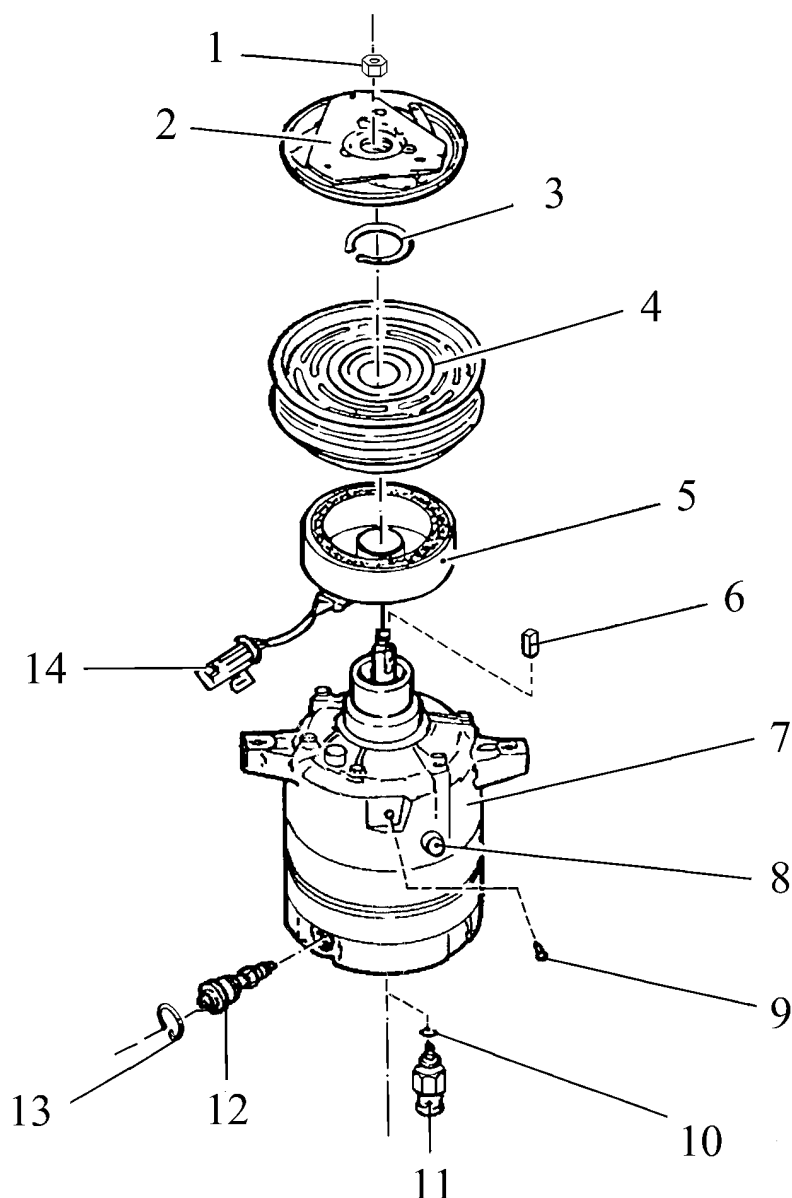
Component view of the HVAC strainer screen, the screen housing, and the HVAC housing on firewall of the front boarding



Legend

- | | |
|---|-------------------------------------|
| (1) Firewall assembly | (3) Strainer screen and its housing |
| (2) A/C chamber assembly, A/C compressor controller | |

Component view of compressor assembly



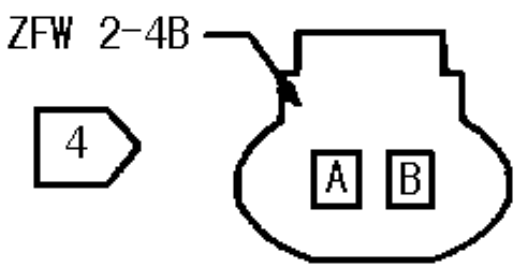
103008

Legend

- | | |
|-------------------------------|---|
| (1) Nut | (8) Screw plug for addition/discharge of engine oil |
| (2) Armature | (9) Bolt |
| (3) Gasket | (10) Gasket |
| (4) Clutch | (11) Pressure Relief Valve |
| (5) Coil and housing assembly | (12) Control valve |
| (6) Key | (13) Gasket |
| (7) Compressor | (14) The fittings |

1.1.3.3HVAC Connector Views

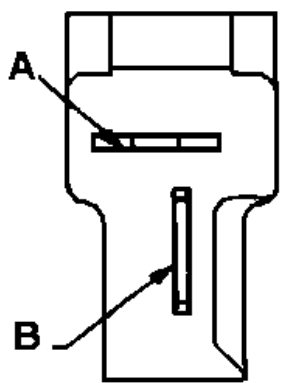
A/C Compressor Clutch Coil



103009

Pin	Wire Color	Function
A	Bluish brown	Supplying power to clutch coil
B	Light brown	Ground

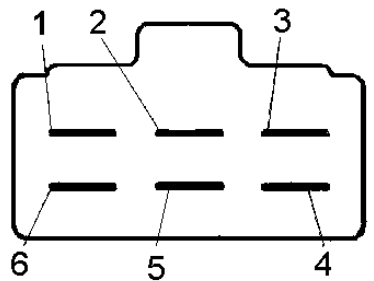
Blower motor



103011

Pin	Wire Color	Function
A	Green	Power supply
B	BRN	Ground

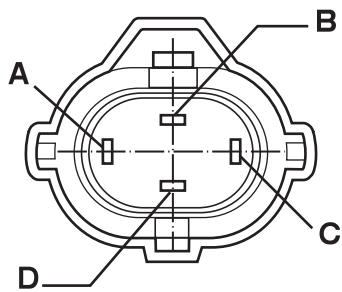
Blower motor resistor



103010

Pin	Wire Color	Function
1	WHT	High speed
2	Blue	Motor
3	YEL	Low speed
4	Red	Medium to low speed
5	—	—
6	PPL	Medium to high speed

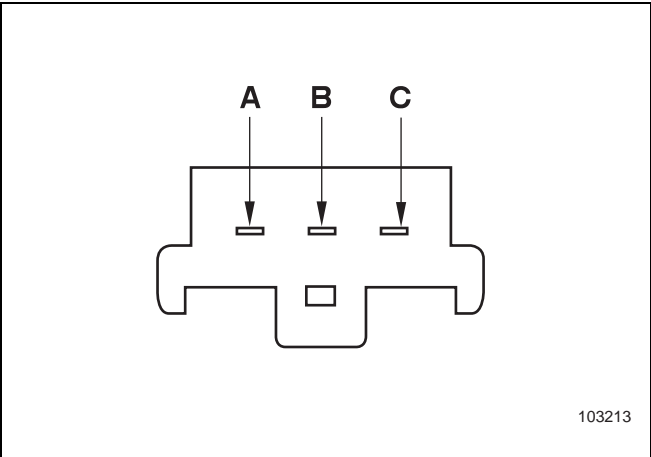
Pressure switch



103212

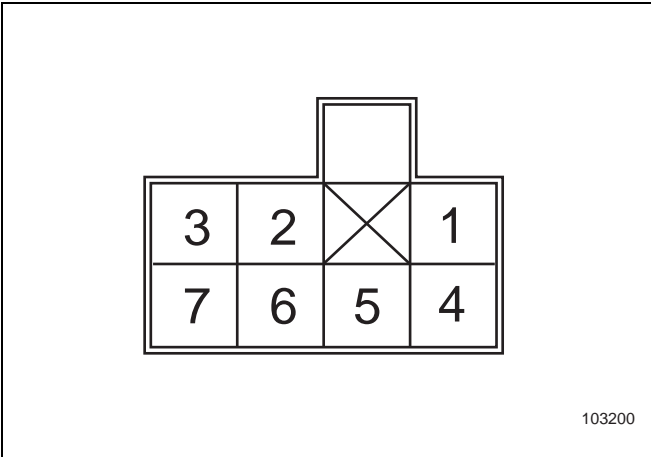
Pin	Wire Color	Function
A	Reddish brown	Medium pressure
B	Black and white	High pressure and low pressure
C	BRN	Medium pressure
D	black and yellow	High pressure and low pressure

Temperature sensitive resistor



Pin	Wire Color	Function
A	Black and red	Power supply
B	BRN	Ground
C	black and yellow	Signal output

Air door actuator for fresh air



Pin	Wire Color	Function
1	BLK	Power supply
2	–	–
3	–	–
4	Red and blue	Corotation
5	WHT	Reverse rotation
6	–	–
7	–	–

1.1.4Diagnostic Information and Procedures

1.1.4.1Functional Check

Air conditioning Controller uses signals from other systems to transfer messages to the driver. Therefore, before further diagnoses, first review general information about how HVAC system operates and how each system interacts with the air conditioning Controller. This will not only save diagnosis time, but also prevent future diagnostic mistake and unnecessary replacement of any component.

Most malfunctions can be traced back to improper wiring and connection, and sometimes involve wrong components, too. A/C control head is very reliable and, generally speaking, will not be the cause of any malfunction.

1. The following conditions indicate the electric wiring is working normally.
 - When the control mode of blast volume is at any position other than OFF, the blower motor of A/C system operates at a proper speed. Verify that the compressor clutch is also engaged.
 - When blast volume controller is at OFF position, the blower motor will not run at any

speed. But it is an exception when air conditioner has been turned on.

2. When there is air coming out of a specified air port, A/C control head (mode selector) works well.

Conduct the following functional tests to the air conditioning system.

Primary inspection:

- When the position of the temperature knob has been changed, check for any change in temperature.
- When internal circulation mode is changed to external circulation mode, because of the closure of recycle valve, there should be an audible reduction of air noises.
- Inspect all outlets of the instrument board. Verify the existence of following conditions:
 - The roller is spinning.
 - The blade is running.
 - When the blower is at HIGH (high speed) operating state, the roller and the blade should keep their current position.

Steps	Measures	Numerical values	Yes	No
1	1. Place the ignition switch in the ON (turn on) position. 2. While listening to the blower motor, use fan speed controller on A/C control head to turn the velocity of blower from low to high. Is the blower motor turned on and the speed changing?	—	Go to Step 2	To the inspection of HVAC blower control system
2	1. Switch on the air conditioner. 2. Set temperature regulator to the COLD (blue) position. When A/C system is being used, can the A/C compressor be turned on and off normally?	—	Go to Step 3	To the inspection of HVAC compressor control system
3	Use MODE controller on the A/C control head to select every mode, so as to test the airflow pattern of them. Is the air flow of each mode coming from the right outlet?	—	Go to Step 4	To the inspection of HVAC air supply system
4	Turn temperature regulator from the maximum cold (blue) to the maximum heat (red). Is the operation of temperature regulator normal?	—	System OK	Inspect the blue cable and its connection on the A/C control head and the A/C box.

1.1.4.2 Inspection of HVAC blower control system

Steps	Measures	Normal result	Abnormal result
1	Place the ignition switch in the ON (turn on) position.	—	—
2	Turn the switch of blower motor from OFF (turned off) position to the I, II, III, IV positions.	Beginning from OFF position, the blower motor operates at an increasing speed.	<ul style="list-style-type: none"> The blower motor would not work at any speed. The blower motor only works at high speed.

1.1.4.3 Inspection of HVAC compressor control system

control system operated by circuits. Refer to Diagnostic Information and Procedures in Engine Control System.

These diagnoses are included in the diagnoses of HVAC compressor control system and the engine

1.1.4.4 Inspection of HVAC air supply system

Steps	Measures	Normal result	Abnormal result
1	<ol style="list-style-type: none"> Start the engine. Set the fan control switch on the A/C control head at medium speed. Turn temperature regulator to the blue area. Set the mode selector to FACE (blowing to the face). Switch on the air conditioner. 	<ul style="list-style-type: none"> The blower runs at medium speed. Air flow comes from the air port on instrument board. The idling speed of the engine increases. Switch on the power supply of the compressor. The air flow cools down. The cooling fan of the engine may be running. 	Refer to Inspection of Power Train On-Board Diagnostic System.
2	Change to DEFROST mode on A/C control head.	Air flow comes from the air port beside the windshield. The air conditioning compressor will run automatically in this setting unless the outside temperature is below 4 ° C.	Inspect the gray and the brown cables and their connection on the A/C control head and the A/C box.
3	Set the A/C control head to the BI-LEVEL (blowing to the face and blowing to the foot) position.	Airflow comes from the vent hole on the boarding.	Inspect the gray and the brown cables and their connection on the A/C control head and the A/C box.
4	Set the A/C control head to the DEFOG position.	Airflow comes from the vent hole on the boarding, the front defroster and the vent hole beside the vehicle window. The air conditioning compressor will run automatically in this setting unless the outside temperature is below 4 ° C.	Inspect the gray and the brown cables and their connection on the A/C control head and the HVAC assembly.
6	Slide the recycle button on the A/C control head.	Internal air will be recycled through outlets on the panel and the boarding.	Inspect the green cables and their connection on the A/C control head and the HVAC subassemblies.

1.1.4.5 The blower motor would not run at any speed

Steps	Measures	Numerical values	Yes	No
1	Inspect fuse F20 in the fuse box. Is the fuse closed?	—	Go to Step 2	Replace fuse F20.
2	Inspect fuse F15. Is the fuse closed?	—	Go to Step 3	Replace fuse F15.
3	Inspect the strand between relay K6 and the blower switch S24. Is the strand working correctly?	—	Go to Step 4	Repair the strand.
4	Inspect relay K6. Is the relay working correctly?	—	Go to Step 5	Replace the relay.
5	Inspect the blower switch S24. Is the blower switch S24 working correctly?	—	Go to Step 6	Replace the blower switch.
6	Inspect blower motor Is the blower motor working correctly?	—	Go to Step 7	Replace the blower motor.
7	Inspect relay K7. Is the relay working correctly?	—	Go to Step 8	Replace the relay.
8	Inspect the strand of relay K7. Is the strand working correctly?	—	Go to Step 9	Repair the strand.
9	Inspect the blower motor resistor M10. Is it working correctly?	—	Go to Step 10	Replace the blower motor resistor.
10	Inspect the strand of blower motor resistor. Is it working correctly?	—	System OK	Repair the strand.

1.1.4.6 The blower motor only runs at high speed

Steps	Measures	Numerical values	Yes	No
1	Inspect the blower motor switch S24. Is it working correctly?	—	Go to Step 2	Replace the blower. Motor switch
2	Inspect the harness between the blower motor switch S24 and the blower motor resistor M10. Is it working correctly?	—	Go to Step 3	Repair the harness.
3	Inspect the blower motor resistor M10. Is it working correctly?	—	System OK	Replace the blower motor. Resistor M10

1.1.4.7The blower motor cannot be turned off

Steps	Measures	Numerical values	Yes	No
1	<ol style="list-style-type: none"> 1. Disconnect the blower motor resistor. 2. Turn the ignition switch to the RUN position. 3. Set the A/C control head to the outside loop position. 4. Turn the blower switch to the OFF position. 5. Use a test lamp to conduct a backside exploration between the harness connector and the grounding of the blower motor resistor. <ul style="list-style-type: none"> • I-B (Circuit 60) • II-A (Circuit 63) • III-D (Circuit 72) • III-C (Circuit 73) <p>Does the test lamp light in every test?</p>	—	Go to Step 2	Go to Step 5
2	<ol style="list-style-type: none"> 1. Continue to connect the test lamp to the same terminal that lights it up. 2. Disconnect the heater-A/C control connector C1. <p>Is the test lamp lit up?</p>	—	Go to Step 3	Go to Step 4
3	<p>Repair any short circuit in the following circuits:</p> <ol style="list-style-type: none"> 1. I - Harness connector terminal B (Circuit 60) of the blower motor resistor 2. II - Harness connector terminal A (Circuit 63) of the blower motor resistor 3. III - Harness connector terminal D (Circuit 72) of the blower motor resistor 4. IIII - Harness connector terminal C (Circuit 73) of the blower motor resistor 5. IIIII - Harness connector terminal F (Circuit 52) of the blower motor resistor <p>Is the repair completed and the system newly inspected?</p>	—	To the inspection of HVAC blower control system	—
4	<p>Replace the HVAC control assembly. Refer to relevant sections of Instrument Board, Cluster Gauge and Auxiliary Instrument Board.</p> <p>Is the repair complete?</p>	—	To the inspection of HVAC blower control system	—
5	<p>Replace the blower motor resistor.Refer to Blower Motor Resistor Replacement.</p> <p>Is the repair complete?</p>	—	To the inspection of HVAC blower control system	—

1.1.4.8 Inspection of Refrigerating System

Steps	Measures	Numerical values	Yes	No
1	Does the performance test of A/C system require further diagnosis of the filling of refrigerant in air conditioner?	—	Go to Step 2	Go to System Performance Test.
2	1. Turn off the ignition unit. 2. Connect A/C measuring instrument. Are the high side and low side pressures equal to the specified value?	kPa	To A/C system diagnosis	Go to Step 3
3	Are the high side and low side pressures equal to the specified value?	kPa	System OK	Go to Step 4
4	1. Add 0.5 kg of R-134a. 2. Inspect system for any leakage. Refer to Leak Testing. Is there any leakage?	—	Go to Step 6	Go to Step 5
5	Are the high side and low side pressures between the specified values?	kPa	System OK	Go to Step 6
6	Repair any leaks. Is the repair complete?	—	Go to Step 7	—
7	Drain and recharge the A/C system.Refer to Refrigerant Recovery and Recharging. Are the high side and low side pressures equal to the specified value?	kPa	System OK	To A/C system diagnosis

1.1.4.9 System Performance Test

Note: Take care to record the relative humidity and the ambient temperature when performing the test.

1. Park the vehicle inside or in the shade. The ambient temperature should be at least 16C.
2. Open the vehicle windows, and ventilate the inside of the vehicle.
3. Exhaust waste gas in the engine.
4. Open the engine hood and install a pressure gauge on the high pressure side and the low pressure side.
5. Record the ambient temperature outside the vehicle.
6. Record the relative humidity. Use a wet-and-dry bulb thermometer or consult the local weather authorities.
7. Close the vehicle doors and windows.
8. Set the A/C control head to the outside loop mode, and set the velocity of the blower to high speed, then turn the temperature regulator to the coldest and turn on the air conditioner.
9. Open the air outlet diffuser of the air conditioner.
10. Place a thermometer at the center of the A/C air outlet.
11. Set the driving axle of the transmission to PARK position and turn on the engine, and stabilize the speed of the engine at 2000 RPM.
12. Run the A/C system until the airflow at the air outlet reaches the lowest temperature (in about 3 minutes).
13. Record air temperature at the air outlet and the pressure of the high side and the low side.
14. Turn off the engine and compare the readings with the upper limit data in A/C performance table. Under normal conditions, A/C system in working state should not exceed the grade shown in the table.
15. If any reading exceeds the limit in the table, refer to A/C System Diagnosis.
16. If any reading is lower than the limit in the table, refer to Refrigerating System Inspection.

A/C Performance Table

Relative humidity (%)	Ambient temperatureC	Maximum pressure at the low side MPa	Engine Speed rpm	Air temperature at the center of the largest air outletC	Maximum pressure at the high side MPa
24	38	0.23	2000	11	2.12
30	32	0.20	2000	9	1.91
	38	0.24	2000	13	2.18
40	27	0.17	2000	6	1.75
	32	0.22	2000	11	1.96
	38	0.27	2000	14	2.27
50	27	0.18	2000	8	1.76
	32	0.23	2000	12	1.98
	38	0.29	2000	16	2.33
60	21	0.17	2000	8	1.72
	27	0.18	2000	9	1.76
	32	0.24	2000	14	2.02
70	21	0.17	2000	8	1.75
	27	0.20	2000	10	1.78
80	21	0.17	2000	8	1.77
	27	0.20	2000	11	1.81
90	21	0.17	2000	8	1.78
* A/C compressor is turned off due to excessive high side pressure.					

1.1.4.10 Leak Testing

Caution: Don't operate the detector in an inflammable environment, for its sensor works at high temperature. It may cause personnel injuries or equipment damage.

Once a leakage is suspected, a refrigerant leak test should be conducted to the system. If the system is found to be insufficiently charged, or whenever any repair work affecting the following components has been performed, the existence of a leakage should be suspected.

- The components
- Pipelines
- Fittings

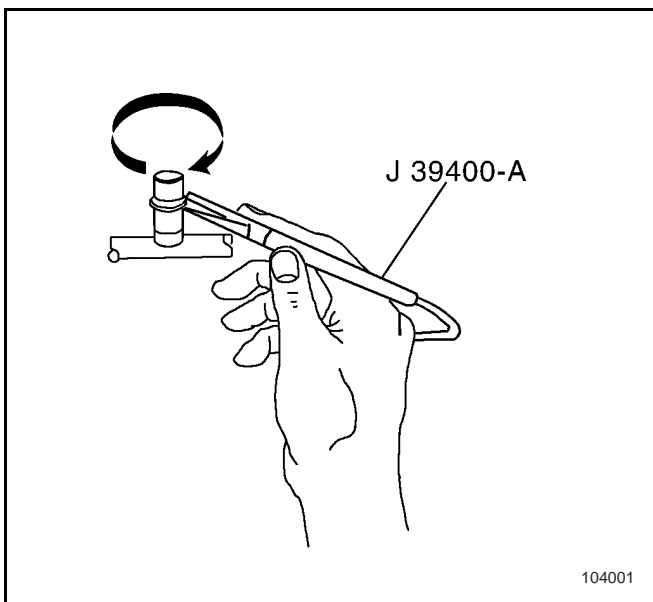
Halogen Leak Detector

Tools required

- J39400-A Halogen Leak Detector
- J39183-CR134A Manifold measuring apparatus
- J39500-5023 kg Refillable recovery tank

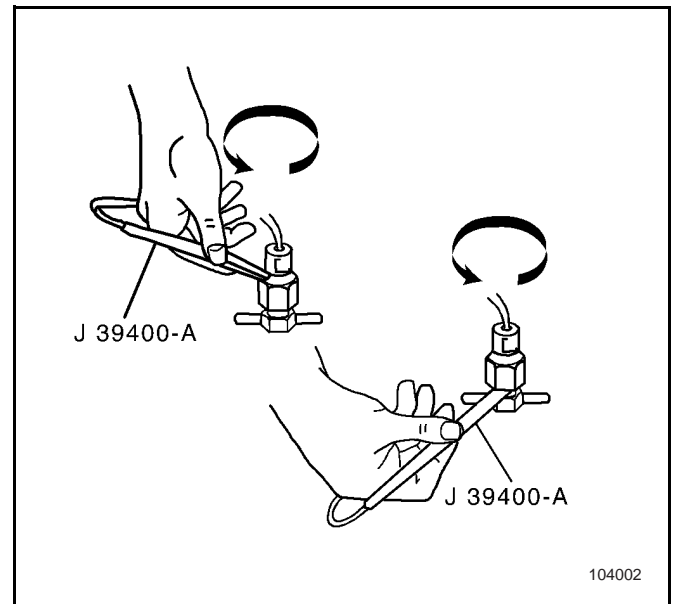
Halogen leak detector is a most effective tool used to detect the leakage of refrigerant. J39400-A is a packaged unit working with a DC of 12 volt, and when R-12 or R-134a is detected, it will generate an audible signal of high frequency. It has three settings:

- R-12
- R-134a
- Severe leakage (complete leakage)

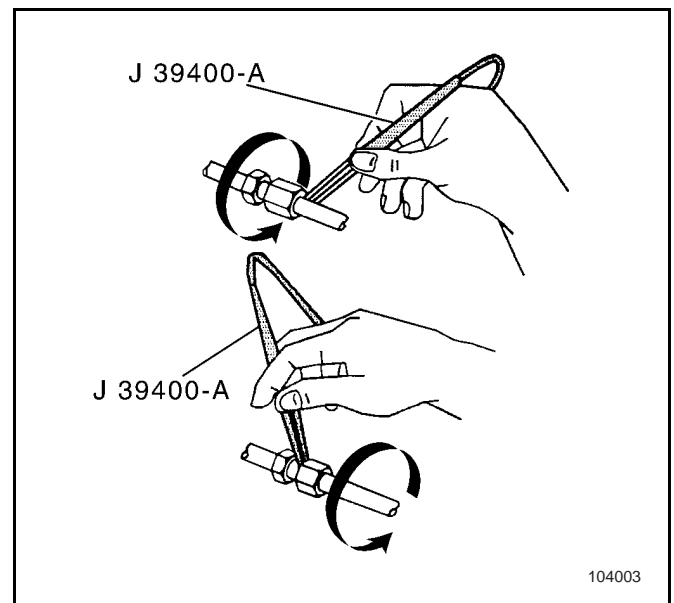


Use Severe Leakage setting to distinguish any mass leakage detected in the other two settings.

Ensure the instrument has been calibrated according to its instructions. Ensure the detector has been correctly set to the type of the refrigerating system to be tested.



Before commencing the test, make sure the refrigerating system has been sufficiently charged for the leak test, which can be confirmed by the measured static pressure on the pressure gauge. A reading between 413 and 689 kPa will be suitable for the leak test.



The most common leakage occurs at refrigerating accessories or the connection. The leakage may be caused by the following reasons:

- Improper torque
- Damaged O-rings
- Lack of lubricant on the O-rings
- Dirt/debris across the O-ring

Even the smallest piece of lint from cotton gloves or a towel can create a leak path across an O-ring.

The successful use of this leak detector or any other electronic leak detector will depend on the scanning frequency. It will also depend on compliance with instructions of the manufacturer in the following respects.

- Calibration
- Operation
- Maintenance

Thorough detection in circling pattern should be performed at every joint at a speed of one to two inches per second, and the tip of the detector should be maintained as close as possible to the surface being inspected. Its distance from the surface should not exceed 1/4 inch, and the opening of the air intake should not be choked. A leak is indicated when the audible tone goes from a steady 1-2 clicks per second to a solid alarm. The balance knob should be adjusted frequently in order to maintain the 1-2 clicks per second rate.

Note: Halogen leak detector is sensitive to the following items:

- Windshield washing solution
- Solvents and cleaning agents
- Binding agents

Clean all surfaces to prevent false warning. Ensure that the surfaces are dry, as ingestion of liquids will damage the detector. The following items can be tested with this procedure:

- Pressure switch
- The evaporator inlet and outlet
- The container intake and outlet
- The condenser intake and outlet
- Other connections
- All brazed and welded areas
- Areas that show signs of damage
- Hose connection
- The compressor rear head
- The housing joints

Note: Always follow the refrigerant system around in a continuous path so that you do not miss any potential leak areas. Even if a leak point has been detected, all of the above areas should be tested to ensure no more leaks exist in the whole system.

Fluorescent Leak Detector

Tools required

- J 41447 Tracer Dye
- J 41436 Tracer Dye Injector
- J 28428-E High Intensity Black Light

Only R-134a refrigerant is different from the R-12 refrigerant used in the past, and it may require other

method for the leak detection. R-134a may leak from a smaller path, as its molecule is smaller than that of R-12. Besides, R-134a does not contain chlorine, which can be easily detected by an electronic leak detector. The method of tracer dye should be used in conjunction with an electronic leak detector, for it can find out the smaller leaks that an electronic leak detector cannot find out alone. R-134a tracer dye requires time. Depending upon the rate of the leak, the leak may take up to 7 days in order to become visible.

Note:

- J 41447 can only be used on vehicles with R-134a, or vehicles changing from R-12 to R-134a.
- Only J 41447 is recommended for use in the R-134a system. The use of any other products will compromise the reliability of the system and cause premature failures to the compressor.
- Only use an injection rate of 1/4 ounce of tracer dye. Larger amounts may compromise the reliability of the A/C system.
- After addition of tracer dye, GM P/N 1050436, an engine degreaser of the GM Company, or an equivalent of it should be used to remove any remaining tracer dye on the surface of the service valve and the equipment, so as to prevent any mistake in diagnosis.

Dye Injection

- You can inject charged systems with tracer dye by using J 41436, according to instructions provided.
- For a discharged system, you can add tracer dye to a replaced component or use ACR4 to add it.

Liquid Leak Detectors and Pressure Testing

The effectiveness of liquid/foam leak detectors is very limited. This is because the visibility of the current refrigerant system is very limited, and liquid/foam leak detectors are not sensitive enough.

The evaporator core

One of the most difficult leaks to find is a leak in the evaporator core. A testing to the evaporator core can be performed according to the following instructions:

1. Switch the blower fan to the high gear and maintain it for more than 15 seconds.
2. Shut the blower fan off.
3. Wait for 10 minutes.
4. Remove the blower fan.
5. Insert the leak detector into the blower position. If the detector sends out a warning, it indicates a leak has been found.

6. Inspect the surface of the evaporator core with an electric torch for any refrigerant. In systems with R-134a the lubricant is water-soluble, therefore no oil can be seen, even when there is a leak.

Compressor shaft seal

1. Blow the rear and the front of the compressor clutch/pulley with compressed air used in factories for at least 15 seconds.
2. Wait 1-2 minutes.
3. Probe the area in front of the pulley. If the detector sends out a warning, it indicates a leak has been found.

1.1.4.11 A/C System Diagnosis

The aim of symptom diagnostic program is to examine the following components for any problem caused by under-cooling.

- V5 Compressor
- Refrigerating system

V5 compressor is a compressor with variable displacement. V5 compressor meets the requirement of air conditioning through stroking other than through cycling the clutch. A control valve is located on the back cover of the compressor. This control valve is used to fulfill the following function: sense the low side pressure and actuate the stroke of the compressor

mechanism. V5 compressor will keep on running, and the whole system will not cycle. This diagnostic process is different from those of systems with fixed displacement. These symptom diagnostic procedures can be used to prevent any unnecessary replacement of A/C system components.

Primary inspection:

- Inspect the fuse of A/C system, and replace it if necessary.
- Inspect the operation of A/C system blower, and replace it if necessary.
- Inspect the electric connection of the clutch coil, and repair it if necessary.
- Inspect the driving belt, and replace it if it has been damaged.
- Inspect the operation of electric cooling fan, and repair it if necessary.
- Inspect the airflow of condenser assembly for any restriction, and clean it as necessary.
- Inspect the airflow of the system for any restriction.

If the outgoing air temperature of the A/C system and the pressure of the compressor are equal to the values in System Performance Test, it indicates the A/C system is OK.

The filling up of refrigerant

Step	Action	Value	Yes	No
1	Did you turn to this step from the A/C System Performance Test?	—	Go to Step 2	Go to System Performance Test.
2	1. The ambient temperature should be at least 16C. Turn the ignition switch to the OFF position. 2. Connect A/C measuring instrument. Are the high side and low side pressures equal to the specified value?	345 kPa	Go to Step 7	Go to Step 3
3	Add 0.5 kg of R-134a. Inspect A/C system for any leakage. Refer to Leak Testing. Is there any leakage?	—	Go to Step 5	Go to Step 4
4	Are the high side and low side pressures within the specified range?	207-345 kilopascal	System OK	Go to Step 5
5	Repair any leaks. Is the repair complete?	—	Go to Step 6	—
6	Drain and recharge the A/C system. Refer to Refrigerant Recovery and Recharging. Are the high side and low side pressures higher than the specified value?	345 kPa	System OK	Go to Step 7

The filling up of refrigerant(Cont' d)

Step	Action	Value	Yes	No
7	1. Let the engine run at idling speed. 2. Set the A/C control head to the FACE mode. 3. Set the blower motor speed to the high speed. 4. Set the temperature to full cold. 5. Turn on the A/C system. Is the clutch engaged?	—	Go to Step 8	Go to Step 15
8	Examine the noise coming out from the compressor or the A/C driving belt area. Is the noise coming from the compressor or the driving belt?	—	Go to Step 9	Go to Step 16
9	Inspect the belt for any skidding. Is the noise caused by the skidding belt?	—	Go to Step 10	Go to Step 11
10	Replace the driving belt of accessories. See Replacement of Driving Belt of Accessories in Engine Mechanical System. Is the repair complete?	—	System OK	Go to Step 14
11	Listen to the A/C compressor for any noise. Is the noise coming from the A/C compressor?	—	Go to Step 12	Go to Step 14
12	Inspect A/C pipelines for any contact with other components. Is it in contact with other components?	—	Go to Step 13	Go to Step 14
13	If necessary, reinstall or replace A/C pipelines. Is the repair complete?	—	System OK	Go to Step 16
14	Is the noise coming from the A/C compressor?	—	Go to Step 15	Go to Step 16
15	Replace the A/C compressor. Refer to Compressor Replacement. Is the noise still present?	—	Go to Step 16	System OK
16	Inspect pipelines at the high pressure side for any restriction; Visually inspect the channels/pipelines for any frosting point, or use physical methods to inspect the channels/pipelines for any difference in temperature, so as to find out any restricted position. Is any fluid resistance present?	—	Go to Step 18	Go to Step 17
17	1. Recover the refrigerant.Refer to Refrigerant Recovery and Recharging. 2. Test the system for any leakage.Refer to Leak Testing. 3. Inspect the outgoing air temperature at the air outlet. Refer to System Performance Test. Is the outgoing air temperature within the specified range?	—	System OK	Go to Step 19
18	Repair the fluid resistance in pipelines of the high pressure side. Is the repair complete?	—	System OK	—
19	1. Run A/C system for 5 minutes or longer. 2. Record pressures on both high pressure and low pressure sides when the electric cooling fan is on. 3. Find out any restriction to the high side pressure and the low side pressure. See A/C Refrigerating Pressure Switch Instruction. Are the low side and high side pressures within the specified range of the pressure switch?	—	Go to Step 20	Go to Step 30

The filling up of refrigerant(Cont' d)

Step	Action	Value	Yes	No
20	1. Set the A/C control head to the FACE mode. 2. Set the blower motor to the high speed. 3. Set the temperature to full cold. 4. Let the engine run at idling speed for 5 minutes. 5. Turn on the A/C system. 6. Touch the liquid pipelines between the condenser and the expansion valve. Are the liquid pipelines cool?	—	Go to Step 21	Go to Step 25
21	Inspect the cooling fan. Is the fan running?	—	Go to Step 22	Go to Step 23
22	Inspect the airflow of the condenser for any restriction. Is the airflow restricted?	—	Go to Step 24	Go to System Performance Test.
23	If necessary, repair the cooling fan. Is the repair complete?	—	System OK	—
24	Eliminate the restriction. Is the repair complete?	—	System OK	—
25	Inspect the A/C system for excessive filling of refrigerant. Is the A/C system overfilled?	—	Go to Step 26	Go to Step 27
26	Recover the refrigerant.Refer to Refrigerant Recovery and Recharging. Drain and recharge the A/C system.Refer to Refrigerant Recovery and Recharging. Is the repair complete?	—	System OK	Go to System Performance Test.
27	Inspect the air in A/C system. Is there any leakage present in A/C system?	—	Go to Step 28	Go to System Performance Test.
28	Leak test the A/C system.Refer to Leak Testing. Is there any leakage present in A/C system?	—	Go to Step 29	Go to System Performance Test.
29	1. Recover the refrigerant.Refer to Refrigerant Recovery and Recharging. 2. Repair the leak of A/C system. 3. Drain and recharge the A/C system.Refer to Refrigerant Recovery and Recharging. Is the repair complete?	—	System OK	—
30	With the engine running, connect a pressure gauge for the high pressure side and the low pressure side. Are the high side and low side pressures equal to the specified value?	207 kPa	Go to Step 31	Go to Step 36
31	1. Close the vehicle doors and windows. 2. Run the engine at a speed of 2000 RPM. 3. Set the temperature control assembly to full cold. 4. Set the blower motor speed to the high speed. 5. From outside loop to air conditioning, cycle the mode once every 20 seconds and for 3 minutes. Are the high side and low side pressures equal to the specified value?	207 kPa	Go to Step 32	—

The filling up of refrigerant(Cont' d)

Step	Action	Value	Yes	No
32	Check for the following conditions: 1. Pressures on the low side and high side pressure gauge increase slowly. 2. The induction pipe of the compressor becomes warm. 3. The blast pipe is very hot. Are the listed conditions present ?	—	Go to Step 33	Go to Step 34
33	Replace the A/C compressor.Refer to Compressor Replacement. Is the repair complete?	—	System OK	—
34	Turn off the engine. With the compressor clutch disengaged, can the driver (not the pulley) of the compressor clutch be rotated manually and freely?	—	Go to Step 33	Go to Step 35
35	Inspect the pressure on the low pressure side. When the rotate speed of the engine is between the shown values, does the pressure on the low side increase rapidly?	2,000-2,800 RPM	Go to Step 40	Go to Step 33
36	Inspect the pressure on the low pressure side. Is the low side pressure within specified value?	172-241 kPa	Go to Step 37	Go to Step 40
37	Add 0.5 kg R-134a refrigerant to the system. Does the cooling performance improve?	—	Go to Step 38	Go to Step 40
38	Perform leak testing. Refer to Leak Testing. Is there any leakage?	—	Go to Step 39	System OK
39	1. Repair any leaks. 2. Drain and recharge the A/C system.Refer to Refrigerant Recovery and Recharging. Is the repair complete?	—	System OK	—
40	1. Connect measuring apparatus to the high pressure and the low pressure sides. 2. Close the vehicle doors and windows. 3. Run the engine at a speed of 2000 RPM. 4. Set the A/C control head to the FACE mode. 5. Set the temperature control to full cold. 6. Turn on the A/C system. 7. Set the blower motor speed to low speed. Is the low side pressure within the shown value?	172-241 kPa	Go to System Performance Test.	Go to Step 41
41	1. Recover the refrigerant.Refer to Refrigerant Recovery and Recharging. 2. Replace the control valve. Refer to Compressor Control Valve Assembly Replacement (V5 - Direct Mount). Is the repair complete?	—	Go to Step 42	—
42	Drain and recharge the A/C system.Refer to Refrigerant Recovery and Recharging. Is the repair complete?	—	System OK	Go to System Performance Test

1.1.4.12Insufficient Defrosting

Condition	Action
The injection nozzle of the defroster is blocked.	<ul style="list-style-type: none"> Inspect the air outlet of the defroster. Remove any foreign objects. Repair any loose instrument panel pad that blocks an outlet.
Shortage of heat.	Refer to Insufficient Heating.

1.1.4.13 Insufficient Heating

Step	Action	Value	Yes	No
1	<ol style="list-style-type: none"> 1. Inspect the level of engine coolant. 2. Inspect the driving belt tensioning force of the coolant pump. 3. Inspect hoses of the radiator and the heater for any leakage or kinking. 4. Make inspection to find out whether the radiator cap is normal. <p>Is the action complete?</p>	—	Go to Step 2	—
2	<ol style="list-style-type: none"> 1. Set the mode to HEAT. 2. Set the blower motor speed to the high speed. 3. Set the temperature control to full heat. 4. Turn the ignition switch to ON. 5. Inspect airflow at the outlet of the heater. <p>Is it the airflow from the heater outlet is very small or no airflow is present?</p>	—	Go to Step 3	Go to Step 7
3	<p>Inspect the outlet of the defroster or the vent hole for any airflow.</p> <p>Is it the airflow from the outlet of defroster or the vent hole is very small or no airflow is present?</p>	—	Go to Step 4	Go to Step 14
4	<ol style="list-style-type: none"> 1. Set the mode to DEFROST. 2. Inspect airflow at the outlet of the defroster. <p>Is it the airflow from the outlet of defroster is very small or no airflow is present?</p>	—	Go to Step 5	Go to Step 15
5	<p>Set the blower speed from the following position to:</p> <ul style="list-style-type: none"> • OFF to 1 • 1-2 • 2-3 • 3-4 <p>Then return to OFF.</p> <p>When the blower speed is turned to HI (high speed) then slows down as the switch is turned to LO (low speed), does the blower motor speed drop to each of the corresponding speed grades?</p>	—	Go to Step 6	Go to Step 16
6	<ol style="list-style-type: none"> 1. Check for any obstruction at the opening of the blower intake and forced ventilator of the system. 2. Repair as necessary. <p>Is the action complete?</p>	—	Go to Step 7	—
7	<p>Set the blower speed from the following position to:</p> <ul style="list-style-type: none"> • OFF to 1 • 1-2 • 2-3 • 3-4 <p>Then return to OFF.</p> <p>When the blower speed is turned to 4 (high speed) then slows down as the switch is turned to 1 (low speed), does the blower motor speed drop to each of the corresponding speed grades?</p>	—	Go to Step 8	Go to Step 16

1.1.4.13 Insufficient Heating(Cont' d)

Step	Action	Value	Yes	No
8	<ol style="list-style-type: none"> 1. Set the blower motor speed to 4 (high speed). 2. Inspect the ambient air temperature with a thermometer. 3. Drive the vehicle at 48 kilometer per hour. The shortest engine warm-up time is 20 minutes. 4. Inspect the exhaust temperature at the heater outlet and the ambient temperature. <ul style="list-style-type: none"> • 54 °C @-18°C • 59 °C @-4 °C • 64 °C @10 °C <p>Is the temperature at the outlet of the heater within the specified value?</p>	—	Go to Step 17	Go to Step 9
9	Is the air door actuator in normal operation?	—	Go to Step 10	Go to Step 18
10	<ol style="list-style-type: none"> 1. Set the temperature control to full heat. 2. Start the engine. 3. Touch the heater hose at the opening of the air intake and air outlet. <p>Is the heater hose at the air inlet hot and the heater hose at the air outlet warm?</p>	—	Go to Step 13	Go to Step 11
11	<ol style="list-style-type: none"> 1. Disconnect the heater hoses at the heater core. 2. Inspect the correct position of the heater hose. 3. Inspect the coolant valve. If the operation of the valve is abnormal, replace it. <p>Is the position of the heater hose reversed?</p>	—	Go to Step 19	Go to Step 12
12	<ol style="list-style-type: none"> 1. Rinse the heater core. 2. Drain and refill the cooling system. 3. Set the temperature regulator to full heat. 4. Start the engine. 5. Touch the heater hose at the opening of air intake and air outlet. <p>Is the heater hose at the opening of air inlet hot and the heater hose at the opening of air outlet warm?</p>	—	Go to Step 24	Go to Step 22
13	<p>Inspect to see if the thermostat is installed correctly.</p> <p>Is the thermostat installed correctly?</p>	-{}--	Go to Step 21	Go to Step 20
14	<p>Inspect the mode throttle controller and the cable.</p> <p>Is the action complete?</p>	—	Go to Step 24	—
15	<ol style="list-style-type: none"> 1. Inspect to see whether the heater outlet has been blocked. 2. Repair as necessary. <p>Is the action complete?</p>	—	Go to Step 24	—
16	<p>Inspect the blower motor, refer to HVAC Blower Control System Inspection.</p> <p>Is the action complete?</p>	—	Go to Step 24	—
17	<ol style="list-style-type: none"> 1. Inspect the following positions of the vehicle for any leakage of cold air. <ul style="list-style-type: none"> • Instrument Panel • Heater case • Front vent 2. Repair as necessary. <p>Is the action complete?</p>	—	Go to Step 24	—
18	<p>Repair or replace the throttle cables.</p> <p>Is the action complete?</p>	—	Go to Step 24	—

1.1.4.13 Insufficient Heating(Cont' d)

Step	Action	Value	Yes	No
19	Reinstall the heater hose at the correct position. Is the action complete?	—	Go to Step 24	—
20	Reinstall the thermostat. Is the action complete?	—	Go to Step 24	—
21	Replace the thermostat. Is the action complete?	—	Go to Step 24	—
22	Replace the heater core. Is the action complete?	—	Go to Step 24	—
23	Check for any obstruction between the blower air inlet of the system and the opening of the forced ventilator. Is the action complete?	—	Go to Step 24	—
24	Perform functional test. Refer to Functional Test. Is the action complete?	—	System OK	—

1.1.4.14 Noise Diagnosis

Step	Action	Value	Yes	No
1	Inspect the electric connection and the grounding of the blower. Is the action complete?	—	Go to Step 2	—
2	1. Sit inside the vehicle. 2. Close the vehicle doors and windows. 3. Turn the ignition switch to ON. 4. Set the blower motor speed to the high speed. 5. Set the mode to FACE. 6. Set the temperature control to full cold. 7. Cycle through all positions of the blower speeds, modes and temperature controls, so as to determine under what condition the noise is present, and under what condition the noise is absent. Is the blower giving out a persistent whining, ticking, trembling, or grating sound? Does the sound weaken as the blower slows down?	—	Go to Step 4	Go to Step 3
3	Listen to the sound of the blower again. Does the blower give out intermittent prolonged squealing/shrilling sounds only at the startup and/or occasionally?	—	Go to Step 4	Go to Step 7
4	Touch the bellows to inspect the vibration of the blower and the fan at each blower speed. Is excessive vibration present?	—	Go to Step 6	Go to Step 5
5	1. Remove the blower from the bellows. 2. Check for the presence of foreign objects at the opening of the blower intake. Was any foreign object found?	—	Go to Step 10	Go to Step 6
6	1. Inspect the blower fan for presence of the following conditions: <ul style="list-style-type: none"> • Wear spots • Cracked blades • Broken wheel hub • Loose fan holder • Misaligned fan 2. Inspect the bellows for any wear spot. Was wearing found?	—	Go to Step 11	Go to Step 12

1.1.4.14 Noise Diagnosis(Cont' d)

Step	Action	Value	Yes	No
7	1. Set the blower motor speed to 4 (high speed). 2. Inspect all temperature positions from full heat to full cold under the FACE, HEAT and DEFROSTER modes. Is excessive blower noise only present in the FACE mode?	—	Go to Step 13	Go to Step 8
8	Listen to the sound of the blower again. Is the blower noise only present in the HEAT and/or DEFROST mode?	—	Go to Step 14	Go to Step 9
9	Listen to the sound of the blower again. Is the blower noise only present in the HEAT and/or DEFROST mode?	—	Go to Step 15	Go to Step 16
10	1. Remove any foreign object from the blower assembly. 2. Repair as necessary. Is the action complete?	—	Go to Step 17	—
11	Repair the blower fan and/or the bellows as necessary. Is the action complete?	—	Go to Step 17	—
12	Replace the blower motor and the fan. Is the action complete?	—	Go to Step 17	—
13	1. Check the ducts for obstructions or foreign materials. 2. Check the seal of the vent hole intake. 3. Repair as necessary. Is the action complete?	—	Go to Step 17	—
14	1. Check the ducts for obstructions or foreign materials. 2. Check the seal of the heater and/or defroster intake. 3. Repair as necessary. Is the action complete?	—	Go to Step 17	—
15	1. Check the seal of air door. 2. Repair as necessary. Is the action complete?	—	Go to Step 17	—
16	1. Check the heating system for any obstruction or any foreign objects between the blower fan and the air door. 2. Repair as necessary. Is the action complete?	—	Go to Step 17	—
17	Perform functional test. Refer to Functional Test. Is the action complete?	—	System OK	—

Cold Air Blast from the Floor

Problem	Measures
The air inlet valve is only partly open.	<ul style="list-style-type: none"> Except when the A/C system is in air conditioning mode, the air intake valve should be properly closed in all modes. Repair as necessary.
The seals on side doors are damaged or absent.	<ol style="list-style-type: none"> Check all door seals. Repair or replace faulty seals as necessary.

1.1.4.16 Odor Diagnosis

Problem	Possible causes	Corrective measure
There may be musty odor under certain climatic or operational conditions. The musty odor is caused by microbial growth in the evaporator core. This odor is usually temporary. As climate changes, this odor will disappear. If the odor is still present, it may be necessary to clean the evaporator core with suitable cleaning agent.		
Musty Smell	<ul style="list-style-type: none"> Water leak (body) Obstruction in the duct of evaporator Musty or mouldy evaporator core 	<ul style="list-style-type: none"> Find out and repair the leaking position. Clean the evaporator drain. Clean the evaporator.
Coolant Smell	<ul style="list-style-type: none"> The heater core is leaking. The heater core pipes or hoses are leaking. 	<ul style="list-style-type: none"> Replace HVAC box.
Refrigerant Oil Smell	The heater core is leaking.	Replace HVAC box.

1.1.5 Repair guidance

1.1.5.1 Correction of Odor

Under tropical climatic conditions, odors may come out of A/C system as it is started. Residues in the housing of the heater/evaporator or moulds growing on the evaporator core will also create such odors. A repair kit is available through GMSPO.

A single application of deodorizer GM P/N 12370470 will remove odors from the air conditioning system. Install a delayed blower control module in order to prevent the odor from returning. Refer to Installation Instruction provided with the part.

1. Remove all residues that have been sucked into the forced ventilation device from outside air.
2. Disconnect the clutch coil. This will shut down the operation of the A/C compressor clutch.
3. Turn on the engine to dry the evaporator core. Besides, run the blower motor at high speed in the recirculation mode, and turn the temperature control knob to the maximum heat and maintain it for 10 minutes.
4. Choose a position on the A/C pipeline between the blower motor and the evaporator core and in the downstream of the blower motor fan.
5. Drill a hole of 1/8 inch at a position that will not interfere the blower motor, evaporator, or any operating part of the system.

Note: Wear safety goggles and emulsion gloves when performing the following steps.

6. Keep the blower motor run at high speed and insert the drawtube of deodorizer GM P/N 12370470 into the hole until the mark on the drawtube has been reached.
7. Spray the area using short bursts. Dispense the contents of the can over a 2-3 minute

period. Spray the interior of the pipeline with changing directions.

8. Turn off the engine.
9. Lay the engine aside for 3-5 minutes.
10. Seal the 1/8-inch hole with body sealant or RTV gasket mixture.
11. Start the engine and run the fan at high speed for 15-20 minutes to dry it.
12. Reconnect the A/C compressor clutch coil and check its operation.

1.1.5.2 Refrigerant Recovery and Recharging

Tools required

- J 39500-B Air Conditioning Refrigerant Recovery, Recycling and Recharging (ACR4) System
- J 41810 Pure Guard 2
- J-41810-100A Positive flow control valve

Caution: Avoid breathing the A/C Refrigerant 134a (R-134a) and the lubricant vapor or the mist. Exposure may irritate the eyes, nose, and throat. Work in a well-ventilated area. In order to remove R-134a from the A/C system, use service equipment that is certified to meet the requirements of SAE J 2210 (R-134a recycling equipment). If an accidental system discharge occurs, ventilate the work area before continuing service. Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

Caution: For personal protection, goggles and gloves should be worn and a clean cloth wrapped around fittings, valves, and connections when doing work that includes opening the refrigerant system. If R-134a comes in contact with any part of the body severe

frostbite and personal injury can result. The exposed area should be flushed immediately with cold water and prompt medical help should be obtained.

Notice: R-134a is the only approved refrigerant for use in this vehicle. The use of any other refrigerant may result in poor system performance or component failure.

Notice: To avoid system damage use only R-134a dedicated tools when servicing the A/C system.

Notice: Use only Polyalkylene Glycol Synthetic Refrigerant Oil (PAG) for internal circulation through the R-134a A/C system and only 525 viscosity mineral oil on fitting threads and O-rings. If lubricants other than those specified are used, compressor failure and/or fitting seizure may result.

Notice: R-12 refrigerant and R-134a refrigerant must never be mixed, even in the smallest of amounts, as they are incompatible with each other. If the refrigerants are mixed, compressor failure is likely to occur. Refer to

the manufacturer instructions included with the service equipment before servicing.

The J 39500-B removes the Refrigerant-134 a from the vehicle's A/C system. The recovery procedure uses one filtering cycle. An automatic multipass filtering cycle will be used for the exhausting process. These filtering cycles ensure a constant supply of clean and dry refrigerant exists for the A/C system charging.

Initial Installation Manual provided with J39500-B.

For ACR4 technical assistance in China, please call 86-10-6496-5588 then switch to 0305 or 0306.

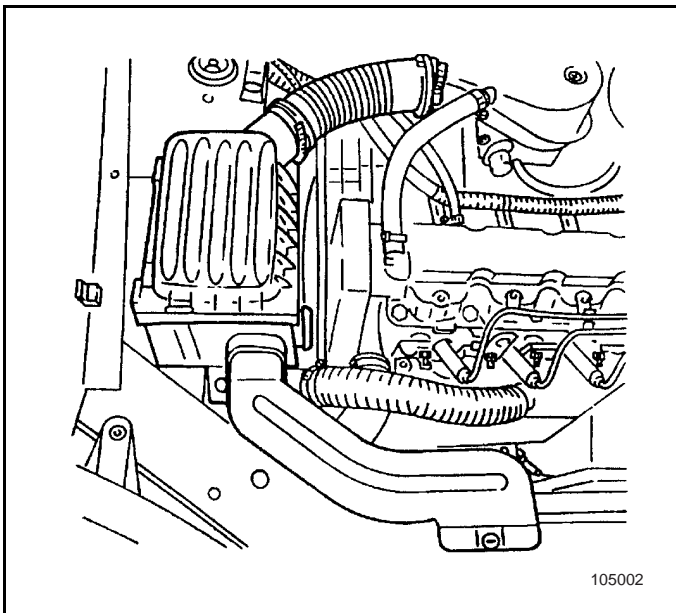
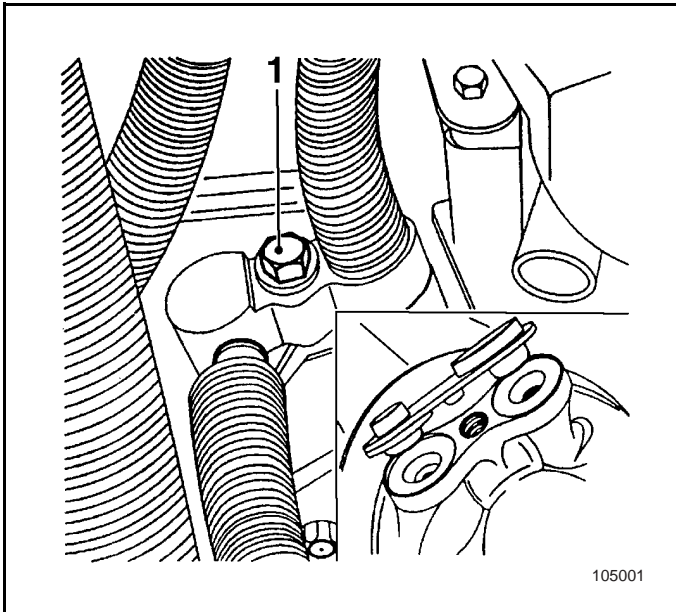
Addition of refrigerant oil

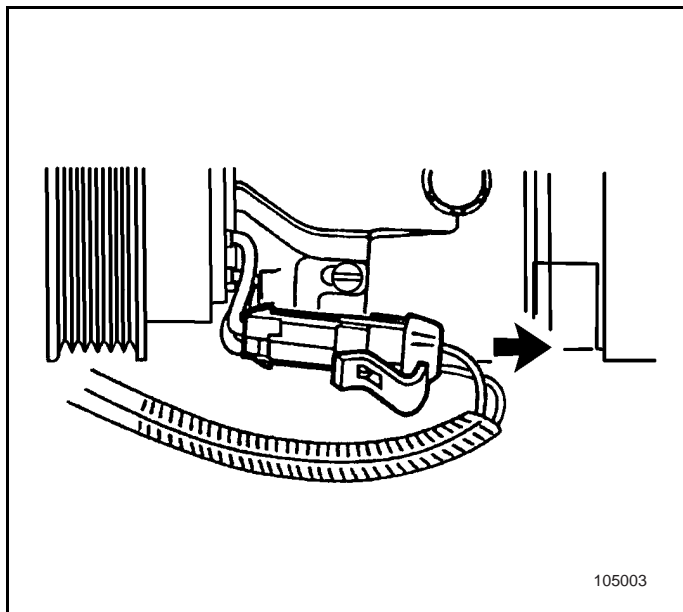
If refrigerant oil of the A/C system has been discharged in the recovery process, the same amount of refrigerant oil should be added in the recharging process. If any reduction of the refrigerant has been caused by component replacement or accidental loss, the refrigerant oil should be added. Refer to Addition of Refrigerant Oil in Sepcifiectons.

1.1.5.3 Replacement of Compressor Assembly

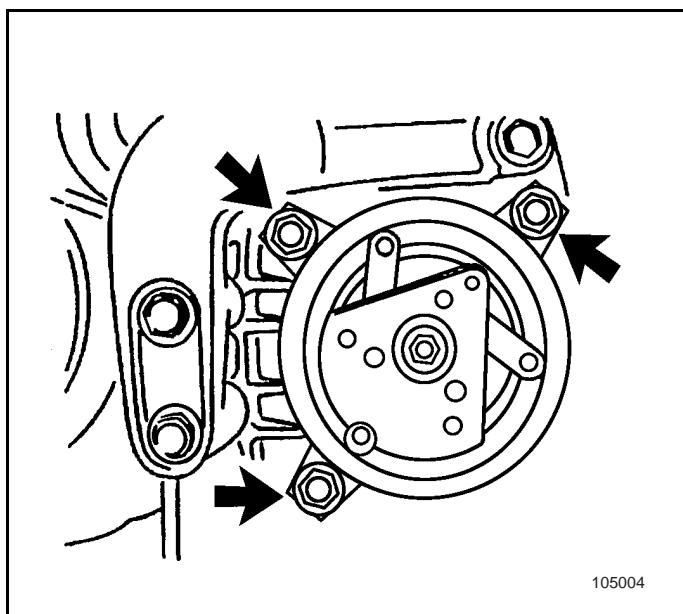
Removal procedures

1. Drain the A/C system.
2. Remove the refrigerant hose assembly from the compressor (1).
3. Install a dust cover on the compressor and the hose immediately.
4. Remove the air intake hose, the air filter housing assembly and the suction hose.
5. Loosen the drive belt.
6. Remove the drive belt.

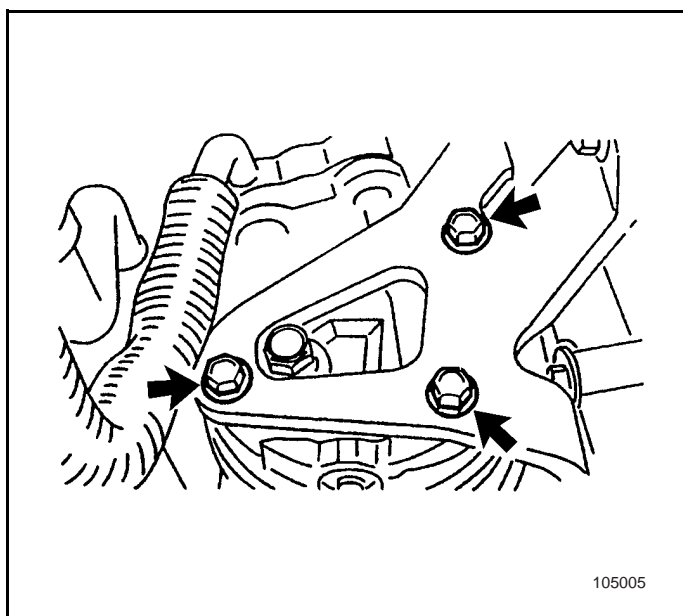




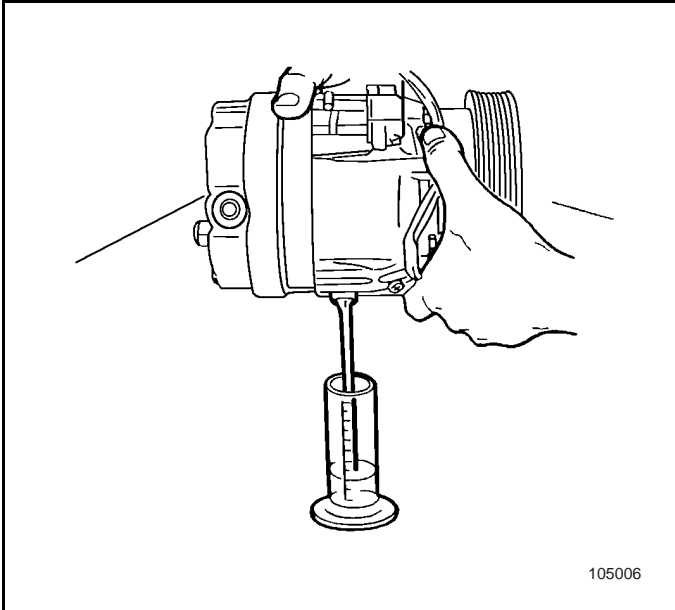
7. Remove wire connector from the compressor clutch.



8. Remove the front bracket of the compressor.



9. Remove the rear bracket of the compressor.



10. Remove the compressor oil screw plug assembly, and let the compressor oil flow into the container.

Make records.

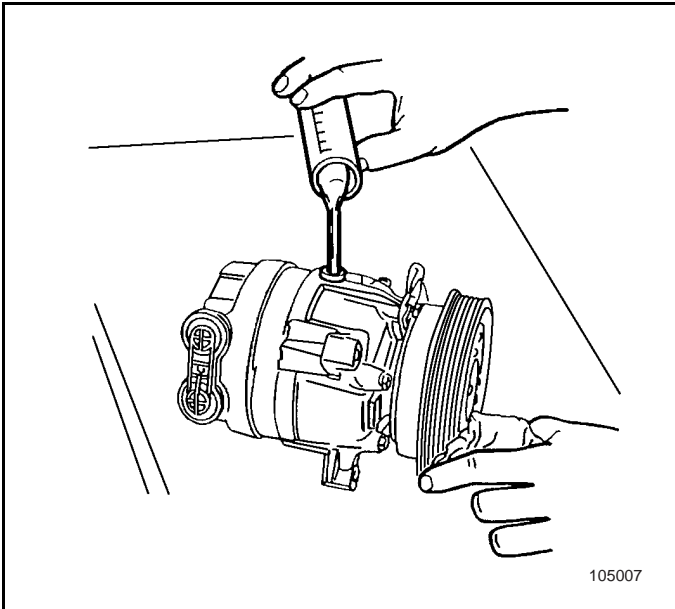
Record the volume of compressor oil.

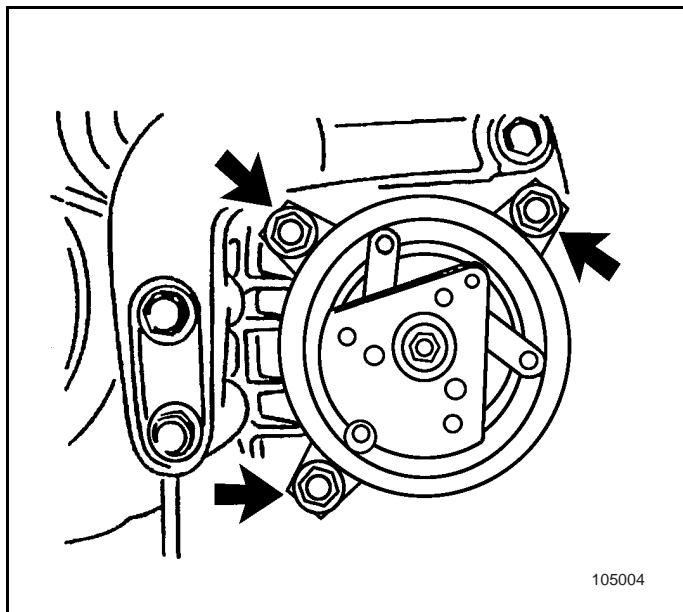
Installation procedures

1. Pour new compressor oil into a clean container. Charge the new compressor, and the volume being charged should equal to the amount of oil that has been drained from the oil compressor. Screw on the oil screw plug.

Tighten

Tighten the oil screw plug to 15-20N•m.

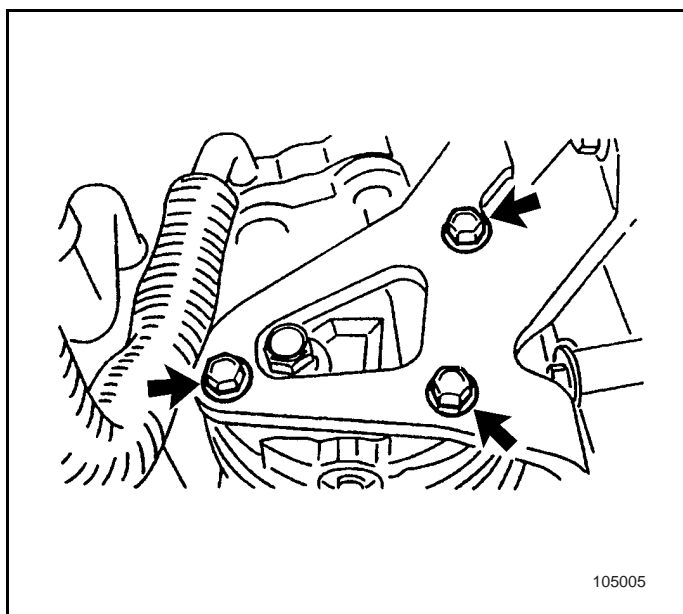




2. Use bolts to install the compressor onto the front bracket.

Tighten

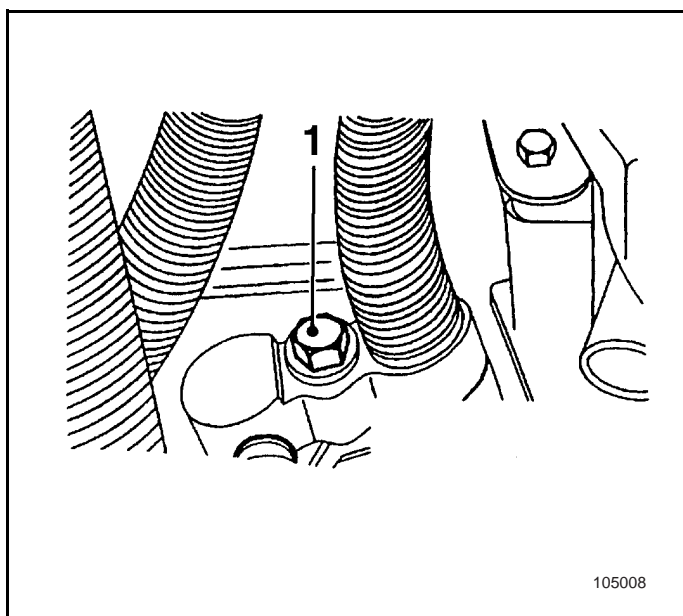
Tighten the bolts to 30-40 N•m.



3. Use bolts to install the compressor onto the rear bracket.

Tighten

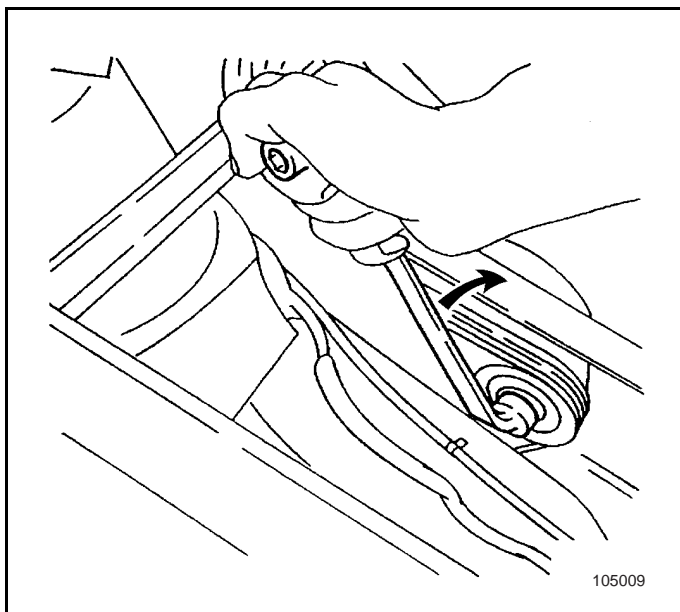
Tighten the bolts to 30-40 N•m.



4. Apply mineral oil on the new sealing member.
5. Connect refrigerant hose to the compressor.
6. Connect wire connector to the compressor clutch.

Tighten

Tighten the bolts from compressor hose assembly to the compressor to 33 N•m.



7. Install drive belt, and tighten the bolts of drive belt tensioner.

Tighten

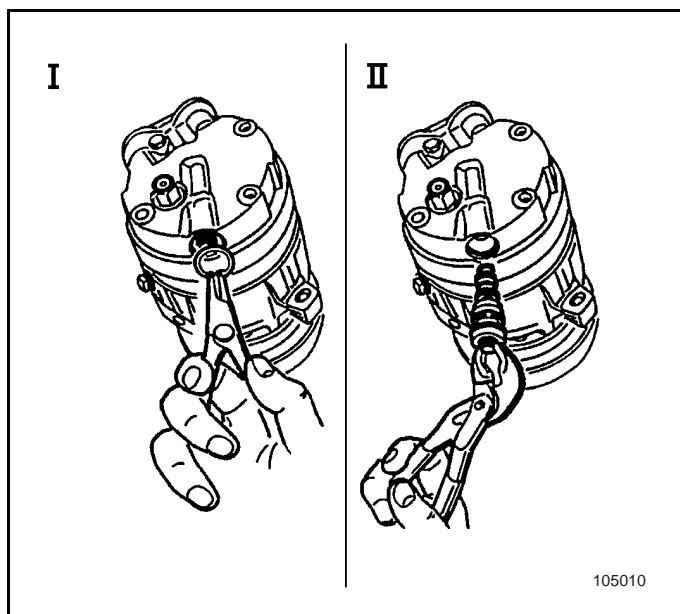
Tighten the bolts of the tensioner to 22-30 N•m.

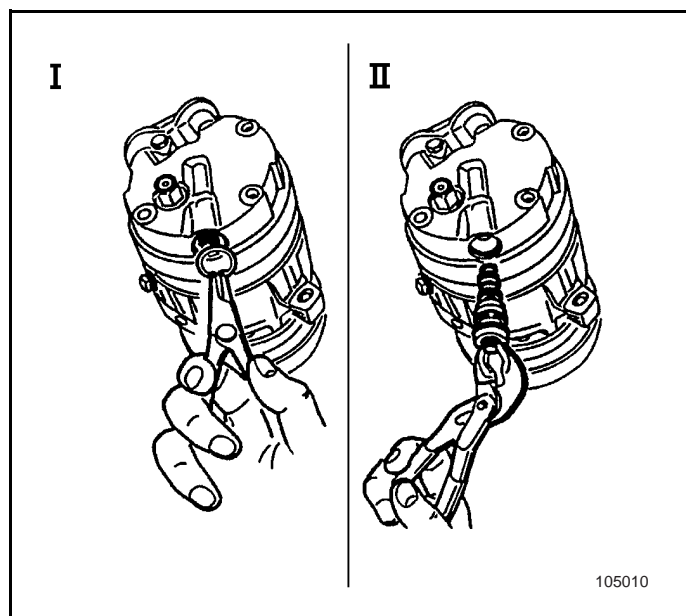
8. Install air intake hose and air filter housing.
9. Drain and recharge the A/C system.

1.1.5.4 Replacement of Compressor Control Valve

Removal procedures

1. Drain the A/C system.
2. Remove the seal.
3. Pull the control valve out of the compressor housing.





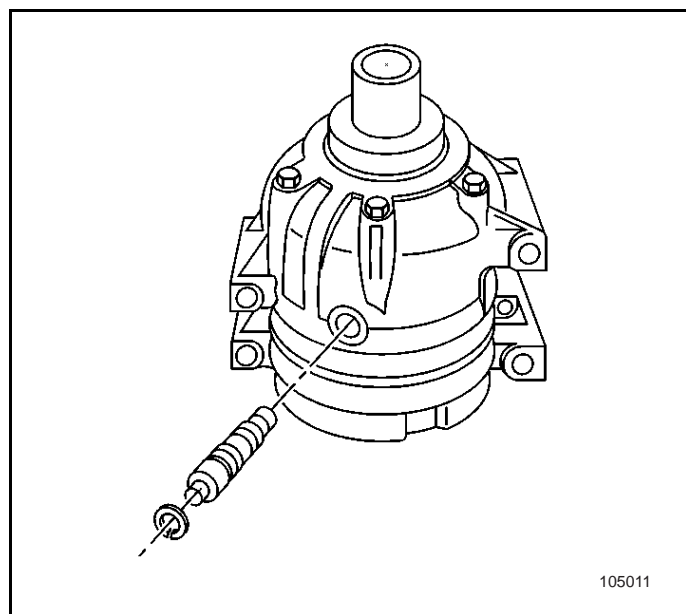
Installation procedures

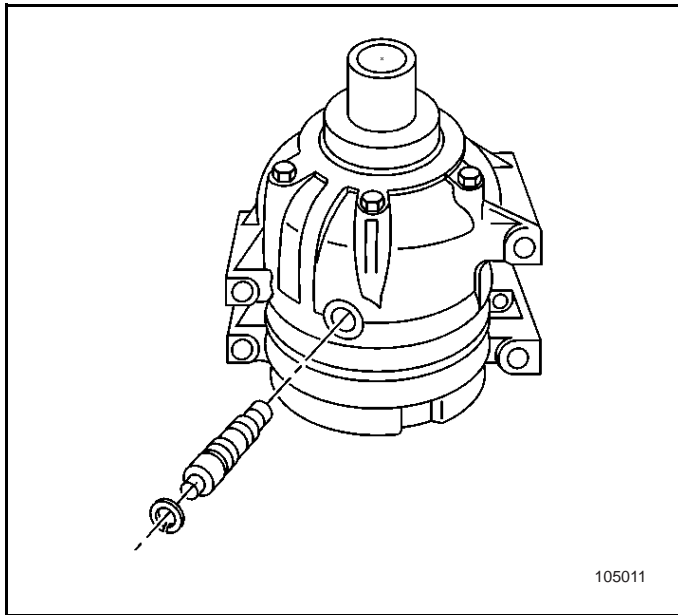
1. Use O-ring to seal the control valve.
2. Install the control valve into the compressor housing.
3. Drain and recharge the A/C system.

1.1.5.4 Replacement of Compressor Control Valve Assembly (V5 - Direct mount)

Removal procedures

1. Install the compressor onto the fixture.
2. Remove the compressor control valve retaining ring with an internal snap ring plier.
3. Remove the compressor control valve from the compressor.





Installation procedures

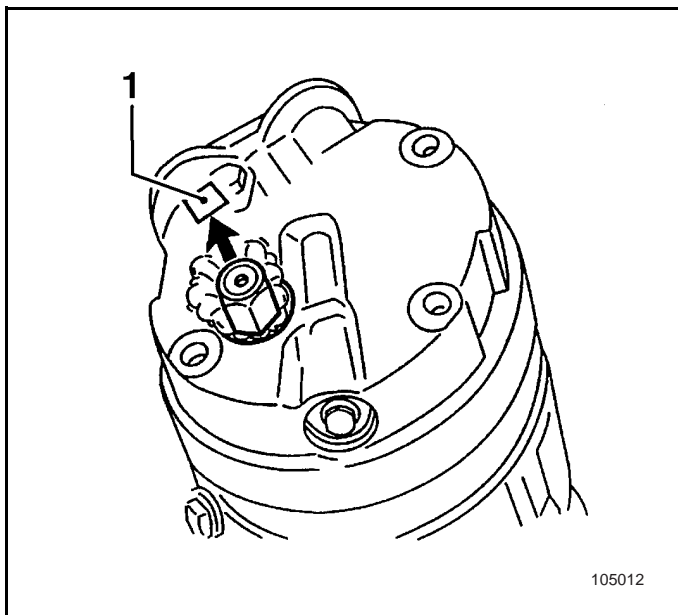
1. Coat the O-ring with clean 525 viscosity refrigerant oil.
2. Push the compressor control valve into the compressor with thumb pressure.
3. Install compressor control valve retaining ring with an internal snap ring plier, and make sure the retaining ring has been properly fixed to the annual recess.
4. Remove the compressor from the fixture.

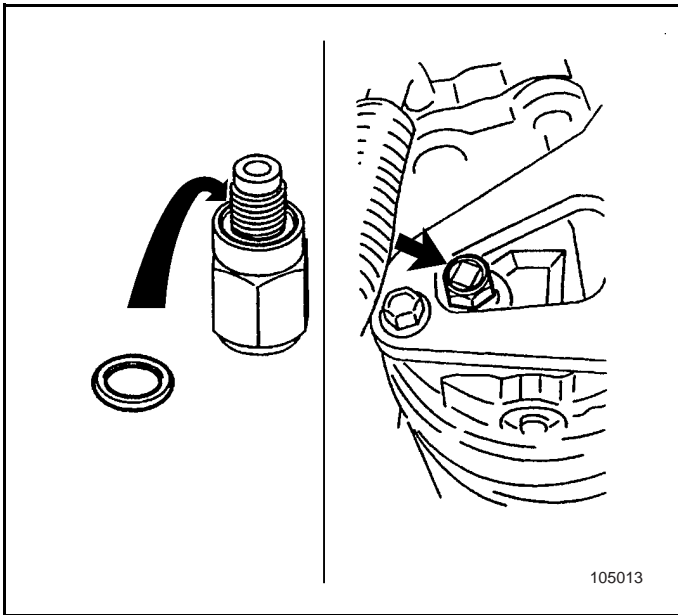
1.1.5.6 Replacement of compressor Pressure Relief Valve (V5-Directly-mounted)

Notice: If there is no label on 1, it indicates HPRV is working. Before disassembly, release the pressure in the A/C system.

Removal procedures

1. Drain the A/C system.
2. Remove HPRV form the rear side of the compressor.





Installation procedures

1. Seal the new O-ring with mineral oil.
2. Screw the HPRV onto the compressor housing.

Tighten

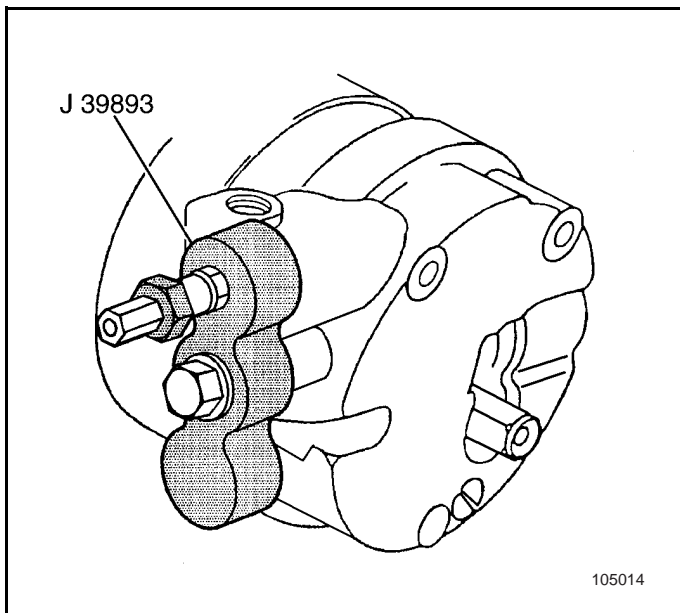
Tighten the bolts connecting to the compressor housing to 6-10 N•m.

3. Drain and recharge the A/C system.

1.1.5.7 Compressor Leak Testing (V5 Directly-mounted)

Tools required

- J 39893
- J 39500-B
- J 39400-A



1. With the sealing washers in place, install the J 39893 on the rear head of the compressor.
2. Connect the gage charging lines and the J 39500-B.
3. Pressurize the suction and the high-side of the compressor with R-134a refrigerant.
4. With the compressor in a horizontal position, rotate by hand the compressor shaft in the operating direction.
5. Rotate the shaft several times.
6. Using the J 39400-A, check for leaks at the following locations:
 - Pressure Relief Valve
 - Rear head switch
 - Front head seals
 - Rear head seals
 - Through bolt head gaskets
 - Compressor shaft seal
7. Perform the measures necessary to correct any external leaks found.
8. Recheck for leaks following any repair.
9. Recover the refrigerant.
10. Disconnect the hoses from the J 39893.
11. Remove the J 39893.

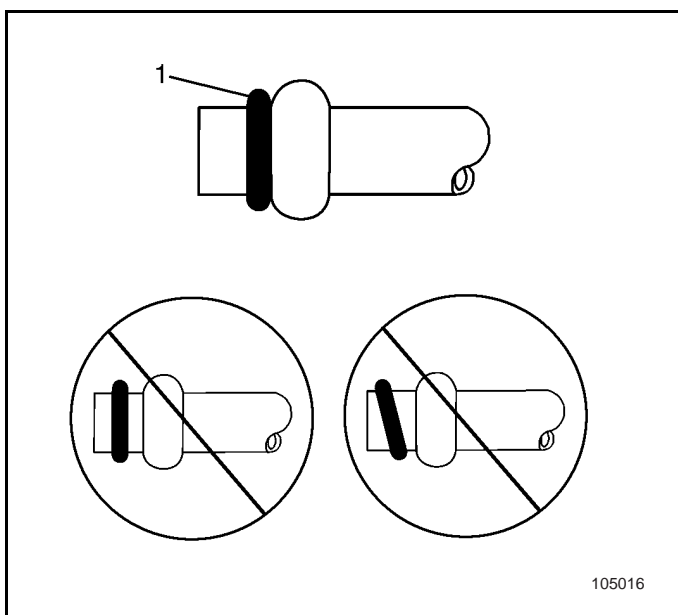
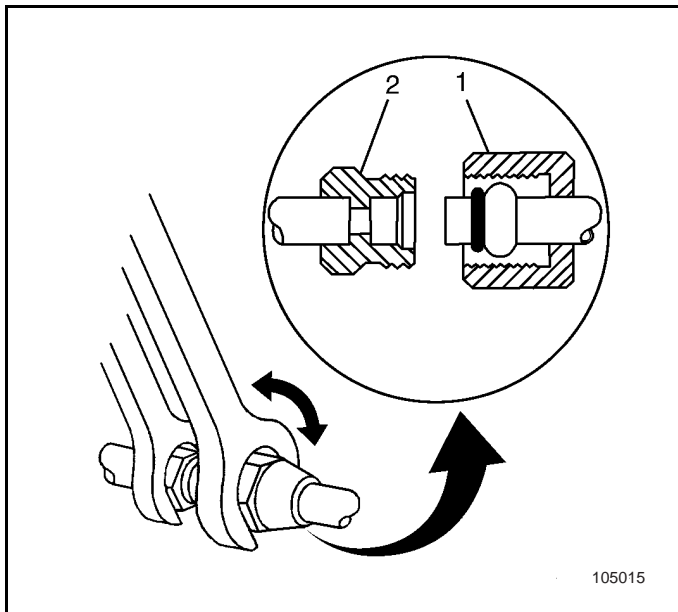
1.1.5.8 Replacement of O-ring Seals

Removal procedures

1. Remove air filter and air-duct assembly.
2. Recover the refrigerant. Refer to Refrigerant Recovery and Recharging.
3. For compression-style fittings: use spare wrench to lock the A/C refrigerant pipeline (of smaller size) connector (2), then loosen the A/C refrigerant hose (of larger size) connector (2).
4. For banjo-style fittings: remove the clamping bolts/nuts retaining the A/C refrigerant hose to the A/C refrigerant pipeline.

Note: Cap or tape the open A/C refrigerant hose and the A/C refrigerant component immediately.

5. Disconnect the A/C refrigerant hose and the A/C refrigerant component, discard the O-ring and the covering cap, or tape the hose and the refrigerant component to prevent pollution.

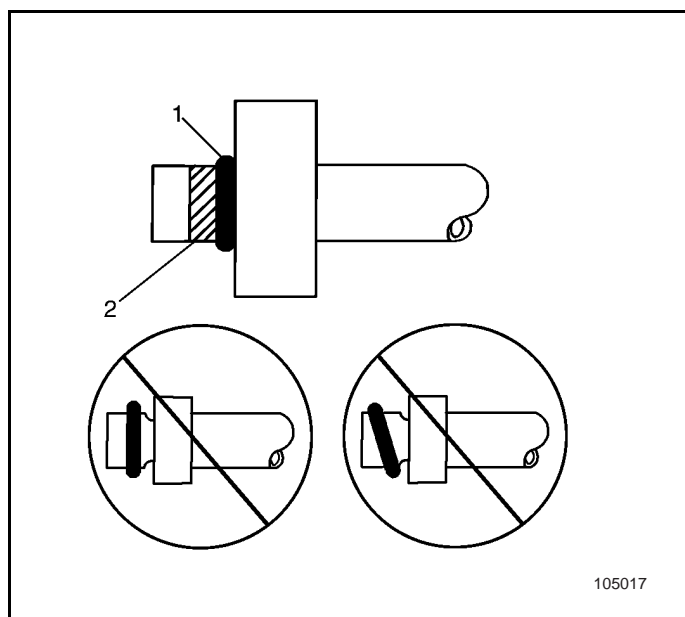


Installation procedures

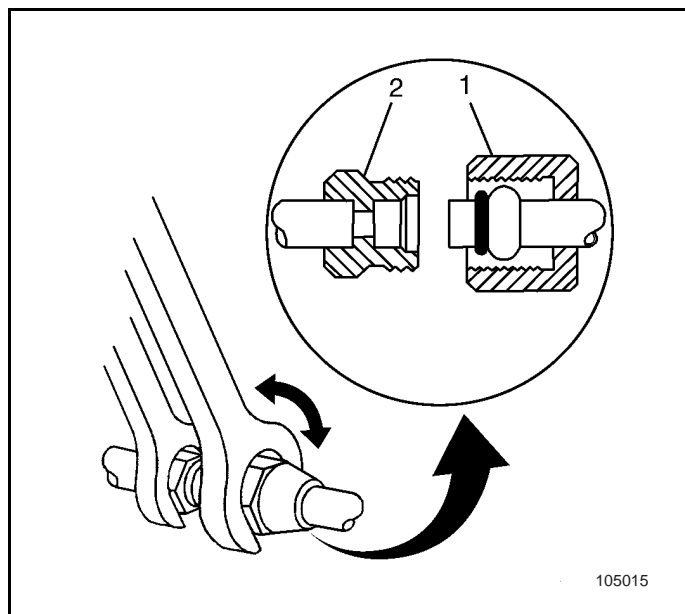
1. Remove the cap or tape from the A/C refrigerant hose and the A/C refrigerant component.
2. Using a lint-free clean, dry cloth, carefully clean the sealing surfaces of the A/C refrigerant hose and the A/C refrigerant component.
3. For banjo-style fittings: carefully slide the new O-ring seal (1) onto the A/C refrigerant hose until seated.

Note: DO NOT allow any of the mineral base 525 viscosity refrigerant oil on the new O-ring seals to enter the refrigerant system.

4. Lightly coat the new O-ring seals (1) with mineral base 525 viscosity refrigerant oil.
5. For banjo-style fittings: carefully slide the new O-ring seal (1) onto the A/C refrigerant hose until seated.



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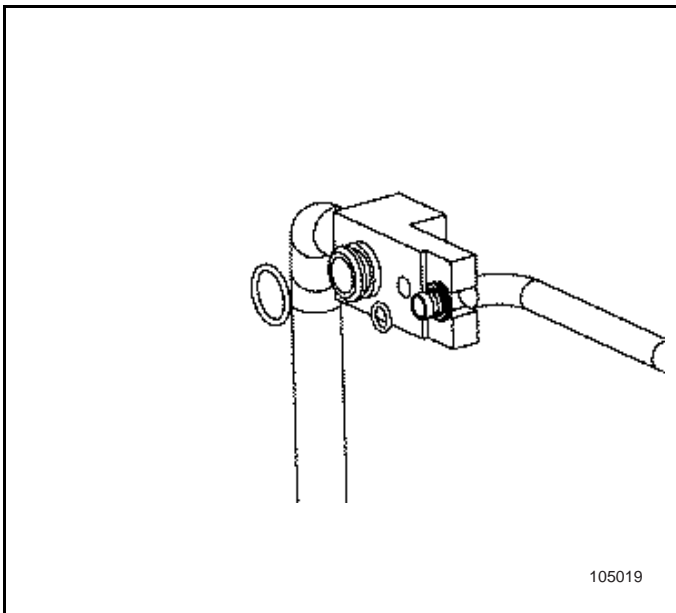
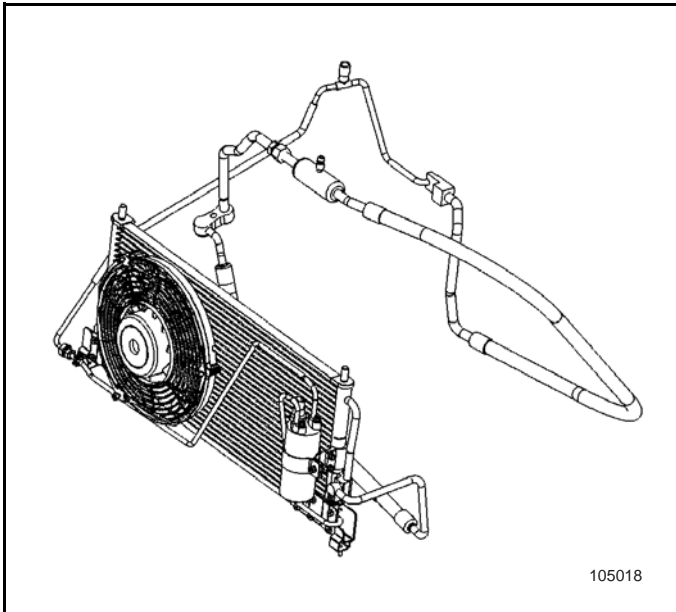
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6. Lightly coat the new O-ring seals (1) with mineral base 525 viscosity refrigerant oil.
7. Allow a light coating of the refrigerant oil to remain on the A/C refrigerant hose in the area indicated (2) only.
8. Install the A/C refrigerant hose to the A/C refrigerant component.
9. For compression-style fittings: use a spare wrench to lock the A/C refrigerant pipeline (of smaller size) connector (2), then retighten the A/C refrigerant hose (of larger size) connector (2).
10. For banjo-style fittings; install the bolt retaining the A/C refrigerant hose to the A/C refrigerant component, then tighten to specification.
11. Evacuate and charge the refrigerant system. Refer to Refrigerant Recovery and Recharging.
12. Check the A/C refrigerant hose(s) to the A/C component(s) joints for leaks. Refer to Leak Testing.
13. Install air filter and air-duct assembly.

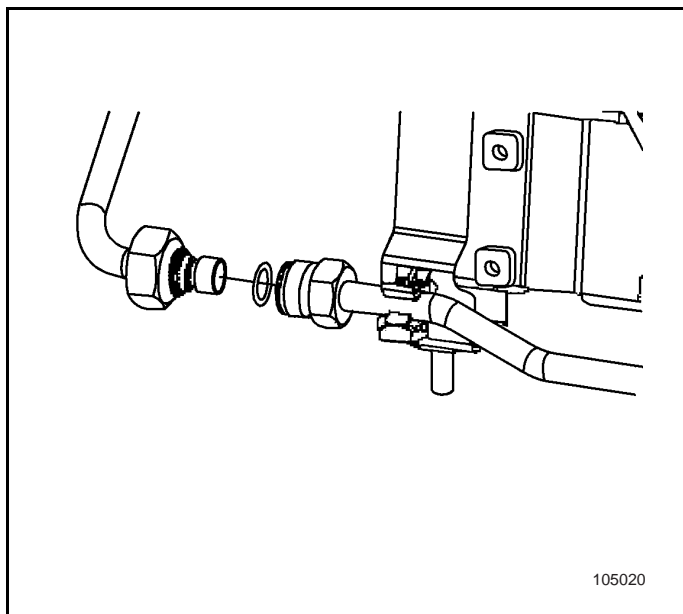
1.1.5.9 Replacement of Evaporator Pipe (Liquid Pipe)

Removal procedures

1. Drain the A/C system.



2. Disconnect the evaporator intake pipe with the expansion valve and the condenser.



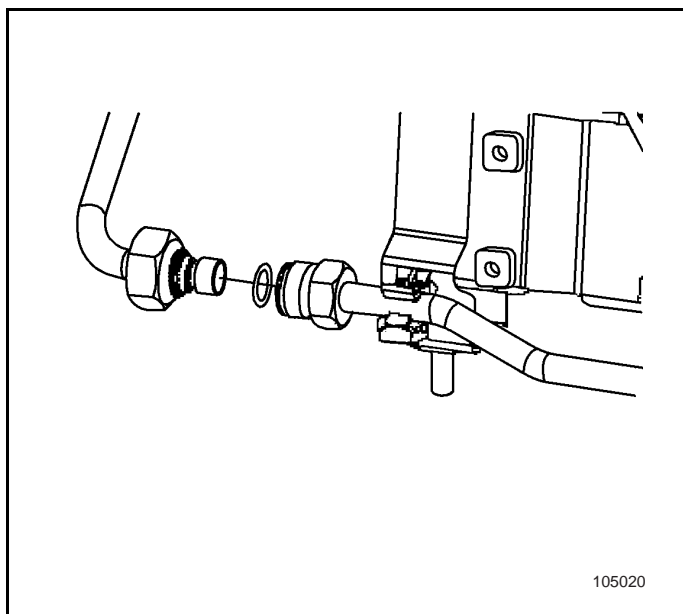
3. Disconnect the evaporator outlet pipe with the condenser.

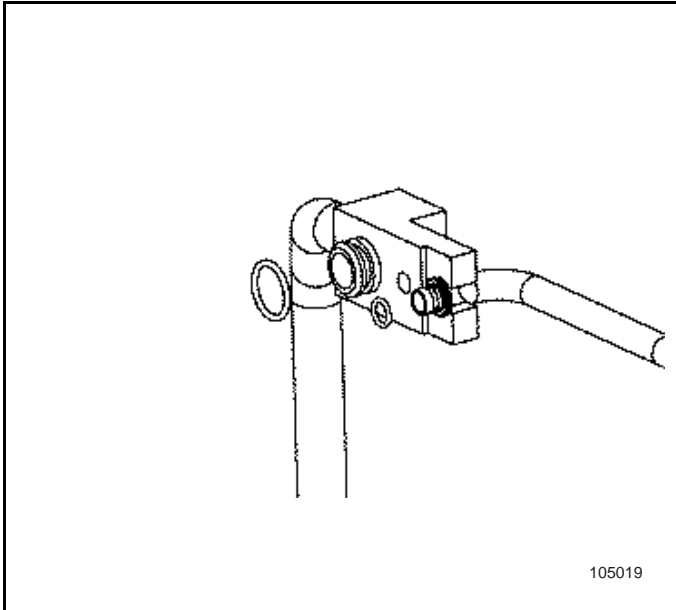
Installation procedures

1. Connect the evaporator outlet pipe with the condenser.

Tighten

Tighten the nut of liquid pipe connector to 16 N•m.

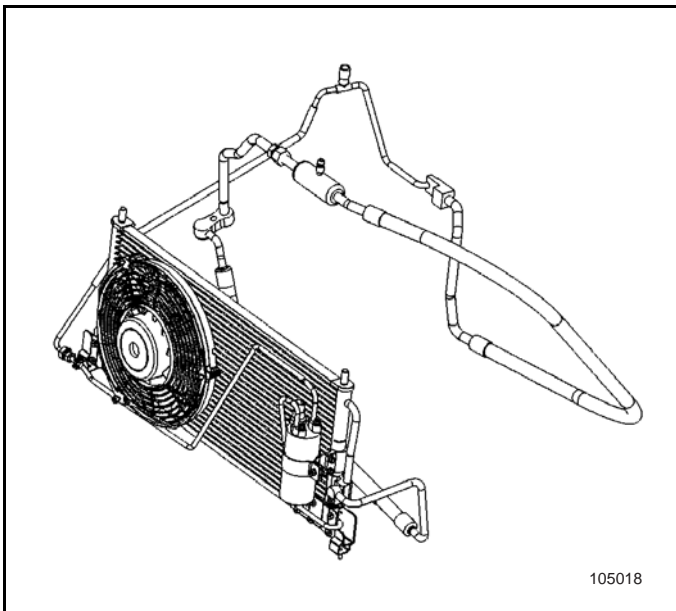




2. Connect the evaporator intake pipe with the condenser.

Tighten

Tighten the bolt of liquid pipe at the expansion valve to 16 N•m.

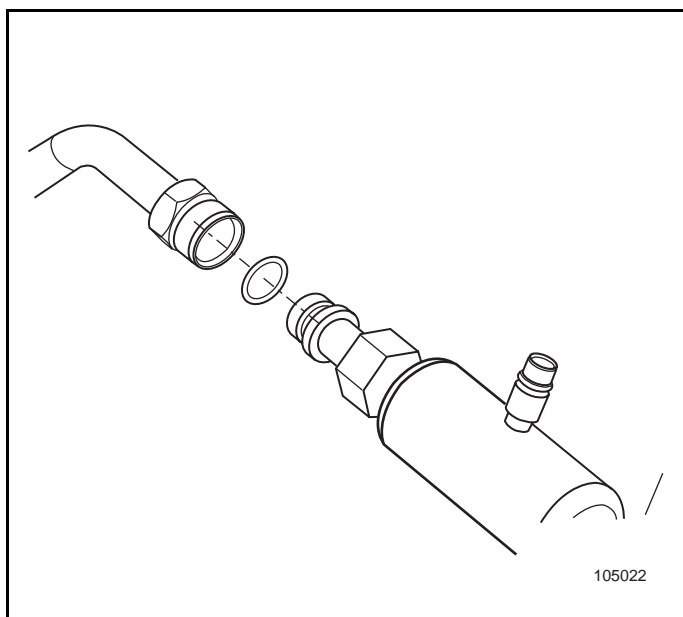
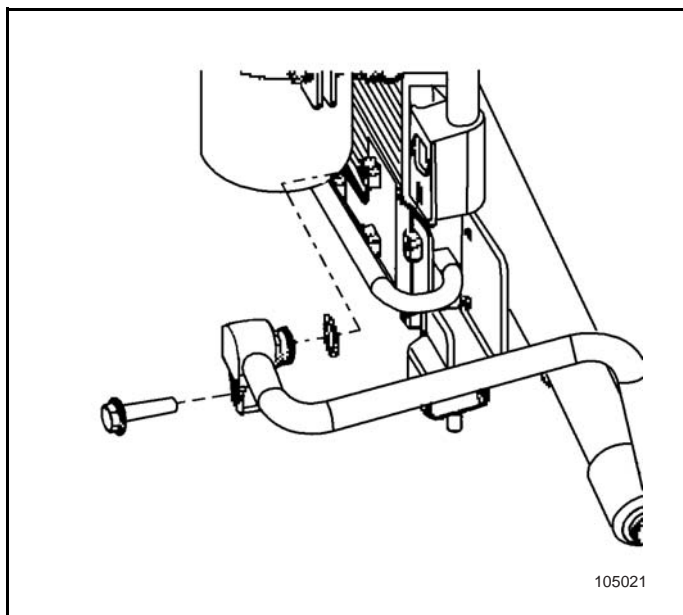


3. Drain and recharge the A/C system.

1.1.5.10 Replacement of Compressor Hose

Removal procedures

1. Disconnect cables at the negative pole of the battery.
2. Recover the refrigerant.
3. Remove the compressor hose nut from the condenser.



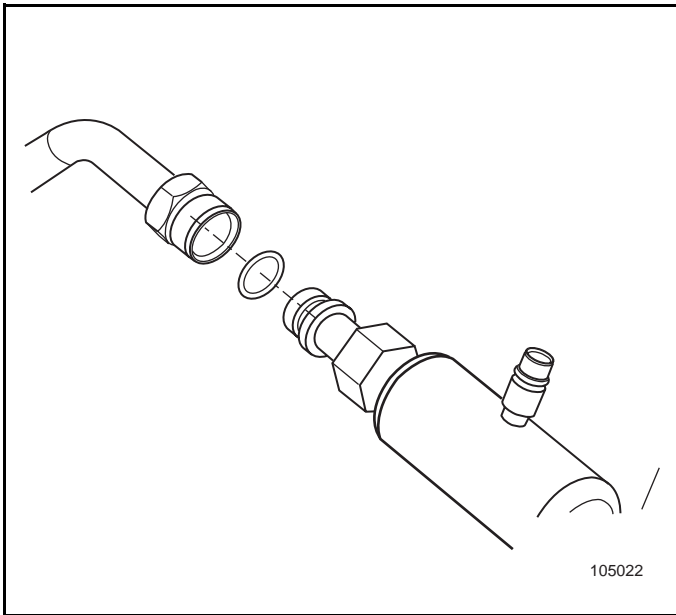
4. Disconnect the evaporator pipe and the compressor hose.

Installation procedures

1. Connect the evaporator pipe and the compressor hose.

Tighten

Tighten the compressor hose connector at the evaporator hose assembly to 36 N•m.

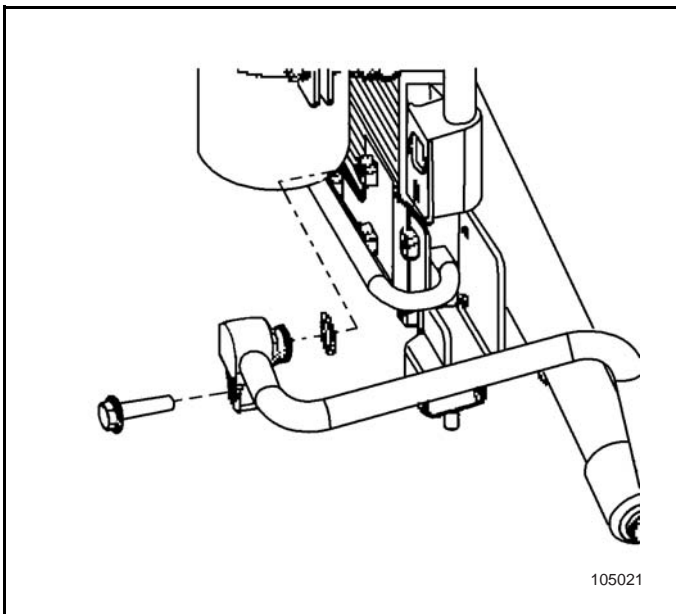


2. Install the compressor hose to the condenser. Tighten the compressor hose nut.

Tighten

Tighten the bolts retaining the compressor hose assembly to the condenser to 16 N•m.

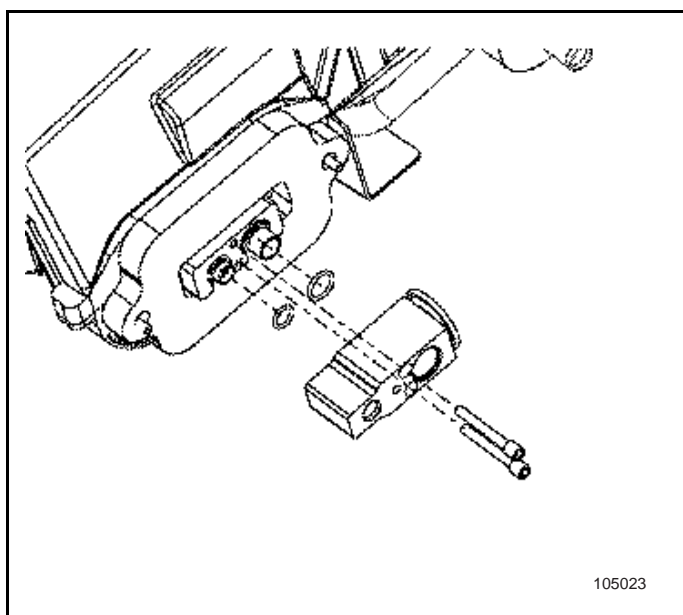
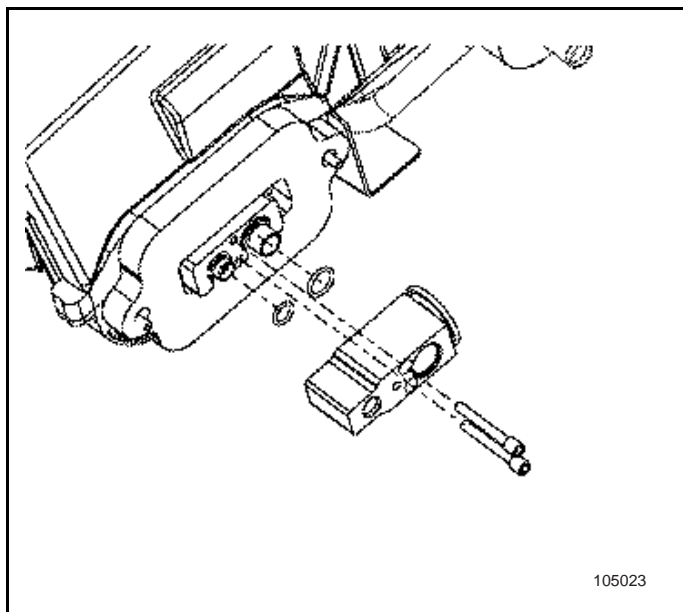
3. Evacuate and recharge the system with refrigerant. Refer to Refrigerant Recovery and Recharging.
4. Inspect system for any leakage. Refer to Leak Testing.
5. Connect cables at the negative pole of the battery.



1.1.5.11 Replacement of Expansion Valve

Removal procedure

1. Recover the refrigerant.
2. Remove A/C pipelines connected to the expansion valve.
3. Remove the expansion valve.
4. Remove the O-ring seal.



Installation procedures

1. Install the O-ring seal.
2. Install the expansion valve.

Tighten

Tighten bolts of the expansion valve to 4-6 N•m.

3. Install A/C pipelines connected to the expansion valve.

Tighten

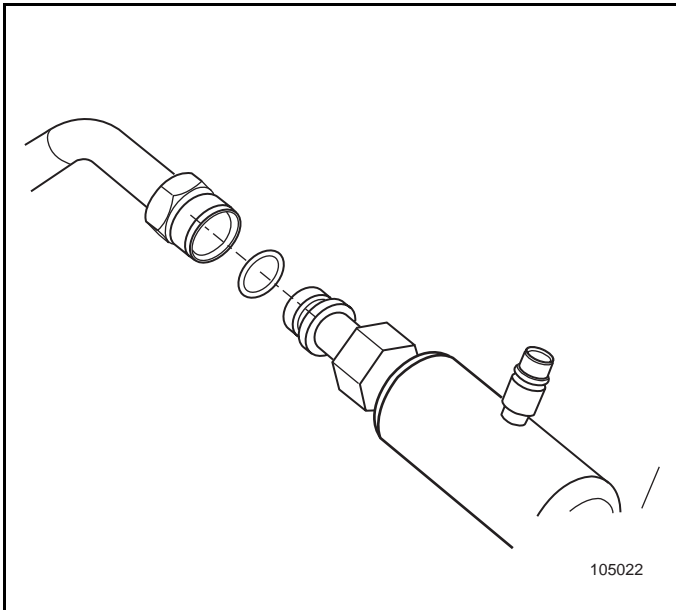
Tighten the pipelines to 4-6 N•m.

4. Evacuate and recharge the system with refrigerant.

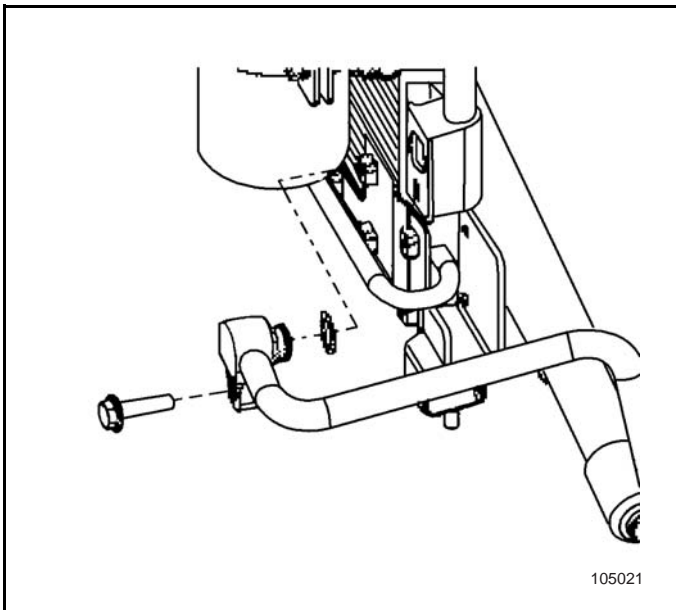
1.1.5.12 Condenser Replacement

Removal procedures

1. Drain the A/C system.
2. Remove the nuts of liquid pipelines from the condenser.



3. Remove the compressor hose bolt from the condenser.
4. Remove the upper bracket of the condenser.
5. Remove the condenser.



Installation procedures

1. Install the condenser.
2. Screw on the bolts of condenser upper bracket.

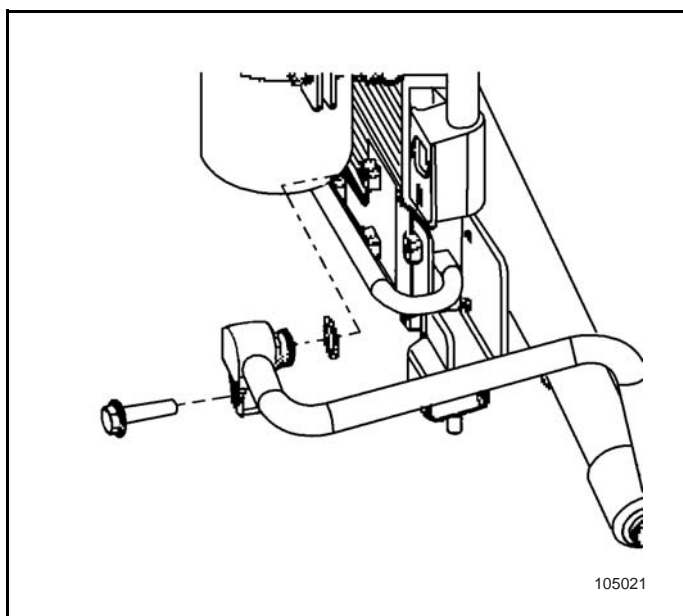
Tighten

Tighten the bolts of the condenser upper bracket to 4-6 N•m.

3. Screw the compressor hose bolt onto the condenser.

Tighten

Tighten the bolts retaining the compressor hose assembly to the condenser to 16 N•m.

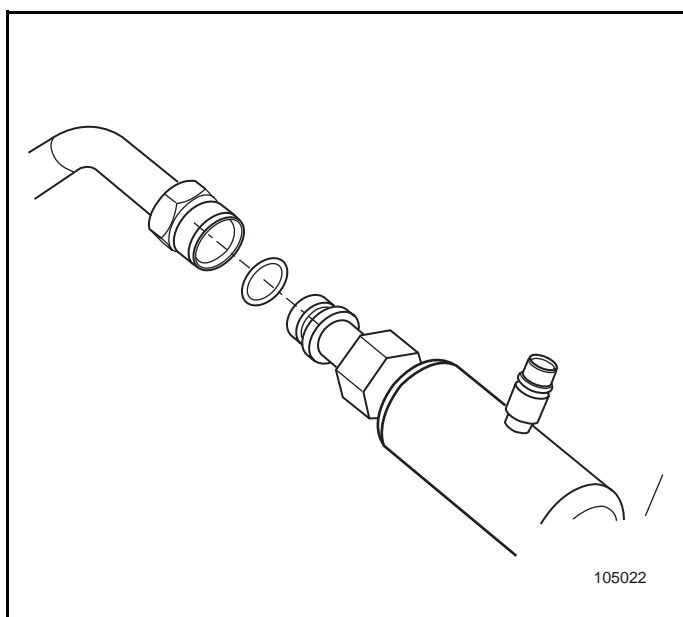


4. Screw on the liquid pipeline nuts on the condenser.

Tighten

Tighten the nuts of the condenser hose connector to 16 N•m.

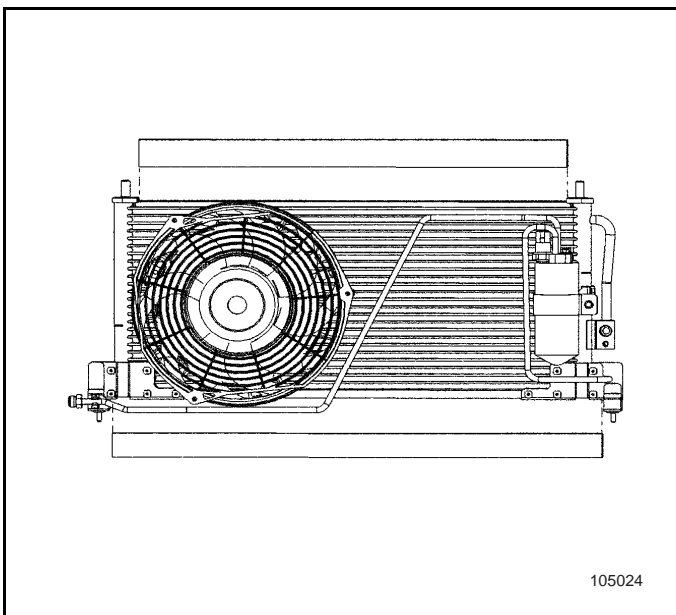
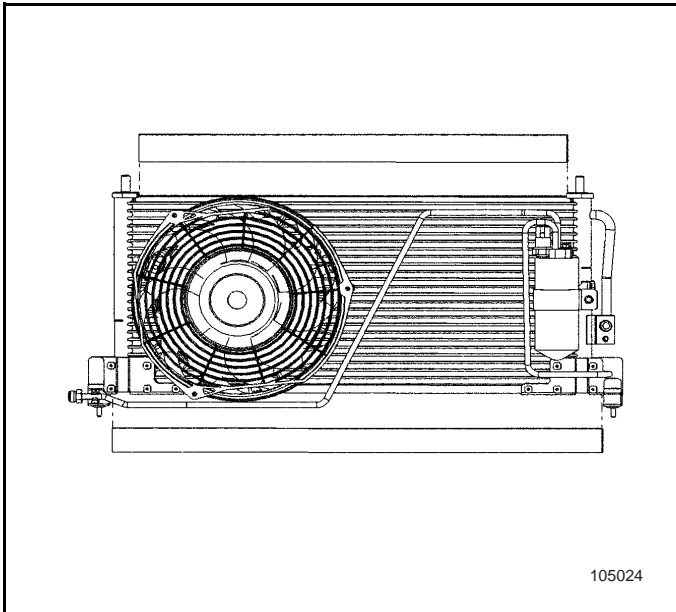
5. Evacuate and recharge the A/C system.



1.1.5.13 Replacement of Condenser Seals

Removal procedures

1. Remove the condenser, refer to Condenser Replacement.
2. Remove the upper and lower seals.



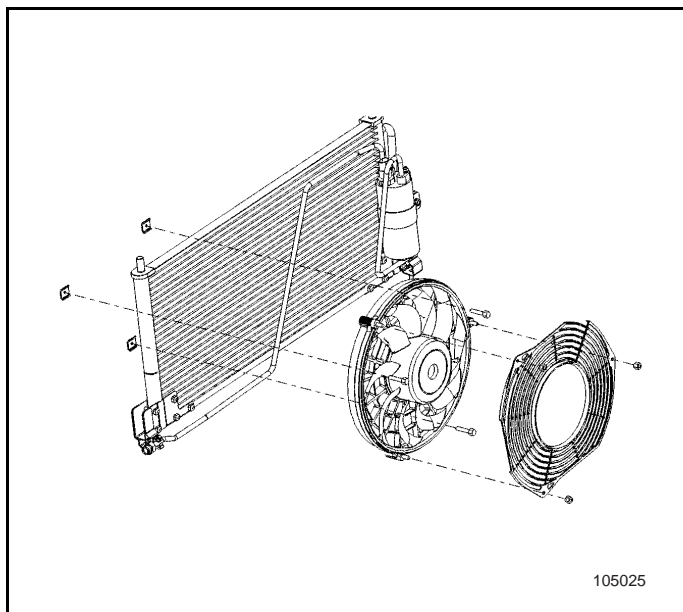
Installation procedures

1. Install the upper and lower seals.
2. Install the condenser, refer to Condenser Replacement.

1.1.5.14 Replacement of Condenser Fan

Removal procedures

1. Remove the condenser, refer to Condenser Replacement.
2. Disconnect the fan, the protective case and the motor.



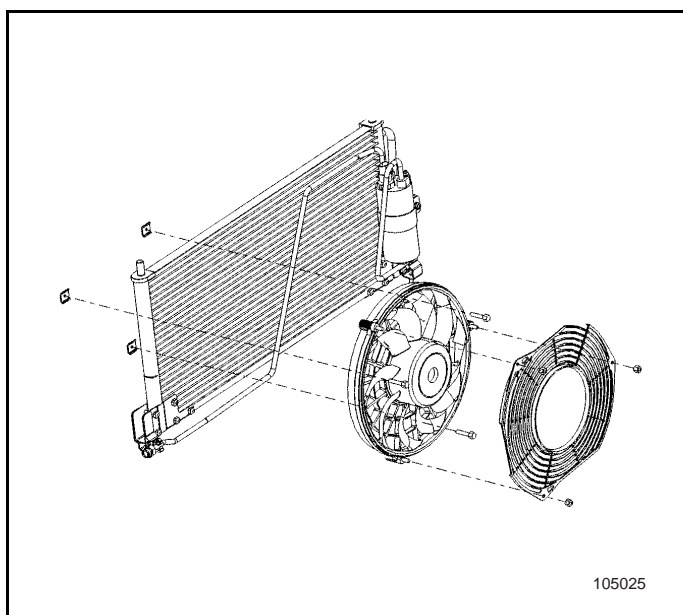
Installation procedures

1. Install the fan, the protective case and the motor.

Tighten

Tighten the bolts of condenser fan to 2 N•m.

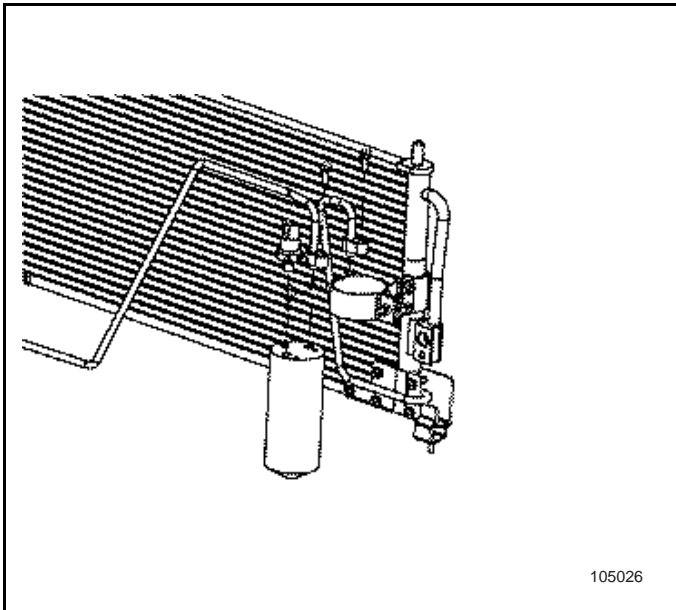
2. Install the condenser, refer to Condenser Replacement.



1.1.5.15 Replacement of Liquid Container

Removal procedures

1. Remove the condenser, refer to Condenser Replacement.
2. Remove the container bolt and the pressure switch.



Installation procedures

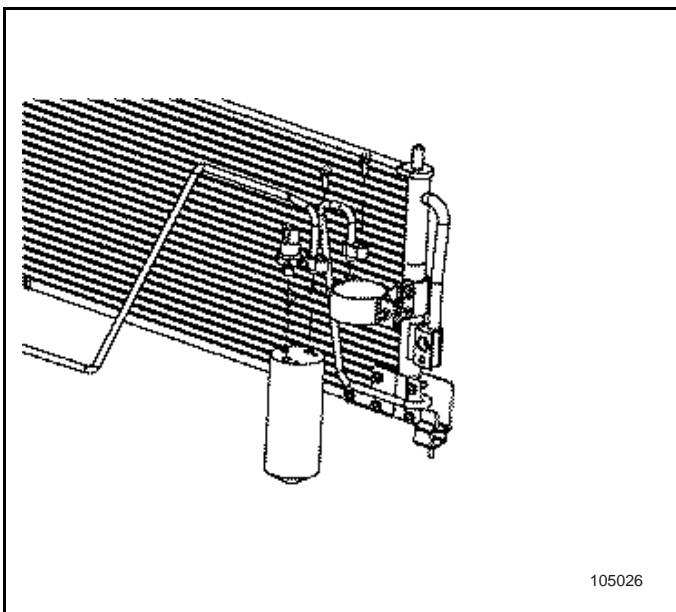
1. Install the container bolt and the pressure switch.

Tighten

Tighten the container bolts to 4-6 N•m.

Tighten the pressure switch to 11-14 N•m.

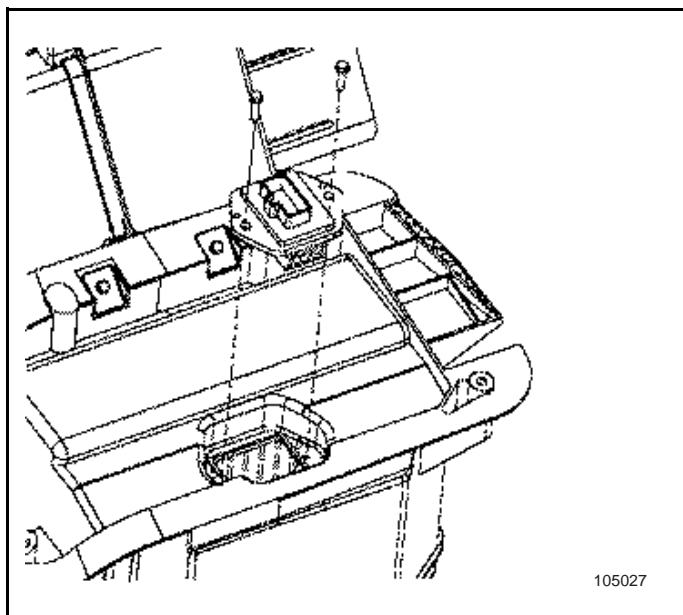
2. Install the condenser, refer to Condenser Replacement.



1.1.5.16 Blower Motor Resistor Replacement.

Removal procedures

1. Disconnect cables at the negative pole of the battery.
2. Remove air filter and its housing. Refer to Replacement of A/C box.
3. Disconnect the electric connector of the blower motor resistor.
4. Disconnect the connection between the blower motor and the blower motor resistor.
5. Remove the resistor.



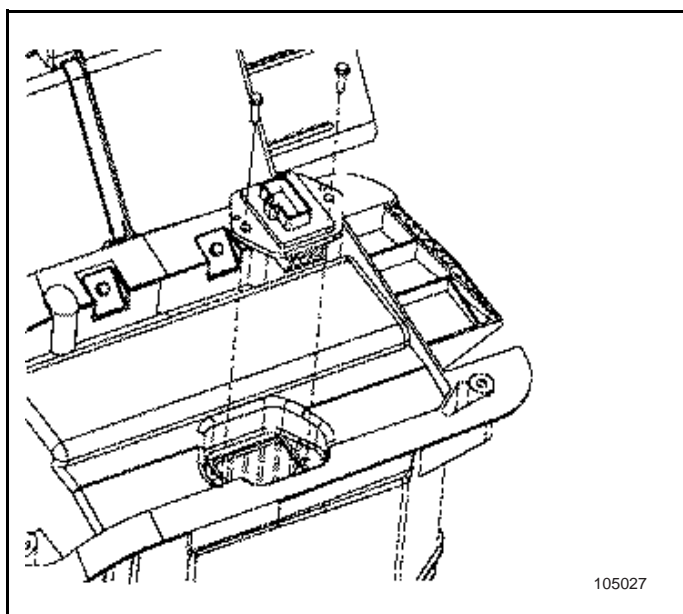
Installation procedures

1. Install the resistor.

Tighten

Tighten the resistor bolts to 2 N•m.

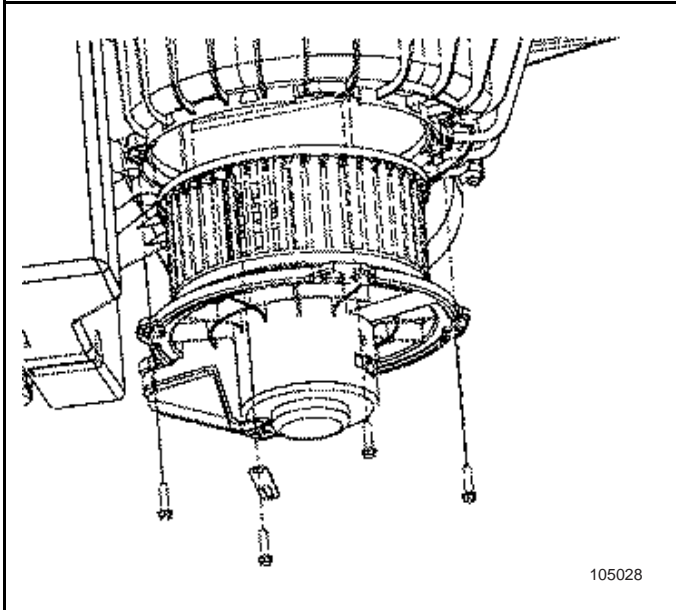
2. Connect the connection between the blower motor and the blower motor resistor.
3. Connect the electric connector of the blower motor resistor.
4. Install air filter and its housing, refer to Replacement of A/C box.
5. Connect cables at the negative pole of the battery.



Replacement of Blower Motor and Blower Fan.

Removal procedures

1. Disconnect cables at the negative pole of the battery.
2. Disconnect the blower motor electrical connectors.
3. Remove the blower motor.
4. Replace the blower motor and the fan.



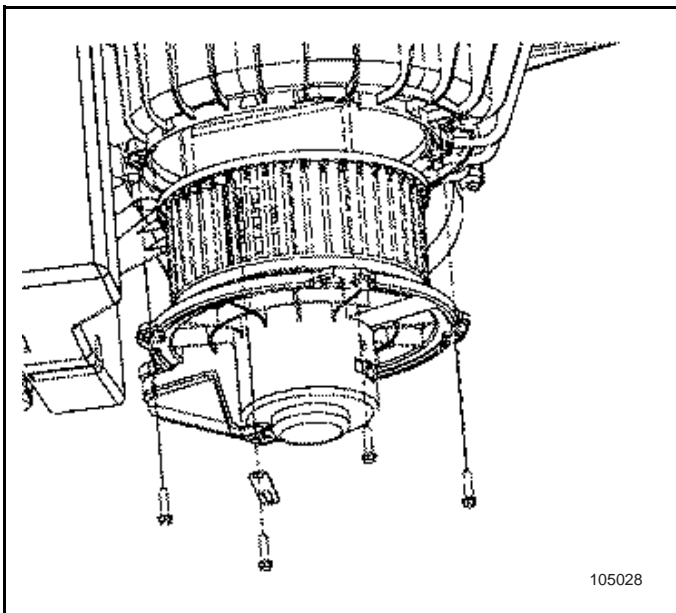
Installation procedures

1. Install the blower motor.

Tighten

Tighten the blower motor bolts to 2 N•m.

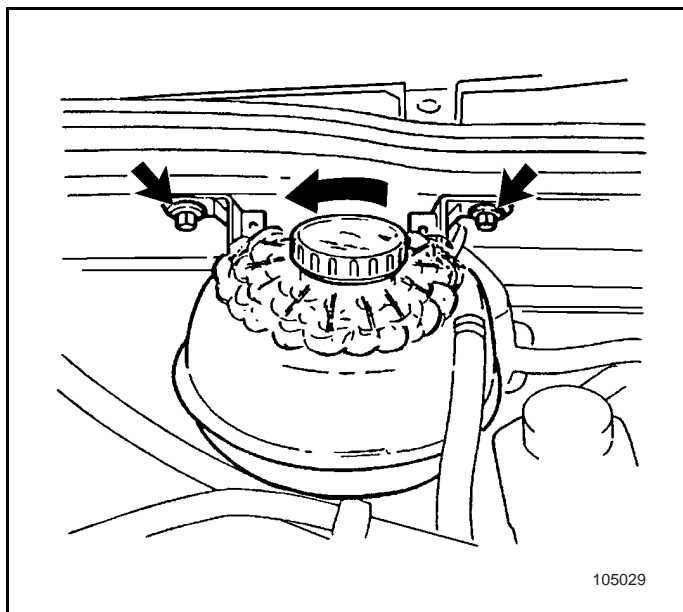
2. Connect the blower motor electrical connectors.
3. Connect cables at the negative pole of the battery.



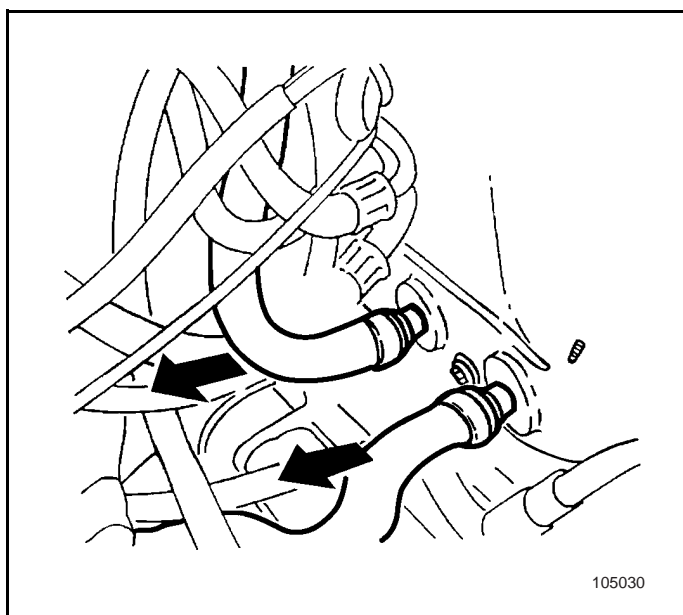
1.1.5.18 Replacement of A/C box

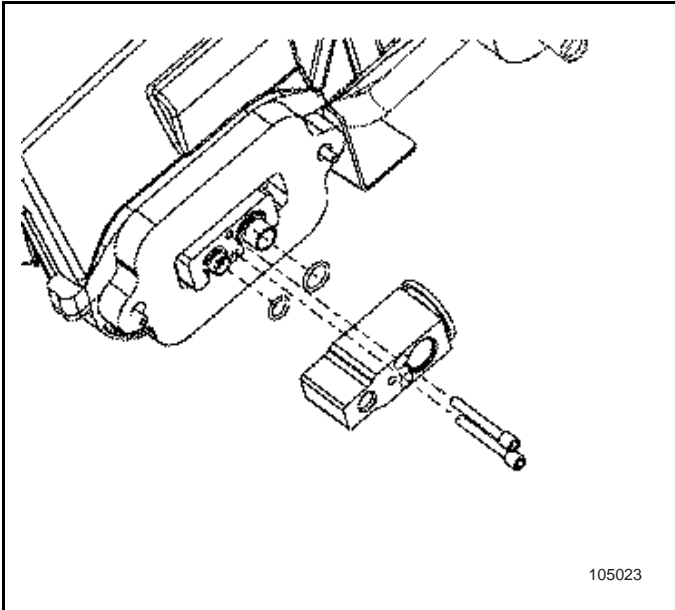
Removal procedures

1. Open the engine hood.
2. Uncap the engine coolant pot, release the engine cooling system pressure, then screw on the cap.
3. If necessary, remove the coolant pot by unscrewing the bolt shown in the figure.

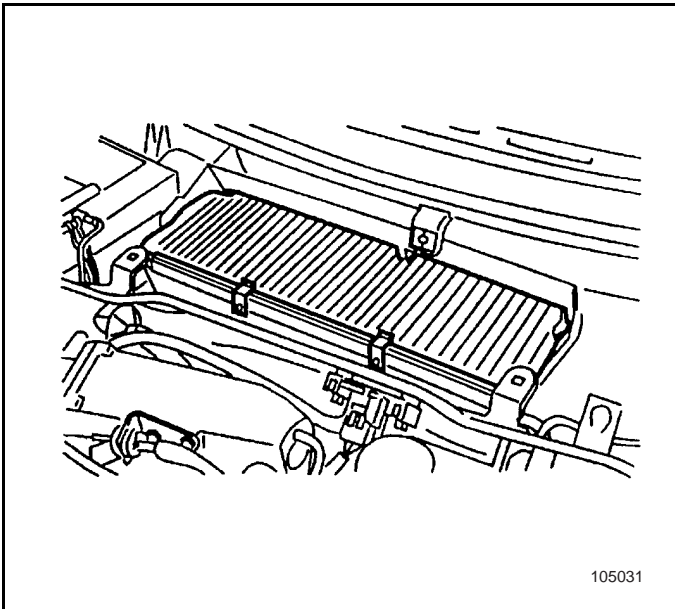


4. Place a container under the hose.
5. Loosen the clamp.
6. Remove the heater intake/outlet hose.

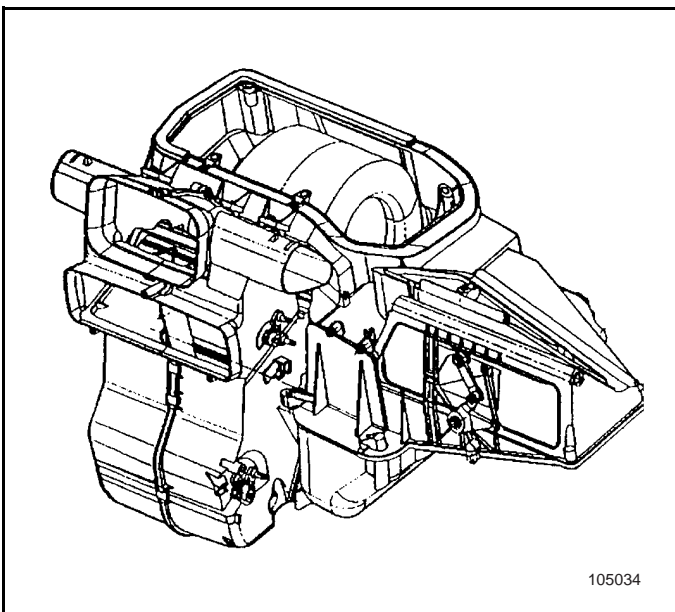




7. Evacuate the A/C system.
8. Unscrew bolts of the expansion valve. Remove the A/C duct.
9. Cover the expansion valve and the refrigerant hose with a dust cover.

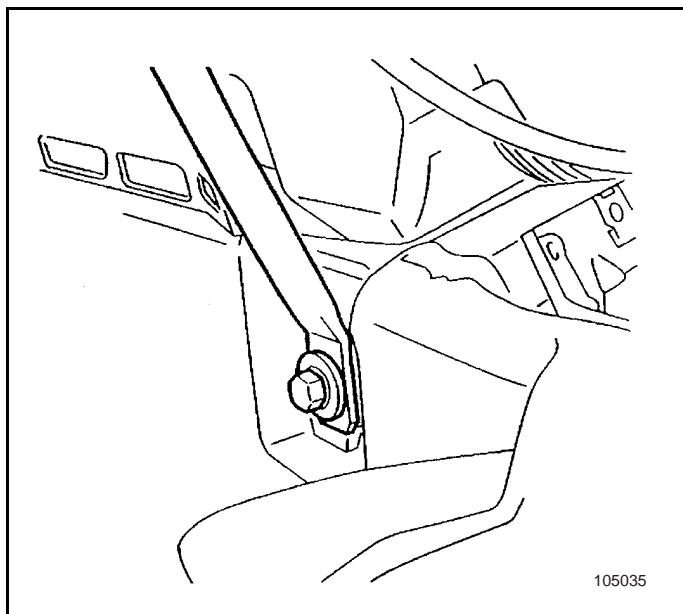


10. Remove the air filter from its housing.
11. Unscrew bolts on the housing.
12. Remove the housing.



Note: Cover foot area to prevent the coolant dropping down to the carpet.

13. Remove air distribution duct
14. Disconnect the connection between the blower motor and the blower motor resistor.



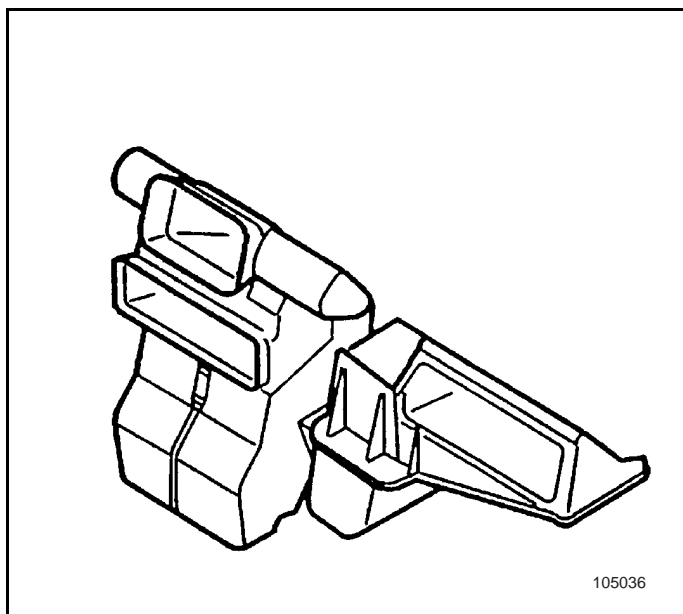
15. Remove the instrument panel. Refer to Replacement of Instrument Board in Instrument Board, Cluster Gauge and Auxiliary Instrument Board.
16. Remove the A/C box.

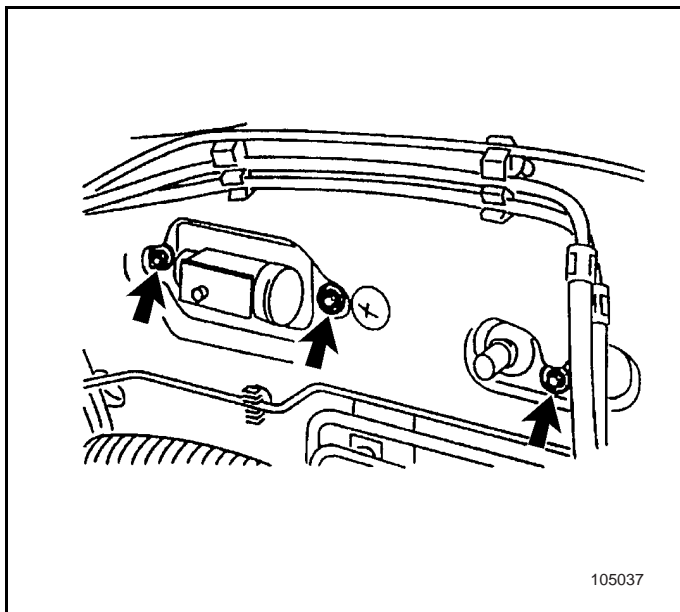
Installation procedures

1. If necessary, replace the heater seal.
2. Install the A/C box onto the front boarding.

Tighten

Tighten the bolts to 2.0-4.0 N•m.

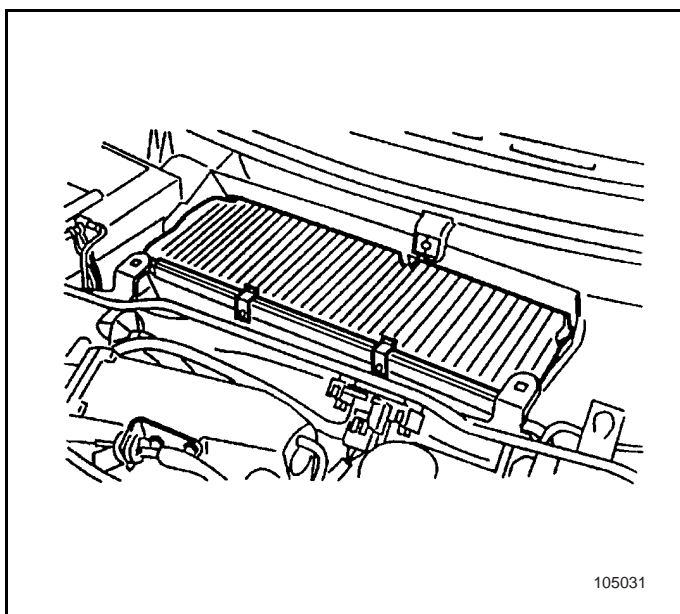




3. Connect the air distribution duct with the connector.
4. Screw on the bolts to retain the heater intake/outlet and the expansion valve.

Tighten

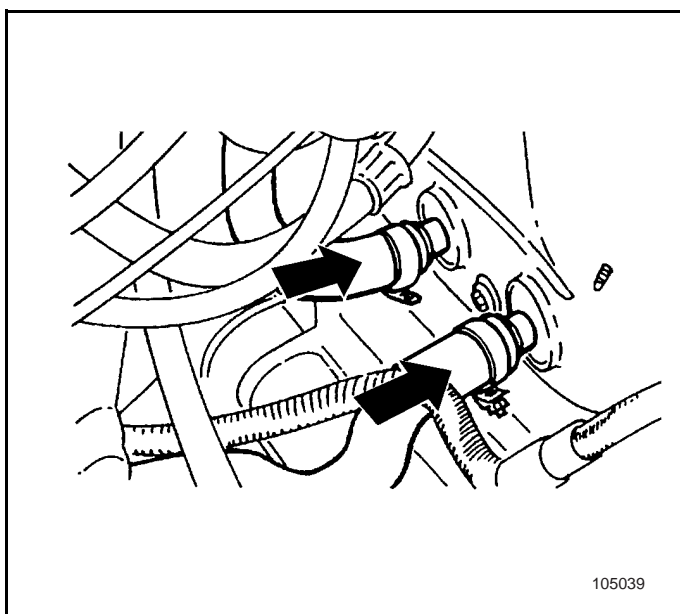
Tighten the bolts to 2.0-4.0 N•m.



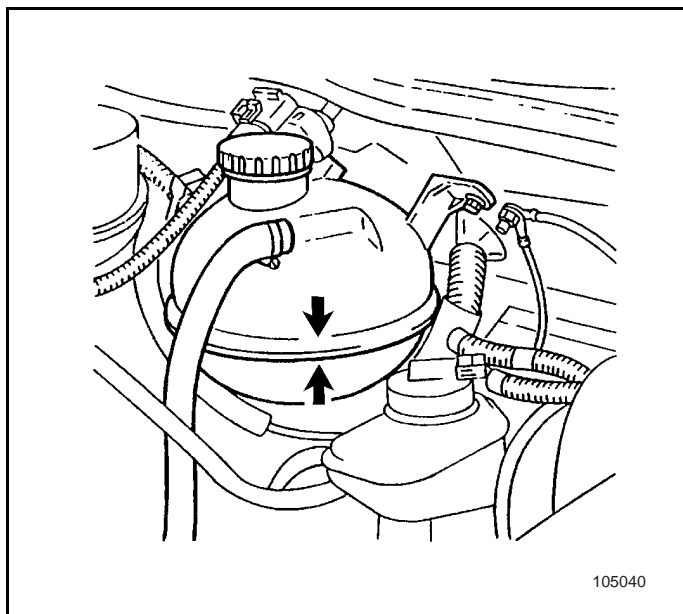
5. Assemble the air filter and install it to its housing.

Tighten

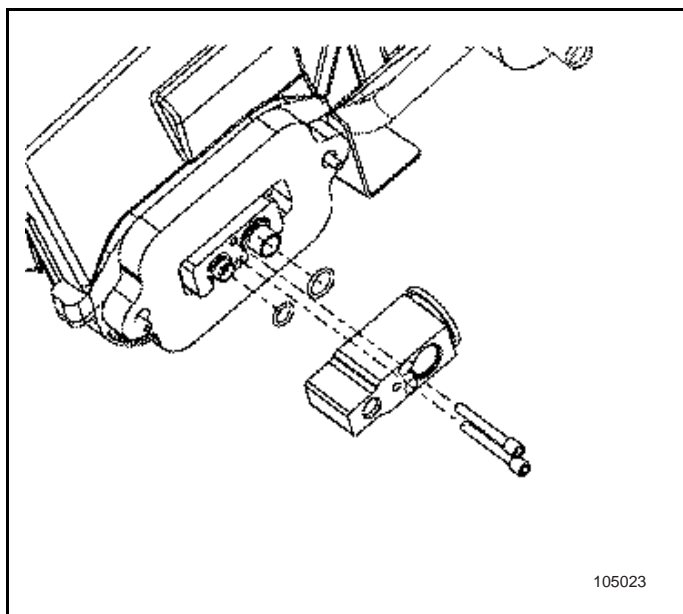
Tighten the bolts to 3-3.5 N•m.



6. Connect the heater intake/outlet hose.
7. Install the clamping collars onto the heater hose.



8. Install coolant pot.

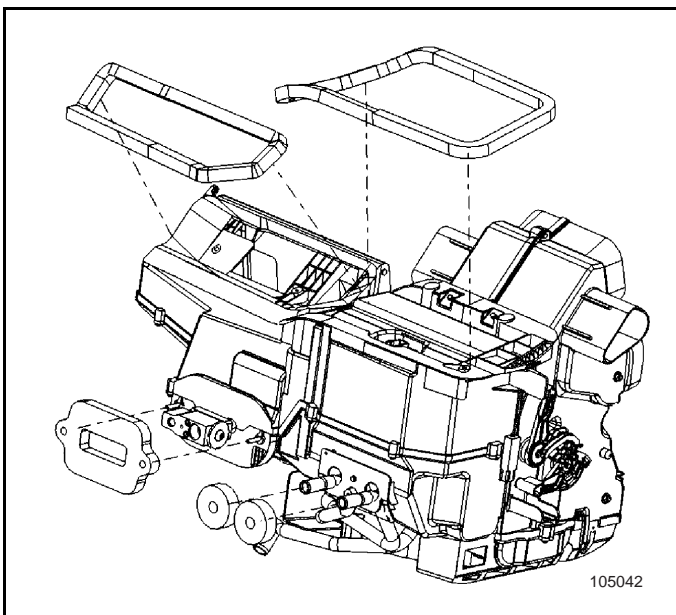
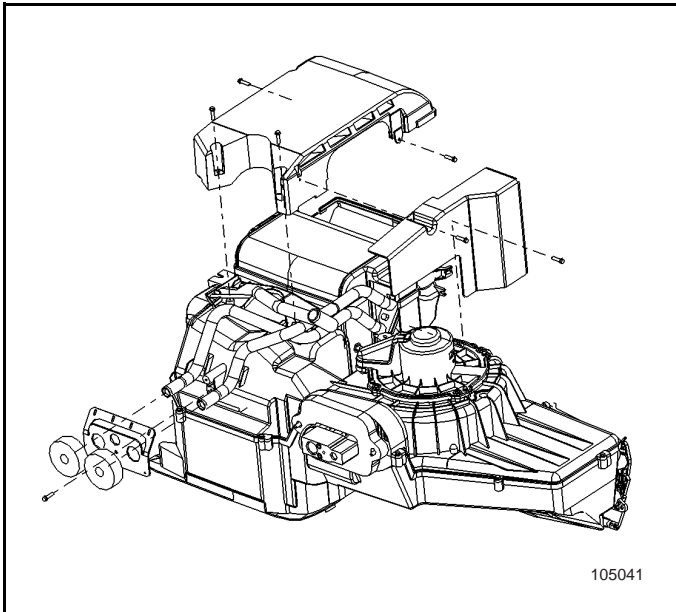


9. Charge the engine cooling system to "COLD".
10. Remove the transport cover on the expansion valve and the refrigerant pipeline. Seal the new O-ring with mineral oil.
11. Install the refrigerant pipeline.
Tighten
Tighten the bolt of liquid pipe at the expansion valve to 16 N•m.
12. Evacuate and recharge the A/C system.

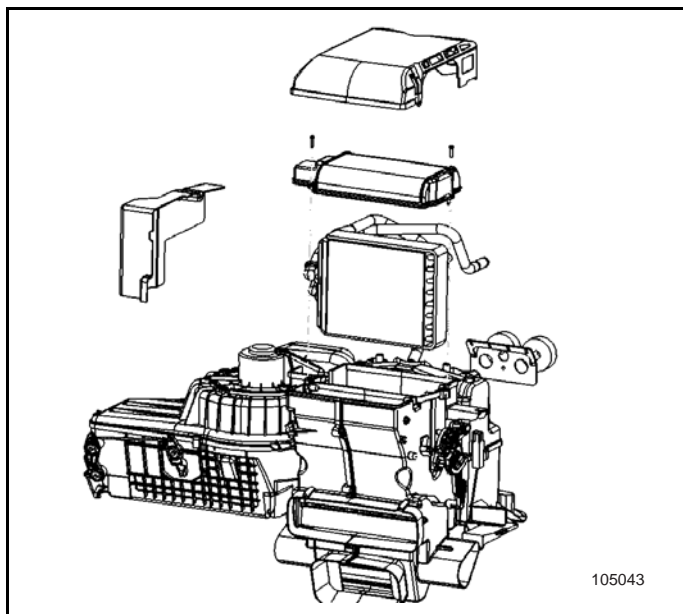
1.1.5.19 Replacement of Heater Core in A/C box

Removal procedures

1. Remove the A/C box, refer to Replacement of A/C box.
2. Remove the side cover.
3. Remove the supporting rack.



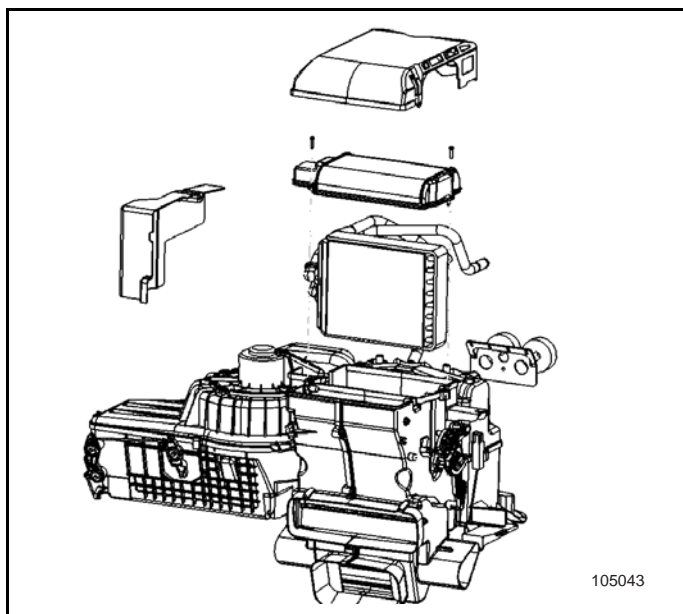
4. Remove all seals of the A/C box.

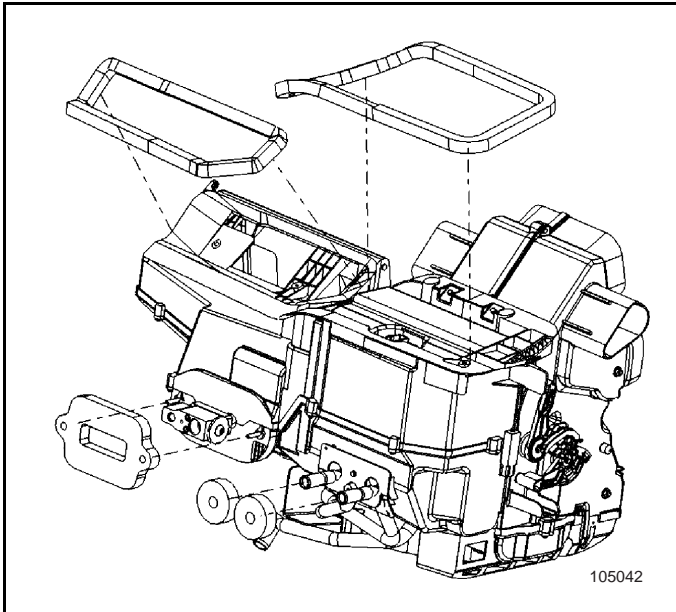


5. Remove the heater core.

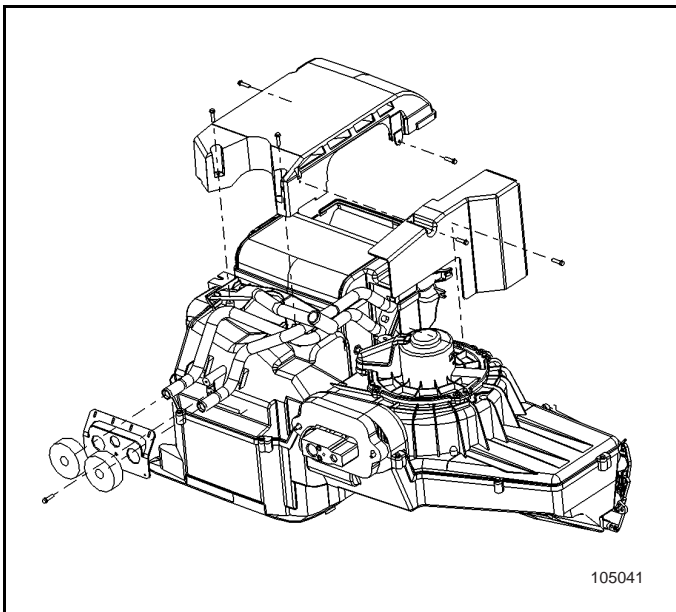
Installation procedures

1. Install the heater core.





2. Install all seals of the A/C box.

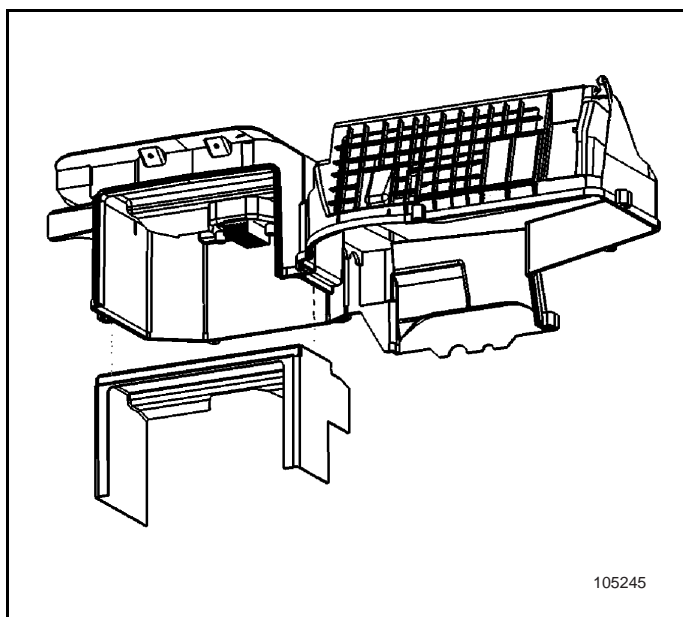
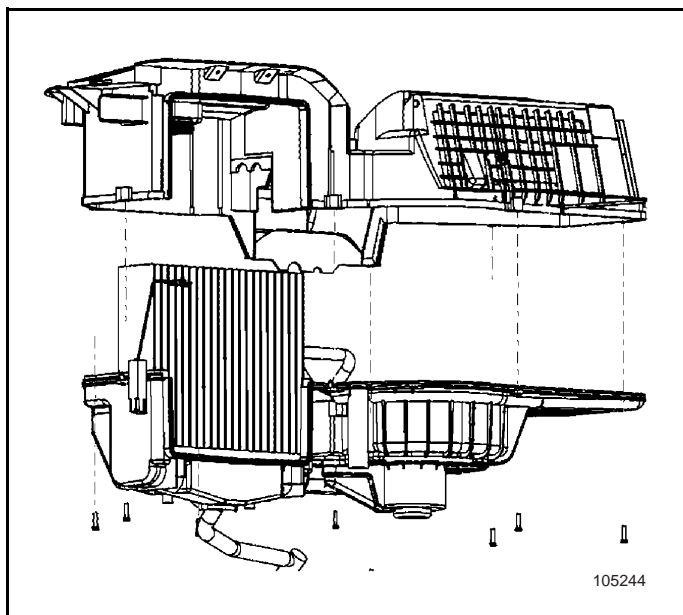


3. Install the supporting rack.
Tighten
Tighten the bolts to 2.0-4.0 N•m.
4. Install the side cover.
Tighten
Tighten the bolts to 2.0-4.0 N•m.
5. Install the A/C box, refer to Replacement of A/C box.

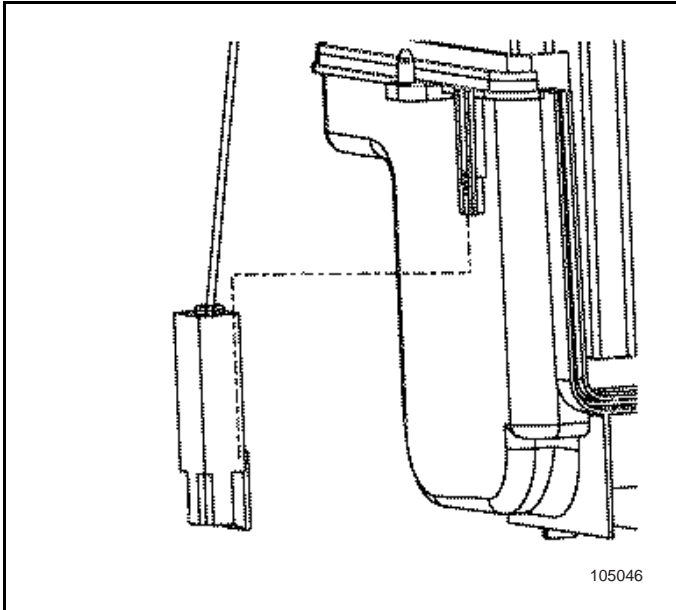
1.1.5.20 Replacement of Evaporator Core in A/C box

Removal procedures

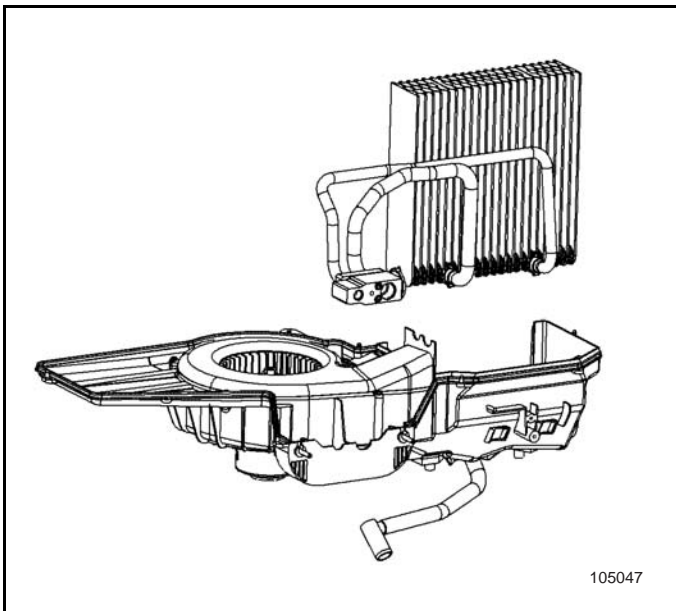
1. The same with Removal procedures in Replacement of Heater Core in A/C box.
2. Remove the upper part of the A/C box.



3. Remove the upper seal.



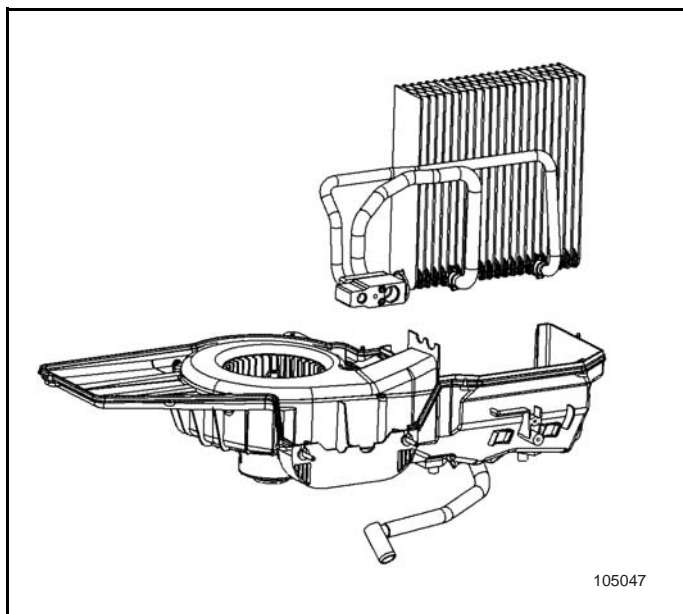
4. Remove the thermistor.



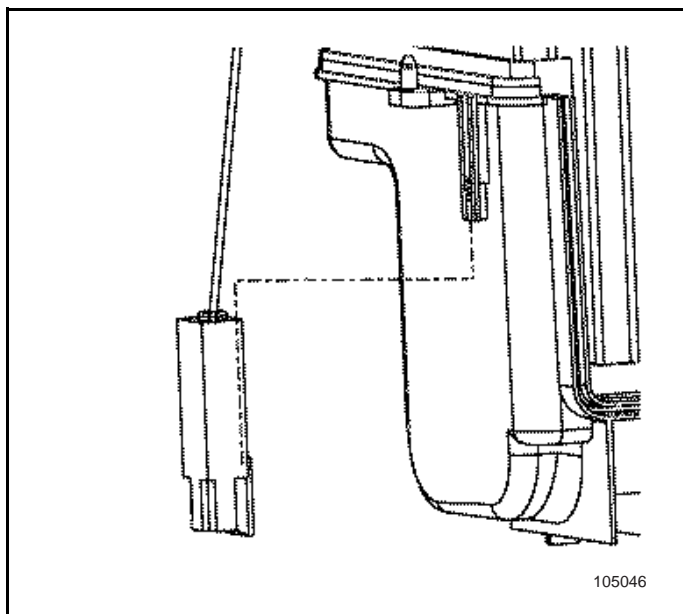
5. Remove the evaporator core.

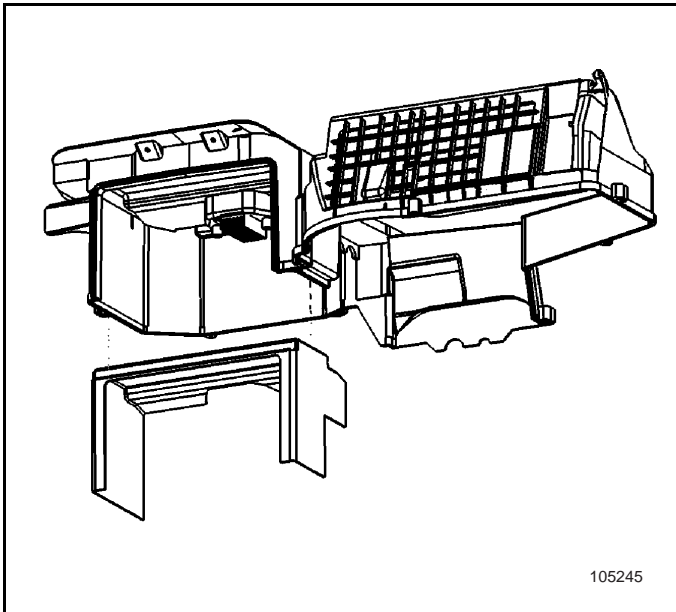
Installation procedures

1. Install the evaporator core.

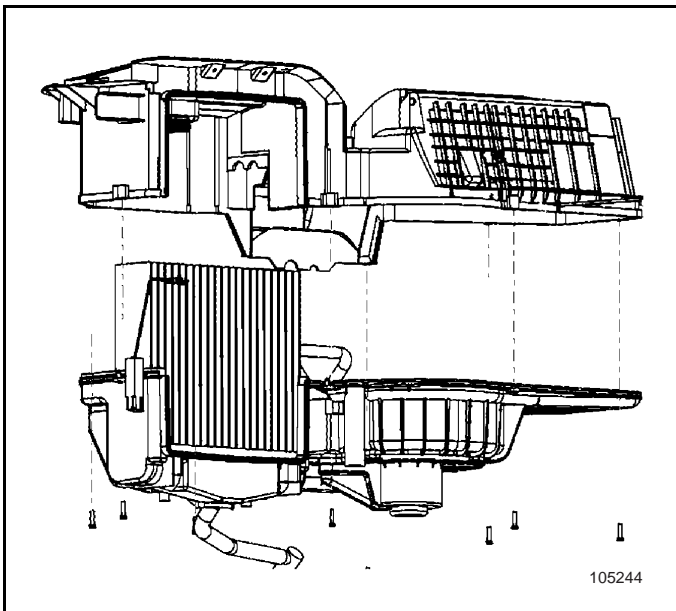


2. Install the thermistor.





3. Install the upper seal.

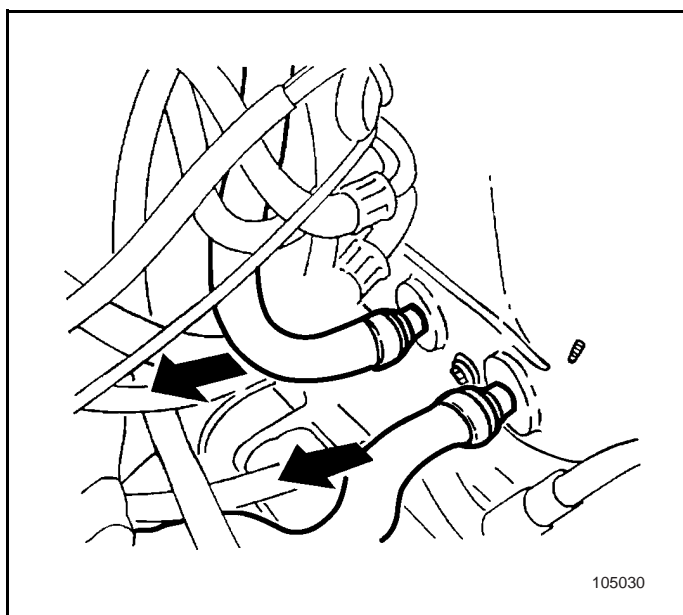
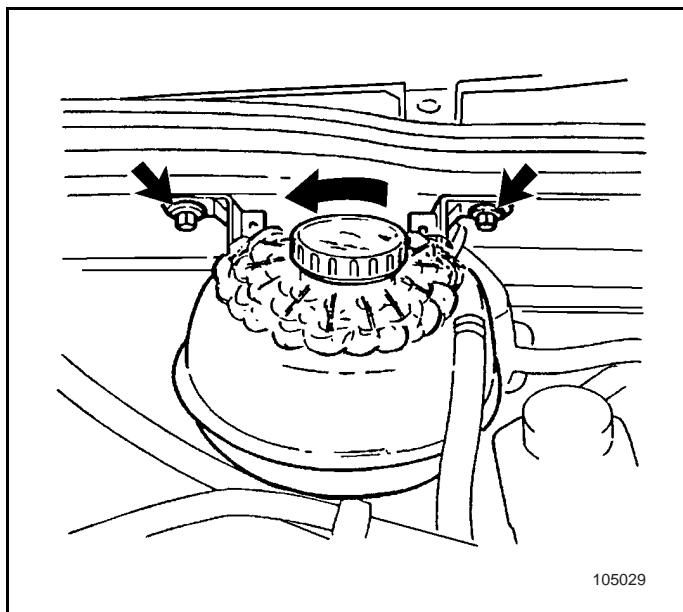


4. Install the upper part of the A/C box.
5. The same with Installation Procedures in Replacement of Heater Core in A/C box.

1.1.5.21 Replacement of Heater Hose

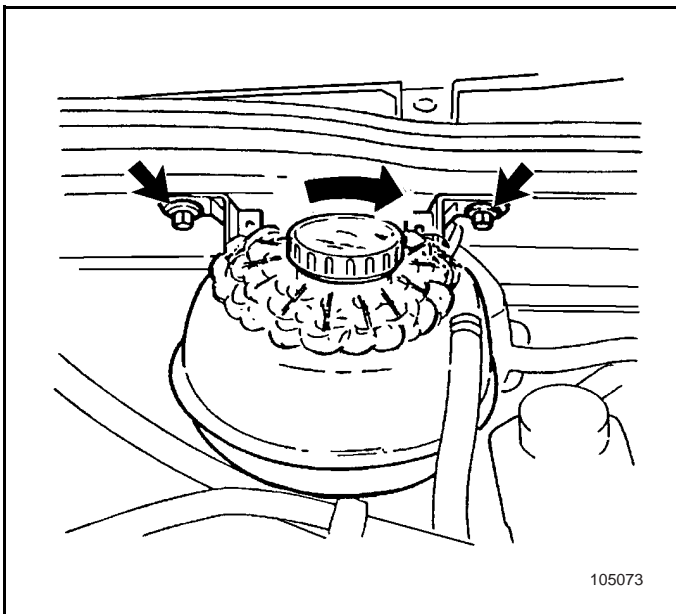
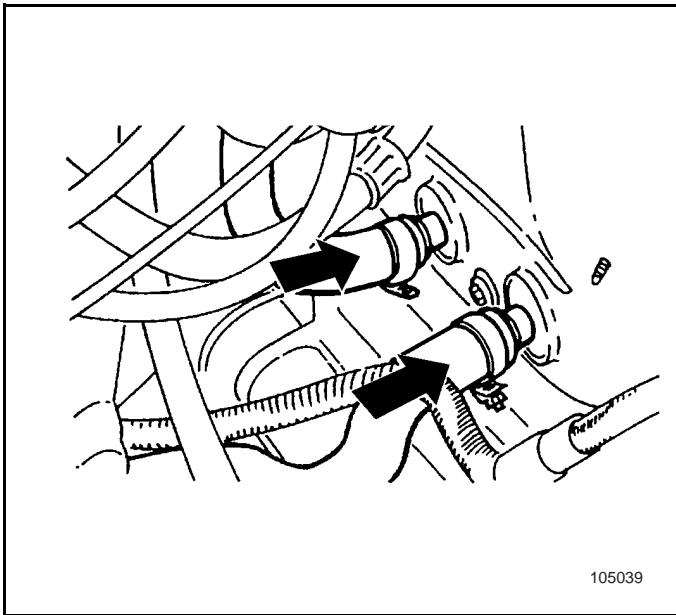
Removal procedures

1. Unscrew the cap of coolant pot (middle arrow) and depressurize the cooling system.
2. Tighten the coolant pot cap.
3. Remove the bolts of coolant pot.
4. Use a clamping collar to clamp the coolant hose.
5. Place a collecting pot under the hose to collect spilling coolant.
6. Loosen the clamping collar and remove the refrigerant hose connecting to the heater core from the connection socket.



Installation procedures

1. Insert the refrigerant hose into the inlet/outlet metal tube of the heater core.
2. Clamp the hose with a clamping collar.

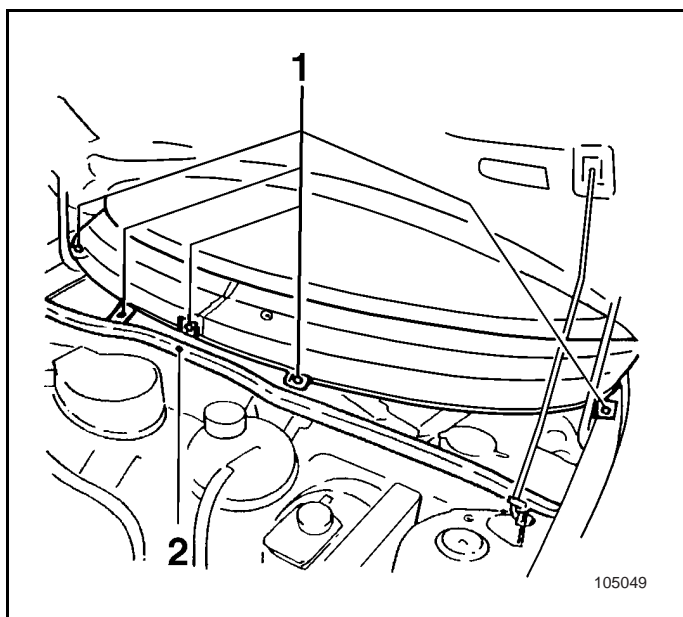
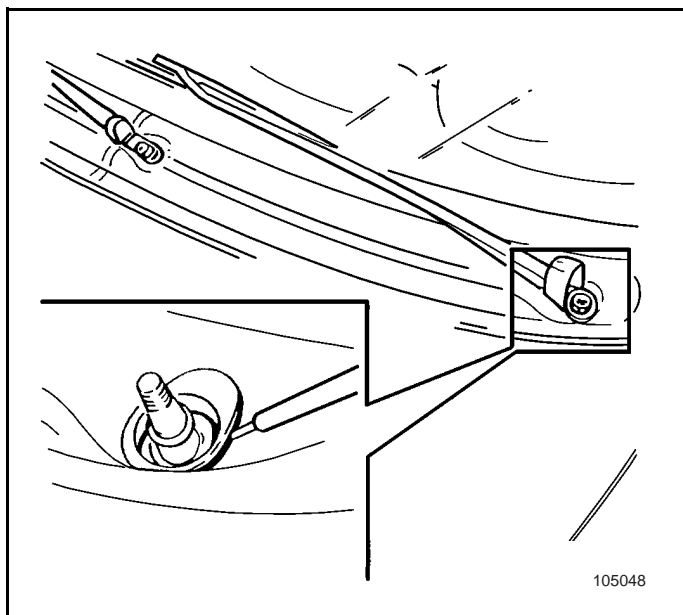


3. Install the coolant pot.
4. Add refrigerant as required.
5. Close the coolant pot.

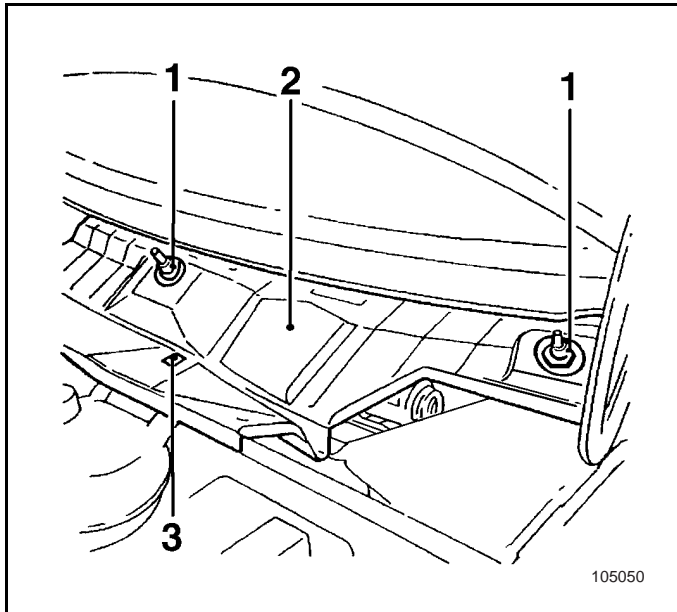
1.1.5.22 Replacement of Passenger Cabin Air Filter

Removal procedures

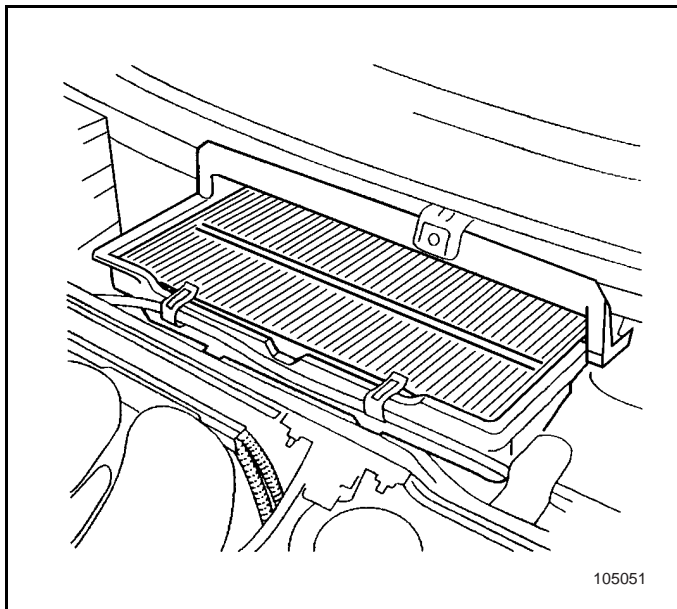
1. Disconnect earth lead from the battery.
2. Remove the windshield wiper arm assembly. Refer to Replacement of Wiper Arm Assembly in Windshield Wiper/Washer System.



3. Remove bolt (1) in the air intake grille plate. Pry open the air intake grille at the center of it and remove the two halves of it one after another from the air compression room. Pull away the engine hood sealing members (2) from the front boarding.

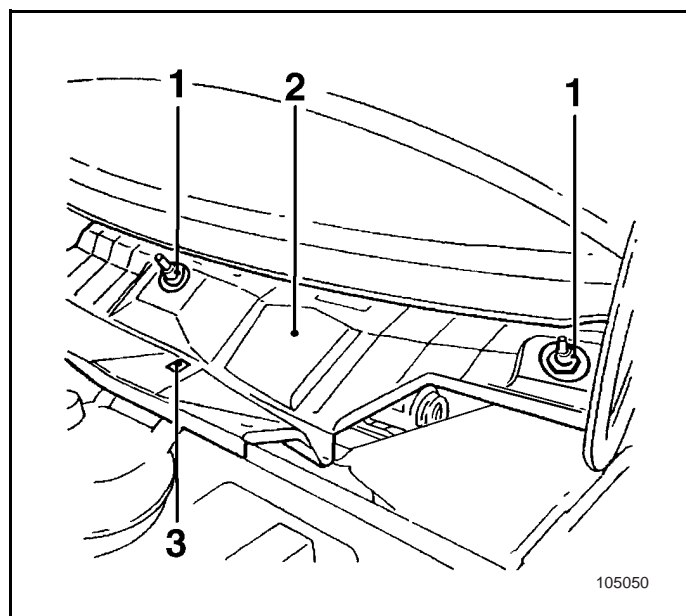


4. Remove plastic nut (1) from the shift driving shaft of the two wipers, and pull down the dasher (2).

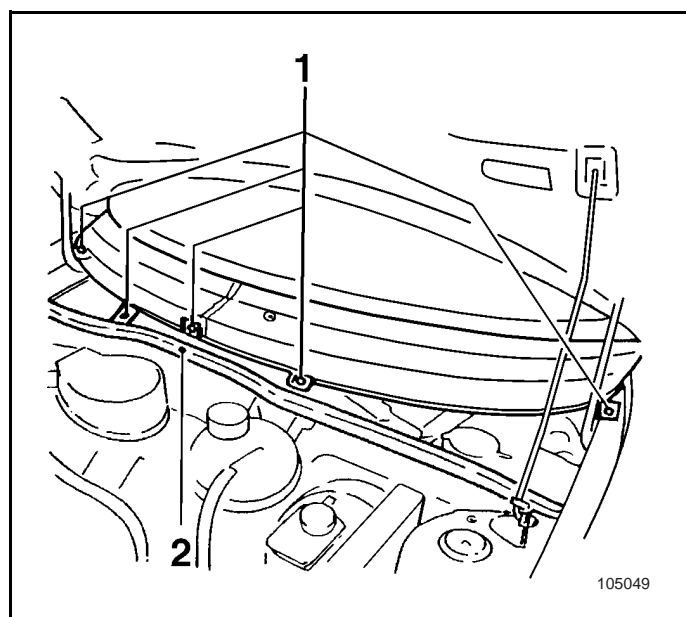


5. On vehicles with clean air filters, loosen the fixing clip of the filter and remove the filter from the filter case.

Installation procedures



1. Unscrew the bolt retaining the clean air filter case in the air compression room. Insert the filter into the filter case and lock the fixing clip.
2. Push the dasher (2) under the edge of the windshield, and screw the plastic nut (1) onto the shift driving shaft.
3. Install expansion nut (3) to fasten the air intake grille board.

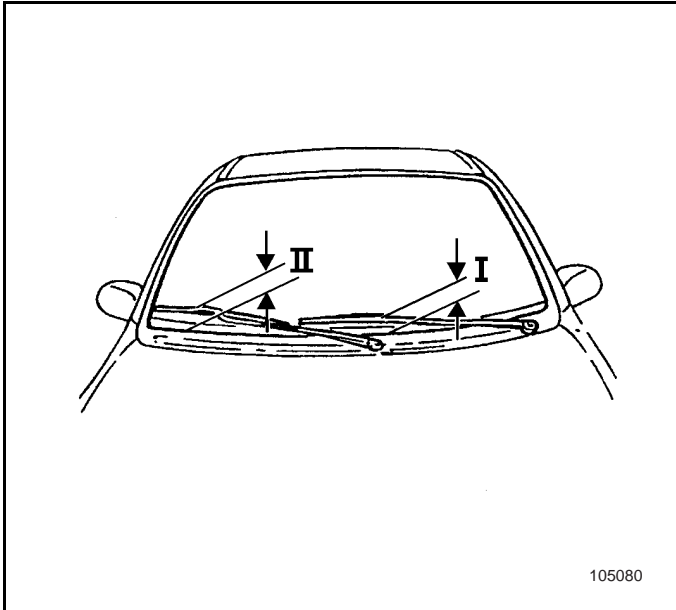


4. Install the two halves of the air intake grille board and beginning from outside use Philips screws (1) to tighten them.

Tighten

Tighten the bolts to 1.0-1.5 N•m.

5. Connect the engine connecting seal (2) to the front boarding.



6. Install the windshield wiper arm assembly. Refer to Replacement of Wiper Arm Assembly in Windshield Wiper/Washer System.
7. Connect earth lead to the battery.

1.1.5.23 Replacment of Controller Assembly

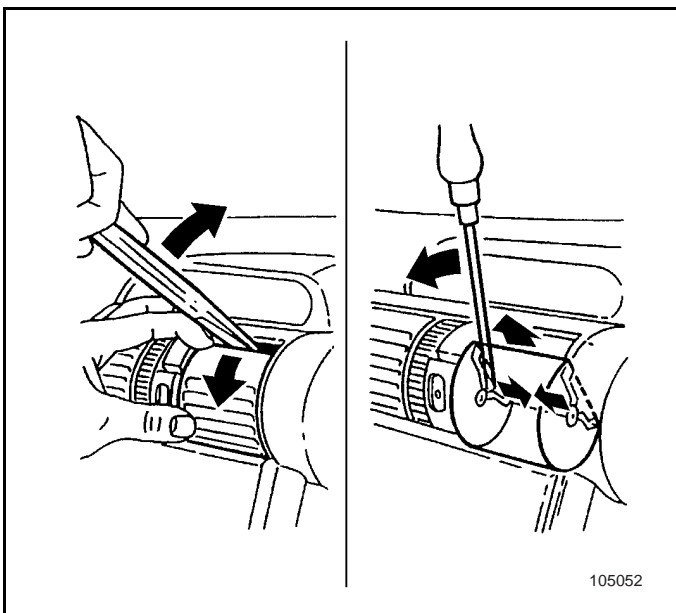
Refer to Replacement of A/C Controller - Central Control Board in Instrument Panel, Gauge and Console.

1.1.5.24 Replacement of Mixing Air Nozzle Case

Notice: All mixing air nozzle cases are identical and interchangeable.

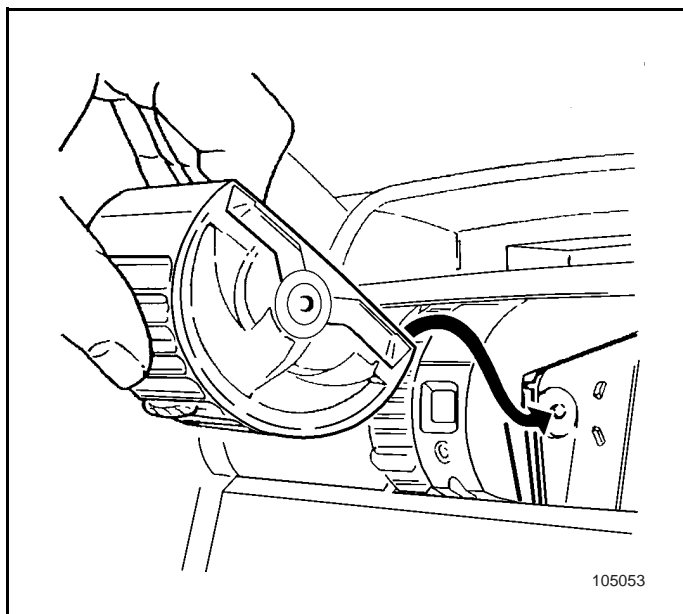
Removal procedures

1. Use a plastic wedge to turn the mixing air nozzle case backwards to the stopper so that a gap as wide as 1.5 cm can be seen on the upside edge. Through this gap pry the nozzle case out of the slewing cam, then pull it out upwards and backwards.



Installation procedures

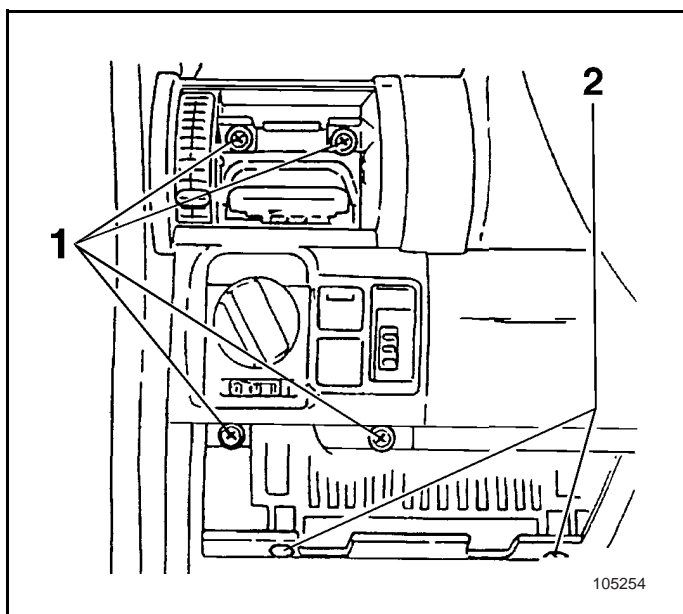
1. According the profile of the nozzle case, lead the mixing air nozzle case into the housing until it is seated with a "click" sound.

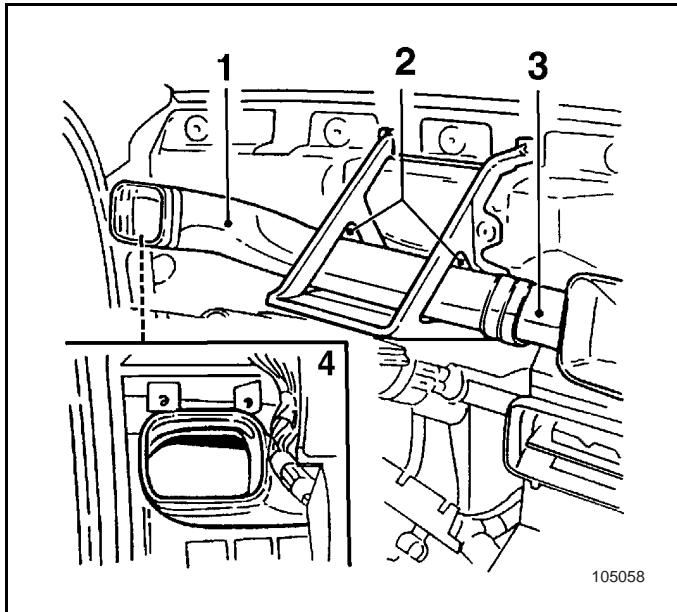


1.1.5.25 Replacement of Air Distribution Duct - Driver Side

Removal procedures

1. Disconnect earth lead from the battery and remove the cover of the fuse box.
2. Turn the mixing air nozzle.
3. Remove bolts (1) from the mixing air nozzle housing.
4. Remove fuse box bolts (2) from the instrument panel and place it the driver's legroom.
5. Separate the mixing air nozzle from the air distribution duct and remove it from the instrument panel.





6. Disconnect the air distribution duct from the port of air distributor housing (3).
7. Pull air distribution duct (1) through the opening of the mixing air nozzle housing (4), and pass it through the groove of the shear plate outside the instrument panel.

Installation procedures

1. Install air distribution duct into the groove of the shear plate that passes through the opening of the mixing air nozzle housing and is located at the port of the air distributor housing.
2. To facilitate the installation, the hose can be bended with the shear plate at "Service groove".
3. Connect the mixing air nozzle housing to the air distribution duct and use bolts to tighten it onto the instrument panel (6).

Tighten

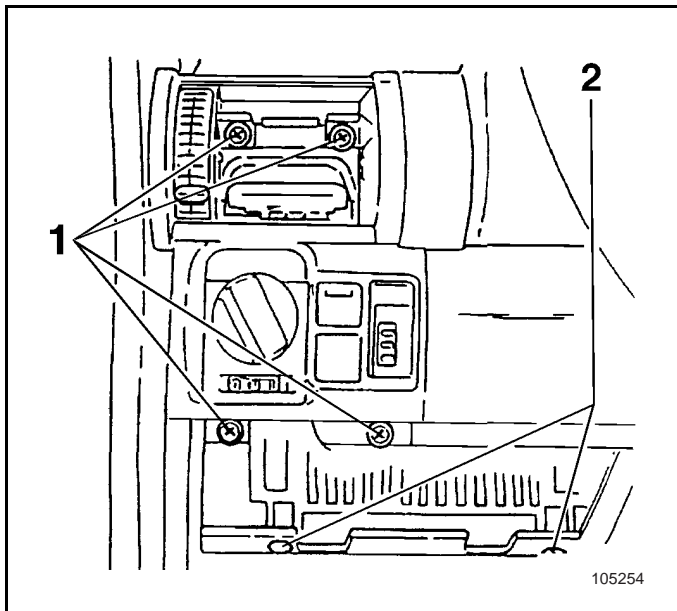
Tighten air duct bolts to 1.5-2.5 N•m.

4. Use bolts to tighten fuse box to the instrument panel (5).

Tighten

Tighten the bolts to 1.5-2.5 N•m.

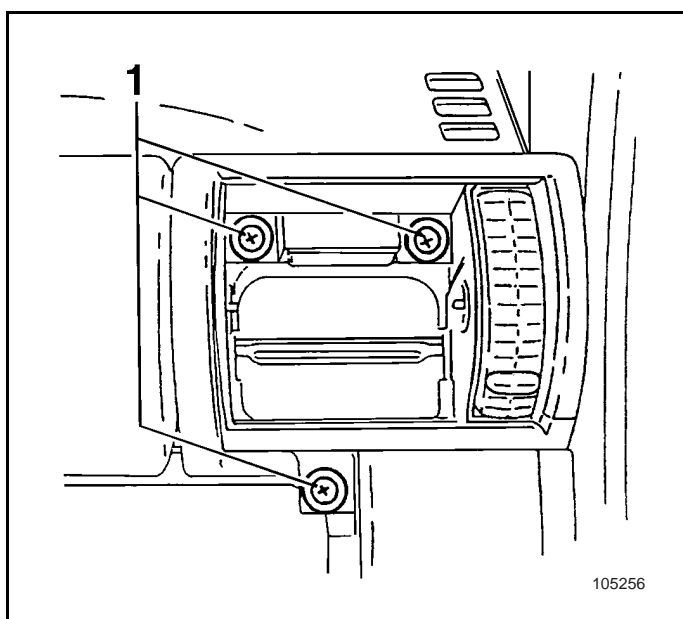
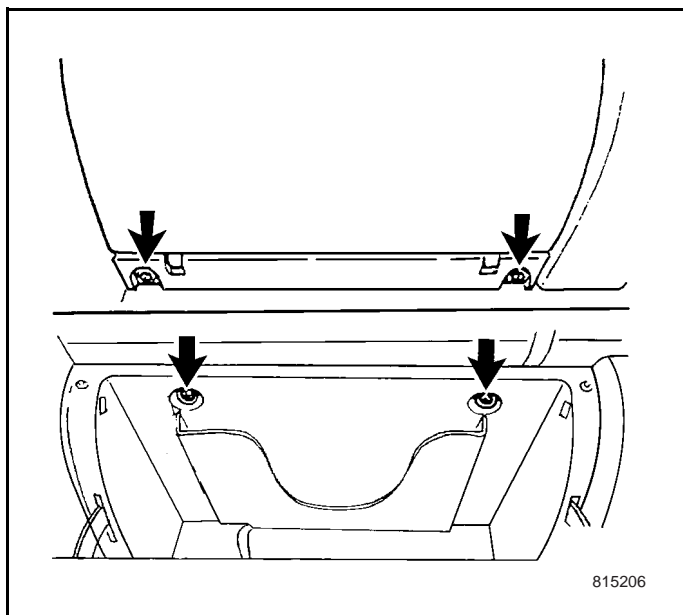
5. Connect earth lead to the battery.
6. Install the mixing air nozzle.



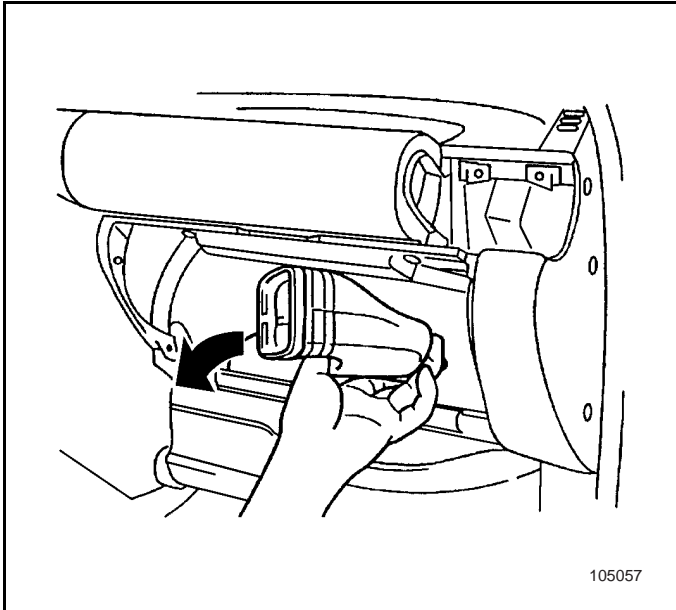
1.1.5.25 Replacement of Air Distribution Duct - Front Passenger Side

Removal procedures

1. Remove glove box from the instrument panel. Refer to Replacement of Glove Box in Instrument Panel, Cluster Gauge and Auxiliary Instrument Panel.
2. Remove the mixing air nozzle.



3. Remove the bolts (1) of mixing air nozzle housing from the instrument panel, loosen it from the air distribution duct, then remove it from the instrument panel.



4. Remove the air distribution duct from connecting devices in the air room.

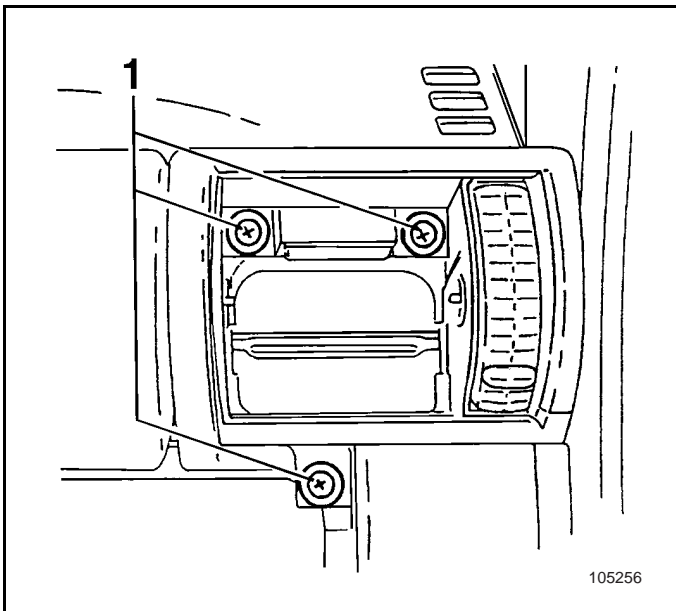
Installation procedures

1. Put the air distribution duct through the opening on the instrument panel used by the grove box, then insert it into the port of air distributor housing.
2. Connect the mixing air nozzle housing to the air distribution duct and use bolts to tighten it onto the instrument panel (1).

Tighten

Tighten the bolt retaining the air duct to the instrument panel to 1.5-2.5 N•m.

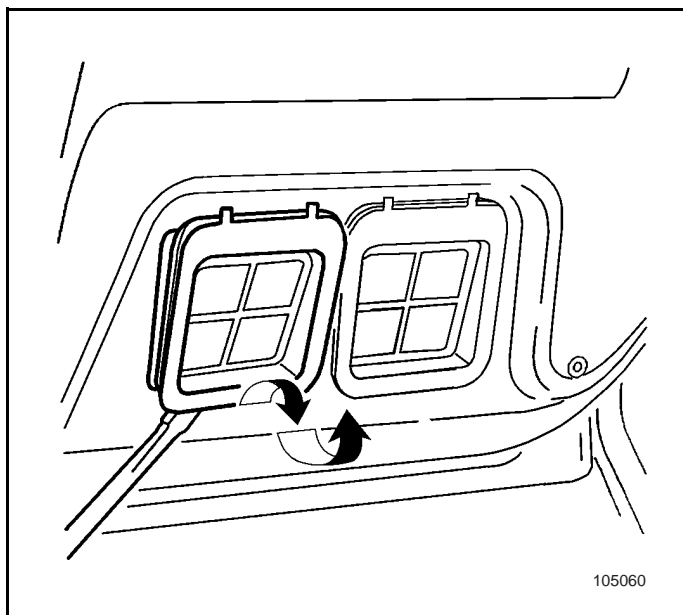
3. According the profile of the nozzle case, lead the mixing air nozzle case into the housing until it is seated with a "click" sound.
4. Install the grove box.



Replacement of Body Pressure Relief Valve

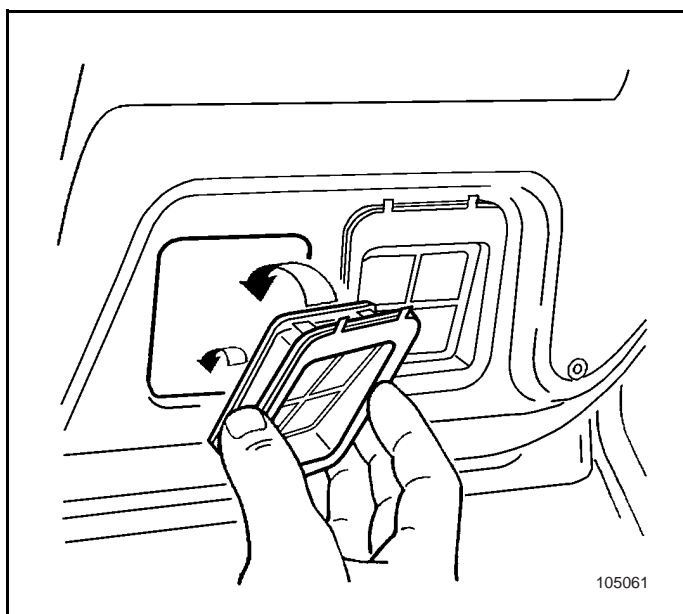
Removal procedures

1. Remove inner air door.
2. Unbolt body pressure relief valve.



Installation procedures

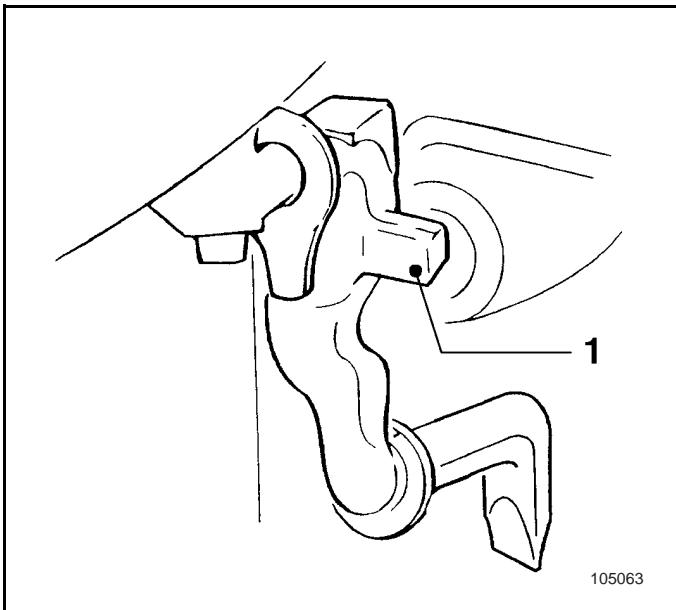
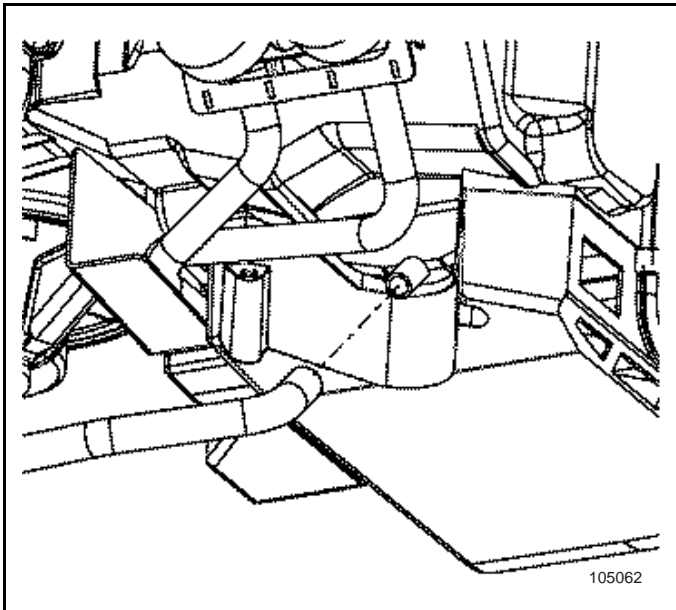
1. Connect body pressure relief valve.
2. Install inner air door.



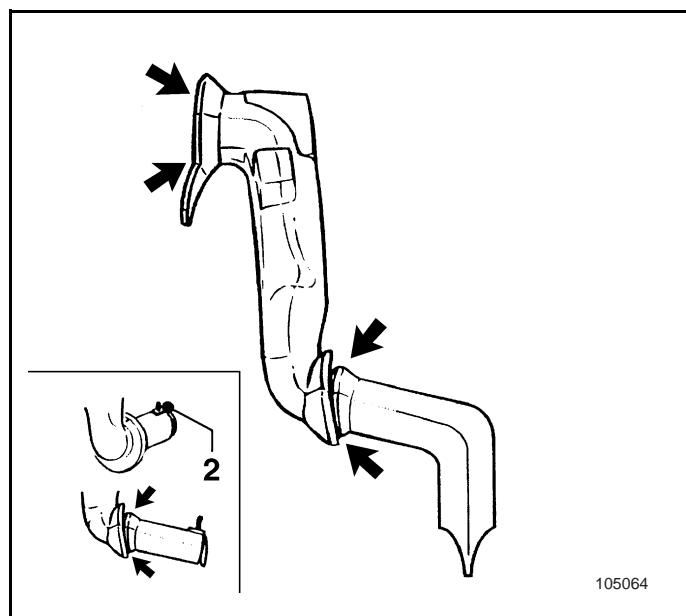
1.1.5.28 Replacement of Drainage Hose

Removal procedures

1. Remove the A/C box, refer to Replacement of A/C box.
2. Remove drainage hose (inside the A/C box).
3. Remove drainage hose (outside the A/C box).



4. Set the carpet aside.
5. Remove drainage hose (1).



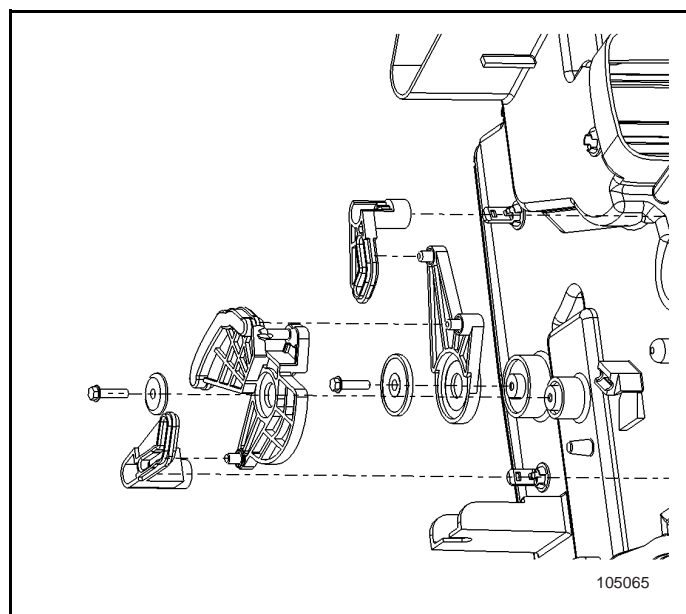
Installation procedures

1. To facilitate installation, the position indicated by the arrow can be coated with soap.
2. Thread the nozzle part through the front boarding and insert it into the engine room.
3. Connect the opening to the hose of the A/C box.
4. Lay the carpet again.

1.1.5.29 Replacement of Heat Distribution Box Rocker

Removal procedures

1. Remove the A/C box, refer to Replacement of A/C box.
2. Remove assembling bolts and sealing members.
3. Disconnect the rocker from the distribution box.



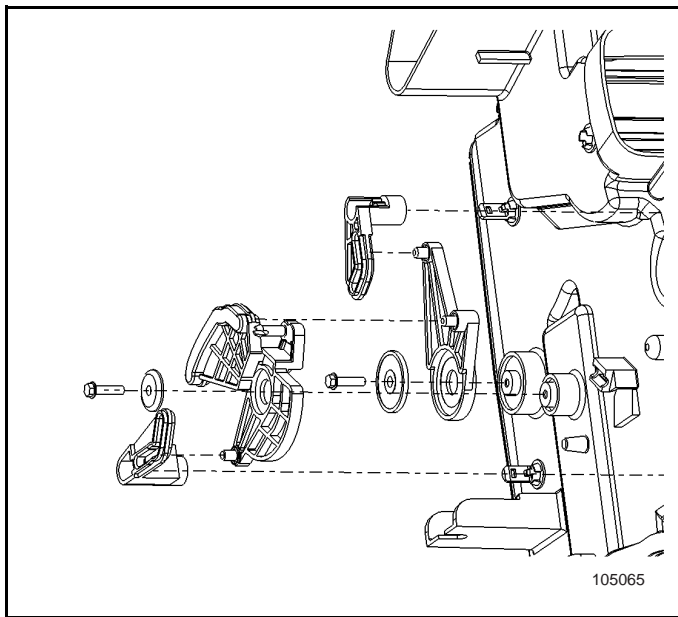
Installation procedures

1. Connect the rocker and the distribution box.
2. Install assembling bolts and sealing members.

Tighten

Tighten the rocker bolts to 2.0-4.0 N•m.

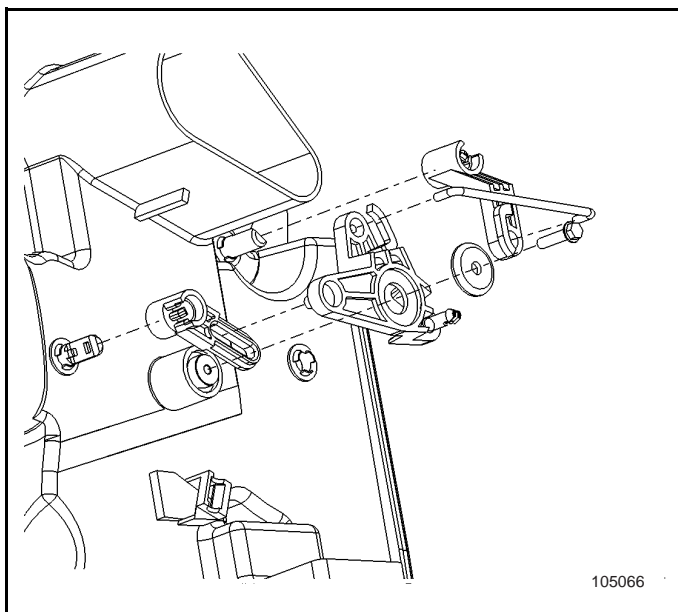
3. Install the A/C box, refer to Replacement of A/C Box.



1.1.5.30 Replacement of A/C and Defrosting Air Door Rocker

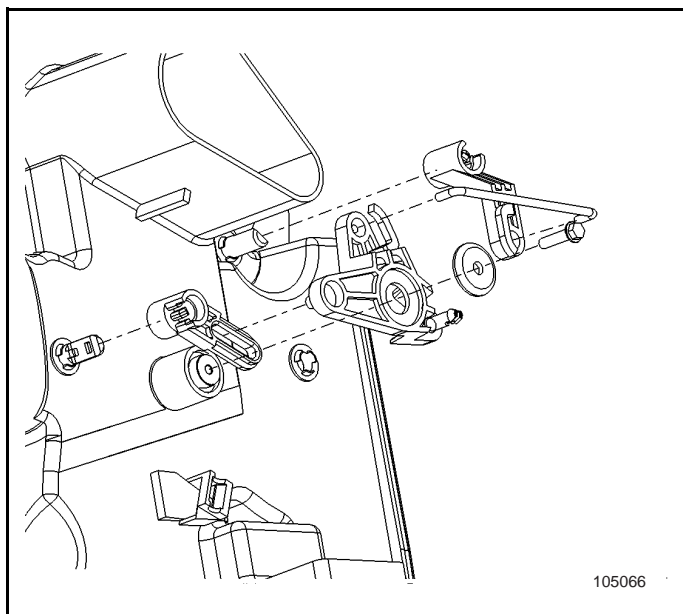
Removal procedures

1. Remove the A/C box, refer to Replacement of A/C box.
2. Disconnect the rocker from the air door.



Installation procedures

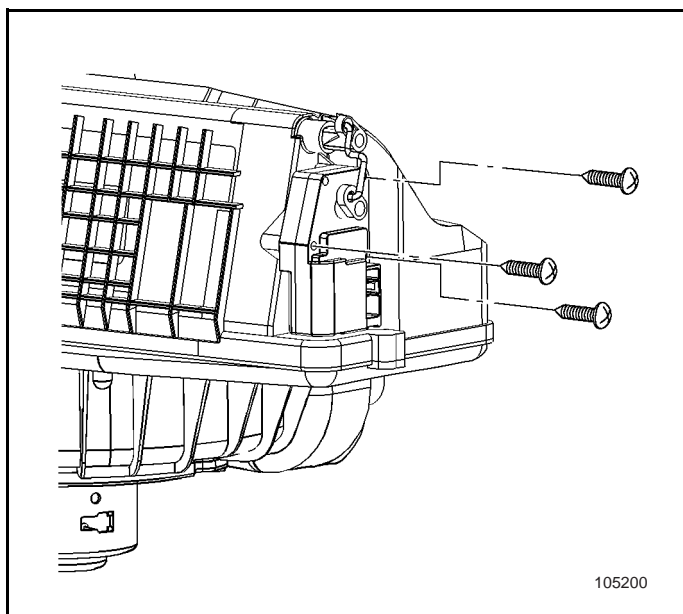
1. Connect the rocker and the air door.
2. Install the A/C box, refer to Replacement of A/C Box.

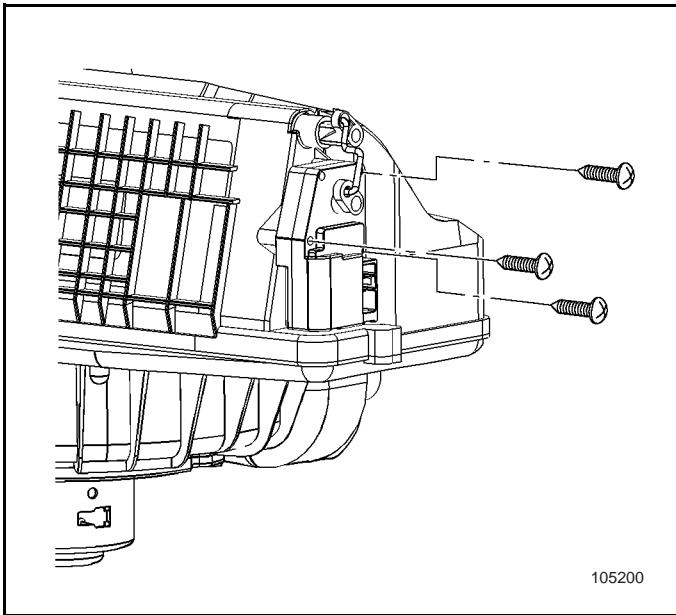


1.1.5.31 Replacement of Fresh Air Door Actuator

Removal procedures

1. Remove the A/C box, refer to Replacement of A/C box.
2. Disconnect the actuator harness connector.
3. Remove actuator control rod.
4. Remove assembling bolts.
5. Remove the actuator.





Installation procedures

1. Use bolts to install the actuator.

Tighten

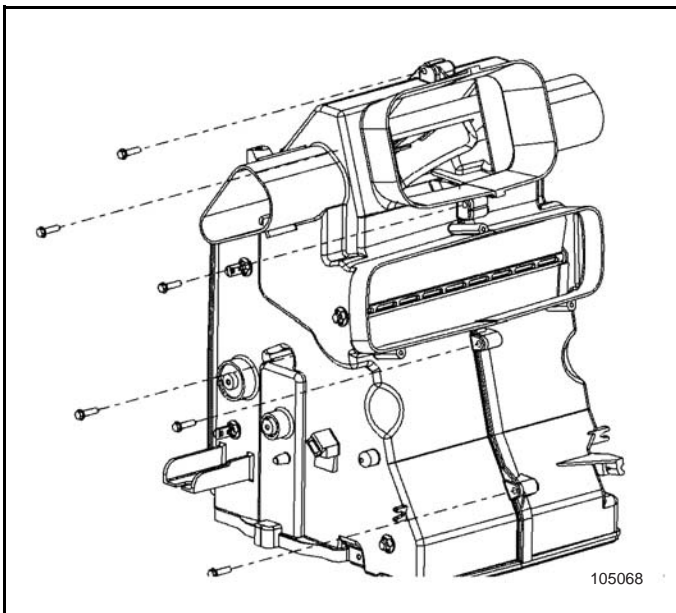
Tighten the bolts to 2.0-4.0 N•m.

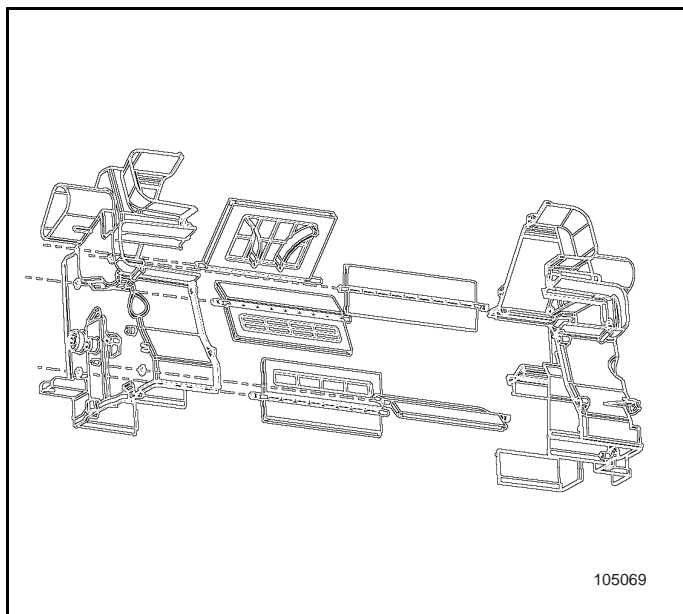
2. Install actuator control rod.
3. Connect the actuator harness connector.
4. Install the A/C box, refer to Replacement of A/C Box.

1.1.5.32 Replacement of Heat Distribution Duct

Removal procedures

1. Remove the A/C box. Refer to Replacement of A/C box.
2. Remove the heater core. Refer to Replacement of Heater Core in A/C Box
3. Remove the rocker. Refer to Replacement of Heat Distribution Box Rocker

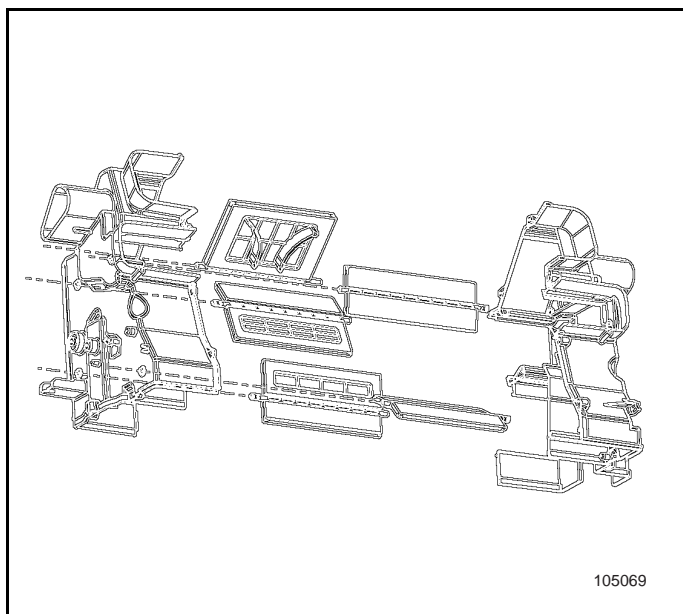


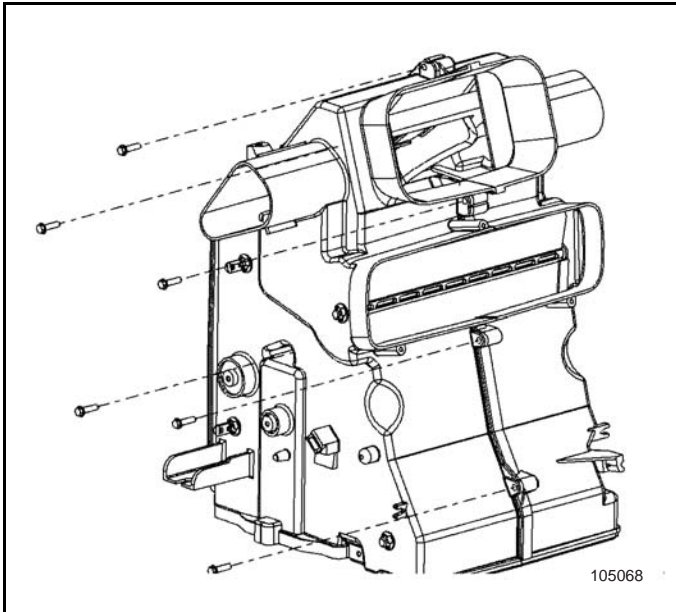


4. Disconnect the air door.

Installation procedures

1. Connect the air door.



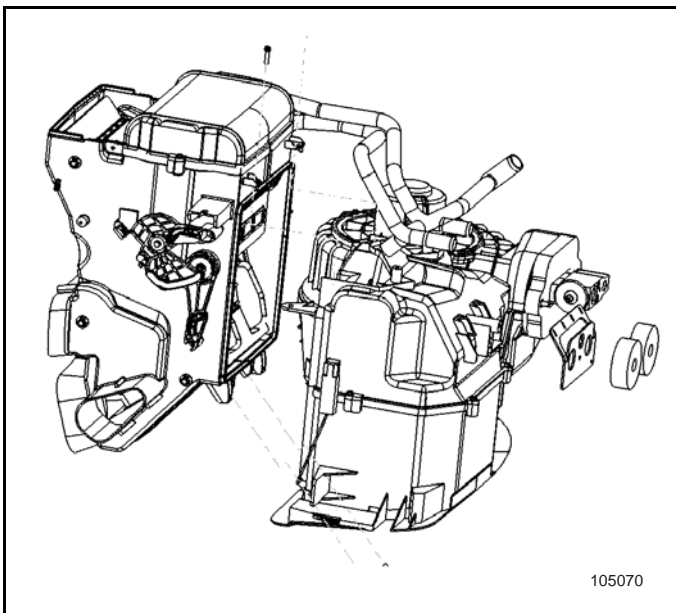


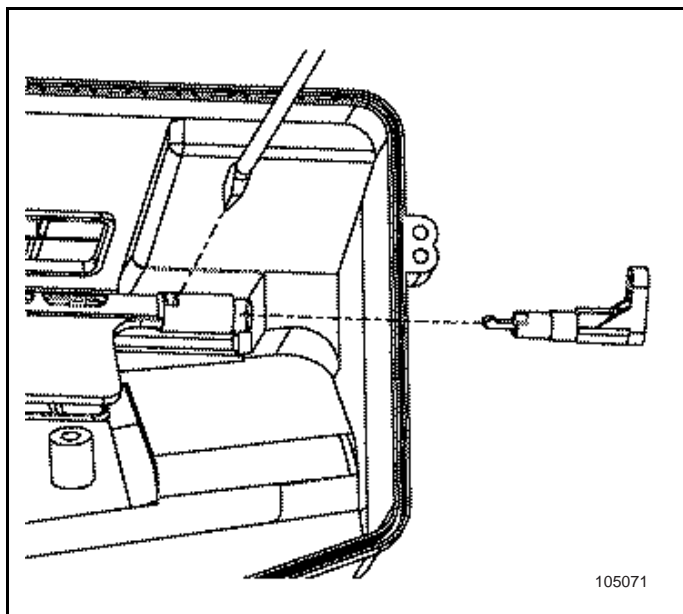
2. Install the rocker. Refer to Replacement of Heat Distribution Box Rocker Arm.
3. Install heater core, refer to Replacement of A/C Box Heater Core.
4. Install the A/C box, refer to Replacement of A/C Box.

1.1.5.33 Replacement of Fresh Air Door

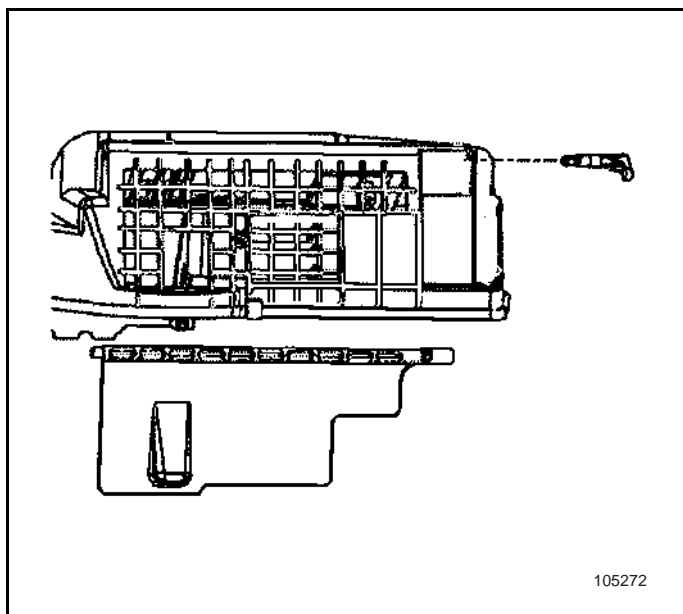
Removal procedures

1. Remove the A/C box, refer to Replacement of A/C box.
2. Disconnect the heater and the evaporator box.





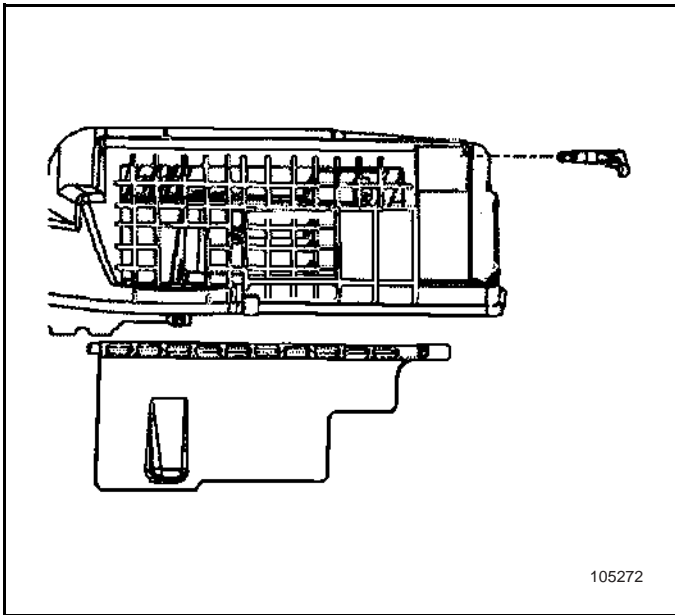
3. Remove the fresh air door rocker.



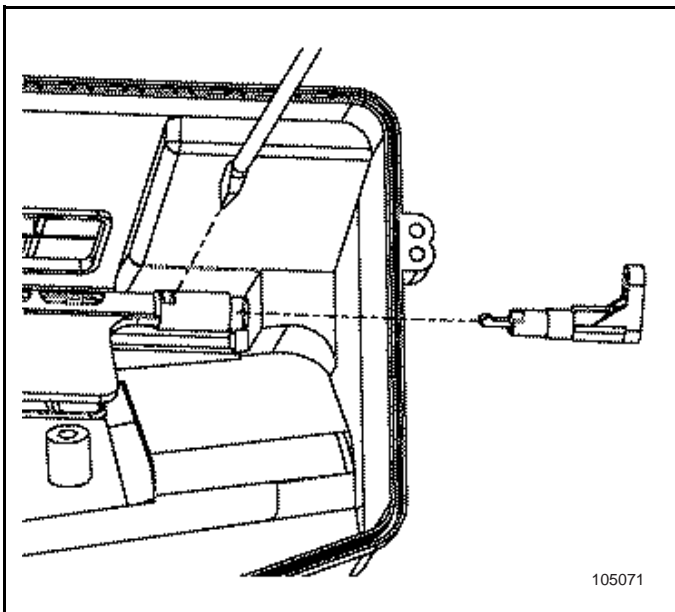
4. Remove the air door.

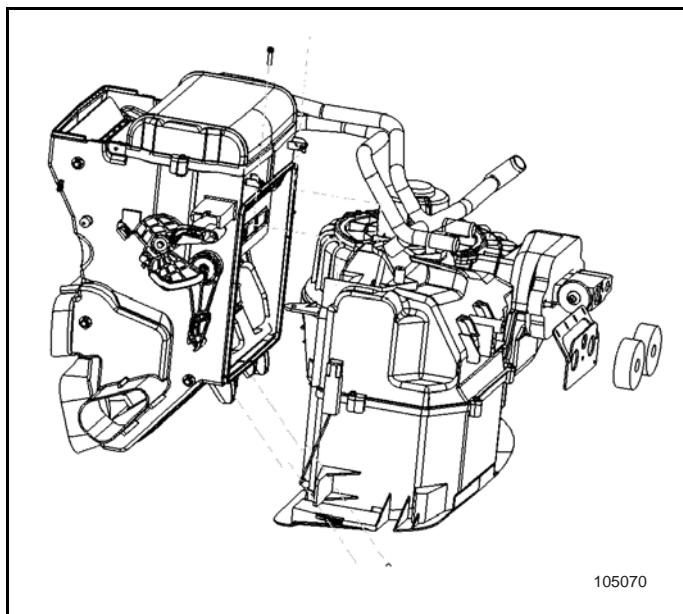
Installation procedures

1. Install the air door.



2. Install the fresh air door rocker.





3. Connect the heater and the evaporator box.
4. Install the A/C box, refer to Replacement of A/C Box.

1.1.6 Description and Operation

1.1.6.1 Description of A/C System

Operation of Heating-Ventilation-Air Conditioning System

Notice: The refrigerating system of this vehicle uses R-134a, a refrigerant incompatible with R-12 refrigerant. Before repairing the system, ensure correct repair equipment will be used, otherwise the system will be severely damaged. Before performing the repair, refer to the service manual and the manufacturer instruction provided with the repair equipment,

The A/C system provides the following features:

- Cooled or dehumidified air for the comfort of the occupants
- Forced ventilation
- Windshield defrosting
- Side Window Defogging

During most operating conditions, outside air enters the vehicle in the following manners:

- The blower motor inhales outside air through the A/C bellows.
- The forward movement of the vehicle forces in outside air.

Air will travel along the following path in the bellows:

1. Through the evaporator core
2. Through the heater core
3. Into the passenger compartment

If the ambient temperature is above 3C, the refrigeration system will chill the evaporator to almost freezing. You can start up the air conditioning or defrosting function.

As the air passes through the evaporator, the air temperature drops. Air moisture condenses on the evaporator core fins. A gravity feed through a drain hole removes the moisture from the vehicle. This action dehumidifies the air.

From the evaporator, some or all of the air may pass through the heater core. If the system is in heating mode, air coming from evaporator will pass through heater core, then warmed up by the engine coolant.

If the maximum air conditioning function is required, you can turn to RECIRC (recycle) mode, so that most of the air coming into the blower motor is from the passenger compartment. The air from the passenger compartment is usually cooler than the outside air.

Air Conditioning

Air conditioning system has a V5 compressor. V5 compressor can satisfy the vehicle's air conditioning requirement without recycle on any condition.

The basic compressor mechanism is a variable angle wobble-plate with five axially oriented cylinders.

A bellows actuated control valve determines the compressor displacement. This control valve is located in the rear head of the compressor, and senses the suction pressure of the compressor.

The crankcase suction pressure differential controls the following:

- The wobble-plate angle
- The compressor displacement

The following actions occur when the A/C capacity demand is high:

- The suction pressure is above the control point.
- The valve maintains a bleed from the crankcase to suction.
- No crankcase-suction pressure differential exists.
- The compressor has maximum displacement.

The following actions occur when the A/C capacity demand is lower and the suction pressure reaches the control point:

- The valve bleeds discharge gas into the crankcase.
- The valve closes off a passage from the crankcase to the suction plenum.

A force balance on the five pistons controls the angle of the wobble plate. A slight increase of the crankcase-suction pressure differential changes the total force on the pistons. This change affects the movement around the wobble-plate pivot pin and reduces the angle of the wobble plate.

The compressor has a unique lubrication system. The crankcase-suction bleed is routed through the rotating wobble-plate. This routing permits lubrication of the wobble-plate bearing. The rotation acts as an oil separator. Some of the oil is removed from the crankcase-suction bleed and rerouted to the crankcase. The rerouted oil can lubricate the compressor mechanism.

According to the service condition of the engine, when any of the following condition is present, the compressor will be shut down:

- Wide-open throttle
- Low idle speed
- Low air temperature

The refrigerant in the system flows from the high pressure side to the low pressure side of the expansion (orifice) tube when the following conditions exist:

- The engine is turned off.
- Air conditioning system is not running.

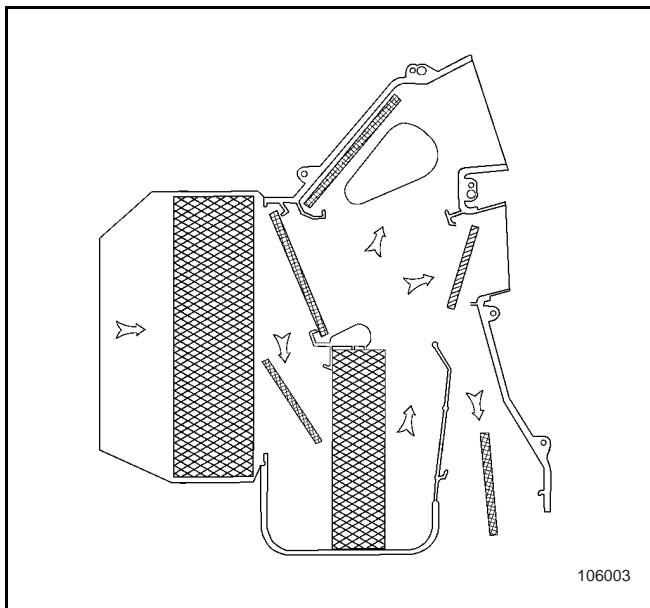
The refrigerant continues to flow until the pressure is equalized. This action may cause a faint sound of liquid flowing (hissing) for 30 to 60 seconds. The sound is a normal condition.

1.1.6.2 Description of Air Distribution System

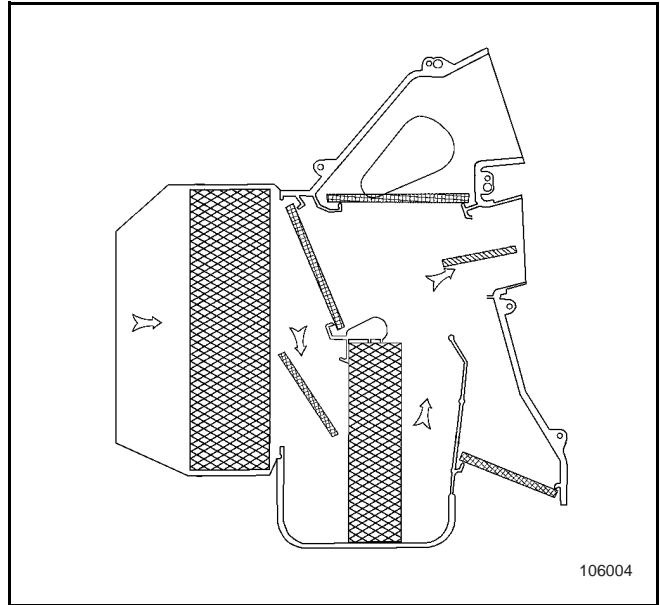
A stay wire is used to control the air flowing through the system. Various positions on the control cause the mode valves to mix and direct cooled, heated and outside air through the air ducts.

Air flows through the HVAC system as described for each of the following modes:

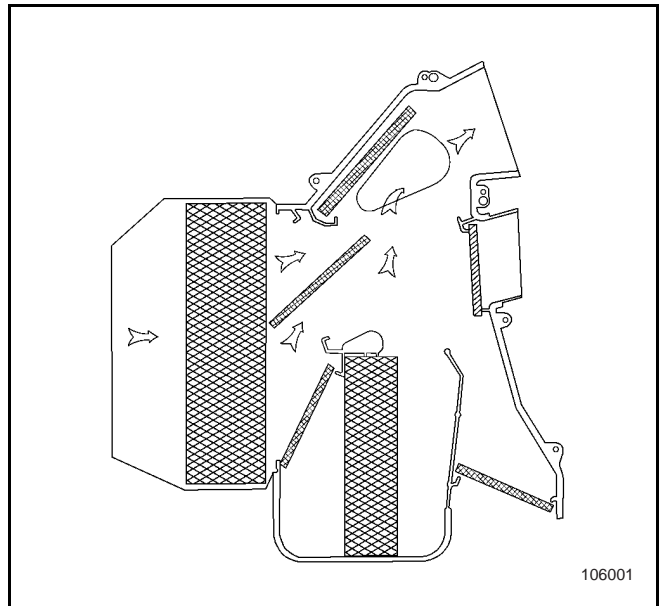
- OFF
- Slight exhaust from all air outlets
- Maximum
- Recirculated air flows through the instrument panel outlets.
- NORM A/C
- Outside air flows through the instrument panel outlets.



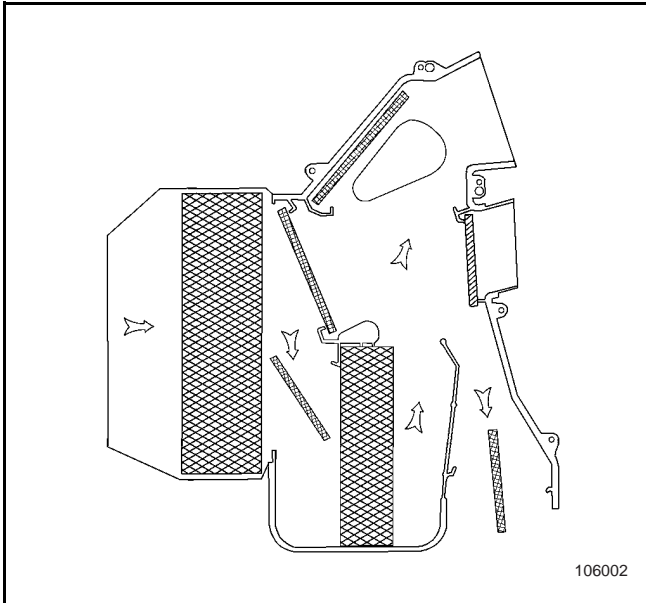
- FACE (Blowing-to-the-face mode)
- Air flows through the instrument panel outlets.



- BI-LEVEL (mixed)
- Air flows through outlets on the floor and outlets on the instrument panel.



- DEFOG
- Air flows through outlets on the floor, outlets on the instrument panel and the defrost outlet.



- DEFROST
- Most air flows through outlets of the defroster.

Air ducts and air outlets

A system of ducts and outlets directs air to the passenger compartment.

Obstructions in these ducts and outlets will block the free output of air. Inspect the following air passages for obstructions such as leaves, dirt or other objects:

- The defroster duct
- The heater duct
- The A/C ducts
- The vent ducts
- Side window demister

1.1.6.3 Refrigeration System Description

Caution: Avoid breathing the A/C Refrigerant 134a (R-134a) and the lubricant vapor or the mist. Exposure may irritate the eyes, nose, and throat. Work in a well-ventilated area. In order to remove R-134a from the A/C system, use service equipment that is certified to meet the requirements of SAE J 2210 (R-134a recycling equipment). If an accidental system discharge occurs, ventilate the work area before continuing service. Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

Similar to the function of engine coolant, refrigerant is a medium used in the A/C system to absorb, transmit and release heat. This vehicle uses refrigerant -134a (R-134a), a nontoxic, uncombustible, clear, colourless, and liquefied gas.

Although R-134a A/C system is similar to the R-12 system, the lubricants and maintaining equipment they

use are different. R-134a contains a special kind of lubricant, i.e. Polyalkylene Glycol Synthetic Refrigerant Oil (PAG). The PAG refrigerant of GM Company has a slight blue colour. This oil can absorb moisture (capable of water absorption), therefore it should be stored in an airtight container.

Use only Polyalkylene Glycol Synthetic Refrigerant Oil (PAG) for internal circulation through the R-134a A/C system and only 525 viscosity mineral oil on fitting threads and O-rings. Using other lubricants will cause failure of the compressor or the fittings.

Notice: R-134a refrigerant is incompatible with R-12 refrigerant in A/C system. Using R-12 in a system with R-134a will cause compressor failure, refrigerant oil deposition, or A/C system performance degradation. R-134a refrigerant contains a special kind of lubricating oil, i.e. Polyalkylene Glycol Synthetic Refrigerant Oil (PAG). The PAG refrigerant of the GM Company has a slight blue colour. This oil can absorb moisture (absorbing moisture from atmosphere) and should be stored in an airtight container. Use only Polyalkylene Glycol Synthetic Refrigerant Oil (PAG) for internal circulation through the R-134a A/C system and only 525 viscosity mineral oil on fitting threads and O-rings. If lubricants other than those specified are used, compressor failure and/or fitting seizure may result.

1.1.6.4 Odor Description

Some vehicles may have odor, which primarily comes out from A/C system when it is started under hot and humid condition. This odor may be caused by residues in the heater and evaporator subassemblies, or it may be caused by a mouldy evaporator core.

Odor in A/C system can be cleared away with Goodwrench A/C deodorizer.

1.1.6.5 Refrigerant R-134a

Caution: Avoid breathing the A/C Refrigerant 134a (R-134a) and the lubricant vapor or the mist. Exposure may irritate the eyes, nose, and throat. Work in a well-ventilated area. In order to remove R-134a from the A/C system, use service equipment that is certified to meet the requirements of SAE J 2210 (R-134a recycling equipment). If an accidental system discharge occurs, ventilate the work area before continuing service. Additional health and safety information may be obtained from the refrigerant and lubricant manufacturers.

Refrigerants in A/C system have the following functions:

- Absorbs heat
- Carries heat
- Releases heat

These vehicles use refrigerant -134a (R-134a). Refrigerant -134a is a nontoxic, unflammable, clear and colourless liquefied gas.

1.1.6.6 Handling Procedure of Refrigerant R-134a

Refrigerant -134a (R-134a) is used in the A/C system of this vehicle.

Whenever you use R-134a, the following special handling procedures should be followed to prevent any personal injury:

- Whenever you open the refrigerant system, please wear grooves.
- Whenever you open the refrigerating system, use a piece of clean cloth to wrap the following positions:
 - The tube fittings
 - The valves
 - The onnections
- Work in a well-ventilated area.Don't inhale refrigerant gas.
- Don't perform welding or evaporating cleaning operations near vehicles equipped with A/C tubes or components.
- If any part of your body comes into contact with R-134a, please complete the following operations:
 - Flush the exposed area with water.
 - Have medical inspection immediately.
- Before commencing any repair operation that has to open the pipelines or components of a refrigerant system, refer to Handling Method of Refrigerant Pipelines and Fittings and How to Maintain Chemical Stability.
- Instructions should be strictly followed when performing the following repair works:
 - Recovery and recirculation of refrigerant
 - Addition of refrigerant oil
 - Drain the refrigerating system.
 - Refill the refrigerating system.
- All R-134a disposable containers (coated with blue color) are shipped with a heavy metal screw cap.This screw cap is used to protect the valve of the container and the safety plug from any damage. After the container has been used, this screw cap should be replaced to continue to protect the valve and the safety plug.

1.1.6.7 Handling Method of Compressor Oil

Extract and use authorized compressor oil from closed and sealed container. When adding refrigerant oil, the conveyor system and the container should be clean and dry, so as to reduce pollution as much as possible. Refrigerant oil does not contain water, but will readily absorb moisture from the air. Don't open the refrigerant oil container until the maintenance procedure requires to use the refrigerant oil. Cap the container immediately after using it. Always extract and use authorized compressor oil from closed and sealed container. Compressor oil in an open or unsealed container will absorb moisture. Don't reuse refrigerant oil taken out from the A/C system. Dispose of wasted oil according the local laws and regulations.

1.1.6.8 Handling Method of Refrigerant Tubes and Fittings

- Ensure none of the following conditions exists in the metal tubes, so as to prevent any damage to the system capability caused by obstruction in pipelines.
 - Dents
 - Kinks
- Do not bend the flexible hose line to a radius of less that 4 times the diameter of the hose.
- Do not allow the flexible hose line to come within a distance of 63.5 mm (2.5 in) of the exhaust manifold.
- Inspect the flexible hose lines regularly.
- Replace the flexible hose line with new hose if one of the following conditions exist:
 - Leaks
 - Brittleness
 - Deterioration
- Disconnecting any fitting in the refrigerating system, drain all of refrigerant R-134a.
- Once you open a refrigerant line to the atmosphere, cap or tape the line immediately.
- This will prevent any of the following items from entering the line:
 - Moisture
 - Dirt
- Use the proper wrenches when you make connections on the O-ring fittings.
- Back-up the opposing fitting with a wrench in order to prevent distortion of the following areas:
 - The connecting lines
 - The components

- Tighten all of the tubing connections to the specified torque.
- Too much or too little torque may result in the following conditions:
 - Joints too loose
 - Deformed joint parts
 - Refrigerant leakage
 - An inoperative A/C system
- Ensure that the O-rings and the seats are in perfect condition.
- A burr or a piece of dirt may cause a refrigerant leak.
- Install new O-rings that you have lubricated with the mineral base 525 viscosity refrigerant oil.
- The use of polyalkylene glycol synthetic refrigerant oil (PAG) is forbidden.
- Do not wipe the threads with a cloth.
- Keep PAG synthetic refrigerant oil off the fitting threads. Long term contact of PAG synthetic oil on threads may cause future disassembly difficulties. Flush threads of fitting with mineral base 525 viscosity refrigerant oil. Do not use PAG synthetic oil. Do not wipe threads with a cloth.
- Before disconnecting any refrigerant connecting device, wipe off dust and/or oil. This will reduce the possibility of particulate contamination.
- Cap, plug up or tape both ends of open-type connecting devices. This will reduce the dust and moisture entering the system.
- Ensure the following items are clean and tidy:
 - Tools used for the maintenance
 - Surrounding area of the maintenance operation
 - The hoses and fittings of ACR4 machine, or the manifold measuring units
 - Replacement parts
- When adding PAG lubricant, ensure the conveyor system and the container is clean and tidy, so as to reduce moisture entering the system.
- Do not leave the A/C system open any longer than necessary.
- Before recharging an A/C system that has been opened, properly exhaust the system and perform vacuum test.
- Service parts are dehydrated and sealed prior to shipping. Leave the components in their hermetic package until preparation for use has been made.
- Before opening the package, ensure the components are at room temperature. This will prevent moisture in the air from condensing into beads on the components.
- After removing the maintenance shield, connect the snap coupling of the A/C system maintenance equipment as quickly as possible.

1.1.6.9 The handling of A/C Compressor

Don't bump or drop the compressor, or turn it upside down. If the compressor is impacted or turned upside down, the compressor clutch should be rotated manually for 5-6 times, so as to circulate the oil in the cylinder. When there is oil in the cylinder, sudden rotation will cause damage to the valve and adverse effect to its durability.

1.1.6.10 Maintaining Chemical Stability

Chemical stability of the A/C system is critical to the efficient operation and the service life of it.

Air, moisture or particulate contamination formed in the refrigerating system will have the following results:

- The stability of R-134a and PAG synthetic lubricant will change.
- The symmetry of pressure/temperature will change.
- The efficiency of A/C system will decrease.
- Abnormal corrosion and/or wearing will occur on internal components of the A/C system.

Use the following practice to maintain the chemical stability of the refrigerating system:

1.1.6.11 Description of Passenger Compartment Air Filter

The filter is located in the filter housing assembly under the windshield. These filters are used to filtrate:

- Fresh air coming into the vehicle

Besides filtrating dirt particles from the air, air filters are also used to reduce unpleasant air coming into the vehicle.

Replacement interval of air filter is 12 months or 20,000 kilometer. According to driving conditions, these filters may need regular replacement.

1.1.6.12 Description of Blower Motor

The blower consists of the following components:

- A permanent magnet type motor
- A squirrel cage type fan

The blower runs at different speeds. Each speed is decided by the blower motor resistor, while the blower motor resistor is controlled by the blower motor speed controller.

1.1.6.13 Description of Blower Motor Resistor

The following components are used together to set the blower speed:

- The blower resistor
- The blower switch

The blower resistor consists of 3 resistors located in the same housing.

When the blower switch is at position 1, the following operations occur:

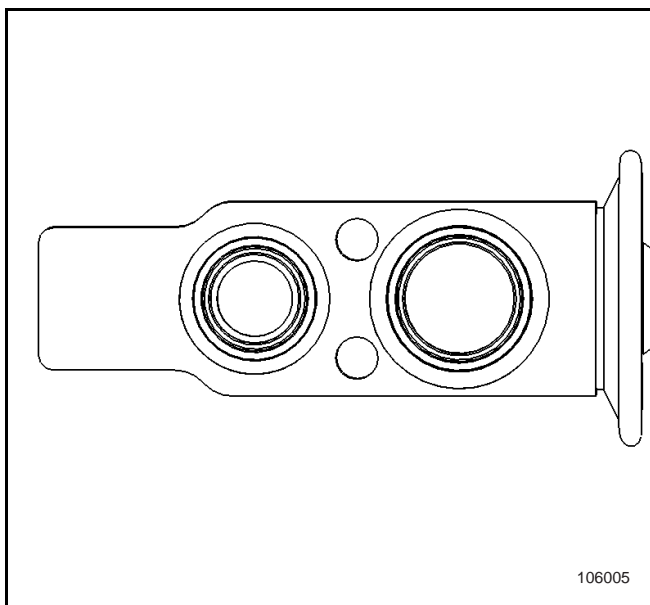
- The blower circuit uses all of the 3 resistors.
- The blower motor runs at the lowest speed.

When the blower switch is at position 2, the following operations occur:

- The blower uses two resistors.
- The blower motor runs faster.

When the blower switch is at position 3, the following operations occur:

- The blower uses only one resistor.
- The blower motor runs faster.



When the blower switch is at position 4, the following operations occur:

- None of the resistors is used.
- The blower motor runs at the highest speed.

1.1.6.14 Description of Expansion Valve

Expansion is located at the opening of the evaporator. It forms restriction to the high-pressure liquid refrigerant in the liquid pipelines, thus making the refrigerant flowing toward evaporator become low-pressure liquid.

The expansion valve changes position from the big to the small according to the following conditions:

- Lower limit of A/C pressure
- Upper limit of A/C pressure

1.1.6.15 Evaporator Description

Before air enters passenger compartment, the evaporator will cool and dry the air. The following situations will happen in the evaporator:

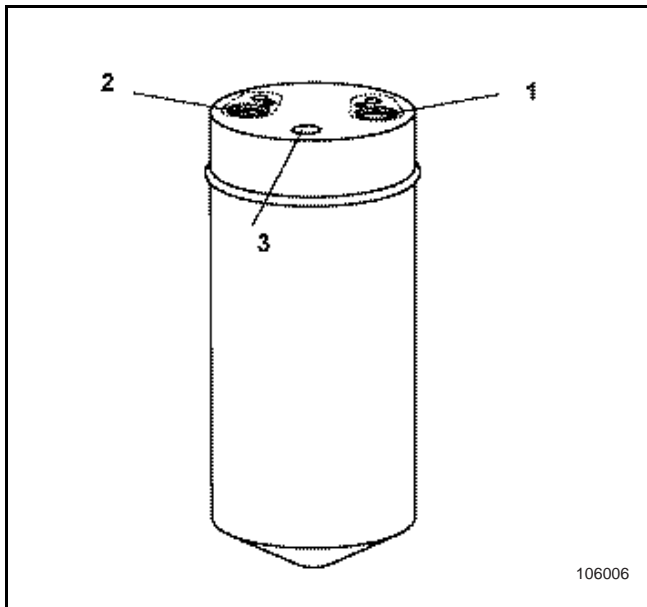
1. The low-pressure, low-temperature liquid/ evaporating refrigerant enters the evaporator.
2. The refrigerant flows through the evaporator pipeline.
3. The refrigerant vaporizes.
4. The refrigerant flows through the evaporator in the form of low-pressure, low-temperature and mostly water vapor.
5. As the refrigerant vaporize, it absorbs heat from the air flowing through the evaporator.

As the heat is transferred from air to the evaporator core, moisture in the air (humidity) will condense on the surface of the evaporator core, and flow away in the form of water.

1.1.6.16 Condenser Description

Condenser is used to receive high pressure and high temperature refrigerant vapor from the A/C compressor. Condensor is composed of aluminium pipes and cooling fins, and the cooling fins can transmit heat away from high-pressure and high-temperature refrigerant vapor. The cooling fins will condense high pressure and high temperature refrigerant vapor into high pressure but moderate temperature liquid.

1.1.6.17 Liquid Container Description



Legend

- 1. Entrance
- 2. Export
- 3. Sensor

The sealed accumulator is connected to the evaporator outlet pipe. This liquid container is used to store refrigerant and oil coming from the evaporator. When leaks are present for the following reasons, the container cannot be used but should be replaced.

- Perforation
- Damaged sealing positions
- Damaged threads on fasteners
- Outside air has entered the system in the prolong time.

1.1.6.18 Heater Core Description

Heater core is the main component of heating system. Heater core is located at the interior of the heater and evaporator subassembly. When the engine runs, engine coolant will be pumped into the heater core from the engine. The heater core cooling fins are used to transfer the heat from the engine coolant to the air flowing through the heater core. The heater core has specific intake and outlet pipe. Before repairing the heater core or the heater hose, replacement of heater hose should be recorded.

Temperature control knob is connect with the temperature valve. When temperature control knob is turned to FULL COLD position, the temperature valve will cling to the air intake leading toward the heater core. The following operations take place:

- All airflows from the evaporator bypass the heater core.
- No heat transfer happens.

When the temperature control knob is turned away from FULL COLD position, the temperature valve begins to guide the air toward the heater core. This operation causes the air flow through the heater core. The more distance the temperature control knob is turned clockwise, the more air will be guided by the temperature valve to flow through the heater core. When air is heated in this way, the air exhausted will be warmed up.

When the temperature control knob is turned to FULL HOT position, the temperature valve will prevent airflows from passing through passages in the heater core. This operation will make all airflows pass through the heater core.

1.1.6.19 Compressor Description

The compressor for the air conditioning system is belt-driven by the engine crankshaft and through the A/C compressor clutch. The compressor pulley rotates freely, without turning the compressor shaft, until an electromagnetic clutch coil is energized. When voltage is applied in order to energize the clutch coil, a clutch plate and hub is drawn toward the pulley. The magnetic force locks the clutch plate and pulley together as one unit in order to drive the compressor shaft.

1.1.6.20 High Pressure Relief Valve (HPRV) Description

The compressor is equipped with a relief valve that plays a safety role in the system. Under certain conditions, the refrigerant on the discharge side may exceed the designed operating pressure. To prevent any damage to the system, this valve is designed to open automatically at approximately 3140 Kpa. Correct any condition that will cause this valve open, and replenish refrigerant that has been removed.

1.1.6.21 A/C Refrigerating Pressure Switch Description

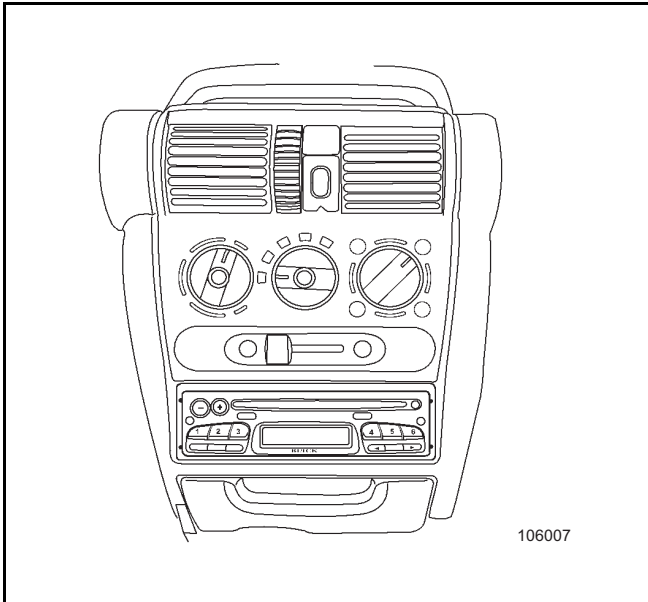
A/C refrigerating pressure switch is installed in the liquid container, and when inner pressure of the A/C system is too high or too low, the pressure switch will open the alternating circuit of the A/C system.

The pressure switch will continuously monitor the pressure of A/C system to realize the following functions:

- When the pressure exceeds 2940 Kpa, switch off A/C clutch; when the pressure


- When the pressure exceeds 177 Kpa, switch off the A/C clutch; when the pressure returns to 186 Kpa, reconnect the A/C clutch.

1.1.6.22 Controller Assembly Description



With this system, you can control the heating, cooling and ventilation in the vehicle. The system works best if you keep your windows closed while using it.

Fan Control knob

The knob in the middle controls the selection of fan speed. To turn the fan off, turn the knob to the  position.

Temperature Control knob

The left knob changes the temperature of air flowing into the system. Turn this knob toward red area for warmer air. Turn it toward blue area for cooler air.

Mode Control

The right knob uses 4 settings to control the direction of airflow.

- **FACE:** Used to import air and direct it through outlets on the instrument panel.
- **BI-LEVEL (mixed):** Most of the air flows through ducts near the floor, and the rest flows through the defroster and the side window outlets.
- **DEFOG:** Air is permitted to flow through the floor ducts, the front defroster, and the side window outlets.
- **DEFROST:** Most of the air is directed through the defroster and side window outlets.

Rear window defogger

The rear window defogger uses a warming grid to remove fog from the rear window. Pressing Rear Window Defrosting button will start the rear window

defogger. Indicator on the button will light up and the system will operate for about ten minutes. Pressing the button again will stop the defroster.

A/C (Air Conditioning) switch

To start A/C system, press Temperature Control button. The air conditioning compressor will run automatically in this setting unless the outside temperature is below 4C.

Recirculation and outside air button

When pressing this button, air in the vehicle will be circulated. When pressing this button again, outside air that has been filtered will come into the vehicle.

1.1.6.23 O-ring Seal/Plain Washer Description

Whenever a joint or a connection is torn apart, an authorized new A/C O-ring seal or plain washer for replacement should be installed.

Some vehicles use plain washers and O-rings to seal refrigerant system. Plain washers are used on cylinder block fittings of refrigerant components. O-ring seals are used to seal refrigerant pipelines.

An O-ring seal consists of the following components:

- An aluminum fitting with outside screw threads and welded to an aluminum tube.
- A nut of free spiral and with outside screw threads
- An aluminum tube end with an O-ring

Before installation, make sure the plain washer or the O-ring seal is in good condition. Replace any damaged part.

Coat the O-ring seal and the plain washer with authorized refrigerant oil.

Using improper service parts and maintenance steps may cause leakage.

Service sealing caps

The primary seal for the service ports is the sealing cap. This cap contains a specially designed O-ring or gasket which provides a leak-free seal. A sealing cap that is too loose, missed or misused will cause a loss of refrigerant.

1.1.6.24 HVAC Blower Controls Circuit Description

Blower motor is a motor with variable speed. The higher the voltage applied to the motor, the faster the speed.

Voltage to the blower motor is supplied by the heater and the A/C system controller through the blower motor resistor. In the setting of medium to low speed (Gear I,

II and III), the voltage will be depressed by the internal blower motor resistor. Each internal resistor will also have a heat restrictor connected with it in series. In the setting of high speed (Gear IV), the blower motor do not use internal blower motor resistors. Voltage will be supplied to the blower motor directly, so that it can run at maximum speed.

1.1.6.25 HVAC Compressor Controls Circuit Description

The compressor for the air conditioning system is belt-driven by the engine through the A/C compressor clutch. The clutch allows the compressor to perform the following functions:

- To engage for A/C and defroster operation
- To disengage when A/C is not needed
- To disengage when the engine load must be reduced

The voltage signal tells the PCM that A/C compressor operation is requested.

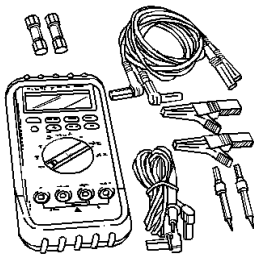
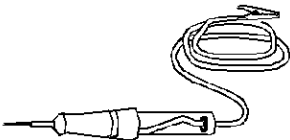
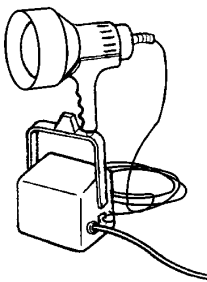
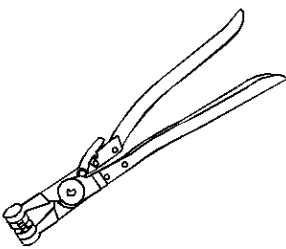
Under normal operating conditions, the following actions occur:

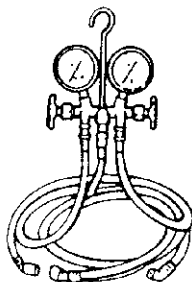
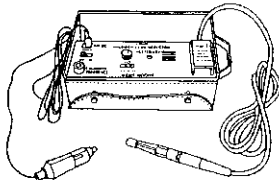
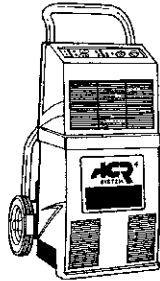
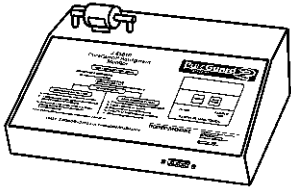
1. The PCM supplies a ground to the relay coil of the A/C compressor controller.
2. The relay energizes.
3. Voltage is supplied to the A/C compressor clutch through the relay fuse.
4. A/C Compressor Clutch is engaged.
5. The compressor runs.

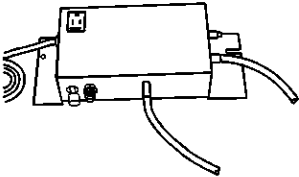

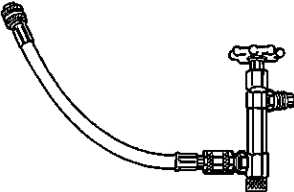

If PCM determines to reduce the load of the engine, such as when the throttle is fully opened, PCM will disconnect the A/C compressor controller, and the compressor clutch will disengage. Even when there is still a voltage signal on the PCM that comes from the heater and the A/C controller, power supply will still be cut off.

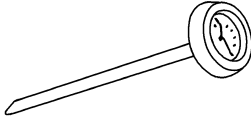

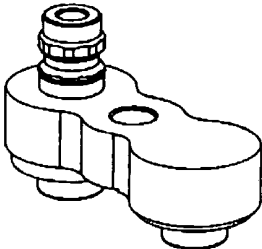
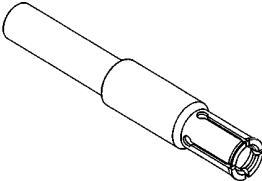
The A/C compressor clutch diode is used to provide a connection between terminals of the A/C compressor clutch. The A/C CLU diode provides a path for the high current that results from voltage spikes generated from the collapsing magnetic field of the A/C compressor clutch coil. Voltage spikes occur every time the coil de-energizes.

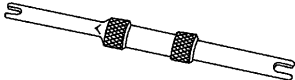

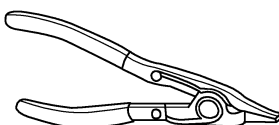
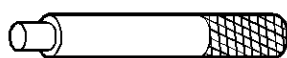
1.1.7Special tools

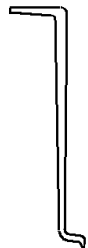
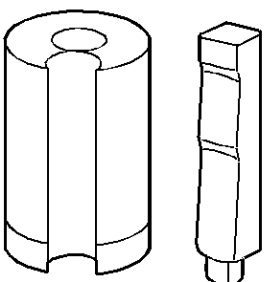
Graphics	Tool Number/ Description
 <p>J39200</p>	J 39200 Digital Multimeter
 <p>J34142-B</p>	J 34142-B Passive Test Lamp
 <p>J28428-E</p>	J 28428-E High Intensity Black Light
 <p>J38185</p>	J 38185 Hose Clamps Pliers

Graphics	Tool Number/ Description
 <p>J39183-C</p>	J 39183-C R134A The manifold gauge set
 <p>J39400-A</p>	J 39400-A Halogen Leak Detector
 <p>J39500-B</p>	J 39500-B Air Conditioning Refrigerant Recovery, Recycling and Recharging (ACR4) System
 <p>J41810</p>	J 41810 Pure Gaurd 2

Graphics	Tool Number/ Description
 J41810-100A	J 41810-100A Positive Flow Control Valve
 J39500-50	J 39500-50 50 Pound Rechargeable Recovery Tank
 J41436	J 41436 Tracer Dye Injector
 J41447	J 41447 R-134A Tracer Dye 24-1/4 Ounce per bottle

Graphics	Tool Number/ Description
 J6742-03	J 6742-03 Microthermometer
 J34614	J 34614 Shaft Seal Protector
 J39893	J 39893 Pressure Test Adapter
 J42136	J 42136 A/C System Lip Seal Disassembly Tool

Graphics	Tool Number/ Description
 <p>J36411</p>	J 36411 Valve Core Disassembly/Installation Tool
 <p>J5403</p>	J 5403 Spring Callipers
 <p>J6083</p>	J 6083 Spring Callipers
 <p>J8092</p>	J 8092 Infiltrator Handle

Graphics	Tool Number/ Description
 <p>J9553-01</p>	J 9553-01 O-ring Seal Remover
 <p>J33011</p>	J 33011 O-ring Seal Installer

2

Steering System

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Blank

2.1 Power Steering System

2.1.1 Specifications

2.1.1.1 Tightening Torque of Fasteners

Applications	Specifications
Assembling nut of power steering gear	20-26N•m
Clamp nut for steering knuckle tie rod and steering rack	63-77N•m
Clamp nut for the end of steering knuckle tie rod and steering knuckle	40-48N•m
Holddown bolt of power steering pump	22-28N•m
Binding bolt for the bracket of liquid reserve tank and the car body	7-8N•m
Binding bolt for clamping collar and the bracket of liquid reserve tank	2-3N•m

2.1.1.2 Tightening Torque of Connectors

Applications	Specifications
Connector between oil suction hose of power steering system and power steering pump	2-3N•m
Connector between oil suction hose of power steering system and liquid reserve tank of power steering system	2-3N•m
Connector between high-pressure hose of power steering system and power steering pump	20-35N•m
Connector between high-pressure hose of power steering system and oil inlet hard tube of power steering gear	20-35N•m
Connector between oil inlet hard tube of power steering gear and power steering gear itself	20-35N•m
Connector between oil outlet hard tube of power steering gear and power steering gear itself	20-35N•m
Connector between oil outlet hard tube of power steering gear and oil return hose of power steering system	2-3N•m
Connector between oil return hose of power steering system and liquid reserve tank of power steering system	2-3N•m

2.1.1.3 General Specifications

Applications	Specifications
Decompression pressure of steering pump	5.51-6.28megapascal

2.1.1.4 Specifications of Steering Liquid, Lubricant and Locking Agent

Specifications	Applications	GM part number
DEXRON III 油液	Steering liquid (1 litre)	12378494(4L) 12378495(4L)
Silicon grease (1 ounce)	Slip joints and plastic seal rings of all temperature (100 gram)	12345579
Locking glue	Screwed joints (10 ml.)	90542117

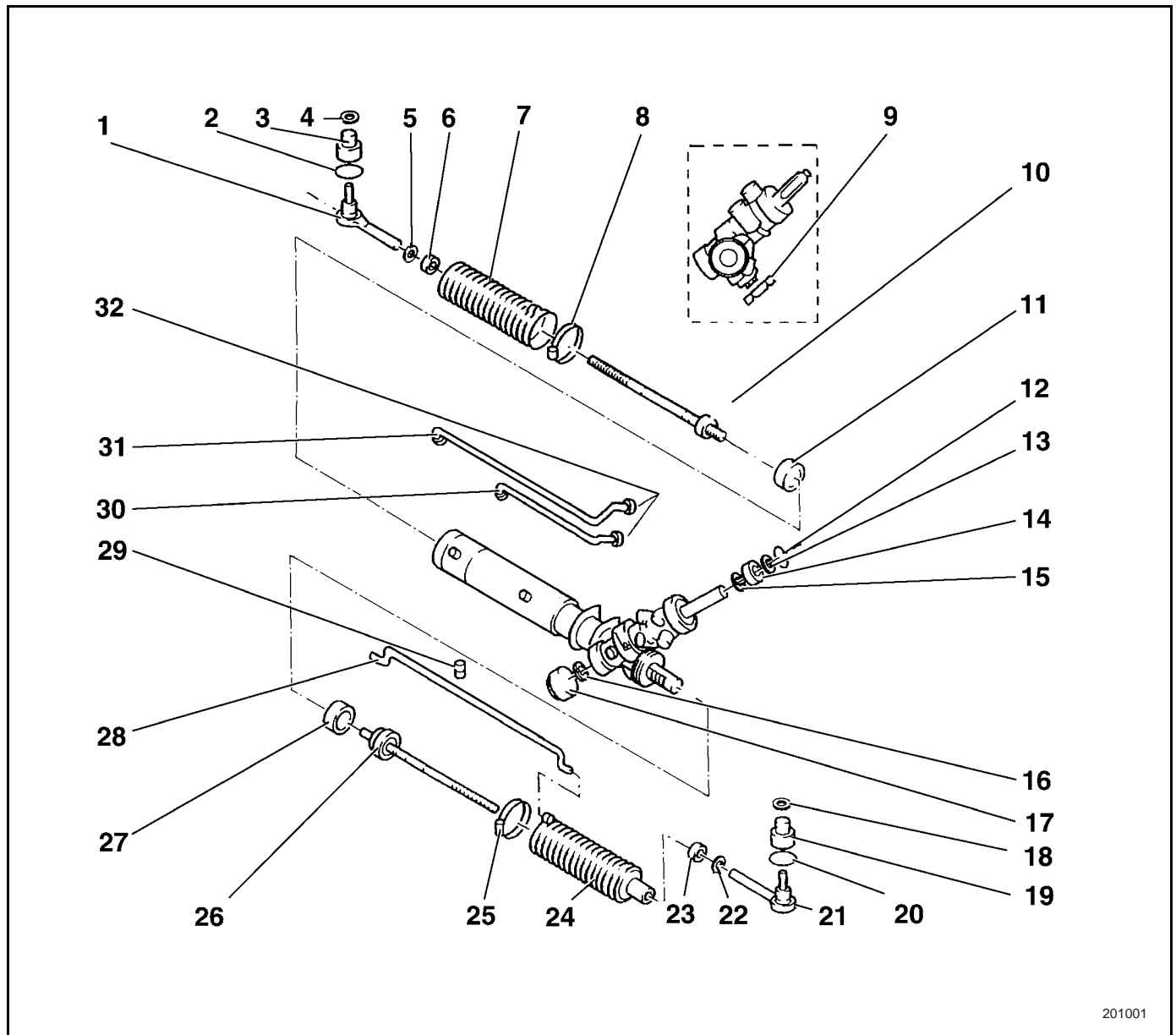
2.1.1.5 Specifications of Hydraulic Steering Unit

Applications		Specifications
Manufacturer: Delphi Brazil Com.		
Overall gear ratio		15.7:1
Part number of steering liquid		12378494, 12378495 (DEXRON III)
Volume of steering liquid		1 litre
Pressure of steering liquid	– When steering wheel turned to limiting position	5510-6280 kilopascal
	– At test point of central position	200-500 kilopascal

2.1.2 Identification of Appearance

2.1.2.1 Power Steering Gear - Exploded View

Output at the End - Pinion and Rack



201001

Legend

- | | |
|--|---|
| (1) Joint assembly of steering knuckle tie rod | (8) Clamping collar for corrugated cover of steering gear case |
| (2) Mounting ring | (9) Locknut |
| (3) Dust cap | (10) Assembly of steering knuckle tie rod with inner buttonhead |
| (4) Locknut | (11) Stopper |
| (5) Jam nut | (12) Check ring |
| (6) Clamping collar for corrugated cover of steering knuckle tie rod | (13) Gasket |
| (7) Corrugated cover | (14) Seal ring |

- | | |
|---|---|
| (15) Bearing | (24) Corrugated cover |
| (16) Nut | (25) Clamping collar for corrugated cover of steering gear case |
| (17) Shroud | (26) Assembly of steering knuckle tie rod with inner buttonhead |
| (18) Locknut | (27) Stopper |
| (19) Dust cap | (28) Breather pipe |
| (20) Check ring | (29) Fuel pipe clamp |
| (21) End of steering knuckle tie rod | (30) Hydraulic piping |
| (22) Jam nut | (31) Hydraulic piping |
| (23) Clamping collar for corrugated cover of steering knuckle tie rod | (32) Thrust seal ring |
-

2.1.3 Diagnostic message and procedure

2.1.3.1 Testing of power steering system

Road test should be conducted before diagnosis.
During diagnosis the following systems should be paid attention to:

- Suspension system;
- Tyres and wheels;
- Tyres should be inspected for improper pressure and uneven wearing.
- The joint between steering column and steering gear should be inspected for looseness or wear;
- The following components should be inspected for looseness or damages:
 - Front suspension;
 - Rear suspension;
 - Steering gear;
 - Steering knuckle tie rod.
- Tyres should be inspected for the following conditions:
 - Out of roundness of tyres;
 - Imbalance of tyres;
 - Blending of tyres;
- Looseness or noisiness of wheel bearing;
- Inspect power steering system for any leakage;
- Inspect the liquid level of power steering system.

2.1.3.2 Hissing Sound in Steering System

Steps	Measures	Numerical values	Yes	No
Definition: Significant hissing sound can be heard during operation of engine and rotation of steering wheel.				
1	Compare the noise level with that of another car in normal operation. Is the hissing sound abnormally loud?	—	To step 2	The system is OK
2	Inspect the liquid level of power steering system. Is the liquid level of power steering system too low?	—	To step 3	To step 4
3	Add steering liquid to the power steering system. See Filling and Discharge of Hydraulic System. Is the customer still complaining?	—	To step 1	The system is OK
4	Is the hissing sound coming from the interior of the car?	—	To step 5	To step 7
5	The hissing sound is probably entering the passenger cabin via an opening in the frontside of the panel. Inspect the steering column and the boot of front enclosure. Are the steering column and the boot of front enclosure damaged or improperly installed?	—	To step 6	To step 7
6	Repair or replace the seal of the steering column. Is the customer still complaining?	—	To step 1	The system is OK
7	Make sure the hoses and hard tubes of the power steering system are properly arranged (not touching the frontside of the panel). If necessary, repair or replace any hose and hard tube. Is the customer still complaining?	—	To step 8	The system is OK
8	Determine the source of the noise with a stethoscope. Inspect the power steering pump and the power steering gear. If necessary, repair or replace any component. Is the customer still complaining?	—	To step 1	The system is OK

2.1.3.2 Clattering Noise in Steering System

Status	Measures
Pipelines of power steering system are worn.	Make sure pipelines in power steering system are properly arranged. See Replacement of Hydraulic Pipeline.
The steering gear is loose.	Tighten the nut of steering gear to the required torque. See Tightening Torque of Fasteners.
One end or both ends of the steering knuckle tie rod are loose.	If necessary, repair or replace any end of the steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod.
Steering universal joint assembly is loose.	If necessary, repair or replace the steering universal joint assembly. See Replacement of Power Steering Gear and Replacement of Steering Column Assembly.

2.1.3.4 Diagnosis of Steering Gear

Hissing noise

- Under normal conditions, some noises might be heard when steering in place.
- Inspect hydraulic system for any leakage.
- Inspect power steering system for any air.

When rapidly turning the steering wheel, a larger force will be needed for an instant.

- Inspect internal pressure for any leakage.
- Inspect steering pump for any under pressure.
- Inspect liquid level to make sure it is not too low.

2.1.3.5 Leakage in Power Steering Gear and Power Steering Pump

The following signs indicate possible leakage of power steering system.

- Visible oily liquid appears on steering gear or steering pump.
- Rumbling noise can be heard when parking the car or when the engine is cool.
- Power steering is lost when parking.
- Heavy steering.

Inspection Procedures

The following steps need to be completed when inspecting power steering system for any external leakage.

1. Dry any suspicious region.
2. Inspect liquid reserve tank of power steering system for any excess of steering liquid.
3. Inspect power steering system for any of the following conditions:
 - Aeration of power steering liquid.
 - Overflow

4. Inspect the following components:
 - Hose connection
 - O-ring

5. Determine the exact leaking position. Positions with dripping oily liquid are not always leaking positions of the system. Use the following method to determine any position of penetrating leakage:
 - 5.1 Turn off the engine.
 - 5.2 Dry the whole power steering system.
 - 5.3 Inspect the liquid level of steering liquid reserve tank. If necessary, add steering liquid.
 - 5.4 Start the engine.

Note: The steering wheel should not be turned to and hold at the extreme position for a long time. The power steering pump will be damaged in this way.

- 5.5 Ask your assistant to turn the steering wheel left and right to the limiting position for several times.
- 5.6 Operate according to Diagnosis Procedures for Power Steering Gear, and determine the exact position of leakage and fix it.
6. If necessary, the repair work should be conducted according to the following procedures.
 - 6.1 Clean the position of leakage before disassembly.
 - 6.2 Replace the leaking seal.
 - 6.3 Inspect the sealing surface for any damage.
 - 6.4 Tighten the bolt to the required torque. See Tightening Torque of Fasteners.

- 6.5 Add steering liquid to the power steering system. See Filling and Deflation of Hydraulic System.
- 6.6 Deflation of power steering system. See Filling and Deflation of Hydraulic System.

Diagnosis Procedures of Power Steering Gear

1. Inspect the connection of power steering system for any leakage around it. See Steering Gear, Seal - Power Steering.
2. If leakage is found between any of the following components, replace the steering gear.
 - Torque arm
 - Input shaft
 See Replacement of Power Steering Gear.
3. If leakage is found on any side of the driver and it is irrelevant to the direction of steering, replace power steering gear. See Replacement of Power Steering Gear.
4. If leakage is found at the end of the housing and oil injection is found when steering wheel is turned left to the extreme position, replace the

power steering gear. See Replacement of Power Steering Gear.

Recommendation about the Replacement of Sealing Members.

Lip seals are used to seal drive shaft. Lip seals need special treatment. Seals of this type are used on the following components:

- Steering gear
- Drive shaft of the steering pump

If leakage is found on any of the above components, complete the following steps:

1. Inspect sealing surface.
2. Clean sealing surface thoroughly.
3. Replace lip seals.

If severe pitting is found on a drive shaft, replace it.

If slight corrosion is found on the contact zone of a lip seal, use crocus cloth to clean the surface of the drive shaft.

If leakage is still found after the drive shaft has been cleaned with crocus cloth, replace the drive shaft.

2.1.3.6 Over Rebound of Steering Wheel or over Looseness of Steering Column

Problems	Measures
There is air in power steering system	<ol style="list-style-type: none"> 1. Inspect power steering system for any leakage. See Leakage in Power Steering Gear and Power Steering Pump 2. Deflation of power steering system. See Filling/Deflation of Hydraulic System.
Loose joint between steering column and steering gear	<ol style="list-style-type: none"> 1. Loose joint between steering column and steering gear See Replacement of Steering Column. 2. If necessary, replace the steering universal joint assembly between steering column and steering gear. See Replacement of Steering Column.
Loose bracket of steering gear	<ol style="list-style-type: none"> 1. Inspect the bracket of steering gear. See Replacement of Power Steering Gear. 2. Tighten holddown bolts of power steering gear to the required torque. See Tightening Torque of Fasteners.
Loose end of steering knuckle tie rod	<ol style="list-style-type: none"> 1. Inspect the end of steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod. 2. Replace the end of steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod.
Worn wheel bearing	<ol style="list-style-type: none"> 1. Replace wheel bearings. See Replacement of Bearing of Front Drive Shaft in Front Suspension. 2. Replace wheel hubs. See Replacement of Bearing of Front Drive Shaft in Front Suspension.

2.1.3.7 It Is More and More Difficult to Turn the Steering Wheel

Problems	Measures
Severe internal leakage	See Leakage in Power Steering Gear and Power Steering Pump
The valve spool of power steering gear is binding/damaged	Replace the steering gear with a new one. See Replacement of Power Steering Gear.
The liquid level of power steering liquid is too low.	Add power steering liquid into the power steering liquid reserve tank. See Filling/Deflation of Hydraulic System.

2.1.3.8 Difficult Homing of Steering Wheel

Problems	Measures
Binding globe joint	<ol style="list-style-type: none"> 1. Inspect the globe joint. See Replacement of Lower Globe Joint in Front Suspension. 2. If necessary, replace the globe joint. See Replacement of Lower Globe Joint in Front Suspension.
Improper front wheel alignment	<ol style="list-style-type: none"> 1. Inspect front wheel alignment. See Wheel Alignment. 2. If necessary, align the front wheel. See Wheel Alignment.
Binding steering gear valve	Replace steering gear. See Replacement of Power Steering Gear.
Loose steering gear	Tighten the holddown bolt of steering gear to the required torque. See Replacement of Power Steering Gear.
The torque of pinch bolt of the steering universal joint assembly is too great.	Tighten the pinch bolt of steering universal joint assembly to the required torque. See Replacement of Steering Column Assembly.
Binding steering column	<ol style="list-style-type: none"> 1. Inspect the alignment of steering column. 2. If necessary, adjust the alignment of steering column. See Replacement of Steering Column Assembly. 3. Inspect the bracket of steering column. 4. If necessary, repair the bracket of steering column. See Replacement of Steering Column Assembly. 5. Inspect the bearing of steering column. 6. If necessary, replace the steering column bearing. See Replacement of Ball Bearing at the Upper End of Steering Shaft.
Improper tyre pressure	Charge the tyre to the required air pressure. See specifications in Tyre and Wheel.

2.1.3.9 Fluctation/Runout of Steering Wheel in the Course of Steering

Problems	Measures
The liquid level of power steering liquid is too low.	If necessary, add power steering liquid. See Filling/Deflation of Hydraulic System.
Binding steering gear valve	<ol style="list-style-type: none"> 1. Flush power Steering System. See Flushing Power Steering System. 2. Add power steering liquid into the power steering system. See Filling/Deflation of Hydraulic System. 3. Deflate power steering system. See Filling/Deflation of Hydraulic System. 4. If the symptom

2.1.3.10 Rebound of Steering Wheel

Problems	Measures
There is air in power steering system	<ol style="list-style-type: none"> 1. Inspect power steering system for any leakage. See Leakage in Power Steering Gear and Power Steering Pump 2. Deflate power steering system. See Filling/Deflation of Hydraulic System.
Loose joint between steering column and steering gear	<ol style="list-style-type: none"> 1. Inspect the steering universal joint assembly between steering column and steering gear. See Replacement of Power Steering Gear. 2. If necessary, replace the steering universal joint assembly between steering column and steering gear. See Replacement of Power Steering Gear.
Loose bracket of steering gear	<ol style="list-style-type: none"> 1. Inspect the bracket of steering gear. See Replacement of Power Steering Gear. 2. Tighten holdown bolts of power steering gear to the required torque. See Tightening Torque of Fasteners.
Loose end of steering knuckle tie rod	<ol style="list-style-type: none"> 1. Inspect the end of steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod. 2. Replace the end of steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod.
Worn wheel bearing	<ol style="list-style-type: none"> 1. Replace wheel bearings. See Replacement of Bearing of Front Drive Shaft in Front Suspension. 2. Replace wheel hubs. See Replacement of Wheel Hub in Front Suspension.

2.1.3.11 Difficult Steering in Both Directions

Problems	Measures
Severe internal leakage	See Leakage in Power Steering Gear and Power Steering Pump
The valve spool of steering gear is binding/damaged	See Replacement of Power Steering Gear.
The liquid level of power steering liquid is too low.	Add power steering liquid into the power steering system. See Filling/Deflation of Hydraulic System.

2.1.3.12 Clearance between Steering Equipment Is Too Large

Problems	Measures
Loose/worn steering universal joint assembly between steering column and steering gear	<ol style="list-style-type: none"> 1. Inspect the steering universal joint assembly between steering column and steering gear for improper torque. See Replacement of Power Steering Gear. 2. If necessary, replace the steering universal joint assembly between steering column and steering gear. See Replacement of Power Steering Gear.
Loose steering gear	Tighten holddown bolts of power steering gear to the required torque. See Replacement of Power Steering Gear.
Loose steering knuckle tie rod	<ol style="list-style-type: none"> 1. Inspect steering knuckle tie rod. See Replacement of Steering Knuckle Tie Rod. 2. If necessary, replace steering knuckle tie rod. See Replacement of Steering Knuckle Tie Rod.
Worn wheel bearing	Replace the hub and bearing assembly. See Replacement of Bearing of Front Drive Shaft in Front Suspension.

2.1.3.13 Staggering or Instability of Steering Gear

Problems	Measures
Improper front wheel alignment	<ol style="list-style-type: none"> 1. Inspect front wheel alignment. 2. If necessary, align the front wheel. See Wheel Alignment.
Improper rear wheel alignment	See Rear Suspension.
Broken/loose spring	<ol style="list-style-type: none"> 1. Inspect broken/loose spring. See Replacement of Shock Strut, Shock Strut Components and/or Spring in Front Suspension. 2. Repair the broken/loose spring. See Replacement of Shock Strut, Shock Strut Components and/or Spring in Front Suspension.
Loose stabilizer bar	Inspect the following components: <ul style="list-style-type: none"> • Holddown bolts • Tighten holddown bolts to the required torque. See Replacement of Stabilizer Bar in Front Suspension.
Worn shock strut	<ol style="list-style-type: none"> 1. Inspect shock strut for any sign of wearing. See Replacement of Shock Strut Assembly in Front Suspension. 2. If necessary, replace shock strut. See Replacement of Shock Strut Assembly in Front Suspension.
Uneven wearing/improper alignment of tyres	<ol style="list-style-type: none"> 1. If necessary, repair tyres. See Diagnosis of Tyres - Irregular or Early Wearing. 2. If necessary, replace any tyre. See Replacement of Tyres in Tyres and wheels. 3. Inspect alignment. See Wheel Alignment. 4. If necessary, adjust the alignment. See Wheel Alignment.

2.1.3.14 Wandering When the Brake Is Applied

Problems	Measures
Uneven/improper caster	See Wheel Alignment.
Loose control arm	<ol style="list-style-type: none"> 1. Inspect control arm. See Replacement of Control Arm in Front Suspension. 2. Replace any component and/or tighten fasteners to the required torque. See Replacement of Control Arm in Front Suspension.
Warped brake disc	If necessary, replace the brake disc. See Replacement of Brake Disc.

2.1.3.14 Wandering When the Brake Is Applied (Cont' d)

Broken/loose spring	<ol style="list-style-type: none"> 1. Inspect the spring. See Replacement of Shock Strut, Shock Strut Components and/or Spring in Front Suspension. 2. If necessary, repair the spring. See Replacement of Shock Strut, Shock Strut Components and/or Spring in Front Suspension.
Worn wheel bearing	<ol style="list-style-type: none"> 1. Replace wheel bearings. See Replacement of Bearing of Front Drive Shaft in Front Suspension. 2. Replace wheel hubs. See Replacement of Wheel Hub in Front Suspension.
Leaking brake tongs of wheels	<ol style="list-style-type: none"> 1. Inspect brake tongs of wheels. See Replacement of Brake Tongs. 2. If necessary, repair the brake tongs of any wheel. See Replacement of Brake Tongs.

2.1.3.15 Blistering, Emulsifying or Low Level of Power Steering Liquid

Problems	Measures
There is air in power steering liquid.	<ol style="list-style-type: none"> 1. Inspect power steering system for any leakage. See Leakage in Power Steering Gear and Power Steering Pump 2. Deflate power steering system. See Filling/discharge of Hydraulic System.
The following conditions exist in power steering liquid: <ol style="list-style-type: none"> 1. Steering liquid is blistering. 2. Liquid level is normal. 	<ol style="list-style-type: none"> 1. Dismount power steering pump. See Replacement of power steering pump. 2. Inspect the soft plug for any crack. 3. Inspect the housing for any crack. 4. If necessary, replace the steering pump. See Replacement of Power Steering Pump.
There is internal leakage in the steering pump.	Inspect power steering pump for any leakage. See Leakage in Power Steering Gear and Power Steering Pump.

2.1.3.16 Clattering or Knocking Sounds in Steering Pump

Problems	Measures
High-pressure hoses of power steering gear are worn.	Inspect high-pressure hoses of power steering system to make sure they are in accordance with the following conditions. <ul style="list-style-type: none"> • Proper installation. See Replacement of Hydraulic Pipelines. • Proper clearance. See Replacement of Hydraulic Pipelines.
Loose steering gear	Inspect power steering gear for any improper installation. See Replacement of Power Steering Gear. Tighten mounting nuts of power steering gear to the required torque. See Tightening Torque of Fasteners.
Loose end of steering knuckle tie rod	Inspect the end of steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod. Replace the end of steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod.
The steering universal joint is loose.	<ol style="list-style-type: none"> 1. Inspect the steering universal joint. See Replacement of Steering Column Assembly. 2. If necessary, replace the steering universal joint. See Replacement of Steering Column Assembly.

2.1.3.17 Swish Sound in Steering Pump

Problems	Measures
The control valve is damaged.	Replace the steering pump. See Replacement of Power Steering Pump.

2.1.3.18 Whining Sound in Steering Pump

Problems	Measures
The liquid level of power steering liquid is too low.	<ol style="list-style-type: none"> 1. Inspect the liquid level of power steering system. See Filling/Discharge of Hydraulic System. 2. If necessary, add power steering liquid. See Filling/Discharge of Hydraulic System. 3. Inspect power steering system for any leakage. See Leakage in Power Steering Gear and Power Steering Pump.
The dogs and blades are scratched.	If necessary, replace the steering pump. See Replacement of Power Steering Pump.
The pump bushing is scratched.	If necessary, replace the steering pump. See Replacement of Power Steering Pump.

2.1.4 Repair Instructions

2.1.4.1 Inspection/Adjustment of Straight Ahead Position

Tools required

- KM-551-A Detector
- J-830901 puller

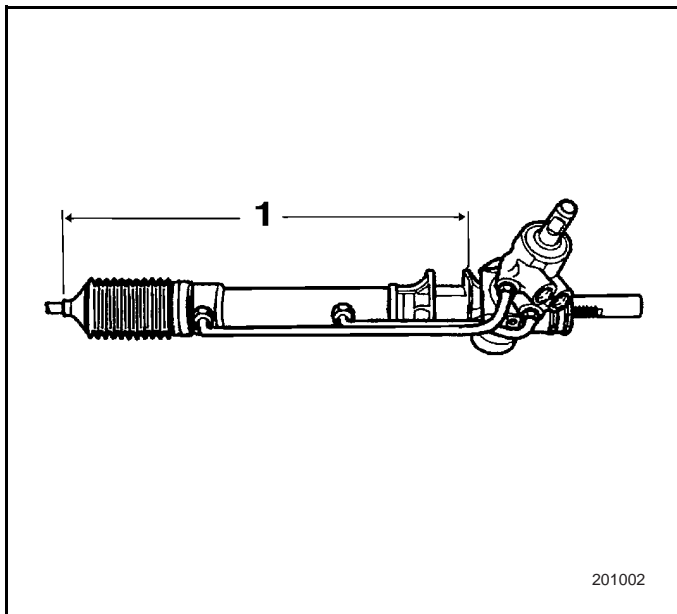
Note: After any operation (dismounting and installation or disassembly or assembly) on steering gear or steering column assembly, always inspect the straightahead position of steering gears.

Measurement

Please use special tool KM-551-A that is built for the measurement of clearance between steering knuckle tie rod and the left mounting shoulder of steering housing.

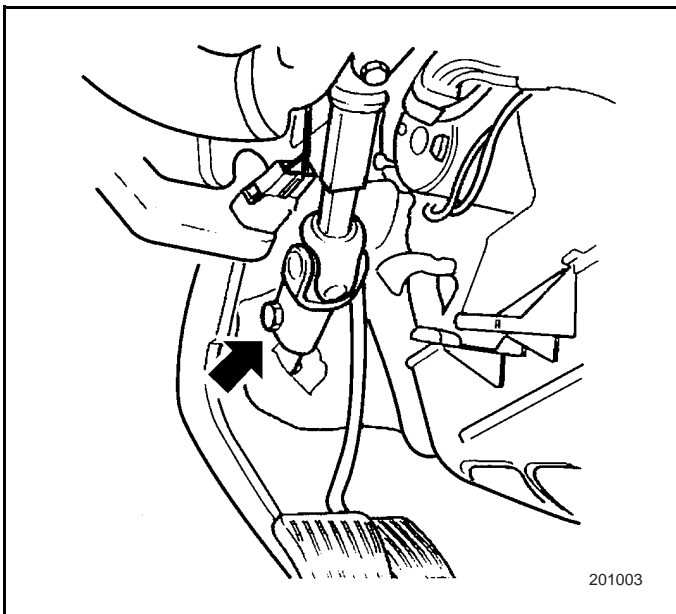
Straightahead position will be obtained through inspection of dimension "1" = $435 \pm 2\text{mm}$.

Note: When the steering wheel is at the straightahead position, the spoke of steering wheel should be level and the bolt of lower clamping flange should be flatly on top.



Adjustment

If there is a deviation of 10 from the center of steering wheel, use J-830901 to dismount the steering wheel from steering shaft, then with center alignment, insert it into the spline of steering shaft, see Replacement of Steering Wheel.



2.1.4.2 Filling/deflation of hydraulic system

Notice: Suitable steering liquid should be used when adding or completely replacing steering liquid. Using unsuitable steering liquid will damage flexible conduits and sealing members and cause leakage of steering liquid. See Specifications of Steering Liquids, Lubricants and Locking Agents for the specifications of Steering liquid.

Amount of steering liquid that should be added: 1 litre.

GM part numbers for steering liquid: 12378494(4L), 12378495(1L)

There is a power steering liquid level indicator mounted on the cover of steering liquid reserve tank. Marks on the power steering liquid level indicator are used to indicate the level of steering liquid.

Measurement

1. Firstly, with the engine unoperated, add steering liquid to the Max (1) position.
2. Start the engine and immediately add steering liquid to the lower mark of Min (2) .

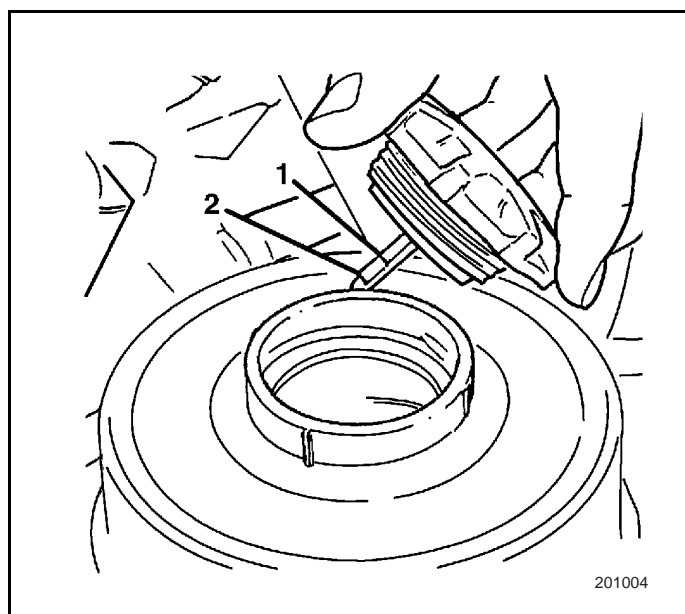
Note:

- The steering liquid pump should not be operated when there is no steering liquid. Turn the steering wheel left and right slowly to 45 degree for two or three times, then turn it to the limit position twice. Correct the level of steering liquid in reserve tank for two times.
- Turn of the engine and inspect liquid level.
- Steering liquid that has been discharged should not be reused.

When inspecting the level of steering liquid, the measuring scale on the cover of liquid reserve tank should be used. The cover of liquid reserve tank should be screwed down completely.

When working temperature is about 80 °C , steering liquid is at the maximum (1) position.

When the engine is cooled down to about 20 °C , steering liquid should be at minimum (2) position.



2.1.4.3 Discharge of Power Steering System

1. Raise the forepart of the vehicle above the ground. Ensure the front wheel can be turned freely. Disassemble oil return hose from power steering liquid reserve tank. Please refer to Replacement of Hydraulic Pipeline.
2. Place the oil return hose into a large container that can hold steering liquid being discharged.
3. Complete the following procedures:
 - 3.1 Start the engine.
 - 3.2 Let the engine run at idle speed.

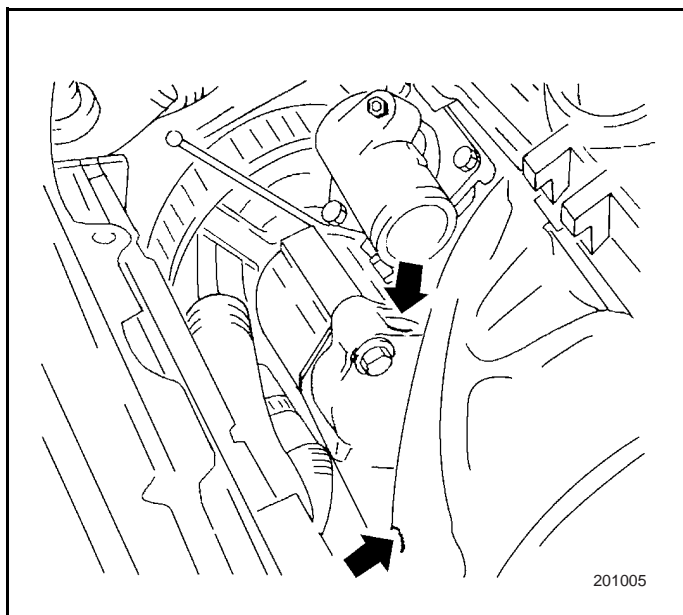
Notice: When flushing power steering system, the steering wheel should not be turned to and held at the limit position. Turning the steering wheel to the limit position and holding it there will bring the system under overpressure and overheat, and cause damage to power steering pump and/or steering gear.

4. Turn the steering wheel left and right to the limit position.
5. Ensure all of old steering liquid in the power steering system has been removed.
6. Turn ignition switch to the OFF position.
7. If power steering liquid has been polluted, flush the power steering system. See Flushing Power Steering System.
8. Reconnect oil return hose in power steering system. See Replacement of Hydraulic Pipeline.
9. Add power steering liquid into the power steering system. See Filling/Deflation of Hydraulic System.
10. Deflate power steering system. See Filling/Deflation of Hydraulic System.

2.1.4.4 Replacement of Power Steering Pump

Disassembly Procedures

1. Disassemble driving belt of accessories. See Replacement of Driving Belt of Accessories in Technical System of Engine.
2. Remove high-pressure hoses and intake lines from power steering pump. Let steering liquid flow out. Place a drip pan under it. Comply with safety regulations.
3. Remove power steering pump from the front engine support (as indicated by arrow in the diagram).



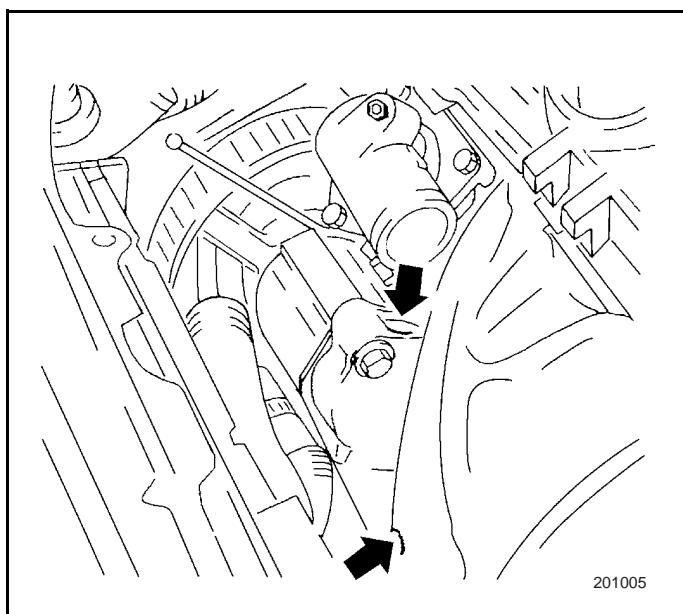
Installation Procedures

1. Place power steering pump onto the bracket.

Tightening

Tighten the power steering pump to 22-28N•m.

2. Install driving belt of accessories. See Replacement of Driving belt of Accessories in Technical System of Engine.
3. Reconnect high-pressure hoses and intake lines onto the power steering pump. See Replacement of Hydraulic Pipeline.

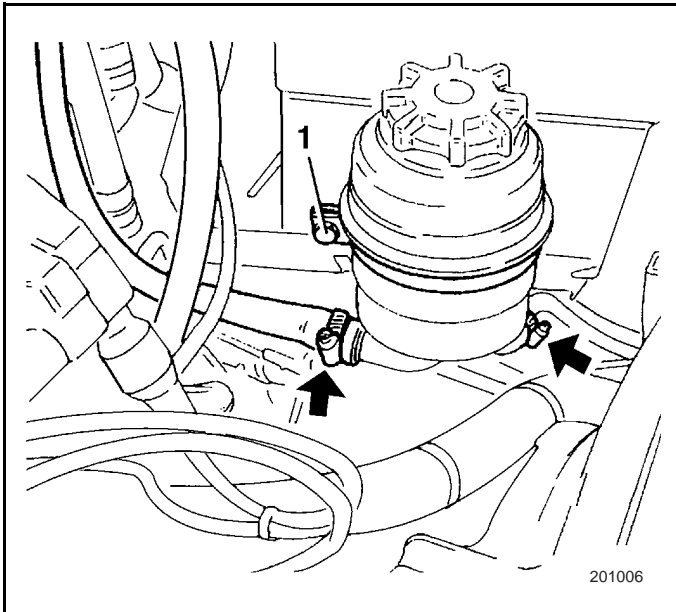


2.1.4.5 Replacement of Power Steering Liquid Reserve Tank

Disassembly Procedures

1. Loosen clamping bolt (1) on the bracket.
2. Loosen two hose couplers (as indicated by arrow in the diagram) and remove the hose.
3. Remove liquid reserve tank from the bracket.

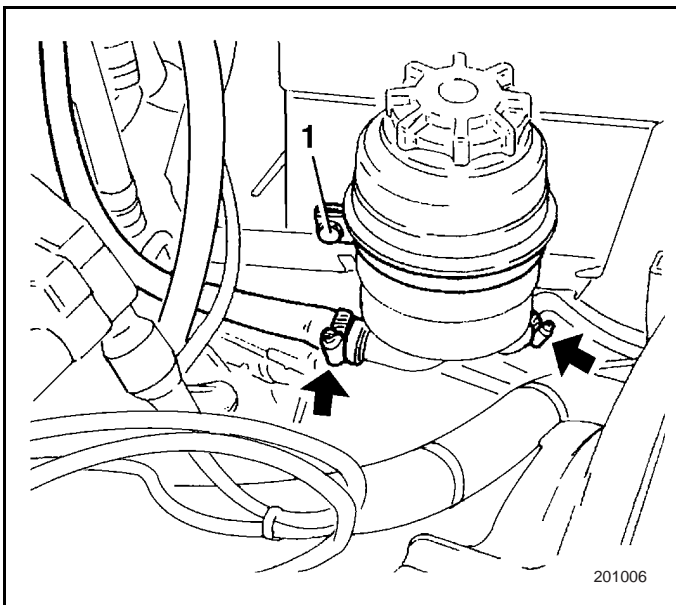
Note: Let residual steering liquid flow out. Place a drip pan under it. Comply with safety regulations.

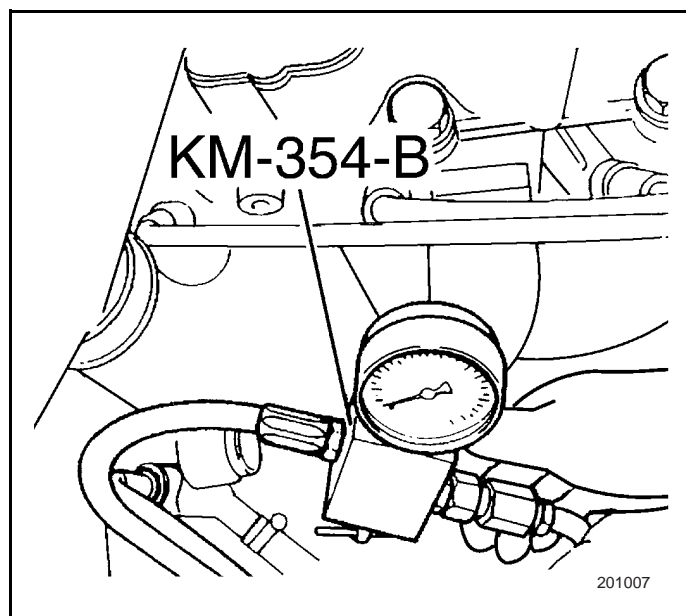


Installation Procedures

Tools required

- KM-354 Pressure Gage
1. Put liquid reserve tank into the bracket and tighten the clamping bolts. Connect two hoses and tighten the hose clamping collar.
 2. Fill/deflat hydraulic system. See Filling/Deflation of Hydraulic System.
 3. Inspect hydraulic system for any leakage.





Measurement

Pressure of Steering Liquid.

If power steering system breaks down, it will be impossible in most cases to determine immediately whether the hydraulic steering engine or the power steering pump should be inspected for any malfunctions. For this sake, connect pressure gage KM-354-B with the oil outlet and high pressure hose of the oil pump.

Note: Let steering liquid flow out. Place a drip pan under it. Comply with safety regulations.

Through liquid reserve tank, fill up power steering pump with dedicated steering liquid DEXRON III. Then run the engine at idle speed and fill it up immediately with dedicated steering liquid DEXRON III. Power steering pump should not be run without steering liquid.

2.1.4.6 Flushing Power Steering System

Notice: Suitable power steering liquid should be used when adding or completely replacing steering liquid. Using unsuitable steering liquid will damage flexible conduits and sealing members and cause leakage of steering liquid.

1. Raise and support the vehicle above the ground until front wheels can rotate freely.
2. Siphon power steering liquid from its reserve tank.
3. Remove oil return hose from power steering liquid reserve tank. See Replacement of Hydraulic Pipeline.
4. Insert the nose of oil return hose of power steering system into power steering liquid reserve tank.
5. Place the oil return hose of power steering system into a large container that can hold steering liquid being discharged.
6. Start the engine and run it at idle speed, at the same time ask an assistant to add power steering liquid into the reserve tank. See Filling/Deflation of Hydraulic System.
7. Turn the steering wheel left and right to the limit position.

Notice: When flushing power steering system, the steering wheel should not be turned to and held at the limit position. Turning the steering wheel to the limit position and holding it there will bring the system under overpressure and overheat, and cause damage to power steering pump and/or steering gear.

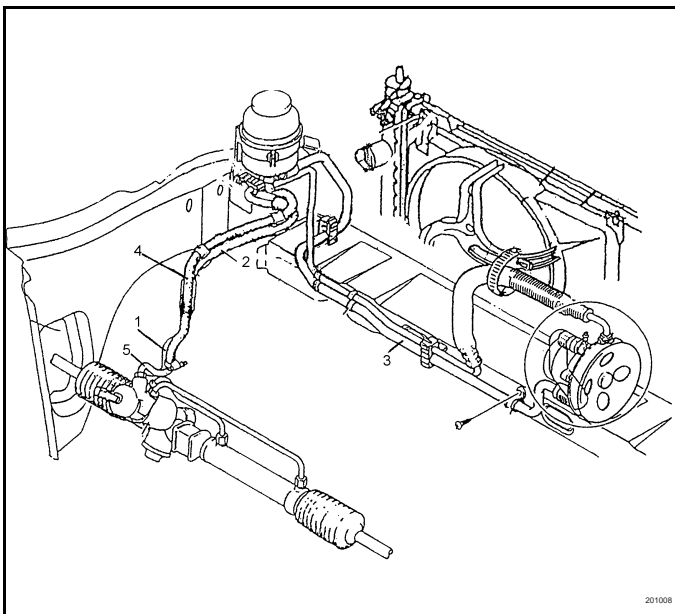
8. Continue to discharge all of the old steering liquid from the power steering system.

9. Use approximately 0.9 litre new power steering liquid to flush the power steering system.
10. Inspect power steering liquid that has been discharged until all of it has been removed.
11. Remove the choke plug on the power steering pump.

Important: Power steering liquid that has been discharged should not be reused.

12. Connect the oil return hose of power steering system with power steering liquid reserve tank. See Replacement of Hydraulic Pipeline.
13. Turn off the engine.
14. Add power steering liquid into the reserve tank. See Filling/Deflation of Hydraulic System.
15. Inspect power steering system for any leakage.
16. Deflate power steering system.

2.1.4.7 Replacement of Hydraulic Pipelines



1. Oil inlet hard tube
2. High-pressure hose
3. Oil suction hose
4. Oil return hose
5. Oilout hard tube

When removing hard tubes and hoses, steering liquid will flow out. A drip pan should be placed under it. Comply with safety regulations.

During installation, ensure there is no bending or torsion in the oil circuit, and avoid any contact with high-temperature or rotating parts. Regularly replace plastic buckles, gaskets, etc, of those hoses.

After installation, deflat and fill up hydraulic system. See Filling/Deflation of Hydraulic System.

When the engine is operating and executing steering, check for any leakage.

Replacement of Oil Inlet Hard Tube (1)

Disassembly Procedures

1. Remove brake booster and brake master cylinder. See Replacement of Brake Master Cylinder in Hydraulic Brake.
2. Loosen the special bolt of steering gear. Remove tube connector from high-pressure hose. Remove oil inlet hard tube from its fastener.

Installation Procedures

1. Press oil inlet hard tube onto its fastener. Tighten the union bolt of oil inlet hard tube.

Tightening

Tighten the union bolt to 20-35 N•m.

2. Insert the special nut into the steering gear, use the new O-ring and

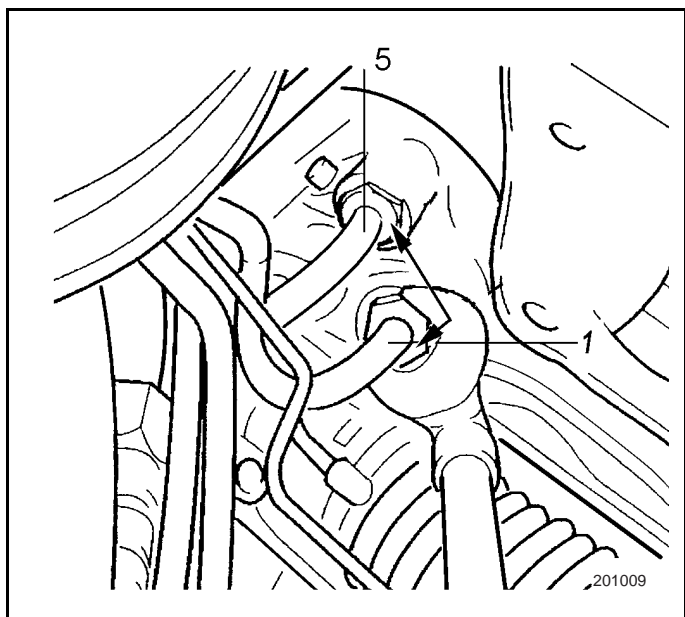
Tightening

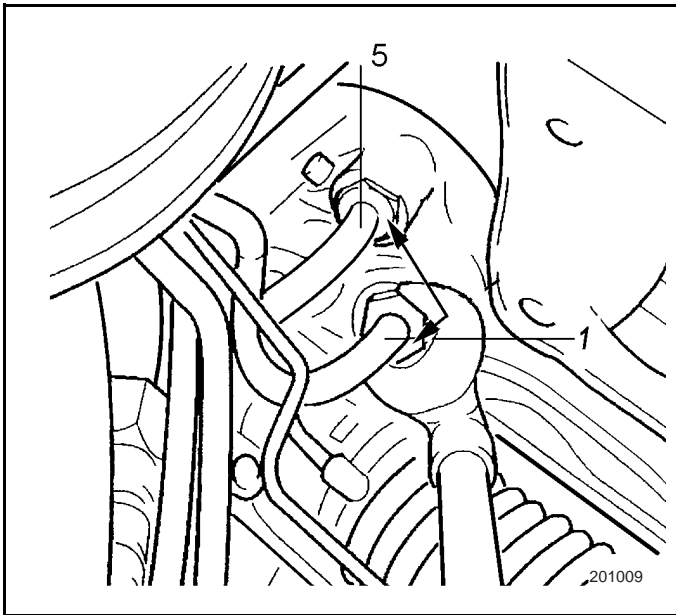
Tighten the nut to 20-35 N•m.

Replacement of High-pressure Hose (2)

Disassembly Procedures

1. Remove oil inlet hard tube and high-pressure hose union on the hydraulic pump. Remove high-pressure hose from its fastener.





Installation Procedures

1. Insert high-pressure hose into its fastener and tighten it. Screw on hydraulic pump and the union nut of oil inlet hard tube.

Tightening

Tighten the union nut between hydraulic lines, hydraulic pump and oil inlet hard tube to $N \cdot m$.

Replacement of Oil Suction Hose (3)

Disassembly Procedures

1. Loosen the hose clamping collars of power steering pump and power steering liquid reserve tank. Remove oil suction hose from its fastener.

Installation Procedures

1. Insert oil suction hose into the fastener, tighten the hose clamping collars between oil suction hose, power steering pump and steering liquid reserve tank.

Tightening

Tighten the bolt of clamping collar to $2-3N \cdot m$.

Replacement of Oil Return Hose (4)

Disassembly Procedures

1. Loosen the hose clamping collars of oilout hard tube and the power steering liquid reserve tank. Remove oil return hose from its fastener.

Installation Procedures

1. Insert oil return hose into the fastener, use hose clamping collar to connect oil return hose with oilout hard tube and power steering liquid reserve tank.

Replacement of Oilout Hard Tube (5)

Disassembly Procedures

1. Remove brake booster and brake master cylinder. See Replacement of Brake Master Cylinder in Hydraulic Brake.
2. Loose the special bolt of steering gear. Loosen the hose clamping collar connecting hoses and remove oilout hard tube.

Installation Procedures

1. Tighten the hose clamping collar of oil return hose and oilout hard tube.
2. Insert a special bolt between oilout hard tube and steering gear and tighten it.

Tightening

Tighten the bolt to 20-35N•m .

2.1.4.8 Inspection of Steering Liquid Pressure

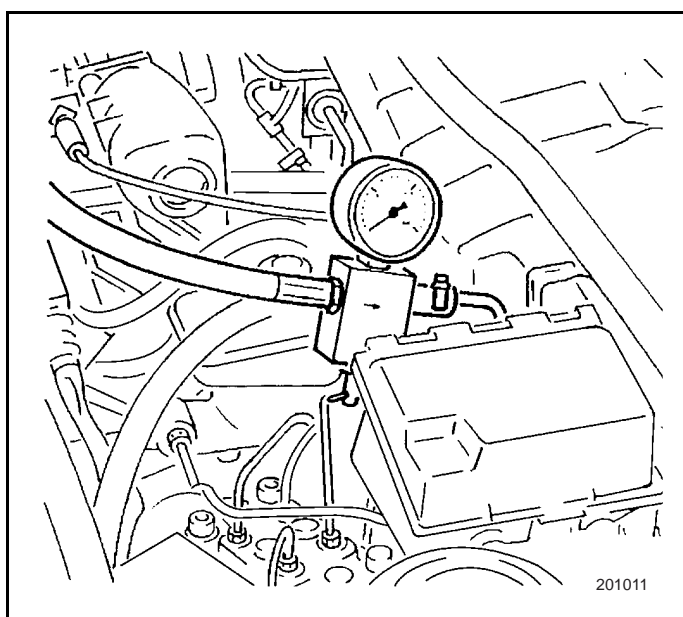
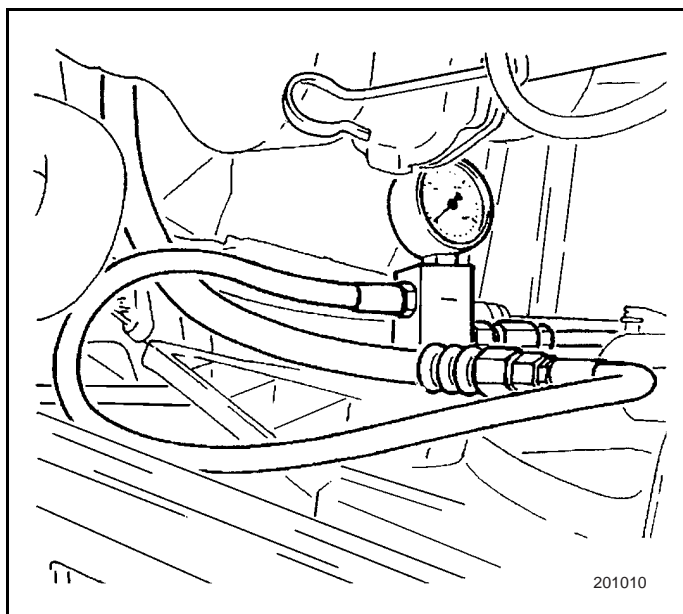
Tools required

- KM-354-B Pressure Gage

Note: If there is any leakage of steering liquid, fill up steering liquid before inspecting its pressure.

Measurement

1. Connect steering liquid pressure gage KM-354-B with high-pressure hose of steering liquid loop.



2. With steering wheel at central position, when stop valve is opened the pressure indicated on the pressure gage is only a few kpa.
3. When the steering wheel is turned to left and right, the pressure will increase and reach maximum value of 5.51-6.28 megapascal when the steering wheel is turned to the limit position. When the steering wheel is turned to the left or right limit position, the slight pressure difference between them is insignificant.

Note: After the steering wheel has been turned to a limit position, it should not be held at that position for more than 10 seconds.

4. Turn the steering wheel to the left or right limit position, turn on the stop valve, and read out the exact maximum pressure of 5.51-6.28 megapascal. Then let the steering wheel return the central position, turn off the stop valve, and

read out the maximum pressure of 5.51-6.28 megapascal.

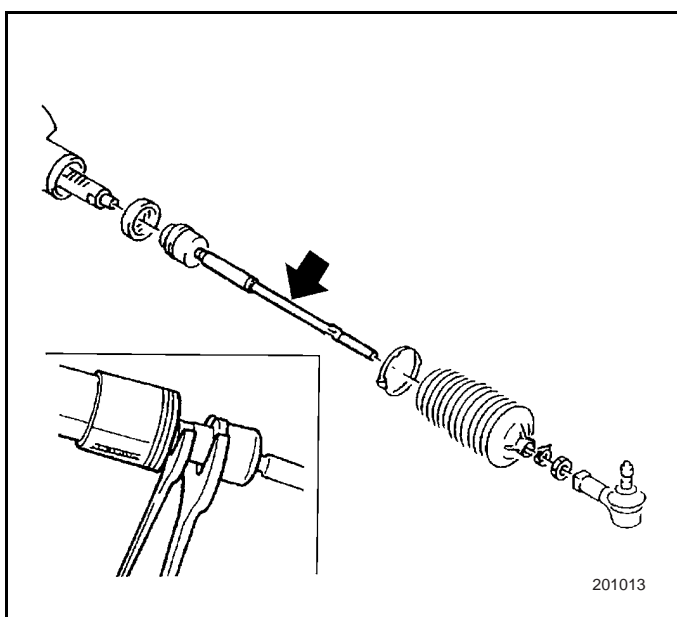
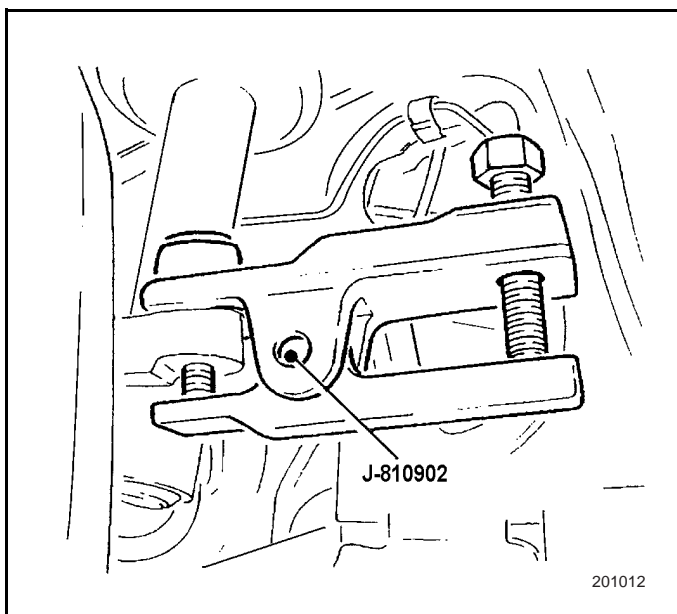
Note: When the stop valve is turned off, steering pump still runs at maximum pressure. When reading out a pressure from the pressure gage, the duration that the stop valve is turned off should not be too long (at most 10 seconds). Compare the two maximum pressure values.

2.1.4.9 Replacement of Steering Knuckle Tie Rod

Disassembly Procedures

Tools required

- J-810902 Removal fork
1. Remove the clamp nut at the end of the steering knuckle tie rod above steering knuckle.
 2. Use J-810902 to press out the end of steering knuckle tie rod.



3. Remove the two clamping collars from the corrugated cover.
4. Remove the assembly of steering knuckle tie rod with inner buttonhead from the steering rack (as indicated by arrow in the diagram).
5. Remove the end of steering knuckle tie rod from the steering knuckle tie rod, and take out the corrugated cover.

Installation Procedures

Tools required

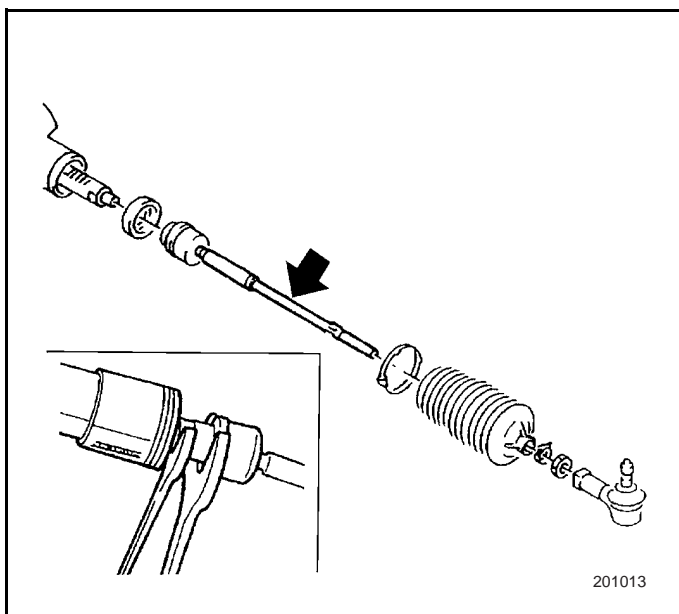
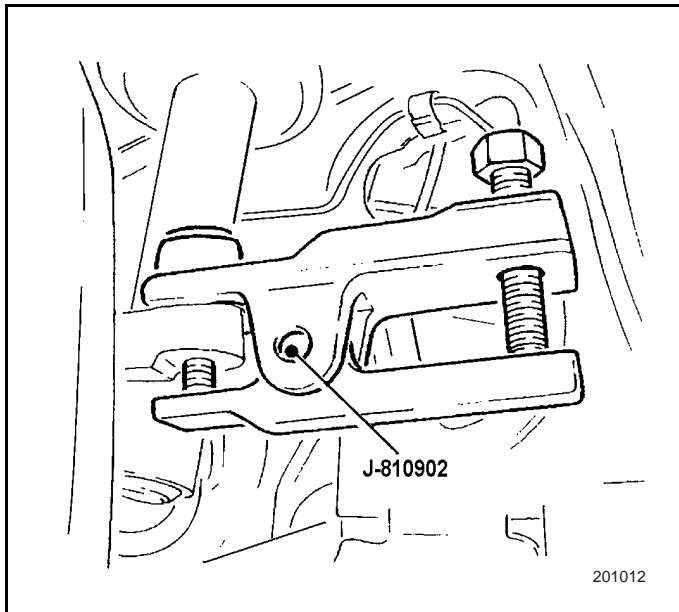
- S-9407235 Nipper

1. Tighten the bolt between the assembly of steering knuckle tie rod with inner buttonhead (as indicated by arrow in the diagram) and steering racks.

Tightening

Tighten the bolt to 70N•m .

2. Install corrugated cover, and use a new clamping collar and S-9407235 to tighten it on the steering gear and the steering knuckle tie rod.



3. Install the end of steering knuckle tie rod onto the steering knuckle.
4. Adjust the gather, See Wheel Alignment.

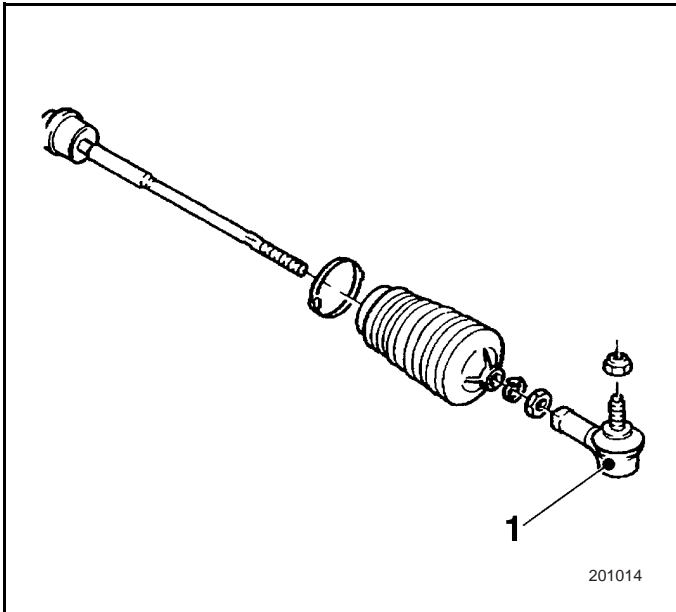
2.1.4.10 Replacement of Steering Knuckle Tie Rod

Disassembly Procedures

Tools required

- J-810902 Removal fork

1. Remove the clamp nut at the end of the steering knuckle tie rod (1) on the steering knuckle. Use J-810902 to press out the steering knuckle tie rod. Loosen the locknut, remove the end of steering knuckle tie rod. It is not necessary to remove the corrugated cover.



Installation Procedures

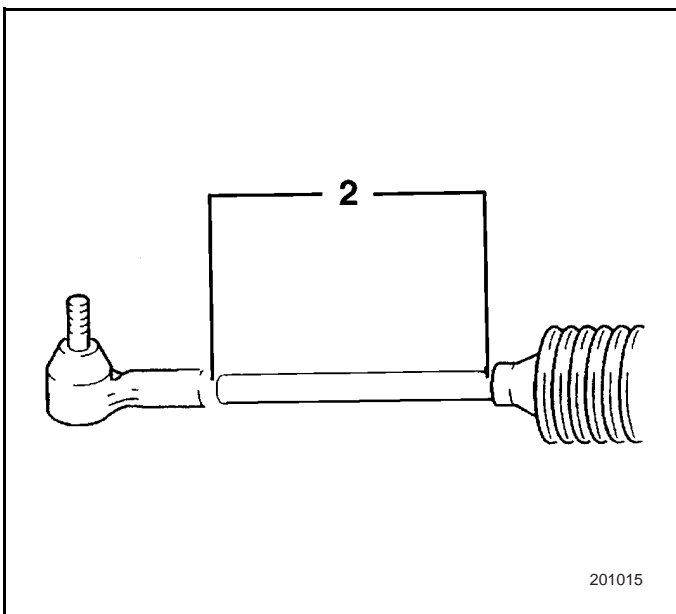
Pay attention to the length of insertion.

1. Install the end of steering knuckle tie rod onto the steering knuckle.

Tightening

Tighten the nut to 40-48N•m. Use new clamp nut.

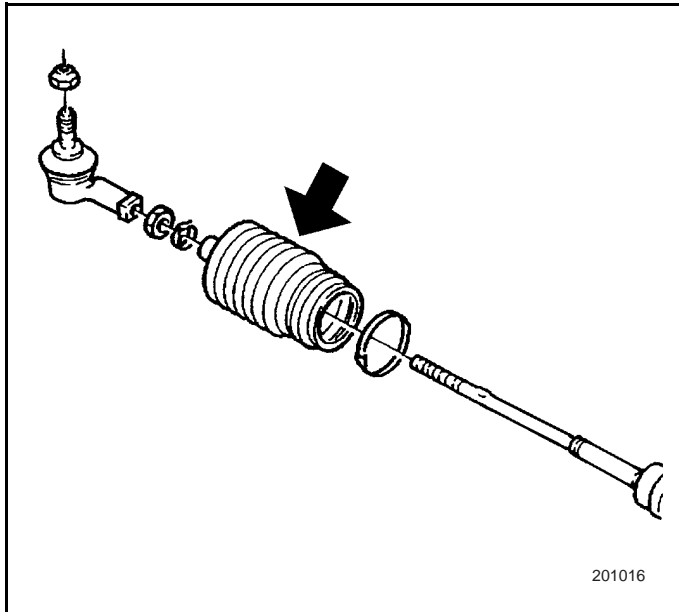
2. The visible length of steering knuckle tie rod $2=158_{-6}^{+6}$ mm.
3. Adjust the gather, See Gather in Wheel Alignment.



2.1.4.11 Replacement of Corrugated Cover of Steering Gear - on the Vehicle

Disassembly Procedures

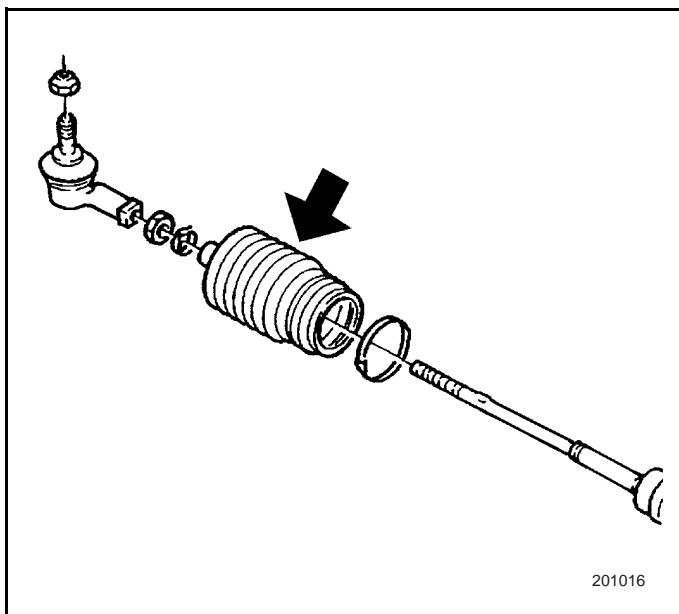
1. Remove the end of steering knuckle tie rod. See Replacement of the End of Steering Knuckle Tie Rod.
2. Loosen the clamping collar and remove the corrugated cover (as indicated by arrow in the diagram).



Installation Procedures

Tools required

- S-9407235 Nipper
1. Install corrugated cover, and use a new clamping collar and S-9407235 to tighten it on the steering gear and the steering knuckle tie rod.



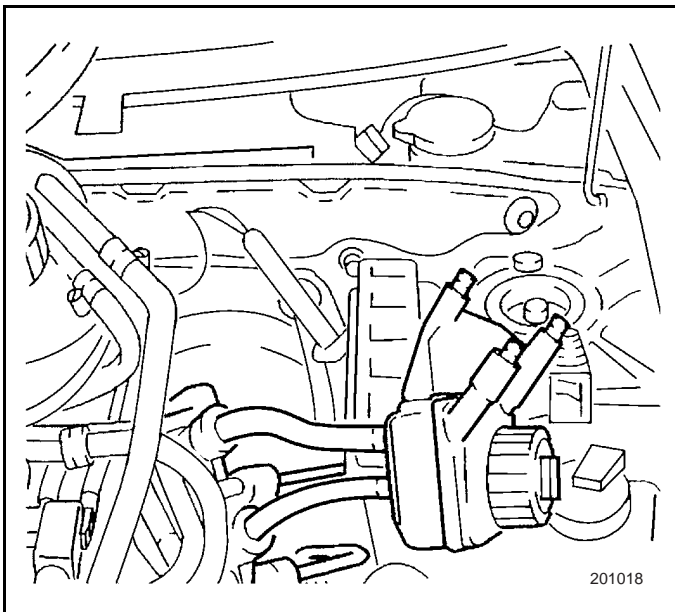
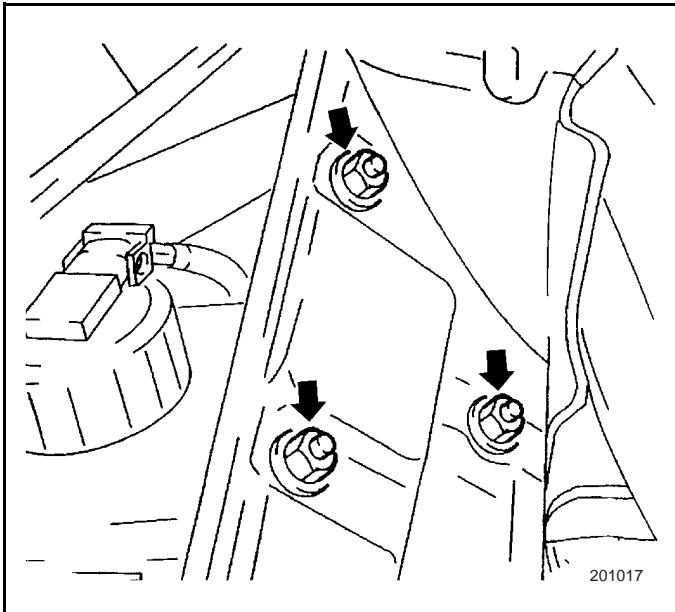
2.1.4.12 Replacement of Power Steering Gear

Disassembly Procedures

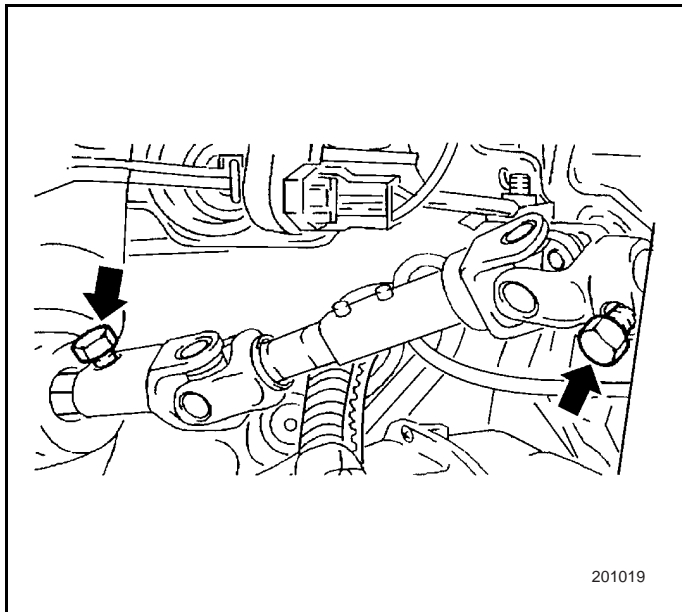
Tools required

- J-810902 Removal fork

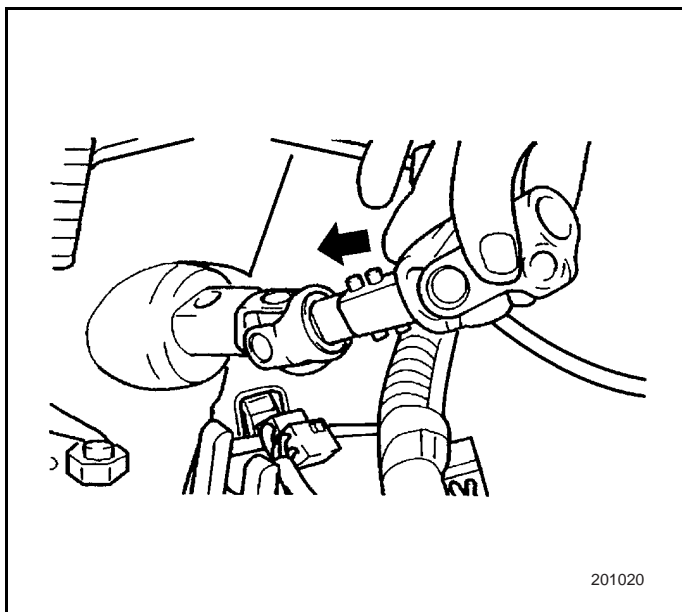
1. Release the air conditioner. See Recovery and Refilling of Refrigerant in Heating, Ventilation and Air Conditioning System.
2. Dismount refrigerant recovery tank and set it aside.
3. Remove the bolt of brake fluid compensation tank (as indicated by arrow in the diagram).



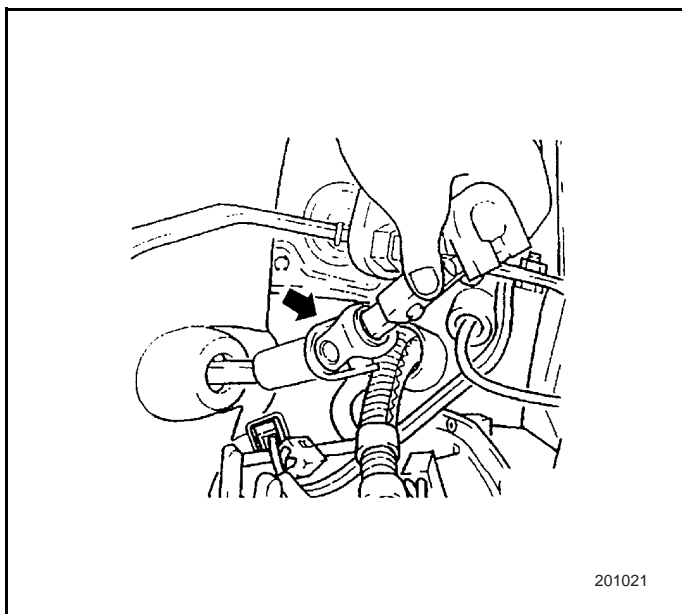
4. Remove brake master cylinder from brake booster and put it aside with brake fluid compensation tank.
5. Keep brake system turned off.
6. Remove vacuum hose from brake booster.



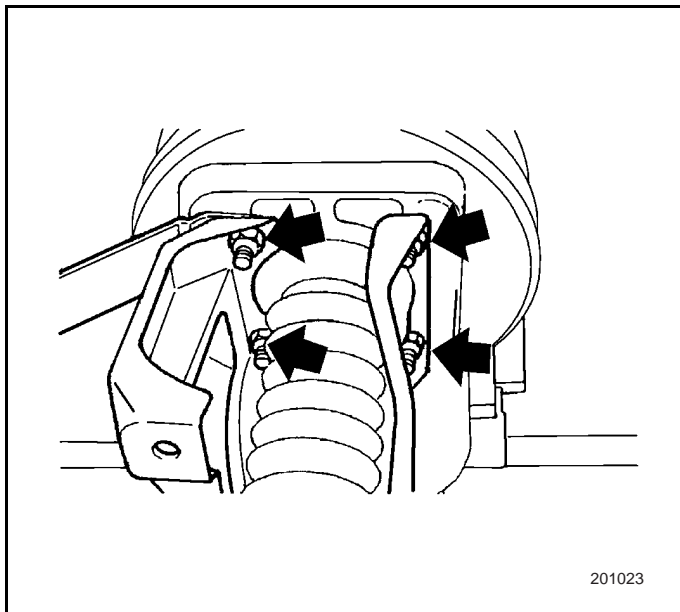
7. Loosen the two bolts on the lower steering knuckle (as indicated by arrow in the diagram).



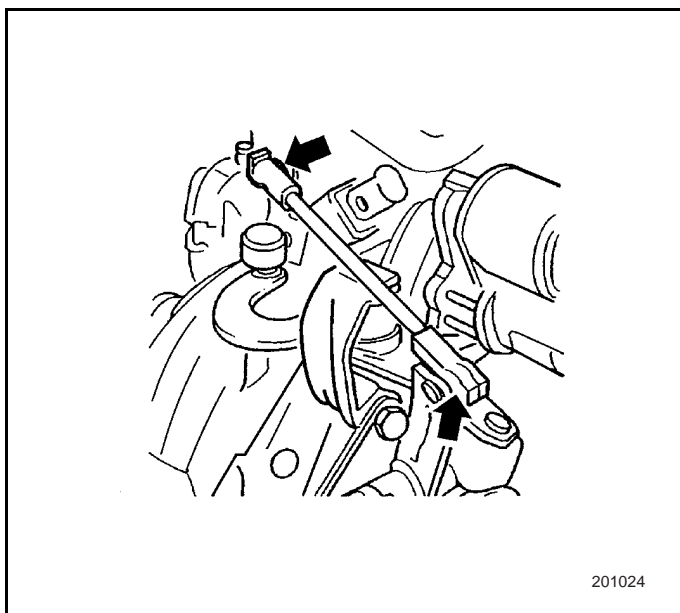
8. Push the lower end of steering knuckle toward steering gear and push it to the bottom, so as to free the upper end of steering knuckle from steering column.
9. Take out the steering knuckle assembly.



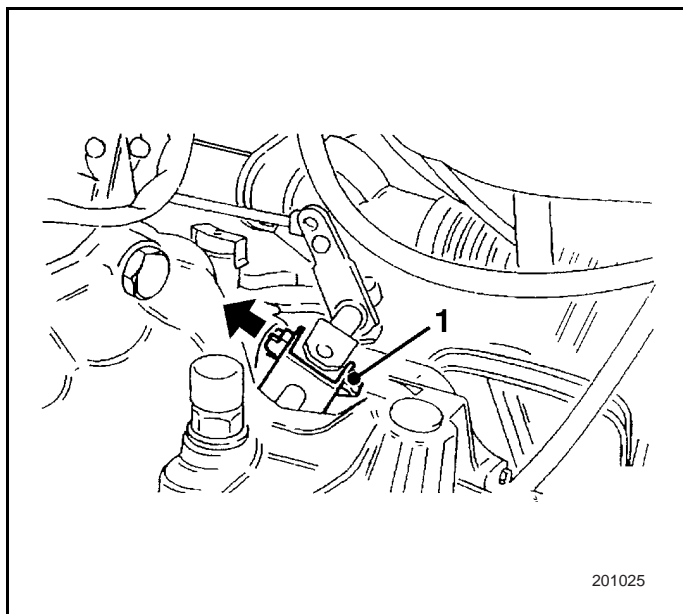
10. Remove mounting spring from pedal shaft.
11. Remove fixing clip from shifting fork and remove the pin of shifting fork.



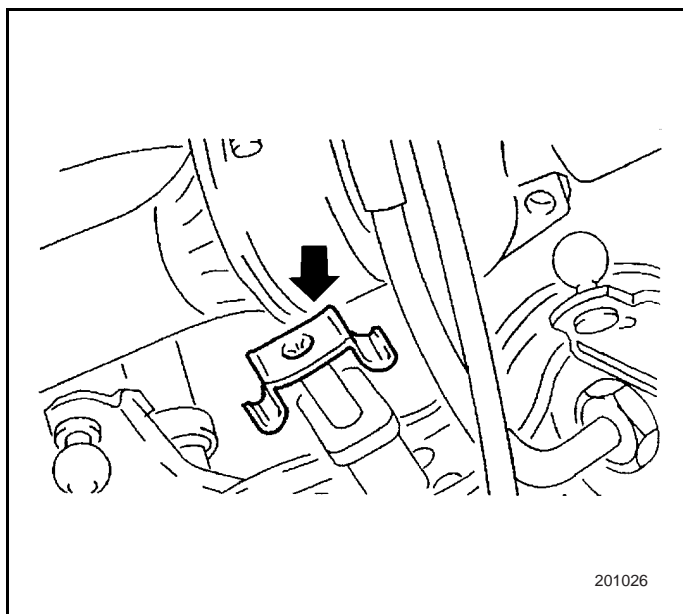
12. Loosen hexagon nuts on the assembly of brake pedal support, and remove the support.
13. Remove brake booster from the engine cabin.



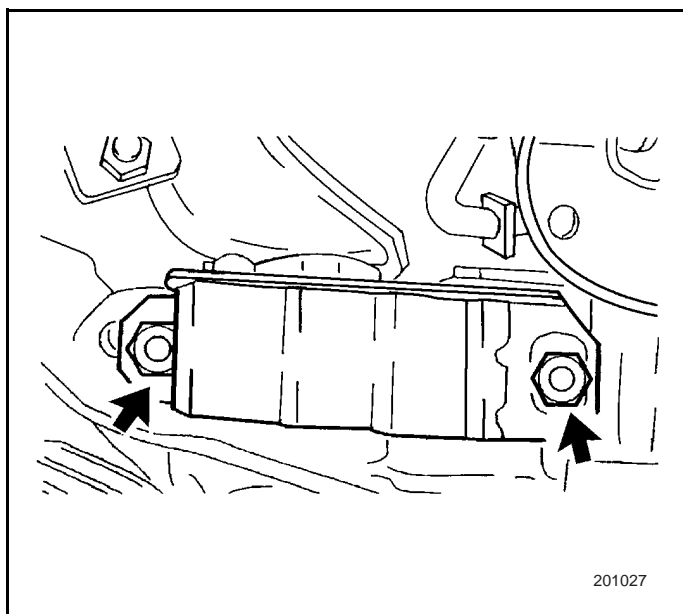
14. Raise the engine.
15. Loosen shifting lever and press it out of the ball socket.



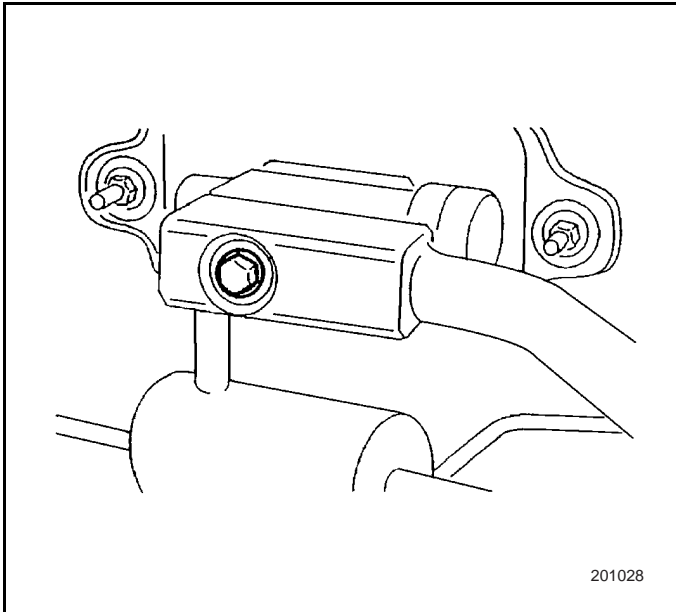
16. Remove universal joint from shifting lever, press the catch springs of the hollow pin together and remove it.



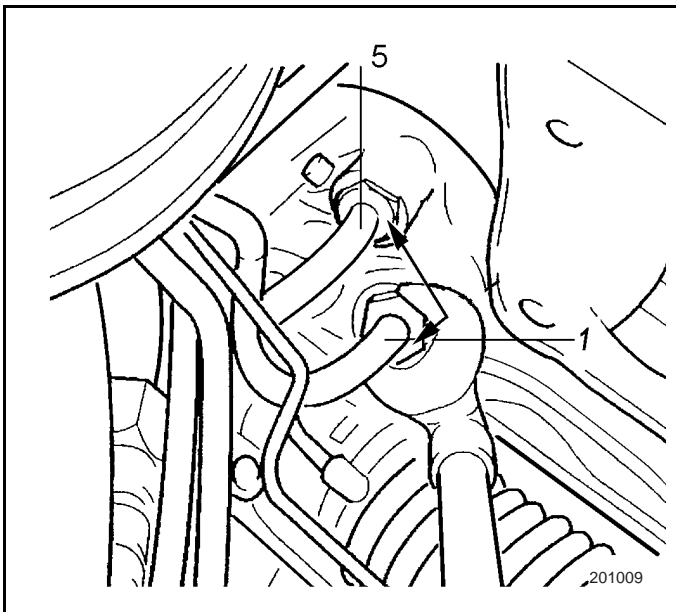
17. Loosen the clip bolt of transmission sliding bar. Press transmission sliding bar out of the knurled bolt. Remove the assembly of bolt and spring clip from the bearing of guide bar. (As indicated by arrow in the diagram) .
18. Remove the assembly of guide bar from the mounting bracket of transmission gear.
19. Disassemble transmission support bracket.



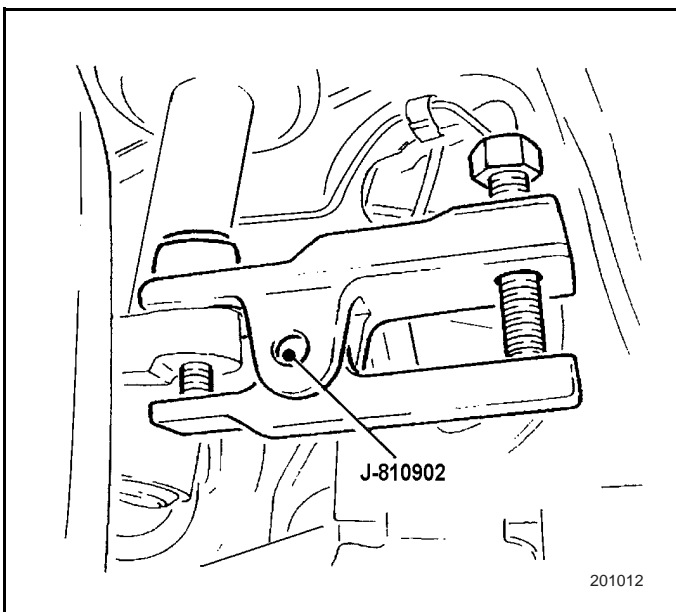
20. Remove the suspension of left front engine from the longitudinal side sill of body framework.



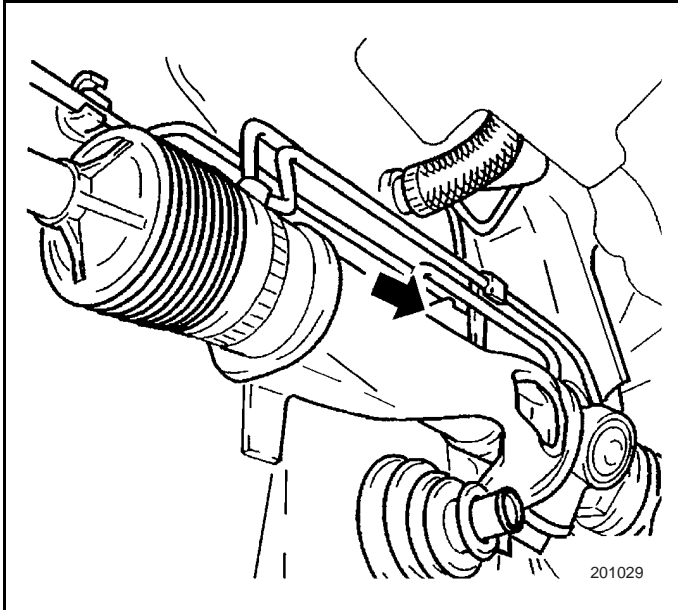
21. Remove refrigerant line of air conditioner from expansion valve and press it out from the separator.
22. Block out the mouth of refrigerant pipelines.



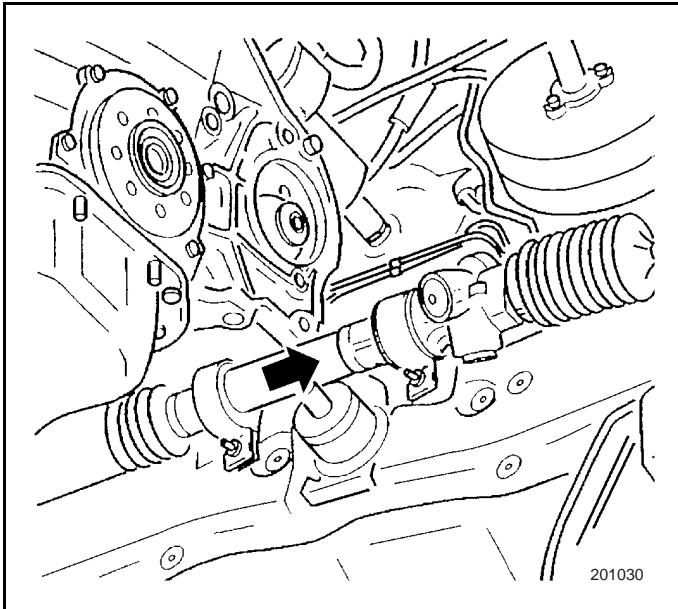
23. Lower the engine.
24. Remove the connectors of oil inlet hard tube and oilout hard tube from steering gear.



25. Remove the two ends of steering knuckle tie rod from the steering knuckle and press it out with J-810902.



26. Press the steering gear out of front enclosure until it can be pushed to the left end. (As indicated by arrow in the diagram) .

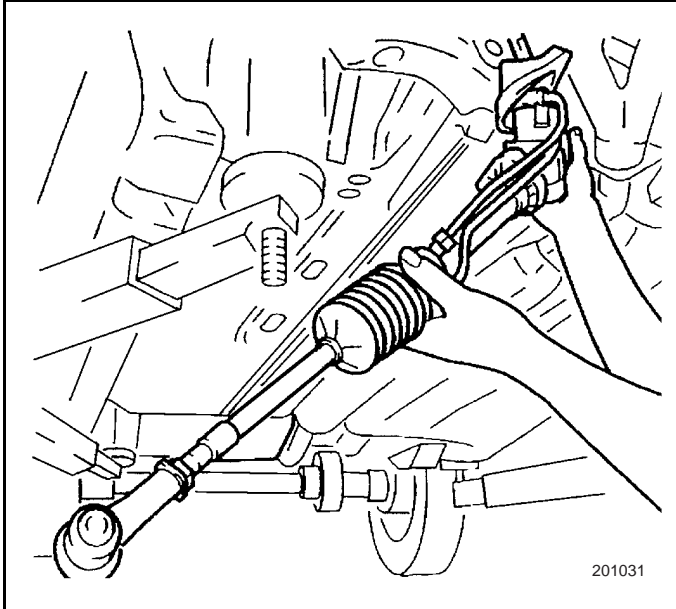


27. Push steering gear left as much as possible so as to push it into the notch of the wheel.
28. On the right side draw steering knuckle tie rod through the notch of the wheel into engine cabin.
29. Incline the steering gear to the left, and take it out from below the vehicle. (As indicated by arrow in the diagram) .

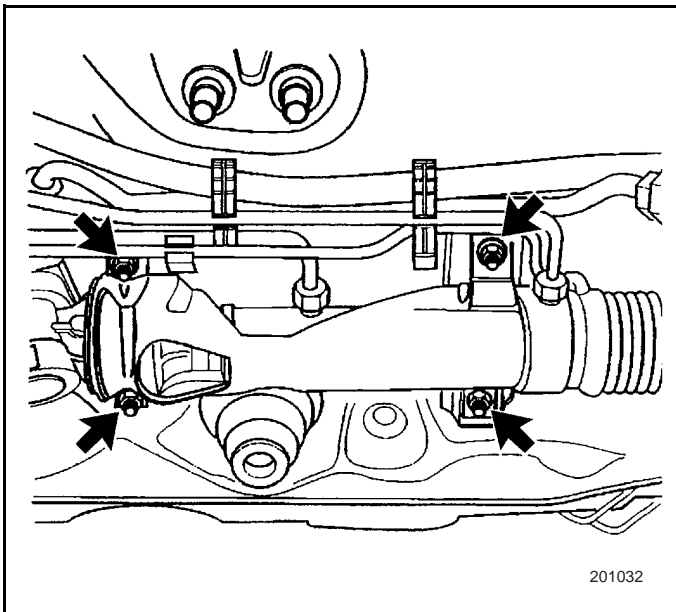
Installation Procedures

Tools required

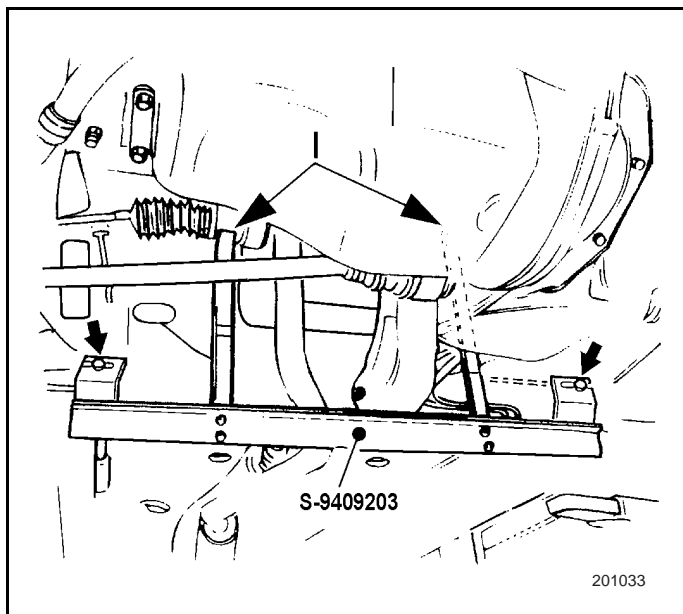
- S-9409203 used to inspect the mounted position of steering mechanism



1. Incline steering gear top left as much as possible from the bottom (right) of vehicle and push it into the notch of the wheel.
2. Lead the right steering knuckle tie rod into the notch of right wheel.



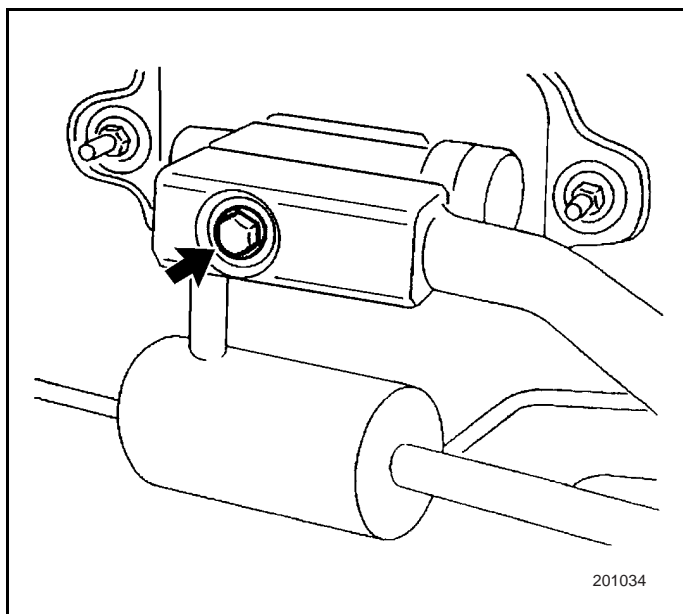
3. Insert steering gear into the notch of partition board.
4. Place steering gear on the mounting position and pretighten the bracket of steering gear. (As indicated by arrow in the diagram) .



5. Use S-9409203 to determine the mounting position of steering gear (as indicated by Arrow I) and tighten it.

Tightening

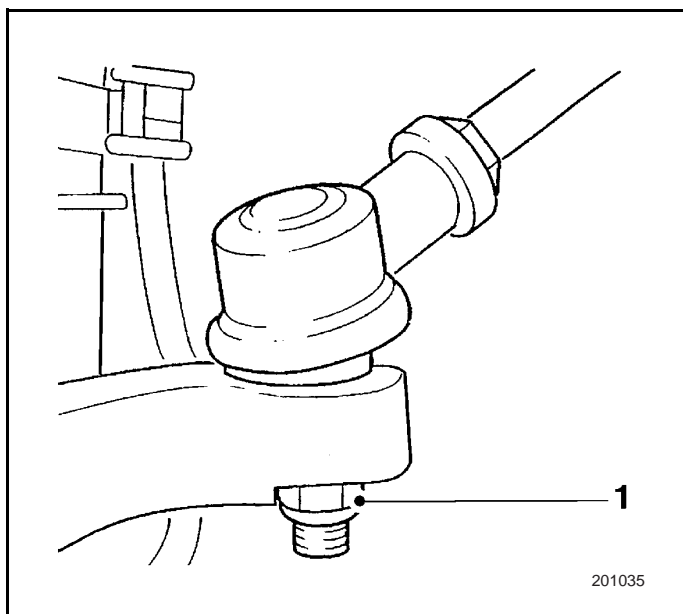
Tighten the steering gear with the front enclosure to 20-26N•m



6. Connect the refrigerant line of air conditioner with expansion valve and tighten it.

Tightening

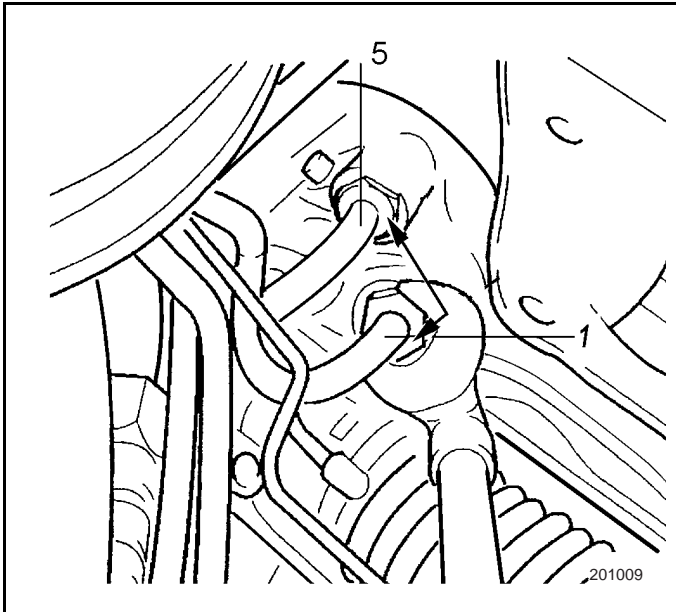
Tighten the refrigerant line with expansion valve to 16 N•m



7. Install the two ends of steering knuckle tie rod onto the steering knuckle (1).

Tightening

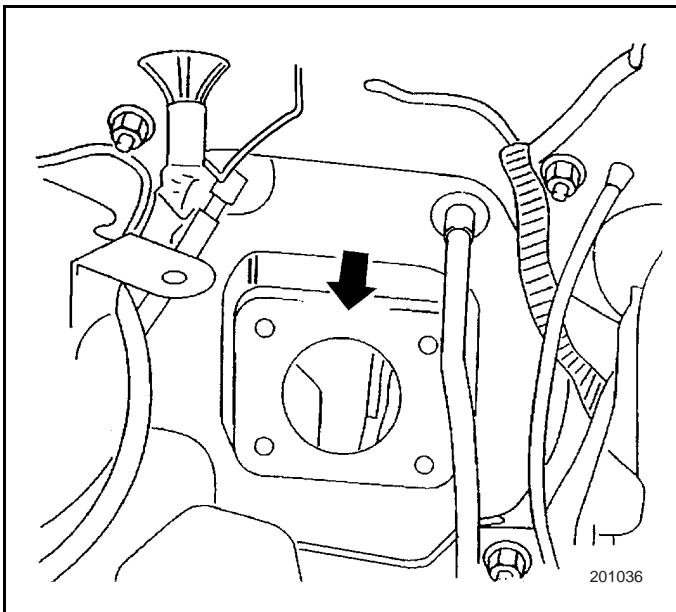
Tighten the end of steering knuckle tie rod with steering knuckle to 40-48 N•m .



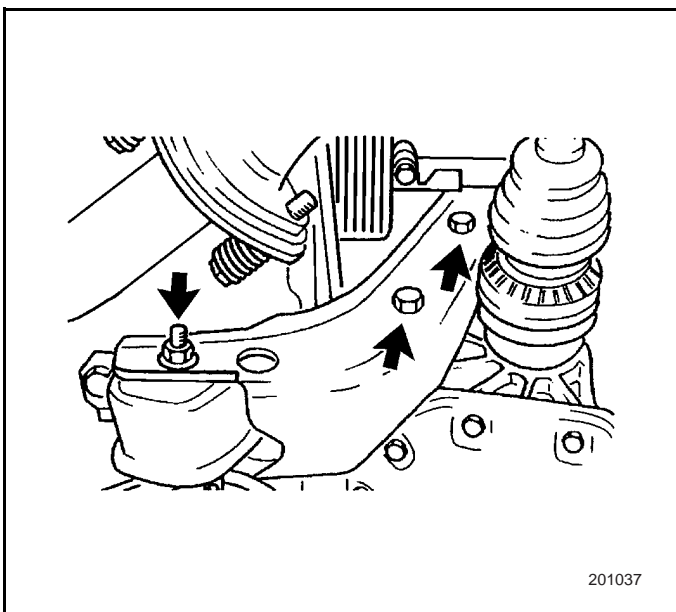
8. Tighten the connector between high-pressure hose and oil return hose and steering gear.

Tightening

Tighten the connector to 20-35N•m .



9. Install a sealing member on the contact surface between brake booster and front enclosure. (As indicated by arrow in the diagram) .
10. Insert brake booster into the bracket of brake pedal.

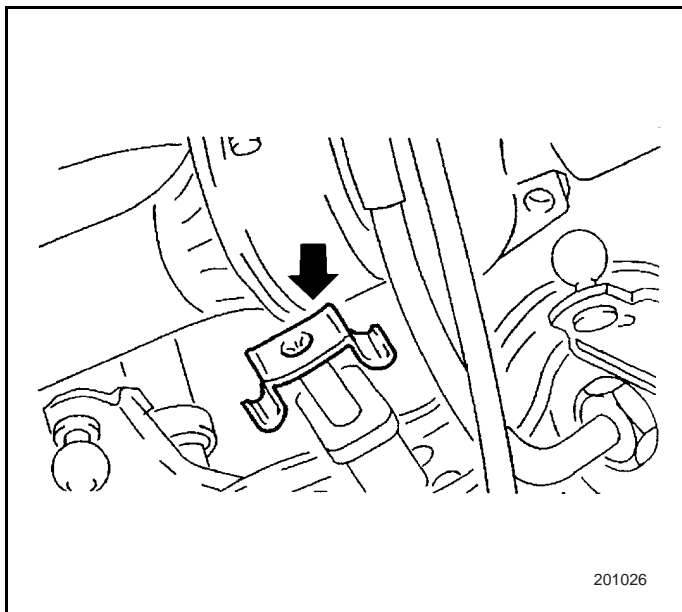


11. Raise the engine.

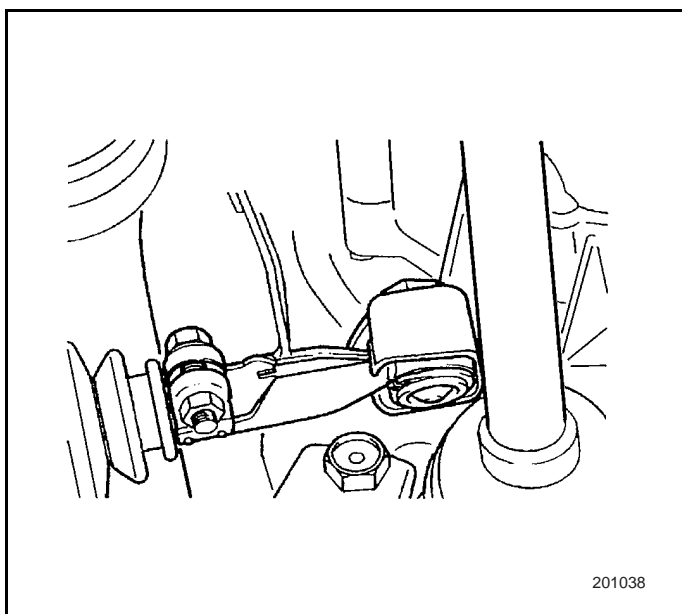
Tightening

Tighten the bolt of left front engine suspension and the longitudinal side sill of body frame to 65 N•m.

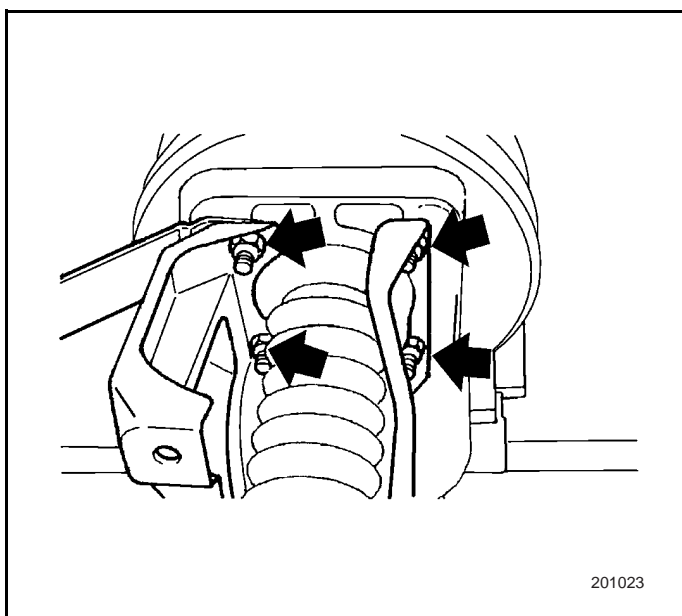
Tighten transmission bracket and snubber beneath body frame to 60 N•m .



12. Install outside connecting bar of transmission. Press in clamp pin with spring (as indicated by arrow in diagram) until both sides of spring clip are locked.



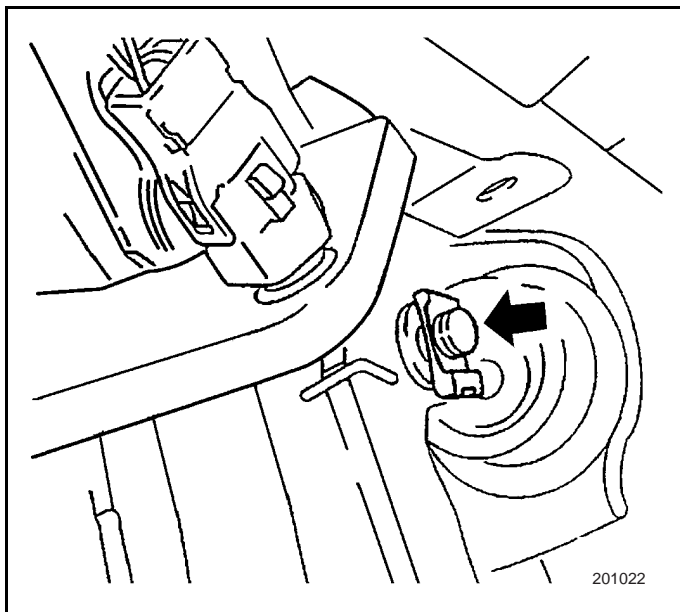
13. Lead the knurled bolt of guide bar into transmission connecting bar. Do not tighten the clamping collar of transmission connecting bar.



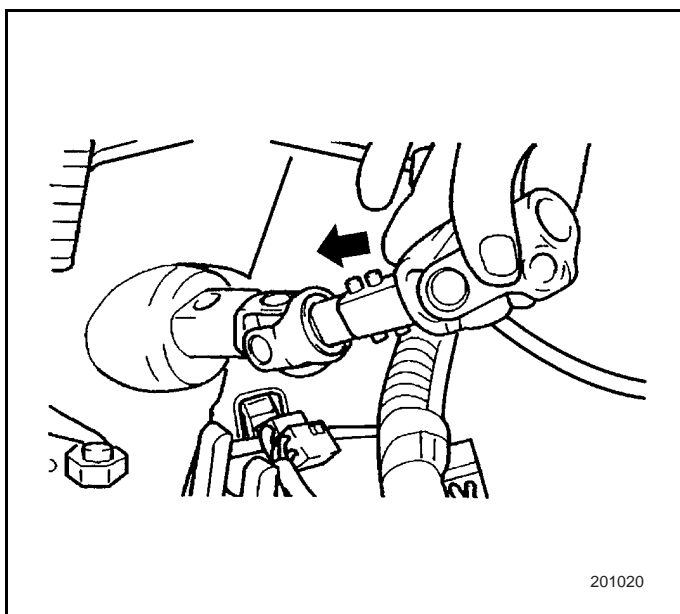
14. Lower the engine.
15. Install brake booster onto the bracket of brake pedal (as indicated by arrow in diagram).

Tightening

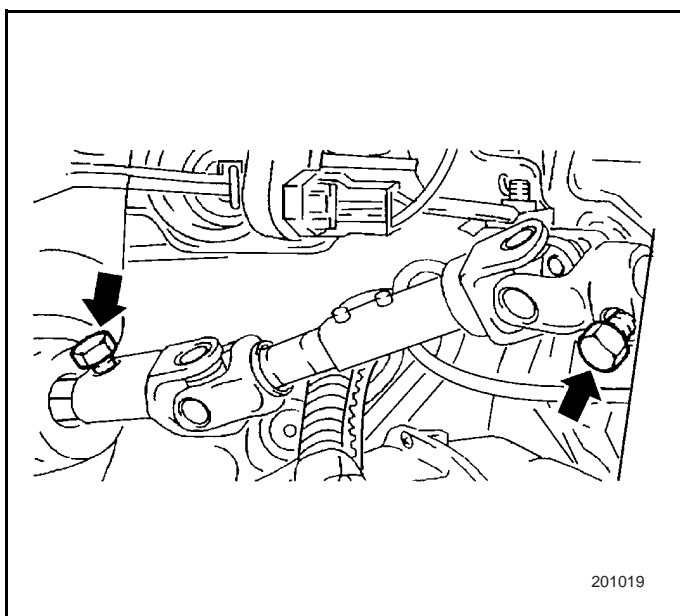
Tighten brake booster and pedal supporter to 22 N•m .



16. Place the fork of brake booster on the brake pedal. Insert the pin of shifting fork (as indicated by arrow in the diagram) and tighten it.



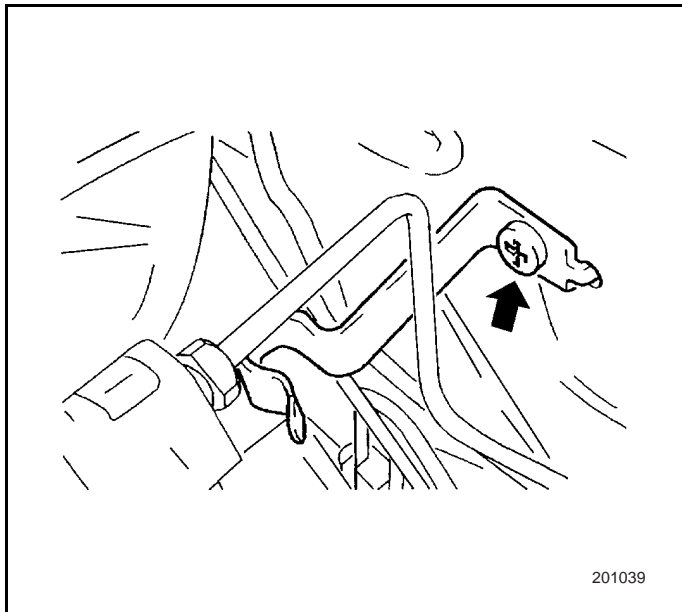
17. Place the lower end of steering knuckle on steering gear and push it to the bottom.



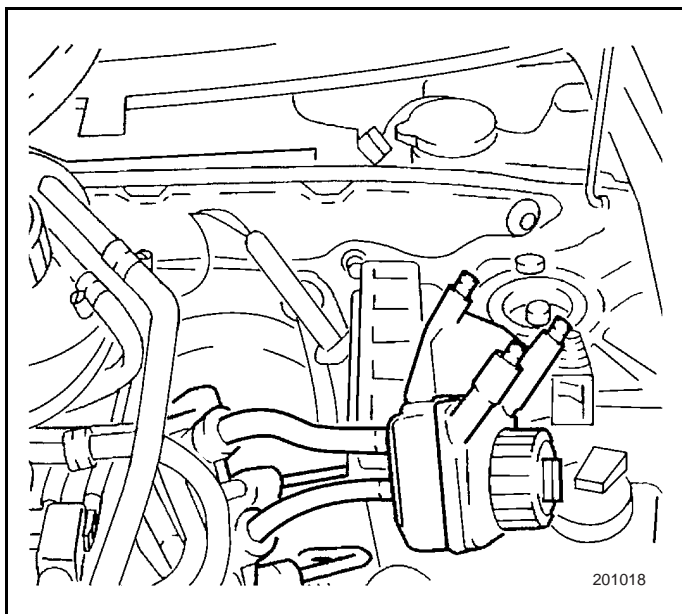
18. Connect steering knuckle with steering column and put it to the mounting position.
19. Tighten the bolts on steering knuckle (as indicated by arrow in the diagram).

Tightening

Tighten steering knuckle and steering gear or steering column to 20-26N•m.



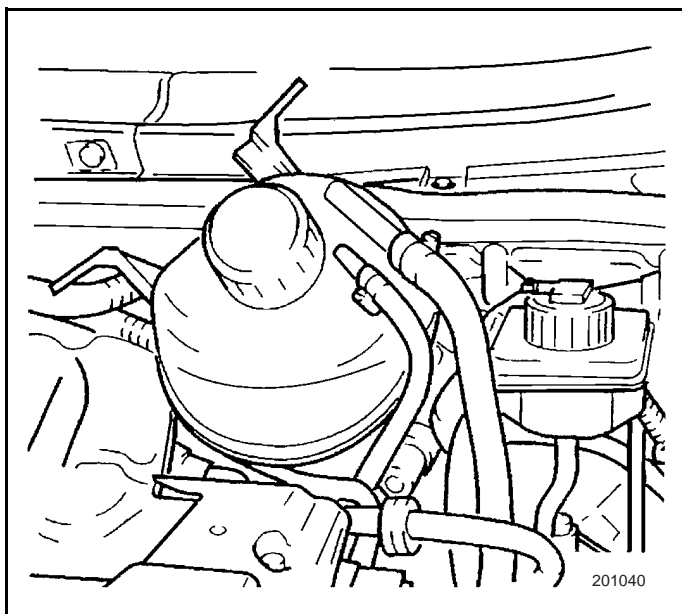
20. Tighten the bolt of clutch dragline bracket (as indicated by arrow in the diagram) and connect clutch dragline.



21. Install brake master cylinder and brake fluid compensation tank.
22. Insert vacuum tube into brake booster.

Tightening

Tighten brake master cylinder and brake booster to 22N•m .



23. Tighten the bolts on refrigerant recovery tank.

Adjustment

Inspect steering liquid level. See Filling/Deflation of Hydraulic System. Inspect gather. See Gather in Wheel Alignment.

Inspect the hydraulic system for any leakage.

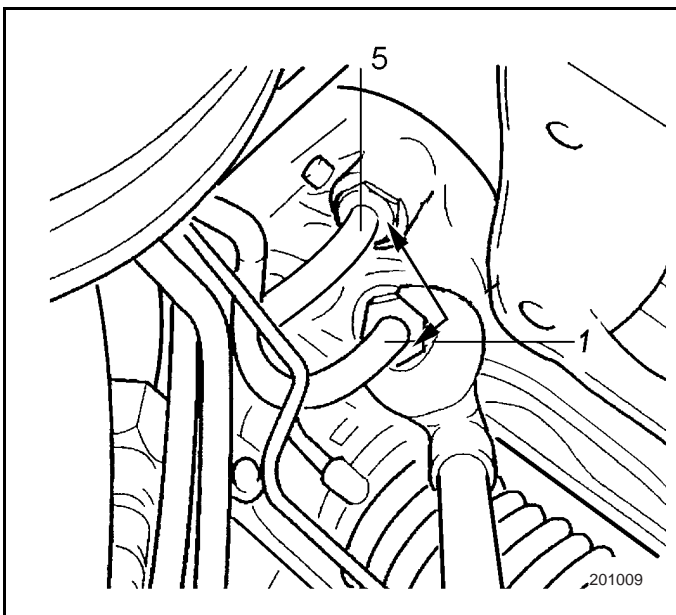
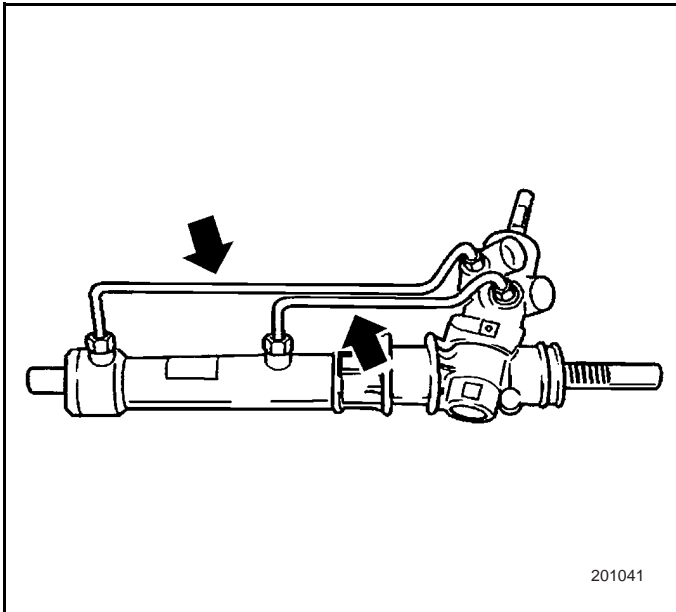
2.1.4.13 Seal of Steering Gear - Power Steering

Disassembly Procedures

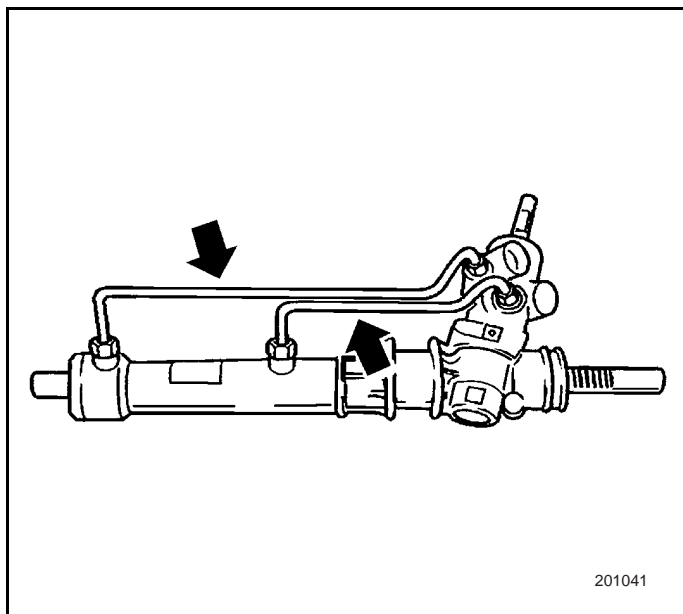
1. Loosen the connector tightening oil inlet and oilout hardtube and the oil pipe of power steering oil cylinder (as indicated by arrow in diagram) and steering gear. When removing pipelines from steering gear, brake booster should be removed from partition board and set aside.
2. Be careful when handling sealing members and sealing surface. Ensure absolute cleanness.

Tightening

Tighten oilin and oilout hard tubes and oil lines of power steering oil cylinder and steering gear to 20-35 N•m .



Note: The two hard tubes should have no contact with corrugated cover, nor should it be blended.



3. Loosen the connector tightening the two hard tubes and tighten oil lines of power steering oil cylinder (as indicated by arrow in diagram) and steering gear.

Note: If there is leakage in any pipeline, the whole pipeline should be replaced. Be careful when making the seal. Ensure absolute cleanness.

Installation Procedures

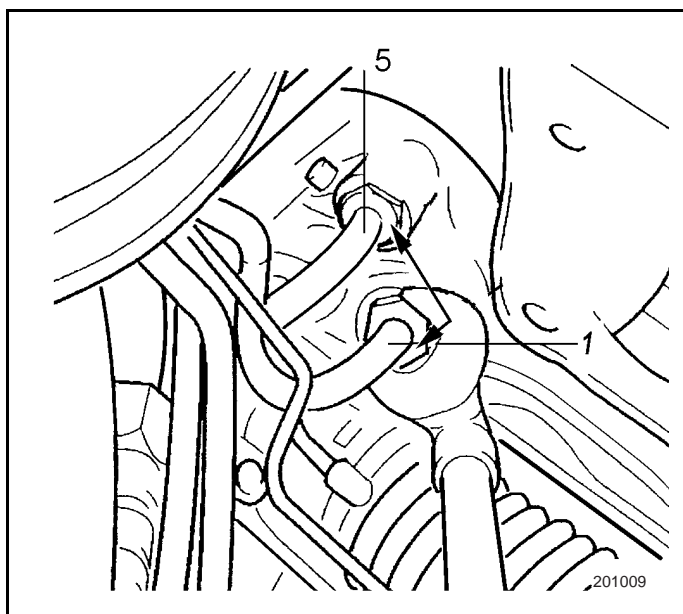
Tools required

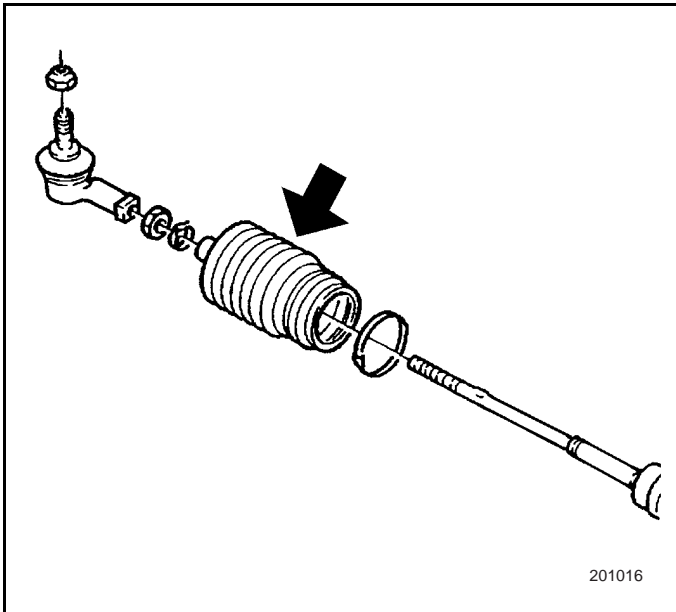
- S-9407235 Nipper

1. Tighten oilin and oilout hard tubes and the steering gear (as indicated by arrow in diagram). The two hard tubes should have no contact with corrugated cover, nor should it be blended.

Tightening

Tighten oilin and oilout hard tubes and the steering gear (as indicated by arrow in diagram) to 20-35 N•m .





2. Replace the two corrugated cover on steering gear (as indicated by arrow in diagram) (with steering gear removed). See Replacement of Corrugated Cover of Steering Gear - On Vehicle.
3. Use special nipper S-9407235 to nip the clamping collar of each corrugated cover.

2.1.5 Explanation and Operation

2.1.5.1 Safety Regulations for Power Steering System

- If there is any electrical danger of short circuit during operation, earthing lead should be disconnected and the negative terminal of battery should be covered.
- The internal threads of a bolt using locking glue should be rethreading, and the external thread of them should be cleaned up. When inserting a bolt, locking glue should be used. Regularly replace locknuts.
- Please do not conduct any heat treatment to the components of steering system; otherwise changes in material behavior thus caused will have negative impact on operation safety of the vehicle.
- When handling steering system (steering gear, steering knuckle tie rod, steering column, etc.), steering mechanism should be held at Straight Ahead position during disassembly and installation.
- When removing steering wheel, steering column should be locked at Straight Ahead position so as to avoid any damage to contact devices and the steering wheel during reinstallation.
- Only authorized dedicated steering liquid should be used, do not reuse steering liquid that has been discharged.

After an accident takes place, besides inspecting the alignment of chassis (inspection of chassis alignment should always be conducted under all circumstances), the following components should also be visually inspected for any blending or cracks:

- Steering system and steering connecting rod. Besides, steering system should also be corrected by turning the steering wheel through its whole travelling circle.
- Chassis and all related components, such as spring hanger, steering knuckle, control arm, bridge, stabilizer bar, and other fasteners.

2.1.5.2 Explanation of Power Steering Pump

Power steering pump is a blade type pump used to provide hydraulic pressure to the system. Steering pump consists of the following components:

- Drive shaft
- Housing of steering pump
- Collar of steering pump
- Dog

- Thrust plate
- Flow control valve
- Rotor
- Blades

The opening at the back of the steering pump housing includes the following components:

- Collar of steering pump
- Dog
- Thrust plate
- Rotor
- Blades
- End plate

The small opening at the side of the steering pump housing includes the following components:

- High-pressure hose connector
- Flow control valve
- Spring

Flow control throttle orifice is a part of the high-pressure hose connector. Pressure relief valve in the flow control valve is used to limit the pressure of steering pump.

2.1.5.3 Explanation of Power Steering Gear

The motion of steering wheel will have the following effect:

1. The motion of steering wheel is transferred to pinion.
2. The motion of pinion is transferred through gear tooth.
3. The teeth of pinion engage with the teeth of rack.
4. This is the motion of rack.

Steering system with pinion and rack has a rotary control valve. The rotary control valve is used to make the steering liquid flow toward the side of rack piston. Integral rack piston is connected with the rack. Integral rack piston has the following functions:

1. Rack piston transforms hydraulic pressure into linear force.
2. Linear force makes the rack move from side to side.
3. Linear force is transferred to internal and external steering knuckle tie rods and the steering knuckle.
4. Steering knuckle turns the wheels.

If there is no hydraulic boosting force, the system will need greater steering force. If there is no hydraulic boosting force, the system will maintain manual control.

2.1.5.4 Recommendation about Replacement of Sealing Members

It is recommended to seal drive shaft with lip seal at the following position:

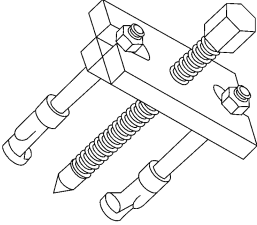
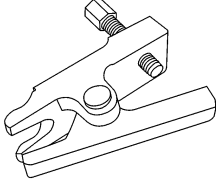
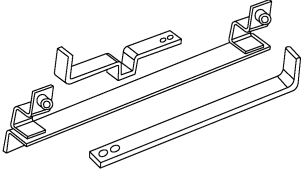
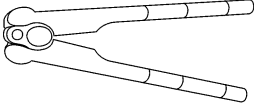
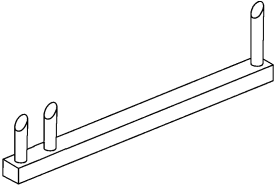
- On the steering gear
- Gear shaft of power steering pump

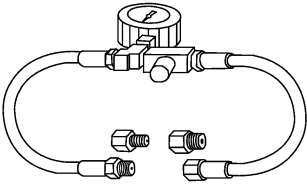
If any leakage is found at the following position, sealing member should be replaced after inspection and sealing surface completely cleaned.

- On the steering gear
- Gear shaft of power steering pump

Only when severe pitting is found should the shaft be replaced. If slight corrosion is found on the contact zone of a lip seal, use crocus cloth to clean the surface of the drive shaft. Only when a leakage still exists after the first cleaning up should the steering gear or steering pump be replaced.

2.1.6 Special Tools

Graphics	Tool identification/ description
 <p>J-830901</p>	<p>J-830901 Puller Used to remove steering wheel</p>
 <p>J-810902</p>	<p>J-810902 Pulling fork Used to press the steering knuckle tie rod of steering knuckle</p>
 <p>S-9409203</p>	<p>S-9409203 Detector Used to inspect the mounted position of steering mechanism</p>
 <p>S-9407235</p>	<p>S-9407235 Nipper Used to tighten retaining clip of corrugated cover</p>
 <p>KM-551-A</p>	<p>KM-551-A Detector Used to inspect the straightahead position of power steering gear</p>

Graphics	Tool identification/ description
 <p>KM-354-B</p>	<p>KM354-B Pressure gage Used to inspect oil pressure of power steering gear</p>

2.2 Steering wheel and Steering Column

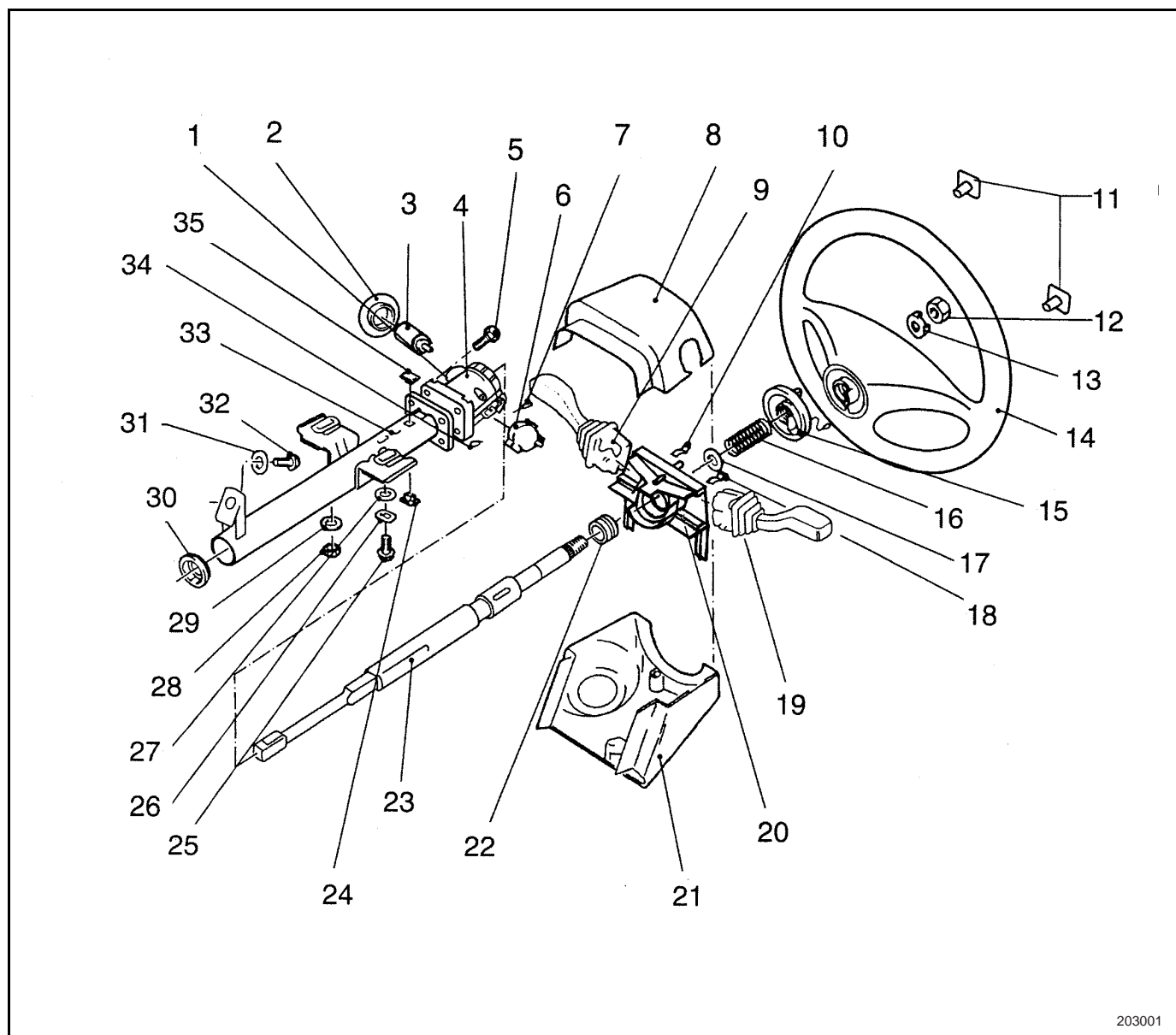
2.2.1 Specifications

2.2.1.1 Tightening Torque of Fasteners

Applications	Specifications
Nut of steering wheel and steering shaft	15-25N•m
Bracket of steering column and lower supporting point of steering column	20-26N•m
Clamping bolt of steering shaft collar	20-26N•m
Clamping bolt of steering gear collar	20-26N•m
Separating die block and steering column bracket	20-26N•m

2.2.2 Identification of Appearance

2.2.2.1 Steering Wheel and Steering Column - Exploded View



203001

Legend

- | | |
|---|--|
| (1) Housing of ignition switch | (12) Nut |
| (2) Outer cover of ignition switch | (13) Lock washer |
| (3) Locking core of ignition switch | (14) Steering wheel |
| (4) Binding clip of ignition lock | (15) Coil of safety air bag (if equipped) |
| (5) Safety bolt | (16) Thrust spring |
| (6) Contact member | (17) Spacer |
| (7) Bolt | (18) Contact spring |
| (8) Upper half of signal switch cover cap | (19) Signal switch |
| (9) Windscreen wiper switch | (20) Housing of signal switch |
| (10) Contact spring | (21) Lower half of signal switch cover cap |
| (11) Horn button | (22) Guide bearing |

-
- (23) Upper steering shaft
 - (24) Positioning plug
 - (25) M8 bolt
 - (26) E-ring
 - (27) Gasket
 - (28) Nut
 - (29) Gasket
-

- (30) Guide bearing
 - (31) Gasket
 - (32) Bolt
 - (33) Steering column
 - (34) Bolt
 - (35) Positioning plug
-

2.2.3 Diagnostic Message and Procedure

2.2.3.1 Locking System Cannot Be Unlocked

Problems	Measures
The core of the lock may have been damaged.	Inspect this component. If required, replace it. See Replacement of the Core of Ignition Switch Lock.
Ignition switch is worn or damaged.	Inspect ignition switch. If necessary, replace ignition switch.

2.2.3.2 Locking System Cannot Be Locked

Problems	Measures
The following components may have been damaged: Core of the lock Steering column	Inspect this component. If required, replace the component. See Replacement of the Core Ignition Switch Lock or Replacement of Steering Column Assembly.

2.2.3.3 Key Cannot Be Drawn out at Closed or Locked Position

Problems	Measures
Setup of the core of ignition switch lock is incorrect.	If required, adjust core of the lock. If required, replace the component. See Replacement of the Core of Ignition Switch Lock.
The core of the lock has been damaged.	If required, replace the core of the lock. See Replacement of the Core of Ignition Switch Lock.

2.2.3.4 Greater locking force is needed between closed and locked positions

Problems	Measures
The core of the lock is worn or damaged.	If required, replace the core of the lock. See Replacement of the Core of Ignition Switch Lock.

2.2.3.5 Greating locking force

Problems	Measures
The following components may have been damaged: core of ignition switch lock.	Inspect the component. If required, replace the component. See Replacement of the Core of Ignition Switch Lock. If necessary, replace ignition switch.

2.2.3.6 Inspection of steering shaft

Inspect to see whether the plastic pin of steering shaft is broken. The following are the symptoms of such condition:

- There is a clattering sound when the steering shaft slightly bumping from the side.

- When turning the steering wheel, a clearance can be felt.

If the pin of steering shaft has been broken by the slight bumping but other components are not severely damaged, the vehicle can still safely steer. But it is recommended to replace the steering shaft.

2.2.3.7 Steering column is loose

Problems	Measures
The holddown bolt of steering column is loose.	Tighten the holddown bolt of steering column to the required torque. See 擧 ithtening Torque of Fasteners.
The supporting assembly of steering column is loose or damaged.	<ol style="list-style-type: none"> 1. Inspect the supporting assembly of steering column. See Replacement of Steering Column Assembly. 2. Repair or replace the supporting assembly of steering column. See Replacement of Steering Column Assembly.

2.2.3.8 Steering wheel is loose

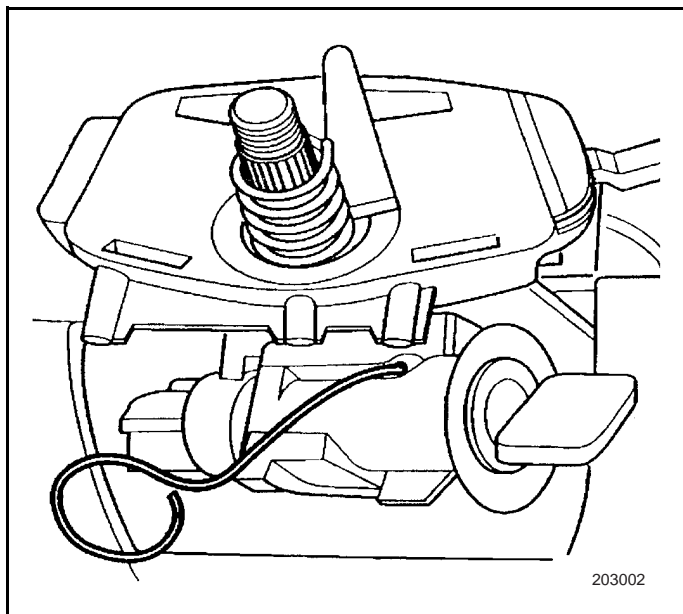
Problems	Measures
The holddown nut of steering wheel is loose.	<ol style="list-style-type: none"> 1. Inspect the installation of steering wheel. See Replacement of Steering Wheel. 2. Retighten the holddown nut of steering wheel. See Replacement of Steering Wheel.
The steering wheel has been damaged.	<ol style="list-style-type: none"> 1. Inspect steering wheel. See Replacement of Steering Wheel. 2. Replace the steering wheel. See Replacement of Steering Wheel.
Steering counter shaft is worn or damaged.	<p>Inspect steering counter shaft. See Replacement of Power Steering Gear.</p> <p>Replace steering counter shaft. See Replacement of Power Steering Gear.</p>

2.2.4 Repair guidance

2.2.4.1 Replacement of the core of ignition switch lock.

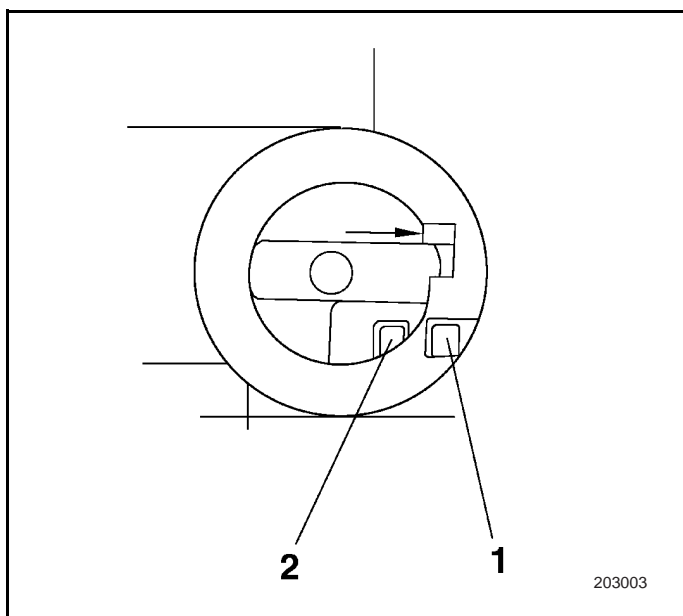
Disassembly procedures

1. Disassemble the plastic jacket of steering column, see Replacement of Panel.
2. Insert the needlepoint into the unlocking hole, then draw out the core of ignition switch lock from the lockseat.



Installation procedures

1. By pushing the travelling block toward the direction of arrow in the diagram, move the core seat from position (1) to position (2) until a "click" indicating it has reached designated position is heard.
2. Align the lobe of the core of ignition switch lock with the groove in the core seat, then insert the core into the core seat. A Click sound indicates it has reached its designated position.



2.2.4.2 Replacement of Steering Wheel

Disassembly Procedures

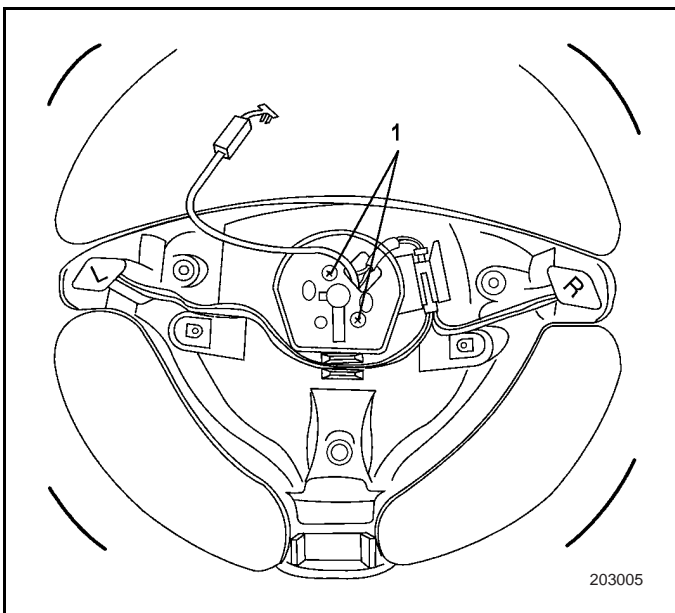
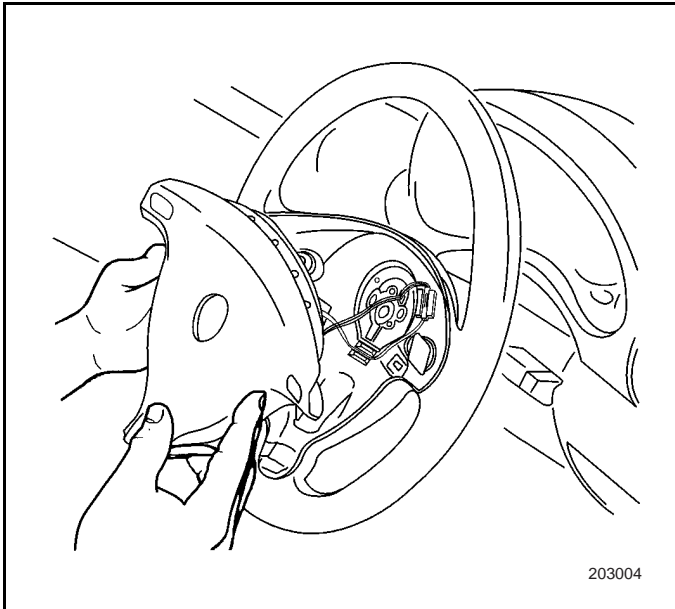
Tools required

- S-9409202 Detector
- KM-551-A Detector
- J830901 puller

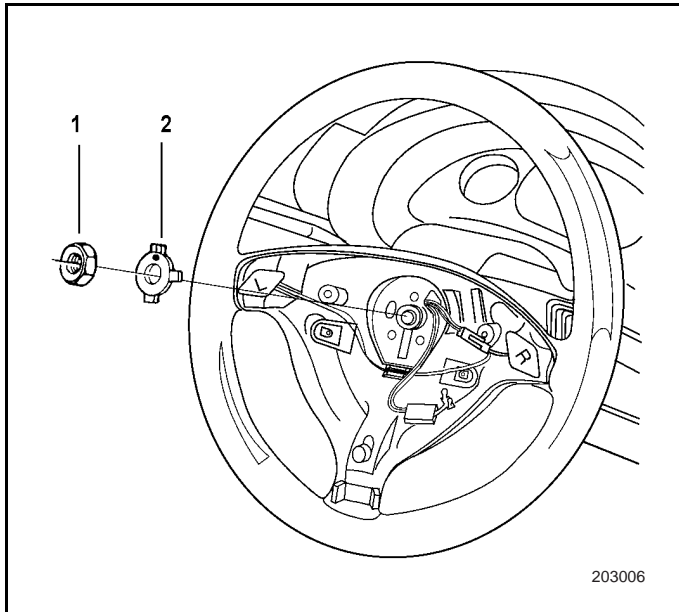
1. Remove the unit of safety airbag, see Replacement of Airbag Device - On the Driver Side in Safety Airbag System.

Caution: When handling safety airbag, Airbag Safety Regulations should be followed.

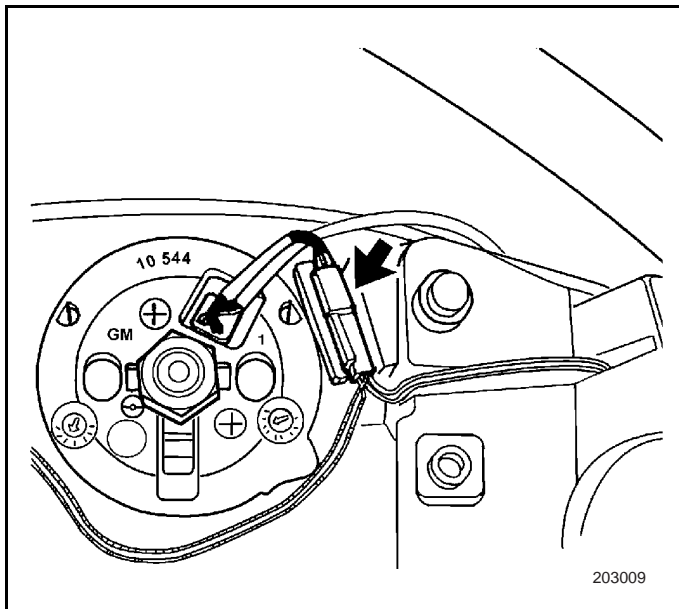
Notice: When removing steering wheel, lock steering column at straightahead position so as to ensure installation hereafter will not damage the coil of safety airbag.



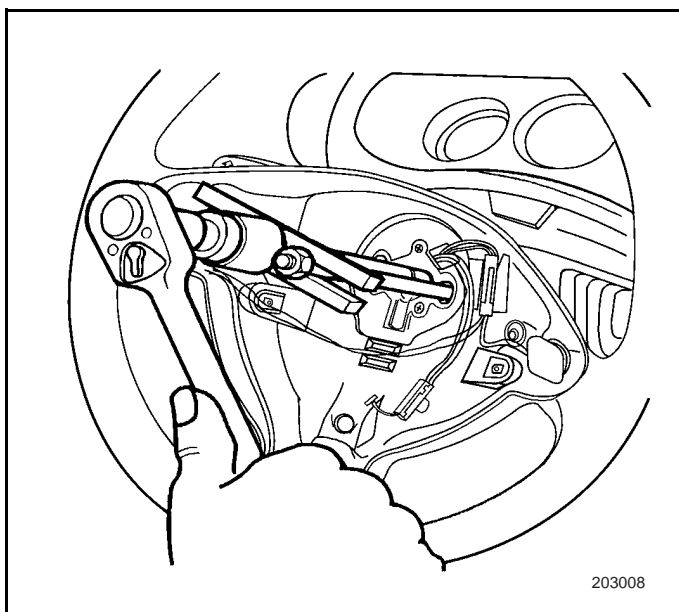
2. Insert S-9409202 to fix steering mechanism at straightahead position; for vehicles with power steering, use KM-551-A. Remove bolt (1) tightening the coil of safety airbag.



3. Blend the lockplate (2) of nut (1) and loose the connection with steering column.

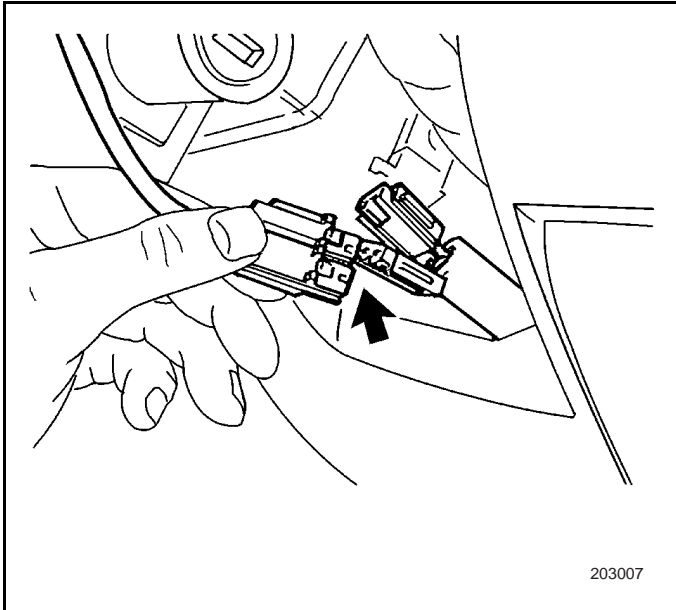


4. Disassemble the harness connector of the horn from the groove of steering wheel.



5. Use steering wheel puller J 830901 to pull the steering wheel out of the spline of steering shaft.

Notice: Do not cause damage to safety airbag coil.

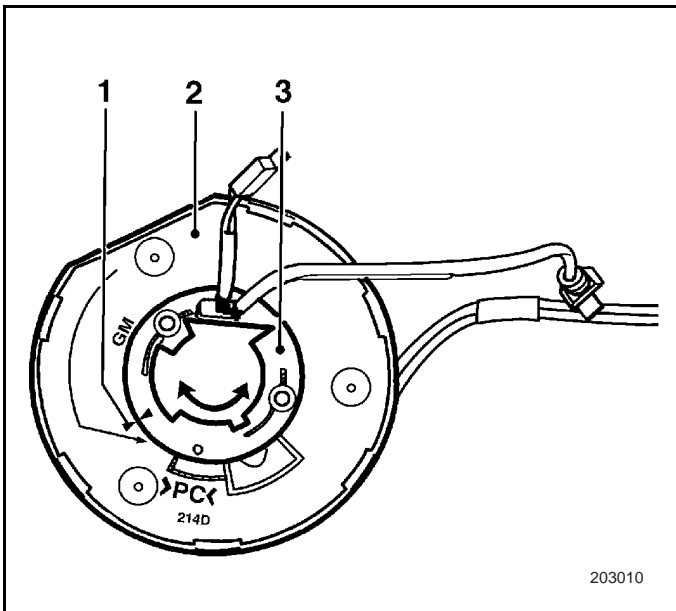


6. Disconnect the harness connector of safety airbag coil at the bracket of steering column. Remove the coil of safety airbag from the spline of steering shaft.

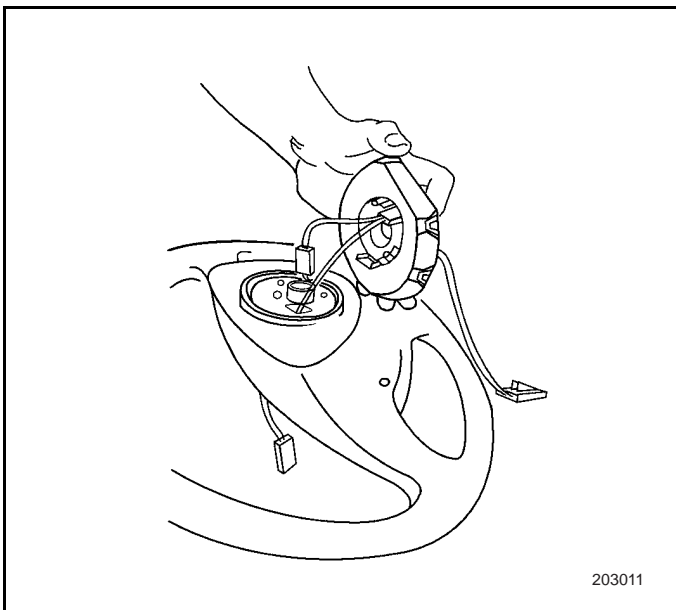
Notice: Before installation ensure the coil of safety airbag is at the central position.

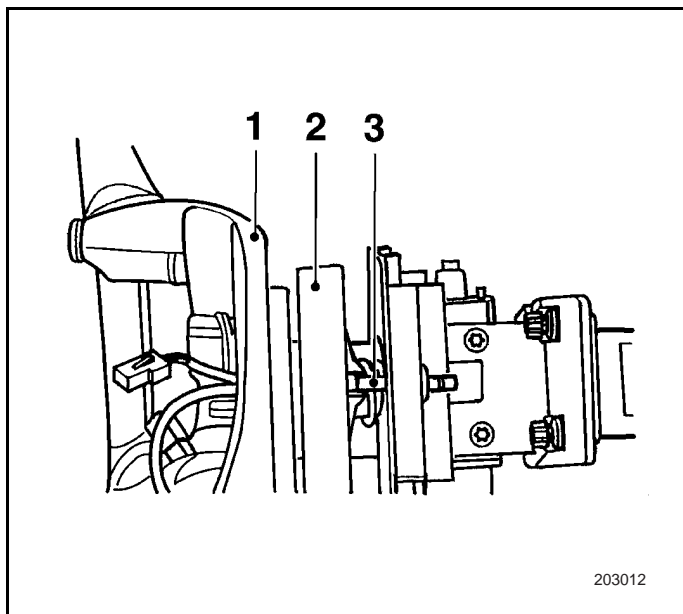
Installation procedures

1. Ensure the coil of safety airbag is at central position: turn the footstep (3) of safety airbag coil (1) counterclockwise toward the left until greater resistance can be clearly felt, then rotate it 2.5 turns toward the right until the arrow mark (1) is aligned.



2. Put the harness of horn and the harness of safety airbag into the opening of steering wheel. Screw on the bolt tightening the safety airbag coil and the steering wheel.

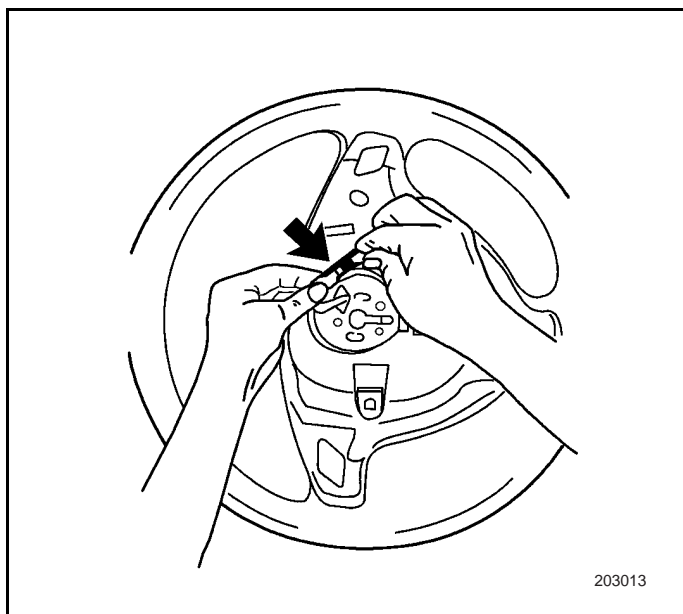




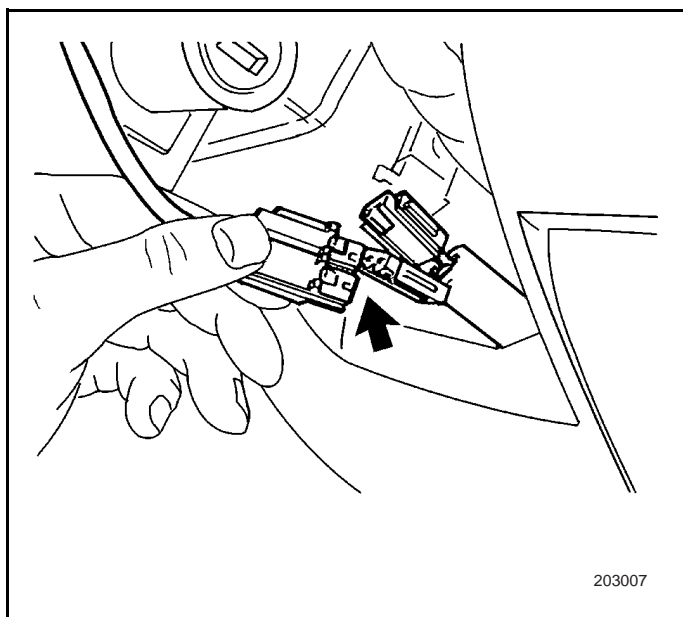
3. Fasten steering wheel (1) and safety airbag coil (2) on the steering column. The anchor pin of switch housing must fit the guiding device of the safety airbag coil.
4. Install the lockplate, screw on the bolt for steering wheel and steering column.

Tightening

Tighten the bolt of steering wheel and steering column to 25 N•m .



5. Tighten the nut of steering wheel, and knik the lockplate to lock up. Connect the harness connector of the horn and tighten it into the groove of steering wheel.



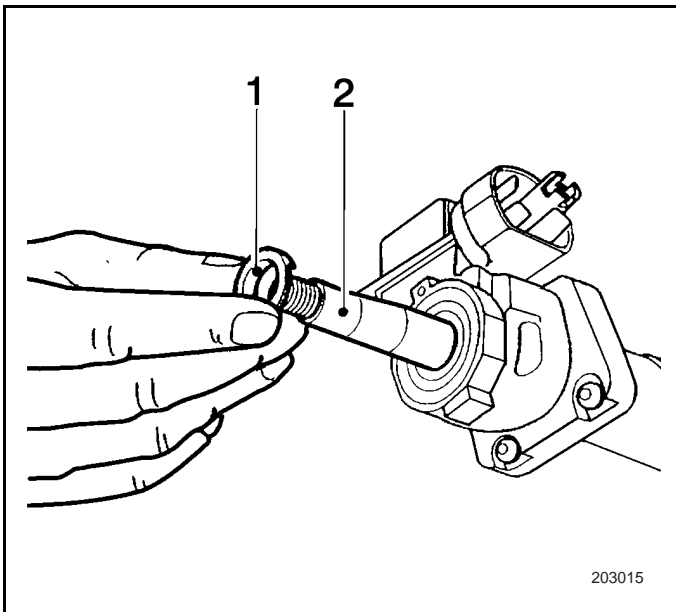
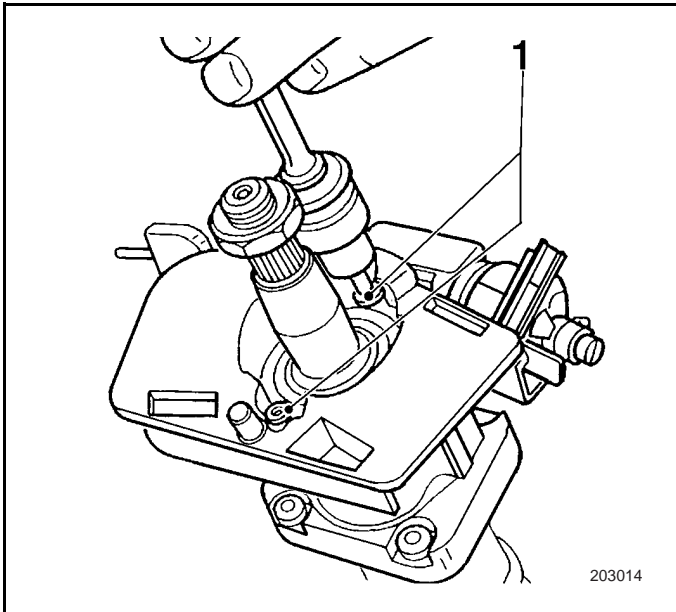
6. Connect the safety airbag unit with the harness connector of the horn, and insert it into the bracket of steering column.
7. Install the unit of safety airbag, see Replacement of Airbag Device - On the Driver Side in Safety Airbag System.

2.2.4.3 Replacement of Ball Bearing at the Upper End of Steering Shaft

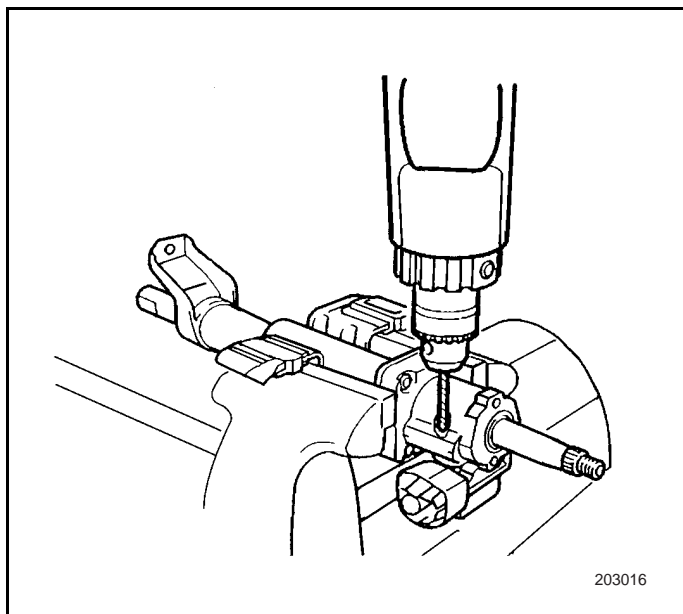
Disassembly procedures

Tools required

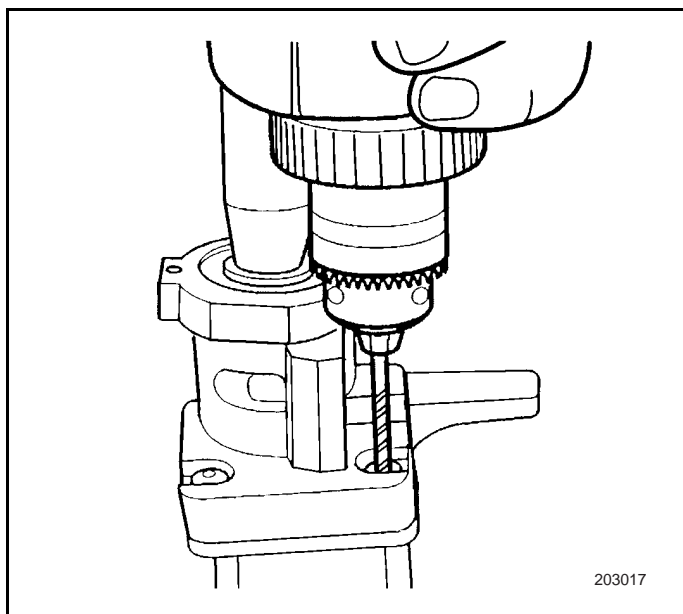
- KM-108 Disassembly/installation rove iron
1. Remove steering column assembly, see Replacement of Steering Column Assembly.
 2. Loosen signal switch (1).



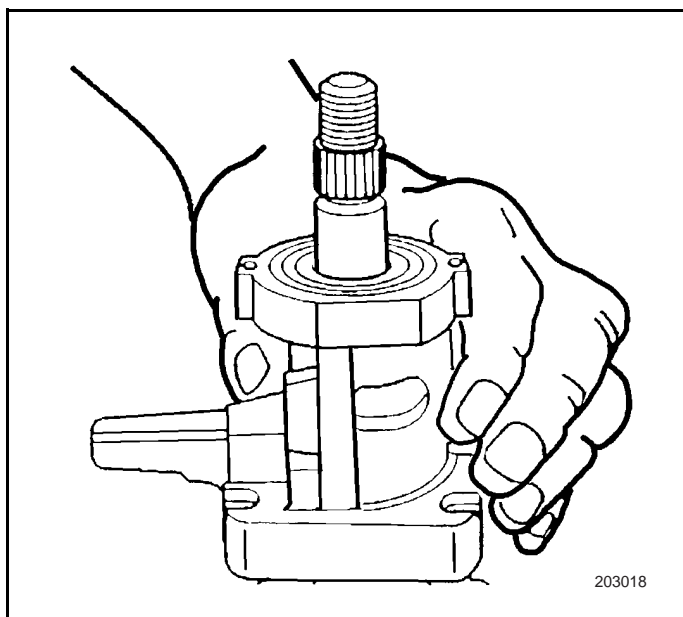
3. Remove spacer (1) from steering shaft (2).



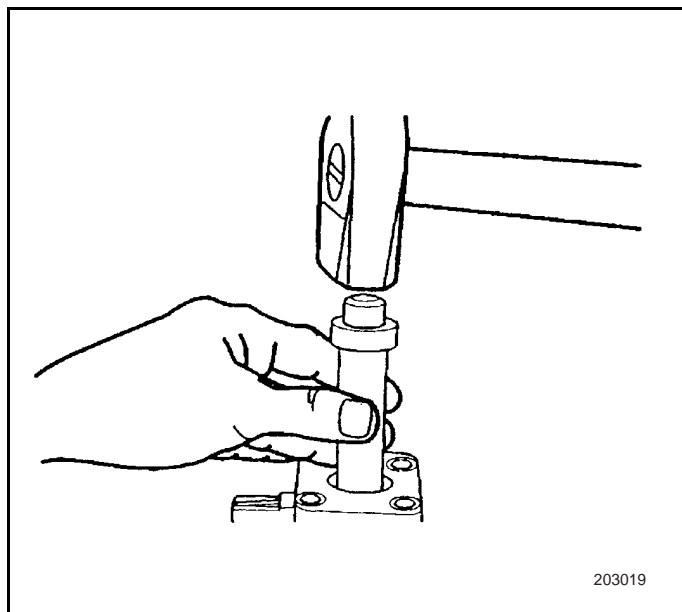
4. Fix steering shaft on the vice. Punch at the center of two safety bolt connecting the steering column and the ignition switch housing. Use electric screwdriver 1411 available at the market and ± 5 mm drilling bit to drill a hole of 15 mm in depth on the safety bolt. Drive the screwdriver into the hole and take out the safety bolt.



5. Punch at the center of 4 safety bolts on steering column. Use electric screwdriver 1411 available at the market and ± 5 mm drilling bit to drill a hole of 15 mm in depth on the safety bolt. Drive the screwdriver into the hole and take out the safety bolt.



6. Remove upper housing and top end ball bearing assembly from steering column.

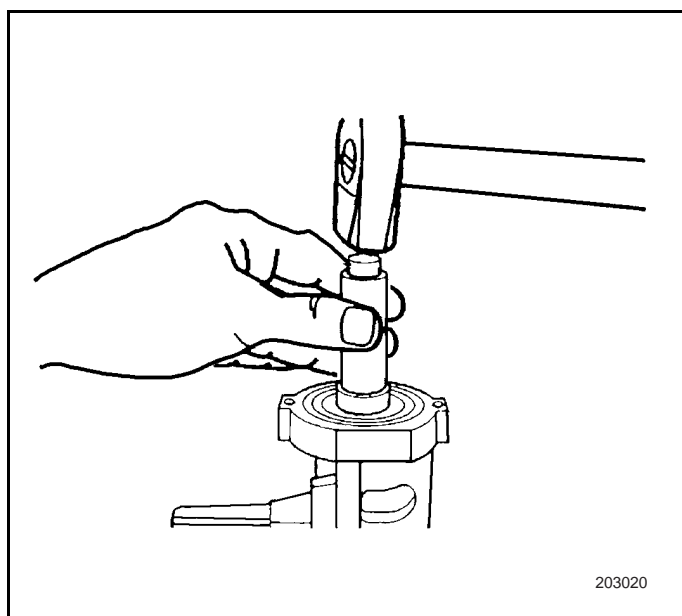


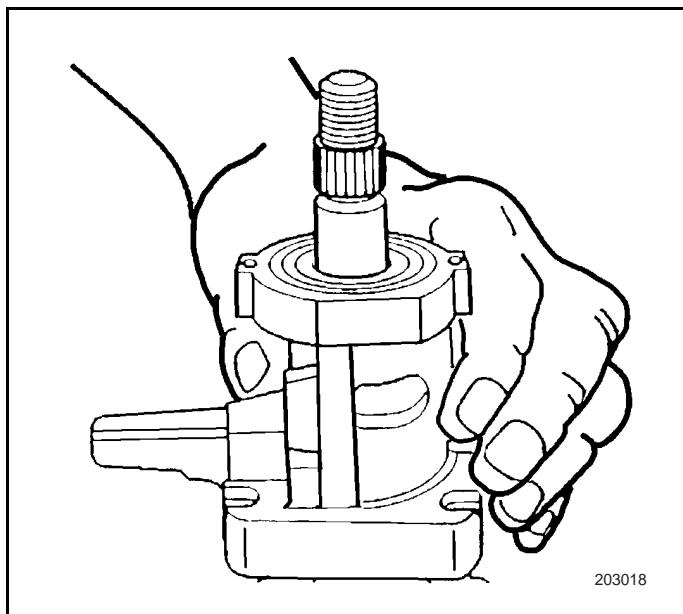
7. Use KM-108 to remove top end ball bearing from steering column.

Installation procedures

Tools required

- KM-108 Disassembly/installation rove iron
1. Use KM-108 to press top end ball bearing into the housing.

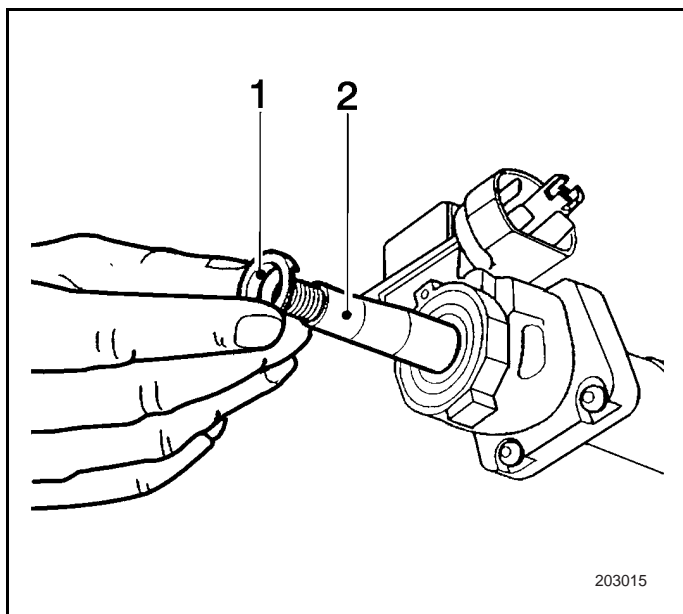




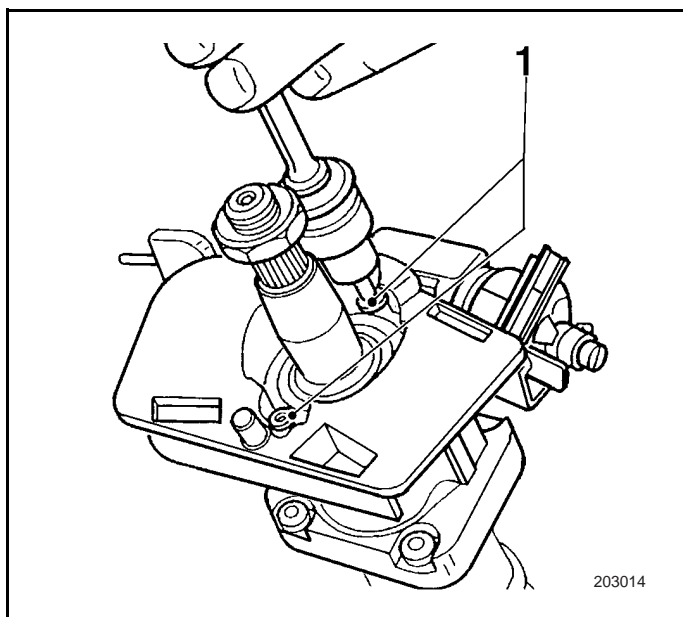
2. Place the upper housing and top end ball bearing assembly on steering column and connect them with a bolt.

Tightening

Use new safety bolt, tighten until the hexagon head is broken.



3. Install spacer (1) into steering column(2).



4. Use bolt (1) to connect signal switch with steering shaft.
5. Install steering column assembly, see Replacement of Steering Column Assembly.

2.2.4.4 Replacement of Upper Steering Shaft

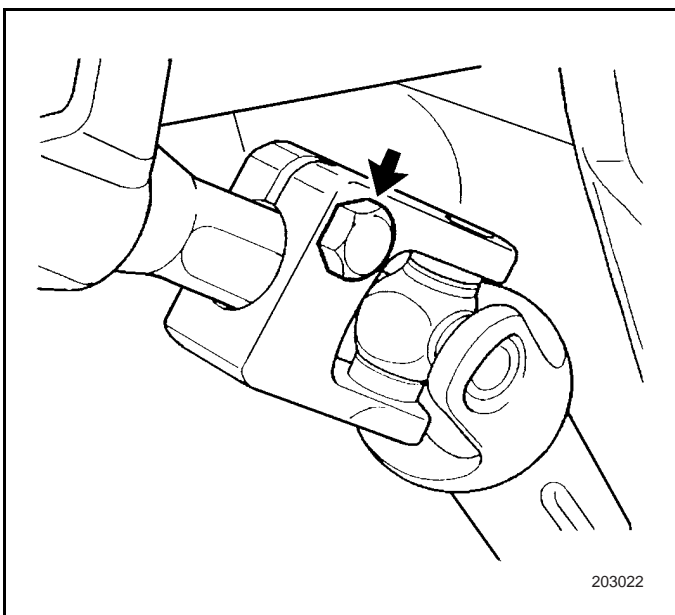
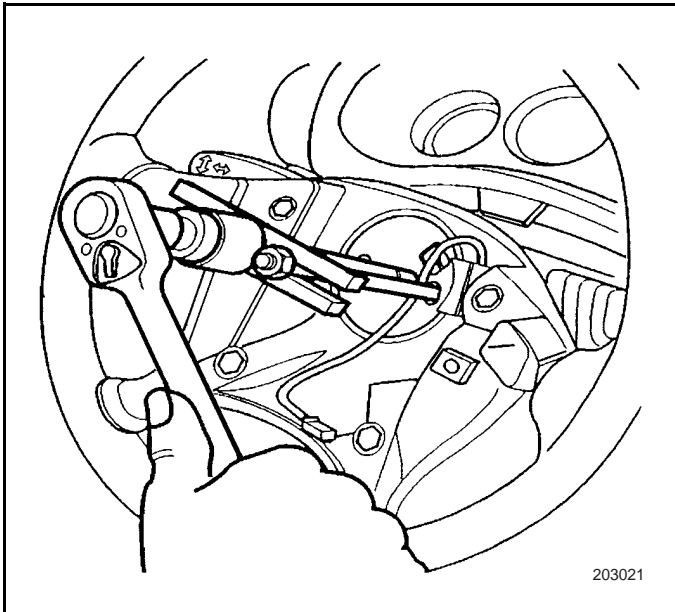
Disassembly Procedures

Tools required

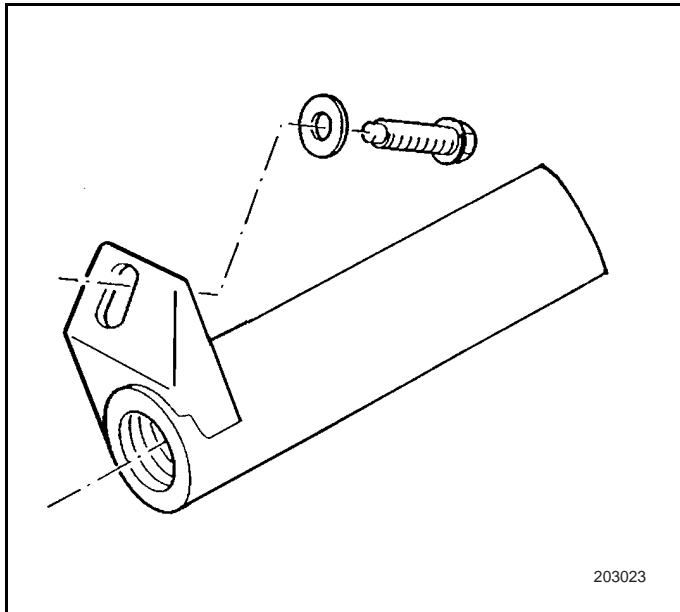
- J830901 puller

1. Keep steering mechanism at straightahead position. Use J 830901 to remove steering wheel from steering column.

Note: When installing or removing steering wheel, do not hammer the steering wheel.

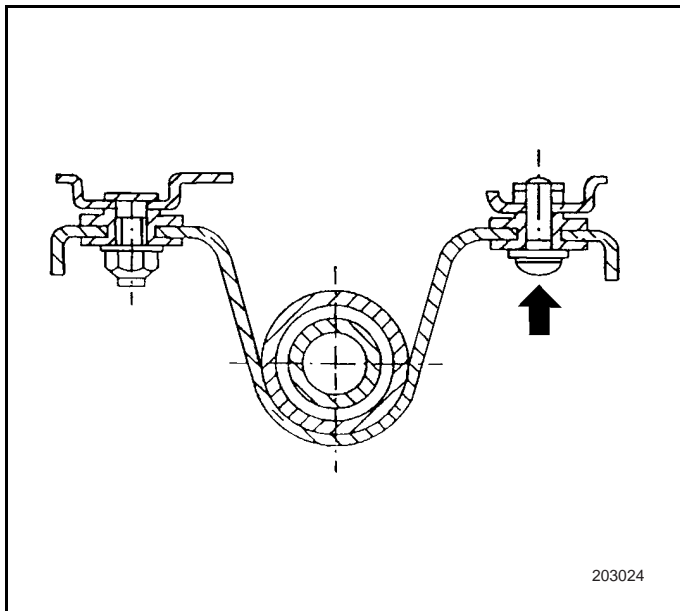


2. Loosen the bolt on upper cover cap of signal switch. Remove signal switch (left) and wiper switch (right) from their switch housing. Loosen the clamping bolt of steering shaft collar between upper and lower steering shafts (as indicated by arrow in diagram).



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3. Loosen hexagon bolt tightening steering column on its bracket.

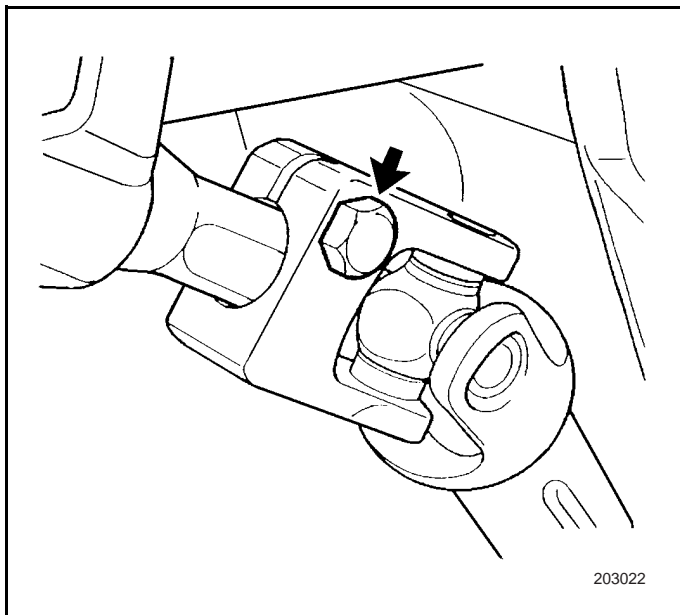


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4. Loosen the bolt with movable die block that is tightening steering column under the panel. Punch at the center of safety bolt (right arrow in figure II). Use electric screwdriver 1411 available at the market and 5mm drilling bit to drill a hole on the safety bolt. Drive the screwdriver into the hole and take out the safety bolt.
5. Remove steering column.
6. Take out the upper steering shaft from below the steering column.

Note:

- The lower guide bearing of steering shaft is a rubber bearing. Use steering shaft to carefully remove lower guide bearing.
- Steering lock should not be at the locking position 0.



Installation Procedures

1. Insert the new steering shaft into the steering column. Insert lower guide tube into rubber bearing. Press rubber bearing to the bottom.
2. Use bolts to connect the separating die block of steering column with the bracket of steering column and the lower support point of steering column with the column bracket. The head of hexagon safety bolt is nipped off. Use a new locknut on the left side.

Tightening

Tighten the separating die block and the bracket of steering column to 20-26 N•m .

Tighten the bracket of steering column and the lower support point of steering column to 20-26 N•m.

3. Insert the steering shaft collar and tighten it (arrow). Insert the harness connector of steering lock and ignition lock into contact member. Insert signal switch and wiper switch. Tighten signal switch cover cap

Tightening

Tighten the clamping bolt of steering shaft collar to 20-26N•m .

Tighten the clamping bolt of steering gear collar to 20-26N•m .

4. Install steering wheel onto the steering shaft.

Tightening

Tighten the nut of steering wheel and steering shaft to 15-25 N•m .

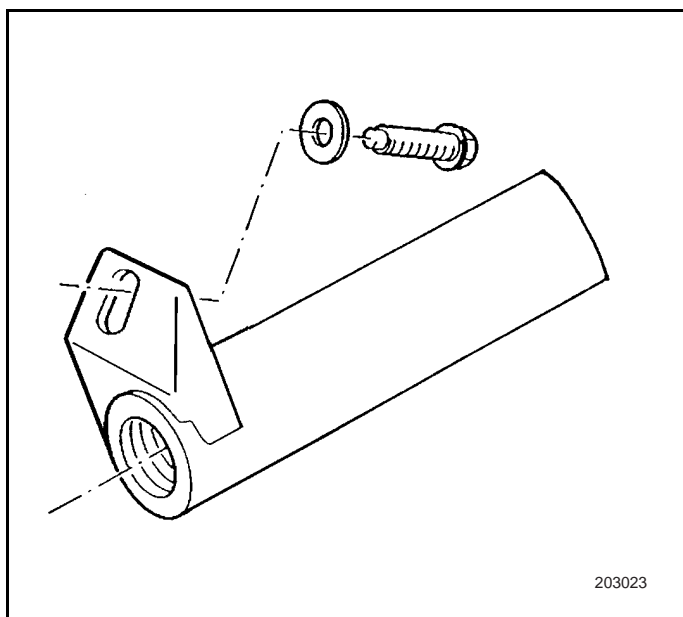
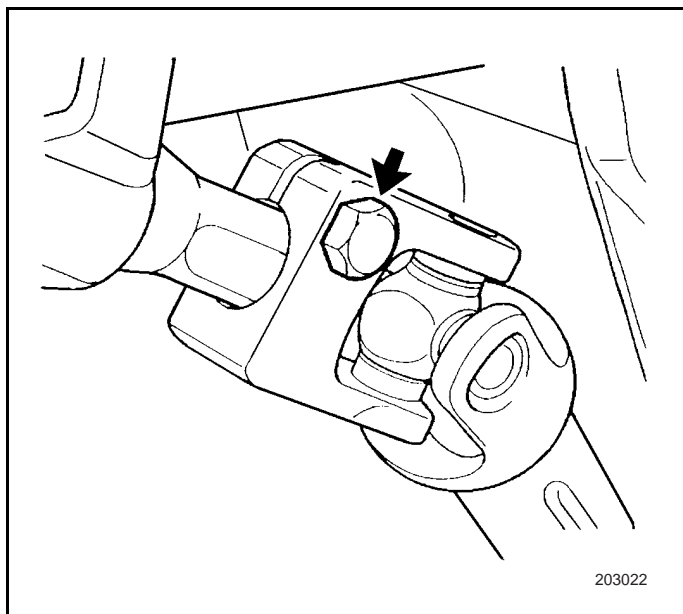
5. Inspect the straightahead position of steering mechanism, see Inspection/adjustment of Straightahead Position.

2.2.4.5 Replacement of steering column assembly

Caution: When handling safety airbag, Airbag Safety Regulations should be followed.

Disassembly procedures

1. Remove safety airbag unit and the steering wheel with it, see Replacement of Steering Wheel.
2. Loosen the clamping bolt of steering shaft collar (as indicated by arrow in diagram).



3. Loosen hexagon bolt tightening steering column on its bracket.
4. Loosen the separating die block under the panel. Punch at the center of safety bolt (on the right side). Use electric screwdriver 1411 available at the market and ϕ mm drilling bit to drill a hole on the safety bolt. Drive the screwdriver into the hole and take out the safety bolt.
5. Remove steering column.

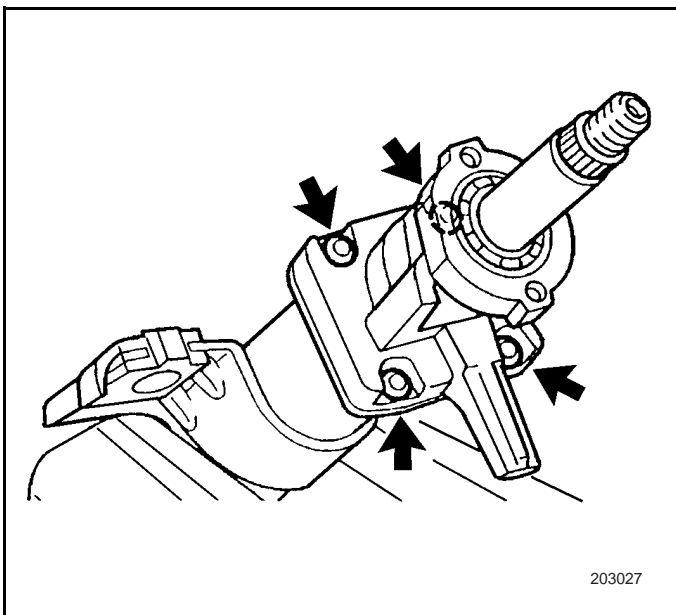
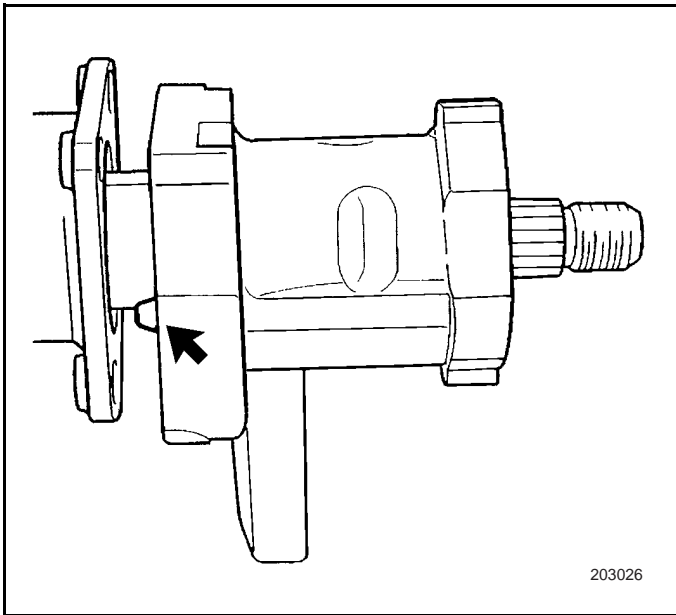
Note: Ignition lock should not be at the locking position *ì0ì*.

6. Take out the upper steering shaft from steering column. Use steering shaft to carefully remove lower guide bearing from steering column. Lower guide bearing is a needle bearing in rubber guide sleeve.
7. Remove the upper steering shaft housing with the upper guide bearing. See Replacement of Ball Bearing at the Upper End of Steering Shaft.
8. Replace the steering column.

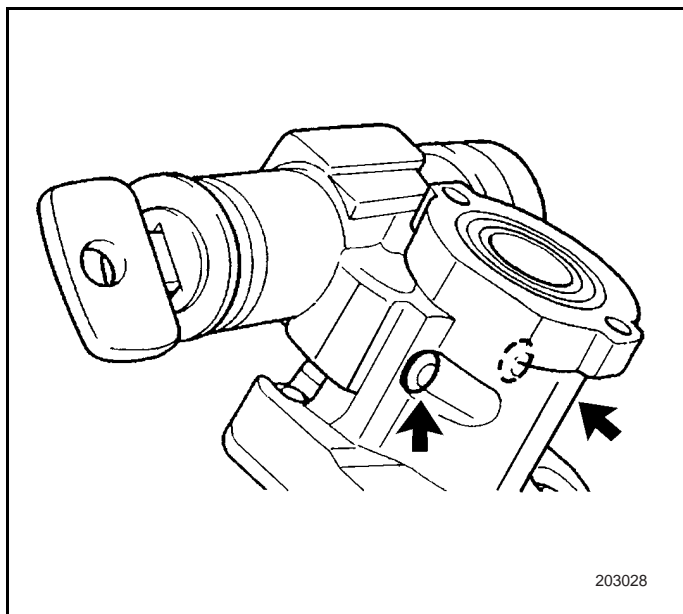
Installation procedures

1. Insert upper steering shaft housing together with upper steering shaft ball bearing into the steering column and tighten it. See Replacement of Ball Bearing at the Upper End of Steering Shaft.

Note: Pay attention to the guide lug in the housing (arrow).

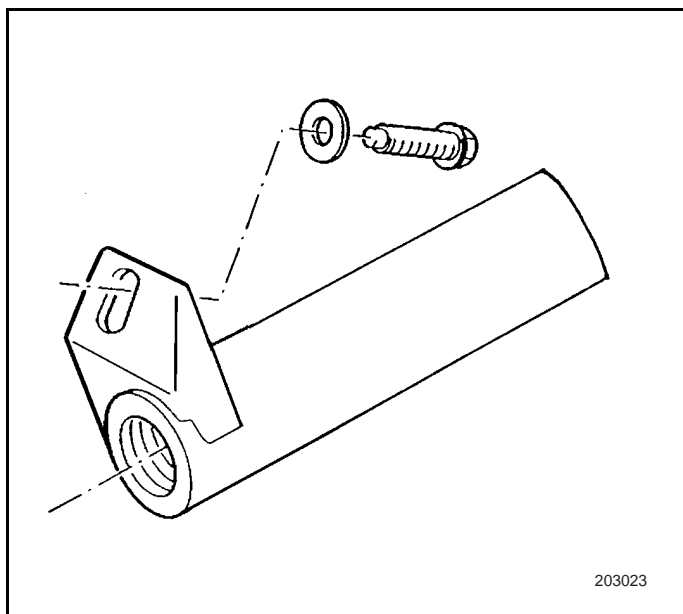


2. Use 4 safety bolts to tighten the upper steering shaft housing and the steering column. (arrow). Tighten the bolts until their heads are nipped off.

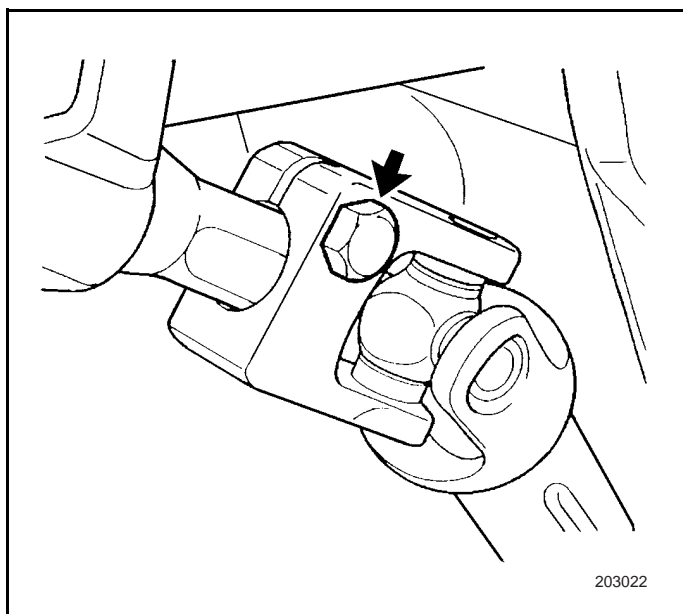


3. Use bolts to tighten the housing of ignition lock and the upper steering shaft housing. Tighten safety bolts. Hexagon heads are nipped off.
4. Insert the new steering shaft into the steering column.

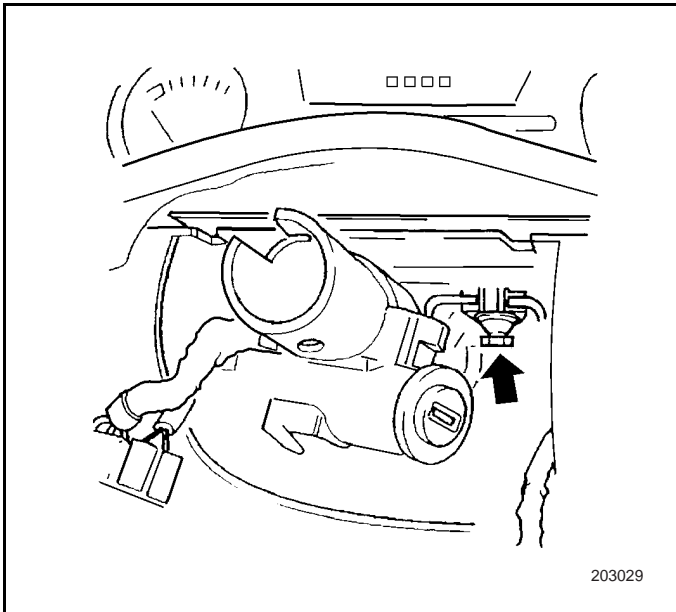
Note: Steering and ignition lock should not be at the locking position i0i.



5. Press lower guide bearing into steering column and press it to the bottom.
6. Install steering column. Screw on hexagon bolts that tighten steering column.



7. Insert steering shaft into steering shaft collar and tighten it.



8. Tighten the separating die block under the panel. Tighten the right side safety bolts until their heads are nipped off.
9. Install steering wheel with safety airbag and the safety airbag unit, see operation procedures in relevant sections.

Tightening

Tighten the clamping bolt of steering shaft collar to 20-26N•m .

Tighten the clamping bolt of steering gear collar to 20-26N•m .

Tighten the separating die block and the bracket of steering column to 20-26N•m .

Tighten the bracket of steering column and the lower support point of steering column to 20-26 N•m.

Tighten the nut of steering wheel and steering shaft to 15-25 N•m .

10. Inspect the straightahead position of steering mechanism, see Inspection/Adjustment of Straight Ahead Position in Power Steering System.

2.2.5 Explanation and Operation

2.2.5.1 Explanation of Steering Wheel and Steering Column

Components of steering column are to fulfill functions other than steering. The following components on steering column will fulfill functions described below:

1. Steering column

Steering column absorbs energy. When central collision occurs, steering column will contract to reduce the probability of injuring the driver.

2. Ignition switch and steering lock on steering column

Ignition and steering can be locked to prevent vehicles with ignition switch and steering lock mounted on steering column be stolen.

3. Multifunction

Multifunction control rod controls the following components:

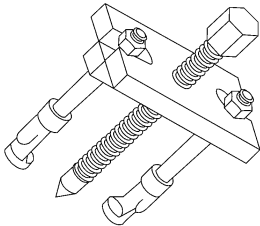
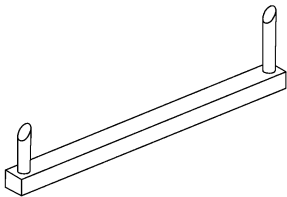
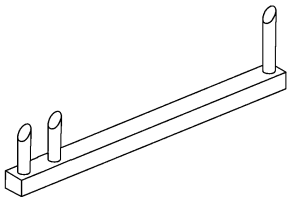
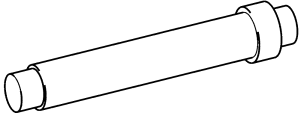
- Traffic beam of front headlight
- Windscreen wiper and cleaner

Disassembly and reinstallation of steering column is simple. Use specified screw threads, bolts and nuts to ensure energy absorption function. Care should be taken when handling steering column after it has been removed from the vehicle.

Plastic will retain the rigidity of steering column and it is likely to be nipped off or become loose under the following conditions:

1. The steering wheel extractor that has been used is not the one recommended.
2. The end of steering shaft has experienced severe bumping.
3. An object is reclining on the steering column.
4. Steering column falls off.

2.2.6 Special Tools

Graphics	Tool identification/ description
 <small>J-830901</small>	J-830901 Puller (used to remove steering wheel)
 <small>S-9409202</small>	S-9409202 Detector(used to inspect the straight ahead position of manual steering gear)
 <small>KM-551-A</small>	KM-551-A Detector (used to inspect the straightahead position of power steering gear)
 <small>KM-108</small>	KM-108 (Disassembly/ Installation Rove Iron 86)

Blank

3

Suspension system

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Blank

3.1 Wheel alignment

3.1.1 Specifications

3.1.1.1 Setting angle (with no load)

Specifications of vehicle in production process and with no load

Front wheel alignment	Specifications
Camber	-0.27 ± 0.50
Caster	1.85 ± 0.50
* Gather ¹⁾	-0.33 ± 0.17

Rear wheel alignment	Specifications
Camber ²⁾	-1.50 ± 0.50
* Gather ^{1) 2)}	$-0.30 \text{ To } +0.10$
Total gather	$-0.40 \text{ To } +0.40$

*Total quality (with no load on the seat)

Maximum difference between Rv and Rh is 10mm.

- 1) Positive value = gather, negative value = toe-out
- 2) Predetermined values have been set in production process. No adjustment can be made in maintenance process.

Note:

Rv - distance between the peak of front (body) wheel cap and the ground.

Rh - distance between the peak of rear (body) wheel cap and the ground.

3.1.2 Inspection of wheel alignment

Note:

- Before inspecting wheel alignment, first inspect:
 - Status of tyres;
 - Calibrate tyres under maximum load. See specifications of tyre and wheel for authorized pressure.
 - Status of outer felloe of the wheel;
 - Free play between globe joint and steering knuckle tie rod.
- Fuel tank should be half full.

3.1.2.1 Camber

Camber is unadjustable; its inspection value is: -0.27 ± 0.50 .

There should be a maximum tolerance of 1° between the left and the right wheels.

Adjustment

In the course of repair, camber angle can be adjusted by changing the size of connecting hole.

1. Remove shock absorbing strut. See replacement of shock absorbing strut for related operations.
2. Enlarge lower fastening hole (see Figure 301008).
 - 1 : $0.8 \pm 0.1 \text{ mm}$
 - 2 : $\phi 12.05 \text{ mm}$
3. Move steering knuckle from central position toward X or Y direction, a camber angle of $0^\circ 50'$ will be obtained.
4. Install shock absorbing strut. See replacement of shock absorbing strut for related operations.

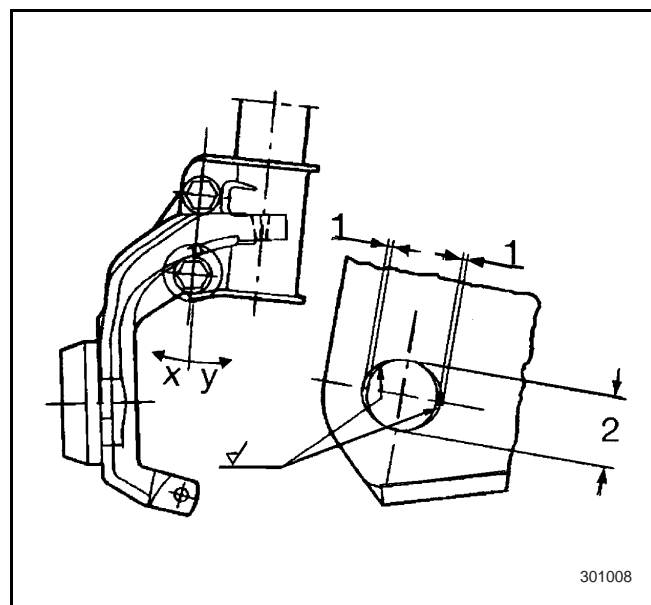
Note: Only after adjusting the camber angle of wheels can the connecting bolt of shock absorbing strut and the steering knuckle be tightened.

Installation

Install front wheel. See Replacement of Wheel.

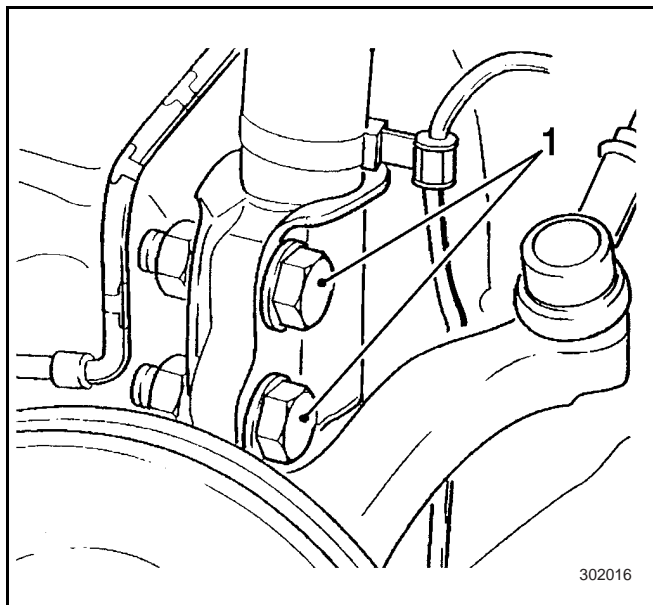
Measurement

Measure camber angle on a test board. See camber, caster and gather for related operations.

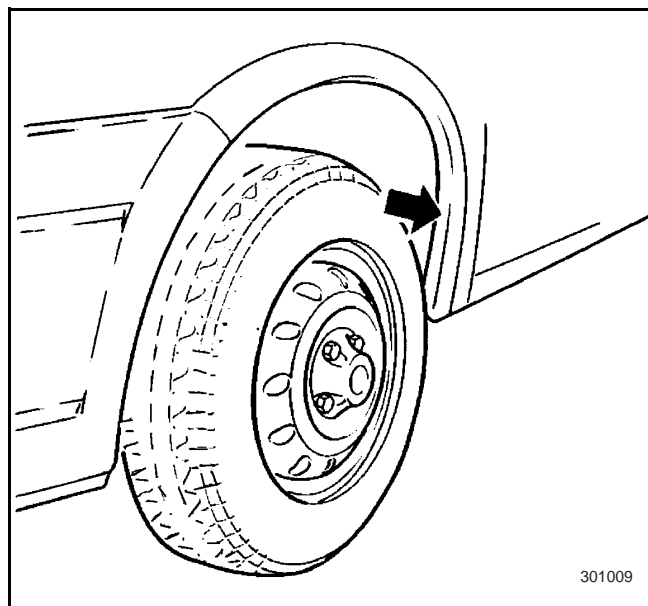


Adjustment

1. Raise the vehicle at the foreside, relevant wheels should be unrestricted.
2. Loosen the bolt (1) of shock absorbing strut and steering knuckle. Every time the bolt is screwed off, it must be replaced.



3. At the peak of the wheel, pull the front wheel outward and set it at the maximum camber angle (see indication of arrow in Figure 301009).
4. To clamp shock absorbing strut and steering knuckle, tighten the bolt to 10 N•m.
5. Lower the vehicle slowly, the camber angle will change in the negative direction.
6. After the normal value has been reached, tighten the bolt to 90 N•m, and change 45 °To 60° .
7. Compress the carriage spring for several times and inspect the change of camber angle.



3.1.2.2Caster

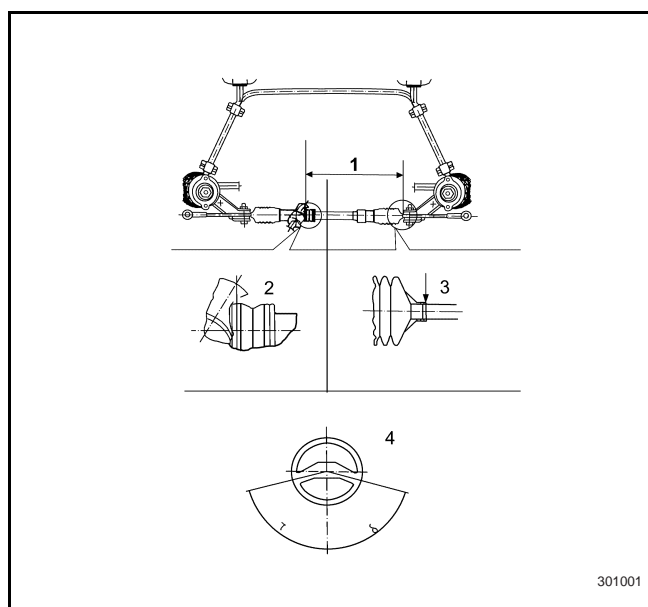
Caster is unadjustable; its inspection value is: $1.85^{\circ} \pm 0.5^{\circ}$.

3.1.2.3 Gather

Gather should be in the following range: $-0.33^{\circ} \pm 0.17^{\circ}$.

Measurement

Set reference dimension at straightahead position $1=404 \pm 3\text{mm}$ ($435 \pm 2\text{mm}$)¹⁾. For this end, insert measuring tool KM-551-A or KM-551-1 together with KM-551-2¹⁾ inbetween the fastening shoulder (2) of left steering housing and the seat of right dust cap (see the graphics).



Use a steering wheel limiter available in the market to set the steering wheel at straightahead position.

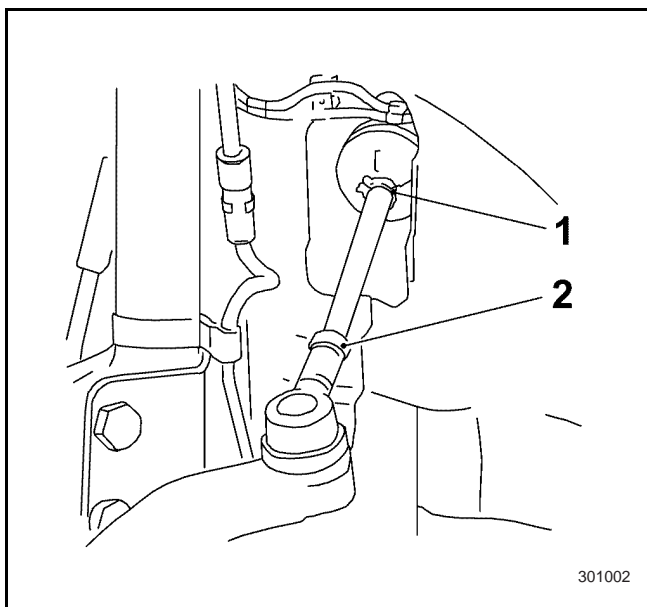
Note: The steering wheel should be at the central position $\pm 5^\circ$, and the bolt of lower clamping flange of steering shaft should be level.

If deviation between the position of steering wheel and the central position of steering wheel is greater than $\pm 5^\circ$, then the steering wheel should be reverted to straightahead position - see alignment of central position of steering wheel (for vehicles with safety airbag) .

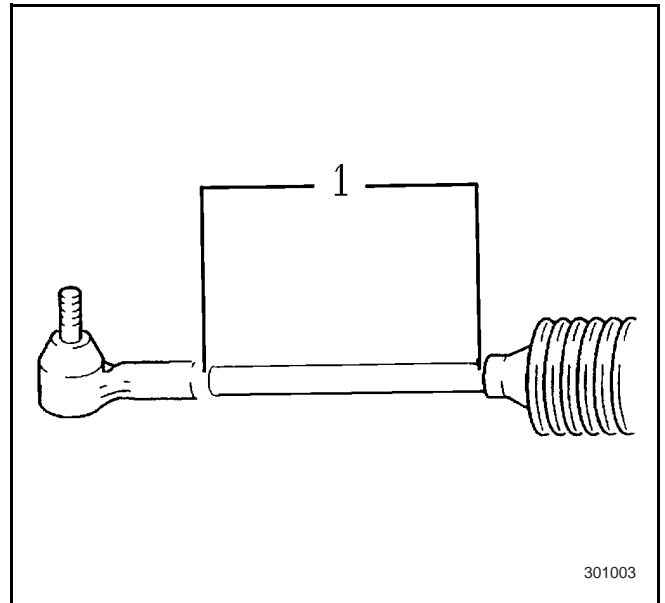
Subscript ¹⁾: for vehicles with power steering.

Adjustment

Remove clamping collar (1) from folded hood. Loosen locknut (2). Adjust gather value by turning steering knuckle tie rod.



Nominal value - when adjusting and inspecting gather value, dimension (1) between the should of dust cap and the lock nut should be retained (see graphics) $174 \pm 6\text{mm}$ ($163 \pm 6\text{mm}$) ¹⁾. Adjust total gather by adjusting one by one the gathers on the left side and the right side.



Adjustment

Retighten the lock nut - tightening torque $50\text{N}\cdot\text{m}$. Remove distortion caused by folded dust cap and replace the clamping collar.

Subscript ¹⁾: for vehicles with hydraulic power steering.

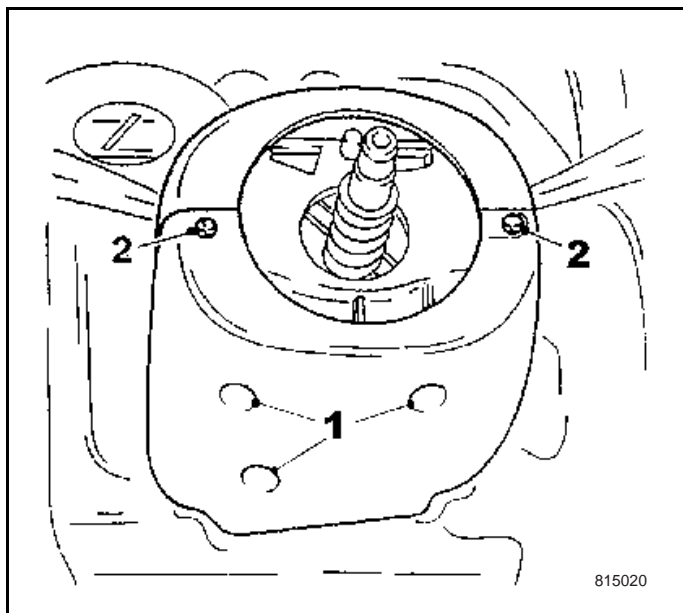
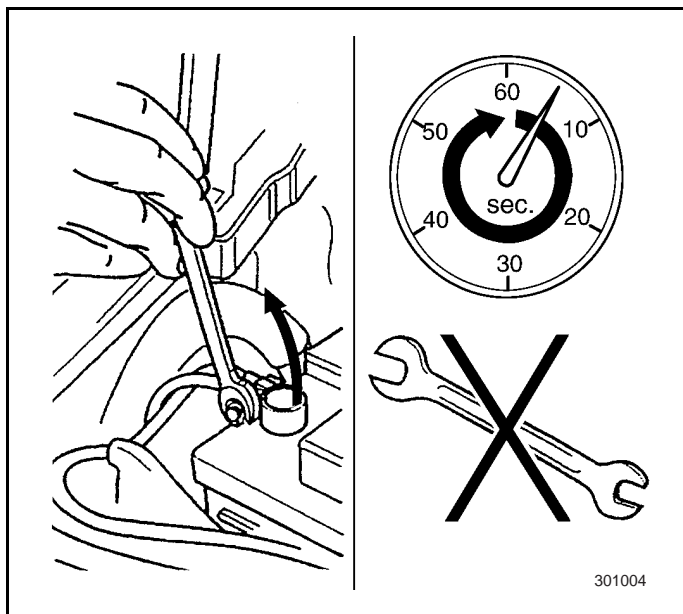
3.1.3 Repair guidance

3.1.3.1 Alignment of steering wheel at central position

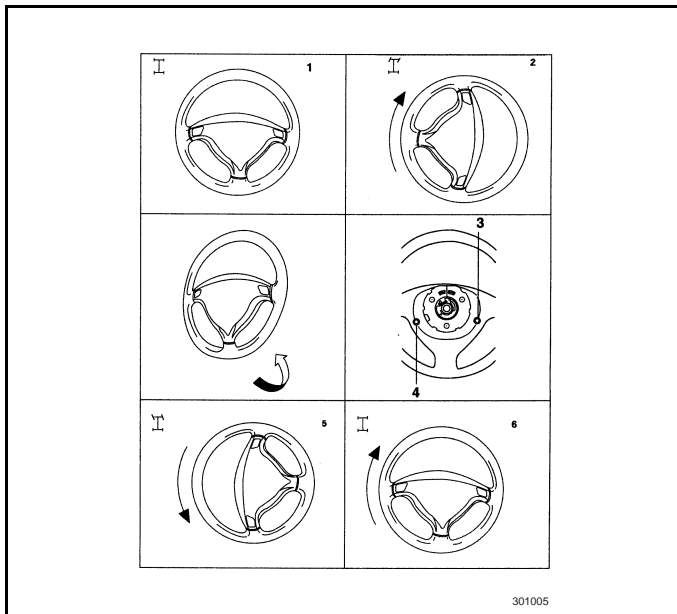
Caution: When handling safety airbag system, airbag safety regulations should be followed.

Disassembly procedures

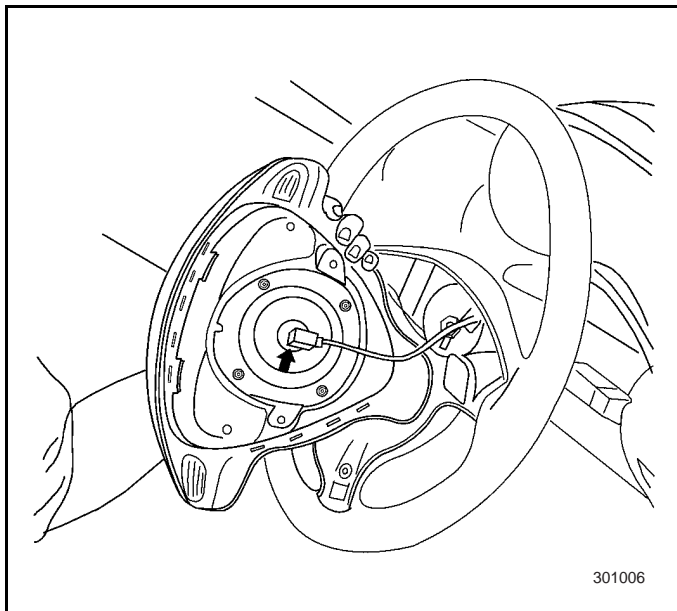
1. Disconnect the earth wire of battery and cover the negative pole.



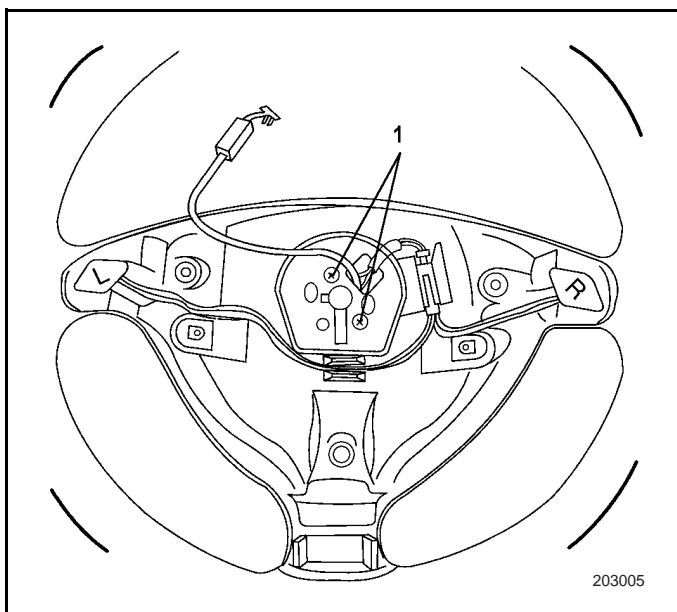
2. Wait one minute before starting operation until condenser discharge is completed.
3. Remove signal control board. Loosen binding bolt (1) and (2).
4. The right graphic representation is a signal control board with steering wheel removed.



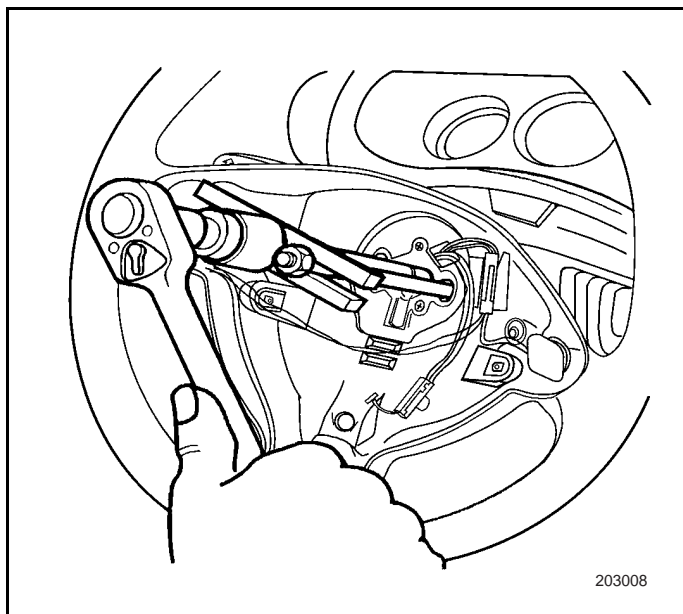
5. Turn the steering wheel rightwards from straightahead position (1) to 90°(2).
6. Remove upper bolt (3) of safety airbag unit from the rear side of steering wheel.
7. Turn the steering wheel backward to 180°(5).
8. Then remove the second upper bolt (4) of safety airbag unit from the rear side of steering wheel.
9. Set the steering wheel at straightahead position (6).



10. Carefully lift safety airbag unit and draw down harness connector from the safety airbag unit (arrow). Remove safety airbag unit from steering wheel. Set safety airbag unit aside, with the side with gasket upward.



11. Set steering mechanisms at straightahead position, see inspection/adjustment of straightahead position.
12. Loosen the two bolts (1) on the coil of safety airbag.
13. Bend the locking plate of steering wheel clamp nut and remove the clamp nut.

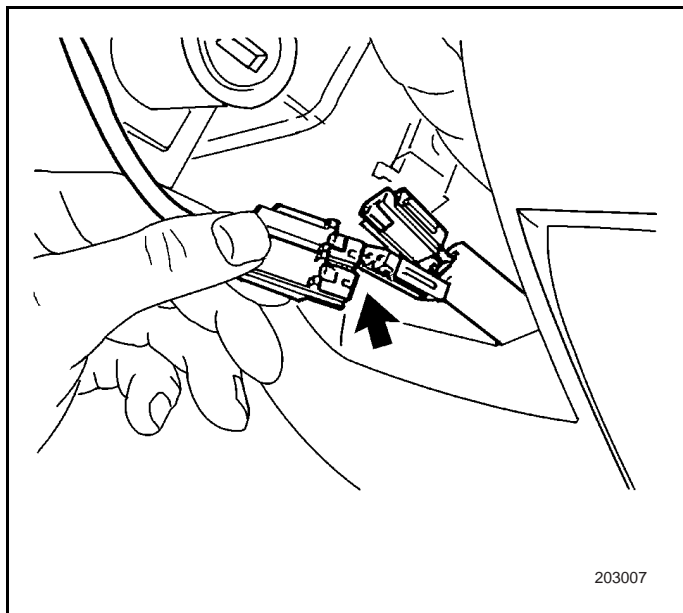


203008

14. Remove harness connector of the horn from the groove of steering wheel.

15. Use steering wheel puller J 830901 to pull the steering wheel out of the spline of steering shaft.

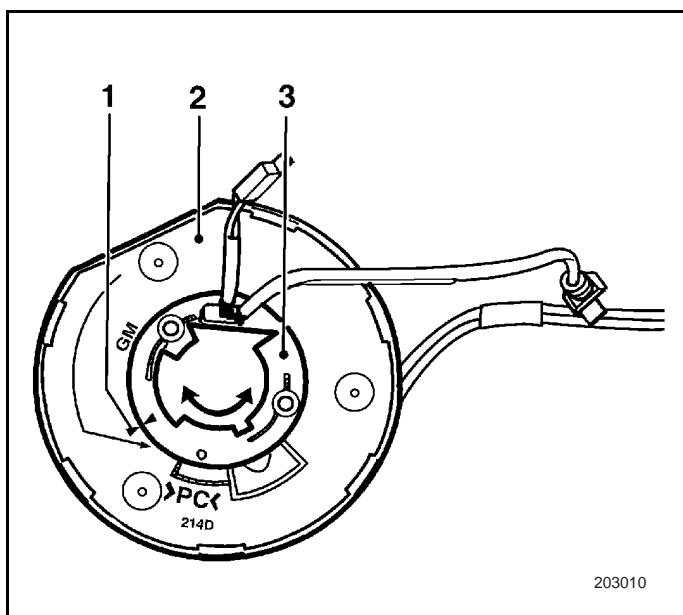
Notice: Don't cause damage to safety airbag coil.



203007

16. Pull out harness connector (arrow in diagram) of the safety airbag from the bracket of steering column.

17. Remove the coil of safety airbag from steering shaft.



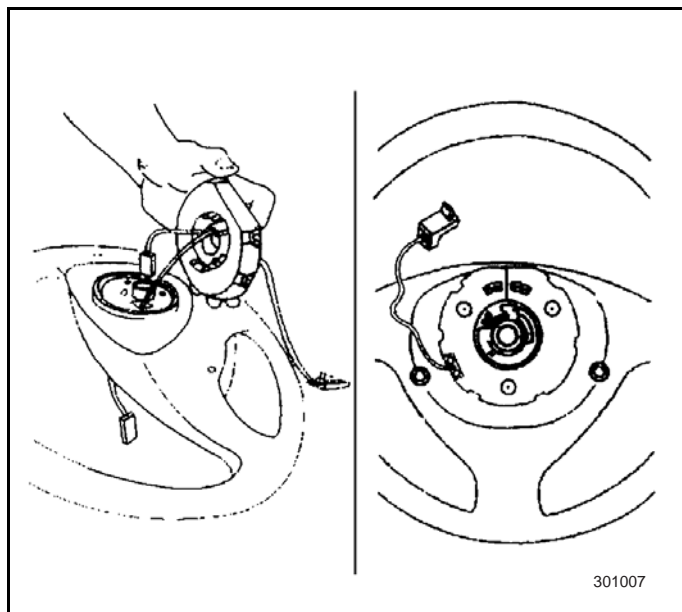
203010

Installation procedures

Determine the central position of the coil of safety airbag.

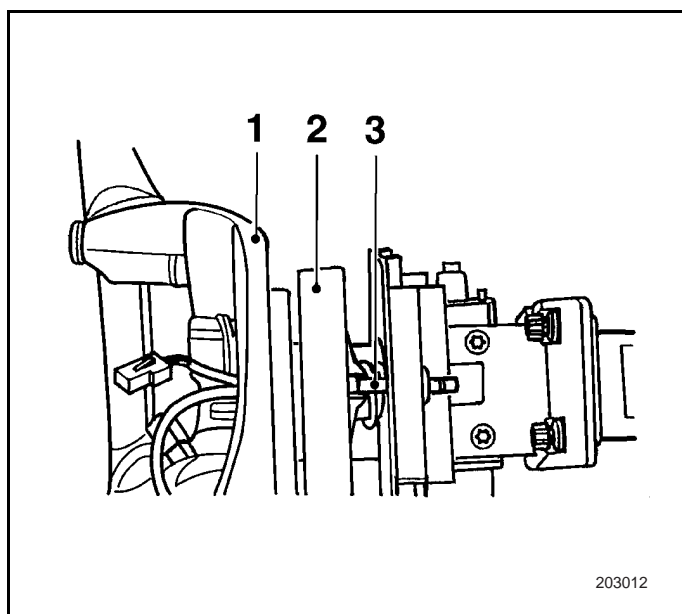
Turn bearer (3) of the coil of safety airbag (2) leftwards until greater resistance can be clearly felt, then turn backwards about two and a half turns until it is aligned with arrow (1).

Note: Don't turn too much, otherwise the spring of contact devices will be damaged.

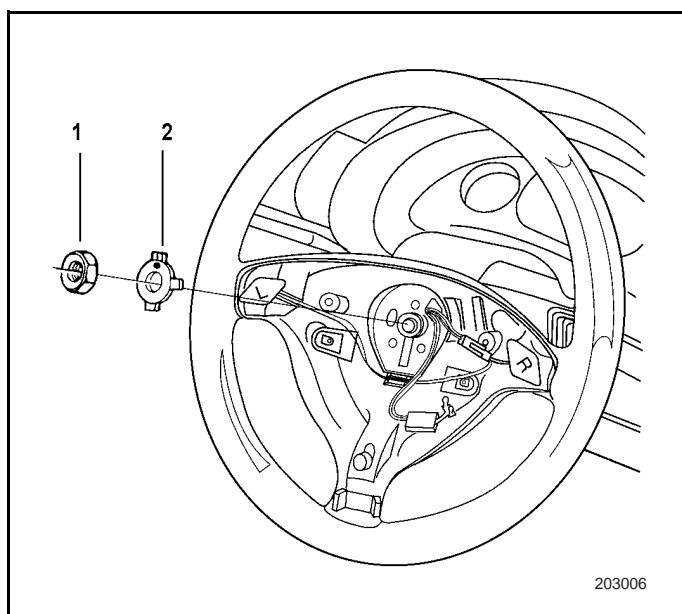


1. Put harness connector of the horn and the safety airbag through the opening of steering wheel.
2. Screw on the bolt tightening the safety airbag coil and the steering wheel.

Note: Ensure steering mechanisms are at straightahead position, see inspection/adjustment of straightahead position.



3. Put steering wheel (1) together with safety airbag coil (2) onto the steering shaft.
4. The anchor pin of signal switch(3) must fit the guiding device of the safety airbag coil.

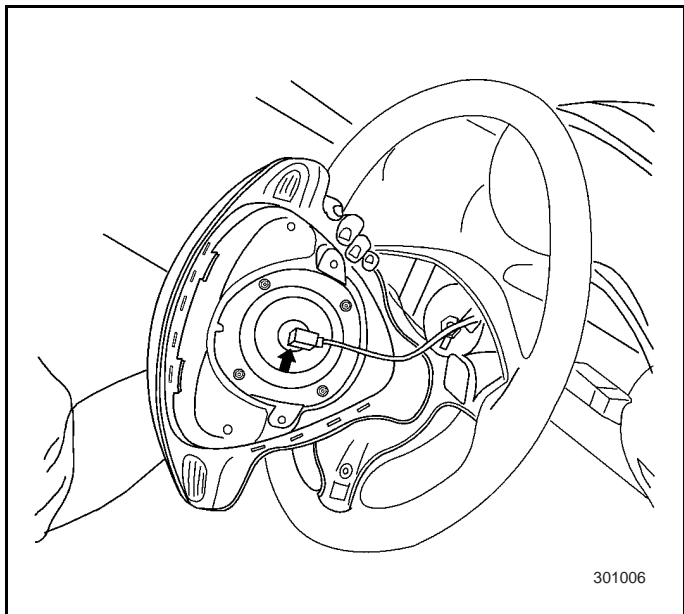


5. Press steering wheel into steering shaft with the opposite force of spring force. Alignment of locking plate(2).

Tightening

Tighten steering wheel and steering shaft to 25 N•m .

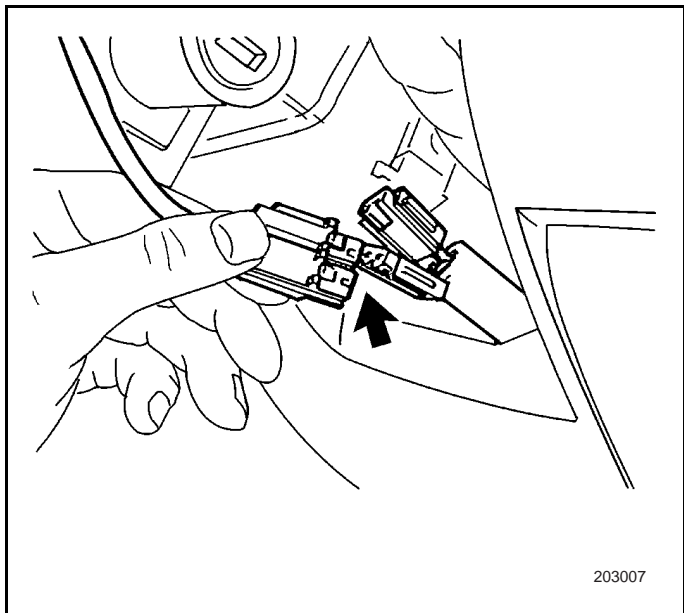
6. Connect harness connector of the horn and the coil of safety airbag and insert it into the groove.
7. Lock the clamping nut of steering wheel with a locking plate.



8. Connect harness connector with safety airbag unit, and install safety airbag unit onto the steering wheel.

Tightening

Tighten safety airbag unit to the steering wheel until 8 N•m.



9. Connect the safety airbag unit with harness connector of the horn, and integrate it with the bracket on steering column.
10. Install signal control board.
11. Connect earth wire of the battery.

3.2 Front suspension

3.2.1 Specifications

Applications	Metric system
Drive shaft and front hub	1)
Brake backing plate and steering knuckle	4 N•M
Brake tongs and steering knuckle	95 N•M
Brake disc and wheel hub	4 N•M
Wheel speed sensor and steering knuckle (for vehicles with ABS)	8 N•M
Front shock absorbing strut and steering knuckle	2)
Lower globe joint and steering knuckle	30 N•M
Lower control arm and body	60 N•M
End of steering knuckle tie rod and steering knuckle	45 N•M
Clamping collar of stabilizer bar and tie bar	20 N•M
Front shock absorbing strut and the dome of it	30 N•M
Bracket of shock absorbing strut and piston rod of shock absorber	60 N•M
Tie bar and tie bar bracket	90 N•M
Tie bar and lower globe joint and lower control arm	3)
Tie bar bracket and front cross rail	4)

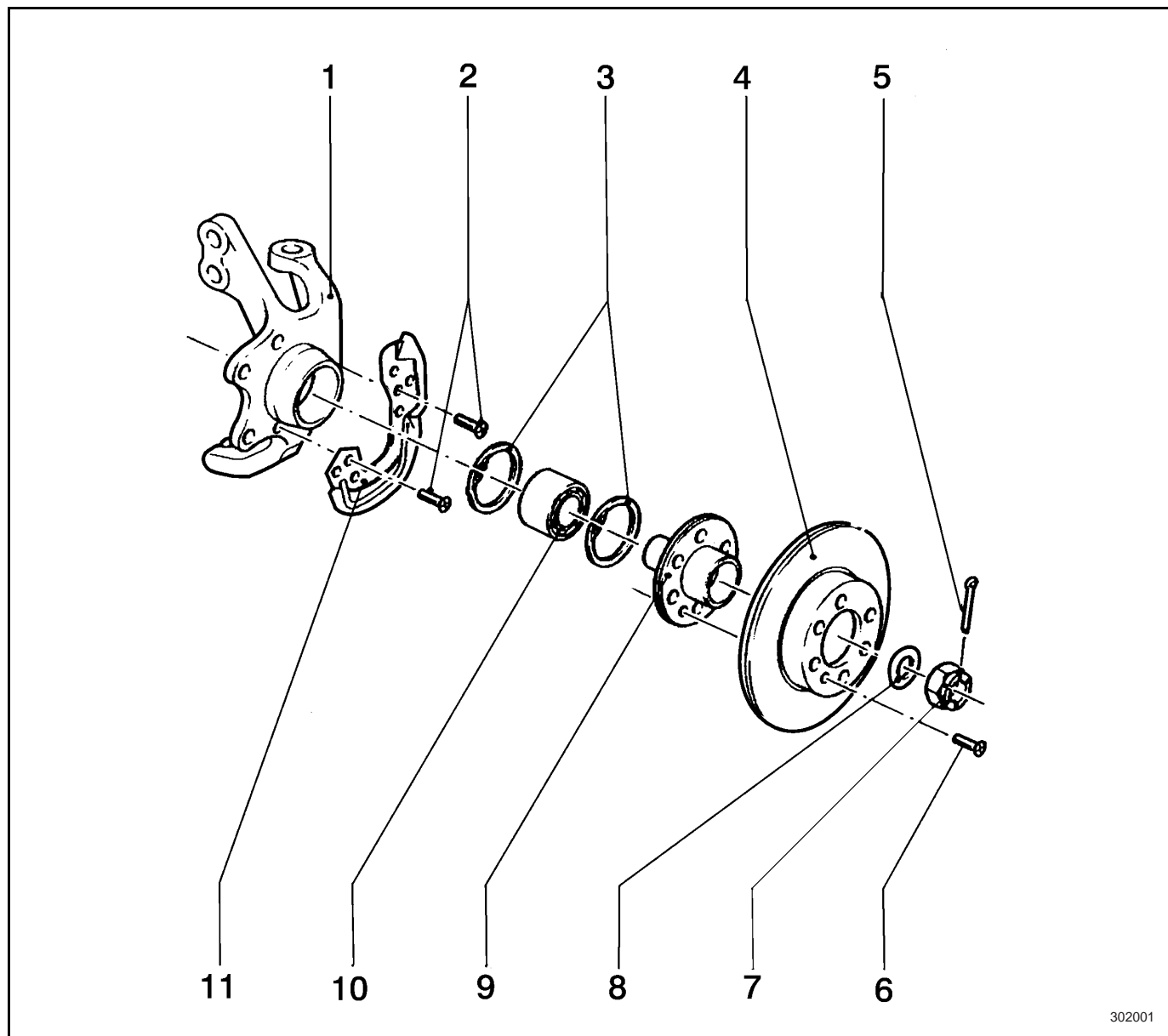
Every time a binding bolt subjected to yield limit is loosened in the process of screw fastening, it should be replaced.

1. Pretighten to 100 N•M. Loosen capstan nut. Then tighten to 20 N•M and turn 90°. If the hole of cotter pin can not align with the capstan nut, loosen it and return to the next hole, and use the cotter pin to fasten it.
2. Pretighten to 50 N•M. Then tighten to 90 N•M and turn 45° to 60°.
3. Then tighten to 90 N•M and turn 30° to 45°.
4. Tighten to 50 N•M and turn 90° to 105°.

3.2.2 Visual Identification

3.2.2.1 Exploded view

Front hub, front drive shaft bearing

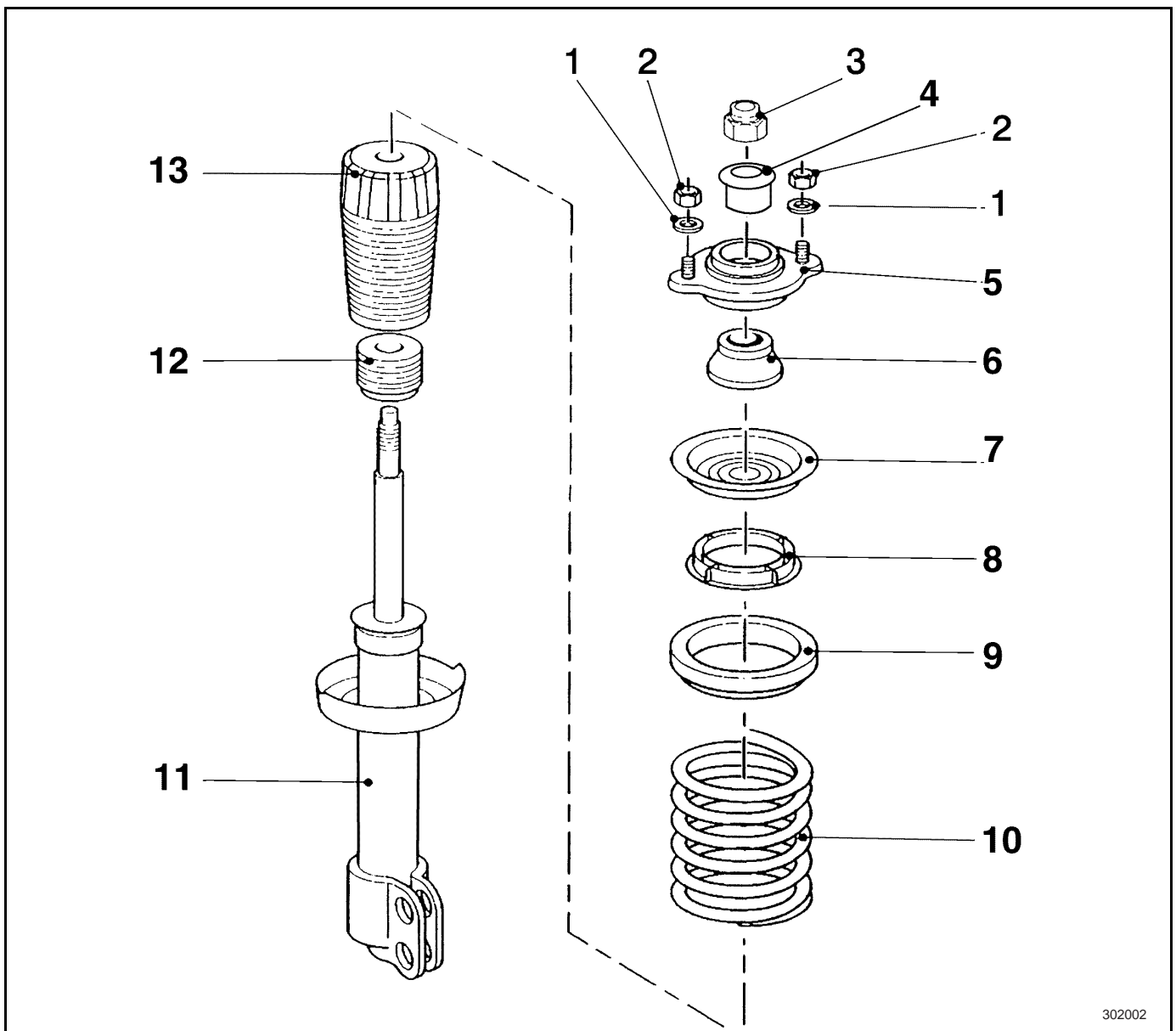


302001

Legend

- | | |
|--------------------------|--------------------------|
| (1) Steering knuckle | (7) Capstan nut |
| (2) Bolt | (8) Gasket |
| (3) Shackles for springs | (9) Wheel hub |
| (4) Brake disc | (10) Bearing |
| (5) Cotter pin | (11) Brake backing plate |
| (6) Bolt | |

Assembly of front shock absorber

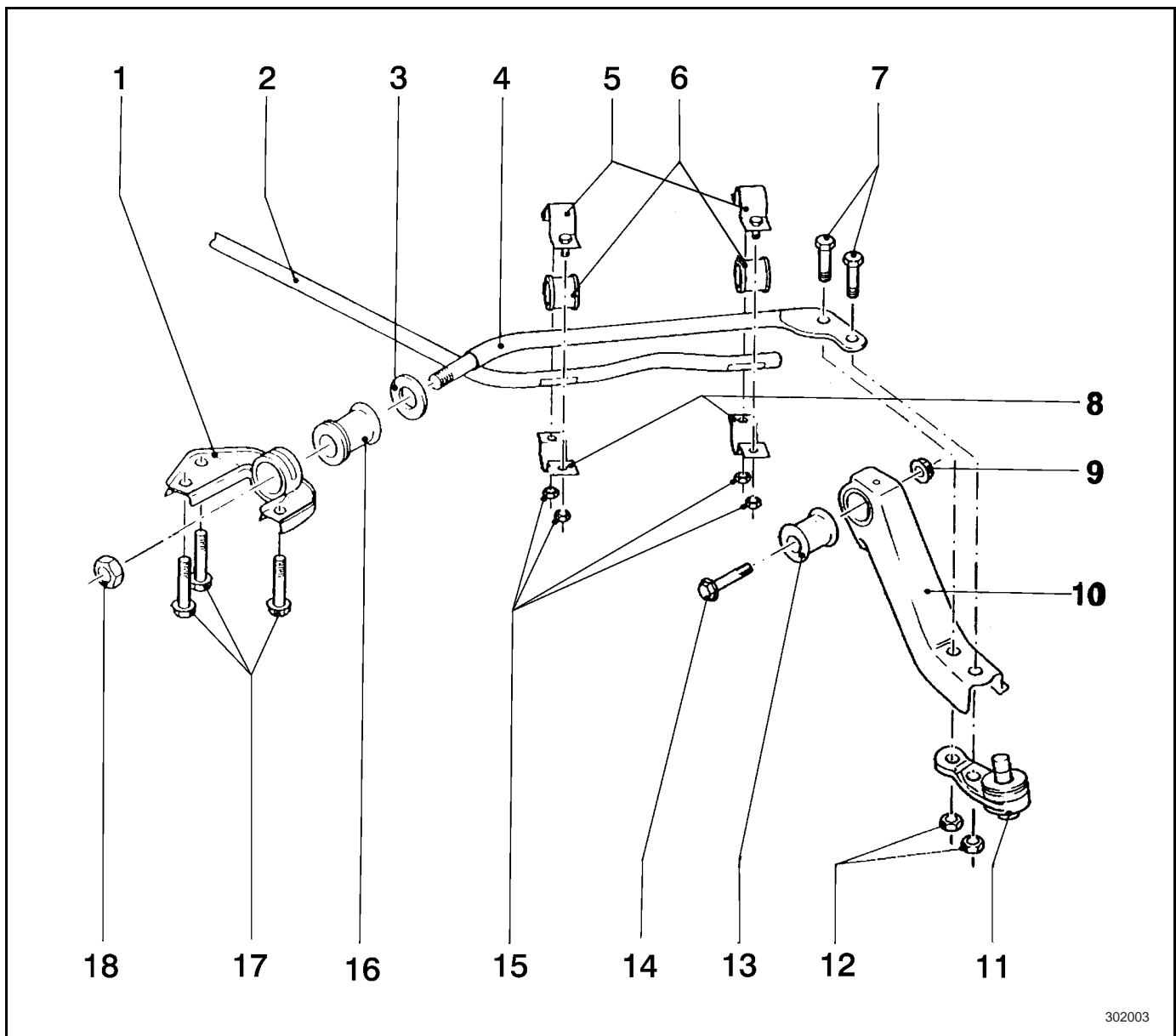


302002

Legend

- | | |
|---------------------------------------|-------------------------------|
| (1) Gasket | (8) Thrust collar |
| (2) lock nut | (9) Vibration isolation block |
| (3) Lock nut | (10) Spring |
| (4) Stopper | (11) Shock absorbing strut |
| (5) Footstep of shock absorbing strut | (12) Buffer block |
| (6) Spacer | (13) Dust cap |
| (7) Spring seat with bearing | |

Stabilizer bar, control arm and tie bar



302003

Legend

- | | |
|-------------------------------|------------------------------|
| (1) Bracket of tie bar | (10) Control arm |
| (2) Stabilizer bar | (11) Globe joint |
| (3) Gasket | (12) Nut |
| (4) Tie bar | (13) Bush of control arm |
| (5) Upper clamping collar | (14) Bolt |
| (6) Vibration isolation block | (15) Lock nut |
| (7) Bolt | (16) Bush of tie bar bracket |
| (8) Lower clamping collar | (17) Bolt |
| (9) Nut | (18) Lock nut |

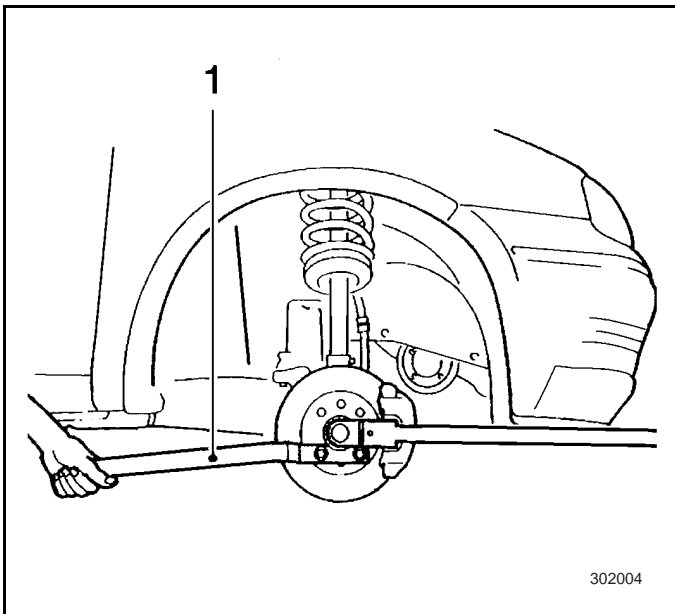
3.2.3 Repair guidance

3.2.3.1 Replacement of front drive shaft bearing

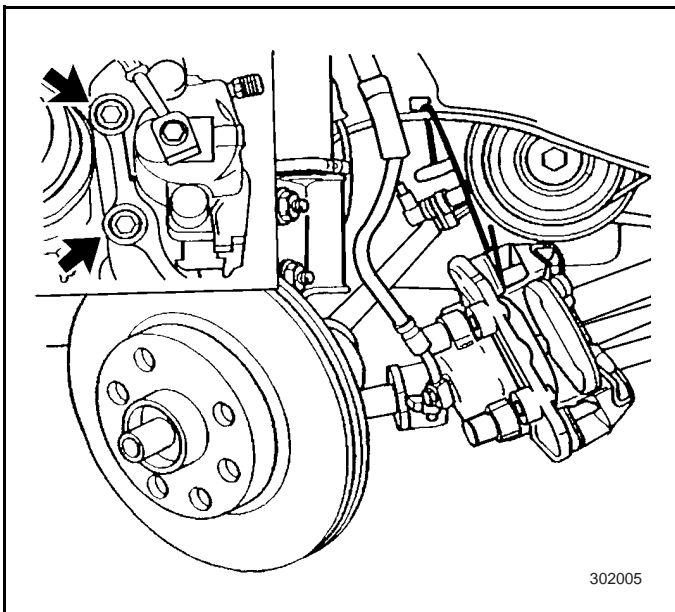
Disassembly procedures

Tools required

- KM-466-A Puller/installer
- J - 810300 Support wrench
- J-810902 puller

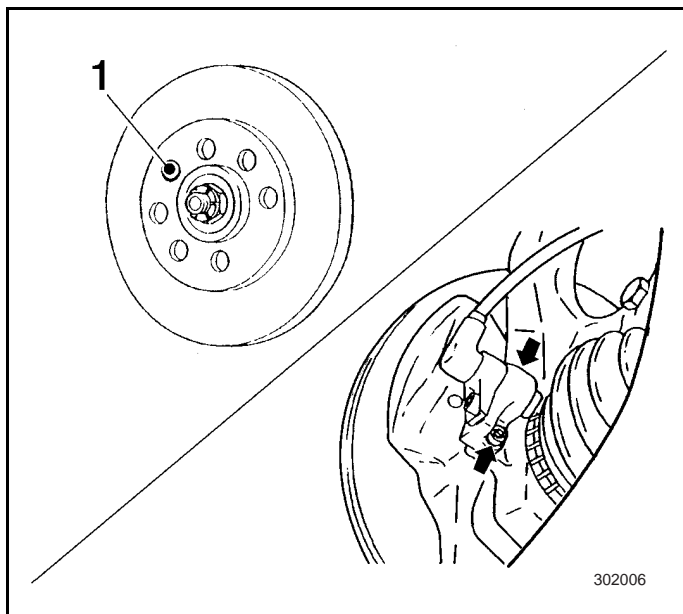


1. Use a bolt to connect J-810300 (1) with the wheel hub.
2. Use it as a support to loosen bolts on the wheel.
3. Use the wheel hub as reference to make alignment.
4. Remove the bolt with cotter pin from the capstan nut.
5. Remove the capstan nut.

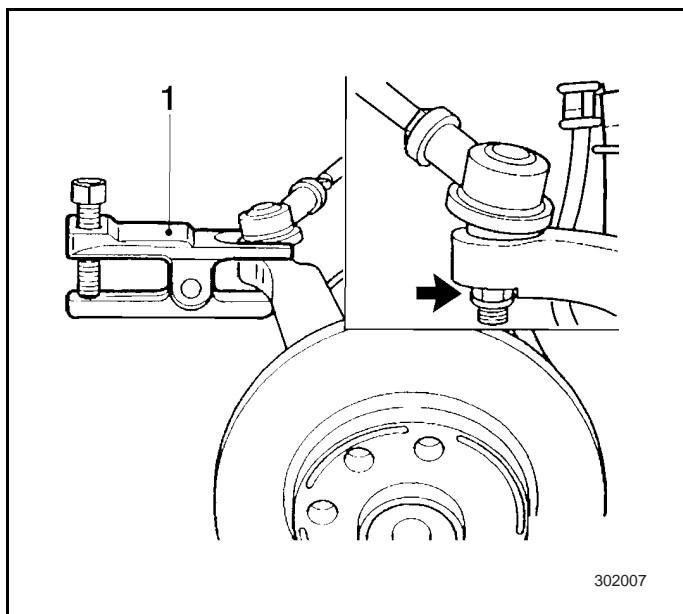


6. Remove the bolt connecting brake tongs and steering knuckle (shown by arrow).
7. Overhang the brake tongs in the arch of the wheel.

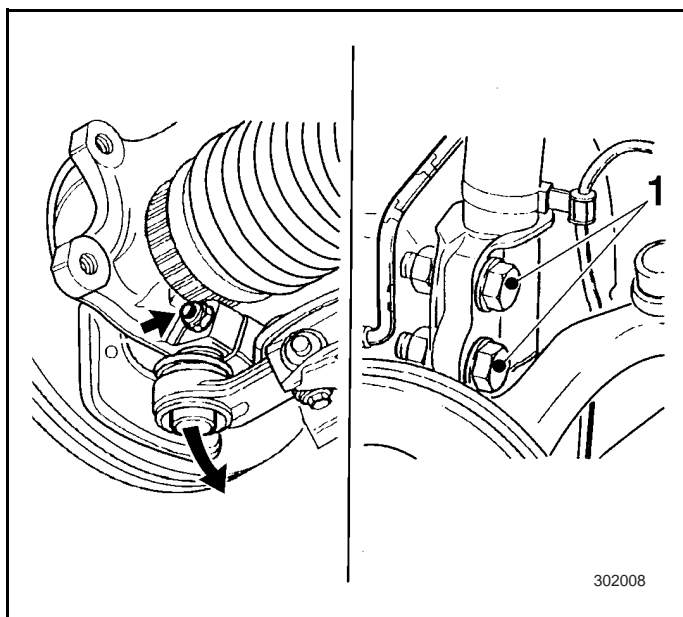
Note: Keep hydraulic brake system turned off.



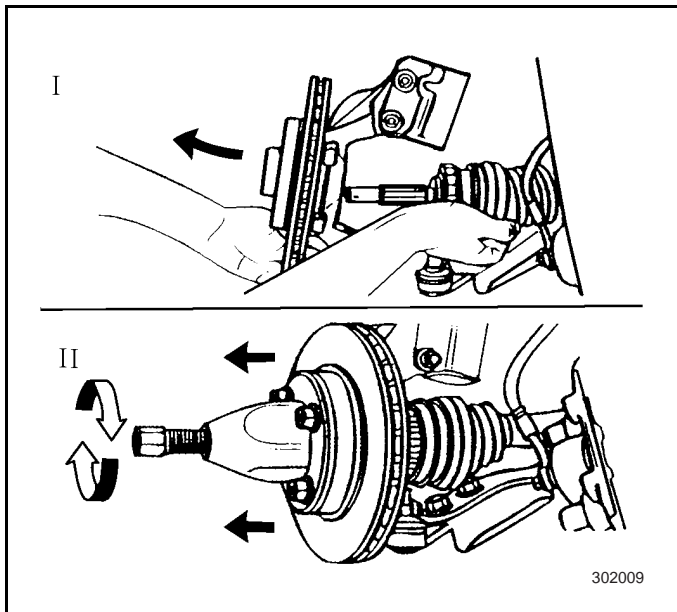
8. Remove check bolt (1) connecting brake disc and wheel hub.
9. Remove brake disc.
10. Remove the bolt connecting wheel speed sensor and steering knuckle (shown by arrow). (for vehicles with ABS).



11. Remove the nut on the end of steering knuckle tie rod (as shown by arrow).
12. Use J-810902 (1) to press the end out of the steering knuckle.

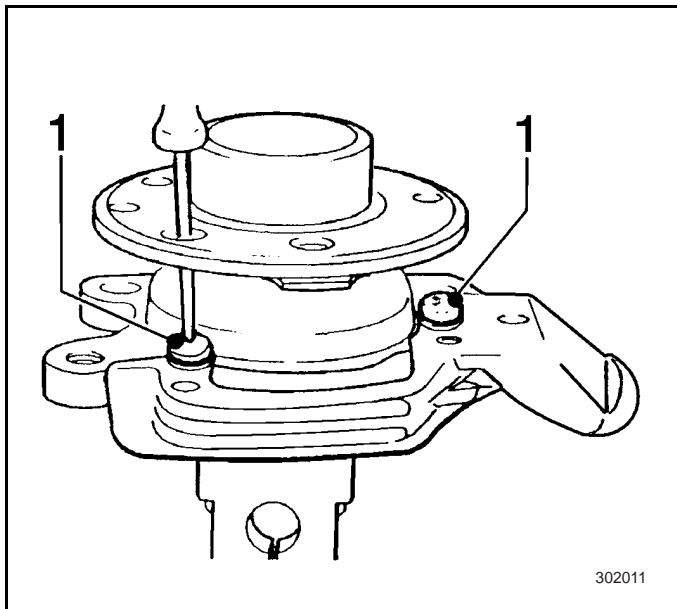


13. Remove the bolt connecting globe joint and steering knuckle (upper arrow).
14. Remove globe joint.
15. Remove bolt(1) connecting steering knuckle and shock absorbing strut.

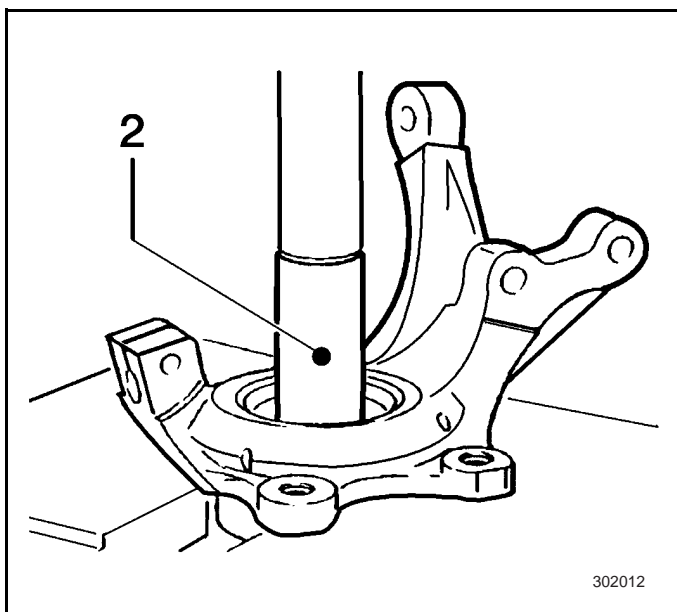


16. Remove the whole steering knuckle from the drive shaft (Figure I). If necessary, use wheel hub removal tool available in the market to press steering knuckle out of the driving shaft (Figure I).

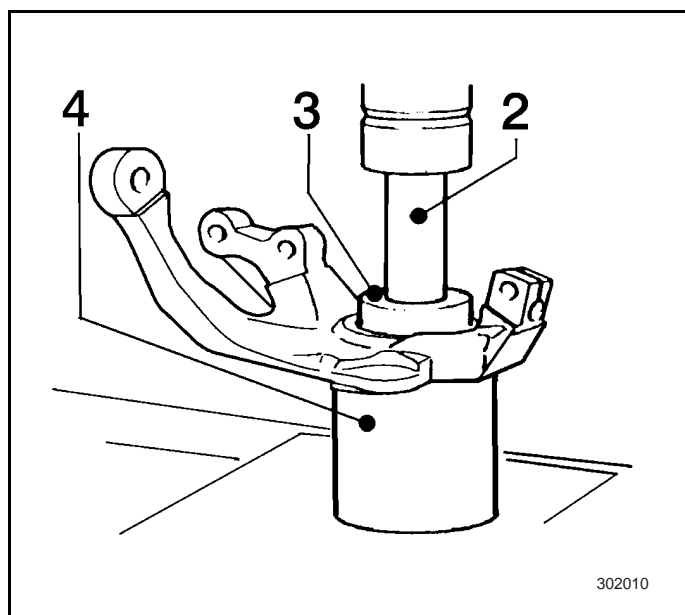
Note: Overhang drive shaft to protect the connector.



17. Loosen bolt(1), then remove brake backing plate.

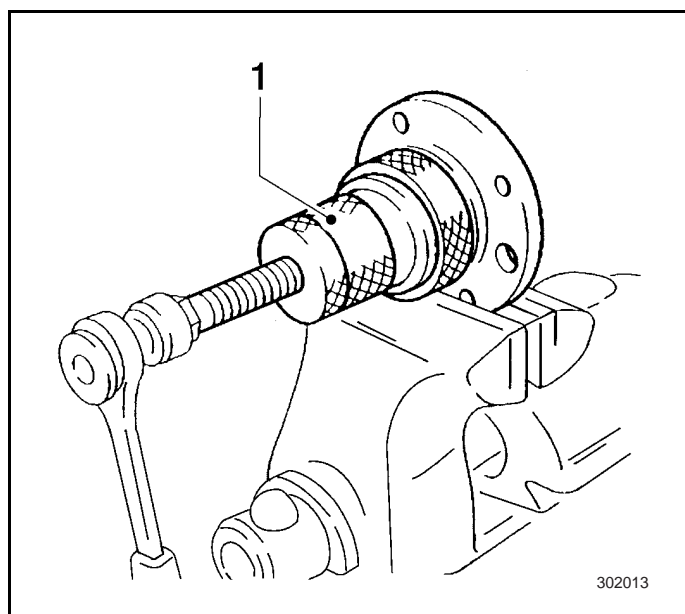


18. Use hydraulic press and KM-466-5(2) to press the bearing out of wheel hub.
19. Use a check ring snipper to remove bearing collar from steering knuckle.



20. Use KM-466-2 (4), KM-466-4 (3) and KM-466-5 (2) to press the bearing out of steering knuckle.

Note: Don't reuse damaged bearing.

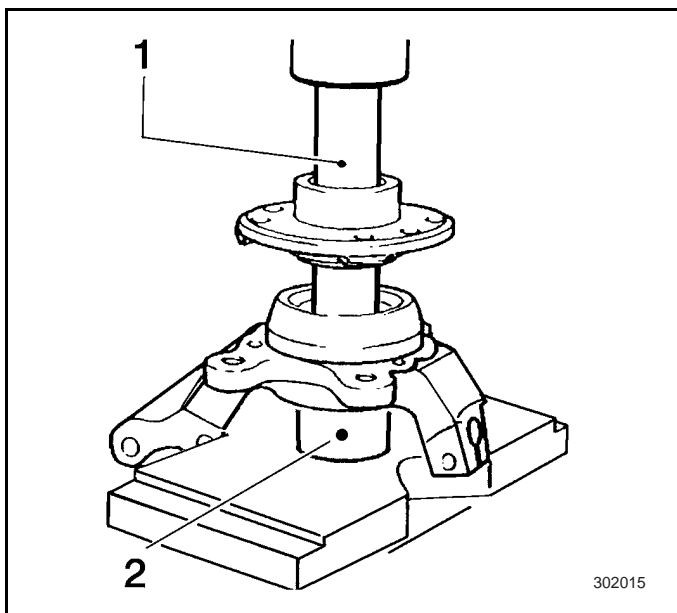
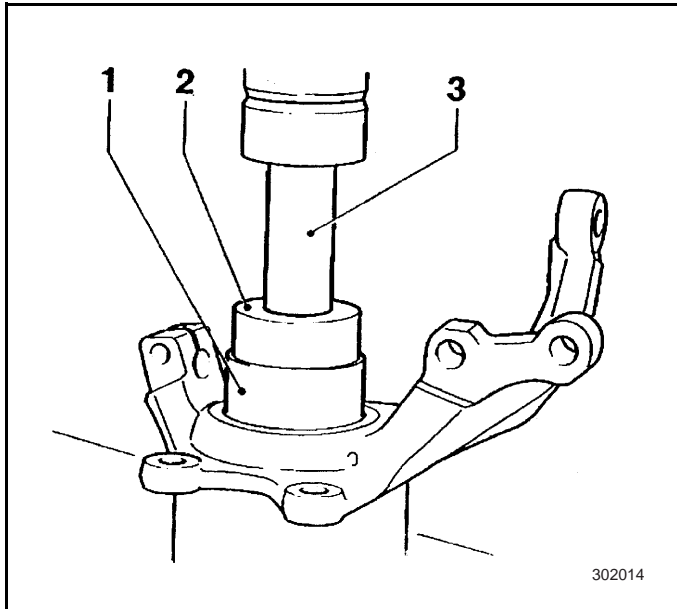


21. Use KM-466-1 (1) to remove inner bearing ring from front wheel hub.
22. Clean up the groove of check ring in steering knuckle to ensure proper alignment.

Installation procedures

Tools required

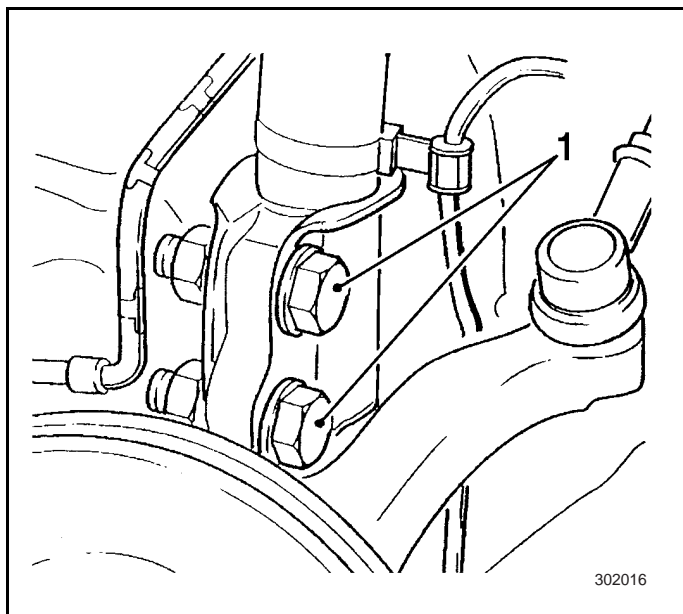
- KM-466-A Puller/installer
- J - 810300 Support wrench



1. Insert outer check ring into the steering knuckle. The locking lobe should face downwards. (Installation position)
2. Use special lubricant to slightly lubricate the inner bearing surface of steering knuckle.
3. Use KM-466-4 (2) and KM-466-5 (3) to press the bearing into steering knuckle so that it is on the check ring.
4. Insert inner check ring into the steering knuckle. Pull lobe should face downwards (installation position).
5. Place KM-466-3 (2) under the inner ring center of the bearing (otherwise the bearing will be damaged).
6. Use KM-466-5 (1) to press wheel hub into the bearing.
7. Apply locking agent on the new bolt connecting brake backing plate with steering knuckle, and tighten the bolt.

Tightening

Tighten the bolt to 4 N•m.

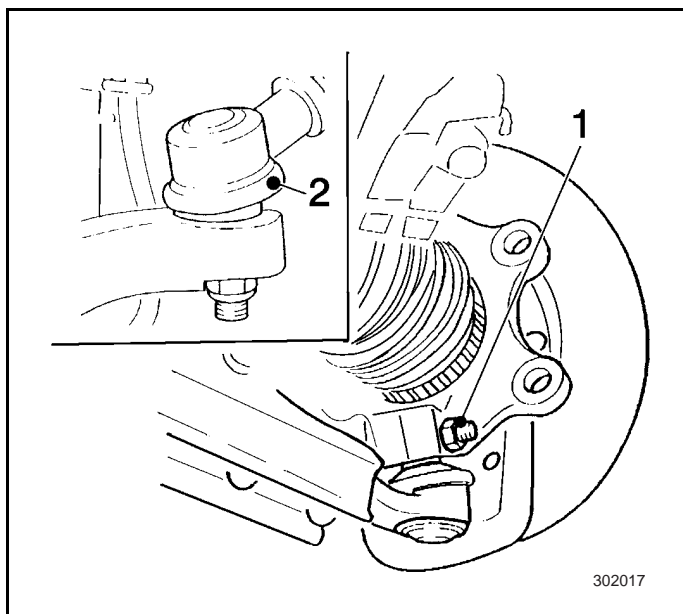


8. From rear to front (driving direction) insert new bolt (1) to connect steering knuckle and shock absorbing strut.
9. Install the new nut.

Tightening

Tighten the new nut to 50 N•M, then tighten it to 90N•M then turn $45^{\circ}+15^{\circ}$.

10. Use transmission oil to lubricate the spline of driving shaft.
11. Insert driving shaft into front wheel hub.



12. Install new capstan nut and gasket. Don't tighten the nut at this moment.
13. From rear to front (viewed from the front of the vehicle) insert bolt (1) to connect globe joint and steering knuckle.
14. Install the new locknut.

Tightening

Tighten the new locknut to 30 N•M.

15. Install the connector(2) of steering knuckle tie rod onto the steering knuckle.
16. Install the new nut.

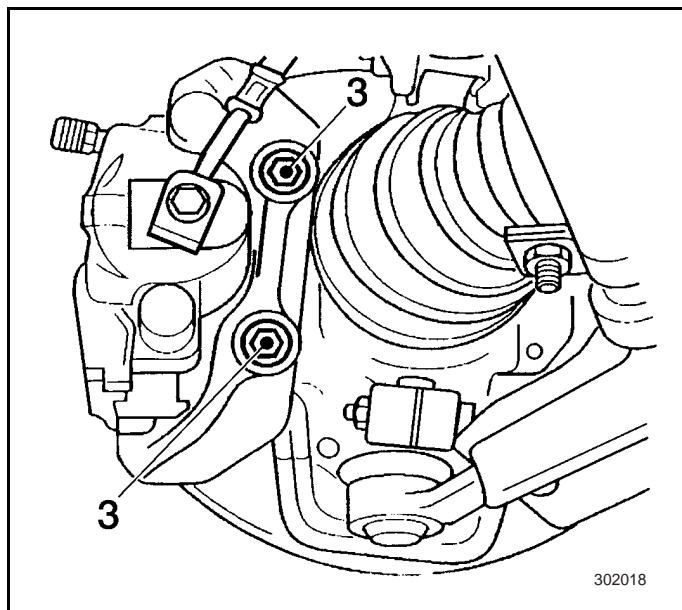
Tightening

Tighten the new nut to 35 N•M.

17. Install check bolt to connect brake disc and wheel hub.

Tightening

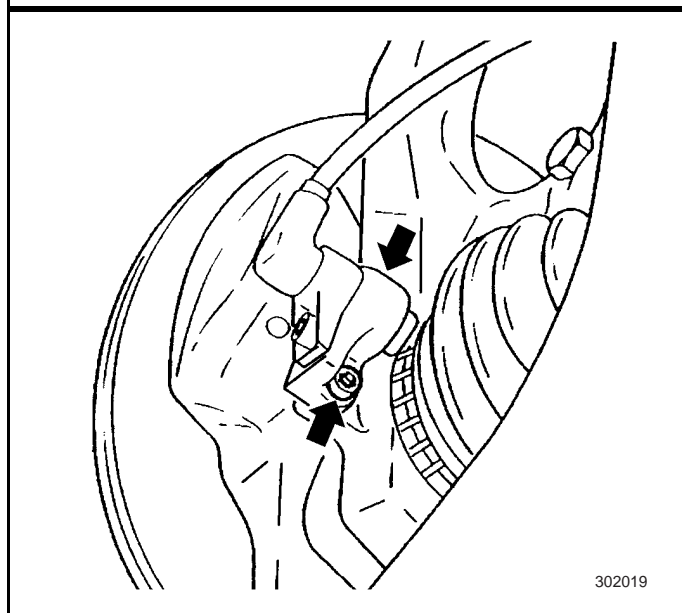
Tighten the bolt for brake disc and wheel hub to 4 N•M.



18. Apply locking agent on the new bolt.
19. Install bolt(3) to connect brake tongs and steering knuckle.

Tightening

Tighten the bolt for brake tongs and steering knuckle to 95 N•M.

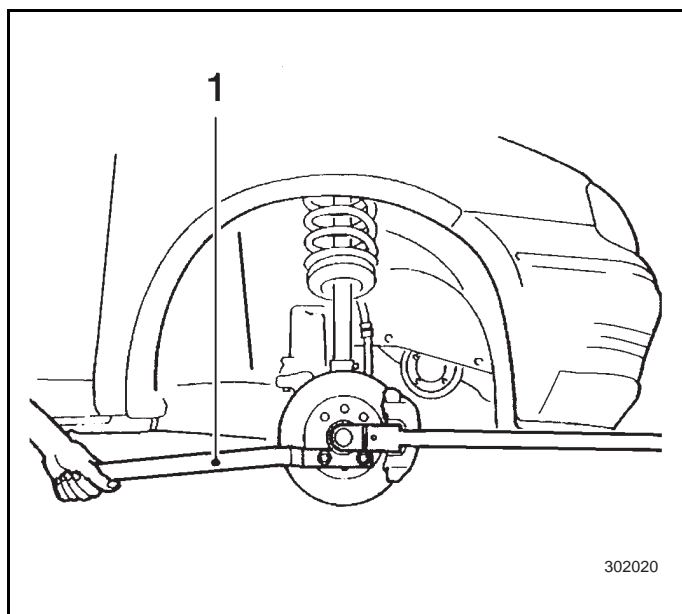


20. Use the new bolt and new nut to connect wheel speed sensor and steering knuckle. (for vehicles with ABS).

Tightening

Tighten the nut for wheel speed sensor and steering knuckle to 8 N•M.

21. Insert driving shaft into front wheel hub.



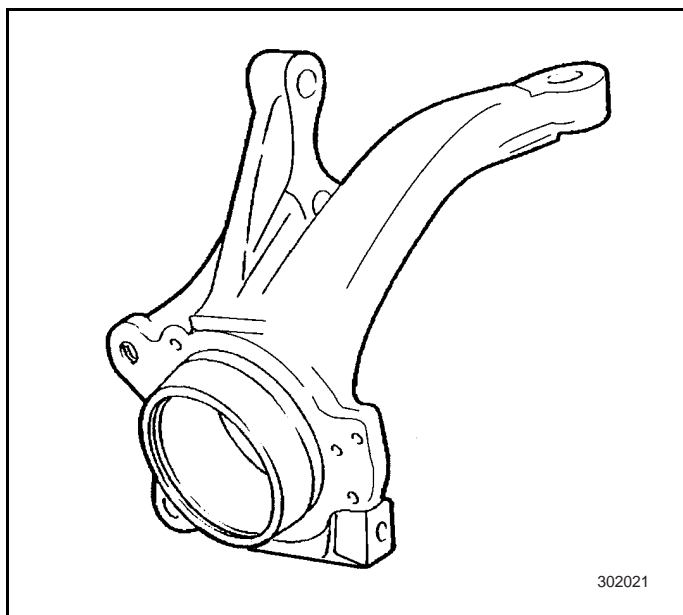
22. Tighten capstan nut and insert it into cotter pin. Use J-810300 to support the wheel hub from reverse direction.
23. Install corresponding wheels and pay attention to the related position of wheel hubs.

Tightening

Pretighten the nut for driving shaft and front wheel hub to 100 N•M, then loosen capstan nut once again. Then tighten to 20 N•M and turn 90°_90°. If the hole of cotter pin can not align with the capstan nut, loosen it and turn to the next hole position, and use the cotter pin to fasten it.

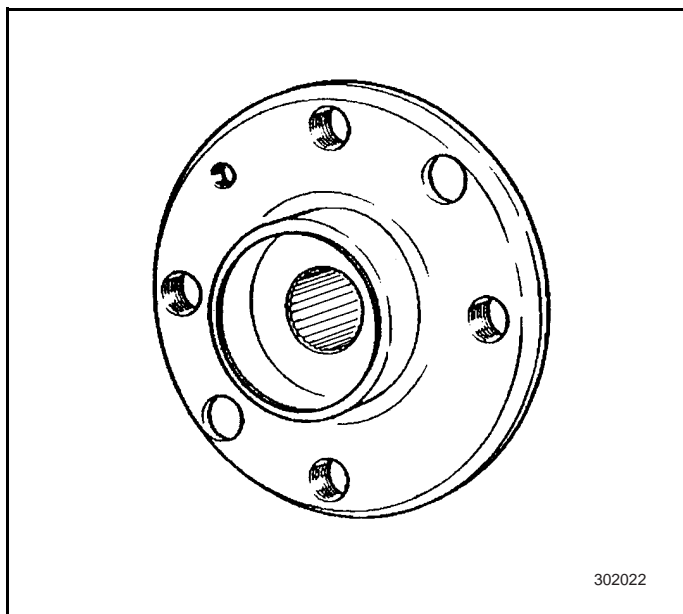
3.2.3.2 Replacement of steering knuckle

1. See replacement of front drive shaft bearing.



3.2.3.3 Replacement of wheel hub

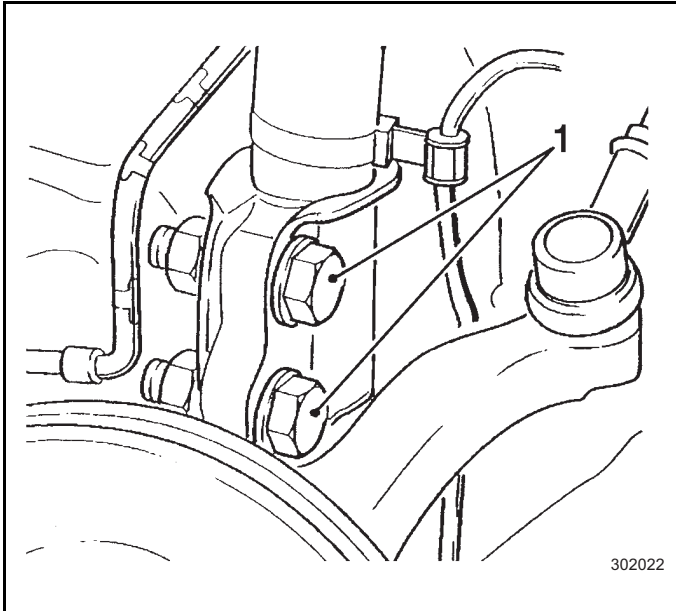
1. See replacement of front drive shaft bearing. The inner ring of bearing can remain in the oil hub.



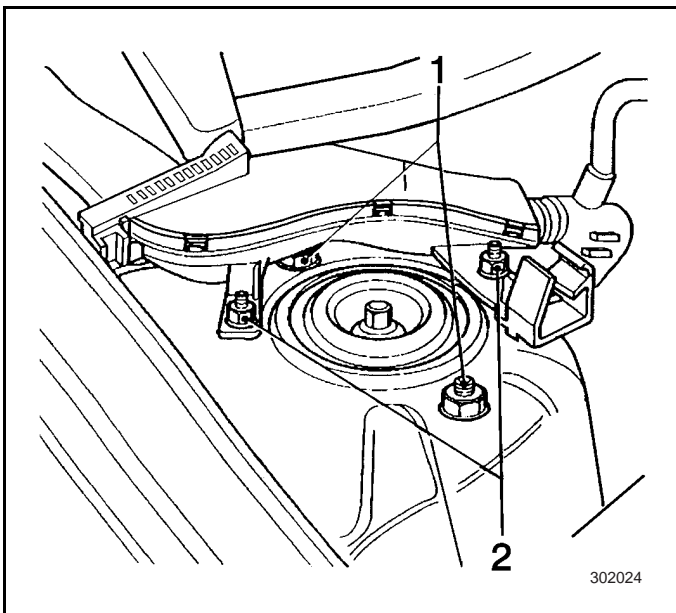
3.2.3.4 Replacement of shock absorbing strut

Disassembly procedures

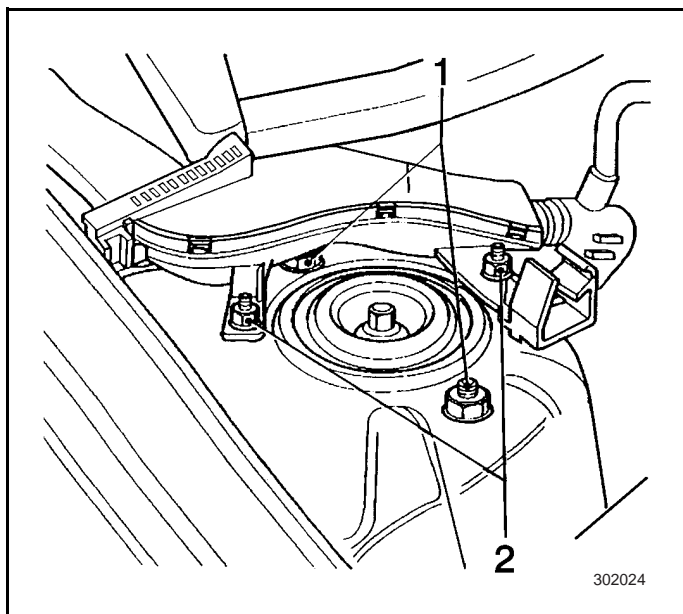
Note: The vehicle can only be raised with a vehicle lifting device of the carriage contacting type. The vehicle cannot be raised by a vehicle lifting device of the suspension contacting type.



1. Raise the vehicle and support it. See hoisting and lifting of vehicle in general information.
2. Disassemble the wheel. See replacement of wheels in tyres and wheels.
3. Remove bolt (1).
4. Disconnect wheel speed sensor. (for vehicles with ABS).



5. Remove nut (1) on shock absorbing strut. For right spring hanger: loosen connector clip of the bracket and remove the bolt of harness guider on the arch cap of spring hanger.
6. Remove shock absorbing strut.



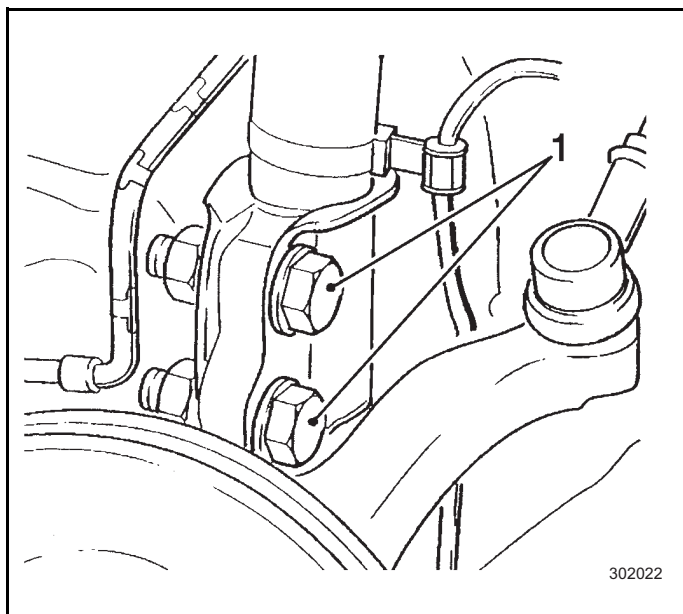
Installation procedures

1. Install shock absorbing strut.
2. Install new locknut M8(1) and the gasket.

Tightening

Tighten the upper nut to 30 N•M. For right front shock absorbing strut: fasten the harness guider to the arch cap of spring hanger, and clamp the connector clip into the bracket.

3. Connect wheel speed sensor. (for vehicles with ABS).



4. From rear to front (viewing from travelling direction) install new bolt (1) and new lock nut connecting the shock absorbing strut and the steering knuckle.

Tightening

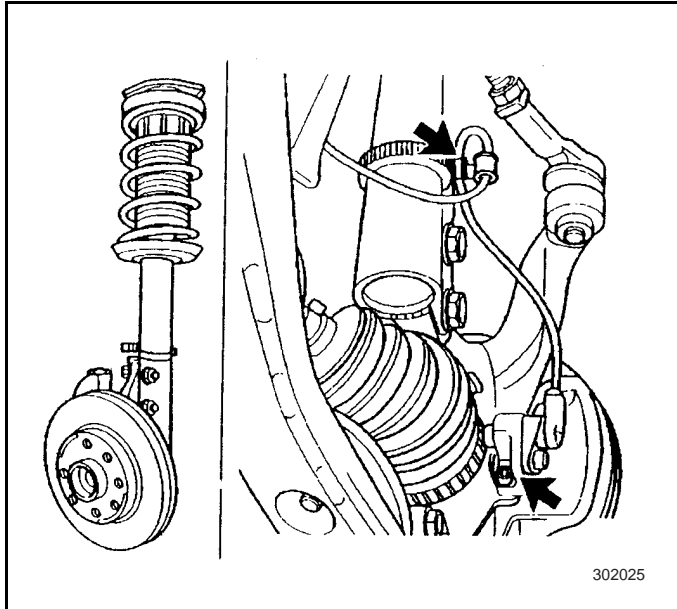
Pretighten the nut to 50 N•M, then tighten to 90 N•M and rotate 45°+15°.

5. Install the wheel. See replacement of wheels in tyres and wheels.
6. Lower the vehicle.

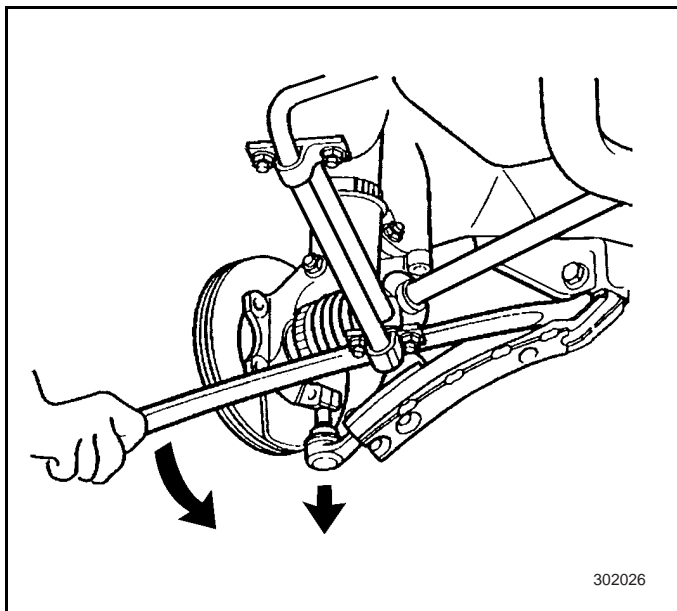
3.2.3.5 Replacement of shock absorbing strut with steering knuckle

Disassembly procedures

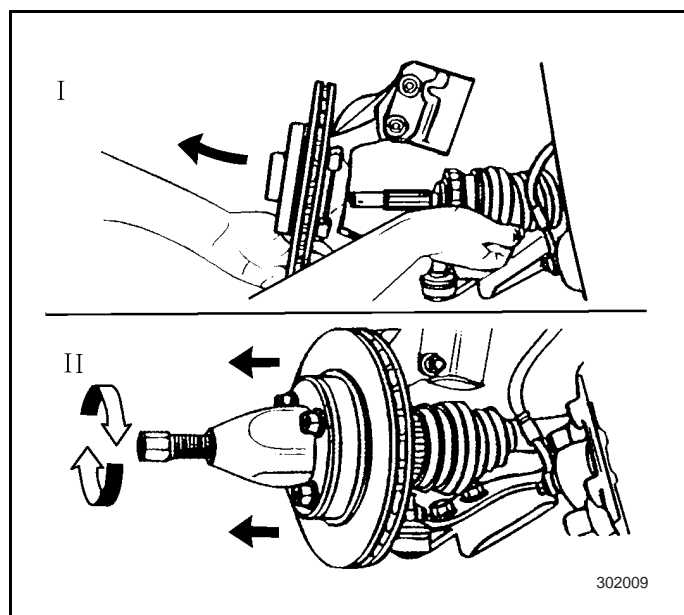
Note: The vehicle can only be raised by a vehicle lifting device of the carriage contacting type. The vehicle cannot be raised with a vehicle lifting device of the suspension contacting type.



1. Raise the vehicle and support it. See hoisting and lifting of vehicle in general information.
2. Disassemble the wheel. See replacement of wheels in tyres and wheels.
3. Remove the capstan nut on drive shaft of the wheel.
4. Remove the bolt of brake tongs.
5. Remove the bolt connecting wheel speed sensor and the bracket (shown by lower arrow). (for vehicles with ABS).
6. Remove the harness clip of wheel speed sensor from the bracket of shock absorbing strut (shown by upper arrow). (for vehicles with ABS).

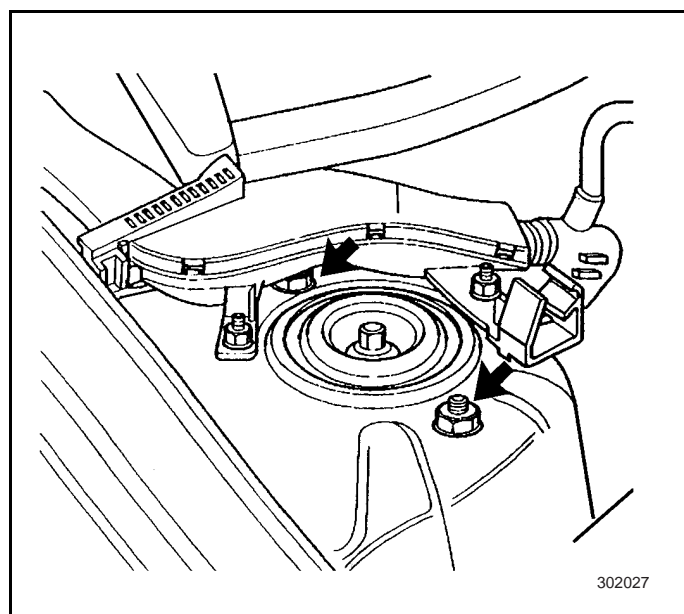


7. Remove the end of steering knuckle tie rod and the globe joint. See replacement of front drive shaft bearing.
8. Place a bar at the position of the bolt connecting the bracket and the tie bar of control arm (as shown in the figure).
9. Press the globe joint together with the control arm out of steering knuckle.

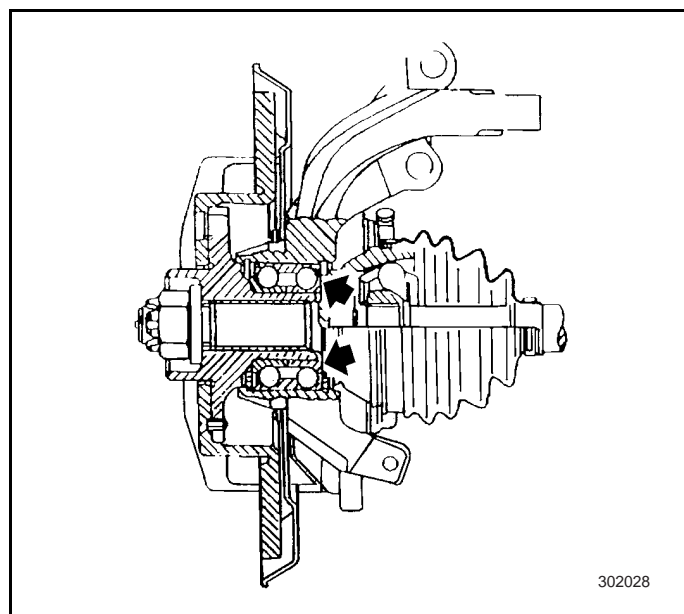


10. Remove upper nut of shock absorbing strut. See replacement of shock absorbing strut assembly.
11. Remove the assembly of shock absorbing strut and the steering knuckle from drive shaft (as shown in Figure I). If necessary, use wheel hub removal tool available in the market to press the assembly out of the driving shaft (Figure II).

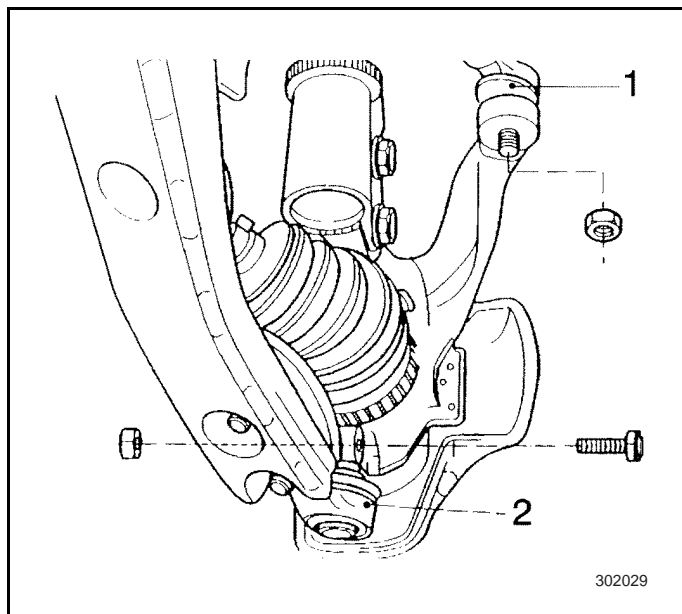
Installation procedures



1. Install shock absorbing strut with steering knuckle.
2. Install new locknut (as shown by arrow), but don't tighten it.



3. Ensure that the fitting surface of wheel hub and wheel bearing is cleared of any dust.

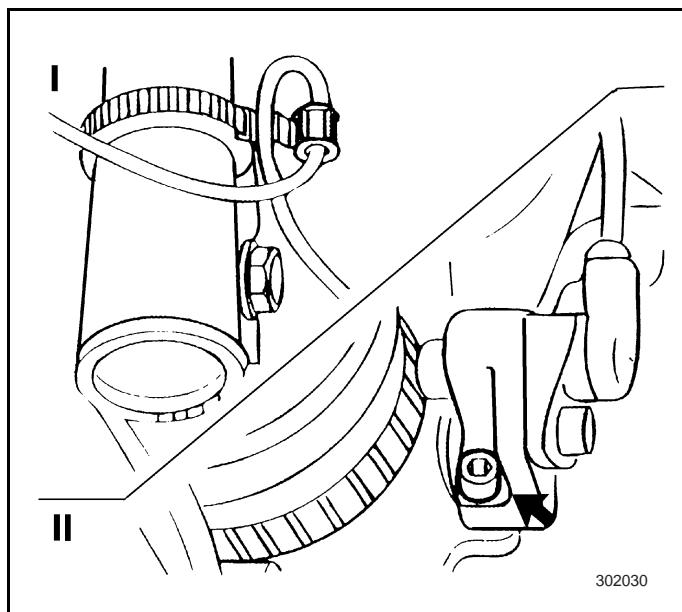


4. Use transmission lubricant to lubricate the spline of wheel hub.
5. Insert wheel driving shaft into front wheel hub.
6. Use the new capstan nut and gasket and loosely install them on the wheel hub. Don't tighten them at this time.
7. Connect steering knuckle tie (1) and globe joint (2) with steering knuckle.
8. Insert the bolt of globe joint from rear to front.
9. Use the new locknut to tighten it.

Tightening

Tighten the nut of steering knuckle tie rod to 40-48 N•M.

Tighten the nut of globe joint to 30 N•M.

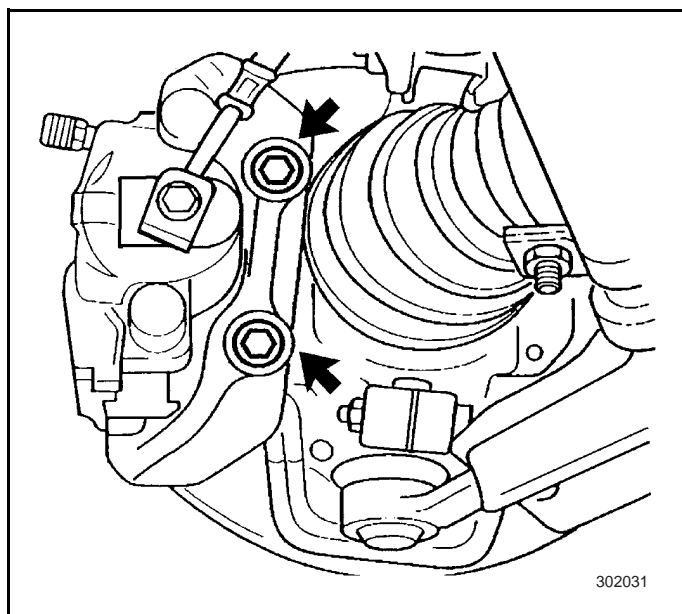


10. Install wheel speed sensor to the steering knuckle (Figure II), then tighten it. (for vehicles with ABS).

Tightening

Tighten wheel speed sensor with steering knuckle to 8 N•M.

11. Clamp the harness of wheel speed sensor with the bracket of shock absorbing strut. Ensure the arrangement of wires is correct (Figure I). (for vehicles with ABS).
12. Install wheel drive shaft. See replacement of front drive shaft bearing.



13. Use the new bolt (as shown by arrow) to install brake tongs onto steering knuckle.

Tightening

Tighten the bolt to 95 N•M.

14. Install shock absorbing strut.
15. Install upper nut of shock absorbing strut.

Tightening

Pretighten to 30 N•M.

16. Tighten the capstan nut. See replacement of wheel drive shaft .
17. Install the wheel. See replacement of wheels in tyres and wheels.
18. Lower the vehicle.

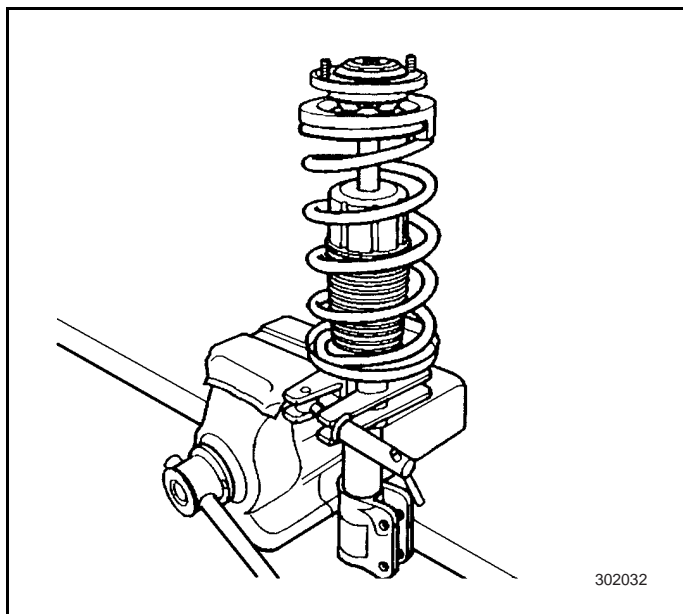
3.2.3.6 Replacement of shock absorbing strut, its components and/or springs

Disassembly procedures

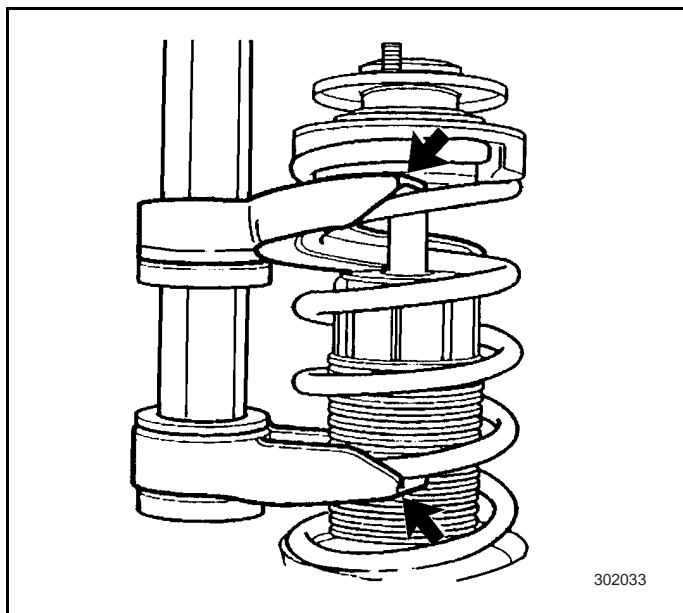
Tools required

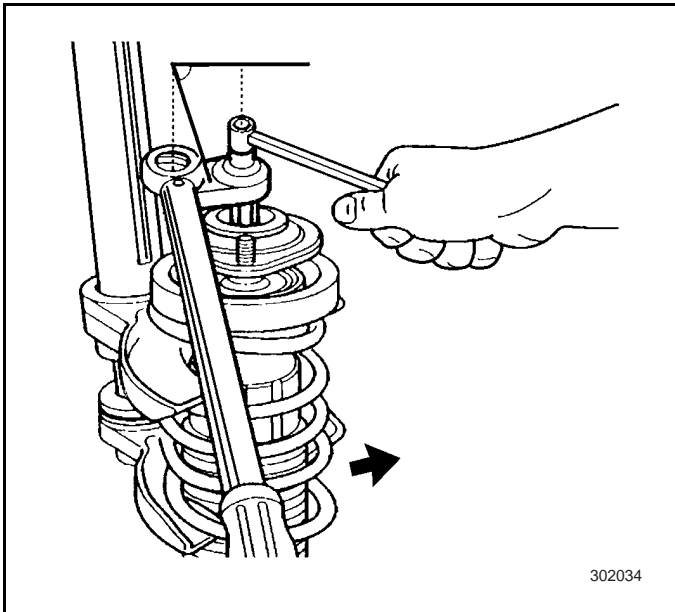
- J-810301-B Spring compressor
- KM-808 Special wrench

1. If assembly fixture cannot be fixed on the work bench, then fix it on a table vice.
2. Install a pair of claws agreeing with diameter of the spring onto spring compressor J-810301-B.

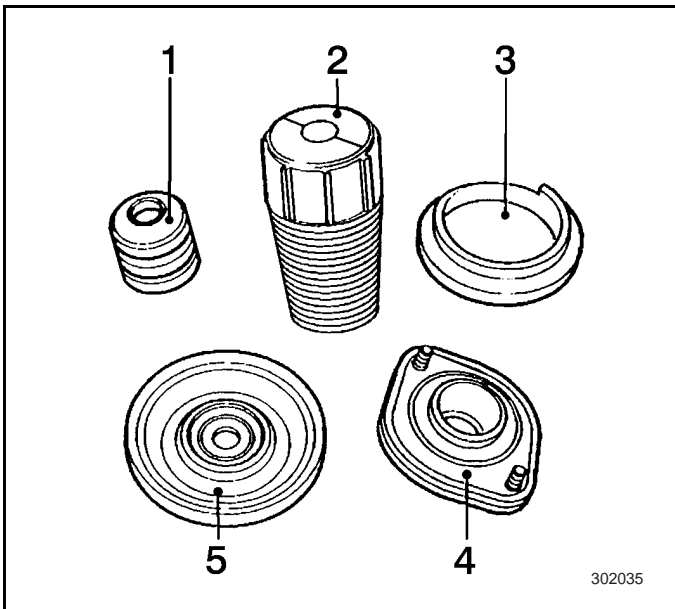


3. Loosen the spring compressor so that the claws are between the top and the bottom of the spring (as shown by arrow).
4. Compress the spring until it is separated from the upper and lower spring seats.





5. Use KM-808 to remove the locknut. The ratchet wrench should be Vertical with KM-808 (as shown by the figure).
6. Remove the bracket of shock absorbing strut with limiter and gasket from piston connecting bar.
7. Remove upper spring seat with shock absorbing strut.
8. Remove spring compressor with spring and dust cap.
9. Remove buffer block.



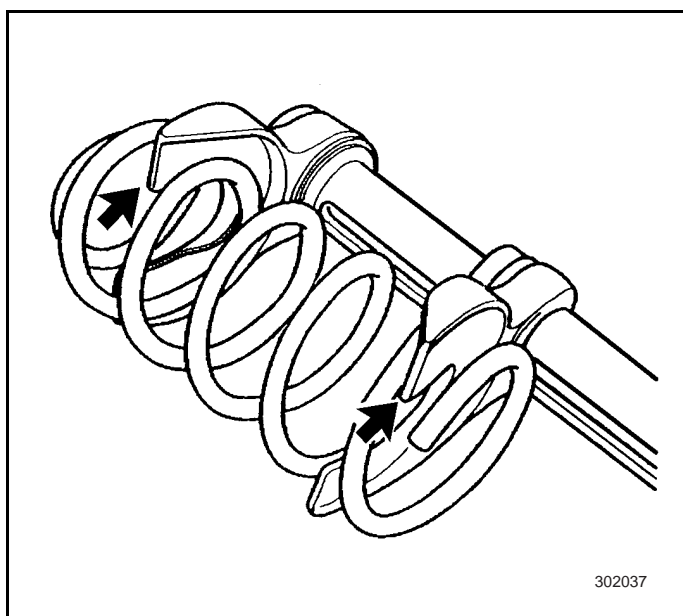
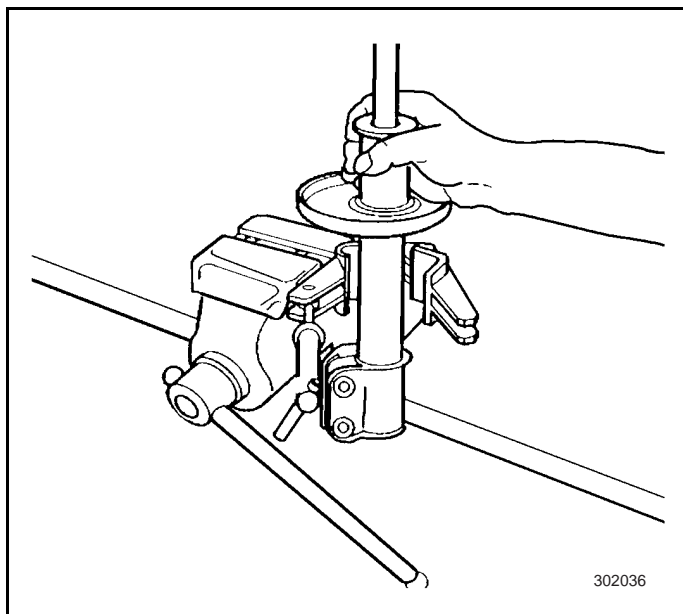
10. Inspection: Inspect the following components according to the degree of damage and wearing.
 - (1) Buffer block
 - (2) Dust cap
 - (3) Vibration isolation block
 - (4) Footstep of shock absorbing strut
 - (5) Upper spring seat with bearing and limiter.
11. If the old shock absorbing strut has to be replaced, dismount the shock absorber, then remove the harness bracket of wheel speed sensor from the old shock absorber and install it onto the new shock absorber.

Installation procedures

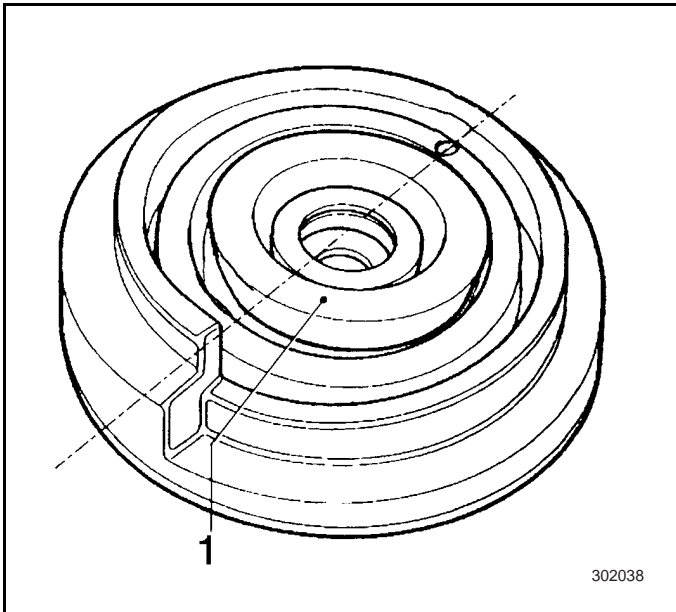
Tools required

- J-810301-B Spring compressor
- KM-808 Special wrench
- KM-610 Torque wrench

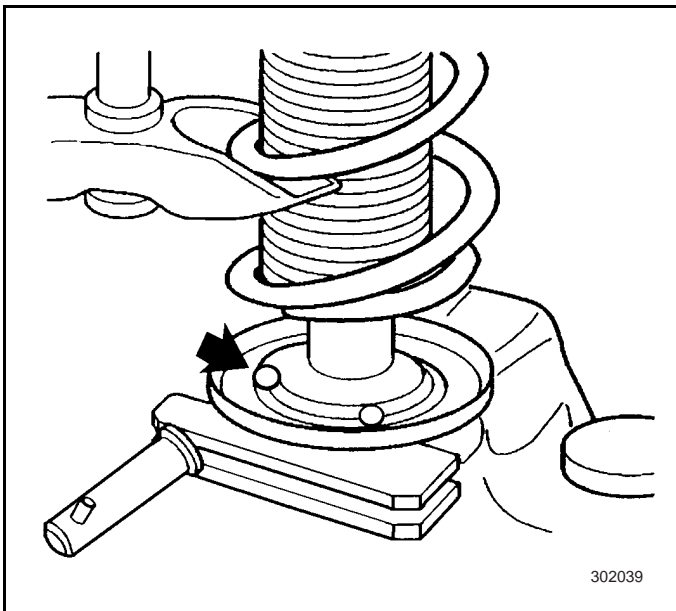
1. Install the new shock absorber into the assembly fixture.



2. If the old spring has to be replaced, loosen the spring, then take the old spring out of spring compressor J-810301-B.
3. Insert the new spring into spring compressor J-810301-B. One circle on upper part of the spring and one and a half circle on lower part of the spring should be retained (as shown by arrow).
4. Compress the spring until the distance between the two claws is $\leq 120\text{mm}$.



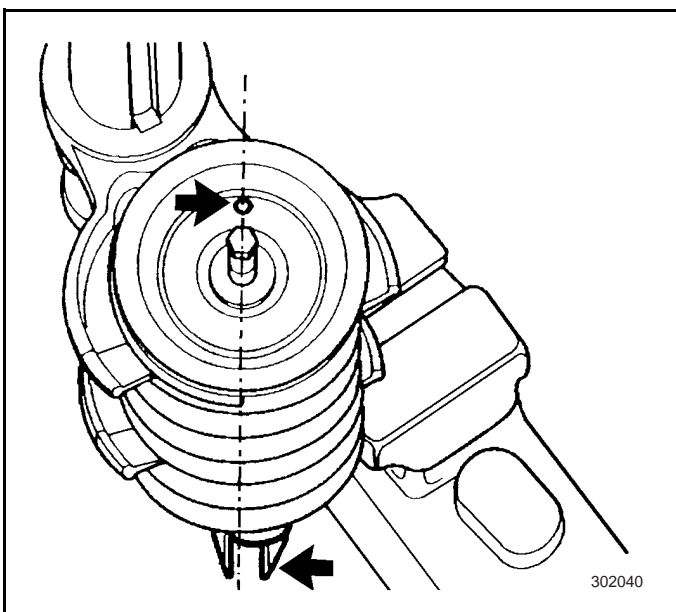
5. Confirm the position of buffer block limiter (1).



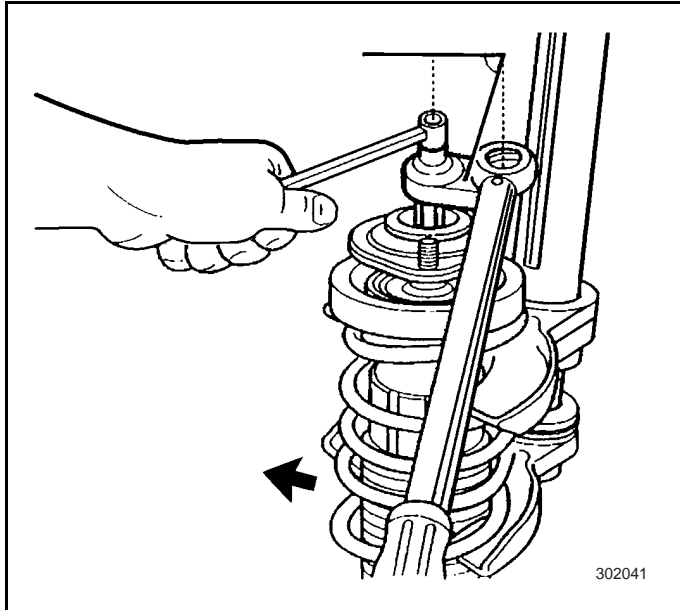
6. Install buffer block, and pull piston rod to the bottom.

7. Place the spring onto spring seat.

Note: The end of spring should be at the limiting hole (as shown by arrow).



8. Install upper spring seat with shock absorbing block. Ensure the offset of tightening position between the punched hole and the lower spring hanger is 180° (as shown by arrow).



9. Install spacer, bearing and positioner.
10. Use the new locknut to tighten them.
11. Use special wrench KM-610 and torque wrench KM-610 to tighten the new lock nut.

Tightening

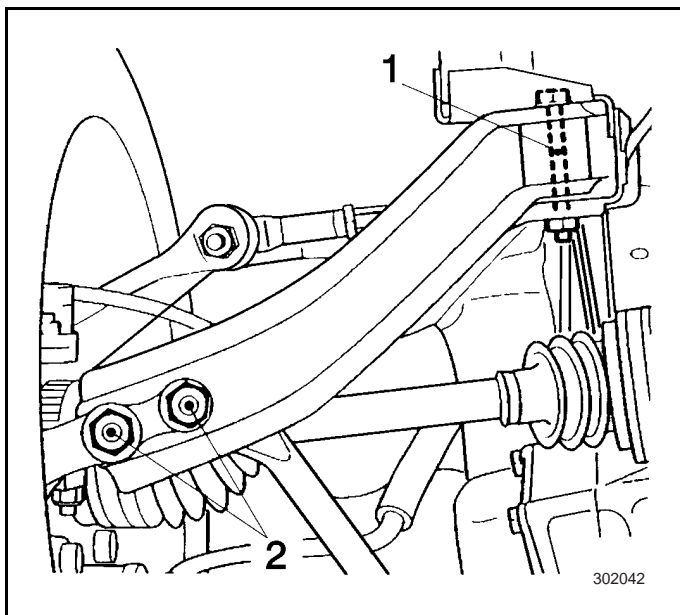
Tighten to 60 N•M.

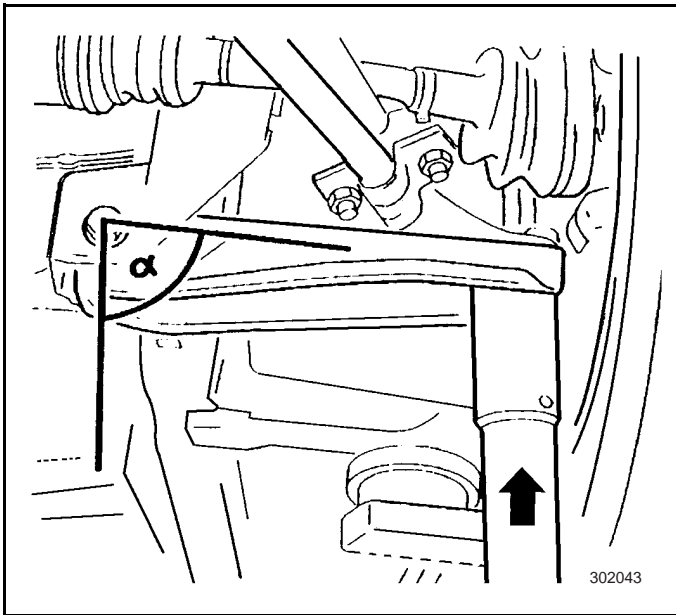
Note: Torque wrench KM-610 should be vertical with KM-808.

3.2.3.7 Replacement of lower control arm

Disassembly procedures

1. Remove blot (1) and the nut connecting control arm with the body
2. Remove bolt (2) and the nut connecting tie bar and globe joint with control arm.
3. Remove lower control arm.





Installation procedures

1. Install globe joint and tie bar onto the control arm.
2. Install new bolt (2) and new locknut to connect globe joint and tie bar with control arm.

Tightening

Tighten the nut to 90 N•M then turn 30 ° +15°.

3. From front to rear insert bolt (1) to connect control arm with the body.
4. Push control arm to nearly level position (α is about $\pm 80^\circ$).
5. Install a new nut to connect control arm with the body.

Tightening

Tighten the nut to 60 N•M.

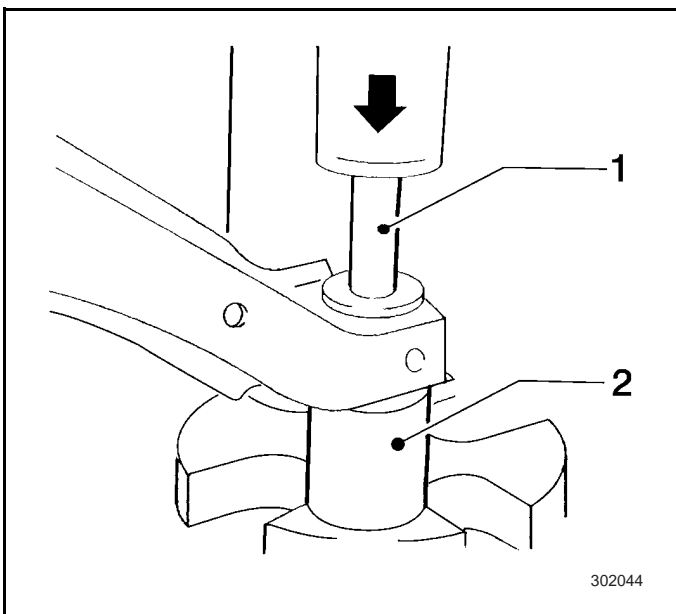
3.2.3.8 Replacement of lower control arm bush

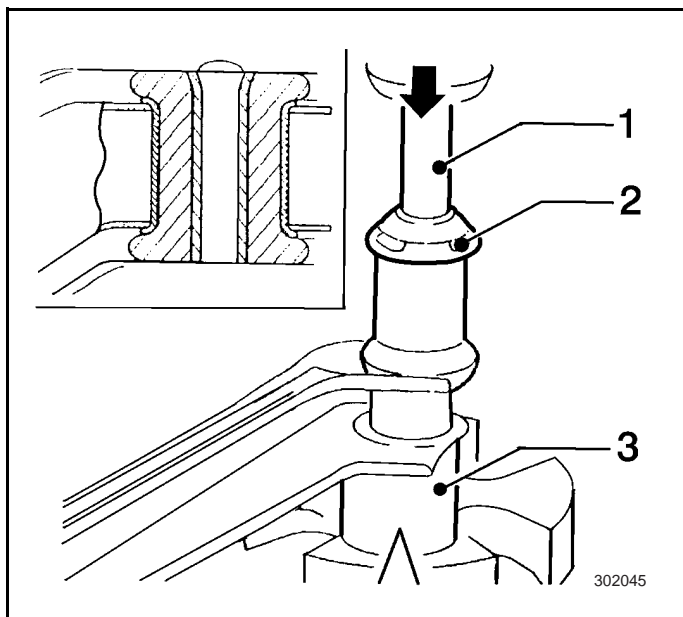
Disassembly procedures

Tools required

- KM-547-1 Puller/installer

1. Use hydraulic press KM-547-1 and a suitable hard tube (2) to press the bush, from front to rear, out of the control arm.





Installation procedures

Tools required

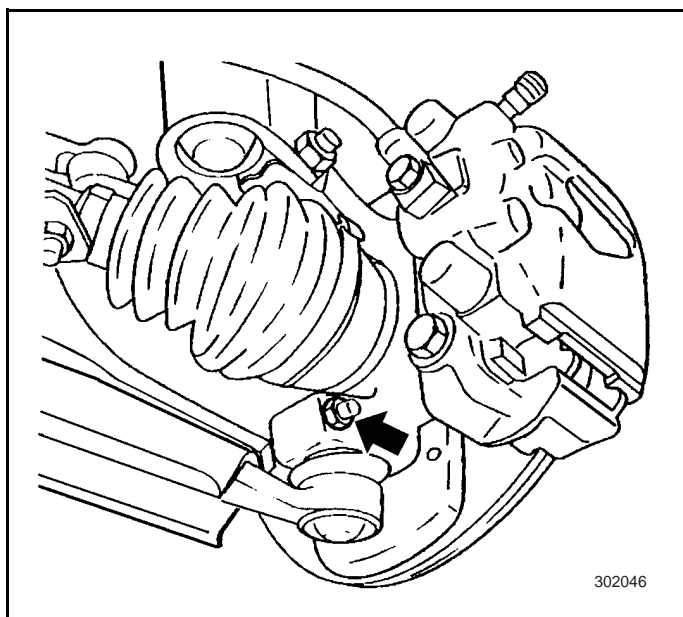
- KM-547-1 Puller/installer
1. Before installation, apply some soap bath on the new bush.
 2. Use KM-547-1 (1) and a suitable hard tube (3) to press the bush into control arm. The three lobes (2) with rubber curling should point to the rear (viewing from the front of the vehicle). The two side of the rubber globe of the bush should be popping out uniformly.

3.2.3.9 Replacement of lower globe joint

Note: Before replacing lower globe joint, inspect front cross rail. If necessary, adjust the front cross rail. Don't try to repair lower globe joint.

Disassembly procedures

1. Remove the nut connecting lower globe joint with steering knuckle (shown by arrow).
2. Remove the bolt connecting lower globe joint with control arm.
3. Remove lower globe joint.

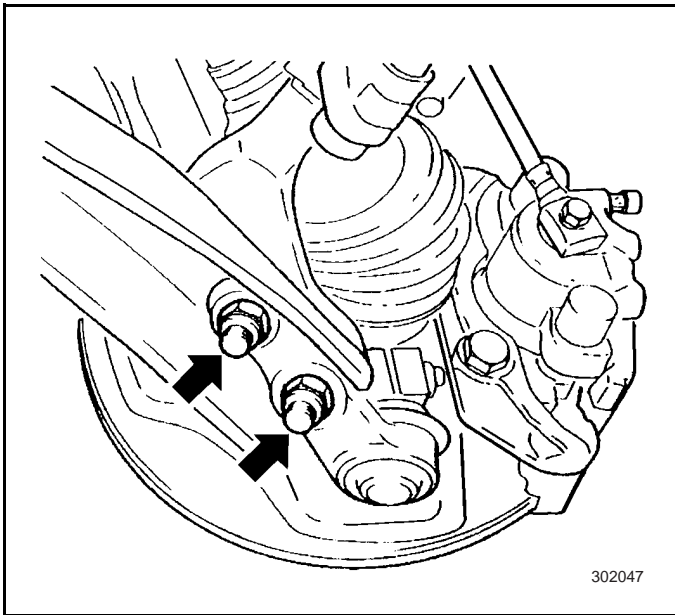


Installation procedures

1. Use a new bolt and a new locknut (as shown by arrow in Figure 1) to install lower globe joint onto control arm.
2. Tighten the nut from below the control arm.

Tightening

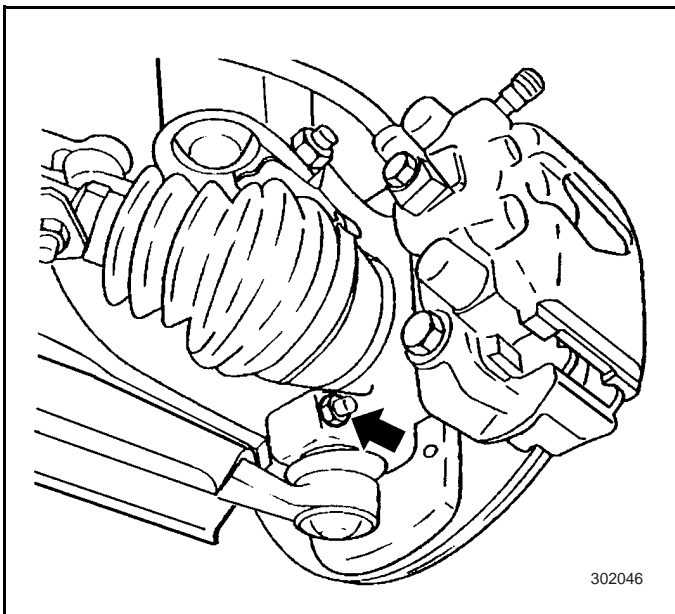
Tighten to 90 N•M then turn 30 ° +15°.



3. Insert lower globe joint into the steering knuckle.
4. Insert the bolt in driving direction (as shown by arrow).
5. Use a new nut to tighten it.

Tightening

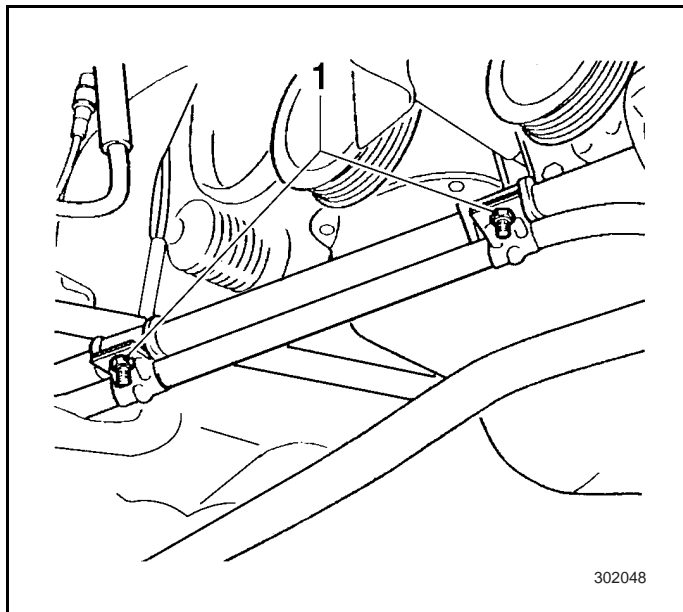
Tighten to 30 N•M.



3.2.3.10 Replacement of stabilizer bar

Disassembly procedures

1. Remove the bolts (1) on clamping collars of the left and right tie bars.
2. Remove stabilizer bar.

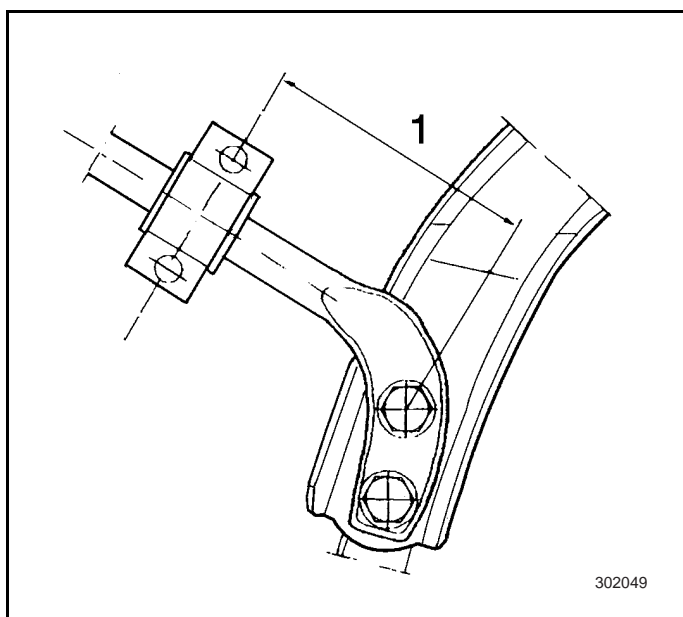


Installation procedures

1. Apply lubricating oil on the rubber bracket.
2. Use new locknuts and clamping collars to tighten stabilizer bar with the left and right tie bars.

Important:

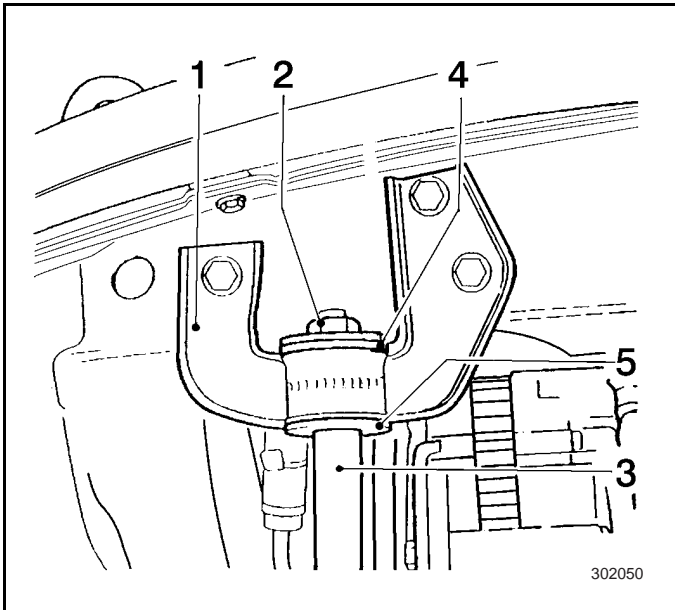
1. Replace the rubber seat that has been worn out or damaged.
2. Keep a distance between the center of clamping collar and the inner bolt. The distance 1 = 121mm.



3.2.3.11 Replacement of tie bar

Disassembly procedures

1. Remove the bolts and nuts connecting stabilizer bar with the tie bar. See replacement of stabilizer bar.
2. Remove the nut (2) of front cross rail (1).
3. Remove the bolt connecting control arm, globe joint and tie bar.
4. Remove the tie bar (6).
5. Remove gasket (5) from the tie bar.



Installation procedures

1. Install the gasket onto the tie bar.
2. Insert the tie bar into the bracket bush (4).
3. Use new bolts and new locknuts (as shown by arrow) to connect the tie bar with control arm and globe joint.

Tightening

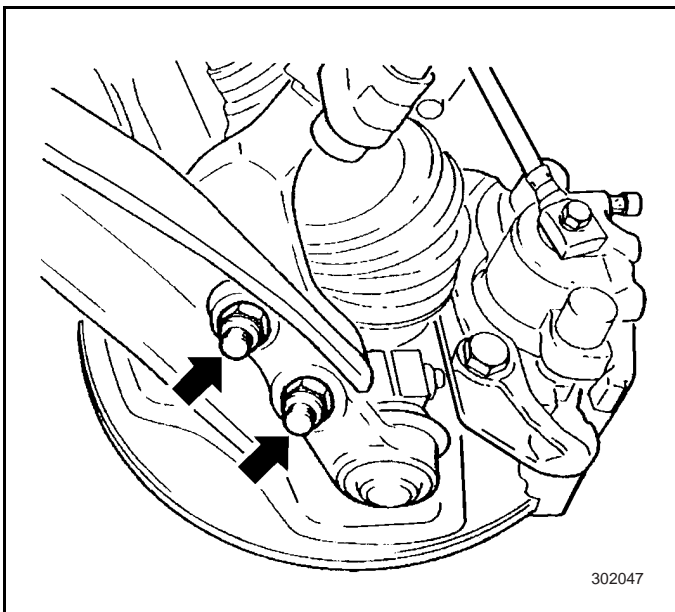
Tighten the nut to 90 N•M then turn 30° +15°.

4. Install the new locknut (2).

Tightening

Tighten the locknut (2) to 90 N•M.

5. Install stabilizer bar. See replacement of stabilizer bar.



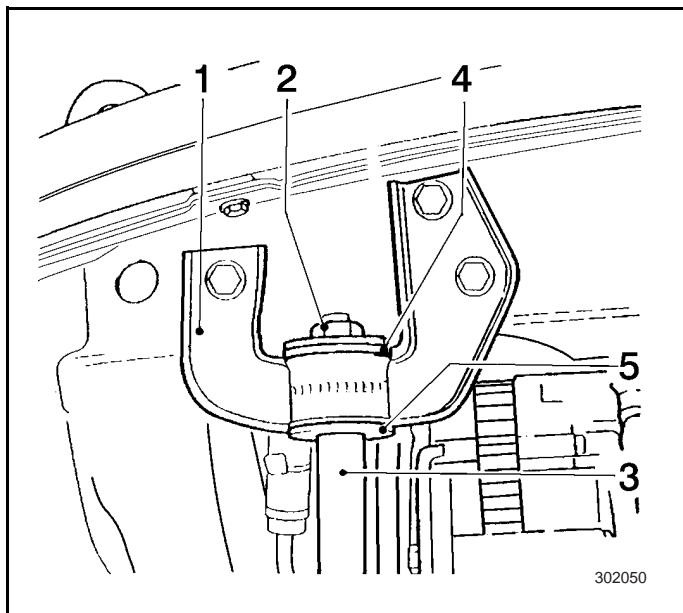
3.2.3.12 Replacement of the bush of tie bar bracket

Disassembly procedures

Tools required

- KM-547-4 Puller/installer

1. Loosen the front nut (2) of tie bar (3).
2. Remove the bolt connecting tie bar bracket (1) with front cross rail.
3. Remove the bolt of engine hood from the bracket.
4. Remove the bracket.
5. Use KM-547-4 and a suitable hard tube to press the bush out of the bracket.



Installation procedures

Tools required

- KM-547-4 Puller/installer

1. Install gasket (5) and the bracket with bush onto the tie bar.
2. Tighten the new bolt connecting the bracket with the front cross rail.

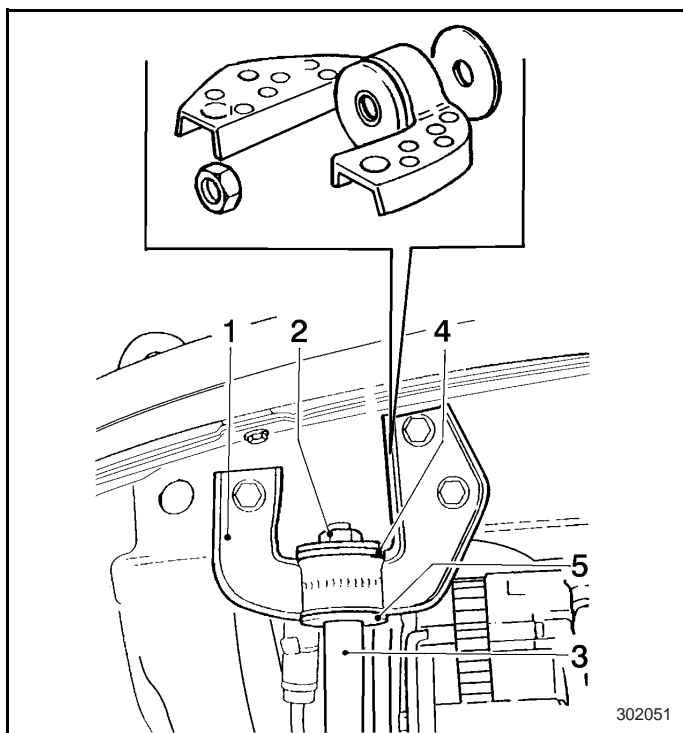
Tightening

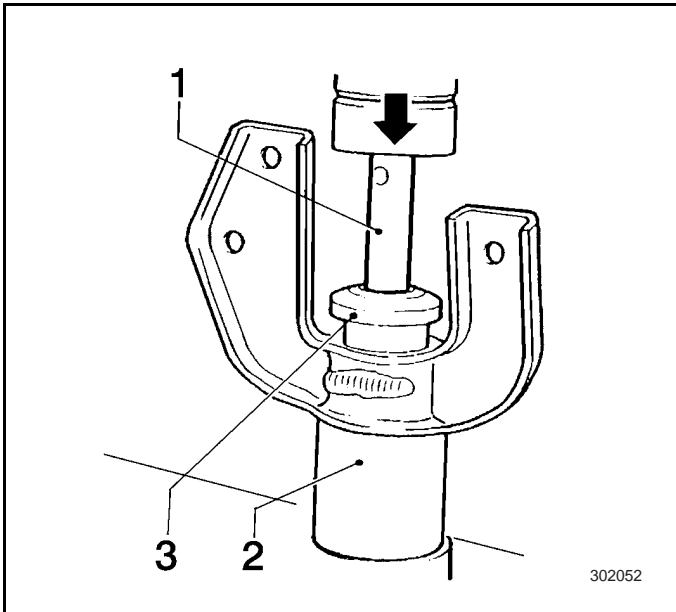
Tighten the bolt to 50 N•M then turn 90° +15°.

3. Tighten the bolt connecting engine hood with the bracket.
4. Tighten new locknut (2) connecting tie bar with the bracket.

Tightening

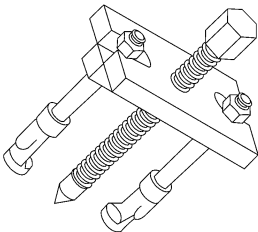
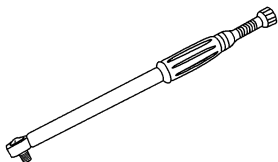
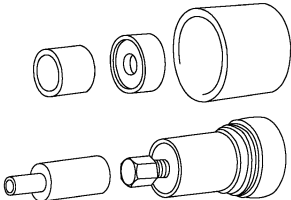
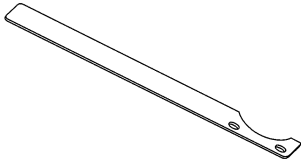
Tighten the nut to 90 N•M.

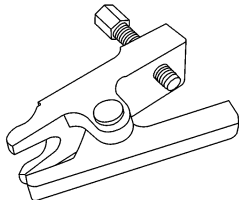
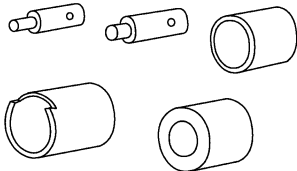
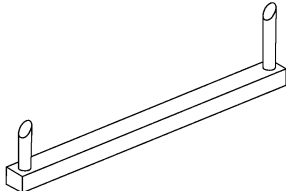
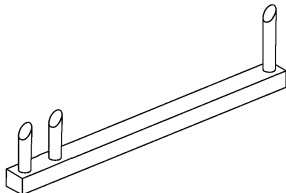


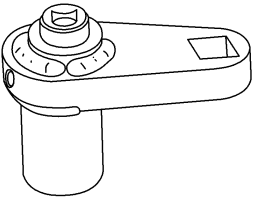
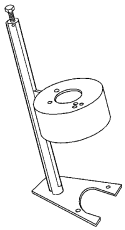


5. Before installation, apply some soap bath on the new bush.
6. Use KM-547-4 and a suitable hard tube to press the bush into the bracket. Ensure the curling of the bush is facing forward (the front of vehicle).
7. Ensure the curling will protrude from the bush after installation.

3.2.4 Special tools

Graphics	Tool identification/ description
 <p>J-830901</p>	<p>J830901 Puller is used to Dismoun steering wheel</p>
 <p>KM-610</p>	<p>KM-610 Toruqe wrench 1/2 搦 - Drive range: 3 - 130N●M</p>
 <p>KM-466</p>	<p>KM-466-A Puller/installer Used to remove Drive shaft from front wheel hub</p>
 <p>J-810300</p>	<p>J-810300 Support wrench Used to support wheel hub reversely When mounting wheel hub</p>

Graphics	Tool identification/ description
 <p>J-810902</p>	<p>J-810902 Disassembly fork - end puller of Steering knuckle tie rod</p>
 <p>KM-547</p>	<p>KM-547-A Puller/installer used to remove and install buffer bush of control arm and buffer block of tie rod</p>
 <p>S-9409202</p>	<p>S-9409202 Detector used to inspect the straightahead position of manual steering gear</p>
 <p>KM-551-A</p>	<p>KM-551-A Detector Used to inspect the straightahead position of power steering gear</p>

Graphics	Tool identification/ description
 <small>KM-808</small>	<p>KM-808 Special wrench used to loosen And tighten the nut of piston rod of shock absorber</p>
 <small>J-810301-B</small>	<p>J-810301-B Spring compressor used to disassemble and assemble the shock absorbing strut of suspension</p>

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3.3 Rear suspension

3.1.1 Specifications

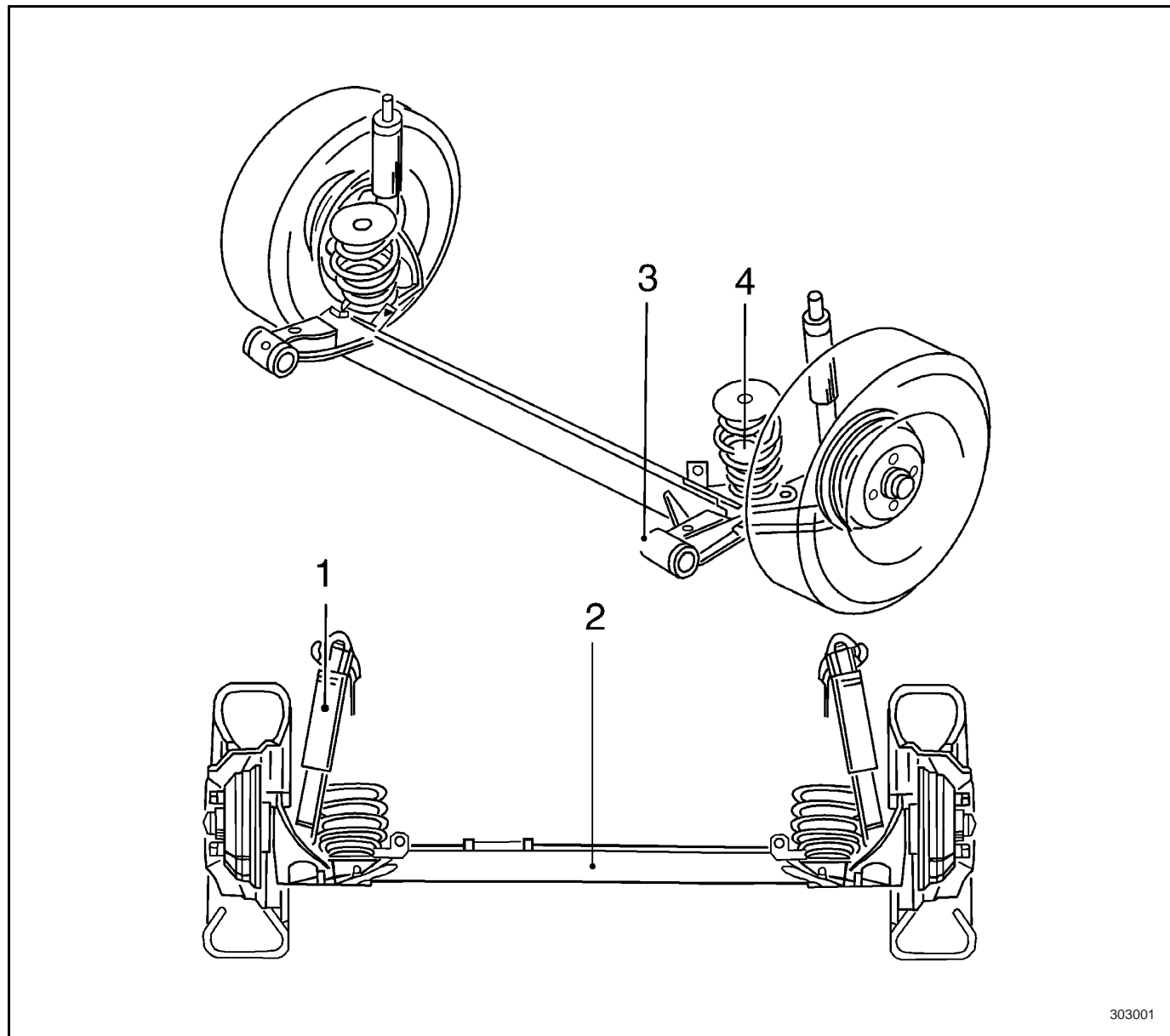
3.3.1.1 Tightening Torque of Fasteners

Applications	Torque
Nuts of back axle and body	50 N•M+45° +15°
Capstan nuts of wheel hub and axle - bearing clearance	25 N•M
Bolts of axle and back plate	50 N•M+30° +15°
Bolts and nuts of stabilizer bar and back axle	60 N•M+60° +15°
Bolts of shock absorber and back axle	60 -70N•M
Nuts of shock absorber and body	18 -20N•M
Bolts of all brake hard tubes	16 N•M
Brake hard tubes and brake hoses	16 N•M
Nuts of wheel	110 N•M

3.3.2 Identification of appearance

3.3.2.1 Exploded view

Back axle

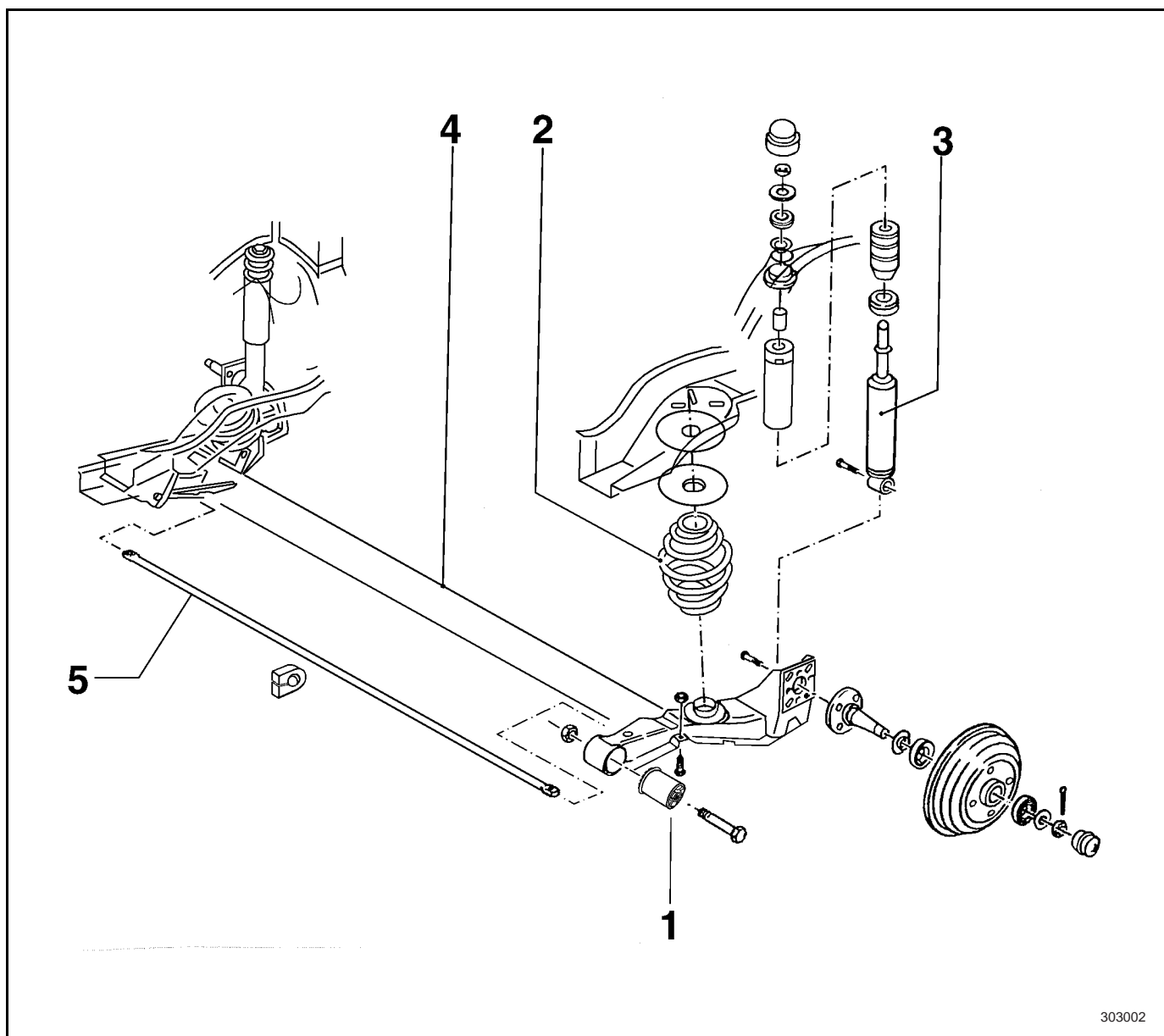


Legend

- (1) Shock absorber
- (2) Back axle

- (3) Buffer bush of back axle
- (4) Rear spring

Rear suspension

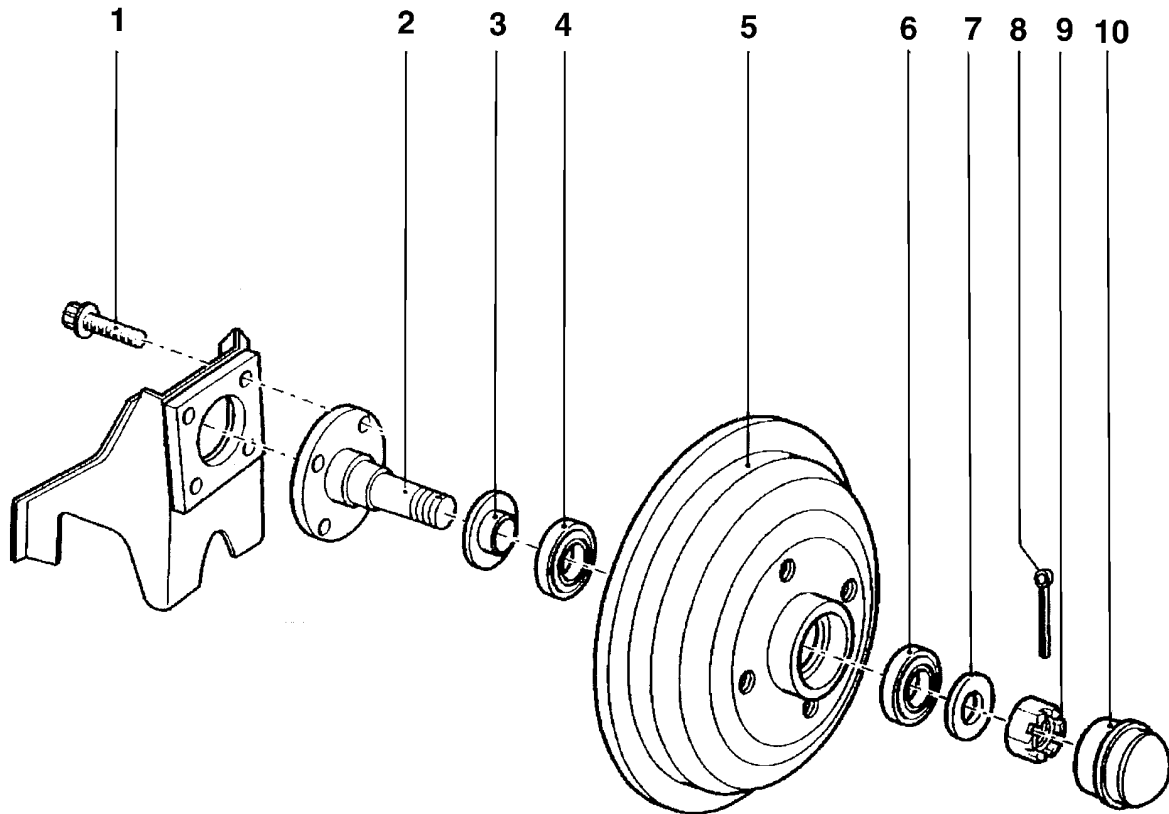


303002

Legend

- | | |
|--|--------------------|
| (1) Dustproof sleeve of shock absorber | (4) Back axle |
| (2) Rear spring | (5) Stabilizer bar |
| (3) Shock absorber | |

Wheel bearing, wheel hub, wheel and axle, oil seal

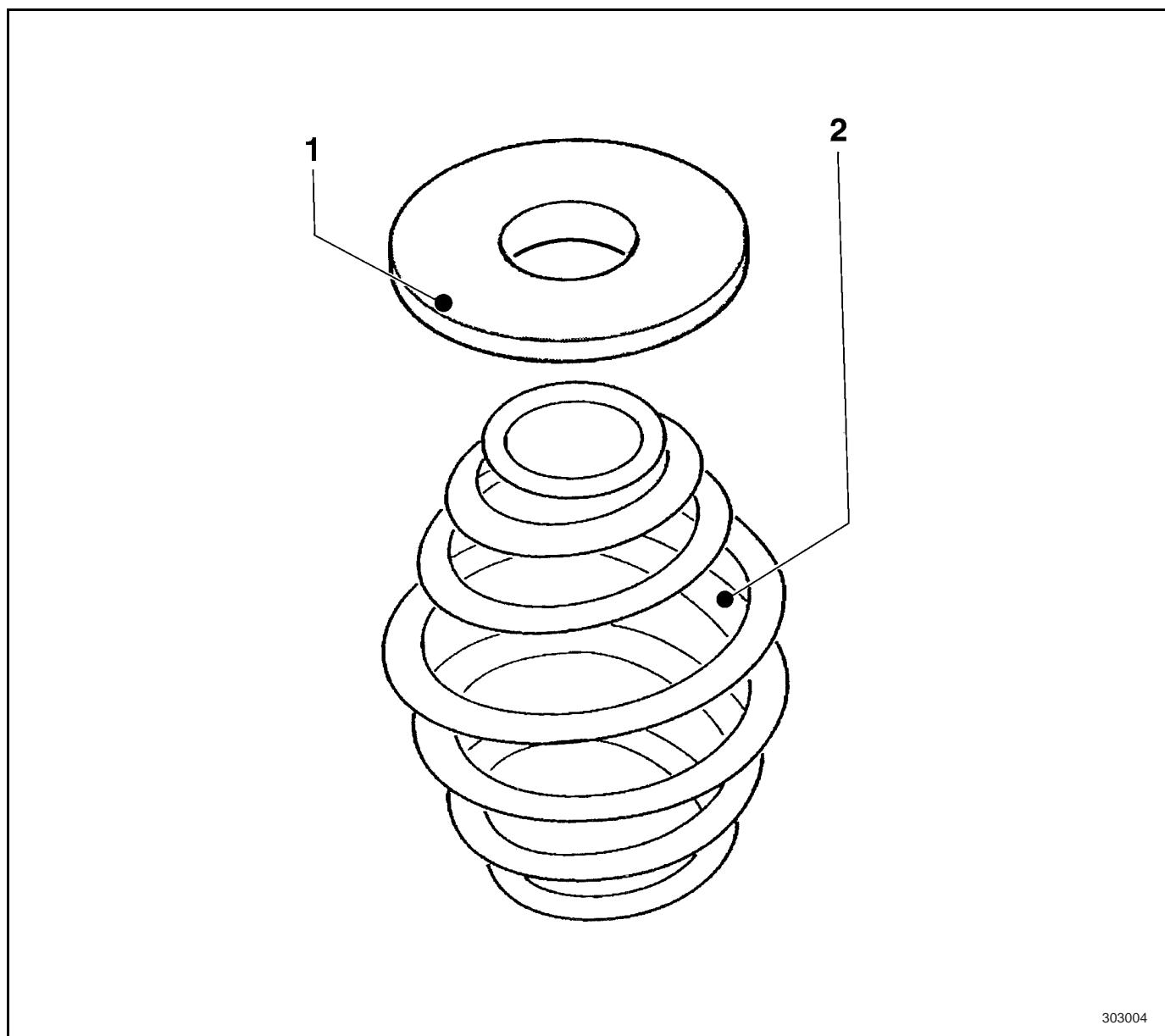


303003

Legend

- | | |
|-------------------------|-------------------------|
| (1) Nut | (6) Outer wheel bearing |
| (2) Wheel and axle | (7) Gasket |
| (3) Oil seal | (8) Cotter pin |
| (4) Inner wheel bearing | (9) Capstan nut |
| (5) Wheel hub | (10) Back axle cup |

Rear spring, isolation block

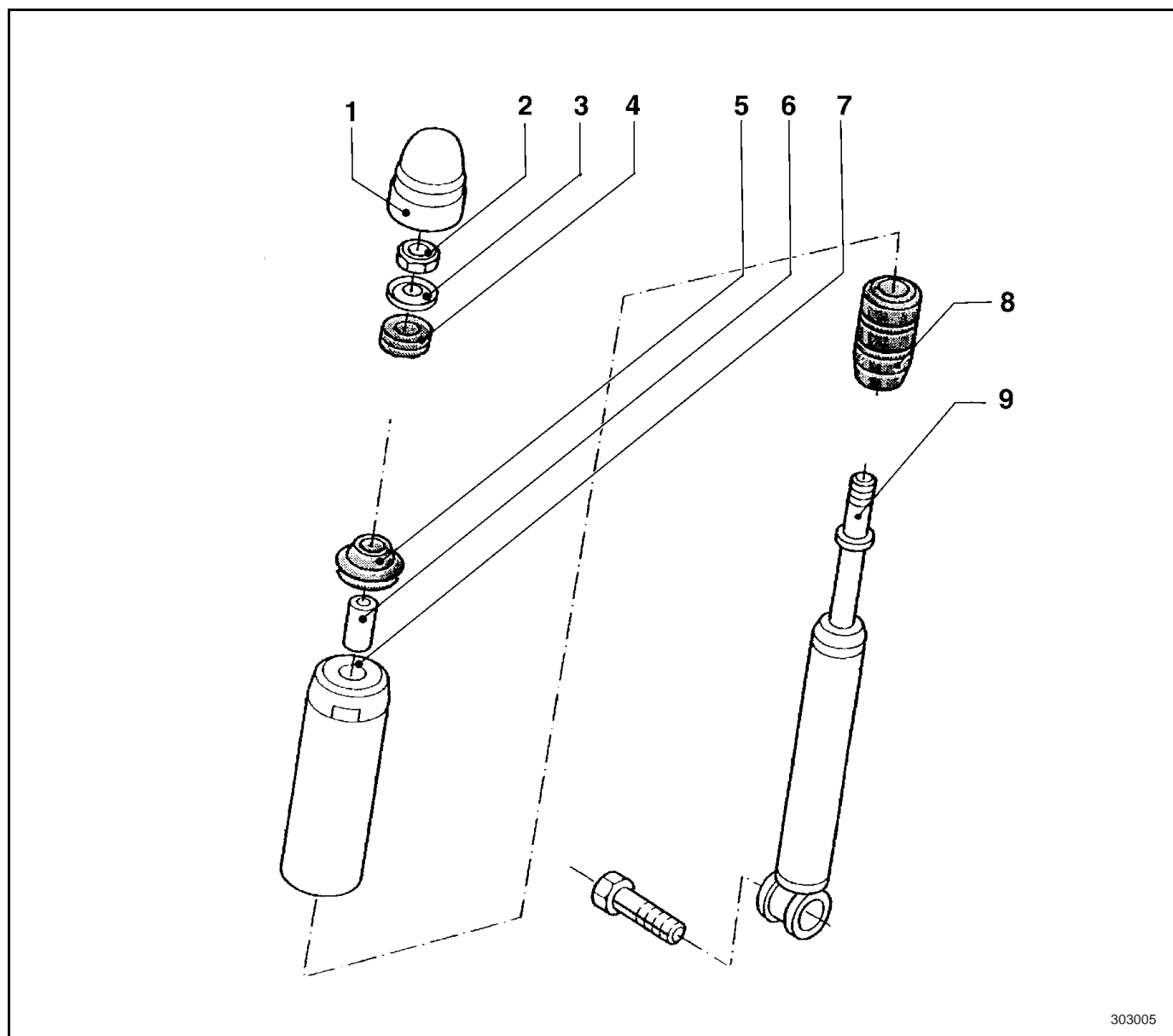


Legend

(1) Isolation block

(2) Rear spring

Shock absorber, buffer block, nonconductor



303005

Legend

- | | |
|---------------------|--------------------|
| (1) lid | (6) Gasket |
| (2) Nut | (7) Dust cap |
| (3) Positioner | (8) Hollow buffer |
| (4) Isolation block | (9) Shock absorber |
| (5) Buffer block | |

3.3.3 Repair guidance

3.3.3.1 General information

When disassembling wheels, the position of wheel hub should be marked as reference for installation.

Wheel nuts should be tighten to 110 N•M.

At the time of installation, all contact surfaces should be clean and without any burr.

When installing axles, new bolts should be used.

Rear spring, rear shock absorber, dustproof sleeve and buffer block should be replaced in pair.

If operation of rear axle on either side is presented, the other side is the same.

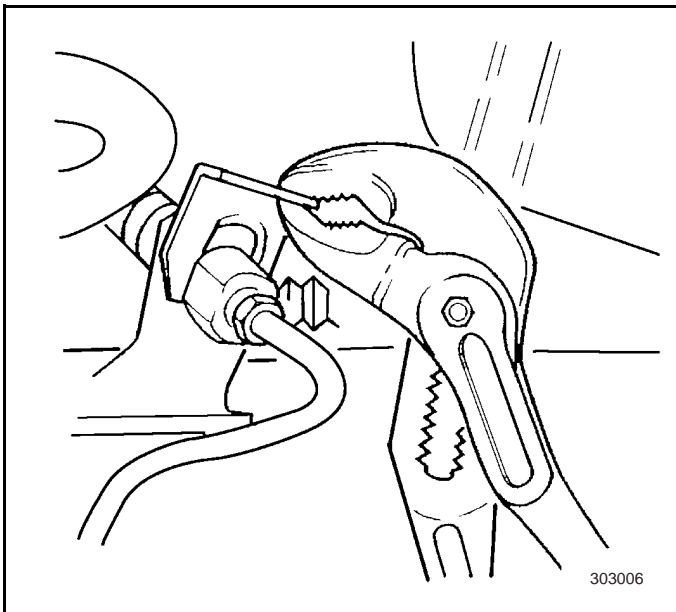
Note: Alignment of rear suspension is unadjustable. When any value is beyond the tolerance range, please inspect the wheel journal or the frame of axle (welded body) for any damage. If necessary, please replace the damaged component.

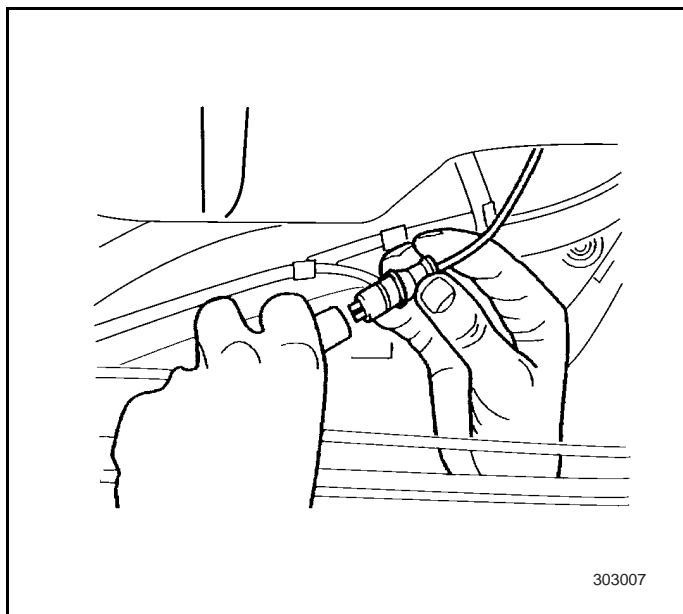
Note: All operations should be conducted by workers according to the health, safety and environmental laws and regulations of the local government.

3.3.3.2 Replacement of back axle assembly

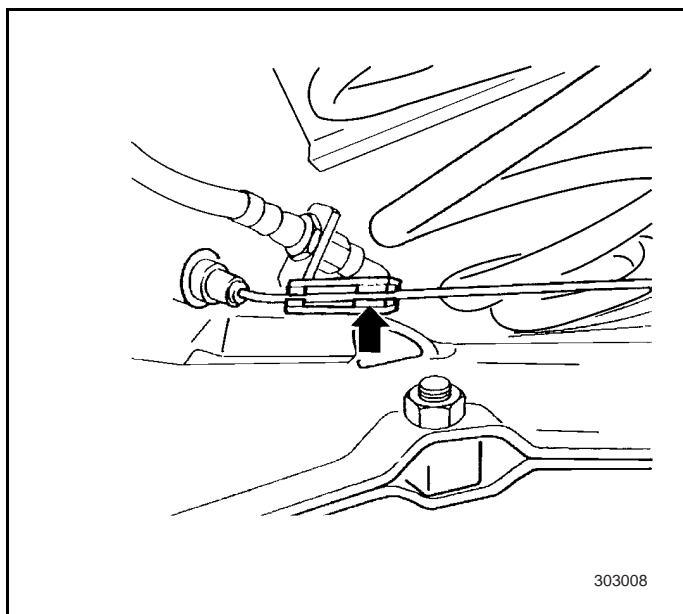
Disassembly procedures

1. Disconnect brake hose, remove the positioner of rear brake hose, and block out brake hose.

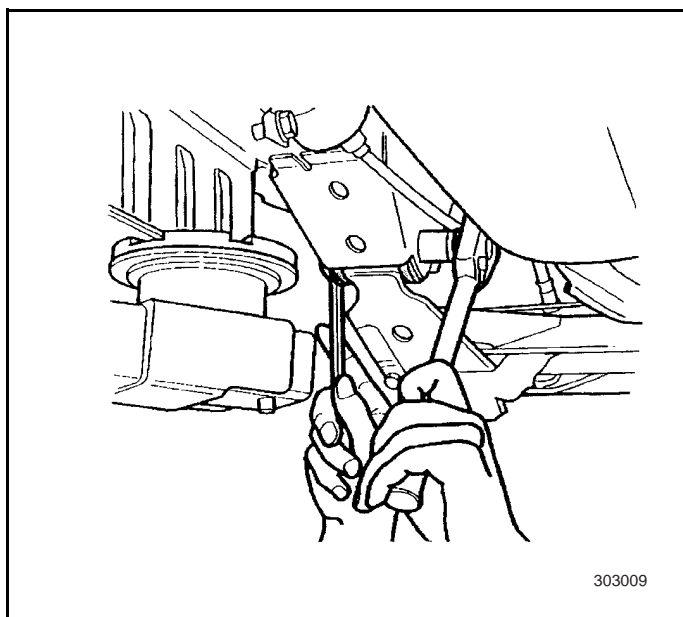




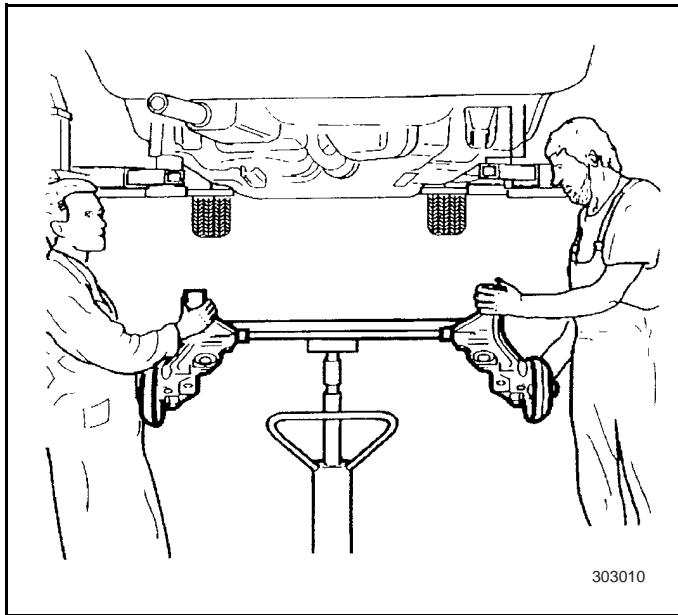
2. Disconnect the connector of ABS sensor. (for vehicles with ABS).



3. Place lifting jack at the central position of back axle and jack up slightly.
4. Disconnect parking brake cable with disengaging rod.
5. Remove rear spring, isolation block and rear shock absorber. See replacement of rear spring, replacement of rear spring isolation block and replacement of shock absorber/buffer block.



6. Loosen and remove fasteners of back axle and the body plate, and remove the back axle.
7. Lower the lifting jack and back axle slowly. (Two persons)

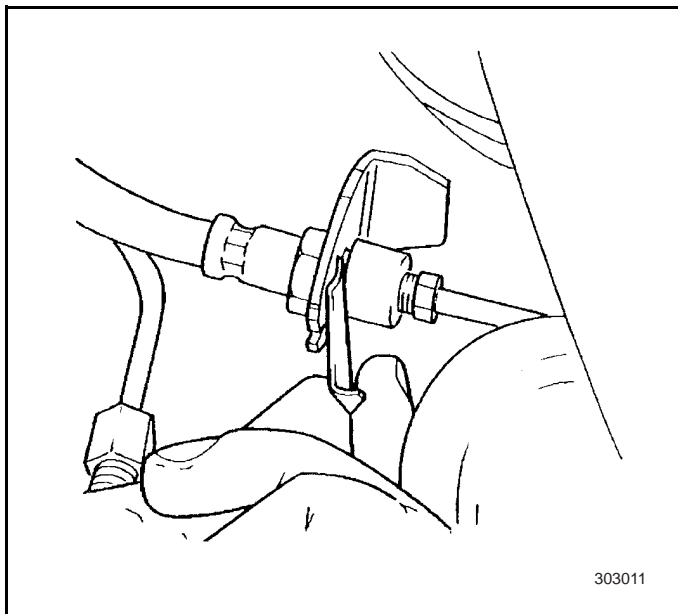


Installation procedures

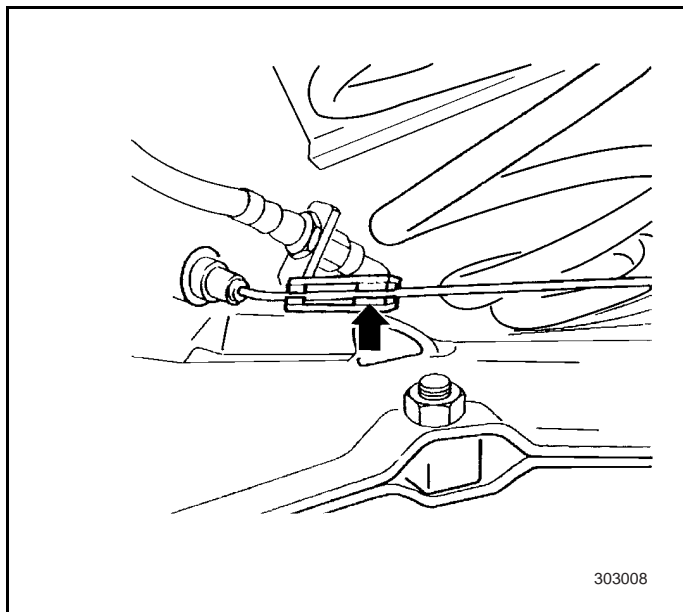
1. Place back axle on the lifting jack. Jack up the lifting jack until back axle can be installed. (Two persons)
2. Install fasteners of back axle and the body. Don't tighten at this time.
3. Install the spring and the spring isolation block. See replacement of rear spring and replacement of rear spring isolation block.
4. Install shock absorber. See replacement of shock absorber / buffer block.
5. Connect brake hard tubes and brake hoses.

Notice: When installing a brake hose, no entwisting or distorting is permitted.

6. Install fixing circlip of the brake hose.



7. Connect ABS sensor. (for vehicles with ABS).



8. Insert hand brake cable into the guide block. Connect the cable with hand brake bar.

Note: See 5.4 parking brake for the adjustment of hand brake cable.

9. Install the wheel and tighten wheel nut.

Tightening

Tighten the wheel nut to 110 N•M.

10. Park the vehicle over service pit or on service rack. Apply a load of 70 kilogram on each of the two front seats. Tighten the nut connecting back axle and the body plate.

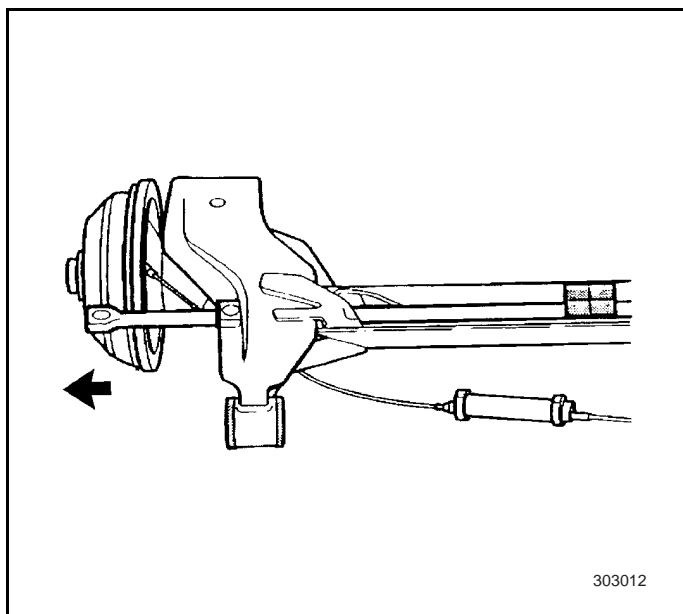
Tightening

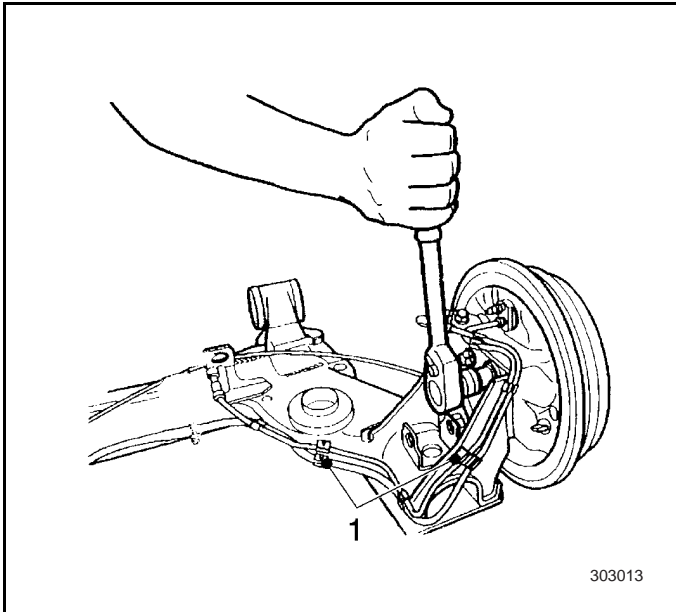
Tighten the nut for back axle and body plate to 50 N•M+45°+15° .

3.3.3.3 Replacement of back axle (welded assembly)

Disassembly procedures

1. Loosen the nut of stabilizer bar, and remove stabilizer bar and rubber shock isolator in the direction shown by the arrow. If necessary, use a punch. Use protection tool to mount rear axle onto the vice.

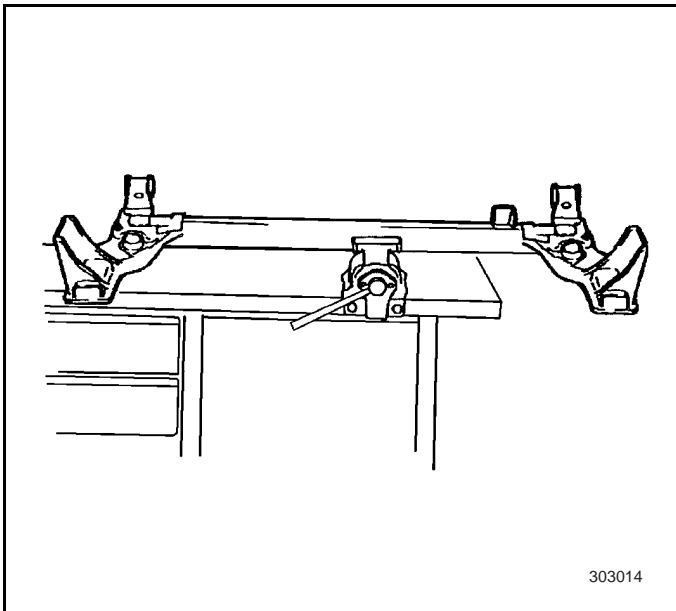


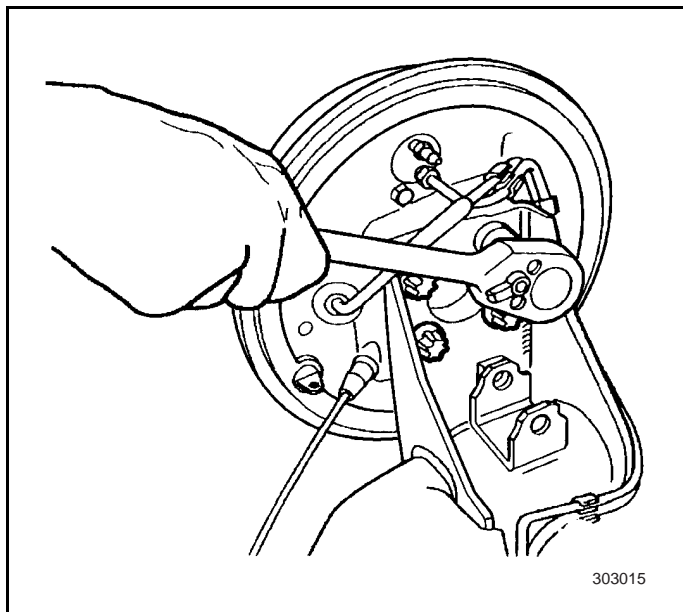


2. Loosen the bolt connecting hard tube of the brake and the brake itself, but don't remove it.
3. Remove the clamp of brake tube on rear axle.
4. Remove the clamping collar(1) of ABS sensor. (for vehicles with ABS).
5. Loosen and remove wheel shaft and brake hard tube and wheel hub.

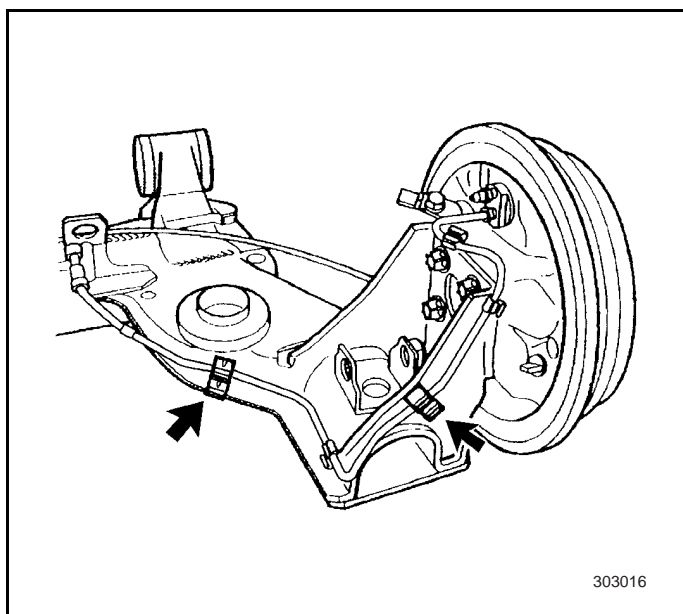
Installation procedures

1. Inspection: Use protection tool to mount the new axle onto the vice; clean the contact surface with wheel shaft, and inspect it for any burr. During installation, don't cause any damage to the profile of rear axle.





2. Assemble wheel shaft with brake backing plate, and wheel hub with brake hard tube. New bolts should be used.

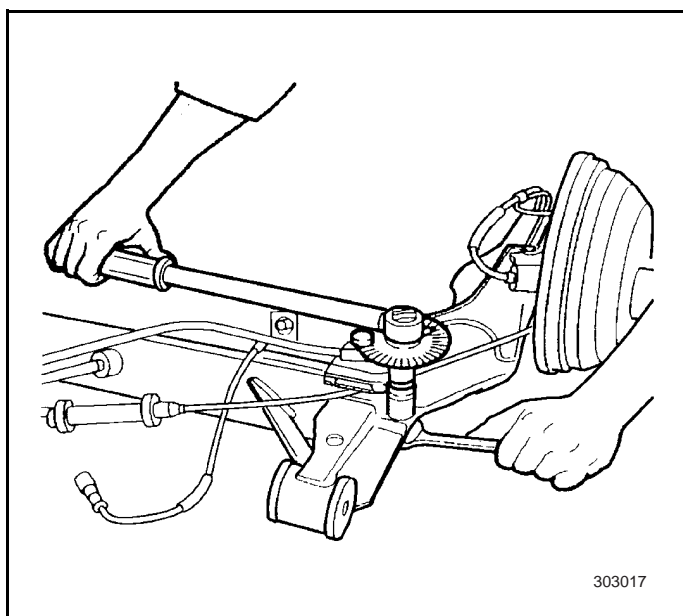


3. Install clamping collar of brake hard tube. Insert brake hard tube into the clamping collar (as shown by arrow).
4. Tighten the bolt connecting brake hard tube with brake backing plate.

Tightening

Tighten the bolt of brake hard tube to 16 N•M.

5. Install the harness of ABS sensor. (for vehicles with ABS).



6. Install the guide block of brake cable into rear axle.
7. Install stabilizer bar with rubber isolator. Use new bolts and nuts.

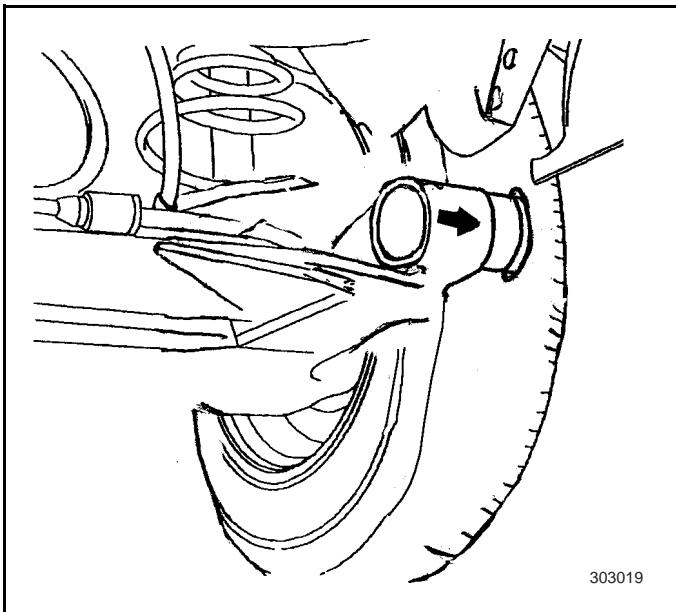
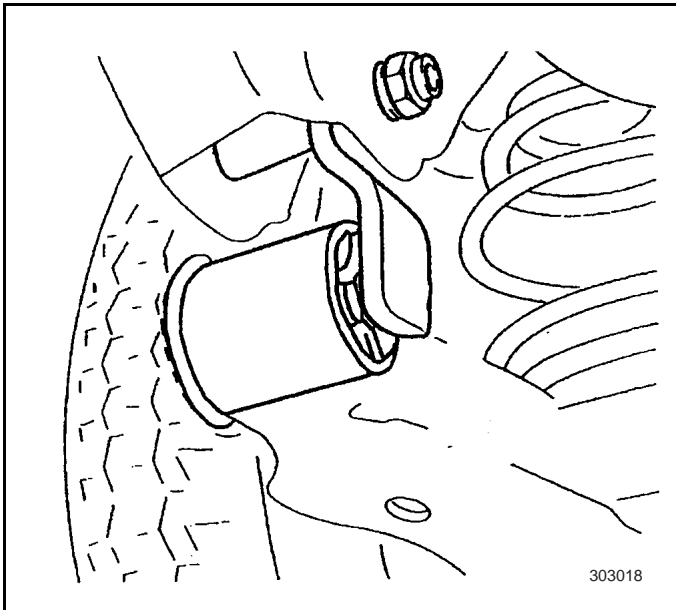
Tightening

Tighten bolts and nuts of stabilizer bar and back axle to 60 N•M+60°+15°.

3.3.3.4 Replacement of bush of rear axle

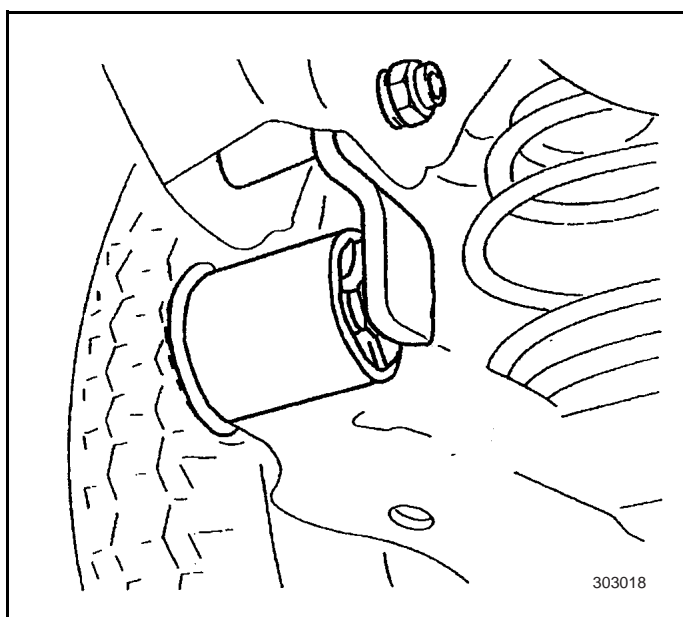
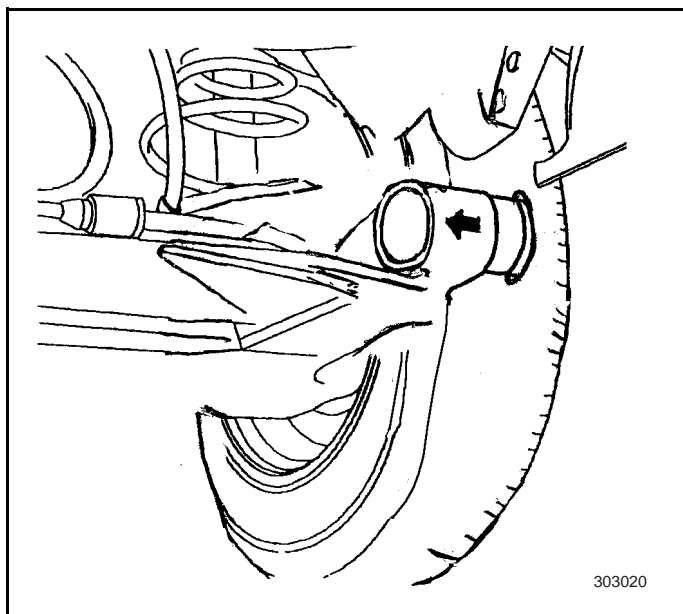
Disassembly procedures

1. Remove the brake hard tube from floor of the body.
2. Loosen and remove ABS sensor. (for vehicles with ABS).
3. Place a hydraulic jack under the center of rear axle; loosen the tightened part on left side and remove the nut. If necessary, use a screwdriver to remove it.
4. Slightly lower rear axle; as shown in the figure, put a tool into the body plate to prevent movement of rear axle.
5. Remove tightened part on the right side.
6. Remove the bush from rear axle (direction as shown by arrow), a punch and a copper tube can be used.

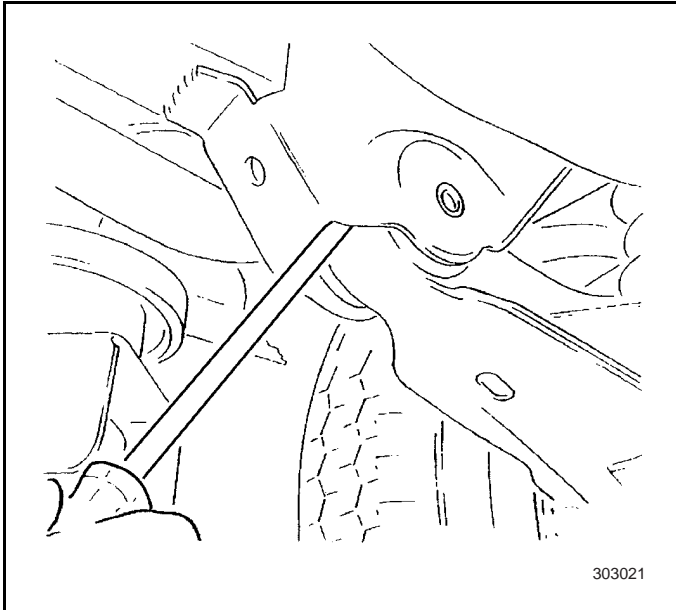


Installation procedures

1. Before installation, apply some soap bath on the new bush.
2. Install the bush (direction as shown by the figure).



3. Clean installation surface. Ensure there is no lubricant.

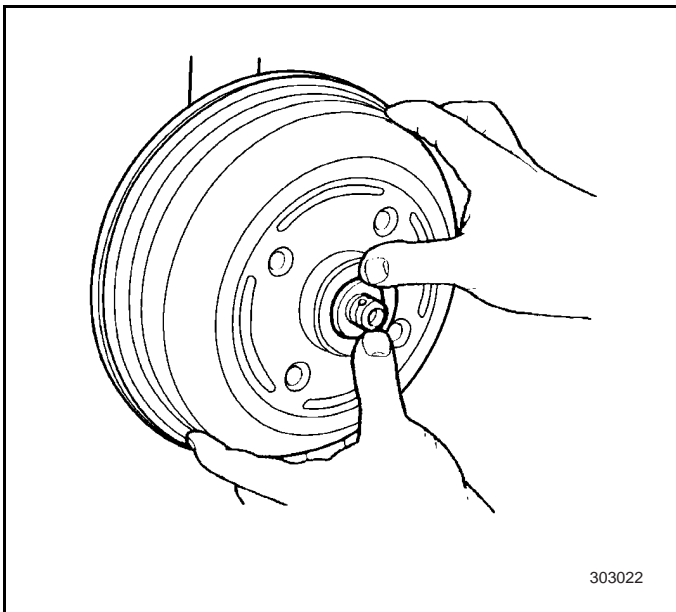


4. Install rear axle, see replacement of rear axle assembly. If necessary, use a screwdriver to adjust the rear axle so that the binding bolt can be inserted more easily.

3.3.3.5 Replacement of wheel hub assembly

Disassembly procedures

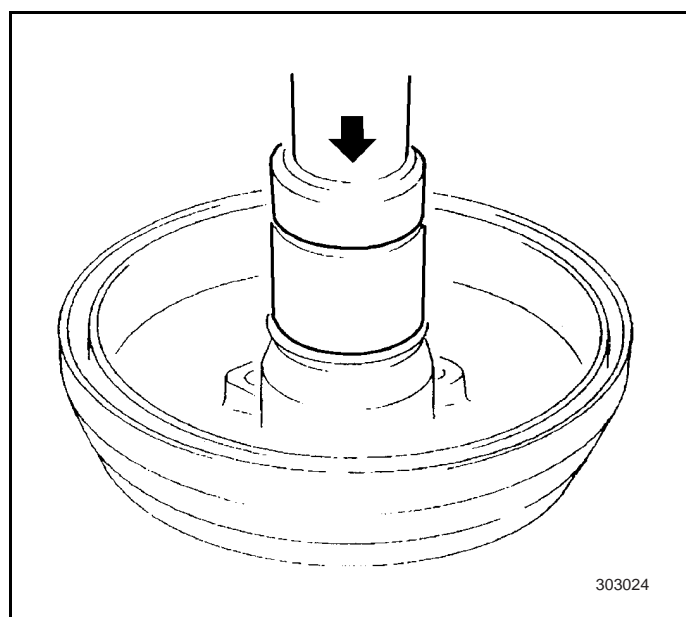
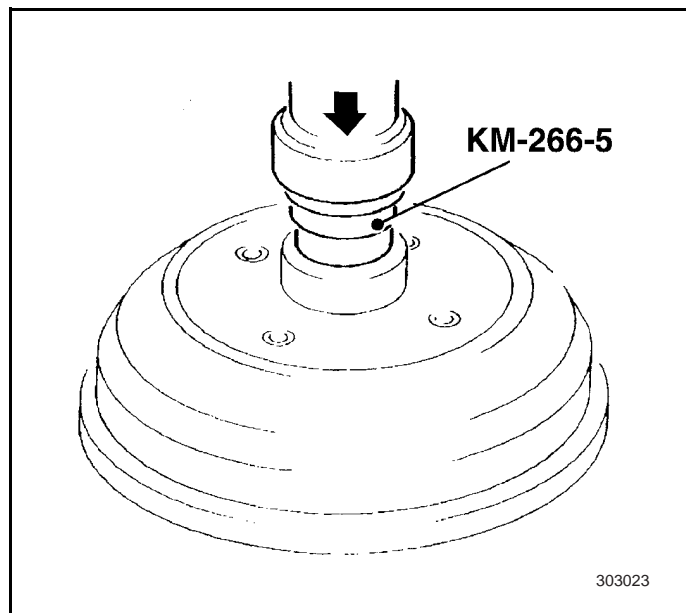
1. Raise the vehicle and remove rear wheels.
2. Remove dust cap from wheel hub assembly.
3. Remove the cotter pin locking wheel shaft and remove the bolt.
4. Remove wheel hub assembly including its gaskets.



Installation procedures

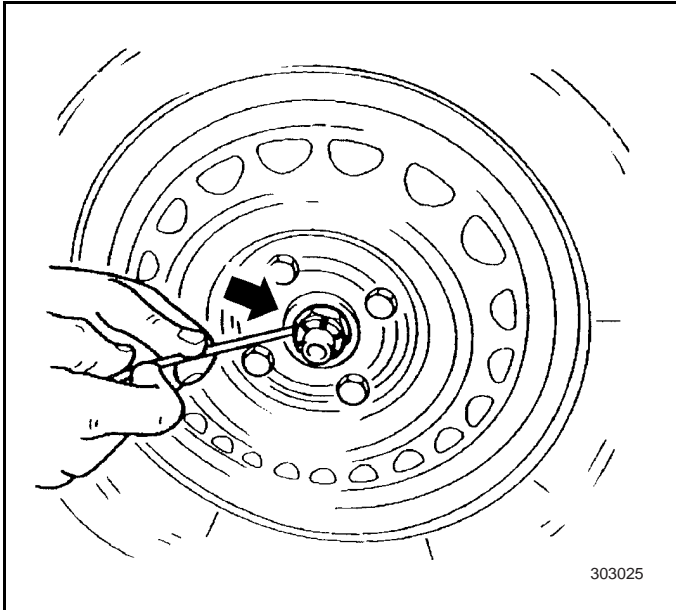
Tools required

- KM-266-5 Puller/installer
- KM-508-1 Puller/installer



1. Clean wheel shaft and inspect it for any damage or wear.
2. Use KM-266-5 to press in the positioner of inner and outer bearings. Install the inner ring of inner bearing assembly into the wheel hub.
3. Fill the free area between the two bearings and the wheel hub with grease.
4. Use KM-508-1 to press oil seal assembly into the wheel hub and tighten it, and apply some grease on the hole cover of oil seal assembly. At the same time apply some grease on the wheel shaft surface connecting the bearing and the oil seal contact surface.
5. Lock adjusting device. Install the wheel hub and the wheel.

3.3.3.6 Adjustment of clearance between wheel bearings



1. Tighten capstan nut to 25 N•M (rated value) and rotate the wheel hub.
2. Loosen or retighten the nut until the groove of capstan nut is aligned with the hole of cotter pin, and when axle force is (100 ± 15) , the pretension of bearing is 0.05mm, and the clearance is 0.03mm. Then tighten the cotter pin.
3. When the cotter pin is tightened the wheel hub should be able to rotate freely in both direction without any binding.

3.3.3.7 Replacement of rear wheel bearing/oil seal

Note: It's the same as 3.3.3.5 except for the following additional operations.

Disassembly procedures

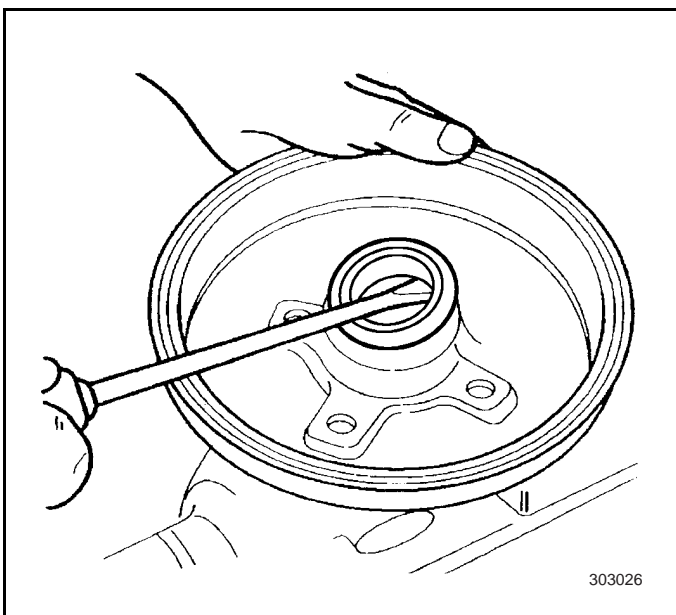
Tools required

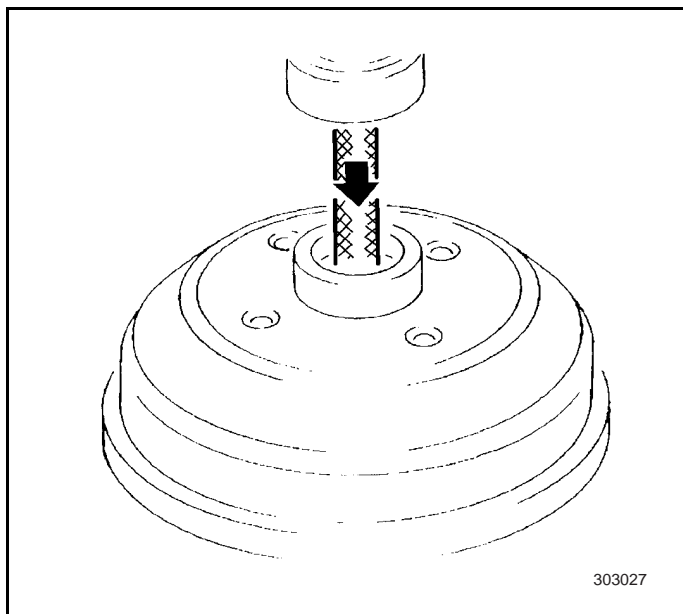
- KM-266-A Puller/installer
- KM-466-2 Puller/installer

1. Replace inner bearing.
2. Use a bar to take oil seal out of the wheel hub and replace it.

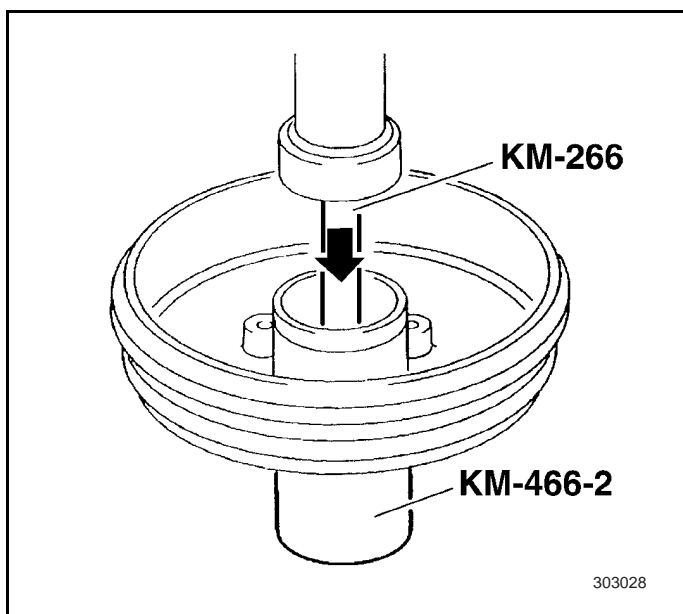
The following operations are for the replacement of wheel bearing only.

3. Remove the inner ring of inner bearing.





4. Use KM-266-2, KM-266-3 and KM-466-2 to press outer ring out of wheel hub assembly.



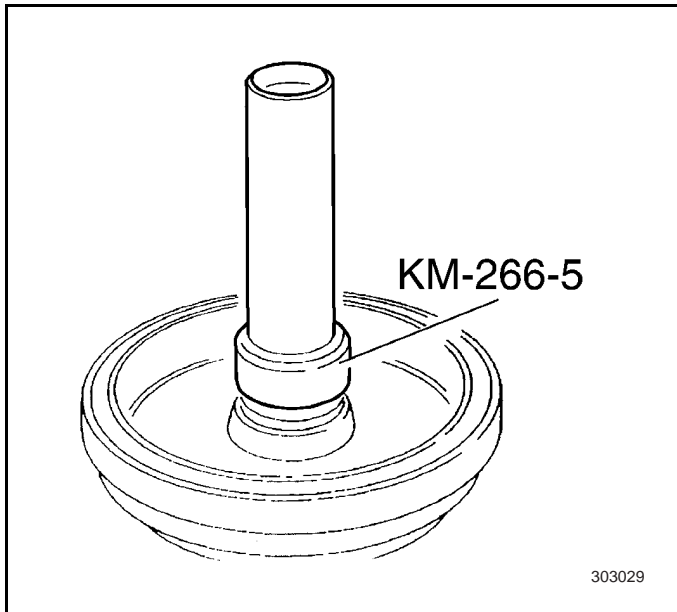
5. Replace the outer bearing of wheel hub. Use KM-266-3, KM-266-1 and KM-466-2 to press outer ring out of wheel hub assembly.
6. Clean wheel hub assembly.

Installation procedures

Tools required

- KM-266-A Puller/installer

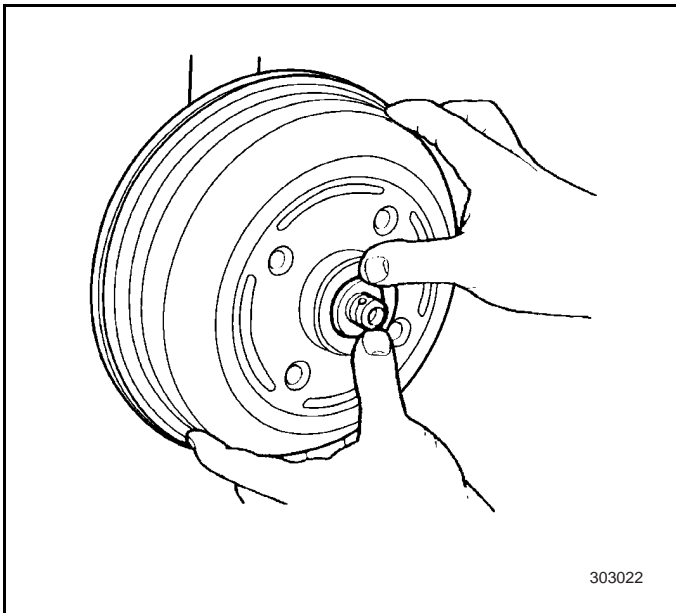
1. Use KM-266-5 to press the outer ring of inner bearing into wheel hub.
2. Install inner ring into wheel hub assembly.
3. Press in the outer ring and the oil seal of outer bearing.
4. Install wheel hub assembly. See replacement of wheel hub assembly.

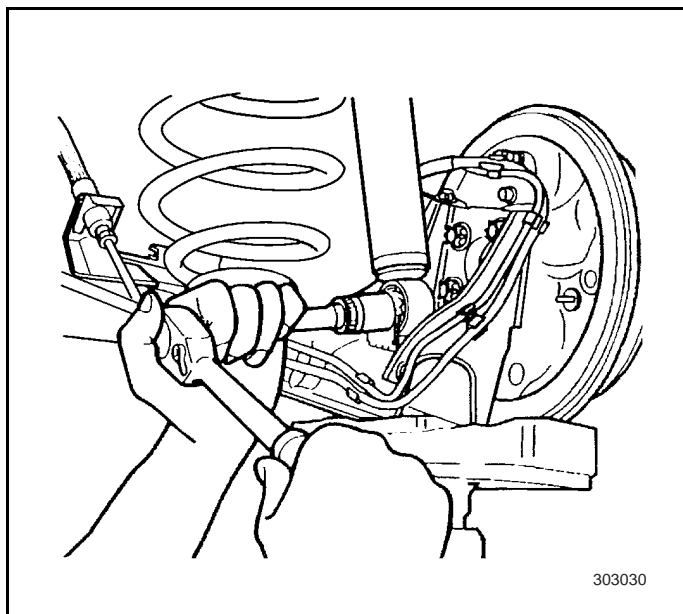


3.3.3.8 Replacement of wheel shaft

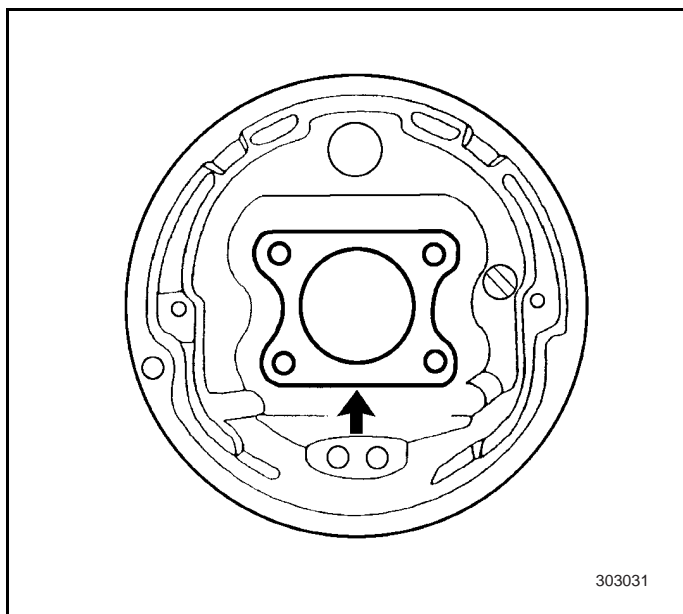
Disassembly procedures

1. Remove dust cap from wheel hub assembly.
2. Remove cotter pin and the nut.
3. Remove wheel hub assembly with brake backing plate.





4. Use lifting jack to support rear axle at a position on the rear axle near shock absorber.
5. Loosen the nut of shock absorber. Loosen the nut of wheel shaft and remove wheel shaft and brake backing plate.



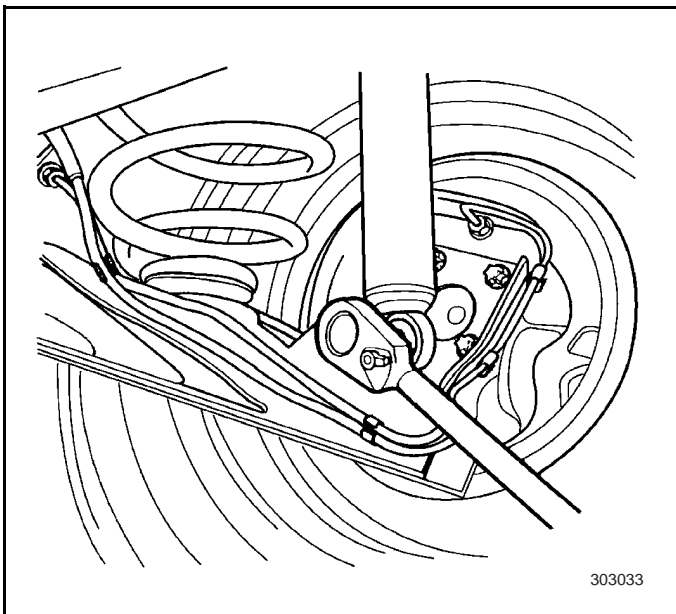
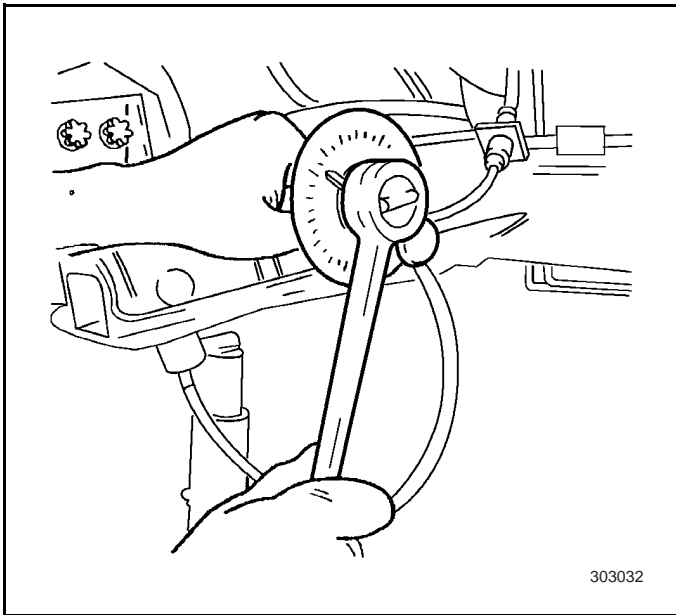
6. Clean up the contact surface of brake backing plate or wheel shaft and inspect for any damage, wearing or burr.

Installation procedures

1. Use new bolts to install wheel shaft and brake backing plate.

Tightening

Tighten the nut of wheel shaft to $50\text{N}\cdot\text{M}+30^\circ+15^\circ$.

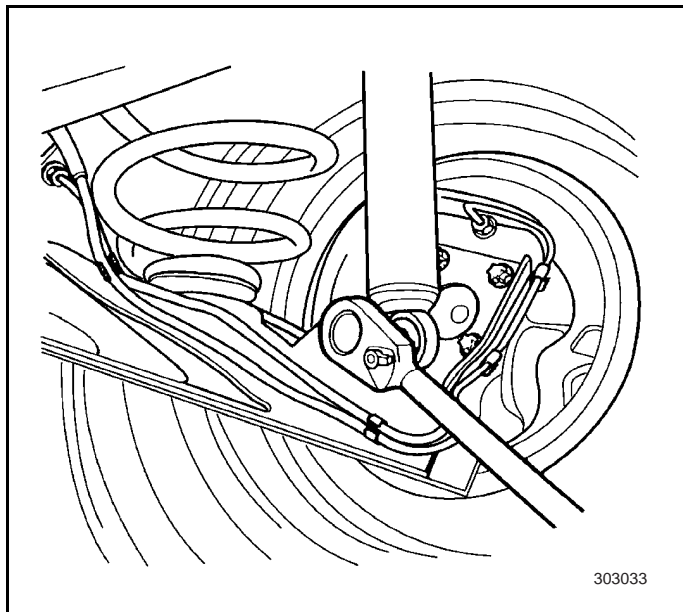


2. Raise the lifting jack and install shock absorber.
3. Lower the lifting jack.
4. Install wheel hub assembly. See replacement of wheel hub assembly.
5. Adjust the clearance between wheel bearings. See adjustment of wheel bearing.
6. Install the rear wheel.

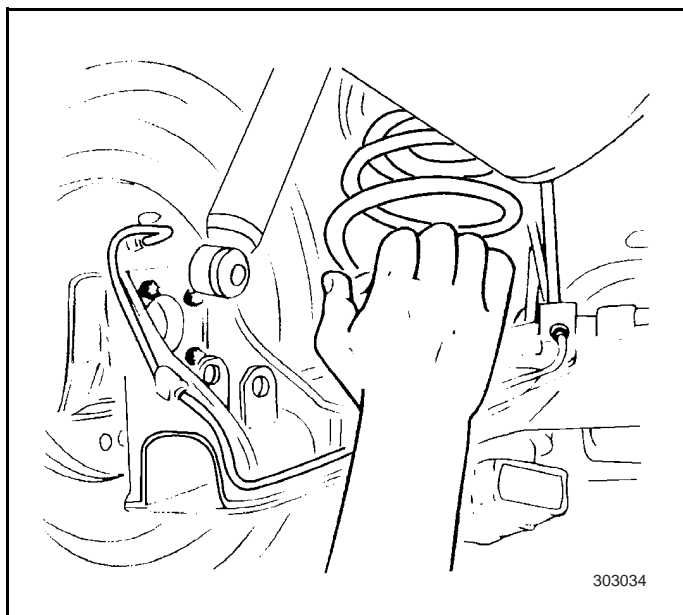
3.3.3.9 Replacement of rear spring.

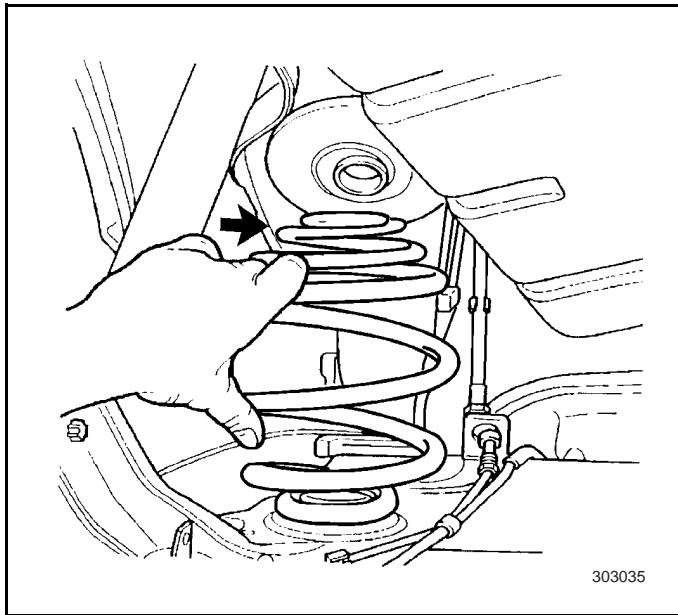
Disassembly procedures

1. Place a hydraulic jack under the right control arm of rear axle and slightly jack up the rear axle.
2. Remove the bolt of shock absorber and the shock absorber itself.



3. If necessary, disconnect brake hoses with brake hard tubes .
4. Lower the lifting jack and place it under the left control arm. Slightly jack up, and remove the bolt of shock absorber and the shock absorber itself.
5. Lower the lifting jack slowly. First remove right spring and isolation block, then remove left spring and isolation block.
6. Remove non-conductor.





Installation procedures

1. Place a lifting jack under the right control arm of rear axle and slightly jack up the rear axle.
2. Install right spring and isolator, then slightly raise the lifting jack.
3. Operation on the left side is the same (pay attention to the installation position of the spring, and ensure the end of coil spring faces toward the plate of body).
4. Install shock absorbers, first the left one then the right one.

Tightening

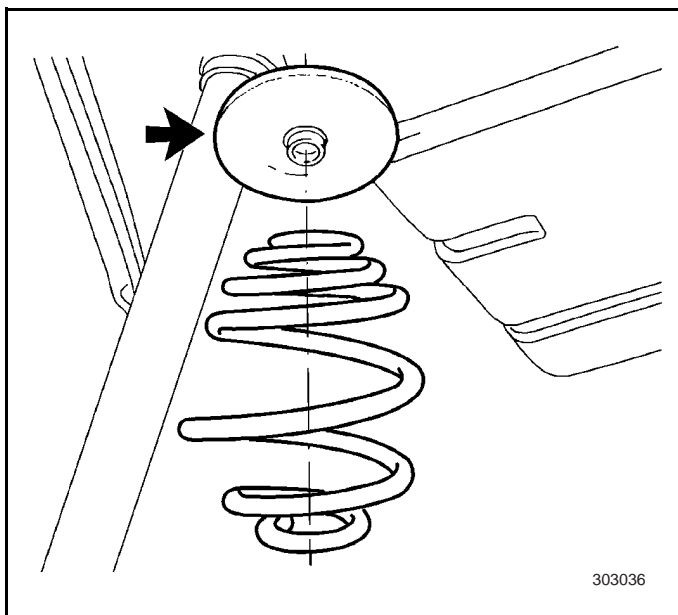
Tighten the bolt of shock absorber and rear axle to 60-70N•M.

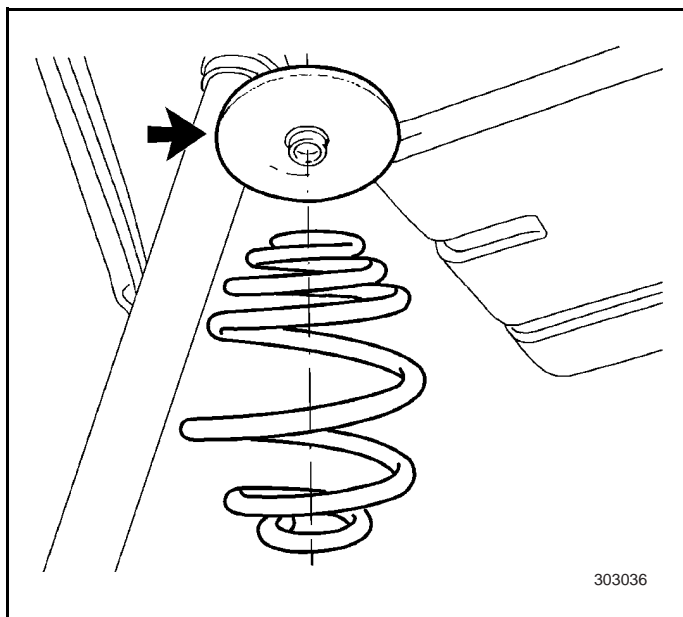
5. Take the lifting jack out.

3.3.3.10 Replacement of rear spring isolation block.

Disassembly procedures

1. Remove rear spring. See replacement of rear spring.
2. Remove isolation block (as shown by arrow).





Installation procedures

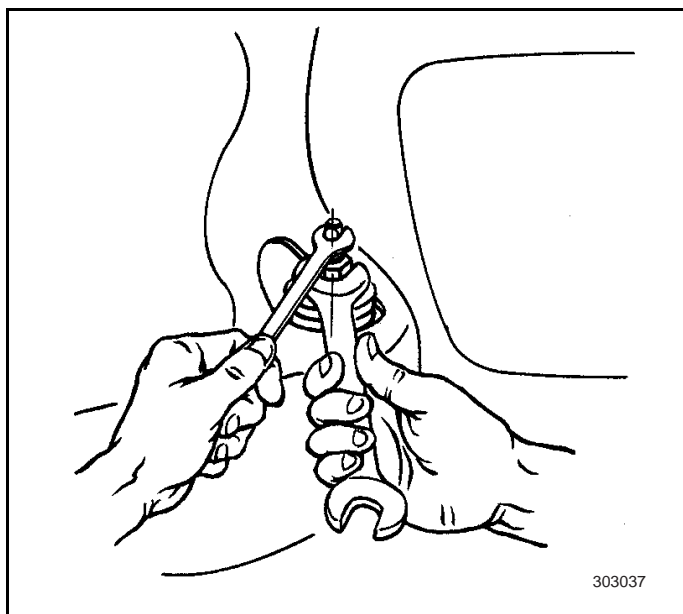
1. Install isolation block (as shown by arrow).
2. Install rear spring. See replacement of rear spring.

3.3.3.11 Replacement of shock absorber / buffer block

Note: Shock absorbers should be installed or removed in series. When operation on only one side is described, the other side is the same.

Disassembly procedures

1. Open the door of baggage compartment.
2. Remove the nut of shock absorber cap.
3. Remove buffer block and the positioner. If necessary, replace buffer block.
4. Raise the vehicle and remove the bolt.
5. Remove shock absorber.

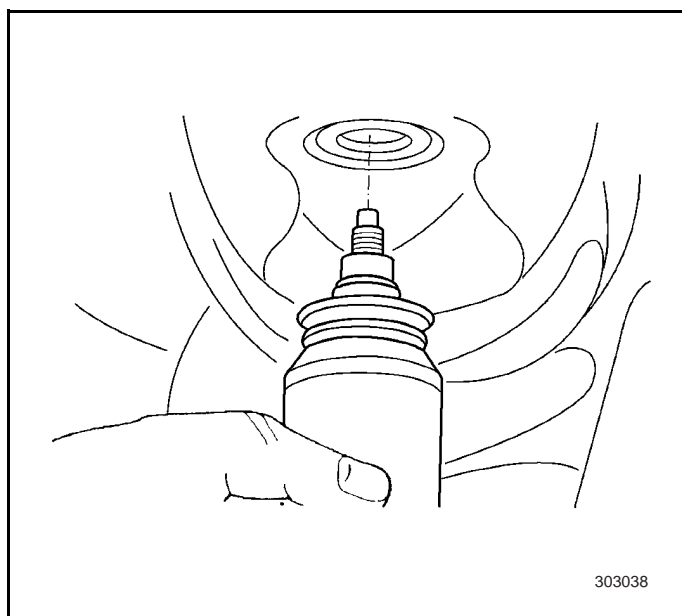


Installation procedures

1. Install the lower bolt connecting rear axle and shock absorber. When installing shock absorber, the piston rod should be aligned with the hole of shock absorber in the body.

Tightening

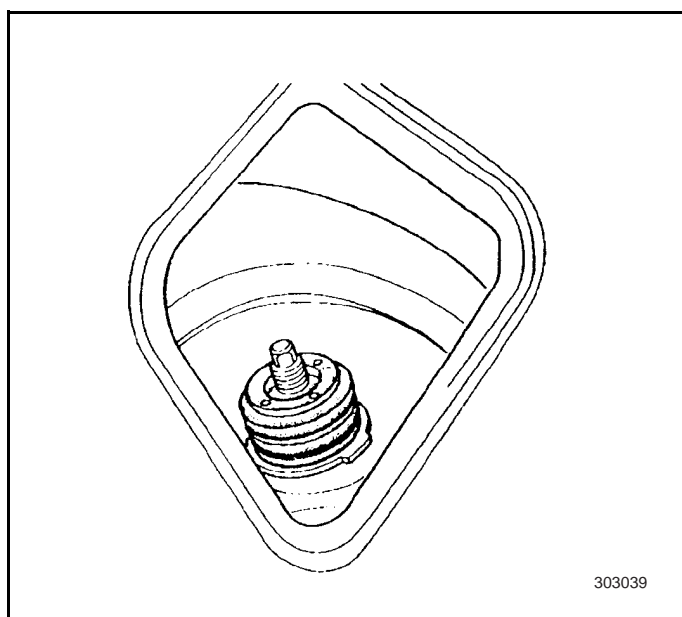
Tighten the bolt of shock absorber and rear axle to 60-70N•M.

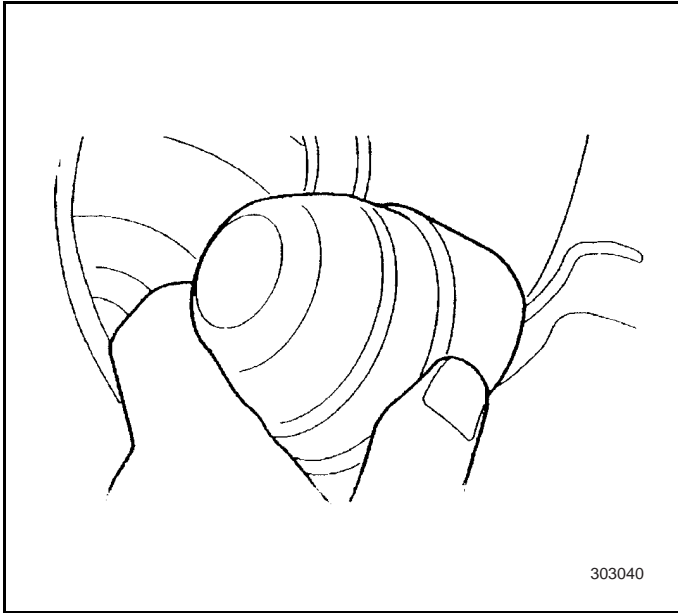


2. Lower the vehicle, and thread the end of shock absorber bar through a hole in the bottom board of the vehicle.
3. Install buffer block, the positioner and their nuts, and tighten the nut of shock absorber.

Tightening

Tighten the nut of shock absorber to 18-20 N•M.



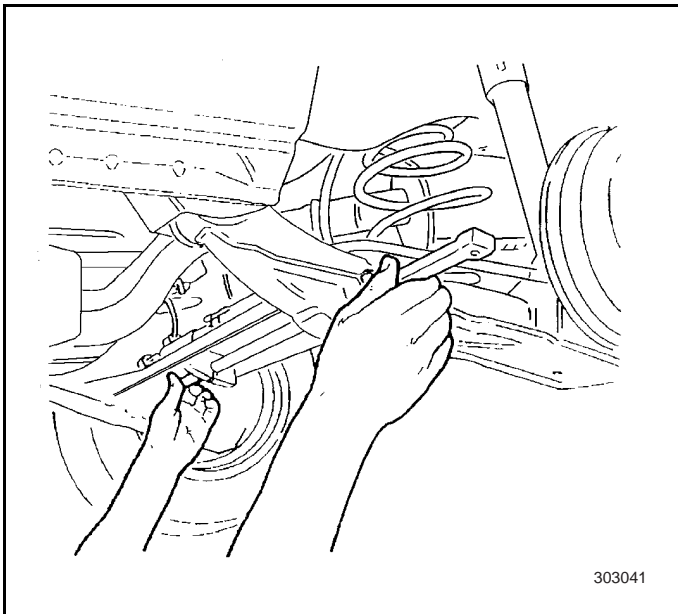


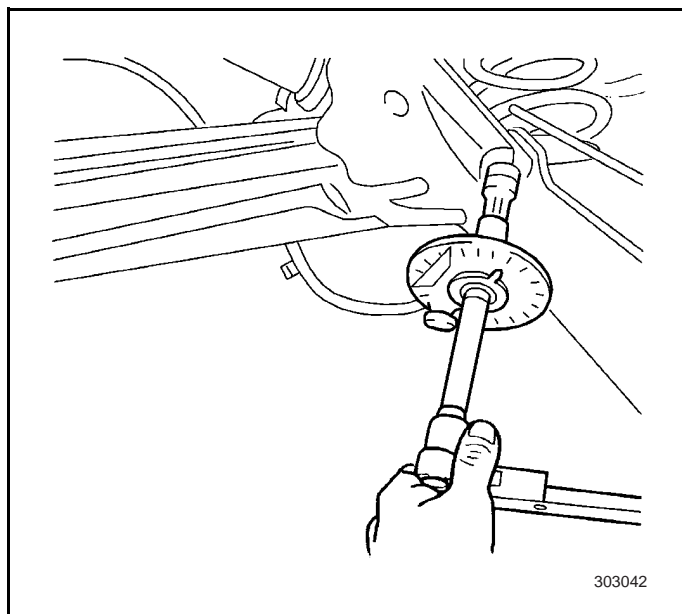
4. Install top cover.

3.3.3.12 Replacement of stabilizer bar

Disassembly procedures

1. Disassemble rear wheel on one side.
2. Remove the fastener of stabilizer bar on rear axle.
3. Remove stabilizer bar.
4. If necessary, remove the wheel on another side, a punch can be used.





Installation procedures

1. For the convenience of installation, apply some grease on the stabilizer bar.
2. Install stabilizer bar and the isolator.
3. Use new fastener to tighten stabilizer bar.

Tightening

Tighten the fastener of stabilizer bar to $60\text{N}\cdot\text{M}+60^\circ+15^\circ$.

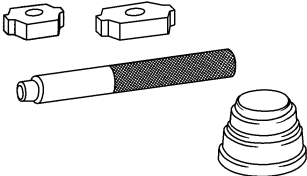
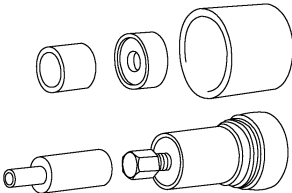
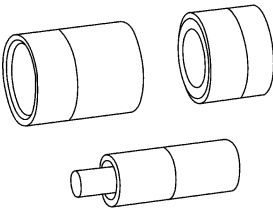
4. Install the rear wheel.

3.3.4 Explanation and operation

3.3.4.1General information

Rear suspension uses a spring with variable rigidity, a twistable axle bracket and a stabilizer bar. Twistable axle bracket helps the suspension to maintain quasi-independence. Alignment of rear wheel is unadjustable.

3.3.5 Special tools

Graphics	Tool identification/ description
 <div>KM-266-A</div>	<div>KM 266-A Puller/installer</div>
 <div>KM-466-A</div>	<div>KM 466-A Puller/installer</div>
 <div>KM508-A</div>	<div>KM 508-AI Puller/installer</div>

3.4 Tyres and wheels

3.4.1 Specifications

3.4.1.1 Specifications of tyres and wheels

Conversion table of charge pressure (kilopascal to pounds per square inch)			
Kilopascal	Pounds per square inch	Kilopascal	Pounds per square inch
140	20	215	31
145	21	220	32
155	22	230	33
160	23	235	34
165	24	240	35
170	25	250	36
180	26	275	40
185	27	310	45
190	28	345	50
200	29	380	55
205	30	415	60
Conversion: 6.9 kilopascal = 1 pound per square inch			

Load index	68	69	70	71	72	73	74	75
Maximum load (kilogram)	315	325	335	345	355	365	375	387

Load index	76	77	78	79	80	81	82	83
Maximum load (kilogram)	400	412	425	437	450	462	475	487

Load index	84	85	86	87	88	89	90	91
Maximum load (kilogram)	500	515	530	545	560	580	600	615

Common grades of speed

Speed symbols	Maximum speed (kilometer per hour)
S	180
T	190
U	200
H	210
V	240
Z	More than 240

Inflation pressure of tyres

Applications	Specifications (fully loaded)
Tyres (185/60 R14-82H)	
Fore wheels	210 kilopascal
Rear tyres	250 kilopascal

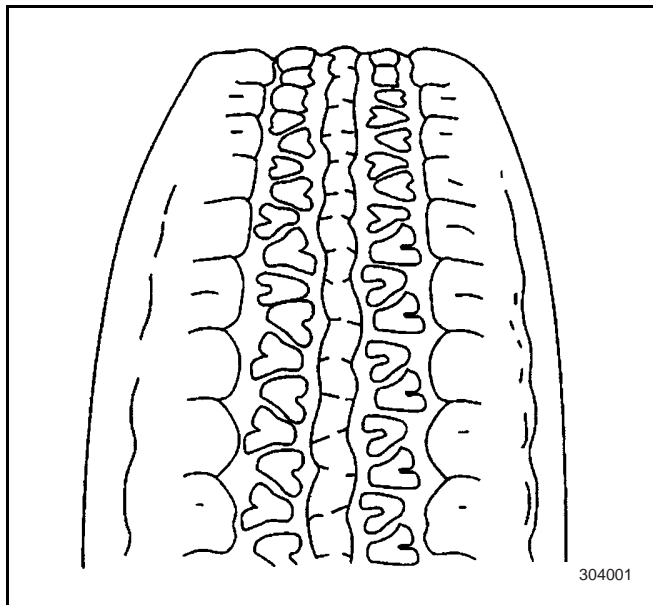
3.4.1.2 Tightening Torque of Fasteners

Applications	Specifications
Nuts of wheel	110 N•M

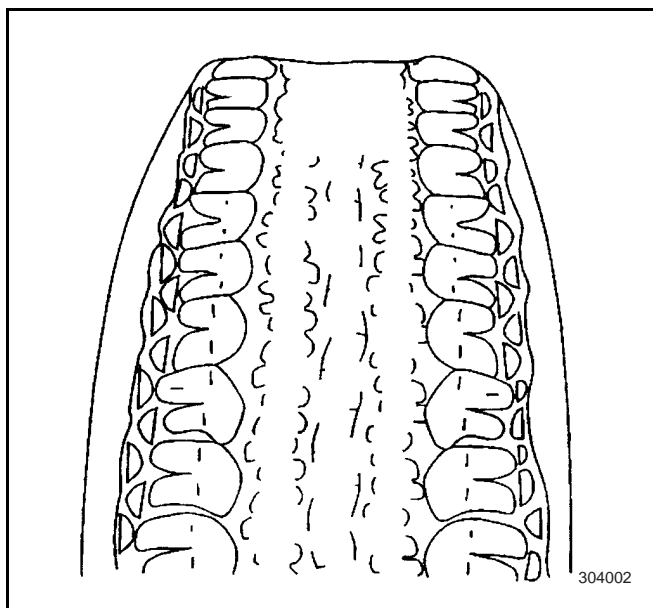
3.4.2 Diagnostic messages and procedures

3.4.2.1 Diagnosis of tyres - irregular or early wearing

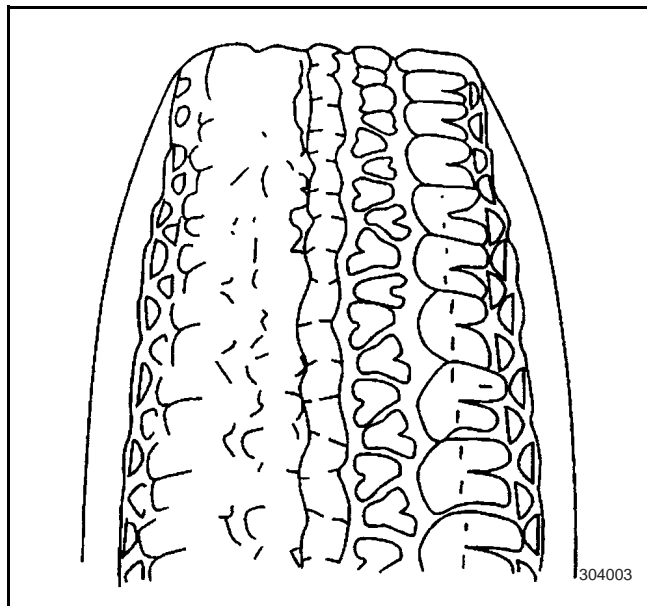
There are many reasons for irregularity or early wearing of wheels .



- Improper inflation pressure will cause irregularity or early wearing to tyres.
- Irregularity in rotation will cause irregular or early wearing to tyres.



- Driving habit may also cause irregular or early wearing to tyres.
- Improper wheel alignment may cause irregularity of tyres and early wearing.



Inspection procedures

1. Inspect the wearing of front wheel tyre. Inspect the wearing of rear wheel tyre.
2. If any one the following conditions is detected, rotate the tyre:
 - Uneven wearing on the tread of any tyre.
 - Uneven wearing between left tyre and right tyre.
 - Schedule maintenance has been suspended.
3. If any of the following conditions exists, wheel alignment should be conducted:
 - Uneven wearing between front wheel tyres on the left side and the right side.
 - Uneven wearing on tire tread.
 - Wearing condition appears on the tread pattern, and feather edge appears on the pattern of wheel ribs or one side of the tread.

3.4.2.2 Correction of departure/wandering of radialply tyre

Steps	Measures	Numerical values	Yes	No
Definition: Departure or wandering towards one side of a vehicle when driving straight forward.				
1	1. Adjust tyre pressure to the required level. 2. Inspect the brake for any binding condition. 3. Conduct road test to the vehicle. Drive forward and backward on a smooth road surface. Is the vehicle departing or wandering toward one side?	—	To step 2	The system is OK
2	1. Exchange the position of front left and front right wheel assemblies. 2. Conduct road test to the vehicle. Is the vehicle still wandering toward one side?	—	To step 3	The system is OK
3	Inspect to see whether the vehicle is wandering toward another direction. Is the vehicle wandering toward another direction?	—	To step 4	To step 5
4	Inspect the orientational parameters of the front wheel caster, camber, gather, etc. See setting angle (fore wheel) in wheel alignment. Is the locator value within the prescribed limit?	—	To step 6	To step 7
5	1. Inspect the tyre. 2. Exchange the position of left front wheel assembly with the position of left rear wheel assembly. 3. Conduct road test to the vehicle. Is the vehicle still wandering toward one side?	—	To step 10	Replace left rear tyre.
6	Change the parameter of caster. Is the vehicle wandering leftwards?	—	To step 8	To step 9
7	Adjust wheel alignment to the required standard. See setting angle (fore wheel) in wheel alignment. Is the adjustment completed?	—	To step 13	—
8	Set left caster to the upper limit, and right caster one degree smaller. Is the adjustment completed?	—	To step 13	—
9	Set right caster to the upper limit, and left caster one degree smaller. Is the adjustment completed?	—	To step 13	—
10	1. Exchange the position of right front wheel assembly with the position of right rear wheel assembly. 2. Conduct road test to the vehicle. Is the vehicle still wandering towards one side?	—	To step 6	Replace right rear tyre.
11	Continue to reduce right caster until the wandering is eliminated. Caster at cross direction should not exceed 2 degrees. Has the wandering been eliminated?	—	The system is OK	To step 12
12	Continue to reduce the trim of left kingpin until the wandering is eliminated. Caster at cross direction should not exceed 2 degrees. Has the wandering been eliminated?	—	The system is OK	To step 11
13	Conduct road test to the vehicle. Is the vehicle still wandering towards one side?	—	To step 14	The system is OK
14	Is the vehicle wandering leftwards?	—	To step 11	The system is OK

3.4.3 Repair guidance

3.4.3.1 Replacement of aluminum wheel cap

Disassembly procedures

1. Use screwdriver to remove wheel cap.

Installation procedures

1. Ensure the anchor pin of wheel cap is aligned with the small hole in the wheel.

Manually press the wheel cap into the wheel.

3.4.3.2 Replacement of steel wheel cap

Disassembly procedures

1. Use screwdriver to remove wheel cap.

Installation procedures

1. Ensure the gap of steel wire (on the wheel cap) is aligned with the air valve of tyre. Manually press the wheel cap into the wheel.

3.4.3.3 Repair of pores on aluminum/steel wheel

Repair procedures

1. Raise and properly support the vehicle. See hoisting and lifting of vehicle in general information.
2. Remove tyre and wheel assembly. See replacement of tyres and replacement of wheels in this chapter.
3. Determine leaking area according to the following procedures:
 - Charge the tyre to 275 kilopascal.
 - Immerge the tyre and wheel into water.
4. Mark leaking area.
5. Remove the tyre from the wheel.
6. Sanding the inner side of the leaking area with sand paper of 80 granularity.
7. Clean up this area with an ordinary cleaner such as 3M#08984 or a similar device.
8. Apply a layer of binding sealant (GM partnumber 1052366) as thick as 1/8 inch to the leaking area.
9. Dry for 12 hours.

Caution: To prevent any injury to personnel, don't stand on the tyre when inflating it. When bead undercut has exceeded safety limit, the bead may fall off. The inflation pressure of any tyre whose bead has not yet been in place should exceed 275 kilopascal. If the pressure of 275 kilopascal fails to put the bead in place, then deflate, relubricate the bead and recharge. Over inflation will cause the bead to break away and cause severe injury to personnel.

10. Install the tyre onto the wheel.
11. Pressurize to 275 kilopascal.
12. Inspect for any leakage.
13. Adjust tyre pressure to the required level. See the table of tyre inflation pressure in this chapter.
14. Balance tyre and wheel assembly. See balance of tyre and wheel in general Information.
15. Install tyre and wheel assembly. See replacement of tyres and replacement of wheels .
16. Lower the vehicle.

3.4.3.4 Surface dressing of aluminum wheel

The surface of aluminum wheel with original equipment has a layer of transparent and/or primary color protective coating. An improperly used weight may cause surface degradation. Frequently cleaning the white side piece and the tyre with tyre brush soaked with excessive silicon carbide at automatic carwash will also damage this coating. Once this protective transparent coating is damaged, exposure of the wheel toward alkali cleaner and/or anti-icing salt used on roads will cause further degradation to its surface.

When dressing an aluminum wheel, a kind of plastic media should be sprayed on the wheel surface so as to eliminate the transparent coating or the paint. For reasons of durability after repair, it is not recommended to machine the wheel or use any scavenging agent of chemical coating. Coat eliminating, cleaning and recoating method of aluminum wheel hubs subject to the above conditions has been described in detail in repair procedures.

Materials needed

Three different kinds of paint series can be used for the dressing of aluminum wheels. These products have been proven to be up to the durability requirement after repair. These products are the only paint series meeting GM Standard 4350M-A336.

- Series 1: Dupont products
- Series 2: PPG products
- Series 3: Spies Hecker

Selection of color

If the wheel to be painted previously uses aluminum with transparent coating, it is recommended to use Corsican SILVER WAEQ9283 for pure aluminum appearance, and Sparkle SILVER WA9967 for extremely shining appearance. The selection and validation of color should be referred to the color manual provided by paint manufacturer. All of the four wheels and hubs should be dressed to ensure uniformity of color.

Note: Refer to and comply with the formulation and technics of each paint series provided by the manufacturer. The products listed are regarded as one series. Don't mix materials of prescribed series with products of other manufacturers. Products listed in this manual have been proved to be up to the requirement of durability after repair. These products are the only paint series meeting GM Standard 4350M-A336.

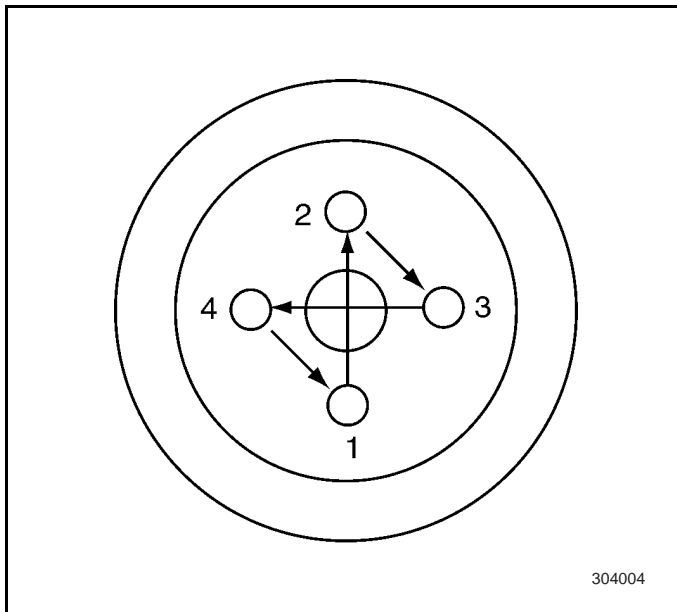
Repair procedures

Caution: When painting any component consisting of two parts, to prevent any injury to personnel, please comply with the preventive measures provided by paint manufacturer. Failing to comply with these preventive measures may result in irritation to the lungs and allergic respiratory reaction.

1. Remove the wheel from the vehicle. See replacement of Wheel. Keep the tyre installed on the wheel.
2. Mark the position of balancer on the tyre.
3. Take off the balancer.
4. Record the weight of each balancer for use in reinstallation.
5. Use wax or grease remover to remove the excess grease and/or dust on the wheel.

Note: For reasons of durability, it is not recommended to machine the aluminum wheel or use any scavenging agent of chemical coating.

6. Spray the wheel with plastic media to remove the old paint or the transparent coating.
7. Cover the wheel and the tyre.
8. Refer to and comply with the paint formulation and technics provided by the paint manufacturer.
9. Take off the covering of wheel and tyre.
10. Install the painted new balance at the marked position of the tyre.
11. Clean up all of the installing surface of the wheel and remove any corrosive or excess spray-paint or dust.
12. Install the wheel onto the vehicle. See replacement of Wheel.



3.4.3.5 Replacement of wheel

Disassembly procedures

Because of corrosion or the tight coupling between the location hole at wheel center and the wheel hub or the brake disc, removal of the wheel may be very difficult. Follow the following procedure to safely remove the wheel:

1. Tighten all wheel nuts on the wheel, then unscrew each nut for two turns.
2. Lower the vehicle to the ground.
3. Rock the vehicle left and right as heavily as possible so as to loosen the wheels. Gear lever can also be shifted from driving (D) gear to reverse (R) gear. Move the vehicle for a few feet in the direction of driving and backing. Energically and rapidly tread the brake pedal to loosen the wheel.
4. Turn off the engine. Raise the vehicle. See hoisting and lifting of vehicle in general information.

Caution: If there is penetrating oil on the vertical surface between the wheel and the brake disc or brake drum, the wheel will become loose in the course of driving and the vehicle will go out of control, thus resulting in accident with injuries. Heating must not be used to loosen a tight wheel. It will reduce the service life of wheels, bolts or hub and bearing assemblies. Wheel nuts should be tightened in turn to the right torque, so as to prevent bending of the wheel or the brake disc or the brake drum.

5. Remove wheel nut and the wheel. Aluminum wheels should never stand vertically. Lay the backside of the wheel that has not been dressed on a soft and clean surface. Penetrating oil will not work when removing a tight wheel.

Note: Don't use excess force when removing a wheel or a tyre, such as blowing with a hammer. It is recommended to tap the sidewall of the tyre lightly with your hand or a rubber club.

Installation procedures

Tools required

- J 39544-KIT Wheel nut torque limiter

Caution: When installing the wheel, use a scraper or a wire brush to remove any cumulative corrosive substance on installation surface of the wheel and installation surface of the brake drum or brake disc. During installation of the wheel, improper contact between metals on the installation surface will cause the wheel nut to become loose. This will cause the wheel to fall off in the course of driving, thus resulting in a loss of control of the vehicle and possible injuries of personnel.

To prevent bending of the wheel or the brake disc or the brake drum, wheel nuts should be tightened in turn to the right torque. Excessive tightening torque on the wheel nut of a steel wheel will damage the mounting hole of the wheel and result in the emergence of cracks. Lubricating liquids and penetrating liquids should not be used on the surface of the bolts, nuts or installation surface of a wheel. Lubricants will increase the actual torque of a nut. Use J 39544-KIT to tighten wheel nuts. J 39544-KIT cannot be used to remove wheel nuts.

3.4.3.6 Replacement of tyre

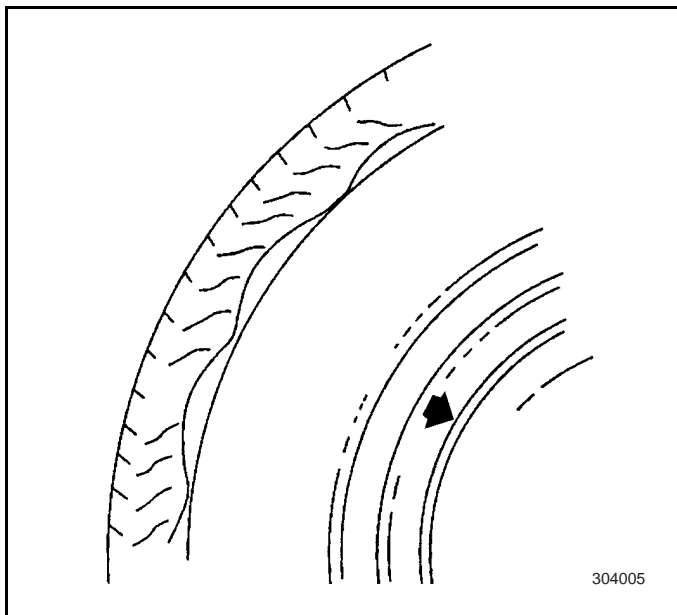
Use tyre changer to install or remove tyres. Follow instructions of the manufacturer. Don't replace tyres with hand tools or tyre lever, because these tools may damage tyre beads or felloes. Use a wire brush or a piece of crude steel wool to remove the following substance from the seat of felloe and bead:

- Lubricant
- Old rubber
- Lightly rusty spot

Caution: To prevent any injury to personnel, don't stand on the tyre when inflating it. When bead undercut has exceeded safety limit, the bead may fall off. The inflation pressure of any tyre whose bead has not yet been in place should exceed 275 kilopascal. If the pressure of 275 kilopascal fails to put the bead into place, then deflate, relubricate the bead and recharge. Over inflation will cause the bead to break away and cause severe injury to personnel. Install rear wheel and inflate it to 275 kilopascal, putting the bead into place.

Note: Do not use lubricants containing silicon to lubricate the tyre bead or felloe. Before installing or removing a tyre, clean up the bead area and use a mixture of 50% lubricant and 50% water to thoroughly lubricate this area.

Install inner valve and inflate the tyre to the required pressure provided in tyre inflation specifications of general information. Ensure the mounting ring of the tyre is around the two sides of wheel rim flange.

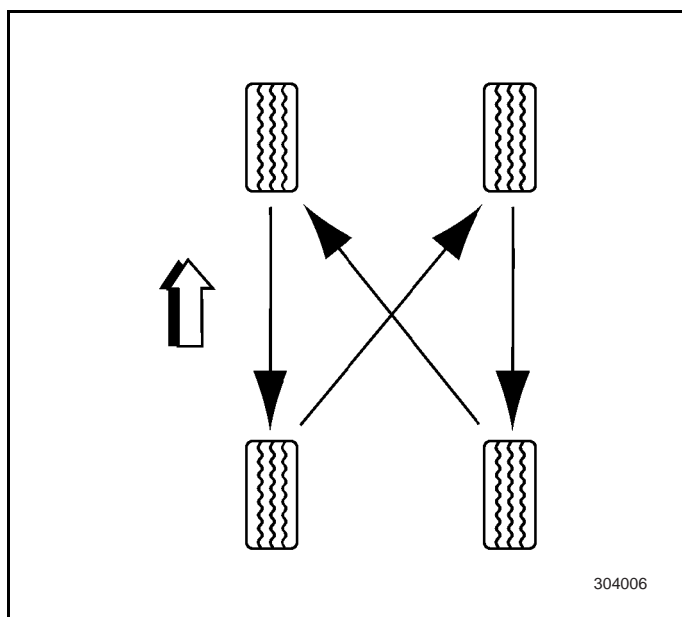


3.4.3.7 Position exchange of tyres

The position of tyres should be exchanged regularly, so as to balance their wearing. Besides regular exchange, the positions of tyres should also be changed whenever uneven wearing is found on any tyres.

The shoulder area of a radial ply tyre, especially at the front end, will be worn at a faster rate. A radial ply tyre at non-driving position will have irregular wearing and thus increase tyre noise. Therefore four-wheel position exchange will be required to solve this problem.

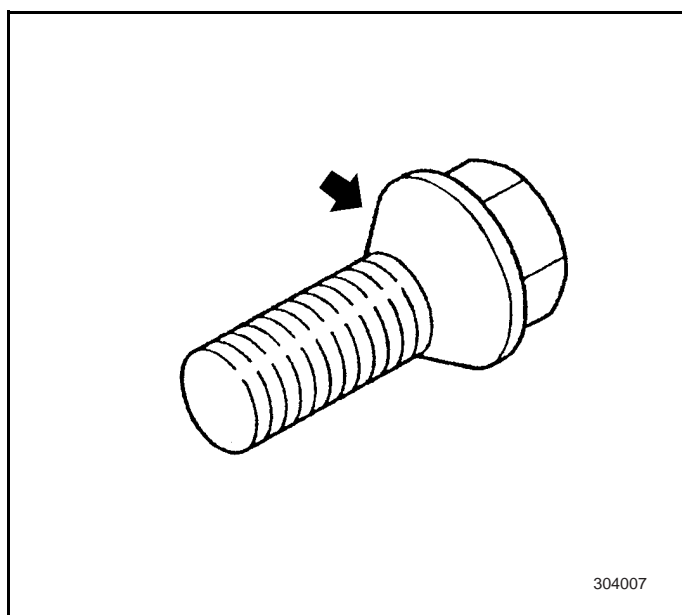
Note: After position exchange wheel nuts should be inspected to ensure proper tightening torque. Then set tyre pressure.



3.4.3.8 Lubrication of wheel bolts

Note: After being installed and removed for several times, wheel bolts will lose a significant amount of the lubricant applied on them in factory. This will change the coefficient of friction in the connection of bolts, and thus make it difficult to meet tightening requirements.

Before installing a dry wheel bolt, please apply bearing oil on its conical surface.



3.4.4 Explanation and operation

3.4.4.1 General information

When inflated to recommended pressure, wheels and tyres installed in factory will work well when the load is close to or has reached full load.

The following factors will have significant effect on the service life of tyres:

- Proper tyre pressure
- Wheel alignment
- Driving techniques

The following driving habits will increase the wearing of tyres:

- Steering heavily
- Accelerating too fast
- Braking heavily

3.4.4.2 Repair instruction of tyres

Various kinds of materials and techniques can be used in the repair of tyres. Tyre manufacturers have published detailed instructions on how and when to repair tyres. These instructions are available from tyre manufacturers. Tyres should never be repaired from outside. Tyres should always be removed from the wheel, inspected for any damage, and repaired from the inside.

3.4.4.3 Inflation instruction of tyres

Recommended pressures for all models of vehicles are carefully calculated to provide the following properties:

- Comfortable riding
- Good reaction to steering
- Maximum tread wear
- Improved tyre life
- Resistance of damage

Inspect tyre pressure monthly or before driving of long distance. For optimum efficiency, comply with the following conditions:

- The tyre should be cold tyre.
- Park the vehicle for three or more hours.
- Drive the vehicle for less than one mile.

Set tyre pressure to the required level. See the table of tyre inflation pressure in this chapter.

Install a valve cap or an extended device on the air gate to prevent entry of dust and water.

Improper air pressure will impact driving condition.

- Pressures exceeding recommended values will cause the following effects:

- Rigid driving
- Wear of tyre or damage of carcass
- Rapid wearing of wheel track at the central position of tyre
- Pressures under recommended values will cause the following effects:
 - Tyre noise at steering
 - Rigid steering
 - Rapid and uneven wearing at the edge of tread
 - Wearing and breaking of felloe
 - Broken tyre cord
 - High temperature of tyre
 - Lowered steering performance
 - Increased fuel consumption
 - Soft driving
- Unequal tyre pressure on the same shaft will have the following effects:
 - Uneven braking
 - Deviation in steering
 - Lowered steering performance
 - Deviation in torsional interaction

3.4.4.4 Direction for use of tyre chain

Because of the limited clearance between the tyre and body of some vehicles, recommended use of tyre chains is also provided in this user manual. If a tyre chain is to be used, most vehicles at present are required to use tyre chains at grade S of SAE. Some of them are identified as 1100 series PL tyre chain. These tyre chains are designed to limit the fly-apart action of wheels when they are rotating.

Manufacturers of tyre chains decide that each kind of tyres should have specific tyre chain dimensions so as to ensure proper match during installation.

- Always purchase tyre chains suitable for the tyres needing to use them.
- If a tyre chain is too loose because of improper size, don't use rubber regulator to tighten the looseness or clearance of it.
- Always follow the installation instructions provided by tyre chain manufacturers.

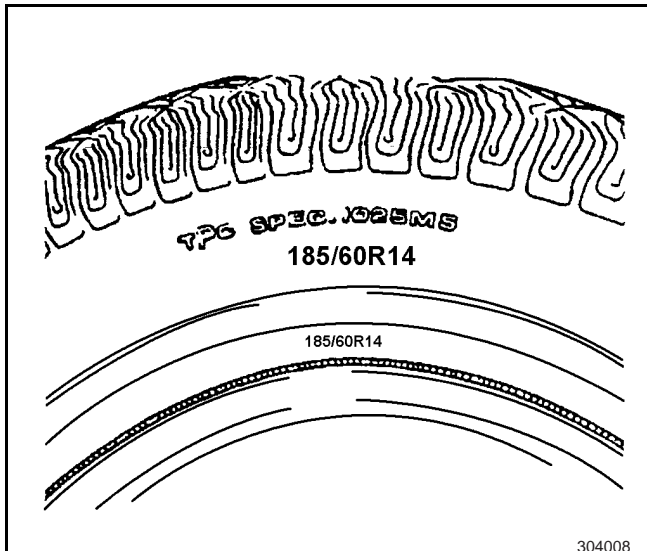
Using tyre chain will have negative impact on the steering performance of a vehicle.

When using tyre chains, the driver should pay attention to the following requirements:

- Adjust vehicle speed according to road conditions
- Avoid hurried steering
- Prevent locking the wheel brake

This user manual has also published other specific information.

3.4.4.5 Instruction of tyres



All tyres are stamped with a specification number of Tyre Performance Code (TPC) on the sidewall near tyre size. This specification number confirms that the tyre is up to the following performance standards:

- Traction force
- Durability
- Size
- Noise
- Steering
- Rolling resistance

Generally each tyre size has a specific TPC number.

Caution: Different kinds of tyres should not be used on the same vehicle, such as radialply tyre, diagonal tyre and diagonal lacing tyre, unless under an emergent condition that the steering performance of the vehicle has been severely compromised and the vehicle may go out of control and cause severe injuries to personnel.

When selecting a tyre for replacement, one with the same PTC number should be chosen. This will ensure the size, load range and structure of the new tyre is consistent with that of the original one. Any other tyres with different size or structure will severely impair the following driving conditions:

- Riding
- Steering

- Scaling of odometer or distance recorder
- Clearance between the vehicle and the ground
- Clearance between tyre and body and chassis

This limitation is not applicable for the spare tyre provided on the vehicle.

New tyres on the same shaft should be installed in pair. If only one tyre is needed to be replaced, the new one should be mated up with the old one that has more tyre treads.

While different tyres may have different tread designs, a mixture of tyres made by different manufacturers but having the same TPC specification numbers can be used.

Replacement of tyres is necessary in any of the following conditions:

- The tyre is worn to the extend that a tyre tread of only 1.6 mm (or less) has been left, or cord threads or cord fabric can be seen. For the convinence of measurement, there is a built-in tyre tread wear indicator in the tyre, and when the tread is 1.6mm (or less) it can be seen between the grooves of tyre tread. When this indicator is seen in two or more adjacent tread grooves at three different positions, the tyre should be replaced.
- The tread or the sidewall is broken, cut open or worn to the extend that cord threads or cord fabrics can be seen from outside.
- The tyre is lumping up, swelling or broken. Slight depression on sidewall is normal, it will no impair the steering performance.
- Puncturing, cutting-open or other damage to a tyre is unreparable for reasons of their size and positions.

3.4.4.6 Repair instruction of sedan tyre

Note: When replacing tyres, tyres with smaller size or with lower velocity level than the original one should not be used. Velocity level is only applicable for tyres with full pressure. Tyres under inflation will unable to reach the value of its velocity level.

Now repair instructions are printed on the side piece of most tyres following the tyre size. Repair instruction includes the following two parts:

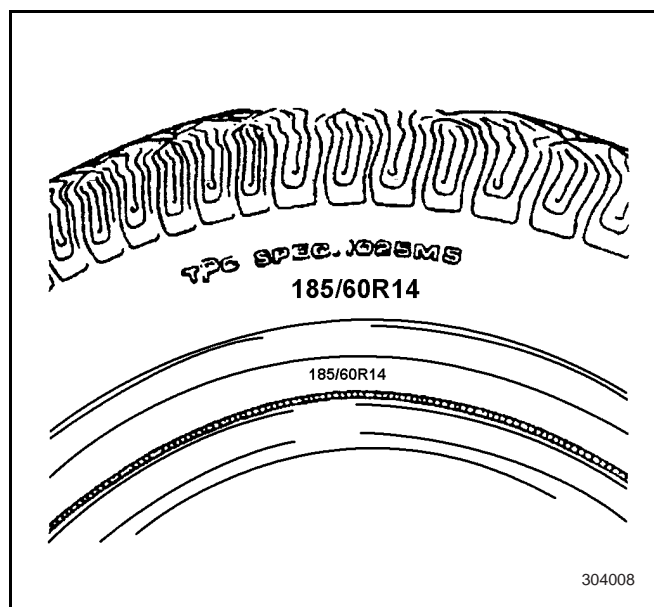
- Load index
- Speed symbol

Load index is usually a numerical value between 75 and 115. Load index specifies the loading capacity when tyres are inflated with maximum air injection amount. The bigger the value, the greater the loading capacity. Speed symbol is usually a letter between P and Z. Speed symbol specifies the speed capacity of the tyre. In the past the letter as speed symbol is a part

of the tyre size, now some tyres at level V and level Z still use this method. The bigger the letter, the greater the speed capacity. A table of loads and speeds corresponding to the load indexes and speed symbols described in this Repair Instruction of Tyres is available from the tyre company.

See tables in general speed levels of this chapter.

3.4.4.7 Explanation of all-weather tyre



Most vehicles are equipped with radialply tyre with steel belts as standard configuration. Used as tyres for snowy weather, these tyres have an average tractive quality better than that of non-all-weather radialply tyres used before. Other properties have also been improved, such as tractive quality on wet road surface, rolling resistance, tread life, and air retaining ability. These are realized through improved tread designs and the use of compound materials. On the sidewall of these tyres, a "M+S" is printed after the tyre size. Besides, TPC specification numbers also have a suffix of "MS" printed on the sidewall.

Now on the optional steering tyres used on some of the vehicles, "MS" is also marked after tyre sizes and TPC specification numbers.

3.4.4.8 Explanation of tyres with P metric size

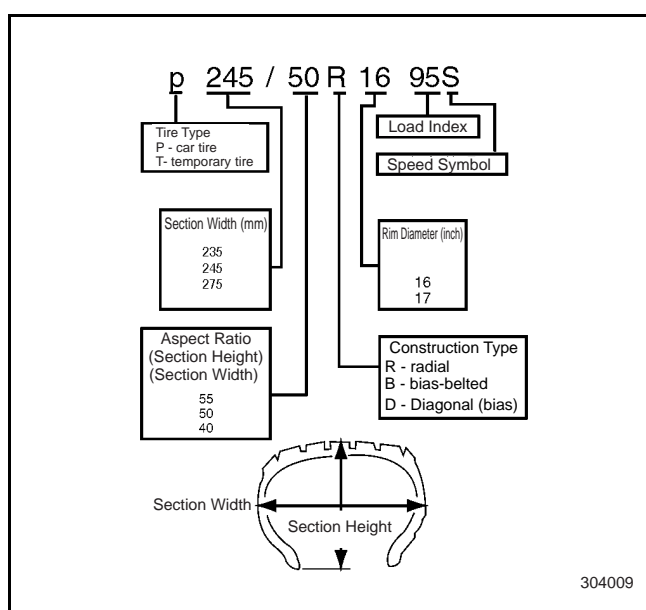
Most vehicles use tyres with P metric size. Tyres with P metric size have two load ranges, with the maximum standard load being 242 kilopascal, and the maximum large load being 283 kilopascal. The load of tyres of most sedans is standard load.

Most P metric tyre size do not have corresponding tyre size described with letters and numerical values. For

instance, the size and load capacity of P205/75R15 is not completely the same with FR78-15. Therefore, the tyre being replaced should have the same TPC number (the same size, load range and structure) with the original tyre the vehicle uses. If a P metric tyre has to be replaced by a tyre of other size, the tyre dealer should be consulted with. Tyre companies can provide alphabet numbers closest to the P metric size for their tyre products. See conversion table of inflation pressure in this chapter.

The metric unit of inflation is kilopascal (kPa). Tyre pressure is provided in kPa and pounds per square inch (psi). 1 psi equals to 6.9 kPa.

3.4.4.9 Explanation of tyre notification



The information tag of tyre is on the back of the driver door. Tyre information is available on this tag. The placard provides the following information:

- Maximum car load
- Tyre size (including emergency tyre)
- Cold inflation pressure (including emergency tyre)

3.4.4.10 Explanation of tyre replacement

Notice: Use of non-GM original wheel will result in:

- Damage to wheel bearing, wheel fasteners and the wheel
- Tyres damaged by changes in the clearance with adjacent vehicle parts
- Unstable steering caused by changes in tyre diameter
- Damage to the vehicle caused by changes in ground clearance

- Inaccuracy in odometer and distance recorder

Note: The wheel used for replacement should have the same load capacity, diameter, rim width, wheel offset and installation configuration with the original one. Improper size or kind of wheels will impair the service life of wheel and bearing, the cooling of brake, the scaling of odometer/distance recorder, the ground clearance and the clearance of tyre to body and chassis.

A wheel should be replaced under the following conditions:

- The wheel is bending or depressed.
- Run out of the wheel is too great.
- There is air leakage at the welding seam of the wheel.
- The bolt hole on the wheel is too long.
- The wheel nut cannot be tightened.
- The wheel is severely rusty.

A run out of the wheel that is too great will produce unacceptable vibration.

Steel wheel is identified by the two or three alphabetic codes printed on the felloe near valve stem. Aluminum wheels have codes, part numbers and the ID of manufacturer casted on their back.

3.4.4.11 Explanation on the repair of steel wheel

Welding, heating or shot blasting should not be used for the repair of wheels. Leakage of wheel or tyre should not be repaired by inserting an inner tube. If a leakage is detected on a steel wheel, replace it with a new wheel up to the quality standard of the original one.

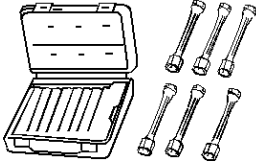
3.4.4.12 Explanation of aluminum wheel

Notice: Do not scratch or damage the transparent finish of the aluminum wheel with tyre replacing equipment. Scratches on the transparent finish will cause corrosion on the aluminum wheel and the flaking of the transparent finish from the wheel.

Remove and install the tyre on outer bead seat. A device without a platform to place the wheel will cause damage to the appearance of the wheel when it is clamped. The stripper of bottom flange on some equipment may also damage the appearance of a wheel.

Most manufacturers of wheel replacing equipment provide adapter kit for aluminum wheels and tools with plastic or Teflon[®] coating to protect the appearance of a wheel from any damage. Even with these tools, some equipment still needs improvement.

3.4.5Special tools

Graphics	Tool labels and descriptions
 <p>J39544</p>	<p>J 39544 General purpose torsional connector of wheel nut (used with air pressure impact wrench not exceeding 250 pound feet)Including: J 39544- 12, J 39544-13, J 39544-14, J 39544-CSE</p>

4

Driveline/ shaft

4.1 Front Wheel Drive Shaft.....	4-3	4.1.3.3 Deep metal friction noise heard during steering acceleration	4-5
4.1.1 Specification	4-3	4.1.3.4 Sway or Vibration during Acceleration.....	4-5
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Blank

4.1 Front Wheel Drive Shaft

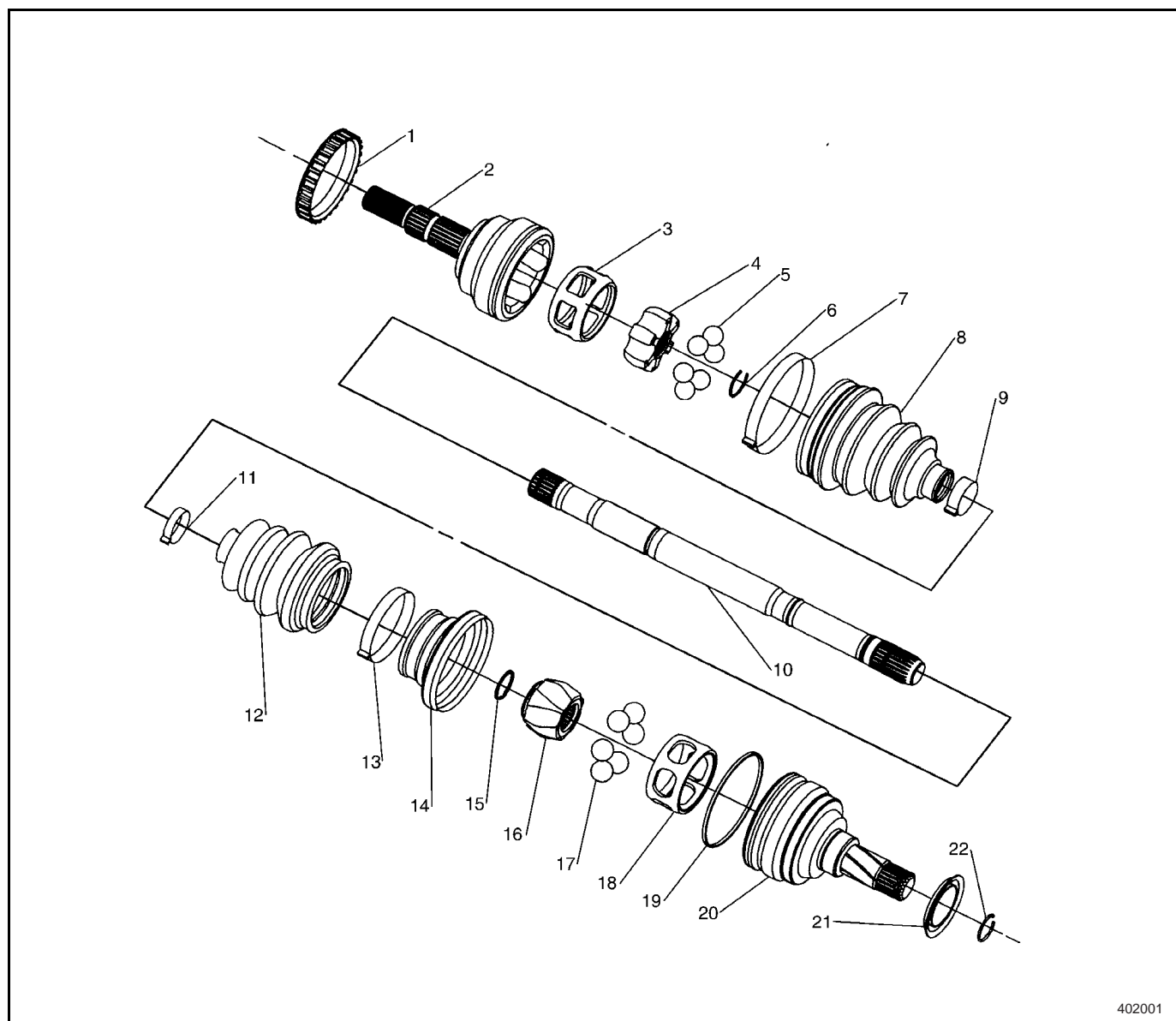
4.1.1 Specification

4.1.1.1 Fastener Tightening Specifications

Application	Specification
Front wheel drive shaft nut	160 N•m
Lower ball joint nut	30 N•m
Front wheel drive shaft retaining clamp	25 N•m

4.1.2 Visual Identification

4.1.2.1 Front Wheel Driveline Disassembled View



402001

Legend

- | | |
|--|---|
| (1) ABS bearing ring (for vehicles with ABS) | (12) Front wheel drive shaft inner protective housing |
| (2) RF outer race flange | (13) Protective housing mounting retainer |
| (3) RF housing | (14) Cover |
| (4) RF inner race flange | (15) Lock ring |
| (5) Ball | (16) VL inner race flange |
| (6) Flexible race | (17) Ball |
| (7) Protective housing mounting retainer | (18) VL case |
| (8) Front wheel drive shaft outer protective housing | (19) O- ring |
| (9) Protective housing mounting retainer | (20) VL outer race flange |
| (10) Front wheel drive shaft | (21) Dust shield |
| (11) Protective housing mounting retainer | (22) Connection ring |

4.1.3 Diagnostic Information and Procedure

4.1.3.1 Clicks while steering

If the front wheel drive shaft CV joint is worn or damaged, there maybe clicks heard during steering. if there is clicks heard, inspect if the front wheel driveline CV joint housing exists crack or damage.

4.1.3.2 Deep metal friction noise heard during coast acceleration

Worn or damaged front wheel driveline CV joint or front wheel driveline 3-pin type universal joint may result in deep metal friction noise during coast acceleration.

4.1.3.3 Deep metal friction noise heard during steering acceleration

If clicks are heard during steering, inspect the following situation:

- outside universal joint wearing or damage;
- sealing breakage or damage;

4.1.3.4 Sway or Vibration during Acceleration

Refer to Vibration Diagnosis and Correction in General Information for sway and vibration.

4.1.4 Repair Guidance

4.1.4.1 Replacement of Front Wheel Drive Shaft

Removal Procedure

Required tools

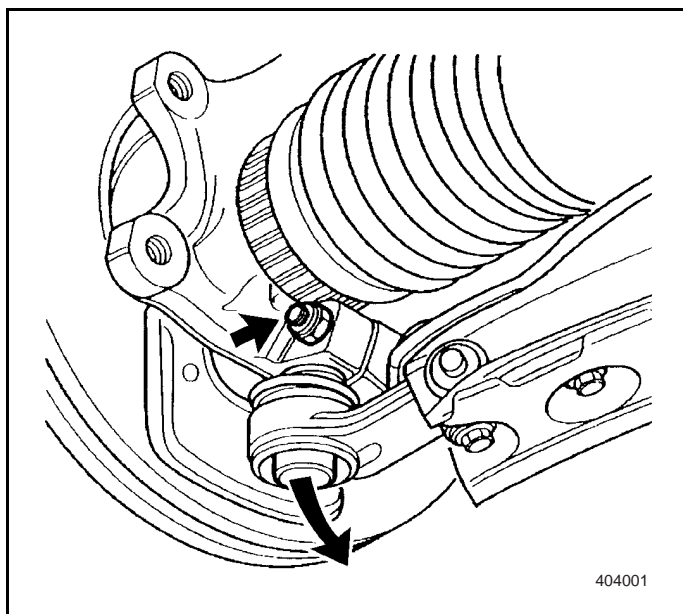
- KM-460 front wheel drive shaft remover
- KM-468-B long handle spinner
- KM-902 remover
- KM-313 shaft remover

If CV joint is found with fault after driving for 80000-10000 km, the front wheel drive shaft must be replaced as a whole.

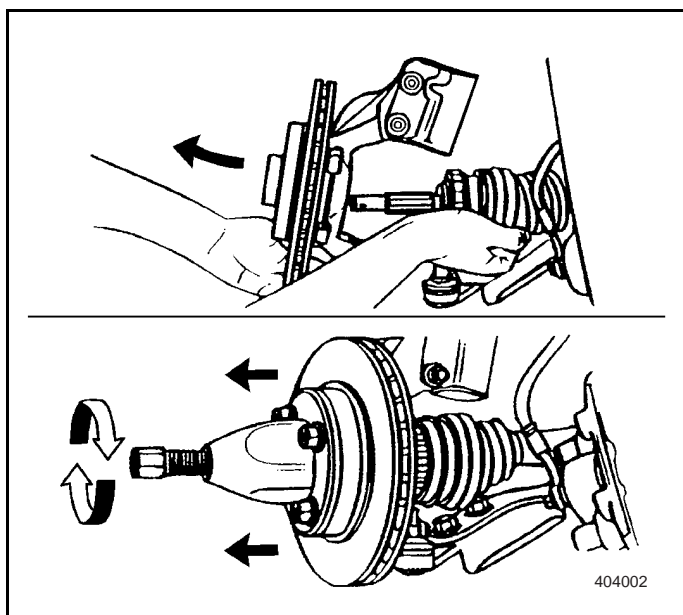
Note: Prevent the sealing (protective housing) from contacting other parts so as to avoid damage to the sealing (protective housing).

1. Remove the wheel. Refer to Replacement of the wheels in Tire & Wheel.
2. Remove front wheel drive shaft slot-type nut pin.
3. Remove front wheel drive shaft slot-type nut. Insert screwdriver head or flat-bladed tool into brake caliper or brake disc so as to prevent the brake disc from rotating.
4. Take out the lower ball joint from the steering knuckle. Refer to Replacement of Lower Ball Joint in Front Suspension.
5. Remove the front wheel drive shaft from the front wheel hub with hand or press it out of the hub with puller. Slot-type nut may be partly fastened to the front wheel drive shaft end to protect the threads.

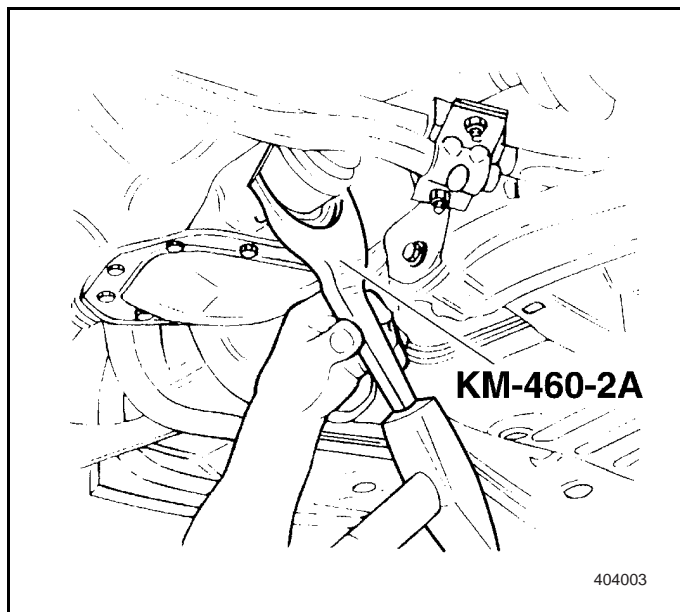
Caution: After take out the front wheel drive shaft from the wheel hub, do not move the vehicle or load on the wheel bearing. Otherwise the wheel bearing may be damaged. If the vehicle must be moved, insert a short bar in the wheel hub at certain fastening in substitution of the front wheel drive shaft.



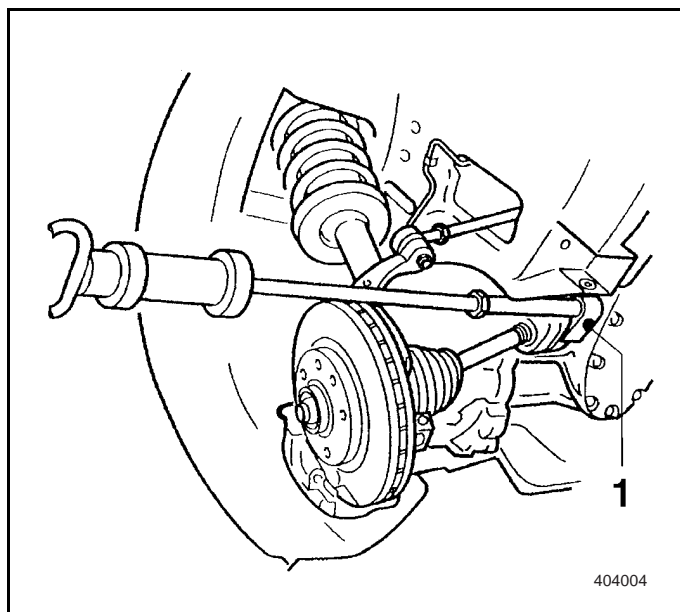
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6. Remove the front wheel drive shaft from the transmission.
 - Right: remove the front wheel drive shaft from the transmission with KM-460-2A or KM-313 and KM-902 (short).



- Left: remove the front wheel drive shaft from the transmission with KM-460-2B or KM-313 and KM-902 (long).

Note: Cover the fluid hole to avoid oil leakage.

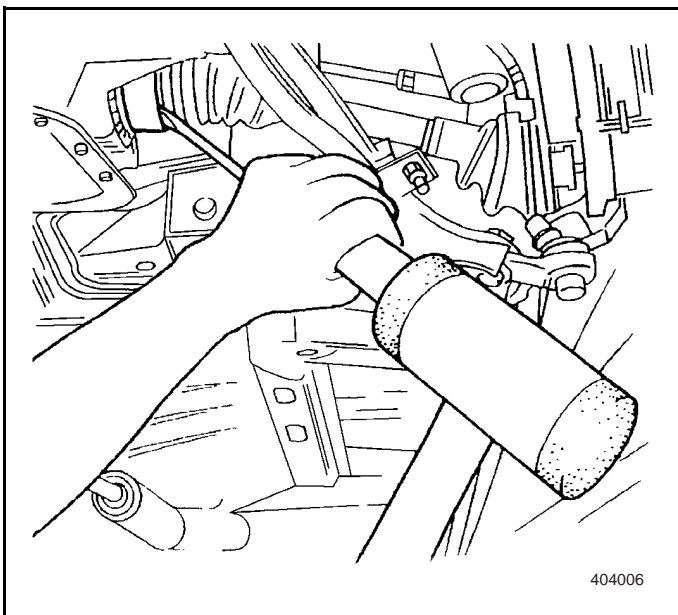
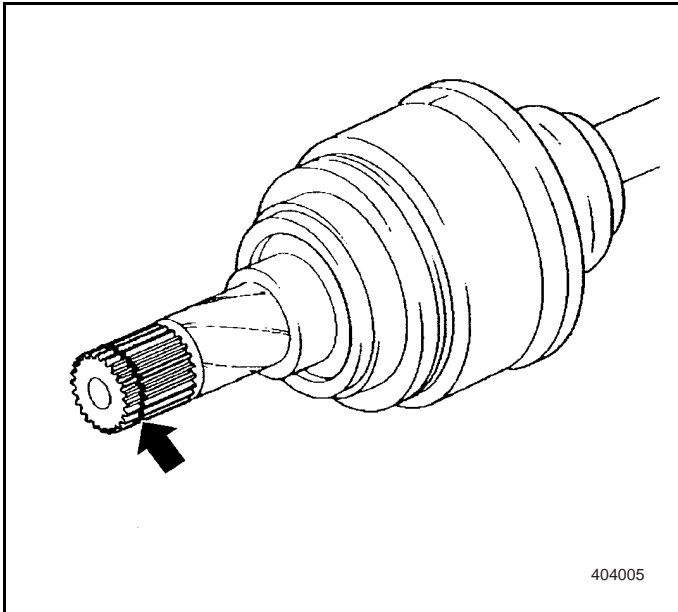
Installation Procedure

Required tools

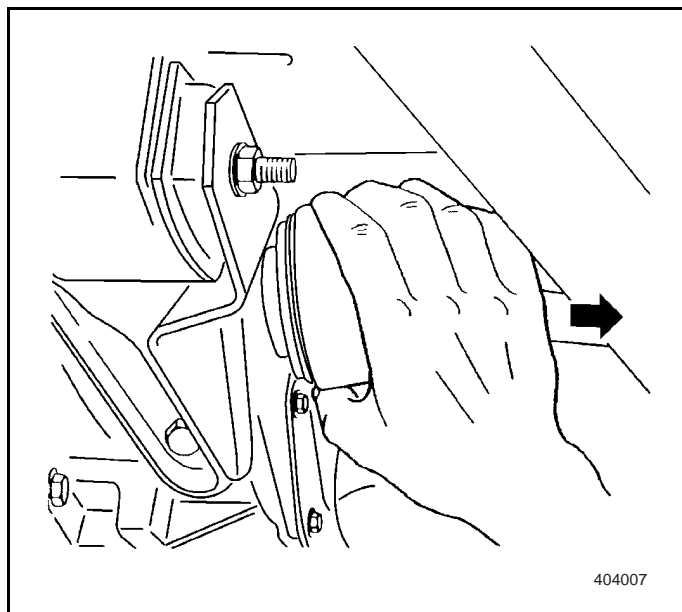
- KM-468-B long handle spinner

Note: Prevent the sealing (protective housing) from contacting other parts so as to avoid damage to the sealing (protective housing).

1. Confirm the fixing ring has seated into the short shaft (arrow) slot at the transmission side of CV joint.

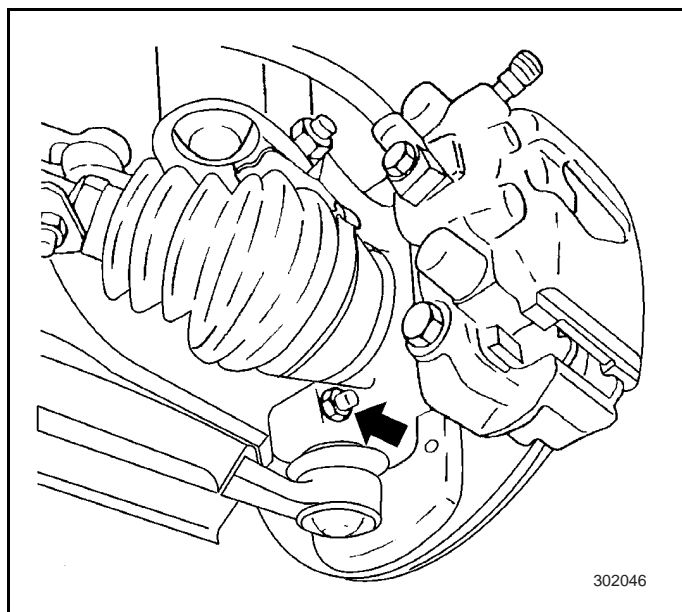


2. Press the front wheel drive shaft into transmission case and strike it slightly so that the CV joint seats and the fixing ring is in place.



Note: Pull the outer part of the universal joint to verify the front wheel drive shaft is in place (arrow in the illustration figure).

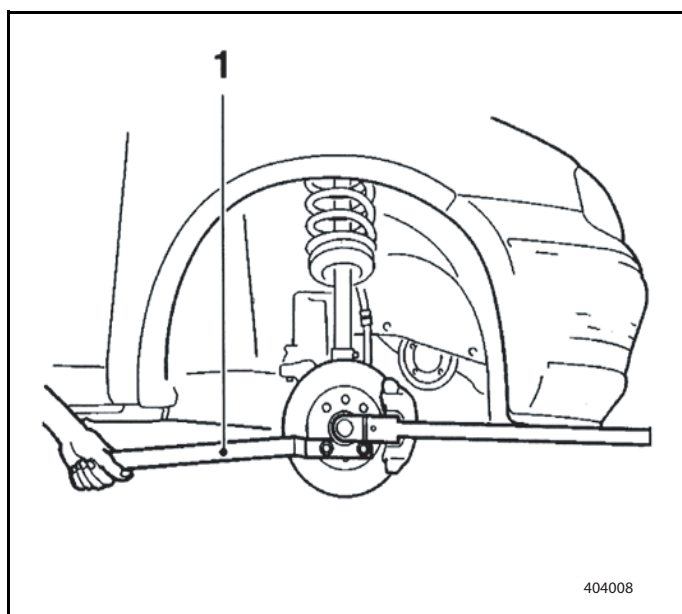
3. Install the front wheel drive shaft to the wheel hub, lubricate the slot manually with transmission oil.



4. Install the hub washer and new front wheel drive shaft slot-type nut, do not fasten.
5. Connect the lower ball joint with the steering knuckle. Refer to Replacement of Lower Ball Joint in Front Suspension. Install the bolts and nuts.

Fastening

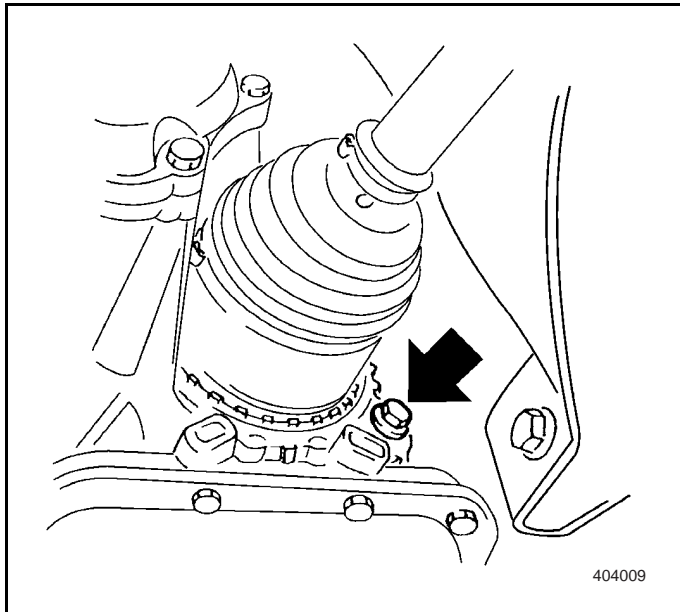
Fasten the lower ball joint nut to 30 N•m.



6. Pre-tighten the wheel hub nut with KM-468(1) to 130 N•m, then loose the nut and fasten to 20 N•m+90°. Insert screwdriver head or flat-bladed tool into brake caliper or brake disc so as to prevent the brake disc from rotating.

Note: If necessary, loose the wheel hub nut until the hole of the pin levels with the channel of the nut, then fix with the pin. Meanwhile, prevent the brake disc from rotating.

7. Refer to Replacement of the wheels in Tire & Wheel for installation of the wheels.
8. Lower the vehicle.

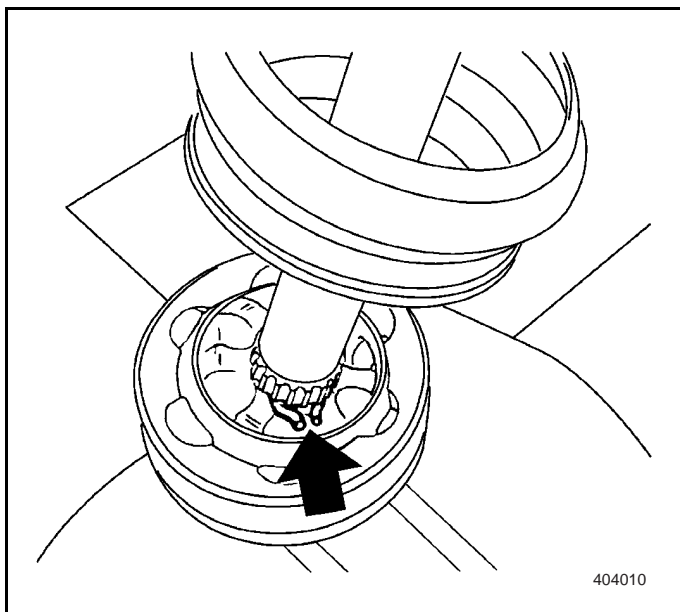


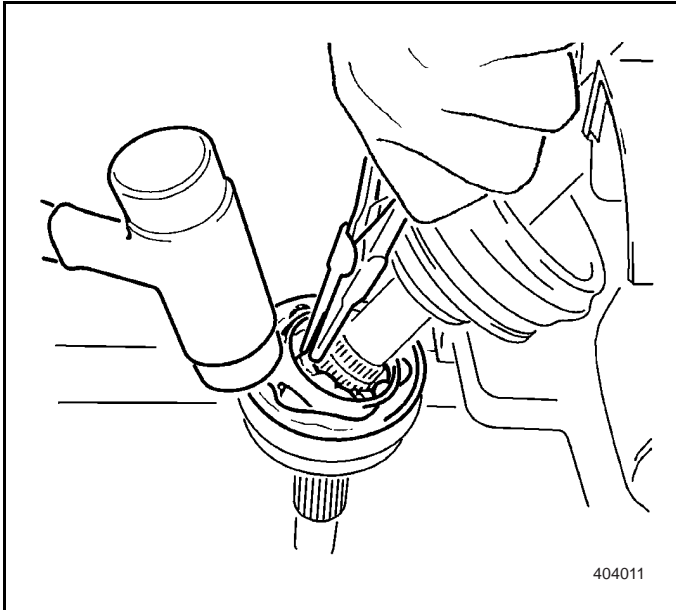
9. Inspect the transmission fluid level, fill to the maximum position if necessary. Minimum level: lower end at the observation hole at the rear of the differential housing (left along the driving direction) (refer to illustration figure).
10. Inspect the wheel positioning. Refer to wheel positioning inspection in Wheel Positioning.

4.1.4.2 Replacement of CV joint and protective housing

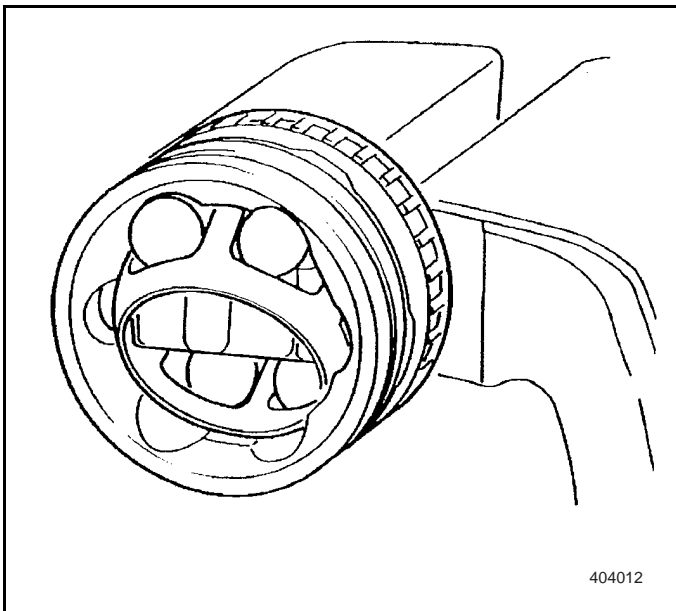
Removal Procedure

1. Remove the fixing caliper from the dust shield housing.
2. Put aside the dust- shield, clean the lubrication grease (arrow) on the locking ring.





3. Remove the front wheel drive shaft CV joint, fix the front wheel drive shaft with protective retainers into the panel, open the locking ring with ring caliper, then slightly strike the CV joint with plastic hammer.
4. Clean the front wheel drive shaft CV joint thoroughly.



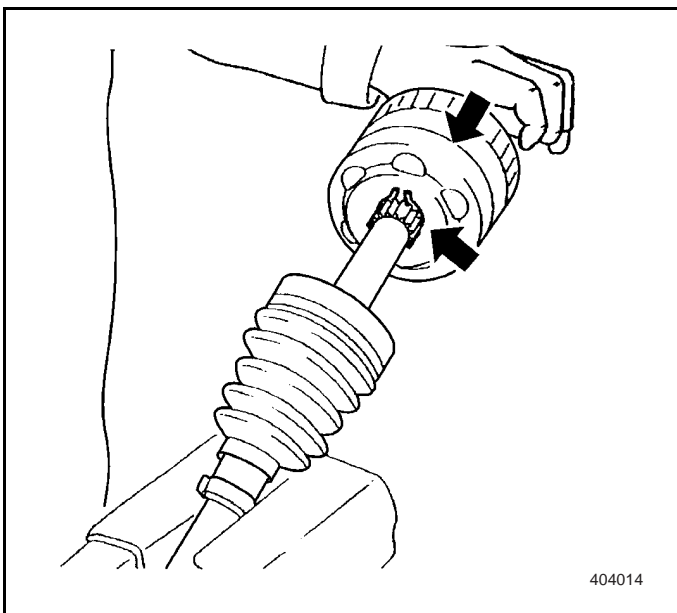
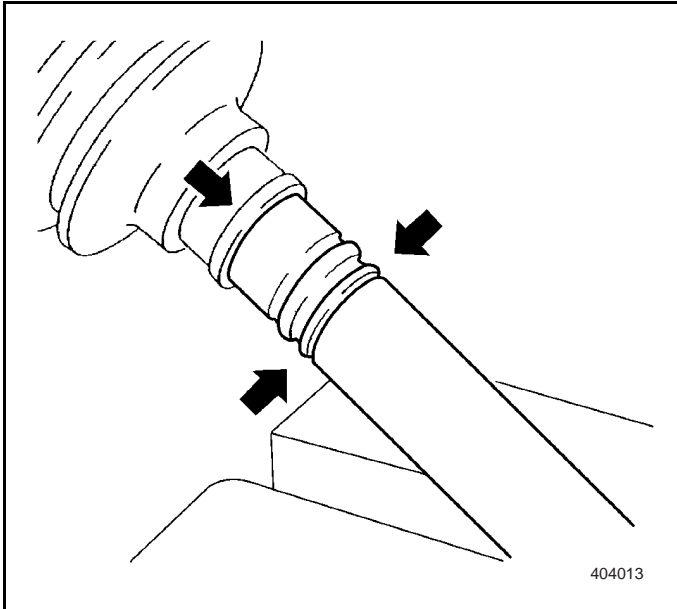
5. Inspect if there is wearing on inner flange, outer flange and balls. Replace the worn front wheel drive shaft CV joint.
6. Take out the dust-shield from the front wheel drive shaft.
7. Replace the front wheel drive shaft after it has been used for 80000 to 100000 km.

Installation Procedure

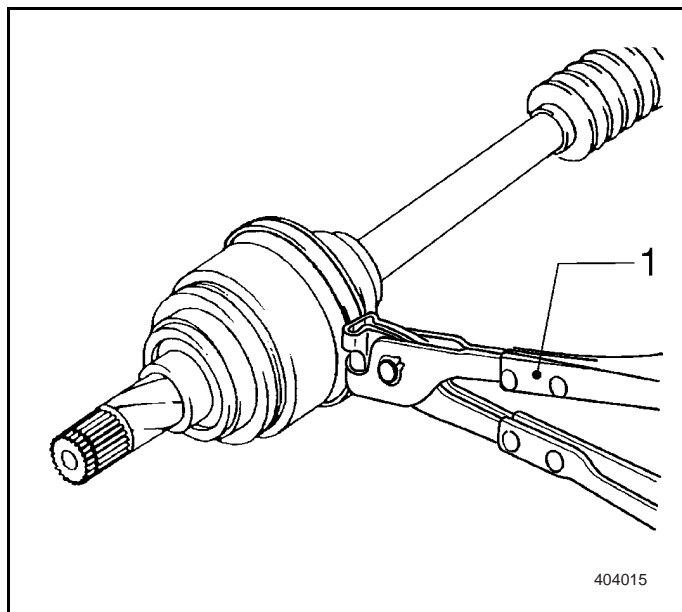
Required tools

- S-9407235 Screwdriver
- MKM 804 Locker
- MKM 611 Torque spanner

1. Slip the new fixing caliper and dust-shield upward to the concave of the front wheel drive shaft (arrow in the illustration figure).



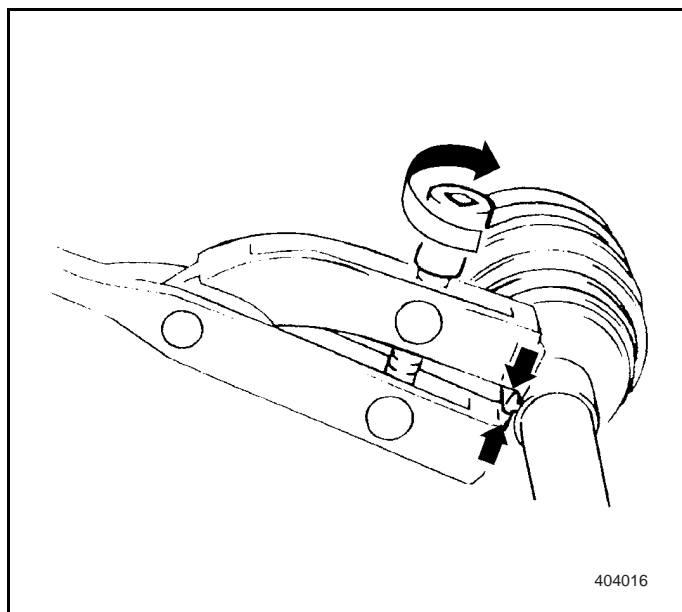
2. Add special lubrication grease into the CV joint. Match the CV joint into the spline of the front wheel drive shaft and press it with plastic hammer until the fixing ring (arrow in the illustration figure) is in place.
3. Add the remained lubrication grease into the protective housing.



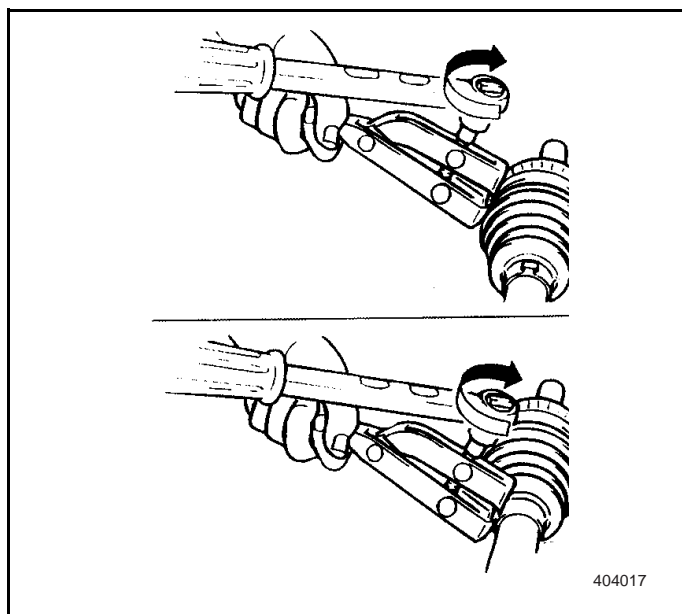
4. Put the new protective housing onto the should of the universal joint shaft. Install the fixing retainer. Fasten the fixing retainer of the CV joint at the transmission side with S- 9407235(1).

Note:

- Do not fold its drapes after installation of the protective housing.
- The fixing retainer of the CV joint at the transmission side is made up of stainless steel. Use special maintenance tool MKM-804 for correct installation.



5. Pre-install the fixing retainer of the protective housing according to regular methods. Manually fasten the fixing retainer with MKM- 804.



6. Fasten the fixing retainer with MKM-804 and torque spanner MKM-611.

Fastening

Fasten the front wheel drive shaft retaining clamp to 25 N•m

7. Install the Front Wheel Drive Shaft. Refer to Replacement of Front Wheel Drive Shaft.

4.1.5 Description & Operation

4.1.5.1 Front Wheel Drive Shaft

The front wheel drive shaft is flexible assembly.

The front wheel drive shaft is made up of the following components:

- front wheel drive shaft VL insert-type universal joint (inner universal joint)
- front wheel drive shaft RF fixed-type universal joint (outer universal joint)
- front wheel drive shaft
- front wheel drive shaft connecting the VL insertion-type universal joint and RF fixed-type universal joint.

Front wheel drive shaft VL insertion-type universal joint is completely flexible. Front wheel drive shaft VL insert-type universal joint can move from inside to outside.

Front wheel drive shaft RF fixed-type universal joint is flexible, however, it can not move from inside to outside.

Protective housing (sealing) and retainer

Front wheel drive shaft RF fixed-type universal joint protective housing (sealing) is made of TPE. Front wheel drive shaft RF fixed-type universal joint protective housing (sealing) is made of CR.

Fixing retainer at the outer universal joint side is made of stainless steel. Fixing retainer at the inner universal joint side is made of chromed iron.

Function of the protective housing is as follows:

- Protect the inner components of the front wheel drive shaft RF fixed-type universal joint and VL insertion-type universal joint.
- The protective housing (sealing) may prevent the lubrication grease from being damaged by the following conditions:
- harmful atmospheric conditions (extreme temperature or ozone)
- foreign matter (such as dust or water)
- Make the front wheel drive shaft VL insertion-type universal joint be able to conduct angular and axial movement.
- Make the front wheel drive shaft RF fixed-type universal joint be able to conduct angular movement.

Note: Prevent the protective housing (sealing) from being damaged by sharp tools or the surrounding sharp edges.

Any damage to the sealing or retainer may result in leakage, which may result in water leaking into front wheel drive shaft VL insertion-type universal joint and RF fixed-type universal joint.

and also result in lubrication grease leaking from the front wheel drive shaft VL insertion-type universal joint and RF fixed-type universal joint.

The leakage may also result in noise of the front wheel drive shaft and finally the failure of the inner components.

Retainers may provide leakage proof connection between the front wheel VL insertion-type universal joint and RF fixed-type universal joint.

- Housing
- front wheel drive shaft

TPE exists good performance under normal conditions and working situation. But its strength can not bear the following conditions:

- rough operation
- damage by sharp objects (such as sharp tool or edges of components in vehicle).

front wheel drive shaft VL insert-type universal joint (inner universal joint)

Front wheel drive shaft VL insertion-type universal joint adopts the cross-type universal joint design.

Universal joint structure is suitable for the following types of vehicles:

- Front wheel drive shaft has outer spline. Front wheel drive shaft uses cylinder clip to interlock with the transmission.

front wheel drive shaft RF fixed-type universal joint (outer universal joint)

Front wheel drive shaft RF fixed-type universal joint uses ball case type design.

There is a helix spline at the shaft end (to engage with the steering joint/ wheel hub). Helix spline can ensure tight match of extrusion.

It can also avoid shaft end gap between wheel hub and front wheel drive shaft.

4.1.6 Special Tools

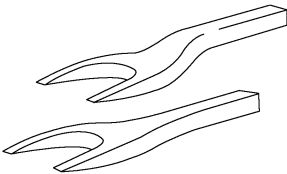
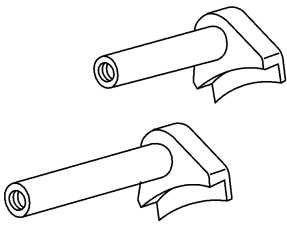
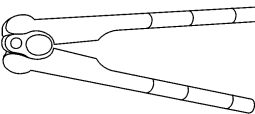
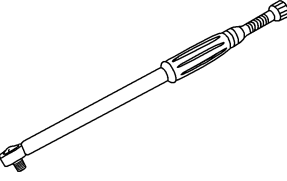
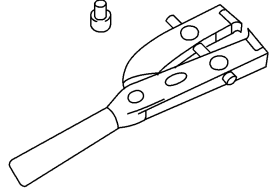
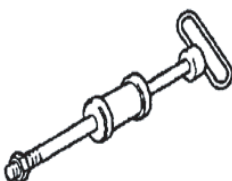

Illustration	Number & Name of the Tools
 KM-460	KM-460 Fork type remover to remove the front wheel drive shaft from side of the transmission
 KM-902	KM-902 Remover (long and short) to remove the front wheel drive shaft
 S-9407235	S-9407235 Plier to fasten the housing onto the body
 MKM-611	MKM-611 Torque spanner 3/8", driving head range 10-60N•m

Illustration	Number & Name of the Tools
 MKM-804	MKM804 Lock plier to fasten the housing at the side of wheel bearing to lock onto the body
 KM-313	KM-313 shaft remover to remove the front wheel drive shaft from side of the transmission
 KM-468	KM-468-B Long handle spanner to fasten the wheel hub nut

Blank

5

Brake

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5.1 Hydraulic brake

5.1.1 Specification

5.1.1.1 Brake system specifications

Application	Specification
servo brake booster dimensions	8 inches
Brake master cylinder diameter	20.64 mm
1st piston travel	17mm
2nd piston travel	15mm
Caliper diameter	48mm
brake disc diameter	236mm
brake disc thickness	20 mm
brake pad thickness	16 mm
wheel brake cylinder diameter	19.05 mm
brake drum diameter	200 mm
brake plate width	28 mm

5.1.1.2 Fastener Tightening Specifications

Application	Specification
Brake pipe nut	16 N•m
Brake master cylinder liquid tank installation nut	3 N•m
caliper discharging valve and wheel cylinder discharging valve	6 N•m
brake hose caliper bolts	40 N•m
Front caliper speed sensor installation bolt (applicable to ABS vehicles)	8 N•m
Rear brake drum vehicle speed sensor installation bolt (applicable to ABS vehicles)	4 N•m
Anti-lock brake system regulator bracket installation bolt (applicable to ABS vehicles)	20 N•m
Anti-lock brake system regulator installation nut (applicable to ABS vehicles)	10 N•m
Pedal bracket installation nut	22 N•m
Brake pedal pushing bar nut	18 N•m
Brake pedal bracket installation bolt	20 N•m
Booster vacuum pipe connection nut	18 N•m
Caliper bracket installation bolt	95 N•m
Rear brake installation bolt, rotate the bolt tightly from 30- 45 degree	50 N•m
Brake disc locking bolt	4 N•m

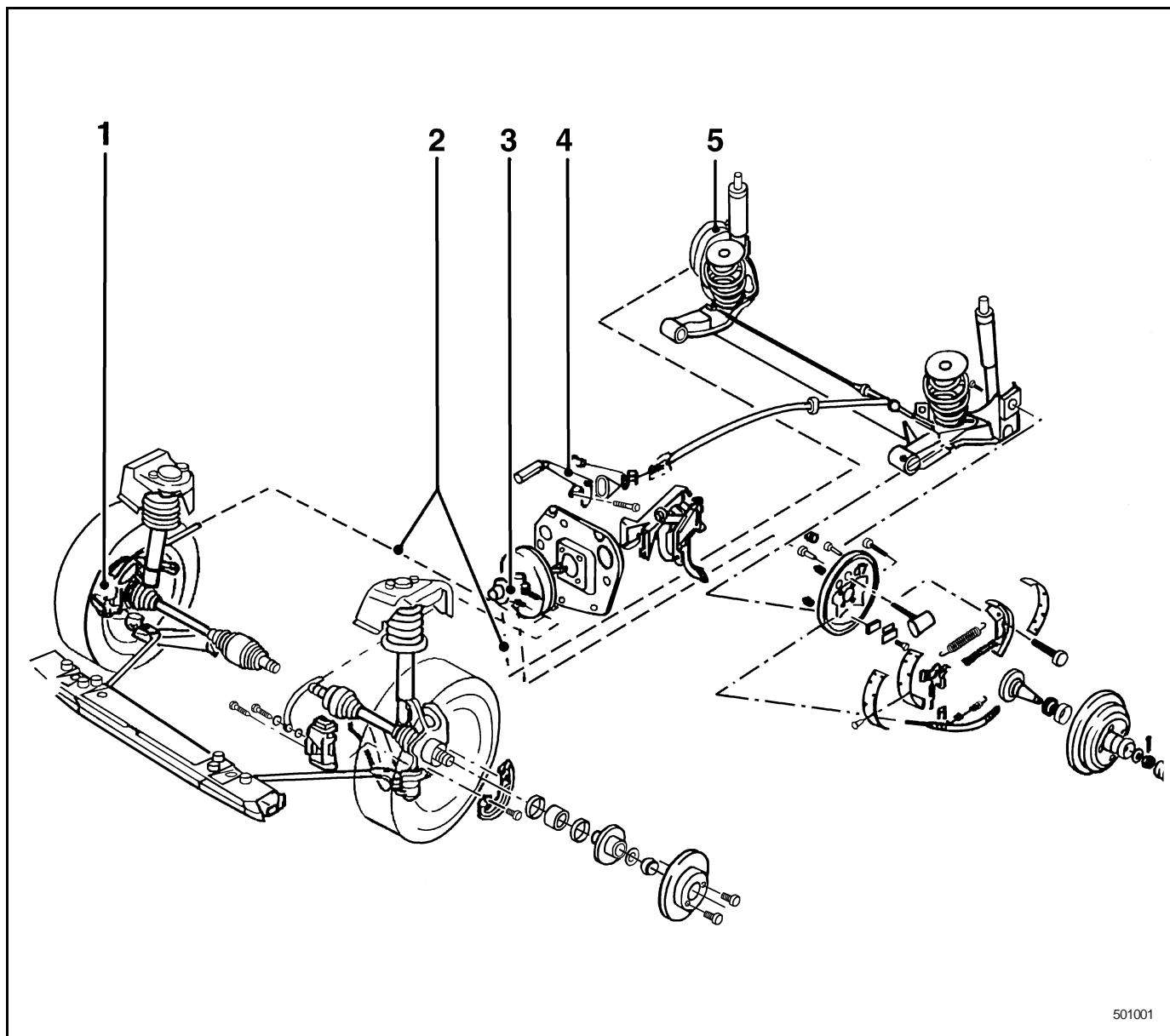
5.1.2 Schematic and Wiring Diagrams

5.1.2.1 Brake System Wiring Diagram

- Refer to 8.20.2.5 for brake fluid sensor and park brake switch wiring diagram.
- Refer to 8.20.2.8 for brake switch wiring diagram.

5.1.3 Visual Identification

5.1.3.1 Hydraulic Brake System Disassembled View

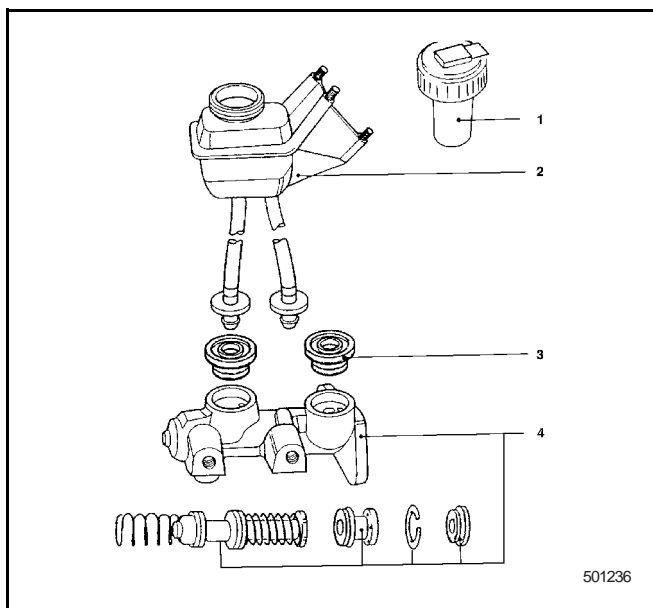


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Legend

- | | |
|---------------------------|-------------------|
| (1) Disc brake | (4) Parking brake |
| (2) Brake oil pipe | (5) Drum brake |
| (3) Brake master cylinder | |

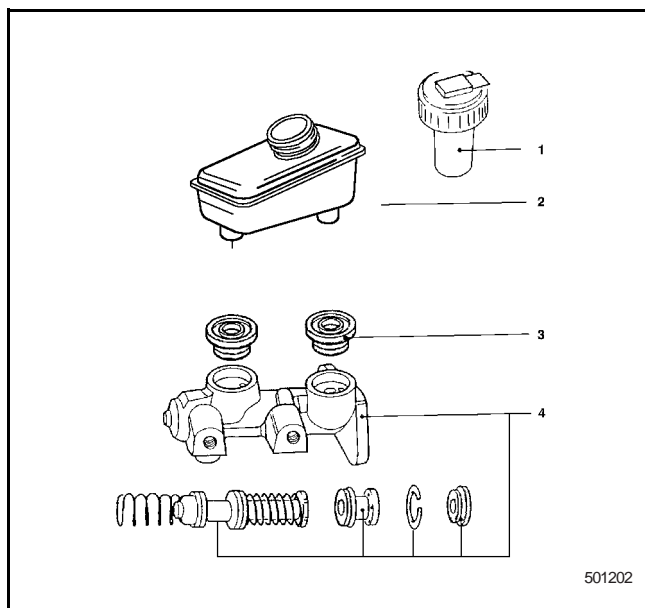
5.1.3.2 Brake Master Cylinder and Reservoir Disassembled View (ABS vehicles)



Legend

- (1) Reservoir cover
- (2) Reservoir
- (3) Sealing pad
- (4) Brake master cylinder

5.1.3.3 Brake Master Cylinder and Reservoir Disassembled View (vehicles without ABS)



Legend

- (1) Reservoir cover
- (2) Reservoir
- (3) Sealing pad
- (4) Brake master cylinder

5.1.4 Diagnostic Information and Procedures

5.1.4.1 Hydraulic Brake Diagnostic System Check

step	action	Normal Result(s)	Abnormal result(s) *
1	Inspect the brake fluid level in the reservoir.	Brake fluid level is normal.	Brake fluid level is too low.
2	<ul style="list-style-type: none"> Turn off ignition switch. Ensure that the parking brake is released. Start the engine. 	<ul style="list-style-type: none"> Brake system malfunction indicator lights when the engine is started. Brake system malfunction indicator is off when the engine is started. 	<ul style="list-style-type: none"> When the engine is started, brake system malfunction indicator does not light. When the engine is started, brake system malfunction indicator lights.
3	Press the brake pedal all the way down.	<ul style="list-style-type: none"> The brake pedal moves steadily towards the floor. Brake pedal stops against the pressure. 	<ul style="list-style-type: none"> Brake pedal moves unsteadily (hard or unsteady) Brake pedal is too soft (too near the floor)
4	Release the brake pedal.	Brake pedal returns to the original position.	<ul style="list-style-type: none"> Brake pedal fails to return to the original position.
5	Hydraulic brake system test.	<ul style="list-style-type: none"> When the brake is stepped down, brake effect takes on immediately. The brake operates steadily and normally without jam or lock-Brake pedal does not tremble. When the brake pedal is stepped down, the steering wheel and pedal does not vibrate (tremble). The vehicle may stop with not too much braking force. The vehicle will not run out during brake. The front and rear brake works at the same time. Not much noise heard when the brake operates. After the brake pedal is released, the brake does not click. 	<ul style="list-style-type: none"> When the brake is stepped down, there is delay in braking. The brake operates roughly when the brake pedal is stepped down slightly. When the brake pedal is stepped down, the steering wheel and pedal trembles. Brake pedal must be stepped forcefully or hard to brake. The vehicle runs out during braking. Front brake and rear brake works unevenly. Brake produces noises. After the brake pedal is released, the brake clicks.
<ul style="list-style-type: none"> * To verify the correct test result, if possible, compare the result with that of the operating vehicle/ system of the same type. Refer to the relevant diagnostic table for the results of operation. 			

5.1.4.2 Outside elements that may influence the brake performance

Tire

Contact with different road surface by tire with different adhesion force may result in different braking. The following conditions may adversely affect braking performance:

- Different tire inflation
- Different tire size
- Different tire thread and figure

Vehicle load

Heavy duty vehicle may require larger braking force. For vehicles with uneven load, the wheel with maximum load requires more braking force than other wheels.

Wheel positioning

If the wheels are not properly positioned, especially when the camber and master pin inclination is too much, the vehicle may run out during braking.

5.1.4.3 Brake System Test

Test the brake system on roads under the following conditions:

- dry
- clean
- adequately smooth
- level

Do not test brake under the following roads since the tires cannot adhere to the road surface evenly.

- wet
- oily and slippery
- covered with loose mud

If the road humps up and weight of the vehicle runs aside, this may also do negative effect to the test. If the road is uneven and the wheel pumps, this may also negatively effect the test result.

Under different speed, use point brake and emergent brake to test braking effect of different braking pedal force. Try to avoid locking of brakes and slippery of the tires. Braking distance for emergency braking resulting in wheel rotation is shorter than that when wheels are locked, therefore, locked brakes and slippery tire cannot reflect the braking effect.

Except under extreme high deceleration speed, it is necessary to balance the braking system so as to avoid locking of the wheels. During emergency braking, feeling of the brake pedal is hard.

5.1.4.4 Travel of the brake pedal

If the travel of the brake pedal is too low, it is usually the result of air in the system. Discharge air in the system until all air is discharged. Refer to Discharge air in the hydraulic braking system. The following are some of the minor reasons for too long travel of the brake pedal:

- Friction pad is heavily worn
- Hydraulic system leakage

Measure the travel of the brake pedal regularly and frequently. Travel of the pedal refers to the distance the pedal moves from the fully released position to the floor.

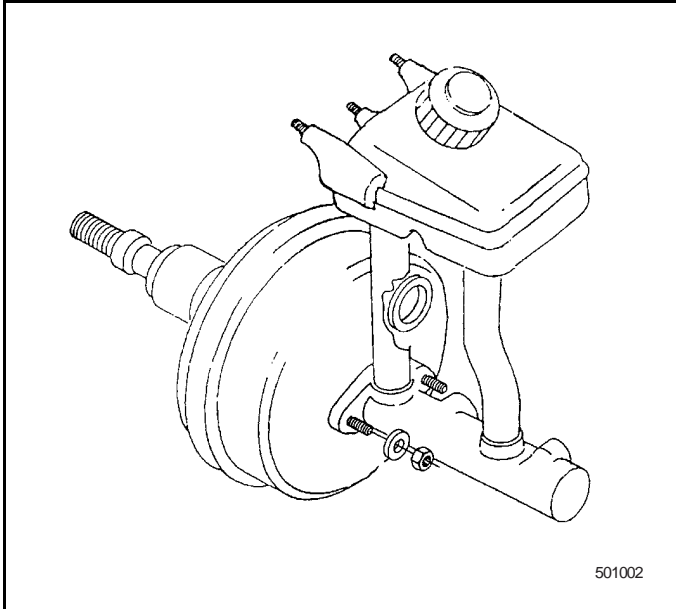
5.1.4.5 Brake Fluid Leakage

Engine idle, shift the transmission to Neutral. Step down the brake pedal and hold the braking force. If the pedal drops slowly while the brake force is kept, there may be leakage in the hydraulic braking system. Conduct the following visual inspection to verify if there is leakage.

- Inspect the fluid level of the brake master cylinder. Normal friction disc worn may result in slight drop of fluid level in the reservoir. If the fluid level in the reservoir is abnormally low, the brake alarm indicator will light to show there is leakage in the system. There may be inside or outside leakage in the hydraulic system.
- Inspect if there is leakage at the connection of brake pipe and brake hose. If there is leakage, inspect the torque of the Fasteners or replace the oil pipe and hose.
- Inspect if there is damage to the connection element of the brakes. If necessary, re-install or replace the elements connecting the brakes.
- Inspect if there is leakage from the housing of the caliper and wheel cylinder. If there is leakage, re-install or replace the elements when necessary.

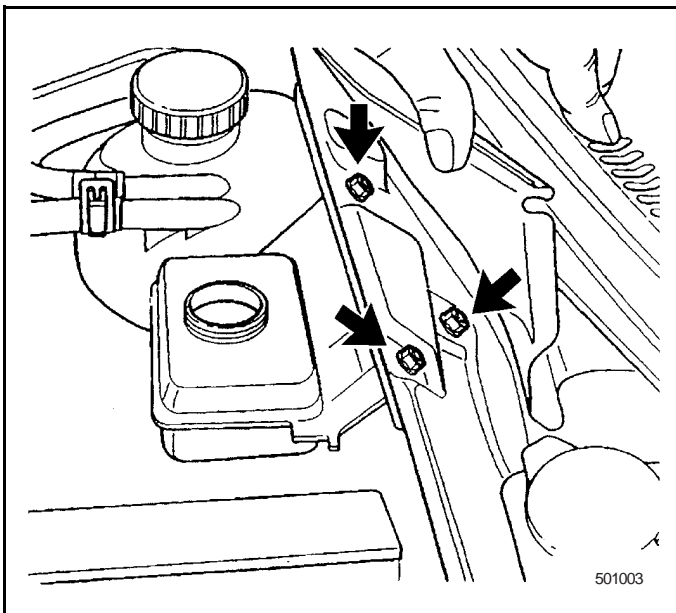
5.1.5 Repair Guidance

5.1.5.1 Add to the brake master cylinder reservoir- with ABS



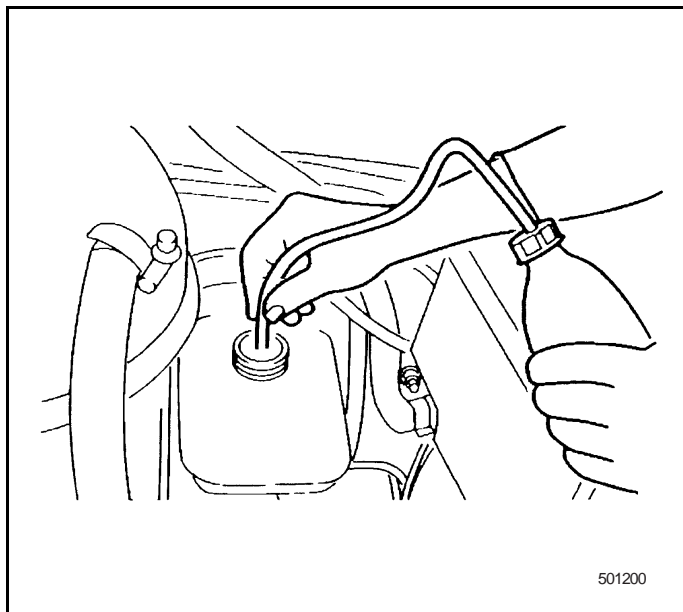
Caution: Do not over-fill the brake fluid reservoir. Otherwise, fluid of the braking system may over flow to the exhaustion components of the engine. Brake fluid is explosive and if contacting the engine exhaustion components, may result in fire and hurt of human bodies.

Brake master cylinder reservoir and brake master cylinder are connected with brake hoses. The fluid reservoir is at the left of the vehicle under the hood. Brake master cylinder reservoir should keep with enough brake fluid. That is, under normal conditions, the reservoir is free of maintenance. When the brake fluid level is too low, sensor of fluid level in the reservoir will alarm in time.



1. Before open the fluid reservoir, clean the surrounding areas to avoid dust from entering.
2. Open the cover and remove the film.
3. Do not over-fill the reservoir to exceed the maximum filling level.
4. Re-tighten the cover and film.

5.1.5.2 Add to the brake master cylinder reservoir- without ABS



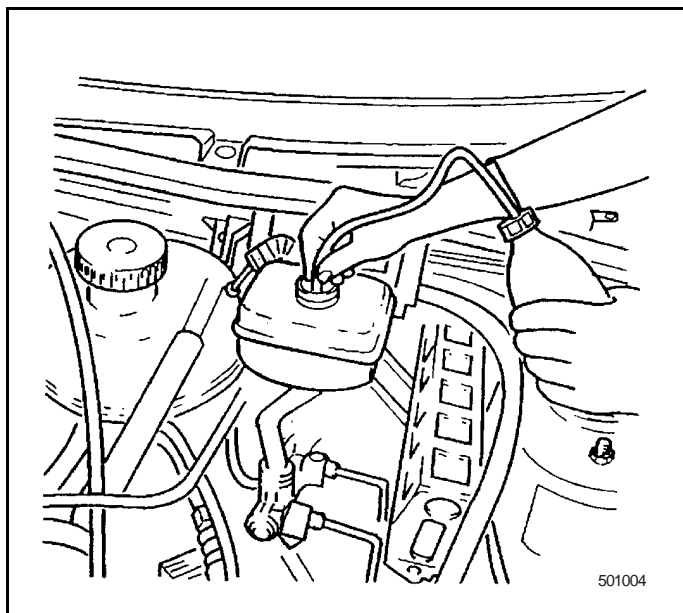
Caution: Do not over-fill the brake fluid reservoir. Otherwise, fluid of the braking system may over flow to the exhaustion components of the engine. Brake fluid is explosive and if contacting the engine exhaustion components, may result in fire and hurt of human bodies.

The fluid reservoir is at the left of the vehicle under the hood. Brake master cylinder reservoir should keep with enough brake fluid. That is, under normal conditions, the reservoir is free of maintenance. When the brake fluid level is too low, sensor of fluid level in the reservoir will alarm in time.

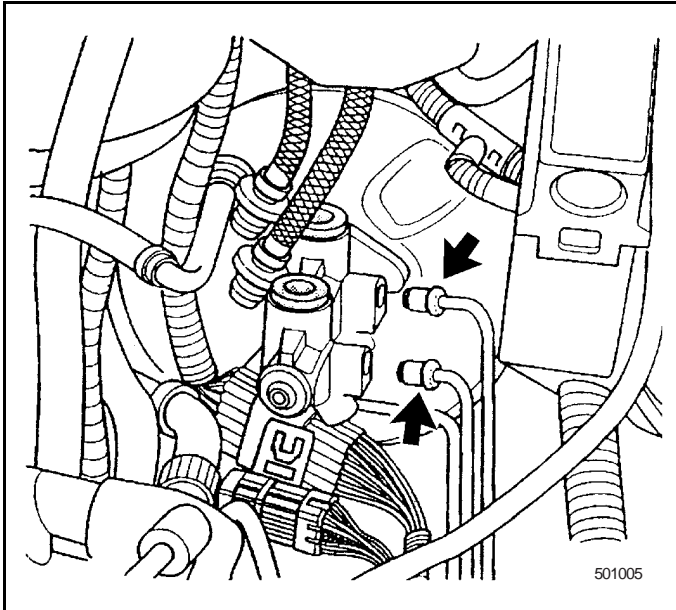
1. Before open the fluid reservoir, clean the surrounding areas to avoid dust from entering.
2. Open the cover and remove the film.
3. Do not over-fill the reservoir to exceed the maximum filling level.
4. Re-tighten the cover and film.

5.1.5.3 Replacement of the brake master cylinder reservoir- with ABS

Removal Procedure

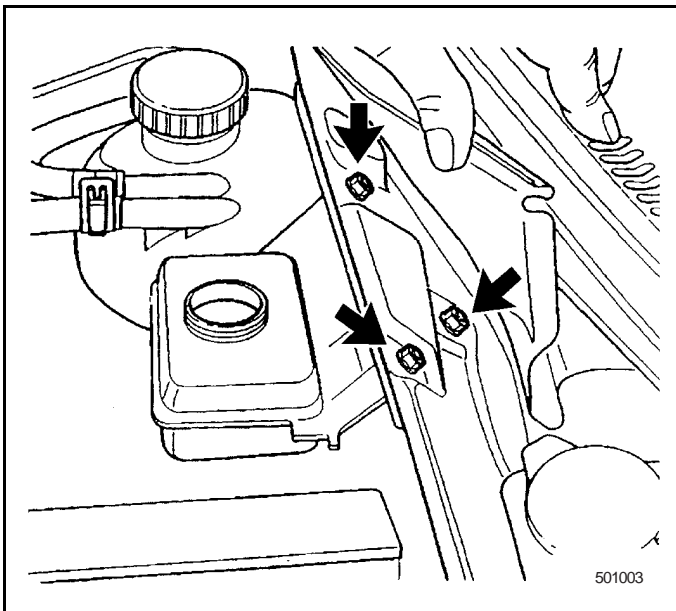


1. Remove the fluid level sensor connector.
2. Remove the brake fluid reservoir cover. Drain off fluid in the pilot bushing.
3. Drain off the brake fluid in the brake fluid reservoir with commercial siphon pipe, the least remained, the better.

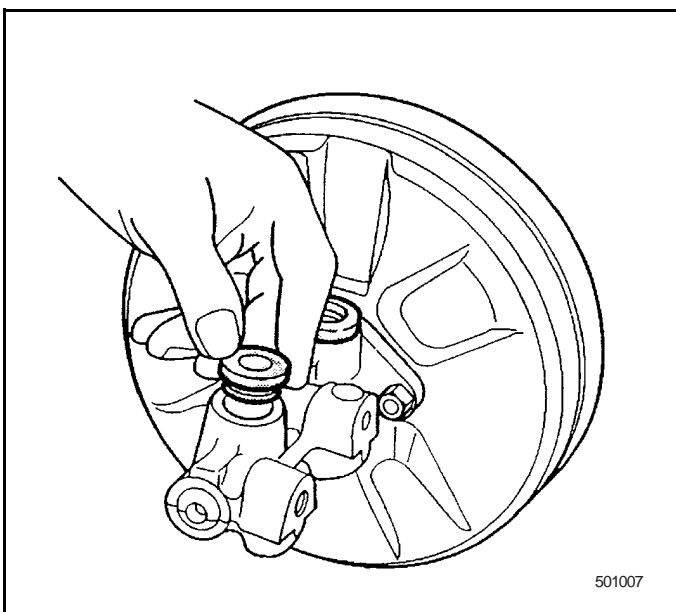


4. Separate the brake master cylinder and conveying pipe.

Note: Pay attention to the over flow brake fluid.



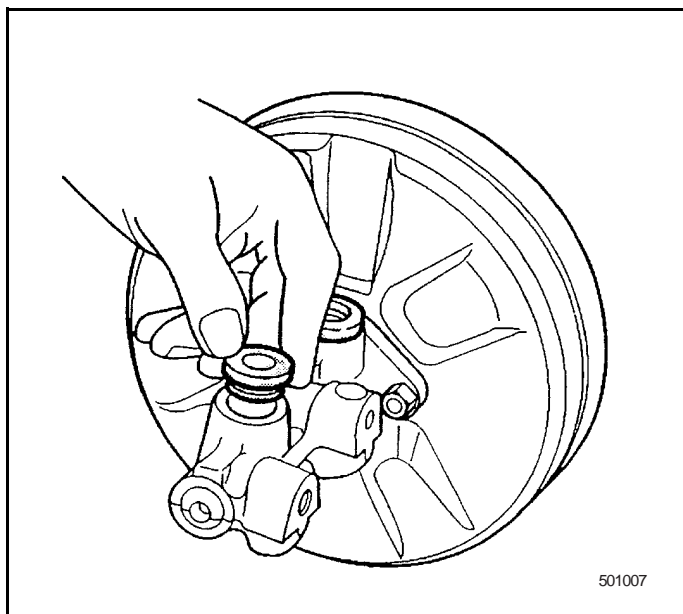
5. Uncover the waterproof panel sealing, loose the brake fluid reservoir nut (as shown by the arrow).



6. Ply off the sealing ring to fluid conveying pipe in the brake master cylinder.
7. Inspect if the fluid reservoir has crack or deformation. If necessary, replace the fluid reservoir.
8. Clean the fluid reservoir with compressed air with no lubrication agent.
9. Dry the fluid reservoir with compressed air with no lubrication agent.

Installation Procedure

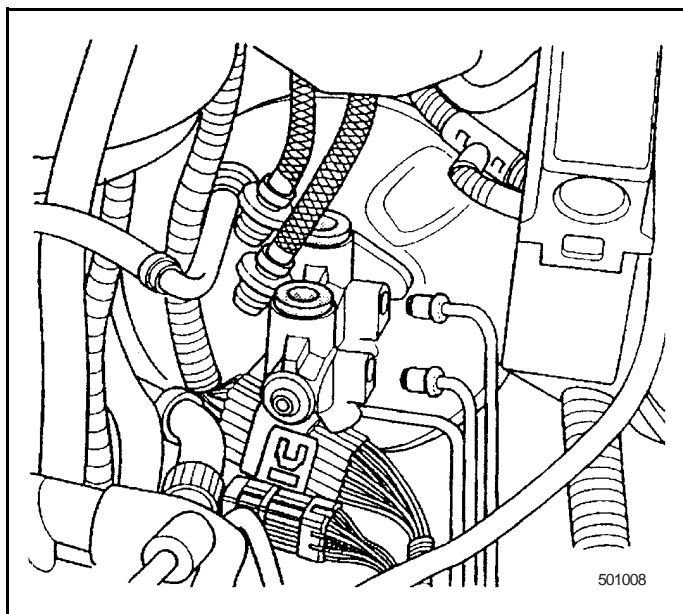
1. Apply brake master cylinder adhesive agent on the new sealing ring, insert the brake master cylinder and install the fluid conveying pipe.

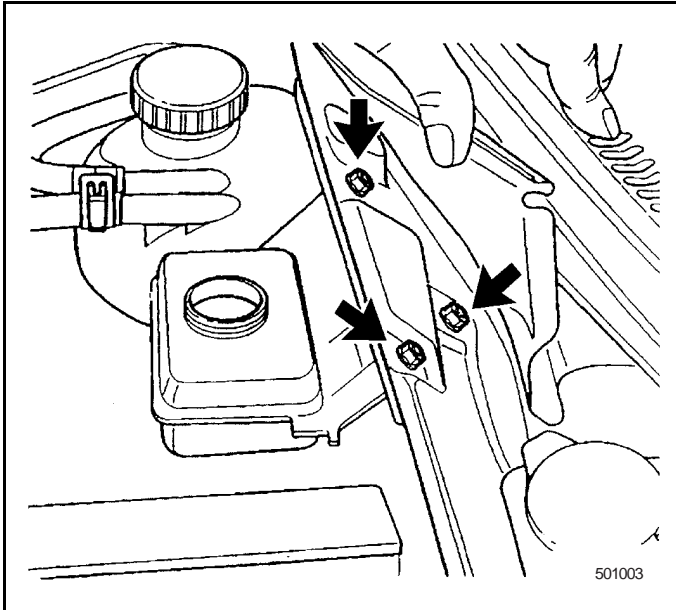


2. Install brake fluid reservoir with new hexagon nuts.

Tightening

Tighten the brake fluid reservoir nut to 3 N•m.



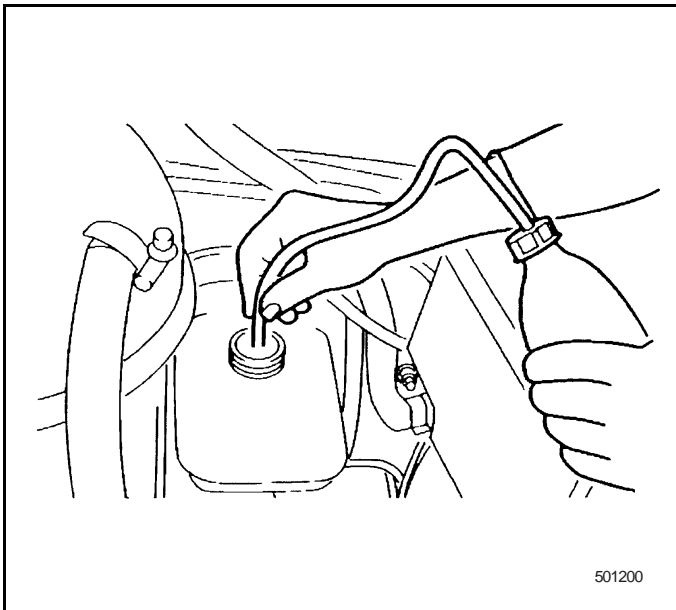


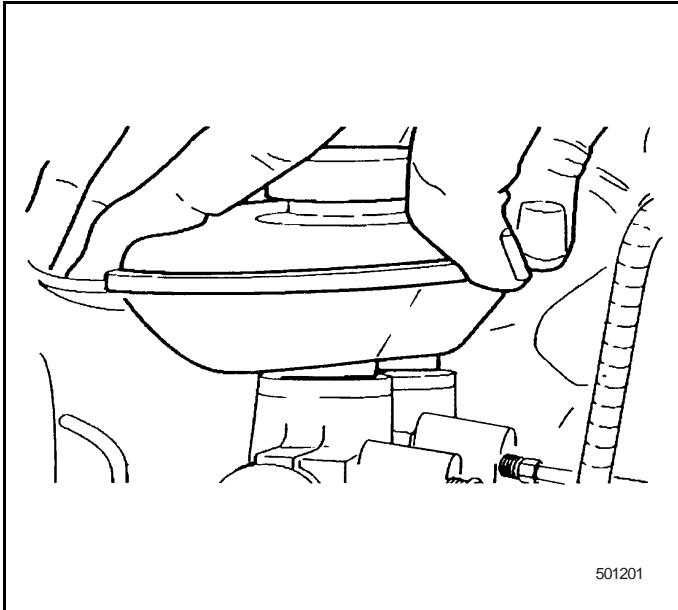
3. Install water drainage collector and body cover.
4. Connect the fluid level sensor connector.
5. Inspect if there is leakage in the brake system exhaust. Refer to Discharge air in the hydraulic braking system.

5.1.5.4 Replacement of the brake master cylinder reservoir- without ABS

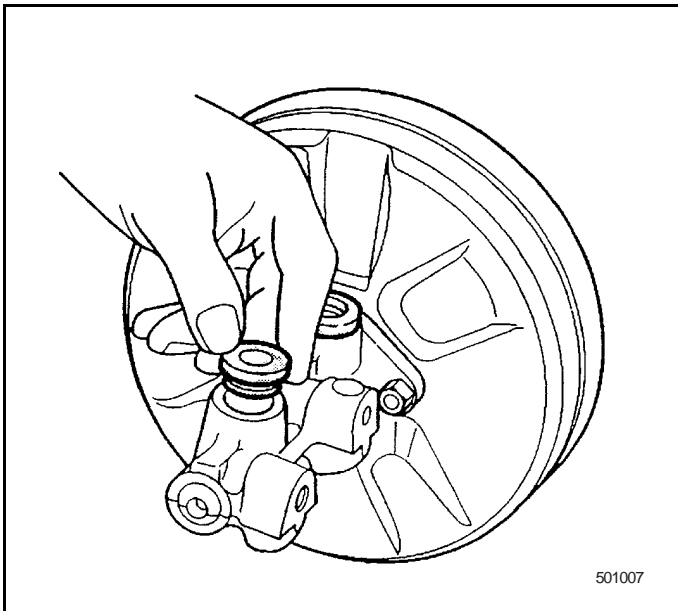
Removal Procedure

1. Remove the fluid level sensor connector.
2. Remove the brake fluid reservoir cover. Drain off fluid in the pilot bushing.
3. Drain off the brake fluid in the brake fluid reservoir with commercial siphon pipe, the least remained, the better.



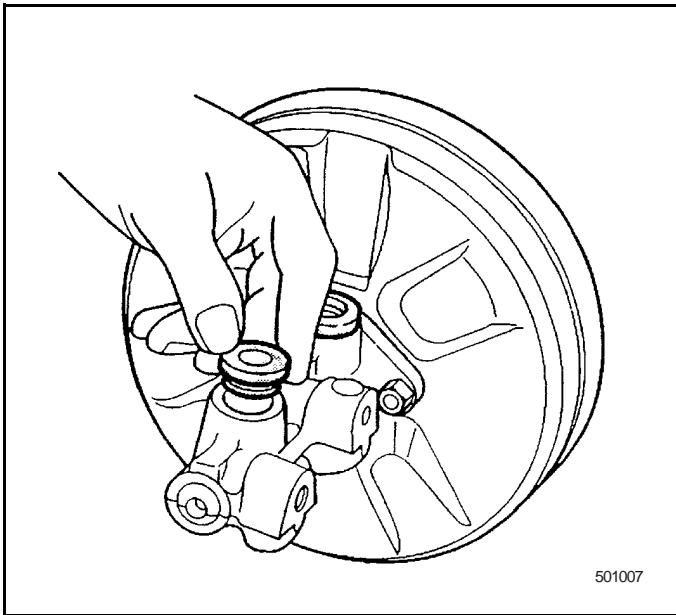


4. Incline the brake fluid reservoir and pull it upward to take it out.

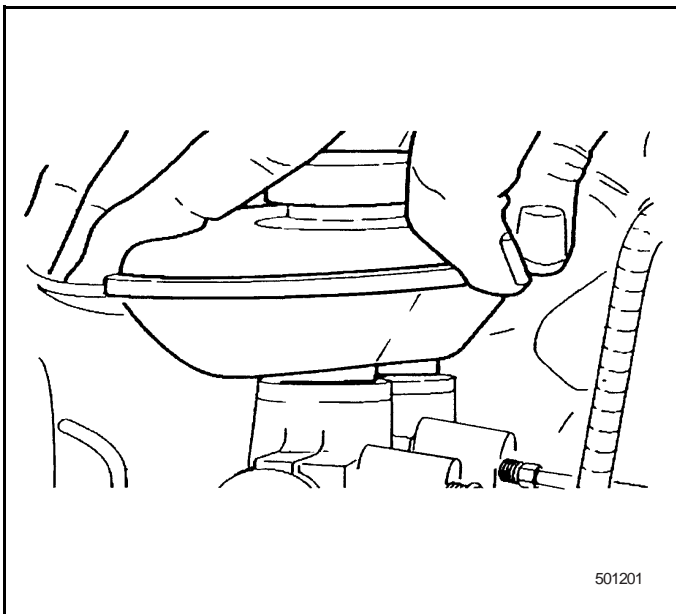


5. Remove the sealing ring from the brake master cylinder.
6. Inspect if the fluid reservoir has crack or deformation. If necessary, replace the fluid reservoir.
7. Clean the fluid reservoir with compressed air with no lubrication agent.
8. Dry the fluid reservoir with compressed air with no lubrication agent.

Installation Procedure



1. Apply brake master cylinder adhesive agent on the new sealing ring, insert the brake master cylinder.



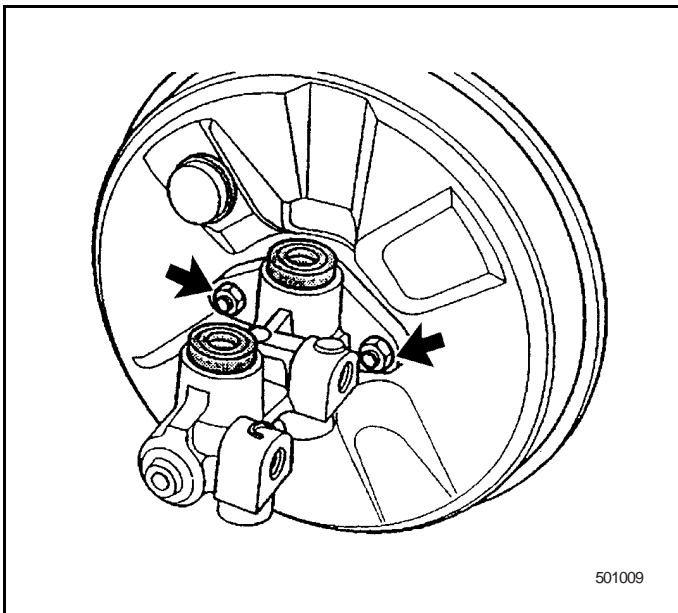
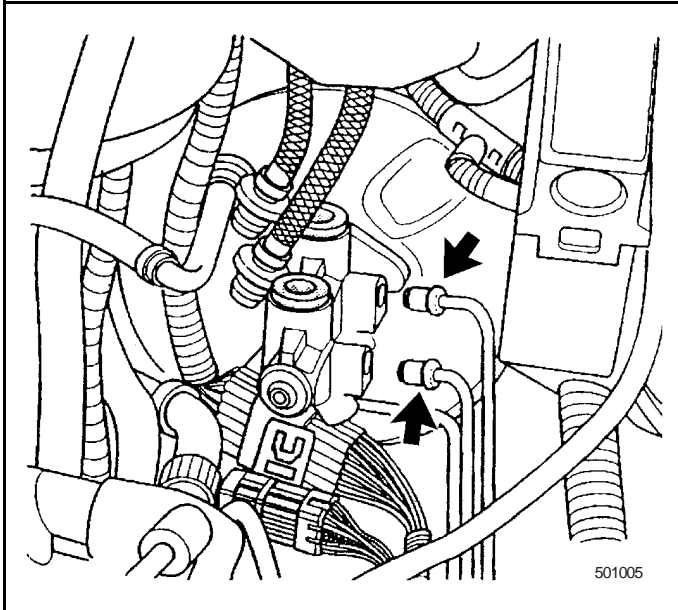
2. Insert and install the brake fluid reservoir to the brake master cylinder. Install the outer cover of the brake fluid reservoir.
3. Connect the fluid level sensor connector.
4. Inspect if there is leakage in the brake system exhaust. Refer to Discharge air in the hydraulic braking system.

5.1.5.5 Brake Master Cylinder Replacement

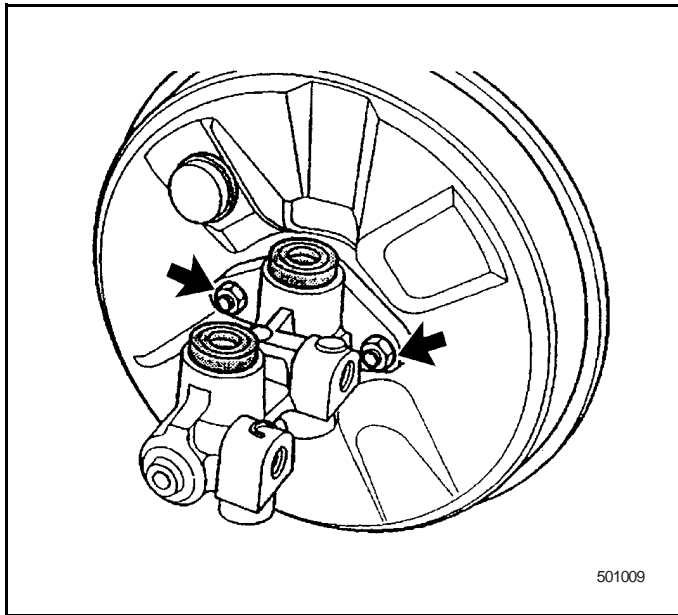
Removal Procedure

1. Remove the brake master cylinder fluid reservoir. Refer to Replacement of Brake master cylinder Fluid Reservoir.
2. Disconnect the brake pipelines and the master pump.

Note: Pay attention to the over flow brake fluid.



3. Remove the brake master cylinder fixing nut.
4. Remove brake master cylinder.

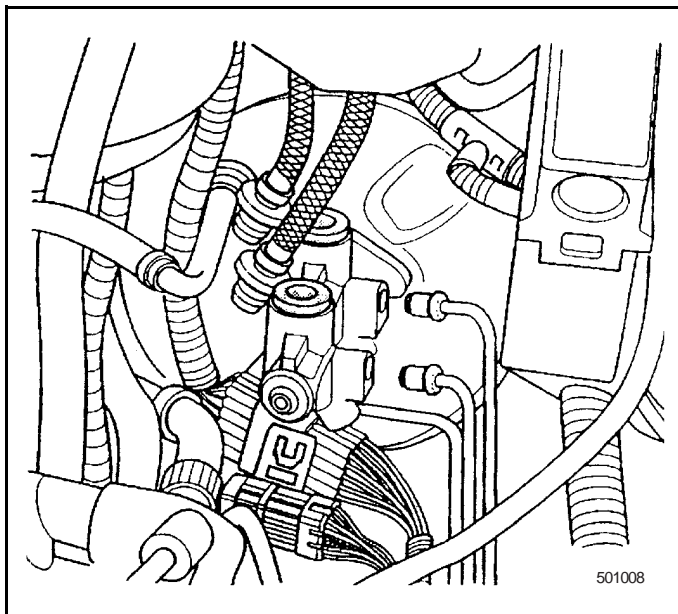


Installation Procedure

1. Install brake master cylinder.
2. Install brake master cylinder nut.

Tightening

Tighten brake booster installation nut to 22 N•m.



3. Connect the brake pipeline and brake master cylinder.

Tightening

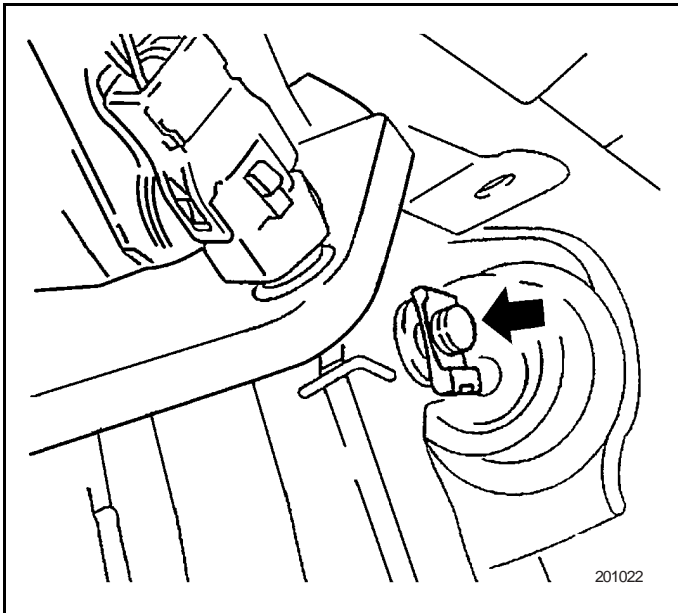
Tighten the brake pipeline nut to 16 N•m.

4. Install the brake master cylinder fluid reservoir, refer to Replacement of Brake master cylinder Fluid Reservoir.
5. Fill in the brake fluid into brake master cylinder fluid reservoir. Refer to Filling of Brake master cylinder Fluid Reservoir.
6. Discharge air in the exhaustion brake system. Refer to Discharge air in the hydraulic braking system.

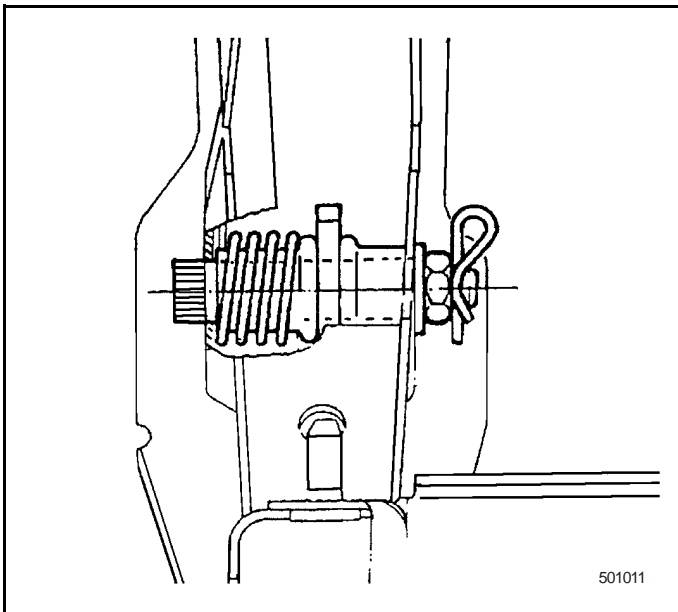
5.1.5.6 Replacement of the brake pedal

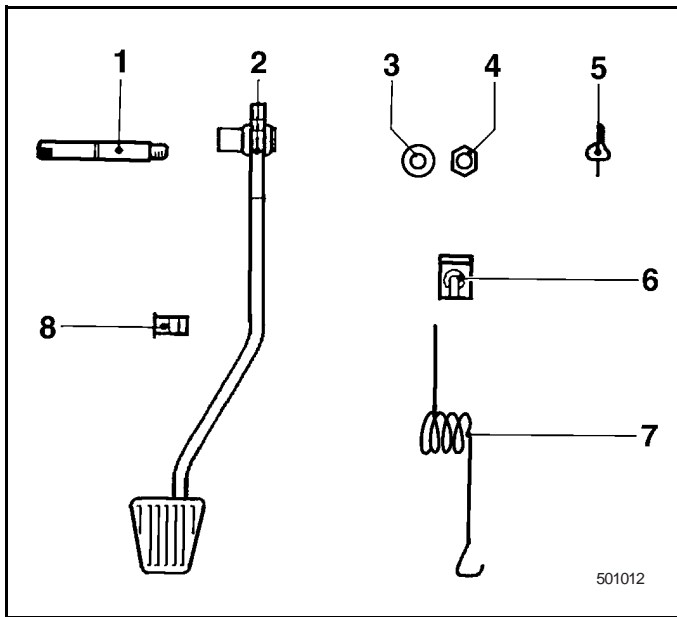
Removal Procedure

1. Disengage the brake pedal spring, clutch pedal and clutch cable.
2. Remove the fixing clips from the fork and pull the fork off.



3. Remove the fixing spring from the pedal shaft. Loosen the hexagon nut of the pedal shaft.
4. Remove the pedal shaft and pull it from the left.
5. Remove the pedal and spring.



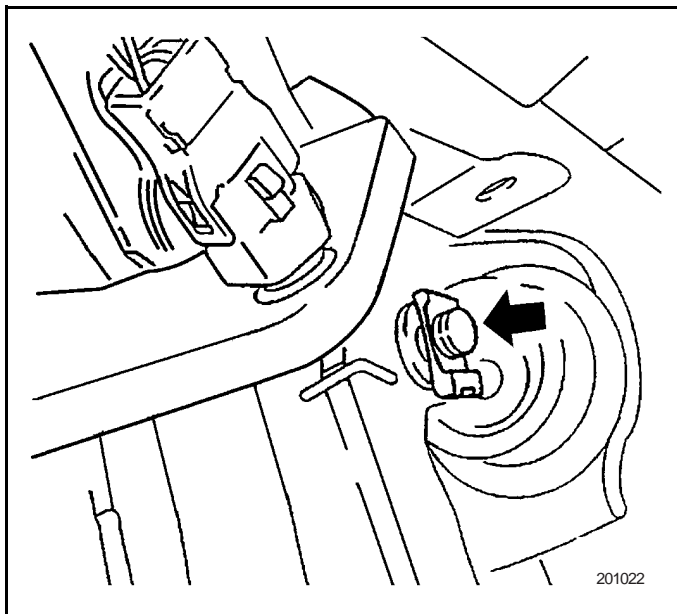


Installation Procedure

1. Lubricate the pedal shaft (1) with special lubrication grease.
2. During replacement, replace the brake pedal with assembly (2) with pedal bushing.
3. Replace the pedal rubber housing.
4. Install the pedal and spring (7) to relevant position and insert the pedal shaft to the pedal bracket.
5. Install washer (3) and hexagon nut (4).

Tightening

Tighten the pedal to pedal bracket to 18 N•m.



6. Fix the pedal shaft so that pusher bar connects with the brake pedal. Install the pusher pin and fixing caliper. Insert the brake pedal spring.
7. Install clutch bracket and Tighten. Install clutch pedal spring and clutch cable. Adjust if necessary.

Tightening

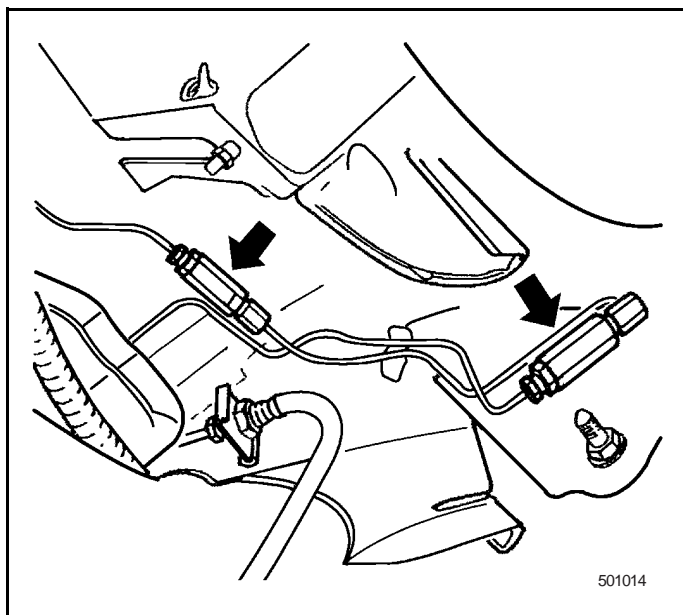
Tighten the clutch bracket to the isolation panel to 20 N•m.

5.1.5.7 Replacement of ratio valve (without ABS)

Removal Procedure

Note: Do not rinse the ratio valve in any washing liquid. The inner components have been lubricated with special lubrication grease. Replace two ratio valves at one time. Use ratio valve with the same pressure grades and pressure switch (0.3/3) (grades= 0.3, pressure switch = 3Mpa).

1. Loosen the fluid reservoir outer cover, fill the brake fluid to the Maximum position. Block the brake fluid reservoir with cover similar to brake fluid reservoir.
2. Raise and adequately support the vehicle.
3. Clean away dust and foreign matter on the brake pipeline and ratio valve.
4. Remove the brake hard pipe connector with supporting spanner.
5. Remove the ratio valve.



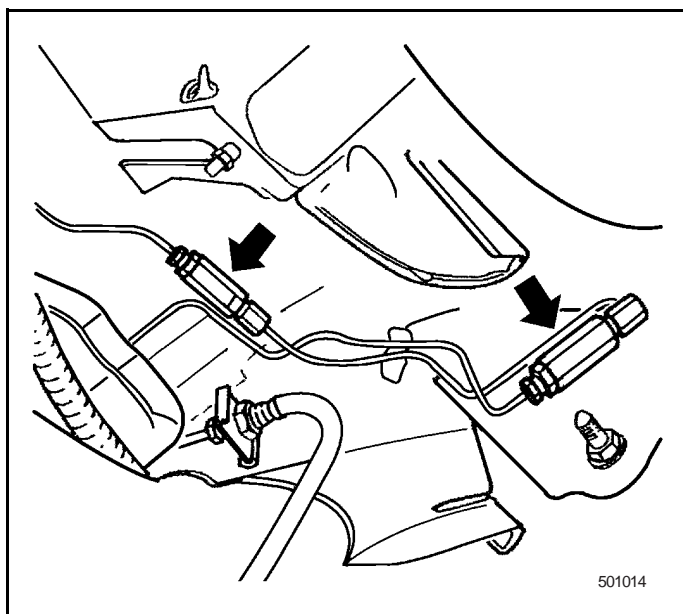
Installation Procedure

1. Install the ratio valve and Tighten the brake hard pipe connector to the ratio valve with hands.
2. Connect the brake hard pipe connector to the ratio valve with support spanner.

Tightening

Tighten the ratio valve nut to 16 N•m.

3. Lower the vehicle.
4. Discharge air in the brake. Refer to Discharge air in the hydraulic braking system.

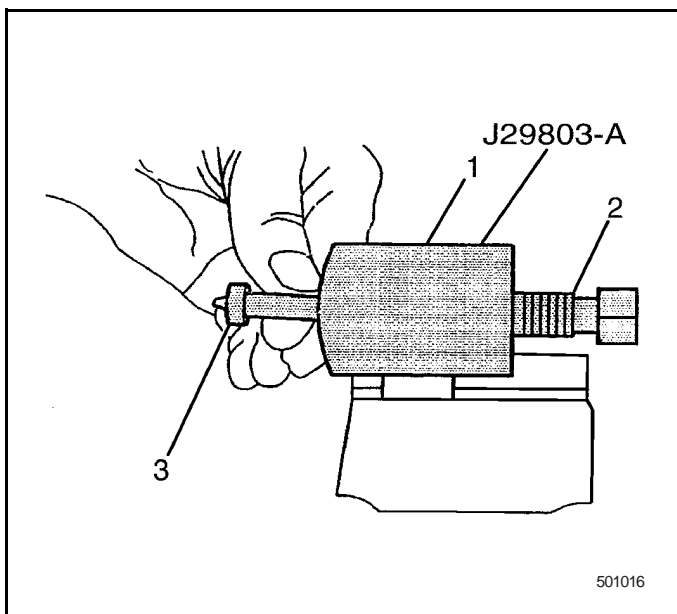
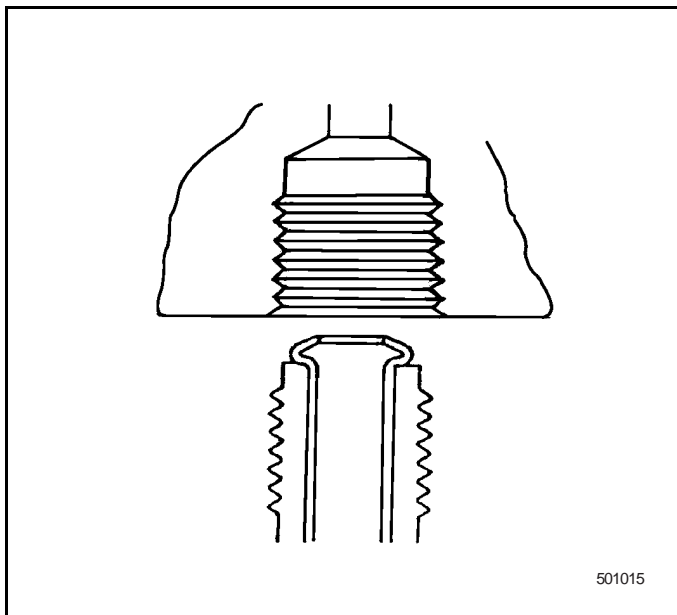


5.1.5.8 Replacement of Brake Pipeline

Tools Required

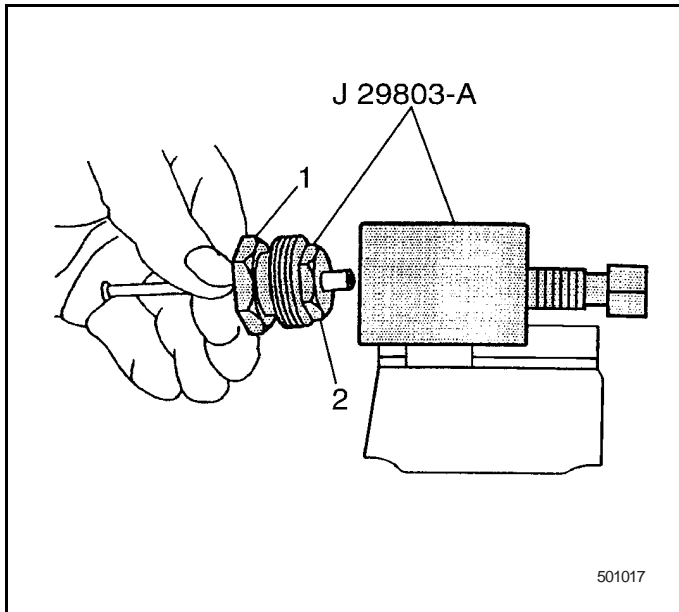
- J 29803-A ISO (ISO) flaring tool

Caution: Be sure to use double wall steel brake pipes to replace the old one. It is recommended not to use any of the other types, otherwise the brake system may result in failure. Place and keep the brake pipe carefully. Use bending equipment in the workshop so as not to deform the brake intersection. Be sure to use the correct Fasteners when replacing the brake at the original position. Unreasonable arrangement and installation may damage the brake pipe and result in brake system failure.



Notice: Do not use single bladed flaring tool. Be sure to use double-bladed flaring tool so that its strength is enough to support the system pressure. Use of the single-bladed flaring tool may damage the system.

1. Obtain pipelines and steel connector nut of adequate size. Choose outer diameter pipe satisfying the specified sizes.
2. Cut to the proper length. To determine the correct length, measure the length of the old pipelines and plus 3mm.
3. Install the connector to the pipeline before start use of the flaring tool.
4. Camber the inside and outside diameter with camber tools.
5. Wiper out the traces of lubrication oil at the brake pipeline and flaring tool.
6. Clamp the flaring tool.
7. Choose the correct pipeline sizes as well as the locking ring and formation cone bar.
8. Insert adequate formation cone bar into tool bar.
9. Maintain the position of the center shaft and press on Tightening screws until the screw contacts formation central shaft and be able to move it.
10. After contact with the formation cone bar, turn backward the Tightening screw one entire cycle.
11. Put the clamp nut onto the brake pipe and insert into the correct lock ring. Extend the pipeline out of the lock ring about 19mm.
12. Insert lock ring into the tool bar. brake pipe end must contact with the cone bar surface.
13. Insert the Tightening nut into tool bar, Tighten, or the pipe may be pushed out.
14. Tighten the Tightening screw with spanner to the end. Do not Tighten the screw too much, or the flare size may be too large.



15. Exit the Tightening nut from the tool.
16. Remove the Tightening nut and locking ring. Now the flare may be used.
17. Bend the pipeline so that it matches with the old pipelines. Keep 19 mm away from moving or vibrating components.

5.1.5.9 Brake hose inspection

Inspect the flexible hydraulic brake hose at least twice a year. The hydraulic brake hose shall pass the hydraulic pressure in the steel brake hard pipe to brake caliper and brake disc.

1. Inspect if the hose has the following situations:
 - damage in road accident
 - broken
 - worn housing
 - leakage
 - pores
 - wiring and assembled correctly
 - Conduct adequate inspection requires lighting and mirrors.
2. If the brake hose is found with any failure, replace the brake hose.

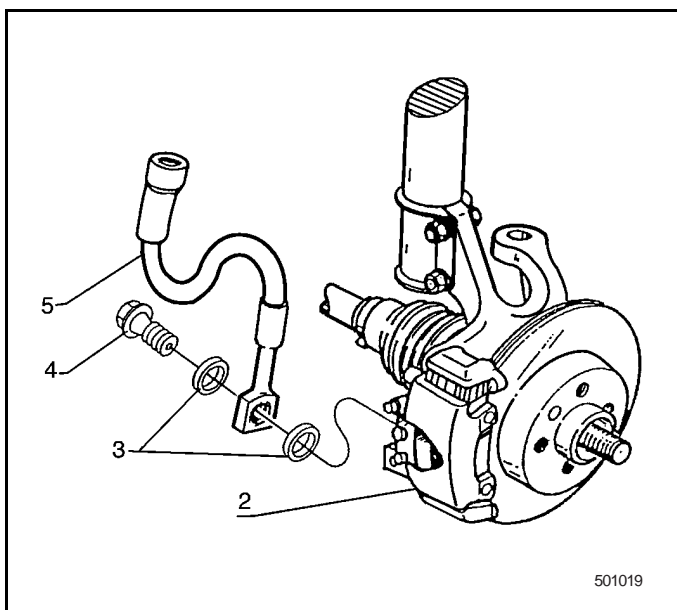
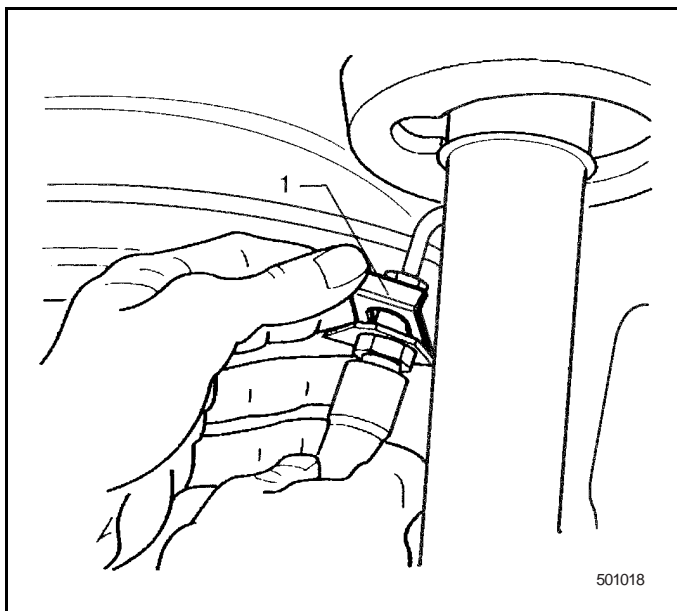
5.1.5.10 Replacement of the Brake Hose-Front

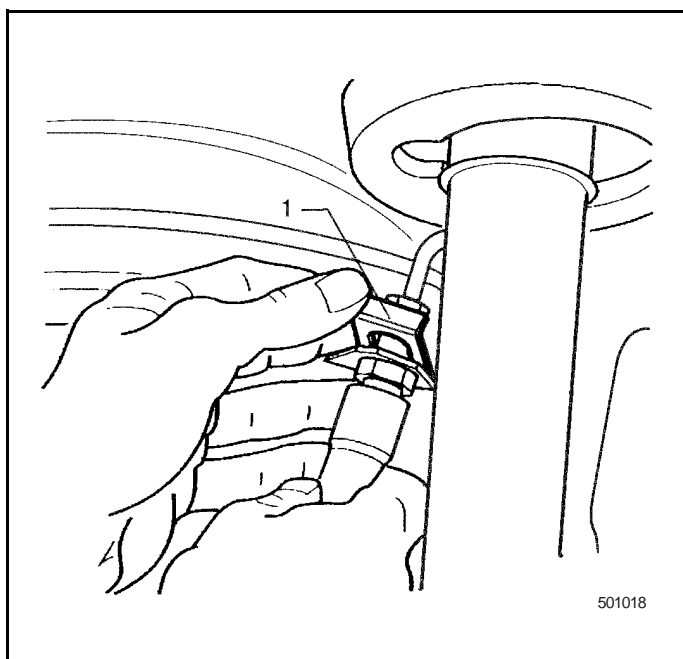
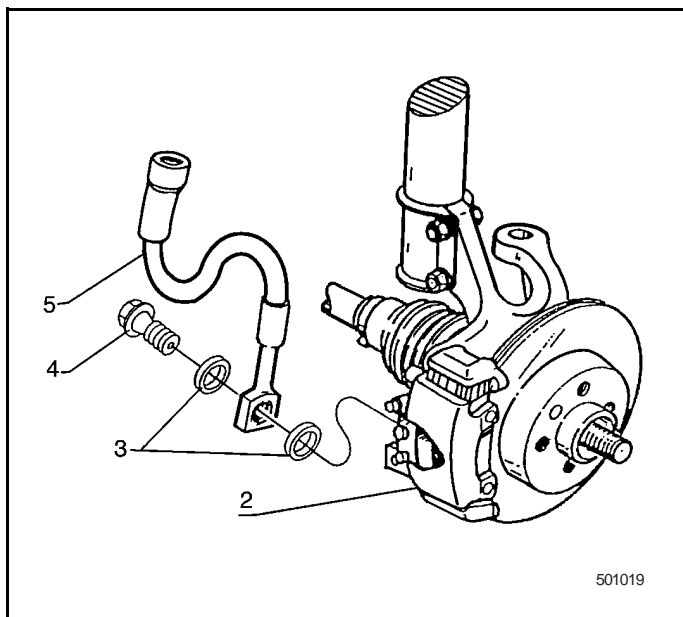
Removal Procedure

Caution: Do not move the vehicle before steady brake pedal travel is obtained. Air in brake system may result in brake failure or casualty accident.

Notice: Do not have the components suspended on flexible hoses, or the hoses may be damaged.

1. Loosen the fluid reservoir outer cover, fill the brake fluid to the Maximum position. Block the brake fluid reservoir with cover similar to brake fluid reservoir.
2. Raise and adequately support the vehicle.
3. Remove the front wheel. Refer to Replacement of the wheel.
4. Clean away dust and foreign matter on the brake hose and connectors.
5. Use support spanner on the hose connector to remove the brake hard pipeline from the brake hose.
6. Remove the fixing clip (1) from the hose mounting bracket. Do not bend brake hard pipe or bracket.
7. Remove the hose (5) from the bracket.
8. Remove the following items from the caliper (2):
 - Brake hose bolt stem (4)
 - hose (5)
 - two washers (3)
 - Discard the two washers





Installation Procedure

1. Install the following part onto caliper (2)
 - Brake hose bolt stem (4)
 - hose (5)
 - two new washers (3)
 - Use the two new washers (according to relevant sequence) and refer to the illustration figures.
2. Lubricate the bolt stem and thread with brake fluid.

Tightening

Tighten the brake hose caliper bolt stem to 40 N•m.

3. Install the brake hose to the bracket. There shall be no distortion on the hose.
4. Tighten the brake hard pipe to the brake hose with fingers.
5. Install the fixing discs to the hose connectors of the bracket.
6. Tightly connect the brake hose onto the brake hard pipe.

- Fix the hose connector with the support spanner.
- Do not bend the bracket or the pipeline.

Tightening

Tighten the brake hard pipeline connector nut to 16 N•m.

7. Install the front wheel. Refer to Replacement of the wheel.
8. Ensure there is no contact between the hose and suspension system. Inspect the operation of hoses at the uttermost right side and left side. If there is contact between the hose and suspension, remove the hose and correct.
9. Lower the vehicle.
10. Discharge air in the brake. Refer to Discharge air in the hydraulic braking system.

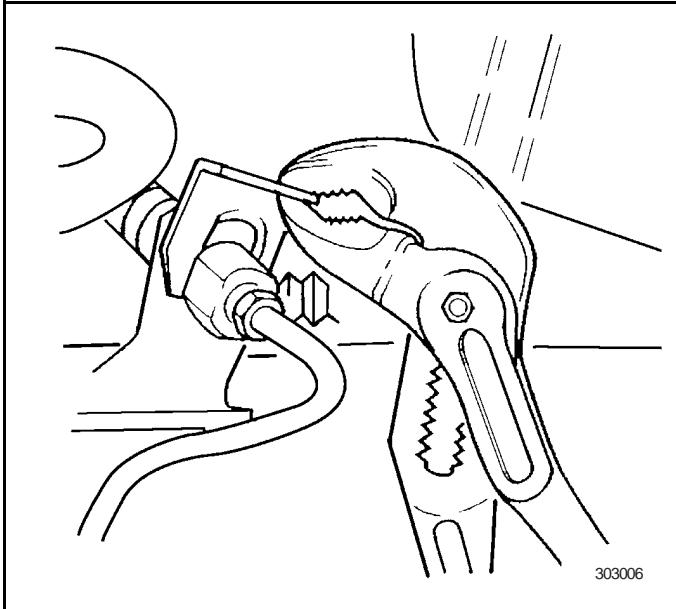
5.1.5.11 Replacement of the brake hose - rear (drum)

Removal Procedure

Caution: Do not move the vehicle before steady brake pedal travel is obtained. Air in brake system may result in brake failure or casualty accident.

Notice: There shall be no crimp on the brake hose anywhere to prevent the components from loss of brake fluid.

1. Raise and adequately support the vehicle.
2. Clean away dust and foreign matter on the brake hose and connectors.
3. Use support spanner on the hose connector to remove the brake hard pipeline from the brake hose. Do not bend brake hard pipe or bracket.
4. Remove the caliper from the brake hose from the bracket.
5. Remove the hoses from the bracket.



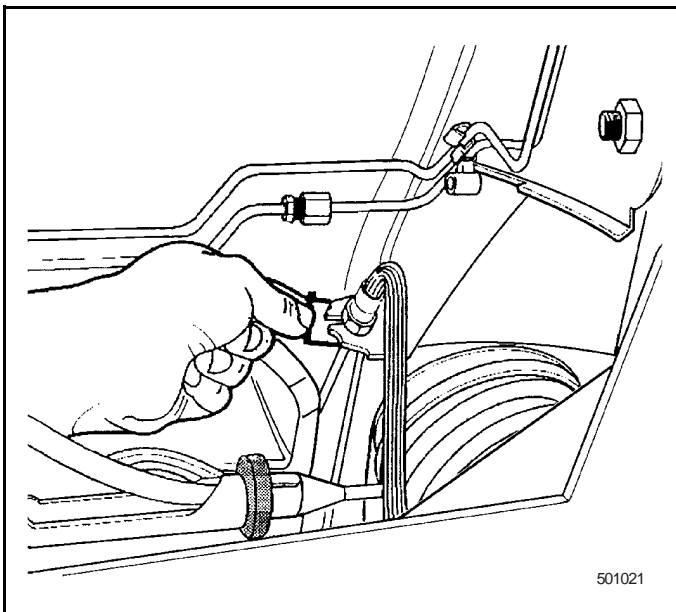
Installation Procedure

1. Install the brake hose to the bracket. There shall be no distortion on the hose.
2. Tighten the brake hard pipe to the brake hose with fingers.
3. Install the fixing discs to the hose connectors of the bracket.
4. Tighten the brake hose onto the brake hard pipelines.
 - Loosen the hose connector with the support spanner.
 - Do not bend the bracket or the pipeline.

Tightening

Tighten the brake hard pipeline connector nut to 16 N•m.

5. Do not bend the bracket or the pipeline.
6. Lower the vehicle.
7. Discharge air in the brake. Refer to Discharge air in the hydraulic braking system.



5.1.5.12 Discharge air from the hydraulic brake system- with ABS

Caution: Do not move the vehicle before steady brake pedal travel is obtained. Air in brake system may result in brake failure or casualty accident.

Caution: Use only clean OPEL DOT 4 brake fluid in enclosed reservoir. Do not use brake fluid in open containers that maybe contaminated by water. If incorrect or contaminated hydraulic fluid is used, components may be damaged or brake performance may lose, which may result in casualty accident.

Caution: Do not over-fill the brake fluid reservoir. Otherwise, fluid of the braking system may over flow to the exhaustion components of the engine. Brake fluid is explosive and if contacting the engine exhaustion components, may result in fire and hurt of human bodies.

Notice: If any brake part is serviced or replaced and air enters into the brake system, the entire discharging procedure must be performed.

Notice: Avoid spraying of brake fluid on paint, wire, cable or electrical connectors. Brake fluid may damage the paint and electrical connection. If brake fluid is sprayed onto the vehicles, rinse the parts with oil so as to reduce the damage degree.

Notice: Before discharging air in the brake, return the front and rear discharging pump to the maximum position. The first choice is to perform reset procedure with the scan tool. If there is not scan tool available, choose the second procedure, but the important thing is to strictly adhere to the following procedures.

The purpose of discharging air in the hydraulic braking system is to discharge air in the system.

If air enters due to low brake fluid level or breaking of the brake hard pipe, perform the procedure to the four brakes to discharge any air in them

.If the brake hose or hard pipe at one wheel breaks, discharge air in this wheel caliper. If the brake hard pipe or hose breaks at the connection of the brake master cylinder and brakes, discharge only the brake system related with the broken pipeline or hose.

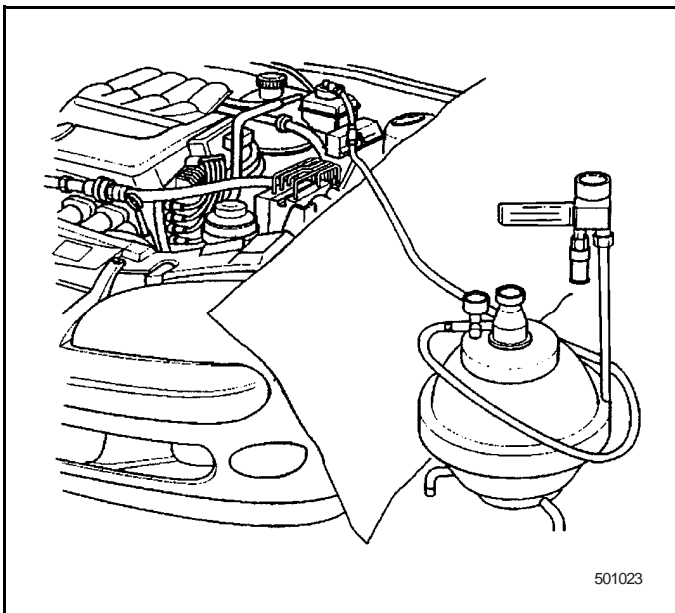
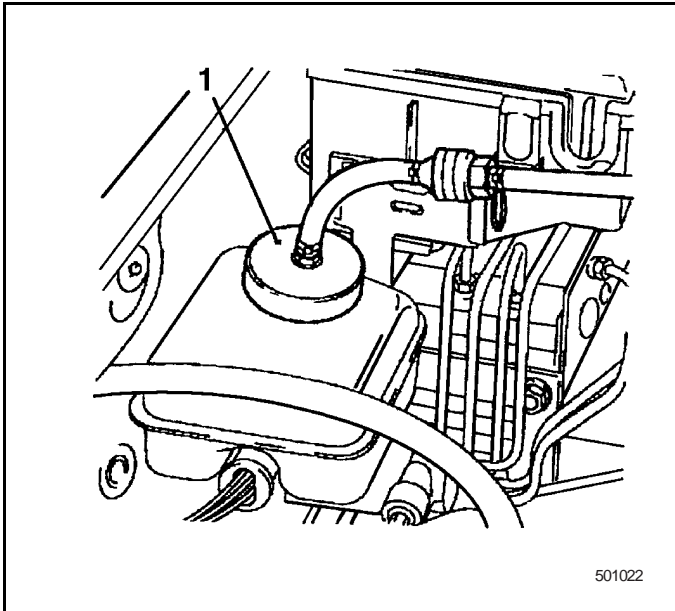
Note: During the entire procedure, do not put the foot on the brake pedal unless otherwise specified.

1. Put away your foot on the brake pedal.
2. Start the engine. Have the engine running at least 10 seconds while observe the light yellow anti-lock braking system alarm indicator.
3. If the light yellow ABS alarm indicator lights and hold for more than 10 seconds, stop the discharging procedure. Use scan tool to diagnose if ABS fails.

4. If the light yellow ABS indicator lights for about 3 seconds, then turns off continuously, turn off ignition.
5. Repeat the above 4 steps.
6. Discharge air in the entire brake system.

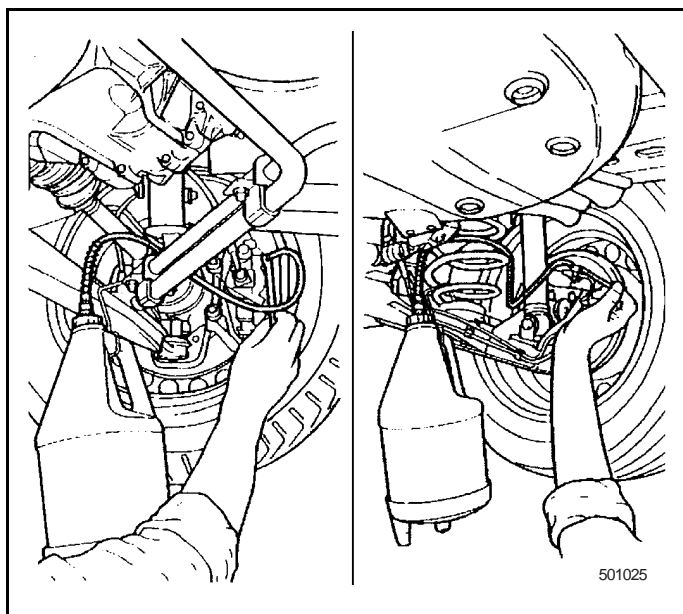
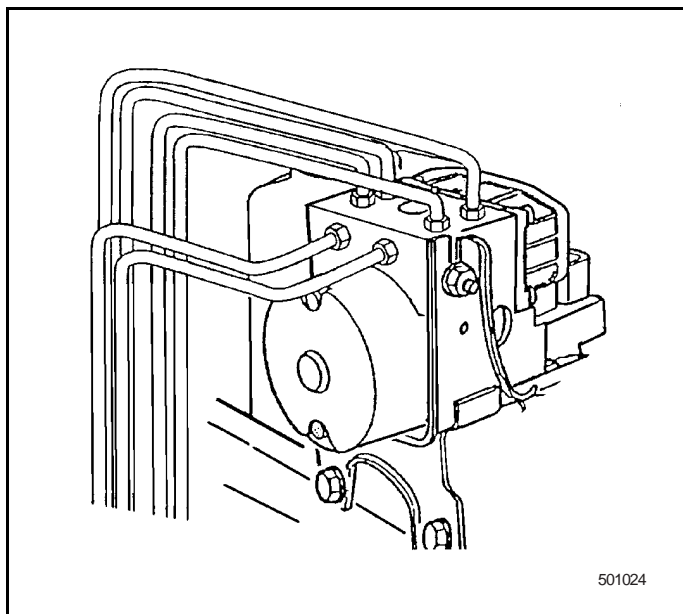
Pressure discharging

1. Inspect and fill brake fluid reservoir to specified level if necessary.
2. Remove the brake fluid reservoir cover.



3. Connect the brake discharging equipment with the brake fluid reservoir with connector (1).
4. Charge pressure to the brake system.
5. Wait for 30 seconds, then inspect the entire hydraulic brake system to ensure no leakage of brake fluid. Repair if there is leakage.

Note: Wipe away the over flow brake fluid.



6. Slowly open one of the ABS brake pipe connector so that the brake fluid flows out.
7. When there is no air in the brake fluid, close the ABS regulator brake pipe connector.

Tightening

Tighten the ABS regulator brake connector to 6N•m.

8. For the remained ABS regulator brake pipe connectors, repeat step 6 and 7.
9. Raise and adequately support the vehicle.
10. Install the transparent plastic discharging hose to the right rear brake exhaustion valve.

11. Immerse the other end of the hose in clean vessel with clean brake fluid.
12. Open the discharging valve slowly. Brake fluid flows out.
13. When there is no air bubble in the brake fluid, close the discharging valve.
14. Tighten the brake drum discharging valve to 6N•m.
15. Remove the transparent discharging hose from the discharging valve.
16. Repeat the above 6 steps (10-15) for left rear brake, right front caliper and left front caliper until no air bubbles occur.

Note: Ensure there is no leakage in the discharging valve.

17. Remove the transparent discharging hose from the discharging valve.
18. Lower the vehicle.
19. Remove the brake discharging equipment. Pay attention to the pressure remained in the brake fluid reservoir.
20. Inspect and fill brake fluid reservoir to specified level if necessary.
21. Install the brake fluid reservoir cover.
22. Start the engine and have the engine running for at least 10 seconds.
23. Turn off ignition switch.
24. Inspect the feeling of brake pedal and its travel.
 - If the brake pedal feels firm and its travel is within the specified value, go to step 25.
 - If the brake pedal feels soft and its travel exceeds the specified value, do not drive the vehicle. to Step 26.
25. Start the engine and inspect the brake pedal.

- If the brake pedal feels firm and steady, go to Step 27.
 - If the brake pedal feels soft, do not drive the vehicle. Go on with Step 26.
26. Confirm the unacceptable soft feeling of brake pedal and its travel are not caused by improper adjustment of the brake disc plate or other mechanical failures, then repeat the brake system pressure discharging procedure. Go to Step 1.

Caution: Do not move the vehicle before steady brake pedal is obtained. Otherwise, human casualty may result.

27. Road test the vehicle. Test brake for several times at middle speed to ensure the brake system functions properly. Between each brake, give enough time for the brake system to cool down.

Brake system manual discharging procedure.

Note: An assistant is required to step the brake pedal during opening and closing of the discharging valves.

Note: Ensure the brake master cylinder brake fluid level is not at its bottom. Inspect and fill the brake master cylinder reservoir according to the volume of discharged brake fluid. If the brake fluid level has dropped to the bottom of the brake master cylinder reservoir, repeat the discharging procedure from Step 1.

1. Inspect and fill brake fluid reservoir to specified level if necessary.

Note: Wipe away the over flow brake fluid.

2. Slowly open one of the ABS brake pipe connector so as to fill the brake fluid.
3. Step down the brake pedal to 75% of the entire travel and hold.
4. When there is no air in the brake fluid, close the ABS regulator brake pipe connector.

Tightening

Tighten the ABS regulator brake connector to 16 N•m.

5. For the remained ABS regulator brake pipe connectors, repeat step 2 and 4.
6. Inspect and fill brake fluid reservoir to specified level if necessary.
7. Raise and adequately support the vehicle.
8. Install the transparent plastic discharging hose to the right rear exhaustion valve.
9. Immerse the other end of the transparent plastic hose in clean vessel with clean brake fluid.
10. Open the discharging valve.
11. Step down the brake pedal to 75% of the entire travel and hold.

12. Close the discharging valve.
13. Release the brake pedal.
14. Repeat step 9 ñ13 until there is no air bubble in the brake fluid.
15. Tighten the discharging valve to 6 N•m.

Note: Ensure there is no leakage in the discharging valve.

16. Remove the transparent discharging hose from the discharging valve.
17. Repeat the above step 8-16 for left rear brake, right front caliper and left front caliper until no air bubbles occur.
18. Lower the vehicle.
19. Remove the brake fluid reservoir cover.
20. Inspect the brake fluid level in the reservoir. Fill in brake fluid to the correct level in the reservoir when necessary.
21. Install the brake fluid reservoir cover.
22. Turn the ignition switch to RUN position, then turn off the engine. Step the brake pedal with medium force and hold. Pay attention to the feeling and travel.
23. If the pedal feels firm and steady and its travel is within the specification, start the engine. Inspect the travel of the pedal again while the engine is running.
24. If the pedal feels firm and steady and its travel is within the specification, perform road test to the vehicle. Test brake for several times at middle speed to ensure the brake system functions properly.
25. If the brake pedal feels soft or its travel exceeds the specifications at the beginning or after the engine is started, repeat the manual discharging procedure and start from Step 1.

Caution: Step down the brake pedal before move the vehicle. Otherwise, human casualty may result.

26. Road test the vehicle. Test brake for several times at middle speed to ensure the brake system functions properly.

5.1.5.13 Discharge air from the hydraulic brake system - without ABS

Caution: Do not move the vehicle before steady brake pedal travel is obtained. Air in brake system may result in brake failure or casualty accident.

Caution: Use only clean OPEL DOT 4 brake fluid in enclosed reservoir. Do not use brake fluid in open containers that maybe contaminated by water. If incorrect or contaminated hydraulic fluid is used, components may be damaged or brake performance may lose, which may result in casualty accident.

Caution: Do not over-fill the brake fluid reservoir. Otherwise, fluid of the braking system may over flow to the exhaustion components of the engine. Brake fluid is explosive and if contacting the engine exhaustion components, may result in fire and hurt of human bodies.

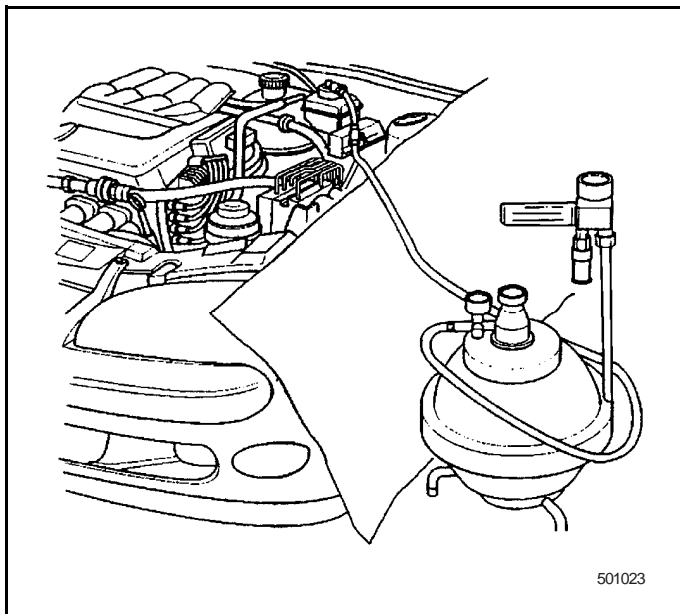
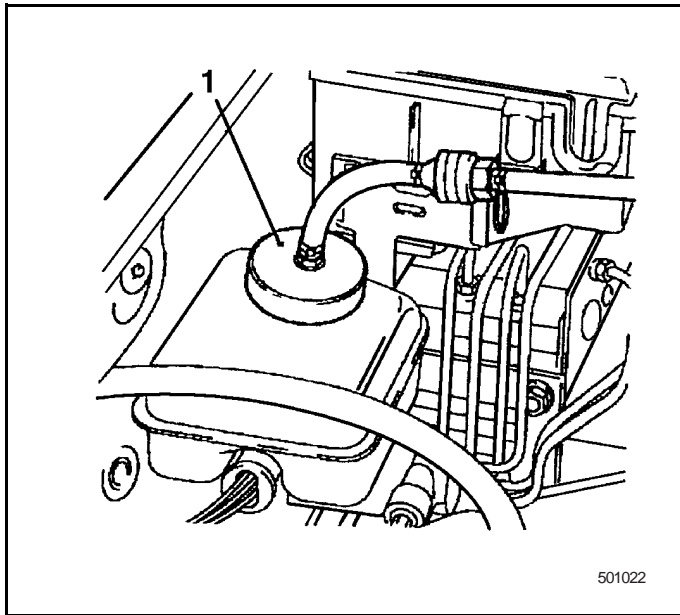
Notice: If any brake part is serviced or replaced and air enters into the brake system, the entire discharging procedure must be performed.

Notice: Avoid spraying of brake fluid on paint, wire, cable or electrical connectors. Brake fluid may damage the paint and electrical connection. If brake fluid is sprayed onto the vehicles, rinse the parts with oil so as to reduce the damage degree.

Notice: Before discharging air in the brake, return the front and rear discharging pump to the maximum position. Be sure to follow the following procedures.

The purpose of discharging air in the hydraulic braking system is to discharge air in the system.

If air enters due to low brake fluid level or breaking of the brake hard pipe, perform the procedure to the four brakes to discharge any air in them. If the brake hose or hard pipe at one wheel breaks, discharge air in this wheel caliper. If the brake hard pipe or hose breaks at the connection of the brake master cylinder and brakes, discharge only the brake system related with the broken pipeline or hose.



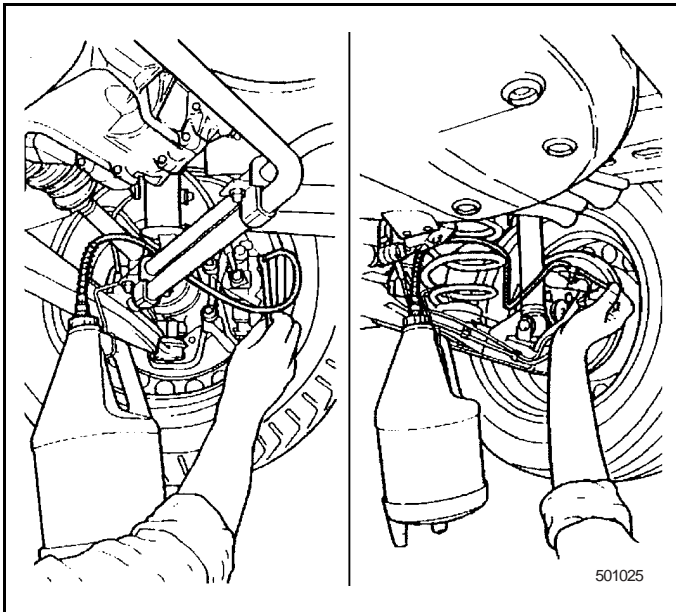
Pressure discharging

1. Inspect and fill brake fluid reservoir to specified level if necessary.
2. Remove the brake fluid reservoir cover.

3. Connect the brake discharging equipment with the brake fluid reservoir with connector (1).
4. Charge pressure to the brake system.
5. Wait for 30 seconds, then inspect the entire hydraulic brake system to ensure no leakage of brake fluid. Repair if there is leakage.

Note: Wipe away the over flow brake fluid.

6. Raise and adequately support the vehicle.
7. Install the transparent plastic discharging hose to the right rear brake exhaust valve.



8. Immerse the other end of the hose in clean vessel with clean brake fluid.
9. Open the discharging valve slowly. Brake fluid flows out.
10. When there is no air bubble in the brake fluid, close the discharging valve.
11. Tighten the brake drum discharging valve to 6 N•m.
12. Remove the transparent discharging hose from the discharging valve.
13. Repeat the above 6 steps (7-12) for left rear brake, right front caliper and left front caliper until no air bubbles occur.

Note: Ensure there is no leakage in the discharging valve.

14. Remove the transparent discharging hose from the discharging valve.
15. Lower the vehicle.
16. Remove the brake discharging equipment. Pay attention to the pressure remained in the brake fluid reservoir.
17. Inspect and fill brake fluid reservoir to specified level if necessary.
18. Install the brake fluid reservoir cover.
19. Start the engine and have the engine running for at least 10 seconds.
20. Turn off ignition switch.
21. Inspect the feeling of brake pedal and its travel.
 - If the brake pedal feels firm and its travel is within the specified value, go to step 22.
 - If the brake pedal feels soft and its travel exceeds the specified value, do not drive the vehicle. Go to Step 23.
22. Start the engine and inspect the brake pedal.
 - If the brake pedal feels firm and steady, go to Step 24.
 - If the brake pedal feels soft, do not drive the vehicle. Go on with Step 23.
23. Confirm the unacceptable soft feeling of brake pedal and its travel are not caused by improper adjustment of the brake disc plate or other mechanical failures, then repeat the brake system pressure discharging procedure. Go to Step 1.

Caution: Do not move the vehicle before steady brake pedal is obtained. Otherwise, human casualty may result.

24. Road test the vehicle. Test the brake for several times at medium speed (without ABS) to ensure the brake system functions properly. Between each brake, give enough time for the brake system to cool down.

Brake system manual discharging procedure.

Note: An assistant is required to step the brake pedal during opening and closing of the discharging valves.

Note: Ensure the brake master cylinder brake fluid level is not at its bottom. Inspect and fill the brake master cylinder reservoir according to the volume of discharged brake fluid. If the brake fluid level has dropped to the bottom of the brake master cylinder reservoir, repeat the discharging procedure from Step 1.

1. Inspect and fill brake fluid reservoir to specified level if necessary.

Note: Wipe away the over flow brake fluid.

2. Raise and adequately support the vehicle.
3. Install the transparent plastic discharging hose to the right rear exhaustion valve.
4. Immerse the other end of the transparent plastic hose in clean vessel with clean brake fluid.
5. Open the discharging valve.
6. Step down the brake pedal to 75% of the entire travel and hold.
7. Close the discharging valve.
8. Release the brake pedal.
9. Repeat step 4 ñ8 until there is no air bubble in the brake fluid.
10. Tighten the discharging valve to 6 N•m.

Note: Ensure there is no leakage in the discharging valve.

11. Remove the transparent discharging hose from the discharging valve.
12. Repeat the above step 3-11 for left rear brake, right front caliper and left front caliper until no air bubbles occur.
13. Lower the vehicle.
14. Remove the brake fluid reservoir cover.
15. Inspect the brake fluid level in the reservoir. Fill in brake fluid to the correct level in the reservoir when necessary.
16. Install the brake fluid reservoir cover.
17. Turn the ignition switch to RUN position, then turn off the engine. Step the brake pedal with medium force and hold. Pay attention to the feeling and travel.
18. If the pedal feels firm and steady and its travel is within the specification, start the engine. Inspect the travel of the pedal again while the engine is running.
19. If the pedal feels firm and steady and its travel is within the specification, perform road test to the vehicle. Test brake for several times at middle

speed to ensure the brake system functions properly.

20. If the brake pedal feels soft or its travel exceeds the specifications at the beginning or after the engine is started, repeat the manual discharging procedure and start from Step 1.

Caution: Step down the brake pedal before move the vehicle. Otherwise, human casualty may result.

21. Road test the vehicle. Test brake for several times at middle speed to ensure the brake system functions properly.

5.1.5.14 Rinsing of the Hydraulic Brake System

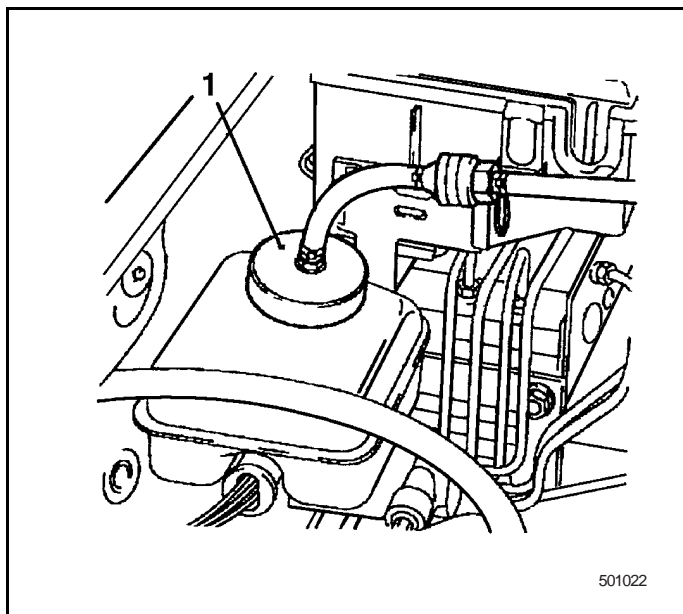
Pressure rinsing

Caution: Use only clean OPEL DOT 4 brake fluid in enclosed reservoir.(P/N93730597). Do not use brake fluid in open containers that maybe contaminated by water. If incorrect or contaminated hydraulic fluid is used, components may be damaged or brake performance may lose, which may result in casualty accident.

Caution: Do not over-fill the brake fluid reservoir. Otherwise, fluid of the braking system may over flow to the exhaustion components of the engine. Brake fluid is explosive and if contacting the engine exhaustion components, may result in fire and hurt of human bodies.

Notice: Pressure discharging equipment may be used to rinse the system. There must be rubber film between air supply and brake fluid to prevent air, moisture and other pollutants entering the hydraulic system.

1. Clean the brake fluid reservoir cover and its adjacent area.
2. Remove the brake fluid reservoir cover.
3. Discharge any brake fluid remained.
4. Fill the brake fluid reservoir with clean brake fluid.



5. Connect the brake discharging equipment with the brake fluid reservoir with connector (1).
6. Charge pressure to the brake system.
7. Raise and adequately support the vehicle.
8. Rinse the brake in line with the following sequence:
 - right rear
 - left rear
 - right front
 - left front
9. Install the transparent plastic discharging hose to the right rear brake drum exhaust valve.
10. Immerse the other end of the hose in clean vessel with clean brake fluid.
11. Open the discharging valve slowly so that brake fluid flows.
12. Close the discharging valve when clean brake fluid flows.

Tightening

Tighten the discharging valve to 6 N•m.

13. Remove the discharging connector.
14. If necessary, replace all the following rubber parts:
 - brake hose assembly.
 - brake master cylinder rubber part
 - brake caliper and brake drum sealing.
15. Inspect the brake fluid level in the reservoir. Fill in brake fluid to the correct level in the reservoir when necessary.
16. Install the brake fluid reservoir cover.
17. Discharge air in the entire brake system. Refer to Discharge air in the hydraulic braking system.
18. Lower the vehicle.

Manual rinsing

Note: Absorb the brake fluid with suitable vessel and / or cloth to prevent it from contacting any paint surface.

1. Clean the brake fluid reservoir cover and its adjacent area.
2. Remove the brake fluid reservoir cover.
3. Discharge any brake fluid remained in the brake fluid reservoir.
4. Use clean OPEL DOT 4(P/N93730597) brake fluid to fill the reservoir to adequate level.
5. Install the brake fluid reservoir cover.
6. Raise and adequately support the vehicle.
7. Rinse the brake in line with the following sequence:
 - right rear
 - left rear
 - right front
 - left front
8. Install the transparent plastic discharging hose to the right rear brake drum exhaustion valve.
9. Immerse the other end of the hose in clean vessel with clean brake fluid.
10. Open the discharging valve slowly so that brake fluid flows out.
11. Close the discharging valve when clean brake fluid flows.

Tightening

Tighten the front caliper discharging valve to 6N•m.

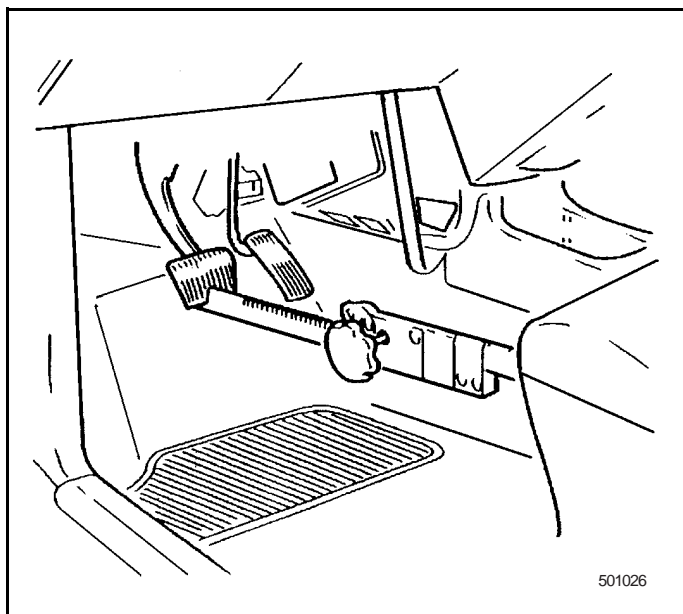
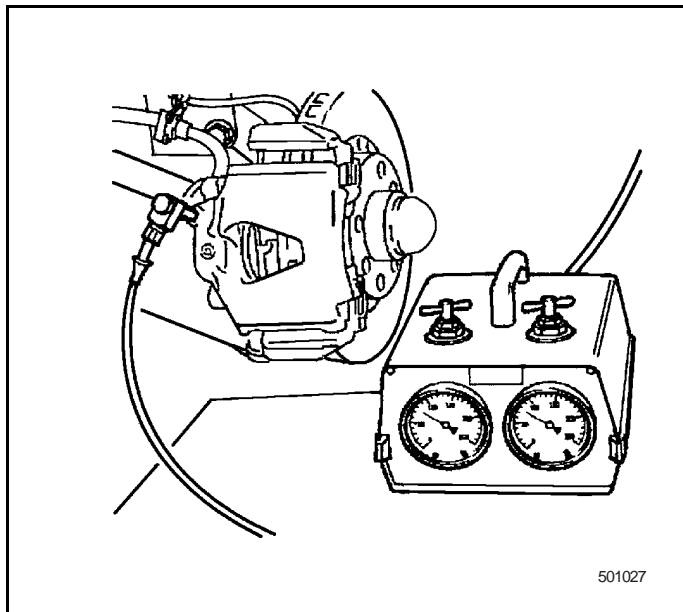
12. If necessary, replace all the following rubber parts:
 - brake hose assembly.
 - brake master cylinder rubber part
 - brake caliper and brake drum sealing.
13. Inspect the brake fluid level in the reservoir. Fill in brake fluid to the correct level in the reservoir when necessary.
14. Install the brake fluid reservoir cover.
15. Discharge air in the entire brake system. Refer to Discharge air in the hydraulic braking system.
16. Lower the vehicle.

Inspect if there is leakage

Tools Required

- MKM-558 brake tester
- KM-325 brake pedal tensioner

1. Connect the test pipeline with brake caliper and brake drum.
2. Install MKM-558 brake tester to read pressure.
3. Activate the brake pedal repeatedly to obtain pressure of 20 bar.



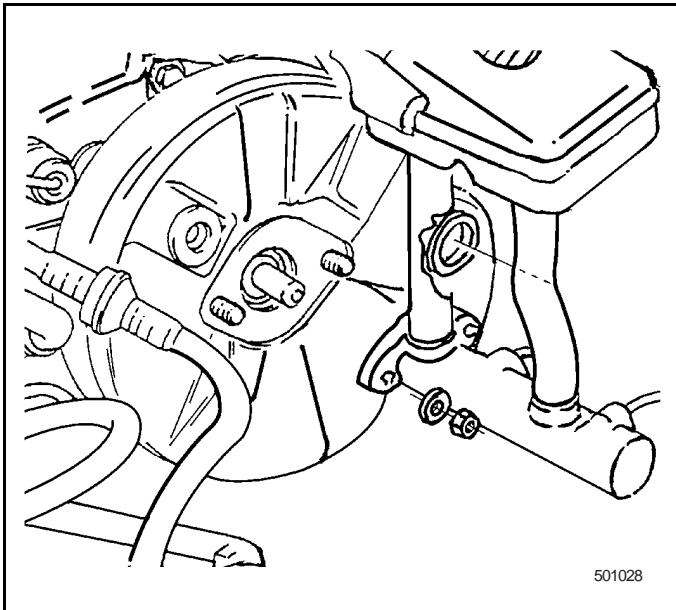
4. Install KM-325 brake pedal tensioner between the driver's seat and the brake pedal.
5. The test lasts for about 5 minutes.
6. If there is no leakage in the brake system, the obtained pressure shall keep without any change.
7. If the established pressure drops, inspect to see if there is leakage in the brake system. Discharge air in the exhaustion brake system.

5.1.5.15 Replacement of vacuum booster

Removal Procedure

Note: It is not necessary to remove the brake hose from the brake master cylinder or regulator.

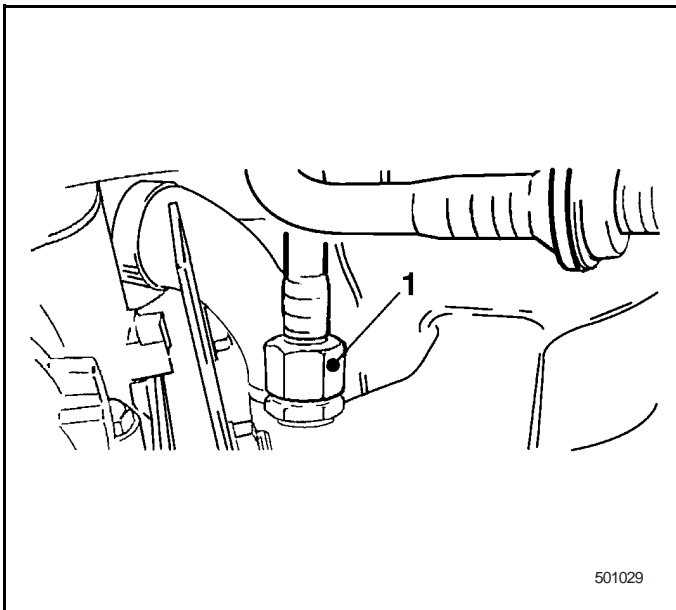
1. Push forward slightly, remove the brake master cylinder mounting nuts and the pump from the booster.

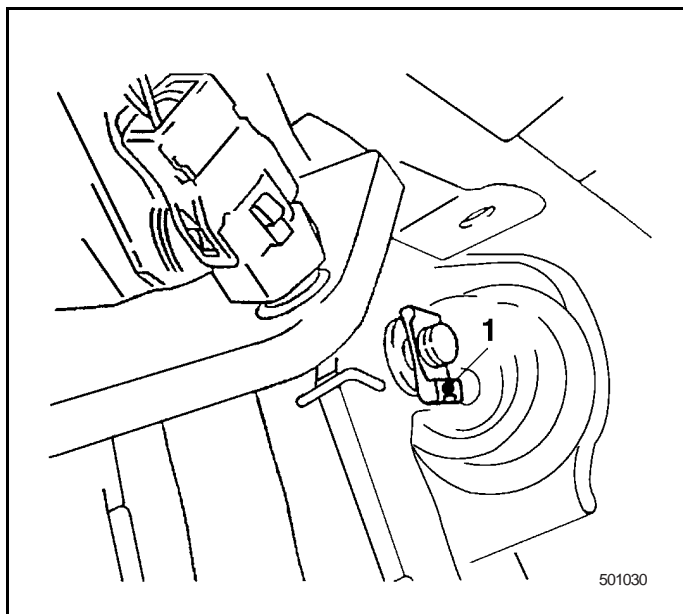


2. Remove vacuum hose from the brake booster.

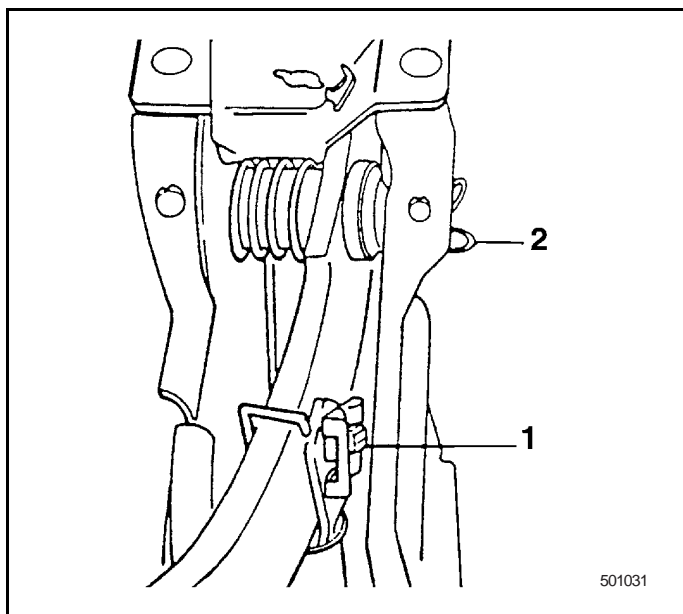
Note: Disconnect pushing bar from the brake pedal, keep the brake pedal in stationary condition, or the brake switch may be damaged. The booster can only be removed when the pushing bar and brake pedal is disconnected.

3. Remove the foot panel cover.
4. Rotate the brake lamp switch and remove it.

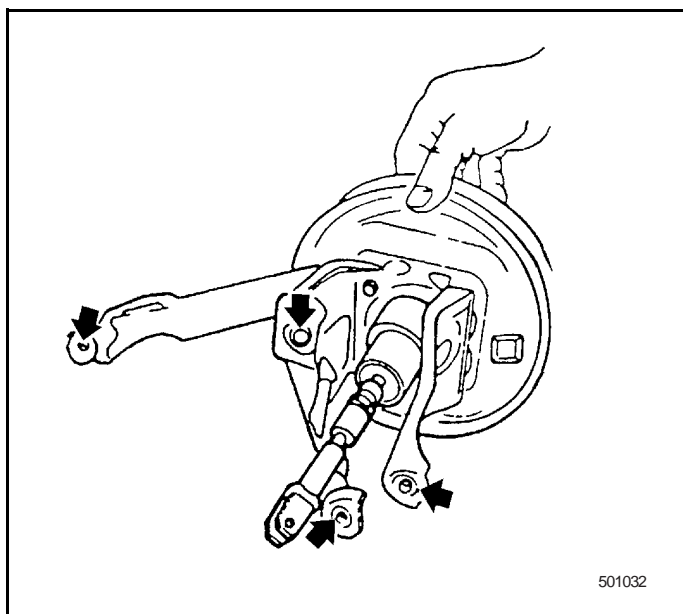




5. Remove the pedal and spring.



6. Remove the booster pusher spring clamp.



7. Remove the connecting nut between booster bracket and front bottom fender.
8. Remove the booster and bracket as a whole.
9. Remove the bracket and washer from the booster.
10. Remove the pusher lock and pusher from the booster.

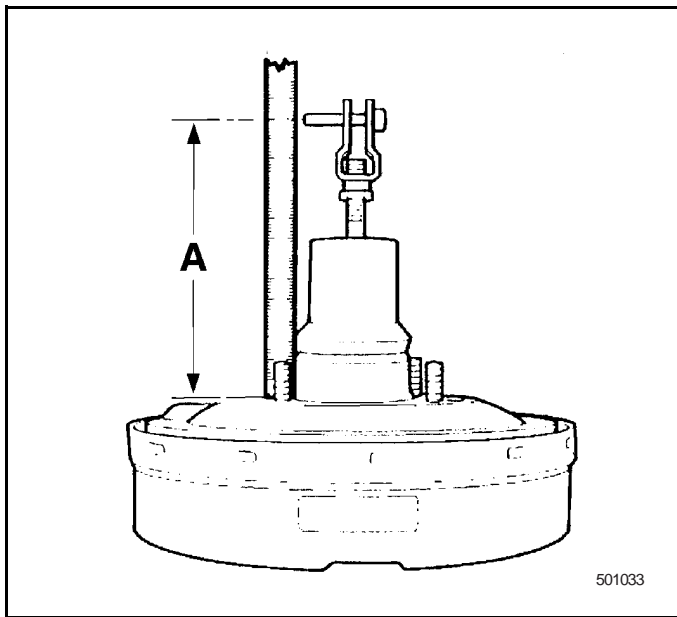
Installation Procedure

1. Install the pusher to the booster.

Adjustment

Adjust the position of the pushing lever so that the distance between the booster surface to the center of pushing lever hole (A) is 141.5mm, lock it.

2. Install the washer.



3. Install booster bracket and nut.

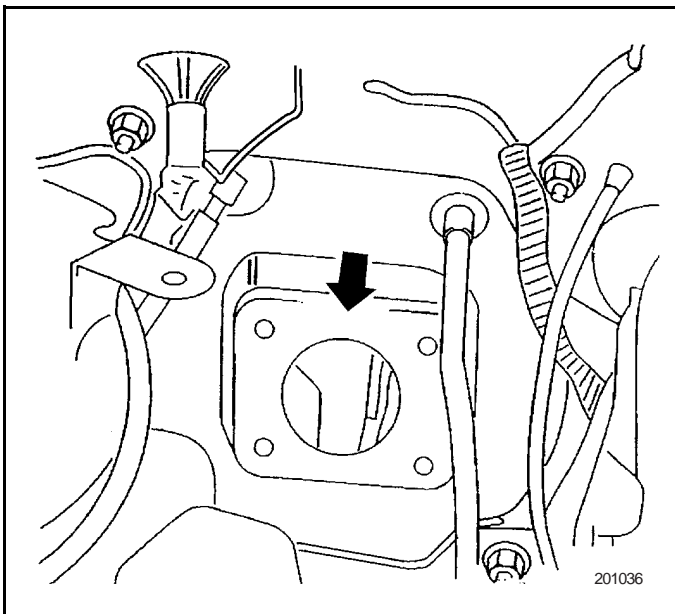
Tightening

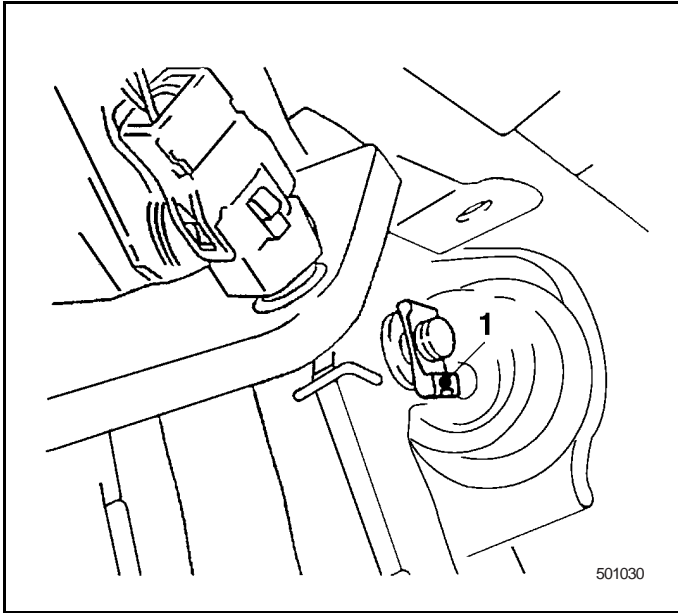
Tighten the nut to 20N•m.

4. Install the booster, connect it with the front bottom fender.
5. Install the connecting nut between the bracket and front bottom fender.

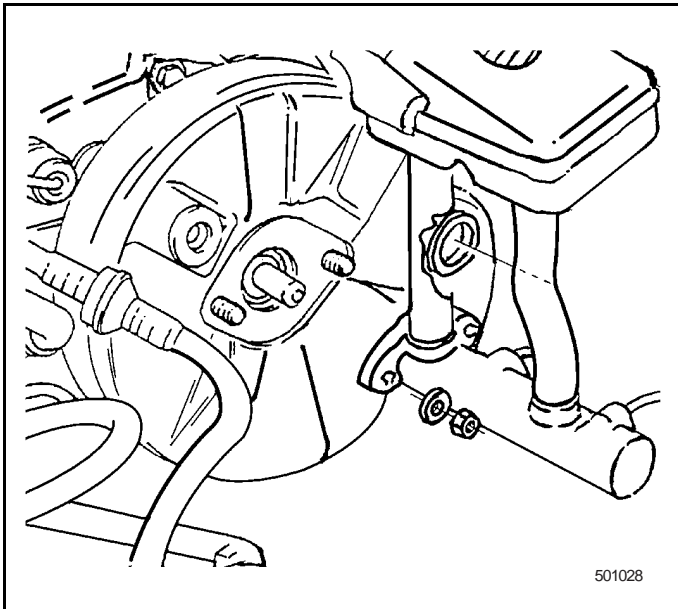
Tightening

Tighten the nut to 22 N•m.





6. Install the booster pushing lever and pedal and the spring clamp together.
7. Install the pedal spring.
8. Install the brake lamp switch.
9. Install floor cover.



10. Install the brake master cylinder onto vacuum booster and tighten the nut.

Tightening

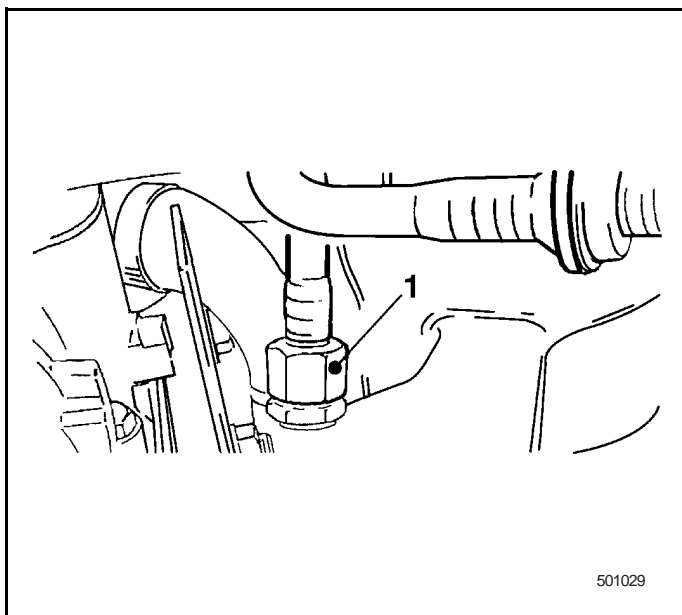
Tighten the nut to 22 N•m.

11. Install vacuum hose to the vacuum booster.

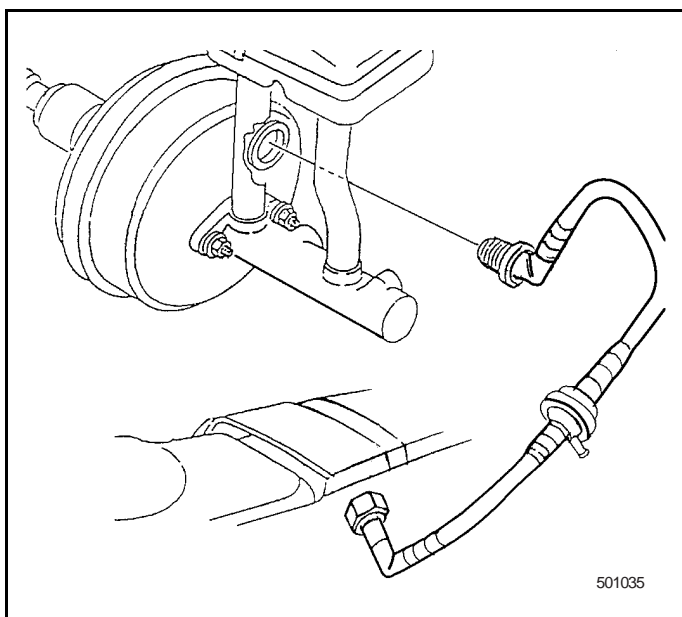
5.1.5.16 Replacement of vacuum booster hose

Removal Procedure

1. Remove vacuum hose from the brake booster.

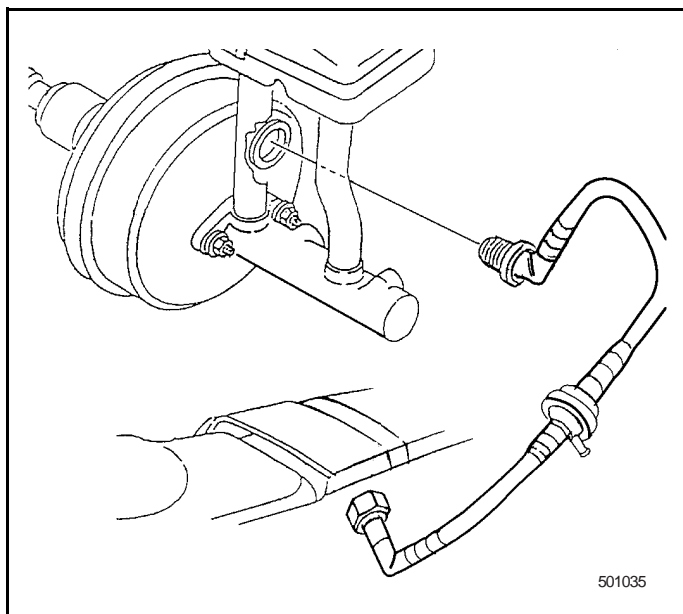


2. Disconnect the vacuum hose from the inlet manifold.

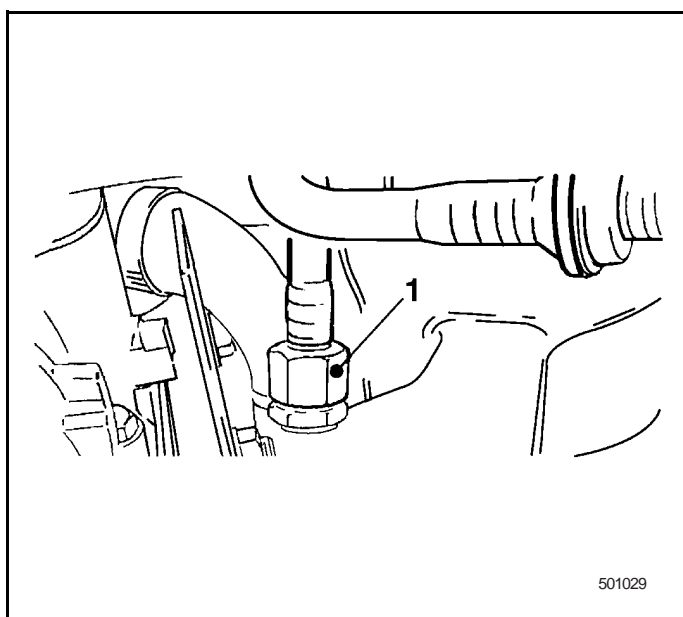


Installation Procedure

1. Connect the vacuum hose to the vacuum brake booster.



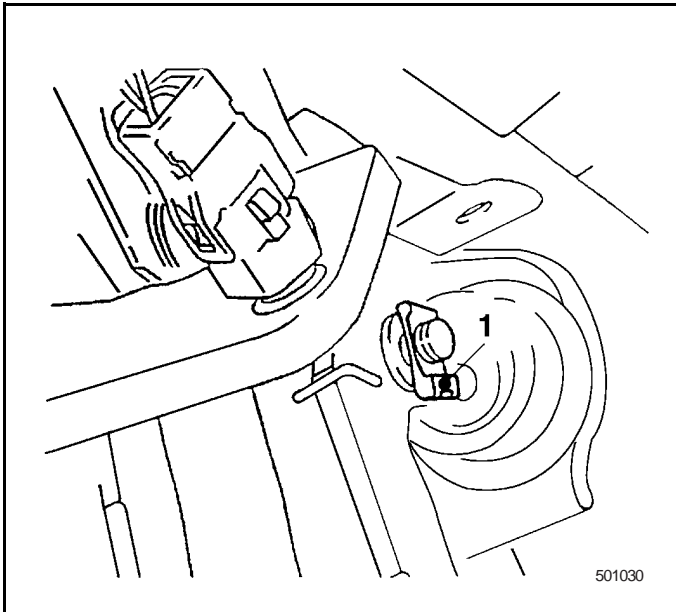
2. Connect the vacuum hose to the inlet manifold.



5.1.5.17 Replacement of the Brake Lamp Switch

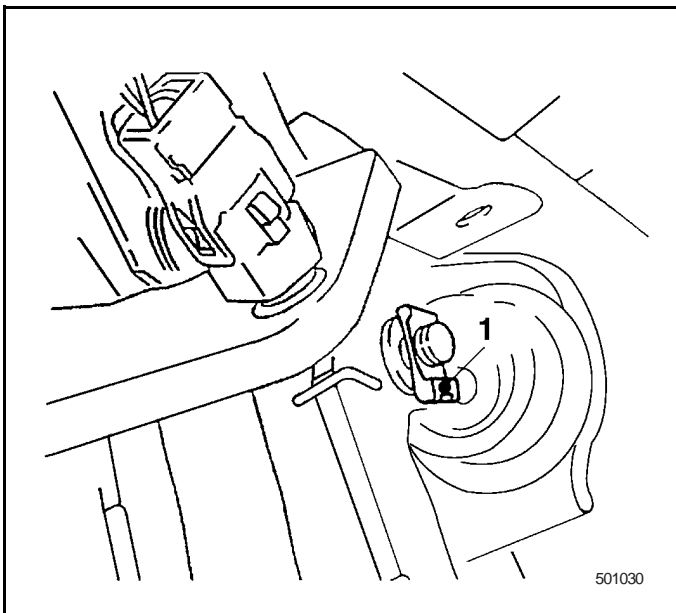
Removal Procedure

1. Remove the instrument panel isolator.
2. Disconnect the electrical connectors.
3. Remove the brake lamp switch from the brake pedal bracket.



Installation Procedure

1. Install the brake lamp switch to the brake pedal bracket.
2. Connect the electrical connectors.
3. Install the instrument panel isolator.
4. Adjust the brake lamp switch.



5.1.6 Description & Operation

5.1.6.1 Brake master cylinder Description

Note:

- Do not use compressed air with lubrication oil on brake components. Otherwise, rubber parts may be damaged.
- When any of the hydraulic components is removed or disconnected, discharge all or part of the air in the brake system.
- The specified torque value applies to dry non-lubricated Fasteners.
- Service and operation on clean platform without mineral oils.

The brake master cylinder is made of Aluminum. It is used in diagonal diffuser braking system. In the system, front and rear brake at diagonal are activated by initial level piston and other pair of brakes are activated by the second level of piston.

The brake master cylinder has integrated standard double brake master cylinder function. The brake master cylinder is also equipped with fluid level sensor. Vehicles with ABS are equipped with EBD (electronic braking distribution) system (refer to ABS for details), while vehicles without ABS are equipped with ratio valve to provide better front and rear brake balance under emergency braking.

5.1.6.2 Description to the Ratio Valve (without ABS)

Note: Do not rinse the ratio valve in any washing liquid. The inner components have been lubricated with special lubrication grease.

The ratio valve is at rear brake connection pipelines. Brake fluid may damage the paint and electrical connection. If brake fluid is sprayed onto the vehicles, rinse the parts with oil so as to reduce the damage degree.

The following conditions may result in boiling away of brake fluid:

- brake fluid not correct
- the brake fluid contains mineral oil or water
- rubber parts in brake hydraulic system aging

If the rubber part ages, the following parts will swell:

- brake master cylinder cover film
- caliper housing

If aging takes place, remove all useful hydraulic components. Refer to Hydraulic Brake, Disc Brake. Rinse all the components with alcohol. Dry the components with compressed air without lubrication grease, prevent the alcohol from entering the

system. Replace all rubber parts in the system, including hoses and useless hydraulic components.

Fill the brake system with new brake fluid. Refer to Filling of Brake master cylinder Fluid Reservoir.

Rinse the brake system. Refer to Rinsing of the Hydraulic Brake System.

Discharge air in the exhaustion brake system. Refer to Discharge air in the hydraulic braking system.

5.1.6.3 Description to the Vacuum Brake Booster

Note:

- Replace all components in the service box used for repairing the booster.
- Lubricate the rubber parts with silicon-based lubrication grease for easy assembly. There is silicon-based lubrication grease in the service box.
- Do not use compressed air with lubrication oil on brake components. Otherwise, rubber parts may be damaged.
- When any of the hydraulic components is removed or disconnected, discharge all or part of the air in the brake system.
- The detailed torque value is for drying Fasteners without lubrication grease.
- Service and operate on clean platform without mineral oils.

5.1.6.4 Description to the Brake Alarming System

If the vehicle is equipped with ABS, ABS system uses yellow anti-lock indicator.

The anti-lock indicator is within the instrument cluster. Under normal conditions, the indicator operates according to the following specifications:

1. Before start the engine, when the ignition is at ON position, the ABS indicator lights.
2. When the engine starts, ABS indicator lights.
3. After the engine starts, ABS indicator turns off.

Operation of the ABS indicator is an important part in diagnosis to ABS system. If the indicator turns on during driving, trouble exists. Refer to ABS Diagnostic System Check in Anti-lock braking System.

5.1.6.5 Description to the Braking System Failure Indicator Circuit

Brake system malfunction indicator in the instrument cluster turns on under the following conditions:

- Ignition ON;

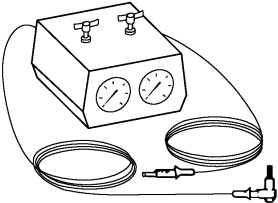
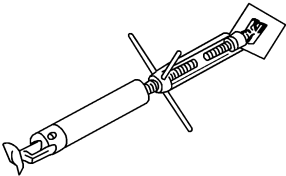
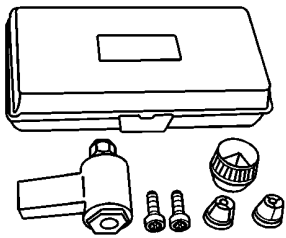
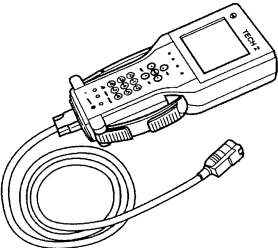
- park brake comes into effect;
- Brake fluid level too low in the brake master cylinder.

Electronic brake control module provide ground for the instrument panel.

When ignition is ON and the park brake works, the indicator lights on to check if it works normal.

When brake fluid level is too low in the brake master cylinder, the brake fluid level sensor will be off. The instrument panel grounds through the sensor and circuit. Brake system malfunction indicator lights on.

5.1.7 Special Tools

Illustration	Number & Name of the Tools
 <p>MKM-558</p>	MKM-558 Brake tester
 <p>KM-325</p>	KM-325 brake pedal tensioner
 <p>J29803-A</p>	J29803-A Brake pilot hose tool package
 <p>TECH2</p>	TECH 2 Scan tool

5.2 Disc brake

5.2.1 Specification

5.2.1.1 Component Specifications

Application	Specification
Caliper piston diameter	48 mm
brake disc diameter	236 mm
Brake disc scraper thickness (refer to the notes)	16 mm
Minimum thickness of the brake disc	17 mm
Fabrication thickness of the brake disc	18 mm
brake disc thickness (new)	20 mm
Thickness deviation	0.01 mm
Maximum lateral runout	0.03 mm
Maximum lateral runout (assembling)	0.1 mm
maximum scratch	0.4 mm
brake pad thickness	16 mm
Minimum brake pad thickness	7 mm

5.2.1.2 Fastener Tightening Specifications

Application	Specification
caliper locator pin	30 N•m
caliper bracket bolt	95 N•m
brake hose bolt connecting the caliper	40 N•m
exhaustion valve	6 N•m
front brake disc bolt	4 N•m
cover plate	4 N•m
ABS front sensor bolt (for vehicles with ABS)	8 N•m

5.2.2 Diagnostic Information and Procedure

5.2.2.1 Check the Brake Disc Thickness Runout

Measure the thickness of the brake disc at four or more points to check the thickness runout of the brake disc. Inspect each measured value at the brake rim with the same interval. For brake disc with thickness variance more than 0.01mm, trembling of pedal and/ or front vibration may occur during braking. Fabricate or replace the brake disc that fail to comply with the above specifications.

5.2.2.2 Brake disc lateral runout check

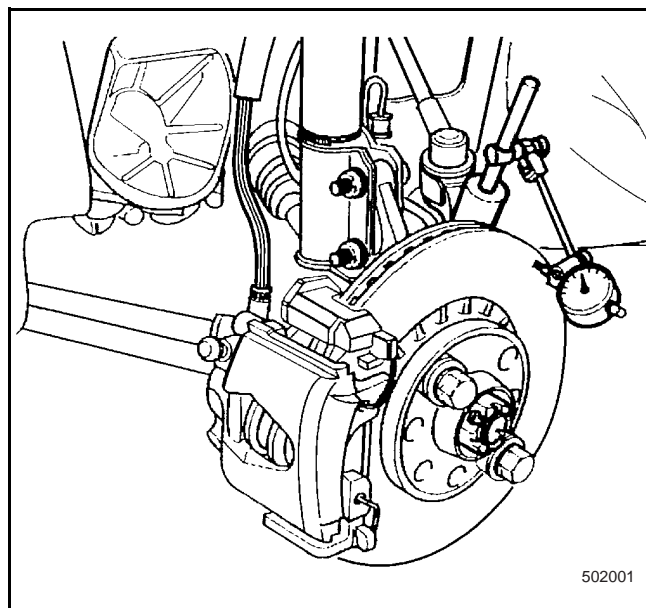
Notice: While removing the brake disc from the wheel bearing flange, use J42450-A wheel hub cleaner to clear away rust or foreign matter on the brake disc connection surface as well as on the flange. Otherwise, larger lateral runout may occur, which may result in braking trembling.

Check the lateral vibration of the wheel, obtain more accurate general runout readings under actual braking condition. If the Tools Required are not available, that is, unable to check while disassembling, remove the wheel, maintain the position of the caliper to obtain accurate readings.

Removal Procedure

Tools Required

- J8001 dial gauge
- 1. Raise and adequately support the vehicle. Refer to Raise and Lift the Vehicle in General Information.
- 2. Take marks on the wheel and hub.
- 3. Remove the wheel. Refer to Replacement of the wheels in Tire & Wheel.
- 4. Clean the brake disc surface.
- 5. Install and Tighten the wheel nut to fix the brake disc.
- 6. Fix the J8001 dial gauge on the steering knuckle. Be sure to have the dial gauge contact the brake disc surface 10mm away from the outer rim.



7. Zero the dial gauge.
8. Rotate the wheel for one cycle. Check the runout shown in dial gauge. If the reading is more than 0.1mm, fabricate or replace the braking disc. If the reading is more than 0.1mm, adjust or replace the braking disc.

Under certain circumstances, mark the position of brake disc on the hub (1 or 2 bolt away) to improve the over lateral runout of brake disc. If the lateral runout cannot be corrected after marking the brake disc, check if the lateral runout of the hub is too much or too loose. If the lateral runout of the hub is more than 0.05mm, the hub must be replaced. If the lateral runout satisfies the specifications, finish the surface or replace the brake disc if necessary.

Installation Procedure

1. Remove the nut fixing the brake disc.
2. Install the tire and wheel assembly according to the marks at the wheel and hub. Refer to Replacement of the wheels in Tire & Wheel.
3. Lower the vehicle.

5.2.2.3 Brake disc geometric tolerance

The following brake disc surface tolerance shall be under strict control during manufacturing:

- flatness
- parallel
- lateral runout

Keep strict brake surface geometrical tolerance may prevent unevenness or vibration.

New brake disc satisfying the above specification will get good re-finished surface. Refer to Brake Disc Surface Finishing. Control the brake disc surface will eliminate the following concerns:

- brake pedal feels hard
- brake performance decline drastically
- delay
- abnormal performance

Control the brake disc surface coarseness can prolong the life of the brake pad. Slight scratch on the brake surface with depth less than 0.4mm will not impact the brake performance. Brake disc may have scores under normal use.

5.2.3 Repair Guidance

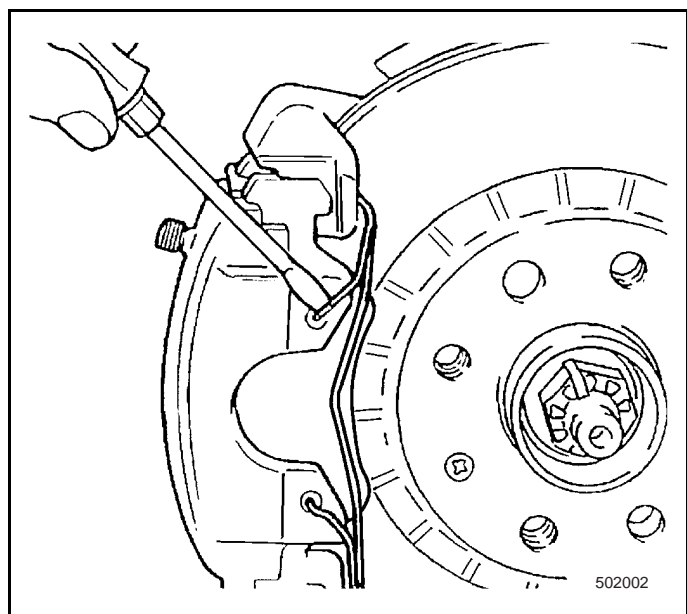
5.2.3.1 Brake Pad Check

- Check the brake pad every 15000 km.
- Check the brake pad whenever remove the wheel (wheel rotation and so on).
- Check the two ends of the caliper and the two ends of the outer pad. These are the position where maximum wearing occurs.
- Check the thickness of the inner brake pad to ensure it is not worn too early. Some of the brake pad has a heat-isolation layer with the pad film. Do not confuse the heat isolation film with the inside and outside brake pad. Observe the inside brake pad through the check hole at the top of the caliper.
- When the brake pad is worn and its thickness is less than 7 mm, replace the brake pad. If the brake pad is rivoted, replace it when it is worn to less than 0.5 mm away from the rivot head. Meanwhile, replace all the disc brake pad.

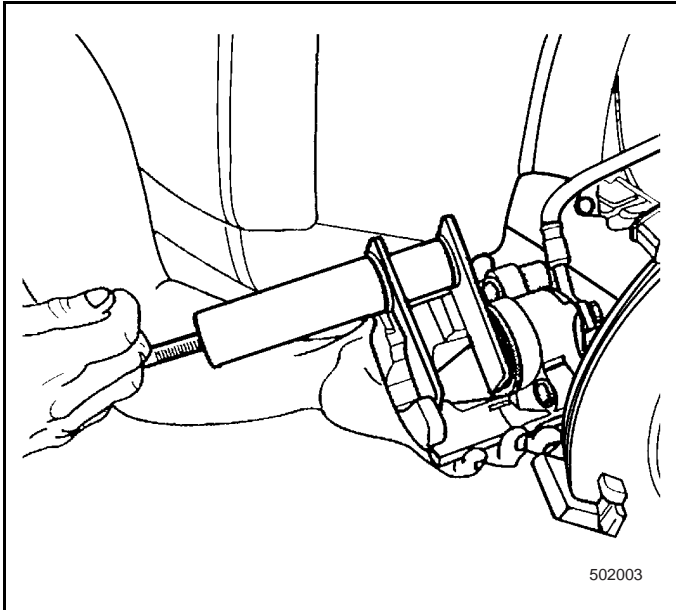
5.2.3.2 Replacement of the brake pad

Removal Procedure

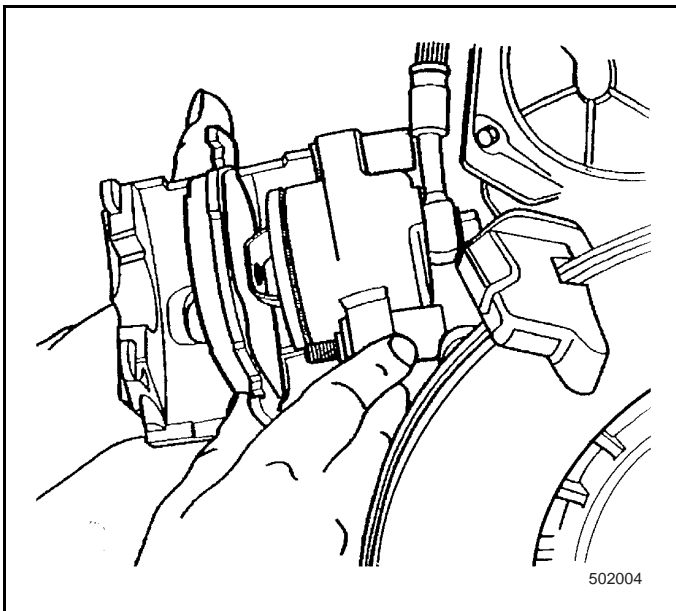
For all vehicles manufactured by GM, replace with original GM brake pad or equivalent to maintain the balance of front and rear brake performance. Brake components for replacement from GM are carefully selected to provide adequate balance under braking and control under various conditions. If the material nature of the front and rear brake pad is different from the replacement components recommended by GM, the braking performance of the vehicle may be changed.



1. Fill the brake fluid to the maximum position.
2. Raise and adequately support the vehicle. Refer to Raise and Lift the Vehicle in General Information.
3. Mark the position of the wheel in relation with the hub.
4. Remove the wheel. Refer to Replacement of the wheels in Wire & Wheel.
5. Install the two wheel nut and fix the brake pad.
6. Push the piston into the caliper cylinder so as to separate the pad and brake disc.
7. Inspect the thickness of the pad: 7mm.
8. Remove the caliper fixing spring.



9. Remove the caliper location pin.



10. Remove the brake pad from the caliper.

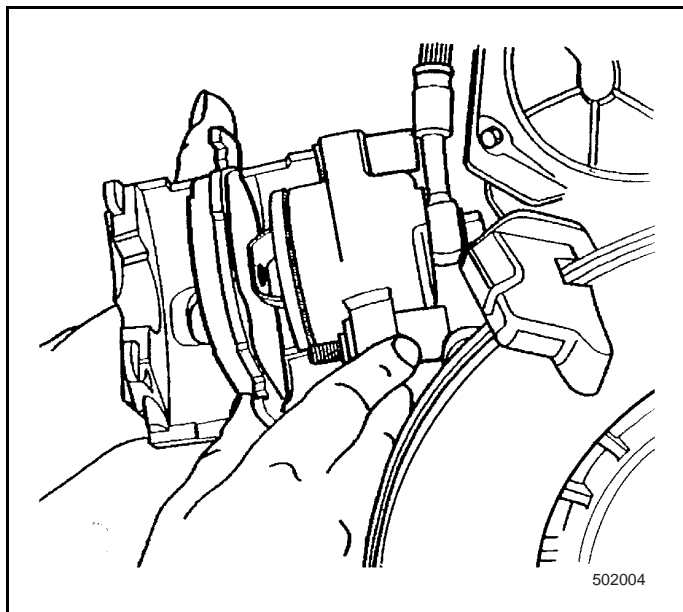
Installation Procedure

Note: Wiper the outer surface of the caliper housing clean prior to installation of new brake pad. Use industrial alcohol.

Press the piston to the bottom of the caliper cylinder. Use C-type clamp to fix the piston while install new brake pad. Place a piece of metal sheet or wooden plate in front of the piston surface. Do not damage the piston or caliper housing.

Notice: Inner and outer brake pad must be new or parallel ones. Otherwise, over-heating of the brake may occur, which may result in damage of brake pad, brake disc or caliper.

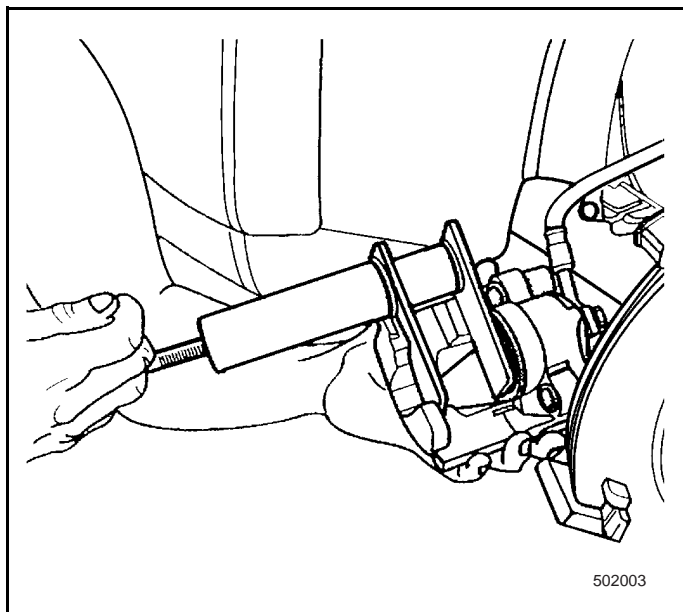
1. Install the brake pad onto the caliper.
2. Lubricate the caliper locator pin and two housing with silicon-based lubrication grease.

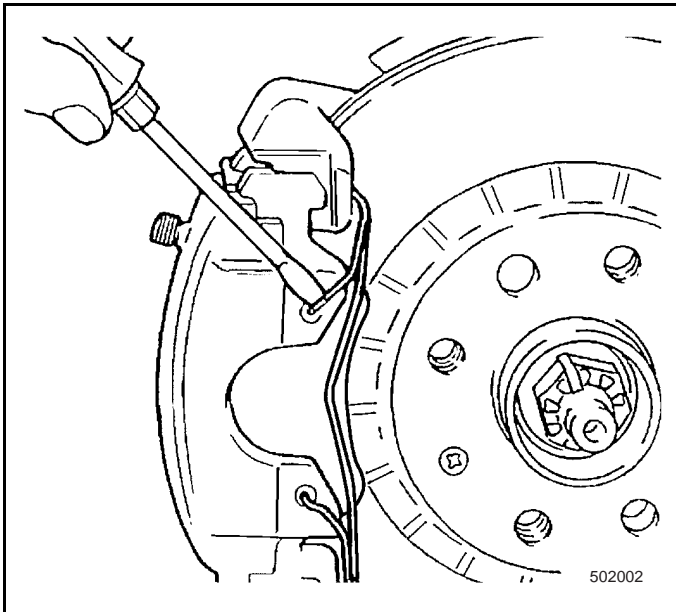


3. Install the caliper location pin.

Tightening

Tighten the caliper pin to 30 N •m.





4. Install the caliper fixing spring.
5. Remove the wheel bolt Tightening the brake disc to the wheel hub.
6. Install the wheel assembly. Refer to Replacement of the wheels in Wire & Wheel.
7. Keep the marks in wheel and hub correlate.
8. Lower the vehicle.
9. Step forcefully the brake pedal three times so that the brake pad is in place.
10. Match the pad and brake disc. Refer to Match the pad and brake disc.

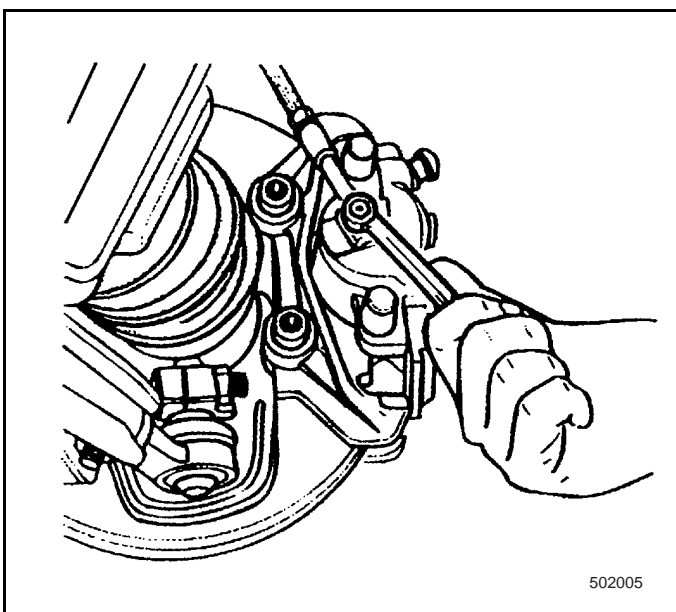
5.2.3.3 Match the pad and brake disc.

- After the brake pad is replaced, the new brake pad has to be matched.
- Match the new brake surface after the surface is finished or new brake disc is replaced.
- Brake 20 times when the vehicle speed is at 48km/h and match the new braking surface.
- Step the brake pedal with force above average. Do not over heat the brake.

5.2.3.4 Replacement of the Brake Caliper

Removal Procedure

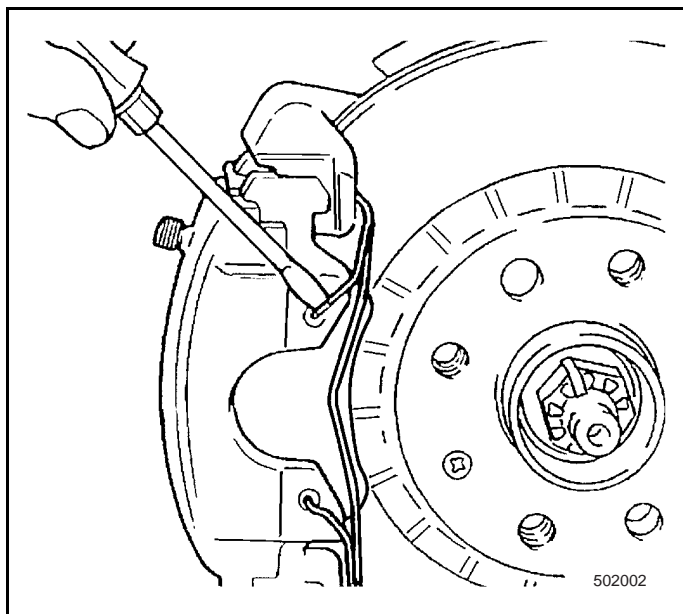
Caution: Caution: Do not move the vehicle before steady brake pedal travel is obtained. Otherwise, human casualty may result.



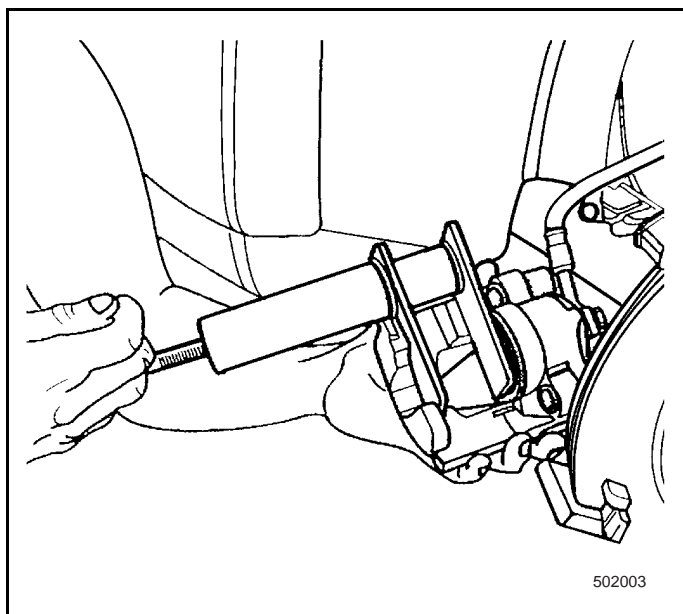
1. Fill the brake fluid to the maximum position.
2. Raise and adequately support the vehicle. Refer to Raise and Lift the Vehicle in General Information.
3. Mark the position of the wheel in relation with the hub.
4. Remove the wheel. Refer to Replacement of the wheels in Wire & Wheel.
5. Install the two wheel nut and fix the brake pad to the wheel hub.

Notice: If only brake pad is removed, do not disconnect the oil inlet pipe connector.

6. Remove the front brake hose and pay attention to the sealing ring.
7. Block the brake caliper case and the brake pipeline so as to prevent the brake fluid front leakage or being contaminated.



8. Remove the caliper fixing spring.



9. Remove the caliper location pin.
10. Inspect the caliper pin to see if there is corrosion or damage. Once corrosion is found, do not try to wear it out. Use new parts including the bushing to install the caliper.
11. Remove the caliper housing from the brake disc and caliper bracket.

Notice: Do not hang the caliper with flexible hose. Or the hose may be damaged.

12. Inspect if the location pin has the following situation:
- cut
 - tearing
 - aging
 - If there is damage, replace the location pin housing. Refer to Replacement of the brake caliper bracket.
13. Inspect if the location pin has the following situation:
- cut
 - tearing
 - aging
 - If there is damage, replace the piston housing. Refer to Brake Caliper Overhaul.

Installation Procedure

1. Install the caliper housing to the brake disc and caliper bracket. Be sure to fix the bushing.
2. Lubricate the caliper location pin. Use silicon-based lubrication oil. Do not lubricate the bolt and thread.
3. Lubricate the two location pin on the caliper bracket. Use silicon-based lubrication oil.
4. Install the caliper location pin.

Tightening

Tighten the caliper pin to 30 N•m.

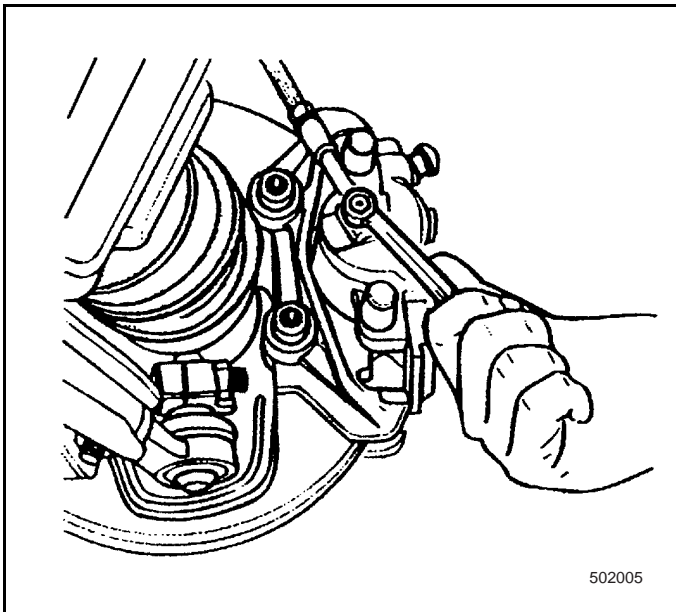
Note: Replace the copper washer.

5. Install brake hose bolt.

Tightening

Tighten the brake hose bolt to 40 N•m.

6. Remove the wheel bolt. Tighten the brake disc to the wheel hub.
7. If the connector is removed, discharge air in the caliper. Refer to Discharge air in the hydraulic braking system.
8. If necessary, step the brake pedal with force of 238N after discharging.
9. Inspect if there is leakage of brake fluid in the hydraulic braking system. Refer to Brake Fluid Leakage.
10. Install the wheel assembly. Refer to Replacement of the wheels in Wire & Wheel.
11. Lower the vehicle.



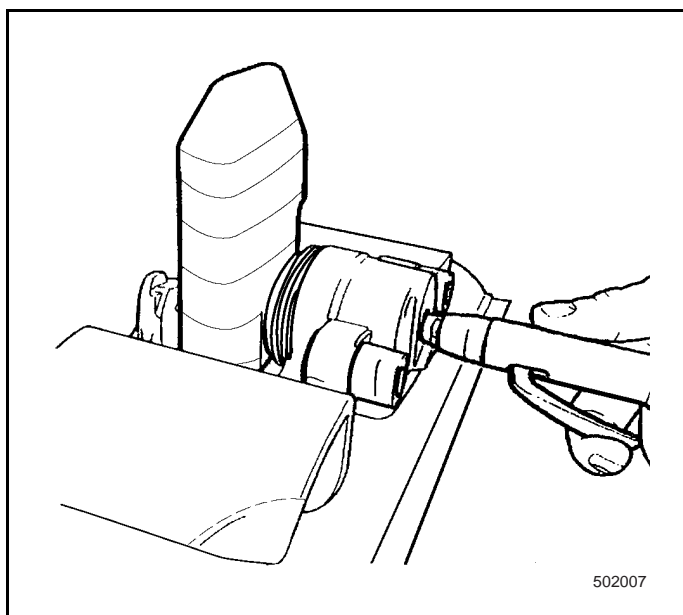
5.2.3.5 Brake Caliper Overhaul

Removal Procedure

Remove brake caliper. Refer to Brake Caliper Replacement.

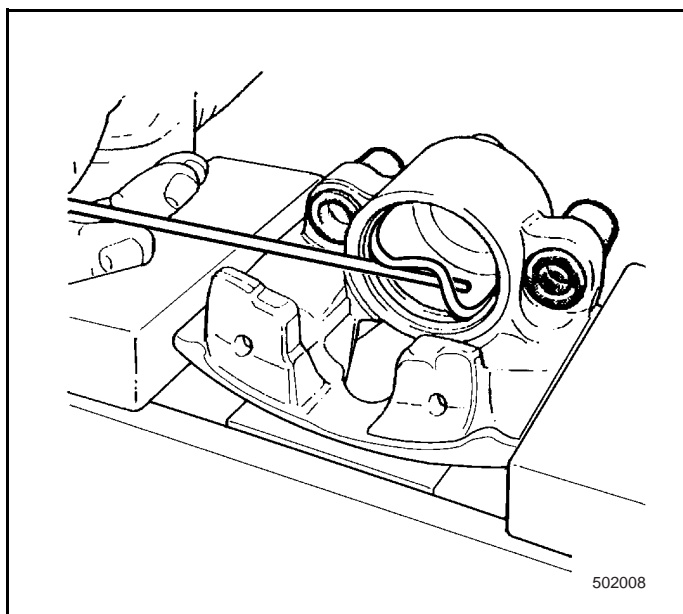
Caution: Blow in compressed air, pay attention not to put your finger in front of the caliper piston, try to grasp or protect the piston. The piston may fly out forcefully, which may result in serious human casualty.

Notice: Use clean cloth in the caliper housing while removing the piston. Push the piston from the cylinder with suitable force. If the piston drops, even if there is pad, damage may also occur.

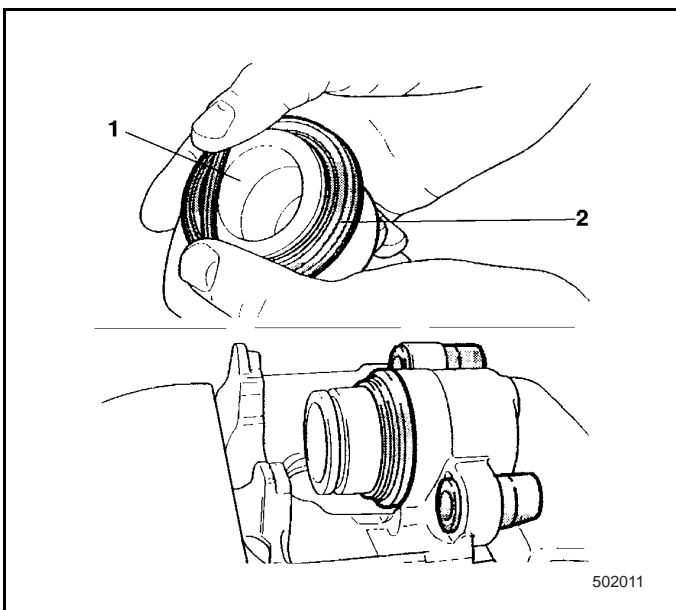
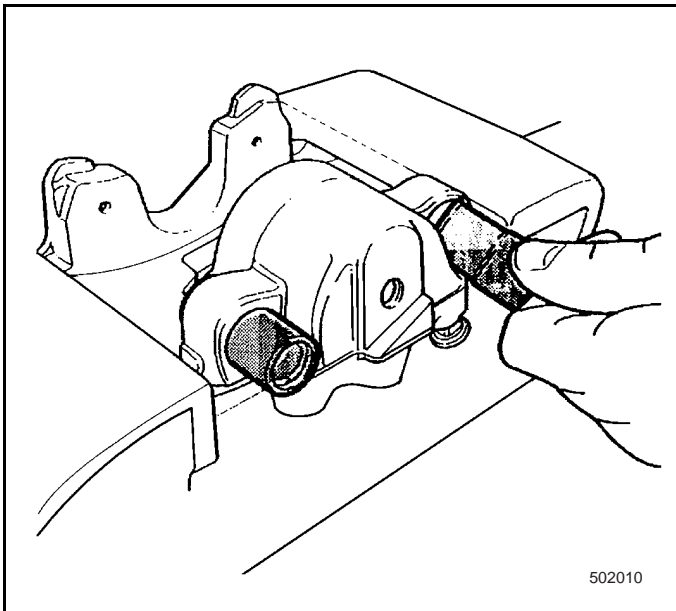
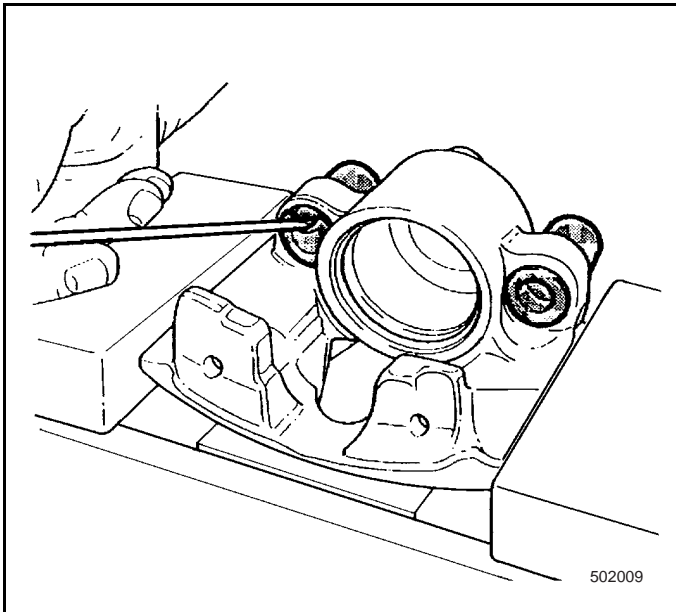


1. Remove the piston. Tighten the caliper. Inject compressed air into the caliper hole with compressed air gun. The piston will drop out of the housing.

Notice: If there is damage to the piston, replace the caliper assembly.



2. Inspect if the piston has the following situations:
 - score
 - scratch
 - corrosion
 - wearing or damage to the chromed layer
 - Replace the piston if one of the above condition is found.
 3. Remove brake caliper housing. Do not score the case cylinder.
- Notice: Do not remove the sealing with metal tools. Or, caliper housing or sealing slot may be damaged.*
4. Remove the piston sealing ring from the caliper housing slot. Remove with small wooden tool or plastic tools.



5. Check if the caliper housing and sealing slot has the following conditions:
 - score
 - scratch
 - corrosion
 - wearing
6. Polish the slight corrosion with fine sand cloth.
7. If corrosion in the sealing slot and surrounding area cannot be removed with fine sand cloth, replace the caliper housing.
8. Inspect if the location pin has the following situation:
 - cut
 - tearing
 - aging
9. replace the damaged housing.
10. Inspect the caliper pin to see if there is corrosion or damage. Replace the corrosive location pin. Do not try to wear the corrosive objects.
11. Inspect if there is score or blur on caliper cylinder sealing slot. If the sealing slot is damaged, replace the caliper.
12. Remove the discharging cover and valve from the caliper housing.
13. Rinse all components with clean industrial alcohol.
14. Dry all parts with filtered compressed air without lubrication grease.
15. Blow dry all passage and discharging valve in the caliper housing. Use filtered compressed air without lubrication oil.

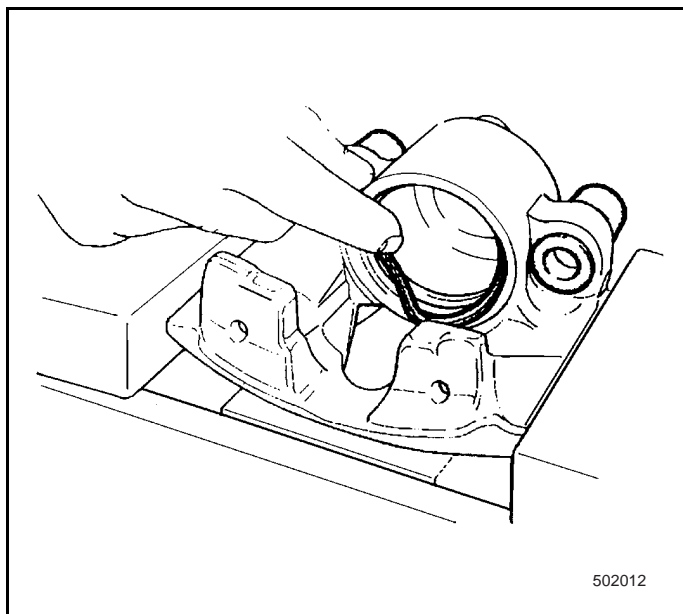
Installation Procedure

1. Install the discharging valve and valve head onto the caliper housing.

Tightening

Tighten the discharging valve to 6 N•m.

2. Place the caliper housing onto the caliper case flaring position.



3. Install the new lubricated piston sealing into caliper cylinder bushing slot. Ensure there is no piston sealing ring distortion.
4. Install the lubricated housing onto the piston.
5. Lubricate the piston with clean brake fluid.
6. Install the piston and housing onto caliper bushing. Push the brake caliper piston to the bottom of the bushing.
7. Install the caliper. Refer to Brake Caliper Replacement.

5.2.3.6 Replacement of the brake caliper bracket

Removal Procedure

Note: Do not remove the brake hose from the caliper. Support or hang the caliper. Do not hang the caliper at brake hose.

1. Remove brake caliper. Refer to Brake Caliper Replacement.

Caution: Replace with new Fasteners when the Fasteners are loosened or removed. Or, the vehicle may be out of control and may result in human casualty.

Note: New brake caliper bolt has already thread sealing agent applied.

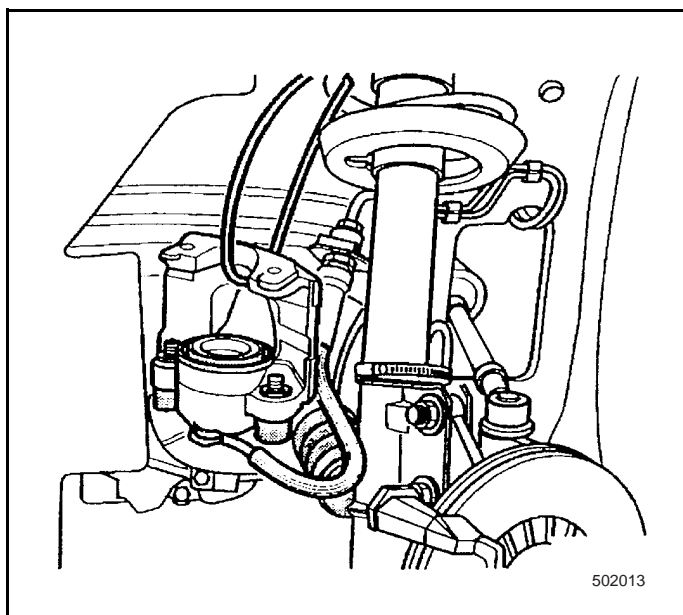
2. Remove the caliper bracket bolt.
3. Remove the caliper bracket.
4. Remove the following components from the bracket.
 - Housing bolt
 - bushing
5. Check if the bracket is broken.
6. If there is broken, replace the bracket.

Installation Procedure

1. Lubricate the following components with silicon-based lubrication grease.
2. Install the following components into the caliper bracket.
 - Housing bolt
 - bushing
3. Use bracket bolt to install the caliper bracket.

Tightening

Tighten the caliper bracket bolt to 95 N•m.



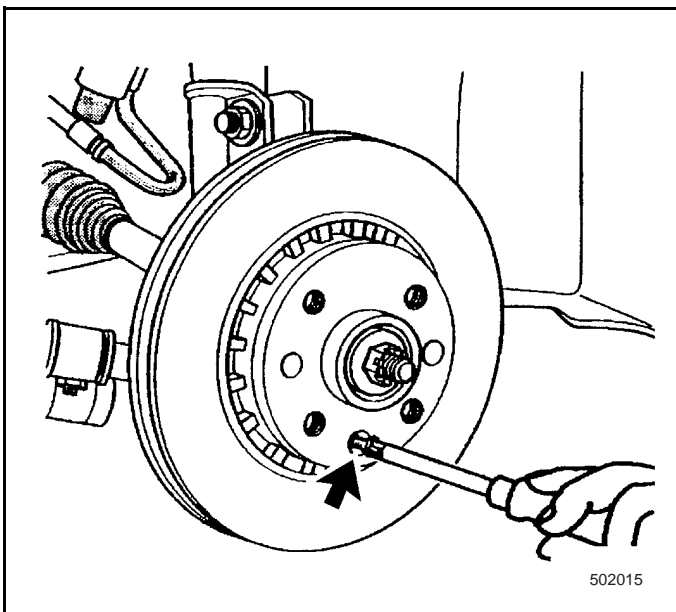
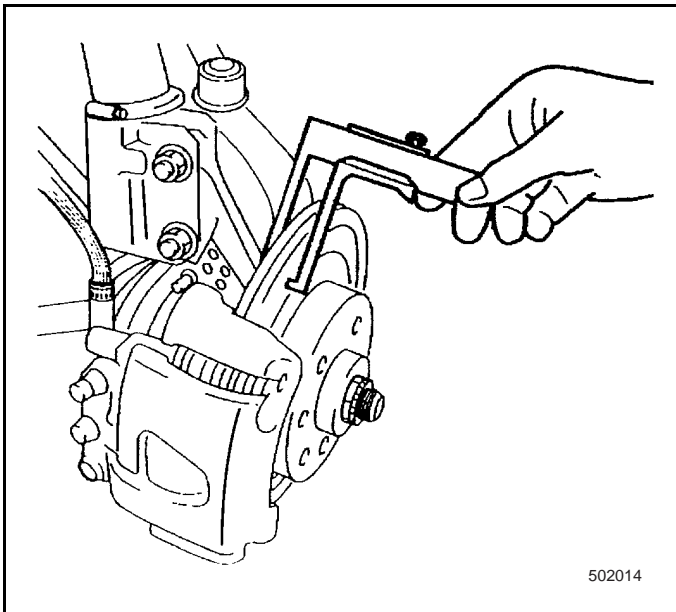
4. Install the caliper. Refer to Brake Caliper Replacement.

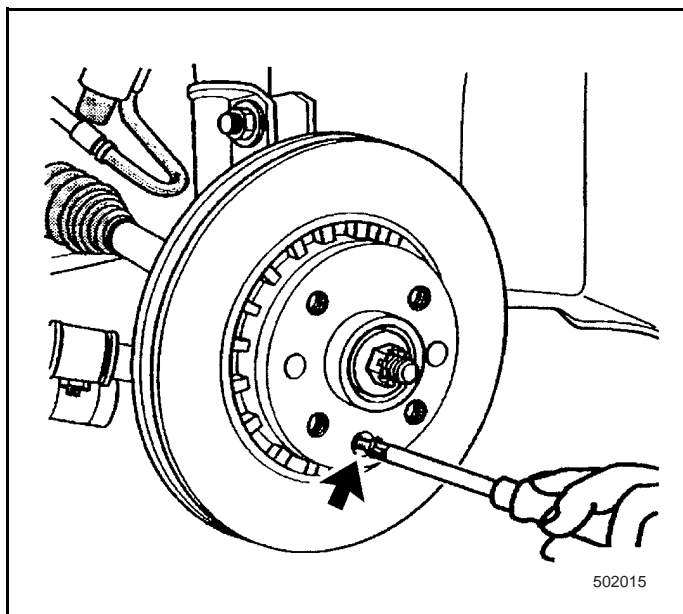
5.2.3.7 Replacement of Brake Disc

Removal Procedure

Tools Required

- MKM-230-A Brake Disc Measuring Gauge
1. Raise and adequately support the vehicle. Refer to Raise and Lift the Vehicle in General Information.
 2. Remove the wheel. Refer to Replacement of the wheels in Tire & Wheel.
 3. Inspect the thickness of the brake rotor.
Inspect the thickness of the brake rotor with MKM- 230-A, if it is less than 17mm, Replace.
 4. Remove brake caliper. Refer to Brake Caliper Replacement.
 5. Remove the caliper bracket. Refer to Replacement of the brake caliper bracket.
 6. Remove the brake fixing bolt and brake disc.
 7. Clean the contacting surface between braking disc and hub bearing flange.





Installation Procedure

1. Install the brake disc.
2. Assemble the brake disc bolt.

Tightening

Tighten the bolt to 4 N•m.

3. Install the caliper. Refer to Brake Caliper Replacement.
4. Install the caliper bracket. Refer to Replacement of the brake caliper bracket.
5. Install the wheel assembly. Refer to Replacement of the wheels in Tire & Wheel.
6. Lower the vehicle.

5.2.3.8 Brake Disc Surface Finishing

Tools Required

- J42450A Hub rinsing tool set
- J41013 Rola flange re-finishing tool package

Note: Do not try to finish the brake disc surface to correct the following conditions:

- brake noise (rumbling/ squealing)
- early wearing of brake pad
- surface corrosion on the brake disc surface
- brake disc dis-colored

Only when one or more of the following conditions occur, it is necessary to finish the brake disc surface.

- Serious score on the brake disc surface (deeper than 0.4 mm)
- Brake runout resulting from the following causes:
 - Brake disc thickness deviation exceeding 0.01mm
 - corrosion or score deeper than the braking surface of the brake disc

Notice: Whenever the brake disc is removed from the wheel bearing flange, use J42450-A hub cleaning kit to clear away any corrosion or foreign matter on the matching surface of brake disc and flange. Otherwise, brake disc lateral runout may increase and vibration may occur during braking.

1. Use J42450-A to clear the wheel bearing and vehicle bearing hub.
2. Measure the thinnest point of the brake disc with dial gauge. If the value is less than the minimum value allowed for the brake disc, so not finish its surface. Rather, replace the brake disc.
3. Use J 41033 or equivalent to clear away rust on brake disc flange thoroughly.
4. Finish the surface of the brake disc. Refer to the operation description provided by the brake machine tool manufacturer.

Note: If best surface accuracy can not be reached, brake performance may deteriorate.

5. After machining the brake disc, use 120 moly-alumina and non-directional brake disc finisher (if available) to obtain a non-directional brake surface.
6. Clean the brake surface with industrial alcohol or adequate other cleaning agent.

Notice: If the wheel nut is improperly Tightened, brake runout or brake disc damage may occur. To avoid expensive service cost to the brakes, be sure to Tighten the wheel nut evenly to specified torque.

5.2.4 Description & Operation

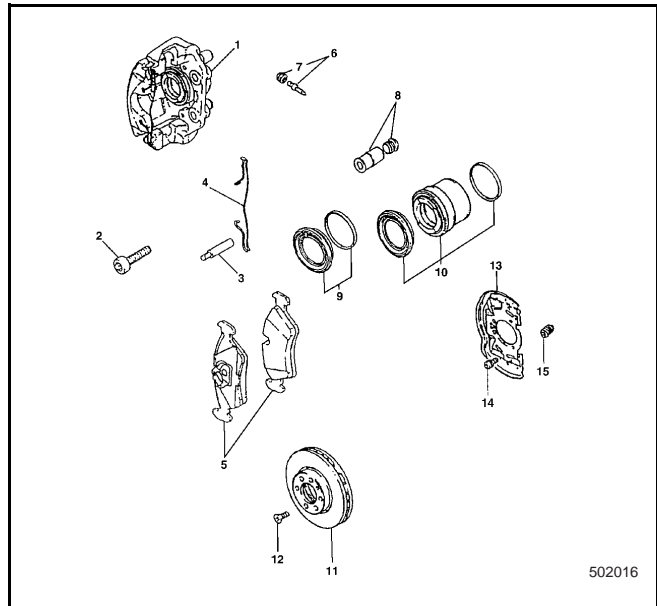
5.2.4.1 Disc Braking System Description

Note:

- Replace all components used to serve the caliper on the service tool package.
- Lubricate all rubber parts with clean brake fluid for easy assembly.
- Do not use compressed air with lubrication oil to the brakes. Or, rubber parts may be damaged.
- Whenever the hydraulic components are removed, discharge any air in the entire braking system.
- Braking pad can only be replaced for each shaft (front shaft or rear shaft).
- The specified torque value applies to dry non-lubricated Fasteners.
- Conduct service on clean operation console.

Caliper (1) of the vehicle has one single bushing. Install the caliper onto the bracket with two bolts (2). Pressure of the fluid at the rear of the caliper piston increases during braking. The pressure shall act evenly on piston (10) bottom and piston bushing bottom. Pressure from the piston passes onto the inner pad (5), which forces the pad against the brake disc inner surface.

Pressure acts on the piston- bushing bottom, which forces the caliper slipping at the assembling bolt. The caliper slips towards the center of the vehicle. Since the caliper is an integrated one, slippery may cause the outer section of the caliper acting on the back of the outer pad (5). Then, the pressure may cause the pad covering the outer surface of the brake disc. With the establishment of pressure in the pipeline, pressure from the pad on the brake disc surface increases accordingly. The force may stop the vehicle. Pressure in the pipeline relieves when the brake pedal is released. Sealing ring (9) and slot will make the piston subtract a little, which may reduce the towing force from inner and outer pads on the brake disc. Piston moves outward and caliper moves from inside to outside may compensate the wearing of the pad. With the wearing of the pad, brake fluid flows from the master pump into the rear of the piston, and the area increases.



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5.2.4.2 Brake Disc Surface Finishing

During regular maintenance of the brakes, if the worn out disc is replaced, do not finish the brake disc surface. Finish the surface only under the following conditions:

- Brake runout
- Score deeper than 0.4mm.

All brake disc is cast with minimum thickness sizes on its surface. The size is the minimum worn size rather than the finishing size. Do not use brake disc not satisfying specifications after surface finishing. Be sure to use new brake disc to replace the old one.

Accurately control the brake disc tolerance to ensure the normal operation of the brake disc. Fabricate the brake disc with precise equipment. Use service devices regularly to process equipment. Observe service procedures recommended by the manufacturers.

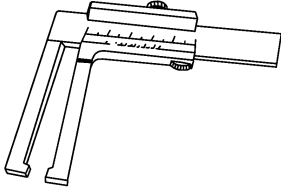
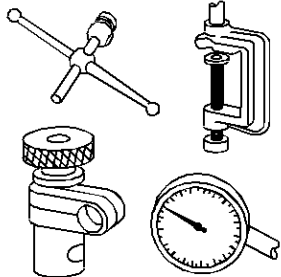
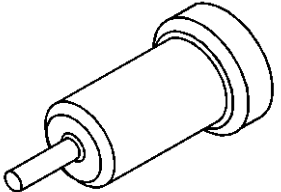
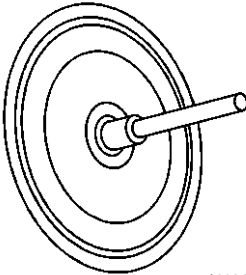
During brake disc surface finishing, the following tools and accessories must be under good conditions.

- connector
- tool frame
- absorber
- tool package

Always use sharp tools. Use only tools recommended by the equipment manufacturer to replace. Blunt or worn tools may result in uneven finishing of the surfaces, which will do negative effect to the brake performance. Use vibration absorber while finishing the brake surfaces. The accessories can eliminate tool vibration so as to improve surface finishing accuracy. Ensure cleanness of the connector with no cracks.

While finishing the brake disc surface, use vehicle-carried brake machine to obtain the best effect and to eliminate troubles relating to the brake runout. Observe the specifications and procedures recommended by the equipment manufacturers.

5.2.5 Special Tools

Illustration	Number & Name of the Tools
 MKM-230-A	MKM-230-A Brake disc measuring gauge
 J8001	J8001 grad indicator kit
 J42450	J42450A Hub rinsing tool set
 J41013	J41013 Rola flange re-finishing tool package

5.3 Shoe-type brake

5.3.1 Specification

5.3.1.1 Component Specifications

Application	Specification
wheel brake cylinder piston diameter	19.05 mm
brake drum width	28 mm
Brake drum diameter (new)	200 mm
Finished brake drum diameter	201 mm
Maximum allowed runout	0.1 mm
Brake lining thickness (to the rivet)	0.5 mm

5.3.1.2 Fastener Tightening Specifications

Application	Value
rear brake back plate bolt	50N•m + 30°- 45°
wheel brake cylinder bolt	9 N•M
brake pipe bolt connecting the wheel brake cylinder	16 N•M
exhaustion valve	6 N•M
ABS rear wheel sensor bolt (for vehicles with ABS)	4 N•M
rear absorber bolt	65 N•M

5.3.2 Repair Guidance

5.3.2.1 Brake Lining Inspection

Brake Lining Inspection

- Inspect the brake lining every 15000 km.
- Inspect the brake lining while removing the wheel (wheel rotation and so on)
- Remove the rubber plug at the observation hole for the brake lining
- Inspect the thickness of the brake lining, 2 mm
- Whenever the thickness of the brake lining is less than 2mm, replace it. If the brake lining is fixed with rivot, when it is worn to less than 0.5 mm away from the rivot head, replace the lining. Meanwhile, replace the lining of the rear axle brake drum.
- Install the rubber plug of the observation hole

5.3.2.2 Brake Lining Replacement

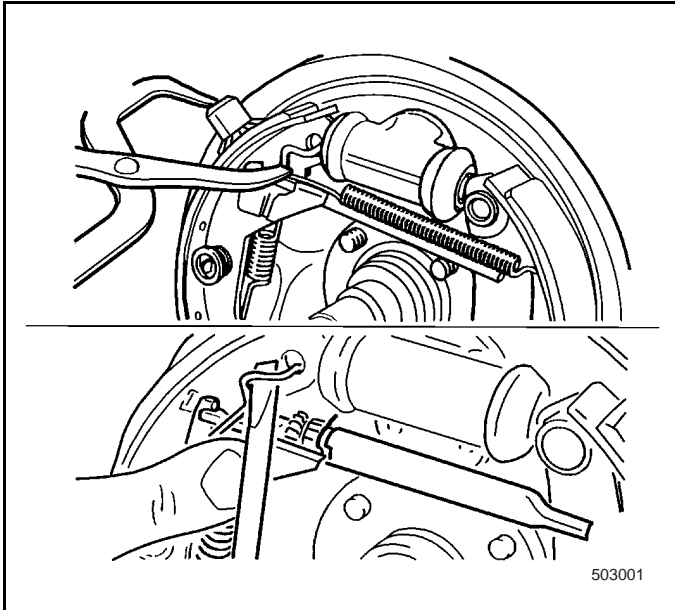
Removal Procedure

Tools Required

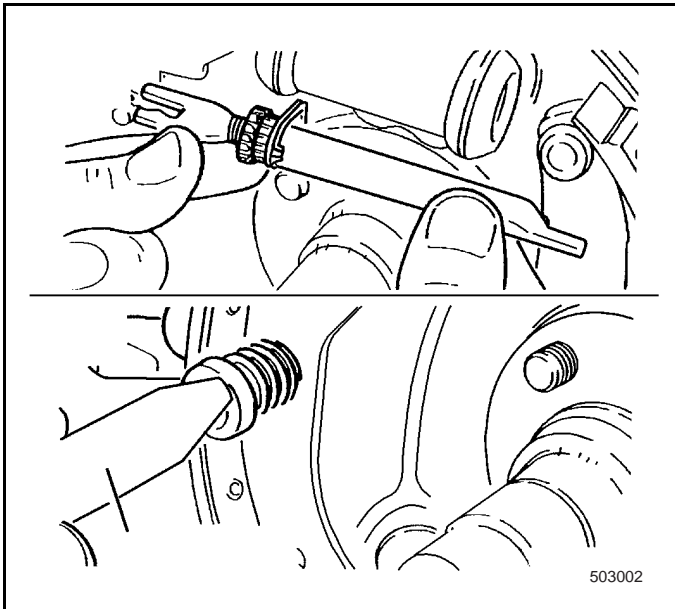
- KM-346 remover

It is recommended that all vehicles use SGM original replacement brake lining materials (or equivalent product) to maintain the front and rear brake performance balance. SGM original brake components for replacement are carefully selected to provide brake balance within the braking distance and the entire travel control. If front or rear brake linings different from the SGM original ones are used, brake balance of the vehicle may be changed.

1. Raise and support the vehicle. Refer to Raise and Lift the Vehicle in General Information.
2. Mark the position of the wheel in relation with the hub.
3. Remove the wheel. Refer to Replacement of the wheels in Tire & Wheel.



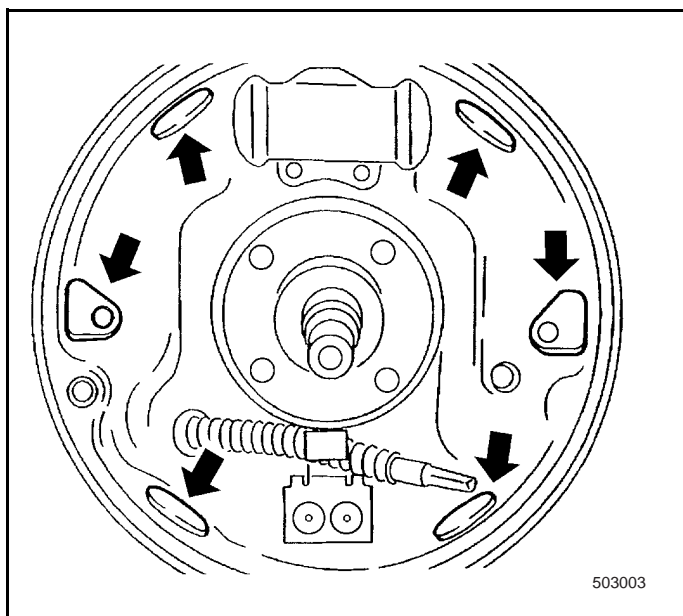
4. Remove the brake drum. Refer to Brake Drum Replacement.
5. Remove the park brake cable from the cable channel.
6. Use spring pliers to remove the return spring.
7. Use pliers to remove the return spring and spring bracket.



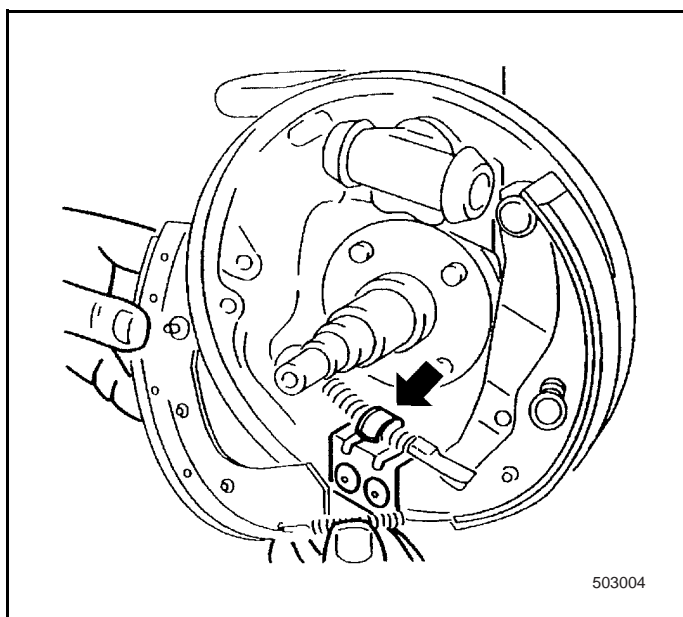
8. Remove the adjustment lever.
9. Use KM-346 to remove the compressed spring chip, spring and the fixing pin.
10. Remove the brake lining.
11. Be sure to replace all brake lining at the same shaft.

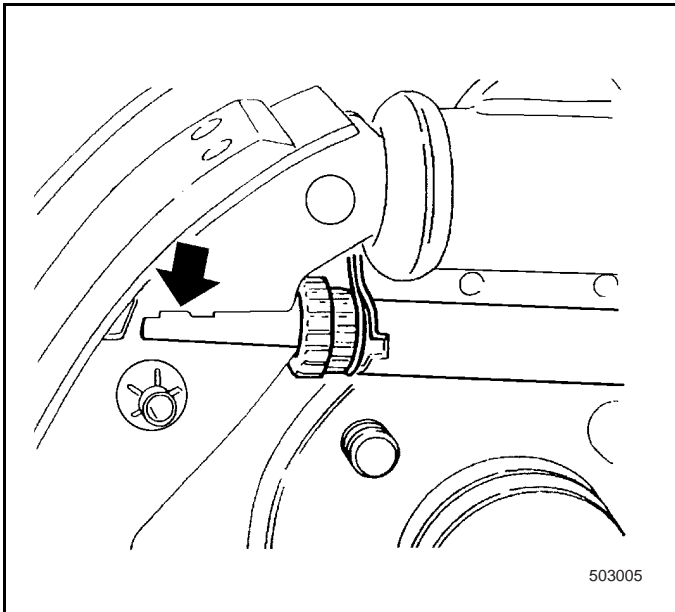
Installation Procedure

1. Clean the brake back plate surface.
2. Use noise-reduction soft cloth at the contact area of the lining (refer to arrow in the figure).



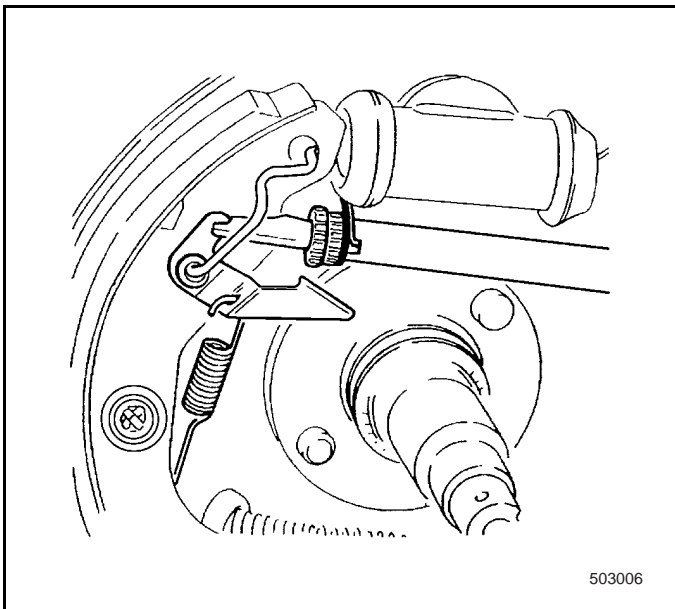
3. Connect the brake cable and the brake driven shoe lining park lever.





4. Install the brake driven shoe lining with fixing pin, compressed spring and thin spring chip.
5. Install the lower returning spring and brake shoe.
6. Ensure correct position of the park cable (refer to arrow in the illustration figure).
7. Install slip bar regulator between the two brake lining.
8. Install small ring washer to the new brake lining (refer to arrow in the illustration figure).

Note: Ensure correct installation of the small washer to the brake lining, otherwise, braking failure or damage to the brake lining may occur.



9. Install the adjustment bracket with spring to the rotational pin.
10. Install the adjustment bracket spring.
11. Use spring pliers to install the upper returning spring.
12. Install the brake drum. Refer to Brake Drum Replacement.
13. Adjust the wheel bearing gap. Refer to Wheel Bearing Adjustment in Rear Suspension.
14. Adjust the brake lining gap. Brake for 10 -15 times to adjust the brake so as to ensure the correct gap.

Notice: Step down the brake pedal forcefully to adjust the brake lining gap automatically.

15. Install the wheel. Refer to Replacement of the wheels in Tire & Wheel.
16. Align the previous marks on the wheel and drum.
17. Lower the vehicle.
18. Fill with clean brake fluid to adequate level. Refer to Filling of Brake master cylinder Fluid Reservoir.
19. Match the lining and drum. Refer to Match the lining and brake drum.

5.3.2.3 Match the lining and brake drum

- After replacement of the brake lining, match the new brake surface.
- Match the new braking surface after finishing the surface or new drum is replaced.
- Brake 20 times when the vehicle speed is at 48km/h and match the new braking surface.
- Step down the brake pedal with medium or strong force. Do not over-heat the brake.

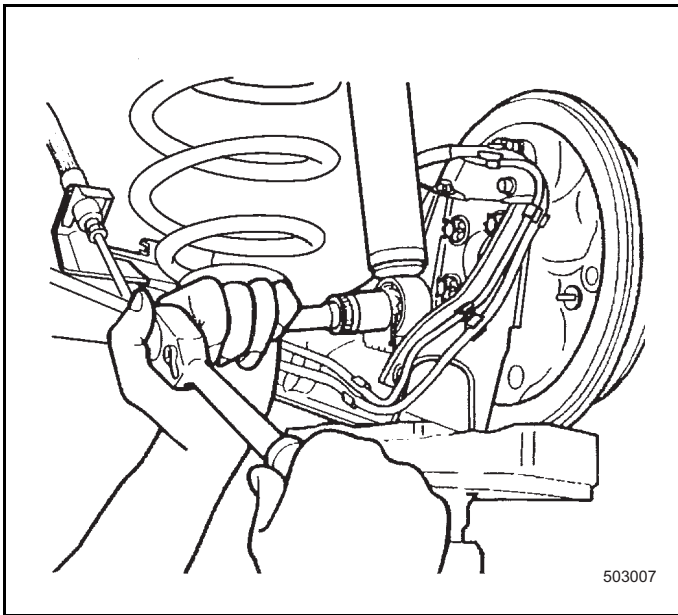
Notice: Avoid emergency braking within 200km after new braking lining is replaced.

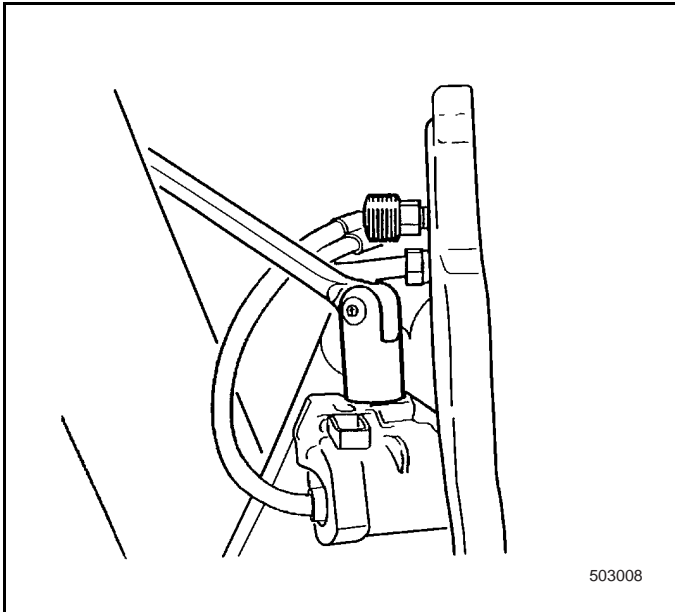
5.3.2.4 Rear Brake Replacement

Removal Procedure

Caution: Do not move the vehicle before steady brake pedal is obtained. Or human casualty accident may occur.

1. Fill brake fluid into the reservoir to the MAX level
2. Raise and adequately support the vehicle. Refer to Raise and Lift the Vehicle in General Information.
3. Mark the position of the wheel in relation with the drum.
4. Remove the wheel. Refer to Replacement of the wheels in Tire & Wheel.
5. Remove the brake drum. Refer to Brake Drum Replacement.
6. Remove park brake cable from the brake. Refer to Replacement of park brake left and right cable.
7. Remove the brake hard pipe at the rear shaft.





8. Remove ABS rear sensor. (vehicles with ABS)
9. Remove the rear absorber bottom bolt.
10. Remove the four bolts at the rear brake.
11. Remove the rear brake.

Installation Procedure

Tools Required

- KM-470-B Angular torque measuring gauge

1. Clean and inspect the shaft surface.
2. Use new bolt to install rear brake for rear brake back plate and rear shaft.

Tightening

Tighten the bolt to $50 \text{ N}\cdot\text{m} + 30^\circ\text{-}45^\circ$.

Note: Do not use the old bolt in the rear brake.

3. Install park brake cable.
4. Install the brake pipe bolt onto the rear brake wheel brake cylinder.

Tightening

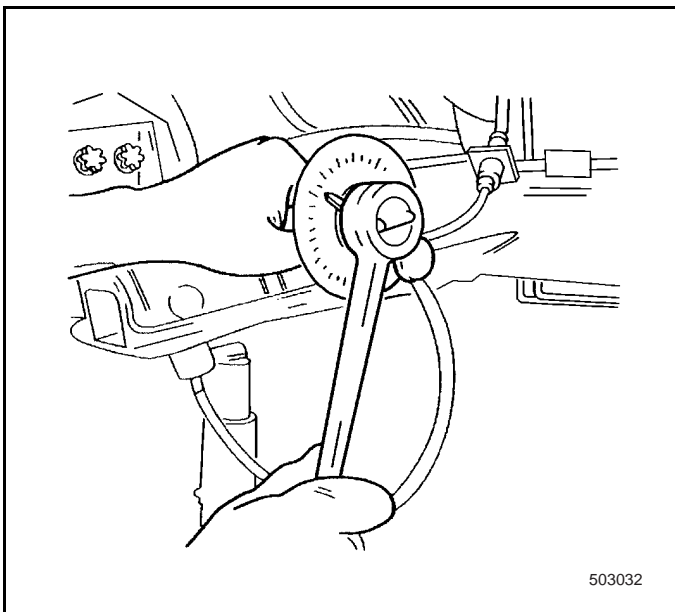
Tighten the brake pipe bolt to $16 \text{ N}\cdot\text{m}$.

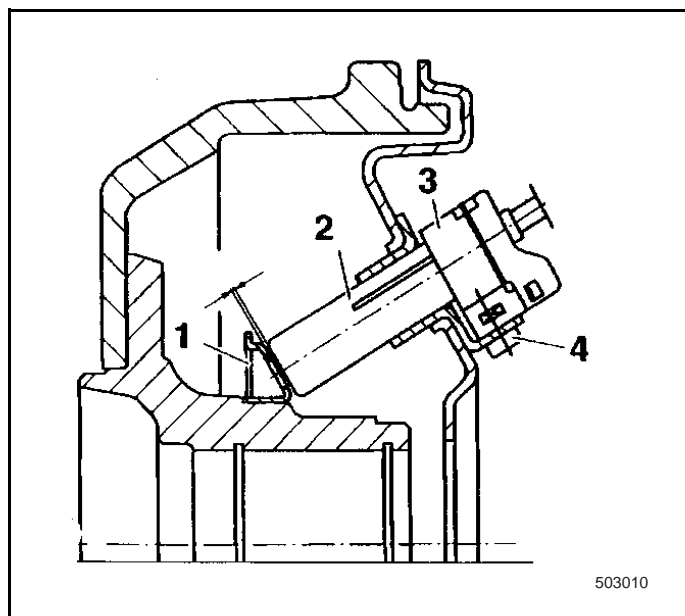
5. Install the rear absorber bolt.

Tightening

Tighten the bolt to $65 \text{ N}\cdot\text{m}$.

6. Install the brake drum. Refer to Brake Drum Replacement.
7. Install ABS rear sensor at the rear brake (refer to the following steps). (vehicles with ABS)





Install and adjust sensors (ABS vehicles)

- Install the sensor and Tighten the screws with fingers.
- Push the sensor to the end and Tighten with screws.
- Rotate the lever clockwise for 30 degree to adjust.

Tightening

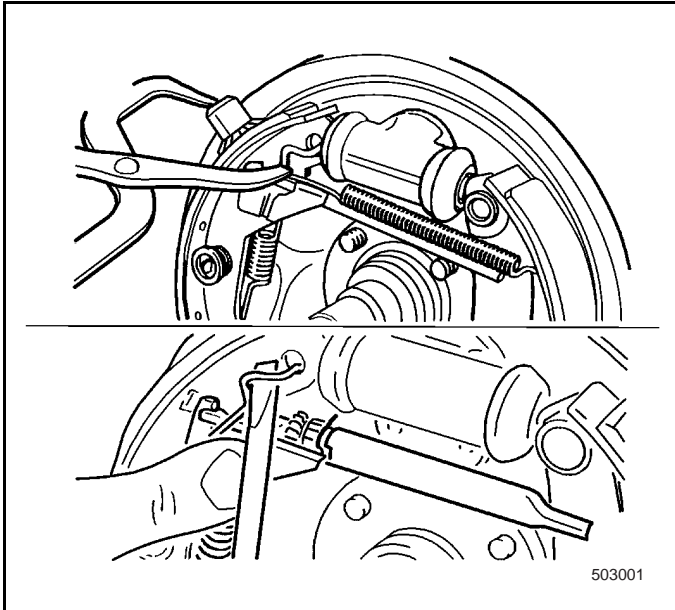
Tighten the sensor bolt to 4 N•m.

8. Fill with clean brake fluid to adequate level. Refer to Filling of Brake master cylinder Fluid Reservoir.
9. If the inlet connector components are removed, discharge air in the brake. Refer to Discharge air in the hydraulic braking system.
10. If necessary, step the brake pedal with force of 238N after discharging.
11. Inspect if there is leakage of brake fluid in the hydraulic braking system. Refer to Brake Fluid Leakage.
12. Install the wheel. Refer to Replacement of the wheels in Tire & Wheel.
13. Lower the vehicle.

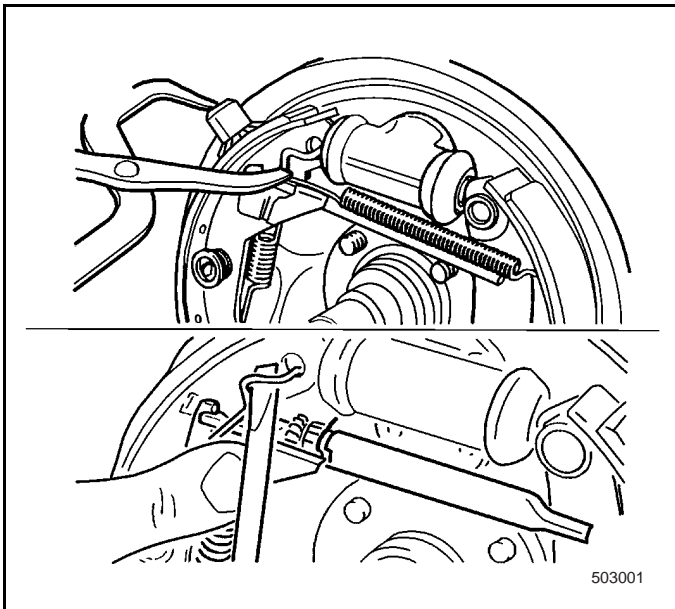
5.3.2.5 Brake Wheel brake cylinder Replacement

Removal Procedure

1. Fill the brake fluid to the maximum position.
2. Move the dust-shield to the brake drum.
3. Remove vehicle shaft lock pin and nut.
4. Remove the brake drum. Refer to Brake Drum Replacement.



5. Use spring pliers to remove the upper returning spring.
6. Remove the wheel brake cylinder brake pipe.
7. Remove the discharging valve.
8. Remove wheel brake cylinder bolt.
9. Remove the wheel brake cylinder.



Installation Procedure

1. Install the wheel brake cylinder to the brake back plate.

Tightening

Tighten the sub-pump bolt to 9 N•m.

2. Install the brake pipe to the wheel brake cylinder.

Tightening

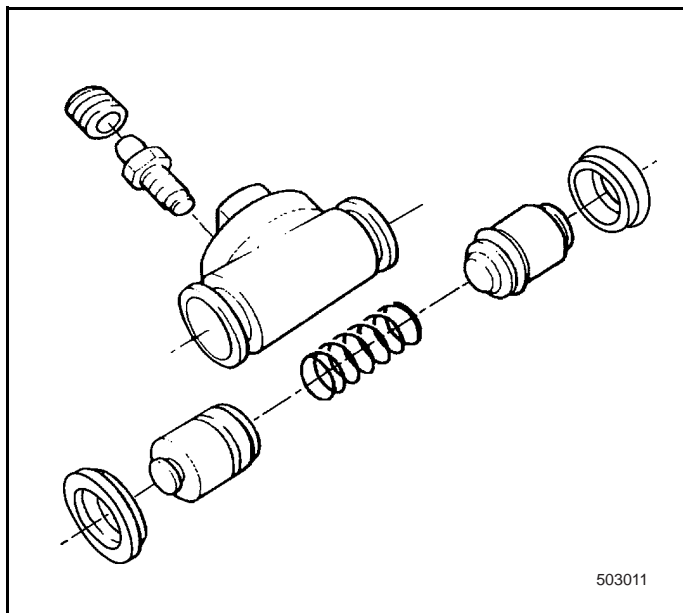
Tighten the brake pipe bolt to 16 N•m.

3. Install the discharging valve to the wheel brake cylinder.

Tightening

Tighten the discharging valve to 6•m.

4. Install the upper spring.
5. Install the brake drum. Refer to Brake Drum Replacement.
6. Adjust the wheel bearing gap. Refer to Wheel Bearing Gap in Rear Suspension.
7. Discharge air in the exhaustion brake system and inspect. Refer to Discharge air in the hydraulic braking system.
8. Adjust the brake lining gap. Brake for 10 -15 times to adjust the brake so as to ensure the correct gap.
9. Install the wheel. Refer to Replacement of the wheels in Tire & Wheel.



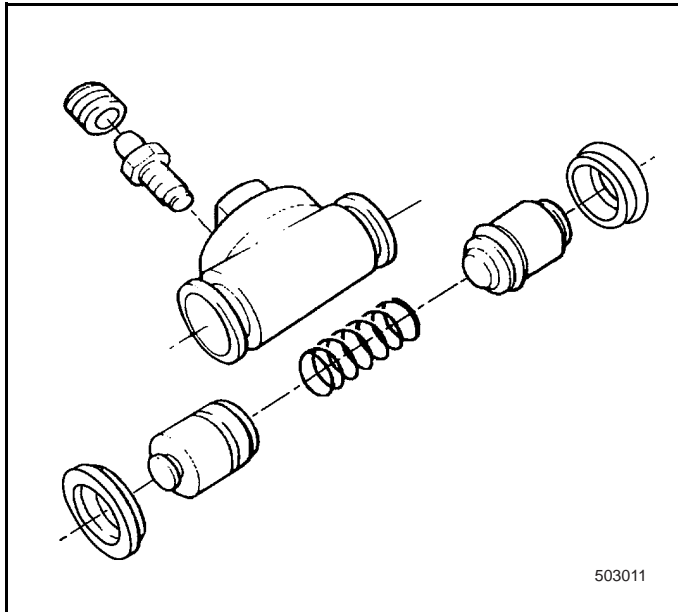
5.3.2.6 Brake Wheel brake cylinder Overhaul

Removal Procedure

1. Remove the brake wheel brake cylinder. Refer to Brake Wheel brake cylinder Replacement.
2. Remove the wheel brake cylinder housing.
3. Remove the wheel brake cylinder piston. Blow compressed air into wheel brake cylinder inlet. The piston will extend from the piston housing.
4. Clean all parts with alcohol, do not use other liquid.
5. Inspect if there is the following condition on wheel brake cylinder cylinder and piston.
 - score
 - scratch
 - corrosion
 - wearing
6. If any one of the above occurs, replace the wheel brake cylinder case and piston.

Notice: Do not remove the sealing with metal tools. Otherwise the cylinder or sealing channel may be damaged.

7. Remove the piston sealing ring from the wheel brake cylinder slot.
8. Inspect if there is the following condition on wheel brake cylinder cylinder and sealing channel.
 - score
 - scratch
 - corrosion
 - wearing
9. Use a fine sand cloth to sand away slight corrosion.
10. If the corrosion around the sealing slot cannot be sand away, replace the wheel sum-pump.
11. Inspect if the housing has the following situations:
 - cut
 - broken
 - aging
12. replace the damaged housing.
13. Inspect if the sealing slot in the wheel sum-pump has scratch or blur. If the sealing slot is damaged, replace the wheel sum-pump.
14. Remove discharging valve cover and discharging valve from the wheel sum-pump.
15. Clear away all components with clean industrial alcohol.
16. Dry all parts with filtered compressed air without lubrication grease.



17. Dry all pipelines in caliper case and discharging valve. Use filtered compressed air without lubrication oil.

Installation Procedure

1. Install a new lubricated piston sealing ring in the wheel sum-pump slot. Be sure there is no distortion in the piston sealing.
2. Install the lubricated housing onto the piston.
3. Lubricate the piston with clean brake fluid.
4. Install piston and housing in wheel brake cylinder. Push the piston to the end of the pump diameter.
5. Place the wheel sum-pump housing in the wheel brake cylinder case flaring hole.
6. Install the discharging valve and discharging valve cover onto the wheel brake cylinder.

Tightening

Tighten the discharging valve to 6 N•m.

7. Install the wheel brake cylinder. Refer to Brake Wheel brake cylinder Replacement.

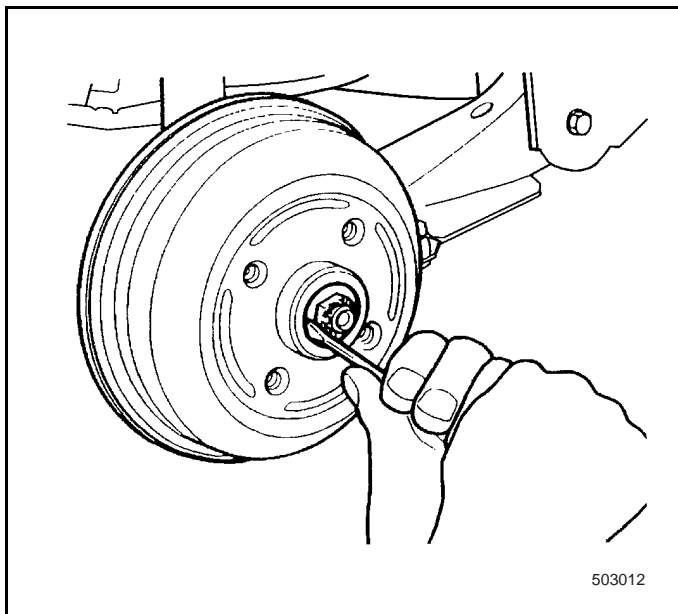
5.3.2.7 Replacement of Brake Drum

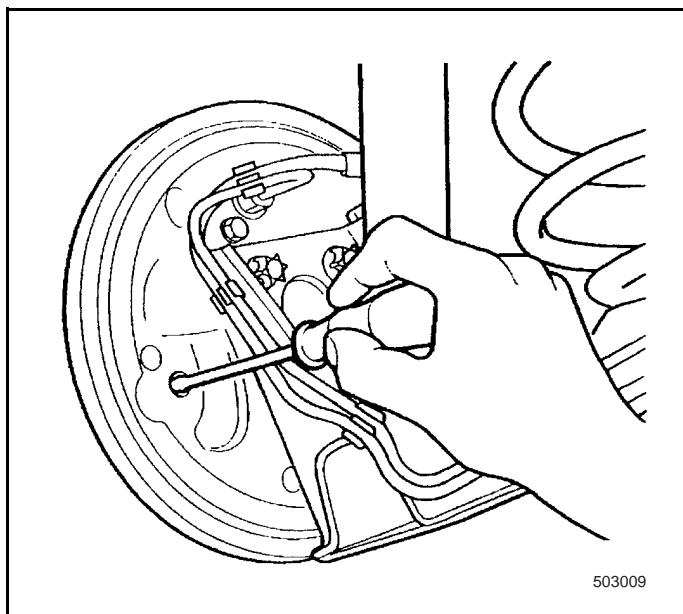
Removal Procedure

1. Raise and adequately support the vehicle. Refer to Raise and Lift the Vehicle in General Information.
2. Remove the wheel. Refer to Replacement of the wheels in Tire & Wheel.
3. Remove brake drum dust-shield cover.
4. Remove wheel bolt and nut pin.

Notice: If necessary, remove the park brake cable on compensation fork. Press the park lever of the brake with screwdriver so that it contacts the brake lining back plate.

5. Remove outer bearing of the brake drum.
6. Remove the brake drum.
7. Remove the inner bearing and sealing ring in the brake drum.
8. Clear the metal contacting surface between the brake bolt and brake drum bearing.





Installation Procedure

1. Install brake drum bearing and new sealing ring.
2. Adjust the wheel bearing gap. Refer to Wheel Bearing Adjustment in Rear Suspension.
3. Install the wheel. Refer to Replacement of the wheels in Tire & Wheel.
4. Lower the vehicle.
5. Adjust the brake lining gap.
6. Brake for 10 -15 times to adjust the brake so as to ensure the correct gap.

5.3.2.8 Brake Drum Surface Finishing

Tools Required

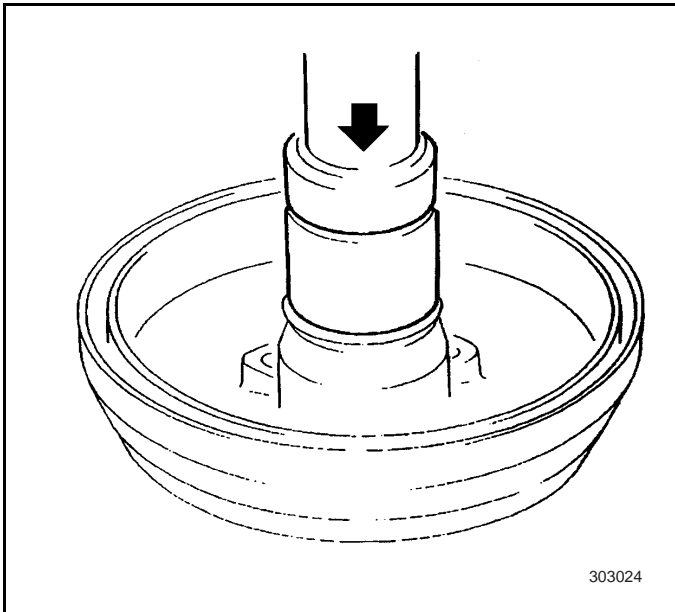
- J21177 Brake drum to brake shoe gap gauge
- KM-508-1 Installer

Note: Do not finish the brake drum surface to correct the following conditions.

- brake noise (rumbling/ squealing)
- early wearing of brake pad

Notice: Whenever the brake drum is separated with the wheel bearing and brake drum bolt, use hub clean tool to clean the brake drum, bearing and rust or foreign matter on the contact surface of brake drum bolt. Other brake noise and runout may increase.

1. Remove the rear brake drum. Refer to Brake Drum Replacement.
2. Remove the bearing sealing ring and brake drum bearing.
3. Clean the wheel bearing and brake drum inner layer.



4. Use J21177 to measure the brake drum inner diameter. If the diameter of the brake drum exceeds 201 mm, do not finish the brake drum surface. Rather, replace the brake drum.

5. Finish the surface of the brake drum.

Note: If the best brake drum process surface can not obtain, braking may be hard.

6. After machining the brake drum, use 120 moly-alumina and non-directional brake drum finisher (if available) to obtain a non-directional brake surface.
7. Clean the brake surface with industrial alcohol or adequate other cleaning agent.
8. Use KM-508-1 to install inner bearing and stick the sealing ring onto rear brake drum.

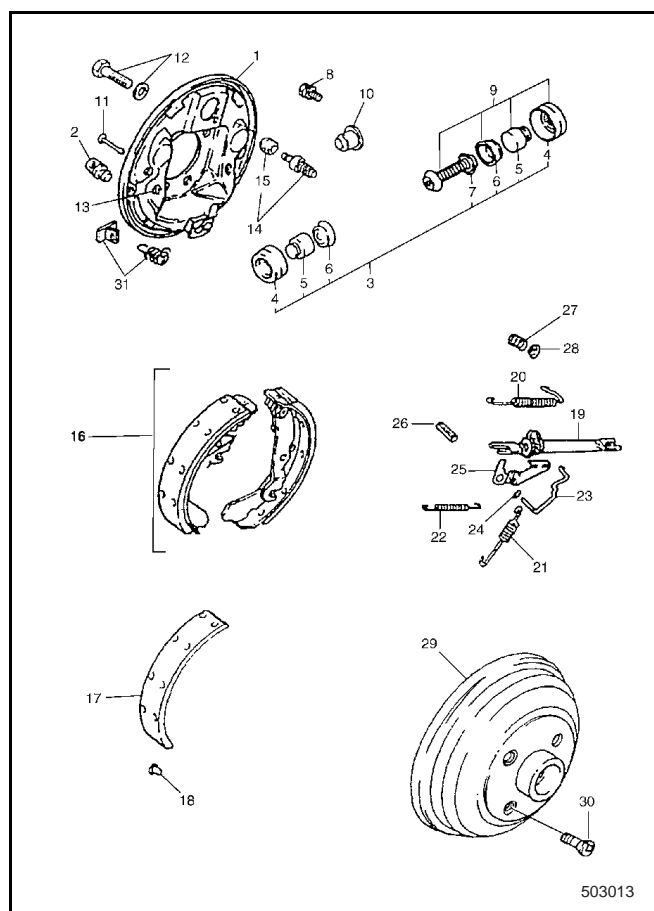
Notice: If the wheel nut is improperly Tightened, brake runout or brake drum damage may occur. To avoid expensive service cost to the brakes, be sure to Tighten the wheel nut evenly to specified torque.

5.3.4 Description & Operation

5.3.3.1 Shoe-type Braking System Description

Note:

- Replace all components used to serve the shoe-type brake in the service tool package.
- Lubricate all rubber parts with clean brake fluid for easy assembly.
- Do not use compressed air with lubrication oil on brake components. Rubber parts may be damaged.
- Whenever the hydraulic components are removed, discharge any air in the entire braking system.
- Meanwhile, replace the lining of the rear axle brake drum.
- The specified torque value applies to dry non-lubricated Tighteners.
- Conduct service on clean operation console.



The rear brake in the vehicle has a wheel brake cylinder. Use four installation bolt to install the rear

brake onto rear axle bracket. Pressure of the fluid at the rear of the wheel brake cylinder increases during braking. The pressure shall act evenly on piston bottom and piston bushing bottom. Pressure acting the piston passes to the two braking lining. The pressure will force the lining to be against the brake drum inner surface. With the establishment of pressure in the pipeline, pressure from the pad on the brake drum surface increases accordingly. The force may stop the vehicle. Pressure in the pipeline relieves when the brake pedal is released. Upper returning spring will extract the brake lining and piston. Lining gap regulating lever moves outward, which compensates automatically the wearing of the lining.

5.3.3.2 Brake Drum Surface Finishing

During regular maintenance of the brakes, if the worn out drum is replaced, do not finish the brake drum surface. Finish the brake drum surface only under the following conditions:

- Brake runout

All brake drum is cast with minimum thickness sizes on its surface. The size is the minimum worn size rather than the finishing size. After finishing, brake drum that fails to satisfy the above specifications shall not be used. Always use new drum to replace the old one.

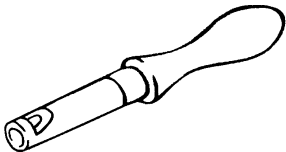
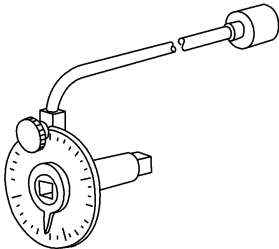
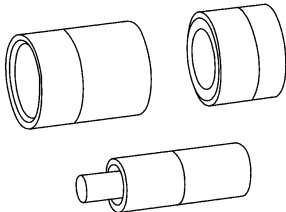
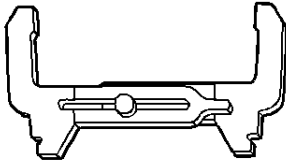
To make the drum brake system operates normally, control the tolerance of the drum accurately. Process the brake drum with only precise equipment. Service the mechanical process equipment regularly. Observe service procedures recommended by the manufacturers.

During brake drum surface finishing, the following tools and accessories must be under good conditions.

- connector
- tool frame
- absorber
- tool

Always use sharp tools. Use only alternative cutting tools recommended by the equipment manufacturers. Blunt or worn tools may result in uneven finishing of the surfaces, which will do negative effect to the brake performance. Use vibration absorber while finishing the brake surfaces. The accessories can eliminate tool vibration so as to finish the surface better. Ensure cleanness of the connector with no cracks.

5.3.4 Special Tools

Illustration	Number & Name of the Tools
 KM-346	KM-346 Remover
 KM-470B	KM-470-B Angular torque measuring gauge
 KM-508-A	MKM-508-A Installer
 J21177	J 21177 Brake drum to brake shoe gap gauge clearance gauge

Blank

5.4 Parking Brake

5.4.1 Specification

5.4.1.1 Tightener Tightening Specifications

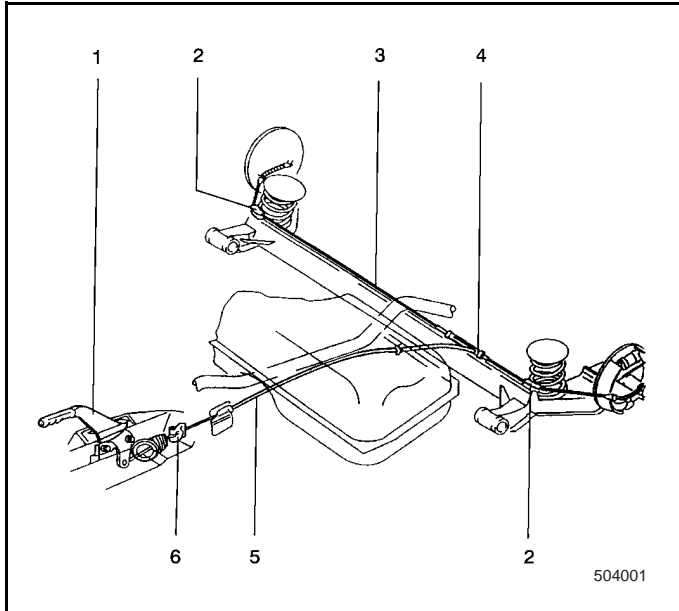
Application	Specification
park brake lever installation bolt	24 N•m
park brake switch installation bolt	3 N•m

5.4.2 Repair Guidance

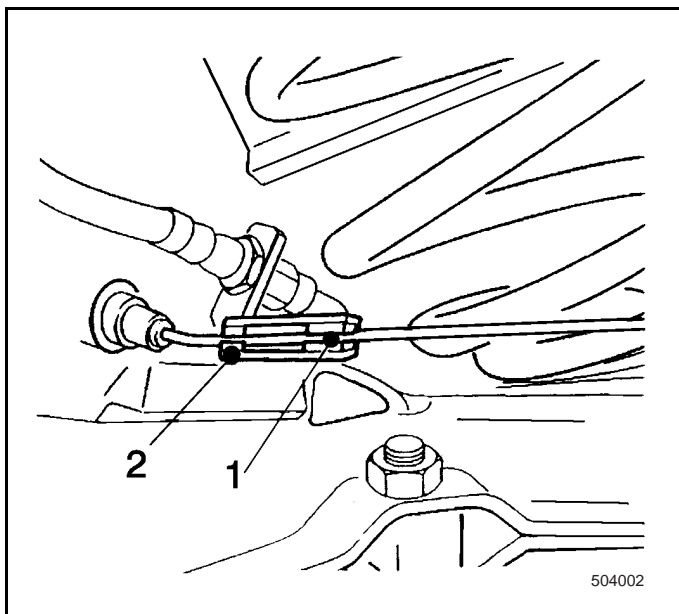
5.4.2.1 Park brake lever and park brake alarm lamp switch replacement

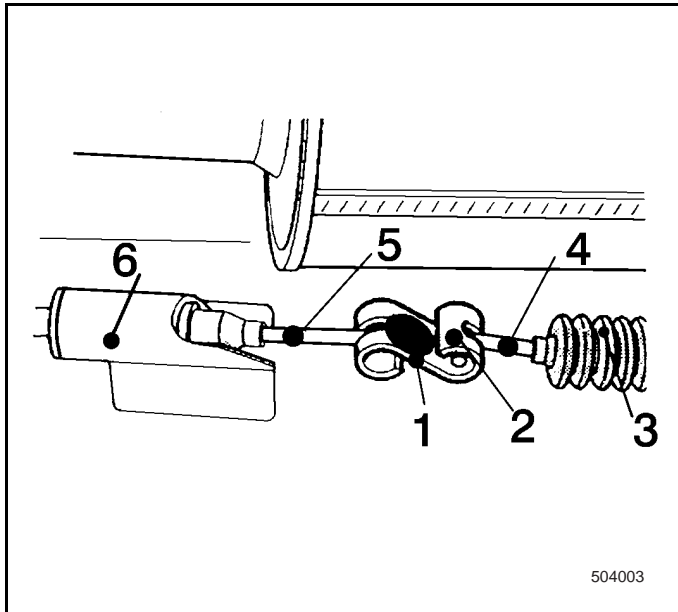
Removal Procedure

1. Raise and adequately support the vehicle rear axle.

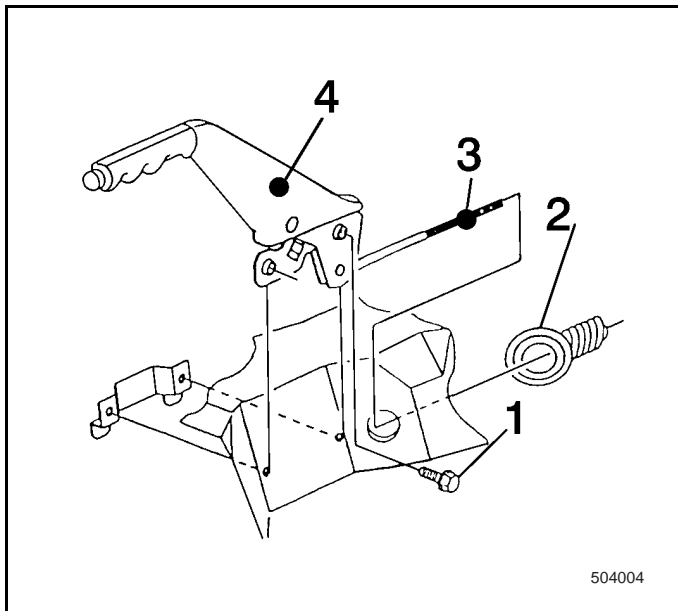


2. Remove cable (1) from the cable channel (2)

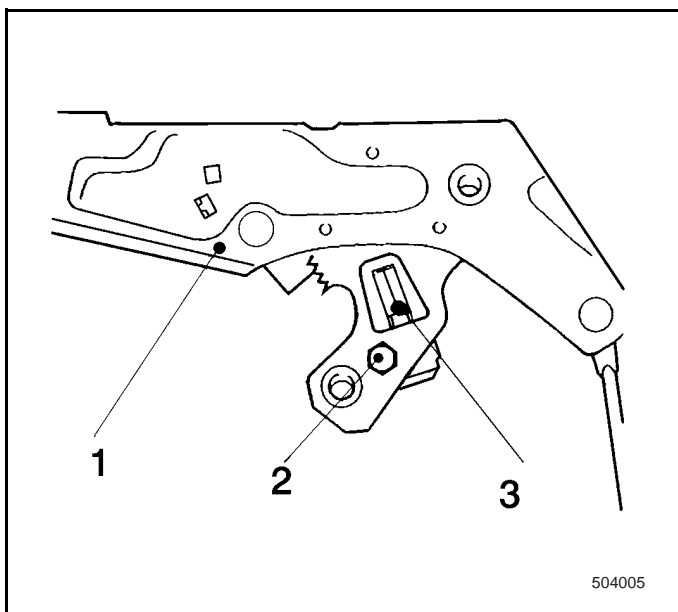




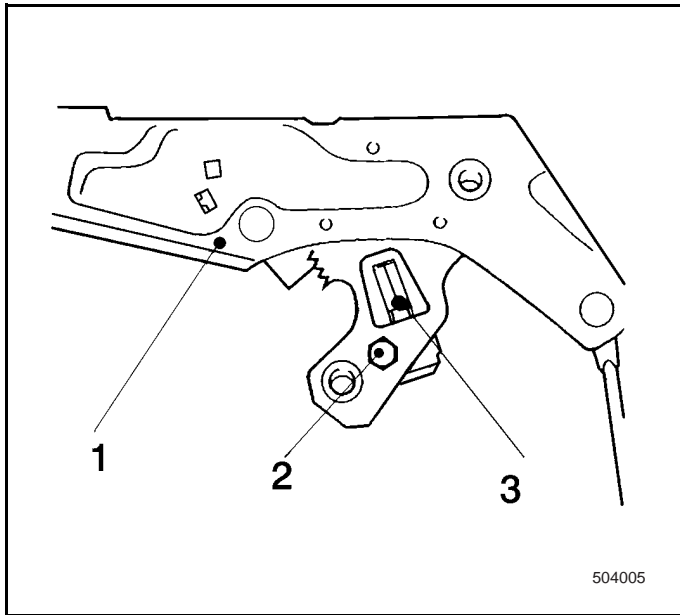
3. Remove the retainer (1) from the connector (2).
4. Remove connector (2) from cable (5) and pulling slip bar (4).
5. Remove housing (3) from the pulling slip bar (4).



6. Remove left front seat, refer to Front Seat Replacement.
7. Fold the carpet to access the park brake lever installation bolt.
8. Remove housing (2) from the pulling slip bar (3).
9. Loosen the installation bolt (1).



10. Remove the electrical connectors from park brake switch (3).
11. Pull out the park brake lever from body floor.
12. Loosen the switch installation screw (2) and remove the switch (3).



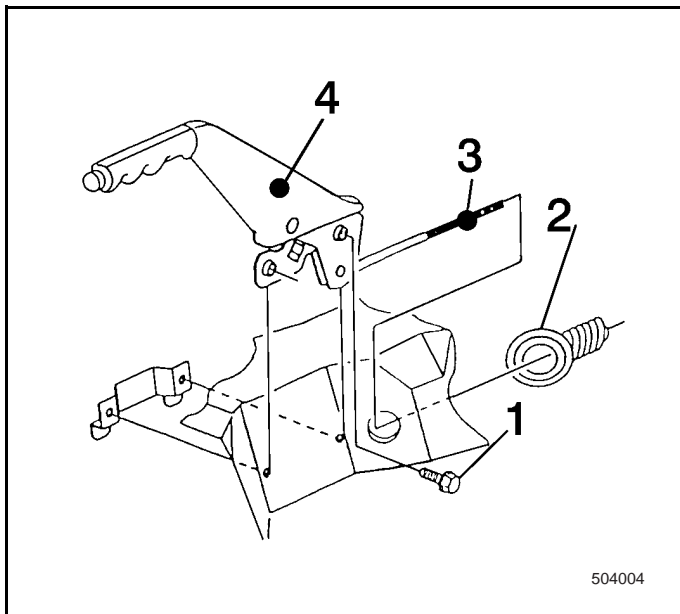
Installation Procedure

1. Install brake switch (3) to lever (1), Tighten the switch screw(2).

Tightening

Tighten the brake switch screw to 3 N•m.

2. Connect the electrical connector and switch (3), inspect the operation of switch 2.

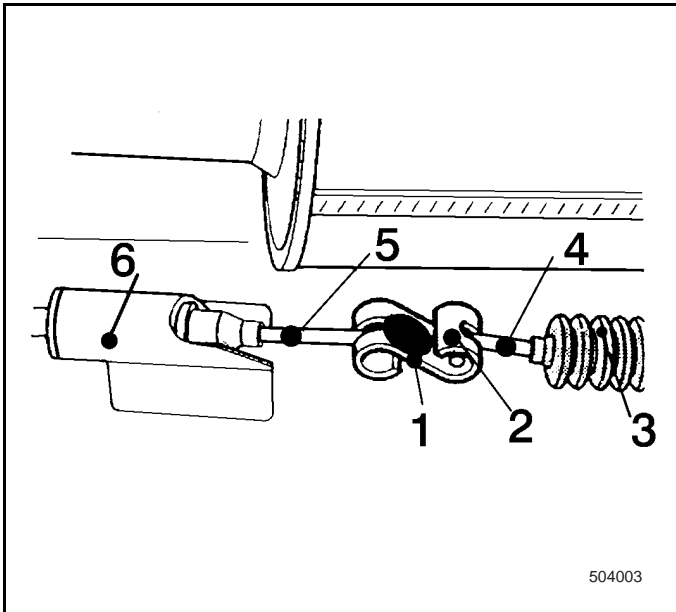


3. Install the park brake lever (4) to the body floor. Tighten bolt (1).

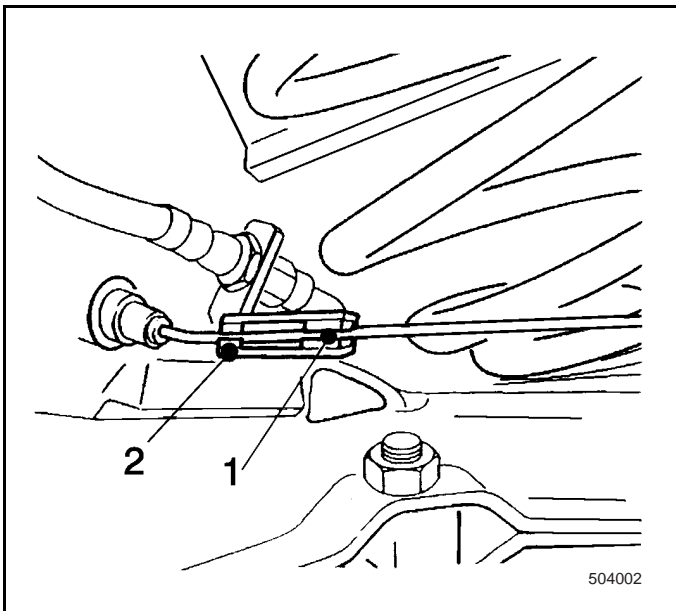
Tightening

Tighten brake lever installation bolt to 24 N•m.

4. Place the carpet at adequate position.
5. Install housing (2) to the pulling slip bar (3).



6. Install the connector (2) to slip bar (4) and cable (5) through the body floor cable channel (6).
7. Insert retainer (1) into connector (2).

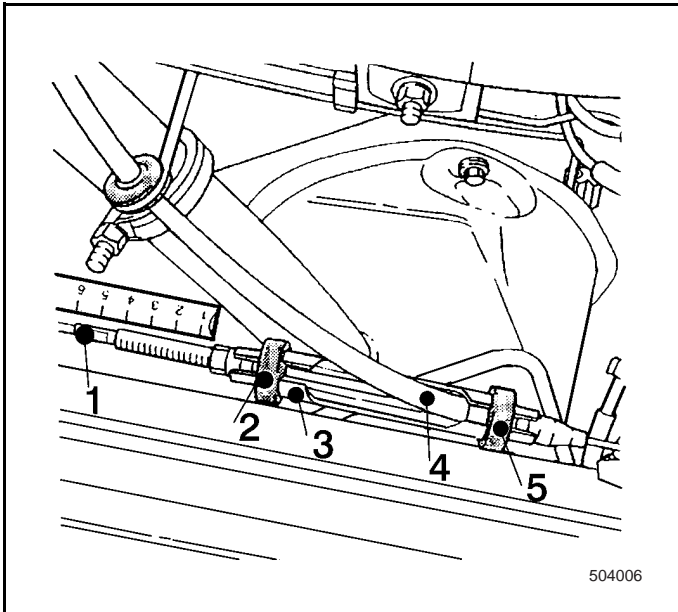


8. Press cable (1) into the cable channel (2).
9. Adjust park Brake. Refer to Replacement of park brake left and right cable.

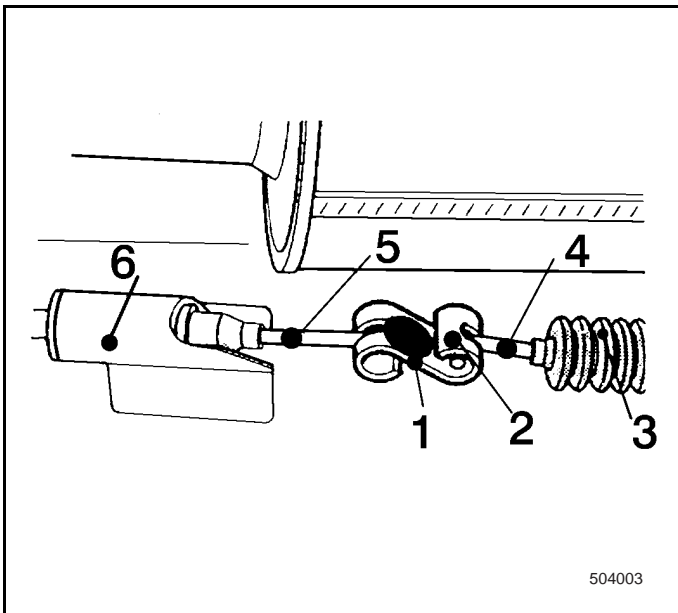
5.4.2.2 Park Brake Left Cable Replacement/ Adjustment

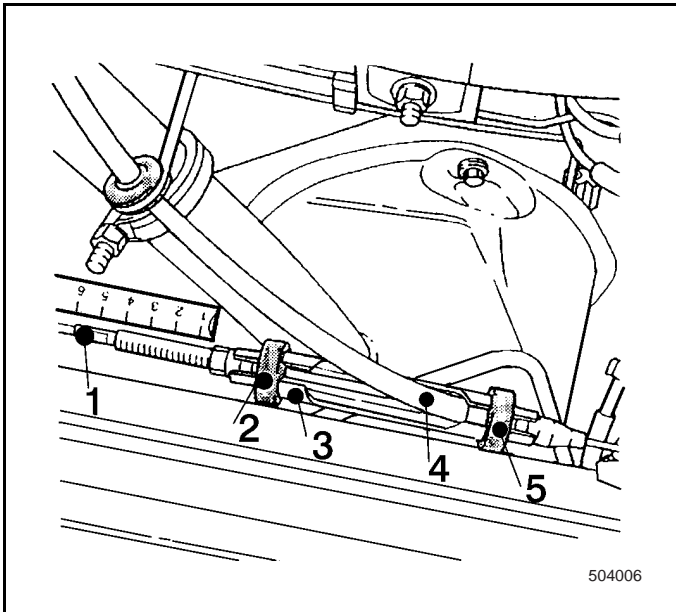
Removal Procedure

1. Measure the thread length of the short cable (1) near the balancer.
2. Pull out rubber protective ring (2) (5) from balancer (3).
3. Remove short cable (1) from the balancer (3).

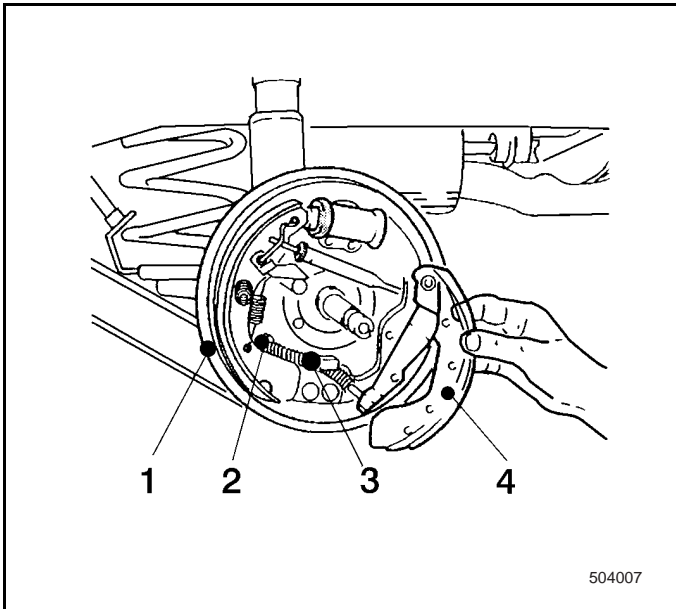


4. Remove cable (5) from the connector (2).





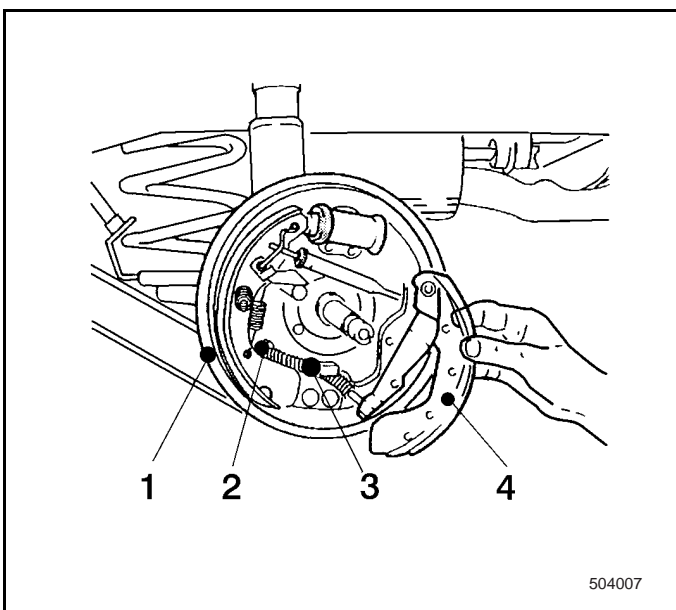
5. Pull out cable (4) from the balancer (3).

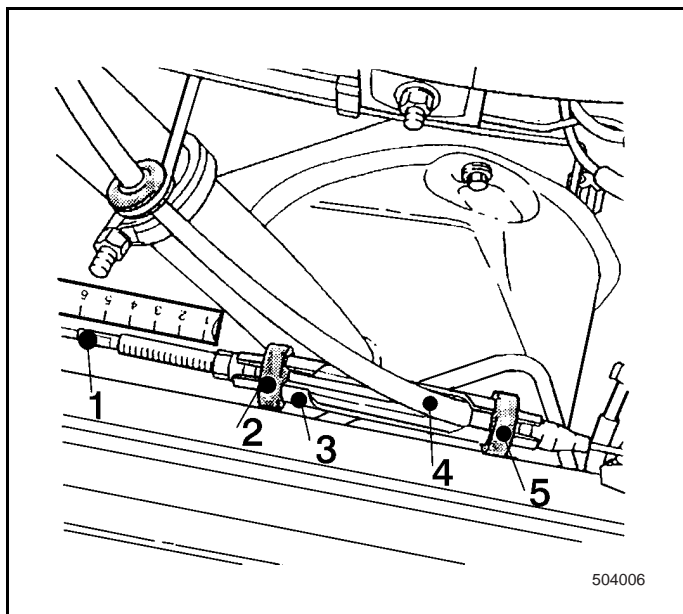


6. Remove brake assembly from the rear axle, refer to Brake Drum Replacement.
7. Remove brake shoe lining (4), refer to Brake Lining Replacement.
8. Remove cable (3) from the brake shoe lining (4).
9. Remove the cable retainer (2) from the brake back plate (1).
10. Pull out cable (3) from the brake back plate (1).

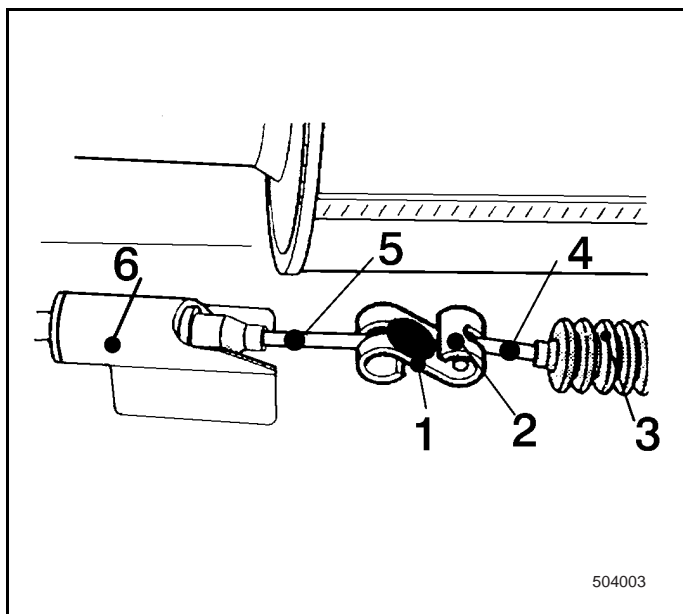
Installation Procedure

1. Install cable (3) to the brake shoe lining (4) through brake back plate.
2. Install brake shoe lining (4) to brake back plate (1), refer to Brake Lining Replacement.
3. Install the cable retainer (2) to the brake back plate (1).

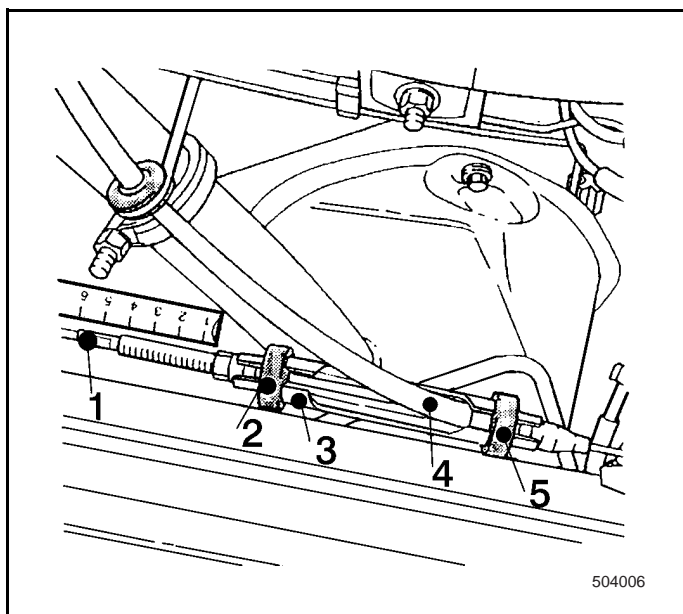




4. Insert rubber protective ring (5) into cable (4).
5. Connect short cable (1) and balancer (3).



6. Install long cable (5) to the connector (2). Insert retainer (1) into connector (2).



7. Install the brake assembly onto the rear axle, refer to Brake Drum Replacement.

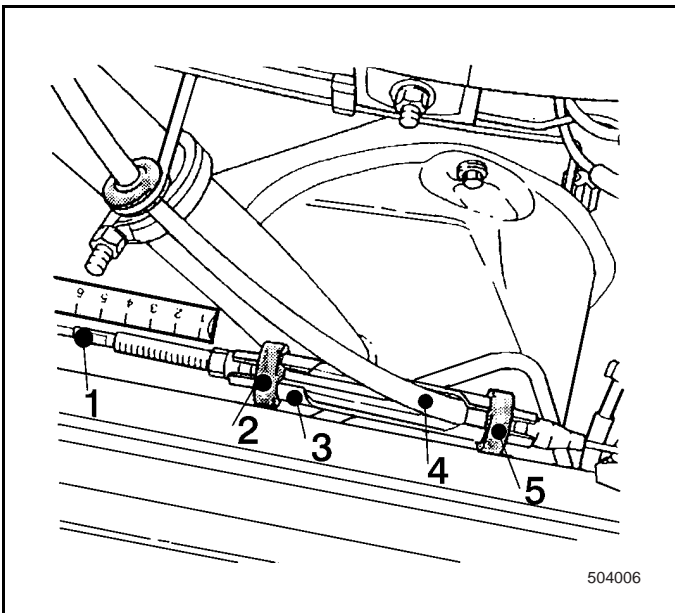
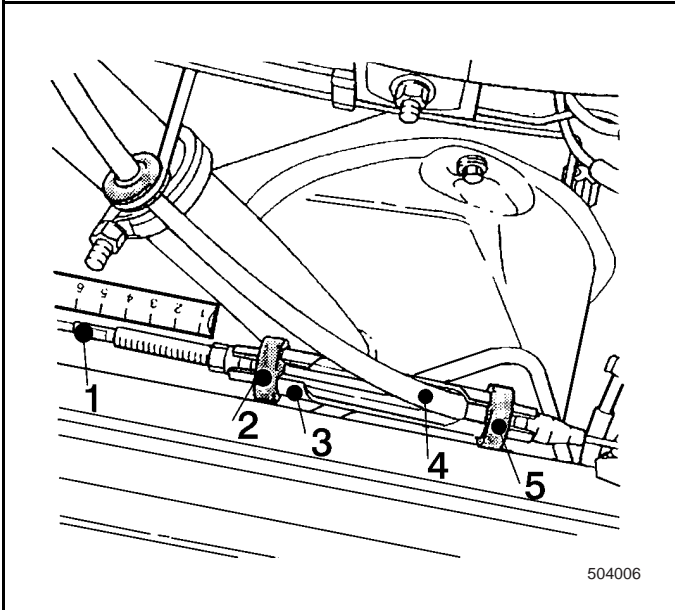
Adjustment

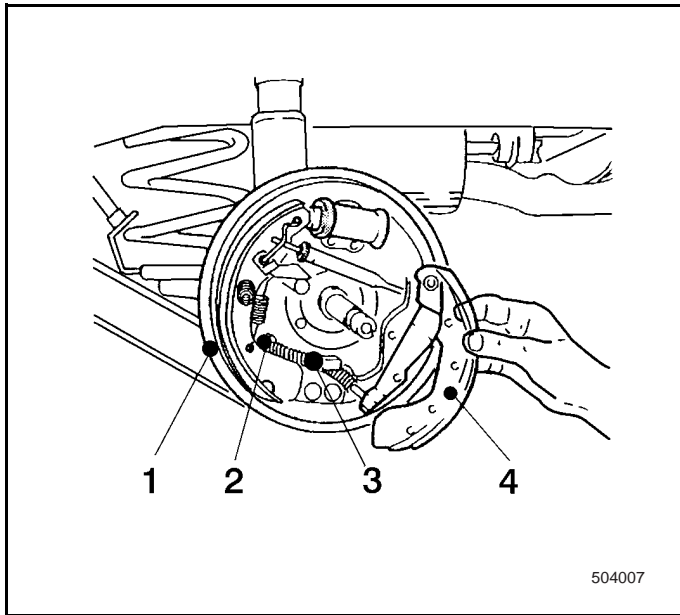
8. Adjust short cable (1) thread to the previously measured length.
9. Install rubber protective ring (2) (5) onto balancer (3).

5.4.2.3 Park Brake Right Cable Replacement/ Adjustment

Removal Procedure

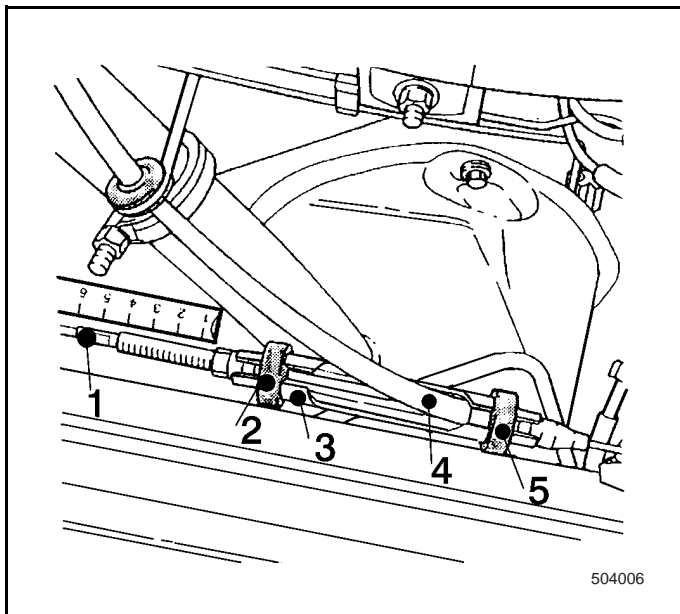
1. Measure the thread length of the short cable (1) near the balancer.
2. Pull out rubber protective ring (2).
3. Remove short cable (1) from the balancer (3).
4. Remove brake assembly from the rear axle, refer to Brake Drum Replacement.
5. Remove brake shoe lining (4) from brake back plate (1), refer to Brake Lining Replacement. Remove cable (3) from the brake shoe lining (4).
6. Remove the cable retainer (2) from the brake back plate (1).
7. Pull out cable (3) from the brake back plate (1).





Installation Procedure

1. Install cable (3) to the brake shoe lining (4) through brake back plate.
2. Install brake shoe lining (4) to brake back plate (1), refer to Brake Lining Replacement.
3. Install the cable retainer (2) to the brake back plate (1).
4. Install the brake assembly onto the rear axle, refer to Brake Drum Replacement.



5. Insert rubber protective ring (2) into cable (1). Install short cable (1) to the balancer (3).

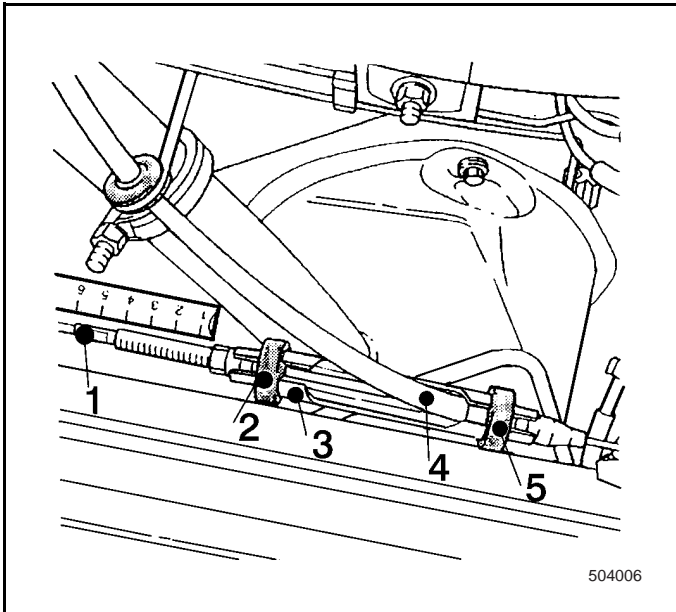
Adjustment

6. Adjust short cable (1) thread to the previously measured length.
7. Install rubber protective ring (2) to the balancer (3).

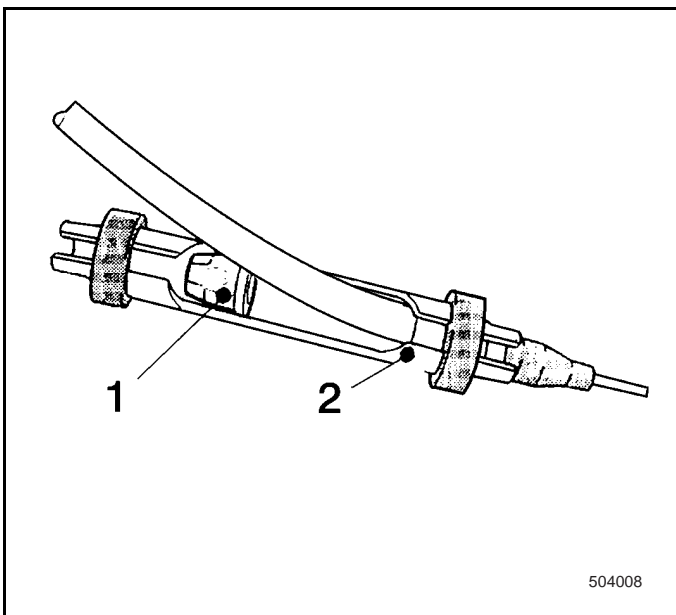
5.4.2.4 Park Brake Balancer Replacement

Removal Procedure

1. Measure the thread length of the short cable (1).
2. Remove short cable (1) from the balancer (3).
3. Remove rubber protective ring (2) (5) from balancer (3).
4. Remove long cable (4) from the balancer (3).

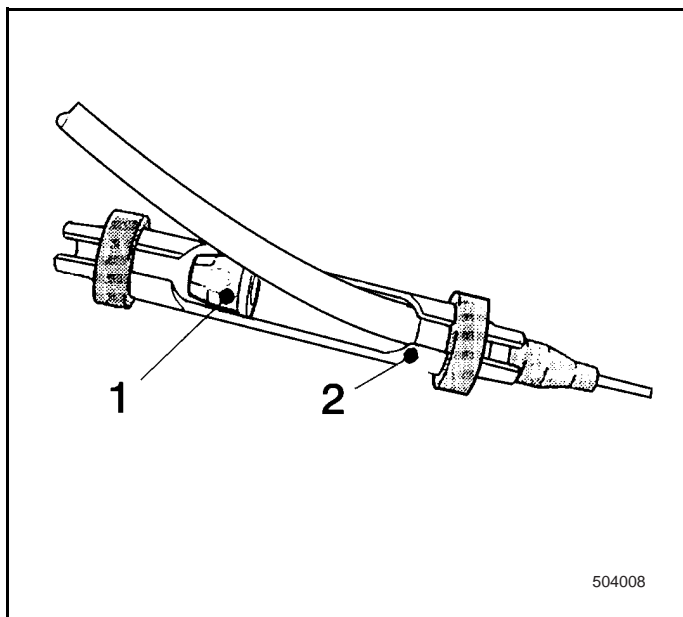


5. Take out nut (1) from the balancer (2).

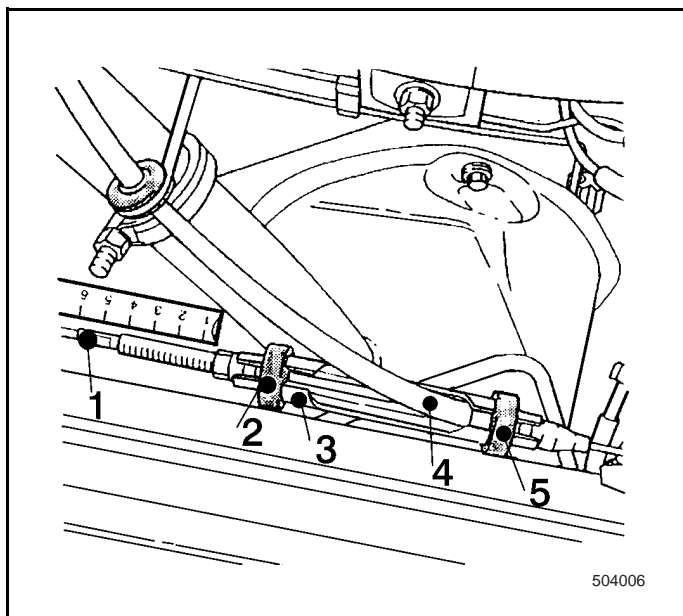


Installation Procedure

1. Install new nut (1) to the balancer (2).



2. Install long cable (4) to the balancer (3). Install rubber protective ring (5) to the balancer (4).
3. Connect short cable (1) and balancer (3).
4. Adjust short cable (1) thread to the previously measured length.
5. Install rubber protective ring (2) to the balancer (3).



5.5 Anti-lock brake system (if equipped)

5.5.1 Specification

5.5.1.1 Tightener Tightening Specifications

Application	Specification
Brake hard pipe fitting nut	16 N•m
caliper discharging valve and wheel brake cylinder discharging valve	6 N•m
brake hose caliper bolts	40 N•m
Front caliper speed sensor installation bolt	8 N•m
rear brake drum speed sensor installation bolt	4 N•m
ABS module bracket installation bolt	20 N•m
ABS module installation nut	10 N•m

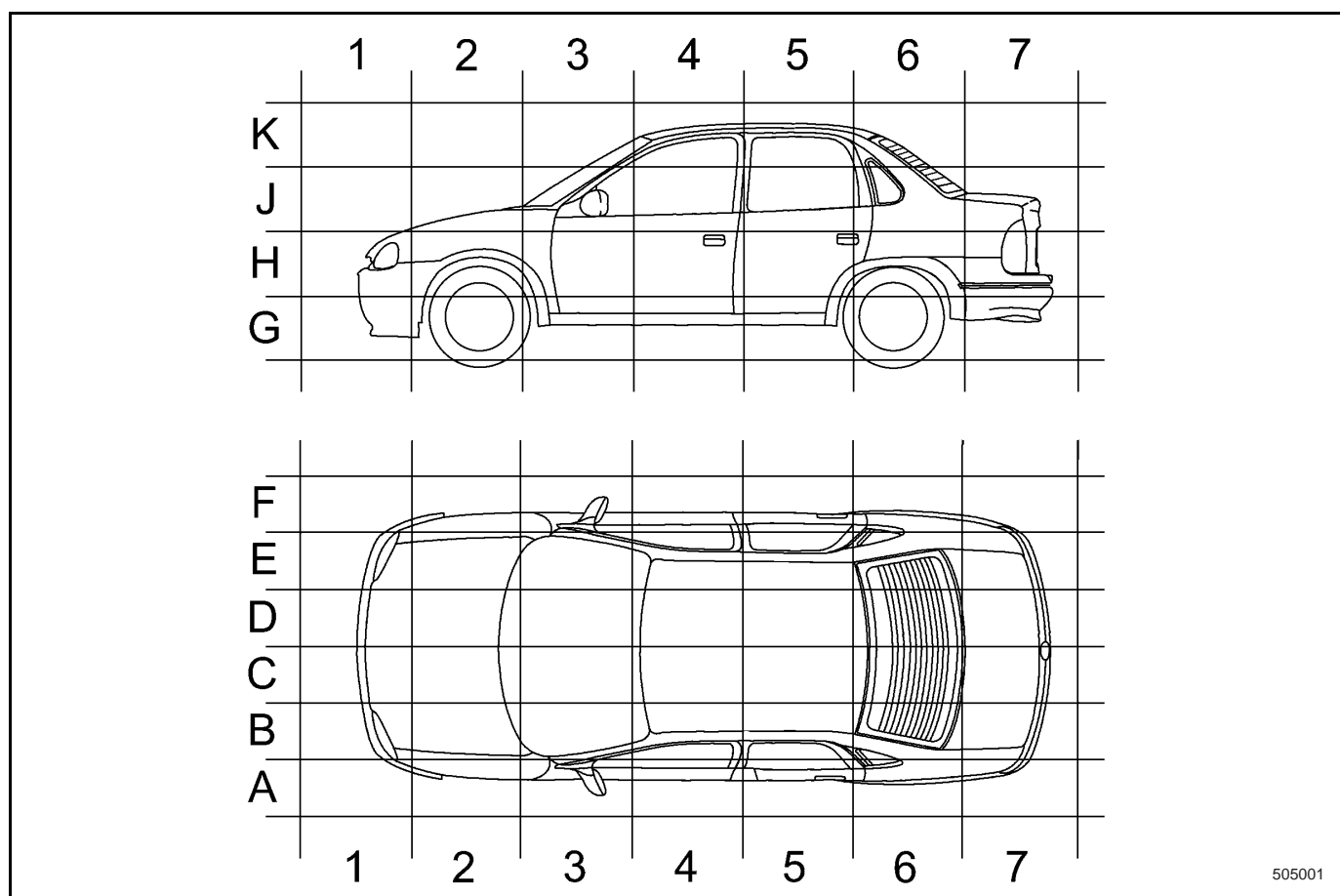
5.5.2 Schemes and Wiring Diagram

5.5.2.1 Anti-lock brake system wiring diagram

Refer to 8.20.2.18.

5.5.3 Component Location

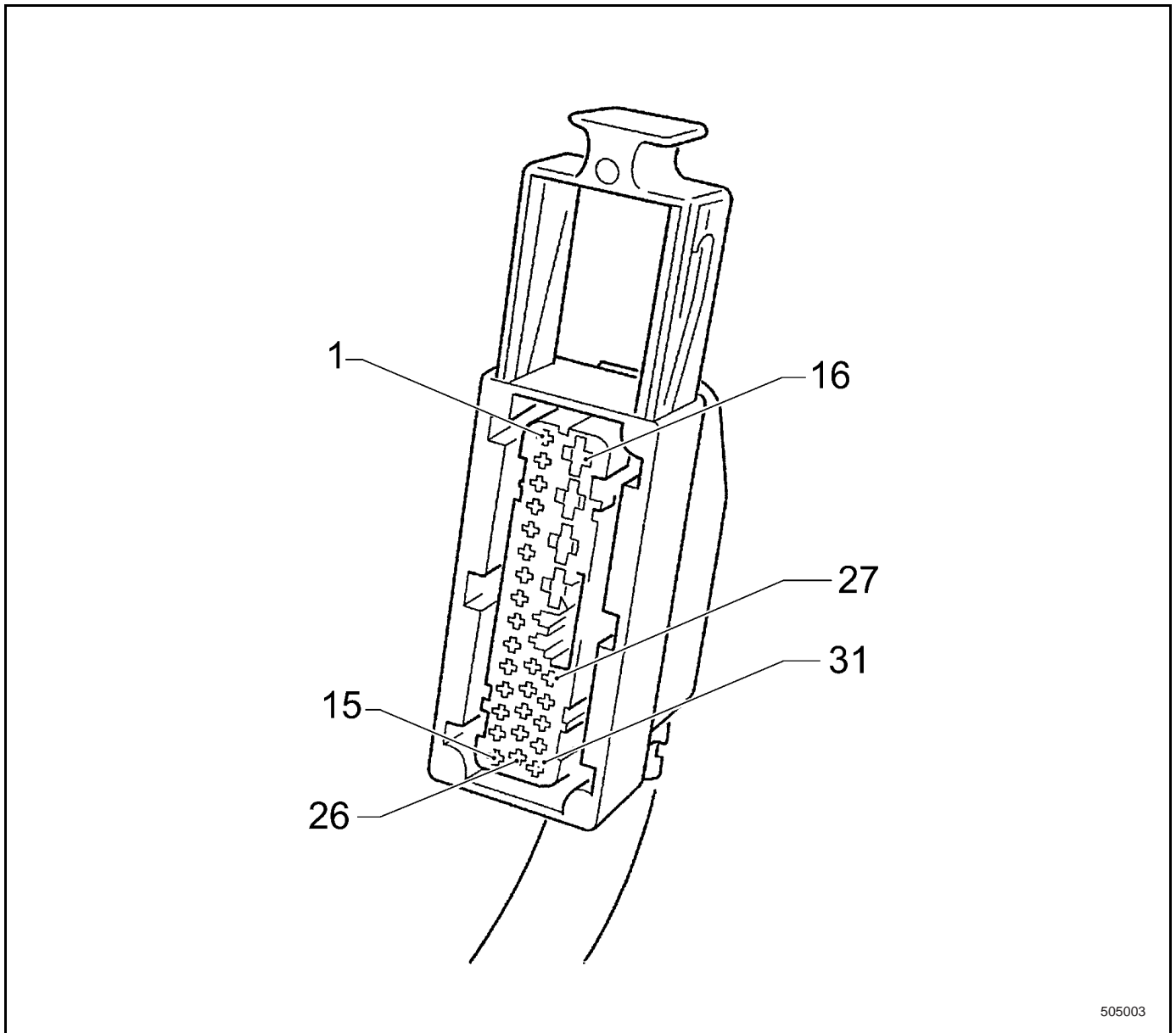
5.5.3.1 Component Location



505001

Component	section	Location
E14 lamp- passenger compartment	CD4K	sunshade panel
F1-F28 fuses	B3H	fuse box, passenger compartment
G1 battery	E2J	Engine compartment
G2 AC alternator	D2H	in Engine
H1 radio	C3H	between the bracket and instrument panel
H2 signal horn	B1H	on the cross member
H7 charging indicator	B3J	within instrument panel
H30 signal device- engine	B3J	within instrument panel
instrument	B3J	instrument panel
K31 control unit- SIR	C4H	right under the console, tail
U4 hydraulic integration assembly- anti-lock braking system	B2H	at ABS module
K 57 control unit- central lock controller	F3H	behind molding, foot space, side
K61 control unit- ignition module	C2H	in air inlet system
K117 Control unit- anti-theft control module	B3H	Under steering column cover plate
S1 switch- ignition switch	C3H	Steering column cover plate
S2 switch assembly- lamps	B3H	within instrument panel
P 17 sensor- speed, left front	A2G	Wheel suspension system, left front
P 18 sensor- speed, right front	F2G	Wheel suspension system, right front
P 19 sensor- speed, left rear	A6G	Wheel suspension system, left rear
P 20 sensor- speed, right rear	F6G	Wheel suspension system, right rear
S8 switch – brake lamp	B3H	above brake pedal
X13 diagnostic interface	B3H	fuse box, passenger compartment

5.5.3.2 Pin arrangement control unit wire connector, K50 Component View



505003

pin	Legend	pin	Legend
1	P 20 sensor- speed, right rear	11	X13 diagnostic interface
2	P 20 sensor- speed, right rear	14	S8 switch – brake lamp
3	P 18 sensor- speed, right front	15	Switch system voltage (pin15)
5	P 18 sensor- speed, right front	16	ground
6	P 17 sensor- speed, left front	17	system voltage (pin 30)
7	P 17 sensor- speed, left front	18	system voltage (pin 30)
8	P 19 sensor- speed, left rear	19	ground
9	P 19 sensor- speed, left rear	21	H26 Alarming lamp- anti-lock braking system

5.5.4 Diagnostic Information and Procedure

5.5.4.1 Overview

Diagnostic Information and Procedures refer to diagnosis to the following electronic system in Sail.

- Anti-lock brake system 5.3

Vehicle diagnostic principles:

The major purpose of the vehicle diagnostic principle is the identify and remove trouble in the vehicle as soon as possible. Thus the following principles are developed for technicians to find the trouble causes directly.

Firstly, vehicle has the following electronic systems, such as engine control system, SIR and ABS system.

Each of the electronic system consists of its functional sets, which are related with each other. For example, coolant temperature sensor circuit is such a functional set.

each functional set consists of several parts, such as switch, sensor, wire and so on. For example, the coolant temperature sensor circuit is made up of sensor, wire harness, control unit and control unit software.

According to the structure, each diagnostic step shall be able to find out troublesome electronic system, and then diagnose related functional set, and finally find out the troublesome parts and repair.

5.5.4.2 Safety measures

Overview

Caution:

- *Do not come into contact with high voltage components (such as ignition system, xenon lamps), otherwise, there may be life danger.*
- *When the engine is running, the fan may turn on automatically, there may be danger of hurt.*

Notice:

- Before charging or quick charging, disconnect the battery and vehicle electronic systems.
- Never start the vehicle with battery quick charger.
- Too high voltage in the circuit may damage the control unit.
- Never start the engine with battery disconnected.
- Never disconnect the battery from the vehicle circuit system when the engine is running.
- Use original aftersales parts (cable clip, retainer, wiring channel bracket and so on), Tighten the released or removed wirings and connecting channels to the previous positions.

- When temperature reaches above 80°C(176°F) (such as during painting operation), remove the control unit.

Wire harness

Caution:

Never serve the following pipelines/ systems.

- *shielding wire/ axial cable (such as ABS sensor harness)*
- *SIR*
- *electronic control throttle*
- *High voltage cables (ignition system, xenon lamps)*

Disconnect the grounding cable of battery when there is danger of short- circuit. This also adapts to welding operation to the vehicles.

Notice:

- To avoid damage to the control unit, never connect/ disconnect the control unit or other electrical part wiring harness connectors while turning on ignition.
- After finishing service, be sure the wire harness is correctly connected and the battery grounds well. Error in circuit connection may result in failure of functions, which may damage the control unit.
- Disconnect the ground and battery will result in loss of certain memory functions in these electronic systems (such as power window regulator, date and time). After the battery is re-connected, re-program the memories that are easily lost and decode the record devices.
- Do not pull the cables while disconnecting the wiring harness. Loose the locking devices of the wiring harness carefully.

Diagnosis

Caution: Use only diagnostic tester to test the SIR. To avoid accident, never use test lamp or DM to measure the SIR, or, danger of human hurt may occur.

Notice:

- Use only voltage tester with high resistance.
- If the harness plug pin must jump to avoid short-circuit, it is recommended that automatic fuses used during trouble shooting.

5.5.4.3 Specific Information of the Electronic System

DTC nature

Sometimes, the scan tool may display non-familiar DTC status or description.

DTC status:

You may read unfamiliar Unknown DTC rather than the familiar Current, historical (and intermittent) info. This shows that the diagnostic software or control unit has errors that the scan tool can not interpret or assess. Under these circumstances, DTC or DTC text will not change.

The special trouble mentioned above can not be eliminated with the scan tool.

5.5.4.4 Fuse Jump Rated Current

wire measuring gauge counts in unit of mm ²	fuse jump rated current counts in unit of A
0.5	5
0.75	7.5
1.0	10
1.5	15
2.5	25
4.0	30
6.0	30

Note: When the rated current of the fuses is similar, while shoot troubles with fuse jump (ground, short-circuited to voltage), automatic fuses may be used to replace the fuses.

5.5.4.5 Diagnostic Starting Point- Anti-lock Braking System

Refer to Diagnostic System Check- Anti-lock braking System to start system diagnosis. Diagnostic system check will provide the following information:

- Command the system to identify the control module
- capacity of the control module to communicate through serial data circuit
- identify the stored DTC and the status.

Use Diagnostic system check may identify correctly the system diagnostic procedure and position of the procedure.

5.5.4.6 Diagnostic System Check- Anti-lock Braking System

Diagnostic system check is a systematic way to identify troubles in ABS system. While shooting troubles in ABS system, it can guide the serviceman to carry out logical steps, therefore, it is the starting point for troubleshooting of ABS system.

Diagnostic aids

Service the ABS/EBD system according to the following steps. Otherwise, important diagnostic data may loss, which can result in difficulty in diagnosis and time-consuming.

1. Perform the following tests.
2. Perform road test according to guidance in the table.
 - Test the vehicle with quick test function of the scan tool.
 - Carry out normal acceleration, stop and steering operation.
 - If the trouble cannot occur again, perform ABS braking on road with low friction (such as gravel road).
3. Clear the DTC after all troubles in the system are removed.

Diagnostic System Check- Anti-lock Braking System

Step	Action	Value	Yes	No
1	1. Install the scan tool. 2. Ignition ON; 3. Select Data List Mode. Is the scan tool receiving data from EBCM?	—	Go to Step 2	Go to Step 6
2	Read the display. Any current DTC displayed?	—	Refer to relevant DTC table	Go to Step 3

Diagnostic System Check- Anti-lock Braking System (Cont' d)

Step	Action	Value	Yes	No
3	1. Turn ignition to LOCK position for 10 seconds. 2. Turn ignition On and observe the ABS indicator. Is the indicator on for 4 seconds and then off?	—	Go to Step 5	Go to Step 4
4	Observe ABS indicator. Is the ABS indicator ON continuously?	—	Go to ABS indicator always ON	Go to ABS indicator Inoperative
5	1. Turn ignition to LOCK position for 10 seconds. 2. Turn ignition On and observe the ABS/EBD indicator. Is the indicator on for 4 seconds and then off?	—	Go to Step 12	Go to Braking Alarm Indicator Inoperative in Hydraulic Brake
6	1. Turn ignition to LOCK position. 2. Disconnect electronic braking control module (EBCM) harness connector. 3. Ignition ON; 4. Use DVM to measure the voltage between the ground and terminal 15, 17 and 18 of the EBCM harness connector. Is the measured voltage within the specified value?	11-14V	Go to step 7	Go to No Communication with EBCM
7	1. Turn ignition to LOCK position. 2. Use DVM to measure the resistance between the ground and terminal 16, 19 of the EBCM harness connector. Is the resistance value equals to the specified value?	0 ohm	Go to Step 9	Go to Step 8
8	Repair open circuit trouble in the harness circuit. Is the trouble corrected?	—	System OK	—
9	Use DVM to measure the resistance between terminal 11 of the EBCM harness connector and terminal 12 of DLC. Is the resistance value less than the specified value?	2 ohm	Go to Step 10	Go to Step 11
10	Replace the ABS assembly. Is the trouble corrected?	—	System OK	—
11	Repair open circuit or high resistance between terminal 11 of the EBCM harness connector and terminal 12 of DLC. Is the trouble corrected?	—	Go to Step 1	—
12	Perform road test described in Diagnosis Procedure. Is there any DTC set?	—	Go to DTC list	—

Scan tool output control

Scan tool output control	Additional menu option	Description
automatic air discharging	—	to bleed hydraulic pressure in anti-lock braking system
left front solenoid test	solenoid test	Command the solenoid to turn on and off.
left rear solenoid test	solenoid test	Command the solenoid to turn on and off.
right front solenoid test	solenoid test	Command the solenoid to turn on and off.
right rear solenoid test	solenoid test	Command the solenoid to turn on and off.

5.5.4. Scan tool data list

EBCM scan tool data list contains all parameters related with ABS system to be used in the scan tool. Parameters in the list is in alphabetic order. Data List column refers to the position of the parameter in scan tool menu options.

According to requirements of the diagnostic table, use EBCM scan tool data list as the amendment to diagnostic procedures. Start all diagnostic procedures from ABS Diagnosis Starting Point. Use EBCM scan tool data list only when the following conditions are met.

- The published DTC procedure and symptoms fail to solve the customer's problems.
- or,
- DTC procedure and symptoms diagnostic procedures indicated in the system check fail to solve the customer's problems.

Typical data are obtained from normal vehicles driving under conditions specified in line 1 in Scan Tool Data List. Compare the values obtained from the troublesome vehicles with the typical data, you may find where the trouble is.

Identification number menu is displayed on main screen of the EBCM.

Scan tool parameter	data list	display unit	typical data
Ignition ON, engine OFF, vehicle stationary			
battery voltage	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	V	B+
brake lamp switch	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	apply / release	apply
left front wheel speed	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	mph, kph	0
left rear wheel speed	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	mph, kph	0
left front drum valve command	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	active/ inactive	inactive
left front drum valve feedback	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	active/ inactive	inactive
left front hold valve command	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	active/ inactive	inactive
left front hold valve feedback	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	active/ inactive	inactive
left rear drum valve command	<ul style="list-style-type: none"> • Anti-lock brake system data • towing control system data 	active/ inactive	inactive

Scan tool parameter	data list	display unit	typical data
left rear drum valve feedback	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
left rear hold valve command	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
left rear hold valve feedback	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
pump motor relay	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	ON/ OFF	OFF
right front wheel speed	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	mph, kph	0
right rear wheel speed	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	mph, kph	0
right front drum valve command	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
right front drum valve feedback	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
right front hold valve command	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
right front hold valve feedback	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
right rear drum valve command	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
right rear drum valve feedback	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
right rear hold valve command	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive

Scan tool parameter	data list	display unit	typical data
right rear hold valve feedback	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	active/ inactive	inactive
towing control system switch valve 1 status	towing control system data	active/ inactive	inactive
towing control system switch valve 2 status	towing control system data	active/ inactive	inactive
towing control system closing valve 1 status	towing control system data	active/ inactive	inactive
towing control system closing valve 2 status	towing control system data	active/ inactive	inactive
valve relay status	<ul style="list-style-type: none"> Anti-lock brake system data towing control system data 	ON/ OFF	OFF

5.5.4.8 Scan tool data definition

Data display function includes ABS and Towing Control System data parameter list. The following are brief descriptions to all ABS and Towing Control System data parameters displayed in scan tool. The list is in alphabetic order.

battery voltage

Scan tool display 0-30V. Measure the voltage between module battery positive voltage circuit and ground circuit.

brake lamp switch

Scan tool display applied or released- scan tool display status of the brake switch.

left front wheel speed

scan tool displays 0-255km/h (0-158m/h) – scan tool displays actual speed of the left front wheel.

left rear wheel speed

scan tool displays 0-255km/h (0-158m/h) – scan tool displays actual speed of the left rear wheel.

left front drum valve command

Scan tool display active or inactive- scan tool display status of the left front drum valve.

left front drum valve feedback

Scan tool display active or inactive- scan tool display actual status of the left front drum valve.

left front hold valve command

Scan tool display active or inactive- scan tool display status of the left front hold valve.

left front hold valve feedback

Scan tool display active or inactive- scan tool display actual status of the left front hold valve.

left rear hold valve command

Scan tool display active or inactive- scan tool display status of the left front hold valve.

left rear hold valve feedback

Scan tool display active or inactive- scan tool display actual status of the left front hold valve.

pump motor relay

Scan tool display ON or OFF- scan tool display the command status of the pump motor.

right front wheel speed

scan tool displays 0-255km/h (0-158m/h) – scan tool displays actual speed of the right front wheel.

right rear wheel speed

scan tool displays 0-255km/h (0-158m/h) – scan tool displays actual speed of the right rear wheel.

right front drum valve command

Scan tool display active or inactive- scan tool display status of the right front drum valve.

right front drum valve feedback

Scan tool display active or inactive- scan tool display actual status of the right front drum valve.

right front hold valve command

Scan tool display active or inactive- scan tool display status of the right front hold valve.

right front hold valve feedback

Scan tool display active or inactive- scan tool display actual status of the right front hold valve.

right rear hold valve command

Scan tool display active or inactive- scan tool display status of the right front hold valve.

right rear hold valve feedback

Scan tool display active or inactive- scan tool display actual status of the right front hold valve.

towing control system switch valve 1 status

Scan tool display active or inactive- scan tool display command status of the towing control system switch valve 1.

towing control system switch valve 2 status

Scan tool display active or inactive- scan tool display command status of the towing control system switch valve 2.

towing control system closing valve 1 status

Scan tool display active or inactive- scan tool display command status of the towing control system closing valve 1.

towing control system closing valve 2 status

Scan tool display active or inactive- scan tool display command status of the towing control system closing valve 2.

valve relay status

Scan tool display ON or OFF - scan tool display the command status of the display valve relay.

5.5.4.9 DTC list

DTC	Diagnostic Procedure	Module
C0035	DTC C0035	Electronic braking control module (EBCM)
C0040	DTC C0040	Electronic braking control module (EBCM)
C0045	DTC C0045	Electronic braking control module (EBCM)
C0050	DTC C0050	Electronic braking control module (EBCM)
C0060/C0065	DTC C0060/ C0065	Electronic braking control module (EBCM)
C0070/C0075	DTC C0070/ C0075	Electronic braking control module (EBCM)
C0080/C0085	DTC C0080/ C0085	Electronic braking control module (EBCM)
C0090/C0095	DTC C0090/ C0095	Electronic braking control module (EBCM)
C0110	DTC C0110	Electronic braking control module (EBCM)
C0121	DTC C0121	Electronic braking control module (EBCM)
C0141-C0156	DTC C0141/ C0156	Electronic braking control module (EBCM)
C0161	DTC C0161	Electronic braking control module (EBCM)
C0245	DTC C0245	Electronic braking control module (EBCM)
C0550	DTC C0550	Electronic braking control module (EBCM)
C0800	DTC C0800	Electronic braking control module (EBCM)

5.5.4.10 DTC C0035

circuit description

Gear rotor generates voltage pulse through sensor. Each tooth-gap-tooth in the gear will produce pulse. EBCM uses the pulse frequency to determine the wheel speed. The generated voltage depends on air gap between the sensor and gear rotor and the wheel speed.

The procedure checks the wheel speed sensor, ground or voltage short circuit, contact trouble of the connectors.

Conditions for DTC to set

- Trouble or disconnection of the wheel speed sensor.
- wire trouble.
- connector trouble.
- tooth ring trouble.
- wheel speed sensor installation error
- sensor signal error
- wheel speed sensor signal noise

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON. EBD activates. Refer to EBD failure matrix.

Diagnostic aids

Ensure correct and firm wiring of the speed sensor so as to avoid pseudo signal resulting from electrical disturbance.

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may result, even if the parts are replaced, the trouble will still occur.

Important: If wrong wheel speed sensor signal has been entered into EBCM, ABS alarm lamp will turn ON. Even if the error may be cleared away with scan tool, the ABS alarm indicator keeps ON. To turn it off, accelerate the vehicle speed to 12km/h.

Monitor wheel speed with scan tool during road test. Observe if there is abnormality in wheel speed displayed in the scan tool, such as one of the speed is different from that of the other three, signal fluctuates. If the method can not identify intermittent trouble, wet the speed sensor harness at the body bottom and perform road test, monitor wheel speed with scan tool.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. This step checks if there is trouble in wheel speed sensor.
6. The step test if there is voltage short circuit in wiring.
8. The step test if there is ground short circuit in wiring.
10. The step test if there is open circuit or high resistance in wiring.

DTC C0035, Left Front Wheel Speed Sensor Circuit Trouble

Step	Action	Value	Yes	No
1	Inspect the wheel speed sensor. Is there physical damage?	-	to step 3	to step 2
2	1. Turn ignition to LOCK position. 2. Disconnect the left front wheel speed sensor connector. 3. Measure the resistance between the terminals of the sensor with DVM. Is the measured resistance value within the specified range of about 25°C(77°F)?	0.5-3kohm	to step 4	to step 3
3	Replace the wheel speed sensor. Is the trouble corrected?	—	system OK	—
4	1. Switch the DVM to AC mv dial. 2. Raise the vehicle with jack, slowly rotate the front left wheel to measure the voltage between the terminals of the wheel speed sensor. Is the output within the specified range?	>0.1V	to step 6	to step 5
5	Replace the speed sensor or gear rotor. Is the trouble corrected?	—	system OK	—

DTC C0035, Left Front Wheel Speed Sensor Circuit Trouble (Cont' d)

Step	Action	Value	Yes	No
6	1. Disconnect electronic braking control module (EBCM) harness. 2. Connect the DVM between ground and one of the terminals of the wheel speed sensor connector. 3. Ignition ON; 4. For other terminals of the wheel speed sensor, repeat step 1- 3. Are voltage values of the terminals less than the specified value?	0.3V	to step 7	to step 8
7	Repair voltage short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
8	1. Turn ignition to LOCK position. 2. Measure the resistance at terminal 6 of the electronic braking control module (EBCM) harness connector. 3. Measure the resistance at terminal 7 of the electronic braking control module (EBCM) harness connector. Any of the two resistance values less than the specified value?	∞	to step 9	to step 10
9	Repair ground short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
10	1. Measure the resistance between EBCM harness connector terminal 6 and wheel speed sensor harness connector terminal. 2. Measure the resistance between EBCM harness connector terminal 7 and wheel speed sensor harness connector terminal. Any of the two resistance values higher than the specified value?	5ohm	to step 11	to step 12
11	Repair open circuit or high resistance in related circuits if necessary. Is the trouble corrected?	—	system OK	—
12	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.11 DTC C0040

circuit description

Gear rotor generates voltage pulse through sensor. Each tooth-gap-tooth in the gear will produce pulse. EBCM uses the pulse frequency to determine the wheel speed. The generated voltage depends on air gap between the sensor and gear rotor and the wheel speed.

The procedure checks the wheel speed sensor, ground or voltage short circuit, contact trouble of the connectors.

Conditions for DTC to set

- Trouble or disconnection of the wheel speed sensor.
- wire trouble.
- connector trouble.
- tooth ring trouble.
- wheel speed sensor installation error
- sensor signal error
- wheel speed sensor signal noise

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON. EBD activates. Refer to EBD failure matrix.

Diagnostic aids

Ensure correct and firm wiring of the speed sensor so as to avoid pseudo signal resulting from electrical disturbance.

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may result, even if the parts are replaced, the trouble will still occur.

Important: If wrong wheel speed sensor signal has been entered into EBCM, ABS alarm lamp will turn ON. Even if the error may be cleared away with scan tool, the ABS alarm indicator keeps ON. To turn it off, accelerate the vehicle speed to 12km/h.

Monitor wheel speed with scan tool during road test. Observe if there is abnormality in wheel speed displayed in the scan tool, such as one of the speed is different from that of the other three, signal fluctuates. If the method can not identify intermittent trouble, wet the speed sensor harness at the body bottom and perform road test, monitor wheel speed with scan tool.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. This step checks if there is trouble in wheel speed sensor.
6. The step test if there is voltage short circuit in wiring.
8. The step test if there is ground short circuit in wiring.
10. The step test if there is open circuit or high resistance in wiring.

DTC C0040, Right Front Wheel Speed Sensor Circuit Trouble

Step	Action	Value	Yes	No
1	Inspect the wheel speed sensor. Is there physical damage?	—	to step 3	to step 2
2	1. Turn ignition to LOCK position. 2. Disconnect the right front wheel speed sensor connector. 3. Measure the resistance between the terminals of the sensor with DVM. Is the resistance value within the specified range of about 25°C(77°F)?	0.5-3kohm	to step 4	to step 3
3	Replace the wheel speed sensor. Is the trouble corrected?	—	system OK	—
4	1. Switch the DVM to AC mv dial. 2. Raise the vehicle with jack, slowly rotate the front right wheel to measure the voltage between the terminals of the wheel speed sensor. Is the output within the specified range?	>0.1V	to step 6	to step 5
5	Replace the speed sensor or gear rotor. Is the trouble corrected?	—	system OK	—

DTC C0040, Right Front Wheel Speed Sensor Circuit Trouble (Cont' d)

Step	Action	Value	Yes	No
6	1. Disconnect electronic braking control module (EBCM) harness. 2. Connect the DVM between ground and one of the terminals of the wheel speed sensor connector. 3. Ignition ON; 4. For other terminals of the wheel speed sensor, repeat step 1- 3. Are voltage values of the terminals less than the specified value?	0.3V	to step 7	to step 8
7	Repair voltage short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
8	1. Turn ignition to LOCK position. 2. Measure the resistance at terminal 3 of the electronic braking control module (EBCM) harness connector. 3. Measure the resistance at terminal 5 of the electronic braking control module (EBCM) harness connector. Any of the two resistance values less than the specified value?	—	to step 9	to step 10
9	Repair ground short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
10	1. Measure the resistance between EBCM harness connector terminal 3 and wheel speed sensor harness connector terminal. 2. Measure the resistance between EBCM harness connector terminal 5 and wheel speed sensor harness connector terminal. Any of the two resistance values higher than the specified value?	5ohm	to step 11	to step 12
11	Repair open circuit or high resistance in related circuits if necessary. Is the trouble corrected?	—	system OK	—
12	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.12 DTC C0045

circuit description

Gear rotor generates voltage pulse through sensor. Each tooth-gap-tooth in the gear will produce pulse. EBCM uses the pulse frequency to determine the wheel speed. The generated voltage depends on air gap between the sensor and gear rotor and the wheel speed.

The procedure checks the wheel speed sensor, ground or voltage short circuit, contact trouble of the connectors.

Conditions for DTC to set

- Trouble or disconnection of the wheel speed sensor.
- wire trouble.
- connector trouble.
- tooth ring trouble.
- wheel speed sensor installation error
- sensor signal error
- wheel speed sensor signal noise

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON. EBD activates. Refer to EBD failure matrix.

Diagnostic aids

Ensure correct and firm wiring of the speed sensor so as to avoid pseudo signal resulting from electrical disturbance.

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may result, even if the parts are replaced, the trouble will still occur.

Important: If wrong wheel speed sensor signal has been entered into EBCM, ABS alarm lamp will turn ON. Even if the error may be cleared away with scan tool, the ABS alarm indicator keeps ON. To turn it off, accelerate the vehicle speed to 12km/h.

Monitor wheel speed with scan tool during road test. Observe if there is abnormality in wheel speed displayed in the scan tool, such as one of the speed is different from that of the other three, signal fluctuates. If the method can not identify intermittent trouble, wet the speed sensor harness at the body bottom and perform road test, monitor wheel speed with scan tool.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. This step checks if there is trouble in wheel speed sensor.
6. The step test if there is voltage short circuit in wiring.
8. The step test if there is ground short circuit in wiring.
10. The step test if there is open circuit or high resistance in wiring.

DTC C0045, Left Rear Wheel Speed Sensor Circuit Trouble

Step	Action	Value	Yes	No
1	Inspect the wheel speed sensor. Is there physical damage?	—	to step 3	to step 2
2	1. Turn ignition to LOCK position. 2. Disconnect the left rear wheel speed sensor connector. 3. Measure the resistance between the terminals of the sensor with DVM. Is the resistance value within the specified range of about 25°C(77°F)?	0.5-3 kohm	to step 4	to step 3
3	Replace the wheel speed sensor. Is the trouble corrected?	—	system OK	—
4	1. Switch the DVM to AC mv dial. 2. Raise the vehicle with jack, slowly rotate the front right wheel to measure the voltage between the terminals of the wheel speed sensor. Is the output within the specified range?	>0.1V	to step 6	to step 5
5	Replace the speed sensor or gear rotor. Is the trouble corrected?	—	system OK	—

DTC C0045, Left Rear Wheel Speed Sensor Circuit Trouble (Cont' d)

Step	Action	Value	Yes	No
6	1. Disconnect electronic braking control module (EBCM) harness. 2. Connect the DVM between ground and one of the terminals of the wheel speed sensor connector. 3. Ignition ON; 4. For other terminals of the wheel speed sensor, repeat step 1- 3. Are voltage values of the terminals less than the specified value?	0.3V	to step 7	to step 8
7	Repair voltage short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
8	1. Turn ignition to LOCK position. 2. Measure the resistance at terminal 8 of the electronic braking control module (EBCM) harness connector. 3. Measure the resistance at terminal 9 of the electronic braking control module (EBCM) harness connector. Any of the two resistance values less than the specified value?	—	to step 9	to step 10
9	Repair ground short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
10	1. Measure the resistance between EBCM harness connector terminal 8 and wheel speed sensor harness connector terminal. 2. Measure the resistance between EBCM harness connector terminal 9 and wheel speed sensor harness connector terminal. Any of the two resistance values higher than the specified value?	5 ohm	to step 11	to step 12
11	Repair open circuit or high resistance in related circuits if necessary.	—	system OK	—
12	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.13 DTC C0050

circuit description

Gear rotor generates voltage pulse through sensor. Each tooth-gap-tooth in the gear will produce pulse. EBCM uses the pulse frequency to determine the wheel speed. The generated voltage depends on air gap between the sensor and gear rotor and the wheel speed.

The procedure checks the wheel speed sensor, ground or voltage short circuit, contact trouble of the connectors.

Conditions for DTC to set

- Trouble or disconnection of the wheel speed sensor.
- wire trouble.
- connector trouble.
- tooth ring trouble.
- wheel speed sensor installation error
- sensor signal error
- wheel speed sensor signal noise

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON. EBD activates. Refer to EBD failure matrix.

Diagnostic aids

Ensure correct and firm wiring of the speed sensor so as to avoid pseudo signal resulting from electrical disturbance.

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may result, even if the parts are replaced, the trouble will still occur.

Important: If wrong wheel speed sensor signal has been entered into EBCM, ABS alarm lamp will turn ON. Even if the error may be cleared away with scan tool, the ABS alarm indicator keeps ON. To turn it off, accelerate the vehicle speed to 12km/h.

Monitor wheel speed with scan tool during road test. Observe if there is abnormality in wheel speed displayed in the scan tool, such as one of the speed is different from that of the other three, signal fluctuates. If the method can not identify intermittent trouble, wet the speed sensor harness at the body bottom and perform road test, monitor wheel speed with scan tool.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. This step checks if there is trouble in wheel speed sensor.
6. The step test if there is voltage short circuit in wiring.
8. The step test if there is ground short circuit in wiring.
10. The step test if there is open circuit or high resistance in wiring.

DTC C0050, Right Rear Wheel Speed Sensor Circuit Trouble

Step	Action	Value	Yes	No
1	Inspect the wheel speed sensor. Is there physical damage?	—	to step 3	to step 2
2	1. Turn ignition to LOCK position. 2. Disconnect the right rear wheel speed sensor connector. 3. Measure the resistance between the terminals of the sensor with DVM. Is the resistance value within the specified range of about 25°C(77°F)?	0.5-3 kohm	to step 4	to step 3
3	Replace the wheel speed sensor. Is the trouble corrected?	—	system OK	—
4	1. Switch the DVM to AC mv dial. 2. Raise the vehicle with jack, slowly rotate the front right wheel to measure the voltage between the terminals of the wheel speed sensor. Is the output within the specified range?	>0.1V	to step 6	to step 5
5	Replace the speed sensor or gear rotor. Is the trouble corrected?	—	system OK	—

DTC C0050, Right Rear Wheel Speed Sensor Circuit Trouble (Cont' d)

Step	Action	Value	Yes	No
6	1. Disconnect electronic braking control module (EBCM) harness. 2. Connect the DVM between ground and one of the terminals of the wheel speed sensor connector. 3. Ignition ON; 4. For other terminals of the wheel speed sensor, repeat step 1- 3. Are voltage values of the terminals less than the specified value?	0.3V	to step 7	to step 8
7	Repair voltage short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
8	1. Turn ignition to LOCK position. 2. Measure the resistance at terminal 1 of the electronic braking control module (EBCM) harness connector. 3. Measure the resistance at terminal 2 of the electronic braking control module (EBCM) harness connector. Any of the two resistance values less than the specified value?	∞	to step 9	to step 10
9	Repair ground short circuit of the related circuits. Is the trouble corrected?	—	system OK	—
10	1. Measure the resistance between EBCM harness connector terminal 1 and wheel speed sensor harness connector terminal. 2. Measure the resistance between EBCM harness connector terminal 2 and wheel speed sensor harness connector terminal. Any of the two resistance values higher than the specified value?	5 ohm	to step 11	to step 12
11	Repair open circuit or high resistance in related circuits if necessary.	—	system OK	—
12	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.14 DTC C0060/ C0065

circuit description

When the solenoid relay is powered on, battery provides power to the solenoid coil circuit. Electronic braking control module (EBCM) provides intermittent ground for each coil.

The procedure checks the function of the left front inlet and outlet valve.

Conditions for DTC to set

- solenoid trouble.
- solenoid coil open or short circuited.

Actions to take after DTC sets

Disable ABS operation and ABS alarm indicator turns ON during the remained time of the ignition cycle. EBD is deactivated. If the trouble is intermittent, EBCM will activate the system in the next ignition cycle and set the historical DTCs.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. The step test inlet valve.
3. The step test outlet valve.

DTC C0060/0065, Left Front Solenoid Circuit Trouble

Step	Action	Yes	No
1	1. Adequately raise the vehicle at the test site. 2. Ignition ON; 3. Install scan tool to DLC, select WHEEL FRONT LEFT, start test to the solenoid in the wheel. It will test inlet and outlet valve. 4. When the scan tool displays PRESSURE HOLD, step down the brake pedal until the test ends. 5. Ask an assistant to rotate the wheel. Can the wheel rotate?	to step 2	to step 6
2	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE INCREASE, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 6	to step 3
3	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE RELEASE ON, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 4	to step 6
4	1. When the scan tool displays PRESSURE RELEASE OFF, relieve pressure of the brake pedal. 2. Clear all DTCs. 3. Road test the vehicle. Is there any DTC set?	to step 6	to step 5
5	1. Inspect if there is intermittent trouble in wiring and connector terminals. 2. Correct the found troubles. Have you found troubles and have them corrected?	system OK	—
6	Replace the ABS assembly. Is the trouble corrected?	system OK	—

5.5.4.15 DTC C0070/ C0075

circuit description

When the solenoid relay is powered on, battery provides power to the solenoid coil circuit. Electronic braking control module (EBCM) provides intermittent ground for each coil.

The procedure checks the function of the right front inlet and outlet valve.

Conditions for DTC to set

- valve trouble.
- solenoid coil open or short circuited.

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON during the remained time of the ignition cycle. EBD is deactivated. If the trouble is intermittent, EBCM will activate the system in the next ignition cycle and set the historical DTCs.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. The step test inlet valve.
3. The step test outlet valve.

DTC C0070/0075, Right Front Solenoid Circuit Trouble

step	action	yes	no
1	1. Adequately raise and support the vehicle at the test site. 2. Ignition ON; 3. Install scan tool to DLC, select WHEEL FRONT RIGHT, start test to the solenoid in the wheel. It will test inlet and outlet valve. 4. When the scan tool displays PRESSURE HOLD, step down the brake pedal until the test ends. 5. Ask an assistant to rotate the wheel. Can the wheel rotate?	to step 2	to step 6
2	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE INCREASE, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 6	to step 3
3	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE RELEASE ON, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 4	to step 6
4	1. When the scan tool displays PRESSURE RELEASE OFF, relieve pressure of the brake pedal. 2. Clear all DTCs. 3. Road test the vehicle. Is there any DTC set?	to step 6	to step 5
5	1. Inspect if there is intermittent trouble in wiring and connector terminals. 2. Correct the found troubles. Have you found troubles and have them corrected?	system OK	—
6	Replace the ABS assembly. Is the trouble corrected?	system OK	—

5.5.4.16 DTC C0080/ C0085

circuit description

When the solenoid relay is powered on, battery provides power to the solenoid coil circuit. Electronic braking control module (EBCM) provides intermittent ground for each coil.

The procedure checks the function of the left rear inlet and outlet valve.

Conditions for DTC to set

- valve trouble.
- solenoid coil open or short circuited.

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON during the remained time of the ignition cycle. EBD is deactivated. If the trouble is intermittent, EBCM will activate the system in the next ignition cycle and set the historical DTCs.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. The step test inlet valve.
3. The step test outlet valve.

DTC C0080/0085, Left Rear Solenoid Circuit Trouble

Step	Action	Yes	No
1	1. Adequately raise and support the vehicle at the test site. 2. Ignition ON; 3. Install scan tool to DLC, select WHEEL REAR LEFT, start test to the solenoid in the wheel. It will test inlet and outlet valve. 4. When the scan tool displays PRESSURE HOLD, step down the brake pedal until the test ends. 5. Ask an assistant to rotate the wheel. Can the wheel rotate?	to step 2	to step 6
2	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE INCREASE, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 6	to step 3
3	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE RELEASE ON, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 4	to step 6
4	1. When the scan tool displays PRESSURE RELEASE OFF, relieve pressure of the brake pedal. 2. Clear all DTCs. 3. Road test the vehicle. Is there any DTC set?	to step 6	to step 5
5	1. Inspect if there is intermittent trouble in wiring and connector terminals. 2. Correct the found troubles. Have you found troubles and have them corrected?	system OK	—
6	Replace the ABS assembly. Is the trouble corrected?	system OK	—

5.5.4.17 DTC C0090/ C0095

circuit description

When the solenoid relay is powered on, battery provides power to the solenoid coil circuit. Electronic braking control module (EBCM) provides intermittent ground for each coil.

The procedure checks the function of the right rear inlet and outlet valve.

Conditions for DTC to set

- valve trouble.
- solenoid coil open or short circuited.

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON during the remained time of the ignition cycle. EBD is deactivated. If the trouble is intermittent, EBCM will activate the system in the next ignition cycle and set the historical DTCs.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. The step test inlet valve.
3. The step test outlet valve.

DTC C0090/0095, Right Rear Solenoid Circuit Trouble

Step	Action	Yes	No
1	1. Adequately raise and support the vehicle at the test site. 2. Ignition ON; 3. Install scan tool to DLC, select WHEEL REAR RIGHT, start test to the solenoid in the wheel. It will test inlet and outlet valve. 4. When the scan tool displays PRESSURE HOLD, step down the brake pedal until the test ends. 5. Ask an assistant to rotate the wheel. Can the wheel rotate?	to step 2	to step 6
2	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE INCREASE, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 6	to step 3
3	1. Keep the pressure on the brake pedal. 2. When the scan tool displays PRESSURE RELEASE ON, ask the assistant to try to rotate the wheel again. Can the wheel rotate?	to step 4	to step 6
4	1. When the scan tool displays PRESSURE RELEASE OFF, relieve pressure of the brake pedal. 2. Clear all DTCs. 3. Road test the vehicle. Is there any DTC set?	to step 6	to step 5
5	1. Inspect if there is intermittent trouble in wiring and connector terminals. 2. Correct the found troubles. Have you found troubles and have them corrected?	system OK	—
6	Replace the ABS assembly. Is the trouble corrected?	system OK	—

5.5.4.18 DTC C0110

circuit description

When EBCM ground the pump motor relay, if the valve relay closes, pump motor relay closes and provides battery voltage to the pump motor. EBCM confirms the running of the motor through sensing of the applied voltage to the pump motor.

When EBCM detects B+, but motor relay is not activated, or when the motor relay is activated but the EBCM does not detect B+, the DTC sets.

Conditions for DTC to set

- pump motor connector terminal trouble.
- Electronic braking control module (EBCM) connector terminal trouble.
- Anti-lock brake system harness trouble.
- Chassis ground resistance too high.
- Electronic braking control module (EBCM) trouble.

- pump motor connector to motor wiring trouble.

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON. EBD is deactivated.

Diagnostic aids

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may occur, even if the parts are replaced, re-occurrence of the trouble cannot be avoided.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. The step checks if there is damage to the connectors
3. The step checks if there ground connection is poor.
7. This step checks if there is trouble in ABS motor connectors.

DTC C0110 Pump Motor Circuit Trouble

step	action	Value	yes	no
1	1. Disconnect electronic braking control module (EBCM) connector. 2. Check harness connector terminal 16 and EBCM connector terminal 16. Is there damage or corrosion to the terminal?	—	to step 2	to step 3
2	Repair or replace terminal, connector, harness or EBCM if necessary. Is the trouble corrected?	—	system OK	—
3	Measure the resistance between harness connector terminal 16 and chassis reliable ground. Is the resistance value equals to the specified value?	0ohm	to step 7	to step 4
4	Measure the resistance of the chassis ground terminals. Is the resistance value equals to the specified value?	0ohm	to step 6	to step 5
5	Repair the chassis ground terminals. Is the trouble corrected?	—	system OK	—
6	Repair open circuit or high resistance between connector terminal 16 and ground terminal, or replace ABS harness. Is the trouble corrected?	—	system OK	—
7	1. Remove the ABS assembly from the vehicle. 2. Disconnect connectors and inspect the terminals. Is there damage or corrosion that results in poor connection in grounding?	—	to step 8	to step 9
8	Repair troublesome terminals, connectors and ABS when necessary. Is the trouble corrected?	—	system OK	—
9	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.19 DTC C0121

circuit description

When ABS activates, valve relay provides voltage to activate the solenoid. Except ABS control module provides ground for each solenoid coil, solenoid does not use the voltage.

If solenoid relay voltage is too low, or when ABS control module requires no voltage, relay power supply voltage is 12V, DTC C0121 sets. If the ABS control module detects three or more solenoid circuit open circuit or short circuit during the self-diagnosing period, the DTC will also set.

The procedure checks if EBCM connection is poor in grounding.

Conditions for DTC to set

- Connector terminal corrosive.
- harness damaged
- ground terminal power irregular.
- Electronic braking control module (EBCM) trouble.

Actions to take when DTC sets

Disable ABS/ EBD operation and ABS/EBD alarm indicator turns ON during the remained time of the ignition cycle. If the trouble is intermittent, EBCM will activate the system in the next ignition cycle and set DTC C0121.

Diagnostic aids

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may occur, even if the parts are replaced, re-occurrence of the trouble cannot be avoided.

DTC C0121 Valve Relay Circuit Trouble

Step	Action	Value	Yes	No
1	1. Clear away all DTCs with scan tool. 2. Road test the vehicle. Is DTC C0121 set again?	—	to step 3	to step 2
2	1. Inspect all system harness connector and terminal, especially the EBCM, to see if there problems inducing intermittent troubles. 2. Correct the found intermittent troubles. Is the trouble corrected?	—	system OK	—
3	1. Disconnect ABS harness connector from EBCM. 2. Check harness connector terminal 19 and EBCM connector terminal 19. Is there damage or corrosion to terminal 19?	—	to step 4	to step 5
4	Repair terminal and connector, or replace ABS harness or ABS system if necessary. Is the trouble corrected?	—	system OK	—
5	Measure the resistance between harness connector terminal 19 and chassis reliable ground. Is the resistance value equals to the specified value?	0ohm	to step 6	to step 7
6	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—
7	Measure the resistance between harness connector terminal 19 and chassis reliable ground. Is the resistance value equals to the specified value?	0ohm	to step 8	to step 9
8	Repair the chassis ground terminals. Is the trouble corrected?	—	system OK	—
9	Repair ABS harness open circuit or high resistance, replace the harness if necessary. Is the trouble corrected?	—	system OK	—

5.5.4.20 DTC C0141 - C0156

circuit description

When ignition switch is powered on, battery provides power to the isolation valve and master solenoid circuit. EBCM controls the function of the valve through circuit ground if necessary.

Conditions for DTC to set

- Ignition ON.
- After system is initialized, DTC sets.

Conditions for DTC to set

When EBCM detects one of the following troubles in the EBCM, DTC sets.

- solenoid coil or circuit open.
- solenoid coil or circuit short circuited to ground.
- solenoid coil or circuit short circuited to voltage.

Actions to take when DTC sets

The following actions will be taken (if equipped):

- During the ignition cycle, EBCM disables ABS/ Towing control system.

- DTC sets.
- Towing control system alarm indicator turns ON.
- Red BRAKE alarm indicator turns ON.
- ABS indicator may also turn ON.

Conditions to clear away DTC

- When conditions for the DTC to set no longer exists, use scan tool to clear the DTC.
- Scan tool does not detect DTC for 100 consecutive ignition cycles.

Diagnostic aids

Solenoid circuit and solenoid coil is inside EBCM. Any part of the solenoid circuit cannot be diagnosed outside EBCM. For EBCM, solenoid circuit will set DTC only when inner function fails.

Test description

The following number refers to the number of procedures in the diagnostic table.

2. This step determines if the DTC is the current one.

DTC C0141-C0156 Towing Control Circuit Trouble

Step	Action	Yes	No
Refer to illustration: Anti-lock brake system illustration diagram Refer to connector end view: ABS connector end view			
1	Have you conducted variable action force steering diagnostic system inspection ?	to step 2	To Diagnostic System Check- Anti-lock Braking System
2	1. Clear away all DTCs with scan tool. 2. Remove scan tool from DLC. 3. Drive the vehicle for several minutes carefully when the speed is higher than 12km/h (8m/h). 4. Ignition OFF. 5. Install the scan tool. 6. Engine OFF, ignition ON. 7. Use scan tool to check if there is DTC. Is any of the DTCs from C0141- C0151 re-set as the current DTC?	to step 3	to Diagnostic Aids
3	Replace the electronic braking control module (EBCM). Refer to Brake. Refer to Replacement of Brake Regulator Assembly. Is the trouble corrected?	to step 4	—
4	1. Clear away all DTCs with scan tool. 2. Operate the vehicle under conditions when DTC runs as specified in supporting documents. Is there any DTC set again?	to step 2	system OK

5.5.4.21 DTC C0161

circuit description

When brake pedal is stepped down, brake lamp switch closes to turn on the brake lamp. Additionally, battery voltage is applied to terminal 14 of EBCM to signal the ABS control unit to step down brake pedal and to apply the ABS to activate. Otherwise, wheel speed sensor signals to require the ABS system to activate is false. When the brake pedal is not pressed down, EBCM terminal 14 grounds through brake lamp.

This procedure checks the brake lamp switch to see if there is no output or the output is constant, and to determine the trouble is in switch or circuit.

Conditions for DTC to set

- EBCM ground connection or positive end trouble.
- Vehicle wiring open circuited, short circuited to ground or the positive end.
- brake lamp switch trouble.

Actions to take when DTC sets

The system records DTC C0161.ABS/ EBD operation activate and ABS/EBD alarm indicator does not turn ON.

Diagnostic aids

Inspect the wiring and connectors carefully and thoroughly. Otherwise, error diagnosis may occur, even if the parts are replaced, re-occurrence of the trouble cannot be avoided.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. The simple test will isolate troubles in fuse-brake lamp switch- connector 301 or connector 301- EBCM.
3. This is the first step to identify open circuit, short circuit to ground, short circuit to voltage or brake lamp switch troubles.
11. This step starts looking for open circuit, troubled connectors or EBCM.

DTC C0161 ABS Brake Switch Trouble

Step	Action	Value	Yes	No
1	Step down the brake pedal. Is the brake lamp on?	—	to step 3	to step 2
2	Put away your foot from the brake pedal. Does the brake lamp still hold on?	—	to step 8	to step 11
3	Inspect fuse F21 in the fuse box in engine compartment. Check to see if fuse F21 is fusing.	—	to step 4	to step 6
4	1. Replace fuse EF3. 2. Inspect the new fuses. Check to see if there is new fuse fusing.	—	to step 5	to step 7
5	1. Repair brake lamp short circuit to grounding. 2. Install the new fuse F21. Is the trouble corrected?	—	system OK	—
6	Repair open circuit trouble between engine fuse compartment connector to brake lamp switch circuit. Is the trouble corrected?	—	system OK	—
7	Inspect the brake lamp and the ABS assembly. Is the trouble corrected?	—	system OK	—
8	Inspect the brake lamp switch in the brake pedal. Is there trouble in the switch?	—	to step 9	to step 10
9	Repair the brake lamp switch. Is the trouble corrected?	—	system OK	—
10	at EBCM terminal 14, repair brake lamp switch, brake lamp, high mounted brake lamp and ABS harness connector short circuit to the positive pole. Is the trouble corrected?	—	system OK	—

DTC C0161 ABS Brake Switch Trouble (Cont' d)

Step	Action	Value	Yes	No
11	1. Disconnect electronic braking control module (EBCM) connector. 2. Use DVM to measure the voltage between ABS harness terminal 14 and 19 at EBCM. 3. Ask an assistant to step down the brake pedal. Is the measured voltage within the specified value?	11-14V	to step 13	to step 12
12	1. Check the connection between ABS harness connector and EBCM connector terminal 14 and 19. 2. Inspect the connection of connector X1-3 terminal 8. 3. Inspect if it is open circuited between EBCM connector terminal 14. 4. Check the ground and connection between ABS harness connector and EBCM connector terminal 19. 5. Repair broken wiring or troubled connector terminals, replace the connector and harness if necessary. Is the trouble corrected?	—	system OK	—
13	Check the interface between ABS EBCM connector and EBCM. Is the interface damaged?	—	to step 14	to step 15
14	Repair the connector, replace wiring or ABS system if necessary. Is the trouble corrected?	—	system OK	—
15	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.22 DTC C0245

circuit description

Gear rotor generates voltage pulse through wheel speed sensor. Each Tooth- gap- tooth in the gear will produce pulse. EBCM uses the pulse frequency to determine the wheel speed. The generated voltage depends on air gap between the sensor and gear rotor and the wheel speed.

When EBCM fails to determine which of the wheel speed sensors has trouble, the DTC sets. It is necessary to check all wheel speed sensor and related wiring to determine the causes of the DTC.

Conditions for DTC to set

- Number of gears incorrect.
- Gear tooth is damaged or broken.
- Open or short circuit of the wheel speed sensor.

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON.

Diagnostic aids

If the data list mode does not update throttle open degree readings, run scan tool automatic test function to set DTC C0245. Clear the DTC, disconnect scan tool, perform road test at speed high than 12km/h (7mph), check if the DTC is re-set.

Inspect the tooth channel, gap and marks that may impact the wheel speed sensor with gear

signals. Additionally, check if there is foreign matter accumulated at the gaps of the gears. Accumulation of foreign matter may result in such troubles.

Severely worn hub/ bearing may also result in such troubles. Gaps in bearing may result in too much air gap change between wheel speed sensor and gear rotor. If the rear wheel hub or front outer CV joint is installed improperly, the number of teeth is incorrect, the DTC will set.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. This step checks front wheel speed sensor.
3. This step checks if there is trouble in one of the front tooth ring.
5. This step checks front wheel speed sensor.
7. This step checks front wheel speed sensor harness is short circuited or not.
9. This step checks front wheel speed sensor harness is open circuited or not.
11. This step checks rear wheel speed sensor.
13. This step checks if there is trouble in one of the rear tooth ring.
15. This step checks rear wheel speed sensor.
17. This step checks rear wheel speed sensor harness is short circuited or not.
19. This step checks rear wheel speed sensor harness is open circuited or not.

DTC C0245 Wheel Speed Sensor Frequency Error

Step	Action	Value	Yes	No
1	Visually check front wheel speed sensor wirings. Is there any damage?	—	to step 2	to step 3
2	Confirm if the outer CV joint is correctly installed. Check if front speed sensor tooth ring and rear speed sensor tooth ring is damaged or not. Is the trouble corrected?	—	system OK	—
3	Inspect engine battery fuse Fusible link 1.0. Check to see if fuse Fusible link 1.0 is fusing.	—	to step 4	to step 5
4	Replace fuse Fusible link 1.0. Is the trouble corrected?	—	system OK	—
5	1. Disconnect the wheel speed sensor harness from the wheel speed sensor connector. 2. Measure the wheel speed sensor resistance at the wheel speed sensor connector terminals. Are the two resistance values within the specified range?	0.5-3kohm	to step 7	to step 6
6	Replace the wheel speed sensor in trouble. Is the trouble corrected?	—	system OK	—

DTC C0245 Wheel Speed Sensor Frequency Error (Cont' d)

Step	Action	Value	Yes	No
7	1. Disconnect ABS connector. 2. Connect DVM to the two terminals at the wheel speed sensor connector side, test if there is short circuit between each wheel speed sensor wirings. 3. Test if there is short circuit to ground in wheel speed sensor harness through its terminals. Is there open or short circuit in the wheel speed sensor harness?	—	to step 8	to step 9
8	Repair wiring or harness short circuit to grounding. Is the trouble corrected?	—	system OK	—
9	Test the connection between the two wheel speed sensor circuits of the ABS connectors at each side and wheel speed sensor connector. • Left: ABS connector terminal 6 and 7. • Right: ABS connector terminal 3 and 5. Are they well connected?	—	to step 11	to step 10
10	Repair the found front wheel speed sensor harness open circuit. Is the trouble corrected?	—	system OK	—
11	1. Visually check rear wheel speed sensor wirings. 2. Ensure the wheel speed sensor is properly installed and the mounting bolts properly Tightened. Is there any damage?	—	to step 12	to step 13
12	If necessary, repair or replace the components. Have you found troubles and have them corrected?	—	system OK	—
13	Remove all wheel speed sensor from the rear steering knuckle, inspect the tooth ring through the wheel speed sensor installation hole. • Check if there is gear tooth damaged or lost. • Check if the tooth ring is correctly located under the wheel speed sensor. Is the speed sensor ring damaged or is there any other trouble?	—	to step 14	to step 15
14	Replace with correct rear hub. Is the trouble corrected?	—	system OK	—
15	1. Disconnect the wheel speed sensor harness from the rear wheel speed sensor connector. 2. Measure the wheel speed sensor resistance at the wheel speed sensor connector terminals. Are the two resistance values within the specified range?	0.5-3k ohm	to step 17	to step 16
16	Replace the wheel speed sensor in trouble. Is the trouble corrected?	—	system OK	—
17	1. Disconnect ABS connector.Or, disconnect now. 2. Connect DVM to the two terminals at the wheel speed sensor connector side, test if there is short circuit between each wheel speed sensor wirings. 3. Test if there is short circuit to ground in wheel speed sensor harness through its terminals. Is there open or short circuit in the wheel speed sensor harness?	—	to step 18	to step 19
18	Repair wiring or harness short circuit to grounding. Is the trouble corrected?	—	system OK	—

DTC C0245 Wheel Speed Sensor Frequency Error (Cont' d)

Step	Action	Value	Yes	No
19	Test the connection between the two rear wheel speed sensor circuits of the ABS connectors at each side and wheel speed sensor connector. <ul style="list-style-type: none">• Left: ABS connector terminal 8 and 9.• Right: ABS connector terminal 1 and 2. Are they well connected?	—	to step 21	to step 20
20	Repair rear wheel speed sensor harness or connector X1-3 short circuit. Is the trouble corrected?	—	system OK	—
21	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.23 DTC C0550

circuit description

ABS control module performs various self-inspection and diagnosis. If troubles are found, DTC C0550 sets.

The procedure checks if EBCM connection is poor in grounding.

Conditions for DTC to set

- Connector terminal corrosive.
- Electronic braking control module (EBCM) trouble.

Actions to take when DTC sets

Disable ABS operation and ABS alarm indicator turns ON. EBD is deactivated. If the trouble is intermittent, EBCM will activate the system in the next ignition cycle and set DTC C0550.

Diagnostic aids

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may result, even if the parts are replaced, the trouble will still occur.

Test description

The following number refers to the number of procedures in the diagnostic table.

3. The step starts test if there is poor connection in voltage or ground circuits.

DTC C0550 ABS Self Diagnosing

Step	Action	Value	Yes	No
1	Use scan tool to determine if there is any other DTC set. Is there any other DTC set?	—	to DTC list	to step 2
2	Clear all DTCs and perform road test to the vehicle. Is DTC C0550 set again?	—	to step 4	to step 3
3	1. Inspect all system harness connector and terminal, especially those on EBCM, to see if there problems inducing intermittent troubles. 2. Correct the found troubles. Have you found troubles and have them corrected?	—	system OK	—
4	1. Ignition OFF. 2. Disconnect electronic braking control module (EBCM) connector. 3. Ignition ON; 4. Measure the resistance at terminal 15, 17 and 18 of the electronic braking control module (EBCM) harness connector. Is the measured voltage within the specified value?	11-14V	to step 6	to step 5
5	1. Inspect electronic braking control module (EBCM) power and ground connection. 2. Repair open-circuit or high resistance. Have you found troubles and have them corrected?	—	system OK	—
6	Is there trouble in electronic braking control module (EBCM) connector terminals? Is there any failed terminals?	—	to step 7	to step 8
7	Repair the found troubles in connectors. Is the trouble corrected?	—	system OK	—
8	Clear all DTCs and perform road test to the vehicle. Is DTC C0550 set again?	—	to step 9	system OK
9	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.24 DTC C0800

circuit description

EBCM operates under the required minimum voltage. EBCM monitors the power supply circuit to determine if the voltage is less than the minimum level.

The test checks the battery output, grounding, fuses, ignition switch and circuit is correct or not.

Conditions for DTC to set

- Battery trouble.
- ground connection trouble.
- connectors damaged
- wiring broken or short circuited.
- fuse burnt.
- Ignition switch trouble.

Actions to take when DTC sets

under low voltage period, disable ABS operation and ABS alarm indicator turns ON during the remained time of the ignition cycle. If the trouble is intermittent, EBCM

will activate the system in the next ignition cycle and set DTC C0800.

Diagnostic aids

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may occur, even if the parts are replaced, re-occurrence of the trouble cannot be avoided.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. This step determines if there is voltage in battery and high voltage power supply.
7. This step tests if there is voltage in ignition switch 1 power supply.
11. This step starts testing if there is voltage at EBCM terminal of ABS harness.
15. This step checks if there is trouble in grounding.
16. This step checks if there is trouble in EBCM connection.

DTC C0800 Power Supply Circuit Trouble

Step	Action	Value	Yes	No
1	Measure the voltage of the battery. Is the measured voltage within the specified value?	11-14V	to step 3	to step 2
2	If necessary, charge or replace the battery. Is the trouble corrected?	—	system OK	—
3	Inspect fuse Fusible link 1.0 connected to the battery. Check to see if the fuse is burnt.	—	to step 4	to step 7
4	1. Replace fuse Fusible link 1.0. 2. Ignition ON; Check to see if the fuse is burnt.	—	to step 5	to step 6
5	1. Ignition OFF. 2. Test the connection between Fusible link 1.0 and EBCM connector terminal 17 and 18 for ABS harness. 3. Repair the found short circuit troubles. Have you found troubles and have them corrected?	—	system OK	—
6	1. Ignition OFF. 2. Install the scan tool. 3. Clear all DTCs. 4. Road test the vehicle. Is DTC C0800 set again?	—	system OK	—
7	Inspect fuse F22 in the fuse box in instrument panel. Check to see if the fuse is burnt.	—	to step 8	to step 11
8	1. Replace fuse F22. 2. Ignition ON; Check to see if the fuse is burnt.	—	to step 9	to step 10

DTC C0800 Power Supply Circuit Trouble (Cont' d)

Step	Action	Value	Yes	No
9	1. Ignition OFF. 2. Test the wiring from fuse F22 to terminal 15 of the electronic braking control module (EBCM) harness connector. 3. Repair the found short circuit troubles. Have you found troubles and have them corrected?	—	system OK	—
10	1. Ignition OFF. 2. Install the scan tool. 3. Clear all DTCs. 4. Road test the vehicle. Is DTC C0800 set again?	—	system OK	—
11	1. Disconnect electronic braking control module (EBCM) connector from EBCM. 2. Ignition ON; 3. Test if there is battery voltage between ground and terminal 17 and between ground and terminal 18. Is the measured voltage within the specified value?	11-14V	to step 13	to step 12
12	1. Ignition OFF. 2. Test EBCM connector terminal 17 and 18 to battery Fusible link 1.0. 3. Correct the open circuit. Have you found troubles and have them corrected?	—	system OK	—
13	Measure the resistance between the ground and terminal 15 of the electronic braking control module (EBCM) connector. Is the measured voltage within the specified value?	11-14V	to step 17	to step 14
14	1. Ignition OFF. 2. Inspect if the circuit between F22 and ignition switch is open.	—	to step 15	to step 16
15	Is the trouble corrected?	—	system OK	—
16	1. Test the wiring from terminal 15 of the electronic braking control module (EBCM) connector to fuse F22 in the fuse box. 2. Repair wiring open circuit, or the possible connector terminal damage or ignition switch trouble. Have you found troubles and have them corrected?	—	system OK	—
17	1. Ignition OFF. 2. Measure the resistance between ground and ABS EBCM harness connector terminal 16 and 19. Is the resistance value equals to the specified value?	0ohm	to step 18	to step 20
18	Electronic braking control module (EBCM) connector terminal 15, 16, 17, 18 and 19. Is there trouble in the terminals?	—	to step 19	to step 21
19	Repair troubled connector terminals, or replace the connector or harness if necessary. Have you found troubles and have them corrected?	—	system OK	—
20	Repair ground connection trouble. Is the trouble corrected?	—	system OK	—

DTC C0800 Power Supply Circuit Trouble (Cont' d)

Step	Action	Value	Yes	No
21	1. Install the scan tool. 2. Clear all DTCs. 3. Road test the vehicle. Is DTC C0800 set?	—	to step 23	to step 22
22	1. Test harness and connector to find out causes of intermittent troubles. 2. Correct the found intermittent troubles. Have you found troubles and have them corrected?	—	system OK	—
23	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—

5.5.4.25 No Communication with EBCM

circuit description

The battery provides voltage to EBCM and EBCM connector terminal 15 through F22 in fuse box in the instrument panel. When ignition is on or at START position, there is voltage.

The test checks the battery output, grounding, fuses, ignition switch and circuit is correct or not.

Conditions for DTC to set

- Battery trouble.
- ground connection trouble.
- connectors damaged
- wiring broken or short circuited.
- fuse burnt.
- Ignition switch trouble.

Actions to take when DTC sets

If the voltage is low, ABS operation is forbidden.

Diagnostic aids

Inspect the wiring and connectors thoroughly. Otherwise, error diagnosis may occur, even if the parts are replaced, re-occurrence of the trouble cannot be avoided.

Test description

The following number refers to the number of procedures in the diagnostic table.

1. This step determines if there is voltage in battery and high voltage power supply.
7. This step tests if there is voltage in ignition switch 1 power supply.
10. This step checks if there is trouble in grounding.
11. This step checks if there is trouble in EBCM connection.

No Communication with EBCM

step	action	Value	yes	no
1	Measure the voltage of the battery. Is the measured voltage within the specified value?	11-14V	to step 3	to step 2
2	If necessary, charge or replace the battery. Have you found troubles and have them corrected?	—	system OK	—
3	Inspect fuse Fusible link 1.0 in the fuse box in engine compartment. Check to see if the fuse is burnt.	—	to step 4	to step 8
4	1. Replace fuse Fusible link 1.0. 2. Ignition ON; Check to see if the fuse is burnt.	—	to step 6	to step 5
5	Inspect the function of the ABS system. Is the trouble corrected?	—	system OK	—
6	1. Ignition OFF. 2. Remove fuse Fusible link 1.0. 3. Disconnect ABS connector from EBCM. 4. Measure the resistance between terminal 16 and 19 and grounding. Is the resistance value equals to the specified value?	0ohm	to step 7	to step 20
7	Repair short circuit between Fuse 1.0 and ABS harness EBCM connector. Is the trouble corrected?	—	system OK	—
8	Inspect fuse F22 in the fuse box in instrument panel. Check to see if the fuse is burnt.	—	to step 9	to step 13
9	1. Replace fuse F22. 2. Ignition ON; Check to see if the fuse is burnt.	—	to step 11	to step 10
10	Inspect the function of the ABS system. Is the trouble corrected?	—	system OK	—

No Communication with EBCM (Cont' d)

step	action	Value	yes	no
11	1. Ignition OFF. 2. Remove fuse F22. 3. Disconnect ABS connector from EBCM. 4. Measure the resistance between terminal 15 and grounding. Is the resistance value equals to the specified value?	0ohm	to step 12	to step 20
12	Repair short circuit between Fuse F22 in the fuse box in instrument panel and terminal 15 of ABS harness EBCM connector. Is the trouble corrected?	—	system OK	—
13	1. Disconnect electronic braking control module (EBCM) connector from EBCM. 2. Ignition ON; 3. Test if there is battery voltage between ground and terminal 17 and between ground and terminal 18. Is the measured voltage within the specified value?	11-14V	to step 15	to step 14
14	1. Ignition OFF. 2. Track and inspect wiring from EBCM connector terminal 17 and 18 to the battery. 3. Correct the open circuit. Is the trouble corrected?	—	system OK	—
15	Measure the resistance between the ground and terminal 15 of the electronic braking control module (EBCM) connector. Is the measured voltage within the specified value?	11-14V	to step 17	to step 16
16	1. Ignition OFF. 2. Test the circuit between ABS harness EBCM connector terminal 15 and Fuse F22 in the fuse box in the instrument panel. 3. Test the circuit between Fuse F22 in instrument panel fuse-box and ignition switch. 4. Repair wiring open circuit, or the possible connector terminal damage or ignition switch trouble. Have you found troubles and have them corrected?	—	system OK	—
17	1. Ignition OFF. 2. Measure the resistance between terminal 19 and 16 of the electronic braking control module (EBCM) connector and grounding. Is the resistance value equals to the specified value?	0ohm	to step 18	to step 21
18	Electronic braking control module (EBCM) connector terminal 15, 19, 17, 18 and 16. Is there trouble in the terminals?	—	to step 19	to step 20
19	Repair troubled connector terminals, or replace the connector or harness if necessary. Is the trouble corrected?	—	system OK	—
20	Replace the ABS assembly. Is the trouble corrected?	—	system OK	—
21	Repair ground connection trouble. Is the trouble corrected?	—	system OK	—

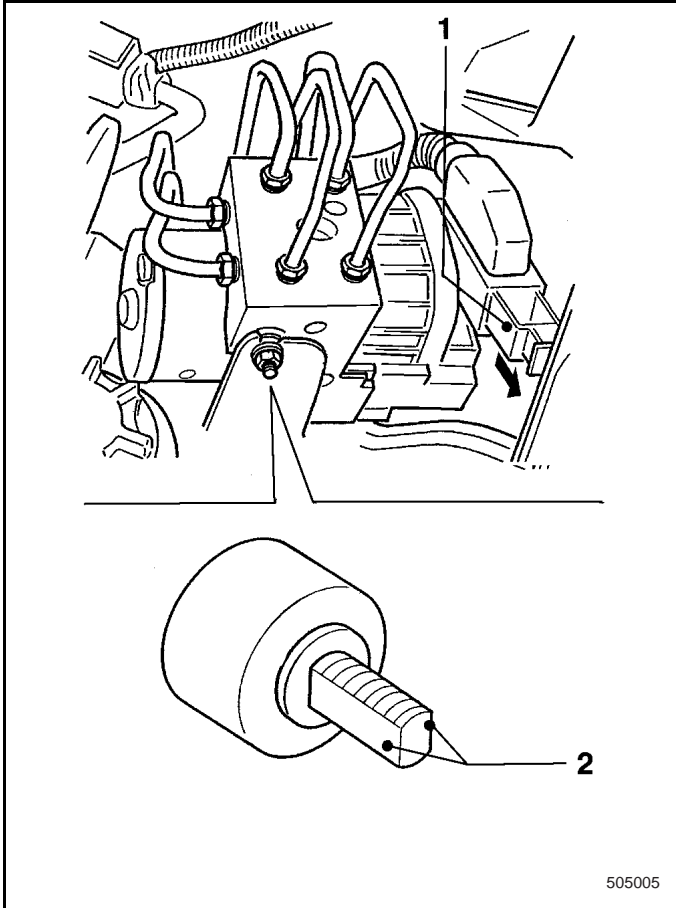
5.5.5 Repair Guidance

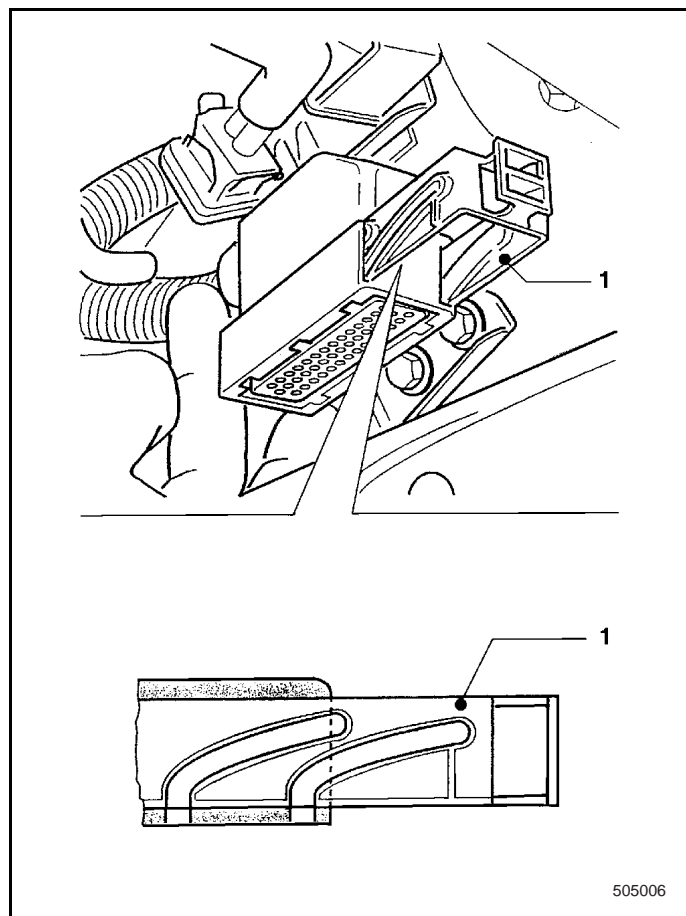
5.5.5.1 Replace the ABS control unit.

Removal Procedure

1. Remove the grounding wire from the battery.
2. Open the brake fluid reservoir cover. Fill brake fluid into the reservoir to the maximum position.
3. Use commercially obtained cover similar to the reservoir cover to cover the reservoir.
4. Pull out the lock slip rail from the pilot harness plug and disconnect the harness plug.
5. Loose the brake pipe on the hydraulic module and seal the mouth.
6. Loose the two Tightening nut and remove the hydraulic module from the bracket.

Caution: Inspect if the hydraulic module bracket is firm or not, clean if necessary. Inspect vibration absorber bearing and its position.





Installation Procedure

1. Insert the hydraulic module with vibration absorber into the bracket and Tighten it. The flat area (2) in the Tightening pin must be vertical.

Tightening

Tighten the hydraulic module with vibration absorber to the bracket to 10N•m.

2. Install all brake hard pipe. Tighten connecting bolt M10 and M12. Pay attention to different thread sizes while replacing the brake hard pipes.

Tightening

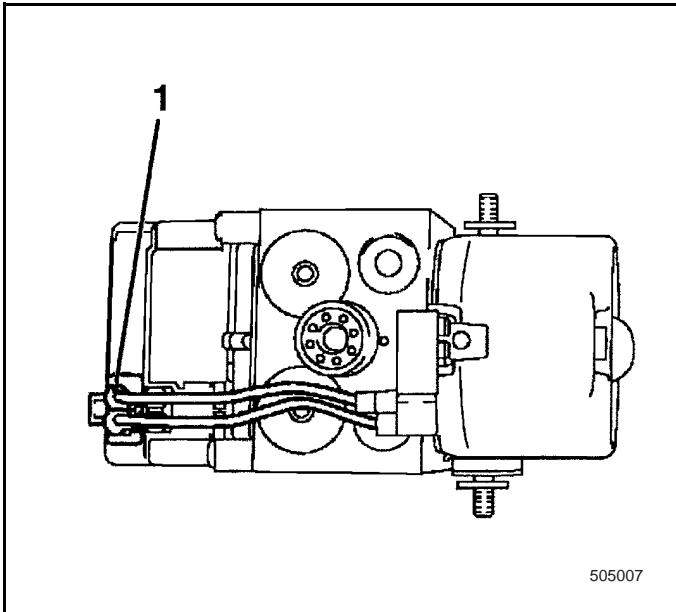
Tighten connecting bolt M10 and M12 to 10 N•m.

3. Adjust the position of lock slip (1). Refer to illustration figures. Connect the wiring plug, press the lock slip into the harness connector.
4. Discharge air in the brake system and inspect if there is leakage. Refer to Discharge air in the hydraulic braking system.

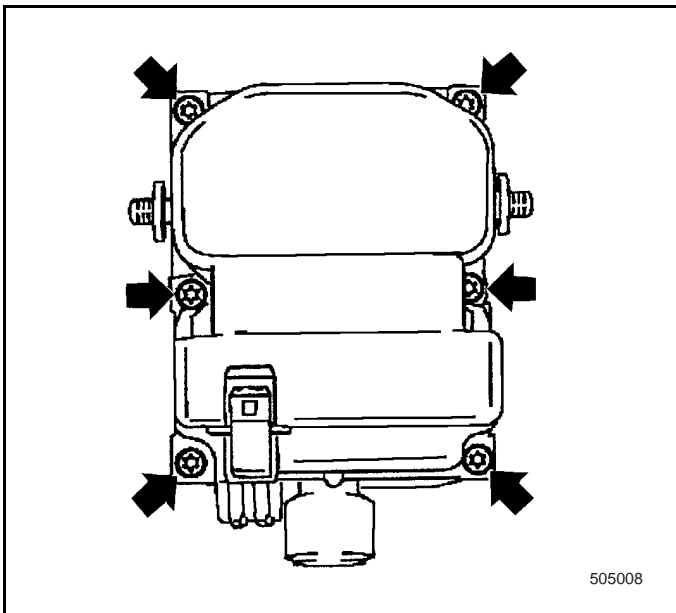
5.5.5.2 Replace the ABS Hydraulic Module

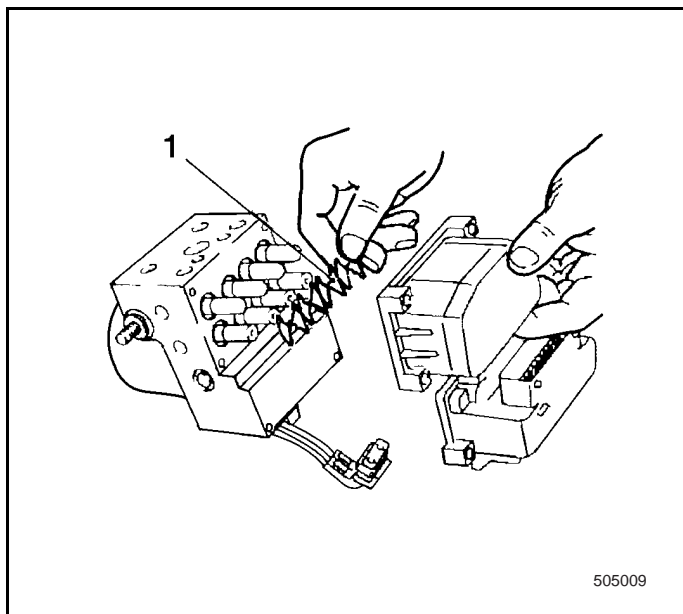
Removal Procedure

1. Remove hydraulic module and the ABS control unit.
2. Clamp tight the hydraulic module with the pump motor facing downward.
3. Remove pump wiring harness plug (1) from the ABS control module. Press out the wiring harness from the bracket carefully.



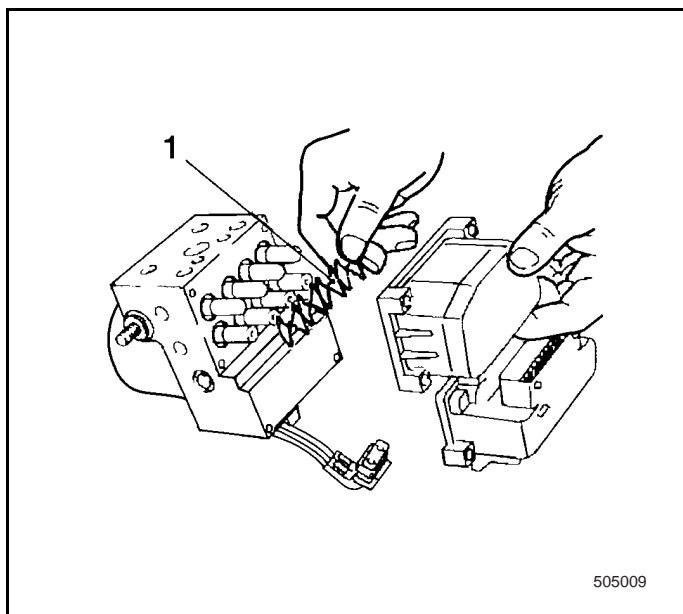
4. Remove Tightening bolt (1).
- Note: Tightening screw may not be used repeatedly.



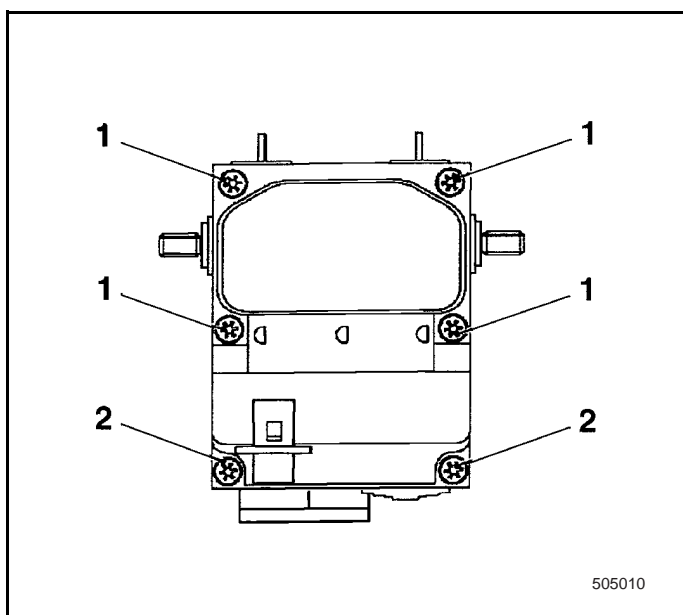


5. Remove ABS control unit from the hydraulic module carefully- ensure there is no damage to the coil bracket. Disconnect the ABS control unit at the coil side.
6. Inspect if the position of the lining is correct and clean. Touch the lining with fingers and inspect if there is breakage, coarseness and dent on the surface. If the sealing surface is damaged, replace the ABS control unit.
7. Clean the sealing surface of the control unit carefully with non-blurred cloth, if there is heavy residue on the lining, immerse the cloth in alcohol.

Installation Procedure



1. When the ABS control unit is removed, if the spring plate is still in, replace it rather than retain it.

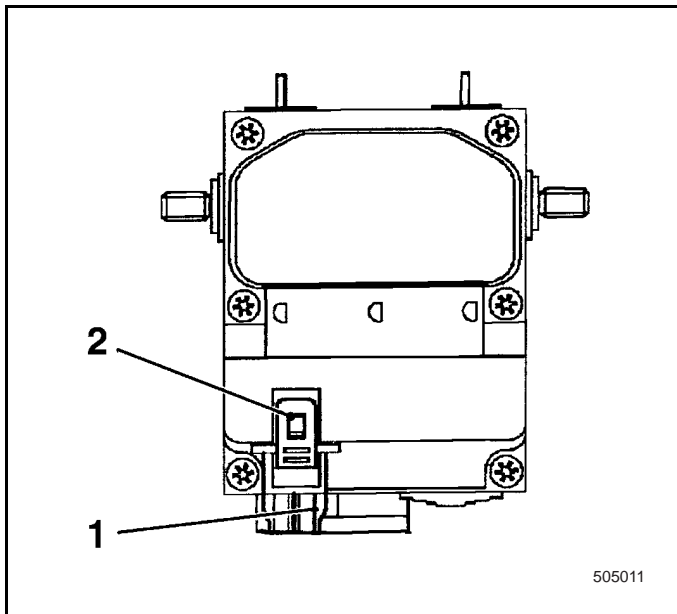


2. With the ABS control unit well centered, put it on the hydraulic module carefully. Do not incline when put the ABS control unit on the hydraulic module.
3. Insert new Tightening bolt. Tighten the screw (1) near the coil with hand until the screw head connects with the ABS control unit.
4. Tighten the screws in several steps until the ABS control unit comes into contact with the pump housing. Tighten the screw properly.
5. Rotate the Tightening screw (2) and Tighten slightly with hand.
6. Tighten the screws (1) and (2) near the coil in sequence.

Tightening

Tighten screw (1) to 2.6 N•m, screw (2) to 2.6 N•m.

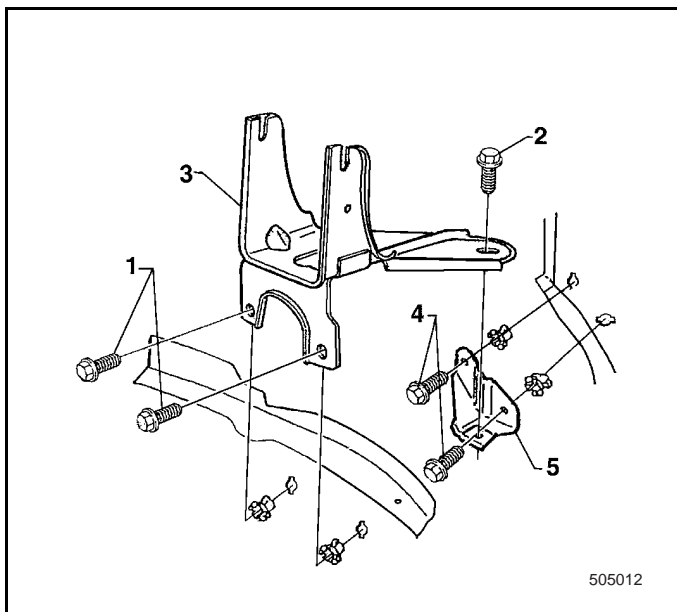
7. Install wiring harness plug.

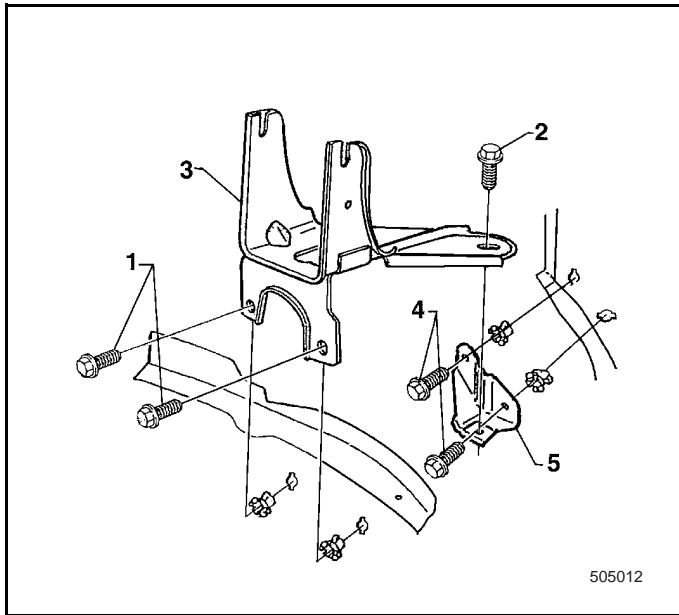


5.5.5.3 Replace the ABS Hydraulic Module Bracket

Removal Procedure

1. Turn off ignition switch.
2. Remove hydraulic module valve, refer to ABS control unit/ hydraulic module replacement.
3. Remove the two bolts (1) used to install the hydraulic module bracket.
4. Remove bolt (2) used to install the hydraulic module bracket.
5. Remove bracket (3) used to install the hydraulic module.
6. Remove the two bolts (4) used to install the hydraulic module bracket.
7. Remove bracket (5) used to install the hydraulic module.





Installation Procedure

1. Install hydraulic module bracket (5). Tighten the two bolts.

Tightening

Tighten the two bolts to 20 N•m.

2. Install the two bolts used to install the hydraulic module bracket (3). Tighten bolt (1) and (2).

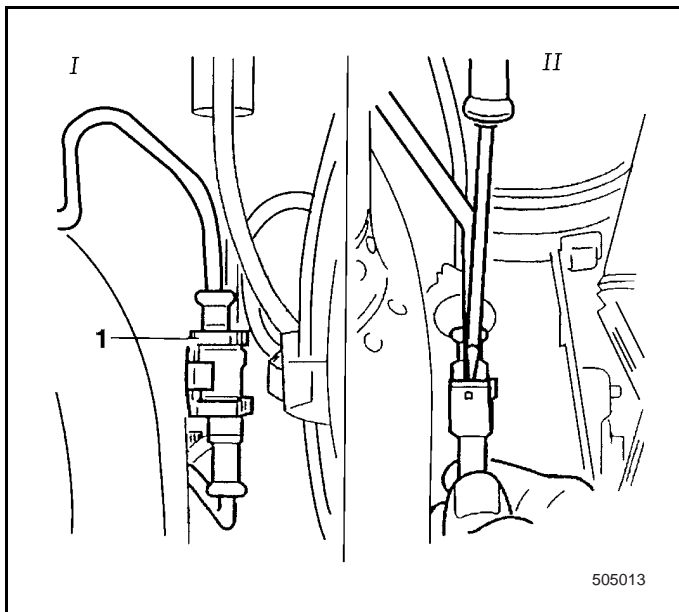
Tightening

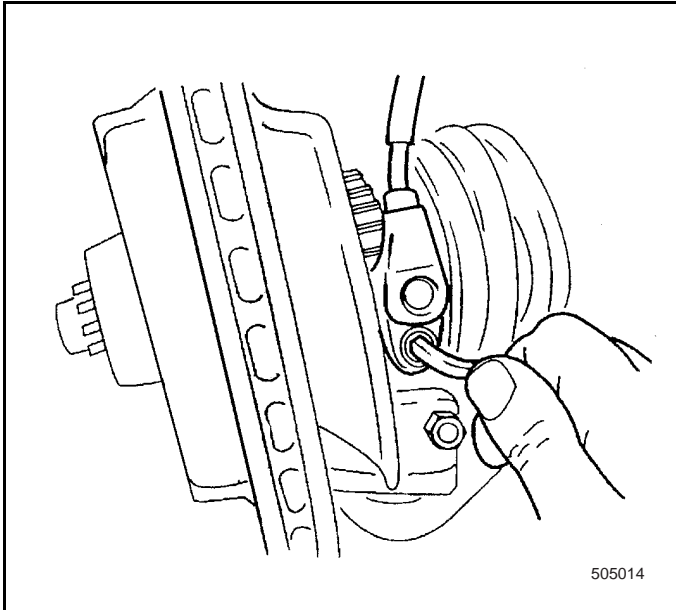
Tighten the bolt (1) and (2) to 20 N•m.

5.5.5.4 Replace the front wheel speed sensor

Removal Procedure

1. Loose and remove the grounding wire from the battery.
2. Use screwdriver to remove wheel speed sensor wiring plug from the bracket (1) and separate them.





3. Loosen the front wheel speed sensor and pry it out.

Installation Procedure

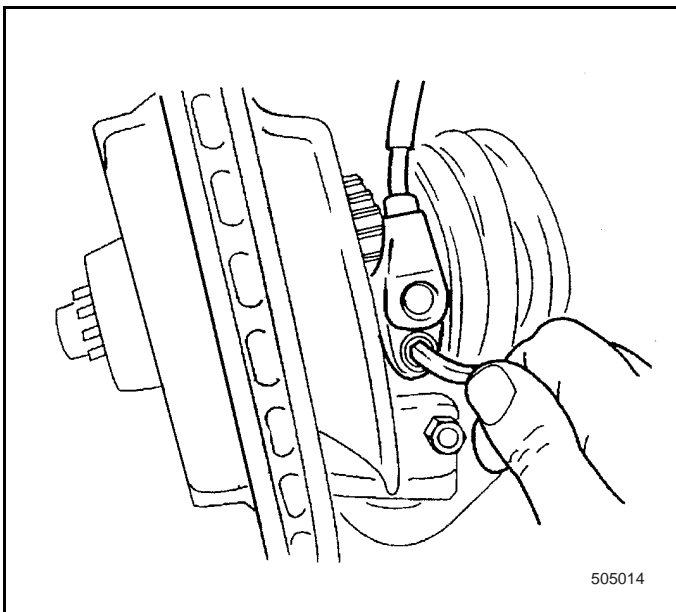
Tools Required

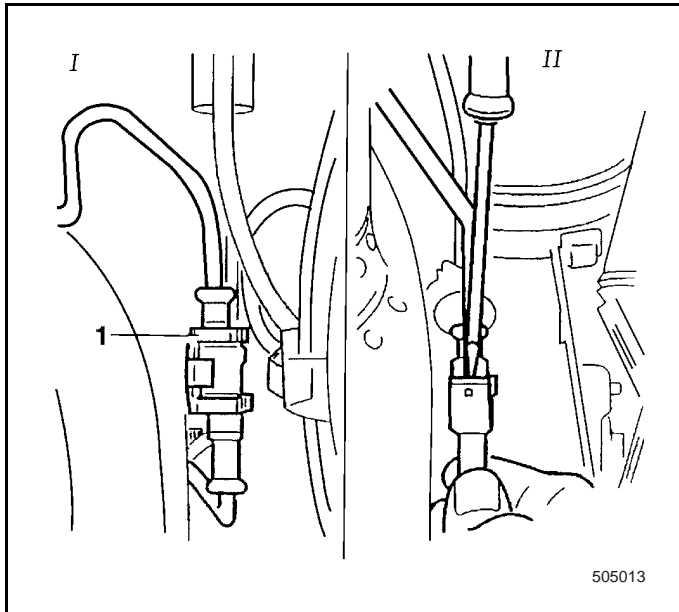
- TECH 2 Scan tool

1. Insert the wheel speed sensor and sensor housing into the bracket together, Tighten it.

Tightening

Tighten the wheel speed sensor and sensor housing to the bracket to 8 N•m.



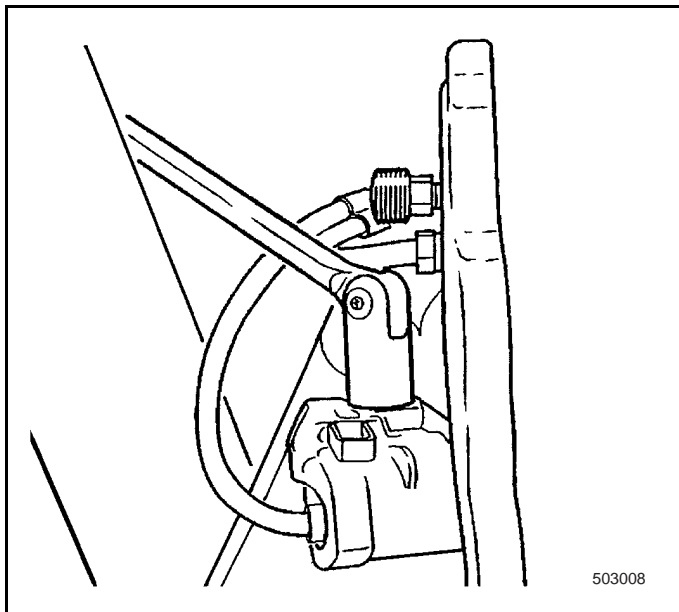


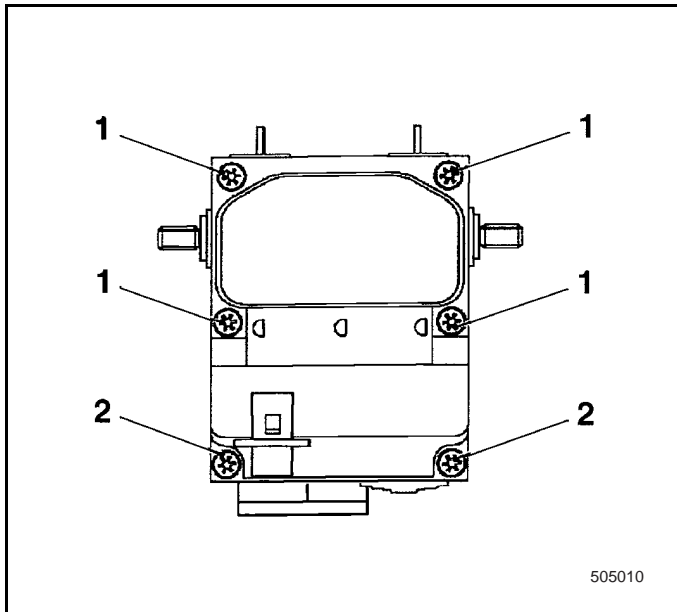
2. Wire the wheel speed sensor. Insert fixing caliper and connect the wiring plug.
3. Install battery ground wire.
4. Conduct functional test with TECH2.

5.5.5.5 Replace the rear wheel speed sensor

Removal Procedure

1. Loose and remove the grounding wire from the battery.
2. Separate the wheel speed sensor wiring harness plug from the bottom, loose the clamp.
3. Remove Tightening bolt and wheel speed sensor.





Installation Procedure

Tools Required

- TECH 2 Scan tool

1. Install wheel speed sensor (2) and Tighten the screws (4) with fingers.
2. Push the sensor to the end and Tighten with screws to 4 N•m.
3. Rotate level (3) to the indicated position in clockwise direction. Thus, adjustment is done to pulse tooth ring (1) and wheel speed sensor (2) so that they keep certain gap.
4. Wire the wheel speed sensor, insert fixing clamp and connect with the wiring plug.
5. Install battery ground wire.
6. Conduct functional test with TECH2.

5.5.6 Description & Operation

5.5.6.1 Anti-lock brake system Operation

Anti-lock brake system mode

If the wheels slip obviously during braking, ABS enters anti-lock mode. During ABS period, pressure of fluid in wheel oil passage is controlled to prevent the wheel from slipping. Each wheel has a separate hydraulic pipeline and solenoid to be determined. ABS system can reduce, maintain or increase fluid pressure in the wheel brakes. However, the ABS system cannot increase the pressure to above that of the master pump during braking. During anti-lock period, you may feel a series of quick pulse from the brake pedal. To respond to the ideal wheel speed, each solenoid changes rapidly, which produces pulsation. Pedal pulsation occurs during the anti-lock braking period, and disappears when normal braking is restored or the vehicle stops. When the solenoids switch rapidly, you may also hear clicks or pings. When anti-lock braking is performed on dry roads, when tire comes to slip, intermittent clicks may be heard. The noise and pedal pulsation is normal phenomena during anti-lock braking operation. During normal braking, operation of the brake pedal will be the same as before. Maintain constant action force in the pedal will bring about not only shortest brake distance, but also stability of the vehicle.

Pressure maintaining

When EBCM senses slippage of the wheel, to separate the system, EBCM will close the inlet pressure valve, which will close the pressure-relief valve in the EBCM valve. Thus to maintain steady pressure on the brake and the fluid pressure will neither rise nor drop.

Pressure drop

If the EBCM still senses slippage of the wheel under pressure maintaining mode, EBCM will relieve pressure on the brakes. Inlet pressure valve keeps closed and pressure relief valve will open. Remained brake fluid will be stored in accumulator until the fluid returning pump returns the brake fluid to the master pump.

Pressure rise

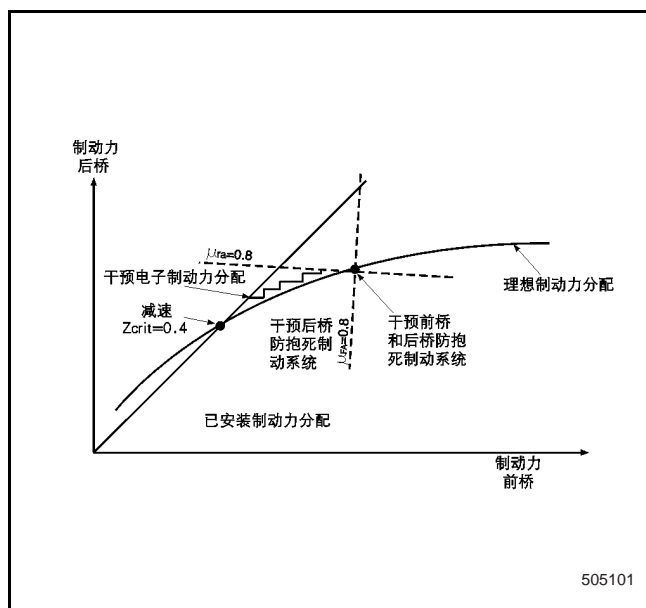
If the EBCM still senses the wheel speed restoring to normal condition or increases under pressure maintaining or drop mode, EBCM will increase pressure on the brakes. Inlet pressure valve opens and pressure relief valve will close. The increased pressure comes from the master pump, which is related with pressure applied on the brake pedal.

5.5.6.2 EBD System

General Information

As an additional logical function of the ABS basic algorithm, EBD system operates when conditions for ABS control are not satisfied.

Electronic braking force distribution sensitivity monitors if the rear wheels slip in relation to the front wheel. If slippery is detected, rear wheel inlet valve is switched to the pressure maintaining position so as to prevent pressure on the rear wheel brake from increasing further and thus re-represents rear wheel brake pressure drop function electrically.



EBD System Benefits

- Eliminate traditional ratio valves.
- EBD adopts the existing rear wheel speed sensor to monitor rear wheel slippage.
- According to changes in the algorithm, activate rear wheel pressure maintaining\ rise or drop pulsation series to maintain the vehicle stability.
- The vehicle approaches the ideal braking force distribution.(front to rear wheel)
- EBD is realized through ABS safety logical function.(traditional ratio valve cannot monitor)
- Hold on function.

Tire and ABS/EBD

Spare tire

Tire size is critical to the correct operation of ABS system. Size, load and structure and the spare tire shall be the same as the original tires. Replace the tires as a set according to the axle, use tires with the same specification to Tire Performance Code (TPC). Use of tires of other sizes and types may severely impact the operation of the ABS system.

Tire and ABS/EBD

Notice: No servicable, removable and programmable CD-ROM available. Replace the electronic braking control module (EBCM) as a set.

EBCM is connected with the hydraulic devices in the engine compartment. The control element of ABS 5.4 is a micro-processor-based EBCM. The system inputs the four wheel speed sensor, stop lamp switch, ignition switch and battery switch without switch. There is a double-way data link output to DLC pin K, DLC is used to connect the diagnostic tool and test in assembly plant.

EBCM monitors the speed of each wheel. If the wheel approaches to anti-lock mode and the brake switch closes (step down brake pedal), EBCM will control solenoid to relief brake pressure on the tire almost locked. When the wheel obtains towing force again, increase brake pressure until the wheel almost locks. The cycle shall occur repeatedly until the vehicle is fully stopped, release the brake pedal or when no wheel approaches to locking status.

Additionally, EBCM will monitor each input (except serial data link) and output to ensure correct operation. If any system error is detected, EBCM will store the DTCs in EEPROM (even if the battery is disconnected, DTCs will not disappear). Refer to the section Self Diagnosis for detailed information.

Front wheel speed sensor.

Front wheel sensor belongs to variable reluctance type. Each sensor is connected with the steering knuckle near the gear ring. Gear generates alternative voltage through the sensor, voltage frequency and wheel speed change proportionally. Voltage and frequency increases with the speed. The sensor cannot be serviced and the air gap cannot be adjusted.

Front wheel speed sensor ring.

Upper gear ring is embed in wheel side (outer) CV joint. Each gear ring has 47 evenly distributed teeth. During the service, pay special attention not to pry or contact the gear ring. Otherwise, one or more gear teeth may be damaged. If the gear ring is damaged, replace the CV joint at the wheel side.

Rear wheel speed sensor and gear ring.

Principle of the rear wheel speed sensor is the same as that of the front wheel speed sensor. It has a long flexible harness with its end connecting the right connector. Rear wheel speed gear ring is embedded in the wheel hub. It is non-serviceable. The rear wheel hub/ bearing must be replaced as an assembly.

Valve relay and pump motor relay

Located in EBCM, Valve relay and pump motor relay cannot be replaced separately. If any of them fails, replace the EBCM.

Wire harness

The harness connects EBCM with power and ground, wheel speed sensor, fuse, switch, indicator and serial communication interface. The harness includes connecting wires and connectors connecting system component electrical / mechanical interfaces (terminal, pin, contact and so on).

Indicator

EBCM monitors continuously the components of itself and ABS system. If EBCM detects failure in the system, the yellow ABS indicator will light and hold on to remind the driver there is failure. If the ABS indicator lights, ABS system has detected failure that may impact the operation of the ABS system. Additionally, functions of non-ABS may also be impacted. Ordinary non-ABS performance is retained. To restore the ABS capacity, maintain ABS immediately.

When the system detects brake fluid in the master pump is too low, or when the brake switch closes (park brake engages) or EBD system closes, red brake indicator lights.

Caution: EBD indicator wire is connected with the park brake lamp. If the park brake lamp lights during driving, check if the park brake handle is engaged or if the brake fluid level is too low. If there is no problem in the system, there must be trouble in EBD system. Have the EBD system serviced immediately.

Self- diagnosis

Note: When DTC sets, EBCM closes valve relay. When scan tool is used to monitor data list, it will command the valve relay to close. This is normal condition rather than failure.





Note: For safety reasons, it is recommended not to drive the vehicle when inspection equipment is connected. Exception, test the wheel speed under specified conditions.

EBCM can perform self-diagnosing, but cannot perform detection to find out system failure. When system failure is found, EBCM sets DTC representing the system. Under most conditions, it will light ABS / EBD indicator and disable the functions of ABS/ EBD during ignition period according to necessities.

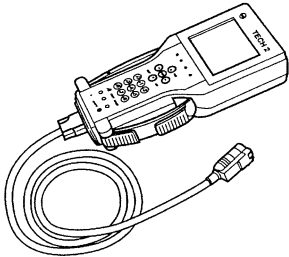
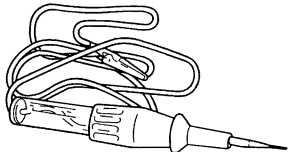
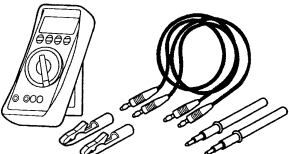
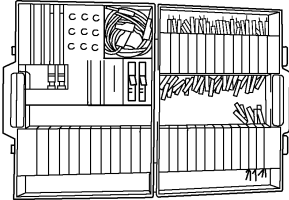
At each ignition cycle, when the vehicle speed reaches 6km/h and the brake pedal is not stepped down, or when the vehicle speed reaches 15 km/h and the brake pedal is not stepped down, EBCM performs self-diagnosing. During the test, the system switches alternatively to each valve solenoid coil and pump motor as well as necessary relays to check the operation of the components. If the EBCM detect any failure, the above mentioned DTC will set.

EBD trouble list

Electronic Brake-force Distribution (EBD) Failure Matrix

		Anti-lock brake system and EBD OFF	Anti-lock brake system OFF; EBD ON	Anti-lock brake system and EBD ON	Impossible
					
VR	Compact spare tire				
	Correction				
	Interrupt				X
MR	Interrupt				X
	Fault				
PM	Fault				
	Fault				
BLS	BLS Fault				
	2 Wheel Speed Sensors fault				
WSS	Wheel Speed Sensor fault, low frequency				
	Wheel Speed Sensor fault, high frequency				
	Wheel Speed Sensor fault, non OHM (FDFP)				
Power	Wheel Speed Sensor fault OHM				
	Voltage too high >17.4V	X			
	Low voltage <6.9V<-reversible	X			
WSS	Low voltage 9.4V >U Z>6.9V	X			
	1 fault cause the power always ON				
	Power: reversible->Low voltage 9.4V>Uz>6.9V				
BLS	Wheel Speed Sensor				
	Non OHM (FDFP)				
	2 Wheel Speed Sensors fault				
PM	reversible->				
	Brake Lamp Switch				
	Motor Relay				
MR	Pump Motor				
	Ventilation Relay				
VR					

5.5.7 Special Tools

Illustration	Number & Name of the Tools
 <p>TECH2</p>	TECH 2 Scan tool
 <p>KM-602-1</p>	KM-602-1 Test Lamp
 <p>MKM-874</p>	MKM-874 precise DVM
 <p>KM-609</p>	KM-609 electronic tool package

Blank

6

Engine

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6.1 Engine Mechanical

6.1.1 Specifications

6.1.1.1 Technical Specification

Application	Specification
Engine ASM (C16NE)	
Type	FQ
Cylinder	4 Cylinders
Main bearings	5
Ignition order	1-3-4-2
Cylinder bore	79 mm
Stroke	81.5 mm
Displacement	1598 cm ³
Compression ratio	9.4:1
Idling speed	900 ± 300 rpm
Net power	65 kw/5600 rpm
Net torque	128 Nm/2800 rpm
Crankshaft	
Journal maximum taper	0.005 mm
Journal maximum out-of round	0.004 mm
Crankshaft maximum deflection	0.03 mm
Journal diameter	54.93 -54.997 mm
Trunnion diameter	42.971 -42.987 mm
Maximum distance between journal enclosure	0.013 -0.043 mm
distance between trunnion and connecting rod cap	0.019 -0.071 mm
Axial distance between trunnion connection	0.11 -0.24 mm
Possible number of main shafts	2
Crankshaft wheelbase	0.1 -0.2 mm
Cylinder head	
The angles of the valve seats (all)	90° ± 1°
Intake valve and Exhaust valve	
The angle of the valve seat	92° ± 15'
Distance between valve stem and guide	0.018 to 0.052 mm (intake) , 0.038 to 0.072 (exhaust)
Eccentricity tolerance of valve seat (Difference between Min. reading and Max. reading)	0.050 mm
The width of the valve seat	
Intake	1.3 -1.4 mm
Exhaust	1.7 -1.8 mm
Cylinder and piston	

6.1.1.1 Technical Specification(Cont' d)

Application	Specification
Distance between piston and cylinder (piston skirt)	0.010 to 0.030 mm
Journal maximum out-of round	0.013 mm
Cylinder maximum taper	0.013 mm
Distance between TDC piston head and cylinder head	0
Angle of pressure ring clearance	90°
Distance of pressure rings	0.3 to 0.5 mm
Distance between pressure ring and guide	
Upper guide	0.060 -0.092 mm
Lower guide	0.030 -0.062 mm
Distance between scrapper ring	0.40 -1.40 mm
Camshaft	
Wheelbase	0.04 -0.16 mm
Camshaft maximum deflection	0.04 mm
Oil pump	
Distance between gear and pump bonnet	0.03 to 0.10 mm
Pressure at 1400 rpm	282-324 kPa
Pressure at 3000 rpm	365-407 kpa

6.1.1.2 Fastener Tightening Torque

Application	Specification
Accessory pulley bolt	95N•m+ (30°-45°)
Accessory tension pulley bolt	26 ± 4N•m
Camshaft housing cover bolt	8 ± 2N•m
Camshaft timing belt bolt	45 ± 5 N•m
Camshaft baffle plate bolt	7 ± 3 N•m
Connecting rod bearing cover bolt	25N•m + (30-60) or 30N•m
Coolant Temperature Sensor	15 ± 3N•m
Crankshaft main bearing cover bolt	50N•m+ (45°-60°)
Crankshaft Position (CKP) Sensor Bolt	9 ± 1N•m
Crankshaft Position (CKP) Sensor Bracket Bolt	9 ± 1N•m
Cylinder head bolt	25N•m+ (180°-190°)
Engine flywheel bolt(automatic shift engine)	60 ± 5N•m
Engine flywheel bolt(automatic shift engine)	35N•m(30°-45) or 50N•m
Exhaust manifold pipe heat shield bolt	9 ± 1N•m
Exhaust manifold pipe nut	20 ± 2N•m
Fuel Pressure Regulator	6N•m
Fuel Rail Bolt	10N•m

6.1.1.2 Fastener Tightening Torque(Cont' d)

Application	Specification
Generator bolt(bracket-upper)	18-22N•m
Generator bolt(upper control bar)	18-22N•m
Generator bracket-upper bolt	18-22N•m
Idle Air Control (IAC) Valve Bolt	3N•m
Ignition coil module bolt	8.5 ± 1.5N•m
Ignition coil module bracket bolt	12 ± 2N•m
Knock Sensor Bolt	20 ± 4N•m
Intake Manifold Absolute Pressure (MAP) Sensor Nut	3N•m
Exhaust manifold pipe nut	20 ± 2N•m
Oil filter	10N•m
Oil filter adapter	15N•m
Oil pan bolt	10N•m
Oil pan drain plug	50N•m
Oil pressure switch	30 ± 10N•m
Oil pump bypass valve	22.5 ± 2.5N•m
Oxygen Sensor	42 ± 4N•m
Oil pump bolt	7 ± 3N•m
Spark plug	27.5 ± 7.5N•m
Suction pipe bolt	8 ± 2N•m
Suction pipe bracket bolt	8 ± 2N•m
Thermostat bolt	11 ± 3N•m
Throttle body bolt	9N•m
Throttle Position (TP) Sensor Bolt	3N•m
Timing belt upper front cover bolt	4 ± 1N•m
Timing belt lower front cover bolt	4 ± 1N•m
Timing belt rear cover bolt	12 ± 2N•m
Timing belt accessory tension pulley bolt	20 ± 2N•m
Water pump bolt	7 ± 3N•m
Fuel clamp return hose	2.5N•m
Fuel tank feed hose clip	1N•m
Left suspension connected to front side member	65N•m
Left engine bracket connected to Automatic Transmission	62.5N•m (*must use new bolts, which shall be painted with reinforcing compos, prior to installation)
Left engine bracket connected to engine suspension	60N•m
Left engine bracket connected to Manual Transmission	60.5N•m (*Use new fastening bolts)
Rear suspension connected to body bottom plate	67.5N•m
Rear engine suspension connected to engine bracket	60N•m

6.1.1.2 Fastener Tightening Torque(Cont' d)

Application	Specification
Fuel return hose clamp	2.5N•m
Right suspension connected to front side member	20N•m
Right engine bracket connected to engine suspension (nut and bolt)	65N•m
Upper screw of oil filler pipe	1N•m
Oil pump safety valve sealing bolt	50N•m

6.1.1.3 Bearing Technical Specification

Main bearing standard dimension

Standard dimensions				
	Cylinder block with standard dimensions		Oversized cylinder block	
Cylinder block	59.000-59.0065		59.0065-59.013	
Identification	0		1	
Crankshaft - standard dimensions				
Crankshaft	54.9885-54.9970	54.9800-54.9885	54.9885-54.9970	54.9800-54.9885
Identification	Brown	Green	Brown	Green
Bearing - standard dimensions				
Upper bearing	1.989-1.995	1.989-1.995	1.995-2.001	1.995-2.001
Identification	Brown	Brown	Green	Green
Lower bearing	1.989-1.995	1.995-2.001	1.989-1.995	1.995-2.001
Identification	Brown	Green	Brown	Green
Clearance	0.040	0.0425	0.0405	0.043 (max)
	0.013 (min)	0.0155	0.0135	0.016

Main bearing - dimensions over 0.25

Standard dimensions				
	Cylinder block with standard dimensions		Oversized cylinder block	
Cylinder block	62.0000-62.0065		62.0065-62.013	
Identification	0		1	
Crankshaft - standard dimensions				
Crankshaft	54.7385-54.7470	54.7300-54.7385	54.7385-54.7470	54.7300-54.7385
Identification	Brown/blue	Brown/blue	Brown/blue	Brown/blue
Bearing - standard dimensions				
Upper bearing	2.114-2.120	2.114-2.120	2.120-2.126	2.123-2.126
Identification	Brown/blue	Brown/blue	Brown/blue	Brown/blue
Lower bearing	2.114-2.120	2.120-2.126	2.114-2.120	2.120-.2.126
Identification	Brown/blue	Brown/blue	Brown/blue	Brown/blue

Main bearing - dimensions over 0.25(Cont' d)

Clearance	0.040	0.0425	0.0405	0 . 043 (max)
	0 . 013 (min)	0.0155	0.0135	0.016

Connecting rod bearing - standard dimensions

Connecting rod	46.000-46.020
Identification	Colorless
Crankshaft	42.971-42.987
Identification	Colorless
Upper cover	1.489-1.497
Identification	Colorless
Lower cover	1.489-1.497
Identification	Colorless
Distance	0.019-0.071

Connecting rod bearing - dimensions over 0.25

Connecting rod	46.000-46.020
Identification	Colorless
Crankshaft	42.721-42.737
Identification	Blue
Upper cover	1.614-1.622
Identification	Blue
Lower cover	1.614-1.622
Identification	Blue
Clearance	0.019-0.071

6.1.1.4 Engine oil

Engine oil viscosity specification

C=Consistent engine oil

NT=New technology engine oil

Dependent on outer temperature of gasoline and diesel engine

It is allowed that engine temperature in short time is higher or lower than the temperature listed in the table. Tell the owner that engine shall be avoided running at high speed under heavy load for relatively long time, when temperature is higher than the limited temperature and low viscosity engine oil is used, such as SAE 5W-30.

Viscosity classification - Class ACEA/API

Engine oil	Viscosity SAE	Temperature range		Quality grade	
		From	to	ACEA standard	API standard
C - Consistent engine oil	5W-30	-20	+20	A1/B1, A2/B2	SH, SJ/CE, CF
	10W-30	-20	+20	A1/B1, A2/B2	SH, SJ/CD, CE
	10W-40	-20	>+40	A2/B2, A3/B3	SH, SJ/CD, CE
	10W-50	-20	>+40	A2/B2, A3/B3	SH, SJ/CE, CF
	10W-60	-20	>+40	A2/B2, A3/B3	SH, SJ/CE, CF
	15W-40	-15	>+40	A2/B2, A3/B3	SH, SJ/CE, CF
	15W-50	-15	>+40	A2/B2	SG/CD
	20W-40	-10	>+40	A2/B2	SF, SG/CD
	20W-50	-10	>+40	A2/B2	SF, SG/CD
NT - New technology	10W-30	-20	>+40	A3/B3	SJ/CF
	10W-40	-20	>+40	A3/B3	SJ/CF
	5W-30	<-30	>+40	A3/B3	SJ/CF
	5W-40	<-30	>+40	A3/B3	SJ/CF
	5W-50	<-30	>+40	A3/B3	SJ/CF
	0W-30	<-30	>+40	A3/B3	SJ/CF
	0W-40	<-30	>+40	A3/B3	SJ/CF
	0W-40	<-30	>+40	A3/B3	SJ/CF

Applicable only when ACEA and API are listed

Note: ACEA cannot substitute for API, while API can substitute for ACEA

Viscosity does not equal to quality.

Engine oil specification

Application	Specification
Engine oil capacity With oil filter With oil filter Between "Min" and "Max"	3.5 L 3.25 L 1.0 L
Engine oil quality	ACEA A2-96 / A3-96
Engine oil process	Waste engine oil process shall comply with laws and legislations
Oil pump (1) Type Engine oil pressure	Crescent pump 150 KPa
Engine oil consumption(1/100 km)	0.075 L

Applicable to idle speed and engine running temperature

6.1.1.5 Lubricant, seal member and retainer

Part Number	Implication	Application
N/A	Molybdenum disulphide paste	Valve tappet mounting lubricant
9309619	N/A	Oil pan bolt threadlocker
N/A	Silicon grease	Crankshaft seal mounting lubricant
9309519	N/A	No.5 main bearing cap mounting surface seal
9309548	N/A	No.5 main bearing cap edge slot seal
N/A	Kerosene	Cylinder polishing lubricant
9309548	N/A	Camshaft case seal
9986126	N/A	Engine oil
9985451	N/A	Radiator protection fluid
9309994	N/A	Water pump silicon grease
9309526	Screw lock seaming	Fastener connecting the reinforcing bolt

6.1.2 Diagnostic Information and Procedures

6.1.2.1 Basic diagnosis to engine misfire

Inspections	Operation
<p>Engine operation diagnostic procedure shall be introduced in Engine Controls. Refer to Engine Controls while diagnosing any problems related with driving performance, exhaust or MIL.</p> <p>The following diagnosis involves common problems and possible causes.</p> <p>After correct diagnosis, adjust, repair or replace to remove the troubles according to actual needs. Refer to relevant chapters for specific procedures.</p> <p>The DTC list may help to diagnose engine misfire due to camshaft, bearing wearing or damage or linkage bending.</p> <p>The list does not explain wiring distortion, oil injector failure and other driving element failure resulting in engine misfire.</p> <p>Go to Power Train On-board Diagnosis (OBD) System Inspection.</p> <p>Review the primary information and info in the list and find the specific category to diagnose the engine misfire failure.</p>	
Preliminary	<ol style="list-style-type: none"> 1. Visually inspect the following conditions: <ul style="list-style-type: none"> • Looseness of improper installation of the engine flywheel and camshaft timing belt. • Accessory driving system components wear, damage or shift in position. 2. If there is abnormal noise in the engine. 3. Inspect if the engine oil pressure is adequate. 4. Inspect if the engine oil consumption is adequate. 5. Inspect if the engine coolant consumption is adequate. 6. Conduct compression test to the engine.
Exhaust manifold bleeding	<p>Inlet manifold with vacuum may result in engine misfire.</p> <p>Inspect the following circumstances:</p> <ul style="list-style-type: none"> • vacuum hose installed improperly or damaged • inlet manifold and /or lining defect or improperly installed • Inlet manifold has crack or damaged • The throttle body or its lining is installed improperly or damaged. • Inlet manifold warpage • Cylinder block head sealing warped or damaged

6.1.2.1 Basic diagnosis to engine misfire(Cont' d)

Inspections	Operation
Coolant Consumption	<p>Coolant consumption may but not necessarily result in engine over-heat. Inspect the following circumstances:</p> <ul style="list-style-type: none"> • Coolant leakage • Cylinder block head lining defect • Cylinder head warpage • Cylinder block head cracks • Engine body damaged • Cylinder block head bolt length incorrect
Engine oil consumption	<ol style="list-style-type: none"> 1. Coolant consumption may but not necessarily result in engine misfire. 2. Remove the spark plug and check if there is oil in it. 3. Conduct cylinder pressure test and or cylinder bleeding test. 4. If cylinder pressure test shows wearings in valve or valve guiding pipe, inspect the following conditions: <ul style="list-style-type: none"> • valve stem oil sealing wearing, crack or improperly installed • Valve guiding pipe wearing • Valve stem wearing • Valve or valve seat wearing or burnt 5. If test shows piston ring wearing or damage, inspect the following conditions: <ul style="list-style-type: none"> • Piston ring broken or improperly installed • Piston ring end gap too large. • Cylinder bore wearing or too much taper • Damaged cylinders • piston damage
If there is abnormal noise in the engine.	<ol style="list-style-type: none"> 1. When the engine is running, determine if the camshaft RPM is correlates with crankshaft. 2. Use the timing lamp, one flash and twice sound means crankshaft RPM, one flash and one sound means camshaft RPM. 3. If the noise has the same frequency with camshaft RPM, inspect the following condition: <ul style="list-style-type: none"> • valve components loose or missing • valve rocker arm wearing or loose • Pushrod wearing or bending • valve spring failure • valve warp or burnt • camshaft lobes wearing • timing belt and / or belt wheel wearing or damage 4. If the knocks have the same frequency with camshaft RPM, inspect the following condition: <ul style="list-style-type: none"> • crankshaft main bearing or linkage bearing wearing • piston or cylinder damage • piston or piston pin wearing • linkage failure • too much carbon accumulated at the piston neck

6.1.2.1 Basic diagnosis to engine misfire(Cont' d)

Inspections	Operation
No abnormal noise in the engine	<ol style="list-style-type: none"> 1. Inspect if the timing belt and / or belt wheel is worn or improperly installed 2. Remove valve rocker arm in the cylinder causing the misfire at the engine side. 3. Inspect the following circumstances: <ul style="list-style-type: none"> • valve rocker arm too loose • Bending pushrod • valve spring failure • valve stem failure (bleeding) • valve wearing or improperly installed • Worn camshaft lobes

6.1.2.2 Engine Pressure test

Pressure test to engine cylinder can determine the status of piston ring, valve and cylinder block head lining.

1. Turn on the engine to obtain normal operating temperature. The battery must be near or fully charged.
2. Turn off the engine.

Note: Remove ECM and ignition fuses from the instrument fusebox.

3. Turn the ignition OFF.
4. Turn off fuel system.
5. Remove all cylinder spark plug.
6. Remove air guiding pipe on the throttle body.
7. Lock the throttle at OPEN position with guardplate.
8. Measure the pressure of the engine according to the following procedures:
 - Install the pressure gauge into the spark plug hole.
 - Rotate the engine with hand, let the cylinder under test undergo at least 4 compression stroke.
 - Inspect and record readings at the stroke pressure gauge.
 - Disconnect the pressure gauge.
 - For all other cylinders, repeat the above-mentioned pressure test steps.
9. Record the pressure readings of all cylinders.
 - The minimum reading shall be no less than 70% of the maximum reading.
 - Reading of each cylinder shall be no less than 689 Kpa.
10. The following are possible measured results:

- When the pressure is measured normal, pressure of each cylinder increases evenly to near the specified pressure.
- If the first stroke pressure is too low, while those of the following strokes rise accordingly but fail to reach the normal pressure, or when oil injectors for three times, pressure rises obviously, the failure cause may be at piston ring.
- If the first stroke pressure is too low, and fails to increase in the following strokes, or there is no change of pressure after oil is injected, the causes may rely in valves.
- If the two adjacent cylinder pressure is too low, or there is coolant in crankshaft, the cause may lay on cylinder block.

11. Remove guardplate from throttle plate.
12. Install the air guiding pipe onto the throttle body.
13. Install the sparking plug.
14. Install engine control module (ECM).
15. Install ignition fuse into I/P instrument panel fusebox.

6.1.2.3 Cylinder Bleeding Test

Tools Required

- J 35667-A Cylinder bleeding tester

Cylinder bleeding tester uses air pressure to assist diagnosing. Cylinder bleeding test may be used together with engine pressure test to find out causes of cylinder bleeding.

Caution: Refer to Cautions for Disconnection of Battery in Cautions and Notices.

1. Disconnect the battery ground (negative) cable.
2. Remove the spark plug.
3. Install J 35667-A.
4. When the valve is at CLOSE status, measure the compressed stroke of each cylinder.

Note: Prevent the piston from moving.

5. Use J 35667-A to apply air pressure.
6. Record the bleeding reading of each cylinder.

Note:

- Normal bleeding of the cylinder is 12% to 18%.
- Record the cylinder with the most bleeding.
- When the cylinder bleeding reaches more than 30%, it must be repaired.
 - 1) Inspect the four major components to diagnose the bleeding cylinder correctly.
 - 2) If bleeding is heard from the intake and exhaust system, perform the following procedures:
 - Remove the valve rocker arm on the suspected cylinder head.
 - Ensure the intake and outlet valves are closed.
 - Inspect the cylinder head to check if the valve spring is broken.
 - Remove the suspected cylinder head and check.
 - 3) If air flowing sound is heard in the crankshaft system at the crankshaft (oil filling pipeline), perform the following procedures:
 - Remove the piston in suspected cylinder.
 - Inspect piston and linkage components.
 - Inspect engine cylinder block. Refer to Cleaning and Inspection of Engine Cylinder Block.
 - 4) If there is air bubble in the radiators, perform the following procedures:
 - Remove the cylinder head and check.
 - Inspect engine cylinder block. Refer to Cleaning and Inspection of Engine Cylinder Block.
 - Remove J 35667-A.
 - Install the sparking plug.
 - Connect the battery ground (negative) cable.

6.1.2.4 Engine Noise Diagnosis (General Description)

Note: Some of the noise of the engines are specially designed. Compared with sound of other engines to make sure you are not serving the normal engine.

- Consider the following four elements while diagnosing the engine noise.

- type of the noise
- conditions for noise to occur
- frequency for noise to occur
- position on the engine producing noise

- Compared with sound of other engines to make sure you are not serving the normal engine.
- Engine noise is usually simultaneous with engine RPM (crankshaft, linkage or piston) or half of the engine RPM (valve noise). Try to determine the frequency of the noise.

Main bearing noise

- Noise caused by main bearing damage or wearing hears like deep pumping or striking, sounding once a RPM. When the engine runs under heavy load, the noise reaches its maximum db.
- Intermittent strike or knocks sharper than the main bearing wearing shows too much crankshaft end gap.
- The following conditions may bring about main bearing noise:
 - Low oil pump pressure
 - Engine oil is too thin, light, oil and / or filter too dirty
 - Main bearing gap too large
 - crankshaft end gap too large
 - crankshaft journal out-of-round
 - Too much tension of the driving belt
 - crankshaft timing belt wheel too loose
 - Flywheel, torque converter or clutch plate too loose
 - main bearing cover too loose
 - driving belt pilling

linkage bearing noise

Striking noise may heard at any speed if the linkage bearing is damaged or worn. During early wearing phase, linkage noise may be confused with sound of piston striking the cylinder or looseness in piston pin. Linkage striking sound may increase with rise of engine RPM. The noise reaches maximum during deceleration.

The following conditions may bring about linkage bearing noise:

- Bearing gap too large
- Crankshaft linkage journal wearing
- Engine oil is too thin, light, oil and / or filter too dirty
- Engine oil pressure too low
- crankshaft linkage journal out-of-round

- linkage position shift
- Linkage nut fastening torque incorrect
- shafting incorrect or position shift

Timing belt or belt wheel noise

Engine with timing belt or belt wheel may produce noise. The most common noise is a kind of high frequency, light striking. Engine noise does not change when the engine is idle, at high speed or under heavy load.

The following conditions may bring about belt and belt wheel noise:

- Timing belt wearing
- Belt wheel wearing
- camshaft or crankshaft belt too loose
- camshaft or crankshaft end gap too large

piston noise

Piston pin, piston and linkage noise hard to identify. Piston pin looseness may result in sharp double striking, which can be heard when the engine is idle, or under sudden acceleration or deceleration. Piston pin installed improperly may produce slight clicks, which is more obvious when the engine has no load. Too much gap between the piston and cylinder housing may produce piston striking sound. It is similar to metal striking when the piston strikes the cylinder wall during its stroke.

For most engine noises, try to know the causes of the noise will do help to determine what the noise sounds like. One of the symptom of piston striking the cylinder is that the noise reduces when the engine is pre-heated. When the engine is cold, gap between the piston and cylinder housing increases and the sound rise in db. The following conditions may bring about main piston noise:

- piston pin wearing or too loose
- piston pin improperly assembled
- Too much gap between piston and cylinder housing
- insufficient lubrication
- Accumulated carbon at the end of the piston strikes the cylinder head
- piston ring channel rim wearing or broken
- Broken piston
- linkage position shift
- piston ring wearing or too loose
- piston channel rim gap too large
- Piston ring end gap insufficient.
- piston out of position for 180 degree
- piston skirt pattern incorrect

flywheel noise

Notice: If the torque convertor bolt is too long, there may be waves on torque convertor clutch, which may result in trembling.

Looseness or broken of the flywheel may produce irregular striking or clicks. Test if the flywheel is loose or broken according to the following procedures:

1. Operate the vehicle at the speed of 32km/h.
2. Turn off the engine.

If strikes are heard, the flywheel may be loose or damaged. This kind of striking is loudest during deceleration.

Loose connection between torque convertor and flywheel or between flywheel and crankshaft bolt may result in bearing striking. The condition may produce several strikings when the engine runs with no load or under sudden acceleration. Decide according to the stability of idleness. When the transmission driving mechanism engages, there may be noise.

Before correlating knocking with the bearing, inspect the connecting bolts between torque convertor and flywheel and between flywheel and crankshaft.

Valve noise

Light striking sound produced by frequency half of the engine RPM or any other frequency shows there may be valve failure. Light striking sound may increase with rise of engine RPM. Before determining if the noise is from the valve, pre-heat the engine first. So that engine components will swell to normal conditions. Have the engine running under different RPM, listen to the noise of the engine when the engine hood is closed.

Caution: It is recommended not to perform the following procedures on engines with stainless steel exhaust manifold.

If valve mechanism noise is abnormal, remove the valve rocker arm cover. Use stethoscope to determine the valve components producing the noise. Causes of noise from the valve include:

- Valve spring broken or insufficient spring force
- Sticking or warping valves
- Bending pushrod
- Valve jib is too dirty, sticking or worn.
- Camshaft lobes wearing or poorly processed
- Valve poorly lubricated (engine oil too low)
- Too much gap between valve jib and guiding pipe
- Valve guiding pipe wearing
- Pushrod wearing
- Worn rocker arm
- Valve rocker arm broken

- Valve rocker arm accessory too loose or wearing
- Valve jib guiding pipe (rotor jib engine) missing or position shift

6.1.2.5 Engine Noise Diagnosis (Symptom- cause/ removal action)

exhaustion

Symptoms	cause/ removal action
exhaustion system vibration or squeaking	<p>Connection of exhaust components loose or position shift. Perform the following procedures:</p> <ol style="list-style-type: none"> 1. Align the connections. 2. Fasten the connections. 3. Inspect the ear and, mounting bracket for damage.
exhausted gas leakage and / or noise	<p>The following conditions may bring about exhausted gas leakage and / or noise:</p> <ul style="list-style-type: none"> • Leakage at the exhaust component connector. • Improper installation or position shift of the exhaust system. • Align the clamps and fasten them. • cracks in the exhaust manifold. • Replace the exhaust manifold. • There is leakage between the exhaust manifold and the cylinder head. • Fix the exhaust manifold at the cylinder head, fasten the nut or replace the exhaust manifold gasket. • Exhaust extraction connection damaged or worn. • Replace the components if necessary. • Burnt or rusted exhaust pipes. • Replace the exhaust pipe if necessary. • Burnt or rusted muffler. • Replace the muffler assembly. • Exhaust clamp and / or bracket damage or loose. • Replace the components if necessary. • Leakage at the exhaust component connector.

Valves

Symptoms	cause/ removal action
Intermittent noise occurs under idle and the noise disappears when RMP of the engine increases.	<ul style="list-style-type: none"> • Dust in valve stem • Replace the valve stem if necessary. • Valve stem positioning steel ball partly corrosive or damaged • Replace the valve stem if necessary.
Noise can be heard under idle or high oil temperature, and disappears when engine RPM is high or oil temperature is relatively cold.	<p>If there is great leakage at the valve stem, noise can be heard under idle or high oil temperature.</p> <p>Replace the valve stem.</p>
There is noise under idle condition, the higher the RPM, the louder the noise.	<p>The noise is not related with failure of the valve stem. This kind of noise is obvious at low shift or when the vehicle speed is at 10- 15 km/h. The noise sounds like clicks. The following conditions may bring about the noise:</p> <ul style="list-style-type: none"> • Valve end or valve rocker arm gasket worn • Too much gap between valve jib and guiding pipe • Too much radial runout at the valve seat • Too much radial runout at the valve operating surface • valve spring position shift <ul style="list-style-type: none"> – Rock the engine until the valve producing the noise disengages from the valve seat. – Rotate valve spring and valve. – If the noise is corrected, inspect if there is position shift at the valve spring. If the valve spring position shift exceeds the limit, replace the valve spring.
There is noise under high vehicle speed and the noise disappears when the vehicle speed is low.	<p>High vehicle noise may be produced by the following conditions:</p> <ul style="list-style-type: none"> • Too high oil level • If oil level is higher than FULL, crankshaft weight will agitate the oil into foams. When foams are pumped into valve stem, noise will occur. Drain the oil to normal level. • Oil level too low • If oil level is lower than ADD, oil pump will pump in air. Noise occur at valve stem. Add oil if necessary. • Oil pump absorbing filter bending or loose
Noise not related to engine RPM	<p>Inspect the following circumstances:</p> <ul style="list-style-type: none"> • lubrication system supplying the rocker • Worn rocker arm ball end • rocker arm warp or damaged • Valve rocker arm too loose or wearing • If the rocker and valve rocker arm are under good condition, there must be failure at valve stem. Replace the valve stem.

Basic diagnosis to engine

Symptoms	cause/ removal action
There is striking noise at start, but lasts only several seconds	Engine oil viscosity inadequate. According to the estimated temperature, choose the correct oil viscosity. Refer to Recommended Oil and Lubricants in Maintenance and Lubrication.
Striking at cold condition and lasts two to three seconds	When the specific cylinder sub-level ignition circuit is grounded, cold engine striking noise usually disappears. Inspect the engine for the following conditions: <ul style="list-style-type: none"> • Engine flywheel contacts the mudguard. • Re-locate the mudguard. • Crankshaft weight or driving belt wheel loose or crack. • If necessary, fasten or replace the components. • Too much gap between piston and cylinder housing. • If necessary, check or replace the piston components. • Bending linkage
Striking under hot idle	Inspect the engine for the following conditions: <ul style="list-style-type: none"> • driving belt wearing • Inspect its tension, replace the driving belt if necessary. • A/C compressor or alternator bearing. • If necessary, repair or replace the components. • Valves. • Replace the components if necessary. • Engine oil viscosity inadequate. • According to the estimated temperature, choose the correct oil viscosity. Refer to Recommended oil and lubricants in Maintenance and Lubrication for engine oil specifications. • Piston pin gap too large. • If necessary, replace the piston and piston pin. • Correct the linkage positioning. • If necessary, check or replace the linkage. • Gap between piston and cylinder housing is insufficient. • Mill the cylinder bore and replace with new piston. • Adjust the looseness or improper torque of the crankshaft weight. • Replace the worn components. • Ensure correct direction of piston pin. • Install the piston properly.
Slight striking in the cylinder when the vehicle is hot.	Inspect the engine for the following conditions: <ul style="list-style-type: none"> • Detonation/Spark Knock • Refer to Engine Control. • Torque convertor bolt loose. • Exhaust manifolds leak. • Fasten bolts and / or replace the gaskets. • Linkage bearing gap too large. • Replace the linkage bearing if necessary.

Basic diagnosis to engine (Cont' d)

Symptoms	cause/ removal action
Striking noise becomes severe when torque is increased.	Inspect the engine for the following conditions: <ul style="list-style-type: none"> • Crankshaft weight or driving belt wheel hub broken. • Replace the components if necessary. • Torque convertor bolt loose. • Fasten the torque convertor bolt. • Accessory driving belt is too much fastened or there is dent on it. • Replace the driving belt if necessary. • Flywheel broken • Replace the flywheel. • Crankshaft main bearing gap too large. • Replace the components if necessary. • Linkage bearing gap too large. • Replace the components if necessary.

Accessory driving belt scratching noise diagnosis

Step	Operation	Yes	No
Definition: There is Scratching noise under the following conditions: <ul style="list-style-type: none"> • High scratching noise can be heard once the driving or belt wheel turns a cycle. • Usually occurs at cold and humid morning. • Spray water to the driving belt to confirm the situation.Noise should stop at once. 			
1	Inspect if the belt wheel has position shift. Is there belt wheel position shift?	Go to Step 3	Go to Step 3
2	Re-position the shifted belt wheel. Does the scratching noise still exist?	Go to Step 3	System OK?
3	Check if the bracket is bending or broken. Is the bracket bending or broken?	Go to Step 4	Go to Step 5
4	Replace bending or broken bracket. Does the scratching noise still exist?	Go to Step 5	System OK?
5	Inspect if the fasteners are loose or missing. If there is any loose or missing components	Go to Step 6	Go to Step 7
6	Fasten any loose fasteners. Replace the missing fasteners immediately.Refer to Fastener Tightening Torque Does the scratching noise still exist?	Go to Step 7	System OK?
7	Inspect if the belt wheel flange is bending. Is there bent belt wheel flange?	Go to Step 8	Go to Step 9
8	Replace the belt wheel. Does the scratching noise still exist?	Go to Step 9	System OK?
9	Inspect if there severe depression deeper than 1/3 of the channel's depth. Is there severe depression?	Go to Step 10	—
10	Replace the accessory drive belt.Refer to Accessory Drive Belt Replacement.	—	System OK?

Accessory driving belt sharp noise diagnosis

Step	Action	Yes	No
Definition: There is Sharp noise under the following conditions: <ul style="list-style-type: none"> • Sharp noise resulting from slippage of the driving belt (usually occurs at driving belt with multiple ribs) • When the load of the driving belt increases, such as when the A/C compressor engages with the valve and is block, or block belt wheel slips, the sharp noise occur. 			

Accessory driving belt sharp noise diagnosis(Cont' d)

Step	Action	Yes	No
1	Inspect if the belt wheel has position shift. Is there shifted belt wheel?	Go to Step 3	Go to Step 2
2	Test for correct length of the accessory driving belt.Refer to Accessory Drive Belt Replacement. Test for correct length of the accessory driving belt.	Go to Step 4	Go to Step 5
3	If necessary, repair or replace the components. Have you finished repairing?	System OK?	—
4	Test the operation of the accessory driving belt tensioner. Is the operation of the accessory driving belt tensioner normal?	Go to Step 3	Go to Step 5
5	Inspect if the belt wheel size is correct. Is the size of all belt wheel correct?	Go to Step 6	Go to Step 3
6	Check if the bearing is blocked. Is there locked bearing?	Go to Step 3	System OK?

Accessory driving belt whimpering noise diagnosis

Step	Action	Yes	No
Definition: Continuous high noise resulting from bearing failure.			
1	Inspect if there is wearing at the accessory bearing. Is there bearing making the noise?	Go to Step 2	System OK?
2	Install new components if necessary. Have you finished repairing?	System OK?	—

Accessory driving belt swelling noise diagnosis

Step	Action	Yes	No
Definition: Deep striking noise resulting from accessory driving belt position shift. The noise occurs when the vehicle is idle at cold condition. High low frequency noise can be heard once the driving or belt wheel turns a cycle.			
1	Is there severe depression? Inspect if there severe depression deeper than 1/3 of the channel 槽 depth.	Go to Step 2	System OK?
2	Clean the accessory drive belt. Have you finished repairing?	System OK?	Go to Step 3
3	Install the new accessory drive belt.Refer to Accessory Drive Belt Replacement. Have you finished repairing?	System OK?	—

Accessory driving belt vibration diagnosis

Step	Action	Yes	No
DEFINITION:Vibration is related with engine RPM. Vibration may be sensitive to the load of the accessory.			
1	Inspect the accessory driving belt is worn, damaged, loose, accumulated with residue or there is any driving belt rib missing. Is there wearing or damage to the accessory driving belt?	Go to Step 2	Go to Step 3
2	Replace if necessary.Refer to Accessory Drive Belt Replacement. Have you finished repairing?	Go to Step 3	—
3	Inspect if the fasteners are loose or missing. If there is any loose or missing components	Go to Step 4	Go to Step 5
4	Fasten or replace according to actual needs. Have you finished repairing?	System OK?	—

Accessory driving belt vibration diagnosis(Cont' d)

Step	Action	Yes	No
5	Inspect if the belt wheel is damaged or bending. Inspect if the belt wheel is damaged.	Go to Step 6	Go to Step 7
6	Repair or replace if necessary. Have you finished repairing?	System OK?	—
7	Inspect the operation of the tensioner. Is the operation of the accessory driving belt tensioner normal?	Go to Step 9	Go to Step 8
8	Replace if necessary. Refer to Accessory Drive Belt Replacement. Have you finished repairing?	System OK?	—
9	Check if the bracket is bending or broken. Is the bracket bending or broken?	Go to Step 10	System OK?
10	If necessary, repair or replace the bracket. Have you finished repairing?	System OK?	—

Accessory driving belt disengaging diagnosis

Step	Action	Yes	No
Definition: The following condition may result in accessory driving belt being disengaged.			
1	Inspect if the belt wheel is shifted or bending. Inspect if the belt wheel has position shift.	Go to Step 2	Go to Step 3
2	Is there shifted or bending belt wheel? Does accessory driving belt still disengage?	Go to Step 3	System OK?
3	Check if the bracket is bending or broken. Is the bracket bending or broken?	Go to Step 4	Go to Step 5
4	Replace the damaged bracket. Does the driving belt still disengage?	Go to Step 5	System OK?
5	Inspect if the fasteners are loose or missing. If there is any loose or missing components	Go to Step 6	Go to Step 7
6	Replace the missing fasteners and fasten according to specifications.Refer to Fastener Tightening Torque Does accessory driving belt still disengage?	Go to Step 7	System OK?
7	Inspect if the steering wheel pump belt wheel has position shift. Inspect if the power steering wheel pump belt wheel has position shift.	Go to Step 8	Go to Step 9
8	Re-position or replace the power steering wheel belt wheel. Does the driving belt still disengage?	Go to Step 9	System OK?
9	Inspect if the driving belt is damaged. Is the driving belt damaged?	Go to Step 10	Go to Step 11
10	Replace the accessory drive belt.Refer to Accessory Drive Belt Replacement. Does accessory driving belt still disengage?	Go to Step 11	System OK?
11	Test the operation of the accessory driving belt tensioner. Is the operation of the accessory driving belt tensioner normal?	—	Go to Step 12
12	Replace the accessory drive belt tensioner.Refer to Accessory Drive Belt Replacement. Does accessory driving belt still disengage?	—	System OK?

Accessory driving belt severe wearing diagnosis

Step	Action	Yes	No
Definition: Accessory driving belt outside enhancement rib wearing resulting from improper installation of accessory driving belt.			

Accessory driving belt severe wearing diagnosis(Cont' d)

Step	Action	Yes	No
1	Inspect if the enhancing rib of the accessory driving belt is matched with the belt wheel channel. Is the enhancing rib of the accessory driving belt matched with the belt wheel channel?	—	Go to Step 2
2	Replace the accessory drive belt. Refer to Accessory Drive Belt Replacement. Have you finished repairing?	System OK?	—

6.1.2.6 Oil Consumption

General Description

Engine oil consumption refer to the amount of oil burnt. Under any circumstances, do not confuse the concept of oil consumption with that of dripping in oil pan, oil leakage from the cylinder head.

Engine oil is used:

1. to separate the contacting surface with oil film to avoid dry frictions.
2. Induce heat produced by friction.
3. Take away residues after burning.

Certain amount of engine oil may be consumed for the above objectives, that is, it is absolutely unreasonable to expect engine requiring no oil.

Oil consumption is impacted by internal operation, driving type and manufacturing tolerance. Generally speaking, oil consumption is very few. Add a few or there is no need to add.

However, when the oil level is below the minimum mark, it is necessary to add oil. Meanwhile, ensure the oil level does not exceed the maximum mark, otherwise, oil consumption will increase.

Due to technology used during oil consumption, if the engines no consumption of oil, the lost oil is dissolved under special working conditions.

Frequent cold start or cold driving will cause the engine oil flowing back to the oil pan with oil particles and compressed fluid, they will dissolve the engine oil and give us the illusion that the engine consumes no oil.

The dissolved engine oil lacks lubrication performance, if we fail to add oil, the engine may be damaged. Engine oil dissolves mainly under urban traffic when the vehicle is driven frequently under low speed.

Oil consumption usually comes to stable after driving for several thousand kilometers, that is, it is necessary to measure oil consumption after the vehicles drives more than 7500km. Ensure the engine consumes no oil due to engine leakage.

Oil dipstick can only used to inspect.

Turn off the engine at least 2 minutes before measuring the oil level.

If the oil has reaches the maximum level, but the dipstick does not show its maximum position, it may be due to manufacturing tolerance.

Refer to the owner's manual for the allowed engine oil consumption and add of oil.

If the engine consumes more than 0.075 L oil after driving for 100 km, it shows engine oil consumption is too much. The following is the list of conditions as well as measure to counter too much oil consumption.

- engine oil level indicator (dipstick) inaccurate
 - Park the vehicle under smooth road to check the oil level.
 - Wait for sufficient time until the engine oil sinks.
- Engine oil viscosity inadequate.
 - According to the local temperature, choose the recommended SAE viscosity.
 - Refer to Recommended oil and lubricants in Maintenance and Lubrication for engine oil viscosity specifications.
- Drive continuously at high speed
- heavy load towing, such as trailer. Reduce oil mileage.
- Crankcase Ventilation System Failure
- Oil flows out.
 - Fasten the bolt if necessary.
 - Replace the gasket and sealing according to actual needs.
- Valve guiding pipe and / or valve stem sealing wearing or missing
 - Ream the valve guiding pipe.
 - Install larger service valve and / or new valve stem sealing.
- Piston ring wearing or broken
- Piston ring improperly installed or seated
- Piston improperly installed or assembled
- Cylinder head lining engine oil bleeding hole blocked

- Inlet lining damaged

Measuring method of engine oil consumption

1. Park the vehicle on leveled road while conducting inspection, have the engine at operation temperature (engine oil temperature shall be at least 80).
2. Have the engine run idle before draining the engine oil.
3. After draining out the engine oil, turn off the engine and record the drainage time; 3 minutes.(Test shows drainage should be finished within 3 minutes).
4. Drain out the engine oil until it drips.
5. Have the drained engine oil cool to 20C (1 to 2 hours).
6. Use graduate to measure the engine oil amount after cooling, re-fill the new engine oil to the maximum position, since the filter is not replaced, deduct 0.25L.
7. The amount of oil is sufficient for the owner to drive at least 500km/ 350mile.(The owner shall drive at normal routes and driving way)
8. Repeat the above-mentioned procedure (1- 4), draining time is the same.
9. Oil consumed in the graduate is the engine oil consumption / trip consumption.

*Transparent graduate: 1 to 2 L.

6.1.2.7 Engine oil pressure diagnosis and test

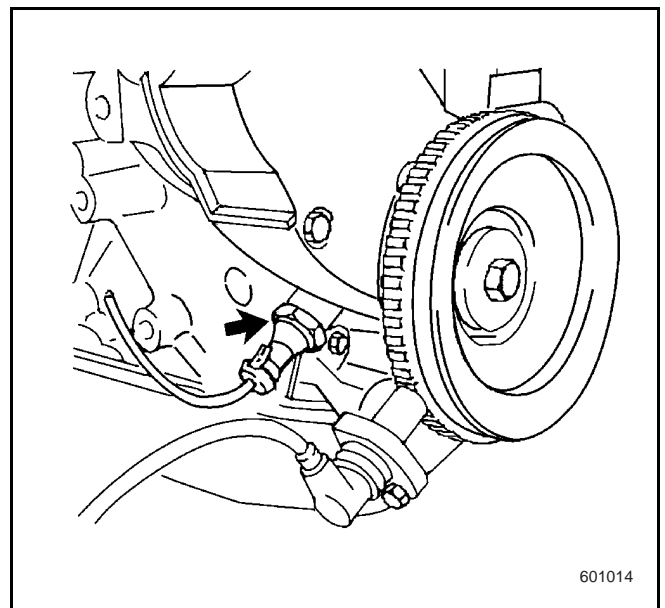
Engine oil pressure too low or no oil pressure

The following condition may bring about engine oil pressure too low or no oil pressure:

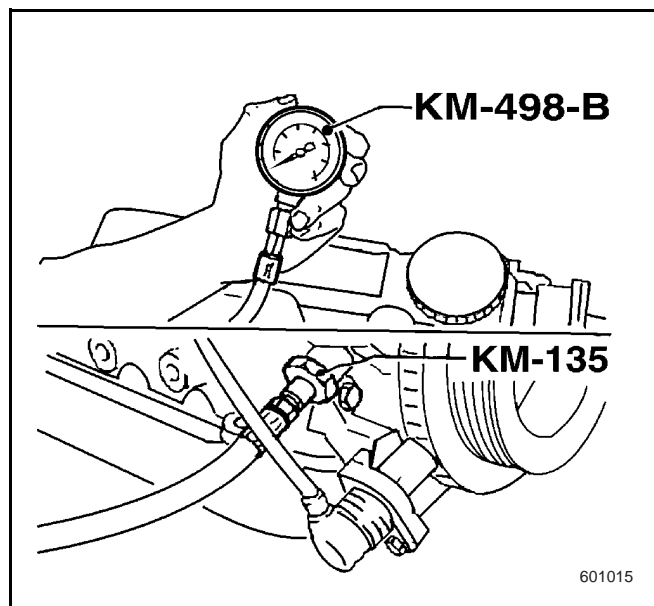
- Engine oil level too low ñ fill engine oil to the maximum scale of the indicator.
- Engine oil pressure switch incorrect or function fails- replace engine oil pressure switch.
- Engine oil pressure gauge incorrect or function fails- replace engine oil pressure gauge.
- Engine oil viscosity incorrect or engine oil dissolved
 - According to the estimated temperature, choose the correct oil viscosity.
 - If the engine oil is dissolved, use new engine oil.
- If engine oil pump is worn or too dirty- clean or replace the engine oil pump.
- Engine oil filter blocked- replace the engine oil filter.
- Linkage filter is too looser blocked- replace the linkage filter.
- There is hole on linkage oil filter pipe- replace linkage oil filter pipe.
- Bearing gap too large- replace bearing.
- Engine oil passage crack, hole or blocked- service or repair the engine body.
- Oil passage hole plug missing or improperly installed- install or repair if necessary.
- Pressure regulation valve sticks.
 - Inspect if the pressure regulation valve sticks in the hole.
 - Inspect if there is dent and blur in the hole.
- Camshaft wearing or mechanical processing improper- replace camshaft.
- Valve guiding pipe wearing- repair if necessary.

Engine oil pressure test

1. Start the engine at operation temperature (engine oil temperature 80C)
2. Remove the oil pressure switch (refer to arrow in the figure).



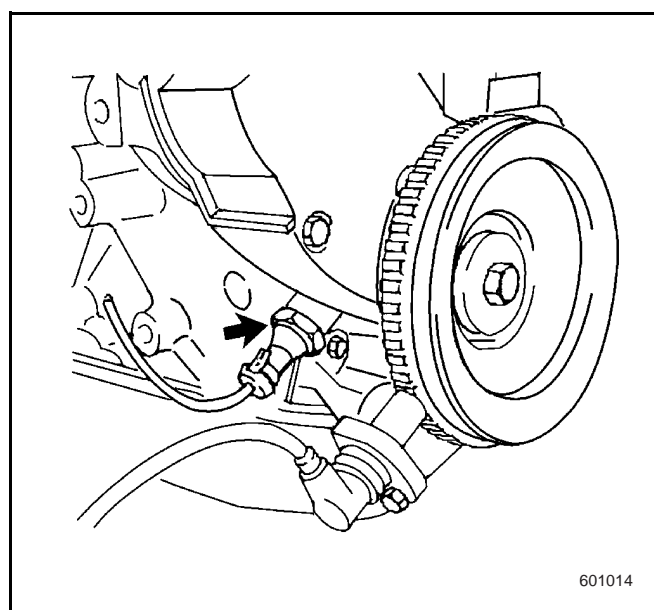
3. Screw oil pressure meter KM-498-B and adapter KM-135 into screw holes in the oil pressure switch (refer to arrow in the illustration) .



4. Measure the oil pressure. Minimum oil pressure under idle 30 Kpa (3 bar).
5. Remove the oil pressure and adaptor.
6. Install the oil pressure switch.

Tightening

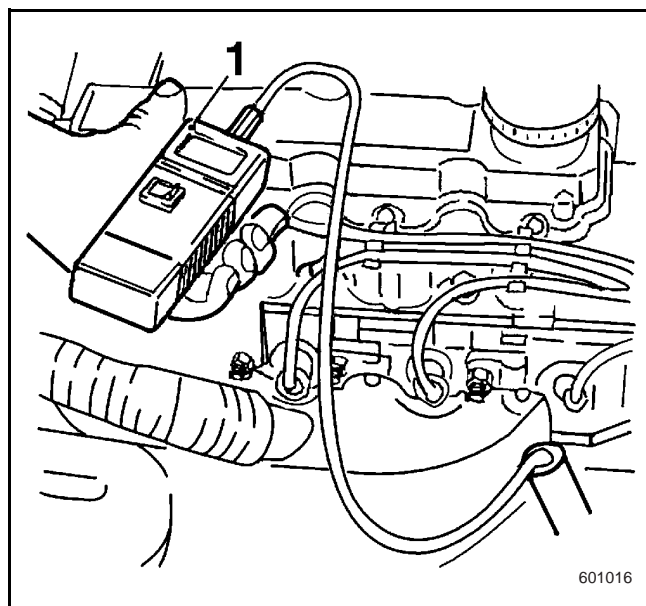
Fasten the oil pressure switch to $30 \pm 10 \text{ N}\cdot\text{m}$



7. Fill oil to the maximum position of the dipstick.

Engine oil temperature measuring

1. Use detector MKM-596-A (I) to replace the oil meter to insert into the indicator guiding pipe till the end, then extract about 1cm.



2. Block the oil level indicator guiding pipe mouth with rubber plug. The rubber plug must have detection probe.
3. After measurement, remove the rubber plug and detection probe, re-install the oil meter.

Important:

Engine oil temperature depends on the relevant engine load, under maximum load, engine oil temperature may reach 150°C.

6.1.2.8 Engine oil leakage diagnosis

Tools Required

- J 28428-E High illumination invisible lamp

During service of most oil leakage, find the outside leakage area, service or repair the components or re-seal the gasket surface. Once the leakage is confirmed, determine the causes of leakage. Service leakage and shoot out the leakage causes.

Determine and confirm the leakage position

Determine if the leaked fluid is one of the following through visual inspection:

- Engine oil
- Transmission oil
- Power steering system fluid
- Brake fluid
- other oil or fluid

visual inspection

Perform the following steps to visually inspect:

- Have the engine reaching normal operating temperature.

- Park the vehicle on a piece of big paper or other clean surface.
- Wait for several minutes and then inspect if there is dripping.
- Identify the type of the dripping fluid and approximate position of the leakage.
- Visually inspect the suspected components. Use a mirror if necessary.
- Inspect the sealing surface, connectors or cracked or damaged components to see if there is leakage.

if the leakage can not be located, perform the following steps.

- Thoroughly clean the engine and the surrounding components.
- Under the normal operating temperature, drive the vehicle for several miles at different speed.
- Park the vehicle on a piece of big paper or other clean surface.
- Wait for several minutes and then inspect if there is dripping.
- Identify the type of the dripping fluid and approximate position of the leakage.
- Visually inspect the suspected components. Use a mirror if necessary.
- Judge the possible causes for the leakage.

If the position of the leakage cannot be located still, use powder or invisible lamp and dye detection method.

Powder detection

1. Thoroughly clean the engine and the surrounding components.
2. Apply fog like powder (children skin powder, foot powder) onto the suspected locations.
3. Under the normal operating temperature, drive the vehicle for several miles at different speed.
4. Identify the type of the fluid, determine the approximate position of the leakage according to position where color the powder surface changes.
5. Visually inspect the suspected components. use a mirror to help locating the areas hard to access.
6. If necessary, refer to the following Possible leakage causes.

Invisible light lamp and dye detection method

Dye and lamp can be used to find out leakage.

1. Use J 28428-E or equivalent products. Refer to the guidance provided by the manufacturer while using the tool.
2. Visually inspect the suspected components. Use a mirror if necessary.

3. If necessary, refer to the following possible leakage causes.

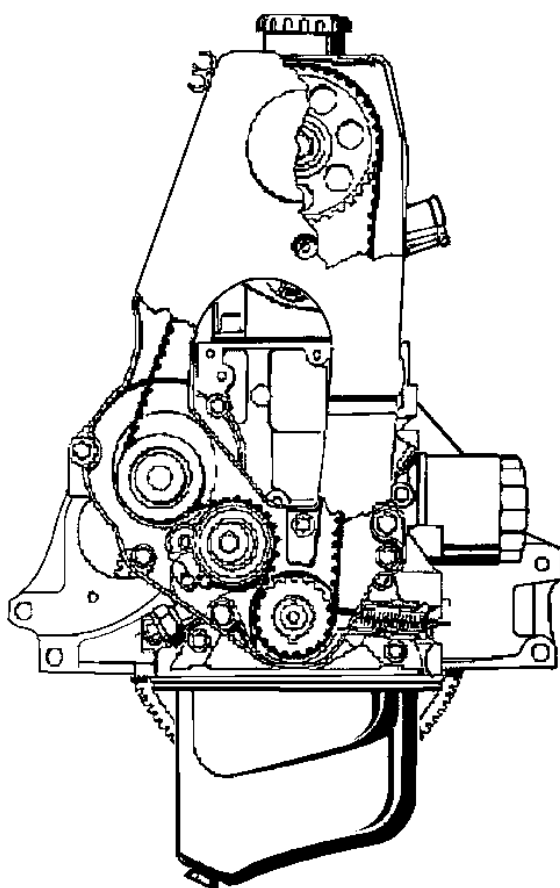
Possible reasons causing leakage

Inspect if the vehicle is under the following conditions:

- Fluid level higher than the recommended value
- Fluid level higher than the recommended value
- Engine oil filter element or pressure by-pass valve blocked or fails
- Engine ventilation system blocked or fails
- Fasteners improperly fastened or damaged
- Parts crack or present gap
- sealing agent or gasket inadequate
- Sealing agent or gasket installed improperly
- Gasket or sealing damaged or worn
- Sealing surface wearing or damage

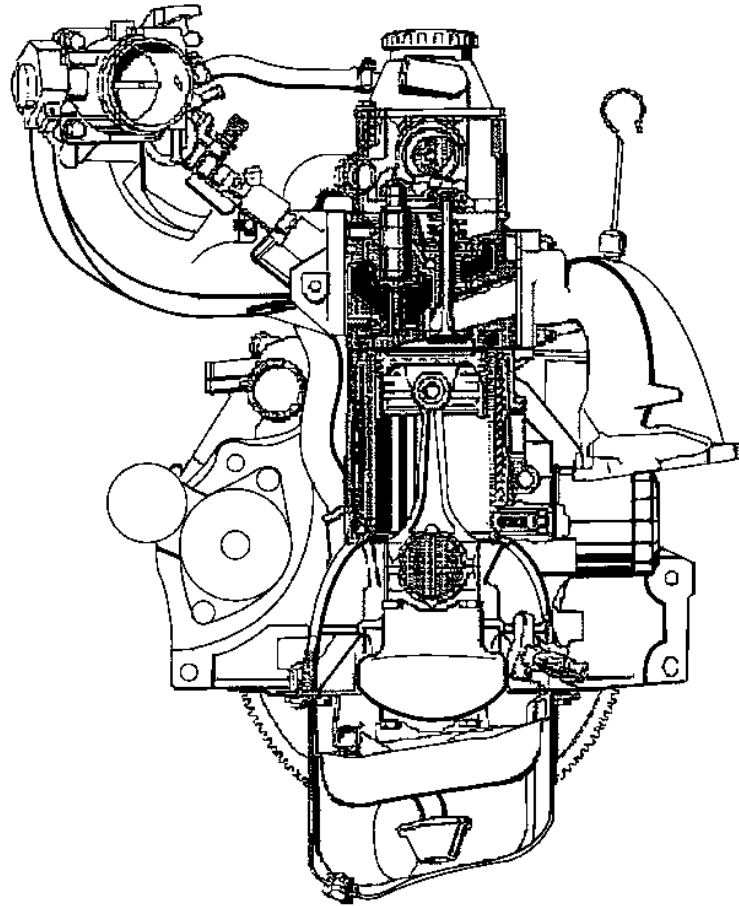
6.1.3 Visual Identification

6.1.3.1 Engine Section View (without intake manifold assembly)



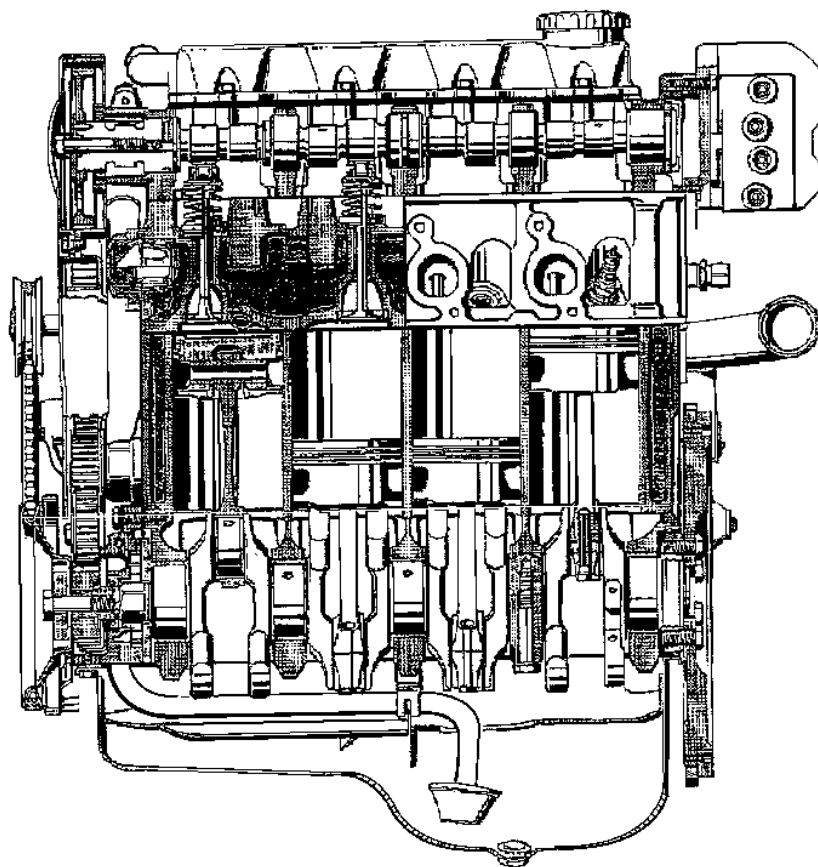
601001

6.1.3.2 Engine Section View



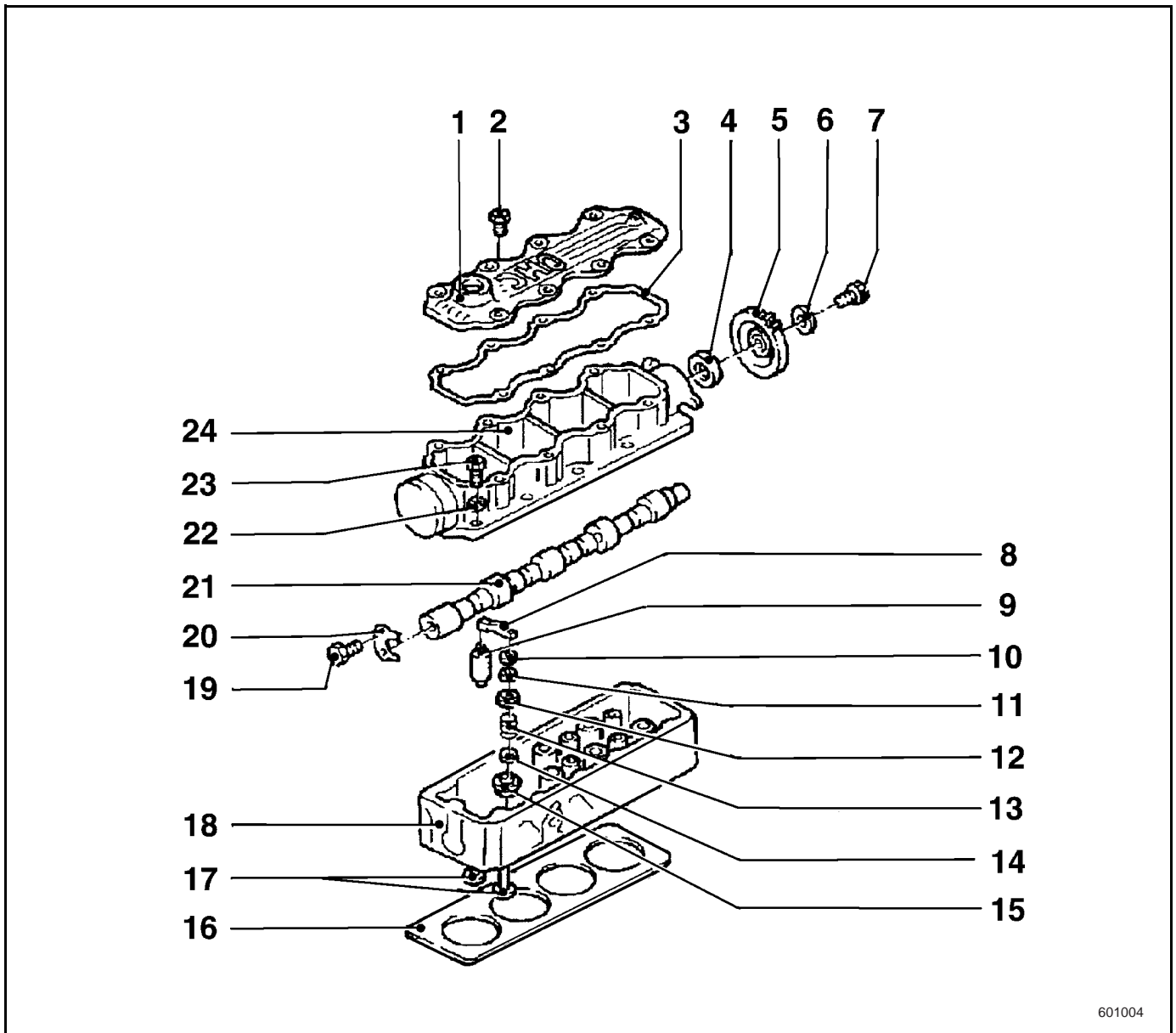
601002

6.1.3.3 Engine Vertical Section View



601003

6.1.3.4 Cylinder Head, OHC Engine(C16NE)

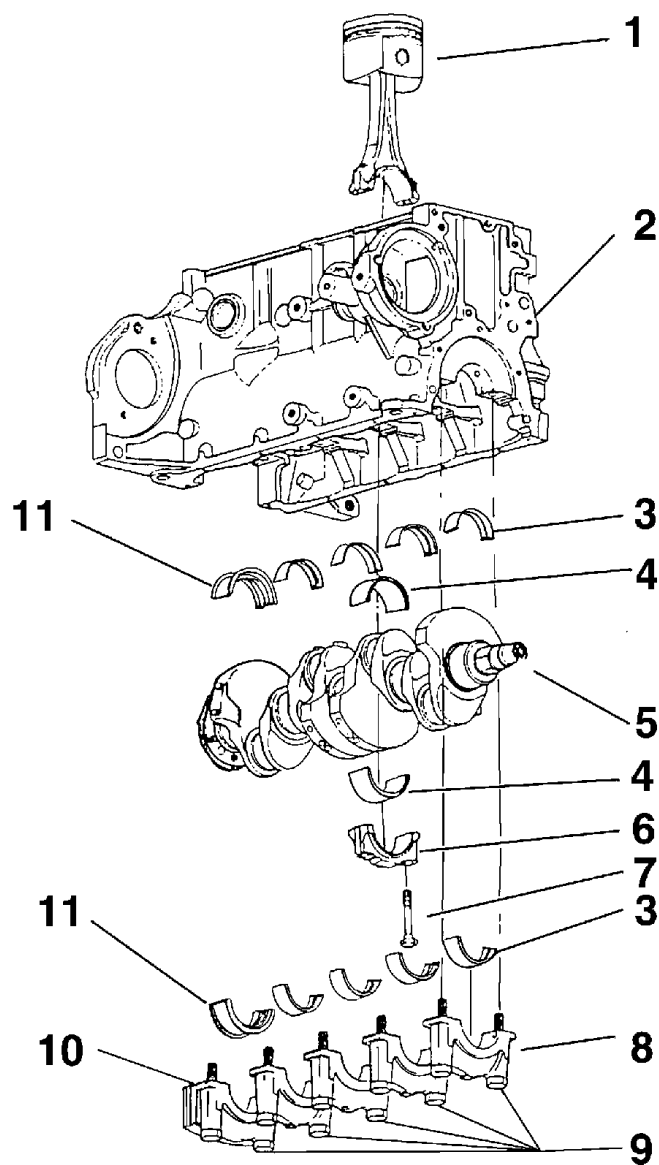


601004

Legend

- | | |
|--------------------------------------|-------------------------------|
| (1) Camshaft bracket housing | (13) valve spring |
| (2) bolt | (14) valve tappet sealing |
| (3) gasket | (15) valve spring lower seat |
| (4) Camshaft front case sealing ring | (16) Cylinder head gasket |
| (5) Camshaft timing belt | (17) valve (outlet and inlet) |
| (6) gasket | (18) Cylinder head |
| (7) bolt | (19) fender bolt |
| (8) rocker arm | (20) Camshaft fender |
| (9) Hydraulic tappet | (21) Camshaft |
| (10) rocker arm | (22) gasket |
| (11) Valve lock chip | (23) Cylinder head bolt |
| (12) valve spring upper seat | (24) Camshaft bracket |

6.1.3.5 Cylinder set, driving chain (C16NE)

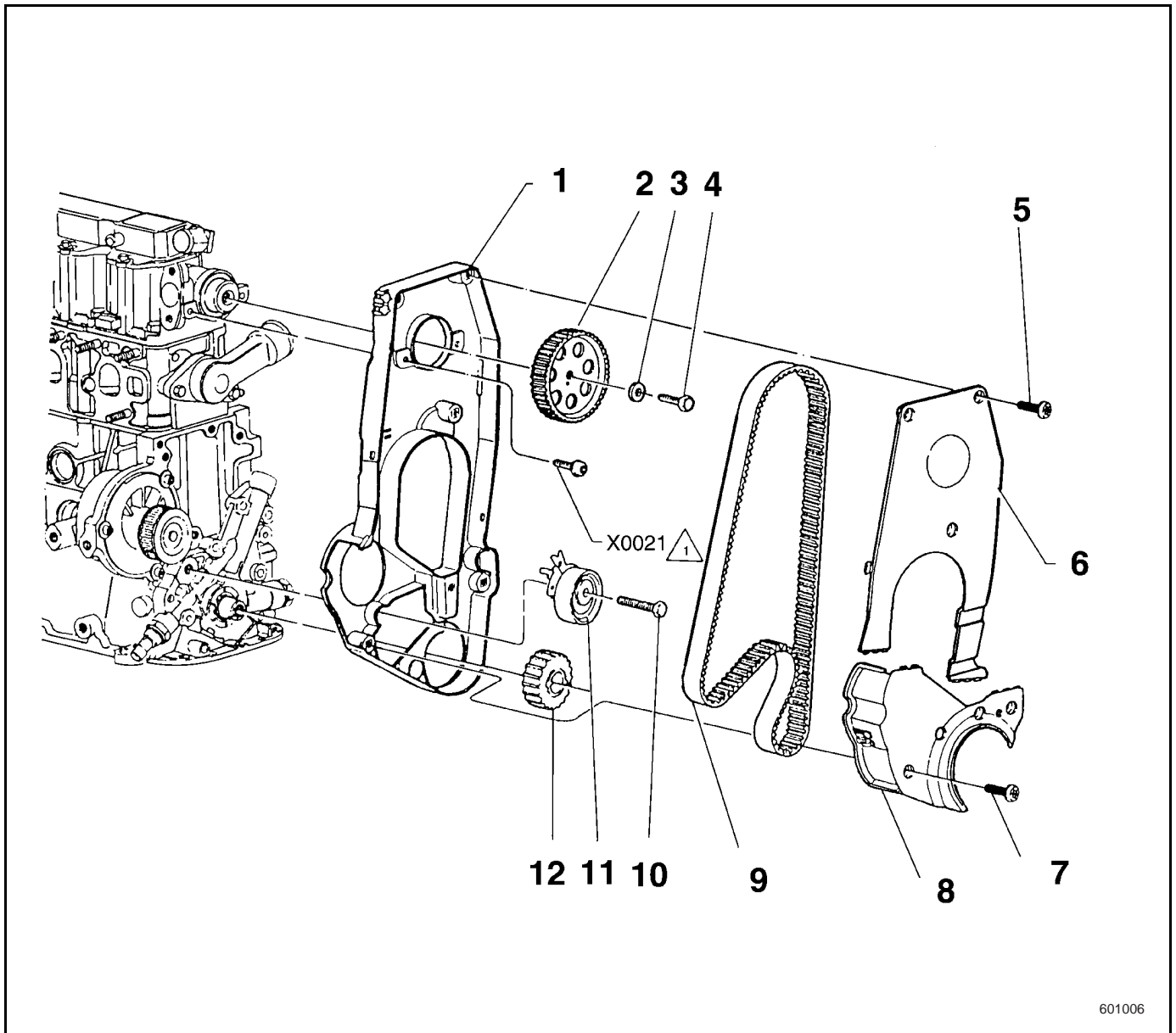


601005

Legend

- | | |
|---|--|
| (1) piston set (with piston pin and tappet) | (7) linkage bolt |
| (2) Cylinder body | (8) Main bearing cover |
| (3) main journal | (9) main bearing cover bolt |
| (4) linkage journal | (10) main bearing cover No 5 |
| (5) Crankshaft | (11) Main bearing, No 3 (thrust bearing) |
| (6) linkage bearing cover | |

6.1.3.6 Illustration, Engine Timing Chain

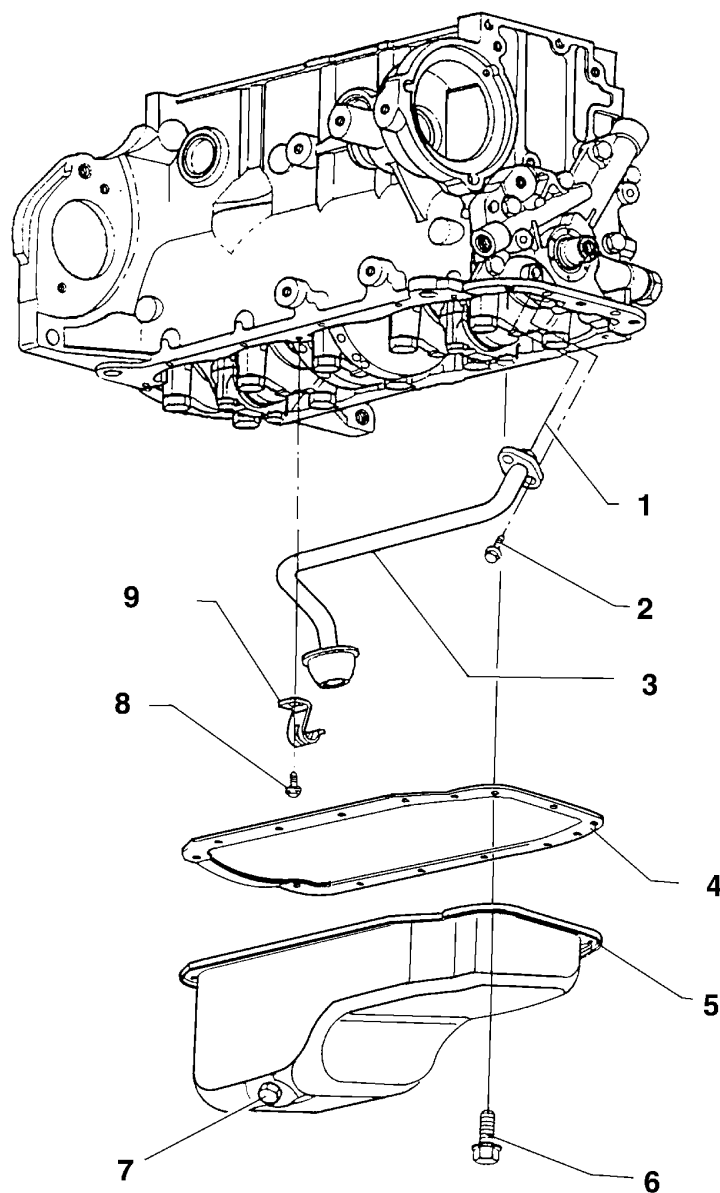


601006

Legend

- | | |
|--------------------------------------|--|
| (1) Timing belt rear cover | (7) Timing belt front lower cover bolt |
| (2) Camshaft timing belt (tooth) | (8) Timing belt front lower cover |
| (3) Camshaft timing belt bolt gasket | (9) Timing belt (tooth) |
| (4) Camshaft timing belt wheel bolt | (10) Timing belt accessory tension pulley bolt |
| (5) Timing belt front cover bolt | (11) Timing belt tensioning pulley |
| (6) Timing belt front upper cover | (12) Crankshaft timing belt wheel (tooth) |

6.1.3.7 Engine Oil System

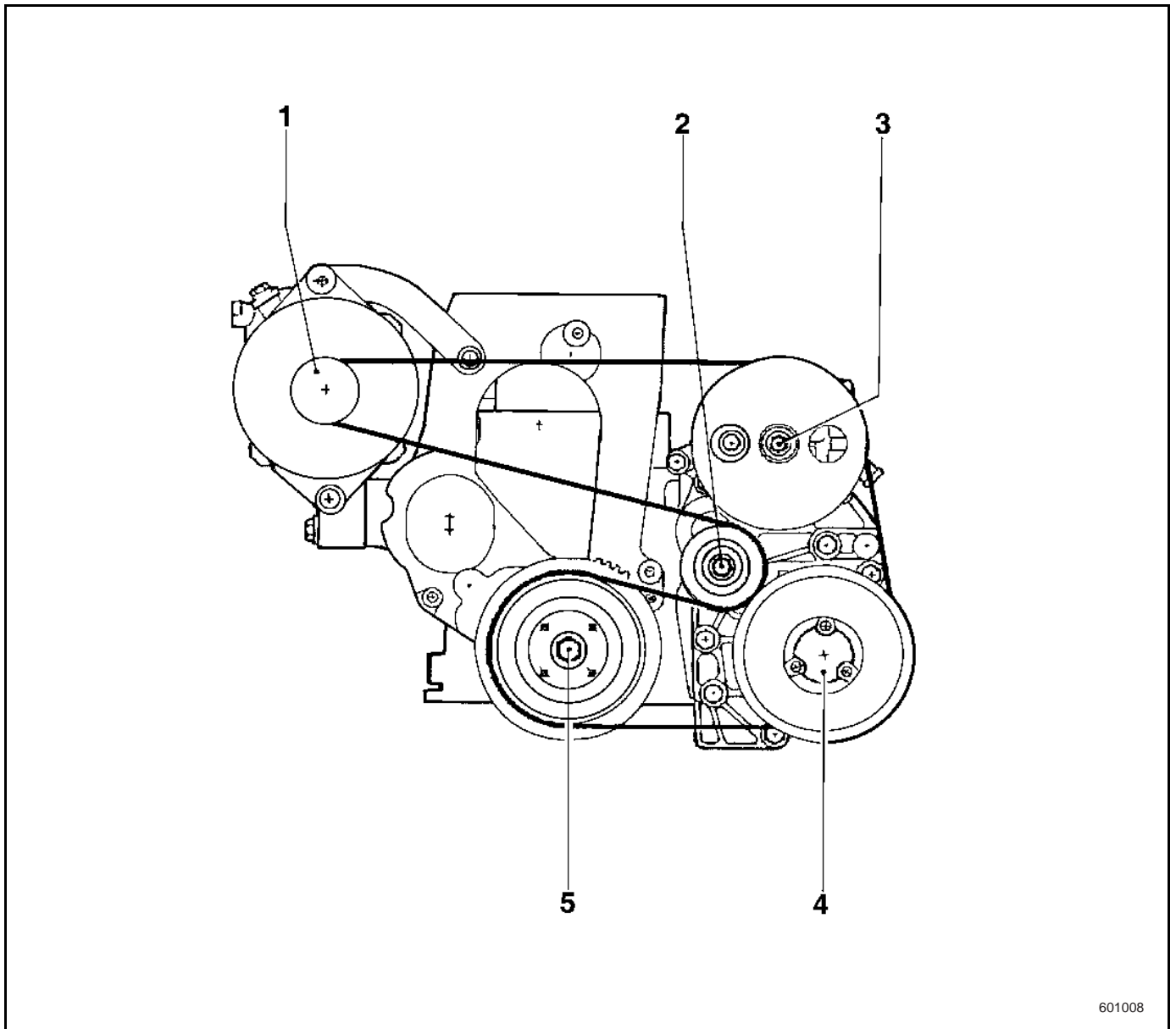


601007

Legend

- | | |
|--------------------------|-------------------------------|
| (1) Suction pipe sealing | (6) Oil pan bolt |
| (2) Suction pipe bolt | (7) Oil bleeding bolt |
| (3) Suction pipe | (8) Suction pipe bracket bolt |
| (4) Oil pan gasket | (9) Suction pipe bracket |
| (5) Oil pan | |

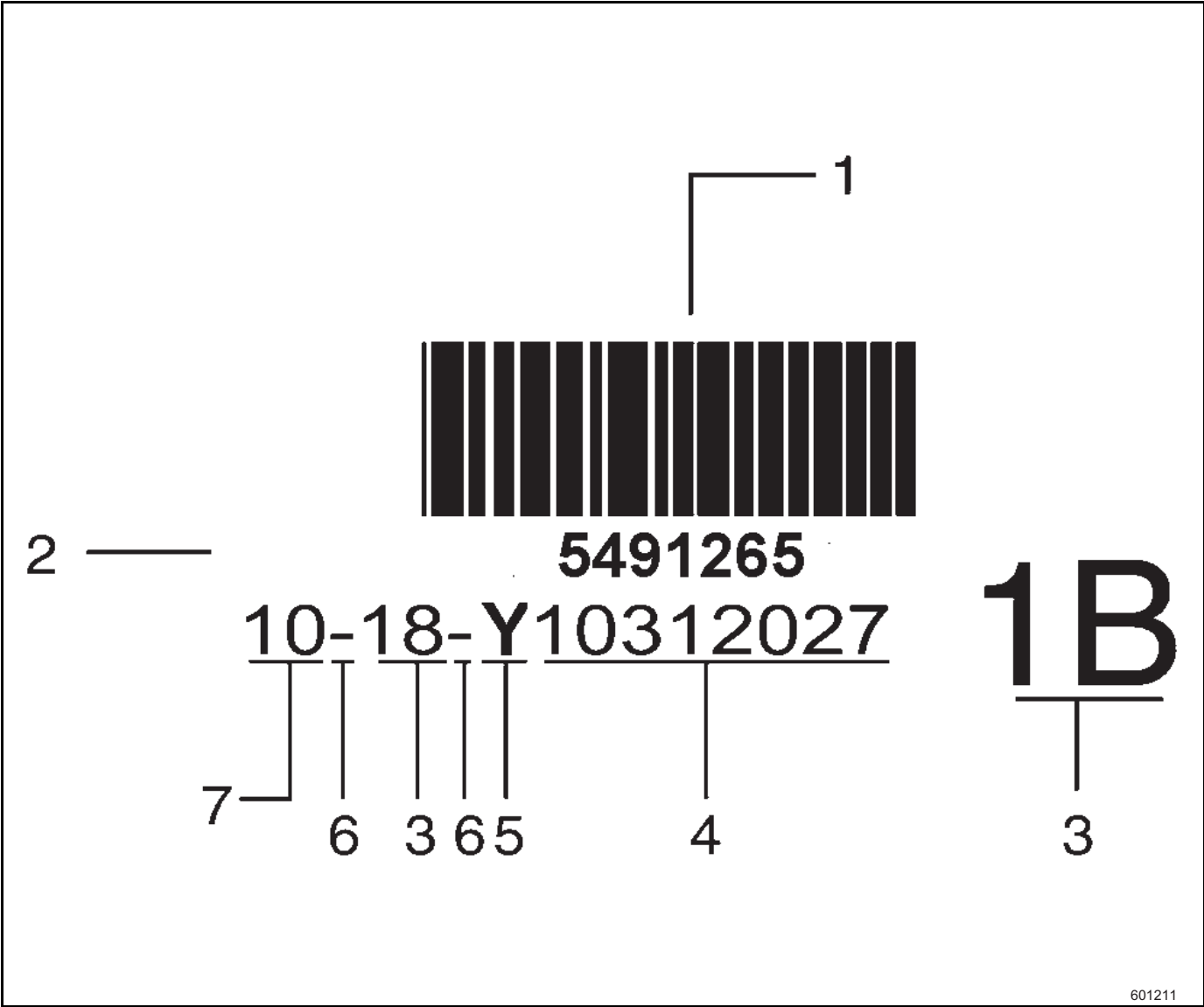
6.1.3.8 Accessory drive belt



Legend

- | | |
|--------------------------|----------------------------------|
| (1) AC alternator | (4) A/C compressor |
| (2) Accessory drive belt | (5) crankshaft timing belt wheel |
| (3) Power steering pump | |

6.1.3.9 Engine Identification



Legend

- (1) bar code

(2) Engine ASM Number

(3) Engine code (2-digits)
- (4) Engine Serial Number

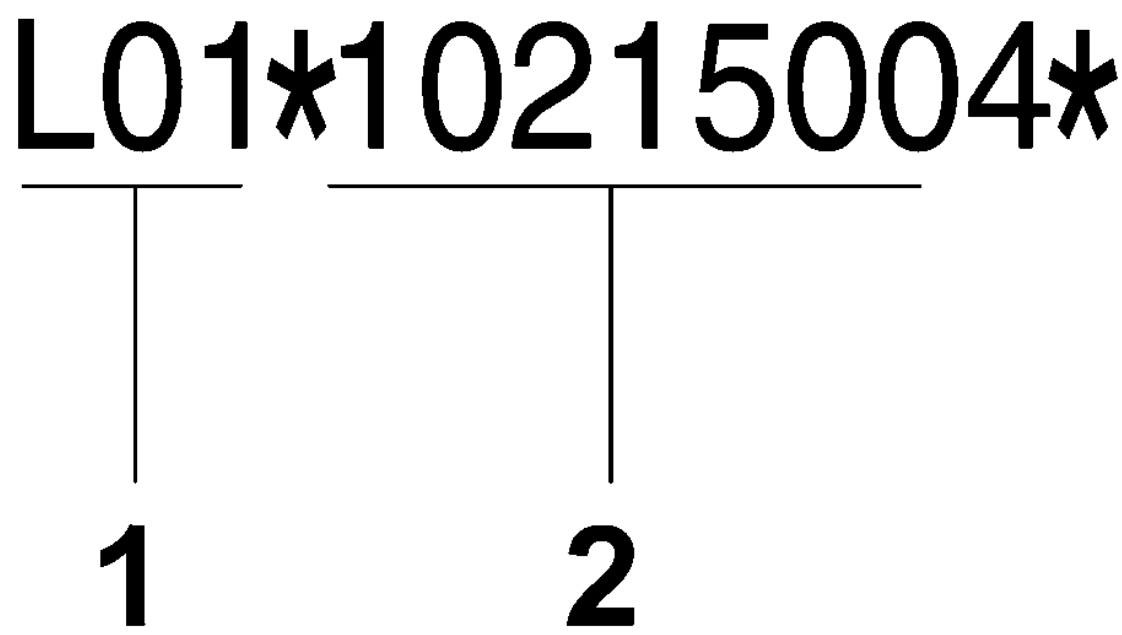
(5) Region code, "Y" SGM Dongyue Co., Ltd. (Yantai).

(6) Separation code "-"

(7) Part identification, (10 refers to engine)

Engine code	Engine ASM Number	Implication
1B	5491389	1.6L Manual Transmission Engine
2B	5491388	1.6L Automatic Transmission Engine

6.1.3.10 Engine code carved on cylinder block



L01*10215004*

1

2

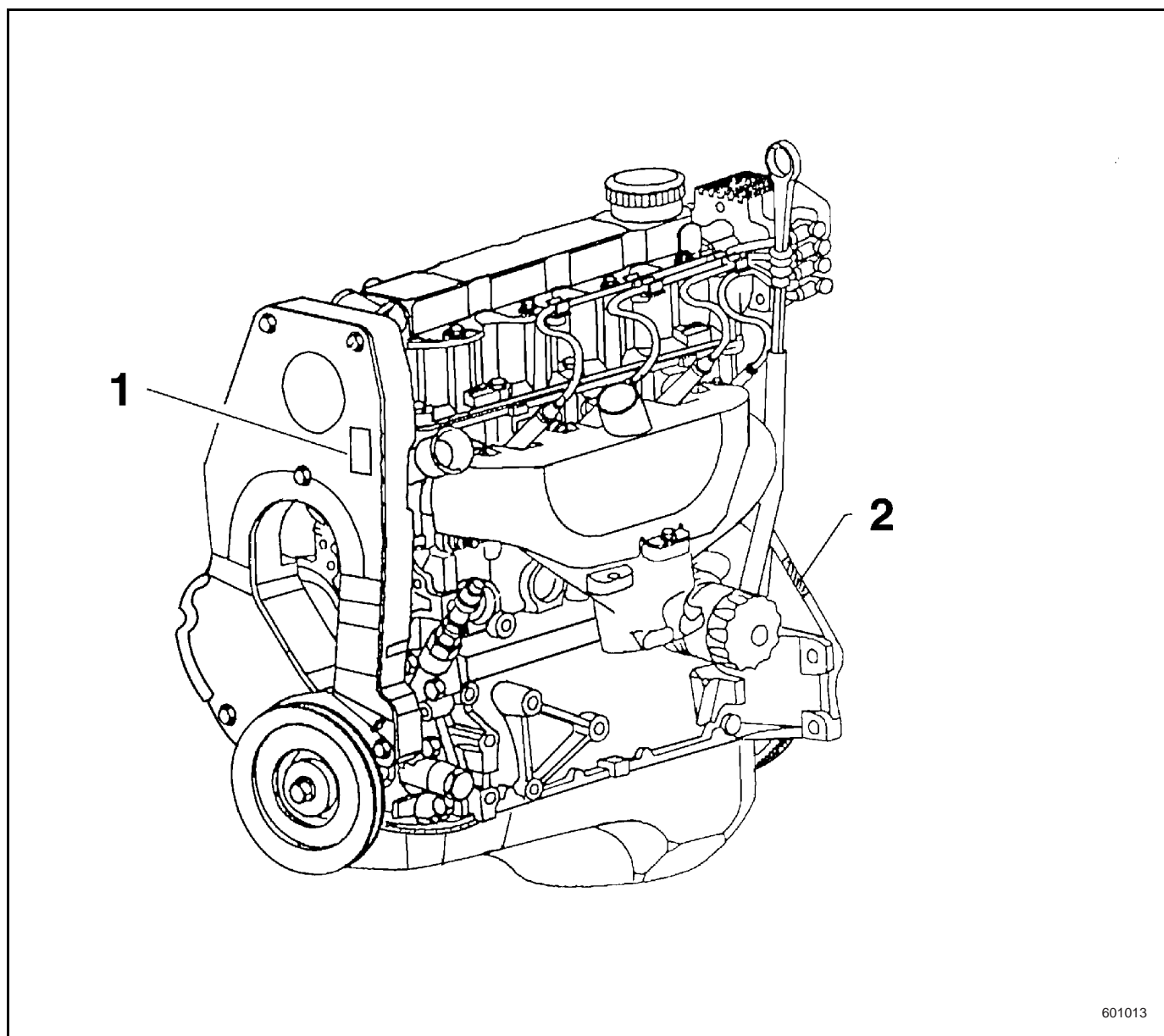
601012

Legend

(1) Engine type code: L01

(2) Serial No.

6.1.3.11 Location of the Engine Code



Legend

(1) Engine label

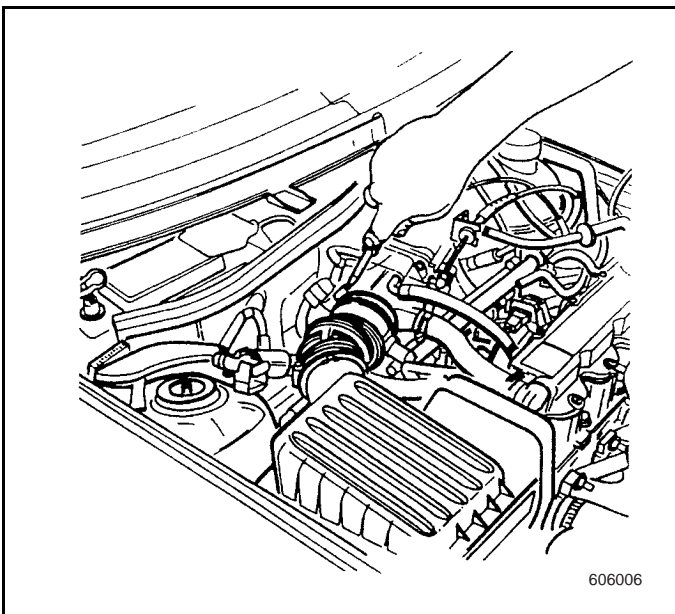
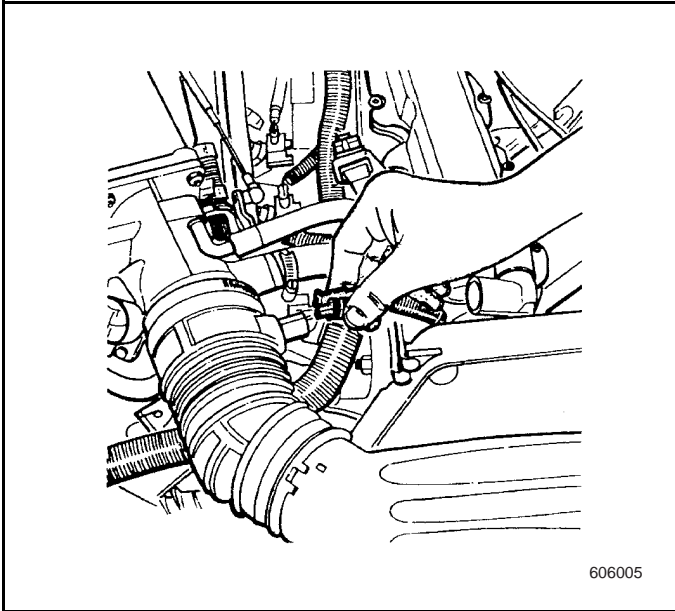
(2) Engine code carved on cylinder block

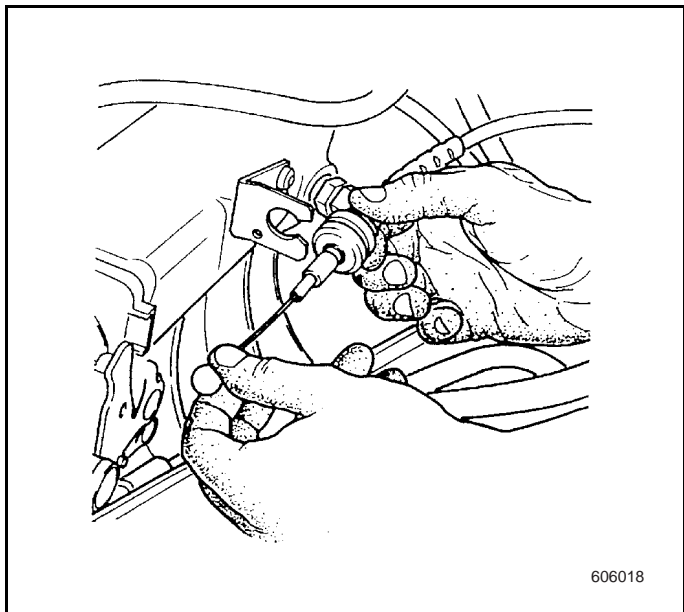
6.1.4 Repair Guidance

6.1.4.1 Replacement of Inlet Manifold and Inlet manifold Washer

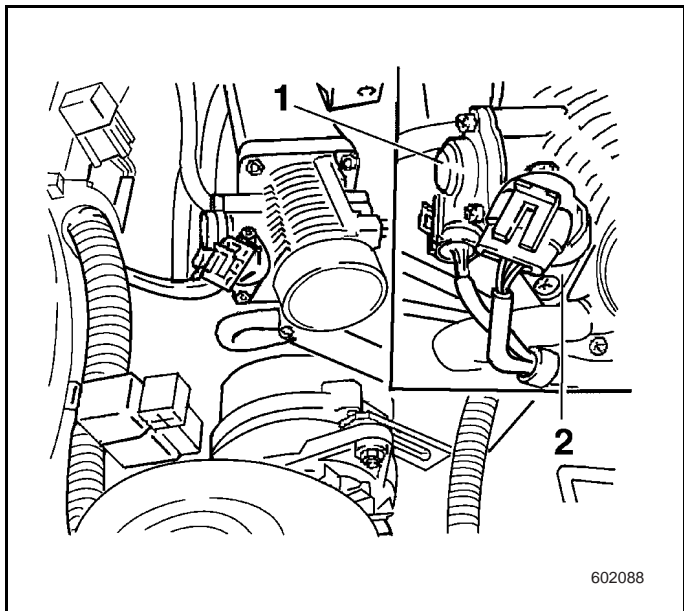
Removal Procedure

1. Remove the battery negative cable.
2. Disconnect the connection between wiring connector and inlet air temperature sensor.
3. Remove the inlet air hose and crankshaft ventilation pipe from the throttle body.
4. Remove the low level cooling hose from the radiator, and collect the coolant.
5. Loose the fastening bolt of the high-mounted alternator and remove the accessory driving belt. Push rearward the AC alternator (refer to relevant chapters).

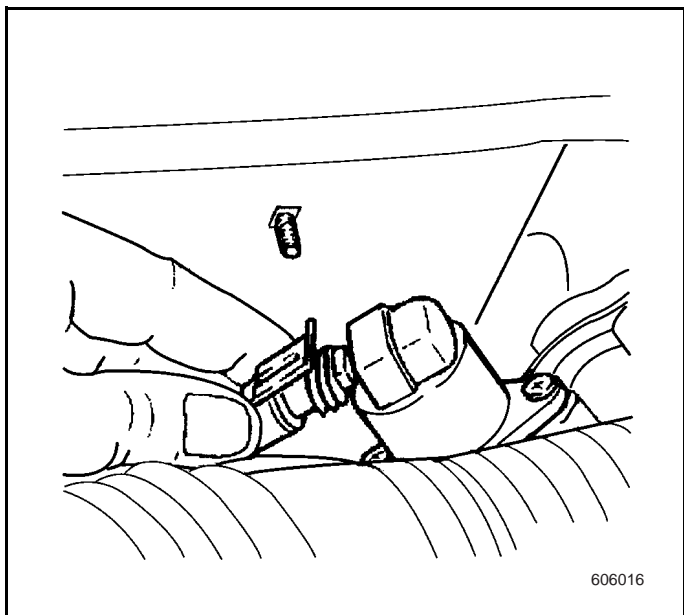




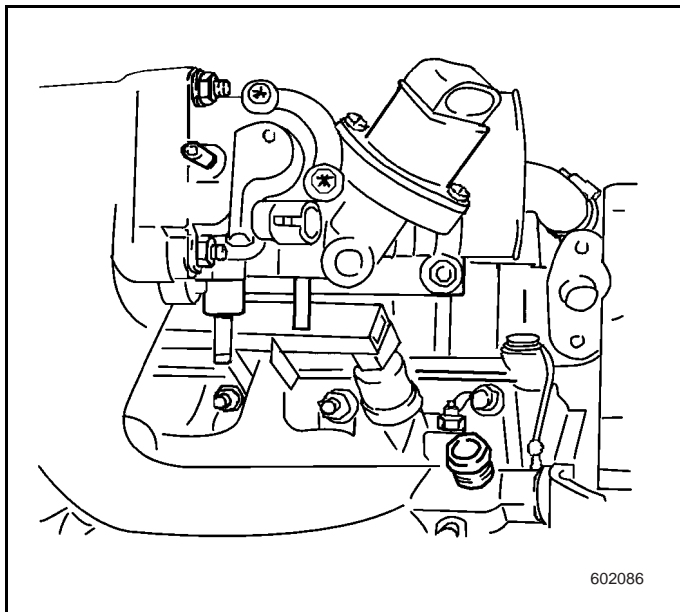
6. Unplug the inlet pipe assembly from the acceleration pedal cable.that is, loose the socket, remove the acceleration pedal cable from the air inlet pipe bracket.



7. Loose the vacuum hose of the brake servo (booster).
8. Unplug the power connector from the oil injector.
9. Unplug the power connector coolant temperature sensor.
10. Disconnect the wiring harness from the power supply connector of throttle position sensor.

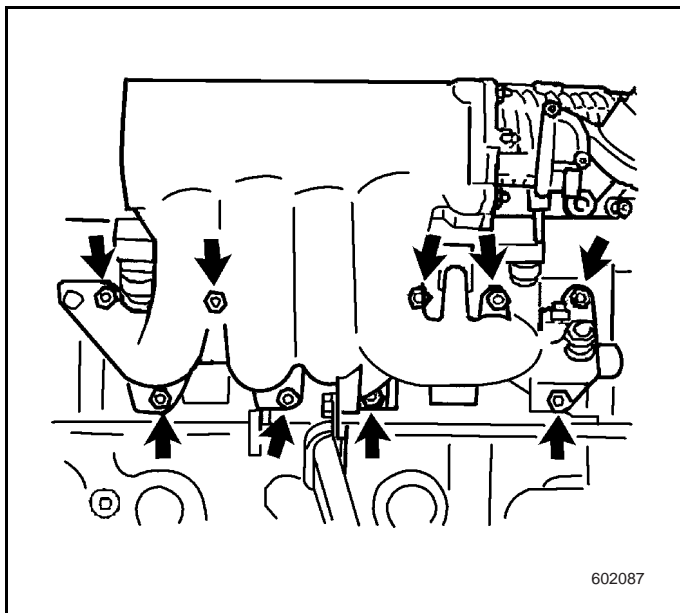


11. Unplug the power supply of the idle air valve.Record the wiring routes.



602086

12. Loosen the fuel pipe and block it. Mark the fuel pipe and clamp with spring clamps.
13. Unplug the heating pipeline from the air inlet manifold.
14. Unplug the throttle heating hose and canister purging hose. (Refer to illustration of engine after being disassembled)

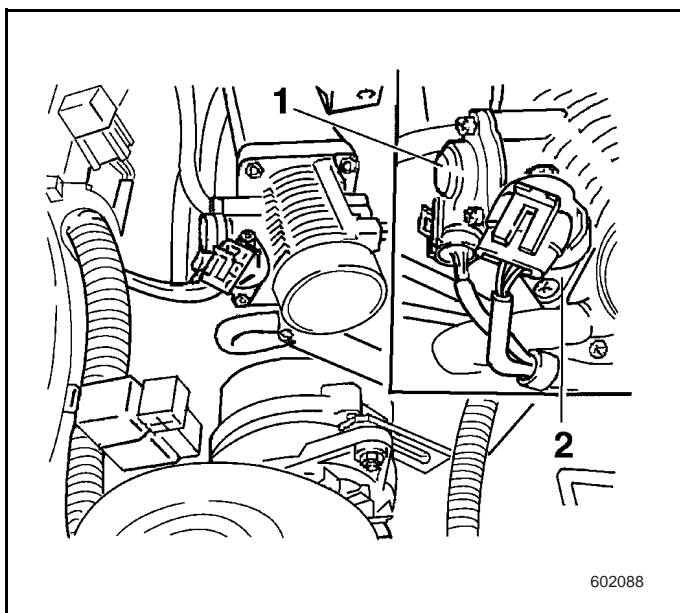


602087

15. Screw down the installation bolt of the air inlet manifold.
16. Remove the air inlet manifold and the lining from the cylinder housing.

Clean

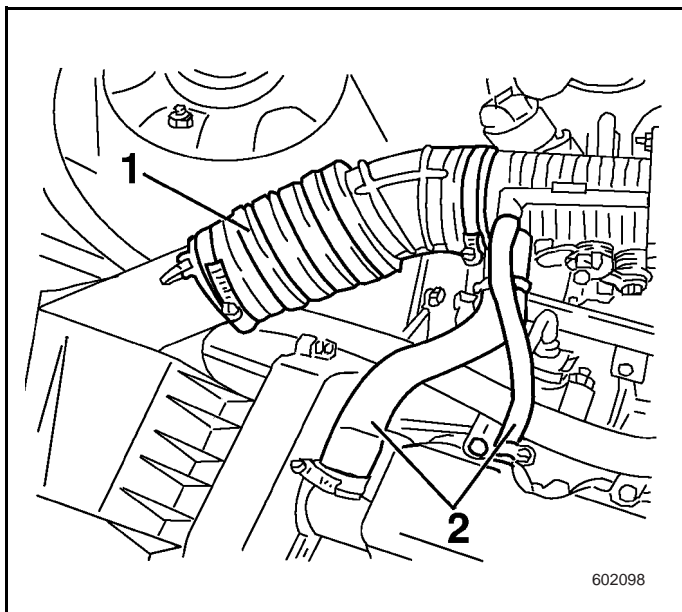
Clean the sealing surface between the air inlet manifold and cylinder head.



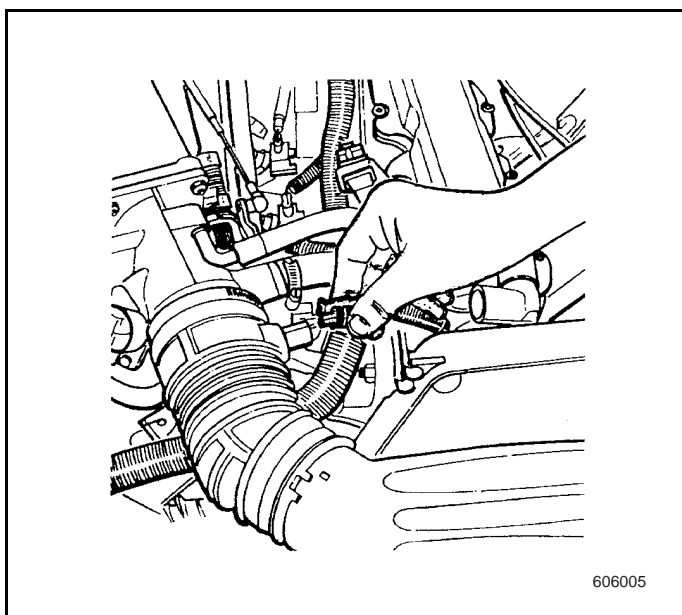
602088

Installation Procedure

1. Place a new gasket between the inlet manifold and the cylinder head.
2. Positioning and installation must be accurate.
3. Connect the heating hose, throttle body heating pipe and vacuum hose, throttle body and inlet manifold.
4. Re-connect the fuel pipe with marks.
5. Connect the throttle position sensor connector (1).
6. Connect the idle air valve connector (20).
7. Connect the fuel injector power.
8. Connect the power of coolant temperature sensor.
9. Pay attention to the routing of wires.
10. Connect the brake servo and intake pipe.



11. Install the acceleration cable and new accessory drive belt.
12. Inspect and adjust the tensioning of accessory drive belt.
13. Connect the inlet air hose (1) and crankshaft ventilation pipe (2).

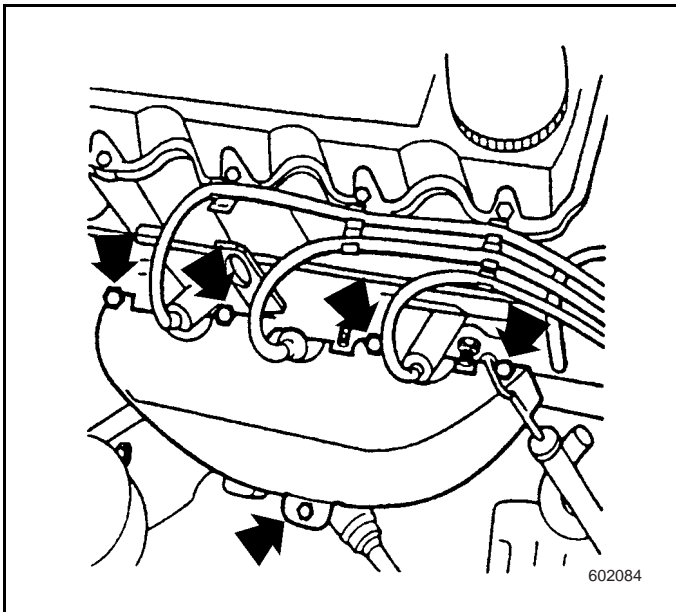
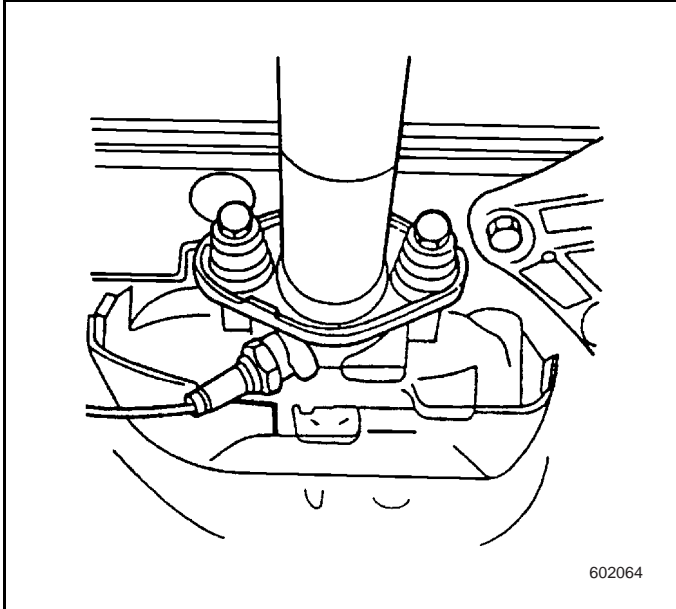


14. Connect the temperature sensor connector.
15. Connect the battery negative.
16. Drain and fill the cooling system, refer to Drain and fill the cooling system.

6.1.4.2 Replacement of Exhaustion Manifold and Exhaustion Manifold Washer

Removal Procedure

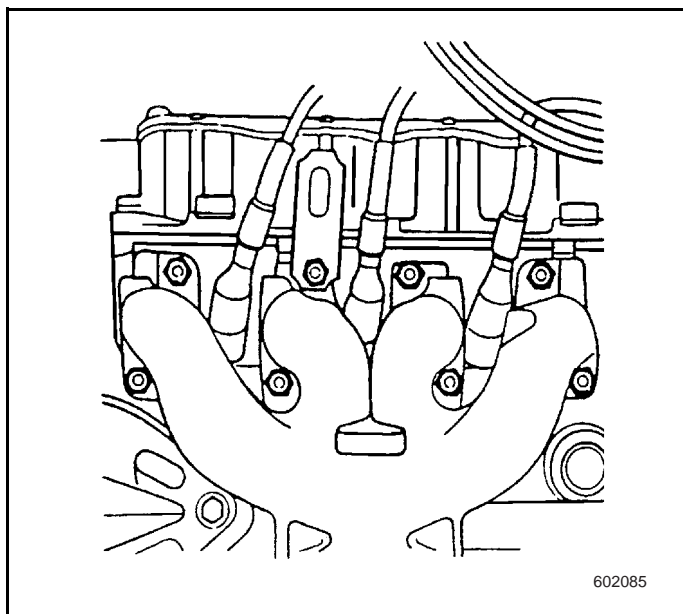
1. Raise and support the vehicle. Remove the oil pan shield.
2. Unplug the exhaust pipeline from the exhaust manifold.
3. Loose and take out the oxygen sensor exhaust pipe. Refer to Replacement of Oxygen Sensor in Engine Controls.
4. Lower the vehicle, remove the protective housing from the exhaust pipe.



5. Loose the exhaust manifold nut.
6. Remove the exhaust manifold and gaskets.

Cleaning

Clean the contact surface between the exhaust manifold and cylinder head.

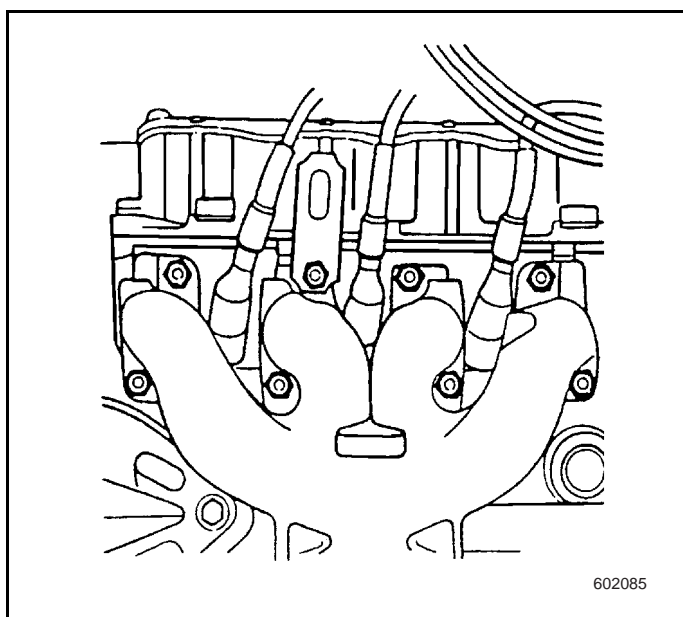


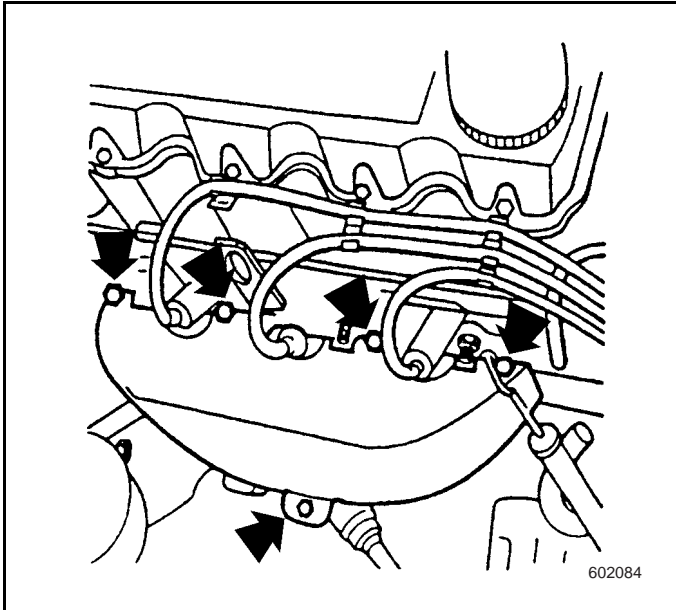
Installation Procedure

1. Install the exhaust manifold and new gasket onto the cylinder head.
2. Screw the nut (new nut must be used, part number: 11082513) and tighten.

Tightening

Tighten the exhaust manifold nut to 20 ± 2 N•m.

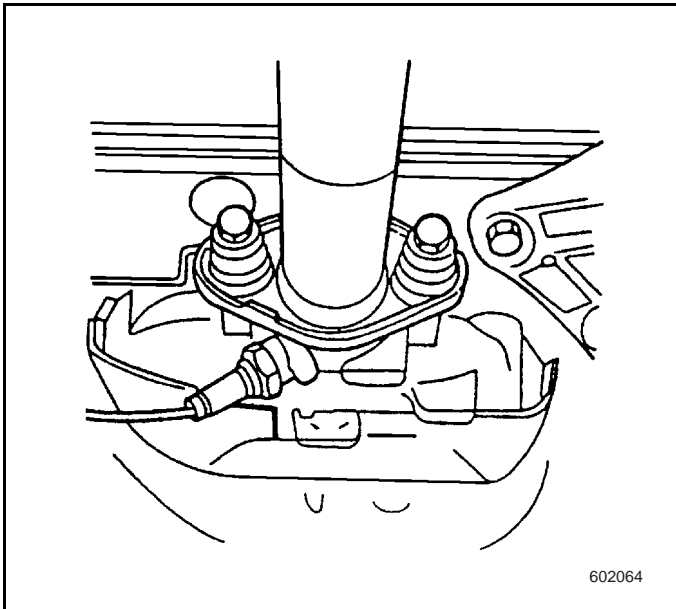




3. Connect the exhaust pipe to the exhaust manifold.
4. Connect the exhaust pipe to the protective housing.

Tightening

Tighten the exhaust manifold protective housing nut to $9 \pm 1 \text{ N}\cdot\text{m}$.



5. Pre-heat the exhaust manifold.
6. Install oxygen sensor to the exhaust manifold.

Tightening

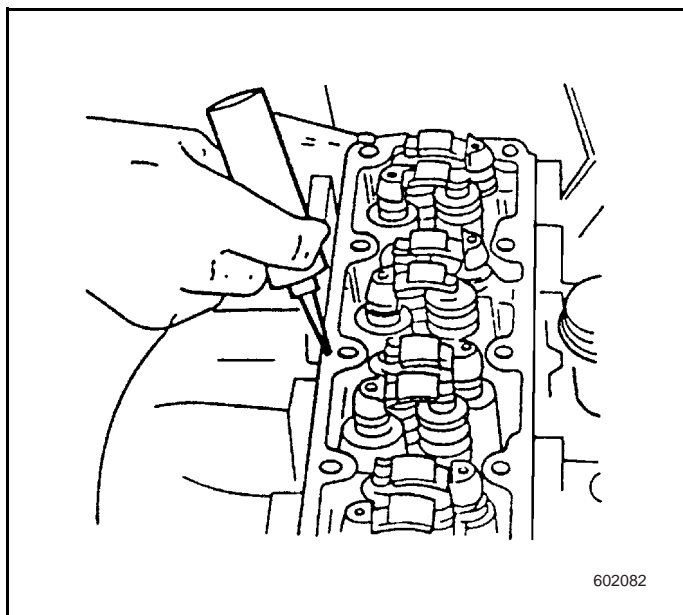
Tighten the oxygen sensor to $42 \pm 4 \text{ N}\cdot\text{m}$.

7. Connect power of the oxygen sensor voltage.

6.1.4.3 Replacement of the camshaft bracket housing

Removal Procedure

1. Remove the ventilation hose between the throttle body and camshaft bracket housing.
2. Loose the bolt of the camshaft housing according to the described sequence.
3. Remove the camshaft housing.



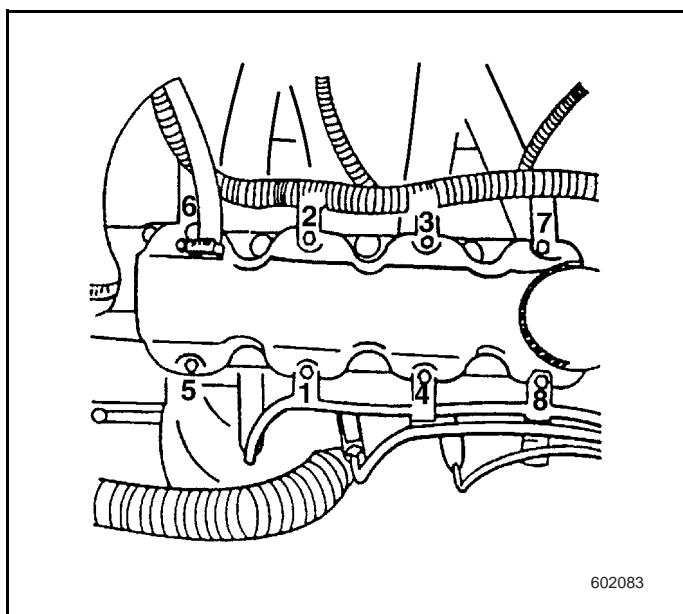
Installation Procedure

1. Re-install the bracket housing of the camshaft with new gasket.
2. Install the bolt and tighten according to the described sequence.

Tightening

Tighten the camshaft bracket cover bolt to $8 + 2$ N•m

3. Re-connect the ventilation hose.



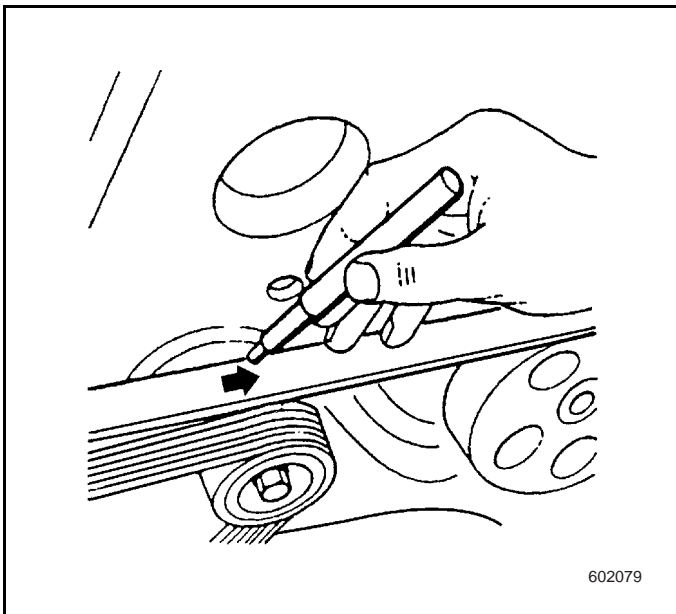
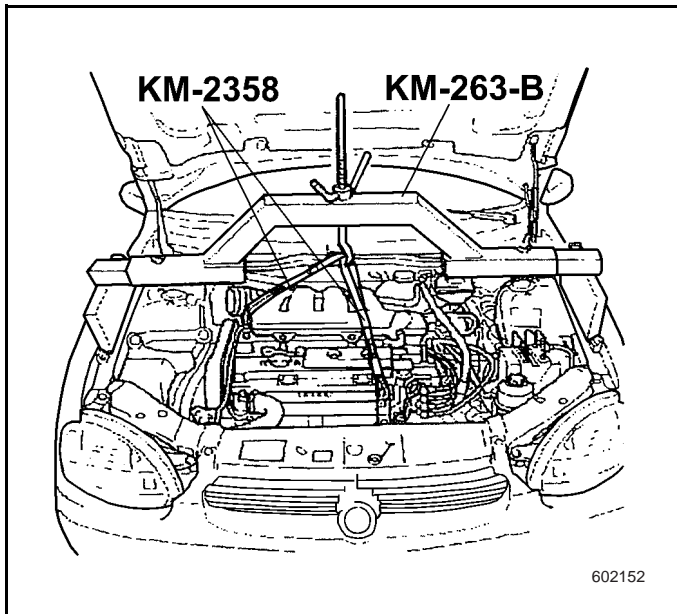
6.1.4.4 Accessory Drive Belt Replacement

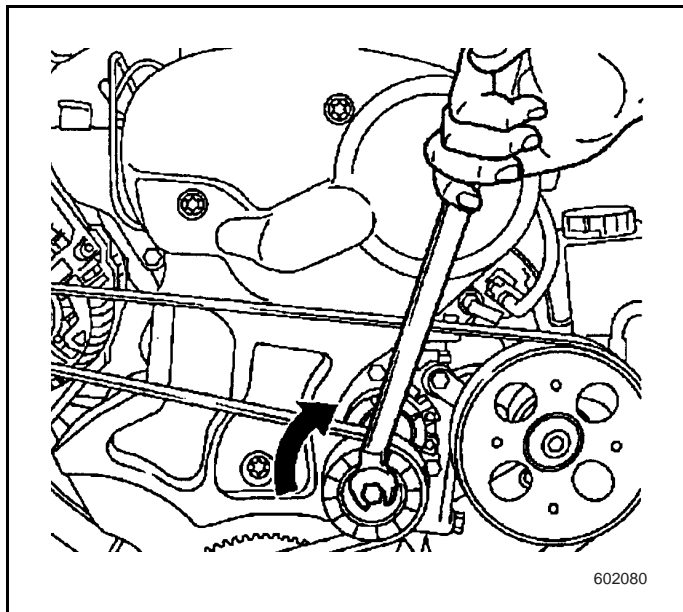
Removal Procedure

Required tool

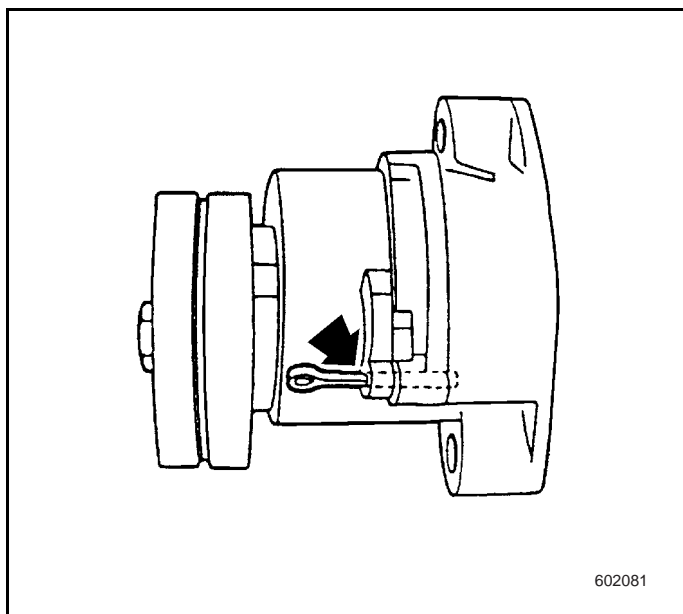
- KM-263-B

1. Take off the air filter and its hose. Refer to Intake System Replacement in Engine Controls.
2. Start the engine with KM-263-B.

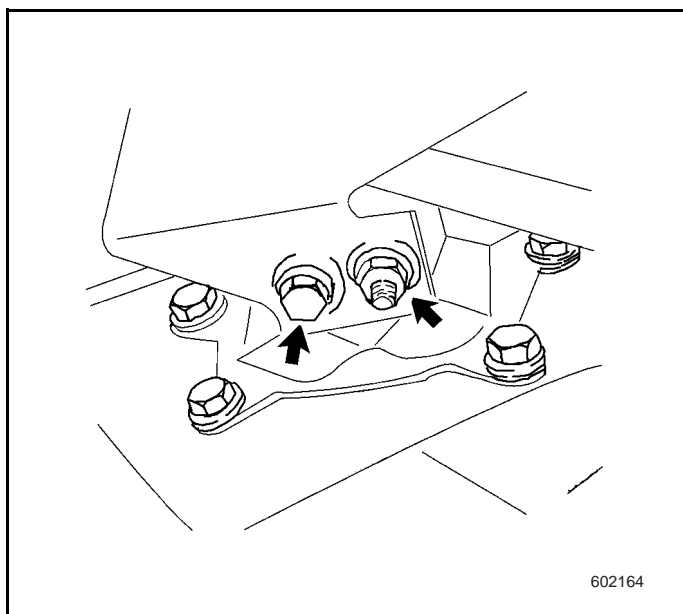




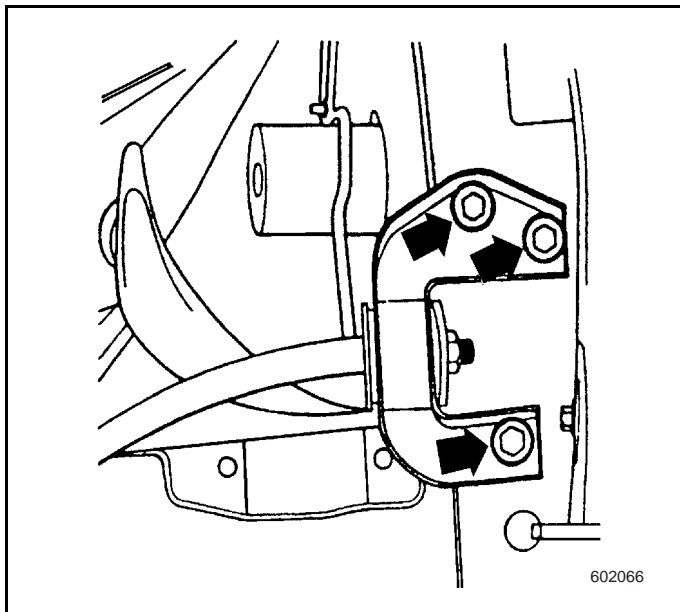
4. Rotate the tensioning wheel with tool (spanner) until the hole at the movable part of the support aligns with the hole in the base.



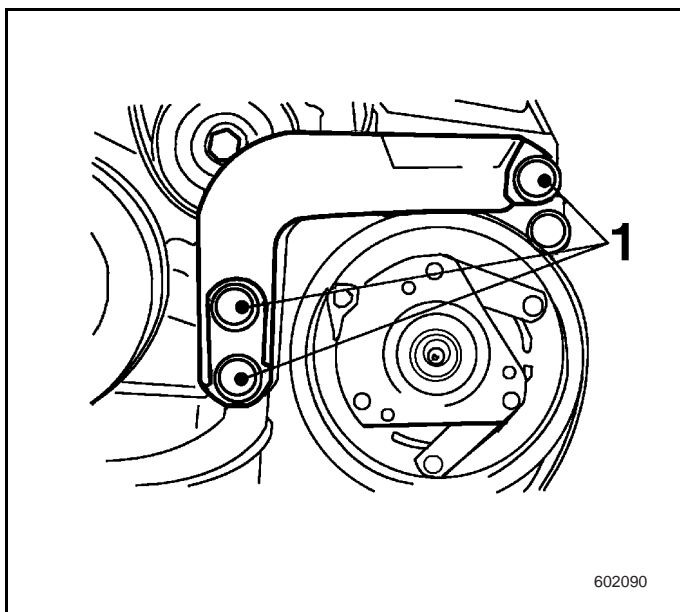
5. Fix it at the two holes with hatch pin.



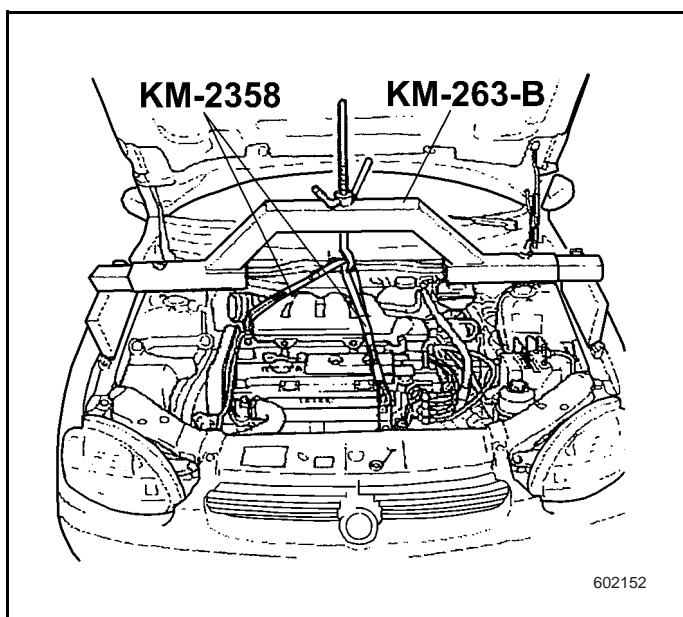
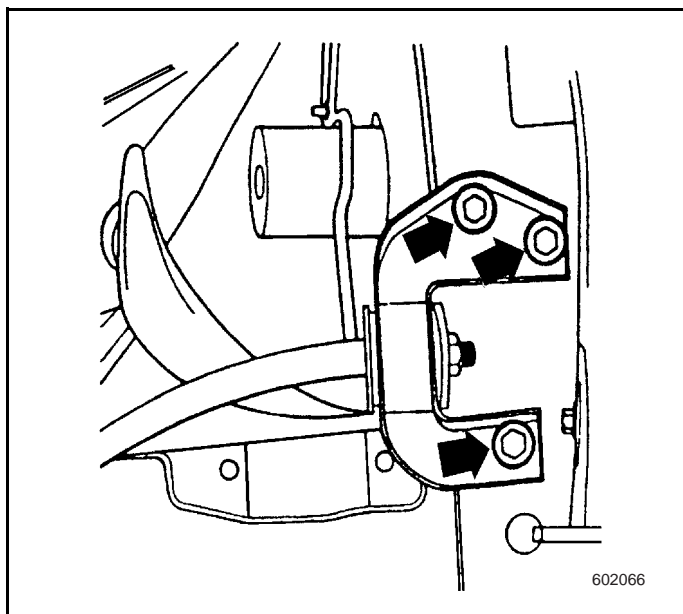
6. Loosen the bolts between engine bracket and engine suspension shock absorber. Refer to 6.1.5.26-29 for relevant content.



7. Take out the left front and right front tensioning lever and the bracket from the cross member.



8. Lower the engine 5cm.
9. Take the right bracket to the engine out from the power steering pump/ air conditioning compressor.
10. Remove the accessory drive belt.



Installation Procedure

1. Well install the accessory driving belt in line with marks made during disassembling.

Note: Ensure the alignment of accessory drive belt and belt wheel channel.

2. Fix the engine right bracket with bolts onto the power steering pump/ air conditioner compressor bracket.
3. Raise the engine. Fix the tensioning lever and left and right front bracket bolt onto the cross member.
4. Loose the spring of the tensioning with a tool, take out the hatch pin and loose the tensioning wheel.

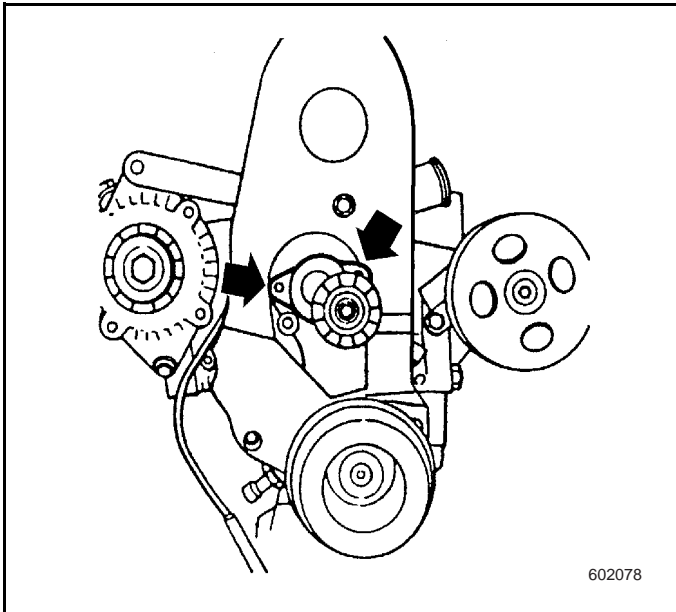
5. Take out KM-263-B.
6. Install the air filter and its hose. Refer to Intake System Replacement in Engine Controls.

6.1.4.5 Accessory Drive Belt Tensioning Wheel Replacement

Removal Procedure

1. Remove the accessory drive belt. Refer to instructions in Accessory Drive Belt Replacement.
2. Loose the bolt mounting the tensioning wheel onto air conditioning compressor bracket. Take it out.
3. Remove the tensioning wheel set.

Caution: Never disassemble the tensioning wheel set. Or, accident may occur!



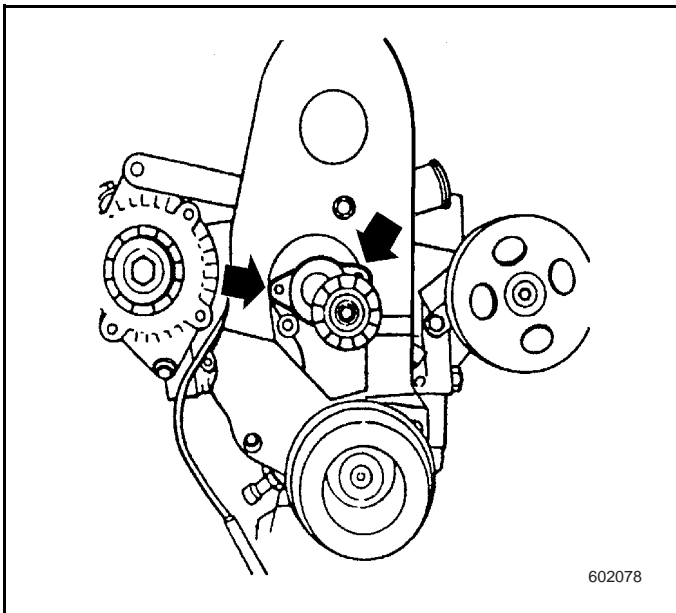
Installation Procedure

1. Install the tensioning wheel set and fix with bolts.

Tightening

Fasten the accessory drive belt tensioning wheel bolt to $26 \pm 4 \text{ N}\cdot\text{m}$

2. Install the accessory drive belt. Refer to Accessory Drive Belt Replacement.



6.1.4.6 Crankshaft timing belt wheel replacement

Removal Procedure

Required tool

- S-9407182
1. Remove the accessory drive belt. Refer to Accessory Drive Belt Replacement.
 2. Loosen the crankshaft timing belt wheel bolt, use S-9407182 to fix the flywheel.
 3. Remove crankshaft timing belt wheel.

Installation Procedure

1. Install the accessory drive belt tensioning wheel onto crankshaft timing gear.
2. Screw the nut (new nut must be used, part number: 11095041) and tighten.

Tightening

Fasten the crankshaft timing belt bolt to $95\text{N}\cdot\text{m} + (30 - 45)$.

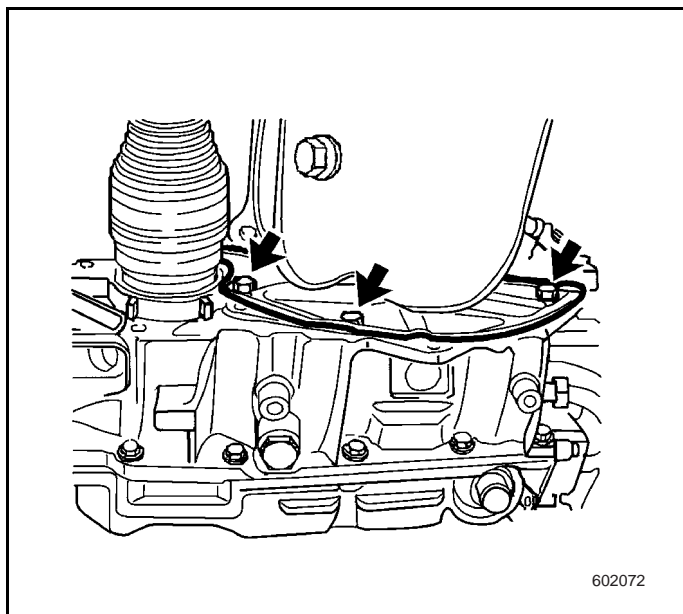
3. Install the accessory drive belt. Refer to Accessory Drive Belt Replacement.

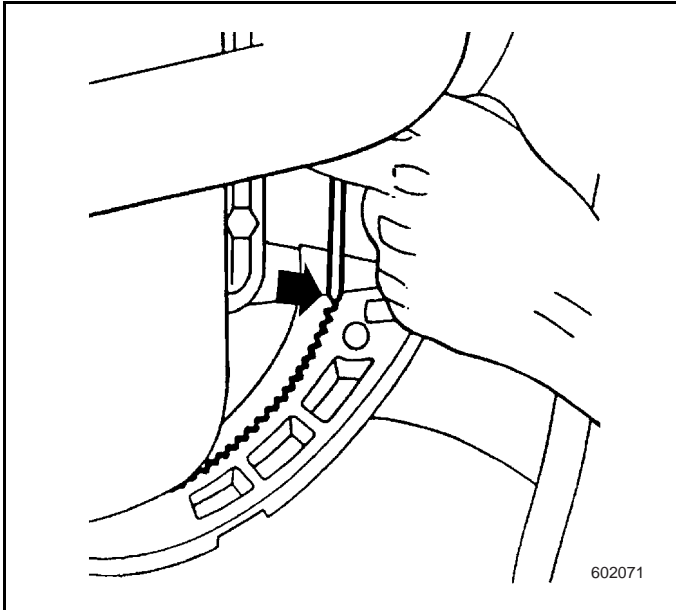
6.1.4.7 Timing Belt Replacement

Removal Procedure

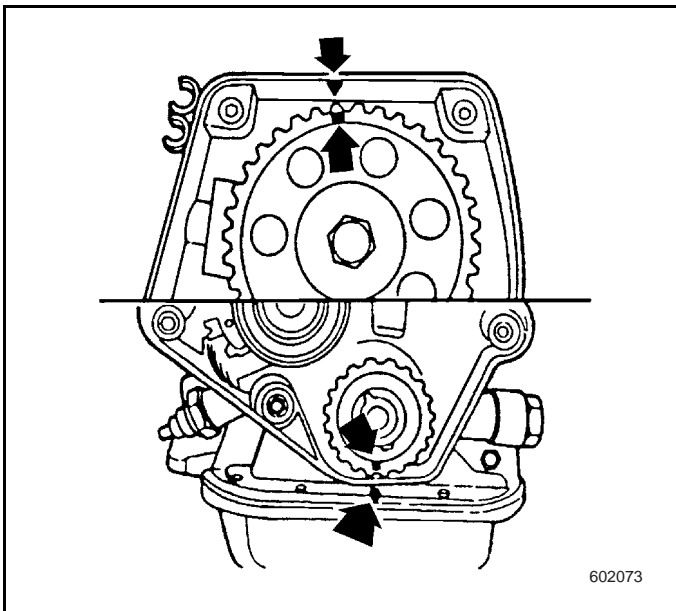
Required tool

- S-9407182
1. Disconnect the battery negative cable.
 2. Remove the accessory drive belt. Refer to Accessory Drive Belt Replacement.
 3. Raise the vehicle and take off the coverplate of the flywheel.



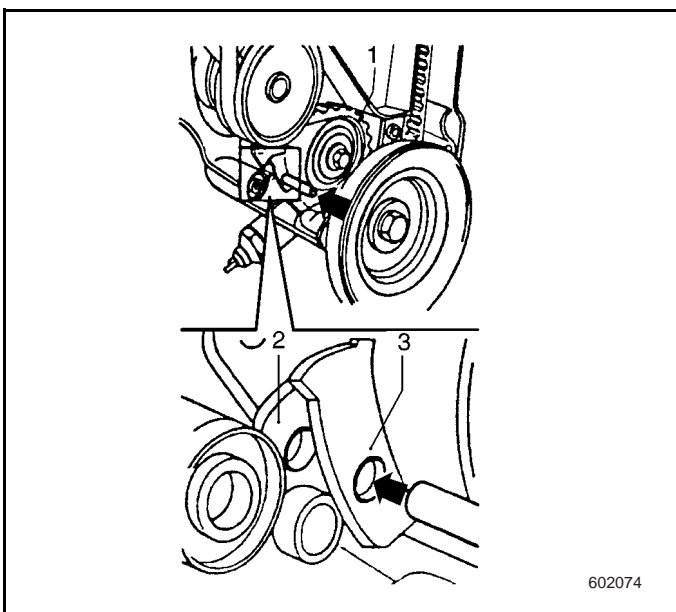


4. Loosen the crankshaft timing belt wheel bolt, use S-9407182 to fix the flywheel during operation.



5. Remove crankshaft timing belt wheel.
6. Remove the timing belt front cover.

Note: During ignition of the 1st cylinder, never unlock the wheel before mark at camshaft timing belt wheel is aligned with the mark at the rear cover edge.



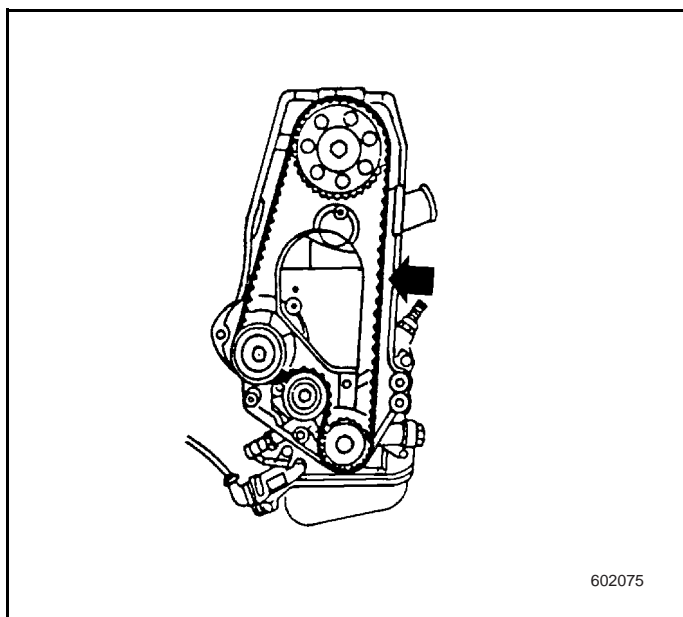
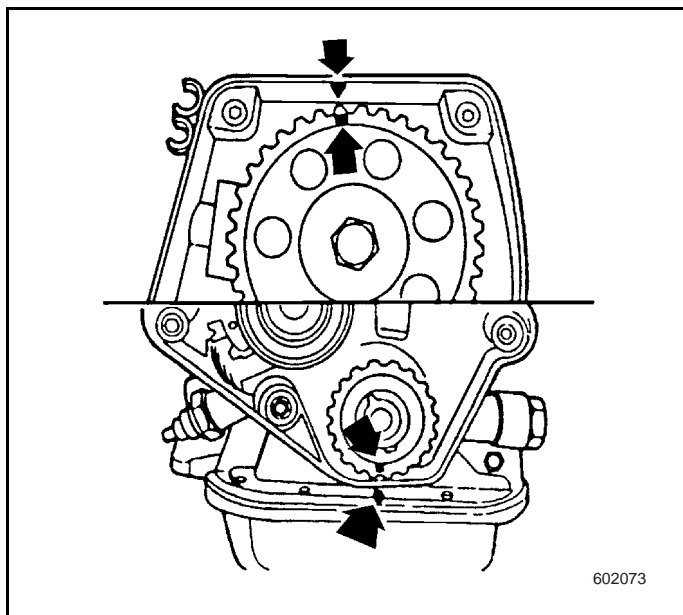
7. Push the timing belt wheel tensioning wheel (1) upward until the support hole (3) and base hole (2) of the tensioning wheel aligns, then fix it with screw.
8. Remove the timing belt.

Installation Procedure

Tools Required

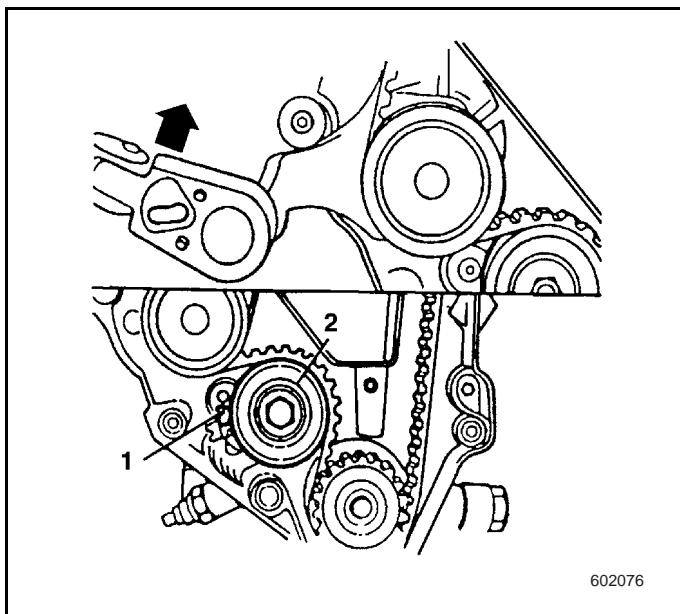
- S-9406184

1. Pay attention that when No. 1 cylinder ignites, marks at the camshaft timing belt wheel and that at the oil pump housing edge must align with each other.
2. Marks at the crankshaft timing belt wheel and that at the timing belt rear cover must align with each other.



3. Install the timing belt, ensure the surface facing the water pump has been fixed (refer to arrow in the figure).

Note: Push the tensioning wheel upward, take out the located screw and then loose the tensioning wheel, thus, the timing belt may be tensioned automatically. Rotate the crankshaft two cycles, inspect the tensioning of the timing belt, that is, support of the tensioning wheel should be at the center of V-shaped base. Adjust if necessary.

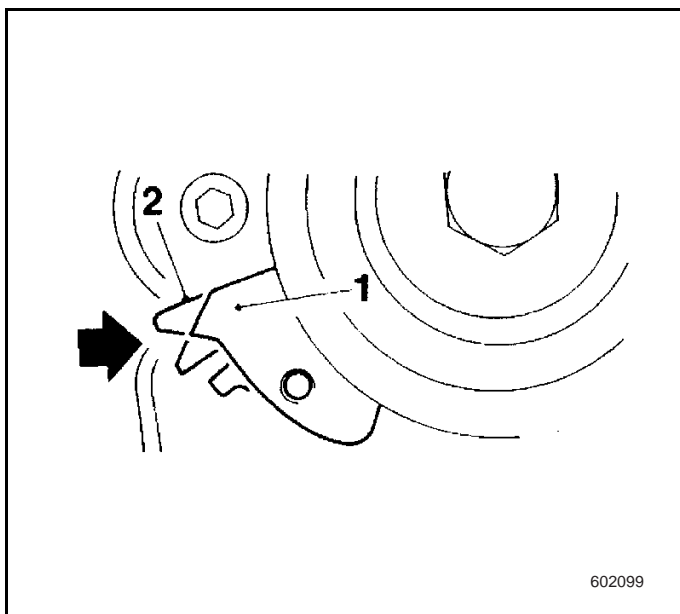


4. Adjust the timing belt according to the following instructions:

Loose the mounting bolt of the water pump.

Use S-9406184 to rotate the water pump until the tensioning wheel support (1) reaches its limit position.

Under this circumstances, turn the crankshaft two cycles.



5. Use S-9406184 to rotate the water pump until the tensioning wheel support (1) reaches the center of V-shaped base. Finally, fasten the mounting bolt of the water pump.

Tightening

Tighten the water pump bolt to 73 N•m.

6. Install the timing belt front cover.

Tightening

Fasten the timing belt front upper cover bolt to 41 N•m

Fasten the timing belt front upper cover bolt to 41 N•m

7. Install the accessory drive belt pulley and pulley bolt (new nut must be used, part number: 11095041) and tighten.

Tightening

Fasten the crankshaft timing belt bolt to 95N•m+(30-45).

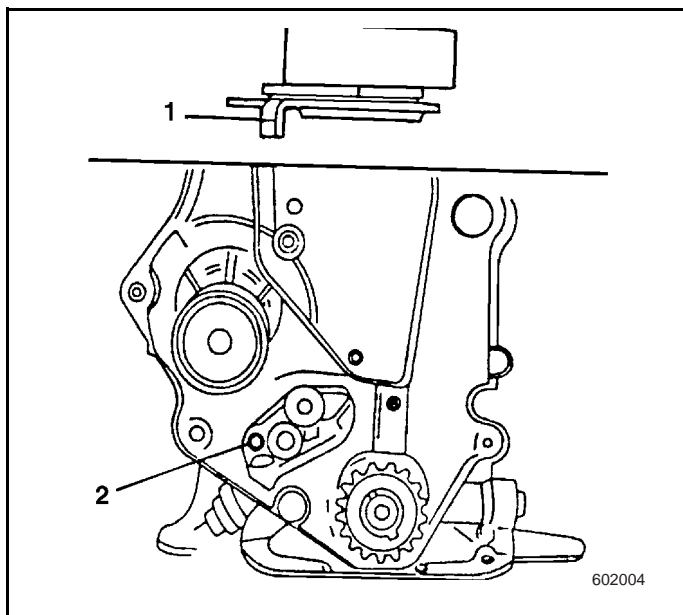
Install the accessory drive belt. Refer to instructions in Accessory Drive Belt Replacement.

8. Connect the battery negative cable.

6.1.4.8 Timing Belt Tensioning Wheel Replacement

Removal Procedure

1. Remove the timing belt. Refer to instructions in Timing Belt Replacement.
2. Take the bolt and timing belt tensioning wheel assembly from the engine oil pump housing.



Installation Procedure

1. Install the new timing belt tensioning wheel assembly into the oil pump box.

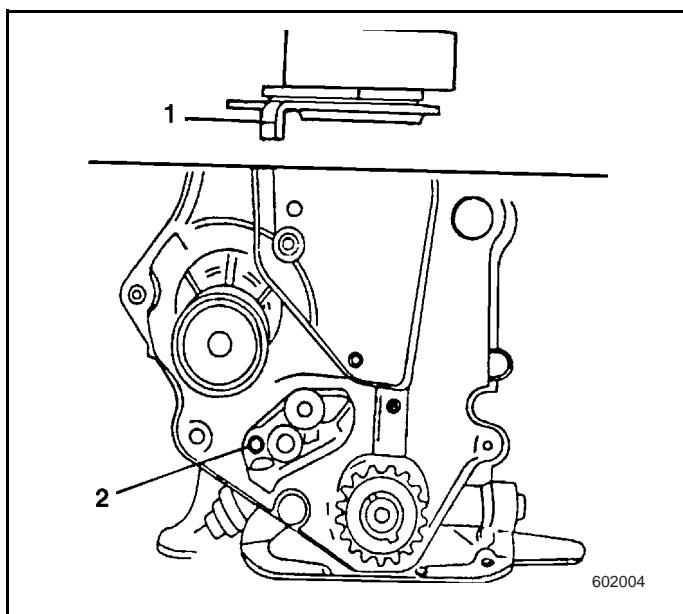
Note: Bottom brake pin (1) of the tensioning wheel shall be insert in engine oil pump housing hole (2).

2. Install and tighten the bolt.

Tightening

Fasten the timing belt tensioning wheel bolt to 202 N•m.

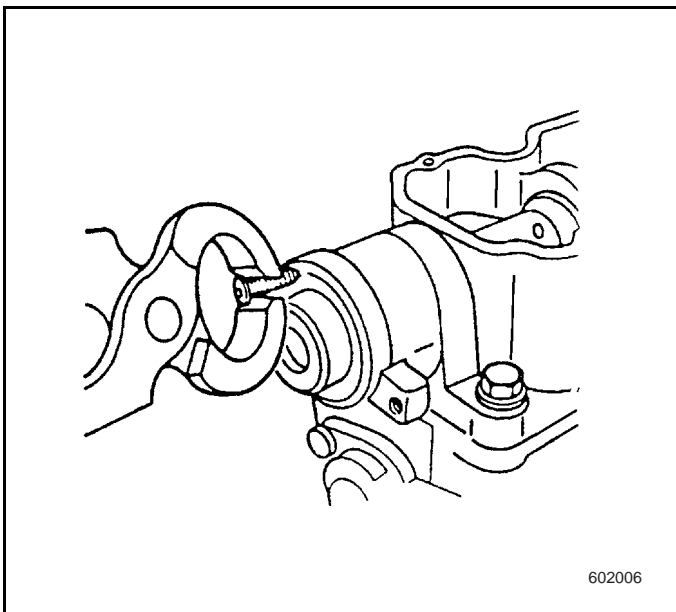
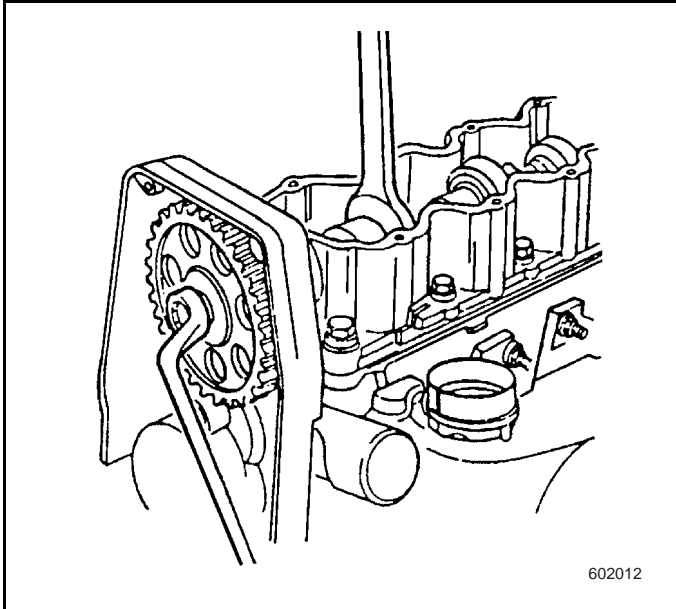
3. Install the timing belt. Refer to Timing Belt Replacement.



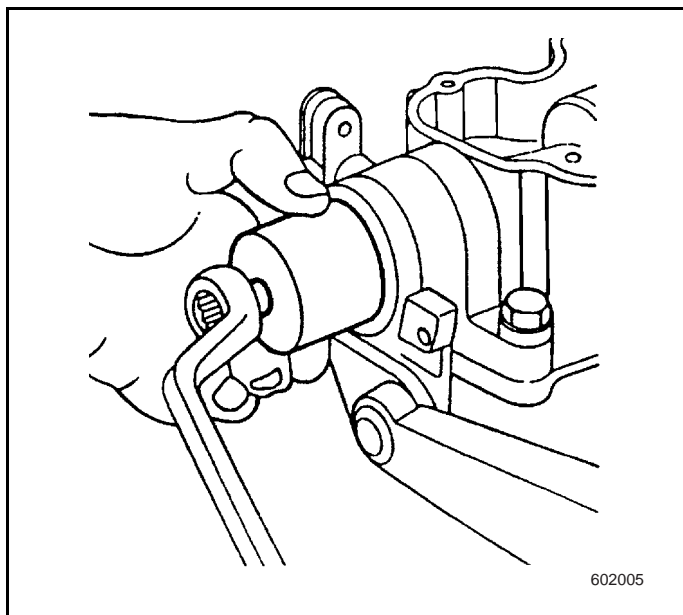
6.1.4.9 Camshaft timing belt wheel and sealing ring replacement

Removal Procedure

1. Take off the timing belt. Refer to instructions in Timing Belt Replacement.
2. Remove the camshaft bracket cap. Refer to Camshaft Bracket Cap Replacement.
3. Screw the fixing bolt of the camshaft timing belt wheel, meanwhile, prevent the camshaft from rotating with spanner.



4. Remove camshaft timing belt wheel.
5. Take off the camshaft sealing ring. Drill a hole on the sealing surface and screw a self-taping screw. Pull the sealing ring with plier. Pay attention not to damage the camshaft bracket.



Installation Procedure

Tools Required

- J -810619

1. Use tool J-810619 and timing belt wheel bolt to push the sealing ring into bracket, thus the installation of new sealing ring fulfills.
2. Install and fasten the camshaft timing belt wheel.

Tightening

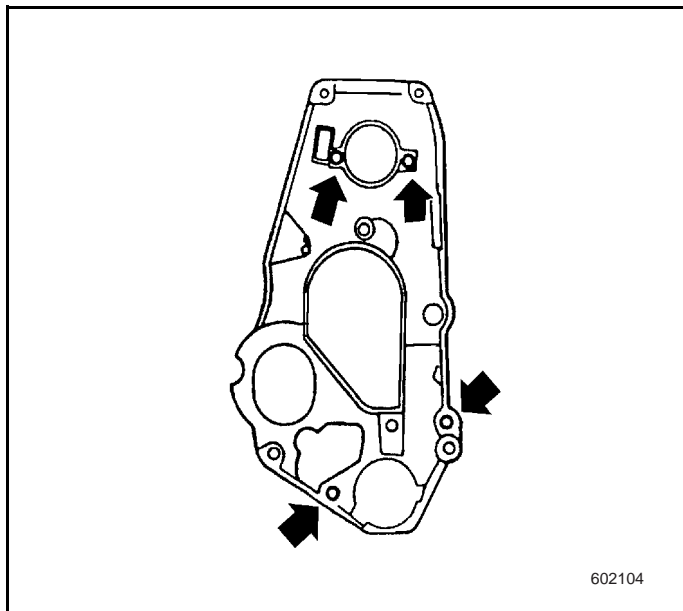
Fasten the camshaft timing belt bolt to 45 ± 5 N•m

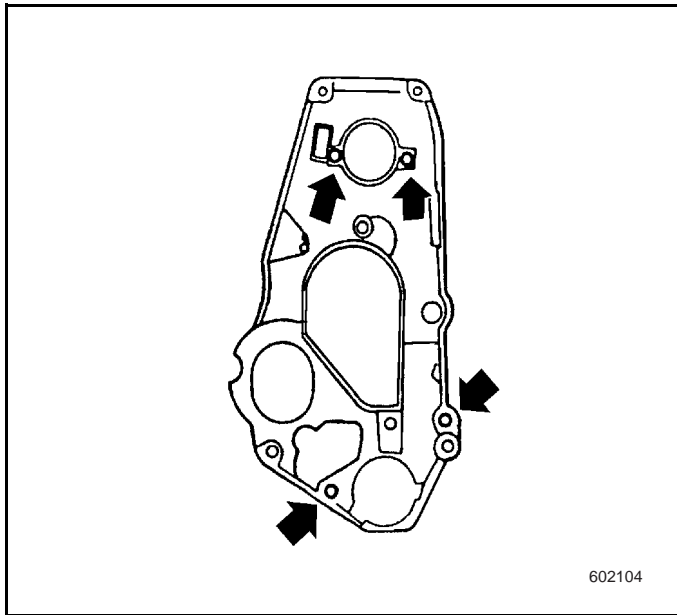
3. Install the camshaft bracket cap. Refer to instructions in Camshaft Bracket Cap Replacement.
4. Install the timing belt. Refer to instructions in Timing Belt Replacement.

6.1.4.10 Timing Belt Rear Cover Replacement

Removal Procedure

1. Remove the timing belt. Refer to Timing Belt Replacement.
2. Remove camshaft timing belt wheel. Refer to Camshaft Timing Belt Pulley and Seal Ring Replacement.
3. Remove the timing belt tensioning wheel set. Refer to Timing Belt Tensioning Wheel Replacement.
4. Loosen the bolt and timing belt rear cover.





Installation Procedure

1. Install timing belt rear cover and tighten the mounting bolts.

Tightening

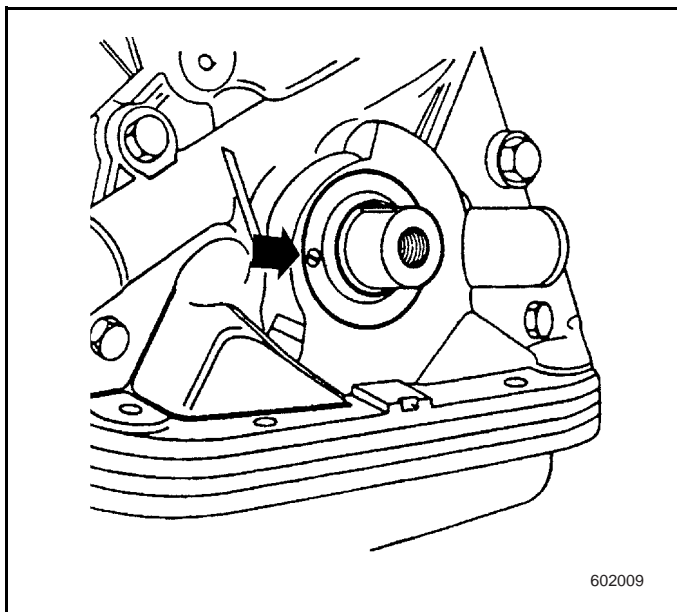
Fasten the timing belt rear lower cover bolt to $12 \pm 2 \text{ N}\cdot\text{m}$

2. Install the timing belt tensioning wheel set. Refer to Timing Belt Tensioning Wheel Replacement.
3. Fix the crankshaft timing belt wheel.
4. Install camshaft timing belt wheel. Refer to Camshaft Timing Belt Pulley and Seal Ring Replacement.
5. Install the timing belt. Refer to Timing Belt Replacement.

6.1.4.11 Crankshaft front sealing ring (oil pump assembly) Replacement

Removal Procedure

1. Remove the timing belt. Refer to Timing Belt Replacement.
2. Remove crankshaft timing belt wheel.
3. Remove the crankshaft front sealing ring. Drill a hole on the sealing surface and screw a self-taping screw.
4. Pull the sealing ring with plier. Pay attention not to damage the oil pump housing.

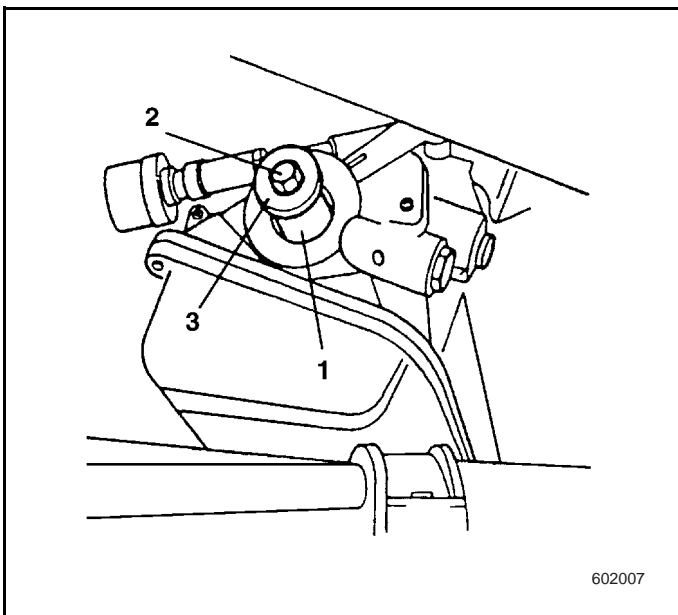
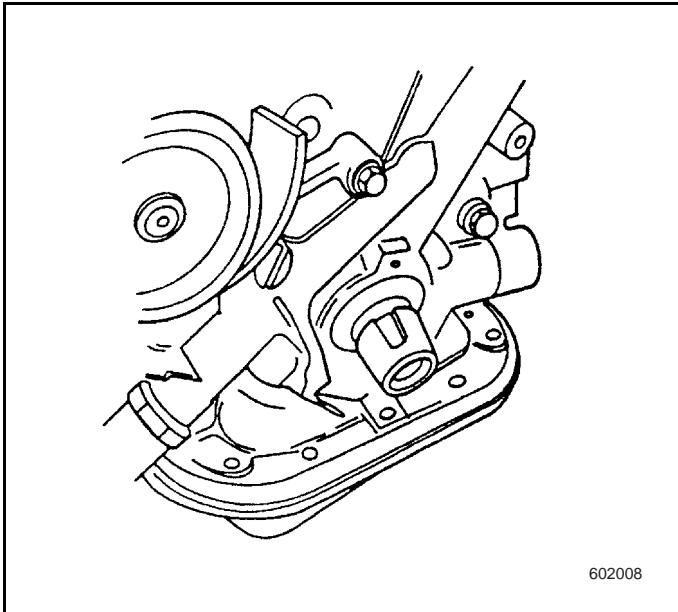


Installation Procedure

Tools Required

- S-9406185

1. Use a new sealing ring to re-install.
2. Add a sleeve S-9406185 at the end of the crankshaft, apply a coat of lubrication oil (part number: 9986126) on the sleeve surface.



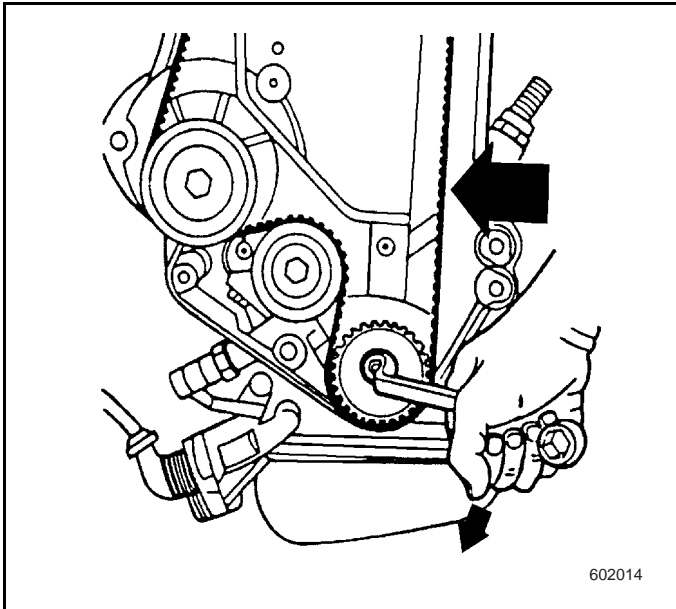
3. Use S- 9406185 (1), crankshaft timing belt wheel washer (3) and bolt (20 to install the sealing ring.
4. Take the tool and sleeve off.
5. Install camshaft timing belt wheel.
6. Install the timing belt. Refer to Timing Belt Replacement.

6.1.4.12 Replacement of the camshaft and hydraulic tappet

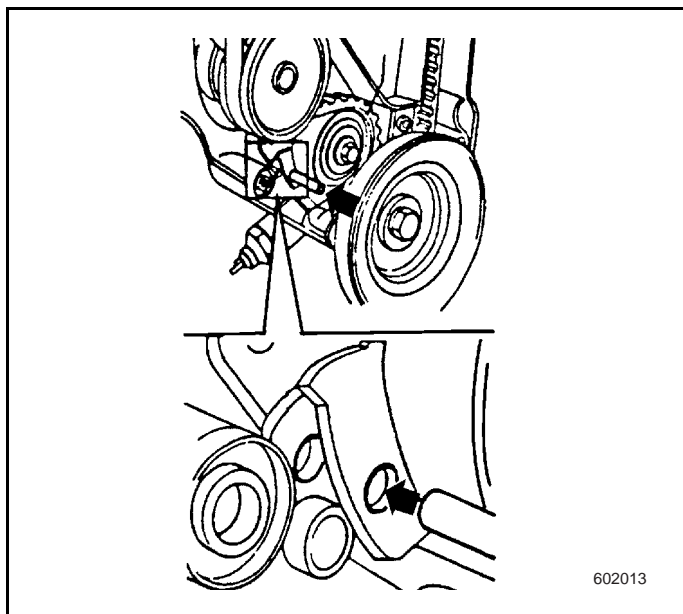
Removal Procedure

Tools Required

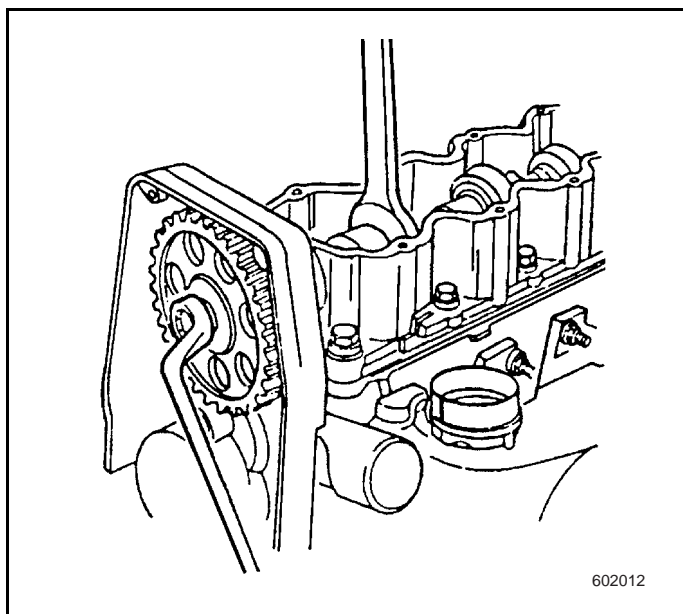
- S-9407182
 - J -830601
1. Disconnect the battery negative cable.
 2. Unplug the intake temperature sensor, disconnect the air filter and hose.
 3. Remove the accessory drive belt. Refer to Accessory Drive Belt Replacement.
 4. Remove crankshaft timing belt wheel. During the operation, use tool S -9407182 to lock the engine flywheel.
 5. Remove the timing belt front cover.
 6. Unlock the engine flywheel.



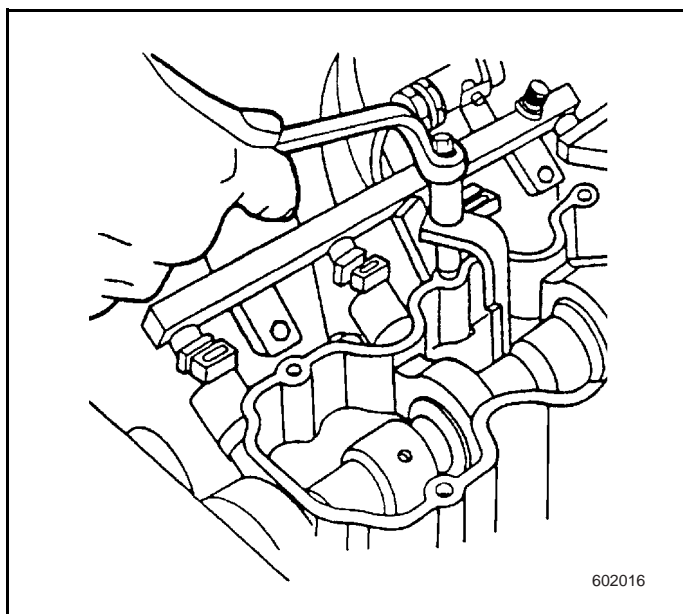
Note: Confirm all pistons are at the center of their travel. To satisfy the purpose, keep the mark at the crankshaft timing belt wheel and the edge mark of the oil pump housing at 90 degree.



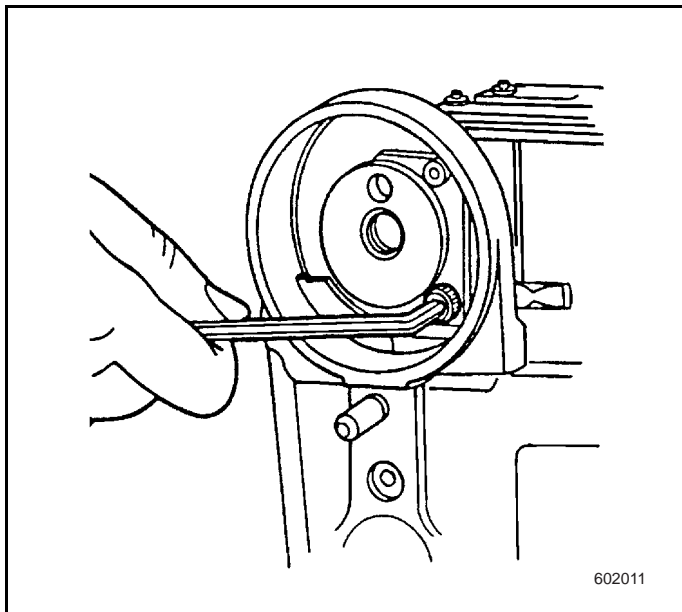
7. Push the timing belt wheel tensioning wheel upward with a spanner until the support hole and base hole of the tensioning wheel aligns, then fix it with positioning pins.



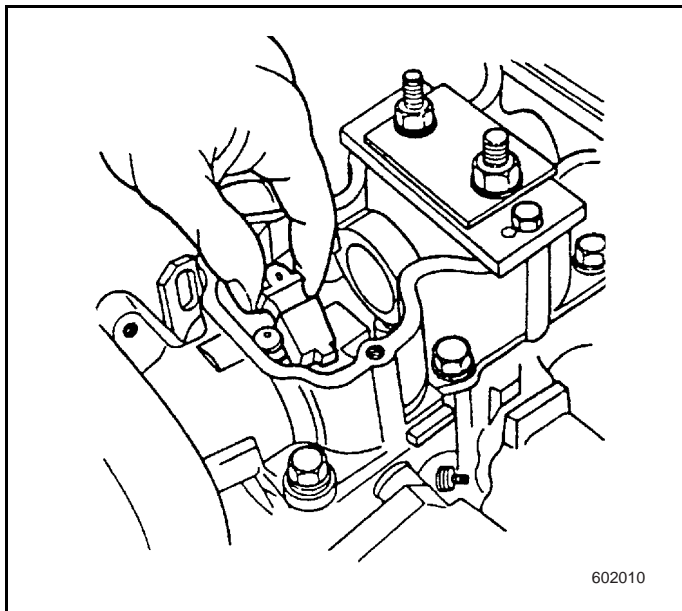
8. Remove the timing belt.
9. Lock the camshaft with a spanner, remove the camshaft timing belt wheel.



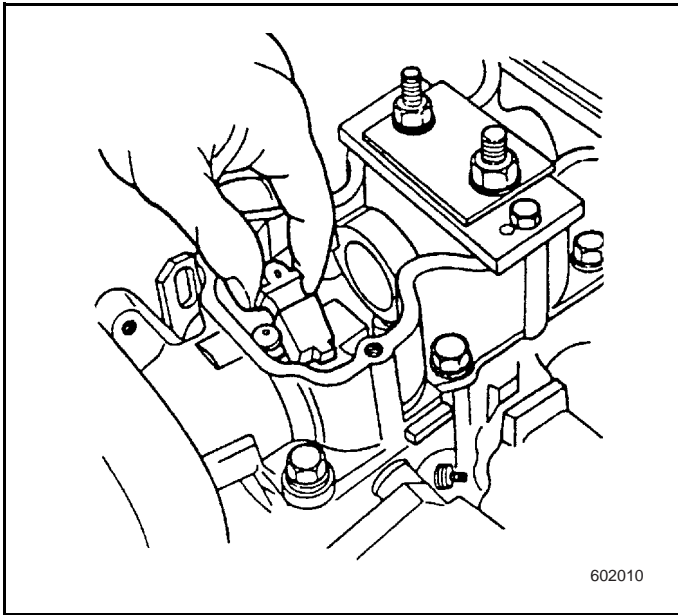
10. Remove the camshaft bracket cap.
11. Install tool J-830601 onto the camshaft bracket, support against the spring seat to be removed for easy removal. Press the valve spring with tools.



12. Remove the ignition coil and camshaft bracket rear cap.
13. Loosen the bolt between camshaft and camshaft isolation plate from the ignition coil side.



14. Pull the camshaft from the box through the ignition coil side.
15. Remove it after releasing the tool.
16. Take out the rocker arm and its seat.
17. Remove the hydraulic tappet.

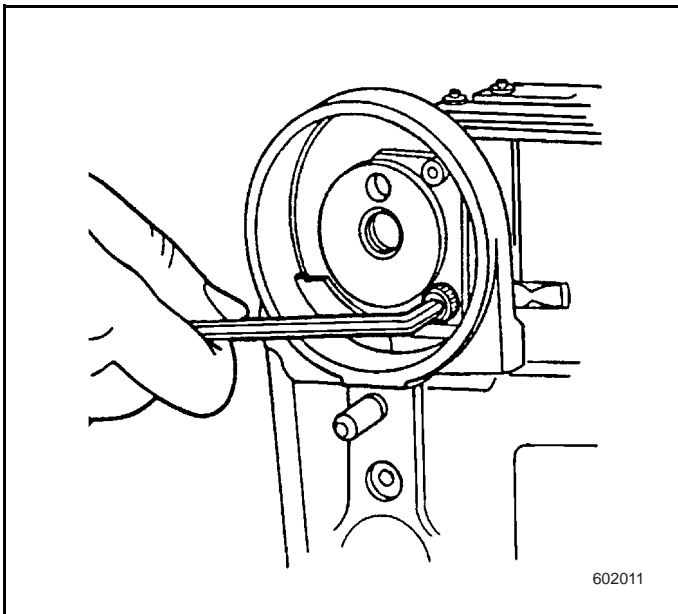


Installation Procedure

1. Install the hydraulic tappet.
2. Install the rocker arm and its seat.

Note: Use molybisulfide paste to lubricate the rocker arm and rocker arm seat.

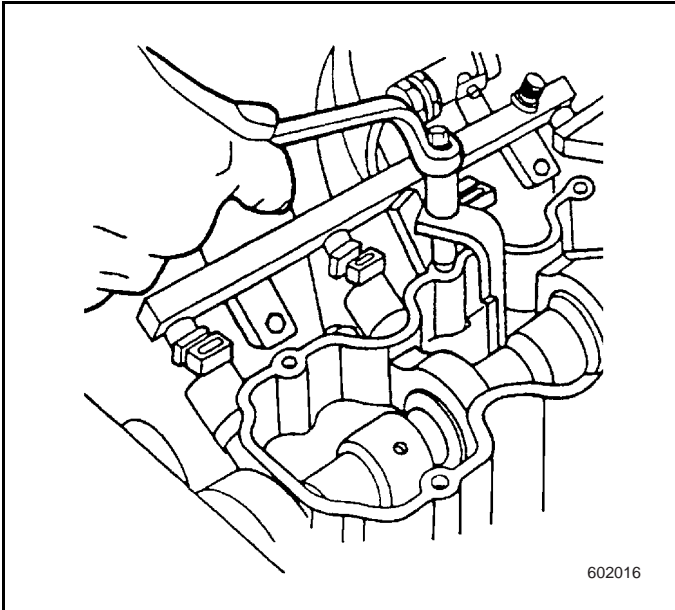
3. Press the valve spring with tools when installing the rocker arm.
4. Install the camshaft from the ignition coil side.



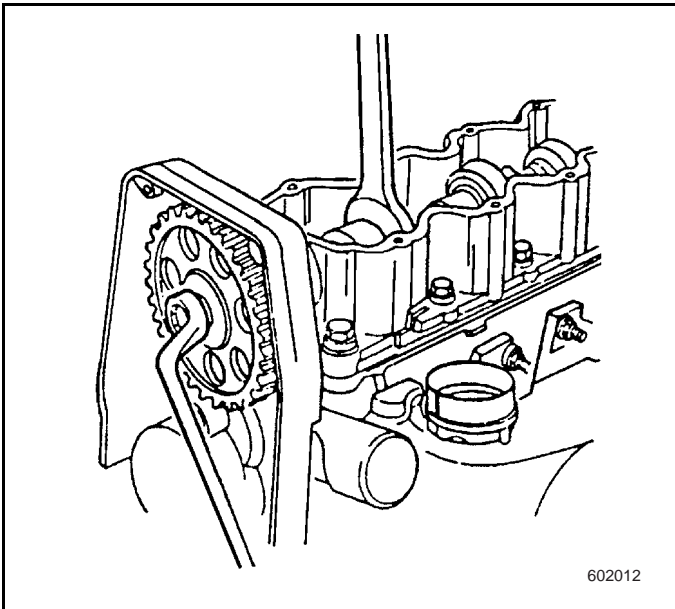
5. Install camshaft isolation plate and camshaft isolation plate bolt.

Tightening

Tighten the camshaft isolation plate bolt to 7 ± 3 N•m.



6. Remove the fixture clamp.
7. Install new camshaft sealing ring (part number: 90285291. 90298390.90280463.90298389.90180529.9208 9916) and install the camshaft timing belt wheel. Refer to instructions in Camshaft timing belt wheel and sealing ring replacement.



8. Install ignition coil.
9. Install the timing belt. Refer to Timing Belt Replacement.

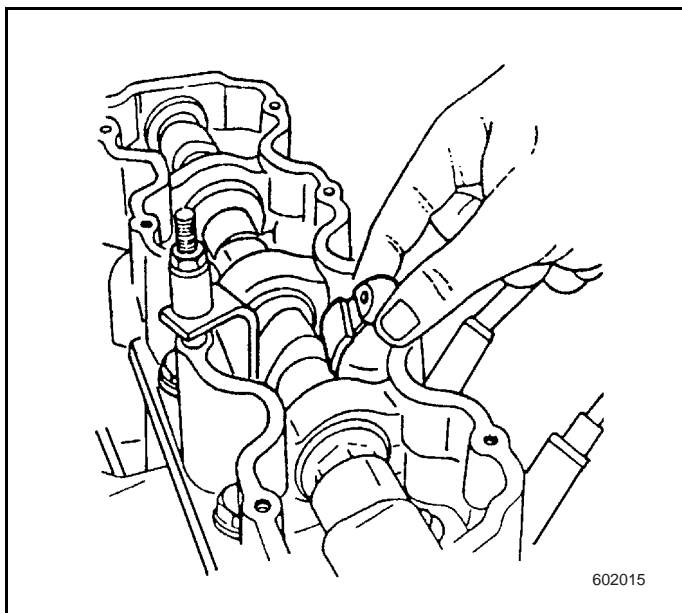
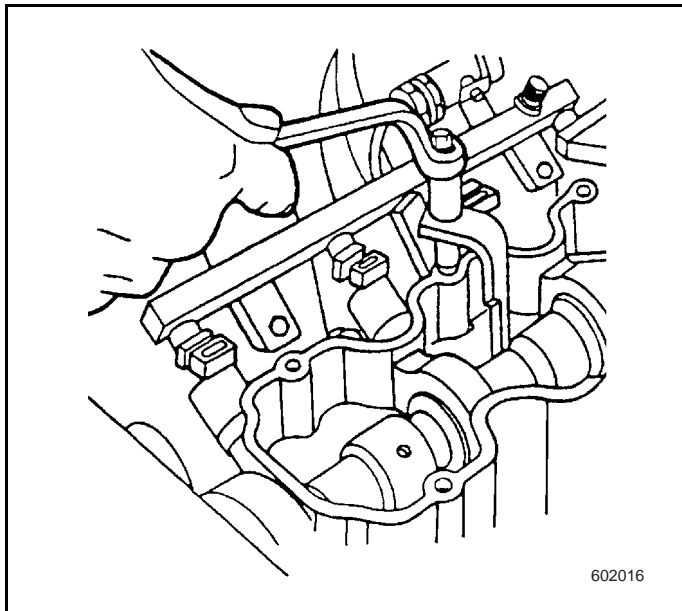
6.1.4.13 Replacement of the rock arm and hydraulic tappet (separately removal and installation)

Removal Procedure

Tools Required

- J -830601

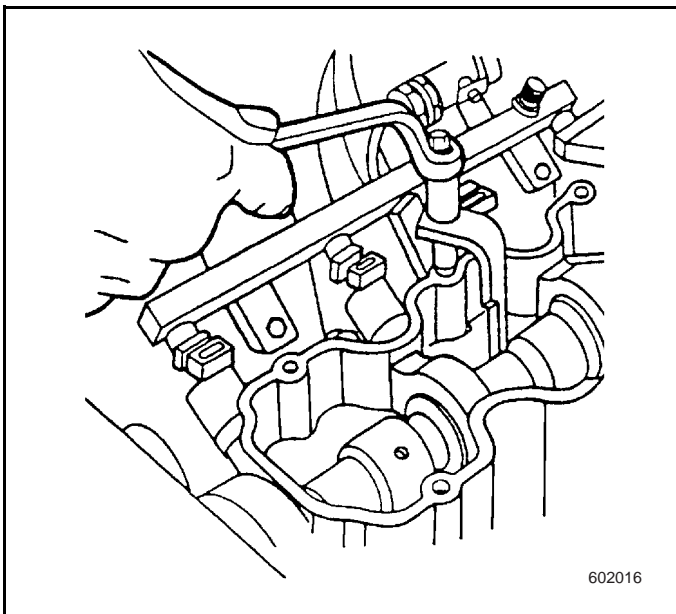
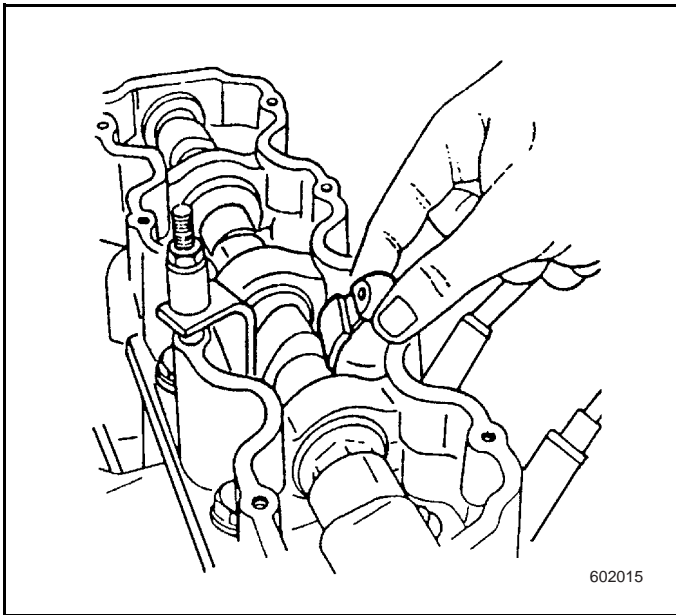
1. Take out the camshaft bracket cap, refer to Camshaft bracket cap replacement.
2. Install tool J-830601 onto the camshaft bracket, support against the spring of the relevant rocker arm to be removed for easy removal. Press the valve spring with tools.



3. Take out the rocker arm and its seat as well as the hydraulic tappet.

Installation Procedure

1. Install the hydraulic tappet, tappet and rocker arm.
2. Loose the valve spring, take out tool J-830601.



3. Install the camshaft housing cover.

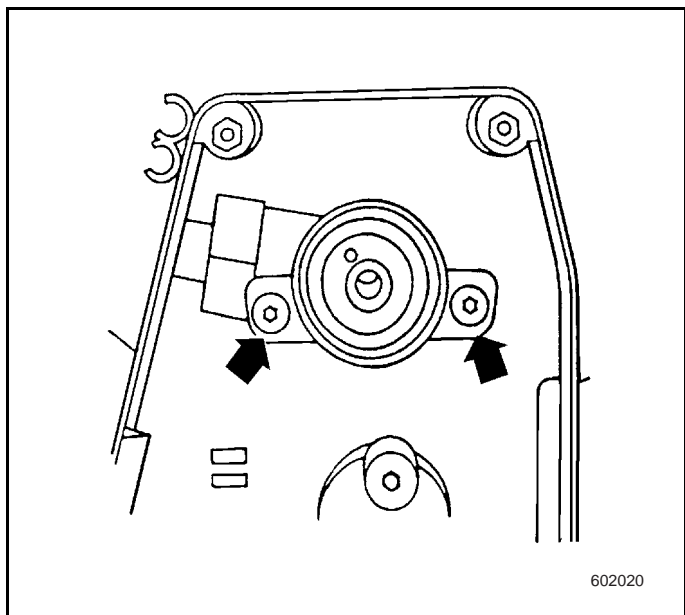
6.1.4.14 Cylinder Head Replacement

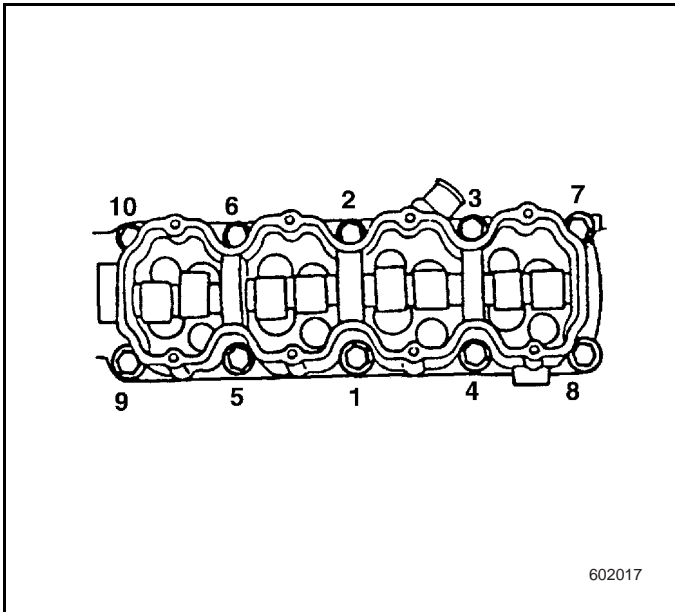
Removal Procedure

1. Remove the fuel pump relay under the instrument panel.

Note: Have the engine running for 5 seconds to reduce system pressure and collect and clean the fuel.

2. Disconnect the battery negative cable.
 3. Remove the air filter and hose, take out intake temperature sensor from the sir filter.
 4. Remove the coolant reservoir cap.
 5. Disconnect the radiator lower hose and collect the coolant.
 6. Remove all hoses, pipes and cables connecting the cylinder head and intake manifold.
 7. Remove the high voltage ignition wires.
 8. Disconnect the exhauston pipe harness and the exhauston manifold.
 9. Disconnect the oxygen sensor and harness, remove the exhauston manifold.
 10. Remove the timing belt. Refer to instructions in Timing Belt Replacement.
 11. Remove camshaft timing belt wheel. Refer to instructions in Camshaft Timing Belt Wheel and Sealing Ring Replacement.
 12. Remove upper mounting bolt at the timing belt rear cover.
- Order; loose 1/4 cycle, then loose 1/2, finally, screw the cylinder head mounting bolt completely.





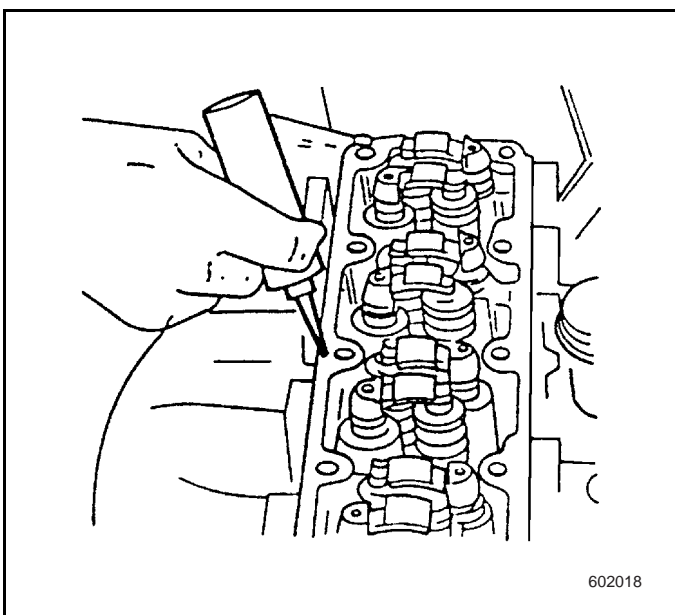
13. Remove the camshaft bracket.
14. Remove the rocker arm, arm seat and hydraulic tappet, pay attention not to confuse so that they may be re-installed to the correct position.
15. Take off the cylinder head.

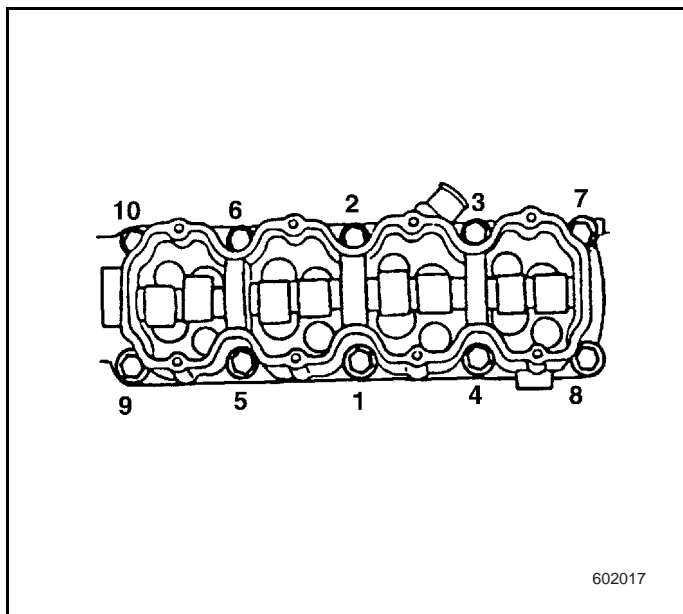
Clean

1. Clean the cylinder head completely, remove the old gasket, wiper away the dust and oil residue.
2. Clean the engine cylinder surface and top of the piston.

Installation Procedure

1. Install new gasket to the cylinder head (part number: 90500102. 90409684. 90410093. 92089943), mark at the gasket shall face upward at the front of the engine.
2. Fix the cylinder head and block.
3. Install hydraulic tappet, rocker arm seat and rocker arm, use molybisulfide paste to lubricate them.
4. Use sealing mixture (part number: 9309548) to apply at the placing surface of the camshaft box.





5. Install the camshaft bracket.
6. Install the tightening bolt of the cylinder head and tighten according to the described sequence.

Tightening

Tighten the cylinder head bolt to $25\text{N}\cdot\text{m} + (180^\circ - 190^\circ)$.

7. Install upper mounting bolt at the timing belt rear cover.

Tightening

Fasten the timing belt rear cover bolt to $12 \pm 2\text{N}\cdot\text{m}$.

8. Install the camshaft timing belt wheel and bolt.

Tightening

Fasten the camshaft timing belt bolt to $45 \pm 5\text{N}\cdot\text{m}$.

9. Install the timing belt. Refer to Timing Belt Replacement.
10. Install the exhaust manifold and gaskets.
11. Install the oxygen sensor onto the exhaust manifold and connect its harness.
12. Install the exhaust pipe.
13. Install the fuel pipe into fuel track.
14. Connect the high voltage ignition harness and the ignition module.
15. Install all hoses, pipes and cables connecting the cylinder head and intake manifold.
16. Connect the radiator lower hose.
17. Fill the coolant into the cooling system. Refer to Empty and Fill Cooling System in Engine Cooling System.
18. Install the air filter and intake hose, and connect the temperature sensor to the harness.
19. Connect the battery negative cable.
20. Install the fuel pump relay.

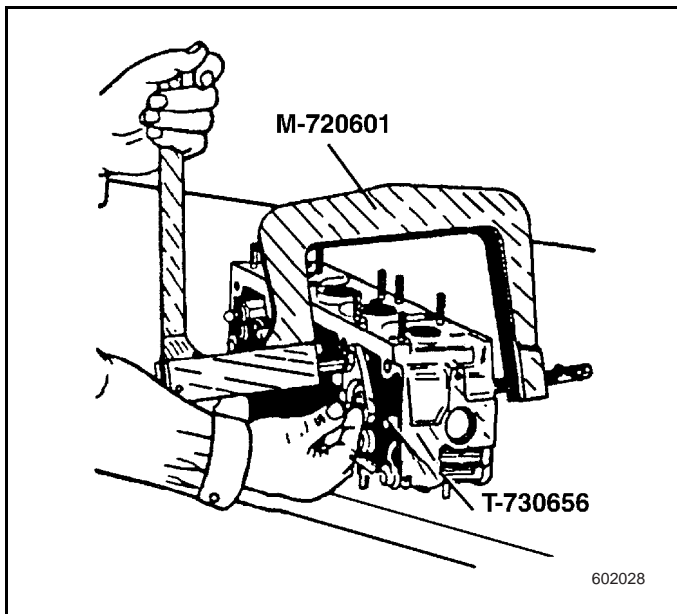
6.1.4.15 Replacement of Valve, Spring, Sealing Ring

Removal Procedure

Tools Required

- M-720601
- V-8606027
- KM-419

1. Remove the cylinder cover. Refer to Cylinder Head Replacement.
2. Use M-720601 and adjustable tool V-8606027 to remove the valve gasket from the cylinder head assembly.
3. Take off the spring guarding board.
4. Remove the spring.
5. Take off the valve sealing ring.
6. Remove the valve.

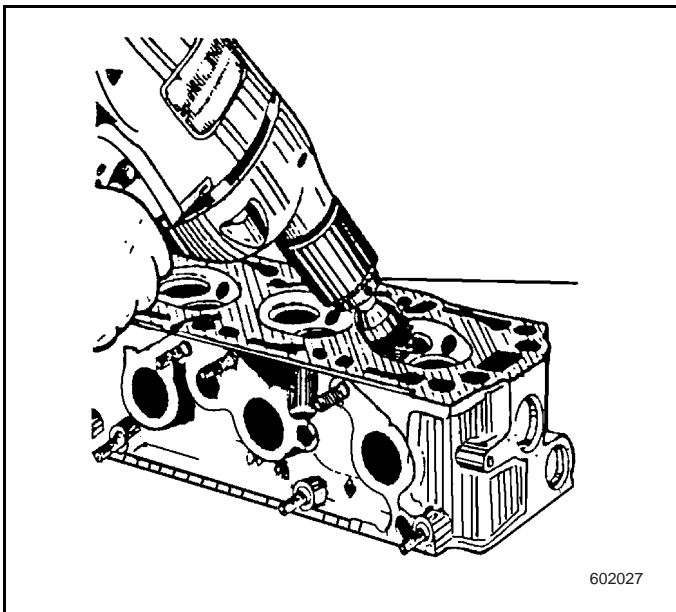


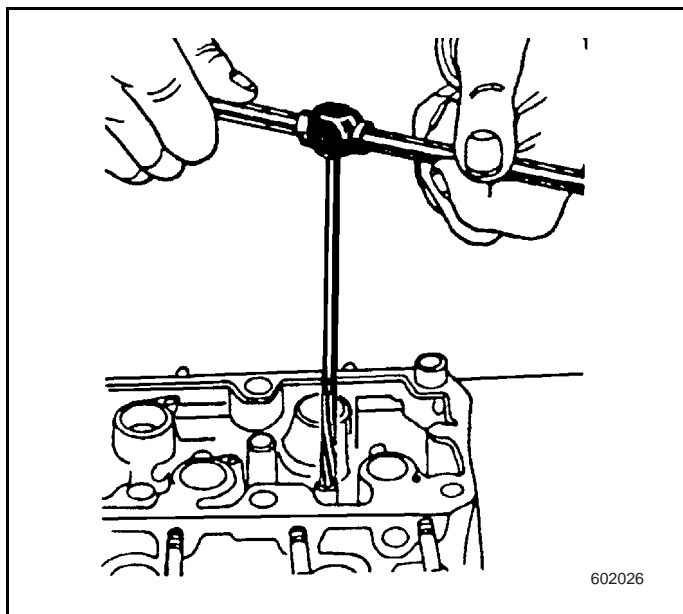
Clean

Clean the burning compartment, install a special brush into a drilling machine.

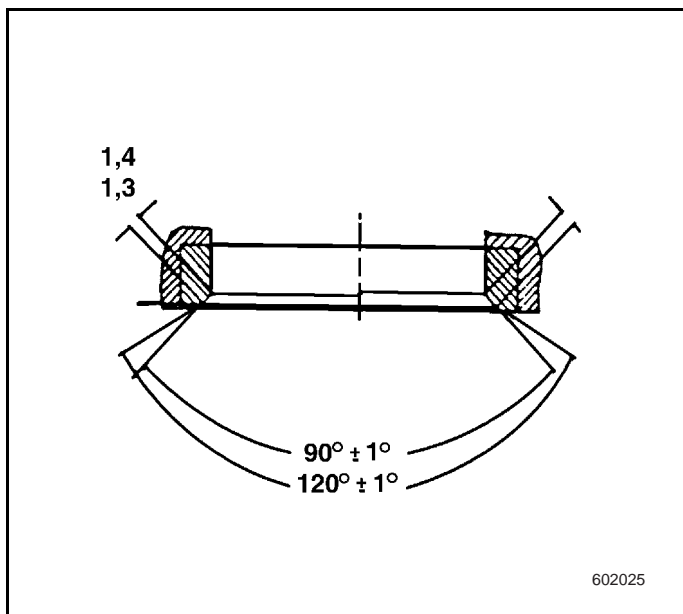
Inspection and Detection

1. Inspect the exhaust pipe and burning compartment to check if there is crack.
2. Inspect if there is trace of burning at the top of the valve, if there is crack on the surface and if the valve stem is damaged.
3. Inspect the clearance between the valve stem and pilot pipe according to the following procedures:
 - Measure the diameter of the valve stem at upper, middle and lower positions.
 - Measure the pilot pipe with telescope from upper, middle and lower positions. The difference between pilot pipe and valve stem is their distance.

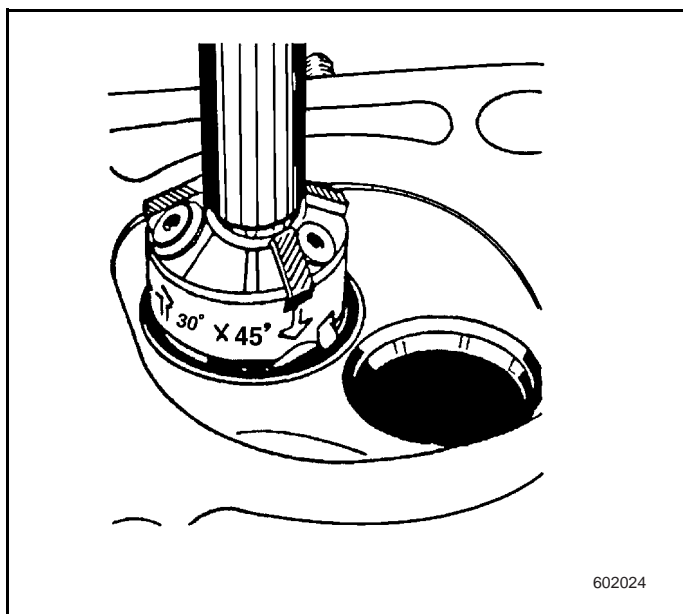




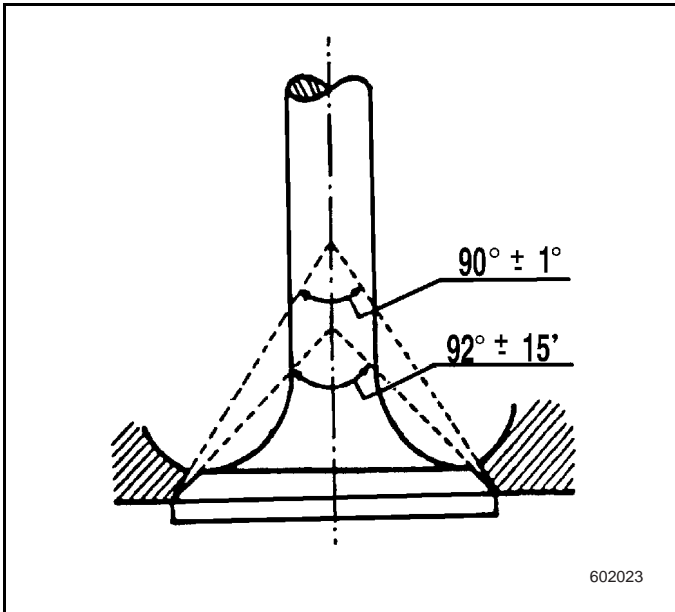
4. If the distance is out of the allowed range, that is, 0.018- 0.052mm (intake) and 0.038 to 0.082 mm (exhaustion), enlarge the hole to install large valve.



5. Inspect the following of the valve seat:
Concentricity of the largest and smallest ring. Should be 0.05mm.
Width should be 1.3 -1.4mm (intake) and 1.7 to 1.8mm (exhaustion).

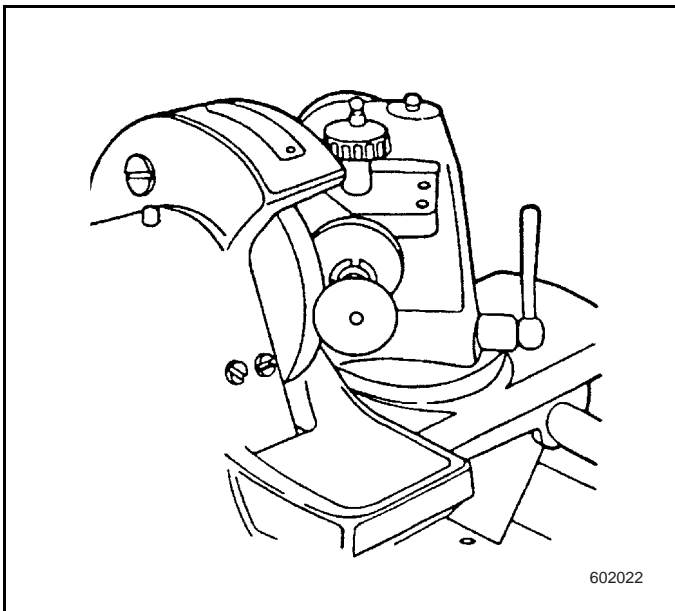


Note: If necessary, use a miller to mill $45 \pm 30'$.

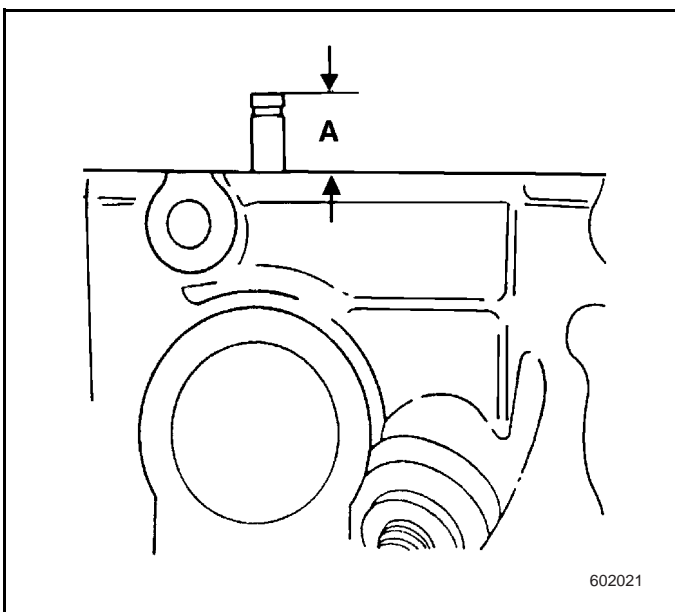


6. Check if there is rust in the valve. If there is no much wearing on the rusted valve, use special equipment to repair the surfaces according to the following procedures.

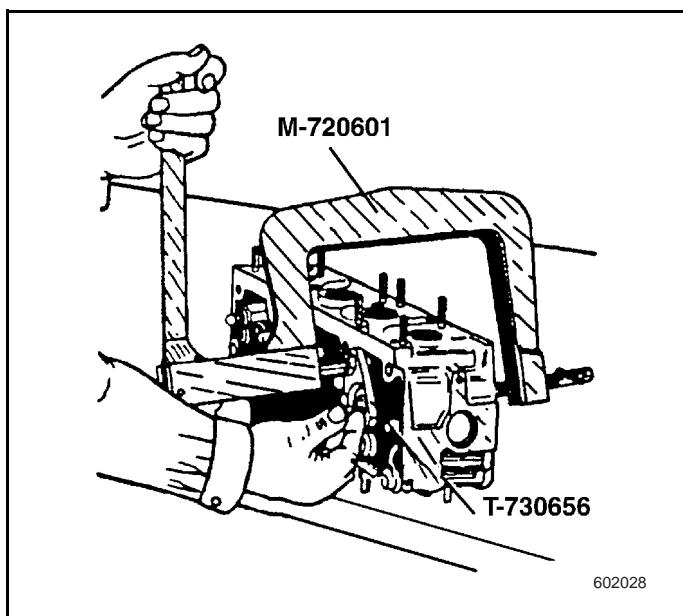
Mill to have an angle of $92^{\circ}15'$.



7. Bottom angle of the valve taper surface may be 44° (at 44° degree with valve top surface), process to correct.



8. Use tool KM-419 to check the valve stem height.



Installation Procedure

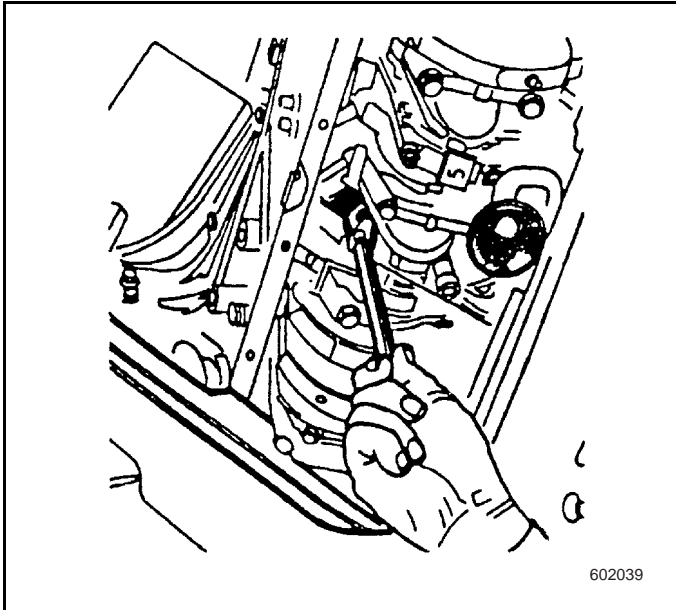
1. Install the valve.
2. Install the valve sealing ring.
3. Install the upper spring.
4. Install the valve spring guarding plate.
5. Use tool M-720601 and adjustable tool V-8606027 to install the valve locking plate.
6. Install the cylinder cover. Refer to Cylinder Cover Replacement.

6.1.4.16 Piston Kit Replacement

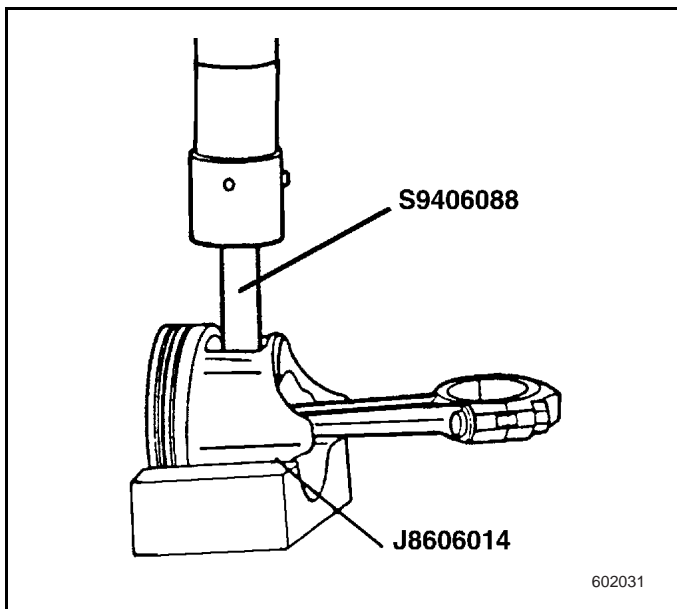
Removal Procedure

Tools Required

- S-9406089
 - J-8606014
 - S-9406188
1. Remove the cylinder cover. Refer to Cylinder Head Replacement.
 2. Wipe away residue or dust accumulated on the cylinder head.
 3. Release the oil drain bolt of oil pan, let oil drip off.
 4. Remove the oil pan.
 5. Remove the oil pan plate.
 6. Remove the linkage bearing cover and bearing, ensure the correspondence of each bearing and bearing cover of the linkage.



7. Remove the piston kit from the cylinder head with tool S-9406089.



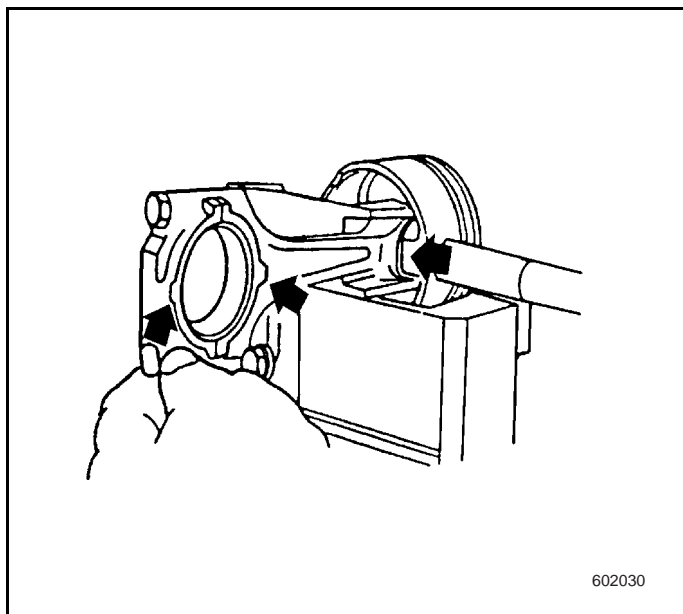
8. Put the piston on support J-8606014, remove the piston pin from the piston kit with remover S-9406188.
9. Take off the linkage from the piston.
10. Measure the clearance between the piston and cylinder, the specified value should be 0.010 to 0.030 mm.

Note: Prepare pistons with standard size of 0.50mm with various tolerances.

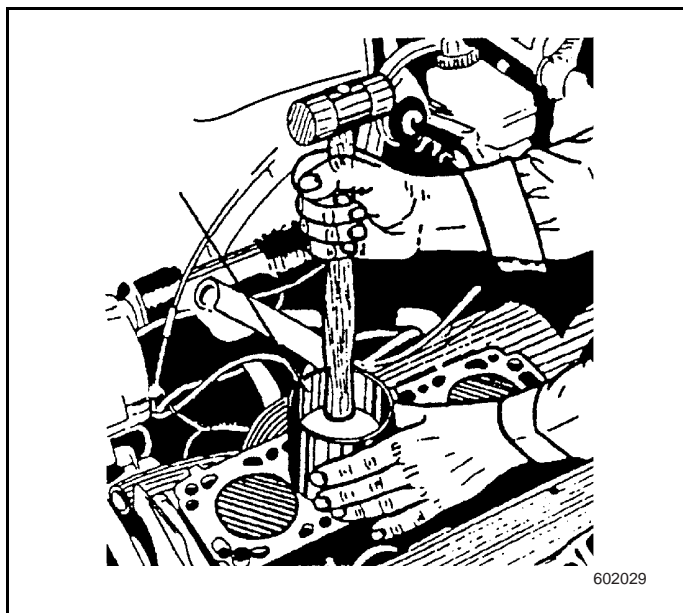
Installation Procedure

Tools Required

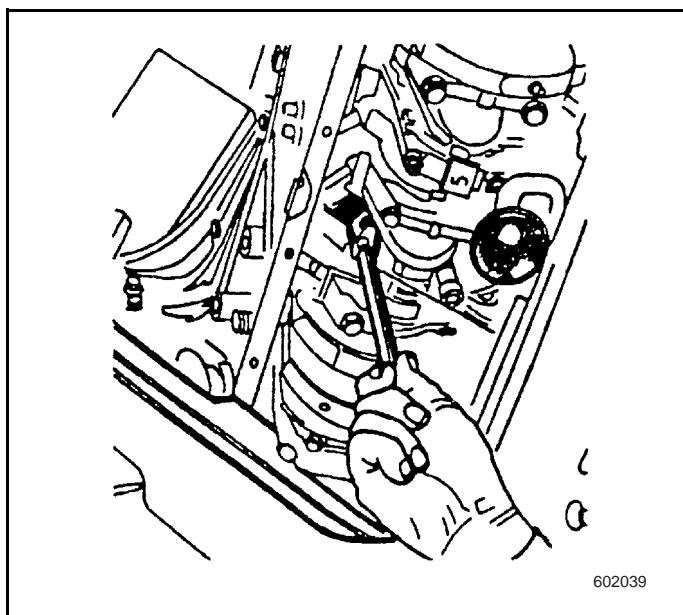
- S-9406187
- S-9406189



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1. Install the linkage to the piston.
2. Install the piston and piston pin according to the following procedures.
 - Heat the linkage to 280 to 320 at the piston pin hole. Better heat it in oil.
 - Cool the piston pin in dry ice.
 - Clamp the heated linkage with jaws of the plier.
3. Have the piston near the linkage, install the piston pin, then use tool
4. J-8606016 to insert the piston pin plug in place. Ensure the extruded smooth and flat surface of the linkage is kept at the same side.
5. Use tool S -9406187 to install the linkage kit to the cylinder block, the surface of the piston with arrow shall face the front of the engine.

Note: Lubricate the piston ring and cylinder hole surface with engine oil. Use S-9406189 tool to install link.

6. When installing the bearing lining on linkage, apply the lubricant only to the side facing to brace, and push the link until it lands on the brace.
7. Install the link bearing cover, and apply lubricant to the surface of lower bearing lining facing to the brace.
8. Install new bolt for the link bearing, but do not tighten.
9. Rotate the crankshaft several cycles so that the linkage aligns completely, then tighten the linkage bolt.

Tightening

Tighten the link bolt to 25N•m+ (30-60)
or 30N•m.

10. Install oil pan, be sure to use tightening glue, part number: 9309619.

Tightening

Tighten the oil pan bolt to 10 N•m.

11. Install the oil drain bolt.

Tightening

Tighten the oil pan bolt to 50 N•m.

12. Install the cylinder cover. Refer to Cylinder Cover Replacement.

Note: Fill the engine with SAE type 10W30 oil.

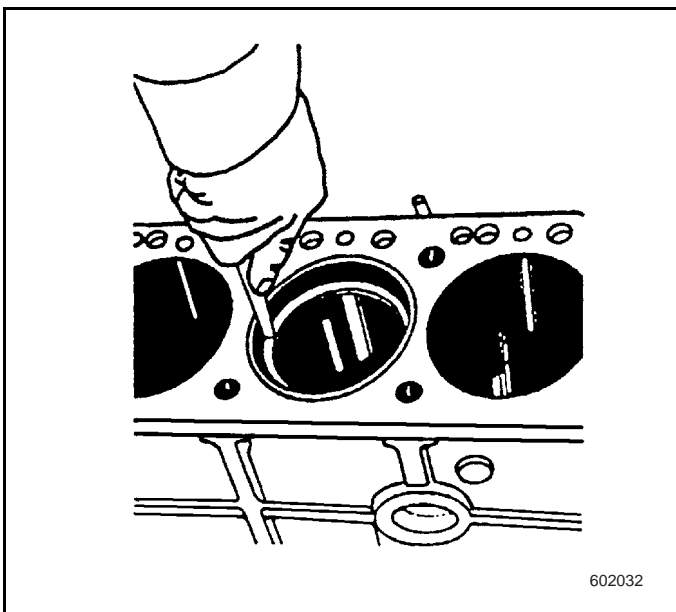
6.1.4.17 Piston Ring Replacement

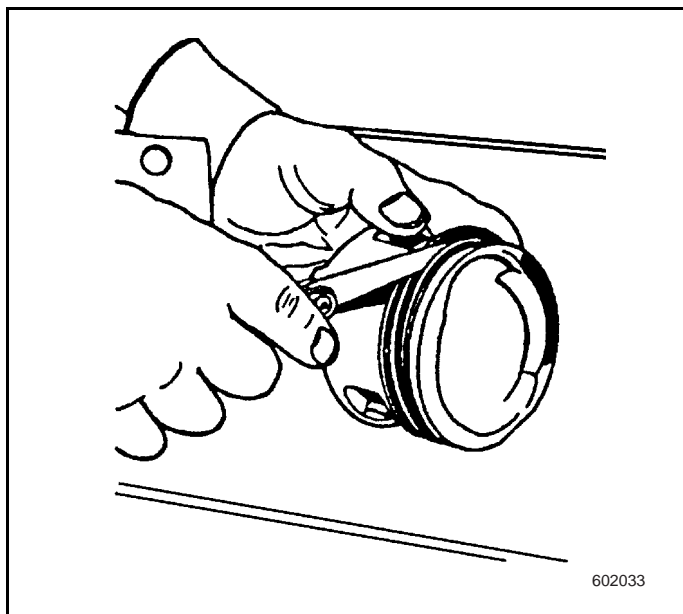
Removal Procedure

1. Remove the piston and linkage. Refer to Piston Kit Replacement.
2. Remove the piston ring.
3. Clean the smooth surface of the piston, use adequate blade to clean the channel, clear away grease in the channel and pin hole.

Inspection and Detection

1. Check if there is crack at the channel, root or skirt of the piston.
2. Check the piston ring.
3. Check if there is deformation, damage or rust at the top of the piston.
4. Measure the clearance between the piston ring ends, place the spring in the cylinder and push it with the piston so that it is upright with the cylinder wall. Clearance shall be:
 - (Piston) gas ring: 0.30 - 0.50 mm.
 - (Piston) oil ring: 0.40 - 1.40 mm.





5. Install the pistons in sequence according to even interval, that is, each ring opening is 180degree apart. Clearance between oil control ring and caliper ring shall be 25 to 50 mm.
6. Clearance between the measuring ring and ring channel shall be:
 upper compression ring: 0.060 -0.092mm.
 lower compression ring: 0.030 -0.062mm.

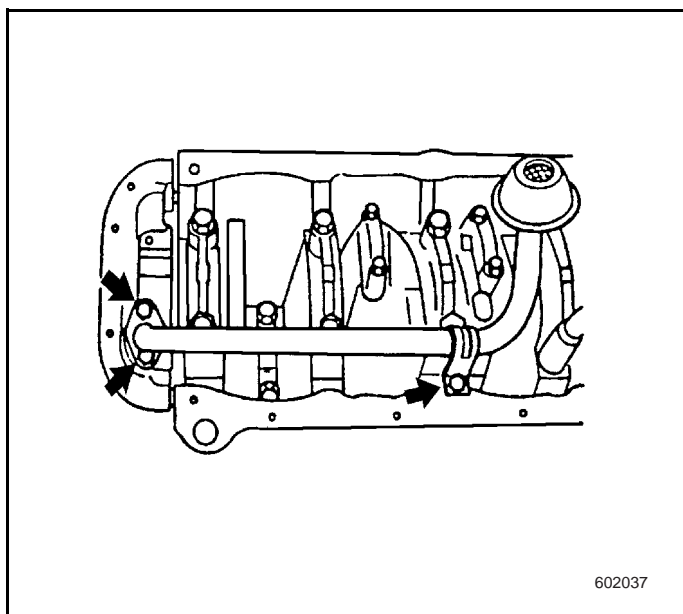
Installation Procedure

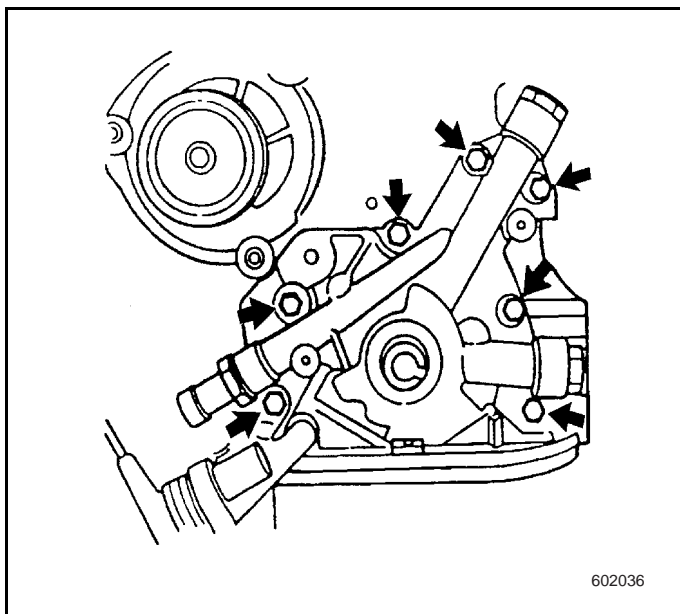
1. Install the piston ring to the piston.
2. Install the piston (linkage) kit to the cylinder block. Refer to Piston Kit Replacement.

6.1.4.18 Engine Oil Pump Replacement

Removal Procedure

1. Remove camshaft timing belt wheel. Refer to Camshaft timing belt wheel replacement.
2. Remove crankshaft timing belt wheel.
3. Remove upper mounting bolt at the timing belt rear cover.
4. Remove the timing belt rear cover.
5. Remove the oil drain bolt of oil pan, drain oil.
6. Remove the oil pressure indicator switch.
7. Remove the exhaust pipe.
8. Remove the oil pan.
9. Remove the engine oil pump suction pipe.





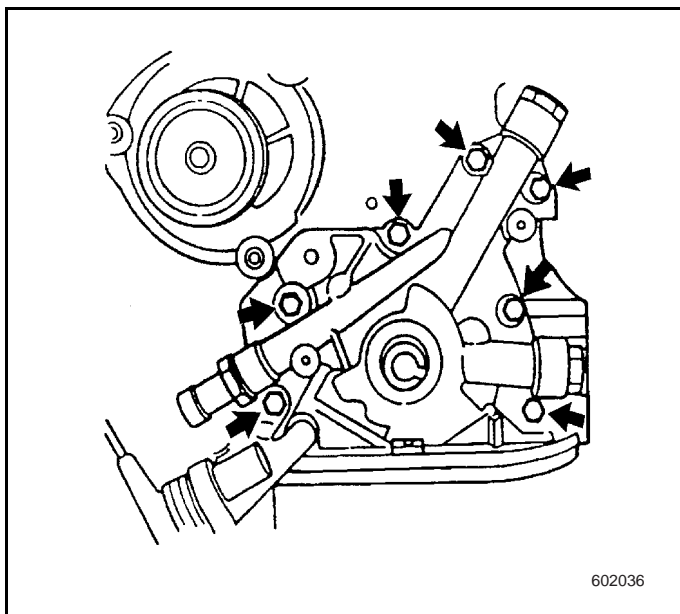
10. Loosen the mounting bolt of the oil pump, remove the oil pump.

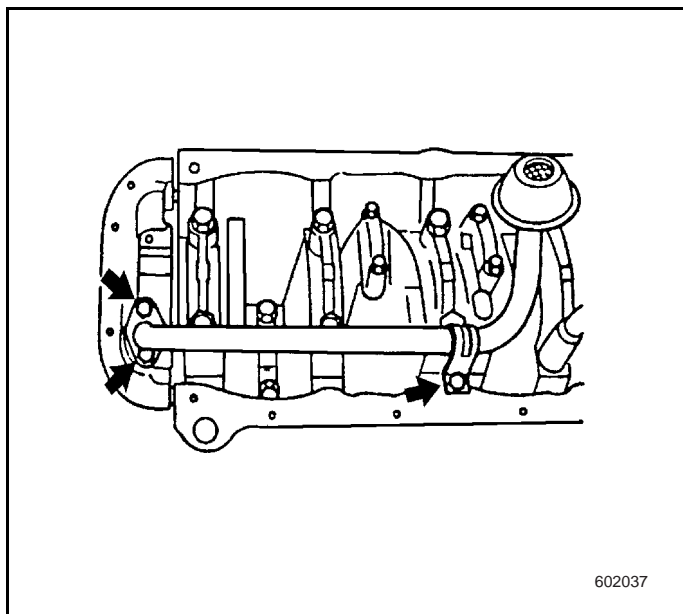
Installation Procedure

1. Install the oil pump and its bolts and tighten.

Tightening

Tighten the engine oil pump bolt to 73 N•m.





2. Install the engine oil pump suction pipe.

Tightening

Tighten the engine oil pump suction pipe bolt to 82 N•m.

Tighten the engine oil pump suction pipe bracket bolt to 82 N•m.

3. Install the oil pan and drain bolt.
4. Install the exhaust pipe.
5. Install the oil pressure switch and tighten.

Tightening

Fasten the oil pressure switch to 30 ± 10 N•m.

6. Install the timing belt rear cover.
7. Install camshaft timing belt wheel.
8. Install camshaft timing belt wheel. Refer to Camshaft Timing Belt Wheel and Sealing Ring Replacement.

Note: Fill the engine with SAE type 10W30 oil, adjust the oil level.

6.1.4.19 Engine Oil Pump Safety Valve Replacement

Removal Procedure

1. Screw down the sealing bolt from the engine oil pump case (Arrow in Figure I), remove the spring and plunger from the bottom.

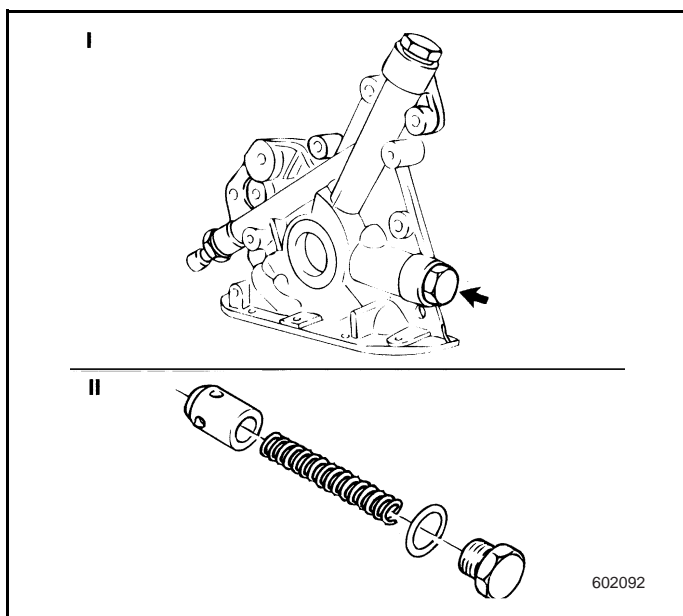
Note: If the signal units light or flash, causes may be insufficient oil pressure, stuck safety valve plunger or dirt adheres on it.

Installation Procedure

1. Install plunger (pay attention to installation position), spring, new sealing race and sealing bolts 9refer to Figure II).

Tightening

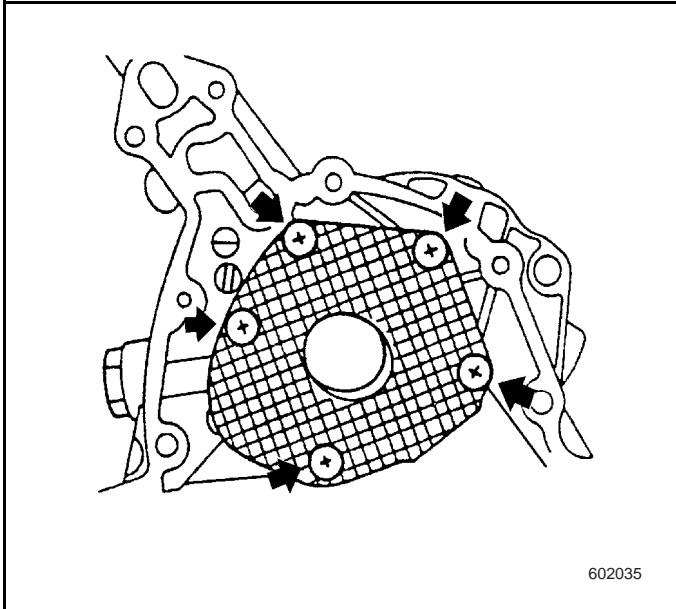
Tighten the safety sealing bolt to 50 N•m.



6.1.4.20 Disassembling and Assembling of the Engine Oil Pump

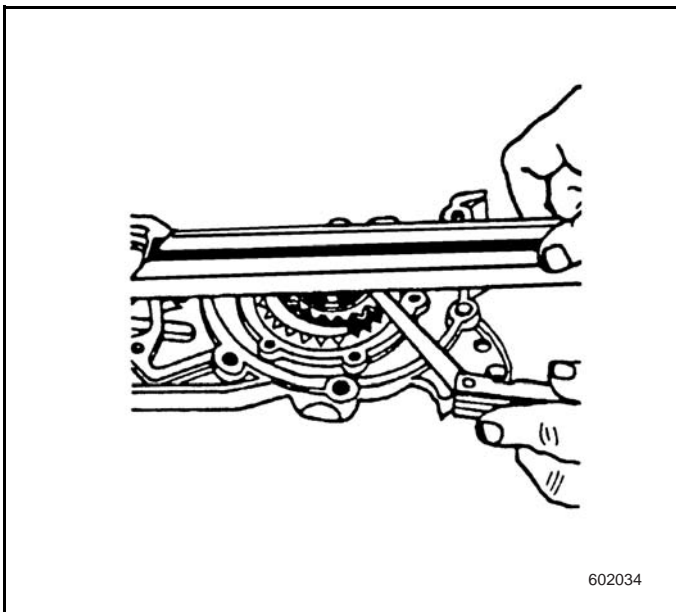
Removal Procedure

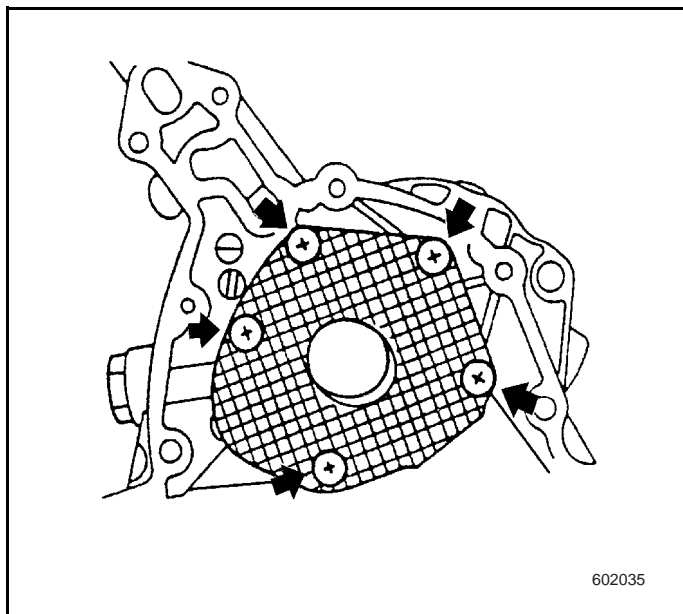
1. Loosen the engine oil pump cover.
2. Remove the bypass valve.



Inspection and Detection

1. Inspect the wearing of the pump and valve.
2. Measure the distance between the gear and cover, the specified value shall be 0.03 to 0.10mm.





Installation Procedure

1. Install cover of the engine oil pump, use sealing agent on the contacting surface.
2. Install the bypass valve.

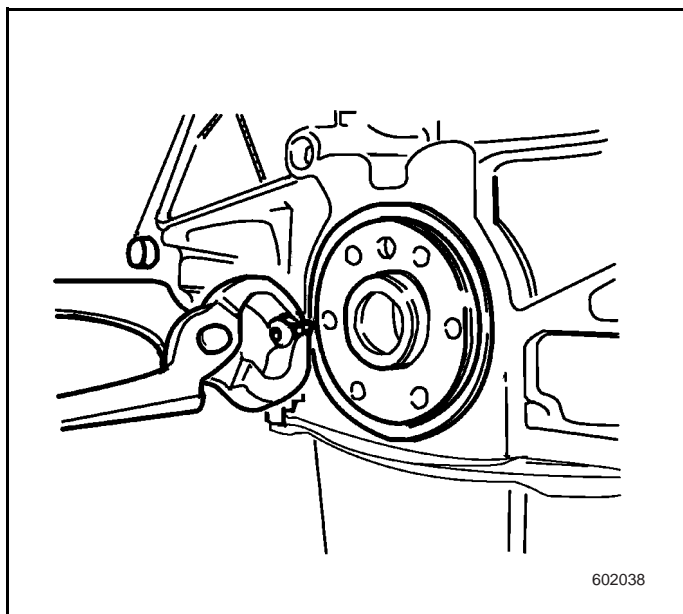
Tightening

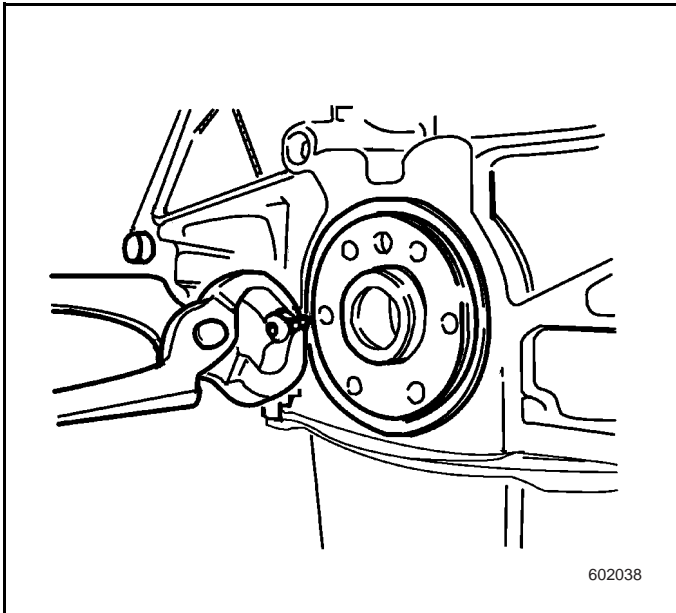
Tighten the engine oil pump bypass valve to $22.5 \pm 2.5 \text{ N}\cdot\text{m}$.

6.1.4.21 Engine Flywheel, Crankshaft Rear Oil Seal Replacement

Removal Procedure

1. Remove the transmission assembly. Refer to relevant contents in Chapter 7.
2. Use tool S- 9407182 to lock the flywheel through start gear ring.
3. Remove the clutch. Refer to relevant contents in Chapter 7. (This step is not applicable to vehicles with automatic transmission.)
4. Remove the flywheel bolt and the flywheel itself.
5. Drill a hole at the center of the shaft sealing ring with a suitable driller.
6. Insert a self-tapping screw, hold it near the cylinder and pull the oil seal out of the cylinder block.





Installation Procedure

1. Install the new crankshaft rear oil seal (part number: 90352111, 90352112, 903055, 90354382, 92089912), use protective sleeve S-9406183 to ensure the sealing surface, use the tool to install according to the following steps:

Note:

- Apply silicon-based grease on the sealing surface of the new sealing ring, fix it on sleeve S-9406183.
 - To avoid damage to the sealing surface, rotate the sealing ring slightly into the sleeve.
 - Place the sleeve with sealing ring at the crankshaft journal and press it flat.
 - Put bushing S-9406183 on the sleeve and press the sealing ring until it levels with the cylinder body side.
2. Clean the contacting surface of the crankshaft and flywheel thoroughly.
 3. Install the flywheel and tighten the bolt.

Note: Use new flywheel bolt, part number: 90232890.

Tightening

Tighten the flywheel bolt (engine with manual transmission) to $35\text{N}\cdot\text{m} + (30^\circ - 45^\circ)$;

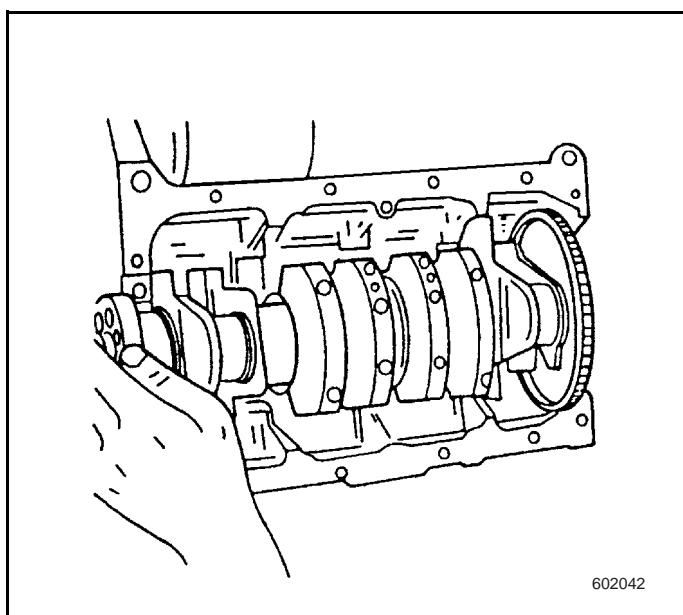
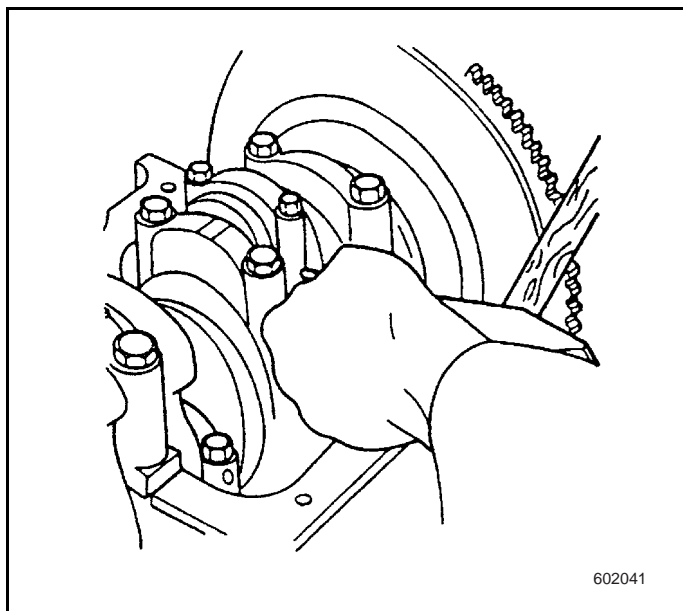
Tighten the flywheel bolt (engine with automatic transmission) to $60\text{N}\cdot\text{m}$

4. Install the clutch. Refer to relevant contents in Chapter 7.
5. Install the transmission to the engine. Refer to relevant contents in Chapter 7.

6.1.4.22 Crankshaft Replacement

Removal Procedure

1. Remove the engine and transmission from the vehicle. Refer to Engine and Transmission Replacement.
2. Remove the transmission from the engine and put on M-780668 bracket.
3. Remove the oil drain bolt of oil pan, drain oil and reserve.
4. Remove the engine oil pan.
5. Remove the oil pump. Refer to Oil Pump Replacement.
6. The clutch should be removed from the manual shift engine.
7. Remove the engine flywheel.
8. Mark on the master bearing and the link bearing.



9. Loosen the bolt of link, and remove the link bearing cover.
10. Loosen the bolt of master bearing, and remove the bearing cover.
11. Remove the crankshaft.

12. Remove the upper master bearing lining.

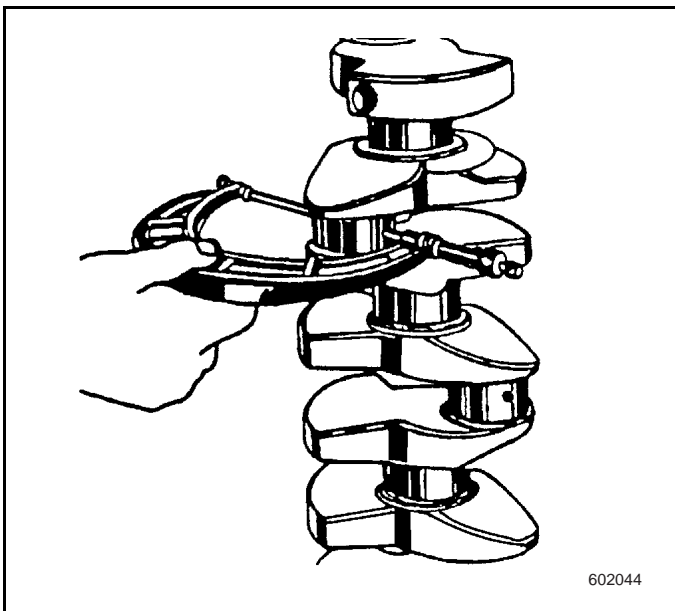
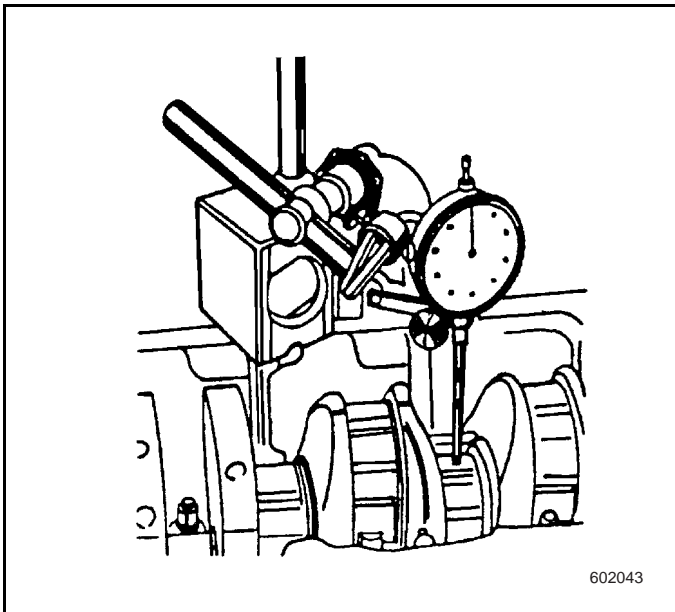
Note: Don't mix up the bearing lining.

Cleaning and Inspection

- Clean the component and blow dry.
- Check the shaft stud for scratch, roughness or other defects.

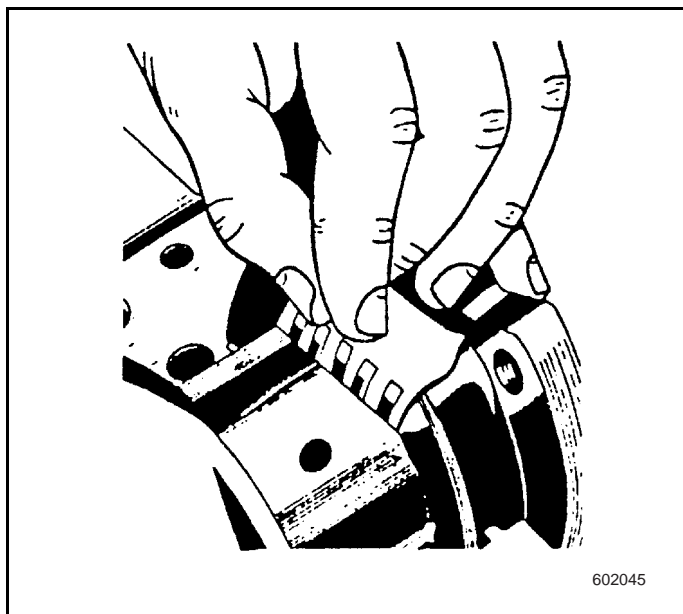
Measurement

- Check the crankshaft for flatness in the following procedure:
- Support the crankshaft with the bearing 1 and 5 (w shaft stud) of engine block.
- Install a dial gauge with contact pin to the bearing 3. If the total reading is $360\text{ }\mu\text{m}$, the most one can reach to 0.03 mm.



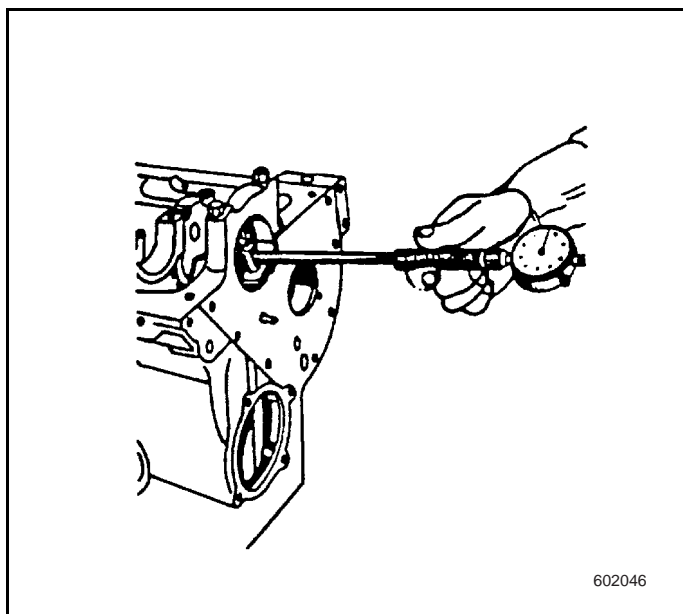
- Observe the shaft stud, and its taper can be 0.005mm at most.
- Observe the shaft stud, and its non-circularity can be 0.004 mm at most.

13. Observe the diameter of shaft stud and brace, and check the measurement list of bearing lining. Then decide which one can be used. If the diameter value is not in the specified range of list, the crankshaft should be reburnished or replaced.



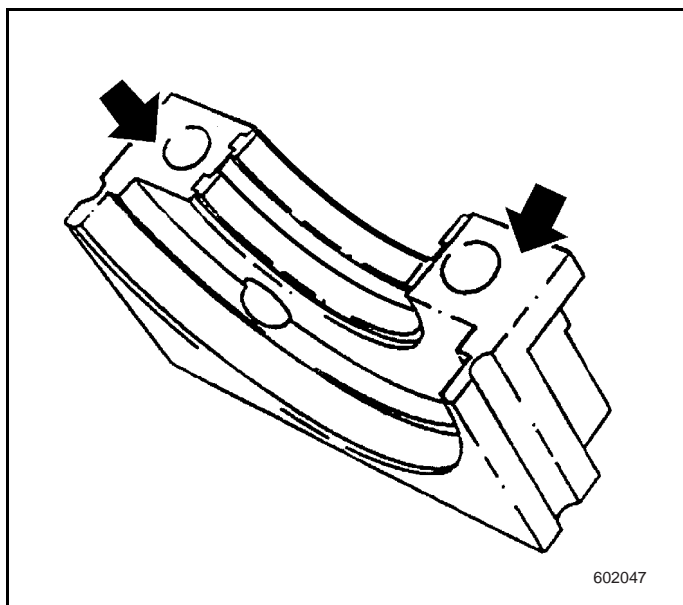
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14. Please use plastic clearance gauge when checking the space between the bearing and bearing lining.



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15. If there's no plastic clearance gauge, remove the crankshaft, position the bearing cover with bearing lining and bolts, and tighten. Measure the inner diameter of bearing lining and the diameter of shaft stud mating with crankshaft bearing. The difference value is the space between shaft stud and bearing lining.



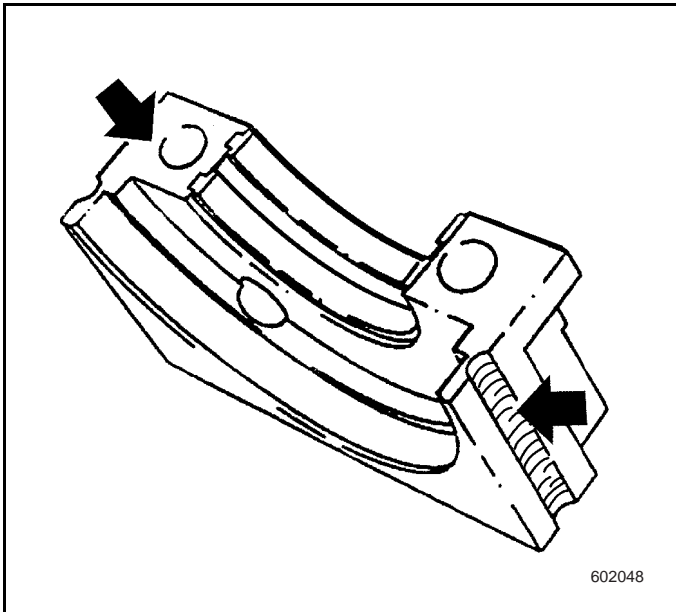
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Installation Procedure

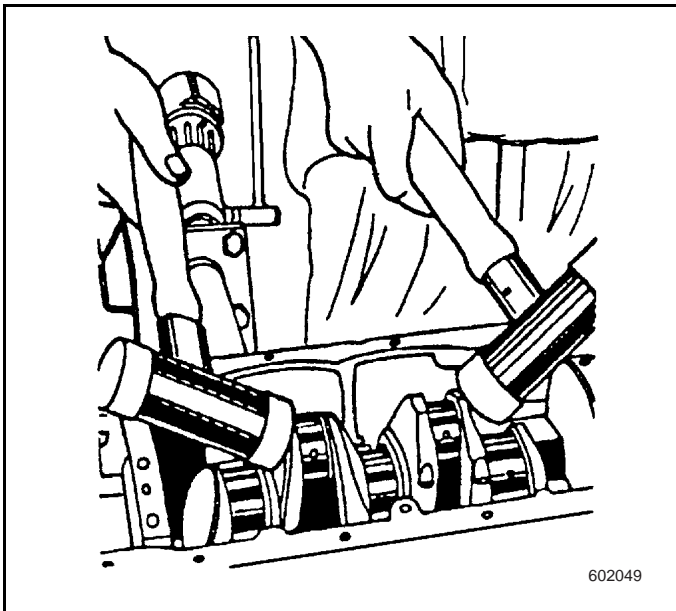
1. Install the upper bearing lining of master bearing into the engine block, and apply lubricant to the shaft stud side.
2. Install the crankshaft in the engine block.
3. Install the master bearing cover of lower bearing lining, and apply lubricant to the shaft stud side.

Note:

- The installation of the bearing cover should conform to the marks made during removing.
- Apply sealant to the indicated area on No.5 bearing cover. The part number is 9309519.



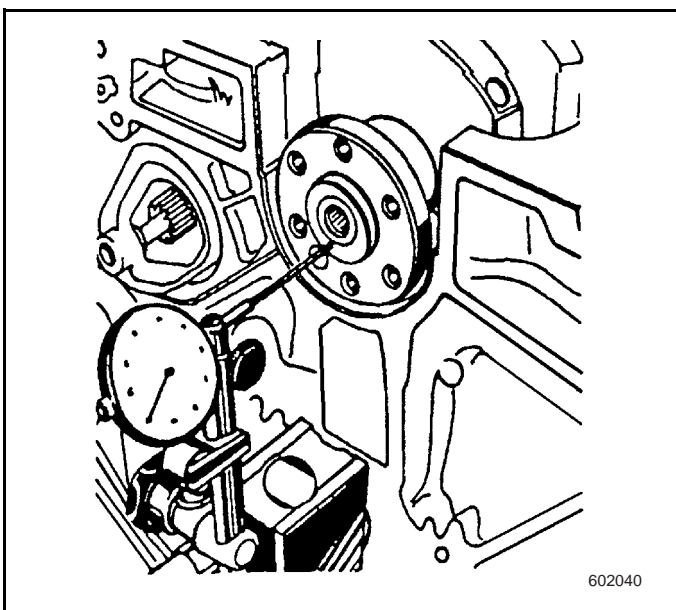
4. Fill the seal ointment into the groove on one side of rear bearing cover (No.5 bearing cover). The part number is 9309548.
5. Install the master bearing bolt, but not tighten.



6. Use a plastic bar to knock on the two sides of crankshaft in order to adjust the rear surface of the thrust bearing, and tighten the bolts.

Tightening

Tighten the crankshaft master bearing cover bolt to $50\text{N}\cdot\text{m} + (45 - 60)$.



Measurement

- Measure the bearing clearance of crankshaft in the following procedure.
 - Install a dial gauge with contact probe, and let the probe contact the surface of crankshaft.
 - Use a screwdriver to move the crankshaft in its direction, and notice the reading of dial gauge.
- The specified clearance is 0.1-0.2 mm.

7. Install the link to the brace.

Note:

- Use S-9406189 tool to install link.
 - When installing the bearing lining on link bearing, apply the lubricant only to the side facing to brace, and push the link until it lands on the brace.
8. Install the link bearing cover, and apply lubricant to the surface of lower bearing lining facing to the brace.
 9. Install the link bearing bolt, but not tighten.
 10. Rotate the crankshaft several times to the best position aligning the link, and tighten.

Tightening

Tighten the link bearing cover bolt to $25\text{N}\cdot\text{m}+(30^\circ\text{-}60^\circ)$ or $30\text{N}\cdot\text{m}$.

11. Install engine flywheel and bolts. Refer to Engine Flywheel, Crankshaft Rear Oil Seal Replacement.
12. Install the clutch (manual transmission). Refer to P-7 relevant contents.
13. Install oil pump. Refer to Oil Pump Replacement.
14. Install the engine oil pan.

Tightening

Tighten the oil pan bolt to $10\text{N}\cdot\text{m}$.

15. Tighten the oil drain bolt.

Tightening

Tighten the oil pan bolt to $50\text{N}\cdot\text{m}$.

16. Install the transmission to engine. Refer to P-7 relevant contents.
17. Install the engine and transmission to the vehicle. Refer to Engine and Transmission Replacement.

6.1.4.23 Engine Block Repair

Removal Procedure

1. Remove the engine and transmission from the vehicle. Refer to Engine and Transmission Replacement.
2. Secure the engine assembly to the M-780668 bracket.

Remove the cylinder cover of engine. Refer to Cylinder Cover Replacement.

Remove the engine plug kit. Refer to Piston Kit Replacement.

Remove the crankshaft. Refer to Crankshaft Replacement.

Clean the engine block completely.

Check the engine block for crack or wear.

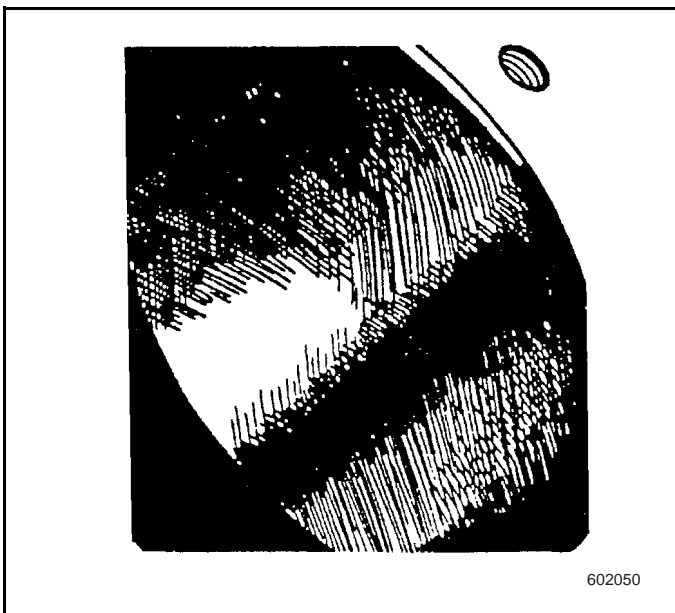
Cylinder Repair

After checking, if there is only something wrong with cylinder, while engine block is still working, the cylinder can be repaired through burnishing and polishing.

If wear or taper is more than 0.127mm, after being burnished and polished, the cylinder can accommodate the bigger plug.

Cylinder Burnishing

Notice: Some steps are not necessary in the engine repair procedure above.



Judge of necessity depends on the check result done before repairing.

Fine whetstone must be used for polishing after burnishing. The rule of burnishing is to use coarse whetstone first and then use fine whetstone. It is unnecessary to be burnished too glossy. Being slightly glossy is enough to help lubrication.

Place the whetstone into the cylinder and be close to cylinder as possible. It is allowed to use hand to rotate the whetstone.

Connect a 19 mm electric drill to the whetstone, and make the drill rotating at the same time moving slowly up and down in all directions until it can rotate freely.

During the process of polishing, it is necessary to add some proper coal oil to keep the whetstone and cylinder clean and lubricative.

Increase the polishing strength of whetstone and repeat this process till the expected diameter is obtained.

Note: Stop polishing at intervals, and put the relevant plug into the cylinder checking whether the space is appropriate. Clean the cylinder completely before putting the plug into it.

Clean the engine block completely after repair.

Installation Procedure

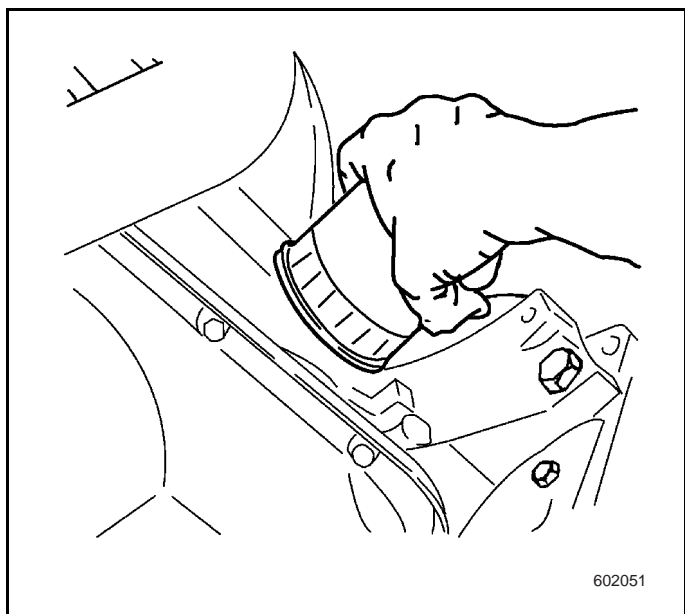
1. Install the crankshaft. Refer to Crankshaft Replacement.
2. Install the plug kit. Refer to Piston Kit Replacement.
3. Install the cylinder cover. Refer to Cylinder Cover Replacement.
4. Install the engine and transmission to the vehicle. Refer to Engine and Transmission Replacement.

6.1.4.24 Engine-Oil Filter Replacement

Removal Procedure

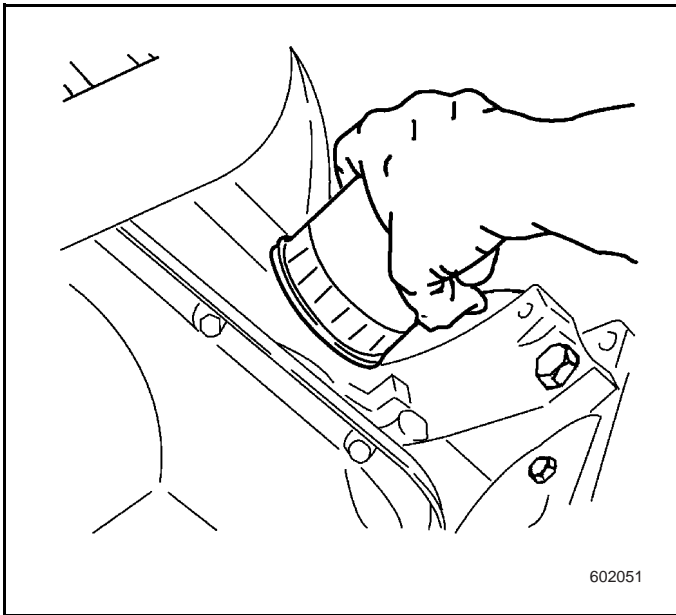
Tools Required

- KM-726-A
1. Loosen the engine-oil filter by KM-726-A.
 2. Collect the engine oil.



Installation Procedure

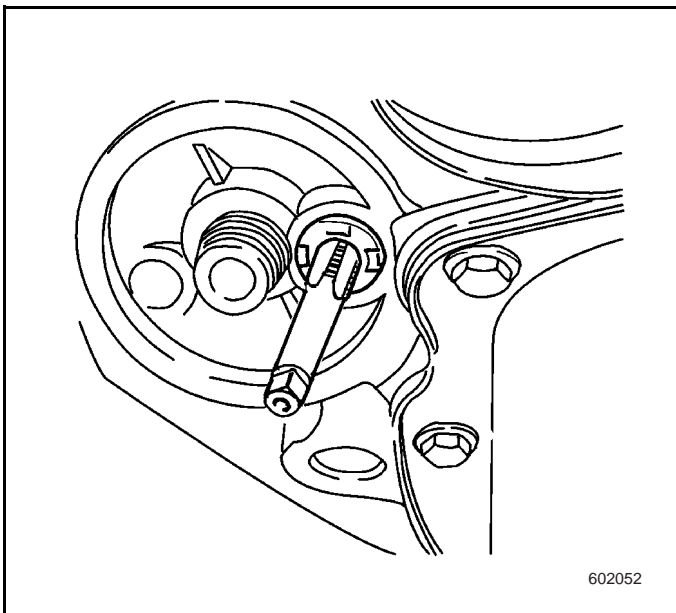
1. Use oil to lubricate the engine-oil filter seal slightly and tighten by hand.
2. Inspect the engine oil level, and adjust if necessary.

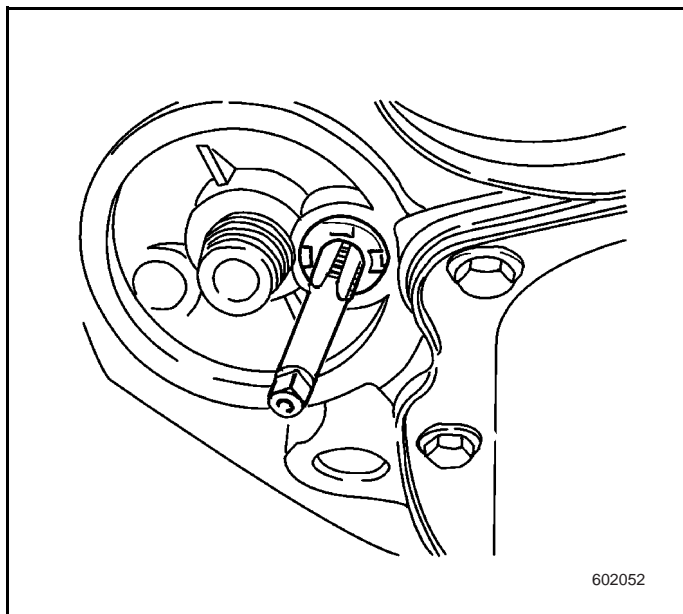


6.1.4.25 Engine Oil Filter Bypass Valve Replacement

Removal Procedure

1. Remove the engine-oil filter.
2. Use screwdriver to do thread chaing to the valve.
3. Tighten a M10 bolt and pull the bypass valve out of the valve seat.





Installation Procedure

1. Use a brass punch (15 mm) to push the bypass valve.
2. Use oil to lubricate the engine-oil filter seal slightly and tighten by hand.
3. Inspect the engine oil level, and adjust if necessary.

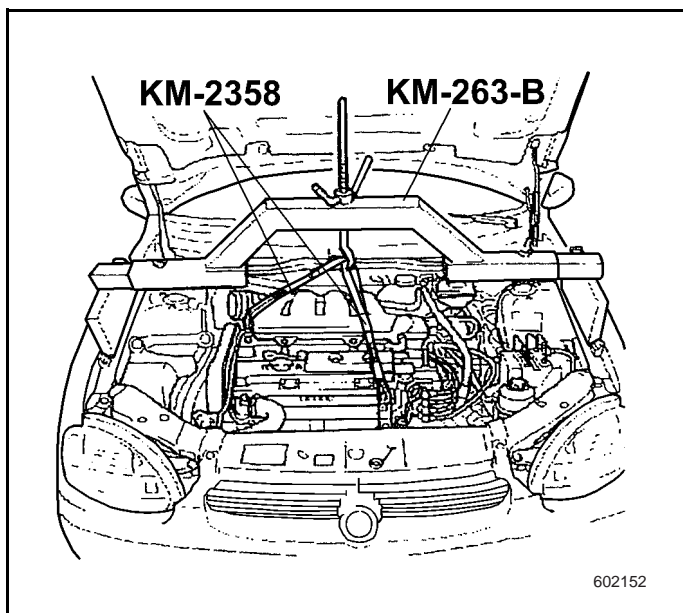
6.1.4.26 Left Front Engine Suspension Replacement (Manual Transmission Vehicle)

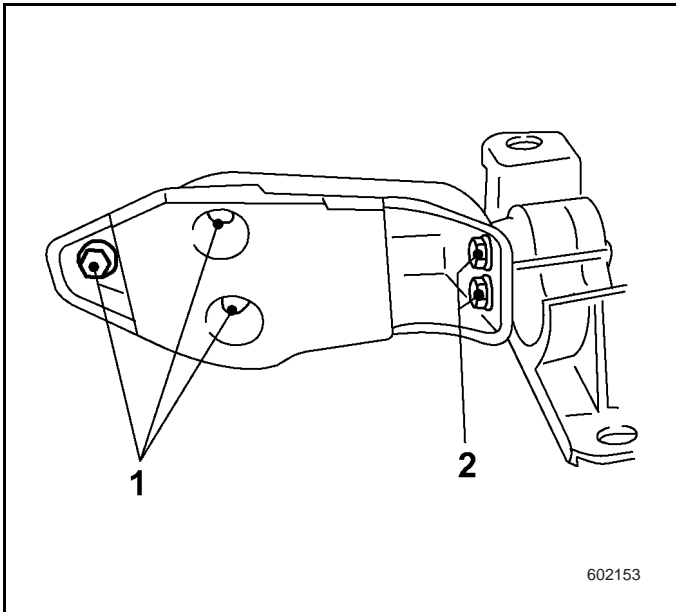
Removal Procedure

Tools Required

- KM-263-B
- MKM-883-1
- KM-2358

1. Remove the sparking plug from the upper intake manifold.
2. Use the engine sling KM-2358 to connect the engine to the engine drive axle KM-263-B (or MKM-883-1).





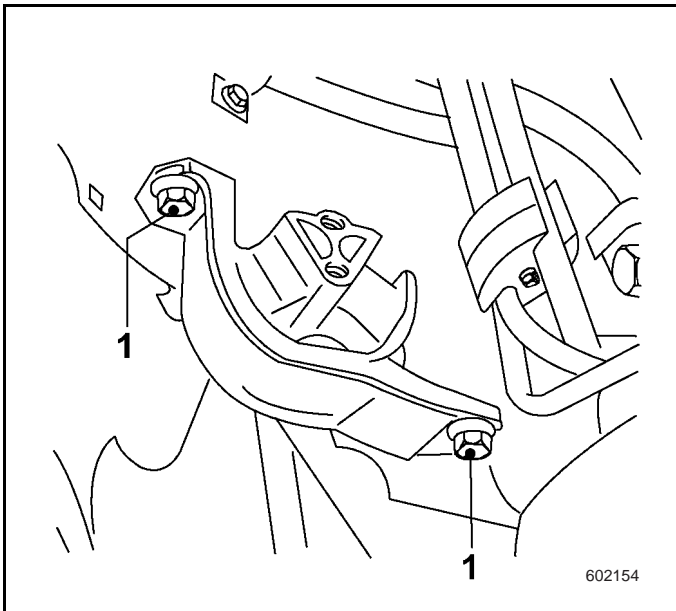
3. Loosen the bolt between the engine bracket and transmission (1).
4. Remove the engine bracket from the left engine suspension (2).
5. Remove the suspension from the front rail (1).

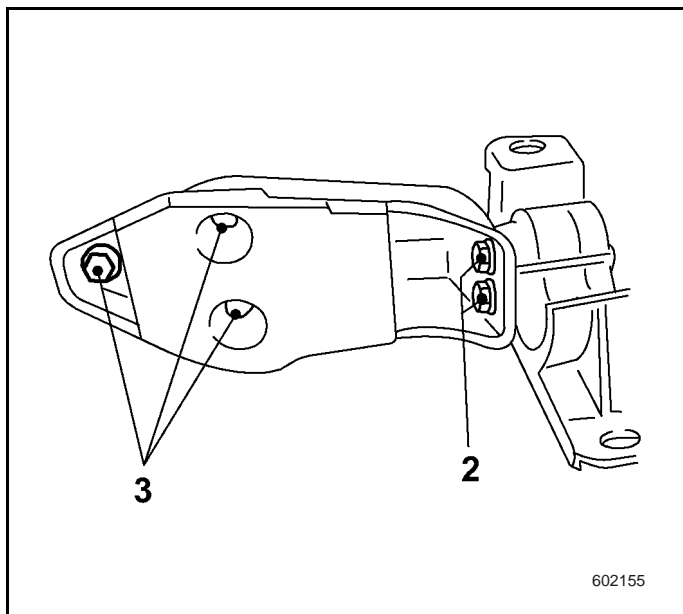
Installation Procedure

1. Use the bolt to secure the engine suspension to the front rail (1).

Tightening

Tighten the bolts to 65 N•m.





2. Secure the engine bracket to the engine suspension (2).

Tightening

Tighten the bolts to 60 N•m.

3. Secure the engine suspension and the transmission (3).

Note: New bolts must be used when installation.

Tightening

Tighten the bolts to 60.5 N•m.

4. Remove the engine KM-263-B and the engine sling KM-2358 (or engine axle MKM-883-1).
5. Connect the ignition harness of the upper intake manifold.

Tightening

Tighten the bolts to 8 N•m.

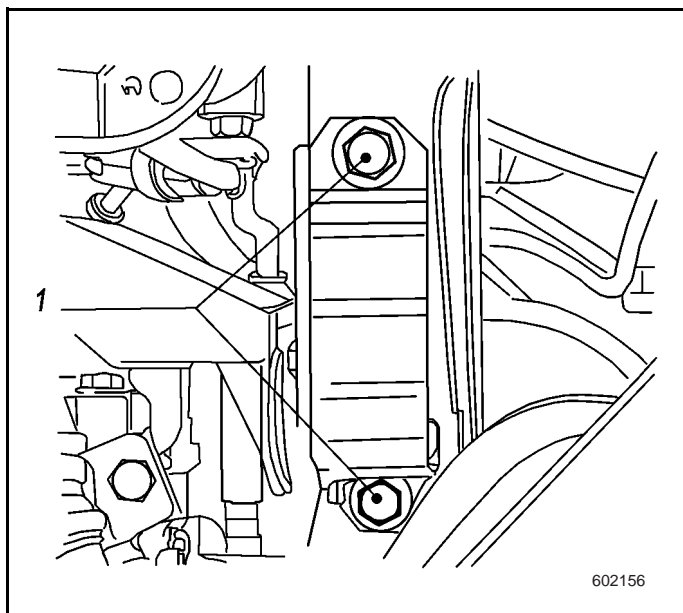
6.1.4.27 Left Front Engine Suspension Replacement (Automatic Transmission Vehicle)

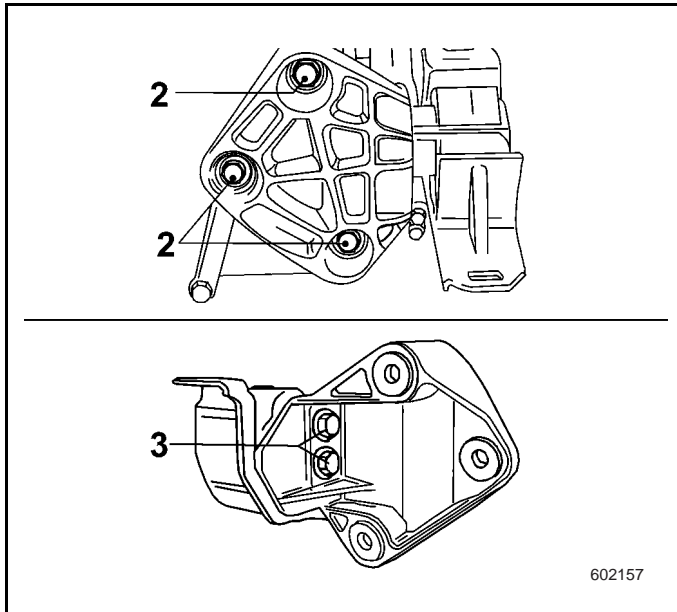
Removal Procedure

Tools Required

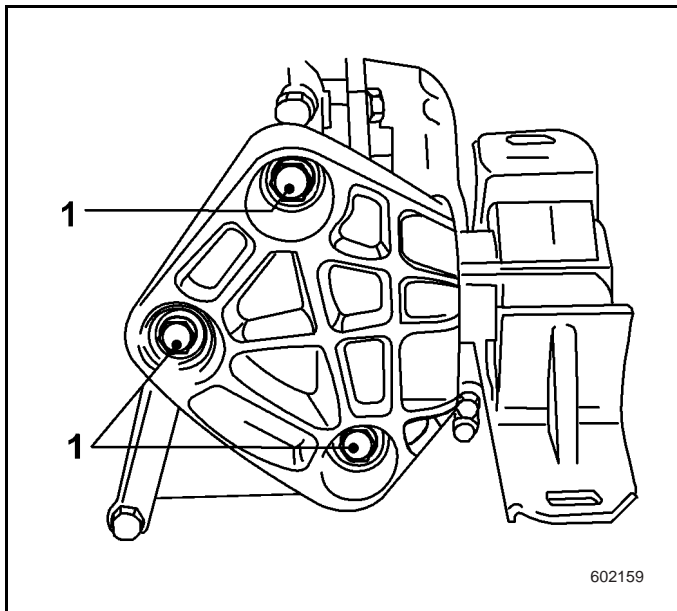
- KM-263-B
- MKM-883-1
- KM-2358

1. Connect the ignition cable of the upper intake manifold.
2. Use the engine sling KM-2358 to secure the engine to the engine axle KM-263-B (or MKM-883-1).
3. Remove the suspension from the front rail (1).





4. Separate the engine bracket and suspension together from the transmission (2).
5. Remove the engine bracket from the engine suspension (3).



Installation Procedure

1. Install the engine bracket to the engine suspension.

Tightening

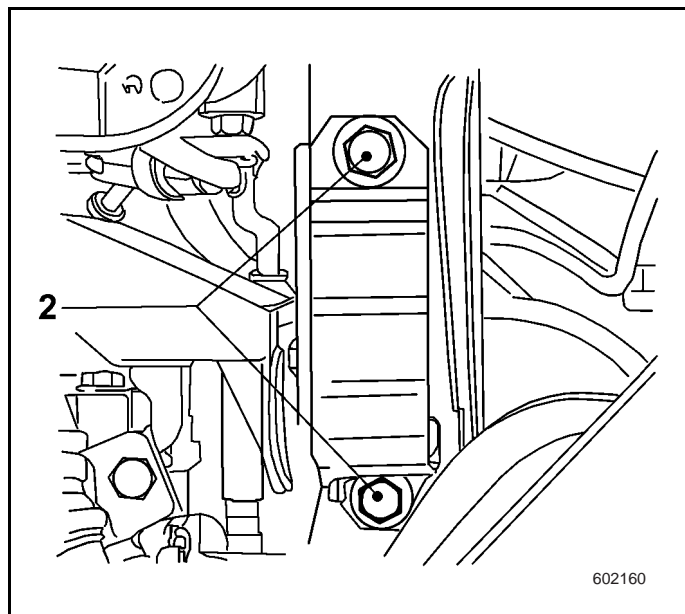
Tighten the bolts to 62.5 N•m.

2. Install the left engine bracket and the suspension together to the transmission (2).

Note: New bolts must be used and applied to tightening glue before installation.

Tightening

Tighten the bolts to 60 N•m.



3. Tighten the engine suspension assembly to the front body rail (2).

Tightening

Tighten the bolts to 65 N•m.

4. Remove the engine axle KM-263-B and the engine sling KM-2358 (or engine axle MKM-883-1).
5. Connect the ignition harness of the upper intake manifold.

Tightening

Tighten the bolts to 8 N•m.

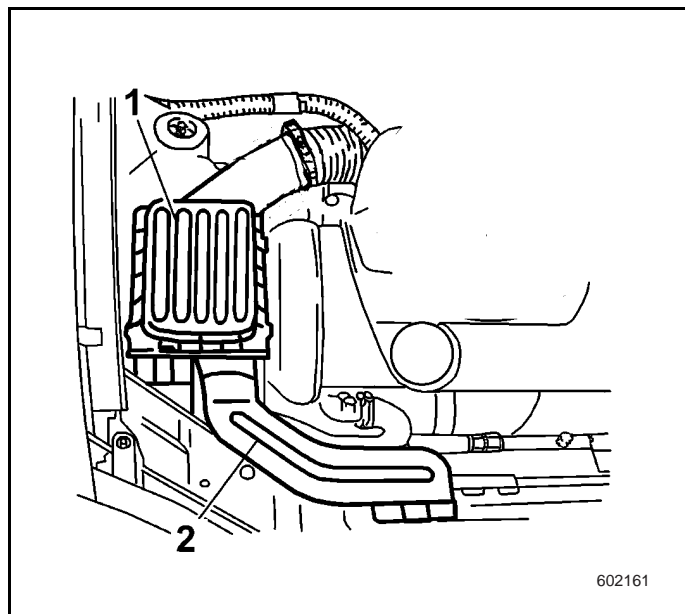
6.1.4.28 Right Front Engine Suspension Replacement

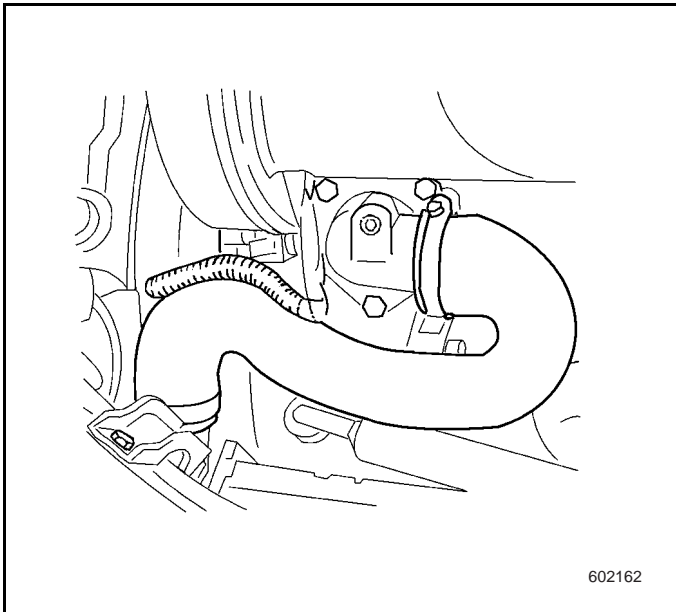
Removal Procedure

Tools Required

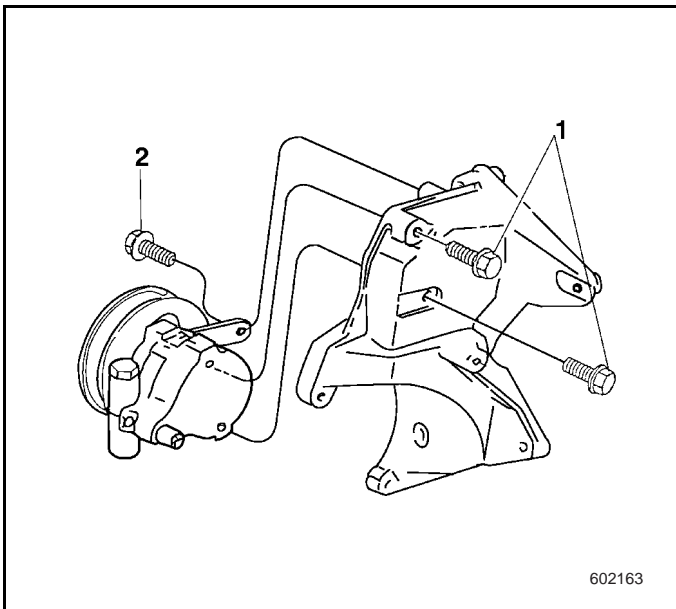
- KM-263-B
- MKM-883-1
- KM-2358

1. Disconnect the battery ground (negative) cable.
2. Remove the intake pipe (2) and the air filter (1).
3. Remove the sparking plug from the upper intake manifold.
4. Use the engine sling KM-2358 to secure the engine to the engine axle KM-263-B (or MKM-883-1).
5. Remove the accessory drive belt. Refer to Accessory Drive Belt Replacement.
6. Open the sealed cap of the coolant recovery tank, and release the cooling system pressure.



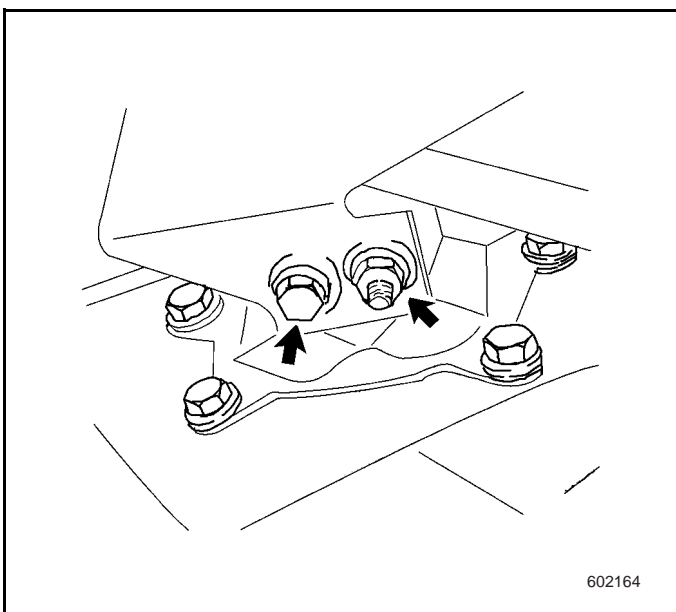


7. Separate the coolant hose from the thermostat seat.
8. Reserve the leaking coolant.
9. Separate the front exhaust pipe from the exhaust manifold.

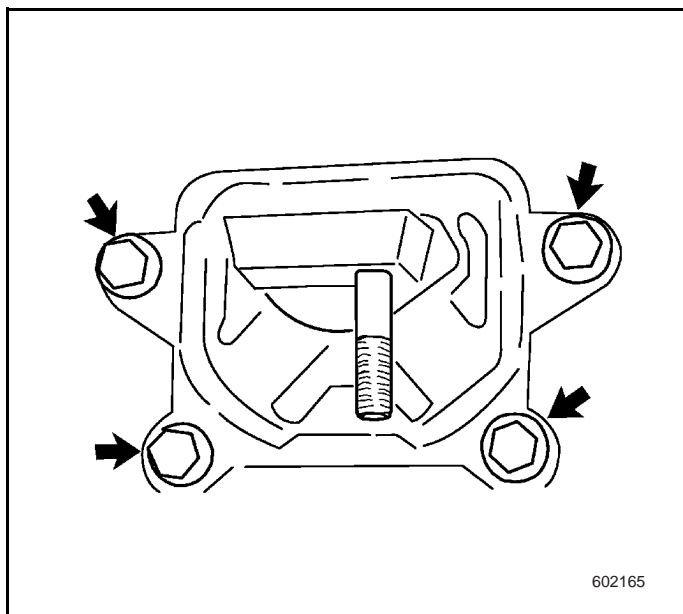


10. Remove the power steering pump from the bracket and connector (2) of the power steering pump / compressor (1).

Note: The whole system should be closed.



11. Remove the engine bracket from the engine suspension. (Indicated by arrow)
12. Remove the stabilizer and the tension rod. Refer to Tension Rod Replacement and Stabilizer Replacement in Front Suspension.
13. Lower the engine.
14. Separate the engine suspension from the front rail (indicated by arrow), and move upward.



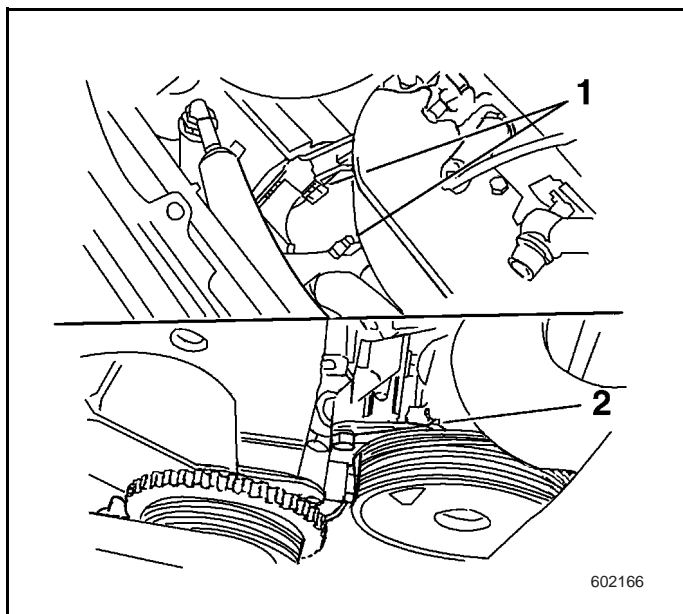
Installation Procedure

1. Connect the front rail (indicated by arrow) to the engine suspension.

Tightening

Tighten the bolts to 20 N•m.

2. Raise the engine.

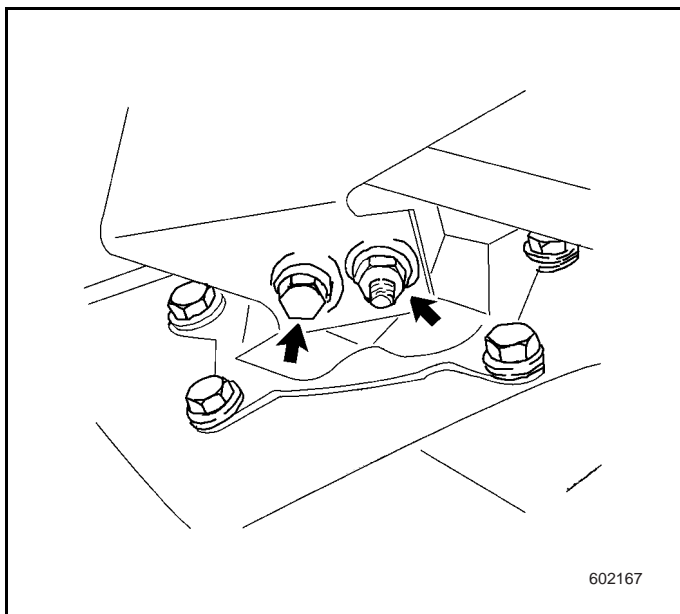


3. Secure the power steering pump to the bracket and connector (2) of the power steering pump / compressor (1).

Tightening

Tighten the bolts to 25 N•m.

4. Use the new gasket to connect the front exhaust pipe with the exhaust manifold.



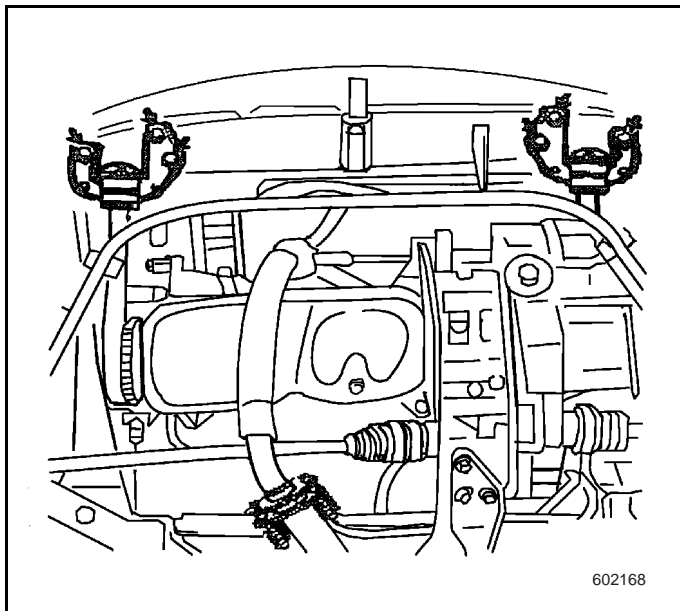
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5. Secure the front right engine bracket and the engine suspension (indicated by arrow).

Tightening

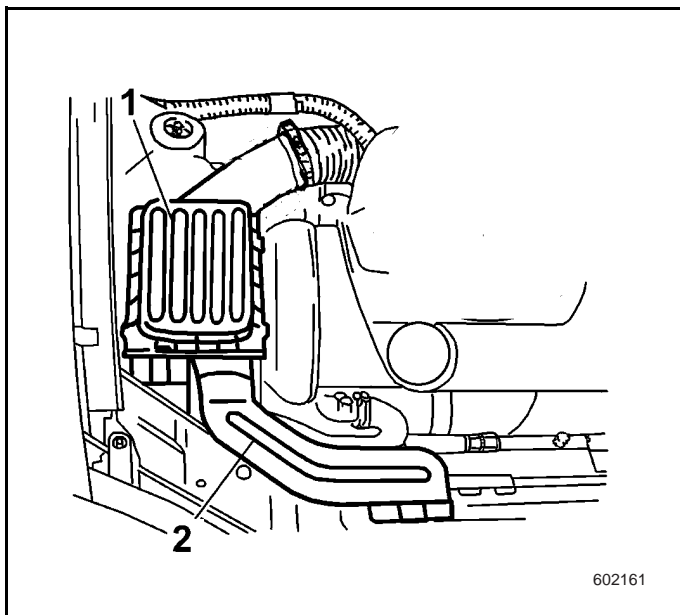
Tighten the engine suspension to bracket bolts to 65N•m.

Tighten the engine suspension to bracket bolts to 65N•m.



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6. Connect the stabilizer and the right tension rod. Refer to Tension Rod Replacement and Stabilizer Replacement in Front Suspension.
7. Connect the coolant hose to the thermostat seat.
8. Install the accessory drive belt. Refer to Accessory Drive Belt Replacement.
9. Remove the engine axle KM-263-B and the engine sling KM-2358 (or engine axle MKM-883-1).
10. Install the sparking plug.



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11. Install the intake pipe (1), and air filter (2).
12. Connect the battery ground cable.
13. Empty the cooling system after completion. Refer to Empty and Fill Cooling System in Engine Cooling System. Ensure the antifreeze temperature satisfying the -30°C requirement.

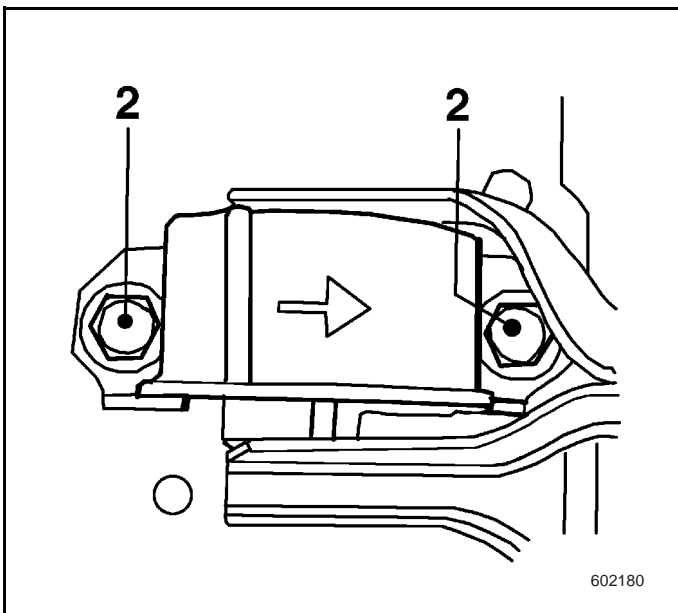
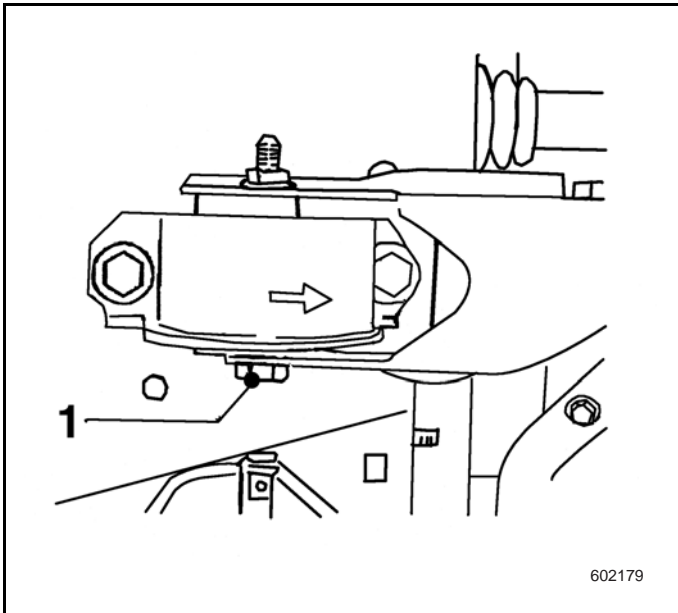
6.1.4.29 Rear Engine Suspension Replacement

Removal Procedure

Tools Required

- KM-263-B
- MKM-883-1
- KM-2358

1. Remove the sparking plug from the upper intake manifold.
2. Use the engine sling KM-2358 to secure the engine to the engine axle KM-263-B (or MKM-883-1).
3. Remove the rear engine suspension tightening bolts (1).



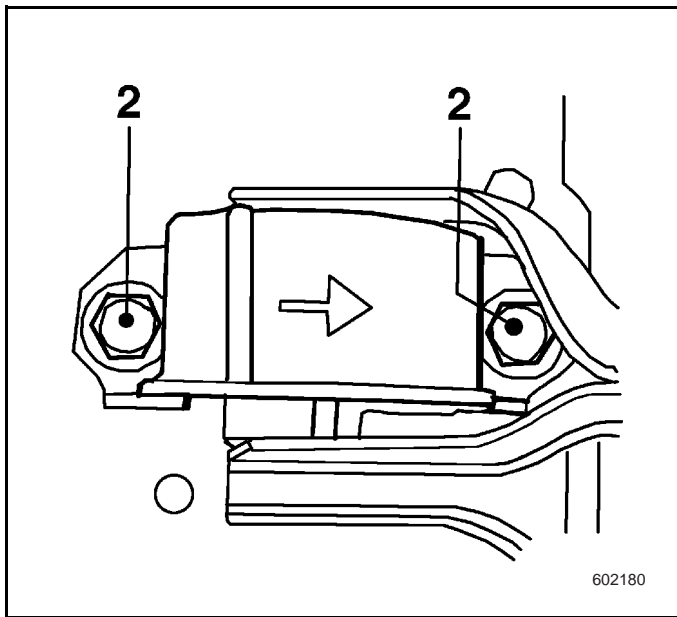
4. Separate the rear engine suspension from the vehicle chassis (2).

Installation Procedure

1. Connect the rear engine suspension to the vehicle chassis (2).

Tightening

Tighten the bolts to 67.5 N•m.



2. Install the engine bracket retaining bolts to the rear engine suspension.

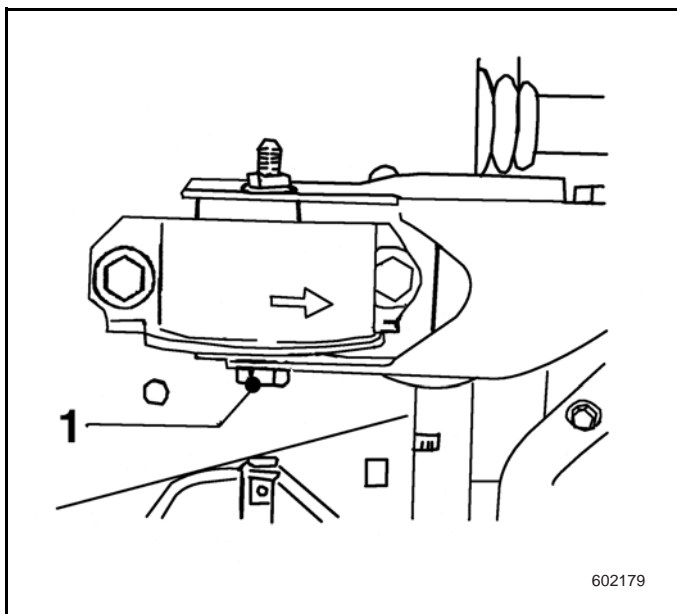
Tightening

Tighten the bolts to 60 N•m.

3. Remove the engine axle KM-263-B and the engine sling KM-2358 (or engine axle MKM-883-1).
4. Install the sparking plug to the upper intake manifold.

Tightening

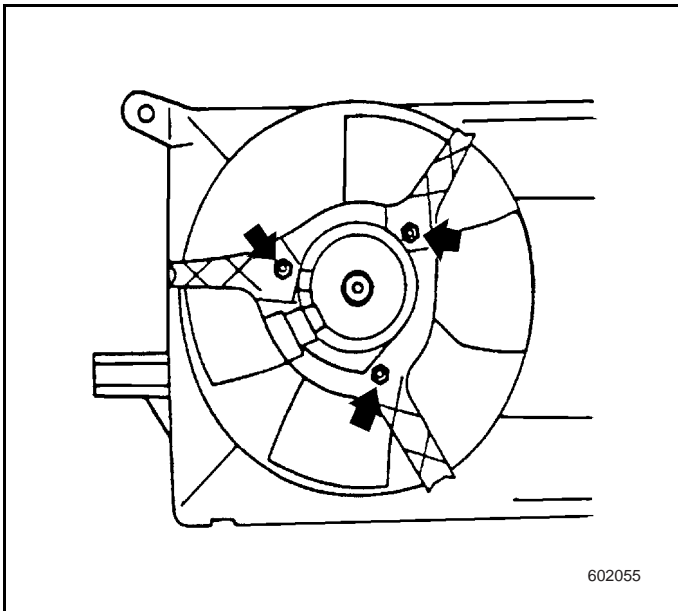
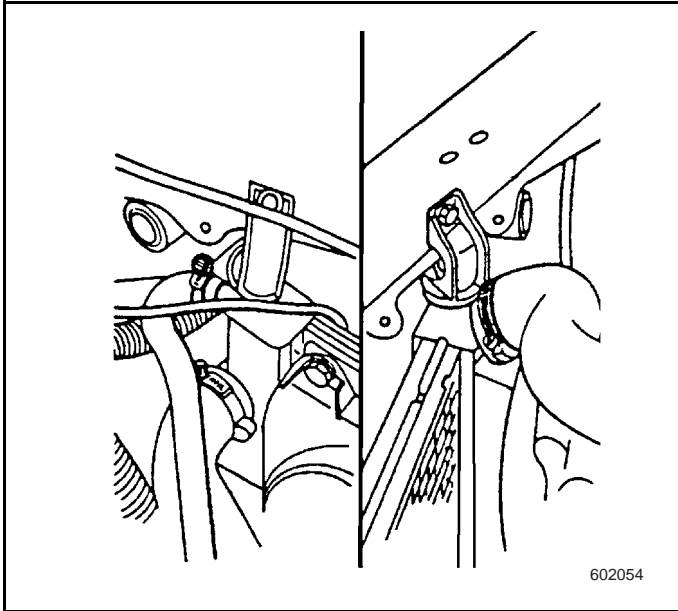
Tighten the bolts to 8 N•m.



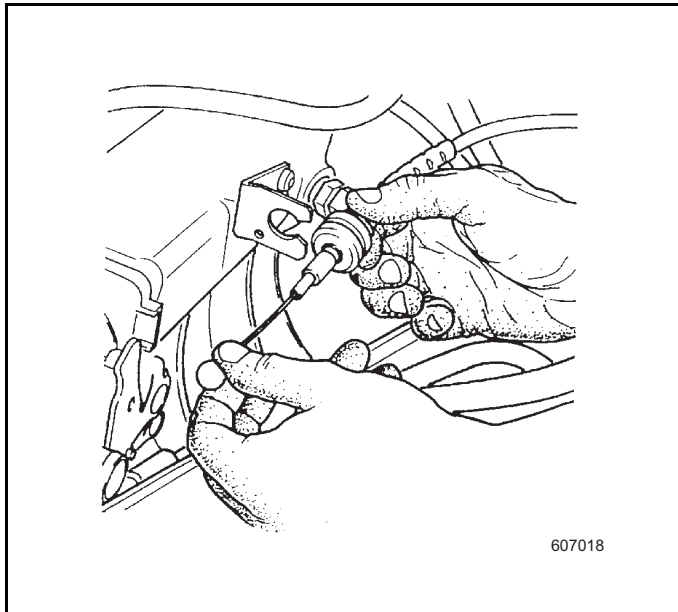
6.1.4.30 Engine and Transmission Replacement.

Removal Procedure

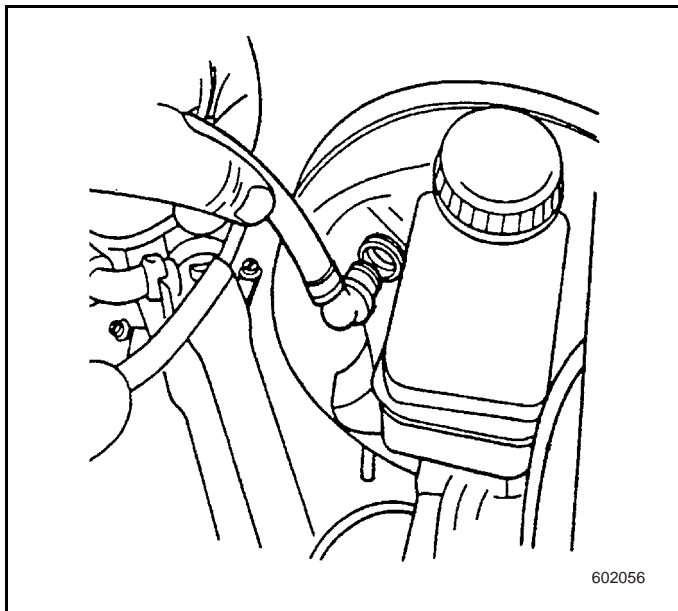
1. Disconnect the battery negative cable.
2. Disconnect the intake temperature sensor from the wire harness, and remove the air filter and intake pipe.
3. Remove the coolant reservoir cap.
4. Disconnect the radiator hose and reserve the fluid.



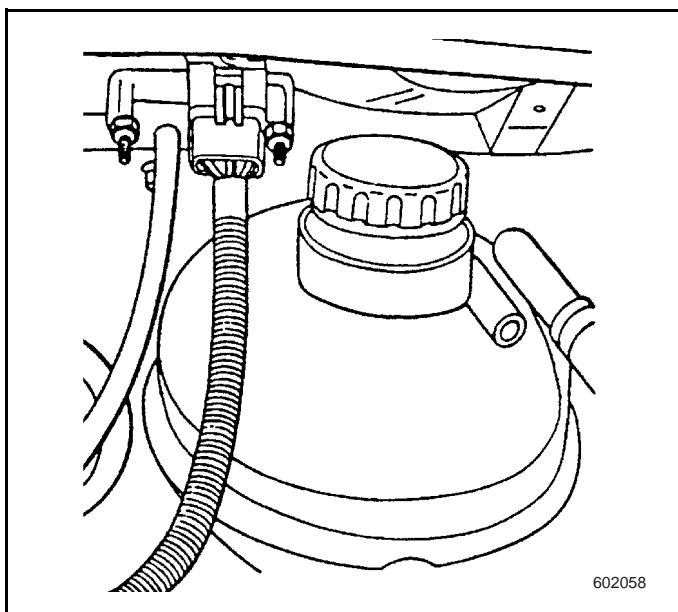
5. Disconnect the fan power.
6. Remove the bolt and fan.



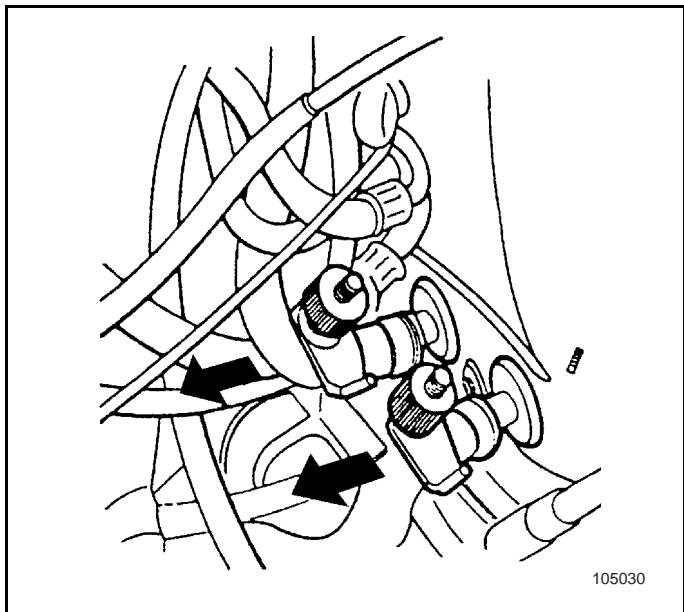
7. Remove the throttle cable.



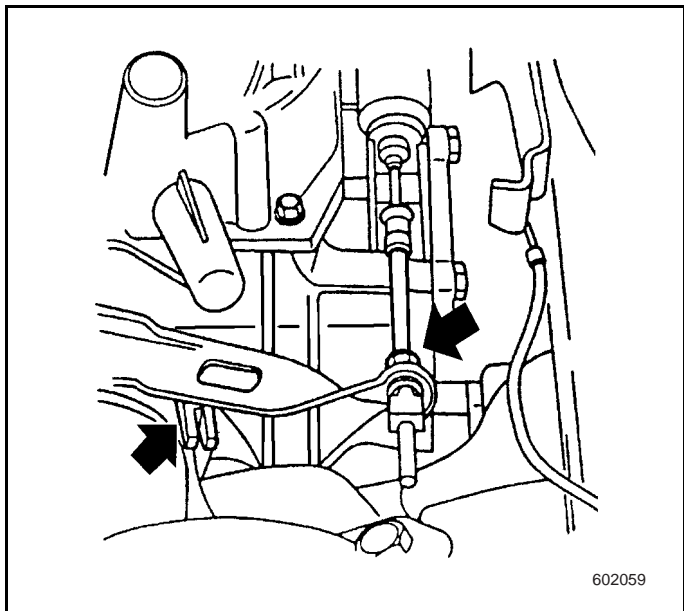
8. Remove the vacuum hose from the brake power assist.



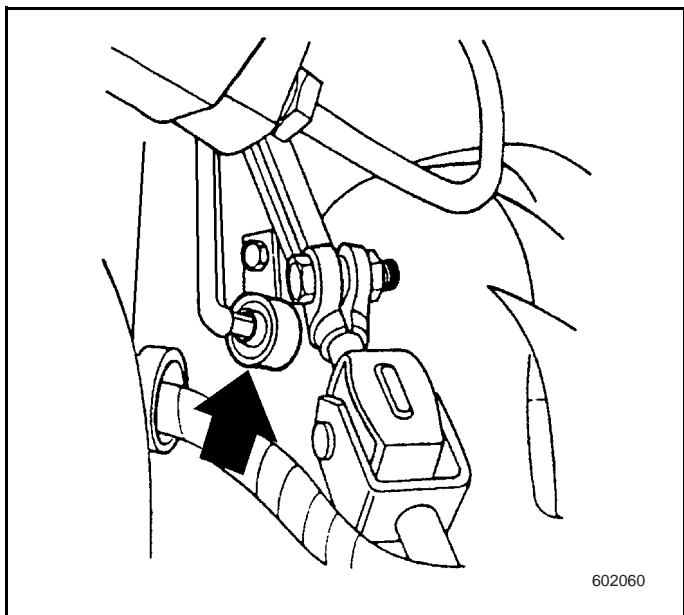
9. Disconnect the hose from the radiator reservoir.



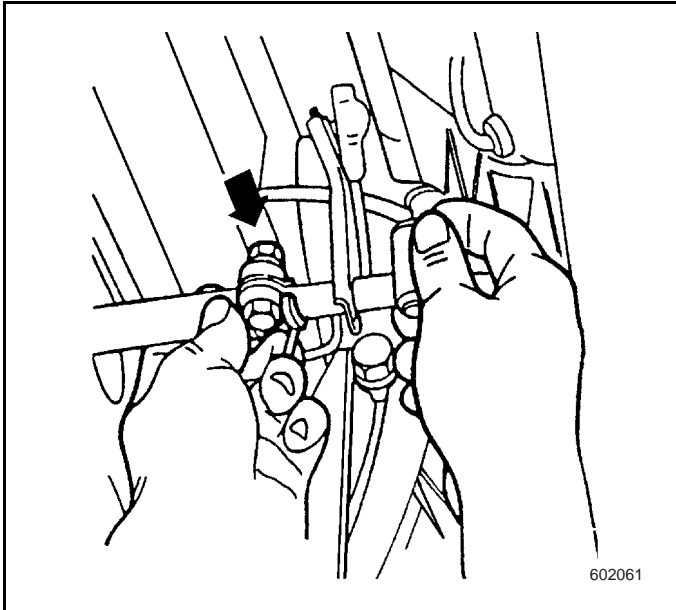
10. Remove the water pipe from the vehicle heater, and use a clamp to clamp the pipe.



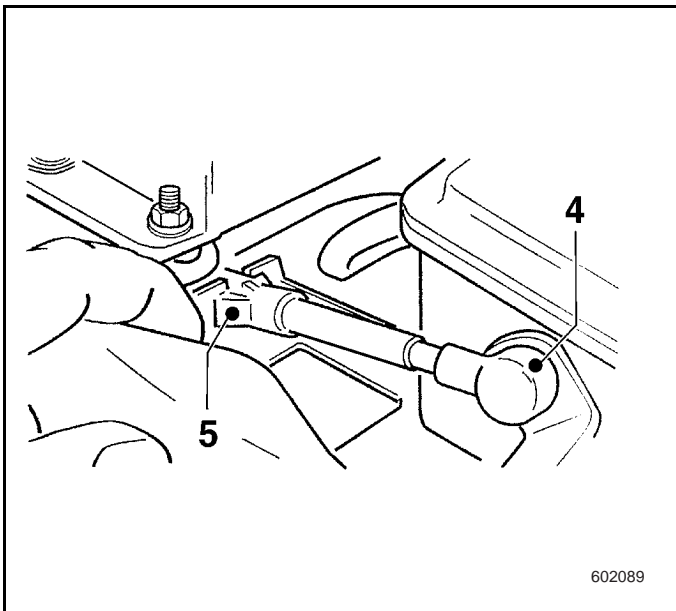
11. Remove the clutch cable from the manual transmission engine.



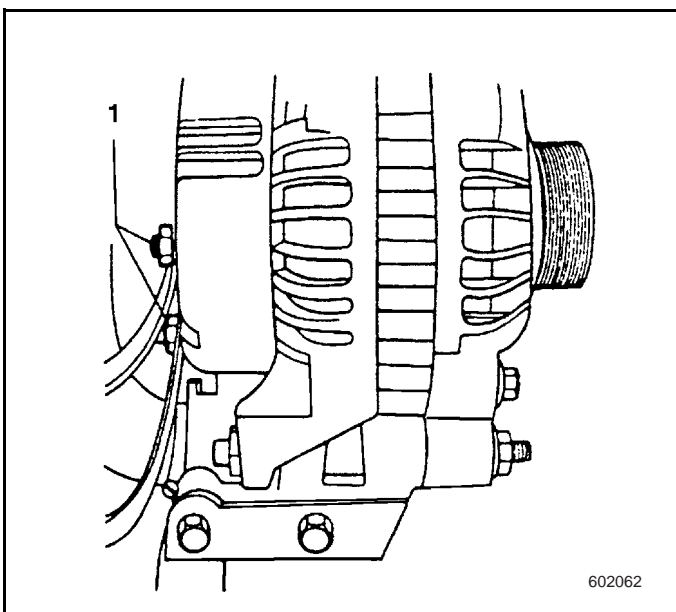
12. Disconnect the reverse-lamp switch terminal from the transmission.
13. Disconnect the engine supply oil hose and return oil hose, and clamp.
14. Disconnect the speed sensor from the wire harness (Schematics 602060 indicated the manual transmission).



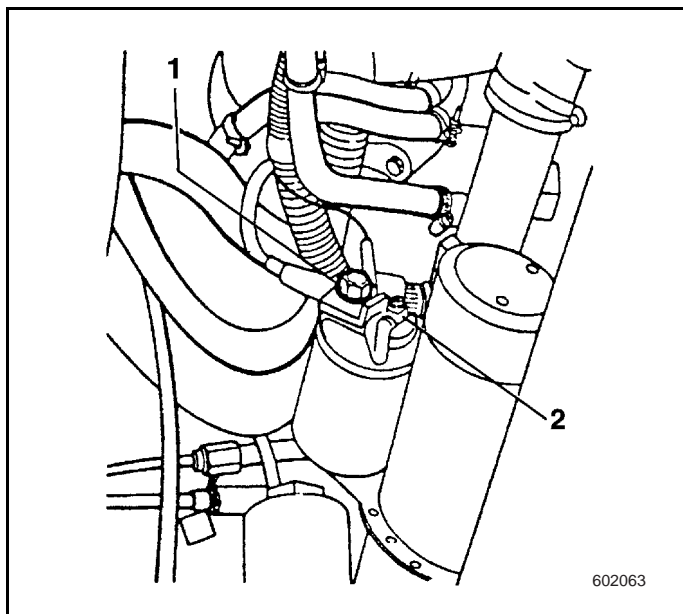
- 15.1 Remove the shift lever from the manual transmission for the vehicle with manual transmission. Refer to Shift Lever Replacement in Manual Transmission.



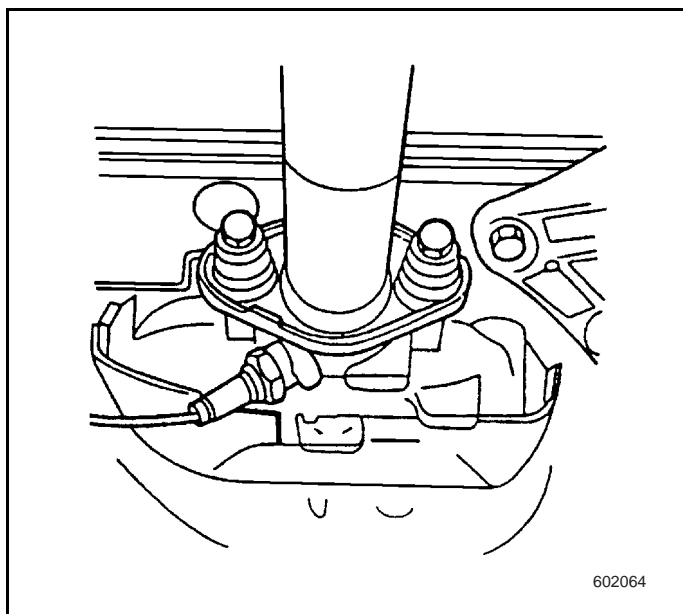
- 15.2 Remove the shift lever drive cable from the auto transmission for the vehicle with auto transmission. Refer to Shift Lever Drive Cable Replacement in Auto Transmission.



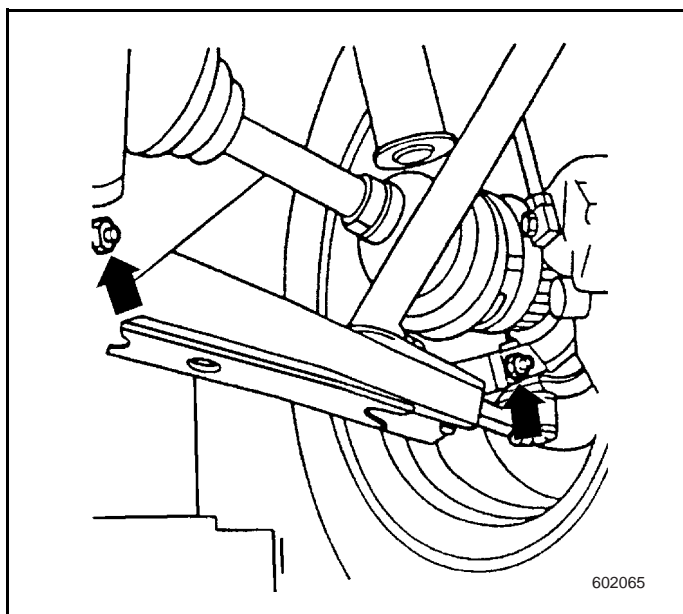
16. Disconnect the engine electrical connection.
17. Remove the front wheel.
18. For the automatic shift vehicle, remove the automatic transmission wire harness, disconnect the transmission cooling pipe, and block the pipe.
19. Disconnect the generator electrical connector. Refer to Generator Replacement in Engine Electrical.



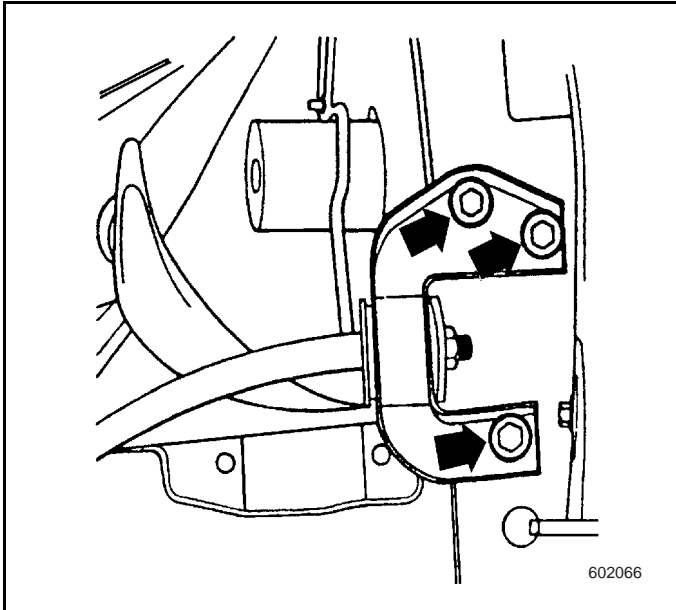
20. Raise and support the vehicle. Remove the oil pan shield.
21. Disconnect the starter power. Refer to Starter Replacement in Engine Electrical.



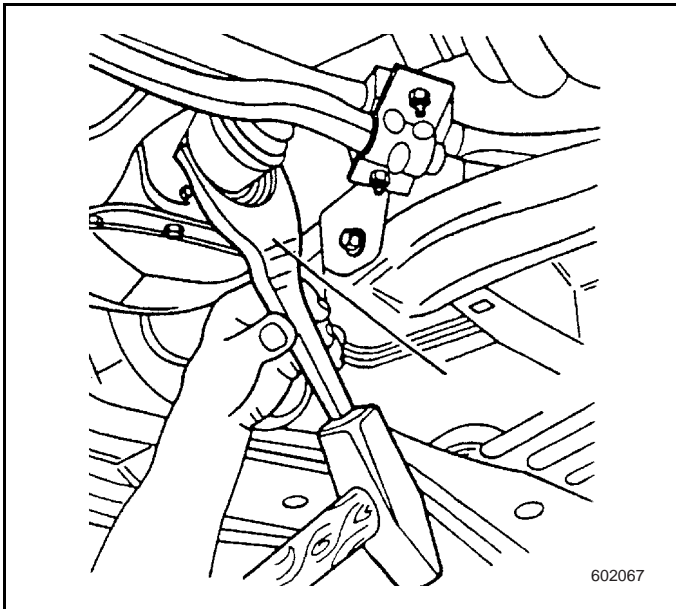
22. Loosen the exhaust pipe bolt, and remove the exhaust pipe from the exhaust manifold.



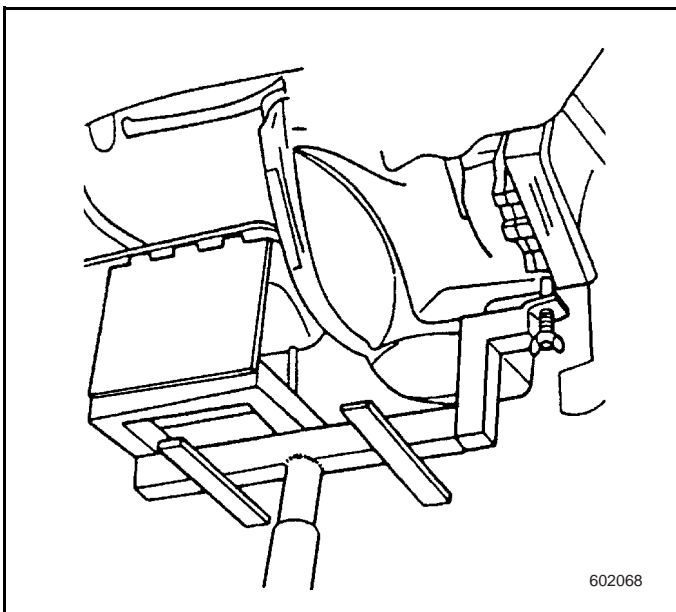
23. Remove the exhaust pipe from the rubber hanger.
24. Remove the ball-and-socket pivot and control arm from the bracket.



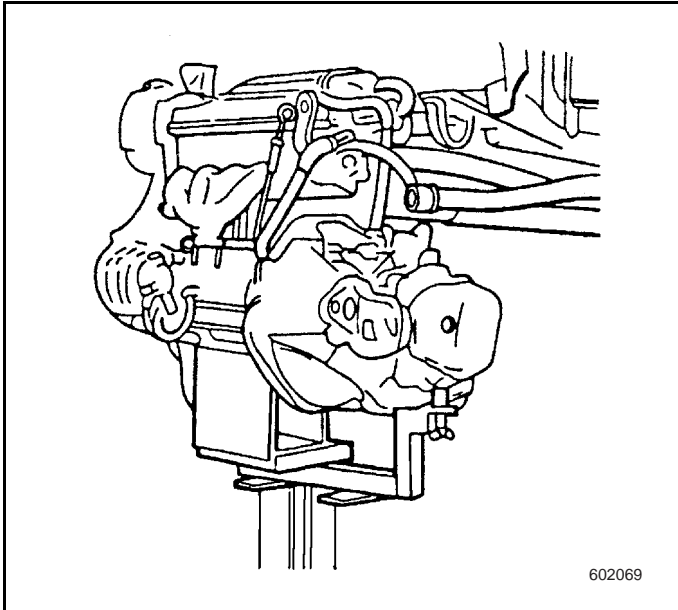
25. Remove the tensioning lever securing on the frame.



26. Loosen the control arm and the tensioning lever.
27. Pull out the front wheel driving shaft with the lever aid.



28. Cover the transmission differential outlet to avoid leaking oil.
29. Use a jack to support and raise the engine and the transmission.



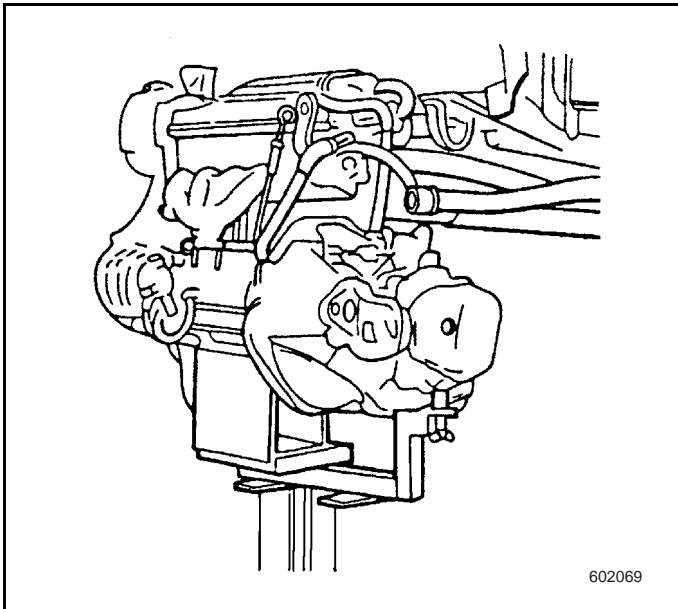
30. Remove the engine support. Refer to 6.1.4.28-29.
31. Lower the jack, and remove the engine and transmission from the vehicle bottom.

Clearing

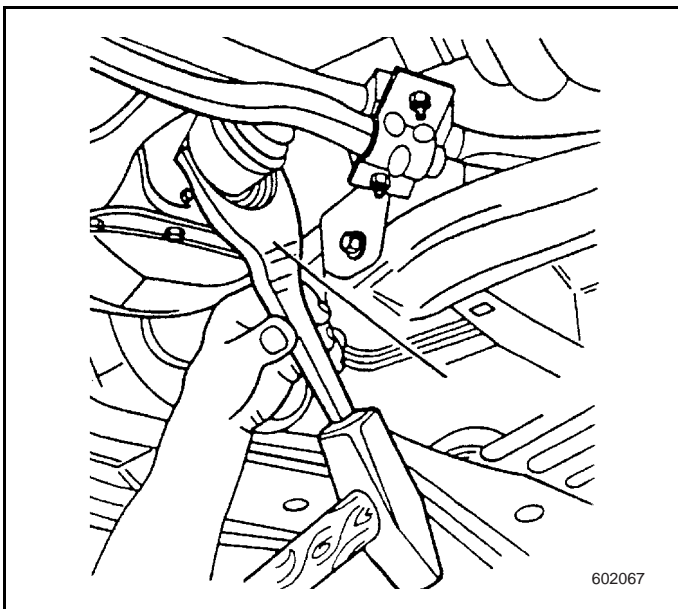
Clear the thread, and use a tap with the same size to remove all the chemical residue.

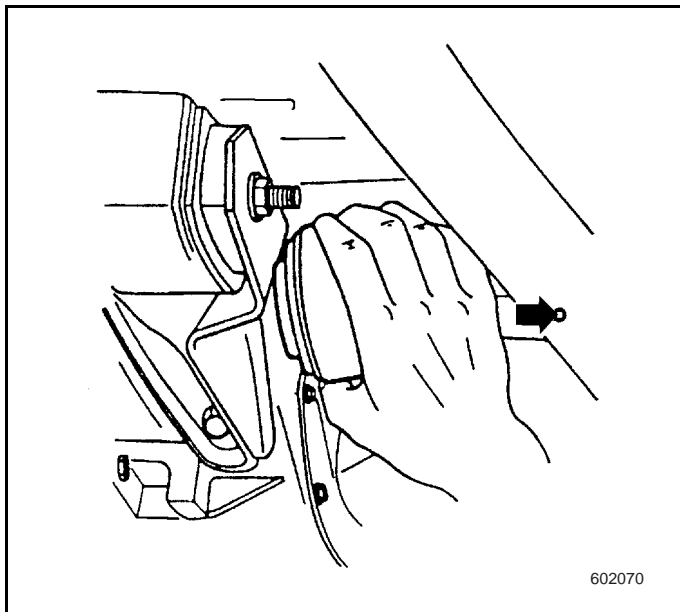
Installation Procedure

1. Use a jack to raise the engine and transmission kit to the engine compartment mounting position from the vehicle bottom.
2. Tighten the engine support, and remove the jack. Refer to 6.1.4.28-29.

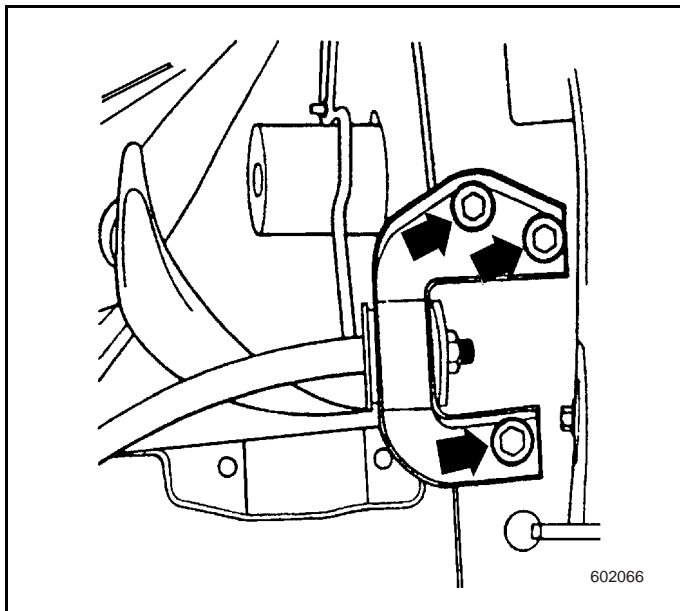


3. Insert the front wheel driving shaft in the transmission differential.

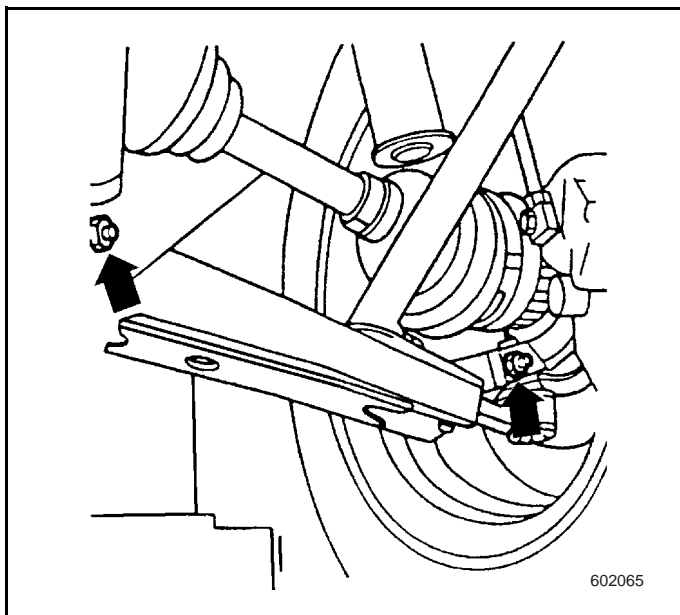




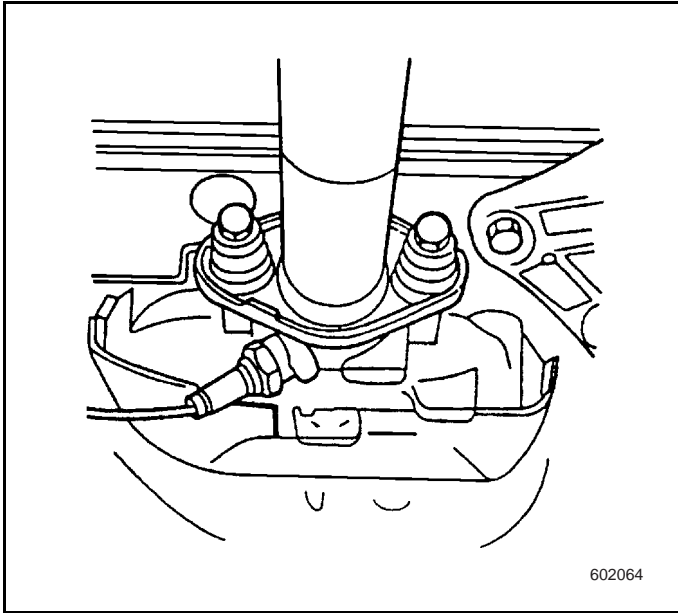
4. Hand pull the terminal to inspect the front wheel driving shaft for fastness and firmness.



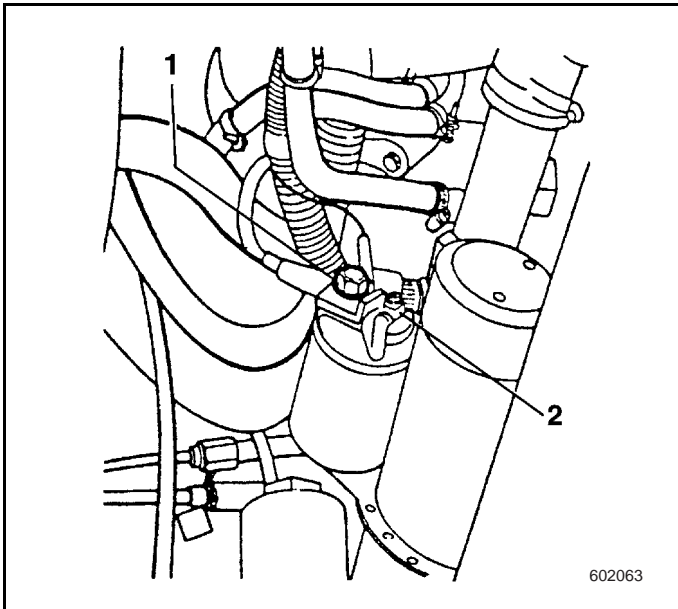
5. Install the tensioning lever and tighten.



6. Install the control arm and tighten.
7. Install the ball-and-socket joint in the shaft sleeve.



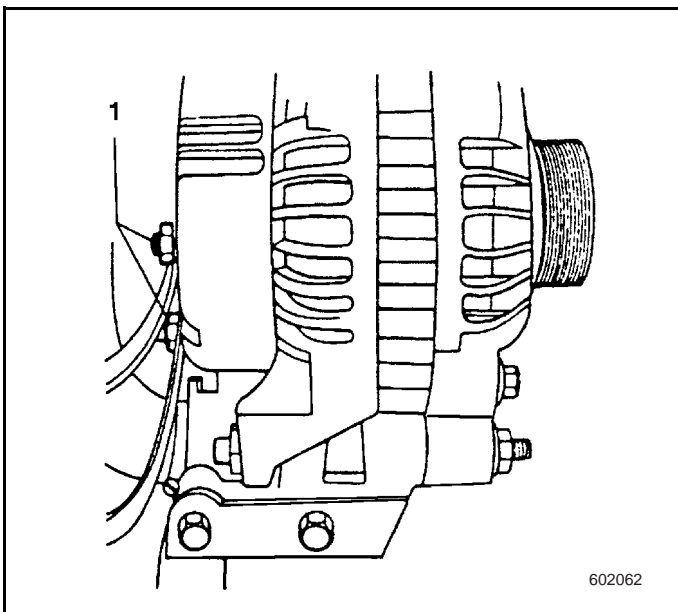
8. Install the exhaust pipe to the rubber hanger and exhaust manifold.



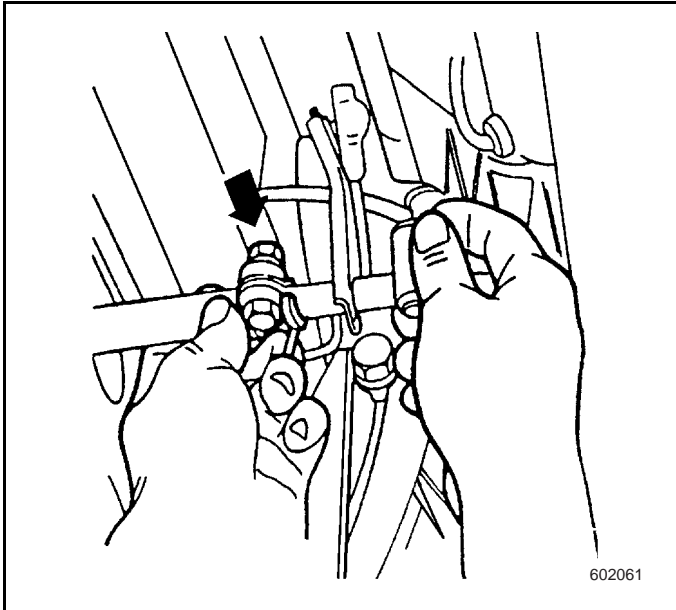
9. Connect the starter power. Refer to Starter Replacement in Engine Electrical.
10. Install the engine oil pan shield.

Tightening

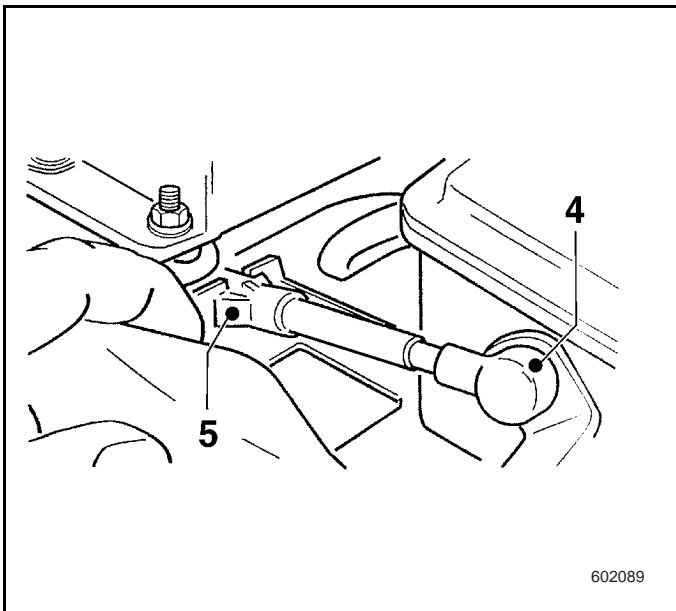
Tighten the engine shield bolts to 14-18 N•m.



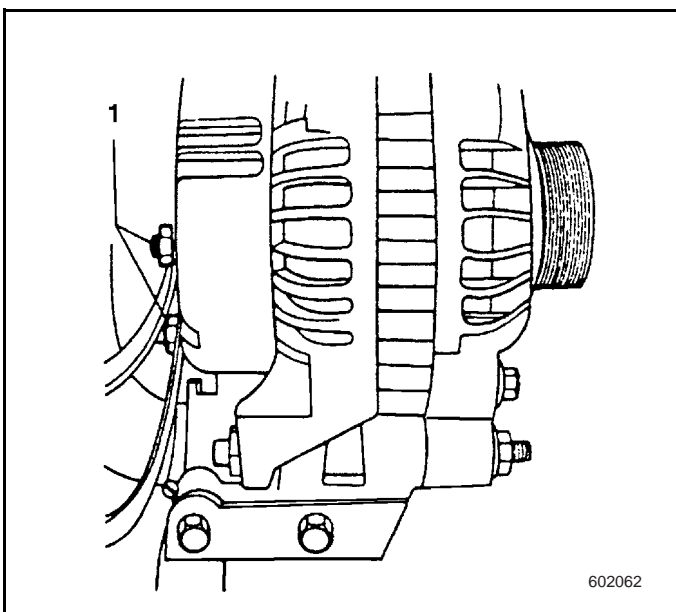
11. Lower the vehicle. Connect the starter power. Refer to Generator Replacement in Engine Electrical.



12.1 Connect the shift lever to the manual transmission for the vehicle with manual transmission. Refer to Shift Lever Replacement in Manual Transmission.

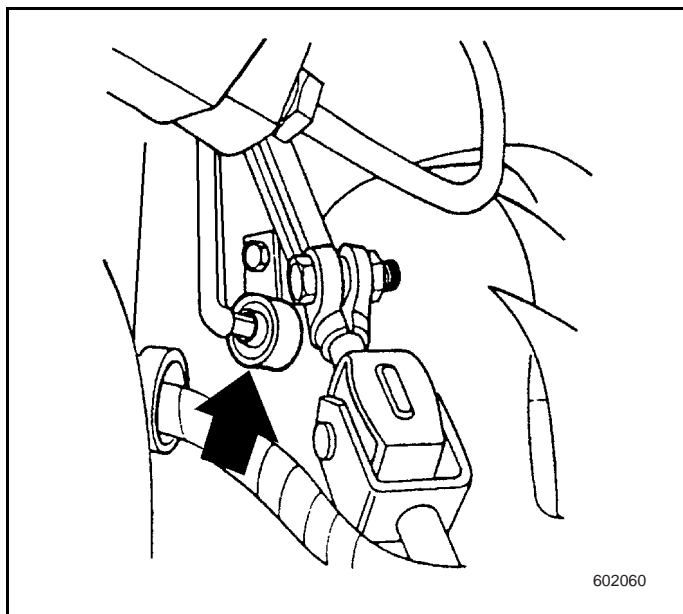


12.2 Connect the shift lever drive cable to the manual transmission for the vehicle with manual transmission. Refer to Shift Lever Drive Cable Replacement in Auto Transmission.

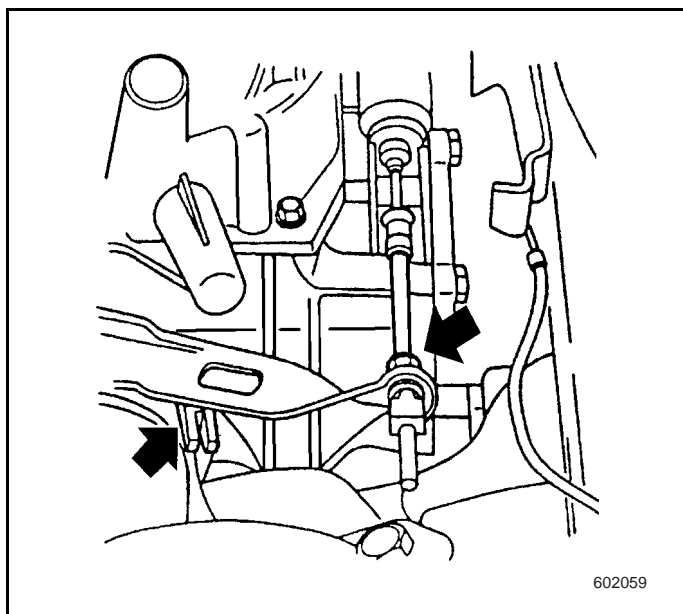


13. Install the front wheel.

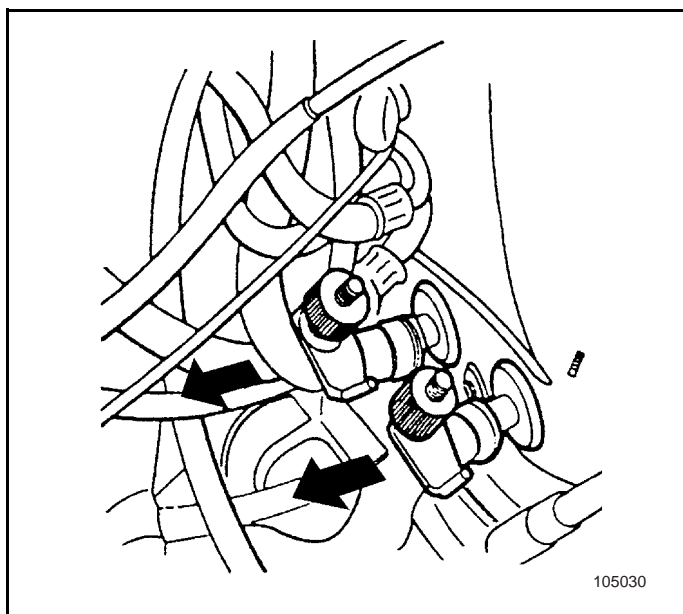
14. Connect the starter power.



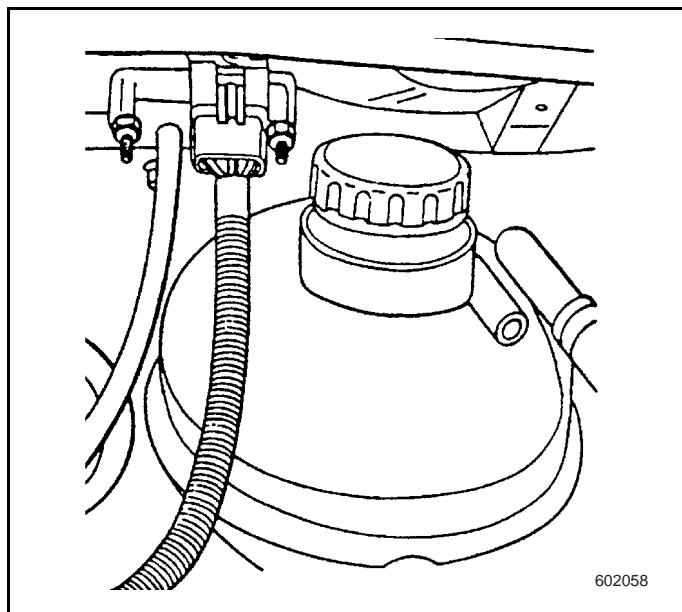
15. Connect the vehicle speed sensor and the reverse lamp switch.
16. Connect the oil rail supply hose and oil return hose.



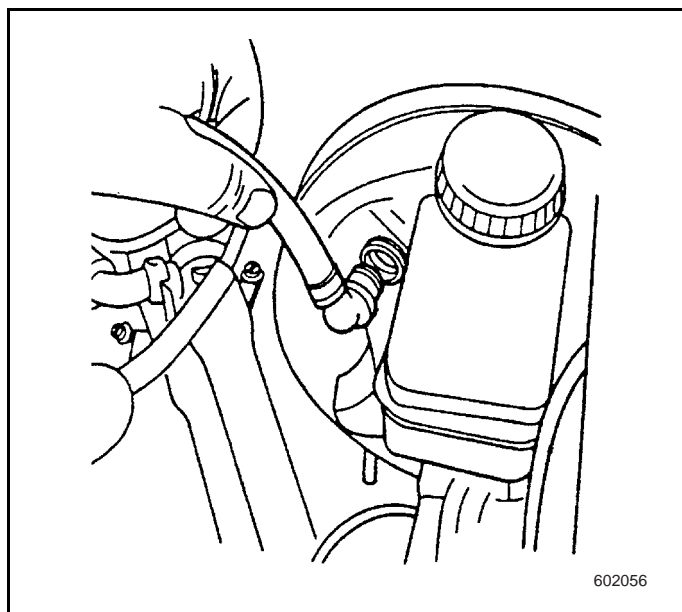
17. Connect the clutch cable.



18. Connect the vehicle heater water pipe.



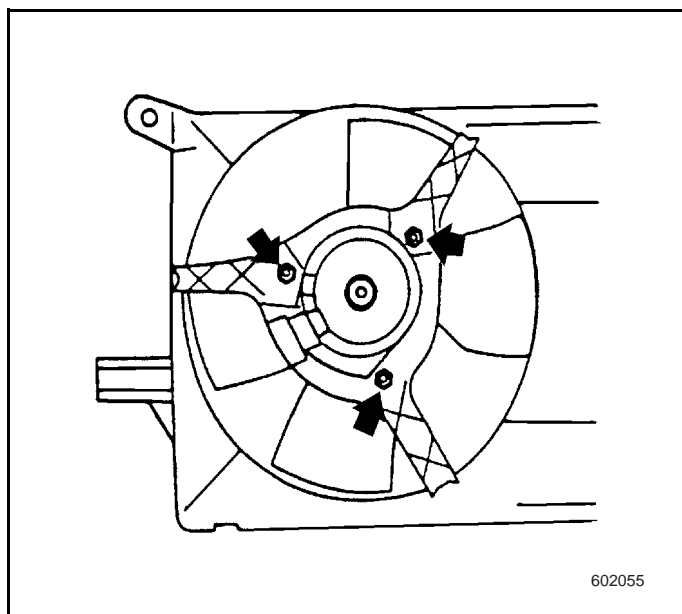
19. Connect the radiator reservoir hose.



20. Connect the vacuum hose to the brake power assist of the intake manifold.

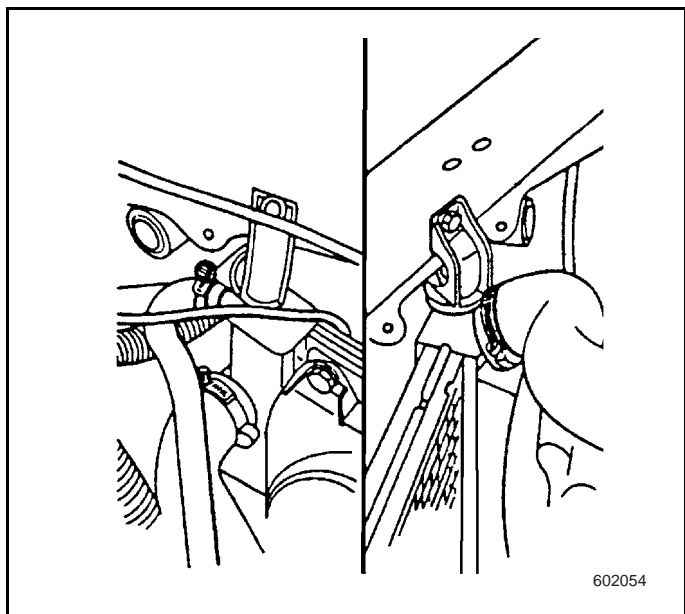
21. Connect the canister purge hose.

22. Install the accelerator pedal cable.



23. Install the fan.

24. Connect the fan power.



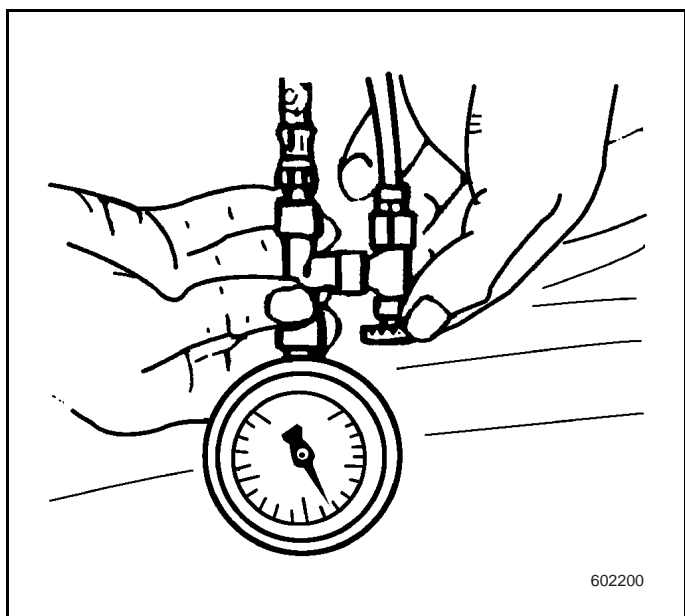
25. Install the radiator hose.
26. Fill the radiator protecting solvent into the cooling system.
27. Install the air filter and intake hose, and connect the wire harness to the intake temperature sensor.
28. For the automatic transmission, connect the engine oil cooling pipe and wire harness.
29. Connect the battery negative cable.
30. Inspect the automatic transmission oil level gauge, and fill engine oil through oil filler tube, if necessary.
31. Inspect the manual transmission oil consumption, and fill engine oil through the air vent. Refer to Transmission Oil Level Inspection.
32. Inspect the coolant level in the engine coolant reservoir, and fill if necessary.

6.1.4.31 Fuel Pressure Release Procedure

Pressure Release Procedure

Tools Required

- KM-J-34730-91



1. Disconnect the battery negative. Refer to Battery Negative Cable Replacement in Engine Electrical.
2. Loosen the oil filler cap to release the steam pressure in the (fuel) tank.
3. Connect the fuel pressure gauge KM-J-34730-91 to the fuel rail pressure check valve and the check joint on fuel delivery pipe. When connecting fuel pressure gauge, cotton silk thread should be twined around the terminal to avoid fuel spillage.
4. Open the oil pressure gauge valve to release the remaining pressure.
5. Use the allowable container to reserve the fuel spilled from fuel drain hose.

6.1.4.32 Oil Passage Fuel Filter Replacement

Removal Procedure

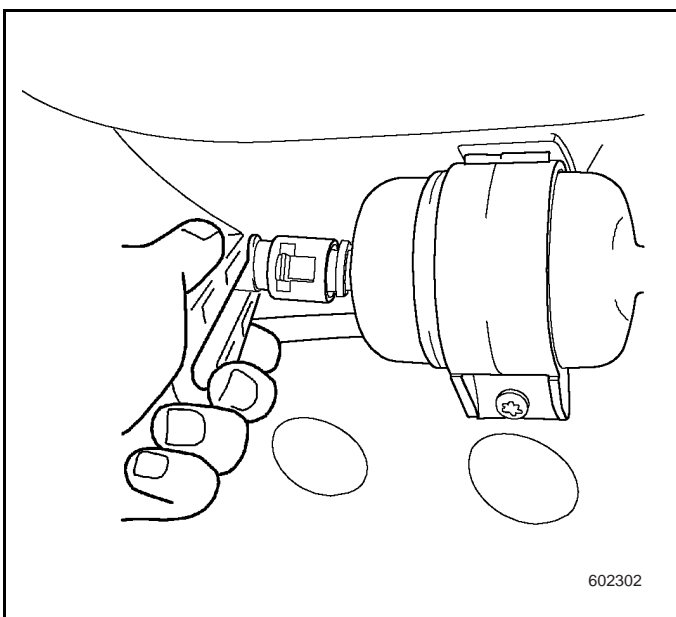
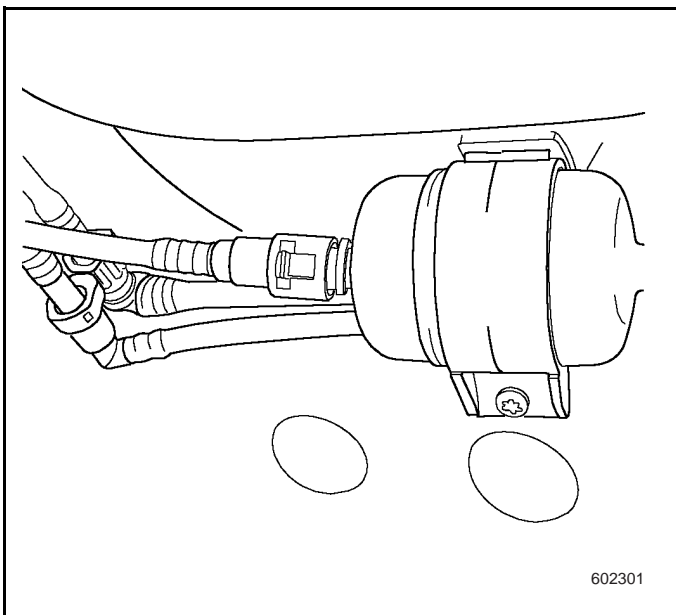
Tools Required

- KM-796
- KM-807

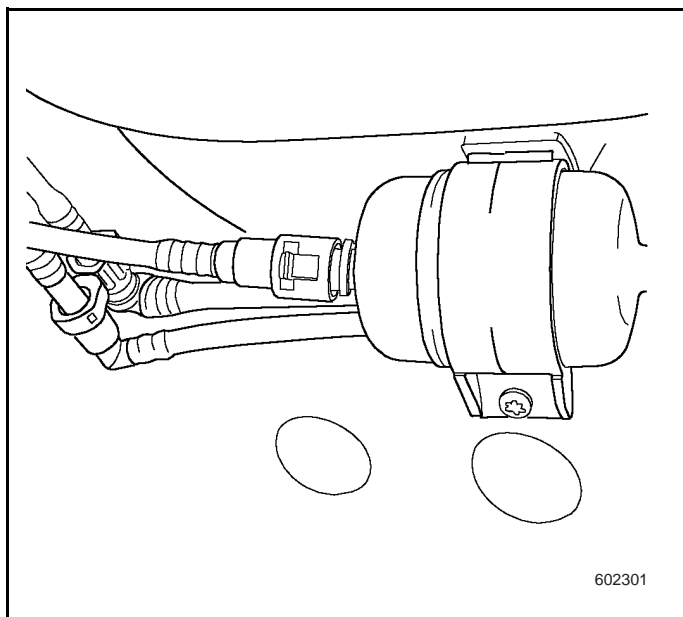
Notice: When repairing the fuel system, cover the terminal and block the hole to prevent dust or other pollution from entering through the open pipe or other passage.

Note: Must keep the fuel system clean when repairing the fuel system.

1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief Procedure.
2. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.



3. Use KM-796 to remove the quick fittings from the fuel filter in fuel passage, and seal with KM-807.
4. Drip the remaining fuel into the allowable container.
5. Loosen the oil passage fuel filter clip.
6. Remove the fuel filter from the clip.



Installation Procedure

1. Remove the protector from the new fuel filter.
2. Insert the fuel filter into the clip carefully.

Tightening

Tighten the oil passage fuel filter clip to 2 N•m

3. Connect the quick fittings to the oil passage fuel filter.
4. Lower the vehicle.
5. Tighten the oil filler cap of oil tank.
6. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
7. Inspect for fuel leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for leakage.

6.1.4.33 Oil Tank Drain Procedure

Caution: Do not drain the fuel to the unsealed container. And do not reserve fuel in the unsealed container, in order to avoid any possibility of causing fire or explosion.

Note: Conform to the safety principle and national regulation.

1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief Procedure.
2. Remove the oil filler cap from oil tank.
3. Insert the siphon tube into the oil tank through oil filler pipe.
4. Use the explosion proof oil pump outward to empty the oil tank.
5. After completing all the other operation, fill the fuel and tighten the filler cap.
6. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
7. Inspect for fuel leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for leakage.

6.1.4.34 Oil Tank Replacement

Tools Required

- KM-796
- KM-807

Removal Procedure

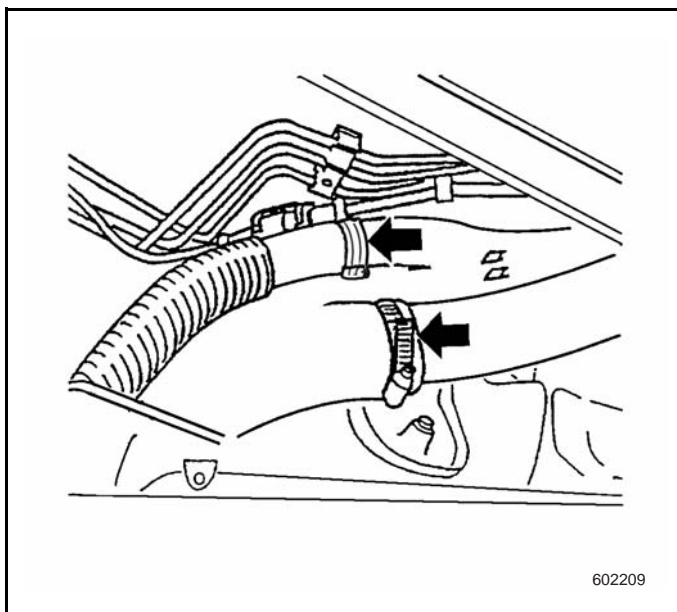
Caution: When using lifter to jack vehicle, an alternate support should be available.. The other end must be supported before removing components. In this way, vehicle can be prevented from sliding.

Before removing the main components, use a chain to connect the frame to the lifter base in the same end. In this way, overturn is avoided.

Being unaware of above cautions is likely to lead to vehicle damage and severe personnel casualty.

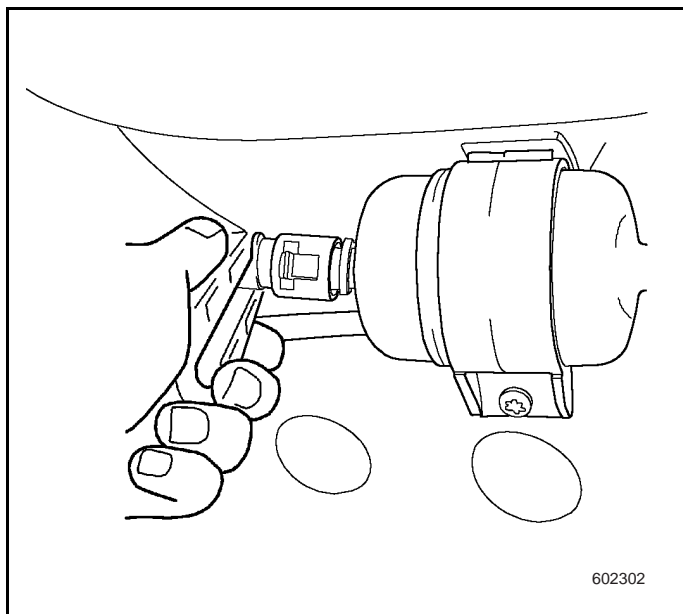
Note:

- Do not try to make the twisted nylon fuel pipe straight. It should be replaced lest vehicle is damaged.
- Do not bend the fuel tank string, because it may be destroyed.
- Do not try to repair some part of nylon pipe. The whole pipe should be replaced.
- When fuel system is running, cover the accessory and block the hole to prevent dust or other pollution from entering through the open pipe or other passage.

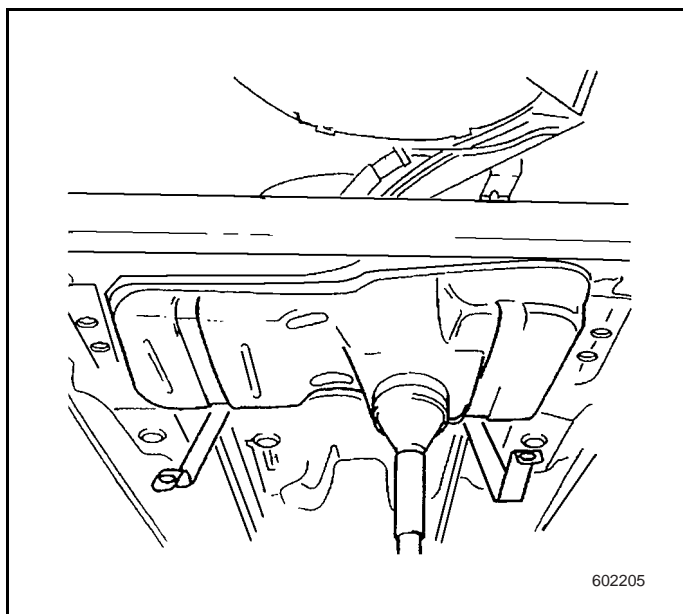


Note: Keep the fuel system clean when repairing the fuel system components..

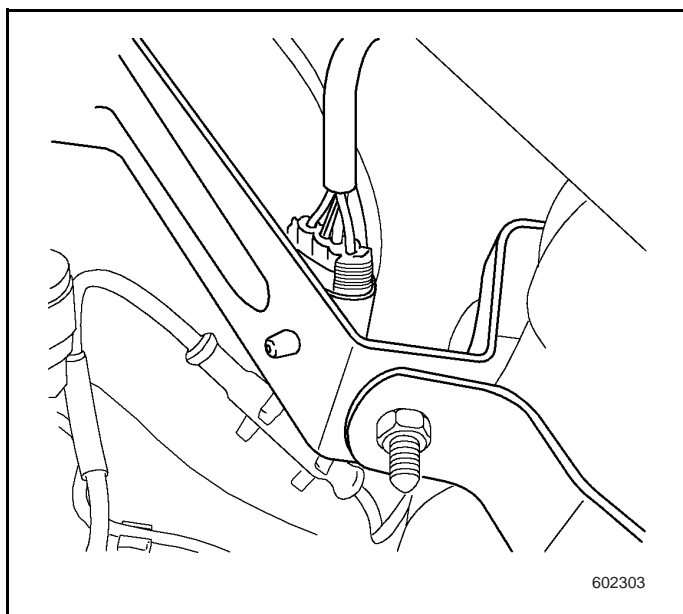
1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief Procedure.
2. Drain the remaining oil from the oil tank. Refer to Fuel Tank Draining Procedure.
3. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
4. Remove the exhaust system. Refer to Exhaust System Replacement.
5. Remove the exhaust pipe heat shield from under the park brake cable. Refer to Park Brake Cable Replacement.
6. Remove the park brake cable. Refer to Park Brake Cable Replacement.
7. Remove the clip securing oil tank filler hose and ventilation pipe from the oil filler pipe.
8. Remove the oil tank filler hose and ventilation pipe from the oil filler pipe.



9. Use KM-796 to disconnect the quick fittings of oil supply pipe, oil return pipe and evaporation pipe oil passage, and seal with KM-807.



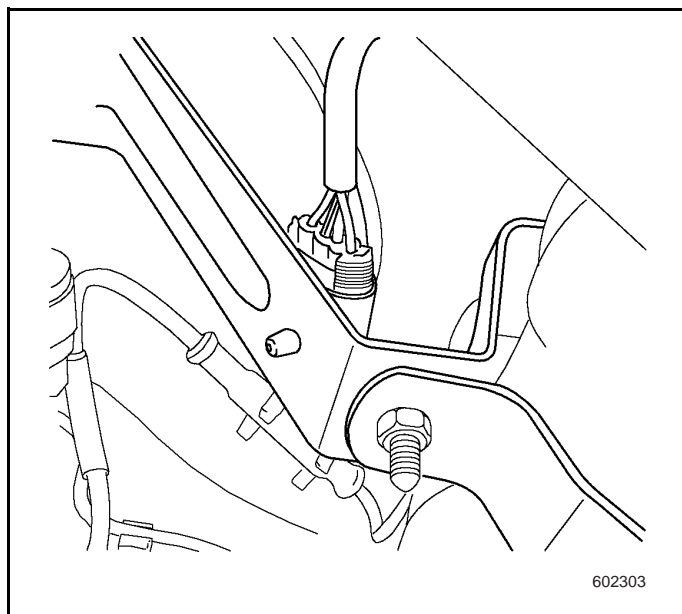
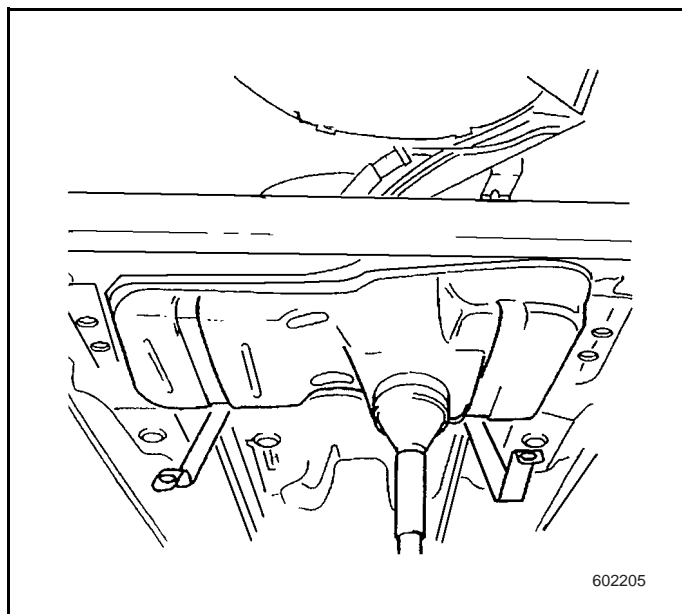
10. Use hydraulic jack and proper set to support oil tank.
11. Remove 2 securing cable screws from oil tank.



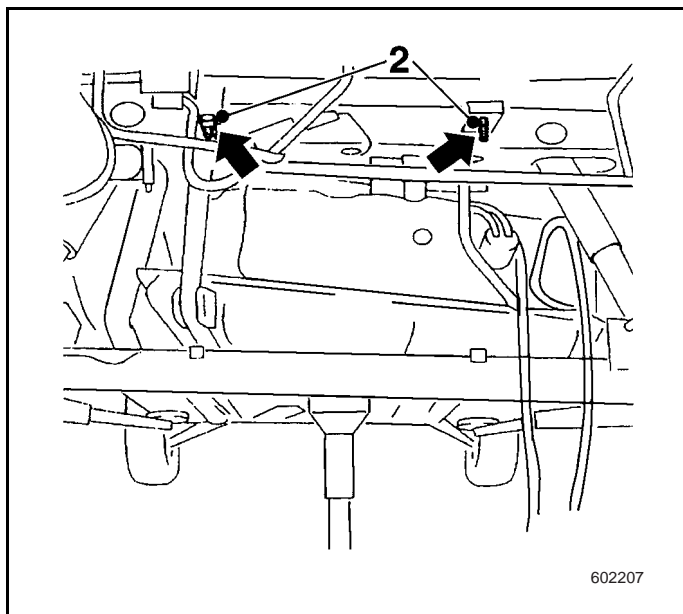
12. Use hydraulic jack to lower the oil tank a little. Disconnect the wire from the body connection.
13. Remove the oil tank from the hydraulic jack, and position in place.
14. If it is not necessary to replace the oil tank, the installation procedure of oil tank can be followed.
15. Remove the oil supply pipe, oil return pipe and evaporation pipe assembly from oil tank.

Installation Procedure

1. Connect the oil supply pipe, oil return pipe and evaporation pipe assembly.
2. Use the hydraulic jack positioned in place to locate and support oil tank.



3. Connect the oil pump harness to body connection.

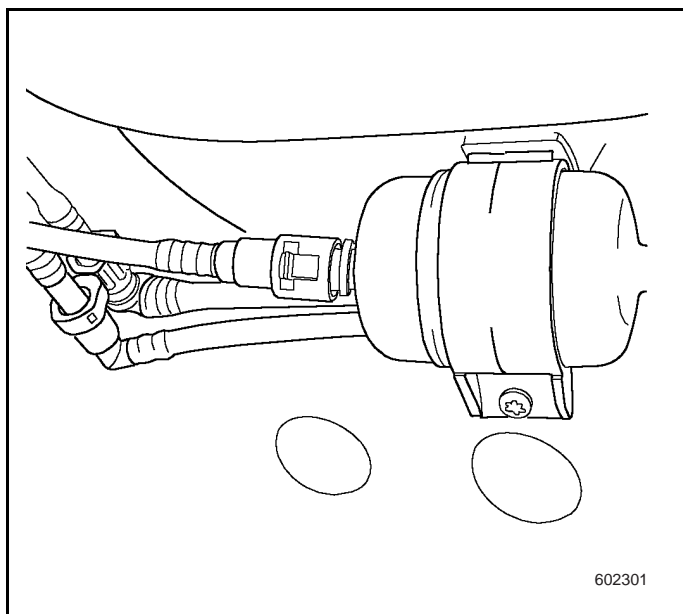


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4. Raise the oil tank to the correct position.
5. Reinstall the 2 retaining bolts securing the oil tank to belt.

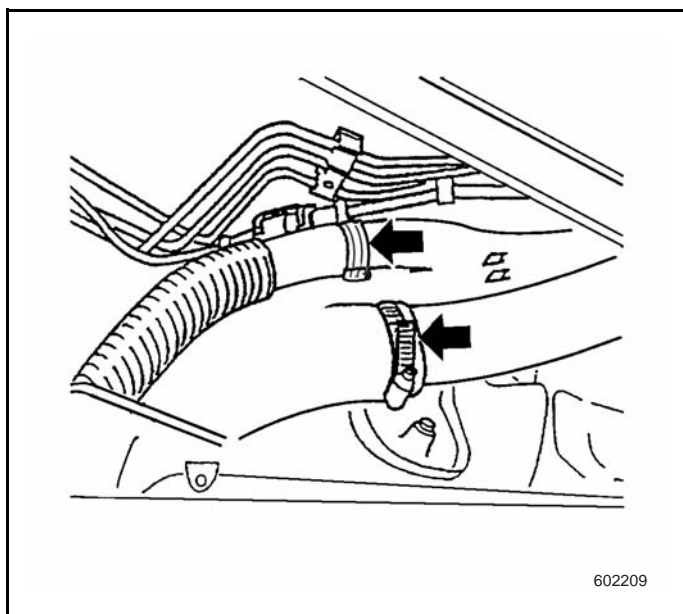
Tightening

Tighten the 2 oil tank retaining belt bolts to 20 N•m.



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6. Connect the quick fittings of oil passage.



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7. Connect the oil filler hose and ventilation hose of oil tank to the oil filler pipe. And install the hose clip. Replace the clip if necessary.
8. Inspect and ensure the oil filler hose, ventilation hose and oil filler pipe for complete connection at joint.
9. Ensure that the clip is positioned correctly at the joint of oil tank curling and oil filler pipe.
10. Tighten the oil filler hose clip.

Tightening

Tighten the fuel tank oil filler hose clip to 2.5 N•m.

11. Connect the park brake cable. Refer to Park Brake Cable Replacement.
12. Reinstall the exhaust pipe heat shield to the park brake cable.

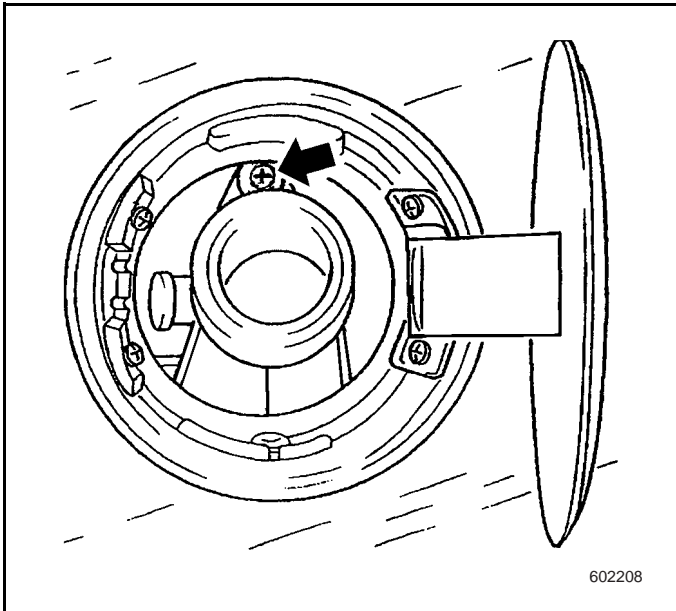
13. Reinstall the exhaust system. Refer to Exhaust System Replacement.
14. Lower the vehicle.
15. Install the oil filler cap to oil tank after filling oil.
16. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
17. Inspect for fuel leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for leakage.

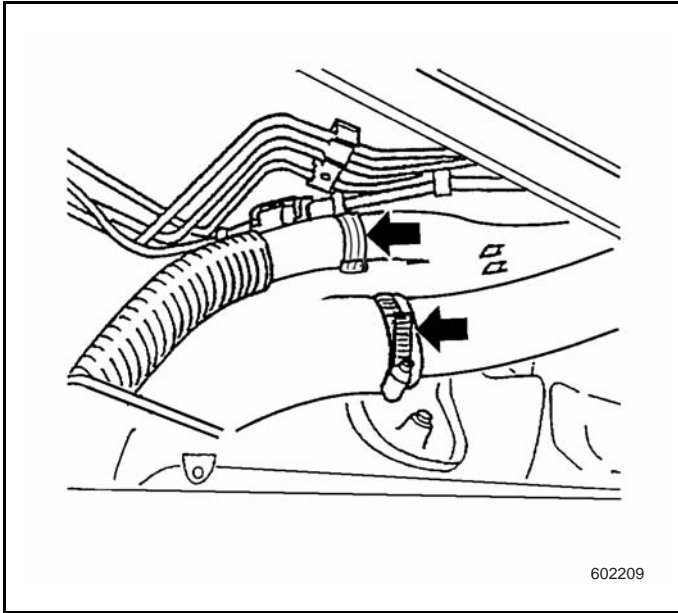
6.1.4.35 Oil Filler Replacement

Removal Procedure

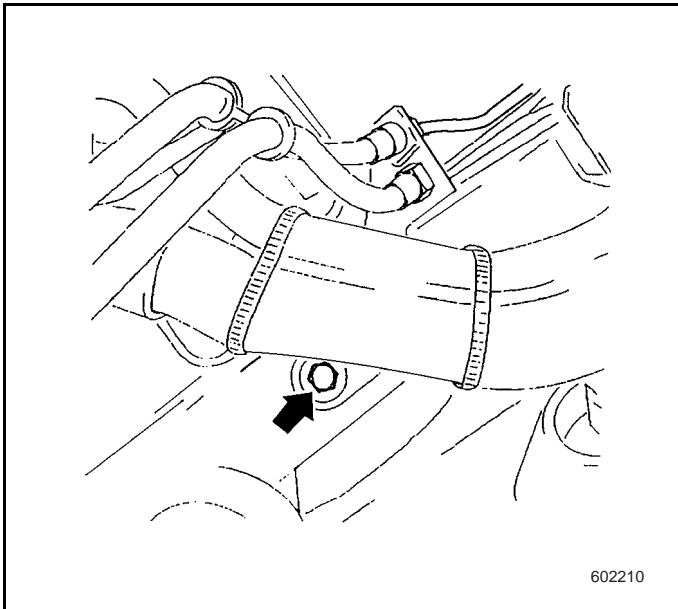
Note: Keep the fuel system clean when repairing the fuel system.

1. Release the fuel pressure. Refer to Fuel Pressure Relief Procedure.
2. Drain the fuel and empty fuel tank if necessary. Refer to Fuel Tank Draining Procedure.
3. Remove the rubber seal ring of oil filler pipe.
4. Loosen the upper screw of oil filler pipe.

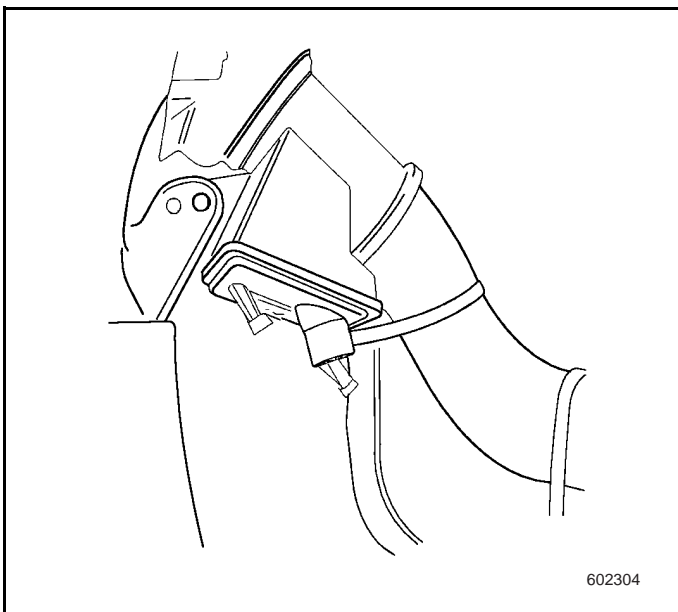




5. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
6. Loosen the clip of oil filler hose and ventilation hose from oil filling pipe.
7. Remove the clip of oil filler hose and ventilation hose from oil filling pipe.



8. Remove the oil filler pipe retaining screw downward.



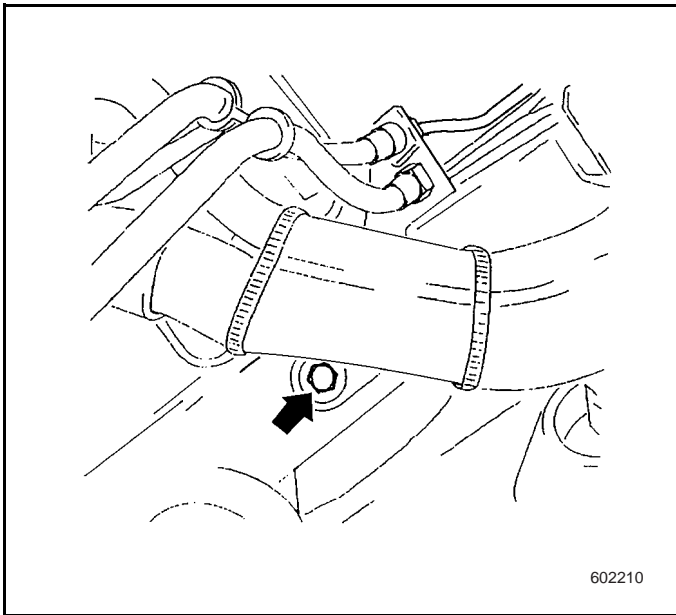
9. Remove the oil filler pipe from the wheelhouse.

Installation Procedure

1. Reinstall the oil filler pipe.
2. Install the oil filler pipe retaining screw (1) downward.

Tightening

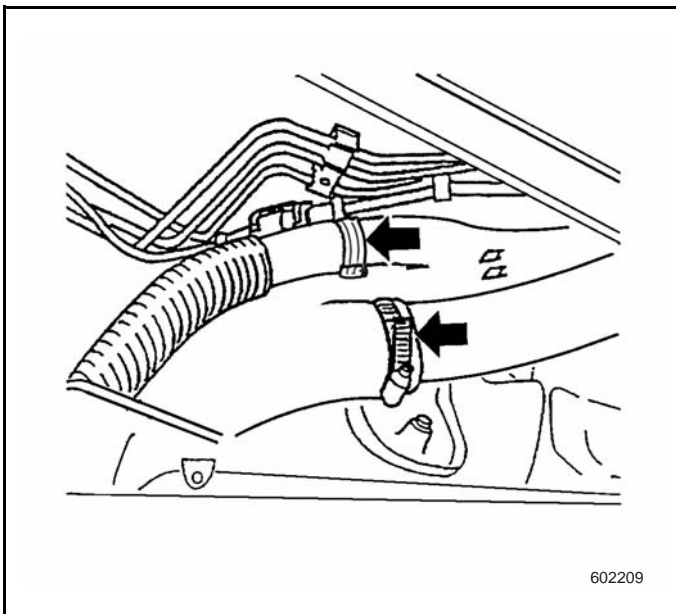
Tighten the oil filler pipe retaining screw to 12.5 N•m.

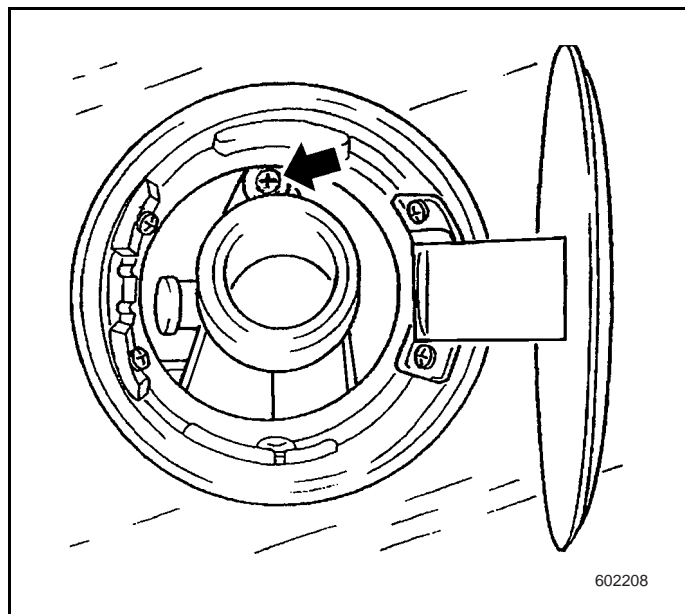


3. Connect the oil filler hose and ventilation hose to the oil filling pipe, and install the hose clip. Use new ventilation hose clip. Replace the oil filler hose clip if necessary.
4. Replace the oil filler hose clip if necessary. Inspect and ensure the oil filler hose and oil tank jointing completely.
5. Ensure that the clip is positioned correctly at the joint of oil tank curling and oil tank.
6. Tighten the oil filler hose clip.

Tightening

Tighten the fuel tank oil filler hose clip to 2.5 N•m.





7. Lower the vehicle.
8. Tighten the upper screw of oil filler pipe.

Tightening

Tighten the fuel tank oil filler hose clip to 1 N•m.

9. Install the rubber seal ring of oil filler pipe.
10. Fill oil and tighten the filler cap if necessary.
11. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
12. Inspect for fuel leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for leakage.

6.1.4.36 Electric Fuel Pump Replacement

Removal Procedure

Tools Required

- KM-797

Caution: When replacing the fuel system components, the fuel steam will assemble in the sealed container like chest. In order to lessen the fire danger and speed up the emanation of fuel steam,

- *Use fan outside the chest to force ventilation.*
- *Block or cover all the fuel system outlet to lessen the formation of fuel steam.*
- *Wipe out the spilled fuel at once.*
- *Avoid sparks and any ignition source.*
- *Use signs to alert others in the work area that fuel system work is in process.*

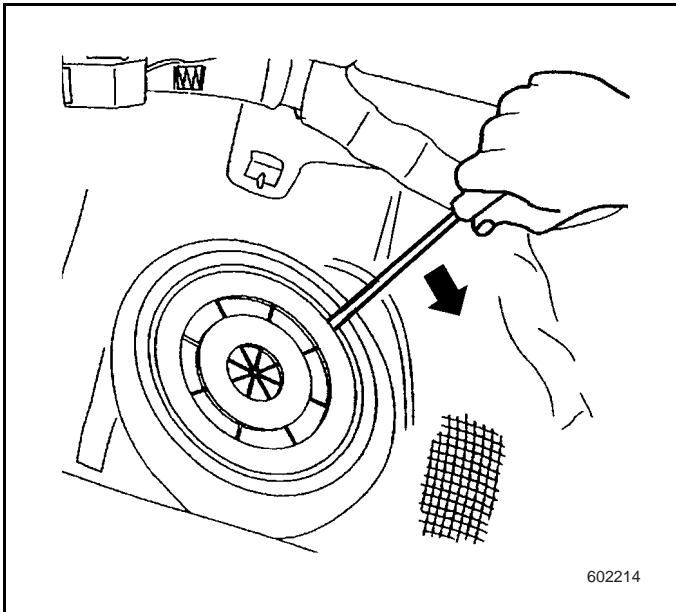
Note: Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system.

- The fuel pipe connections.
- The hose connections.
- The area surrounding the connections.

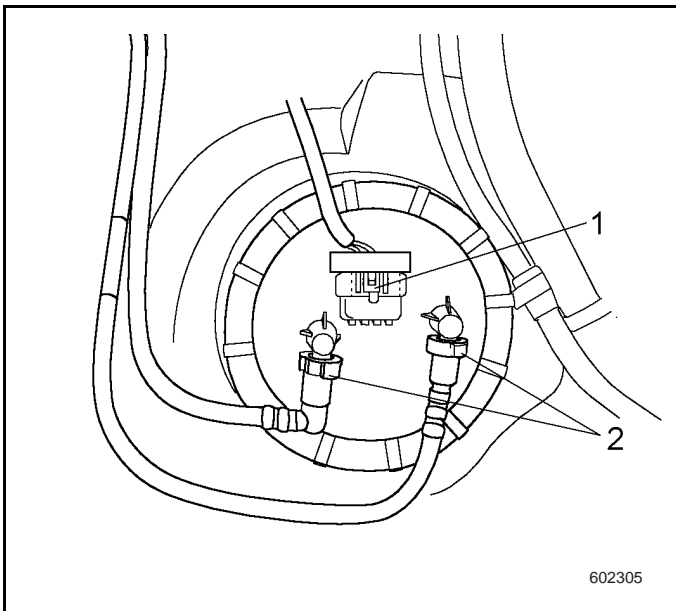
Note: Always replace the fuel sender O-ring each time reinstalling the fuel sender assembly.

Note: Keep the fuel system clean.

1. Release the fuel pressure. Refer to Fuel Pressure Relief Procedure.
2. Drain the remaining oil from the oil tank. Refer to Fuel Tank Draining Procedure.
3. Lift up the rear seat cushion.
4. Raise the carpet on the fuel tank access hole.

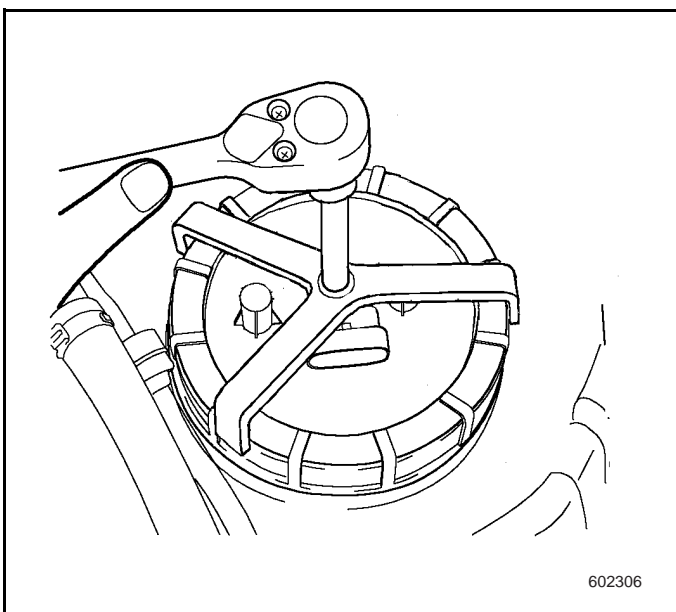


5. Use the screw driver to pry the access hole cover.

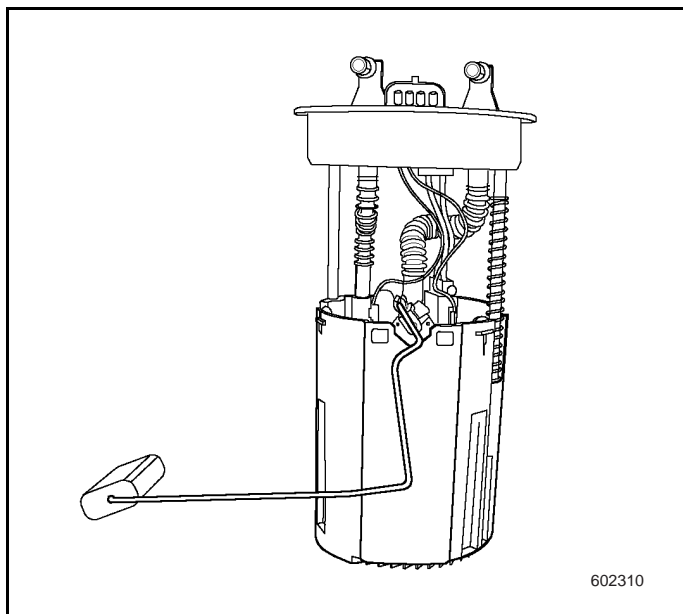


6. Remove the wire plug from the electric fuel pump
7. Disconnect the fuel feed and fuel return pipe quick-connect fittings at the electric fuel pump.
8. Remove the fuel feed pipe and the fuel return pipe from the electric fuel pump.

Note: Place a catch basin below the vehicle as fuel may escape. Observe the safety regulation.



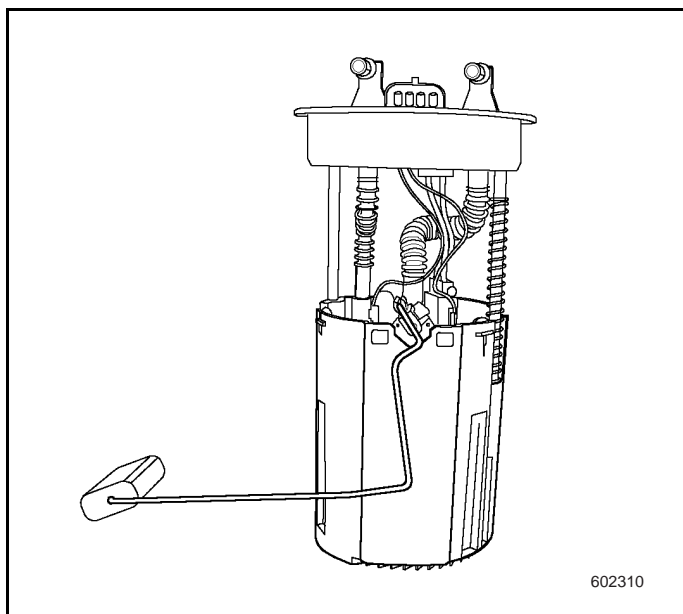
9. Use KM-797 to unscrew the electric fuel pump cover.

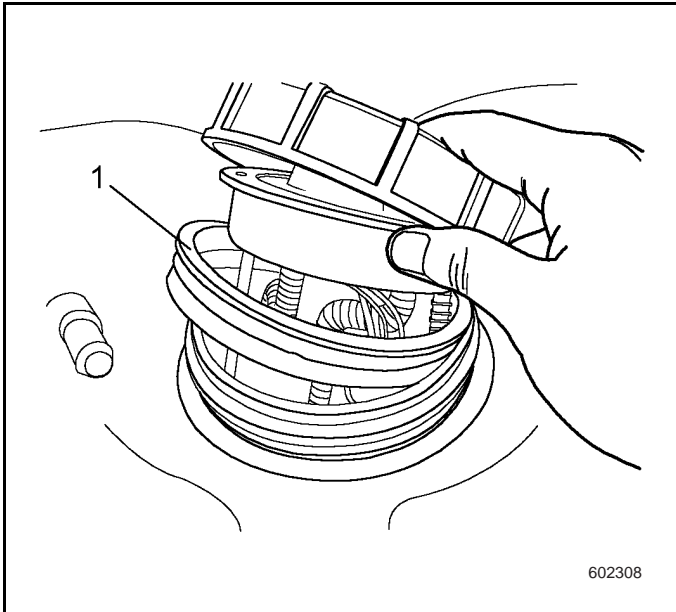


10. The illustration is a picture of the electric fuel pump for clear discription. Remove the electric fuel pump from inside the fuel tank.

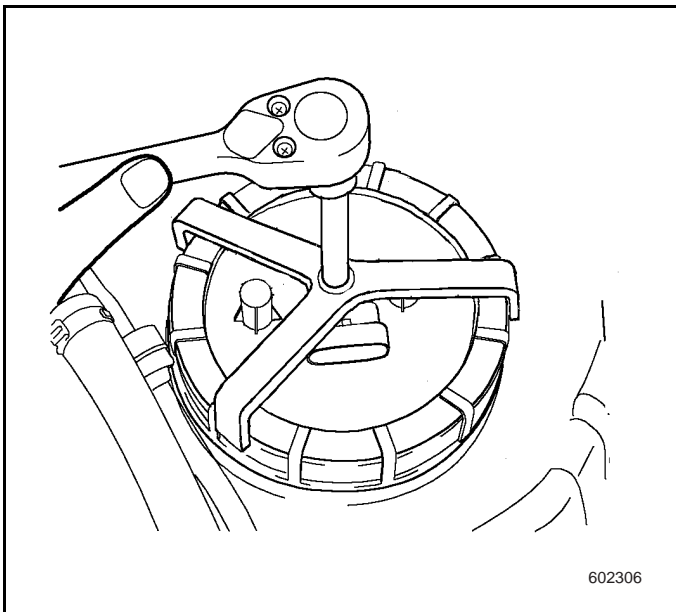
Installation Procedure

1. Install the electric fuel pump into the fuel tank.





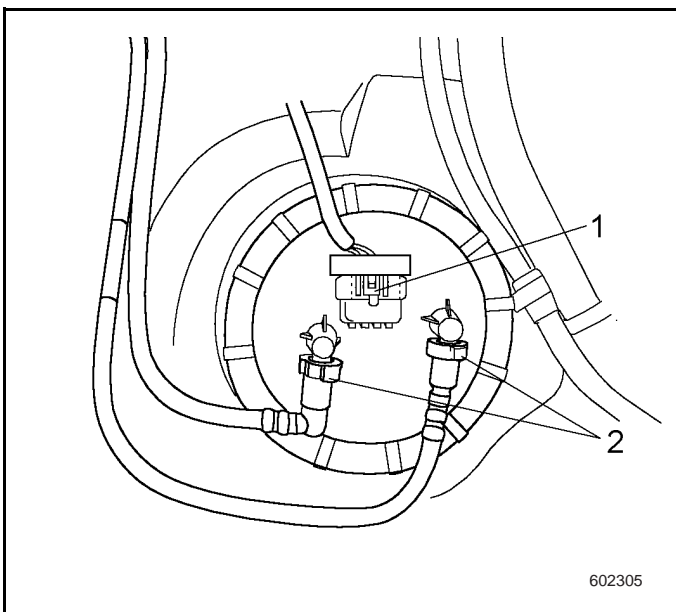
2. Install a new rubber sealing ring. Add a few oil grease.



3. Use KM-797 to tighten the fuel pump cover.

Tightening

Tighten the electric fuel pump cover to 655 N•m.



4. Connect the fuel feed and fuel return pipe quick-connect fittings at the electric fuel pump.
5. Connect the wire plug from the electric fuel pump.
6. Return the access hole cap to the position.
7. Place the carpet on the access hole cover.
8. Pull down the rear seat cushion.
9. Tighten the oil filler cap.
10. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
11. Inspect for leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for leakage.

6.1.4.37 Fuel Level Sensor Replacement

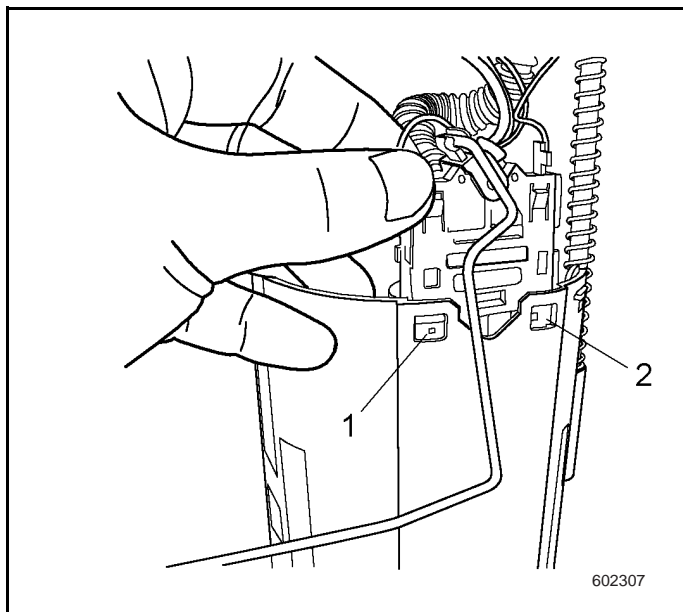
Removal Procedure

Tools Required

- KM-797

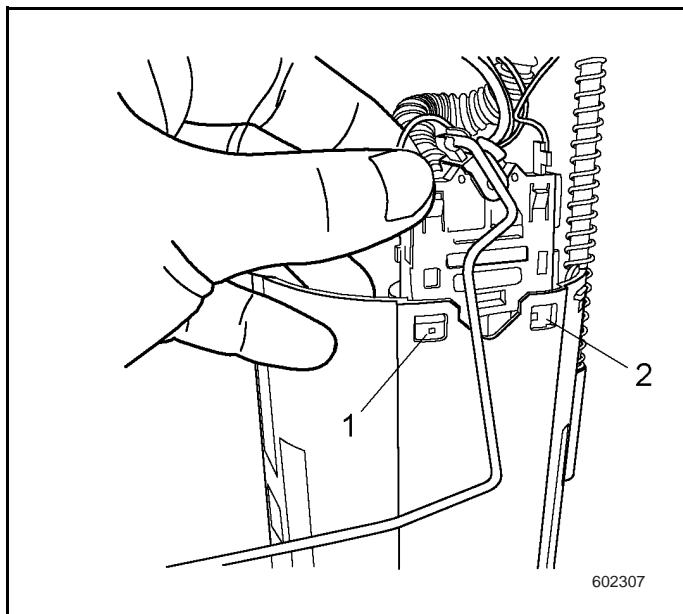
Note: Keep the fuel system clean when repairing the fuel system.

1. Release the fuel pressure. Refer to Fuel Pressure Relief Procedure.
2. Drain the remaining oil from the oil tank. Refer to Fuel Tank Draining Procedure.
3. For removal of the electric fuel pump, refer to Electric Fuel Pump Replacement.
4. Remove the fuel level sensor cable plug, then press the 2 clips and remove the fuel level sensor from the fuel pump body.



Installation Procedure

1. Position the guide slot of the oil level sensor inserted into the oil pump body, and connect the cable plug.
2. For installation of the electric fuel pump, refer to Electric Fuel Pump Replacement.
3. Return the access hole cover to the position.
4. Place the carpet on the fuel tank observation port.
5. Pull down the rear seat cushion.
6. Fill oil and tighten the oil filler cap.
7. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
8. Inspect for fuel leakage and the function of the fuel level sensor.
 - The ignition switch is ON for 2 seconds for inspection of the fuel level sensor function.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for leakage.



6.1.4.38 Fuel Hose/Pipes Replacement(to the engine)

Removal Procedure

Tools Required

- KM-796
- KM-807

Caution: In Order to Reduce the Risk of Fire and Personal Injury:

If nylon fuel pipes are nicked, scratched or damaged during installation, Do Not attempt to repair the sections of the nylon fuel pipes. Replace them.

When installing new fuel pipes, Do Not hammer directly on the fuel harness body clips as it may damage the nylon pipes resulting in a possible fuel leak.

Always cover nylon vapor pipes with a wet towel before using a torch near them. Also, never expose the vehicle to temperatures 115C(239F) for more than one hour, or more than 90C(194F) for any extended period.

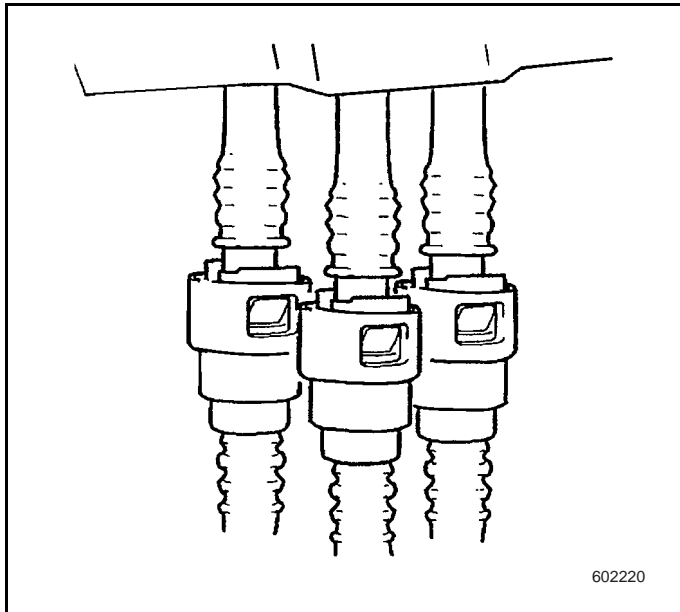
Before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends. This will ensure proper reconnection and prevent a possible fuel leak. (During normal operation, the quick-connect fitting O-ring will swell and may prevent proper reconnection if not lubricated.)

Note: Do not make the twisted nylon fuel pipe straight. It should be replaced lest vehicle is damaged.

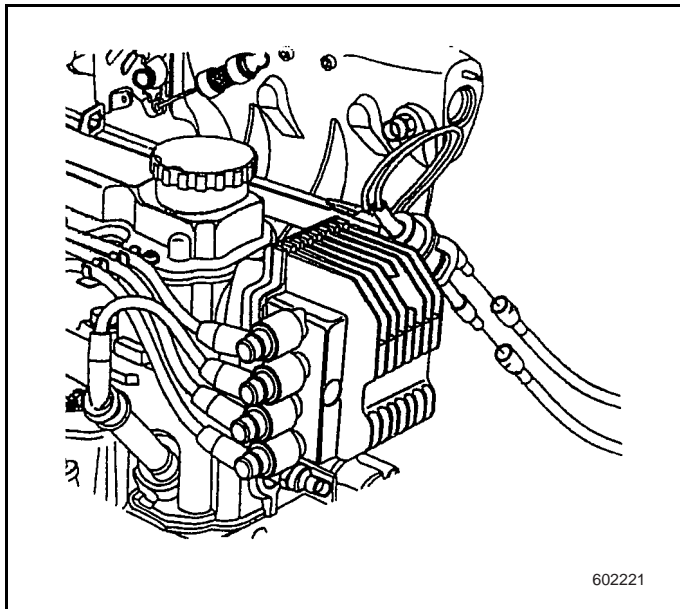
Note: When fuel system is running, cover the connector and block the hole to prevent dust or other pollution from entering through the open pipe or other passage.

Note: The quick connector of the fuel feed pipe, the fuel return pipe and the evaporation pipe are blue, black and green respectively.

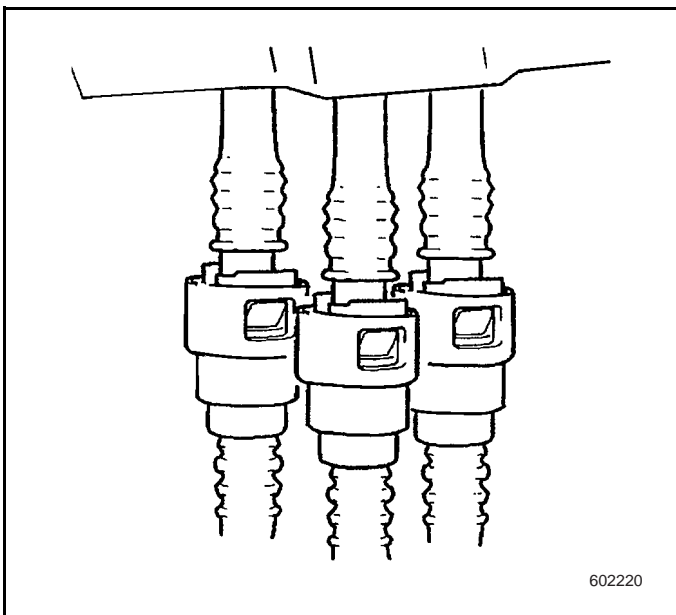
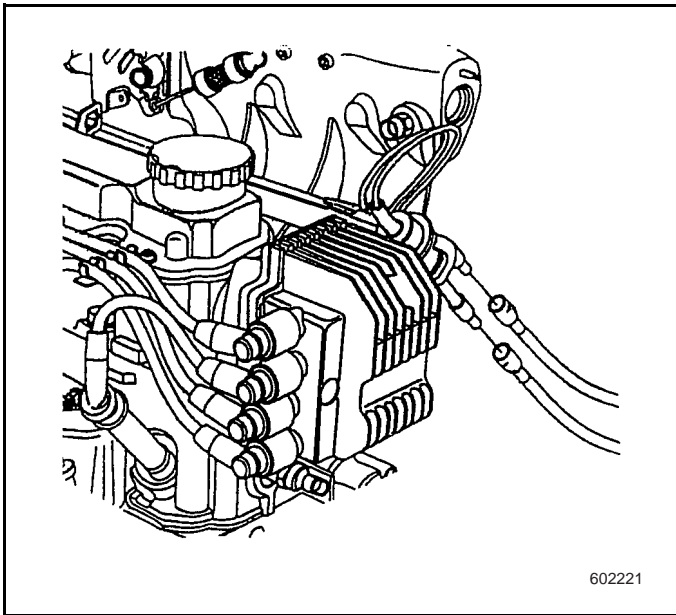
Note: Keep the fuel system clean when repairing.



1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief Procedure.
2. Clean all connectors at the fuel pipes.
3. Clean the area surrounding the fuel pipe connections.
4. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
5. Use KM-796 to remove the quick fittings of fuel feed pipe, fuel return pipe, and seal with KM-807.



6. Lower the vehicle.
7. Use KM-796 to remove the quick fittings of fuel feed pipe, fuel return pipe in the engine compartment, and seal with KM-807.
8. Remove the fuel feed pipe and the fuel return pipe.
9. Inspect the pipes for bends, kinks, and cracks.
10. Repair or replace the pipe(s) as required.



Installation Procedure

Caution: In order to reduce the risk of fire and personal injury: If nylon fuel pipes are nicked, scratched, or damaged during installation, replacement must be done.

Note: Fasteners with the same type as the original must be used for reattaching the fuel pipes.

Do not attempt to repair a section of the fuel pipe.

Note: The quick connector of the fuel feed pipe, the fuel return pipe and the evaporation pipe are blue, black and green respectively.

Note: Do not allow the fuel pipes to come into contact with the fuel tank or underbody.

1. Remove the caps of fuel feed pipe and the fuel return pipe.
2. Connect the quick fittings of the fuel feed pipe and the fuel return pipe to the engine.
3. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
4. Connect the quick fittings of the fuel return pipe under the front floor.
5. Lower the vehicle.
6. Install the oil filler cap to oil tank after filling oil.
7. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
8. Inspect and make sure all of fuel pipe bundle clips, and fasteners are properly installed.
9. Inspect for leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for fuel leakage.

6.1.4.39 Fuel Hose/Pipes Replacement (Underbody)

Removal Procedure

Tools Required

- KM-796
- KM-807

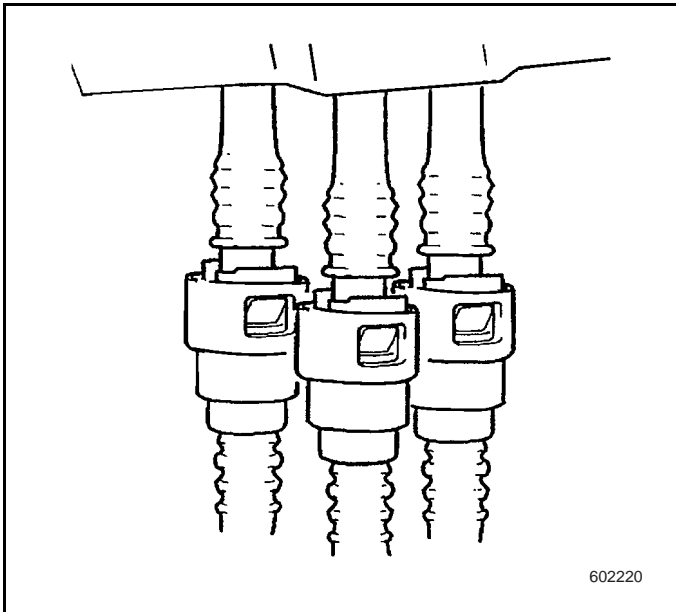
Caution: In Order to Reduce the Risk of Fire and Personal Injury:

- *If nylon fuel pipes are nicked, scratched or damaged during installation, Do Not attempt to repair the sections of the nylon fuel pipes. Replace them.*
- *When installing new fuel pipes, Do Not hammer directly on the fuel harness body clips as it may damage the nylon pipes resulting in a possible fuel leak.*
- *Always cover nylon vapor pipes with a wet towel before using a torch near them. Also, never expose the vehicle to temperatures 115C(239F) for more than one hour, or more than 90C(194F) for any extended period.*
- *Before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends. This will ensure proper reconnection and prevent a possible fuel leak. (During normal operation, the quick-connect fitting O-ring will swell and may prevent proper reconnection if not lubricated.)*

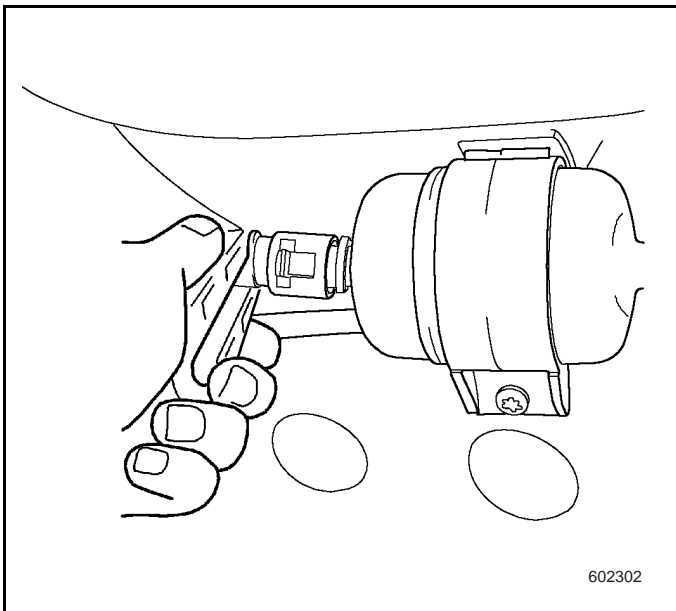
Note: Do not make the twisted nylon fuel pipe straight. It should be replaced lest vehicle is damaged.

Note: When fuel system is running, cover the connector and block the hole to prevent dust or other pollution from entering through the open pipe or other passage.

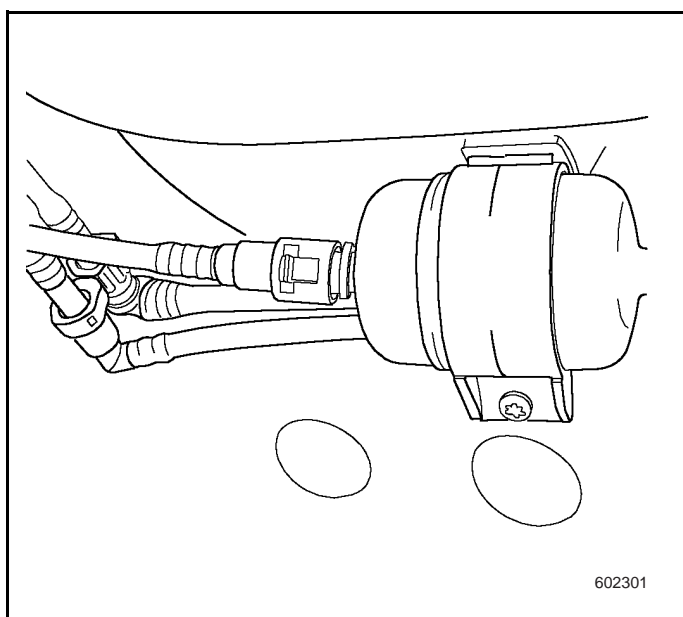
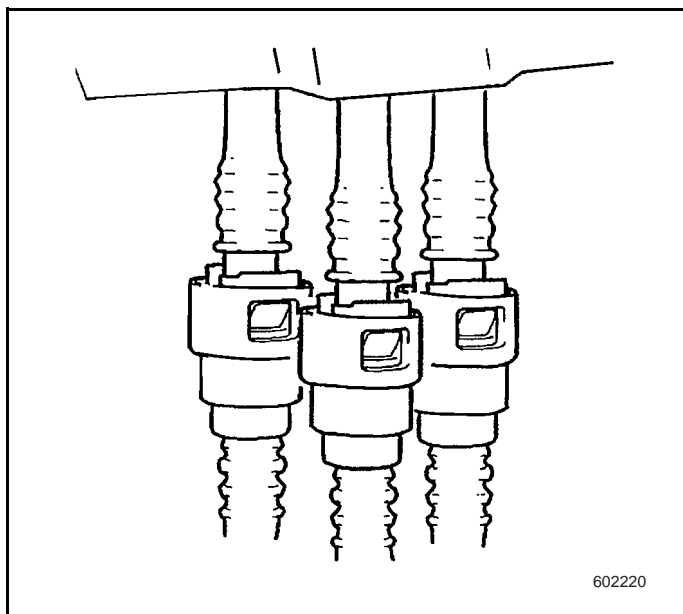
Note: Keep the fuel system clean when repairing.



1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief Procedure.
2. Raise the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
3. Clean all connectors at the fuel pipes.
4. Clean the area surrounding the fuel pipe connections.
5. Use KM-796 to remove the fuel feed, fuel return, and EVAP pipe quick-connect fittings under the front floor, and seal with KM-807.



6. Use KM-796 to remove the fuel feed, fuel return, and EVAP pipe quick-connect fittings near the oil passage filter, and seal with KM-807
7. Remove the oil supply pipe, oil return pipe and evaporation pipe assembly.
8. Inspect the pipes for bends, kinks, and cracks.
9. Repair or replace the pipe(s) as required.



Installation Procedure

Caution: In order to reduce the risk of fire and personal injury: If nylon fuel pipes are nicked, scratched, or damaged during installation, replacement must be done.

Note: Fasteners with the same type as the original must be used for reattaching the fuel pipes.

Do not attempt to repair a section of the fuel pipe.

Note: The fuel feed pipe quick connectors are blue. The fuel return and the EVA pipe connectors are black and green.

Note: Do not allow the fuel pipes to come into contact with the fuel tank or the bottom.

1. Remove the caps of fuel feed, fuel return, and EVA pipes.
2. Connect the fuel return, fuel return, and EVA pipe quick-connect fittings under the front floor.
3. Connect the fuel return, fuel return, and EVA pipe quick-connect fittings near the oil passage filter.
4. Lower the vehicle.
5. Fill oil and tighten the filler cap when necessary.
6. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
7. Inspect and make sure all of fuel pipe bundle clips, and fasteners are properly installed.
8. Inspect for leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for fuel leakage.

6.1.4.40 Fuel Hose/Pipes Replacement (Filter to Engine)

Removal Procedure

Tools Required

- KM-796
- KM-807

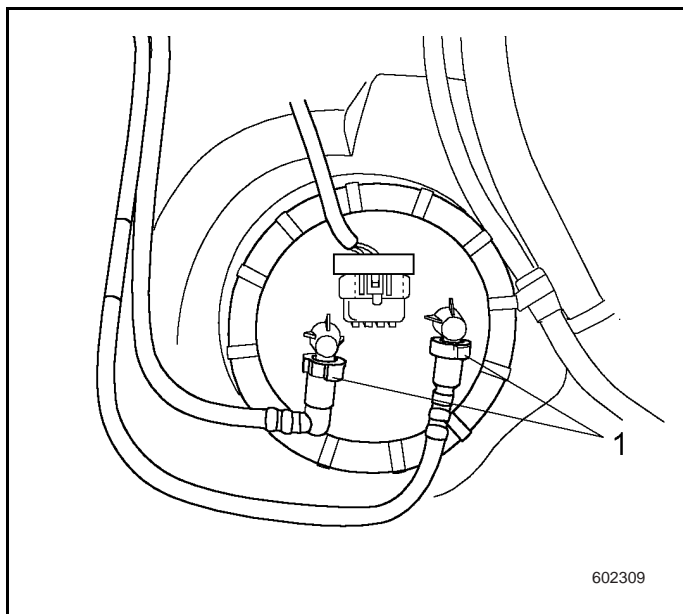
Caution: In Order to Reduce the Risk of Fire and Personal Injury:

- *If nylon fuel pipes are nicked, scratched or damaged during installation, Do Not attempt to repair the sections of the nylon fuel pipes. Replace them.*
- *When installing new fuel pipes, Do Not hammer directly on the fuel harness body clips as it may damage the nylon pipes resulting in a possible fuel leak.*
- *Always cover nylon vapor pipes with a wet towel before using a torch near them. Also, never expose the vehicle to temperatures 115C(239F) for more than one hour, or more than 90C(194F) for any extended period.*
- *Before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends. This will ensure proper reconnection and prevent a possible fuel leak. (During normal operation, the quick-connect fitting O-ring will swell and may prevent proper reconnection if not lubricated)*

Note: Do not make the twisted nylon fuel pipe straight. It should be replaced lest vehicle is damaged.

Note: When fuel system is running, cover the connector and block the hole to prevent dust or other pollution from entering through the open pipe or other passage.

Keep the fuel system clean when repair are carried out.



1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief Procedure.
2. Drain the remaining oil from the oil tank. Refer to Fuel Tank Draining Procedure.
3. Remove the fuel tank. Refer to Fuel Tank Replacement.
4. Disconnect the fuel feed and fuel return pipe quick-connect fittings at the fuel pump.
5. Remove the fuel feed pipe and the fuel return pipe from the fuel tank.
6. Release the clip of the EVA pipe, and remove the EVA pipe from the fuel tank.
7. Inspect the pipes for bends, kinks, and cracks.
8. Repair or replace the pipe(s) as required.

Installation Procedure

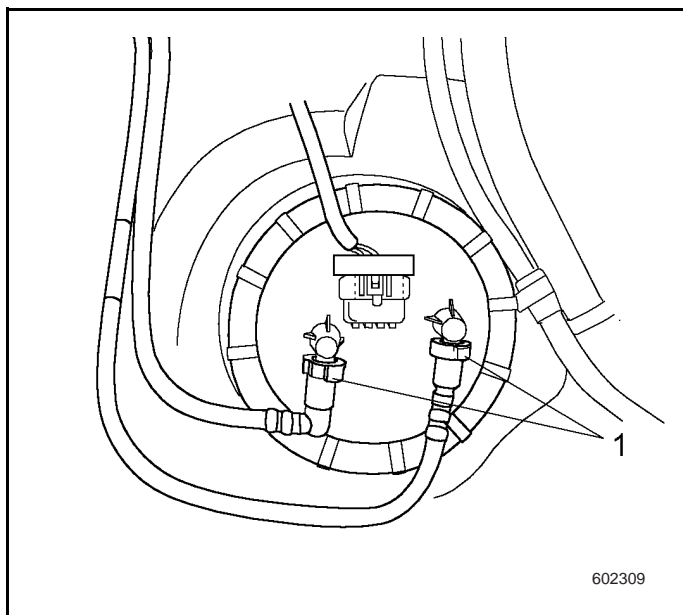
Caution: In order to reduce the risk of fire and personal injury: If nylon fuel pipes are nicked, scratched, or damaged during installation, replacement must be done.

Note: Fasteners with the same type as the original must be used for reattaching the fuel pipes.

Do not attempt to repair a section of the fuel pipe.

Note: The fuel feed pipe quick connectors are blue. The fuel return and the EVA pipe connectors are black and green.

Note: Do not allow the fuel pipes to come into contact with the fuel tank or underbody.



1. Remove the caps of fuel feed, fuel return, and EVA pipes.
2. Install the fuel feed, fuel return and EVAP pipes.
3. Connect the fuel feed and fuel return pipe quick-connect fittings at the fuel pump, then the EVA pipe and install new hose clamps.
4. Install the fuel tank. Refer to Fuel Tank Replacement.
5. Lower the vehicle.
6. Fill oil and tighten the filler cap when necessary.
7. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
8. Inspect and make sure all of fuel pipe bundle clips, and fasteners are properly installed.
9. Inspect for leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for fuel leakage.

6.1.4.41 Fuel Sysgtem Cleaning

Cleaning Procedure

Note: When fuel system is running, cover the connector and block the hole to prevent dust or other pollution from entering through the open pipe or other passage.

Note: After washing the fuel tank, the fuel water mixture should be treated as a hazardous material. The material needs to be handled in accordance with state, provincial, and municipal laws and regulations.

Note: Whenever the fuel tank is cleaned, carefully inspect the fuel pump strainer. If the strainer is contaminated, the strainer must be replaced and the fuel pump must be inspected.

Note: Keep the fuel system clean when repairing.

1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief Procedure.
2. Drain the remaining oil from the oil tank. Refer to Fuel Tank Draining Procedure.
3. Remove the fuel tank. Refer to Fuel Tank Replacement.
4. Remove the electric fuel pump. Refer to Electric Fuel Pump Replacement.
5. Inspect the fuel pump inlet for dirt and debris. If found, the fuel pump should be replaced.
6. Flush fuel tank with hot water.
7. Pour the water out of the fuel sender assembly opening in the fuel tank. Rock the fuel tank in order to be sure that the removal of the water from the fuel tank is complete.
8. Allow tank to dry completely before installation.
9. Install the electric fuel pump. Refer to Electric Fuel Pump Replacement.
10. Install the fuel tank. Refer to Fuel Tank Replacement.
11. Install the oil filler cap to oil tank after filling oil.
12. Reconnect the battery negative cable. Refer to Battery Negative Cable Replacement in Engine Electrical.
13. Inspect for leakage.
 - Turn on the ignition switch for 2 seconds.
 - Turn off the ignition switch for 10 seconds.
 - Turn on the ignition switch.
 - Inspect for fuel leakage.

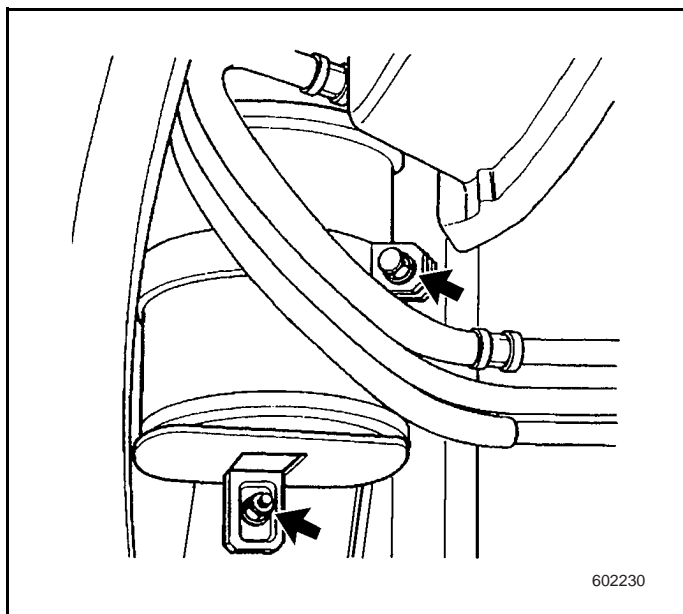
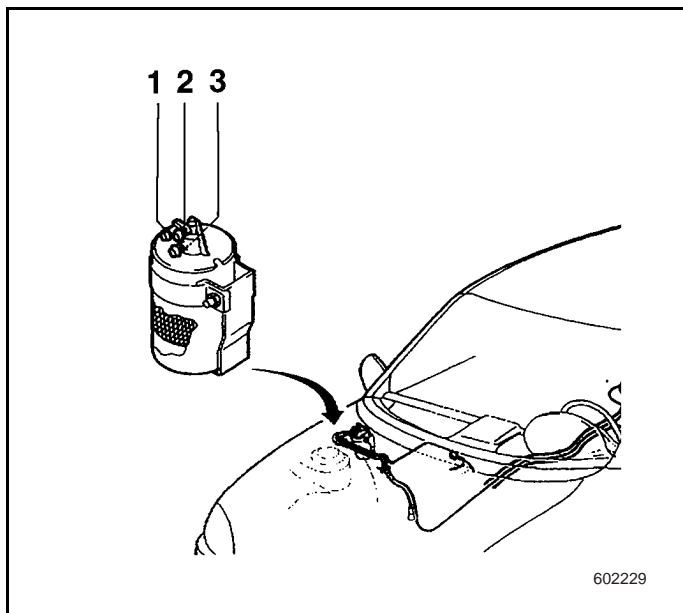
6.1.4.42 Fuel Pump Relay Replacement

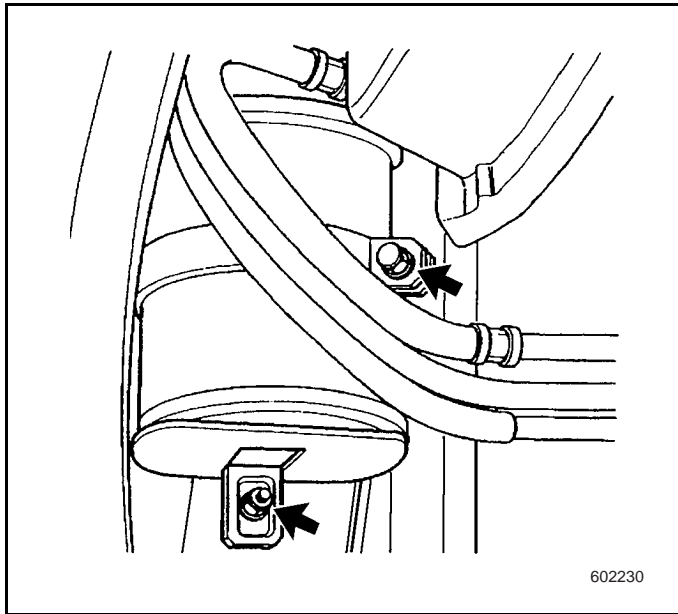
Refer to Fuse and Relay Box Position and Introduction in Wiring System

6.1.4.43 Canister Replacement

Removal Procedure

1. Remove the right front wheel. Refer to Replacement of Wheels.
2. Remove the right front fender from the wheel housing. Refer to Sun Visor Replacement.
3. Release the clip of the fuel tank EVA pipe.
4. Remove the hose from the canister. Install to the new canister.
5. Connect the canister support to the underbody bolt.
6. Remove the canister assembly from the body.
7. Loosen the screws of the canister installation support.
8. Remove the canister from the support.





Installation Procedure

1. Install the canister to the support bracket.
2. Install the attaching screws of the canister support bracket.

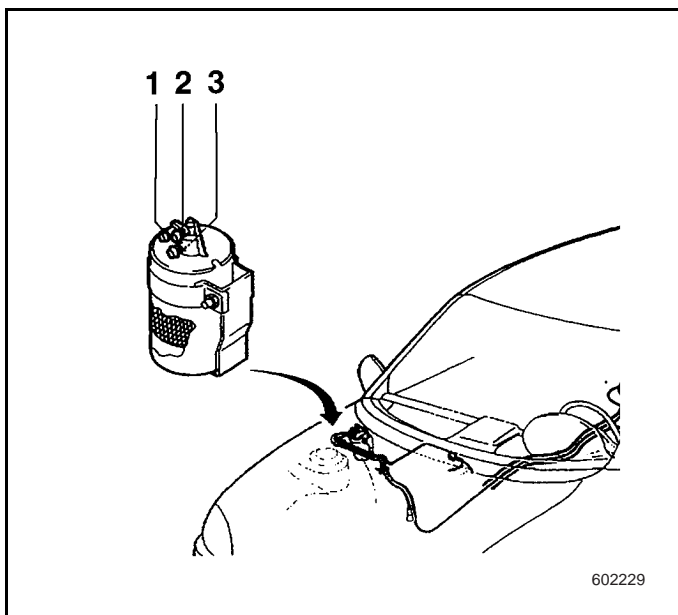
Tightening

Screw torque 0.5-1.0 N•m.

3. Install the canister assembly to the body.
4. Install the canister support bracket to the body.

Tightening

Screw torque 4.0 N•m.



5. Connect the canister hose and install the clip of the EVA pipe.
6. Install the right front fender to the wheel housing. Refer to Sun Visor Replacement.
7. Install the right front wheel. Refer to Replacement of Wheels.
8. Lower the vehicle.

6.1.4.44 EVA Hose/Pipe Replacement

Removal Procedure

Tools Required

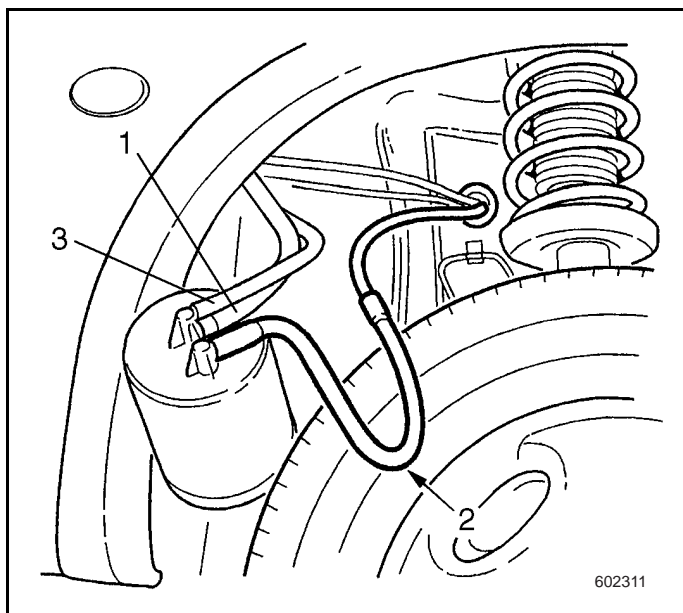
- KM-796
- KM-807

Notice: Do not make the twisted nylon fuel pipe straight. It should be replaced lest vehicle is damaged.

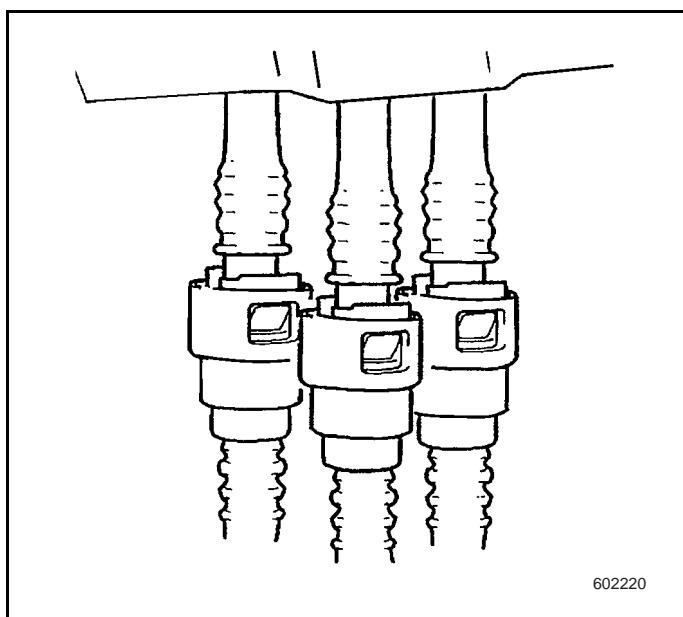
Notice: When fuel system is running, cover the connector and block the hole to prevent dust or other pollution from entering through the open pipe or other passage.

Notice: The fuel feed pipe quick connectors are blue. The fuel return and the EVA pipe connectors are black and green.

Important: Keep the fuel system clean when repairing the fuel system.



1. Remove the right front wheel. Refer to Replacement of the wheel.
2. Remove the right front fender from the wheel housing. Refer to Sun Visor Replacement.
3. For removal of the canister, refer to Canister Replacement.
4. Remove the clip of the fuel tank EVA pipe.
5. Remove the fuel tank EVA pipe (1) from the canister.
6. Remove the canister vent hose (2) and the purge hose (3) from the canister.

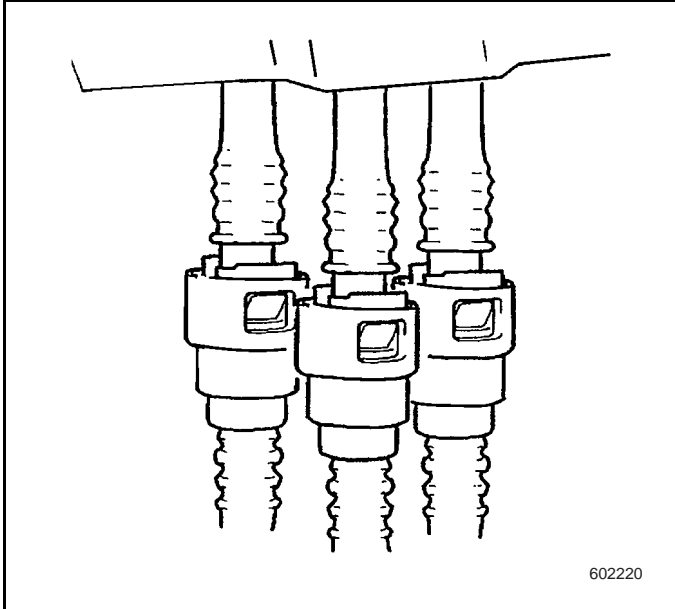


7. Use KM-796 to remove the quick fittings of fuel tank EVA pipe from the front floor, and seal with the KM-807.
8. Remove the EVA pipe. Record the installation position of the EVA pipe.

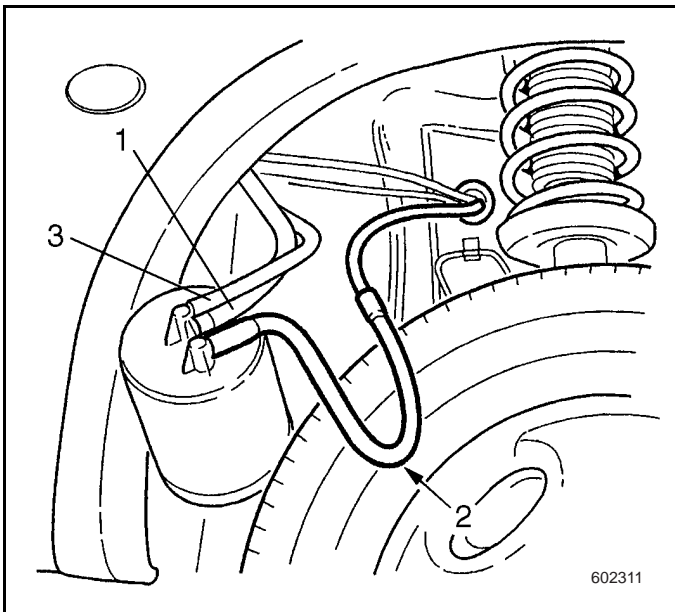
Installation Procedure

Notice: Correctly attach the EVA pipe and avoid to be worn.

Important: EVA pipe replacement should be consistent with the previous arranging pattern.



1. Reinstall the EVA pipe to the vehicle.
2. Connect the EVA quick-connect fittings under the front floor.

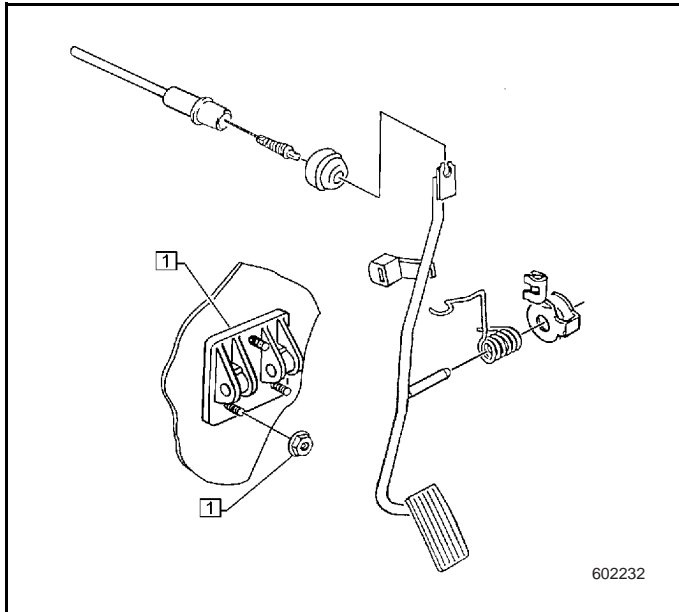


3. Connect the EVA hose (1) to the canister.
4. Install the clip of the EVA hose of the fuel tank.
5. Connect the canister vent hose (2) and the purge hose (3) to the canister.
6. For installation of the canister, refer to Canister Replacement.
7. Install the right front fender to the wheel housing. Refer to Sun Visor Replacement.
8. Install the right front wheel. Refer to Replacement of Wheels procedure.
9. Lower the vehicle.

6.1.4.45 Acceleration Control Pedal (acceleration pedal) Replacement

Removal Procedure

1. Disconnect the acceleration pedal cable from the pedal.
2. Remove the attaching acceleration pedal bolts and screws.
3. Remove the acceleration pedal.



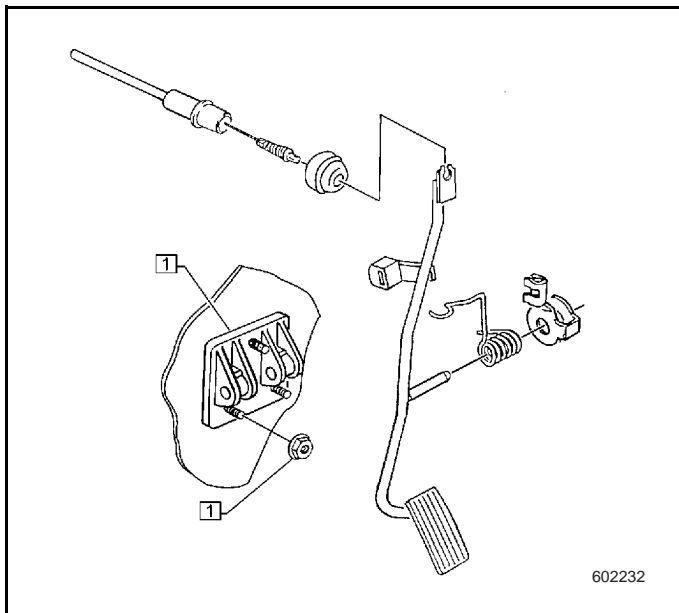
Installation Procedure

1. Install the acceleration pedal to the support bracket.
2. Install the acceleration bolts and screws.

Tightening

Tighten the acceleration assembly screws and bolts to 6.0 N•m.

3. Connect the acceleration pedal and cable.
4. Inspect the acceleration pedal. Inspect the acceleration pedal circumstances (depressing to the bottom and there should not be any obstacles during release)



6.1.5 Description & Operation

6.1.5.1 Engine Description

The C16NE engine is a in-line 4 cylinder, single overhead camshaft engine. The cylinder number starts from the camshaft transmission end of the engine. Ignition sequence: 1 3 4 2

The balance crankshaft (nodular graphite cast iron) has 5 main bearing. The balance of the crankshaft includes the fly wheel, crankshaft main journal, and connecting rod big head bearing, all journal fillets have gone through rolling depression process to endure more stress; the axial float is born by the trust bearing and the crankshaft at the engine camshaft transmission end directly drives a gear fuel pump, with the camshaft transmission gear and the slavery gear directly installed at the front the fuel pump.

The piston is made of aluminum alloy with the concaved top and each piston employs 2 compression ring and a 3 section fuel control ring. The piston pin is assorted to forgeable connecting rod by heat embedding and the bearing cap bolt is positioned on the connecting rod.

The aluminum cylinder heads have valve seat hole and heat assembled valve guide slots. The valve is perpendicular with the cylinder top and arranged in 2 lines. The exhaust valve is of a construction of 2 pieces. The inlet and exhaust valves have valve spindle oil seal. The exhaust valves is equipped with rotation mechanism.

The cylinder head is designed as 8 port cross flow feature therefore the inlet is of tangential rotary type, and when air flows into the special form combustion chamber, the rotary motion can be reinforced for the fuel-air mixture. Such high effective fuel air mixture has increased the combustion quality and explode combustion limit, while decreasing the exhaust gas emission and fuel consumption.

The hydraulic valve transverse member brings along the cast iron rock arm to move, and further drives the valve in operation; the rock arm seat is positioned on the valve spindle and the rock arm seat has slot to secure one end of the rock arm. Arrangement of the valve cross member follows as the that of the valve and appears in 2 lines too.

The camshaft is supported by 5 bearings. The camshaft support bracket is installed on the cylinder head and attached by bolts.

The camshaft box head is made of molded casting aluminum.

After the fuel pump collects oil in the oil pan body, the pressured oil enters into the main oil groove of the cylinder set through the entire fuel type oil filter. There is

a oil pressure limit valve and a oil filter bypass valve operating in collaboration in the system.

Camshaft drive

The engine camshaft is driven by the gear transmission belt of the automatic tension roller. Because the tension roller can maintain stable load for the transmission belt, it is unnecessary to perform daily adjustment for the driving belt. The gear driving belt also brings the water pump to move.

Driven by Accessory

Power steering pump, for example installation, the AC motor and air compression motor are driven by the automatic tension roller rib type driving belt.

Using rib type V driving belt with automatic tension roller has the following advantages:

- It is unnecessary to repair during operation.
- The rib type driving belt needs no adjustment of tension, so the tension roller can ensure the tension unchanged.
- All accessories are tightly attached to the solid bracket. Replacement of the V driving belt needs no releasing of these modules and also needs no readjustment.

The rib type driving belt should be replaced under the following conditions:

- Early embrittlement or formation of cracks ;
- If noise appears after oil is applied.

Fuel system

C16NE engine has a fuel mixture system and ignition system, equipped with multi point injection system. This system is referred to as Multipoint Technology.

The illustration shows the position of the multipoint components used for the OHC engine.

Air Intake System

Air in the OHC engine needs to go through the filter installed in the engine compartment and connected to the engine intake system with a contracted hose. This kind of installation can reduce the air intake noise. All inlet pipe and inlet box of the air filter system are made of polypropylene material by molding.

Emission Control

The engine emission control system includes purification and reduction of oil tank emission fuel evaporation active canister. The active canister is periodically purged at intervals and the fuel steam in the canister flows into the engine through the air intake system.

6.1.5.2 Safety measures

Here it should be specifically pointed out that the warning and precaution measures in this instruction should be carefully read and be observed strictly to reduce personal injury, vehicle damage or non safety conditions caused by no professional instructions.

The vehicle can be equipped with safety airbag (SRS-attached safety system), and read Book 1 of Section C in SB service instruction on the airbag safety usage rules before perform any operation to the airbag, surrounding components, or steering wheel mechanical or electronic wiring.

Non observance of airbag safety usage rule will cause the airbag to be opened, resulting in personal injury or unnecessary airbag system service.

If there exists a risk of a short during the operation, disconnect the grounding cable to the battery. The grounding cable should be disconnected when performing electric welding to the vehicle. Disconnecting the grounding cable will automatically eliminate the memory content stored in the electronic elements. When the cable is reconnected, the 3 digit message display unit should be reprogrammed. Because the radio message is encrypted and its status has been programmed, so you must inform the customer how to decrypt and the radio memory contents deleted.

Remove the control unit when the temperature is more than 80°C (dry oven).

Do not connect wire to the control unit and plug in or out the cable connector on the fuse box when the ignition switch is turned on.

Before charging or quick charging, disconnect the battery and vehicle electronic systems.

Never use a quick charger to start the vehicle.

Be exceptionally careful for contacting the ignition system powering up components.

Stay far away from the fire source in avoidance of sparks when operating the fuel system.

Before removing the fuel system components, clean thoroughly each connecting points and the periphery.

If it cannot be immediately repaired, the opened components should be closed or covered with care for protection

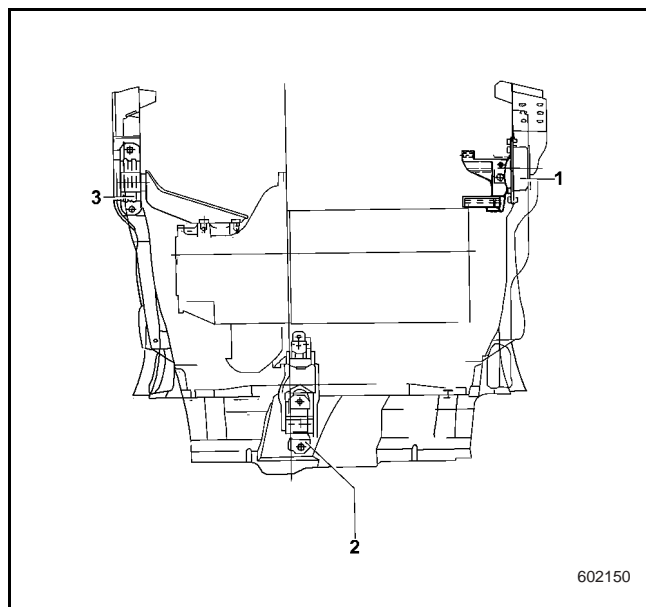
When perform operation in the engine compartment, notice that the fan could be automatically opened, causing risks of personal injury.

1. Install KM-263-B or MKM-883-1.
2. Raise the engine to eliminate the weight loaded on the engine bracket and to allow force produced by the rubber to become smaller.
3. Meanwhile raising up the engine, observe the engine mount. If the engine mount occurs with the following conditions, the engine mount should be replaced.
 - Cracks are spread on the rubber surface.
 - The separation of the engine mount rubber and metal sheet.
 - The engine mount rubber cracks from the center.
4. If the engine mount metal sheet has deviation between the metal sheet and the connecting points, lower the engine to the the engine bracket. Tighten the attaching bolts or nuts between the engine mount and box or between the engine mount brackets. See Engine Mount Replacement.

6.1.5.4 Engine Mount Arrangement

Vehicle with manual transmission (MT)

1. Engine Mount, right front;
2. Engine Mount, Rear
3. Engine Mount, left front;



602150

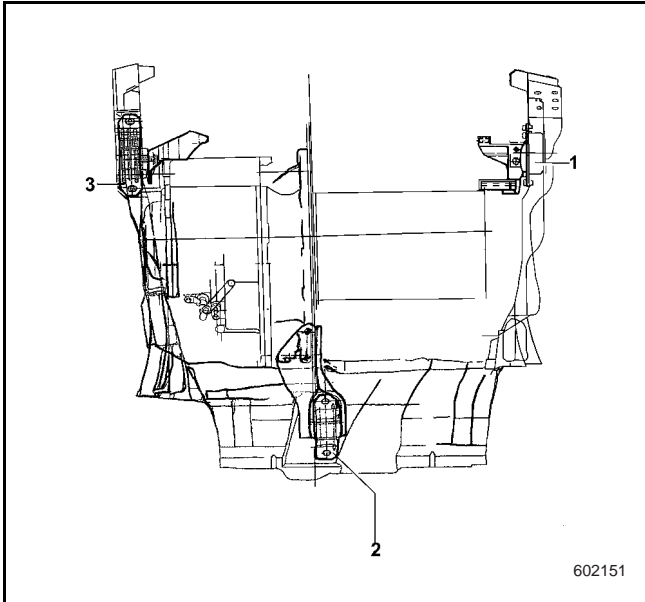
6.1.5.3 Engine mount Inspection

Tools Required

- KM-263-B engine axle
- MKM-883-1 Engine Axle

Vehicle with automatic transmission (AT)

1. Engine Mount, right upper;
2. Engine Mount, Rear
3. Engine Mount, left front;



6.1.6 Special Tools


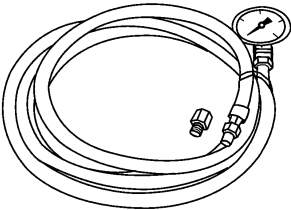
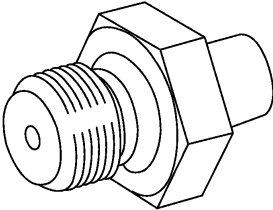
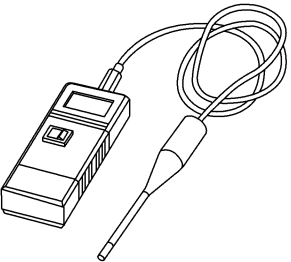
Illustration	Tool Number/Name
 <p>J35667-A</p>	J 35667-A Cylinder Leakage Tester
 <p>KM-498-B</p>	KM-498-B Engine Oil Pressure Meter
 <p>KM-135</p>	KM-135 Adaptor assorted with KM-498-B to measure the engine oil pressure.
 <p>KM-596-A</p>	KM-596-A Engine Oil Temperature Gauge

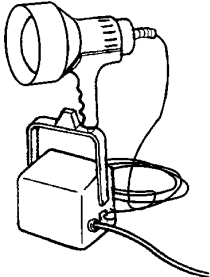
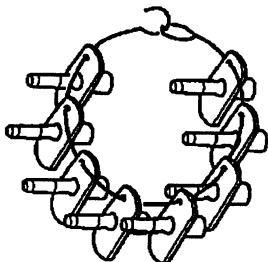
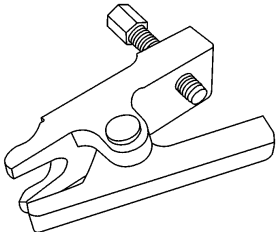
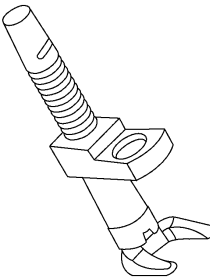
Illustration	Tool Number/Name
 <p>J28428-E</p>	J 28428-E High Intensive Invisible Light Lamp
 <p>KM-807</p>	KM-807 Quick Pipe Plug
 <p>J-810902</p>	J -810902 Camshaft Sealing Ring Installation
 <p>J-830601</p>	J -830601 Valve Spring Compressor

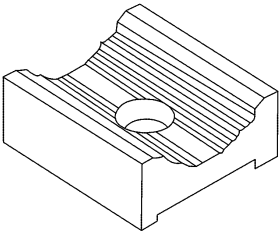
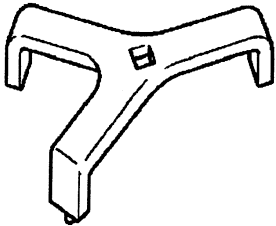
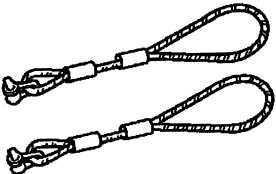
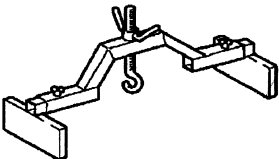
Illustration	Tool Number/Name
 J-8606014	J-8606014 与 9406188 Remove the piston pin base seat, apply
 KM-797	KM-797 Fuel Pump Remover
 KM-2358	KM-2358 Engine Hoist Steel Wire Rope
 KM-263-B	KM-263-B engine suspension rack

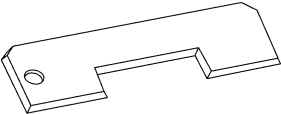
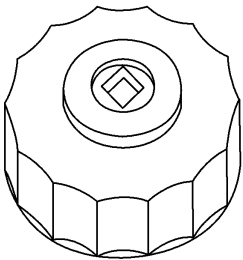
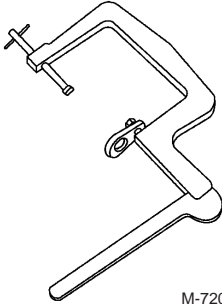
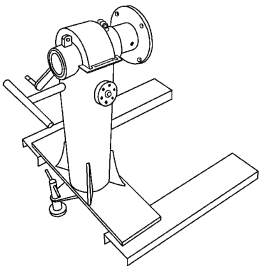
Illustration	Tool Number/Name
 KM-419	KM-419 Valve Gear Height Gauge
 KM-726-A	KM-726-A Engine Oil Filter Removal Mechanism
 M-720601	M-720601 and V- 8606027 to carry out valve installation and removal.
 M-780668	M-780668 Engine SupportBracket

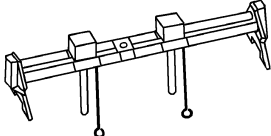
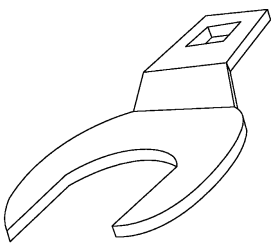
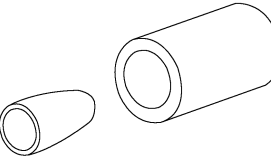
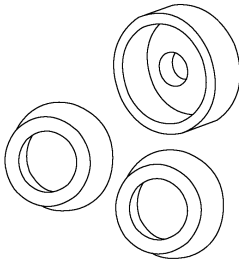
Illustration	Tool Number/Name
 <p>MKM-883-1</p>	MKM-883-1 engine suspension rack
 <p>S-9406184</p>	S-9406184 Timing Gear Belt Tension
 <p>S-9406185</p>	S-9406185 Camshaft Sealing Ring Installation
 <p>S-9406186</p>	S-9406186 Camshaft Rear Sealing Ring Installation

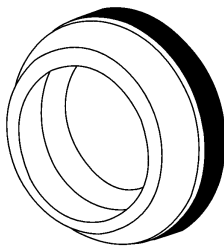
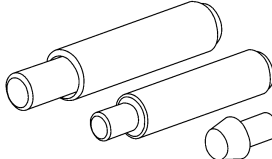
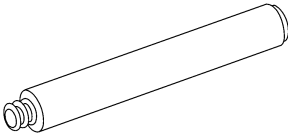
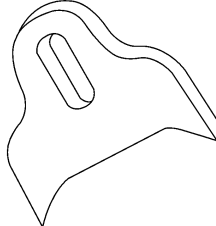
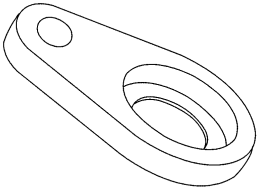
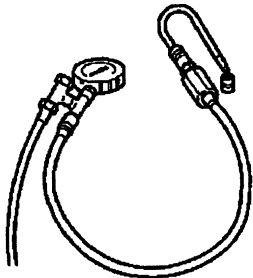
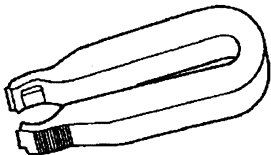
Illustration	Tool Number/Name
 <p>S-9406187</p>	S-9406187 Piston Installation
 <p>S-9406188</p>	S-9406188 piston pin pulling out and installation
 <p>S-9406189</p>	S-9406189 Connecting Rod Guide Rail
 <p>S-9407182</p>	S-9407182 Flywheel Lock

Illustration	Tool Number/Name
 V-8606027	M-720601 and V-8606027 to carry out valve installation and removal.
 KM-J-3473091	KM-J-3473091 Oil Pressure Gauge
 KM-796	KM-796 Oil Passage Quick-connect Fitting Removal

Blank

6.2 Engine Cooling System

6.2.1 Specification

6.2.1.1 Fastener Tightening Torque

Application	Specification
Coolant Recycle Liquid Storage Attaching Nut	1.5-2.5 N•m
Cooling Fan Attaching Bolt	3.5-4.5 N•m
Cooling Fan Blade Nut	4.0-6.0 N•m
Radiator Support Bracket Attaching Bolt	6.0-8.0 N•m
Impact Bar Bolts	7.0-9.0 N•m
Thermostat Housing Bolts	11 ± 3 N•m
Water pump bolt	7 ± 3 N•m

6.2.1.2 Engine Cooling System Capacity

Application	Specification
1.6V Engine (L01)	5.8 L

6.2.2 Schematic and Routing Diagrams

6.2.2.1 Cooling System Wiring Diagram

Refer to 8.20.2.21

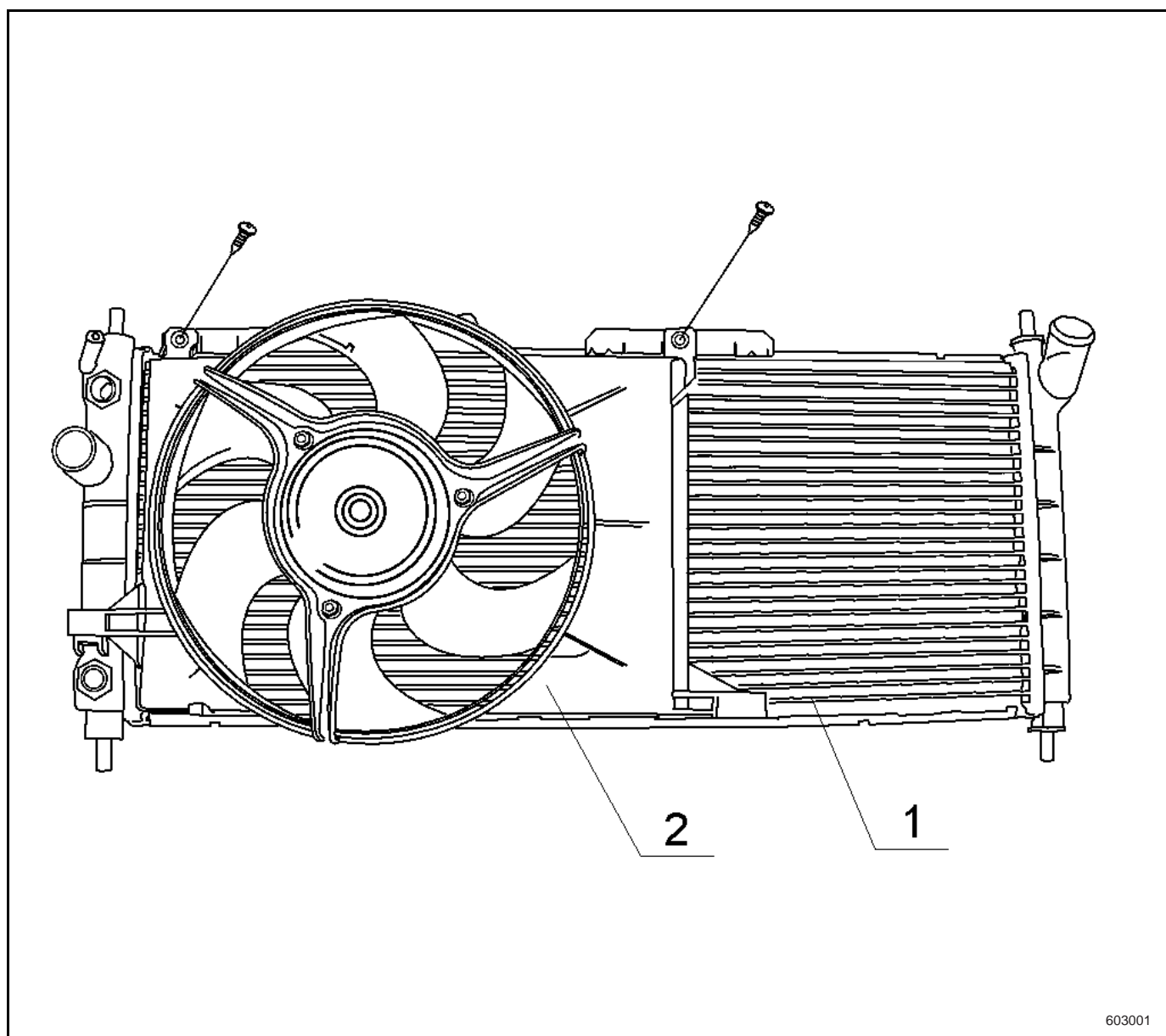
6.2.3 Component Position

6.2.3.1 Cooling System Component Position

Name	Location	Locator View	Connector End View
Engine Cooling Fan Motor	Installed at the left side of the radiator	Refer to Cooling System Component View in Engine Cooling System	Refer to Cooling System Connector End View in Engine Cooling System
Condenser Assembly Fan Motor	Installed at the right side of the condenser assembly	Refer to Cooling System Component View in Engine Cooling System	Refer to Cooling System Connector End View in Engine Cooling System
Engine control module (ECM)	Right lower side of the copilot driver compartment	—	Refer to Engine Control System Connector End View in Engine Control System

6.2.3.2 Cooling System Component View

Under the right rear part of the radiator



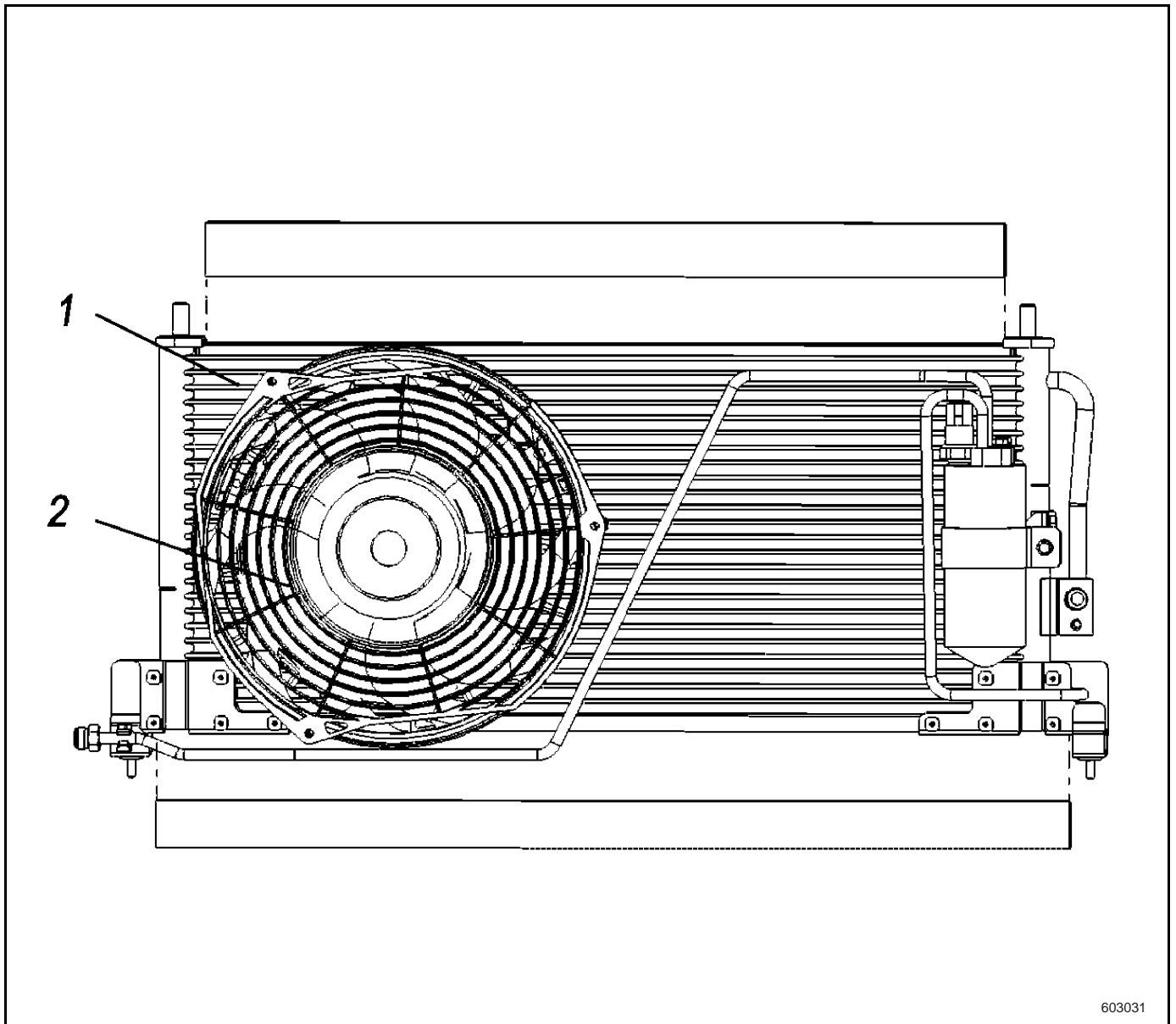
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Legend

(1) Radiator

(2) Engine Cooling Fan

Cooling Fan Right Front Side



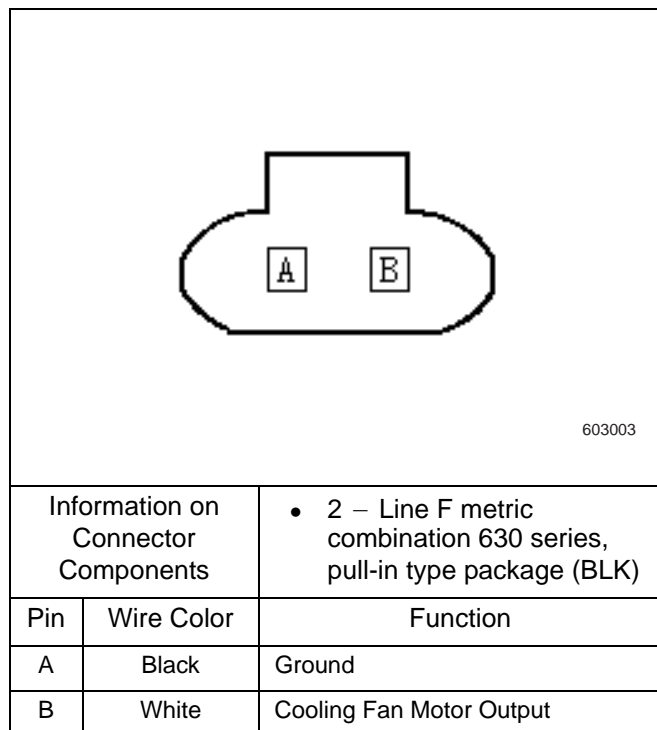
Legend

(1) Condenser

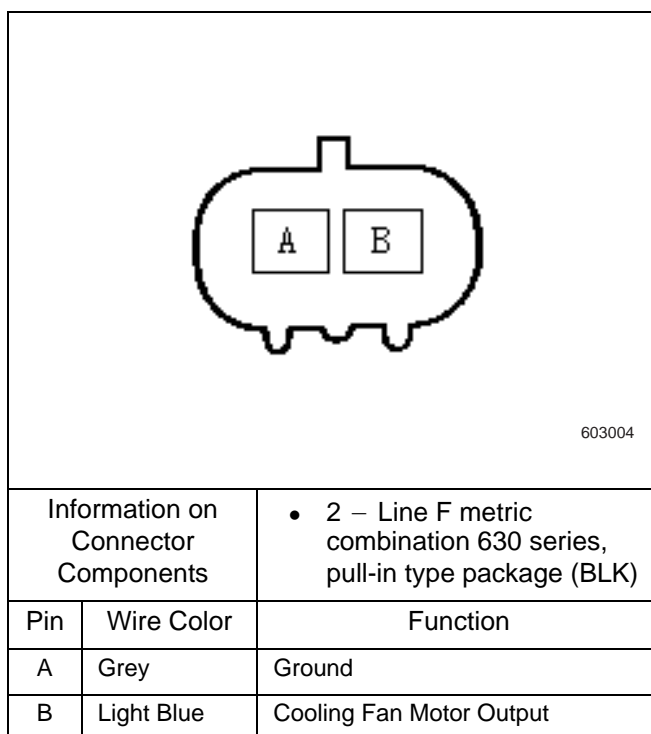
(2) Condenser Fan

6.2.3.3 Cooling System Connector End View

Engine Cooling Fan Motor



Condenser Fan Motor



6.2.4 Diagnostic Information and Procedures

6.2.4.1 Engine Overheating

Step	Action	Value	Yes	No
Definition: The engine temperature indicator light illuminates and maintain this status, and during the engine operation, the temperature gauge indicates heating or overflow of coolant from the coolant container to the ground.				
1	Inspect for a loss of coolant. Is there a loss of coolant?	—	Go to Step 2	Go to Step 3
2	Refer to Loss of Coolant Is the engine overheating?	—	Go to Step 3	System OK?
3	Inspect for a loss of the system pressure. <ul style="list-style-type: none"> J 24460-01 Refer to Coolant System Leakage Test. Inspect for a loss of the system pressure?	—	Go to Step 4	Go to Step 5
4	Calibration of the system pressure Is the engine overheating?	—	Go to Step 5	System OK?
5	<ul style="list-style-type: none"> Inspect for low coolant protection. Ensure the solution to maintain the designated temperature. Is there any low coolant protection?	-39C	Go to Step 6	Go to Step 7
6	Perform calibration when necessary. Is the engine overheating?	—	Go to Step 7	System OK?
7	Inspect the radiator fins for blockage. Are the radiator fins clogged?	—	Go to Step 8	Go to Step 13

6.2.4.1 Engine Overheating(Cont' d)

Step	Action	Value	Yes	No
8	1. Remove or reinstall attached components preventing air from entering into the radiator. 2. Remove chips on the radiator fins. Is the engine overheating?	—	Go to Step 9	System OK?
9	Inspect the cooling system passages for rust or scale. Are any of the cooling system passages blocked by rust or scale?	—	Go to Step 10	Go to Step 15
10	1. Drain the cooling system.Refer to Draining and Filling Cooling System. 2. Flush the cooling system.Refer to Flushing. 3. Repair it if necessary. Is the engine overheating?	—	Go to Step 11	System OK?
11	Inspect for pinched or kinked coolant recovery reservoir hose. Is the reservoir hose pinched or kinked?	—	Go to Step 12	Go to Step 17
12	Replace or reroute the hose as necessary.Refer to Coolant Reservoir Replacement Is the engine overheating?	—	Go to Step 13	System OK?
13	Check for inoperative cooling fans.Refer to Electric Cooling Fan Diagnosis in Engine Controls. Are there any inoperative cooling fans?	—	Go to Step 14	Go to Step 19
14	Repair or replace the electric cooling fans as necessary.Refer to Cooling Fan Replacement - Electric . Is the engine overheating?	—	Go to Step 15	System OK?
15	Check for a loose, damaged, and/or missing deflector. Are there any loose, damaged, or missing deflectors?	—	Go to Step 16	Go to Step 21
16	Replace the deflectors. Is the engine overheating?	—	Go to Step 17	System OK?
17	Check for a faulty radiator. Is the radiator faulty?	—	Go to Step 19	—
18	Install the correct radiator.Refer to Radiator Replacement. Is the engine overheating?	—	—	System OK?

6.2.4.2 Loss of Coolant

Step	Action	Value	Yes	No
1	Inspect for fitted or incorrect coolant reservoir cover Refer to Pressure Cover Test. Is the pressure cover installation correct, or is it faulty?	—	Go to Step 2	Go to Step 3
2	Replace the filler cap Is there a loss of coolant?	120 kPa	Go to Step 3	System OK?
3	Check for a leaking coolant recovery reservoir or reservoir hose. Is the coolant recovery reservoir leaking, or is the reservoir hose leaking?	—	Go to Step 4	Go to Step 5
4	Replace the reservoir or the hose.Refer to Coolant Reservoir Replacement Is there still a loss of coolant?	—	Go to Step 5	System OK?
5	Check for any loose or damaged radiator hoses and connections. Are any radiator hoses loose or damaged?	—	Go to Step 6	Go to Step 7

6.2.4.2 Loss of Coolant(Cont' d)

Step	Action	Value	Yes	No
6	Re-seat the hoses and clamps.If necessary, replace the hoses and the clamps. Refer to Radiator Hose Replacement - Inlet Is there still a loss of coolant?	—	Go to Step 7	System OK?
7	Check for a water pump gasket leak. Is there a leak at the water pump gasket?	—	Go to Step 8	Go to Step 9
8	Replace the water pump gasket. Refer to Water Pump Replacement. Is there still a loss of coolant?	—	Go to Step 9	System OK?
9	Check for a seal leak at the water pump. Is there a leak at the water pump seal?	—	Go to Step 10	Go to Step 11
10	Replace the water pump Refer to Water Pump Replacement. Is there still a loss of coolant?	—	Go to Step 11	System OK?
11	Inspect the radiator for coolant leakage.Refer to Coolant System Leakage Test. Is there a leak at the radiator?	—	Go to Step 12	Go to Step 15
12	1. Inspect the radiator. 2. If necessary replace the radiator.Refer to Radiator Replacement. Is there still a loss of coolant?	—	Go to Step 13	System OK?
13	Inspect the following for leaks: <ul style="list-style-type: none"> • The intake manifold • Throttle Body Heater • Heater Core Is there a leak at these positions?	—	Go to Step 14	System OK?
14	Make the necessary repairs or replace the components as necessary in order to repair the leak. Is there still a loss of coolant?	—	—	System OK?

6.2.4.3 Coolant Concentration Testing

Coolant Concentration Tester

Due to a worldwide shortage of Ethylene Glycol, some coolant manufacturers have started to mix other types of glycol into their coolant formulations.Propylene glycol is the most common new ingredient.A hydrometer will not always provide a correct measurement of freeze protection when anything other than ethylene and water is being tested.The degree of inaccuracy will vary depending on the proportion other than glycols present in the coolant.

All GM vehicle are produced with coolant you can accurately measure with a hydrometer.However, when the type and quality of the coolant being measured is unknown, such as a vehicle that has accumulated mileage, use a refractometer.

Use coolant testers J 26568 or J 23688 to check the antifreeze protection of the coolant.The marking of the refractometer must be correct.Unless J 23688 of J 26568 has a provision for temperature correction, test the temperature at which J 26568 or J 23688 is

calibrated.If the coolant is warmer or cooler, the reading may be incorrect.Follow the manufacturer's directions on using J 26568 or J 23688.

Test procedure

Tools Required

- J 23688 Coolant Tester (Fahrenheit Scale)
- J 26568 Coolant Tester (Fahrenheit Scale)

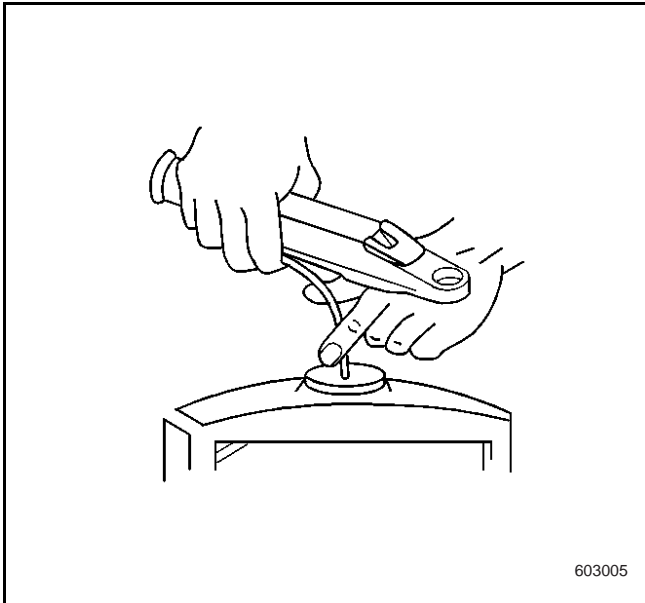
Note:

- Both J 23688 and J 26568 automatically compensate for temperature.
 - Before each use, swing back the plastic cover at the slanted end of the coolant tester, exposing the measuring window and the bottom of the plastic cover.
 - Wipe the measuring window dry with a tissue or a clean, soft cloth.
 - Close the plastic cover.
1. Release the tip of the pump from the housing of the J 23688 or J 26568.

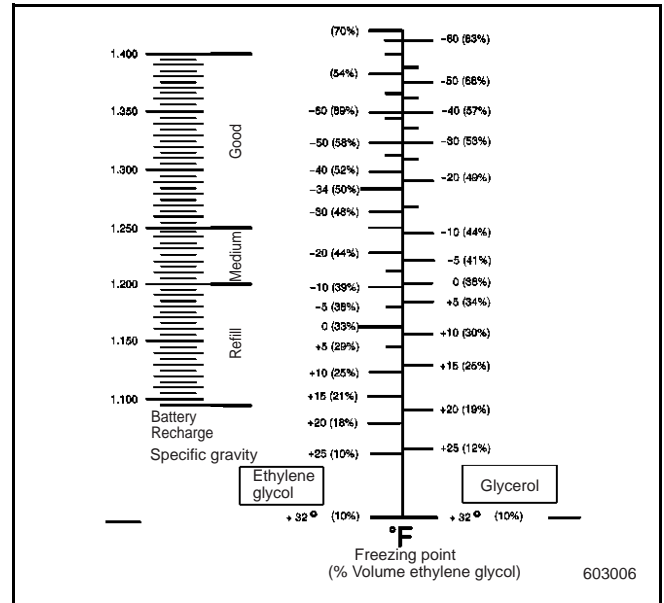
2. Do not remove the clear plastic pump from the J 23688 or J 26568.

Caution: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the pressure cap while the engine is hot and pressure is high will cause the solution to boil -instantaneously possibly with explosive force -spewing the solution over the engine, fenders and the person removing the cap.

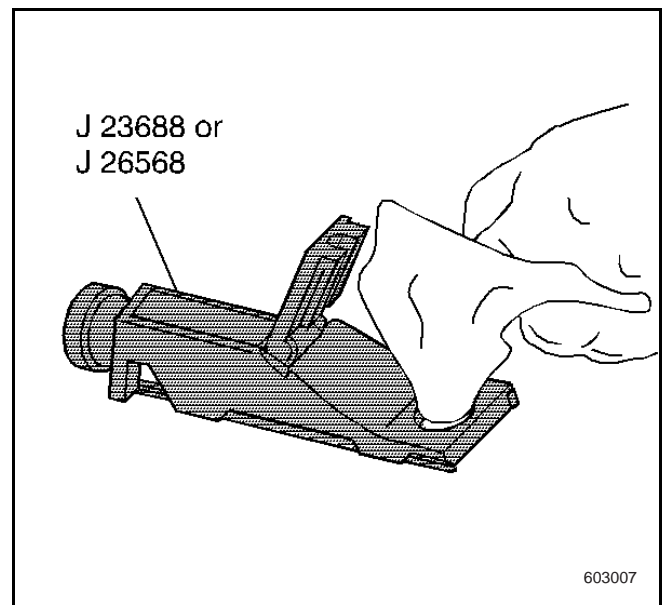
3. Unscrew the pressure cap.



4. Insert the tip of the pump into the coolant reservoir. The tip of the pump must be below the level of the coolant.
5. Press the bulb. Release the pump bulb in order to obtain a sample of the coolant.
6. Bend the tube around the J 23688 or the J 26568. Insert the tip of the pump into the cover plate opening.
7. Press the pump bulb. Allow a few drops to fall onto the measuring surface. Do not open the plastic cover when taking readings because any water evaporation will change the reading.



8. Point the coolant concentration tester toward any light source. Look into the eyepiece.
 - The coolant protection reading is at the point where the dividing line between light and dark crosses the scale. Antifreeze protection is the scale on the right.
 - The temperature scale is reversed from a standard thermometer scale. Below zero readings are on the upper half of the scale.
9. If the readings are not clear, properly clean and dry the measuring surface. Make sure there is enough fluid on the measuring surface.



6.2.4.4 Fuel System Leakage Testing.

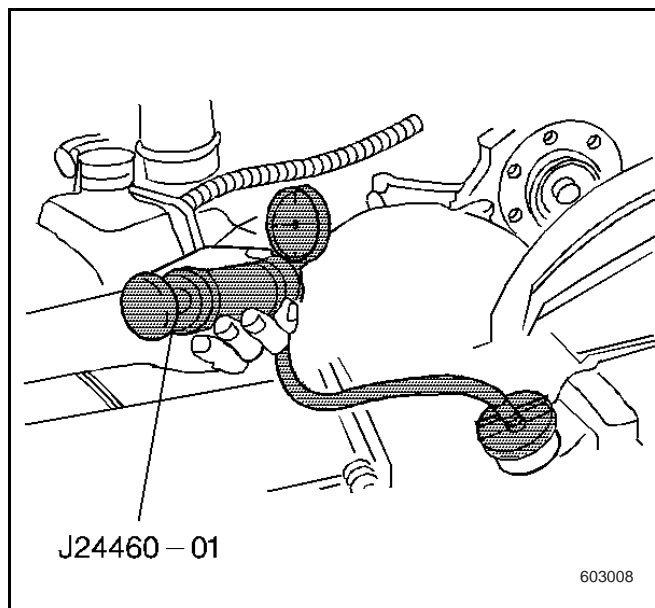
Leak Testing

1. Add water to the radiator to detect core leaks. Clean the core in order to make it easier to find the damaged area.
2. Remove dirt and insects from the from the fins with a common hose without a nozzle. Excessive water pressure could damage the fins.
3. Clean the radiator core with a soft brush. Flush with clean hot water or hot water with pH-neutral cleaning agent.

On-Vehicle Testing

Tools Required

- J 24460-01 Cooling System Tester
1. Pressure test the aluminum/plastic radiator using a common pump and pressure gauge.
 2. Make sure the cooling system is at a cool temperature, then remove the radiator cap.

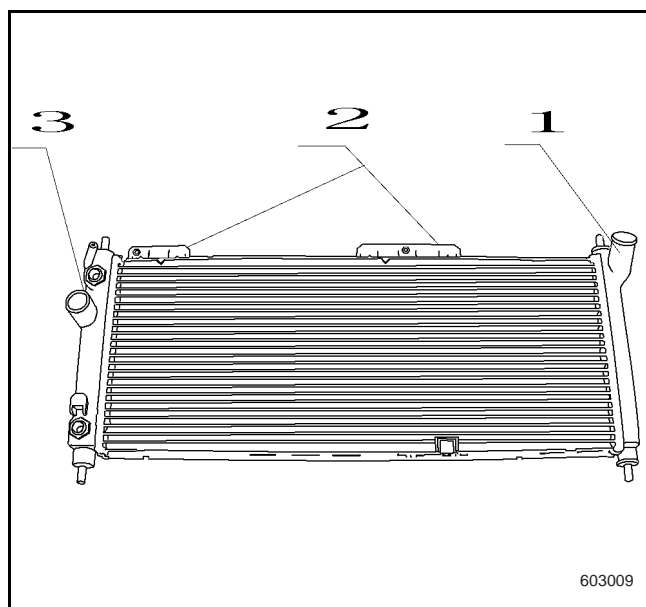


3. Connect the gauge and apply normal system operating pressure. Do not exceed 150 kPa.
4. Watch the gauge needle for an indication of a leak.
5. Examine the radiator and other cooling system parts for signs of escaping coolant.
6. Repair all hoses and hose connections as required.
7. Check the radiator cap to ensure that it will maintain the correct pressure.
8. If the radiator is leaking during the pressure test, mark the leak area in order to find the leak once the radiator is removed.

Off-Vehicle Testing

Note: Never use compressed air to pressure test a radiator that is not regulated to 159 kPa. Pressure over 150 kPa will damage the radiator.

Do not use the boil-out tanks or vats or other tanks that have been used for copper and brass radiators. The flux, acid and caustic cleaners remaining in these tanks will attack the aluminum and cause radiator failure. A separate test tank containing clean water is strongly recommended for servicing an aluminum/plastic radiator.



1. Install the test fittings or rubber test caps in the inlet and outlet necks and seal the oil cooler footing with metal plugs. This will protect the cooler and keep the fluid from running out.
2. Attach the pressure tester and gradually apply air pressure.
 - Do not exceed 150 kPa.
 - Check pressure gauge to see if there is a pressure drop.
 - To ensure that there are no small leaks, run water over the repair area and look for bubbles. (A mild detergent is very helpful)
 - If a large water tank is available, submerge the radiator and check for bubbles at the following locations:
 - Inlet Tank(1)
 - Core tubes(2)
 - Outlet Tank(3)

6.2.4.5 Pressure Cover Test.

Tools Required

- J 24460-01 Cooling System Tester

Caution: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the pressure cap while the engine is hot and pressure is high will cause the solution to boil -instantaneously possibly with explosive force -spewing the solution over the engine, fenders and the person removing the cap.

Use the outlined instructions in Pressure Cap Description in order to remove the cap:

1. Remove the cap.
2. Wet the radiator cap gasket with water.
3. Wash off any sediment from the sealing surface.
4. Install the cap to the J 24460-01.
5. Use the plunger handle of the J 24460-01 in order to increase the pressure as specified on the cap.
6. Note the rate of decrease in the pressure.
7. The specified reading of the pressure should remain within the corresponding pressure scale for more than 10 seconds.
8. Replace the radiator cap if it does not maintain the pressure for more than 10 seconds.

6.2.5 Repair Instructions

6.2.5.1 Draining and Filling Cooling System.

Ethylene glycol/water fill ratio have been established to ensure a minimum of 50 percent ethylene glycol. Ensure that all engine block drains and air bleeds are utilized.

The cooling system capacity is 5.8 liters for 1.6v engine. Capacities listed in the filling procedure include the extra amount of air remained in the coolant system discharging after performing static refilling.

Follow the correct filling ratio and the following procedure to ensure a minimum concentration of 50 percent ethylene glycol in the cooling system. Every five years or 240,000 km, whichever occurs first, the cooling system should be drained and filled using the following procedure.

Caution: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the pressure cap while the engine is hot and pressure is high will cause the solution to boil -instantaneously possibly with explosive force -spewing the solution over the engine, fenders and the person removing the cap.

Note: When adding coolant, it is important that you use GM Goodwrench DEX-COOL or HAVOLINE DEX-COOL coolant. If the Coolant other than DEX-COOL or HAVOLINE DEX-COOL is added to the system the engine coolant will require change sooner - at 50,000 km or 24 months.

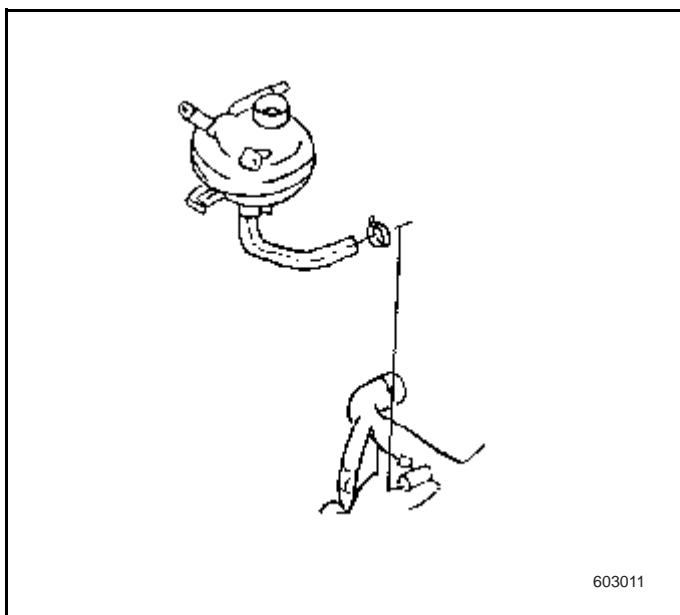
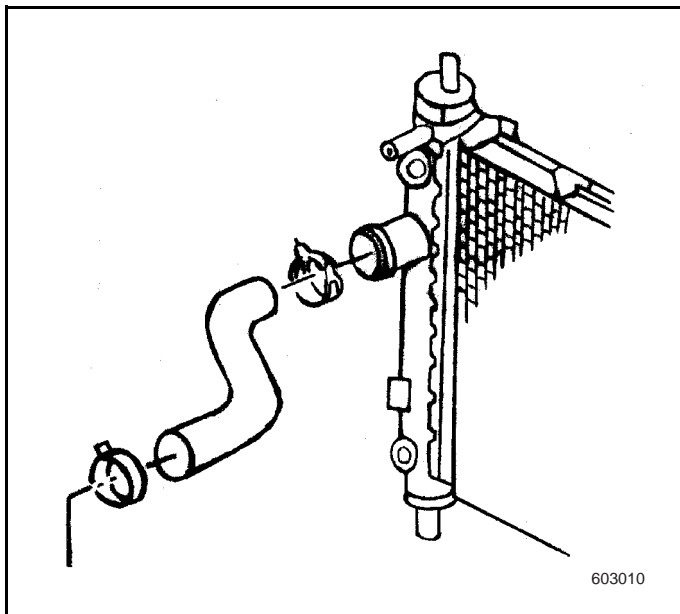
Draining

Note: The coolant can not be completely drained, unless when removing the water pump.

Note: This procedure significantly increases the amount of used coolant and diluted hazardous waste.

1. Park the vehicle on a level surface.
2. Use the following procedure to remove the coolant reservoir cap when the engine is cool.
 - Slowly rotating the cap counterclockwise to detent. Do not press down while rotating pressure cap.
 - Wait until any residual pressure (indicated by a hissing sound) is relieved.
 - After all the hissing stops, continue to rotate counterclockwise until the cap is removed.

Note: Recycle and store coolant in a used coolant holding tank, and periodically submit the used coolant for recycling. This procedure significantly increases the amount of used coolant and diluted hazardous waste.



3. Place a drain pan under the vehicle in order to collect all the drained coolant.
4. Release the radiator outlet hose clip at the rear left side of the radiator in order to remove the radiator outlet hose.

5. Release the hose from the coolant reservoir to the manifold inlet to remove the reservoir and the hose.

Note: It is only necessary to remove the radiator outlet hose and the reservoir hose when partially draining the system.

Note: Properly dispose of the used coolant, i.e. never pour the used coolant down the drain. Ethylene glycol antifreeze is a very toxic chemical, and disposing of ethylene glycol into the sewer system or ground water is illegal and ecologically unsound.

6. Allow the coolant to drain slowly from the system.

Refilling

Note: DO NOT use the cooling system sealant (or similar sealant), unless otherwise specified. The use of cooling system sealant (or similar compounds) may restrict coolant flow through the cooling system or the engine components. Restricted coolant flow may cause engine overheating and/or damage to the cooling system or the engine components/assembly.

1. Tighten the radiator outlet hose clip.
2. Flush the reservoir in order to discharge the waste water, and reinstall.

Note:

- When refilling the engine coolant system, add GM approved Ethylene Glycol Coolant DEX-COOL™ GM P/N12346290.

- If the cooling system is being refilled ONLY (no flush), a 50 percent ethylene glycol and 50 percent clean drinkable water mixture should be used to fill the system.
3. Follow the procedure below to fill the cooling system slowly through the coolant reservoir
 - 3.1 fill a 50 percent ethylene glycol and 50 percent clean drinkable water mixture until the coolant reaches between the MAX and MIN marks on the coolant reservoir.
 - 3.2 Wait two minutes, and inspect again the coolant if it reaches between the MAX and MIN marks on the coolant reservoir. If not, continue filling until it reaches the MIN mark.
 - 3.3 Start the engine and allow it the engine to warm up in order to let the coolant flow from the radiator into the reservoir, thus removing the air in the engine cooling system. Inspect again the coolant if it reaches between the MAX and MIN marks on the coolant reservoir. If not, continue filling until it reaches the MIN mark.
 4. Install the coolant reservoir cap in order to ensure the arrow on it to be in the same direction as the coolant overflow pipe.
 5. Inspect the freeze protection of the engine coolant after the engine heats up and cools down three times using a refractometer or a thermohydrometer to ensure proper freeze 19°C (-34°F) protection. Obtain some of the coolant mixture for the inspection from the coolant reservoir.

6.2.5.2 Flushing

Flushing Procedure

You can use various methods and equipment to flush the cooling system. If special equipment is used (such as a back flusher) follow the manufacturer's instructions.

6.2.5.3 Radiator Cleaning

Caution: NEVER spray water on a hot radiator. The resulting steam could cause personal injury.

Note: The radiator fins are necessary for good heat transfer. Do not brush the fins. This may cause damage to the fins, reducing heat transfer.

Note: Compressed air or water can be used to clean the radiator fins. Do not exceed 150 kPa. Pressure over 150 kPa will damage the radiator.

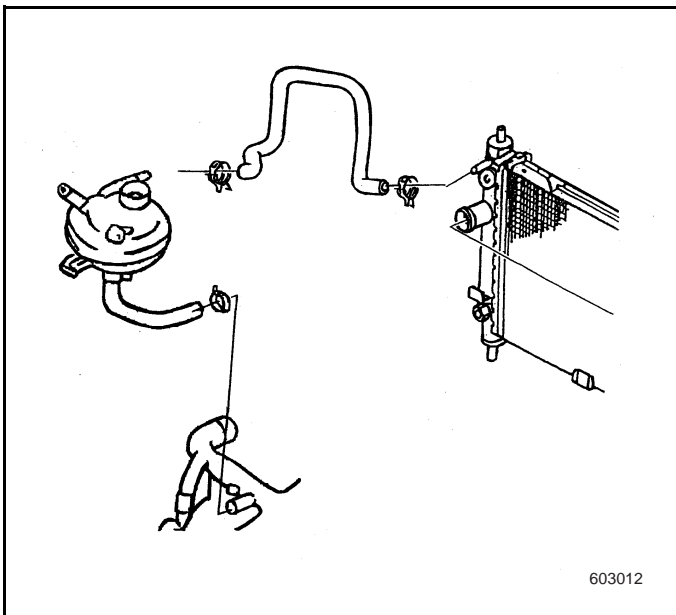
Clean the front face of the radiator annually.

- Clean the front face of the condenser.
- Remove bugs, leaves and debris by blowing compressed air through the radiator.
- Blow the air from the rear toward the front. If compressed air is not available a water hose can be used to force water through the radiator.
- Use water only with the engine not running and cool.

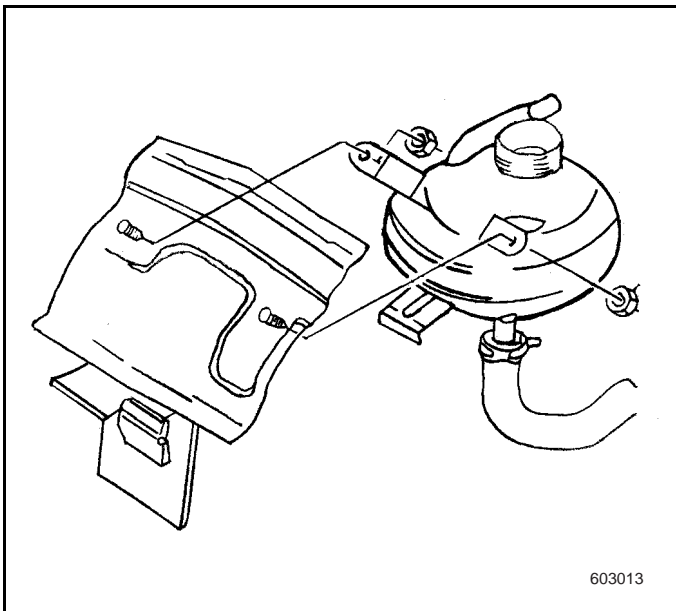
6.2.5.4 Coolant Reservoir Replacement

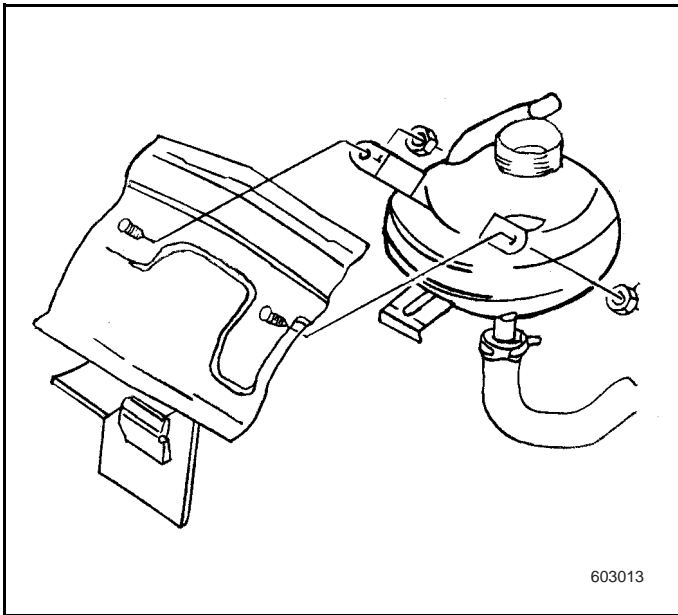
Removal Procedure

1. Remove the reservoir hose and the manifold clips, and the hose stretched out from the radiator overflow neck fitting.



2. Remove the nuts at the fire wall.
3. Remove the coolant reservoir from the lower support and fire wall.
4. Drain the coolant reservoir. Refer to Draining and Filling Cooling System.





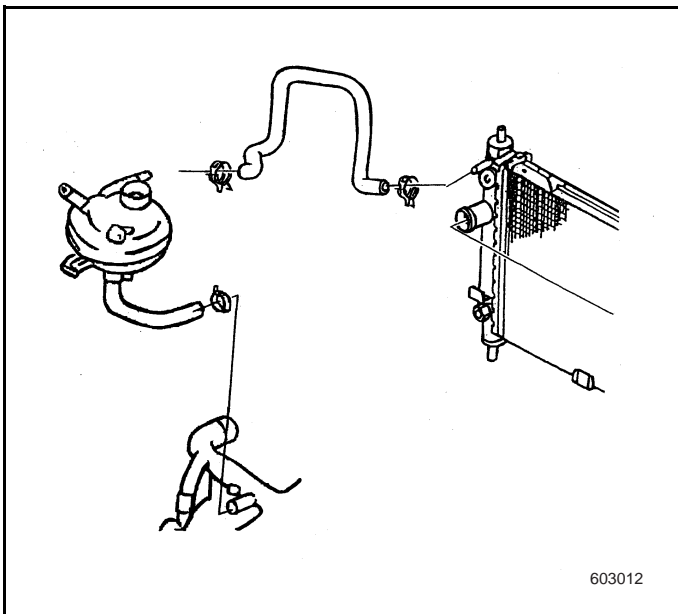
Installation Procedure

1. Install the coolant reservoir to the lower support and fire wall.
2. Install the nuts to the stud on the shock absorber support.

Tightening

Tighten the nuts to 1.5-2.5 N•m

3. Lubricate the reservoir hose with clean water. Route the hose to the radiator overflow neck fitting. Route the hose to the coolant manifold.

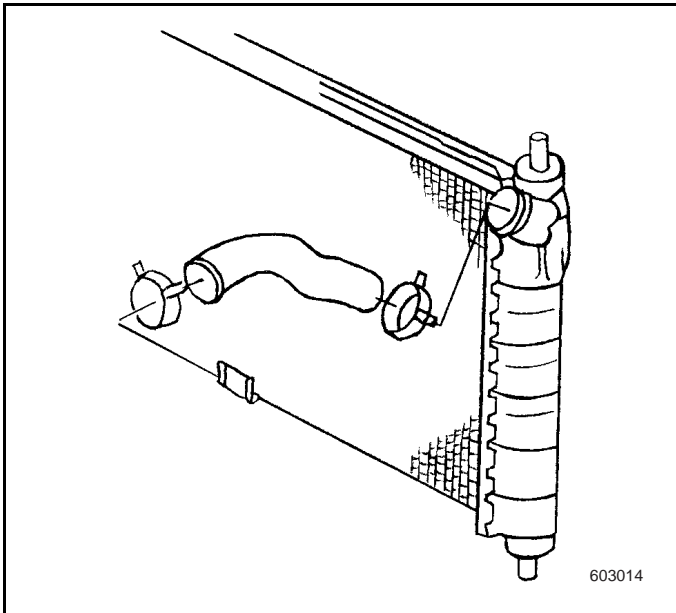


4. Install the reservoir hose and the clip.
5. Fill the coolant reservoir. Refer to Draining and Filling Cooling System.

6.2.5.5 Radiator Hose Replacement - Inlet

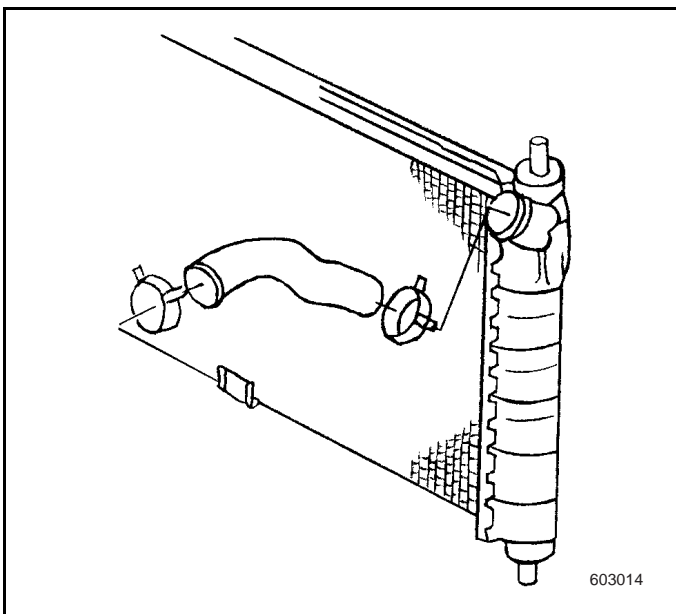
Removal Procedure

1. Drain the cooling system components. Refer to Draining and Filling Cooling System.
2. Remove the inlet hose from the thermostat housing.
3. Remove the inlet hose from the radiator..
4. Remove the inlet hose.



Installation Procedure

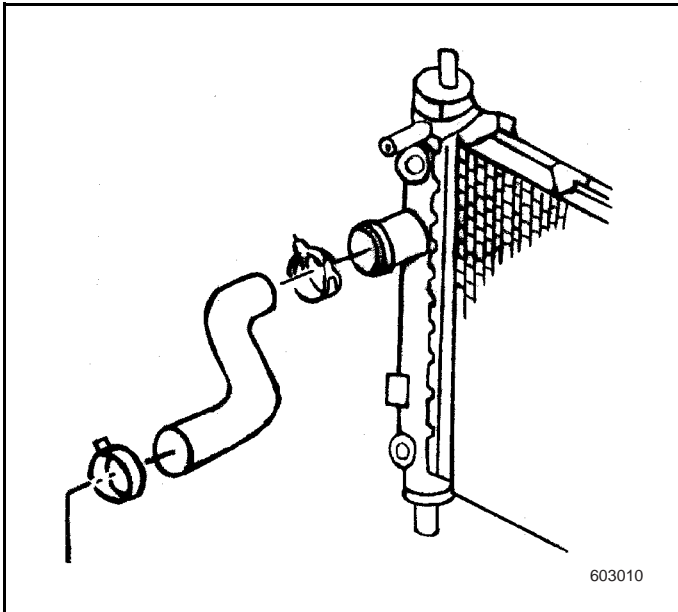
1. Position the inlet hose and align the marks on the hose.
2. Connect the inlet hose to the radiator.
3. Connect the inlet hose to the thermostat housing.
4. Refill the coolant. Refer to Draining and Filling Cooling System.



6.2.5.6 Radiator Hose Replacement - Outlet

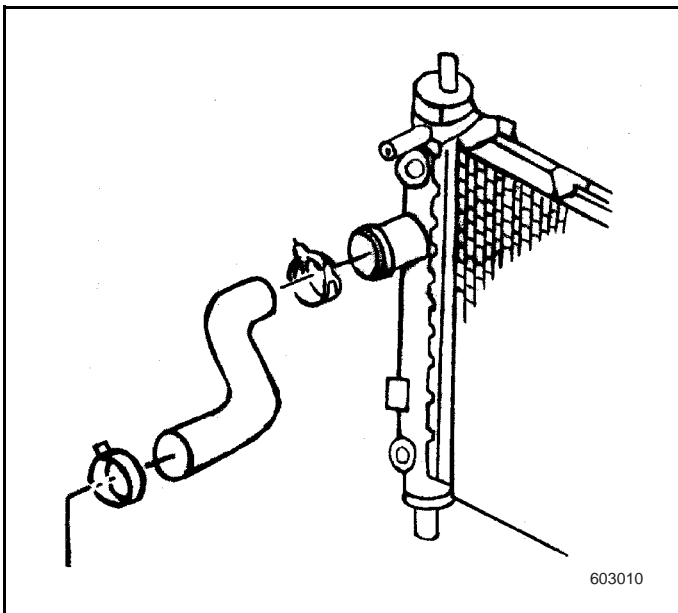
Removal Procedure

1. Drain the cooling system components. Refer to Draining and Filling Cooling System.
2. Remove the outlet hose from the engine cooling manifold.
3. Remove the outlet hose from the radiator..
4. Remove the outlet hose.



Installation Procedure

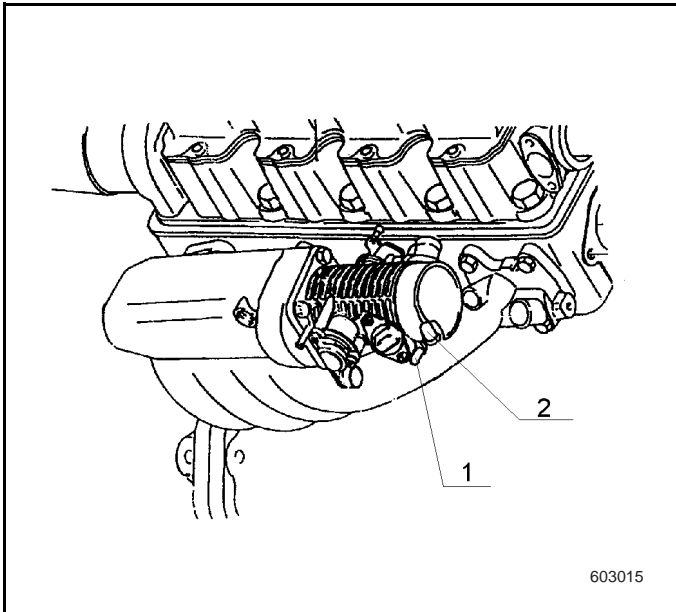
1. Position the outlet hose and align the marks on the hose.
2. Connect the outlet hose to the radiator.
3. Connect the outlet hose to the engine cooling manifold.
4. Refill the cooling system. Refer to Draining and Filling Cooling System.



6.2.5.7 Throttle Body Heater Hose Replacement-Inlet

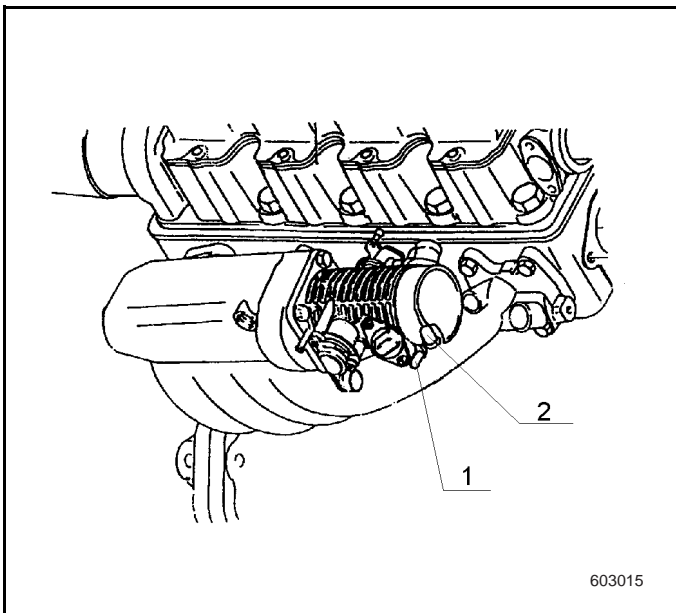
Removal Procedure

1. Drain the cooling system. Refer to Draining and Filling Cooling System.
2. Release the throttle body inlet pipe clip and the valve pipe, and close the heater water inlet valve.
3. Release the throttle body inlet hose (1) on the throttle body.
4. Remove the throttle body inlet hose (1).



Installation Procedure

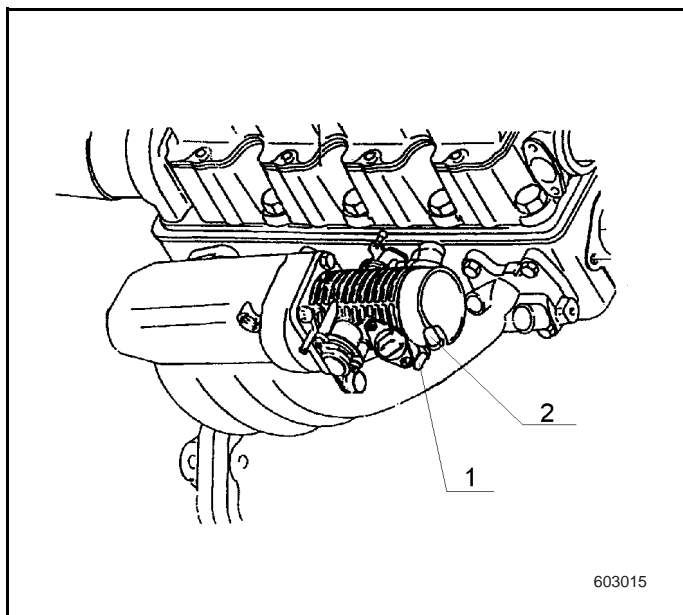
1. Install the throttle body inlet hose.
2. Tighten the throttle body inlet pipe clip and the valve pipe, and close the heater water inlet valve.
3. Connect the throttle body inlet hose and clip to the throttle body.
4. Refill the cooling system. Refer to Draining and Filling Cooling System.



6.2.5.8 Throttle Body Heater Hose Replacement-Inlet

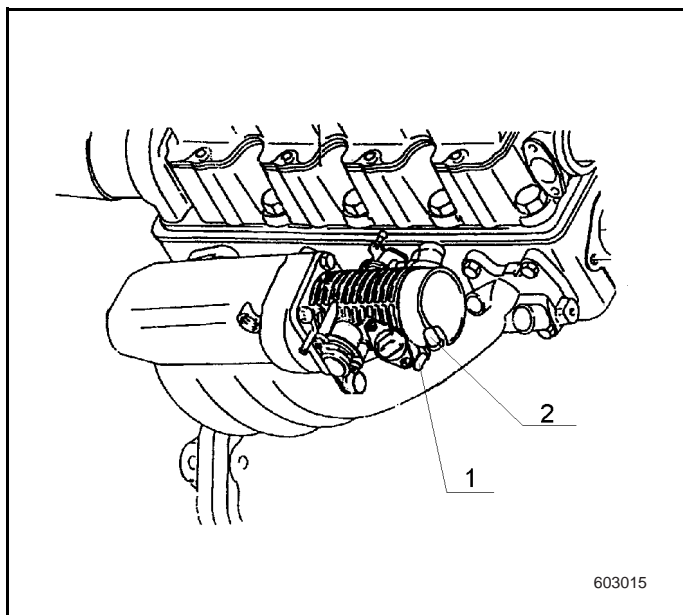
Removal Procedure

1. Drain the cooling system. Refer to Draining and Filling Cooling System.
2. Disconnect the throttle body outlet (2) hose clamp and the hose from the cooling pipe assembly.
3. Loosen the throttle body outlet hose clamp, and disconnect the hose from the throttle body.
4. Remove the throttle body outlet (2) hose.



Installation Procedure

1. Install the throttle body outlet (2) hose.
2. Connect the throttle body outlet hose and clamp to the throttle body.
3. Connect the throttle body outlet hose to the cooling pipe assembly.
4. Refill the cooling system. Refer to Draining and Filling Cooling System.



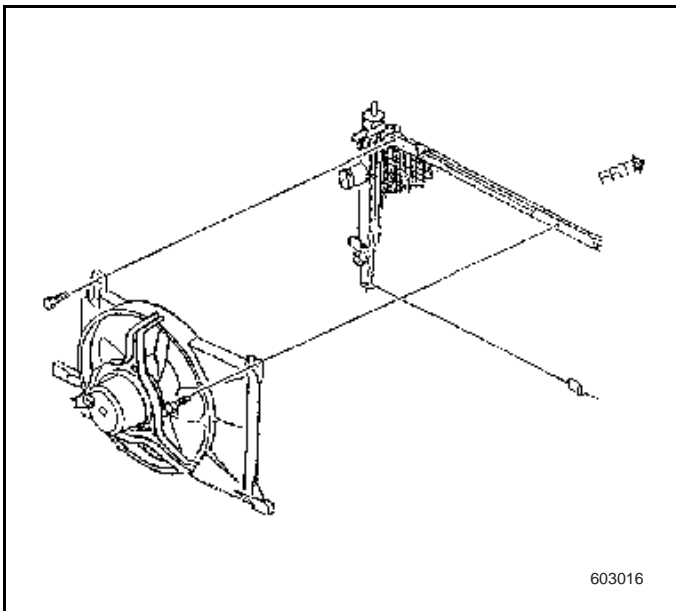
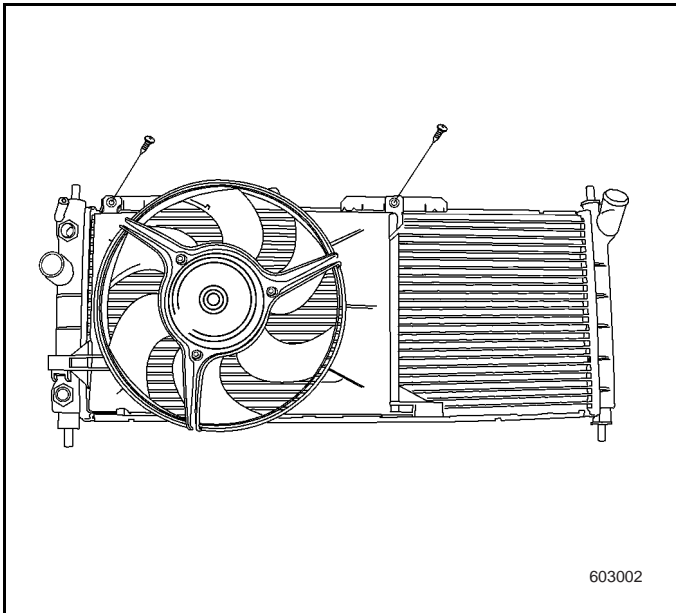
6.2.5.9 Cooling Fan Replacement-Electric

Removal Procedure

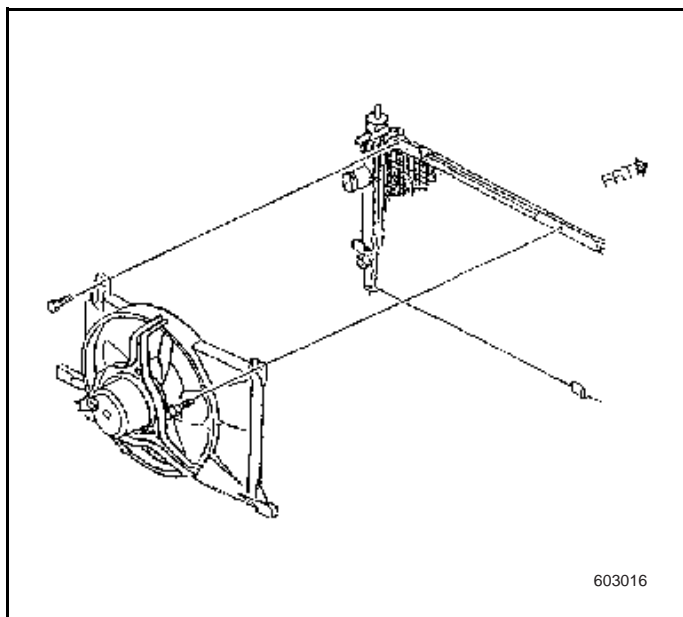
Caution: An electric fan under the hood can start up and injure you even when the engine is not running. Keep hands, clothing and tools away from any underhood electric fan.

Caution: To help avoid personal injury or damage to the vehicle, a bent, cracked, or damaged fan blade or housing should always be replaced.

1. Disconnect the engine cooling fan power.
2. Remove the fan shroud mounting bolts from the radiator.



3. Remove the engine cooling fan.



Installation Procedure

1. Install the cooling fan.
2. Install the fan mounting bolts.

Tightening

Tighten the nuts to 3.5 -4.5 N•m.

3. Connect the cooling fan power.
4. Inspect the fan motors for proper operation.

6.2.5.10 Cooling Fan Motor Replacement

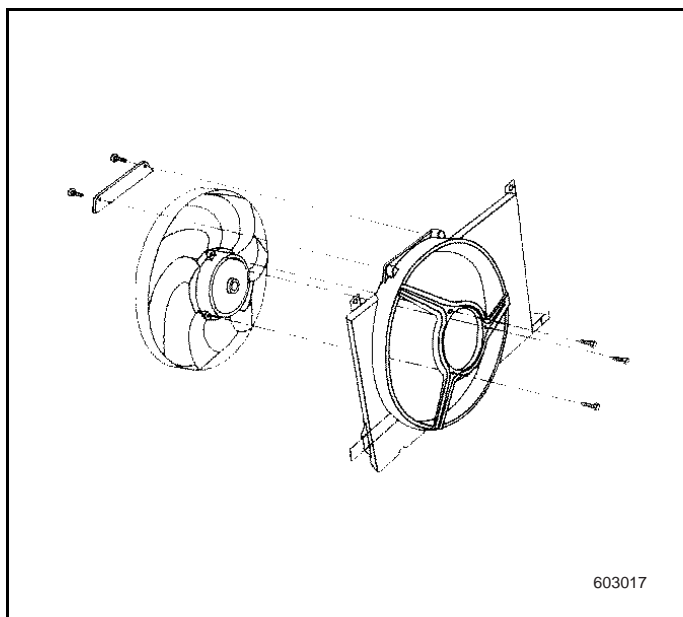
Removal Procedure

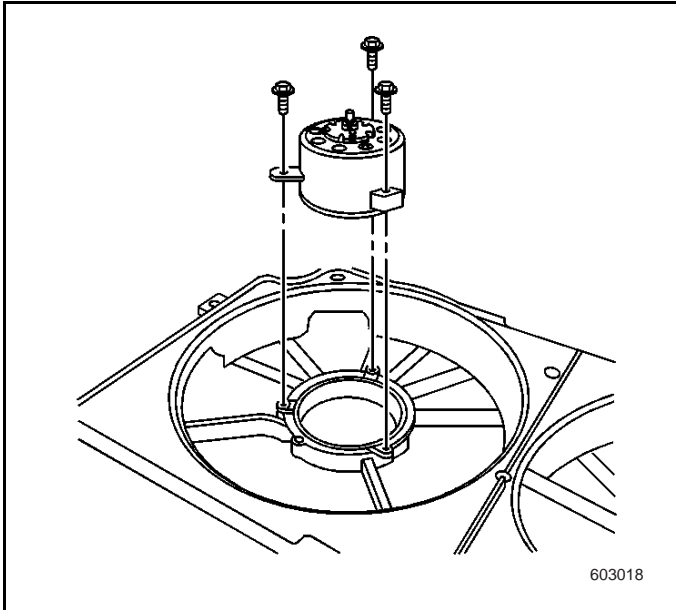
1. Remove the cooling fan assembly.
2. Remove the cooling fan shroud nuts, and remove the small shroud items from large items.
3. Remove the cooling fan shroud screws.
4. Remove the cooling fan blade and motor from the shroud.

Caution: If a fan blade is bent or damaged in any way, no attempt should be made to repair or reuse the damaged part. Always replace a bent or damaged fan blade. You cannot assure fan blade balance, and it may fly away from the fan in the future usage. This may cause extreme dangers.

The fan blades must remain in proper balance. You cannot assure fan blade balance once a fan blade has been bent or damaged. A fan blade that is not in proper balance could fail and fly apart during use, creating an extremely dangerous situation.

5. Inspect the cooling fan for the following conditions:
 - Bent or cracked cooling fan blades
 - Smoothness between the cooling fan blade and its mating surfaces
 - Remove burrs or other imperfections as necessary





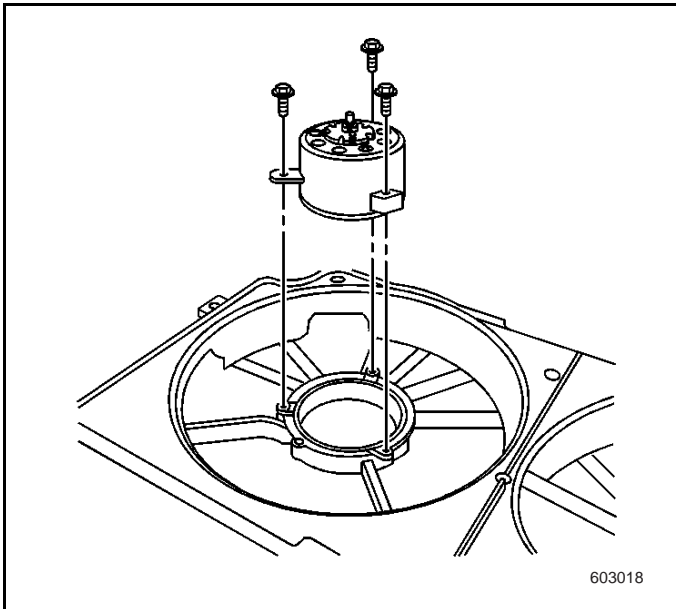
6. Remove the cooling fan motor bolts.
7. Remove the cooling fan motor.

Installation Procedure

1. Install the fan blade and motor to the shroud.

Tightening

Tighten the cooling fan blade and motor nuts to 4.0-6.0N•m.

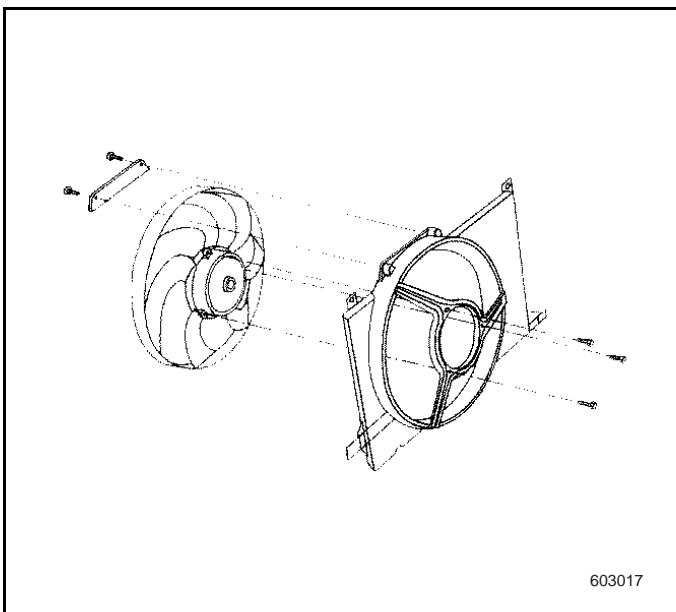


2. Install the small fan shroud.

Tightening

Tighten the cooling fan and motor to the fixed status.

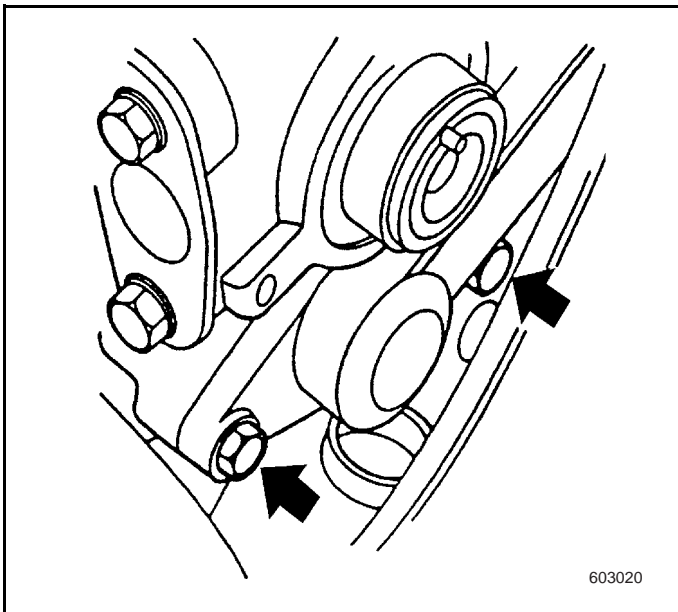
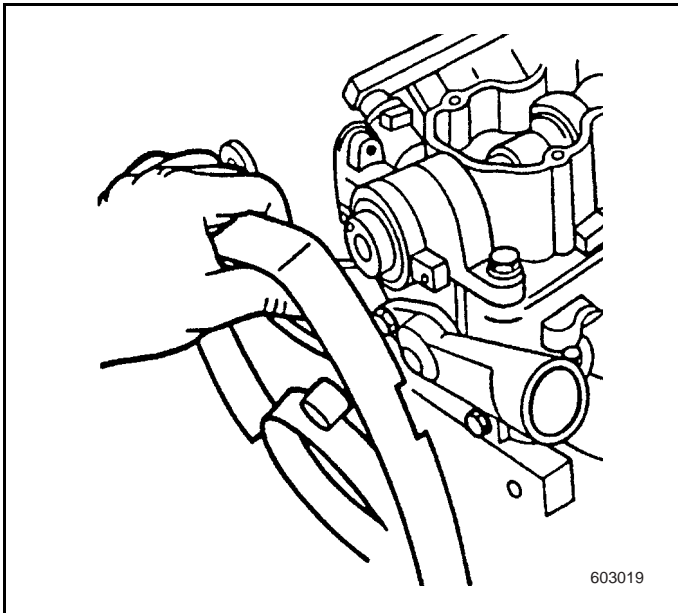
3. Install the cooling fan assembly. Refer to Cooling Fan Replacement-Electric
4. Inspect the fan motors for proper operation.



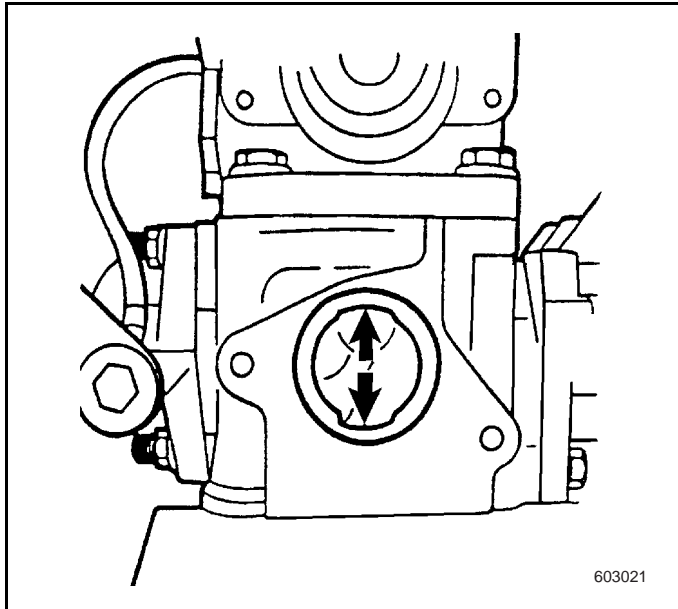
6.2.5.11 Thermostat Replacement

Removal Procedure

1. Remove the timing belt. Refer to Timing Belt Replacement.
2. Remove the camshaft timing belt pulley. Refer to Camshaft Timing Belt Pulley and Seal Ring Replacement.
3. Remove the timing belt cover bolts and the rear timing belt cover.



4. Screw off the thermostat bolts and remove.
5. Remove the thermostat.



Installation Procedure

1. Install the thermostat and the new gasket (if needed), and screw down the bolts.

Note: Put the gasket in place correctly and take care the re-entry port.

2. Screw down the bolts.

Tightening

Tighten the thermostat outside bolts to 11 ± 3 N•m.

3. Connect the hose to the thermostat.
4. Connect the inlet hose to the thermostat housing.
5. Install the rear timing belt cover.
6. Install the camshaft timing belt pulley. Refer to Camshaft Timing Belt Pulley and Seal Ring Replacement.
7. Install the timing belt. Refer to Timing Belt Replacement.

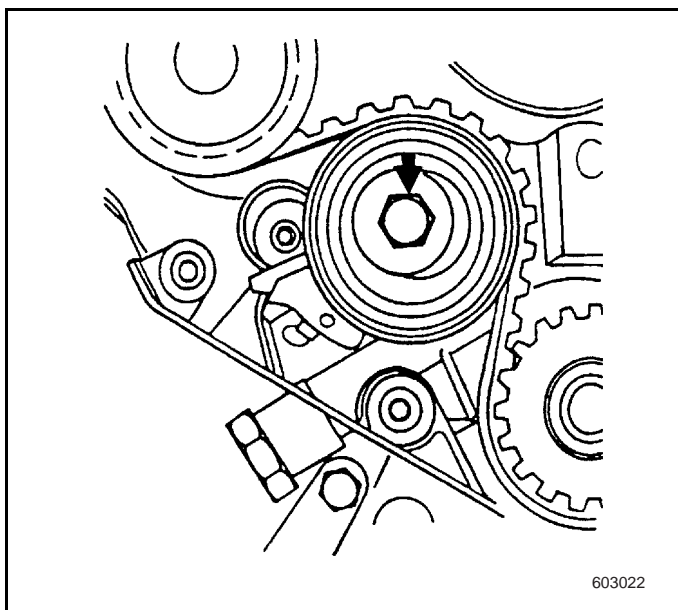
Note:

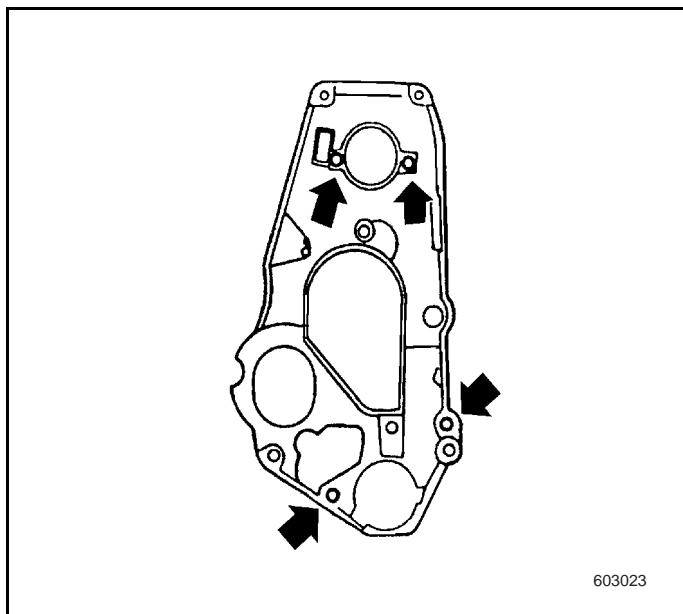
- Fill the system with drinkable water and 3.3L radiator protective fluid, P/N 9985451.
- Remove the water temperature bulb at the top of temperature control valve, and drain the air out of the engine block.
- After the system resumes, start the engine, allowing it to idle run at 900 rpm.
- After the air is drained, replace the bulb and continue to supply the coolant.

6.2.5.12 Water Pump Replacement

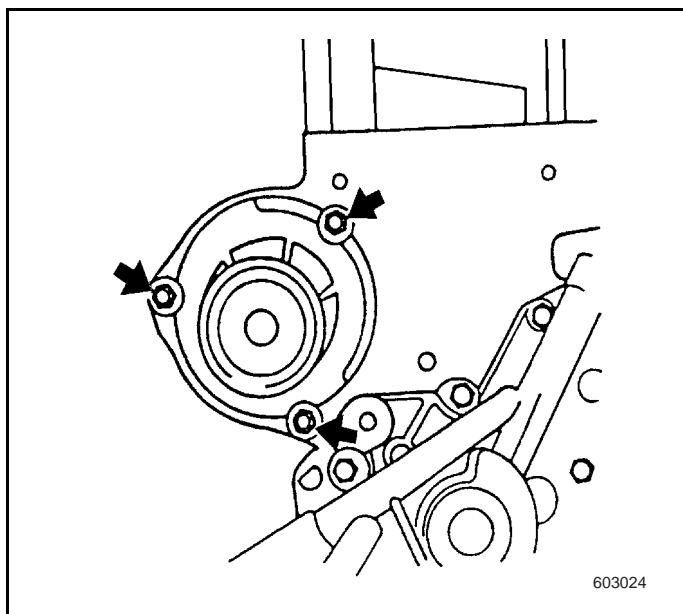
Removal Procedure

1. Remove the timing belt. Refer to Timing Belt Replacement.
2. Remove the camshaft timing belt pulley. Refer to Camshaft Timing Belt Pulley and Seal Ring Replacement.
3. Remove the crankshaft timing pulley from the crankshaft. Refer to Crankshaft Timing Pulley Replacement.
4. Screw off the timing belt tensioner pulley bolts, and remove the timing belt tensioner pulley.





5. Remove the rear timing belt cover.
6. Disconnect the lower radiator hose, and collect the coolant.
7. Screw off and remove the water pump bolts, remove the water pump.



Installation Procedure

1. Install the new seal ring (P/N 9158173), use silicon oxide grease to lubricate (P/N 9309994).
2. Mount the water pump onto the engine block, do not tighten the bolts to the specified torque.
3. Connect the lower radiator hose.
4. Install the rear timing belt cover.
5. Install the crankshaft timing pulley on the crankshaft. Refer to Crankshaft Timing Pulley Replacement.
6. Install the timing belt pulley on the camshaft. Refer to Camshaft Timing Belt Pulley and Seal Ring Replacement.
7. Install the timing belt. Refer to Timing Belt Replacement.
8. After adjusting the timing belt tensioner pulley, screw down the water pump bolts to the specified torque.

Tightening

Tighten the water pump bolts to $7 \pm 3 \text{ N} \cdot \text{m}$.

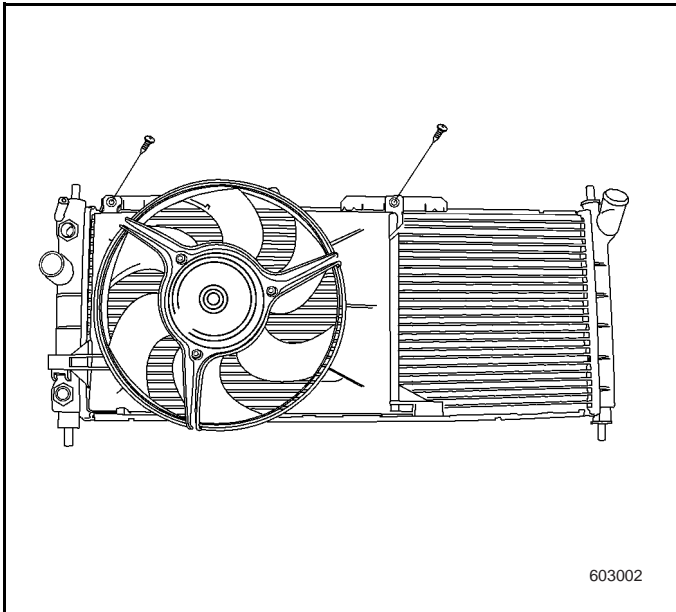
Note:

- Fill the system with drinkable water and 3.3L radiator protective fluid, P/N 9985451.
- Remove the water temperature bulb at the top of temperature control valve, and drain the air out of the engine block.
- After the system resumes, start the engine, allowing it to idle run at 900 rpm.
- After the air is drained, replace the bulb and continue to supply the coolant.

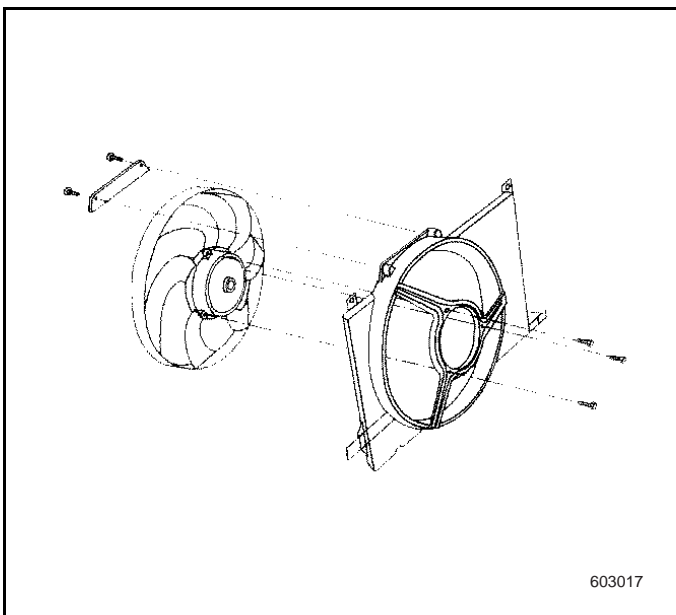
6.2.5.13 Cooling Fan Shroud Replacement

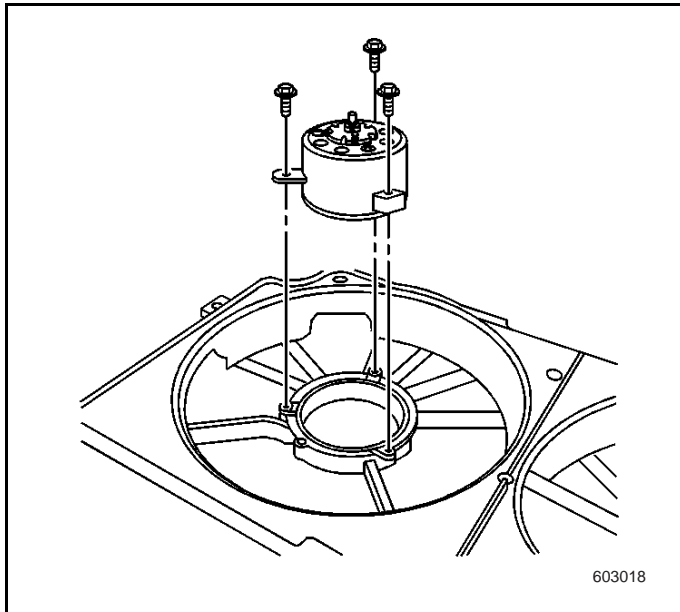
Removal Procedure

1. Remove the cooling fan assembly.



2. Disconnect the cooling fan shroud and the cooling fan harness.
3. Remove the cooling fan blade nuts.





4. Remove the cooling fan blades.
5. Remove the cooling fan motor bolts.
6. Remove the cooling fan blade and motor from the shroud.

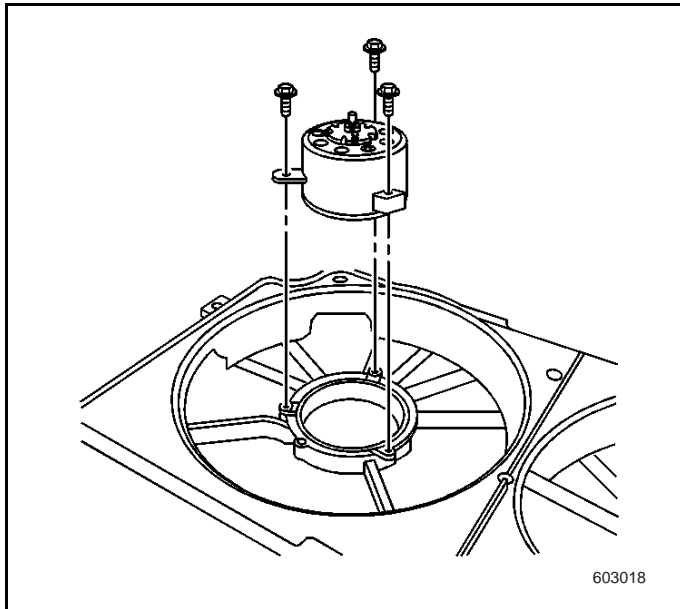
Installation Procedure

1. Install the cooling fan motor and blade on the fan shroud.
2. Install the cooling fan motor and blade bolts.

Tightening

Tighten the cooling fan blade and motor bolts to the fixed status.

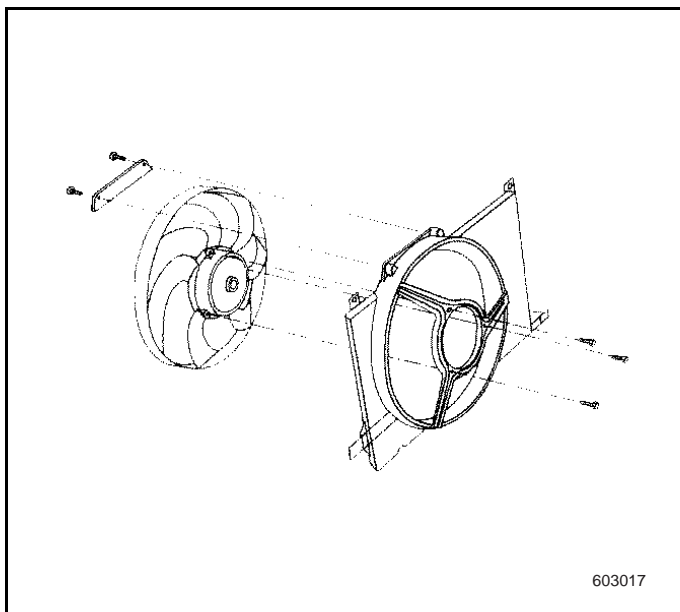
Caution: Refer to Electric Coolant Fan Caution in Cautions and Notices.

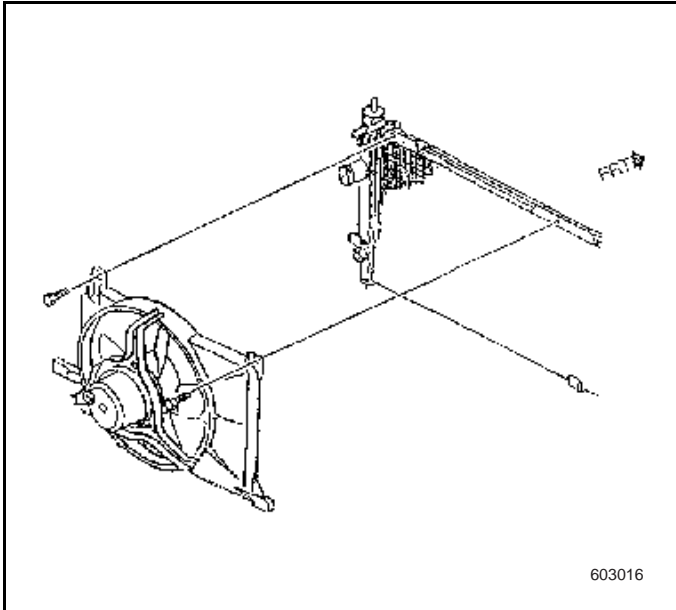


3. Connect the two parts of cooling fan shroud together with three bolts.

Tightening

Tighten the cooling fan blade nuts to 4.0-6.0N•m.



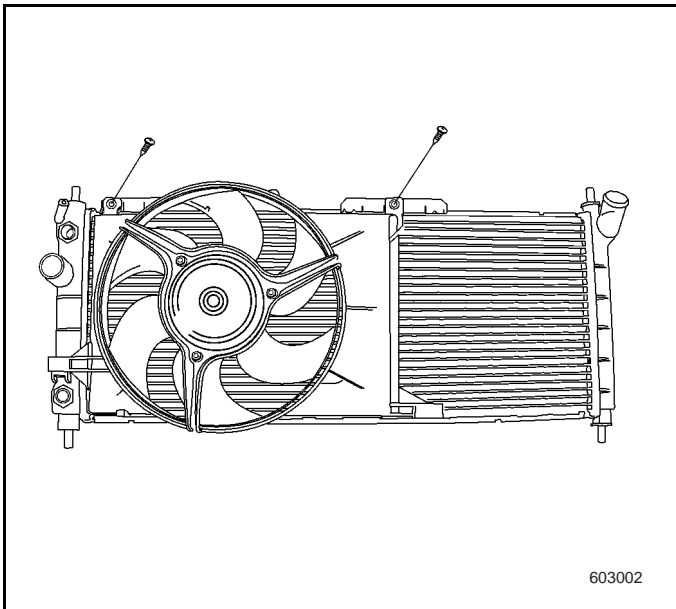


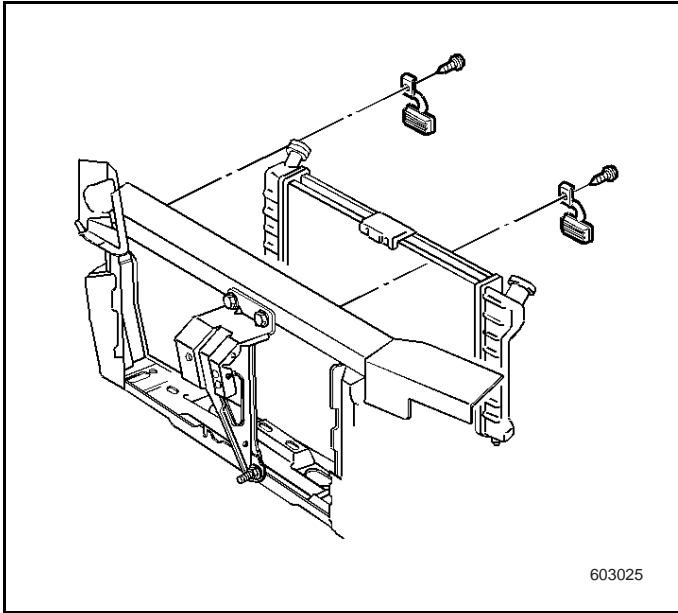
4. Install the cooling fan.

6.2.5.14 Radiator Replacement

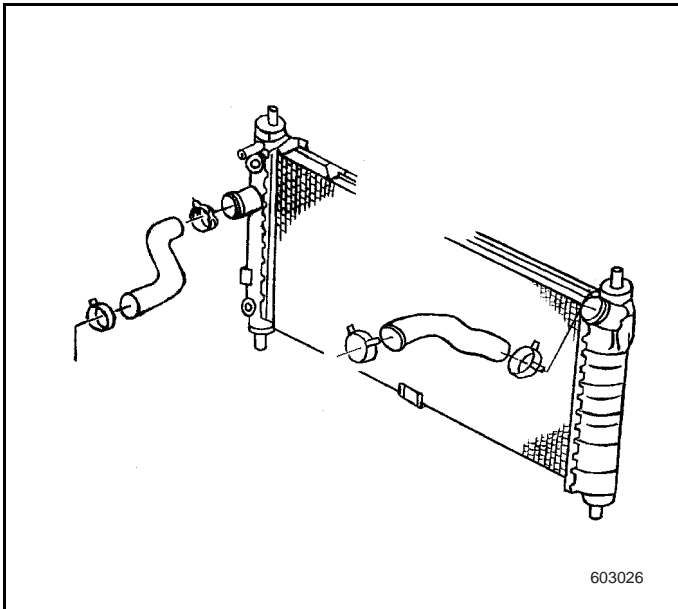
Removal Procedure

1. Remove the air filter and air duct assembly. Refer to Air Intake System Replacement in Engine Controls.
2. Remove the radiator upper air deflector. Refer to Radiator Air Baffle Assemblies and Deflectors (Upper Air Deflector).
3. Drain the cooling system. Refer to Draining and Filling Cooling System.
4. Remove the cooling fan assembly. Refer to Cooling Fan Replacement-Electric.

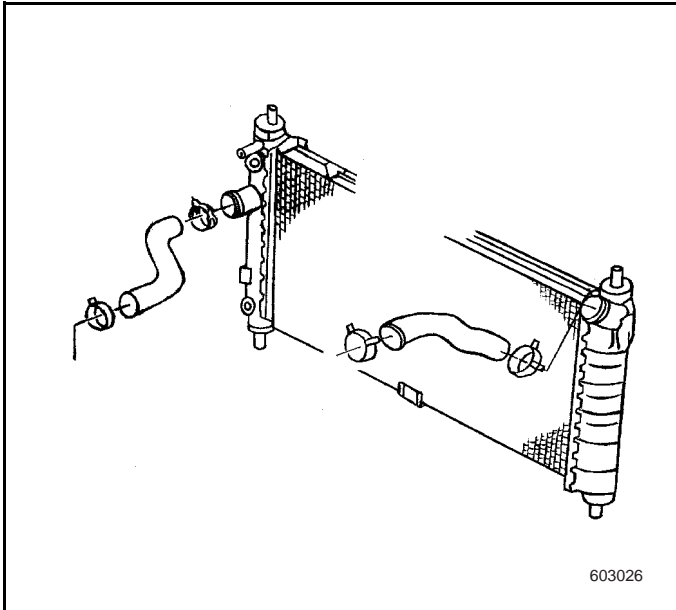




5. Remove the radiator upper support and bolts.



6. Loosen the radiator inlet pipe.
7. Loosen the radiator outlet pipe.
8. Loosen the coolant overflow hose.
9. Remove the transmission oil cooler from the radiator (only for A/T vehicles).
10. Remove the radiator.



Installation Procedure

1. Install the radiator into the lower mounts.
2. Connect the transmission oil cooler to the radiator (only for A/T vehicles).
3. Connect the upper radiator hose.
4. Connect the lower radiator hose.
5. Connect the coolant overflow hose.
6. Install the radiator support and bolts.

Tightening

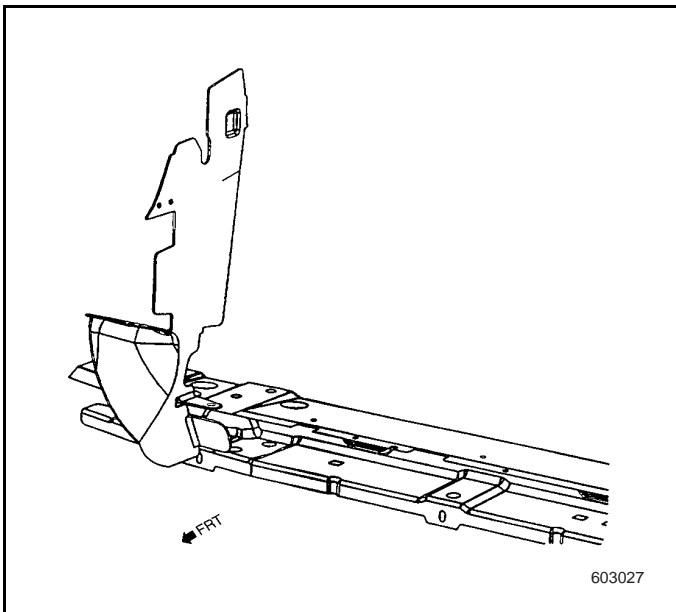
Tighten the bolts to 6.0 -8.0 N•m.

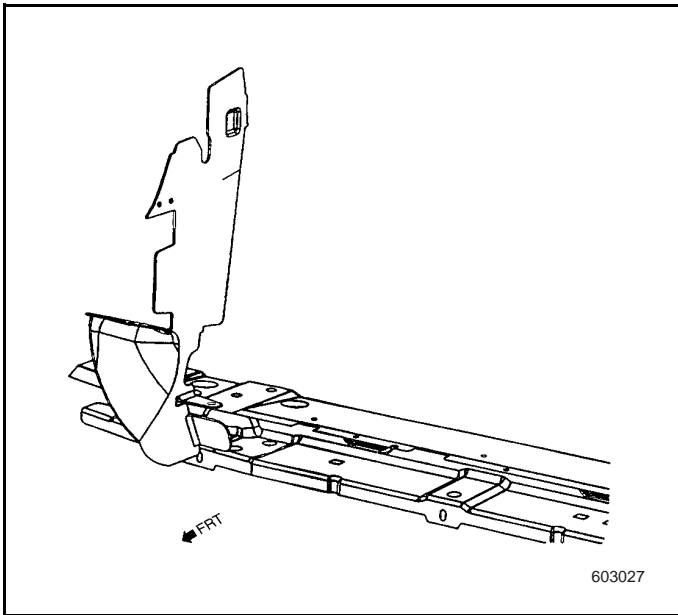
7. Install the electric cooling fan.
8. Refill the cooling system.
9. Install the air filter and air duct assembly. Refer to Air Intake System Replacement in Engine Controls.
10. Inspect if there is leakage.

6.2.5.15 Radiator Air Baffle Assemblies and Deflectors (Radiator Side Air Deflector).

Removal Procedure

1. Lift up the engine hood.
- Note: Left side and right side are symmetrical.
2. Remove the push-in retainers from the radiator front side air baffle (three retainers each side).
 3. Remove the radiator front side air baffle.
 4. Remove the impact bar bolts.
 5. Remove the push-in retainers from the radiator rear side air baffle (two retainers each side).
 6. Remove the radiator rear side air baffle.





Installation Procedure

1. Install the radiator rear side air baffle into the vehicle.
2. Install the push-in retainers into the radiator rear side air baffle.
3. Install the impact bar bolts.

Tightening

Tighten the impact bar bolts to 7.0 -9.0 N•m.

4. Install the push-in retainers into the radiator front side air baffle.
5. Remove the radiator front side air baffle.
6. Lower the engine hood.

6.2.5.16 Radiator Air Baffle Assemblies and Deflectors (Upper Air Deflector).

Removal Procedure

1. Lift up the engine hood.
2. Remove the air filter and air duct assembly.
3. Remove the push-in retainers from radiator upper air baffle.
4. Remove the radiator upper air deflector.

Installation Procedure

1. Install the radiator upper air deflector.
2. Install the push-in retainers into the radiator upper air baffle.
3. Install the air filter and air duct assembly.
4. Lower the engine hood.

6.2.6 Description and Operation

6.2.6.1 Cooling System Description

Cooling system

The cooling system maintains the engine temperature at a proper level during all engine operating conditions. When the engine is cold, the system cools slowly, or not at all, to allow the engine to warm up quickly.

The cooling system includes a radiator and coolant recovery subsystem, cooling fans, thermostat and housing, water pump and drive belt.

The cooling system operation requires all the parts to operate normally. The coolant is drawn from the radiator by the water pump and circulated through coolant jackets in the engine block, intake manifold, and cylinder heads, then back to the radiator for cooling there.

This system directs some coolant through hoses to the heater core, to provide for heating and defrosting. The surge tank is connected to the radiator to recover the coolant displaced by expansion from the high temperatures, and maintains at the proper coolant level. As the coolant cools and contracts, it is drawn back into the radiator by vacuum.

Cooling System Circulation

The water pump is belt-driven. Coolant from the radiator outlet (lower left side of radiator) flows to the water pump inlet and is pumped through coolant passages in the cylinder block and into the cavities surrounding the cylinder liners. Coolant then flows through holes in the cylinder head gaskets into the cylinder head coolant passages and into the thermostat bypass system. Passages in the intake manifold direct the coolant to the thermostat at the rear of the manifold. When the thermostat is closed (cold engine), the coolant is prevented from returning to the radiator and is recirculated for quick engine warm-up.

Once the engine has warmed sufficiently, the thermostat opens and coolant flows to the inlet tank on the top right side of the radiator. It is cooled as it flows across the horizontal core tubes to the outlet tanks on the left side of the radiator, completing the cycle.

Cooling Fan Relay

For the cooling fan relay information, See 8.20.2.21.

Thermostat

Use the thermostat to replace the warning lamp. Use the sensor to replace the temperature switch.

For the thermostat, the initial open temperature is 94 °C , and the full open temperature is 107 °C .

Coolant Temperature Control (System) Switch

The switch controls the cooling fan relay voltage. When the engine coolant temperature is greater than 95 °C , and the engine coolant temperature is greater than 102 °C , the relay makes the fan to run at a high speed.

6.2.6.2 Coolant Description

Note: Antifreeze can be added to raise the boiling point of the coolant, but too much will affect the freezing point. Do not use a solution stronger than 70 percent antifreeze, as the freeze level rises rapidly after this point. Pure antifreeze will freeze at -22°C (-8°F).

This vehicle model uses the new developed engine coolant. GM Goodwrench DEX-COOL Obey the guidance in Draining and Filling Cooling System. When adding or replacing the coolant, only use the mixture of GM Goodwrench DEX-COOL or HAVOLINE DEX-COOL50 / 50 ethylene glycol DEX-COOL and clean, drinkable water to provide the following protections:

- Provide with antifreeze protection lower than -39.
- Give boiling protection up to 131.
- Rust and Corrosion Prevention
- Help maintain a proper engine temperature.
- Allow the warning lamp and the thermostat to work as required.

6.2.6.3 Coolant Recovery System Description

Coolant Surge Tank

The surge tank is a transparent plastic reservoir, similar to the windshield washer reservoir. The surge tank is connected to the hose and the radiator. The surge tank collects the overflowed coolant when the temperature rises, otherwise the coolant may flow out of the system. The coolant level should be at or higher than LOW mark on the tank lid overflow hose (in the tank).

6.2.6.4 Throttle Body Coolant System Description

The throttle body coolant system uses pipes and hoses to divert coolant to the throttle body. Coolant flows through the throttle body for cold weather starts and helps provide a smooth idle until the engine reaches operating temperature.

6.2.6.5 Radiator Description

These engines use a cross-flow, lightweight aluminum and plastic radiator.

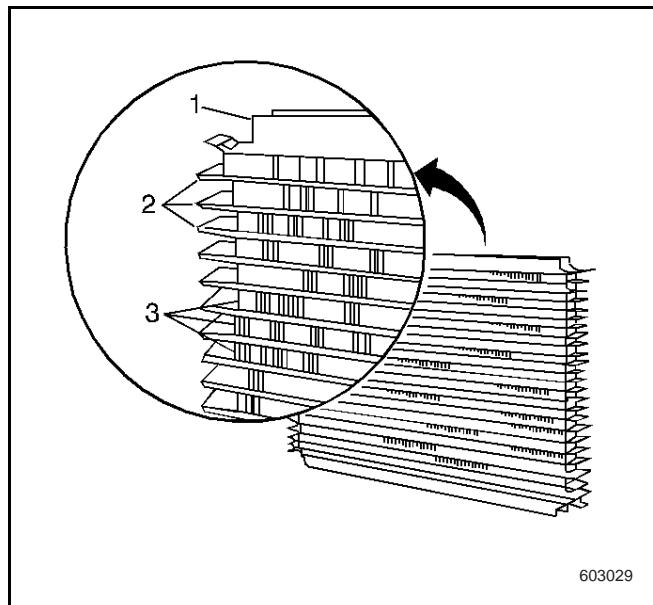
- A brazed aluminum tube and center core.

- Two plastic end tanks
- A transmission oil cooler (only for vehicles with A/T)

Use the rivet to fix the end tank in the center. A high temperature rubber gasket seals each of the end tanks. The left side end tank houses the transmission oil cooler.

Cross-Flow Radiator Core and Outlet and Inlet Tanks

These types utilize an aluminum core and are of the cross-flow design (1). The core is connected to many horizontal hoses (2) that cannot be pulled out. The cooling fan (3) is surrounding these hoses. Upper and Lower Rib Reinforcement Assembly. The saw-cut in each strengthening rib allows for expansion during temperature changes.



The inlet and outlet tanks are molded with a high temperature, nylon reinforced plastic. A high-temperature rubber gasket seals the tank flange around the edge. The inlet and the outlet tanks are clamped to the right side and the left side of the core with rivets. These rivets are part of the aluminum header at each end of the core. Radiators used with automatic transmissions have transmission oil coolers with inlet and outlet fittings for transmission fluid circulation.

You can identify an aluminum-plastic radiator by the black plastic side tanks and an aluminum radiator core.

6.2.6.6 Pressure Cap Description

Coolant Surge Tank Cap

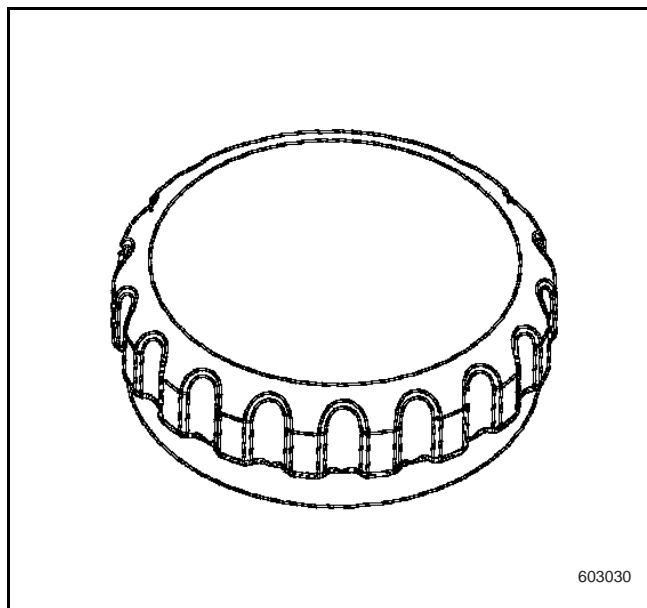
The coolant surge tank uses a pressure-vent filler cap to allow a buildup of 120 kPa in the cooling system. The cap allows the system to operate at a higher than atmospheric pressure. This pressure raises the boiling point of the coolant to about 130°C at sea level, which

increases the cooling efficiency of the radiator. The pressure-type cap contains a blowoff (pressure) valve and a vacuum (atmospheric) valve.

A spring of pre-determined strength holds the pressure valve against the valve's seat. The spring can release a pressure more than the designed upper limit, thus protect the radiator and other parts. The vacuum valve is held against the valve seat by a spring which permits opening of the valve to relieve vacuum created in the cooling system during cooling. This can prevent the radiator from being damaged.

Caution: To avoid being burned, do not remove the surge tank cap while the engine is hot. The cooling system will release scalding fluid and steam under pressure if surge tank cap is removed while the engine and radiator are still hot.

Caution: As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the pressure cap while the engine is hot and pressure is high will cause the solution to boil instantaneously - possibly with explosive force - spewing the solution over the engine, fenders and the person removing the cap.



The coolant surge tank cap is designed to prevent the tank from being opened accidentally. Remove the cap safely according to the following methods:

1. Slowly rotate the cap counterclockwise, do not press down the stopper.
2. Release the remaining pressure, and a hiss will be present.
3. After the hiss, continue to rotate the cap counterclockwise until the cap is removed.

The stamper on the cap is molded with the following content:

- The cautions for opening the cap;
- The arrow indicating the correct closed position.

6.2.6.7 Engine Cooling Fan Description- Engine Electric Cooling Fan Circuit Description

Action

The engine cooling fans receive power from Fuse 20#30A and Fuse 14#30A located in the wiring junction block at the left side of I/P. During low speed operation, the Powertrain Control Module (PCM) supplies a path to ground for Relay K51 through the Low Speed Fans control circuit. This energizes the relay coil, closes Relay K51's contacts, and supplies current from Fuse 20#30A to the engine cooling fans. Engine Coolant Fan Motor (RH) grounds through the series/parallel cooling fan relay (Relay K52) and Engine Coolant Fan Motor (LH). This forms a series circuit to allow the two fans to run at a low speed.

To command high speed cooling fan operation, the PCM first supplies a ground path for Relay K51 through the Low Speed Fans Control circuit. After a 3 second delay, the PCM supplies a path for ground through Relay K52 and Relay K70 through the High Speed Fans Control circuit. Engine Coolant Fan Motor (RH) continues to receive current from Fuse 20#30A. However, Fuse 14#30A supplies current to Engine Coolant Fan Motor (LH). Each fan receives a separate path to ground. Therefore, the fans operate at high speed.

Note: When certain Diagnostic Trouble Codes (DTCs) set, the PCM may command the cooling fans to run all the time. It is important to perform the Powertrain On-Board Diagnostic System Check. Before performing a diagnosis on the engine cooling fan, refer to Powertrain On-Board Diagnostic (OBD) System Check in Engine Controls.

The PCM completes the ground path for Relay K51 under any of the following conditions:

- When the engine coolant temperature is greater than 93°C (199°F).
- When the A/C is needed, and the ambient temperature is greater than 50°C (122°F).
- When A/C refrigerant pressure is greater than 190psi (2V).
- When the ignition is off and engine coolant temperature is greater than 140°C (284°F).

For high speed operation, the PCM delays control of the Engine Coolant Fan Motor (LH) and Relay K70 for 3 seconds. The 3 second delay ensures that cooling fan electrical load does not exceed the capacity of the system. The PCM completes the ground path for Relay K51, K52 and K70 under any of the following conditions:

- When the engine coolant temperature is greater than 106°C (223°F).
- When A/C refrigerant pressure is greater than 240psi (2.5V).

Troubleshooting

DTC P1651 is set for solving the problem which affects the low speed fans control circuit. Refer to DTC P1652 if a problem occurs which affects the high speed fans control circuit. If a problem occurs to the engine coolant temperature (ECT), refer to DTC 0117, P0118, P1114, or P1115. All these DTCs may solve the problems which may affect the cooling fan operation. Therefore, before using the diagnostic table for the electric cooling fan, first determine if a PCM DTC set. Refer to Electric Cooling Fan Diagnosis in Engine Controls. If no DTC is set, and a problem exists with the cooling fan, perform a cooling fan diagnosis. Refer to Electric Cooling Fan Diagnosis in Engine Controls to diagnose the PCM controlled cooling fans.

6.2.6.8 Water Pump Description

The cooling pump is a centrifugal-type pump that consists of the following components:

The back side of the drive belt drives the pulley. The pulley is connected to the water pump. Therefore, all the said parts are a part of the non-removable assembly.

6.2.6.9 Thermostat Description

The cooling system uses a wax pellet-type thermostat. The thermostat has the following functions:

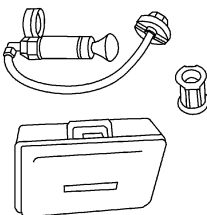
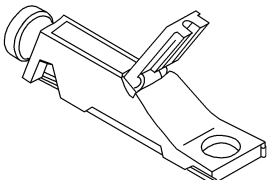
- Controls the flow of coolant;
- Provides fast engine warm-up;
- Adjusts the coolant temperature.

6.2.6.10

Deflectors redirect the air flow. Deflectors are installed under the vehicle and redirect the air flow beneath the vehicle to flow through the cooling system and increase radiator cooling.

Air baffles are used to direct air into the radiator and A/C condenser. Air seals ensure that air passes through, and does not bypass, the radiator and the A/C condenser. A missing, damaged, or incorrectly installed baffle or seal may cause the engine to overheat.

6.2.7 Special Tools

Illustration	Tool Number/Name
<div><p>J24460-1</p></div>	<p>J 24460-01 Cooling System Tester</p>
<div><p>J23688</p></div>	<p>J 23688 or J26568 Coolant Tester</p>

6.3 Engine Electrical

6.3.1 Specifications

6.3.1.1 Fastener Tightening Torque

Application	Specification
Battery support retainer	8-12 N•m
Battery negative cable bolts	3-3.5 N•m
To BIW battery negative cable	12-18 N•m
Battery negative terminal nut	3-3.5 N•m
Battery position cable bolts	3-3.5 N•m
Battery position terminal nut	3-3.5 N•m
Ignition module bolts	8.5 ± 1.5 N•m
Ignition module support (camshaft support side cover) bolt	12 ± 2 N•m
Generator low pivot bolt - nut	30-40 N•m
Generator bolt (bracket-upper)	18-22 N•m
Generator bolt (upper control bar)	18-22 N•m
Generator upper bracket bolt	18-22 N•m
Generator output BAT terminal nut	11-15 N•m
Generator ground terminal nut	3 ± 1 N•m
Spark plug	27.5 ± 7.5 N•m
Starter tightening bolt	18-30 N•m
Starter ground wire nut	10-15 N•m
Starter solenoid battery terminal nut	12.5 ± 2.5 N•m
Starter solenoid S terminal nut	4 ± 1 N•m

Battery Usage

Application	Specification
Model	T5
SGM/PN	92098170
Load test	170 A
Cold cranking amperage	225 A(DIN)
C20	55AH

Battery Description

	Description	SGM P/N
1	Battery	92098170
2	Insulator-Battery positive PLT	92098171
3	Label the battery	92098172

Battery Cable Description

	Description	SGM P/N
1	Cable ASM-BAT negative	92098175
2	Cable ASM-BAT negative	92098827

Generator Usage

Application	Specification
Model	SG10B
SGM/PN	93278385
Output	100 A/6000 rpm

Starter Motor Usage

Application	Specification
Perform an off-load test at 12V.	65A
Pinion speed	2800 RPM
Hold-in winding	10A
Hold-in winding and pull-in winding	40A
Voltage	12 volts
Power	1.2kw
Weight	2.7 kilos
Pinion End to Pinion Stop Collar Clearance	Min. 0.6mm

Spark Plug Usage

Specification	Clearance (mm)
PPR6YE	0.7-0.8

6.3.2 Schematic and Routing Diagrams

6.3.2.1 Engine Starter and Generator Wiring Diagram

See 8.20.2.3.

6.3.3 Component Locator

6.3.3.1 Engine Electrical Component Locator

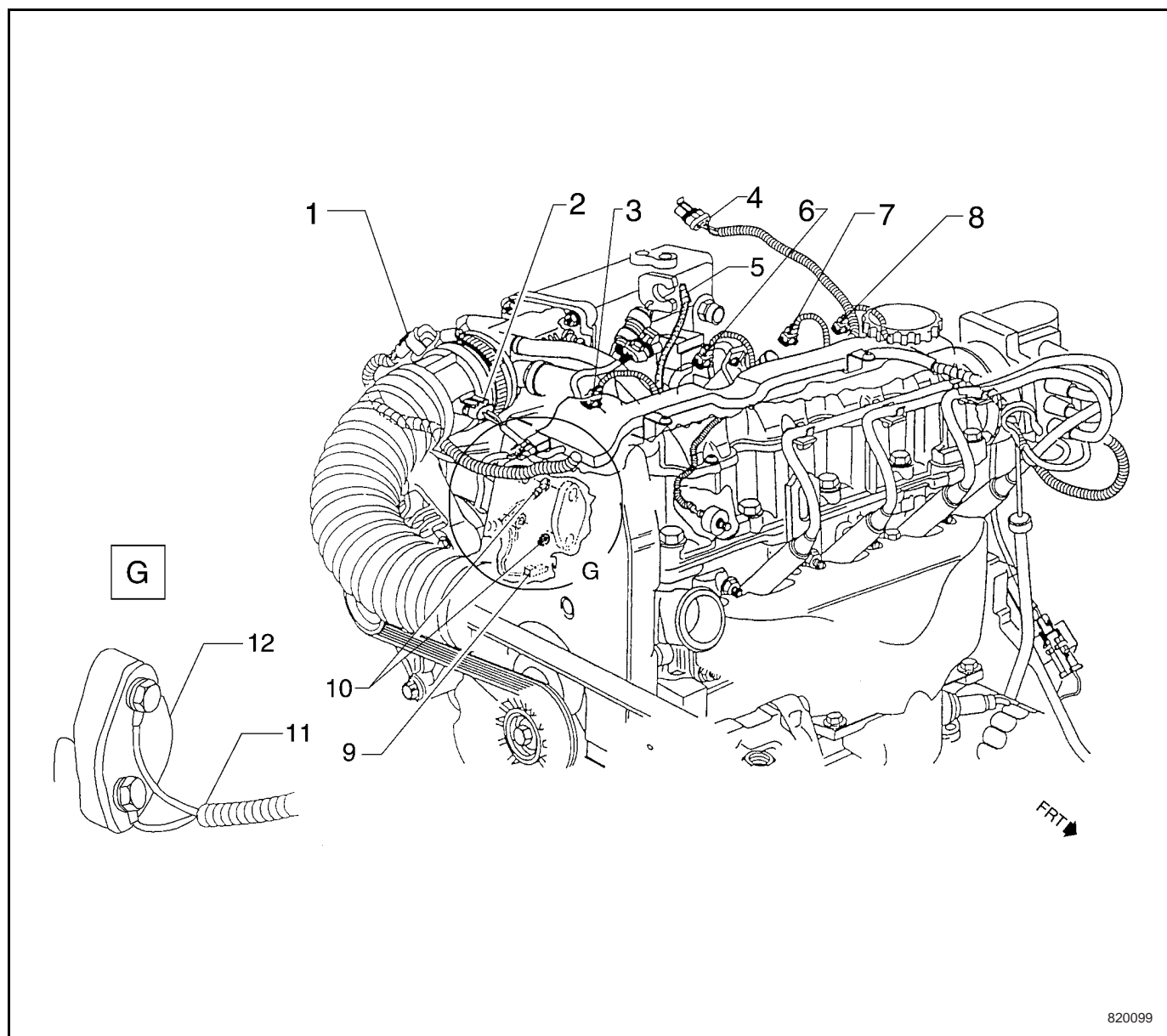
Name	Location	Locator View	Connector End View
Battery	Extended right side panel of control panel	See 8.20.3.27.	—
Starter	Rear, under the inlet manifold assembly	—	—
AC alternator	Between the engine and the control panel	Refer to Engine Electrical Component Views	—
Ignition Switch	Inside the steering wheel	Refer to Steering Wheel and Steering Column-Disassemble.	—
Instrument Cluster	At top of IP, above the steering column	Refer to Instrument Panel, Gauges and Console Component Views.	—
Fuse box	Left side of I/P, below left outlet.	See 8.20.3.4.	—
Engine control module (EMC)	Mounted below side panel A pillar, near right side of I/P	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Ignition module	Engine left side, above transmission	Refer to Engine Controls component views.	Refer to Engine Electrical Connector End Views
Idle Air Control Valve	On throttle body assembly	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Manifold Absolute Pressure Sensor	On firewall	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Coolant Temperature Sensor	At left side of engine cylinder head, below ignition coils	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Crankshaft Position Sensor	Below water pump	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Knock sensor	Rear side of engine, under inlet manifold assembly	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Intake Air Temperature Sensor	On air filter outlet pipe assembly	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Throttle Position Sensor	On throttle body assembly	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Data Link Connector (DLC)	Left side of fuse box	Refer to Data Link Connector View	Refer to Data Link Connector End Views
Fuel Injector	On inlet manifold	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views

6.3.3.1 Engine Electrical Component Locator(Cont' d)

Name	Location	Locator View	Connector End View
Oxygen Sensor	On engine exhaust manifold	Refer to Engine Controls component views.	Refer to Engine Control System Connector End Views
Relay-Fuel Pump	Connected to Support-IP harness joint, near cowl panel, IP right side	—	—
Fuel Pump	In Fuel tank	—	—

(23) Insulation, diode

Engine Wiring Harness Routing in the Engine Compartment



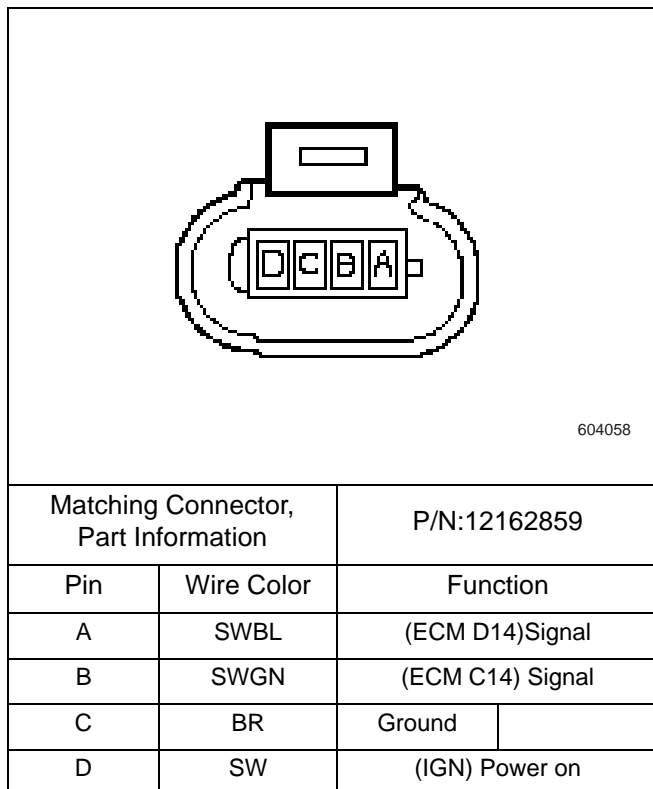
820099

Legend

- | | |
|--|--|
| (1) Idle Sensor connection | (7) Cylinder 3 Injector connection |
| (2) Intake Air Temperature Sensor connection | (8) Cylinder 4 Injector connection |
| (3) Cylinder 1 Injector connection | (9) Temperature Sensor connection |
| (4) Absolute pressure sensor connection | (10) Engine wiring harness ground terminal |
| (5) Canister Purge Valve connector | (11) Engine wiring harness |
| (6) Cylinder 2 Injector connection | (12) Ground Point |

6.3.3.3 Engine Electrical Connector End Views

Ignition module



6.3.4 Diagnostic Information and Procedures

6.3.4.1 Battery Diagnosis

Use the following procedures to diagnose the battery:

1. Visual check

Check the battery for obvious damage, such as a cracked or broken case or cover, which could permit the loss of electrolyte. If obvious damage is noted, replace the battery. Find out the cause of damage, and make necessary repairs. If no damage, proceed to Step 2.

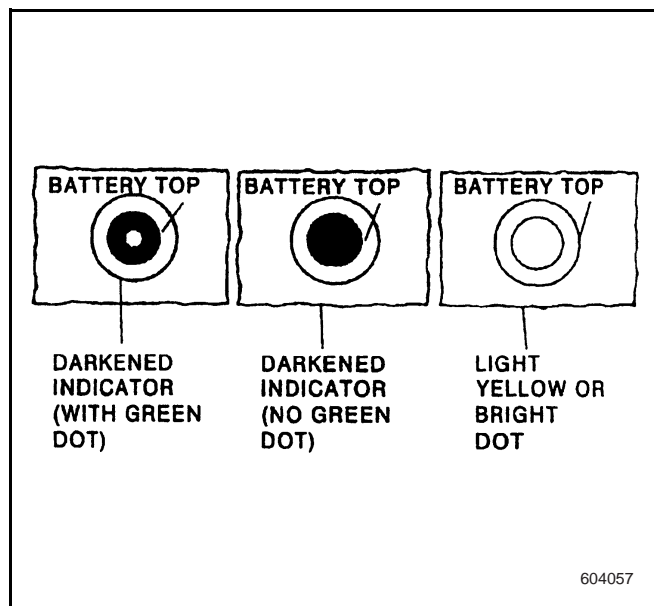
2. Hydrometer check

- A. Green dot is visible-go to Step 3
- B. Black, green dot is not visible. Charge according to the procedures in Battery Charging section, then go to Step 3
- C. Transparent or yellow, if the hydrometer is transparent or light yellow, the battery electrolyte is insufficient. Replace the battery.

3. Load Test

Load test requires to use the battery side terminal or equivalence to ensure a good connection. Do not test on the battery that appears to be frozen, replace instead.

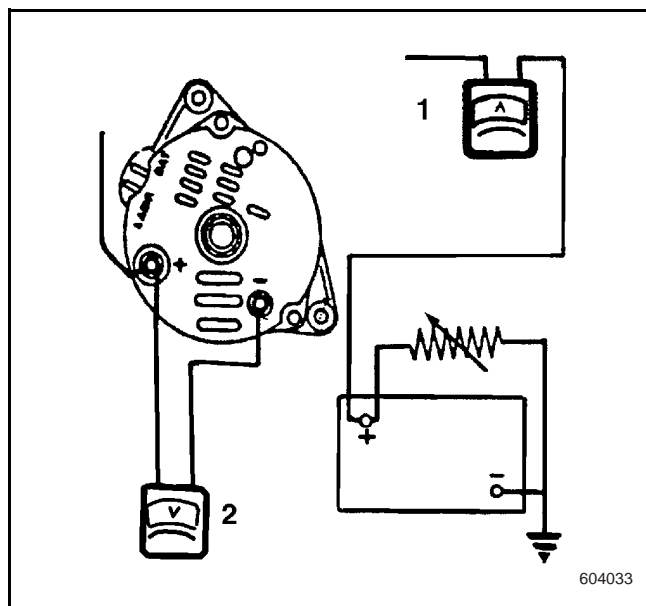
- A. Use the voltmeter to measure the crossover voltage on the terminals. Under the condition that all the load is disconnected and the green dot (Step 2) is visible in the hydrometer, the voltage should be 12V or higher. Unless the battery is just discharged completely (such as a load test or starting the engine), when the voltage is lower than 12V, replace the battery. The voltage is lower than 12V, replace the battery.
- B. While maintaining the voltmeter connection, cross over the battery terminal to connect a battery load tester.
- C. If the battery is being charged all the time, apply a 170amp load for 15 seconds to remove any surface charge from the battery. Remove load. (If the battery has not been charged recently, do not proceed with this step).
- D. Wait 15 seconds, allowing the battery to recovery. Apply all the loads marked on the battery label or listed in the Specifications of this section. Wait 15 seconds, then read the voltage and remove the load.



- E. If the voltage does not drop below the minimum value listed in the following diagrams, it indicates that the battery is OK and can be used. (Always estimate on the battery temperature by touching and reckoning the battery temperature in the previous hours).
- F. If the voltage drops below the minimum value, replace the battery.

6.3.4.2 Vehicle Operation (Generator) Test

Disconnect the generator positive terminal cable (+), serially connect an amperemeter. Connect a voltmeter (2) between the generator positive and negative again. Slowly accelerate the generator speed, observe the voltage change. If the voltage exceeds the control range with the rotor speed change, and is greater than 15.5V, inspect the generator brush for ground. If no grounding, replace the regulator and test the grounding coils. If the voltage is lower than 15.5V, connect a rheostat. Start the generator at an immediate speed, adjust the rheostat as required to obtain the maximum current output. If the output does not reach 10% of the rated value marked on the engine cover, it means it is alright. If not, continue to charge the battery and allow the generator to ground with the rheostat connected.



Start the generator at an immediate speed, adjust the rheostat as required to obtain the maximum output. If 10% of the specified tolerance is not reached, replace the regulator and test the coils.

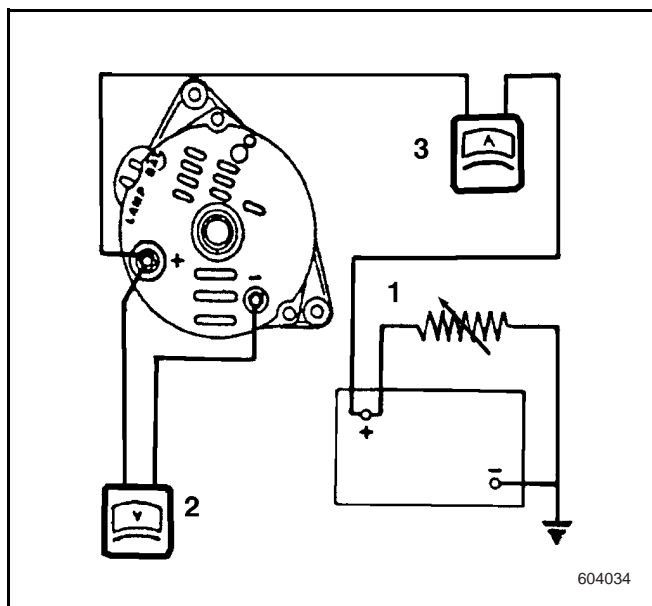
Note: If 10% of the tolerance is not reached, test coils, diode, rectifier bridge and stators.

6.3.4.3 Generator Power Test

Sometimes, when the vehicle runs with the accessories ON, the power consumption is great, and the generator can only keep balance at maximum power operation. In this case, obtain a greater power as much as possible. Make a power test based on the following steps.

Connect a rheostat (1) to the battery terminal, simulate the situation with all the accessories ON. Then serially connect a voltmeter (2) to output terminal, generator ground and amperemeter in order to measure the generator output.

Increase the engine RPM, the amperemeter should reach the maximum rated value on the engine cover. The voltmeter should display 15.5V.



6.3.4.4 Charge Indicator Lamp Test

Test lamp related to ignition switch and engine.

To determine if the indicator operates normally, inspect the operation of ignition switch and engine related.

On/Off	Engine	Lamp
Off	Off	OFF (turned off)
Switch on	Off	Switch on
Switch on	Operating	Off

Switch on-Indicator ON-Engine operating status Test

The most common reasons that cause this condition include: loose generator belt, broken resistor, or a problem with transistor adjuster, test as required and make a correction if necessary.

Switch on-Indicator OFF-Engine OFF status Test

The most common reasons that cause this condition include: bulb burnout, jacket contact problem, transistor adjuster problem, current cutoff between battery and switch, mismatching wires between Lamp and Battery.

Test and make a correction if necessary.

The following tests can also be performed:

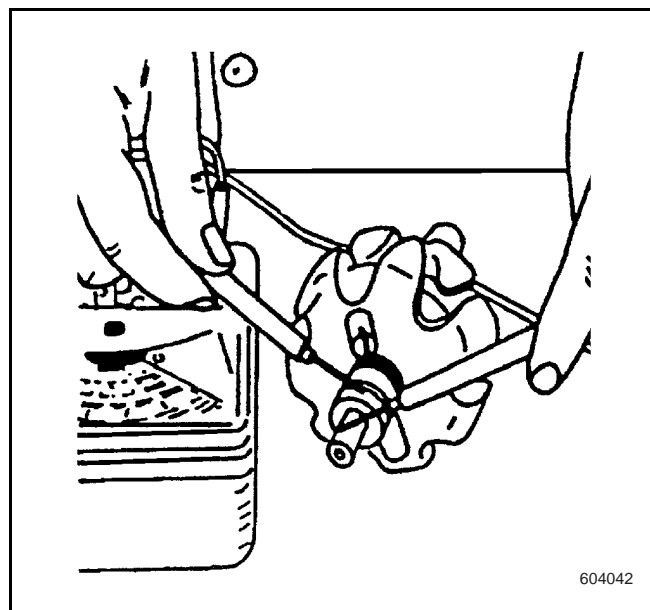
Temporarily make the Lamp ground, if the lamp is not on, inspect bulb, ignition switch, connection between switch and battery. If the bulb is on, re-connect Lamp wire and Battery wire to generator. Insert a screwdriver into the test hole, make the coils ground. The other will be directed with action taken.

If the lamp is not on, inspect the connection between wiring harness and generator Lamp terminal, and inspect brush, slide ring and field coils for open.

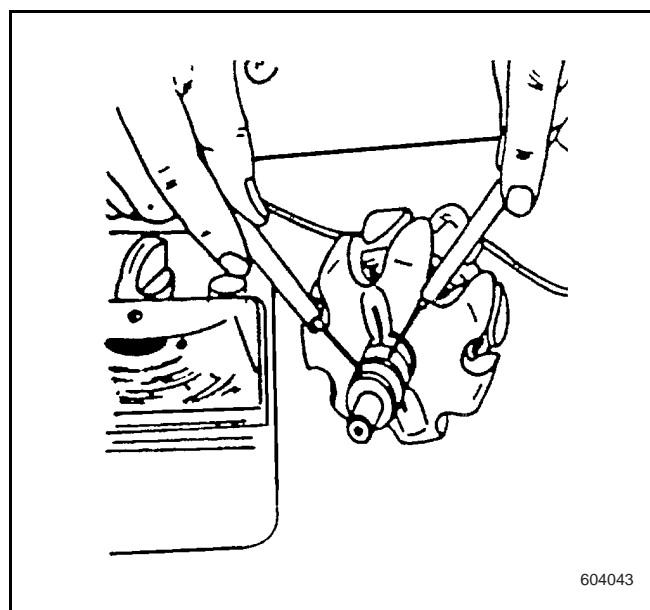
If the lamp is brightening now, replace the regulator in order to test the field coils.

6.3.4.5 Generator Rotor Test

To inspect the rotor for short, connect one ohmmeter probe to rotor shaft, the other to any slide ring. If the reading displayed on the ohmmeter does not reach a certain ohm, it means a short to the winding.

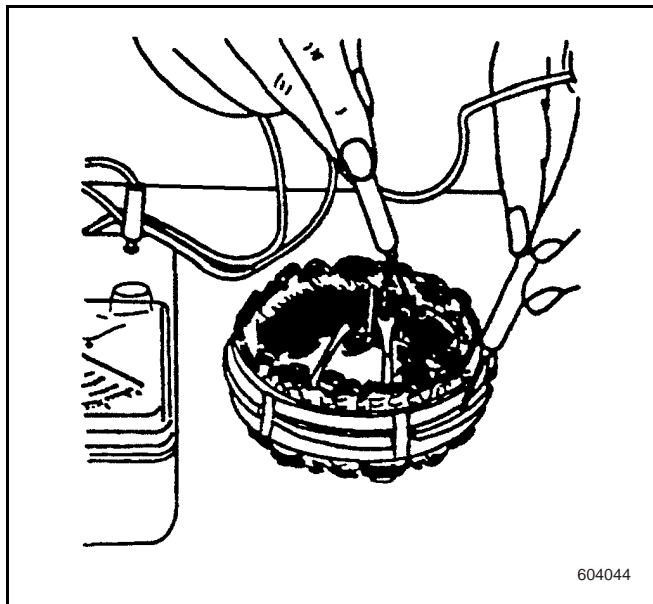


To inspect the rotor for open, connect the ohmmeter probes to each slide ring. If the ohmmeter reading is high, the winding is open.



6.3.4.5 Generator Stator Test

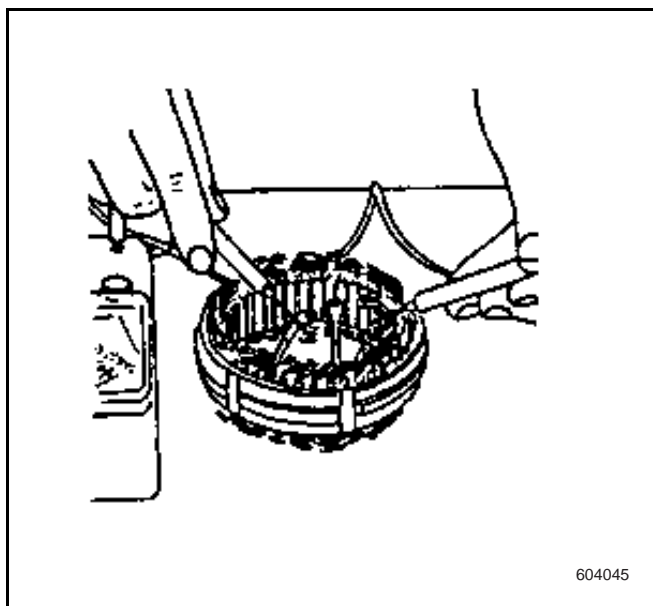
To determine if the stator is grounded, connect one probe of ohmmeter to any terminal, the other probe to housing. If the ohmmeter reading is low, the winding is grounded.



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Connect an ohmmeter control pin between each pair of stator terminals in order to test the open. If the ohmmeter displays a high reading in any one of the above three tests, it indicates an open to the winding.

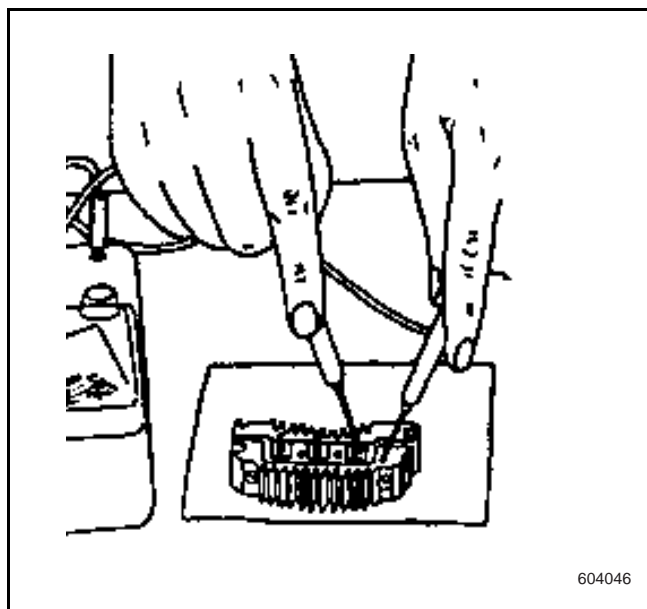
For the short in the stator winding, the winding resistance is not easier to test without the help of special equipment because the winding resistance is low. However, if all the other tests are normal, but the generator cannot reach the specified charge rate yet, it indicates that a short exists in the winding.



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6.3.4.7 Generator Rectifier Jumper Test

Adjust the ohmmeter to the lowest scale. Connect one of the ohmmeter probes to the positive rectifier jumper, and the other probe to three terminals separately. Then resume the probe position and repeat the test three times.

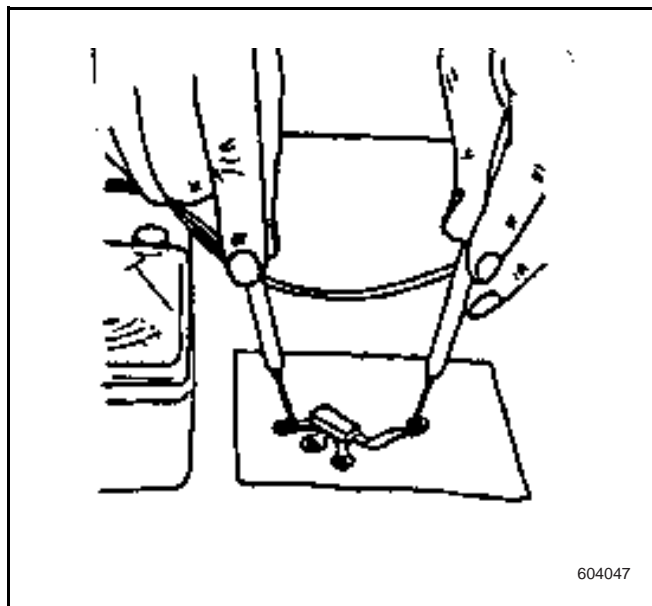


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If the ohmmeter does not display any resistance in two tests, always replace the rectifier jumper. (Fine diode only has a resistance in one direction.) Repeat the entire tests on the negative rectifier jumper.

6.3.4.8 Generator Diode Test

Connect one of the ohmmeter probes to the long terminal, the other probe to one of the three short terminals separately. Then, reverse the probe position, and repeat the above procedures. If under any one of the conditions does not display a resistance, always replace the diode. (Fine diode has a resistance in one direction) If the workbench is metallic, place a sheet of paper or any other insulated thing on it.



604047

6.3.4.9 Generator Voltage Regulator Test

This part does not need a special test. If all the other tests show that each component is in normal condition, but the generator voltage is out of the specifications, replace the voltage regulator.

6.3.4.10 High Tension Ignition Cable Resistance Test

Measure the spark plug resistance, and compare with the values in High Tension Ignition Cable Resistance List.

High Tension Ignition Cable Resistance List	
Length (mm)	Resistance (k)
100-200	1-5
200-400	2-10
400-640	4-15
640-900	6-20
Over 900	8-25

6.3.4.11 Starter Free Spin Test

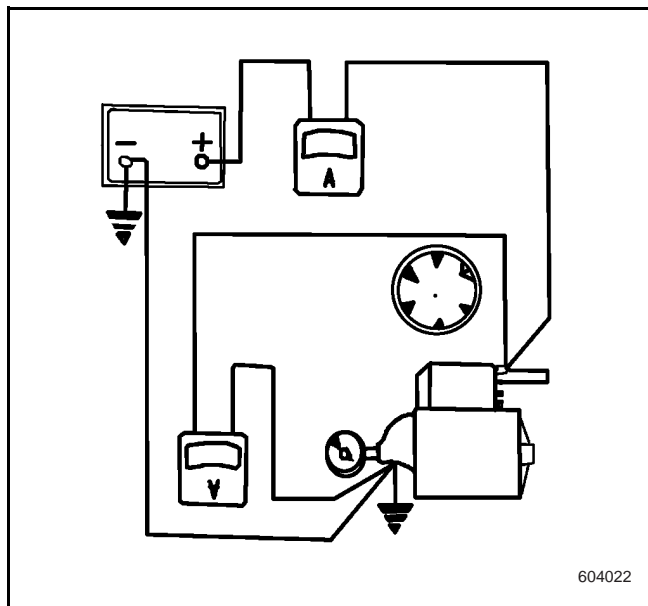
Use the fully charged battery to connect according to the rules. Read the AMP-HOUR gauge, Voltmeter and Tachometer (in the following three diagrams)

The following results must be given:

AMP-HOUR gauge: 49-76 A

Voltmeter: 10.4V

Tachometer: 620-9,400RPM



604022

6.3.4.12 Current Test when Starter fixes Rotor

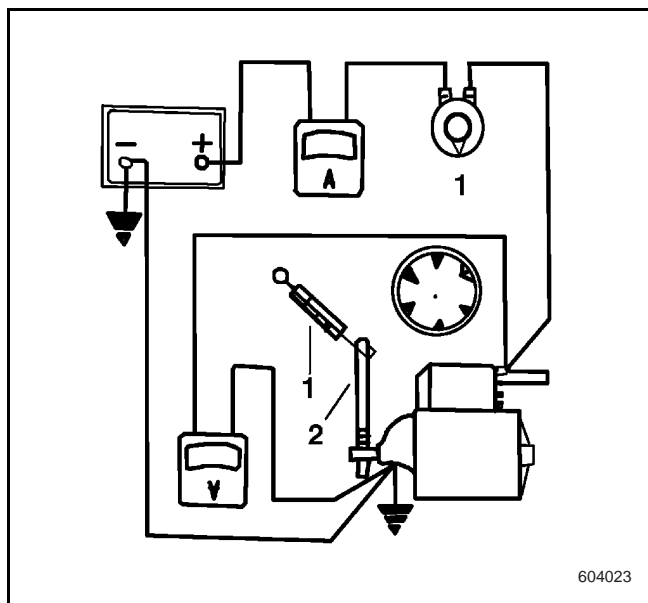
Use the following units as shown in the diagram to make a connection as specified. Use the rheostat (1) of high power. Always fasten the starter motor tightly, and use the lever to lock the pinion (2). When applying the specified voltage, the current must drop between lowest value and immediate value as specified.

Voltmeter:

- Min. 9.5V
- Immediate Value 9.5V

Amp-Hour Gauge:

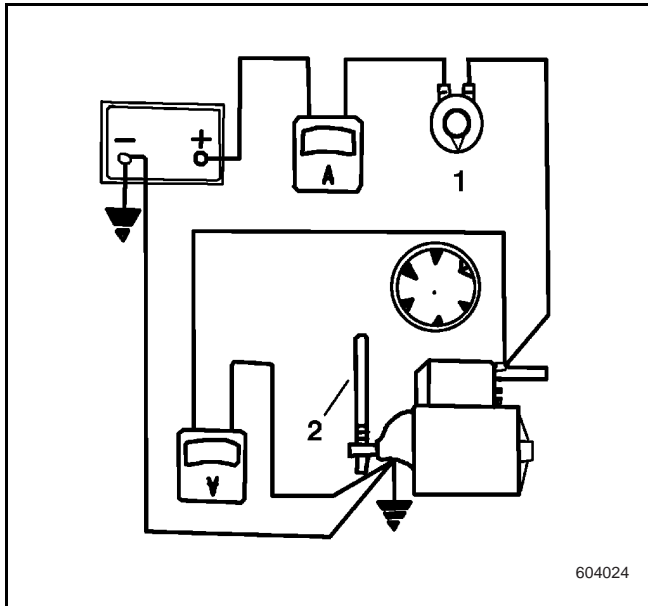
- Min. 210A
- Max. 250A



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6.3.4.13 Starter Torque Test

Use the same component and connection as the previous test. Connect a (Scaled) dynamometer (1), which is 30.5cm away from the motor shaft, to the locking lever arm (2). The power displayed on the dynamometer must be 14.7N.

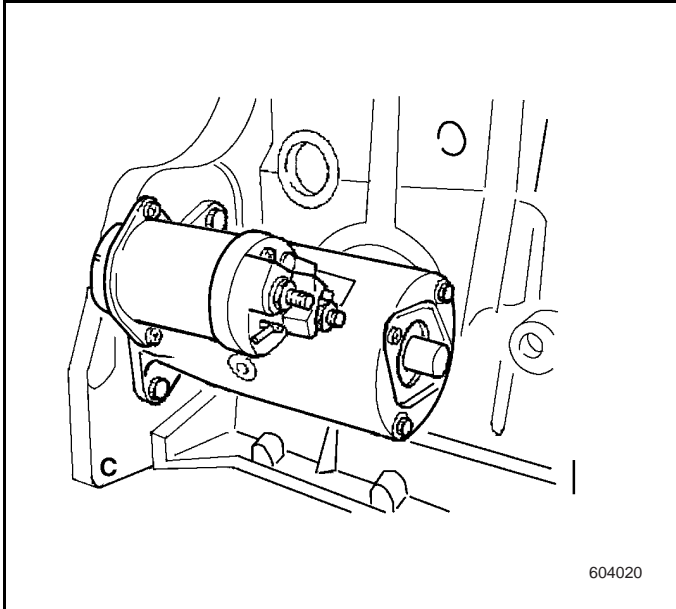


6.3.5 Repair Instructions

6.3.5.1 Starter Replacement

Removal Procedure

1. Disconnect the battery negative cable.
2. Disconnect the wiring connection from the starter. (For the sake of understanding, the figure shows the engine placed outside the vehicle.)
3. Screw off the upper tightening bolts.
4. Screw off the lower tightening bolts.
5. Remove the engine.



Installation Procedure

1. Insert the engine (6), screw down the upper and lower tightening bolts.

Tightening

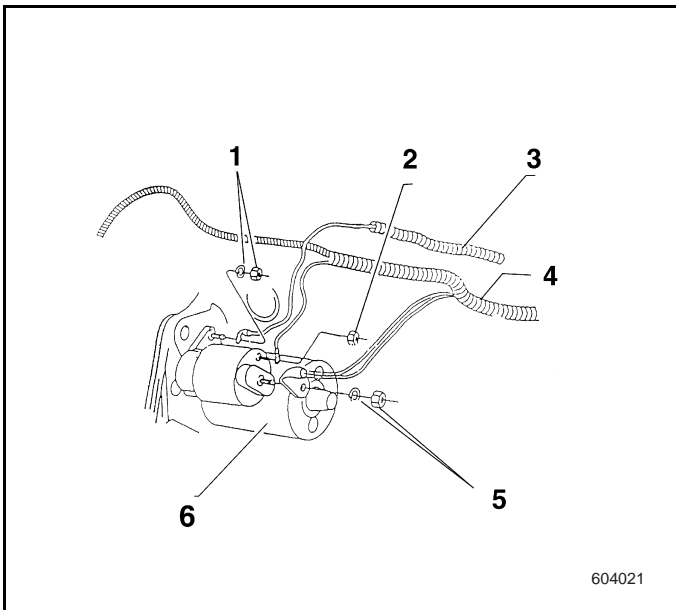
Tighten the starter bolts to 18 -30 N•m.

2. Re-connect the wiring harness on the starter.

Tightening

- Tighten the starter grounding wire nut (1) to 10-15 N•m,
- Tighten the starter solenoid battery terminal nut (5) to 12.5 ± 2.5 N•m,
- Tighten the starter solenoid S terminal nut (2) to 3.5 N•m.

3. Connect the battery.



6.3.5.2 Spark plug Replacement

Removal Procedure

1. Turn off the ignition starter switch.
2. Remove the spark plug lead from the spark plug.

Notice: Before removing the spark plug, allow the engine to cool first. Attempting to remove the spark plug from a hot engine may cause the plug threads to seize, causing tearing to spark plug threads.

3. Remove the spark plug from the engine.

Notice: Clean the spark plug recess area before removing the spark plug. If not so, the cylinder head or spark plug threads may be contaminated because of the possible impurities entry, and thus damage the engine. The contaminated threads may not allow the new spark plug to be installed normally. Use a thread chaser to clean the threads of any contamination.

Notice: Only the spark plug specified to use in the vehicle may be used. Do not install the spark plug with a heat value higher or lower than the vehicle specifications. Installing spark plugs of another type can severely damage the engine.

Notice: Before installation, inspect the new spark plug and the treated spark plug gap first. The preset gap may change during the treat process. Use a round feeler gage to ensure an accurate check. Installing the spark plugs with the wrong gap can cause poor engine performance and may even damage the engine.

Installation Procedure

1. Measure the spark plug gap on the spark plug to be installed. Compare the measurement with the gap specification. Refer to Spark Plug Specifications. Make a correction if necessary.

Notice: Be sure that the spark plug threads smoothly into the cylinder head and the spark plug is fully seated. Use a thread chaser if necessary to clean threads in cylinder head. Cross-threading or failing to fully seat spark plug can cause overheating of plug, exhaust blow-by, or thread damage.

2. Install the spark plug on the engine and tighten properly.

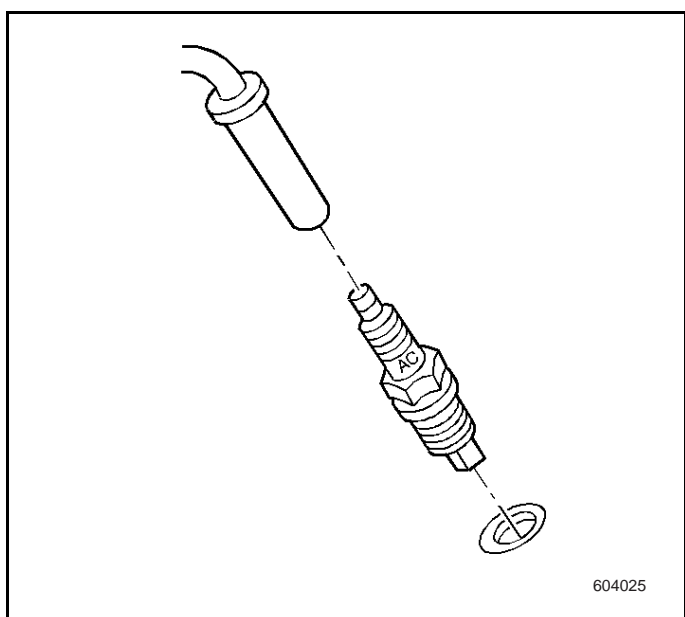
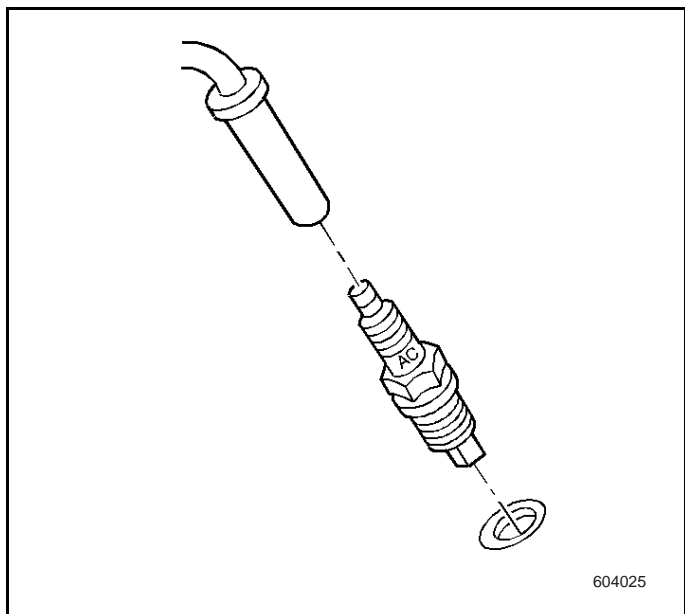
Tightening

Tighten the spark plug to $27.5 \pm 7.5 \text{ N}\cdot\text{m}$.

3. Connect the high tension ignition cable to the spark plug.

Inspect, clean and adjust the spark plug

1. Visually inspect the spark plug for crack and electrode colors. If no problem with the spark plug after visual inspection, begin to clean.
2. Place the spark plug on the retainer, and make a blasting clean. Then use the air to blow off the impurities.



3. Adjust the gap between electrodes from the side of electrode.

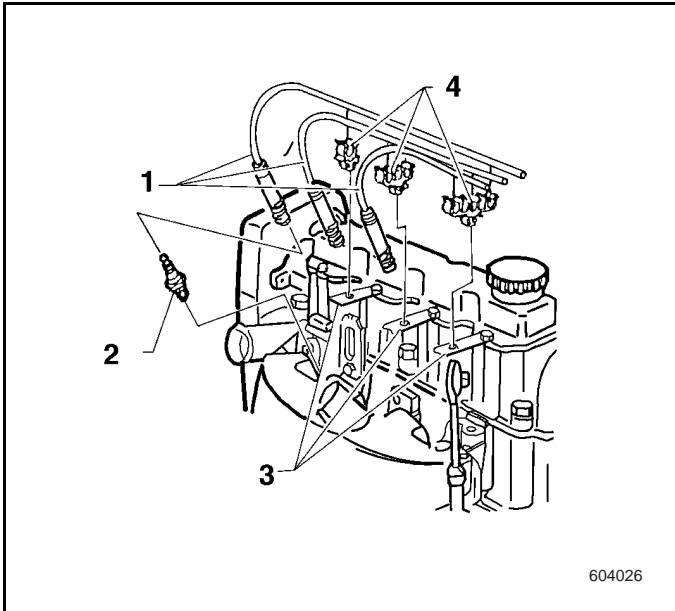
6.3.5.3 High Tension Ignition Cable Replacement

Removal Procedure

1. Turn ignition to OFF position.
2. Remove the high tension ignition cable (1).

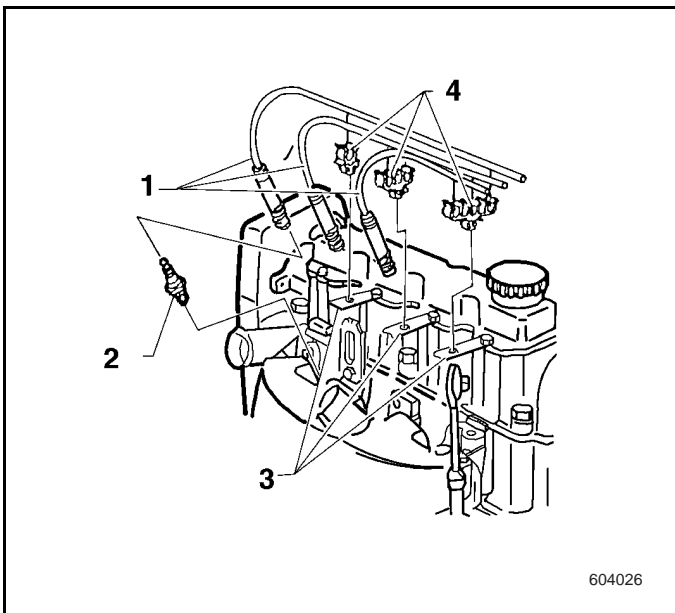
Notice: Pull on the spark plug (2) shield only. DO NOT pull the spark plug lead, otherwise may cause damages.

3. Mark the high tension ignition cable position. Draw out the spark plug cable from the cable holder.
4. Remove the spark plug lead from the ignition coil.



Installation Procedure

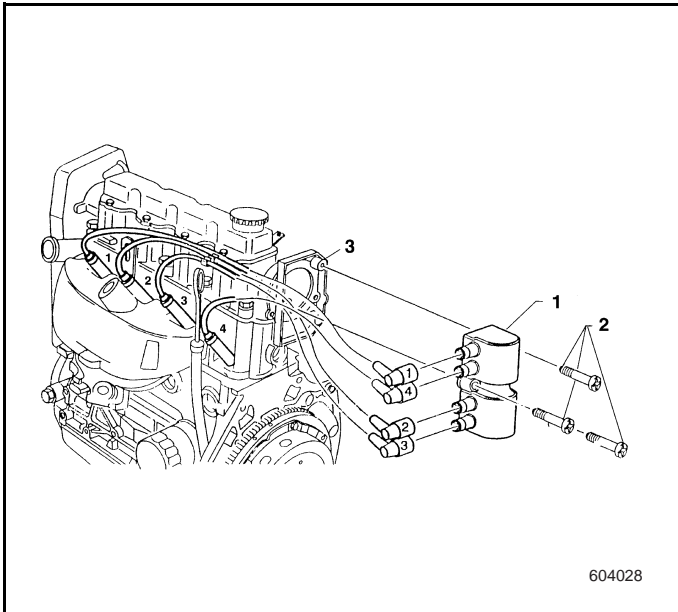
1. Connect the high tension ignition cable (1) to the proper position of ignition coil.
2. Insert the high tension ignition cable into the cable holder (4) correctly.
3. Push on the spark plug shield in order to install the high tension ignition cable on the spark plug (2).



6.3.5.4 Direct Ignition Moduel (Dual Ignition Coil) Replacement

Removal Procedure

1. Disconnect the high tension ignition cable and the engine harness connector from the ignition module (1).
2. Screw off the tightening nut (2).
3. Remove the ignition module.



Installation Procedure

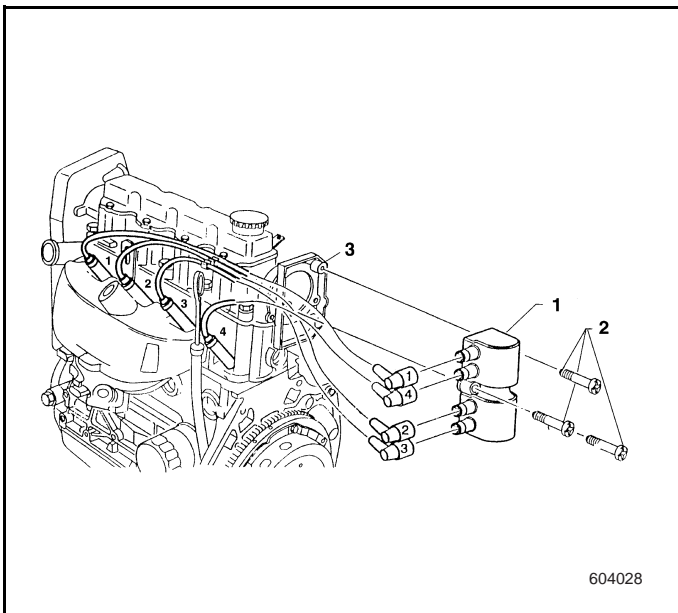
1. Install the ignition module (1).Screw down the bolts (2).

Tightening

Tighten the ignition coil bolts to $8.5 \pm 1.5 \text{ N}\cdot\text{m}$

2. Connect the electrical harness connector and the ignition wires.Take care the ignition order.

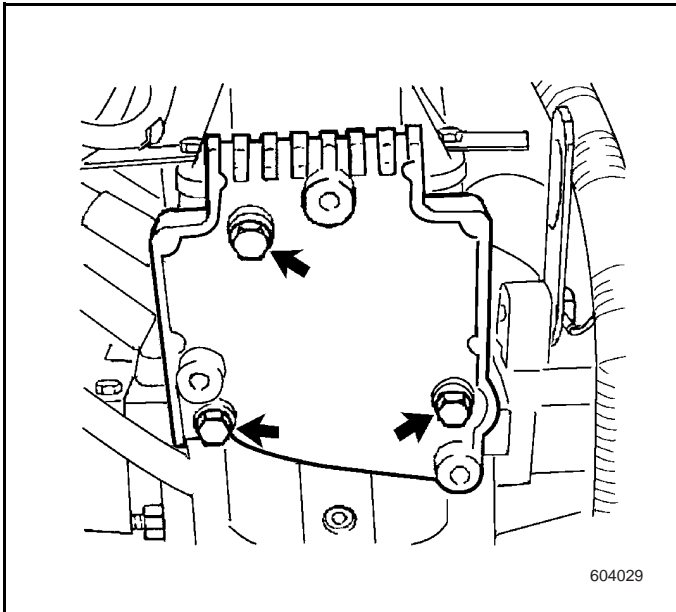
Note: There is a cylinder number at the side of ignition module.



6.3.5.5 Ignition Coil Bracket (Side Camshaft Carrier Cover) Replacement

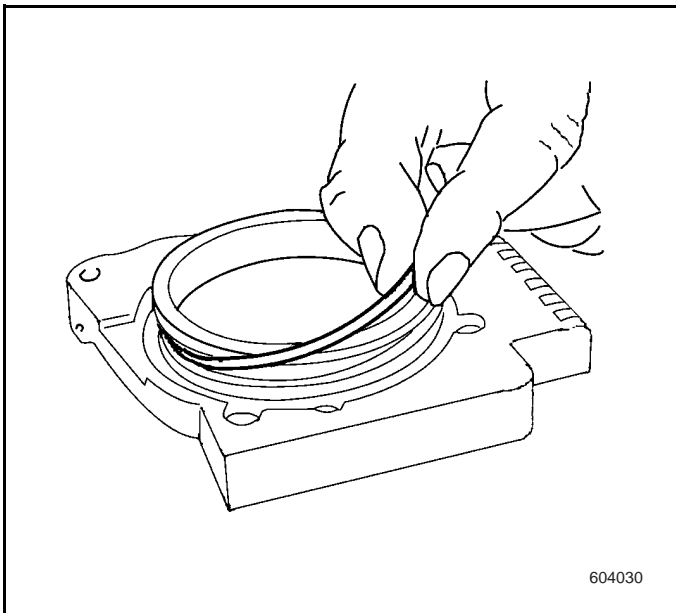
Removal Procedure

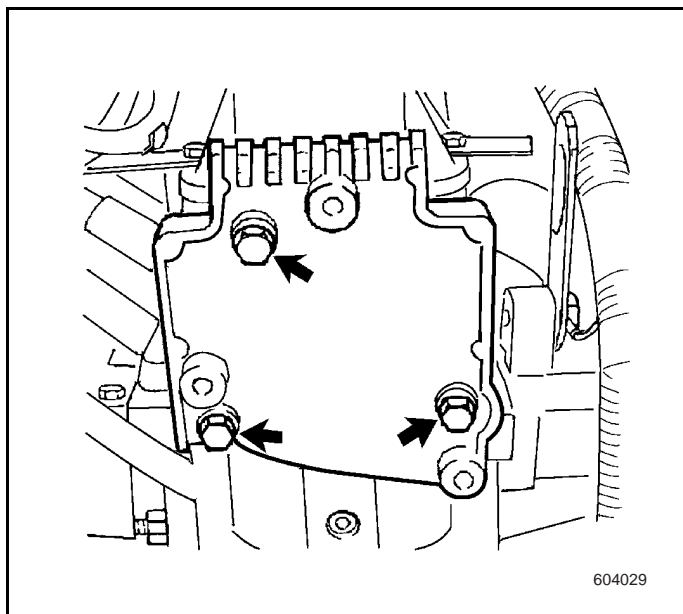
1. Remove the electrical harness connector and the high tension ignition cable from DIS ignition module.
2. Screw off the DIS ignition module from the bracket plate. Screw off the bracket.
3. Screw off the carrier nut (Arrow) from the camshaft carrier, and remove the carrier.



Installation Procedure

1. Use the new seal ring (P/N 93278441) in order to install onto the side camshaft carrier cover.





2. Mount the DIS ignition module to the bracket plate with bolts.

Tightening

Tighten the ignition module bracket/rear camshaft carrier cover bolts to $12 \pm 2 \text{ N}\cdot\text{m}$.

3. Connect the high tension ignition cable and harness connector to DIS ignition module.

Tightening

Tighten the ignition module bolts to $8.5 \pm 1.5 \text{ N}\cdot\text{m}$

6.3.5.6 Battery Replacement

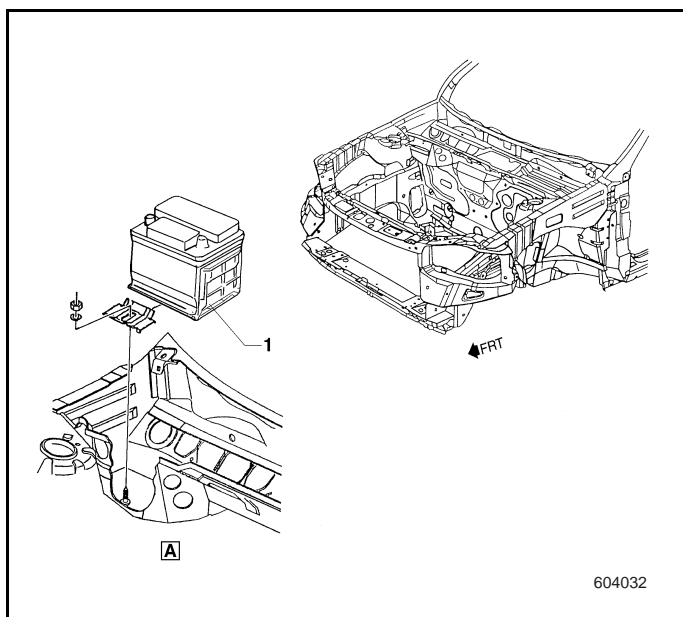
Removal Procedure

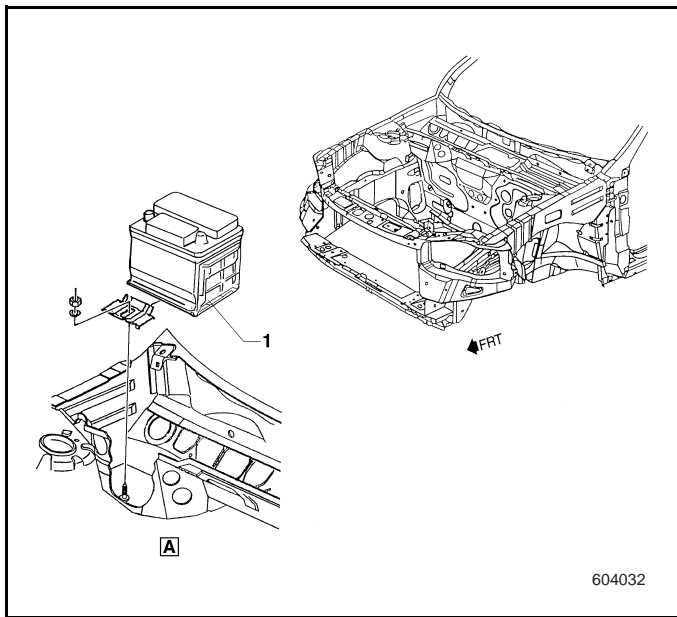
1. Disconnect the negative cable from the battery negative.
2. Disconnect the positive cable from the battery positive.
3. Battery retainer and nuts
4. Battery

Inspections

1. If the battery is damaged
2. If the electrical wire and connectors are worn or corroded
3. If the handling equipment are damaged or have foreign materials.

Note: If any damage occurs, find out the reasons and make corrections.





Installation Procedure

1. Place the battery in the clean handling equipment.
2. Retainer and nuts

Tightening

Tighten the retainer nuts to 8 -12 N•m.

3. Positive cable to anode
4. Negative cable to cathode

Tightening

Tighten the battery terminals to 3-3.5 N•m

6.3.5.7 Battery Cable Replacement

Note: When replacing the battery cables, be sure to use replacement cables that are the same type, gauge, and length. Some positive cables are attached with other feed wires, while some negative cables are attached with other grounding wires.

When replacing the battery cables, be sure to use the original wires and follow the same routing.

- Battery negative cable replacement (92098827)

Removal Procedure

1. Remove the cable from the battery.
2. Remove the cable clips.
3. Remove the cables from the engine starter terminal block.
4. Remove the cable.

Installation Procedure

1. Install the cable terminals on the engine starter.
2. Install the cable clips.
3. Install the battery cables.
- Battery negative cable replacement (92098175)

Removal Procedure

1. Remove the cable from the battery.
2. Remove the cable from the BIW terminal block.
3. Remove the cable.

Installation Procedure

1. Install the cable, and the electrical harness grounding to BIW, and Install the battery cable.

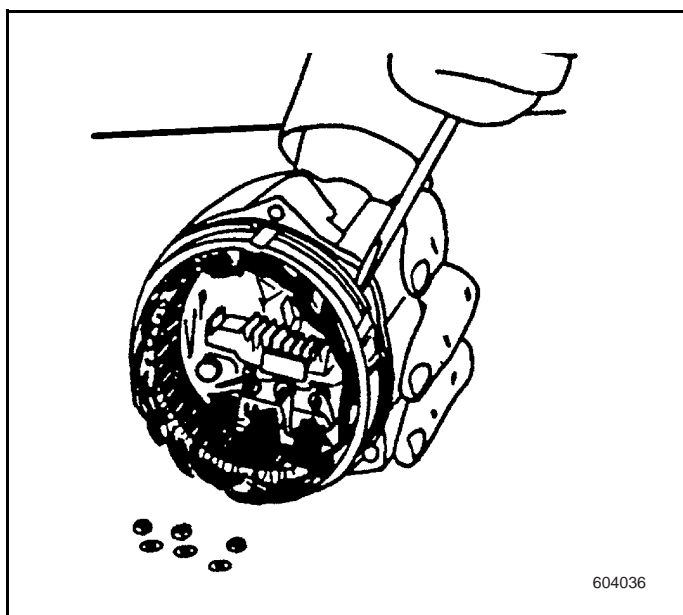
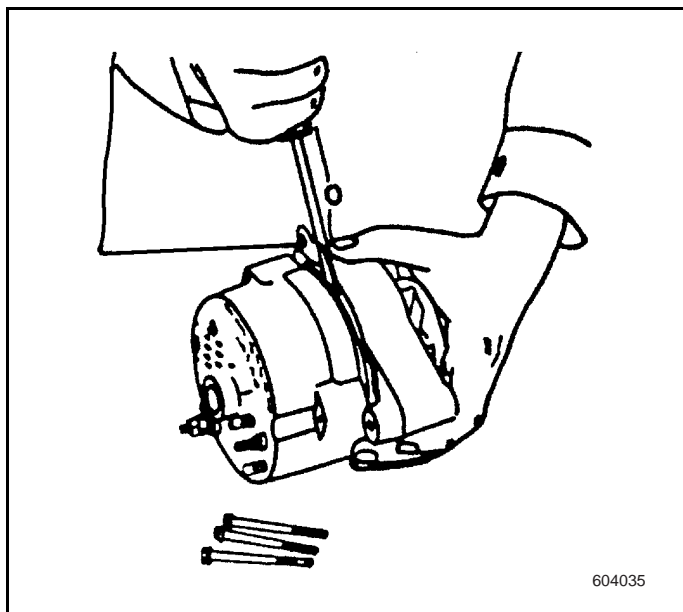
Note: The battery positive cable is a section of starting harness.

6.3.5.8 Generator Assembly Replacement

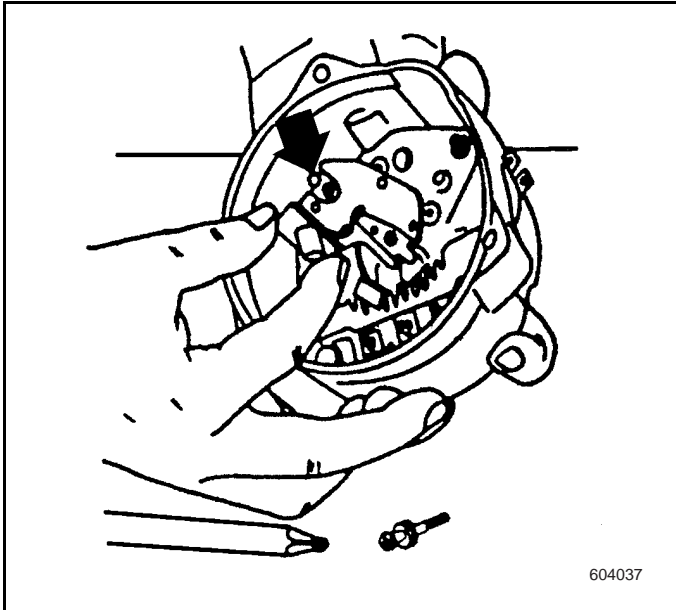
Removal Procedure

1. Remove or disconnect:
 - Battery negative cable
 - Terminal cable BAT
 - LAMP BAT connector
 - Ground
 - Fan belt
 - Generator
2. Remove the rear cover.

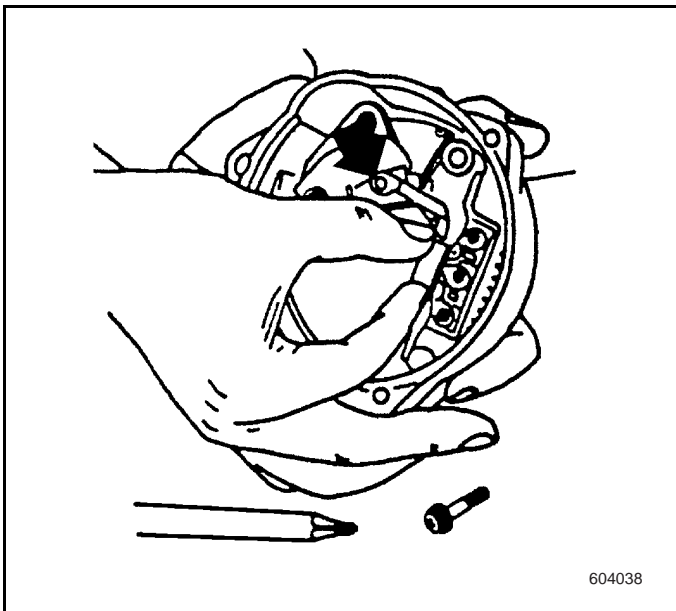
Note: Leave the stator on the rear cover.



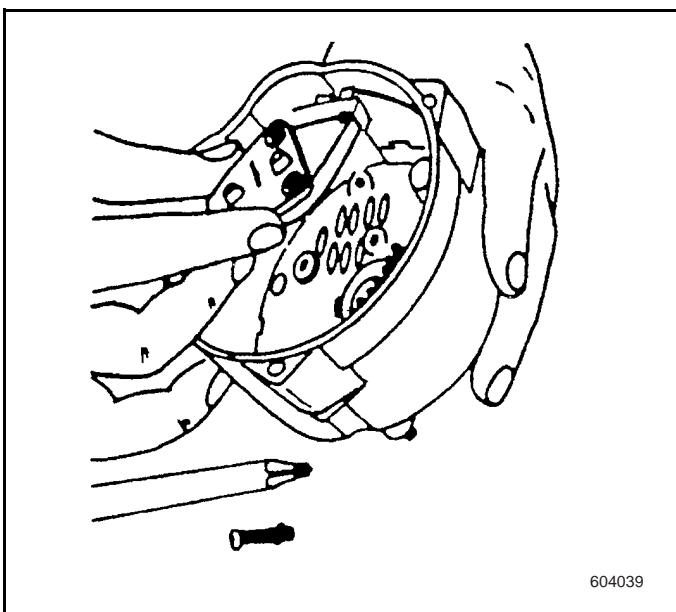
3. Remove the nut from the stator terminal.
4. Remove the stator.



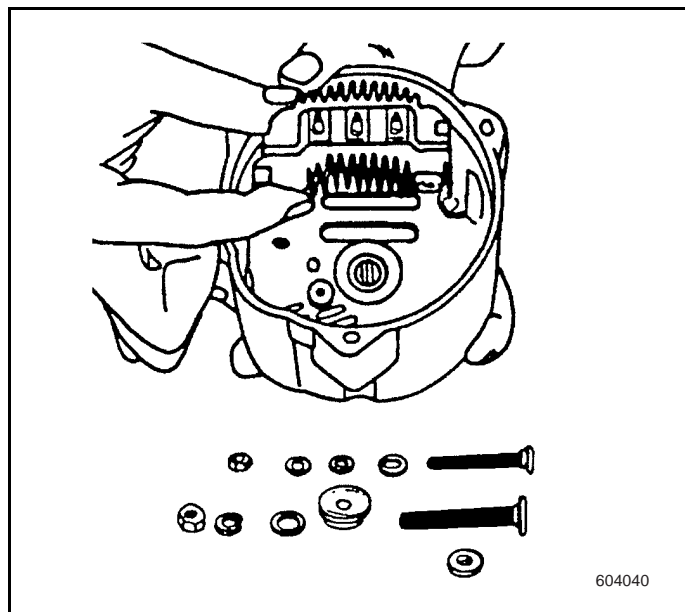
5. Remove the brush from the brush holder.



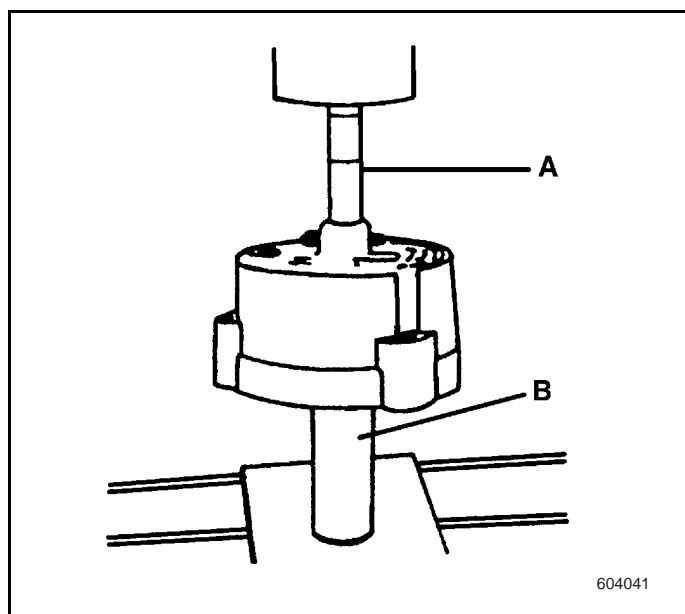
6. Remove the diode.



7. Remove the voltage retaining holder.
8. Remove the regulator.



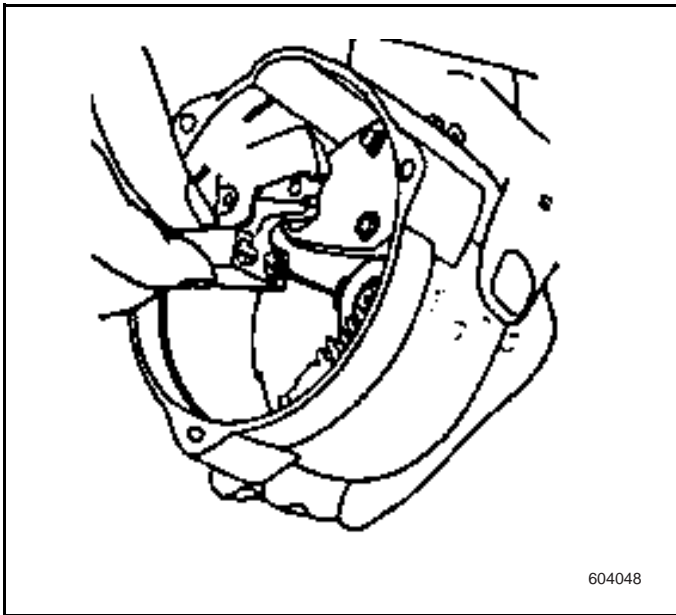
9. Remove the rectifier jumper.



Note: If necessary, remove the rear cover bearing, place it on the inner ring (B) and press the bearing with a bar.

10. Remove the following parts:

- Pulley
- Fan
- Outer washer (Narrow)
- Rotor
- Inner washer
- Retainer
- Gasket
- Rear cover bearing
- Jacket



Installation Procedure

1. Install the rear cover bearing, use an inner tube large enough as the base, install the pilot pin and press tightly.
2. Install the jacket.
3. Install the front cover bearing.
4. Install the gasket.
5. Install the retainer.
6. Install the inner washer.
7. Install the rotor.
8. Install the outer washer (Narrow).
9. Install the fan.
10. Install the pulley.
11. Install the rectifier jumper.

Note: Place an insulating washer at the battery terminal between rectifier jumper and cover.

12. Install the voltage regulator (Use a non-insulating bolt to connect to the washer, and do not make the final tightening).
13. Install the brush holder. The brush is secured with a section of electrical wire with the bolt connecting brush holder to outer cover. The bolt is also passing through the regulator, and do not make the final tightening.
14. Install the diode.

Note: After installing the diode, make the final tightening for voltage regulator and brush holder.

15. Use the bolt to tighten from rear cover to front cover. Remove the brush fastening wire, allowing it to contact the slide ring.
16. Install or connection:
 - Generator on the carrier
 - Fan belt
 - Ground
 - LAMP BAT connector
 - BAT Terminal cable
 - Battery negative cable

6.3.6 Description and Operation

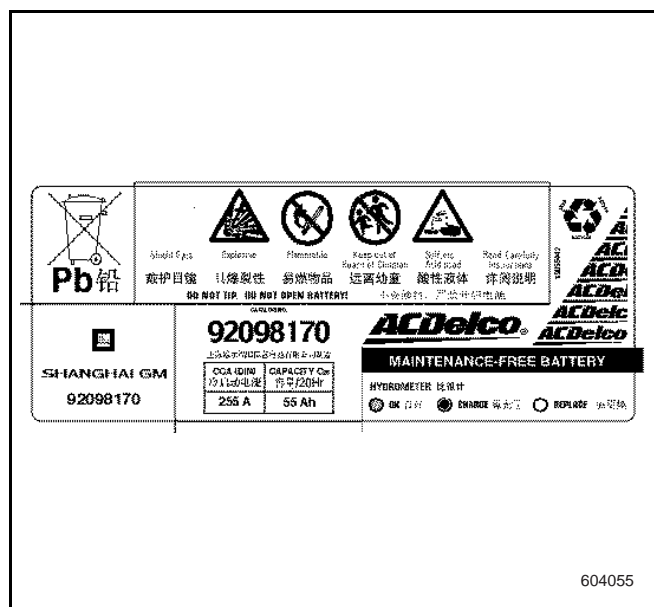
6.3.6.1 Battery

General

1. The maintenance free batteries of all Sail series vehicles are standard (Figure 1).The maintenance free battery is completely sealed except for two small vent holes in the side.These vent holes release the small amount of gas that is produced in the battery.The battery does not need distilled water to fill, and is installed with a head-up display, which can display the current charging.Before inspecting the charging, use your finger tips to tap the display.

The battery has 2 functions in the electrical system.First, the battery acts as the power supply in 12V electrical system; Second, the battery acts as a voltage stabilizer for the electrical system.

2. On the battery label is printed the Usage Description (Figure 2).The description includes battery ratings, part number and other service conditions.



Battery Ratings

The battery has two ratings: Reserve Capacity and Cold Cranking AMPs

Reserve Capacity

Reserve capacity is the amount of driving time required for turning on the lighting lamp, minimum electrical load (most of the accessory equipments are turned off) without input current.This is the longest time in minutes it takes a fully charged battery, being discharged at a constant rate of 25 amperes and a constant

temperature of 27°C (80°F) to reach a terminal voltage of 10.5V.Other temperature, or value of current, charging, battery conditions, etc. may affect the actual operating time of battery when the vehicle is without input current.

Cold cranking amperage

The cold cranking amperage is an indication of the ability of the battery to crank the engine at cold temperatures.The rated power is the minimum value maintained by the battery for 30 seconds at a temperature of -18°C (0°F), and at the same time the voltage must be maintained at least 7.2V.The actual battery performance will vary with the actual temperature change.

General reasons that cause a condition

The battery can not be used without limits. However, with proper care, the battery will provide many years of service.

If the battery tests good but still fails to perform well without obvious reasons, the following are some of the more common causes:

1. With the key off, the vehicle accessories were left on overnight.
2. The vehicle's electrical load is more than the generator input, particularly with the addition of part equipment for repairs.
3. Battery abuse against the rules, including failure to keep the battery cable terminal clean and tight, or a loose battery hold-down clamp.
4. Mechanical problems in the electrical system, such as shorted or pinched wires, or the cracked battery housing due to the impact.

Regularly inspect the battery for damage, such as cracked top cover or housing.

Electrolyte Freezing

The freezing point of electrolyte depends on its specific gravity.Because the electrolyte freezing may damage the battery, always keep the battery at fully charged conditions in order to avoid the electrolyte freezing.As long as green dots are displayed on the built-in hydrometer, the battery will not freeze, except that the temperature drops below -32°C.The fully charged battery will not freeze, except that the temperature is lower than -54°C.

Battery Protection During Vehicle Storage

Caution: Observe all the safety measures.Refer to Figure 2-Battery Label

Certain devices on the vehicle maintain a small continuous current drain on the battery, which is known as parasitic load.If the vehicle has not been used for a time, these parasitic loads will allow the battery to

discharge, and cause a permanent damage. The discharged battery will freeze in cold weathers. Refer to Electrolyte Freezing in this section.

Notice: Turn OFF the ignition when connecting or disconnecting the battery cables, the battery charger or the jumper cables. Otherwise it may damage the engine control module or other electrical components.

To keep the battery to be charged during the vehicle is unused:

1. If the vehicle storage time is over 30 days, ensure the green dot is visible and disconnect the battery negative cable then. This will prevent the battery from being discharged due to current drain of parasitic load. When re-connecting battery is needed:
 - Clean any existing oxidation from the contact face of the battery terminal using a wire brush, then re-connect the cables.
 - Tighten the battery cable bolts to 3-3.5 N•m.
 - Before the vehicle is put into use again, reset the clock, button radio adjustment.
2. If the battery cannot be disconnected, make a plan to regularly recharge the battery every 25-40 days in order to keep a high charging capacity. When the green dot is not visible in the battery hydrometer, re-connect the battery immediately.
3. To keep charge time to a minimum, use a battery charger capable of providing an charge voltage greater than 16V. The original maintenance-free battery will not be damaged when it is charged at a charge rate of 50A or more, as long as no acid solvent spews from the vent holes or the battery temperature is lower than 52°C (125°F). Inspect the battery which is being charged every 45-60 minutes, if necessary, stop the charge or decelerate the charging rate. Stop charging within one hour after the green dot appears in the hydrometer in order to avoid over discharged.

Leaving enough charge time. Refer to Battery Charging Components in this section. A battery that is discharged for an extended period of time will be hard to recharge, and if not charged all the time, it may cause a permanent damage.

Built-in Hydrometer

The maintenance-free battery has a built-in, humidity-compensated hydrometer in the top of the battery. Use the hydrometer to perform the following diagnostic procedures.

When observing the hydrometer, make sure that the battery has a clean top. In the dark area it may need lamp lighting.

- In the normal operation, one of the following three situations may occur:
1. The green dot is visible.
Any green appears in the hydrometer is considered as Green Dot. It indicates the battery is ready for testing.
 2. The green dot is not visible.
If no green dot is visible, and a warning of power up appears, refer to Battery Diagnosis in this section to make a further test. Inspect the electrical system for over current drain.

ESTIMATED TEMPERATURE	MINIMUM VOLTAGE
70° F. (21° C.)	9.6
50° F. (10° C.)	9.4
30° F. (0° C.)	9.1
15° F. (– 10° C.)	8.8
0° F. (– 18° C.)	8.5
0° F. (BELOW – 18° C.)	8.0

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3. Obvious or light yellow dot
It indicates that the fluid level is lower than the bottom of hydrometer, and it is too low to make a diagnosis. The possible reasons include overcharging or charging over a longer period, cracked housing or heavy impact. When the battery is found in this case, it may indicate that the charging system has a condition and causes the charging voltage too high. Therefore, be sure to inspect the electrical system. If the battery hydrometer displays any yellow dot or is transparent, replace the battery.

6.3.6.2 Battery On-vehicle Use

Charging

- When the battery needs charging, be sure to observe the following regulations:
1. The used end charging voltage should be 16V, and there is a charger equipped with a voltmeter of a precision within 1%.
 2. The ambient temperature should be 15-38 °C (60-100 °F). When the battery is too cold, it may

not accept the measurable current within several hours after the charger is started.

3. The charging area should have a sufficient ventilation.
4. If the built-in hydrometer is transparent or appears yellow, do not charge.
5. If the battery electrolyte appears to be frozen, do not charge.
6. Do not charge a battery with a green dot in the hydrometer unless it has just been discharged.

Charging procedures

Caution: Be sure to allow the key at OFF position when connecting or disconnecting the battery cables, the battery charger or the jumper cables. Or it may cause personal injuries or death, and damage the engine management system, transfer control module or other electronic components.

When charging a battery in the vehicle, go to Step 1.

1. Make sure all the charger connections are clean and tight.
2. Set the charger at 12V to charge a battery so as to charge the battery at the highest charge rate until a green dot is visible. (Do not use the charger set by the starting vehicle to charge a battery). Inspect the battery regularly when it is being charged. Tap the hydrometer top lightly in order to dislodge any air bubbles that produce incorrect indications.
3. If during charging the battery feels hot, (52°C), or if much gassing or spewing of the electrolyte through the vent holes occurs, discontinue the charging or reduce the charging rate.
4. After charging, test the battery according to Battery Diagnosis in this section.

Required Charging Time

The battery charging time depends on the following factors:

1. Size of Battery-A completely discharged, large, heavy-duty battery requires more than twice the recharging time as a completely discharged, smaller capacity battery.
2. Battery Temperature-The colder the battery is, the more time it takes to recharge the battery. When connecting a quick charger to a low-temperature battery, the initial current accepted by the battery will be very low. When the battery temperature increases, the rate of its accepted current will be faster.
3. Charger Power - The greater the charger's amperage is, the less time it takes to recharge the battery.
4. Charging Status - A completely discharged battery requires more than twice as much

charging time as a half charged battery. Because the electrolyte is nearly pure water and a poor conductor in a completely discharged battery, the battery accepts very low current at first. Slowly, as the charging current causes the acid content to increase in the electrolyte, the charging current will increase.

The battery, which discharges due to parasitic load and keeps this status for a time, may not be charged immediately. However, if the charging time is long enough, many batteries can still resume to be used.

If the battery is at a status of being fully discharged for a long time, it may cause a permanent damage. The temperature change may speed up the damage. The fully discharged battery may freeze at -7°C (20°F), and cause a permanent damage.

To avoid the battery damage and charging conditions, for the vehicle that will not be used within 30 days, its battery negative cable should be disconnected in order not to cause current drain to the battery. If cannot, charge the battery every 30-45 days until a green dot is visible.

Battery Charge Low or Completely Discharged

Observe the following procedure to charge a low or completely discharged battery. If not, it may be possible to cause an unnecessary replacement for the battery that is still fine.

1. Use the voltmeter to measure the battery terminal voltage. If lower than 11V, the charging current may be low, and may need a period to exceed a few milliamperes. Only voltmeter can measure so low current.
2. Place the battery charger at a set value.
3. Some chargers feature polarity protection circuitry, which prevents charging unless the charger leads are correctly connected to the battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are properly connected, implying that the battery will not accept a charge. Therefore, follow the specific charger manufacturer's instruction for connecting the circuitry so that the charger will turn on and charge a low-voltage battery.
4. The voltage and the value of current provided by the battery charger vary each other. The required time for the battery, which accepts the measurable charger current under the different voltages condition, as follows:
 - 16.0V or greater, 4 hours
 - 14.0-15.9V, 8 hours
 - 13.9V or lower, 16 hours

Notice:

- If the charge current cannot be measured after the above charge time ends, replace the battery.
 - If the charge current can be measured during the charging, the battery is considered normal. Fully charge the battery based on the normal methods.
5. A point to be noted that the fully discharged battery must reach enough ampere-hours (AH) in order to resume the status that can be used. Our experience is to use the reserve capacity, refer to Reserve Capacity in this section. Divide the reserve capacity ratings by the charge value of ampere, the result of which is the required hours for charging. (Ratings by amp = hours)

For example, the battery with the reserve capacity rating of 75, being charged at a rate of 10A, needs 7.5 hours when fully charged ($75 \div 10 = 7.5$). The same battery, being charged at a rate of 25A, needs 3 hours when fully charged ($75 \div 25 = 3$).

All the batteries, being charged according to this procedure, need a load test in order to ensure the availability. Refer to Battery Diagnosis in this section.

Starting in emergency

The booster battery and discharged battery should be treated carefully when using jumper cables. Observe the following procedure, take care not to produce sparks.

Caution: Batteries produce explosive gases, contain corrosive acids and supply levels of electrical current high enough to cause burns. Therefore, to reduce the risk of personal injury or death when they work near the battery:

- Always shield your eyes carefully and avoid leaning over the battery whenever possible.
- DO NOT let the battery contact flames or sparks.
- Do not allow the acid liquid of the battery to contact your eyes or skin. Flush immediately and thoroughly any contacted areas with water and get medical help.
- Observe all the requirements in the starting instructions.

Notice: Do not push or pull the vehicle. In some cases, this will damage the vehicle components. Additionally, because this vehicle type has a 12V negative grounding system, so ensure the vehicle and the equipment used to start the vehicle also has a 12V grounding voltage. Using other types of system may damage the vehicle electronic components.

Starting Procedure

1. Connect the vehicles with fine (discharged well) batteries and the jumper wires, never allow the

vehicles to contact each other. What 且 more, ensure the insulator of jumper wires are not loose or stripped.

2. Place the vehicle at parking brake, allowing the transmission selector lever at PARK position. Switch off the ignition system, lamps and all other unnecessary electrical load. Place the hazard flasher at ON position.
3. Inspect the built-in hydrometer. If it is transparent or displays light yellow, do not charge the battery.
4. Connect one end of a jumper wire to the booster battery positive, and the other end to red starting block positive of power-off vehicle.
5. Connect one end of the remaining negative jumper wire to the booster battery negative.
6. Finally connect the negative cable to the engine grounding slice, with a distance of at least 450 mm (18 in) away from the vehicle battery to be started.
7. Start the vehicle engine that provides the cranking power and turn off all the accessory equipment. Then place the ignition switch of vehicle equipped with a discharged battery at RUN position.
8. When removing the jumper wire, proceed with the steps in reverse order. Always disconnect the negative cable from the engine which is jump started.

Blank

6.4 Engine Controls

6.4.1 Specifications

6.4.1.1 Fastener tightening Specifications

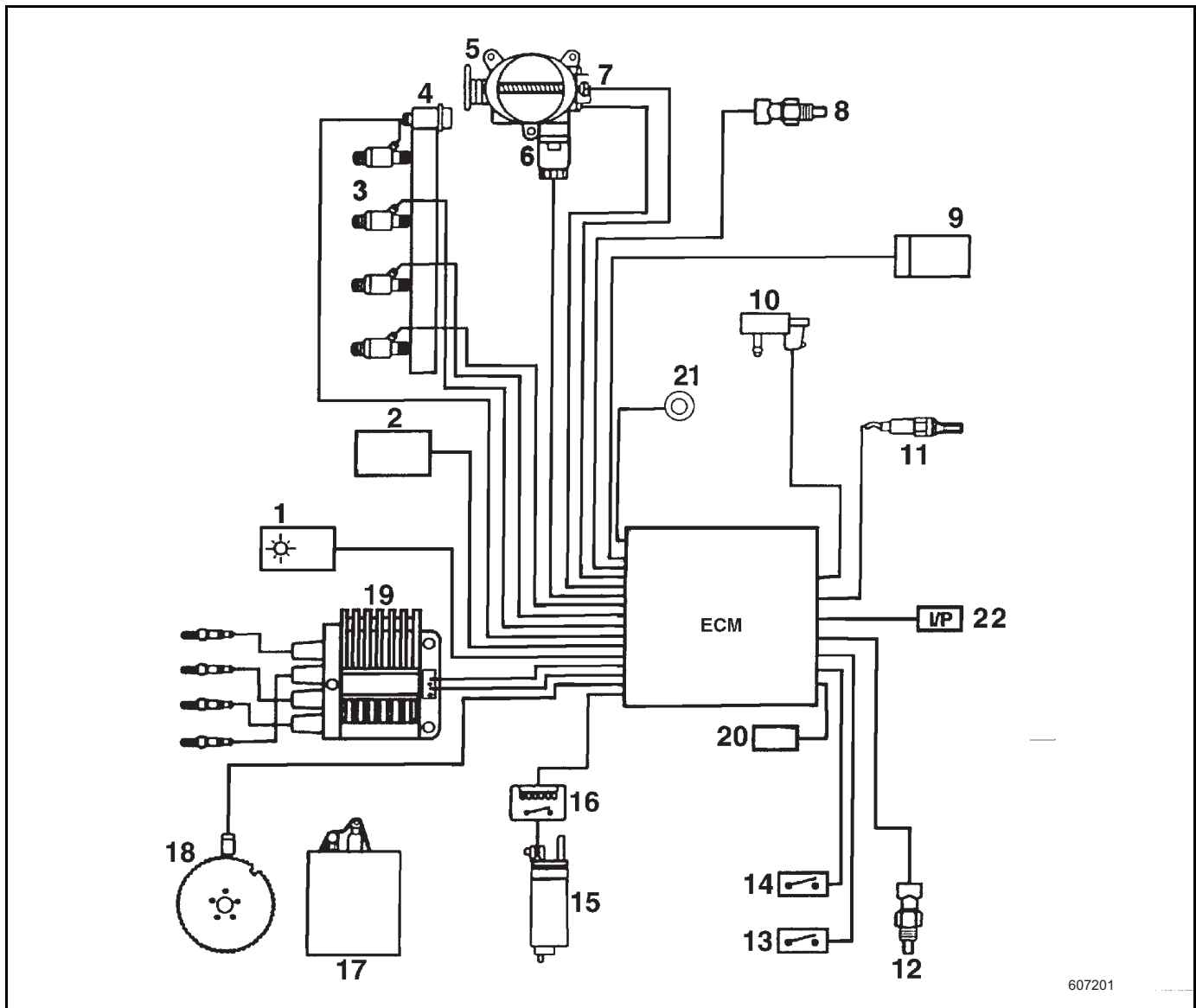
Application	Specification
Air Cleaner Duct Clamps	2.5-3.5 N•m
Coolant Temperature Sensor (CTS)	15±3 N•m
Crankshaft Position (CKP) Sensor Bolt	9±1 N•m
Crankshaft Position (CKP) Sensor Bracket Bolt	9±1 N•m
Fuel Pressure Regulator	6 N•m
Fuel Rail Bolt	10 N•m
Idle Air Control (IAC) Valve Bolt	3 N•m
Manifold Absolute Pressure (MAP) Sensor Nut	3 N•m
Knock Sensor Bolt	20±4 N•m
Oxygen Sensor	42±4 N•m
Throttle Assembly Nut	9 N•m
Throttle Position (TP) Sensor Bolt	3 N•m
Vehicle Speed Sensor Bolt	4 N•m

6.4.2 Schematic and Routing Diagrams

6.4.2.1 Engine Control Module Routing Diagram

See 8.20.2.4.

6.4.2.2 Motronic M7.9.7 System Schematics



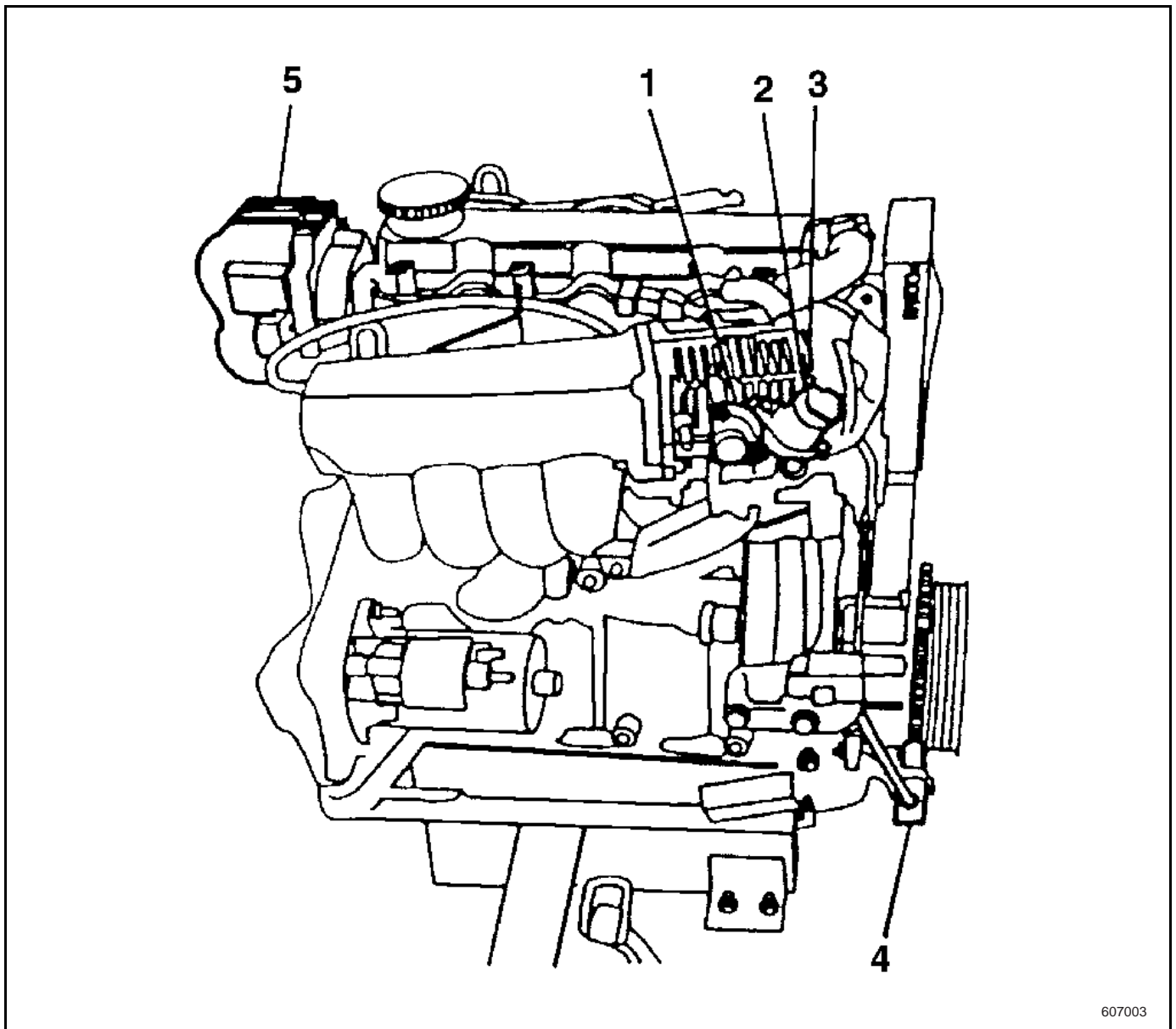
607201

Legend

- | | |
|--|---------------------------------------|
| (1) Engine Warning Light (MIL) | (12) Coolant Temperature Sensor (CTS) |
| (2) ALDL Connector | (13) Air Conditioner Switch |
| (3) Fuel Injector | (14) Not Used |
| (4) Fuel Pressure Regulator | (15) Fuel Pump |
| (5) Throttle Body | (16) Fuel Pump Relay |
| (6) Idle Air Control (IAC) Valve | (17) Canister |
| (7) Throttle Position Sensor (TPS) | (18) Crankshaft Position Sensor (CPS) |
| (8) Intake Air Temperature (IAT) Sensor | (19) Direct Ignition System (DIS) |
| (9) Not Used | (20) Power Supply |
| (10) Manifold Absolute Pressure (MAP) Sensor | (21) Knock Sensor (KS) |
| (11) Oxygen Sensor | (22) Instrument Cluster |

6.4.3 Component Locator

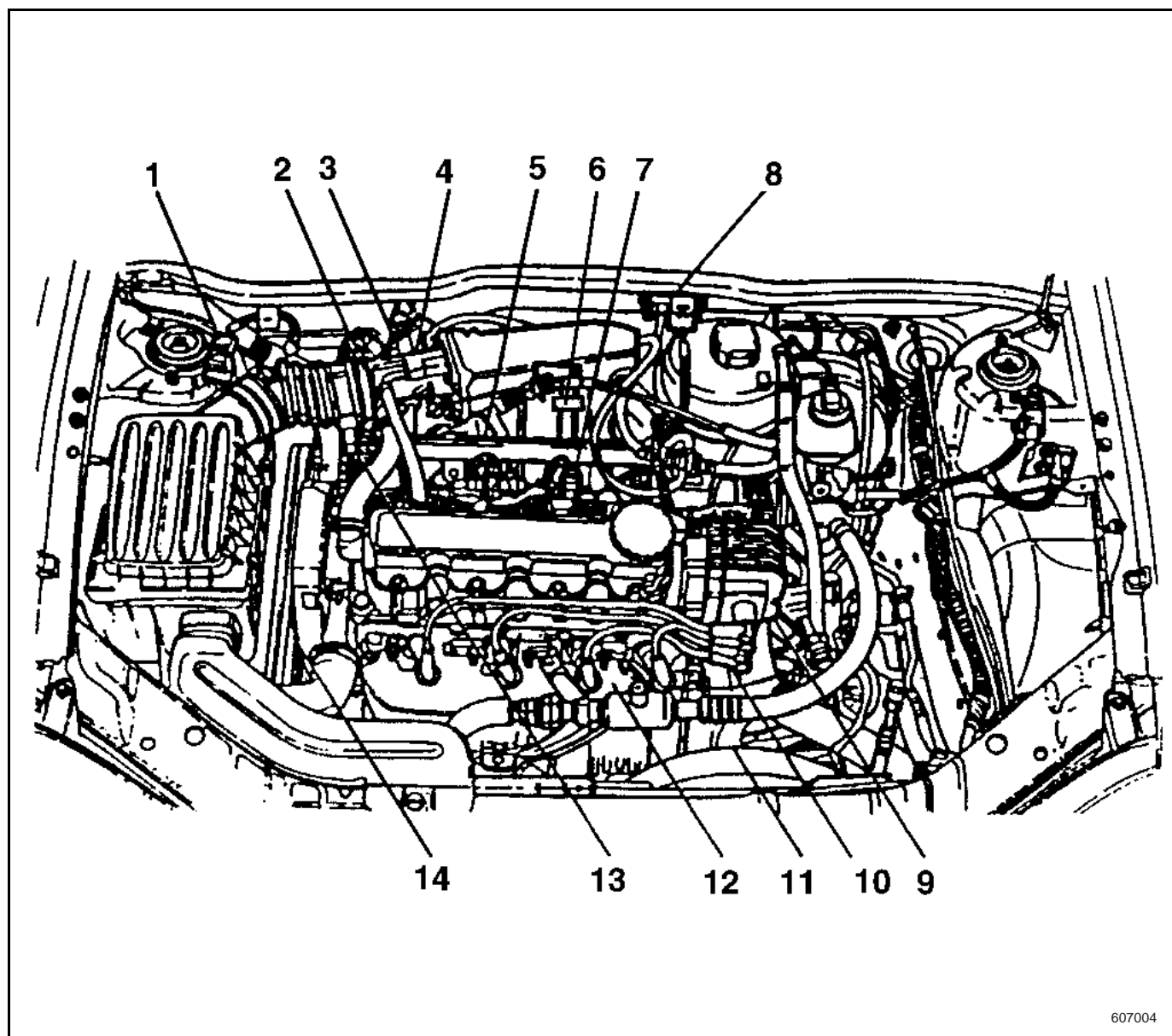
6.4.3.1 The Position of Engine Controls Compartment on the Engine



Legend

- | | |
|------------------------------|--------------------------------|
| (1) Throttle Position Sensor | (4) Crankshaft Position Sensor |
| (2) Idle Air Control Valve | (5) DIS Ignition Module |
| (3) Throttle Body | |

6.4.3.2 The Position of Engine Controls Compartment in the Engine Compartment

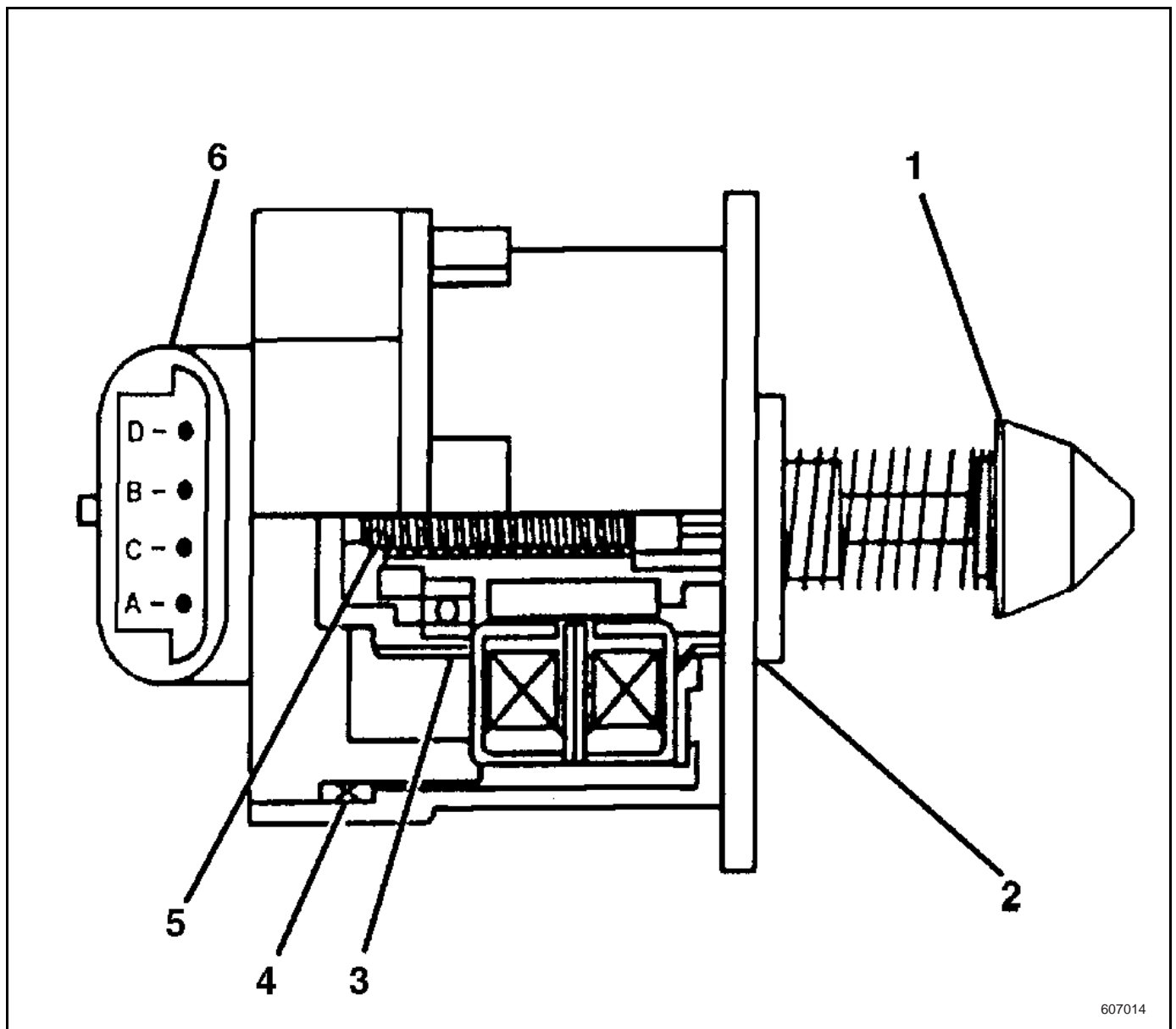


607004

Legend

- | | |
|------------------------------|---------------------------------------|
| (1) Not Used | (8) Manifold Absolute Pressure Sensor |
| (2) Idle Air Control Valve | (9) DIS Module |
| (3) Throttle Position Sensor | (10) Coolant Temperature Sensor |
| (4) Throttle Body | (11) Radiator Fan |
| (5) Fuel Rail Assembly | (12) Oxygen Sensor |
| (6) Canister Purge Valve | (13) Intake Air Temperature Sensor |
| (7) Fuel Injector | (14) Crankshaft Position Sensor |

6.4.3.3 Idle Air Control (IAC) Valve

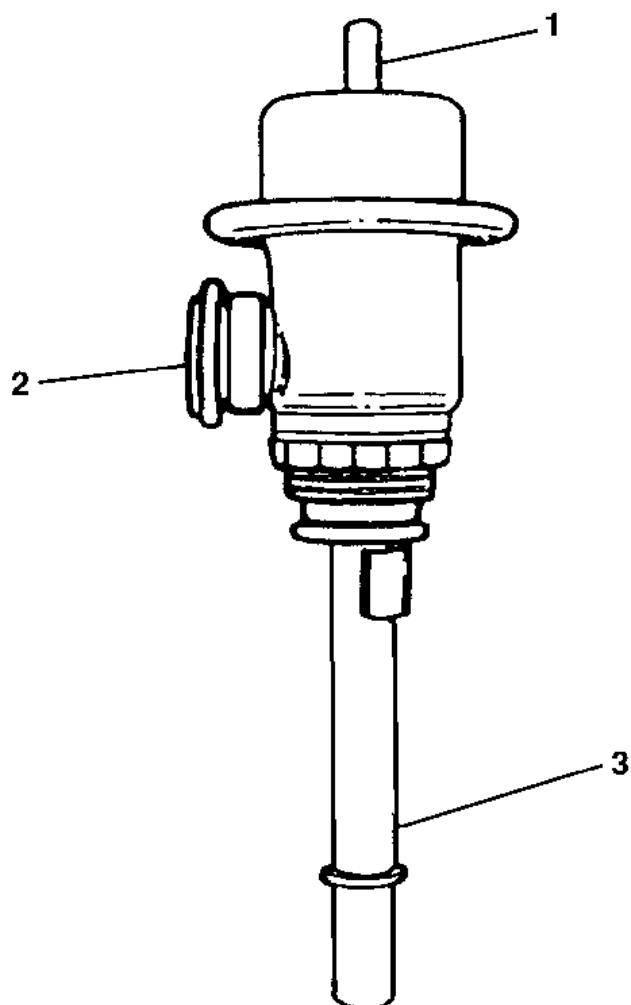


607014

Legend

- | | |
|---------------------|--------------------|
| (1) Valve Cone | (4) Sealing ring |
| (2) Gasketed Flange | (5) Orbicular Gear |
| (3) Rear Bearing | (6) Connection |

6.4.3.4 Pressure Regulator



606030

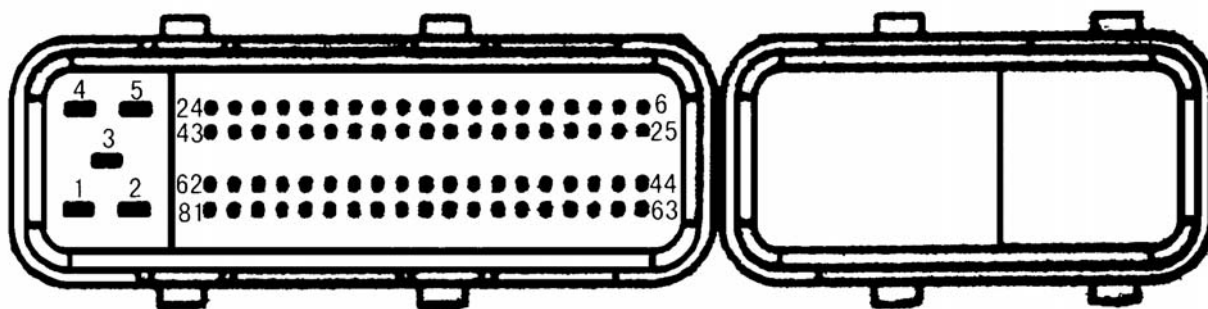
Legend

- (1) Intake Manifold Vacuum Connection
- (2) Fuel Rail Connection

- (3) Fuel Outlet

6.4.3.5 Engine Control System Connector End Views

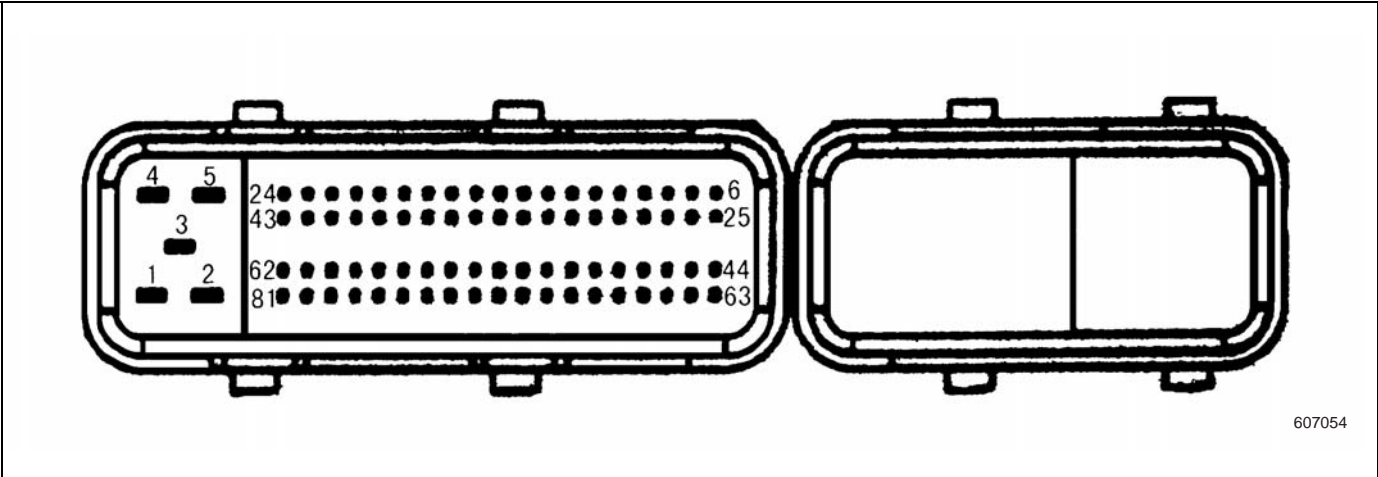
Engine Control Module(ECM)



607054

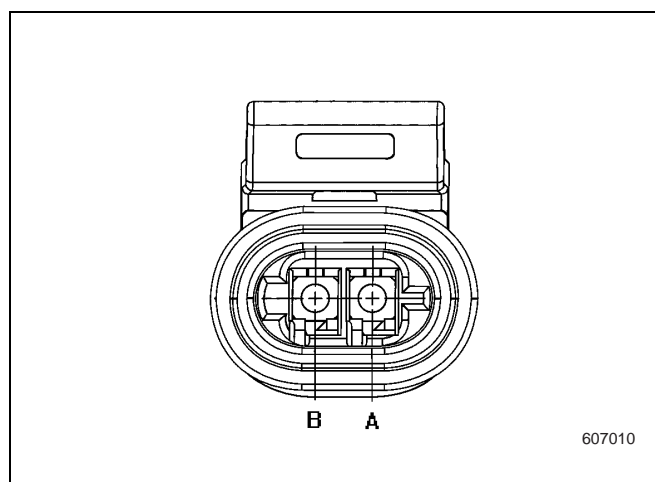
Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	Oxygen Sensor Heating Control	22		43		64	Idle Motor 1
2	Ignition Coil 2	23		44	Power Supply	65	Idle Motor 2
3		24		45	Power Supply	66	Idle Motor 3
4		25		46	Canister Purge Valve	67	Idle Motor 4
5	Ignition Coil 1	26		47	Fuel injector 4	68	Fan 2
6	Fuel injector 2	27	Fuel injector 1	48		69	A/C Compressor Relay
7	Fuel injector 3	28		49		70	Fuel Pump Relay
8	Engine Speed	29		50	Fan 1	71	Diagnostic Data K wire
9	Throttle	30		51	Ground	72	Requested Torque Signal
10		31	Malfunction Indicator Lamp	52		73	Manual/Auto Signal (TCM-ECM)
11		32	5 V Power Supply 2	53	Ground	74	Gear Signal
12	Battery	33	5 V Power Supply 1	54		75	Air Conditioner Request Signal
13	Ignition Switch	34	Crankshaft Position Sensor B	55		76	
14	Main Relay	35	Sensor Ground 3	56		77	
15	Crankshaft Position Sensor A	36	Sensor Ground 2	57		78	
16	Throttle Position	37	Intake Air Pressure	58	Ground	79	
17	Sensor Ground 1	38		59	Vehicle Speed Sensor	80	Ground
18	Oxygen Sensor	39	Coolant Temperature	60		81	

Engine Control Module(ECM)



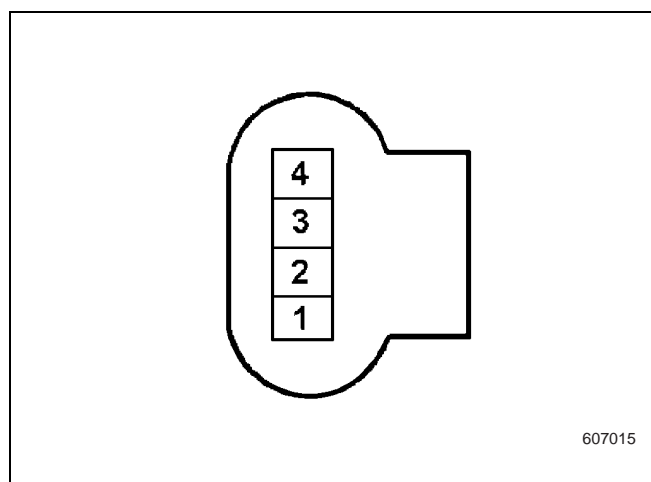
Pin	Function	Pin	Function	Pin	Function	Pin	Function
19	Knock Sensor A	40	Intake Air Temperature	61	Ground		
20	Knock Sensor B	41		62			
21		42		63	Power Supply		

Intake Air Temperature Sensor(IAT)



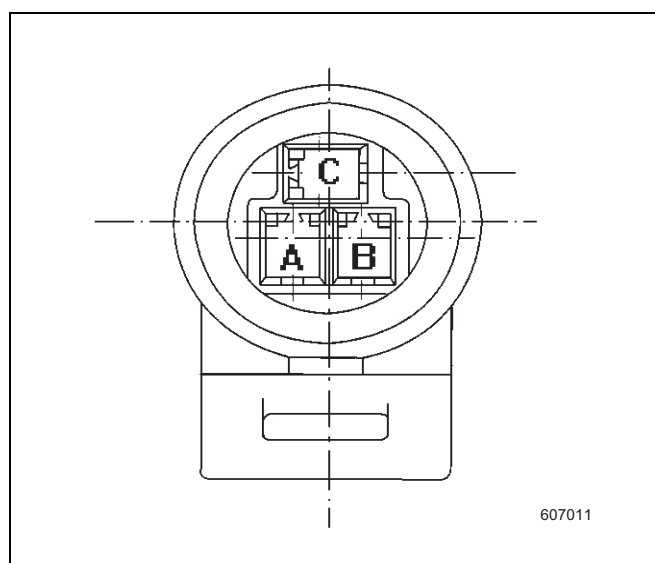
Connector Part Information		P/N: 12162198
Pin	Wire Color	Function
A	BRN/BLU	Singal (ECM 40)
B	BRN	Ground (ECM 17)

Idle Air Control (IAC) Valve



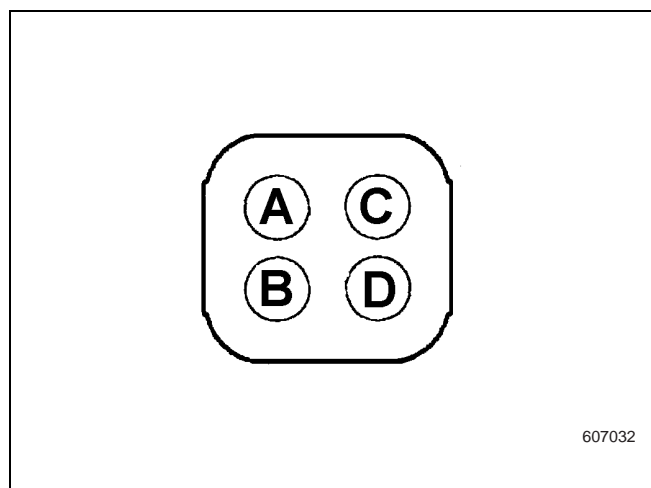
Connector Part Information		P/N:12162189
Pin	Wire Color	Function
1	BLSW	Signal (ECM A3)
2	BLGN	Singal (ECM A4)
3	GN	Singal (ECM A2)
4	GNWS	Signal (ECM A1)

Throttle Position Sensor



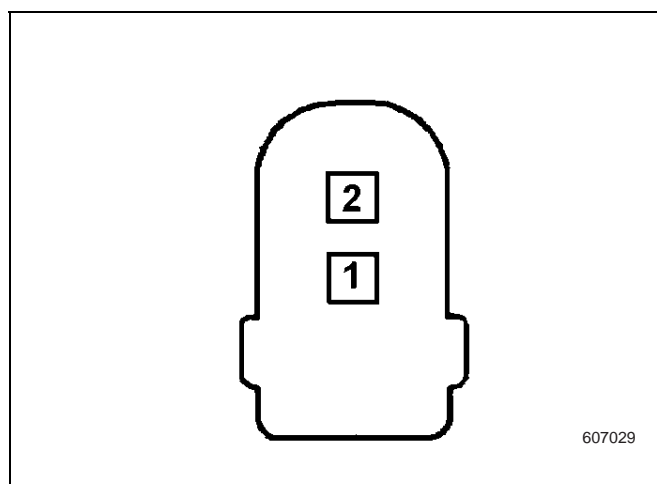
Connector Part Information		P/N:10717473
Pin	Wire Color	Function
A	SWWS	ECM D8
B	BR	ECM B2
C	BL	ECM D5

Oxygen Sensor



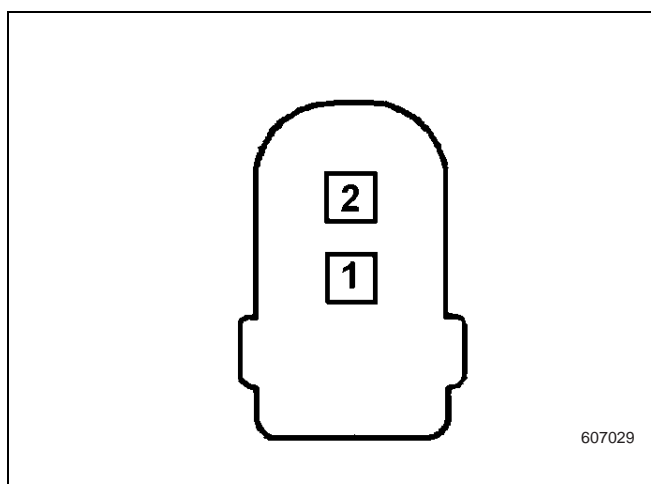
Connector Part Information		P/N:12162189
Pin	Wire Color	Function
A	BLSW	Signal (ECM A3)
B	BLGN	Singal (ECM A4)
C	GN	Singal (ECM A2)
D	GNWS	Signal (ECM A1)

Injector - Fuel (Cylinder 1)



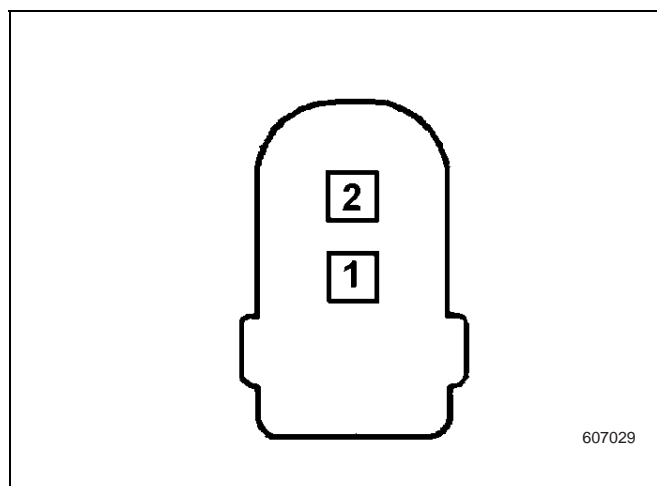
Connector Part Information		P/N:12162189
Pin	Wire Color	Function
1	BLSW	Signal (ECM A3)
2	BLGN	Singal (ECM A4)

Injector - Fuel (Cylinder 3)



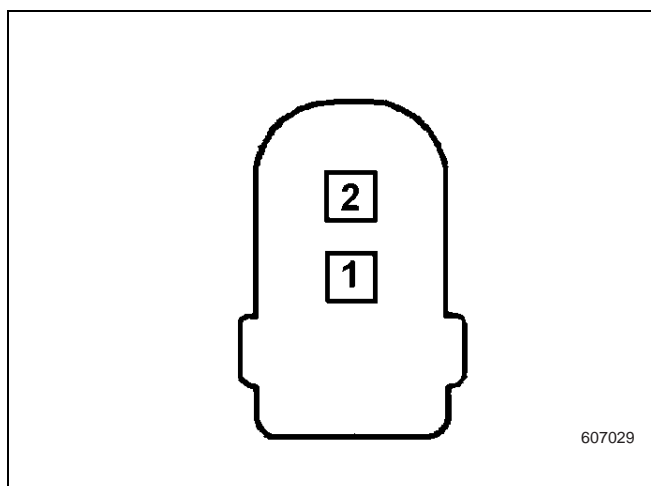
Connector Part Information		P/N:12162189
Pin	Wire Color	Function
1	BLSW	Signal (ECM A3)
2	BLGN	Singal (ECM A4)

Injector - Fuel (Cylinder 2)



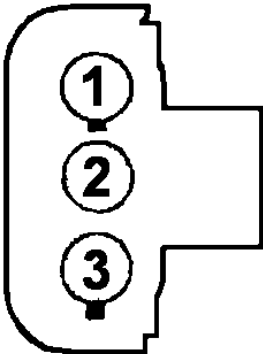
Connector Part Information		P/N:12162189
Pin	Wire Color	Function
1	BLSW	Signal (ECM A3)
2	BLGN	Singal (ECM A4)

Injector - Fuel (Cylinder 4)



Connector Part Information		P/N:12162189
Pin	Wire Color	Function
1	BLSW	Signal (ECM A3)
2	BLGN	Singal (ECM A4)

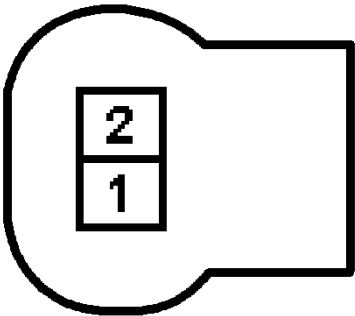
Manifold Absolute Pressure Sensor
(MAP)



607035

Connector Part Information		P/N: N/A
Pin	Color	Function
1	BR	Singal (ECM D15)
2	GN	Singal (ECM A7)
3	SWWS	Singal (ECM D8)

Sensor - Coolant Temperture

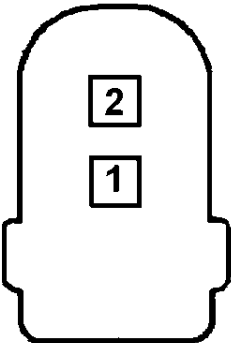


607042

Connector Part Information		P/N: N/A
Pin	Wire Color	Pin
1	BR	A
2	BL	B

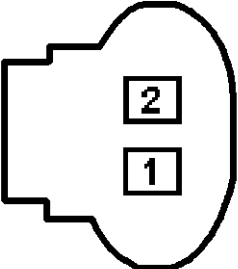
Sensor - Knock Sensor

Canister Purge Solenoid Valve



607029

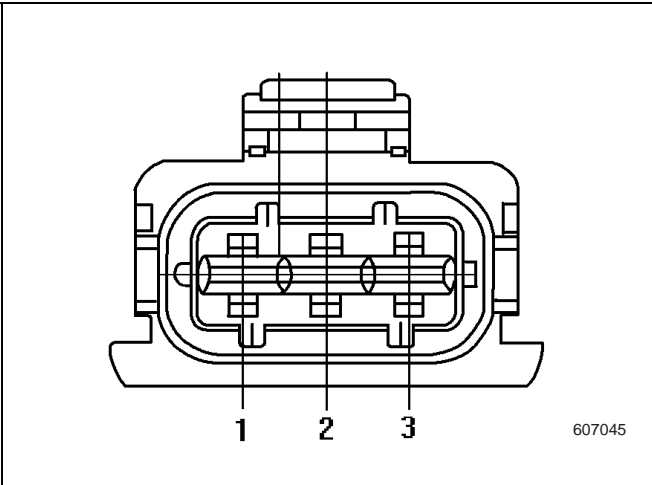
Connector Part Information		P/N:15326181
Pin	Color	Function
1	BL	Turn On (IGN)
2	BRWS	Singal (ECM C6)



607052

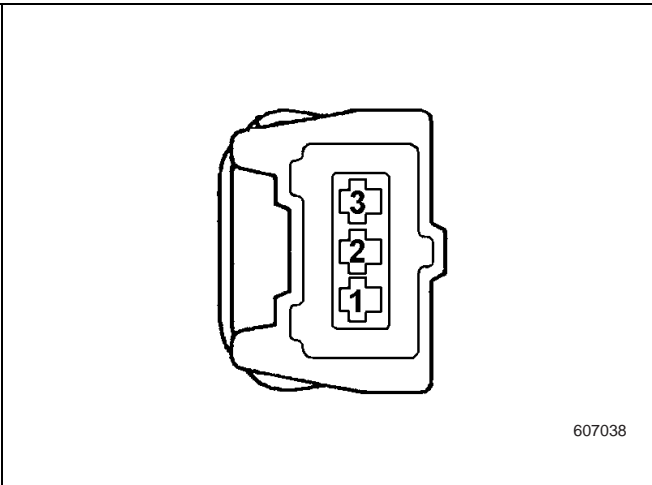
Connector Part Information		P/N: N/A
Pin	Wire Color	Pin
1	BR	A
2	BL	B

Vehicle Speed Sensor



Connector Part Information		P/N:12158455
Pin	Wire Color	Function
1	BLRT	ECM D10
2	BR	Ground
3	SW	Turn On (F19)

Pulse Sensor - Crankshaft



Connector Part Information		P/N:15364318
Pin	Wire Color	Function
A	BL	Singal (ECM B14)
B	BR	Signal (ECM A16)
C	BR	Ground

6.4.4 Diagnostic Information and Procedures

6.4.4.1 Diagnostic Starting Point

Begin the system diagnosis with Powertrain on Board Diagnostic (OBD) System Check. Powertrain on Board Diagnostic (OBD) System will provide the following information:

- The identification of the control modules which command the system.
- The ability of the control modules to communicate through the serial data circuit.
- The identification of any stored DTCs and the code status

The use of the Powertrain on Board Diagnostic (OBD) System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

6.4.4.2 Powertrain On Board Diagnostic (OBD) System Check

Circuit Description

Powertrain On Board Diagnostic (OBD) System Check must be the starting point for any driveability concern. Before starting the procedure, visual and physical check should be performed to identify if the engine control module and engine ground are clean and tight. Powertrain On Board (OBD) System Check is an effective method of identifying the condition created by the electrical engine controls malfunction.

Malfunction Indicator Lamp (MIL) Operation:

MIL is located on the instrument panel (CHECK ENGINE) or (SERVICE ENGINE SOON). MIL performs the following functions:

- Inform the driver that a malfunction has occurred and that the vehicle should be taken in for service as soon as possible.
- During the system check, Malfunction Indicator Lamp should illuminate when the ignition switch is turned to the ON position, with the engine OFF. When the engine is started, the MIL will turn OFF. If the MIL remains on, self-diagnostic system has detected a malfunction. If the malfunction is eliminated, MIL will be turned off under the most conditions, but the DTC will be stored.
- If the MIL illuminates, and then the engine stalls, MIL will remain on if the ignition is on.
- If the MIL does not illuminate and the engine stalls, before the ignition is switched from Off to On, the MIL will not illuminate.

Perform the Powertrain On Board Diagnostic System Check first if the following situations occur:

- The MIL does not illuminate when the ignition switch is in the RUN position.
- The MIL remains on when the engine is running.
- When driveability is suspected of malfunctions.

Diagnostic Aids:

The intermittent conditions may be caused by the following reasons:

- Poor Connection
- Wire insulation is rubbed through
- Wiring broken inside the insulation

Check for poor connections and damaged wiring.

Check the ECM wiring and connections for the following conditions:

- Improper mating
- Broken Locks
- Improperly formed or damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

Test Description

The numbers below refer to the step numbers on the diagnostic table.

1. The MIL should be on steady with the key ON and the engine OFF. If it does not illuminate, see MIL is Inoperative Due to a Malfunction of this section to eliminate the malfunction.
2. This test ensures that ECM could transfer the Class 2 serial data to the data link connector (DLC) and the Class 2 serial data circuit is not open or short. If you experience problems or suspect that the scan tool is at fault, use the scan tool on another vehicle to verify the working condition. If data link connector malfunction exists, use the Data Link Connector Diagnostic Table to carry out the diagnosis.
5. For a complete list of the diagnostic trouble code which is supported on the vehicle application, refer to the diagnostic trouble code list. If multiple DTCs are stored, diagnose each DTC according to the following priority:
 - ECM Error DTCs
 - System Voltage DTCs
 - Component level DTCs (switches, sensor range/performance, sensor high voltage, sensor voltage, ODMs, etc)
 - System Level DTCs (Idle Control System, Heated Oxygen Sensor Response)

6. A scan tool parameter which is not within the typical range may help to isolate the area which is causing the problem.

Powertrain On Board Diagnostic(OBD)System Check

Step	Action	Value	Yes	No
1.	<p>Note:</p> <ul style="list-style-type: none"> Before you proceed with diagnosis, check the applicable service bulletins. When carrying out the steps on the diagnostic table, do not turn the ignition off. if there is no driveability concern, do not perform this test. Unless instructed, do not clear any DTCs. <p>1. With the engine off, turn on the ignition. 2. Observe the MIL. Does the MIL illuminate?</p>	—	Go to Step 2	Inspect the Malfunction Indicator Lamp (MIL) which is inoperative due to a malfunction
2.	<p>1. Turn the ignition off. 2. Install the scan tool. 3. Turn the ignition ON with the engine OFF. 4. Display the ECM data with the scan tool. Does the scan tool display the ECM data?</p>	—	Go to Step 3	Inspect the data link connector (DLC).
3.	Start the engine.Does the engine start?	—	Go to Step 4	Inspect the engine if it could not start
4.	Does the engine start and continue to operate?	—	Go to Step 5	Inspect the engine if it cranks but does not run
5.	<p>Note:</p> <ul style="list-style-type: none"> If the scan tool displays that all DTCs are set, record the frozen malfunction status/malfunction record. Use the scan tool in order to display the Diagnostic Trouble Code (DTC) . <p>Does the scan tool indicate any DTCs set?</p>	—	Go to applicable DTC table	Go to Step 6
6.	<p>With a scan tool, Compare the ECM data to the Scan Tool Data List. Does the scan tool indicate that the values of ECM are equal to or within the typical range.</p>	—	System OK	Go to Symptoms

6.4.4.3 Scan Tool Data List

The Scan Tool Data List contains all engine related parameters that are available on the scan tool. The list is arranged in alphabetical order. The specific parameters may appear in any data list, in some cases, they may appear multiple times or appear in multiple data lists in order to combine the related parameters together.

Use the Scan Tool Data List only after the following is determined:

- Powertrain On Board Diagnostic(OBD)System Check is completed.
- No Diagnostic Trouble Codes (DTCs).
- The On Boarddiagnostics are functioning correctly.

Scan tool values from a properly running engine may be used for comparison with the engine you are

diagnosing. The Scan Tool Data List represents values that would be seen on a normal running engine.

Note: A scan tool that displays faulty data should not be used. The scan tool condition should be reported to the manufacturer. Use of a faulty scan tool can result in misdiagnosis and unnecessary parts replacement.

Only the parameters listed below are referenced in this service manual for use in diagnosis. If all values are within the typical range described below, refer to Symptoms for diagnosis.

The column labeled Data List indicates where a parameter is located on the scan tool. Review the scan tool operating manual for the exact locations of the data lists. The following is a description of each term listed:

Engine Data (Engine data 1):

Engine Data List

Scan Tool Data List

Scan Tool Parameter	Data List	Parameter Range/Units	Typical Data Values
Engine Idling/Radiator Hose Hot/Closed Throttle/Park or Neutral/Closed Loop/Accessories Off/Released Brake			
Engine Speed	Engine Data	Revolutions Per Minute (RPM)	0-6350
Desired Idle Speed	Engine Data	Revolutions Per Minute (RPM)	920_20
Idle Motor Position	Engine Data	Count	0-220
Engine Coolant Temperature Sensor	Engine Data	Degrees	-35-135°C
Engine Coolant Temperature Sensor	Engine Data	Volts	0-5
Intake Air Temperature (IAT) Sensor	Engine Data	Degrees	-33-126°C
Intake Air Temperature (IAT) Sensor	Engine Data	Volts	0-5
Ambient Temperature	Engine Data	Degrees	-40-60°C
Engine Load	Engine Data	%	0-100%
Throttle Position Sensor	Engine Data	Volts	0.5-4.5
Throttle Position Angle	Engine Data	%	0-80
Throttle at Idle Position	Engine Data		Y/N
Throttle at Wide Open Position	Engine Data		Y/N
Manifold Absolute Pressure Sensor	Engine Data	kPa	15-120
Manifold Absolute Pressure Sensor	Engine Data	Volts	0.195-4.883
Fuel Injector 1 Pulse Width	Engine Data	ms	0-16
Heated Oxygen Sensor 1 Voltage	Engine Data	mV	0-1000

Scan Tool Data List(Cont' d)

Scan Tool Parameter	Data List	Parameter Range/Units	Typical Data Values
Heated Oxygen Sensor 1 Heater Status	Engine Data		ON/OFF
Rich/Lean Status	Engine Data		Rich/Lean
Short Term Fuel Trim Value	Engine Data	%	
Long Term Fuel Trim Value	Engine Data	%	
Canister Purge solenoid Duty Ratio	Engine Data	%	0-100
Power Enrichment	Engine Data	Active/Inactive	Inactive
Deceleration Fuel Mode	Engine Data	Active/Inactive	Inactive
Ignition	Engine Data	Degrees	-12-60
Knock Sensor Voltage	Engine Data	mV	0-100
Cylinder 1 Knock Retard	Engine Data	Degrees	0-6
Cylinder 2 Knock Retard	Engine Data	Degrees	0-6
Cylinder 3 Knock Retard	Engine Data	Degrees	0-6
Cylinder 4 Knock Retard	Engine Data	Degrees	0-6
Battery Voltage	Engine Data	Volts	0-6
Torque Request	Engine Data	%	0-80
Torque Delivered	Engine Data	%	0-80
Fuel Pump Relay Status	Engine Data		ON/OFF
A/C Request Signal	Engine Data		ON/OFF
A/C Relay Status	Engine Data		ON/OFF
Fan 1 Status	Engine Data		ON/OFF
Fan 2 Status	Engine Data		ON/OFF
Starter Motor Switch	Engine Data		ON/OFF
Vehicle Speed Sensor	Engine Data	Km/h	0-250
TCC Solenoid Status	Engine Data		ON/OFF
MIL Status	Engine Data		ON/OFF/blinking
DTC(S) Coding	Engine Data		

6.4.4.4 Scan Tool Data Definitions

The Engine Scan Tool Data Definitions list contains a brief description of all the engine related parameters that are available on the scan tool.

Engine Speed

The scan tool displays 0-2,400 RPM - the ECM computes engine speed from the camshaft position (CMP) sensor input. The engine speed should be consistent with the applicable desired idle value while it is idling.

Desired Idle Speed:

The scan tool displays 0-3,000 RPM - which indicates the idle speed as commanded by the ECM. The ECM compensates for various engine loads based on engine coolant temperature to keep the engine at the desired idle speed.

Idle Motor Position:

The scan tool displays 0-255 counts - it displays the commanded position of the idle air control (IAC) pintle in counts. A larger number of counts means that more air is being commanded through the idle air passage. IAC position should respond fairly quickly to changes in engine loads to maintain desired idle RPM.

Engine Coolant Temperature Sensor:

The scan tool displays -40 ~ 151°C - the Engine Coolant Temperature (ECT) Sensor is mounted in the coolant stream. The ECM applies 5 volts to the Engine Coolant Temperature (ECT) sensor circuit. The sensor is a thermistor, which changes internal resistance as temperature changes. When the sensor is cold (internal resistance high), the ECM monitors a high signal voltage and interprets it as a cold engine. As the sensor warms (internal resistance decreases), the voltage signal will decrease and the ECM will interpret the lower voltage as a warm engine.

Intake Air Temperature (IAT) Sensor:

The scan tool displays -40 ~ 151°C - the ECM converts the resistance of the Intake Air Temperature (IAT) sensor to degrees. The ECM uses IAT sensor to adjust fuel delivery and spark timing according to incoming air density. The IAT is also compared to the ECT at startup to identify cold starts for the Heated Oxygen Sensor and the EVAP diagnostics.

Ambient Temperature:

The scan tool displays -40 ~ 151°C - it indicates the intake air temperature (IAT) at the time that the vehicle was started. With heated oxygen sensor diagnostic, identify if the last start is a cold start.

Engine Load:

The scan tool displays 0 - 100% - engine load is calculated by the ECM from the engine speed and MAP

sensor readings. Engine load should increase with an increase in RPM or air flow.

Throttle Position Sensor:

The scan tool displays 0 -5 volts - voltage is monitored by the system control module on the throttle position signal circuit.

Throttle Position Angle:

The scan tool displays 0 - 100% - throttle position angle is calculated by the ECM from the throttle position sensor voltage. For the throttle position angle, it will display 0% at idle speed and 80% at wide open throttle (WOT).

Throttle at Idle Position:

The scan tool displays if the throttle is at idle position.

Throttle at Wide Open Position:

The scan tool displays if the throttle is at wide open position.

Manifold Absolute Pressure Sensor:

The scan tool displays 15-120 kPa - Manifold Absolute Pressure (MAP) sensor measures the change in the intake manifold pressure which results from engine load and speed changes. As the intake manifold pressure increases, intake vacuum decreases resulting in a higher MAP sensor voltage and kPa reading.

Fuel Injector 1 Pulse Width:

The scan tool displays 0-16 milliseconds. Indicates the amount of time the ECM is commanding each injector ON during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width (IPW) should increase with increased engine load.

Heated Oxygen Sensor 1 Voltage:

The scan tool displays 0-1000 millivolts - it represents the fuel control exhaust oxygen sensor output voltage. This voltage will fluctuate constantly between 0 mv (lean exhaust) and 1000 mv (rich exhaust) when the system is operating in a Closed Loop.

Heated Oxygen Sensor 1 Heater Status:

The scan tool displays On/Off - it represents the status of the heated oxygen sensor/heater.

Rich/Lean Status:

The scan tool displays the rich/lean status of the mixed air.

Short Term Fuel Trim Value:

The scan tool displays -15 - 15% - Short term fuel trim represents a short term correction to fuel delivery by the ECM in response to the amount of time the fuel control oxygen sensor voltage spends above or below the 450 mv threshold. If the oxygen sensor voltage has mainly remained less than 450 mv, indicating a lean air/

fuel mixture, short term fuel trim will increase into the positive range above 0 percent and the ECM will add fuel. If the oxygen sensor voltage stays mainly above the threshold, short term fuel trim will decrease below 0 percent into the negative range while the ECM reduces fuel delivery to compensate for the indicated rich condition. Under certain conditions such as extended idle and high ambient temperatures, canister purge may cause short term fuel trim to read in the negative range during the normal operation. The ECM's maximum authority to control long term fuel trim allows a range between -10(+10) percent. Fuel trim values at or near maximum authority may indicate an excessively rich or lean system.

Long Term Fuel Trim Value:

The scan tool displays -1-(10)% - Long term (LT) fuel trim is derived from the short term (ST) fuel trim value and represents a long-term correction of fuel delivery. A value of 0 percent indicates that fuel delivery requires no compensation to maintain the ECM commanded air/fuel ratio. A negative value significantly below 0 percent indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly more than 0 percent indicates that a lean condition exists and the ECM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. The ECM's maximum authority to control long term fuel trim allows a range between -10 - (10) percent. Fuel trim values at or near maximum authority may indicate an excessively rich or lean system.

Canister Purge solenoid Duty Ratio:

The scan tool displays 0-100% - it represents the ECM commanded PWM duty cycle of the EVAP purge valve. 0 percent displayed indicates no purge, 100 percent displayed indicates full purge.

Power Enrichment:

The scan tool displays active or inactive - ACTIVE displayed indicates that the ECM has detected conditions appropriate to operate in power enrichment mode. When a large increase in throttle position and load is detected, the ECM will increase the amount of fuel delivered by entering Open Loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

Deceleration Fuel Mode:

The scan tool displays active or inactive - Active is displayed if the ECM has detected conditions appropriate to operate in deceleration fuel mode. The ECM will command deceleration fuel mode when a sudden decrease in throttle position has been detected while the vehicle is traveling over 40 km/h (25 mph). While in deceleration fuel mode, the ECM will decrease

the amount of fuel delivered by entering Open Loop and decreasing the injector pulse width.

Ignition:

The scan tool displays -12 - 60 degrees - displays the ignition timing commanded by the ECM on the IC circuit. A negative value indicates degrees Before Top Dead Center (BTDC) or spark advance. A positive value indicates degrees After Top Dead Center (ATDC) or spark retard.

Knock Sensor Voltage:

The scan tool displays 0 -100 mv - it represents the knock sensor signal voltage received by the ECM.

Cylinder 1 - 4 Knock Retard:

The scan tool displays 0 -6 degrees - it indicates the ignition retard degrees of ECM in response to the signals from the knock sensor.

Battery Voltage:

The scan tool displays 8 -16 volts - it represents the system voltage measured by the ECM at its ignition feed.

Torque Request:

The scan tool displays 0 -80 % - it represents the percentage of torque request sent from the automatic transmission to the ECM.

Torque Delivered:

The scan tool displays 0 -80 % - it represents the percentage of torque delivered by the ECM to the automatic transmission.

Fuel Pump Relay Status:

The scan tool displays ON or OFF - indicates the ECM commanded state of the fuel pump relay control circuit.

A/C Request Signal:

The scan tool displays YES or NO - indicates the state of the A/C request input circuit from the A/C controls. The ECM uses the A/C request signal to determine whether A/C compressor operation is being requested.

A/C Relay Status:

The scan tool displays ON or OFF - indicates the ECM commanded state of the A/C compressor clutch relay driver circuit. A/C compressor clutch should be engaged when Commanded A/C displays ON.

Fan 1 Status:

The scan tool displays ON or OFF - indicates the ECM commanded state of Fan 1.

Fan 2 Status:

The scan tool displays ON or OFF - indicates the ECM commanded state of Fan 2.

Starter Motor Switch:

The scan tool displays the state of the starter motor switch.

Vehicle Speed Sensor:

The scan tool displays 0-255 km/h (0-155 mph), the vehicle speed sensor signal is converted into mph and km/h for display.

TCC Solenoid Status:

The scan tool displays ON or OFF - indicates the on/off status of the TCC solenoid.

MIL Status:

The scan tool displays ON or OFF - indicates that the ECM commands MIL on and off or blink.

DTC(S) Coding:

Indicates the DTC(S) Coding.

6.4.4.5 Diagnostic Trouble Code (DTC)**Type Definition****Type 30**

1. Action Taken When the DTC Sets
 - Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
 - The failure will be identified by the ECM during the first drive cycle in which the diagnostic test has been run and failed, and the ECM will illuminate the malfunction indicator lamp (MIL).
2. Conditions for Clearing the MIL/DTC
 - The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
 - After 20 consecutive warm-up cycles without failure, the DTC will be cleared.

Type 31

1. Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- The failure is identified by the ECM during the first drive cycle in which the diagnostic test has been run and failed, and the ECM will not illuminate the malfunction indicator lamp (MIL).

2. Conditions for Clearing the MIL/DTC

- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.

Type 32

1. Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- The failure is identified by the ECM during the second drive cycle in which the diagnostic test has been run and failed, and the ECM will illuminate the malfunction indicator lamp (MIL).

2. Conditions for Clearing the MIL/DTC

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.

Type 33

1. Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- The failure is identified by the ECM during the second drive cycle in which the diagnostic test has been run and failed, and the ECM will not illuminate the malfunction indicator lamp (MIL).

2. Conditions for Clearing the MIL/DTC

- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.

Type 36

1. Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- 2 seconds after the diagnostic test has been run and failed, the failure is identified by the ECM and the ECM will illuminate the malfunction indicator lamp (MIL).

2. Conditions for Clearing the MIL/DTC

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.

Type 37

1. Action Taken When the DTC Sets
 - Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
 - 200 milliseconds after the diagnostic test has been run and failed, the failure is identified by the ECM and the ECM will illuminate the malfunction indicator lamp (MIL).
2. Conditions for Clearing the MIL/DTC
 - The MIL will be turned off when the diagnostic test passes without any failure and time delay.

- The MIL will be turned off when the diagnostic test passes without any failure and time delay.

Type 39

1. Action Taken When the DTC Sets
 - Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
 - 200 milliseconds after the diagnostic test has been run and failed, the failure is identified by the ECM and the ECM will allow the malfunction indicator lamp (MIL) to flash at the frequency of $2\text{Hz} \pm 10\%$.
2. Conditions for Clearing the MIL/DTC
 - The MIL will be turned off when the diagnostic test passes without any failure and time delay.
 - After 20 consecutive warm-up cycles without failure, the DTC will be cleared.

Diagnostic Trouble Code (DTC) List/Type

Description	Type	MIL
DTC P0107 Manifold Absolute Pressure Sensor Circuit Low Voltage	32	on
DTC P0108 Manifold Absolute Pressure Sensor Circuit High Voltage	32	on
DTC P0112 Intake Air Temperature Sensor Indicated Temperature too High	32	on
DTC P0113 Intake Air Temperature Sensor Indicated Temperature too Low	32	on
DTC P0116 Engine Coolant Temperature Sensor Signal Irrational Faults	32	on
DTC P0117 Engine Coolant Temperature Sensor Indicated Temperature too High	32	on
DTC P0118 Engine Coolant Temperature Sensor Indicated Temperature too Low	32	on
DTC P0120 Throttle Position Sensor Circuit fault	32	on
DTC P0130 HO2S Signal Circuit Low Voltage	32	on
DTC P0132 HO2S Signal Circuit High Voltage	32	on
DTC P0134 HO2S Circuit Insufficient Activity	32	on
DTC P0135 HO2S Heater Circuit Fault	32	on
DTC P0201 Cylinder 1 Fuel injector Circuit fault	30	on
DTC P0202 Cylinder 2 Fuel injector Circuit fault	30	on
DTC P0203 Cylinder 3 Fuel injector Circuit fault	30	on
DTC P0204 Cylinder 4 Fuel injector Circuit fault	30	on
DTC P0230 Fuel Pump Control Circuit fault	36	on
DTC P0325 Knock Sensor Circuit fault	32	on
DTC P0335 Crankshaft Position Sensor Signal Error	36	on
DTC P0443 Canister Purge Valve Drive Level Control Circuit fault	32	on

Diagnostic Trouble Code (DTC) List/Type(Cont' d)

Description	Type	MIL
DTC P0443 Canister Purge Valve Drive Level Control Circuit Voltage too Low	32	on
DTC P0443 Canister Purge Valve Drive Level Control Circuit Voltage too High	32	on
DTC P0480 A/C Condenser Cooling Fan Relay Control Circuit fault	32	on
DTC P0500 Vehicle Speed Signal Irrational Faults	32	on
DTC P0506 Idle Speed is Lower Than the Desired Idle Value	32	on
DTC P0507 Idle Speed is Higher than the Desired Value	32	on
DTC P0508 Idle Regulator Control Circuit Voltage too Low	32	on
DTC P0509 Idle Regulator Control Circuit Voltage too High	32	on
DTC P0511 Idle Regulator Control Circuit fault	32	on
DTC P0560 System Voltage Signal Irrational	31	off
DTC P0562 System Voltage too Low	31	off
DTC P0562 System Voltage too High	31	off
DTC P0601 Electronic Control Unit Check Code Error	30	on
DTC P0601 Electronic Control Unit Programming Error	37	on
DTC P0610 Control Module (Model) Type Selection Error	33	off
DTC P0630 Vehicle Identification Number (VIN) Not Programmed or Matched	37	on
DTC P0645 A/C Compressor Relay Control Circuit fault	31	off
DTC P0646 A/C Compressor Relay Control Circuit Voltage too Low	31	off
DTC P0647 A/C Compressor Relay Control Circuit Voltage too High	31	off
DTC P0650 MIL Control Circuit fault	33	off
DTC P1740 Automatic Transmission Torque Request Signal	33	off

6.4.4.6 Malfunction Indicator Lamp (MIL) is Inoperative Due to a Malfunction

Refer to Engine Controls Schematics: Engine Power, Ground, MIL and Data Link.

Circuit Description

The MIL should be on steady with the ignition ON and the engine OFF. The ignition supply voltage should be applied directly on the MIL. The ECM illuminates the MIL by grounding the MIL control circuit. With the ignition ON and the engine OFF, MIL DTC sets and MIL does not illuminate, which indicates that an open exists in the MIL control circuit.

Malfunction Indicator Lamp (MIL) Operation

The MIL is located on the instrument panel (CHECK ENGINE) or (SERVICE ENGINE SOON). The MIL performs the following functions:

- Inform the driver that a malfunction has occurred and that the vehicle should be taken in for service as soon as possible.
- During the system check, Malfunction Indicator Lamp should illuminate when the ignition switch is turned to the ON position, with the engine OFF. When the engine is started, the MIL will turn OFF. If the MIL remains on, self-diagnostic system has detected a malfunction. If the malfunction is eliminated, MIL will be turned off under the most conditions, but the DTC will be stored.
- If the MIL illuminates, and then the engine stalls, MIL will remain on if the ignition is on.
- If the MIL does not illuminate and the engine stalls, before the ignition is switched from Off to On, the MIL will not illuminate.

Perform the Powertrain On Board Diagnostic System Check first if the following situations occur:

- The MIL does not illuminate when the ignition switch is in the RUN position.
- The MIL remains on when the engine is running.
- When driveability is suspected of malfunctions.

Diagnostic Aids

Intermittent conditions may be induced by poor connection, poor wiring insulation or wiring broken inside the insulation. Inspect the following items:

- Check the ECM wiring and connections for the following conditions:
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
 - Damaged harness
 - If the engine runs OK, check for a malfunctioning MIL, an open in the MIL control circuit or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open ECM ignition, battery feed, or a poor ECM to engine ground.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2. If the MIL DTC is set, the MIL Control Circuit table will better diagnose the condition.
6. Connect a test lamp to the battery positive voltage, probe each of the ECM ground terminals to ensure that a good ground is present.

Malfunction Indicator Lamp (MIL) is inoperative due to a malfunction

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnostic (OBD) System Check
2	Does the scan tool indicate the MIL DTC set?	—	Go to DTC P0650 Malfunction Indicator Lamp (MIL) Control Circuit	Go to Step 3
3	Inspect the ECM feed fuse. Is the fuse OK?	—	Go to Step 4	Go to Step 9

Malfunction Indicator Lamp (MIL) is inoperative due to a malfunction (Cont' d)

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnostic (OBD) System Check
4	1. Turn the ignition off. 2. Disconnect the Engine Control Module. 3. Turn the ignition ON. 4. With a test lamp connected to a good ground, probe the ECM ignition feed circuit. Does the test lamp illuminate?	—	Go to Step 5	Go to Step 8
5	With a test lamp connected to a good ground, probe the ECM battery feed circuit. Does the test lamp illuminate?	—	Go to Step 6	Go to Step 8
6	Test for faulty ECM grounds or poor ECM ground connection. Refer to Testing for Intermittent Conditions and Poor Connections in Wiring Systems. Do you find and correct the condition?	—	Go to Powertrain On Board Diagnostic (OBD) System Check	Go to Step 7
7	Note: The replacement ECM must be programmed. Replace the ECM. See ECM Replacement. Do you complete the replacement?	—	Go to Powertrain On Board Diagnostic (OBD) System Check	—
8	Locate and repair the opens in the ECM battery feed circuit or the ECM ignition feed circuit. Refer to Wiring Repairs in Wiring Systems. Do you complete the repair?	—	Go to Powertrain On Board Diagnostic (OBD) System Check	—
9	Locate and repair short to ground in the ECM ignition feed circuit or the ECM battery feed circuit. Refer to Wiring Repairs in Wiring Systems. Do you complete the repair?	—	Go to Powertrain On Board Diagnostic (OBD) System Check	—

6.4.4.7 Data Link Connector Diagnosis

Refer to Engine Controls Schematics: Power, Ground, MIL and Data Link Connector.

Circuit Description

The Class 2 serial data circuit to the Data Link Connector (DLC) allows the ECM to communicate with the scan tool. If communication between the scan tool and the ECM can not be established, the procedure in the DLC diagnosis table should be used to diagnose the condition.

Diagnostic Aids

Inspect the following items:

- For the ECM to establish communication with the scan tool, the system voltage must be between 9.0 and 16.0 volts. If the system voltage is not within this range, please refer to Diagnostic System Check-Starting and Charging in Engine Electrical.
- Ensure that the correct application (model year, carline, VIN code) has been selected on the scan tool. If communication still can not be established, try the scan tool on another vehicle to ensure that the scan tool or cables are not the

cause of the condition. Poor connection, wiring insulation damage and wiring broken inside the insulation may cause an intermittent condition.

- Check for poor connections and damaged wiring.
- Check the ECM wiring and connections for the following conditions:
 - Improper mating
 - broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
 - Damaged harness
- Use a corresponding mating terminal to test for proper terminal tension.

Test Description

See the numbers of the procedures in the DLC Diagnosis table for the following numbers:

11. This vehicle is equipped with an ECM which utilizes an electrically erasable programmable read only memory (EEPROM). When the ECM is replaced, the new ECM must be programmed.

Data Link Connector Diagnosis

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnostic (OBD) System Check
2	1. With the engine off, turn on the ignition. 2. Connect a test lamp between the battery feed circuit and the ground circuit of the DLC. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 3
3	Connect a test lamp between the battery feed circuit of the DLC and chassis ground. Does the test lamp illuminate?	—	Go to Step 9	Go to Step 10
4	Turn the ignition ON with the engine OFF. Connect a DMM between the Class 2 serial data circuit of the DLC and a good ground. Does the voltage equal to the specified value?	0.0 volt	Go to Step 5	Go to Step 7
5	1. Turn the ignition off. 2. Disconnect the Engine Control Module. 3. Turn the ignition ON with the engine OFF. 4. Connect a DMM between the Class 2 serial data circuit of the DLC and battery positive voltage. Does the voltage measure equal to the specified value?	0.0 volt	Go to Step 6	Go to Step 8

Data Link Connector Diagnosis(Cont' d)

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnostic (OBD) System Check
6	1. Repair the open in the Class 2 serial data circuit. 2. Refer to Wiring Repairs in Wiring Systems. Do you find and correct the condition?	—	Go to Powertrain On Board Diagnostic(OBD)System Check	Go to Step 11
7	1. Repair the short to voltage in the Class 2 serial data circuit. 2. Refer to Wiring Repairs in Wiring Systems. Do you find and correct the condition?	—	Go to Powertrain On Board Diagnostic(OBD)System Check	Go to Step 11
8	Repair the short to ground in the Class 2 serial data circuit. Refer to Wiring Repairs in Wiring Systems. Do you find and correct the condition?	—	Go to Powertrain On Board Diagnostic(OBD)System Check	—
9	Repair the open in the DLC ground circuits. Refer to Wiring Repairs in Wiring Systems. Do you find and correct the condition?	—	Go to Powertrain On Board Diagnostic(OBD)System Check	—
10	Repair the open or short to ground in the DLC battery feed circuit. Replace the fuse as necessary. Refer to Wiring Repairs in Wiring Systems. Do you find and correct the condition?	—	Go to Powertrain On Board Diagnostic(OBD)System Check	—
11	Note:The replacement ECM must be programmed. Replace the ECM. See ECM Replacement. do you complete the repair?	—	Go to Powertrain On Board Diagnostic(OBD)System Check	—

6.4.4.8 DTC P0107 Manifold Absolute Pressure Sensor Circuit Low Voltage

Description

There are three pins connected to the Manifold Absolute Pressure (MAP) sensor, which is 5 V reference voltage (Pin 33), ground terminal (Pin 35) and signal output terminal (Pin 37) separately. Within the certain measure range, the force applied on the sensor is linear with the measure signal (voltage signal), this is the characteristic curve of the pressure sensor. According to this characteristic curve, ECU will convert the voltage signal received into intake air pressure. When the sensor works properly, the output voltage of Pin 37 should be 0.4V - 4.65V (corresponding intake pressure is 20 kpa - 115 kpa). In the diagnostic test, ECU will treat the MAP output voltage signal to the average output voltage of the cycle in which crankshaft rotates every 180 degrees, as the input of the diagnostic module to identify the condition.

Conditions for running the DTC

- The ignition is ON.

Conditions for Setting the DTC

- Average output voltage of the Manifold Absolute Pressure Sensor is <0.195 V

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory after 2 consecutive drive cycles in which diagnostic test has been run and failed.

- The MIL on the instrument cluster will be illuminated after 2 consecutive drive cycles in which the diagnostic test has been run and failed.

Conditions for Clearing the MIL/DTC

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- Poor connection between the ECU and MAP- inspect the harness connector of the ECU:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Damaged harness -inspect the wiring harness for damage. If the harness appears OK, observe the intake air pressure display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If the DTC cannot be duplicated and is determined to be intermittent, reviewing the failure records can be useful in determining when the DTC is last set.

DTC P0107 Manifold Absolute Pressure Sensor Circuit Low Voltage

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnosis System check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. If the engine idle is unstable, repair the idle problem before continuing with this table. see Rough, Unstable, or Incorrect Idle and Stalling. 2. Install the scan tool, start the engine and allow it to idle. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0107 is current?	—	Go to Step 3	Go to Diagnostic Aid
3	With the scan tool, monitor the data display of the MAP. Is the data display of the sensor less than the specified value?	0.195 V	Go to Step 4	Go to Diagnostic Aid

DTC P0107 Manifold Absolute Pressure Sensor Circuit Low Voltage(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the MAP sensor plug. 3. Turn on the ignition. 4. Use a DMM to measure the voltage between the MAP harness connector Pin 1 and ground. Does the voltage measure near the specified value?	5.7 V	Go to Step 5	Go to Step 6
5	Check the MAP signal circuit for a short to ground. Do you find and correct the condition?	—	Go to Step 10	Go to Step 6
6	Test the MAP circuit for a short, an open, a high resistance in the harness, and a poor connection of pins at the ECU end or the sensor end. Do you find and correct the condition?	—	Go to Step 10	Go to Step 7
7	To test the MAP, remove the MAP sensor, and connect a vacuum gauge at the sensor end, a 5 volts DC power source to the Pin 3 at the MAP end, Pin 2 to ground, Pin 1 to a DMM. When the pressure indicated on the vacuum gauge drops from 100 Kpa to 20 Kpa, does the output voltage between the Pin 3 and ground also drops from 4.5 volts to 0.4 volts correspondingly?	—	Go to Step 9	Go to Step 8
8	Replace the MAP sensor. Do you complete the replacement?	—	Go to Step 10	—
9	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 10	—
10	1. Clear the DTC. 2. Restart the engine, use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0107 is current?	—	Go to Step 3	System OK

6.4.4.9 DTC P0108 Manifold Absolute Pressure Sensor Circuit High Voltage

Description

There are three pins connected to the Manifold Absolute Pressure (MAP) sensor, which is 5 V reference voltage (Pin 33), ground terminal (Pin 35) and signal output terminal (Pin 37) separately. Within the certain measure range, the force applied on the sensor is linear with the measure signal (voltage signal), this is the characteristic curve of the pressure sensor. According to this characteristic curve, ECU will convert the voltage signal received into intake air pressure. When the sensor works properly, the output voltage should be 0.4V - 4.65V (corresponding intake pressure is 20 kpa - 115 kpa). In the diagnostic test, ECU will treat the MAP output voltage signal to the average output voltage of the cycle in which crankshaft rotates every 180 degrees, as the input of the diagnostic module to identify the condition.

Conditions for running the DTC

- The ignition is ON.

Conditions for Setting the DTC

- Average output voltage of the Manifold Absolute Pressure Sensor is >4.883 V

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory after 2 consecutive drive cycles in which diagnostic test has been run and failed.

- The MIL will be illuminated after 2 consecutive drive cycles in which the diagnostic test has been run and failed.

Conditions for Clearing the MIL/DTC

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- Poor connection between the ECU and MAP - inspect the harness connector of the ECU:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Damaged harness - inspect the wiring harness for damage. If the harness appears OK, observe the manifold absolute pressure display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If the DTC cannot be duplicated and is determined to be intermittent, reviewing the failure records can be useful in determining when the DTC is last set.

DTC P0108 Manifold Absolute Pressure Sensor Circuit High Voltage

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. If the engine idle is unstable, repair the idle problem before continuing with this table. see Rough, Unstable, or Incorrect Idle and Stalling. 2. Install the scan tool, start the engine and allow it to idle. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0108 is current?	—	Go to Step 3	Go to Diagnostic Aid
3	With the scan tool, monitor the data display of the MAP. Is the data display of the sensor greater than the specified value?	4.88 V	Go to Step 4	Go to Diagnostic Aid

DTC P0108 Manifold Absolute Pressure Sensor Circuit High Voltage(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the MAP sensor plug. 3. Turn on the ignition. 4. Use a DMM to measure the voltage between the MAP harness connector Pin 1 and ground. Does the voltage measure near the specified value?	5.7 V	Go to Step 5	Go to Step 6
5	check for MAP block or intake manifold vacuum leak. Do you find and correct the condition?	—	Go to Step 11	Go to Step 6
6	Inspect the MAP signal circuit for a short to power or a short to 5 volt reference circuit. Do you find and correct the condition?	—	Go to Step 11	Go to Step 7
7	Test the MAP circuit for a short, an open, a high resistance in the harness, and a poor connection of pins at the ECU end or the sensor end. Do you find and correct the condition?	—	Go to Step 11	Go to Step 8
8	To test the MAP, remove the MAP sensor, and connect a vacuum gauge at the sensor end, a 5 volt DC power source to the Pin 3 at the MAP end, Pin 2 to ground, Pin 1 to a DMM. When the pressure indicated on the vacuum gauge drops from 100Kpa to 20Kpa, does the output voltage between the Pin 3 and ground also drops from 4.5 volts to 0.4 volts correspondingly?	—	Go to Step 10	Go to Step 9
9	Replace the MAP sensor. Do you complete the replacement?	—	Go to Step 11	—
10	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 11	—
11	1. Clear the DTC. 2. Restart the engine, use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0108 is current?	—	Go to Step 3	System OK

6.4.4.10 DTC P0112 Intake Air Temperature Sensor Indicated Temperature too High

Description

There are two pins connected to the Intake Air Temperature Sensor (IAT), which is sensor signal terminal (IAT end pin 1 connected to ECU pin 40) and signal ground terminal (IAT end pin 2 connected to ECU pin 17).

Measuring element of the IAT is a resistor with negative temperature coefficient. When the intake air is cold, the sensor resistance is high and the IAT signal voltage input to the ECU is high. When the intake air is warm, the sensor resistance is low and the IAT signal voltage input to the ECU is low. When the IAT sensor works properly, the intake air temperature utilized by the system equals to that indicated by the IAT signal voltage. If the IAT signal terminal is short to ground, the indicated intake air temperature correspondingly may be higher, and DTC P0112 will be set.

Conditions for running the DTC

- Start and run the engine for 1 minute.

Conditions for Setting the DTC

- Intake air temperature indicated by IAT signal voltage > 126°C

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU

illuminates the Malfunction Indicator Lamp (MIL).

- After the DTC P0112 is set, the ECU will use 20°C as a substitute for the intake air temperature, and when the fault is corrected, the IAT input signal value will be reused automatically.

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- Poor connection between the ECU and MAP ñ inspect for the existence of the ECU harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Is the harness damaged ñ inspect the harness for damage. If the harness appears OK, observe the intake air temperature display on the scan tool while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

DTC P0112 Intake Air Temperature Sensor Indicated Temperature too High

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Turn on the ignition, with the engine OFF. 2. Observe the intake air temperature parameter with a scan tool. Does the scan tool show the intake air temperature parameter greater than the specified value?	126°C	Go to Step 4	Go to Step 3
3	Operate the vehicle according to the conditions for running the DTC. Does the scan tool indicate DTC P0112 is current?	—	Go to Step 4	Go to Diagnostic Aid

DTC P0112 Intake Air Temperature Sensor Indicated Temperature too High(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the Intake Air Temperature (IAT) Sensor. 3. Turn on the ignition, with the engine OFF. 4. Observe the intake air temperature parameter with a scan tool. Does the scan tool show the intake air temperature parameter less than the specified value?	-33°C	Go to Step 6	Go to Step 5
5	Check the IAT sensor signal circuit for a short to ground. Do you find and correct the condition?	—	Go to Step 9	Go to Step 6
6	Check the circuit between the IAT and ECU for a high resistance, a poor connection of the pins at the ECU end or the sensor end. Do you find and correct the condition?		Go to Step 9	Go to Step 7
7	Replace the Intake Air Temperature (IAT) Sensor. Do you complete the replacement?	—	Go to Step 9	—
8	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 9	—
9	1. Use the scan tool to clear the DTC. 2. Operate the vehicle according to the conditions for running the DTC. Is the DTC reset?	—	Go to Step 2	System OK

6.4.4.11 DTC P0113 Intake Air Temperature Sensor Indicated Temperature too Low

Description

There are two pins connected to the Intake Air Temperature Sensor (IAT), which is sensor signal terminal (IAT end pin A connected to ECU pin 40) and signal ground terminal (IAT end pin B connected to ECU pin 17).

Measuring element of the IAT is a resistor with negative temperature coefficient. When the intake air is cold, the sensor resistance is high and the IAT signal voltage input to the ECU is high. When the intake air is warm, the sensor resistance is low and the IAT signal voltage input to the ECU is low. When the IAT sensor works properly, the intake air temperature utilized by the system equals to that indicated by the IAT signal voltage. If the IAT signal terminal is short or open to power, the indicated intake air temperature correspondingly may be lower, and DTC P0113 will be set.

Conditions for running the DTC

- Start and run the engine for 1 minute.

Conditions for Setting the DTC

- With the engine at idle, without fuel cutoff condition, and the intake air temperature indicated by the IAT signal voltage is lower than -33°C .

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition

will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

- After the DTC P0113 is set, the ECU will use 20°C as a substitute for the intake air temperature, and when the fault is corrected, the IAT input signal value will be reused automatically.

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- Poor connection between the ECU and MAP ñ inspect for the existence of the ECU harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Is the harness damaged ñ inspect the harness for damage. If the harness appears OK, observe the intake air temperature display on the scan tool while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

DTC P0113 Intake Air Temperature Sensor Indicated Temperature too Low

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Turn on the ignition, with the engine OFF. 2. Observe the intake air temperature parameter with a scan tool. Does the scan tool show the intake air temperature parameter less than the specified value?	-33°C	Go to Step 4	Go to Step 3
3	Operate the vehicle according to the conditions for running the DTC. Does the scan tool indicate DTC P0113 is current?	—	Go to Step 4	Go to Diagnostic Aid

DTC P0113 Intake Air Temperature Sensor Indicated Temperature too Low(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the Intake Air Temperature (IAT) Sensor. 3. Connect a 3-ampere jumper wire between the ground wire and signal wire of the sensor. 4. Turn on the ignition, observe the intake air temperature parameter with a scan tool. Does the scan tool show the intake air temperature parameter greater than the specified value?	126°C	Go to Step 6	Go to Step 5
5	1. Connect one end of the jumper wire to the pins at the signal terminal of the IAT sensor, and the other end of it to a good ground. 2. Observe the intake air temperature parameter with a scan tool. Does the scan tool show the intake air temperature parameter greater than the specified value?	126°C	Go to Step 8	Go to Step 6
6	Inspect the IAT signal wire for a short or open to the electricity. Do you find and correct the condition?	—	Go to Step 10	Go to Step 7
7	Check the circuit between the IAT and ECU for a short, an open, a high resistance, a poor connection of the pins at the ECU terminal or the sensor terminal. Do you find and correct the condition?	—	Go to Step 10	Go to Step 8
8	Replace the Intake Air Temperature (IAT) Sensor. Do you complete the replacement?	—	Go to Step 10	—
9	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 10	—
10	1. Use the scan tool to clear the DTC. 2. Operate the vehicle according to the conditions for running the DTC. Is the DTC reset?	—	Go to Step 2	System OK

6.4.4.12 DTC P0116 Engine Coolant Temperature Sensor Signal Irrational Faults

Description

There are two pins connected to the Engine Coolant Temperature Sensor (ECT) , which is sensor signal terminal (ECT end pin 1 connected to ECU pin 39) and sensor ground terminal (ECT end pin 2 connected to ECU pin 35).

Measuring element of the ECT sensor used by the system is a resistor with negative temperature coefficient.

When the engine coolant is cold, the sensor resistance is high and the ECT signal voltage input to the ECU is high. When the engine coolant is warm, the sensor resistance is low and the ECT signal voltage input to the ECU is low. When the ECT sensor works properly, the engine coolant temperature utilized by the system equals to that indicated by the ECT signal voltage.

After the engine has been running for a while, if the engine coolant temperature indicated by the ECT signal voltage increases quite slowly and much lower than the reference temperature calculated from the system internal value, it will be considered that the ECT signal is irrational, and DTC P0116 will be set.

Conditions for running the DTC

- The ignition switch is turned on.

Conditions for Setting the DTC

- The engine coolant temperature is lower than the ECU internal calculated reference value 20°C.

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.

- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- Poor connection between the ECU and ECT sensor - inspect for the existence of the ECU harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Damaged harness - inspect the wiring harness for damage. If the harness appears OK, observe the engine coolant temperature (ECT) display on the scan tool while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If the DTC can not be duplicated, the information in the failure records can be used to determine the mileage that has elapsed since the DTC last set. It can determine how often the condition for setting the DTC occurs, this may assist in diagnosing the condition.

DTC P0116 Engine Coolant Temperature Sensor Signal Irrational Faults

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Install the scan tool. 2. Operate the vehicle according to the conditions for running the DTC. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0116 is current?	—	Go to Step 3	Go to Diagnostic Aid

DTC P0116 Engine Coolant Temperature Sensor Signal Irrational Faults(Cont' d)

Step	Action	Value	Yes	No
3	1. Turn off the engine. 2. Remove the ECT sensor when the engine is cold. 3. Place the sensor in the beaker and have it heated, use a DMM to measure the sensor resistance. Does the sensor resistance comply with the parameter in the data list?	See Data List.	Go to Step 4	Go to Step 5
4	Check the circuit between the ECT and ECU for a short, an open, a high resistance, a poor connection of the pins at the ECU terminal or the sensor terminal. Do you find and correct the condition?	—	Go to Step 7	Go to Step 6
5	Replace the ECT sensor. Do you complete the replacement?	—	Go to Step 7	—
6	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 7	—
7	1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0116 is current?	—	Go to Step 3	System OK

6.4.4.13 DTC P0117 Engine Coolant Temperature Sensor Indicated Temperature too High

Description

There are two pins connected to the Engine Coolant Temperature Sensor (ECT) , which is sensor signal terminal (ECT end pin 1 connected to ECU pin 39) and sensor ground terminal (ECT end pin 2 connected to ECU pin 35).

Measuring element of the ECT sensor used by the system is a resistor with negative temperature coefficient. As the engine coolant warms, the sensor resistance will decrease, which results in the signal value input to the ECU in the form of voltage becoming less. The range of the voltage signal is between 0-5V, the ECU converts it to engine coolant temperature by searching for the characteristic curve of the sensor. The diagnostic module of the ECT sensor will determine the condition according to this temperature.

Conditions for running the DTC

- The ignition switch is turned on.

Conditions for Setting the DTC

- Engine coolant temperature indicated by ECT signal voltage > 135°C

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU

illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- Poor connection between the ECU and ECT sensor ñ inspect for the existence of the ECU harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Damaged harness - inspect the wiring harness for damage. If the harness appears OK, observe the engine coolant temperature (ECT) display on the scan tool while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If the DTC can not be duplicated, the information in the failure records can be used to determine the mileage that has elapsed since the DTC last set. It can determine how often the condition for setting the DTC occurs, this may assist in diagnosing the condition.

DTC P0117 Engine Coolant Temperature Sensor Indicated Temperature too High

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Turn on the ignition, with the engine OFF. 2. Observe the engine coolant temperature parameter with a scan tool. Does the scan tool show the engine coolant temperature parameter greater than the specified value?	140°C	Go to Step 4	Go to Step 3
3	Operate the vehicle according to the conditions for running the DTC. Does the scan tool indicate DTC P0117 is current?	—	Go to Step 4	Go to Diagnostic Aid

DTC P0117 Engine Coolant Temperature Sensor Indicated Temperature too High(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the engine coolant temperature (ECT) sensor. 3. Turn on the ignition, with the engine OFF. 4. Observe the engine coolant temperature parameter with a scan tool. Does the scan tool show the engine coolant temperature parameter less than the specified value?	-40°C	Go to Step 6	Go to Step 5
5	Test the ECT sensor signal circuit for a short to ground or a short to the ECT sensor ground circuit. Do you find and correct the condition?	—	Go to Step 8	Go to Step 7
6	Remove the engine coolant temperature (ECT) sensor. Do you complete the replacement?	—	Go to Step 8	—
7	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 8	—
8	1. Use the scan tool to clear the DTC. 2. Operate the vehicle according to the conditions for running the DTC. Is the DTC reset?	—	Go to Step 2	System OK

6.4.4.14 DTC P0118 Engine Coolant Temperature Sensor Indicated Temperature too Low

Description

There are two pins connected to the Engine Coolant Temperature Sensor (ECT) , which is sensor signal terminal (ECT end pin 1 connected to ECU pin 39) and sensor ground terminal (ECT end pin 2 connected to ECU pin 35).

Measuring element of the ECT is a resistor with negative temperature coefficient. When the engine coolant is cold, the sensor resistance is high and the ECT signal voltage input to the ECU is high. When the engine coolant is warm, the sensor resistance is low and the ECT signal voltage input to the ECU is low. When the ECT sensor works properly, the engine coolant temperature utilized by the system equals to that indicated by the ECT signal voltage.

If the ECT signal terminal is short or open to power, the indicated temperature correspondingly may be lower, and DTC P0118 will be set.

Conditions for running the DTC

- The ignition switch is turned on.

Conditions for Setting the DTC

- Engine coolant temperature indicated by ECT signal voltage < -35°C

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition

will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- Poor connection between the ECU and ECT sensor - inspect for the existence of the ECU harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Damaged harness - inspect the wiring harness for damage. If the harness appears OK, observe the engine coolant temperature (ECT) display on the scan tool while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If the DTC can not be duplicated, the information in the failure records can be used to determine the mileage that has elapsed since the DTC last set. It can determine how often the condition for setting the DTC occurs, this may assist in diagnosing the condition.

DTC P0118 Engine Coolant Temperature Sensor Indicated Temperature too Low

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Turn on the ignition, with the engine OFF. 2. Observe the engine coolant temperature parameter with a scan tool. Does the scan tool show the engine coolant temperature parameter less than the specified value?	-40°C	Go to Step 4	Go to Step 3
3	Operate the vehicle according to the conditions for running the DTC. Does the scan tool indicate that DTC P0118 failed this ignition?	—	Go to Step 4	Go to Diagnostic Aid

DTC P0118 Engine Coolant Temperature Sensor Indicated Temperature too Low(Cont' d)

Step	Action	Value	Yes	No
4	Test the ECT sensor signal circuit for a short to power. Do you find and correct the condition?	—	Go to Step 13	Go to Step 5
5	1. Turn off the ignition. 2. Disconnect the engine coolant temperature (ECT) sensor. 3. Connect a 3-ampere fused jumper wire between the signal circuit and ground circuit of the ECT sensor. 4. Observe the engine coolant temperature parameter with a scan tool. Does the scan tool show the engine coolant temperature parameter greater than the specified value?	140°C	Go to Step 7	Go to Step 6
6	1. Connect one end of a 3-ampere fused jumper wire to the ECT sensor signal terminal, and ensure the other end of it to a good ground. 2. Observe the engine coolant temperature parameter with a scan tool. Does the scan tool show the engine coolant temperature parameter greater than the specified value?	140°C	Go to Step 8	Go to Step 9
7	Inspect for a faulty connection at the ECT sensor. Do you find and correct the condition?	—	Go to Step 13	Go to Step 11
8	Test the ground circuit of the ECT sensor for an open. Do you find and correct the condition?	—	Go to Step 13	Go to Step 10
9	Test the signal circuit of the ECT sensor for an open. Do you find and correct the condition?	—	Go to Step 13	Go to Step 10
10	Check the signal circuit and the ground circuit of the ECT sensor for the connections on the ECU. Do you find and correct the condition?	—	Go to Step 13	Go to Step 12
11	Remove the engine coolant temperature (ECT) sensor. Do you complete the replacement?	—	Go to Step 13	—
12	Replace the ECU module and have it programmed. Do you complete the replacement?	—	Go to Step 13	—
13	1. Use the scan tool to clear the DTC. 2. Operate the vehicle according to the conditions for running the DTC. Is the DTC reset?	—	Go to Step 2	System OK

6.4.4.15 DTC P0120 Throttle Position Sensor Circuit Fault

Description

There are three pins connected to the Throttle Position Sensor (TPS), which is 5 V reference voltage (TPS terminal pin A connected to ECU pin 32), ground terminal (TPS terminal pin B connected to ECU pin 17) and signal output (TPS terminal pin C connected to ECU pin 16) separately. TPS is a potentiometer type sensor. From closed throttle to wide open throttle, the ECU will get the corresponding voltage signals from a range which is higher than 0 but lower than 1 V to a range which is higher than 4 V but lower than 5 V, the ECU will convert the voltage signal to the throttle position absolute angle (displayed in percentage) in the software.

When the TPS works properly, corresponding to the operation condition of closed throttle, since there is an angle which could not be fully closed mechanically, the throttle position absolute angle will not equal to zero, at this time, the output value of the throttle position absolute angle reflects this mechanical angle, generally it is about 10%; corresponding to the operation condition of wide open throttle, the throttle position absolute angle is about 90% generally. The diagnostic module monitors the value of the throttle position absolute angle to determine the condition. Then the following can be diagnosed:

- Maximum fault: a short to power
- Minimum fault: a short to ground

The DTC of both fault types is DTC P0120.

Conditions for running the DTC

- Engine Speed>920 rpm and maintains for 0.1 second.

Conditions for Setting the DTC

- Maximum fault: a short to power
Throttle Position Absolute Angle>95% and sustains for 0.1 second
- Minimum fault: a short to ground
Throttle Position Absolute Angle<3% and sustains for 0.1 second

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- MAP sensor faults - MAP sensor faults may cause the ECU to make an incorrect determination that the TPS is out of range. Check for an unusually low or high MAP reading. This condition will set DTC P0120. See MAP Sensor Fault Diagnosis.
- Poor connection between the ECU and TPS - inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Use appropriate matching terminals to test if the tensile force is proper.
- Damaged harness - inspect the wiring harness for damage. If the harness appears OK, observe the TPS display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If the DTC P0120 can not be duplicated, the information in the failure records can be used to determine the mileage that has elapsed since the DTC last set. It can determine how often the condition for setting the DTC occurs, this may assist in diagnosing the condition.

DTC P0120 Throttle Position Sensor Circuit Fault

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check

DTC P0120 Throttle Position Sensor Circuit Fault(Cont' d)

Step	Action	Value	Yes	No
2	1. Operate the vehicle according to the conditions for running the DTC. 2. Connect the scan tool. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0120 is current?	—	Go to Step 3	Go to Diagnostic Aid
3	If there are other DTCs, please repair those faults first. 1. Turn on the ignition. 2. Observe the throttle position angle signal with the scan tool when the throttle moves from closed to wide open position. Does the signal change evenly within the specified range?	0%-100%	Go to Diagnostic Aid	Go to Step 4
4	1. Turn off the ignition. 2. Disconnect the TPS connectors. 3. Turn on the ignition. 4. Use a DMM to measure the voltage between the TPS harness connector Pin A and ground. Does the voltage measure equal to the specified value?	5V	Go to Step 5	Go to Step 8
5	Use a DMM to measure the voltage between the TPS harness connector Pin C and ground. Does the voltage measure equal to the specified value?	5V	Go to Step 6	Go to Step 8
6	Use a DMM to measure the resistance between the Pin A and B of the TPS. (Throttle Position Angle 0%). Does the resistance measure equal to the specified value?	20°C, 6.5 k Ω around	Go to Step 7	Go to Step 9
7	Use a DMM to measure the resistance between the Pin C and B of the TPS. (Throttle Position Angle 0%). Is the resistance measure within the specified range?	20°C, 1.8 k Ω around	Go to Step 8	Go to Step 9
8	Check the TPS circuit for a short, an open, a high resistance in the harness, and a poor connection of pins at the ECU end or the sensor end. Do you find and correct the condition?	—	Go to Step 11	Go to Step 10
9	Replace the Throttle Position Sensor. Do you complete the replacement?	—	Go to Step 11	—
10	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 11	—
11	1. Clear the DTC. 2. Operate the vehicle according to the conditions for running the DTC. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0120 is current?	—	Go to Step 3	System OK

6.4.4.16 DTC P0130 HO2S Signal Circuit Irrational Voltage signal

Description

There are 4 pins connected to the Oxygen Sensor (HO2S), which is 12 V heater power end (HO2S terminal pin D connected to the main relay terminal pin 87), sensor end (HO2S terminal pin A connected to the ECU pin 36), signal end (HO2S terminal pin B connected to the ECU terminal pin 18) and heater control end (HO2S terminal pin C connected to the ECU terminal pin 1) separately.

The system uses a heated oxygen sensor (Model LSH25), in addition to the oxygen sensor signal circuit, there is a heater circuit. The oxygen sensor inputs the HO2S signal voltage to the ECU through the ECU pin 18.

When the oxygen sensor works properly, the signal voltage value of the HO2S changes between 0 V and 1 V. The reference voltage is $450 \pm 30 \text{ mV}$, when the HO2S voltage is higher than this value, indicating that the air mixtures is rich ($\hat{I} < 1$); when the value is lower than this value, indicating that the air mixtures is lean ($\hat{I} > 1$).

When the \hat{I} closed loop control is activated, the ECU monitors the HO2S signal, and adjusts the amount of fuel delivery according to the rich or lean condition of the air mixtures reflected by the signal. If the signal is always restrained within the range which is lower than the reference voltage, DTC P0130 will be set.

Conditions for running the DTC

- Battery voltage $> 11 \text{ V}$
- Engine reaches normal operating temperature
- $2000 \text{ rpm} < \text{Engine Speed} < 3000 \text{ rpm}$
- Throttle Position Angle 5% - 30%

Conditions for Setting the DTC

- \hat{I} Closed loop control is activated, and there is no canister control solenoid fault
- and $0.06 \text{ V} < \text{HO2S Signal Voltage} < 0.4 \text{ V}$, and sustains for 20 S

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.

- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- HO2S wires - the sensor pigtail may be routed incorrectly and contacting the exhaust system.
- Poor ECU and engine body grounds.
- Fuel pressure - if the pressure is low, the system will become lean. The ECU can compensate for some decrease. However, if the fuel pressure is too low, DTC P0130 will be set.
- Vacuum leaks - inspect for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body and crankcase ventilation system.
- Exhaust leaks - an exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- Uneven fuel injection of the fuel injectors, fuel injectors need to be washed.
- Fuel contamination - even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition.

If none of the above conditions are present, replace the affected H2OS.

DTC P0130 HO2S Signal Circuit Irrational Voltage Signal

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check

DTC P0130 HO2S Signal Circuit Irrational Voltage Signal (Cont' d)

Step	Action	Value	Yes	No
2	1. Install the scan tool. 2. Operate the vehicle according to the conditions for running the DTC. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0130 is current?	—	Go to Step 3	Go to Diagnostic Aid
3	Inspect and test for the following: 1. Exhaust pipes leak. 2. Is the sensor installed correctly? 3. Damaged harness. Do you find and correct the condition?	—	Go to Step 8	Go to Step 4
4	1. Turn off the ignition. 2. Disconnect the HO2S connectors. 3. Turn on the ignition. 4. Observe the HO2S voltage parameter with a scan tool. Does the scan tool indicate the HO2S voltage less than the specified value?	400 mv	Go to Step 6	Go to Step 5
5	Inspect the HO2S signal circuit for a short to ground or a short to sensor ground. Do you find and correct the condition?	—	Go to Step 7	Go to Step 7
6	Replace the HO2S. Do you complete the replacement?	—	Go to Step 8	—
7	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 8	—
8	1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0130 is current?	—	Go to Step 3	System OK

6.4.4.17 DTC P0132 HO2S Signal Circuit High Voltage

Description

There are 4 pins connected to the Oxygen Sensor (HO2S), which is 12 V heater power end (HO2S terminal pin D connected to the main relay terminal pin 87), sensor end (HO2S terminal pin A connected to the ECU pin 36), signal end (HO2S terminal pin B connected to the ECU terminal pin 18) and heater control end (HO2S terminal pin C connected to the ECU terminal pin 1) separately.

The system uses a heated oxygen sensor (Model LSH25), in addition to the oxygen sensor signal circuit, there is a heater circuit. The oxygen sensor inputs the HO2S signal voltage to the ECU through the ECU pin 18.

When the oxygen sensor works properly, the signal voltage value of the HO2S changes between 0 V and 1 V. The reference voltage is 450 ± 30 mV, when the HO2S voltage is higher than this value, indicating that the air mixtures is rich ($\hat{I} < 1$); when the value is lower than this value, indicating that the air mixtures is lean ($\hat{I} > 1$). When the \hat{I} closed loop control is activated, the ECU monitors the HO2S signal, and adjusts the amount of fuel delivery according to the rich or lean condition of the air mixtures reflected by the signal. If the HO2S signal voltage is excessively high and maintains for a period of time, DTC P0132 will be set.

Conditions for running the DTC

- Battery voltage > 11 V
- Engine reaches normal operating temperature
- $2000 \text{ rpm} < \text{Engine Speed} < 3000 \text{ rpm}$
- Throttle Position Angle 5% - 30%

Conditions for Setting the DTC

- HO2S Signal Voltage > 1.5 V, and sustains for 20 S

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect the following items:

- Fuel pressure - if the pressure is high, the system will become rich. The ECU can compensate for some increase. However, if the fuel pressure is too high, DTC P0132 will be set.
- Inspect the EVAP canister for fuel saturation. If the EVAP canister is full of fuel, inspect the canister control and hoses.
- Inspect for a leaking fuel pressure regulator diaphragm by checking the vacuum line to regulator for the presence of fuel.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- The fuel injectors are leaking, which should be replaced.
- Shorted HO2S - If the HO2S is internally shorted, the HO2S voltage displayed on the scan tool will be over 1.5 volt. Disconnect the affected HO2S and jumper the HO2S low circuit to ground with the key ON, engine OFF. If the displayed HO2S voltage changes from over 1500 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition can be determined by the powdery white deposit on the exhaust portion of the HO2S. If contamination is noticed, replace the affected HO2S.
- Open HO2S signal or low circuit or faulty HO2S - A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a scan tool. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.

DTC P0132 HO2S Signal Circuit High Voltage

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Install the scan tool. 2. Operate the vehicle according to the conditions for running the DTC. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0132 is current?	—	Go to Step 3	Go to Diagnostic Aid
3	With the scan tool, monitor the data display of the HO2S. Is the data display of the HO2S greater than the specified value?	1500 mV	Go to Step 4	Go to Diagnostic Aid
4	Test-drive the vehicle, accelerating it to the speed of above 40 km/h and then releasing the acceleration pedal, with the throttle position angle less than 3 percent and the engine in deceleration fuel mode, observe the HO2S voltage value. Does the HO2S voltage measure near the specified value?	110 mV	Go to Diagnostic Aid	Go to Step 5
5	1. Turn off the ignition. 2. Disconnect the HO2S connectors. 3. Turn on the ignition. Does the scan tool indicate the HO2S voltage greater than the specified value?	480 mV	Go to Step 6	Go to Step 7
6	Inspect the HO2S signal circuit for a short to voltage. Do you find and correct the condition?	—	Go to Step 9	Go to Step 8
7	Replace the HO2S. Do you complete the replacement?	—	Go to Step 9	—
8	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 9	—
9	1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0132 is current?	—	Go to Step 3	System OK

6.4.4.18 DTC P0134 HO2S Circuit Insufficient Activity

Description

There are 4 pins connected to the Oxygen Sensor (HO2S), which is 12 V heater power end (HO2S terminal pin D connected to the main relay terminal pin 87), sensor end (HO2S terminal pin A connected to the ECU pin 36), signal end (HO2S terminal pin B connected to the ECU terminal pin 18) and heater control end (HO2S terminal pin C connected to the ECU terminal pin 1) separately.

The system uses a heated oxygen sensor (Model LSH25), in addition to the oxygen sensor signal circuit, there is a heater circuit. The oxygen sensor inputs the HO2S signal voltage to the ECU through the ECU pin 18.

When the oxygen sensor works properly, the signal voltage value of the HO2S changes between 0 V and 1 V. The reference voltage is $450 \pm 30 \text{ mV}$, when the HO2S voltage is higher than this value, indicating that the air mixtures is rich ($\hat{I} < 1$); when the value is lower than this value, indicating that the air mixtures is lean ($\hat{I} > 1$). When the \hat{I} closed loop control is activated, the ECU monitors the HO2S signal, and adjusts the amount of fuel delivery according to the rich or lean condition of the air mixtures reflected by the signal. If the HO2S signal voltage remains at or near the reference voltage of 450 mV for an extended period of time, DTC P0134 will be set.

Conditions for running the DTC

- Battery voltage $> 11 \text{ V}$
- Engine reaches normal operating temperature
- $2000 \text{ rpm} < \text{Engine Speed} < 3000 \text{ rpm}$
- Throttle Position Angle 5% - 30%

Conditions for Setting the DTC

- Open HO2S signal circuit
- $0.4 \text{ V} < \text{HO2S Signal Voltage} < 0.6 \text{ V}$, and sustains for 20 S

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.

- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- A poor connection or a damaged harness ñ inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
 - Damaged harness
- Faulty HO2S heater or heater circuit - with the ignition ON, engine OFF, the HO2S voltage displayed on a scan tool should gradually drop to below 250 mV or rise to above 600 mV. If not, disconnect the HO2S and connect a test lamp between the HO2S feed and heater control circuits. If the test lamp does not illuminate, repair the open in the feed circuit or sensor control circuit. If the test lamp lights and the HO2S signal and low circuit are OK, replace the HO2S.
- Test for Intermittent conditions - with the ignition ON, monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help to isolate the location of the problem.

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0134 HO2S Circuit Insufficient Activity

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check

DTC P0134 HO2S Circuit Insufficient Activity(Cont' d)

Step	Action	Value	Yes	No
2	<p><i>Notice:</i> Before proceeding with this table, please observe if there are any other DTCs present first.</p> <ol style="list-style-type: none"> 1. Engine reaches normal operating temperature 2. Operate the engine above 1200 rpm for 2 minutes. 3. Observe the HO2S voltage parameter with a scan tool. <p>Does the scan tool indicate the HO2S voltage change within the specified range?</p>	400-600 mv	Go to Step 3	Go to Step 4
3	<p>Operate the vehicle according to the conditions for running the DTC.</p> <p>Monitor the DTC information with a scan tool.</p> <p>Does the scan tool indicate DTC P0445 as current trouble code?</p>	—	Go to Step 4	Go to Diagnostic Aid
4	<p>Inspect and test for the following:</p> <ol style="list-style-type: none"> 1. Exhaust leakage. 2. The HO2S is installed correctly. 3. Damaged wires. <p>Do you find and correct the condition?</p>	—	Go to Step 9	Go to Step 5
5	<ol style="list-style-type: none"> 1. Turn off the ignition. 2. Disconnect the HO2S connectors. 3. Turn on the ignition. 4. Observe the HO2S voltage with a scan tool. <p>Does the voltage measure near the specified value?</p>	400 mv	Go to Step 7	Go to Step 6
6	<p>Check the HO2S circuit for a short, an open, a high resistance in the harness, and a poor connection of pins at the ECU end or the sensor end.</p> <p>Do you find and correct the condition?</p>	—	Go to Step 9	Go to Step 8
7	<p>Replace the HO2S.</p> <p>Do you complete the replacement?</p>	—	Go to Step 9	—
8	<p>Replace the ECU and have it programmed.</p> <p>Do you complete the replacement?</p>	—	Go to Step 9	—
9	<ol style="list-style-type: none"> 1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. <p>Does the scan tool indicate DTC P0134 is current?</p>	—	Go to Step 4	System OK

6.4.4.19 DTC P0135 HO2S Heater Circuit Fault

Description

There are 4 pins connected to the Oxygen Sensor (HO2S), which is 12 V heater power end (HO2S terminal pin D connected to the main relay terminal pin 87), sensor end (HO2S terminal pin A connected to the ECU pin 36), signal end (HO2S terminal pin B connected to the ECU terminal pin 18) and heater control end (HO2S terminal pin C connected to the ECU terminal pin 1) separately.

The system uses a heated oxygen sensor (Model LSH25), in addition to the oxygen sensor signal circuit, there is a heater circuit. The ECU controls the heating process by the output switch signal of pin 1, that is, when the pin 1 is low potential (ground), the heater circuit is closed; when the pin 1 is high potential (power on), the heater circuit is open, stops heating the HO2S.

At the same time, the ECU monitors the heater control circuit voltage. According to the heating control switch signal of pin 1 and the condition of the voltage, the diagnostic module diagnoses the heater circuit. The fault types that can be diagnosed are:

- Maximum fault: a short to power
- Minimum fault: a short to ground
- Singal fault: open or broken
- Irrational fault: excessively high HO2S internal resistance

The DTC for the above 4 fault types is P0135.

Conditions for running the DTC

- After the engine is started and reaches normal operating temperature for 5 minutes, and $10.98 \text{ V} < \text{Battery Voltage} < 15.47 \text{ V}$

Conditions for Setting the DTC

- Maximum fault: a short to power
Heater Control Circuit Voltage $> 3.6 \text{ V}$, and sustains for 0.05 S with the heater control switch ON.
- Minimum fault: a short to ground
Heater Control Circuit Voltage $< 2.2 \text{ V}$, and sustains for 0.05 S with the heater control switch OFF.
- Signal Fault: open
 $2.2 \text{ V} < \text{Heater Control Circuit Voltage} < 3.6 \text{ V}$, and sustains for 0.05 S with the heater control switch OFF.
- Irrational Fault
The HO2S internal resistance are mainly subject to the exhaust temperature and heating power. When a fault is present on the heater circuit, its resistance will be excessively high. If the condition in which the HO2S internal resistance

is greater than the HO2S internal resistance predetermined thresholds is met and maintains for 15 S, it should be determined as an irrational fault.

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

Inspect for the following conditions:

- A poor connection or a damaged harness ñ inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
 - Damaged harness
- Faulty HO2S heater or heater circuit ñ with the ignition ON, engine OFF, the HO2S voltage displayed on a scan tool should gradually drop to below 250 mV or rise to above 600 mV. If not, disconnect the HO2S and connect a test lamp between the HO2S feed and heater control circuits. If the test lamp does not illuminate, repair the open in the feed circuit or sensor control circuit. If the test lamp lights and the HO2S signal and low circuit are OK, replace the HO2S.
- Test for Intermittent conditions ñ with the ignition ON, monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help to isolate the location of the problem.

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0135 HO2S Heater Circuit Fault

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the conditions for running the DTC. 2. Connect the scan tool. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0445 as current trouble code?	—	Go to Step 3	Go to Diagnostic Aid
3	1. Disconnect the HO2S. 2. Turn on the ignition. 3. Connect a test lamp between HO2S heater feed circuit and ground. Does the test light illuminate?	—	Go to Step 4	Go to Step 6
4	Use a DMM to measure the sensor connector pin C voltage. Does the voltage measure near the specified value?	About 2.5V	Go to Step 5	Go to Step 6
5	After the HO2S has cooled down for at least 10 minutes, measure the HO2S Heating wire resistance. Does the resistance measure near the specified value?	2-5 Ω (20°C)	Go to Step 8	Go to Step 7
6	Check the HO2S circuit for a short, an open, a high resistance in the harness, and a poor connection of pins at the ECU end or the sensor end. Do you find and correct the condition?	—	Go to Step 9	Go to Step 6
7	Replace the HO2S. Do you complete the replacement?	—	Go to Step 9	—
8	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 9	—
9	1. Use the scan tool to clear the DTC. 2. Operate the vehicle according to the conditions for running the DTC. Is the DTC reset?	—	Go to Step 3	System OK

6.4.4.20 DTC P0201 Cylinder 1 Fuel injector Circuit Fault

Description

There are 2 pins connected to the Cylinder 1 fuel injector, which is 12 V feed voltage (cylinder 1 fuel injector pin 1 connected to the main relay terminal pin 87), control terminal input (cylinder 1 fuel injector pin 2 connected to the ECU pin 27) separately. In the system, cylinder 1 fuel injector is driven by the driving chip, which can realize the self diagnostic function on drive level and notify the CPU's internal failure diagnostic module of the failure information, by comparing the switch signal from CPU to the actual potential of drive level output end. The fault types that can be diagnosed are:

- Maximum fault: a short to power
- Minimum fault: a short to ground
- Singal fault: open or broken

The DTC for the three fault types is P0201.

Conditions for running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- Max. Failure:
The driving chip detects that the pin 27 is short to power
- Min. Failure:
The driving chip detects that the pin 27 is short to ground
- Signal Failure:
The driving chip detects that the pin 27 is open or broken

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.

- After the first consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

The following conditions can cause an intermittent malfunction to occur:

Important: Prior to repairing the parts, remove all the chips from the connector surface. Prior to diagnosing or replacing the parts, check the connector gasket. Ensure the gasket is mounted correctly. The gasket may prevent the pollutant from entering.

- A poor connection at terminal - inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection. Use a corresponding mating terminal to test for proper tension.
- Damaged harness - inspect the wiring harness for damage. If the harness inspection does not reveal a problem, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display on the scan tool will indicate the location of the fault.
- Inspect the ECU and engine grounds for secure and clean connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

DTC P0201 Cylinder 1 Fuel injector Circuit Fault

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the conditions for running the DTC. 2. Connect the scan tool. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0201 is current?	—	Go to Step 3	Go to Diagnostic Aid

DTC P0201 Cylinder 1 Fuel injector Circuit Fault(Cont' d)

Step	Action	Value	Yes	No
3	1. Turn off the ignition. 2. Disconnect the fuel injector 1 connector. 3. Turn on the ignition. 4. Use a DMM to measure the voltage between the cylinder 1 fuel injector harness connector Pin 2 and ground. Is the voltage measure within the specified range?	3.7 volt	Go to Step 4	Go to Step 6
4	Connect a test lamp between cylinder 1 fuel injector harness connector Pin 1 and ground. When the battery voltage is OK, does the test lamp reach its normal brightness?	—	Go to Step 5	Go to Step 6
5	Test the fuel injector. See Fuel Injector Coil Test. Does the test meet the specified value?	20°C, 13-16 Ω	Go to Step 6	Go to Step 7
6	Check the cylinder 1 fuel injector circuit for a short, an open, a high resistance in the harness, or a poor connection of pins at the ECU end or the fuel injector end. Do you find and correct the condition?	—	Go to Step 9	Go to Step 8
7	Replace the fuel injector. Do you complete the replacement?	—	Go to Step 9	—
8	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 9	—
9	1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the DTC information. Does the scan tool indicate DTC P0201 is current?	—	Go to Step 3	System OK

6.4.4.21 DTC P0202 Cylinder 2 Fuel injector Circuit Fault

Description

There are 2 pins connected to the Cylinder 2 fuel injector, which is 12 V feed voltage (cylinder 2 fuel injectotr pin 1 connected to the main relay terminal pin 87), control terminal input (cylinder 2 fuel injector pin 2 connected to the ECU pin 6) separately. In the system, cylinder 2 fuel injector is driven by the driving chip, which can realize the self diagnostic function on drive level and notify the CPU's internal failure diagnostic module of the failure information, by comparing the switch signal from CPU to the actual potential of drive level output end. The fault types that can be diagnosed are:

- Maximum fault: a short to power
- Minimum fault: a short to ground
- Singal fault: open or broken

The DTC for the three fault types is P0202.

Conditions for running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- Max. Failure:
The driving chip detects that the pin 6 is short to power
- Min. Failure:
The driving chip detects that the pin 6 is short to ground
- Signal Failure:
The driving chip detects that the pin 6 is open or broken

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.

- After the first consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

The following conditions can cause an intermittent malfunction to occur:

Important: Prior to repairing the parts, remove all the chips from the connector surface. Prior to diagnosing or replacing the parts, check the connector gasket. Ensure the gasket is mounted correctly. The gasket may prevent the pollutant from entering.

- A poor connection at terminal - inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection. Use a corresponding mating terminal to test for proper tension.
- Damaged harness - inspect the wiring harness for damage. If the harness inspection does not reveal a problem, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display on the scan tool will indicate the location of the fault.
- Inspect the ECU and engine grounds for secure and clean connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

DTC P0202 Cylinder 2 Fuel injector Circuit Fault

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the conditions for running the DTC. 2. Connect the scan tool. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0202 is current?	—	Go to Step 3	Go to Diagnostic Aid

DTC P0202 Cylinder 2 Fuel injector Circuit Fault(Cont' d)

Step	Action	Value	Yes	No
3	1. Turn off the ignition. 2. Disconnect the fuel injector connector. 3. Turn on the ignition. 4. Use a DMM to measure the voltage between the cylinder 2 fuel injector harness connector Pin 2 and ground. Is the voltage measure within the specified range?	3.7 volt	Go to Step 4	Go to Step 6
4	Connect a test lamp between cylinder 2 fuel injector harness connector Pin 1 and ground. When the battery voltage is OK, does the test lamp reach its normal brightness?	—	Go to Step 5	Go to Step 6
5	Test the fuel injector. See Fuel Injector Coil Test. Does the test meet the specified value?	20°C, 13-16 Ω	Go to Step 6	Go to Step 7
6	Check the cylinder 2 fuel injector circuit for a short, an open, a high resistance in the harness, or a poor connection of pins at the ECU end or the fuel injector end. Do you find and correct the condition?	—	Go to Step 9	Go to Step 8
7	Replace the fuel injector. Do you complete the replacement?	—	Go to Step 9	—
8	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 9	—
9	1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the DTC information. Does the scan tool indicate DTC P0202 is current?	—	Go to Step 3	System OK

6.4.4.22 DTC P0203 Cylinder 3 Fuel injector Circuit Fault

Description

There are 3 pins connected to the Cylinder 3 fuel injector, which is 12 V feed voltage (cylinder 3 fuel injectotr pin 1 connected to the main relay terminal pin 87), control terminal input (cylinder 3 fuel injector pin 2 connected to the ECU pin 7) separately. In the system, cylinder 3 fuel injector is driven by the driving chip, which can realize the self diagnostic function on drive level and notify the CPU's internal failure diagnostic module of the failure information, by comparing the switch signal from CPU to the actual potential of drive level output end. The fault types that can be diagnosed are:

- Maximum fault: a short to power
- Minimum fault: a short to ground
- Singal fault: open or broken

The DTC for the three fault types is P0203.

Conditions for running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- Max. Failure:
The driving chip detects that the pin 7 is short to power
- Min. Failure:
The driving chip detects that the pin 7 is short to ground
- Signal Failure:
The driving chip detects that the pin 7 is open or broken

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.

- After the first consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

The following conditions can cause an intermittent malfunction to occur:

Important: Prior to repairing the parts, remove all the chips from the connector surface. Prior to diagnosing or replacing the parts, check the connector gasket. Ensure the gasket is mounted correctly. The gasket may prevent the pollutant from entering.

- A poor connection at terminal - inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection. Use a corresponding mating terminal to test for proper tension.
- Damaged harness - inspect the wiring harness for damage. If the harness inspection does not reveal a problem, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display on the scan tool will indicate the location of the fault.
- Inspect the ECU and engine grounds for secure and clean connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

DTC P0203 Cylinder 3 Fuel injector Circuit Fault

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the conditions for running the DTC. 2. Connect the scan tool. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0203 is current?	—	Go to Step 3	Go to Diagnostic Aid

DTC P0203 Cylinder 3 Fuel injector Circuit Fault(Cont' d)

Step	Action	Value	Yes	No
3	1. Turn off the ignition. 2. Disconnect the fuel injector 3 connector. 3. Turn on the ignition. 4. Use a DMM to measure the voltage between the cylinder 3 fuel injector harness connector Pin 2 and ground. Is the voltage measure within the specified range?	3.7 volt	Go to Step 4	Go to Step 6
4	Connect a test lamp between cylinder 3 fuel injector harness connector Pin 1 and ground. When the battery voltage is OK, does the test lamp reach its normal brightness?	—	Go to Step 5	Go to Step 6
5	Test the fuel injector. See Fuel Injector Coil Test. Does the test meet the specified value?	20°C, 13-16 Ω	Go to Step 6	Go to Step 7
6	Check the cylinder 3 fuel injector circuit for a short, an open, a high resistance in the harness, or a poor connection of pins at the ECU end or the fuel injector end. Do you find and correct the condition?	—	Go to Step 9	Go to Step 8
7	Replace the fuel injector. Do you complete the replacement?	—	Go to Step 9	—
8	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 9	—
9	1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the DTC information. Does the scan tool indicate DTC P0203 is current?	—	Go to Step 3	System OK

6.4.4.23 DTC P0204 Cylinder 4 Fuel injector Circuit Fault

Description

There are 2 pins connected to the Cylinder 4 fuel injector, which is 12 V feed voltage (cylinder 4 fuel injectotr pin 1 connected to the main relay terminal pin 87), control terminal input (cylinder 4 fuel injector pin 2 connected to the ECU pin 47) separately. In the system, cylinder 4 fuel injector is driven by the driving chip, which can realize the self diagnostic function on drive level and notify the CPU's internal failure diagnostic module of the failure information, by comparing the switch signal from CPU to the actual potential of drive level output end. The fault types that can be diagnosed are:

- Maximum fault: a short to power
- Minimum fault: a short to ground
- Singal fault: open or broken

The DTC for the three fault types is P0204.

Conditions for running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- Max. Failure:
The driving chip detects that the pin 47 is short to power
- Min. Failure:
The driving chip detects that the pin 47 is short to ground
- Signal Failure:
The driving chip detects that the pin 47 is open or broken

Action Taken When the DTC Sets

- Corresponding DTCs as well as the related DTC information will be stored in the DTC memory.

- After the first consecutive drive cycle that the diagnostic test has run and failed, the condition will be identified by ECU. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

The conditions for clearing MIL/DTC.

- The MIL will be turned off after 3 consecutive drive cycles that the diagnostic test passes and does not fail.
- After 20 consecutive warm-up cycles without failure, the DTC will be cleared.
- The DTC can be cleared with the scan tool.

Diagnostic Aids

The following conditions can cause an intermittent malfunction to occur:

Important: Prior to repairing the parts, remove all the chips from the connector surface. Prior to diagnosing or replacing the parts, check the connector gasket. Ensure the gasket is mounted correctly. The gasket may prevent the pollutant from entering.

- A poor connection at terminal - inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection. Use a corresponding mating terminal to test for proper tension.
- Damaged harness - inspect the wiring harness for damage. If the harness inspection does not reveal a problem, observe the display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display on the scan tool will indicate the location of the fault.
- Inspect the ECU and engine grounds for secure and clean connections.

If the DTC is determined to be intermittent, reviewing the Failure Records can be useful in determining when the DTC was last set.

DTC P0204 Cylinder 4 Fuel injector Circuit Fault

Step	Action	Value	Yes	No
1	Do you perform the Powertrain On Board Diagnostic System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the conditions for running the DTC. 2. Connect the scan tool. 3. Monitor the DTC information with a scan tool. Does the scan tool indicate DTC P0204 is current?	—	Go to Step 3	Go to Diagnostic Aid

DTC P0204 Cylinder 4 Fuel injector Circuit Fault(Cont' d)

Step	Action	Value	Yes	No
3	1. Turn off the ignition. 2. Disconnect the fuel injector 4 connector. 3. Turn on the ignition. 4. Use a DMM to measure the voltage between the cylinder 4 fuel injector harness connector Pin 2 and ground. Is the voltage measure within the specified range?	3.7 volt	Go to Step 4	Go to Step 6
4	Connect a test lamp between cylinder 4 fuel injector harness connector Pin 1 and ground. When the battery voltage is OK, does the test lamp reach its normal brightness?	—	Go to Step 5	Go to Step 6
5	Test the fuel injector. See Fuel Injector Coil Test. Does the test meet the specified value?	20°C, 13-16 Ω	Go to Step 6	Go to Step 7
6	Check the cylinder 4 fuel injector circuit for a short, an open, a high resistance in the harness, or a poor connection of pins at the ECU end or the fuel injector end. Do you find and correct the condition?	—	Go to Step 9	Go to Step 8
7	Replace the fuel injector. Do you complete the replacement?	—	Go to Step 9	—
8	Replace the ECU and have it programmed. Do you complete the replacement?	—	Go to Step 9	—
9	1. Clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the DTC information. Does the scan tool indicate DTC P0204 is current?	—	Go to Step 3	System OK

6.4.4.24 DTC P0230 Control Circuit Failure - Oil Pump

Description

Four pins connected to oil pump relay. They are 12V main relay supply power (Relay end pin 30 connected to main relay end pin 87), control end (Relay end pin 85 connected to ECU pin 69), ignition switch signal input (Relay end pin 86 connected to ignition switch pin 15), relay voltage output end (Relay end pin 87 connected to oil pump motor pin A).

Low potential of oil pump relay control end (ECU Pin 69) is valid. Oil pump relay is driven by the drive chip, which realize the self diagnostic function on drive level and can notify the Internal CPU failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of drive level output end. The failure types that can be diagnosed are:

- Max. failure: a short circuit of Pin to Power when the drive level switch is turned on
- Min. failure: a short circuit of Pin to Ground when the drive level switch is turned off
- Signal failure: an open or short circuit of Pin when the drive level switch is turned off

The DTC of the three failure types is P0230.

Conditions for Running the DTC

- Max. Failure:
Engine is operative.
- Min. Failure, Signal Failure:
The ignition switch is turned on.

Conditions for Setting the DTC

- Max. Failure:
Drive level switch of oil pump relay is turned on, and an short circuit with Pin to Power Supply.
- Min. Failure:
Drive level switch of oil pump relay is turned off, and an short circuit with Pin to Ground.

- Signal Failure:
An open or broken circuit with Pin 69, drive level switch of oil pump relay is turned off, and an open or broken circuit with the pin.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After 2 seconds when the diagnostic test has run and failed, the trouble is identified by ECU immediately. At this time ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC.

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Intermittent conditions may occur due to a poor connection, wire insulating layer worn out or wire damaged inside the insulating layer.

Check the following:

- A poor connection with ECU or fuel pump relay - inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness damaged - inspect the harness damage

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0230 Control Circuit Failure - Oil Pump

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Turn on the ignition. 2. With a scan tool instruct the fuel pump relay to switch on and off. Does the relay execute each Switch On and Switch Off order?	—	Go to Diagnostic Aids	Go to Step 3

DTC P0230 Control Circuit Failure - Oil Pump(Cont' d)

Step	Action	Value	Yes	No
3	1. Turn off the ignition. 2. Disconnect the relay, turn on the ignition switch, and do not start the engine. 3. Use the test lamp with a good connection, and connect to the power supply end Pin 2 of oil pump relay. 4. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 5
4	1. Connect a test lamp between the relay control circuit and the power supply end of relay. 2. With a scan tool instruct the relay to switch on and off. Does each order allow the test lamp to turn on and off?	—	Go to Step 6	Go to Step 5
5	Check the relay circuit if a short, an open circuit, a great resistance in the harness, or a poor connection with ECU end or relay end pin. Is any failure found and repaired?	—	Go to Step 8	Go to Step 7
6	Replace the relay. Is the replacement operation completed?	—	Go to Step 8	—
7	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 8	—
8	1. Clear off the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0230 as current DTC?	—	Go to Step 3	System OK

6.4.4.25 DTC P0325 Circuit Failure - Knock Sensor

Description

The two pins connected to the knock sensor (KS) are separately signal output (KS end pin 1 connected to ECU end pin 19), and signal output (KS end pin 2 connected to ECU Pin 20).

The knock sensor is mounted on the engine block, and vibrates at different vibration frequencies under the different engine operating conditions, and produces the voltage signal containing different kinds of frequency. This signal is magnified, filtered, rectified and integrated in ECU, and in the end this integral value of knocking signal is compared with the knock reference value. And if the specific value exceeds a certain value, a knock may be considered to happen, and the ECU may retard the ignition timing based on it.

Diagnostic module may monitor the standardized knock reference value (Unit: V). When the engine operates normally, and the knock sensor is operative regularly, the voltage signal of knock sensor may fluctuate in the upper and lower limits corresponding to the RPM. Once the signal voltage exceeds the valve value, the knock sensor with trouble may be considered. Then the following can be diagnosed:

- Max. Failure: The background noise may rise abruptly due to the engine damage.
- Min. Failure: The background noise may be extremely low due to a short or open circuit to the ground.

The failure code of the two faults are both P0325.

Conditions for Running the DTC

- The ignition switch is turned on.
- Engine Cooling Water Temperature > 40°C
- Engine Speed > 2000 rev/min.

Conditions for Setting the DTC

If any of the following two conditions happens, the knock sensor may be considered as fault.

- Min. Failure: a short or open circuit to the ground
 - The standardized knock reference value < the lower limit (the limit value is relative to the speed)
 - And the engine speed > 2200 rev/min.
- Max. Failure: The background noise rises abruptly due to the engine damage. The standardized knock reference value > the upper limit (the limit value is relative to the speed).

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this time ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC.

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU - inspect the knock sensor and the ECU connector.
 - Backed-out terminals
 - Broken locks
 - Improperly formed or damaged terminals
- Harness laying error - inspect the knock sensor harness to ensure the harness is not too near to the high voltage wire.

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0325 Circuit Failure ñ Knock Sensor

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check

DTC P0325 Circuit Failure ñ Knock Sensor(Cont' d)

Step	Action	Value	Yes	No
2	<p><i>Notice:</i> If the engine knock can be heard, repair the engine mechanical failure prior to performing this diagnosis.</p> <ol style="list-style-type: none"> 1. Operate the vehicle according to the operating conditions of DTC. 2. For DTC P 0325, use a scan tool to monitor the given information of diagnostic DTC until the test runs. <p>Does the scan tool indicate the DTC failed this ignition?</p>	—	Go to Step 3	Go to Diagnostic Aids
3	<ol style="list-style-type: none"> 1. Disconnect the engine control module and the knock sensor. 2. Test the knock sensor circuit if an open or short circuit to the ground. <p>Is any failure found and repaired?</p>	—	Go to Step 7	Go to Step 4
4	<p>Check the circuit terminal of knock sensor if a poor connection occurs.</p> <p>Is any failure found and repaired?</p>	—	Go to Step 7	Go to Step 5
5	<p>Replace the knock sensor.</p> <p>Is the replacement operation completed?</p>	—	Go to Step 7	—
6	<p>Replace the ECU and perform the programming.</p> <p>Is the replacement operation completed?</p>	—	Go to Step 7	—
7	<ol style="list-style-type: none"> 1. Clear off the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. <p>Does the scan tool indicate DTC P0325 as current DTC?</p>	—	Go to Step 2	System OK

6.4.4.26 DTC P0335 Signal Error - Crankshaft Position Sensor

Description

Crankshaft position sensor has two pins, Pin 1 connected to ECU Pin 15, and Pin 2 connected to ECU Pin 34.

The signal wheel of crankshaft position sensor is 60-2 Tooth, mounted on the belt disk, among which the width of 57 tooth spaces is 3_, and the 58th tooth width is 15_, the 2nd tooth falling edge after the wide tooth space (15_) as the ECU reference position. ECU calculates the engine speed and senses the crankshaft position according to 58 X signal of crankshaft position sensor and the signal of reference point. If the following occurs, DTC P0335 may be set up.

- Max. Failure: Too more frequent correction to one more tooth space
- Min. Failure: Too more frequent correction to one less tooth space
- Signal Failure: The crankshaft rotates one circle, and ECU doesn't find reference points.
- Unreasonable Failure: The reference point signal loses frequently.

Conditions for Running the DTC

- Max., Min. Failure
 - Vehicle speed > 25 km/h; or when DTC P0500 is set, Vehicle speed < 1 km/h; or the engine speed > 850 rev/min.
- Unreasonable failure
 - Vehicle speed > 25 km/h; or when DTC P0500 is set, Vehicle speed < 1 km/h; or the engine speed > 850 rev/min.
- Signal Failure
 - RPM signal is consecutive.

Conditions of setting the DTC

- Max. Failure: ECU senses that each loop is more than 58 tooth spaces.
- Min. Failure: ECU senses that each loop is less than 58 tooth spaces.
- Signal Failure: The crankshaft rotates one circle, and ECU doesn't receive reference points.
- Unreasonable Failure: The reference point signal loses frequently.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After 2 seconds when the diagnostic test has run and failed, the trouble is identified by ECU

immediately. At this time ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

DTC P0335 may be caused due to the reason that the secondary parts leak high voltage to the ignition module. Check the following:

- The harness laying is incorrect, and near to the secondary ignition parts.
- Electric arc is emitted from between the ignition coils and the harness or ignition control module (Inspect the ignition for cracks, carbon tracking, or other damages).
- Electric arch is emitted from the secondary ignition coils and the wiring harness.

Important: Prior to repairing the parts, remove all the chips from the connector surface. Prior to diagnosing or replacing the parts, check the connector gasket. Ensure the gasket is mounted correctly. The gasket may prevent the pollutant from entering.

- A poor connection with terminals - inspect the harness connector if a failure of Backed-out terminals, mismatching, damaged locking, improper or damaged shape, and a connection failure with the wires. Use appropriate matching terminals to test if the tensile force is proper.
- Harness damaged - inspect if the harness damaged. If there is no harness failure, move the connector and wires relative to the sensor, while observing the indication shown on the scan tool. Change the indication failure position on the scan tool.
- If ECU and the engine grounding connection is reliable and clean.

If the DTC is determined as intermittent failure, look up the failure record, and it can be determined how the DTC is set last time.

DTC P0335 Signal Failure ñ Reference Point of Crankshaft Position Sensor

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	Does the engine crank?	—	Go to Step 3	Go to 掬 engine crank with difficulties, Poor Idling and Engine Stall Inspection Procedures
3	1. Disconnect the crankshaft position sensor. 2. Use a DMM to measure the sensor resistance. Is it near to the specified value?	20°C, 770-950 Ω	Go to Step 4	Go to Step 7
4	Inspect the CKP sensor harness if a short circuit to ground, a short or open circuit or great resistance to power supply, and inspect a poor connection with CKP and ECU end pins. Is any problem found and repaired?	—	Go to Step 9	Go to Step 5
5	Inspect if the CKP sensor signal wheel is damaged, or installed improperly. Is any problem found or repaired?	—	Go to Step 6	Go to Step 7
6	Replace CKP sensor signal wheel or re-install it. Is the repair completed?	—	Go to Step 9	—
7	Replace the CKP sensor. Is the replacement operation completed?	—	Go to Step 9	—
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Use a scan tool to clear the DTCs. 2. Operate the vehicle according to the DTC operating conditions, and is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.27 DTC P0443 Control Circuit Failure - Drive Level of Canister Control Valve

Description

There are two pins connected to the canister purge control valve (EVAP for short). They are separately 12V main relay supply power (EVAP Pin 1 connected to Main Relay 87), and control end (EVAP end Pin 2 connected to ECU Pin 46).

Drive level of canister purge control valve is driven by the drive chip, which realizes the self diagnostic function on drive level and can notify the CPU internal failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of drive level output end.

Conditions for Running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- The control end is open, and the drive level is disconnected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this time ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU - Inspect if the harness connector exists:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness Laying Error - Inspect if the harness is damaged. If the harness appears normal, disconnect ECU and EVAP, turn on the ignition switch and observe the voltmeter connected between the EVAP end and the ECU end of canister solenoid control circuit, at the same time move the connector and the harness relative to the canister solenoid. If the voltage changes, it indicates that a failure exists at this location.

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0443 Control Circuit Failure - Drive Level of Canister Purge Control Valve

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0443 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	With the scan tool, instruct the purge solenoid valve to actuate, does the purge solenoid react to each order?	—	Go to Diagnostic Aids	Go to Step 4

DTC P0443 Control Circuit Failure - Drive Level of Canister Purge Control Valve(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the canister solenoid. 3. Turn on the ignition. 4. Connect a test lamp between EVAP wire plug Pin 1 and the ground. When the battery is normal, does the test lamp reach its normal brightness?	—	Go to Step 5	Go to Step 6
5	1. The ignition switch is turned on. 2. Use a DMM to test the voltage between the ECU control circuit of canister solenoid harness plug Pin 2 and the ground. Test if the voltage meets the specified value?	About 3.7V	Go to Step 7	Go to Step 6
6	Test if the EVAP control circuit is open. Is any failure found and repaired?	—	Go to Step 10	Go to Step 7
7	Inspect the EVAP harness if a short circuit to ground, a short or open circuit or great resistance to power supply, and inspect a poor connection with EVAP and ECU end pins. Is any problem found and repaired?	—	Go to Step 10	Go to Step 8
8	Replace the purge solenoid. Is the replacement operation completed?	—	Go to Step 10	—
9	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 10	—
10	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.28 DTC P0444 Too Low Voltage for Control Circuit - Drive Level of Canister Purge Control Valve

Description

There are two pins connected to the canister purge control valve (EVAP for short). They are separately 12V main relay supply power (EVAP Pin 1 connected to Main Relay 87), and control end (EVAP end Pin 2 connected to ECU Pin 46).

Drive level of canister purge control valve is driven by the drive chip, which realizes the self diagnostic function on drive level and can notify the CPU internal failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of drive level output end.

Conditions for Running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- The control end is short to the ground, and the drive level is disconnected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU - Inspect if the harness connector exists:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness Laying Error - Inspect if the harness is damaged. If the harness appears normal, disconnect ECU and EVAP, turn on the ignition switch and observe the voltmeter connected between the EVAP end and the ECU end of canister solenoid control circuit, at the same time move the connector and the harness relative to the canister solenoid. If the voltage changes, it indicates that a failure exists at this location.

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0444 Too Low Voltage for Control Circuit - Drive Level of Canister Purge Control Valve

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0444 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	With the scan tool, instruct the purge solenoid valve to actuate, does the purge solenoid react to each order?	—	Go to Diagnostic Aids	Go to Step 4

DTC P0444 Too Low Voltage for Control Circuit - Drive Level of Canister Purge Control Valve(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the canister solenoid. 3. Turn on the ignition. 4. Connect a test lamp between EVAP wire plug Pin 1 and the ground. When the battery is normal, does the test lamp reach its normal brightness?	—	Go to Step 5	Go to Step 6
5	1. The ignition switch is turned on. 2. Use a DMM to test the voltage between the ECU control circuit of canister solenoid harness plug Pin 2 and the ground. Test if the voltage meets the specified value?	About 3.7V	Go to Step 7	Go to Step 6
6	Test if the EVAP control circuit is short to the ground. Is any failure found and repaired?	—	Go to Step 10	Go to Step 7
7	Inspect the EVAP harness if a short circuit to ground, a short or open circuit or great resistance to power supply, and inspect a poor connection with EVAP and ECU end pins. Is any problem found and repaired?	—	Go to Step 10	Go to Step 8
8	Replace the purge solenoid. Is the replacement operation completed?	—	Go to Step 10	—
9	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 10	—
10	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.29 DTC P0445 Too High Voltage for Control Circuit - Drive Level of Canister Purge Control Valve

Description

There are two pins connected to the canister purge control valve (EVAP for short). They are separately 12V main relay supply power (EVAP Pin 1 connected to Main Relay 87), and control end (EVAP end Pin 2 connected to ECU Pin 46).

Drive level of canister purge control valve is driven by the drive chip, which realizes the self diagnostic function on drive level and can notify the CPU internal failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of drive level output end.

Conditions for Running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- The control end is short to the power supply, and the drive level is connected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU - Inspect if the harness connector exists:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness Laying Error - Inspect if the harness is damaged. If the harness appears normal, disconnect ECU and EVAP, turn on the ignition switch and observe the voltmeter connected between the EVAP end and the ECU end of canister solenoid control circuit, at the same time move the connector and the harness relative to the canister solenoid. If the voltage changes, it indicates that a failure exists at this location.

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0445 Too High Voltage for Control Circuit - Drive Level of Canister Purge Control Valve

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0445 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	With the scan tool, instruct the purge solenoid valve to actuate, does the purge solenoid react to each order?	—	Go to Diagnostic Aids	Go to Step 4

DTC P0445 Too High Voltage for Control Circuit - Drive Level of Canister Purge Control Valve(Cont' d)

Step	Action	Value	Yes	No
4	1. Turn off the ignition. 2. Disconnect the canister solenoid. 3. Turn on the ignition. 4. Connect a test lamp between EVAP wire plug Pin 1 and the ground. When the battery is normal, does the test lamp reach its normal brightness?	—	Go to Step 5	Go to Step 6
5	1. The ignition switch is turned on. 2. Use a DMM to test the voltage between the ECU control circuit of canister solenoid harness plug Pin 2 and the ground. Test if the voltage meets the specified value?	About 3.7V	Go to Step 7	Go to Step 6
6	Test if the EVAP control circuit is short to the electricity Is any failure found and repaired?	—	Go to Step 10	Go to Step 7
7	Inspect the EVAP harness if a short circuit to ground, a short or open circuit or great resistance to power supply, and inspect a poor connection with EVAP and ECU end pins. Is any problem found and repaired?	—	Go to Step 10	Go to Step 8
8	Replace the purge solenoid. Is the replacement operation completed?	—	Go to Step 10	—
9	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 10	—
10	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.30 DTC P0480 Control Circuit Failure - Cooling Fan Relay of A/C Condenser

Description

There are three pins connected to the A/C cooling fan relay. They are 12V power supply end (Relay end pin 30 connected to Fuse F20), main relay power supply (Relay end pin 85 connected to main relay 87), control end (Relay end pin 86 connected to ECU Pin 50).

For the control signal end ECU Pin 50 of A/C cooling fan relay, the low potential is valid. For the A/C cooling fan relay, CJ920 acts as the drive chip. Drive chips realize the self diagnostic function on drive level and can notify the Internal CPU failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of drive level output end. The failure types that can be diagnosed are:

- Max. failure: a short circuit of Pin to Power when the drive level is switched on.
- Min. failure: a short circuit of Pin to Ground when the drive level is disconnected.
- Signal failure: an open or broken circuit of Pin when the drive level is disconnected.

The DTC of the above three troubles is P0480.

Conditions for Running the DTC

- After the engine starts normally

Conditions for Setting the DTC

- Max. Failure:
The control end pin is short to the power supply, and the drive level is connected.
- Min. Failure:
The control end is short to the ground, and the drive level is disconnected.
- Signal Failure:
The control end is open, and the drive level is disconnected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU - Inspect the following for the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness Laying Error - Inspect if the harness is damaged. If the harness appears normal, disconnect ECU, turn on the ignition switch, and observe the ECU harness voltmeter connected between the drive circuit of fan relay and the ground, at the same time move the fan relay connector and the wiring harness. The changed voltage indicates the place where failure occurs.

View the mileage in the frozen malfunction status/ malfunction record which failed in the last diagnosis. It is helpful to determine the frequency formed by the setting conditions of DTC.

DTC P0480 Control Circuit Failure - Cooling Fan Relay of A/C Condenser

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Close the engine, turn on the ignition. 2. With the scan tool, instruct the electric fan relay to switch on and off. Does the relay execute each Switch On and Switch Off order?	—	Go to Diagnostic Aids	Go to Step 3

DTC P0480 Control Circuit Failure - Cooling Fan Relay of A/C Condenser(Cont' d)

Step	Action	Value	Yes	No
3	1. Turn off the ignition. 2. Disconnect the relay, turn on the ignition, and do not start the engine. 3. Use the test light with good grounding to test the power supply end of the relay. Does the test light illuminate?	—	Go to Step 4	Go to Step 5
4	1. Connect a test lamp between the relay control circuit and the power supply end of relay. 2. With the scan tool, instruct the relay to switch on and off. Does each order allow the test lamp to turn on and off?	—	Go to Step 6	Go to Step 5
5	Check the relay circuit if a short, an open circuit, a great resistance in the harness, or a poor connection with ECU end or relay end pin. Is any failure found and repaired?	—	Go to Step 8	Go to Step 7
6	Replace the relay. Is the replacement operation completed?	—	Go to Step 8	—
7	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 8	—
8	1. Clear off the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0480 as current DTC?	—	Go to Step 3	System OK

6.4.4.31 DTC P0500 Unreasonable Failure - Speed Signal

Description

The speed sensor is Hall sensor, with ECU Pin 59 as speed sensor signal end. ECU converts the frequency signal produced by the speed sensor to speed signal. If the engine is at a certain load and some rotation speed, and the vehicle speed is too low, DTC P0500 will be set.

Conditions for Running the DTC

Engine Coolant Temperature > 65°C

Conditions for Setting the DTC

If any of the following two conditions happens, the speed sensor may be determined as fault.

- The vehicle is skidding at oil break, namely 2000 rev/min. < Engine RPM < 4000 rev/min, and the vehicle speed < 20 km/h

- The vehicle gear is applied (AT: D Gear or R Gear) and the engine is at operating conditions, namely the cylinder charging efficiency > 50% and the engine RPM > 4000 rev/min. The vehicle speed < 5 km/h

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

DTC P0500 Signal Error - Vehicle Speed Sensor

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0500 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn off the ignition. 2. Disconnect VSS. 3. Switch on the ignition, and do not start the engine. 4. Use the test light to check the VSS supply circuit. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 5
4	Use the test lamp to inspect the VSS grounding circuit, does the test lamp illuminate?	—	Go to Step 6	Go to Step 5
5	Inspect the VSS harness if a short or open circuit, or a great resistance to the power supply. Inspect a poor connection with the VSS terminal and ECU terminal pins, is the trouble found and repaired?	—	Go to Step 11	Go to Step 6

DTC P0500 Signal Error - Vehicle Speed Sensor(Cont' d)

Step	Action	Value	Yes	No
6	1. Remove the VSS, and connect to the harness connector. 2. Use a DMM to test the voltage of the VSS harness connector Pin 1 to the ground. <ul style="list-style-type: none"> When the VSS is near to the iron, its voltage should be 0V. When the VSS is far away from the iron, its voltage should be 0V. Measure if the voltage meets the above voltage?	—	Go to Step 7	Go to Step 9
7	Inspect if the signal wheel of vehicle speed sensor is damaged, or installed improperly. Is any problem found or repaired?	—	Go to Step 8	Go to Step 9
8	Replace or re-install the signal wheel. Is the replacement operation completed?	—	Go to Step 11	—
9	Replace the VSS. Is the replacement operation completed?	—	Go to Step 11	—
10	Replace the ECU, and perform the programming. Is the replacement operation completed?	—	Go to Step 11	—
11	1. Use a scan tool to clear the DTCs. 2. Operate the vehicle according to the operating conditions of DTC. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.32 DTC P0506 Idle Speed Lower Than Desired Idle Value

Description

The main task of idle control is: Frequently correct the output torque transferred by the engine to the clutch to get the steady idling. When the accelerator is at idle position and the idle control is set up, always make corrections. The correction indicates the increased or reduced torque adjustment at some time to ensure the idle speed is consistent with the desired idle value. And this part of torque adjustment is realized by adjusting the position of idle actuator (Step Motor) motor pivot, and accordingly adjusting the air amount bypassed by the step motor.

Suppose the correction has reached the limit value, but the idle speed is quite different from the desired idle value. At this time a failure may likely occur to the idle actuator (step motor), and thus influence the idle control results. Therefore, the diagnostic module takes the correction of idle control and the engine speed as the main monitoring object, and make judgements on the failures. Then the following can be diagnosed:

- Min. Failure: The idle speed is greatly lower than the desired idle value, and meanwhile the correction has reached the highest limit value.

Conditions for Running the DTC

- The vehicle is below the altitude of 4000m.
- The engine runs and is at idle operation.
- Engine Coolant Temperature > 80°C
- Intake Air Temperature > 20°C
- No failure with the canister purge control valve and its drive level, No failure record on revolution sensor, vehicle speed sensor, intake temperature sensor, water temperature sensor, and idle control.

Conditions for Setting the DTC

- The desired idle value is 150 rev/min greater than the idle speed.
- And the correction reaches the limit value.
- The cylinder charging efficiency < 70%, namely remove the failure caused by the increasing of resistance torque due to personal factors.
- No failure with intake air pressure sensor

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU or idle air control valve - inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- If the harness is damaged - inspect if the harness is damaged
- Is the air intake system blocked up - inspect if the air inlet pipe is dented, the air filter element is choked up or the foreign material clogs up the air intake system.
- Throttle Body - inspect if the idle air control channel or the throttle is blocked up, if the idle air control channel, the throttle or the valve flap is over deposited.
- A great deal of vacuum leakage - inspect the causes why a great deal of vacuum leakage occurs, such as improper installation of or a failure with the positive crankcase ventilation valve, or disconnection with the brake booster hose.

If the DTC cannot be recreated and determined as intermittent symptom, viewing the failure record is helpful to determine the time when the DTC is set finally. Also see Testing for Intermittent Conditions and Poor Connections in the Wiring System.

DTC P0506 Idle Speed Lower Than Desired Idle Value

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Connect the scan tool. 2. Use the scan tool to monitor the DTC information. Does any other DTC exist?	—	Go to Other DTC Diagnostic Table.	Go to Step 4
3	1. Start the engine. 2. Close all of the accessories. 3. With the scan tool, instruct the revolution to rise to 1500rpm, fall down to 650rpm, then rise to 1500rpm again, while monitoring the engine speed on the scan tool. And under each instructed revolution, does the engine speed maintain the desired idle value as specified?	± 50 rpm	Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the idle motor. 2. Install J370327-A idle motor analyzer onto the control harness connector of idle motor. 3. Start the engine, instruct the revolution to rise to 1500rpm, fall down to 650rpm, and rise to 1500rpm again with the scan tool, while observing the node lamps. Do all the node lamps switch over circularly between red and green (never go out)?	—	Go to Step 6	Go to Step 5
5	1. Test the following circuits if an open circuit, if a short to the power supply or the ground. <ul style="list-style-type: none"> Low voltage circuit of Idle Regulator Coil 1. High voltage circuit of Idle Regulator Coil 1. Low voltage circuit of Idle Regulator Coil 2. High voltage circuit of Idle Regulator Coil 2. 2. A poor connection with the harness connector of idle motor and with the ECU harness connector. When any failure is found, repair it if needed. Is the failure removed?	—	Go to Step 11	Go to Step 9
6	Inspect the idle regulator connector for loose or a poor connection. Is any failure found and removed?	—	Go to Step 11	Go to Step 7

DTC P0506 Idle Speed Lower Than Desired Idle Value(Cont' d)

Step	Action	Value	Yes	No
7	Inspect the following with your eyes/apparently. <ul style="list-style-type: none"> Throttle Body Movement - twisting with the check screw of the throttle retaining bar Air intake system is blocked up - inspect if the air inlet pipe is dented, the air filter element is dirt or the foreign material clogs up the air intake system. Remove the idle motor. Inspect if the idle motor is too dirt, and the throttle is too dirt. Do the above conditions need repairing?	—	Go to Step 11	Go to Step 8
8	Replace the idle motor. Are the replacement procedures completed?	—	Go to Step 11	—
9	Inspect the ECU connector for loose or a poor connection. Is any failure found and removed?	—	Go to Step 11	Go to Step 10
10	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 11	—
11	1. When necessary, re-install and connect the parts. 2. Start the engine. 3. Close all of the accessories. 4. With the scan tool, instruct the revolution to rise to 1500rpm, fall down to 650rpm, rise to 1500rpm again, while monitoring the engine revolution on the scan tool. Under each revolution order, does the engine RPM maintain within the desired idle value range as specified?	± 50 rpm	Go to Step 11	Go to Step 3
12	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the code information. Is the diagnostic code re-set?	—	Go to Step 3	System OK

6.4.4.33 DTC P0507 Idle Speed Greater Than Desired Idle Value

Description

The main task of idle control is: Frequently correct the output torque transferred by the engine to the clutch to get the steady idling. When the accelerator is at idle position and the idle control is set up, always make corrections. The correction indicates the increased or reduced torque adjustment at some time to ensure the actual RPM is consistent with the desired RPM. And this part of torque adjustment is realized by adjusting the position of idle actuator (Step Motor) motor pivot, and accordingly adjusting the air amount bypassed by the step motor.

Suppose the correction has reached the limit value, but the actual RPM is quite different from the desired RPM. At this time a failure may likely occur to the idle actuator (step motor), and thus influence the idle control results. Therefore, the diagnostic module takes the correction of idle control and the engine speed as the main monitoring object, and make judgements on the failures. Then the following can be diagnosed:

- Max. Failure: The actual RPM is greatly higher than the desired RPM, and meanwhile the correction has reached the lowest limit value.

Conditions for Running the DTC

- The vehicle is below the altitude of 4000m.
- The engine runs and is at idle operation.
- Engine Coolant Temperature > 80°C
- Intake Air Temperature > 20°C
- No failure with the canister purge control valve and its drive level, No failure record on revolution sensor, vehicle speed sensor, intake temperature sensor, water temperature sensor, and idle control.

Conditions for Setting the DTC

- The desired idle is less than the actual revolution - 150 rev/min..
- And the correction reaches the minimum limit value.
- Non-engine braking conditions

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this

time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU or idle air control valve - inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Is the harness damaged - inspect if the harness is damaged
- Is the air intake system blocked up - inspect if the air inlet pipe is dented, the air filter element is choked up or the foreign material clogs up the air intake system.
- Throttle body - inspect if the idle air control channel or the throttle is blocked up, the idle air control channel and the idle air control pivot is severely deposited, the throttle hole or the throttle valve flap is severely deposited.
- A great deal of vacuum leakage - inspect the conditions that causes a great deal of vacuum leakage, such as improper installation of or a failure with the positive crankcase ventilation valve, or disconnection with the brake booster hose.

If the DTC cannot be recreated and determined as intermittent symptom, viewing the failure record is helpful to determine the time when the DTC is set finally.

DTC P0507 Idle Speed Higher Than Desired Idle Value

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Connect the scan tool. 2. Use the scan tool to monitor the DTC information. Does any other DTC exist?	—	Go to Other DTC Diagnostic Table.	Go to Step 4
3	1. Start the engine. 2. Close all of the accessories. 3. With the scan tool, instruct the revolution to rise to 1500rpm, fall down to 650rpm, then rise to 1500rpm again, while monitoring the engine speed on the scan tool. And under each instructed revolution, does the engine speed maintain the desired idle value as specified?	± 50 rpm	Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the idle motor. 2. Install J370327-A idle motor analyzer onto the control harness connector of idle motor. 3. Start the engine, instruct the revolution to rise to 1500rpm, fall down to 650rpm, and rise to 1500rpm again with the scan tool. At the same time, observe the node lamps. Do all the node lamps switch over circularly between red and green (never go out)?	—	Go to Step 6	Go to Step 5
5	1. Test the following circuits if an open circuit, if a short to the power supply or the ground. <ul style="list-style-type: none"> Low voltage circuit of Idle Regulator Coil 1. High voltage circuit of Idle Regulator Coil 1. Low voltage circuit of Idle Regulator Coil 2. High voltage circuit of Idle Regulator Coil 2. 2. A poor connection with the harness connector of idle motor and with the ECU harness connector. When any failure is found, repair it if needed. Is the failure removed?	—	Go to Step 11	Go to Step 9
6	Inspect the idle regulator connector for loose or a poor connection. Is any failure found and removed?		Go to Step 11	Go to Step 7

DTC P0507 Idle Speed Higher Than Desired Idle Value(Cont' d)

Step	Action	Value	Yes	No
7	Inspect the following with your eyes/apparently. <ul style="list-style-type: none"> Throttle Body Movement - twisting with the check screw of the throttle retaining bar Air intake system is blocked up - inspect if the air inlet pipe is dented, the air filter element is dirt or the foreign material clogs up the air intake system. Remove the idle motor. Inspect if the idle motor is too dirt, and the throttle is too dirt. Do the above conditions need repairing?	—	Go to Step 11	Go to Step 8
8	Replace the idle motor. Are the replacement procedures completed?	—	Go to Step 11	—
9	Inspect the ECU connector for loose or a poor connection. Is any failure found and removed?	—	Go to Step 11	Go to Step 10
10	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 11	—
11	1. When necessary, re-install and connect the parts. 2. Start the engine. 3. Close all of the accessories. 4. With the scan tool, instruct the revolution to rise to 1500rpm, fall down to 650rpm, rise to 1500rpm again, while monitoring the engine revolution on the scan tool. Under each revolution order, does the engine RPM maintain within the desired idle value range as specified?	± 50 rpm	Go to Step 11	Go to Step 3
12	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the code information. Is the diagnostic code re-set?	—	Go to Step 3	System OK

6.4.4.34 DTC P0508 Too Low Voltage with Control Circuit - Idle Regulator

Description

There are four pins connected to the idle regulator (IAC for short). They are control signal end of Coil 1 (IAC end Pin 1 connected to ECU Pin 64), control signal end of Coil 1 (IAC end Pin 2 connected to ECU Pin 65), control signal end of Coil 2 (IAC end Pin 3 connected to ECU Pin 66), control signal end of Coil 2 (IAC end Pin 4 connected to ECU Pin 67).

The driver of two-phase step motor controls the angular displacement of step motor rotors by changing the polarity of two coils. If the diagnostic module detects a short with some pin of step motor to the ground, DTC P0508 will be set.

Conditions for Running the DTC

- ECU is not within the time from the turning off of ignition switch to the ending of ECU internal treatment.
- And $10\text{ V} < \text{Battery Voltage} < 16\text{ V}$
- And the DTC of step motor drive level is not set yet.

Conditions for Setting the DTC

- A short with one pin of step motor to the ground

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this

time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU or idle motor
Inspect if the harness connector exists:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness damaged - inspect if the harness damaged
- While moving the connector and the harness relative to the idle motor, observe the step indication of idle motor on the scan tool. If it shows a change, it means a failure to the location.

If the DTC cannot be recreated and determined as intermittent symptom, viewing the failure record is helpful to determine the time when the DTC is set finally.

DTC P0508 Too Low Voltage with Control Circuit - Idle Regulator

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0508 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids

DTC P0508 Too Low Voltage with Control Circuit - Idle Regulator(Cont' d)

Step	Action	Value	Yes	No
3	1. Start the engine. 2. Close all of the accessories. 3. With the scan tool, instruct the revolution to rise to 1500rpm, fall down to 650rpm, then rise to 1500rpm again, while monitoring the engine revolution on the scan tool. Under each revolution order, does the engine RPM maintain within the desired idle value range as specified?	± 50 rpm	Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the idle motor. 2. Install J370327-A idle motor analyzer onto the control harness connector of idle motor. 3. Start the engine, instruct the revolution to rise to 1500rpm, fall down to 650rpm, and rise to 1500rpm again with the scan tool. At the same time, observe the node lamps. Do all the node lamps switch over circularly between red and green (never go out)?	—	Go to Step 9	Go to Step 5
5	A poor connection with the idle control harness connector and with the ECU harness connector. If any failure occurs, it needs repairing. Is the failure removed?	—	Go to Step 9	Go to Step 6
6	1. Inspect the following circuit for a short to the ground <ul style="list-style-type: none"> • Low voltage circuit of Idle Regulator Coil 1 • High voltage circuit of Idle Regulator Coil 1 • Low voltage circuit of Idle Regulator Coil 2 • High voltage circuit of Idle Regulator Coil 2 2. When any failure occurs, make a repair if needed. Is the failure removed?	—	Go to Step 9	Go to Step 7
7	Replace the idle regulator, is the failure removed?	—	Go to Step 9	Go to Step 8
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.35 DTC P0509 Too High Voltage with Control Circuit - Idle Regulator

Description

There are four pins connected to the idle regulator (IAC for short). They are control signal end of Coil 1 (IAC end Pin 1 connected to ECU Pin 64), control signal end of Coil 1 (IAC end Pin 2 connected to ECU Pin 65), control signal end of Coil 2 (IAC end Pin 3 connected to ECU Pin 66), control signal end of Coil 2 (IAC end Pin 4 connected to ECU Pin 67).

The driver of two-phase step motor controls the angular displacement of step motor rotors by changing the polarity of two coils. If the diagnostic module detects a short with some pin of step motor to the power supply, DTC P0509 will be set.

Conditions for Running the DTC

- ECU is not within the time from the turning off of ignition switch to the ending of ECU internal treatment.
- And $10\text{ V} < \text{Battery Voltage} < 16\text{ V}$
- And the DTC of step motor drive level is not set yet.

Conditions for Setting the DTC

- A short with one pin of step motor to the power supply

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After the second consecutive drive cycle that the diagnostic test has run and failed, the trouble may be identified by ECU immediately. At this

time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU or idle motor - Inspect if the harness connector exists:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness damaged - inspect if the harness damaged
- While moving the connector and the harness relative to the idle motor, observe the step indication of idle motor on the scan tool. If it shows a change, it means a failure to the location.

If the DTC cannot be recreated and determined as intermittent symptom, viewing the failure record is helpful to determine the time when the DTC is set finally.

DTC P0509 Too High Voltage with Control Circuit - Idle Regulator

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0509 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids

DTC P0509 Too High Voltage with Control Circuit - Idle Regulator(Cont' d)

Step	Action	Value	Yes	No
3	1. Start the engine. 2. Close all of the accessories. 3. With the scan tool, instruct the revolution to rise to 1500rpm, fall down to 650rpm, then rise to 1500rpm again, while monitoring the engine speed on the scan tool. And under each instructed revolution, does the engine speed maintain the desired idle value as specified?	± 50 rpm	Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the idle motor. 2. Install J370327-A idle motor analyzer onto the control harness connector of idle motor. 3. Start the engine, instruct the revolution to rise to 1500rpm, fall down to 650rpm, and rise to 1500rpm again with the scan tool, while observing the node lamps. Do all the node lamps switch over circularly from red to green (never go out)?	—	Go to Step 9	Go to Step 5
5	A poor connection with the idle control harness connector and with the ECU harness connector.If any failure occurs, it needs repairing. Is the failure removed?	—	Go to Step 9	Go to Step 6
6	1. Inspect the following circuit for a short to the power supply <ul style="list-style-type: none"> • Low voltage circuit of Idle Regulator Coil 1 • High voltage circuit of Idle Regulator Coil 1 • Low voltage circuit of Idle Regulator Coil 2 • High voltage circuit of Idle Regulator Coil 2 2. When any failure is found, repair it if needed. Is the failure removed?	—	Go to Step 9	Go to Step 7
7	Replace the idle regulator, is the failure removed?	—	Go to Step 9	Go to Step 8
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.36 DTC P0511 Control Circuit Failure - Idle Regulator

Description

There are four pins connected to the idle regulator (IAC for short). They are control signal end of Coil 1 (IAC end Pin 1 connected to ECU Pin 64), control signal end of Coil 1 (IAC end Pin 2 connected to ECU Pin 65), control signal end of Coil 2 (IAC end Pin 3 connected to ECU Pin 66), control signal end of Coil 2 (IAC end Pin 4 connected to ECU Pin 67).

The driver of two-phase step motor controls the angular displacement of step motor rotors by changing the polarity of two coils. If the diagnostic module detects an open circuit to some pin of step motor, or no less than one failure type exists, or if a short with some pin to the power supply, and a open to the other pin, DTC P0511 will be set.

Conditions for Running the DTC

- ECU is not within the time from the turning off of ignition switch to the ending of ECU internal treatment.
- And $10\text{ V} < \text{Battery Voltage} < 16\text{ V}$
- And the DTC of step motor drive level is not set yet.

Conditions for Setting the DTC

- Signal Failure: An open to one pin of step motor
- Or Unreasonable Failure: More than one failure type may exist at a time, such as a short with one pin, and an open to the other pin.

Action taken when the DTC sets.

The corresponding DTC, and the relative failure information enter the DTC memory.

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU or idle motor - Inspect if the harness connector exists:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness damaged - inspect if the harness damaged
- While moving the connector and the harness relative to the idle motor, observe the step indication of idle motor on the scan tool. If it shows a change, it means a failure to the location.

If the DTC cannot be recreated and determined as intermittent symptom, viewing the failure record is helpful to determine the time when the DTC is set finally.

DTC P0511 Control Circuit Failure - Idle Regulator

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0511 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids

DTC P0511 Control Circuit Failure - Idle Regulator(Cont' d)

Step	Action	Value	Yes	No
3	<ol style="list-style-type: none"> 1. Start the engine. 2. Close all of the accessories. 3. With the scan tool, instruct the revolution to rise to 1500rpm, fall down to 650rpm, then rise to 1500rpm again, while monitoring the engine speed on the scan tool. And under each instructed revolution, does the engine speed maintain the desired idle value as specified? 	± 50 rpm	Go to Diagnostic Aids	Go to Step 4
4	<ol style="list-style-type: none"> 1. Disconnect the idle motor. 2. Install J370327-A idle motor analyzer onto the control harness connector of idle motor. 3. Start the engine, instruct the revolution to rise to 1500rpm, fall down to 650rpm, and rise to 1500rpm again with the scan tool, while observing the node lamps. Do all the node lamps switch over circularly from red to green (never go out)? 	—	Go to Step 9	Go to Step 5
5	<ol style="list-style-type: none"> 1. A poor connection with the idle control harness connector and with the ECU harness connector. 2. If any failure occurs, it needs repairing. Is the failure removed? 	—	Go to Step 9	Go to Step 6
6	<ol style="list-style-type: none"> 1. Inspect the following circuit for a short or an open to the power supply. <ul style="list-style-type: none"> • Low voltage circuit of Idle Regulator Coil 1 • High voltage circuit of Idle Regulator Coil 1 • Low voltage circuit of Idle Regulator Coil 2 • High voltage circuit of Idle Regulator Coil 2 2. When any failure is found, repair it if needed. Is the failure removed? 	—	Go to Step 9	Go to Step 7
7	Replace the idle regulator, is the failure removed?	—	Go to Step 9	Go to Step 8
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	<ol style="list-style-type: none"> 1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set? 	—	Go to Step 3	System OK

6.4.4.37 DTC P0560 System Voltage Signal is Unreasonable

Description

The nominal value of system voltage is 12V, but under the normal conditions, the actual voltage value may change between 9-16V. ECU makes a sampling to the system voltage (ECU Pin 63, 44, 45) after the voltage passes through the main relay, and do the monitoring and the diagnosing based on the sampling results. If the sampling value is lower than an impossible value (lower than 2.5V), it can be considered that the sampling circuit of system voltage has a failure, and thus causes ECU to get an unreasonable system voltage signal, then DTC P0560 will be set.

Conditions for Running the DTC

The engine runs

Conditions for Setting the DTC

Sampling Value of System Voltage < 2.5 V

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.

- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

A poor connection with or a damage to the harness - inspect if the harness is damaged. If the harness appears normal, observe the system voltage shown on the scan tool, at the same time move the connectors and the harness relative to ECU, Instrument Harness and Engine Harness. If it shows a change, it means a failure to the location.

If the DTC cannot be recreated, view the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0560 System Voltage Signal is Unreasonable

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0560 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Start the engine, allowing the revolution greater than 1000RPM. 2. Use a DMM to test the charging voltage of the engine. Is the voltage within the specified value range?	9-16 V	Go to Step 4	Go to DTC P0562 Diagnostic Procedures
4	1. Close the engine, and disconnect the negative of the battery. 2. Disconnect ECU connectors. 3. Connect the battery negative cable. 4. Turn on the ignition. 5. Connect the test light between the harness terminal Pin 44, Pin 63 and Pin 45 of ECU and the ground. Does the test light reach the normal brightness?	—	Go to Step 7	Go to Step 5

DTC P0560 System Voltage Signal is Unreasonable(Cont' d)

Step	Action	Value	Yes	No
5	Inspect an open or a short to the circuit between the battery and the harness terminal Pin 44, Pin 63 and Pin 45 of ECU, and check the harness resistance, a poor connection with ECU end pin. Is any failure found and repaired?	—	Go to Step 7	Go to Step 6
6	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 7	—
7	1. Use the scan tool to clear the DTC. 2. Start and run the engine. 3. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.38 DTC P0562 System Voltage is Too Low

Description

The nominal value of system voltage is 12V, but under the normal conditions, the actual voltage value may change between 9-16V. ECU makes a sampling to the system voltage (ECU Pin 63, 44, 45) after the voltage passes through the main relay, and do the monitoring and the diagnosing based on the sampling results. If the system voltage is lower than one valve value (10 V), DTC P0562 will be set.

Conditions for Running the DTC

The engine runs

Conditions for Setting the DTC

2.5 V < Sampling Value of System Voltage < 10 V

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.

- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

A poor connection with or a damage to the harness ñ inspect if the harness is damaged. If the harness appears normal, observe the system voltage shown on the scan tool, at the same time move the connectors and the harness relative to ECU, Instrument Harness and Engine Harness. If it shows a change, it means a failure to the location.

If the DTC cannot be recreated, view the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0562 System Voltage is Too Low

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0562 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Start the engine, allowing the revolution greater than 1000RPM. 2. Use a DMM to test the charging voltage of the engine. Is the voltage within the specified value range?	9-16 V	Go to Step 9	Go to Step 4
4	At different RPM of the engine, are all the charging voltages within the specified values?	9-16 V	Go to Step 6	Go to Step 5
5	Inspect an open or a short to the charging harness from Generator to Battery, too high internal resistance within the harness, a poor connection with the generator harness connector pins. Is any failure found and repaired?	—	Go to Step 9	Go to Step 7
6	Inspect an open or a short to the circuit between the battery and the harness terminal Pin 44, Pin 63 and Pin 45 of ECU, and check too high internal resistance within the harness, a poor connection with ECU end pin. Is any failure found and repaired?	—	Go to Step 9	Go to Step 7
7	Replace the generator. Is any failure removed?	—	Go to Step 9	Go to Step 8

DTC P0562 System Voltage is Too Low(Cont' d)

Step	Action	Value	Yes	No
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Use the scan tool to clear the DTC. 2. Start and run the engine. 3. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.39 DTC P0563 System Voltage is Too High

Description

The nominal value of system voltage is 12V, but under the normal conditions, the actual voltage value may change between 9-16V. ECU makes a sampling to the system voltage (ECU Pin 63, 44, 45) after the voltage passes through the main relay, and do the monitoring and the diagnosing based on the sampling results. If the system voltage is higher than one valve value (16V), DTC P0563 will be set.

Conditions for Running the DTC

The engine runs

Conditions for Setting the DTC

- Sampling Value of System Voltage > 16 V
- And the vehicle speed > 25 km/h
- No failure with the vehicle speed sensor.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.

- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

A poor connection with or a damage to the harness - inspect if the harness is damaged. If the harness appears normal, observe the system voltage shown on the scan tool, at the same time move the connectors and the harness relative to ECU, Instrument Harness and Engine Harness. If it shows a change, it means a failure to the location.

If the DTC cannot be recreated, view the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0563 System Voltage is Too High

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the conditions under which the failure occurs. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0563 as a current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Start the engine, allowing the RPM greater than 1000RPM. 2. Observe the system voltage on the scan tool. Is the system voltage within the specified values?	9-16 V	Go to Step 8	Go to Step 4
4	Use a DMM to test the engine charging voltage. At different RPMs of the engine, is the charging voltage within the specified values?	9-16 V	Go to Step 8	Go to Step 5
5	Inspect an open or a short to the circuit between the battery and the harness terminal Pin 44, Pin 63 and Pin 45 of ECU, and check too high internal resistance within the harness, a poor connection with ECU end pin. Is any failure found and repaired?	—	Go to Step 8	Go to Step 6
6	Replace the generator. Is the failure removed?	—	Go to Step 8	Go to Step 7

DTC P0563 System Voltage is Too High(Cont' d)

Step	Action	Value	Yes	No
7	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 8	—
8	1. Use the scan tool to clear the DTC. 2. Operate the vehicle according to the conditions under which the failure occurs. 3. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.40 DTC P0601 Check Code Error - Electronic Control Unit

Description

There is some necessary information inside the ECU. Originally there are some default values, but they must be finally re-programmed by the Assembly Facilities or ECU supplier, otherwise self-test of ECU will be considered as a failure. The diagnostic module is diagnosing on the ECU check code programming (The information is re-programmed by the ECU supplier).

Conditions for Running the DTC

The ignition switch is turned on.

Conditions for Setting the DTC

ECU check code has not been programmed

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.

- After the first driving cycle in the diagnosis test failure reporting, the trouble may be identified by ECU immediately. At this time, ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- The MIL will be turned off after the third consecutive drive cycle that the diagnostic test passes without a fault.
- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

DTC P0601 indicates some necessary information inside the ECU. Originally there are default values, but they are not re-programmed by the Assembly Factory or ECU supplier. The only repair method is to replace ECU. Correct software and nominal files must always be used to program the replaced ECU.

DTC P0601 Check Code Error - Electronic Control Unit

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Operate the vehicle according to the operating conditions of DTC. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0601 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 4	Go to Step 2
4	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 5	—
5	1. The ignition switch is turned on. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.41 DTC P0602 Check Code Error - Electronic Control Unit

Description

There is some necessary information inside the ECU. Originally there are some default values, but they must be finally re-programmed by the Assembly Facilities or ECU supplier, otherwise self-test of ECU will be considered as a failure.

- Diagnose on the programming of type selection coding (This information is re-programmed by the Assembly Facilities).
- Diagnose on the programming of diagnostic data identification code (The information is re-programmed by the ECU supplier).
- Diagnose on the programming of lock-up code for locking ECU function (This information is re-programmed by the Assembly Facilities).

Conditions for Running the DTC:

- The ignition is switched on.

Conditions for Setting the DTC:

- The type selection coding has not been programmed.
- The diagnostic data identification code has not been programmed.
- The lock-up code for locking the ECU function doesn't work.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After 200 milliseconds when the diagnostic test has run and failed, the trouble is identified by ECU immediately. At a time ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC:

- When the diagnostic test passes without failure or time delay, the MIL will be turned off immediately.
- When the diagnostic test passes without failure or time delay, the DTC will be cleared off immediately.

DTC P0602 Programming Error - Electronic Control Unit

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Programme on the engine control module with a correct software. 2. Re-test DTC P0602. Is DTC P0602 set?	—	Go to Step 3	System OK
3	Replace the engine control module (Replacing the engine control module needs programming). Is the operation completed?	—	Go to Powertrain On Board Diagnosis System Check	—

6.4.4.42 DTC P0610 Control Module (Vehicle Model)

Type Selection Error

Description

ECU Pin.73 is used to judge Manual Gear/Auto Gear. If the pin is connected to the ground, it means ECU is considered as Auto Gear. Otherwise, if Pin 73 is suspended in the air, it means ECU considers it as Manual Gear. When the engine speed and its load are always higher than a certain value at a time, it can be considered that the vehicle gear has been applied. At

this time ECU automatically considers it as Auto Gear or Manual Gear. When the recognized value is not consistent with the reserved internal value, DTC P0610 is set.

Conditions for Running the DTC

- A/C switch is turned off.
- And Engine Coolant Temperature > 75°C
- And 6,200 rev/min. > Engine Speed > 2,000 rev/min.
- And Engine Relative Load > 50.3%

Conditions for Setting the DTC

Manual Gear	Manual Gear
When the vehicle is running (D gear or R gear), the marking position of driving status indicates as Auto gear, and ECU recognizes that the high potential of Pin 73 (that is Pin 73 is suspended in the air) lasts 7 seconds.	When the vehicle is running (D gear or R gear), the marking position of driving status indicates as Manual gear, and ECU recognizes that the low potential of Pin 73 (that is Pin 73 is suspended in the air) lasts 7 seconds.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

- The DTC can be cleared off with a scan tool.

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.

Diagnostic Aids

DTC P0610 indicates a type selection error to the control module ECU, and the only repair method is to replace the ECU which matches with the vehicle. Always use the correct software and the vehicle nominal value, make a programming on the replaced ECU.

DTC P0610 Type Selection Error of Control Module (Vehicle Model)

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Install the scan tool. 2. Operate the vehicle according to the operating conditions of DTC. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0610 failed this ignition?	—	Go to Step 3	Go to Diagnostic Aids
3	Is the vehicle equipped with automatic transmission?	—	Go to Step 4	Go to Step 5
4	1. Close the engine, and disconnect the battery. 2. Disconnect the ECU connectors, use a DMM to test the resistance between ECU harness Pin 73 and the ground. Is ECU harness Pin 73 grounding well?	—	Go to Step 7	Go to Step 6
5	Test if the ECU harness Pin 73 is suspended and corrected?	—	Go to Step 9	Go to Step 7

DTC P0610 Type Selection Error of Control Module (Vehicle Model)(Cont' d)

Step	Action	Value	Yes	No
6	Test an open to ECU harness Pin 73, a great resistance in the harness, a short to the power supply or a poor connection with the connectors. Is any failure found and repaired?	—	Go to Step 9	Go to Step 8
7	Re-program the ECU. Is the operation completed?	—	Go to Step 9	—
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Use the scan tool to clear the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0610 as current DTC?	—	Go to Step 3	System OK

6.4.4.43 DTC P0630 Vehicle

Identification Number (VIN) Not Programmed, or Mismatched - Electronic Control Unit

Description

There is some necessary information inside the ECU. Originally there are some default values, but they must be finally re-programmed by the Assembly Facilities or ECU supplier, otherwise self-test of ECU will be considered as a failure. This module diagnoses on the programming of VIN (The information is programmed by the Assembly Facilities).

Conditions for Running the DTC

- The ignition is switched on.

Conditions for Setting the DTC

- VIN has not been re-programmed.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- After 200 milliseconds when the diagnostic test has run and failed, the trouble is identified by ECU immediately. At a time ECU illuminates the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC:

- When the diagnostic test passes without failure or time delay, the MIL will be turned off immediately.
- When the diagnostic test passes without failure or time delay, the DTC will be cleared off immediately.

DTC P0630 Vehicle Identification (VIN) Not Programmed, Mismatched - Electronic Control Unit

Step	Action	Value	Yes	No
1	Has the Powertrain On Board Diagnosis (OBD) System Check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check.
2	Do you programme the VIN on ECU? Re-test DTC P0630. Is DTC P0630 set?	—	Go to Step 3	System OK
3	Replace the engine control module (Replacing the engine control module needs programming). Is the operation completed?	—	Go to Powertrain On Board Diagnosis System Check	—

6.4.4.44 DTC P0645 Control Circuit Failure - A/C Compressor Relay

Description

There are four pins connected to the A/C compressor relay. They are separately 12 V common power supply end (Relay end Pin 30 connected to Battery), 12 V main relay power supply (Relay end Pin 85 connected to Main Relay 87), control signal end (Relay end Pin 86 connected to ECU Pin 70), power supply end of A/C compressor electromagnetic clutch (Relay end Pin 87 connected to Electromagnetic Clutch Pin A).

For the control signal end of the A/C compressor relay, the low potential is valid. A/C compressor relay is driven by the drive chip, which realizes the self diagnostic function on the internal circuit and can notify the Internal CPU failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of ECU-level output end.

Conditions for Running the DTC

After the engine starts normally

Conditions for Setting the DTC

Drive chip detects an open or broken circuit with Pin 70, and the internal ECU drive level is disconnected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.

- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Intermittent conditions may occur due to a poor connection, wire insulating layer worn out or wire damaged inside the insulating layer.

Check the following:

- A poor connection with ECU or A/C compressor relay - inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness damaged - inspect the harness damage

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0645 Control Circuit Failure - A/C Compressor Relay

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Install the scan tool. 2. Operate the vehicle according to the operating conditions of DTC. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0645 failed this ignition?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn off the ignition. 2. Disconnect the relay. 3. Turn on the ignition switch, and do not start the engine. 4. Use the test lamp with good grounding to test the relay power supply end. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 6

DTC P0645 Control Circuit Failure - A/C Compressor Relay(Cont' d)

Step	Action	Value	Yes	No
4	1. Connect a test lamp between the relay control circuit and the power supply end of relay. 2. With the scan tool, instruct the relay to switch on and off. Does each order allow the test lamp to turn on and off?	—	Go to Step 7	Go to Step 5
5	Inspect an open to the relay control circuit. Is any failure found and repaired?	—	Go to Step 9	Go to Step 6
6	Check the relay circuit if a short, an open circuit to the ground, a great resistance in the harness, or a poor connection with ECU end or relay end pin. Is any failure found and repaired?	—	Go to Step 9	Go to Step 8
7	Replace the relay. Is the replacement operation completed?	—	Go to Step 9	—
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Clear off the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0645 as current DTC?	—	Go to Step 3	System OK

6.4.4.45 DTC P0646 Too Low Voltage for Control Circuit - A/C Compressor Relay

Description

There are four pins connected to the A/C compressor relay. They are separately 12 V common power supply end (Relay end Pin 30 connected to Battery), 12 V main relay power supply (Relay end Pin 85 connected to Main Relay 87), control signal end (Relay end Pin 86 connected to ECU Pin 70), power supply end of A/C compressor electromagnetic clutch (Relay end Pin 87 connected to Electromagnetic Clutch Pin A).

For the control signal end of the A/C compressor relay, the low potential is valid. A/C compressor relay is driven by the drive chip, which realizes the self diagnostic function on the internal circuit and can notify the Internal CPU failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of ECU-level output end.

Conditions for Running the DTC

After the engine starts normally

Conditions for Setting the DTC

The control signal end is short to the ground, and the drive level of ECU control end is disconnected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.

- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Intermittent conditions may occur due to a poor connection, wire insulating layer worn out or wire damaged inside the insulating layer.

Check the following:

- A poor connection with ECU or A/C compressor relay ñ inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness damaged ñ inspect the harness damage

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0646 Too Low Voltage for Control Circuit - A/C Compressor Relay

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Install the scan tool. 2. Operate the vehicle according to the operating conditions of DTC. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0646 failed this ignition?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn off the ignition. 2. Disconnect the relay, turn on the ignition, and do not start the engine. 3. Use the test lamp with good grounding to test the relay power supply end. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 6
4	1. Connect a test lamp between the relay control circuit and the power supply end of relay. 2. With the scan tool, instruct the relay to switch on and off. Does each order allow the test lamp to turn on and off?	—	Go to Step 7	Go to Step 5

DTC P0646 Too Low Voltage for Control Circuit - A/C Compressor Relay(Cont' d)

Step	Action	Value	Yes	No
5	Inspect if the relay control circuit is short to the ground. Is any failure found and repaired?	—	Go to Step 9	Go to Step 6
6	Check the relay circuit if a short circuit to the ground, a great resistance in the harness, or a poor connection with ECU end or relay end pin. Is any failure found and repaired?	—	Go to Step 9	Go to Step 8
7	Replace the relay. Is the replacement operation completed?	—	Go to Step 9	—
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Clear off the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0646 as current DTC?	—	Go to Step 3	System OK

6.4.4.46 DTC P0647 Too High Voltage for Control Circuit - A/C Compressor Relay

Description

There are three pins connected to the A/C compressor relay. They are separately 12V common power supply end (Relay end Pin 30 connected to Battery k1.30), 12 V main relay power supply (Relay end Pin 85 connected to Main Relay k1.87), control end (Relay end Pin 86 connected to ECU Pin 70). Power supply end of A/C compressor electromagnetic clutch (Relay end Pin 87 connected to Electromagnetic Pin A).

For the control signal end of the A/C compressor relay, the low potential is valid. A/C compressor relay is driven by the drive chip, which realizes the self diagnostic function on the internal circuit and can notify the Internal CPU failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of ECU output end.

Conditions for Running the DTC

After the engine starts normally

Conditions for Setting the DTC

The control signal end is short to the power supply, and the drive level of ECU control end is connected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.

- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Intermittent conditions may occur due to a poor connection, wire insulating layer worn out or wire damaged inside the insulating layer.

Check the following:

- A poor connection with ECU or A/C compressor relay - inspect the harness connector:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Harness damaged - inspect the harness damage

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0647 Too High Voltage for Control Circuit - A/C Compressor Relay

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Install the scan tool. 2. Operate the vehicle according to the operating conditions of DTC. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P0647 failed this ignition?	—	Go to Step 3	Go to Diagnostic Aids
3	1. Turn off the ignition. 2. Disconnect the relay, turn on the ignition, and do not start the engine. 3. Use the test lamp with good grounding to test the relay power supply end. Does the test lamp illuminate?	—	Go to Step 4	Go to Step 6
4	1. Connect a test lamp between the relay control circuit and the power supply end of relay. 2. With the scan tool, instruct the relay to switch on and off. Does each order allow the test lamp to turn on and off?	—	Go to Step 7	Go to Step 5

DTC P0647 Too High Voltage for Control Circuit - A/C Compressor Relay(Cont' d)

Step	Action	Value	Yes	No
5	Inspect if the relay control circuit is short to the power supply. Is any failure found and repaired?	—	Go to Step 9	Go to Step 6
6	Check the relay circuit if an open circuit, a great resistance in the harness, or a poor connection with ECU end or relay end pin. Is any failure found and repaired?	—	Go to Step 9	Go to Step 8
7	Replace the relay. Is the replacement operation completed?	—	Go to Step 9	—
8	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 9	—
9	1. Clear off the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0647 as current DTC?	—	Go to Step 3	System OK

6.4.4.47 DTC P0650 Control Circuit

Failure - MIL

Description

There are two pins connected to MIL: Ignition Switch Signal Input (MIL end Pin 4 connected Main Relay 15), Control Signal End (The other MIL pin connected to ECU Pin 31).

MIL is driven by the drive chip, which realizes the self diagnostic function on the internal circuit and can notify the Internal CPU failure diagnostic module of the failure information, by comparing the switch signal from CPU with the actual potential of ECU output end. The failure types that can be diagnosed are:

- Max. failure: a short circuit of Pin to Power when the drive level of internal control is switched on.
- Min. failure: a short circuit of Pin to Ground when the drive level of internal control is disconnected.
- Signal failure: an open or broken circuit of Pin when the drive level of internal control is disconnected.

The DTC of the above three troubles is P0650.

Conditions for Running the DTC

After the engine starts normally

Conditions for Setting the DTC

- Max. Failure:
The control end pin is short to the power supply, and the drive level of internal control is connected.
- Min. Failure:
The control end is short to the ground, and the drive level of internal control is disconnected.
- Signal Failure:
The control end circuit is open, and the drive level of internal control is disconnected.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

- A poor connection with ECU - Inspect if the harness connector exists:
 - Backed-out terminals
 - Improper mating
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Use the matching terminals to test the correct tensile force of the terminals.
- Is the harness damaged - inspect if the harness is damaged. If the instrument is normal, disconnect the ECU, turn on the ignition switch, and while moving the connectors and the harness relative to the MIL, observe the voltage changes on the DMM which is connected between the MIL control circuit of ECU harness connector and the ground. If the voltage changes, it indicates a failure at this location.

View the vehicle driving mileage since the last diagnostic test failed in the trouble record, and determine the frequency of occurrence in setting the DTC. It is helpful to the diagnosis of the conditions.

DTC P0650 Control Circuit Failure - MIL

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	Does any other DTC exist?	—	Go to Step 3	Go to Diagnostic Aids
3	Turn on the ignition switch, and observe the gauge. Does the MIL lamp illuminate?	—	Go to Step 4	Go to Step 5
4	Start the engine. Does the MIL lamp go out?	—	Go to Diagnostic Aids	Go to Step 6

DTC P0650 Control Circuit Failure - MIL(Cont' d)

Step	Action	Value	Yes	No
5	1. Turn off the ignition switch. 2. Remove the instrument panel. 3. Inspect the MIL lamp. Is the MIL lamp damaged and replaced?	—	Go to Step 11	Go to Step 6
6	1. Use the uncharged test lamp to connect in series between the MIL control circuit and the battery. 2. Turn on the ignition. 3. Use the scan tool to operate the MIL lamp. Does the test lamp go out according to the order?	—	Go to Step 7	Go to Step 8
7	Inspect a poor connection with the instrument plug. Is any failure found and repaired?	—	Go to Step 11	Go to Step 9
8	Inspect the MIL circuit if a short to the power supply, a short or an open to the ground, a poor connection with ECU end or MIL end pin, a great resistance in the harness. Is any failure found and repaired?	—	Go to Step 11	Go to Step 10
9	Replace the instrument panel. Is the replacement operation completed?	—	Go to Step 11	—
10	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 11	—
11	1. Clear off the DTC. 2. Operate the vehicle according to the DTC operating conditions, and use a scan tool to monitor the failure information. Does the scan tool indicate DTC P0650 is current?	—	Go to Step 3	System OK

6.4.4.48 DTC P1740 Torque Request Signal - Automatic Transmission

Description

The control module TCU of automatic transmission transfers a torque request signal to ECU by means of the ECU (Pin 72). The torque request signal is a PWM (Pulse-Width Modulation) input with a frequency of 100HZ, and a voltage amplitude of 12V. The request signal is converted to a certain duty ratio after the ECU received it. Under the normal conditions, the torque request signal is stable at 12V most of the time, namely the duty ratio is 100% most of the time. Only under some conditions, such as sudden vehicle acceleration or deceleration, TCU requests ECU to control the engine torque output so as to improve the softness of gearshift. And the torque request signal will transfer the torque adjusting request, and finally makes it by means of ECU changing to the ignition advance angle, at a certain range of duty ratio (9-91%, according to the supplier's Technical Specifications). Generally, the gearshift time will not be long, so the above torque adjusting request from TCU will also be short. The torque request signal will go back to 12V soon, and the duty ratio returns to 100% again. The failure types that have been diagnosed are:

- Max. Failure: The duty ratio of torque request signal is always at a higher status.
- Min. Failure: The duty ratio of torque request signal is always at a lower status.
- Unreasonable Failure: The duty ratio of torque request signal is within the torque adjusting request range, but the torque adjusting request will last too long.

If any one of the above three troubles occurs, DTC P1740 will be set.

Conditions for Running the DTC

- ECU has recognized the automatic transmission.
- Starting Conditions ended.

Conditions for Setting the DTC

- Min. Failure:
The time delay with the adjusting signal of zero exceeds 2 S.
- Unreasonable Failure:
Within the same drive cycle, the torque request signal has not been found, and the torque adjusting request from TCU has exceeded 2.5S. And this condition exceeds 3 times.

Action taken when the DTC sets.

- The corresponding DTC, and the relative failure information enter the DTC memory.
- ECU doesn't illuminate the Malfunction Indicator Lamp (MIL).

Conditions for clearing the MIL/DTC

- After 20 consecutive warm-up cycles without a fault, the DTC is cleared off immediately.
- The DTC can be cleared off with a scan tool.

Diagnostic Aids

Check the following:

A poor connection with or a harness damage to ECU end and TCU end plug - inspect the harness connector:

- Backed-out terminals
- Improper mating
- Broken locks
- Improperly formed or damaged terminals
- Poor terminal-to-wire connection
- Damaged harness

DTC P1740 Torque Request Signal - Automatic Transmission

Step	Action	Value	Yes	No
1	Has the powertrain On Board Diagnosis (OBD) system check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis System Check
2	1. Start and run the engine. 2. Connect the scan tool. 3. Use the scan tool to monitor the DTC information. Does the scan tool indicate DTC P1740 as current DTC?	—	Go to Step 3	Go to Diagnostic Aids
3	Use the DMM to test an open, a short circuit between ECU Pin 72 and TCU, a great resistance in the harness, a poor connection with ECU end or TCM end pin. Is any failure found and repaired?	—	Go to Step 7	Go to Step 4

DTC P1740 Torque Request Signal - Automatic Transmission(Cont' d)

Step	Action	Value	Yes	No
4	1. Operate the vehicle according to the conditions under which TCU requests ECU to control the engine torque change. 2. Use the oscilloscope to test the duty ratio of torque request signal for the automatic transmission, and see if any change occurs to the signal duty ratio.	—	Go to Step 6	Go to Step 5
5	Replace the TCU. Is the failure removed?	—	Go to Step 7	Go to Step 6
6	Replace the ECU and perform the programming. Is the replacement operation completed?	—	Go to Step 7	—
7	1. Use the scan tool to clear the DTC. 2. Use the scan tool to monitor the DTC information. Is the DTC re-set?	—	Go to Step 3	System OK

6.4.4.49 Symptoms

Important Preliminary Inspections Before Starting

Before using the symptom table:

- Perform Powertrain On Board Diagnosis (OBD) System Check and verify all of the following conditions:
 - The engine control module and the malfunction indicator lamp (MIL) are operating correctly.
 - There are no DTCs stored.
 - The scan tool data is within the normal operating range. See Scan Tool Data List.
- Verify the customer's concern.
- Perform a visual check.

Find the proper symptom position in the list at the end of this chapter. Operate according to procedures in the appropriate diagnosis table. If the failure cannot be recreated, see Intermittent Conditions.

Visual Check

If only perform a careful check on some symptom procedures. The failure can be found out, and thus you can save valuable time. Visual checks include the following items:

- Check the engine control module (ECU) grounds for being clean, tight and in the correct locations.

- Check the vacuum hose for cracking, twisting and proper connection according to the vehicle emission control information shown on the label. Perform a thorough check for any forms of leakage or block-up.
- Check the air intake pipe for any dent or damage.
- Check the installation location of the throttle body for air leakage.
- Check the harness for improper connection, sticking, scratch or other damages.
- Check the sensor/components for loss, damage or looseness.

Use the following tables to diagnose the symptom complaints:

- Hard Start
- Surges/Chuggles
- Lack of Power, Sluggishness, or Sponginess
- Detonation/Spark Knock
- Hesitation, Sag, Stumble
- Cuts out, Misses
- Poor Fuel Economy
- Rough, Unstable, or Incorrect Idle and Stalling
- Dieseling, Run-on
- Backfire
- Blocked Engine Exhaust System Check

6.4.4.50 Intermittent Conditions

Inspections	Action
DEFINITION: The condition is not currently present but is indicated in DTC history. OR There is a customer concern, but the symptom cannot currently be duplicated, if the condition is not DTC related).	
Preliminary	<ul style="list-style-type: none"> • Before starting, refer to Important Preliminary Inspections in Symptoms. • The fault must be present to locate a condition using the DTC table. If a condition is intermittent, the use of DTC tables may result in the replacement of good parts.
Harness/Connector Inspection	<p>Many intermittent conditions (Open or short circuit) occur with harness/connector movement caused by vibration, engine torque, impact/rough pavement of the circuits. Apply the appropriate procedures in the following to check this condition:</p> <ul style="list-style-type: none"> • Move the related connector and harness, meanwhile monitor the appropriate scan tool data. • Move the related connector and harness, and with the scan tool, instruct the components to open (or close). Observe the component operation. • When the engine is operating, move the related connector and harness, meanwhile monitor the engine operation. <p>If the movement of harness or connector can affect the indicating data, the component/system operation or the engine operation, make necessary inspection on and repair to the harness/connector. Refer to Electrical Connection or Wires in this table.</p>

6.4.4.50 Intermittent Conditions(Cont' d)

Inspections	Action
Quick Scan Tool Check	<p>Use the scan tool to quick check the parameters.Quick check function can be used to record the realtime data at a time.The recorded data can be played back and analyzed.The scan tool can also be used to draw single parameter diagrams and combined parameter diagrams for comparing.Quick check not only can be manually triggered when the symptom is noted, but also can be set to an advance trigger when the DTC sets.</p> <p>Record the abnormal values captured in the data, the system or components may be instructed to perform a further inspection.</p>
Electrical Connection and Wires	<p>Intermittent conditions may be caused by the improper electrical connection/lack of terminal tensile force or many failures with the wires.Carefully inspect the suspected circuit for the following conditions:</p> <ul style="list-style-type: none"> • Inspect the plug for improper mating, or if the terminal is not inserted into the connector case completely (backed out). • Inspect the improperly formed or damaged terminals.Tetst if the terminals lack of tensile force. • Inspect the wires and terminals for a poor connection, including the terminal wound on the insulator.The test requests the terminal to be removed from the connector case. • Inspect if any corrosion/water feeding occurs. • The wire is tight, cut out or scratched. • The routing is incorrect, too near to the high voltage/high current devices, such as secondary ignition parts, motor, generator.These parts may cause electric noise to happen in the circuit, and interfere with the normal operation for the circuit. • The incorrect installation of non-factory or aftermarket add-on accessories.
Intermittent Malfunction Indicator Lamp (MIL) with NO DTCs	<p>The following conditions may cause an intermittent MIL and no DTCs:</p> <ul style="list-style-type: none"> • Electromagnetic interference caused by a malfunctioning relay, ECU driven solenoid, or switch.They may cause strong electric fluctuations.Generally, such condition may occur when the fault parts are operating. • The incorrect installation of non-factory or aftermarket add-on accessories, such as lights, radio equipment, and motors. • The Malfunction Indicator Lamp (MIL) is intermittently shorted to ground. • The ECU grounds are loose. <p>If the scan tool can be used to instruct the MIL to open and close, and the above conditions do not occur and the DTC doesn't set, then use the latest calibration software to re-programme the ECU and re-inspect the MIL operation.</p>
The stored DTCs are lost.	<p>Take a test and detect if the DTC memory is lost as follows:</p> <ol style="list-style-type: none"> 1. Disconnect the engine coolant temperature (ECT) sensor. 2. Start the engine. 3. Use the scan tool to monitor the DTC status, and observe if the DTC occurs. 4. Allow the engine to idle, until the DTC occurs. 5. Turn off the ignition key switch and wait at least 30 seconds. 6. Turn on the ignition. 7. Monitor the scan tool if the DTC occurs. <p>Even if the ignition is turned off and lasts at least 30 seconds, the ECU should also store the information and keep it in the memory (As long as the ECU battery input and the ground circuit are not interfered, the information should be stored randomly).If the DTC information is not stored, the ECU battery and its ground is normal, then the ECU may have a failure.</p>
Additional Inspections	<p>Test for an open diode across the A/C compressor clutch and for other open diodes. The incorrect installation of non-factory or aftermarket add-on accessories, such as lights, radio equipment, and motors.</p> <p>Test the generator for a faulty rectifier bridge that may allow AC noise into the electrical system.</p>

6.4.4.51 Hard Start

Inspections	Action
DEFINITION:Engine cranks OK, but does not start for a long time.Does eventually run, or may start but immediately dies.	
Preliminary	<ul style="list-style-type: none"> • Refer to Powertrain On Board Diagnostic(OBD)System Check. • Before starting, first refer to Intermittent Conditions. • Search for technical bulletins.
Sensor/System	<ul style="list-style-type: none"> • Inspect the engine coolant temperature (ECT) sensor for being skewed in value.Connect the scan tool and compare the ECT value to the intake air temperature (IAT) value on a cold engine.The temperature difference between ECT value and IAT value should be within $\pm 3^{\circ}\text{C}$ (5°F).If the temperature difference between ECT sensor and IAT sensor is out of range, test the resistance.If the resistance of ECT sensor is not within the specification, refer to Low Voltage Circuit for Engine Coolant Temperature (ECT) Sensor or High Voltage Circuit for Intake Air Temperature (IAT) Sensor. • Inspect the crankshaft position (CKP) sensor on the scan tool.If there is no responding, inspect the sensor input circuit. • Inspect the MAP sensor for correct installation and connection. • Use the scan tool to inspect the Idle Air Control (IAC) operation.Refer to Control Circuit Failure - Idle Regulator.
Fuel System	<ul style="list-style-type: none"> • Inspect the fuel pump relay circuit for operating correctly.Refer to Control Circuit Failure - Oil Pump. • Inspect if the fuel pressure is too low.Refer to Fuel System Pressure Test. • Inspect the fuel injector for a fault.Refer to ECT within $10\text{-}35^{\circ}\text{C}$ ($50\text{-}95^{\circ}\text{F}$) or Fuel Injector Coil Test - ECT Exceeds $10\text{-}35^{\circ}\text{C}$ ($50\text{-}95^{\circ}\text{F}$). • Inspect the fuel for a contaminated condition.Refer to Alcohol/Contaminants - in - Fuel Diagnosis.

6.4.4.51 Hard Start(Cont' d)

Inspections	Action
Ignition System	<ul style="list-style-type: none"> Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> Attach J26792 Spark Tester to the engine ground. Connect one end of the spark plug wire to the J26792 Spark Tester. Connect the other end of spark plug wire to the coil to be tested. Connect one end of the second spark plug wire to the other coil brace. Connect the other end of the second spark plug wire to the ground. Start the engine, meanwhile observe the J26792 Spark Tester. The spark can be seen. For each ignition coil, repeat the above procedures. If the spark does not occur on the spark plug, inspect the following conditions: <ul style="list-style-type: none"> Inspect the coil for cracks, carbon tracking/spark over or a resistance value outside the specified range. <p>Coil Resistance 11-15 k Ω</p> Inspect the spark plug wire for spark over/crossed discharging, cracks, carbon tracking, spark plug boot damage, pinched, improper routing or a resistance value outside the specified range. <p>Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft)</p> <p>Note: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions. If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> Damaged Module Ignition system wire - a damage to the ignition module input, loose grounding or system wire. Remove the spark plug and inspect for the following conditions: <ul style="list-style-type: none"> Heavy deposits Cracks Wear Improper gap Burned or damaged electrodes Incorrect type If the spark plugs are gas or oil fouled, determine the cause before replacing the spark plugs.
Engine Mechanical	<ul style="list-style-type: none"> Excessive oil in combustion chamber - leaking valve seals Low cylinder compression - refer to Engine Compression Test in Engine Mechanical. Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> Cylinder heads Camshafts and valve assembly Pistons, etc.

6.4.4.52 Surges/Chuggles

Inspections	Action
DEFINITION: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down without a change in the accelerator pedal position.	

6.4.4.52 Surges/Chuggles(Cont' d)

Inspections	Action
Preliminary	<ul style="list-style-type: none">• Refer to Powertrain On Board Diagnostic (OBD) System Check.• Refer to Intermittent Conditions.• Search for technical bulletins.• Ensure that the driver understands the operation of the transmission torque converter clutch (TCC) and A/C compressor operation as explained in the owner's manual. Inform the customer how the TCC and the A/C clutch operates.
Sensor/System	<ul style="list-style-type: none">• Inspect the heated oxygen sensor (HO2S).The heated oxygen sensor should respond quickly to different throttle positions.If not, inspect the HO2S for silicon or other contaminants from fuel or use of improper sealant.The sensors may have a white powdery coating..Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication).Refer to Silicon Contamination of Heated Oxygen Sensors Notice.The engine control module may reduce the engine oil feeding, and cause a severe deterioration of drive performance.• Inspect the related MAP wires.
Fuel System	<ul style="list-style-type: none">• Inspect the fuel pressure.Refer to Fuel System Pressure Test.• Inspect the fuel for a contaminated condition.Refer to Alcohol/Contaminants - in - Fuel Diagnosis.• Ensure each injector wire is connected to the proper injector/cylinder correctly.

6.4.4.52 Surges/Chuggles(Cont' d)

Inspections	Action
Ignition System	<ul style="list-style-type: none"> Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> Attach J26792 Spark Tester to the engine ground. Connect one end of the spark plug wire to the J26792 Spark Tester. Connect the other end of spark plug wire to the coil to be tested. Connect one end of the second spark plug wire to the other coil brace. Connect the other end of the second spark plug wire to the ground. Rotate the engine, meanwhile observe the J26792 Spark Tester. The spark can be seen. For each ignition coil, repeat the above procedures. If no spark appears on the spark plug, inspect for the following conditions: <ul style="list-style-type: none"> Inspect the coil for cracks, carbon tracking/spark over or a resistance value outside the specified range. <p>Coil Resistance 11-15 k Ω</p> Inspect the spark plug wire for spark over/crossed discharging, cracks, carbon tracking, hole plug boot damage, pinched, improper routing or a resistance value outside the specified range. <p>Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft)</p> <p>Important: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions. If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> Damaged Ignition Module Ignition system wire - a damage to the ignition module input, loose grounding or system wire. Remove the spark plug and inspect the following: <ul style="list-style-type: none"> Heavy deposits Cracks Wear Improper gap Burned or damaged electrodes Incorrect type If the spark plugs are gas or oil fouled, determine the cause before replacing the spark plugs.
Additional Inspections	<ul style="list-style-type: none"> Inspect the TCC operation. Inspect the exhaust system for blocking up. Inspect the exhaust system pipeline for a damage or dent. Inspect the silencer for thermal fatigue or possible internal failure. Inspect the 3-way catalyst for blocking up by measuring the rear pressure of the exhaust system. Refer to Blocked Engine Exhaust System Check.

6.4.4.53 Lack of Power, Sluggishness, or Sponginess

Inspections	Action
DEFINITION: The engine delivers less than expected power. Little increase in speed, or a total lack of acceleration when the accelerator pedal is pushed down.	
Ignition System	<ul style="list-style-type: none"> Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> Attach J26792 Spark Tester to the engine ground. Connect one end of the spark plug wire to the J26792 Spark Tester. Connect the other end of spark plug wire to the coil to be tested. Connect one end of the second spark plug wire to the other coil brace. Connect the other end of the second spark plug wire to the ground. Rotate the engine, meanwhile observe the J26792 Spark Tester. The spark can be seen. For each ignition coil, repeat the above procedures. If no spark appears on the spark plug, inspect for the following conditions: <ul style="list-style-type: none"> Inspect the coil for cracks, carbon tracking/spark over or a resistance value outside the specified range. <p>Coil Resistance 11-15 k Ω</p> Inspect the spark plug wire for spark over/crossed discharging, cracks, carbon tracking, hole plug boot damage, pinched, improper routing or a resistance value outside the specified range. <p>Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft)</p> <p>Important: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions. If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> Damaged Ignition Module Ignition system wire - a damage to the ignition module input, loose grounding or system wire. <ul style="list-style-type: none"> Remove the spark plug and inspect the following: <ul style="list-style-type: none"> Heavy deposits Cracks Wear Improper gap Burned or damaged electrodes Incorrect type If the spark plugs are gas or oil fouled, determine the cause before replacing the spark plugs.
Engine Mechanical	<ul style="list-style-type: none"> Excessive oil in combustion chamber - leaking valve seals Low cylinder compression Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> Camshafts Cylinder heads Pistons, etc.
Additional Inspections	<p>Inspect the exhaust system for blocking up. Check the following:</p> <ul style="list-style-type: none"> Inspect the exhaust system pipeline for a damage or dent. Inspect the silencer for thermal fatigue or possible internal failure. Inspect the 3-way catalyst for possible blocking up. Refer to Blocked Engine Exhaust System Check. Inspect the correct TCC operation.

6.4.4.54 Detonation/Spark Knock

Inspections	Action
DEFINITION: A mild to severe ping which usually occurs worse while under acceleration. The engine makes sharp metallic knocks that change with throttle opening.	
Preliminary	<ul style="list-style-type: none"> • Refer to Powertrain On Board Diagnostic (OBD) System Check. • Before starting, first refer to Intermittent Conditions. • Search for technical bulletins.
Fuel System	<ul style="list-style-type: none"> • Inspect if the fuel pressure is too low. Refer to Fuel System Pressure Test. • Inspect the fuel for a contaminated condition. Refer to Alcohol/Contaminants - in - Fuel Diagnosis.
Ignition System	<ul style="list-style-type: none"> • Inspect the correct heat type of spark plug. Refer to Spark Plug Usage in Engine Electrical.
Engine Cooling System	Test for obvious overheating conditions. <ul style="list-style-type: none"> • Low engine coolant level • Restricted air flow to the radiator or restricted water flow through the radiator • Electric cooling fan circuit has a failure and does not work. • The correct coolant mixture ratio is 50/50. Refer to Coolant Description in Engine Cooling.
Engine Mechanical	<ul style="list-style-type: none"> • Excessive oil in combustion chamber - leaking valve seals • Low cylinder compression - refer to Engine Compression Test in Engine Mechanical. • Excessive carbon buildup in the combustion chamber. Clean the chambers using top engine cleaner. Follow the instructions on the can. • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Camshafts – Cylinder heads – Pistons, etc.
Additional Inspections	<ul style="list-style-type: none"> • Drive the vehicle and apply the shift lever to Drive gear or Overdrive gear, and inspect the gear switch input for the transmission. • Inspect the TCC operation. Applying the TCC too soon can cause the engine to spark knock. • If the scan tool readings are normal, and there are no engine mechanical faults, fill the fuel tank with a know quality gasoline that has a minimum octane reading of 87 and re-evaluate vehicle performance.

6.4.4.55 Hesitation, Sag, Stumble

Inspections	Action
DEFINITION: Momentary lack of response as the accelerator is pushed down. This condition can occur at any vehicle speed. This condition is usually more pronounced when first trying to make the vehicle move, as from a stop sign. This condition may cause the engine to stall if severe enough.	
Preliminary	<ul style="list-style-type: none"> • Refer to Powertrain On Board Diagnostic (OBD) System Check. • Refer to Intermittent Conditions. • Search for technical bulletins.

6.4.4.55 Hesitation, Sag, Stumble(Cont' d)

Inspections	Action
Sensor/System	<ul style="list-style-type: none"> Inspect the heated oxygen sensor (HO2S).The heated oxygen sensor (HO2S) should respond quickly to a change in throttle position.If the HO2S does not respond to different throttle positions, inspect for contamination from fuel, silicon or other contaminants, or incorrect use of sealant.The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication).Refer to Silicon Contamination of Heated Oxygen Sensors Notice.The engine control module may reduce the engine oil feeding, and cause a severe deterioration of drive performance. Inspect the crankshaft position (CKP) sensor on the scan tool. If there is no responding, inspect the sensor input circuit. Inspect the throttle position adjuster and related wires. Inspect the MAP sensor and related wires.
Fuel System	<ul style="list-style-type: none"> Inspect the fuel pressure.Refer to Fuel System Pressure Test. Inspect the fuel for a contaminated condition.Refer to Alcohol/Contaminants - in - Fuel Diagnosis. Inspect the fuel injectors. Inspect the items that cause an engine to run rich. Inspect the items that cause an engine to run lean.
Ignition System	<ul style="list-style-type: none"> Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> Attach J26792 Spark Tester to the engine ground. Connect one end of the spark plug wire to the J26792 Spark Tester.Connect the other end of spark plug wire to the coil to be tested. Connect one end of the second spark plug wire to the other coil brace.Connect the other end of the second spark plug wire to the ground. Rotate the engine, meanwhile observe the J26792 Spark Tester.The spark can be seen. For each ignition coil, repeat the above procedures. If no spark appears on the spark plug, inspect for the following conditions: <ul style="list-style-type: none"> Inspect the coil for cracks, carbon tracking/spark over or a resistance value outside the specified range. <p>Coil Resistance 11-15 k Ω</p> Inspect the spark plug wire for spark over/crossed discharging, cracks, carbon tracking, hole plug boot damage, pinched, improper routing or a resistance value outside the specified range. <p>Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft)</p> <p>Important: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions.If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> Damaged Module Ignition system wire - a damage to the ignition module input, loose grounding or system wire. Remove the spark plug and inspect the following: <ul style="list-style-type: none"> Heavy deposits Cracks Wear Improper gap Burned or damaged electrodes Incorrect type If the spark plugs are gas or oil fouled, determine the cause before replacing the spark plugs.

6.4.4.56 Cuts out, Misses

Inspections	Action
DEFINITION: A steady pulsation or jerking that follows engine speed, which is usually more pronounced as the engine load increases.	
Preliminary	<ul style="list-style-type: none"> • Refer to Powertrain On Board Diagnostic(OBD)System Check. • Refer to Intermittent Conditions. • Search for technical bulletins.
Fuel System	<ul style="list-style-type: none"> • Inspect the system fuel pressure. Refer to Fuel System Pressure Test. • Inspect the fuel injector. • Inspect the fuel for a contaminated condition. Refer to Alcohol/Contaminants - in - Fuel Diagnosis. • Inspect for the fuel in the vacuum hose of fuel pressure regulator.
Sensor/System	<ol style="list-style-type: none"> 1. Inspect the conditions that cause a incorrect idle. <ul style="list-style-type: none"> • The throttle body is restricted, of heavy deposits or damaged. • Restricted intake air system; • Large vacuum leaks. 2. Inspect the throttle position sensor and related circuit wires. Refer to Throttle Position Sensor Circuit Failure. 3. Inspect the correct operating of positive crankcase ventilation. 4. Drive the vehicle and apply the shift lever to Drive gear or Overdrive gear, and inspect the input signal of gear selector switch for the transmission. 5. Inspect the following parts for the damage: <ul style="list-style-type: none"> • Damaged crankshaft absorber. • Damaged crankshaft position sensor

6.4.4.56 Cuts out, Misses(Cont' d)

Inspections	Action
Ignition System	<ul style="list-style-type: none"> ● Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> – Attach J26792 Spark Tester to the engine ground. – Connect one end of the spark plug wire to the J26792 Spark Tester. Connect the other end of spark plug wire to the coil to be tested. – Connect one end of the second spark plug wire to the other coil brace. Connect the other end of the second spark plug wire to the ground. – Rotate the engine, meanwhile observe the J26792 Spark Tester. The spark can be seen. – For each ignition coil, repeat the above procedures. <p>If no spark appears on the spark plug, inspect for the following conditions:</p> <ul style="list-style-type: none"> – Inspect the coil for cracks, carbon tracking/spark over or a resistance value outside the specified range. <p style="margin-left: 40px;">Coil Resistance 11-15 k Ω</p> – Inspect the spark plug wire for spark over/crossed discharging, cracks, carbon tracking, hole plug boot damage, pinched, improper routing or a resistance value outside the specified range. <p style="margin-left: 40px;">Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft)</p> <p>Important: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions. If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> – Damaged Ignition Module – Ignition system wire - a damage to the ignition module input, loose grounding or system wire. <ul style="list-style-type: none"> ● Remove the spark plug and inspect the following: <ul style="list-style-type: none"> – Heavy deposits – Cracks – Wear – Improper gap – Burned or damaged electrodes – Incorrect type – If the spark plugs are gas or oil fouled, determine the cause before replacing the spark plugs. – Inspect the following intermittent ignition system for the conditions: <ul style="list-style-type: none"> – Intermittent signal of crankshaft position sensor. ● Intermittent from the ignition supply circuit or the sensor ground circuit to the crankshaft position sensor.

6.4.4.56 Cuts out, Misses(Cont' d)

Inspections	Action
Engine Mechanical	<ul style="list-style-type: none"> Inspect the engine for the following conditions: <ul style="list-style-type: none"> Inspect the compression. Sticking or leaking valves Worn camshaft lobes Valve timing Worn rocker arm Broken valve spring Excessive oil in combustion chamber - leaking valve seals Low cylinder compression Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> Camshafts Cylinder heads Pistons, etc.
Additional Inspections	<ul style="list-style-type: none"> Inspect the exhaust system for blocking up. <ul style="list-style-type: none"> Inspect the exhaust system pipeline for a damage or dent. Inspect the silencer for thermal fatigue or possible internal failure. Inspect the 3-way catalyst for possible blocking up. Electromagnetic interference (EMI) can cause an engine misfire condition. You can usually detect EMI with a scan tool by monitoring the engine speed parameter. A sudden increase in the engine speed parameter, with little change in actual engine speed indicates that EMI is present. Inspect the secondary ignition coil routing for high voltage components (near the ignition control circuits) if a condition exists. Inspect the intake and the exhaust manifold passages for casting flash. Inspect the motor base for a condition.

6.4.4.57 Poor Fuel Economy

Inspections	Action
DEFINITION: Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, the fuel economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.	
Preliminary	<ul style="list-style-type: none"> Refer to Powertrain On Board Diagnostic(OBD)System Check. Refer to Intermittent Conditions. Search for technical bulletins. Verify the owner's driving habits, by asking the following questions: <ul style="list-style-type: none"> Is the A/C ON very frequently? Are the tires at the correct pressure? Are the tires sticking? Is there excessively heavy loads being carried? Is the acceleration rate too much, too often?
Fuel System	<ul style="list-style-type: none"> Inspect the fuel pressure. Refer to Fuel System Pressure Test. Inspect the fuel injector. Inspect the fuel for a contaminated condition. Refer to Alcohol/Contaminants - in - Fuel Diagnosis. Ensure each injector wire is connected to the proper injector/cylinder correctly. Inspect for the fuel in the vacuum hose of fuel pressure regulator.

6.4.4.57 Poor Fuel Economy(Cont' d)

Inspections	Action
Sensor/System	<ul style="list-style-type: none"> Inspect the crankshaft position (CKP) sensor on the scan tool.If there is no responding to both, inspect the sensor input circuit. Inspect the air intake system and the crankcase for air leaks. Test for correct calibration of the speedometer.Connect the J33431-B Signal Generator to the electrical connector of speed sensor. Turn on the ignition (Switch), open the visual inspector, and monitor the speedometer.
Ignition System	<ul style="list-style-type: none"> Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> Attach J26792 Spark Tester to the engine ground. Connect one end of the spark plug wire to the J26792 Spark Tester.Connect the other end of spark plug wire to the coil to be tested. Connect one end of the second spark plug wire to the other coil brace.Connect the other end of the second spark plug wire to the ground. Rotate the engine, meanwhile observe the J26792 Spark Tester.The spark can be seen. For each ignition coil, repeat the above procedures. If no spark appears on the spark plug, inspect for the following conditions: <ul style="list-style-type: none"> Inspect the coil for cracks, carbon tracking/spark over or a resistance value outside the specified range. Coil Resistance 11-15 k Ω Inspect the spark plug wire for spark over/crossed discharging, cracks, carbon tracking, hole plug boot damage, pinched, improper routing or a resistance value outside the specified range. Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft) <p>Important: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions.If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> Damaged Ignition Module Ignition system wire - a damage to the ignition module input, loose grounding or system wire. Remove the spark plug and inspect the following: <ul style="list-style-type: none"> Heavy deposits Cracks Wear Improper gap Burned or damaged electrodes Incorrect type If the spark plugs are gas or oil fouled, determine the cause before replacing the spark plugs.
Engine Cooling System	<ul style="list-style-type: none"> Inspect for the engine coolant level. Test if the engine thermostat is incorrect or has a failure.For the thermostat, the initial open temperature is 94 °C , and the full open temperature is 107 °C .
Automatic Transmission System	<ul style="list-style-type: none"> Inspect if the high speed gear TCC cannot be engaged. Inspect if the clutch disk is skidding.

6.4.4.57 Poor Fuel Economy(Cont' d)

Inspections	Action
Engine Mechanical	<ul style="list-style-type: none"> • Inspect the engine for the following conditions: <ul style="list-style-type: none"> – Inspect the compression. – Sticking or leaking valves – Worn camshaft lobes – Valve timing – Worn rocker arm – Broken valve spring – Excessive oil in combustion chamber - leaking valve seals • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Camshafts – Cylinder heads – Pistons, etc.
Additional Inspections	<ul style="list-style-type: none"> • Inspect the exhaust system for blocking up. <ul style="list-style-type: none"> – Inspect the exhaust system pipeline for a damage or dent. – Inspect the silencer for thermal fatigue or possible internal failure. – Inspect the 3-way catalyst for possible blocking up.

6.4.4.58 Rough, Unstable, or Incorrect Idle and Stalling

Inspections	Action
DEFINITION:The engine runs unevenly at idle. If severe, the engine or the vehicle may shake.Engine idle may vary in speed.Either conditions may be severe enough to stall the engine.	
Preliminary	<ul style="list-style-type: none"> • Refer to Powertrain On Board Diagnostic(OBD)System Check. • Refer to Intermittent Conditions. • Search for technical bulletins.
Fuel System	<ul style="list-style-type: none"> • Inspect the fuel pressure.Refer to Fuel System Pressure Test. • Inspect the fuel injectors. • Inspect the fuel for a contaminated condition. • Inspect for the fuel in the vacuum hose of fuel pressure regulator. • Ensure each injector wire is connected to the proper injector/cylinder correctly.
Sensor/System	<ul style="list-style-type: none"> • Inspect the conditions that cause a incorrect idle. <ul style="list-style-type: none"> – The throttle body is restricted, of heavy deposits or damaged. – Restricted intake air system. – Large vacuum leaks. • Inspect the correct operating of the crankcase ventilation. • Inspect the throttle position sensor and related wires. • Inspect if the sensor circuit voltage is correct. • Drive the vehicle and apply the shift lever to Drive gear or Overdrive gear, and inspect the input signal of gear selector switch for the transmission.

6.4.4.58 Rough, Unstable, or Incorrect Idle and Stalling(Cont' d)

Inspections	Action
Ignition System	<ul style="list-style-type: none"> • Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> – Attach J26792 Spark Tester to the engine ground. – Connect one end of the spark plug wire to the J26792 Spark Tester. Connect the other end of spark plug wire to the coil to be tested. – Connect one end of the second spark plug wire to the other coil brace. Connect the other end of the second spark plug wire to the ground. – Rotate the engine, meanwhile observe the J26792 Spark Tester. The bright blue spark should be seen. – For each ignition coil, repeat the above procedures. • If no spark appears on the spark plug, inspect for the following conditions: <ul style="list-style-type: none"> – Inspect the coil for cracks, carbon tracking/spark over or a resistance value outside the specified range. <p style="margin-left: 40px;">Coil Resistance 11-15 k Ω</p> – Inspect the spark plug wire for spark over/crossed discharging, cracks, carbon tracking, hole plug boot damage, pinched, improper routing or a resistance value outside the specified range. <p style="margin-left: 40px;">Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft)</p> <p>Important: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions. If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> – Damaged Ignition Module – Ignition system wire - a damage to the ignition module input, loose grounding or system wire. <ul style="list-style-type: none"> • Remove the spark plug and inspect the following: <ul style="list-style-type: none"> – Heavy deposits – Cracks – Wear – Improper gap – Burned or damaged electrodes – Incorrect type • If the spark plugs are gas or oil fouled, determine the cause before replacing the spark plugs.
Engine Mechanical	<ul style="list-style-type: none"> • Inspect the engine for the following conditions: <ul style="list-style-type: none"> – Inspect the compression. – Sticking or leaking valves Worn camshaft lobes – Valve timing – Worn rocker arm – Broken valve spring – Excessive oil in combustion chamber - leaking valve seals • Inspect the following components for incorrect basic engine parts: <ul style="list-style-type: none"> – Camshafts – Cylinder heads – Pistons, etc.

6.4.4.58 Rough, Unstable, or Incorrect Idle and Stalling(Cont' d)

Inspections	Action
Additional Inspections	<ul style="list-style-type: none"> • Inspect the exhaust system for blocking up. <ul style="list-style-type: none"> – Inspect the exhaust system pipeline for a damage or dent. – Inspect the silencer for thermal fatigue or possible internal failure. – Inspect the 3-way catalyst for possible blocking up. • Inspect the motor base for a condition. • Electromagnetic interference (EMI) on the reference circuit can cause an engine misfire condition. You can usually detect EMI with a scan tool by monitoring the engine speed parameter. A sudden increase in the engine speed parameter, with little change in actual engine speed indicates that EMI is present. Inspect the secondary ignition coil routing for high voltage components (near the ignition control circuits) if a condition exists. • Inspect the motor base for a condition. • Inspect the intake and the exhaust manifold passages for casting flash.

6.4.4.59 Dieseling, Run-on

Inspections	Action
DEFINITION: The engine continues to run after the key is turned OFF, but runs very rough. If the engine runs smooth, inspect the ignition switch and the ignition switch adjustment.	
Preliminary	<ul style="list-style-type: none"> • Refer to Powertrain On Board Diagnostic(OBD)System Check. • Refer to Intermittent Conditions. • Search for technical bulletins.
Fuel System	Inspect the fuel injector.
Additional Inspections	Inspect if the batter positive voltage is short to any ignition supply circuit.

6.4.4.60 Backfire

Inspections	Action
DEFINITION:Fuel ignites in the intake manifold or in the exhaust system, making a loud popping noise.	
Preliminary	<ul style="list-style-type: none"> • Refer to Powertrain On Board Diagnostic (OBD) System Check. • Refer to Intermittent Conditions. • Search for technical bulletins.
Sensor/System	<ul style="list-style-type: none"> • Inspect the following intermittent ignition system for the conditions: <ul style="list-style-type: none"> – Intermittent signal of crankshaft position – Intermittent from the ignition supply circuit or the sensor ground circuit to the crankshaft position sensor. • Inspect the MAP sensor.
Fuel System	<ul style="list-style-type: none"> • Inspect if the fuel pressure is too low.Refer to Fuel System Pressure Test. • Inspect the fuel for a contaminated condition.Refer to Alcohol/Contaminants - in - Fuel Diagnosis. • Ensure each injector wire is connected to the proper injector/cylinder correctly.
Ignition System	<ul style="list-style-type: none"> • Inspect if the ignition voltage output is correct according to the following procedures: <ul style="list-style-type: none"> – Attach J26792 Spark Tester to the engine ground. – Connect one end of the spark plug wire to the J26792 Spark Tester.Connect the other end of spark plug wire to the coil to be tested. – Connect one end of the second spark plug wire to the other coil brace.Connect the other end of the second spark plug wire to the ground. – Rotate the engine, meanwhile observe the J26792 Spark Tester.The spark can be seen. – For each ignition coil, repeat the above procedures. • If the spark does not occur on the spark plug, inspect the following conditions: <ul style="list-style-type: none"> – Coil - cracks, carbon tracking/spark over or a resistance value outside the specified range. Coil Resistance 11-15 k Ω – Spark plug wire - spark over/crossed discharging, cracks, carbon tracking, hole plug boot damage, pinched, improper routing or a resistance value outside the specified range. Resistance of Spark Plug Wire 1968 Ω /m (600 Ω /ft) <p>Important: Spray a little water fog to the secondary ignition coils, and help to determine the intermittent conditions.If the secondary ignition parts fail, the spark will occur with the ignition parts to the ground.</p> <ul style="list-style-type: none"> – Damaged Ignition Module – Ignition system wire - a damage to the ignition module input, loose grounding or system wire. • Remove the spark plug and inspect the following: <ul style="list-style-type: none"> – Heavy deposits – Cracks – Wear – Improper gap – Burned or damaged electrodes – Incorrect type • If the spark plugs are gas or oil fouled, first determine the cause before replacing the spark plugs.

6.4.4.60 Backfire(Cont' d)

Inspections	Action
Engine Mechanical	<p>Inspect the engine for the following conditions:</p> <ul style="list-style-type: none">• Inspect the compression.• Sticking or leaking valves• Worn camshaft lobes• Valve timing• Bending pushrod• Worn rocker arm• Broken valve spring• Excessive oil in combustion chamber - leaking valve seals• Low cylinder compression• Inspect the following components for incorrect basic engine parts:<ul style="list-style-type: none">— Camshafts— Cylinder heads— Pistons, etc.
Additional Inspections	<ul style="list-style-type: none">• Inspect the intake and the exhaust manifold for casting flash.• Inspect the TCC operation.• Inspect the exhaust system for blocking up.<ul style="list-style-type: none">— Inspect the exhaust system for a damage or the passages for a dent.— Inspect the silencer for thermal fatigue or possible internal failure.— Inspect the 3-way catalyst for possible blocking up. Refer to Exhaust Leaks in Engine Exhaust System.

6.4.4.61 Blocked Engine Exhaust System Check

Step	Action	Value	Yes	No
1	Has the Powertrain On Board Diagnosis (OBD) System Check been performed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis (OBD) System Check.
2	1. Remove the heated oxygen sensor. 2. Install the exhaust back pressure tester J35314-A/BT-8515/BT-8515A or equivalence onto HO2S1 position of the heated oxygen sensor. 3. Under the normal operating temperature, allow the engine to idle. 4. Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value?	8.6 kpa.	Go to Step 4	Go to Step 3
3	1. Place the exhaust pressure tester on the heated oxygen sensor, and increase the engine speed to 2,000 rev/min. 2. Observe the exhaust system back pressure reading on the gauge. Does the reading exceed the specified value?	20.7 kpa.	Go to Step 4	System OK
4	Repair the restricted condition for the exhaust system. The possible conditions may include: <ul style="list-style-type: none"> • Damaged pipelines • Heat deformation • Internal conditions of the silencer • Restricted converter Is the operation completed?	—	Go to Step 5	—
5	1. Install the exhaust pressure tester onto the position of the heated oxygen sensor, and increase the engine speed to 2000 rev/min. 2. Observe the exhaust system back pressure reading on the measuring gauge. Does the reading exceed the specified value?	20.7 kpa.	Go to Step 2	System OK

6.4.4.62 Engine Control Module Diagnosis

Engine Diagnosis System Check

Important: Correctly understand and use the table to narrow the diagnosis time and prevent unnecessary part replacement.

After completing the appearance inspection, Power System On Board (OBD) Diagnosis System Check should be performed. On Board Diagnosis System Check will provide instructions for diagnosis of the following conditions:

- Engine Control Module will have inoperative or damaged, non engine control module data or immediately repair the engine (Multifunction Indication Lamp), Multifunction Indication Lamp inoperative.
- Engine Control Module Diagnosis MalfunctionCode.
- Fuel System excessive rich or lean.
- Customer Complaint Drive Performance Symptom

Power System On Board Diagnostic (OBD) System Check is designed as a drive performance and emission system diagnostic main table. Always take Power System On Board Diagnostic (OBD) System Check as the starting point of power system diagnosis.

Power System On Board System Check is a edit method for identification of malfunction. The opinion of the driver normally could be divided as one of the following:

- Immediately repair the engine (multifunction indication light) continuous illumination.
- Drive Ability Multifunction
- Engine not Start or stall after start

Diagnostic Procedure Application

The used diagnostic procedure of this section is designed for finding and repairing malfunctions of related to the power system. The common practice is to employ the following introduced 5 basic steps to find appropriate malfunction diagnostic plan.

- To learn about customer complaint, it is very important to let the technician to be informed about complaint contents. Otherwise it will cause wrong diagnosis or unnecessary diagnosis. Among them, the technician must learn if that the condition is always happening, only appears in a particular situation, or definitely is of discontinuity. Thus in helping the technician to reproduce or diagnosis the problem. The other reason that the technician must understand the customer complaint contents is that, the technician can decide if the complaint needs repair or it is of vehicle normal

operation from this. Attempt to diagnosis a complaint that belongs to a normal phenomena, but also to cause unnecessary maintenance.

- Is the diagnosis operation normal? Use Powertrain On Board (OBD) System Check. This is the starting point of procedure diagnosis, and be always to begin from here.
- Does this indicates diagnostic malfunction code? If the diagnostic malfunction code is identified through diagnosis, Powertrain On Board Diagnosis (OBD) System Check will lead you to appropriate table.
- Is the customer complaint related to special Powertrain system sub system? If no setting of related diagnostic malfunction code, the short cut mode for the next step to determine malfunction position is to narrow it to a particular special Powertrain sub system. If a particular Powertrain subsystem could be defined as malfunction cause, the diagnosis will be more easy.
- Is the malfunction related to the power system? Some customer complaint is observed as it may be relating to the Powertrain, but in fact it is caused by the other system of vehicles.

Necessary Basic Knowledge

Contents of this section of the manual must be used, to be familiar with some basic knowledge. These knowledge will help you to finish the diagnostic procedure introduced by this section.

Basic Circuit Knowledge

Basic electric knowledge must be understand, and learn the meaning of voltage (v), ampere (am) and electric resistance (ohm). You should understand what happens in a circuit with an open or a shorted wire, and you should be able to identify a shorted or open circuit using a DMM.

Application of DMM

You should be familiar with DMM. Use DMM to measure the voltage (v), resistance (ohm), electricity (amp), capacity (Faraday), Interruption (Min/Max) and frequency.

Use of circuit test tools

Only when the diagnostic procedure is raised, use the test lamp. You should know how to use the jumper wire test components with fuse and DMM for indication of read out. But not to damage the terminal. You should know how to use J35616-A adapter socket to test the adaptor modules, and apply when the diagnostic procedure needs to probe connectors at front.

Engine Control Module Repair Notice

Engine Control Module is able to accept vehicle normal current, but must cautiously operate, avoiding any

circuit overload. When testing open or short circuit, do not be grounded or apply with voltage on the engine control module, unless special notification to the non diagnostic procedure. These circuit can only use J39200 DMM for test.

Only for removal or replacement of engine control module, you must follow the procedural operation introduced in this section.

Static discharge damage

Electric components used in the control system is designed normally for only transmitting very low voltage. Electric components is easily subject to static discharge damage. Static electricity not more than 100v can cause some electric components being damaged. Some person has several approach to carrying static electricity. The most common electricity carrying way is abrasion and induction. Personal sliding on vehicle seats is a example of attrited electrification. When a shoe of sound insulation is beside a high voltage object and grounded instantly, it will produce faradic electricity. Load with the same polarity has mutual exclusiton enable people to bring same popularity load. Static electricity can cause damage. You must carefully deal with and test the electrical components.

After sales (added) electrical and vacuum equipment

After sale (added) electrical and vacuum equipment is defined as equipment connected with electrical or vacuum system that is installed to the vehicle in any form after the vehicle leaves the original plant. For this kind of equipment, design on the vehicle is not allowed. For this, you must be specially cautious when adding equipment after the vehicle is sold.

Underhood appearance inspection

Underhood appearance inspection is very important. Appearance inspection normally can exclude malfunction. These quick inspection only spends a few minutes, but can economize time and help you clear the problem. For details refer to Appearance Inspection in Symptom.

All Powertrain malfunction diagnosis have to start from appearance inspection. Appearance inspection often enables you to clear simple malfunction, but not need to use tables.

- Inspect all vacuum hose for clamping, cutting, disconnect or inappropriate arrangement.
- Inspect appropriate grounding connection for correct, grounding hole eye for connecting to the grounding point, star pattern pad for installation.
- Inspect the battery positive connection box clamping nut if it is loosened.
- Inspect the other guiding wire inside the engine chamber for sound connection, burn out, or fragments attainment, wire dead clamp or

harness contact sharp edge or heat exhaustion manifold.

- Inspect the fuse for melt or loss, relay for loss or installation position incorrect.

Diagnosis malfunction (DTC) table application

When diagnose the Powertrain system, diagnostic procedure in this section or introduced in other section on Powertrain will almost all be used. The diagnostic procedure will be mainly presented in the form of table. At the beginning of each diagnostic malfunction code, it is a circuit diagram or a reference circuit diagram, circuit description, and condition or note reading support information of the diagnostic malfunction code in the table will help you to understand the tested system, related components in the test, engine control module test system (provocation condition) mode, engine control module for how to define diagnostic failure (setting of diagnostic malfunction code condition), and which table can be executed. The following serves an example of diagnostic support information and diagnostic malfunction code table.

Circuit Diagram

Circuit diagram on the diagnostic support information page will exhibit the related circuit and components when setting of diagnostic malfunction code. When checking the circuit in the table, you may refer to the diagram. If there is only one circuit diagram for reference, or needing more detailed circuit information, you may refer to Engine Control Module Schematic Diagram in Wiring System.

Circuit description

The circuit description interprets related sensor and/or circuit for setting of diagnostic malfunction code. Brief introduction of time for setting diagnostic malfunction code.

Run diagnostic malfunction code condition

Running condition (induction condition) is the engine control module test sensor/system front must meet. Only these conditions are created, reliable sensor/system could be carried, and will not cause false indication. And it will not produce false indication.

Conditions for diagnostic malfunction code

Setting of conditions is that must be met for setting of diagnostic malfunction code. Only after the running conditions are met (like the above mentioned), you can only inspect the sensor/system. If induction condition are met, and engine control module has detected a abnormal sensor/system condition, appropriate malfunction code will be setted.

Actions adopted for setting of diagnostic malfunction code

Action employed refers to adopted steps of engine control module for setting of diagnostic malfunction code. Purpose for these action is for one of the following 3 kinds.

- Inform the malfunction to the driver
- Maintain vehicle drive performance
- In prevention of any malfunction that causes vehicle damage.

Clearance of malfunction indication lamp/ diagnostic malfunction code conditions.

A particular condition must be met, can only closing of malfunction indication lamp and/or clearance of diagnostic malfunction code.

Diagnostic aid

When producing of diagnostic malfunction code or drive performance malfunction conditions, Diagnostic aid provides useful information. Some times, relying on diagnostic malfunction code setting of data quick retrieve, or driver information, it can recognize the failure, at least also to narrow the malfunction to small list of possible interruption conditions. If like this, diagnostic aid can be interpreted as searching for contents and the most reasonable path of determining interruption conditions.

Test Description

Test description has interpreted the cause of execution of a particular test, and what will the test find. Information is numbered according to the corresponding steps in the diagnostic table. As for why to carry out a particular step, or such a step should produce what kind of result, refer to the next step number needed for execution. Refer to the explanation description with the same number of Test Description

Diagnostic Table

Diagnostic Table is a systematic method for diagnostic malfunction code. This table consists of 5 columns: step number, operation, numeric value, Yes and No. Step number indicates for steps of execution. Operation column includes required information for execution of test. The final sentence of each operational block always raises one question. The question can only be answered by YES or NO. The answer of the question will indicate you the next step to which column Yes or No. The answer of YES or No for each test will lead to the next reasonable step in the diagnostic table. A large part of YES and NO frame will lead you to the next reasonable step in the diagnostic table. However, some frames may guide you to receive diagnostic help during other system diagnosis, or when interruptive condition exists.

Beginning from step 1 of table top, unless indicated with notice or caution. Do not jump over this step or table, unless YES/NO column especially stipulated. Shuffling through normally cause misdiagnosis. After malfunction is find, perform necessary inspection, then inspect the maintenance effect.

Inspection of maintenance effect

You must explain and ensure diagnostic code operation and passing through, If you want to know if the test runs and pass the test, use the malfunction diagnostic instrument and select malfunction code status, note the code that needs verification. Now you can observe the diagnosis test status. For diagnosis repair, you can drive the vehicle and ensure the symptom to disappear.

Check the terminal contact

Before replacing a component, it is required to check the terminal contact for many tables. The reason lies in that, executing of inspection in the table can only be done by checking the jumper or the continuity of direct connection circuit, but not the jump connection continuity of components. Check the terminal contact, avoiding replacing perfect components, and repeating of malfunction due to indirect connection, to allow part of the repair work more easy, for example to replace terminal of components but not components itself. For this, if it is required to do this operation, it is very important to check the terminal contact.

Only there is a new terminal in hand, it is very easy to check the terminal. J38125-B terminal repair tool kit is for checking the terminal source for sound terminal contact. It includes all terminal series used at present. When inspect of terminal contact, start from checking the positive terminal. The terminal should straightly and aligned to other terminals in other terminal row. The terminal should not be distorted, bended or damaged. As the same, the negative terminal should be checked for alignment for damage. Finally, use the new positive terminal of the same series.

(for example metric combination 150, Weatherpack etc) to connect the negative terminal to be checked. It should not come away or should not be easily shake off. Connection can only be disconnected with force. Force needed for interrupt of connection depends on the inspected terminal dimension. Big terminal, such as metric combination series, it can be interrupted with hand, but not to be shake off. Replace the damaged terminal, but not need to repair.

Diagnosis interruptive malfunction

Diagnosis interruptive condition is very hard. Setting conditions of diagnostic malfunction code will not surely appear. This does not mean the failure has been excluded, and it only indicates malfunction interruptive appearing. Malfunction will appear in the future. Therefore, try every means to diagnosis the

malfunction and inflict for exclusion. The only way for diagnosis of interruptive condition is to collect information when diagnosing malfunction code. Practice with the 2 kind of method, and observe through quick retrieval data and by the driver. Refer to the latest Techline Procedure

6.4.4.63 Air Conditioning Circuit System Diagnosis Controlled by Engine Control Module

Circuit Diagram Description (refer to air conditioning system schematic diagram)

When selecting of heating, ventilation and air conditioning system controller, send a signal through the air conditioner switch circuit to the control module. Air conditioning relay is controlled by the engine control module. Control module monitor air conditioning system refrigerant pressure. If the air conditioning refrigerant and engine operation condition is between specified acceptable demarked range, the engine the engine control module will allow the air conditioning relay to operate. Meanwhile provide grounding wiring to the air conditioning system relay in the engine control module. When the air conditioning relay operates, the battery positive voltage is applied on the compressor clutch coil.

Only asking for opening of the air conditioning system when the engine runs, the engine control module will enable the air conditioner compressor clutch, unless the following situation appears:

- Vehicle speed less than 40 KM/h, and throttle opening greater than 50-60% (relating to specific rpm)
- Engine water temperature below 15°C or greater than 115°C

- Within a particular delay time after the engine starts, the specific value depends on the starting water temperature and altitude, in plain area, delay time more than -10°C equals to 10 seconds, -20°C is 200 seconds, -30°C is 240 seconds.
- Air conditioning closes within 4 seconds.
- Air conditioning pressure sensor is over 440p/sq.mi (4.6v) or below 35p/sq.mi (0.35v) (determined by the air conditioning system pressure)

Diagnostic aid

Inspect the following items:

Important: Before repair components, clear any scraps on the connector surface. Before diagnosis or replacement of components, first to check the connector gasket. Ensure the pad to be installed correctly. The pad can stop pollutants to enter.

- Poor terminal contact-inspect wiring harness connector terminal for loosening, mismatch, lock pad broken, deformation, and wiring connection for failure. Use the appropriate match terminal to test tensile for appropriateness.
- Wiring harness damage- inspect wiring harness for damage. If it fails to find any problem in the wiring harness, move away the harness related with the sensor, and meanwhile observe the indication of the malfunction diagnosis instrument. If the malfunction diagnosis instrument indicates a change, it shows there is a problem in this position.
- If engine control module and engine grounding connection reliable, and clean.

If it is determined that the diagnostic code belongs to interruptive malfunction, then check the malfunction record which can determine when is the diagnostic code set.

Air conditioning circuit diagnosis of controlled by engine control module

Step	Action	Numeric value	Yes	No
1	Whether having executed Powertrain On Board (OBD) System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis (OBD) System Inspection
2	Whether stored any engine control module, heating, ventilation, in air conditioning system malfunction code?	—	Diagnosis appropriate diagnosis malfunction code.	Go to Step 3

Air conditioning circuit diagnosis of controlled by engine control module (Cont' d)

Step	Action	Numeric value	Yes	No
3	<p>Note: Before continuing execution of this step, the following conditions must be followed:</p> <ul style="list-style-type: none"> Ambient temperature must be higher than 5°C (41°F) Air conditioning pressure must be above 35p/sq.mi.(0.4v) Coolant temperature must be lower than 121°C (250°F) <ol style="list-style-type: none"> Turn the air conditioning shifting switch to OFF Turn on the ignition switch, and keep the engine blowing out Test the air conditioning clutch for engagement <p>Air conditioning clutch for engagement?</p>	—	Go to Step 13	Go to Step 4
4	<ol style="list-style-type: none"> Start and keep the engine to run at the speed of 1000 - 1500rpm Turn the air conditioning shifting switch to air conditioning mode. Observe the air conditioning system clutch <p>Air conditioning clutch for engagement?</p>	—	Refer to Diagnosis Aid	Go to Step 5
5	<ol style="list-style-type: none"> Hold the air conditioning shift switch on to the air conditioning mode Observe the air conditioning system request indication on the malfunction diagnostic instrument. <p>Air conditioning request indication is YES.</p>	—	Go to Step 8	Go to Step 6
6	<p>Observe the air conditioning system pressure sensor indication on the malfunction diagnostic instrument.</p> <p>Whether pressure indicated by air conditioning system pressure sensor indication comply with the stipulation?</p>	0.4v – 4.6v	Go to Heating, Ventilation and Air Conditioning System Air Conditioning System Diagnosis	Go to Step 7
7	<ol style="list-style-type: none"> Connect J39500-B refrigerant recycle, recirculation and restaffing (ACR4) instrument to monitor the refrigerant high end pressure. Use J39500-B refrigerant for recycle, recirculation and restaffing (ACR4) instrument to monitor the refrigerant high end pressure <p>If the high pressure side refrigerant pressure is between the stipulated value?</p>	35p/sp.mi-440p/sp.mi	Go to Air Conditioning System Diagnosis in Heating, Ventilation and Air Conditioning System	Go to Air System (A/C) Refrigerant Pressure Sensor Circuit
8	<p>Inspect the air conditioning system clutch fuse</p> <p>If the conditioning system clutch fuse melted</p>	—	Go to Step 9	Go to Step 10

Air conditioning circuit diagnosis of controlled by engine control module (Cont' d)

Step	Action	Numeric value	Yes	No
9	1. Remove the air conditioning clutch fuse 2. Remove the air conditioning system relay 3. Test the following circuit status: <ul style="list-style-type: none"> • If air conditioning system relay accumulator positive power supply circuit short circuit to the ground. • If accumulator positive power supply to air conditioning system clutch grounding short • Diode tube short circuit 4. If failure is found, perform necessary repair work. Whether find and correct the status?	—	Go to Step 18	Go to Step 15
10	1. Remove the air conditioning system relay 2. Connect the jumper wire of the 10A fuse to between the air conditioning system clutch coil power supply socket of the accumulator positive and air conditioning system relay connector If the air conditioning clutch is engaged?	—	Go to Step 12	Go to Step 11
11	Test the following circuit status: <ol style="list-style-type: none"> 1. The accumulator positive power supply circuit to the air conditioning relay open circuit. 2. The accumulator positive power supply circuit to the air conditioning relay open circuit. 3. The air conditioning system clutch grounding circuit open 4. Poor contact of air conditioning clutch coil connector terminal Do you find and correct the status?	—	Go to Step 18	Go to Step 15
12	Test the air conditioning relay terminal in the under-hood attachment wiring conjunction box for poor contact. If poor terminal contact is found, replace the under-hood attachment wiring conjunction box. Do you find and correct the status?	—	Go to Step 18	Go to Step 16
13	1. Close the ignition switch 2. Remove the air conditioner system relay 3. Connect the ignition switch Is the air conditioning clutch engaged?	—	Go to Step 14	Go to Step 16
14	Disconnect the air conditioning clutch connector. Is the air conditioning clutch engaged?	—	Go to Step 15	Go to Step 17
15	Replace the air conditioning system clutch Is the replacement operation finished?	—	Go to Step 18	—
16	Replace the air conditioning relay compressor. Is the replacement operation finished?	—	Go to Step 18	—
17	Determine and repair the malfunction of short circuit to voltage between the accumulator positive power supply circuit to the air conditioning system clutch. Is the repair completed?	—	Go to Step 18	—

Air conditioning circuit diagnosis of controlled by engine control module (Cont' d)

Step	Action	Numeric value	Yes	No
18	<p>Note: Before continuing execution of this step, the following conditions must be followed:</p> <ul style="list-style-type: none"> • Ambient temperature must be higher than 5°C (41°F) • The air conditioning system pressure must be higher than 35p/sp.mi (0.4v) . • Cooling temperature must be lower than 121°C (41°F) <ol style="list-style-type: none"> 1. Start and keep the engine to run at the speed of 1000-1500rpm 2. Turn the air conditioning system selection switch to ON. 3. The air conditioning clutch engagement sound is heard. 4. Wait for 5 seconds, then turn the air conditioning shifting switch to OFF. 5. The air conditioning clutch engagement sound is heard. <p>Is the air conditioning system clutch coil engaged and separated?</p>	—	System OK	Go to Step 3

6.4.4.64 Electric cooling fan diagnosis

Circuit description

Fan motor is supplied by the wiring conjunction box for power. When current control fuse 1 and fan 2, 3 from the fan in the wiring conjunction box controls the fuse via the relay coil flowing through the engine control module to be grounded, the cooling fan relay is power on. When the fan is at high speed operation, the low speed control circuit of the fan and high speed control circuit are all grounded. When the low speed fan control circuit is grounded, the low speed fan operates.

When the fan is at low speed operation, the engine control module provides grounding access for cooling fan 1 relay. Close fan 1 relay, current reaches the right side cooling fan motor from the underhood attachment wiring conjunction box through the relay angle end. During the low speed operation, the grounding access of the right side cooling fan motor is through the cooling fan 2 relay and left side engine cooling fan motor. Allow the 2 low speed operating cooling fan to form connection in series.

When the fan is at high speed operation, the engine control module provides grounding access for cooling fan 1 relay. The engine control module provides grounding access for cooling fan 2 relay and cooling fan 3 relay. Thus close all 3 cooling fan relays. During fan high speed operation, left and right side engine cooling fan all attain current from the wiring conjunction box and each cooling fan has their own grounding access.

Diagnostic aid

If it is a over heat problem for customer complaint, determine the complaint for actual overflow owing to boiling, and illumination of the warning lamp, or engine coolant temperature (ECT) meter for indication of over heat. Metering gauge precision is to indicate the engine coolant temperature sensor reading and that of the metering gauge reading for comparison through indication of the malfunction diagnosis instrument. If the engine indeed is too hot and the metering instrument indicates too hot, but the cooling fan isn't turned on, the engine cooling temperature sensor (ECT) may drift to be out of the calibration range, needing replacement. If the engine too hot and cooling fan is on, the cooling system is suspected to have problem, needing inspection.

Inspect the following circumstances:

- Poor contact of the engine control module, cooling fan relay or cooling fan motor-inspect the wiring harness connector for the following problem.
 - Terminal loosen
 - Fit inappropriated
 - Broken locks

- Improperly formed or damaged terminals
- Poor terminal-to-wire connection

Test Description

The step number in the following number malfunction diagnosis table:

1. When setting of particular diagnosis malfunction code, the engine control module will allow the engine cooling fan for operation. Before using this table, first refer to the appropriate diagnosis code table.
2. Before diagnosis, allow the engine coolant temperature dropping to below 100°C (212°F).
3. Cooling fan operating condition:
 - When there is a problem with the water sensor, no matter for any other condition, the 2 fans are all running at a high speed.
 - Water temperature exceeds the high threshold value 103°C, no matter in any other condition, both fans are running at high speed.
 - Idle speed with the air conditioning not turned on: water temperature exceeds the low threshold value 93°C, both fans are running at low speed;
 - Turn on the air conditioner with idle speed: both fans running a low speed.
 - Air conditioner isn't turned on during driving: when water temperature exceeds low threshold value 93°C, and vehicle speed is lower than 80 KM/h, both fans are running at a low speed.
 - Drive with air conditioner turned on: when vehicle speed is lower than 45 KM/h; vehicle speed is at 45-80 KM/h and water temperature exceeds the low threshold value 93°C, both fans are running at low speed.

Electric Cooling Fan Diagnosis

Step	Action	Numeric value	Yes	No
1	Whether having executed Powertrain On Board(OBD) System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis (OBD) System Inspection
2	Is malfunction diagnosis code set?	-	Go to corresponding diagnostic malfunction code table	Go to Step 3
3	1. Installation of malfunction diagnosis instrument 2. When at diagnosis of all fan malfunction, engine cooling temperature must be lower than the stipulated value. 3. When the engine and air conditioner is turned off, turn on the ignition switch. Is the cooling fan turned off?	100°C (212°F)	Go to Step 4	Go to cooling fan table #1
4	Use malfunction diagnostic instrument to command the fan running at low speed. Did the 2 cooling fans shift to high speed?	—	Go to Step 5	Go to cooling fan table #2
5	Important: Wait for 3-5 seconds, to determine if the fan has been shifted from low speed to high speed. Use the malfunction diagnostic instrument to command the fan running at low speed. Did the 2 cooling fans shift to high speed?	—	Go to Step 6	Go to cooling fan table #3
6	1. Exit from the output window on the malfunction diagnostic instrument. 2. Air conditioner is turned off, the engine is running at idle speed. Is the cooling fan turned on?	—	Go to Step 8	Go to Step 7
7	Turn on the air conditioner Is the cooling fan turned on?	—	System OK	Go to Step 9
8	Air conditioner request indicated on the malfunction diagnosis instrument is YES?	—	Go to Air Conditioning System Diagnosis in Heating, Ventilation and Air Conditioning System	Go to Step 10
9	Air conditioner request indicated on the malfunction diagnosis instrument is YES?	—	Go to Air conditioning circuit diagnosis controlled by engine control module.	Go to Air Conditioning System Diagnosis in Heating, Ventilation and Air Conditioning System
10	Note:Replace the required programme of the engine control module Replace the engine control module, is the operation completed?	—	System OK	—

6.4.4.65 Fuel System Pressure Test

System description

Appropriate fuel pressure is necessary to maintain engine effective operation and emission, and if the fuel pressure is not within the specification, the vehicle drive performance may be affected or the emission level is increased.

The fuel system include the following components:

- Fuel strainer
- Fuel pump
- Fuel oil filter
- Fuel feed pipe
- Fuel oil pressure regulator
- Fuel oil duct
- Oil injector
- Fuel return hose

Test Description

The step number in the following number malfunction diagnosis table:

2. Test the ability of fuel system to reach a particular fuel pressure range. Fuel pump may need circulation for multiple times, then it can reach the pressure range.
6. If the fuel system pressure decreases to above 5p/sq.mi. within 10 minutes, that shows one or multiple leakage.

8. Test the ability of fuel system to maintain a particular fuel pressure range. Fuel pump may need circulation for multiple times, then it can reach the pressure range.
9. When accelerating cruise or steering difficulty, decrease of fuel pressure may cause insufficient oil supply. Insufficient oil supply may cause power damage, surge, or engine misfiring, the malfunction diagnosis instrument may be used. If it happens with extreme insufficient oil supply, the oxygen sensor may be lower than 500 millivolt and the fuel injector pulse width will increase.
13. When the engine is at idle, the manifold pressure is very low (degree of vacuum very high) The low pressure (degree of vacuum very high) acts on the fuel pressure regulator membrane, causing the fuel pressure to further decrease. Fuel pressure at idle slightly changes with the pressure, but the fuel pressure at idle speed can not be lower than that when the engine burning out indicated in Step 2.
14. This test is designed to determine if the fuel pressure too high is caused by fuel return pipe or fuel pressure regulator detent plug. Too densely status will set DTC P0132. Driving condition relating to too densely fuel instance include walking difficulty (then emitting with black smoke) and thick sulphur smell.

Fuel system pressure test

Step	Action	Numeric value	Yes	No
1	Has Powertrain On Board (OBD) System Check been executed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis (OBD) System Check
2	1. Installation of fuel pressure meter. 2. Turn on the ignition switch, and keep the engine burning out. 3. Use the malfunction diagnosis instrument to command the fuel pump to be turned on. 4. When the fuel pump is running, monitor the fuel pressure. Is the fuel pressure indicated by the fuel pressure meter within specified range?	Fuel Pressure 335 KPa at Idle	Go to Step 6	Go to Step 3
3	Is the fuel pressure indicated by the fuel pressure meter within the specified range?	335 KPa	Go to Step 14	Go to Step 4
4	Visual inspect the fuel system of oil leakage. Do you find and correct the status?	—	Go to Step 21	Go to Step 5
5	Is the fuel pressure indicated by the fuel pressure meter within the specified range?	0 KPa	Go to Step 7	Go to Step 16

Fuel system pressure test(Cont' d)

Step	Action	Numeric value	Yes	No
6	Note:When the fuel pump stalls for operation, the fuel pressure may slightly change, then is at stable and keeps unchanged. Observe the fuel pressure on the fuel pressure meter. Is fuel pressure decreased to below specified value within 10 minutes?	34 KPa	Go to Step 7	Go to Step 9
7	1. Release the fuel pressure. 2. Install the fuel pipe cut-out connector to between oil supply pipe, fuel return pipe and fuel distribution passage. 3. Open the fuel supply valve, close the return pipe valve. 4. Turn on the ignition switch, and keep the engine burning out. 5. Discharge air in the fuel system. 6. Use the malfunction diagnosis instrument to command the fuel pump to be turned on. 7. Wait for creation o fuel pressure. Does the fuel pressure meter indicate the fuel pressure stable within specified range?	335 KPa	Go to Step 19	Go to Step 8
8	1. Command the fuel pump to be turned on. 2. With the fuel pump running, close the fuel feed valve. Is the fuel pressure indicated by the fuel pressure meter within the specified range?	—	Go to Step 17	Go to Fuel Injector Balance Test
9	Is the fuel pressure suspected of dropping-off during acceleration, cruise, or hard cornering?	—	Go to Step 10	Go to Step 12
10	Visual inspect of the following components, whether they have blockage. • Fuel oil filter • Fuel feed pipe Do you find and correct any of the conditions?	—	Go to Step 21	Go to Step 11
11	1. Remove the fuel pumpRefer to Electric Fuel Pump Replacement 2. Visual Inspection of the Following Components: • Is the fuel pump strainer blocked, and is the position and installation on the fuel transmitter assembly correct. • If there is a leakage with the fuel pump hose • Inspect the fuel pump, whether they are suitable to this vehicle. Do you find and correct any of the conditions?	—	Go to Step 21	Go to Step 17
12	1. Start the engine. 2. Allow the engine to run at idle, until the engine reaches the normal operation temperature. If the fuel pressure decreases to be within the specified range?	21-69 kilopascal	Go to Symptom	Go to Step 13

Fuel system pressure test(Cont' d)

Step	Action	Numeric value	Yes	No
13	1. Disconnect the fuel pressure regulator vacuum hose. 2. When the engine runs at idle, allow the 12-14 inch vacuum to act to the fuel pressure regulator. If the fuel pressure is decreased to be within the specified range?	21-69 kilopascal	Go to Step 17	Go to Step 18
14	1. Release the fuel pressure. 2. Disconnect the fuel return pipe 3. Connect a particular long flexible fuel hose to the fuel return pipe outlet passage. 4. Place the flexible hose opening end to the gasoline container permitted. 5. Use the malfunction diagnosis instrument to command the fuel pump to be turned on. Is the fuel pressure indicated by the fuel pressure meter within specified range?	335 KPa	Go to Step 20	Go to Step 15
15	Visual inspection of fuel outlet passage, if they are blocked. Do you find and correct any of the conditions?	—	Go to Step 21	Go to Step 19
16	Visual Inspection of the Following Conditions: <ul style="list-style-type: none"> Fuel oil filter blockageRefer to Oil Duct and Fuel Filter Replacement Fuel oil pipe blockedRefer to Fuel Feed Hose/Hard Pipe Replacement (filter to the engine) Fuel Pump Strainer blockage Fuel Pump Flexible Pipe LeakageRefer to Electric Fuel Pump Replacement Do you find and correct any of the conditions?	—	Go to Step 21	Go to Fuel Pump Circuit Diagnosis"
17	Change fuel oil pumpRefer to Electric Fuel Pump Replacement Is the repair completed?	—	Go to Step 21	—
18	Determine and repair the fuel pressure regulator vacuum leakage Is the repair completed?	—	Go to Step 21	—
19	Change fuel pressure regulatorRefer Fuel Pressure regulator Replacement Is the repair completed?	—	Go to Step 21	—
20	Determine and exclude blockage in the fuel return pipe. Is the repair completed?	—	Go to Step 21	—
21	1. Release the fuel pressure. 2. Restore the fuel system to the original status. 3. Installation of fuel pressure meter. 4. Turn on the ignition switch, and keep the engine burning out. 5. Use the malfunction diagnosis instrument to command the fuel pump to be turned on. 6. When the fuel pump is running, monitor the fuel pressure. Does the fuel pressure meter indicate the fuel pressure stable within specified range?	335 KPa at idle	System OK	Go to Step 2

6.4.4.66 Fuel Injector Coil Test-engine coolant temperature (ECT) between 10-35 °C (50-95 °C)

Circuit description

Engine Control Module (ECU) utilizes the driver control fuel injector control circuit. Fuel injector fuse provides power supply to fuel injector, and controls the module grounding through the engine. The driver controls the fuel injector grounding circuit, and allows for fuel pulse.

Diagnostic aid

Test the engine fuel injector harness if there exists the following conditions:

- Poor contact of terminals.
- Inspect the harness connector if there exists the following conditions:
 - Terminal loosen
 - Fit inappropriate
 - Broken locks
 - Improperly formed or damaged terminals
 - Poor terminal-to-wire connection
- Use the appropriate match terminal to test tensile for appropriateness.

- Wiring harness damage

Inspect the wiring harness for damage.

Test Description

The step number in the following number malfunction diagnosis table:

2. Engine Coolant temperature (ECT) affects the fuel injector resistance and fuel injector detector detects the malfunction fuel injector ability. If the engine coolant temperature is within specified value, refer to Fuel Injector Coil Test- Engine coolant temperature (ECT) is between 10-35°C"
3. Due to current initial fluctuation, the indication on the DMM in the first 1 second is not surely accurate. Therefore, the lowest voltage indicated by the DMM after the 1st second should be recorded. Voltage indication on the DMM is between the specified value. Refer to examples. Owing to fuel injector winding preheating and resistance change, the voltage indicated on the DMM may increase during the whole test process. Abnormal reading shows there is interruption exists in the fuel injector, and the fuel injector must be changed. Fuel injector exceeding the specified range must be regarded as having problem, and it must be changed.

Resistance (ohm)	Voltage indicator under 10°C-35°C (50°F-95°F)	
	5.7-6.6	
Fuel injector number	Voltage reading	Pass/Failure
1	6.3	Pass
2	5.6	Failure
3	6.2	Pass
4	6.1	Pass

Fuel injector coil test-engine coolant temperature(ECT), between 10°C-35°C (50°F-95°F)

Step	Action	Numeric value	Yes	No
1	Has Powertrain On Board(OBD) System Check been executed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis (OBD) System Check
2	1. Use malfunction diagnostic instrument to monitor the engine coolant temperature parameter 2. When the engine is turned OFF, TURN ON the ignition If measured value is between the specified value?	10°C-35°C (50°F-95°F)	Go to Step 6	Go to fuel injector coil test - engine cooling temperature (ECT) exceeds 10°C-35°C (50°F-95°F)
3	Note:Fuel system may not be applied with pressure.Refer to Fuel Pressure Release Pressure 1. Install J39021 fuel injector coil/equalizer tester, J39021-210 fuel injector selector switch box and J39021-410 fuel injector coil test wiring harness. 2. Select the coil test on the fuel injector tester 0.5AMP position 3. Connect the lead of the DMM to the fuel injector tester and select DC voltage tenths scale. 4. Select an fuel injector on the J39021-210 injector selector switch box. 5. Press down Press Start Test button on the fuel injector coil/equalizer tester. 6. After the first second, record the lowest reading. 7. For each of the fuel injector, repeat this test. Is the fuel injector reading abnormal or exceeds the specified value range?	5.7-6.6v	Go to Step 4	Go to Fuel Injector Balance Test
4	1. Remove the upper intake manifold. 2. Test the fuel injector wiring harness between connector and fuel injector for the following conditions: <ul style="list-style-type: none"> • There exists an open or short circuit to the ground in the fuel injector wiring harness. • Poor terminal contact in the fuel injector. Do you find and correct any of the conditions?	—	Go to Step 6	Go to Step 5
5	Replace the malfunction fuel injector. Is the replacement operation finished?	—	Go to Step 6	—
6	If there still exists any driving performance problem?	—	Go to corresponding diagnostic malfunction code table	System OK

6.4.4.67 Fuel injector coil test -engine Coolant temperature (ECT) exceeds 10- 35 °C (50-95degrees Fahrenheit)

Circuit description

Engine Control Module (ECU) utilizes the driver control fuel injector control circuit. Fuel injector fuse provides power supply to the fuel injector, and controls the module grounding through the engine. The driver controls the fuel injector grounding circuit, and allows for fuel pulse.

Diagnostic aid

Test the engine fuel injector harness if there exists the following conditions:

- Poor contact of terminals.
- Inspect the harness connector if there exists the following conditions:
 - Terminal loosen
 - Fit inappropriate
 - Broken locks
 - Terminal deformation or damage and failure with the wiring connection
- Use the appropriate match terminal to test tensile for appropriateness.

- Wiring harness damage

Inspect the wiring harness for damage.

Test Description

The step number in the following number malfunction diagnosis table:

2. Engine Cooling Liquid Temperature (ECT) affects the fuel injector resistance and fuel injector detector detects the malfunction fuel injector ability.
3. Due to current initial fluctuation, the indication on the DMM in the first 1 second is not surely accurate. Therefore, the lowest voltage indicated by the DMM after the 1st second should be recorded. Owing to fuel injector winding preheating and fuel injector winding resistance change, the voltage indicated on the DMM may increase during the whole test process. Abnormal voltage reading or comparatively large unstable voltage pulse indicates fuel injector internal poor contact. Find out the highest voltage as the reference below 95v from the recorded voltage, then calculate the difference of the voltage of each fuel injector nozzle and reference voltage. If it is greater than 0.6v, that indicates it should be changed due to failure and the nozzle with measured voltage higher than 9.5v also indicates a malfunction.

Highest voltage reading		Acceptable difference higher/lower than 10°C-35°C (50°F-95°F)	
6.9v		6.9v	
Injector number	Voltage	Difference value	Pass/Failure
1	9.8	—	Failure
2	6.6	0.3	Pass
3	6.9	0	Pass
4	5.8	1.1	Failure

Fuel injector coil test - engine coolant temperature (ECT) exceeds 10°C-35°C (50°F-95°F)

Step	Action	Numeric value	Yes	No
1	Has Powertrain On Board(OBD) System Check been executed?	—	Go to Step 2	Go to Powertrain On Board Diagnosis (OBD) System Check

Fuel injector coil test - engine coolant temperature (ECT) exceeds 10°C-35°C (50°F-95°F) (Cont' d)

Step	Action	Numeric value	Yes	No
2	1. When the engine is turned OFF, TURN ON the ignition 2. Use malfunction diagnostic instrument to monitor the engine cooling liquid temperature parameter If measured value is between the specified value?	10°C-35°C (50°F-95°F)	Go to Step 3	Go to Fuel Injector Coil Test - engine cooling temperature (ECT) exceeds 10°C-35°C (50°F-95°F)
3	Note: Fuel system may not be applied with pressure. Refer to Fuel Pressure Release Pressure 1. Install J39021 fuel injector coil/equalizer tester, J39021-210 fuel injector selector switch box and J39021-410 fuel injector coil test wiring harness. 2. Select the coil test on the fuel injector tester 0.5AMP position 3. Connect the lead of the DMM to the fuel injector tester and select DC voltage tenths scale. 4. Select an fuel injector on the J39021-210 injector selector switch box. 5. Press down Press Start Test button on the fuel injector coil/equalizer tester. 6. After the first second, record the lowest reading. 7. For each of the fuel injector, repeat this test. Is the fuel injector reading abnormal or exceeds the specified value range?	9.5v	Go to Step 5	Go to Step 4
4	1. From the recorded readings, identify the highest voltage. 2. Subtract all other voltage reading from the highest recorded voltage respectively. Is there exists any difference exceeding the specified value?	6.9v	Go to Step 5	Go to Fuel Injector Balance Test
5	1. Remove the upper intake manifold. 2. Test the fuel injector wiring harness between connector and fuel injector for the following conditions: <ul style="list-style-type: none"> There exists an open or short circuit to the ground in the fuel injector wiring harness. Poor terminal contact in the fuel injector. Do you find and correct any of the conditions?	—	Go to Step 7	Go to Step 6
6	Replace the malfunction fuel injector. Refer to Electric Fuel Pump Replacement Is the replacement operation finished?	—	Go to Step 7	—
7	If there still exist any driving performance problem?	—	Go to corresponding diagnostic malfunction code table	System OK

6.4.4.68 Fuel Tank Leakage Inspection

remarks

- Before performing fuel tank leakage inspection, place the chemical extinguisher near the working area.
 - Before removing the suspected leak fuel tank, identify the fuel hose not leaking to the fuel tank. Additionally, you still need to identify no leakage around the fuel transmitter pad.
1. Leak of fuel system pressure. Refer to Fuel Pressure Release Pressure
 2. Remove the fuel tank, refer to Fuel Tank Replacement
 3. Block all outlet as per the following steps:
 - Install the filler port journal and ventilation hose, upper journal assembly, and install the filler port cover cap.
 - Use seal to install the fuel tank transmitter, and block the oil duct with the male plug.
 - Install a short oil duct to the fuel tank oil gauge breather pipe.
 4. Apply air pressure to the fuel tank vent hole duct. Allow the pressure to reach 7-10 kilopascal (1-1.5p/sq.mi.), and clamp the fuel filler hose to maintain the pressure.
 5. Use soap or immersed method to inspect the leakage position. If leakage observed, replace the fuel tank. Refer to Rear Window Replacement.

6.4.4.69 Alcohol/fuel pollution diagnosis

Alcohol thickness in fuel greater than 10%, and it is harmful to the fuel system components, which could cause driving performance malfunction, such as gasp, insufficient power, flat spot, and not start etc.

The malfunction cause lies in the fuel system corrosion, further to cause the fuel filter blockage, rubber part damage and/or air-fuel mixture air become thinner.

Type and thickness of alcohol employed in the finished fuel is different with each other. Effect of some alcohol type to the fuel system components is higher than other alcohol type. If the higher alcohol thickness is suspected in the fuel, causing the driving performance to decrease, then the following procedures can be employed to detect the alcohol in the fuel.

remarks

Fuel sample should be drawn from the fuel tank bottom, allowing that any moisture in the fuel tank could be detected. Sample must be clear and transparent. If the sample is feculence or polluted by water (a layer of

water appears on the sample lower part), this procedure should not be employed and fuel system must be clean.

1. Use a particular oil duct of 100 millilitre with 1 millilitre scale to fill 90 millilitre of fuel.
2. Fill 10 millilitre of water to allow it reaching full scale of 100 millilitre and install the plug.
3. Shake with great force the oil duct for 10-15 seconds.
4. Release pressure among them, and carefully hear the sound of plug.
5. Reinstall the plug, and shake with great force the oil duct for 10-15 seconds.
6. Place the oil duct on the horizontal surface for 5 minutes, allowing the liquid to produce delamination.

If there is alcohol in the fuel, the capacity of the lower part (including alcohol and water) will exceed 10 millilitre. For example, if the bottom layer is increased to 15 millilitre, this indicates at least 5 percent alcohol in the fuel. Actual alcohol content may be slightly much more, because this procedure has not completely absorbed alcohol in the fuel.

The malfunction cause lies in the fuel system corrosion, further to cause the fuel filter blockage, rubber part damage and/or air-fuel mixture air become thinner.

Type and thickness of alcohol employed in the finished fuel is different with each other. Effect of some alcohol type to the fuel system components is higher than other alcohol type. If the higher alcohol thickness is suspected in the fuel, causing the driving performance to decrease, then the following procedures can be employed to detect the alcohol in the fuel.

6.4.4.70 Electric ignition (EI) system diagnosis

Refer to Engine Control Module Schematic Diagram in Wiring System

Circuit description

Auxiliary ignition inspection test for existence of spark plug, spark wiring or ignition control module and malfunction of a coil. This table needs J26792 spark tester (ST125)

Electric ignition mechanism (EI) System Malfunction Diagnosis

Step	Action	Numeric value	Yes	No
1	Whether having executed Powertrain On Board(OBD) System Check?	—	Go to Step 2	Go to Powertrain On Board Diagnosis (OBD) System Check
2	Use (J26792) spark tester to test each cylinder for spark. If you observe any cylinder without spark?	—	Go to Step 3	Go to Step 6
3	<i>Notice:</i> Spark to ignition control module wiring electroarcing or ignition coil to ignition control electroarcing may cause flat spot or not start Inspect and test the spark plug wire of affected cylinder, ignition coil and spark plug for short to ground or ignition to grounding. If carbon creepage or corrosion appears, replace the affected 2 components. Do you find and correct any of the conditions?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	Go to Step 4
4	Test the affected spark plug wire resistance for appropriateness. Replace the spark plug wire quite different with the specification. Do you find and correct any of the conditions?	1,968ohm/m	Go to Powertrain On Board Diagnosis (OBD) System Check	Go to Step 5
5	Replace the affected cylinder coil with a known good coil. If the malfunction follows the affected coil, replace the coil. Do you find and correct any of the conditions?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	Go to Step 10
6	Inspect the spark plug wiring for appropriateness, and ignition sequence for correctiveness. If the spark plug wiring not correct, you need to rearrange the wiring. Do you find and correct any of the conditions?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	Go to Step 7
7	Use the DMM to inspect the spark plug for internal short to ground. Replace any grounded spark plugs found Do you find and correct any of the conditions?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	Go to Step 8
8	1. Remove the spark plug. 2. Inspect the spark plug for damage. 3. If any spark plug damage are found, replace the affected spark plugs. Is the replacement operation finished?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	—
9	1. Disconnect the ignition control module 2. Turn on the ignition switch 3. Use reliable test lamp connected to ground to probe the ignition power supply circuit of the ignition control module. Does the test light illuminate?	—	Go to Step 10	Go to Step 12

Electric ignition mechanism (EI) System Malfunction Diagnosis(Cont' d)

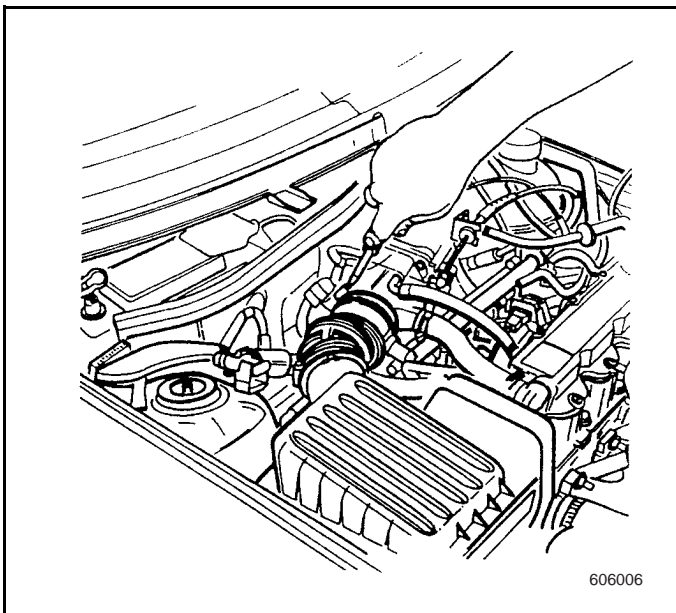
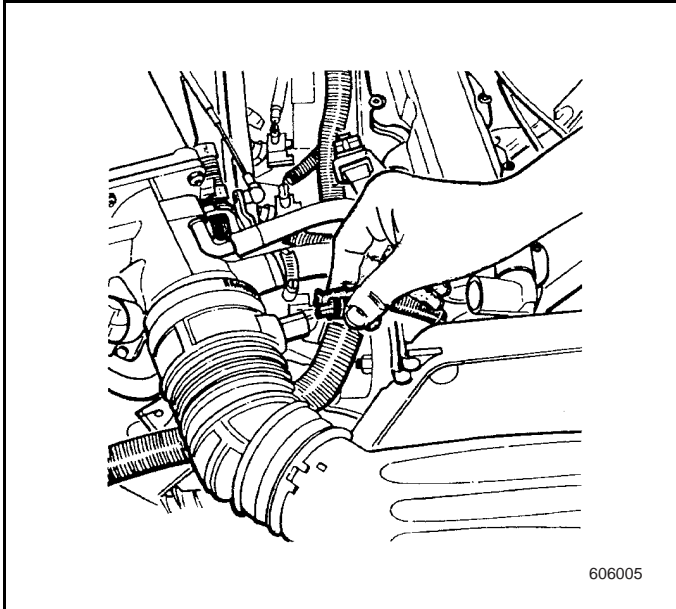
Step	Action	Numeric value	Yes	No
10	1. Ensure the accumulator voltage to be within the specified range. 2. Turn off the ignition switch 3. Connect the DMM to the ignition control module wiring harness connector between the 58X high voltage reference circuit and the 58X low voltage reference circuit. 4. Crank the engine while observing the AC Duty cycle(%) The DMM indicates If the AC Duty cycle occurs?	—	Go to Step 13	Go to Step 11
11	Test the 58X curve crank sensor circuit for the following conditions: <ul style="list-style-type: none"> • Opened • Short to ground • Short to voltage • Short between the 58X high voltage reference and the 58X low voltage reference circuits. Repair any damage wire. Do you find and correct any of the conditions?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	Go to Step 14
12	Repair the open and short to ground malfunctions in the ignition power supply circuit of the ignition control module. Is the repair completed?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	—
13	Replace the ignition control module Is the replacement operation finished?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	—
14	Replace the 58X crank sensor. Is the replacement operation finished?	—	Go to Powertrain On Board Diagnosis (OBD) System Check	—

6.4.5 Repair Instructions

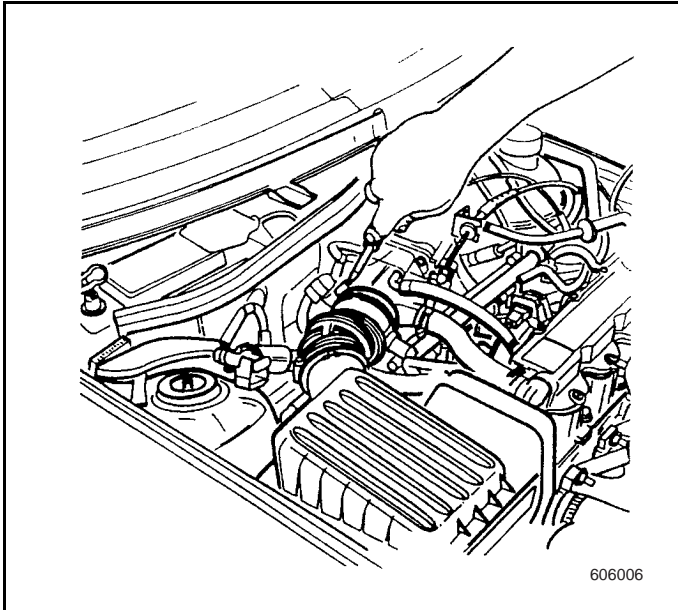
6.4.5.1 Intake Air System Replacement

Removal Procedure

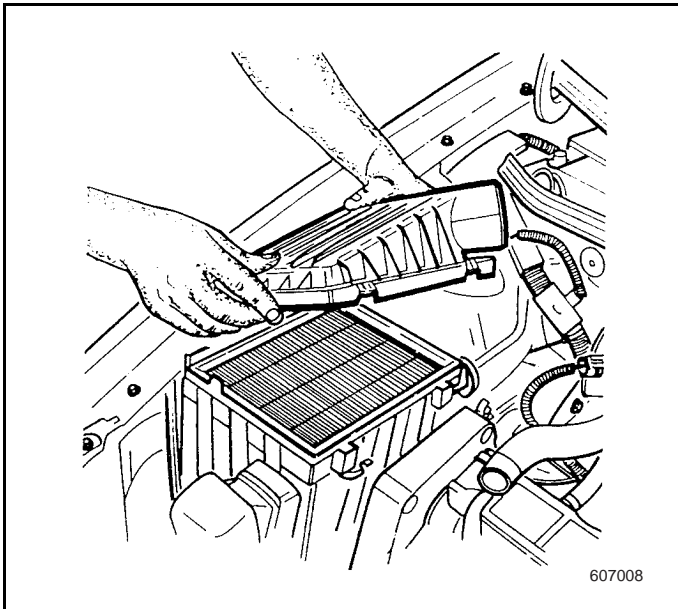
1. Disconnect the negative wire of the accumulator.
2. Pull down out the intake air temperature sensor connector.



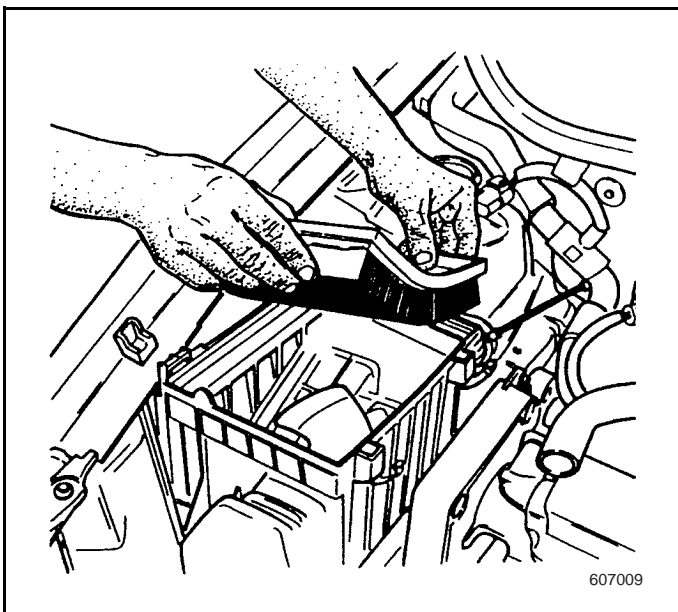
3. Screw down the air filter hose clamp



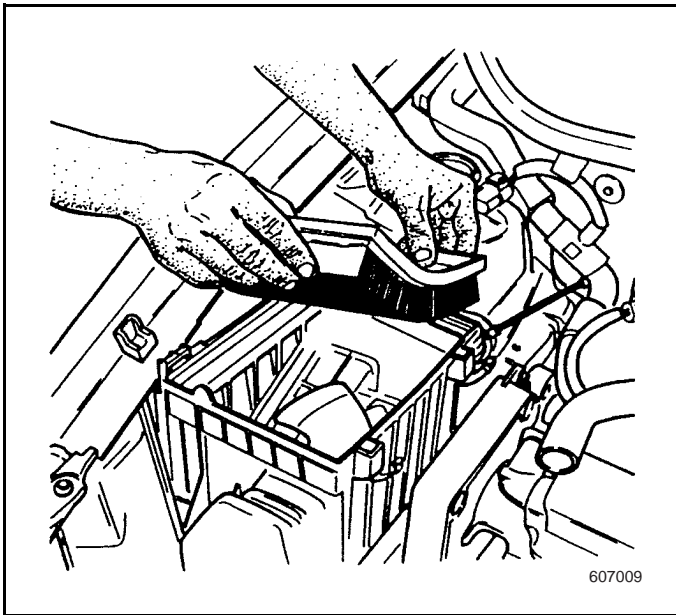
4. Take off the air filter hose clamp



5. Take off the air filter inlet pipe.
6. Loosen the air filter cover clamp, and take off the air filter cover.



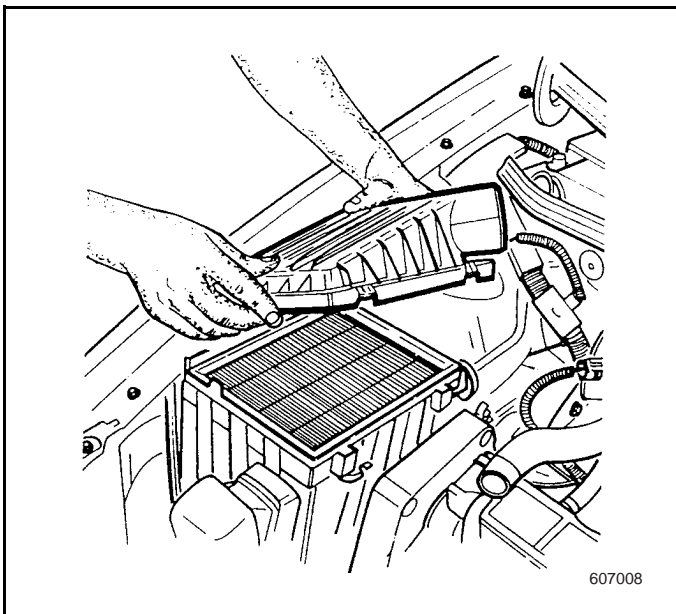
7. Take off the air filter
8. Take off the air filter box.



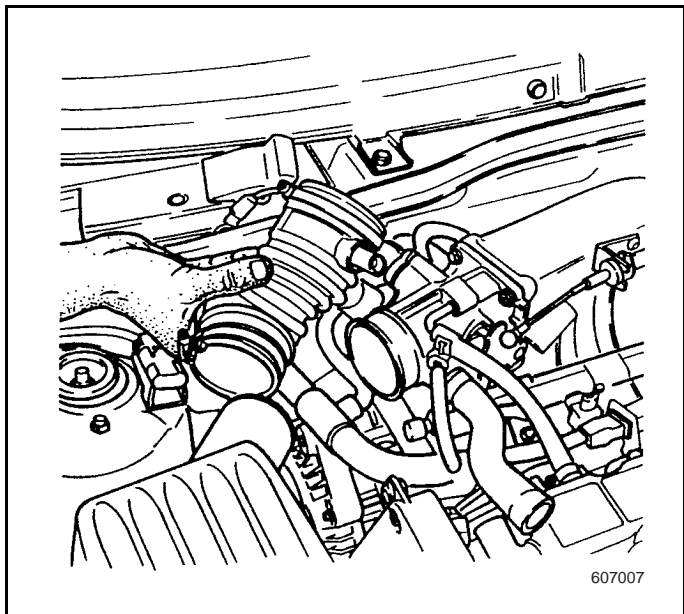
Installation Procedure

1. Install the air filter box.
2. Install the air filter.
3. Use the compressed air to clean the core filter from inside to outside. Maximum compressed air pressure shall not exceed 484 kilopascal.
4. Clean the inner surface of the air filter box.

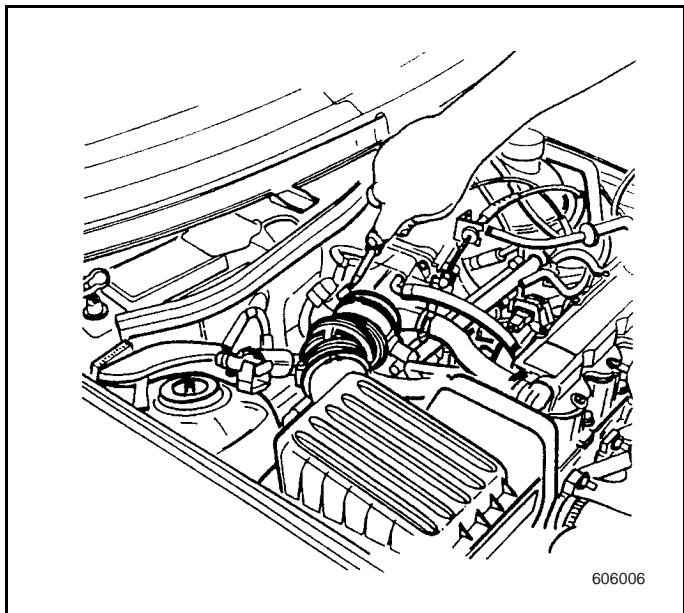
Note: When the air filter element is fouled, it will not increase the fuel consumption or carbon monoxide emission, but it will cause the engine power to decrease.



5. Install the air filter cover.
6. Install the air filter inlet pipe.



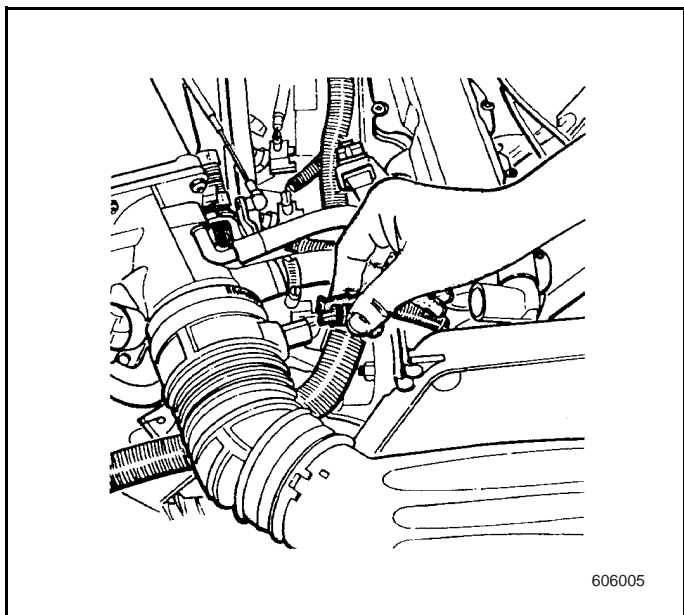
7. Install the air filter hose.
8. Check the air filter hose for hole, cut, coil cuckling, or possible damaged hose abrasion point.



9. Install the air filter hose clamp.

Tightening

Tighten the air filter hose clamping screw to 2.5-3.5 N•m



10. Connect the air intake temperature sensor to the wiring harness.

6.4.5.2 Intake air temperature sensor replacement

Removal Procedure

1. Disconnect the air temperature sensor power supply.
2. Take out the air temperature sensor from the hose.

Installation Procedure

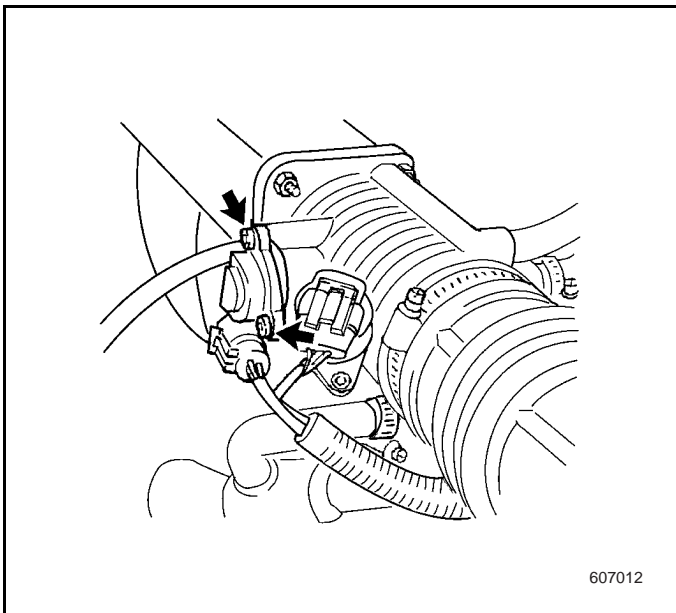
1. Install the air temperature sensor to the air filter hose until to the sensor limits.

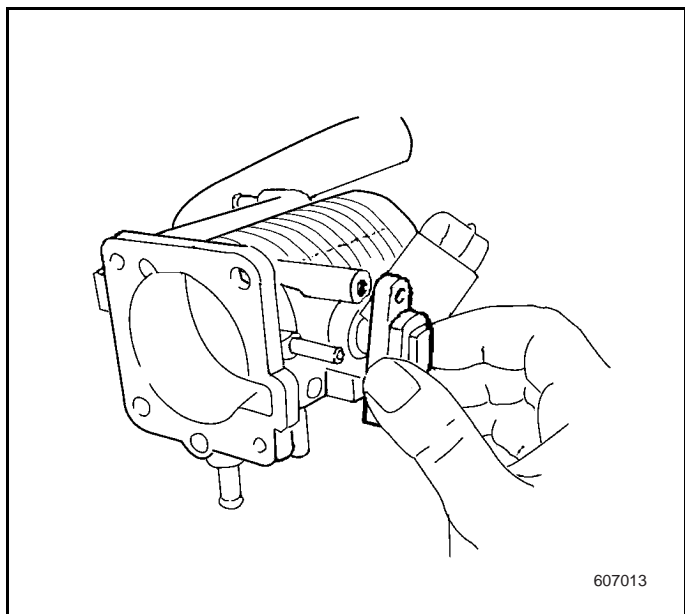
Note: Use lithium soap to install the sensor, but do not use ore base grease (petroleum). Plug the wiring harness to the power supply connector of the air temperature sensor.

6.4.5.3 Throttle Position Sensor Replacement

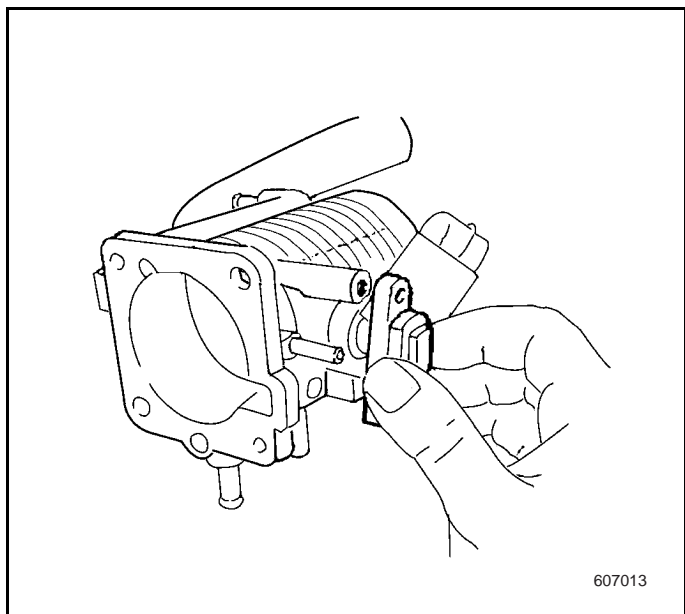
Removal Procedure

1. Disconnect the wiring harness from the power supply connector of throttle position sensor.





2. Screw down the throttle position sensor bolt.
3. Carefully take down the throttle position sensor.



Installation Procedure

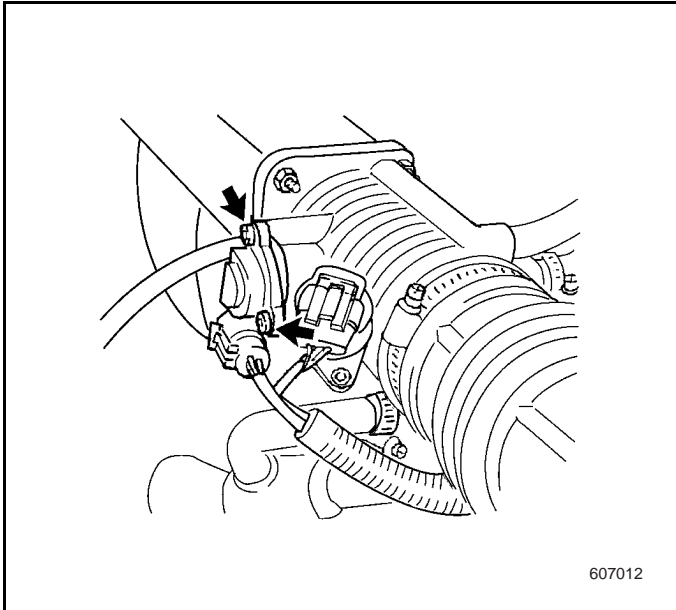
1. Install the throttle position sensor.

Note: Inspect the valve cross latch if it is tightly secured on the sensor.

2. Connect and tighten the throttle position sensor screw.

Tightening

Tighten the throttle position sensor bolt to 3N•m.



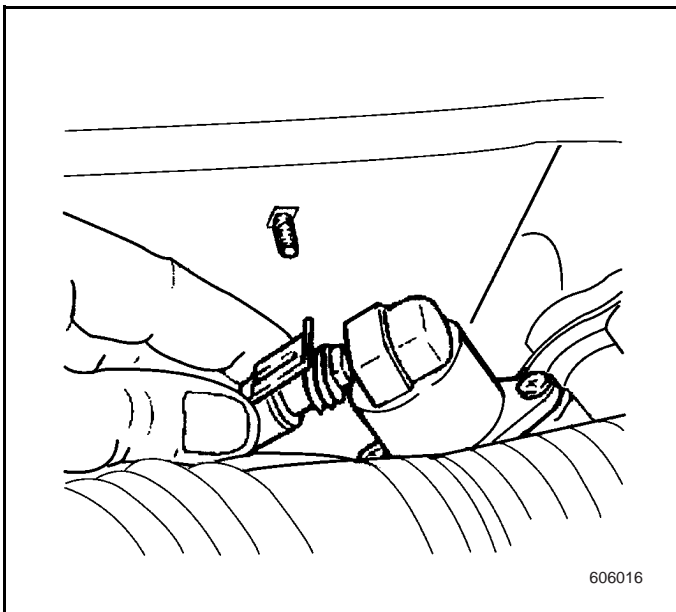
3. Insert the electric connector to the throttle position sensor.

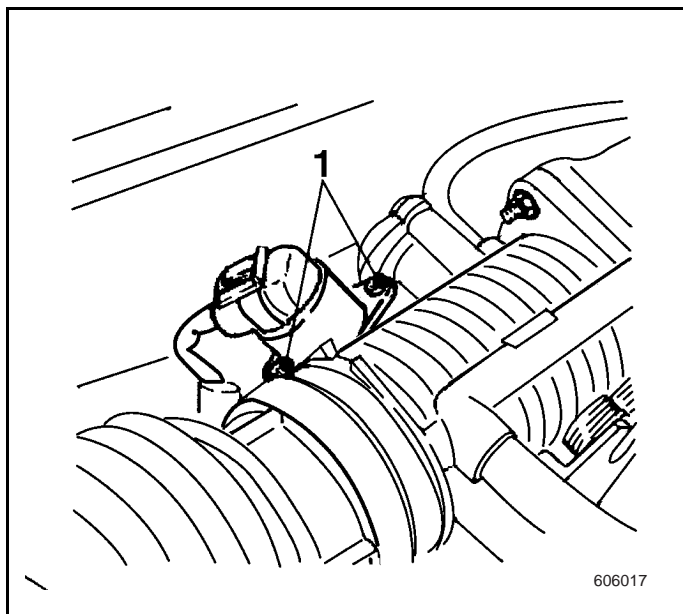
6.4.5.4 Idle Air Control Valve Replacement

Removal Procedure

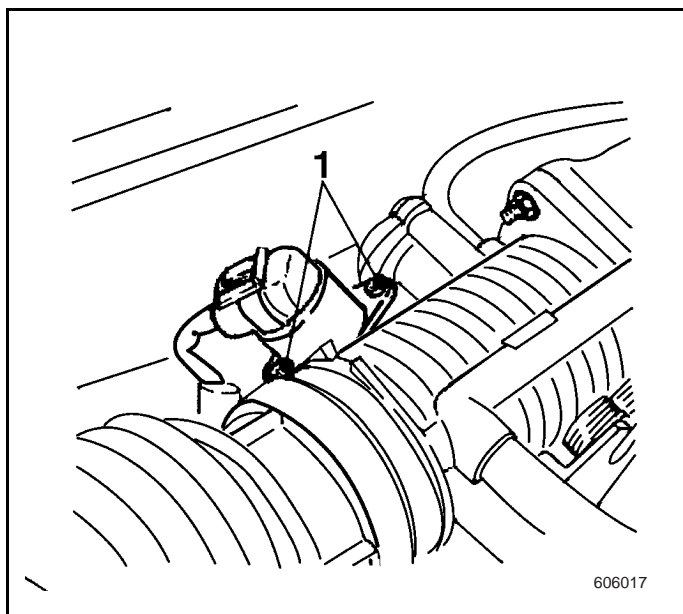
Caution: Before removing IAC valve connector, the ignition start key must be turned off for at least 10 seconds. During this period of time, the valve returns to the static position.

1. Disconnect the electric connector of idle air control valve from the wiring harness.





2. Screw down the idle air control valve bolt, and take it off.
3. Carefully take the idle air control valve from the throttle body.

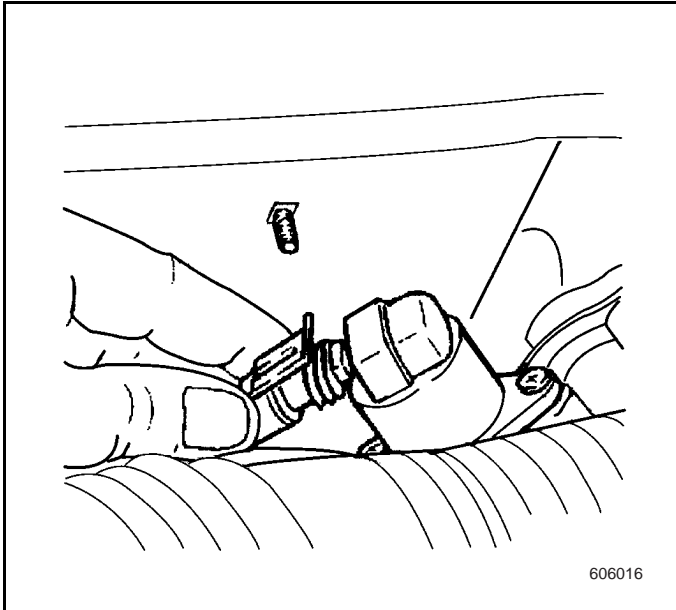


Installation Procedure

1. Use a sealing ring (if any) to install the idle air control valve.
2. Use the fixture adhesive (Leitai) to install the idle air control valve screw and tighten it.

Tightening

Tighten the idle air control valve screw to 3N•m.

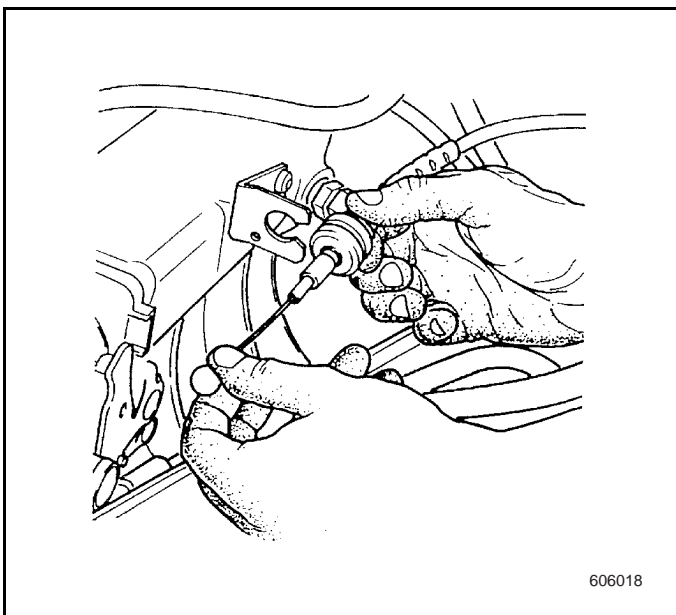


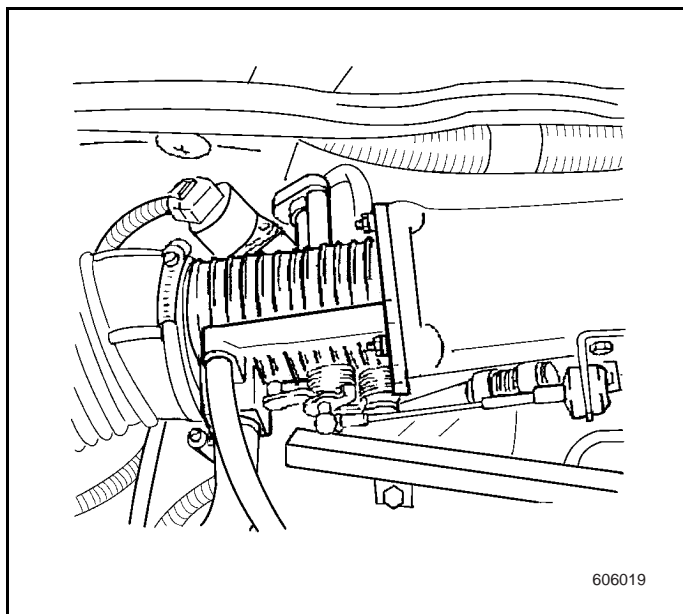
3. Connect the wiring harness to the idle air control valve connector.

6.4.5.5 Throttle body replacement

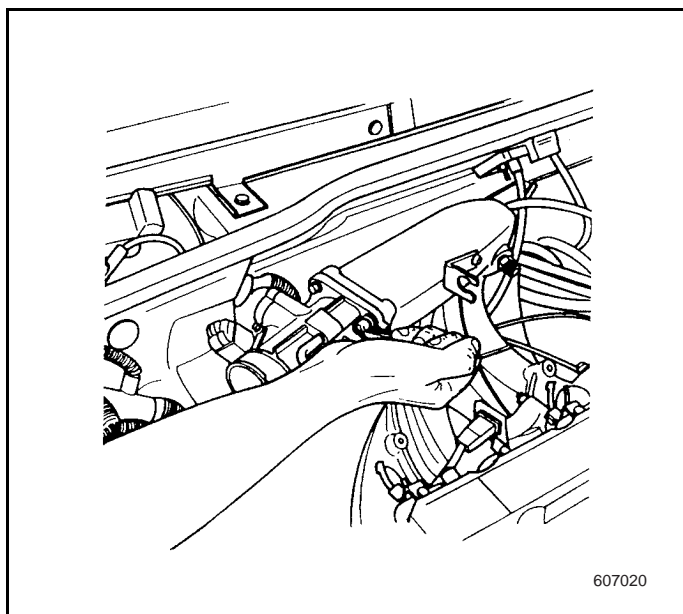
Removal Procedure

1. Disengage the throttle cable and throttle body camshaft and inlet manifold bracket.

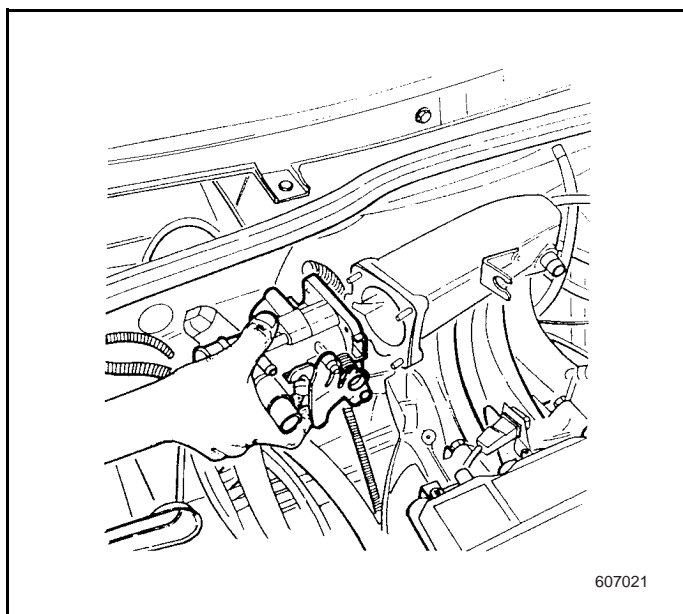




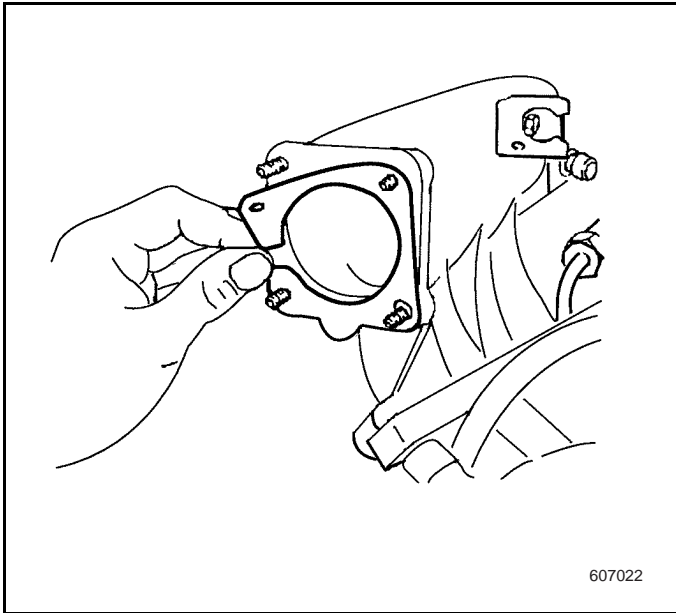
2. Allow the crankshaft positive (positive voltage) ventilation hose and camshaft bracket hood cover to be disconnected, to allow the vacuum hose and camshaft bracket hood cover to be disconnected.



3. Allow the canister purge pipe and throttle body to be disconnected.
4. Disconnect the throttle body heating pipe and throttle, use the commercial hose clip for clamping and carefully clean the throttle body.
5. Disconnect all electric connection of the throttle body
6. Disengage the return spring from the throttle body.
7. Screw off and take off the throttle body nut.



8. Carefully remove throttle body.

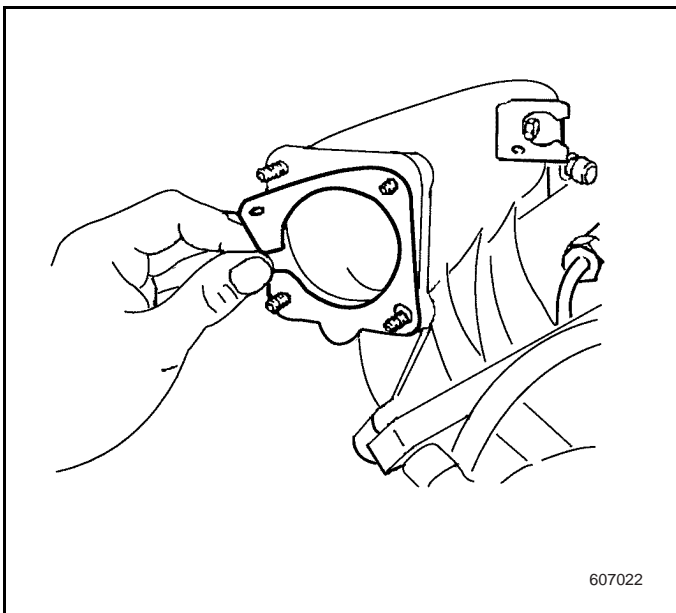


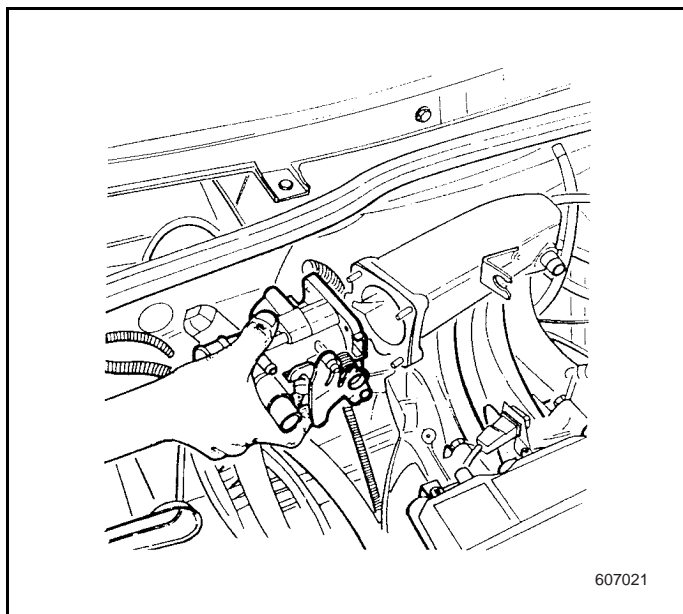
9. Carefully remove the throttle body gasket.

Installation Procedure

Note: Remove and clean residues on the gasket.

1. Install new gasket (component number: 90411524 or 92089888)

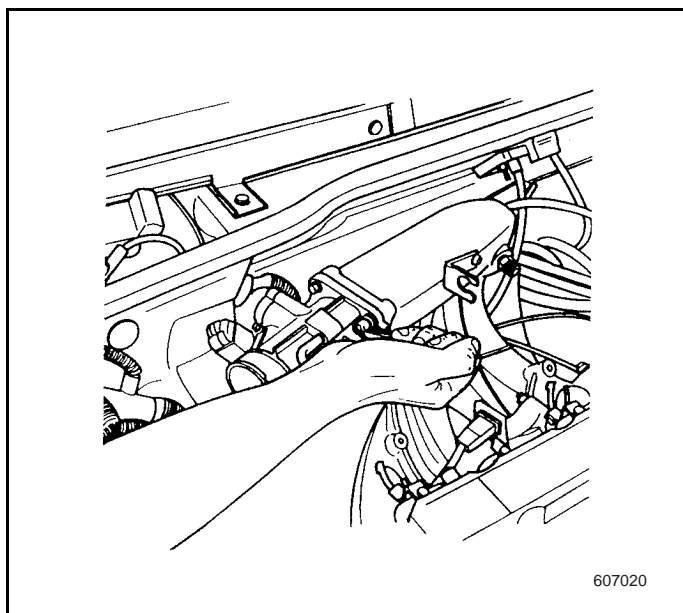




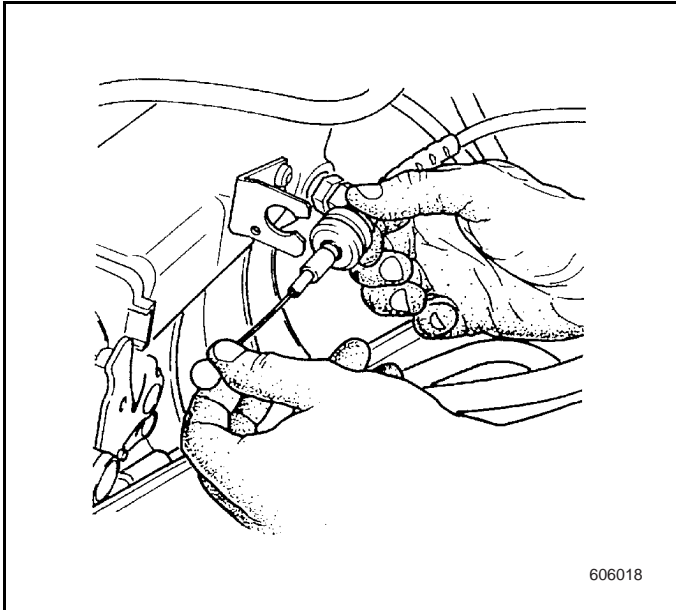
2. Install the throttle body, and fix the nut and tighten.

Tightening

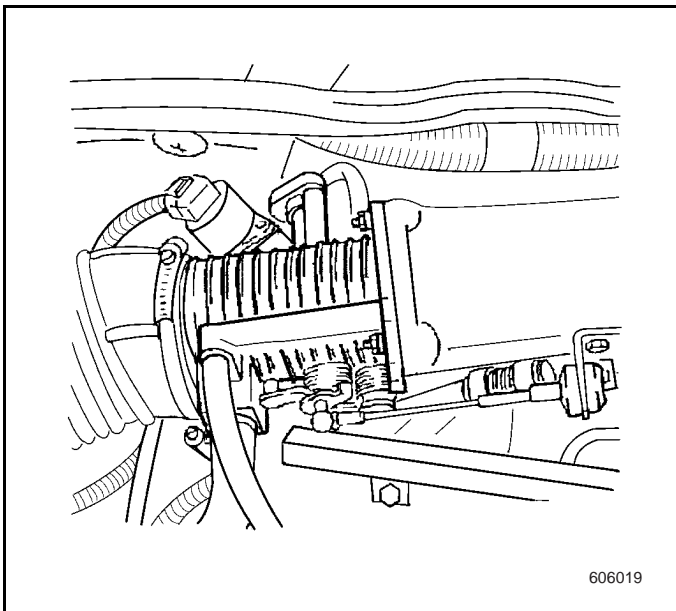
Tighten the throttle body nut to 9 N•m.



3. Install the throttle body return spring.



4. Connect the vacuum hose to the camshaft bracket hood cover, and connect the ventilation hose to the camshaft bracket hood cover.

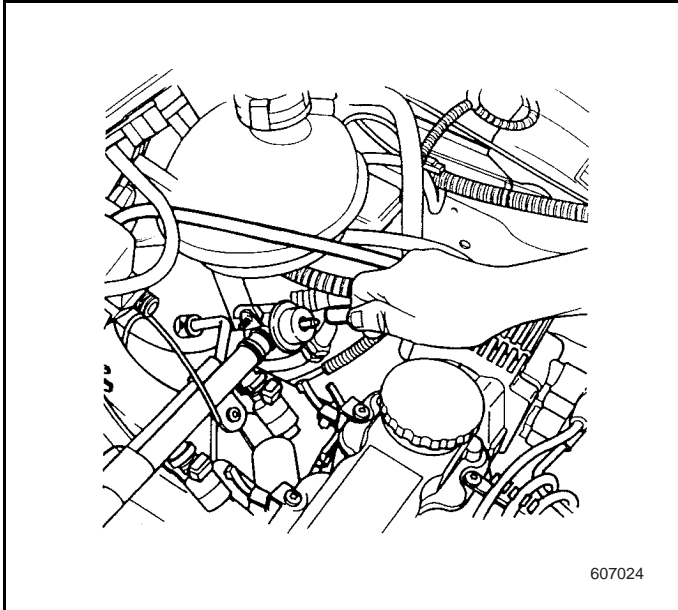


5. Connect the throttle cable and throttle body camshaft and inlet manifold bracket.
6. Connect the canister blowpipe.
7. Connect the throttle body heating pipe and throttle body.
8. Connect all electrical connection between the wiring harness and the throttle body.

6.4.5.6 Fuel Track Replacement

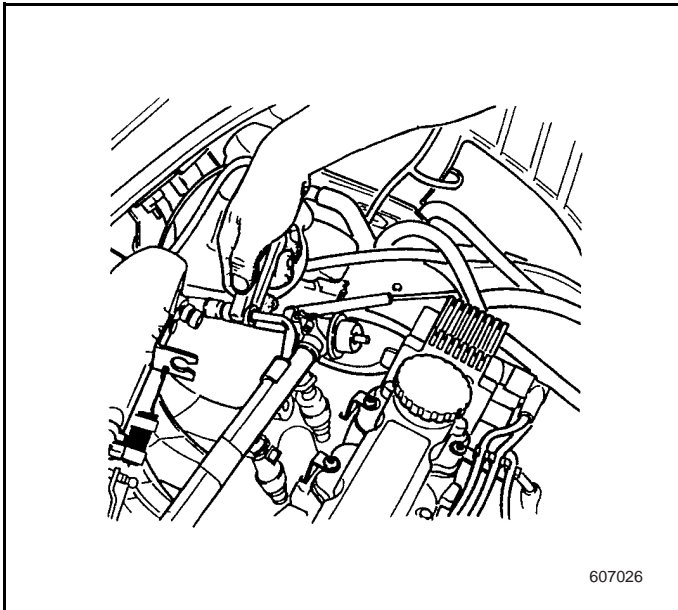
Removal Procedure

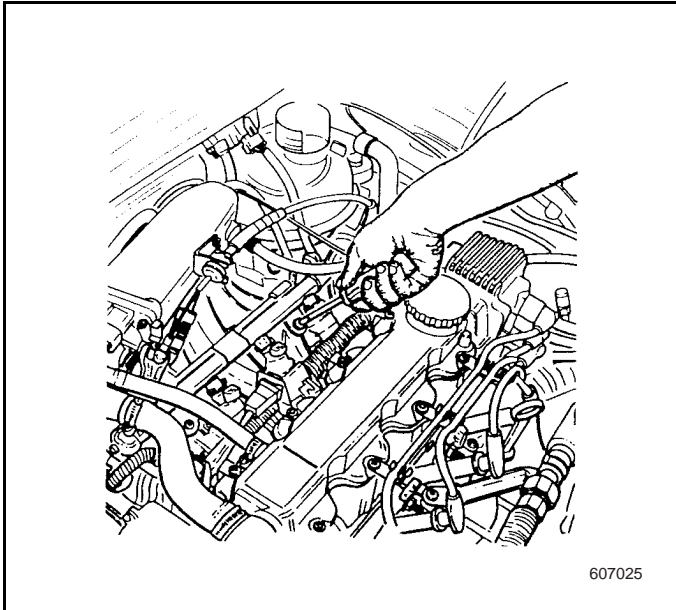
1. Disconnect the connector from the fuel injector.
2. Disengage the vacuum pipe and pressure regulator.



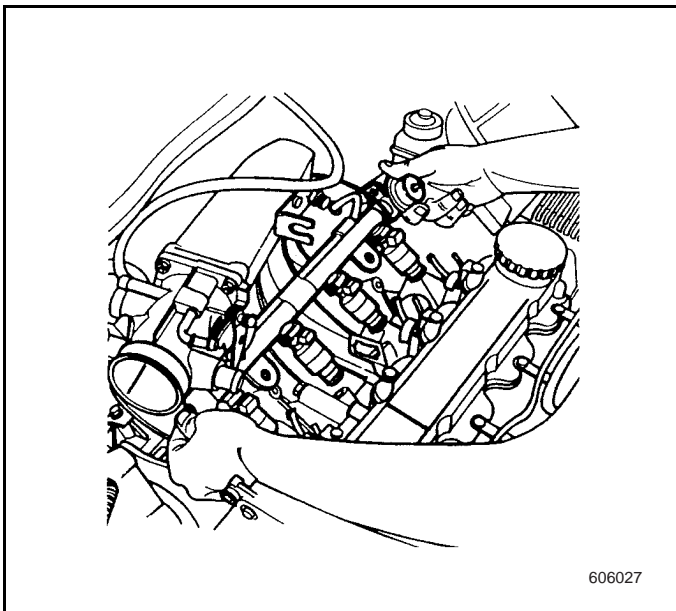
3. Use the special tool J-370088-A to take of the inlet and outlet oil passage pipe from the fuel distribution line.

Caution: Fuel in the system has been always under pressure, which must be released before removal of the oil line.





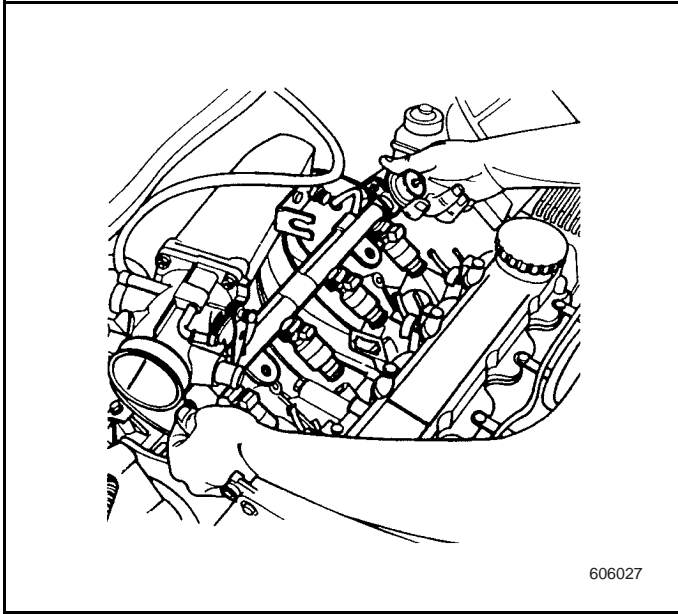
4. Screw down and take off bolts on the fuel distribution line.



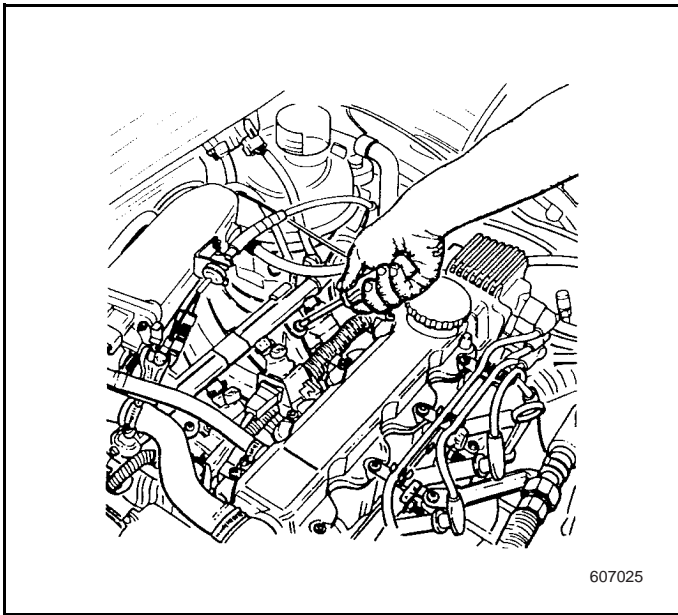
5. Take out the fuel rail together with fuel injector and pressure regulator. Carefully lift it up and avoid to damage of the fuel injector sealing ring.

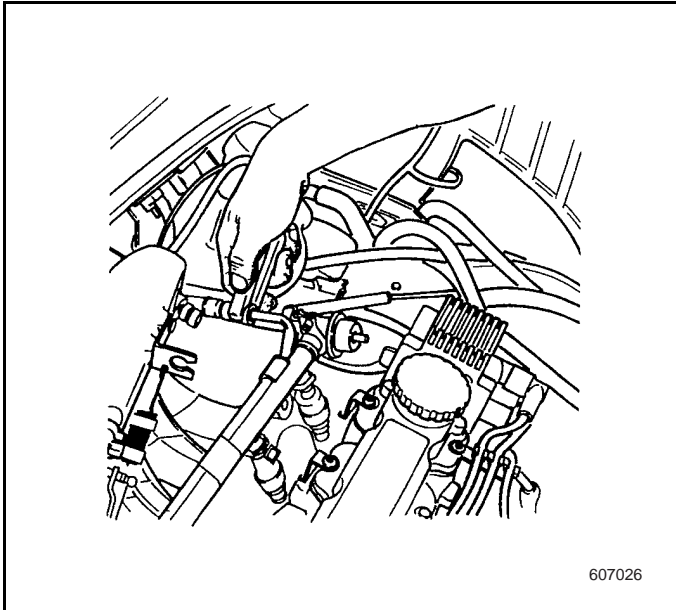
Installation Procedure

1. Install the fuel rail with fuel injector and pressure regulator together. Carefully lift it up and avoiding to damage of the fuel injector sealing ring. Use a thin layer of Vaseline to lubricate the sealing ring.

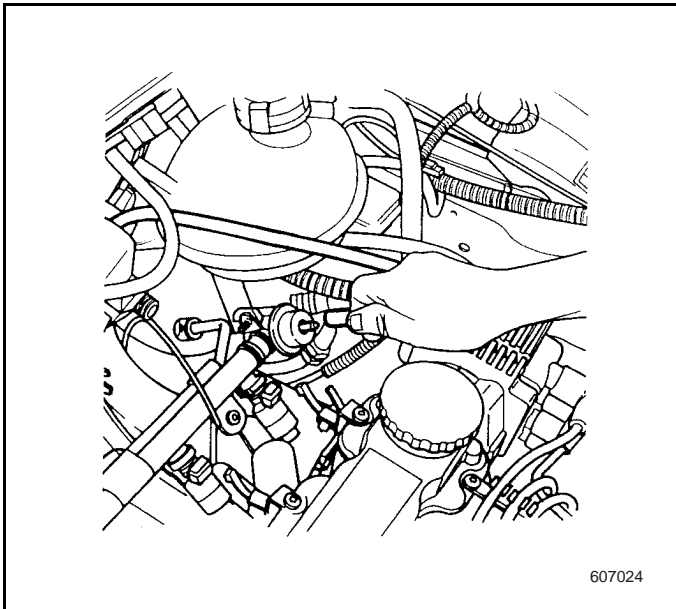


2. Install the fuel rail bolt and tighten
Tighten
Tighten the fuel rail to 10N•m.





3. Connect the vehicle oil line with the fuel rail inlet and outlet pipe.



4. Connect the vacuum pipe to the pressure regulator.
5. Connect the power supply connector of the fuel injector with the wiring harness.

6.4.5.6 Fuel Injector Replacement

Removal Procedure

1. Remove the fuel distribution line from the engine. Refer to Electric Fuel Rail Replacement
2. Remove the fuel injector clamp of the fuel injector of the fuel rail, remove the clamp with the screw driver.
3. Carefully remove the fuel injector from the fuel rail and avoiding damage of the sealing ring.

Installation Procedure

1. Carefully insert the fuel injector into the fuel rail, and inspect the sealing ring for deviation or kinks. Use a thin layer of Vaseline to lubricate the sealing ring.
2. Slide the fuel injector clamp toward the fuel rail until it is clamped tight.
3. Install the fuel rail. Refer to Electric Fuel Rail Replacement

6.4.5.8 Fuel Pressure regulator Replacement

Removal Procedure

1. Remove the fuel distribution line from the engine. Refer to Electric Fuel Rail Replacement
2. Screw down the pressure regulator from the fuel rail
3. Remove the pressure regulator from the fuel rail
4. Remove the pressure regulator gasket.

Installation Procedure

1. Install the pressure regulator gasket.
2. Install the pressure regulator to the fuel rail.
3. Tighten the pressure regulator on the fuel rail.

Tighten

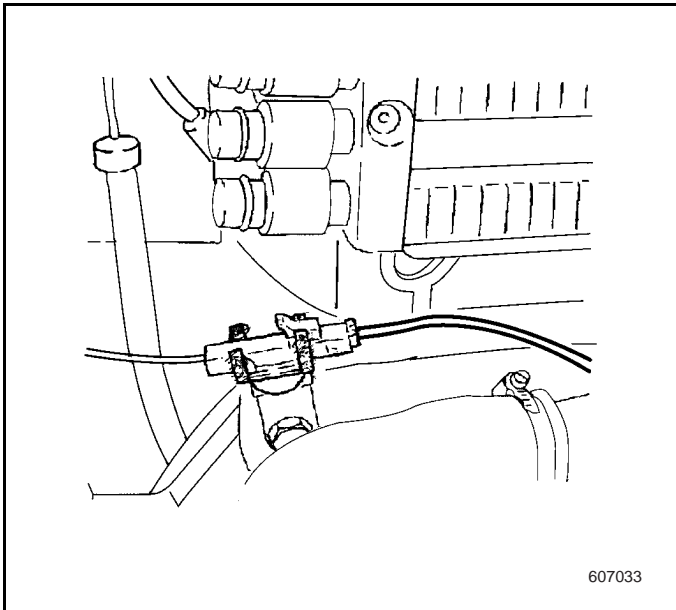
Tighten the fuel pressure regulator to 6N•m.

4. Install the fuel rail to the engine. Refer to Electric Fuel Rail Replacement

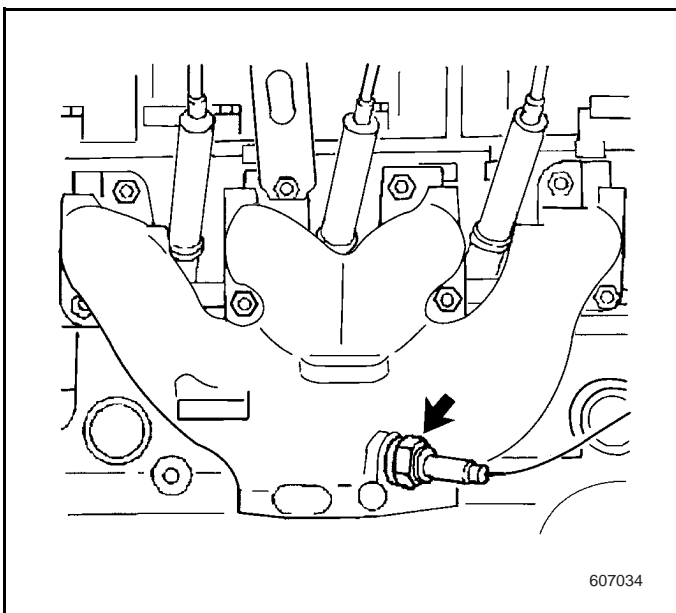
6.4.5.9 Oxygen Sensor Replacement

Removal Procedure

1. Take off the power supply of the wiring harness from the oxygen sensor.
2. Take off the oxygen sensor from the clamp bracket.



3. Screw down the oxygen sensor from the exhaust manifold.

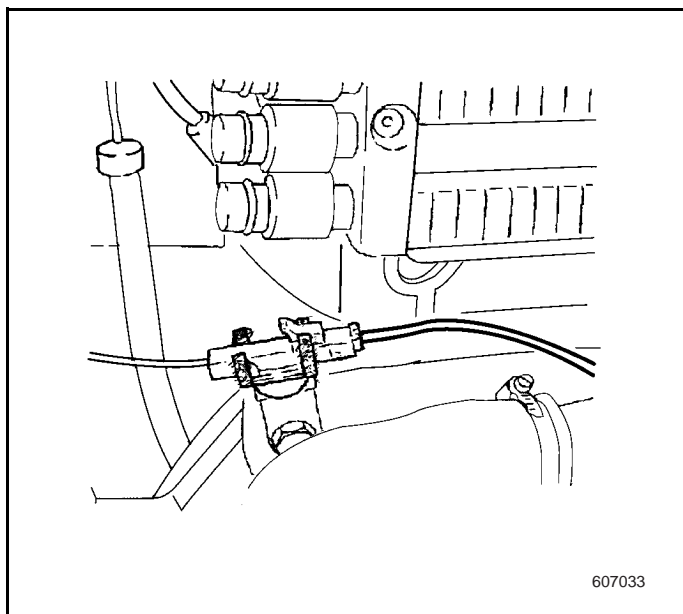
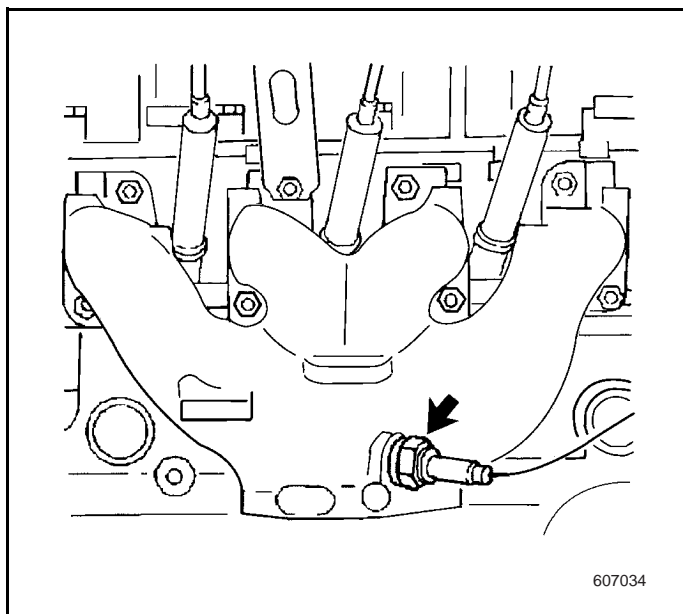


Installation Procedure

1. Install the oxygen sensor to the exhaust manifold and tighten.

Tightening

Tighten the oxygen sensor to 42 ± 4 N•m.

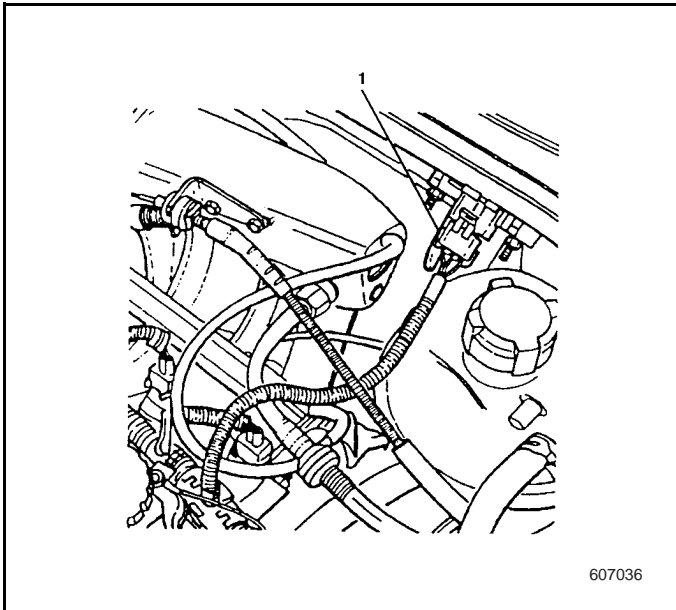


2. Connect the oxygen sensor connector to the holder bracket.
3. Connect the wiring harness with the oxygen sensor.

6.4.5.10 Intake Manifold Absolute Pressure Sensor (MAP) Replacement

Removal Procedure

1. Remove the electric connector and vacuum pressure hose from the manifold pressure sensor.
2. Screw down the tightening nut.
3. Remove the sensor from the front wall plate.



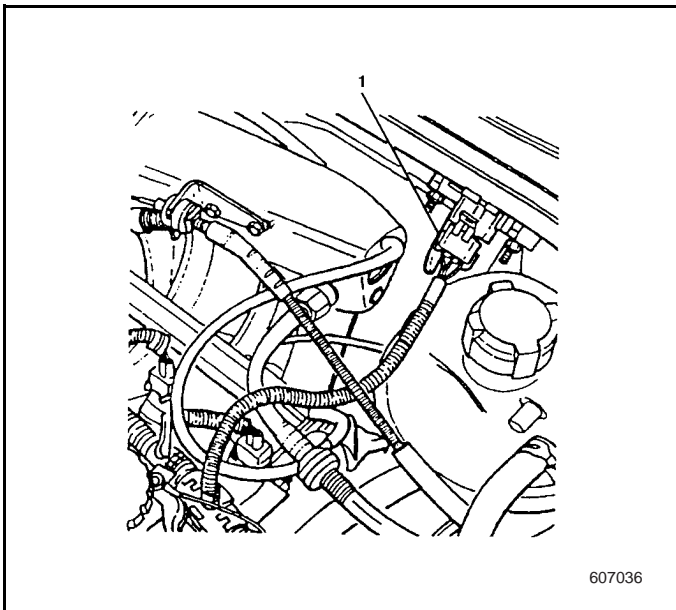
Installation Procedure

1. Install the sensor to the double head bolt welded on the front wall plate.
2. Tighten the nut.

Tightening

Tighten the intake manifold absolute pressure sensor nut to 3 N•m.

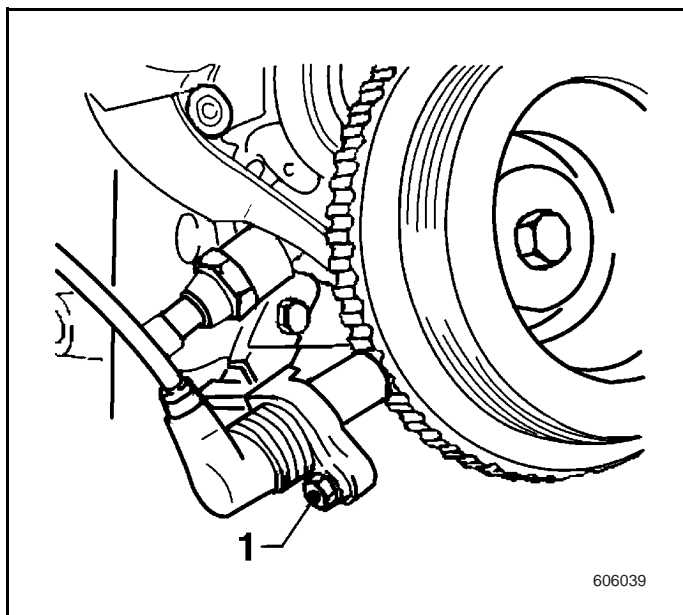
3. Connect the vacuum hose and electric connector.



6.4.5.11 Crankshaft Position Sensor (CPS) Replacement

Removal Procedure

1. Disconnect the wiring harness connector of the crankshaft sensor from the engine wiring harness, and take off the wiring harness from under the clamp behind the timing belt rear cover.
2. Remove the crankshaft position sensor from bracket of the oil pump housing



Installation Procedure

1. Insert the sensor to the bracket.

Note: ensure the bracket and sensor absolutely clean, otherwise the dimensional distance between the sensor and sawtooth disc will be affected, thus having an effect on the signal sent to the electronic control module.

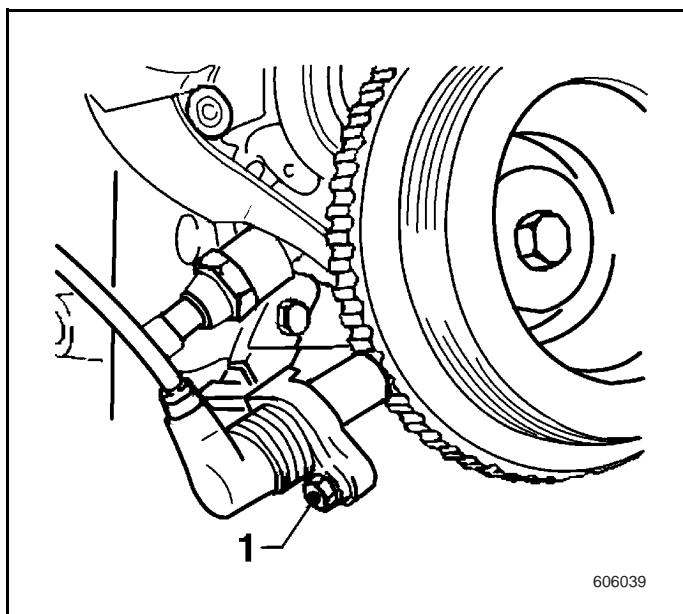
2. Tighten the bolt

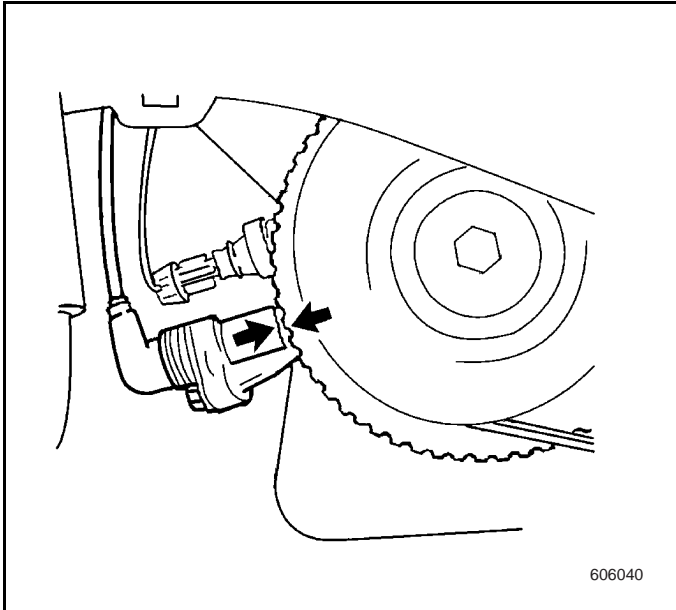
Tightening

Tighten the crankshaft position sensor bolt to $9 \pm 1 \text{ N}\cdot\text{m}$.

3. Clamp the wiring harness of crankshaft box position sensor to the clamp of the timing belt sheath, and connect the power supply connector with engine wiring harness.

Note: When routing, the development heat area and that could produce abrasion to the cable should be avoided.





4. Adjust the reference span between the crankshaft position sensor and the signal trigger plate.

- Use the feeler gauge to measure the crankshaft position sensor and signal trigger plate.

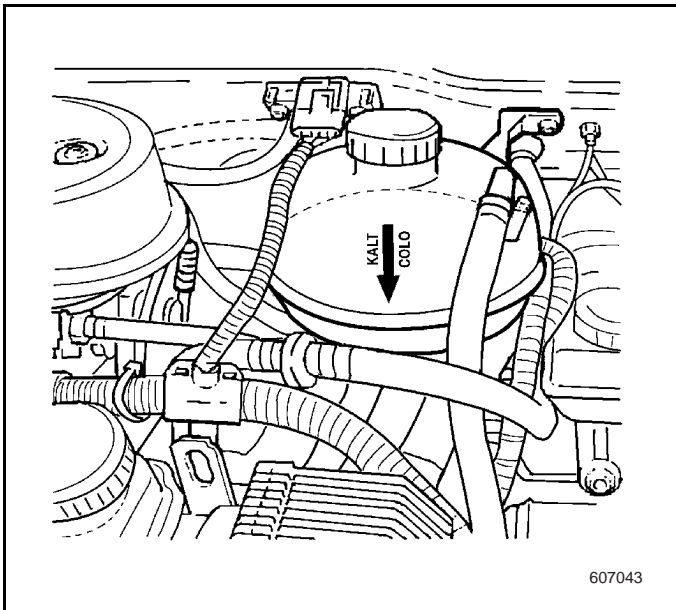
(Attached to the crankshaft accessory transmission belt pulley, indicated by the arrow) interval span. Metric value should be 1.0 ± 0.7 mm.

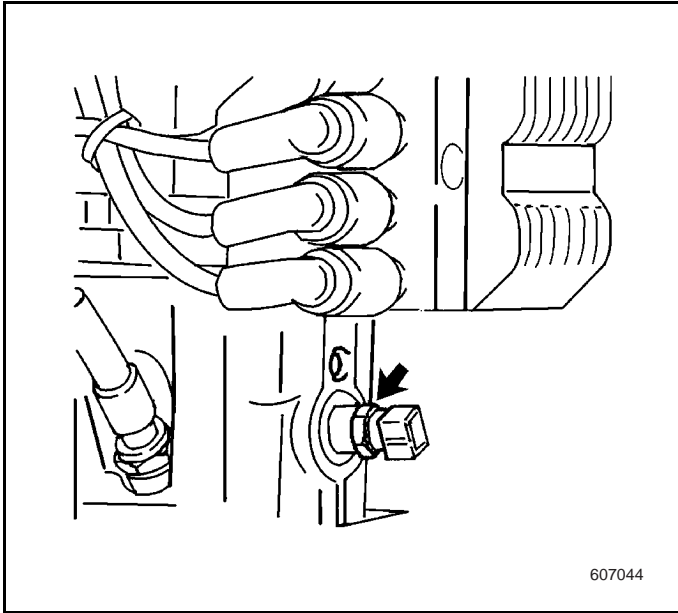
Note: If the metric value cannot be reached, the crankshaft position sensor bracket must be replaced.

6.4.5.12 Coolant Temperature Sensor (CTS) Replacement

Removal Procedure

1. Open the sealing cover of the coolant compensation box, allowing the cooling system to decompress. Refer to Drain and Refill Cooling System in Engine Cooling System





2. Disconnect the wiring harness connector from the coolant temperature sensor.
3. Screw down the coolant temperature sensor from the cylinder cover.
4. Collect overflow coolant.

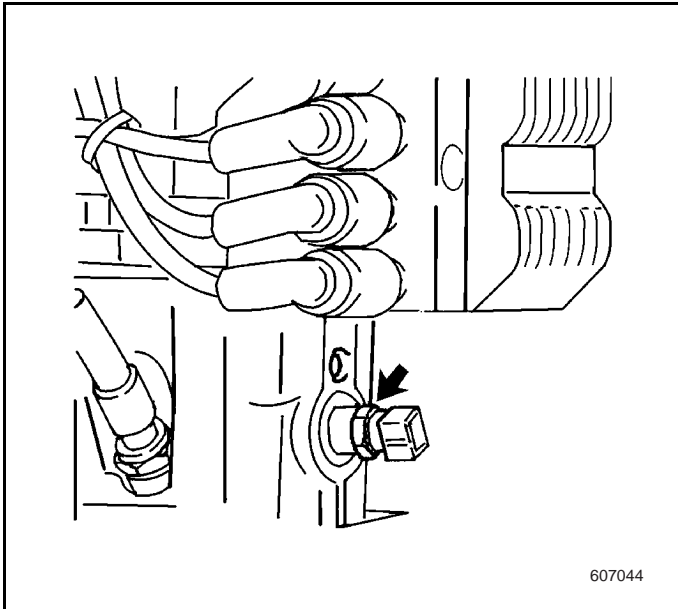
Installation Procedure

1. Install the coolant temperature sensor to the cylinder head.

Tightening

Tighten the coolant temperature sensor to 15 ± 3 N•m.

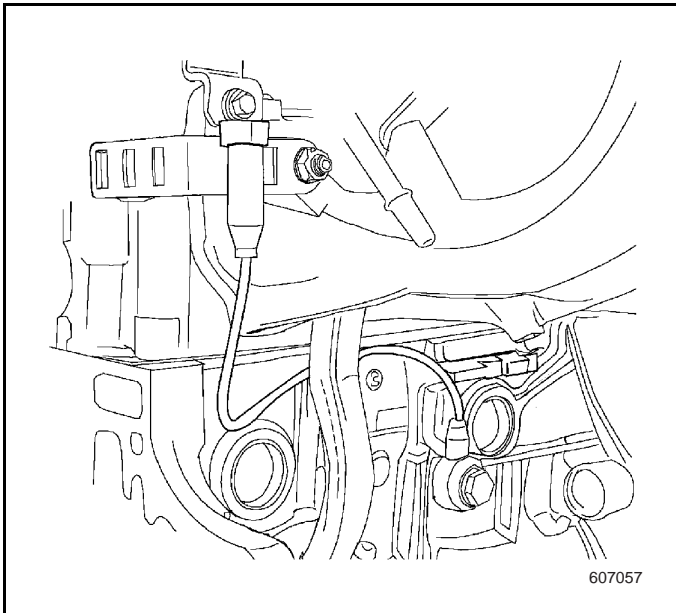
2. Connect the wiring harness connector.
3. Charge and discharge air in the coolant system. Ensure the antifreeze able to reach -30°C .



6.4.5.13 Knock Sensor (KS) Replacement

Removal Procedure

1. Disconnect the wiring connector from the wiring harness.
2. Take off the connector from the bracket.
3. Screw off the bolt, and take off the knock sensor.



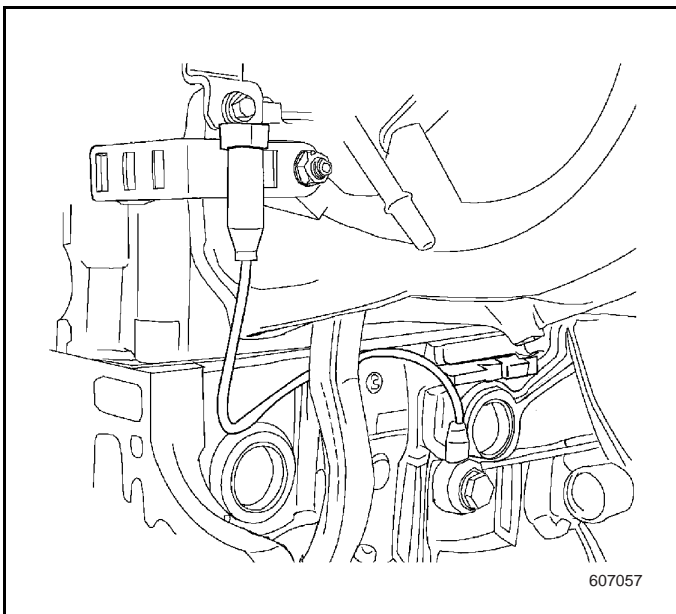
Installation Procedure

1. Use the bolt to install the knock sensor to the cylinder body, and screw up.

Tightening

Tighten the knock sensor bolt to $20 \pm 4 \text{ N}\cdot\text{m}$.

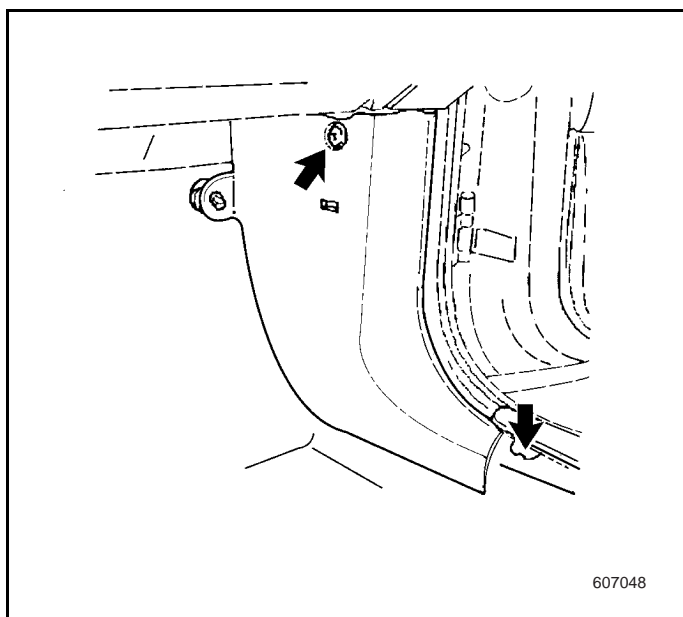
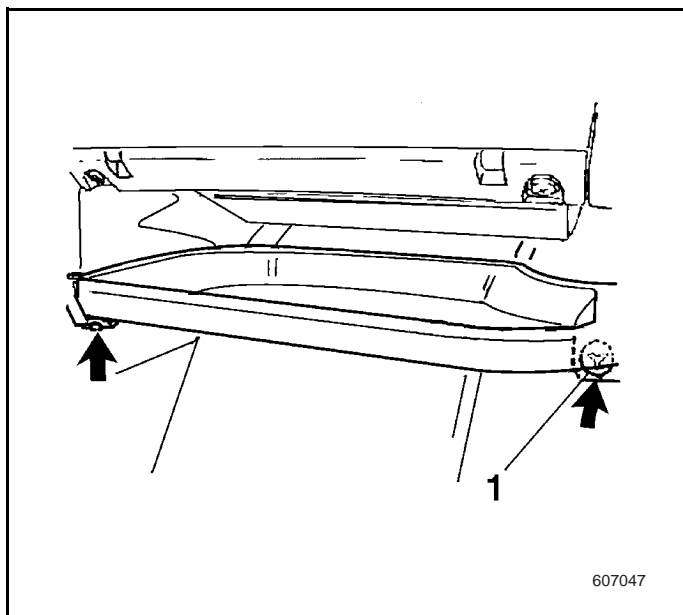
2. Connect the knock sensor to the wiring harness, and clamp the connector to the bracket.



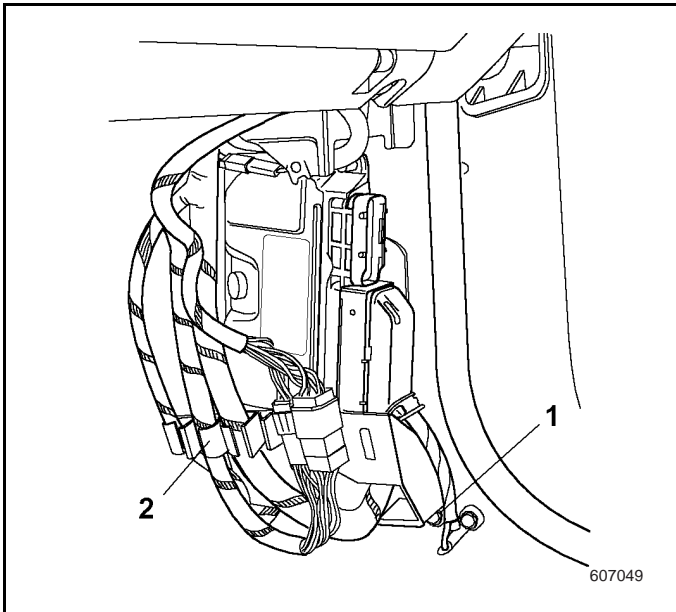
6.4.5.14 Engine Control Module (ECM) Replacement

Removal Procedure

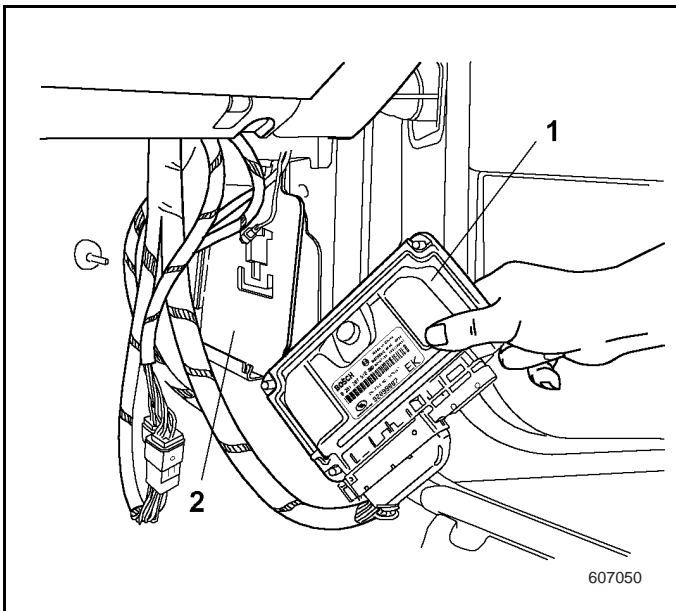
1. Disconnect the negative wire of the accumulator.
2. Remove the inside panel of the right front door.
3. Remove the right side button and left side screw under the instrument panel glove box.



4. Screw down the screw of the base board under the right side column A
5. Take of the base board Refer to Base Board Replacement in Interior Trim
6. Expose the electronic control module and wiring harness.



7. Remove the wiring harness connector from the wiring harness bracket (2).
8. Screw off the wiring harness bracket bolt (1).
9. Screw of the wiring harness bracket.

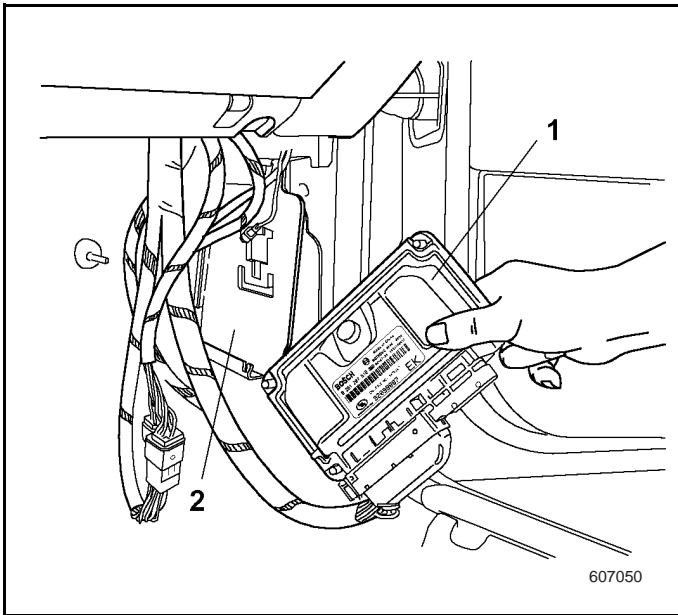


10. Draw out the electronic control module (1) and wiring harness connector from the module bracket (2) horizontally and outward.
11. Disengage the wiring harness connector and the socket on the electronic control module.

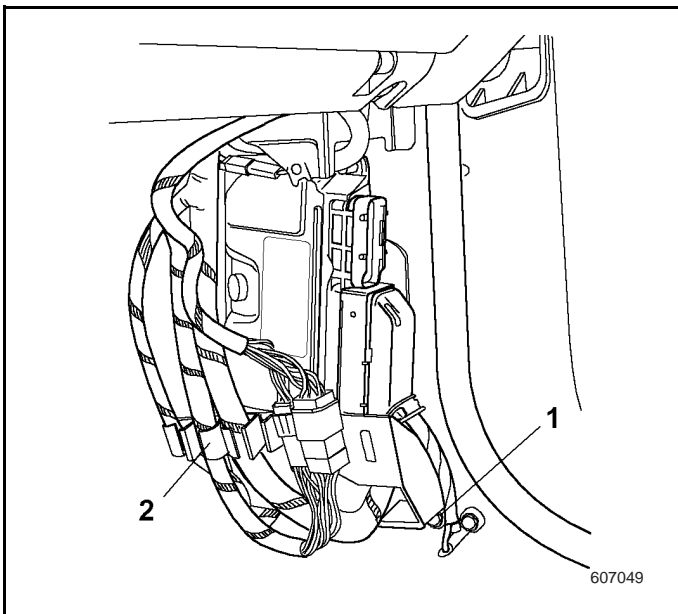
Caution: Ensure to disconnect the connection with the accumulator for at least 20 seconds before removing the module connector.

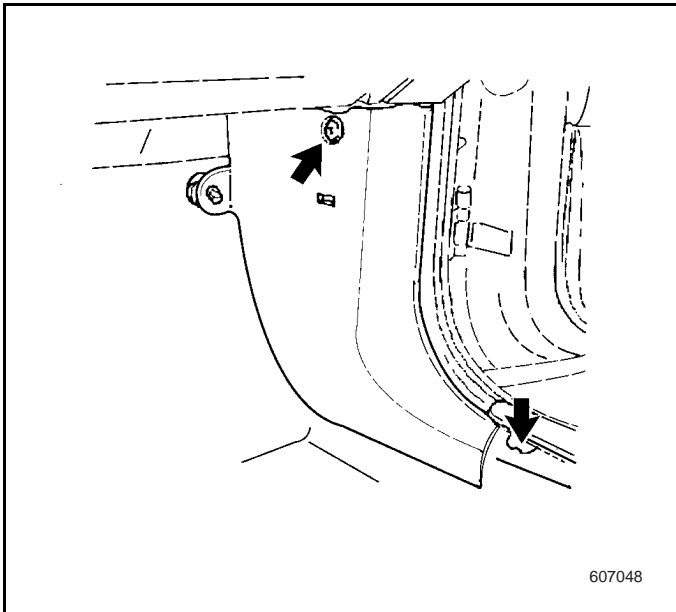
Installation Procedure

1. Disengage the wiring harness connector and the socket on the electronic control module (1).
2. Insert the electronic control module and the wiring harness connector horizontally into the module bracket (2).



3. Install the wiring harness bracket (2) .
4. Screw down the wiring harness bracket bolt (1).
5. Connect the wiring harness connector from the wiring harness bracket.



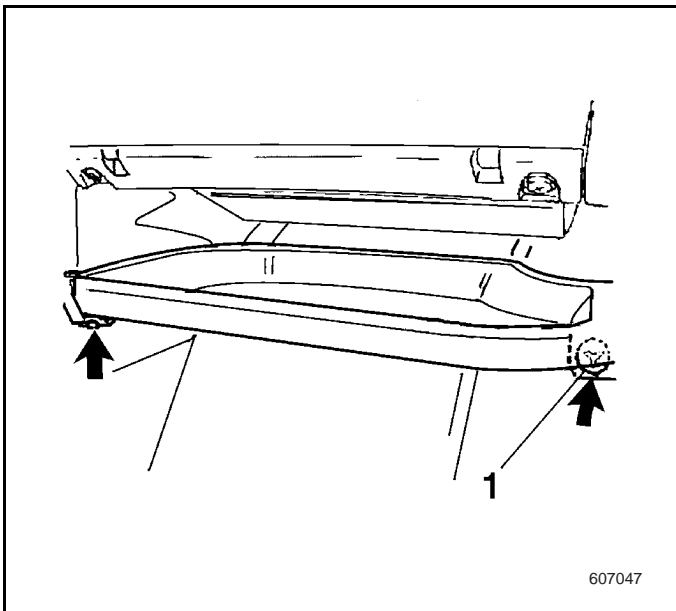


6. Place the base board. Refer to Base Board Replacement in Interior Trim

7. Install the base board screw

Tightening

Tighten the screw to 1.2-1.6 N•m.



8. Install the button at the right side, and the screw at the left side.

9. Install the right door inside panel.

10. Connect the negative cable to the accumulator.

Note: Engine control module equipped on this vehicle employs electronic erasable and programmable read only memory. Reprogram must be done after replacing the engine control module (ECM). For engine control module (ECM) reprogram method, refer to the latest Techline program.

6.4.6 Description and Operation

6.4.6.1 General Description

C16NE engine is installed with improved engine control system. The system provides independent fuel injector, which is controlled by the ECM, and it is powered on to the fuel injector in pairs, that is to say, for every 180 degree of crank revolution, just make contact in turns to the fuel injector 1, and 4, 2, 3 once a time. Its action is to ensure sufficient fuel combustion in the circumstances of maintaining the engine low speed running and low emission level, to attain the maximum torque. Ignition is subject to the direct control of the direct ignition system.

Important repair description

- Only allow to use the PROM assigned for vehicle application.
- Do not let the oxygen sensor to contact fuel and silicone. Do not use gasoline to wash or contact it.
- Do not use anti corrosion coating in the catalyst converter or oxygen sensor and its surrounding area.
- Leakage (static air) of the intake and exhaust system before catalytic converter may cause the oxygen sensor reading error.
- Vapor control system leakage may cause idle steering angle fluctuation.
- If the fuel injector occurs leakage, the engine could continue running (diesel effect) after the ignition is turned off.
- If the engine has difficulty to start, inspect the fuel system, fuel pump relay and ignition system.
- Disconnect the grounding wire of the accumulator before removing the electronic components.
- When the accumulator connection is disconnected, all malfunction code stored in the memory cell and correction value of idle and mixture self studied will be cancelled.

Notice: To prevent catalytic converter overheated, perform cylinder balance test according to the following steps carried out as per the time sequence (if necessary):

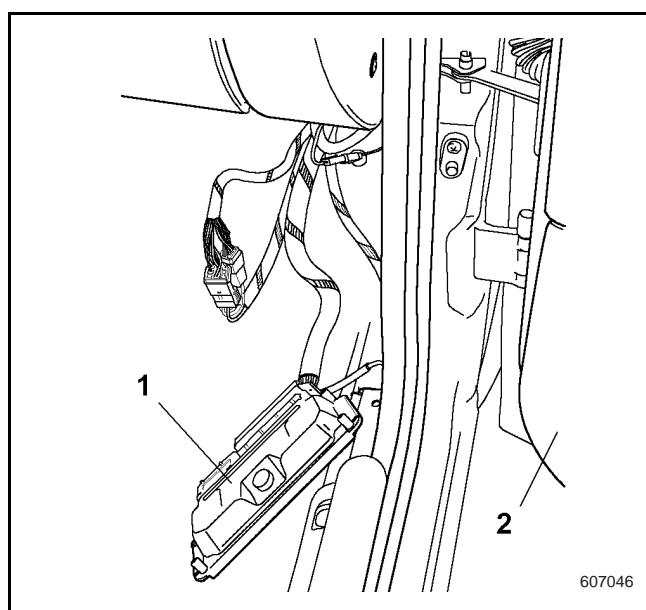
- The longest close time of a cylinder is 8 seconds.
- Minimum interval time is 8 seconds to open and close the cylinder each time.

6.4.6.2 Engine Control Module (ECM) Description

The Engine Control Module (ECM) is the control center of the engine management system. It controls datum received from different sensor and controller. These information is used for controlling the engine operation (fuel, ignition advance angle, air compressor speed). ECM is responsible for allowing the engine to play the ideological performance under the lowest exhaust gas emission.

The control module is behind the panel, and on the front right column.

1. Electronic Control Module
2. Passenger Door



6.4.6.3 Air Intake System Description

The system performs collection, cleaning, inspection and control to air flow, and send it into the intake manifold where it mixes with fuel.

The system consists of the following components: air filter, throttle body, air intake temperature (IAT), idle air control valve (IAC) and throttle body position sensor (TPS).

Throttle Body

Throttle body controls air flow entered into the intake manifold. Air flowing into the engine is controlled by the throttle valve, which is connected with the acceleration pedal and the pull wire. Except for control function, there is still holes for transmitting vacuum signal on the throttle body.

The intake air temperature (IAT) sensor

Intake air temperature utilizes the heat sensor to control the voltage signal of the ECM.

When the intake air temperature is low, the sensor has high resistance, therefore with a high voltage at the ECM. The intake air temperature is used to control the fuel volume, advance ignition angle and idle air control

Idle Air Control Valve (IAC)

Idle air control valve controls air when the engine is running at idle. It can alter the engine speed during the idle duty changing process, avoiding the engine idle, and keep the lowest speed rotation. Valve position is controlled by the engine control module (ECM), which adjust the IAC valve according to the idle speed.

Throttle position sensor (TPS)

The throttle position sensor is a potentiometer connected with throttle body shaft, which send information to the engine control module (ECM), and these information are the engine power requirement determined by the throttle position.

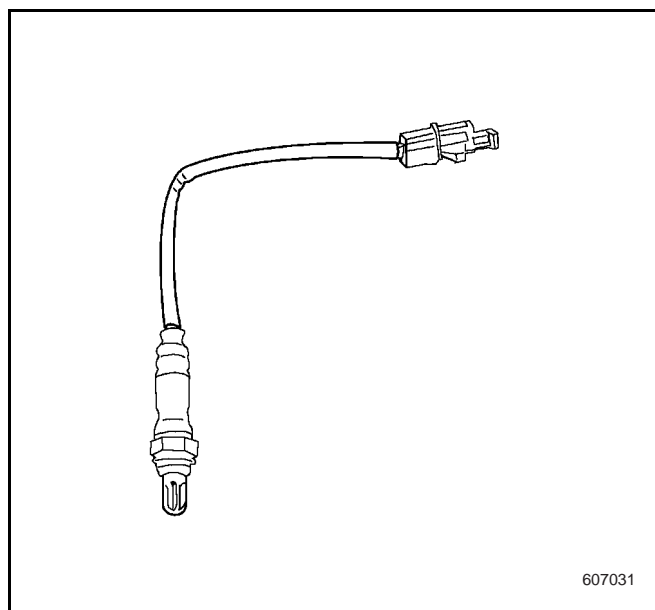
6.4.6.4 Information Sensor/Switch

Description

Oxygen sensor

The oxygen sensor is installed on the exhaust manifold, near by the cylinder head. Its action is to monitor the oxygen content in the exhaust gas, and send information related with mixed air/fuel ratio to the electronic control module (ECM).

When the mixture thickness is high, data will be sent to the ECM, reducing the injected fuel, contrarily when the mixture thickness is low, increase the injected fuel.



Intake Air Manifold Absolute Pressure Sensor (MAP)

The intake air manifold absolute pressure sensor (MAP) is on the front wall panel of the engine compartment.

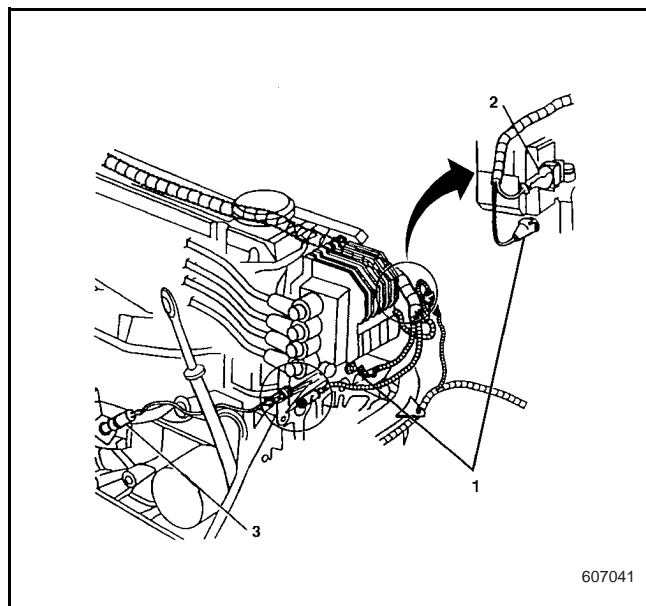
Its action is to measure the pressure change on the intake air manifold as the engine duty and speed changes, and convert this data to voltage.

Coolant Temperature Sensor (CTS)

Located at the engine right side, under the direct ignition system (DIS), its action is to inform the engine coolant temperature to the engine compartment control module (ECM), which reflects the engine temperature.

The ECM utilizes received information to alter the advance ignition, and change the fuel injection according to the engine temperature. When the coolant temperature sensor displays the value of 2.7 V, equaling to 40 °C, inside the Loop Control of the oxygen sensor.

1. Coolant Temperature Sensor (CTS)
2. Connector with the direct ignition module
3. Oxygen sensor



The intake manifold absolute pressure sensor (MAP) is used to measure the air pressure under some circumstances, thus allowing the engine control module (ECM) to perform necessary correction, to compensate for different height.

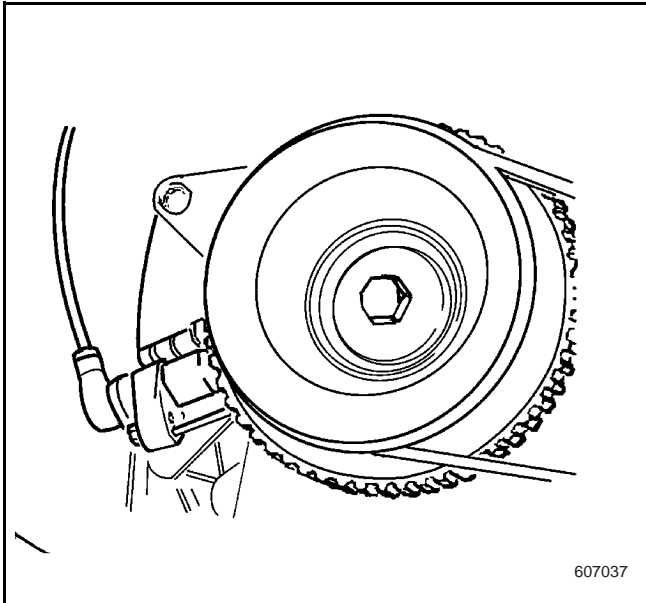
The engine control module (ECM) utilizes the MAP sensor signal to control fuel transmission and ignition advance angle.

Crankshaft position sensor (CPS)

The system has a sawtoothed disc tightly attached to the transmission belt pulley of the crankshaft, and still it has a induction sensor connected with the cylinder radius position, nearby the sawtoothed disc. There are 58 tooth and a neutral gear for the tooth disc, here with 2 teeth fewer, and each degree number for inter tooth is 15 degree.

As tooth passes the sensor, the current will change. The current changing frequency may be changed by the control unit, and converted into engine speed.

Higher voltage will be produced in the space between 2 teeth, thus inform the ECM of the crankshaft position, and the ECM will determine the advance angle according to this.



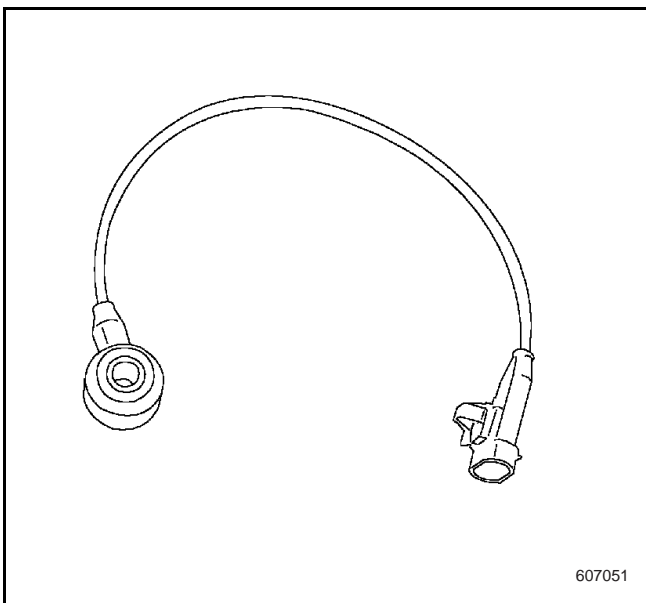
Vehicle Speed Sensor (VSS)

The action of the sensor is to inform to the ECM of the vehicle speed. The module utilizes this information to control the idle speed, and determine the vehicle if it is stopped or still running.

ECM counts the signal (rectangular pulse), with km/h as the unit for calculation of vehicle speed.

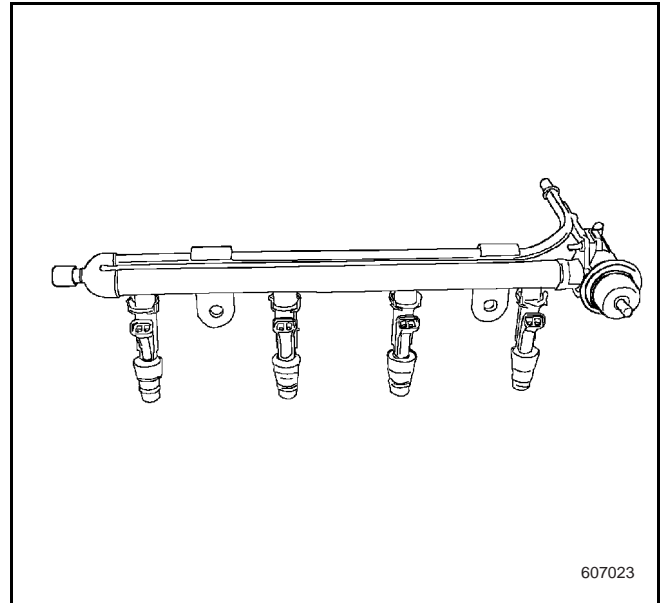
Knock sensor (KS)

The knock sensor of the engine management system is the self produced piezoelectric sensor. It is installed on the engine block, and can produce output voltage according to the engine vibration amplitude caused by knock. When there is knock existing on the sensor signal, which is controlled by the ECM through adjusting the ignition advance angle.



6.4.6.5 Oil Rail Description

The oil rail is installed on the inlet manifold, the function of which is to determine the oil injector position, distributing pressure fuel to the fuel injector and supporting the pressure regulator.



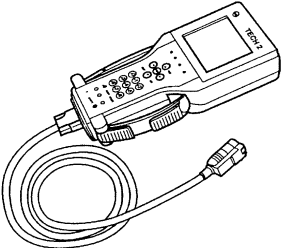
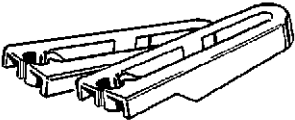
6.4.6.6 Fuel Injector Description

The fuel injector is the solenoid controlled by the ECM. There is a ball valve, which is normally kept close, and opens through the action of the solenoid, so as to allow the fuel flow through the fuel injector to the orifice plate. The calibrated holes on the orifice plate controls the fuel flow and form a taper spray, which is sent to the combustion chamber after atomization and gasification.

6.4.6.7 Pressure regulator Description

The action of the pressure regulator is to keep the fuel pressure difference inside the fuel rail and the inlet manifold as of constant pressure. It increases the fuel pressure to compensate for engine load as the inlet manifold pressure increases. When balance is reached between the calibrated spring, inlet manifold vacuum and fuel pressure, that is pressure equalizing has been reached. Pressure regulator is installed on the fuel rail, as amour type.

6.4.7 Special Tools

Legend	Tool Number/Description
 tech-2	TECH2 DTC Inspection
 J-37088-A	J -37088-A Remove the oil duct from the fuel distribution line.

6.5 Engine Exhaust

6.5.1 Specification

6.5.1.1 Fastener Tighting torque

Application	Specification
Exhaust Pipe Heat Shield Nut	2.5-3.0 N.●m
Exhaust Manifold Bolts	15-35 N.●m
Exhaust Silencer Inlet Pipe Clamp	25-30 N.●m

6.5.1.2 Exhaust System Clearance

Application	mm
At empty load, the exhaust system to the body and the heat shield.	30-53
At full load, the exhaust system to the ground	131
The exhaust system to the catalytic converter heat shield.	36
Exhaust System to the Resonator Heat Shield	30
Exhaust System to the Silencer Heat Shield	30

6.5.2 Diagnostic Information and Procedures

6.5.2.1Tingle and Rattle

Step	Action	Numeric value	Yes	No
1	Inspect for loosening components, such as ear or heat shield etc. If there is any loose components?	—	Go to Step 2	Go to Step 3
2	Tighten all loose fasteners to the specified torque.Refer to Fastener Tightening Torque If the exhaust system still has tingle and rattle sound?	—	Go to Step 3	The System is OK.
3	Inspect for inaccurate components Is there any inaccurate components?	—	Go to Step 4	—
4	Positioning System.Inspect the ear and, mounting bracket for distortion or damage. When calibrating the system, loosen all fasteners before correct calibration of all exhaust system components.When tightening fasteners, start from the vehicle front until to the tail. If the exhaust system still has tingle and rattle sound?	—	—	The System is OK.

6.5.2.2 Exhaust Leakage

Step	Action	Numeric value	Yes	No
1	Inspect for miss installed or inaccurate components. Is there any miss installed or inaccurate components?	—	Go to Step 2	Go to Step 3
2	Position components and tighten the connector to the specified torque.Refer to Fastener Tightening Torque Is there still exhaust leakage and/or excessive noise?	—	Go to Step 3	The System is OK.
3	Inspect for loose exhaust manifold or exhaust silencer inlet connector Inspect for loose exhaust manifold or exhaust silencer inlet connector	—	Go to Step 4	Go to Step 5
4	Tighten all fasteners to the specified torque.Refer to Fastener Tightening Torque Is there still exhaust leakage and/or excessive noise?	—	Go to Step 5	The System is OK.
5	Inspect the exhaust manifold for crack or break. Crack and break appears on the exhaust manifold?	—	Go to Step 6	Go to Step 7
6	Replace any broken exhaust manifold.Refer to Exhaust Manifold, Exhaust Manifold Pad Replacement in Engine Mechanical Is there still exhaust leakage and/or excessive noise?	—	Go to Step 7	The System is OK.
7	Inspect the bridging connector for leakage. Bridging connector leakage?	—	Go to Step 8	Go to Step 9
8	Adjust the clamping attachments position, and tighten the clamping parts to the specification.Refer to Fastener Tightening Torque and Exhaust Silencer Inlet Clamp Replacement Procedure. Is there still exhaust leakage and/or excessive noise?	—	Go to Step 9	The System is OK.
9	Inspect the gasket and clamp for damage or wear. Inspect the gasket and clamp for damage or wear.	—	Go to Step 10	Go to Step 11
10	Replace damaged or worn gasket and clamping parts. Is there still exhaust leakage and/or excessive noise?	—	Go to Step 11	The System is OK.
11	Inspect for burned or rusted exhaust silencer with exhaust pipe and tail pipe. Inspect for burned or rusted exhaust silencer with exhaust pipe and tail pipe.	—	Go to Step 12	Go to Step 13
12	Replace the exhaust silencer with the exhaust pipe and tail pipe.Refer to Silencer Replacement. Is there still exhaust leakage and/or excessive noise?	—	Go to Step 13	The System is OK.
13	Inspect the exhaust component connector or coupling (if repair performed in advance) for leakage. If there is leakage at the exhaust component connector.	—	Go to Step 14	—
14	Replace the gasket and clamp ring, and tighten the flange nut and clamp ring.If necessary, weld the leakage position.Refer to Fastener Tightening Torque Is there still exhaust leakage and/or excessive noise?	—	—	The System is OK.

6.5.2.3 Internal Silencer Rattle Sound/Power Damage

Step	Action	Numeric value	Yes	No
1	Has the blocked exhaust system been inspected?	—	Go to Step 2	To Exhaust Blockage Inspection-1.6L in the engine control system
2	Replace the exhaust silencer with the exhaust pipe and tail pipe. Inspect the silencer appearance Is there a problem with the silencer?	—	Go to Step 3	Go to Step 3
3	Replace the exhaust silencer with the exhaust pipe and tail pipe.Refer to Silencer Replacement. Is there still power decrease circumstances and/or internal rattle sound?	—	Go to Step 4	The System is OK.
4	Inspect the exhaust pipe resonator duct. Is there a problem with any of the exhaust resonator pipe?	—	Go to Step 5	The System is OK.
5	Inspect the exhaust pipe resonator duct.Refer to Catalytic Converter and Resonator Replacement (with exhaust manifold bolt). Is there still power decrease and/or internal rattle sound?	—	—	The System is OK.

6.5.2.4 Exhaust Noise

Step	Action	Numeric value	Yes	No
1	After preheating when in cold weather, inspect the heat shield contacting with the exhaust pipe.Has the heat shield not been installed or loosen?	—	Go to Step 2	Go to Step 3
2	If necessary, replace the fastener of the heat shield. Is there still exhaust noise?	—	Go to Step 3	The System is OK.
3	Inspect the exhaust manifold or duct connector for leakage. Are there any leaks?	—	Go to Step 4	Go to Step 5
4	Tighten the connection that has leaks according to the specifications.Refer to Fastener Tightening Torque Does the exhaust noise still exist?	—	Go to Step 5	System OK?
5	Inspect the exhaust pipe muffler with exhaust pipe and tail pipe. Is the exhaust pipe muffler with exhaust pipe and tail pipe burned out or blown out?	—	Go to Step 6	Go to Step 7
6	Replace the exhaust pipe muffler with exhaust pipe and tail pipe.Refer to Muffler Replacement. Does the exhaust noise still exist?	—	Go to Step 7	System OK?
7	Inspect the crossover exhaust pipe at the manifold flange for any leaks. Are there any leaks?	—	Go to Step 8	Go to Step 9
8	Repair the leaks. Does the exhaust noise still exist?	—	Go to Step 9	System OK?

6.5.2.4 Exhaust Noise(Cont' d)

9	Inspect the exhaust manifold for cracks or breaks. Does any cracks or breaks occur to the exhaust pipe ?	—	Go to Step 10	Go to Step 11
10	Replace the exhaust manifold.Refer to Exhaust Pipe, Exhaust Manifold Gasket Replacement in Engine Mechanical. Does the exhaust noise still exist?	—	Go to Step 11	System OK?
11	Inspect the exhaust manifold and the cylinder head for any leaks? Are there any leaks?	—	Go to Step 12	System OK?
12	Tighten the fasteners between the exhaust manifold and the cylinder head.Refer to Fastener Tightening Torque in Engine Mechanical. Does the exhaust noise still exist?	—	—	System OK?

6.5.2.5 Basic Diagnosis Information

Diagnosis	
The reasons that possibly cause a high rate of exhaust gas discharge	
Excessive carbon monoxide (CO) (caused by the air/fuel ratio of high concentration)	Main reason <ul style="list-style-type: none"> • The vehicle engine runs at a temperature higher than the normal operating temperatures. • Incorrect idle speed • Restricted air filter elements • Restricted hose or correction orifice of crankcase ventilation system
Excessive hydrocarbon (HC) (caused due to the high temperature in the combustion chamber).	Main reason <ul style="list-style-type: none"> • When the vehicle is running, the engine exceeds the normal operating temperature. • Vacuum tube is broken, restricted or in improper installation position. • Incorrect idle speed Spark plug, high voltage ignition wires Improper ignition advance angle
Excessive nitrogen oxides (NOx) (caused due to the high temperature in the combustion chamber).	Possible reasons Improper ignition advance angle Vacuum tube is broken, restricted or in false installation position.

Note:Excessive carbon monoxide and hydrocarbon is related to the high concentration of air/fuel mixture.High mixture concentration can accelerate the forming of

carbon monoxide.When the mixture concentration is high, the fuel cannot be burned sufficiently, and thus excessive hydrocarbon is produced.

6.5.3 Repair Instructions

6.5.3.1 Exhaust System Check

Inspect the exhaust resonator pipe and the exhaust muffler with exhaust pipe and tail pipe for the following conditions:

- Broken joint
- Broken welding

Corrosive damage (Corrosive damage may cause the exhaust system to leak)

- Inspect the clips, brackets, and the vibration damper for the following conditions:
- Broken Bolts
- Stripped bolt threads
- Corroded bolts

The exhaust system (including the heat shield) must be free of the following conditions:

- Leaks
- Joint
- Ground
- Excessive vibration

When the following components are loose or damaged, these conditions may occur.

- Flange bolts
- Heat shield
- Supporting stand, brackets
- Duct

If these condition occur, inspect the exhaust system. Make calibrations and replace the necessary components, including new manifold gaskets, nuts.

6.5.3.2 Exhaust Pipe Gasket (Exhaust Manifold Gasket) Replacement

Removal Procedure

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Replace the bolts and the spring of exhaust manifold.

Note: Properly support the exhaust system at the location that the hanger rod is removed.

3. If necessary, remove the hanger rod so as to relocate the exhaust system in place.
4. Re-locate the exhaust system.
5. Replace the exhaust manifold gaskets.
6. Inspect all the components for the following conditions:
 - Cracks
 - Bending
 - Stripped bolt threads
 - Corrosive damage
 - Leaks
 Replace the necessary components.

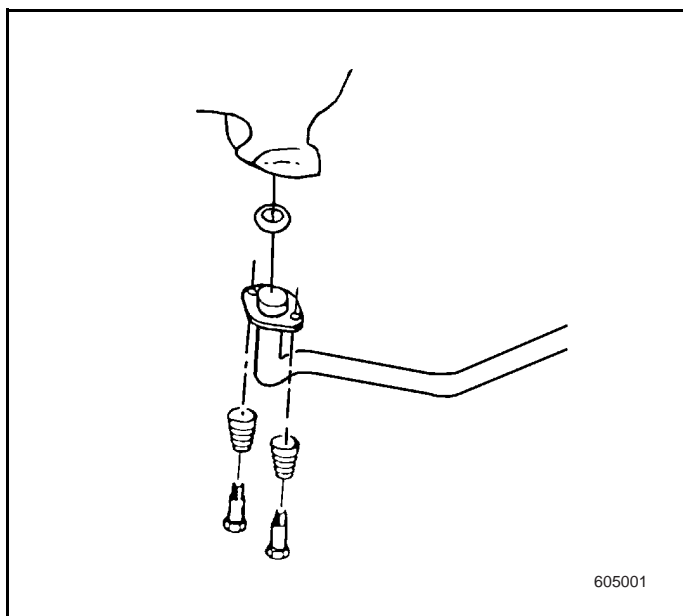
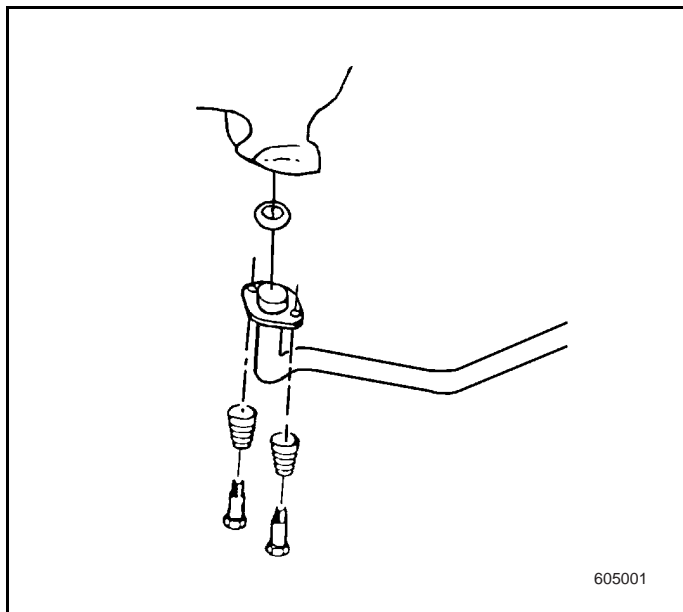
Installation Procedure

1. Install the exhaust manifold gaskets.
2. Allow the exhaust system to resume the normal location.
3. Connect the hanger rod.
4. Install the exhaust manifold spring and the exhaust manifold bolts.

Tightening

Tighten the exhaust manifold bolts to 15-35 N•m.

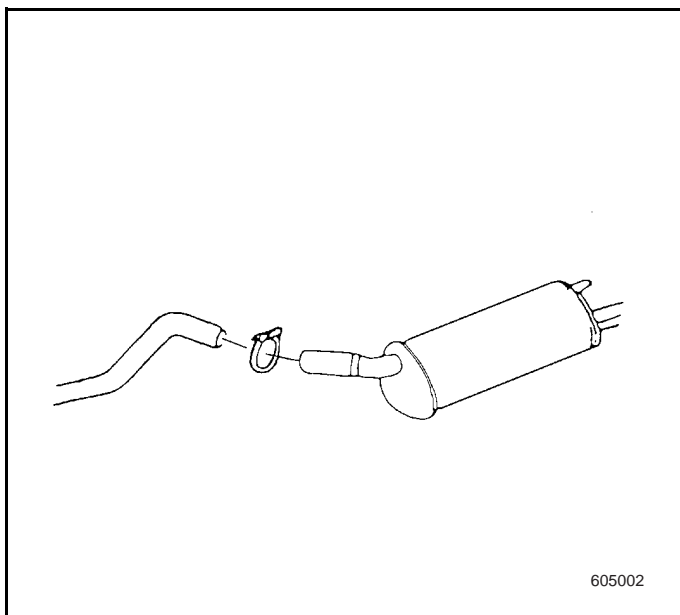
5. Remove the support of the exhaust system.
6. Inspect the exhaust system for any leaks and the contact with the underbody.
7. Lower the vehicle.



6.5.3.3 Exhaust Pipe Muffler Inlet Clamp Replacement

Removal Procedure

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Support the exhaust pipe muffler inlet and the exhaust resonator pipe.
3. Remove the inlet clamp of the exhaust pipe muffler.
4. Inspect all the components for the following conditions:
 - Cracks
 - Bending
 - Corrosive damage
 - LeaksReplace the necessary components.



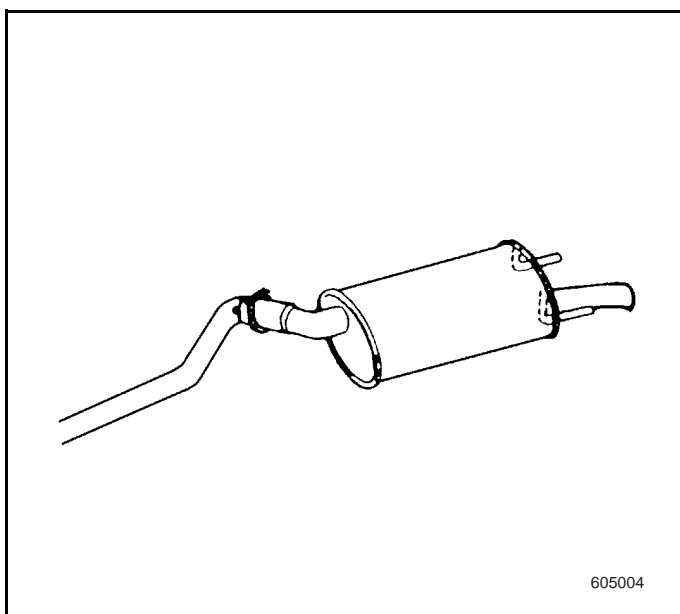
Installation Procedure

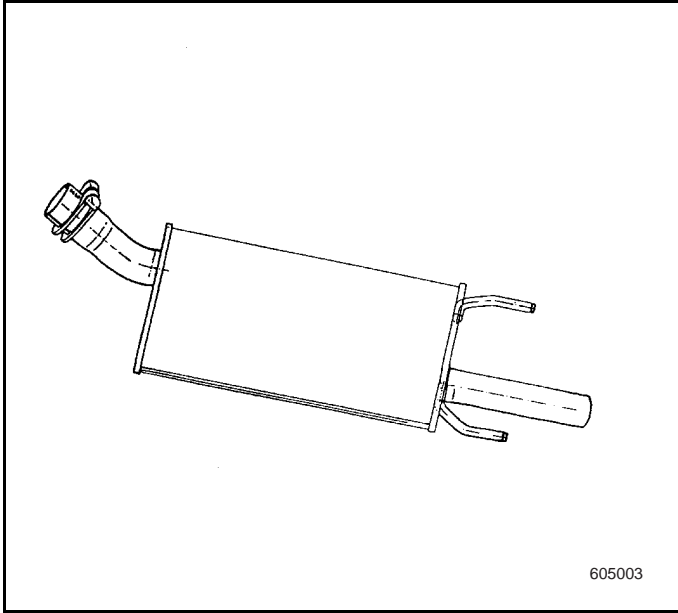
1. Install the inlet clamp of the exhaust pipe muffler.

Tightening

Tighten the inlet clamp of the exhaust pipe muffler to 25-30 N•m.

Note: (1) The mounting position of exhaust pipe muffler inlet clamp must be correct. Improper mounting position can cause a severe leak. When the clamp position is correct, it can cover the inlet slot of the exhaust pipe muffler, and the covered slot length is about 3/4 of the clamp width. (2) There is an installation sign (a circular hole) behind the exhaust muffler pipe. When mounting the exhaust muffler pipe and the exhaust pipe muffler inlet, the pipe nozzle of the exhaust pipe muffler inlet must within the installation sign (a circular hole) range. (3) Inspect the two procedures, then install the inlet clamp of the exhaust pipe muffler.



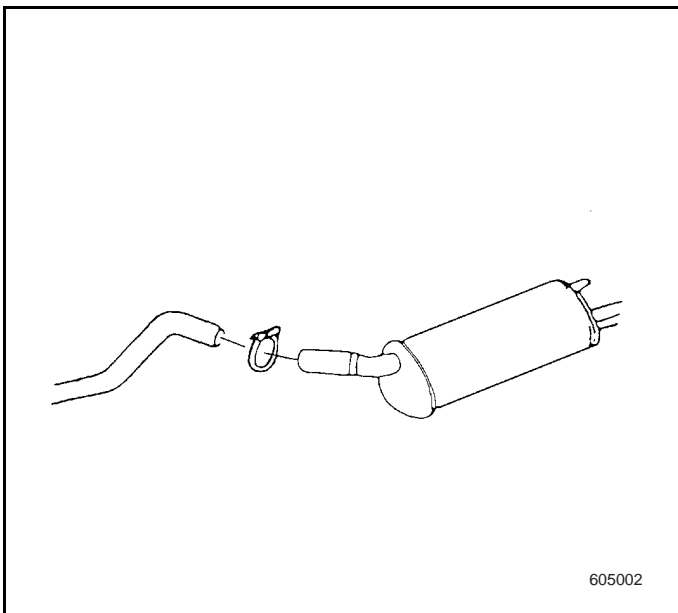


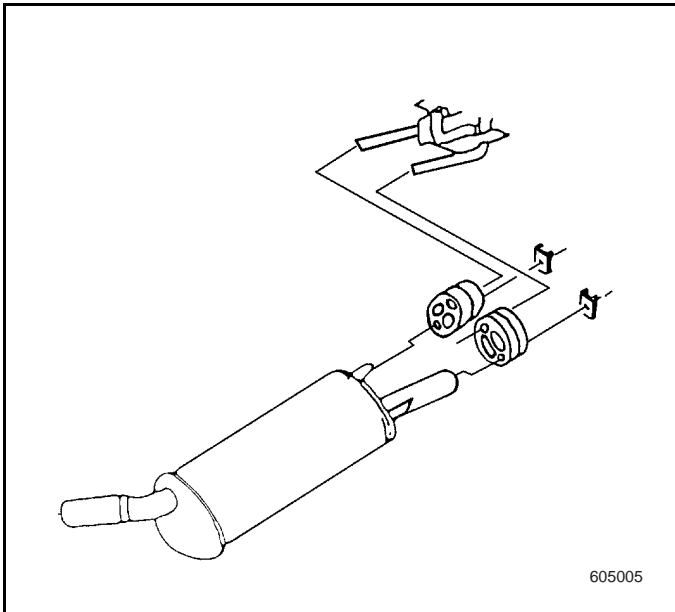
2. Remove the support of the exhaust system.
3. Inspect the system for any leaks.
4. Lower the vehicle.

6.5.3.4 Exhaust System Replacement

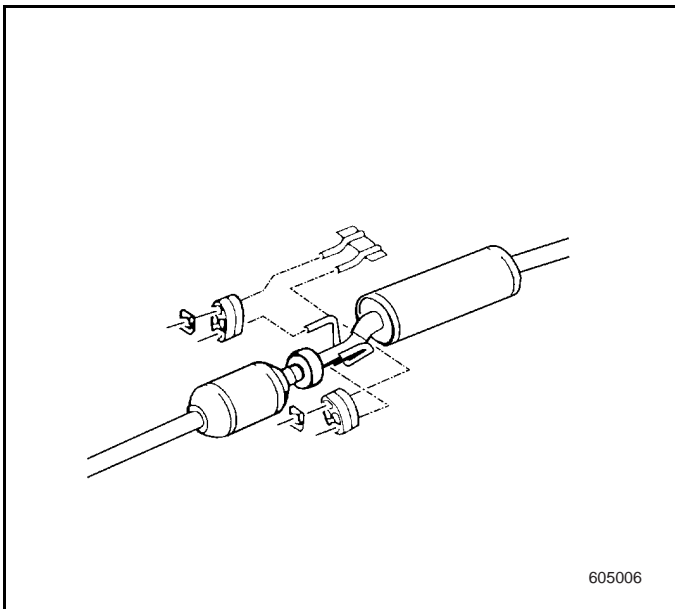
Removal Procedure

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Properly support the exhaust system.
3. Remove the inlet clamp of the exhaust pipe muffler.

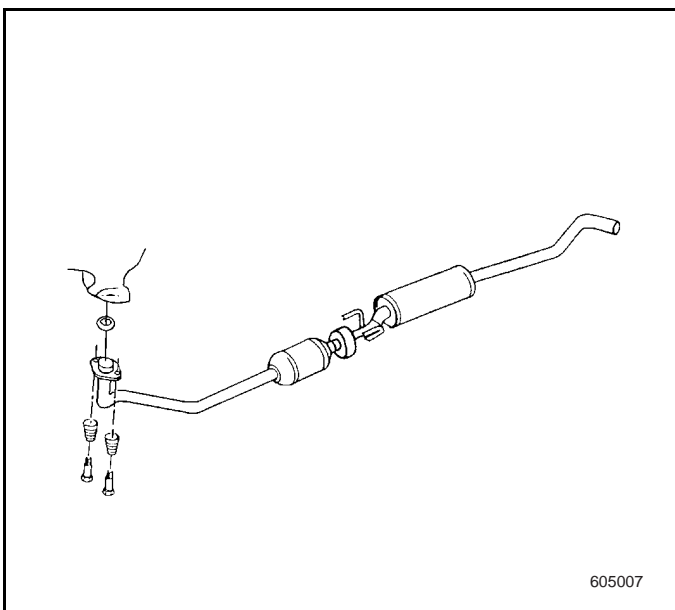




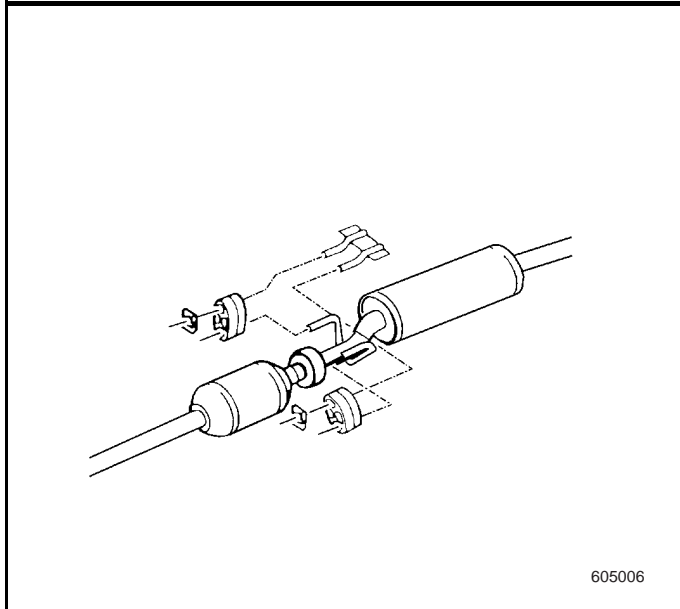
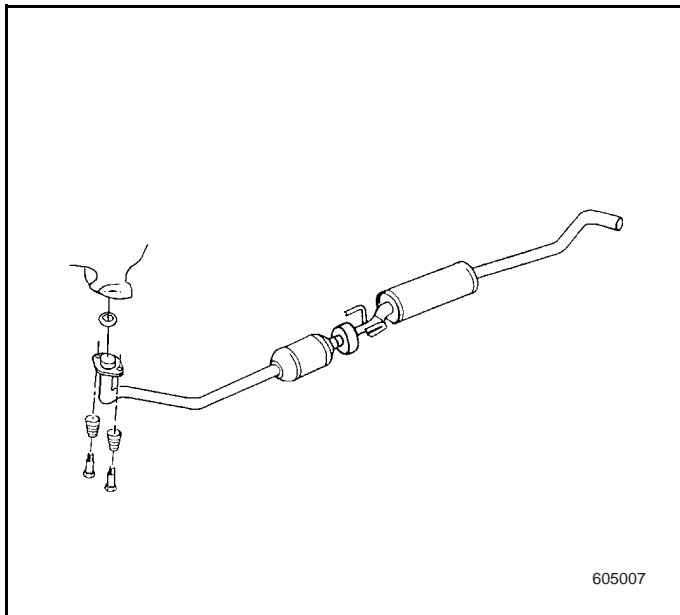
4. Remove the vibration damper tab of the exhaust pipe rear hanger rod.
5. Remove the vibration damper of the exhaust pipe rear hanger rod from the exhaust pipe muffler with exhaust pipe and tail pipe.
6. Replace the exhaust pipe muffler with exhaust pipe and tail pipe.



7. Remove the vibration damper tab of the exhaust pipe hanger rod.
8. Remove the vibration damper of exhaust pipe hanger rod from the hanger rod support of exhaust resonator pipe.



9. Remove the exhaust manifold bolts and the exhaust manifold spring.
10. Remove the exhaust pipe resonator and the catalytic converter.
11. Replace the exhaust manifold gaskets.



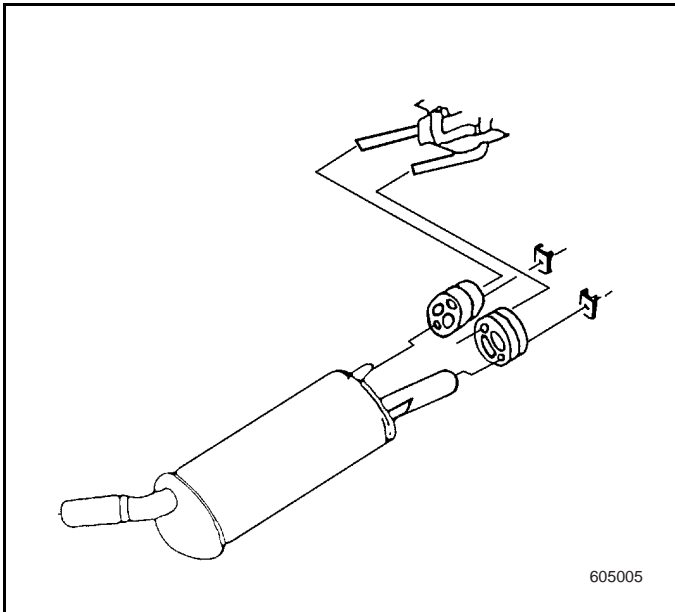
Installation Procedure

1. Install the exhaust manifold gaskets.
2. Install and properly support the exhaust pipe muffler and the catalytic converter.
3. Install the exhaust manifold spring and its bolts.

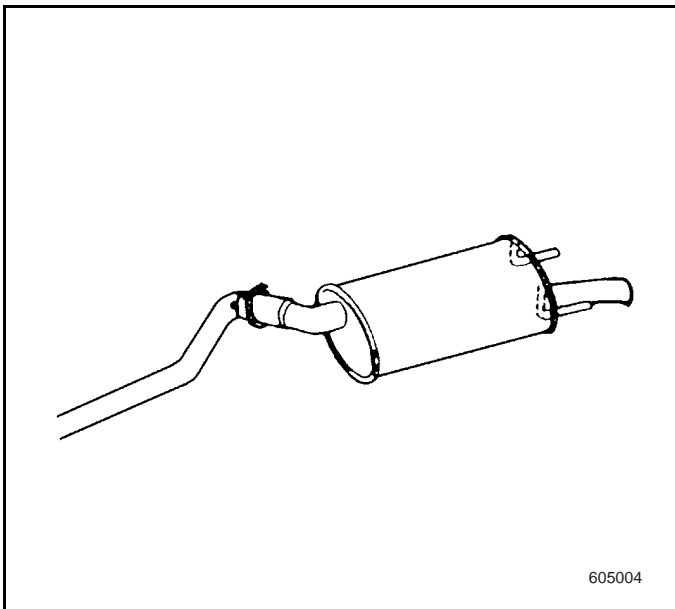
Tightening

Tighten the exhaust manifold bolts to 15-35 N•m.

4. Install the vibration damper of exhaust pipe hanger rod onto the hanger rod support of exhaust muffler pipe.
5. Install the vibration damper tab of the exhaust pipe hanger rod.



6. Install the exhaust pipe muffler with exhaust pipe and tail pipe.
7. Install the vibration damper of exhaust pipe rear hanger rod onto the exhaust pipe muffler with exhaust pipe and tail pipe. Viewing from the rear, the included angle between the two central lines of vibration damper is about 100 degrees.
8. Install the vibration damper tab of the exhaust pipe rear hanger rod.



9. Install the inlet clamp of the exhaust pipe muffler. Refer to Exhaust Pipe Muffler Inlet Clamp Replacement.

Tightening

Tighten the inlet clamp of the exhaust pipe muffler to 25-30 N•m.

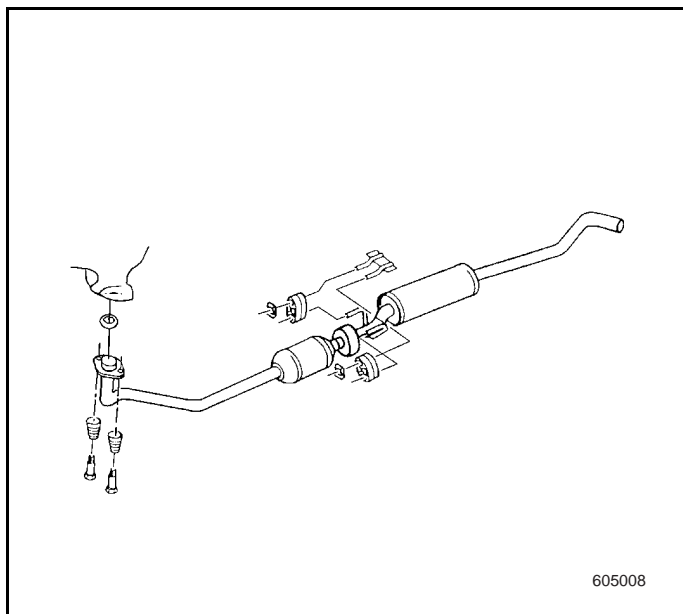
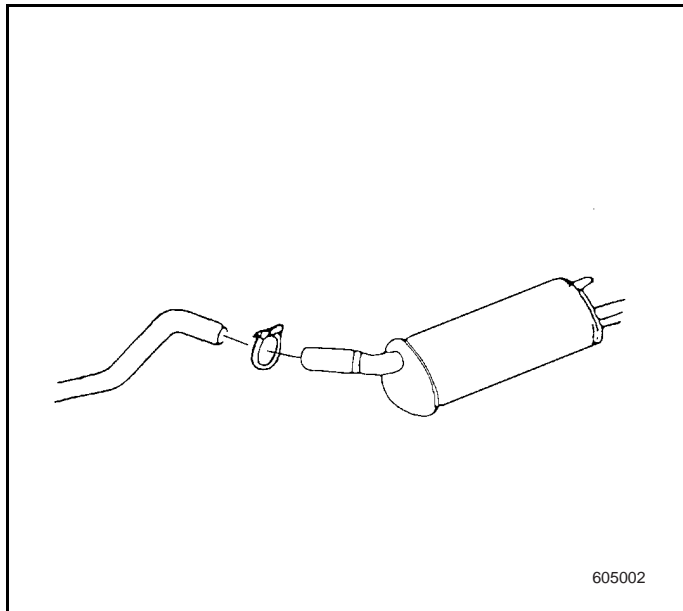
10. Remove the support of the exhaust system.
11. Inspect the exhaust system for any leaks and the contact with the underbody.
12. Lower the vehicle.

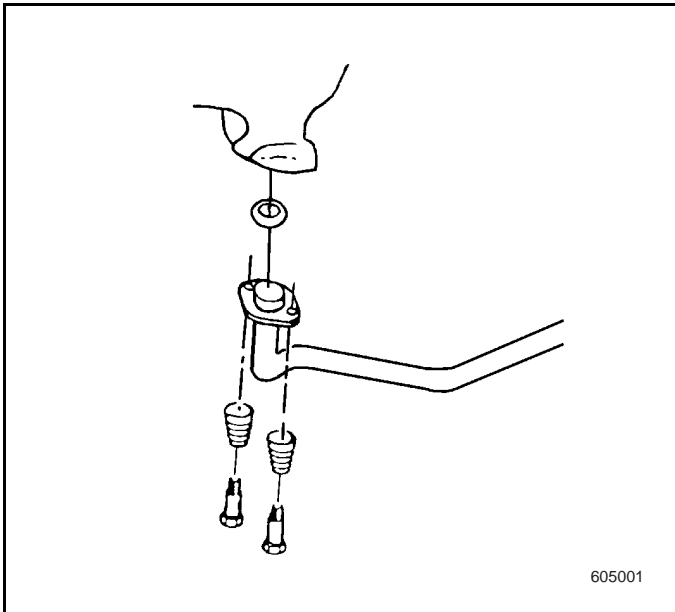
6.5.3.5 Catalytic Converter and Resonator Replacement (with Exhaust Manifold Bolts)

Removal Procedure

The catalytic converter and the resonator are welding connected. Repairing the catalytic converter and the resonator need repairing the complete assembly. When repairing the catalytic converter and the exhaust pipe resonator, the gasket of front flange must be replaced. Never re-install the original gasket again.

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Properly support the exhaust system.
3. Remove the inlet clamp of the exhaust pipe muffler.
4. Remove the vibration damper tab of the exhaust pipe hanger rod.
5. Remove the vibration damper of exhaust pipe hanger rod from the hanger rod support of exhaust resonator pipe.
6. Remove the exhaust manifold bolts and the exhaust manifold spring.
7. Remove the catalytic converter and the resonator.



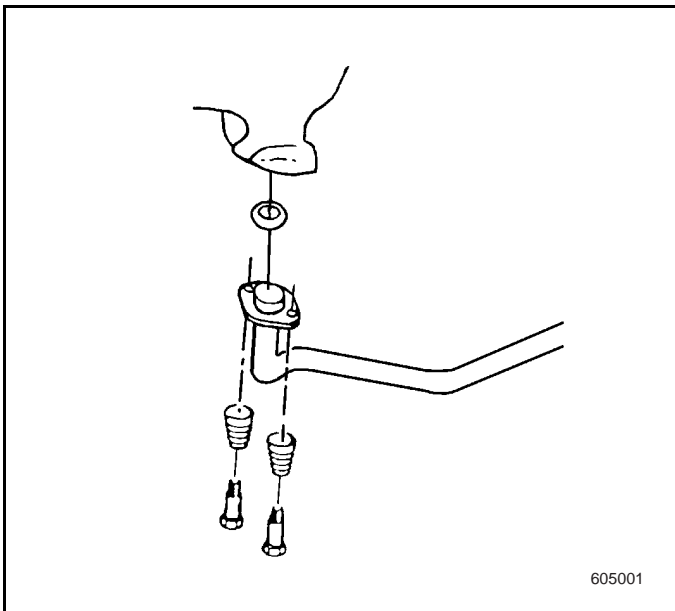


8. Replace the exhaust manifold gaskets.

Installation Procedure

Note: In order to prevent the flexible coupling of the catalytic converter assembly from being internally damaged, the converter must be supported. The vertical movement at the rear of the catalytic converter assembly must not exceed 6 degrees up or down.

1. Install the new exhaust manifold gaskets.

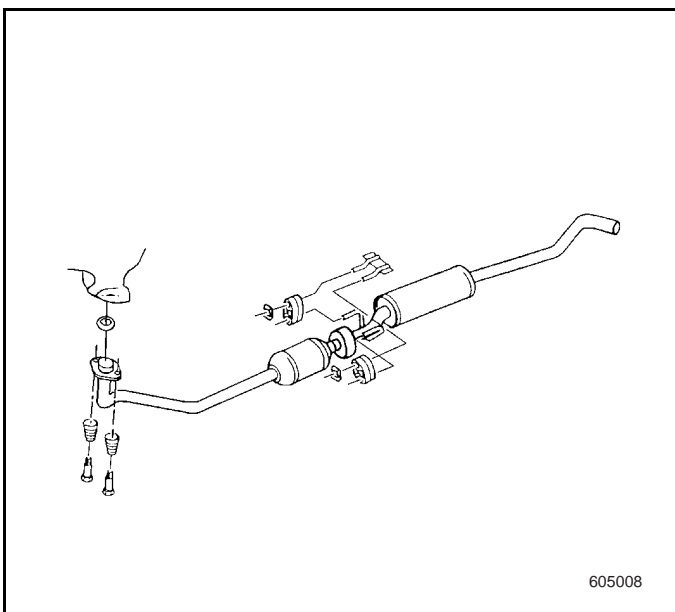


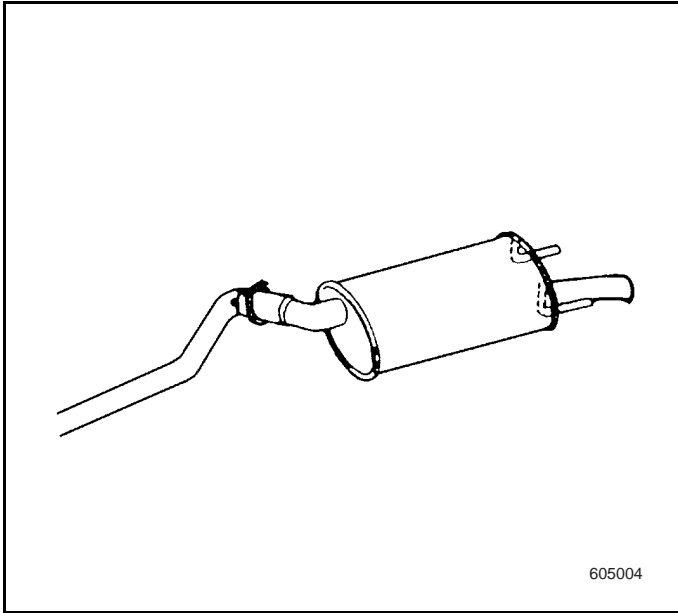
2. Install and support the catalytic converter and the resonator.
3. Install the exhaust manifold spring and the exhaust manifold bolts.

Tightening

Tighten the exhaust manifold bolts to 15-35 N•m.

4. Install the vibration damper of exhaust pipe hanger rod onto the hanger rod support of exhaust muffler pipe.
5. Install the vibration damper tab of the exhaust pipe hanger rod.





6. Install the inlet clamp of the exhaust pipe muffler. Refer to Exhaust Pipe Muffler Inlet Clamp Replacement.

Tightening

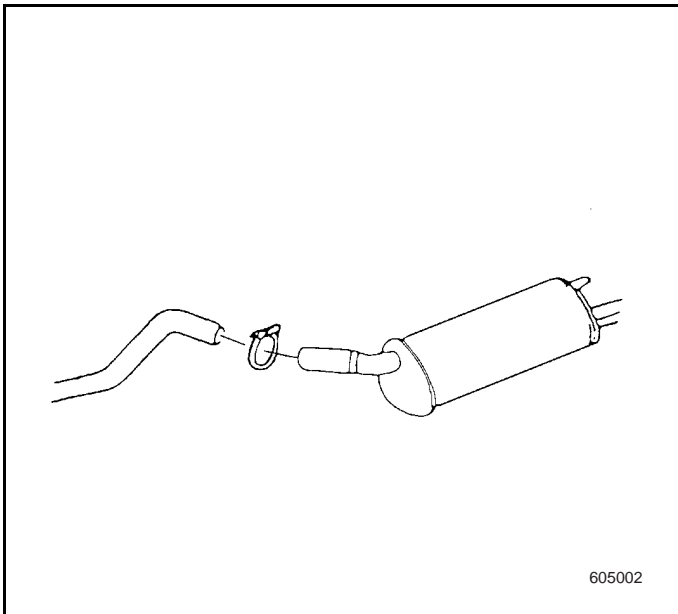
Tighten the inlet clamp of the exhaust pipe muffler to 25-30N•m.

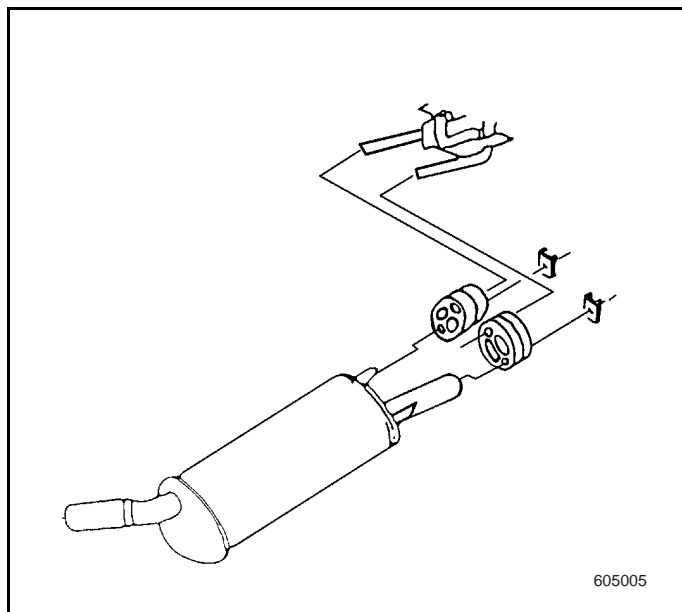
7. Remove the support of the exhaust system.
8. Inspect for any leaks and the contact with the underbody.
9. Lower the vehicle.

6.5.3.6 Muffler Replacement

Removal Procedure

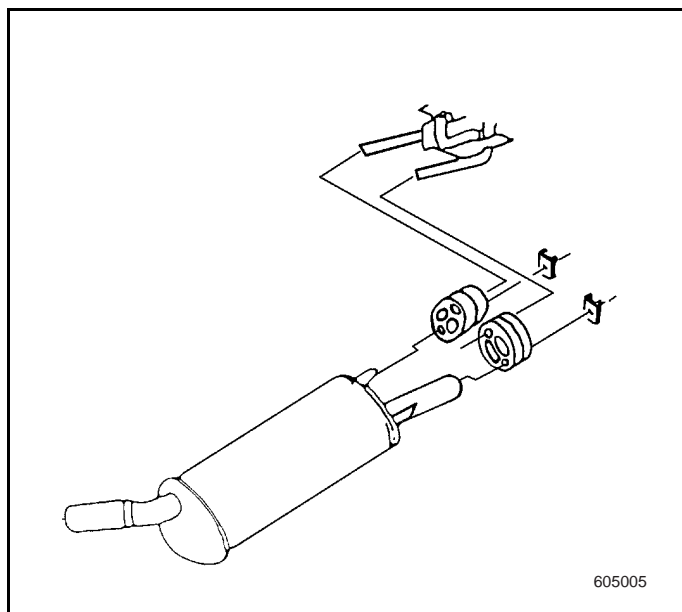
1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Properly support the exhaust system.
3. Remove the inlet clamp of the exhaust pipe muffler.



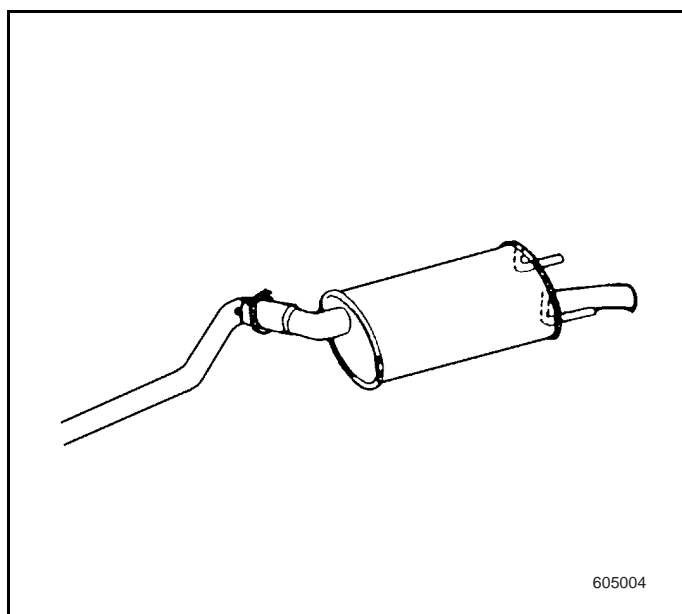


4. Remove the vibration damper tab of the exhaust pipe rear hanger rod.
5. Remove the vibration damper of the exhaust pipe rear hanger rod from the exhaust pipe muffler with exhaust pipe and tail pipe.
6. Replace the exhaust pipe muffler with exhaust pipe and tail pipe.

Installation Procedure



1. Install and properly support the exhaust pipe muffler with exhaust pipe and tail pipe.
2. Install the vibration damper of exhaust pipe rear hanger rod onto the exhaust pipe muffler with exhaust pipe and tail pipe. Viewing from the rear, the included angle between the two central lines of vibration damper is about 100 degrees.
3. Install the removed vibration damper tab of the exhaust pipe rear hanger rod.



4. Install the inlet clamp of the exhaust pipe muffler. Refer to Exhaust Pipe Muffler Inlet Clamp Replacement.

Tightening

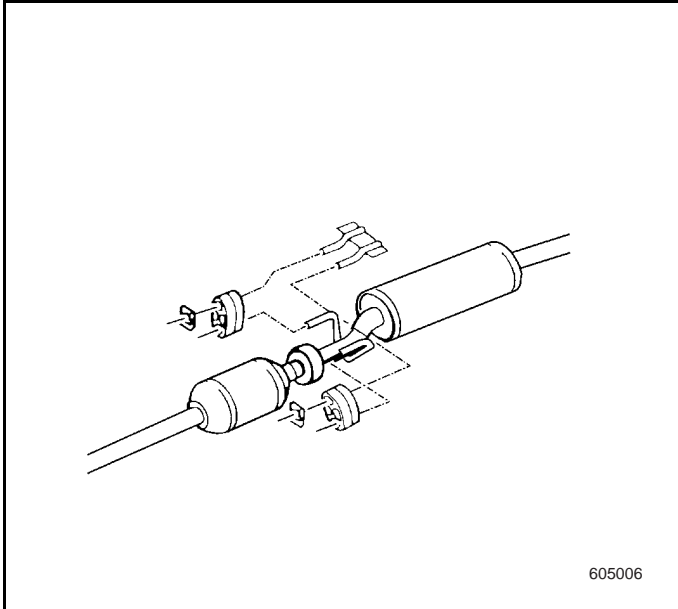
Tighten the inlet clamp of the exhaust pipe muffler to 25-30 N•m.

5. Inspect the exhaust system for any leaks and the contact with the underbody.
6. Remove the support of the exhaust system.
7. Lower the vehicle.

6.5.3.7 Hanger Rod of Exhaust Pipe Resonator Replacement (Hanger Rod Support of Exhaust Pipe)

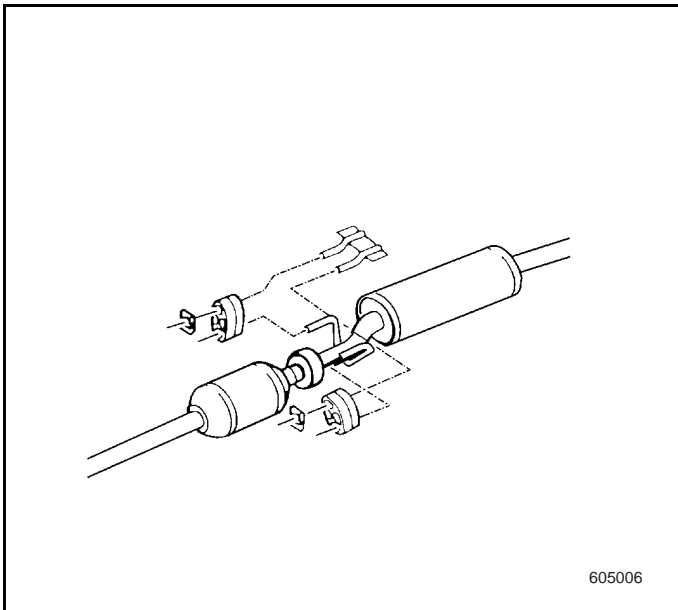
Removal Procedure

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Properly support the exhaust system.
3. Remove the vibration damper tab of the exhaust pipe hanger rod.
4. Remove the vibration damper of exhaust pipe hanger rod from the hanger rod support of exhaust resonator pipe.



Installation Procedure

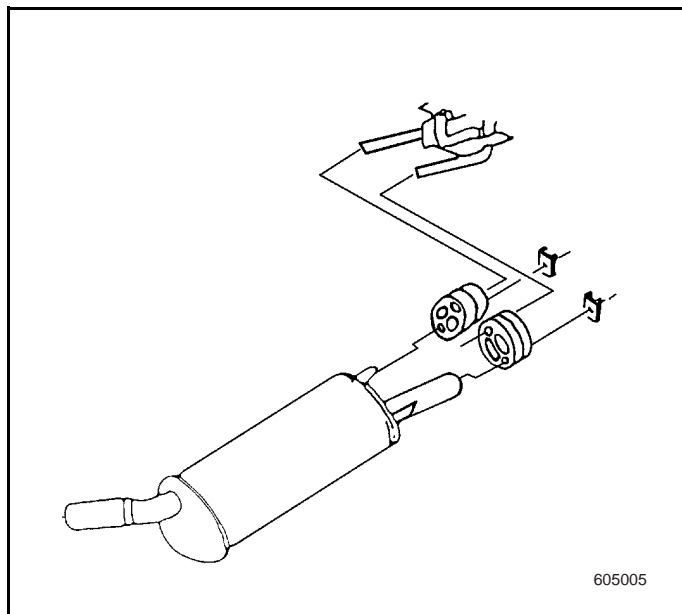
1. Install the vibration damper of exhaust pipe hanger rod onto the hanger rod support of exhaust muffler pipe.
2. Install the vibration damper tab of the exhaust pipe hanger rod.
3. Remove the support of the exhaust system.
4. Inspect the exhaust system for any leaks and the contact with the underbody.
5. Lower the vehicle.



6.5.3.8 Hanger Rod of Exhaust Pipe Muffler Replacement (Muffler Rear Hanger Rod Support)

Removal Procedure

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Properly support the exhaust system.
3. Remove the inlet clamp of the exhaust pipe muffler.
4. Remove the vibration damper tab of the exhaust pipe rear hanger rod.
5. Remove the vibration damper of exhaust pipe rear hanger rod from the rear hanger rod support of exhaust pipe muffler.



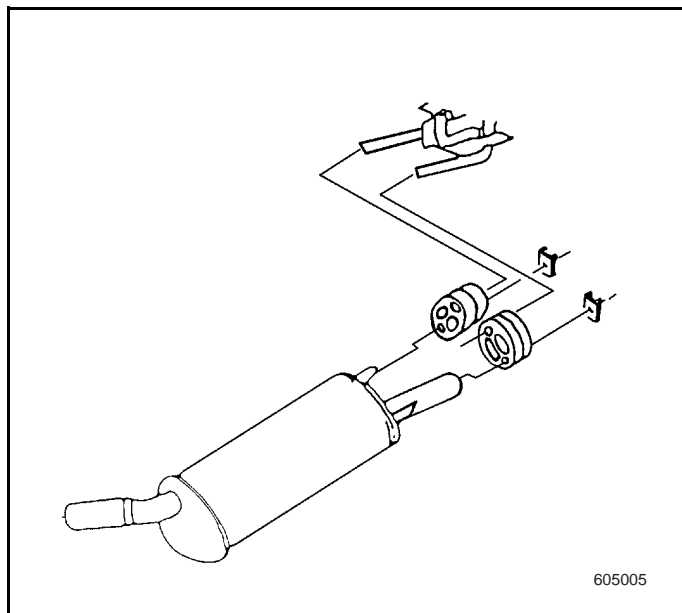
Installation Procedure

1. Install the vibration damper of exhaust pipe rear hanger rod onto the rear hanger rod support of exhaust pipe muffler. Viewing from the rear, the included angle between the two central lines of vibration damper is about 100 degrees.
2. Install the vibration damper tab of the exhaust pipe rear hanger rod.
3. Install the inlet clamp of the exhaust pipe muffler. Refer to Exhaust Pipe Muffler Inlet Clamp Replacement.

Tightening

Tighten the inlet clamp of the exhaust pipe muffler to 25-30 N•m.

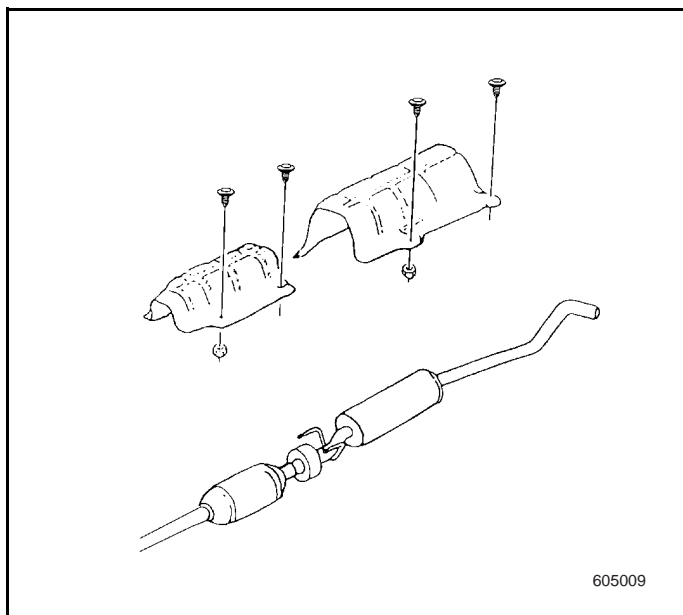
4. Remove the support of the exhaust system.
5. Inspect the exhaust system for any leaks and the contact with the underbody.
6. Lower the vehicle.



6.5.3.9 Heat Shield of Catalytic Converter or Resonator Replacement

Removal Procedure

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Properly support the exhaust system.
3. Remove the catalytic converter and the resonator. Refer to Catalytic Converter and Resonator Replacement (with Exhaust Manifold Bolts).
4. Remove the nuts of catalytic converter heat shield or the nuts of resonator heat shield.
5. Remove the catalytic converter heat shield or the resonator heat shield.



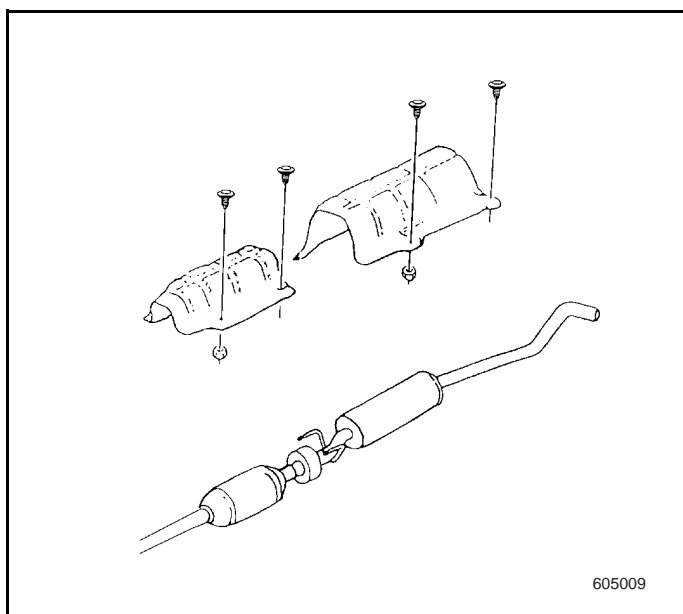
Installation Procedure

1. Install the catalytic converter heat shield or the resonator heat shield.
2. Install the nuts of catalytic converter heat shield or the nuts of resonator heat shield.

Tightening

Tighten the nuts of catalytic converter heat shield or the nuts of resonator heat shield to 2.5-3 N•m.

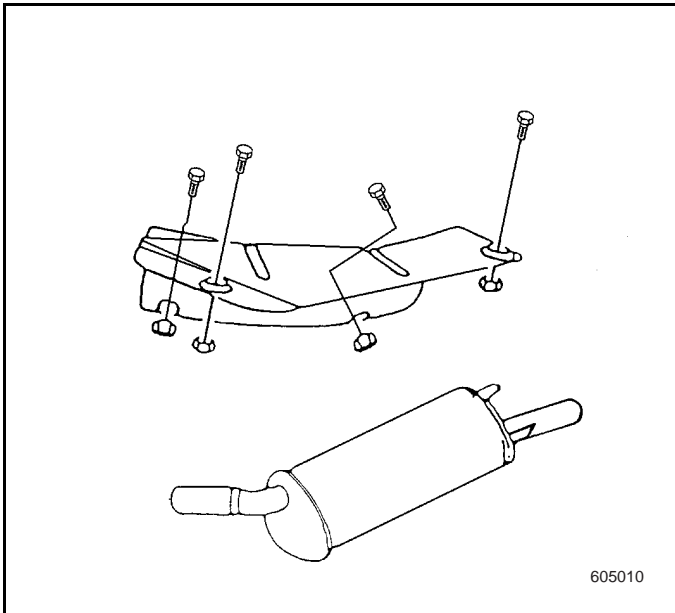
3. Install the catalytic converter and the resonator. Refer to Catalytic Converter and Resonator Replacement (with Exhaust Manifold Bolts).
4. Remove the support of the exhaust system.
5. Inspect the exhaust system for any leaks and the contact with the underbody.
6. Lower the vehicle.



6.5.3.10 Muffler Heat Shield Replacement

Removal Procedure

1. Lift up and properly support the vehicle. Refer to Lifting and Jacking the Vehicle in General Information.
2. Properly support the exhaust system.
3. Replace the exhaust pipe muffler with exhaust pipe and tail pipe. Refer to Muffler Replacement.
4. Remove the nuts of muffler heat shield.
5. Remove the muffler heat shield.



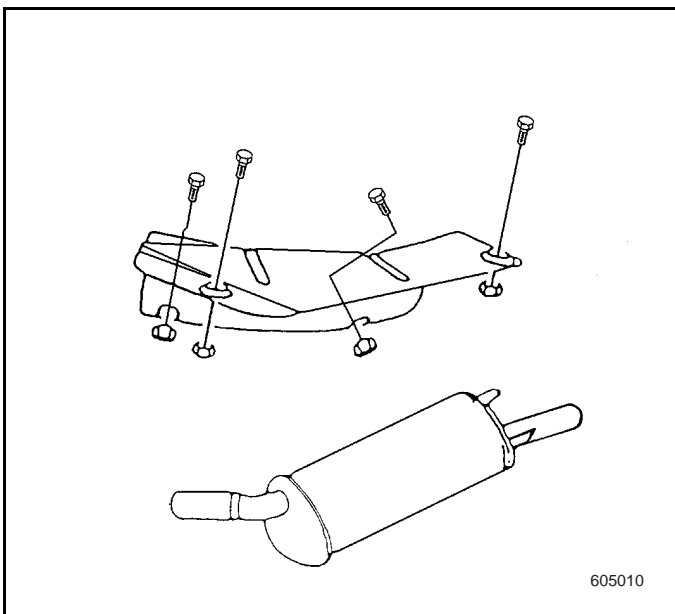
Installation Procedure

1. Install the muffler heat shield.
2. Install the nuts of muffler heat shield.

Tightening

Tighten the nuts of muffler heat shield to 2.5-3 N•m.

3. Install the exhaust pipe muffler with exhaust pipe and tail pipe. Refer to Muffler Replacement.
4. Remove the support of the exhaust system.
5. Inspect the exhaust system for any leaks and the contact with the underbody.
6. Lower the vehicle.



6.5.4 Description and Operation

6.5.4.1 General Description

Air pollution and correct vehicle maintenance

Advanced vehicle concept, especially in the fuel feeding and ignition system, can reduce the substance amount that may be harmful to the human body and the environment, such as carbon monoxide (CO), hydrocarbon (HC), nitrogen oxides (NOx) and aldehydes. And correct maintenance can be sure to reduce the proportion of pollutant elements in the exhaust gas composition at the maximum. Improper fuel feeding, incorrect idle speed adjustment, and wrong air/fuel mixture ratio adjustment can possibly increase the discharge of carbon monoxide and hydrocarbon. Insufficient adjustment of ignition system can also increase the hydrocarbon and the nitrogen oxides. Using of restricted air filter can cause the fuel air ratio to be richer, and thus increase the pollution discharge.

These examples indicate how incorrect vehicle maintenance will affect the air quality.

Strictly observe the SGM vehicle maintenance regulations, and contribute to the reduction of air pollution.

Ignition System

If all the components of ignition system can operate normally, improve the engine performance under all the drive conditions, and reduce the pollution to the minimum. For example, excessive engine ignition advance angle (Ignition advance angle exceeds the specified value), using of spark plug outside the specified range, and overheated to the engine, all can increase the discharge of hydrocarbon (HC) and nitrogen oxides (NOx). Reduction of the engine ignition advance angle can reduce the discharge of NOx, but increase the HC quantity.

Crankcase Ventilation System

During the engine running period, a certain amount of unburned material, high corrosive gas and water vapor transfers to the crankcase by means of the piston ring. In order to prevent the engine lubricating oil from being polluted by these substances, and damaging the piston and the piston ring, etc., it may be removed from the crankcase through the air circulation in air filter.

After mixing with the air, they flow to the intake manifold, then to the combustion chamber for burning. Because they are highly pollutant gas, they cannot be discharged into the atmosphere.

Catalytic Converter

Catalytic converter is an accessory of the exhaust system, being responsible to control the harmful discharge of exhaust gas.

Catalytic converter equipped vehicle needs the lead free fuel to be used.

EVAP Canister - Canister

The system controlling the evaporative fuel gas, consisting of an active canister known as Canister.

The system allow the vapor to flow in the fuel system through Canister. Even though the engine is turned off, they still remain there. When the engine is starting, the air flow in the intake manifold will absorb the fuel vapor from the activated carbon, and consume during the process of engine combustion.

Vapor outlet of Canister is controlled by a solenoid valve, which receives the signal from the engine management system.

6.5.4.2 Exhaust System Description

The exhaust system is used to carry over the gas produced by the engine. When the engine exhaust valve opens, hot gas created by the engine combustion cycle is allowed to travel out through the cylinder head into the exhaust manifold. The exhaust gas mixes with the gas from other cylinders in the exhaust manifold, and travels out through a flange port into the catalytic converter and the exhaust resonator. The resonator and the muffler are used to reduce the noise level of exhaust gas. The exhaust system exits at the rear of vehicle, which can reduce exhaust noise and fume particles or pollutant from entry into the vehicle. Hanger rod and vibration damper of exhaust system are used to support the weight of exhaust system, isolate the engine noise, separate the engine vibration, allow the system far from the body floor, and reserve an expanding space when heated for the exhaust system.

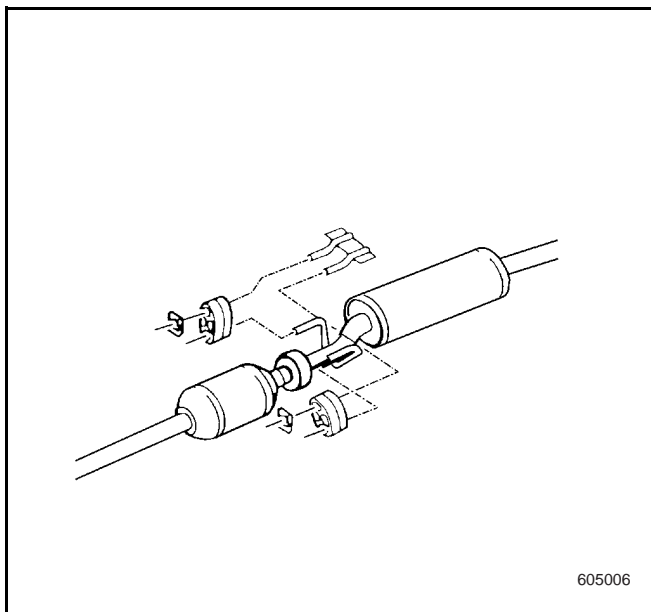
- Exhaust resonator pipe is supported by the hanger rod of exhaust resonator pipe.

6.5.4.3 Exhaust Manifold Description

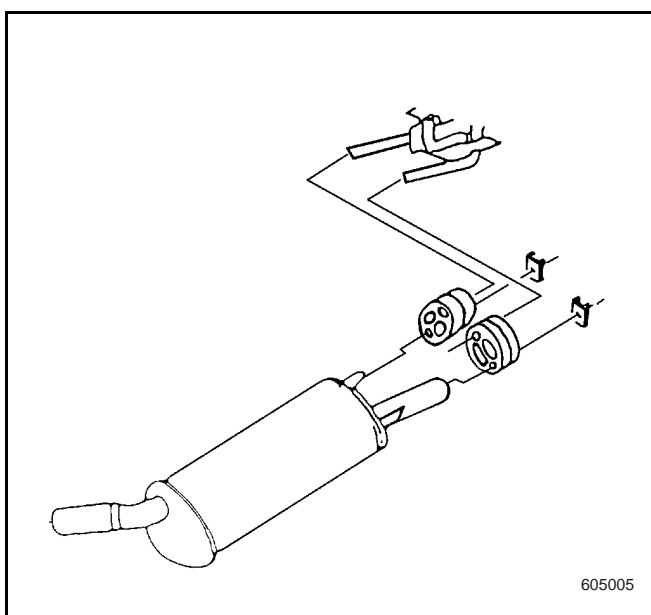
Exhaust manifold is an accessory of the exhaust system, being used to collect and transfer the hot gas created by the engine. The exhaust manifold made of the cast iron, is used to mix the gas from several cylinders. The exhaust manifold is connected to the cylinder head. There is a gasket between the exhaust manifold and the cylinder head. Front exhaust manifold is connected to the crossover exhaust pipe, and is used to transfer the exhaust gas from the front engine to the rear exhaust manifold. The gas is mixed in the rear manifold, and guided into the exhaust resonator pipe.

6.5.4.4 Muffler Description

The muffler reduces the discharging noise of engine exhaust gas by the deflector. The deflector inside the muffler allows the muffler inside to form a passage, thus reduces the noise level created by the engine combustion. Install a catalytic converter and a resonator at the front of muffler, and reduce more noise level. The exhaust system hanger rod is used to support the weight of the exhaust muffler.



- The exhaust system uses several hanger rods and vibration dampers.



- There are two vibration dampers of exhaust muffler rear hanger rod, and a rear hanger rod bracket of exhaust muffler (welded on the underbody) at the rear of muffler. The exhaust

muffler and the exhaust pipe and tail pipe constitute the exhaust muffler assembly.

6.5.4.5 Hanger Rod Description

The exhaust system hanger rod and the vibration damper have the following functions:

- To support the weight of exhaust system.
- To isolate the engine noise.
- To separate the engine vibration.
- To separate the exhaust system from the underbody so as to allow the exhaust system to expand when heated.

6.5.4.6 Clean and Maintenance

In order to make the exhaust system perform the designed functions, always carefully clean all the contact surfaces. The clean surfaces have the following advantages:

- Avoid adhesiveness
- Correct calibrated parts
- allow the gasket to have a good sealing surface.
- Prevent the exhaust system from leaking.

7

Clutch and transmission

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7.1 Manual transmission

7.1.1 Specification

7.1.1.1 Fastener Tightening Specifications

Applications	Specifications
Tachometer harness to the transmission	4 N•m
Transmission ventilation/ filler bolt	4 N•m+45 to 180
Bearing plug (transmission shift linkage) to shift lever seat	5 N•m
Clutch thrust bearing pilot bushing to the transmission housing	5 N•m
transmission to flywheel guard board	7 N•m
Lock pin bridge to bearing plate bolt	7 N•m ^{1) 2)}
differential lock plate mounting bolt	7-10 N•m
Pawl bracket to bearing plate bolt	9 N•m ^{1) 2)}
shift linkage bolt	12 N•m+180 to 225
Bearing plate end cover bolt-M7115	15 N•m
shift cover to transmission case bolt	15 N•m
Clutch assembly to flywheel bolt	15 N•m
Bearing plate end cover bolt-M81.2558	20 N•m
back-up lamp switch to the transmission	20 N•m
5th gear fork bracket bolt	22 N•m ^{1) 2)}
bearing plate to transmission case bolt	22 N•m
differential case cover to transmission bolt	30 N•m
transmission check oil level bolt	30 N•m
Clutch fork to transmission separation bar	35 N•m
transmission support bracket to chassis bolt	60 N•m
engine front support bracket to front frame bolt	65 N•m ²⁾
transmission to engine rear support bracket bolt	70 N•m ^{1) 2)}
differential gear ring connection bolt	70 N•m+30 to 45
transmission assembly to flywheel bolt	75 N•m

- 1) Use new Tightening bolt.
- 2) Cut again the thread, apply locking agent while screwing the Tightening bolt.
- 3) Use new Tightening nut.

7.1.1.2 Pinion housing bearing pre-tensioning specifications

Applications	Specifications
used bearing	60-100 N•m
new bearing	150-210 N•m

7.1.1.3 Sealing agent, lubrication oil and lock agent specifications

Specifications	Description	Trademark	Applications	supplier
B0401108	oil grease lithium EP2	Renolit EP2		Fuchs
B4400429	anti-corrosion oil	Anitcorit Rp4107		Fuchs
B0400881	protective grease	Centoplex-3	input shaft sealing, differential bearing assembly, driving shaft sealing inner surface	Kluber
B0400043	lubrication grease (used in clutch element)	Microlobe		Kluber
B0400063	MT- engine oil	MTF0063	transmission internal parts	Castrol
B0401132 (optional B0400571)	Silicon grease		gear shift guiding lever assembly and shift lever assembly part	

7.1.1.4 transmission

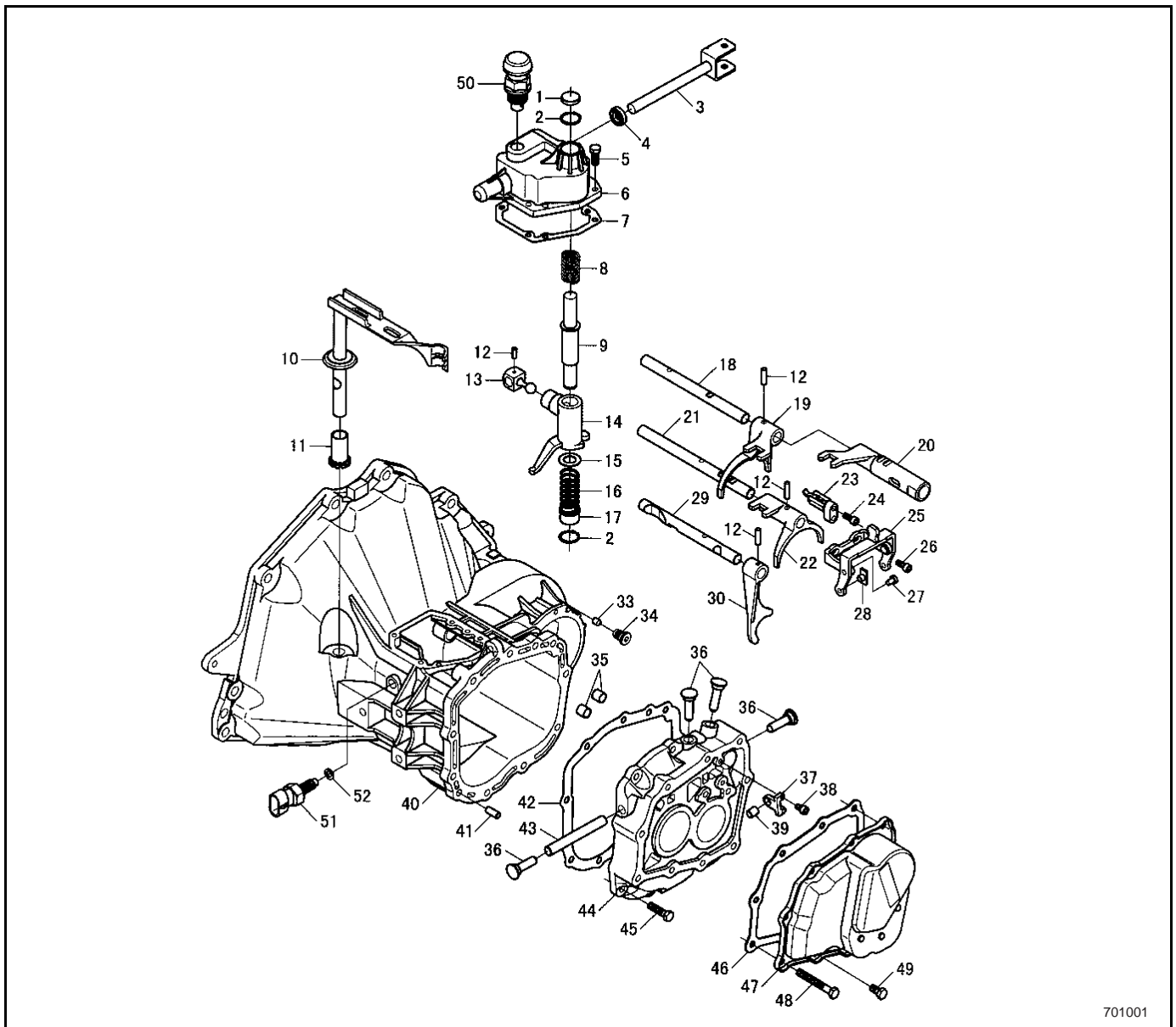
F15-5 Transmission	Transmission driving ratio	Transmission oil
Sail is equipped with F15-5WR4.19 type transmission F15-5WR4.19 means: 1. F- front wheel drive 2. 15-maximum input torque = 150 N•m 3. 5- driving gear number 4. WR – width ratio value 5. 3.94 – main speed reduction ratio	1st gear 3.73(41/11) 2nd gear 1.96(49/25) 3rd gear 1.32(41/31) 4th gear 0.95(35/37) 5th gear 0.76(31/41) Reverse 3.31	synthetic oil fluid MTF 0063 Part Number:12378495 approved supplier CASTROL displacement: 1.6L

7.1.1.5 Clutch

Type	single plate clutch
clutch plate diameter	200 mm
inner and outer diameter of the lining plate	200/145 mm
lining plate thickness:	3.5 mm
material:	B-9705 (Raybestos, Suzhou, PRC)

7.1.2 Component Location

7.1.2.1 Transmission Operation and Housing



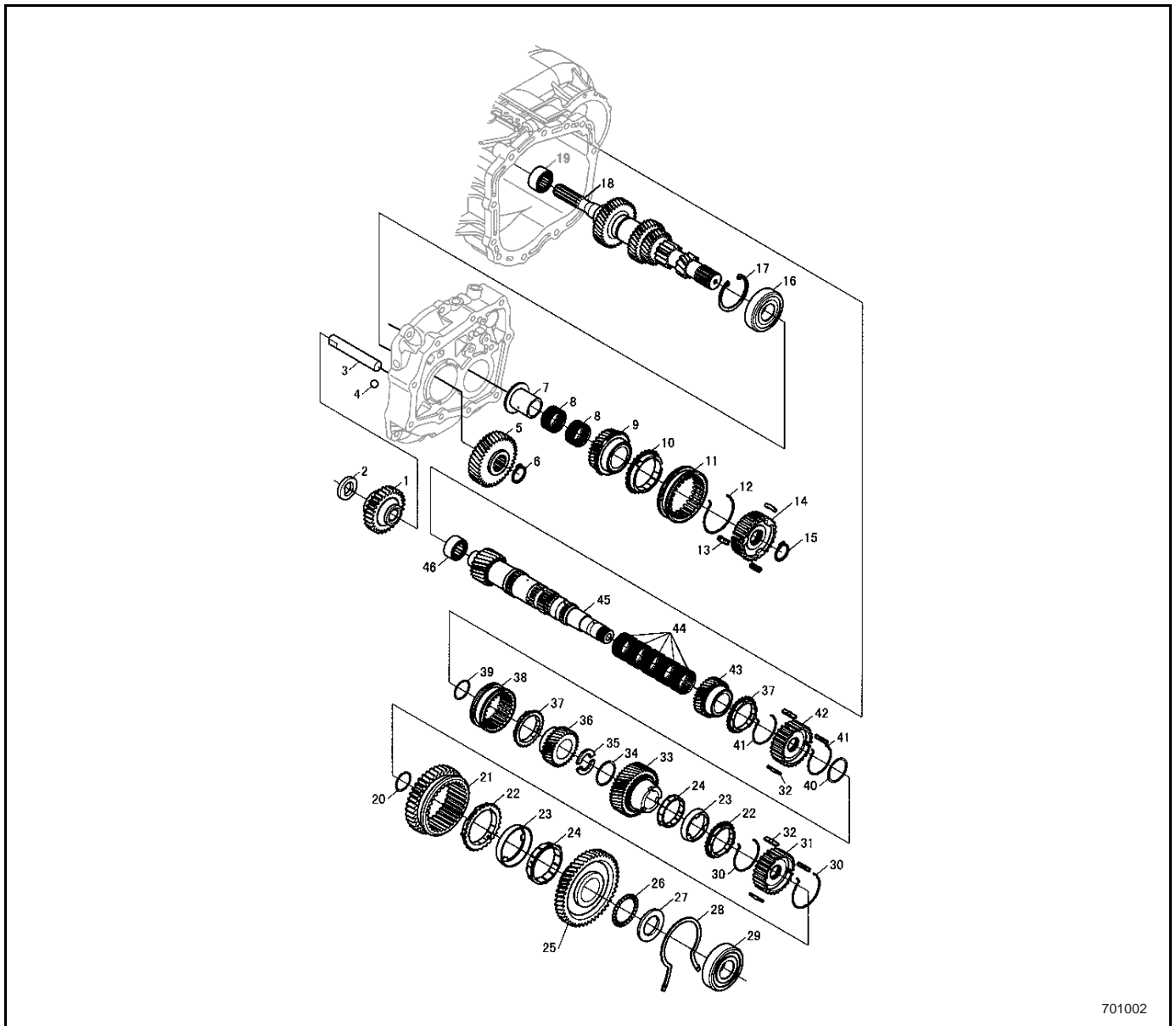
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Legend

- | | |
|--|-----------------------------------|
| (1) shift shaft gasket | (12) shift shaft pin |
| (2) shift rocker arm shaft spring seat guarding ring | (13) shift shaft puller |
| (3) transmission shift shaft assembly | (14) shift rocker arm assembly |
| (4) shift shaft sealing ring | (15) shift rocker arm washer |
| (5) shift cover bolt | (16) shift rocker arm spring |
| (6) shift selector shaft cover assembly | (17) shift rocker arm spring seat |
| (7) shift cover sealing gasket | (18) 3- 4 shift shaft |
| (8) shift rocker arm shaft spring | (19) 3- 4 fork (TPE) |
| (9) pilot shaft | (20) 5th gear bearing assembly |
| (10) clutch separation handle assembly | (21) 1- 2 shift shaft |
| (11) clutch form shaft bushing | (22) 1- 2 shift fork assembly |

- | | |
|---|---|
| (23) 5th shift pawl assembly | (38) transmission cover locator pin |
| (24) 5th shift pawl bracket bolt | (39) shift shaft pin |
| (25) 5th shift fork assembly | (40) transmission housing assembly |
| (26) inner hexagon bolt | (41) locator pin |
| (27) bolt | (42) bearing cover gasket |
| (28) 5th shift fork foot | (43) shift shaft pin |
| (29) Reverse shaft | (44) bearing cover |
| (30) reverse fork | (45) transmission housing bolt |
| (31) transmission cover locator pin | (46) rear cover gasket |
| (32) locator screw | (47) transmission cover assembly |
| (33) Oil bleeding plug | (48) transmission housing bolt |
| (34) 5th shift shaft gasket | (49) transmission housing bolt |
| (35) fork shaft self inclining lock pin | (50) transmission ventilation unit assembly |
| (36) shift shaft interlock pin | (51) back-up switch indicator |
| (37) inner hexagon bolt | (52) back-up switch lamp sealing ring |
-

7.1.2.2 Gear driving mechanism



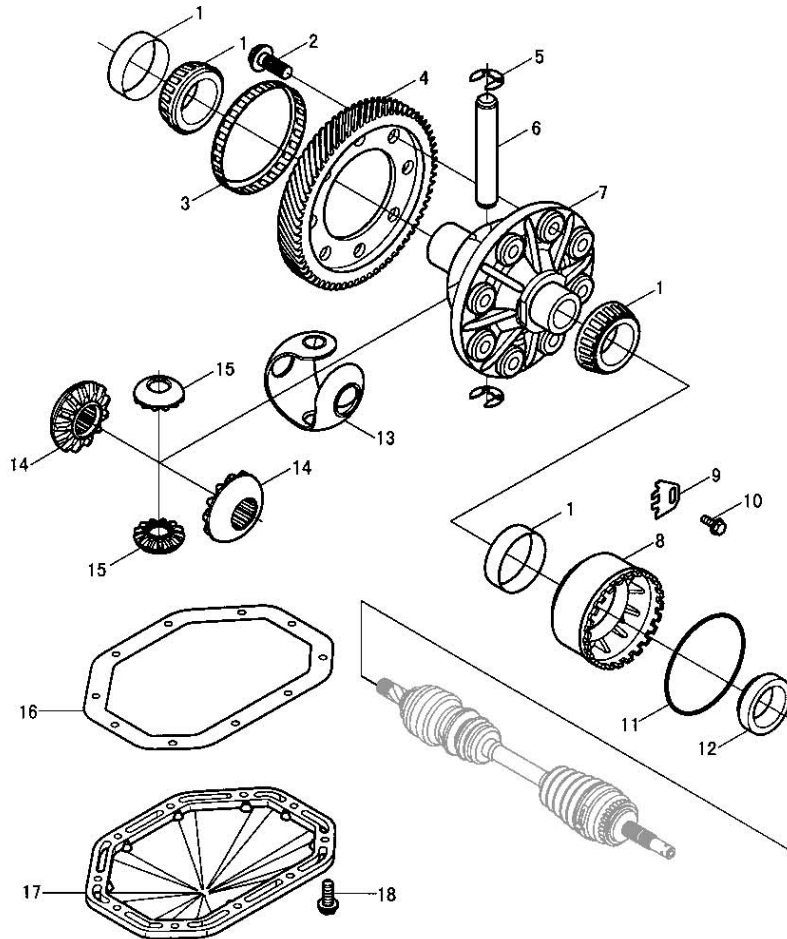
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Legend

- | | |
|---|--|
| (1) reverse idle gear assembly | (13) 5th gear synchronizer slip |
| (2) reverse idle gear thrust gasket | (14) 5th gear hub |
| (3) Reverse gear shaft | (15) output shaft flange race |
| (4) steel ball | (16) ball bearing |
| (5) 5th driving gear | (17) caliper |
| (6) caliper | (18) input shaft gear |
| (7) 5th shift needle bearing inner race | (19) input shaft bearing assembly |
| (8) needle bearing | (20) output shaft flange race |
| (9) 5th gear assembly | (21) 1- 2 synchronizer gear bushing |
| (10) 5th gear synchronized ring | (22) 1- 2 synchronizer outer push ring |
| (11) 5th synchronizer gear bushing | (23) 1st gear intermediate ring |
| (12) 5th gear synchronizer spring | (24) 1st gear synchronizer bushing |

- | | |
|--|--|
| (25) 1st gear assembly | (36) 3rd gear assembly |
| (26) flat bearing | (37) 3rd gear synchronizer ring |
| (27) 1st gear thrust plate | (38) 3- 4 synchronizer gear bushing |
| (28) output shaft rear end bearing flange race | (39) output shaft flange race |
| (29) caliper | (40) output shaft rear end gear thrust plate |
| (30) 1st and 2nd gear synchronizer spring | (41) 5th gear synchronizer spring |
| (31) 1-2 gear hub | (42) 3- 4 synchronizer gear hub |
| (32) 1st and 2nd gear synchronizer slip | (43) 4th gear assembly |
| (33) 2nd gear | (44) output shaft needle |
| (34) 5th gear thrust plate | (45) output shaft |
| (35) output shaft rear end gear thrust plate | (46) main shaft bearing assembly |
-

7.1.2.1 Differential Assembly

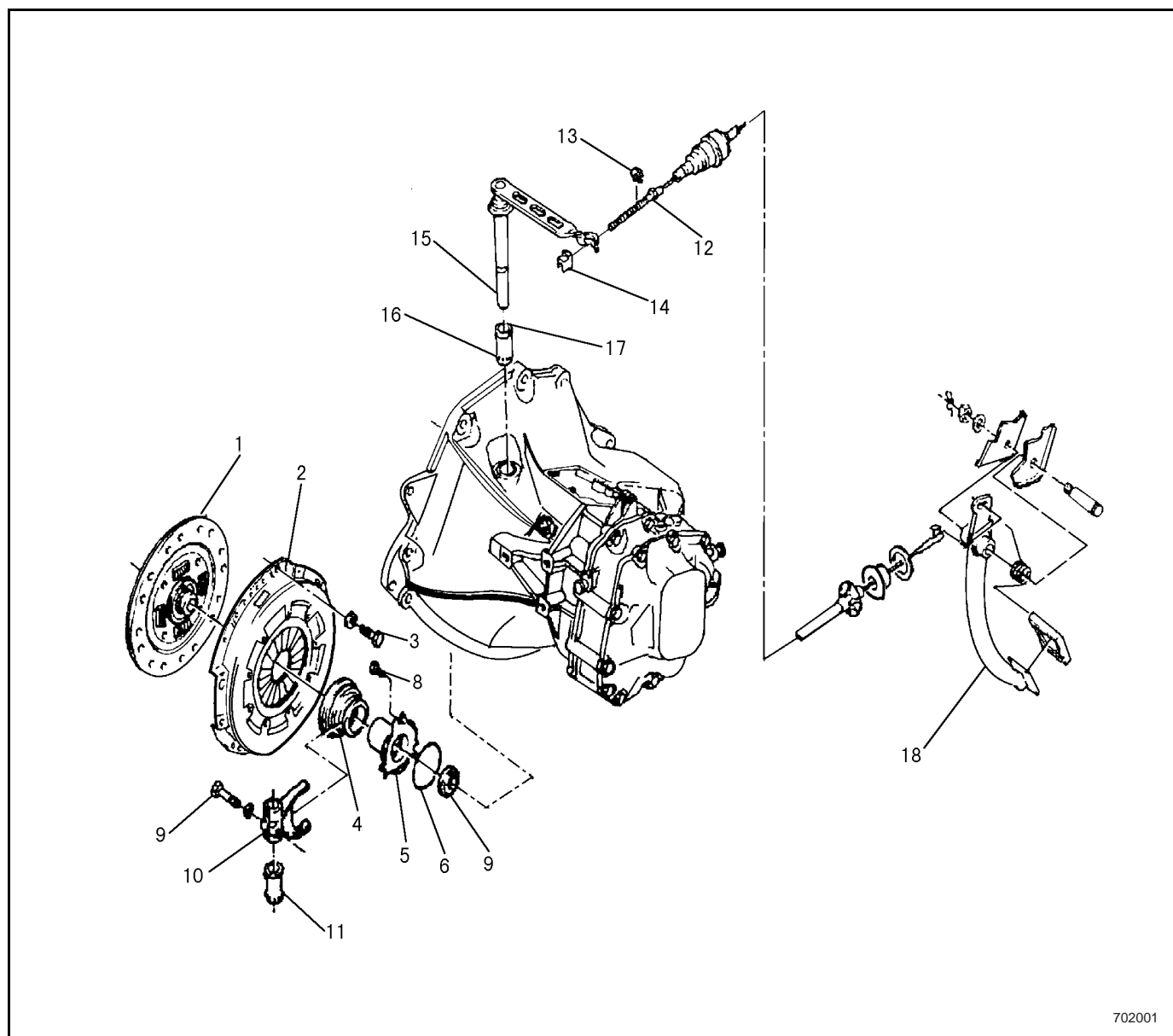


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Legend

- | | |
|---------------------------------------|-------------------------------------|
| (1) taper ball bearing | (10) hexagon bolt |
| (2) bolt | (11) O-ring sealing |
| (3) Rear wheel speed sensor gear ring | (12) Oil sealing |
| (4) main deceleration driven gear | (13) differential washer |
| (5) caliper | (14) half shaft gear |
| (6) sun gear shaft | (15) sun gear |
| (7) differential case | (16) differential side cover gasket |
| (8) differential bearing cover | (17) differential side cover |
| (9) brake plate | (18) differential side cover screw |

7.1.2.4 Clutch Assembly



702001

Legend

- | | |
|--------------------------------------|--|
| (1) clutch driving plate | (10) clutch fork |
| (2) clutch pressure plate | (11) clutch fork gasket |
| (3) clutch bolt | (12) clutch cable assembly |
| (4) clutch isolation bearing | (13) clutch cable thrust plate |
| (5) clutch isolation bearing bushing | (14) clutch cable nut |
| (6) O-ring sealing | (15) clutch separation handle sub-assembly |
| (7) input shaft bearing assembly | (16) clutch isolation shaft sealing ring |
| (8) clutch fork shaft bushing bolt 3 | (17) clutch form shaft bushing |
| (9) clutch fork bolt | (18) clutch pedal assembly |

7.1.3 Diagnostic Information and Procedure

7.1.3.1 Transmission hard or loud noise

Complaint:

Poor performance.

Transmission hard or loud noise.

possible causes:

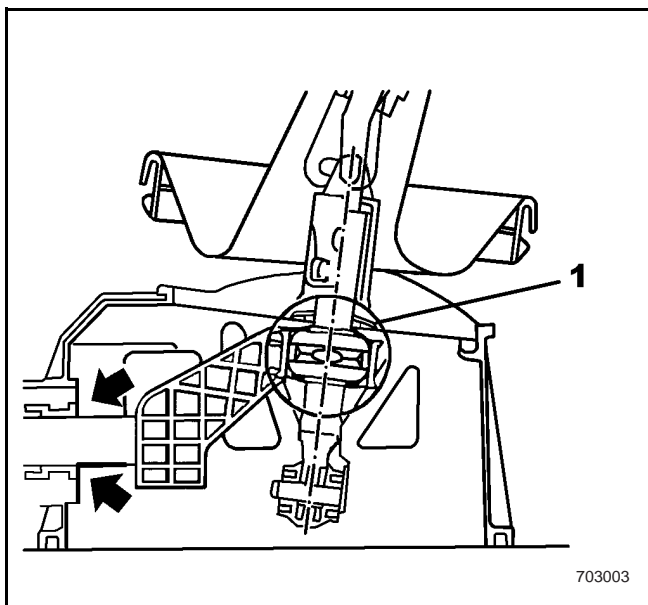
Inadequate lubricants resulting in insufficient lubrication

Clutch fails to be separated completely.

Removal Procedure:

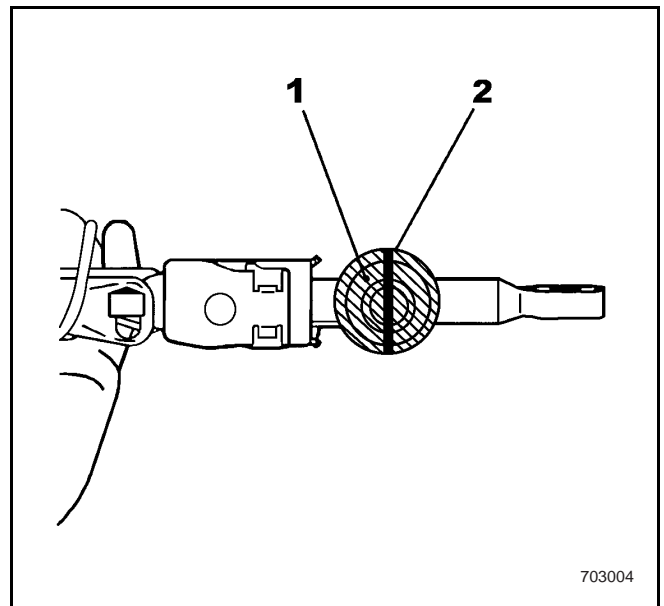
1. Remove the shift selector lever and clear away used lubricants on it, lubricate the shift selector lever with suitable lubricants and re-install.
2. To remove the transmission shift lever, remove the corrugated pipe clamped at the central console with hand. Loose the clamp at the bottom of the shift lever and take out the pin. Remove the transmission shift lever. Use brush to lubricate the transmission shift lever (1) and shift linkage with silicon-based lubricants (as shown by arrow in the figure). Install the transmission shift lever into shift mechanism housing. Install the clamp and pin.
3. Clamp the corrugated pipe at the central console. There is no need to adjust the transmission shift.

Notice: Refer to "Replacement of the Transmission Shift Lever" for detailed information about removal and installation of the transmission shift lever.



4. Wiper away the used grease on transmission shift lever ball head surface as shown in shades in the figure (1). If rubber sealing ring (2) is

installed at the transmission shift lever ball head, it is necessary to inspect it.



5. If the lubricants are polluted by winding material particles, replace the rubber sealing. Because of influence of slight winding particles, color of the grease may turn dark, it is acceptable since it will not influence its function.
6. Before assembly, apply grease B0401132 (optional B0400571) of 0.5mm thick at surface of the shift lever and lever seat assembly that requires lubrication.
7. If the trouble is caused by incomplete separation of the clutch, refer to the clutch diagnosis information for correction procedures.

7.1.3.2 Clutch Failure Diagnosis

Clutch assembly and clutch control system performance diagnosing shall be performed by experience driver or service technicians.

The following diagnosis involves common problems and possible causes.

After conducting relevant diagnosis, adjust or replace the components if necessary according to the relevant solutions and specific procedures in respective chapters.

During vehicle service, clutch pressure plate and clutch plate cannot be serviced, if any of them is damaged, replace the entire assembly.

If rivet of the clutch plate is worn or the clutch plate is polluted by oil or grease, discard the clutch plate.

If any of the parts should be replaced, replace with a new one of sound quality.

The diagnosis table helps to diagnose the clutch system troubles caused by the following conditions, unable to separate, incomplete separation, incomplete engagement, slip, noise, vibration / trembling.

Digit number in the table does not represent the actual sequence, there is no sequencing among different trouble causes.

Clutch Failure Diagnosis

Inspections	Possible reasons	remedy
unable to separate	<p>The clutch unable to separate is inoperative, that is, unable to cut the power from the engine. Inspect the following circumstances:</p> <ol style="list-style-type: none"> 1. Clutch separation lever deforms. 2. Film spring deforms. 3. Film spring support ring breaks. 4. Clutch pedal control system poorly aligned with the clutch cable. 5. Clutch plate and flywheel adheres or clutch pressure plate adheres. 	<p>Replace the deformed, worn and broken parts. Adjust the clutch system.</p>
Separation incomplete	<p>If the clutch is separated incompletely, it will not be able to cut off power from the engine normally, the transmission selector may hard to operate due to rotation of clutch plate and transmission input shaft. Inspect the following circumstances:</p> <ol style="list-style-type: none"> 1. Clutch plate deformation, swaying during rotation. 2. clutch plate damage 3. Clutch plate spline does not match the transmission input spline, or spline tooth surface damaged. 4. Clutch plate adheres with the flywheel partly or engages with the clutch pressure plate. 5. Flywheel/ clutch pressure plate/ clutch plate thickness exceeds the specified dimensions. 6. Clutch pedal control system is poorly aligned with the clutch cable or there is mechanical failures. 	<p>Replace the deformed, worn, broken and out-of-specification parts. If the clutch fails to cooperate with the transmission input shaft spline, replace the clutch plate, if necessary, replace the transmission input shaft. If size of the clutch plate exceeds the specified value or damaged, replace it. Replace the inadequate clutch thrust bearing. Adjust the clutch system to remove the unnecessary gap and to eliminate the mechanical failures. Re-install the improperly assembled parts.</p>

Clutch Failure Diagnosis(Cont' d)

Inspections	Possible reasons	remedy
incomplete engagement	<p>If the clutch is engaged incompletely, power from the engine may not be able to reach the transmission input shaft, clutch plate slips.</p> <p>Inspect the following circumstances:</p> <ol style="list-style-type: none"> 1. Clutch plate polluted by engine oil or grease. 2. Clutch plate damage. 3. Clutch pedal has no free play. 4. Film spring/ clutch pressure plate/ clutch separation lever/ clutch plate spline deforms or damaged. 5. Clutch pedal control system is poorly aligned with the clutch cable or there is mechanical failures. 	<p>Replace the deformed, worn and broken parts.</p> <p>Replace the clutch assembly with troublesome clutch plate.</p> <p>Correctly adjust the free play of the clutch pedal.</p> <p>Adjust the clutch system to remove the unnecessary gap and to eliminate the mechanical failures.</p> <p>Re-install the improperly assembled parts.</p>
Slippery	<p>Clutch plate slips may result in failure to transmit the engine power.</p> <p>Inspect the following circumstances:</p> <ol style="list-style-type: none"> 1. clutch plate wearing. 2. Clutch plate polluted by engine oil or grease. 3. Clutch fails to engage completely. 4. Flywheel/ clutch pressure plate/ clutch plate thickness exceeds the specified dimensions. Friction surface exceeds the specified specifications. 5. Driving improperly may cause overheat in the transmission housing. 6. Install the improperly installed clutch. 	<p>Replace the deformed, worn, broken and out-of-specification parts.</p> <p>Solutions to Incomplete separation and Incomplete engagement.</p> <p>Turn off ignition, cool the clutch housing (if overheated), diagnose in further details.</p> <p>Install the designated clutch correctly.</p> <p>Adjust the clutch system and clutch cable to remove the unnecessary gap and to eliminate the mechanical failures.</p> <p>Re-install the improperly assembled parts.</p> <p>Do not put your foot on the clutch pedal all the time.</p>
Noise	<p>Inspect the following circumstances:</p> <ol style="list-style-type: none"> 1. Unsuitable clutch plate. 2. Poor balance. 3. Clutch thrust bearing fails. 4. Clutch plate torque shock absorber spring damaged. 	<p>Replace the deformed, worn and broken parts.</p> <p>Install the designated clutch plate.</p> <p>If certain part is poorly balanced, replace the clutch assembly.</p> <p>Adjust the clutch system and cable system.</p> <p>Re-install the improperly assembled parts.</p>
Vibration/ Trembling	<p>When the clutch plate fails to engage with the flywheel, the situation occurs.</p> <p>Clutch fails to engage.</p> <p>Inspect the following circumstances:</p> <ol style="list-style-type: none"> 1. Clutch shock absorber spring fails to comply with specifications. 2. Clutch plate gasket fails to comply with specifications. 3. Clutch plate polluted by engine oil or grease. 	<p>Replace the clutch assembly.</p>

7.1.4 Repair Guidance

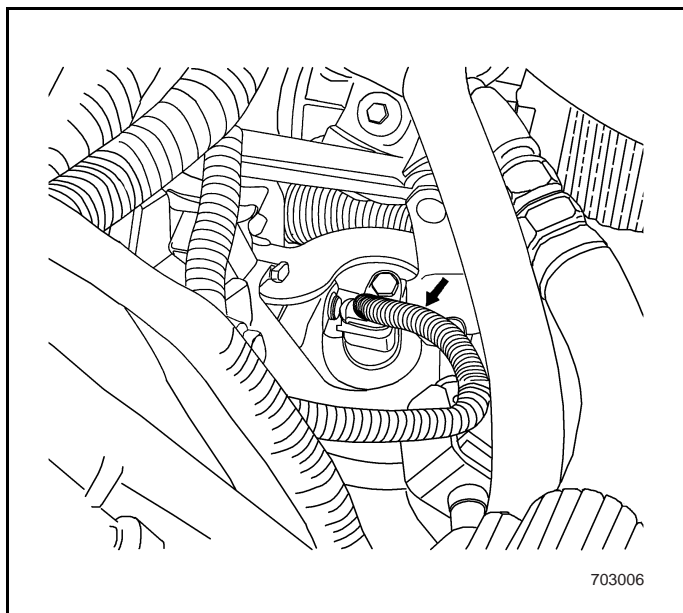
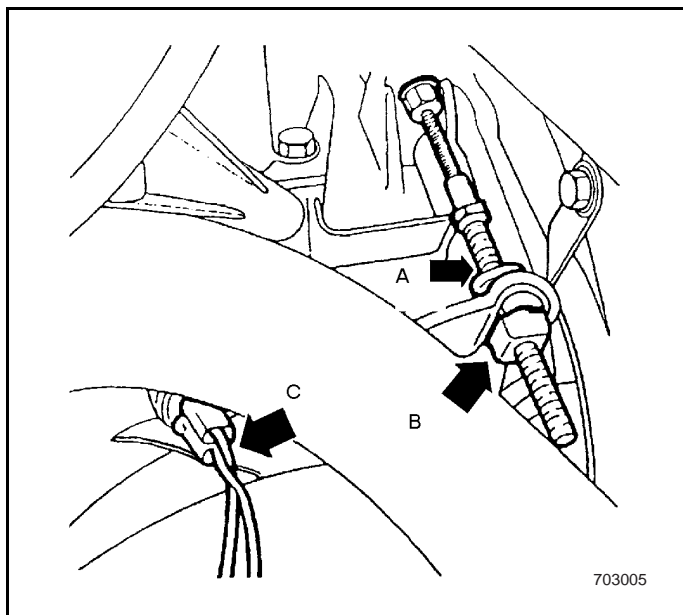
7.1.4.1 Replacement of transmission assembly

Removal Procedure

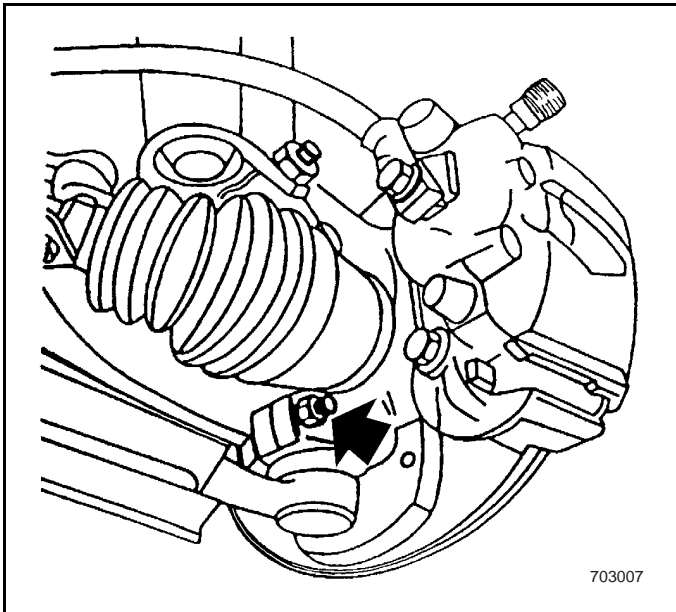
Required tools

- KM-902 remover
- J -840732 bracket

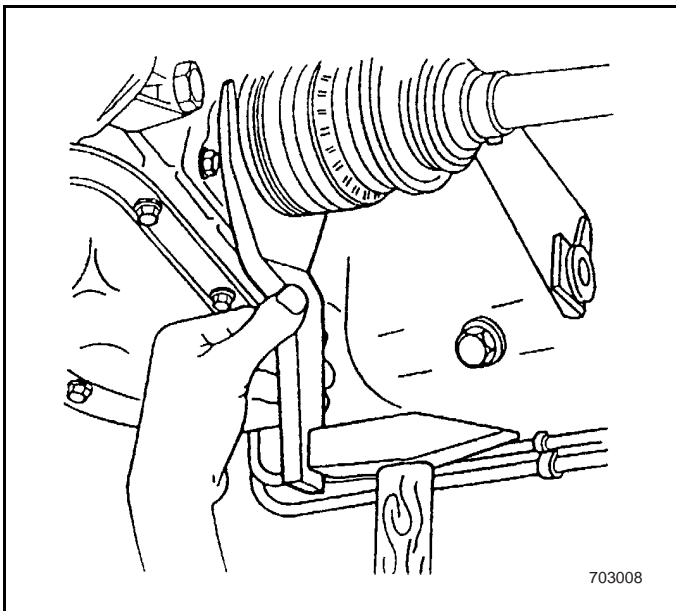
1. Place the vehicle on hoist.
2. Disconnect the battery.
3. Remove thrust plate A from the clutch cable, remove clutch cable B from the clutch separation lever.
4. Remove connector C of the back-up lamp wiring harness.



5. Disconnect the tachometer harness connection.
6. Remove the shift selector guiding lever assembly, refer to Replacement of Shift Selector Guiding Lever Assembly.
7. Remove the front wheel.
8. Remove the engine oil pan guard plate.

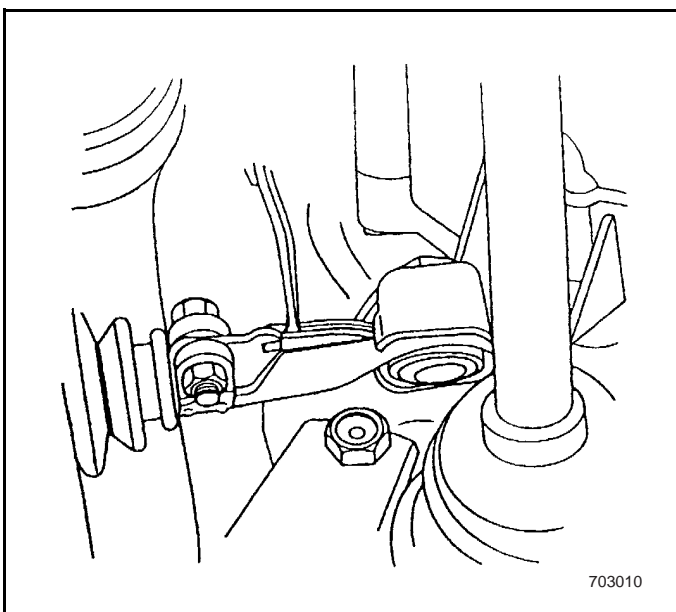


9. Remove the stability lever assembly, steering tie-bar, control arm and ball joint, put a plate under the vehicle.

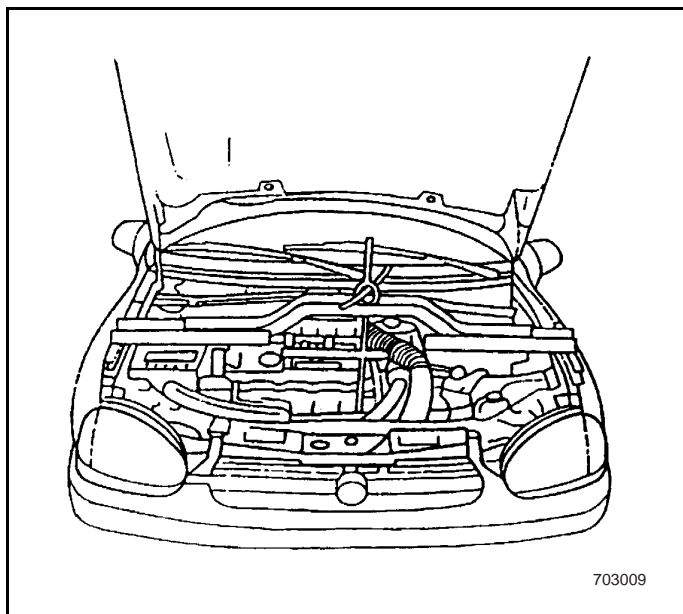


10. Remove the driving shaft, pull them out from the transmission housing. Use KM-902 if necessary.

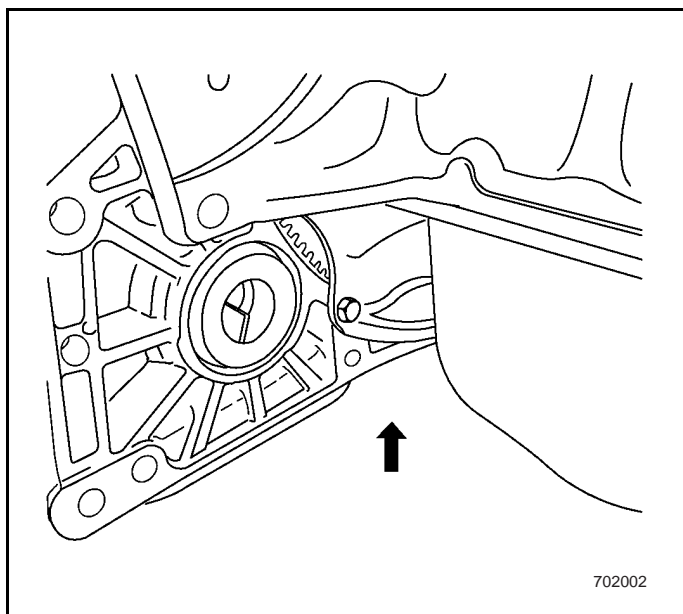
Note: Cover the differential two ends output hole to prevent the oil from flowing out.



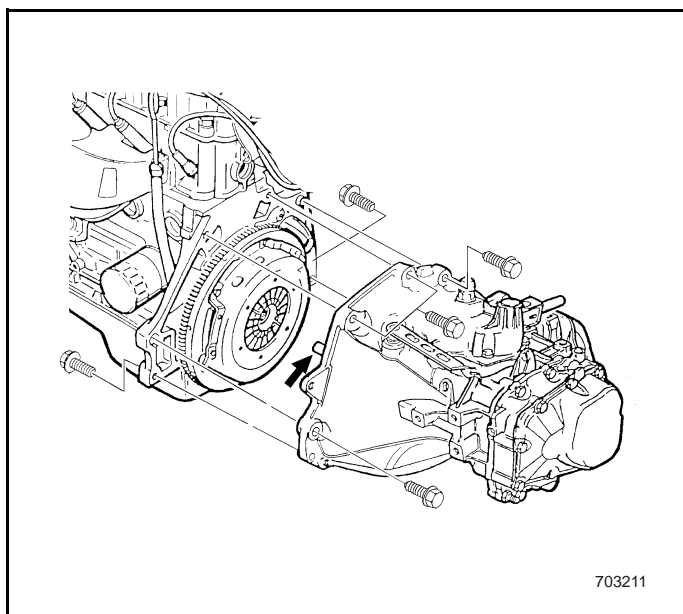
11. Disconnect the shift lever by loose its Tightening bolts.



12. With the help of J -840732, support the engine and remove the front support bracket from the body.
13. Remove the transmission support bracket from the chassis.



14. Remove the flywheel guard plate.



Note: use suitable devices to support the transmission, loose the bolt connecting the transmission and engine.

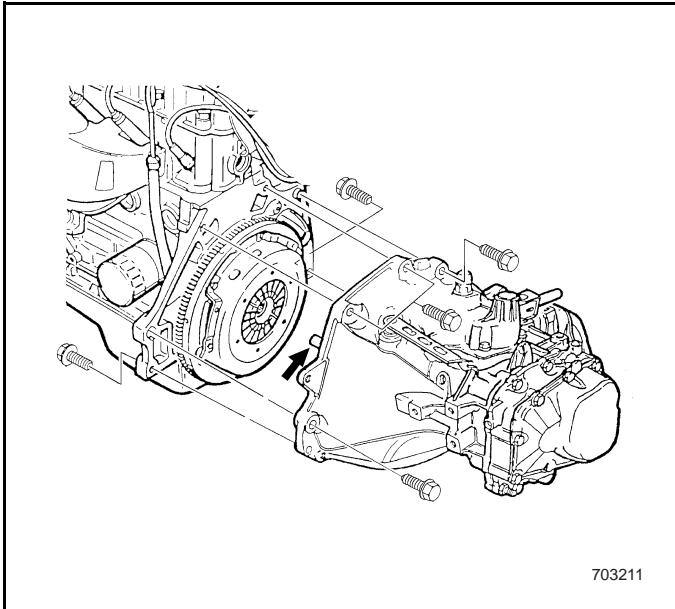
15. Remove the transmission assembly together with the engine front support bracket, transmission support bracket.

Installation Procedure

Required tools

- J - 840732 bracket

Note: Put the transmission on adequate support, lower the vehicle carefully.



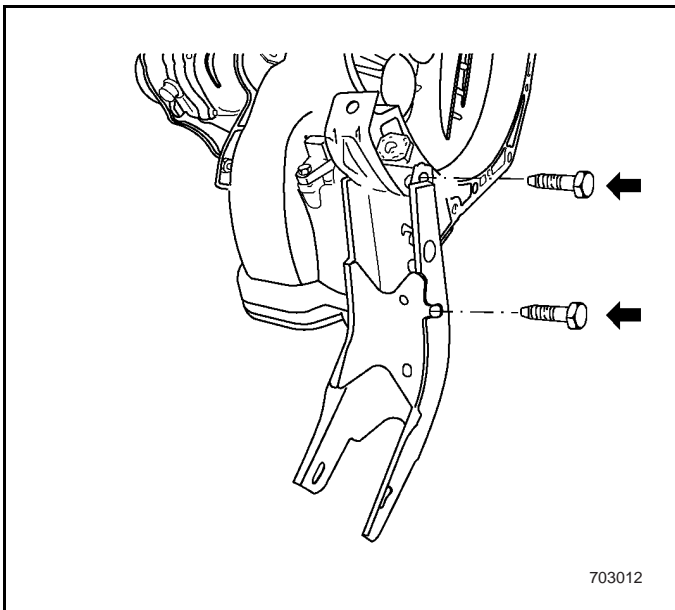
1. Install the transmission to the engine together with the engine front support bracket, transmission support bracket.

Tightening

Tighten the bolt connecting the transmission assembly and engine to 75 N•m

2. Apply multi-purpose grease onto transmission input spline (as shown by arrow in the figure).

Note: Apply only lubrication grease in spline channel, remove the excessive lubrication grease. Friction surface of the clutch plate shall not contact with the lubrication grease.



Note: Use new bolt applied with LOTA thread Tightening agent (transmission to engine rear support bracket, arrow in the figure) (LOTA part number 24166, optional: 24266). Use LOTA according to technical specifications.

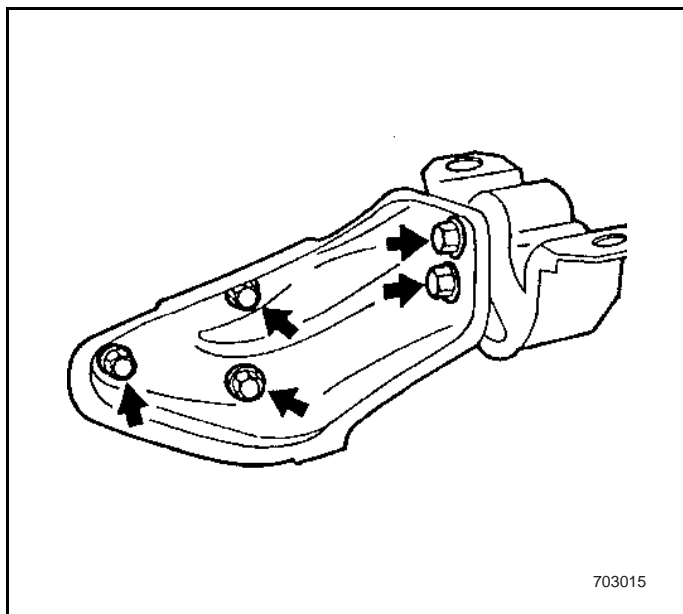
Tightening

Tighten the bolt connecting the transmission assembly and engine rear support bracket to 70 N•m

3. Install the flywheel guard plate.

Tightening

Tighten the flywheel guard plate to transmission bolt to 7 N•m.



4. Install the engine front support bracket to front wheel (as shown by two arrows at right).

Tightening

Tighten the engine support bolt to 65 N•m.

5. Install the transmission support bracket to the chassis (as shown by the three arrows at left).

Tightening

Tighten the transmission support to chassis bolt to 60 N•m.

6. Install the shift linkage to maintain the bolt at loose status.

Note: Remove the engine support tool J-840732.

7. Install the driving shaft.
8. Install steering tie-bar, control arm and stability lever assembly.
9. Install the ball joint.
10. Install the engine oil pan shield.
11. Install the front wheel.
12. Install the shift lever guiding lever assembly.
13. Install tachometer harness.
14. Install back up lamp harness.
15. Install the clutch cable.
16. Connect the battery wiring

Notice: Adjust the shift linkage interlock mechanism correctly (then tighten the shift linkage bolt to the designated torque), adjust clutch cable and inspect the transmission oil level.

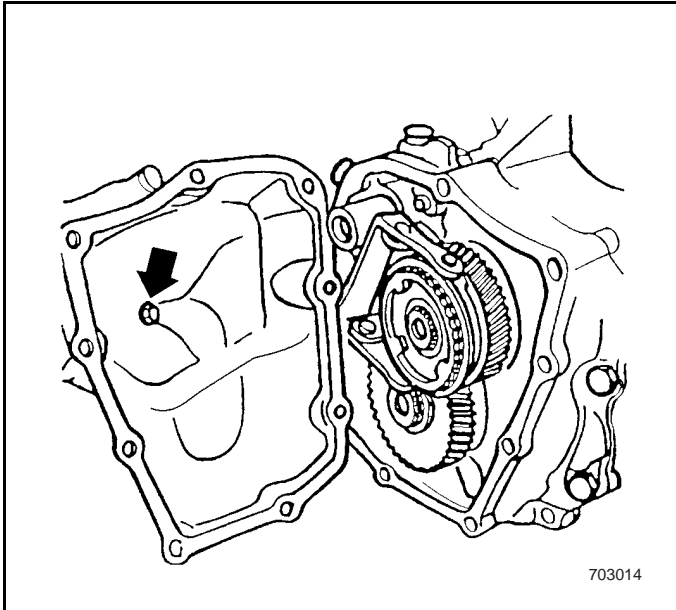
7.1.4.2 Transmission Disassembling

Note: Prepare a clean table to put the removed parts.

Removal Procedure

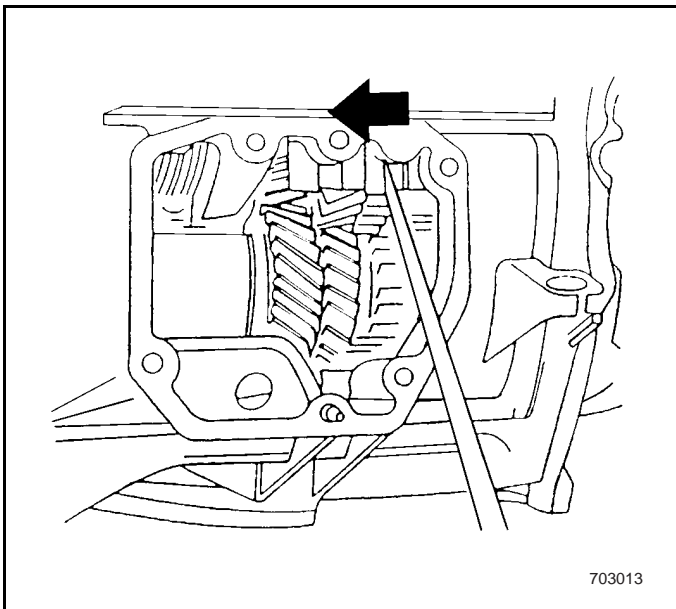
Required tools

- J -810725 bracket
- V-8607010 support
- J-810704 puller
- J-820726-A puller
- V-9307207 lock-up slip hammer
- V-9307211 plug puller
- J-820729 locker

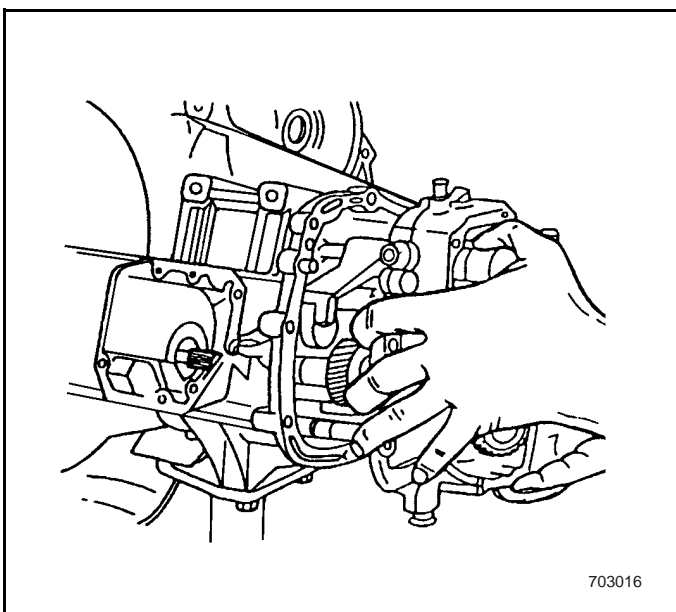


1. Remove the transmission.
2. Remove the bearing plate end cover and the bolt.

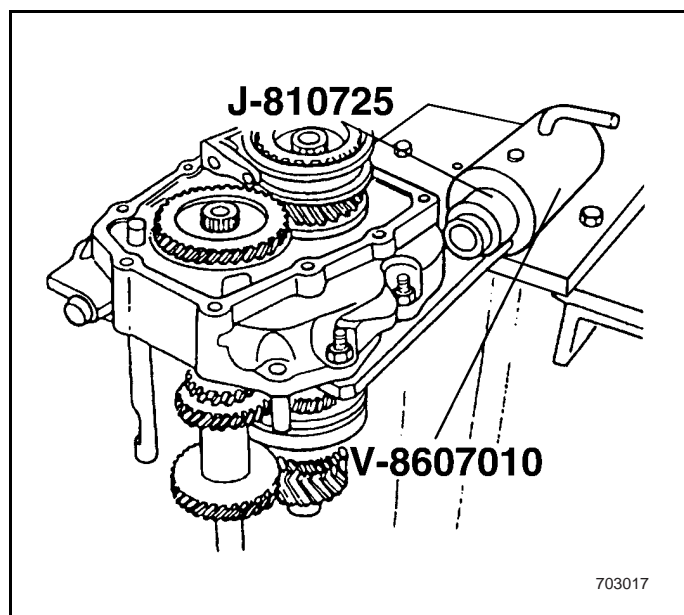
Note: Pay attention to the bushing of the cover (as shown by arrow in the figure).



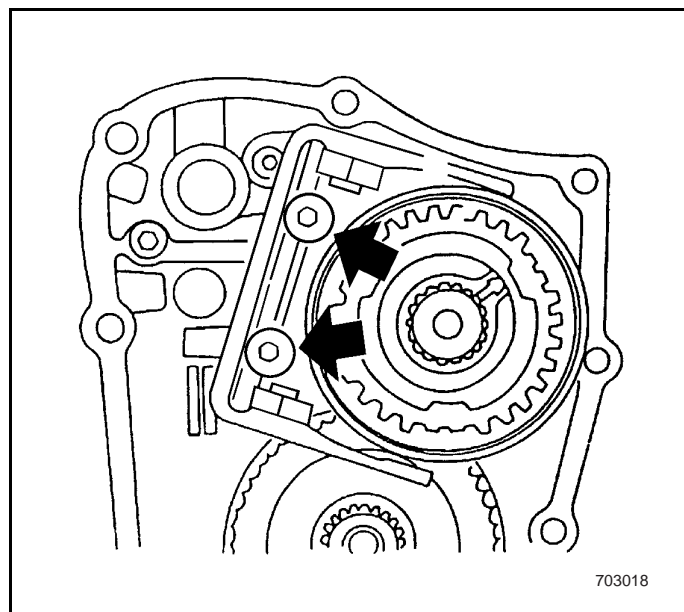
3. Remove the shift control cover.
- Note: Direct the shift fork to the designated direction, switch to 2nd gear.
4. Remove the bolt connecting the transmission case to the bearing plate.



5. Remove the transmission case assembly.



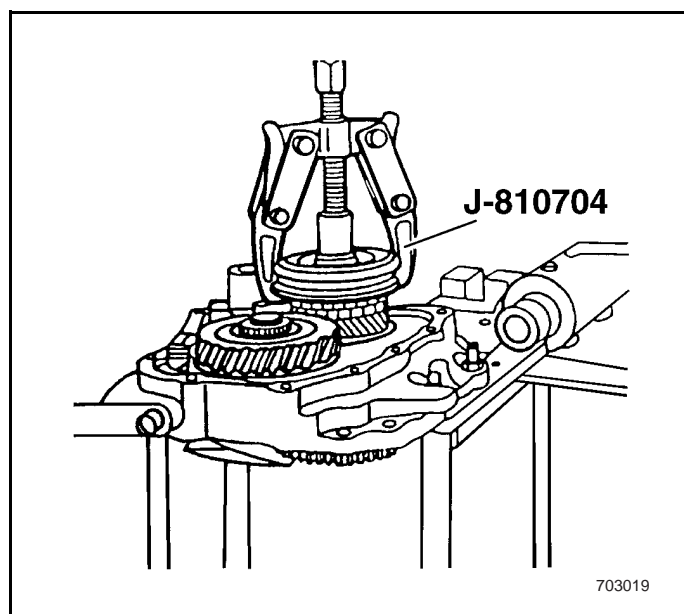
Note: Install the bearing plate and gear set assembly to the tool J-810725, then onto bracket V-8607010.



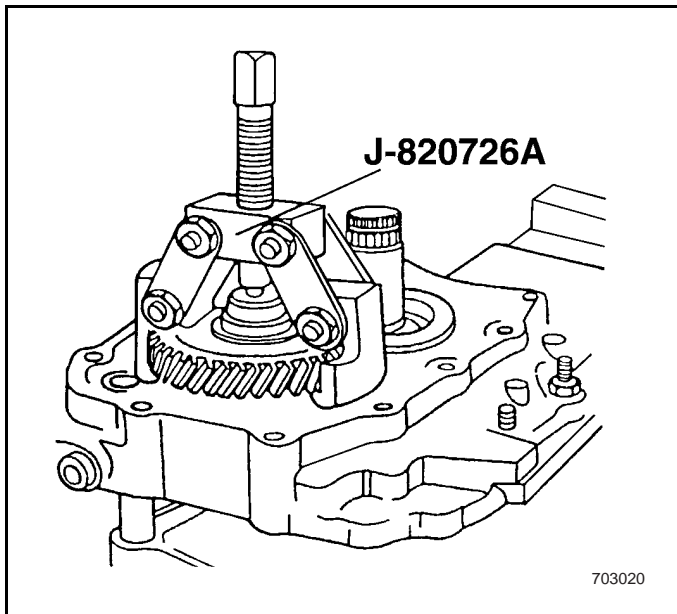
6. Remove the 5th gear fork bolt

7. Remove the 5th gear fork.

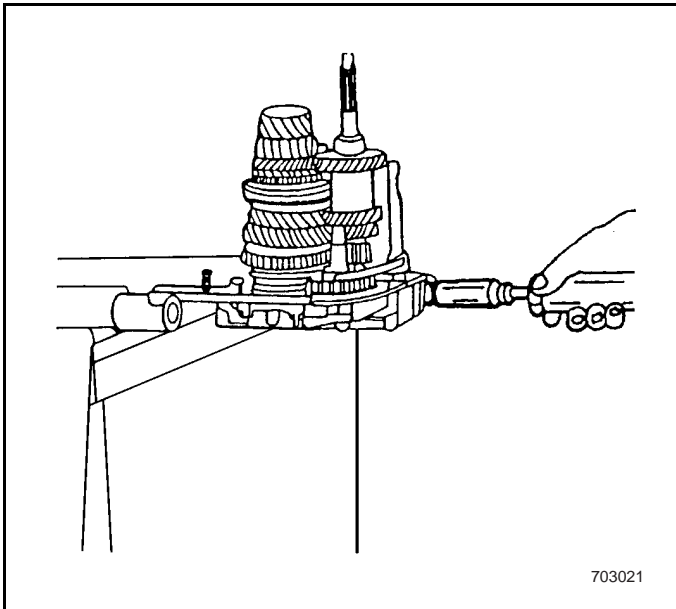
Note: Fork bolt is small bag-shaped. It may be difficult to remove. To avoid damage to it, use a heating blower to heat the area (to about 80°C).



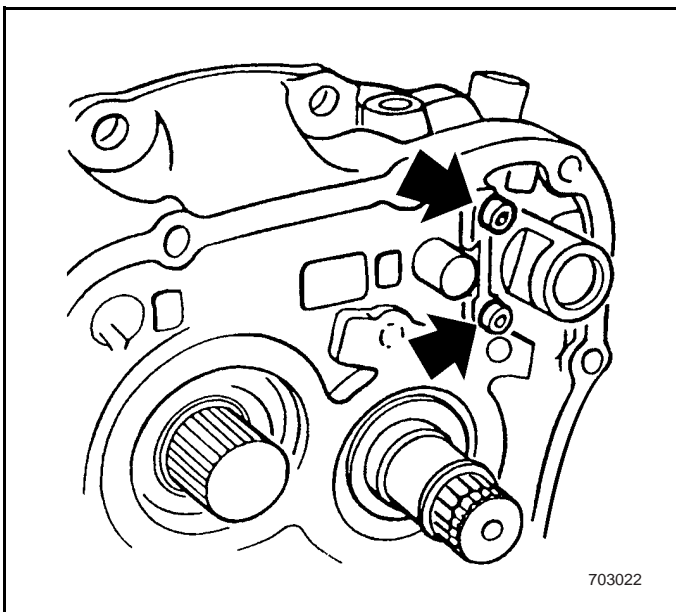
8. Grasp the 5th synchronizer engaging set, use 5th shift tool J-810704 to remove it.



9. Remove the needle bearing.
10. With the help of tool J-820726-A, remove caliper and 5th shift driving gear.
11. Remove the pawl bracket bolt.
12. Remove the pawl bracket.

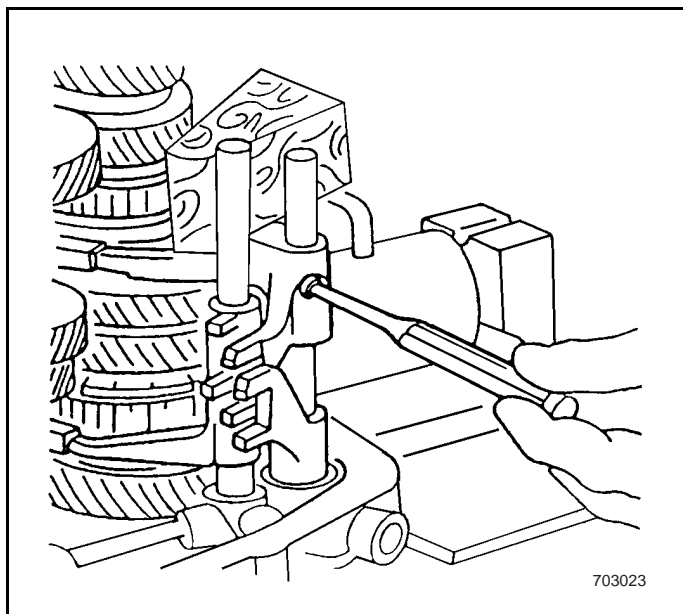


13. With the help of V- 9307207 and V- 9307211, remove the self-lock pin.
14. Unplug the fork location spring and the small ball.



15. Lock-pin bridge.

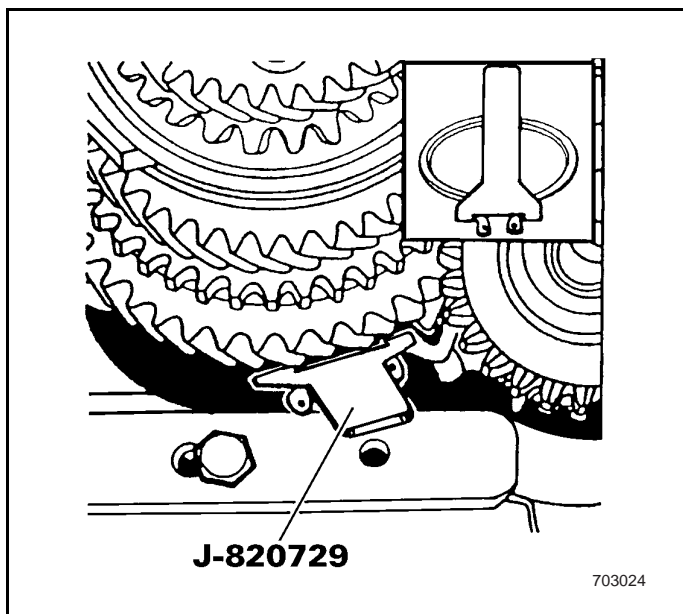
Note: For this procedure, switch to 2nd and 5th shift. If it is hard to remove the bag-shaped bolt, use heat blower to heat the area.



16. Remove fork spring pin of R, 3rd and 4th shift with punch.

Note: Support the fork shaft with wooden wedge to avoid damage to the shaft.

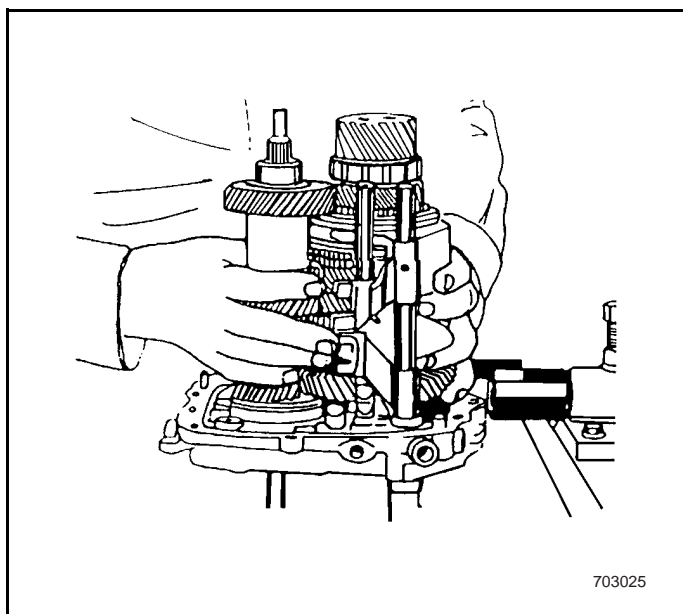
17. Remove the fork and the respective shafts.



18. Remove main shaft rear bearing ear spring ring.

Note: For this procedure, use tool J-820729 to press the spring caliper.

19. Remove the main shaft.
20. Remove the gear set.
21. Remove the shaft with 1st and 2nd shift fork.



22. Remove the reverse shift idle wheel.

Note: Flare the gear set rear bearing spring caliper while performing the removal procedures. If necessary, use a heat blower to heat the bearing housing.

23. Remove the bearing plate lock.

7.1.4.3 Replacement of main shaft assembly

Removal Procedure

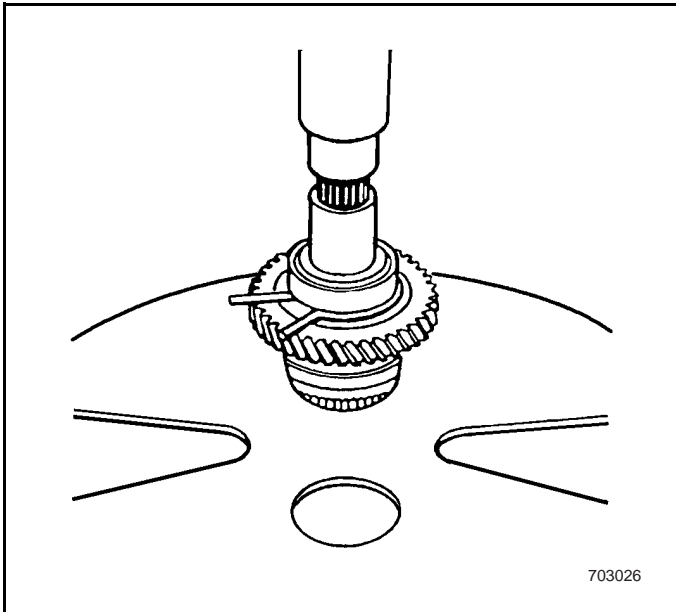
Required tools

- J-9307206 puller

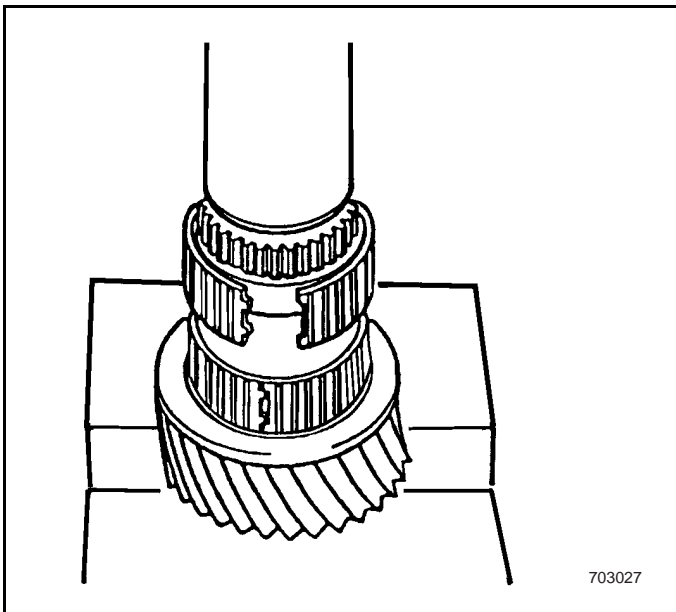
1. Remove the transmission assembly with reference to "ransmission Assembly Removal".
2. Remove the main shaft.

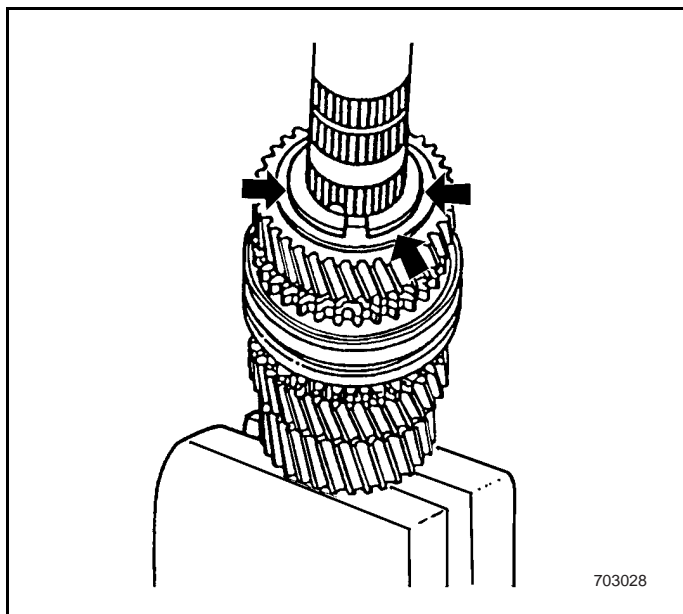
Note: Prepare a clean table to put the removed parts.

3. Remove the spring caliper at the end.
4. Remove the 1st gear fork.
5. Remove the bearing.
6. Remove the caliper.

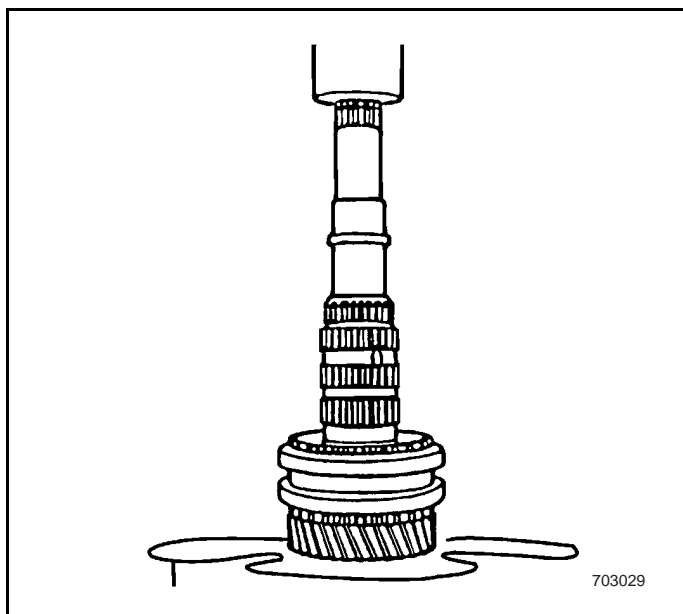


7. With the help of V-9307206 and press machine, remove the needle bearing set.
8. Remove the spring caliper at the engaging point of 1st and 2nd shift synchronizer.
9. Remove the 2nd shift gear and the synchronizer engaging set of 1st and 2nd shift.
10. Remove the caliper from the thrust washer.





11. Remove the thrust washer.
12. Remove the 3rd shift gear.



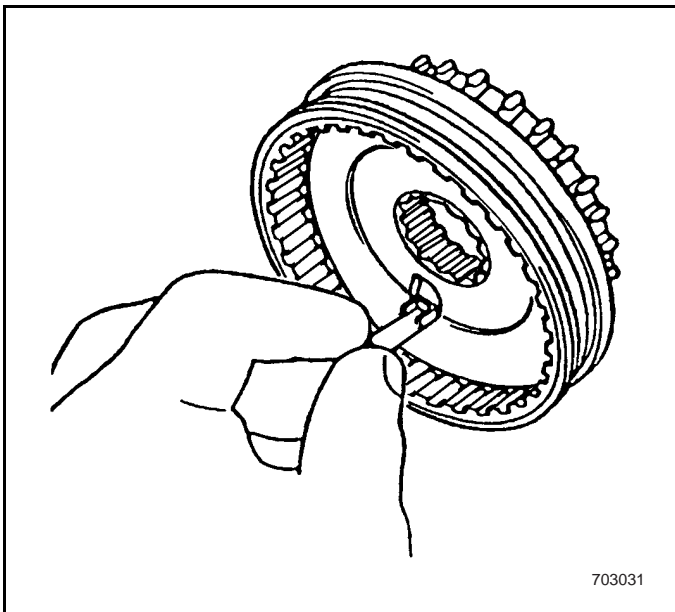
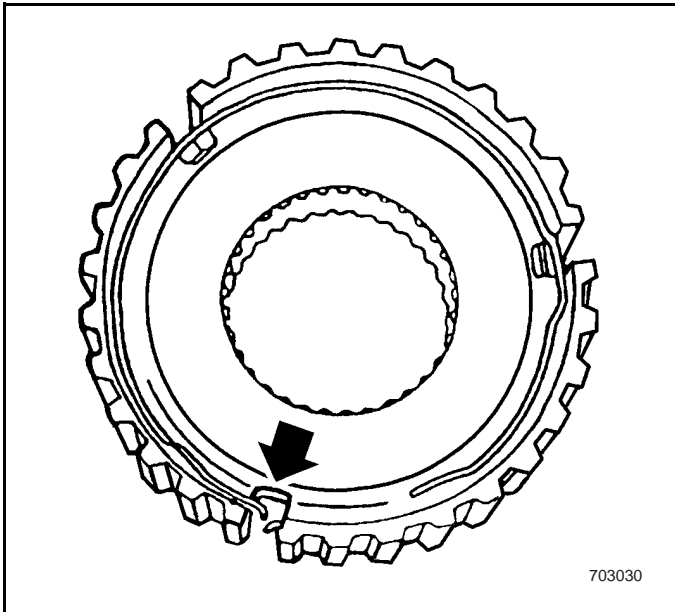
13. Remove the caliper at the engaging point of 3rd and 4th shift synchronizer.
14. With the help of tool V- 9307206 and the press machine, remove the 4th shift gear and the synchronizer engaging set of 3rd and 4th shift.

Installation Procedure

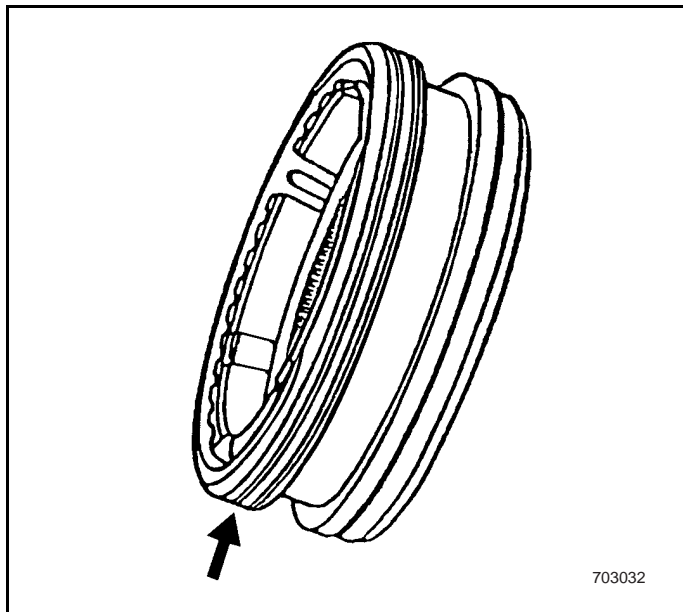
Note:

- Clean all parts and sealings before assembling.
- Use the original transmission oil to lubricate the bearing, rotation parts, slippery channel, seat and pressure surface.
- Inspect if there is wearing, scratch, damage to the parts, replace if necessary.

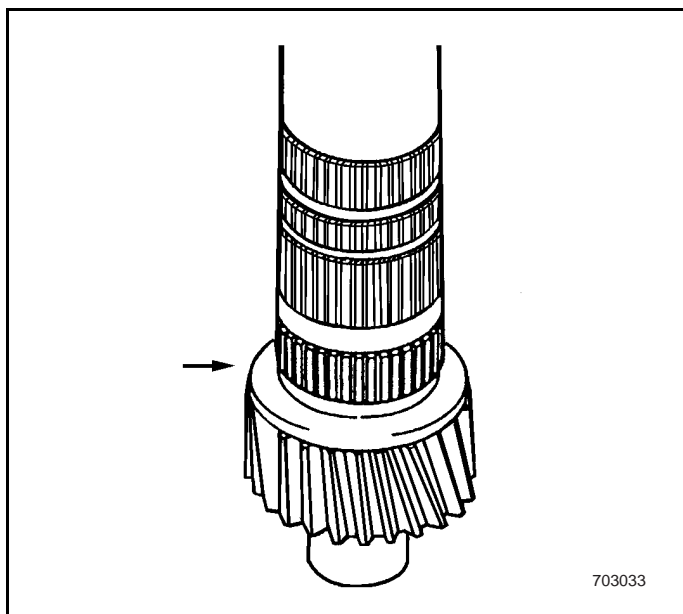
1. Install the spring in 1st and 2nd shift synchronizer engaging set (with diameter smaller) so that the slip key locates at the opposite direction, the spring end may extrude in relation to the engaging set (as shown by the arrow).



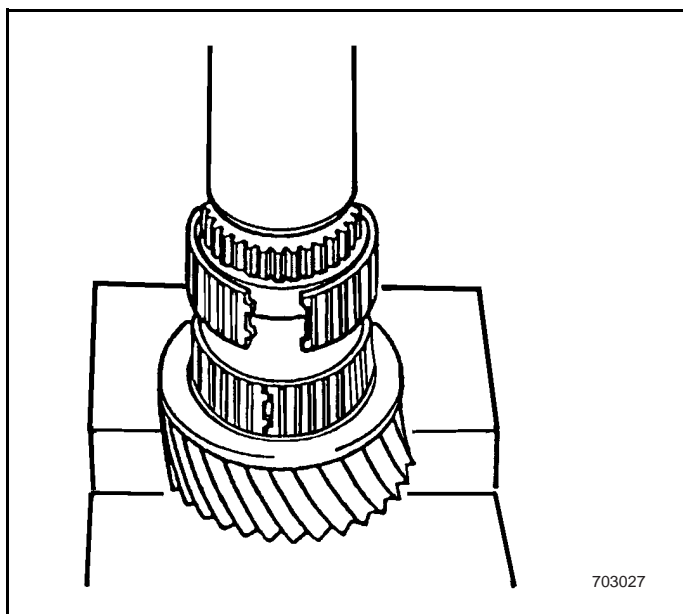
2. Install the slip spline into the accessed channel.
3. Install spring in the engaging set of 3rd and 4th synchronizer.



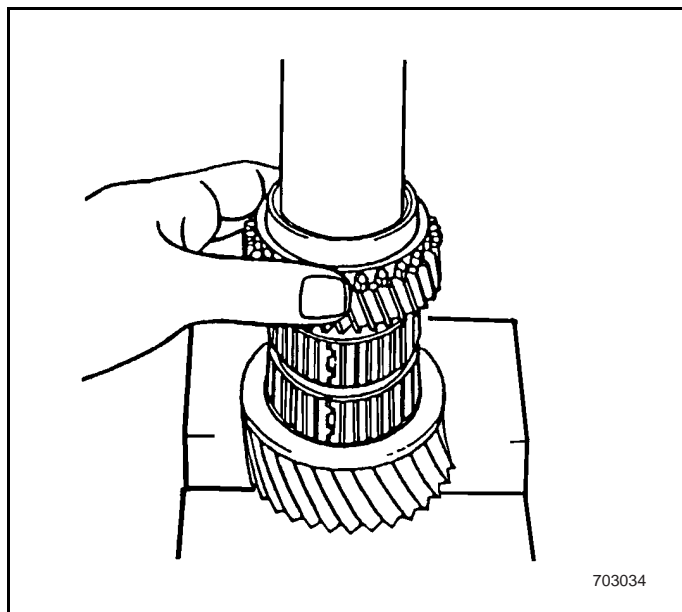
4. Taper surface with accessed channel shall face the 4th shift gear.



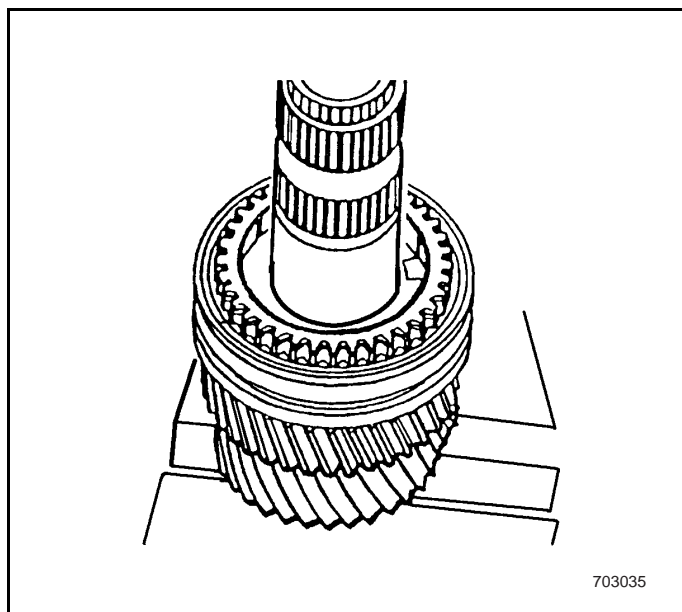
5. Heat the 4th gear thrust washer (about 100°C), install it to the shaft.



6. Lubricate the 4th needle bearings and install them to the shafts.



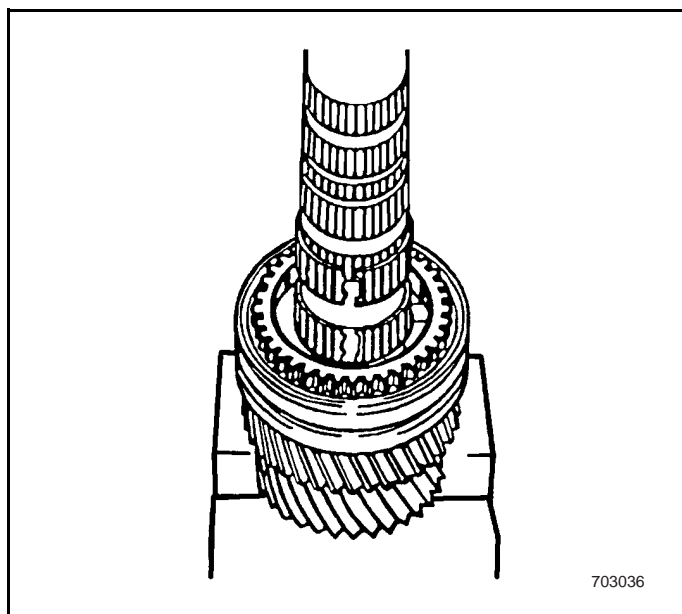
7. Install the 1st gear.



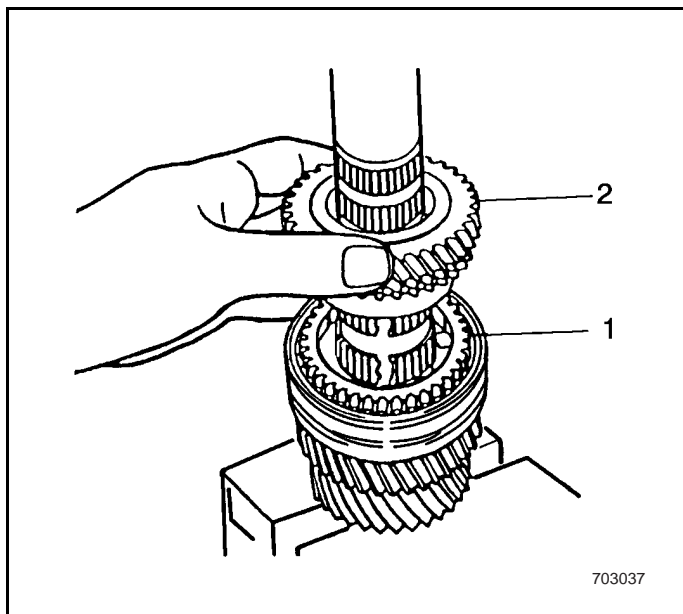
Note: Heat the 3rd and 4th synchronizer engaging set.(about 100°C), and with the help of the press machine, install it to the shaft.

Taper surface with accessed channel shall face the 4th shift gear.

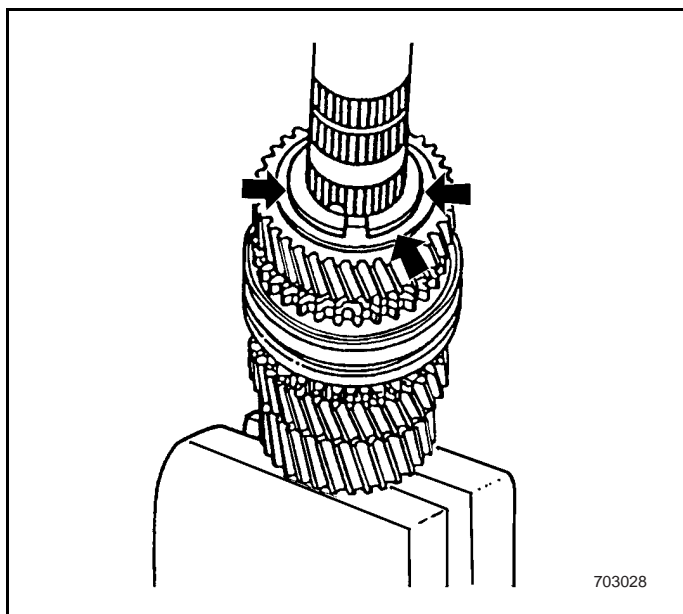
8. Install the spring caliper at the engaging point of 3rd and 4th shift bearing bushing.
9. Install the synchronizer.



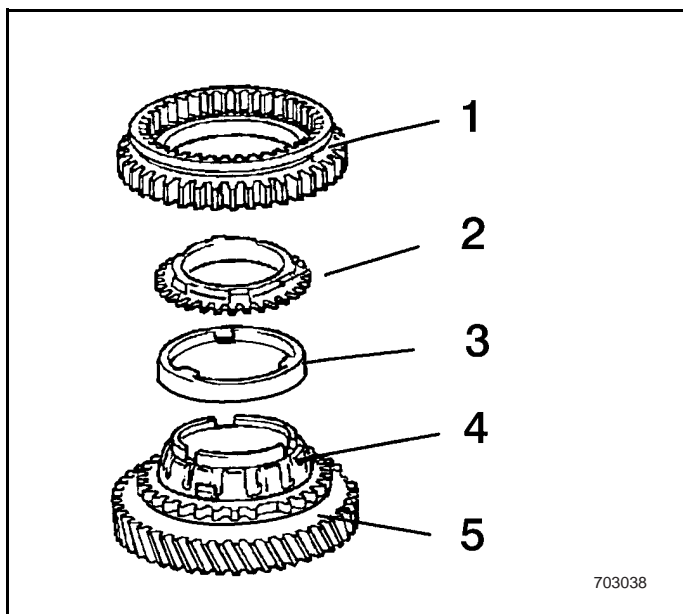
10. Lubricate the 3rd needle bearings and install it.



11. Install synchronizer ring (1) and 3rd gear (2).



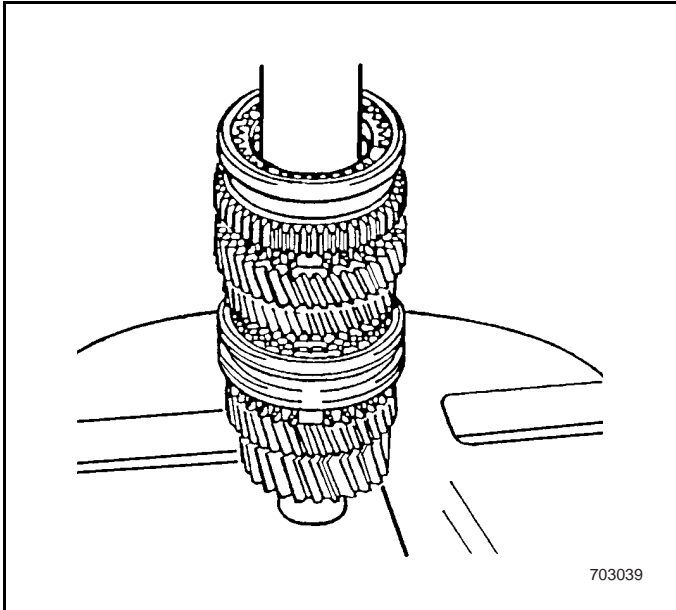
12. Install the two half ring of the thrust washer and a new spring caliper.
13. Install the 2nd gear.



14. Install the two synchronizer and middle ring (3 taper).

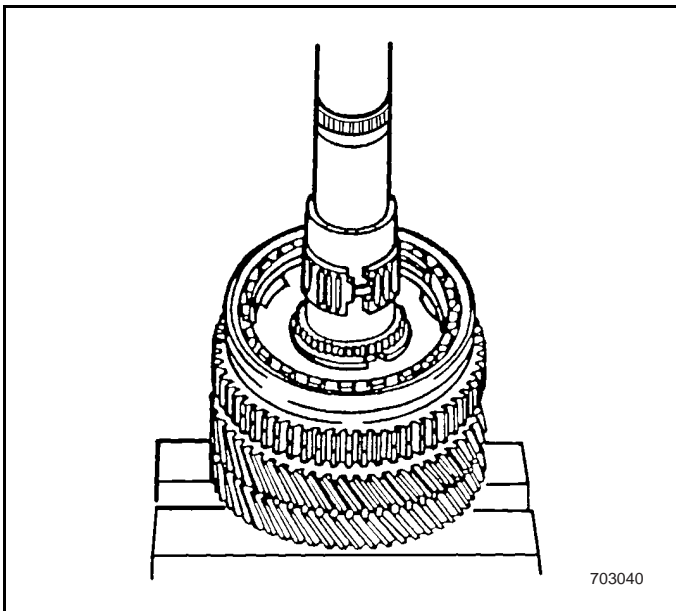
parts from upper to bottom:

- 1-synchronizer engaging set
- 2-synchronizer ring
- 3-middle ring
- 4-synchronizer ring
- 5-gear



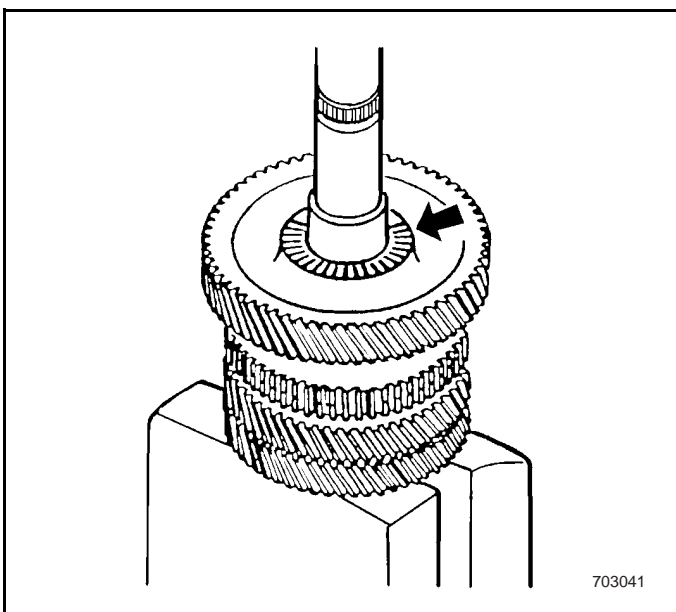
Note: Heat 1st and 2nd engaging set to about 100°C and with the help of the press machine, install it to the shaft.

15. Install the spring caliper at the engaging point of 1st and 2nd shift synchronizer.

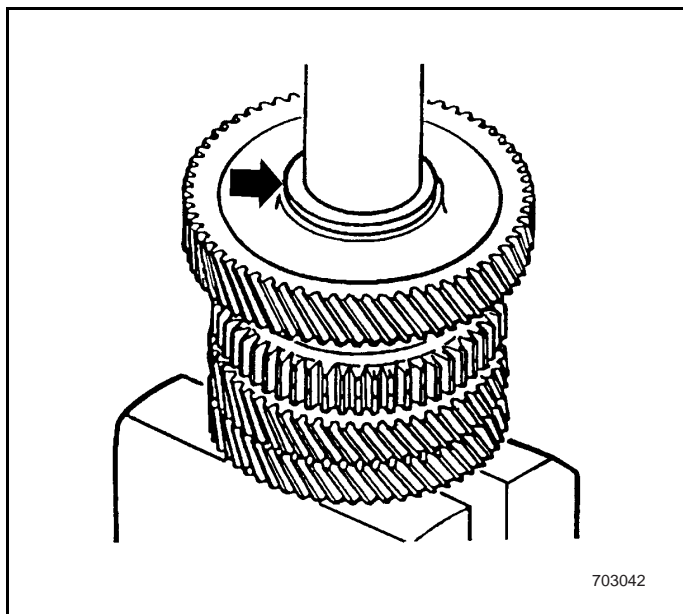


Note: Lubricate and install the 1st needle bearings.

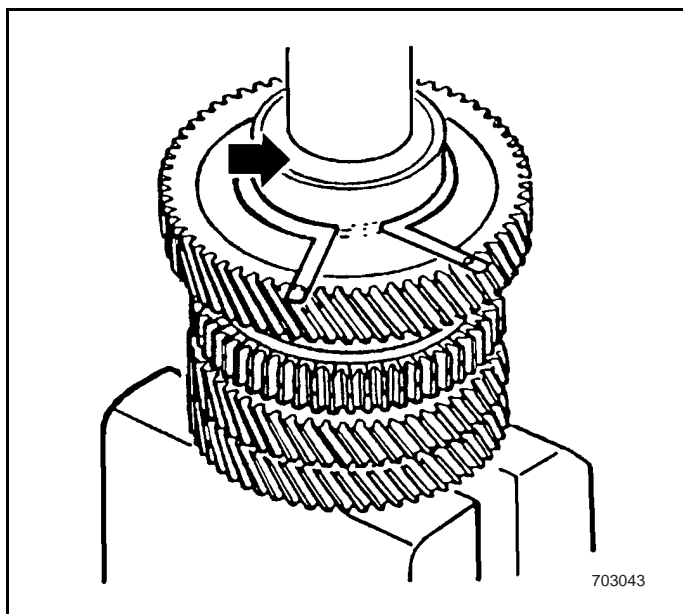
16. Install the 1st shift gear and synchronizer to the shaft, ensure the correct placement of the synchronizer.



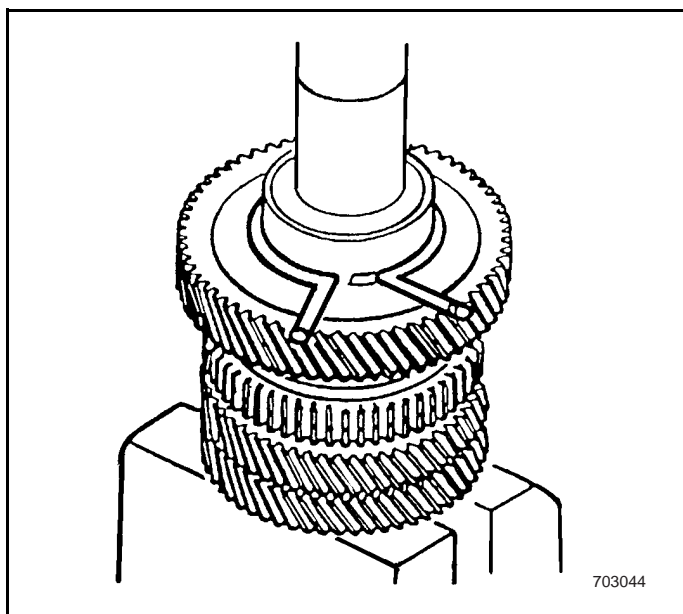
Note: Lubricate and install the thrust bearing to the 1st gear.



Note: Heat thrust washer to about 100°C and with the help of the press machine, install it to the shaft.



17. Install the spring retainer.
18. Install the bearing with the help of the pressure machine and a suitable pipeline.



Note: Heat the 5th gear ball bearing inner race to about 100°C, and install it to the shaft until it matches with the bearing. Use a press machine and a suitable pipeline to perform the procedure.

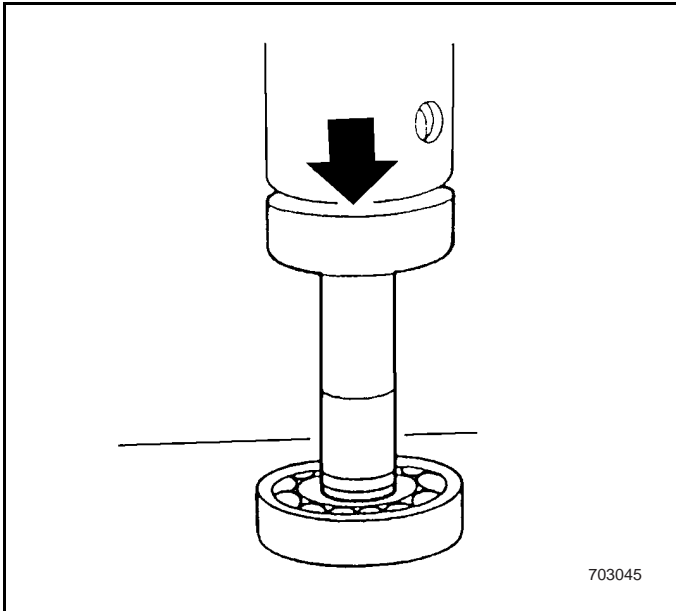
7.1.4.4 Replacement of the gear set bearing

Removal Procedure

Required tools

- J-9307206 puller
- J -810725 bracket

1. Remove the transmission assembly with reference to Transmission Assembly Removal.
2. Use press machine and tool V- 9307206 to remove the gear set bearing.



Installation Procedure

1. Install the bearing with the help of the pressure machine and a suitable pipeline.

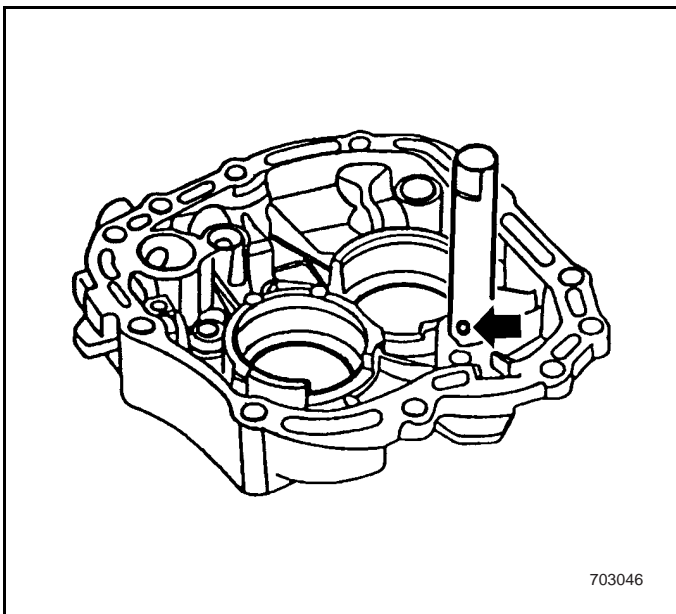
Note: After installing the bearing, install a new spring caliper. Clean all parts and sealing surface before assembling.

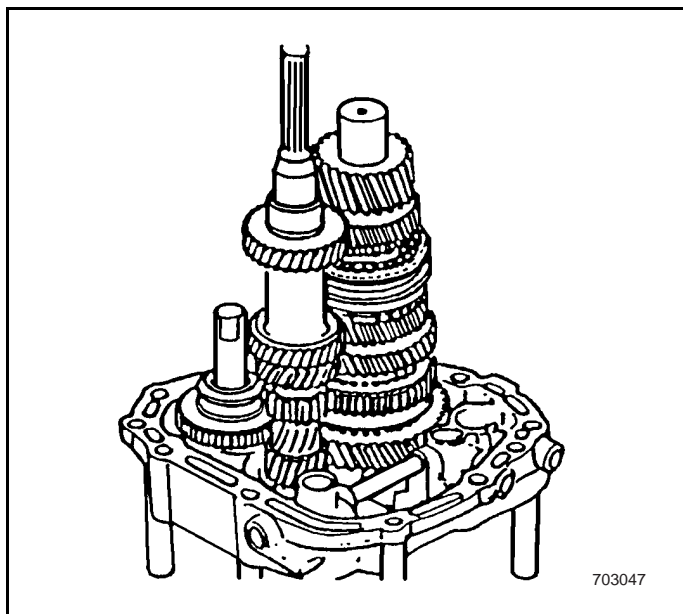
Inspections

Inspect if there is wearing, scratch, damage to the parts, replace if necessary.

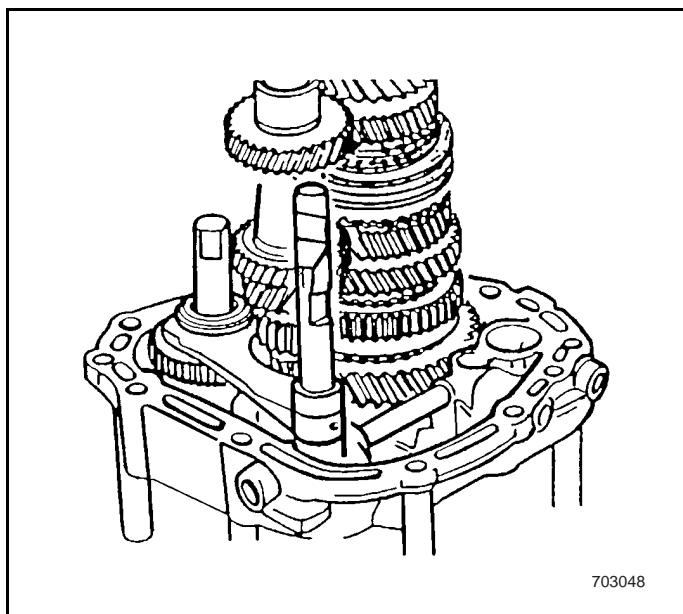
2. With the help of the press machine, install the reverse idle wheel shaft to the guarding block.

Note: Pay attention to the position of the clamping ball (as shown by arrow in the figure).

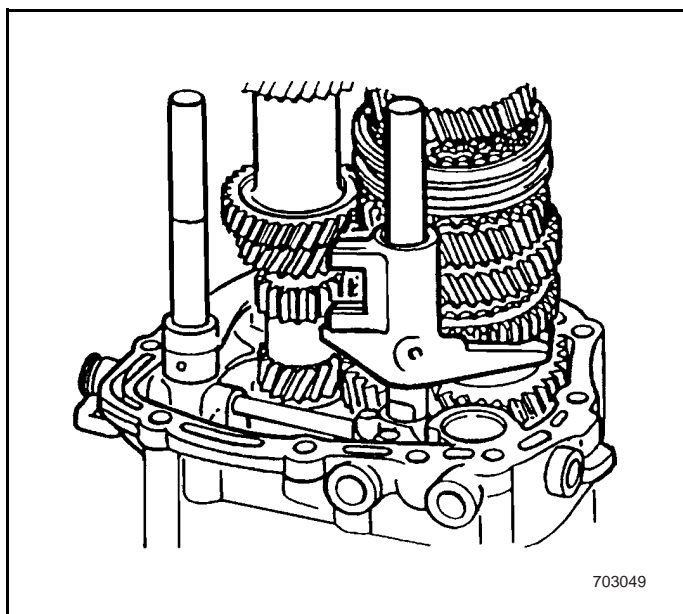




3. Heat gear set bearing and main shaft support area (about 80°C), install the gear set, main shaft assembly and reverse idle wheel. Install the spring caliper to the respective accessed channel.
4. Install reverse idle wheel fork with its accessed channel facing upward.

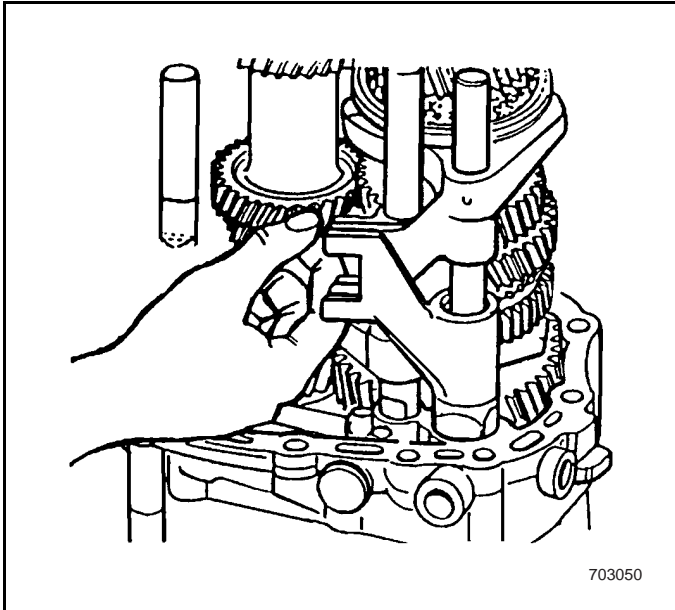


5. Install the spring pin until it extrudes about 2mm.
6. Install reverse transmission fork shaft pawl.
7. Install 1st and 2nd gear fork and spring pin.

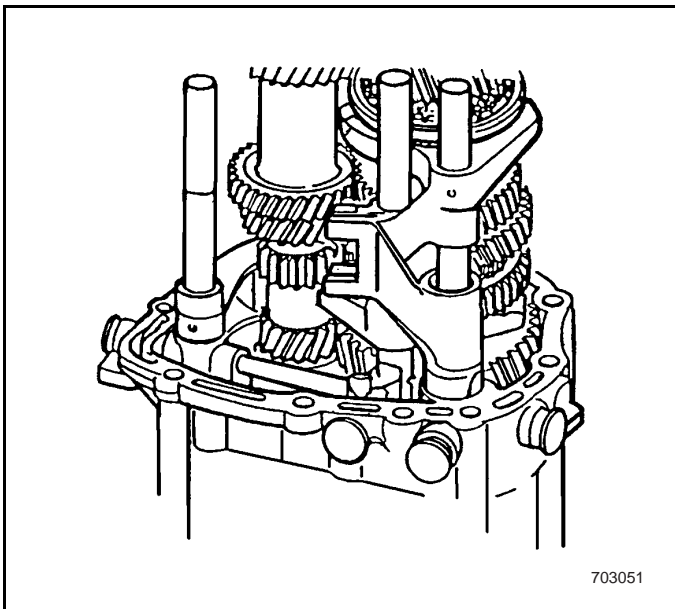


Note: Use wooden support fork shaft while installing spring pin.

8. Install 1st and 2nd gear pawl, with the help of a plastic hammer, insert it until it stops.
9. Install 5th shift, 3rd shift and 4th shift fork.



10. Use wooden support shaft while installing spring pin.
11. Install 5th gear and 3rd gear and 4th gear pawl, with the help of a plastic hammer, insert it until it stops.



Note: Shift the fork at Neutral position.

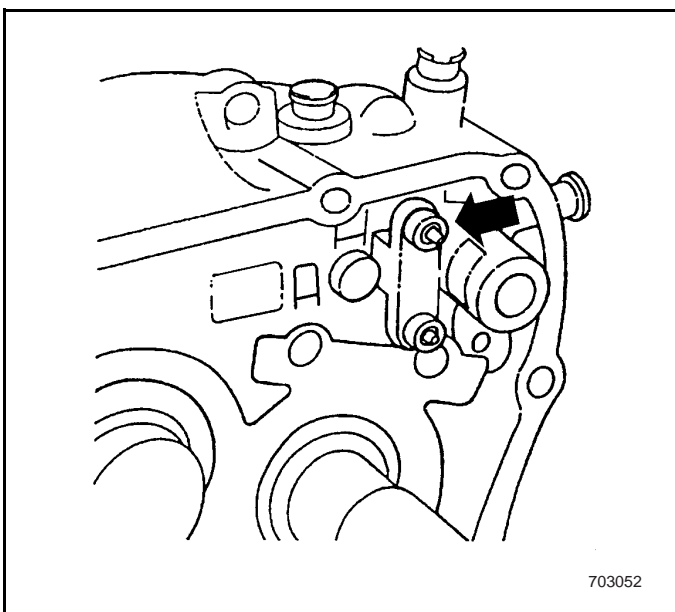
Note: Shift to 2nd and 5th gear.

12. New bolts must be used when installing the bearing plate lock pin.

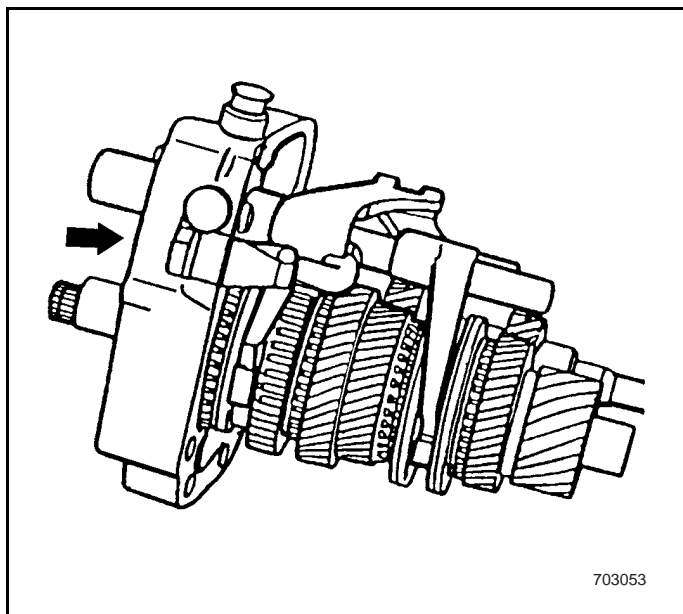
Tightening

Apply LOTA onto the new lock pin bolt, Tighten to 7 N•m.

Note: Shift to Neutral position.



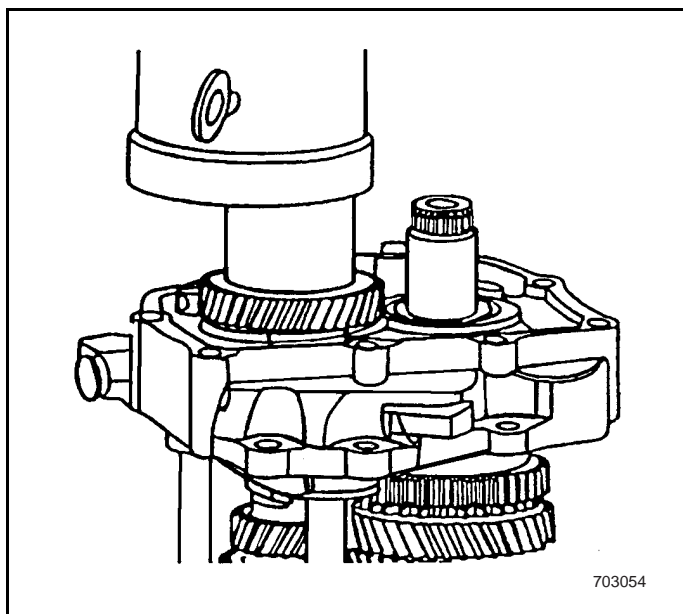
13. Install the bearing and pawl bracket (as shown by arrow in the figure).



14. Install the pawl bracket mounting bolt.

Tightening

Tighten the pawl bracket fixing bolt to 9 N•m.

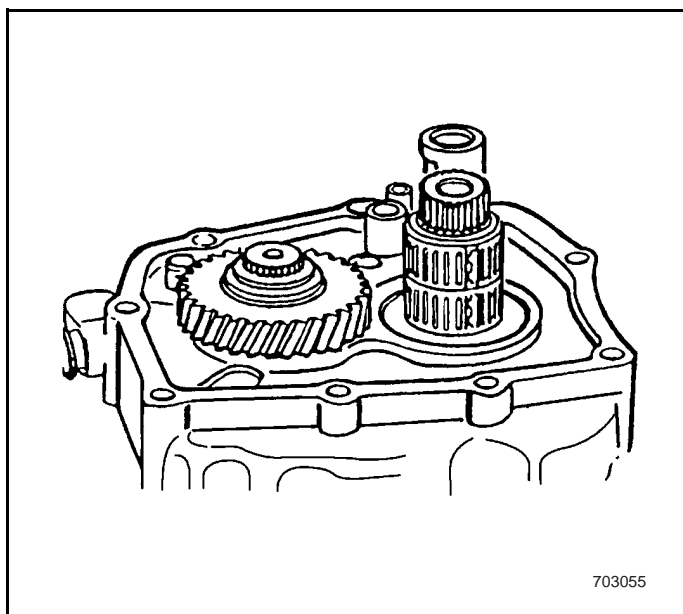


15. With the help of pipe and press machine, install the 5th shift driving gear.

Note: Heat (about 100°C), install the 5th driving gear.

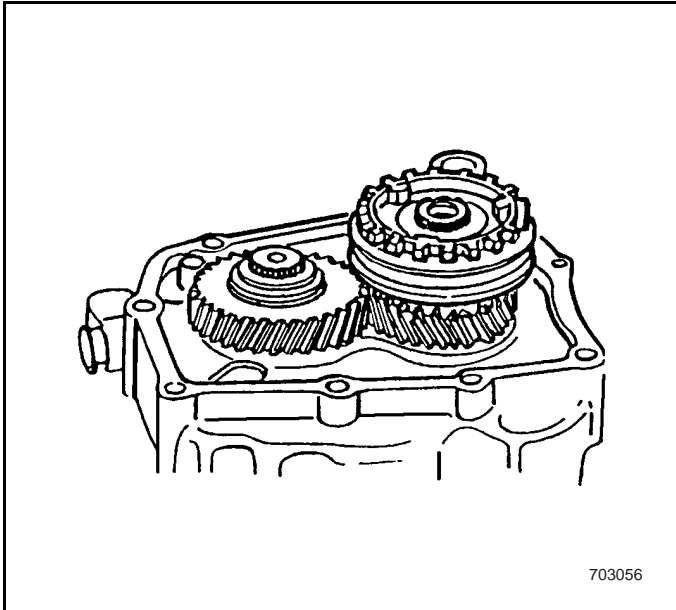
Notice: Gear hub surface shall face the bearing plate.

16. Install a new spring retainer.



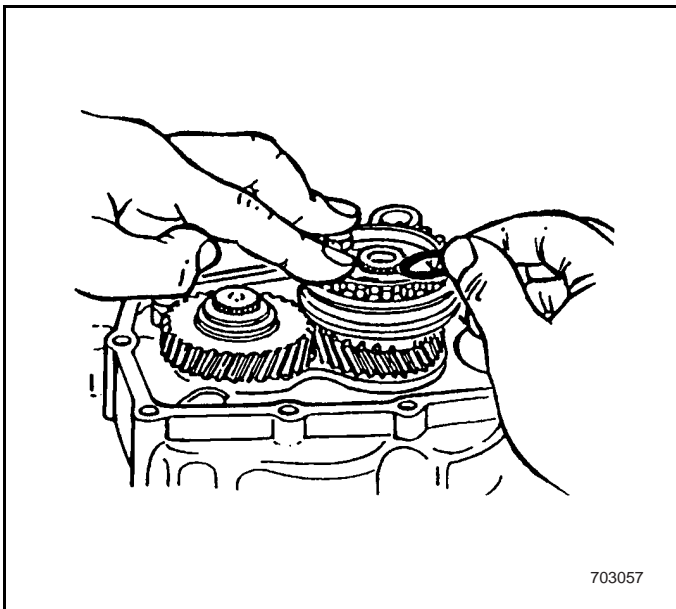
Note: Lubricate the needle bearings and install them to the shafts. Ensure correct positioning of the bearing.

17. Install the 5th driven gear.



18. Install the main shaft synchronizer assembly.

Note: Use transmission oil to lubricate the bearing seat surface.

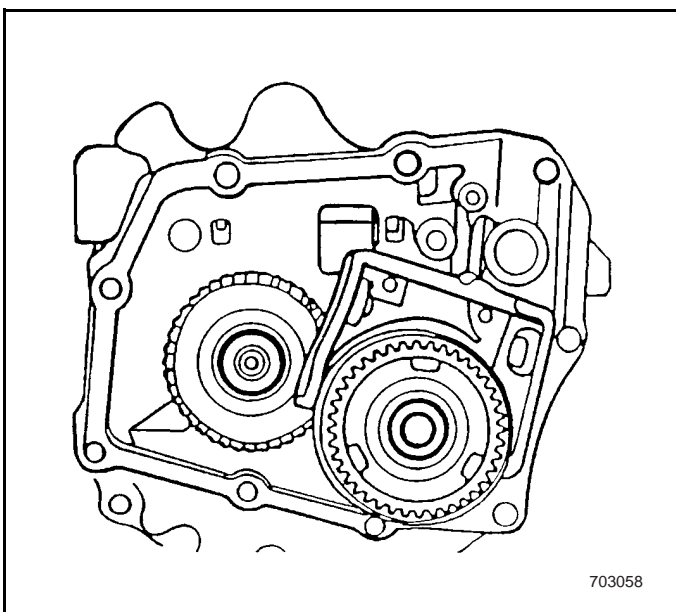


Note: Select a new spring retainer and install it. Selection of the caliper is to control the assembly shaft clearance.

19. Use new mounting bolt to install the bracket and 5th shift fork.

Tightening

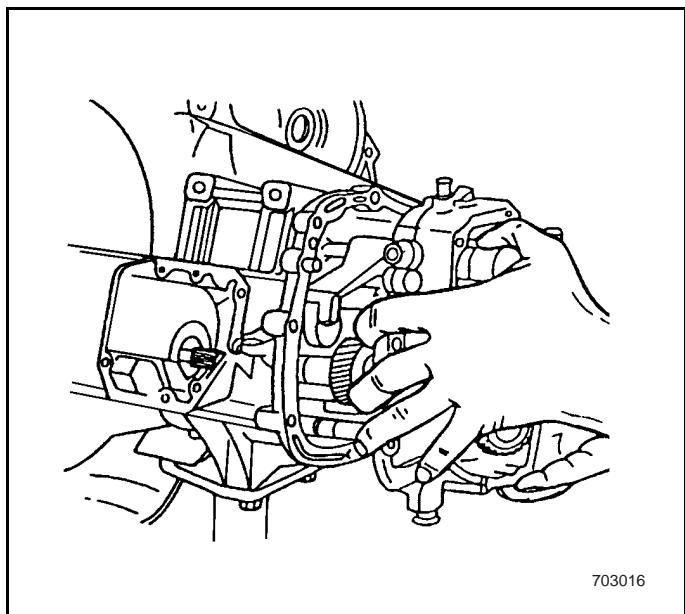
Apply LOTA to the new bearing, Tighten 5th shift fork bracket mounting bolt to 22 N•m.



20. Install reverse shaft thrust gasket.

Note: Remove the transmission assembly from bracket J-810725.

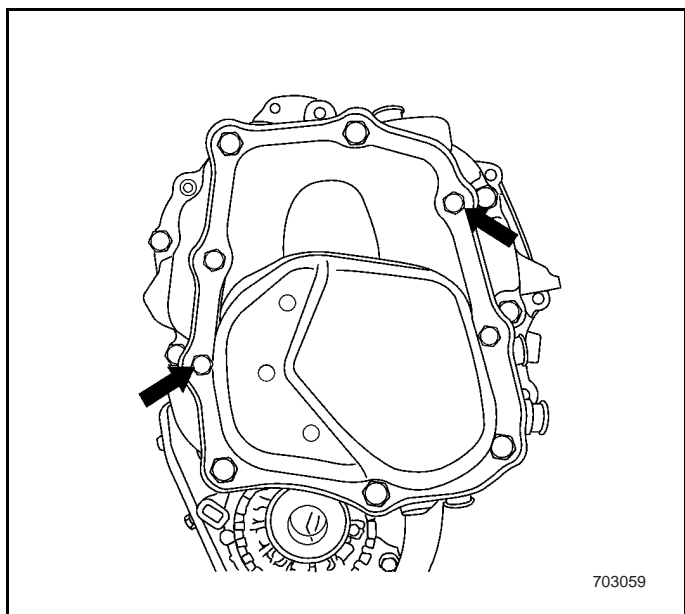
21. Install the new bearing plate gaskets.



22. Install the bearing plate mounting bolt.

Tightening

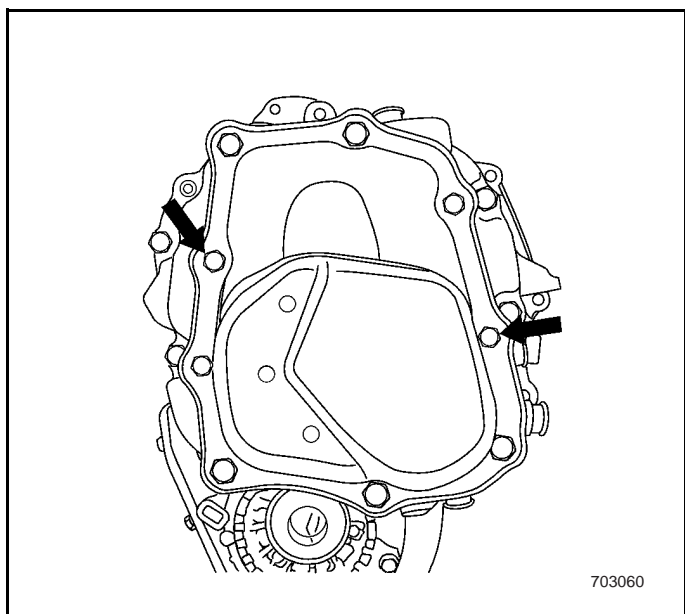
Tighten the bearing plate fixing bolt to 22 N•m.



23. Two end cover bolts M7115 (as shown by arrow in the figure).

Tightening

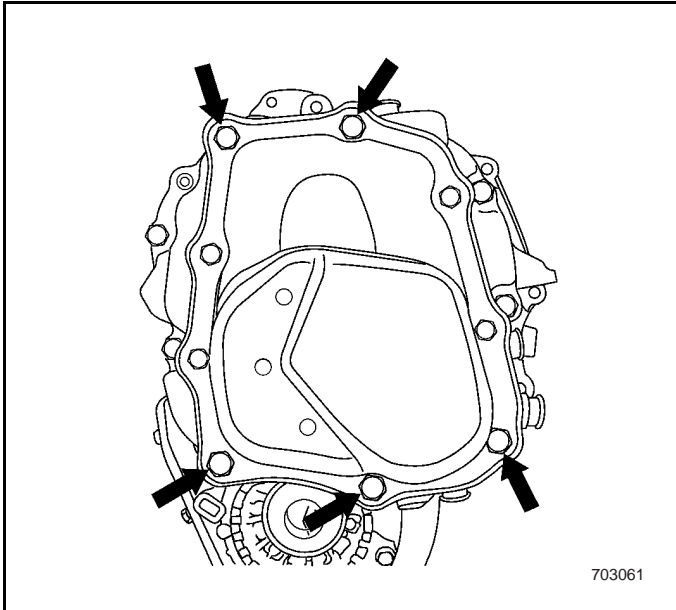
Tighten the two end cover clamping bolts to 15 N•m.



24. The other two end cover bolts M7115 (as shown by arrow in the figure).

Tightening

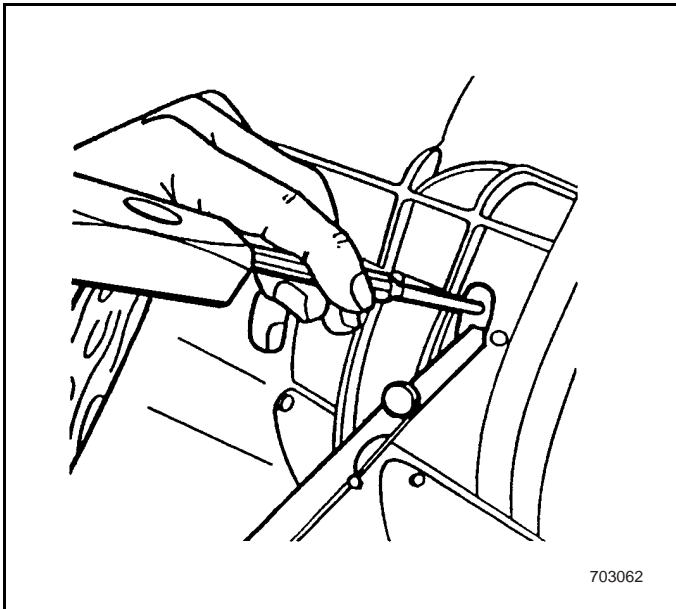
Tighten the two end cover clamping bolts to 15 N•m.



25. Five larger end cover bolts M81.2558 (as shown by arrow in the figure).

Tightening

Tighten the five end cover bolts to 20 N•m.



Note: Inspect the clearance of the 5th fork guarding block.

The specified clearance is 0.2 mm.

26. Install the tachometer harness.

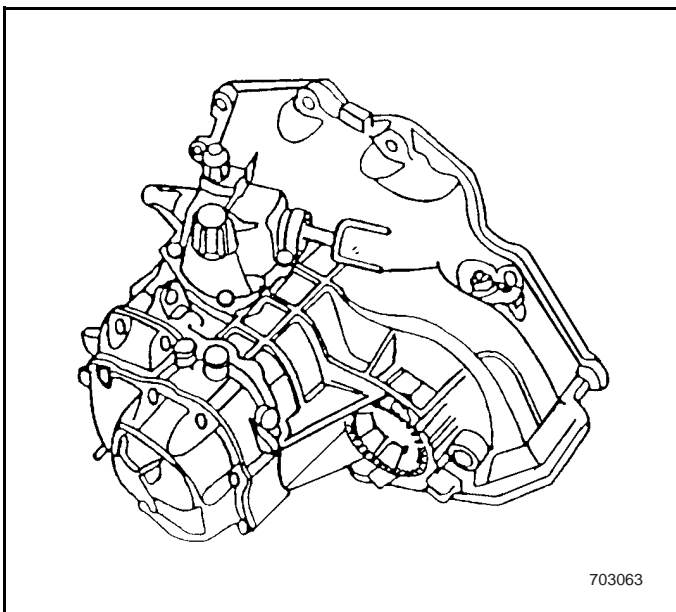
Tightening

Tighten the tachometer harness to 4 N•m.

27. Install the back-up lamp switch and gasket.

Tightening

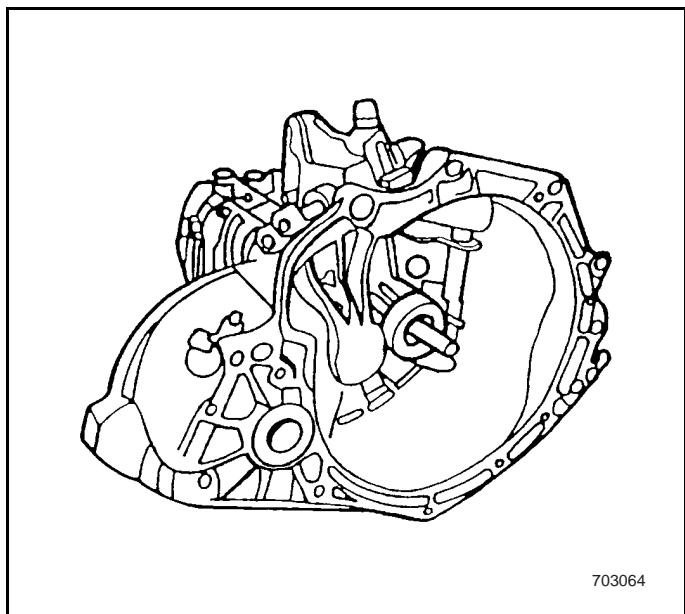
Tighten the back-up switch lamp to 20 N•m.



28. Install shift control cover and its fixing bolt.

Tightening

Tighten the shift cover fixing bolt to 15 N•m.



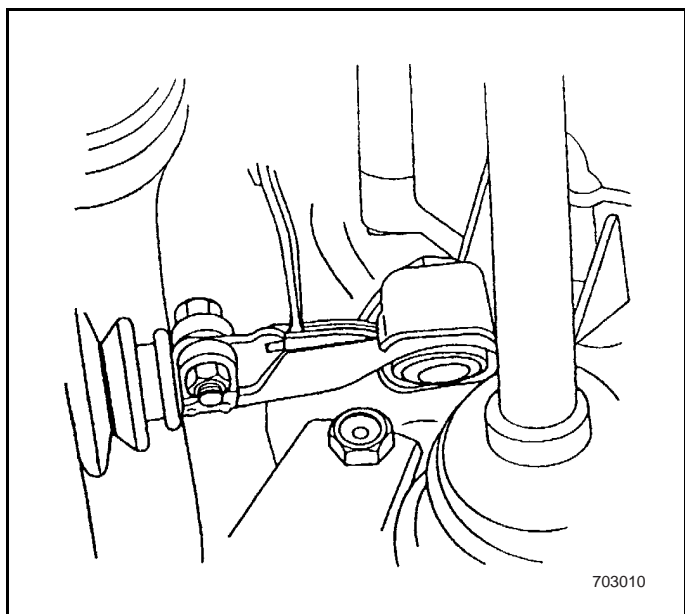
29. Install clutch fork, pilot bushing and separation bearing.

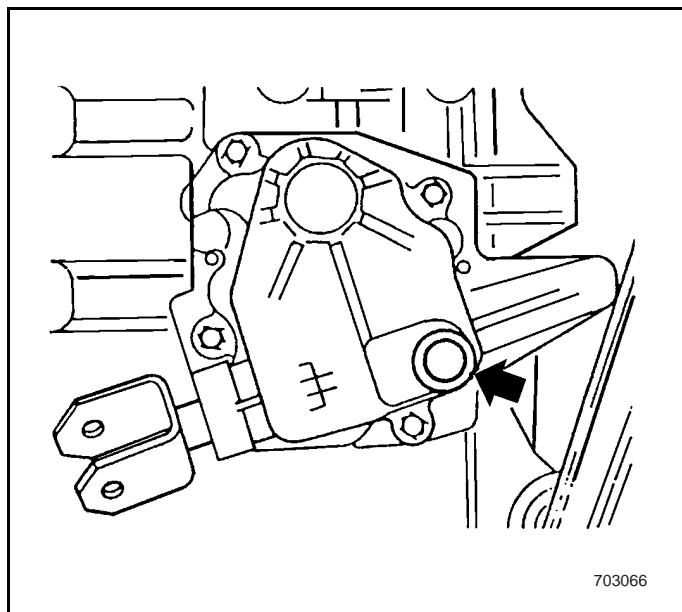
Note: Lubricate it according to relevant procedures before assembly.

7.1.4.5 Replacement of shift control cover

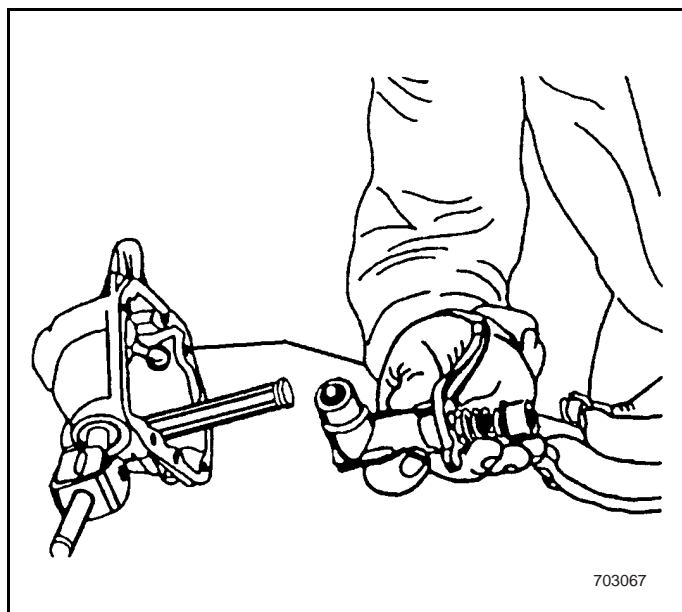
Removal Procedure

1. Remove the shift linkage clamping bolt.

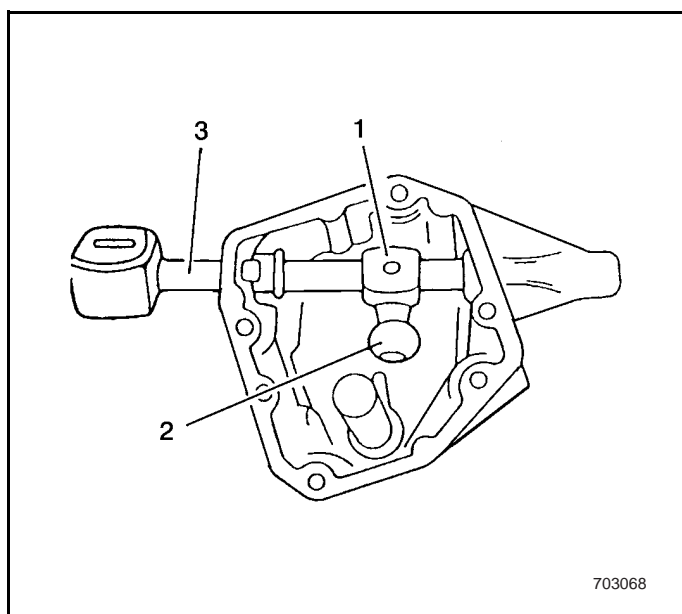




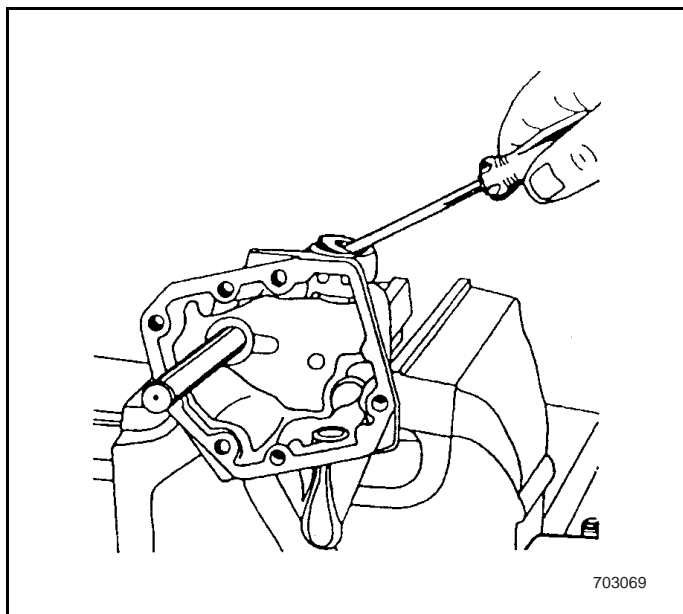
2. Remove the bolt from the cover and the shift outside control connecting mechanism.
3. Remove the shift control cover.



4. Remove the spring caliper.
5. Remove the bearing bushing.
6. Remove the spring.
7. Remove the bearing middle lever.
8. Remove the guiding pin spring.



9. Remove the spring pin (1), shift finger (2) and lever (3).

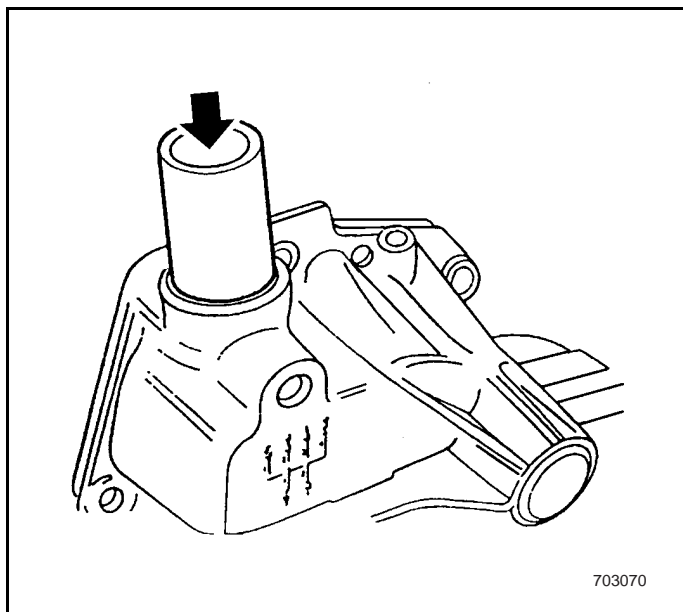


10. With the help of adequate spanner, remove the sealing cover.

Note: Take care not to damage the housing.

Installation Procedure

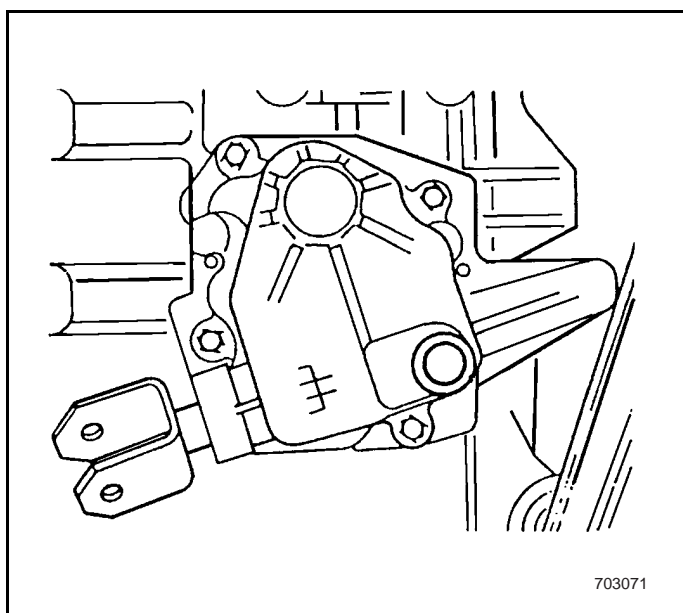
1. Use adequate pipe to install the sealing ring.
2. Install the lever, shift finger and spring pin.
3. Install the middle lever.
4. Install the spring.
5. Install the shaft bushing.
6. Install the spring retainer.
7. Install the new shift outside control mechanism.



8. Install shift control cover bolt.

Tightening

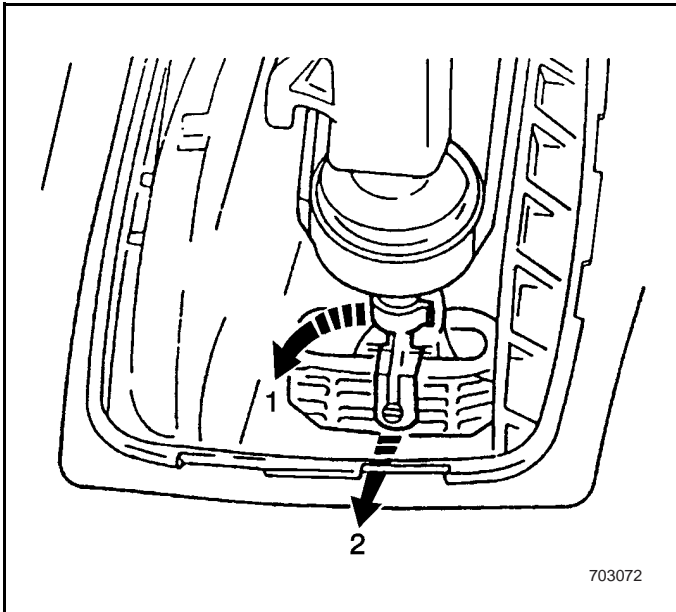
Tighten the shift cover bolt to 15 N•m.



7.1.4.6 Replacement of transmission shift lever

Removal Procedure

1. Place the shift lever at Neutral position.
2. Fold the shroud upward.
3. Remove the spring pin (1), shift lever pin (2).

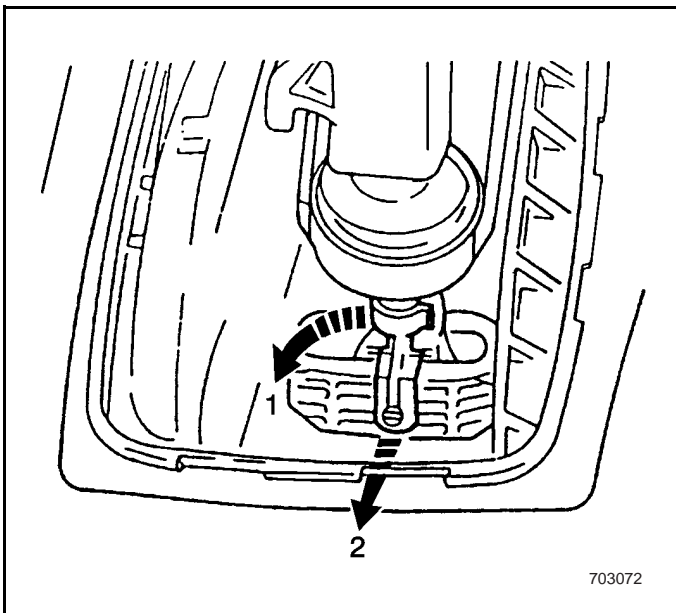


Installation Procedure

1. Place the shift lever to position.
2. Install the pin and spring retainer.
3. Install the shroud.

Adjust

Refer to Transmission Shift Interlock Mechanism Adjustment.



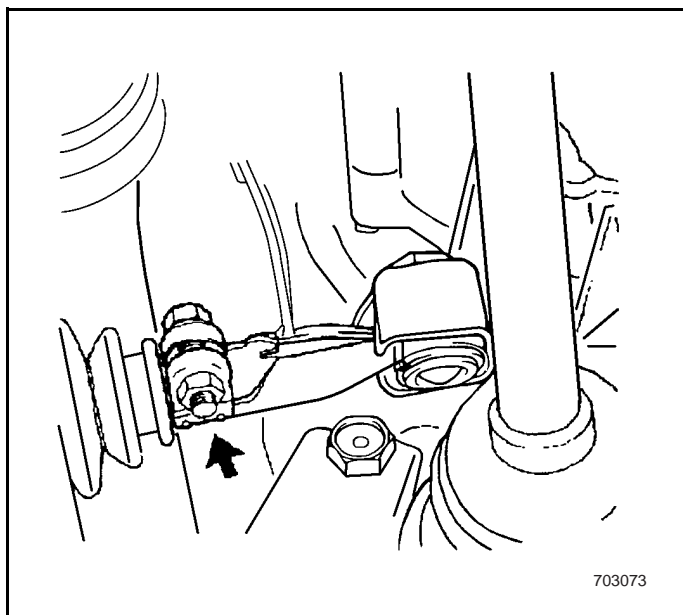
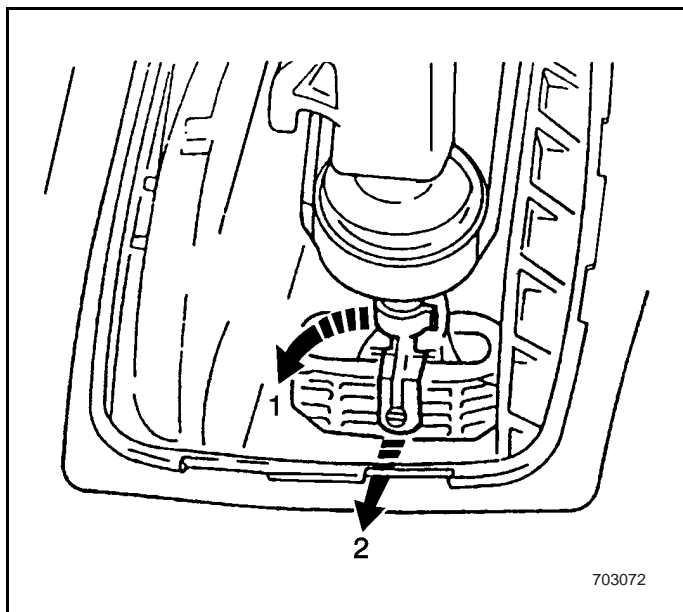
7.1.4.7 Replacement of Shift Linkage

Removal Procedure

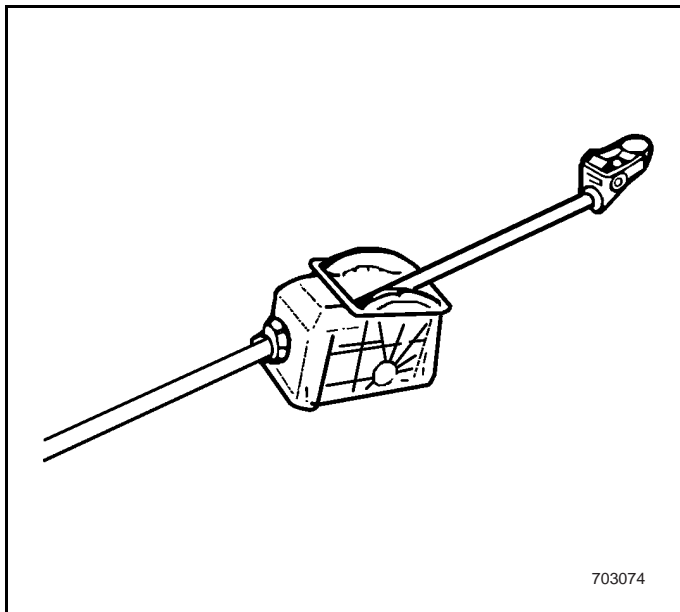
1. Remove shroud from the shift lever seat, press down clamp (1) from the lever, remove pin (2) with clamp, take out transmission lever from the shift linkage.

Clean

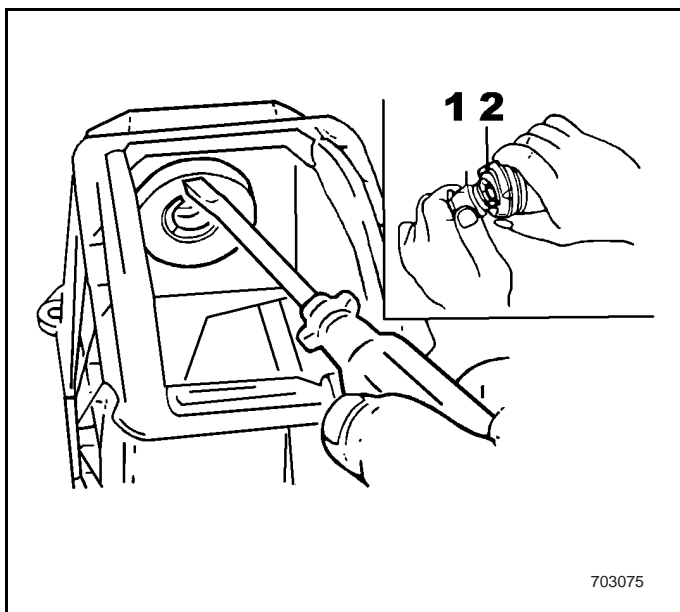
Before installation, clear away all foreign matter and lubrication agent from all parts of the shift driving system, then use silicon-based grease to lubricate.



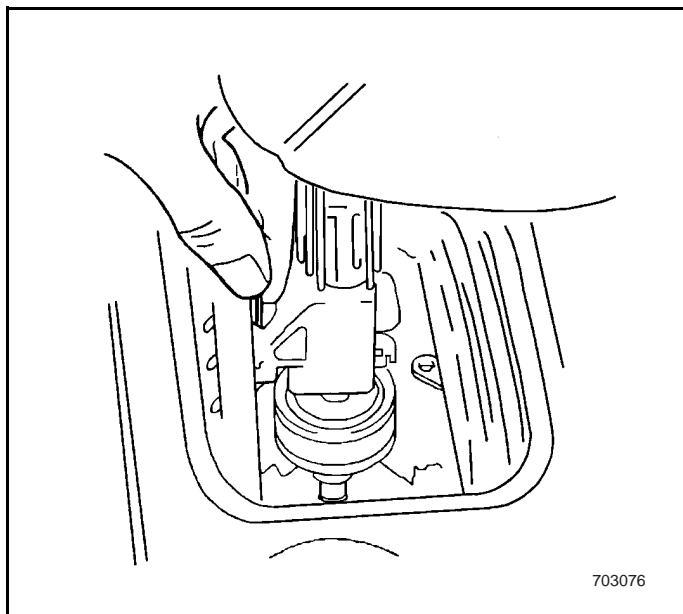
2. Raise the vehicle, loose the shift linkage bolt, press down shift linkage from the spline bolt.



3. Screw down shift linkage bearing plug from the transmission shift lever seat, take out shift linkage from the bearing hole.



4. Press the pilot bushing of the shift linkage and bearing bushing together from the bearing plug. Screw down bearing bushing from the pilot bushing.



Installation Procedure

1. Press the new bearing bushing onto shift linkage pilot set, use silicon-based grease to fill the inner channel.
2. Guide the shift linkage into bearing bushing, fix the transmission lever bearing plug to the transmission shift lever seat.

Tightening

Tighten the bearing plug to transmission shift lever to 5 N•m.

3. Assemble the shift linkage, install the transmission shift linkage.

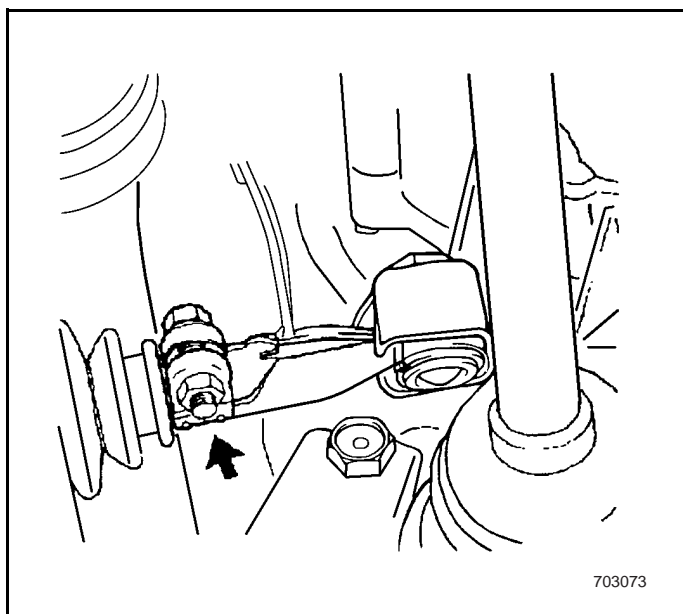
Adjust

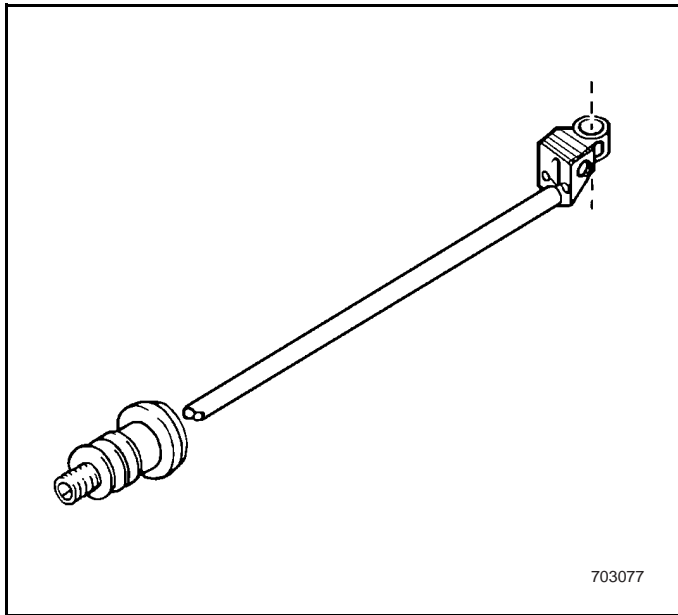
Adjust the linkage and refer to Transmission Shift Interlock Mechanism Adjustment.

7.1.4.8 Replacement of Corrugated Pipe in Shift Linkage

Removal Procedure

1. Loosen the shift linkage bolt (as shown by the arrow in the figure), press out the shift linkage from the spline bolt, remove the clamp and corrugated pipe from the shift linkage.





Installation Procedure

1. Put the new corrugated pipe onto the linkage.

Notice: Do not bend the corrugated pipe when it is in place.

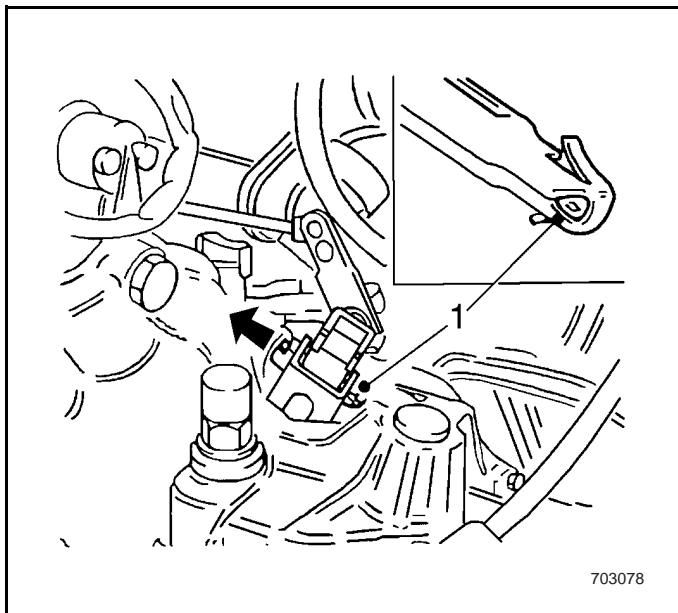
Adjust

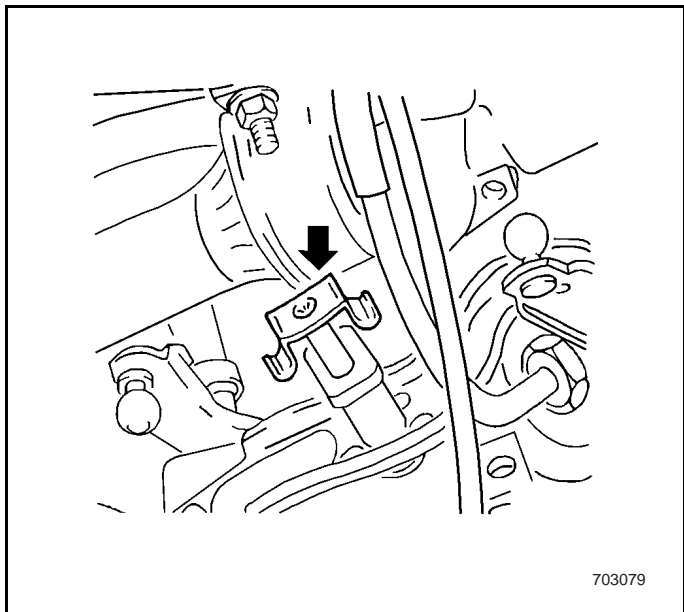
Adjust the transmission shift inter-lock mechanism, refer to Transmission Shift Interlock Mechanism Adjustment.

7.1.4.9 Replacement of pilot lever assembly

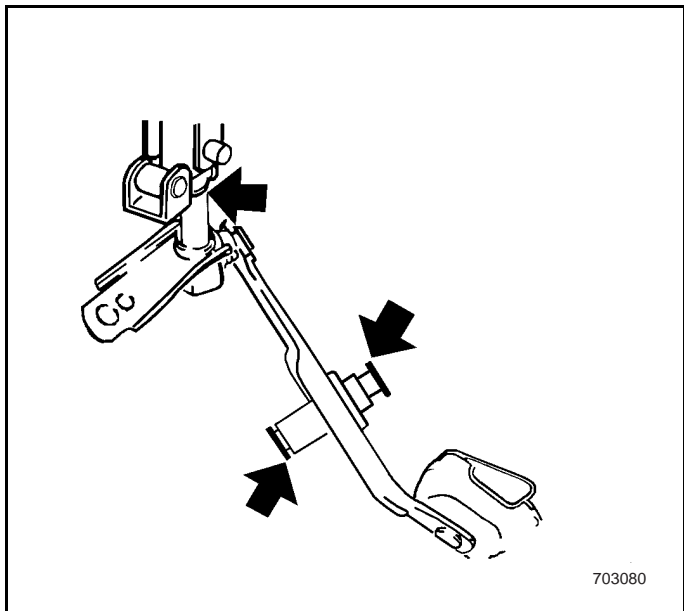
Removal Procedure

1. Place the transmission shift lever at Neutral position.
2. Disconnect the universal joint from the shift inter-lock. Press the expansion spring (1) from the hollow pin, remove the hollow pin (as shown by the arrow in the figure).

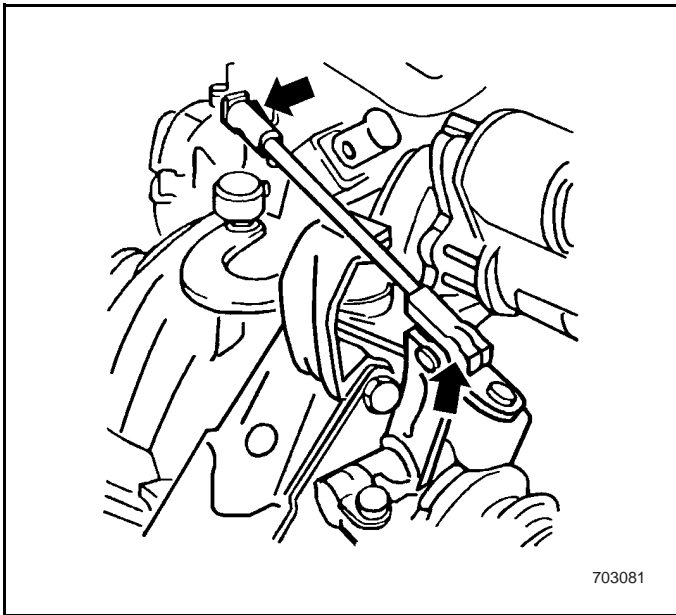




3. Loosen the shift linkage bolt, press down shift linkage from the spline bolt, disconnect the shift pilot lever ball interlocking.
4. Remove the pin with spring caliper (as shown by the arrow in the figure) from the shift pilot lever.
5. Remove the pilot lever assembly from the rear engine support bracket.



6. Replace the two bushings of the shift pilot lever. If necessary, replace the connection of universal joint. There is no need to remove the connection part.



Installation Procedure

1. Fix the shift pilot lever assembly to the transmission with pins. Spring clamps of the pins must interlock with each other. Lubricate the bushing with silicon based grease. Install the shift pilot lever ball joint (as shown by arrow in the figure).
2. Connect the spline bolt of the shift pilot lever with the shift linkage, do not tighten. Lubricate the hollow pin with silicon based grease. Press the new hollow pin into the universal joint, the expansion spring must interlocks.

Adjust

Adjust the transmission shift inter-lock mechanism, refer to Transmission Shift Interlock Mechanism Adjustment.

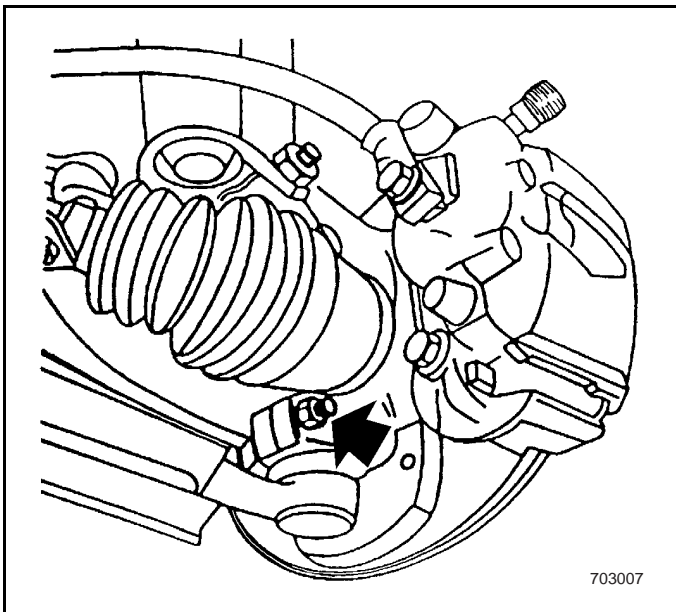
7.1.4.10 Replacement of differential assembly

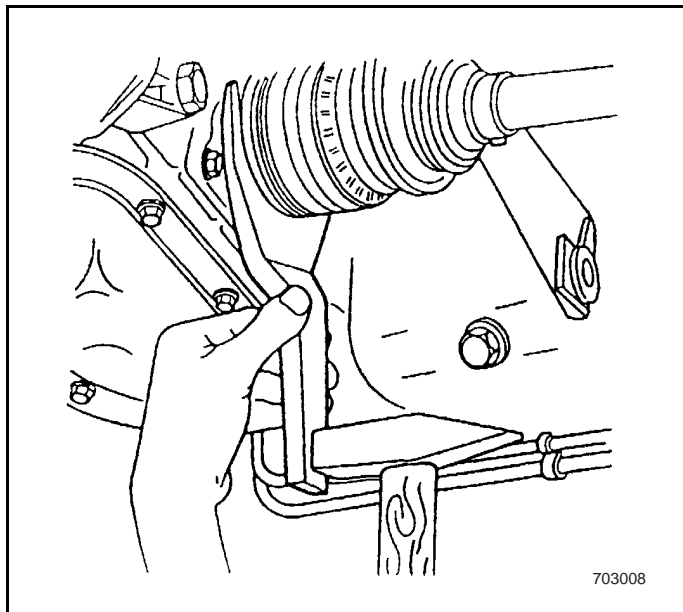
Required tools

- J-810902 puller
- KM-902 remover
- S-9407198 spanner
- J-810704 puller
- J-810720 puller
- J-810721 seat

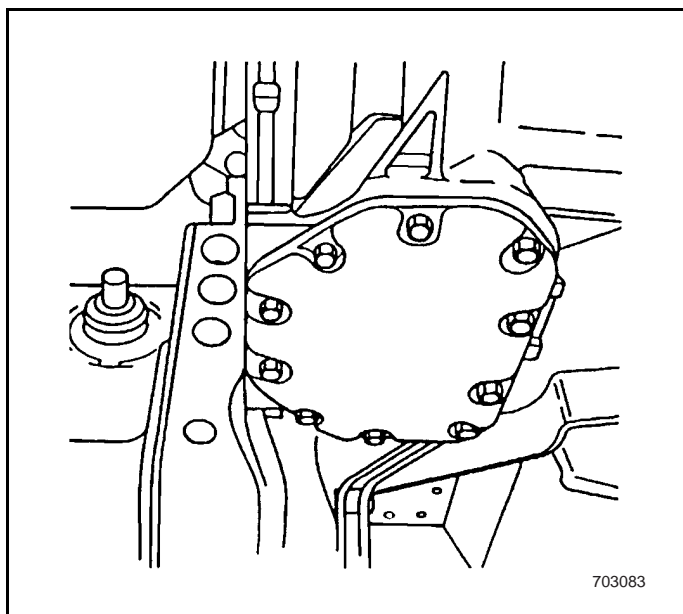
Removal Procedure

1. Remove the front wheel.
2. Use tool J- 810902 to remove the steering tie-bar end connection.
3. Remove the ball joint.

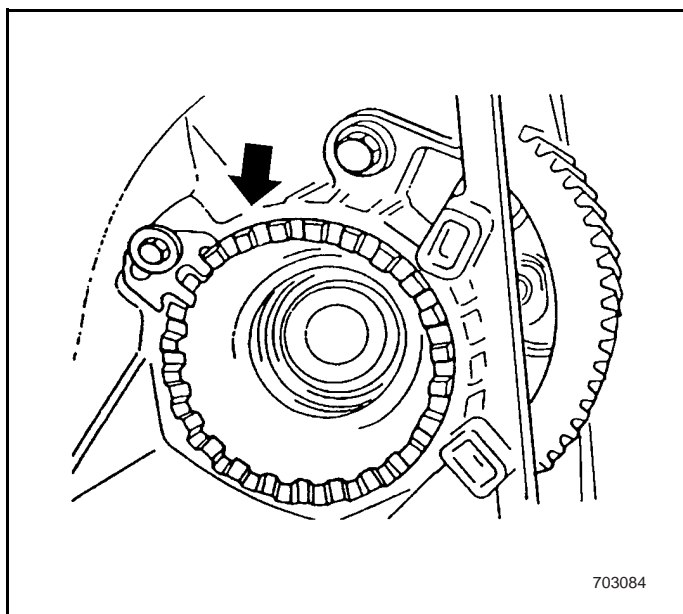




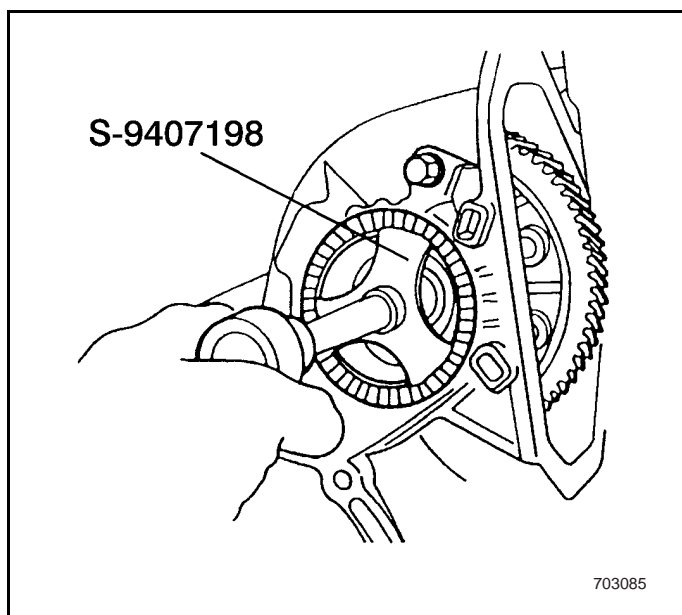
4. Remove the driving shaft, use KM-902 if necessary.



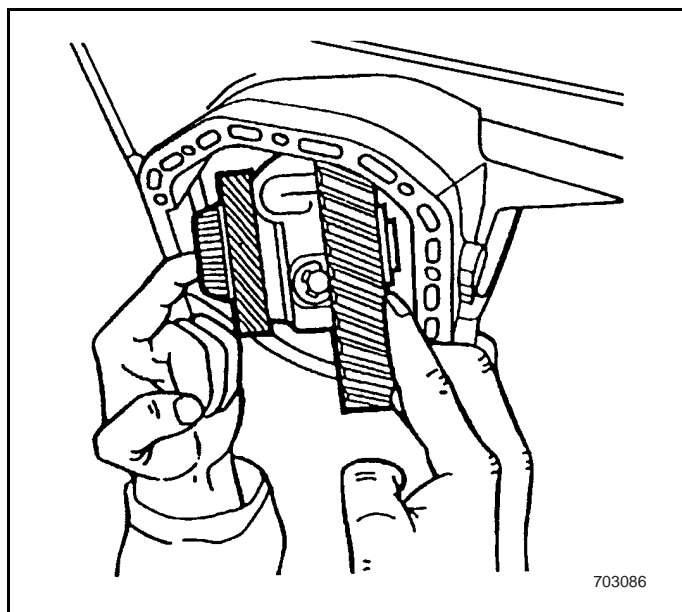
5. Remove the differential cover bolt.
6. Remove the differential cover.
7. Drain the oil.



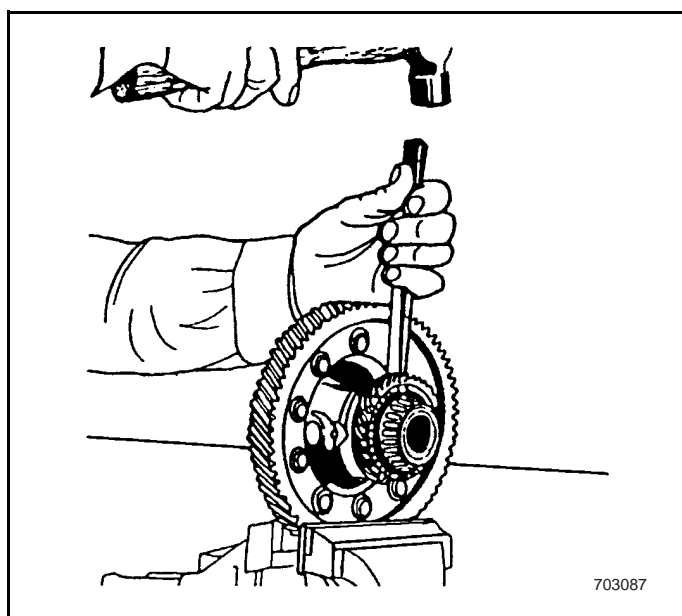
8. Remove the bearing adjustment set lock.
- Note: Use punch to mark the adjustment housing and transmission housing 9as shown by the arrow in the figure).



9. Remove the bearing adjustment housing, use S-9407198 to loosen it.

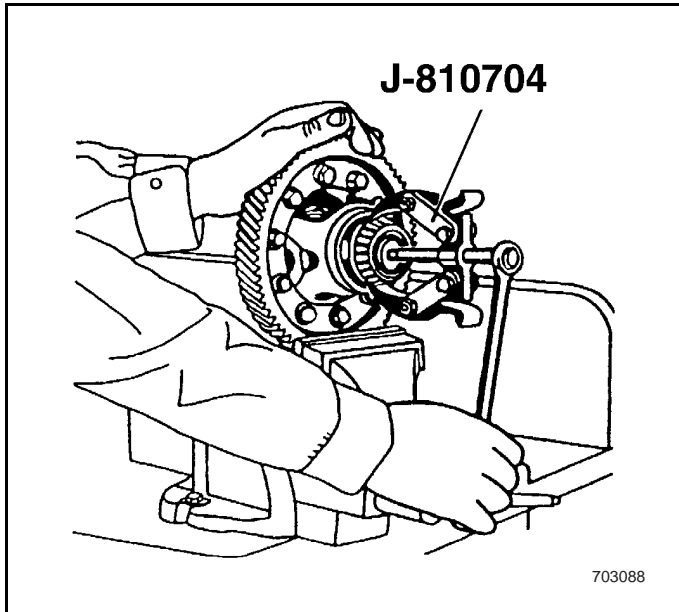


10. Remove the differential gear assembly through the inner opening.

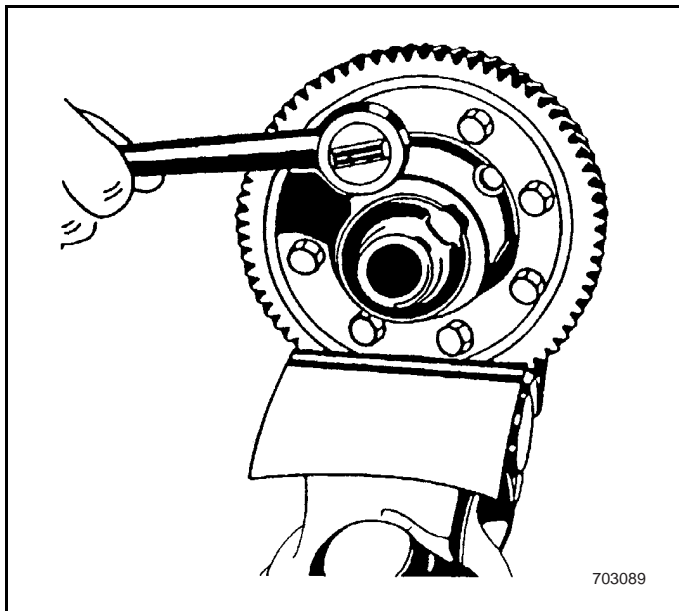


Note: Prepare a clean table to put the removed parts.

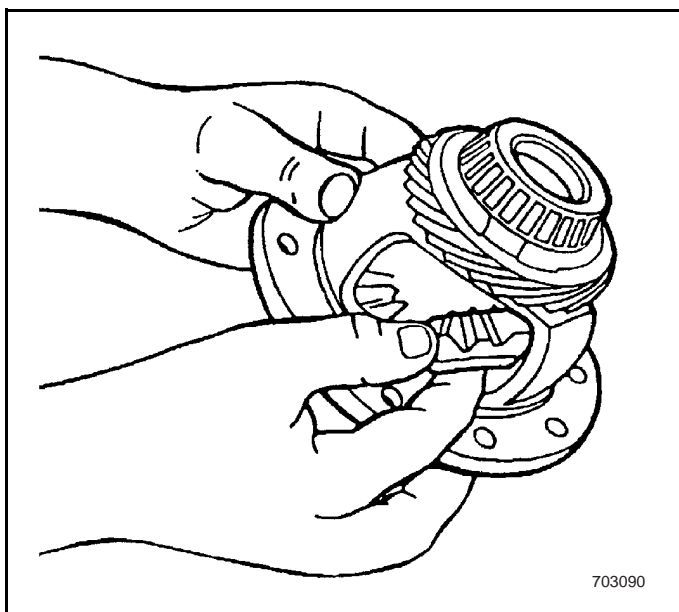
11. Use chisel to remove the tachometer driving gear.



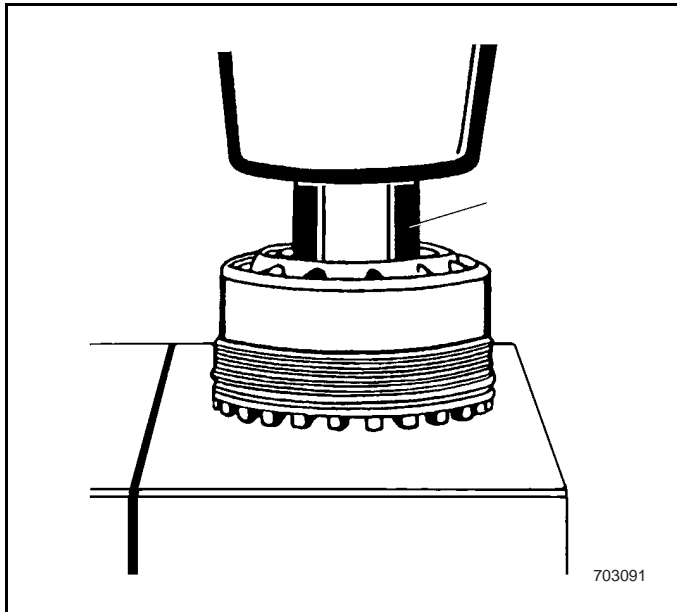
12. Use tool J-810704 to remove the bearing.



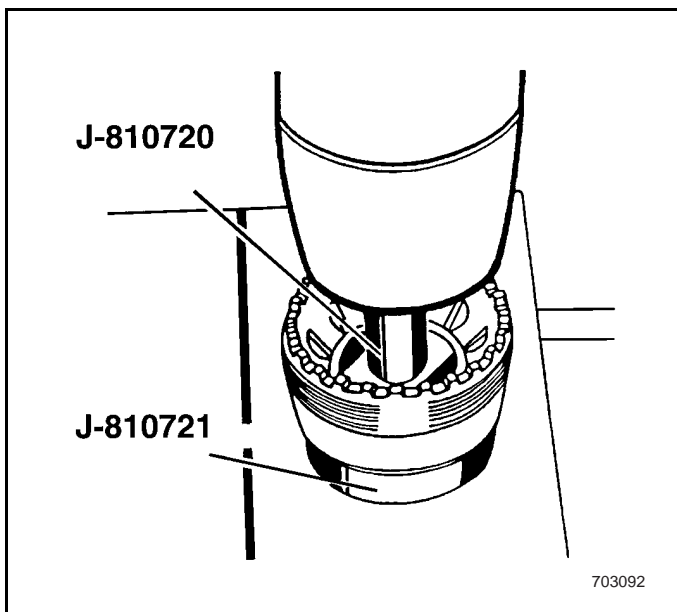
13. Remove the main deceleration gear ring.
14. Remove pinion gear shaft lock plate.
15. Remove pinion gear shaft.
16. Remove pinion gear.



17. Remove the sun gear.
18. Remove the plastic support piece.
19. Remove the adjustment sealing ring.



20. Use adequate pipe and pressure machine to remove the adjustment housing sealing.



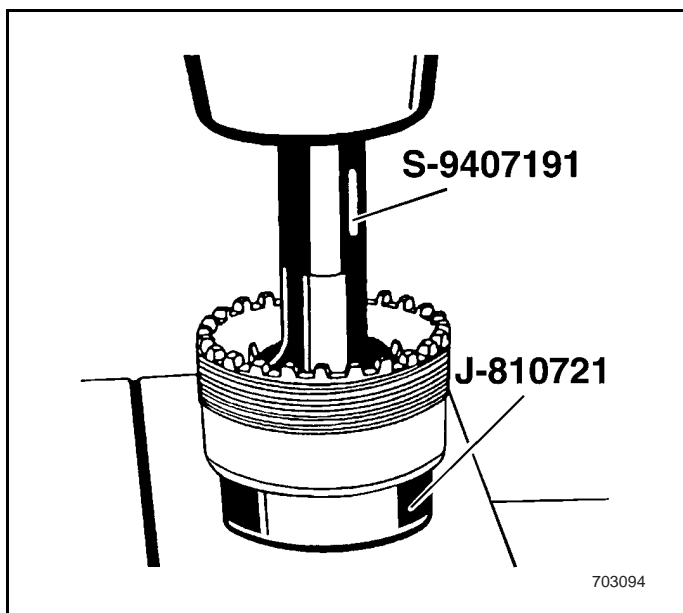
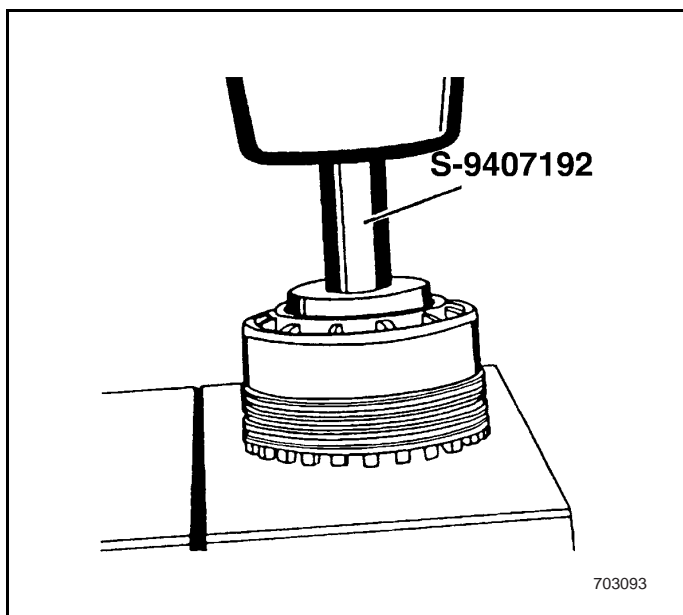
21. Use tool J- 810720, bracket J 810721 and press machine to remove the bearing cover from the adjustment housing.

Required tools

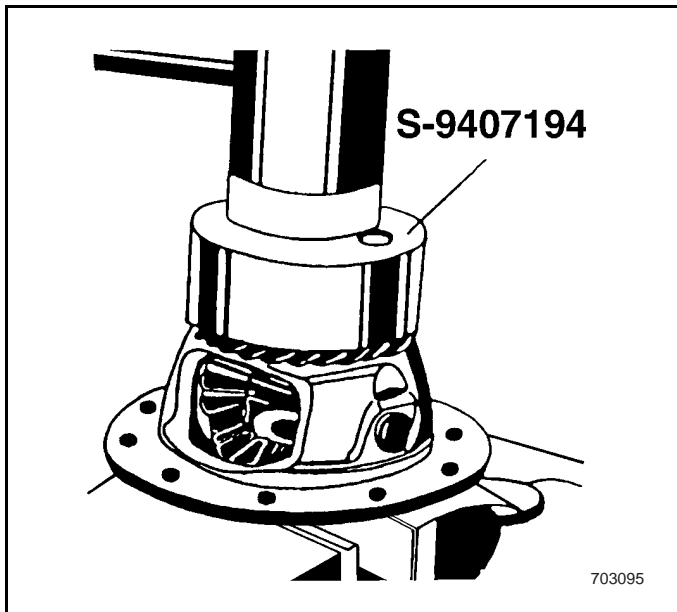
- S-9407192 installer
- S-9407191 sleeve
- J 810721 seat
- S-9407194 installer
- S-9407195 installer
- S-9407197 measuring gauge
- S-9407198 spanner

Installation Procedure

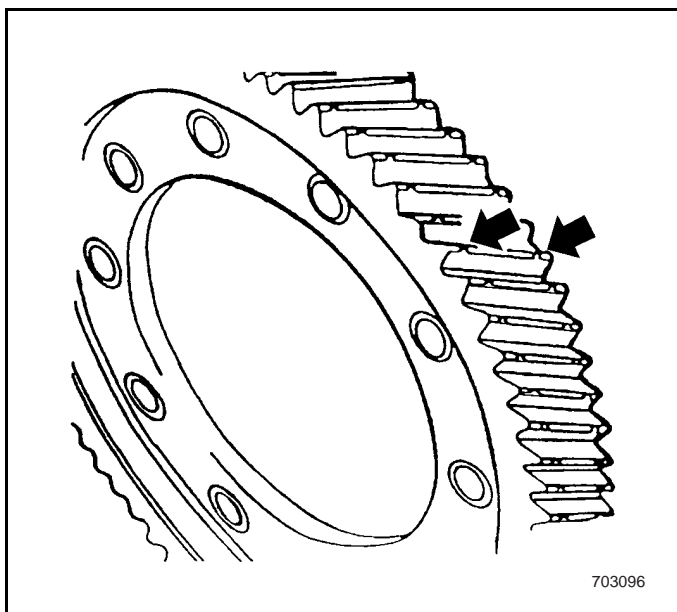
1. Use tool S- 9407192 and press machine to install the bearing cover in the adjustment housing.



2. Use tool J-9407191, bracket J 810721 and press machine to install new sealing in the adjustment housing.
3. Install new sealing ring.
4. Install the sun gear.
5. Install the plastic support piece.
6. Install the pinion gear.
7. Install the pinion gear shaft.
8. Install new pinion gear shaft lock plate.



9. Use tool S-9407194 to install new tachometer driving gear



10. Install the gear ring.

Note: Heat the gear ring to 80°C

11. Install new gear ring bolt.

Tightening

Tighten the differential gear ring bolt to 70 N•m + 30 - 45.

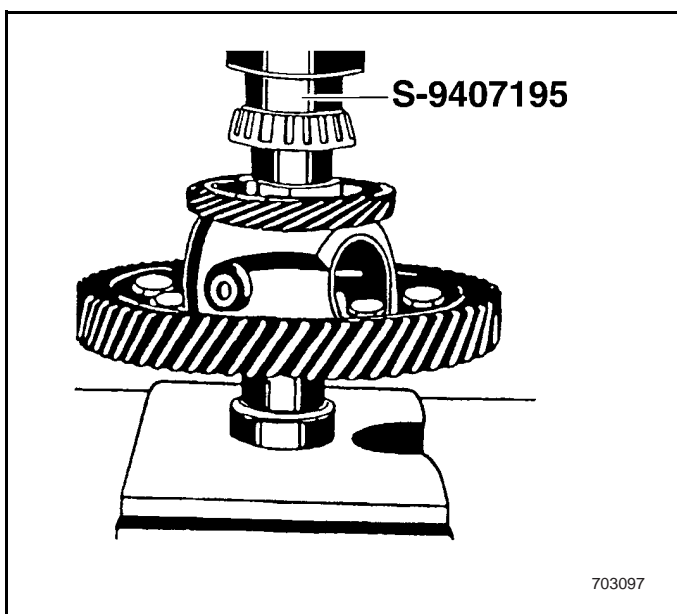
Note: usually, gear ring and pinion gear are replaced as an assembly (a pair).

It is necessary to note that gear ring and pinion are confirmed through slots in the gear, it indicates the transmission ratio. For example,

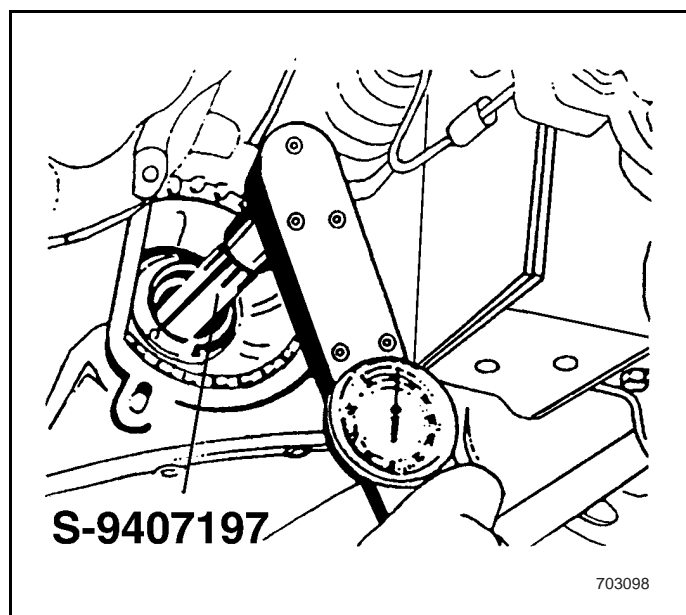
3.74 relates to 1-5 slot

3.94 relates to 1-3 slot

4.19 relates to 1- no slot



12. Use S-9407195 tool to install bearing.



13. Install the differential assembly into its housing.
14. With the help of S- 9407198, install the adjustment housing.

Adjust

Pre-tension the differential journal according to the following methods:

- If the bearing is used while the other parts are new, use tool S-9407198 to tightening adjustment housing until torque of 60 to 100N•cm is obtained to satisfy requirements for the assembly to operate.
- If the bearing is new, tighten the adjustment housing to obtain torque of 150 to 210 N•cm.
- To measure the torque, use tool S -9407197 and torque spanner.

Notice: For pre-tensioning load measurement, rotate the assembly at the speed of about 1 cycle per second, conduct measurement with the bearing plate, gear, shaft assembly removed.

Note: If replace the following parts, pinion gear, sun gear or gear ring, it will not influence the pre-tensioning load of the bearing, align the marks made previously on the adjustment housing and case. Under this circumstances, there is no need to adjust the pre-tensioning load.

15. Install the adjustment housing lock plate.
16. Install lock plate mounting bolt.

Tightening

Tighten the lock plate fixing bolt to 7- 10 N•m.

17. Install the differential cover and bolt.

Tightening

Tighten the differential cover bolt to 30 N•m.

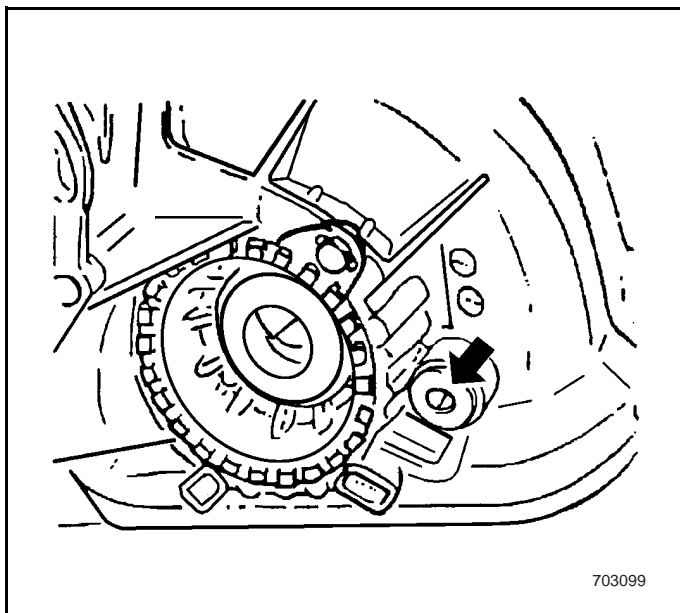
18. Install the driving shaft.

Note: Add only the designated lubrication oil MTF 0063 (Specification: SAE 75/85, API GL4), red, fill through the filler at the shift control cover until oil level satisfies requirements.

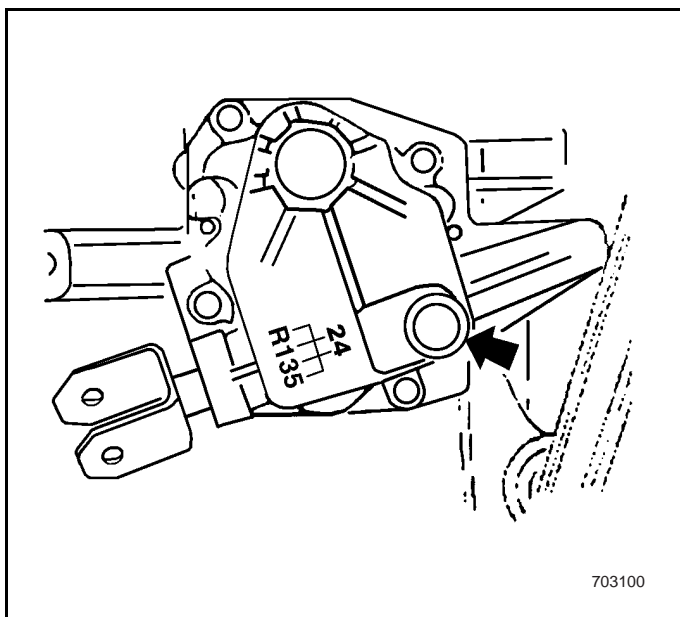
7.1.4.11 Transmission Oil Level Inspection

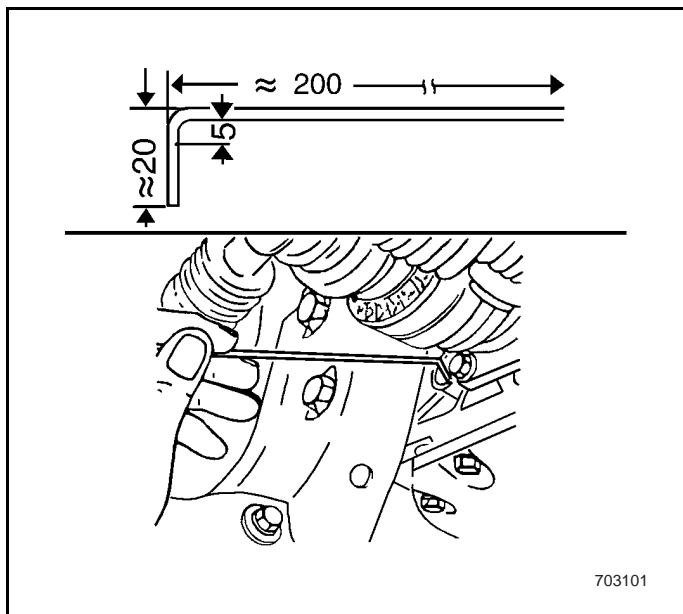
Inspections

1. There is an inspection hole at the front left side of the transmission.



2. Fill in the transmission oil through the ventilation/filler at the shift control cover.





3. To inspect the oil level, make a special tool (for example, use electrode wire).
4. The minimum oil level shall be 20mm lower than the low edge of inspection hole (ex-factory default).
5. If transmission oil has already filled, the procedure may be simplified, add engine oil until it flows out from the inspection hole.

Tightening

Tighten the inspection oil level bolt at the transmission support to 30 N•m.

Tighten the ventilation / filler bolt at the transmission to 4 N•m + 45 -180.

7.1.4.12 Transmission Shift Interlock Mechanism Adjustment

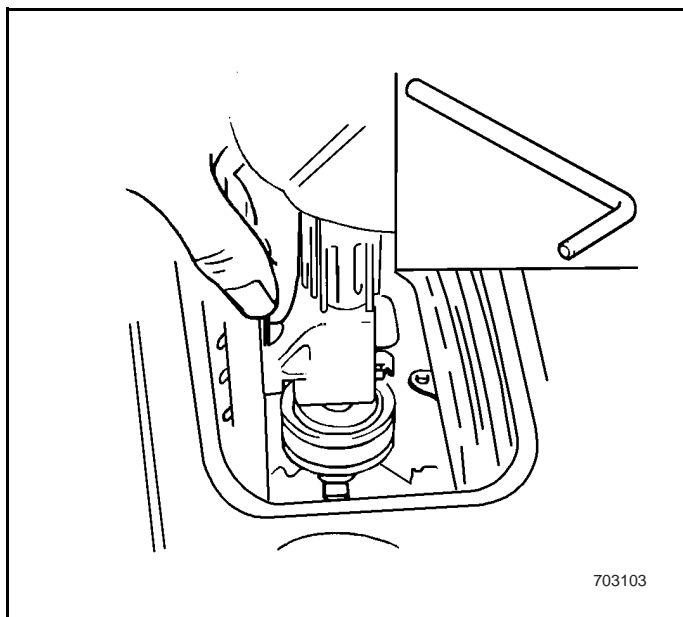
Note: Place the shift lever at Neutral position.

Required tools

- J-810711 regulator

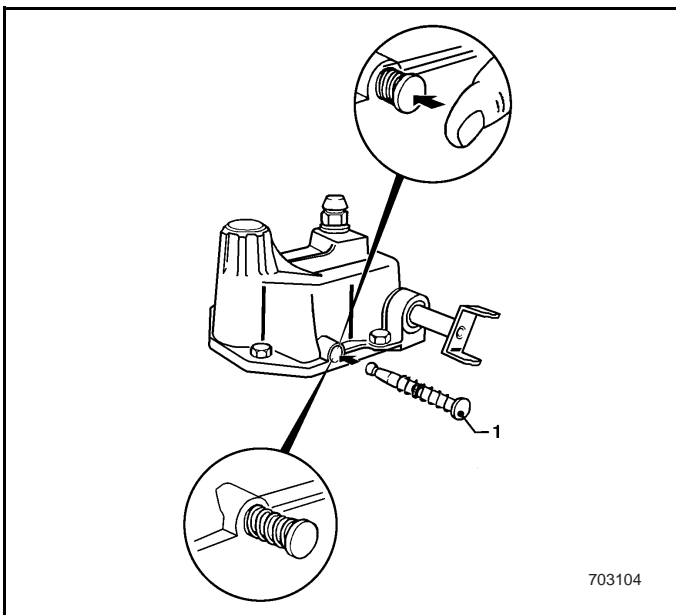
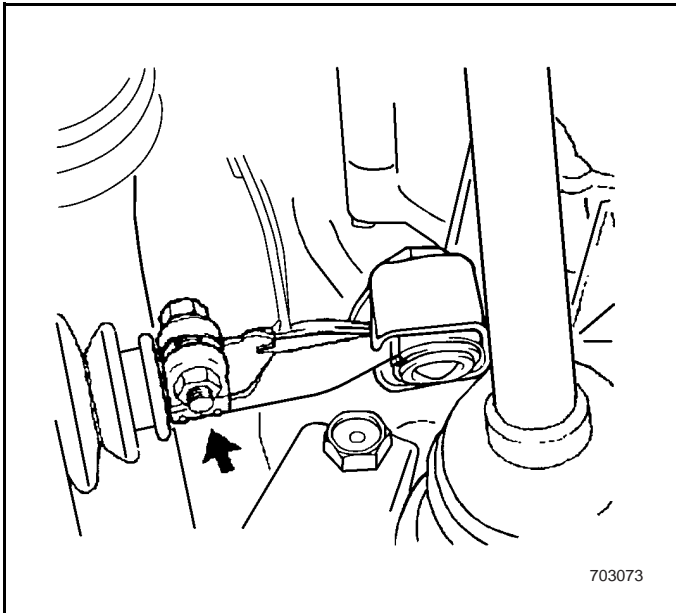
Adjust

Remove the rubber cover cap from the shift lever. Shift the lever at N position left until the hole at shift lever lobe aligns with the hole at shift lever seat. Use J-810711 to lock the shift lever at this position.



Removal Procedure

1. Support the vehicle.
2. Loosen the shift linkage bolt.



Note: To adjust the transmission shift inter-lock mechanism, use the adjustment pin in the shift cover. If there is no adjustment pin, remove the hole plug, then insert the adjustment pin.

Adjust

Force the shift selector to rotate counterclockwise (view from the adjustment pin). Push the adjustment pin to the end, screw the shift linkage bolt to 12 N • m +180 to 225. Remove J- 810711 from the shift lever, clamp the shift lever cover to the shift lever seat.

Switch to reverse. The adjustment pin will jump out. If not, pull it out.

Inspections

When the engine operates while the clutch does not engage, inspect if all gears can shift smoothly.

7.1.4.13 Replacement of clutch plate and pressure plate

Removal Procedure

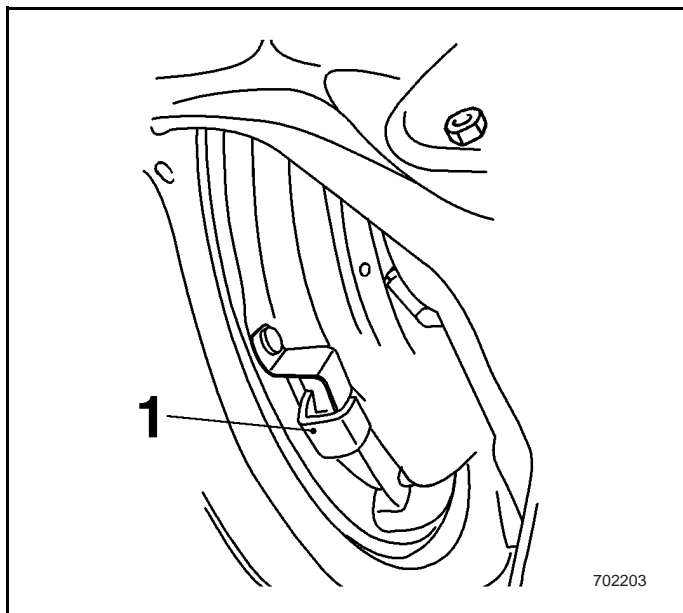
Required tools

- J -810705-A pressure block

1. Refer to Replacement of transmission assembly for removal of the transmission.

Note:

- Transmission oil overflows. Place an collector under the vehicle.
 - Observe safety rules.
2. Tension the pressure plate, place three J-810705-A so that it matches with the pressure plate spring, which disengages with the clutch plate.
 3. Remove the clutch assembly from the flywheel, loose the bolt gradually and alternatively.



Installation Procedure

Required tools

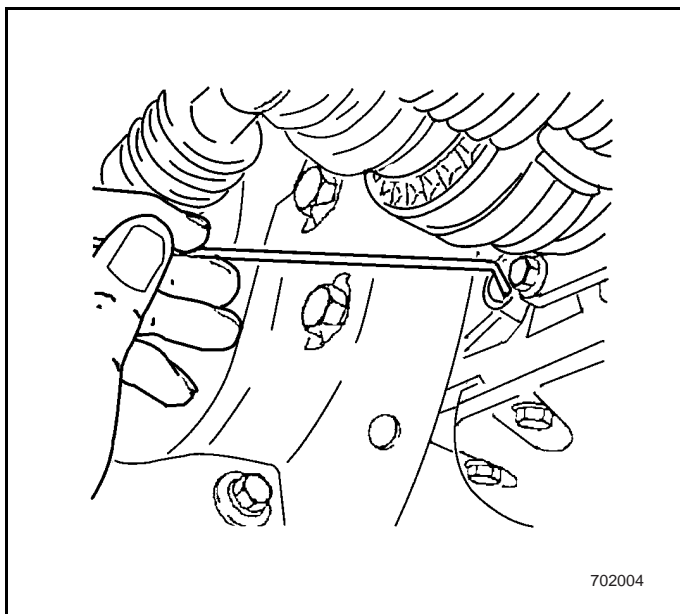
- S-9407183 locator
- J -810705-A pressure block

1. Pre-install the clutch assembly, put the clutch plate onto the flywheel loosely. The face with longer extruded clutch plate inner spline faces the transmission. Pay attention to the text description on the clutch plate.
2. Use S- 9407183 in the clutch to center the clutch plate and tension the clutch pressure plate. Apply torque gradually and alternatively to different bolts connecting the clutch plate and flywheel.

Tightening

Tighten the clutch assembly to flywheel bolt to 15 N•m.

3. Remove the three pressure blocks J -810705-A.



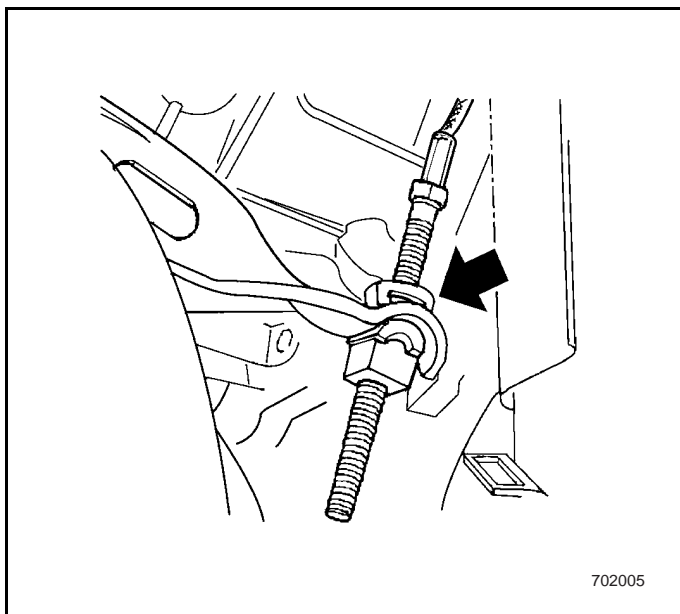
4. Refer to Replacement of transmission assembly for installation of the transmission.

Inspections

Inspect the transmission fluid level, correct if necessary. Refer to Transmission Oil Level Inspection.

Adjustment

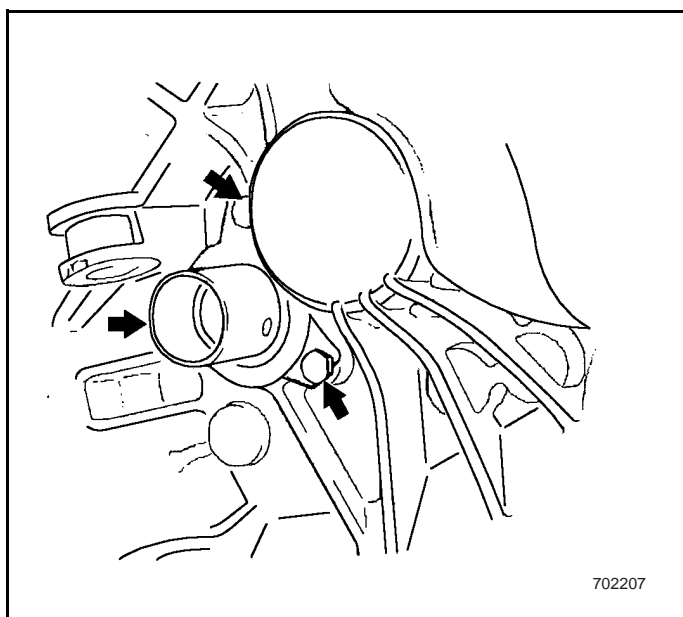
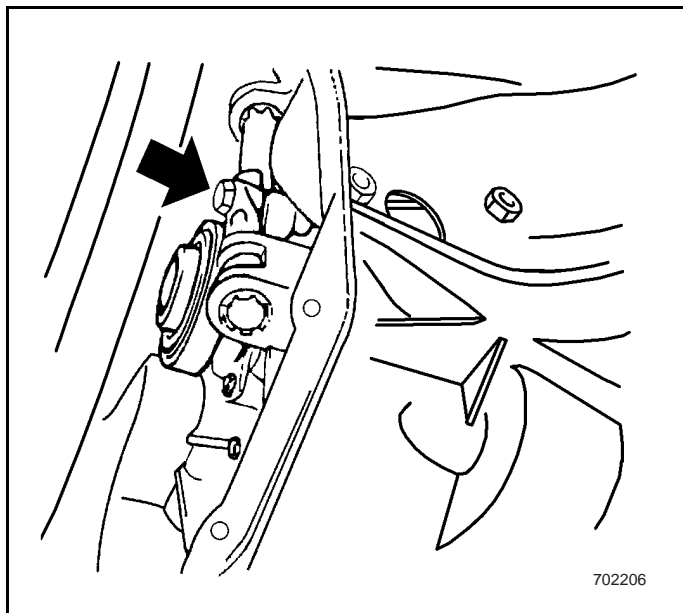
Adjust clutch clearance (clutch pedal), refer to Clutch Cable Adjustment.

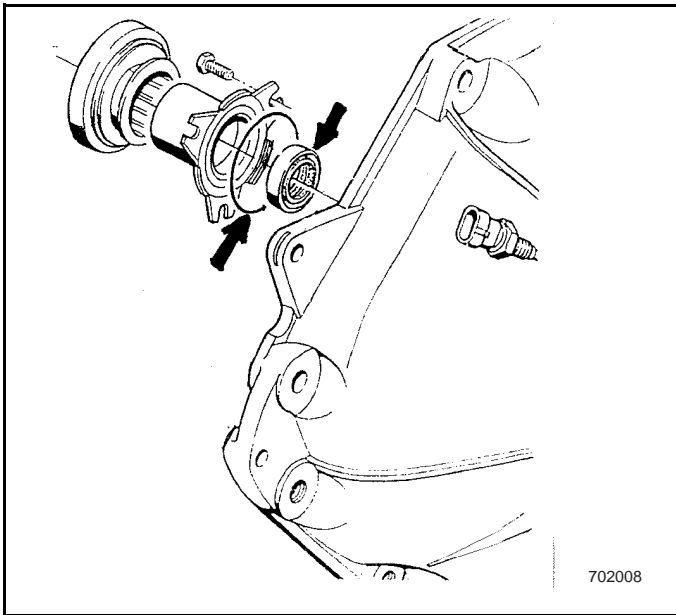


7.1.4.14 Replacement of clutch thrust bearing and thrust bearing pilot sleeve, clutch separation lever and clutch separation lever bushing

Removal Procedure

1. Remove the transmission.
2. Screw down the clutch fork bolt from the clutch separation lever (as shown by arrow in the figure).
3. Pull out the separation lever, remove the clutch fork, remove the thrust bearing from the thrust bearing pilot bushing.
4. If necessary, remove the clutch thrust bearing pilot bushing from the clutch end housing on transmission. (Indicated by arrow)

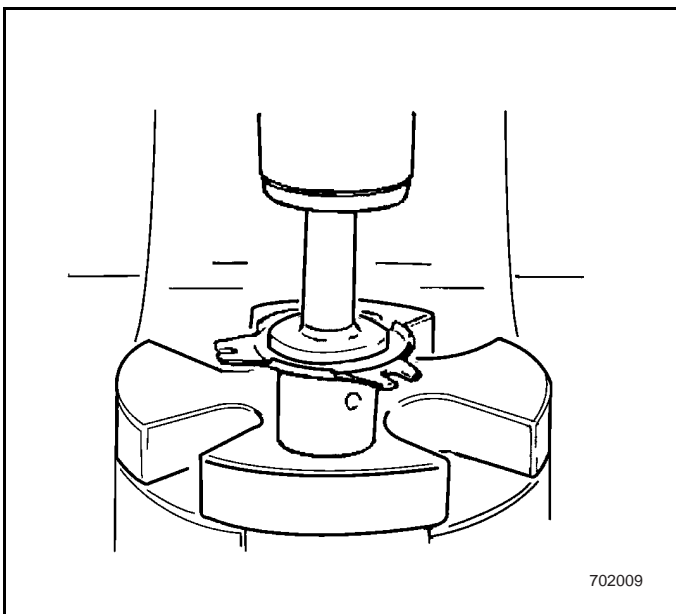




Inspections

Inspect if there is dust or damage to the thrust bearing pilot bushing sealing ring (indicated by arrow), replace if necessary.

Inspect if there is damage to the O-ring (indicated by arrow), replace if necessary.



Installation Procedure

1. If the clutch thrust bearing pilot bushing is removed, Fill the sealing ring lip with multiple lubrication grease. Use tool KM-445 to press the sealing ring into thrust bearing pilot bushing. Insert O-ring into housing channel, ensure no leakage of oil, grease or fluid.

Note: Take care not to have the O-ring damaged by sharp edges.

2. Install the thrust bearing pilot bushing to the transmission housing with bolts. Tighten the three thrust bearing pilot bushing gradually and alternatively until the specified torque is obtained.

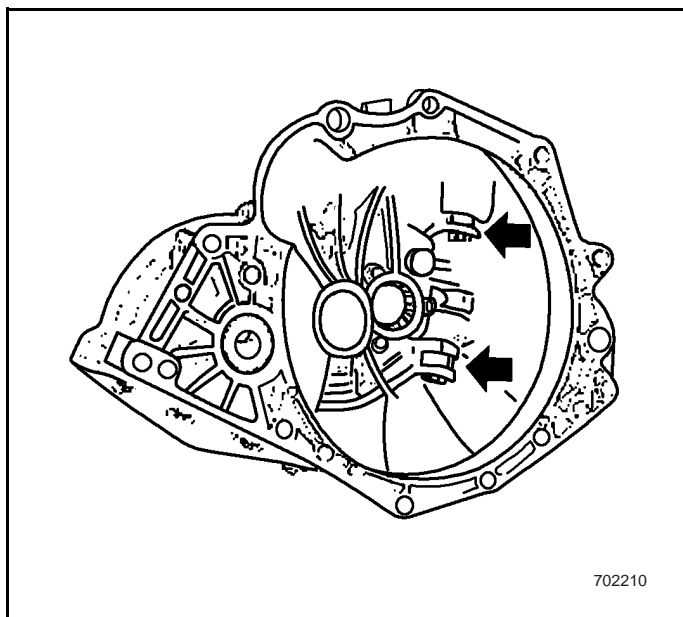
Tightening

Tighten the thrust bearing pilot bushing to the transmission housing bolt to 5 N•m

3. Clean the surface to be lubricated before lubrication. Use multiple lubrication grease to lubricate the thrust bearing slip surface. Clear away the solid residue oil grease if necessary.

Note: Lubricate the thrust bearing surface with grease, remove the excessive grease to ensure no contact between the clutch plate friction surface and the lubricants.

Note:



Inspections

Inspect if there is damage to the clutch separation gasket (indicated by arrow).

If they are already damaged, remove them according to the following methods:

Cut away the lower end of the gasket, push it upward.

Cut away the upper end out of the housing, push it downward.

Install the new gasket. Gasket must be installed in place (as shown by arrow in the figure). Use multiple lubrication grease to lubricate the gasket inside. Use only adequate amount of grease.

4. Install the clutch separation lever with the fork, push the thrust bearing to the pilot sleeve, mount the clutch fork to the clutch separation lever.

Tightening

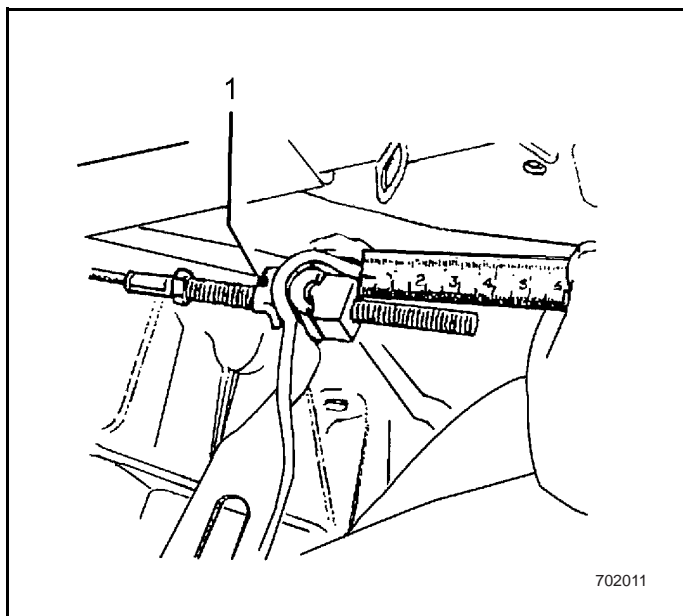
Tighten the clutch fork to clutch separation lever to 35 N•m.

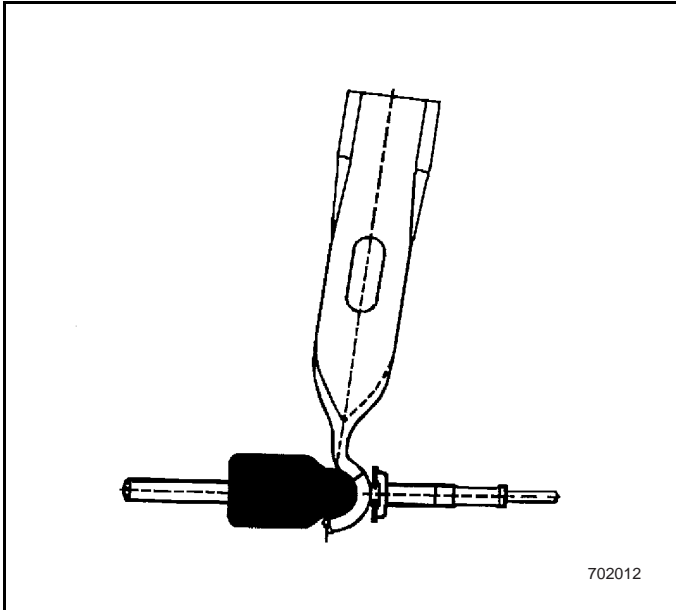
7.1.4.15 Replacement of transmission cable

if the clutch cable is damaged, replace it.

Measurement

Measure the clutch cable thread extrusion length.

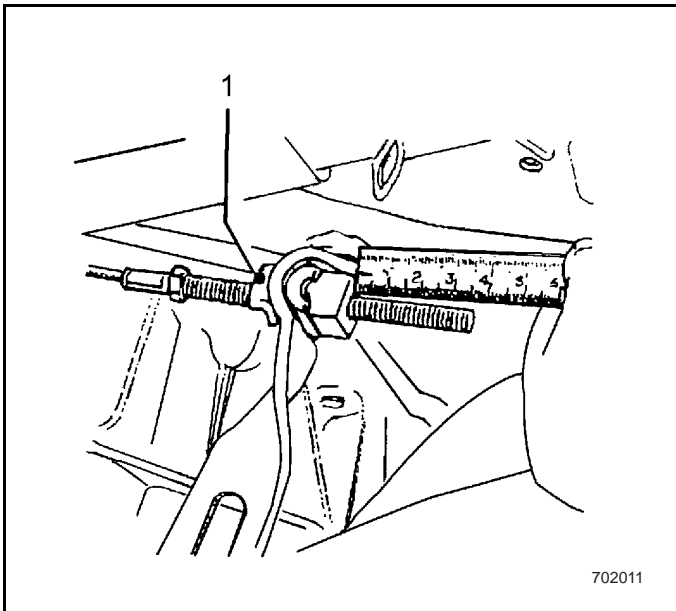


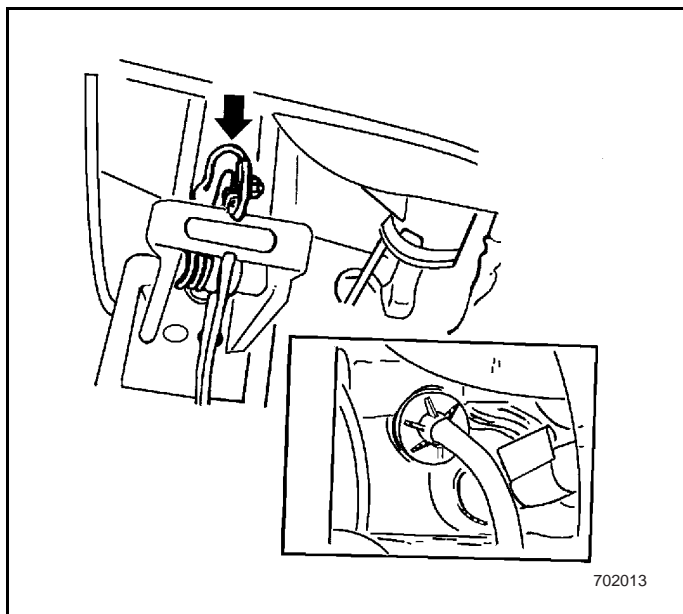


Note: Clutch cable is mounted on the separation lever by a shock absorber.

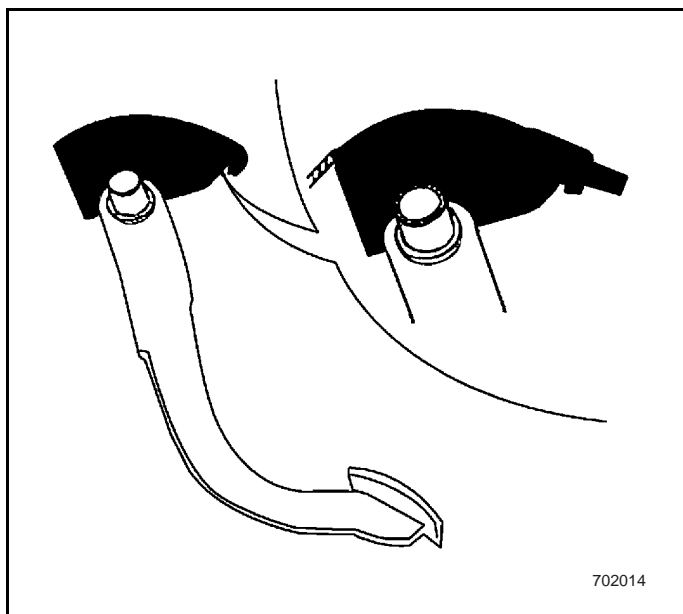
Removal Procedure

1. Remove the thrust plate (1) from the cable.
2. Remove the cable from the separation lever.
3. Press the cable from the bracket.



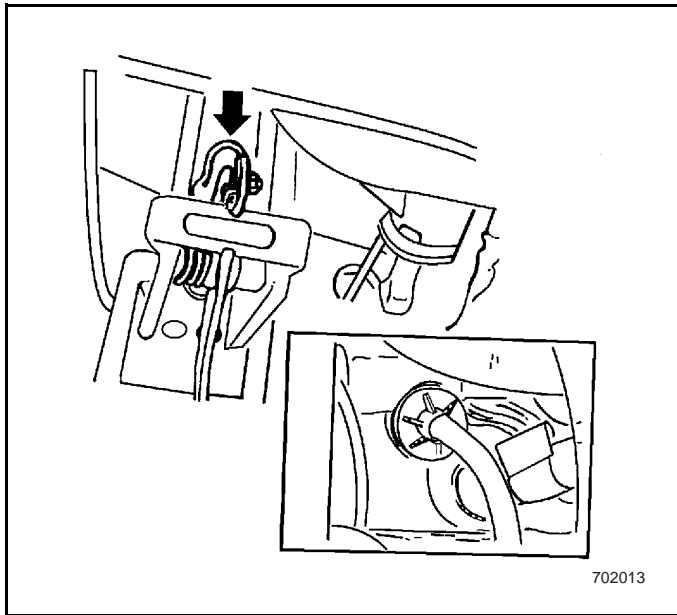


4. Remove the spring and clutch cable from the clutch pedal.



Note: Clutch cable pilot is composed of a plastic plate with adaptive cable retainers.

5. Remove the clutch cable from the engine side of the isolator.



Installation Procedure

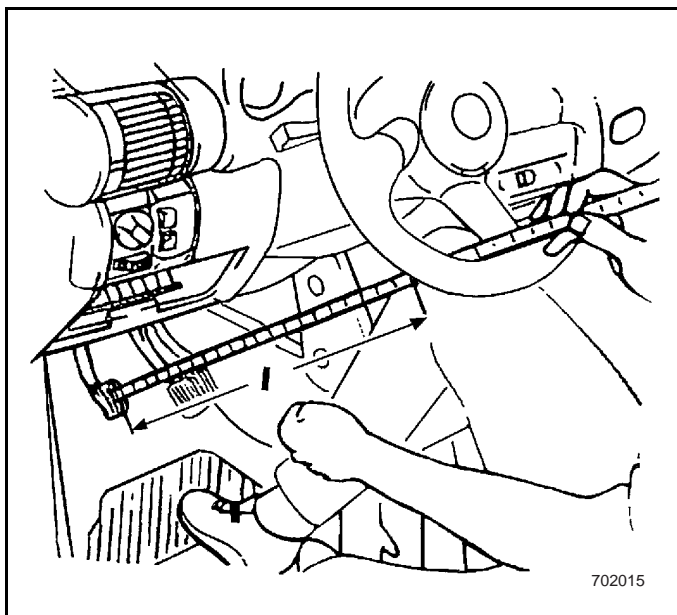
1. Pull the clutch cable through the isolation, fix it and the spring onto the clutch pedal lever.
2. Install the clutch cable onto the bracket and separation lever.
3. If necessary, grease (B0400852) shall be applied to the contacting surface of the rubber shock absorber and separation lever.

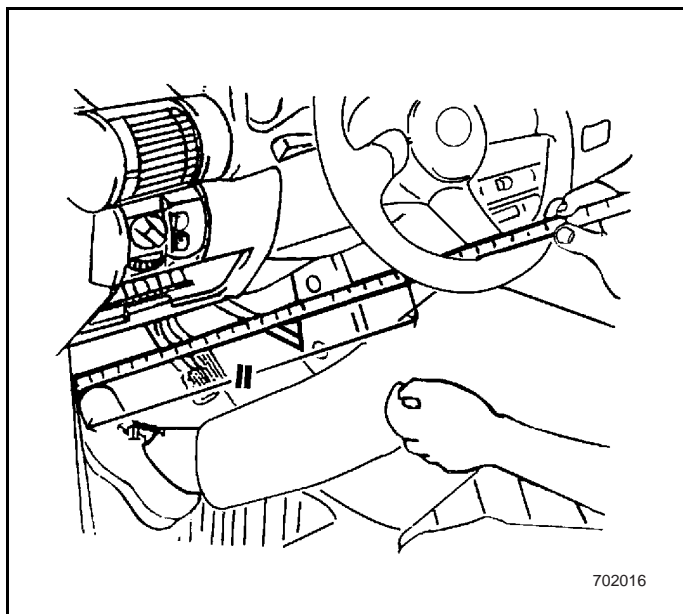
Adjustment

Adjust clutch pedal, refer to Clutch Cable Adjustment.

7.1.4.16 Adjustment of transmission cable

Size 1: distance from mid of clutch pedal to the low end of the steering wheel hub. Brake pedal is not stepped at loose position.





Size 2: Measure with the same method, step down the pedal completely.

The value variance between the two (2 minus 1) is the brake pedal travel, which should be between 135- 145 mm.

If necessary, adjust the clutch cable to adjust clutch pedal travel. Fix the cable with thrust plate.

Note: Clutch pedal is higher than the brake pedal.

Parallel pedal position is incorrect since there is no clutch clearance. Clutch pedal rises with the wearing of the clutch plate.

Adjust

Clutch pedal travel is about 135- 145mm.

Push the clutch separation lever afterwards until the clutch thrust bearing contacts the film spring. Rotate the clutch cable shock absorber until it matches with the separation channel while not loose.

Place the cable thrust plate at 2-4 mm away from the distance separation lever.

7.1.5 Description & Operation

7.1.5.1 General Safety Rules

- When the operation involves electrical short circuit risk, disconnect the battery grounding.
- Do not pull the cables while disconnecting the wiring harness. Loose the locking devices of the wiring harness carefully.
- Ensure all wiring correctly grounded and routed while removing/ installing at the engine or transmission. Start the engine without grounding may damage the control unit.
- Each time replace the sealing, sealing ring, O-ring, fixing element, do not over stretch the fixing ring.
- During service of the all transmissions, ensure the cleanness of all parts and tools to avoid transmission failure.
- Clean all removed parts carefully, inspect if there is wearing or damage. Inspect if there is foreign matter, blur or damage to the channel and seat surface.
- Use designated sealing agent to install the housing components.
- Apply transmission oil onto the parts before they are installed.

- Apply grease before installation of the bearing, gasket and sealing ring.
- If it is removed, use new bolts to replace the connecting bolts (tensioning bolts) according to instructions in the service manual.
- For bolts installed with locking liquid glue, re-cut the inner thread, clear the outside thread of the bolt. Use new thread locking glue.
- Replace the self-locking nut.
- If threads of Al parts flake or damage, they may not be discarded. Under most circumstances, these thread may be repaired.
- Use only fluid approved, do not re-use the discarded engine fluid.
- Disconnect the ground and battery will result in loss of certain memory functions in these electronic systems (such as power window regulator, date and time). After the battery is re-connected, re-program the memories that are easily lost and decode the record devices.

7.1.5.2 Clutch and Transmission Safety Regulations

- Friction surface of the clutch plate shall not contact with the lubrication grease.
- The grease can only be used for designated purpose. Remove the excessive grease, especially grease in the clutch.

7.1.6 Special Tools

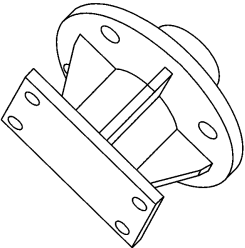
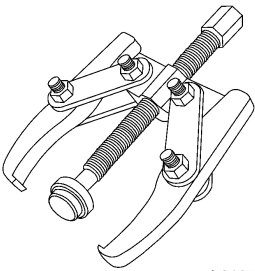
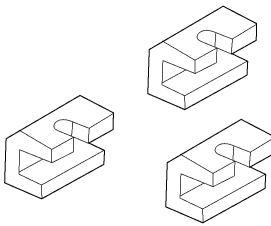
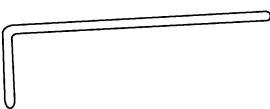
Illustration	Number & Name of the Tools
 <p>3-9506289</p>	<p>3-9506289 universal joint M-780668 and R-0007758</p>
 <p>J-810704</p>	<p>J -810704 common puller</p>
 <p>J-810705-A</p>	<p>J -810705-A pressure block to maintain the low pressure at pressure plate (option: KM-526-A)</p>
 <p>J-810711</p>	<p>J -810711 Regulator shift linkage, adjustment (option: KM-527-A)</p>

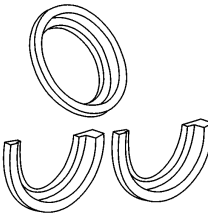
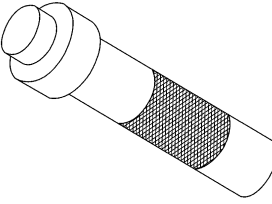
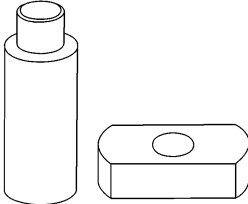
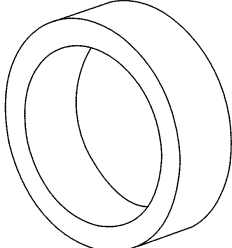
Illustration	Number & Name of the Tools
 <p>J-810713</p>	<p>J -810713 puller, main shaft rear bearing puller, 1st and 2nd synchronizer hub puller</p>
 <p>J-810718</p>	<p>J -810718 installer, install the main shaft bearing while removing the transmission Installer</p>
 <p>J-810720</p>	<p>J -810720 Puller gear ring bearing outer ring puller</p>
 <p>J-810721</p>	<p>J -810721 seat ring gear bearing tension force ring bottom seat</p>

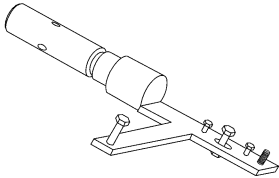
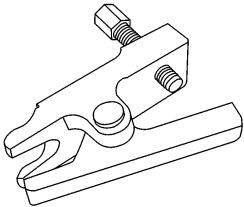
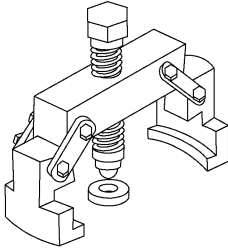
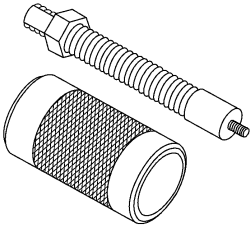
Illustration	Number & Name of the Tools
 <p>J-820725</p>	<p>J -810725 Transmission Bracket and V-8607010 and used together with V- 9307138</p>
 <p>J-810902</p>	<p>J -810902 puller operation handle terminal puller</p>
 <p>J-820726-A</p>	<p>J -820726-A puller 5thgear puller</p>
 <p>J-820728</p>	<p>J -820728 puller input shaft puller</p>

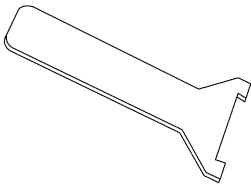
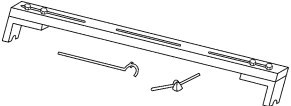
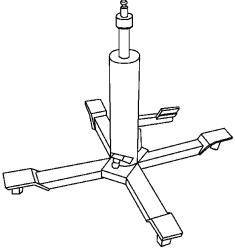
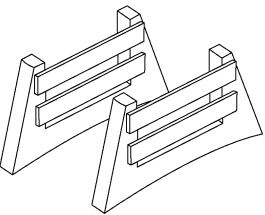
Illustration	Number & Name of the Tools
 <p>J-820729</p>	<p>J -820729 locker, lock the main shaft ring</p>
 <p>J-840732</p>	<p>J -840732 Bracket, to suspend the engine, used together with J-9706538 (optional: MKM-883- 1)</p>
 <p>J-9703392</p>	<p>J -9703392 Hydraulic hoist</p>
 <p>J-9706538</p>	<p>J -9706538 Engine support adaptor adaptor, used together with J-840732</p>

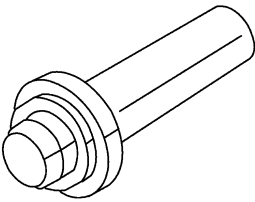
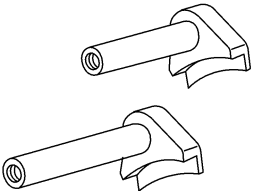
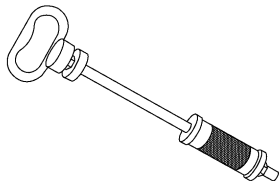
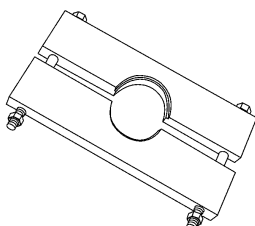
Illustration	Number & Name of the Tools
 <p>KM-445</p>	<p>KM-445 installer, install the sealing ring at thrust bearing guiding rail.</p>
 <p>KM-902</p>	<p>KM-902 Remover to remove vehicle shafts from the transmission (option: KM-460-B)</p>
 <p>M-680770</p>	<p>M-680770 slip gavel</p>
 <p>M-740479-A</p>	<p>M-740479-A base, used to remove the 4 speed gear</p>

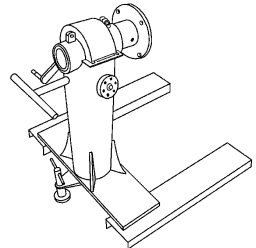
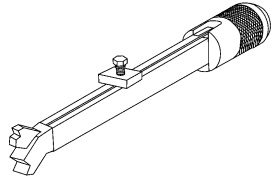
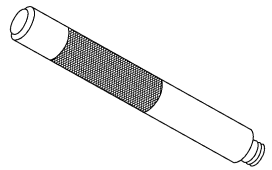
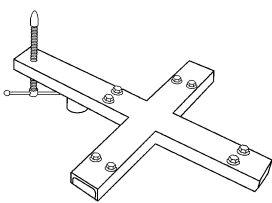
Illustration	Number & Name of the Tools
 <p>M-780668</p>	<p>M-780668 transmission bracket</p>
 <p>M-840702</p>	<p>M-840702 puller, bearing cover common puller</p>
 <p>M-840911-A</p>	<p>M-840911-A common handle</p>
 <p>R-0006747-1</p>	<p>R-0006747-1 cross structure device, used to removal and install the engine and transmission, used together with J- 9703392</p>

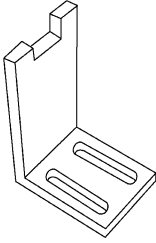
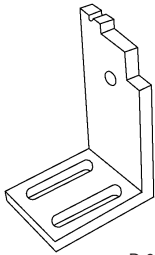
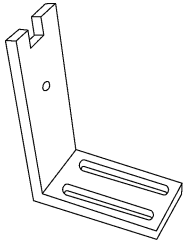
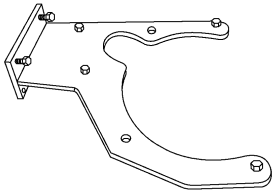
Illustration	Number & Name of the Tools
 R-0006747-2	R-0006747-2 Front support and tool parallel connection R-0006747-1, used together with R-0006747-7/8
 R-0006747-7	R-0006747-7 right support attachment tool R-0006747-1 and R-0006747-2/8 are used together
 R-0006747-8	R-0006747-8 left support attachment tool R-0006747-1 and R-0006747-2/7 are used together
 R-0007758	R-0007758 Support equipment attached with the transmission and used together with 3-9506289 and M-780668

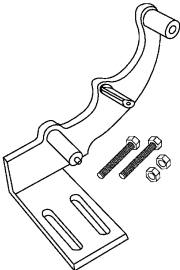
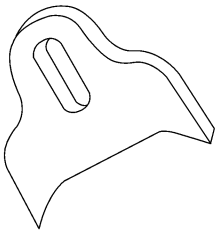
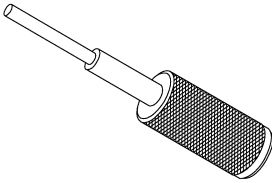
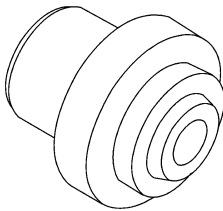
Illustration	Number & Name of the Tools
 S-0007763	S-0007763 support, support used to remove and install the transmission, used together with J-9703392 and R-0006747-1
 S-9407182	S-9407182 flywheel locking device
 S-9407183	S-9407183 Locator clutch disc centering device
 S-9407191	S-9407191 Sleeve housing bearing puller and installer, sleeve sealing installer used together with M-840911-A

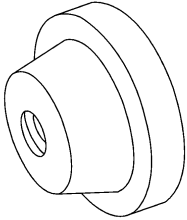
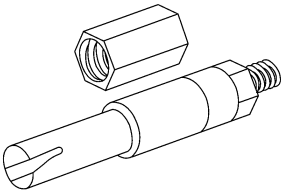
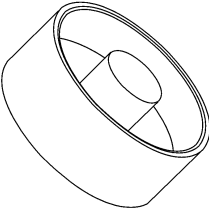
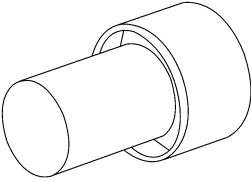
Illustration	Number & Name of the Tools
 <p>S-9407192</p>	<p>S-9407192 installer, gear bearing outer race installer, used together with M- 840911-A.</p>
 <p>S-9407193</p>	<p>S-9407193 puller, idle shaft bearing puller, used together with M-680770</p>
 <p>S-9407194</p>	<p>S-9407194 installer, tachometer gear installer</p>
 <p>S-9407195</p>	<p>S-9407195 installer, ring-shaped gear bearing installer</p>

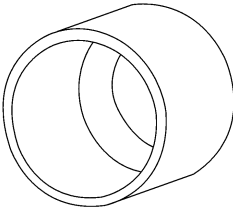
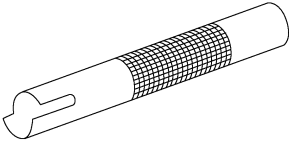
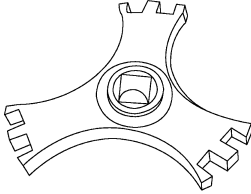
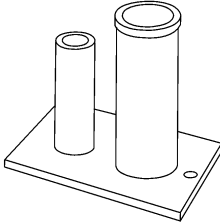
Illustration	Number & Name of the Tools
 <p>S-9407196</p>	<p>S-9407196 installer, differential sealing Installer</p>
 <p>S-9407197</p>	<p>S-9407197 measuring gauge, equipment used to measure the sun gear housing bearing journal pre-tensioning load</p>
 <p>S-9407198</p>	<p>S-9407198 Spanner, to Tighten and loosen differential bearing race</p>
 <p>S-9407199</p>	<p>S-9407199 base, to install the transmission</p>

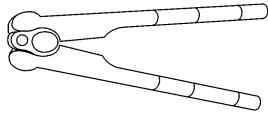
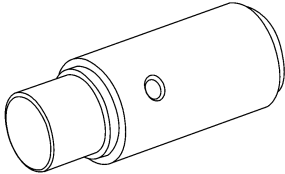
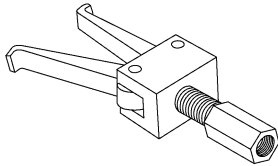
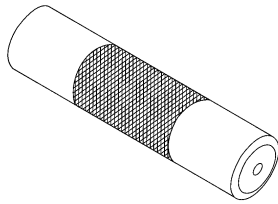
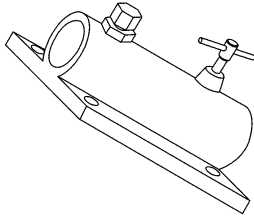
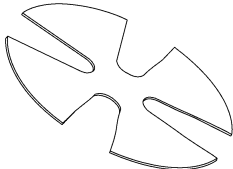
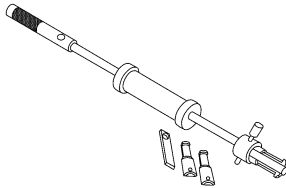
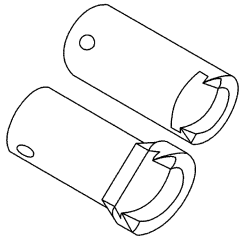
Illustration	Number & Name of the Tools
 <p>S-9407235</p>	S-9407235 caliper, install C.V. joint
 <p>S-9807564</p>	S-9807564 installer, shift equipment bushing Installer
 <p>T-730465</p>	T-730465 puller, vehicle shaft sealing race puller, used together with M-680770
 <p>T-730668</p>	T-730668 Puller gear set bearing puller

Illustration	Number & Name of the Tools
 <p>V-8607010</p>	V-8607010 support, common support used to remove and install the transmission, used together with J-810725 and V-9307138.
 <p>V-9307206</p>	V-9307206 puller, disc bearing and gear puller, T-730668 and the former KM-307-B
 <p>V-9307207</p>	V-9307207 lock-up slip hammer former KM-328-B
 <p>V-9307211</p>	V-9307211 plug puller and V-9307207 and KM-630

Blank

7.2 Automatic transmission (if equipped)

7.2.1 Specification

7.2.1.1 Tightening Torque

Applications	specification (N•m)
Screw - start switch at neutral position	9-29
nut- shift lever	6-8
screw- input and output sensor	4-7
hole plug- oil drain plug	23-55
hole plug- pressure sensor	6-9
screw- shift solenoid	6-7
screw- torque convertor clutch solenoid	6-7
screw- pipe control solenoid	6-7
screw - side cover	19-29
screw- transmission to engine- bottom side	55-80
screw- torque convertor to flywheel	40-50
screw - bottom side cover	4-7
screw- shock absorber- vertical beam front	65
connector- fluid cooling hose connector	1,2
screw- transmission to engine- upper side	55-80

7.2.1.2 Technical parameter

number of shifts	4
equipped with torque convertor locker	
ratio	
1st gear	2.807:1
2nd gear	1.479:1
3rd gear	1.000:1
4th gear	0.735:1
Reverse	2.769:1
differential	4.048:1
torque convertor deceleration (stall)	2.15:1
maximum input torque	130Nm
ATF (automatic transmission fluid) capacity	6.0L
ATF Type	DEXRON III TEXAMATIC 7045E
Transmission weight	64 kg

7.2.1.3 Shift and mode description

shift	shifting points according to acceleration condition (KM)					
	minimum throttle opening		acceleration pedal contacts the full acceleration switch		full acceleration connected	
	economic mode	sports mode	economic mode	sports mode	economic mode	sports mode
1-2	12	15	41	52	52	52
2-3	27	30	82	98	98	98
D3-4	40	70	135	150	150	150
D4-3	22	20	120	145	145	145
3-2	10	12	65	88	88	88
2-1	10	12	33	42	42	42

Note: The above values may vary due to tolerance and tire pressure change, usually, variance range is -2% to +6%.

When the speed is lower than the following value, manual downshift is allowed.	143	D-3
	96	3-2 (economic mode and sports mode)
	48	2-1 (economic mode and sports mode)

When the speed is lower than the following value, manual downshift is allowed.	7	D-R
	7	N-R
	0	R-R 0 – vehicle brake (mechanical lock)

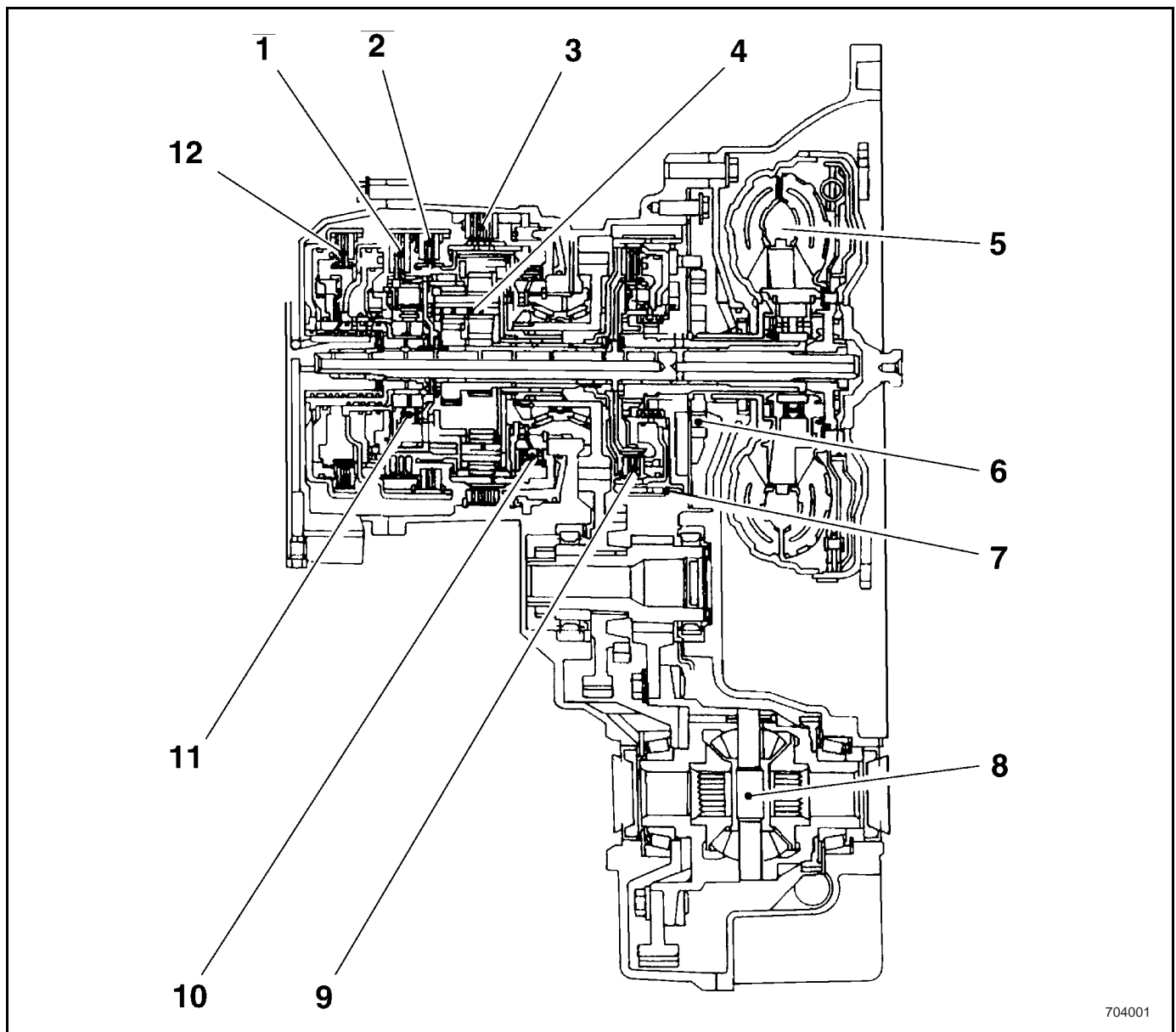
7.2. Schemes and Wiring Diagram

7.2.2.1 Automatic transmission control module wiring diagram

Refer to 8.20.2.22.

7.2.3 Component Location

7.2.3.1 Automatic Transmission Assembly

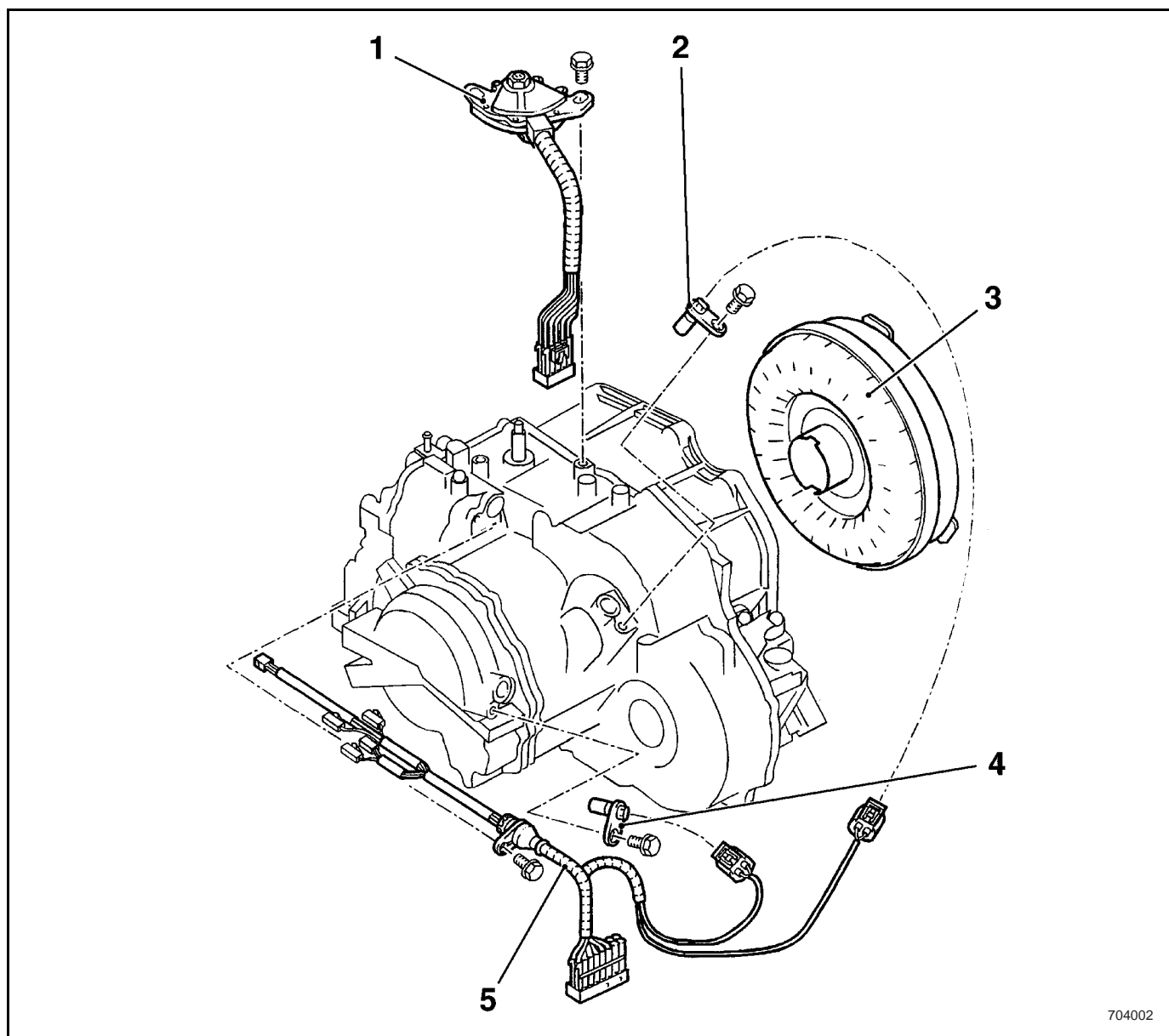


704001

Legend

- | | |
|----------------------------|---------------------------------|
| (1) C3 deceleration clutch | (7) B1 brake band |
| (2) C0 deceleration clutch | (8) Differential |
| (3) B2 deceleration clutch | (9) C2 reverse clutch |
| (4) Sun gear set | (10) F1 single direction clutch |
| (5) Torque converter | (11) F0 single direction clutch |
| (6) Oil pump | (12) C1 forward clutch |

7.2.3.2 Automatic Transmission Harness Position

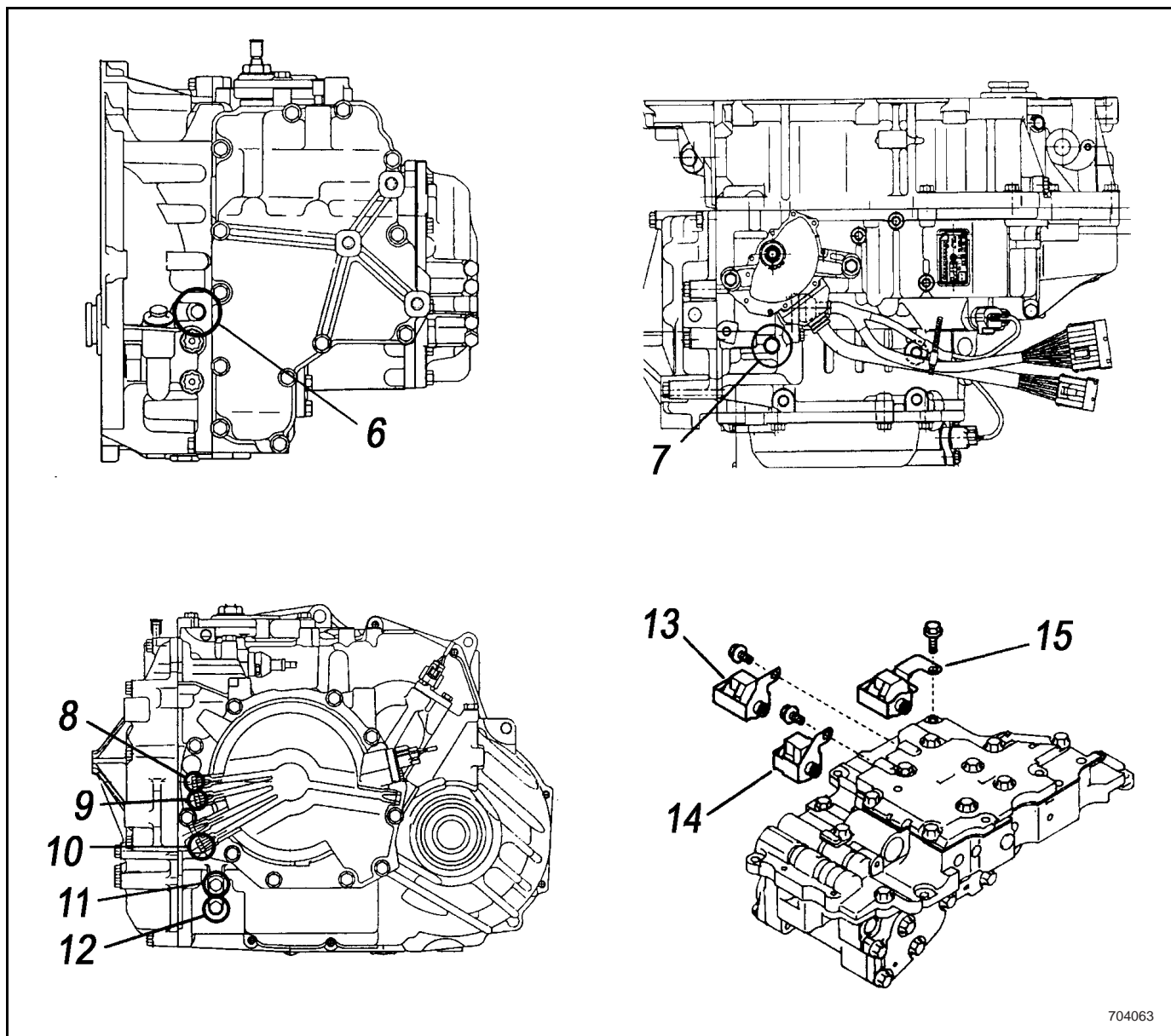


704002

Legend

- | | |
|--------------------------------------|-------------------------------------|
| (1) Shift switch | (4) Transmission input speed sensor |
| (2) Transmission output speed sensor | (5) Transmission valve body harness |
| (3) Torque convertor | |

7.2.3.3 Test socket and solenoid

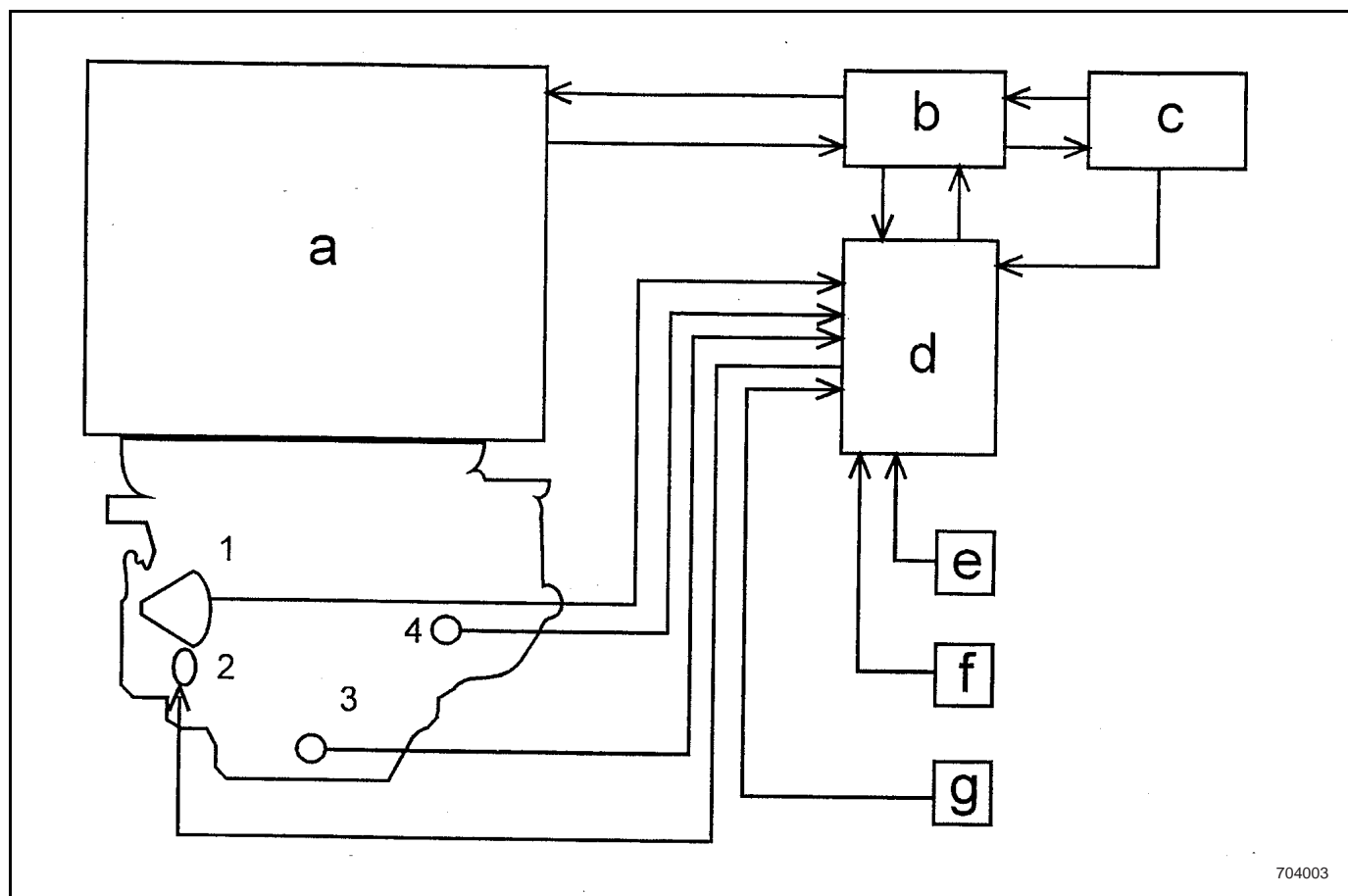


704063

Legend

- | | |
|------------------------|-------------------------------|
| (6) Test socket (PL) | (11) Test socket (PB1RELEASE) |
| (7) Test socket (PTH) | (12) Test socket (PB1APPLY) |
| (8) Test socket (PC3) | (13) Solenoid 1 |
| (9) Test socket (PC1) | (14) Solenoid 2 |
| (10) Test socket (PC0) | (15) L-UP solenoid |

7.2.3.4 Electronic Control System

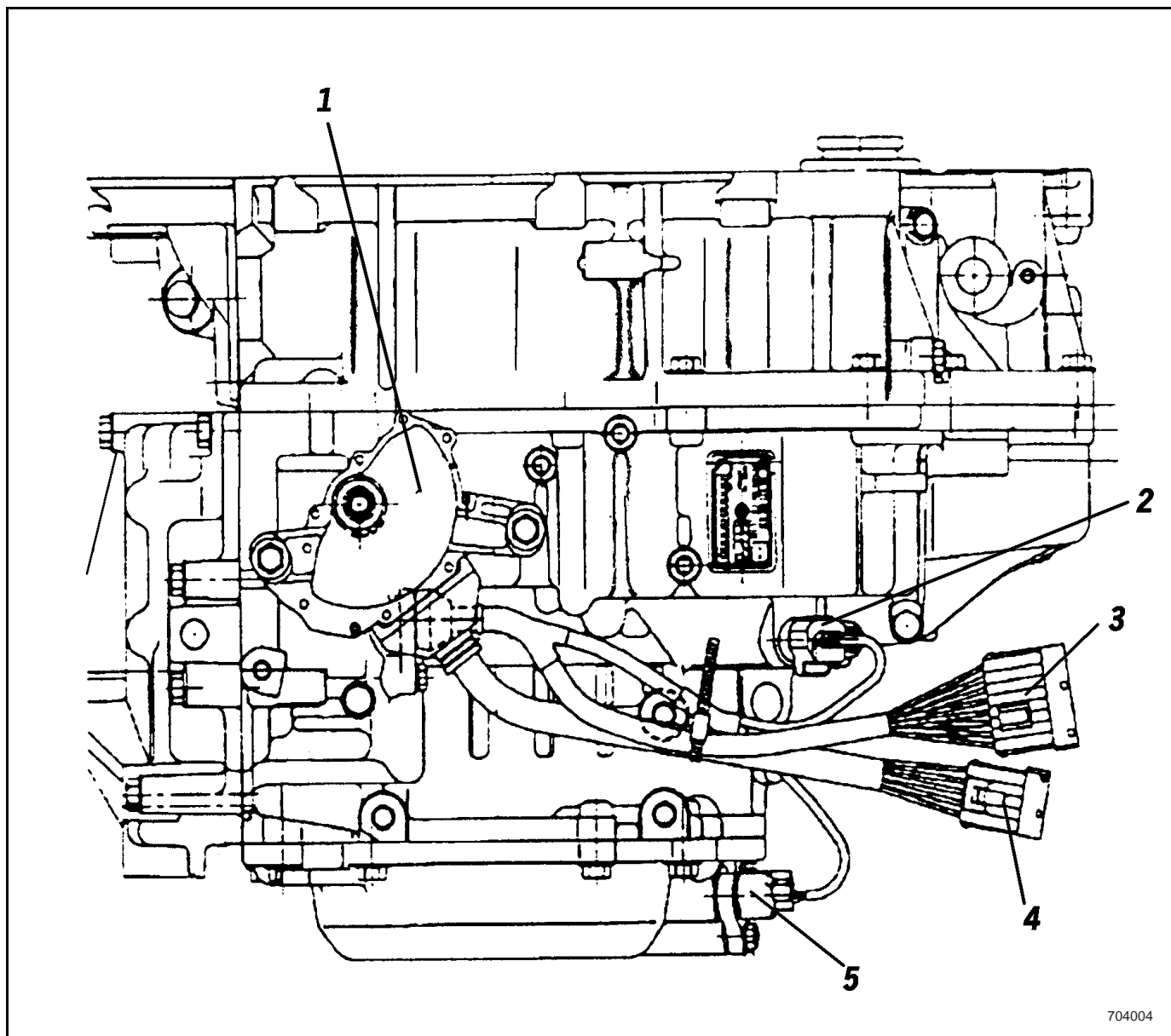


704003

Legend

- | | |
|--|--|
| (1) Shift switch | (3) Transmission input shaft speed sensor |
| (2) Solenoid connector | (4) Transmission output shaft speed sensor |
| a. Engine | e. Mode selection contact switch |
| b. Ignition control module | f. Full acceleration switch |
| c. Fuel control module | g. Brake lamp switch |
| d. Automatic transmission control module | |

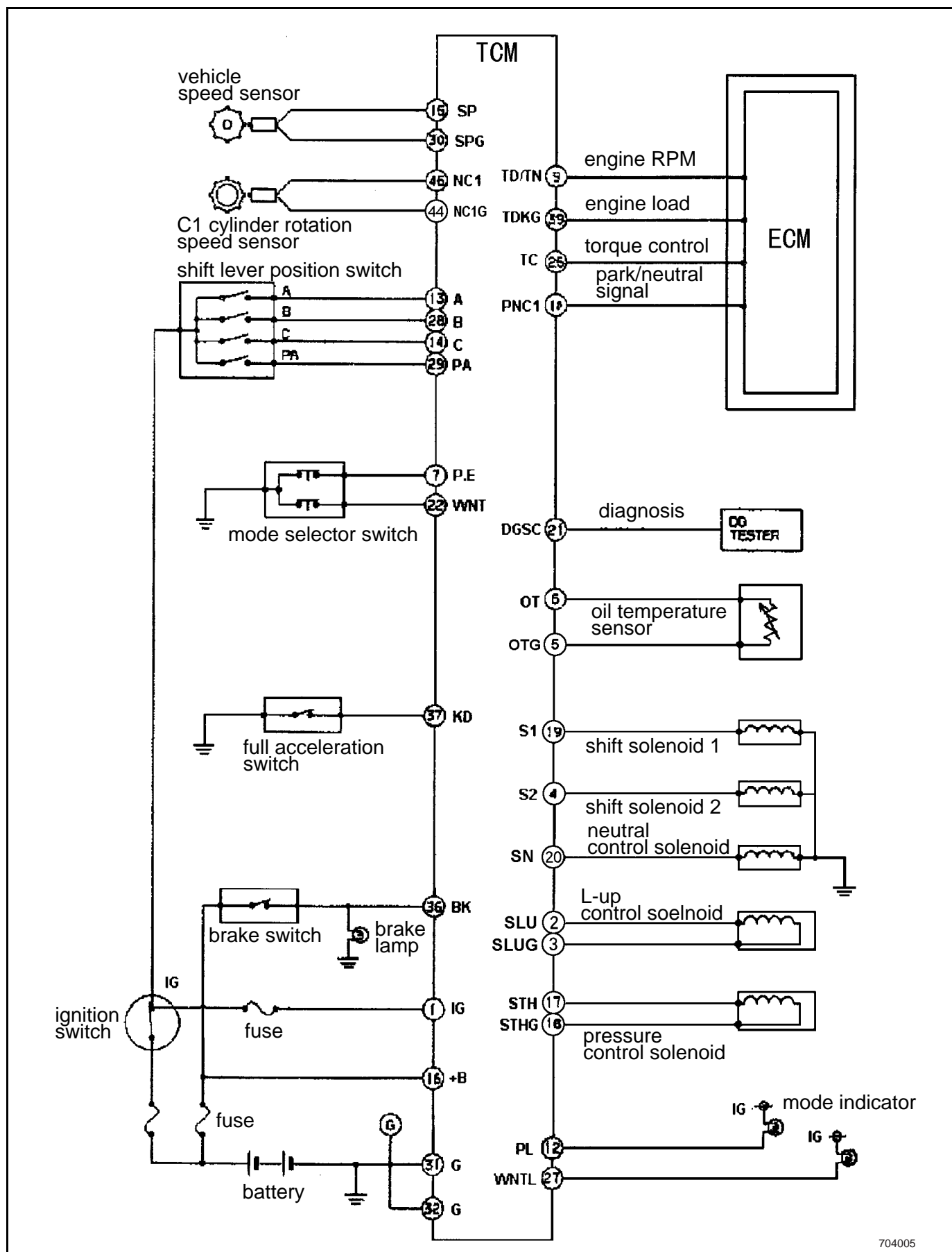
7.2.3.5 Electrical Connector Position



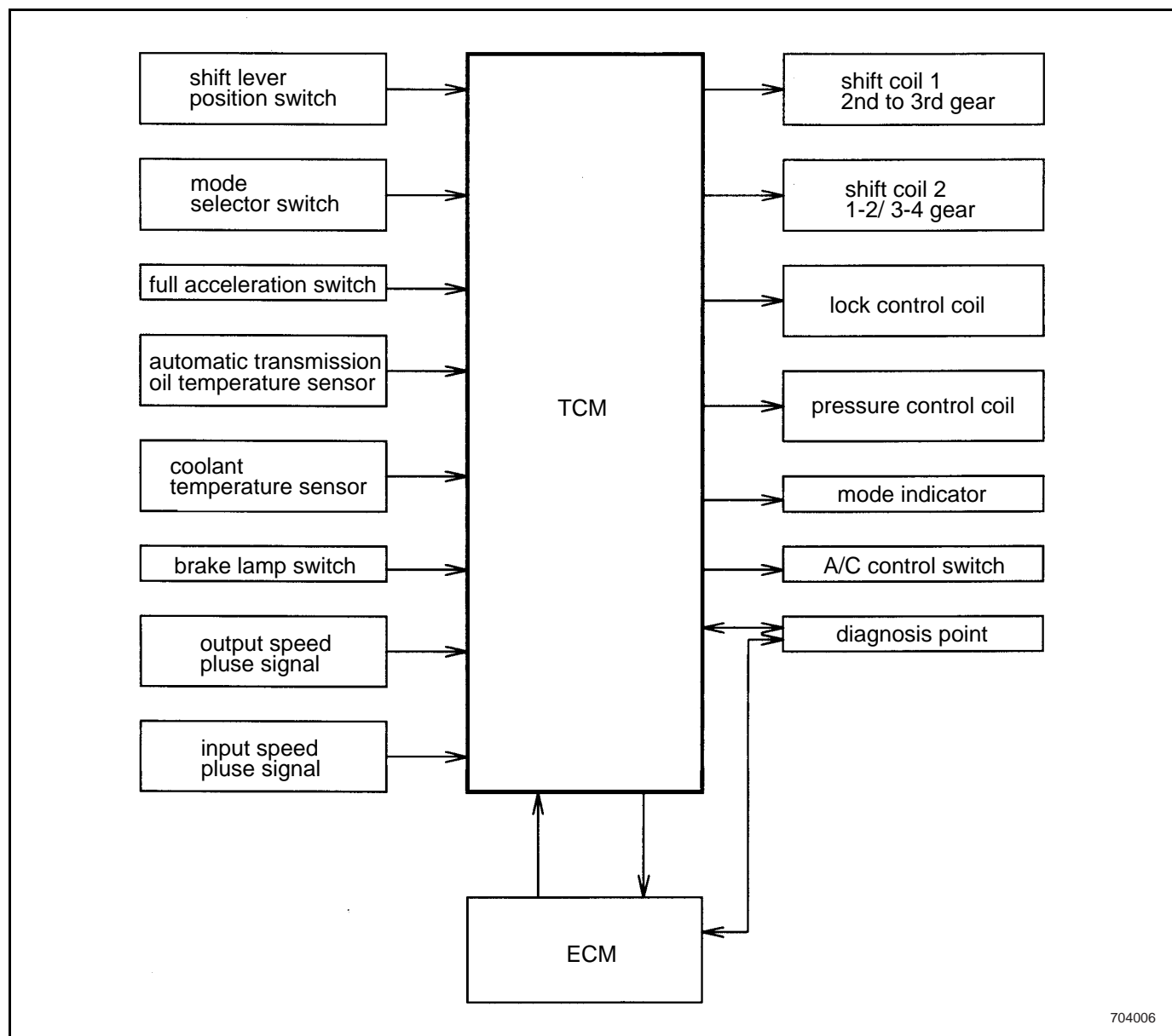
Legend

- | | |
|---|--|
| (1) position of the shift lever | (4) shift lever position interface |
| (2) Output shaft speed sensor interface | (5) Input shaft speed sensor interface |
| (3) solenoid interface | |

7.2.3.6 Transmission control module electrical diagram



7.2.3.7 Transmission control module illustration diagram



7.2.3.8 Transmission control module connector end view

7.2.4 Diagnostic Information and Procedure

7.2.4.1 Opel KEYWORD2000 DTC

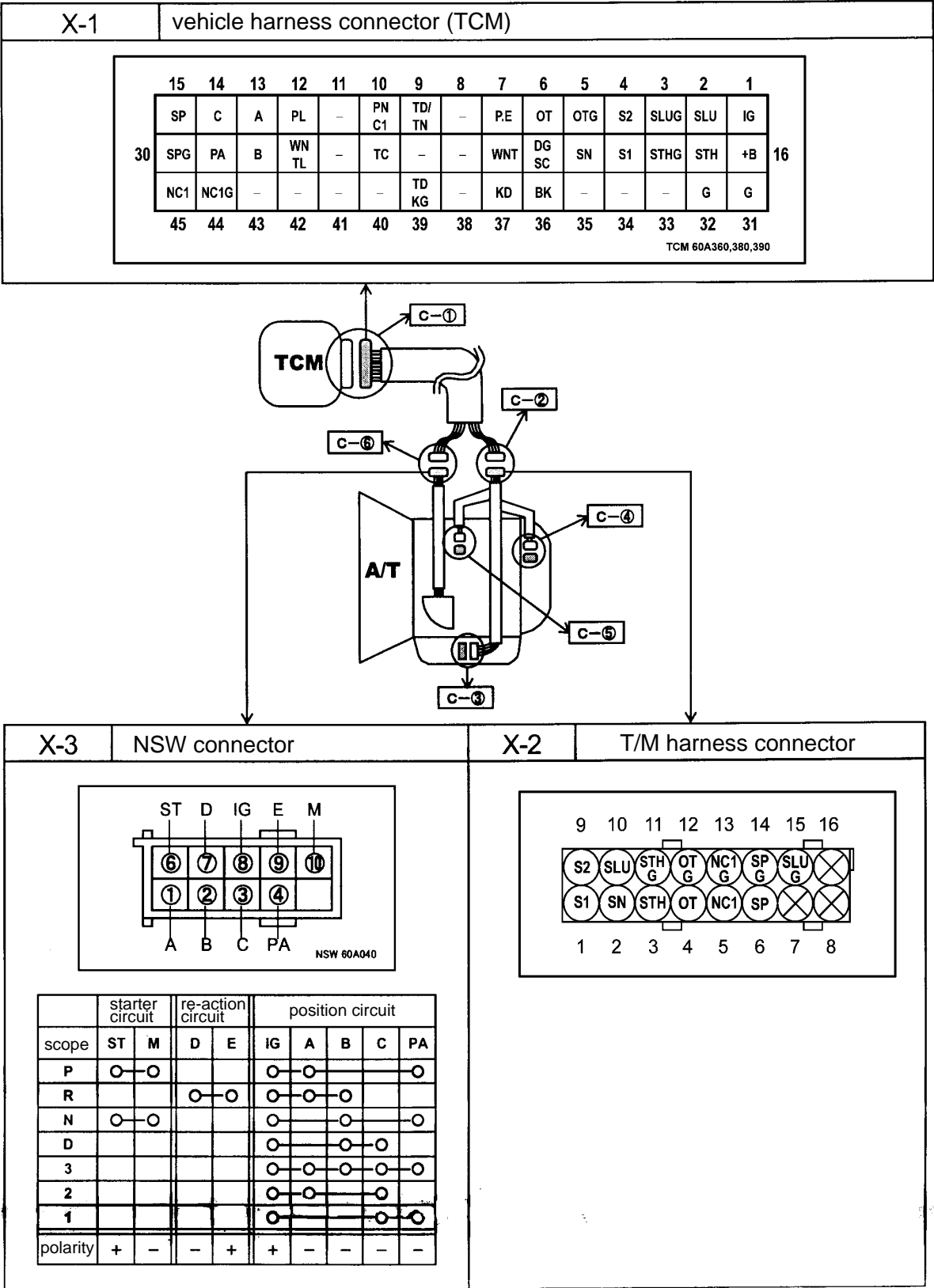
code	mark	circuit malfunction	Malfunction condition	CGL*7	failure protection
P0560	0010	Battery Voltage	Battery voltage low	○	Emergency condition
	0001		Battery voltage high	○	
P0705	1000	Neutral start switch	Middle position	○	Emergency condition
P0710	0001	oil temperature sensor	high input	×	no winter mode, no WUSP mode
	0010		low input	×	
P0715	0100	input speed sensor	no signal	○	Emergency condition
P0720	0100	output speed sensor	no signal	○	Emergency condition
P0725	0100	Engine RPM signal (TD/TN)	No signal from ECM	×	No L-UP
P0730	1000	gear error	gear ratio error	○	Emergency condition
P0743	0010	L-UP solenoid (SL)	low input	×	No L-UP
	0100		open circuit / high input	×	
P0748	0010	Pressure control solenoid (SLT)	low input	○	Emergency condition
	0100		Opened	○	
	0001		high input	○	
P0753	0010	shift solenoid 1	low input	○	Emergency condition
	0101		open/ high circuit	○	
P0758	0010	shift solenoid 2	low input	○	Emergency condition
	0101		open/ high circuit	○	
P0780	1000	downshift to protect	input speed error	○	Emergency condition
P1813	0010	Torque control signal (TC)* 3	low input	○	Emergency condition
P1835	0010	downshift switch (KD)	low input	×	KD no signal
P1890	1000	Throttle Open Signal (TDKG)* 5	Error Signal	○	Emergency condition

* 3: used to control engine torque, TCM → ECM

* 5: main throttle opening signal, ECM → TCM

* 7: Inspect the transmission lamp (A/T alarm lamp)

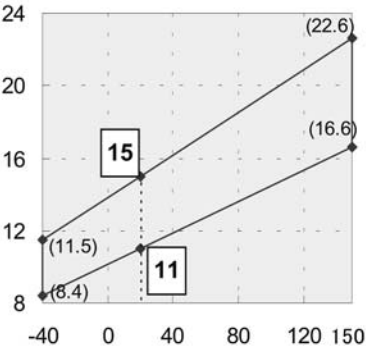
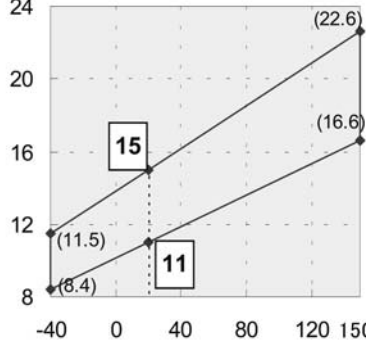
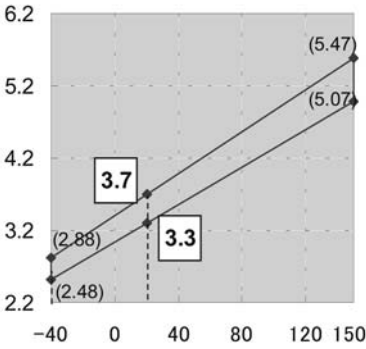
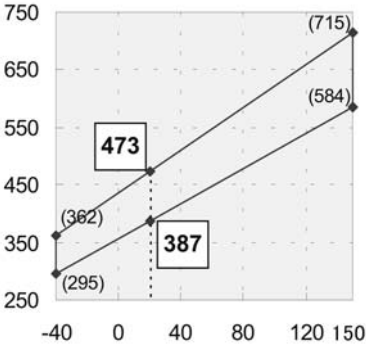
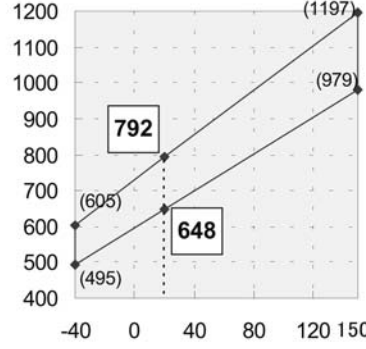
7.2.4.2 Automatic Transmission Electronic Components TS



7.2.4.3 Standard Resistance Value of Various Parts

Notice to take when measure the resistance of the electronic components.

1. Ambient temperature shall be about 20°C while measuring the resistance of the electronic parts. Values measured under any other conditions are only for reference.
2. Parts acceptable at 20°C may fail at higher temperature, and the resistance may become very large. Under this circumstances, replace the failed parts.

<p style="text-align: center;">shift solenoid 1 and 2</p>  <p style="text-align: center;">Standard: 11-15 Ω (ambient temperature 20°C)</p>	<p style="text-align: center;">L-UP solenoid (SL)</p>  <p style="text-align: center;">Standard: 11-15 Ω (ambient temperature 20°C)</p>
<p style="text-align: center;">Pressure control solenoid (SLT)</p>  <p style="text-align: center;">Standard: 3.3-3.7 Ω (ambient temperature 20°C)</p>	
<p style="text-align: center;">input speed sensor</p>  <p style="text-align: center;">Standard: 387-473 Ω (ambient temperature 20°C)</p>	<p style="text-align: center;">output speed sensor</p>  <p style="text-align: center;">Standard: 648-792 Ω (ambient temperature 20°C)</p>

P0573 solenoid valve 1

Step	Action	Value	Yes	No
1	Measure the resistance between pins of the connector in vehicle harness: <ul style="list-style-type: none"> • X-1 pins 19 and 31 ; • X-1 pins 19 and 32 ; 	11-15 Ω (20°C)	Go to Step 2	Go to Step 6
2	Check connector socket (C-1) for its connection: <ul style="list-style-type: none"> • disconnect the connector • rust in connector • deformation in connector • looseness in matching of connector • water drain cap is not connected. 	—	Go to Step 3	Go to Step 4
3	Set up main TCM, then conduct the following simulation test: <ul style="list-style-type: none"> • Slightly rock socket and harness of connector horizontally or vertically; • Slightly rock the sensor component regarded as in trouble with hand. Note: serious vibration of relay may result in its turning on. Does the failure re-occur?	—	Go to Step 13	Go to Step 5
4	Adjust	—	—	—
5	Replace the TCM	—	—	-
6	Measure the resistance between pins of T/M harness connector: <ul style="list-style-type: none"> • X-2 pin SI and body; • X-2 grounding. 	11-15 Ω (20°C)	Go to Step 7	Go to Step 9
7	Check if harness is broken. <ul style="list-style-type: none"> • Disconnect both ends of the harness; • Measure if the resistance between one socket terminal and the other one is less than 1 Ω . Check if harness is short-circuited. <ul style="list-style-type: none"> • Disconnect both ends of the harness socket; • Measure the resistance between the socket connector and body grounding >1 M Ω ; • Measure the resistance between the same connector socket and the other connector >1 M Ω . Check connector socket (C-1、C-2) <ul style="list-style-type: none"> • Connector is disconnected; • Rust in connector; • deformation in connector • looseness in matching of connector • Water drain cap is not connected. 	—	Go to Step 13	Go to Step 8
8	Replace or adjust vehicle harness.	—	—	—
9	Measure the change of 1/2 resistance of shift valve: <ul style="list-style-type: none"> • X-1 pins 19 and 31 ; SI and body ; • X-1 pins 19 and 32 ; grounding. 	11-15 Ω (20°C)	Go to Step 13	Go to Step 10
10	Replace shift valve 1/2.	—	—	—

P0573 solenoid valve 1(Cont' d)

Step	Action	Value	Yes	No
11	<p>Check if T/M circuit is broken</p> <ul style="list-style-type: none"> • Disconnect both ends of the harness; • Measure if the resistance between one socket terminal and the other one is less than 1 Ω . <p>Check if T/M circuit is broken</p> <ul style="list-style-type: none"> • Disconnect both ends of the harness socket; • Measure the resistance between the socket connector and body grounding >1 M Ω • Measure the resistance between the same connector socket and the other connector >1 M Ω . <p>Check connector socket (C-2, C-3)</p> <ul style="list-style-type: none"> • Connector is disconnected • Rust in connector; • deformation in connector • looseness in matching of connector • water drain cap is not connected 	11-15 Ω (20°C)	Go to Step 2	Go to Step 6
12	Replace or adjust T/M.	—	—	—
13	Connection of the socket may result in failure of clearance.	—	—	—

P0578 solenoid valve 2

Step	Action	Value	Yes	No
1	<p>Measure the resistance between pins of the connector in vehicle harness:</p> <ul style="list-style-type: none"> • X-1 pins 4 and 32 ; • X-1 pins 4 and 31 ; 	11-15 Ω (20°C)	Go to Step 2	Go to Step 6
2	<p>Check connector socket (C -1) for its connection :</p> <ul style="list-style-type: none"> • Connector is disconnected • Rust in connector; • deformation in connector • looseness in matching of connector • water drain cap is not connected 	—	Go to Step 3	Go to Step 4
3	<p>Set up main TCM, then conduct the following simulation test:</p> <ul style="list-style-type: none"> • Slightly rock socket and harness of connector horizontally or vertically; • Slightly rock the sensor component regarded as in trouble with hand. <p>Note: Severe vibration of relay may result in its turning on. Does the failure re-occur?</p>	—	Go to Step 13	Go to Step 5
4	Adjust	—	—	—
5	Replace the TCM	—	—	—
6	<p>Measure the resistance between pins of T/M harness connector:</p> <ul style="list-style-type: none"> • X-2 pin S2 and body; • X-2 grounding. 	11-15 Ω (20°C)	Go to Step 7	Go to Step 9

P0578 solenoid valve 2(Cont' d)

Step	Action	Value	Yes	No
7	Check if harness is broken. <ul style="list-style-type: none"> • Disconnect both ends of the harness; • Measure if the resistance between one socket terminal and the other one is less than $1\ \Omega$. Check if harness is short-circuited. <ul style="list-style-type: none"> • Disconnect both ends of the harness socket; • Measure the resistance between the socket connector and body grounding $>1\ M\ \Omega$ • Measure the resistance between the same connector socket and the other connector $>1\ M\ \Omega$. Check connector socket (C-1, C-2) <ul style="list-style-type: none"> • Connector is disconnected; • Rust in connector; • deformation in connector • looseness in matching of connector • Water drain cap is not connected. 	—	Go to Step 13	Go to Step 8
8	Replace or adjust vehicle harness.	—	—	—
9	Measure the change of 1/2 resistance of shift valve: <ul style="list-style-type: none"> • X-1 pins 4 and 32 ; S2 and body ; • X-1 pins 4 and 31 ; grounding. 	11-15 Ω (20°C)	Go to Step 13	Go to Step 10
10	Replace shift valve 1/2.	—	—	—
11	Check if T/M circuit is broken <ul style="list-style-type: none"> • Disconnect both ends of the harness; • Measure if the resistance between one socket terminal and the other one is less than $1\ \Omega$. Check if T/M circuit is broken <ul style="list-style-type: none"> • Disconnect both ends of the harness socket; • Measure the resistance between the socket connector and body grounding $>1\ M\ \Omega$ • Measure the resistance between the same connector socket and the other connector $>1\ M\ \Omega$. Check connector socket (C -2, C -3) <ul style="list-style-type: none"> • Connector is disconnected • Rust in connector; • deformation in connector • looseness in matching of connector • water drain cap is not connected 	11-15 Ω (20°C)	Go to Step 2	Go to Step 6
12	Replace or adjust T/M.	—	—	—
13	Connection of the socket may result in failure of clearance.	—	—	—

P0743 lock up control solenoid valve trouble

Step	Action	Value	Yes	No
1	Measure the resistance between pins of the connector in vehicle harness: <ul style="list-style-type: none"> • X-1 pins 2 and 3 	11-15 Ω (20°C)	Go to Step 2	Go to Step 3

P0743 lock up control solenoid valve trouble (Cont' d)

Step	Action	Value	Yes	No
2	Check connector socket (C-1) for its connection and correct it: <ul style="list-style-type: none"> Connector is disconnected Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 10
3	Measure the resistance between pins of T/M harness connector: <ul style="list-style-type: none"> X-2 pin SLU and SLUG 	11-15 Ω (20°C)	Go to Step 4	Go to Step 5
4	Check if harness is broken. <ul style="list-style-type: none"> Disconnect both ends of the harness; Measure if the resistance between one socket terminal and the other one is less than 1 Ω. Check if harness is short-circuited. <ul style="list-style-type: none"> Disconnect both ends of the harness socket; Measure the resistance between the connector and body grounding >1 M Ω Measure the resistance between the same connector socket and the other connector >1 M Ω. Check connector socket (C-1, C-2) <ul style="list-style-type: none"> Connector is disconnected; Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 8
5	Measure the resistance of lock up control solenoid valve	11-15 Ω (20°C)	Go to Step 6	Go to Step 7
6	Check if T/M circuit is broken <ul style="list-style-type: none"> Disconnect both ends of the harness; Measure if the resistance between one socket terminal and the other one is less than 1 Ω. Check if T/M circuit is broken <ul style="list-style-type: none"> Disconnect both ends of the harness socket; Measure the resistance between the socket connector and body grounding >1 M Ω Measure the resistance between the same connector socket and the other connector >1 M Ω. Check connector socket (C-2, C-3) <ul style="list-style-type: none"> Connector is disconnected Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 9
7	Replace lock up control solenoid valve	—	—	—
8	Replace or adjust vehicle harness (C-1, C-2).	—	—	—
9	Replace or adjust T/M harness.	—	—	—
10	Replace the TCM	—	—	—

P0743 lock up control solenoid valve trouble (Cont' d)

Step	Action	Value	Yes	No
11	Connect the TCM, then conduct the following simulation test: <ul style="list-style-type: none"> Slightly rock socket and harness of connector horizontally or vertically; Slightly rock the sensor component regarded as in trouble with hand. Note: Severe vibration of relay may result in its turning on. Does the failure re-occur?	—	Go to Step 1	System OK

P0748 pressure control solenoid valve trouble

Step	Action	Value	Yes	No
1	Measure the resistance between pins of the connector in vehicle harness: <ul style="list-style-type: none"> X-1 pins 17 and 18 	3.3-3.7 Ω (20°C)	Go to Step 2	Go to Step 3
2	Check connector socket (C -1) for its connection and correct it: <ul style="list-style-type: none"> Connector is disconnected Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 10
3	Measure the resistance between pins of the connector in vehicle harness: <ul style="list-style-type: none"> X-2 pins STH and STHG 	3.3-3.7 Ω (20°C)	Go to Step 4	Go to Step 5
4	Check if harness is broken. <ul style="list-style-type: none"> Disconnect both ends of the harness; Measure if the resistance between one socket terminal and the other one is less than 1 Ω . Check if harness is short-circuited. <ul style="list-style-type: none"> Disconnect both ends of the harness socket; Measure the resistance between the connector and body grounding >1 M Ω Measure the resistance between the same connector socket and the other connector >1 M Ω . Check connector socket (C-1、C-2) <ul style="list-style-type: none"> Connector is disconnected; Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 8
5	Measure the resistance of pressure control solenoid valve	3.3-3.7 Ω (20°C)	Go to Step 6	Go to Step 7

P0748 pressure control solenoid valve trouble (Cont' d)

Step	Action	Value	Yes	No
6	Check if T/M circuit is broken <ul style="list-style-type: none"> • Disconnect both ends of the harness; • Measure if the resistance between one socket terminal and the other one is less than 1 Ω . Check if T/M circuit is broken <ul style="list-style-type: none"> • Disconnect both ends of the harness socket; • Measure the resistance between the socket connector and body grounding >1 M Ω • Measure the resistance between the same connector socket and the other connector >1 M Ω . Check connector socket (C-2,C-3) <ul style="list-style-type: none"> • Connector is disconnected • Rust in connector; • deformation in connector • looseness in matching of connector • water proof cap is not connected 	—	Go to Step 11	Go to Step 9
7	Replace pressure control solenoid valve	—	—	—
8	Replace or adjust vehicle harness (C-1、C-2) .	—	—	—
9	Replace or adjust T/M harness.	—	—	—
10	Replace the TCM	—	—	—
11	Connect the main TCM, then conduct the following simulation test: <ul style="list-style-type: none"> • Slightly rock socket and harness of connector horizontally or vertically; • Slightly rock the sensor component regarded as in trouble with hand. Note: Severe vibration of relay may result in its turning on. Does the failure re-occur?	—	Go to Step 1	System OK

P0715 Input speed sensor trouble

Step	Action	Value	Yes	No
1	Measure the resistance between pins of the connector in vehicle harness: <ul style="list-style-type: none"> • X-1 pins 45 and 44 	387-473 Ω (20°C)	Go to Step 2	Go to Step 3
2	Check connector socket (C -1) for its connection and correct it: <ul style="list-style-type: none"> • Connector is disconnected • Rust in connector; • deformation in connector • looseness in matching of connector • water proof cap is not connected 	—	Go to Step 11	Go to Step 10
3	Measure the resistance between pins of the connector in vehicle harness: <ul style="list-style-type: none"> • X-2 pins NC1 and NC1G ; 	387-473 Ω (20°C)	Go to Step 4	Go to Step 5

P0715 Input speed sensor trouble(Cont' d)

Step	Action	Value	Yes	No
4	<p>Check if harness is broken.</p> <ul style="list-style-type: none"> • Disconnect both ends of the harness; • Measure if the resistance between one socket terminal and the other one is less than 1 Ω . <p>Check if harness is short-circuited.</p> <ul style="list-style-type: none"> • Disconnect both ends of the harness socket; • Measure the resistance between the connector and body grounding >1 M Ω • Measure the resistance between the same connector socket and the other connector >1 M Ω . <p>Check connector socket (C-1、 C-2)</p> <ul style="list-style-type: none"> • Connector is disconnected; • Rust in connector; • deformation in connector • looseness in matching of connector • water proof cap is not connected 	—	Go to Step 11	Go to Step 8
5	Measure the resistance of the input speed sensor:	387-473 Ω (20°C)	Go to Step 6	Go to Step 7
6	<p>Check if T/M circuit is broken</p> <ul style="list-style-type: none"> • Disconnect both ends of the harness; • Measure if the resistance between one socket terminal and the other one is less than 1 Ω . <p>Check if T/M circuit is broken</p> <ul style="list-style-type: none"> • Disconnect both ends of the harness socket; • Measure the resistance between the socket connector and body grounding >1 M Ω • Measure the resistance between the same connector socket and the other connector >1 M Ω . <p>Check connector socket (C-2,C-4)</p> <ul style="list-style-type: none"> • Connector is disconnected • Rust in connector; • deformation in connector • looseness in matching of connector • water proof cap is not connected 	—	Go to Step 11	Go to Step 9
7	Replace the input speed Sensor.	—	—	—
8	Replace or adjust vehicle harness (C-1、 C-2) .	—	—	—
9	Replace or adjust T/M harness.	—	—	—
10	Replace the TCM	—	—	—
11	<p>Connect the main TCM, then conduct the following simulation test:</p> <ul style="list-style-type: none"> • Slightly rock socket and harness of connector horizontally or vertically; • Slightly rock the sensor component regarded as in trouble with hand. <p>Note: Severe vibration of relay may result in its turning on. Does the failure re-occur?</p>	—	Go to Step 1	System OK

P0720 output speed sensor trouble

Step	Action	Value	Yes	No
1	Measure the resistance between pins of the connector in vehicle harness: <ul style="list-style-type: none"> X-1 pins 15 and 30 	648-792 Ω (20°C)	Go to Step 2	Go to Step 3
2	Check connector socket (C -1) for its connection and correct it: <ul style="list-style-type: none"> Connector is disconnected Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 10
3	Measure the resistance between T/M harness connectors: <ul style="list-style-type: none"> X-2 pins SP and SPG ; 	648-792 Ω (20°C)	Go to Step 4	Go to Step 5
4	Check if harness is broken. <ul style="list-style-type: none"> Disconnect both ends of the harness; Measure if the resistance between one socket terminal and the other one is less than 1 Ω . Check if harness is short-circuited. <ul style="list-style-type: none"> Disconnect both ends of the harness socket; Measure the resistance between the connector and body grounding >1 M Ω Measure the resistance between the same connector socket and the other connector >1 M Ω . Check connector socket (C-1、 C-2) <ul style="list-style-type: none"> Connector is disconnected; Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 8
5	Measure the resistance of the output speed sensor sensor:	648-792 Ω (20°C)	Go to Step 6	Go to Step 7
6	Check if T/M circuit is broken <ul style="list-style-type: none"> Disconnect both ends of the harness; Measure if the resistance between one socket terminal and the other one is less than 1 Ω . Check if T/M circuit is broken <ul style="list-style-type: none"> Disconnect both ends of the harness socket; Measure the resistance between the socket connector and body grounding >1 M Ω Measure the resistance between the same connector socket and the other connector >1 M Ω . Check connector socket (C-2,C-5) <ul style="list-style-type: none"> Connector is disconnected Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 11	Go to Step 9
7	Replace the output speed sensor.	—	—	—
8	Replace or adjust vehicle harness (C-1、 C-2) .	—	—	—
9	Replace or adjust T/M harness.	—	—	—
10	Replace the TCM	—	—	—

P0720 output speed sensor trouble(Cont' d)

Step	Action	Value	Yes	No
11	<p>Connect the main TCM, then conduct the following simulation test:</p> <ul style="list-style-type: none"> Slightly rock socket and harness of connector horizontally or vertically; Slightly rock the sensor component regarded as in trouble with hand. <p>Note: Severe vibration of relay may result in its turning on. Does the failure re-occur?</p>	—	Go to Step 11	Go to Step 9

P0705 Neutral start switch trouble

Step	Action	Value	Yes	No
1	<p>at "P" position, measure the resistance between pins of the connector in vehicle harness:</p> <ul style="list-style-type: none"> X-1 pins 1 and 13 X-1 pins 1 and 29 	<10 Ω (20°C)	Go to Step 2	Go to Step 3
2	<p>Check connector socket (C -1) for its connection and correct it:</p> <ul style="list-style-type: none"> Connector is disconnected Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 8	Go to Step 7
3	<p>at "P" position, measure the resistance between socket pins of the NSW harness connector:</p> <ul style="list-style-type: none"> X-3 pins 6 and 10 X-3 pins 8 and 1 X-3 pins 8 and 4 	<10 Ω (20°C)	Go to Step 4	Go to Step 5
4	<p>Check if harness is broken.</p> <ul style="list-style-type: none"> Disconnect both ends of the harness; Measure if the resistance between one socket terminal and the other one is less than 1 Ω . <p>Check if harness is short-circuited.</p> <ul style="list-style-type: none"> Disconnect both ends of the harness socket; Measure the resistance between the connector and body grounding >1 M Ω Measure the resistance between the same connector socket and the other connector >1 M Ω . <p>Check connector socket (C-1,C-6)</p> <ul style="list-style-type: none"> Connector is disconnected; Rust in connector; deformation in connector looseness in matching of connector water proof cap is not connected 	—	Go to Step 8	Go to Step 6
5	Replace NSW.	—	—	—
6	Replace or adjust vehicle harness (C-1、 C-6) .	—	—	—
7	Replace the TCM	—	—	—

P0705 Neutral start switch trouble(Cont' d)

Step	Action	Value	Yes	No
8	<p>Connect the main TCM, then conduct the following simulation test:</p> <ul style="list-style-type: none">• Slightly rock socket and harness of connector horizontally or vertically;• Slightly rock the sensor component regarded as in trouble with hand. <p>Note: Severe vibration of relay may result in its turning on. Does the failure re-occur?</p>	—	Go to Step 1	System OK

Non-locking trouble

Step	Action	Value	Yes	No
1	Connect the voltmeter with 2(SLU) and 3(SLUG) in TCM socket (X-1). Is voltage output in the defined range during driving?	9-15 V	Go to Step 2	Go to Step 5
2	Output TCM standard signal to the locking solenoid valve. Mechanical check for locking solenoid valve: <ul style="list-style-type: none"> Using compressed air (2 kgf/cm²), check if locking solenoid valve is leaking. Supply the locking solenoid valve with battery and check if the solenoid valve is turned on. 	—	Go to Step 3	Go to Step 4
3	Locking solenoid valve can operate normally. Check if there is any internal trouble in A/T?	—	Repair	Go to Step 12
4	Locking solenoid valve can not operate normally. Check the locking solenoid valve any mechanical trouble?	—	Repair	Go to Step 9
5	Output TCM non-standard signal to the locking solenoid valve	0-2 V	Go to Step 6	—
6	Connect the voltmeter with 36(BK) and 31(G) in TCM socket (X-1) and check if its voltage is as follows. <ul style="list-style-type: none"> Press down brake pedal: 0-2 V Release the brake pedal: 9-15 V 	—	Go to Step 7	Go to Step 8
7	The brake pedal can operate normally. Check for TCM trouble.	—	Go to Step 11	—
8	If the brake pedal can not operate normally, check if there is trouble in the braking system.	—	Go to Step 10	—
9	Replace the locking solenoid valve	—	—	—
10	Replace the braking switch or braking switch harness	—	—	—
11	Replace the TCM	—	—	—
12	Replace the A/T	—	—	—

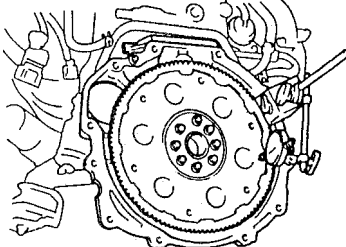
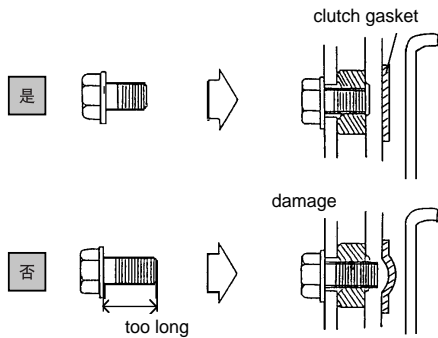
(60 – 40LE) Minor Repairs - Troubleshooting (1/2)

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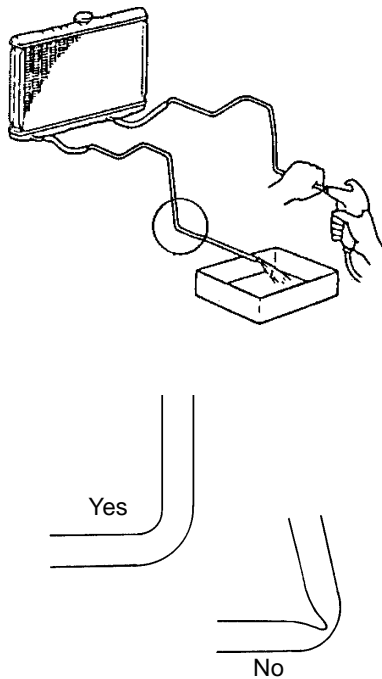
(60 – 40LE) Minor Repairs - Troubleshooting (1/2)

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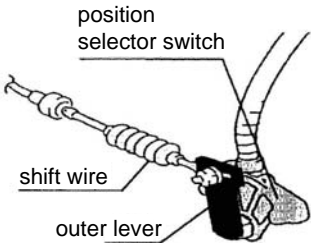
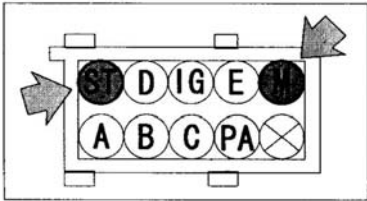
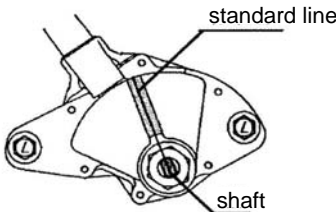
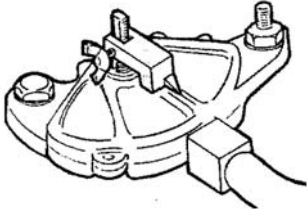
Troubleshooting procedure

Check items	Driving disc deviation		
Customer	SGM	A/T model	60-40LE
Inspections			
		Check if the deviation of the driving disk is within the standard standard: within 0.2 mm	
countermeasures			
If the result of the inspection is no, replace the drving disk. (If abnormal wear is found and/ or it is adhered to the torque converter, replace the torque converter and A/T) <i>Notice:</i> When install the torque converter on the driving disk, use defined screws. Tightening torque: 40-50 Nm (408-510 kgfcm)			
Suggestion			
 <p>Too long screw drilling through the bottom. In case the too long screw penetrates through the bottom.</p>		The length of the screw is important for driving disk and torque converter. Too long screw will result in the distortion of torque converter cover and damage the pad of torque converter (non locking trouble)	

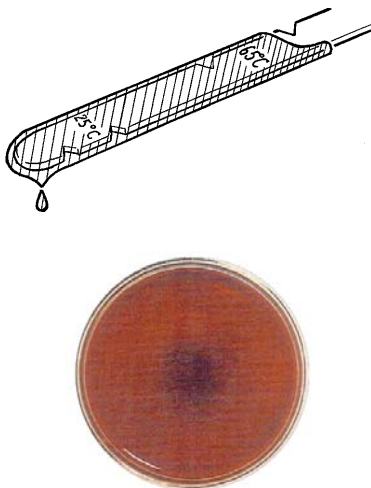
Troubleshooting procedure

Check items		Bending and blocking up of cooling oil pipe.	
Customer	SGM	A/T model	60-40LE
Inspections			
		<div>1. Check if any bending, distortion of pipe and pipeline. (1) Pay special attention to check if the diameter of the pipe is accepted or has not been reduced for its excessive distortion.</div> <div>2. Inner wall of the pipe is blocked up. (1) On the inlet side of the cooling pipe, charge 2kg/cm² of compressed air, and check if its ventilation is unblocked.</div> <div>3. After washing, check if there is oil leaking from the connecting component of A/T and cooling agent pipe with die inspecting liquid. (1) Check if the hose clamp ring is loose. (2) Check the tightening torque of pipe socket.</div>	
countermeasures			
<div>1. No refers to the inspection item No.1 ⇒ replace the defective component (2)</div> <div>2. No refers to the inspection item No.2 ⇒ Remove foreign particles and clean the inside of the pipe.</div> <div>3. When install the refrigerant pipe, after replacing O ring, turn the connector to a specific matrix. On the exit side, confirm if the hose clamp has been tightened.</div>			
Suggestion			
<div>As for troubles such as bending, distortion and blockage:</div> <div>1. Because of temperature rise of automatic transmission fluid and decrease in velocity of flow to the cooler, the aerator of automatic transmission fluid type malfunctions and/or deflates.</div> <div>2. Converter clutch lock up turns off and the reflux pipe shall be closed. It will stop during idle running of the engine when the lock up is on.</div>			

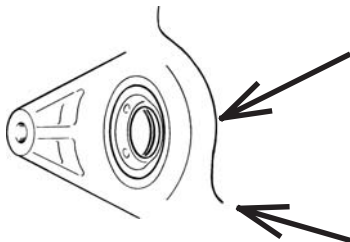
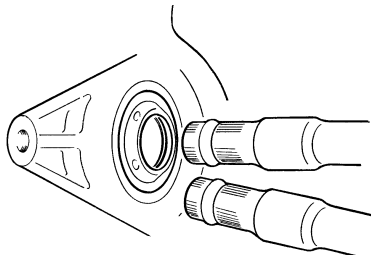
Troubleshooting procedure

Check items	Shift cable or selective position S/W mal-adjusted		
Customer	SGM	A/T model	60-40LE
<div></div> <div></div> <div></div>		<div>1. Check the shift cable. Check the adjustment of shift cable for if the outer lever can shift to every position steadily and accurately and if the position indicator can indicate the position correctly.</div> <div>2. Check the selective position switch</div> <div>2-1 consistency inspection Within the range of P position and N position, measure the resistance between the socket terminals ST-M with multi-meter. Standard: not exceed 10 Ω</div> <div>2-2 Check the adjustment of the selective position switch and if the standard image of the neutral is aligned with the extended line.</div>	
countermeasures			
<div>1. No means the inspection items No.1 and No.2-+2 ⇒Adjust the component in trouble</div> <div>2. No refers to the inspection item No.2-1 ⇒Replace the component in trouble</div>			
Suggestion			
		When adjust the selective position switch, set the position control axis for special repair tool and align the pointer of the special repair tool with the neutral standard line.	

Troubleshooting procedure

Check items	ATF （automatic transmission fluid）		
Customer	SGM	A/T model	60-40LE
Inspections			
<div></div> <div>Make use of coloring limits for automatic transmission fluid</div>		<div>1. Inspection of oil level</div> <div>In the hot condition after driving, check the oil level at 80°C with oil level gauge, despite of the oil level gauge has enough oil level points to correspond to oil temperature.</div> <div>Notice:</div> <div><div>(1) With thermometer, check if the oil temperature is at 80°C.</div><div>(2) Inspection shall be finished on the road surface without any slope.</div><div>(3) After change the shift lever from P to position 1, complete the inspection at the position P of the shift lever.</div></div> <div>2. Inspection of the ATF condition</div> <div>Check if the ATF has no any white pollution, is not mixed with too much foreign metal or wearing piece, or has no any burnt odor.</div>	
preventive measures			
<div>1. means the inspection item No.1</div> <div>⇒After it has discharged to the standard ATF level, increase the ATF or recharge the ATF.</div> <div>2. No refers to the inspection item No.2</div> <div>⇒ Replace A/T and T/C （A/T and / or T/C may has trouble） .</div> <div>3. White pollution of ATF used to check the inspection item No.2:</div> <div>⇒Check relevant components of related oil cooler, and complete necessary countermeasures since the ATF is polluted for the ATF is mixed with refrigerant.After completing the necessary countermeasures, the compressed air of 2kg/cm²shall also be used to clean the inner wall of oil cooling pipeline.</div> <div>Notice:</div> <div>The automatic transmission fluid of TEXMATIC-7045E must be used or the transmission property and / or activity may influence the accuracy and durability of the automatic transmission.</div>			
Suggestion			
<div>1. Lack automatic transmission fluid.</div> <div>Inspiration of oil pump results in the pressure drop of the pipeline, which causes the trouble in automatic transmission.</div> <div>2. The fluid level of the automatic transmission is too high.</div> <div>By stirring and producing air bubbles to increase the oil level, discharge the ATF from the breather pipe.</div> <div>3. Mix water with oil of different types and ATF.</div> <div>Transmission troubles resulted from changes in property of disk lining materials and sealing materials.</div>			

Troubleshooting procedure

Check items	Oil seal for differential		
Customer	SGM	A/T model	60-40LE
Inspections			
	<div>1. Simulation test After washing the oil leakage part and spray die inspection fluid, conduct the simulation test (the test time is from 10 to 120 minutes depending on the oil leakage level)</div> <div>2. Oil leakage from outer perimeter of the oil seal. (1) Check if the oil seal has been installed correctly (2) Check if there is scratch and/or dent around the jointing surface of T/A case and T/V cover.</div> <div>3. Oil leakage from inner perimeter of the oil seal. (1) Check the driving axle for any dent, scratch or wear. (2) Check the lip of oil seal for any foreign matter, notch or wear.</div>		
preventive measures			
<div>1. Yes means the inspection item No.1 ⇒ Refer to the following suggestion column.</div> <div>2. If the T/A box and / or T/A cover is no, it means the inspection item No.2 ⇒ Replace A/T</div> <div>3. The driving axle means the inspection item No.3 ⇒ Replace the driving axle.</div> <div>4. If the oil seal is no, it means the inspection items No.2 and No.3: ⇒ Conduct light repair (Repair the oil seal of the differential)</div>			
Inspection			
	<div>1. The simulation test must be conducted. Since the oil dripping around the oil seal during installation of the automatic transmission device may result in the maladjustment for oil leakage troubles.</div> <div>2. The driving axle must be aligned with the automatic transmission. After replacing the oil seal, incautious error during installation of driving axle on the automatic transmission may result in the damage in the oil seal.</div>		

Troubleshooting procedure

Check items	Pipeline trouble and O-ring trouble		
Customer	SGM	A/T model	60-40LE
Inspections			
Simulation test After washing/cleaning the oil leakage part and spray die inspection fluid, conduct the simulation test (the test time is from 10 to 120 minutes depending on the oil leakage level)			
preventive measures			
1. Yes means inspection ⇒ Refer to the following suggestion column. 2. Oil leakage in contacting part of T/A box and T/A cover. ⇒ Replace A/T 3. Oil leakage between T/A and the side cover of T/A shell, and / or the contacting part of T/A box and the rear box. Remove existing sealing agent thoroughly and apply new sealing agent on the contacting surface. (1) Check the contacting surface for any dent, scratch or distortion on both faces If any problem on the contacting surface: minimal damage - light repair (repair of failure component) serious damage - light repair (replace the failure component) or replace the A/T (2) Before applying the sealing agent, wash and clean the contacting surface. 4. If the O ring is no, it means inspection. Conduct the light repair. ⇒ Replace the driving axle. (1) Attention shall be paid to not damage new O-shaped sealing ring, such as distort or cut it. And before installation, use the automatic transmission fluid on the O-shaped sealing ring.			
Suggestion			
The simulation test must be conducted to avoid misjudging for piling up of oil seals and oil dripping during installation of automatic transmission.			

Troubleshooting procedure

Check items	Troubles of internal components of A/T											
Customer	SGM	A/T model	60-40LE									
Inspections												
Before replacing the automatic transmission for troubles of internal components, check the following items:												
1. Stall test When the throttle is on the positions R and D, read the maximum RPM of the engine. When the stall test is conducted, make sure that the brake, park brake and braking block be pressed with foot. Standard stall RPM: 2400 ± 150 R.P.M. <i>Notice:</i> When the stall test is conducted, the time must not exceed 5 seconds.												
2. Time interval testing Check the transmission time of shift driving force from N to D, and make sure that the vehicle be stopped with the same condition as that for the stall test. Standard: Time interval from N to D is less than 0.7sec. Time interval from N to D is less than 1.2 sec. <i>Notice:</i> When the time interval test is conducted, keep the interval time above 1 minute (to avoid the influence from the pressure of remained oil)												
3. Measurement of pressure of oil circuit After installing the manometer in pressure test plug of the oil circuit, measure the pressure of the oil circuit at positions D and R during idle running and stalling of the engine. Make sure it stops with the same condition as that for the stall test.												
<table><tr><td></td><td>Idle running of engine</td><td>Engine stalling</td></tr><tr><td>D</td><td>0.37-0.43 (3.8-4.4)</td><td>1.10-1.28 (11.2-13.0)</td></tr><tr><td>R</td><td>0.54-0.63 (5.5-6.4)</td><td>1.47-1.69 (15.0-17.2)</td></tr></table>					Idle running of engine	Engine stalling	D	0.37-0.43 (3.8-4.4)	1.10-1.28 (11.2-13.0)	R	0.54-0.63 (5.5-6.4)	1.47-1.69 (15.0-17.2)
	Idle running of engine	Engine stalling										
D	0.37-0.43 (3.8-4.4)	1.10-1.28 (11.2-13.0)										
R	0.54-0.63 (5.5-6.4)	1.47-1.69 (15.0-17.2)										
Mpa (kgf/cm ²)												

Troubleshooting procedure

Check items	Troubles of internal components of A/T		
Customer	SGM	A/T model	60-40LE
Preventive measures			
No means the inspection. Replace the A/T or torque converter.			
Suggestion -1			
<p>Make sure that the trouble be confirmed by comparing with other vehicles of the same type. Especially for troubles of noise, vibration and management, sometimes whether it has some trouble depends on the personal feeling. Therefore, before replacing the automatic transmission, it is necessary to compare with other vehicles of the same model.</p> <p>1 Result of stall test and possible causes</p> <p>1) Both D position and R position is lower than that of the standard</p> <ul style="list-style-type: none"> • The power of the engine is relatively small. • Trouble in the unilateral clutch of torque converter <p>2) Only higher than that of standard D position</p> <ul style="list-style-type: none"> • Pressure of the oil circuit decreases • Trouble exists in C-1 • Trouble exists in C-3 • Trouble exists in F-1 <p>3) Only higher than that of standard R position</p> <ul style="list-style-type: none"> • Pressure of the oil circuit decreases • C-2 trouble • C-3 trouble • B-2 trouble <p>4) Both D position and R position is higher than that of the standard</p> <ul style="list-style-type: none"> • Pressure of the L oil circuit decreases • C-3 trouble 			

Troubleshooting procedure

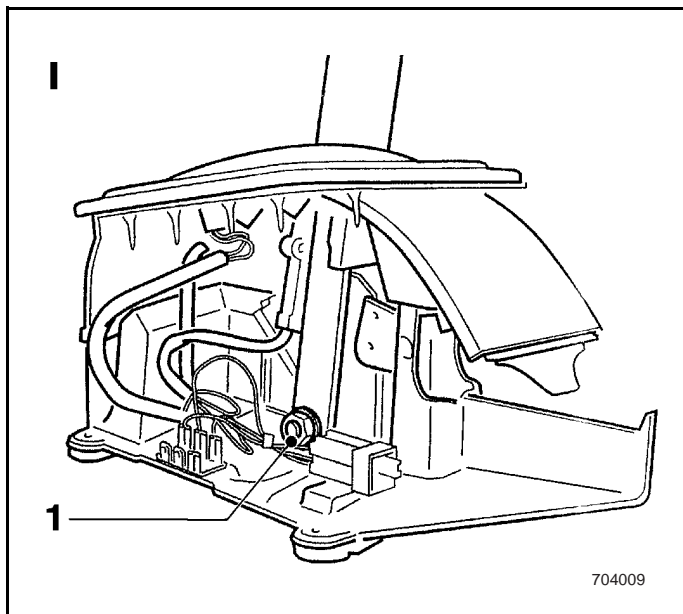
Check items	Troubles of internal components of A/T		
Customer	SGM	A/T model	60-40LE
Suggestion -2			
<p>2 Result of time interval test and possible causes</p> <p>1) longer than the standard time from N to D</p> <ul style="list-style-type: none"> • Pressure of the oil circuit decreases • C-1 trouble • C-3 trouble • F-1 trouble <p>2) longer than the standard time from N to R</p> <ul style="list-style-type: none"> • Pressure of the oil circuit decreases • C-2 trouble • C-3 trouble • B-2 trouble <p>3 Result of oil circuit pressure test and possible causes</p> <p>1) Both "D" position and "R" position is higher than that of the standard</p> <ul style="list-style-type: none"> • Pressure control solenoid valve trouble • Primary adjusting valve trouble <p>2) Both "D" position and "R" position is lower than that of the standard</p> <ul style="list-style-type: none"> • Pressure control solenoid valve trouble • Primary adjusting valve trouble • Oil pump trouble <p>3) Only lower than the standard for "D" position</p> <ul style="list-style-type: none"> • Trouble in hydraulic oil circuit for "D" position <p>4) Only lower than the standard for "R" position</p> <ul style="list-style-type: none"> • Trouble in hydraulic oil circuit for "R" position 			

7.2.5 Repair Guidance

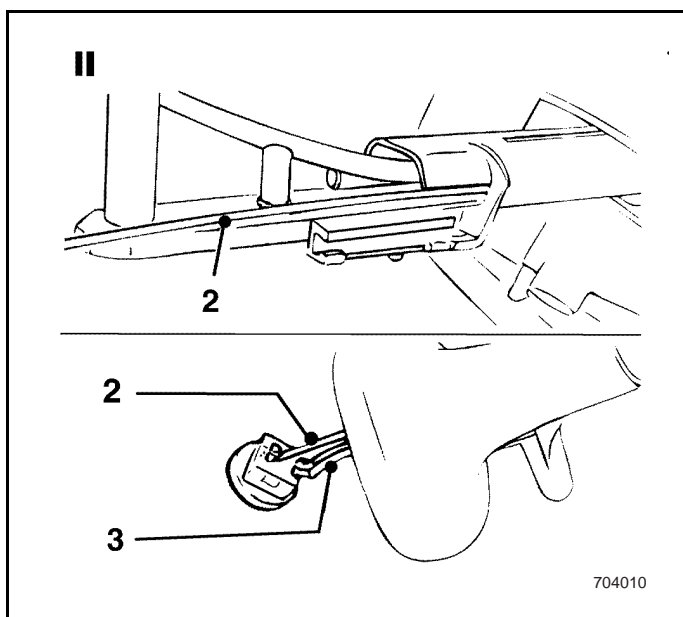
7.2.5.1 Replacement of shift lever assembly

Removal Procedure

1. Remove the lower shift lever cover from the shift base. Unplug the harness connector of Winter mode and Economic/sport mode from the shift lever (1).
2. Remove the Winter mode contactor switch from the shift panel.



3. Press the Economic/sport mode contactor switch out of shift lever electrode wire (2).
4. Disconnect the harness (3).
5. Remove the shift lever from the shift lever console.



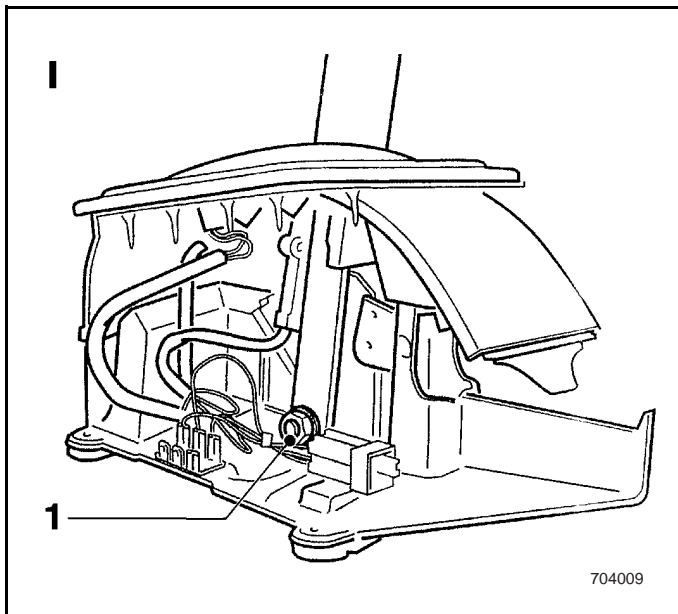
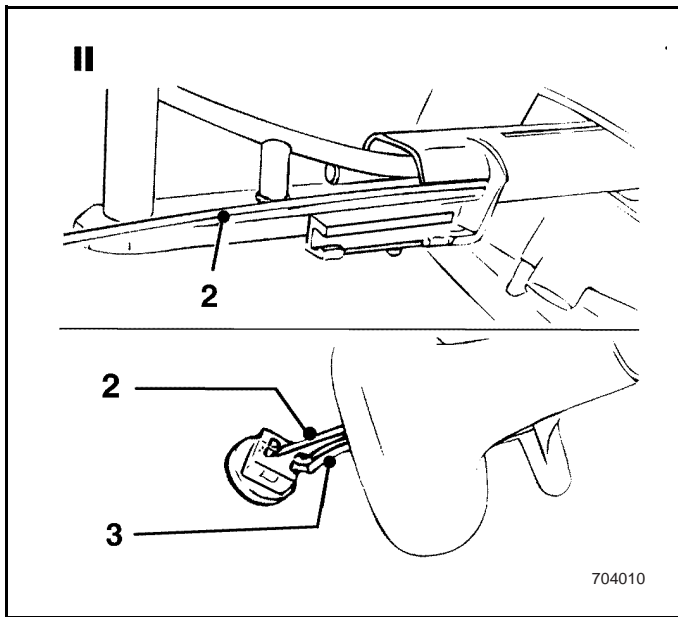
Installation Procedure

1. Connection of welding cable. Pay attention to the label. Insert the shift lever into the shift lever console and tighten it to the shaft of the shift lever with screw.

Tightening

Tighten the bolt to

2. Insert the lighting socket into the shift panel. Connect Winter mode and Economic/sport mode contactor switch harness connectors.

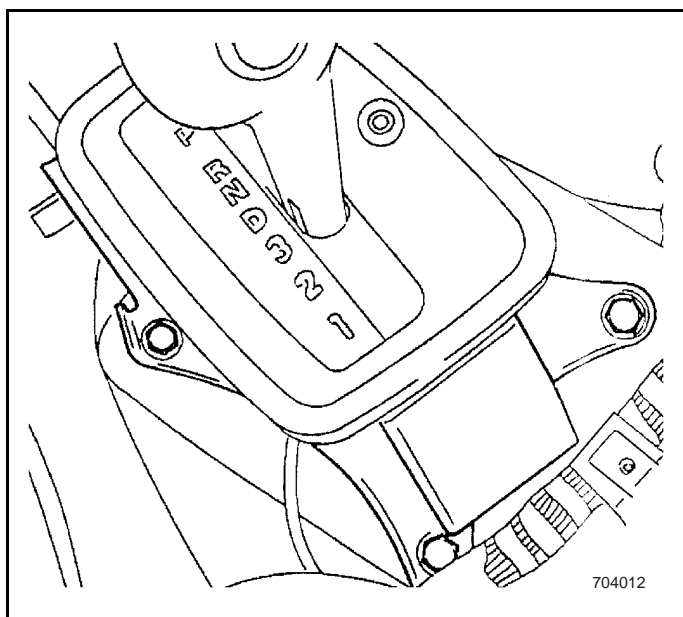
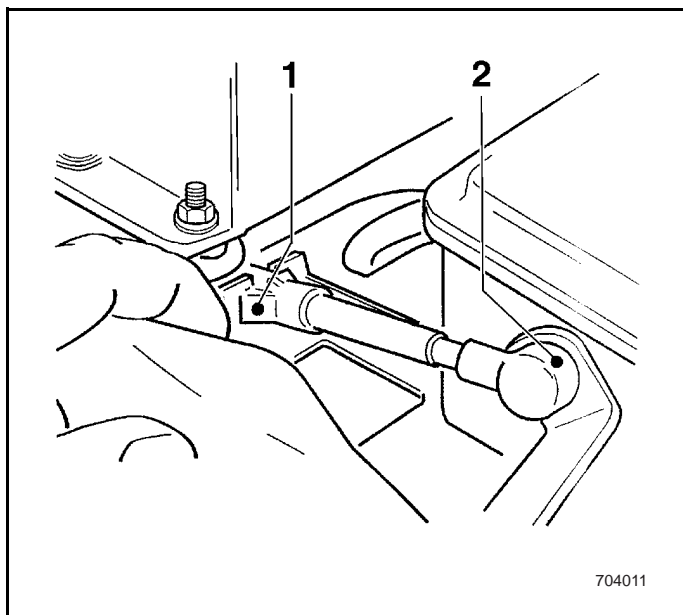


3. Install the shift lever cover on the shift lever base.

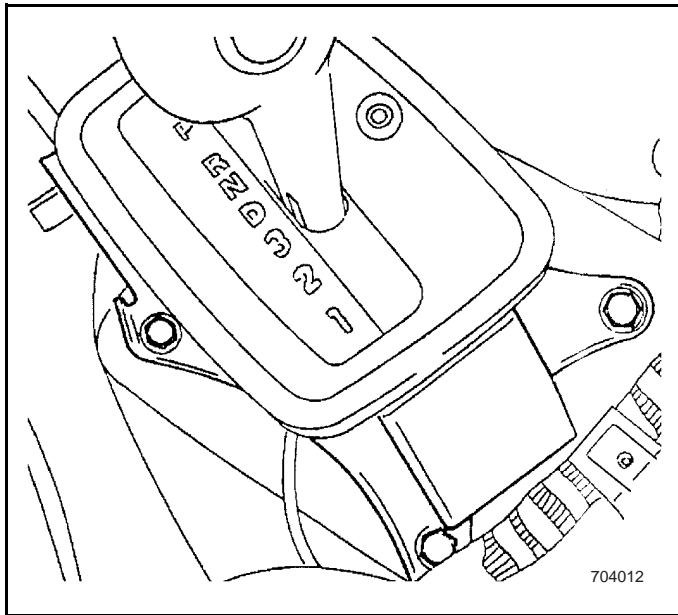
7.2.5.2 Replacement of shift lever console

Removal Procedure

1. Remove the shift lever cover from the shift lever base.
2. Removing ball head connection (1) and pressing the lug (2) at the same time, remove the shift lever drive from the shift lever console.



3. Remove the shift lever console from the floor board.



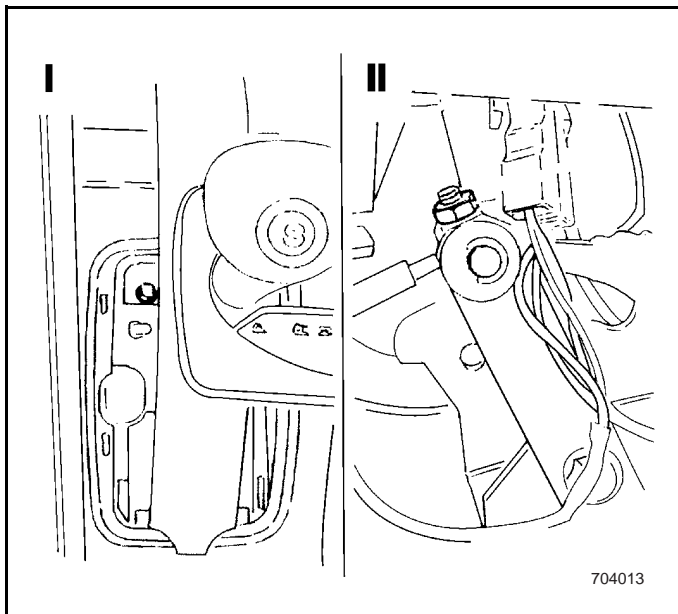
Installation Procedure

1. Fix the shift lever console to the floor board with bolts.

Tightening

Tighten the bolt to

2. Install the shift lever drive on the shift lever console.
3. Install the shift lever cover on the shift lever base.



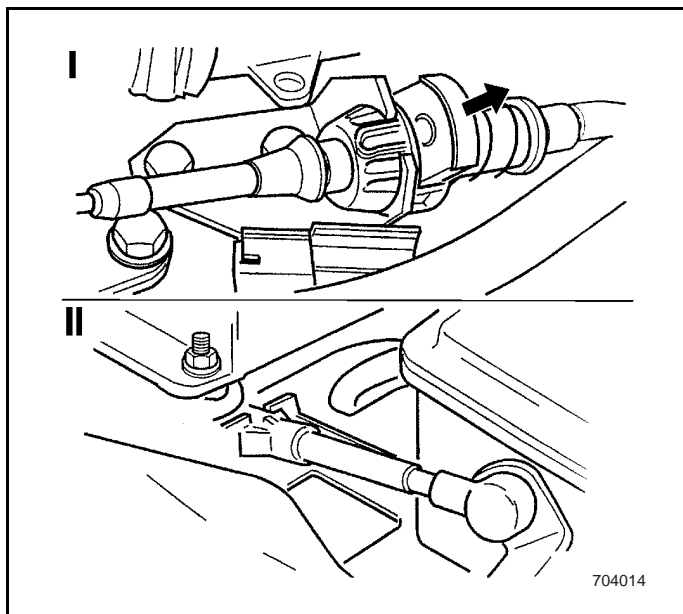
Adjustment

Guide the socket spanner through the opening (Figure I), then loose cable clamp bolts. Adjust shift lever drive cable (Figure II, the shift lever console has been disassembled).

Tightening

Tighten the cable clamping bolts to 6 N•m.

4. Check it according to the above instructions.

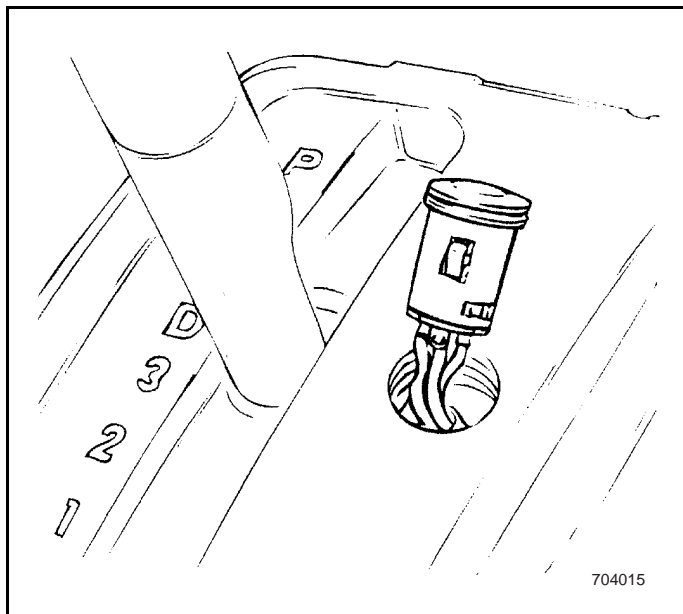


5. Clamp the shift lever cover into the shift lever console. It is necessary to adjust the cable for driving shift lever. Because of the new installed supports (figures 1 and 2) at the transmission and shift lever, it is no longer to adjust the shift lever driving cable.
6. Using a fixing clip (as shown by the arrow), secure the thrust bearing on the transmission.

7.2.5.3 Replacement of Winter Mode contactor switch

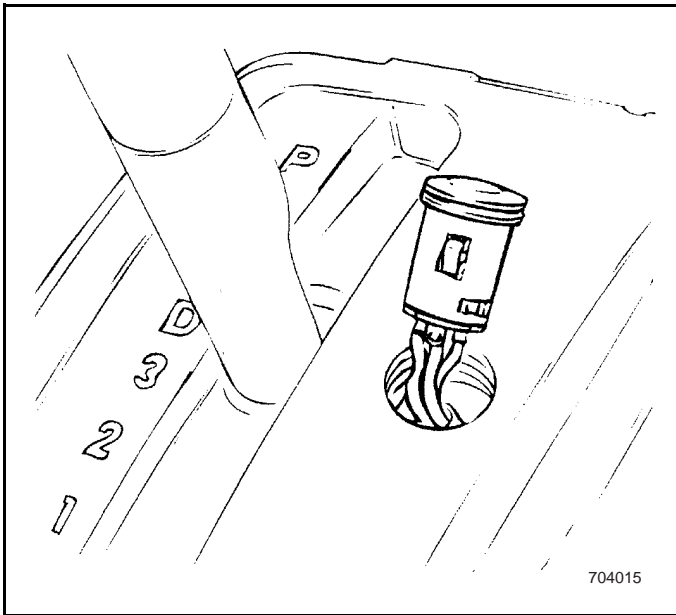
Removal Procedure

1. Remove the shift lever cover.
2. Screw off the contactor switch from the shift cover panel.
3. Disconnect the harness plug.
4. Remove the contactor switch.



Installation Procedure

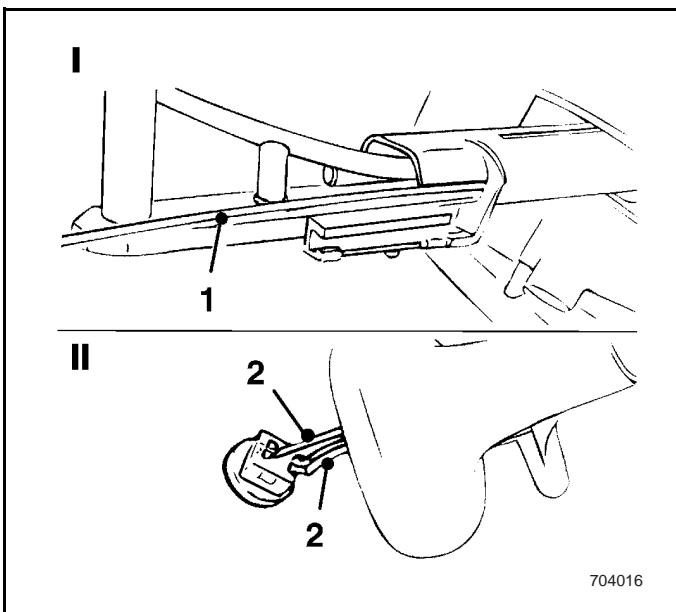
1. Connect the harness plug. Remove the contactor switch.
2. Install the contactor switch into the shift cover panel.
3. Install the shift lever cover.



7.2.5.4 Replacement of Economic/Sport Mode contactor switch

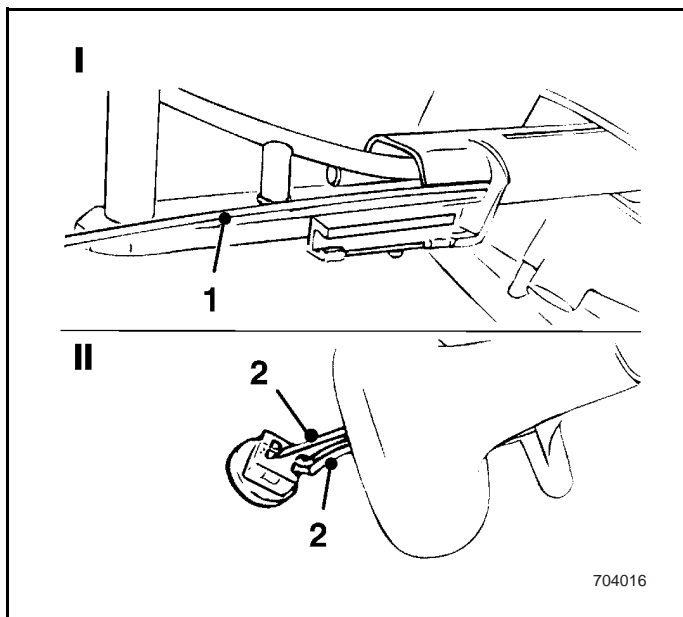
Removal Procedure

1. Remove the shift lever.
2. Press down the contactor switch and pull it out together with the electrode wire (1) and cable (2).



Installation Procedure

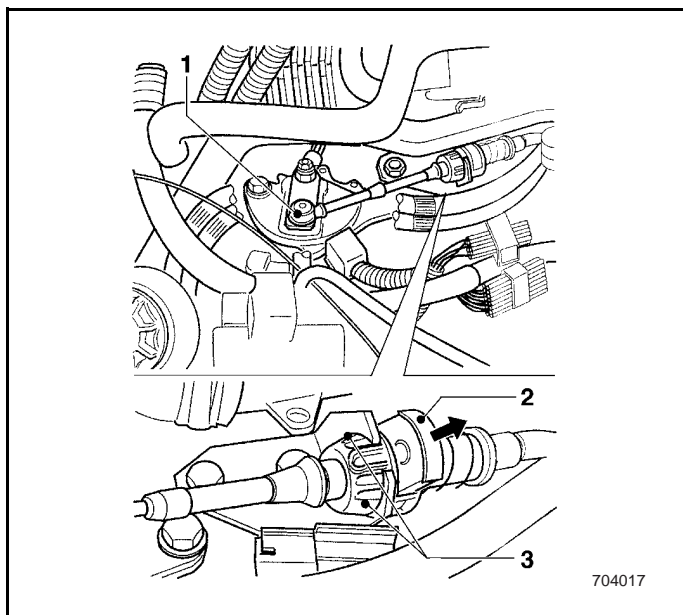
1. Weld the new contactor switch. Install the shift lever.

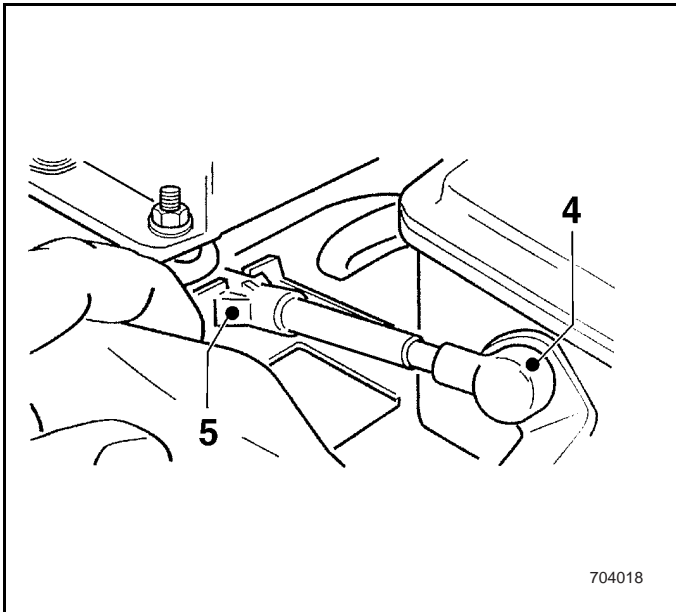


7.2.5.5 Replacement of shift lever driving cable

Removal Procedure

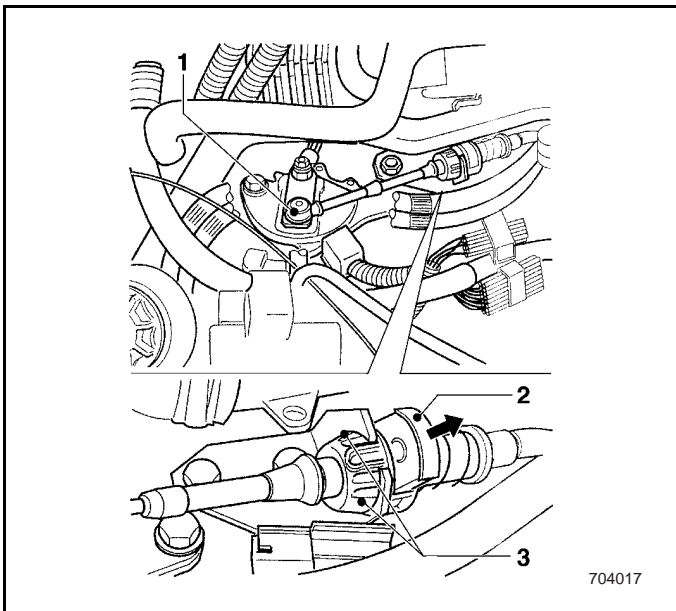
1. Remove the ball head (1) from the transmission drive lever.
2. Pull up the fixing clip (2) on the thrust bearing and slide the bearing out of the bracket and press the lug (3) at the same time.





3. Remove the shift lever cover from the shift lever base.
4. Place the shift lever on P and press the ball head (4) out of the shift lever. Pull the driving cable out of the console while pressing the lug (5). Pull the cable into the engine compartment through the separator.

Installation Procedure



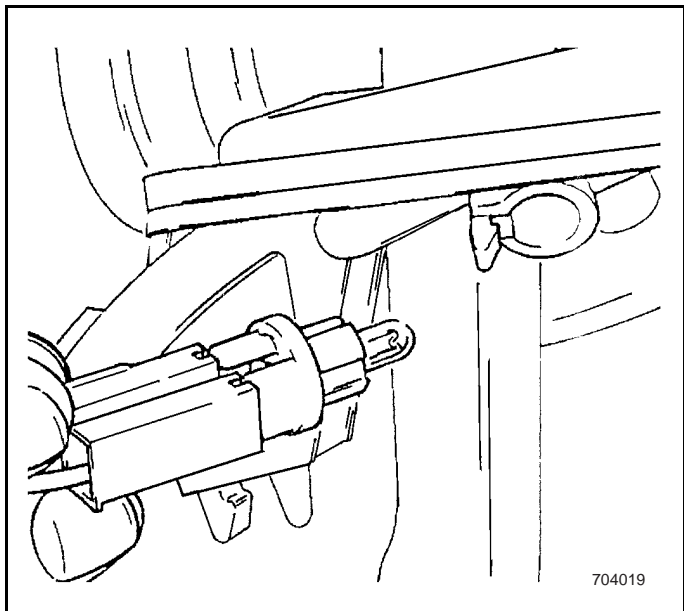
1. Guide the cable from the engine compartment and make sure that the rubber bush be correctly installed.
2. Install the shift lever drive cable. Install the ball head on the transmission drive lever. Install the thrust bearing into the bracket until the lug has been joined and press the fixing clip on the thrust bearing. Install the shift lever cover on the shift lever base.
3. Install shift lever console.

7.2.5.6 Relevant operations of shift linkage (automatic transmission)

Replacement of bulb/socket used for lighting.

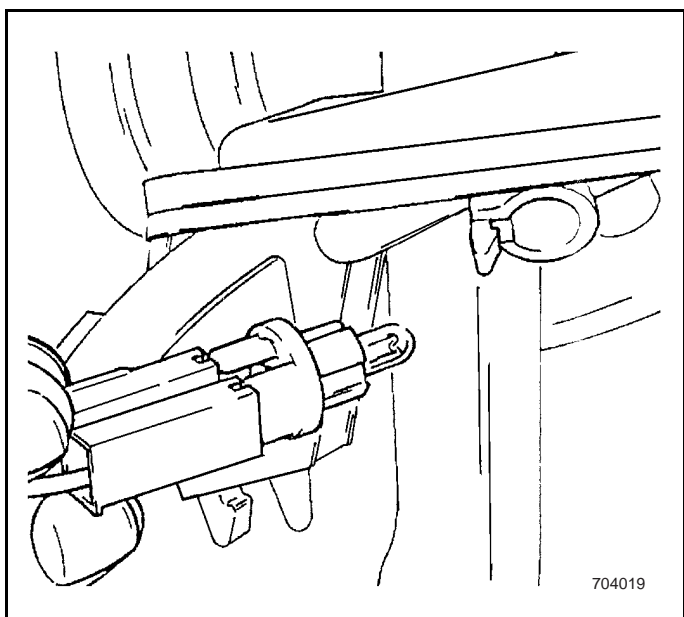
Removal Procedure

1. Remove the shift lever cover from the shift lever base. Refer to Replacement of shift lever assembly.
2. Remove the bulb and socket from the shift lever cover panel.



Installation Procedure

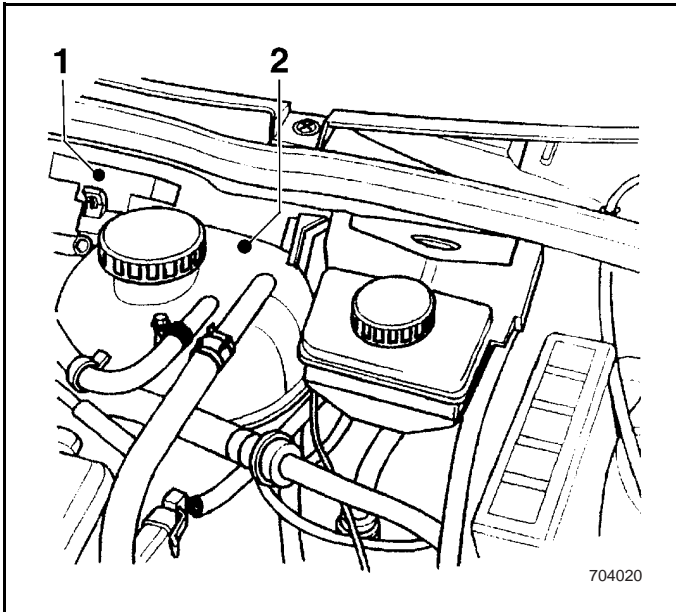
1. Insert the bulb/socket into the shift lever cover panel.
2. Install the shift lever cover and clips on the panel.



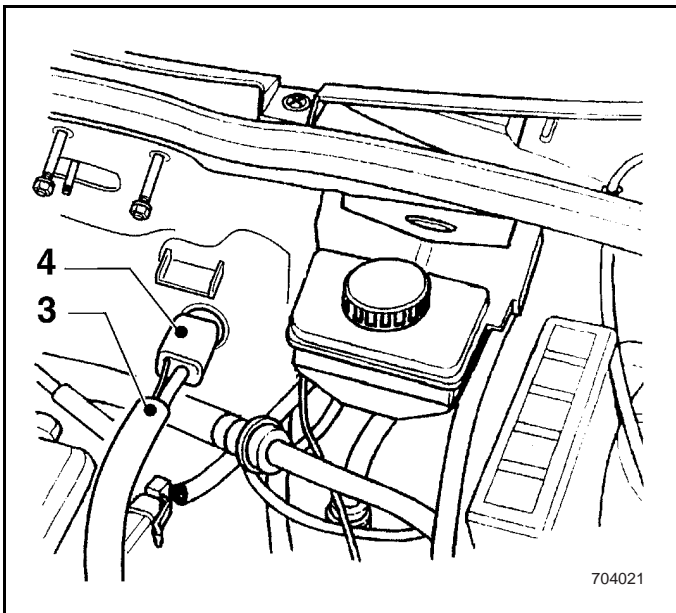
7.2.5.7 Full acceleration switch with accelerator cable

Removal Procedure

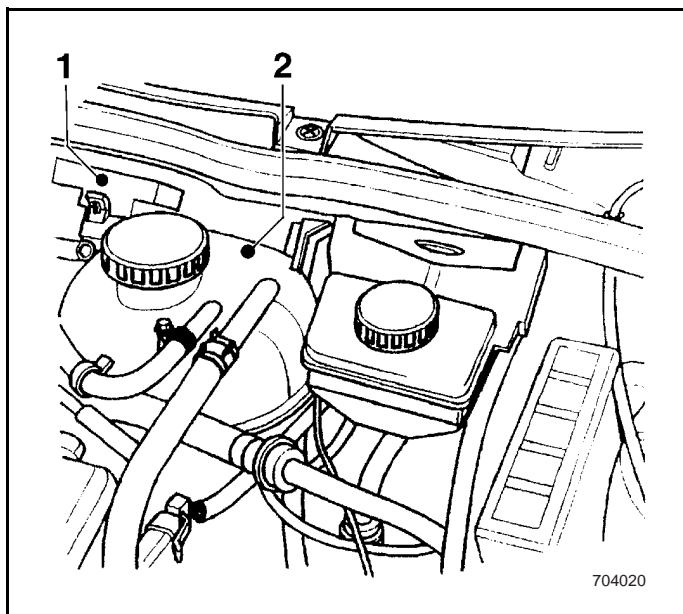
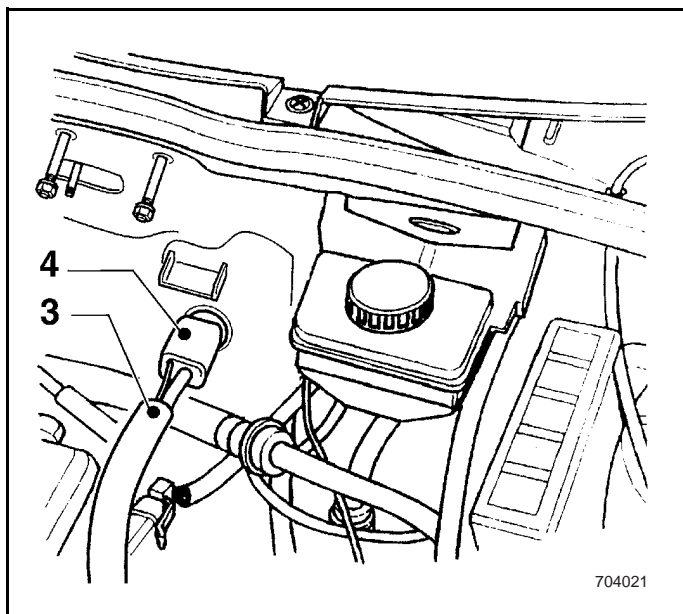
1. Remove the coolant hose at the left of the reservoir (2) and radiator - collect the coolant.
2. Remove the Manifold Absolute Pressure Sensor (1). Refer to Replacement of manifold absolute pressure sensor (MAP) in Engine Control.
3. Remove the reservoir (2).



4. Remove accelerator cable from the throttle body and accelerator pedal. Remove the harness plug used for full acceleration switch from the separator at a lower position and disconnect it.
5. Remove accelerator cable (4) from the engine compartment.



Installation Procedure



1. Install the accelerator cable (4) and make sure that the rubber sleeve be correctly installed.
2. Connect the harness plug of the full acceleration switch and clamp it into the bracket on the separator. Install the accelerator cable on the throttle body and accelerator pedal.
3. Install the reservoir (2).
4. Install the Manifold Absolute Pressure Sensor (1). Refer to Replacement of manifold absolute pressure sensor (MAP) in Engine Control.
5. Connect the refrigerant hose with the reservoir (2) and connect it on the left side of the radiator box.
6. Check the level of the refrigerant, fill up the refrigerant and check if any leakage in the refrigerating system.

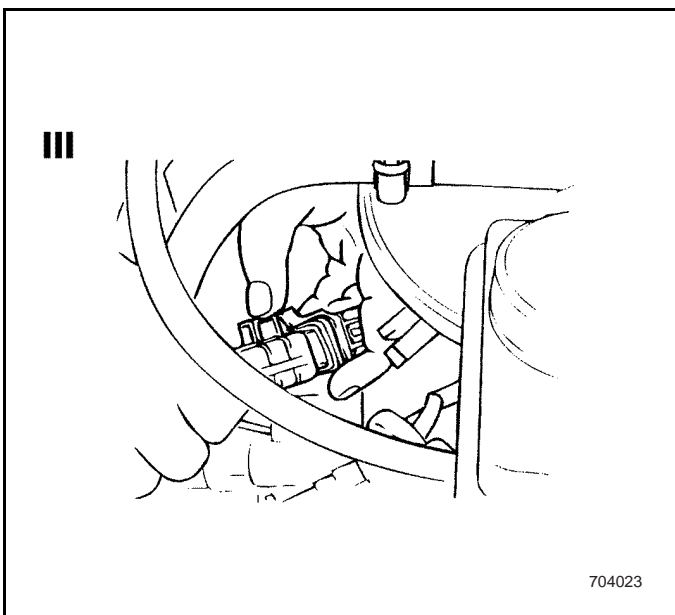
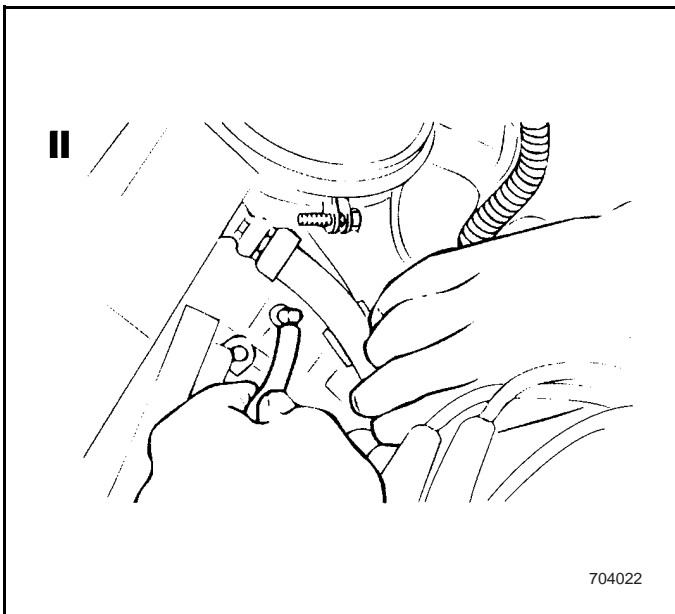
7.2.5.8 Replacement of automatic transmission

Required tools

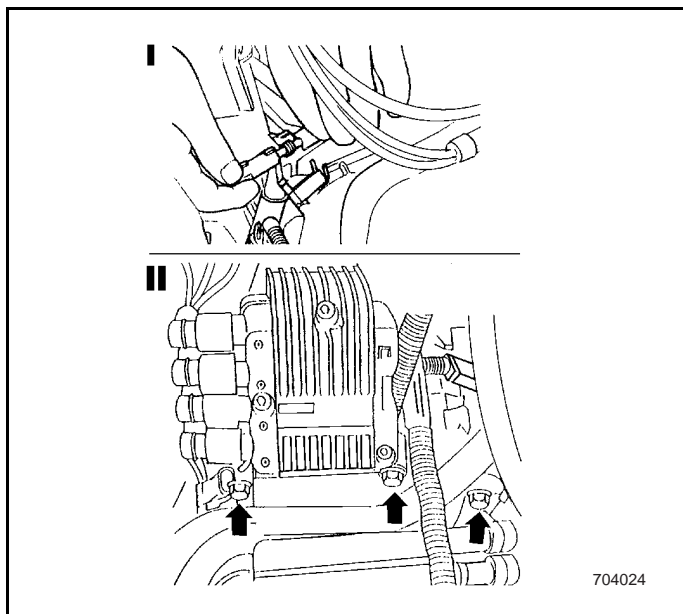
- J -820725
- J-840732 (MKM-883-1)
- J -9706538
- KM-460-B
- KM-902

Removal Procedure

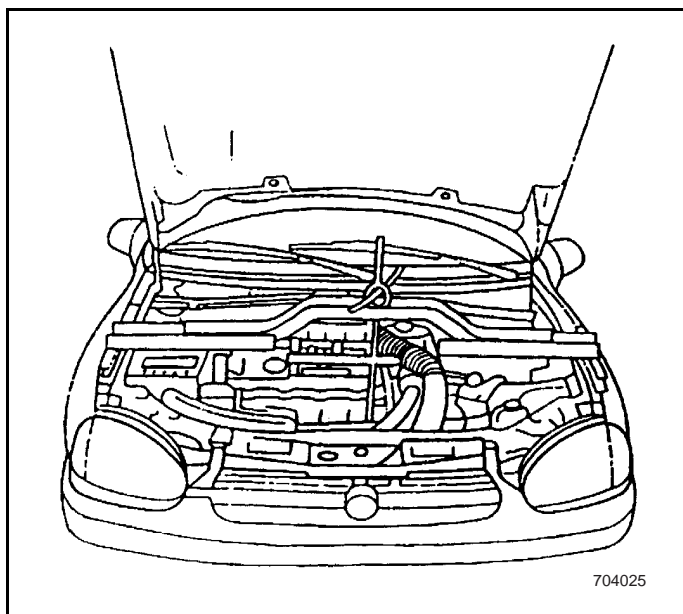
1. Disconnect grounding of battery.
2. Disengage the cable from the shift lever actuator. Refer to the operation in Replacement of Shift Lever Driving Cable.
3. Install the ventilation hose (Figure II) (ahead of the radiator fan).



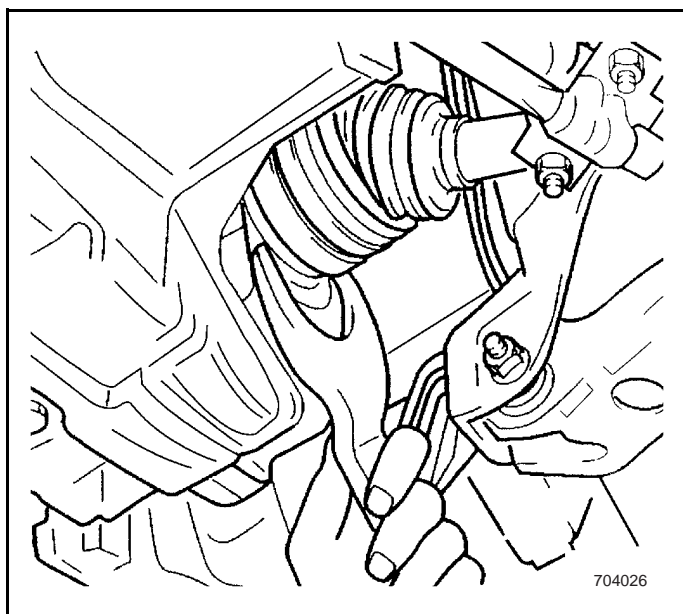
4. Disconnect all harness plugs (Figure III) from transmission (5 harness plugs). Only 2 harness plugs available.



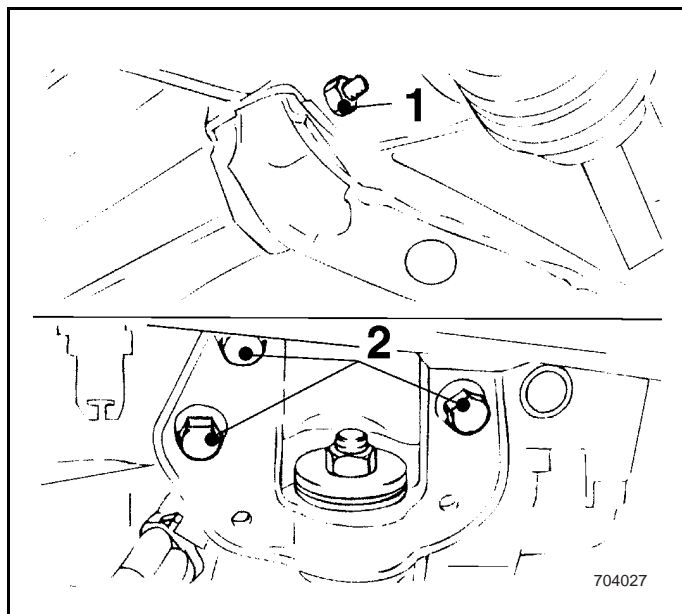
5. Disconnect oxygen sensor cable from the bracket (Figure I).
6. Remove 3 upper bolts between the transmission and the engine (Figure II).
7. If the rear bolt interferes the coolant pipeline, suspend the coolant pipeline with wires.
8. Take out oil dipstick from the transmission case.



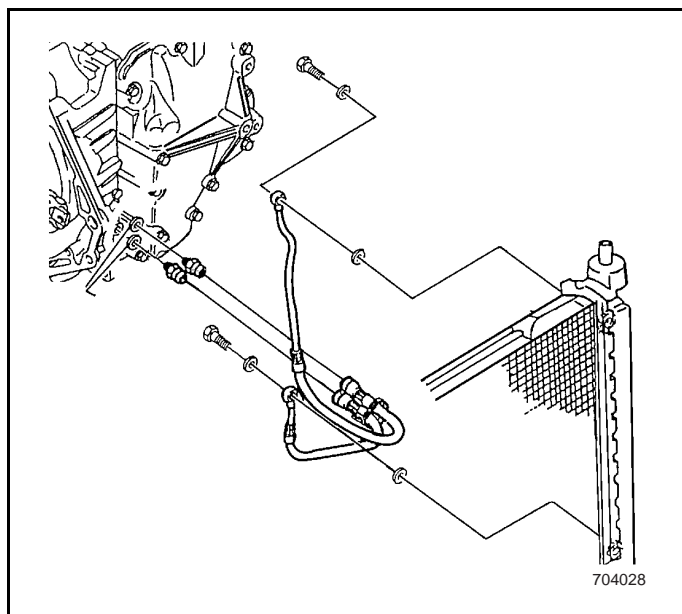
9. Use J- 840732 and J- 9706538 and spring catch to suspend the engine. Fix the spring catch to the U-shaped hook behind the power distributor (use MKM-883-1).
10. Remove the front wheel.
11. Remove the speed meter harness from the transmission. There is an odometer frequency sensor in the transmission, remove the speed meter harness with speed meter harness remover.



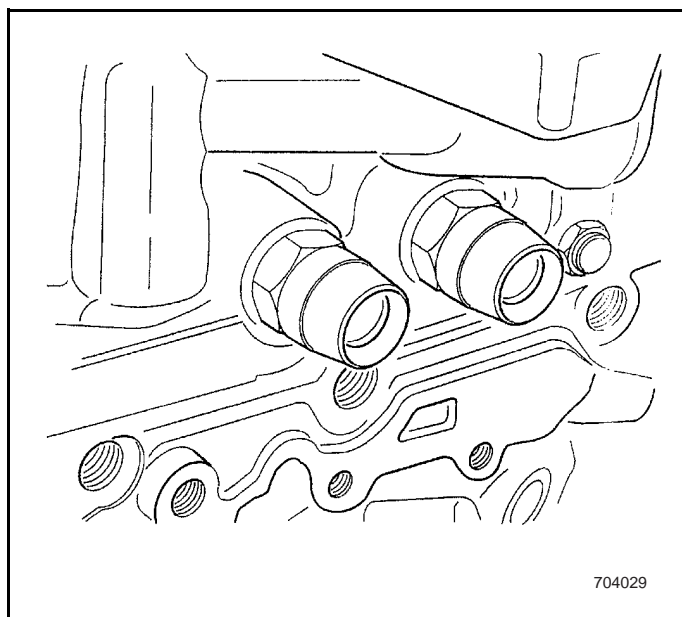
12. Raise the vehicle and use KM-460-B to remove the two driving shafts. In terms of operation, you may also use new remover KM-902.
13. Oil flows out. Close the inlet and suspend the driving shafts.



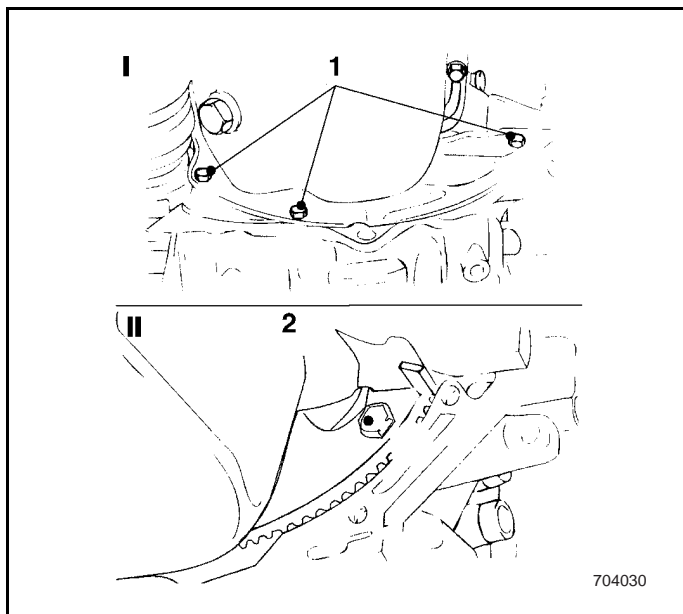
14. Remove tensioning lever (2) and stability lever with control arm.



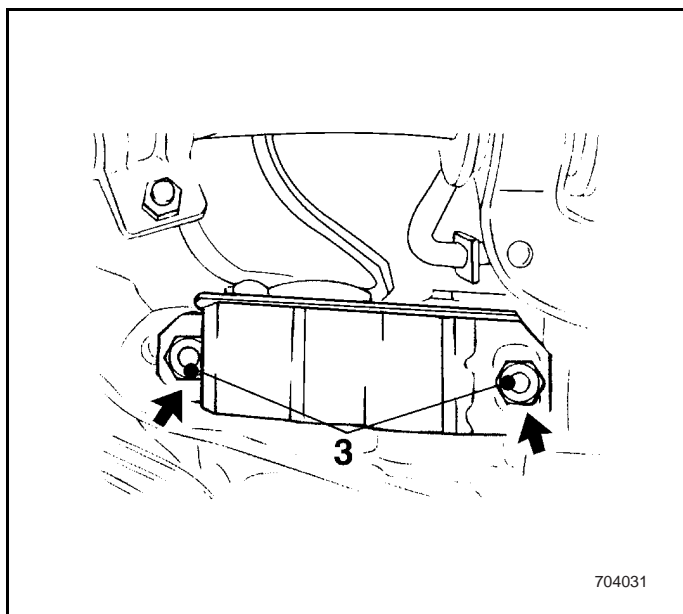
15. Loose the Fasteners on the quick assembling parts and disconnect the quick assembling parts.



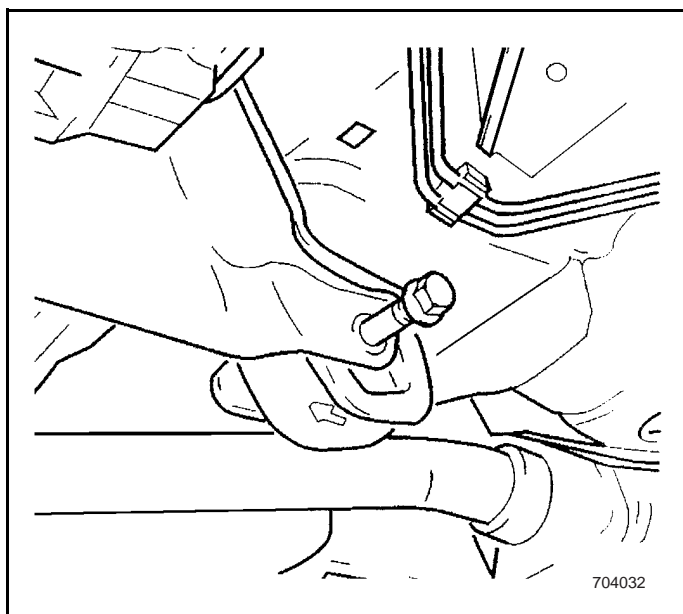
Note: Oil flows out. Close the mouth and put the oil collector under it



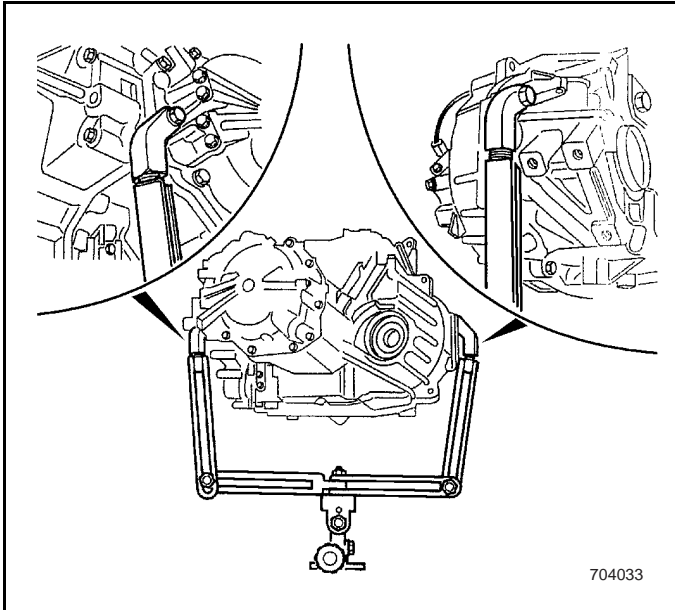
16. Remove the cover plate from the transmission (1).
17. Remove the 3 bolts in hydraulic torque converter with 120° apart from the flywheel(2).
18. Support the driving disc in opposite direction.
19. Use flat bushing spanner to one of the bolt and rotate the driving disc until the next bolt can be seen.



20. Screw off the screws mounting the bumper (3) to the frame beam.

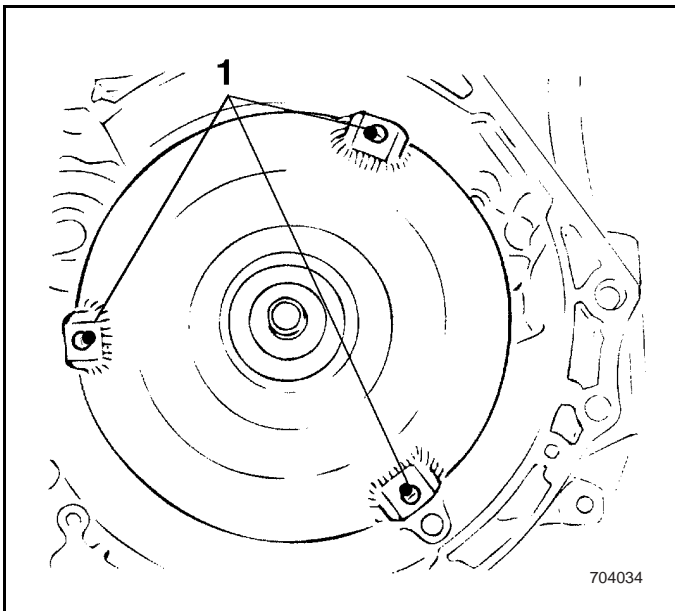


21. Screw off transmission rear support bolt.
22. Lower the vehicle. Use J-840732 and J- 9706538 (or engine hoist KMK-883-1) to lower the engine. Upper rim of the transmission case must be leveled with the frame beam.
23. Remove 3 lower bolts between the transmission and the engine.

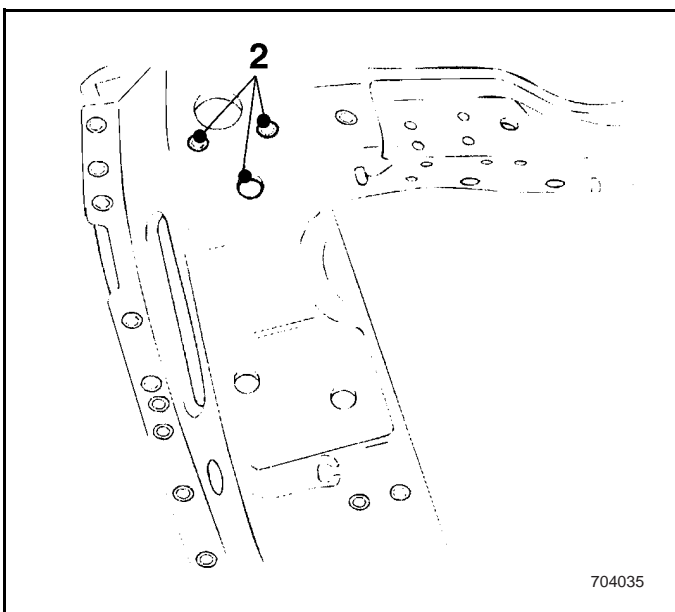


24. Install the transmission mounting rack J- 820725 to the transmission. Remove the transmission.

Note: Press out the transmission carefully- hydraulic torque convertor must be located in the transmission.



25. Remove the torque convertor from the transmission.
26. Cut again the thread (1) in torque convertor, M10 X1.25.



27. Cut again the thread of the left front frame beam bumper, M10 X1.25 (2).

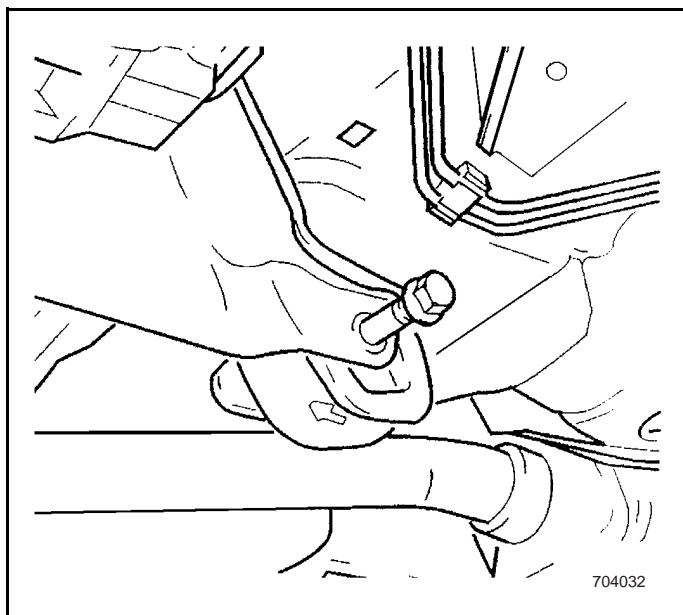
Installation Procedure

Note: Before installation of the transmission, blow the oil cooler from two directions with low pressure compressed air. Drain the oil.

1. Install the torque convertor. Install the transmission to the engine with hydraulic jack. Pay attention to the pilot bushing.
2. Remove the 3 lower bolts between the transmission and the engine.

Tightening

Tighten the bolt to 75 N•m.



704032

3. Install the torque convertor to the flying wheel (as shown by the arrow in the figure), tighten the 3 bolts at 120° interval.

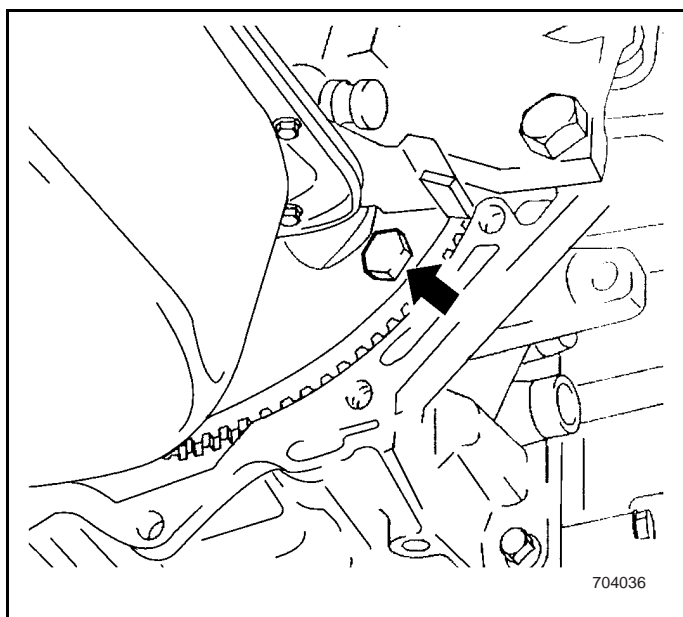
Tightening

Tighten the bolt to 50 N•m.

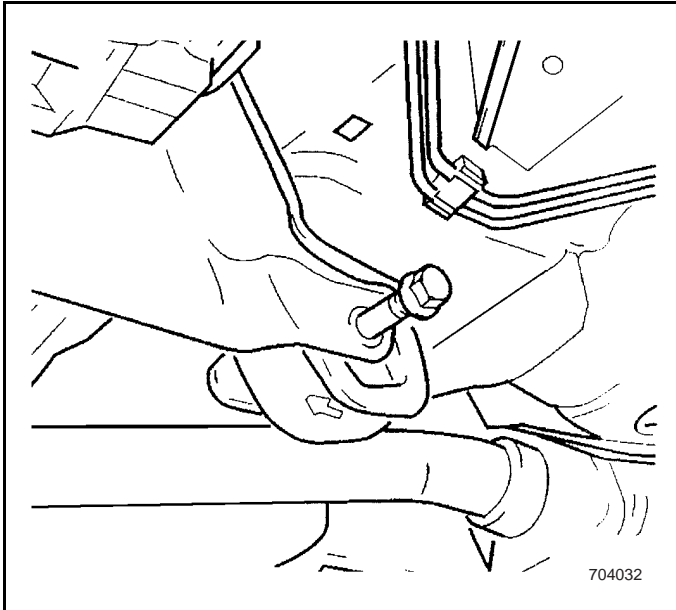
4. Use new bolt and torque spanner with ring type adaptor. Support the driving disc in opposite direction.
5. Install the bolt mounting cover plate to the transmission.

Tightening

Tighten the bolt to 7 N•m.



704036



6. Lower the vehicle. Use J-840732 and J- 9706538 (or engine hoist KMK-883-1) to raise the engine.
7. Fix the bumper to left frame beam with bolts.

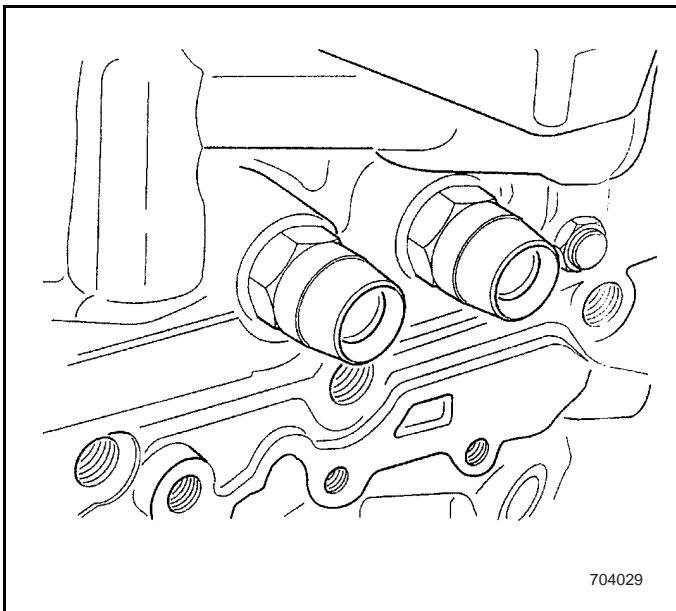
Tightening

Tighten the bolt to 65 N•m.

8. Install the rear engine bracket to the bumper bolts.

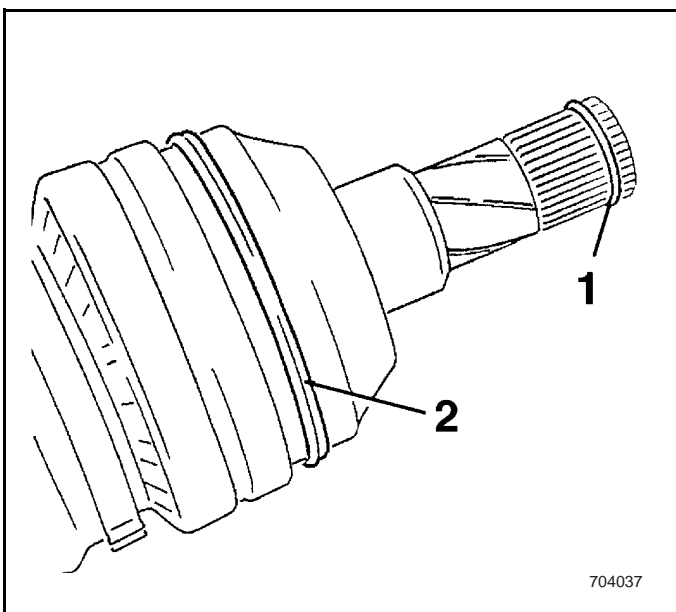
Tightening

Tighten the bolt to 65 N•m.



9. Install the quick assembly parts and Tighten with Fasteners.

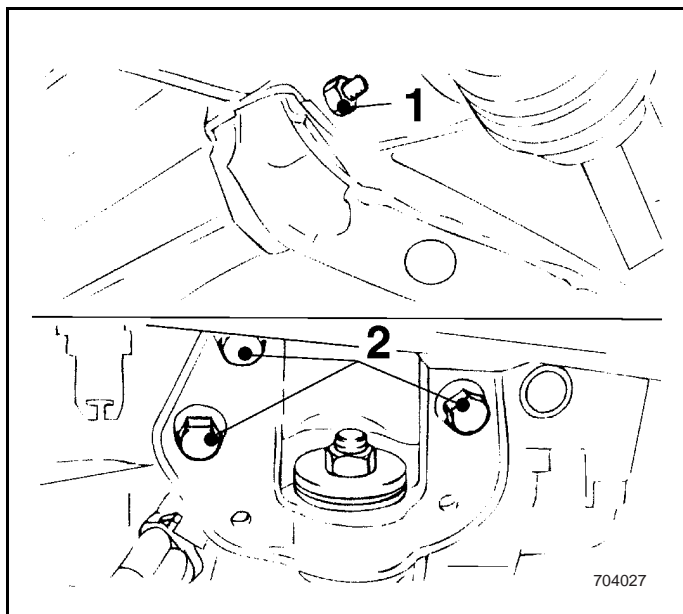
Note: Oil flows out.



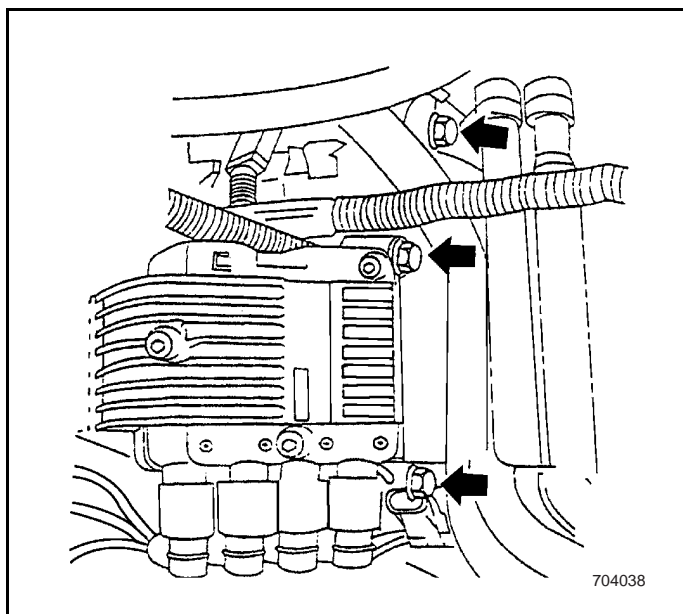
10. Install the left driving shaft, use new ring clip (1) to lubricate splines. Insert the driving shaft into the transmission. Clicks for the clip to engage must be heard.

Inspections

Pull the connector rather than the shaft to check if the driving shaft is well installed.



11. Install the tensioning lever (2) and stability lever with control arm.
12. Install the front wheel. Lower the vehicle, remove the engine riser.
J-840732 and J-9706538 (Optional: MKM-883-1) .Connect the ventilation hose to the transmission.



13. Install the 3 upper bolts between the transmission and the engine.

Tightening

Tighten the bolt to 75 N•m.

14. Connect all harness connectors with the transmission (5 harness connector). Connect wiring harness connected with the battery to grounding of the battery.
15. Adjust the shift lever drive cable. Refer to Replacement of Shift Lever Driving Cable.
16. Fill in transmission oil.

7.2.6 Description & Operation

7.2.6.1 Automatic Transmission AF13 (60-40LE)

Buick Sail equipped with 1.6L SOHC engine may choose to equip automatic transmission AF13. AF 13 automatic transmission is also marked as 60-40LE.

AF 13 means:

A – automatic

F- front wheel drive

13 – maximum input torque = 130N•m (maximum engine torque)

Since the vehicle is equipped with front wheel driving system, the differential is bed in the automatic transmission case.

7.2.6.2 Automatic Transmission Safety Regulations

- Test the stall speed of vehicles with automatic transmission. During the test period, high driving force is completely under the control of the vehicle braking system. The test can only lasts for seconds, or the automatic transmission will be overheated. Put brake wedge in front and behind the driving wheel to ensure the vehicle is fixed. During the test, ask an assistant to monitor the condition of the vehicle and the wedges.
- Before repairing the automatic transmission, use scan tool to test in line with relevant check procedures applicable to the transmission.
- During the repairing of the transmission, if clutch is found to have residues, metal chips, pollutants or other foreign matters, disassemble the transmission completely and rinse it cleaning solution. Dry all parts and fluid passages with compressed air.

7.2.6.3 Oil- ATF (automatic transmission fluid)

Designated ATF: DEXRON-III-TEXAMATIC 7045E

Never use other kinds of oils.

Inspection of oil level

transmission cold oil level check

(when the engine is turned off for more than 8 hours).

Park the vehicle under smooth road, brake the parking brake, start the engine to run for 3 minutes.

Step down the brake pedal and switch the shift lever between all gears. Maintain at each shift for about 3 seconds and then shift to PARK position, have the

engine idle, check the oil level with dipstick. The procedure is very important to ensure all transmission parts are fully lubricated.

Transmission hot oil level check

Drive the car for 24 km so that transmission reaches its normal operation temperature at (82°C to 93°C).

Park the vehicle under smooth road, brake the park brake, step down the brake pedal and switch among all shifts, maintain at each shift for about 3 seconds. Then shift the lever to PARK position, have the engine idle, check the oil level with dipstick.

Under hot condition, oil level shown by the dipstick must be between the shown minimum and maximum scale.

Note:

- Oil level shown by the dipstick must be between the shown minimum and maximum scale
- Shortage or too much oil will both damage the transmission.
- There are scales at both sides of the dipstick.

Inspection of oil level

1. Oil level lower than specification:
 - Add oil until the dipstick shows oil level is within the specified range.
 - Inspect if there is leakage in the transmission.
 - Eliminate leakage.
 - Bubbles in the oil:
 - If bubbles come from the oil, there may be too much oil in the transmission.
 - Remove the over-flown oil.
2. Polluted oil:
 - Inspect ATF, there shall be no white pollution, no inclusion of metal particles and disc lining powder, there shall be no smell of burning.
 - Remove all pollutants on the transmission and hydraulic torque convertor.
 - Search the pollution sources.
 - Eliminate the pollution sources.
 - Add new oil and check the oil level.
 - If the pollution is caused by coolant, replace it also.
3. Color of the oil
 - Oil may turns into red or brown, which does not mean it is polluted.
 - Oil in dark is polluted.

- Observe procedures described in item 3.
- 4. There is solid particles in the oil.
 - It is normal to have few solid particles at the bottom of the oil pan. Replace the filter and oil.
 - Metal chips at the bottom of the oil pan shows deterioration of certain internal parts. Replace the transmission.

7.2.6.4 Transmission control module (TCM) function

1. Shifting Procedure

TCM signals gear solenoids (1 and 2) operating the shift valve according to vehicle speed and throttle angle.

TCM has different shifting procedures under each driving mode (economic, power, winter)

2. Lock Procedure

Lock procedure is also controlled by TCM electrically based on vehicle speed and throttle angle.

Lock control solenoid adjust the open and close pressure of the shift lock.

Under the following conditions, lock clutch will stop working:

- TCM receives trouble signals from other electrical elements. (Driving under spare procedures).
- When the coolant temperature is lower than the specified value.
- When the brake lamp lights and the input speed of the transmission is lower than the specified value.

3. Throttle pressure control

According to different throttle angles and shifts, throttle pressure is controlled by TCM.

4. Pipeline pressure control

4.1 N-R Main oil pressure drops
TCM signals to the pressure control solenoid to reduce pressure in pipelines so as to relieve shifting vibration.

4.2 Increase pipeline pressure at low temperature

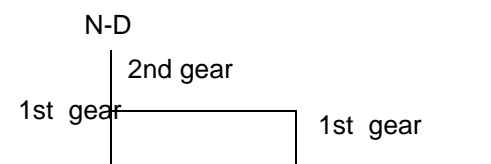
When transmission oil temperature is lower than 10°C and the vehicle speed is less than 5 km/h, TCM will signals to the pressure control solenoid to increase pressure in the pipelines so as to reduce the shifting time of N-D and N-R.

Under the following conditions, the function is disabled.

- Transmission oil temperature is above 20°C.
- vehicle speed is above 7km/h
- Change the position of the shift lever

5. N – D stability control

When the transmission shifts from “N” to “D”, shift to 2nd gear temporarily may reduce shifting vibration and keep the vehicle stable.



Only when the following conditions exists, can you shift afterward.

- brake lamp switch
- 0% throttle angle
- Transmission shifts from N to D.
- vehicle speed is less than 4 km/h
- Driving in Economic Mode or Power Mode

6. N-D、N-R, garage shift control

When the transmission shifts from N (or P、R) to D (or 3、2、1), or from other gears to R, TCM will signals ECU to reduce torque so as to reduce shifting vibration.

7. Driving mode selection

Shifting programming of the transmission has the following three modes.

- Economic: fuel saving
- Power: sport driving
- Winter: for easy start on slippery road

7.1 economic/power mode

The two mode are switched by contact switches. Select Economic mode each time ignition is turned on, Power mode may be selected through the contact switch.

Power mode may be turned off through the following ways:

- Start the contactor switch again.
- Switch to Winter mode.
- Driving under spare procedures.

7.2 Winter mode

The special driving mode is for easy start on slippery roads. (Start at 3rd shift) When the shift is at D, you may activate Winter mode by pressing down contact switch. When TCM detects the following conditions, Winter mode closes.

- Activate Winter mode contact switch

- Change the position of the shift lever
- Full acceleration switch opens and lasts for more than 2 seconds.
- Turn off ignition switch
- vehicle speed is above 80 km/h
- Transmission oil temperature is above specification.
- Driving under spare procedures.

8. Self- diagnosis

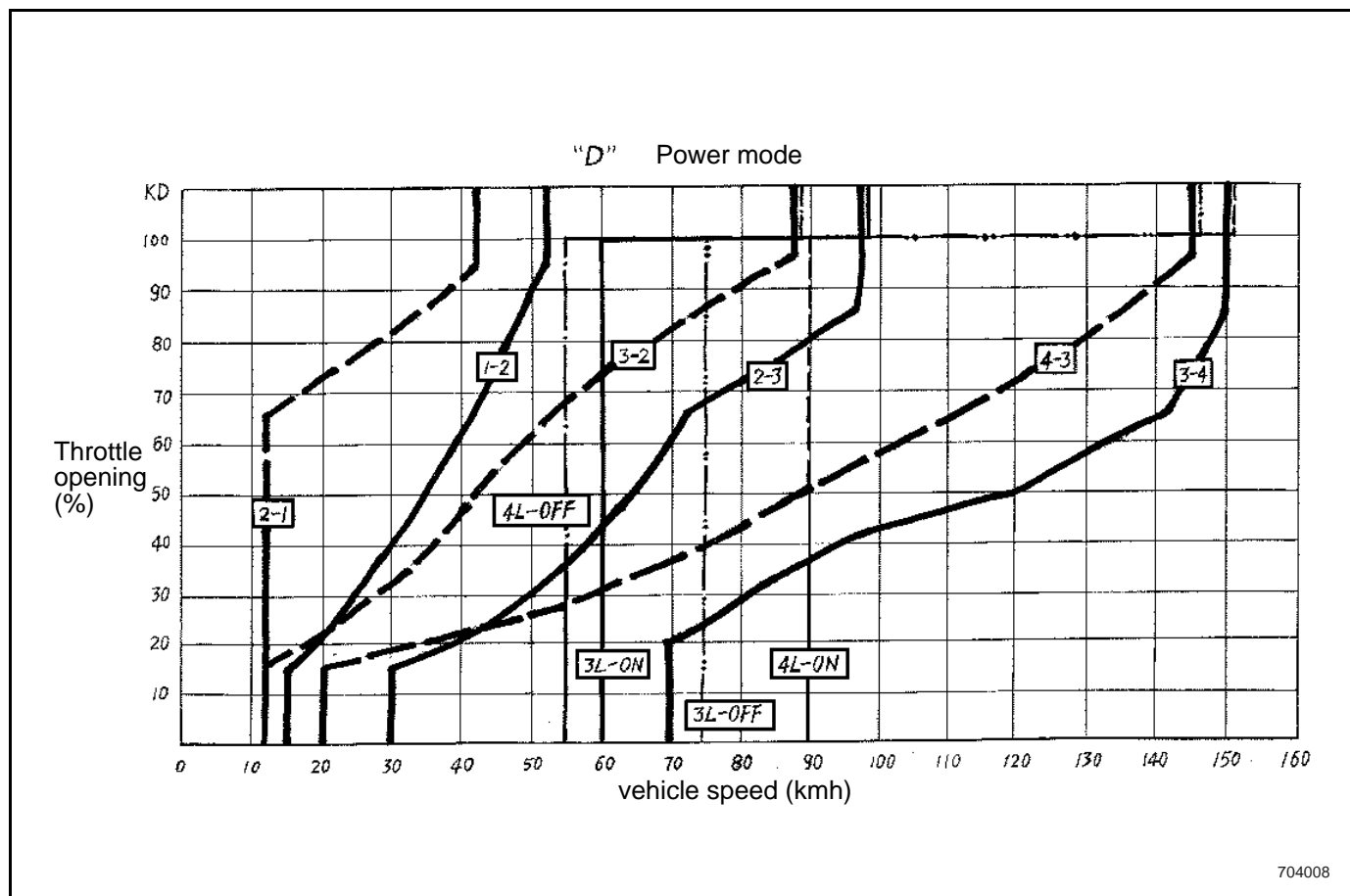
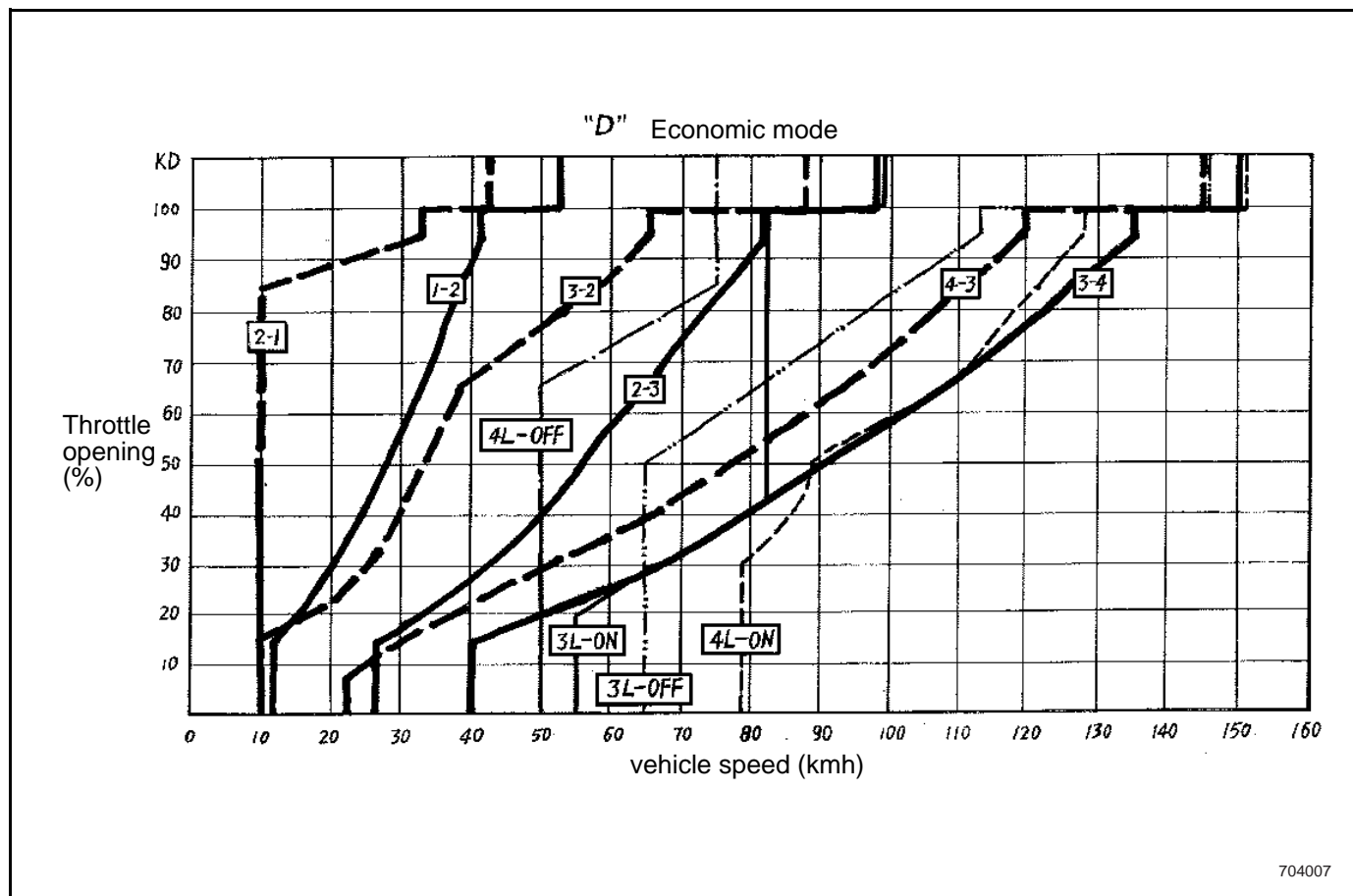
TCM monitors continuously the sensor, solenoid and other electrical components, when failure is detected, it will send out alarm. When there is system failure, TCM will flash POWER mode indicator on the instrument panel, and display the failed part through relevant DTCs.

9. Spare Procedure

When TCM detects failure, all the four solenoids will be closed. However, the vehicle may drive to the nearest service workshop under manual transmission mode.

< Shifts available stored in spare programs at different shift lever position >

position of the selector	R	D	3	2	1
actual shift	Reverse	4th gear	4th gear	3rd gear	1st gear



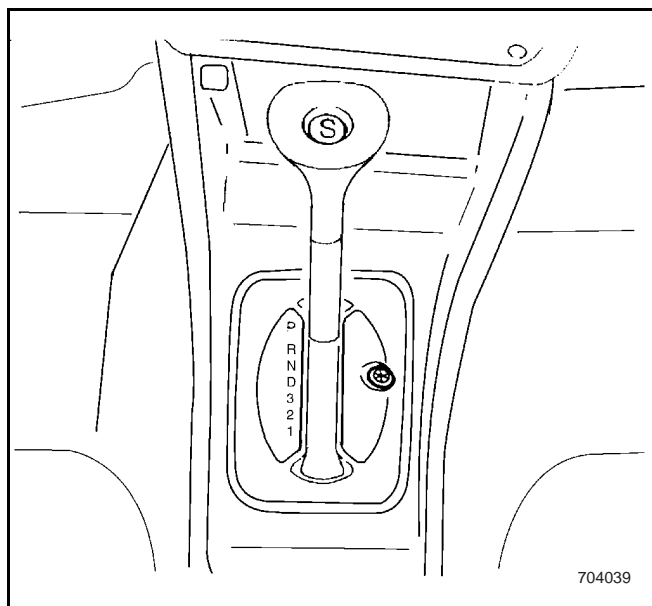
7.2.6.5 Function of the shift lever position switch

Inspect the function of the shift lever position switch. The switch is used as follows.

Select position	function
P,N	Start the engine.
R,D,3,2,1	The engine may not be started.
R	Reverse lamp turns on

The function fails, please inspect:

Wiring or shift lever drive - refer to illustration in chapter of shift lever drive cable and shift linkage operation.



7.2.6.6 Automatic Transmission Test

maximum efficiency test (stall test)

Before the test, brake the vehicle and ensure all personnel is away from the vehicle.

When the engine is under normal operation temperature (85°C-95°C), step down brake pedal firmly and shift to D or R position, step the pedal to its maximum travel to observe the rotation speed of the engine.

Standard stall RPM: 2400 ± 150 R.P.M.

Please refer to relevant information in Failure Check.

Note: Never accelerate the engine for more than 5 seconds to avoid severe damage to the transmission.

Repeat the test if necessary until the temperature of the transmission restores to the normal status.

Road test

Drive the vehicle and select all driving shifts (1-2-3-D). The transmission will not be engaged on any of the shift you choose.

The shift point must change with the change of the acceleration position. Inspect the engine delay during manual downshifting.

Main oil pressure test

Before test the main oil pressure, adjust the pressure-relief valve cable according to specifications and inspect the operation of the entire vehicle. Repair if necessary.

Start the engine and brake.

When the engine RPM reaches 2,500 rpm +150 rpm, the pressure data can be obtained. The lasting time for the test shall not exceed 5 seconds.

- Pause for certain time during the test to cool the transmission.
- Always brake the vehicle during the test.

Please refer to relevant information in Failure Check.

main oil pressure data

kgf/cm²

	Engine idle	Engine stalling
D	3.8-4.4	11.2-13.0
R	5.5-6.4	15.0-17.2

7.2.7 Special Tools

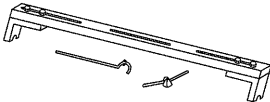
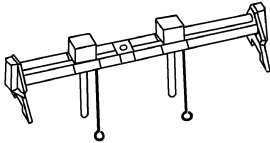
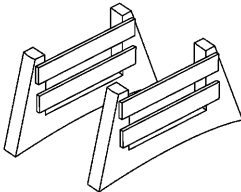
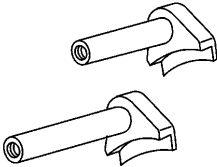
Illustration	Number & Name of the Tools
 <p>J-840732</p>	<p>J -840732 Support to suspend the engine, used together with J-9706538 (optional: MKM-883-1)</p>
 <p>MKM-883-1</p>	<p>MKM-883-1 engine suspension rack</p>
 <p>J-9706538</p>	<p>J -9706538 Engine support adaptor used together with J-840732</p>
 <p>KM-902</p>	<p>KM-902 Remover to remove vehicle shafts from the transmission (optional: KM-460-B)</p>

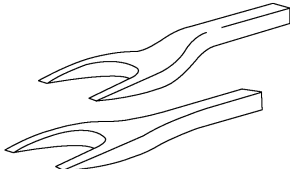
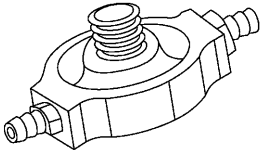
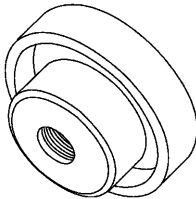
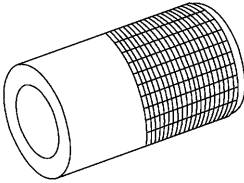
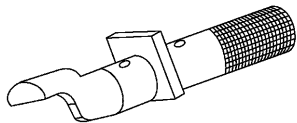
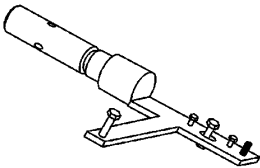
Illustration	Number & Name of the Tools
 <p>KM-460</p>	<p>KM-460 fork shaped remover Remove the front wheel drive shaft from one side of the transmission</p>
 <p>S-9407499</p>	<p>S-9707499 Automatic transmission fluid filter</p>
 <p>S-9707500</p>	<p>S-9707500 automatic transmission vehicle shaft sealing installer, used together with the GM handle</p>
 <p>S-9707501</p>	<p>S-9707501 Shifting device sealing installer</p>

Illustration	Number & Name of the Tools
 S-9707532	S-9707532 Locker of automatic transmission torque convertor
 J-820725X	J -820725 Transmission Bracket

Blank

8

Body and Attachments

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8.1 Lighting System

8.1.1 Specifications

8.1.1.1 Fastener Tightening Torque

Application	Specification
Head Lamp Bolt	1.5-2 N•m
Fog Lamp Bolt	1.5-2 N•m

8.1.1.1A Fastener Tightening Torque

Application	Specification
Tail Lamp A Bolt	2.5-3.5 N•m
Tail Lamp B Bolt	1-2 N•m
License Plate Nut	3.5-4.0 N•m

8.1.1.1B Fastener Tightening Torque

Application	Specification
Tail Lamp Nut	2.5-3.5 N•m

8.1.1.2 Bulb Specifications

Type of Lamp	Specification
Head Lamp (High/Low Beam)	H4 12V 60W/55W
Head Lamp (Front Turn Signal Lamp)	PY21W 12V 21W yellow bulb
Head Lamp (Position)	W5W 12V 5W
Front Fog Lamp	H3 12V 55W
Rear Lamp (Turn Signal Lamp)	PY21W 12V 21W yellow bulb
Rear Lamp (Fog Lamp)	P21W 12V 21W
Rear Lamp (Back Up Lamp)	P21W 12V 21W
Rear Lamp (Park/Position Lamp)	P21/5W 12V 21W,5W
Turn Signal Indicator Lamp	W5W 12V 5W
High Mounted Stop Lamp	412V 2W
Dome Lamp	112V 10W

8.1.1.2A Bulb Specifications

Type of Lamp	Specification
License lamp	12V 10W

8.1.1.2A Bulb Specifications

Type of Lamp	Specification
Trunk Lamp	112V 10W
Reading Lamp	112V 5W

8.1.1.2B Bulb Specifications

Type of Lamp	Specification
License lamp	12V 5W two pieces
Rear Compartment Lamp	112V 10W

8.1.2 Schematic and Routing Diagrams

8.1.2.1 Parking, Tail Lamp & Head Lamp (High & Low Beam) Routing Diagrams

See 8.20.2.7.

8.1.2.2 Stop Lamp, Turn Signal & Harzard Lamps

See 8.20.2.8.

8.1.2.3 Interior Lamps and Fog Lamps Routing Diagrams

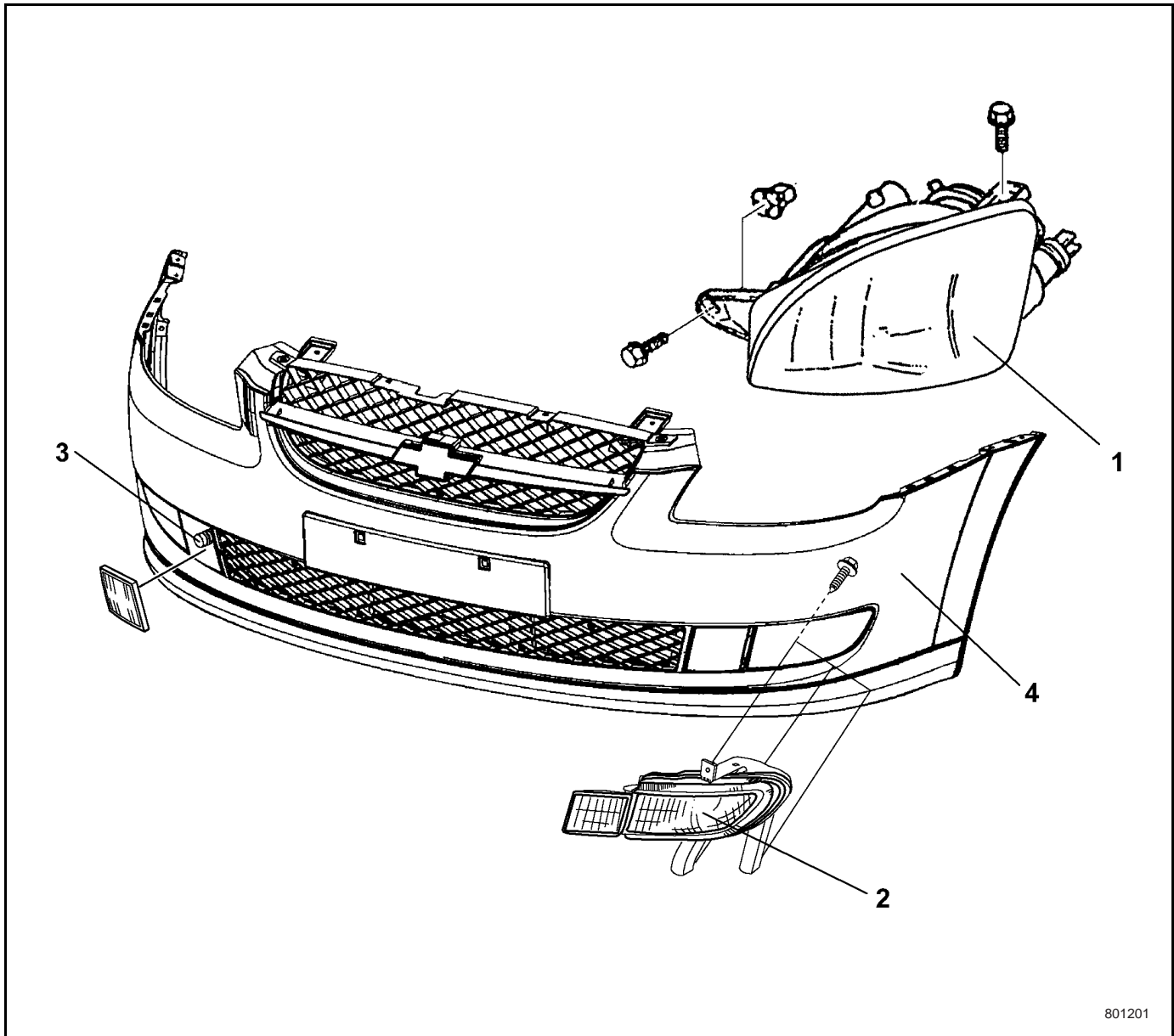
See 8.20.2.9.

8.1.2.4 Back up Lamp Routing Diagrams

See 8.20.2.10.

8.1.3 Component Position

8.1.3.1 Front Head Lamp & Front Fog Lamp

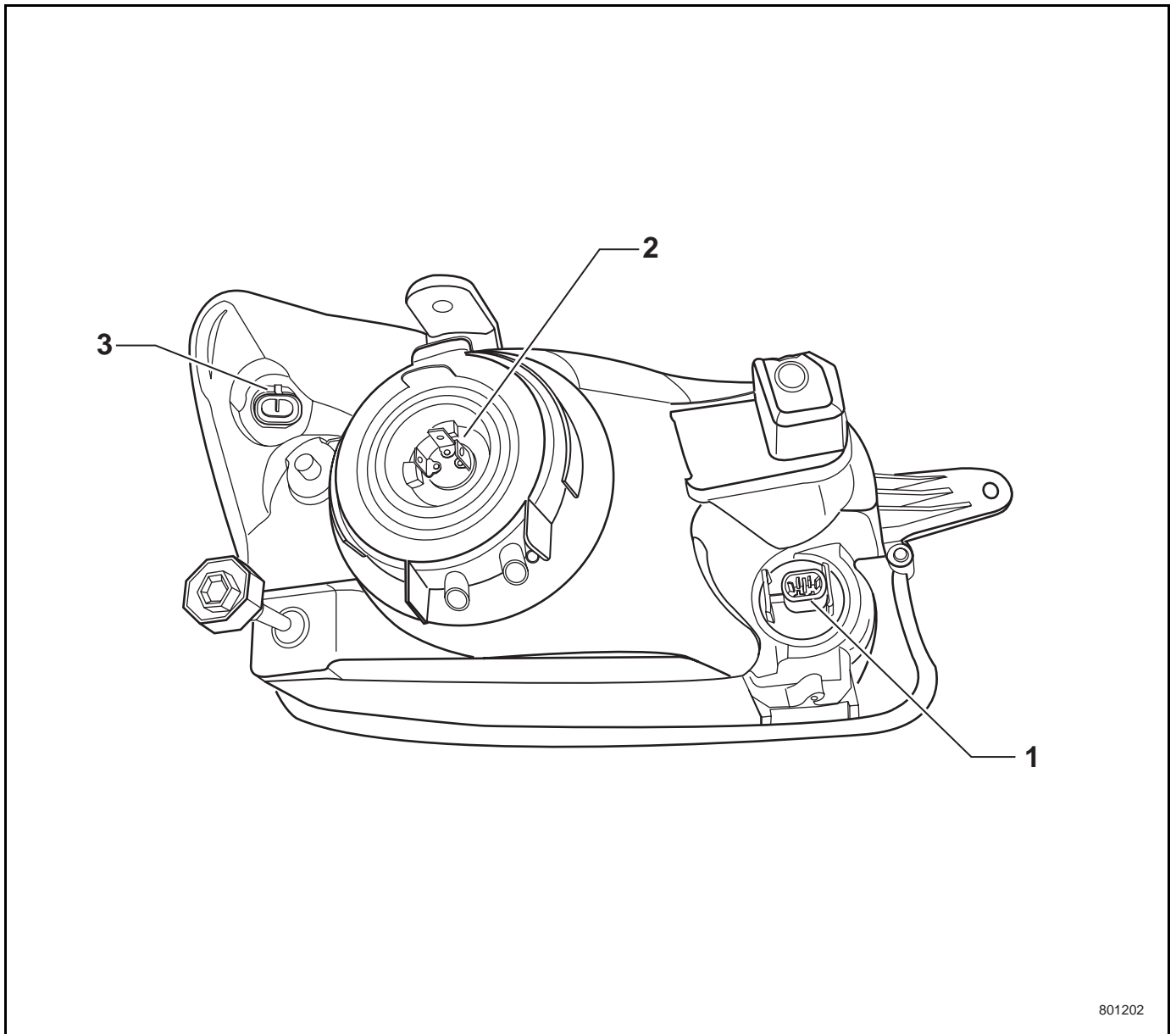


Legend

- (1) Front Head Lamp
- (2) Fog Lamp

- (3) Lashing Hook Cover
- (4) Front Bumper Fascia

8.1.3.2 Front Head Lamp Components



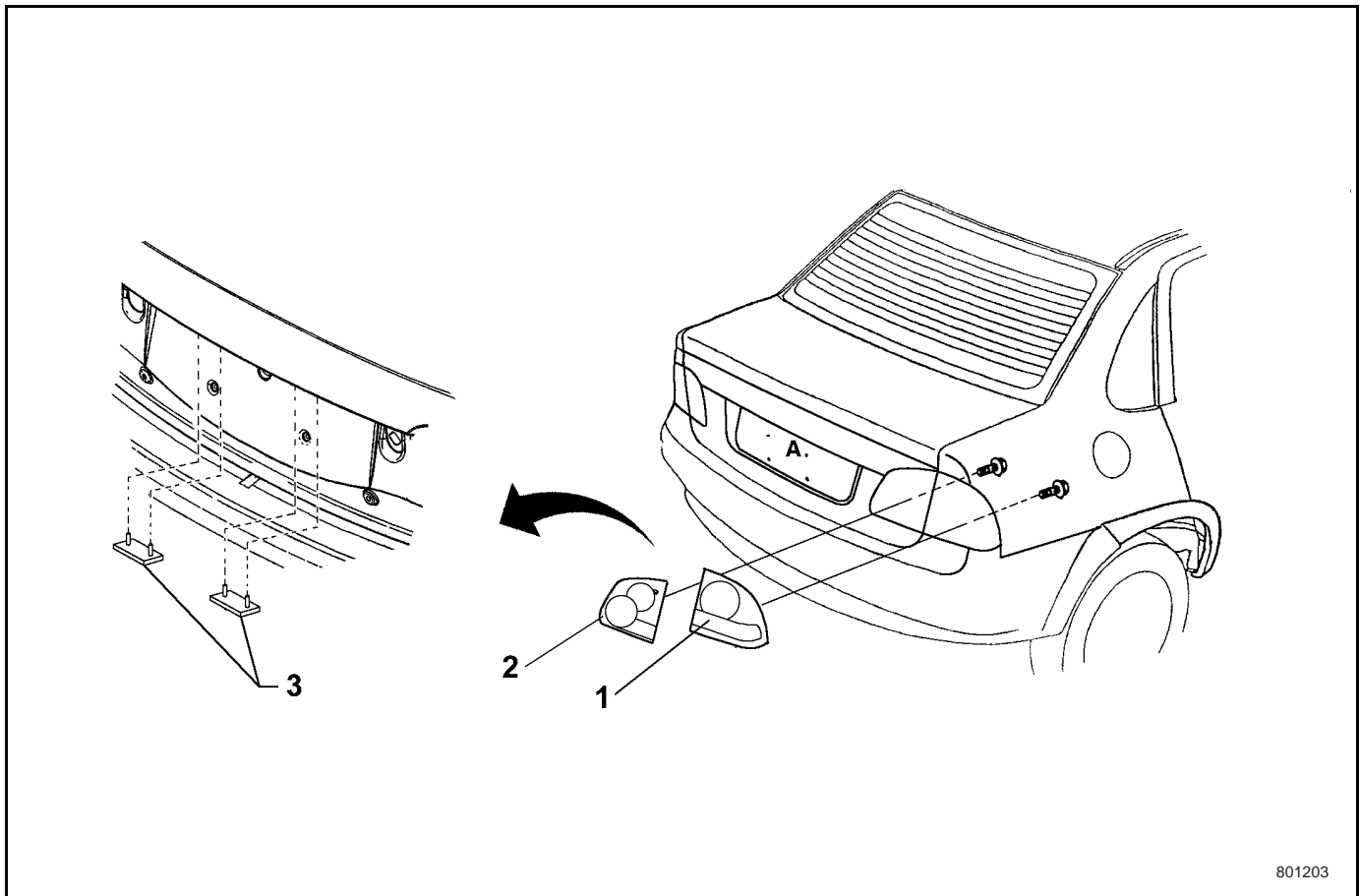
Legend

(1) Position Lamp

(2) High and Low Beam Lamp

(3) Turn Signal Lamp

8.1.3.3A Tail Lamp and License Lamp

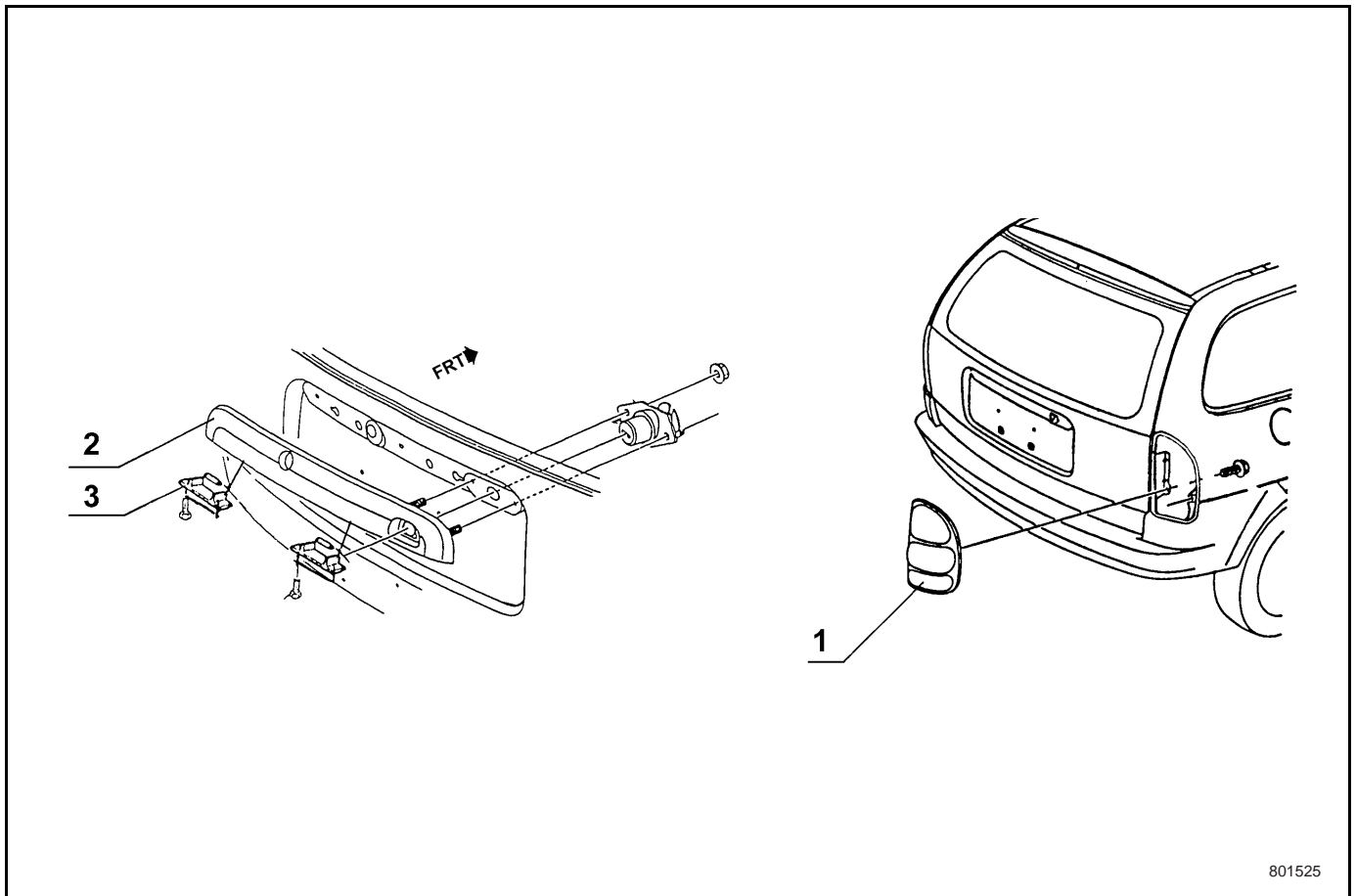


Legend

- (1) Tail Lamp A
- (2) Tail Lamp B

- (3) License lamp

8.1.3.3B Tail Lamp and License Lamp



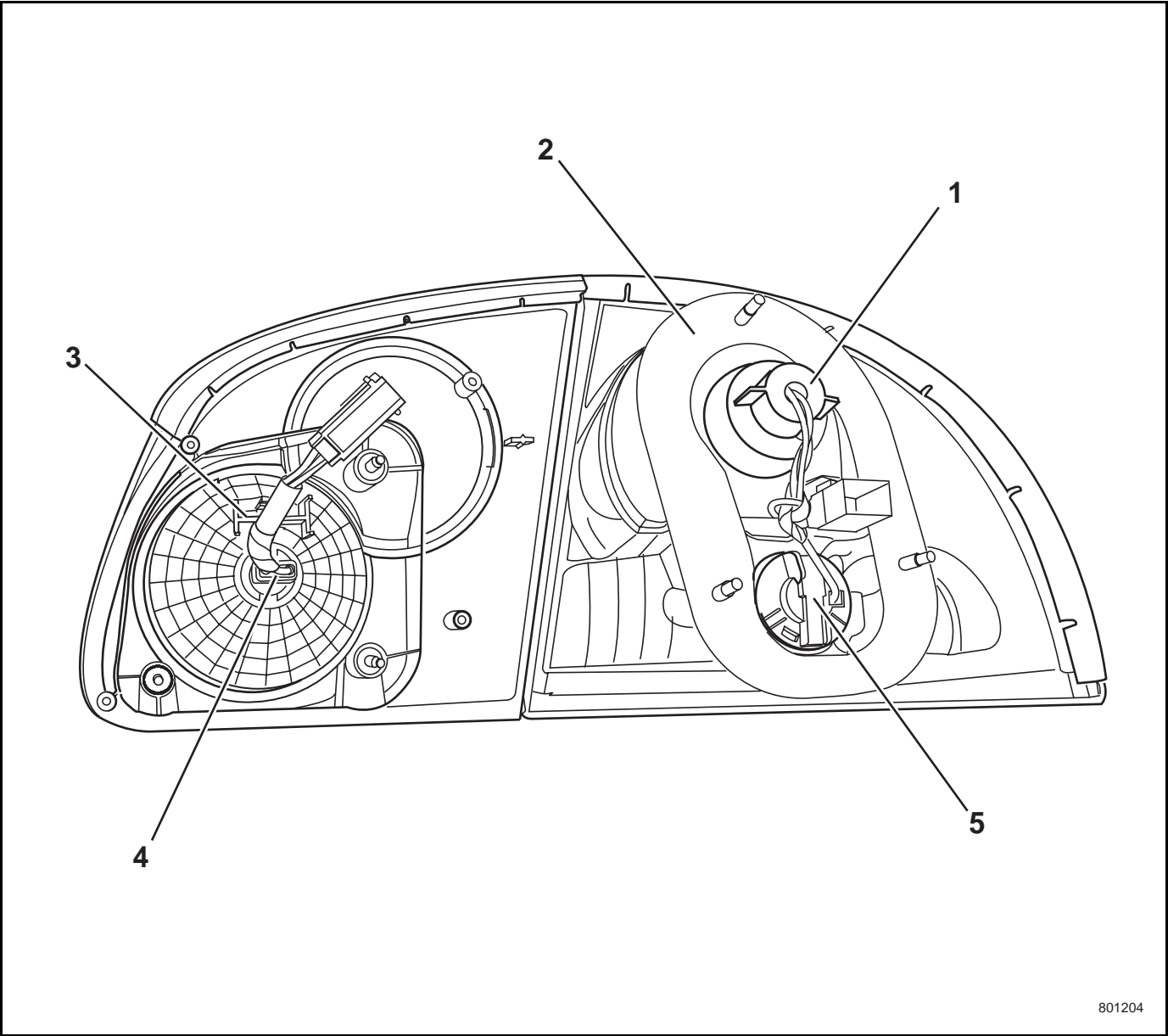
801525

Legend

- (1) Tail Lamp
- (2) Handle Assembly

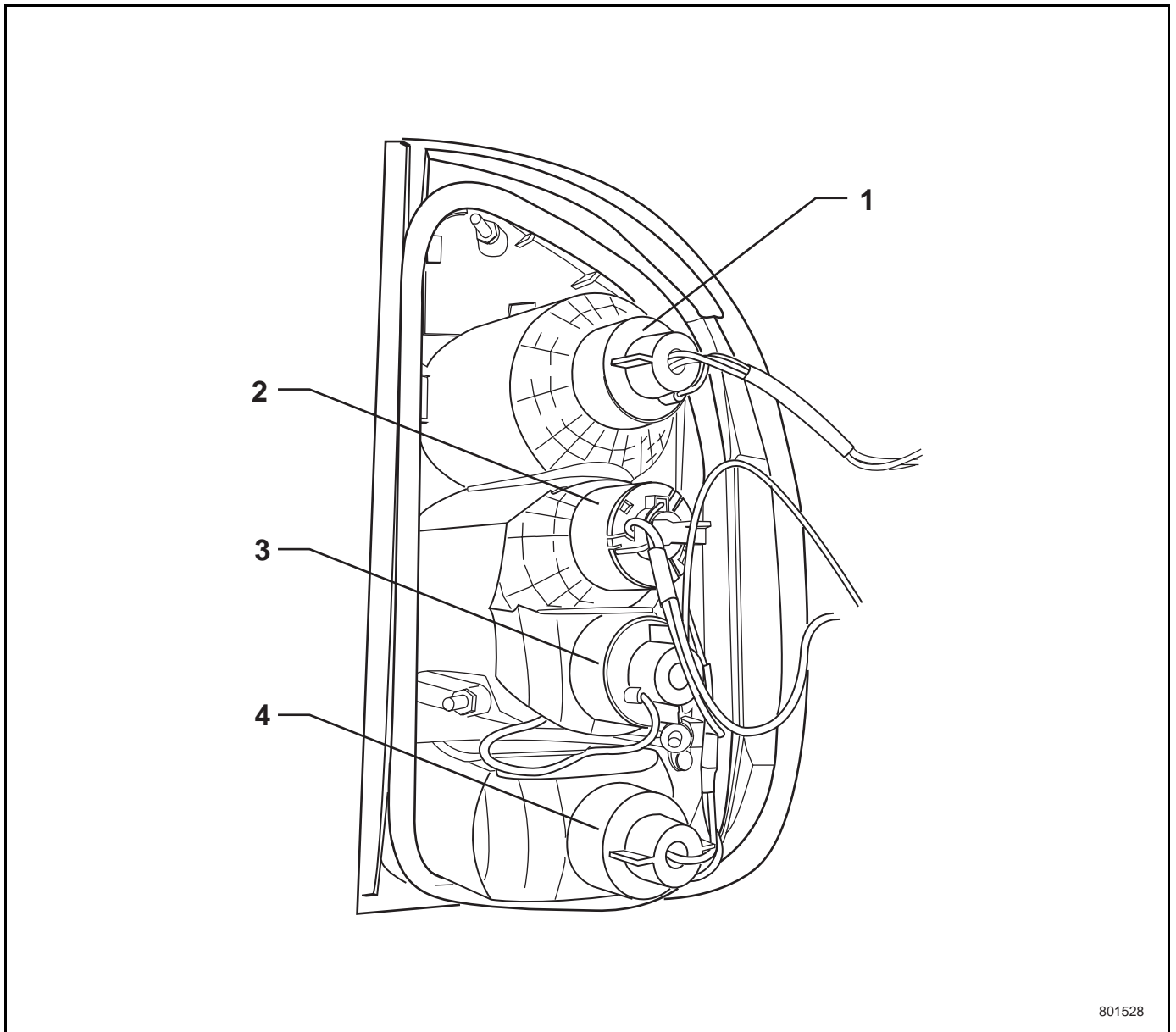
- (3) License lamp

8.1.3.4A Tail Lamp Components



- Legend
- | | |
|-------------------------|--|
| (1) Brake/Position Lamp | (4) Back up Lamp (Right Side Tail Lamp B), Rear Fog Lamp (Left Side Tail Lamp B) |
| (2) Tail Lamp A Socket | (5) Turn Signal Lamp |
| (3) Tail Lamp B Socket | |

8.1.3.4B Tail Lamp Components

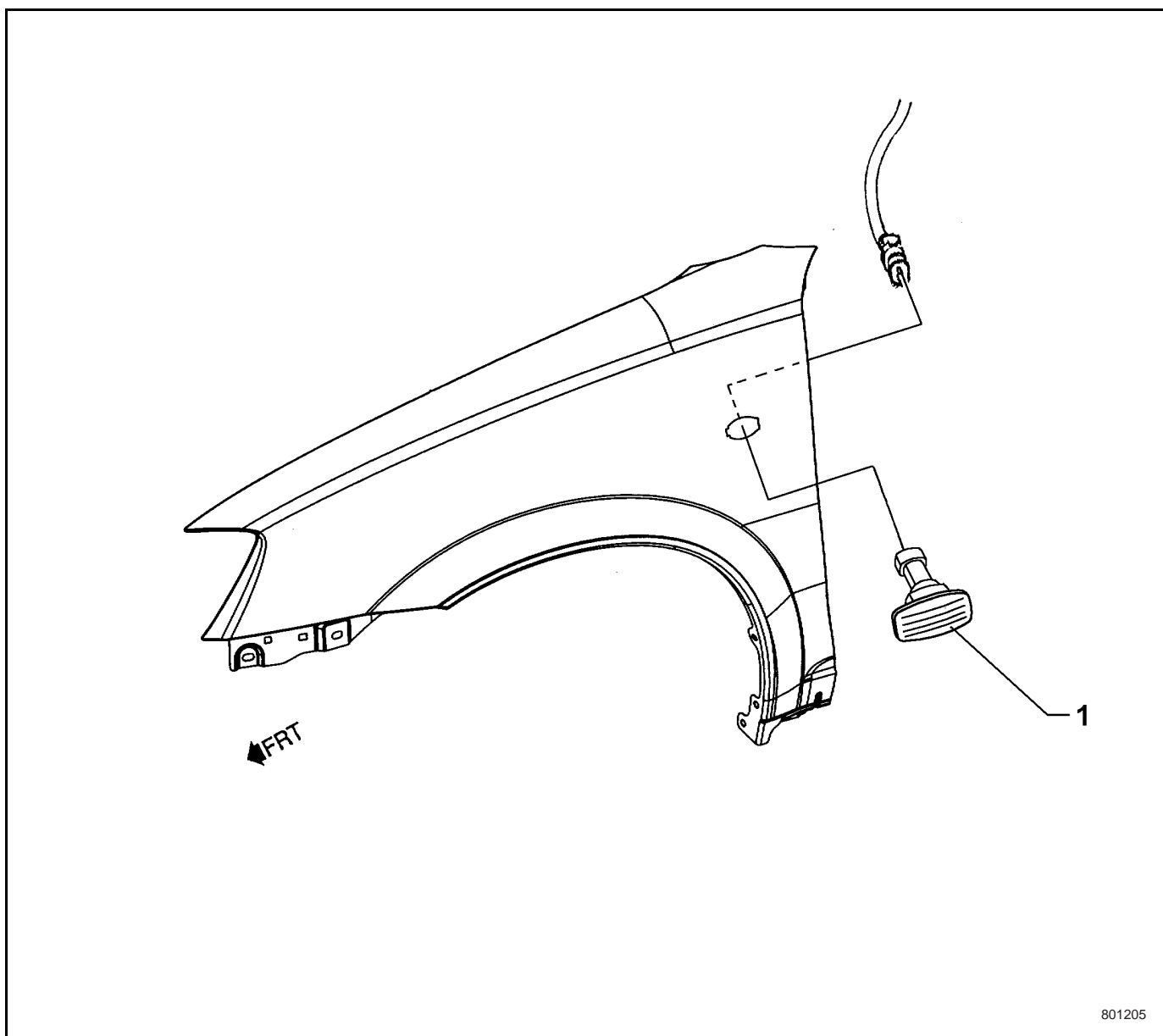


Legend

- (1) Brake/Position Lamp
- (2) Turn Signal Lamp

- (3) Back up Lamp
- (4) Rear Fog Lamp

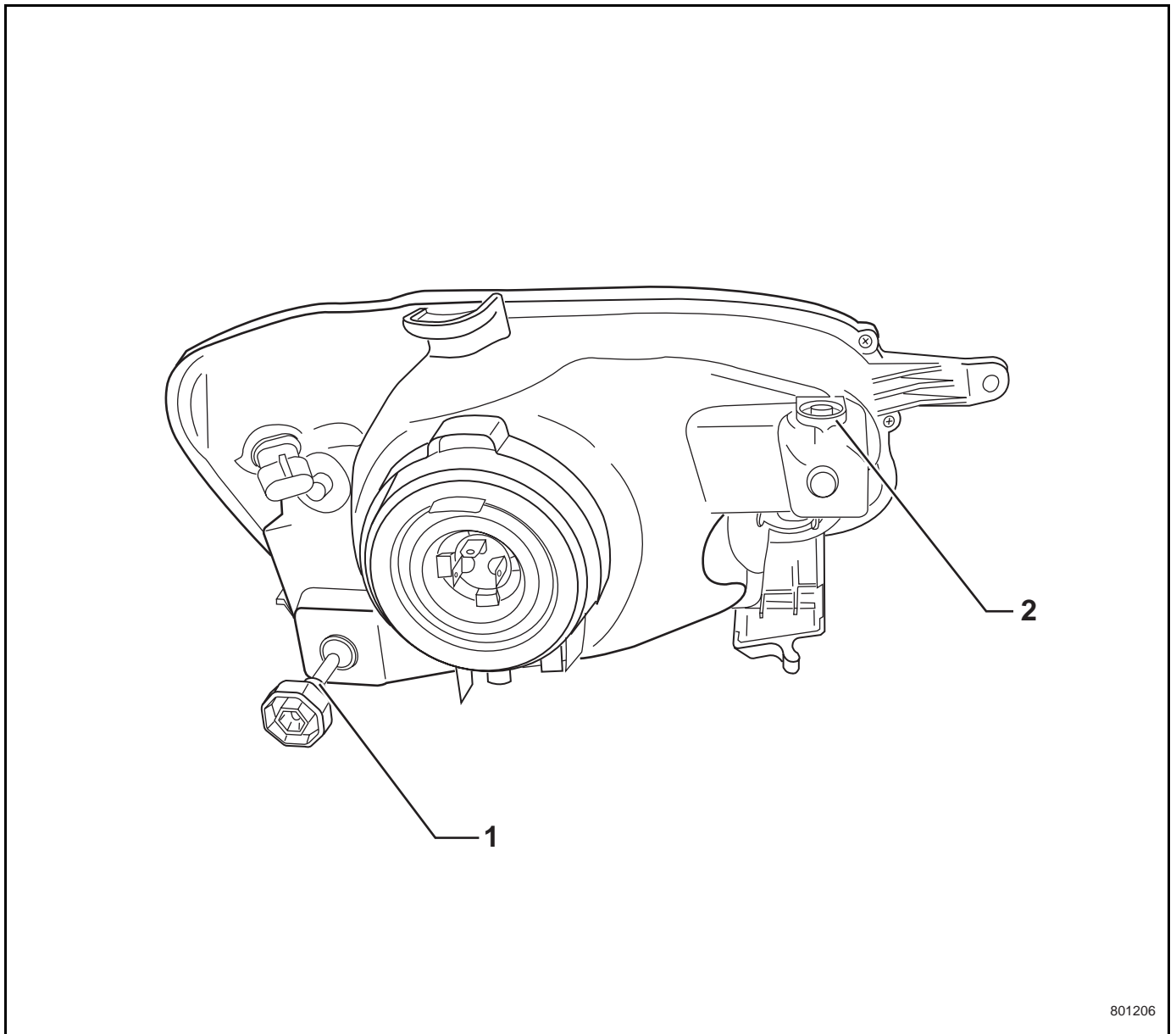
8.1.3.5 Turn Signal Lamp



Legend

- (1) Side Turn Signal Lamp

8.1.3.6 Front Head Aiming Components

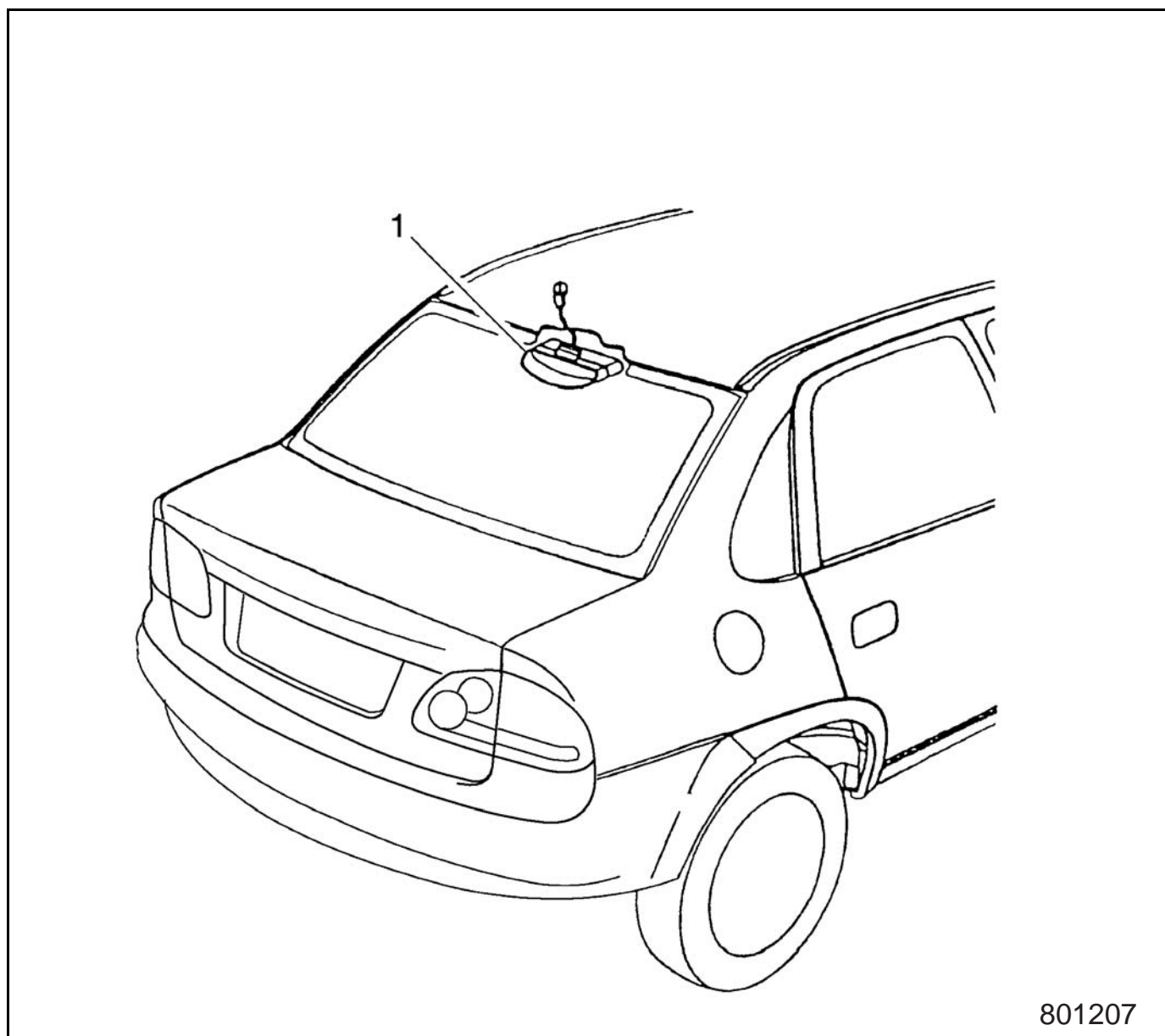


Legend

(1) Left and Right Adjusting Knob

(2) Up and Down Adjusting Knob

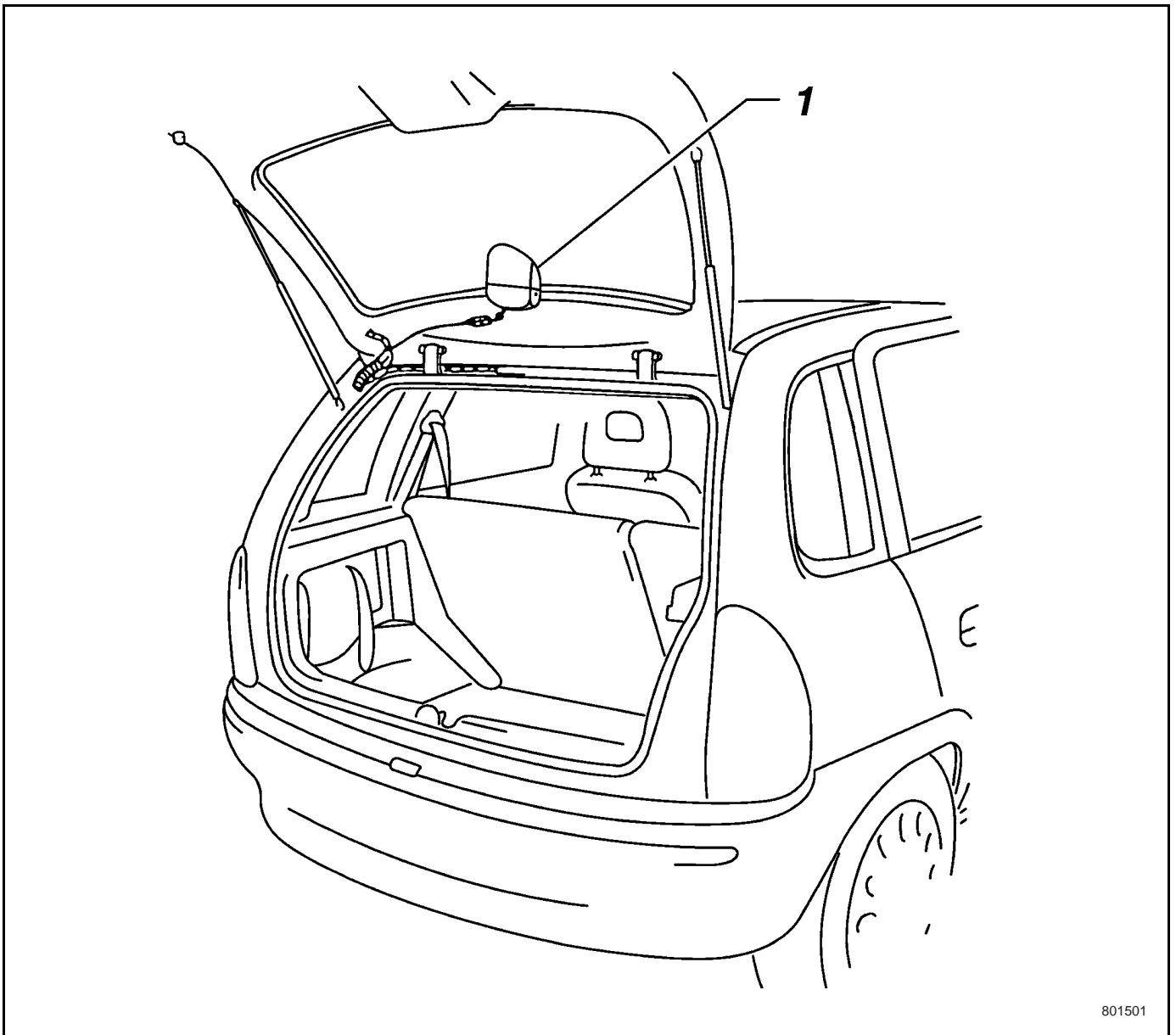
8.1.3.7A High Mounted Stop Lamp



Legend

- (1) High Mounted Stop Lamp

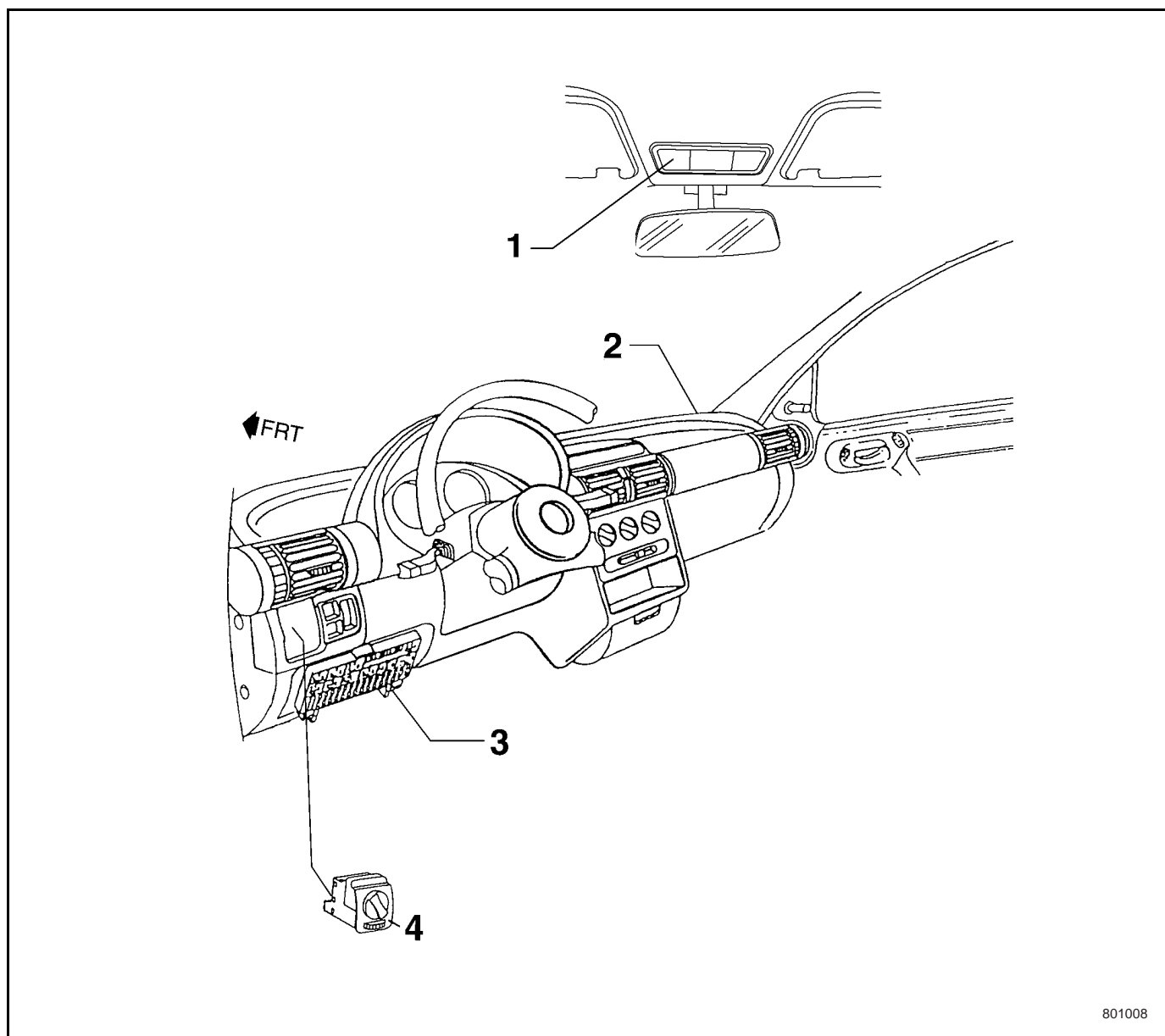
8.1.3.7B High Mounted Stop Lamp



Legend

- (1) High Mounted Stop Lamp

8.1.3.8 Dome Lamp

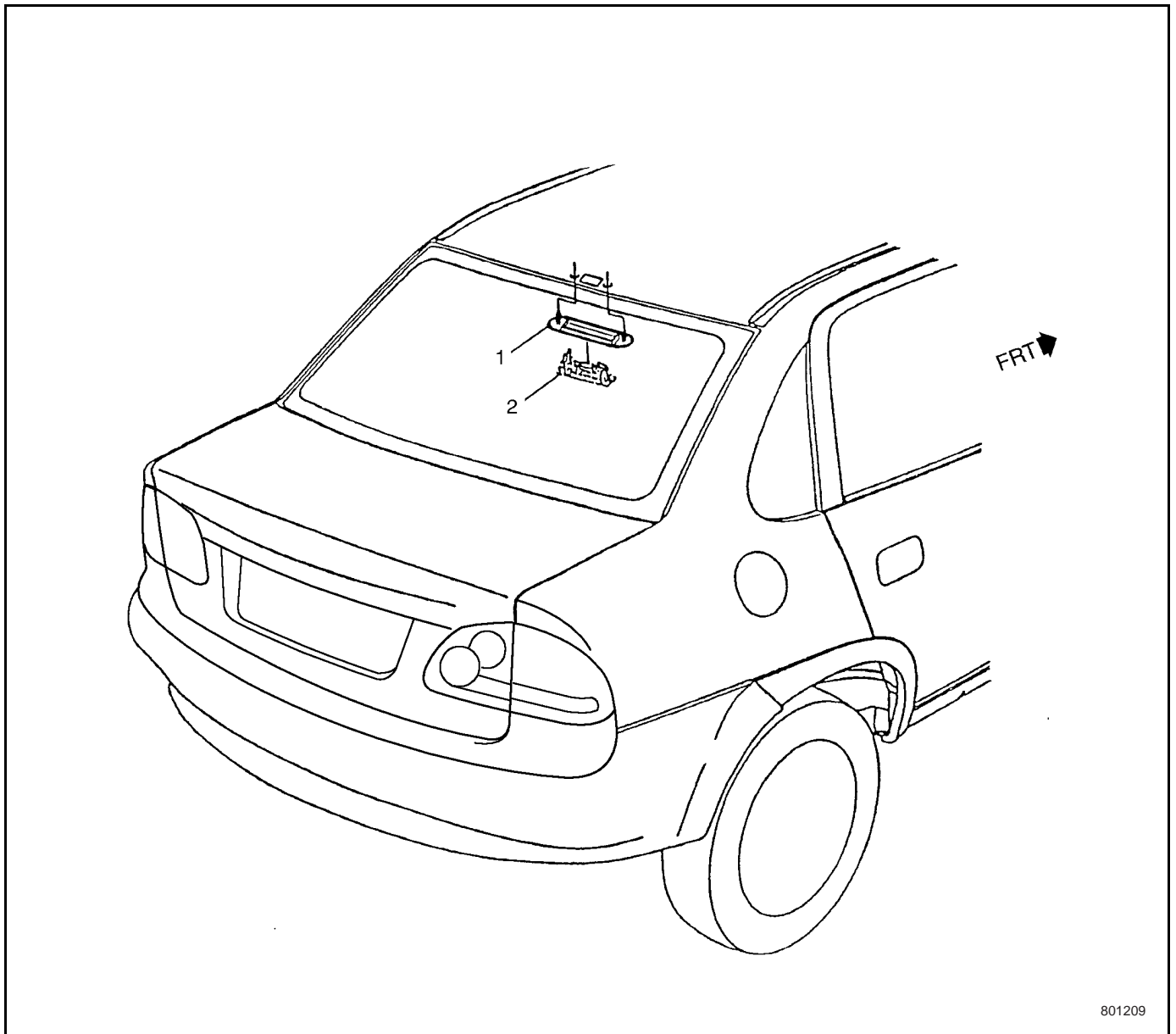


Legend

- (1) Dome Lamp
- (2) Instrument Panel

- (3) Fuse box
- (4) Light switch

8.1.3.9A Reading Lamp

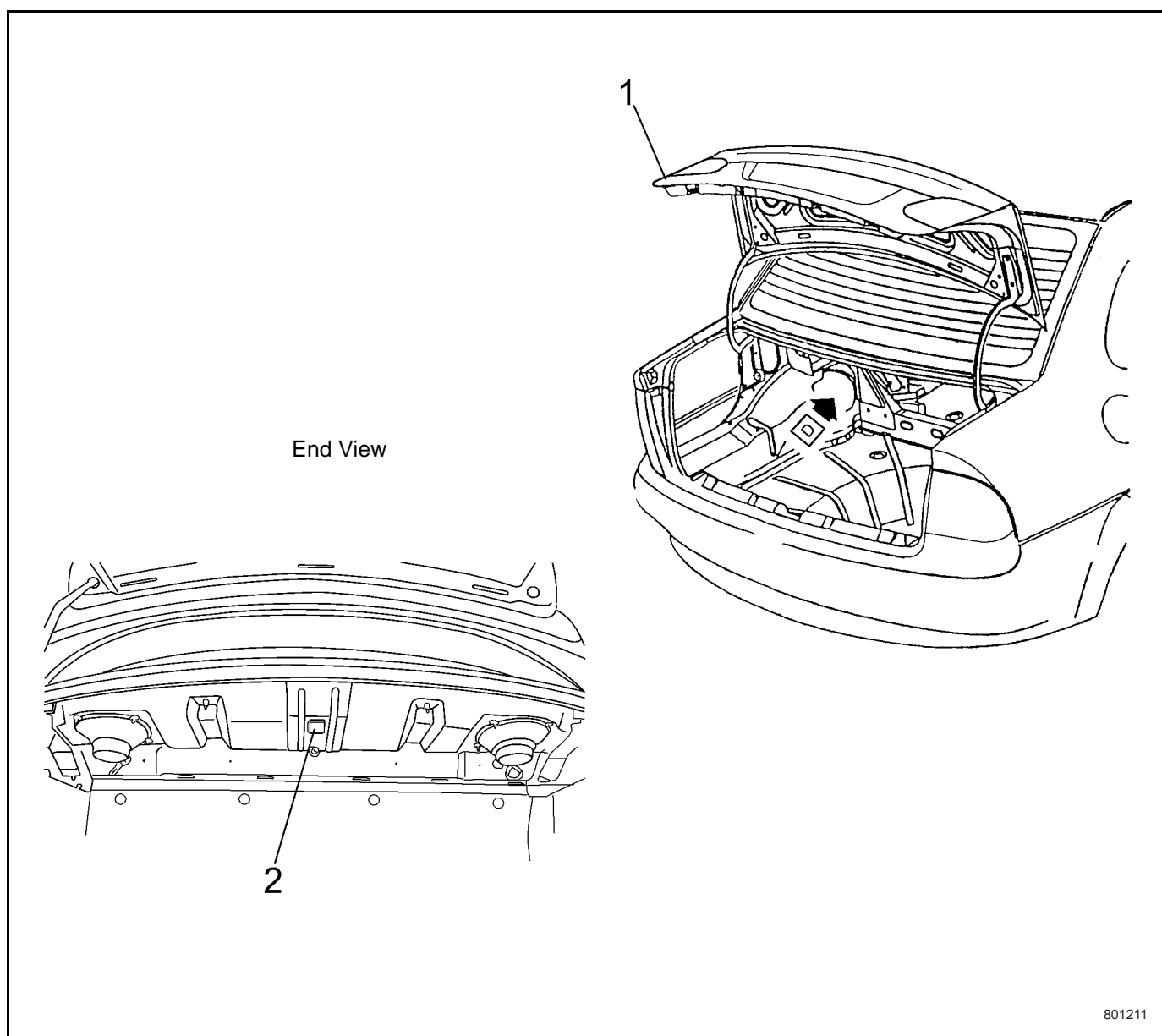


Legend

(1) Bezel

(2) Reading Lamp

8.1.3.11A Trunk Lamp

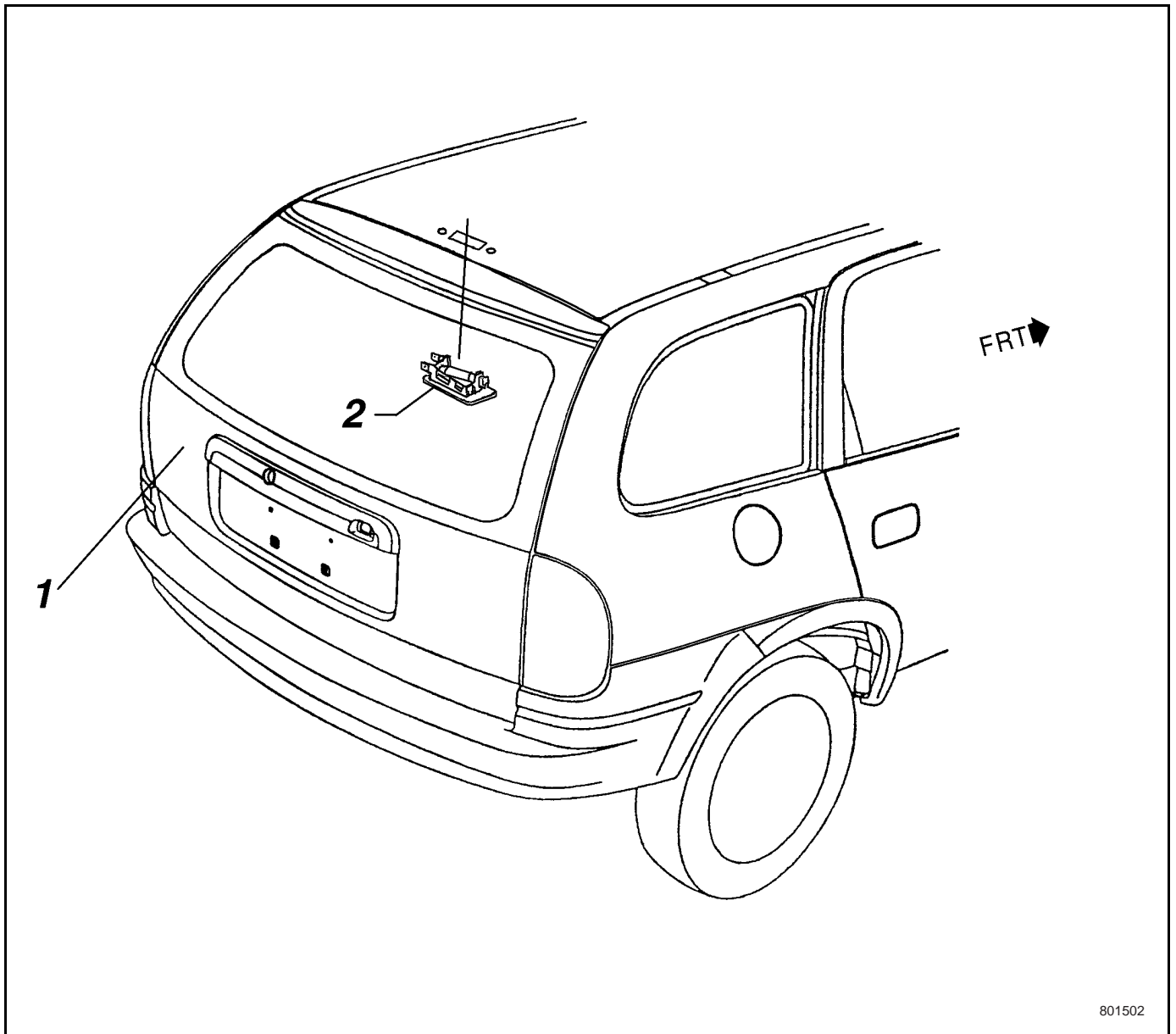


Legend

(1) Trunk Lid

(2) Trunk Lamp

8.1.3.11B Rear Compartment Lamp



801502

Legend

(1) Rear Lift Gate

(2) Rear Compartment Lamp

8.1.4 Diagnostic Information and Procedures

8.1.4.1 High Mounted Stop Lamp Inoperative

Step	Action	Yes	No
1	Check fuse F21 Is it open?	Go to Step 4	Go to Step 2
2	Using a test lamp, connect between the two terminals of the stop lamp switch. Does the test lamp illuminate?	Go to Step 5	Go to Step 3
3	1. Using a test lamp, connect between the two terminals of the CHMSL. 2. Depress and hold the brake pedal. Does the test lamp illuminate?	Go to Step 6	Go to Step 7
4	Replace the fuse F21.	—	Go to Interior Lighting System Check
5	Replace the stop lamp switch.	—	Go to Interior Lighting System Check
6	Replace the high mounted stop lamp.	—	Go to Interior Lighting System Check
7	Repair the wiring harness with a poor connection.	—	Go to Interior Lighting System Check

8.1.4.2 Dome Lamp Inoperative

Step	Action	Yes	No
1	Inspect the dome lamp bulb filament for an open. Did you find an open?	Go to Step 4	Go to Step 2
2	Inspect fuse F1 is the fuse open?	Go to Step 5	Go to Step 3
3	Using a test lamp, connect between the two terminals of the contact switches (LHF, RHF, LHR, RHR), and terminal 4 and 2 of the lighting switch. Does the test lamp illuminate?	Go to Step 6	Go to Step 7
4	Replace the bulb.	—	Go to Interior Lighting System Check
5	Replace the fuse.	—	Go to Interior Lighting System Check
6	Replace the contact switch or lighting switch.	—	Go to Interior Lighting System Check
7	Repair the wiring harness with a poor connection.	—	Go to Interior Lighting System Check

8.1.4.3 Dome Lamp Always ON

The dome lamp stays ON under the following conditions:

- All of the doors are closed.
- The lighting switch is OFF. Troubleshooting Steps:
 - Inspect the left front contact switch; replace it if the malfunction occurs.
 - Inspect the right front contact switch; replace it if the malfunction occurs.
 - Inspect the left rear contact switch; replace it if the malfunction occurs.
 - Inspect the right rear contact switch; replace it if the malfunction occurs.
 - Inspect the lighting switch; replace it if the malfunction occurs.

8.1.4.4A Reading Lamp Inoperative

Step	Action	Yes	No
1	Inspect the reading lamp bulb filament for an open. Did you find an open?	Go to Step 4	Go to Step 2
2	Inspect fuse F1 is the fuse open?	Go to Step 5	Go to Step 3
3	Using a test lamp, connect between the two terminals of the contact switches (LHF, RHF, LHR, RHR), and terminal 4 and 2 of the lighting switch. Does the test lamp illuminate?	Go to Step 6	Go to Step 7
4	Replace the bulb.	—	Go to Interior Lighting System Check
5	Replace the fuse.	—	Go to Interior Lighting System Check
6	Replace the contact switch or lighting switch.	—	Go to Interior Lighting System Check
7	Repair the wiring harness with a poor connection.	—	Go to Interior Lighting System Check

Note: The reading lamp switch stays at the Middle position while checking.

8.1.4.5 Reading Lamp Always On

The reading lamp stays ON under the following conditions:

- All of the doors are closed.
- The lighting switch is OFF. Troubleshooting Steps:
 - Inspect the left front contact switch; replace it if the malfunction occurs.
 - Inspect the right front contact switch; replace it if the malfunction occurs.
 - Inspect the left rear contact switch; replace it if the malfunction occurs.
 - Inspect the right rear contact switch; replace it if the malfunction occurs.
 - Inspect the lighting switch; replace it if the malfunction occurs.

8.1.4.6 Trunk Lamp Inoperative

Step	Action	Yes	No
1	Inspect the trunk lamp bulb filament for an open. Did you find an open?	Go to Step 4	Go to Step 2
2	Check fuse F1 Did you find an open?	Go to Step 5	Go to Step 3
3	Using a test lamp, connect between the two terminals of the trunk lamp switch. Does the test lamp illuminate?	Go to Step 6	Go to Step 7
4	Replace the bulb.	—	Go to Interior Lighting System Check
5	Replace the fuse.	—	Go to Interior Lighting System Check
6	Replace the trunk lamp switch.	—	Go to Interior Lighting System Check
7	Inspect and repair the wiring harness with a poor connection.	—	Go to Interior Lighting System Check

8.1.4.7 High/low beam lamp diagnostic procedure

A: all high/low beam lamp are not work.	Yes	No
1. Turn the light switch to " " position, turn the high/low beam switch to high beam position. Check the Fuse 10, 12, 25, 27, are they ok?	Go to Step 2	Go to Step 3
2. Please measure the voltage of the fuse NO.10, 12, 25, 27, is it normal?	Go to Step 7	Go to Step 4
3. Please replace the damaged fuse, and is it still damaged?	Go to Step 7	Go to Step 2
4. Please check the high/low beam switch, confirm that there is no problem.	Go to Step 5	—
5. Please check the light switch, confirm that there is no problem.	Go to Step 6	—
6. Please check the I/P wire harness, according to the schematic diagram.	—	—
7. Check the high beam telltale if it is operative?	Go to Step 8	Go to Cluster Diagnostic
8. Please check the high/low beam lamps and it's connectors to wire harness, be confirm it's ok.	Go to Step 9	—
9. Check the Pin 1 of the lamp connector for a good ground of the wire.	Go to Step 10	—
10. Separate the connector (X1) between the I/P and the Front Body wire harness, check the voltage of the pins: Are the voltages of these pins OK?	Go to Step 11	Go to Step 12
11. Confirm that the connectors contact well, and check the front body wiring harness which is from the connector to the lamps according to the schematic diagram.	—	—
12. Confirm that the connectors contact well, and check the I/P wiring harness, from the fuse to the connector according to the schematic diagram.	—	—

B. Only the high beam lamps are not work	Yes	No
1. Check the high beam telltale, is it operative? (for high beam only)	Go to Step 2	Go to Step 3
2. Please check the lamps and their wiring harness connector, confirm that there is no problem when switching to the high beam position.	Go to Step 3	—
3. Separate the connector (X1) between the I/P and Front Body wire harness, measure the voltage of the pins: B11, C1, is it normal?	Go to Step 4	Go to Step 5
4. Please check the Front Body wire harness from the connector to the high beam lamps, according to the schematic diagram.	Go to Step 6	—
5. Please check the I/P wire harness from the fuse to the connector (X1), according to the schematic diagram.	—	—
6. Check the fuse NO.10, 25, it's ok?	Go to Step 7	Go to Step 9
7. Measure the voltage of the fuse NO.10, NO.25, it's ok?	Go to Step 8	Go to Step 11
8. Please check the I/P wire harness from the fuse to the connector (X1).	Go to Step 10	—
9. Replace the fuse, and is it still damaged?	Go to Step 8	Go to Step 7
10. Check the connector (X1) and the Front Body wire harness.	Go to Step 2	—
11. Check the high/low beam switch and the I/P wiring harness from the switch to the fuse.	—	—

C. Only the low beam lamps are not work	Yes	No
1. Please check the lamps and their wiring harness connectors. Confirm that there is no problem.	Go to Step 2	—
2. Check the fuse NO.10, 27, it is ok?	Go to Step 3	Go to Step 8
3. Measure the voltage of the fuse, is it normal?	Go to Step 4	Go to Step 7
4. Please check the connector (X1) between the I/P and the Front Body wire harness, measure the voltage of the pin: C4, C5, it is normal?	Go to Step 5	Go to Step 6
5. Check the front body wiring harness.	—	—
6. Check the I/P wiring harness.	—	—
7. Check the high/low beam switch and the I/P wiring harness from the switch to the fuse.	—	—
8. Replace the fuse, and is it still damaged?	Go to Step 4	Go to Step 3

D. Only one of the high or low beam lamps is not work	Yes	No
1. Please check the lamp and their wiring harness connector.	Go to Step 2	—
2. Check the fuse according to the schematic diagram.	Go to Step 3	—
3. Check the connector (X1) and the I/P or front Body wire harness.	—	—

8.1.4.8 Diagnostic Procedures for Parking / Tail Lamps

A. All the parking / tail lamps are not work	Yes	No
1. Turn the light switch to " " position. Check fuses 8 and 23, are they OK?	Go to Step 2	Go to Step 3
2. Use the DMM to measure the voltage of the fuse (NO.8 and NO.23) is ok?	Go to Step 4	Go to Step 7
3. Replace the fuse, and is it still damaged?	Go to Step 4	Go to Step 1
4. Check the /P wire harness and the connectors (X1, X5) to the Front Body and Rear Body wire harness, is it ok?	Go to Step 6	Go to Step 5
5. Repair or replace the wiring harness or connectors.	—	—
6. Check the front body and rear body wiring harness.	—	—
7. Remove the light switch and have it checked, does it work well?	Go to Step 9	Go to Step 8
8. Replace the light switch	—	—
9. Check the light switch connector and I/P harness.	—	—

B. The Right or Left Side of Parking / Tail Lamps are not work	Yes	No
1. Turn the light switch to " " position, check fuses 23 (right) and 8 (left), are they OK?	Go to Step 2	Go to Step 3
2. Check the /P wire harness and the connectors (X1, X5) to the Front Body and Rear Body wire harness, is it ok?	Go to Step 4	Go to Step 5
3. Replace the fuse, and is it still damaged?	Go to Step 2	Go to Step 1
4. Check the front body and rear body wiring harness.	—	—
5. Repair the wire harness or connectors.	—	—

C. The Front (parking) or Rear (tail) lamps are not work	Yes	No
1. Separate the connector to Front Body harness (X1) or connector to Rear Body harness (X5). Check the voltage at Pins B10 and B12 (X1) or Pins B5 and B7 (X5). Are they OK?	Go to Step 3	Go to Step 2
2. Replace the lamp.	—	—
3. Check the front body harness or rear body harness.	—	—

D. Only one parking or tail lamp is not work	Yes	No
1. Please check the lamp is ok?	Go to Step 3	Go to Step 2
2. Replace the lamp.	—	—
3. Check the pin voltage of the connector between the lamp and the wiring harness, is it OK?	Go to Step 4	Go to Step 5
4. Confirm that the connectors contact well.	—	—
5. Please check the wiring harness.	—	—

8.1.4.9 Diagnostic Procedures for Front / Rear Fog Lamps

A. The Below Procedure for Front / Rear Fog Lamps	Yes	No
1. Turn the light switch to " " position, turn on the front fog lamp switch. Check the indicator on the switch, is it OK?	Go to Step 7	Go to Step 2
2. Check Fuse NO.9 is ok?	Go to Step 4	Go to Step 3
3. Replace the damaged fuse.	Go to Step 4	—
4. Remove the front fog lamp relay, measure the voltages at the pins 1 & 5 of the relay, are the voltages normal?	Go to Step 6	Go to Step 5
5. Please check the I/P wire harness and the front fog lamp switch, according to the circuit diagram, is the circuit ok? repair it if necessary.	—	—
6. Replace the relay, the fog lamps are ok?	—	Go to Step 7
7. Please check the fog lamp connector, ensure that the voltage and the ground pin have no problem.	Go to Step 8	—
8. Check the I/P wiring harness from the relay to the fog lamps according to the circuit diagram.	—	—

B. The Below Procedure for Front / Rear Fog Lamps		
I. When the low beam lamps be turned on the rear fog lamps are not work.	Yes	No
1. Remove the rear fog lamp relay, turn on the low beam lamps, measure the voltage at pin 2 of the relay, is the voltage normal?	Go to Step 3	Go to Step 2
2. Check the I/P wiring harness between the light switch and the rear fog lamp relay according to the circuit diagram. Repair it as necessary.	—	—
3. Replace the relay and check the I/P wiring harness.	—	—

II . When the front fog lamps are turned on, the rear fog lamps don't work	Yes	No
1. Remove the rear fog lamp relay, turn on the front fog lamps, measure the voltage at pin 1 of the relay, is the voltage normal?	Go to Step 2	Go to Step 4
2. Please replace the relay, the rear fog lamps are ok?	—	Go to Step 3
3. Please check the I/P wiring harness to pin 4 of the relay.	—	—
4. Please check the I/P wiring harness from the front fog lamp switch to the relay.	—	—

III . When the front fog lamps and the low beam lamps are turned on at the same time, but the rear fog lamps do not work	Yes	No
1. Turn on the low beam lamps and the front fog lamps, turn on the rear fog lamps switch, is the indicator on the switch operative?	Go to Step 2	Go to Step 6
2. Please check the rear fog lamps and the connector to the wiring harness, be sure that the voltage and ground pin have no problem.	Go to Step 3	Go to Step 11

III . When the front fog lamps and the low beam lamps are turned on at the same time, but the rear fog lamps do not work	Yes	No
3. Please check the in NO.C11 on the connector (X5) between the I/P and the Rear Body wire harness, measure the voltage is ok?	Go to Step 4	Go to Step 5
4. Please check the Rear Body wire harness from the connector (X5) to the rear fog/lamps.Repair it as necessary.	—	—
5. Please check the I/P wire harness from the rear fog lamp switch to the connector (X5).Repair it as necessary.	—	—
6. Remove the rear fog lamps switch, measure the voltage at pin 3 of the connector on the wiring harness, is the voltage OK?	Go to Step 7	Go to Step 8
7. Please replace the rear fog lamps switch, are the rear fog lamps OK?	—	Go to Step 3
8. Please replace the relay, the rear fog lamps are ok?	—	Go to Step 9
9. Check the I/P wiring harness from the relay (pin 5) to the switch (pin 3), be sure that it has no problem.	Go to Step 10	—
10. Please check the I/P wiring harness to the rear fog lamps relay (pins 2, 4, 1 and 3).Repair it as necessary.	—	—
11. Replace the rear fog lamps.	—	—

8.1.4.10 Diagnostic Procedures for Back Up Lamps

A. The back up lamps are not work.	Yes	No
1. Check the Fuse 18, is it OK?	Go to Step 3	Go to Step 2
2. Replace the damaged fuse, are the back up lamps OK?	—	Go to Step 3
3. Check the connector (X5) between the I/P and Rear Body wire harness.Measure the voltage at pin B9 , is it normal?	Go to Step 4	Go to Step 6
4. Please check the back up lamps and its connector to the wiring harness, be sure that it has no problem.	Go to Step 5	Go to Step 10
5. Please check the Rear Body wire harness from the connector (X5) to the rear fog/lamps.	—	—
6. Separate the connector of the back up lamp switch, measure the voltage at pin B, is it OK?	Go to Step 8	Go to Step 7
7. Please check the I/P wiring harness from fuse 18 to the back up lamp switch (pin B).	—	—
8. Check the I/P wire harness from the connector of the back-up switch (pin A) to the connector (X5), be sure it has no problem.	Go to Step 9	—
9. Check the back up lamp switch, and Repair it as necessary.	—	—
10. Replace the back up lamps.	—	—

8.1.4.11 Diagnostic Procedures for the Brake Lamps

A. All the brake lamps and high level brake lamps are not work.	Yes	No
1. Turn the ignition switch to ON position, check the fuse NO.21, this fuse is ok?	Go to Step 3	Go to Step 2
2. Replace the fuse, and is it still damaged?	Go to Step 5	Go to Step 3
3. Measure the voltage of the fuse, is it normal?	Go to Step 5	Go to Step 4
4. Please check the I/P wiring harness.	—	—
5. Separate the brake switch connector, and check the brake switch, be sure that the brake switch has no problem. Measure the voltage of pin 2, is it normal?	Go to Step 7	Go to Step 6
6. Check the I/P wiring harness from the fuse to the brake switch.	—	—
7. Check the connector (X5) between the I/P and the Rear Body wire harness, be sure it has no problem.	Go to Step 8	—
8. Please check the Rear Body wire harness from the connector (X5) to the brake lamps.	Go to Step 9	—
9. Please check the brake lamps and their connectors to the wiring harness.	Go to Step 10	—
10. Please check the rear body harness grounding point. Be sure it is grounding well.	—	—

8.1.4.12 Diagnostic Procedure for Turn Signal and Harzard Lamps

A. All the lamps don't work, when the turn signal or hazard switch are turned on.	Yes	No
1. Please check the fuse F1 and F21, is it ok?	Go to Step 3	Go to Step 2
2. Replace the damaged fuse.	Go to Step 3	—
3. Tear down the flash relay, use the DMM to measure the voltage of pin 6 on the relay home, is voltage normal?	Go to Step 7	Go to Step 4
4. Remove the hazard lamp switch, use the DMM to measure the voltage at pin 6 and pin 9 of the switch, are the voltages normal?	Go to Step 5	Go to Step 6
5. Please check the hazard lamp switch and the I/P harness from the hazard lamp switch (pin 3) to flash relay (pin 6).	—	—
6. Please check the I/P wiring harness from fuses 1 and 21 to the hazard switch.	—	—
7. Check the flash relay, ensure that it has no problem, check the ground wire (pin 4) of the relay, ensure that it grounds well.	Go to Step 8	—
8. Check the I/P wire harness from the relay home (pin 8) to the hazard switch home (pin 1) and turn signal switch home (pin 4). Repair it as necessary and ensure that it has no problem.	Go to Step 9	—
9. Check the hazard switch and turn signal switch, please replace it as necessary and ensure that it has no problem.	Go to Step 10	—
10. Please check the turn signal lamps and their connectors to the wiring harness.	Go to Step 11	—
11. Please check the I/P wiring harness and front body, rear body wiring harness, Repair it as necessary.	Go to Step 12	—

8.1.4.12 Diagnostic Procedure for Turn Signal and Harzard Lamps(Cont' d)

A. All the lamps don't work, when the turn signal or hazard switch are turned on.	Yes	No
12. Check the connector (X1, X5) between the I/P and the Front Body. Rear Body wire harness.	—	—

B. The hazard lamps don't work, but the turn signal lamps are no problem	Yes	No
1. Please check fuse 1, is it OK?	Go to Step 3	Go to Step 2
2. Replace the damaged fuse, the hazard lamps are ok?	—	Go to Step 3
3. Remove the hazard switch, check it and ensure that the switch has no problem.	Go to Step 4	—
4. Check voltage wire of the hazard switch home (pin 6) is the voltage normal?	Go to Step 6	Go to Step 5
5. Please check the I/P wire harness from the Fuse (NO.1) to the hazard switch(pin 6).	—	—
6. Check the ground wire of the hazard switch home (pin 2) it is grounding well?	Go to Step 8	Go to Step 7
7. Check the ground wire of the I/P wiring harness.	—	—
8. Check the I/P wire harness about the wires to the hazard switch home (pin 1, pin 4, pin 7).	—	—

C. The turn signal lamps are not work, but the hazard lamps are no problem	Yes	No
1. Check Fuse 21, is it OK?	Go to Step 3	Go to Step 2
2. Replace the damaged fuse, and the turn signal lamps are ok?	—	Go to Step 3
3. Remove the hazard switch, measure the voltage at pin 9 of the switch, is the voltage normal?	Go to Step 5	Go to Step 4
4. Please check the I/P wire harness from the Fuse (NO.21) to hazard switch home (pin 9).	—	—
5. Check the hazard switch for pins 9 and 3, ensure that it has no problem.	Go to Step 6	—
6. Tear down the turn signal switch, check the I/P wire harness from the flash relay (pin 8) to the switch home (pin 4), and check the turn signal switch.	Go to Step 7	—
7. Check the I/P wiring harness from the turn signal switch.	—	—

D. All the lamps are lighted on all the time not flash.	Yes	No
1. Please Remove the flash relay, check the integrity of the wires to the relay, and check the relay if necessary.Please replace it, are the lamps OK?	—	Go to Step
2. Please check the wire harness system according to the circuit diagram.	—	—

E. The Turn Signal or Hazard lamps are no problem, but the indicator don't work. Please see the diagnostic procedure of the instrument cluster		
I. The Left (Right) side Lamps don't work, but the other side are ok.	Yes	No
1. Please tear down the turn signal switch or the hazard switch, check it, if necessary. Please replace it The lamp is OK?	—	Go to Step 2
2. Please check the wire harness system from the switch to the lamps.	—	—

II . The only front (or rear) lamps are not work	Yes	No
1. Separate the connector X1 (or X5), use the DMM to measure the voltage of the pin C3 (or B1) and pin C2 (or B2), the voltage is normal?	Go to Step 3	Go to Step 2
2. Check the I/P wire harness from the turn signal or hazard switch to the connector.	—	—
3. Check the connector X1 (or X5), be confirm it contact well.	Go to Step 4	—
4. Check the wire harness from the connector X1 (or X5) to the lamps.	Go to Step 5	—
5. Check the lamps and its connector to the wire harness.	—	—

III . Only one or two lamps don't work.	Yes	No
1. Please check the lamps and its connector to the wire harness, be sure the lamps and the voltage or ground wire is no problem.	Go to Step 2	—
2. Please check the wire harness according to the circuit diagram.	—	—

8.1.4.13A Interior Lightign System Check

Step	Action	Normal Result(s)	Abnormal Result(s)
1	Depress and held the brake pedal.	The HMSL is illuminated	The HMSL is not illuminated
	Release the brake pedal	The HMSL goes out	The HMSL is illuminated
2	Close all doors, and put the light switch on 0 position	The dome lamp goes out	The dome lamp is illuminated
	Open any of the doors, or put the light switch on " " or " " position	The dome lamp is illuminated	The dome lamp is not illuminated
3	(1) Place the reading lamp switch at MIDDLE position (2) Close all doors, and put the light switch on 0 position	The reading lamp goes out	The reading lamp is illuminated
	(1) Place the reading lamp switch at MIDDLE position (2) Open any of the doors, or put the light switch on " " or " " position	The reading lamp is illuminated	The reading lamp is not illuminated
4	Open the glove box lid	The glove box lamp is illuminated.	The glove box lamp is not illuminated.
	Close the glove box lid.	The glove box lamp goes out.	The glove box lamp is illuminated.

8.1.4.13A Interior Lightign System Check(Cont' d)

Step	Action	Normal Result(s)	Abnormal Result(s)
5	Open the trunk lid	The trunk lamp is illuminated.	The trunk lamp is not illuminated.
	Close the trunk lid	The trunk lamp goes out.	The trunk lamp is illuminated.

8.1.4.13B Interior Lighting System Check

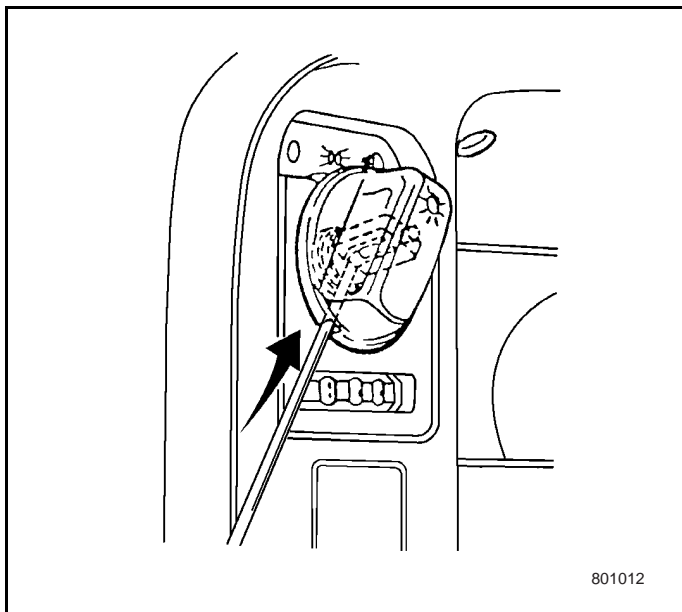
Step	Action	Normal Result(s)	Normal Result(s)
1	Depress the brake pedal	The HMSL is illuminated	The HMSL is not illuminated
	Release the brake pedal	The HMSL goes out	The HMSL is illuminated
2	Close all doors, and put the light switch on 0 position.	The dome lamp goes out.	The dome lamp is illuminated.
	Open any of the doors, or place the light siwtch at " " or " "	The dome lamp is illuminated.	The dome lamp is not illuminated.
3	Open the glove box lid	The glove box lamp is illuminated.	The glove box lamp is not illuminated.
	Close the glove box lid	The glove box lamp goes out.	The glove box lamp is illuminated.
4	Open the rear lift gate.	The rear compartment lamp is illuminated.	The rear compartment lamp is not illuminated.
	Close the tail gate.	The rear compartment lamp goes out.	The rear compartment lamp is illuminated.

8.1.5 Repair Instructions

8.1.5.1 Light Switch Replacement

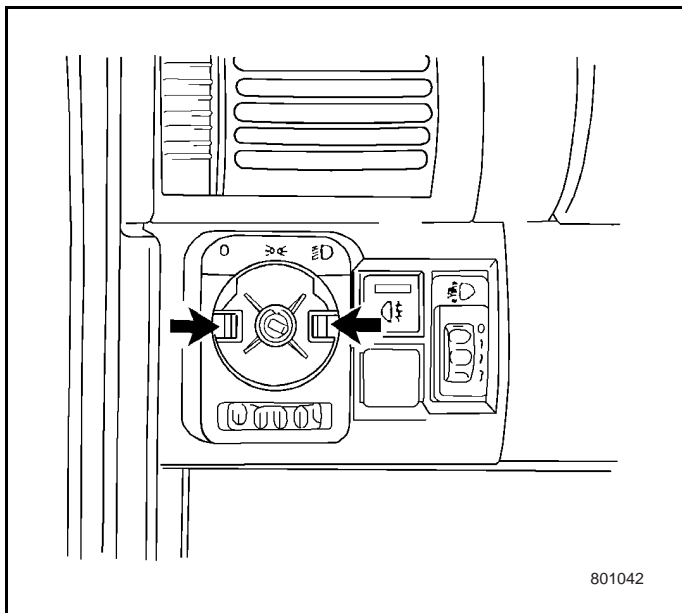
Removal procedure

1. Turn the knob to low beam position and pull it out.
2. Use a small tool inserting into the gap, then tear it down.



Installation Procedure

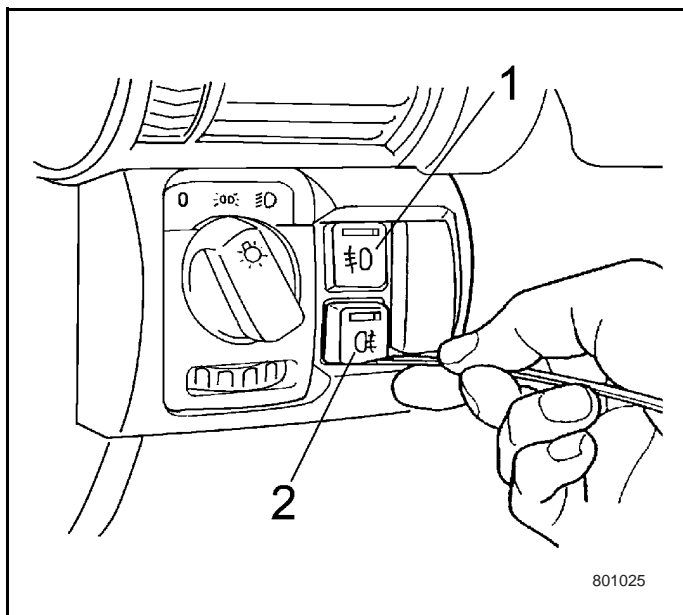
1. Insert the light switch into the instrument panel, push the knob till end.



8.1.5.2 Fog Lamp Switch Replacement Front & Rear

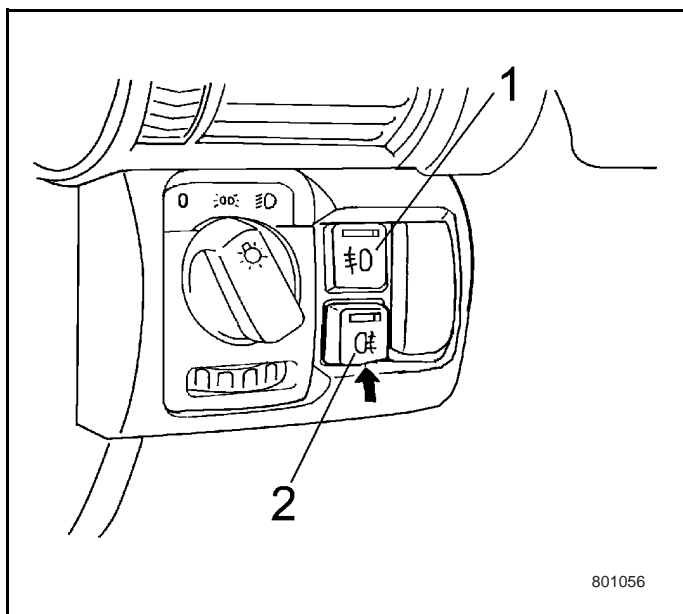
Removal procedure

1. Use a special tool to tear down the fog lamp switch (front 1/rear 2).



Installation Procedure

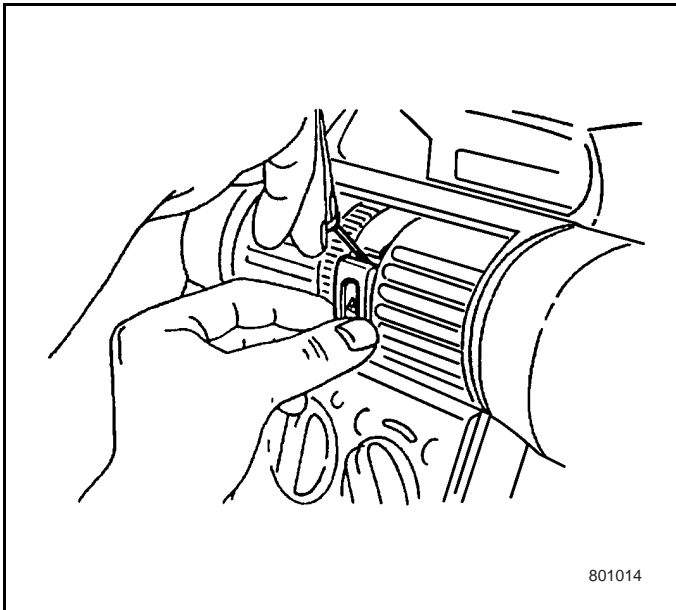
1. Insert the fog lamp switch (front 1/rear 2) to the hole of instrument.



8.1.5.3 Hazard Switch Replacement

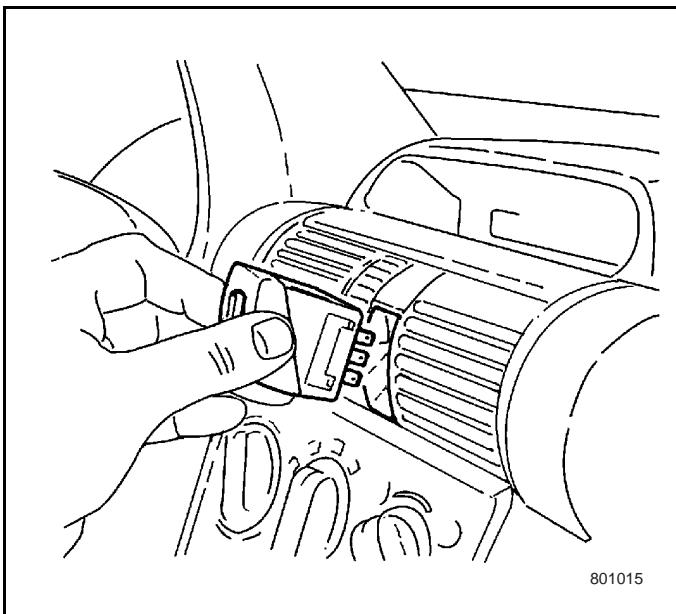
Removal procedure

1. Use a small screw driver to tear down the hazard switch.



Installation Procedure

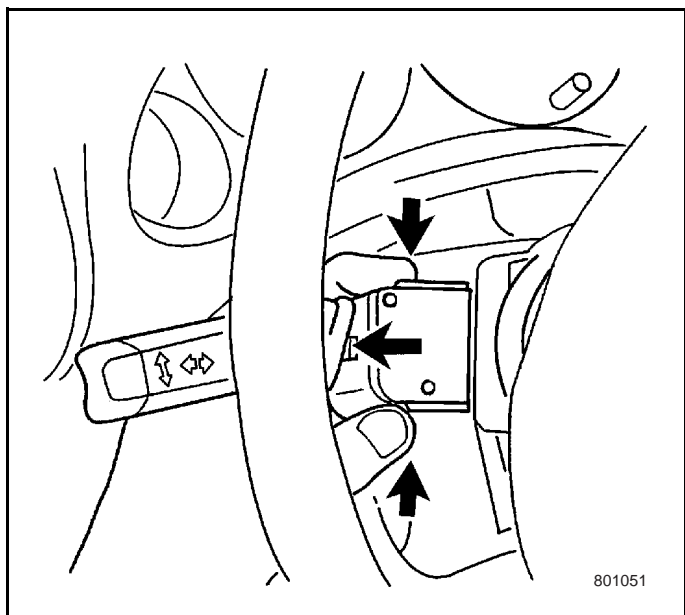
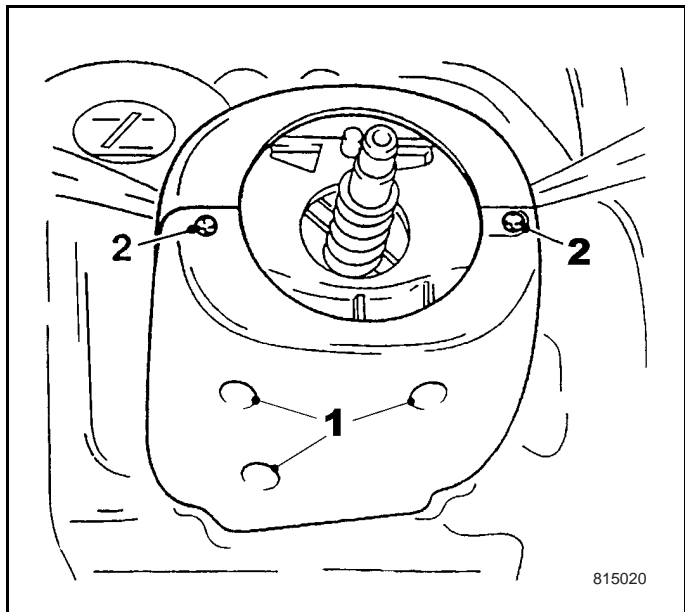
1. Insert the hazard switch into the hole of A/C control head till the end.



8.1.5.4 Turn Signal Switch Replacement

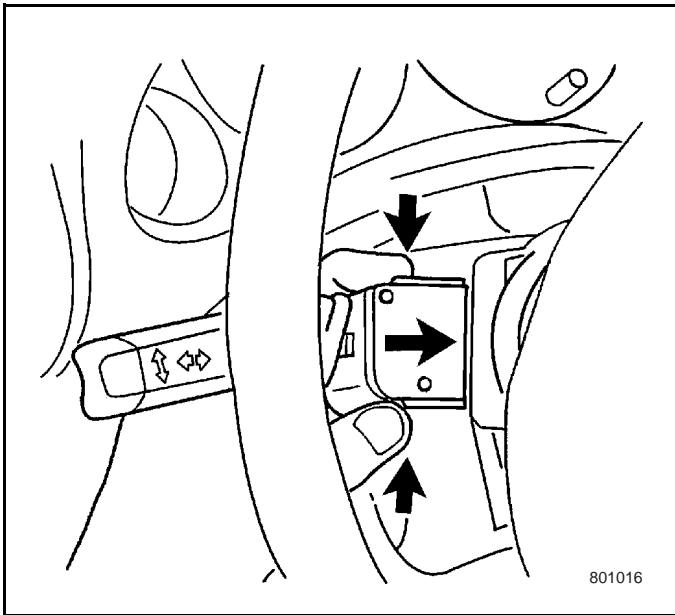
Removal procedure

1. Loosen the screw of steering column cover, and remove the cover.

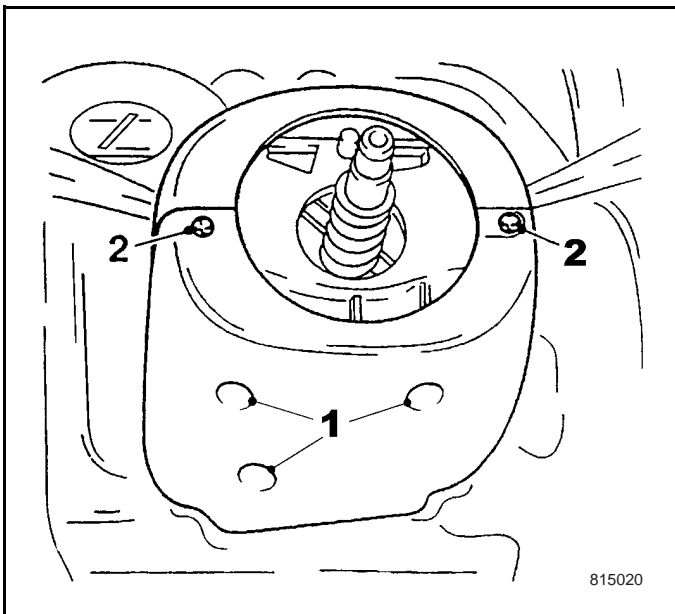


Installation Procedure

1. Insert the signal switch into the groove.



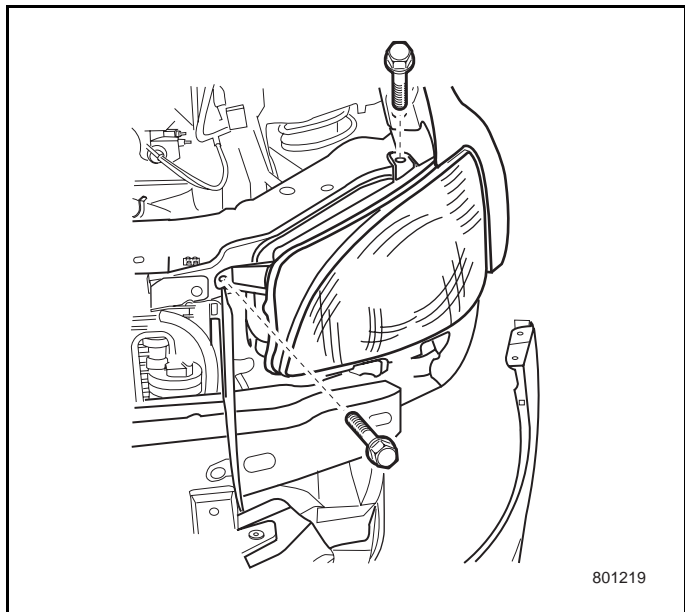
2. Install the steering column cover.



8.1.5.5 Headlamp Replacement

Removal procedure

1. Remove the front bumper fascia assembly. See Front bumper fascia Replacement
2. Remove headlamp attaching bolt.
3. Take the headlamp from the secured position out.
4. Remove electric connections.



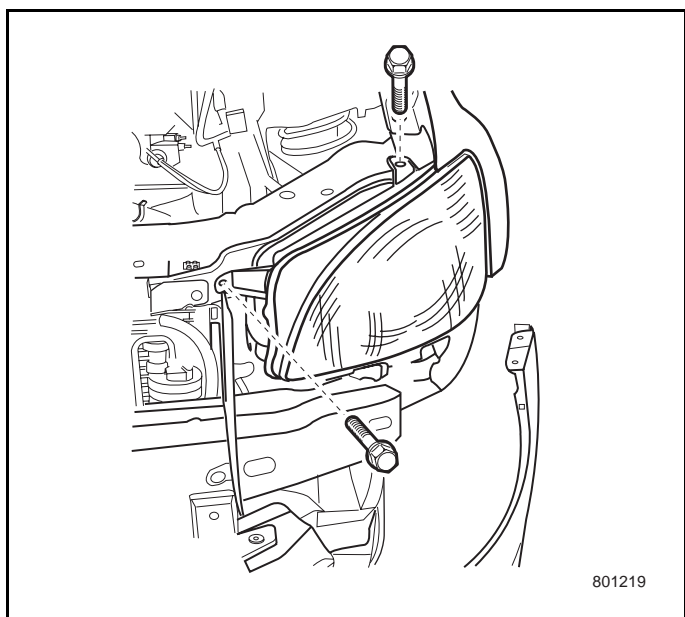
Installation Procedure

1. Electric connections to the headlamp assembly.
2. Install the headlamp assembly and its attaching bolt

Tightening

Tighten the front headlamp screw to 1.5-2.0 N•m.

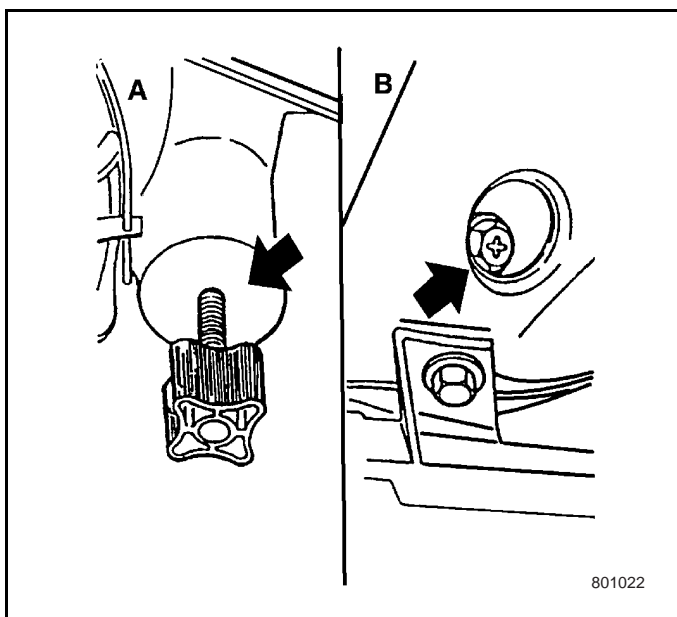
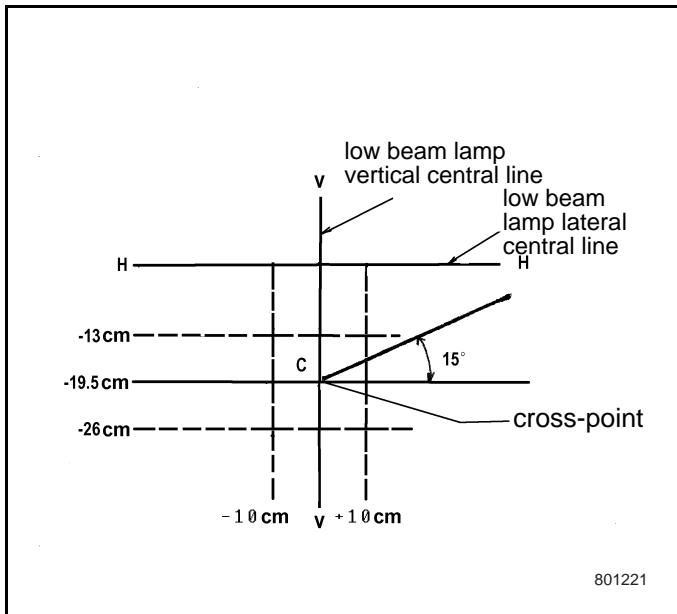
3. Install the front bumper fascia assembly. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.



8.1.5.6 Front Headlamp Aiming

The headlamps aiming adjustment should be made under the following conditions:

1. Vehicle at empty weight, plus fuel 4 liter.
2. Calibrated tires
3. Leveled floor
4. Headlamps height control set to in the Zero position that the distance from H-H to ground is 64.5 cm.
5. Place the adjusting board 10 meters from the vehicle front. When adjusting one headlamp, cover the other.
6. Adjust the low beam so that the horizontal limit of the light-dark zone is located $19.5 \text{ cm} \pm 6.5 \text{ cm}$ below the horizontal line H-H and that intersection point C of the horizontal limit with the inclined limit is located over the vertical line V-V, and the tolerance is $\pm 10 \text{ cm}$.
7. In the case of unavailable space, the measures can be proportionally reduced.
8. In vehicles without headlamp height adjustment, use vertical adjustment bolts shown on Figure A and lateral adjustment bolts shown in Figure B.

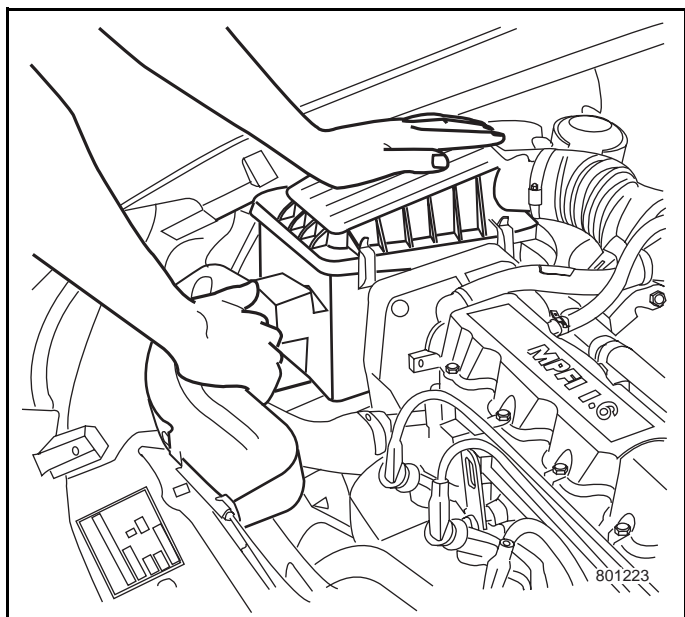


8.1.5.7 Front Headlamp (High/Low Beam) Bulb Replacement

Removal procedure

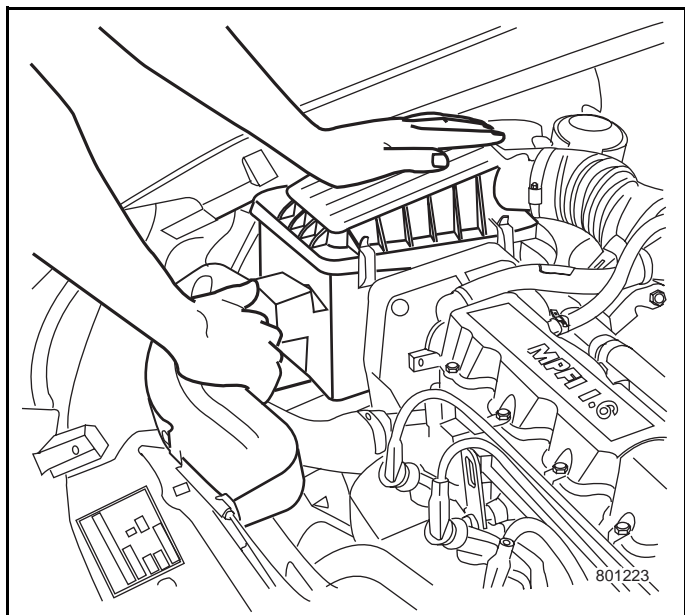
1. Open the engine hood.
2. Remove the inlet passage (for right side front headlamp).
3. Remove the electric connectors
4. Open the rubber cover, push the bulb clip out of the buttress, then substitute new bulb for bad bulb.

Note: Please take out the bulb with hand holding at the lamp seat when removing and placing the headlamp bulb.



Installation Procedure

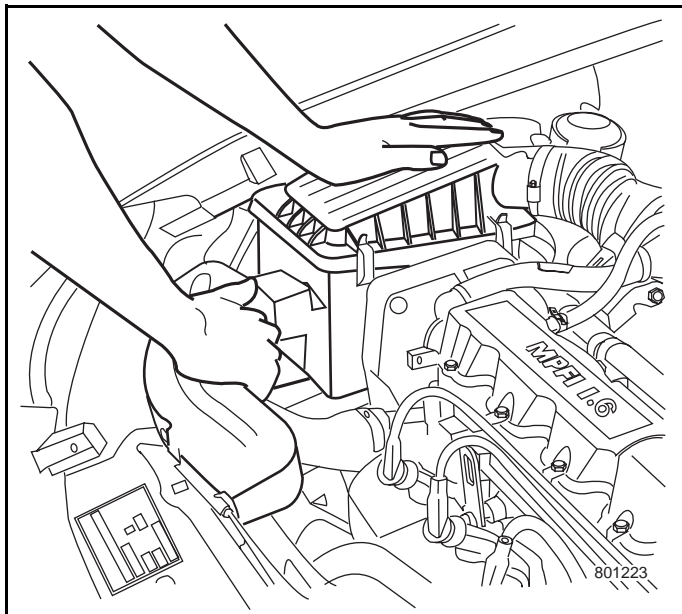
1. Install new bulb, and restore the bulb clamp to the position, then close the rubber cover.
2. Connect the appropriate electric connectors.
3. Install the inlet passage (right side front headlamp).
4. Close the Hood.



8.1.5.8 Turn Signal Bulb Replacement Front Headlamp

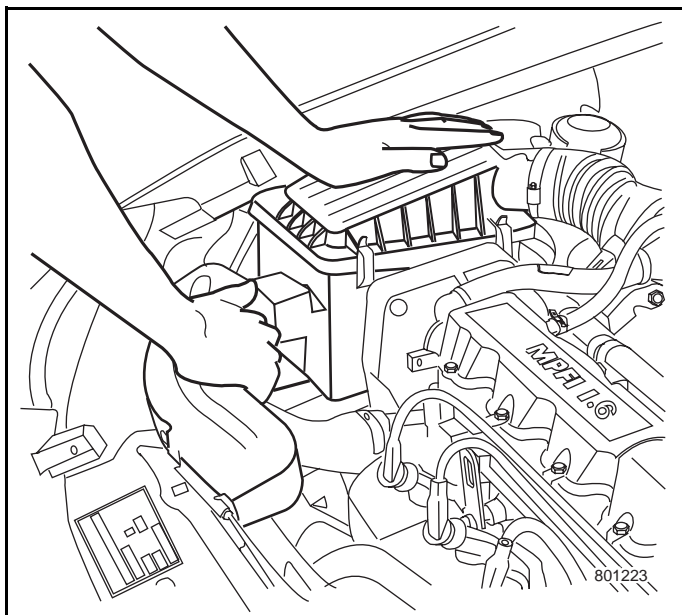
Removal procedure

1. Open the engine hood.
2. Remove the inlet passage (for right side front headlamp).
3. Rotate the bulb seat counter clockwise and take out the bad bulb.



Installation Procedure

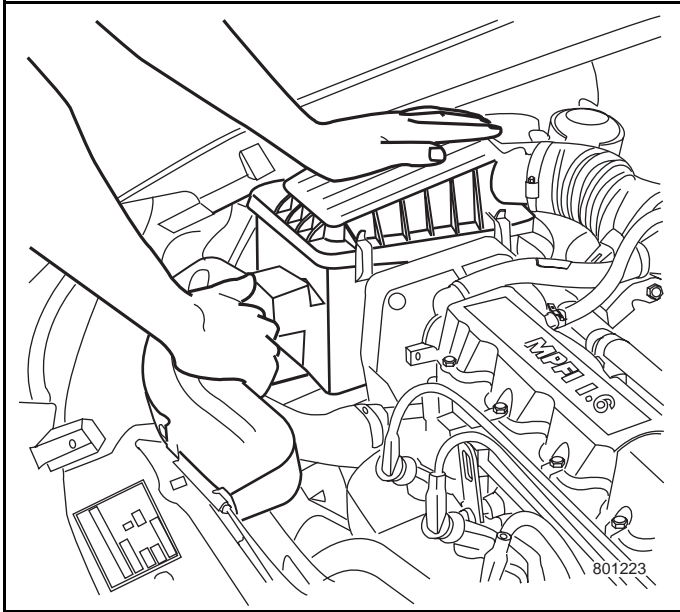
1. Install new bulb, and rotate the bulb seat counter clockwise.
2. Install the inlet passage (right side front headlamp).
3. Close the Hood.



8.1.5.9 Positioning Bulb Replacement - Headlamp

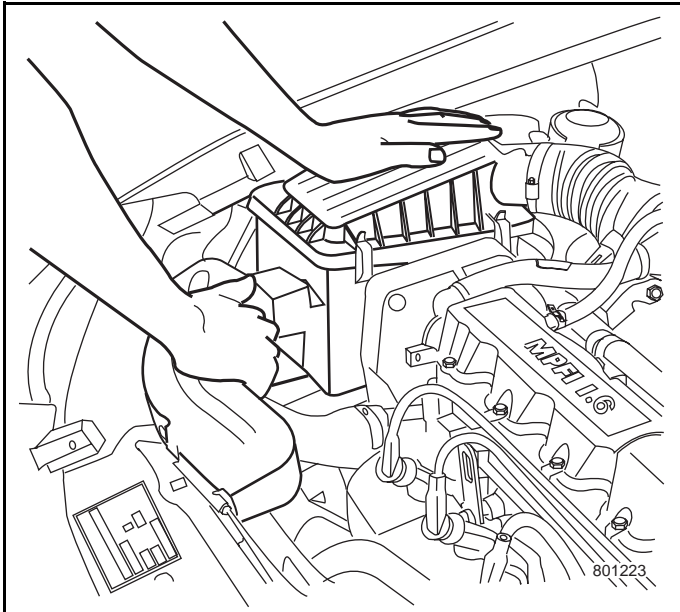
Removal procedure

1. Open the engine hood.
2. Remove the inlet passage (for right side front headlamp).
3. Rotate the bulb seat counter clockwise and take out the bad bulb.



Installation Procedure

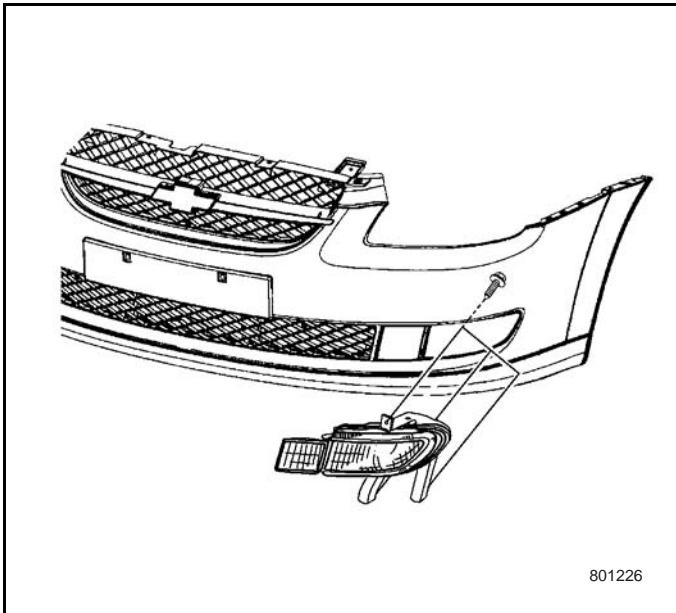
1. Install new bulb, and rotate the bulb seat counter clockwise.
2. Install the inlet passage (right side front headlamp).
3. Close the Hood.



8.1.5.10 Fog Lamp Replacement - Front

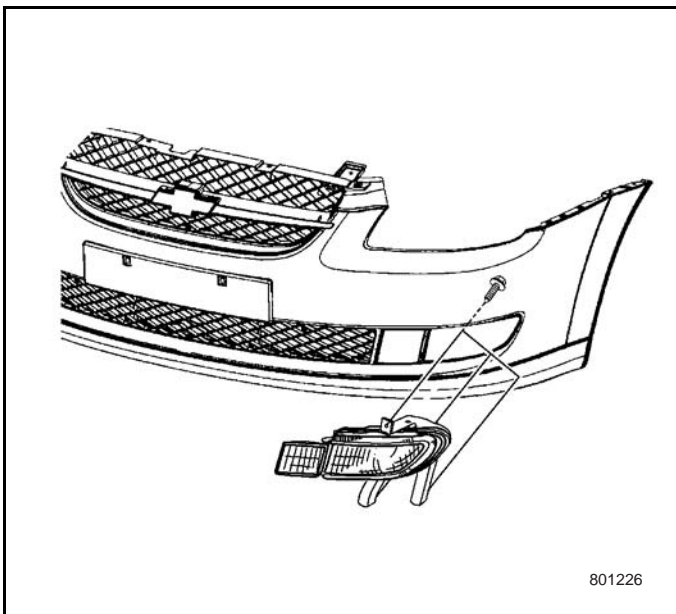
Removal procedure

1. Open the hood, remove the front fascia. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.
2. Remove the electric connections.
3. Remove the three bolts attached the fog lamp from front fascia. Then remove the fog lamp assembly.



Installation Procedure

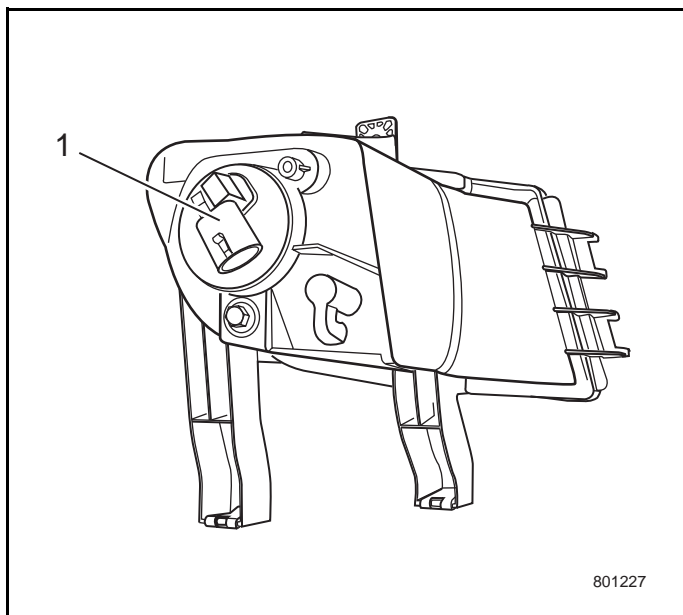
1. Install the fog lamp assembly and bolt
Tightening
Tighten the fog lamp bolt to 1.5-2.0 N.●m.
2. Connect electric connections.
3. Install the front bumper fascia assembly. See Front Bumper Fascia Replacement in Exterior Trims
4. Close the Hood.



8.1.5.11 Fog Lamp Bulb Replacement - Front

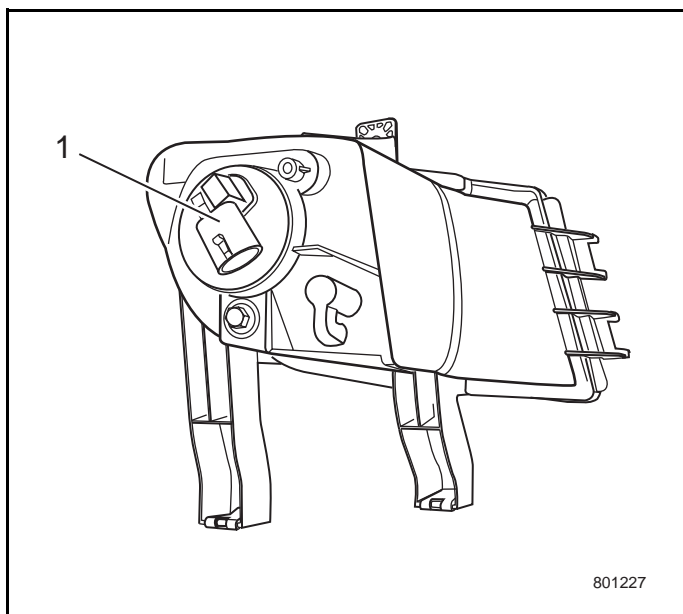
Removal procedure

1. Remove the front bumper fascia. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.
2. Remove the electric connections.
3. Rotate the bulb seat counter clockwise and take out the back of the bulb seat (1) and its circuit breaker.
4. Push down the bulb's clip out of the buttress and take out the bad bulb.



Installation Procedure

1. Install new bulb and restore the bulb clip to the position.
2. Place again the circuit breaker and the back (1) of the bulb seat, and rotate the bulb seat counter clockwise.
3. Connect electric connections.
4. Install the front bumper fascia assembly. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.
5. Close the Hood.

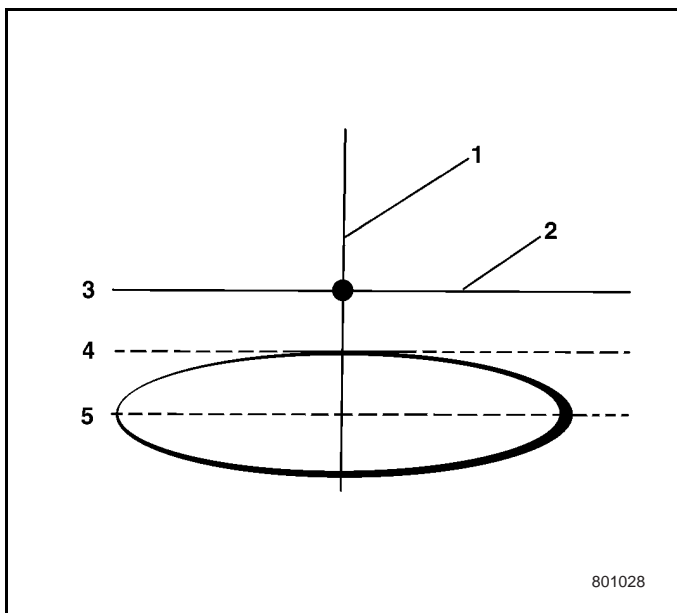


8.1.5.12 Fog Lamp Aiming-Front

The front fog lamps must be aimed for proper illumination of the road. The front fog lamp aim should be checked when a new fog lamp assembly is installed, or if service or repairs in the front end area may have disturbed the fog lamp mounting.

There is no horizontal adjustment for aiming the front fog lamp assemblies on this vehicle.

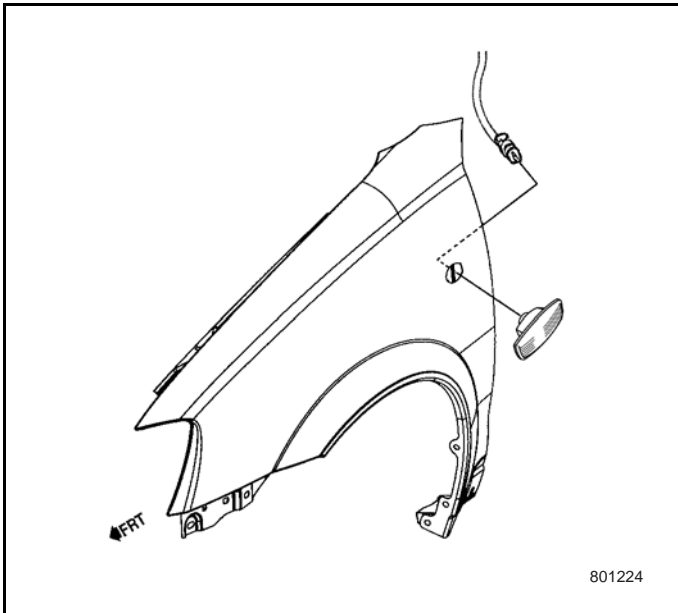
1. To ensure accurate vertical front fog lamp aiming, first perform the following steps to prepare the vehicle.
 - Make sure that all the components are in place on the vehicle, if other service has been performed on the vehicle.
 - Make sure the fuel level is full or less.
 - Place the vehicle on a level surface 1.52 m away from a target screen.
 - Stop all other operations of work on the vehicle.
 - Jounce the vehicle to settle the suspension.
 - Cover the headlamps while aiming the front fog lamps.
2. Turn the front fog lamps ON.
3. Insert a HEX driver in the underside of the front bumper fascia to access the fog lamp vertical adjustment screw.
4. Adjust the fog lamp up or down until the top edge of the high intensity zone on the screen is 102 mm (4 in) below the horizontal centerline (2), within the range of 0 mm (0 in) (3) to ground limits (5), below the horizontal centerline, on the target screen.
5. Turn OFF the front fog lamps.



8.1.5.13 Turn Signal Lamp Replacement

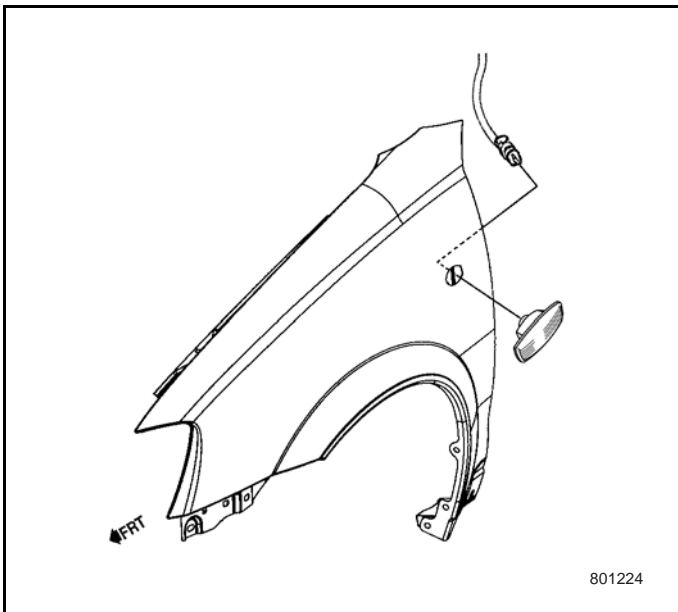
Removal procedure

1. Remove the turn signal lamp from the fender with screw driver.
2. Remove the electric connections.



Installation Procedure

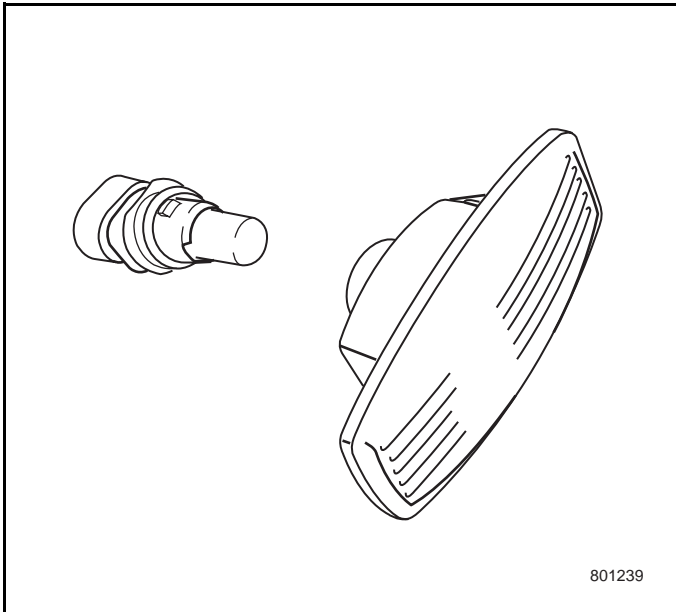
1. Connect electric connections.
2. Install the turn signal lamp on the fender.



8.1.5.14 Turn Signal Lamp Bulb Replacement

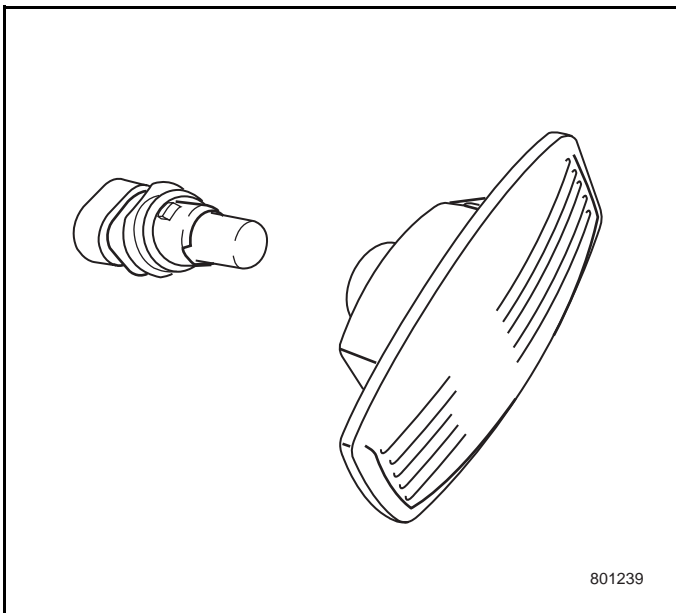
Removal procedure

1. Remove Turn Signal Lamp, Refer to Turn Signal Lamp Replacement.
2. Take off the bulb from the seat, then substitute bad bulb for new bulb.



Installation Procedure

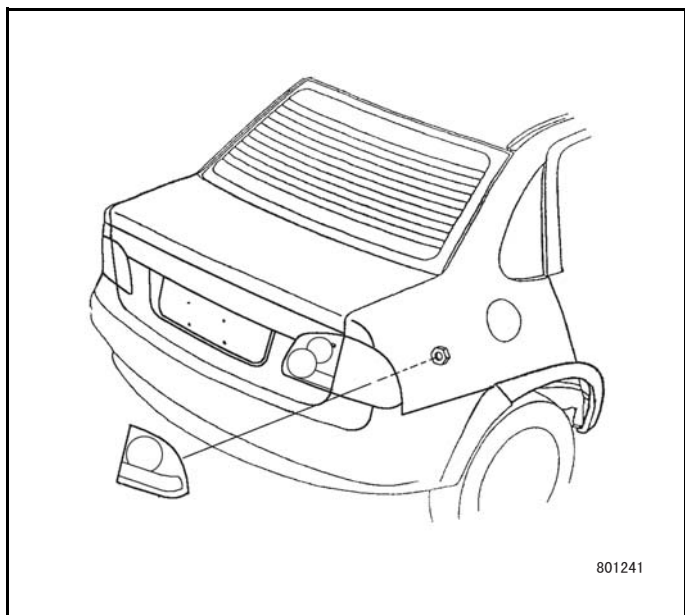
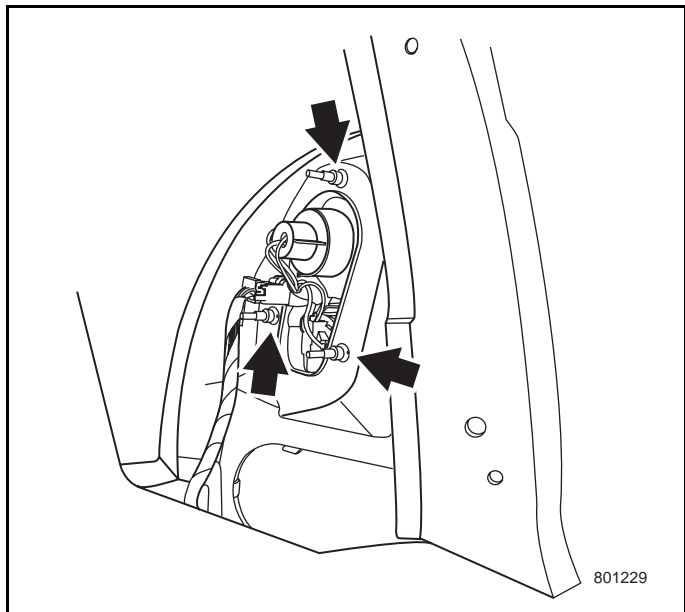
1. Install new bulb.
2. Remove Turn Signal Lamp, Refer to Turn Signal Lamp Replacement.



8.1.5.15A1 Tail Lamp A Replacement

Removal procedure

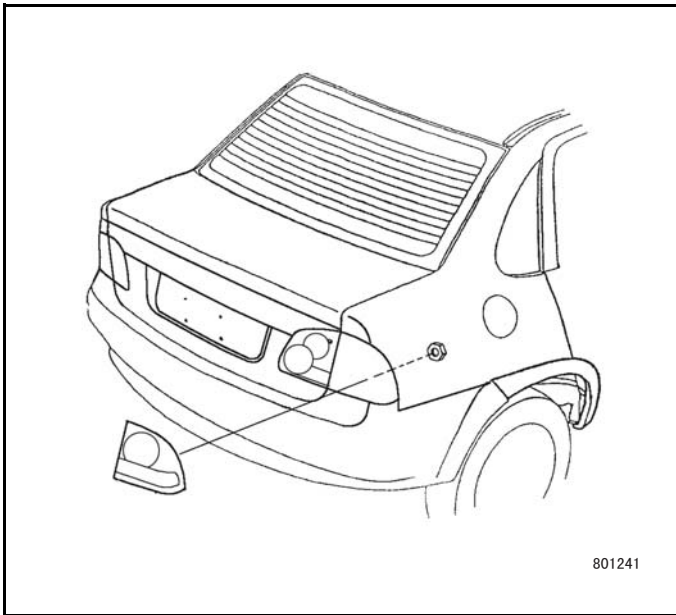
1. Open the rear compartment lid.
2. Remove the internal cover.
3. Remove Tail Lamp A tightening nut.



4. Remove the connector.

Installation Procedure

1. Connect the tail lamp to the wire harness.



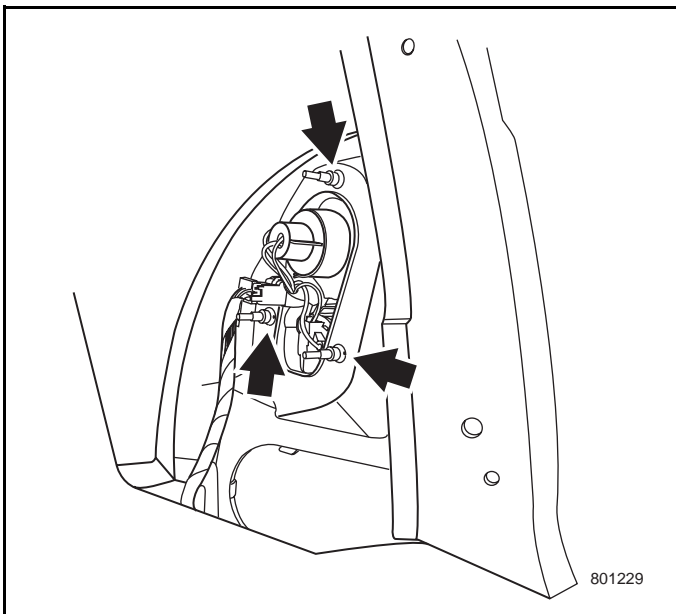
801241

2. Install tail lamp to the vehicle & attach with nuts.

Tightening

Tighten the tail lamp nut to 2.5-3.5 N•m.

3. Install the internal cover.
4. Close the rear compartment lid.

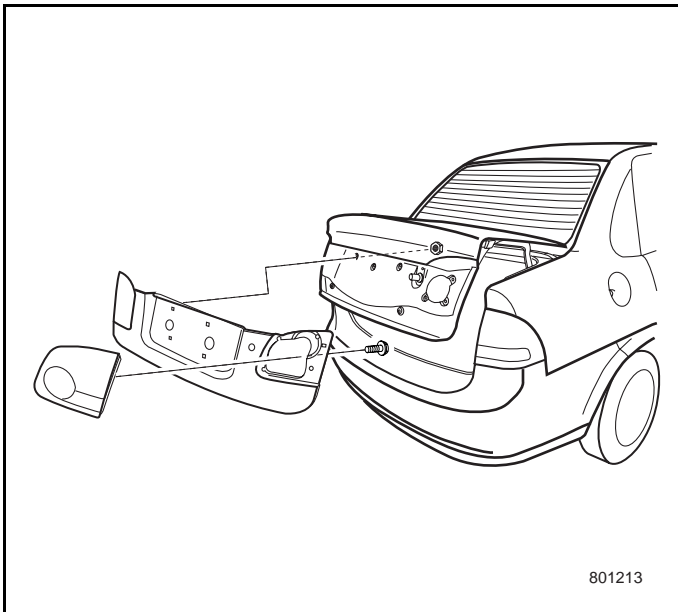


801229

8.1.5.15A2 Tail Lamp B Replacement

Removal procedure

1. Open the rear compartment lid.
2. Remove the connector.
3. Remove the license plate attaching nut, and take off the plate.
4. Remove Tail Lamp B tightening screw.



Installation Procedure

1. Attach Tail Lamp B with screw on the license plate.

Tightening

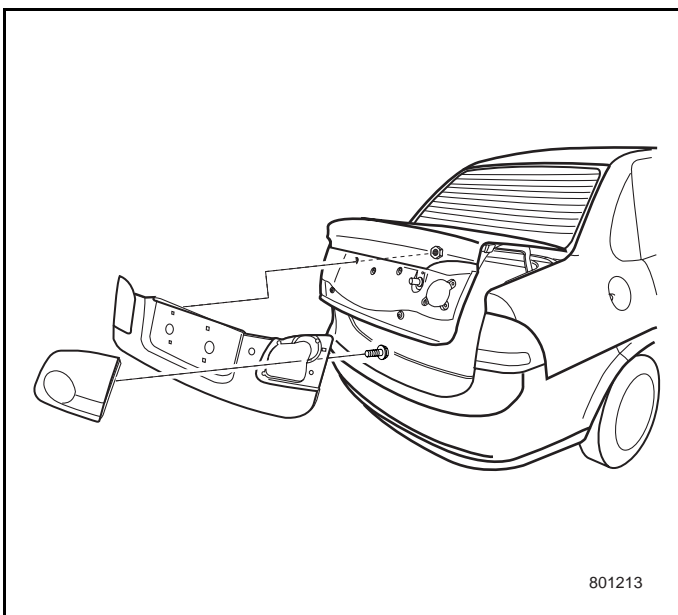
Tighten the bolts to 1-2 N•m.

2. Install the license plate and tighten the nut.

Tightening

Tighten the license lamp nut to 3.5-4.0 N•m.

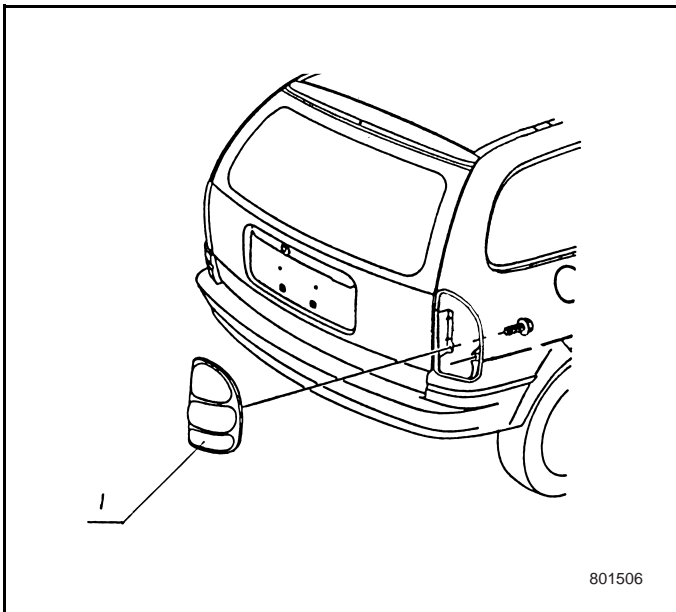
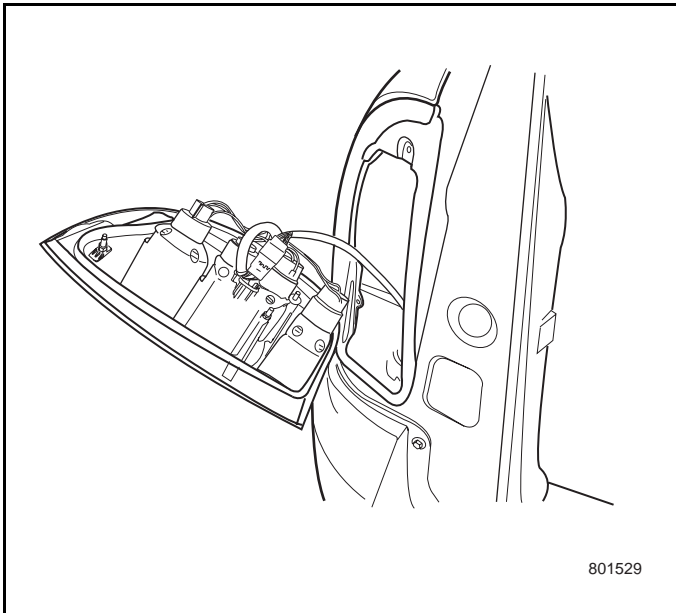
3. Connect connectors.



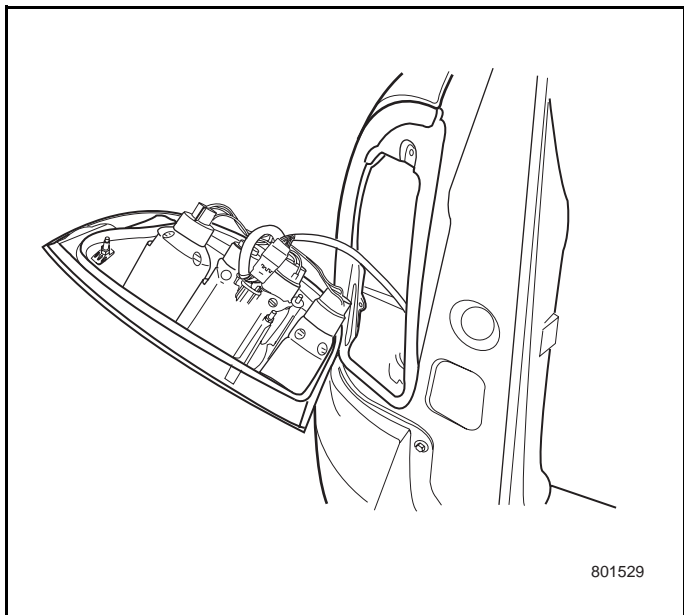
8.1.5.15B Tail Lamp Replacement

Removal procedure

1. Open the rear compartment lid.
2. Remove the internal cover.
3. Remove tail lamp tightening nut.



4. Remove the connector.



Installation Procedure

1. Connect the tail lamp to the wire harness.
2. Install tail lamp to the vehicle & attach with nuts.

Tightening

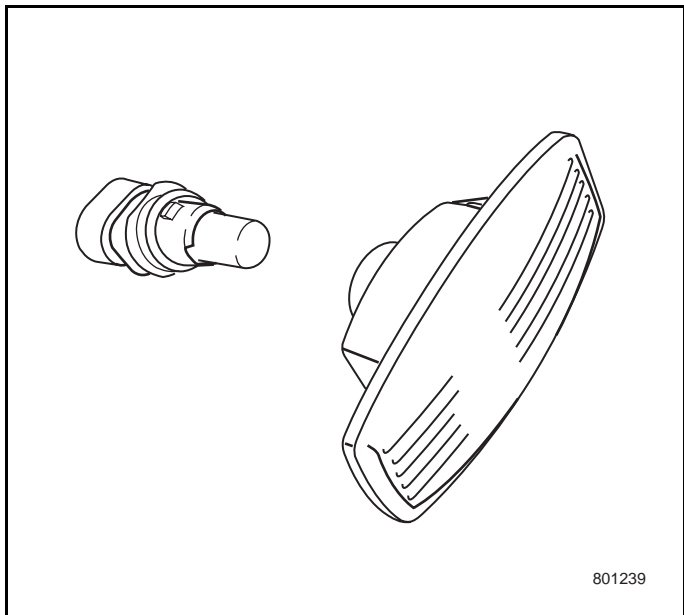
Tighten the tail lamp nut to 2.5-3.5N•m.

3. Install the internal cover.
4. Close the rear compartment lid.

8.1.5.16A1 Tail Lamp A Bulb Replacement-Brake/Position Lamp, Turn Signal Lamp

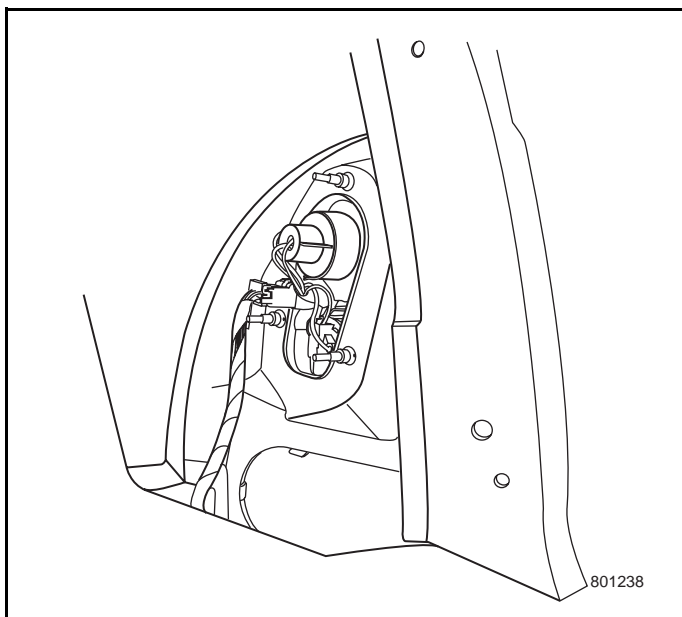
Removal procedure

1. Open the rear compartment lid.
2. Remove the internal cover.
3. Counter clockwise rotate lamp seat, then remove the bulb from the seat.



Installation Procedure

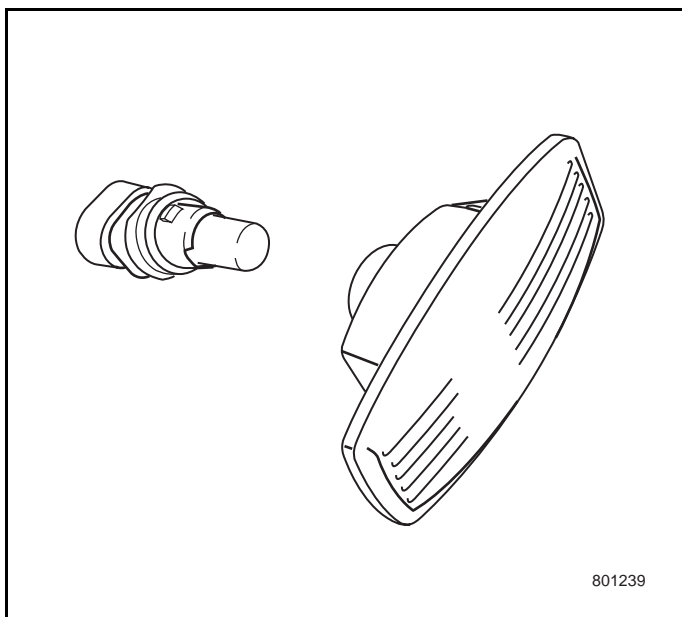
1. Install the bulb to the tail lamp socket.
2. Install the tail seat to the tail lamp assembly.
3. Install the internal cover.
4. Close the rear compartment lid.

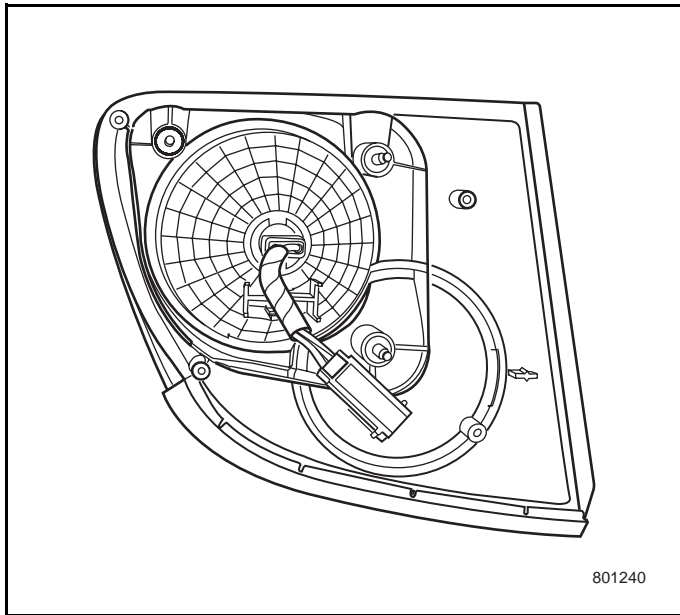


8.1.5.16A2 Tail Lamp B Bulb Replacement- Right Back Up Lamp, Rear Left Fog Lamp

Removal procedure

1. Open the rear compartment lid.
2. Counter clockwise rotate the lamp socket out.
3. Take off the bad bulb.





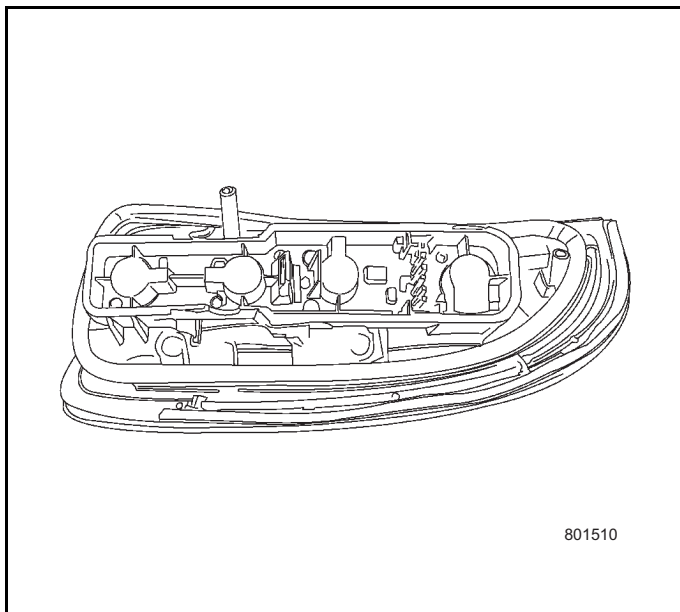
Installation Procedure

1. Install new bulb.
2. Turn tight the lamp socket clockwise.
3. Close the rear compartment lid.

8.1.5.16B Tail Lamp Bulb Replacement- Brake/Position Lamp, Turn Signal Lamp, Back Up Lamp, and Rear Fog Lamp.

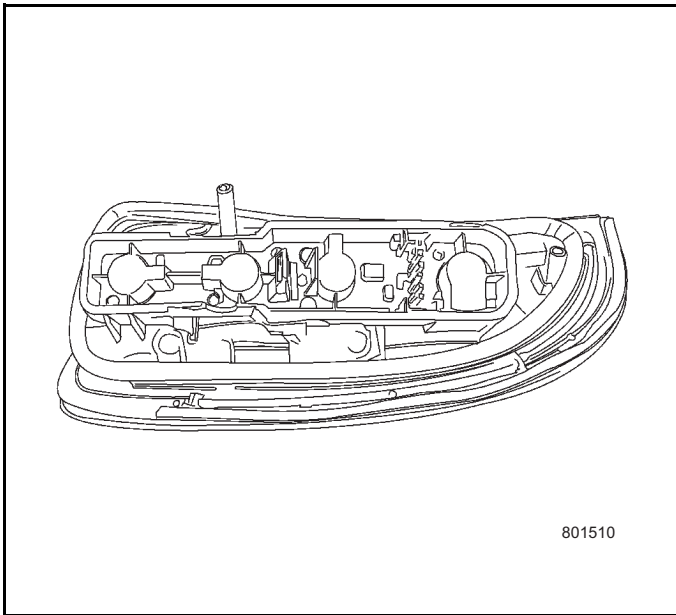
Removal procedure

1. Open the rear compartment lid.
2. Remove the tail lamp assembly from the rear body tail lamp bracket. Refer to Tail Lamp Replacement.
3. Counter clockwise rotate lamp seat, then remove the bulb from the seat.



Installation Procedure

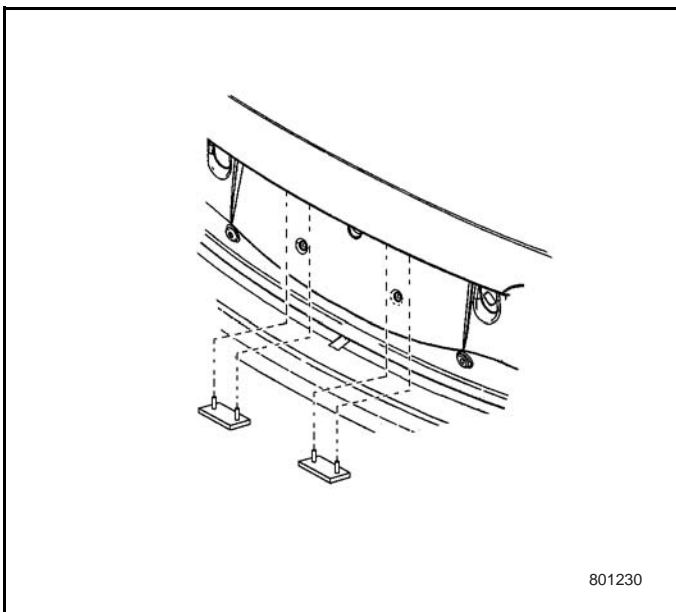
1. Install the bulb to the tail lamp socket.
2. Install the tail lamp assembly to the rear body tail lamp bracket. Refer to Tail Lamp Replacement.
3. Close the rear compartment lid.

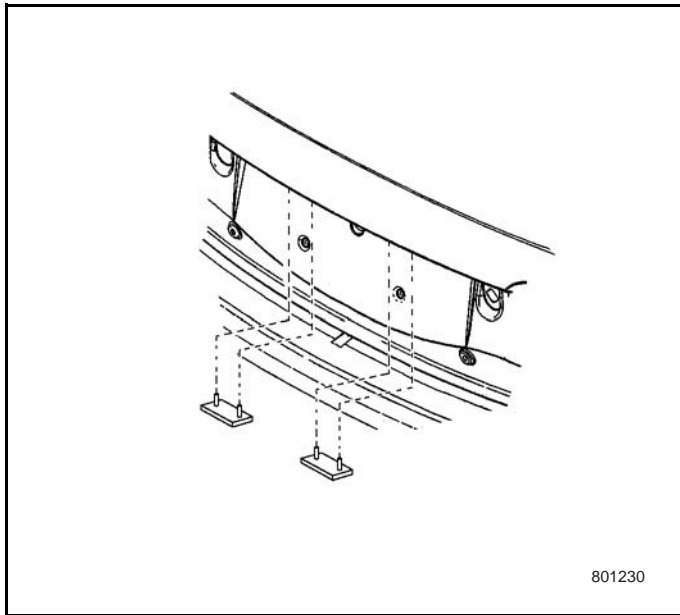


8.1.5.17A License Lamp and Bulb Replacement

Removal procedure

1. Remove the license lamp from the rear compartment lid with screw driver.
2. Remove the electric connections.
3. Substitute new bulb for the bad bulb.





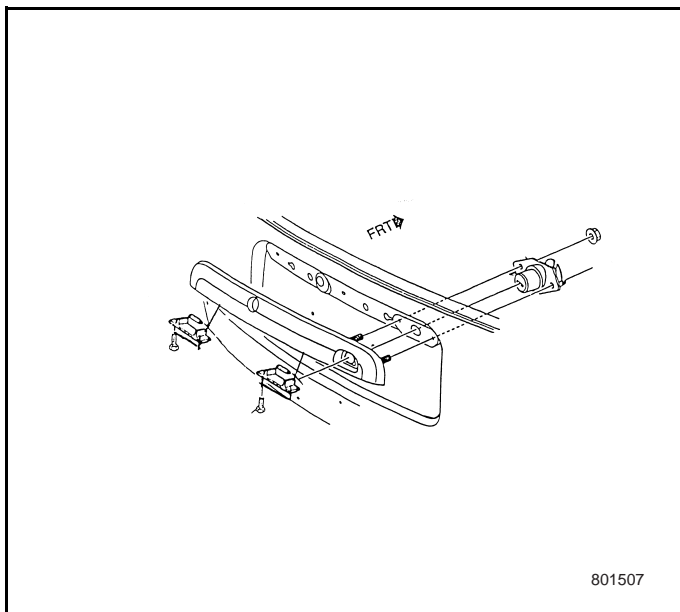
Installation Procedure

1. Install the electric connector to the license lamp ASM.
2. Install the license lamp ASM to the rear compartment lid.

8.1.5.17B License Lamp & Bulb Replacement

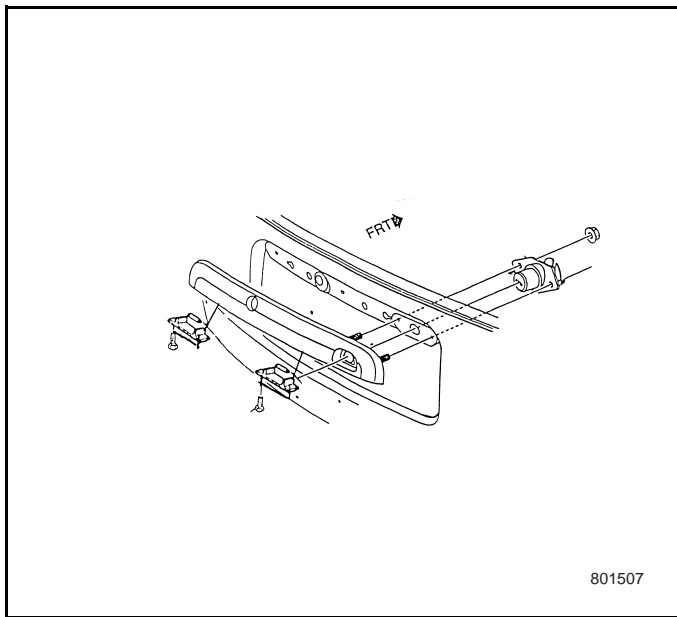
Removal procedure

1. Remove the license lamp from the handle assembly with a screwdriver.
2. Remove the electric connections.
3. Substitute new bulb for the bad bulb.



Installation Procedure

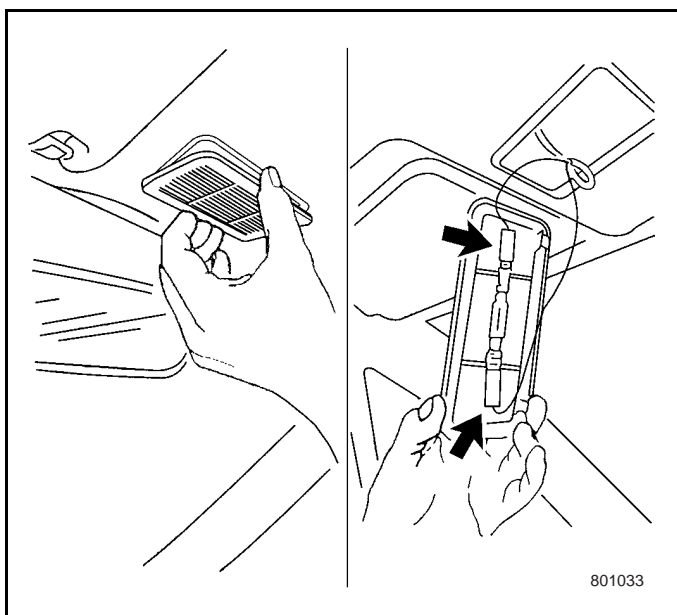
1. Install the electric connector to the license lamp ASM.
2. Install the license lamp on the handle assembly with screw driver.



8.1.5.18 Dome Lamp Replacement

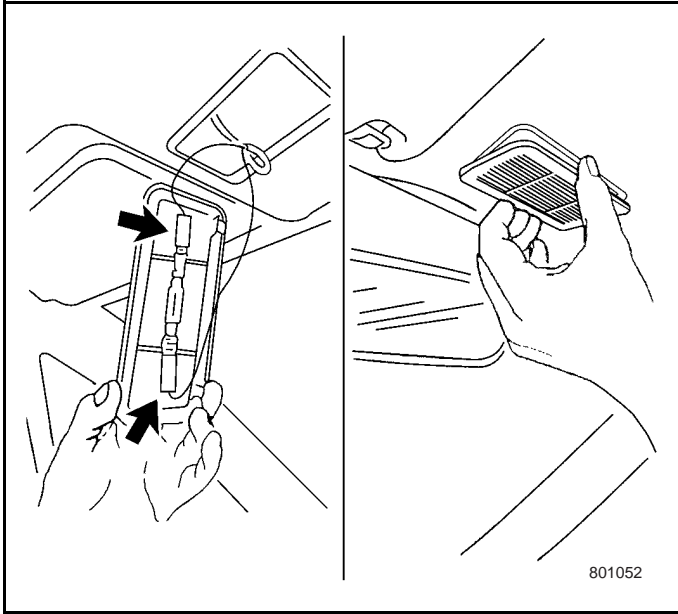
Removal procedure

1. Remove the dome lamp from the headliner carefully
2. Remove the connector wiring harness.



Installation Procedure

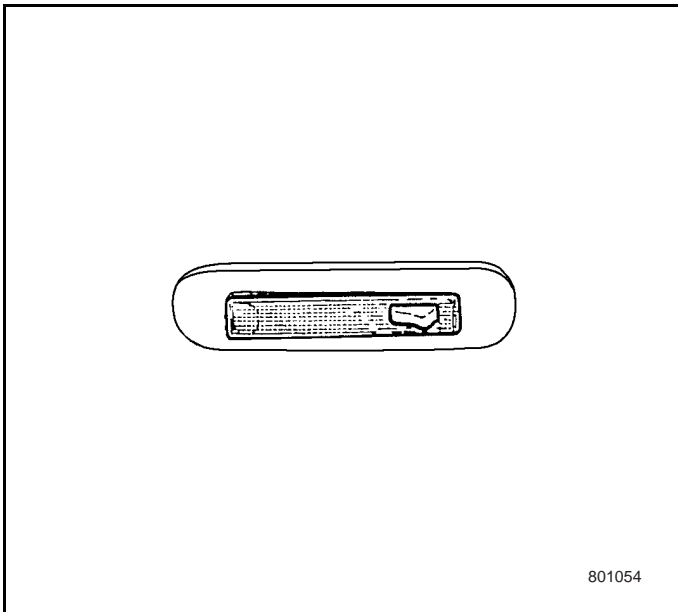
1. Connect the wiring harness.
2. Push the dome lamp back inside the mounting hole on the headliner.

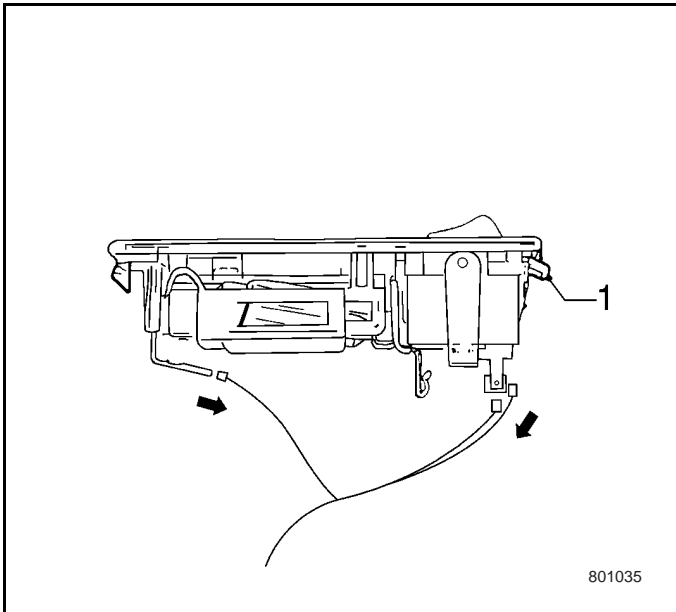


8.1.5.19A Reading Lamp Replacement

Removal procedure

1. Tear down the reading lamp from the socket with screw driver.

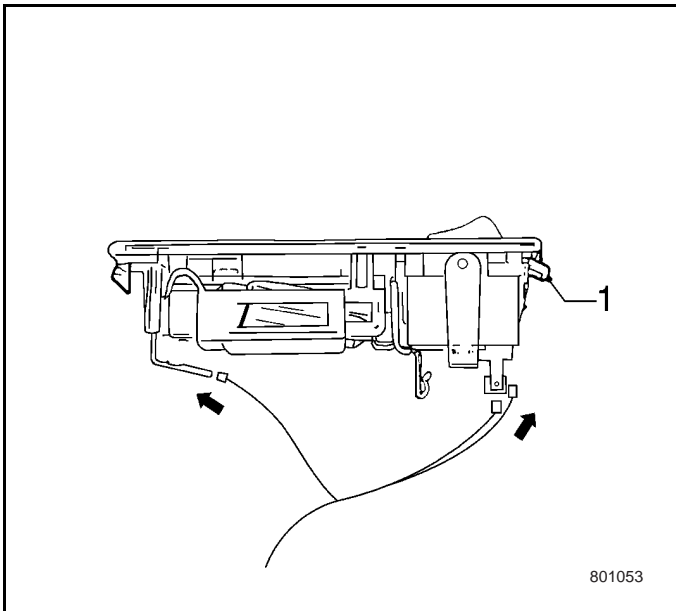


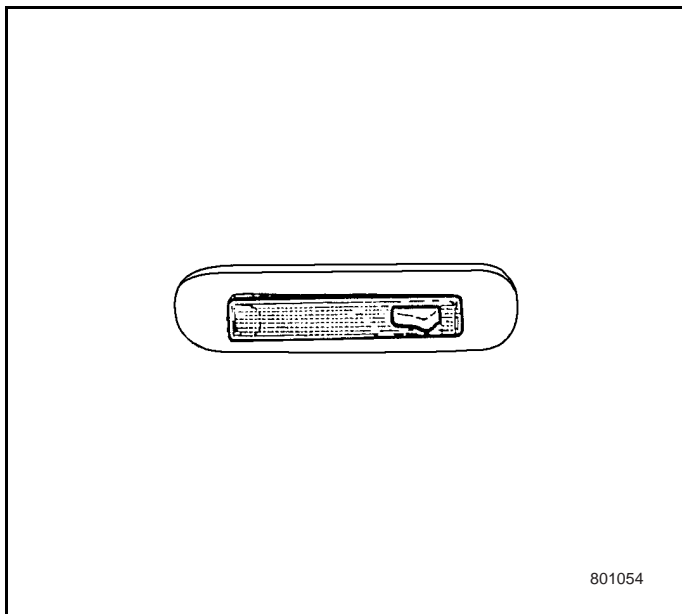


2. Remove the wiring harness.

Installation Procedure

1. Connect the wiring harness.



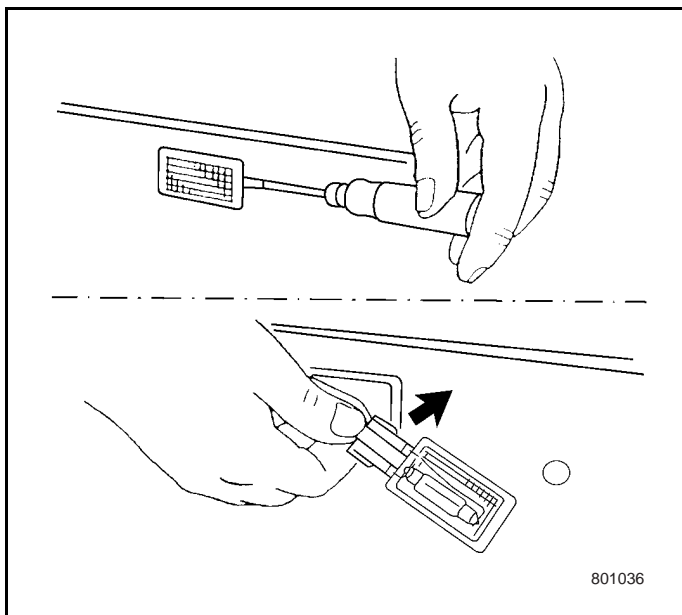


2. Insert one side of the reading lamp into the bezel, then push the whole lamp into it.

8.1.3.11A Trunk Lamp Replacement

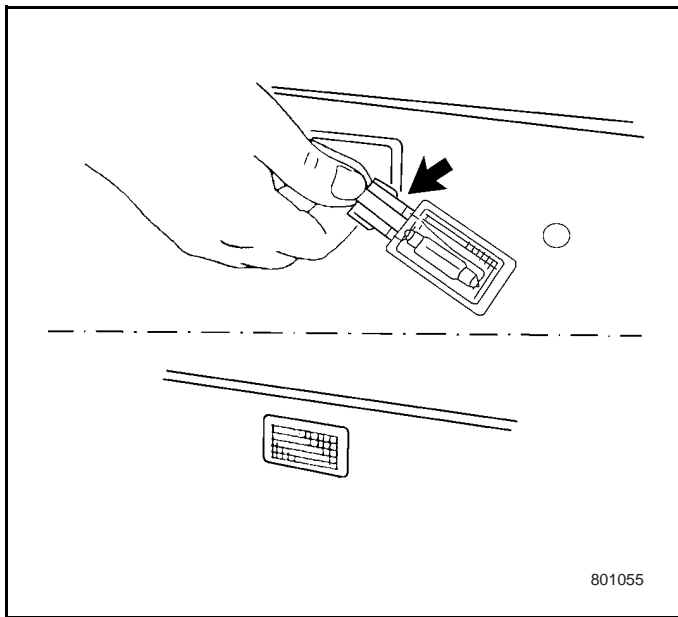
Removal procedure

1. Open the trunk lid.
2. Tear down the lamp with screw driver.
3. Remove the wiring harness.



Installation Procedure

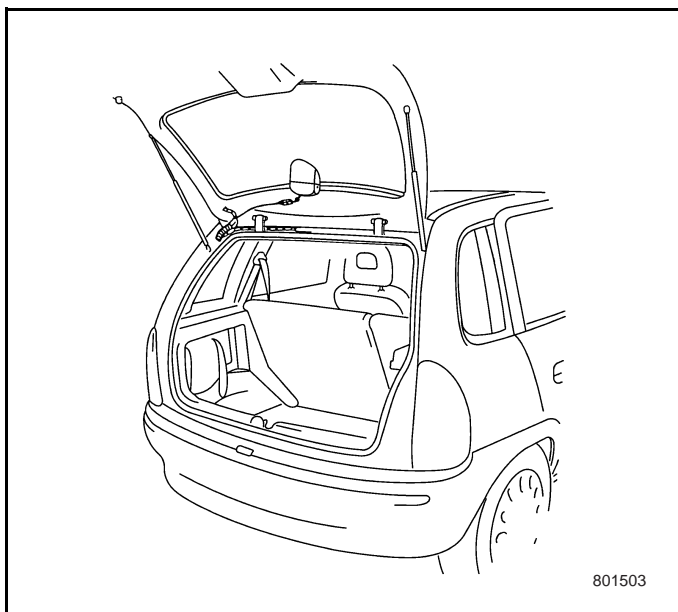
1. Connect to the wiring harness.
2. Insert the lamp into the trunk compartment lamp hole.

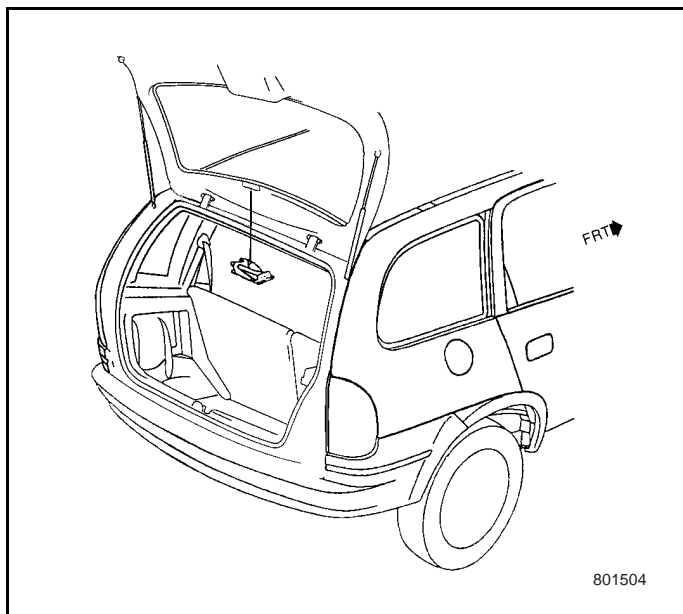


8.1.5.20B Rear Compartment Lamp Replacement

Removal procedure

1. Open the rear lift gate.
2. Tear down the lamp with screw driver.

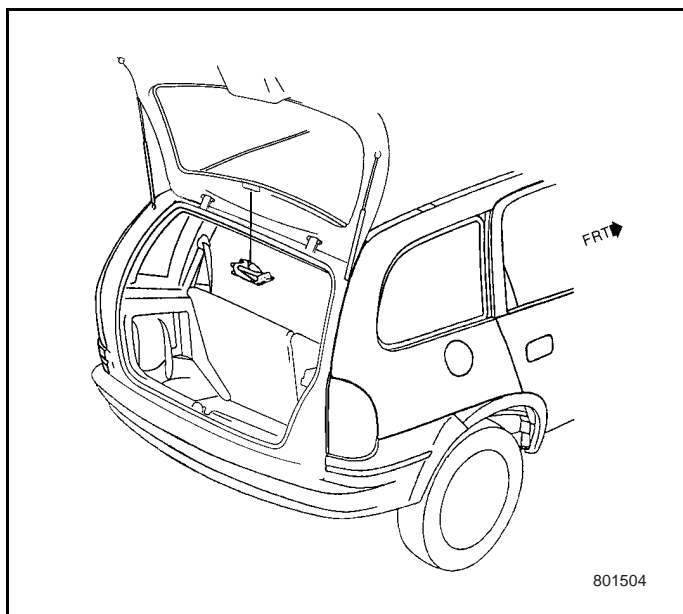


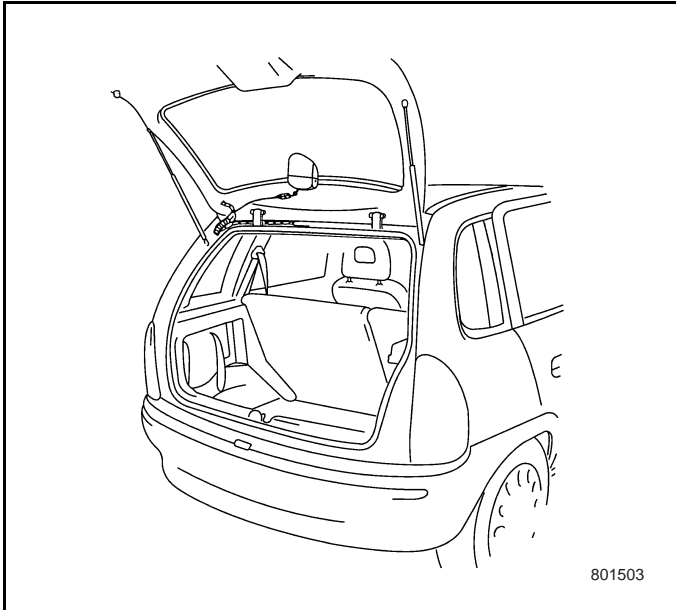


3. Disconnect the wiring harness.

Installation Procedure

1. Connect to the wiring harness.
2. Insert the lamp into the rear compartment lamp hole.



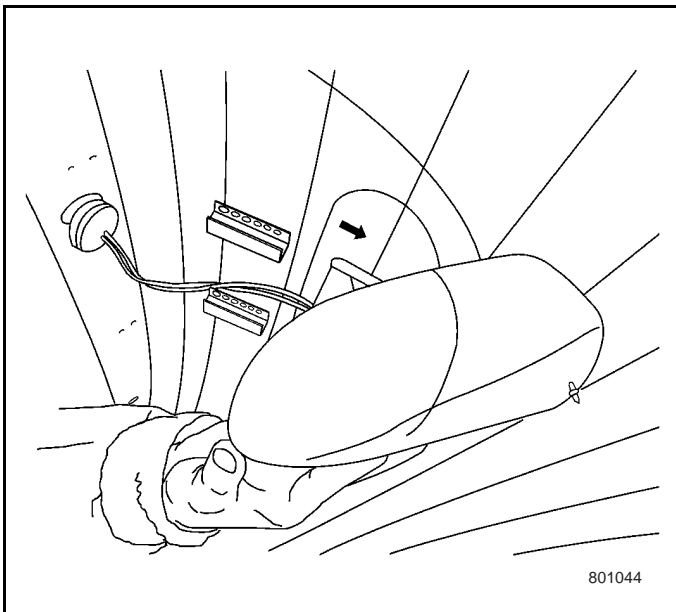


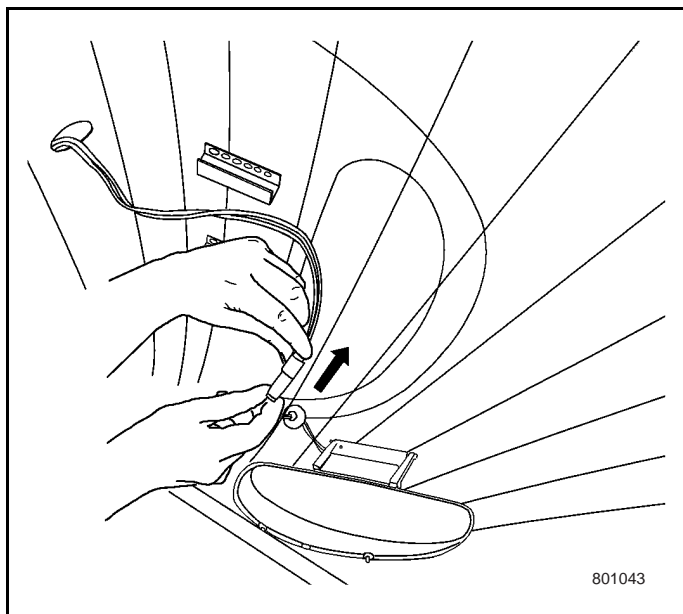
3. Close the tail gate.

8.1.5.21 High Mounted Stop Lamp Replacement

Removal procedure

1. Squeeze both heaves of the lamp flap into the groove by using screw driver
2. Push out the high mounted stop lamp downward the slot.

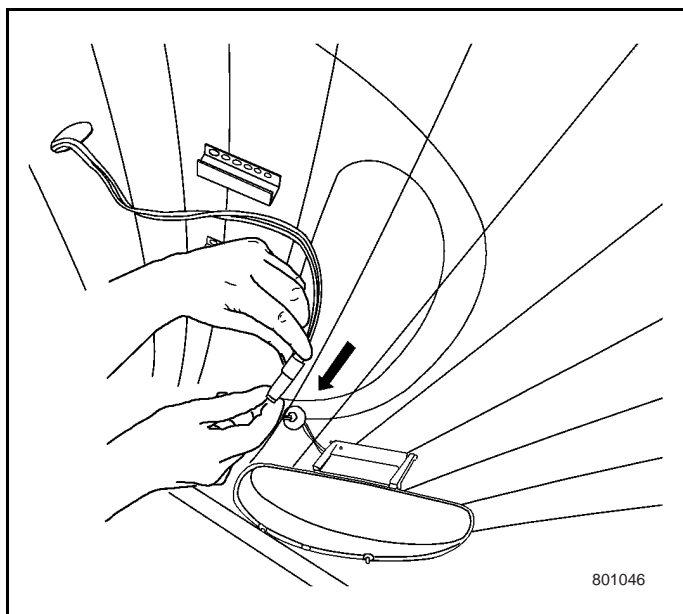


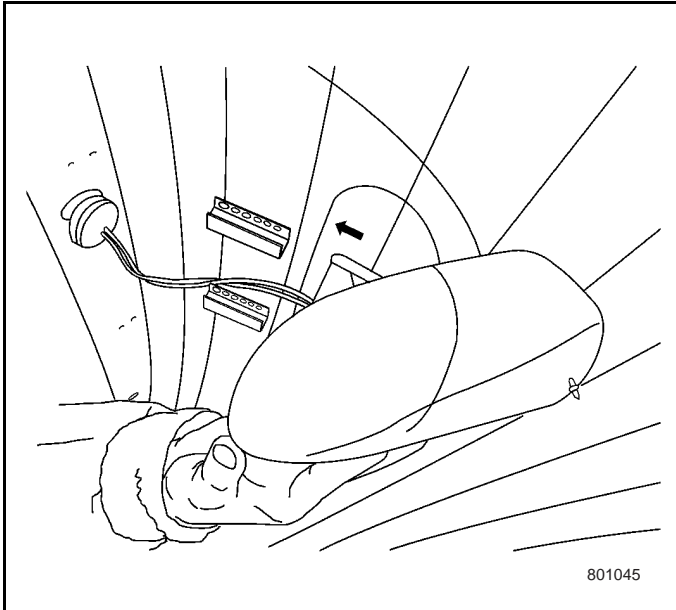


3. Disconnect the wiring harness.

Installation Procedure

1. Connect the wiring harness.





2. Insert the lamp into the mounting slot.

Blank

8.2 Wiper/Washer System

8.2.1 Specification

8.2.1.1A Fastener tightening torque

Application	Specification
Washer Solvent Container Assembly Mounting Nut	1.5-2 N•m
Wiper Arm Assembly to Shaft Nut	10-12 N•m
Wiper Drive System Module to the vehicle Screws	3.5-4.5 N•m
Wiper Motor Assembly Mounting Screw	9-12 N•m

8.2.1.1B Fastener Tightening Torque

Application	Specification
Rear Wiper Arm Assembly to Shaft Nut	10.0-11.0 N•m
Rear Wiper Motor Assembly Mounting Screw	2.0-3.0 N•m
Rear Wiper Motor Mounting Nut	1.0-2.0 N•m

See 8.20.2.16.

8.2.2 Schematic and Wiring Diagram

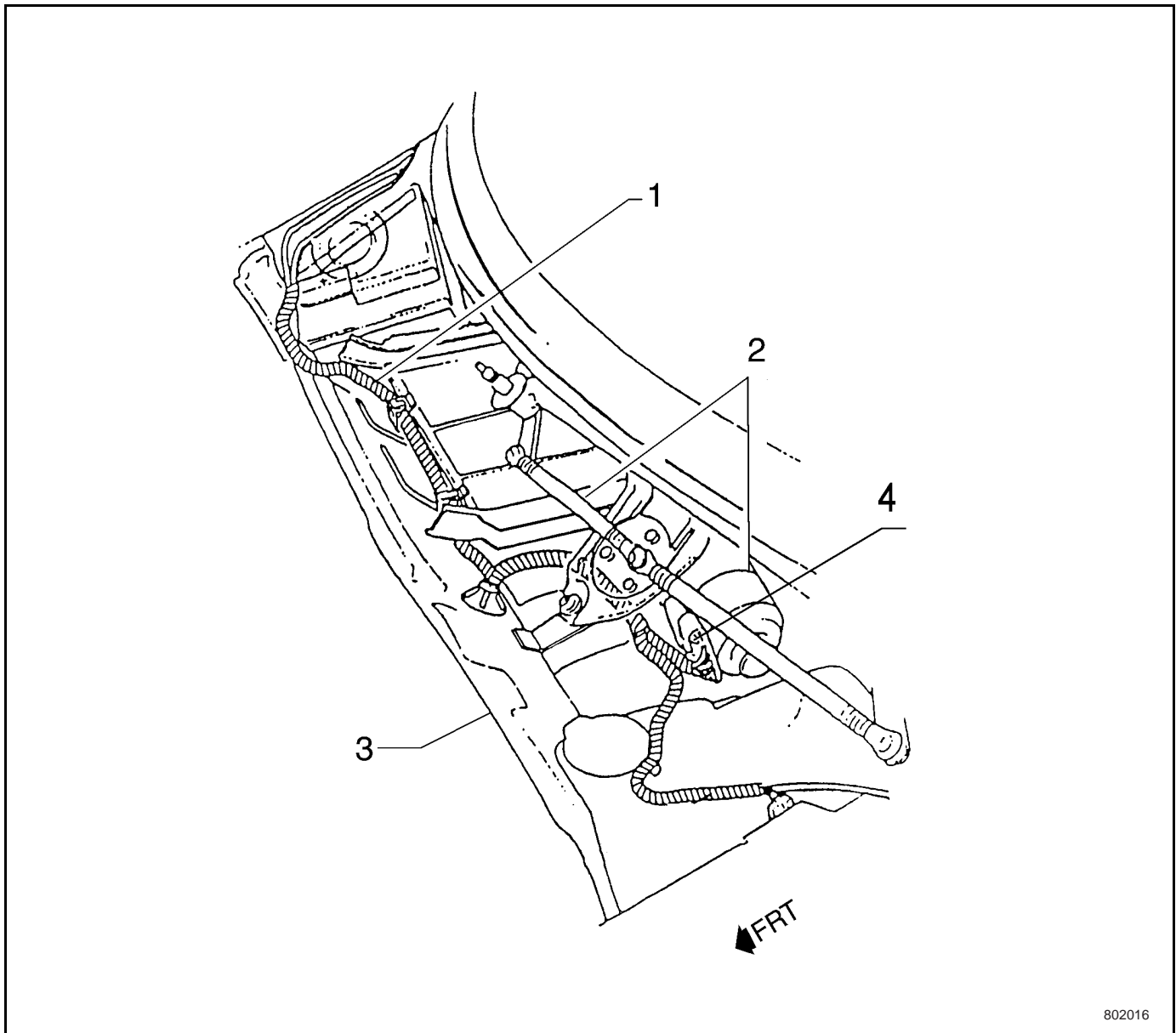
8.2.2.1 Wiper/Washer System Wiring Diagram

8.2.3 Component Position

8.2.3.1 Wiper/Washer System Components

Name	Location	Component Locator	Connector End Views
Fuse box	Inside I/P, Steering Column Leftside.	Fuse and Relay Box Components View in Wiring System	—
Windshield Washer Pump	Windshield Washer Solvent Container Inside, of Engine Compartment Left Side	—	—
Front Windshield Wiper Motor	Under Front Hood, I/P Left Front	Front Windshield Wiper Motor Component View	—
Windshield Wiper/Washer Switch	Steering Column Right Side	Steering Wheel and Steering Column-Exploded View in Steering Wheel and Steering Column	—
Rear Wiper/Washer Motor	Tail Gate Middle (only wagon)	Rear Wiper/Washer Motor Component View	—

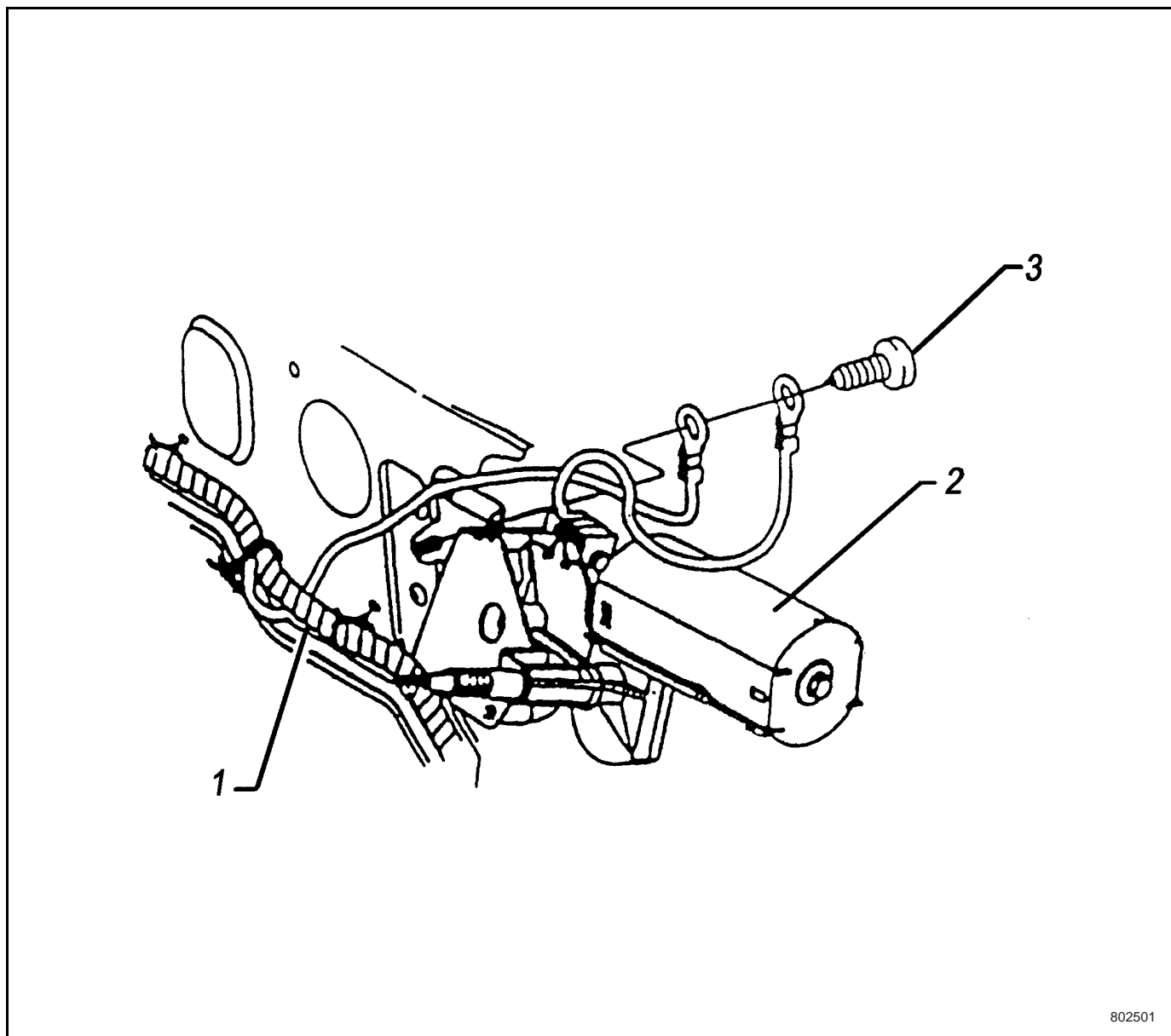
8.2.3.2 Front Windshield Wiper Motor Component View



Legend

- | | |
|--------------------------------|---|
| (1) I/P Wiring Harness | (3) Firewall |
| (2) Wiper Motor and Rocker Arm | (4) To Wiper Motor Wiring Harness Connector |

8.2.3.3B Rear Wiper/Washer Motor Component View



Legend

- (1) Tail Gate Wiring Harness Assembly
- (2) Motor, Rear Wiper/Washer

- (3) Rear Wiper/Washer Motor

8.2.4 Diagnostic Information and Procedures

8.2.4.1 Wiper/Washer System Inspection

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	Turn the ignition switch on RUN position Keep the washer switch to ON position	Low Speed Wiper Operation Once the washer switch is kept to ON position, the washer will spray to the windshield. After the switch is disconnected, the washer will stop operation, and the wiper will return to stop position after 2-4 times of wiping.	Washer inoperative
2	Turn the wiper to DELAY (pulse) position.	Pause for 1-22 seconds after the wiper has one time complete wiping.	<ul style="list-style-type: none"> Wiper DELAY inoperative Wiper DEFOG, DELAY, and LOW SPEED patterns inoperative
3	Turn the wiper to DELAY position. Keep the wiper switch open for 1-2 seconds.	As long as the washer switch is kept to ON position, the washer will spray to the windshield. The wiper is operating at low speed during spray, and will continue wiping for 2-4 times after the washer switch is released. The wipers then return to pulse operation.	<ul style="list-style-type: none"> Washer inoperative Wiper DELAY inoperative Wiper DEFOG, DELAY, and LOW SPEED patterns inoperative
4	Turn the wiper to Low Speed position.	The wiper continues at low speed operation.	Wiper DEFOG, DELAY, and LOW SPEED patterns inoperative
5	Turn the wiper to High Speed position.	The wiper continues at high speed operation.	Wiper HIGH SPEED inoperative, but LOW SPEED operative
6	Turn the wiper to OFF position.	The wiper returns to STOP position at low speed.	<ul style="list-style-type: none"> Windshield wiper blade uninterrupted The wiper is always ON
7	Turn the wiper switch to ON position.	The wiper stops operation for approximately 8 seconds.	<ul style="list-style-type: none"> Wiper DELAY inoperative due to malfunction Wiper DEFOG, DELAY, and LOW SPEED patterns inoperative due to malfunction

8.2.4.2A Wiper/Washer System Diagnostic Procedure

Step	No matter the wiper switch is at which position, wiper/washer inoperative.	Yes	No
1	Inspect Fuse F16 for damage.	Go to Step 3	Go to Step 2
2	Remove the wiper switch and perform inspection; confirm there is no problem with it. Use DMM to measure the voltage from the wiring harness to the wiper switch pin 4	Go to Step 5	Go to Step 4
3	Replace the damaged fuse.	Go to Step 2	—
4	Please check the I/P harness from fuse 16 to the wiper switch..Repair as necessary.	Go to Step 5	—
5	Confirm sound contact of the wiper switch and wire harness connector I Disconnect the wire harness and wiper motor, and inspect I/P harness from the wiper switch and fuse 16 to the wiper motor, repair if necessary.	Go to Step 6	—
6	Inspect the wiper motor, repair if necessary; confirm no problem with it. Confirm sound contact to the wiper motor connector.	Go to Step 7	—
7	Inspect the grounding wire of the wiper motor at the I/P wire harness, repair if necessary.	Go to Step 8	—
8	System OK?	—	—

Step	Only inoperative at high level	Yes	No
1	Disconnect the wire harness connector from the wiper motor. Use DMM to measure the voltage of pin E beside the wire harness if it is normal?	Go to Step 2	Go to Step 3
2	Inspect the internal structure of the wiper motor, replace or repair as necessary.	—	—
3	Remove the wiper switch and perform inspection; confirm there is no problem with it. Inspect the I/P wiring harness from the wiper switch pin 2 to wiper switch motor pin E; repair it if necessary.	—	—

Step	Only inoperative at middle	Yes	No
1	Disconnect the wire harness connector from the wiper motor. Use DMM to measure the voltage of the wire harness side pin A if it is ok?	Go to Step 2	Go to Step 3
2	Inspect the internal structure of the wiper motor, replace or repair as necessary.	—	—
3	Remove the wiper switch for inspection; replace or repair if necessary and confirm no problem with it.	Go to Step 4	—
4	Inspect the I/P wiring harness from the wiper switch pin 5 to wiper switch motor pin A; repair it if necessary.	—	—

Step	Only inoperative at intervals	Yes	No
1	Remove the wiper relay, turn the ignition switch to ON position and the wiper switch to the internal position. Use DMM to measure the voltage of pin 1 on the relay. Is the voltage normal?	Go to Step 4	Go to Step 2
2	Remove the wiper switch and perform inspection; confirm there is no problem with it. Otherwise, replace or repair if necessary.	Go to Step 3	—
3	Inspect the I/P wiring harness from the wiper switch pin 9 to the wiper relay pin 1, repair if necessary.	—	Go to Step 7
4	Inspect the ground wire of the relay pin 4 if it is sound grounded?	Go to Step 6	Go to Step 5
5	Repair the ground wire, and confirm it is sound grounded.	—	—
6	Replace the wiring relay. Is the system OK?	—	—
7	Inspect the I/P harness from the wiper switch pin 8 to the relay pin 2, confirm there is no problem with it.	Go to Step 8	Go to Step 10
8	Remove the new wiper relay, use the DMM to measure the voltage of pin 8 on the relay home if it is normal?	Go to Step 10	—
9	Inspect the I/P wiring harness, repair if necessary and confirm no problem with it.	Go to Step 10	—
10	Inspect the I/P wiring harness from the relay (pin 5) to the wiper motor, repair the I/P if necessary and confirm no problem with it. The system is OK.	—	—

Step	The wiper is always ON.	Yes	No
1	Check if Fuse 20A No. 16 is ok?	Go to Step 2	Go to Step 3
2	Replace the damaged fuse.	Go to Step 3	—
3	Remove the wiper switch, and use the DMM to measure the voltage of the pin 4 on the switch home if the voltage is normal?	Go to Step 5	Go to Step 4
4	Please check the I/P wiring harness from fuse 16 to the wiper switch, repair if necessary.	Go to Step 5	Go to Step 6
5	Inspect the internal structure of the wiper switch, replace or repair as necessary. Confirm no problem with it. Is the System OK?	—	Go to Step 10
6	Disconnect the connector away from the wiper motor, turn the ignition switch to ON position, and place the wiper switch in the high position. Use the DMM to measure the voltage of pin E at the connector (wiring harness side) if it is normal?	Go to Step 7	Go to Step 10
7	Please check the I/P harness from the wiper switch to the relay (pin 2). Confirm no problem with it.	Go to Step 8	Go to Step 9
8	Use the DMM to confirm if the ground wire (pin B) is sound grounded?	—	—

9	Remove the wiper motor, replace or repair it. The system is OK.	—	Go to Step 10
10	Inspect the I/P wire harness from the wiper switch to wiper motor; Repair if necessary and be sure it has no problem. Is the System OK?	—	—

Step	Wiper blades do not rest on its original position.	Yes	No
1	Remove the wiper switch and inspect the internal structure of the wiper switch. Repair if necessary and confirm there is no problem with it.	Go to Step 2	—
2	Disconnect the wiper motor connector; use the DMM to measure the voltage of pin D at the wiring harness side whether it is OK.	Go to Step 4	Go to Step 3
3	Inspect the wiring harness from fuse 16 to the wiper motor I/P; confirm there is no problem with it.	Go to Step 4	—
4	Remove the wiper motor, and inspect the structure; repair or replace if necessary. The system is OK.	—	—

Step	Washer inoperative.	Yes	No
1	Remove wiper/washer switch; turn the ignition switch to ON position; use the DMM to measure the voltage of pin 4 at the switch original position whether it is ok?	Go to Step 3	Go to Step 2
2	Please check the I/P wiring harness from fuse 16 to the wiper/washer switch, repair if necessary. Be sure it's no problem.	Go to Step 3	—
3	Inspect the internal structure of the wiper switch. Repair if necessary and confirm there is no problem with it. Is the System OK?	—	Go to Step 4
4	Install the wiper/washer switch; disconnect the washer motor connector, turn the wiper/washer switch to WASHER position. Use the DMM to measure the voltage of pin A at the washer motor connector (wire harness side) if it is ok?	Go to Step 6	Go to Step 5
5	Inspect and repair the wiring harness from the wiper/washer (pin 3) to washer motor (pin A) according to the circuit diagram.	Go to Step 6	—
6	Inspect the I/P wiring harness from the wiper switch (pin B) to wiper/washer switch (pin 7). Is it OK?	Go to Step 7	—
7	Replace the washer motor. The system is OK.	—	—

8.2.4.2B Rear Wiper/Washer System Diagnostic Procedure

Step	Whichever position the wiper switch is, the wiper/washer will not work.	Yes	No
1	Inspect Fuse 16 for damage.	Go to Step 3	Go to Step 2
2	Remove the wiper switch and perform inspection; confirm there is no problem with it. Use DMM to measure the voltage from the wiring harness connector (pin 40) to the wiper switch whether the voltage is ok?	Go to Step 5	Go to Step 4
3	Replace the damaged fuse.	Go to Step 2	—
4	Please check the I/P harness from fuse 16 to the wiper switch..	Go to Step 5	—
5	Inspect the inner wire of the I/P wiring harness inside from the wiper switch to the wiper rear window according to the circuit diagram, confirm it is ok, and repair if necessary.	Go to Step 6	—
6	Ensure sound contact of the wiper switch and the wiring harness connector; and disconnect the tail gate wiring harness connectors with the rear wiper motor, inspect the I/P wiring harness from the wiper switch and fuse 16 to the wiper motor via the rear body wiring harness and tail gate wiring harness (X5 A4 TO X9 3 ; X5 A3 TO X9 6) according to the diagram.	Go to Step 7	—
7	Inspect the wiper motor, repair if necessary; confirm there is no problem with it. Confirm sound contact to the wiper motor connector.	Go to Step 8	—
8	Inspect the ground wire of the wiper motor at the I/P wiring harness and that of the body at the rear wiper, repair if necessary.	Go to Step 9	—
9	Is the System OK?	—	—

Step	The wiper is always ON.	Yes	No
1	Check if 20A Fuse 16 is ok?	Go to Step 2	Go to Step 3
2	Replace the damaged fuse.	Go to Step 3	—
3	Remove the wiper switch, and use the DMM to measure the voltage of the pin 4 on the switch home if the voltage is normal?	Go to Step 5	Go to Step 4
4	Please check the I/P wiring harness from fuse 16 to the wiper switch, repair if necessary.	Go to Step 5	Go to Step 6
5	Inspect the internal structure of the wiper switch, repair or replace if necessary and confirm there is no problem with it. Is the System OK?	—	Go to Step 10
6	Disconnect the connector from the wiper motor, turn the ignition switch to ON position and the wiper switch to WIPER position; use the DMM to measure the voltage of the connectors (wiring harness side) pin 1 and pin 2 for normal condition.	Go to Step 7	Go to Step 10

7	Inspect the I/P harness from the wiper switch pin 1 to the relay pin 1, confirm there is no problem with it.	Go to Step 8	Go to Step 9
8	Use the DMM to confirm the body grounding of the rear wiper whether it is sound grounded?	—	—
9	Remove the wiper motor, replace or repair it. The system is OK.	—	Go to Step 10
10	Inspect the I/P wiring harness from the wiper switch to the wiper motor according to the circuit diagram, repair the rear body wiring harness of the I/P and the tail gate wiring harness, and confirm there is no problem with it. Is the System OK?	—	—

Step	Wiper blades do not rest on its original position.	Yes	No
1	Remove the wiper switch and inspect the internal structure of the wiper switch. Repair or replace if necessary and confirm there is no problem with it.	Go to Step 2	—
2	Disconnect the wiper motor connector; use the DMM to measure the voltage of at the wiring harness side pin 1 whether it is OK.	Go to Step 4	Go to Step 3
3	Inspect the wiring harness from fuse 16 to the wiper motor I/P; confirm there is no problem with it.	Go to Step 4	—
4	Remove the wiper motor, and inspect the structure; repair or replace if necessary. The system is OK.	—	—

Step	Washer inoperative.	Yes	No
1	Remove wiper/washer switch; turn the ignition switch to ON position; use the DMM to measure the voltage of pin 4 at the switch position whether it is ok?	Go to Step 3	Go to Step 2
2	Please check the I/P wiring harness from fuse 16 to the wiper/washer switch, repair if necessary. Be sure it's no problem.	Go to Step 3	—
3	Inspect the internal structure of the wiper switch. Repair or replace if necessary and confirm there is no problem with it. Is the System OK?	—	Go to Step 4
4	Install the wiper/washer switch; disconnect the washer motor connector, turn the wiper/washer switch to WASHER position. Use the DMM to measure the voltage of pin A at the washer motor connector (wire harness side) if it is ok?	Go to Step 6	Go to Step 5
5	Inspect and repair the wiring harness from the wiper/washer (pin 3) to washer motor (pin A) according to the circuit diagram.	Go to Step 6	—
6	Inspect the I/P wiring harness from the wiper switch (pin B) to wiper/washer switch (pin 7) according to the circuit diagram. Is it OK?	Go to Step 7	—
7	Replace the washer motor. The system is OK.	—	—

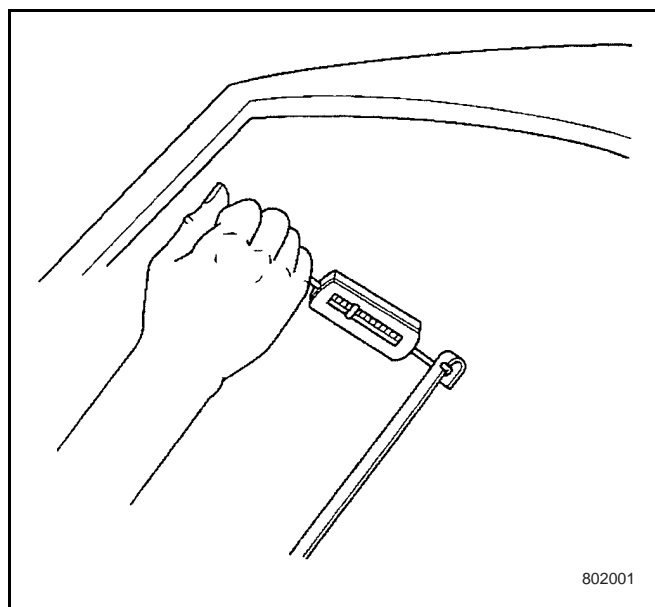
8.2.4.3 Wiper Arm End Pressure and Blade Element Inspection

Wiper Arm End Pressure Inspection

1. Run the wiper arm and blade to the middle position.
2. Remove the wiper blade from the wiper arm. Refer to Wiper Arm Blade Replacement.
3. Connect the spring scale to the wiper arm end and measure the force needed for lifting rearward the wiper arm to normal operational height (when connecting with blades) and that is perpendicular to the windshield.

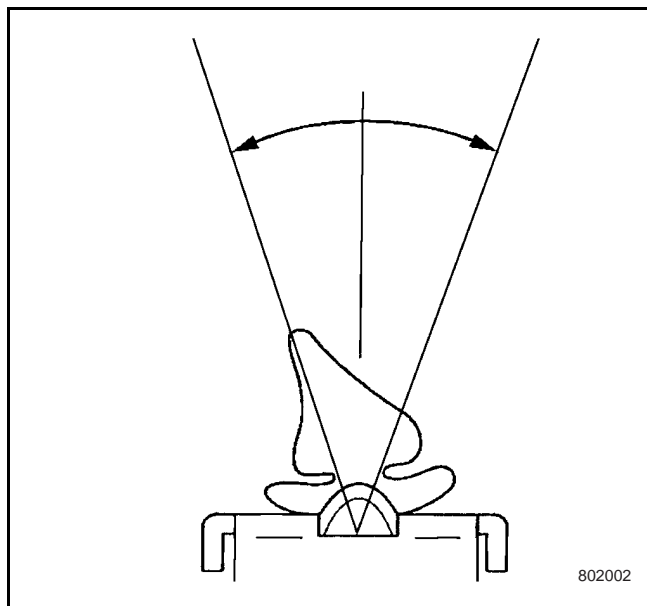
End Pressure

6 - 8 N.m



Blade Element Adjustment Inspection

1. Remove the wiper blade from the wiper arm.
2. Refer to Wiper Arm Blade Replacement.
3. Inspect the wiper blade element length.
4. Replace the wiper blade element if the rubber parts contacting with the glass fails to be within ± 15 degrees of the blade center line. Refer to Wiper Blade Element Replacement.
5. Install the wiper blade onto the wiper arm. Refer to Wiper Arm Blade Replacement.



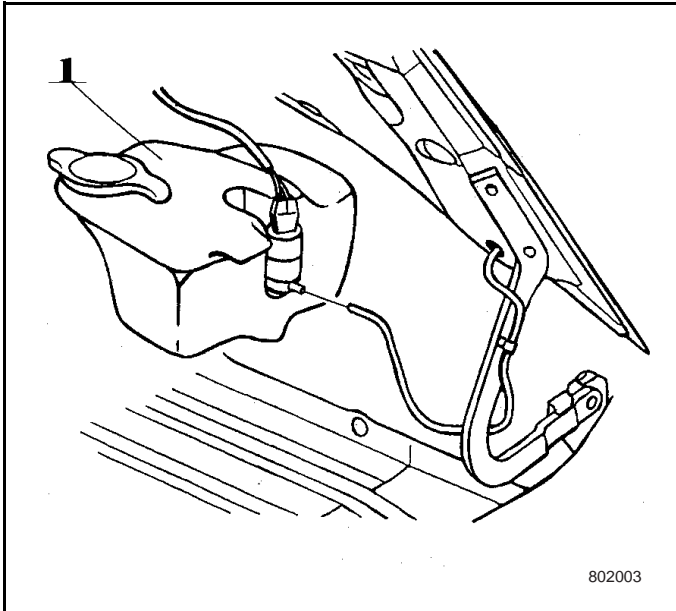
4. Replace the wiper arm if the measured value does not match the specification. Refer to Wiper Arm Blade Replacement.
5. Install the wiper blade onto the wiper arm. Refer to Wiper Arm Blade Replacement.

8.2.5 Repair Instructions

8.2.5.1A Washer Solvent Container, Pump, Nozzle and Hose Replacement

Removal procedure

1. Disconnect the washer pump from the electric connector.
2. Remove the nut from the washer solvent flange.
3. Remove the washer solvent container from the I/P.
4. Disconnect the hose on the washer pump.
5. Remove the pump from the washer solvent container.
6. Remove the pump sealing from the solvent container.
7. Remove the clip from the hook slot position of the hood.
8. Remove the nozzle from the hood, and disconnect the hose from it.
9. Remove the nozzle assembly from the hood.



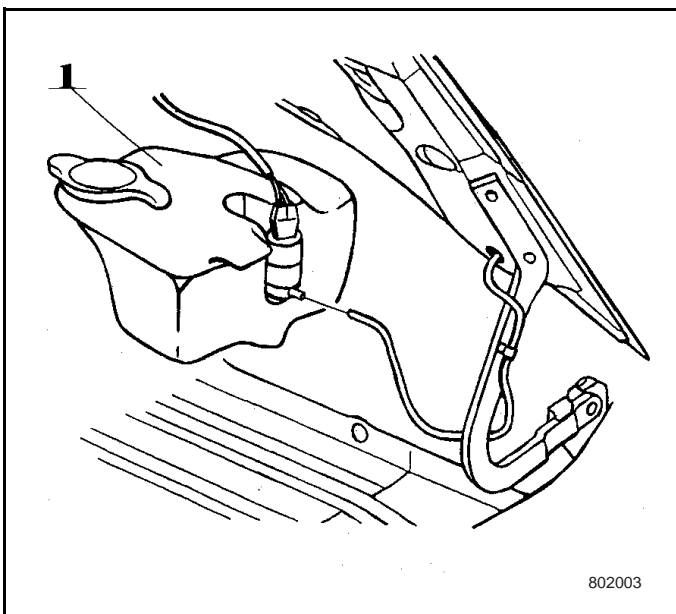
Installation Procedure

1. Install the hose assembly onto the hood.
2. Connect the nozzle with the hose and install it onto the hood.
3. Install the sealing onto the solvent container.
4. Install the pump on the container.
5. Connect the hose with the pump.
6. Install the clamp to the hose on the hook slot position of the hood.
7. Install the washer solvent container from the I/P.
8. Install nut to tighten the container.

Tightening

Tighten the nut to 1.5-2.0N•m.

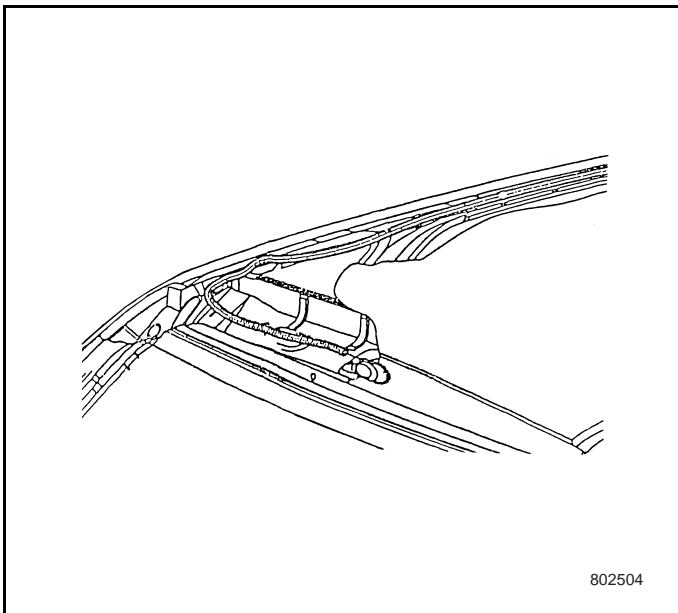
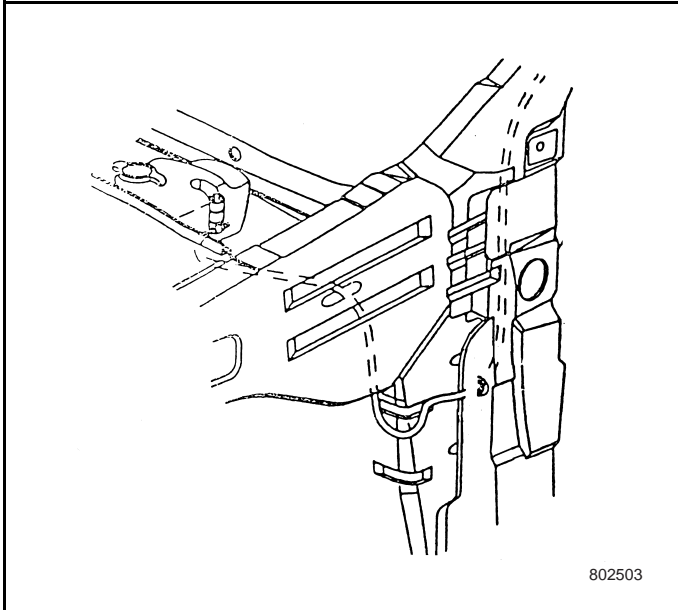
9. Connect the electric connector to the pump.



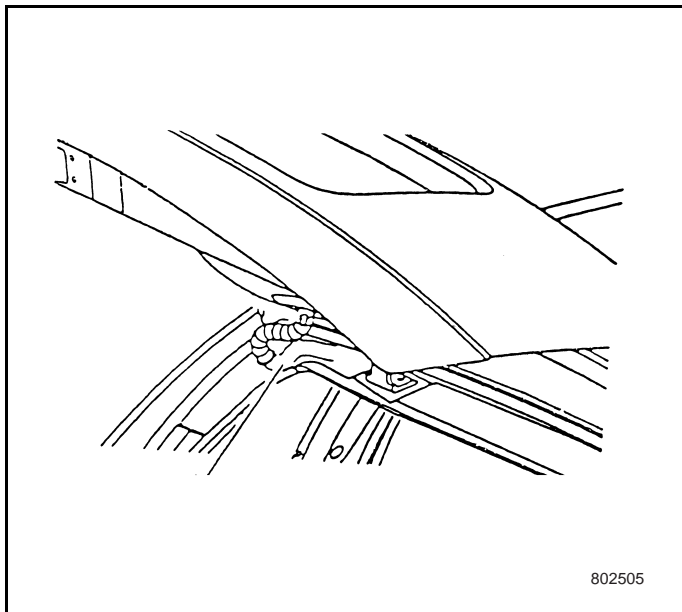
8.2.5.1B Rear Nozzle and Hose Replacement

Removal procedure

1. Disconnect the rear hose on the washer pump.
2. Remove the sealing ring from the left side body.



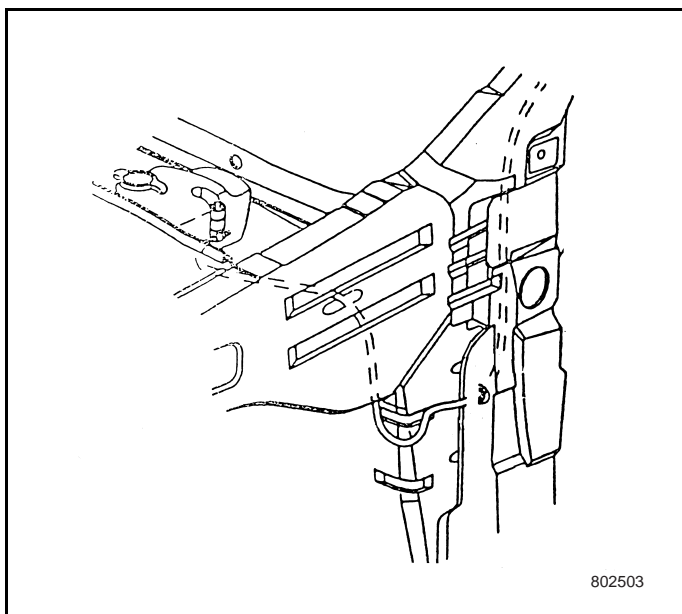
3. Remove the rear nozzle from the tail gate and disconnect the rear hose on the rear nozzle.



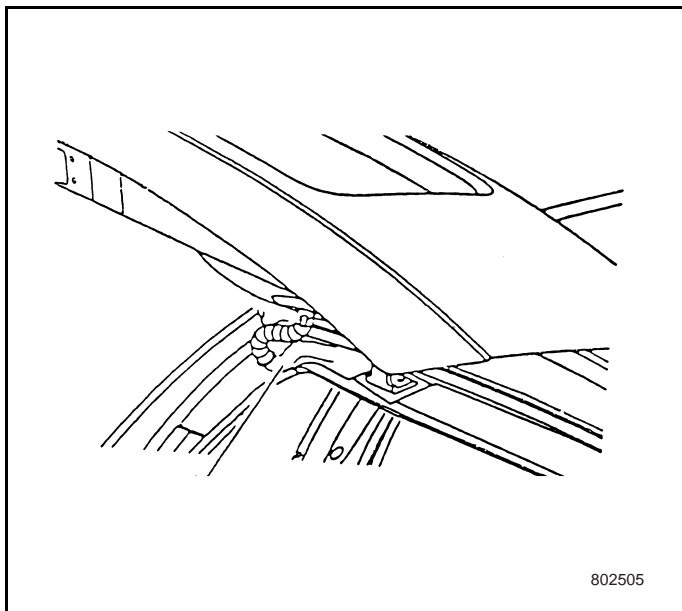
4. Remove the hook slot from the tail gate and left side body.
5. Remove the rear hose from the left side body.

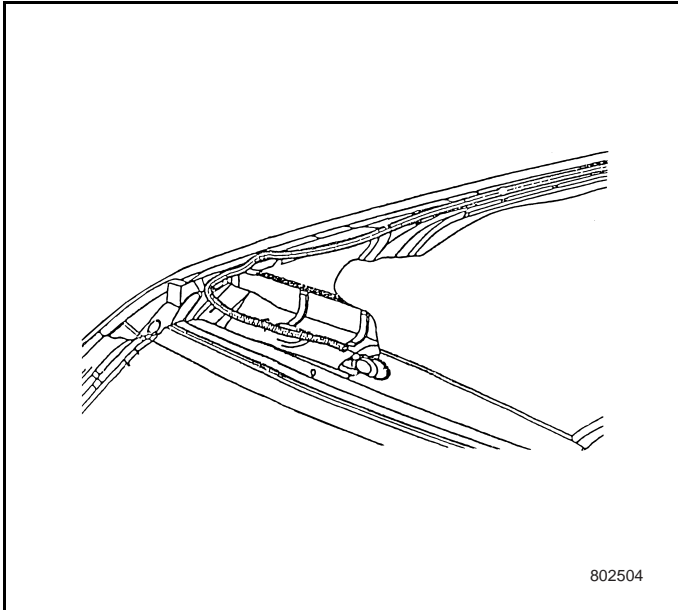
Installation Procedure

1. Install the rear hose from the left side body.
2. Install the sealing ring from the left side body.
3. Connect the rear hose to the washer pump.



4. Pass the hose through the hook slot and install the rear hose inside the tail gate.
5. Install the hook from the tail gate and left side body.





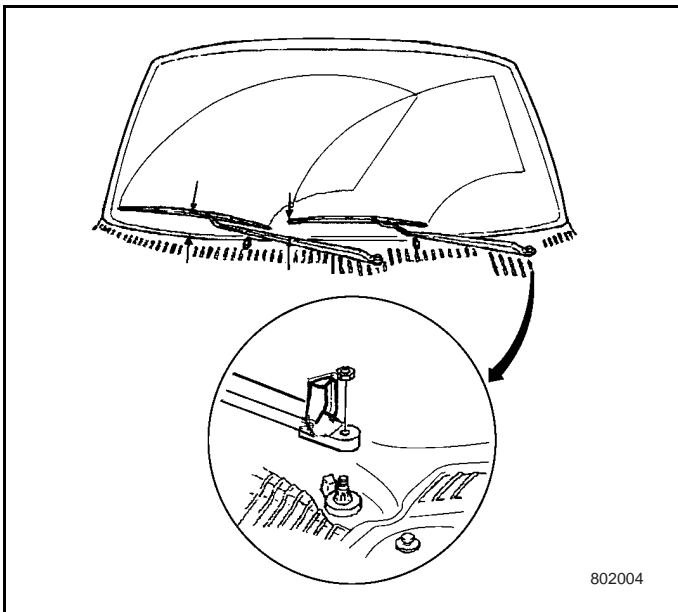
6. Connect the hose to the rear nozzle and install the rear nozzle onto the tail gater.

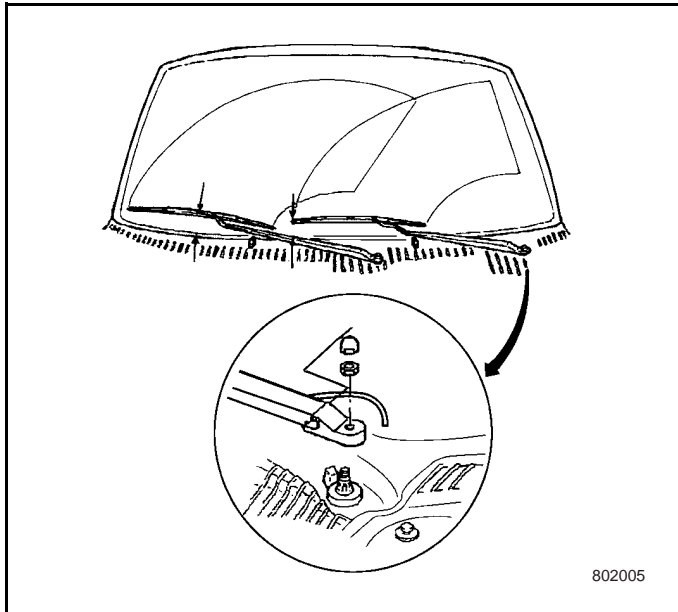
8.2.5.2A Wiper Arm Assembly Replacement

Removal procedure

Tools required

- J 39822 Wiper Arm Puller
1. Turn the light switch to ACCY position.
 2. Turn the wiper switch to PULSE position.
 3. When the wiper arm is place at the stop position, turn off the ignition switch.
 4. Rip away the cap from the nut.
 5. Remove the nut from the wiper arm.
 6. Remove the wiper arm assembly from the wiper transmission drive axle.





Installation Procedure

1. Install the wiper arm assembly onto the wiper transmission drive axle.
 - Turn the light switch to ACCY position.
 - Turn the wiper switch to PULSE position. The windshield wiper motor should be running.
 - Turn off the ignition switch when the wiper transmission system stops.
 - Install the wiper arm on the drive axle of the wiper transmission and maintain a distance as follows at the same time.
 - a. Left Side 50-60mm
 - b. Right Side 45-55mm
2. Install the nut onto the wiper transmission drive axle and the wiper arm.

Tightening

Tighten the nut to 10-12 N•m.

3. Place the cap on the nut.
4. Operate the wiper and inspect for normal operation.

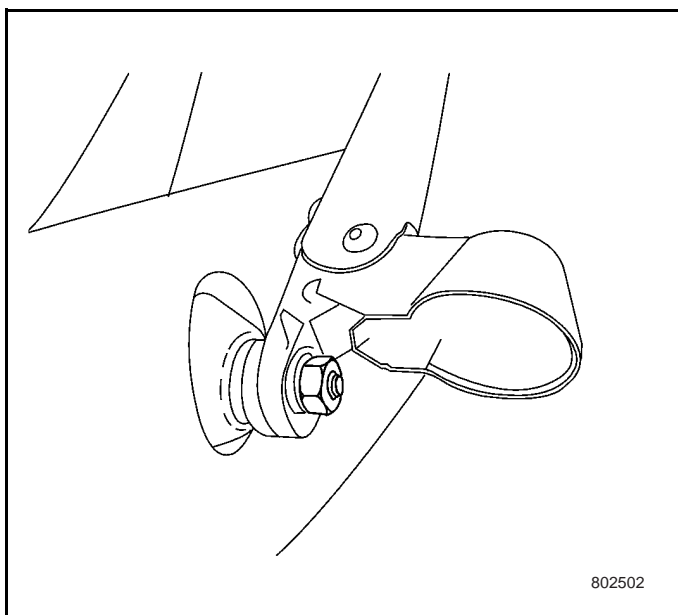
8.2.5.2B Rear Wiper Arm Replacement

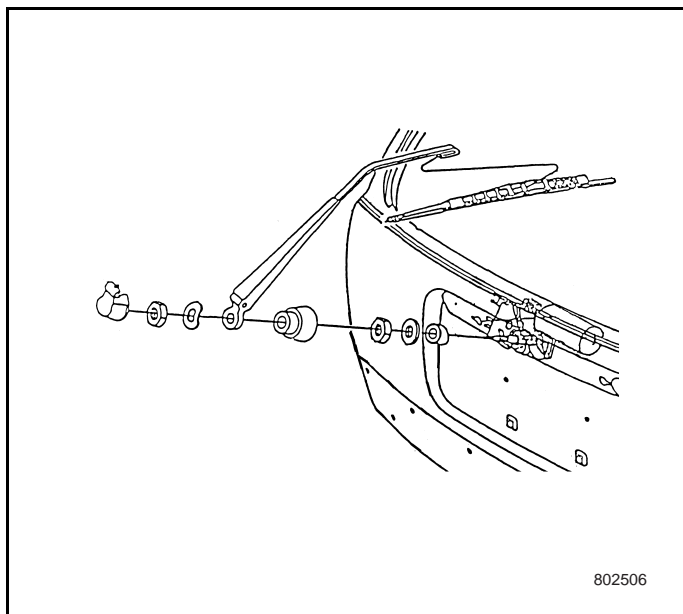
Removal procedure

Tools required

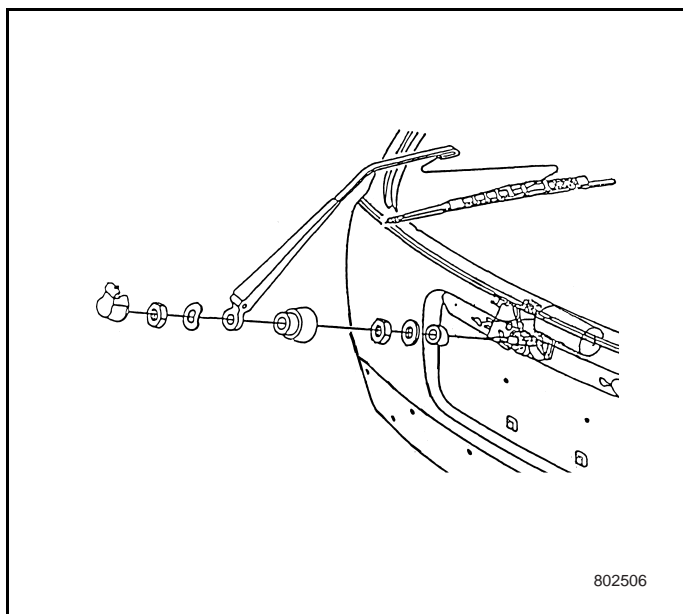
- J 39822 Wiper Arm Puller

1. Turn the light switch to ACCY position.
2. Turn the rear wiper switch to PULSE position.
3. Turn off the ignition switch when the wiper arm is at stop position and not moving.
4. Remove the cap away from the nut.





5. Remove the nut and pad from the motor shaft.
6. Remove the rear wiper arm from the motor shaft.
7. Remove the wiper blade from the wiper. Refer to Wiper Arm Blade Replacement.

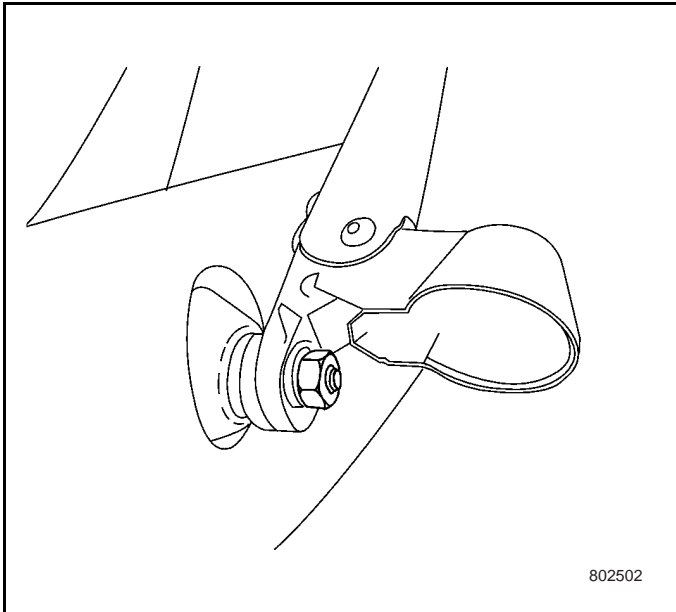


Installation Procedure

1. Install the wiper blade onto the wiper arm. Refer to Wiper Arm Blade Replacement.
2. Install the rear wiper arm onto the motor shaft.
 - Turn the light switch to ACCY position.
 - Turn the rear wiper switch to PULSE position. The rear wiper system should be running.
 - Turn off the ignition switch when the wiper drive system is at stop position and not moving.
 - Install the rear wiper arm onto the motor shaft.
3. Install the gasket and nut onto the motor shaft.

Tightening

Tighten the nut to 10-11 N•m.

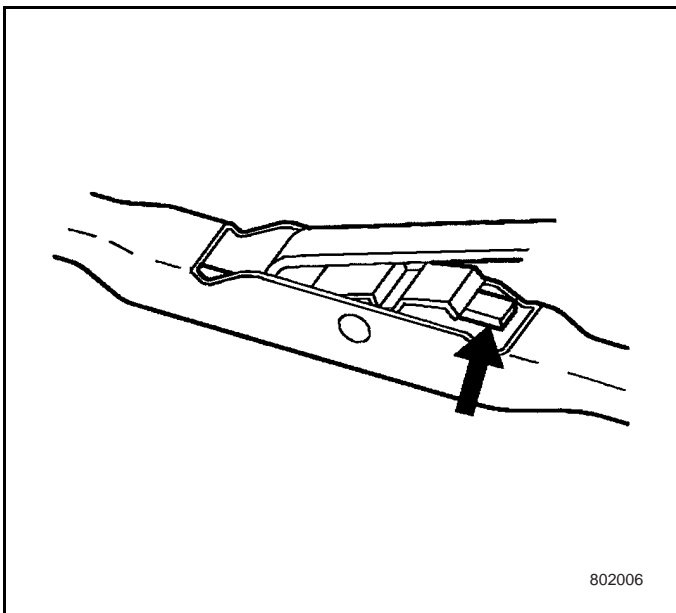


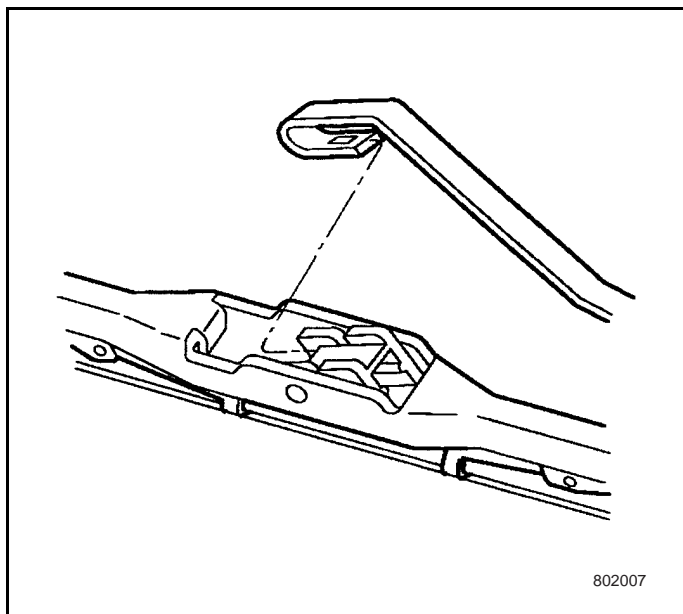
4. Press down the cap.
5. Run the rear wiper and inspect for normal operation.

8.2.5.3 Wiper Arm Blade Replacement

Removal procedure

1. Push in the bottom of the wiper blade clip and remove the wiper blade from the wiper arm inside.

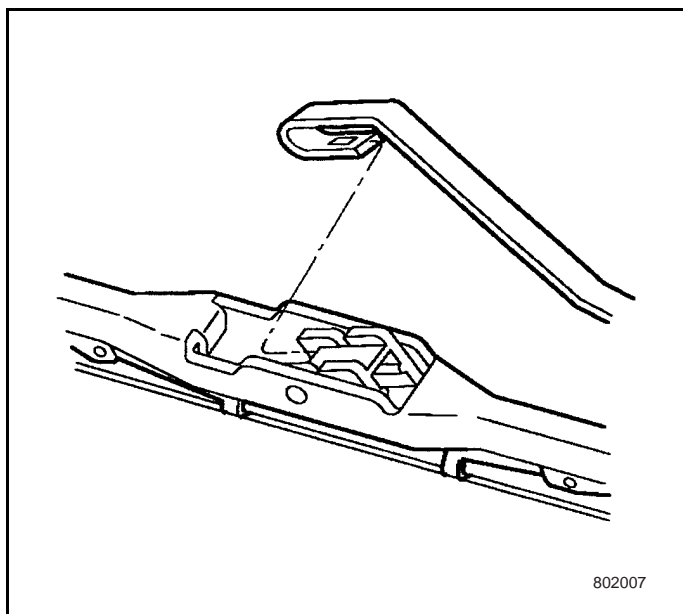


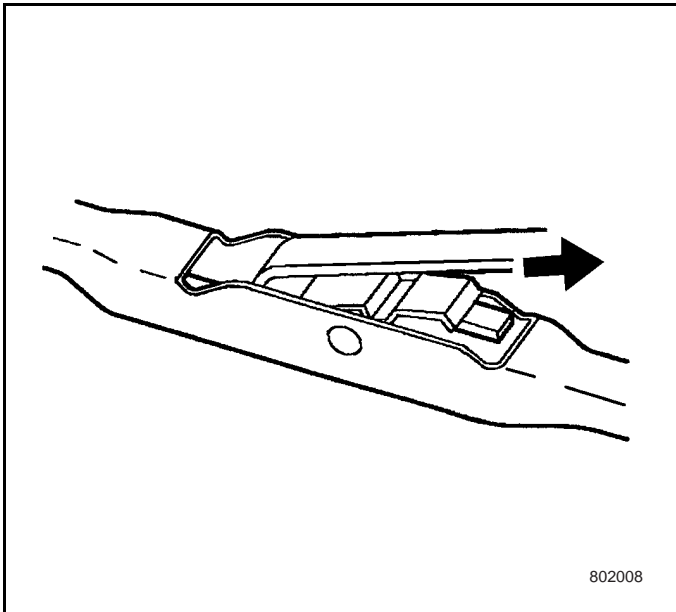


2. Take out the wiper arm through the opening in the wiper blade.

Installation Procedure

1. Install the wiper arm through the opening in the wiper blade.



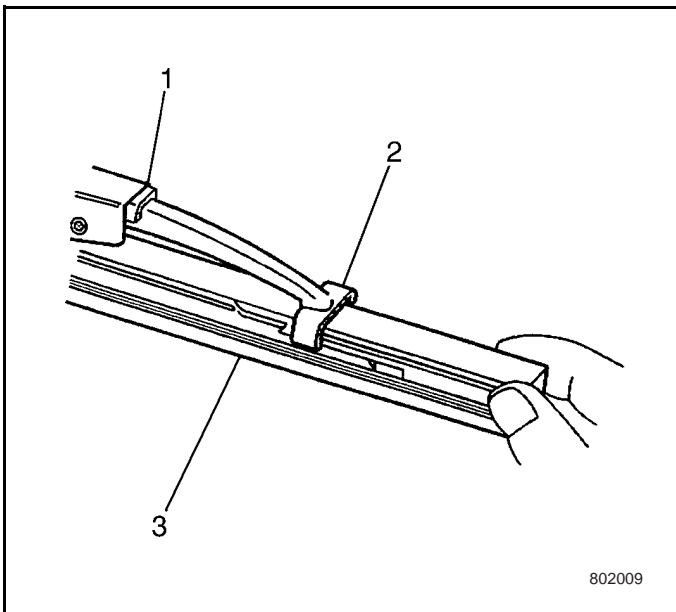


2. Place the wiper blade hook slot position inside the wiper arm hook.
3. Pull the wiper blade hook slot position into the wiper arm hook until the hook slot position locked in the hook.
4. Run the wiper and inspect for normal operation.

8.2.5.4 Wiper Blade Element Replacement

Removal procedure

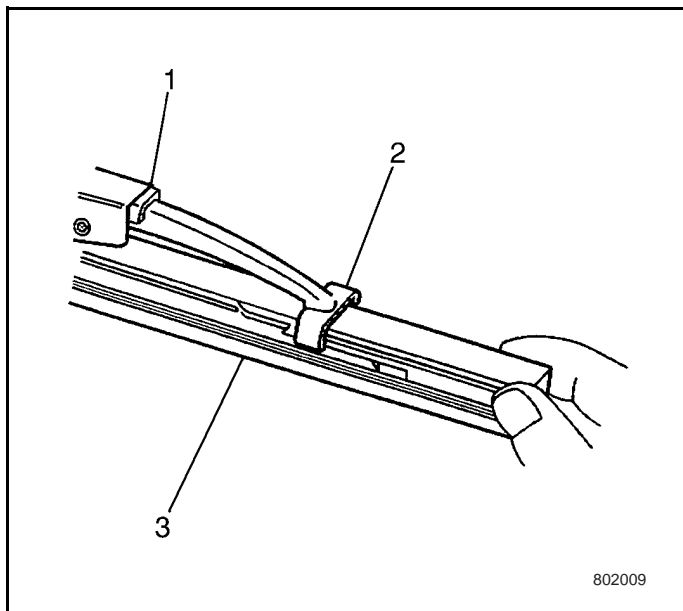
Note: Replace the wiper blade element if removing from the wiper blade.



1. Remove the wiper blade from the wiper arm. Refer to Wiper Arm Blade Replacement.
2. Remove the wiper blade (1) and claw (2) from the wiper blade element (3).
3. Draw out the wiper blade element (3) through the wiper blade claw (2).

Installation Procedure

Note: Keep the wiper blade claw in the rubber claw sliding channel of the wiper element. Do not let the wiper blade claw to contact the metal slot of the wiper element.



1. Insert the opening end of the wiper blade element (3) the bottom claw of the wiper blade.
2. Guid the wiper blade element (3) through the wiper blade (1) claw sets.
3. Engage the bottom claw (2) of the wiper blade element (1) in the notches in the wiper blade
4. Install the wiper blade onto the wiper arm. Refer to Wiper Arm Blade Replacement.

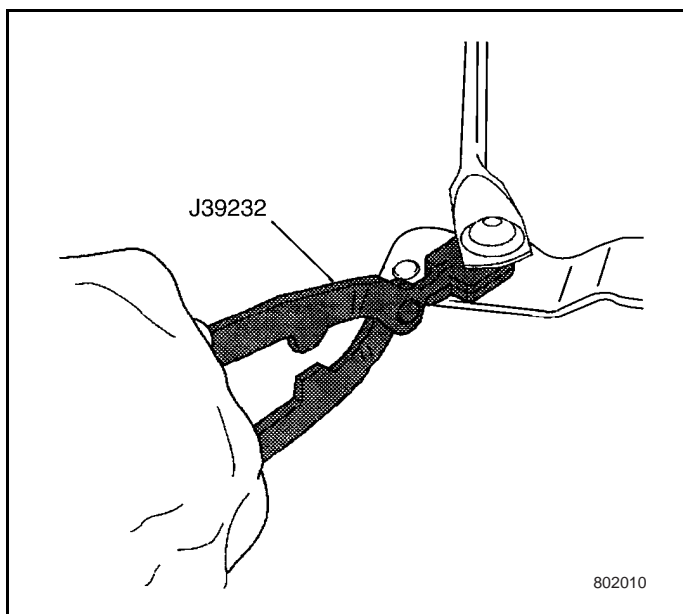
8.2.5.5A Wiper Motor Replacement (with rocker arm and driving member)

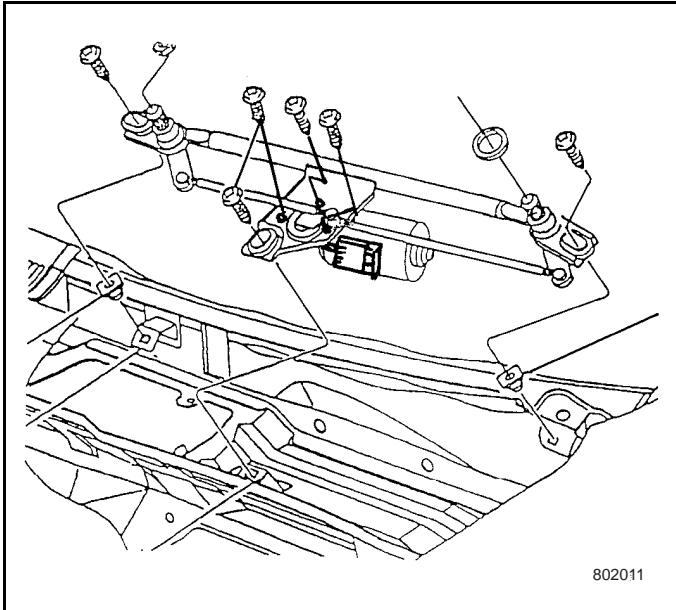
Removal procedure

Tools required

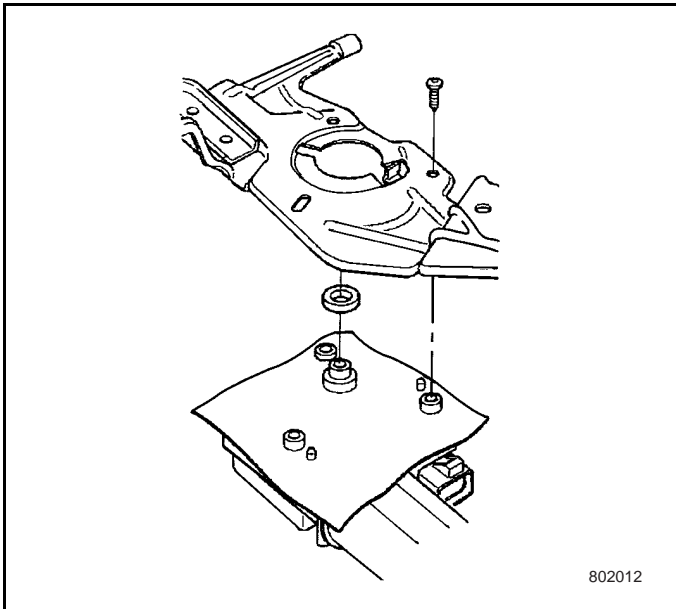
- J 39232 Wiper transmission lever separator

1. Remove the wiper arm from the wiper transmission lever. Refer to Wiper Arm Blade Replacement.
2. Remove the air inlet grid from the vehicle. Refer to Air Inlet Grille Panel Replacement in Body Front End.
3. Remove the connector from the wiper motor.
4. Remove the wiper motor rocker arm from the wiper transmission linkage.





5. Remove the wiper transmission system from the vehicle.



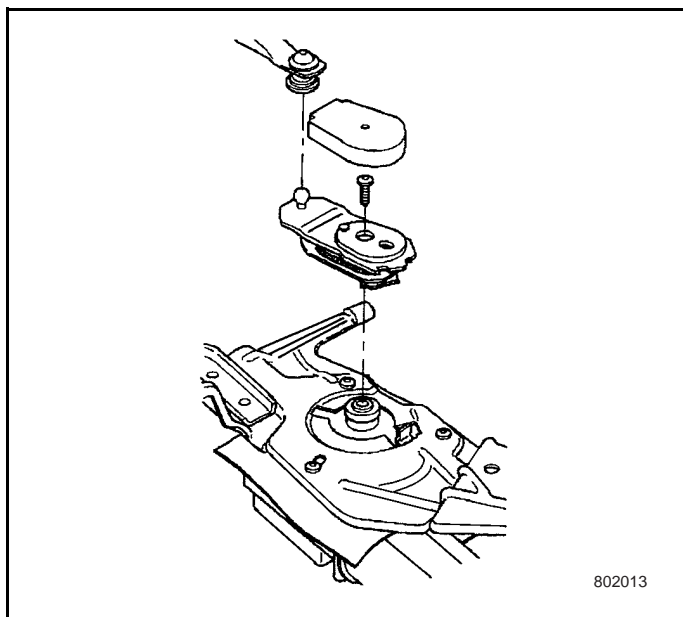
6. Remove the 3 screw from the wiper motor and wiper transmission linkage.
7. Separate the motor rocker arm from the wiper transmission linkage.

Installation Procedure

1. Use 3 screws to install the wiper onto the wiper transmission assembly.

Tightening

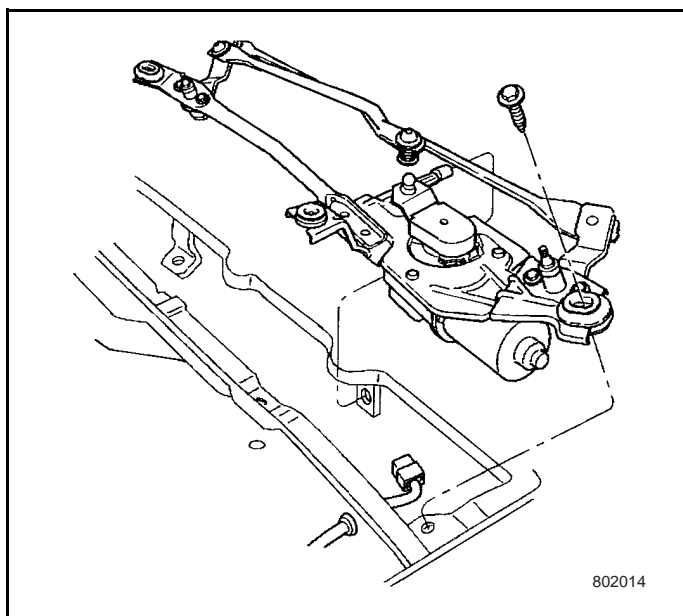
Tighten the 3 screws to 9-12 N•m.

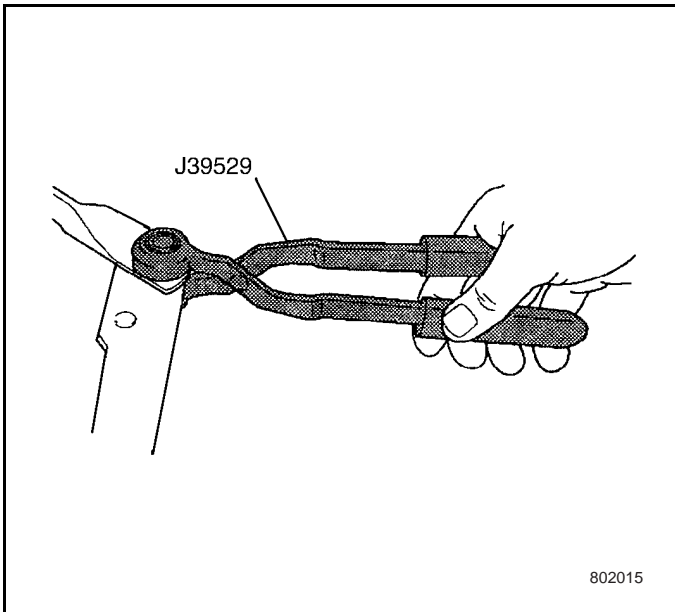


2. Disconnect the motor rocker arm from the wiper transmission linkage.
3. Install the screws.
4. Use 3 screws to install the wiper transmission assembly onto the vehicle.

Tightening

Tighten the 3 screws to 3.5-4.5 N•m.



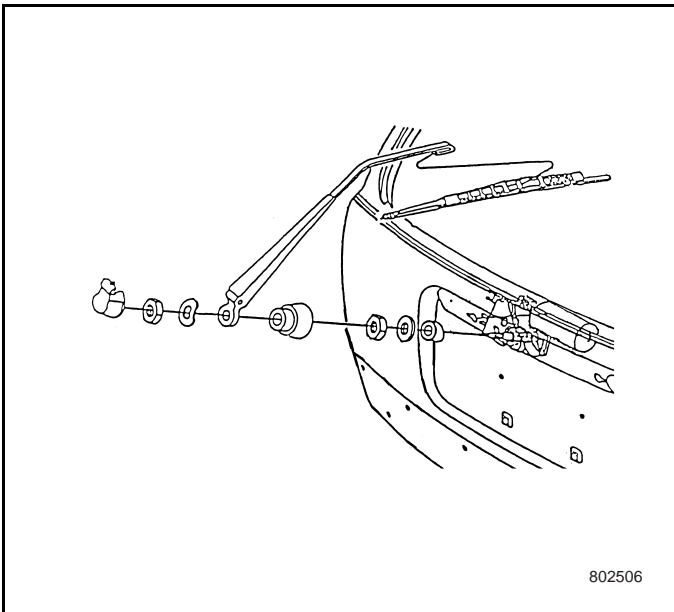


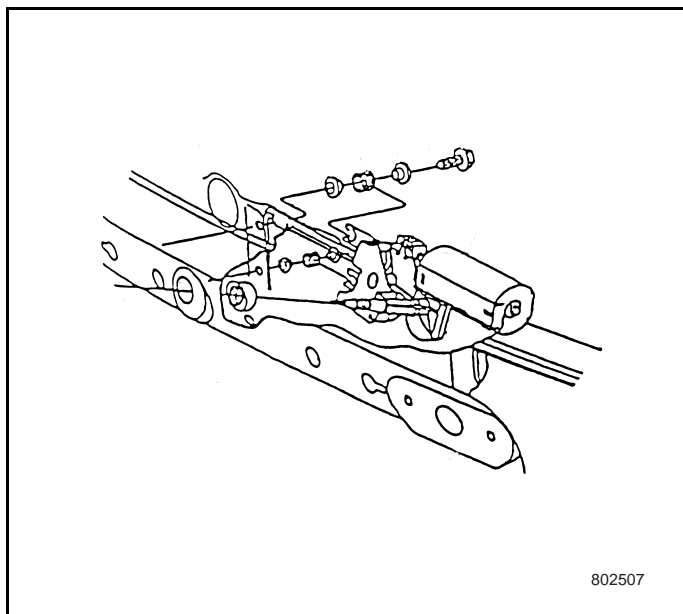
5. Install the connector onto the wiper motor.
6. Remove the air inlet grille from the vehicle. Refer to Air Inlet Grille Panel Replacement in Body Front End.
7. Install the wiper arm into the drive shaft of the wiper transmission mechanism. Refer to Wiper Arm Blade Replacement.
8. Run the wiper and inspect for normal operation.

8.2.5.5B Rear Wiper Motor Assembly Replacement

Removal procedure

1. Remove the rear wiper arm from the motor shaft. Refer to Rear Wiper Arm Replacement.
2. Remove the escutcheon from the motor shaft.
3. Remove nut, pad and insulated bush from the motor shaft.





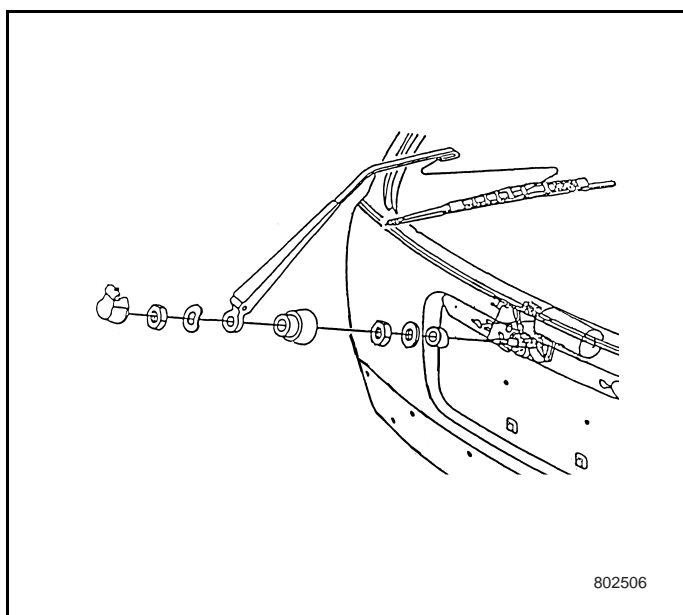
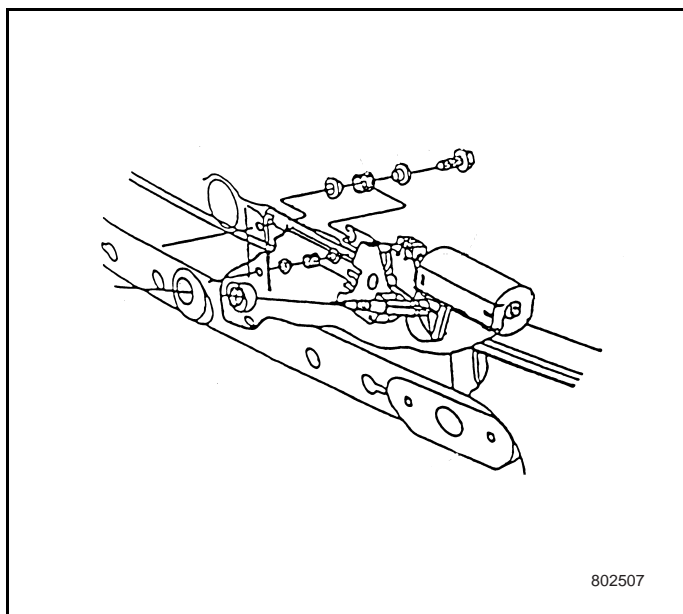
4. Remove the 2 screw from the wiper motor assembly.
5. Remove the rear wiper motor from the tail gate.

Installation Procedure

1. Install 2 sets of partition boards (2) and insulator.
2. Install the rear wiper motor assembly with 2 screws on the tail gate.

Tightening

Tighten the 2 screws to 2.0-3.0 N•m.



3. Install insulator, gasket, and nut onto the motor shaft.

Tightening

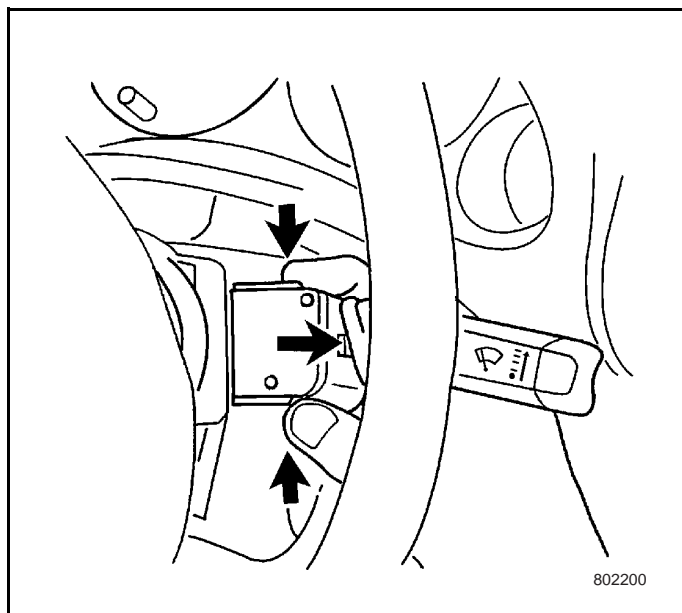
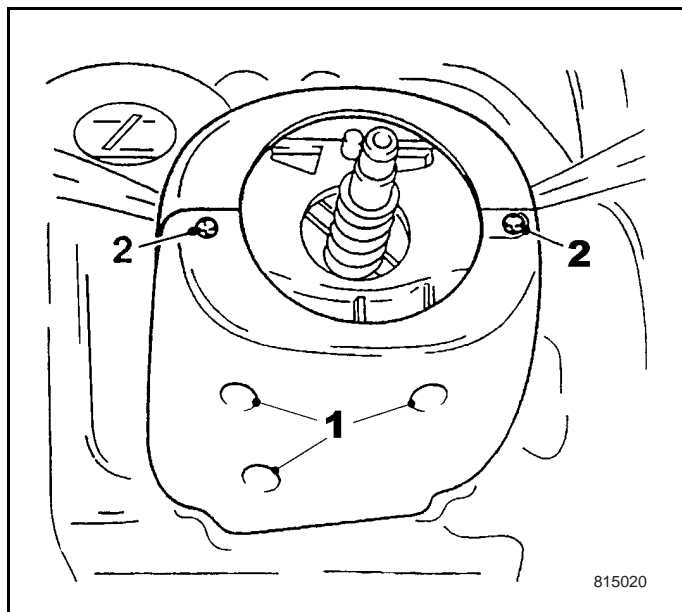
Tighten the screw to 1.0-2.0 N•m.

4. Install the escutcheon onto the motor shaft.
5. Install the rear wiper arm onto the motor shaft. Refer to Rear Wiper Arm Replacement.
6. Run the rear wiper and inspect for normal operation.

8.2.5.6 Wiper Switch Replacement

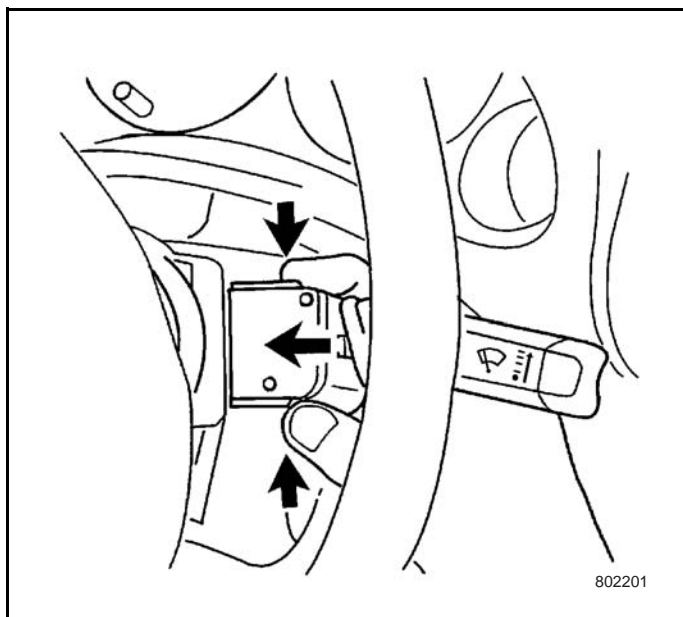
Removal procedure

1. Remove the steering wheel. Refer to Steering Wheel Replacement in Steering Wheel and Column
2. Loosen the screw (1), and (2) on the steering column cover. Then remove the lower and upper cover of the steering column.
3. Press down the flaps of the wiper switch and pull it out.



Installation Procedure

1. Insert the wiper switch into the mounting slot.

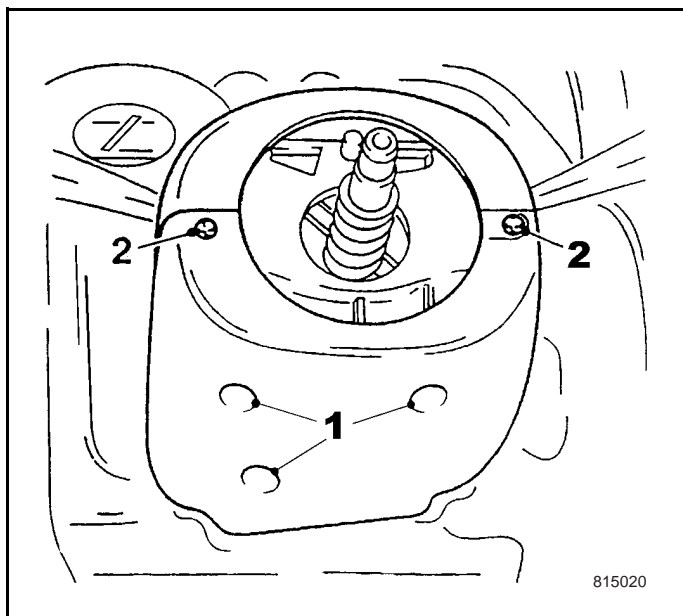


2. Tighten the screw on the steering column cover. Install the steering column cover.

Tightening

Tighten the steering column cover screw to $2.0 \pm 0.3 \text{ N}\cdot\text{m}$

3. Install the steering wheel. Refer to Steering Wheel Replacement in Steering Wheel and Column



8.2.5.7 Wiper lever chatter repair when the wiper is operating

Chatter and/or uneven wiping and washing will occur on the windshield wiper of some vehicle. Several items may contribute to this condition. The following listed items should be tested and repaired according to the condition if it is to be completely repaired.

- Clean the windshield
- Clean the wiper blade element
- Perform wiper arm pressure test
- Inspect the wiper blade element adjustment.

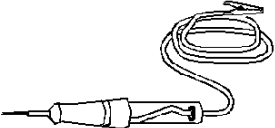
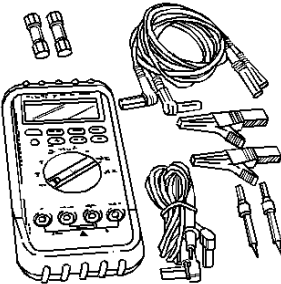
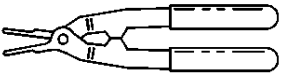
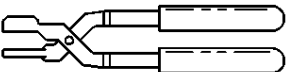
8.2.5.8 Windshield Glass Cleaning

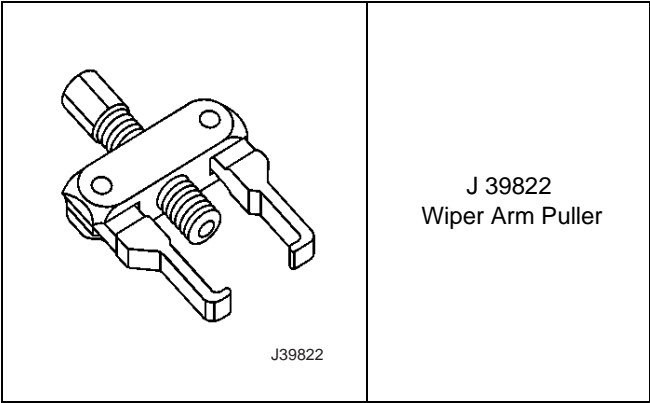
Use the windshield cleaning agent general part No 105001 or equivalent product to clean the windshield. The cleaning agent should not damage the paint surface or scrub glass. The glass is clean when the water no longer beads, but sheets across the entire glass surface.

8.2.5.9 Wiper Element Cleaning

Lift up each blade assembly off of the windshield, and use cloth saturated full with washer solvent to clean the element. Then rinse the blade assembly with water.

8.2.6 Special Tools

Illustration	Tool Number/Name
 <p>J34142-B</p>	J 34142-B No Power Supply Test Lamp
 <p>J39200</p>	J 39200 Digital Multimeter
 <p>J39232</p>	J 39232 Wiper transmission lever separator
 <p>J39529</p>	J 39529 Wiper Transmission Lever Installer



8.3 Exterior Trim

8.3.1 Specification

8.3.1.1 Fastener Tightening Torque

Application	Specification
Front Bumper Fixture Bolts	1.0-1.5 N•m
Front Bumper Fascia Lower Bolt	2.5-3.2 N•m
Front Bumper Fascia Side and Wheel Cap Attaching Bolt	1.25-2.15 N•m
Front Bumper Fascia Upper Bolt	2.0-2.5 N•m
Rear Bumper Fascia Upper Bolt	1.0-1.5 N•m
Rear Bumper Fascia Lower Bolt	1.0-1.5 N•m
Lower Radiator Face Shield Screw	2.0-3.0 N•m
Floor Exterior Trim Screw	3.0-3.5 N•m
Rear Wheel Opening Nut	31.5 N•m
Baggage Rack Nut	12-15 N•m
Tail Gate Lower Trim Strip Central Nut	1.0 N•m

8.3.2 Diagnostic Information and Procedures

8.3.2.1 Inspection after Collision

If serious collision moves away the bumper from its original position, you may need to replace the following parts

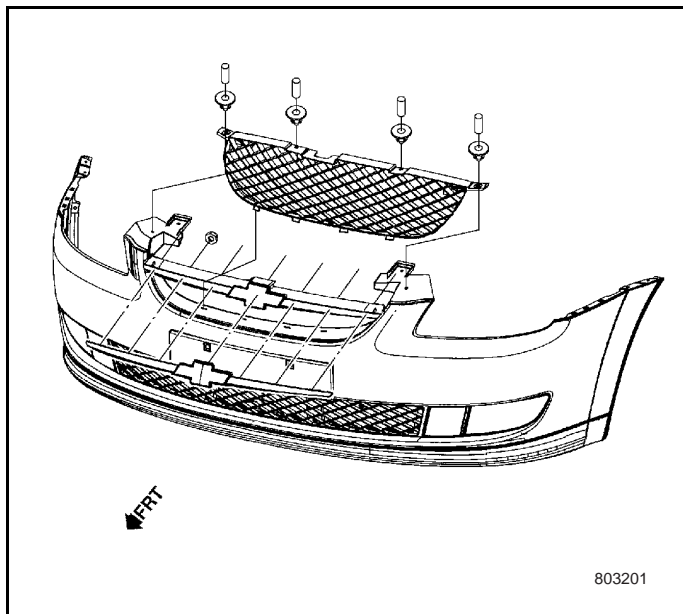
- Bumper Fascia
- Bumper Anti-collision Bar

8.3.3 Repair Instructions

8.3.3.1 Grille Emblem Replacement-Grille

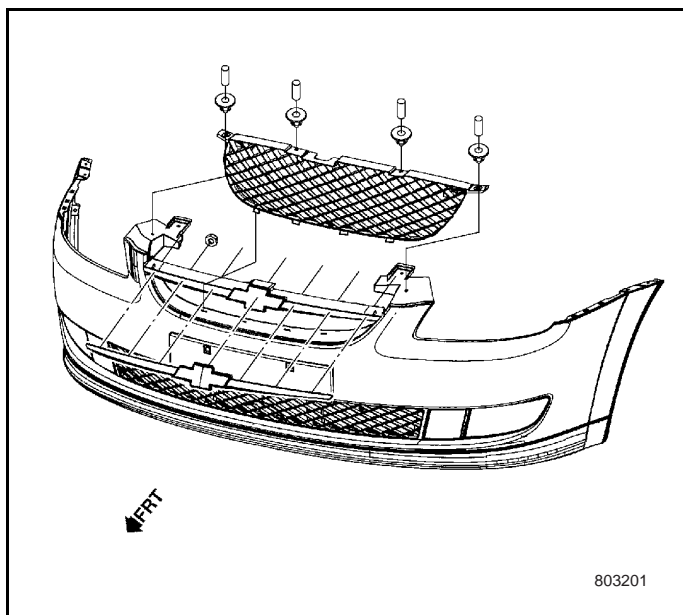
Removal procedure

1. Open the engine hood.
2. Take out the radiator face shield, refer to Upper Radiator Face Shield Replacement.
3. Remove the 7 attaching screws behind the emblem plates.
4. Take off the front emblems.



Installation Procedure

1. Install the emblem plates onto the front bumper fascia with 7 screws.
2. Install the radiator face shield. Refer to Upper Radiator Face Shield Replacement.
3. Close the Hood.



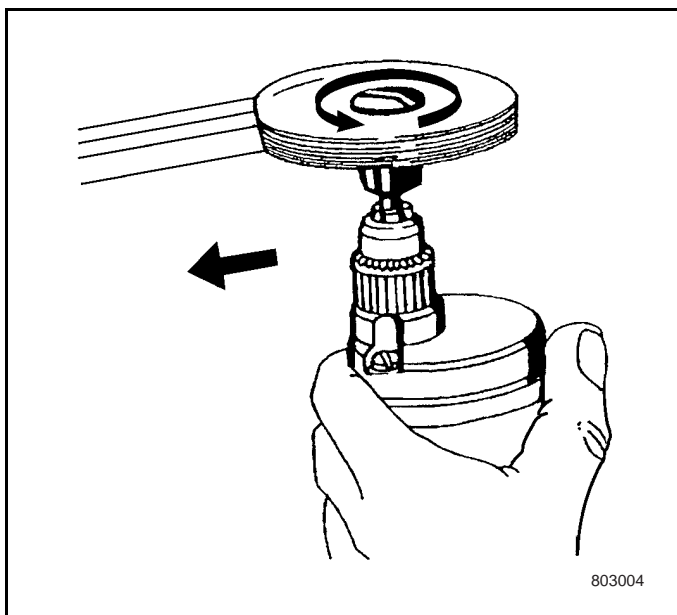
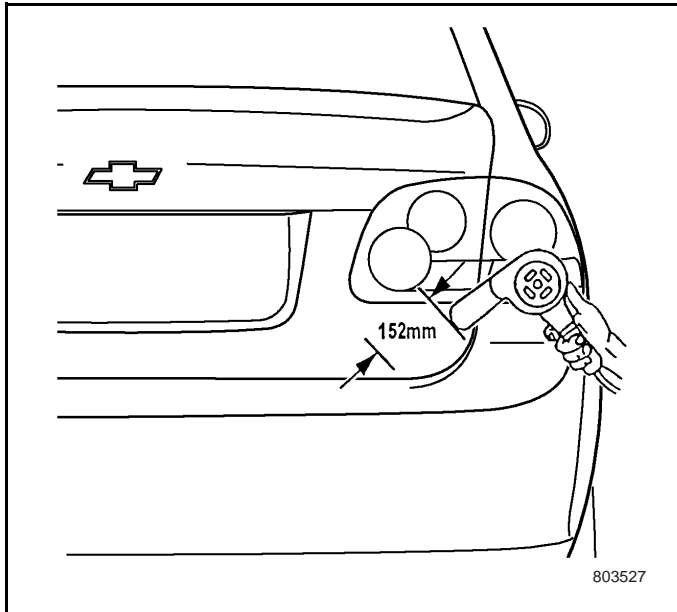
8.3.3.2A Name Plate Replacement – 1.6SL/1.6SE

Removal procedure

Tools required

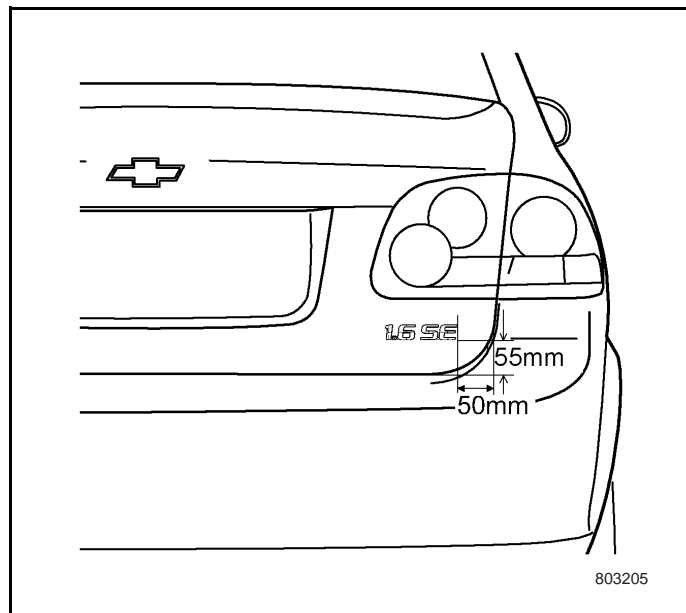
- J 25070 – Blower

1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Tape used as mark of installation emblem/ name plate calibration.
2. Use J 25070 to heat the emblem plates or name plate 152mm from the surface if to remove them.
3. Heat them in a circular motion for about 30 seconds.



Notice: Use plastic flat-bladed tool in prevention of paint surface damage when removing the identification or name plates.

4. Use plastic flat-bladed tool to tear down or remove the identification or name plate.
5. Apply the adhesive foam tap on the back of the emblem and name plates and squeeze the proper position of them.
6. Remove all adhesive from the body using 3MTM Scotch Brite molding adhesive remover disk 3MTM P/N 07501 or equivalent.



Installation Procedure

Note: Apply the emblem/name plate in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.

1. Clean the area where the emblem/name plate will be installed.
Use clean lint cloth and Varnish Makers and Painters (VMP) naphths or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
2. Completely dry the area.
3. Mark the tap as the reference point of the proper position of the emblem plate.
4. If the emblem/name plate locations has not been marked, apply tape and use dimensions shown in the diagram.
5. Heat the mounting surface to approximately 27-41°C.
6. Ensure that the temperature of the emblem/name plate is approximately C.
7. Remove the protection pad from the back of the emblem/name plate.
8. Position the emblem/name plate to the location marks and press the emblem/nameplate to the mounting surface.
9. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.
10. Remove the protection tape from the mounting surface.

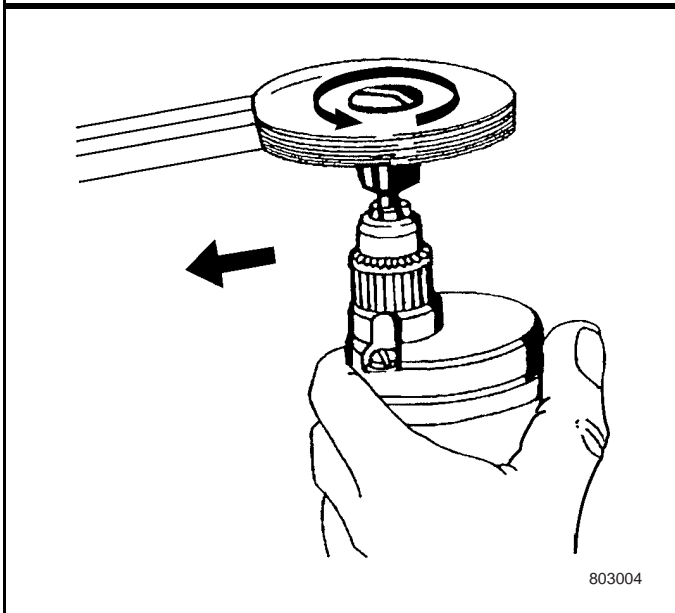
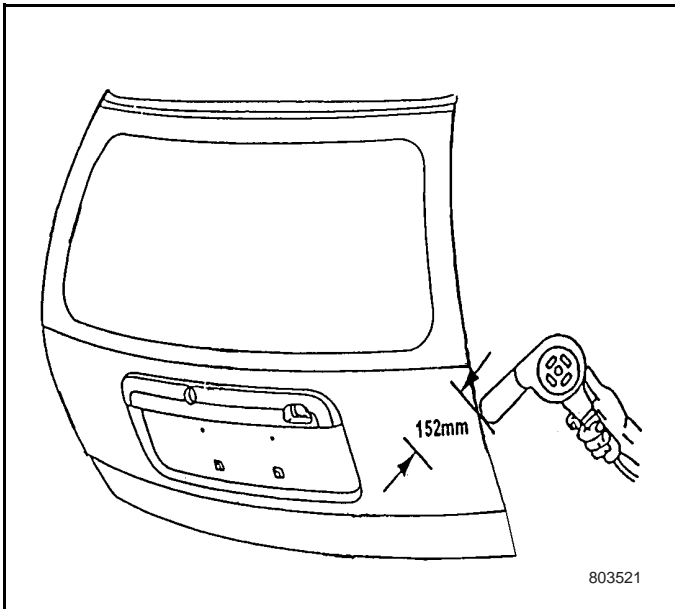
8.3.3.2B Name Plate Replacement-1.6SL/ 1.6SE/1.6SX

Removal procedure

Tools required

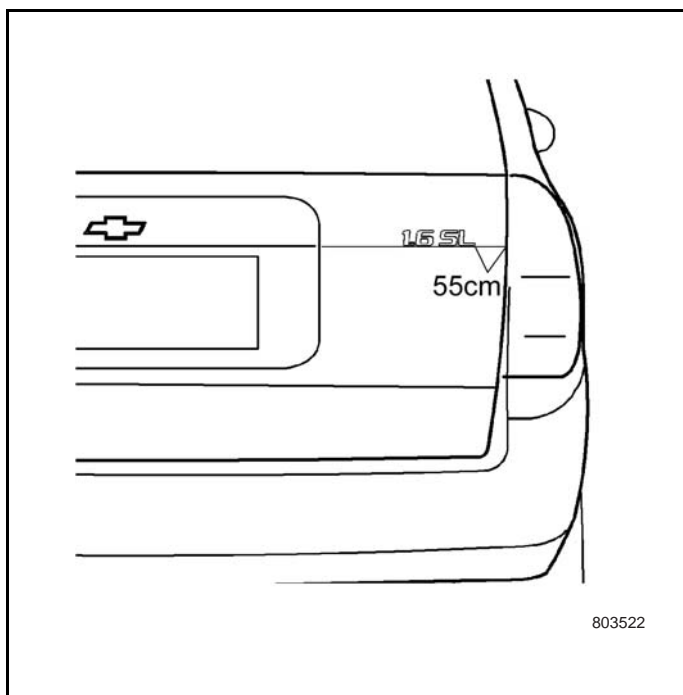
- J 25070 – Blower

1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Tape used as mark of installation emblem/ name plate calibration.
2. Use J 25070 to heat the identification plate or name plate 152mm from the surface if to remove them.
3. Heat them for about 30 seconds in a circular motion.



Notice: Use plastic flat-bladed tool in prevention of paint surface damage when removing the identification or name plates.

4. Use plastic flat-bladed tool to tear down or remove the identification or name plate.
5. Apply the adhesive foam tap on the back of the emblem and name plates and squeeze the proper position of them.
6. Remove all adhesive from the body side using 3MTM Scotch Brite molding adhesive remover disk 3MTM P/N 07501 or equivalent.



Installation Procedure

Note: Apply the trademark in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.

1. Clean the area where the emblem/name plate will be installed.
2. Use clean lint cloth and naphthols or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
3. Completely dry the area.
4. Mark the tap with measurement for the proper location of the emblem.
5. If the location of the emblem/name plate has not been marked, apply tape and use the following body dimensions.
 - The lower edge of the emblem fits with the tail gate handle lower edge.
 - The emblem right side is 55 mm away from the tail gate right edge.
6. Heat the mounting surface to approximately 27-41°C.
7. Ensure that the temperature of the emblem/name plate is approximately C.
8. Remove the protection pad from the back of the emblem/name plate.
9. Position the emblem/name plate to the location marks and press the emblem/nameplate to the mounting surface.
10. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.
11. Remove the protection tape from the mounting surface.

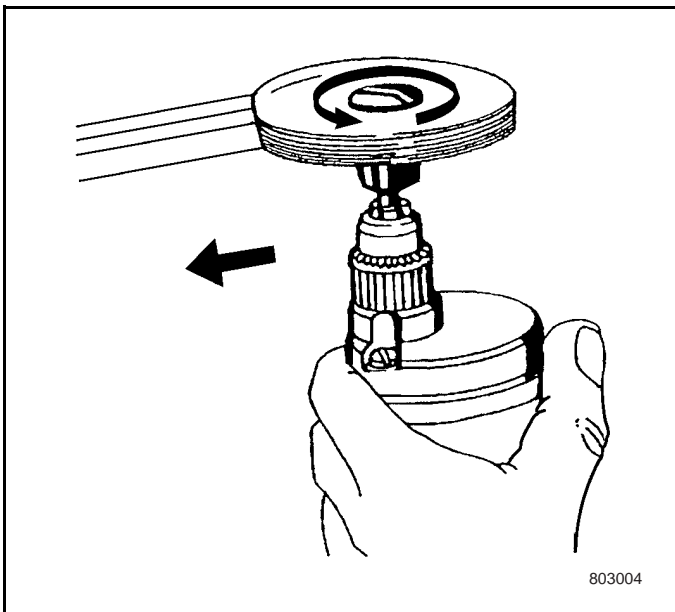
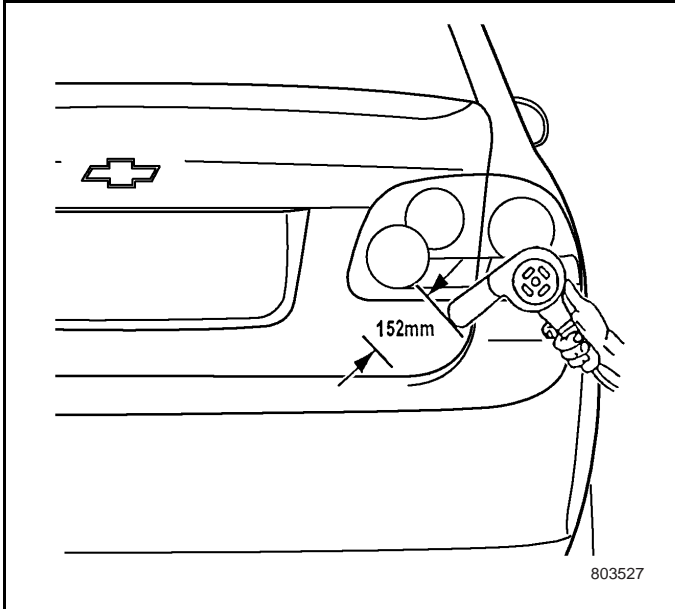
8.3.3.3A Name Plate Replacement-LAVI

Removal procedure

Tools required

- J 25070 – Blower

1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Use tap as the calibration mark when installing emblem/name plate.
2. Use J 25070 to heat the emblem 152 mm from the surface if to remove the emblem/nameplate.
3. Heat them in a circular motion for about 30 seconds.

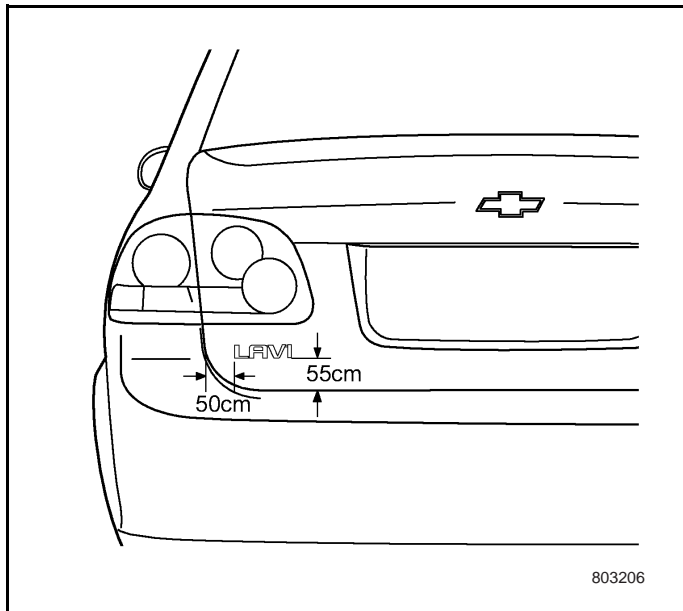


Notice: Use a plastic flat-bladed tool to prevent damage of the paint surface when removing the emblem/nameplate.

4. Use plastic flat-bladed tool to lift or remove the identification or name plate from the panel surface.
5. Apply the adhesive foam tap to the back of the emblem/nameplate and press the emblem/nameplate to the proper position.
6. when replacing, remove all adhesive from the body panel using 3MTM Scotch Brite molding adhesive remover disk 3MTM P/N 07501 or equivalent.

Installation Procedure

Note: Apply the emblem/name plate in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.



1. Clean the area where the emblem/name plate will be installed.
Use lint free cloth and Varnish Makers and Painters (VMP) naphtha or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
2. Completely dry the area.
3. Mark the tap as the reference point of the proper position of the emblem plate.
4. If the emblem/name plate locations has not been marked, apply tape and use dimensions shown in the diagram.
5. Heat the mounting surface to approximately 27-41°C.
6. Ensure that the temperature of the emblem/name plate is approximately C.
7. Remove the protection pad from the back of the emblem/name plate.
8. Position the emblem/name plate to the location marks and press the emblem/nameplate to the mounting surface.
9. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.
10. Remove the protection tape from the mounting surface.

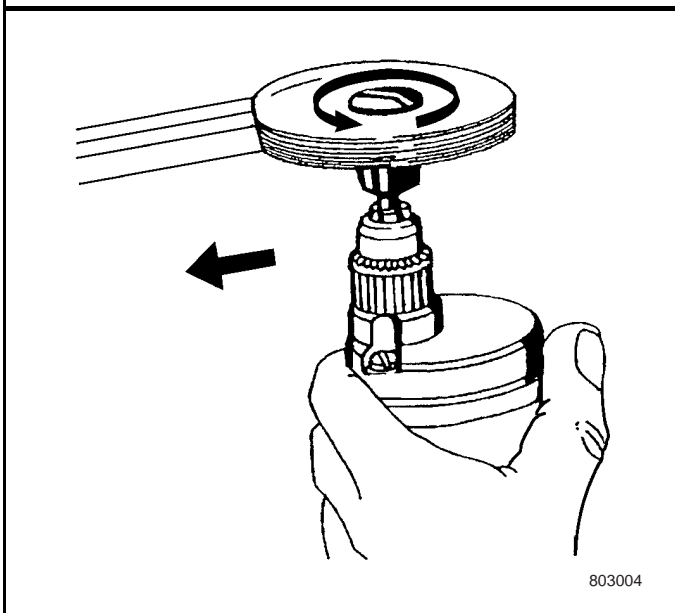
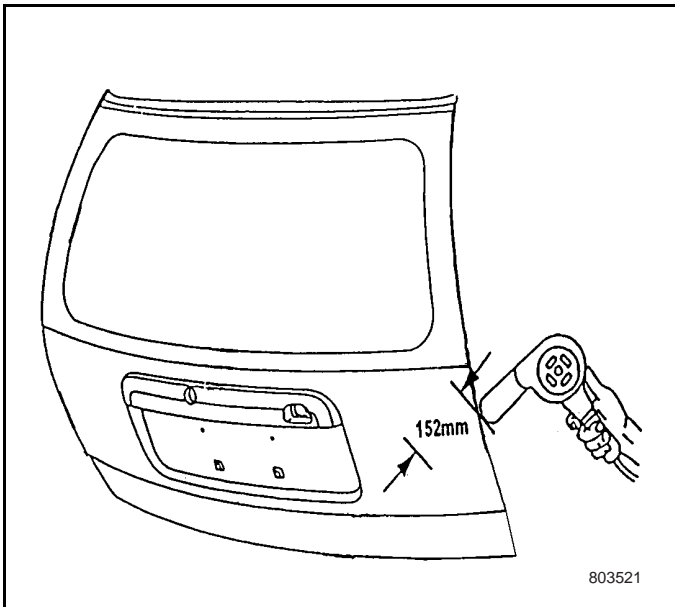
8.3.3.3B Name Plate Replacement-LAVI

Removal procedure

Tools required

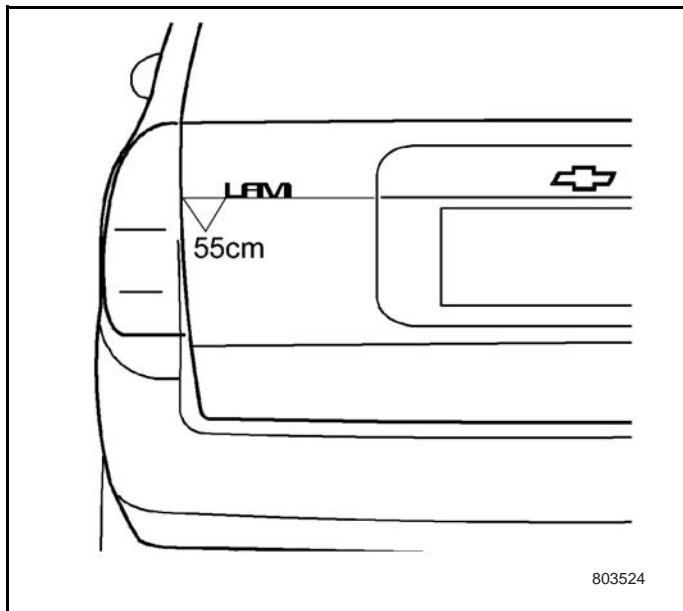
- J 25070-Blower

1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Tape used as mark of installation emblem/ name plate calibration.
2. Use J 25070 to heat the identification plate or name plate 152 mm from the surface if to remove them.
3. Heat them for about 30 seconds in a circular motion.



Notice: Use plastic flat-bladed tool in prevention of paint surface damage when removing the identification or name plates.

4. Use plastic flat-bladed tool to lift or remove the identification or name plate from the panel surface.
5. Apply the adhesive foam tap on the back of the emblem and name plates and squeeze the proper position of them.
6. When replacing, remove all adhesive from the body panel using 3MTM Scotch Brite molding adhesive remover disk 3MTM P/N 07501 or equivalent.



Installation Procedure

Note: Apply the trademark in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.

1. Clean the area where the emblem/name plate will be installed.
2. Use clean lint cloth and naphtha or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
3. Completely dry the area.
4. Mark the tap with measurement for the proper location of the emblem.
5. If the location of the emblem/name plate has not been marked, apply tape and use the following body dimensions.
 - The lower edge of the emblem fits with the tail gate handle lower edge.
 - The emblem left side is 55mm away from the tail gate left edge.
6. Heat the mounting surface to approximately 27°C-41°C.
7. Ensure that the temperature of the emblem/name plate is approximately 29°C-32°C.
8. Remove the protection pad from the back of the emblem/name plate.
9. Position the emblem/name plate to the location marks and press the emblem/nameplate to the mounting surface.
10. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.
11. Remove the protection tape from the mounting surface.

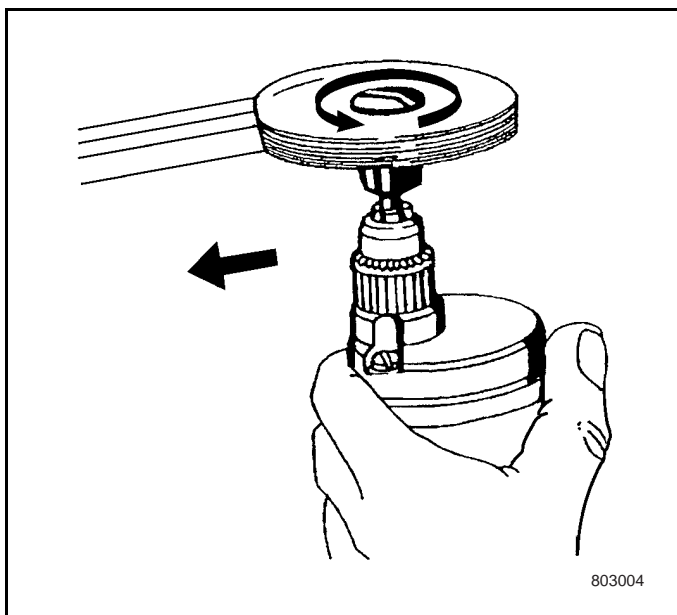
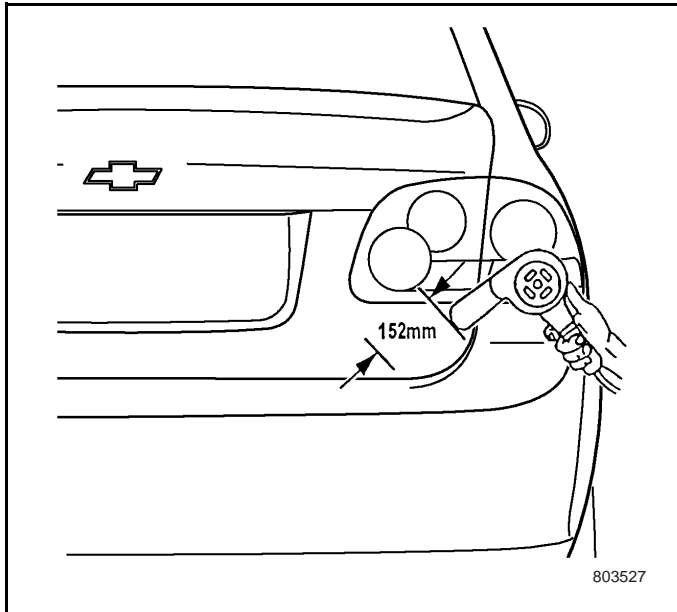
8.3.3.4A Name Plate Replacement-SGM 7165

Removal procedure

Tools required

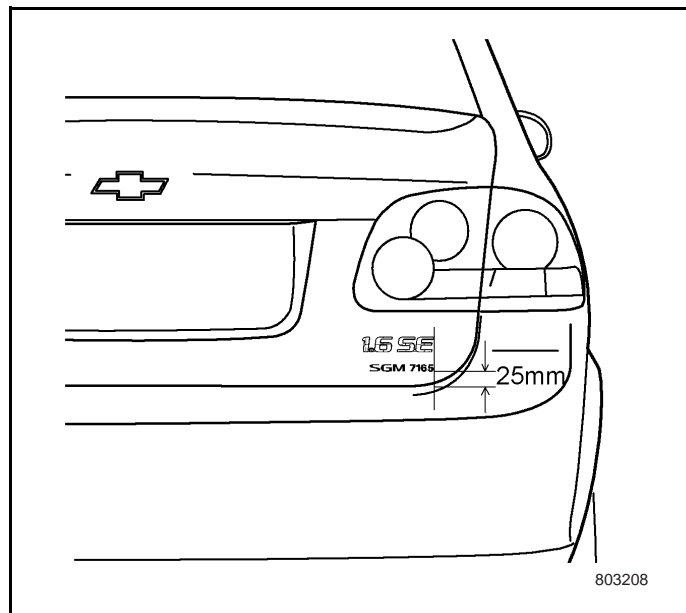
- J 25070 – Blower

1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Use tap as the calibration mark when installing emblem/name plate.
2. Use J 25070 to heat the identification plate or name plate 152 mm from the surface if to remove them.
3. Heat them in a circular motion for about 30 seconds.



Notice: Use a plastic flat-bladed tool to prevent damage of the paint surface when removing the emblem/nameplate.

4. Use plastic flat-bladed tool to lift or remove the identification or name plate from the panel surface.
5. Apply the adhesive foam tap to the back of the emblem/nameplate and press the emblem/nameplate to the proper position.
6. When replacing, remove all adhesive from the body panel using 3MTM Scotch Brite[®] molding adhesive remover disk 3MTM P/N 07501 or equivalent.



Installation Procedure

Note: Apply the emblem/name plate in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.

1. Clean the area where the emblem/name plate will be installed.
Use lint free cloth and Varnish Makers and Painters (VMP) naphtha or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
2. Completely dry the area.
3. Mark the tap with dimensions for the proper location of the emblem.
4. If the location of the emblem/name plate has not been marked, apply tape and use the following body dimensions.
 - The right end of SGM7165 aligns vertically with the right end of 1.6SL/1.6SE
 - The lower edge of SGM7165 is 25mm away from that of the trunk lid.
5. Heat the mounting surface to approximately 27-41°C.
6. Ensure that the temperature of the emblem/name plate is approximately C.
7. Remove the protection pad from the back of the emblem/name plate.
8. Position the emblem/name plate to the location marks and press the emblem/nameplate to the mounting surface.
9. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.
10. Remove the protection tape from the mounting surface.

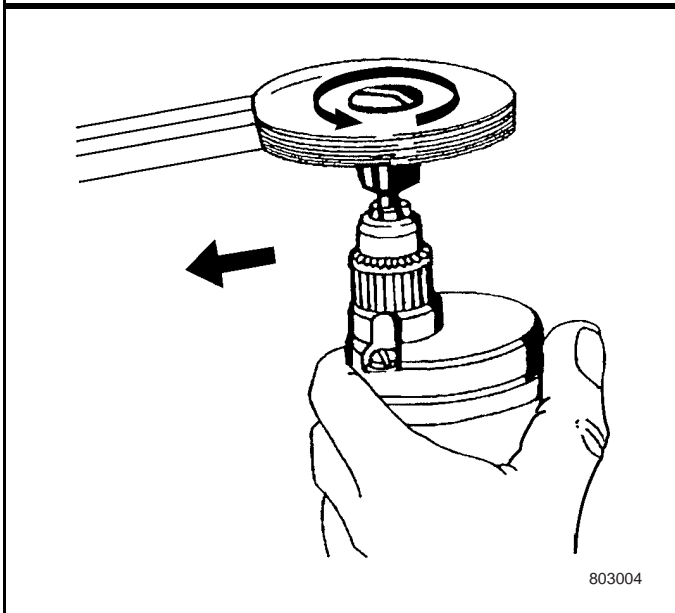
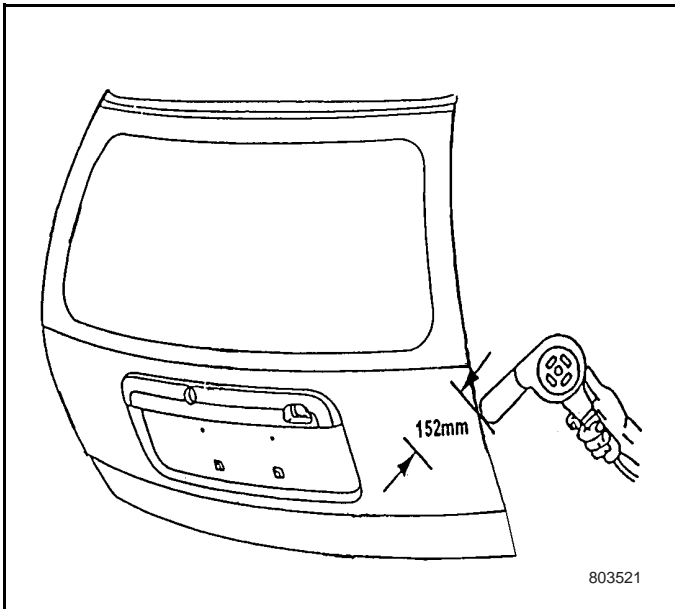
8.3.3.4B Name Plate Replacement-SGM 7166

Removal procedure

Tools required

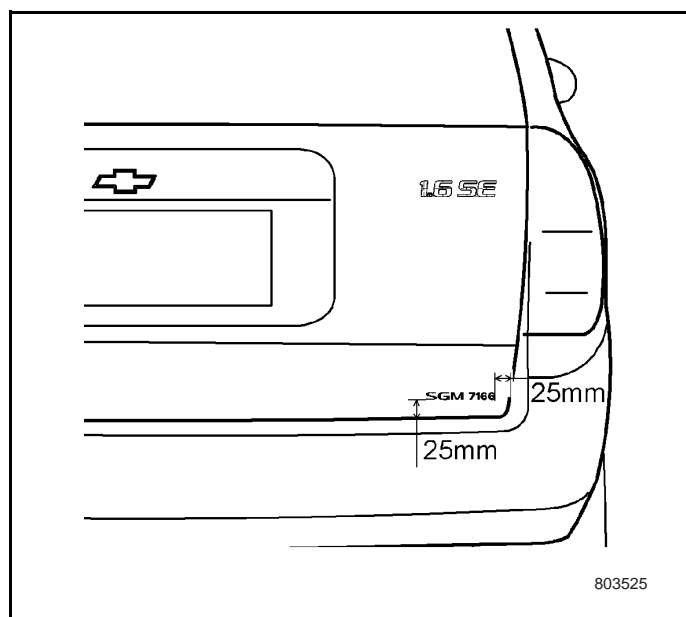
- J 25070 – Blower

1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Tape used as mark of installation emblem/ name plate calibration.
2. Use J 25070 to heat the identification plate or name plate 152 mm from the surface if to remove them.
3. Heat them for about 30 seconds in a circular motion.



Notice: Use plastic flat-bladed tool in prevention of paint surface damage when removing the identification or name plates.

4. Use plastic flat-bladed tool to lift or remove the identification or name plate from the panel surface.
5. Apply the adhesive foam tap on the back of the emblem and name plates and squeeze the proper position of them.
6. When replacing, remove all adhesive from the body panel using 3MTM Scotch Brite molding adhesive remover disk 3MTM P/N 07501 or equivalent.



Installation Procedure

Note: Apply the emblem/name plate in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.

1. Clean the area where the emblem/name plate will be installed.
Use clean lint cloth and naphtha or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
2. Completely dry the area.
3. Mark the tap with measurement for the proper location of the emblem.
4. If the location of the emblem/name plate has not been marked, apply tape and use the following body dimensions.
 - The lower edge of SGM7166 is 25mm away from that of the trunk lid.
 - The lower edge of SGM7166 is 25mm away from that of the trunk lid.
5. Heat the mounting surface to approximately 27°C-41°C.
6. Ensure that the temperature of the emblem/name plate is approximately 29°C-32°C.
7. Remove the protective spacer liner from the back of the emblem/name plate.
8. Position the emblem/name plate to the location marks and press the emblem/nameplate to the mounting surface.
9. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.
10. Remove the protection tape from the mounting surface.

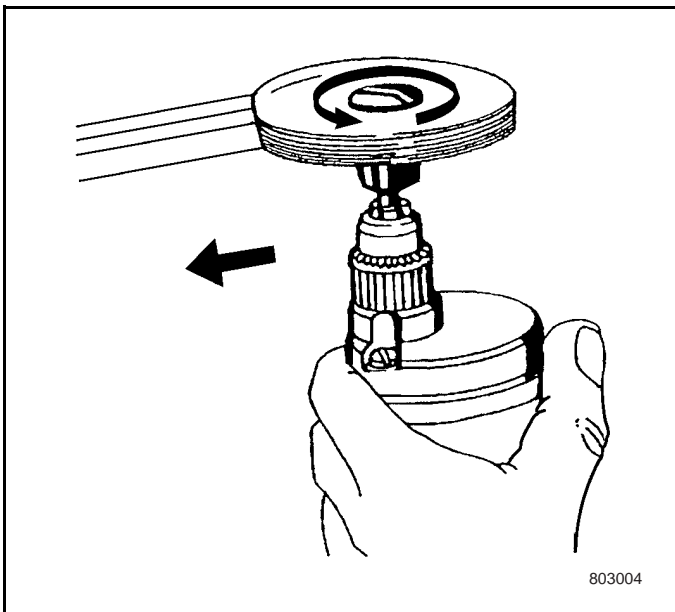
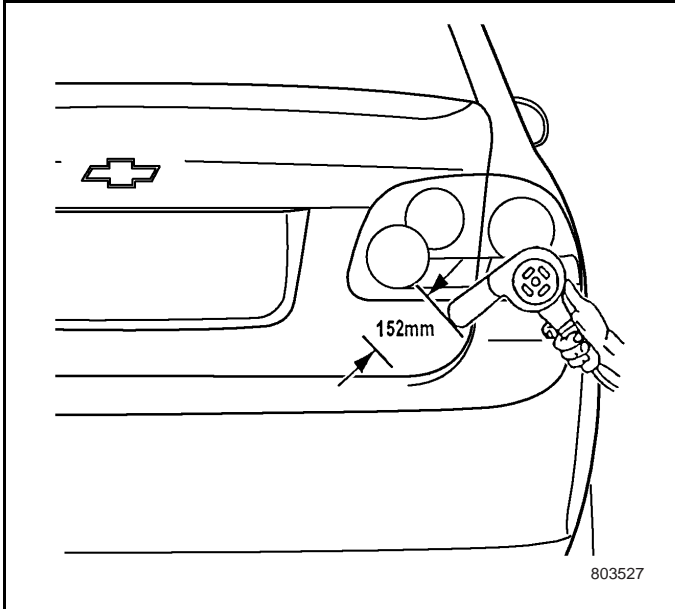
8.3.3.5A Trunk Lid Emblem Replacement

Removal procedure

Tools required

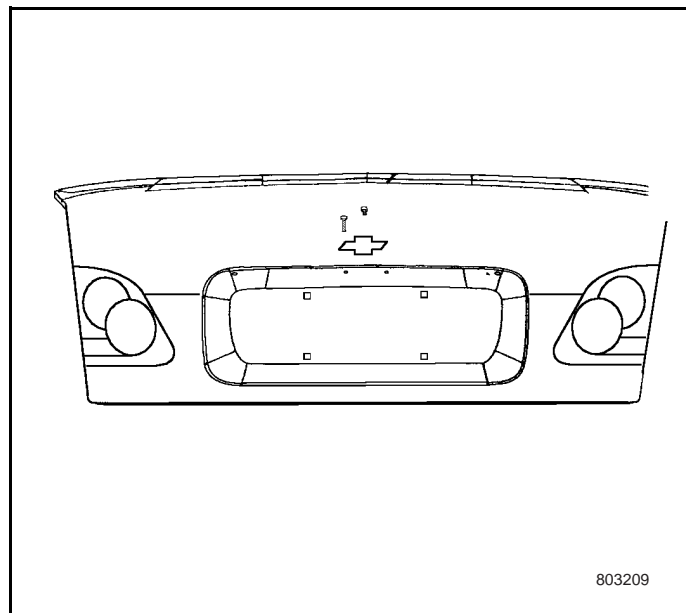
- J 25070 – Blower

1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Use tap as the calibration mark when installing emblem/name plate.
2. Use J 25070 to heat the identification plate or name plate 152mm from the surface if to remove them.
3. Heat them in a circular motion for about 30 seconds.



Notice: Use a plastic flat-bladed tool to prevent damage of the paint surface when removing the emblem/nameplate.

4. Use plastic flat-bladed tool to lift or remove the identification or name plate from the panel surface.
5. Apply the adhesive foam tap to the back of the emblem/nameplate and press the emblem/nameplate to the proper position.
6. When replacing, remove all adhesive from the body panel using 3MTM Scotch Brite molding adhesive remover disk 3MTM P/N 07501 or equivalent.



Installation Procedure

Note: Apply the emblem/name plate in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.

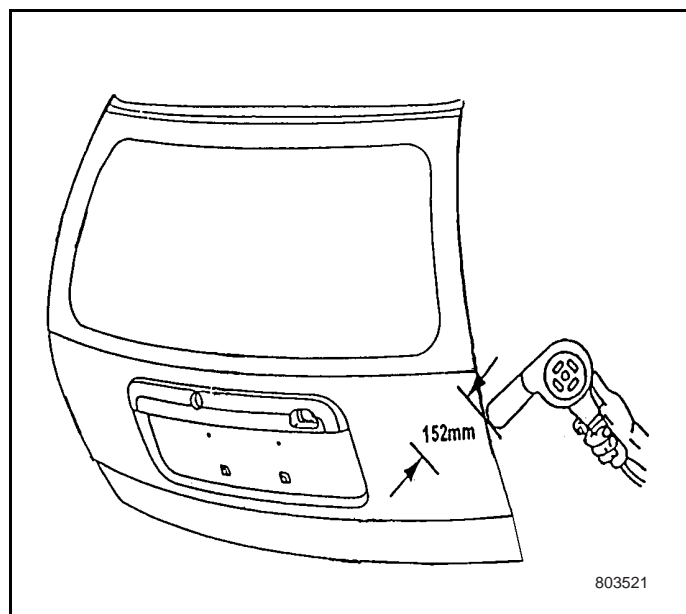
1. Clean the area where the emblem/name plate will be installed.
Use lint free cloth and Varnish Makers and Painters (VMP) naphtha or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
2. Completely dry the area.
3. Heat the mounting surface to approximately 27-41°C.
4. Ensure that the temperature of the emblem/name plate is approximately C.
5. Remove the protection pad from the back of the emblem/name plate.
6. Ensure the emblem/nameplate pin to mate with the hole, and press the emblem/nameplate to the mounting surface.
7. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.

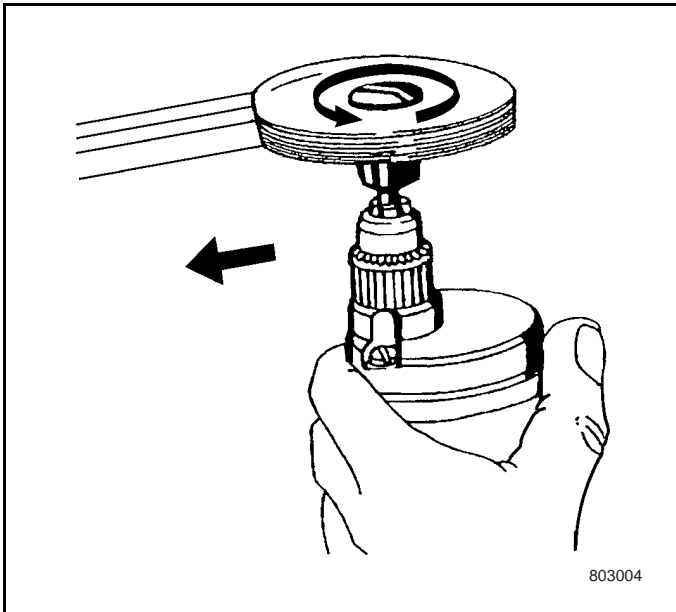
8.3.3.5B Tail Gate Emblem Replacement

Removal procedure

Tools required

- J 25070 – Blower
1. When replacing or repairing the identification plate or name plate, perform the following:
 - Use tape to protect the mounting surface during removal.
 - Tape used as mark of installation emblem/name plate calibration.
 2. Use J 25070 to heat the identification plate or name plate 152mm from the surface if to remove them.
 3. Heat them for about 30 seconds in a circular motion.



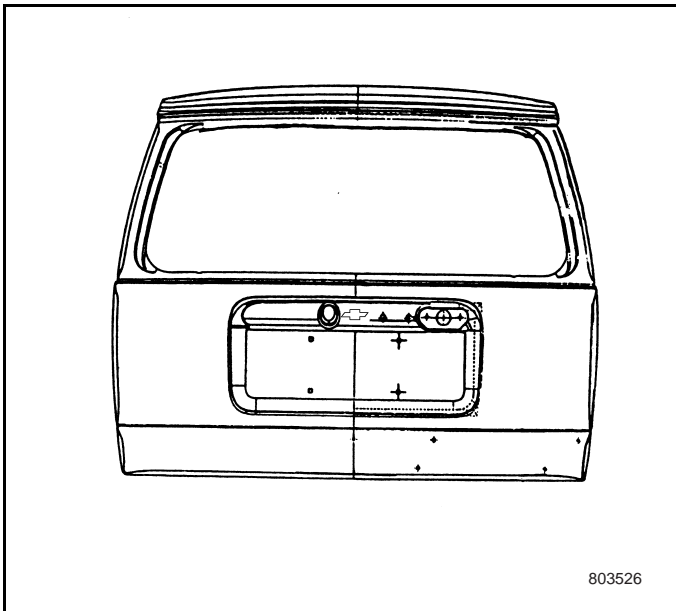


Notice: Use plastic flat-bladed tool in prevention of paint surface damage when removing the identification or name plates.

4. Use plastic flat-bladed tool to lift or remove the identification or name plate from the panel surface.
5. Apply the adhesive foam tap on the back of the emblem and name plates and squeeze the proper position of them.
6. When replacing, remove all adhesive from the body panel using 3MTM Scotch Brite[®] molding adhesive remover disk 3MTM P/N 07501 or equivalent.

Installation Procedure

Note: Apply the trademark in an environment that is free from dust or dirt that could come into contact with sticky backing. Foreign matter may cause improper adhesion.

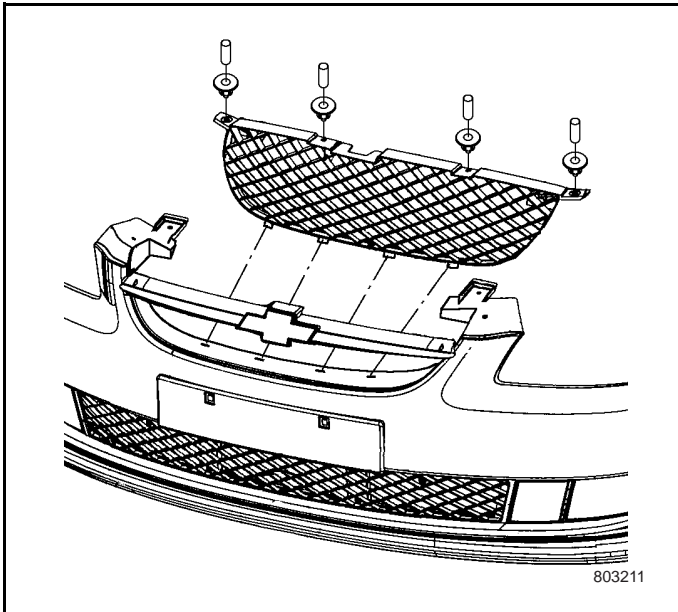


1. Clean the area where the emblem/name plate will be installed. Use clean lint cloth and naphtha or 50/50 mixture by volume of isopropyl alcohol and water to clean the area.
2. Completely dry the area.
3. Heat the mounting surface to approximately 27-41°C.
4. Ensure that the temperature of the emblem/name plate is approximately C.
5. Remove the protective spacer liner from the back of the emblem/name plate.
6. Ensure the emblem pin to mate with the hole, and press the emblem/nameplate to the mounting surface.
7. Apply equal pressure along the emblem/nameplate in order to stick the part uniformly on the mounting surface.

8.3.3.6 Upper Radiator Face Shield Replacement

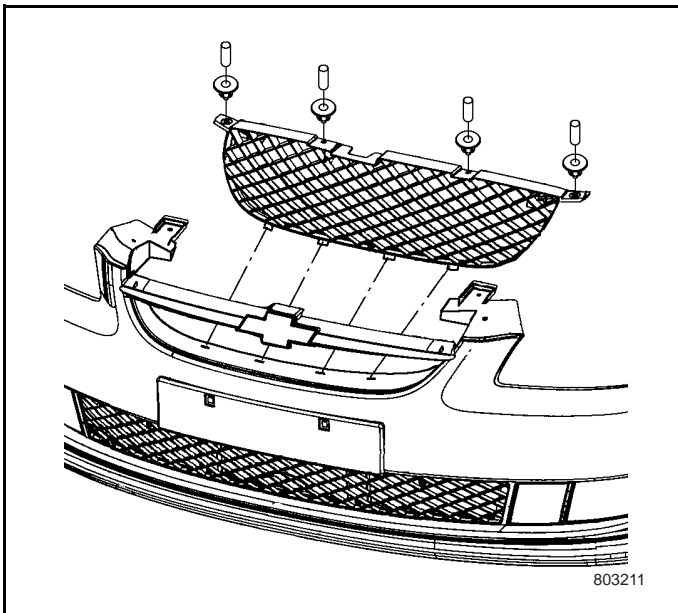
Removal procedure

1. Open the engine hood.
2. Take out the 4 push pins used for attaching the radiator face shield.
3. Lift up and out the upper radiator face shield from the front fascia.



Installation Procedure

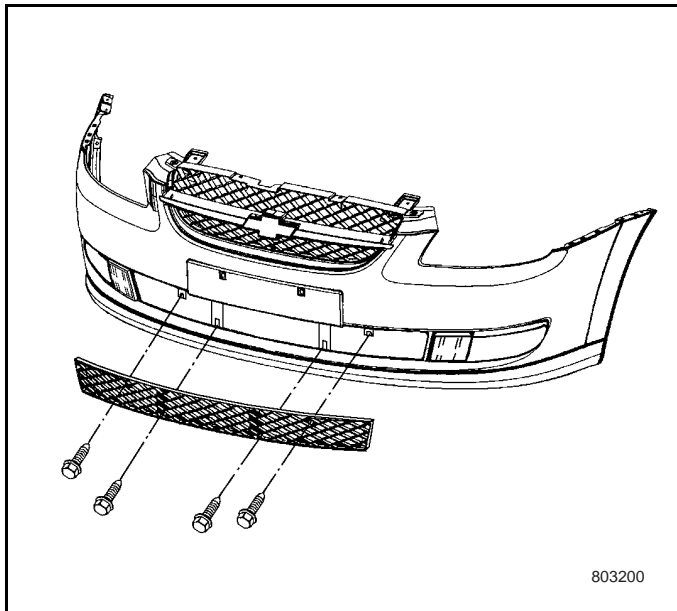
1. Place the upper radiator face shield anchor pin into the front fascia feed hole.
2. Install the 4 push pins.
3. Close the Hood.



8.3.3.7 Lower Radiator Face Shield Replacement

Removal procedure

1. Remove the 4 attaching screws of the lower radiator face shield.
2. Take off the lower radiator face shield.

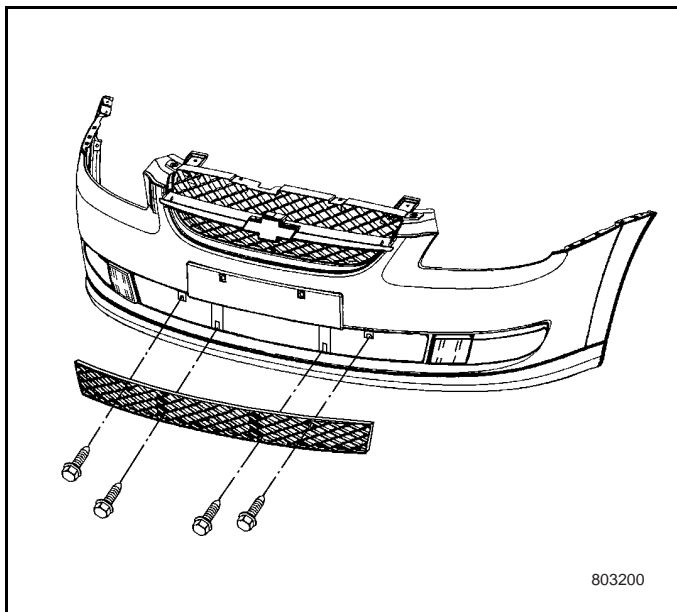


Installation Procedure

1. Secure the lower radiator face shield to the front bumper fascia with screws.

Tightening

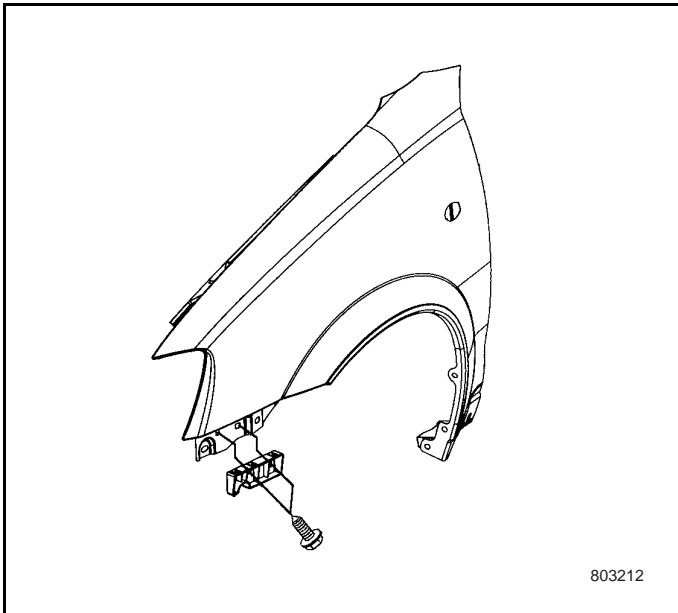
Tighten the screw to 2-3 N•m.



8.3.3.8 Front Bumper Fixture Bolts

Removal procedure

1. Remove the front bumper from the body. Refer to Front Bumper Replacement.
2. Remove bolts from the front bumper fixture.

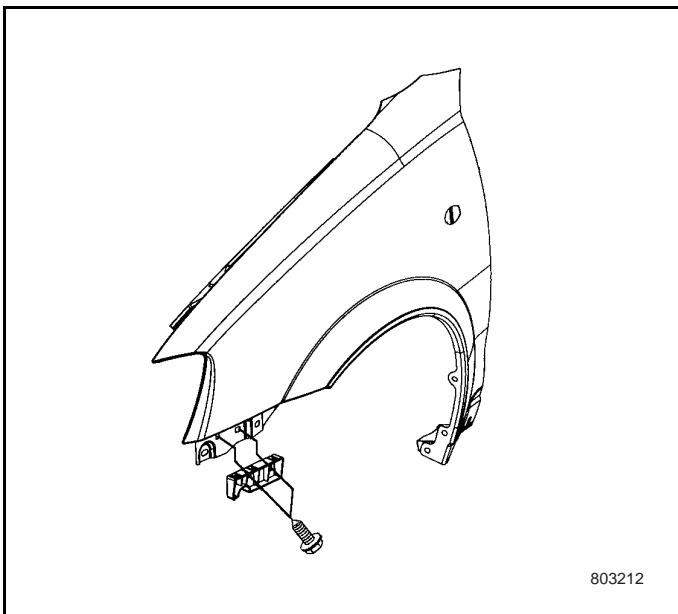


Installation Procedure

1. Engage the front bumper fixture into the front fender.
2. Tighten the front bumper fixture with screws.

Tightening

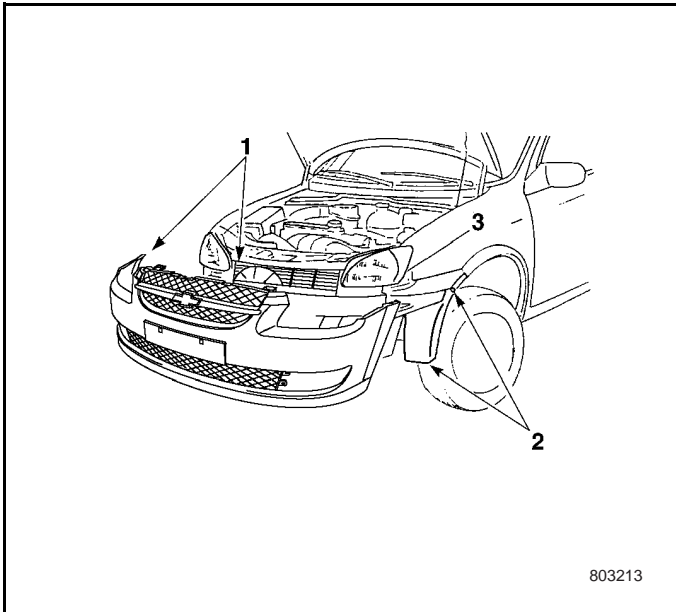
Tighten the front bumper fixture bolts to 1.0-1.5 N•m.



8.3.3.9 Front Bumper Fascia Replacement

Removal procedure

1. Remove screws attaching the front wheel cover to the front bumper fascia. Refer to Front Wheel Cover Replacement in Body Front End.
2. Open the engine hood.
3. Remove bolts securing the front bumper fascia lower part to the front beam.
4. Remove bolts securing the front bumper fascia upper part to the radiator crossmember.
5. Remove the front bumper from the vehicle.
6. Disconnect the front fog lamp harness connector.
7. Remove the front fog and Ornament lamps from the front bumper fascia.



Installation Procedure

1. Install the front fog and ornament lamps to the front bumper fascia.
2. Move the front bumper fascia close to the body, and connect the front fog lamp harness connector.
3. Position the front bumper to the body.
4. Install the front bumper fascia upper bolts.

Tightening

Tighten the upper bolts to 2.0-2.5 N•m.

5. Install the front bumper fascia lower bolts.

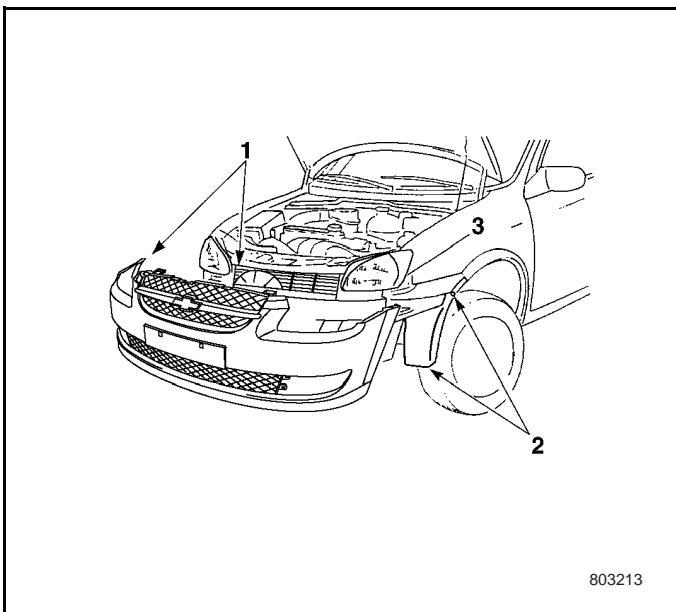
Tightening

Tighten the lower bolts to 2.5-3.2 N•m.

6. Install screws shared with the wheel cover.

Tightening

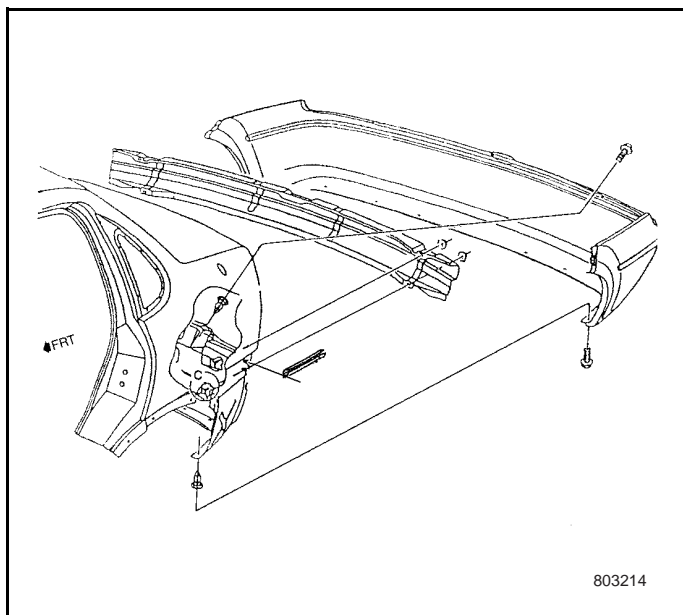
Tighten the screw to 1.25-2.25 N•m.



8.3.3.10A Rear Bumper Fascia Replacement

Removal procedure

1. Remove the tail lamp A. Refer to Tail Lamp A Replacement in Lighting System.
2. Remove the rear wheel opening. Refer to Rear Wheel Opening Replacement.
3. Remove the 6 bottom attaching bolts.
4. Remove the 3 upper attaching bolts.
5. Move the rear bumper fascia to the rear part and disengage from the rear bumper fascia fixture.



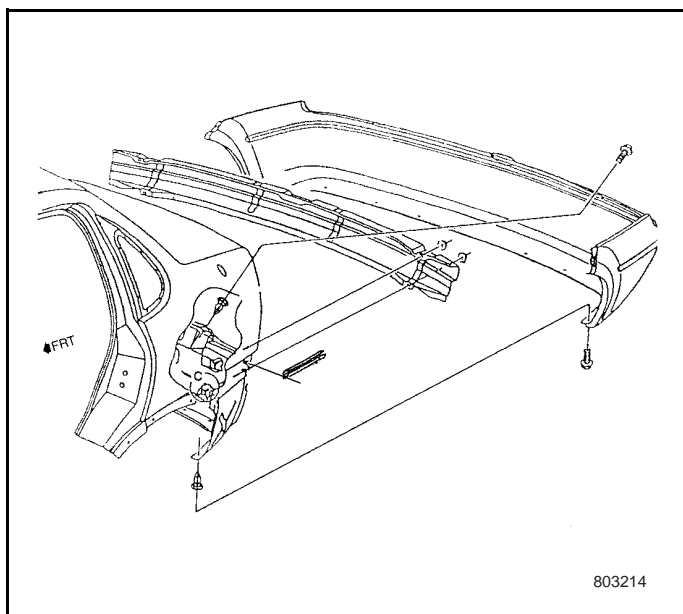
Installation Procedure

1. Install the rear bumper fascia to the vehicle.
2. Install the rear bumper fascia to the fixture.
3. Install the 3 upper attaching bolts.
4. Install the 6 bottom attaching bolts.

Tightening

Tighten the upper and bottom nuts to 1.0-1.5 N•m.

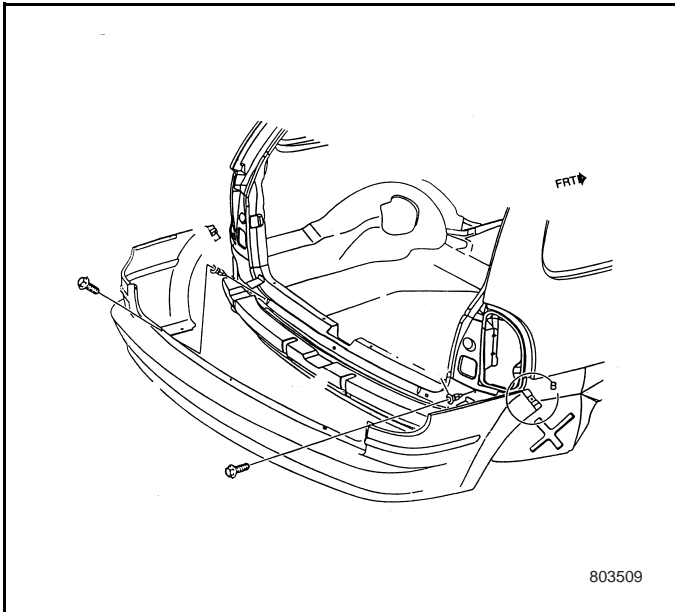
5. Install the rear wheel opening. Refer to Rear Wheel Opening Replacement.
6. Install the tail lamp A. Refer to Tail Lamp A Replacement in Lighting System.



8.3.3.10B Rear Bumper Fascia Replacement

Removal procedure

1. Remove the tail lamp. Refer to Tail Lamp Replacement in Lighting System. Remove the rear wheel opening. Refer to Rear Wheel Opening Replacement.
2. Remove the 6 bottom attaching bolts.
3. Remove the 5 upper attaching bolts.
4. Move the rear bumper to the rear part and disengage it from the rear fixture.



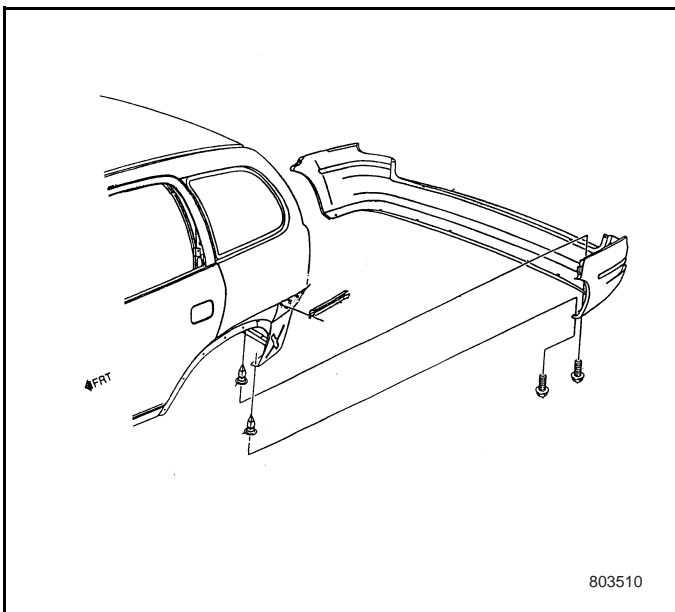
Installation Procedure

1. Install the rear bumper fascia to the vehicle.
2. Install the rear bumper fascia to the fixture.
3. Install the 5 upper attaching bolts.
4. Install the rear wheel opening. Refer to Rear Wheel Opening Replacement.
5. Install the 6 bottom attaching bolts.

Tightening

Tighten the upper and bottom nuts to 1.0-1.5 N•m.

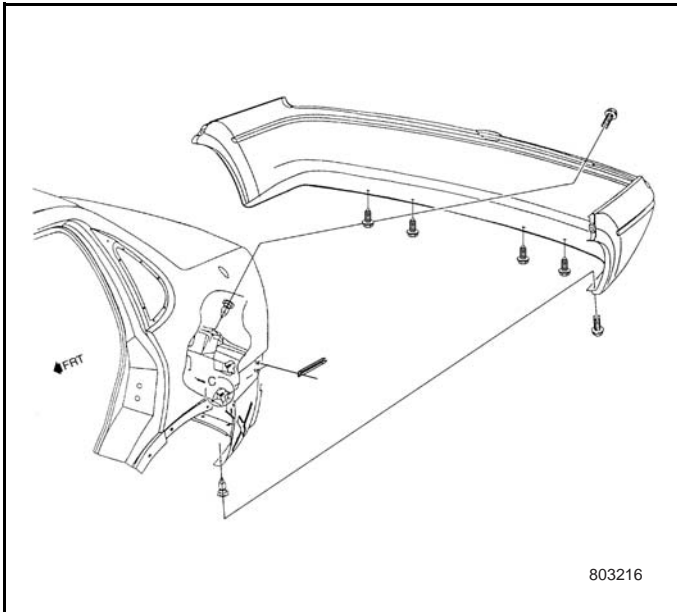
6. Install the tail lamp. Refer to Tail Lamp Replacement in Lighting System.



8.3.3.11A Rear Bumper Fascia Fixture Replacement

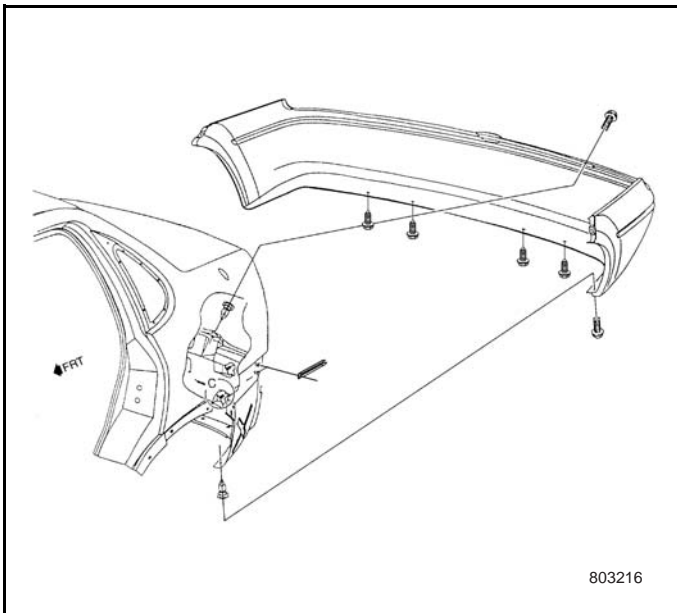
Removal procedure

1. Remove the front bumper fascia. Refer to Rear Bumper Fascia Replacement.
2. Lift up the stopper and push the rear bumper fascia fixture to the rear body.



Installation Procedure

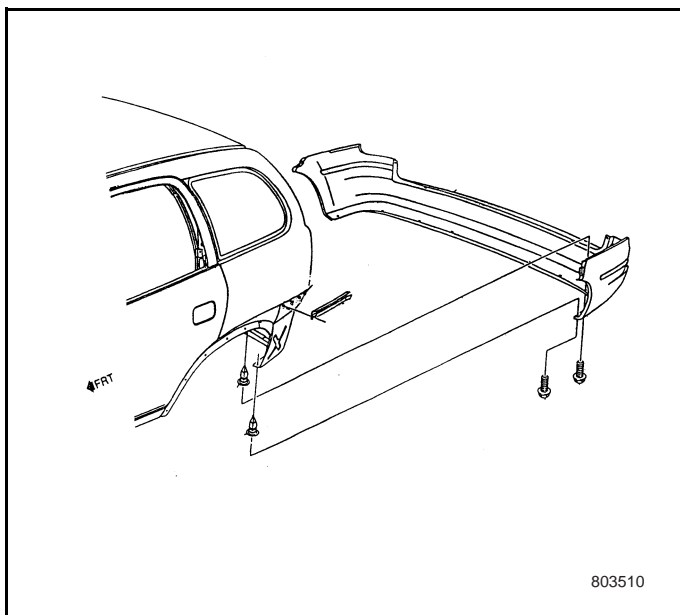
1. Position the rear bumper fascia fixture to the body outer panel pins.
2. Push the rear bumper fascia fixture to the body front until the pin is locked into the slot.



8.3.3.11B Rear Bumper Fascia Fixture Replacement

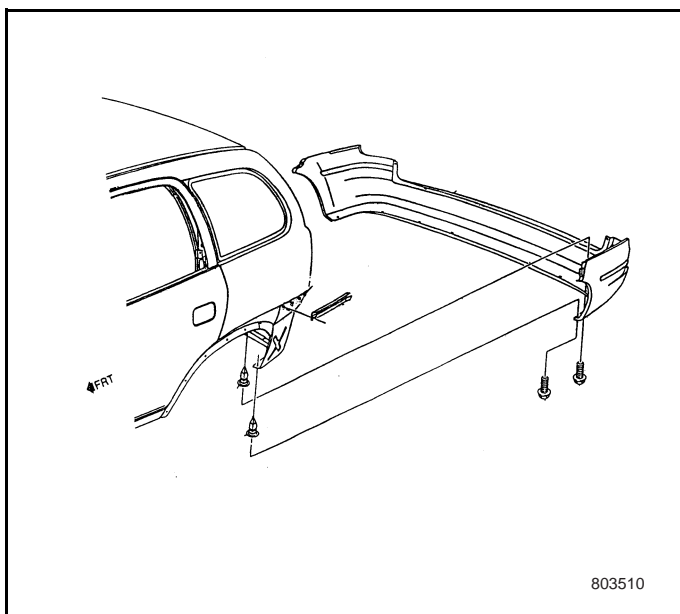
Removal procedure

1. Remove the rear bumper fascia. Refer to Rear Bumper Fascia Replacement.
2. Lift up the stopper and push the retainer to the body rear end.



Installation Procedure

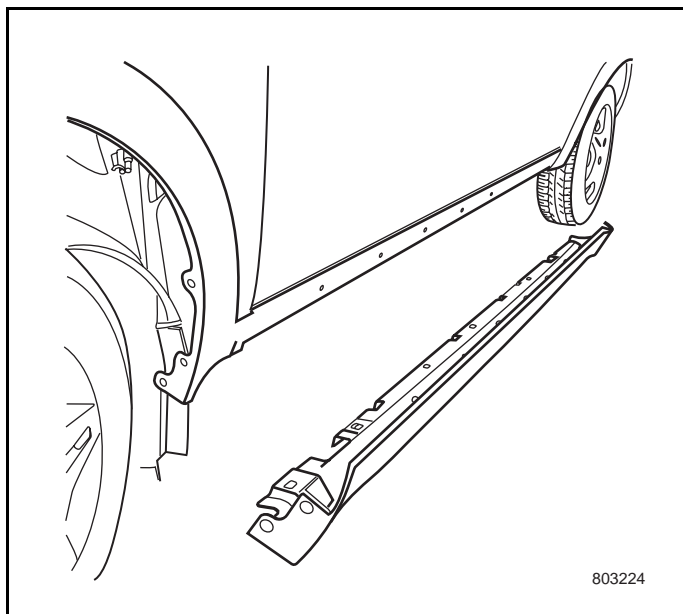
1. Position the rear bumper fascia fixture to the body outer panel pins.
2. Push the rear bumper fascia fixture to the body front until the pin is locked into the slot.



8.3.3.12 Floor Exterior Trim Replacement

Removal procedure

1. Remove the 6 push pins securing the floor exterior trim to the body bottom.
2. Remove the 2 screws securing the floor exterior trim to the front wheel opening.
3. Pull outward the floor exterior trim and disengage the 8 attaching clips from the body.



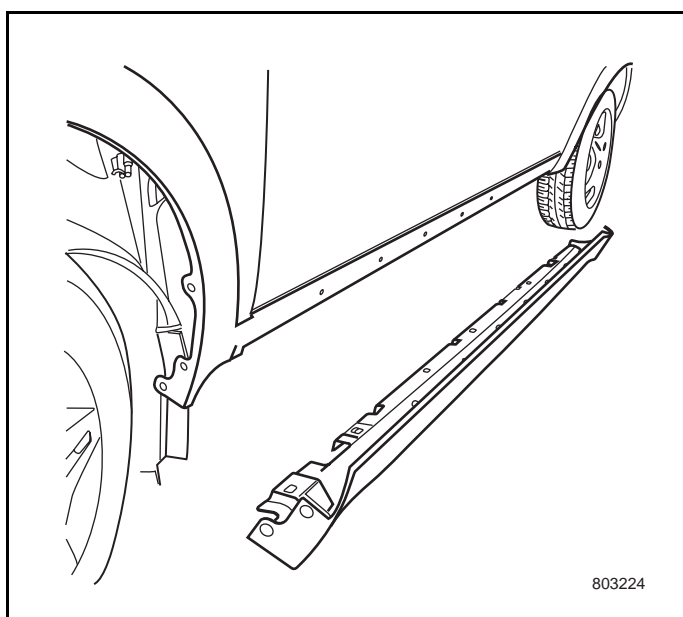
Installation Procedure

1. Secure the floor exterior trim to the body with 8 attaching clips.
2. Secure the floor exterior trim to the front wheel opening with 2 screws.

Tightening

Tighten the screw to 3-3.5 N•m.

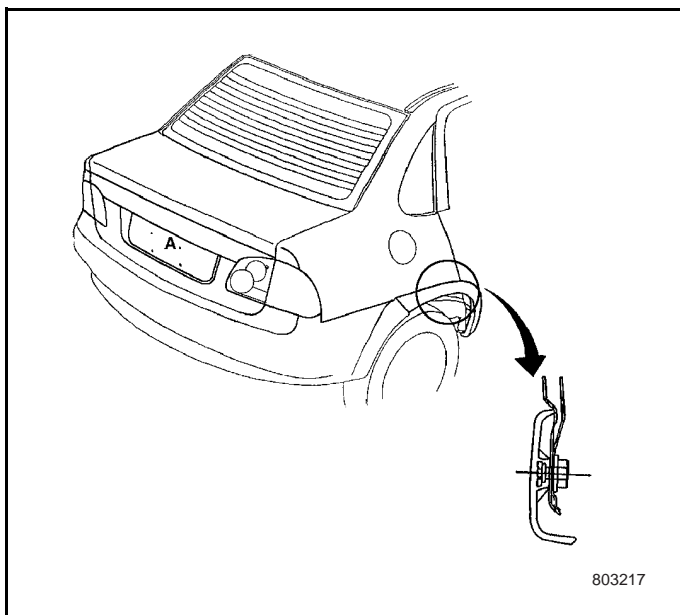
3. Install the push pins.



8.3.3.13A Rear Wheel Opening Replacement.

Removal procedure

1. Remove the floor exterior trim panel. Refer to Floor Exterior Trim Replacement
2. Remove the attaching nut from the side wall.



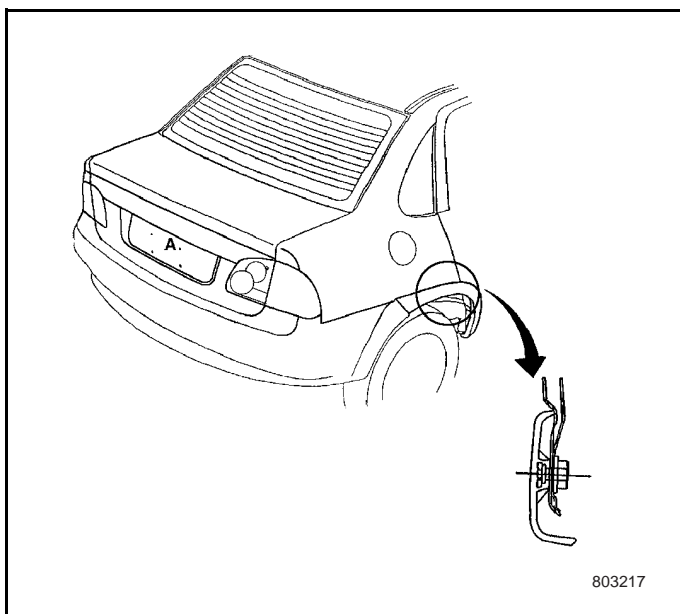
Installation Procedure

1. Install the rear wheel opening through the hole of the rear bumper fascia and side wall.
2. Install screws.

Tightening

Tighten nut to 1.5 N•m.

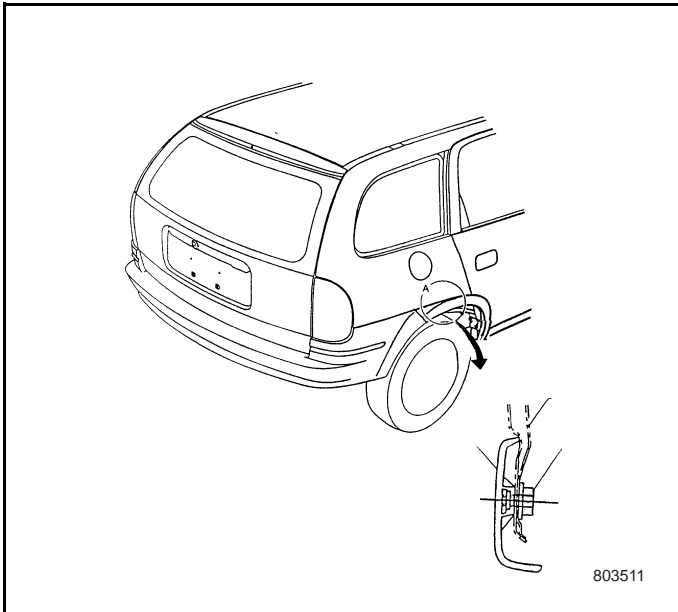
3. Install the exterior floor trimming. Refer to Floor Exterior Trim Replacement



8.3.3.13B Rear Wheel Opening Replacement

Removal procedure

1. Remove the exterior floor trimming. Refer to Floor Exterior Trim Replacement
2. Remove the attaching nut from the side wall.



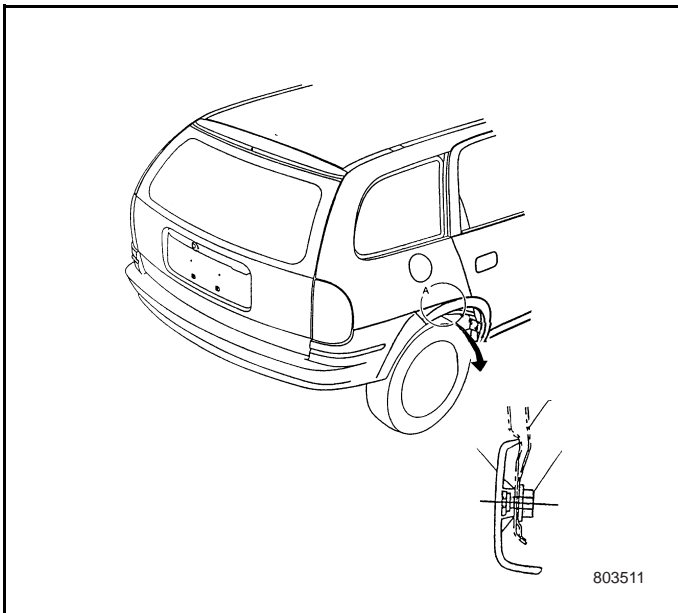
Installation Procedure

1. Install the rear wheel opening through the hole of the rear bumper fascia and side wall.
2. Install screws.

Tightening

Tighten the nut to 1.5 N•m.

3. Install the exterior floor trimming. Refer to Floor Exterior Trim Replacement



8.3.3.14 Body Side Rubbing Strip Replacement

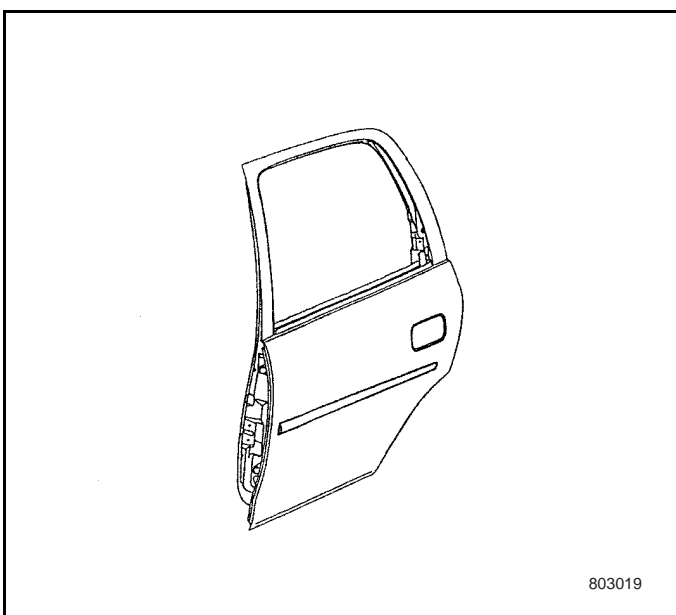
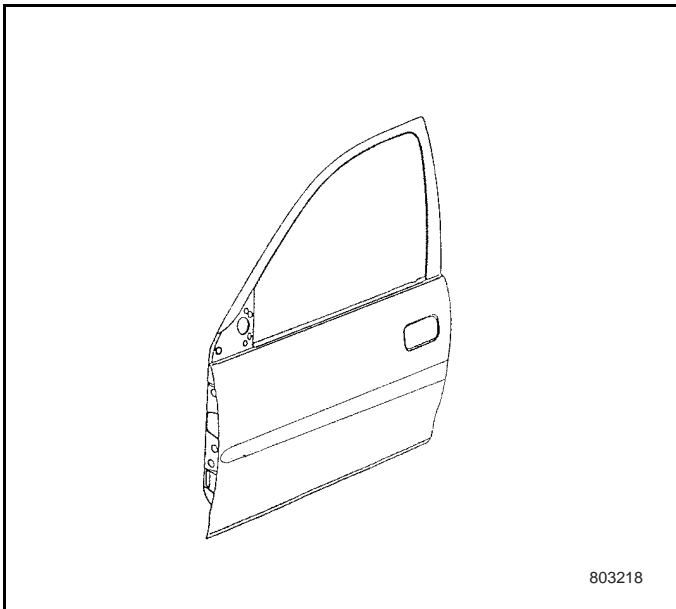
Adhesive Rubbing Strip End Loosening

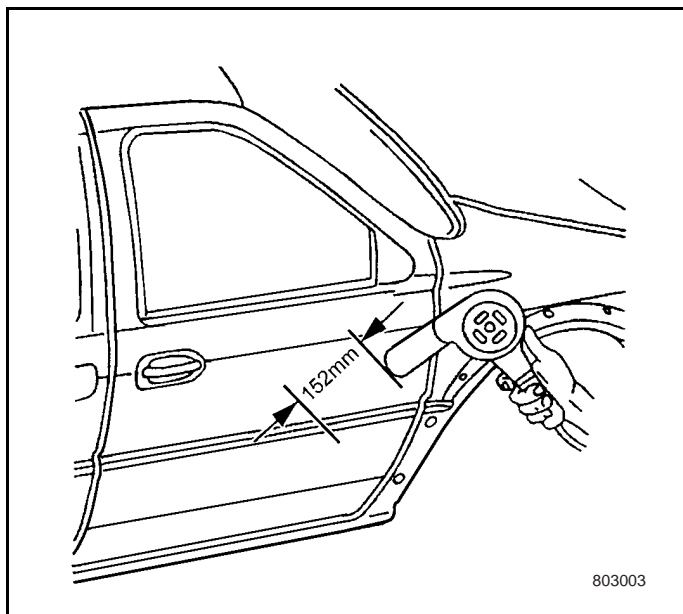
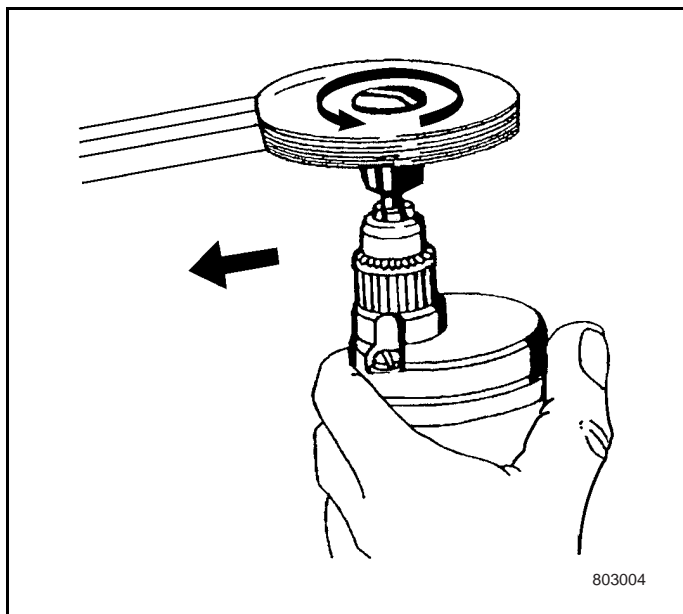
Tools required

- J 25070 – Blower

Note: Rubbing Strip is attached to the body with tap. To ensure sound replacement of new and old rubbing strip, emblem and nameplate, the body surface should be heated to and maintain the temperature of 21°C to 32°C, to keep it clean and remove any wax or oil film. Ways of applying the trim strip loosened at the end, completely removing the rubbing strip, and replacing the rubbing strip, emblem and nameplate is as follows:

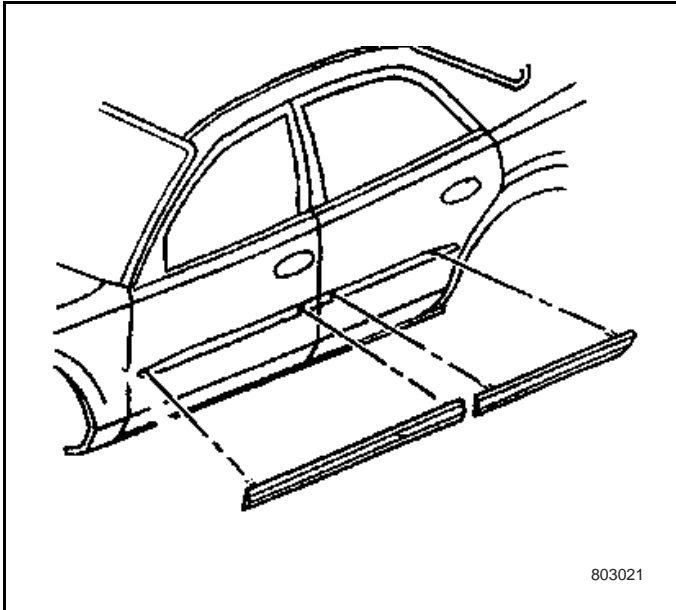
1. Wash with soap and water the concerned area, and wipe it clean. Use Varnish Makers and Painters (VMP) naphtha and clean cloth to wipe the body and the part to be installed with tap on the trim.
2. If necessary, apply a certain long tap as the rubbing strip guide. Straight line ruler may also be used.
3. Apply the tap on the rubbing strip back, and press it to the position. If when the tap or similar objects is used, apply to the trim with a constant pressure of about 30 seconds, or until it is stuck.





Completely remove the attached rubbing strip.

1. Use 3MTM P/N 0750 of similar objects to remove all taps from the body side board and the back of the trim.
2. Wash with soap and water the concerned area, and wipe dry.
3. Use Varnish Makers and Painters (VMP)naphtha to remove all traces of the tap from the body outer board and from the back of the trim.
4. Use a certain length of tap to mark the correct position of the trim. With the adjacent trim as the reference.
5. Use the heating lamp or blower to heat the body exterior board to about 27°C-41°C.



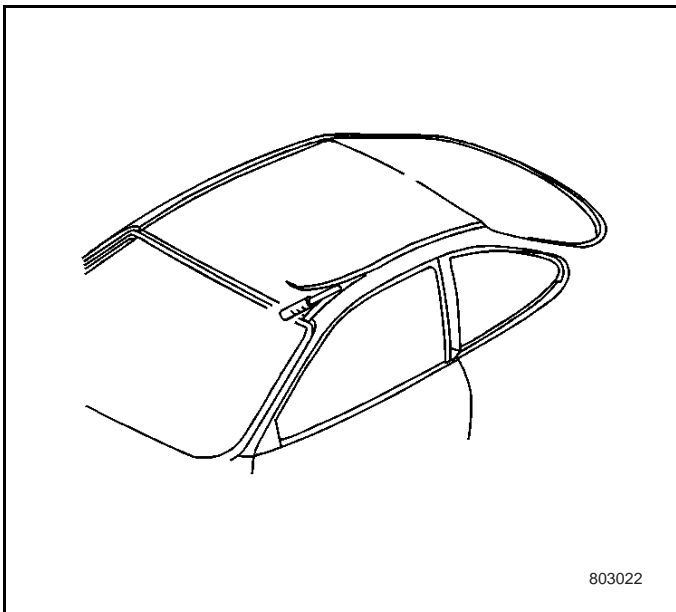
6. Apply bottom paint to the trim according to GM9985881:B1, and a sheet of grey double paint foam tap 3MTM P/N 06382 or similar objects.
7. Align the trim to the tap lead on the body board.
8. Remove the baking from the trim end.
9. Tightly press it to the position when continuing to remove the backing.
10. Roll and press the trim on the body to ensure complete adhesion.

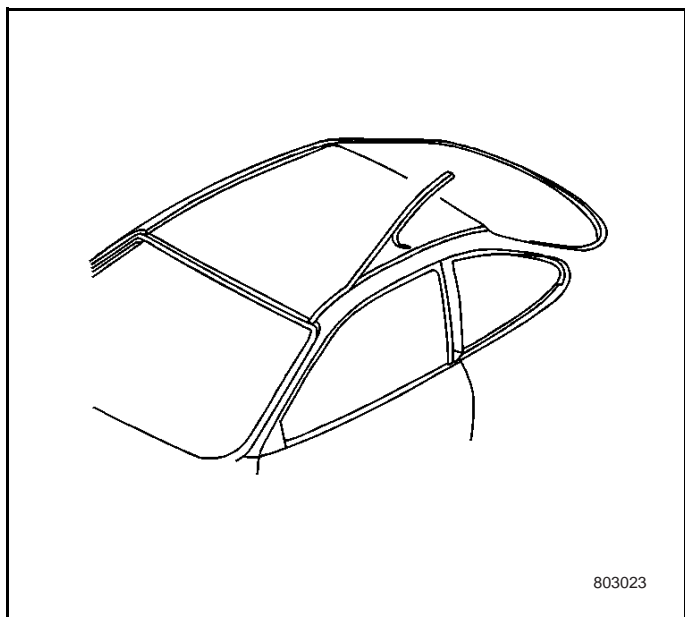
8.3.3.15A Dome Welding Edge Top Trim Replacement.

Removal procedure

1. Use the plastic flat-edge tool to lift up the trim from the dome welding position.
2. Strip off the dome trim from the dome welding position.

Note: Do not damage the clamp on the dome trim with care, or it is necessary to replace the trim.





Installation Procedure

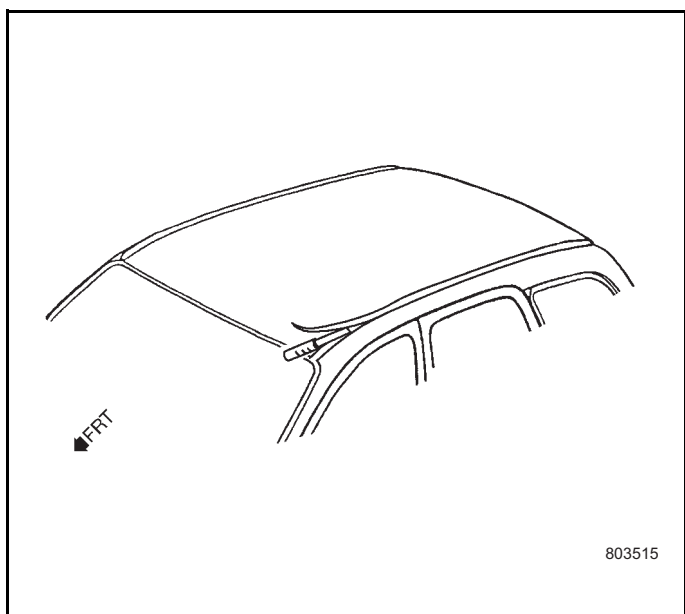
1. Align the trim front end to the welding edge front end, and to make the trim end to cover the sealing of the front window.
2. Engage the trim to the position.
3. Cover the trim rear end to the rear window sealing.

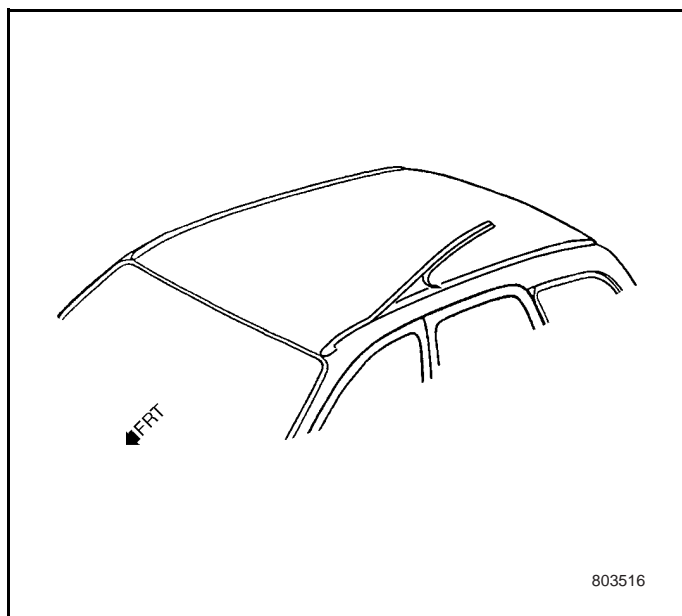
8.3.3.15B Dome Welding Edge Top Trim Replacement.

Removal procedure

1. Remove the baggage rack. Refer to Baggage Rack Replacement.
2. Use the plastic flat-edge tool to lift the trim from the dome welding position.
3. Remove the dome trim from the dome welding position.

Notice: Do not damage the clamp on the dome trim with care, or it is necessary to replace the trim.





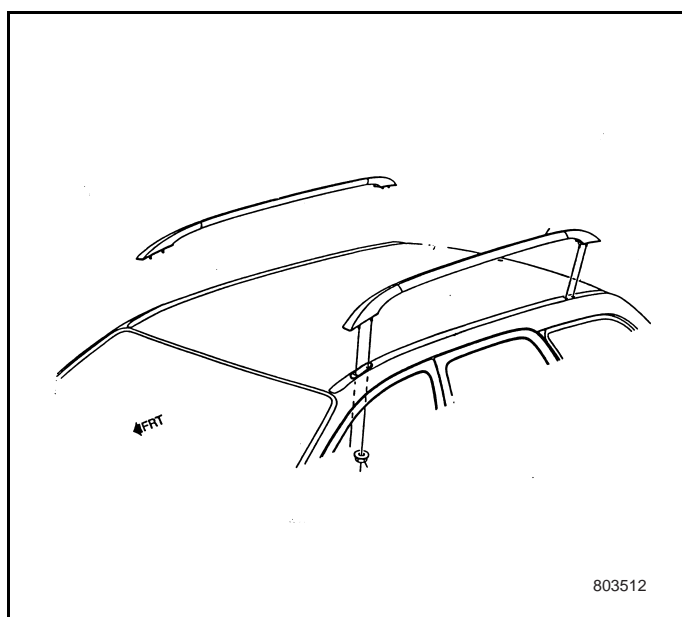
Installation Procedure

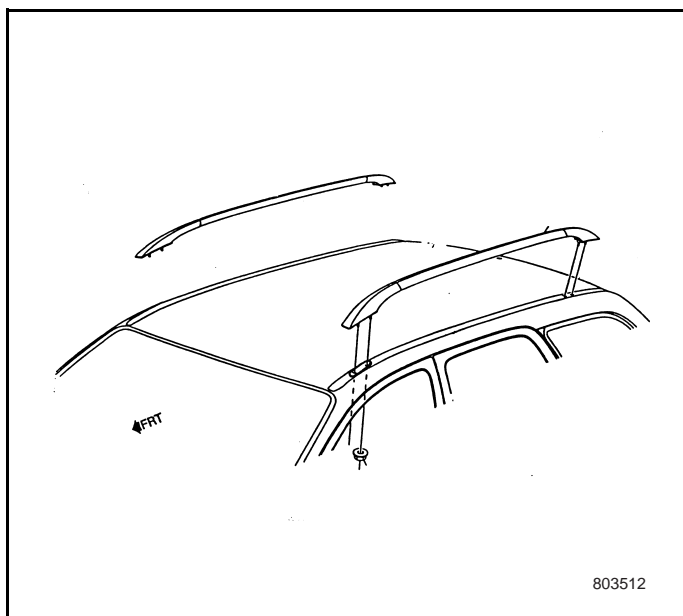
1. Align the trim front end to the welding edge front end, and to make the trim end to cover the sealing of the front window.
2. Engage the trim to the position.
3. Cover the trim rear end to the rear window sealing.
4. Install the baggage rack. Refer to Baggage Rack Replacement.

8.3.3.16B Baggage Rack Replacement

Removal procedure

1. Remove the dome interior trim liner. Refer to Dome Interior Trim Replacement in Interior Trim
2. Remove the 4 nuts (left or right) from the body inner top slot.
3. Remove the baggage rack from the body.





Installation Procedure

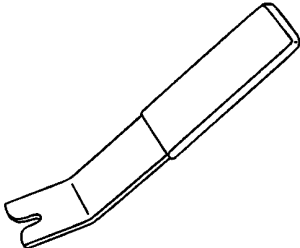
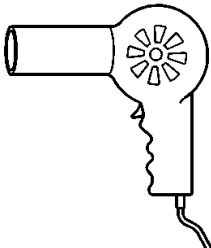
1. Place the baggage rack on the dome. Ensure the bolts of the baggage rack from the rear to reach the front through the body hole.
2. Install the 4 nuts (left or right)

Tightening

Tighten the nuts to 12-15 N•m.

3. Install the dome interior trim liner. Refer to Dome Interior Trim Replacement in Interior Trim

8.3.4 Special Tools

Illustration	Tool Number/Name
 <p>J38778</p>	J 38778 Door Trim Panel and Trim Clamp Removal Tool
 <p>J25070</p>	J 25070 Blower

Blank

8.4 Water Leakage

8.4.1 Specification

8.4.1.1 Recommended Material (water leakage repair)

Leakage Area	Repair Material
Bolt, Stud, Screw, and Other Transitional Area	Stuffing Strip/3M Quality Sealing 08578
Cracks and holes (normal, smaller)	3M Entire Automobile Body Sealant 08500
Cracks and holes (normal, smaller)	3M Drop and Leakage Inspection Sealing
Drop and Leakage Parts	3M Automobile Gasket and Grinding Compounds.
Joining Position (metal)	Detectable /Paint Joining Sealing
Rear Window	Urethane Adhesive Slot Blocking Sets GM P/N 12346284
Static Window	Urethane Adhesive Slot Blocking Sets GM P/N 12346284
Ventilation Duct	3M Automobile Gasket and Grinding Compounds.
Windshield	Urethane Adhesive Slot Blocking Sets GM P/N 12346284
* If necessary, use equivalent material.	

8.4.2 Diagnostic Information and Procedures

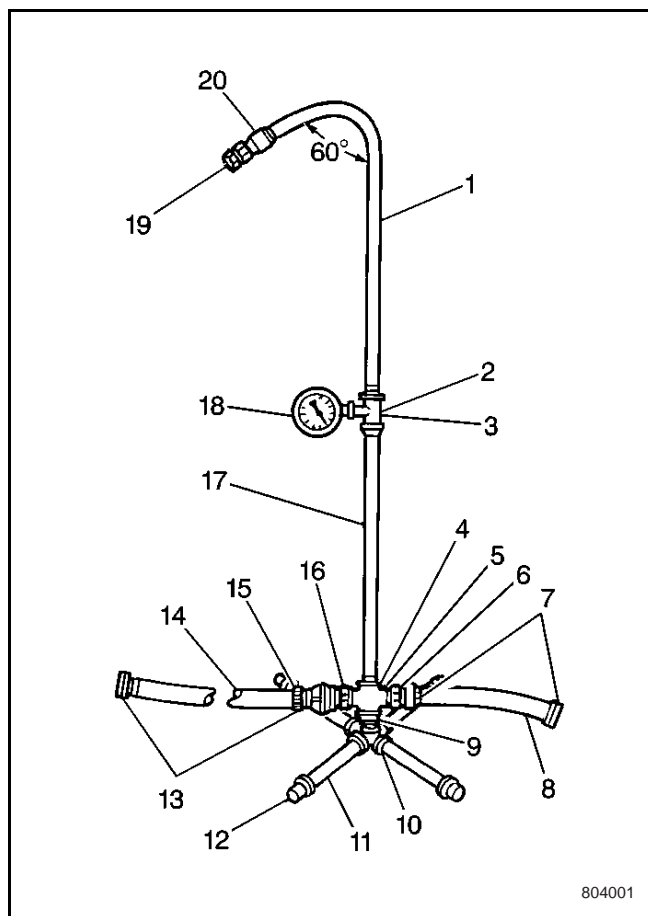
8.4.2.1 Water Leakage Test Preparation

- GM vehicle is designed for operation under normal environment conditions.
- Design criteria for sealing material and components must be considered for the sealing strength with the requirement of natural factors. These specifications must not be considered for all manpower conditions, such as high pressure vehicle wash.
- Water leakage test procedure is related with natural elements, but will decide the presented performance under normal operational conditions.
- The first step of leakage diagnosis is to determine the happening conditions. If a normal leakage area is found, water duct or pneumatic hose may be used to separate the ingress point. Sometimes in order to repair a leakage, it may need to remove the trim panel or components.
- Door or window vicinity leakage doesn't certainly represent the body window weathering strip has been damaged. Adjusting the doors may solve this kind of instance.

Bracket Assembly of Water Detection Method

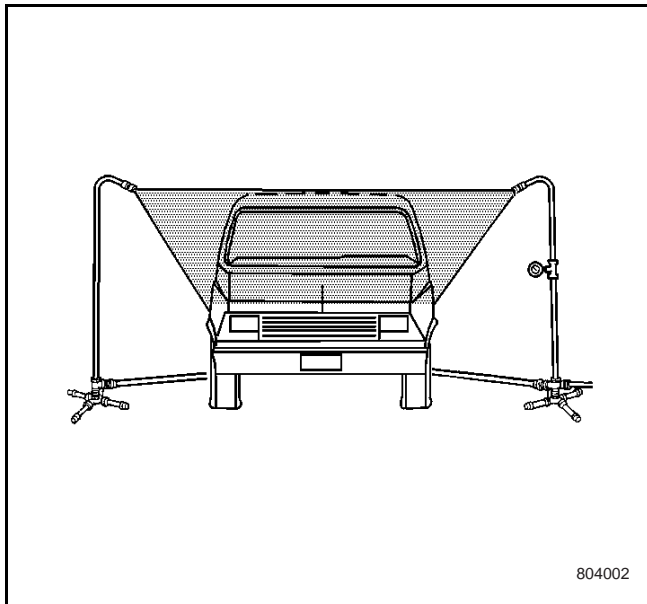
Legend

- (1) Duct 12mm 900mm
- (2) 3-way connection with different diameter x12mmx6mm
- (3) Duct connector (only used for left bracket) 12mm
- (4) 3-way pipe (only used for left bracket) 12mm
- (5) 4-way pipe (only used for left bracket) 12mm
- (6) Connector of duct to hose (only for right side bracket) 12mm
- (7) Female hose connector (15mm)
- (8) Into the hose (only for right side bracket) (600mm)
- (9) Duct connector (12mm)
- (10) 4-way pipe with welding duct bottom (12mm).
- (11) Duct Connector 12mm300mm
- (12) Cap (12mm)
- (13) Female hose connector (15mm)
- (14) 4-way hose 3,600mm with diameter of 15mm

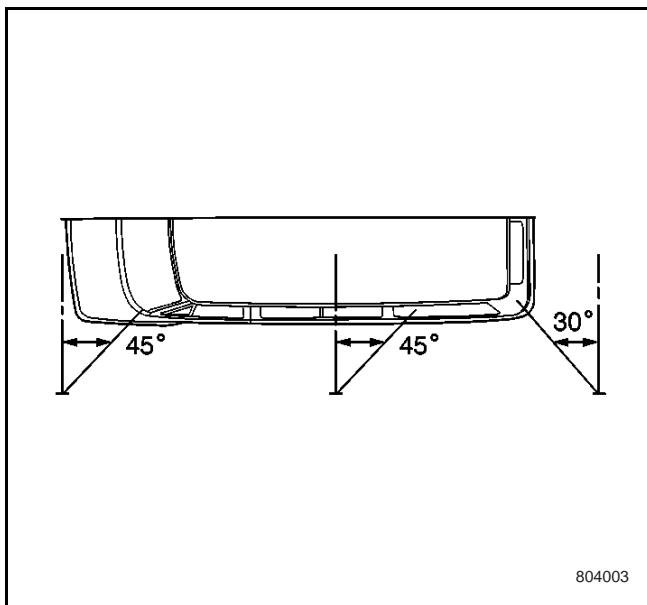


- (15) Hose quick connector
- (16) Connector of duct to hose (12mm)
- (17) Duct (12mm 1500mm)
- (18) Water Pressure Gauge (only for right side bracket)
- (19) Stream Spray Nozzle (No.1/2 GG-25 or similar objects)
- (20) Connector (12mm)

1. Assembled water detection bracket as shown in the diagram.



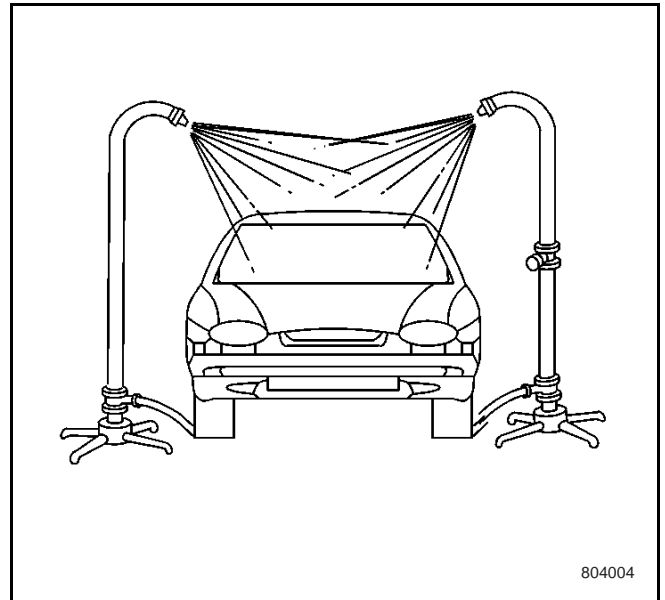
2. Determined bracket as shown in the diagram.
Water mist from the bracket should cover the vehicle as shown in the diagram.
3. To determine any leakage position, keep an assistant inside the vehicle during test.
4. Water pressure at the nozzle should be kept to be 155 kPa for at least 4 minutes.



5. To inspect the windshield, position the water mist to be at an angle of 30 degrees and of rearward 45 degrees.
Align the water flow to the the windshield corner.
6. To check for leakage of side window, align the water bracket to the rear side board center, and position the water mist to be at downward 30 degrees and 45 degrees at tail.

7. To inspect the rear window, position the water mist to be at downward 30 degrees and foreward 30 degrees.

8.4.2.2 General Test



If the leakage source is unclear, use the water pressure test bracket and execute the general leakage test method. Once the approximate leakage area is found, use water duct or pneumatic hose and execute localized test procedure, thus to determine the accurate position of specific leakage area. Refer to Water Hose Test or Pneumatic Hose Test.

1. Make the vehicle to accept a water mist of 155 kPa for 10 to 20 minutes.
2. When testing the windshield, set the bracket distance 600mm away from the windshield, meanwhile point the nozzle to be at about 30 degrees and 30 degrees toward the rear part of the vehicle.
3. When testing the vehicle side, set the bracket to enable the nozzle pointing downward about 30 degrees and 45 degrees toward the rear part of the vehicle.
4. When testing the rear window and rear compartment cover, set the bracket distance 600mm away from the rear window cover, meanwhile point the nozzle to be downward about 30 degrees and 30 degrees toward the front part of the vehicle.

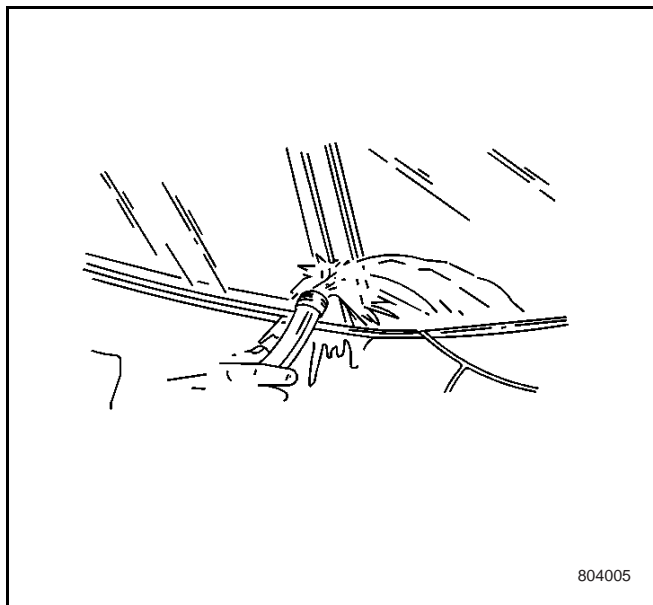
8.4.2.3 Localized Test (drop test)

Note: First determine the leakage position before any repair can be taken. Randomly repair only temporarily block water ingress, and will bring about more difficult to future diagnosis and repair.

Localized test can carried out by using water or air.

1. Start test at the suspicious leakage area base and continue slowly upward until the leakage position is determined.
2. To confirm the all possible determined leakage, continue to perform localized test in the same approximate area.
3. Refer to Water Hose Test if using water to execute localized leakage test. Refer to Pneumatic Hose Test if using air to execute localized leakage test.

8.4.2.4 Water Hose Test



Use water hose without attached nozzle.

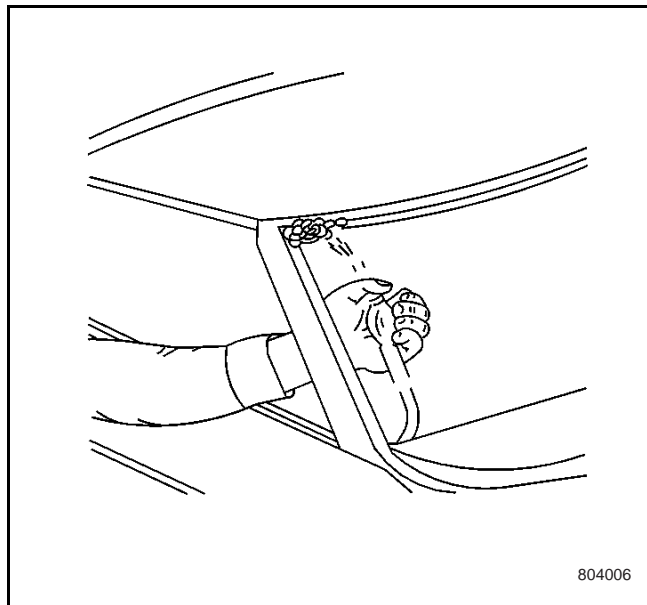
To determine the leakage position, let one person to stay inside the vehicle.

Start from the window or windshield bottom.

Slowly move upward the hose to cover the whole dome.

8.4.2.5 Pneumatic Hose Test

Notice: Pneumatic hose test is only applied on the urethane adhesive completely solidified. Otherwise, the urethane adhesive will cause leakage to increase.



Use fluid solvent, dilute it with water in the spray bottle, and spray to the window at the edge. Start from the bottom, and gradually move upward and pass through to the top.

Note: Compressed air should not surpass 205kPa. Let one assistant to bring air pressure hose staying inside the vehicle. Ask the assistant to align the compressed air to the suspicious area. Soap solvent will form bubble at the leakage position.

8.4.2.6 Dust Leakage

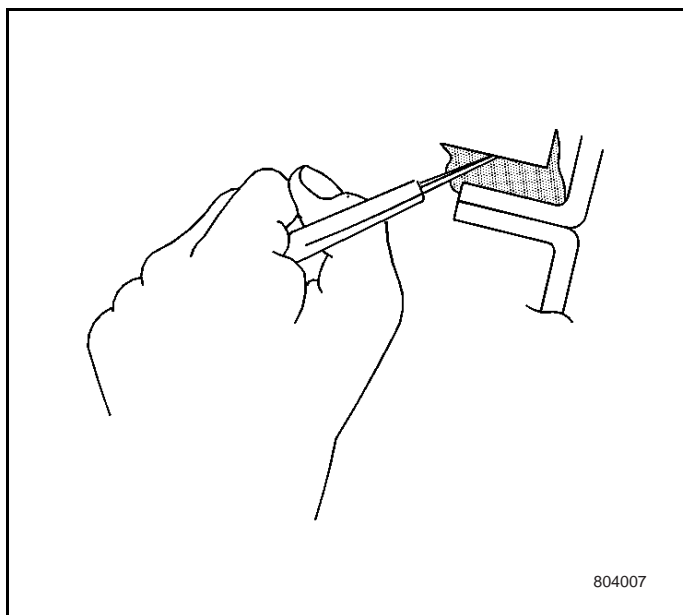
The dust could be leaked into the vehicle at the water not leaked position. Particularly so at the comparative low part inside the vehicle.

Foreward movement of the vehicle could produce light vacuum, and it will suck air and dust into the vehicle. To determine the dust leakage position, perform the following steps:

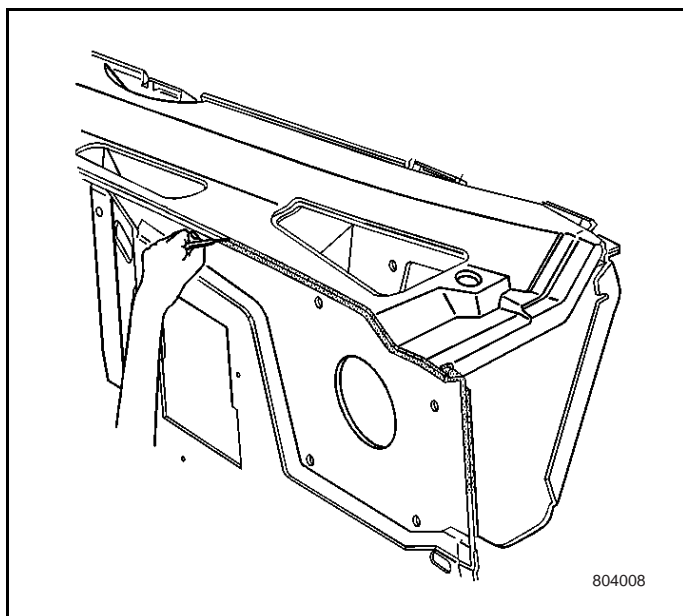
1. Move gasket away from the floor.
2. Move gasket away from the pedal.
3. Move the insulation material from the floor.
4. Move the insulation material from the pedal.
5. To drive the vehicle on dusty road.
6. Check the vehicle inside. Normally leakage point will be found with small taper or long slot shape dust.
7. Mark the leakage point.
8. Light up the floor and lower side of the cowl with bright light. Ensure the vehicle inside to keep dark when performing this step.
9. Let one assistant to mark any sighting point of light inside the vehicle.
 - Check the welded joint.
 - Check the body assembly.
10. Use wind dry body sealing compound to seal any leakage.

8.4.3 Repair Instructions

8.4.3.1 Body Leakage Repair



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1. To repair the leakage, the inner components may have to be removed according to the water leakage position.
2. Cut off part of adhesive caulk from the vehicle inside or outside in the leakage area.
3. Clean and remove all loosen used adhesive leak preventive on the position.
4. Apply sealant for body at joining and for seam joint where used adhesive leak preventive is removed
5. Let the adhesive to be dried up for several hours.
6. Test for leakage.
7. If trim had been removed, install it.

8.4.3.2 Weathering strip Leakage Repair

Removal procedure

1. Before removing the weathering strip, attempt to repair water leakage through adjusting the weathering strip or stuffing with gasket to it.
2. If the weathering strip is removed, it should be replaced.
3. Remove the weathering strip from the vehicle.
4. If to retain the weathering strip with adhesive or foam weathering strip, clear all traces of the used adhesive or foam weathering strip from the vehicle mounting surface.

Installation Procedure

1. If necessary, use nylon spatula as an aid to install the weathering strip to the vehicle.
2. Adjust the weathering strip at the mounting surface to ensure appropriate fit. Use top-grade sealant according to circumstances.
3. If adhesive had been used, make it be solidified before inspecting for water leakage once again.

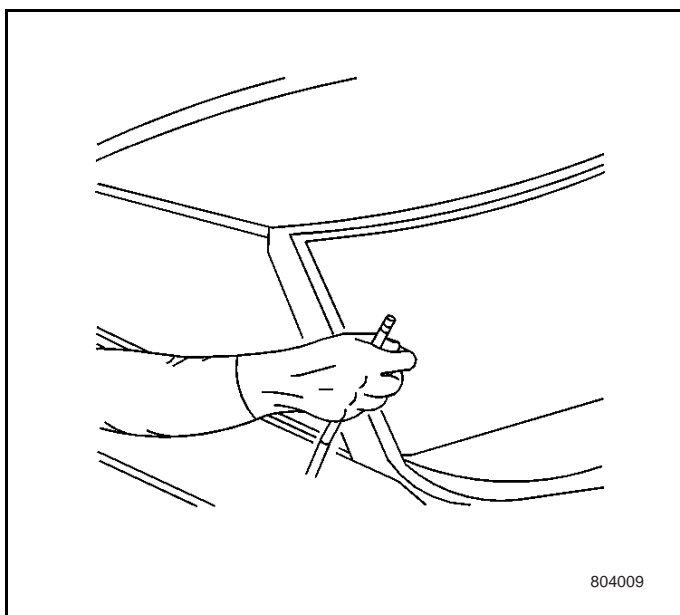
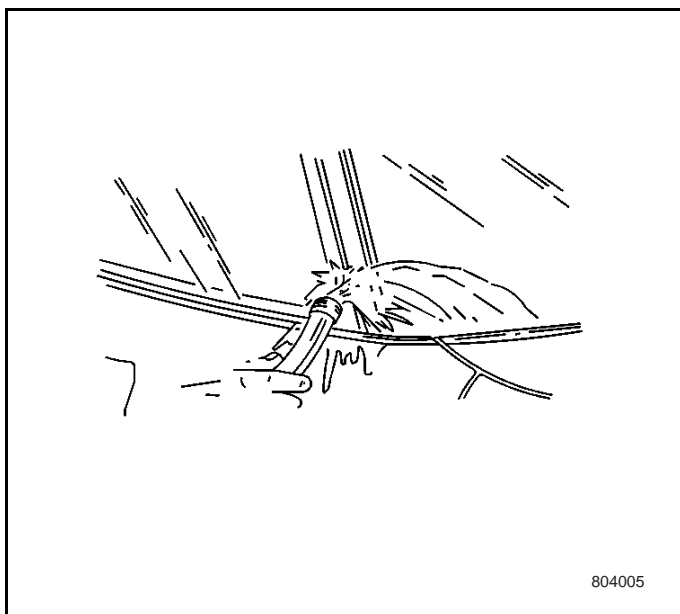
8.4.3.3 Static Window Water Leakage Repair

Removal procedure

Tools required

- Adhesive set of modules GM P/N 12346284
- Air pressure hose
- Water pipe without nozzle.

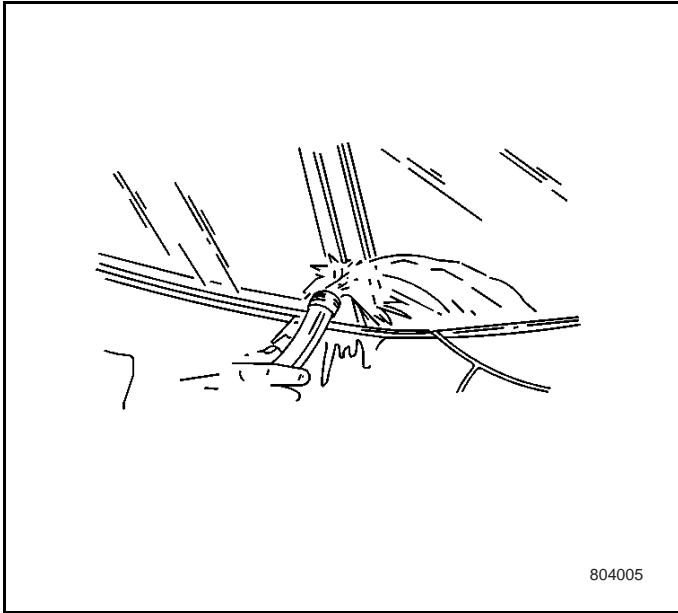
1. If the leaked area is hidden, remove the window trim part.
2. If necessary, remove any auxiliary sealing or window side trim to strip off urethane sealing.
3. Spray a small sheaf of water to the window of the leakage area and carefully push the window outward.
4. Mark the leakage range.



5. Use a sharp edge knife to trim any uneven part of urethane material at the leakage point, and cut off 75-100mm at both side of the leakage point.
6. Use water to clear any dust from the leakage area.
7. Use the pneumatic hose to dry up the leakage area.

Note: Do not apply the primer to the existing urethane adhesive.

8. If necessary, apply the primer.
 - If the urethane is not glued to the glass, clean the glass surface, and then apply bottom paint to the clean glass with black bottom #2.
 - If the urethane is not glued to the clamped welding point, clean the clamped welding surface, and then apply bottom paint by



using black bottom paint #3 to the clean clamped welding point.

9. Apply new urethane adhesive to the repair area.
10. Use a flat bladed tool to press the urethane into the repair area.
11. Water test the original leak area.
12. Continue to press the adhesive into the leak area, or apply the extra adhesive as needed.
13. If it had been for stripping of the urethane sealing to remove any auxiliary sealing or widow side trim, install it on.
14. If it had been for reaching the leakage area to remove the window trim parts, install it on.

8.5 Air/Wind Noise

8.5.1 Diagnostic Information and Procedures

8.5.1.1 Air/Wind Noise

Many procedures used in water leakage diagnosis can also be used in diagnosing wind noise. And wind noise repair is also similar to water leakage repair. The actual repair procedure to be used is depending on the gap type to be repaired. Adjusting the door or door window may solve the problem. If any abnormal wind noise is reported, check the following situations with your eyes before attempting to make any further diagnoses on this problem.

- Orientation deviation with parts
- Loose fasteners
- Worn weather strip
- Disconnected welding joint
- Sealant/Adhesive leakage

The four methods to diagnose air and wind noise are:

- Chalk (Trace Powder) Test
- Air Pressure Test
- Air Pressure Hose (Soap Suds/Bubble) Test
- Exterior Wind Noise Road Test

After the thorough check with your eyes, perform one or more diagnostic test procedures when air or wind noise source are still not found.

8.5.1.2 Trace Powder or Chalk Test

Use cleaning agent to rinse the weather strip and contact surfaces.

1. Along the circumference of suspected area, apply powder or use chalk to mark a continuous line on contact surface of weather strip.
2. In case without bashing the liner, close the liner completely. Close the liner completely, and firmly press the weather strip against the contact surface.
3. Check the marking line on the weather strip. When the marking line of the good contact area is damaged, appropriate mark will be left on the contact surface.
4. Powder or chalk line gap, or irregular powder or chalk graphics on the contact surface indicate a poor sealing area.

8.5.1.3 Air Pressure Test

1. Screen pressure and safety valve.
2. Close all of the vehicle windows.
3. Place the vehicle circulating fan at OPEN position, and at the same time put the selector lever at high velocity and defrosting mode.
4. Open the vehicle lock and close the door.
5. Use an engine stethoscope, or a heater hose of some length to listen to the outlet air noise along the door and window weather strip.

8.5.1.4 Soap Suds or Bubble Test

1. Screen the body pressure release valve.
2. Close all of the vehicle windows.
3. Place the vehicle circulating fan at OPEN position, and at the same time put the selector lever at high velocity and defrosting mode.
4. Open the vehicle lock and close the door.
5. Apply soapsuds to locations where leakage may occur.
6. Check if any bubble occurs, and consequently indicates the air outflow.

8.5.1.5 Exterior Wind Noise Road Test

Required Tools

- J 39570 Chassis stethoscope

Some wind noise is normal. Prior to the vehicle wind noise road test, ensure if the wind noise becomes greater when the window is raised up or lowered down, then continue one or both of the following road tests:

Perform a road test on the vehicle with one or more windows lowered down.

- Perform a road test at locations with few vehicles or extremely small noise.
- Perform road tests in four directions: South, east, north and west.
- Drive at a safe velocity in compliance with the laws.
- Perform road tests at a speed with wind noise heard by the customers.

- Cover the body seam and opening with a 50mm wide tape at a time before the noise disappears.
- Re-test and find the second wind noise location.
- Return the repair facilities and use the proper aligning process and sealing material to make a permanent repair.

Perform a road test on the vehicle with the windows closed.

- Use tapes to cover the pressure release valve.
- The pressure release valve is reached from the inside vehicle by determining the rear compartment trim panel location again.
- Perform a road test at locations with few vehicles or extremely small noise.
- Perform road tests in four directions: South, east, north and west.
- Drive at a safe velocity in compliance with the laws.
- Perform road tests at a speed with wind noise heard by the customers.
- Let an assistant drive the vehicle, and use mechanical engine stethoscope J 39570 or equivalence, or a heater hose of a length to determine the wind noise source location.
- Temporarily use a 50 mm wide tape to cover the air leakage source.
- Perform a test if there is any leakage.
- Return the repair facilities and use the proper aligning process and sealing material to make permanent repair.
- Remove the tape which covers the body pressure release valve.

8.5.2 Repair Instructions

8.5.2.1 Exterior Wind Noise

Caution: An assistant drives the vehicle, and at the same time a technician checks the repair reporting locations. Otherwise personal hurt may occur.

When driving the vehicle with one or more windows lowered down, exterior wind noise may be greater. When the air passes by the body liner, seam, or opening, the exterior wind noise occurs. During the driving test, use the following articles to help leakage detection:

- Mechanical engine stethoscope or heater hose
 - 51 mm wide tape
 - Long caulking joint
 - Marker pencil of water solubility
1. When driving, the exterior wind noise locations can be determined by lowering one window at a time. If that location is relative to the case in Step 2, stop your vehicle at one side, and use a 51 mm wide tape to make temporarily repair.
 2. Cover one gap and one trimming article at a time. Perform a test between openings every time. Covering the gap and the trimming article will correct the situation.
 3. Use tape to temporarily correct the situation. If needed, adjust and correct the tape.

4. To determine if the noise is removed or there is any other leakage area, continue to perform tests.
5. When all the locations in the leakage reporting are determined, use proper aligning processes and sealing material to make permanent repair.

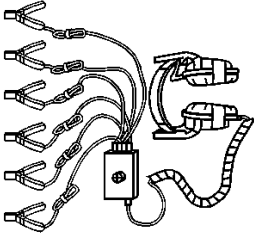
8.5.2.2 Interior Wind Noise

Caution: An assistant drives the vehicle, and at the same time a technician checks the repair reporting locations. Otherwise personal hurt may occur.

When the window is lowered down, interior wind noise can not be heard. Interior wind noise is produced due to the result when air passes through the sealing or seam and escapes from inside the vehicle.

1. Cover the safety valve, and accordingly produce more air pressures inside the vehicle.
2. Perform the driving test on vehicle, and hear if there is any wind noise or squealing.
3. Stop the vehicle by the road, and use tape to make temporary repair. If the wind noise source can not be determined, perform one or more of the following diagnostic tests:
 - Trace powder or chalk test
 - Air Pressure Test
 - Soap Suds or Bubble Test

8.5.3 Special Tools

Illustration	Tool Number/Name
 <p>J39570</p>	J 39570 Chassis stethoscope

8.6 Squeaks and Rattle

8.6.1 Diagnostic Information and Procedures

8.6.1.1 Squeaks and Rattle

Squeaks and rattle are basically caused by the relative movement between parts without proper control. To prevent squeaks and rattle, there are three methods.

- Firmly connect the parts, and make no relative movement during the operation.
- Separate the parts and make no contact under the operating conditions.
- Insulate the parts, and make no noise between parts when relative movement occurs. Uneven frictional surface may be used to eliminate the sticking ñ skidding movement.

8.6.1.2 Interior Trimming – Ablation Noise

Failure Causes	Removal Method
The trim panel contacts the window.	<ol style="list-style-type: none"> 1. Remove the door trim panel. 2. Remove the trim strip. 3. Trim 2-3 mm (0.08-0.12 inches) from the trim strip to produce a clearance. 4. Re-install the trim strip.
The door lock pillar trimming rubs the door trim panel.	Attach the low friction tape (GM P/N 2258 6239 or equivalence) to the door lock pillar trimming.

8.6.1.3 Door Inner Panelling Squeaks

Failure Causes	Removal Method
Door Inner Panelling Squeaks.	At the door center, use foam tape to fill the door inner and outer paneling.
Foot mat rubs the door base.	Re-assemble the foot mat lip.

8.6.1.4 Noise Squeaks at Lock Striker

Failure Causes	Removal Method
Latch and Striker Displacement	<ol style="list-style-type: none"> 1. Check if the locking cam has any distinct marks. 2. Remove/Install the gasket from striker. 3. Align the latch with the striker.

8.6.1.5 Noise Squeaks around the Window

Failure Causes	Removal Method
The rear edge of window trim strip squeaks.	Use foam tape to separate the window inner trim strip.

8.6.1.6B Noise Diagnosis - Sunroof (If equipped)

Failure Causes	Removal Method
The sun shield to guide pin is loose, and it causes the sunroof to squeak.	Check if the guide pin is in the guide rail, and re-install it correctly.

Blank

8.7 Stationary Windows

8.7.1 Schematic and Wiring Diagram

8.7.1.1 Rear Window Defogger Wiring Diagram

Refer to 8.20.2.14.

8.7.2 Diagnostic Information and Procedures

8.7.2.1 Defogger Inoperative-Rear Window

Step	Action	Yes	No
1	Inspect fuses 3 and 17, Are these fuses OK?	Go to Step 3	Go to Step 2
2	Replace the damaged fuse.	Go to Step 3	—
3	Use the DMM to measure the voltage of the fuses, Is the voltage normal?	Go to Step 5	Go to Step 4
4	Please inspect and repair the I/P wire harness.	—	—
5	Inspect carefully the defogger on the rear window glass, Are electric heating wire and power ground circuit contact in sound condition?	Go to Step 7	Go to Step 6
6	Repair the electric heating wire or power ground wire.	—	—
7	Remove the relay; and measure at the relay socket (pin 2), (pin 4) Is the voltage normal?	Go to Step 9	Go to Step 8
8	Inspect the I/P wiring harness from the fuse to the relay.	—	—
9	Inspect the relay, replace as necessary.	Go to Step 10	—
10	Inspect the wiring harness from the relay (pin 8) to the defogger, power source line, and that from the relay (pin 6) to the defogger switch (pin 8), Be sure whether they are normal?	Go to Step 11	Go to Step 4
11	Inspect the defogger switch and its ground wire.	—	—

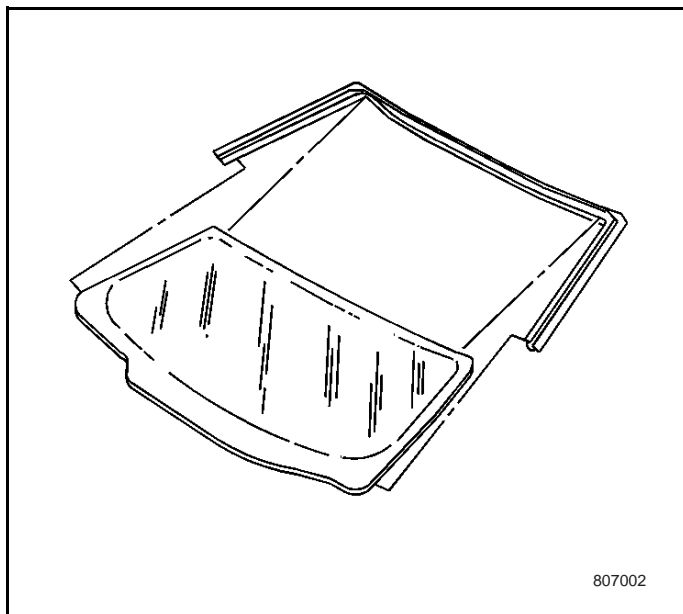
8.7.3 Repair Instructions

8.7.3.1 Windshield Molding Replacement

Removal Procedure

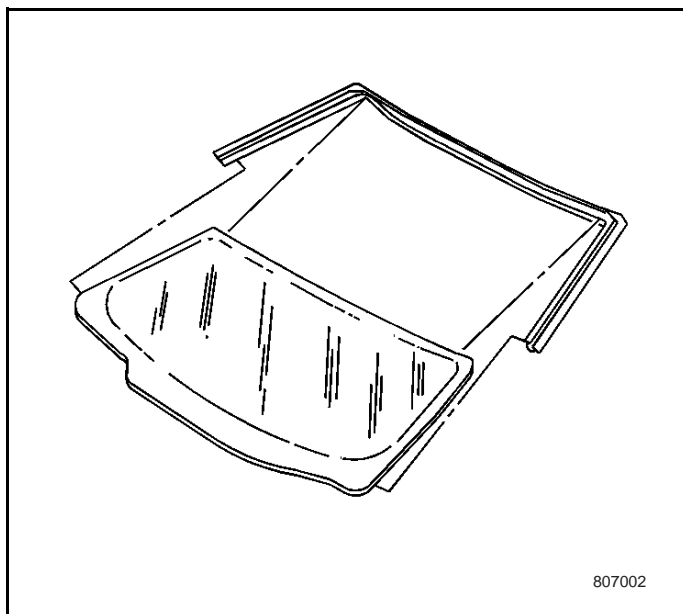
Note:

- The windshield molding can not be replaced unless the windshield is removed.
 - The original windshield molding cannot be reused.
 - Be sure to prefit the windshield molding to the windshield as an assembly to the body prior to actual installation.
 - The new windshield moldings are primed and will adhere to the urethane adhesive.
 - A heat lamp may be used to make the windshield molding more pliable.
1. Use a flat bladed tool to carefully pry out the windshield molding approximately 75mm.
 2. Hold the windshield molding with hand and slowly pull it off the body.
 3. Remove the windshield molding off the windshield.
 4. Remove the windshield. Refer to Windshield Replacement.



Installation Procedure

1. To clean surface used for installation of new windshield molding, use a clean P/N 105042 soaked with GM designated window detergent or cloth of isopropyl alcohol to wipe the windshield molding area. Dry it well.
2. Put the new windshield molding (used for repair and maintenance) on the body for pre-fitting before actual installation.
3. Starting from the center, press the windshield molding to proper position by hand.
4. Use tape to glue the molding if necessary, to fit it with the windshield.
5. Make the windshield molding as an assembly to be fitted with the windshield before actual installation to the body.
6. Install the windshield. Refer to Windshield Replacement.

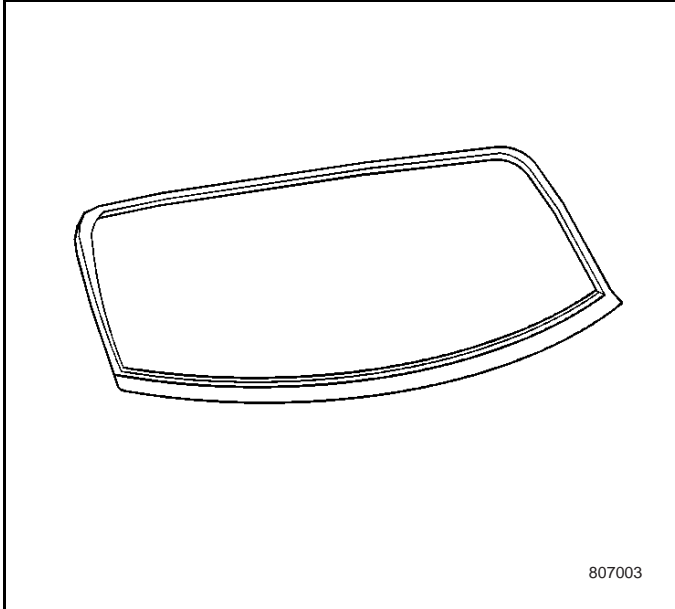


8.7.3.2A Rear Window Molding Replacement

Removal Procedure

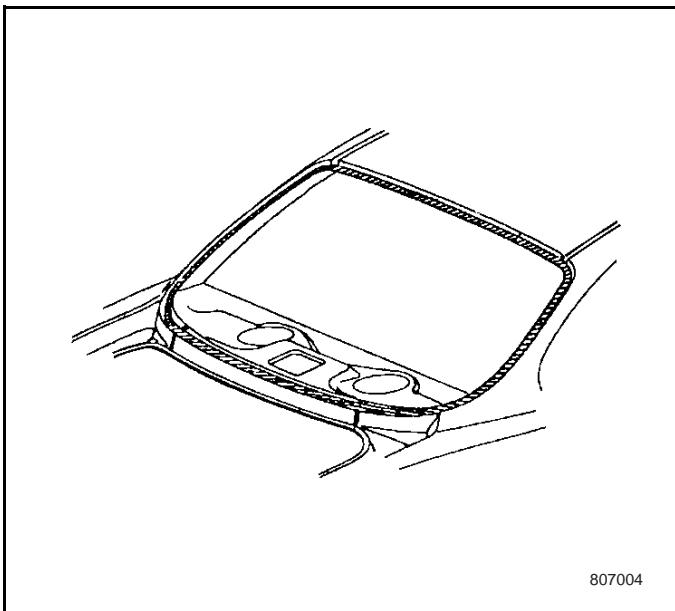
Note:

- To replace rear window molding, it is necessary to remove the rear window.
 - After the removal, new maintenance parts must be used to replace the original rear window molding.
 - Apply primer to rear windshield molding and glue it on urethane adhesive.
 - Be sure to make the rear windshield molding as an assembly to be fitted with the windshield before actual installation to the body.
 - Heating lamp may be used to make the windshield molding more flexible.
1. Use a flat bladed tool to pry the molding out approximately 75mm.
 2. Hold the window molding with hand and slowly pull it off the body.
 3. Remove the rear window. Refer to Rear Window Replacement.



Installation Procedure

1. To clean rear window surface used for installation of new window molding, use a clean P/N 105042 soaked with GM designated window detergent or a cloth of isopropyl alcohol to wipe the rear window area. Dry it well.
2. Starting at the center, install window molding to the rear window, and press it to proper position by hand.
3. To maintain the molding on the rear window, use the tape if necessary.
4. Install the rear window. Refer to Rear Window Replacement.

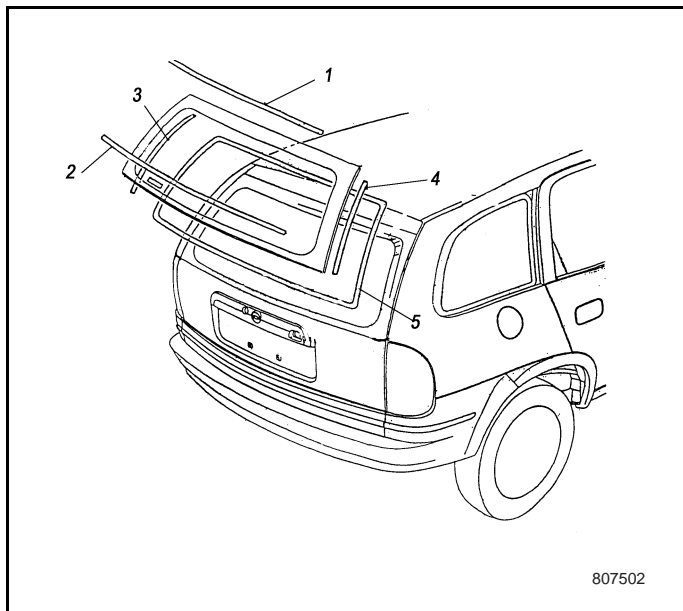


8.7.3.2B Garnish Molding Replacement - Rear Window

Removal Procedure

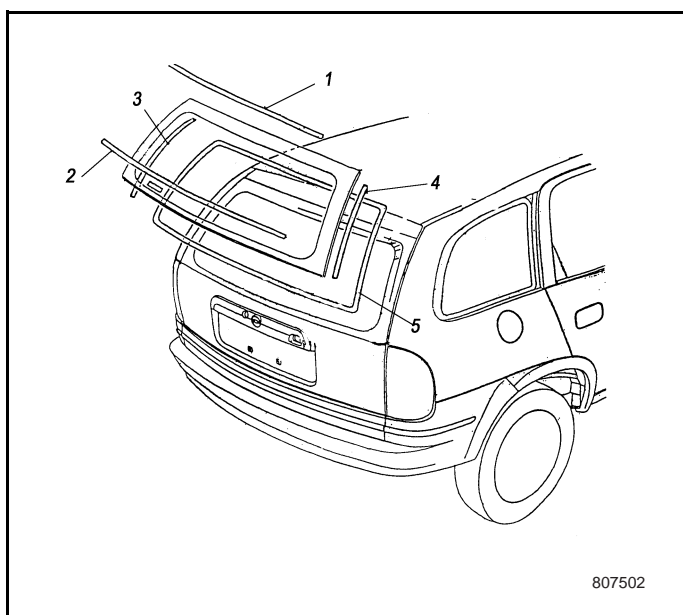
Note:

- To replace rear window molding, it is necessary to remove rear window.
 - After removal, new maintenance parts must be used to replace the original rear window molding.
 - Apply primer to the rear windshield molding and glue it on urethane adhesive.
 - Be sure to make the molding as an assembly to be fitted to rear window before installation to the body.
 - Heating lamp may be used to make the windshield molding more flexible.
1. Use a flat bladed tool to pry the molding out approximately 75mm from the body.
 2. Hold the window moldings 1,2,3,4,5 with hand and slowly pull them off the body.
 3. Remove the rear window. Refer to Rear Window Replacement.



Installation Procedure

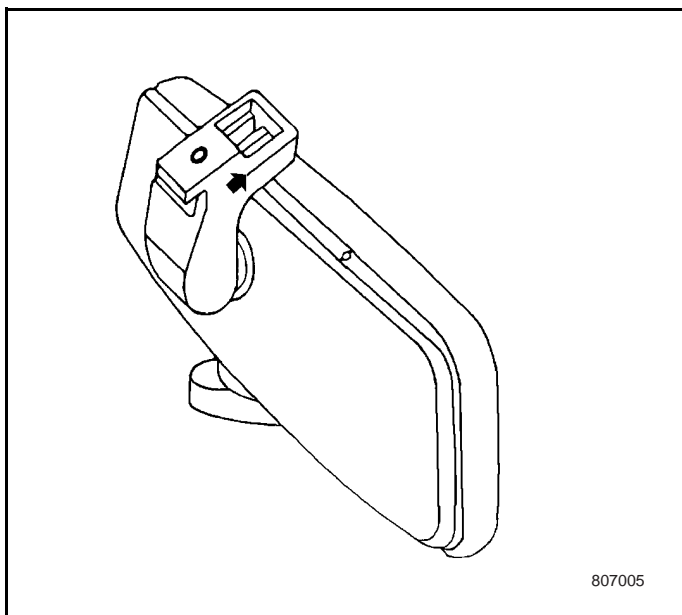
1. To clean rear window surface used for installation of new window molding, use a clean P/N 105042 soaked with GM designated window detergent or a cloth of isopropyl alcohol to wipe the rear window area.
2. Install the hatch back moldings 3,4,5, starting from center (1), and press the rear window molding into proper position.
3. Install moldings 1, 2 to rear window and press it into proper position with hand.
4. To keep the molding on the rear window, apply tape if needed.
5. Install the rear window. Refer to Rear Window Replacement.



8.7.3.3 Interior Rearview Mirror Replacement

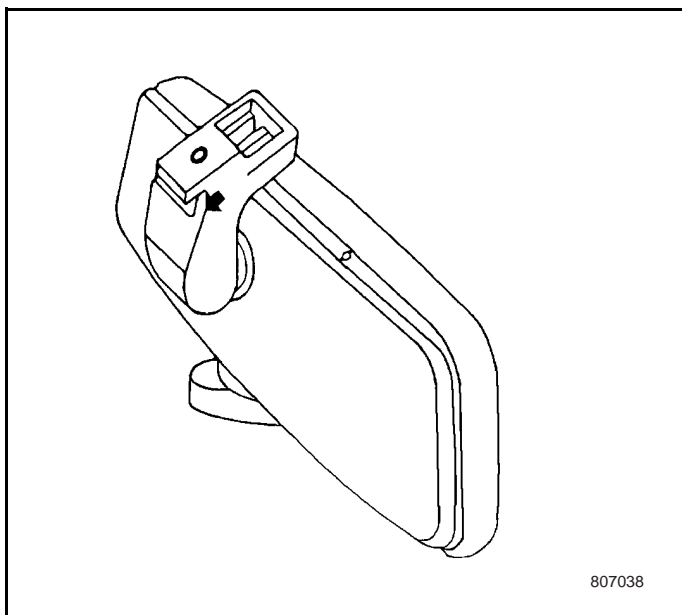
Removal Procedure

1. Use a small flat bladed tool to remove the interior rear-view mirror from the interior rearview mirror bracket.



Installation Procedure

1. Install the interior rear-view mirror onto the interior rear-view mirror bracket by the way of clamping the interior rear-view mirror into the interior rear-view bracket and make sure it has fully been inserted.



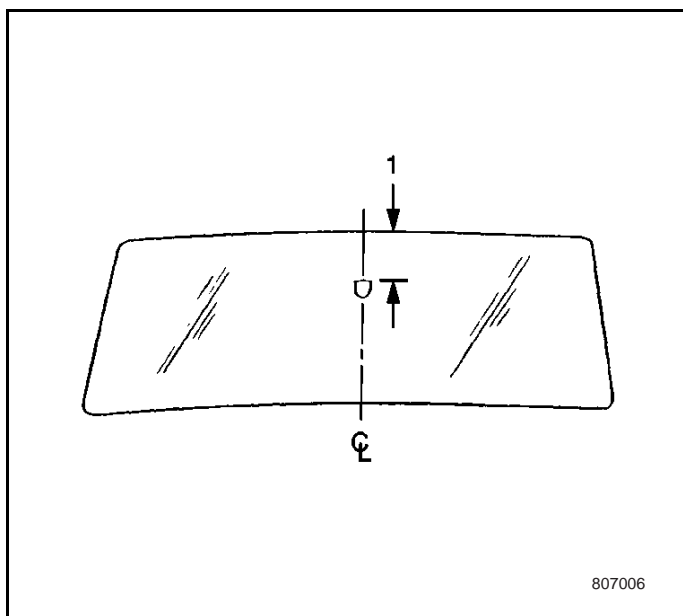
8.7.3.4 Interior Rear-view Mirror Bracket Installation

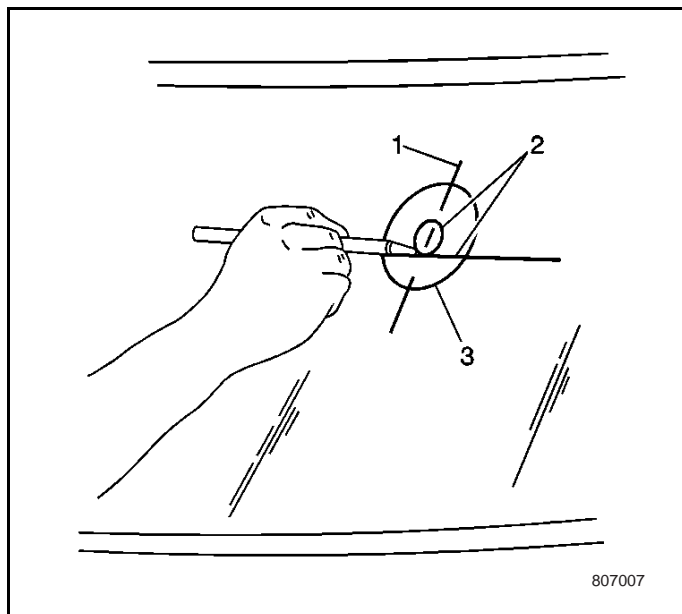
Note: Interior rear-view mirror is attached to the interior rear view mirror bracket. Interior rear-view mirror bracket is glued to the windshield with plastic polyethylene butyral.

To install an independent interior rear-view mirror bracket or a new part, following items are needed.

- Loctite Instant Adhesive 312.
- 2-Element Pack P/N 10523 69 or Equivalent
- (Prepared according to installation procedure step 4 and 5) original interior rear-view mirror bracket, or newly replaced interior rear-view mirror bracket.
- Wax Mark Pen or Crayon
- Isopropyl Alcohol
- Clean Tissue-Paper
- Fine Emery Cloth or Sand Paper (320 or 360)

1. Measure the dimension from the windshield top (1) to the top of interior rearview mirror bracket (2). The dimension is 70mm.

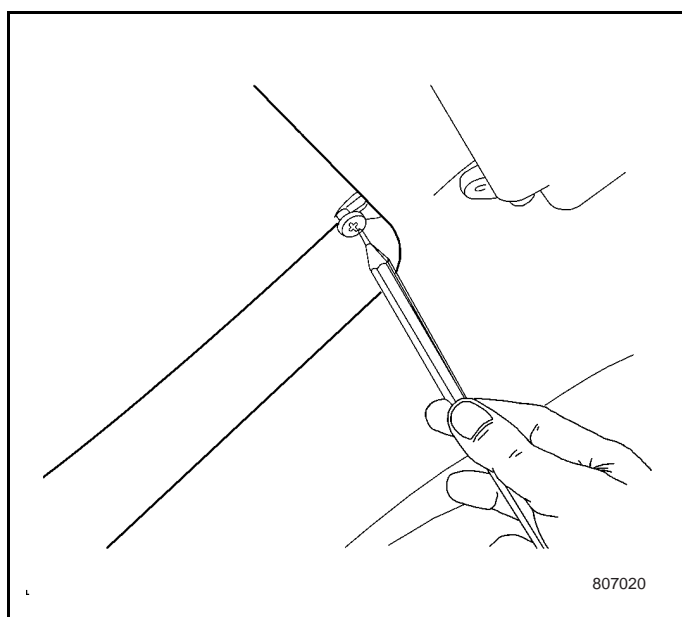




2. Mark the windshield outside position with wax mark pen or crayon. Draw a big circle along the interior rear-view mirror bracket ring on the windshield outer surface (3).
3. Use tissue paper soaked in GM glass detergent GM P/N 1050427 tissue paper soaked in polish to clean the big circle on the windshield inner surface. Scrub the area till it is completely cleaned and dried. After drying, use tissue-paper soaked with isopropyl alcohol to clean the area, and erase traces of washing powder or detergent.

Note: If reusing the original interior rear-view mirror bracket, all factory installation adhesive traces must be removed before reinstallation.

4. To grind the new interior rear-view mirror or the bonding surface of workshop mounted original interior rear-view mirror bracket by using a fine (320 or 360) emery cloth or sand paper.
5. Use clean tissue paper soaked with isopropyl alcohol to wipe the grinded interior rear-view mirror bracket clean. Dry it well.
6. Before installation to the windshield, prepare the interior rear-view mirror bracket as according to instructions provided by suppliers.
7. Place the interior rear-view mirror properly on the pre-marked position, half circular hole end pointing upward. Instance is not allowed, press the interior rear-view mirror bracket on the windshield for 30-60 seconds, pressure onto the windshield should be constant.
8. 5 minutes later, clear all excessive adhesive by tissue paper soaked in isopropyl alcohol or window detergent.
9. Reinstall the interior rear-view mirror. Refer to Interior Rear-view Mirror Replacement



8.7.3.5 Windshield Replacement.

Removal Procedure

Tools required

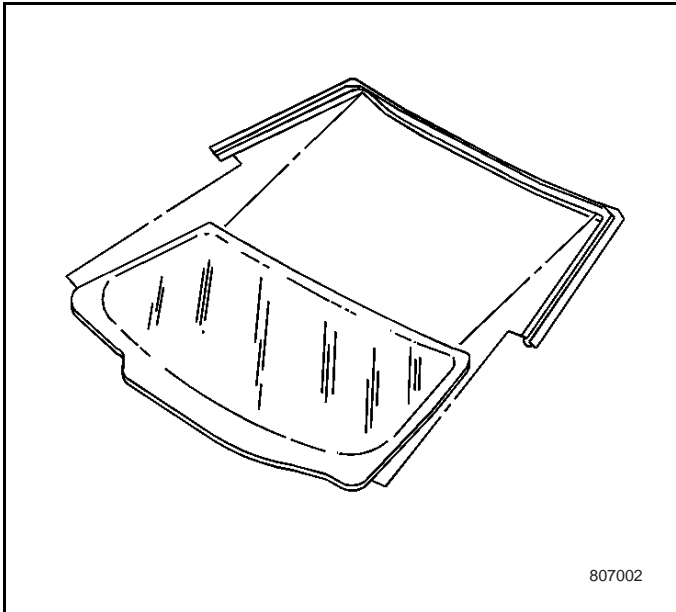
- J 24402-A Glass Sealing Layer Removal Tool
- J 39032 Stationary Glass Removal Tool
- Isopropyl Alcohol or Equivalent
- Cartridge-Type Caulking Gun
- Commercial-type Utility Knife
- Razor Blade
- Suction Cup
- Plastic Scraper

1. Open the engine hood.
2. Obscure the windshield surrounding area to protect the paint surface and interior roof lining.
3. Remove the windshield wiper arm and the blades.

Refer to Wiper Arm Replacement in Wiper/Washer System

4. Remove air inlet grille. Refer to Air Inlet Grille Panel Replacement in Body Front End.
5. Remove interior rear-view mirror. Refer to Interior Rear-view Mirror Replacement
6. Disconnect windshield radio antenna connector.
7. Remove windshield trim. Refer to Trim Panel Replacement-Windshield Column in Interior Trim

Caution: If the broken glass falls into the defroster outlet, it will be blown into the passenger compartment and cause personal injuries.



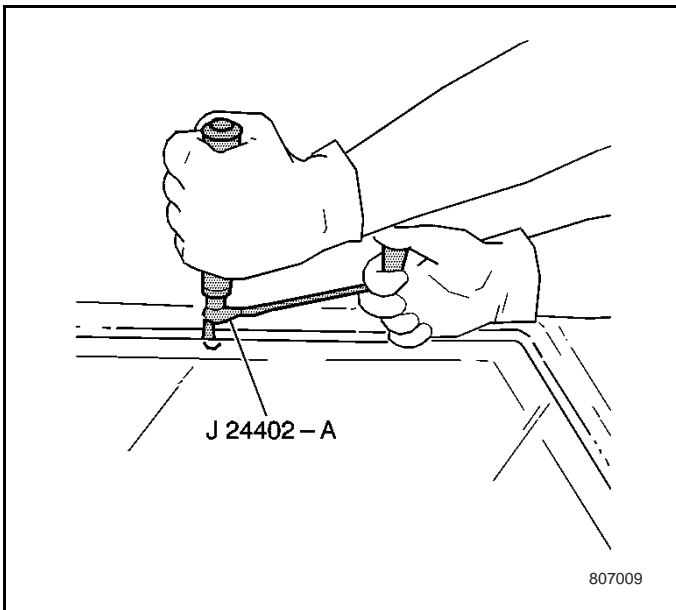
8. Cover defroster opening.

Caution: Use certified safety goggles and gloves in avoidance of personal injury when disposing any type of glass.

Note: The windshield molding is filled and installed in the flute between the body and windshield, if stretched or damaged, it cannot be reused.

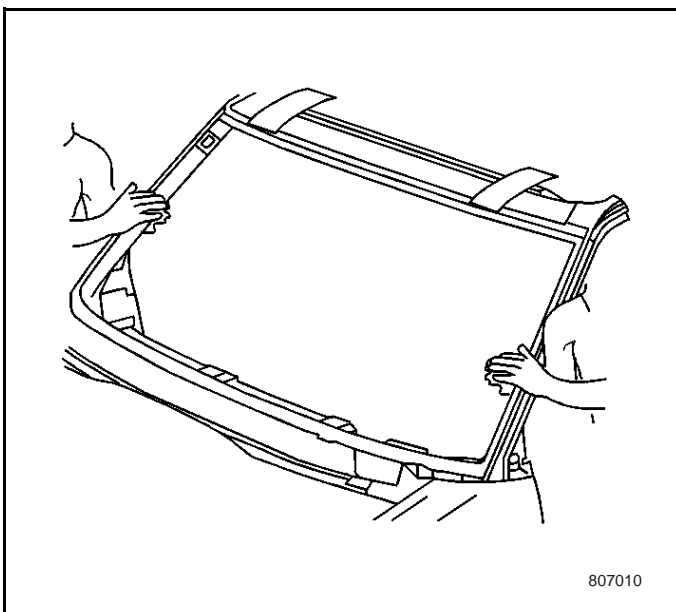
9. Remove windshield molding.

- Hold the lower corner of the windshield and slowly pull out the window molding from the windshield.
- If the windshield molding is not easy to be loosened, use a multifunctional knife to cut open along it to remove the windshield molding.



Note: When removing the windshield, press the edge of the tool continually on the windshield. This will clear the urethane adhesive off the windshield. Retain the urethane base on the pinchweld flanging. The only applicable lubricant is clean water.

10. Use J 24402-A or J 39032 to remove the windshield.



11. Under the aid of an assistant, remove the windshield from the vehicle.

12. Inspect the following components that may cause windshield broken:

- Windshield Frame Edge
- Windshield Molding
- Windshield

13. Check following items to prevent the windshield from being broken.

- High Weld Spots
- Welding Spots
- Hard Point Welding Sealant
- Other blocked objects in welded pressed flanging or abnormal phenomena.

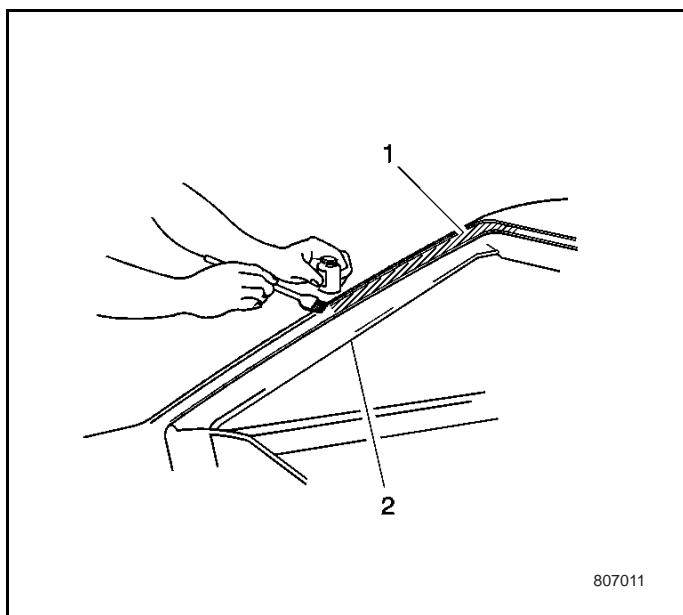
Note: If corrosion appears in welded pressed flanging or metal plate needs to be repaired or replaced, the pressed welded flanging must be finely molding to restore the strength of the bonding area. If paint restoration is needed, before colour coating, cover the flanging bonding position first to keep the primed surface clean. Here applicable products include BASF DE17[®], DuPont 2610[®], Sherwin-Williams PSE 4600[®], NP70[®] and Martin-Semour 5120 和 5130[®] etc.

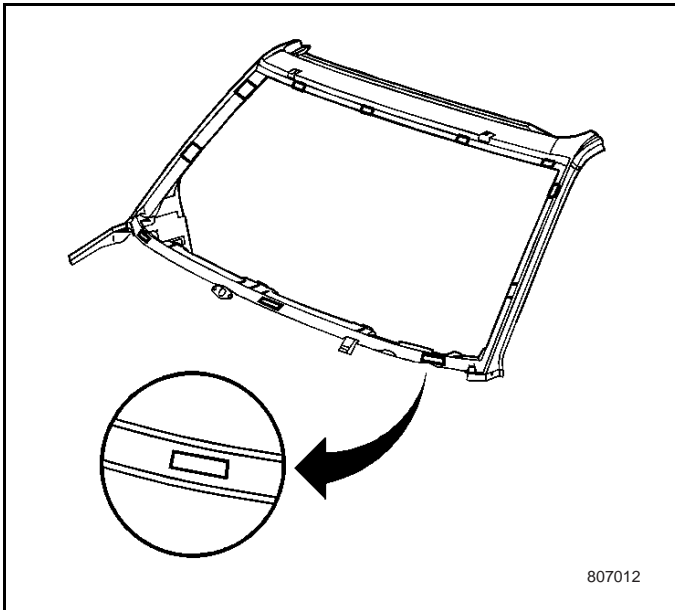
14. Check windshield frame and bonding flanging edge status, to determine which installation way should be adopted. Refer to Short Term Description or Extended method Description
15. Remove unnecessary urethane adhesive from the press welding edge so as to maintain the original shape. Thus to ensure proper clearance between windshield and pressed welded flanging.
16. Clear all broken glasses off the front hood, seat, floor, and defroster pipe.
17. Use a fluff free cloth immersed into a 50/50 (by volume) of isopropyl alcohol and water solution to clean the inner surface edge of windshield.

Installation Procedure

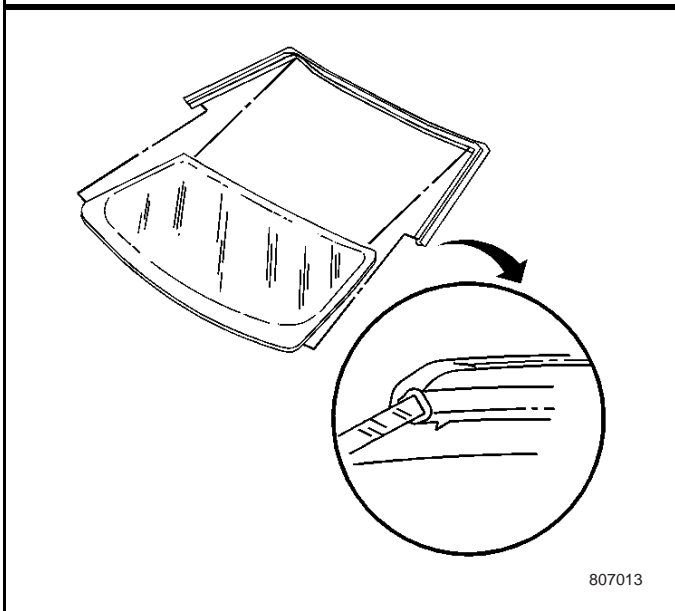
Caution: When replacing the static window, the urethane adhesive set GM P/N 12346392 or urethane bonding system complying with GM 3651 to maintain the original installation integrity. Not using the urethane adhesive set tool will cause poor retention of the window, which may throw unprotected passenger out of the vehicle resulting in injuries. Repair the window frame according to the instruction and then perform the following operation:

1. Shake the pinchweld primer (black#3) for at least 1 minute.
2. Take a new dauber to apply pressed welding primer (black#3) on bonding position surface (1).
3. Wait 10 minutes for priming paint to dry. Ensure all scratch and scrubbing to be covered.

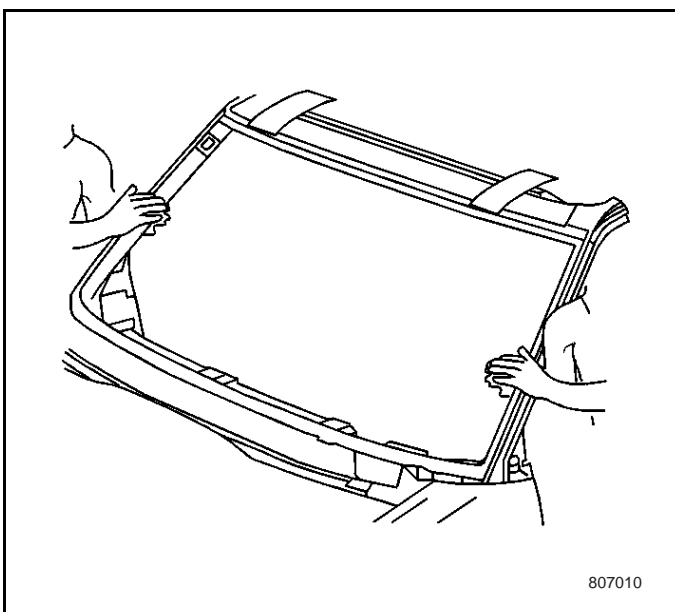




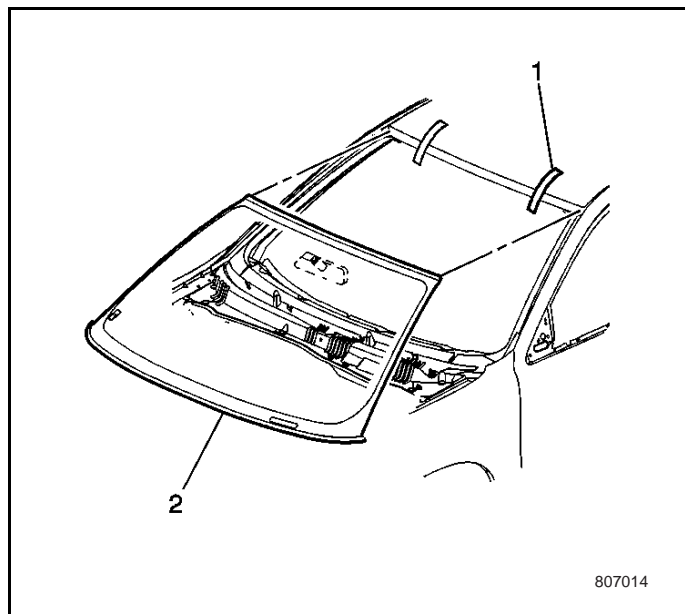
4. If you are using a long term practice, install the washer and VIN plate stuffing tape.



5. Install the window molding on the windshield edge. If the original window side molding is damaged, it must be replaced.



6. With the aid of an assistant, adapt the windshield to the window frame to determine the proper way of positioning the windshield into the frame.



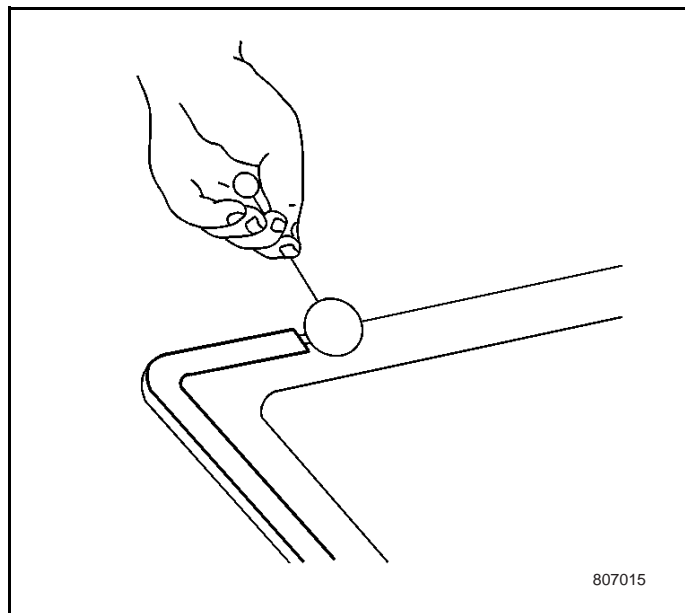
7. Use tape (1) to mark the windshield position in the frame.
8. Cut off the tape from the windshield top edge.
9. With the aid of an assistant and a suction cup, remove the windshield off the window frame.
10. Place the windshield on the clean, safe surface to let its inner face upwards.
11. To reuse the original windshield, remove all but a thin film of the existing urethane adhesive from the windshield surface by using a utility knife or razor blade scraper.
12. Use a fluff free cloth immersed into a 50/50 (by volume) of isopropyl alcohol and water solution to clean the inner surface edge of windshield.

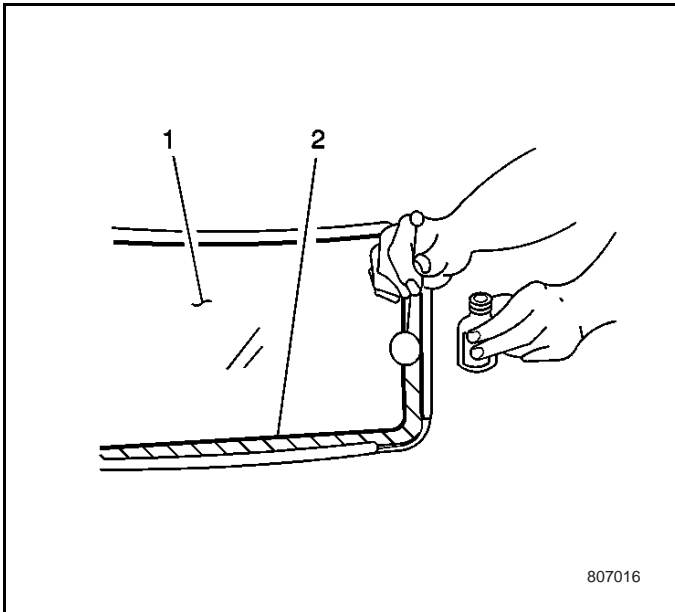
Note: Do not clear all adhesive traces. Clear all heaped or fallout urethane adhesive scraps.

13. If a long term practice is adopted, clear all adhesive on press edge welded flanging, keeping only approximately 2mm.
14. Shake the pinchweld primer (black#3) for at least 1 minute.
15. Apply primer with new dauber onto the pinchweld flanging surface.
16. Dry the clamping welding primer for about 10 minutes.

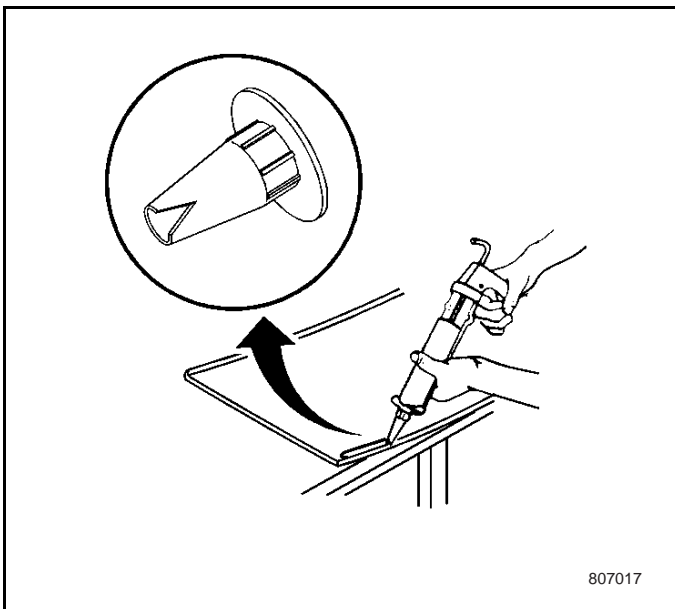
Note: Be careful when applying glass protective agent (transparent) to the windshield. This kind of primer will dry immediately, and uneven application may pollute visible area of the windshield.

17. Using a new dauber to apply glass protective agent (transparent#3) along the whole window inner surface's outer edge for 10-16mm.
18. Apply the second layer of glass protective agent (transparent #1) on the same position of the glass.
19. Wipe the priming area clean immediately by using a clean fluff free cloth.
20. Shake the glass protective agent (black#2) for at least 1 minute.

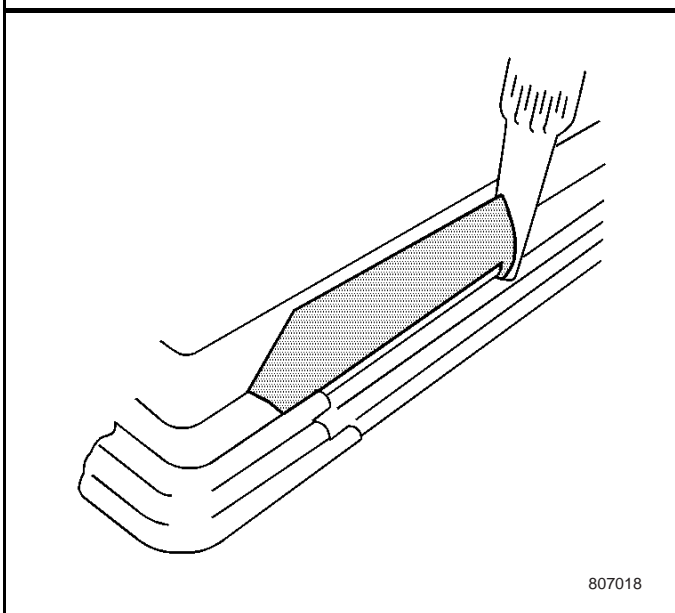




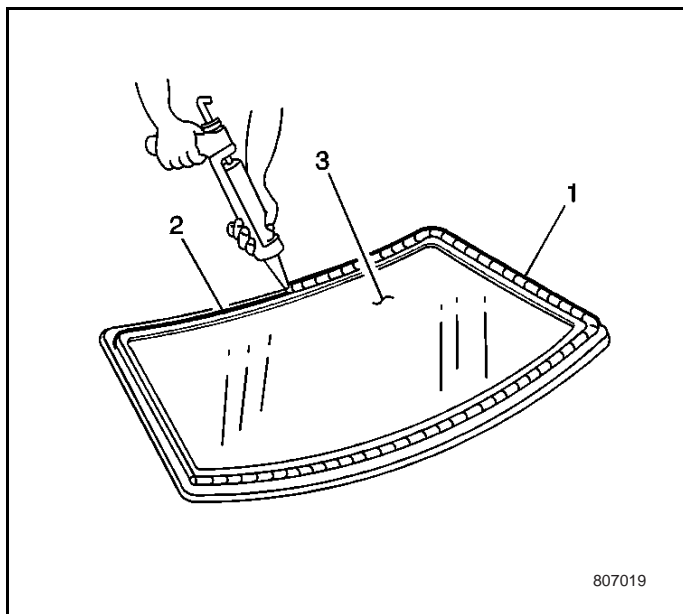
21. Using a new dauber, apply glass primer (black#2) to the same area as that of glass protective agent (transparent#1). The glass primer (black#2) is good up to 8 hours after applying it to the glass. The primed surface of the glass must be kept clean.
22. Allow the glass primer to dry for approximately 10 minutes.



23. In a short term practice, cut the dauber nozzle off to form a 6.0mm flanging edge.
24. In a long term practice, cut the dauber nozzle off to form a flanging edge of 12.7mm wide and 12.7mm high.

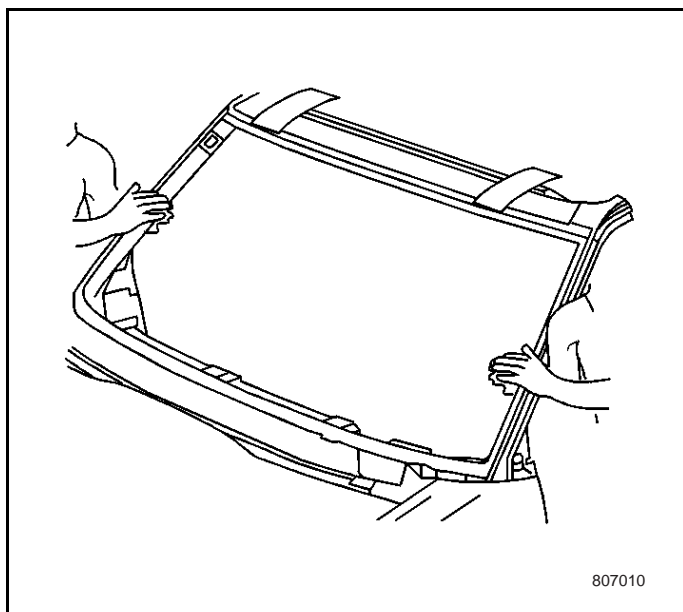


25. Use sleeve type caulking gun to uniformly and continuously apply the urethane adhesive flanging edge.
26. When using short method, apply the urethane adhesive on the existing urethane adhesive on the body.



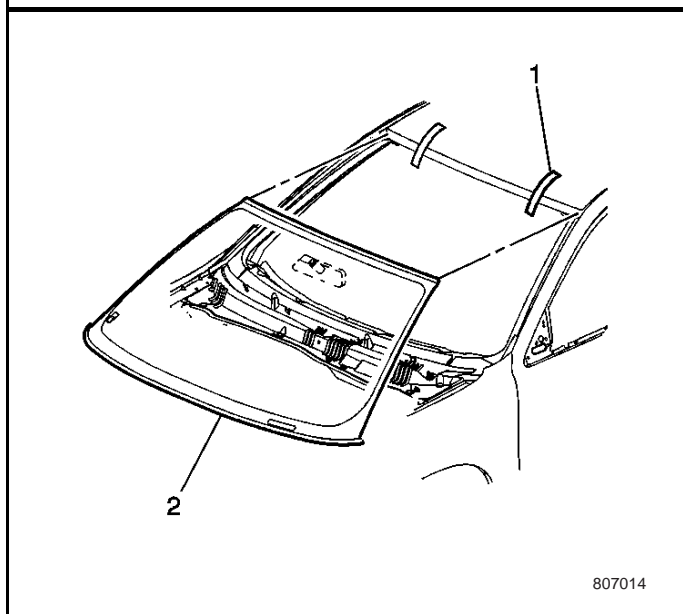
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27. When using extended method, take the windshield edge or window molding inner molding as coating nozzle guide, and apply the urethane adhesive (1) to the windshield (3) inner surface.
28. When applying urethane adhesive onto the windshield molding (1) inner edge, take the windshield molding as the spray nozzle guide.



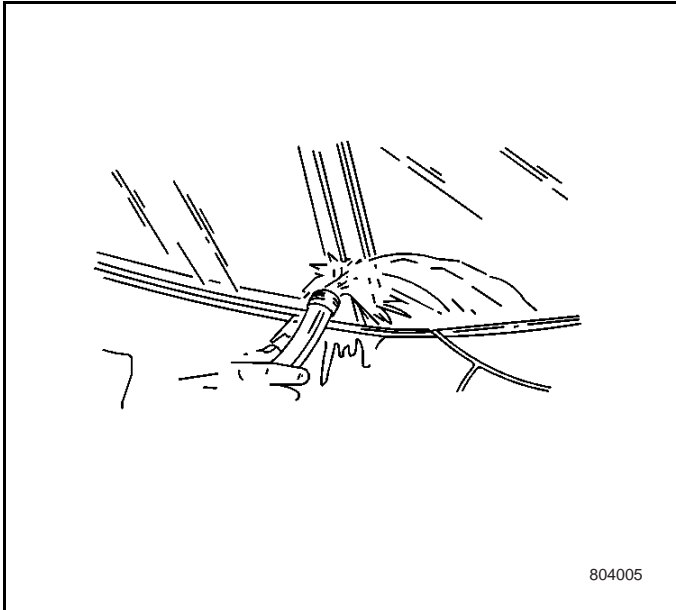
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29. With the aid of an assistant, install the windshield into the frame by using the suction cups.



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30. Align the tape line (1) of the windshield with that on the body.
31. Press the windshield in place.
32. Tape the windshield to the body in order to minimize movement until the urethane adhesive cures.
33. Clean any excessive urethane adhesive on the body.

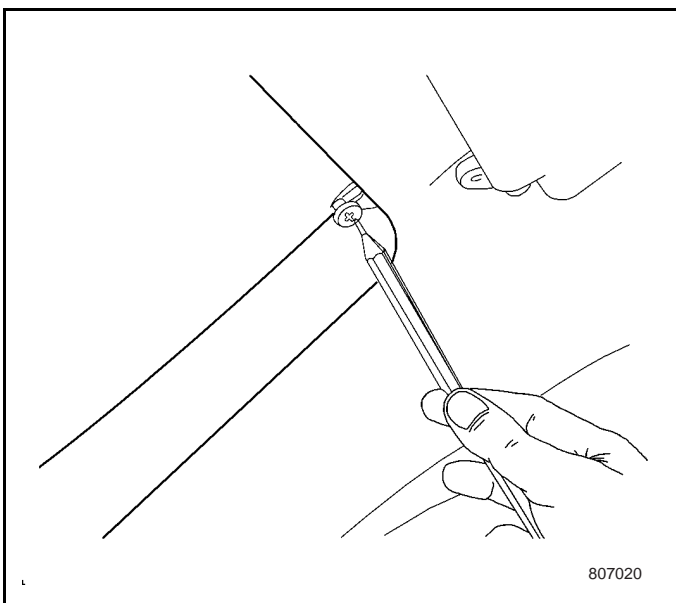


Note: Do not direct a hard stream of high pressure water at the fresh urethane adhesive.

34. Use a soft spray of warm water in order to immediately water test the rear window.
35. Inspect the windshield for leaks.
36. If any leaks are found, use a plastic paddle in order to apply extra urethane adhesive at the leak point.
37. Retest the windshield for leaks.

Caution: Complete curing of repair material requires 24 hours. Before this period, do not disturb the repair area. Insufficient curing of urethane adhesive may allow unrestrained occupants to be thrown out of the vehicle, resulting in personal injury.

38. The following conditions must be maintained to properly cure the urethane:
 - Keep the vehicle at a room temperature of 21°C(70°F) and with a relative humidity of at least 30%.
 - Allow a minimum of 6 hours for the moisture curing urethane adhesive.
 - Allow a minimum of 1-1½ hours for chemical curing the urethane adhesive.
 - Partially lower a door window in order to prevent pressure buildups when closing doors before the urethane adhesive cures.
 - Do not drive the vehicle until the urethane adhesive is cured. Refer to the above curing times.
 - Do not use compressed air to dry the urethane adhesive.



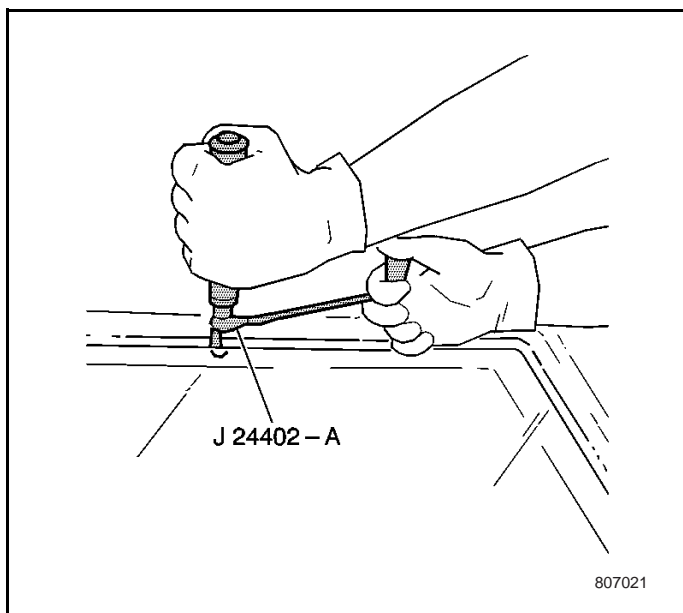
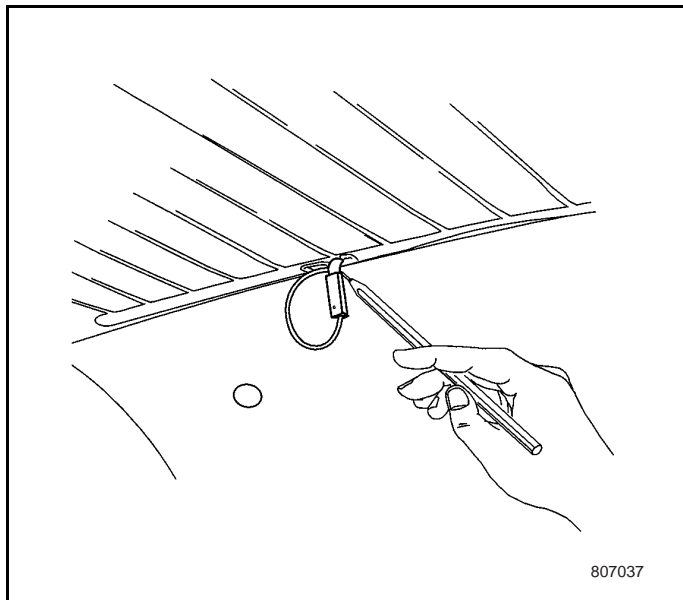
39. Install the windshield trim. Refer to Trim Panel Replacement - Windshield Column in Interior Trim.
40. Install the air inlet grille panel. Refer to Air Inlet Grille Panel Replacement in Body Front End.
41. Install the windshield wiper arms and blades. Refer to Wiper Arm Replacement in Wiper/Washer System
42. Connect windshield radio antenna connector.
43. Install interior rear-view mirror. Refer to Interior Rear-view Mirror Replacement
44. Remove the protective tape and coverings from the windshield area.
45. Close the engine hood properly.

8.7.3.6 A Rear Window Replacement

Removal Procedure

Tools required

- J 24402-A Glass Sealant (Cold Knife) Remover



- J 39032 Stationary Glass Removal Tool
- Isopropyl Alcohol or Equivalent
- Cartridge-Type Caulking Gun
- Commercial-type Utility Knife
- Razor Blade
- Rubber Suction Cup
- Plastic Scraper

1. Glue tape on the rear window to protect the painted surface and roof's inner lining.

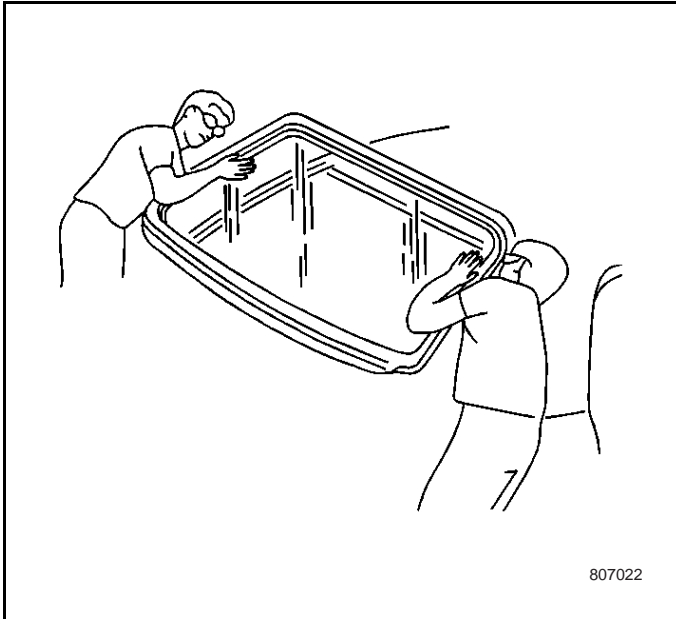
Caution: Take certified safety goggles and gloves in avoidance of any injuries when processing any type of glass.

2. Remove rear window molding. Refer to Rear Window Molding Replacement.
3. Disconnect rear defogger's electric connector.

Important: When removing it, keep the cutting tool edge against the rear window. This will make the urethane adhesive be separated from the rear window. Leave a base of urethane on the press welding edge. The only applicable lubrication is to use clean water.

4. Use J 24402-A or J 39032 to cut the static window from the pinchweld flange.

Perform the operation from the vehicle inside, to protect the outside paint surface.

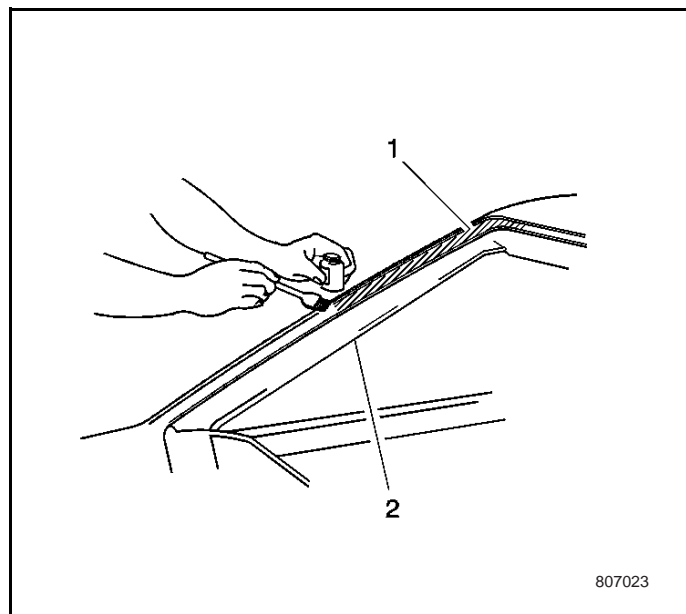


5. With the aid of an assistant and a suction cup, take off rear window from the frame.
6. Inspect the following components in avoidance of rear window broken:
 - Rear window frame edge
 - Rear Window Molding
 - Rear Window
7. Inspect for existence of the following instances, in avoidance of rear window broken in the future.
 - High Weld Seam
 - Welding Spots
 - Hard Point Welding Sealant
 - Any blocked object in pressed welded flanging or abnormal phenomena.

Note: If corrosion appears in pressed welded flanging area or metal plate needs to be repaired/replaced, the pressed welded flanging must be finely moldinged to make only clean priming paint appear on the surface. If paint restoration is needed, cover the flanging bonding area first before color spray coating in order to keep the priming surface clean. BASF DE17[®], DuPont 2610[®], Sherwin-Williams PSE 4600 和 NP70, Martin-Semour 5120 and 5130[®] etc, are allowed to use.

8. Repair the window frame as according to the instruction and then perform the following operation:
9. Inspect the rear window frame and urethane adhesive welding edge conditions, to determine which installation method should be selected. Refer to Short method Description or Extended method Description for appropriate criteria.
10. Remove all broken glasses from the vehicle.
11. A fluff free cloth moistened by a 50/50 (by volume) isopropyl alcohol and water solution could be used to clean the inner surface edge of the windshield.

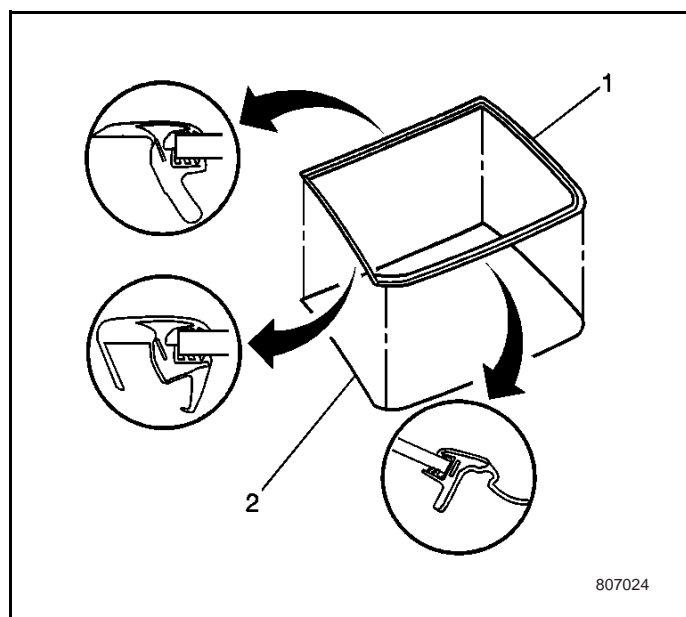
Installation Procedure



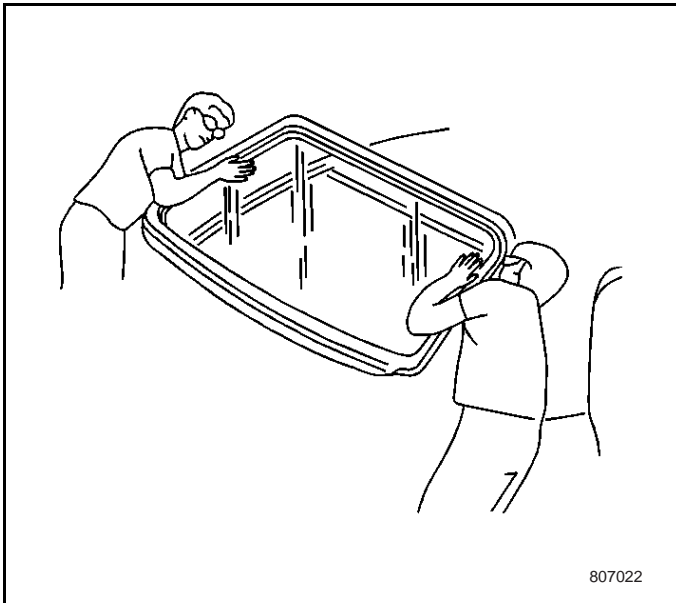
Caution: When replacing the static window, urethane module GM P/N 12346392 or urethane adhesive system complying with GM 3651M to maintain the integrity of the original assembly. Not using urethane module, window retaining ability may be reduced and unprotected passengers may be thrown out of the vehicle, resulting in injury.

1. Shake the pinchweld primer (black#3) for at least 1 minute.

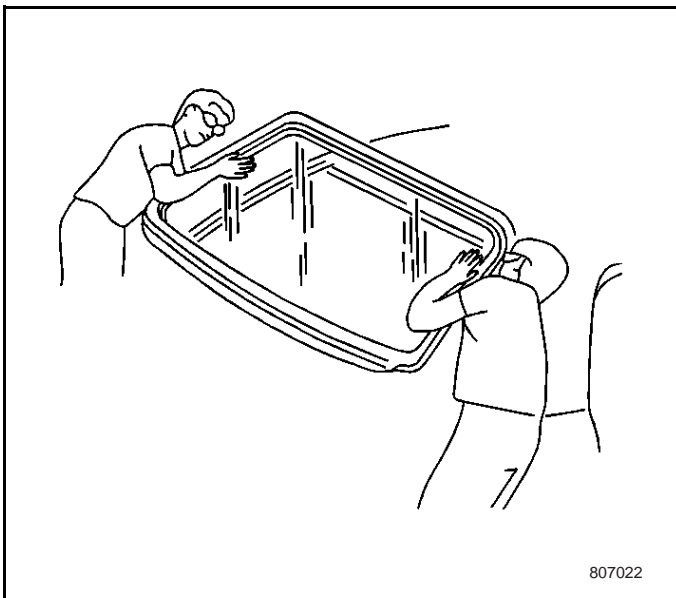
Caution: If proper preparation has not been performed before applying primer, it will cause urethane adhesive capability to reduce. Insufficient urethane adhesion may cause unprotected passenger to be thrown out of the vehicle, resulting in injury.



2. Take a new dauber to apply pressed welding primer (black#3) on bonding position surface (1).
3. Wait 10 minutes for priming paint to dry. Ensure all scratch and scrubbing to be covered.
4. The original window molding must be replaced if it is damaged. Install new rear window molding (1). Refer to Rear Window Molding Replacement.
5. Starting at the center, press rear window molding (1) to rear window (2) by hand.



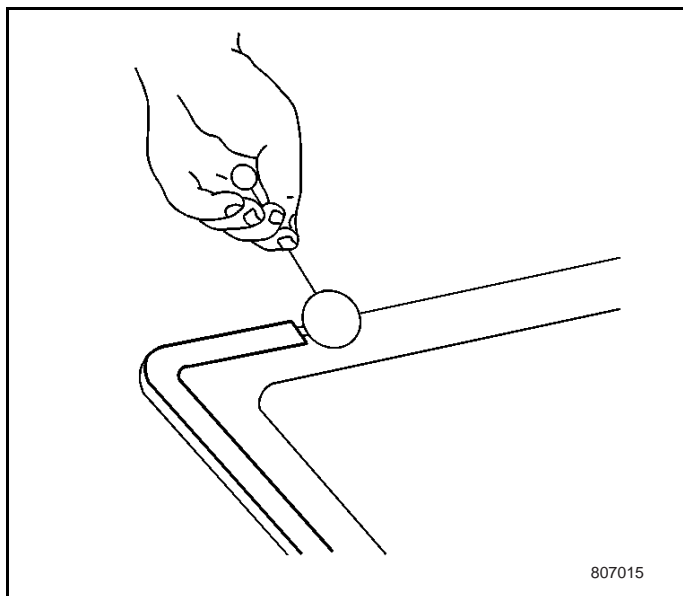
6. With the aid of an assistant, adapt the rear window to the window frame to determine the proper way of positioning rear window into the frame.
7. Mark the rear window position in the frame by the tape.
8. Cut the tape off from the rear window edge.



9. With the aid of an assistant and a suction cup, remove the rear window.
10. Place rear window on a clean, safe surface, put its inner side upwards.
11. If intending to reuse the original rear window, take a clean multifunction knife or shaver to clear all urethane adhesive from the rear window surface, keeping only 2 mm thick.
12. A fluff free cloth moistened with a 50/50 (by volume) solution of isopropyl alcohol and water to clean the inner surface edge of the windshield.

Note: Do not clear all adhesive traces. Clear all heaped or fallout urethane adhesive scraps.

13. In a long term practice, clear all adhesive on press edge welded flanging, keeping only 2 mm thick.
14. Shake the pinchweld primer (black#3) for at least 1 minute.
15. Apply primer using a new dauber to the pinchweld flanging surface.
16. It 拘 I take about 10 minutes to dry the pinchweld primer.
17. In case of taking extended method, perform as follows:



Note: Be careful when applying glass protective agent (transparent#1) onto the windshield. This kind of primer will dry immediately, and uneven application may pollute the visible area of the rear window.

18. In case of installing new non airproofed window:

- Take a new dauber to apply the rear window. Apply protective agent (transparent#3) onto surrounding 10-16mm area along the entire circumference of the rear window glass inner surface.
- Apply rear window protective agent (transparent#1) to the same position of the glass.
- Immediately take clean fluff free cloth to wipe the primer painted window clean.
- Shake the glass coating (black#2) for at least 1 minute.

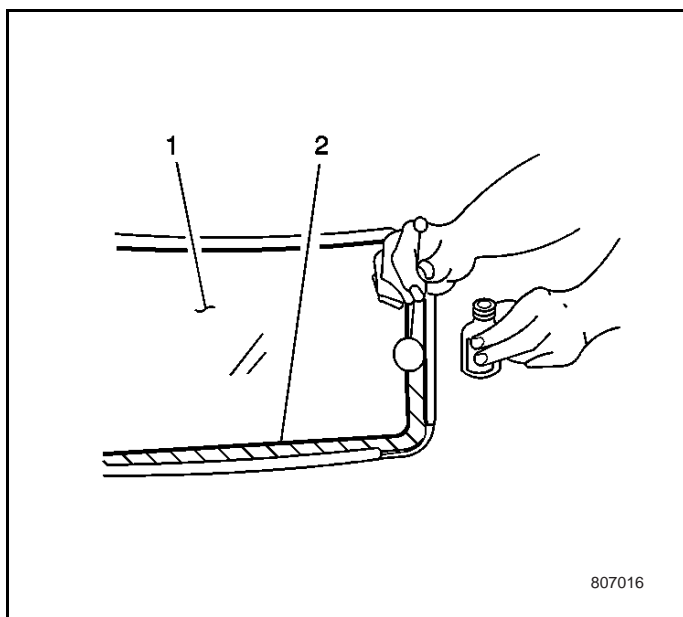
19. In case of installing a new airproofed window:

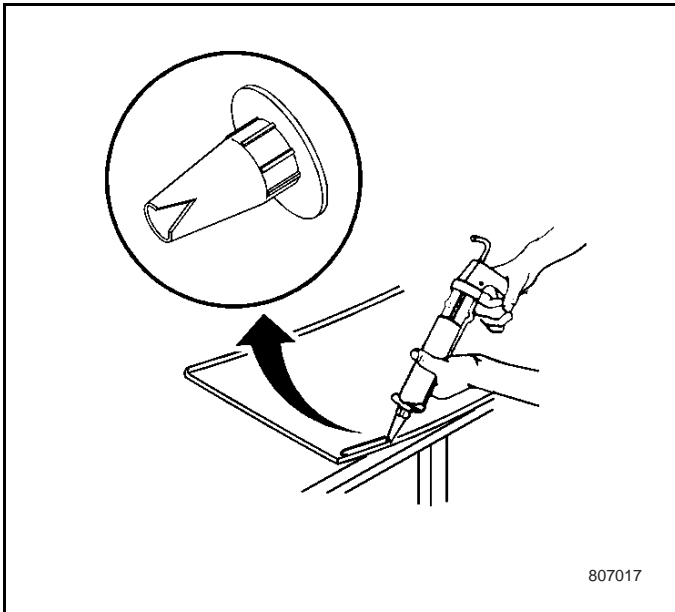
- Take a new dauber to apply glass protective agent (transparent#2) along the whole window inner surface outer edge for 10-16mm. After applying primer onto it, glass must be installed within 8 hours.
- The surface where priming paint is applied must be kept clean.
- It takes about 10 minutes to dry the glass priming coating.

20. Shake glass priming coating (black#2) for at least 1 minute.

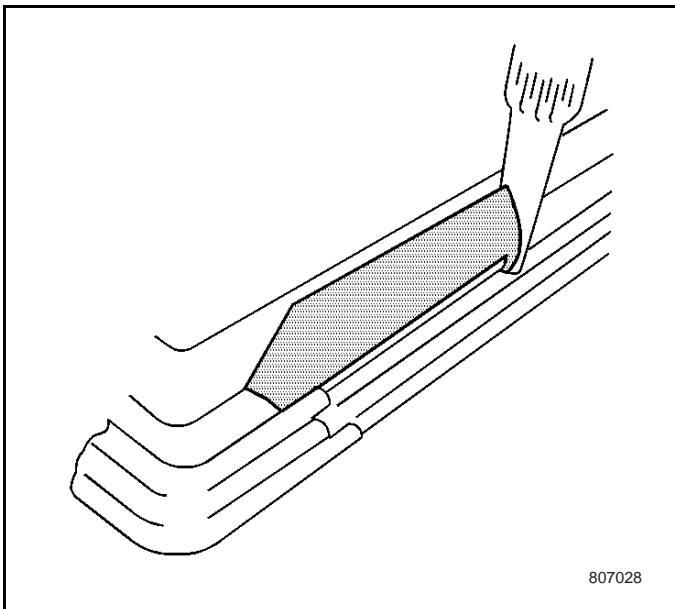
21. Take a new dauber to apply the rear window coating (black#2) to the same position of the rear window as where glass protective agent (transparent#1) is applied.

22. Wait 10 minutes for priming paint to dry.

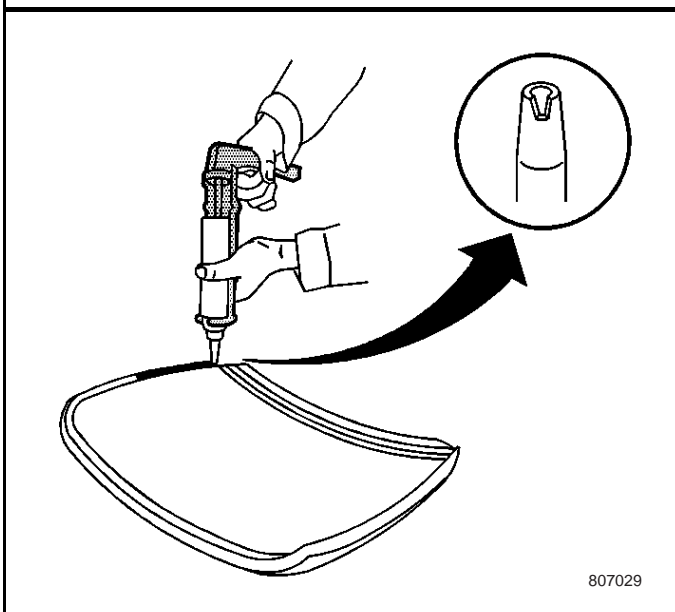




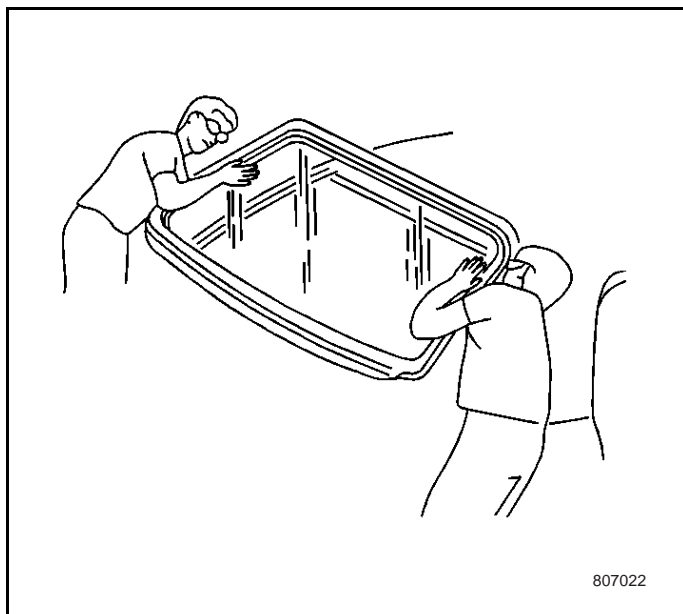
23. In a short method, cut open the dauber coating nozzle, to allow the flange width reaching 6.0mm.
24. In a extended method, cut open the dauber coating nozzle, to allow the flange width reaching 10.5mm and 10.5mm in height.



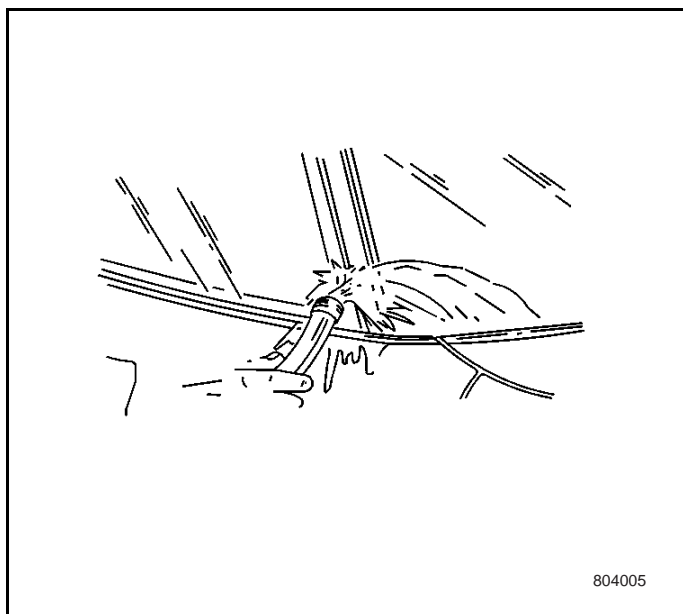
25. Take a pipe caulking gun to apply slick and continuous new urethane adhesive flange edge, surrounding rear window edge, where primer is applied.
26. When taking short method, apply urethane adhesive onto the existing flange edge on the body with urethane.



27. When taking extended method, use the windshield edge or window molding inner edge as coating nozzle guide, and apply amido ether adhesive (1) to the windshield (3) inner surface.



28. With the aid of an assistant and a suction cup, install the rear window into the window frame.
29. Align tape on the rear window with that on the body.
30. Press rear window tightly in place to wet the urethane and make it fit to the position.
31. Glue the windshield onto the body by tape to reduce its movement till the urethane adhesive to be solidified.
32. Clean any excessive urethane adhesive on the body

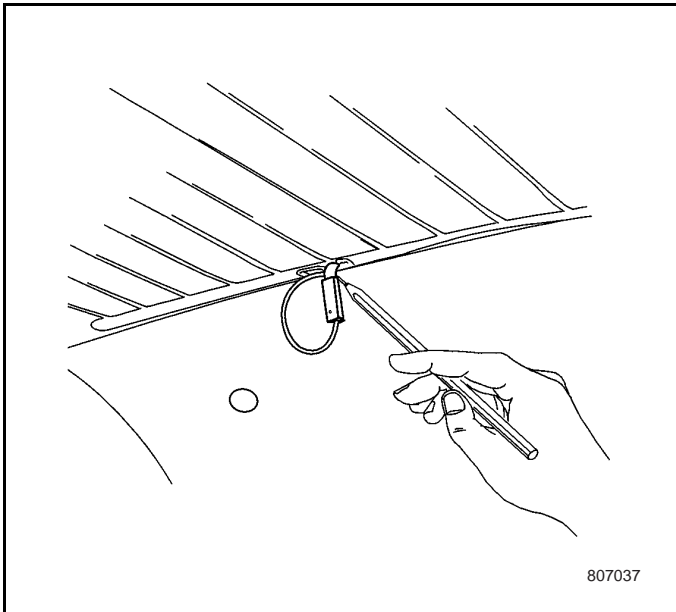


Note: Do not directly spray high pressure water flow onto urethane adhesive which had just been applied.

33. Perform water tightness test for the windshield with a gentle warm water spray.
34. Inspect the windshield for leakage.
35. If leakage is found, to apply more urethane adhesive to the leakage area by a plastic scrapper.
36. Retest the rear window for leakage.
37. Keep the vehicle to be at a room temperature of 21°C (70°F) and with at least a 30% relative humidity.

Caution: Complete solidification of repair material needs 24 hours. Before this, do not interfere the repaired area. Insufficient amido ether adhesive solidification will cause unprotected passengers to be thrown off the vehicle, resulting in injury.

38. Give moistened urethane at least 6 hours of solidification time.



39. A minimum of 1 hour to 1 1/2 hours for chemical curing urethane adhesive is needed.
40. Lower the rear window of the door halfway to prevent urethane adhesive pressure from accumulated inside the vehicle due to door closing before its curing.
41. Do not drive the vehicle until amido ether adhesive is solidified. Refer to the solidification time mentioned above.
42. Do not take compressed air to dry the urethane adhesive.
43. Connect the rear defogger electric connector.
44. Remove the protective masking layer or tape from the vehicle.

8.7.3.6 B Rear Window Replacement

Removal Procedure

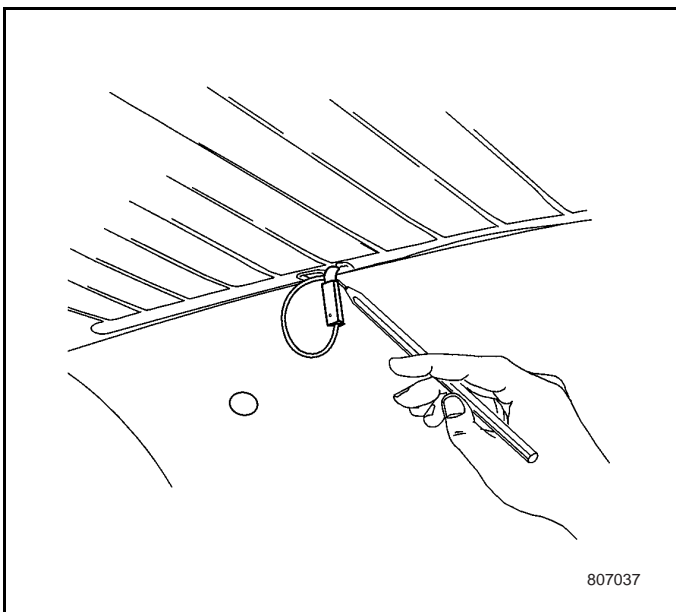
Tools required

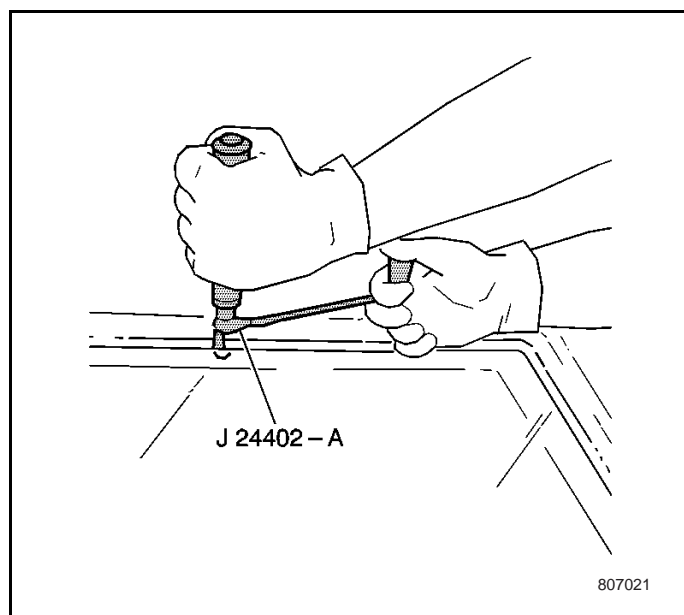
- J 24402-A Glass Sealant (Cold Knife) Remover
- J 39032 Stationary Glass Removal Tool
- Isopropyl Alcohol or Equivalent
- Cartridge-Type Caulking Gun
- Commercial-type Utility Knife
- Razor Blade
- Rubber Suction Cup
- Plastic Scraper

1. Apply the tape onto the rear window part thus to protect the painted surface and dome inner lining.

Caution: Take certified safety goggles and gloves in avoidance of personal injury when installing any type of glass.

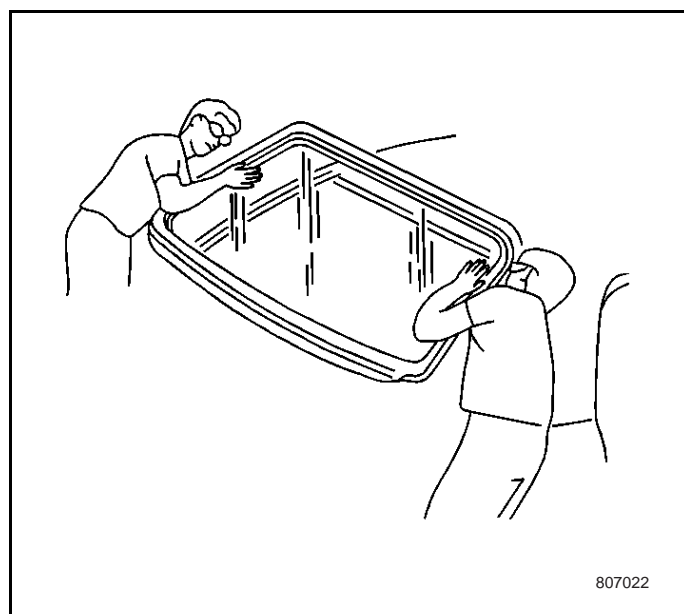
2. Remove rear window molding. Refer to Rear Window Molding Replacement.
3. Disconnect rear defogger electric connector.





Note: When removing it, keep the cutting edge of the tool against the rear window. This will allow the urethane adhesive to be separated from the rear window. Leave a base of urethane on the pinchweld flanging. The only applicable lubrication is to use clean water.

4. Use J 24402-A or J 39032 to cut the static window off from the pinchweld flange.
Perform the operation from the vehicle inside, to protect the outside paint surface.



5. With the aid of an assistant and a suction cup, take off rear window from the frame.
6. Inspect the following components that may cause windshield broken.
 - Rear Window Frame Flanging
 - Rear Window Molding
 - Rear Window
7. Inspect for existence of the following instances, in avoidance of rear window broken in the future.
 - High Weld Seam
 - Welding Spots
 - Hard Point Welding Sealant
 - Any blocked object in the pressed welded flanging or abnormal phenomena.

Note: If corrosion appears at pinchweld flanging area or metal plate needs to be repaired or replaced, the flanging area must be finely molding to make only clean priming paint appear on the surface. If paint restoration is needed, before colour coating, cover the flanging bonding position first to keep the primed surface clean. Here applicable products include BASF DE17[®], DuPont 2610[®], Sherwin-Williams PSE 4600[®], NP70[®] and Martin-Semour 5120 和 5130[®] etc.

8. Repair the window frame as according to the instruction and then perform the following operation:
9. Inspect the rear window frame and urethane adhesive flanging edge condition, to determine which installation method should be adopted. Refer to Short method Description or Extended method Description for appropriate criteria.
10. Remove all broken glasses from the vehicle.

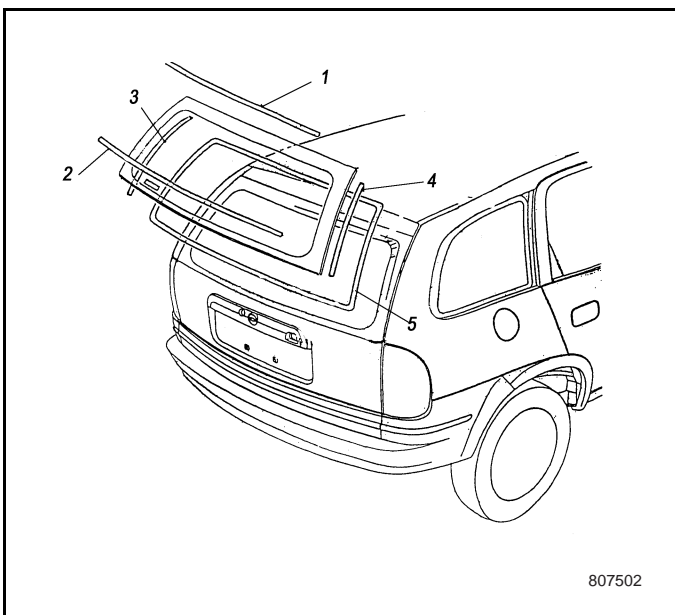
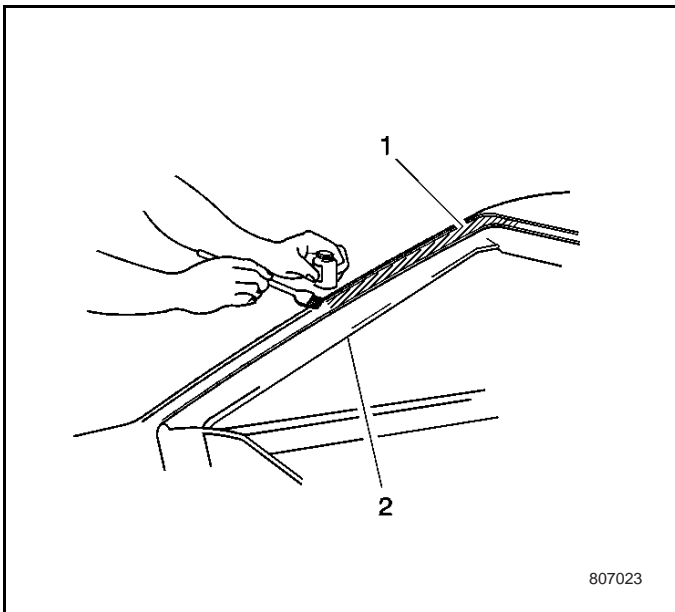
11. A fluff free cloth moistened in a 50/50 (by volume) mixture isopropyl alcohol and water could be used to clean inner surface edge of the rear window.

Installation Procedure

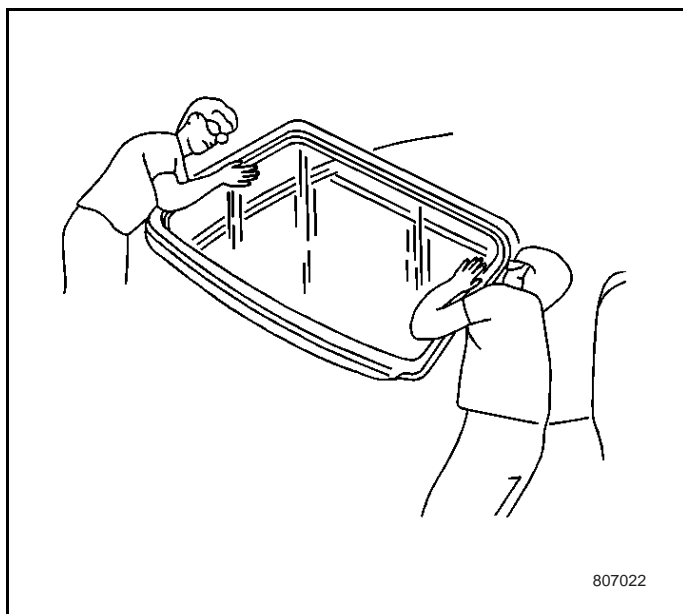
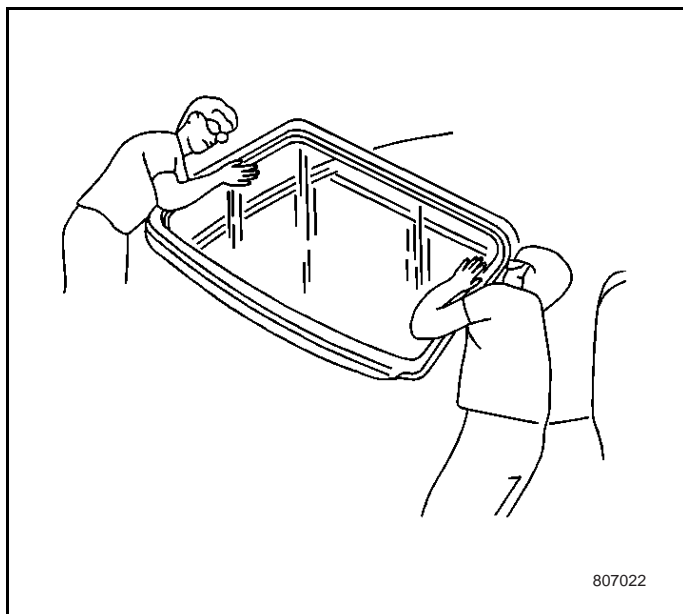
Caution: When replacing the stationary window, urethane module GM P/N 12346392 or urethane adhesive system complying with GM 3651M must be used to maintain the integrity of the original assembly. Failure to use the urethane adhesive kit will result in poor retention of the window which may allow unrestrained occupants to be thrown out of the vehicle, resulting in personal injury.

1. Shake the pinchweld primer (black#3) for at least 1 minute.

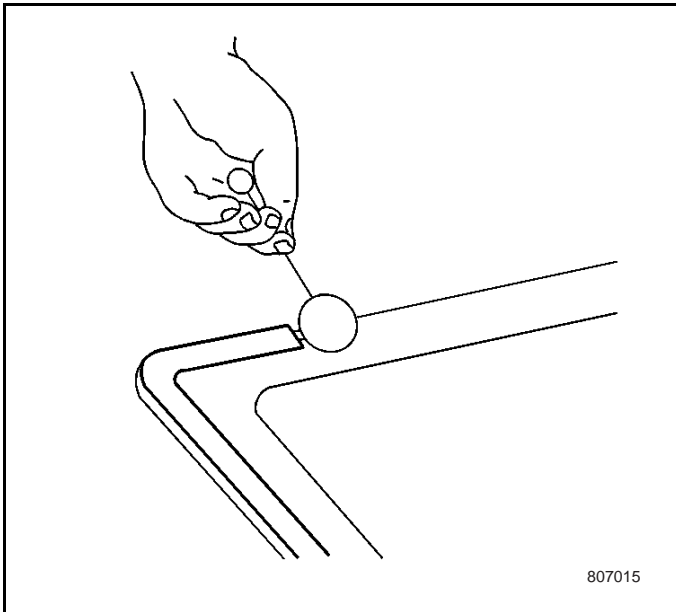
Caution: If proper preparation has not been performed before applying primer, it will cause urethane adhesive capability to reduce. Insufficient urethane adhesive capability may cause unprotected passenger to be thrown out of the vehicle, thus resulting in injury.



2. Take a new dauber to apply pressed welding primer (black#3) on bonding position surface (1).
3. Allow the primer to dry for approximately 10 minutes. Ensure that all nicks and scratches are covered.
4. The original window molding must be replaced if it is damaged.
5. Install new rear window molding (1). Refer to Rear Window Molding Replacement.
6. Starting from the center and press the rear window molding (1) onto the rear window (2) by hand.

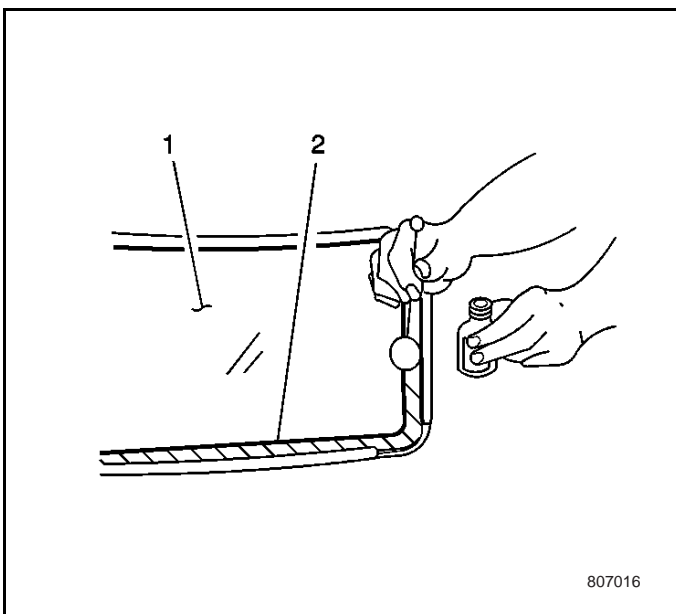


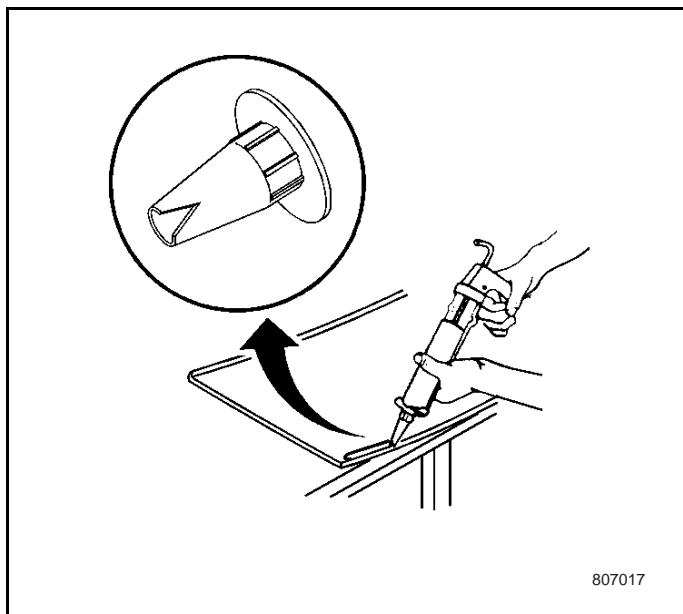
7. With the aid of an assistant, adapt the rear window to the window frame to determine the proper way of positioning rear window into the frame.
 8. Take a tape to mark the rear window position in the frame.
 9. Cut the tape off from the rear window edge.
 10. With the aid of an assistant, use the suction cups to remove the rear window.
 11. Place the rear window on a clean, protected surface, with its inner side upwards.
 12. If the original rear window is being reused, remove all but approximately 2 mm of the existing urethane adhesive from the rear window surface, using a clean utility knife or razor blade scraper.
 13. Clean around the edge of the inside surface of the rear window with a 50/50 mixture of isopropyl alcohol and water by volume on a dampened lint free cloth.
- Note:** Do not clear all adhesive traces. Clear all heaped or fallout urethane adhesive scraps.
14. If the extended method is being used, remove all but approximately 2 mm of the existing adhesive from the pinchweld flange.
 15. Shake the pinchweld primer (black#3) for at least 1 minute.
 16. Apply the primer to the surface of the pinchweld flange with a new dauber.
 17. Allow the pinchweld primer to dry for approximately 10 minutes.
 18. If the extended method is being used, do the following:



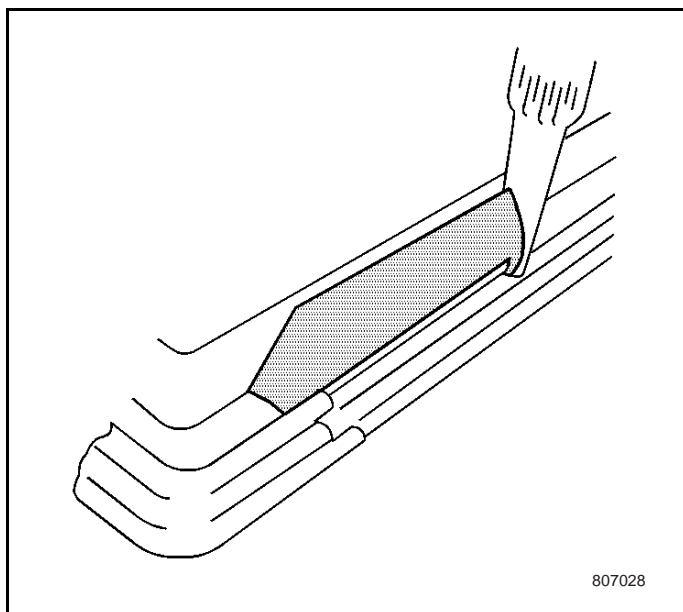
Note: Use care when applying the glass prep (clear#1) to the rear window. This primer dries almost instantly, and may stain the viewing area of the rear window if not applied evenly.

19. If installing a new non encapsulated window:
 - Use a new dauber to apply on the rear window. Apply glass prep (clear #3) to the area approximately 10-16mm around the entire perimeter of the rear window glass inner surface.
 - Apply the rear window glass prep (clear#1) to the same area of the glass.
 - Wipe the primed glass area immediately with a clean lint free cloth.
 - Shake the glass primer (black#2) for at least 1 minute.
20. If installing a new encapsulated window:
 - Use a new dauber to apply the glass prep (clear#2) to the area approximately 10-16 mm around the entire perimeter of the window inner surface. The glass must be installed within 8 hours after applying the primer to the glass.
 - The primed surface of the glass must be kept clean.
 - Allow the glass primer to dry for approximately 10 minutes.
21. Shake the rear window primer (black#2) for at least 1 minute.
22. Use a new dauber to apply the rear window primer (black#2) to the same areas of the rear window to which the glass prep (clear#1) was applied.
23. Allow the primer to dry for approximately 10 minutes.

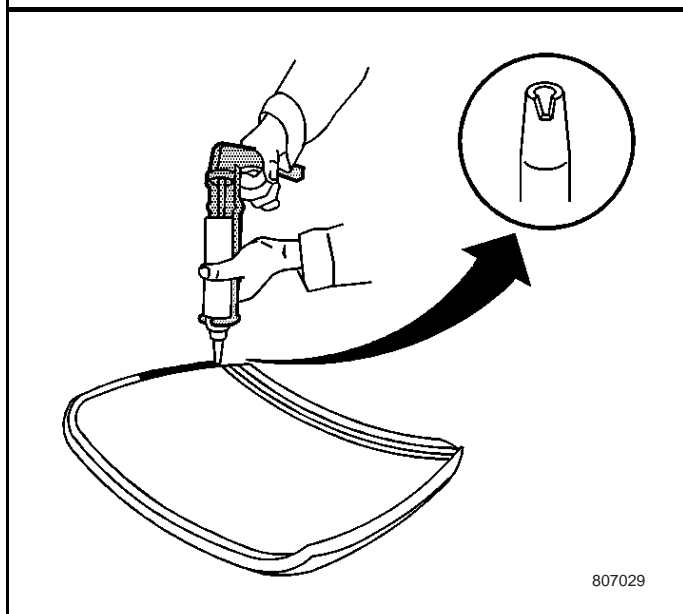




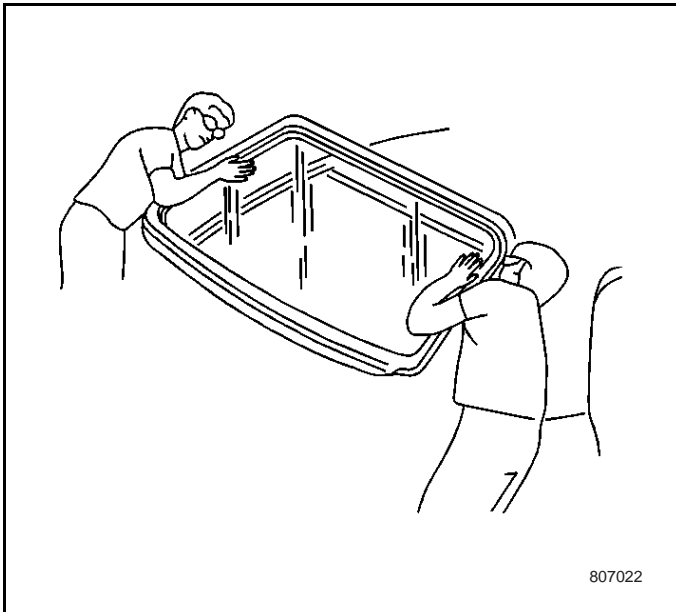
24. if using the short method, cut the tip of the applicator nozzle to provide a bead of 6.0mm.
25. In a extended method, cut open the dauber coating nozzle, to allow the flange width reaching 10.5mm and 10.5mm in height.



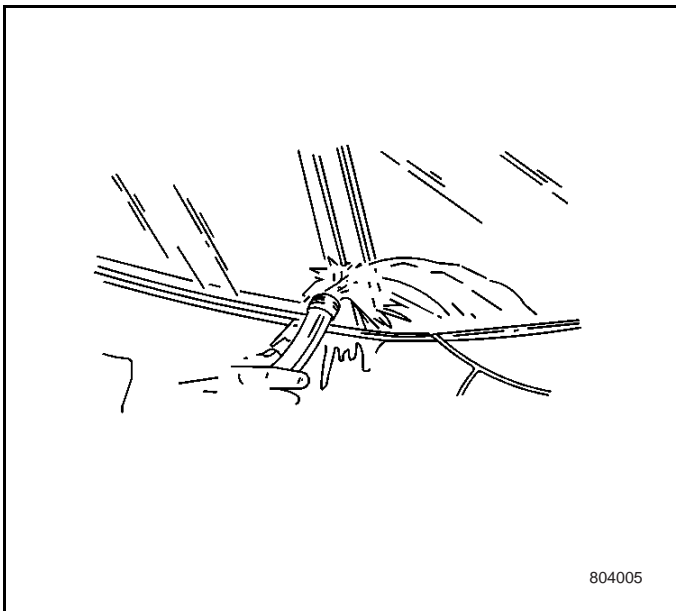
26. Use a cartridge type caulking gun, apply a smooth and continuous bead of new urethane adhesive around the edge of the rear window where the primer was applied.
27. When using the short method, apply the urethane adhesive to the existing bead of urethane adhesive on the body.



28. When using the extended method, use the edge of the rear window or the inside edge of the molding as a guide for the nozzle, in order to apply the urethane adhesive to the inner surface of the rear window.



29. With the aid of an assistant, use the suction cups to install the rear window into the frame.
30. Align the tape on the rear window and on the body.
31. Press the rear window firmly into place to wet-out and seat the urethane adhesive.
32. Tape the rear window in places to the body in order to minimize movement until the urethane adhesive cures.
33. Clean any excessive urethane adhesive from the body.

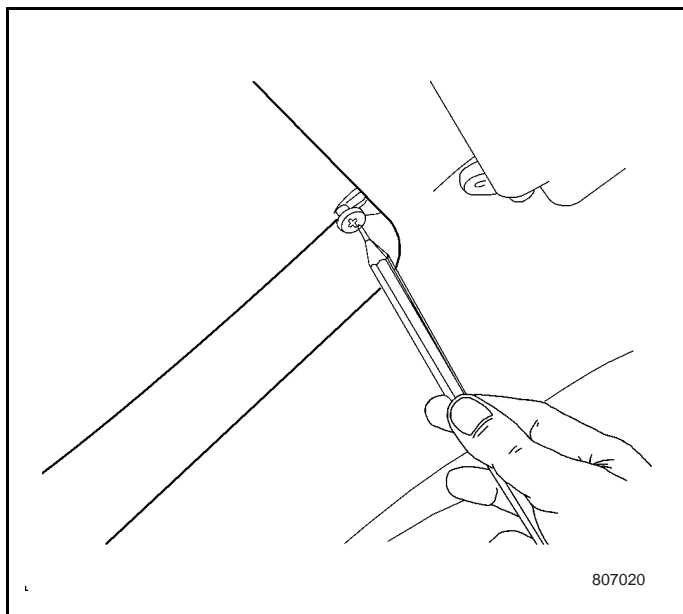


Note: Do not direct a hard stream of high pressure water at the fresh urethane adhesive.

34. Use a soft spray of warm water in order to immediately water test the rear window.
35. Inspect the windshield for leaks.
36. If any leaks are found, use a plastic paddle in order to apply extra urethane adhesive at the leak point.
37. Retest the rear window for leakage.
38. Keep the vehicle at a room temperature of 21°C(70°F) and at least a 30% relative humidity environment.

Caution: Complete curing of repair material requires 24 hours. Before this, do not interfere the repaired area. Insufficient curing of urethane adhesive may allow unrestrained occupants to be thrown out of the vehicle, resulting in personal injury.

39. Allow a minimum of 6 hours for the moisture curing urethane adhesive.



40. Chemical curing urethane needs at least 1-1/2 hours.
41. Partially lower a door rear window to prevent pressure buildups when closing doors before the urethane adhesive cures.
42. Do not drive the vehicle until the urethane adhesive is cured. Refer to the above curing times.
43. Do not use compressed air to dry the urethane adhesive.
44. Connect the rear window defogger electric connectors.
45. Remove the protective coverings and tape from the vehicle and headliner.

8.7.3.7 Window Polishing

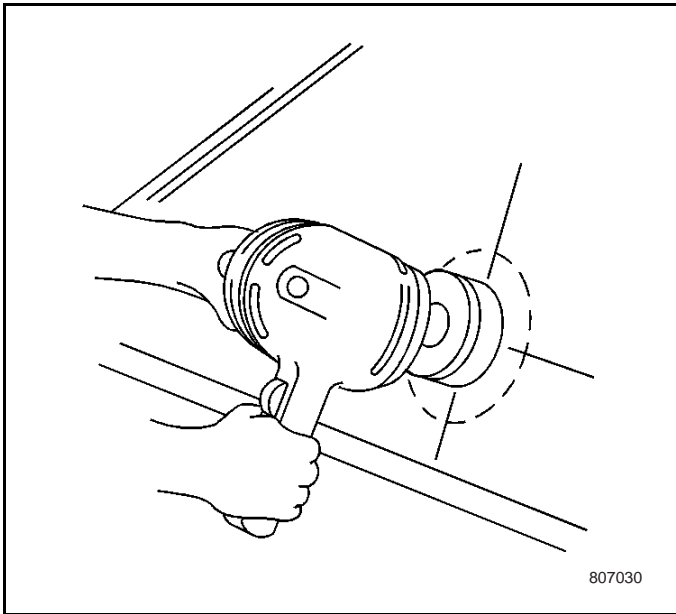
Slight scratches and wears elimination

Perform the following procedure to eliminate any scratches and wear. Use care to prevent distortions of vision. If attempting to eliminate deep scratches from the vicinity of the driver's vision, diplopia may be produced. If deep scratches are present, replace the window.

Polishing procedure that follows was developed using a cerium oxide compound. If any other materials are used, follow the manufacturer's instructions. The polishing procedure should not be used on deep tinted window. The coating on the windows may be damaged.

Recommended Equipments

- A low speed (600-1,300rpm) rotary polisher
- A wool felt, rotary polishing pad with a diameter of 76mm and a thickness of 51mm.
- Powdered cerium oxide mixed with water.
- This is the abrasive compound.
- A wide mouth container to hold the abrasive compound.



Polishing Procedure

1. Mix at least 44 ml of cerium oxide with enough water to obtain a creamy consistency.
 - If the mixture is too thick, it'll cake on the felt pad more rapidly.
 - If the mixture is too runny, more polishing time will be needed.
2. Draw a circle around the scratches on the opposite side of the window, to serve as a guide for locating the scratches while polishing.
3. Use masking paper to cover the surrounding position, in prevention of polishing fluid to drop or splash.

Note: Do not submerge the pad or allow the pad to stay in the mixture, as the bond may loosen between the pad and metal plate.

4. Soak the felt cloth, and place the polisher into the compound.
5. When polishing the scratched area, following suggestion should be noticed.
 - According to the requirement, mix the compound frequently as much as possible to maintain its creamlike density.
 - Apply medium but constant pressure.
 - Let the pad directly contacting the window.
 - Thin sheet type Spreading Out Movement.
 - Immerse the pad into the compound every 15 seconds, to ensure wheel and window always kept wet during polishing operation.
 - Dry pad may produce superabundant heat.
 - Do not let the pad contact dust and other foreign matter.
6. After removing scratches, wipe the polishing position clean.
7. Clean the polishing pad.

8.7.3.8 Window Cleaning

Periodically clean the window. Use GM glass cleaner P/N 1050427 or equivalent to remove common tobacco tar drop and dust film.

Non abrasive filter may be used for windshield outer side.

Clean wiper blade, and perform the following procedure:

1. Use a cloth immersed with half water and half GM Optikleen or equivalent to clean the wiper blade.
 - Optikleen- or equivalent.
 - A solution of half water and half methanol may be used.
2. Clean the blade with water.

8.7.3.9 Grille Repair

Installation Procedure

Tools required

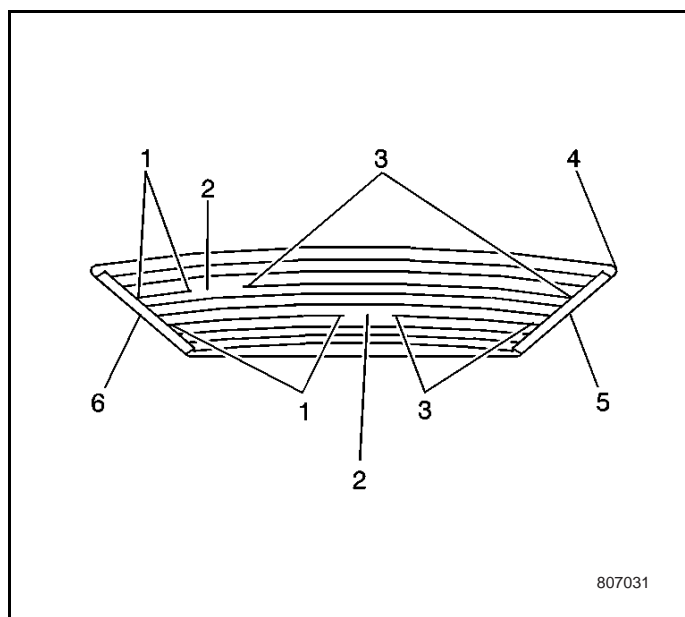
- J25070 Blower — able to reach 260°C, or equivalent.
- Test Lamp
- Rear Window Defogger Repair Tool Pack GM P/N 12346001 or equivalent.

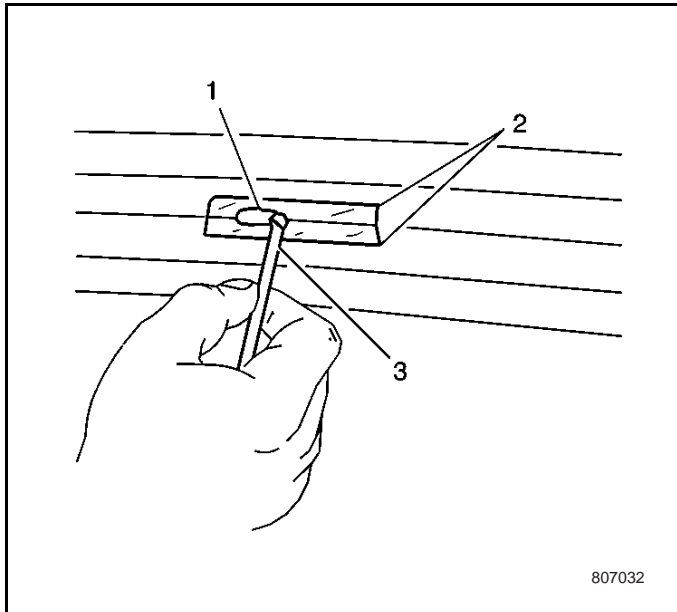
Caution: Avoiding personal injury:

- Do not allow repair material to contact skin or eye, and in avoidance of suction of vapor.
 - Do not approach spark or open fire.
1. Disconnect the electrical connector.
 2. Inspect rear window grid lines.
 3. Ensure the rear window to be below room temperature environment.
 4. Inspect grid lines to be repaired. Confirm the said area has already been dried and no pollutants.
 5. Use isopropyl alcohol to moisten the cloth. Use wet cloth to wipe the grille position clean.

Note:

- Ensure the grid line repair material not to be expired.
- Repair decal or tape must be used to control the repair part width.
- If using decal, ensure punching and cutting measurement slot to have the same width with the grid lines.
- Do not stop adequately mixing up grid lines repair material until its colour is in uniformity.
- Be sure there is no bubble at the repairing area in the grid line repair material.

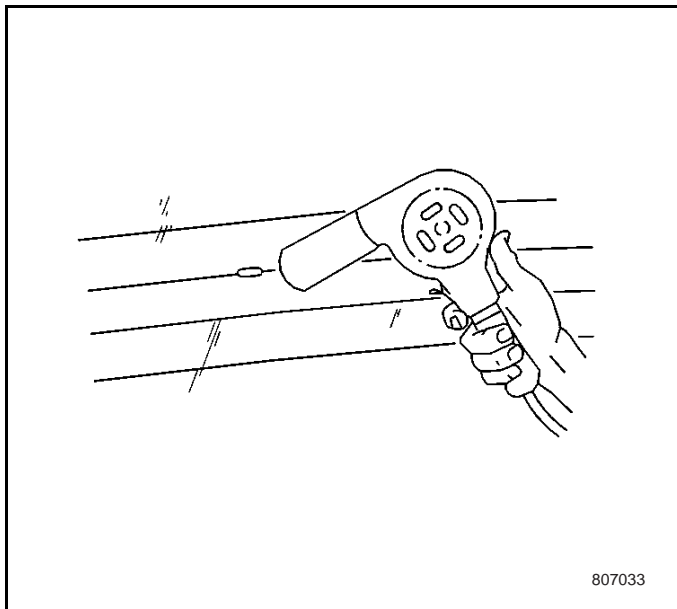




6. Use a paper leather oil painting pencil to mark the grid line broken position (2) at rear window outside.
7. Place the grid line repair (2) applique or 2 tapes on the upper and lower part of the repair position.
8. Use brush (3) to apply the grid line repair material (1). Ensure the repair material to cover all cut open position.

Notice: For grid line repair material, heat curing must be adopted. In avoidance of interior molding damage by heating, molding parts located at the heating repair position side should be protected.

9. Carefully remove decal or tape (2), never disturb grid line repair material.



Note: If blower is not available, retain at least 24 hours under the environmental temperature of 21°C-32°C to let the repair material completely harden. Do not disturb the repair area afterwards.

After repairing, grid lines should be available to carry out electrical operation immediately.

10. Use blower to repair grid lines.
 - Keep a distance of about 25mm (1 inch) between blowing nozzle and the surface.
 - Heat the repair area for 2-3 minutes.
11. Connect the electric connector.
12. Test the operation of the grid lines and inspect its repair effect.

8.7.3.10 Rear Window Defogger Braided Lead Wire

Repair Procedure

Caution: Use certified safety goggles and gloves in avoidance of personal injury when disposing any type of glass.

Caution: To avoid personal injury:

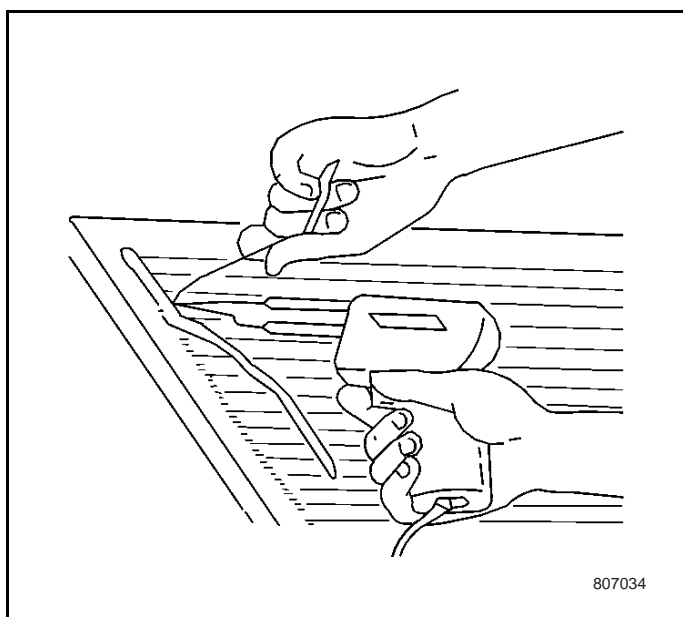
- Do not allow repair material to contact skin or eye, and in avoidance of suction of vapor.
 - Do not approach spark or open fire.
1. Use soft soldering flux containing silver of 3% and flux and paste to weld and attach the rear defogger bus lead wire and/or defogger end.
 2. Use qualified steel wire to polish repaired position and to remove the oxidization layer formed during window producing process.
 3. Use a brush to apply small amount of paste type solder onto appropriate position.
 - Rear Defogger Bus Lead Wire
 - Defogger End Repair Position.

Note: Do not let the tool to stay at one welding point or operate the tool for more than 30-40 seconds on the window.

If overheated is found when contacting the window, cool the window by wind before moving to next step. Cooling with water may cause the heated window to be broken.

Avoid overdue pressure to ensure the window not overheated.

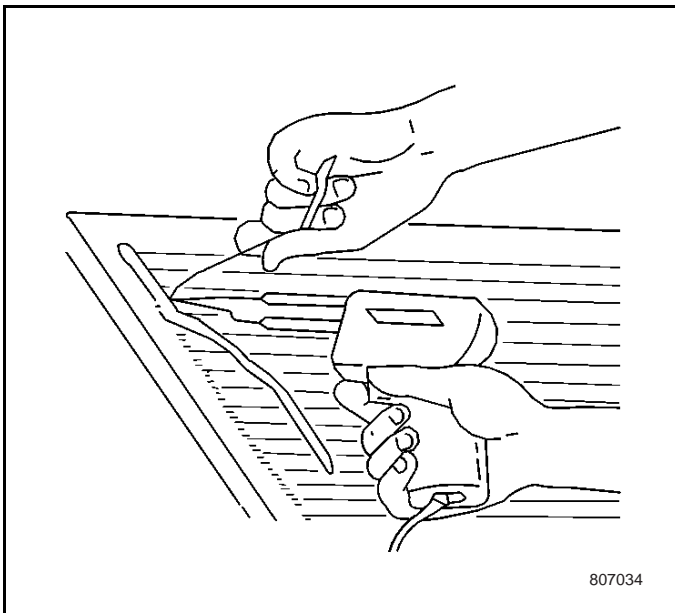
4. Apply soft soldering flux to the searing iron tip. Heating soft soldering flux adequately till it is molten, and it should be able to be restored completely.
5. Apply the soft soldering flux to the power supply bus or grounding bus.
6. Pull the searing iron tip out from the soldering flux processed position. Apply the soft soldering flux slightly onto the bus.
7. Apply a small amount of soldering flux to the appropriate position.
 - Rear Defogger Bus Lead Wire Lower Side.
 - Defogger Terminal
8. Align the welding point with solder to the appropriate position:
 - Rear Defogger Bus Lead Wire Lower Side.
 - Defogger Terminal
9. Coat the searing iron tip with solder.
10. Weld the appropriate position:



- Rear Defogger Bus Lead Wire Lower Side.
 - Defogger Terminal
11. The searing-iron scratches across solder coated blemishes. Slightly coat the said welding spot with soft brazing solvent flux.
 12. Connect the braided wire welding spot to the power supply bus or grounding bus welding spot.
 13. Use the pincer to clamp the appropriate components:
 - Rear Defogger Bus Lead Wire
 - Defogger Terminal
 14. Heat appropriate position to ensure the welding spot melted and fused together.
 - Rear Defogger Bus Lead Wire Upper Side.
 - Defogger Terminal
 15. Never remove clamping force until the soft brazing solvent flux to be solidified.

Use solvent to remove the remaining solder.
 16. Connect the electric connector.

8.7.3.11 Bus/Antenna Terminal Repair



1. Use qualified cotton-like steel wire to polish the repairing area. This will remove the oxidization layer formed during window production.
2. Use a brush to apply a small amount of paste type solder to the rear defogger bus lead wire antenna and defogger terminal repair position.
3. Apply soft soldering flux to the searing iron tip. Heating soft soldering flux adequately till it is molten, and it should be able to be restored completely.
4. Apply the soft soldering flux to the power supply bus or grounding bus.
5. Pull the searing iron tip from the fluxed area and use soft soldering flux to coat the bus thinly.
6. Apply a small amount of soldering flux to the rear defogger bus lead wire, antenna and defogger terminal bottom.
 - Align weld spot with soldering flux which is slightly applied to the lead wire antenna of the rear defogger bus and to the defogger terminal bottom.
 - Coat the searing iron tip with solder.
7. Apply a small amount of flux to the rear defogger bus lead wire, antenna and defogger terminal bottom.

Pull the searing iron tip from the fluxed area, and thinly coating the bus with solder.

Draw the searing iron tip from the welding point, and thinly coat the soft soldering spot.

8. Connect the braided wire's welding spot to the power supply bus or grounding bus' welding spot.

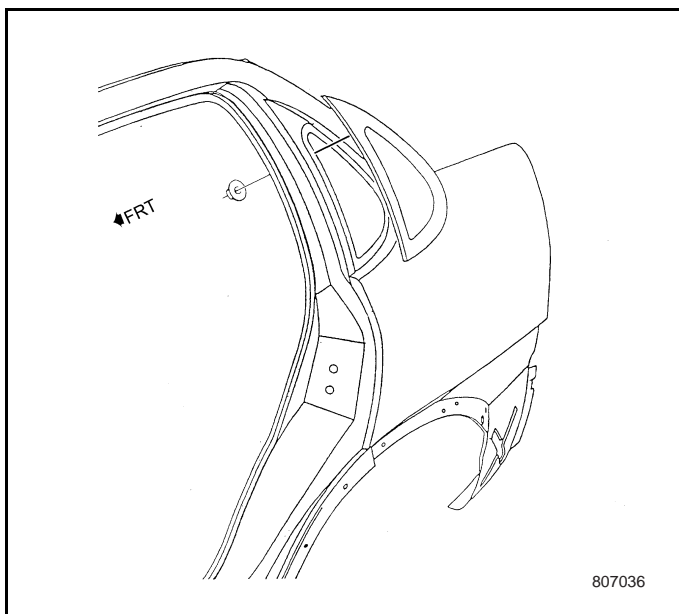
Note: When re-weld the terminal and weld it onto the bus, do not over heat the terminal. Temperature of searing iron tip should be high enough to melt the soft soldering flux and to flow freely. Time for the searing iron to contact the bus should be as short as possible.

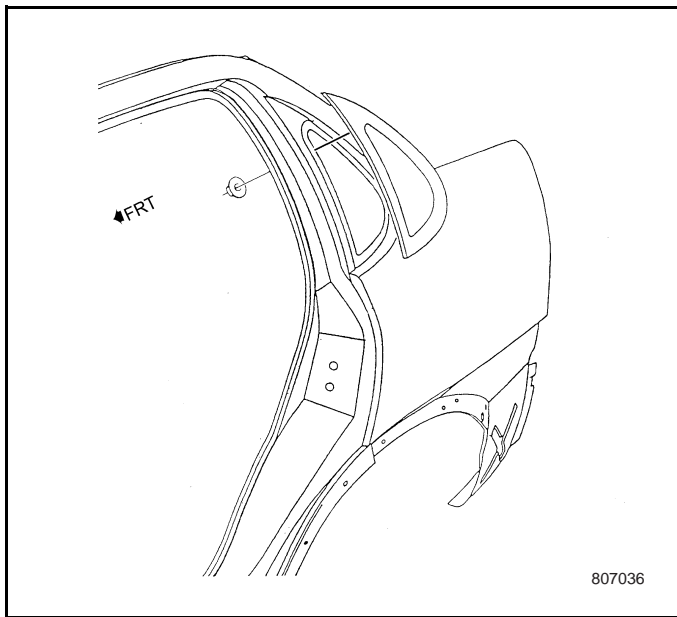
- Heat the top of the rear defogger bus lead wire antenna and/or the defogger terminal to melt soft soldering flux and to fuse together.
 - Use pliers to hold rear defogger bus lead wire, antenna and defogger terminal.
 - Never remove clamping force until the soft brazing solvent flux to be solidified.
9. Use solvent to wipe off excessive soldering.
 10. Connect the electric connector.

8.7.3.12A Quarter Window Replacement

Removal Procedure

1. Remove inner liner of the quarter window.
2. Remove quarter window mounting nut.
3. Remove quarter window.





Installation Procedure

1. Position the quarter window on the side panel.
2. Tighten quarter window with new nuts.

Tightening

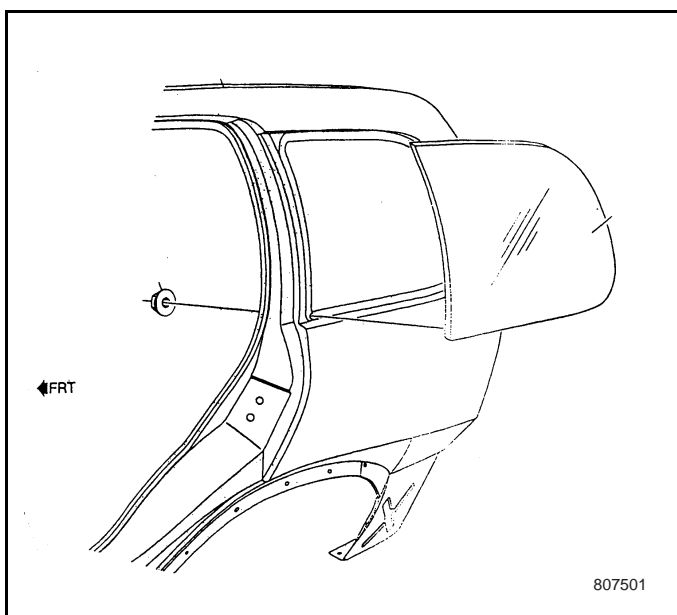
Tighten nut to 1.5-2.0 N•m.

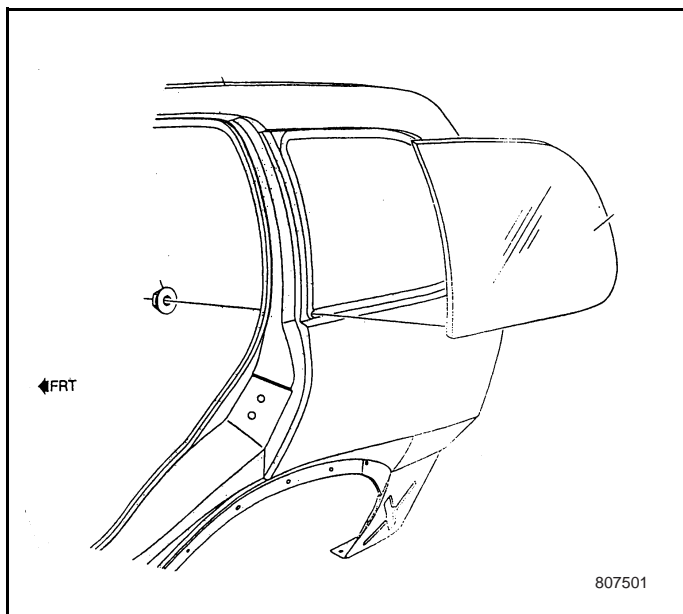
3. Install the quarter window molding panel.

8.7.3.12B Quarter Window Replacement

Removal Procedure

1. Remove inner liner of the quarter window.
2. Remove all nuts.
3. Remove quarter window





Installation Procedure

1. Position the quarter window on the side panel.
2. Tighten quarter window with new nuts.

Tightening

Tighten nut to 1.5-2.0 N•m.

3. Install the quarter window inner liner.

8.7.4 Description and Operation

8.7.4.1 Adhesive Repair Tool Kit

Instruction

GM adhesive caulking tool kit P/N 10952983 includes the following components:

- 2 different priming paint
- Urethane Adhesive with a Nozzle
- Dauber
- Warning instruction

Use urethane adhesive caulking tool kit in the following procedure:

- Use short method to replace windows which is installed with urethane adhesive
- Use extended method to replace windows which is installed with urethane adhesive

If the system complies with the GM 3651M, equivalent adhesive may also be used. The system manufacturer's instructions for application, handling, and curing must be followed.

8.7.4.2 Short method Description

If original urethane adhesive (after windows removed) retained on the frame press welding edge is able to be used as the new window's installment base, short method would be adopted. With this kind of method, only a few urethane adhesive is needed to adhere the window inside the frame to the original urethane adhesive.

When the original urethane adhesive meets one of the following conditions, the short method can be used.

- Adhesive being complete, without loss
- Adhere tight with the pinch weld flanging, and no corrosion on the flanging
- Uniform in Shape Uniformity means no cutting off or loose material appears.

The short method may also be employed under the following conditions:

- Re-spraying window frame or no need for crash repair/replacement of metal plate.
- Urethane adhesive shows no obvious deterioration (no powder residue).

8.7.4.2 Extended method Description

If original urethane adhesive (after window removed) retained on the frame pinch welding flanging can not be used as a base of the new window installing or the effect the short method can not be assured, then extended method will be selected.

The method contains the following instances:

- Replace large portion of urethane adhesive but a thin layer of adhesive will still be kept.
- Apply welding pinch priming paint to the exposed painting position on the pinch-weld flanging.

No heap or loose urethane adhesive should remain on the pinch welding flange. Do not clear all traces of urethane adhesive.

Note:

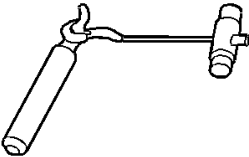
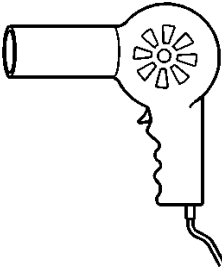
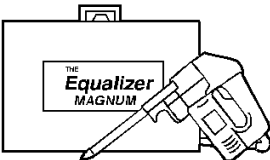
- If corrosion appears at the pinch-weld flanging or metal plate needs to be repaired or to replaced, the pinch-weld flanging must be finely moldingmed and only primer to be kept on the clean surface.
- If paint needs repairing, cover the flanging bonding position (before spraying color coating), to make the surface clean and keep only primer.
- Normally, appropriate material for these priming paint is a product catalyzed by 2 compounds, for example, BASF DE17[®], DUPONT 2610[®], PPG DP90[®] or equivalent. Mixing, applying and drying as according to instructions provided by manufacturers.
- Sufficiently shake the press welding priming paint#3(black) after repairing the frame according to instructions. Use new dauber to apply the primer to bonding position's inner flanging surface where original primer is applied. Wait 10 minutes for priming paint to dry.
- When installing the window, use long term replacing method and appropriate urethane edge size.

8.7.4.4 Static Window Description

Most static window, especially the windshield is adhered to the body by employing urethane adhesive. Thus structure integrity is increased. There is a need to partly or completely replace the urethane adhesive when windows are re-installed through it:

- Short method (also referred to as shortcut or quick method) --- partial replacement.
- Extended method (also referred to long effect, complete sealing strip or complete cut method) -- whole replacement.

8.7.5 Special Tools

Legend	Tool/Description
<div><p>J24402-A</p></div>	<div>J 24402-A Glass Sealant (cool knife) Removal Tool</div>
<div><p>J25070</p></div>	<div>J 25070 Blower</div>
<div><p>J39032</p></div>	<div>J 39032 Static Window Glass Removal Tool</div>

8.8 Body Front End

8.8.1 Specifications

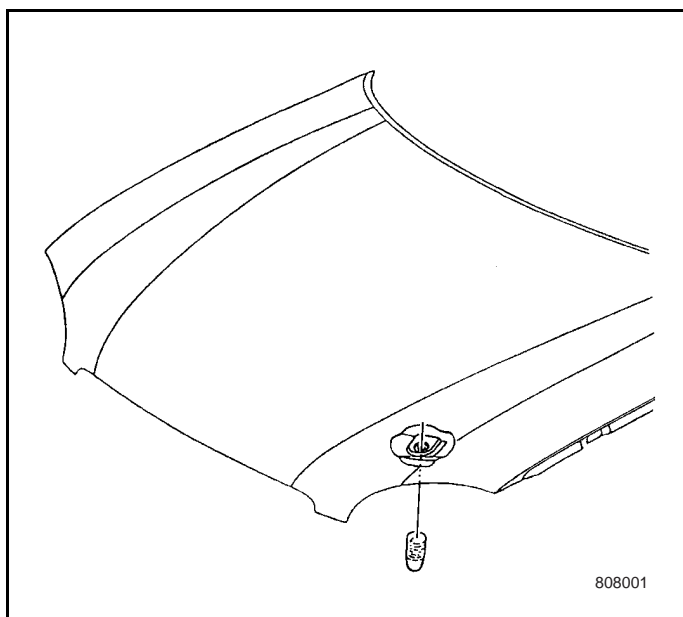
8.8.1.1 Fastener Tightening Torque

Application	Specification
Bolts - Front Fender to Front Wheelhouse Panel Upper Outside	4-4.5 N•m
Bolts - Front Fender to Cowl Panel	3-3.5 N•m
Fastening Bolts - Front Fender to Front End	4-4.5 N•m
Stud - Front Wheelhouse, Rear	1.25-2.25 N•m
Bolts - Front Wheelhouse to Front Bumper Fascia Assembly	1.25-2.25 N•m
Nuts - Front Wheelhouse to Engine Compartment Lower	1.5 N•m
Bolts - Engine Hood Hinge to Engine Hood	7-10 N•m
Cap Bolts - Engine Hood Release Cable	1.5-2.0 N•m
Fixing Nuts - Front Bumper Impact Bar Bracket	8-12 N•m
Fixing Nuts - Front Bumper Impact Bar	8-12 N•m
Nuts - Engine Hood Primary Latch	20-25 N•m

8.8.2 Repair Instructions

8.8.2.1 Engine Hood Adjustment

Engine hood is fixed on the engine hood hinge with bolts. And it can be vertically adjusted by means of engine hood hinge hole. The front end can be vertically adjusted by adjusting the engine hood long/short bumper bar and adjusting the engine hood primary latch length. The clearance tolerance is $4.0\text{mm} \pm 1.0\text{mm}$, and the flatness tolerance is 0mm to 1.0mm .



1. Open the engine hood.
2. Release the bolts between engine hood and hinge. See Engine Hood Hinge Replacement.
3. Adjust the engine hood and front fender position.
4. Cover the engine hood.
5. Check the alignment.
6. Open the engine hood. Adjust to meet the requirements.
7. Adjust the engine hood buffer stopper according to the cases.
8. Check the alignment.
9. Adjust the engine hood primary latch. See Engine Hood Primary Latch Replacement.
10. Tighten the bolts between engine hood and hinge. See Engine Hood Hinge Replacement.
11. Cover the engine hood.

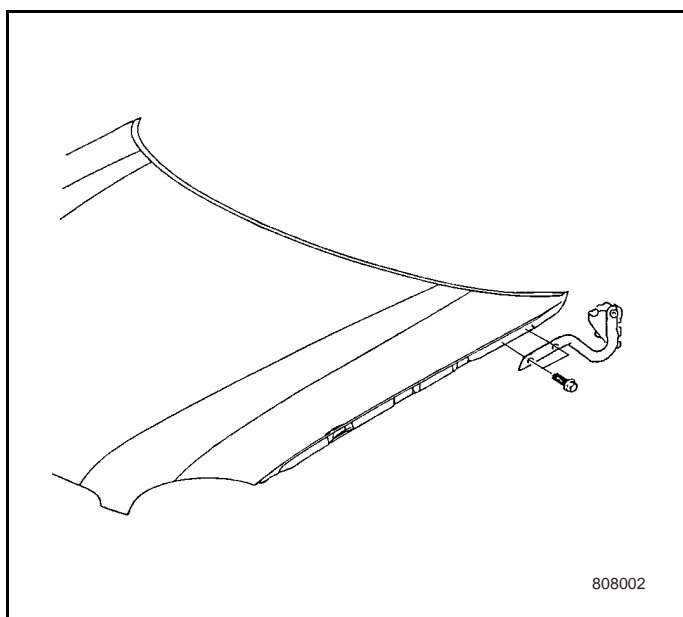
8.8.2.2 Engine Hood Replacement

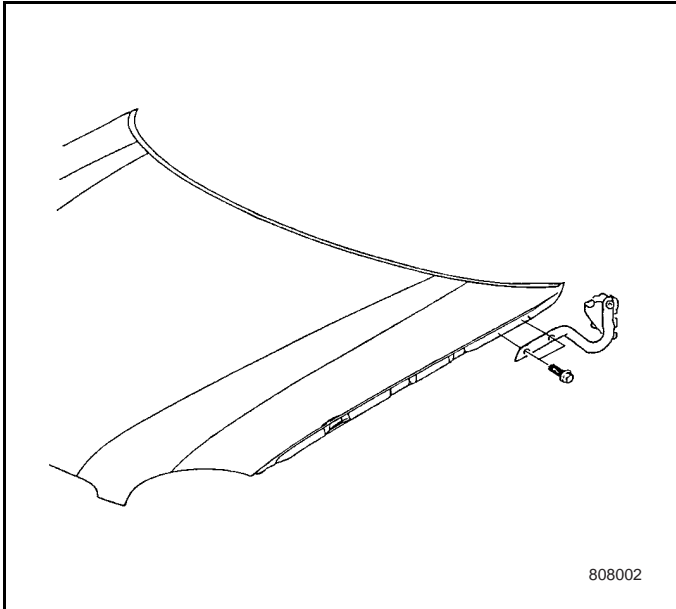
Removal Procedure

1. Open the engine hood.
2. Place protective panel on the adjoining body and glass.

Caution: When removing or installing the engine hood hold rod, the alternate support method must be used to avoid the possible vehicle damage or personal injury.

3. Remove the washing agent nozzle and hose. See Washer solvent reservoir, Pump Nozzle and Hose Replacement.
4. With the help of your assistant, remove the upper bolts of engine hood hinge.
5. With the help of your assistant, remove the engine hood.
6. Remove the upper insulator of engine hood, see Engine Hood Insulator Replacement.
7. Remove the engine hood primary latch. See Engine Hood Primary Latch Replacement.
8. Remove the engine hood secondary latch. See Engine Hood Secondary Latch Replacement.





9. Remove the upper rubber bumper of engine hood.
10. Remove the engine hood hold rod grommet.

Installation Procedure

1. Install the engine hood hold rod grommet.
2. Install the rubber bumper of engine hood.
3. Install the engine primary latch, see Engine Hood Primary Latch Replacement.
4. Install the engine hood secondary latch. See Engine Hood Secondary Latch Replacement.
5. Install the insulator of engine hood, see Engine Hood Insulator Replacement.
6. With the help of your assistant, place the engine hood at Body position.
7. With the help of your assistant, install the bolts between engine hood hinge and engine hood.
8. Check the fit between engine hood and body, and adjust the engine hood according to the requirements. See Engine Hood Adjustment.
9. Install the washing agent nozzle and hose, see Washer Solvent Reservoir, Pump Nozzle and Hose Replacement.
10. Tighten the bolts of engine hood hinge.

Tightening

Tighten the bolts of engine hood hinge to 7-10 N•m.

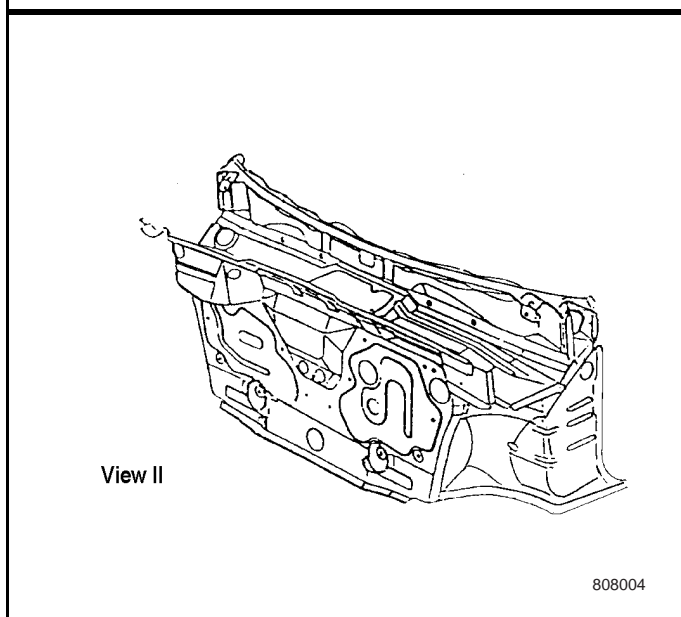
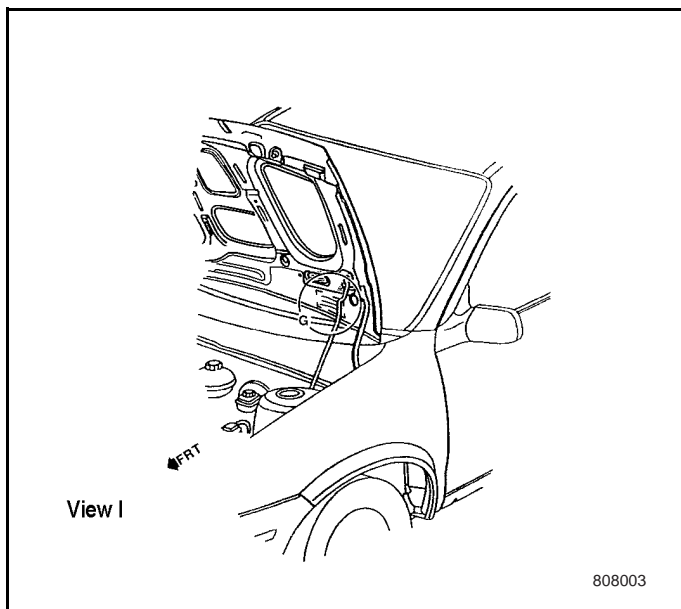
11. Remove the protective panel.
12. Close the engine hood.

8.8.2.3 Engine Hood Hinge Replacement

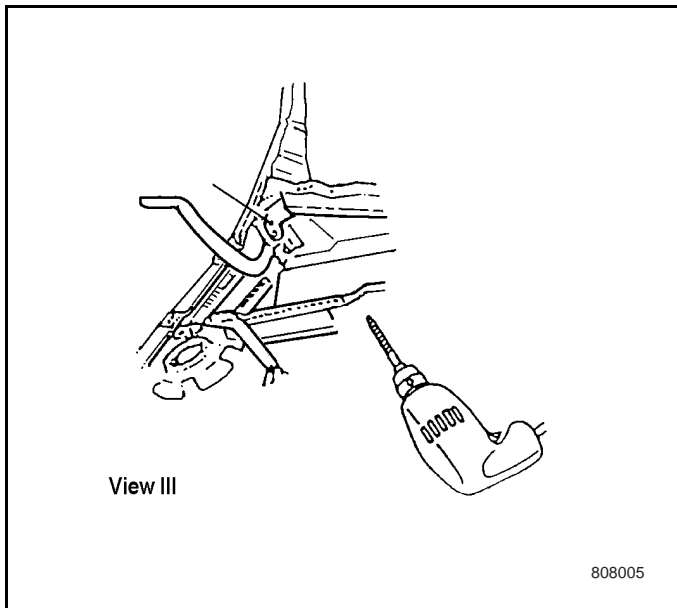
Caution: When removing or installing the engine hood hold rod, the additional support method must be used to avoid the possibility of vehicle damage or personal injury.

Removal Procedure

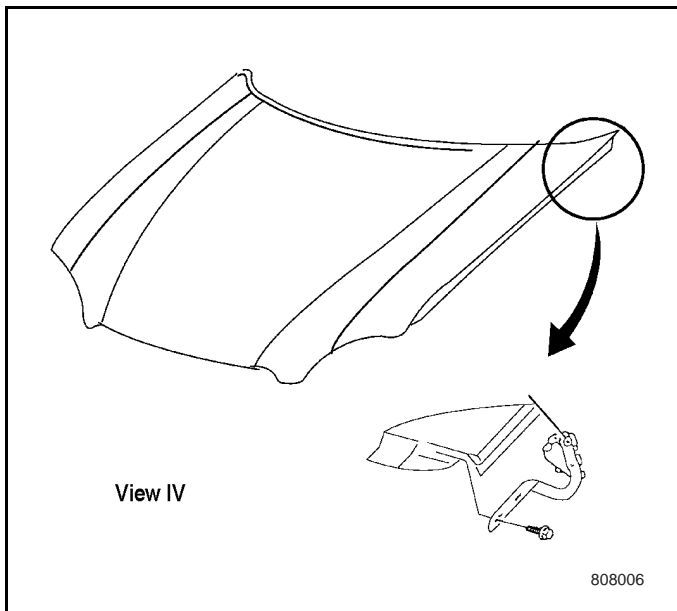
1. Remove the engine hood. See Engine Hood Replacement.
2. Remove the washer hose.



3. Remove the seal of engine hood rear corner. See Engine Hood Rear Corner Seal Replacement.
4. Central Welding Point



5. Use a 9.5mm drill bit to bore at the welding center.
6. Remove the engine hood hinge assembly from the I/P trim panel.



Installation Procedure

1. Repair the bored hole on the I/P trim panel. See Anti-Corrosive Treatment and Repair in Paint/Coating.
2. Align the engine hood hinge to the I/P trim panel, and perform plug welding.
3. Install the engine hood. See Engine Hood Replacement.

Tightening

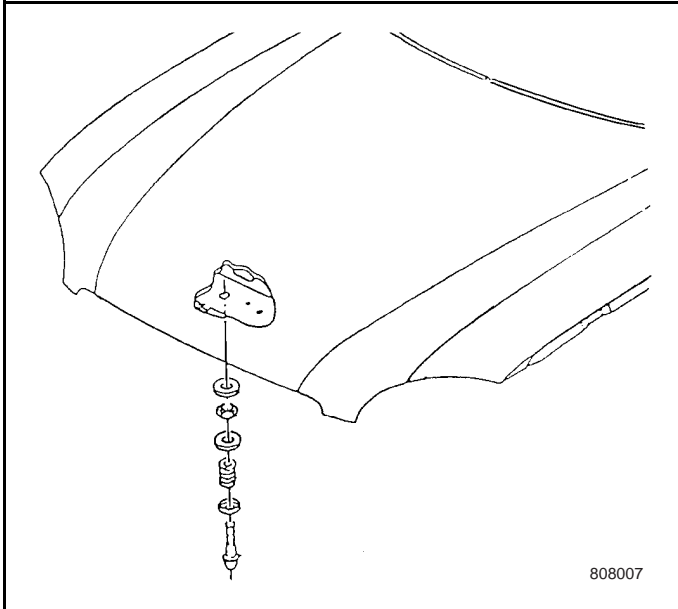
Tighten the engine hood hinge onto the engine hood to 7-10 N•m.

4. Install the seal of engine hood rear corner. See Engine Hood Rear Corner Seal Replacement.
5. Connect the washer hose retainer.
6. Check the fit between engine hood and body. Make adjustment according to the requirements, see Engine Hood Adjustment.

8.8.2.4 Engine Hood Primary Latch Replacement

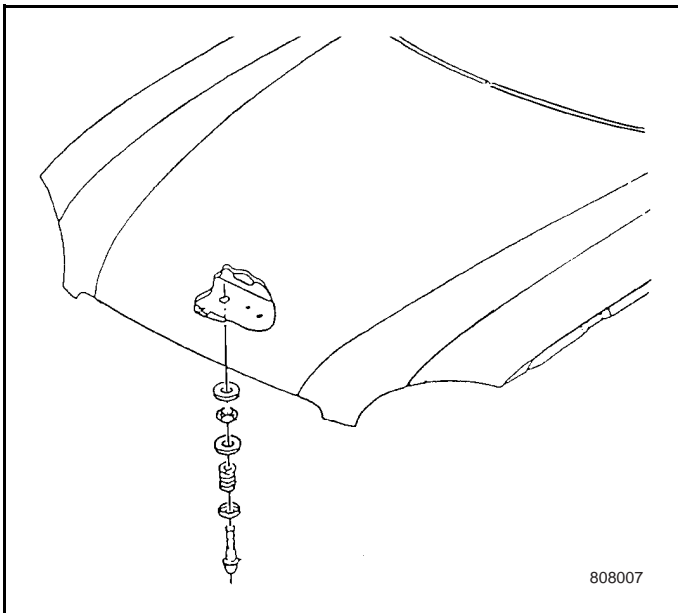
Removal Procedure

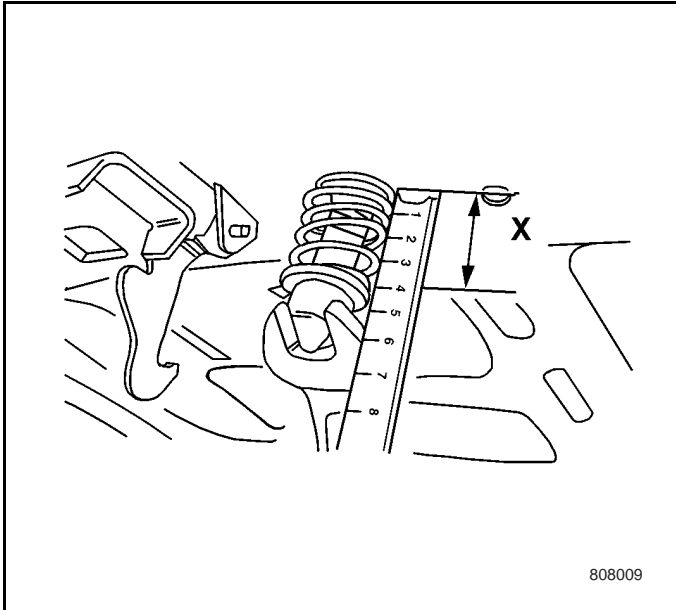
1. Open the engine hood.
2. Release the nuts of primary latch assembly.
3. Screw out the primary latch assembly.
4. Remove the engine hood primary latch and spacer from the engine hood.



Installation Procedure

1. Put the spacer on the engine hood primary latch assembly.
2. Screw the engine hood primary latch into the nuts of engine hood assembly.





3. Adjust the latch pin.
 - Adjust the spring size $X=30\pm1$ mm, with the measuring point at upper spring spacer lower edge to lower spring spacer upper edge.
 - Adjust the latch assembly position to align the latch pin with the latch hole center.
4. Check the flatness with front fender.
5. Tighten the hexagonal nuts.

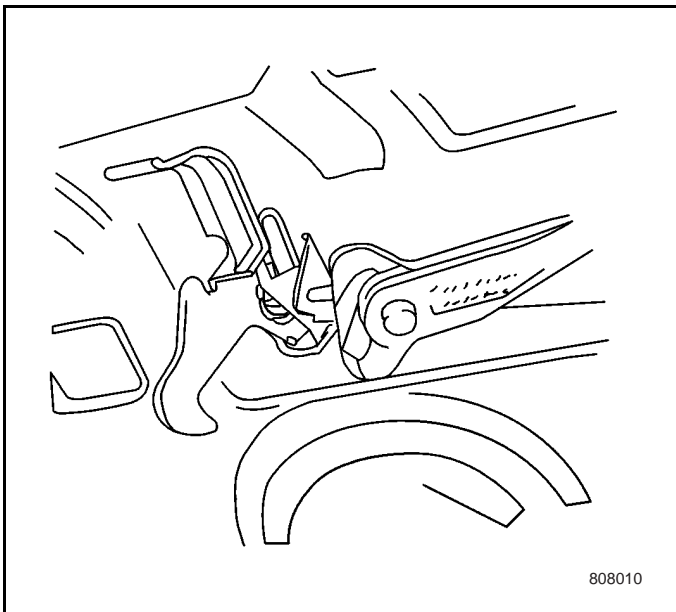
Tightening

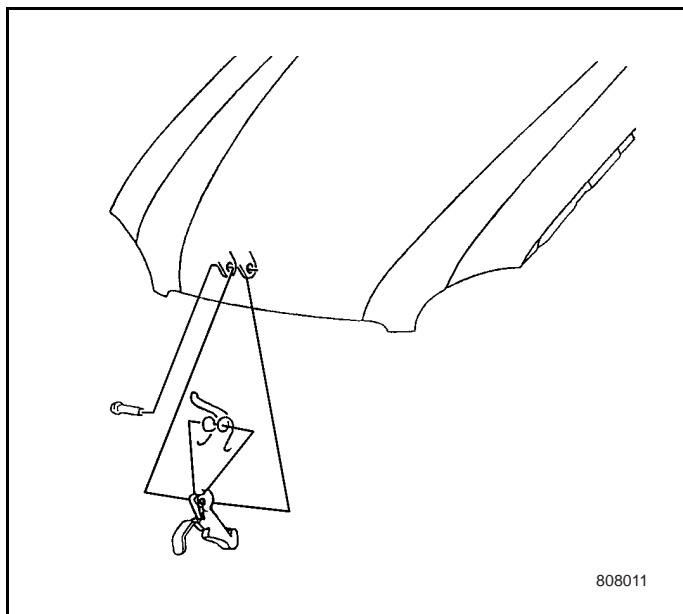
Tighten the engine hood primary latch nuts to 20-25 N•m.
6. Cover the engine hood.

8.8.2.5 Engine Hood Secondary Latch Replacement

Removal Procedure

1. Open the engine hood.
2. Use the pliers to trim rivet end, and remove the rivet of engine hood secondary latch.

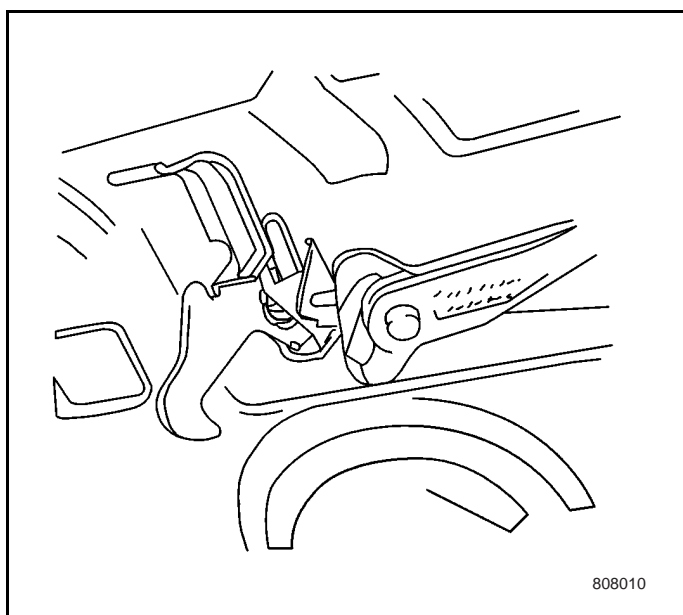
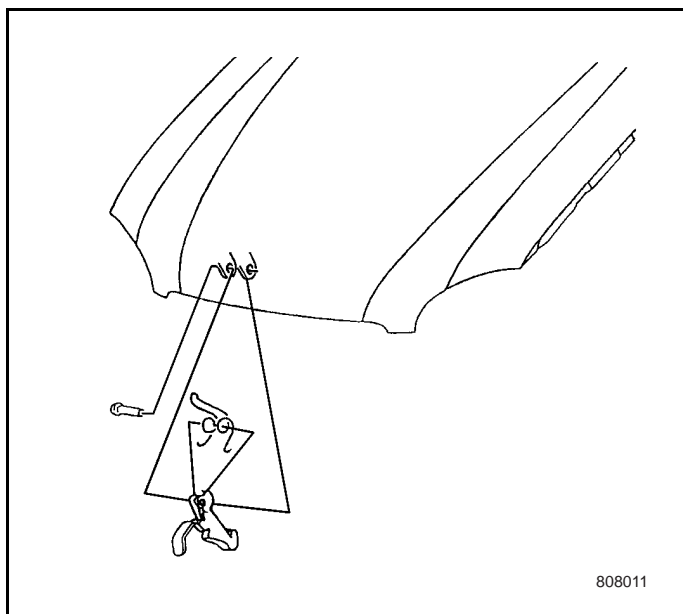




3. Remove the engine hood secondary latch and spring.

Installation Procedure

1. Install the engine hood secondary latch spring on the latch.
2. Install the engine hood rivet to make it through the engine hood reinforcement, latch and spring in turn.



3. Use the pliers to transform the rivet end and avoid the rivet to exit.
4. Cover the engine hood.

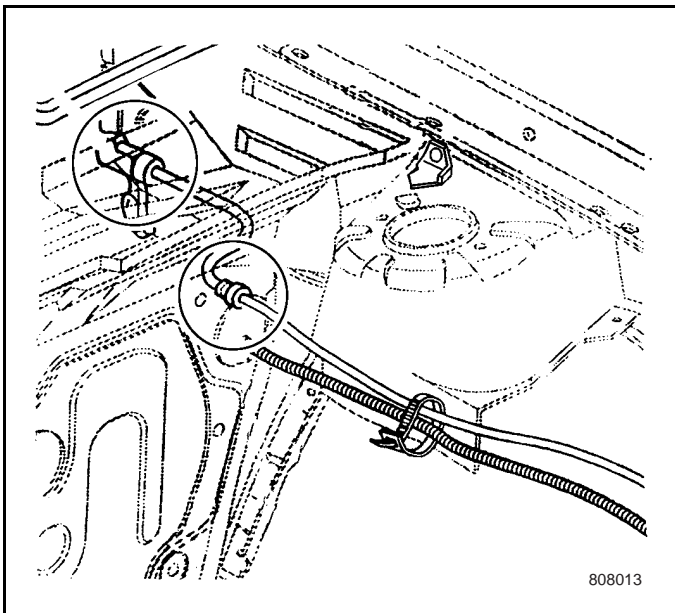
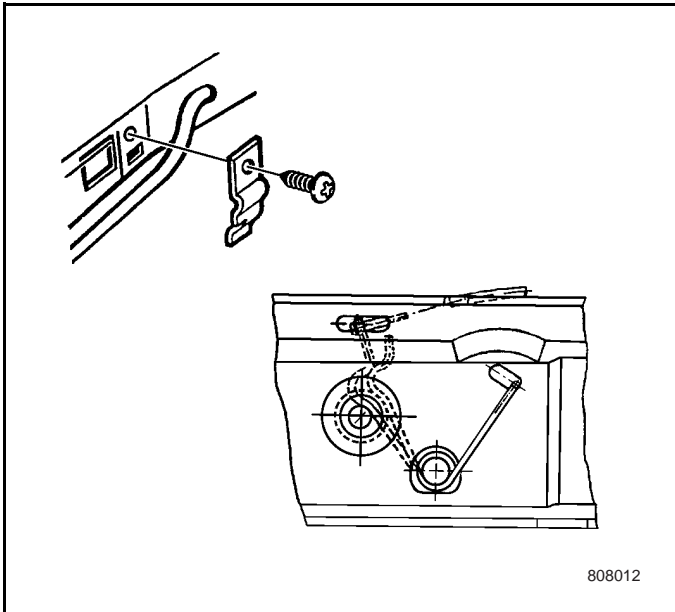
8.8.2.6 Engine Hood Release Cable ASM Replacement

Removal Procedure

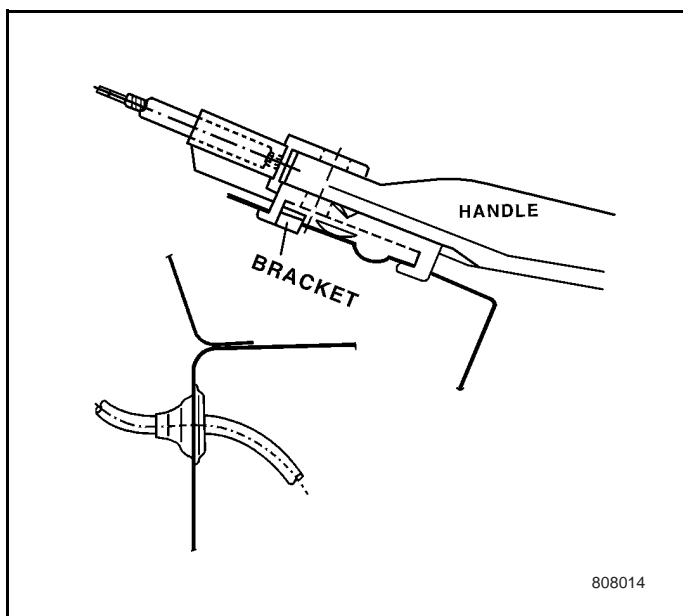
1. Open the engine hood.
2. Remove the cable cap bolt.

Note: Block up the engine hood latch and avoid the engine hood to be locked, until the engine hood release cable is re-installed.

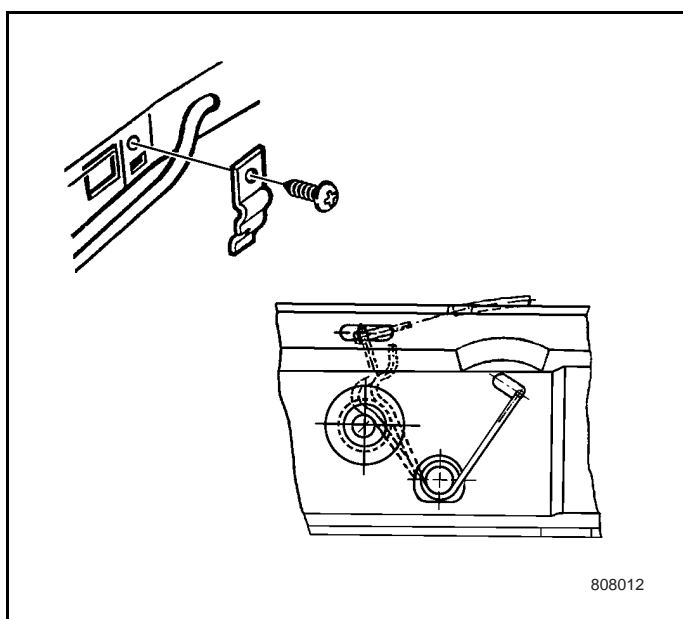
3. Make the cable end disengage from the engine hood primary latch spring.



4. Remove the engine hood latch cable and front compartment harness.
5. Tie a line or rope onto the engine hood release cable end, and help the installation of the new engine hood release cable. Ensure that the line or rope end is inside the engine hood.
6. Pull the handle bracket backwards and remove it from the body reinforcement.
7. Use a small flat blade tool to exit the seal ring from I/P trim panel.
8. Pass the engine hood release cable through I/P trim panel, and unfasten the engine hood release cable assembly from the line.



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Installation Procedure

1. Tie the engine hood release cable onto the line or rope used during the removal. Make it pass through the I/P trim panel and seal ring.
2. Use the tied line or rope to pull out the engine hood release cable from the front compartment.
3. Remove the line or rope, and connect the engine hood release cable end to the latch spring.
4. Pull straight the cable (including the steel cable and protective tube), and install the cable cap bolts.

Note: When the cable end is connected to the engine hood primary latch spring, the spring should be at natural status and the cable must be pulled straight.

5. Tighten the cable cap to fix the engine hood release cable.

Tightening

Tighten the cable cap bolt to 1.5-2.0 N•m.

6. Place the cable assembly bracket in the body reinforcement, and push forward to secure the reinforcement.
7. Use a band to fix the engine hood release cable and front compartment harness.
8. Remove the block device on the latch.
9. Check the engine hood latch spring and make sure it runs normally.
10. Cover the engine hood.

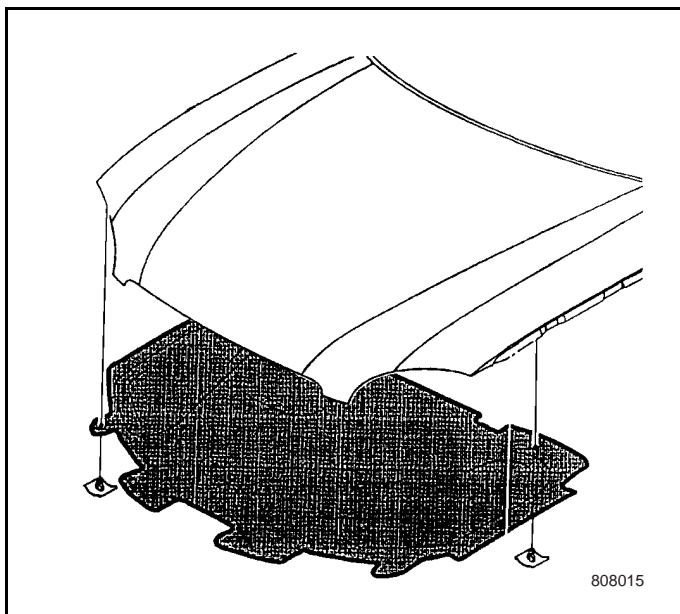
8.8.2.7 Engine Hood Insulator Replacement

Removal Procedure

Required Tools

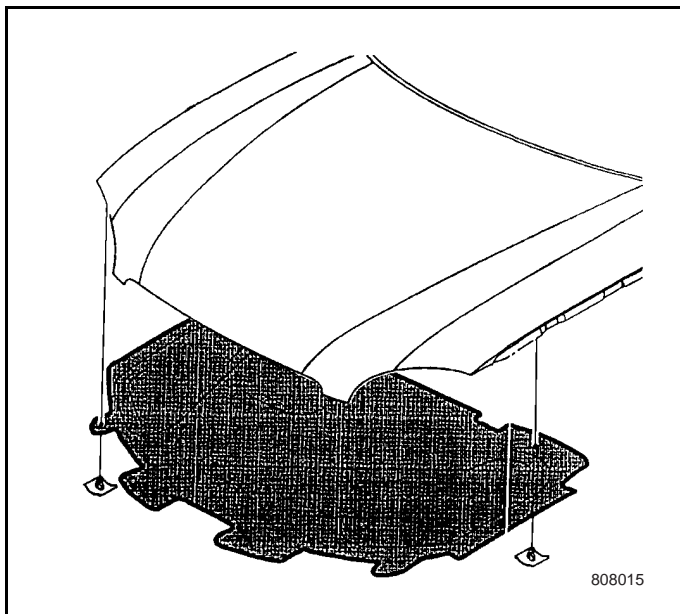
- J 38778 Special Trim Panel
- Garnish Clip Remover

1. Open the engine hood.
2. Use the special tool J38778 to remove the clips on the engine hood insulator.
3. Remove the engine hood insulator.



Installation Procedure

1. Place the engine hood insulator on the engine hood.
2. Align the engine hood fixing hole to the engine hood hole.
3. Install and secure the engine hood insulator.
4. Cover the engine hood.

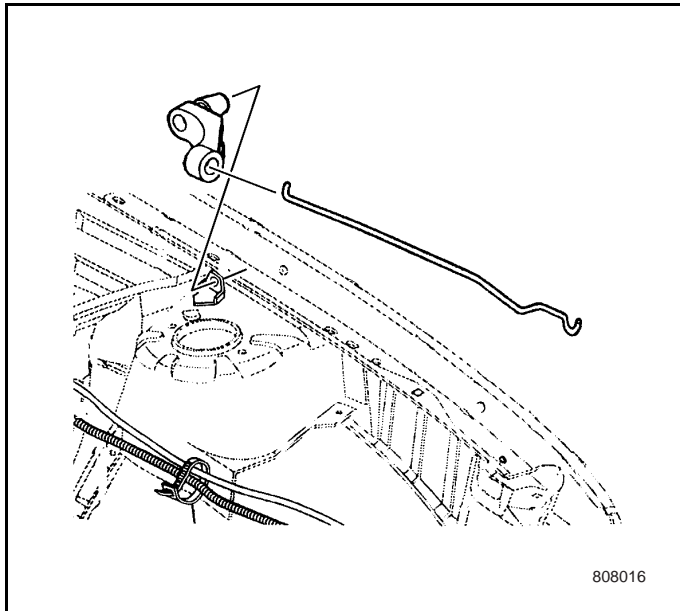


8.8.2.8 Engine Hood Hold Rod Replacement

Removal Procedure

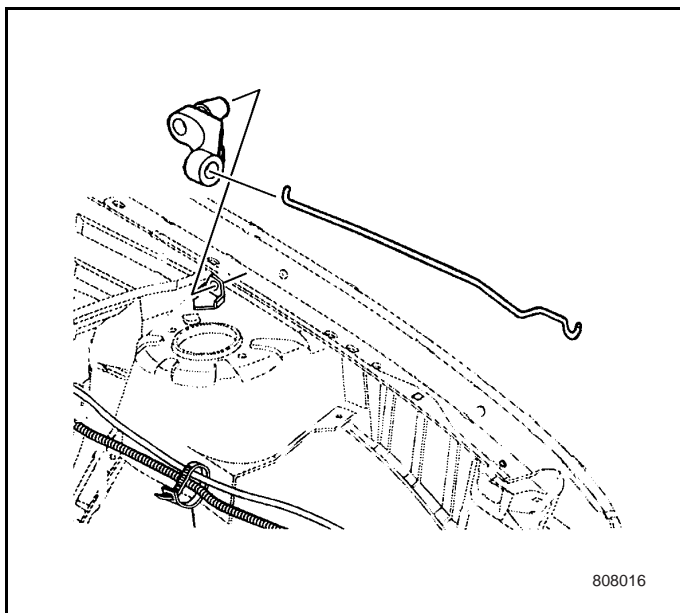
Caution: When removing or installing the engine hood hold rod, the additional support method must be used to avoid the possibility of vehicle damage or personal injury.

1. Open and support the engine hood.
2. Turn up the retaining clip on the engine hood hold rod bracket.
3. Exit the engine hold rod from the retaining clip.



Installation Procedure

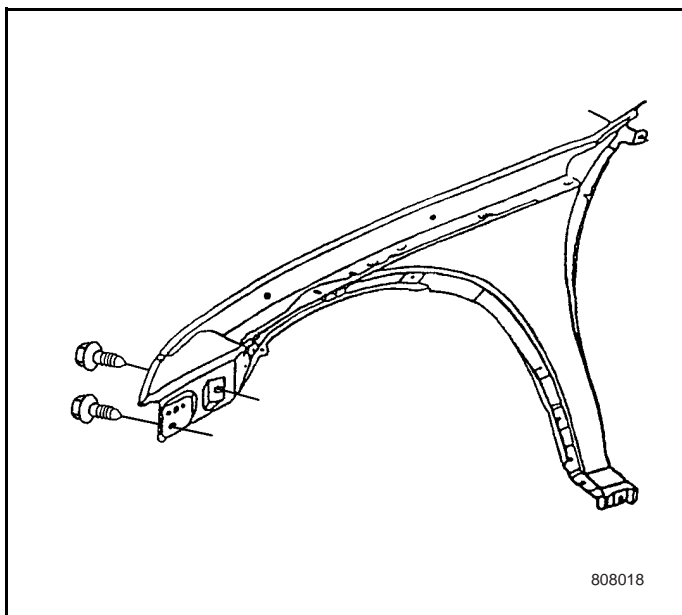
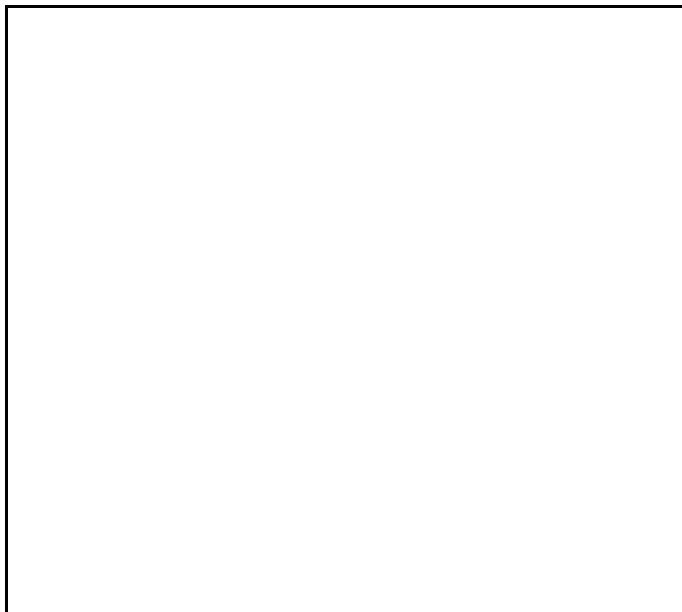
1. Pass the engine hood hold rod through the retaining clip and buckle on the clamping plate.
2. Remove and support the additional supporter of engine hood.
3. Cover the engine hood.

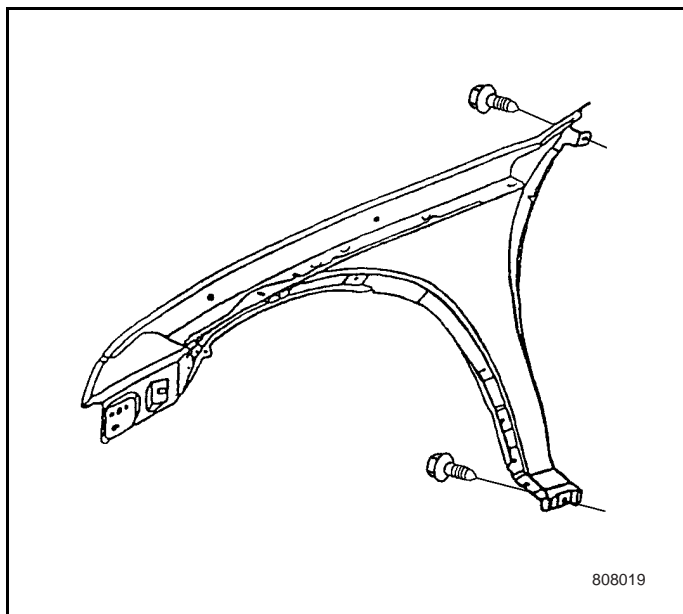


8.8.2.9 Front Fender Replacement

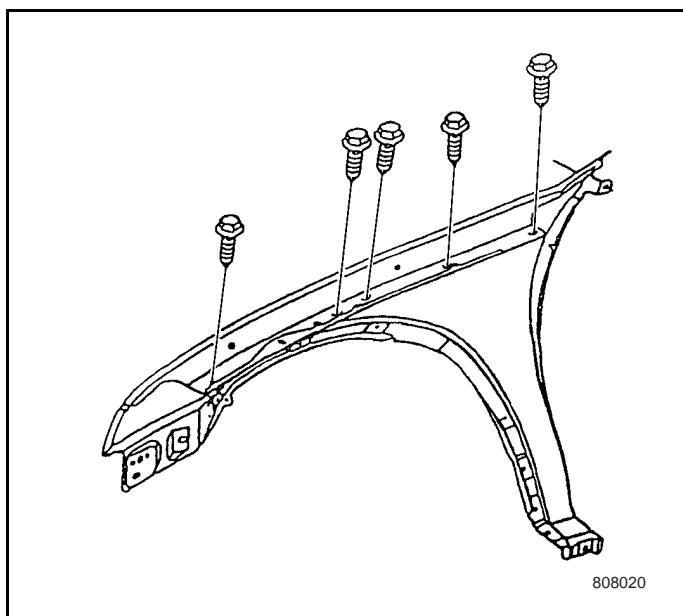
Removal Procedure

1. Remove the turn signal lamp. See Turn Signal Lamp Replacement in Lighting System.
2. Remove the front wheelhouse. See Front Wheelhouse Replacement.
3. Remove the exterior floor trimming. Refer to Exterior Floor Trimming Replacement of Exterior Trim.
4. Remove the front bumper fascia assembly. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.
5. Remove the front side fixing bolts of front fender.

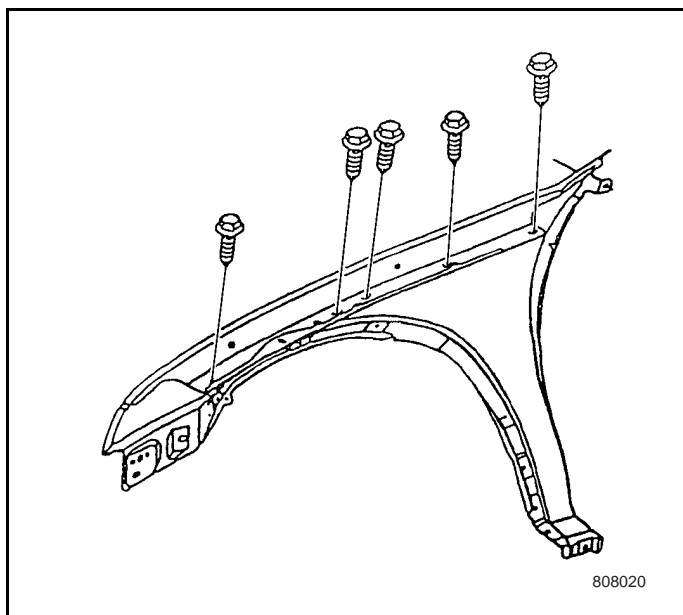




6. Remove the bolts which fix the front fender on the cowl panel.



7. Remove the bolts which fix the front fender on the front compartment panel upper outside.
8. Take out the insulator from the front fender.
9. Remove the front fender from the vehicle.

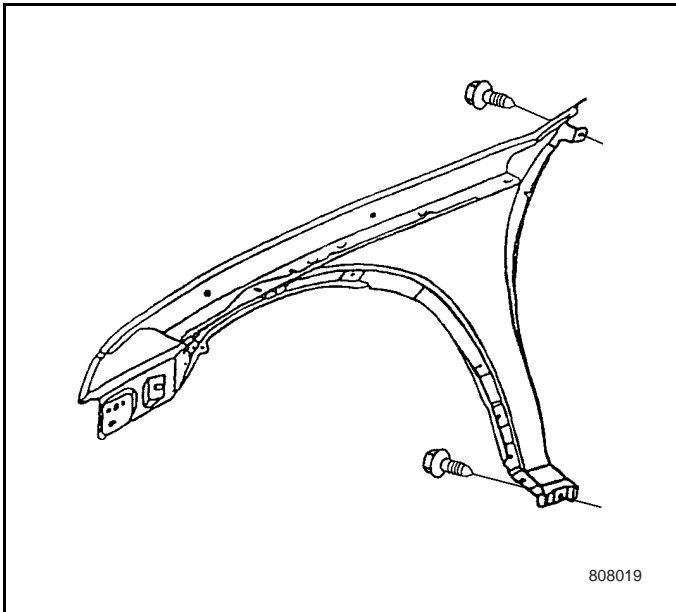


Installation Procedure

1. Install the front fender.
2. Place the insulator inside the fender.
3. Install the turn signal lamp. See Turn Signal Lamp Replacement in Lighting System.
4. Install the bolts which are fixed on the front wheelhouse panel upper outside.

Tightening

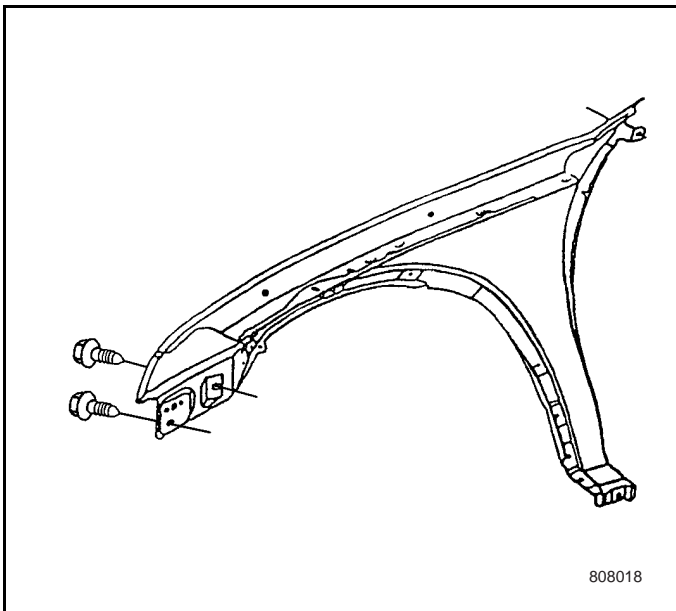
Tighten the bolts which fix the front fender on the front wheelhouse panel upper outside to 4-4.5 N•m.



5. Install the bolts fixed on the cowl panel.

Tightening

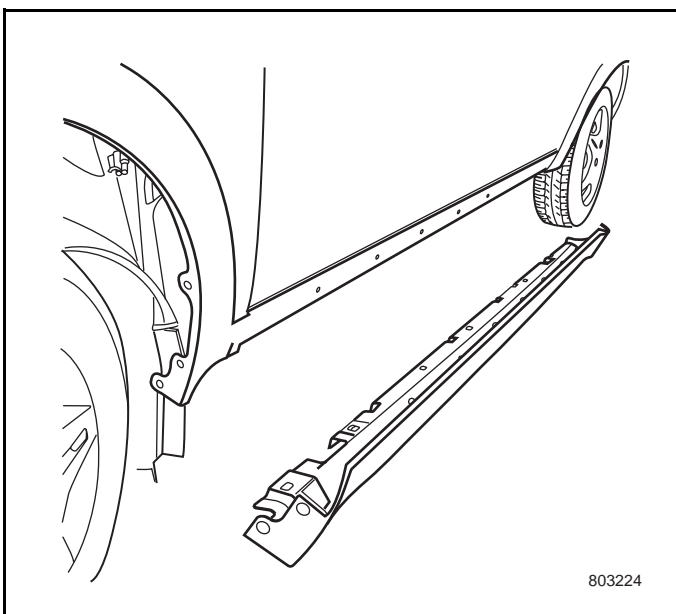
Tighten the bolts which fix the front fender on the cowl panel to 3-3.5 N•m.



6. Install the bolts fixed on the front end of front fender.

Tightening

Tighten the bolts fixed on the front end of front fender to 4-4.5 N•m.



7. Install the front bumper fascia assembly. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.
8. Install the exterior floor trimming. Refer to Exterior Floor Trimming Replacement of Exterior Trim.
9. Install the front wheelhouse. See Front Wheelhouse Replacement.

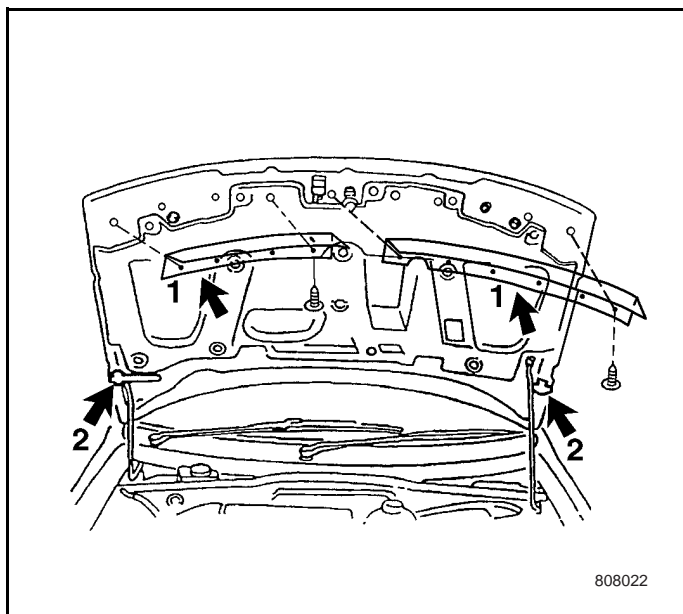
8.8.2.10 Front Engine Hood Sealing Replacement

Removal Procedure

Required Tools

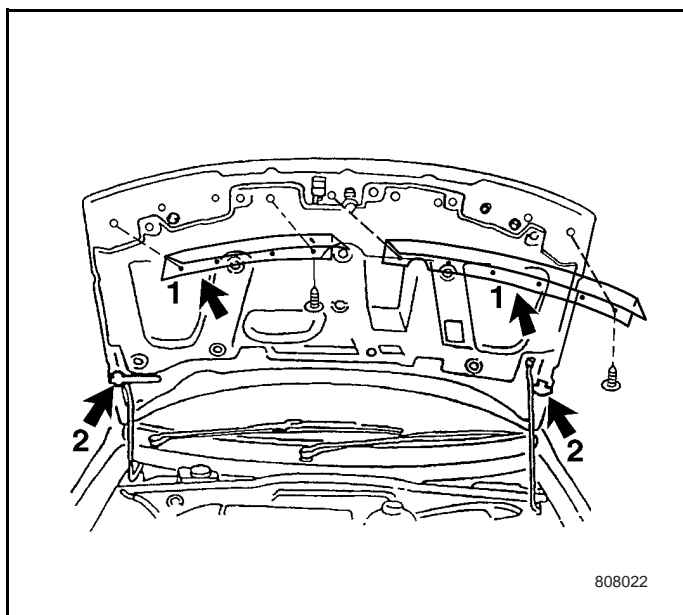
- J38778 Door Trim Pad and Garnish Clip Remover

1. Open the engine hood.
2. Use J38778 to remove the engine sealing clips from the engine hood side.
3. Remove the front engine hood sealing (1) from the engine hood.



Installation Procedure

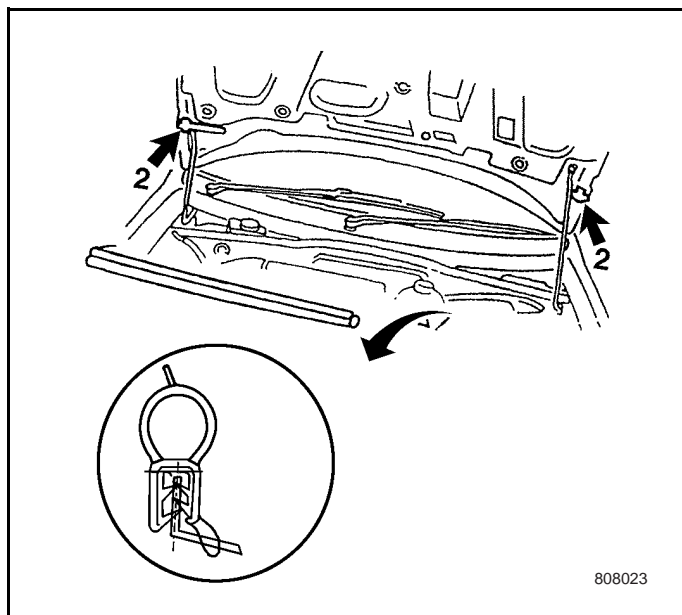
1. Install the engine hood side sealing onto the engine hood.
2. Install the thrust-in holder to engine hood side sealing (1) into the engine hood.
3. Cover the engine hood.



8.8.2.11 Engine Hood Sealing Replacement

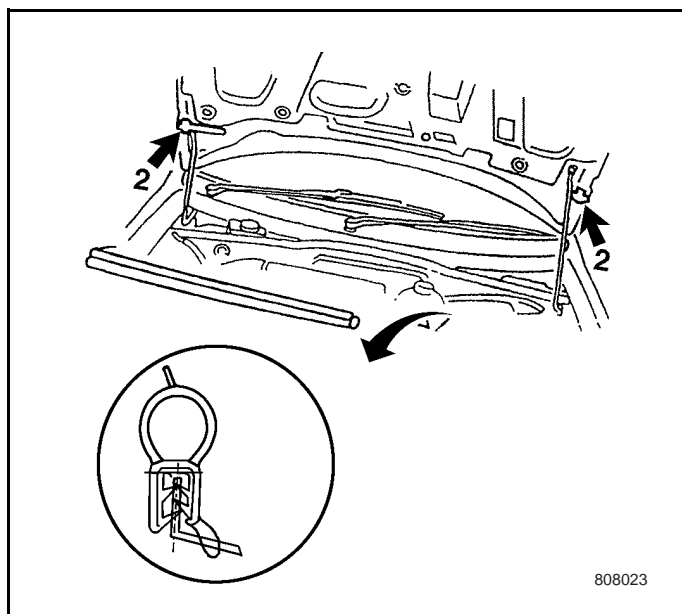
Removal Procedure

1. Open the engine hood.
2. Pull down the rear engine hood sealing from the welding flange.
3. Remove the rear engine hood sealing from the vehicle.



Installation Procedure

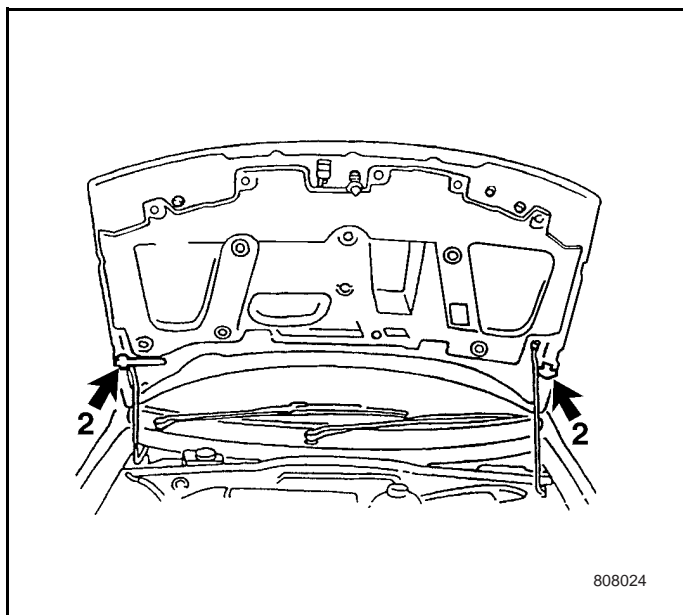
1. Install the rear engine hood sealing on the welding flange.
2. Press the rear engine hood sealing on the welding flange.
3. Cover the engine hood.



8.8.2.12 Engine Hood Rear Corner Seal Replacement

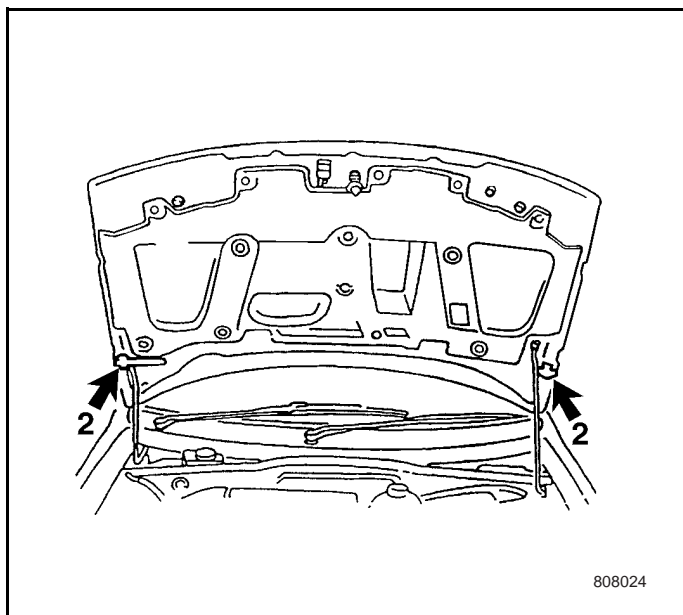
Removal Procedure

1. Open the engine hood.
2. Pull down the engine hood corner seal (2) from the engine hood edge and engine hood hinge surface.
3. Remove the engine hood rear corner seal from the vehicle.
4. Clean all the adhesive on the engine hood flange and engine hood hinge surface.



Installation Procedure

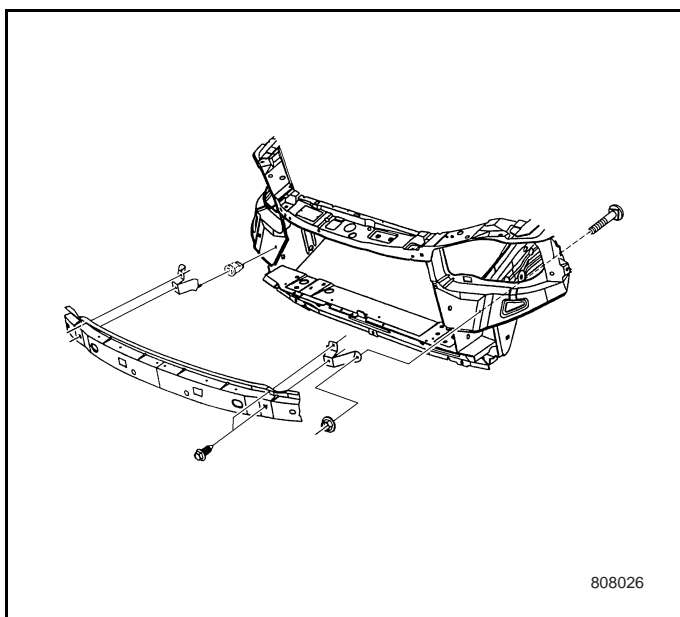
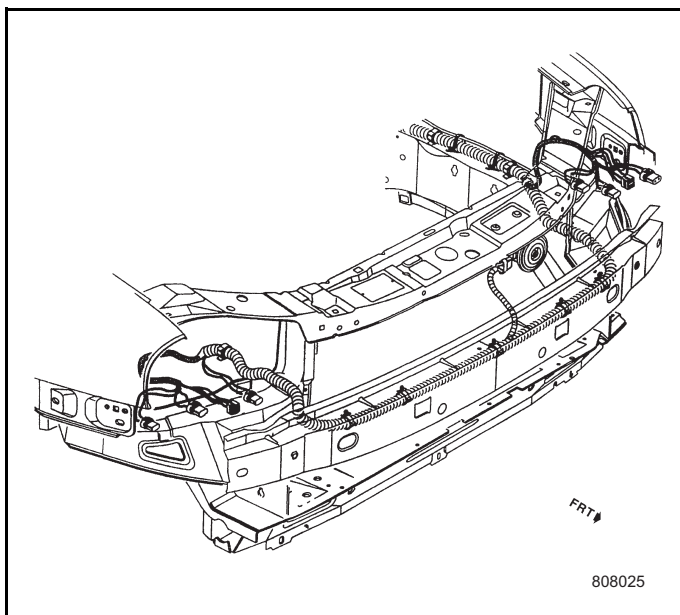
1. Remove the protective lining paper from the adhesive of the engine hood rear corner seal.
2. Install the rear engine hood corner seal (2) on the engine hood edge and engine hood hinge surface.
3. Press the rear engine hood corner seal on the engine hood flange and engine hood hinge surface, until the adhesive is bound completely.
4. Cover the engine hood.



8.8.2.13 Front Bumper Impact Bar Replacement

Removal Procedure

1. Remove the front bumper fascia assembly. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.
2. Remove the wiring harness from the rear of front bumper impact bar.



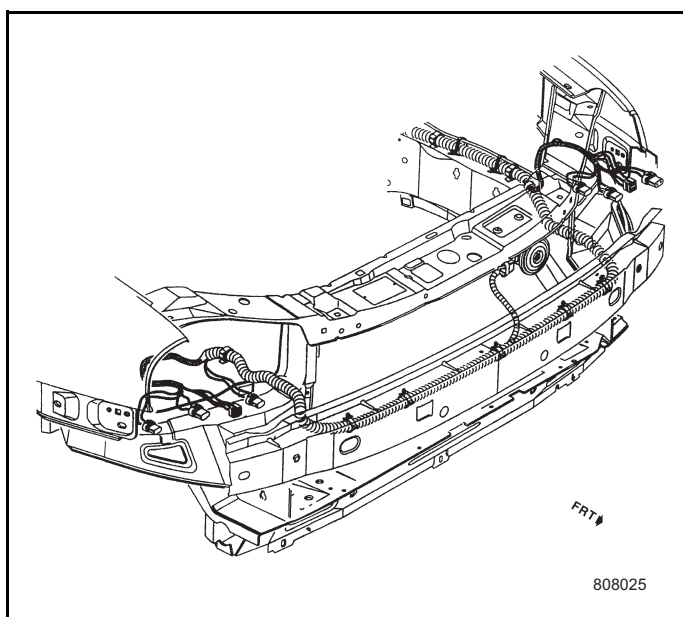
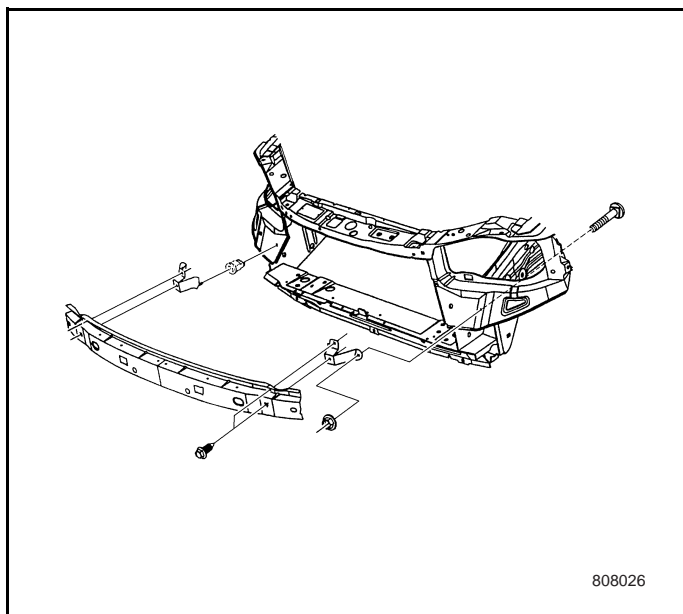
3. Remove the front bumper impact bar from the front impact bar bracket.
4. Remove the front impact bracket from the body.

Installation Procedure

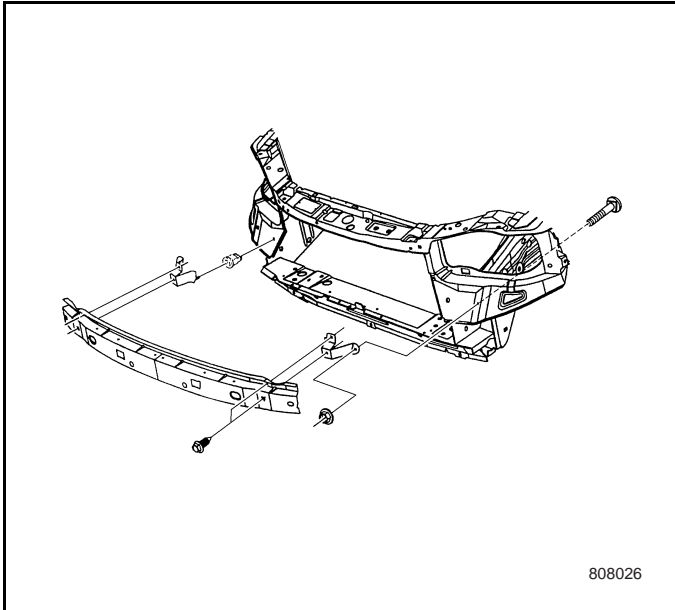
1. Install the front impact bracket on the body.

Tightening

Tighten the fixing nuts of front impact bar bracket to 8-12 N•m.



2. Install the wiring harness at the rear of front bumper impact bar.



3. Install the front bumper impact bar on the front impact bar bracket.

Tightening

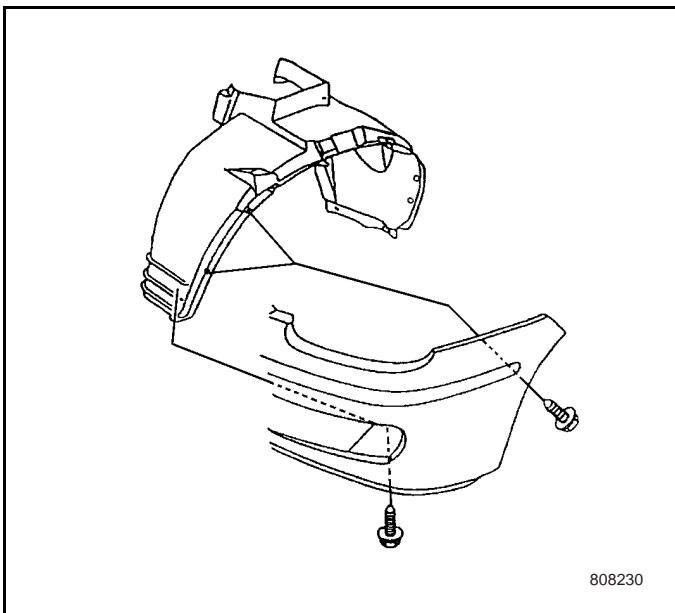
Tighten the front impact bar to 8-12 N•m.

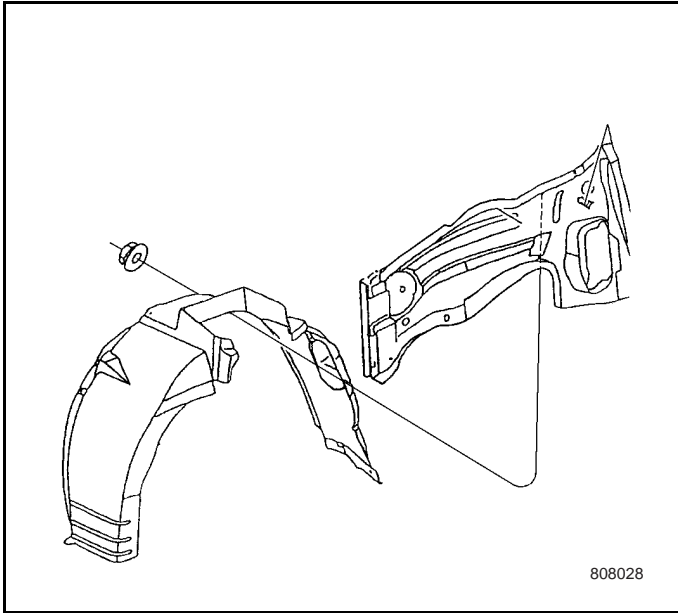
4. Install the front bumper fascia assembly. Refer to Front Bumper Fascia ASM Replacement of Exterior Trim.

8.8.2.14 Front Wheelhouse Replacement

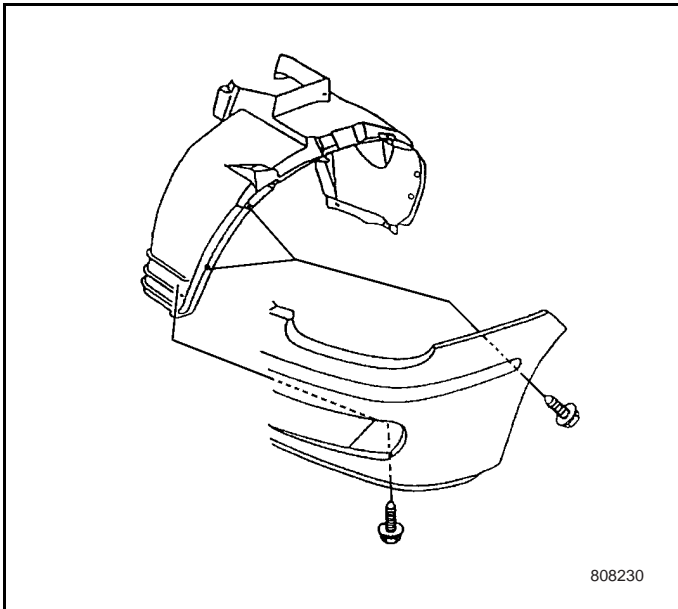
Removal Procedure

1. Remove the three thrust pins on the front wheelhouse.

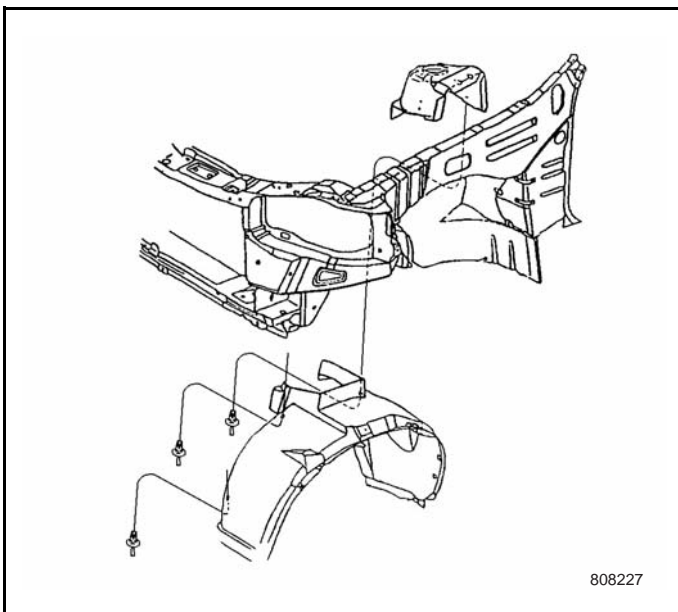




2. Remove the nuts from lower part of the engine hood.



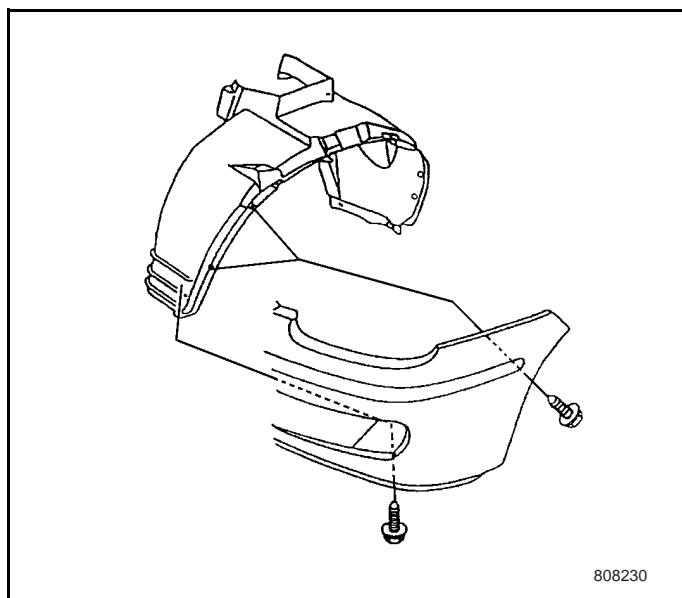
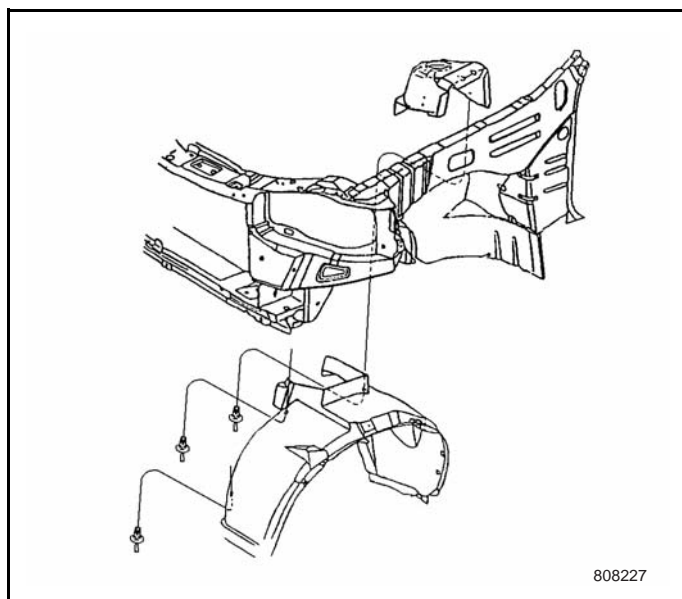
3. Remove the three studs connected to the front bumper fascia assembly.
4. Remove the three studs on the rear of front wheelhouse.



5. Cut out the clips connecting the front wheelhouse center to the lower part of engine hood.
6. Remove the front wheelhouse from the wheel opening and the underbody.

Installation Procedure

1. Put the front wheelhouse on the mounting position.
2. Install the three thrust pins on the front wheelhouse.



3. Connect the three studs on the rear of front wheelhouse.

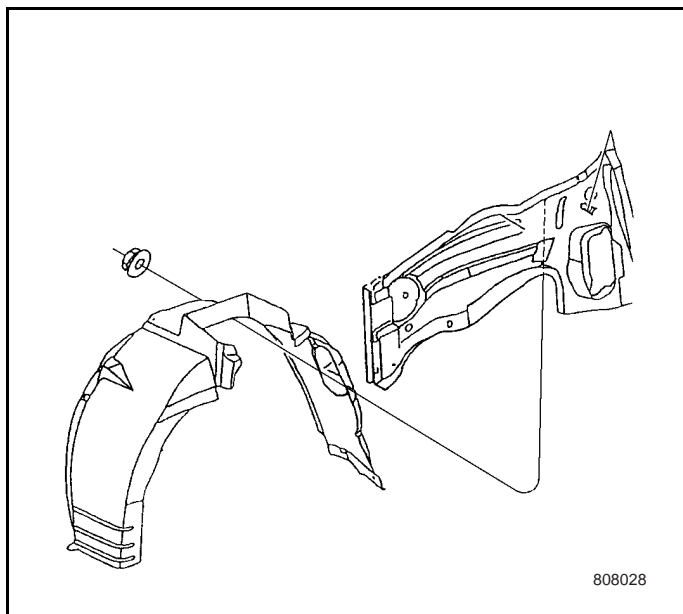
Tightening

Tighten the stud to 1.75 ± 0.5 N•m.

4. Install the bolts on the front side of front wheelhouse and connect to the front bumper fascia assembly.

Tightening

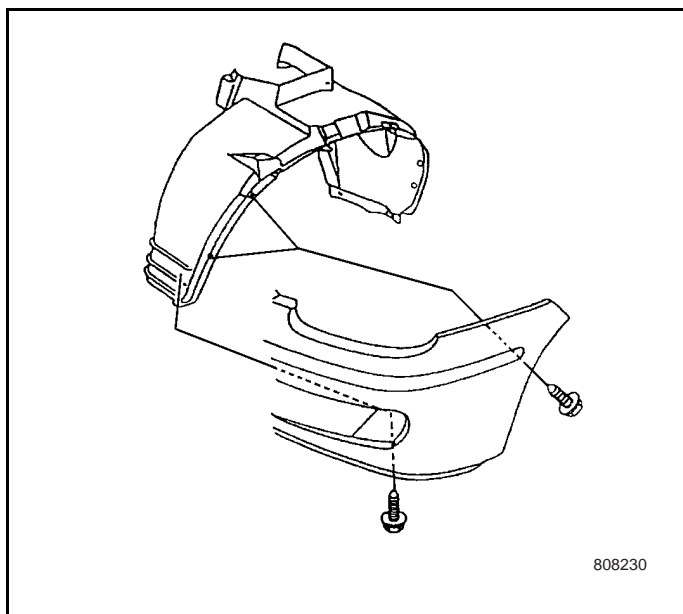
Tighten the bolts to 1.75 ± 0.5 N•m.



5. Install the nuts on the lower part of engine hood.

Tightening

Tighten the nuts to 1.5 N•m.

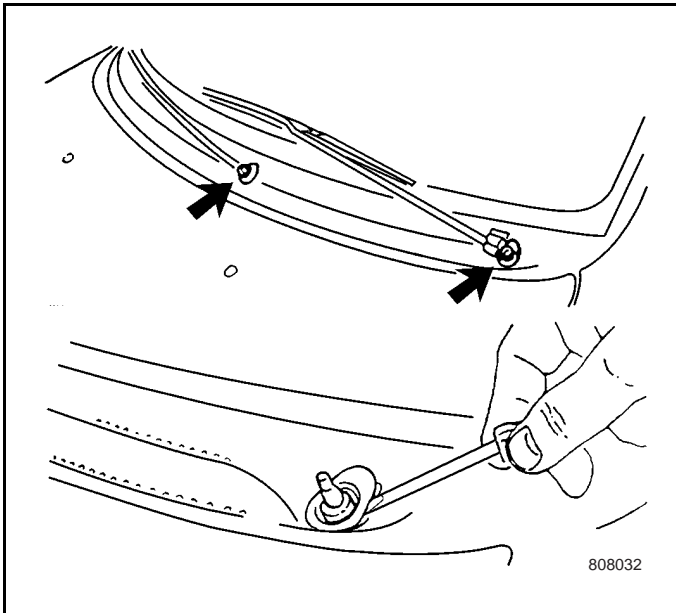


6. Use new clips to connect the lower part of engine hood at the front wheelhouse.

8.8.2.15 Inlet Grille Replacement

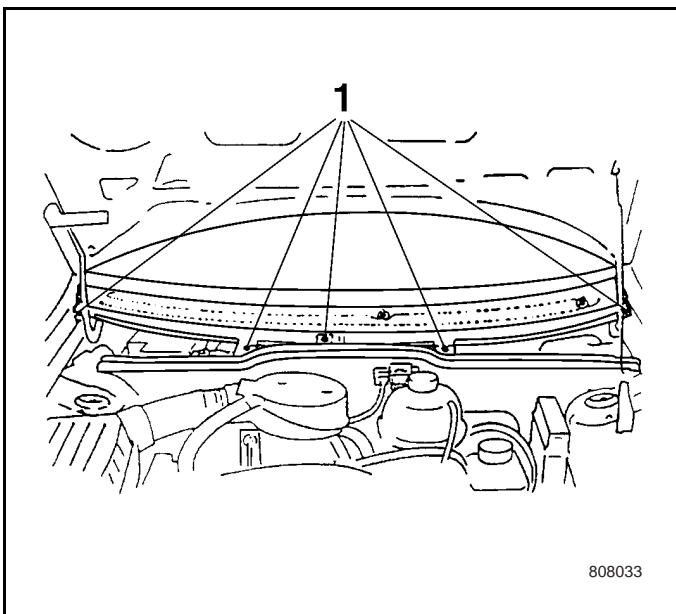
Removal Procedure

1. Remove the wiper arm assembly. See Wiper Arm ASM Replacement in Wiper/Washer System.
2. Remove the jacket from the inlet grille.
3. Open the engine hood.
4. Remove the screws from the inlet grille.
5. Lift up the inlet grille at the center. At the same time remove the left and right inlet grille from the windscreen.



Installation Procedure

1. Install the left and right inlet grille, and insert the flange to the windscreen.
2. Install the jacket into the inlet grille.
3. Install all the screws (1).
4. Cover the engine hood.
5. Install the wiper arm assembly. See Wiper Arm ASM Replacement in Wiper/Washer System.



8.8.3 Description and Operation

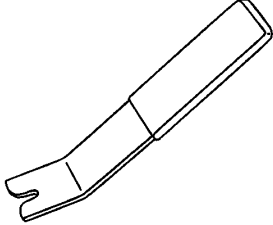
8.8.3.1 Body Front End Description

Anti-corrosive material is applied to the inner surface of some metal panels. When repairing these panels, the affected parts should be properly re-applied with servicing anti-corrosive material. See Anti-Corrosive Treatment and Repair in Paint/Coating.

8.8.3.2 Front End Sealing Description

All the parts with possible water leaks are sealed with durable sealant of high quality in the production. If necessary, re-seal the given position, and use the sealant medium of high quality which can maintain the flexibility after curing and can be applied with paints.

8.8.4 Special Tools

Illustration	Tool Number / Description
 <p>J38778</p>	J 38778 Door Trim Pad and Garnish Clip Remover

Blank

8.9Door

8.9.1 Specifications

8.9.1.1 Fastener Tightening Torque

Application	Specification
Door Lock Screws	8-12 N•m
Check Link Screws	4-6 N•m
Window Rear Guide Screws	8-12 N•m
Window Channel Screws	8-12 N•m
Front Door Pull Handle Screws	1.5 ± 0.3 N•m
Striker Screws	25 N•m
Outside Handle Screws	4 - 5 N•m
Window Switch Base Screws	1.5 -2.0 N•m
Trim Panel Screws	1.5 ± 0.3 N•m
Front Door Horn Screws	2 ± 0.5 N•m
Outside Mirror Screws	1.5 -2.0 N•m
Outside Handle Nuts	4 - 5 N•m
Windows Lifter Guide	8 -12 N•m
Bolts / Screws - Trunk Compartment Lid Latch Relay Actuator	1 -3 N•m
Bolts / Screws - Door Lock and Deterrent Control Module	1.2 -2.5 N•m

8.9.2 Schematic and Wiring Diagrams

8.9.2.1 Window Lifter - Front Door Wiring Diagram (Only Front Windows are electric)

See 8.20.2.15.

8.9.2.1 Window Lifter - Door Wiring Diagram (All Four Windows are electric)

See 8.20.2.23.

8.9.2.3 Central Lock Wiring Diagram (Except Fuel Cap)

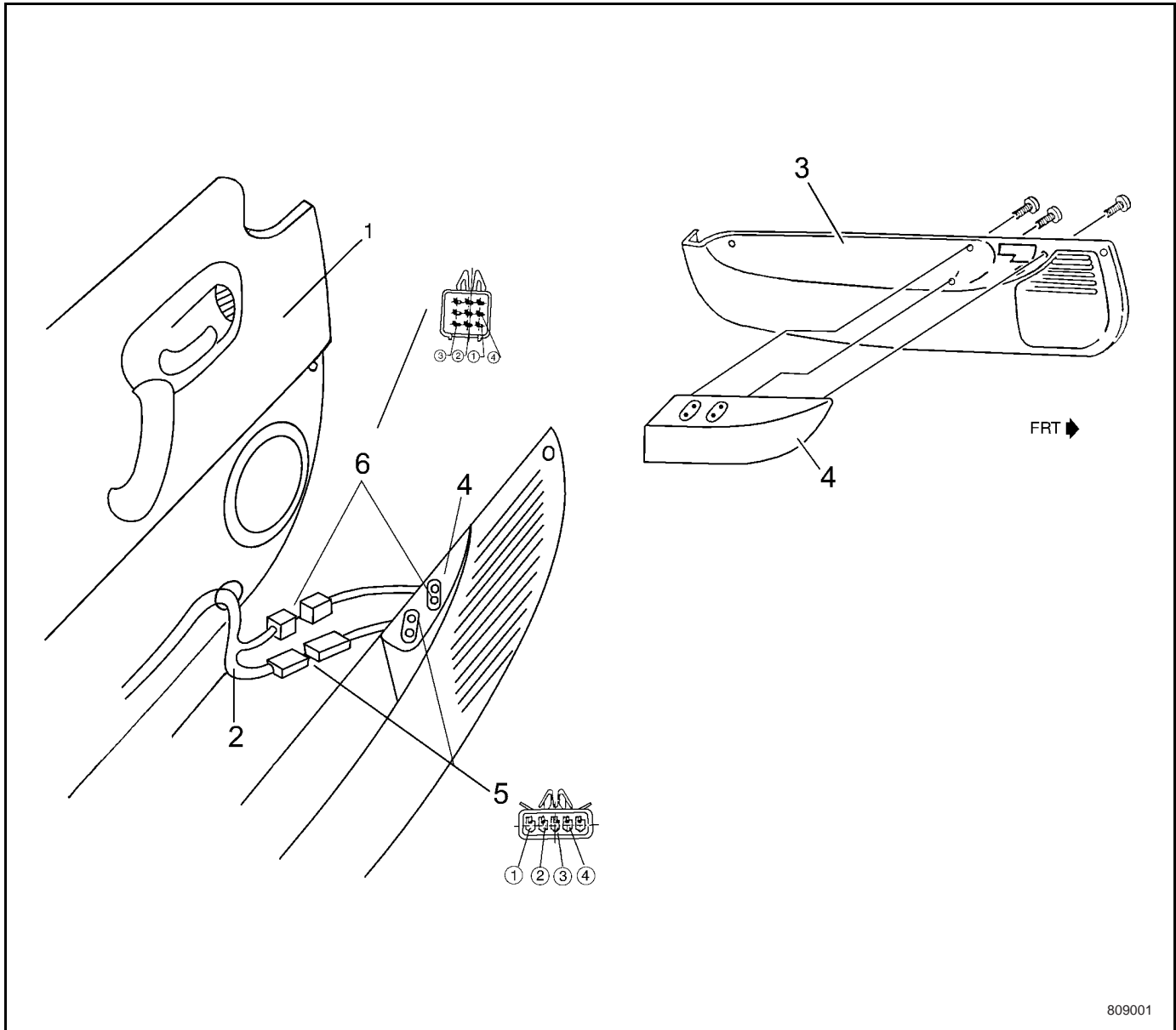
See 8.20.2.11.

8.9.2.4 Mirror Wiring Diagram - Outside (Electrical) (If equipped)

See 8.20.2.24.

8.9.3 Component Locator

8.9.3.1 Electrical Window Switch I- Driver Side Component View (Only Front Windows are electric)

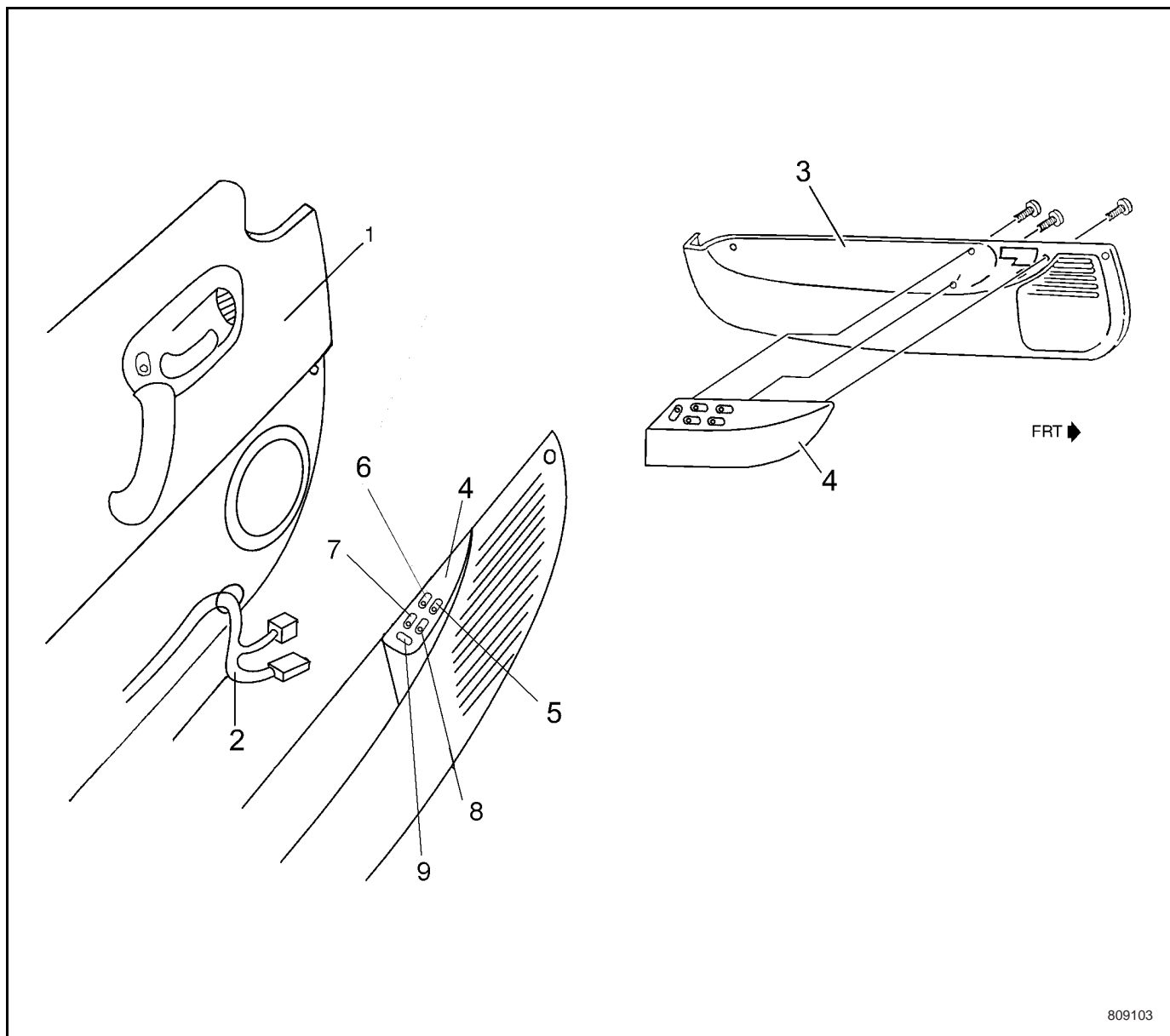


809001

Legend

- | | |
|--------------------------------|---|
| (1) Left Front Door Trim Panel | (4) Left Front Door Console |
| (2) Left Front Door Harness | (5) Electrical Window Switch - for Driver Window |
| (3) Left Front Door Pocket ASM | (6) Electrical Window Switch - for Co - Driver Window |

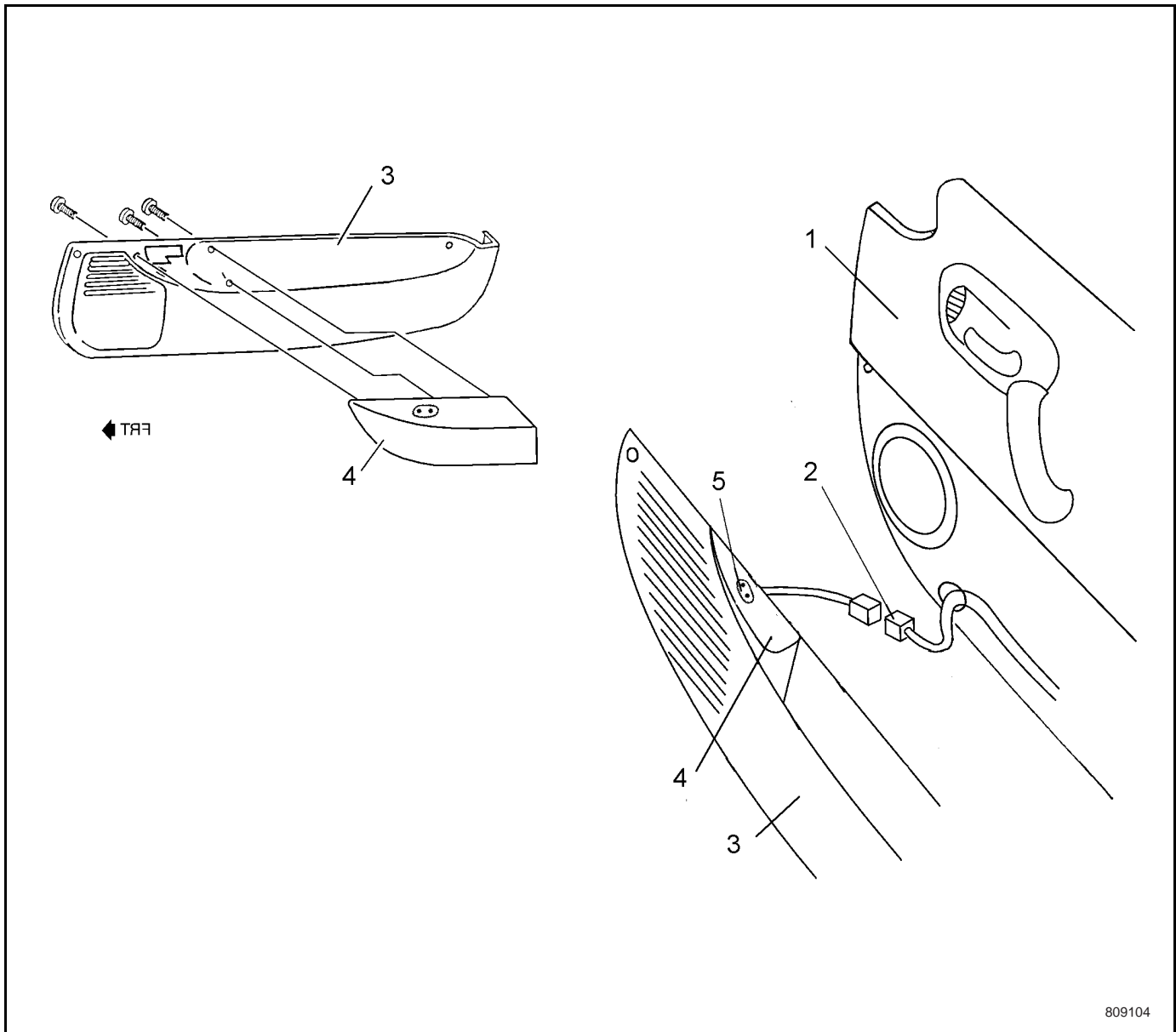
8.9.3.1 Electrical Window Switch II - Driver Side Component View (All four Windows are electric)



Legend

- | | |
|--|---|
| (1) Left Front Door Trim Panel | (6) Electrical Window Switch - for Co - Driver Window |
| (2) Left Front Door Side Harness | (7) Electrical Window Switch - Left Rear Door |
| (3) Left Front Door Pocket ASM | (8) Electrical Window Switch - Right Rear Door |
| (4) Left Front Door Window Console | (9) Side Window Locking Switch |
| (5) Electrical Window Switch - for Driver Window | |

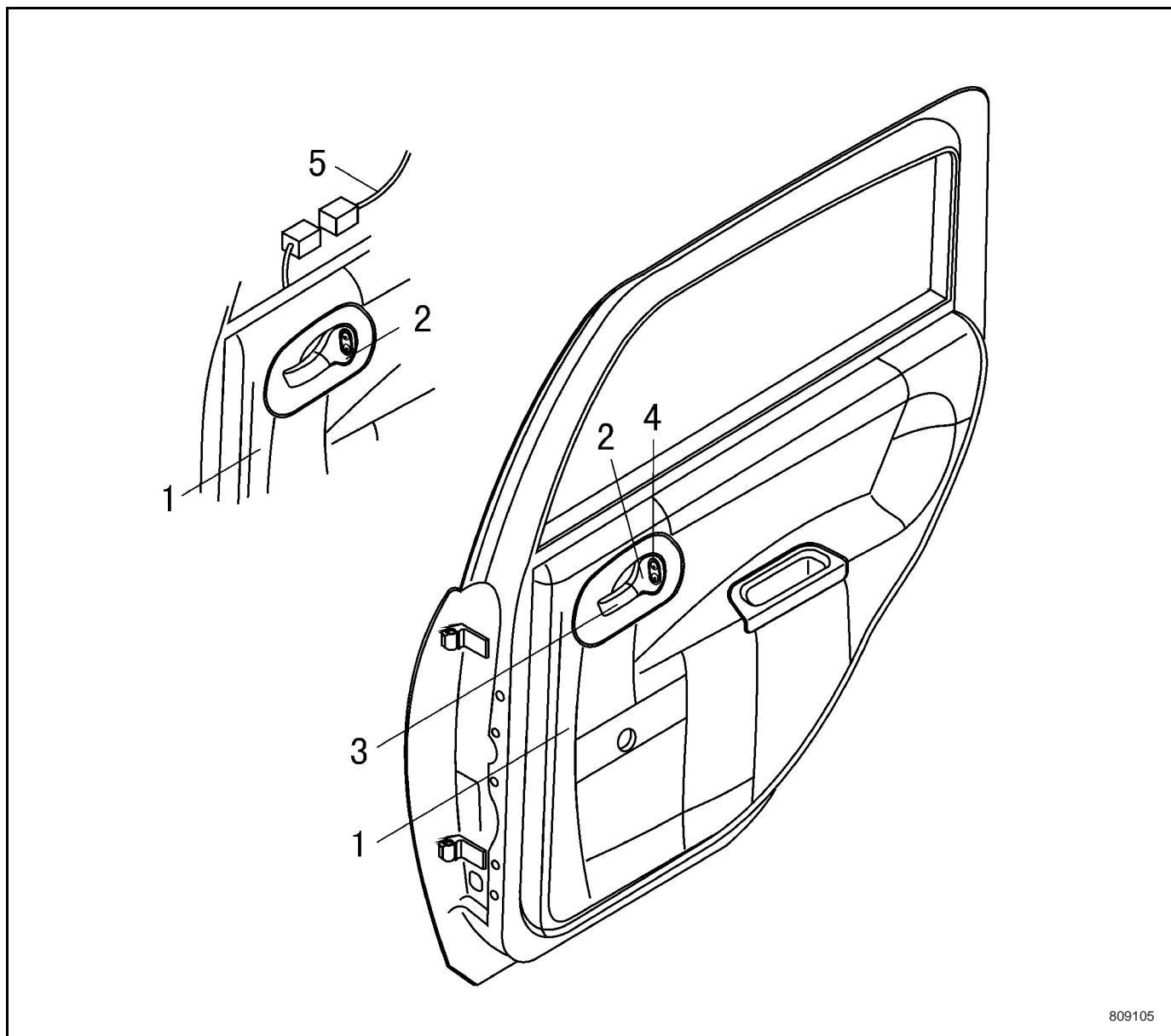
8.9.3.3 Electrical Window Switch Component View - for Co - Driver Window



Legend

- | | |
|---------------------------------|---|
| (1) Right Front Door Trim Panel | (4) Right Front Door Window Console |
| (2) Right Front Door Harness | (5) Electrical Window Switch - for Co - Driver Window |
| (3) Right Front Door Pocket ASM | |

8.9.3.4 Electrical Window Switch Component View (Symmetrical) - Right (Left) Door

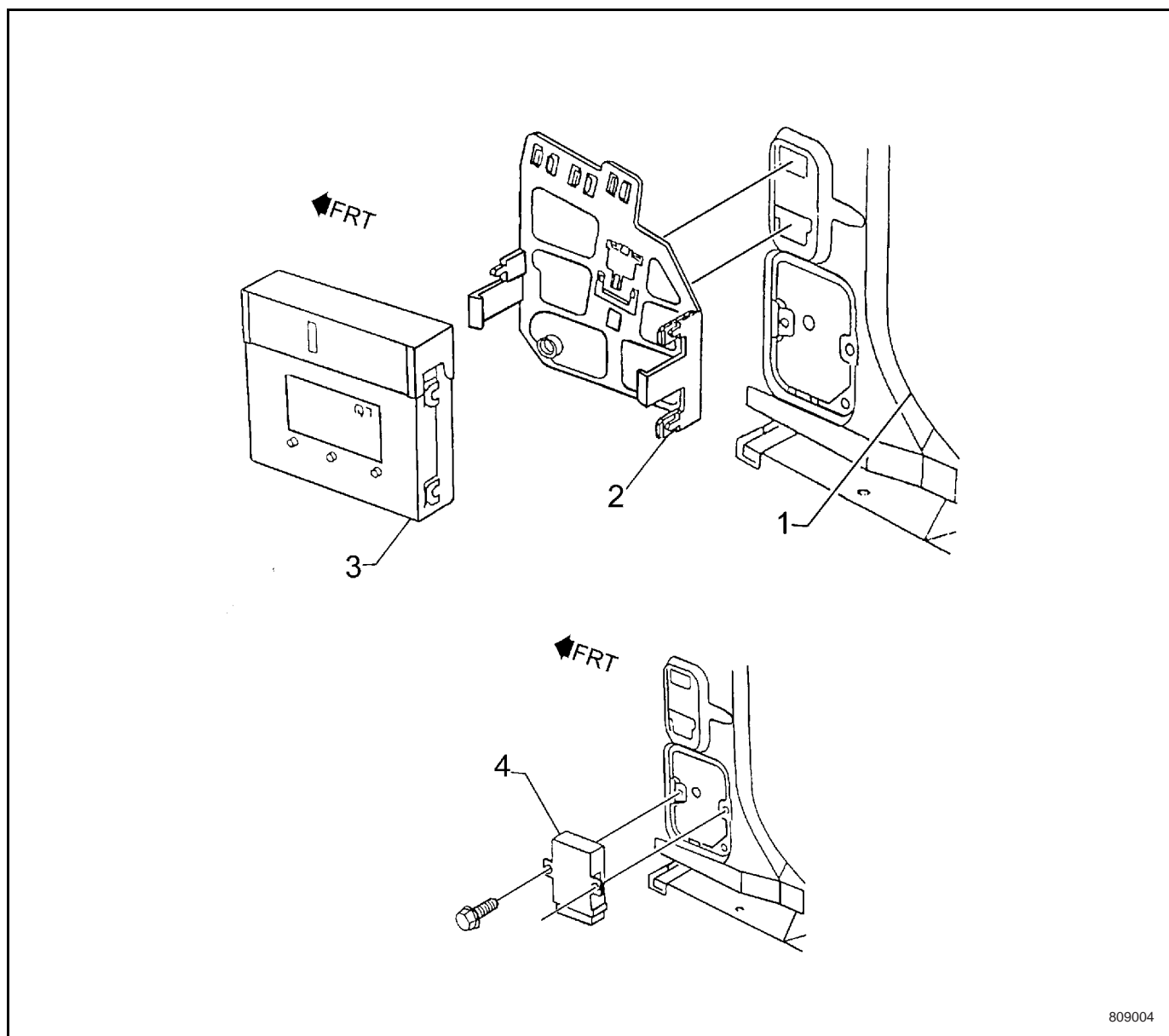


809105

Legend

- | | |
|---|---|
| (1) Right (Left) Rear Door Trim Panel | (4) Electrical Window Switch - Right (Left) Rear Door |
| (2) Right (Left) Rear Door Pull-in Handle Cover | (5) Right (Left) Rear Door Harness |
| (3) Right (Left) Rear Door Pull-in Handle ASM | |

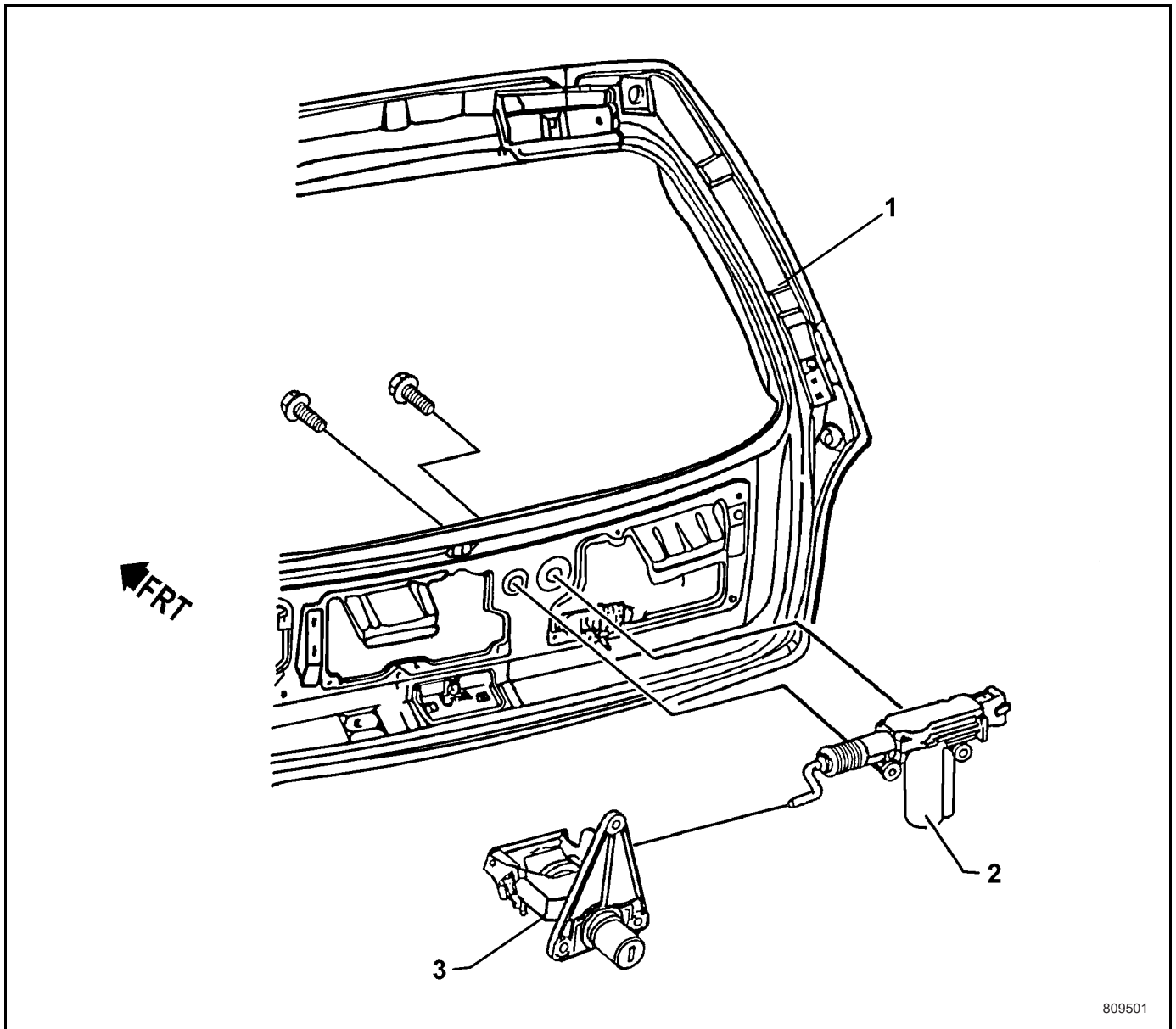
8.9.3.5 Electrical Door Module Component View



Legend:

- | | |
|-----------------------------------|------------------------------------|
| (1) Cowl Side Panel (Right) | (3) Engine Control Module |
| (2) Engine Control Module Bracket | (4) Electrical Door Control Module |

8.9.3.6B Electrical Door Locking Actuator - Trunk Lid Component View



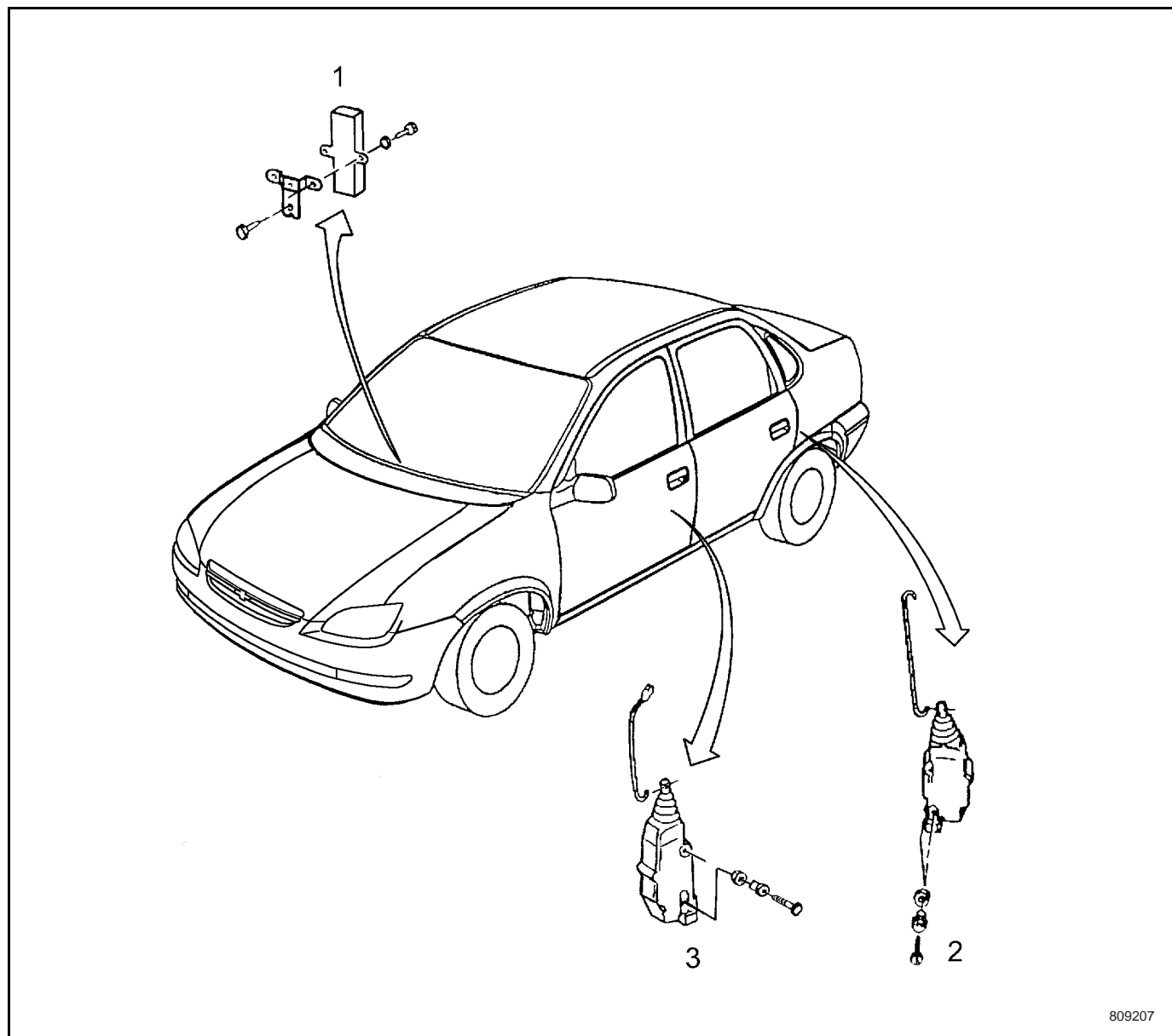
Legend:

(1) Rear Lift Gate

(2) Actuator - Rear Compartment

(3) Rear Lift Gate Lock

8.9.3.7A Electrical Door Lock System Component View

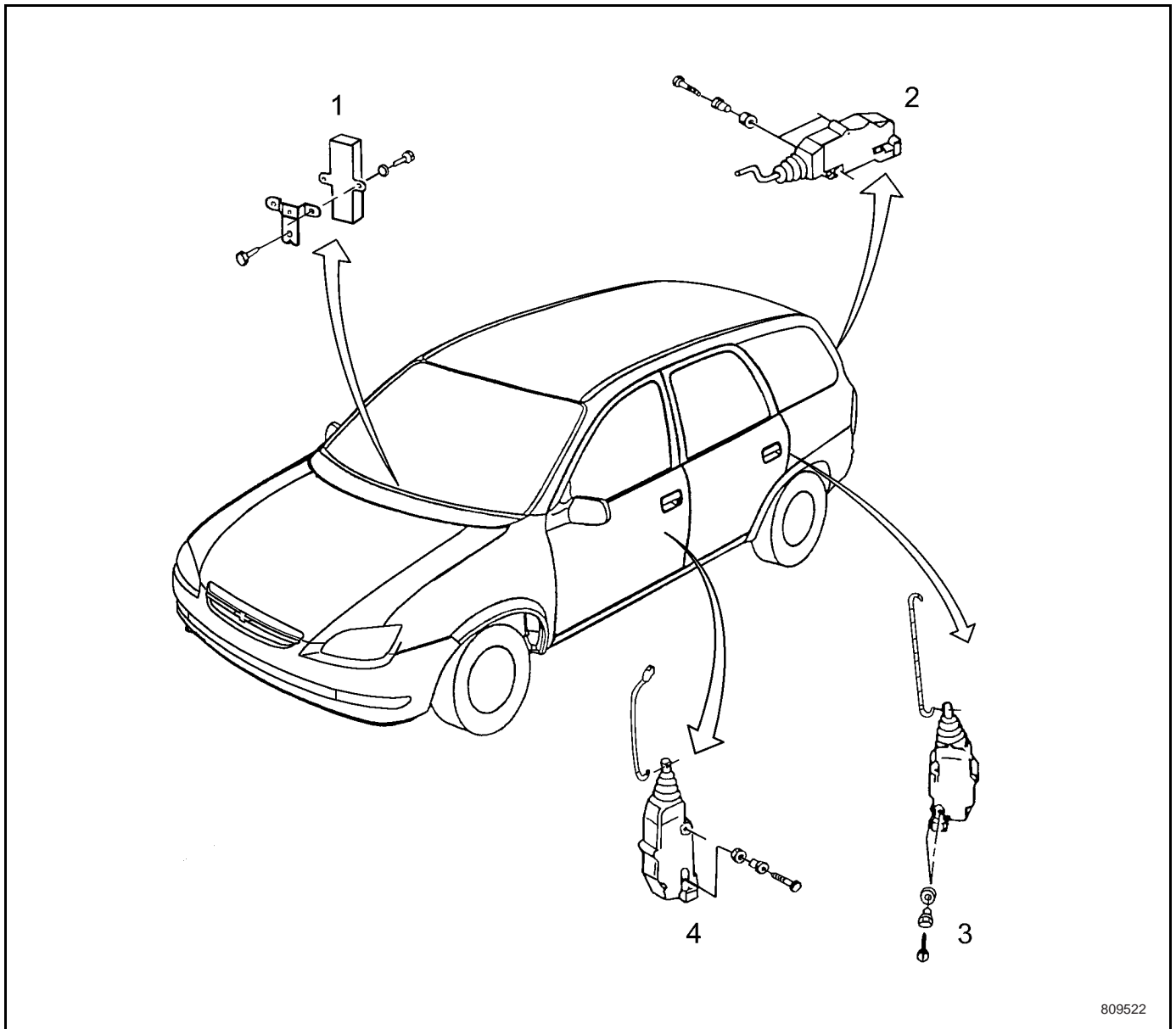


Legend:

- (1) Central Lock Control Module
- (2) Actuator - for Driver Side Door

- (3) Actuator - Left Rear Side Door

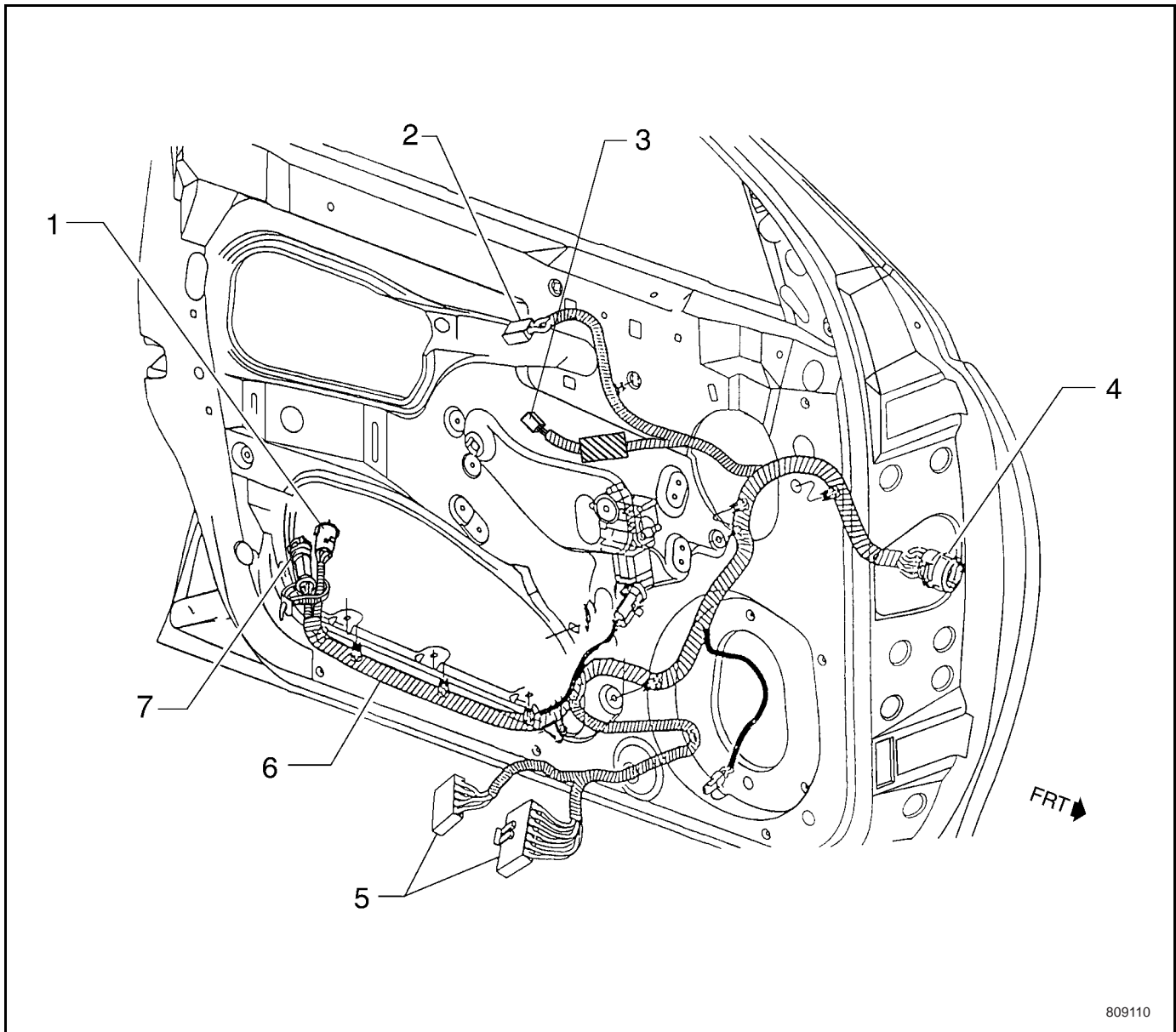
8.9.3.7B Electrical Door Lock System Component View



Legend:

- | | |
|-------------------------------------|-------------------------------------|
| (1) Central Lock Control Module | (3) Actuator - Left Rear Side Door |
| (2) Actuator - Rear Compartment Lid | (4) Actuator - for Driver Side Door |

8.9.3.8 Left Front Door Harness Component View

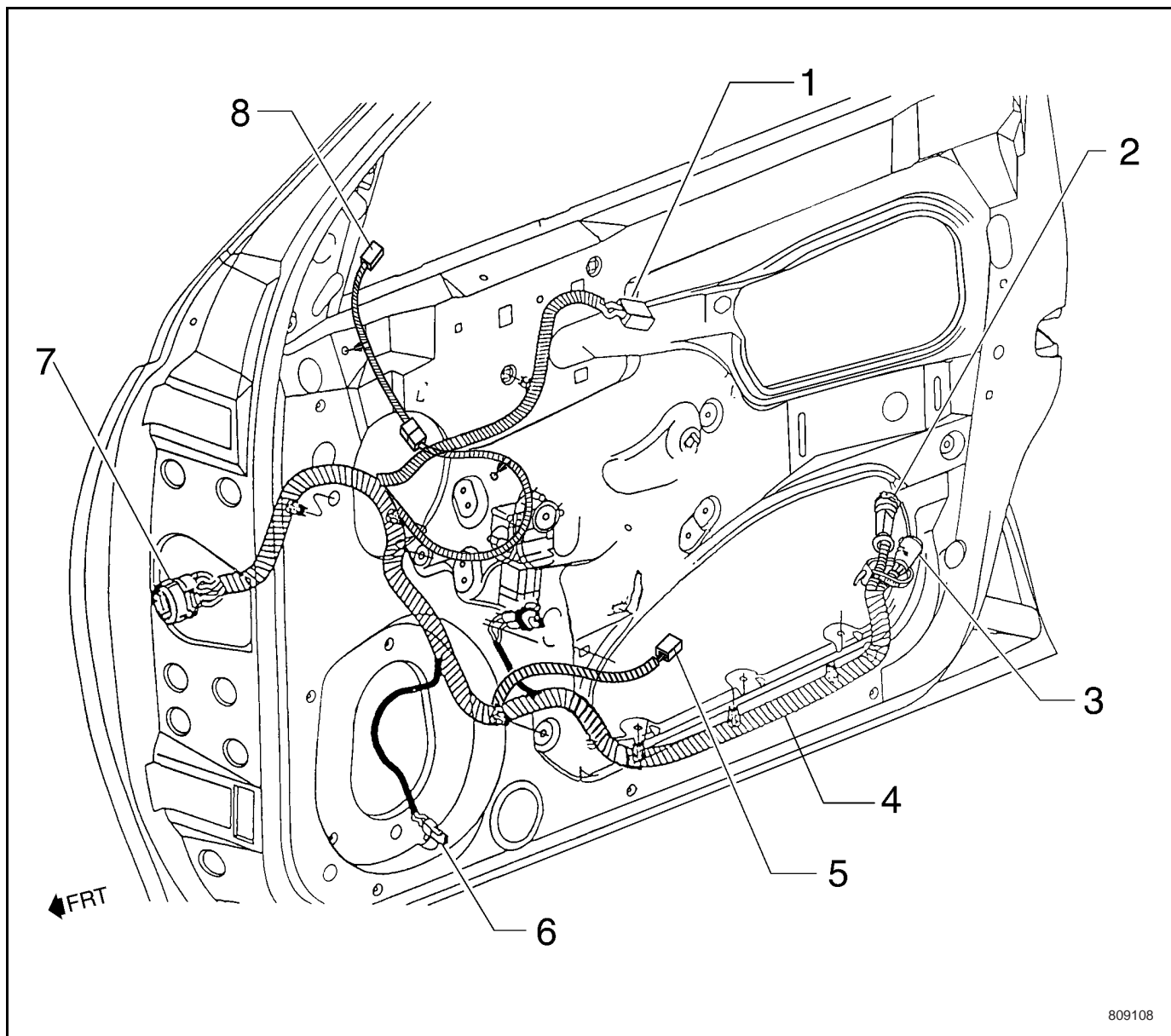


809110

Legend

- | | |
|--|--|
| (1) Connection to Switch - Door Lock System | (5) Connection to Switch - Electrical Window |
| (2) Connection to Tweeter | (6) Connection to Front Door Harness ASM |
| (3) Connection to Outside Electrical Mirror Switch | (7) Connection to Door Lock Actuator |
| (4) Connection to Body Harness | |

8.9.3.9 Right Front Door Harness Component View

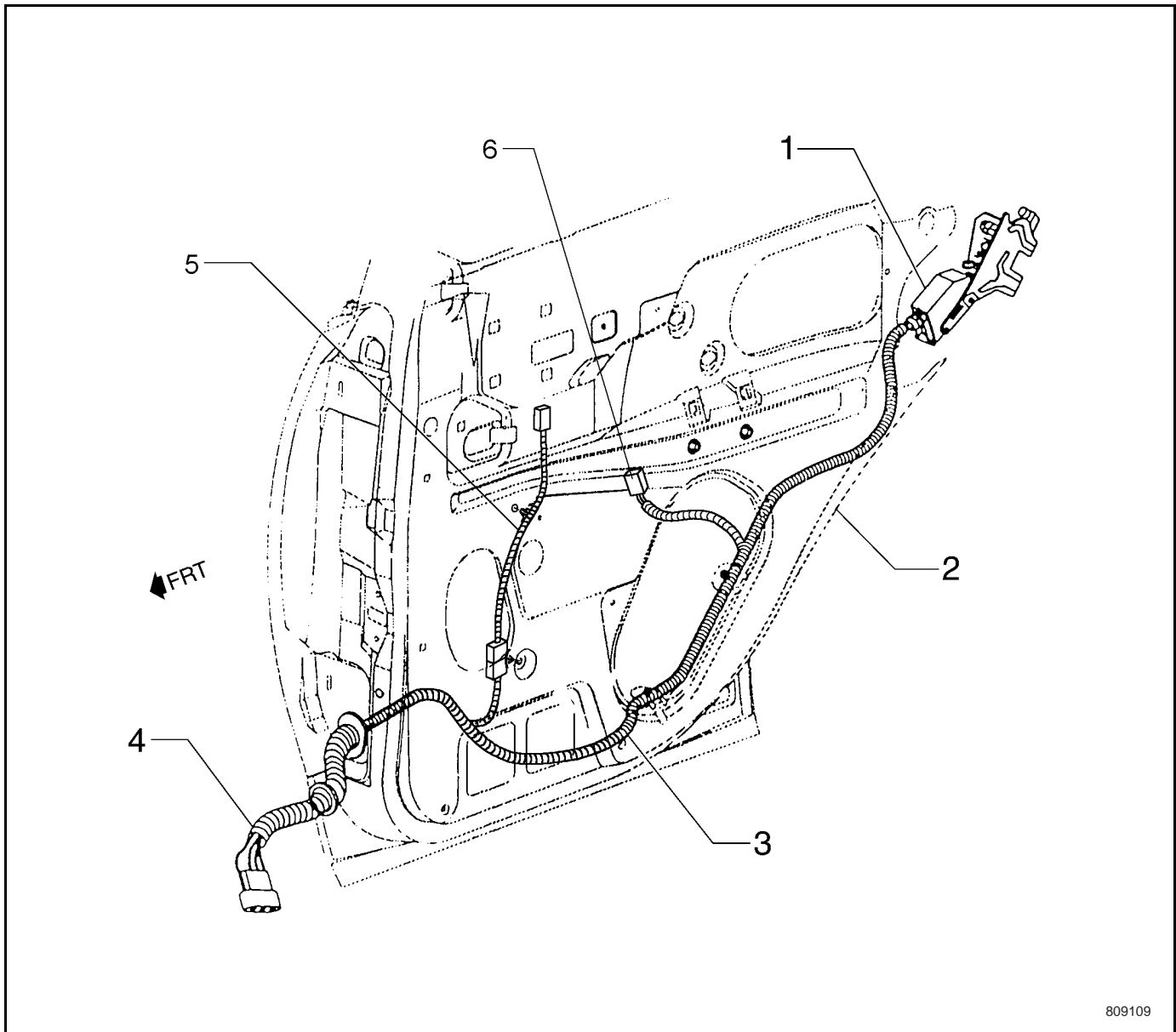


809108

Legend:

- | | |
|---|--|
| (1) Connection to Tweeter (12I) | (5) Connection to Switch, Window Lifter Co - Driver Side |
| (2) Connection to Switch - Door Lock System | (6) Connection to Tweeter (12I) |
| (3) Connection to Door Lock | (7) Connection to Body Harness |
| (4) Connection to Front Door Harness | (8) Connection to Outside Electrical Mirror Switch |

8.9.3.10 Right / Left Rear Door Harness Component View(Symmetrical)

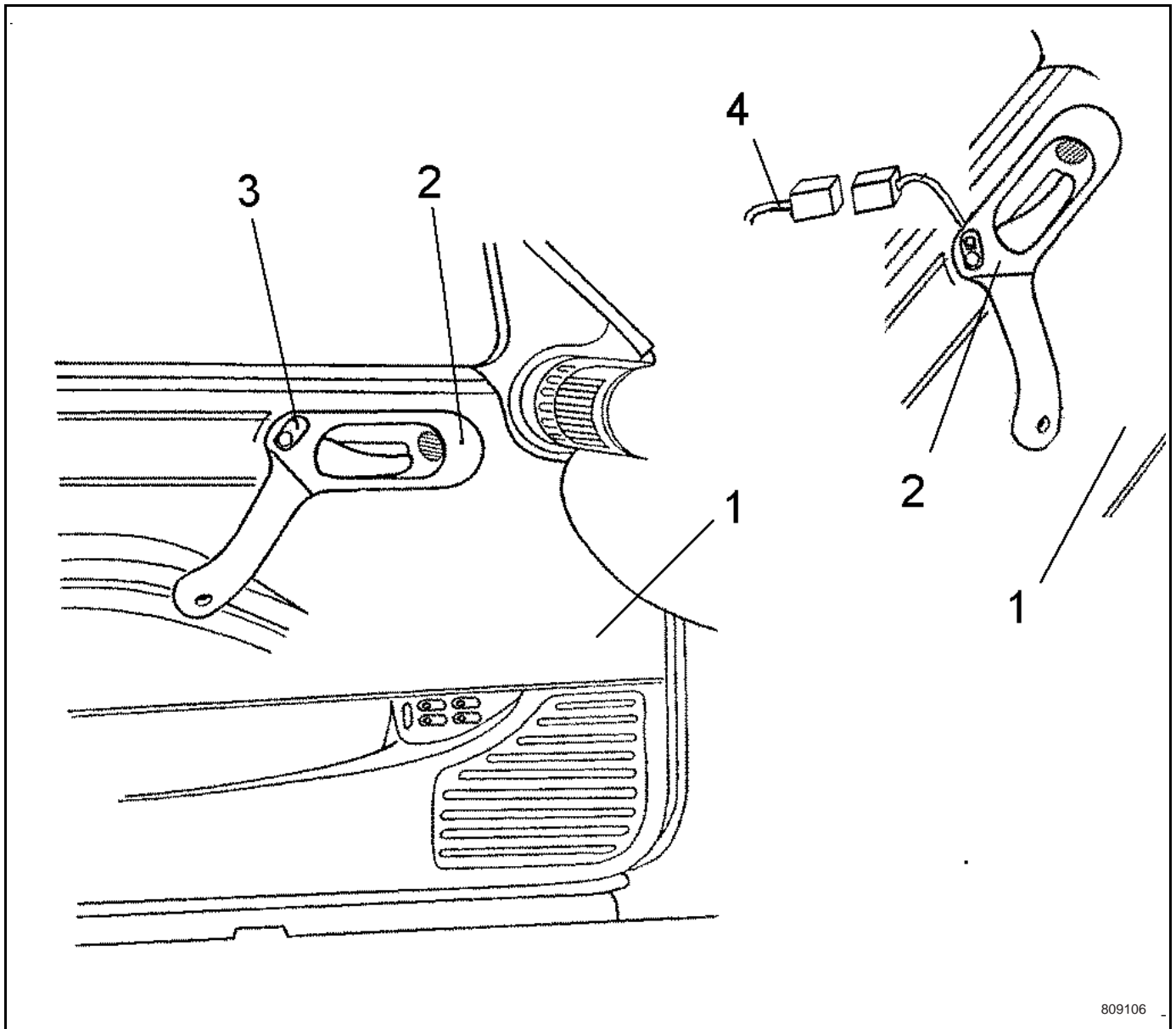


809109

Legend:

- | | |
|--------------------------------------|--|
| (1) Connection to Door Lock Actuator | (4) Connection to Rear Body Harness |
| (2) Rear Door (Left) | (5) Connection to Window Lifter Switch |
| (3) Rear Body Wiring Harness ASM | |

8.9.3.11 Outside Electrical Mirror Switch Component View

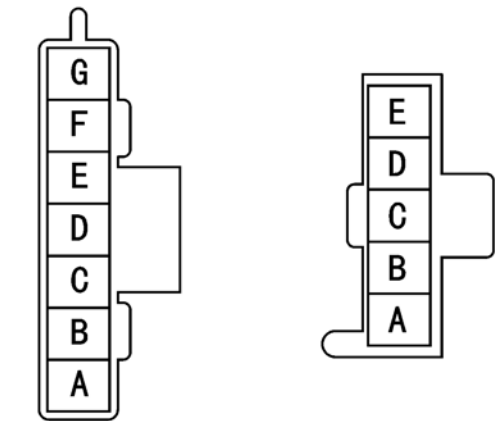


809106

Legend:

- | | |
|------------------------------------|--------------------------------------|
| (1) Left Front Door Trim Panel | (3) Outside Electrical Mirror Switch |
| (2) Left Front Door Pull-in Handle | (4) Front Body Harness |

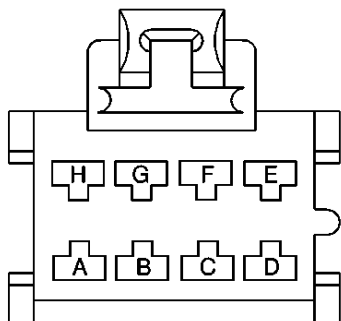
8.9.3.12 Left Front Window Switch Connector End View



809117

Connector Part Information			Connector Part Information		
• 12052854 Black			• 12041429 Black		
Pin	Wire Color	Function	Pin	Wire Color	Function
A	Black	Back Lighting Source - Switch	A	Blue	Right Front and Rear Window Switch Locking
B	Brown	Ground	B	Brown white	Control RR Window Motor Down Feed
C	Black red	Control RF Window Motor Down Feed	C	Brown white	Control LR Window Motor Down Feed
D	Red	Control LF Window Motor Down Feed	D	Green	Control LR Window Motor Up Feed
E	Blue	Control LF Window Motor Up Feed	E	Green	Control RR Window Motor Up Feed
F	Blue	Control RF Window Motor Up Feed			
G	Red	Window Regulator Motor Power			

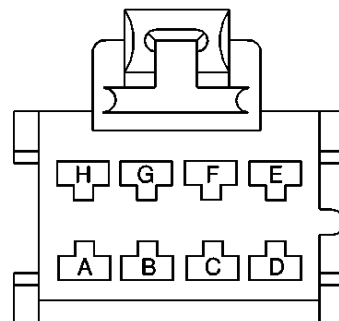
8.9.3.13 Right Front Window Switch Connector End View



809008

Connector Part Information		<ul style="list-style-type: none"> 12064998 Black
Pin	Wire Color	Function
A	Blue	Window Regulator Motor Ground
B	Blue	Power Supply
C	Brown	Back Lighting Ground - Switch
D	Blue	Control Window Regulator Motor Up Feed
E	Black red	Window Regulator Motor Ground
G	Black	Back Lighting Source - Switch
H	Red	Control Window Regulator Motor Down Feed

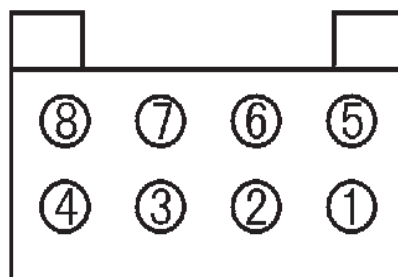
8.9.3.14 Rear Window Switch Connector End View



809008

Connector Part Information		<ul style="list-style-type: none"> 12064998 Black
Pin	Wire Color	Function
A	Green	Ground
B	Blue	Power Supply
D	Blue	Control Window Regulator Motor Up Feed
E	Brown white	Ground
H	Red	Control Window Regulator Motor Down Feed

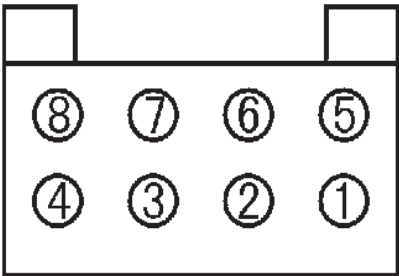
8.9.3.15 Rear View Mirror Switch Connector End View



809118

Connector Part Information		<ul style="list-style-type: none"> 5327190280 Grey
Pin	Wire Color	Function
1	Black	Power Supply
2	Brown	Ground

8.9.3.15 Rear View Mirror Switch
Connector End View(Cont' d)



809118

Connector Part Information		<ul style="list-style-type: none">5327190280 Grey
Pin	Wire Color	Function
3	Brown white	Control Rearview Mirror Motor Down Feed
5	Grey	Control Rearview Mirror Motor Up and Leftwards Feed
8	Brown red	Control Rearview Mirror Motor Rightwards Feed

8.9.4 Diagnostic Information and Procedure

8.9.4.1 Electrical Window Lifter - Front Door Inoperative (Only Front Windows are electric)

All

Step	Action	Yes	No
1	1. Turn the ignition switch to RUN (Operative) position. 2. Inspect the circuit F ₂₄ and F ₂₈ fuse for an open Is the fuse open?	Go to Step 7	Go to Step 2
2	1. Turn the ignition switch to the lock position. 2. Disconnect the left front window switch. 3. Turn the ignition switch to RUN (Operative) position. 4. Using a test light back probe between rear body harness connector X6 Pin 29 and ground. Does the light illuminate?	Go to Step 3	Go to Step 5
3	Using a test light back probe between rear body harness connector X6 Pin 19 and ground. Does the light illuminate?	Go to Step 4	Go to Step 6
4	Repair a poor connection with switch or replace the left window switch.	—	—
5	Repair a poor connection or an open between the fuse block F ₂₈ and left front door harness connector X ₆ .	—	—
6	Repair a poor connection or an open between the fuse block 24 and rear body harness connector X ₅ Pin A1, Pin C ₁₀ and rear body harness connector X ₆ Pin 19, X ₇ Pin 19.	—	—
7	Repair a short to ground in circuit F ₂₈ and F ₂₄ fuse. Is the repair complete?	—	Go to Step 2

LH

Step	Action	Yes	No
1	Inspect the circuit F ₂₄ and F ₂₈ fuse for an open. Is the circuit open?	Go to Step 11	Go to Step 2
2	1. Disconnect the window regulator motor M ₄₇ . 2. Using the test light front probe between the left front window regulator motor M ₄₇ Pin 1. 3. Turn the ignition switch to RUN (Operative) position. Does the test light illuminate?	Go to Step 3	Go to Step 10
3	1. Disconnect the left front window switch. 2. Using a digital multimeter. Firstly, test the circuit between left front window regulator motor M ₄₇ Pin 1 and rear body harness connector X ₆ Pin 30. Secondly test the circuit M ₄₇ Pin 1 and connector X ₆ Pin 29. Are there continuity in both circuits?	Go to Step 4	Go to Step 8
4	1. Use a test light front probe between the left front window switch S _{37.1} Pin 2 and ground, then front probe between S _{37.1} Pin 3 and ground. 2. Turn the ignition switch to RUN (Operative) position. 3. Press the left front window switch to the UP (upwards) position, and then to the DOWN (downwards) position. Does the test light ever illuminate in one of cases?	Go to Step 6	Go to Step 5

LH(Cont' d)

Step	Action	Yes	No
5	Disconnect the left front window switch using a test light front probe between the left window switch S _{37.2} Pin 4 or Pin 1 and ground. Does the test light illuminate in both cases?	Go to Step 7	Go to Step 9
6	Repair a poor connection or an open in circuit between left window regulator motor S _{37.1} Pin 2 and regulator motor M ₄₇ Pin 3 or S _{37.1} Pin 3 and M Pin 2.	—	—
7	Replace the left front window switch S _{37.1} . Is the repair complete?	—	—
8	Repair a poor connection or an open in the circuit between window regulator M ₄₇ Pin 4 and rear body harness connector X ₆ Pin 30 or test circuit between M ₄₇ Pin 1 and X ₆ Pin 29.	—	—
9	Repair a poor connection or an open in the circuit between left window switch S _{37.2} Pin 1, Pin 4 and rear body harness connector X ₅ Pin A.	—	—
10	Replace the left front window regulator motor. Is the repair complete?	—	—
11	Repair a short to ground or an open in circuit F24 and F28 fuse. Is the repair complete?	—	Go to Step 2

RH

Step	Action	Yes	No
1	Inspect the circuit F ₂₄ - F ₂₈ fuse for an open. Is the circuit open?	Go to Step 7	Go to Step 2
2	1. Disconnect the right front window switch. 2. Turn the ignition switch to RUN (Operative) position. 3. Connect a test light. 4. Back probe between the right rear body harness connector X ₇ Pin 29 and ground. Does the test light illuminate?	Go to Step 3	Go to Step 6
3	1. Connect a test light back probe between the rear body harness connector X ₇ Pin 19 and the ground. Does the light illuminate?	Go to Step 4	Go to Step 5
4	Repair a poor connection or an open with the switch, and replace the right window switch.	—	—
5	Repair a poor connection or an open in circuit between the fuse block F ₂₈ and body harness connector X ₇ Pin 29.	—	—
6	Repair a poor connection or an open in circuit between the fuse block F24 and rear body harness connector X ₅ Pin C ₁₀ , and rear body harness connector X ₇ Pin 19.	—	—
7	Repair a short to ground in circuit F24 - F28 fuse. Is the repair complete?	—	—

8.9.4.2 Electrical Window Failure and Inoperative (all the four windows are electric) - Lifter

All

Step	Action	Yes	No
1	1. Turn the ignition switch to RUN (Operative)position. 2. Check the fuse F17 and F14. Is the fuse open?	Go to Step 7	Go to Step 2
2	1. Turn the ignition switch to LOCK (Locking)position. 2. Disconnect the left front window switch. 3. Turn the ignition switch to RUN (Operative)position. 4. Using a test light to probe between the connector X6 Pin 29 and the ground. Does the test light illuminate?	Go to Step 3	Go to Step 6
3	Using a test light to probe between the connector X6 Pin 29 and the cable plug J1-B of left front window switch assembly. Does the test light illuminate?	Go to Step 4	Go to Step 5
4	Replace the left front window switch assembly.	—	—
5	Repair a poor connection in circuit (2.5 / BRN) between left front window switch Pin J1-B and the ground, or an open in circuit between Pin J1-B and the ground.	—	—
6	Repair an open in circuit between the connector X5 Pin D4 and connector X6 Pin 29, or a poor connection with connector in the circuit , or the relay failure.	—	—
7	Repair the fuses F17 and F14 or a short failure to the fuses.	—	—

Left Front Window

Step	Action	Yes	No
1	1. Disconnect the regulator motor cable plug of left front door window. 2. Using a test light to jump between regulator motor cable Plug A and B of left front window. 3. Turn the ignition switch to RUN (Operative)position. 4. Separately press the left front window UP / DOWN button. Does the test light illuminate?	Go to Step 15	Go to Step 2
2	1. Disconnect the left front window switch 2. Using an ammeter to test the circuit (2.5 RED) between left front window motor cable plug Pin A and left front window switch cable plug Pin J1-D. Is there an open in the circuit?	Go to Step 4	Go to Step 3
3	Using a test light to probe between the left front window switch cable plug Pin J1-D and the ground. Does the test light illuminate?	Go to Step 5	Go to Step 6
4	Repair a poor connection with connectors of both end in circuit, or repair an open in the circuit (2.5 RED) between left front window motor plug Pin A and left front window switch Pin J1-D.	—	—
5	Repair a short circuit between left front window motor cable plug Pin A and left front window switch cable plug Pin J1-D, to the power (+).	—	—
6	Using a test light to probe between the left front window switch cable plug Pin J1-D and the anode of battery. Does the test light illuminate?	Go to Step 7	Go to Step 8

Left Front Window(Cont' d)

Step	Action	Yes	No
7	Repair a short circuit between left front window motor cable plug Pin A and left front window switch cable plug Pin J1-D, to the ground.	—	—
8	Using an ammeter to test the circuit (2.5 BLU) between left front window motor cable plug Pin B and left front window switch cable plug Pin J1-E. Is there an open in the circuit?	Go to Step 9	Go to Step 10
9	Repair a poor connection or an open in the circuit between left front window motor cable plug Pin B and left front window switch cable plug Pin J1-E.	—	—
10	Using a test light to probe between the left front window switch cable plug Pin J1-E and the ground. Does the test light illuminate?	Go to Step 11	Go to Step 12
11	Repair a short circuit between left front window motor cable plug Pin B and left front window switch cable plug Pin J1-E, to the power (+).	—	—
12	Using a test light to probe between the left front window switch cable plug Pin J1-E and the anode of battery. Does the test light illuminate?	Go to Step 13	Go to Step 14
13	Repair a short circuit between left front window switch cable plug Pin J1-E and left front window motor cable plug Pin B, to the ground.	—	—
14	Replace the left front window switch assembly.	—	—
15	Replace the left front door window motor.	—	—

RH

Step	Action	Yes	No
1	Press the right front window regulator button on left front door. Is the right front window moving?	Go to Step 2	Go to Step 5
2	1. Disconnect the right front door window switch. 2. Turn the ignition switch to RUN (Operative) position, and move the Lockout (Locking) button on the left front door to Unlocking. 3. Using a test light to probe between the right front window switch cable Plug X7 and the ground. Does the test light illuminate?	Go to Step 3	Go to Step 4
3	Replace the right front window switch.	—	—
4	Repair a poor connection with the circuit connector or an open to the circuit (2.5 BLU) between cable Plug X7 Pin 1 and left front window cable plug Pin J2-A.	—	—
5	1. Disconnect the right front door window motor plug. 2. Using a test light to connect between right front window motor cable Plug A and B. 3. Press the right front window switch UP / DOWN button on left front door. Does the test light illuminate?	Go to Step 6	Go to Step 7
6	Replace the right front window motor.	—	—
7	1. Disconnect the right front window switch. 2. Turn the ignition switch to RUN (Operative) position. 3. Using a test light to probe between cable Plug X7 Pin 3 and cable Plug X7 Pin 2. 4. Press the right front window switch UP / DOWN button on left front door. Does the test light illuminate?	Go to Step 8	Go to Step 9
8	Replace the right front window switch.	—	—

RH(Cont' d)

Step	Action	Yes	No
9	Disconnect the left front window switch, and use an ammeter to test an open in circuit between cable Plug X7 Pin 2 and cable Plug X6 Pin 2.	Go to Step 10	Go to Step 11
10	Repair an open in circuit between cable Plug X7 Pin 2 and cable Plug X6 Pin 2, or a poor connection with connector in the circuit.	—	—
11	Use a test light to probe between cable Plug X6 Pin 2 and the ground. Does the test light illuminate?	Go to Step 12	Go to Step 13
12	Repair a short circuit between cable Plug X7 Pin 2 and cable Plug X6 Pin 2, to the anode of battery.	—	—
13	Use a test light to probe between cable Plug X6 Pin 2 and the anode of battery. Does the test light illuminate?	Go to Step 14	Go to Step 15
14	Repair a short circuit between cable Plug X7 Pin 2 and cable Plug X6 Pin 2, to the ground.	—	—
15	Use an ammeter to test the circuit between cable Plug X7 Pin 3 and cable Plug X6 Pin 3. Is there an open in the circuit?	Go to Step 16	Go to Step 17
16	Repair an open in circuit between cable Plug X7 Pin 3 and cable Plug X6 Pin 3, or a poor connection with connector in the circuit.	—	—
17	Use a test light to probe between cable Plug X6 Pin 3 and the ground. Does the test light illuminate?	Go to Step 18	Go to Step 19
18	Repair a short circuit between cable Plug X7 Pin 3 and cable Plug X6 Pin 3, to the anode of battery.	—	—
19	Use a test light to probe between cable Plug X6 Pin 3 and the anode of battery. Does the test light illuminate?	Go to Step 20	Go to Step 21
20	Repair a short circuit between cable Plug X7 Pin 3 and cable Plug X6 Pin 3, to the ground.	—	—
21	Replace the window switch assembly on left front door.	—	—

LR / RR (Single)

Step	Action	Yes	No
1	For the logic procedure of diagnosis, please refer to RF.	—	—

8.9.4.3 Electrical Window Failure and Inoperative (all the four windows are electric) - Locking

Step	Action	Yes	No
1	1. Turn the ignition switch to RUN (Operative) position. 2. Turn Lockout (Locking) switch to off (Unlocking) position. 3. Using a test light to probe between the left front window switch cable connector Pin J2-A and the ground. Does the test light illuminate?	Go to Step 3	Go to Step 2
2	Repair a poor connection with connector Pin J2-A of left front window, or repair an open to the circuit (2.5 / BLU) between J2-A and X6 connector Pin 1.	—	—
3	Replace the left front window switch assembly.	—	—

8.9.4.4 Electrical Window Failure and Inoperative - Fast Down

Step	Action	Yes	No
1	Replace the left front window switch assembly.	—	—

8.9.4.5 Electrical Window System Check (Only Front Windows are electric)

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	Turn the ignition switch to RUN (Operative) position.	—	—
2	Operate the left front windows from its switch on the left console.	Operate quietly and smoothly, without sticking.	Electrical Windows Inoperative.
3	Operate the right front windows from its switch on the left console.	The right front window operates quietly and smoothly, without sticking.	Electrical Windows Inoperative.
4	Operate the right front window from its switch on the right indoor handle.	The right front window operates quietly and smoothly, without sticking.	Electrical Windows Inoperative.

*For abnormal result(s), please see Diagnosis on Electrical Window Failure.

8.9.4.6 Electrical Window System Check (All Four Windows are electric)

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	1. Turn the ignition switch to RUN (Operative) position. 2. Operate all the electrical windows separately on the left front door window switch.	Each window operates smoothly, quietly, without sticking.	Electrical Windows Inoperative.
2	Click and press the left front window downwards button under the condition of left front window glass lifted.	The left front window glass automatically lowers all the way down.	It cannot lower all the way down.
3	1. On the left front door, turn the locking switch to OFF (Unlocking) position. 2. Operate window switches on all the doors separately.	All the windows operate smoothly, without sticking.	Some windows cannot move.
4	1. On the left front door, turn the locking switch to LOCK (Locking) position. 2. Operate window switches on all the doors separately.	It is valid only to the left front window of left front door. Other door window switches cannot operate normally.	The locking button doesn't work.

*For abnormal result(s), please see Diagnosis on Electrical Window Failure.

8.9.4.7 Outside Electrical Mirror Inoperative

All

Step	Action	Yes	No
1	Check the fuse F34 and F24. Is the fuse open?	Go to Step 2	Go to Step 3
2	Repair a short to circuit causing fuse F34, F24 open, or replace fuse F34, F24.	—	—
3	Using a test light to probe between the electrical rearview mirror switch cable plug Pin 1 and the ground. Does the test light illuminate?	Go to Step 4	Go to Step 7
4	Using a test light to probe between the electrical rearview mirror switch cable plug Pin 1 and Pin 2. Does the test light illuminate?	Go to Step 5	Go to Step 8
5	1. Using a test light to probe between the anode of battery and circuit joint B of rearview mirror actuating motor. 2. Press against the electrical rear mirror adjusting button. Does the test light illuminate?	Go to Step 6	Go to Step 9
6	Replace the electrical rear mirror adjusting switch assembly. Is the system normal?	Go to Outside Rearview Mirror System Check.	Go to Step 10
7	Repair an open to the circuit between cable Plug X5 Pin B3 and electrical rearview mirror switch Plug Pin 1, or a poor connection with the circuit connectors of both ends.	—	—
8	Repair an open to the circuit between electrical rearview mirror switch plug Pin 2 and the ground, or a poor connection with circuit end connectors.	—	—
9	Repair an open to the circuit between electrical rearview mirror switch cable plug Pin 5 and rearview mirror actuating motor plug Pin B, or a poor connection with both circuit end connectors.	—	—
10	See the diagnosis from Outside Rearview Mirror Inoperative - Up / Down, Left / Right, and repair each inoperative failure for Up / Down, Left / Right.	—	—

Upwards / Downwards

Step	Action	Yes	No
1	1. Disconnect the rearview mirror Upwards / Downwards Move motor plug. 2. Use a test light to jump connect between the motor cable plug Pin C and B. 3. Click and press rearview mirror UP / DOWN adjusting button. Does the test light illuminate?	Go to Step 2	Go to Step 3
2	Replace UP / DOWN Moving motor.	—	—
3	Disconnect the rearview mirror adjusting switch, and use a multimeter to test the circuit between motor cable plug Pin C and rearview mirror adjusting switch cable plug Pin 3. Is there an open in the circuit?	Go to Step 4	Go to Step 5
4	Repair an open to the circuit between motor cable plug Pin C and rearview mirror adjusting switch cable plug Pin 3, or a poor connection with the circuit connectors.	—	—

Upwards / Downwards(Cont' d)

Step	Action	Yes	No
5	Use a test light to jump connect between rearview mirror adjusting switch cable plug Pin 3 and the ground. Does the test light illuminate?	Go to Step 6	Go to Step 7
6	Repair a short circuit between motor cable plug Pin C and rearview mirror adjusting switch cable plug Pin 3, to the anode of battery.	—	—
7	Use a test light to jump connect between rearview mirror adjusting switch cable plug Pin 3 and the anode of battery, and test if the test light illuminates.	Go to Step 8	Go to Step 9
8	Repair a short circuit between motor cable plug Pin C and rearview mirror adjusting switch cable plug Pin 3, to the ground.	—	—
9	Replace the rearview mirror adjusting switch.	—	—

Leftwards / Rightwards

Step	Action	Yes	No
1	1. Disconnect the rearview mirror Leftwards / Rightwards Move motor plug. 2. Use a test light to jump connect between the motor cable plug Pin A and B. 3. Click and press rearview mirror LEFT / RIGHT adjusting button. Does the test light illuminate?	Go to Step 2	Go to Step 3
2	Replace LEFT / RIGHT Moving motor.	—	—
3	Disconnect the rearview mirror adjusting switch, and use a multimeter to test the circuit between motor cable plug Pin A and rearview mirror adjusting switch cable plug Pin 8. Is there an open in the circuit?	Go to Step 4	Go to Step 5
4	Repair an open to the circuit between motor cable plug Pin A and rearview mirror adjusting switch cable plug Pin 8, or a poor connection with the circuit connectors.	—	—
5	Use a test light to jump connect between rearview mirror adjusting switch cable plug Pin 8 and the ground. Does the test light illuminate?	Go to Step 6	Go to Step 7
6	Repair a short circuit between motor cable plug Pin A and rearview mirror adjusting switch cable plug Pin 8, to the anode of battery.	—	—
7	Use a test light to jump connect between rearview mirror adjusting switch cable plug Pin 8 and the anode of battery, and test if the test light illuminates.	Go to Step 8	Go to Step 9
8	Repair a short circuit between motor cable plug Pin A and rearview mirror adjusting switch cable plug Pin 8, to the ground.	—	—
9	Replace the rearview mirror adjusting switch.	—	—

8.9.4.8 Outside Electrical Rearview Mirror System Check

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	Click and press rearview mirror LEFT / RIGHT adjusting button.	The rearview mirror rotates smoothly leftwards / rightwards.	1. The rearview mirror cannot rotate at all. 2. It cannot rotate in some direction.

8.9.4.8 Outside Electrical Rearview Mirror System Check

Step	Action	Normal Result(s)	Abnormal Result(s)*
2	Click and press rearview mirror UP / DOWN adjusting button.	The rearview mirror rotates smoothly upwards / downwards.	1. The rearview mirror cannot rotate at all. 2. It cannot rotate in some direction.

Note: For all the abnormal result(s), please refer to the appropriate Outside Rearview Mirror Failure Diagnosis.

8.9.4.9A Diagnostic Procedure for Central Lock System (The central locks don't work)

Action	Yes	No
1. Please check the fuse (No.13, 20 A), is it undamaged?	Go to Step 2	Go to Step 3
2. Replace the damaged fuse.	Go to Step 3	—
3. Check the fuse (No.18, 20 A), is it undamaged?	Go to Step 4	Go to Step 5
4. Replace the damaged fuse with a new 20 A fuse.	Go to Step 5	—
5. Please separate the connector (X5) between the I/P and the rear body wiring harness; Use the DMM to measure the voltage of the pin D3 at the I/P wiring harness side, is the voltage normal?	Go to Step 7	Go to Step 6
6. Please check and repair the I/P wiring harness from the fuse (No.13) to the connector (X5, Pin D3), be sure it's of no problem.	Go to Step 7	—
7. Use the DMM to measure the voltage of the pin C12 at the connector (X5) (I/P wiring harness side), is the voltage normal?	Go to Step 9	Go to Step 8
8. Please check and repair the I/P wiring harness from the fuse (No.18) to the connector (X5), be sure it's of no problem.	Go to Step 9	—
9. Tear down central lock module, turn the ignition switch to ON position, turn the wiper - switch to interior - shift position. Use the DMM to measure the voltage of the pin 3 and pin 9; Is the voltage normal?	Go to Step 11	Go to Step 10
10. Please check and repair the rear body wiring harness from the connector (x 5) to the central lock module according to the circuit diagram. Be sure it's no problem.	Go to Step 11	—
11. Replace the central lock module with a new one, is the system OK?	—	Go to Step 12
12. Use the DMM to measure the ground wire (Pin 11) of the central lock module, is it grounding well?	Go to Step 13	Go to Step 14
13. Please separate the connector (X6, X7, X9) between the Rear Body and the Front Left door (Front Right door, Lid - trunk) wiring harness; Use the DMM to measure the ground wire (Pin 30, Pin F), is it grounding well?	Go to Step 16	Go to Step 15
14. Please repair the rear body wiring harness for the ground wire, is the system OK?	—	Go to Step 13
15. Please repair the ground wire at the connector (X6, X7, X9), Be sure it is grounding well.	Go to Step 16	—

8.9.4.9A Diagnostic Procedure for Central Lock System (The central locks don't

Action	Yes	No
16. Please disconnect the central lock motor connector and the switch connector at every door; Use the DMM to test and check the Rear Body; Front - Left door, Front - Right door the Rear door and the Lid Trunk wiring harness according to the circuit diagram; repair the wiring harness if necessary. Be sure the wiring harness is no problem. Is the system OK?	—	Go to Step 17
17. Please check the interior structure of the central lock switch and the central motor at every door, replace or repair it if necessary. The system is OK.	—	—

8.9.4.9B Diagnostic Procedure for Central Lock System (The central locks don't work)

Step	Action	Yes	No
1	Please check the fuse (No.13, 20 A), is it undamaged?	Go to Step 2	Go to Step 3
2	Replace the damaged fuse.	Go to Step 3	—
3	Please check the fuse (No.18, 20 A), is it undamaged?	Go to Step 4	Go to Step 5
4	Replace the damaged fuse with a new 20 A fuse.	Go to Step 5	—
5	Please separate the connector (X5) between the I/P and the rear body wiring harness; Use the DMM to measure the voltage of the pin D3 at the I/P wiring harness side, is the voltage normal?	Go to Step 7	Go to Step 6
6	Please check and repair the I/P wiring harness from the fuse (No.13) to the connector (X5, Pin D3), be sure it's no problem.	Go to Step 7	—
7	Use the DMM to measure the voltage of the pin C12 at the connector (X5) (I/P wiring harness side), is the voltage normal?	Go to Step 9	Go to Step 8
8	Please check and repair the I/P wiring harness from the fuse (No.18) to the connector (X5), be sure it's of no problem.	Go to Step 9	—
9	Tear down central lock module, turn the ignition switch to ON position, turn the wiper - switch to interior - shift position. Use the DMM to measure the voltage of the pin 3 and pin 9; Is the voltage normal?	Go to Step 11	Go to Step 10
10	Please check and repair the rear body wiring harness from the connector (x 5) to the central lock module according to the circuit diagram. Be sure it's no problem.	Go to Step 11	—
11	Replace the central lock module with a new one, is the system OK?	—	Go to Step 12
12	Use the DMM to measure the ground wire (Pin 11) of the central lock module, is it grounding well?	Go to Step 13	Go to Step 14
13	Please separate the connector (X6, X7, X9) between the Rear Body and the Front Left door (Front Right door, tailgate) wiring harness; Use the DMM to measure the ground wire (Pin 30, Pin F), is it grounding well?	Go to Step 16	Go to Step 15
14	Please repair the rear body wiring harness for the ground wire, is the system OK?	—	Go to Step 13
15	Please repair the ground wire at the connector (X6, X7, X9). Be sure it is grounding well.	Go to Step 16	—

8.9.4.9B Diagnostic Procedure for Central Lock System (The central locks don't

Step	Action	Yes	No
16	Please disconnect the central lock motor connector and the switch connector at every door; Use the DMM to test and check the Rear Body; Front - Left door, Front - Right door the Rear door and the tailgate wiring harness according to the circuit diagram; repair the wiring harness if necessary. Be sure the wiring harness is no problem. Is the system OK?	—	Go to Step 17
17	Please check the interior structure of the central lock switch and the central motor at every door, replace or repair it if necessary. The system is OK.	—	—

8.9.4.10A Electrical Door Locks System Check

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	<ol style="list-style-type: none"> 1. Remove the key from the ignition lock key cylinder. 2. Close all of the vehicle doors. <ul style="list-style-type: none"> • Operate according to 8.9.4.4.1. 	<ul style="list-style-type: none"> • All of the doors lock and unlock according to the guide listed in 8.9.4.4.1. 	<ul style="list-style-type: none"> • Doors are not locked and unlocked according to the guide 8.9.4.4.1.

Central Door Lock Usage Guide

1. LHF Cylinder

Be able to control unlock/lock all doors, except that luggage cylinder is deadlocked. (It can not unlock the luggage door when luggage door is deadlocked)

2. LHF Knob

Be able to control unlock/lock all doors, except that luggage cylinder is deadlocked. (It can not unlock the luggage door when luggage door is deadlocked)

3. RHF Cylinder

Be able to control unlock/lock all doors, except that DEADLOCK condition applies. (When LHF cylinder is deadlocked, it loose control functions; when luggage door is deadlocked, it can not unlock the luggage door).

4. RHF Knob

Be able to control unlock all doors, except that DEADLOCK condition applies. (When LHF cylinder is deadlocked, it loose control functions; when luggage door is deadlocked, it can not unlock the luggage door).

5. Luggage Cylinder

Be able to control unlock/lock all doors, except when LHF luggage cylinder is deadlocked. (It can not control all four doors of passenger compartment)

6. LHF Cylinder Deadlock

All four doors of passenger compartment are locked, but only using luggage key to unlock / lock luggage door.

7. Luggage Cylinder Deadlock

Luggage door is locked, none of the LHF CYLINDER, LHF KNOB, RHF CYLINDER and RHF KNOB can unlock the luggage door.

8.9.4.10B Electrical Door Locks System Check

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	<ol style="list-style-type: none"> 1. Remove the key from the ignition lock key cylinder. 2. Close all of the vehicle doors. <ul style="list-style-type: none"> • Operate according to 8.9.4.4.1. 	<ul style="list-style-type: none"> • All of the doors lock and unlock according to the guide listed in 8.9.4.4.1. 	<ul style="list-style-type: none"> • Doors are not locked and unlocked according to the guide 8.9.4.4.1.

Central Door Lock Usage Guide

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. LHF Cylinder
Be able to control unlock/lock all doors. 2. LHF Knob
Be able to control unlock/lock all doors. 3. RHF Cylinder
Be able to control unlock/lock all doors, except that DEADLOCK condition applies. | <ol style="list-style-type: none"> 4. RHF Knob
Be able to control unlock all doors, except that DEADLOCK condition applies.
Only can Lock RHF door. 5. LHF Cylinder Deadlock
All doors are locked, no other way can open them. |
|---|--|

8.9.5 Repair Instructions

8.9.5.1 Front Door Replacement

Removal Procedure

1. Remove Mirror. Refer to Mirror Replacement.
2. Remove Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.
3. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
4. Remove Window. Refer to Window Replacement.
5. Remove Weather Strip. Refer to Weather Strip Replacement - Front Door Window .
6. Remove Window Rear Guide. Refer to Front Door Window Rear Guide Replacement.
7. Remove Window Lifter. Refer to Front Door Lifter Replacement.
8. Remove Inside Handle. Refer to Inside Handle Replacement of Interior Trim.
9. Remove Latch. Refer to Latch Replacement.
10. Remove Outer Handle & Lock Cylinder Assembly. Refer to Front Door Outer Handle Replacement.
11. Remove Limiter.
12. Remove Cables.
13. Remove Hinge Pin.

Installation Procedure

1. Install Hinge Pin.
2. Install Cables.
3. Install Limiter.
4. Install Outer Handle & Lock Cylinder Assembly. Refer to Front Door Outer Handle Replacement.
5. Install Latch. Refer to Latch Replacement.
6. Install Inside Handle. Refer to Inside Handle Replacement of Interior Trim.
7. Install Window Lifter. Refer to Front Door Lifter Replacement.
8. Install Window Rear Guide. Refer to Front Door Window Rear Guide Replacement.
9. Install Weather Strip. Refer to Weather Strip Replacement.
10. Install Window. Refer to Window Replacement.
11. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
12. Install Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.

13. Install Mirror. Refer to Mirror Replacement.

8.9.5.2 Rear Door Replacement

Removal Procedure

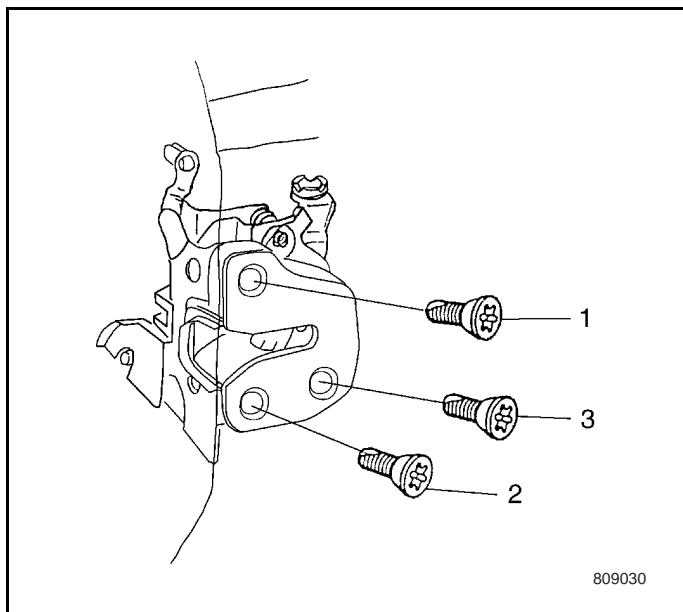
1. Remove Inner Triangle Panel. Refer to Rear Door Triangle Panel Replacement of Interior Trim.
2. Remove Glass Lifter Handle.
3. Remove Handle Bezel.
4. Remove Pull Handle. Refer to Pull Handle Replacement of Interior Trim.
5. Remove Window Sill Inner Sealing Strip. Refer to Rear Door Window Sill Inner Sealing Strip Replacement.
6. Remove Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
7. Remove Water Deflector. Refer to Rear Door Water Deflector and Rear Door Trim Panel Plastic Bracket Replacement in Interior Trim.
8. Remove Window Sill Outer Sealing Strip. Refer to Rear Door Window Sill Outer Sealing Strip Replacement.
9. Remove Window Glass Rear Guide. Refer to Rear Door Window Rear Guide Replacement.
10. Remove Window. Refer to Rear Door Window Replacement.
11. Remove Window Weather Strip. Refer to Weather Strip Replacement-Rear Door Window .
12. Remove Lock Cover.
13. Remove Window Lifter (Manual). Refer to Rear Door Window Lifter (Manual) Replacement.
14. Remove Lock Rod. Refer to Rear Door Lock Rod, Bellcrank and Clip Replacement.
15. Remove Inside Handle Rod. Refer to Rear Door Inside Handle Rod Replacement.
16. Remove Outside Handle Rod. Refer to Rear Door Outer Handle Rod, Adjusting Nut Replacement.
17. Remove Latch. Refer to Rear Door Latch Replacement.
18. Remove Outer Handle & Lock Cylinder Assembly. Refer to Rear Door Outer Handle Replacement.
19. Remove Outer Triangle Panel. Refer to Rear Door Outer Triangle Panel Replacement of Interior Trim.
20. Remove Checklink.
21. Remove Cables.
22. Remove Hinge Pins.

Installation Procedure

1. Install Hinge Pins.
2. Install Cables.
3. Install Checklink.
4. Install Outer Triangle Panel. Refer to Rear Door Outer Triangle Panel Replacement of Interior Trim.
5. Install Outer Handle & Lock Cylinder Assembly. Refer to Rear Door Outer Handle Replacement.
6. Install Latch. Refer to Rear Door Latch Replacement.
7. Install Outer Handle Rod. Refer to Rear Door Outer Handle Rod, Adjusting Nut Replacement.
8. Install Inside Handle Rod. Refer to Rear Door Inside Handle Rod Replacement.
9. Install Lock Rod. Refer to Rear Door Lock Rod, Bell crank and Clip Replacement.
10. Install Window Lifter (Manual). Refer to Rear Door Window Lifter (Manual) Replacement.
11. Install Lock Cover.
12. Install Window Weather Strip. Refer to Weather Strip Replacement-Rear Door Window.
13. Install Window. Refer to Rear Door Window Replacement.
14. Install Window Glass Rear Guide. Refer to Rear Door Glass Rear Guide Replacement.
15. Install Window Sill Outer Sealing Strip. Refer to Rear Door Window Sill Outer Sealing Strip Replacement.
16. Install Water Deflector. Refer to Rear Door Water Deflector and Rear Door Trim Panel Plastic Bracket Replacement in Interior Trim.
17. Install Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
18. Install Window Sill Inner Sealing Strip. Refer to Rear Door Window Sill Inner Sealing Strip Replacement.
19. Install Pull Handle. Refer to Pull Handle Replacement of Interior Trim.
20. Install Handle Bezel.
21. Install Glass Lifter Handle.
22. Install Inner Triangle Panel. Refer to Rear Door Triangle Panel Replacement of Interior Trim.

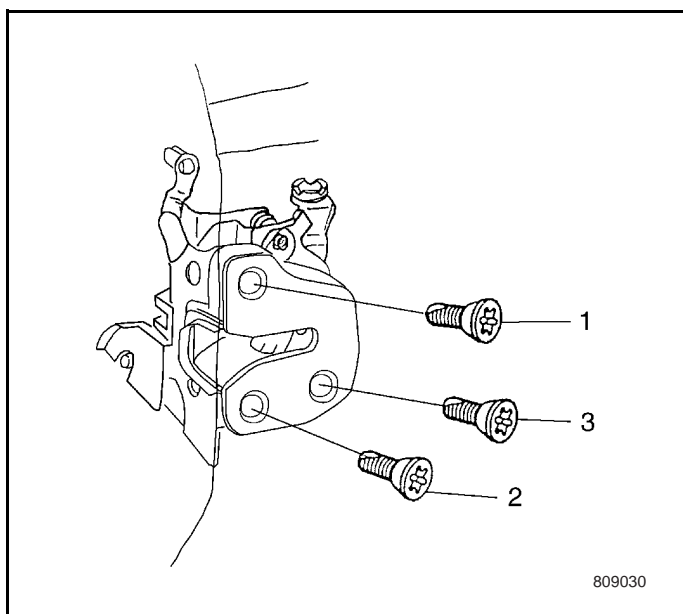
8.9.5.3 Latch Replacement - Front Door

Removal Procedure



1. Remove Outer Mirror Assembly. Refer to Manual / Electrical Outer Mirror Replacement.
2. Remove Trim Panel and Glove Compartment. Refer to Front Door Trim Panel Replacement of Interior Trim.
3. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
4. Remove Window Rear Guide. Refer to Front Door Window Rear Guide Replacement.
5. Release Outside Handle Rod. Refer to Front Door Outer Handle Rod, Adjusting Nut Replacement.
6. Release Inside Handle Rod. Refer to Front Door Inside Handle Rod Replacement.
7. Release Lock Rod. Refer to Front Door Lock Rod Replacement.
8. Release Lock Cylinder Rod. Refer to Front Door Lock Cylinder Rod Replacement.
9. Remove the Door Latch Screw (1, 2, 3).
10. Disconnect the Electrical connectors from Latch (SE, SX only).

Installation Procedure

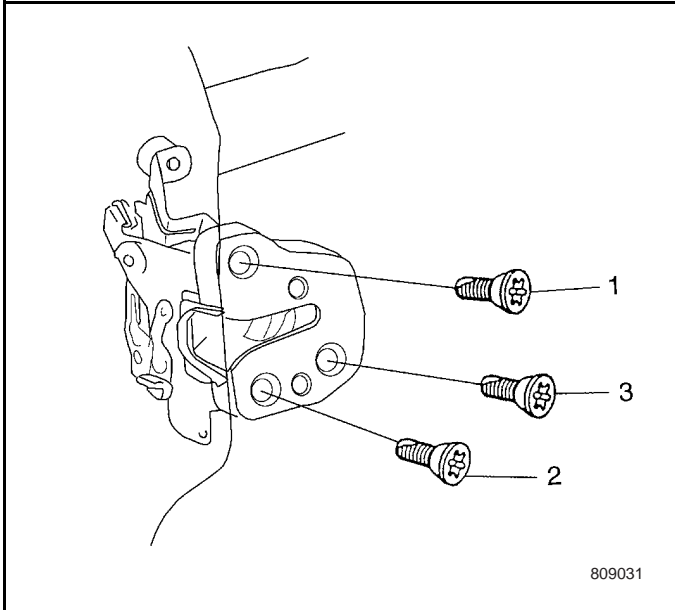


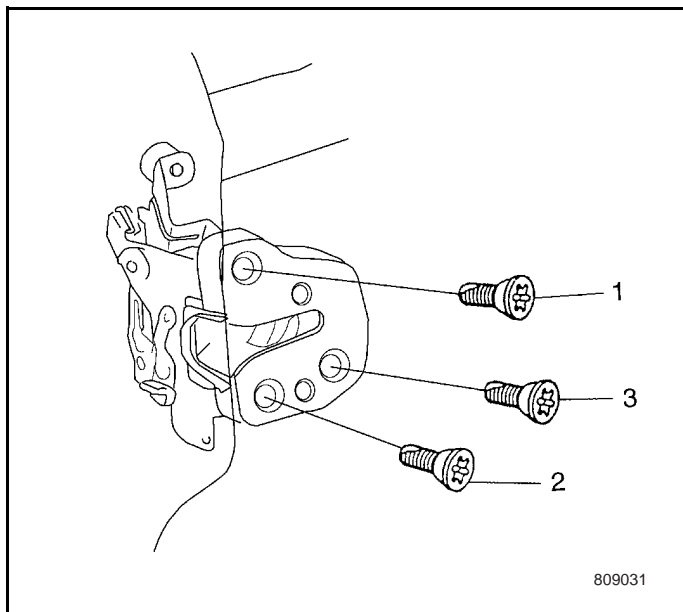
1. Connect the Electrical connectors from Latch (SE, SX only).
2. Install the screws of latch, and tighten the screws to 8 - 12 N•m.
3. Install Lock Cylinder Rod. Refer to Front Door Lock Cylinder Rod Replacement.
4. Install Lock Rod. Refer to Front Door Lock Rod Replacement.
5. Install Inside Handle Rod. Refer to Front Door Inside Handle Rod Replacement.
6. Install Outside Handle Rod. Refer to Front Door Outer Handle Rod, Adjusting Nut Replacement.
7. Install Window Glass Rear Guide. Refer to Front Door Window Rear Guide Replacement.
8. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
9. Install Trim Panel and Glove Compartment. Refer to Front Door Trim Panel Replacement in Interior Trim.
10. Install Outer Mirror Assembly. Refer to Manual / Electrical Outer Mirror Replacement.

8.9.5.4 Latch Replacement - Rear Door

Removal Procedure

1. Remove Inner Triangle Panel. Refer to Rear Door Triangle Panel Replacement of Interior Trim.
2. Remove Window Glass Lifter Handle (Manual). Refer to Rear Door Window Lifter (Manual) Replacement.
3. Remove Handle Bezel.
4. Remove Pull Handle. Refer to Pull Handle Replacement of Interior Trim.
5. Remove Window Sill Inner Sealing Strip. Refer to Rear Door Window Sill Inner Sealing Strip Replacement.
6. Remove Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
7. Remove Water Deflector. Refer to Rear Door Water Deflector and Rear Door Trim Panel Plastic Bracket Replacement in Interior Trim.
8. Remove Window Sill Outer Sealing Strip. Refer to Rear Door Window Sill Outer Sealing Strip Replacement.
9. Remove Window Glass Rear Guide. Refer to Rear Door Window Rear Guide Replacement.
10. Remove Window. Refer to Rear Door Window Replacement.
11. Remove Lock Cover.
12. Release Locking Rod from Latch.
13. Release Inside Handle Rod from Latch.
14. Remove Outside Handle Rod. Refer to Rear Door Outside Handle Rod, Adjusting Nut Replacement.
15. Remove the Door Latch Screw (1, 2, 3).
16. Remove the door electrical connectors from the door latch. (SE, SX only).





Installation Procedure

1. Connect the Electrical connectors from Lock (SE, SX only).
2. Install the screws of door latch.

Tightening

Tighten the screws to 8 -12 N•m.

3. Install Outside Handle Rod. Refer to Rear Door Outside Handle Rod, Adjusting Nut Replacement.
4. Connect Inside Handle Rod to Latch.
5. Connect Locking Rod to Latch.
6. Install Lock Cover.
7. Install Window. Refer to Rear Door Window Replacement.
8. Install Window Glass Rear Guide. Refer to Rear Door Window Rear Guide Replacement.
9. Install Window Sill Outer Sealing Strip. Refer to Rear Door Window Sill Outer Sealing Strip Replacement.
10. Install Water Deflector. Refer to Rear Door Water Deflector and Rear Door Trim Panel Plastic Bracket Replacement in Interior Trim.
11. Install Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
12. Install Window Sill Inner Sealing Strip. Refer to Rear Door Window Sill Inner Sealing Strip Replacement.
13. Install Pull Handle. Refer to Pull Handle Replacement of Interior Trim.
14. Install Handle Bezel.
15. Install Glass Lifter Handle.
16. Install Inner Triangle Panel. Refer to Rear Door Triangle Panel Replacement of Interior Trim.

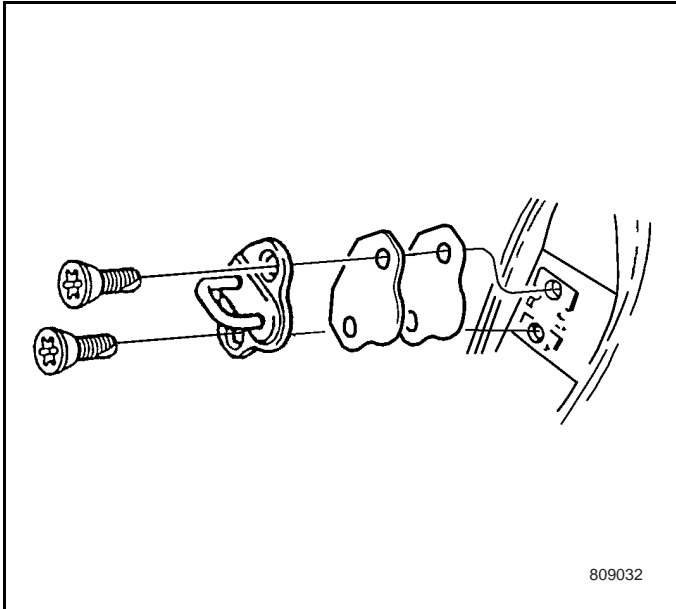
8.9.5.5 Door Striker adjustment

Adjust the striker up or down and inboard or outboard.

1. Loosen the striker screws.
2. Move the striker up or down and inboard or outboard as required.
3. Tighten the door lock striker screws to 25 N•m.

Adjust the striker forward or rearward.

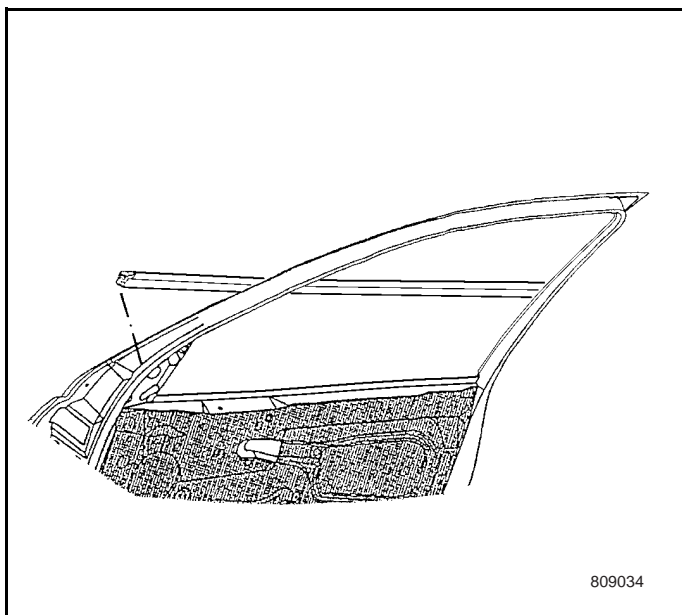
1. Apply modeling clay or the body caulking compound to the door lock opening.
2. Close the door far enough for the striker to make compound.
3. Closing the door all the way will make removing the clay or caulking compound difficult.
4. Open the door and check the striker impression is centered forward and rearward in the lock opening.
5. If the adjustment is needed, please follow these procedures:
 - Remove the striker.
 - Add or remove spacers as needed.
 - Install the striker.
 - Tighten the door lock striker screws to 25 N•m.
6. After installing the striker, paint any exposed, unpainted areas.



8.9.5.7 Sealing Strip Replacement - Front Door Window Sill Outer

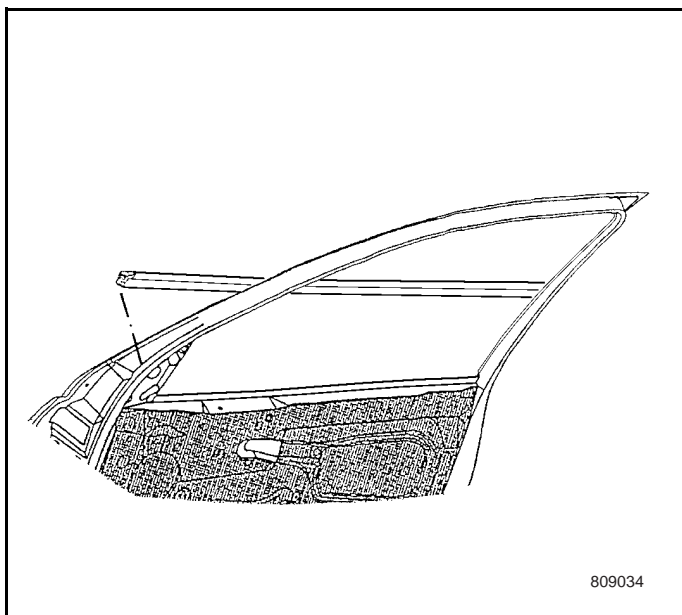
Removal Procedure

1. Remove the Outer Rearview Mirror Assembly. Refer to Manual / Electrical Outer Mirror Replacement.
2. Remove the Window Sill Outer Sealing Strip.



Installation Procedure

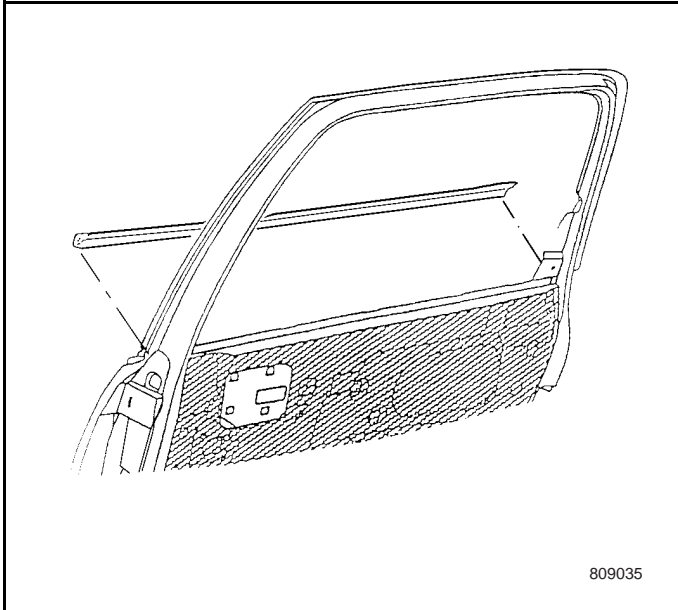
1. Install the outer sealing strip on the door flange by pressing the strip in place.
2. Install the Outer Rearview Mirror Assembly. Refer to Manual / Electrical Outer Mirror Replacement.



8.9.5.8 Sealing Strip Replacement - Rear Door Window Sill Outer

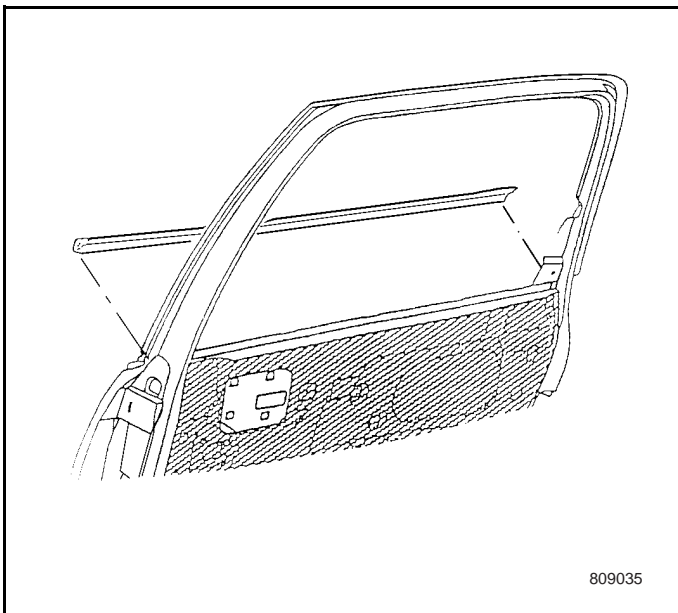
Removal Procedure

1. Position the window all the way down.
2. Use your fingertips in order to pull window sill outer sealing strip from the door flange.



Installation Procedure

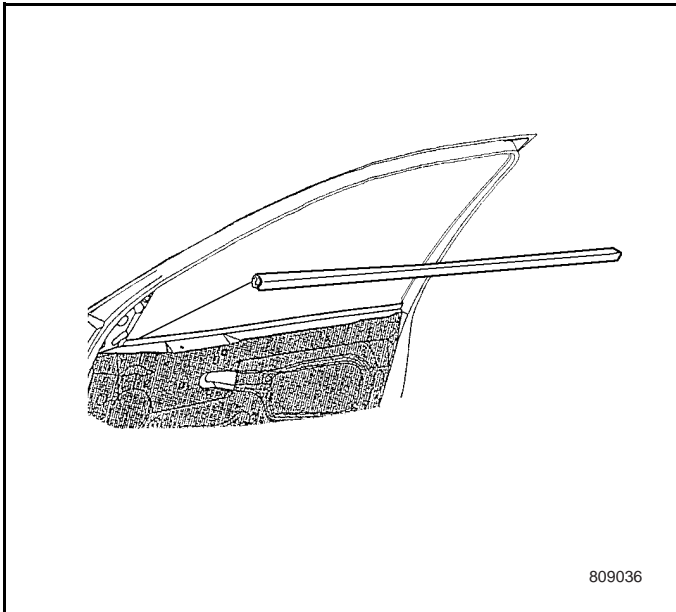
1. Install the outer sealing strip on the door flange by pressing the strip in place.
2. Install the cover - outer.



8.9.5.9 Sealing Strip Replacement - Front Door Window Sill Inner

Removal Procedure

1. Lower the window.
2. Remove Front Door Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.
3. Remove the window sill inner sealing strip by lifting it off the weld flange.

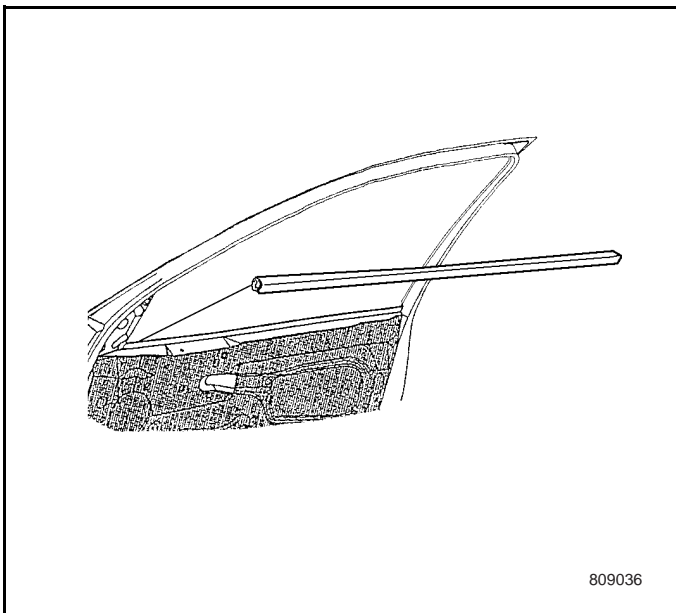


Installation Procedure

1. Install Window Sill Inner Sealing Strip. Engage each end of the sealing strip by pressing firmly onto the front and the rear ends of the weld flange.

Note:

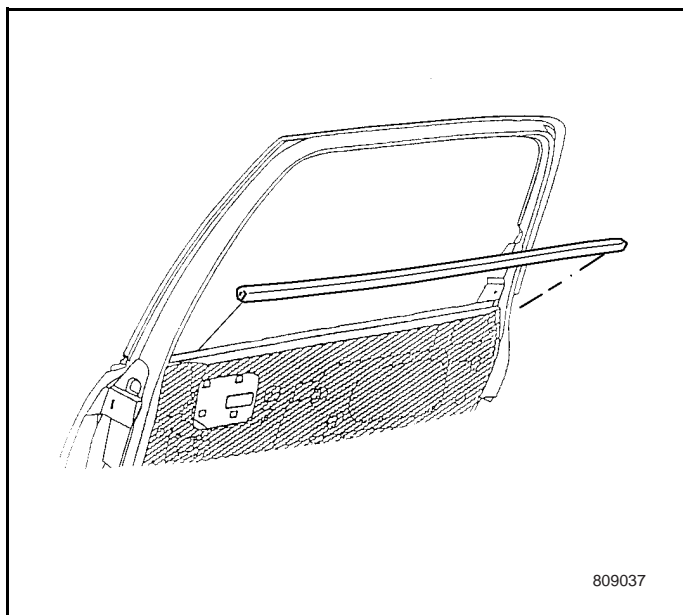
- Ensure the front end of the strip is inserted into the gap formed by the window weather - strip and the door inner panel.
 - Ensure the rear end of the strip is flush to the rear leg of the window weather - strip, but not interfering with the path of the window.
2. Firmly seat the entire length of the sealing strip.
 3. Install Front Door Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.
 4. Raise the window.



8.9.5.10 Sealing Strip Replacement - Rear Door Window Sill Inner

Removal Procedure

1. Lower the window.
2. Remove Rear Door Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
3. Remove the window sill inner sealing strip by lifting it off the weld flange.

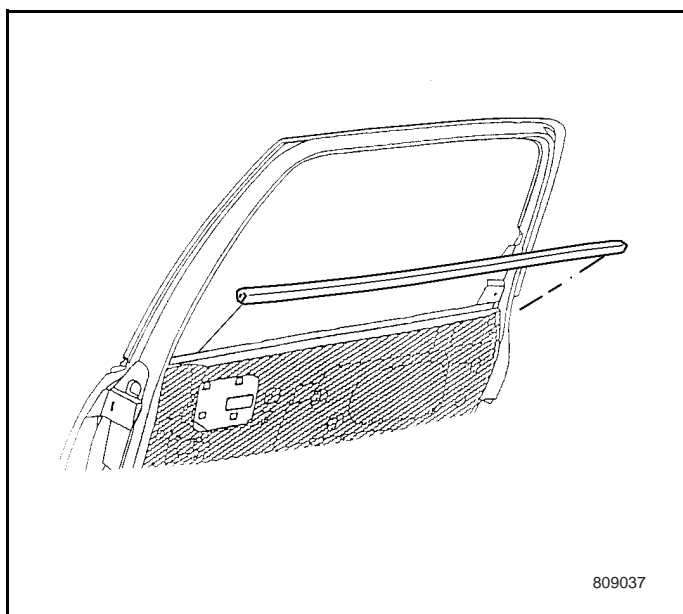


Installation Procedure

1. Install the sealing strip by engaging each end of the sealing strip by pressing firmly onto the front and the rear ends of the weld flange.

Note:

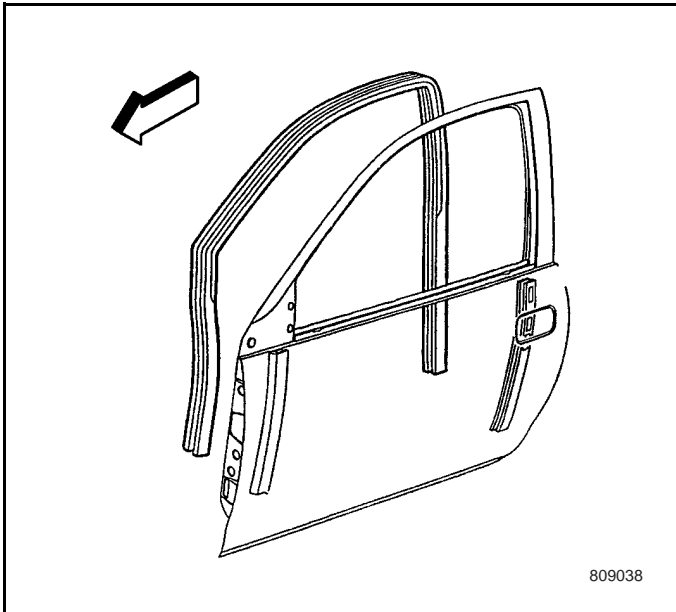
- Ensure the front end of the strip is inserted into the gap formed by the window weather - strip and the door inner panel.
 - Ensure the rear end of the strip is flush to the rear leg of the window weather - strip, but not interfering with the path of the window.
2. Use hand pressure to firmly seat the sealing strip on the door weld flange.
 3. Install Rear Door Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
 4. Raise the window.



8.9.5.11 Weather Strip Replacement - Front Door Window

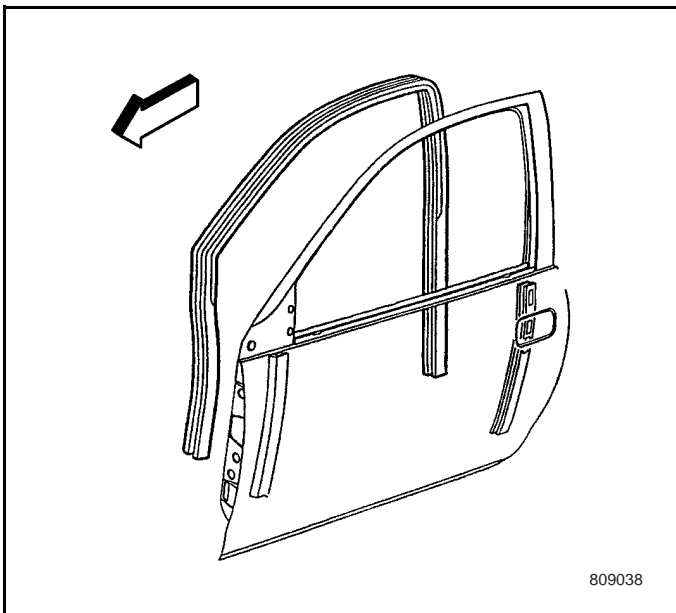
Removal Procedure

1. Remove Front Door Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.
2. Remove the water deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
3. Remove Front Door Window Sill Inner Sealing Strip. Refer to Front Door Window Sill Inner Sealing Strip Replacement.
4. Remove Front Door Window Sill Outer Sealing Strip. Refer to Front Door Window Sill Outer Sealing Strip Replacement.
5. Remove Front Window. Refer to Front Door Window Replacement.
6. Carefully pull the window weather - strip from the door.



Installation Procedure

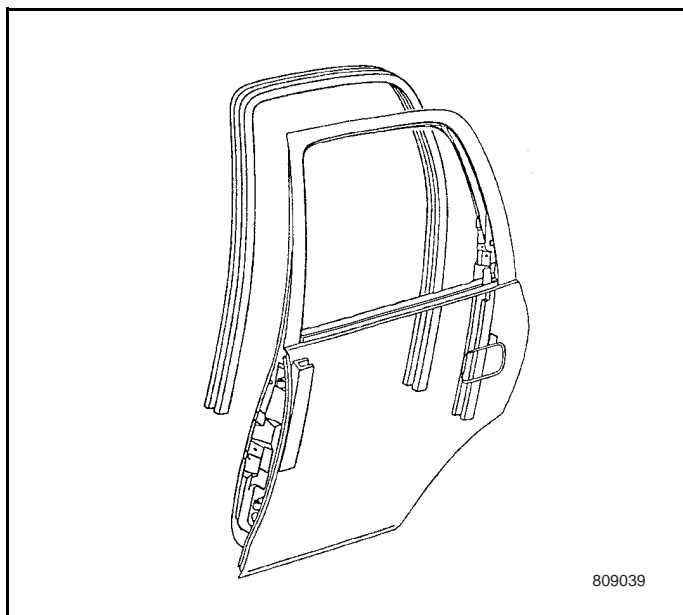
1. Install the window weather - strip to the door starting in the top corner working out in both directions.
2. Firmly seat the window - strip to the door.
3. Install the door window. Refer to Front Door Window Replacement.
4. Install Window Sill Outer Sealing Strip. Refer to Front Door Window Sill Outer Sealing Strip Replacement.
5. Install Window Sill Inner Sealing Strip. Refer to Front Door Window Sill Inner Sealing Strip Replacement.
6. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
7. Install Front Door Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.



8.9.5.12 Weather Strip Replacement - Rear Door Window

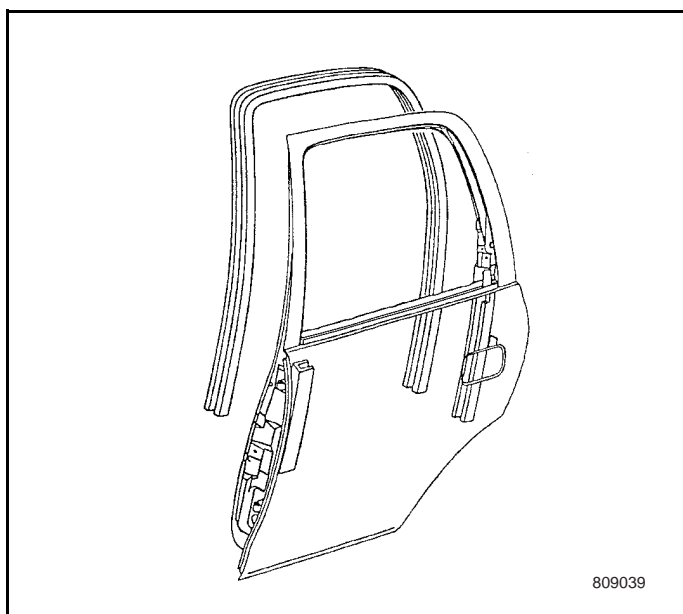
Removal Procedure

1. Position the window in the full down position.
2. Remove Rear Door Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
3. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
4. Remove Window Sill Inner Sealing Strip. Refer to Rear Door Window Sill Inner Sealing Strip Replacement.
5. Remove Window. Refer to Rear Door Window Replacement.
6. Pull the weather - strip from the door.



Installation Procedure

1. Install the window weather - strip to the door starting in the top corner and working out in both directions.
2. Firmly seat the window - strip to the door.
3. Install Window. Refer to Rear Door Window Replacement.
4. Close the window.
5. Inspect the glass to ensure it is properly positioned in the window weather - strip.
6. Install Window Sill Inner Sealing Strip. Refer to Rear Door Window Sill Inner Sealing Strip Replacement.
7. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
8. Install Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.

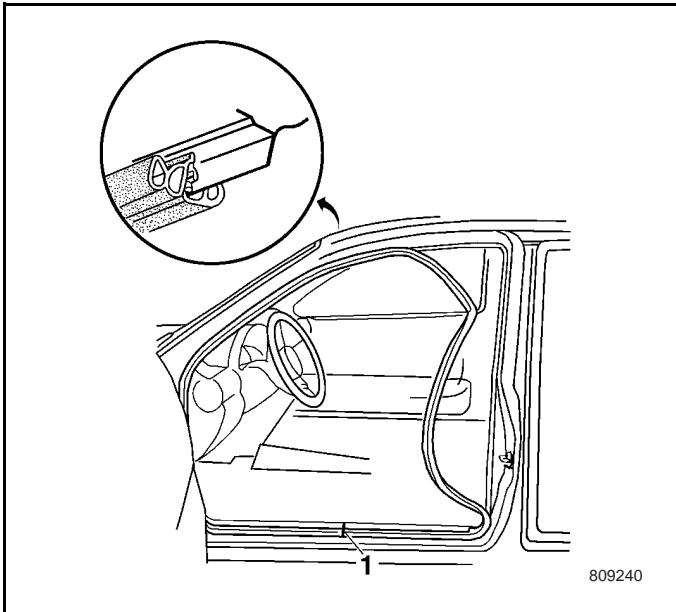


8.9.5.13 Weather Strip Replacement - Front Door Opening

Removal Procedure

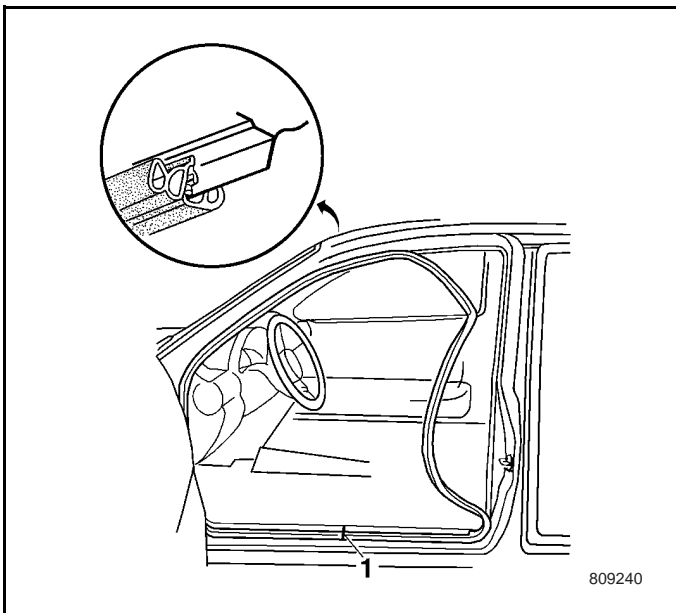
1. Open the front door.
2. Remove Door Sill Trim Panel. Refer to Door Sill Trim Panel Replacement of Interior Trim.
3. Remove the front door weather - strip by pulling it off the pinchweld flange.

Note: Mark the position of gap (1) completely. Removing door weather - strip must not be re-used in compliance with the mounting instructions.



Installation Procedure

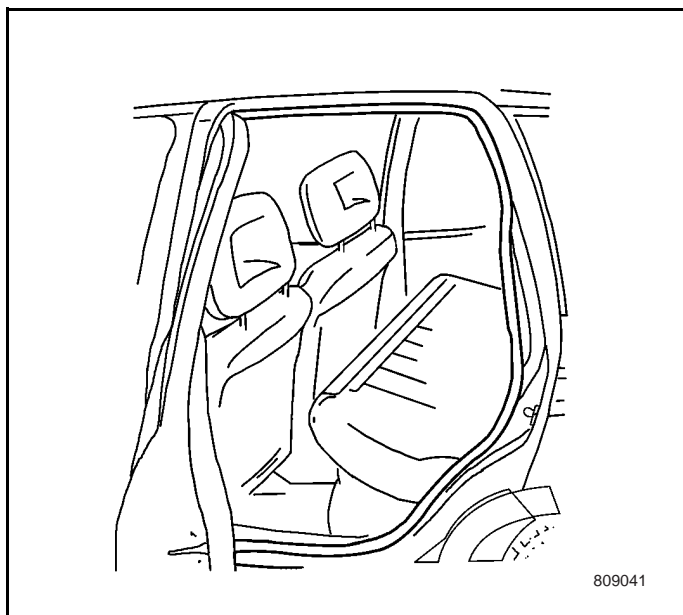
1. Push the weather - strip onto the flange of the body.
2. Install Side Sill Trim Panel. Refer to Door Sill Trim Panel Replacement of Interior Trim.
3. Pull out the insert line from weather - strip and inspect if lips cover the trim panel.
4. Close the front door.



8.9.5.14 Weather Strip Replacement - Rear Door Opening

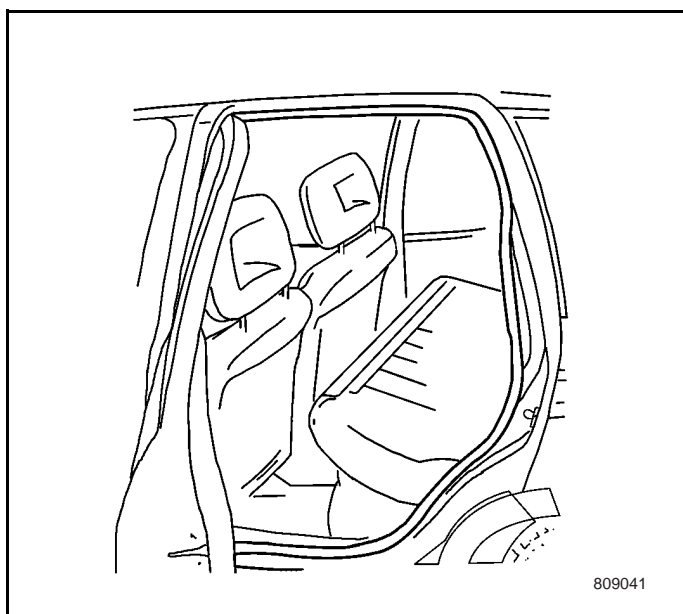
Removal Procedure

1. Open the rear door.
2. Remove Rear Door Sill Trim Panel. Refer to Door Sill Trim Panel Replacement of Interior Trim.
3. Remove the rear door weather - strip by pulling it off the pinchweld flange.



Installation Procedure

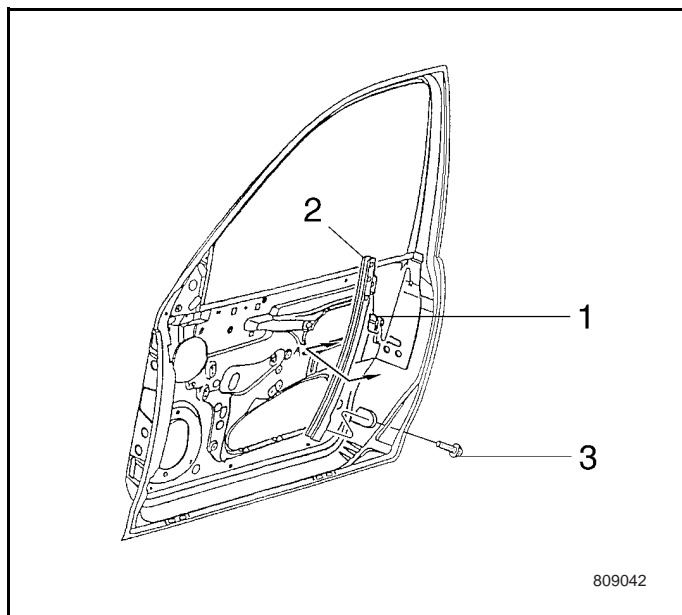
1. Push the weather - strip onto the pinchweld flange.
2. Inspect that the weather - strip is smooth and flat in appearance.
3. Pull out the insert line from weather - strip and inspect if lips cover the trim panel.
4. Install Side Sill Trim Panel. Refer to Door Sill Trim Panel Replacement of Interior Trim.
5. Close the rear door.



8.9.5.15 Window Rear Guide Replacement - Front Door

Removal Procedure

1. Remove Window Weather Strip. Refer to Weather Strip Replacement-Front Door Window.
2. Loosen and remove the fixing bolt.
3. Haul down and remove the window glass rear guide from door.



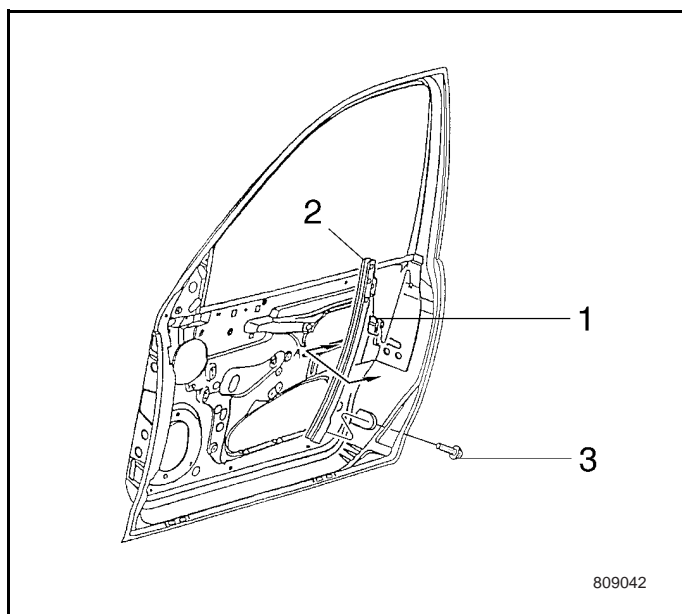
Installation Procedure

1. Install the window glass rear guide and the fixing bolt.

Tightening

Tighten the guide bolt to 8-12 N•m.

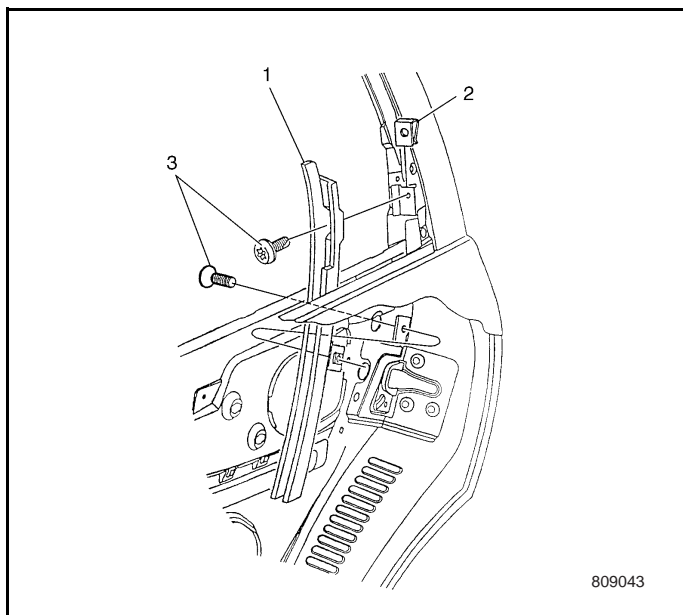
2. Install Window Weather Strip. Refer to Weather Strip Replacement - Front Door Window.



8.9.5.16 Window Rear Guide Replacement - Rear Door

Removal Procedure

1. Remove Weather Strip. Refer to Weather Strip Replacement-Rear Door Window .
2. Remove the guide by means of loosening and removing 2 fastening bolts.



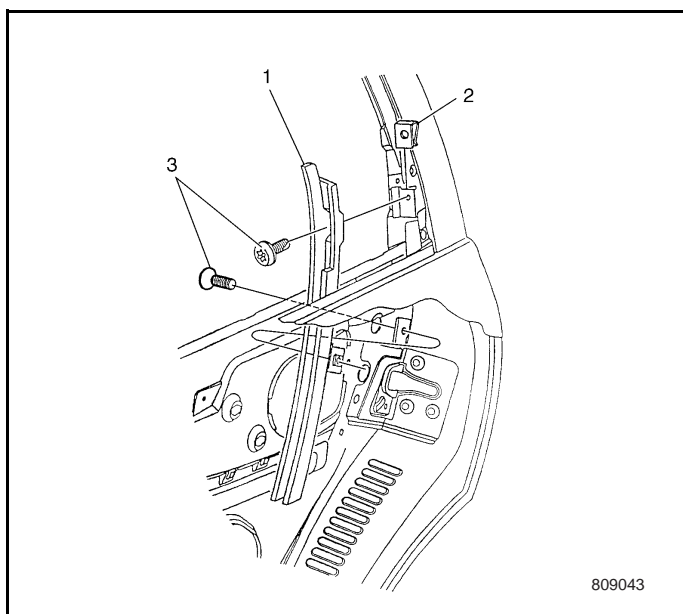
Installation Procedure

1. Install window glass rear guide and tighten it with fixing bolt.

Tightening

Tighten the guide bolt to 8-12 N•m.

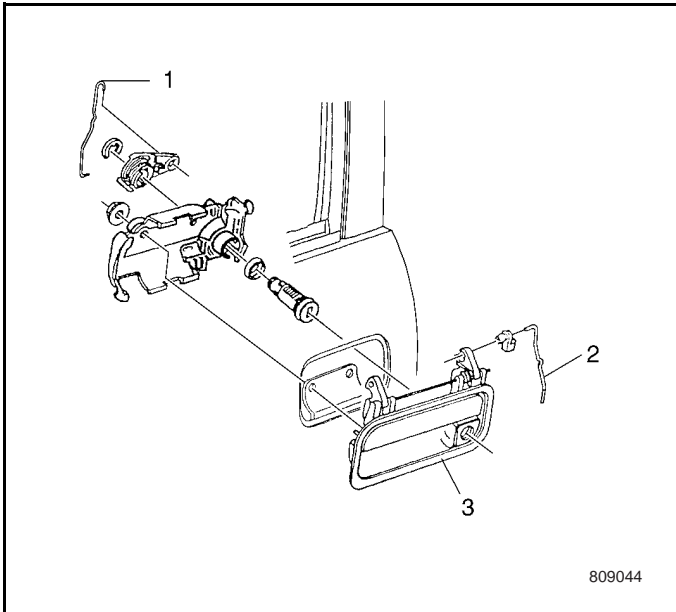
2. Install Window Weather Strip. Refer to Weather Strip Replacement - Rear Door Window.



8.9.5.17 Door Handle O/S Replacement - Front

Removal Procedure

1. Remove Window Weather Strip. Refer to Weather Strip Replacement - Front Door Window.
2. Remove the cylinder rod from lock, refer to Cylinder Rod Replacement - Front.
3. Remove the two fixing screws of the handle on the door inner panel.
4. Remove Outer Handle & Lock Cylinder Assembly.



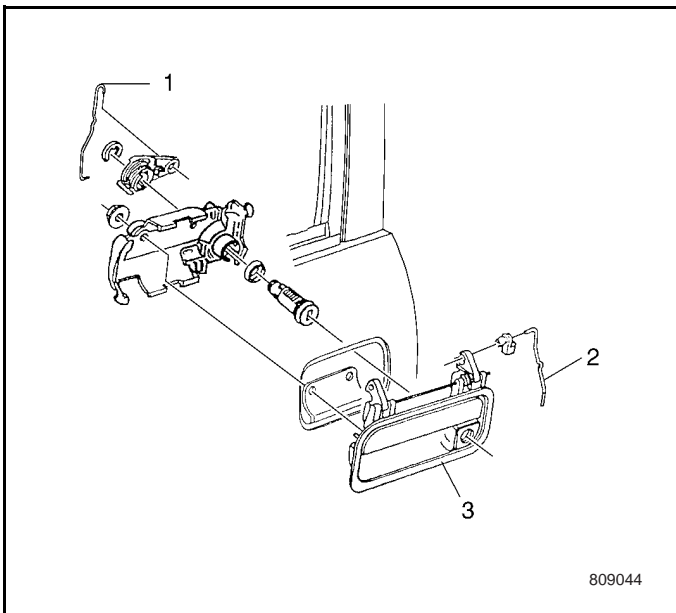
Installation Procedure

1. Install Outer Handle & Lock Cylinder Assembly.
2. Install the two fixing screws of the handle on the door inner panel.

Tightening

Tighten the bolts to 1.2 - 1.8 N•m.

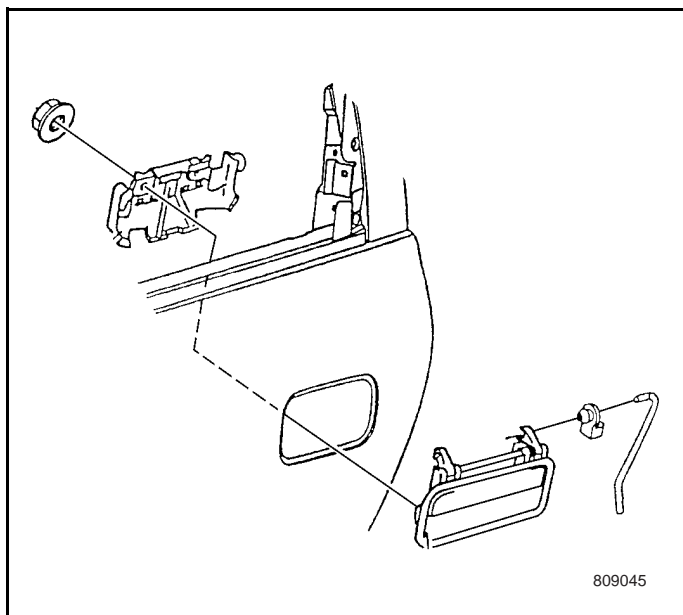
3. Install the cylinder rod onto lock, refer to Cylinder Rod Replacement - Front.
4. Install the weather - strip, please refer to Weather Strip Replacement-Front Door Window.



8.9.5.18 Door Handle O/S Replacement - Rear

Removal Procedure

1. Remove Window Weather Strip. Refer to Weather Strip Replacement - Rear Door Window.
2. Remove the two fixing screws of the handle on the door inner panel.
3. Remove the outside handle and the cylinder bracket.



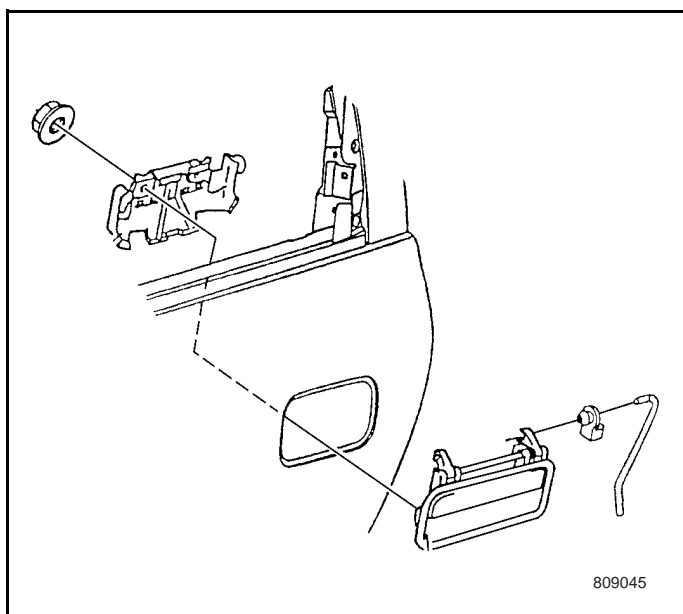
Installation Procedure

1. Install the outside handle and the cylinder bracket.
2. Install the two fixing screws of the handle on the door inner panel.

Tightening

Tighten the bolts to 1.2 - 1.8 N•m.

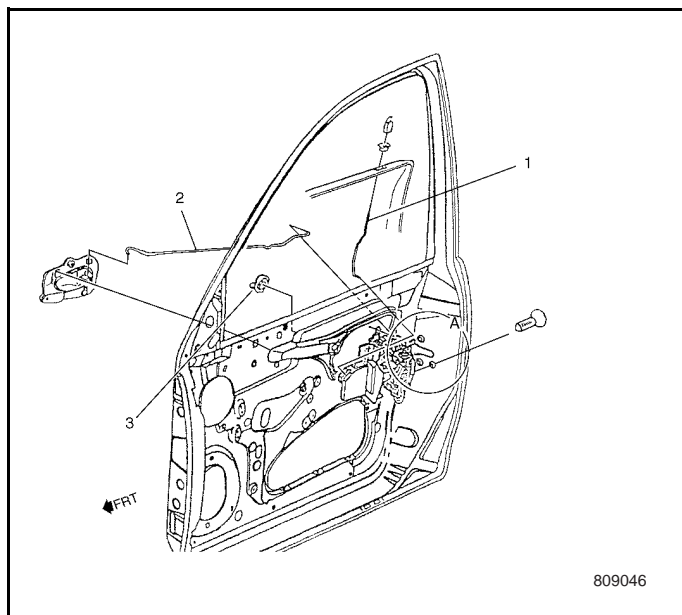
3. Install the weather - strip, please refer to Weather Strip Replacement - Rear Door Window.



8.9.5.19 Locking Rod Replacement - Front Door

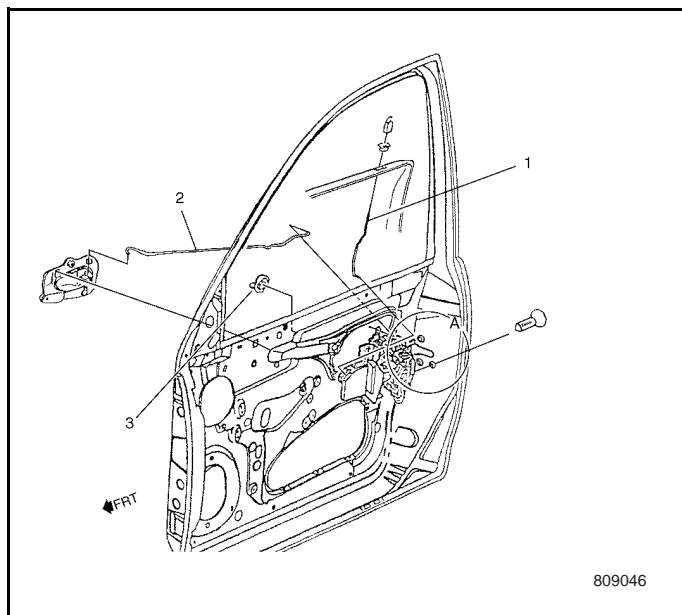
Removal Procedure

1. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
2. Remove Locking Rod from the lock.



Installation Procedure

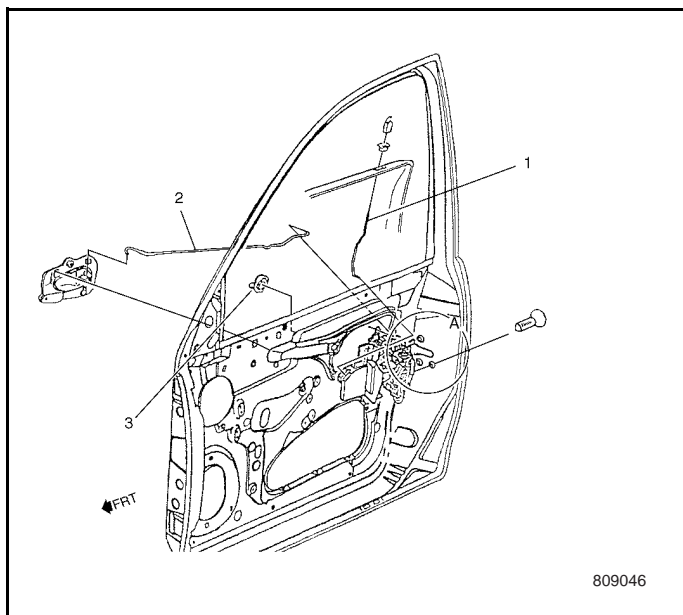
1. Install the locking rod to the lock.
2. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.



8.9.5.20 Door Handle Rod Replacement - Front Inside

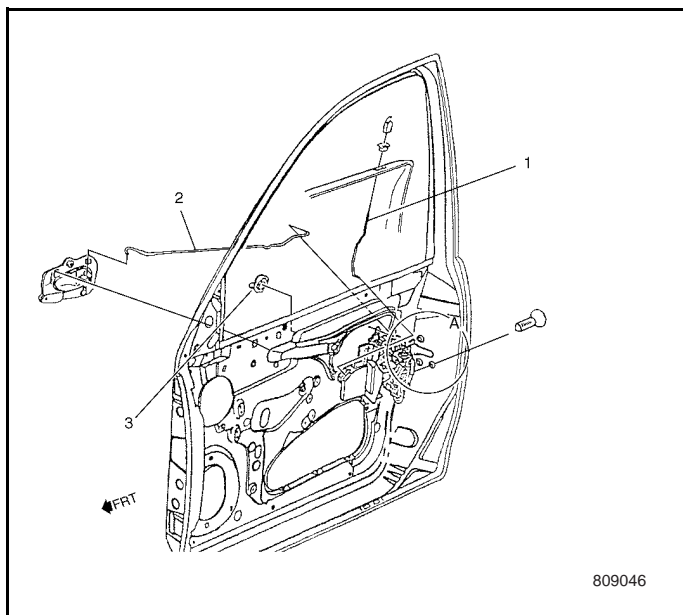
Removal Procedure

1. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
2. Remove Handle Rod from the lock.
3. Remove the handle rod from clip with aid of pushing the clip's back.
4. Remove the handle (with rod).
5. Remove the handle rod from the lock.



Installation Procedure

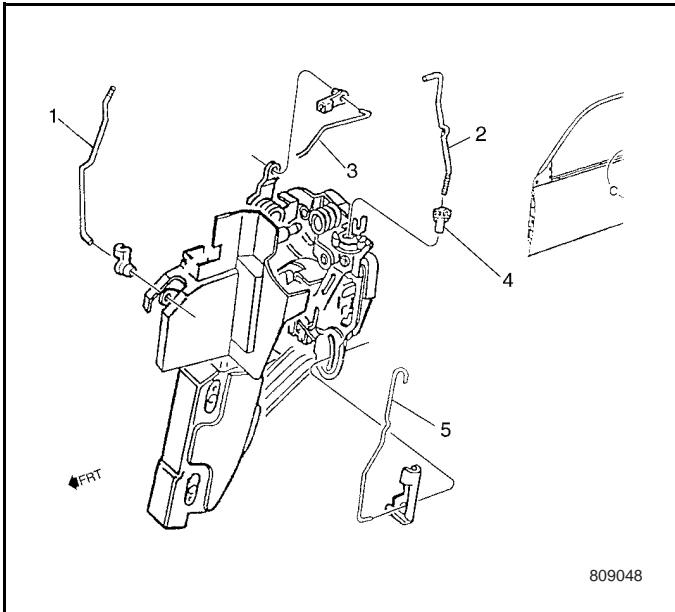
1. Install the handle rod and the handle.
2. Fix the handle rod and the clip together.
3. Install the handle rod to the lock.
4. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.



8.9.5.21 Door Handle Rod, Adjust Nut Replacement - Front Outside

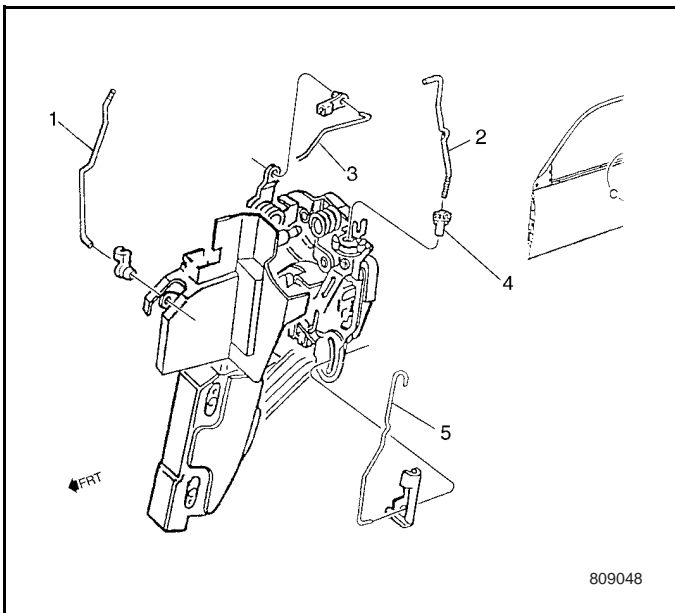
Removal Procedure

1. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
2. Lift window glass to full up position.
3. Remove the rod from the handle.
4. Remove the rod (with adjusting nut).
5. Remove adjusting nut from the rod.



Installation Procedure

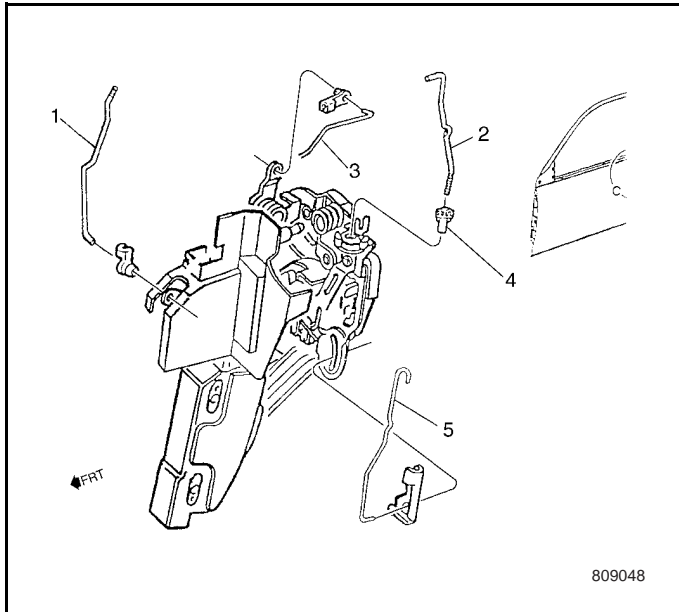
1. Install the adjusting nut to the rod.
2. Lift window glass to full up position.
3. Plug the rod (with adjusting nut) into the seat on the lock.
4. Install the rod to the handle.
5. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.



8.9.5.22 Cylinder Rod Replacement - Front Door Lock

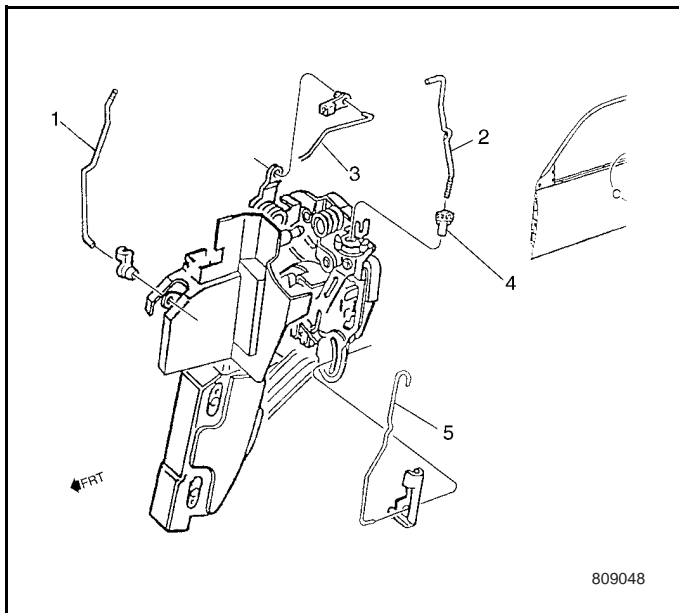
Removal Procedure

1. Remove the lock, refer to Front Door Latch Replacement.
2. Remove the rod from the lock.
3. Remove the cylinder assembly, refer to Door Handle O/S Replacement - Front.
4. Remove the rod from the cylinder assembly.



Installation Procedure

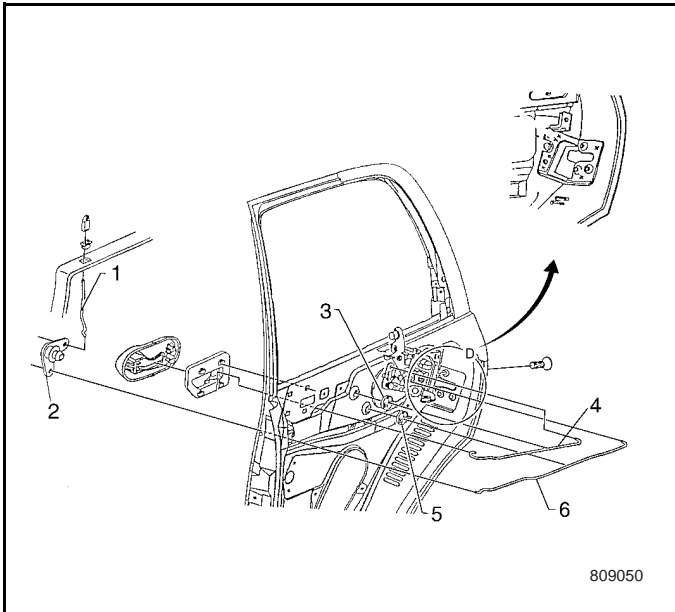
1. Install the rod to the cylinder assembly.
2. Install the cylinder assembly, refer to Door Handle O/S Replacement - Front.
3. Attach the rod to the lock.
4. Install the lock, refer to Front Door Latch Replacement.



8.9.5.23 Locking Rod, Bellcrank, Clip Replacement - Rear Door

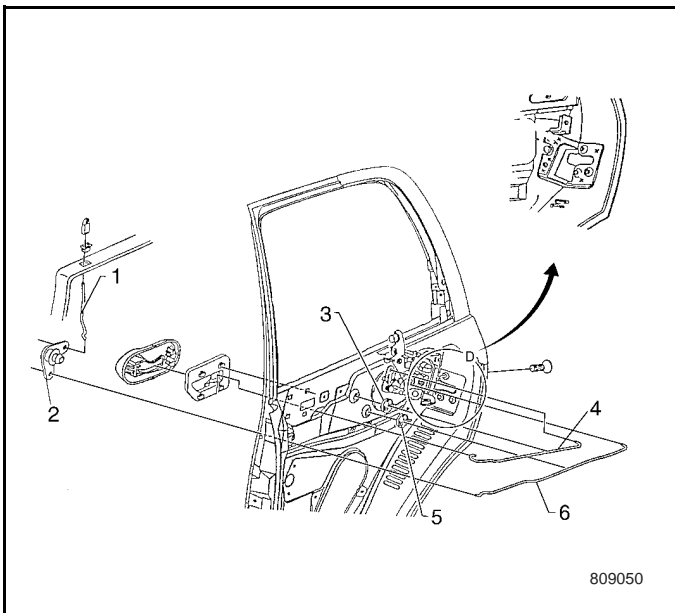
Removal Procedure

1. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
2. Push the bellcrank pin end and remove it, then remove the bellcrank from door inner panel.
3. Remove vertical locking rod from bellcrank.
4. Remove horizontal locking rod from the lock.
5. Remove bellcrank from horizontal locking rod.
6. Push the back of horizontal locking rod clip, then remove the locking rod from clip.
7. Remove the clip from door panel by means of rotating it for about 90°.



Installation Procedure

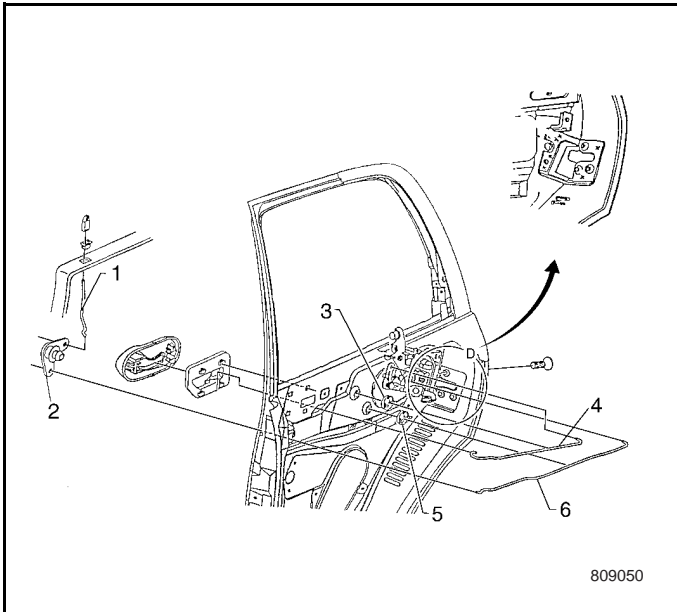
1. Install the clip to the door panel, and reversely rotate it about 90°.
2. Install the locking rod to clip.
3. Install bellcrank to horizontal locking rod.
4. Install horizontal locking rod to the lock.
5. Install vertical locking rod to the bellcrank.
6. Install the bellcrank and the bellcrank pin end.
7. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.



8.9.5.24 Door Handle Rod Replacement - Rear Inside

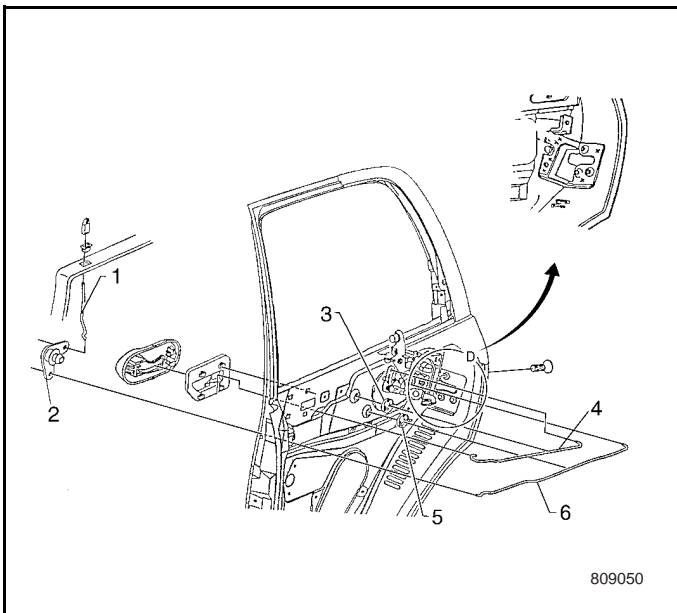
Removal Procedure

1. Remove Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.
2. Remove Handle Rod from the lock.
3. Remove handle rod from clip with aid of pushing the clip's back.
4. Remove the handle (with rod).
5. Remove the handle rod from the handle.



Installation Procedure

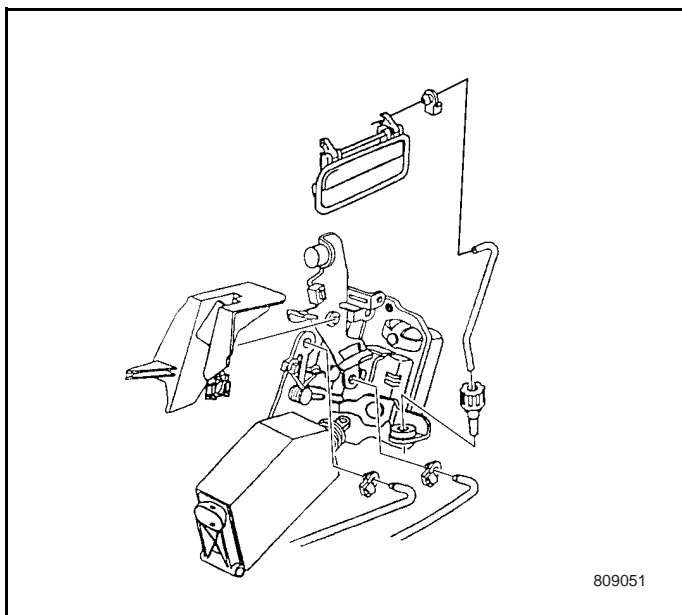
1. Install the handle rod to the handle.
2. Install Pull Handle.
3. Install the handle rod to clip.
4. Install the handle rod to lock.
5. Install Water Deflector. Refer to Front Door Water Deflector and Front Door Trim Panel Plastic Bracket Replacement in Interior Trim.



8.9.5.25 Door Handle Rod, Adjust Nut Replacement - Rear Outside

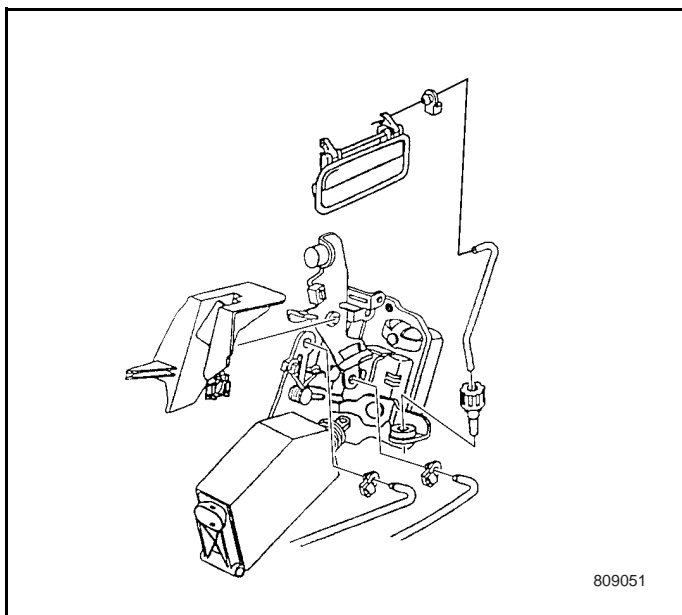
Removal Procedure

1. Remove Lock Cover. Refer to Rear Door Latch Replacement.
2. Remove the rod (with adjust nut) from the handle.
3. Remove adjusting nut from the rod.



Installation Procedure

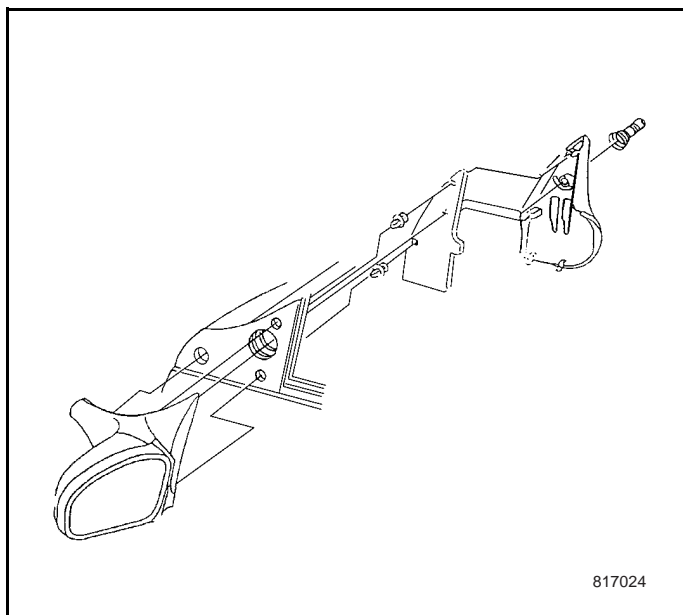
1. Install the adjusting nut to the rod.
2. Plug the rod (with adjusting nut) into the seat on the lock.
3. Install the rod to the handle.
4. Install the lock cover, refer to Rear Door Latch Replacement.



8.9.5.26 Mirror Replacement - Outside (Manual)

Removal Procedure

1. Remove the inside knob of mirror.
2. Remove Front Door Triangle Panel. Refer to Front Door Triangle Panel Replacement of Interior Trim.
3. Remove the mirror fastening screws.
4. Remove Mirror.



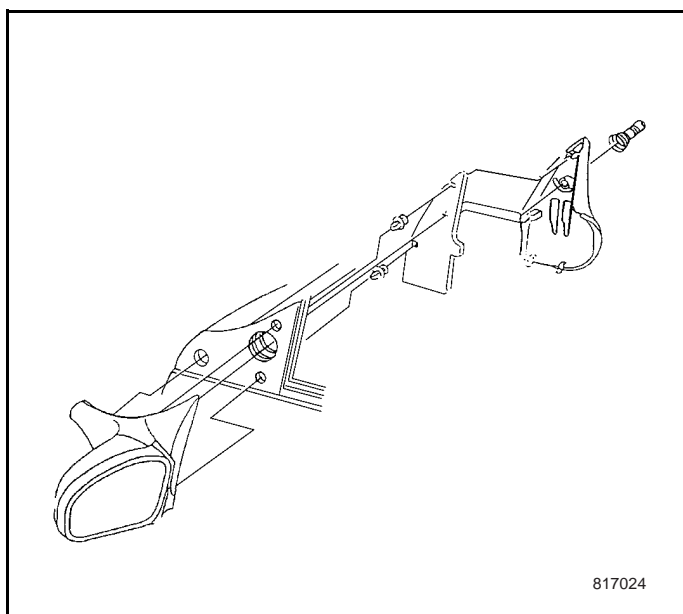
Installation Procedure

1. Position the mirror to the door.
2. Fasten the screws. Start at the lower left screw and tighten in clockwise direction.

Tightening

Tighten the outside mirror screws to 1.5-2 N•m.

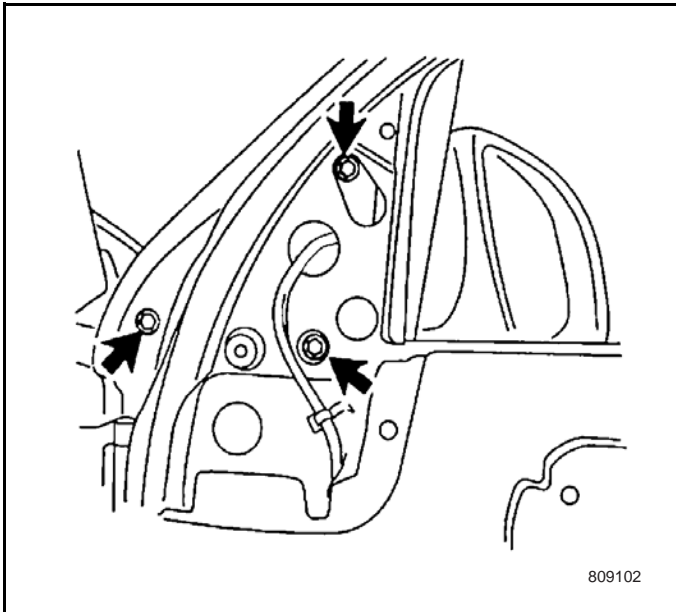
3. Install Front Door Triangle Panel. Refer to Front Door Triangle Panel Replacement in Interior Trim.
4. Install the inside knob of mirror.



8.9.5.26 Mirror Replacement - Outside (Electric) (If equipped)

Removal Procedure

1. Remove front door handle and trim panel, please refer to Front Door Trim Panel Replacement of Interior Trim.
2. Remove Front Door Triangle Panel from Outside Mirror. Refer to Front Door Triangle Panel Replacement of Interior Trim.
3. Remove the mirror fastening screws.
4. Disconnect the electrical connector.
5. Remove Outer Mirror Assembly.



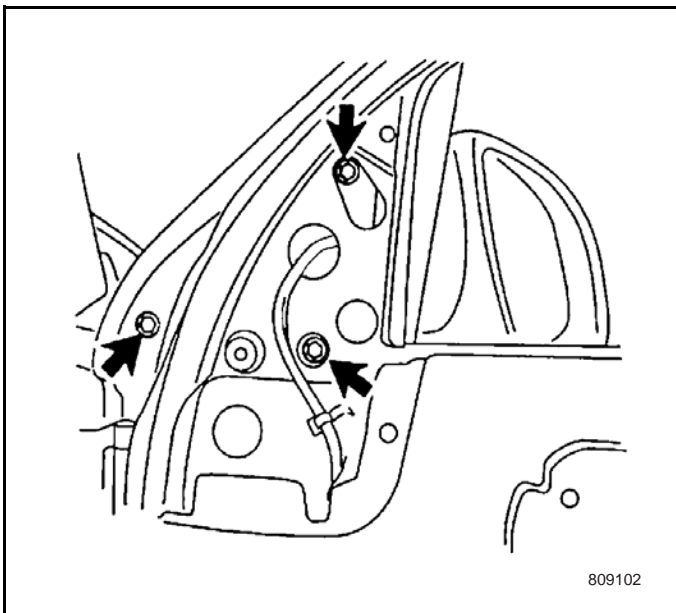
Installation Procedure

1. Position the mirror assembly to the door.
2. Fasten the screws. Start at the lower left screw and tighten in clockwise direction.

Tightening

Tighten the outside mirror screws to 1.5-2 N•m.

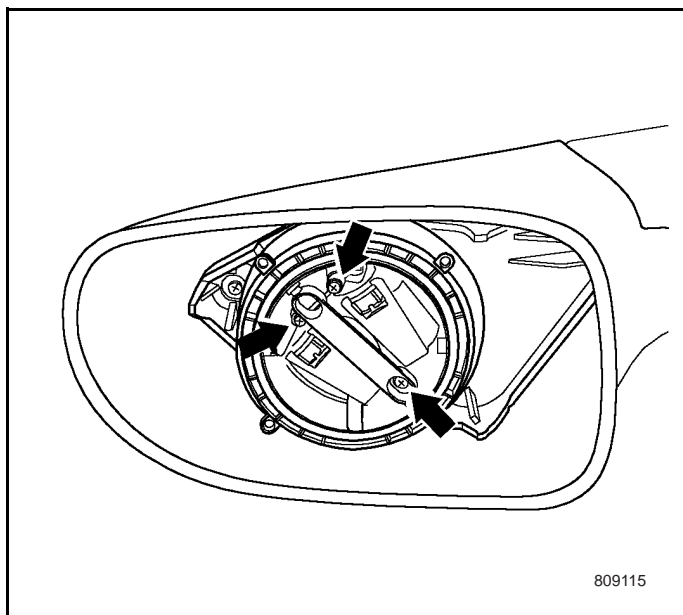
3. Connect the electrical connectors.
4. Install front door trim panel and handle, please refer to Front Door Trim Panel Replacement of Interior Trim.
5. Install Front Door Triangle Panel. Refer to Front Door Triangle Panel Replacement of Interior Trim.



8.9.5.28 Mirror Motor Replacement - Outside (Electrical)

Removal Procedure

1. Remove electric electrical mirror, refer to Mirror Replacement - Outside (Electrical).
2. Pry out the mirror plate, refer to Outside Mirror Plate Replacement.
3. Remove the mirror plate motor screws (At Arrow).
4. Remove the mirror motor with the harness from the mirror cover.



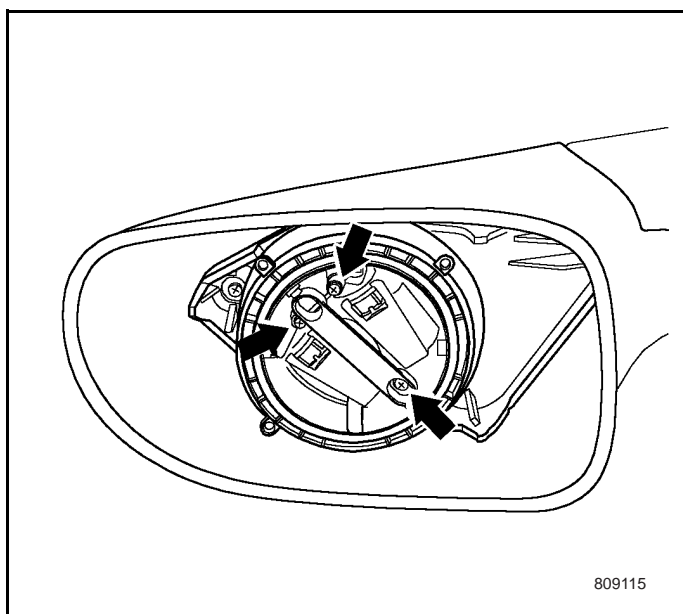
Installation Procedure

1. Install the mirror motor with the harness into the mirror cover.
2. Install the mirror motor. And tighten the motor fixing screws (At Arrow).

Tightening

Tightening

3. Press the mirror plate in place, refer to Outside Mirror Plate Replacement.
4. Install electric electrical mirror, refer to Mirror Replacement - Outside (Electrical).



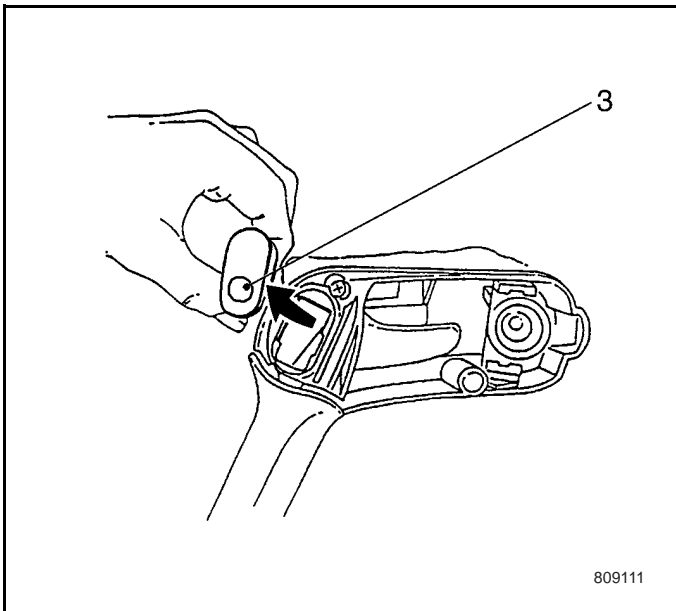
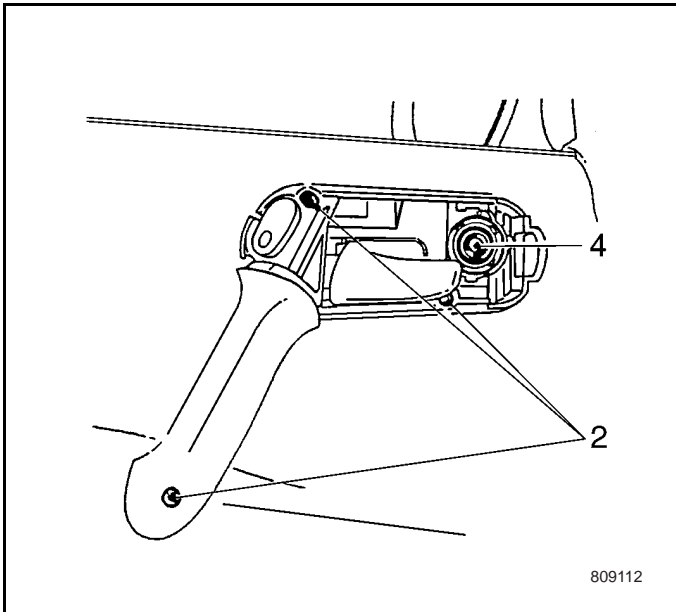
5.8.9.5.29 Mirror Switch Replacement - Outside (Electrical)

Removal Procedure

Required Tool: Plastic Wedge

Note: In order to avoid the damage, plastic wedge must be used to remove the handle cover.

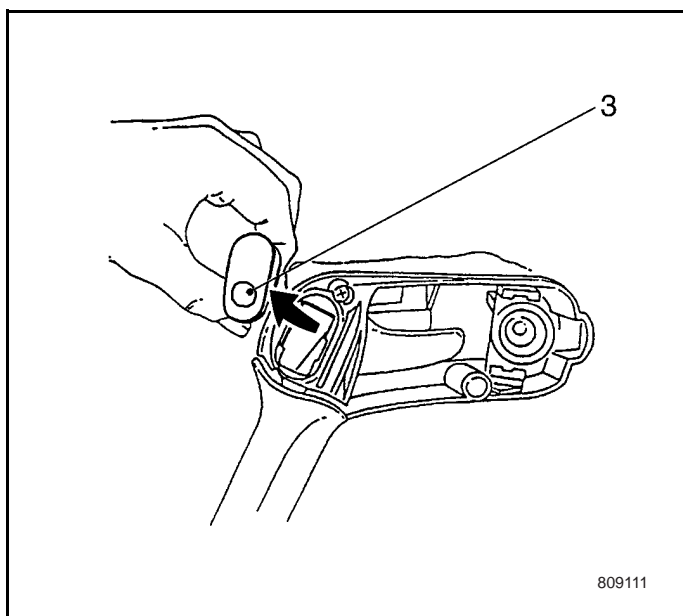
1. Use the plastic wedge to remove the cover from the sliding door handle.
2. Remove the three handle Screw 2, and release the handle.



3. Press out the switch from the handle (See Figure 817007).
4. Disconnect the electrical connector.

Installation Procedure

1. Connect the electrical connectors.
2. Install Switch 3 into the handle.

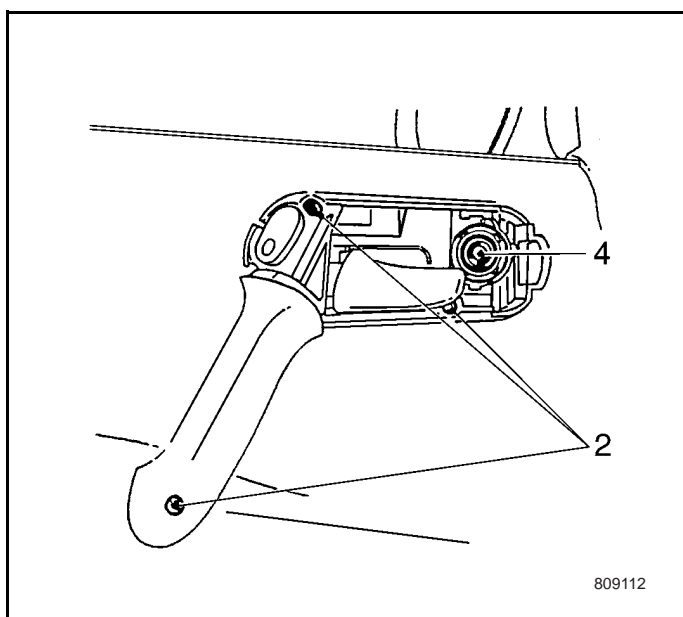


3. Position the handle on the door trim, and use three screws to fix it.

Tightening

Tighten the screws to 1.2 - 1.8 N•m.

4. Install the Cover.



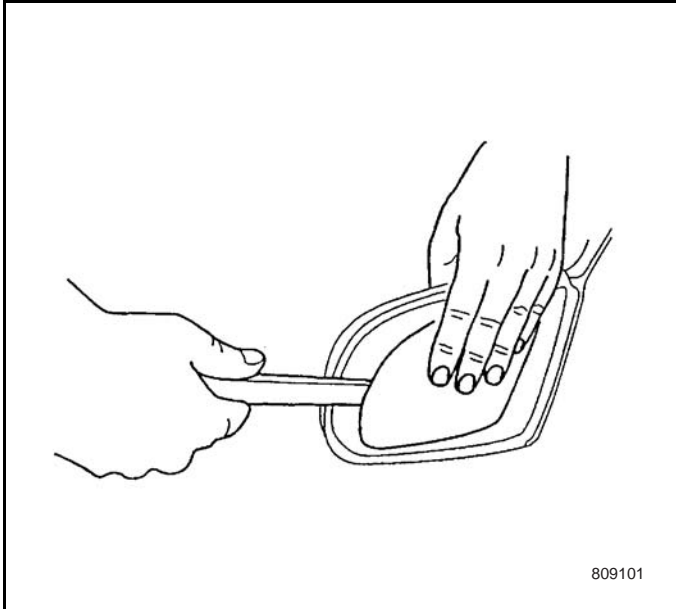
8.9.5.30 Mirror Plate Replacement - Outside

Removal Procedure

Required Tool: Plastic Wedge

Note: In order to avoid the damage, plastic wedge must be used to remove the mirror plate.

1. Use the plastic wedge to pry out the mirror plate from the mirror cover.



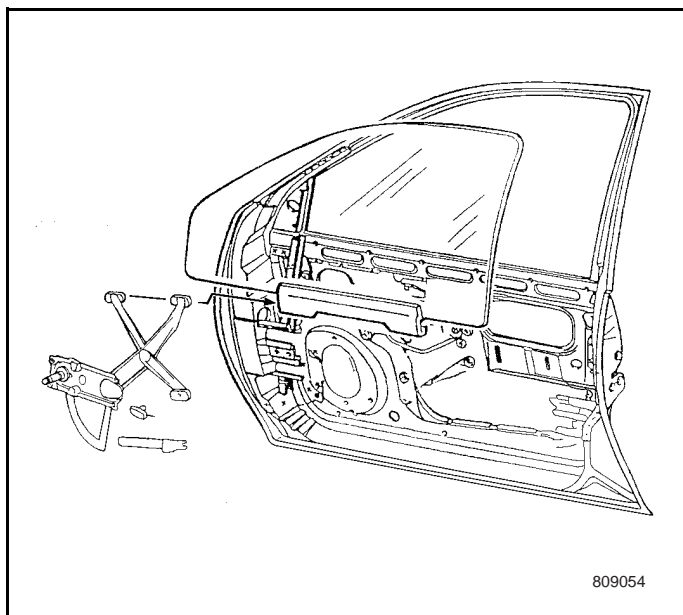
Installation Procedure

1. Press the mirror plate into the mirror cover.

8.9.5.31 Window Replacement - Front Door

Removal Procedure

1. Position the window in the half down position.
2. Remove the adjust knob of rear view mirror.
3. Remove the inner trim panel of rear view mirror.
4. Remove the inside door pull handle bezel.
5. Remove the inner sealing strip of front door.
6. Remove the Trim Panel of front door.
7. Remove the plastic nuts for tightening trim panel.
8. Remove Water Deflector.
9. Loosen the regulator channel.
10. Move the slider of regulator out of glass rail and take out the glass.



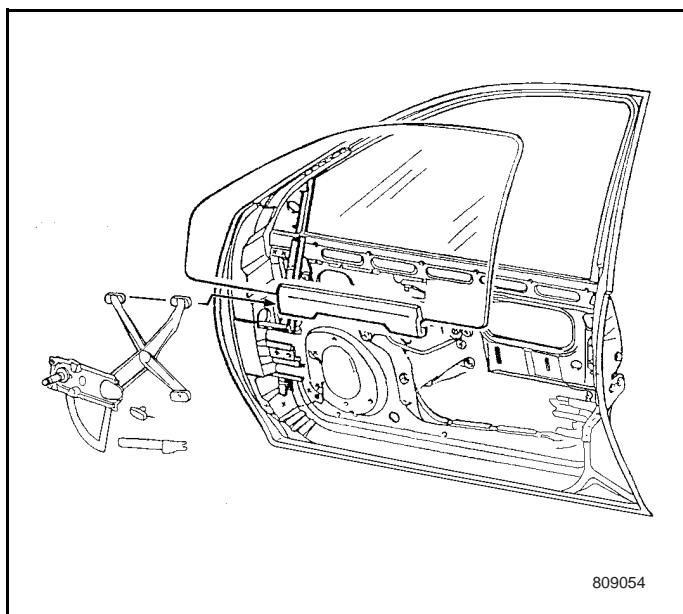
Installation Procedure

1. Position the front door window between the inner and the outer door panels.
2. Assemble the sliders of regulator into the rail of glass.
3. Align the edges with the front door window weatherstrip.
4. Tighten the regulator channel.

Tightening

Tighten the regulator channel bolts to 8-12 N•m.

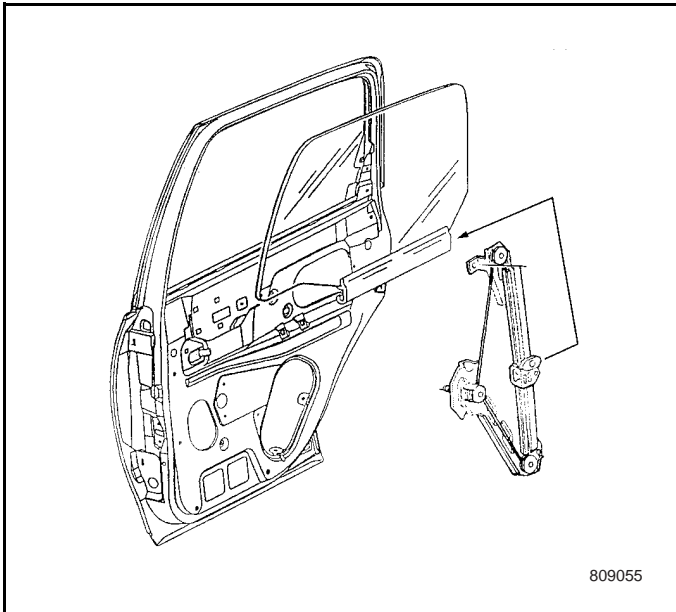
5. Install Water Deflector.
6. Install Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.
7. Install the inner sealing strip of front door.
8. Install the inside door pull handle bezel.
9. Install the inner trim panel of rear view mirror.
10. Install the adjust knob of rear view mirror.



8.9.5.32 Window Replacement - Rear Door

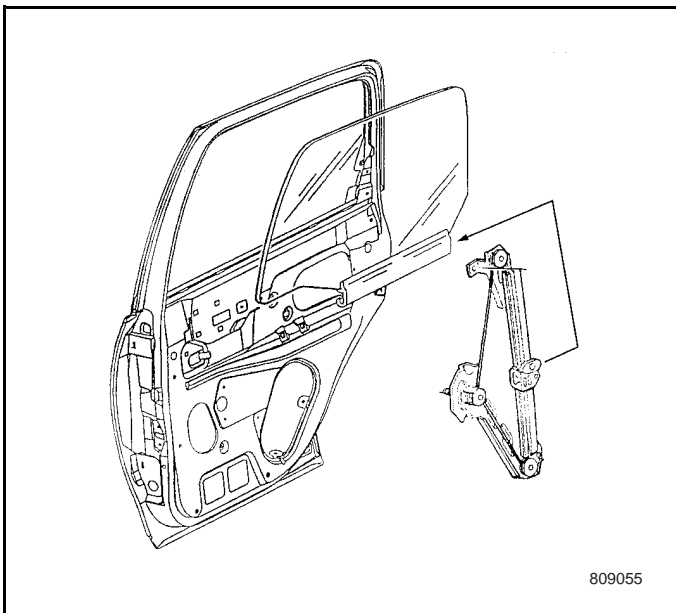
Removal Procedure

1. Position the window in the full down position.
2. Remove the regulator handle and the inside pull handle bezel.
3. Remove Inner Triangle Panel of Rear Door.
4. Remove the inside sealing strip.
5. Remove the Trim Panel of rear door.
6. Remove the plastic brackets for tightening trim panel of rear door.
7. Remove Water Deflector.
8. Remove the weather strip from the rear channel of window.
9. Remove the rear channel of rear window.
10. Make certain the installation direction of limiter buckle, and push out the buckle from the channel back under the glass.
11. Move the slider of regulator out of glass rail. Take out the glass.



Installation Procedure

1. Position the rear door window between the inner and the outer door panels.
2. Assemble the sliders of regulator into the rail of glass.
3. Push the limiter buckle into the channel's location hole under the glass in a right direction.
4. Install the rear channel of rear window.
5. Install Weather Strip.
6. Install Water Deflector.
7. Install the plastic brackets for tightening trim panel.
8. Install the Trim Panel of rear door.
9. Install the inside sealing strip.
10. Install the inside door pull handle bezel.
11. Install the regulator handle.



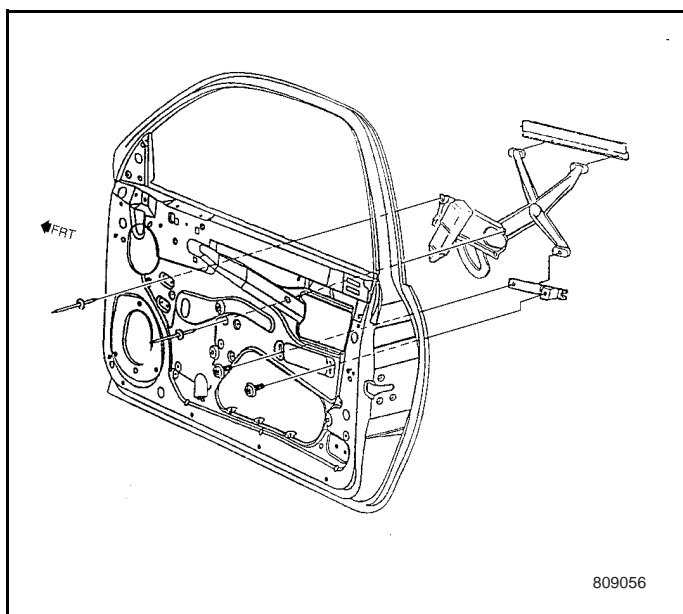
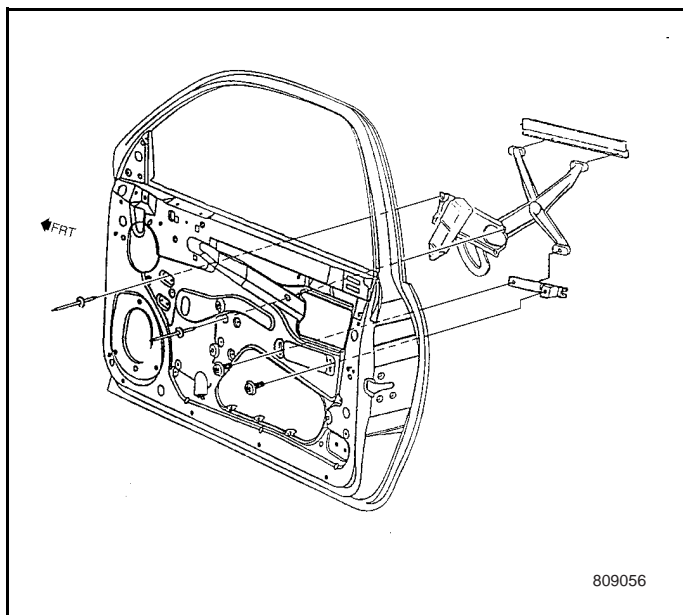
8.9.5.33 Window Regulator Replacement - Front Door (Electrical)

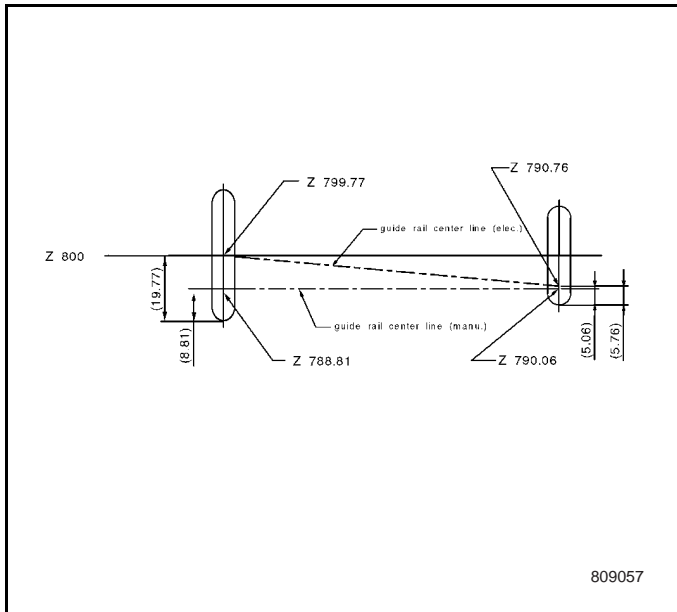
Removal Procedure

1. Remove the inner and outer sealing strip. Refer to Weather Strip Replacement - Front Door Window.
2. Remove Front Door Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.
3. Loosen the two fixing bolts of the small channel.
4. Remove the four rivets with rivet gun, by raising the window far enough to make easy escape of the small channel from the sliders.
5. Raise the window regulator in full up position.
6. Remove the door glass assembly.
7. Remove the small channel.
8. Remove the regulator from the door.
9. Disconnect the electrical connector.

Installation Procedure

1. Position the regulator by the door.
2. Connect the regulator motor to the door electrical harness.
3. With rivet gun, rivet the window regulator and the rear door inner panel.
4. Raise the window regulator in full up position, then make the sliders in the channel.

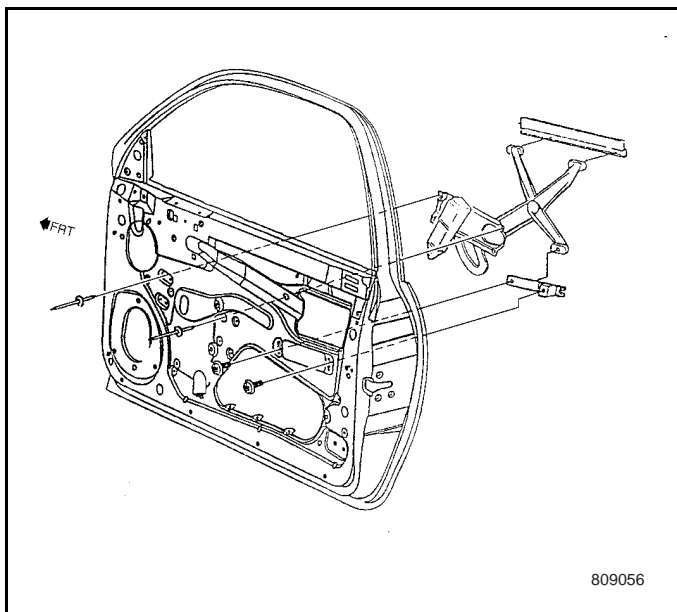




5. Adjust the small channel fixing position as shown in the view, then tighten the two bolts.

Tightening

Tighten the bolts to 8 -12 N•m.

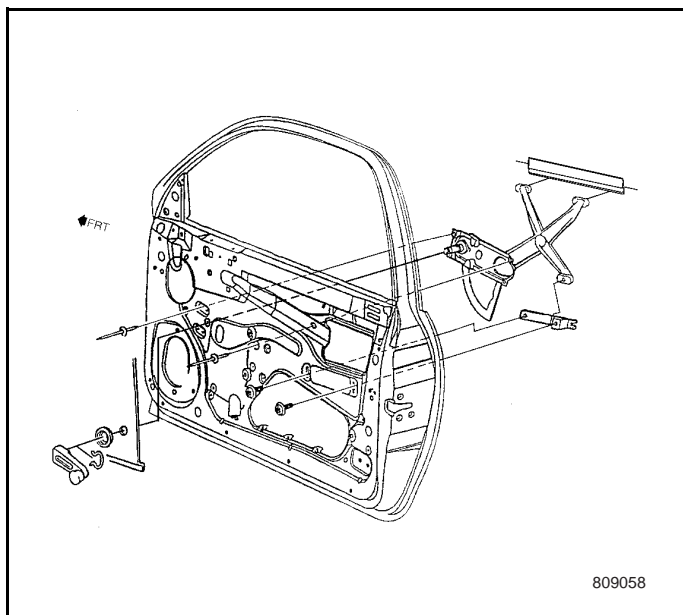


6. Install Water Deflector.
7. Install the electrical connectors.
8. Install Front Door Trim Panel.
9. Install the inside sealing strip.
10. Install the outer sealing strip.
11. Install Rearview Mirror.

8.9.5.34 Window Regulator Replacement - Front Door (Manual)

Removal Procedure

1. Remove the inner and outer sealing strip. Refer to Weather Strip Replacement - Front Door Window.
2. Remove Front Door Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.
3. Loosen the two bolts of the small channel.
4. Remove the four rivets with rivet gun, by raising the window far enough to make easy escape of the small channel from the sliders.
5. Raise the window regulator in full up position.
6. Remove the door glass assembly.
7. Remove the small channel.
8. Remove the hand assembly of front door window regulator.
9. Remove the regulator from the door.



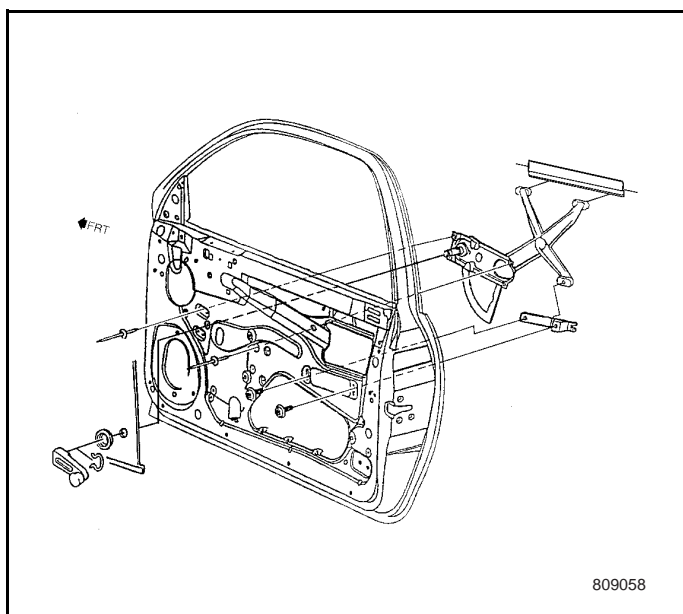
Installation Procedure

1. Position the regulator by the door.
2. With rivet gun, rivet the regulator and the rear door inner panel.
3. Raise the window regulator in full up position, then make the sliders in the channel.
4. Adjust the small channel fixing position as shown in Figure 809057.

Tightening

Tighten the two bolts of small channel to 8-12 N•m.

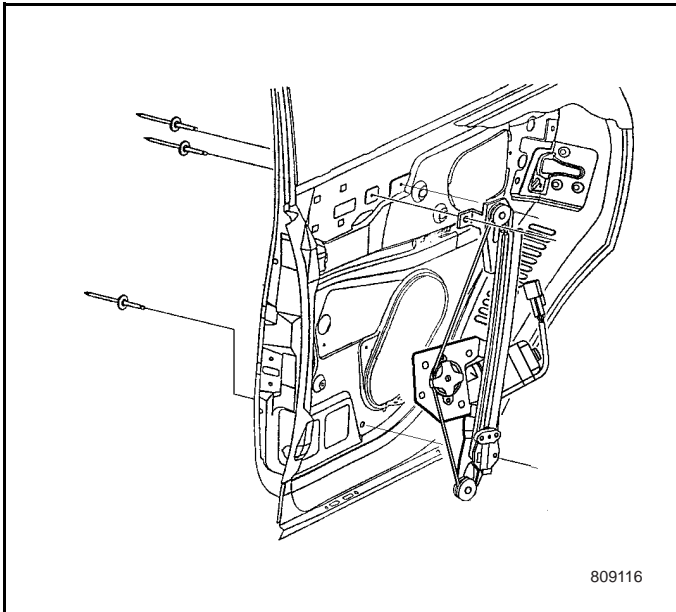
5. Install Water Deflector.
6. Install Front Door Trim Panel.
7. Install the inside sealing strip.
8. Install the outer sealing strip.
9. Install Rearview Mirror.
10. Install the handle assembly.



8.9.5.35 Window Regulator Replacement - Rear Door (Electrical)

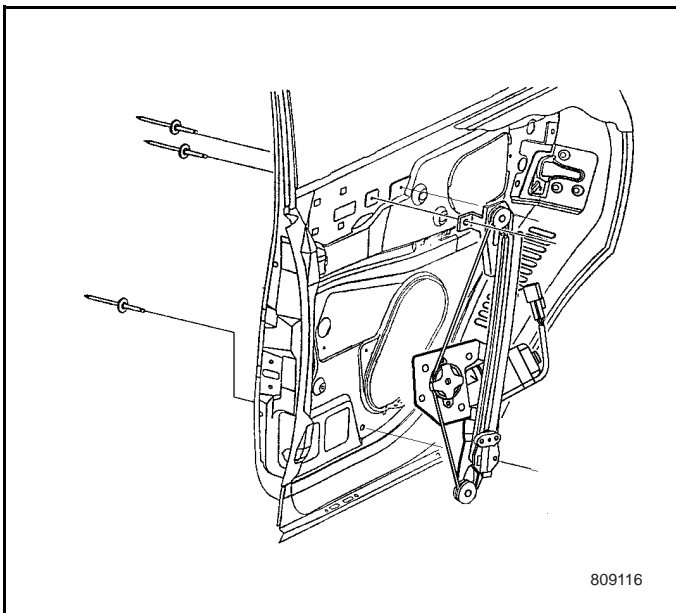
Removal Procedure

1. Remove the inner and outer sealing strip. Refer to Window Strip Replacement - Rear Door Window.
2. Remove Rear Door Trim Panel. Refer to Rear Door Trim Panel Replacement of Interior Trim.
3. Remove the fix rivets with rivet gun.
4. Raise the window in the full up position.
5. Remove the door glass assembly.
6. Remove the regulator from the door.
7. Disconnect the electrical connector.



Installation Procedure

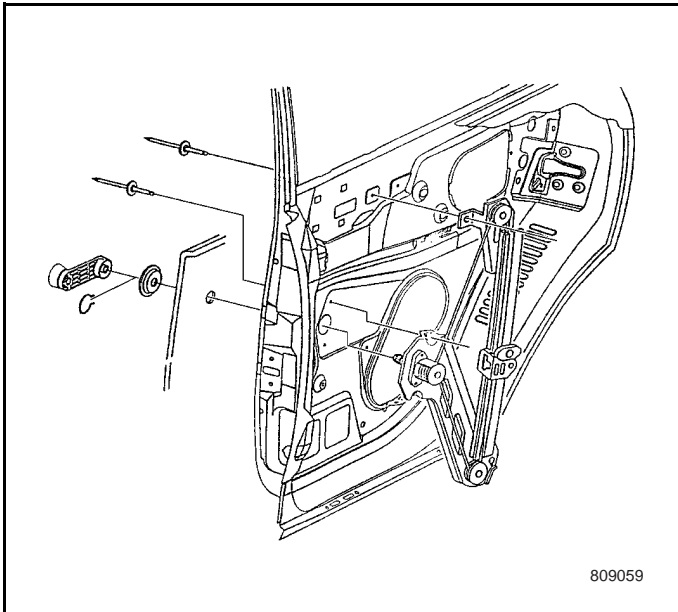
1. Position the regulator by the door.
2. Connect the regulator motor to the door electrical harness.
3. Install the rear door glass assembly.
4. Install Water Deflector.
5. Install Rear Door Trim Panel.
6. Install the inside sealing strip.
7. Install the outer sealing strip.



8.9.5.35 Window Regulator Replacement - Rear Door (Manual)

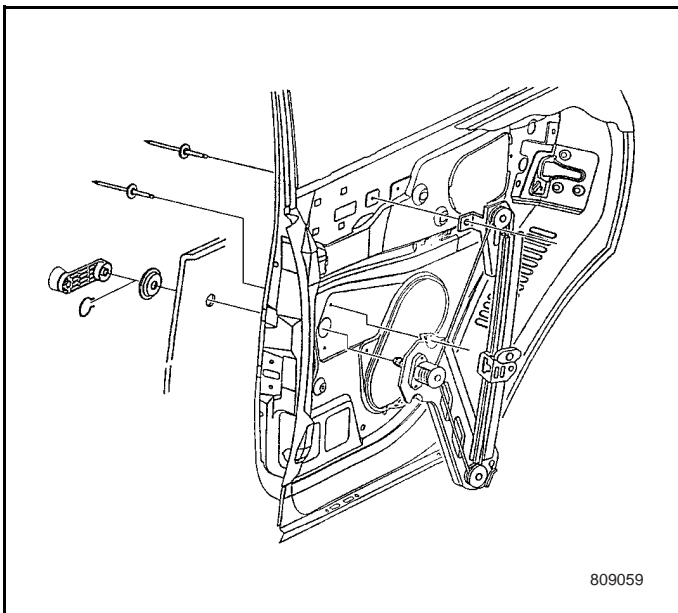
Removal Procedure

1. Remove the rear door glass assembly. Refer to Rear Door Window Replacement.
2. Remove the fix rivets with rivet gun.
3. Remove the regulator from the door.



Installation Procedure

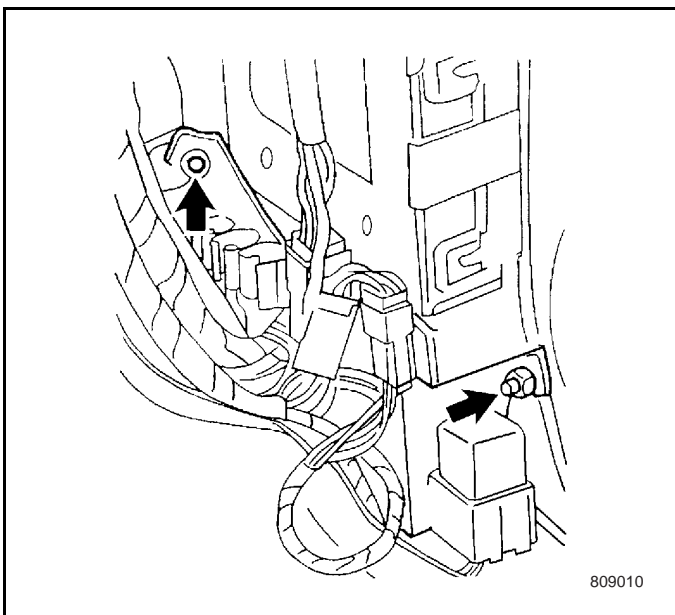
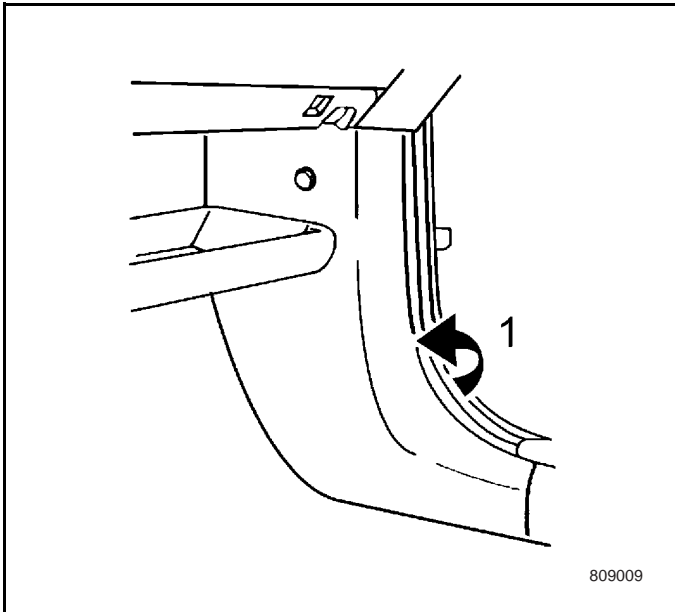
1. Position the regulator by the door.
2. With rivet gun, rivet the regulator and the rear door panel.
3. Install the rear door glass assembly. Refer to Rear Door Window Replacement.



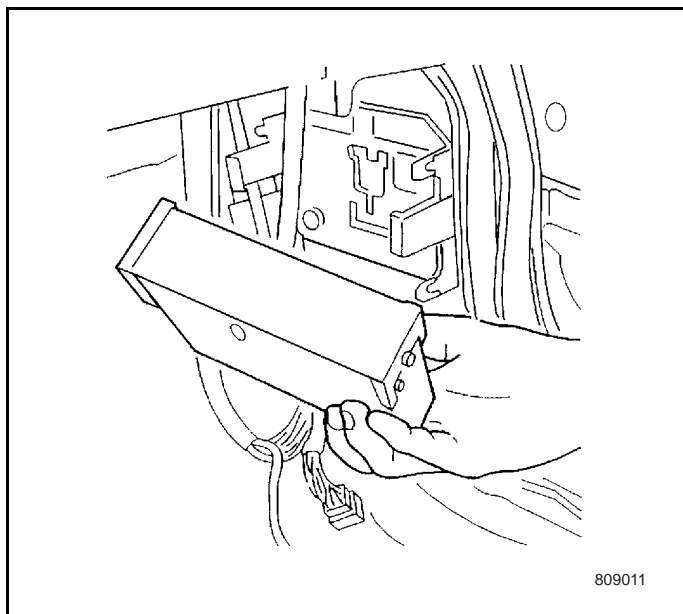
8.9.5.37 Central Door Lock Control Module Replacement

Removal Procedure

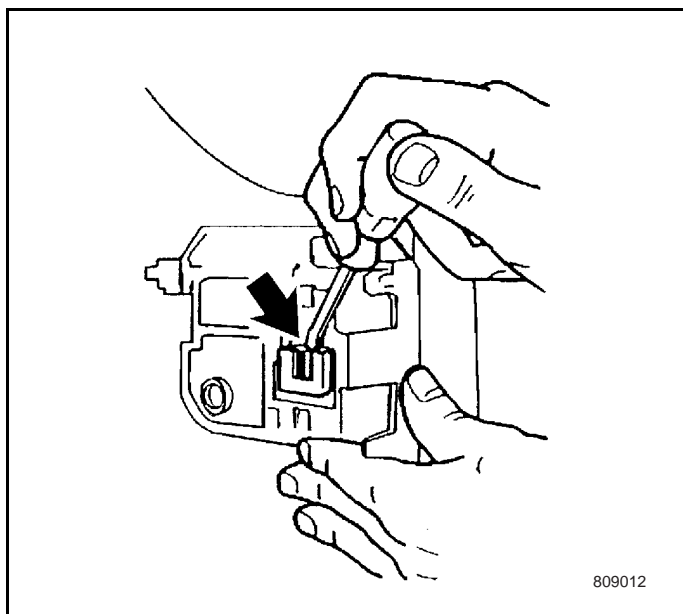
1. Remove the base board. Refer to Base Board Replacement of Interior Trim.



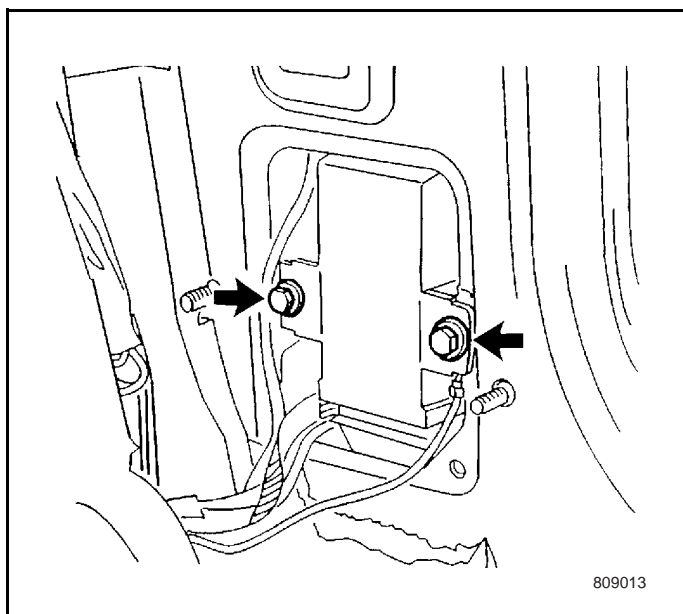
2. Loosen bolts of Engine Control Module bracket.



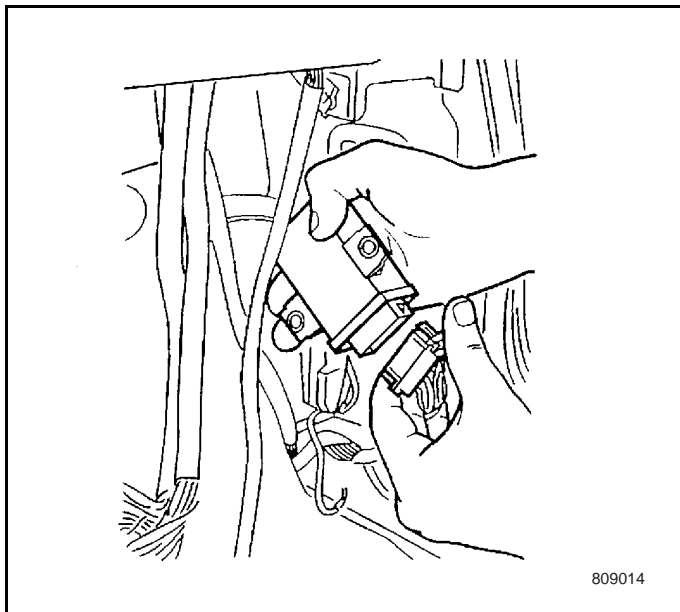
3. Remove the Engine Control Module.



4. Remove Engine Control Module Bracket.



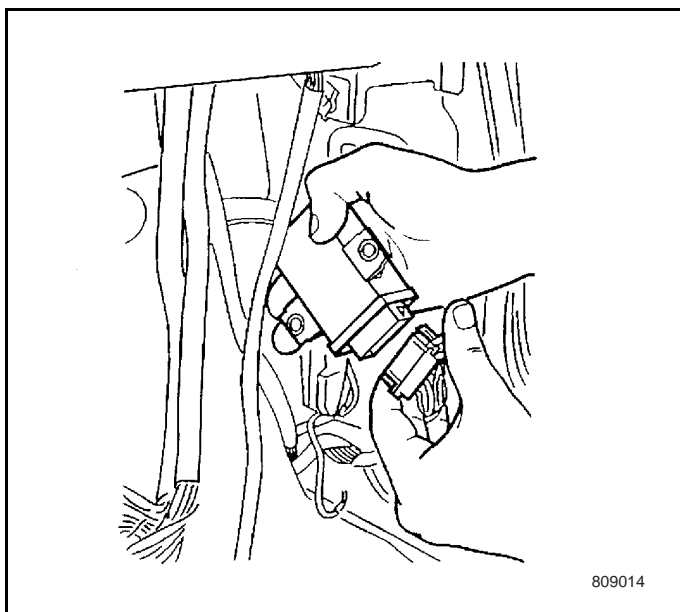
5. Loosen bolts of Central Door Lock Control Module.
6. Remove Central Lock Control Module.



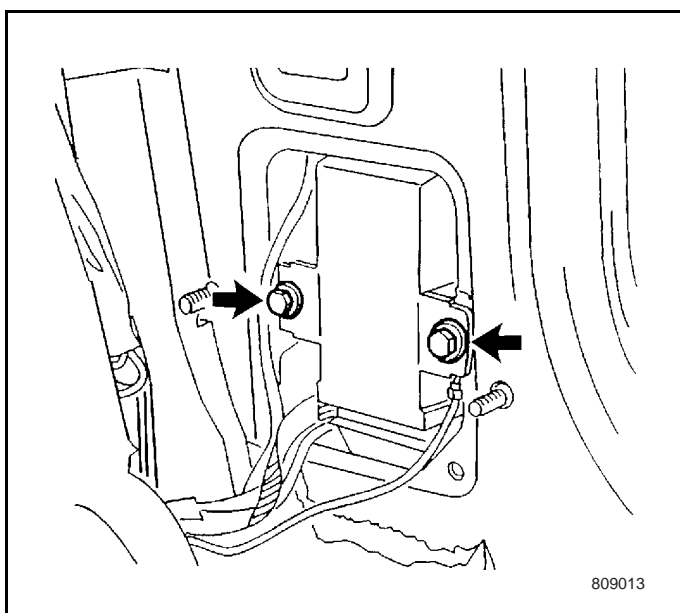
7. Disconnect the wiring plug.

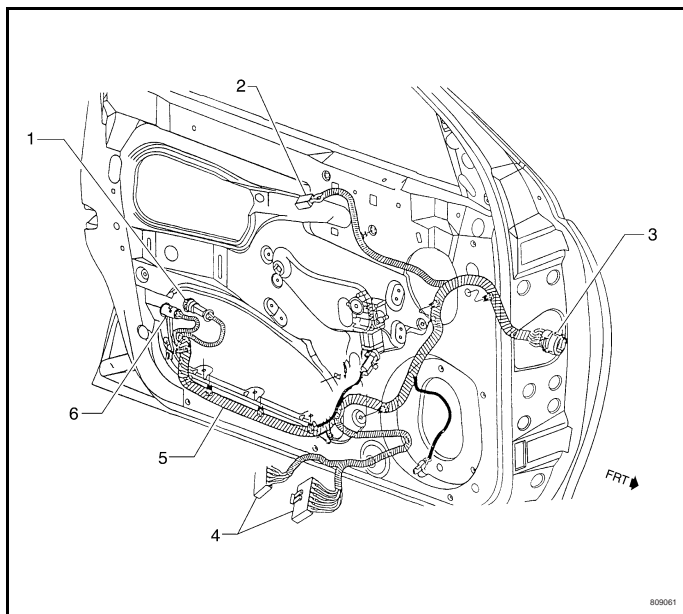
Installation Procedure

1. Connect the wiring plug.

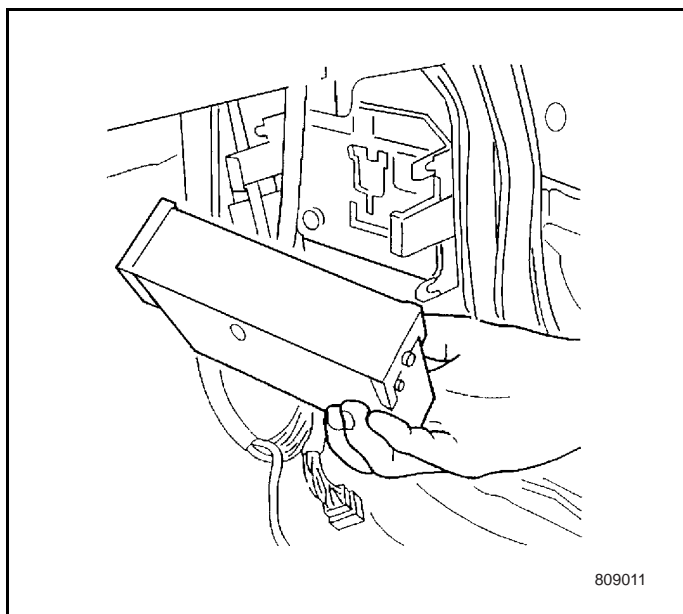


2. Install Central Lock Control Module.

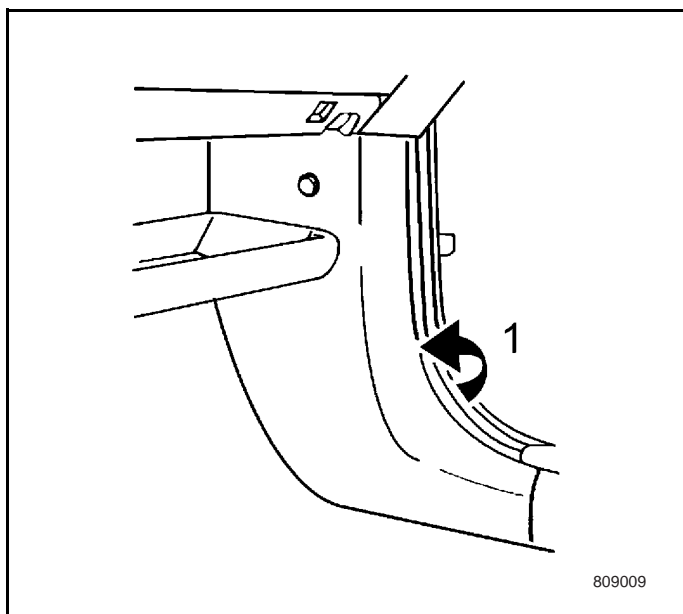




3. Install Engine Control Module Bracket.



4. Install the Engine Control Module.

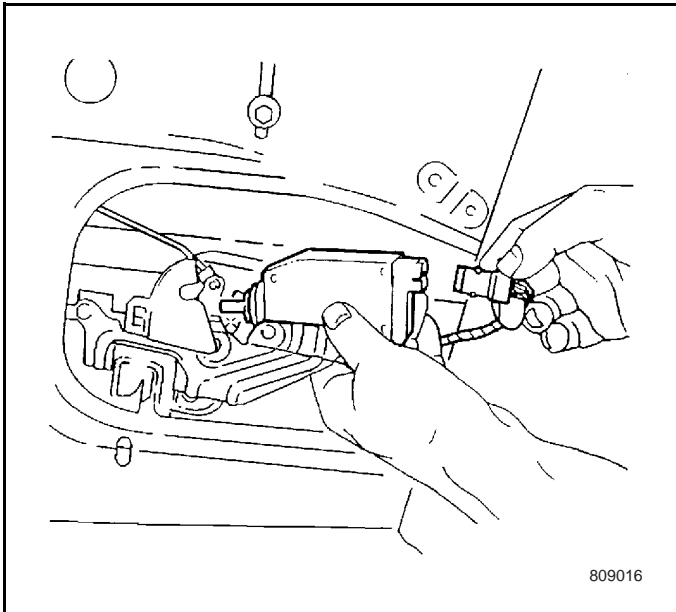


5. Install the base board. Refer to Base Board Replacement in Interior Trim.

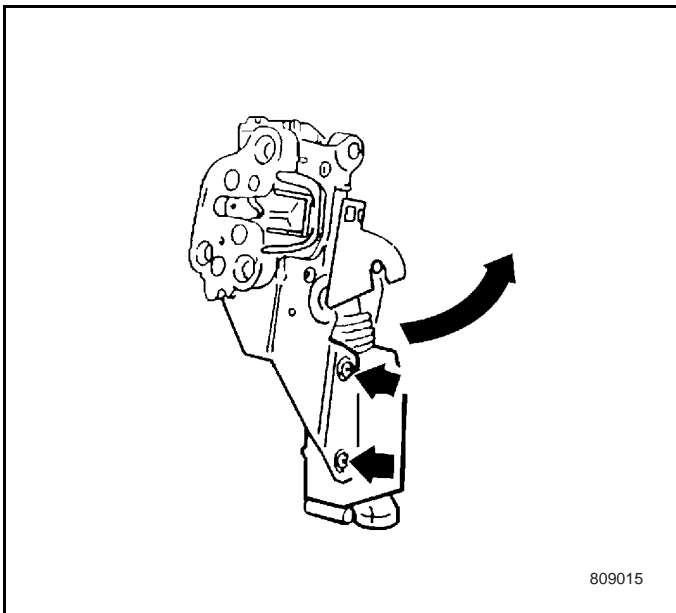
8.9.5.38 Actuator Replacement - Front Doors

Removal Procedure

1. Tear down door trim panel and door locks of front side.
2. Disconnect the wiring plug.

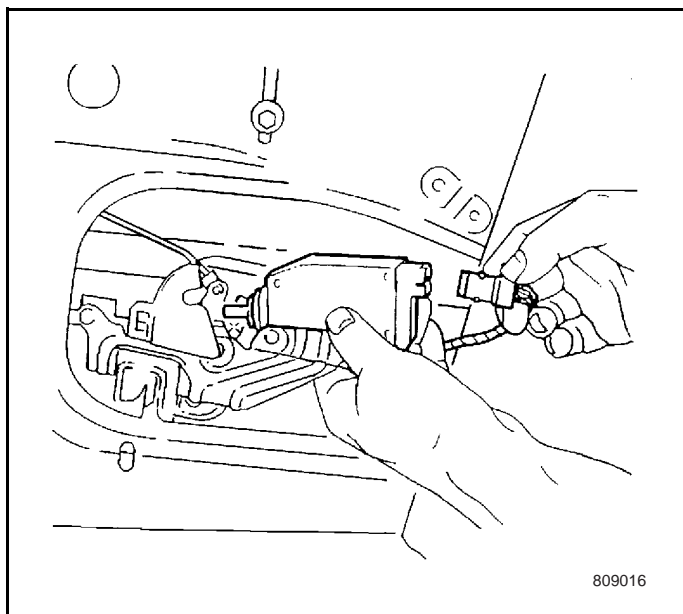
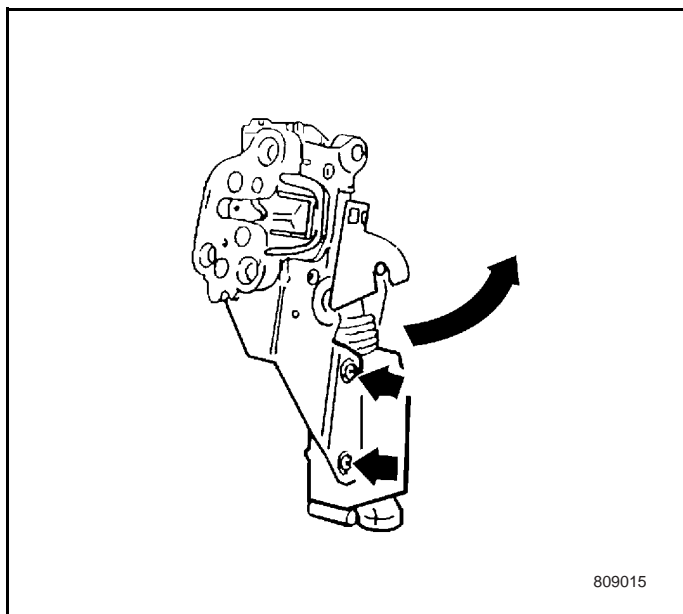


3. Tear down actuators of front door lock assembly.



Installation Procedure

1. Install actuator of front door lock on the door lock assembly.
2. Check and adjust the actuator.

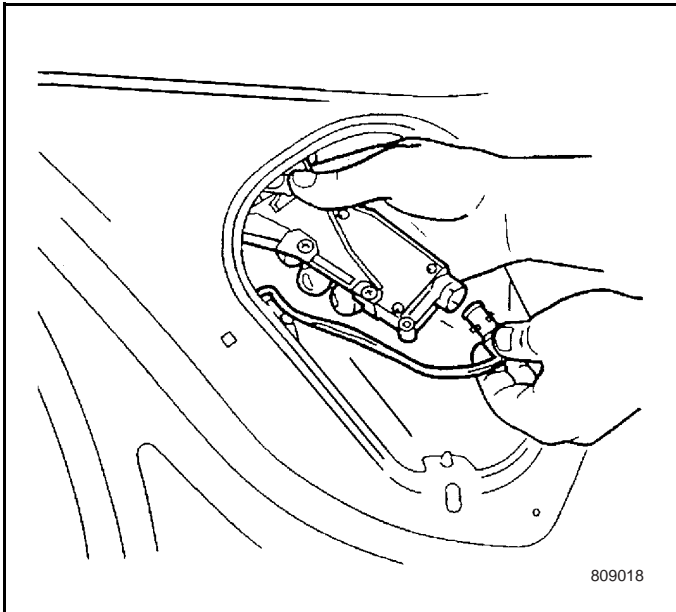


3. Connect the wiring plug.
4. Install locks and door panel.

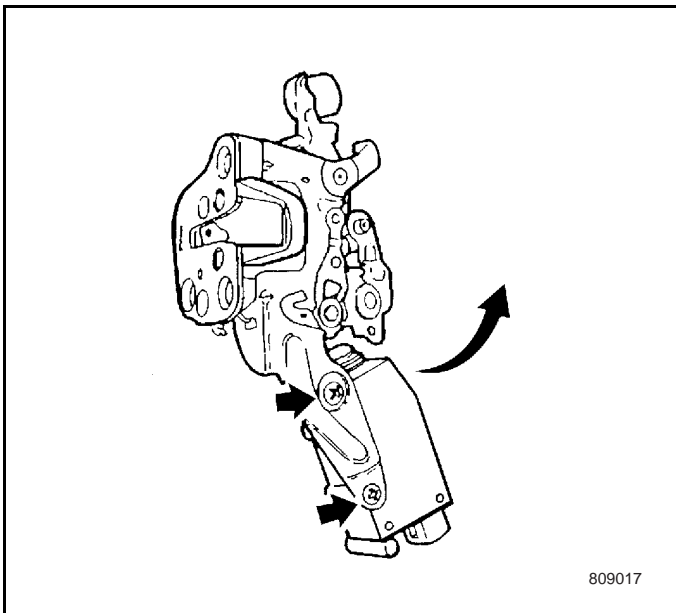
8.9.5.39 Actuator Replacement - Rear Doors

Removal Procedure

1. Tear down door trim panel and door locks of rear side.
2. Disconnect the wiring plug.

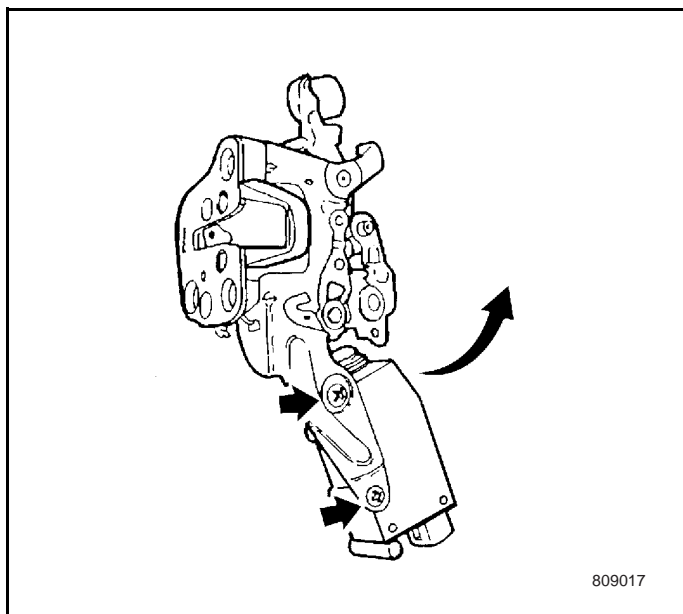


3. Tear down actuators of rear door lock assembly.

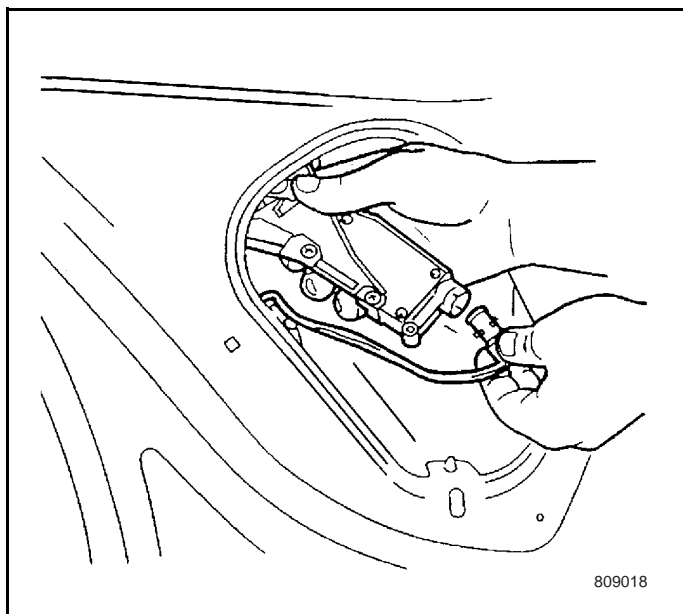


Installation Procedure

1. Install actuator in door lock assembly.



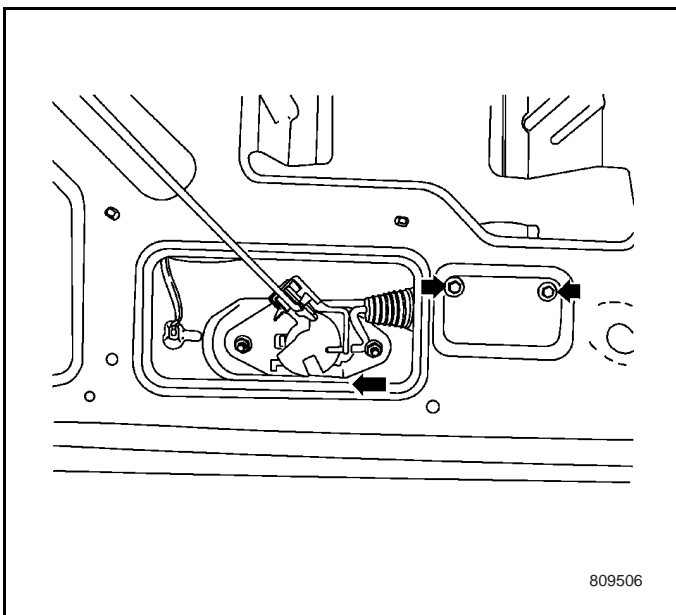
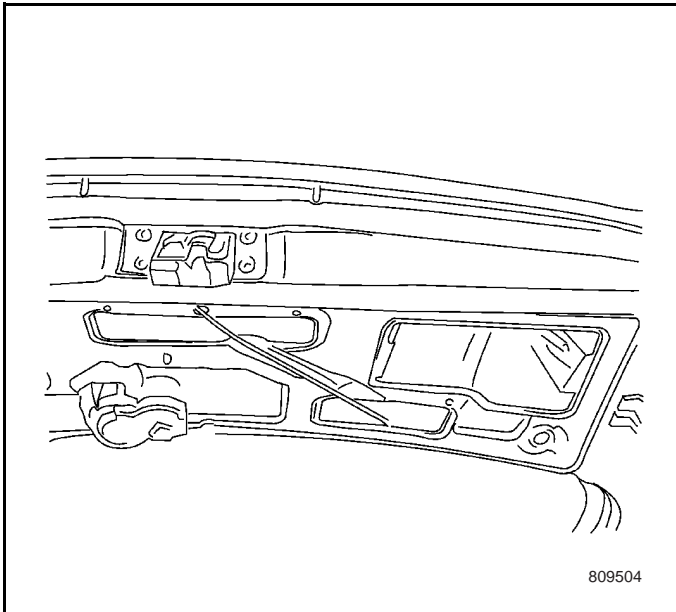
2. Connect the wiring plug.
3. Install locks and rear door trim panel.



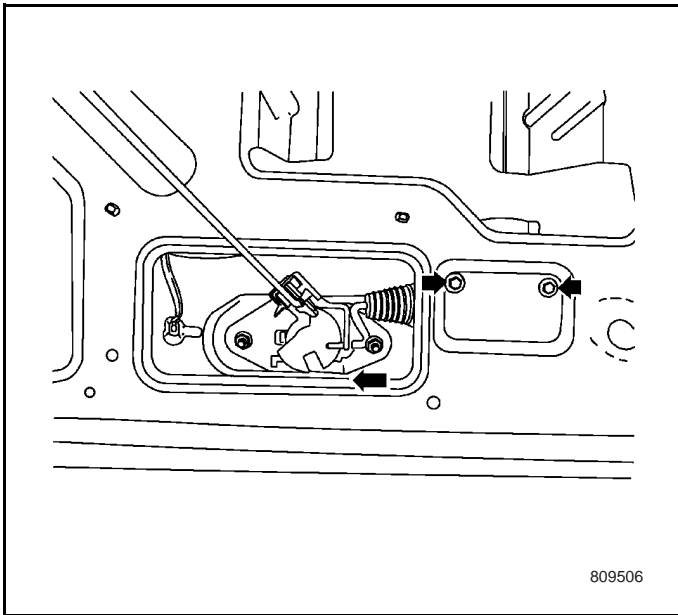
8.9.5.40B Actuator Replacement - Tail Gate

Removal Procedure

1. Open the tail gate.
2. Remove Tail Gate Trim Panel.



3. Loosen the installation screws with screwdriver.
4. Take the actuator out from the lock head.
5. Disconnect the wiring harness.



Installation Procedure

1. Connect the wiring harness.
2. Position the actuator in the lock head.
3. Tighten the installation screws with screwdriver.

Tightening

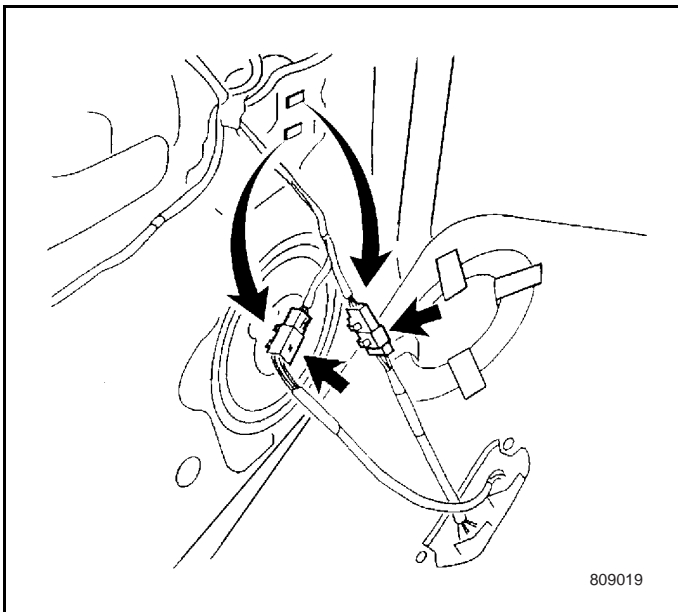
Tighten the actuator screws to 1 -3 N•m.

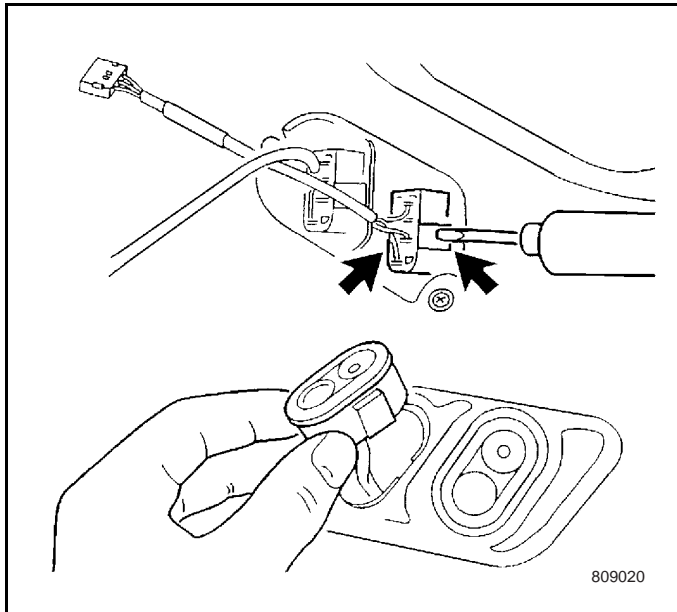
4. Install Tail Gate Trim Panel.
5. Close the tail gate.

8.9.5.41 Electrical Window Switches Replacement - Driver Side (only Front Window is electrical)

Removal Procedure

1. Remove Door Trim Panel.
2. Disconnect the wiring plug.

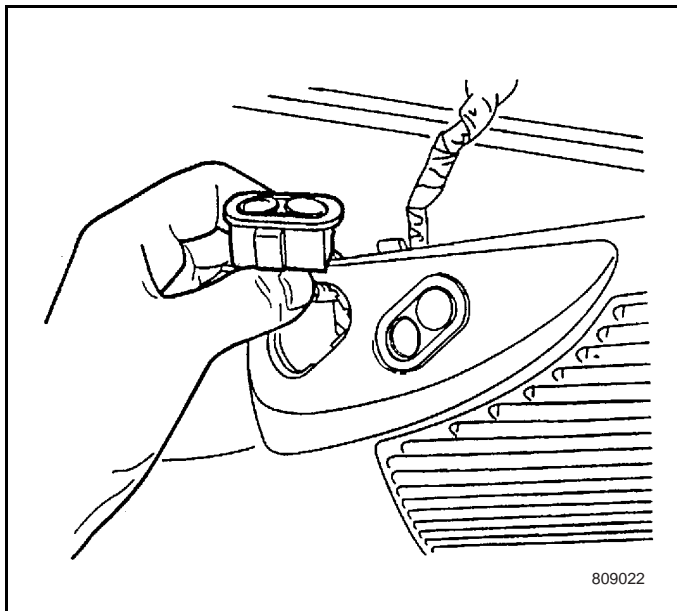




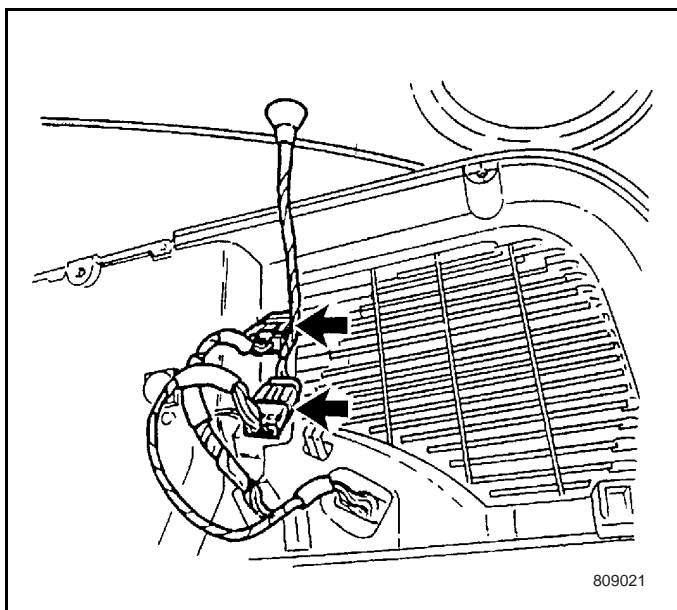
3. Push against the two lock plates behind the switch and loosen them.
4. Push against and prop up the switch from the panel.

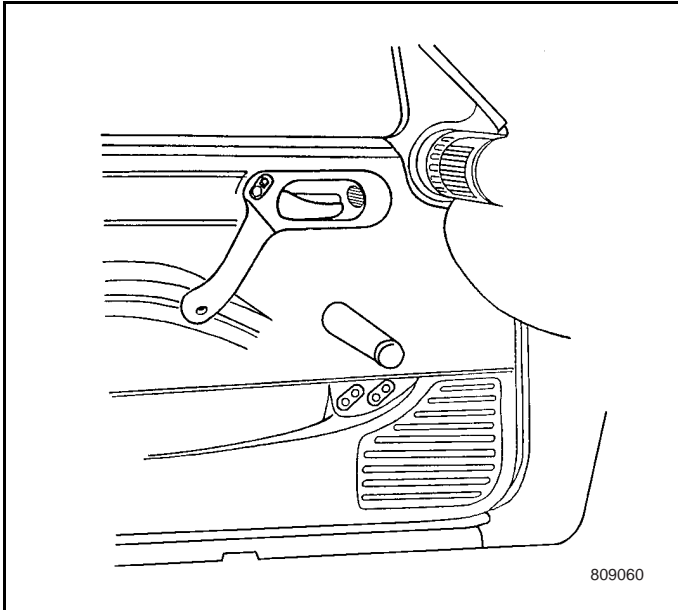
Installation Procedure

1. Press the control switch into the panel opening.



2. Connect to the wiring harness plug.



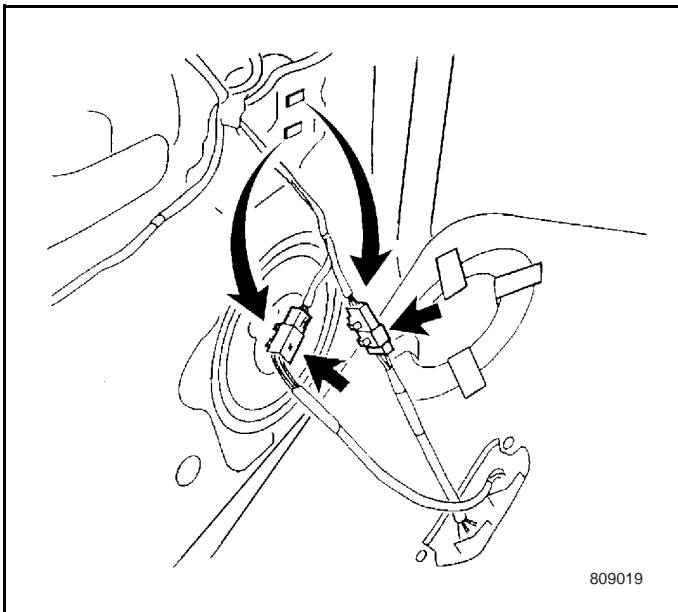


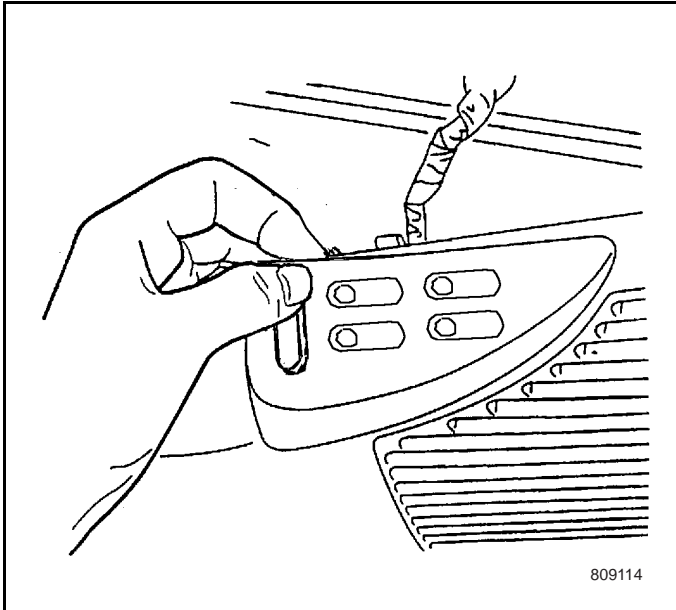
3. Install the switch panel on the glove compartment assembly.
4. Install the Door Trim Panel.

8.9.5.42 Electrical Window Switch Replacement - Driver Side (All the four windows are electrical)

Removal Procedure

1. Remove Door Trim Panel.
2. Disconnect the wiring plug.

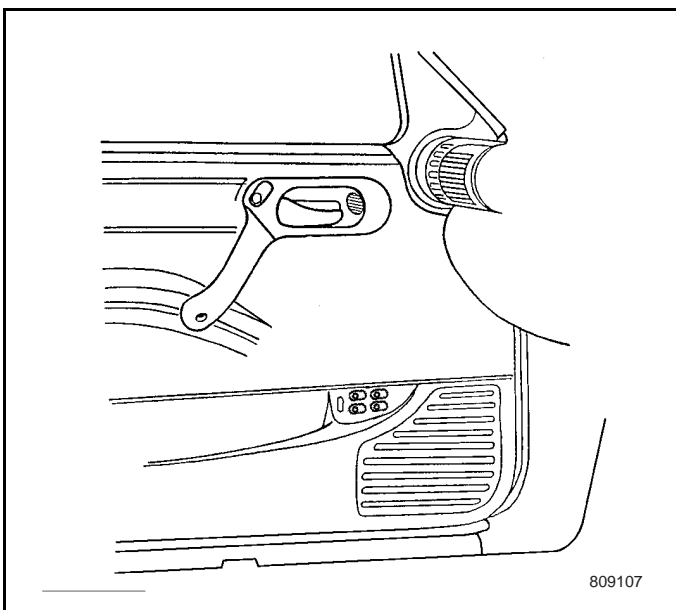
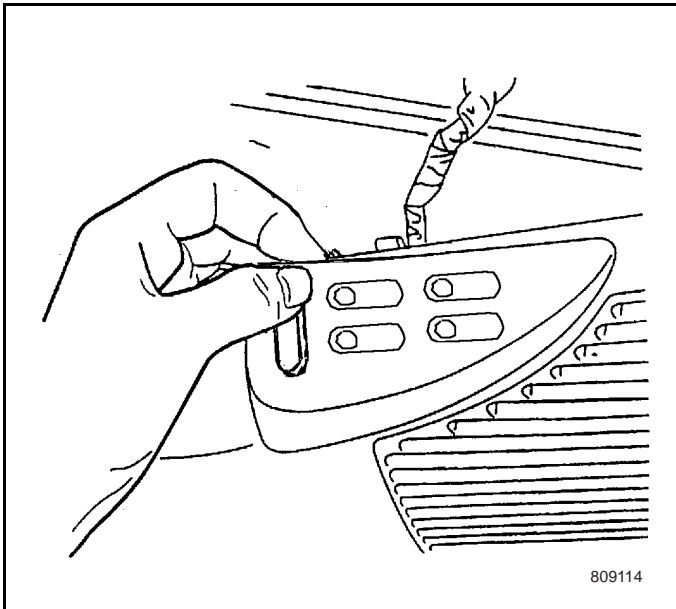




3. Push against and prop up the switch assembly from the panel.

Installation Procedure

1. Connect to the wiring harness plug.
2. Press the control switch assembly into the glove compartment assembly of trim panel.



3. Install the Door Trim Panel.

8.9.5.43 Electrical Window Switch Replacement - Co-Driver Side

Removal Procedure

1. Remove Door Trim Panel.
2. Disconnect the wiring plug.
3. Push against the two lock plates behind the switch and loosen them.
4. Push against and prop up the switch assembly from the panel.

Installation Procedure

1. Press the control switch into the panel opening.
2. Connect the wiring harness.
3. Install the switch panel on the glove compartment assembly.
4. Install the Door Trim Panel.

8.9.5.44 Electric Window Switch Replacement - Rear Door

Removal Procedure

Required Tool: Plastic Wedge

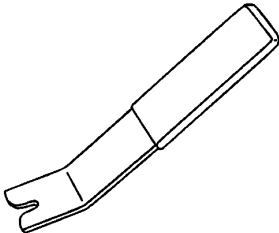
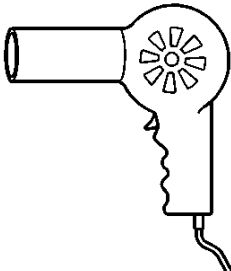
Note: In order to avoid the damage, plastic wedge must be used to remove the handle.

1. Use the plastic wedge to remove the rear door handle.
2. Press out the electrical window switch.
3. Disconnect the wiring plug.

Installation Procedure

1. Install the electric window switch into the handle.
2. Connect the wiring harness.
3. Install the rear door handle.

8.9.6 Special Tools

Illustration	Tool Number / Description
 <p>J38778</p>	J38778 Door Trim Pad and Garnish Clip Remover
 <p>J25070</p>	J25070 Air Blower

Blank

8.10Horn

8.10.1 Specifications

8.10.1.1 Fastener Tightening Torque

Application	Specification
Horn Assembly Mounting Bolts	18-23 N•m

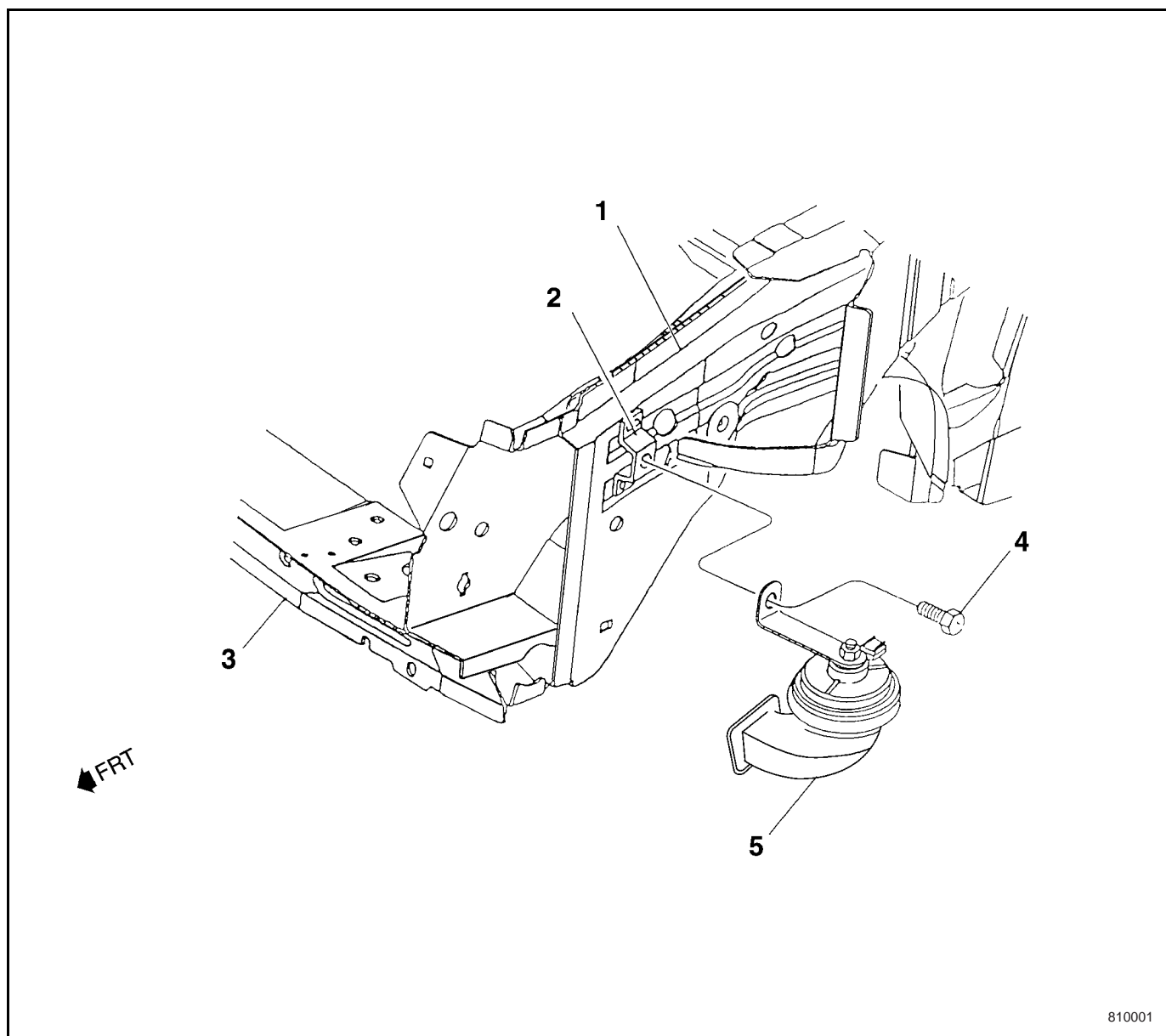
8.10.2 Schematic and Routing Diagrams

8.10.2.1 Horn Wiring Diagram

See 8.20.2.12.

8.10.3 Component Locator

8.10.3.1 Horn

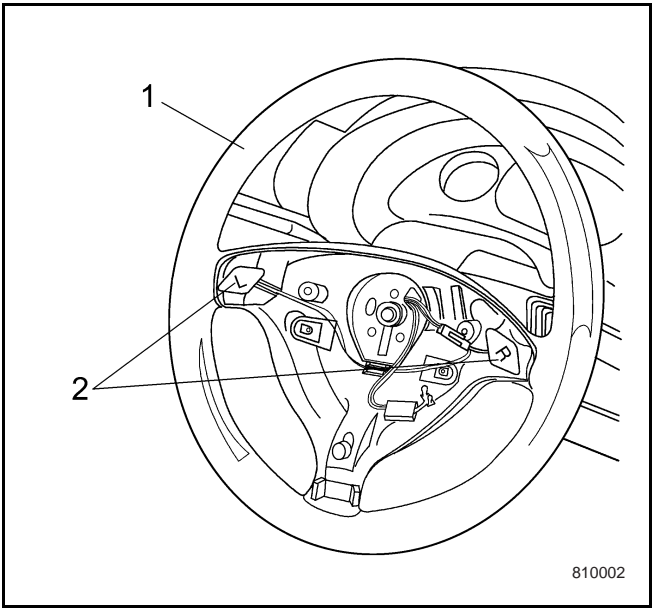


Legend

- (1) Front Side Member
- (2) Horn Bracket
- (3) Front Body Panel

- (4) Bolts
- (5) Horn

8.10.3.2 Horn Button



- Legend
- (1) Steering Wheel
 - (2) Horn Button

8.10.3.3 Horn Connector

A line drawing of a rectangular horn connector with rounded corners. It has two pins on the left side, labeled 'A' and 'B'. Pin 'A' is the top pin and pin 'B' is the bottom pin. The connector has a central slot and two smaller slots on the right side.

810003

Pin	Wire Color	Function
A	Brown White	Horn Supply Circuit
B	Black	Battery Power

8.10.4 Diagnostic Information and Procedures

8.10.4.1 Horn System Check

Step	Action	Normal Result(s)	Abnormal Result(s)*
1	Press and release the horn button.	When pressing the horn button, the horn will sound. When releasing the horn button, the horn sound will stop.	<ul style="list-style-type: none"> Horn doesn't work Horn ñ Abnormal Sound

8.10.4.2 Horn Inoperative

Step	Action	Yes	No
1	Check if the horn fuse blown. Is the horn fuse blown?	Go to Step 3	Go to Step 2
2	1. Pull out the horn assembly connector. 2. Use a test light to join the horn assembly connector between Terminal B and Terminal A. 3. While pressing the horn button, observe the test light. Does the test light illuminate?	Go to Step 4	Go to Step 5
3	Replace the horn fuse.	Go to Horn System Check	—
4	Replace the horn assembly.	Go to Horn System Check	—
5	1. Re-connect the horn. 2. Disconnect the horn relay. 3. Use a test light to join between Relay Pin 4 and Pin 8. Does the horn sound?	Go to Step 8	Go to Step 6
6	1. Re-install the horn relay. 2. Disconnect the air bag circuit system. 3. Remove the horn switch wires from the steering wheel. 4. Use a test light to join between the horn button Connector 1 and 2. Does the horn sound?	Go to Step 7	Go to Step 8
7	Replace the horn button.	Go to Horn System Check	—
8	1. Still place the test light at the same position (Between the horn button Connector 1 and 2). 2. Temporarily jump a 5A fuse between the horn relay terminal Pin 4 and 8. Does the test light illuminate?	Go to Step 9	Go to Step 10
9	Replace the horn relay.	Go to Horn System Check	—
10	Check if a poor connection with the ground, and join the test light. 1. Horn relay Terminal 8 and the ground. 2. Horn button Terminal 1 and the ground. Does the test light illuminate?	Go to Step 11	Go to Step 12

8.10.4.2 Horn Inoperative(Cont' d)

11	Repair the poor ground with the wires.	Go to Horn System Check	—
12	Repair a poor connection between the circuits.	Go to Horn System Check	—

8.10.4.3 Horn - Poor Tone

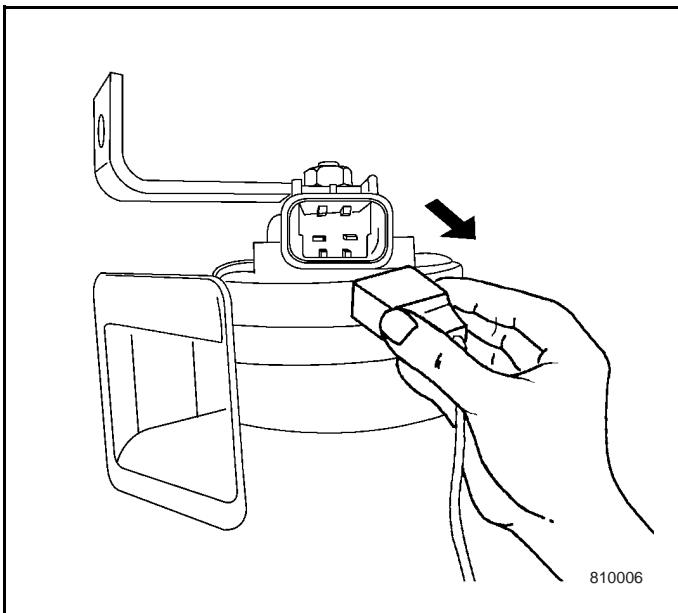
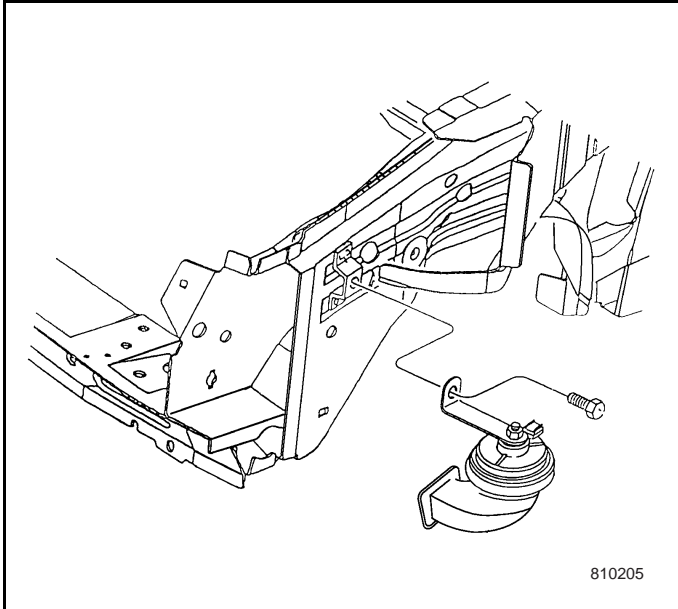
- Operate the horn to validate the owner's Attention. Refer to Horn System Check.
- If the horn has a distinctly poor tone, perform the following routine inspection.
 - Check if a poor connection with the terminals; Repair any poor connection that was found.
 - Check the ground connection.If apparently a poor connection occurs, repair it.
 - Ensure that the horn assembly fixing bolts are tightened properly.
 - Ensure that the horn assembly doesn't contact any other items; if any contact occurs, re-determine the proper position of other items, or if necessary, bend the horn assembly bracket.
- Operate the horn to determine if the case still exist.If the case still exists apparently, perform the exact inspections as the following:
 - Determine the tone type which the horn sounds.
 - 1) Grave tone.
 - 2) Shrill and weak tone.
 - If the tone apparently grave, it means the current is too high and the horn assembly must be replaced.Refer to Horn Replacement.
 - If the tone is apparently shrill and weak, the horn may contain some adhesive foreign material, so remove the horn assembly and check if any foreign material exists.Refer to Horn Replacement.
 - Remove any adhesive foreign material, and re-install the horn assembly.
 - If you didn't find any adhesive foreign material, or if you cannot remove the material, replace the horn assembly.
- Operate the horn to validate if the concerned attentions have been repaired.Refer to Horn System Check.

8.10.5 Repair Instructions

8.10.5.1Horn Replacement

Removal Procedure

1. Open the engine hood.
2. Remove the horn assembly fixing bolts near the left front fender.



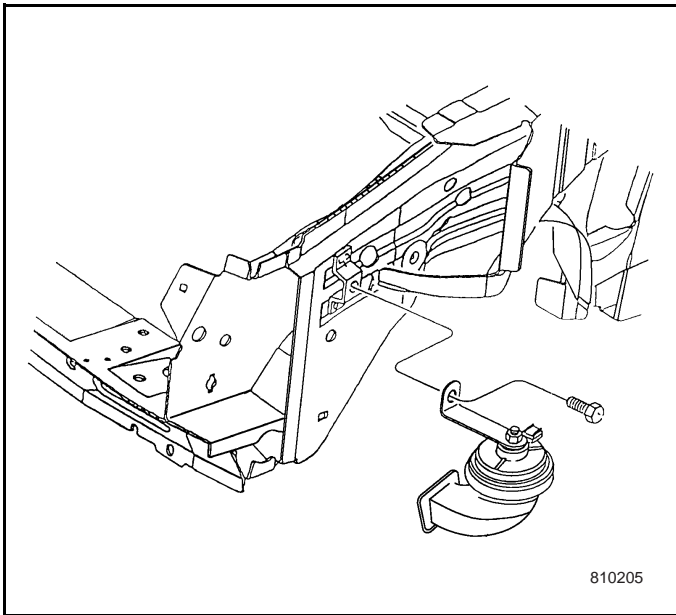
3. Disconnect the horn assembly connector.
4. Remove the horn assembly.

Installation Procedure

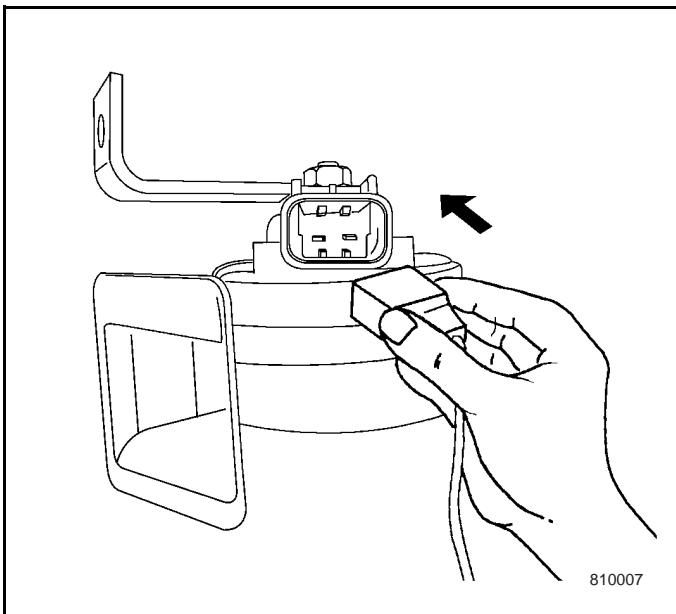
1. Install the horn assembly bolts.

Tightening

Tighten the horn bolts to 18-23 N•m.



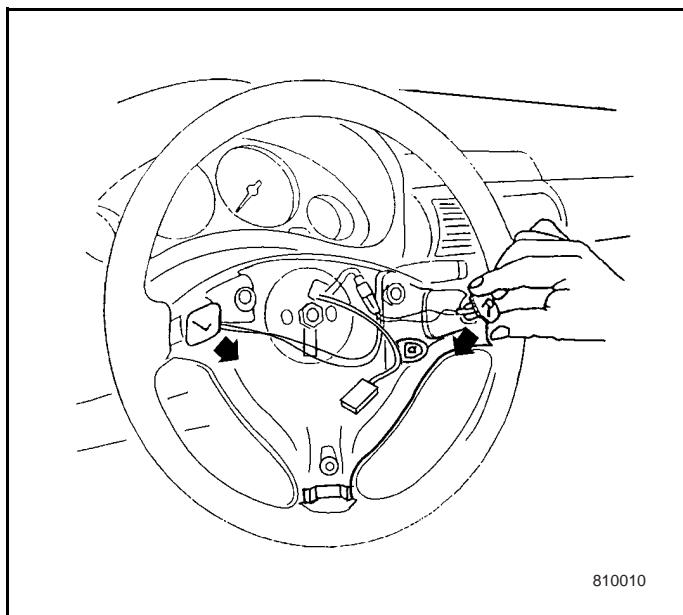
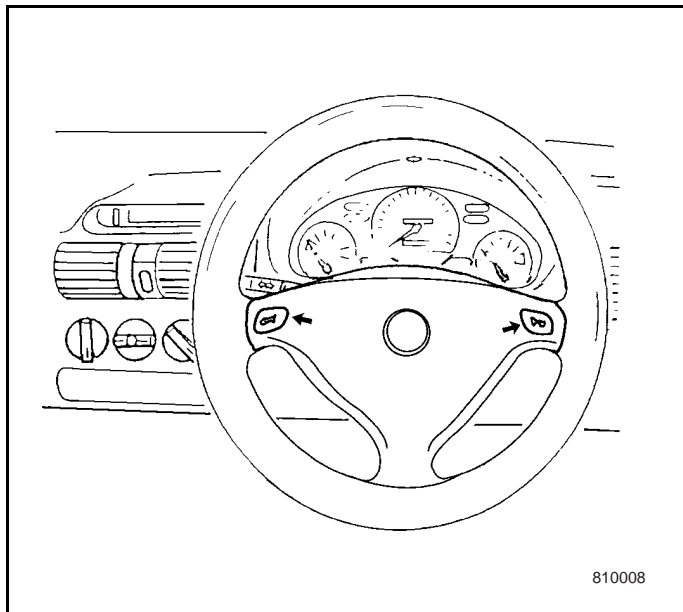
2. Install the horn assembly connector.
3. Cover the engine hood.



8.10.5.2 Horn Button Replacement

Removal Procedure

1. Remove the air bag (Refer to Air Bag Replacement - Driver Side).

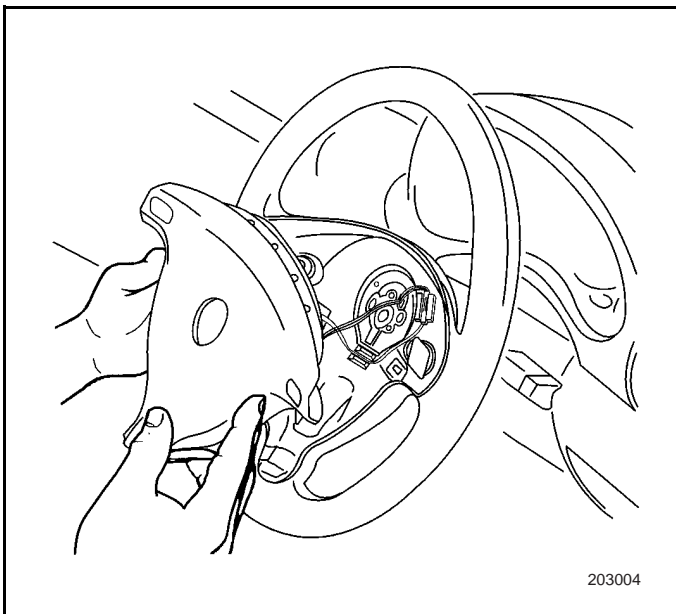
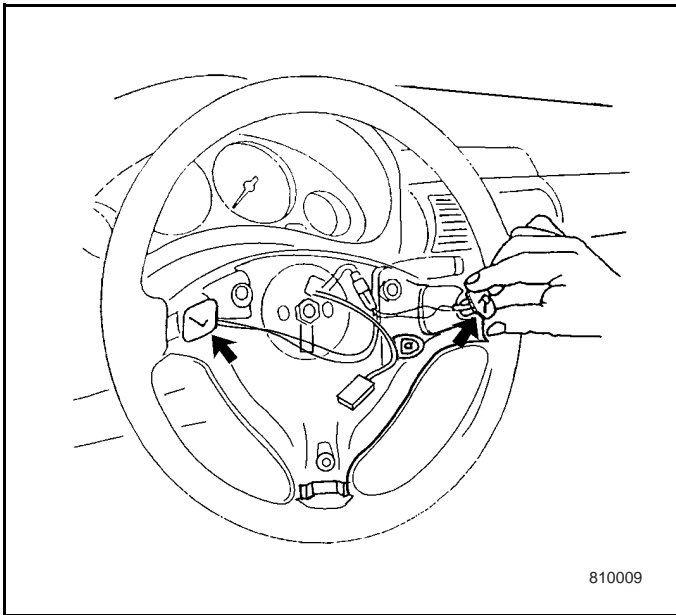


2. Remove the left and right horn buttons.
3. Open the horn button connector.

Installation Procedure

1. Join the horn button connector.

Note: L means Left, R means Right.



2. Install the air bag (Refer to Air Bag Replacement - Driver Side) and cover.

Blank

8.11 Body Rear End

8.11.1 Specifications

8.11.1.1A Fastener Tightening Torque

Application	Specification
Oil Filler Screw	0.6-1.0 N•m
Oil Filler Latch Screw	1.0-2.5 N•m
Lock Latch Bolt	18-22 N•m
Rear Compartment Hinge Connected to Rear Side Panel Nut	15-25 N•m
Rear Compartment Hinge Bolt	7-10 N•m
Rear Handle ASM Nut	2.5-4.0 N•m
Rear Impact Nut	7.0-9.0 N•m
Rear Compartment Latch Bolt	35.0-7.0 N•m
Lock Cylinder ASM - Rear Compartment Cover Nut	2.5-4.0 N•m

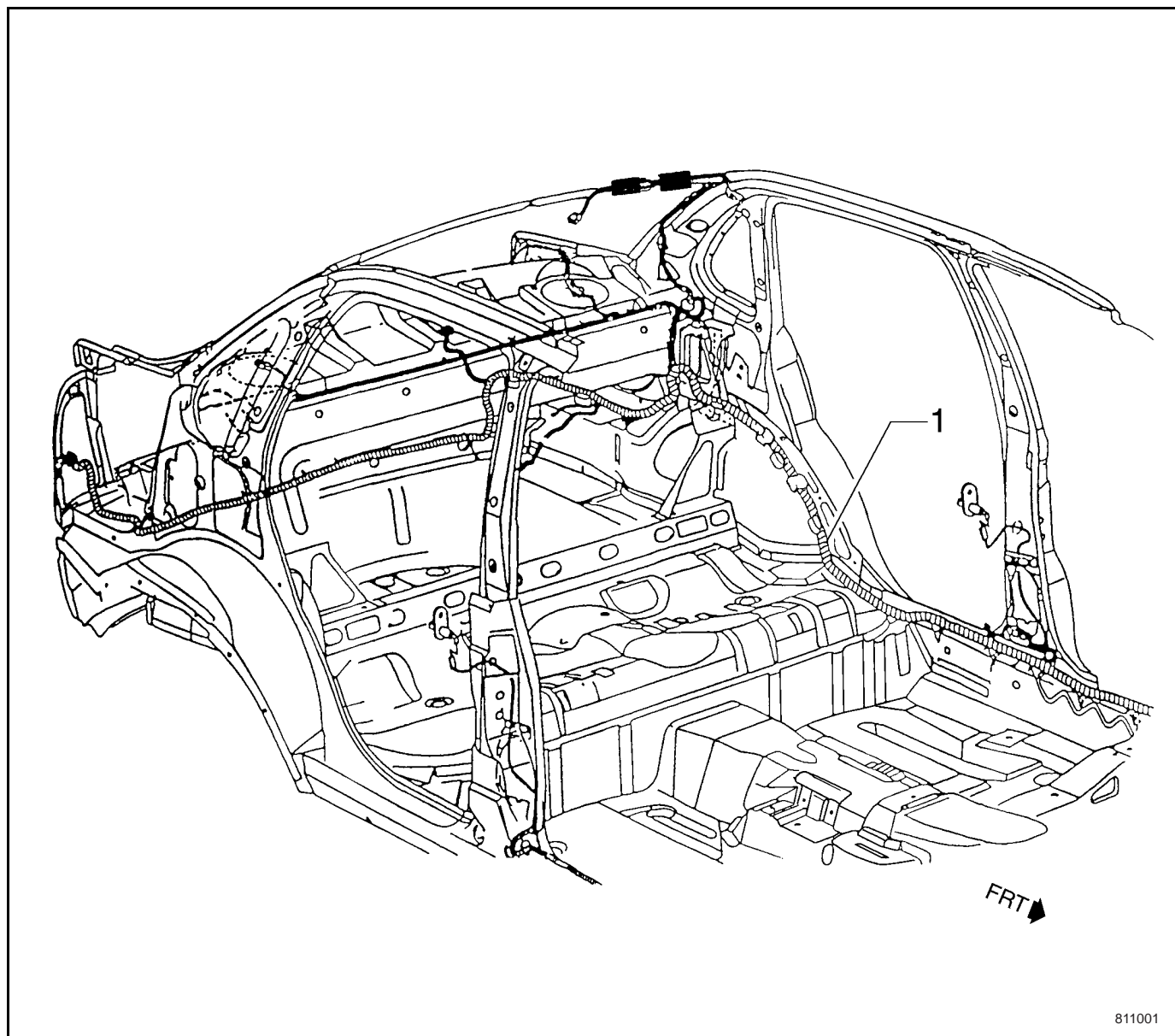
8.11.1.1B Fastener Tightening Torque

Application	Specification
Rear Lift Gate Actuator Screw	1-3 N•m
Rear Lift Gate Hinge Connected to Body Bolt	15.0-18.0 N•m
Rear Lift Gate Latch Bolt	5.0-7.0 N•m
Rear Lift Gate Lock Latch Bolt	18.0-22.0 N•m
Bolts - Rear Lift Gate Adjusting Panel ASM	1.4 ± 0.2 N•m
Ball Bolt - Rear Lift Gate Bracket	15.0-18.0 N•m
Nut - Rear Lift Gate Adjustable Bumper	3.5-5.0 N•m
Rear Handle Assembly - Rear Lift Gate Nut	2.5-4.0 N•m
Lock Cylinder ASM - Rear Lift Gate Nut	2.5-4.0 N•m

Note: For Rear Lift gate actuator, please refer to Door.

8.11.2 Component Locator

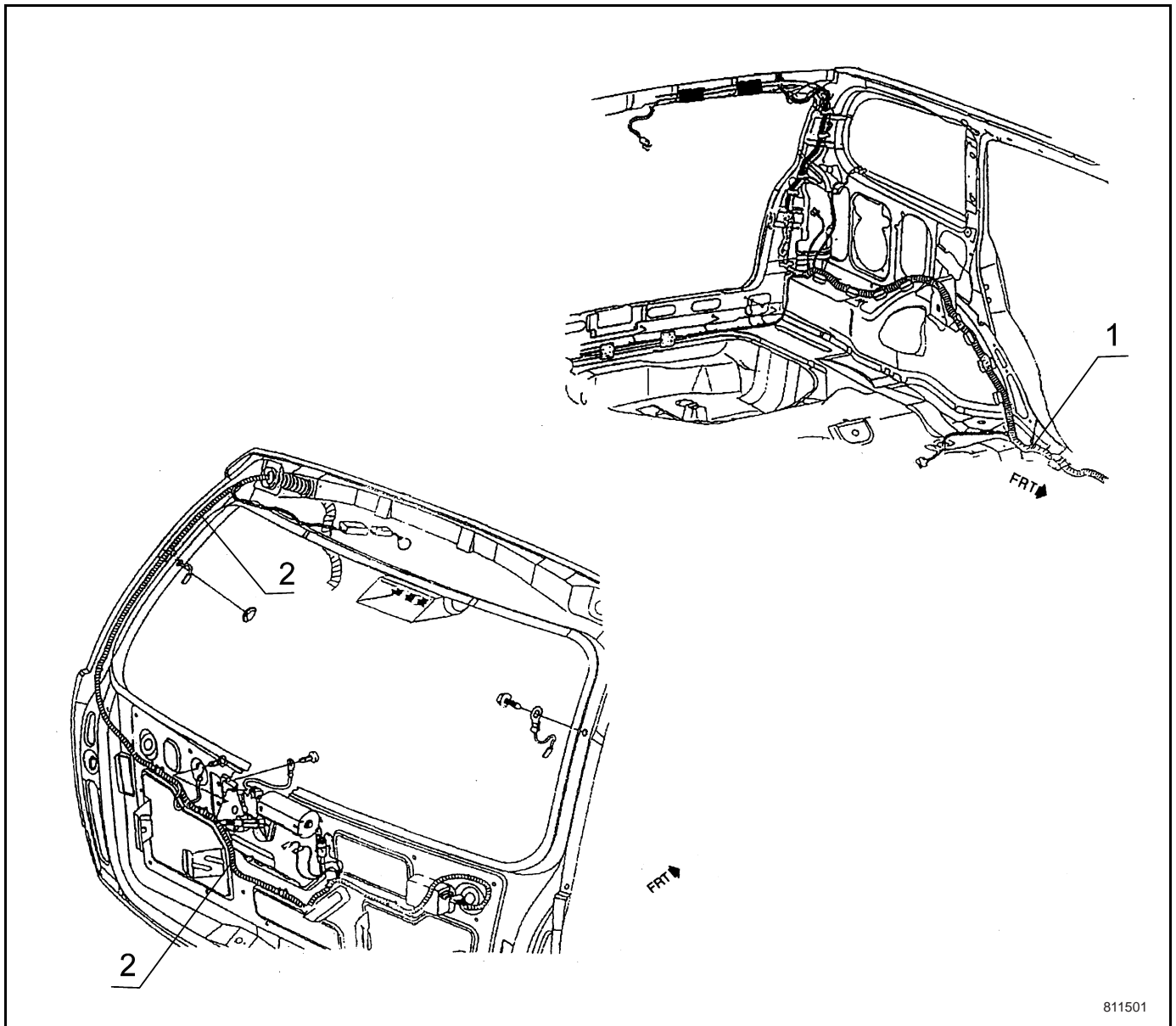
8.11.2.1A Part-View Drawing of Wiring Harness in the Rear Compartment



Legend

(1) Rear Body Harness

8.11.2.1B Part-View Drawing of Wiring Harness in the Rear Compartment

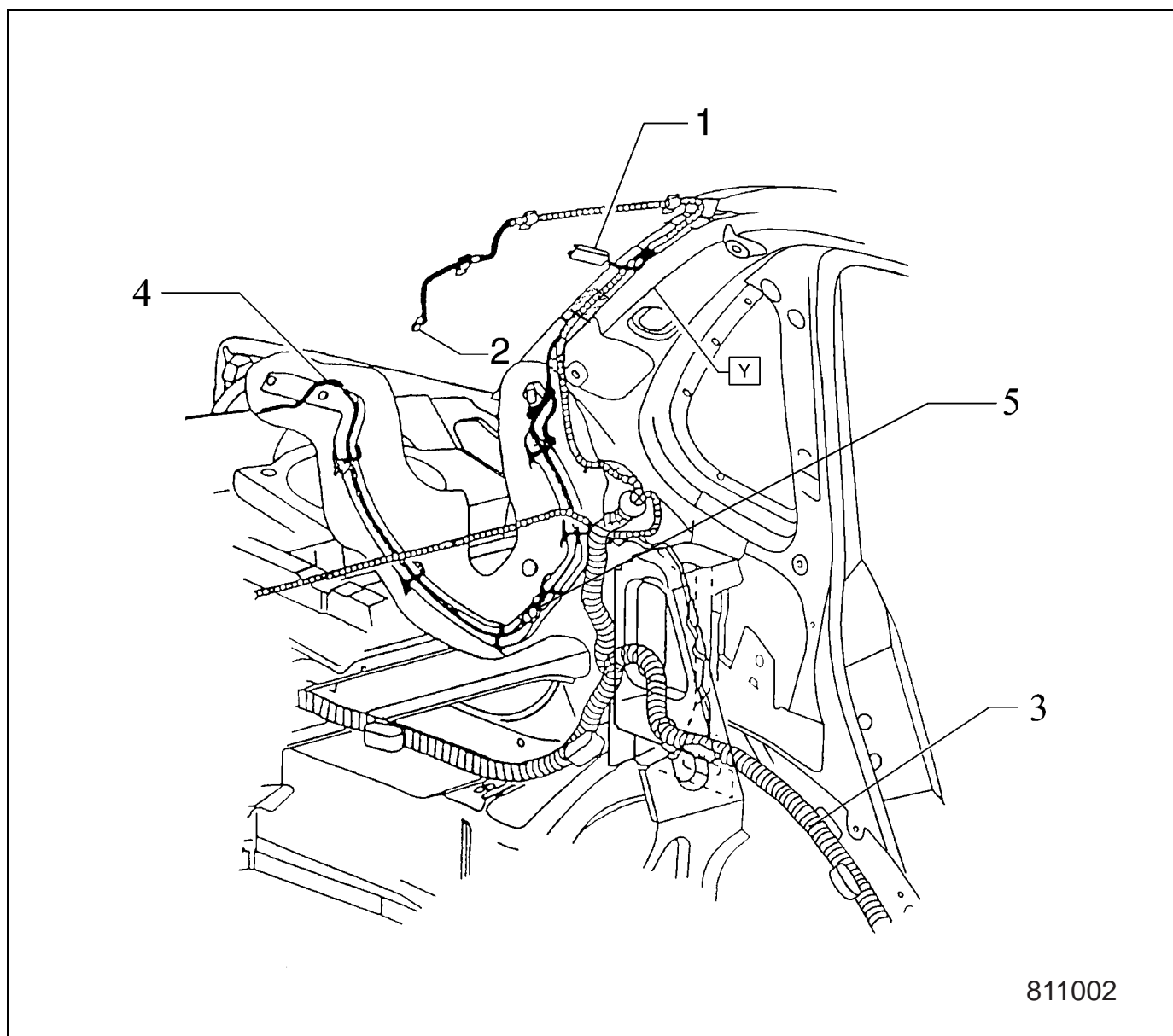


Legend

(1) Rear Body Wiring Harness ASM

(2) Rear Lift Gate Harness ASM

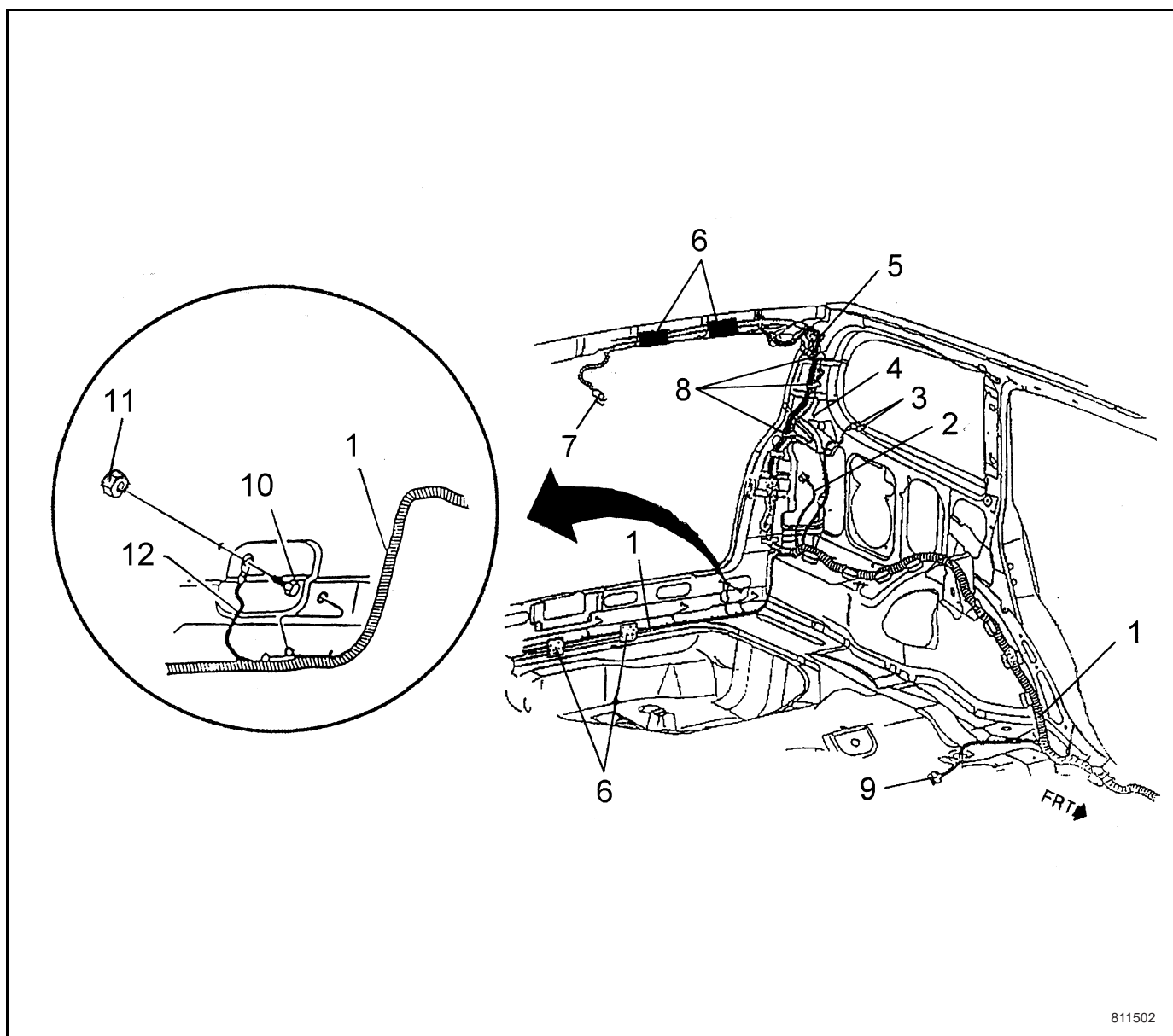
8.11.2.2A Part-View Drawing of Rear-body & Trunk Lid



Legend

- | | |
|---|--|
| (1) Connect to the rear defogger. | (4) Trunk Lid Harness |
| (2) Connect to the high mount brake light | (5) The joint connected between rear body and trunk lid harness. |
| (3) Rear Body Harness | |

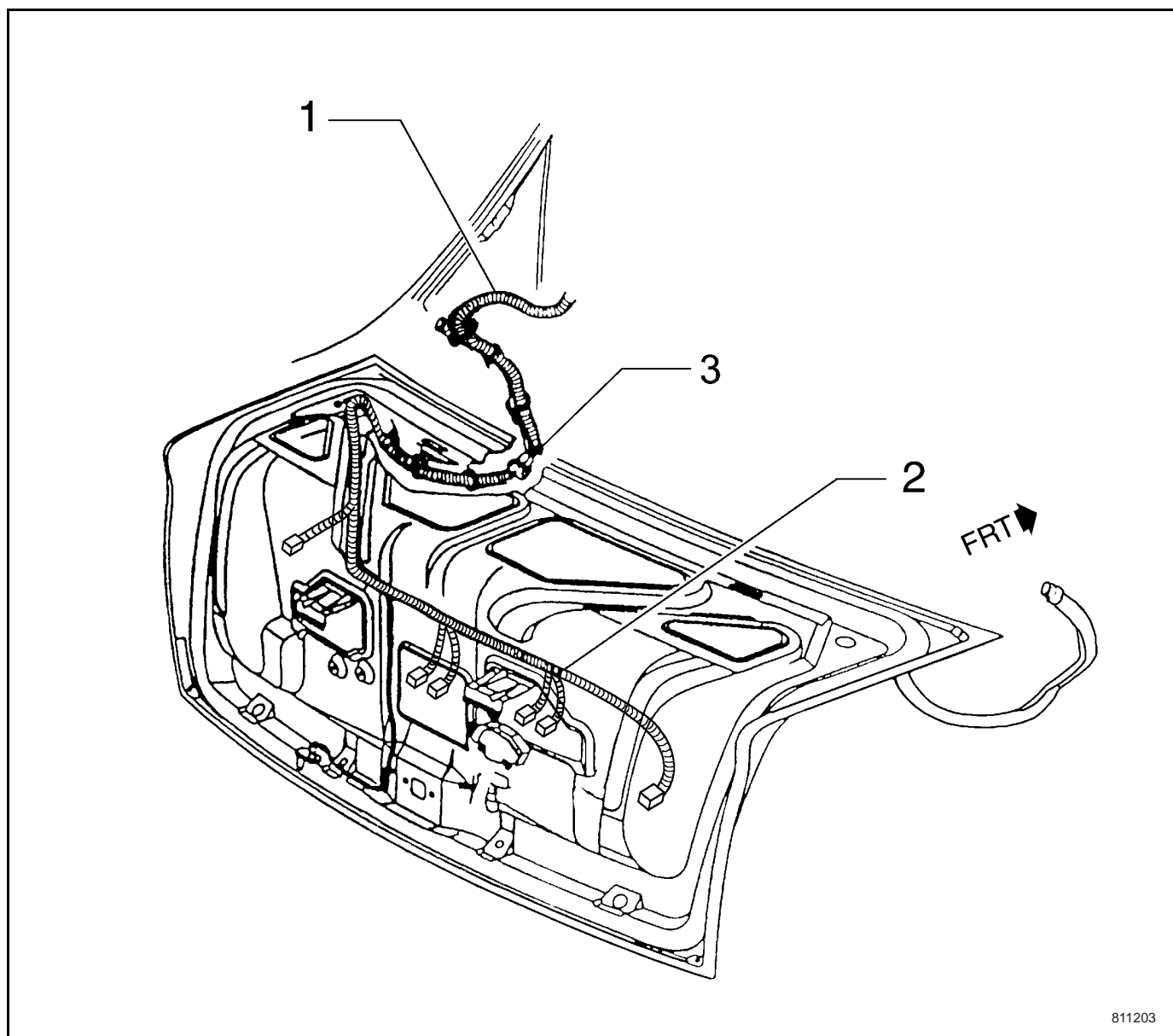
8.11.2.2B Part-View Drawing of Rear Body and Tail Gate



Legend

- | | |
|---|---|
| (1) Rear Body Wiring Harness ASM | (7) Connector, Roof Lamp |
| (2) Connector to Tail Lamp | (8) Clips - Rear Body Harness |
| (3) Connector, Speaker | (9) Connector to Fuel Tank |
| (4) Connector, Tweeter | (10) Bolt/Screw - Rear Body Harness Ground |
| (5) Harness Assembly - Rear Lift Gate Harness | (11) Nut - Rear Body Harness Ground |
| (6) Tape - Rear Body Harness | (12) Connector, Ground to the Panel, Rear Lower |

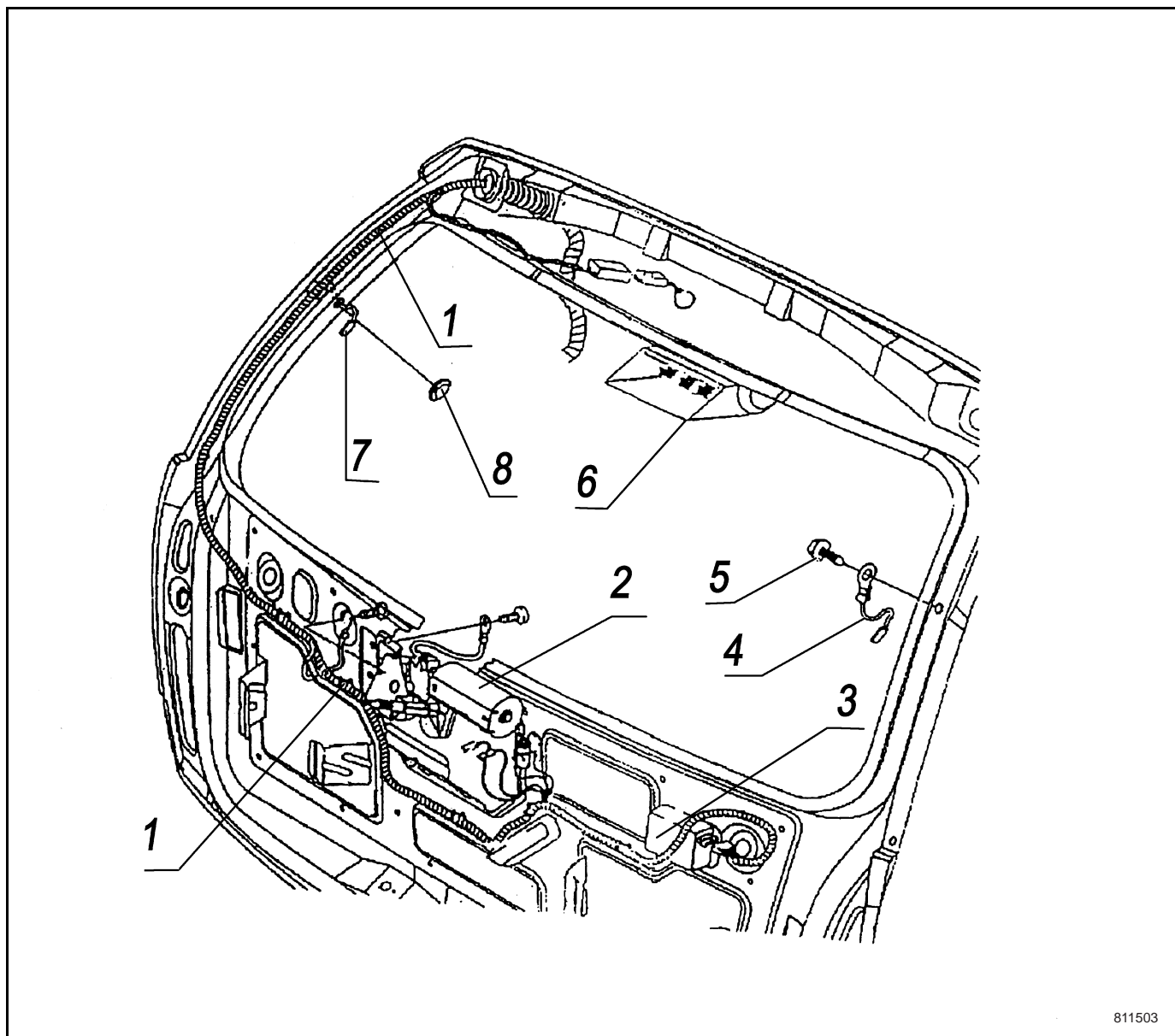
8.11.2.3A Part-View Drawing of Lid Harness - Rear Compartment



Legend

- | | |
|----------------------------------|--|
| (1) Rear Body Harness | (3) The joint connected between rear body and trunk lid harness (X9) |
| (2) Rear Compartment Lid Harness | |

8.11.2.3B Part-View Drawing of Lid Harness - Rear Compartment



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Legend

- | | |
|---|--|
| (1) Harness Assembly - Rear Lift Gate Harness | (5) Bolt/Screw - Rear Window Defogger Harness Ground |
| (2) Rear Wiper/Washer Motor | (6) Lamp, Auxiliary Brake |
| (3) Drive Unit, Rear Lift Gate | (7) Rear Window Defogger, Electric |
| (4) Harness Assembly - Rear Window Defogger | (8) Spacer - Rear Window Defogger Harness |

8.11.3 Diagnostic Information and Procedures

8.11.3.1A Diagnostic Procedure for Central Lock System

Step	Central Lock Inoperative	Yes	No
1	Please check the fuse (No.13, 20A), is it damaged?	Go to Step 2	Go to Step 3
2	Replace the damaged fuse.	Go to Step 3	—
3	Please check the fuse (No.18, 20A), is it damaged?	Go to Step 4	Go to Step 5
4	Replace the damaged fuse with a new 20 A fuse.	Go to Step 5	—
5	Separate the connector (X5) between I/P and rear body harness; Use a DMM to measure the voltage of Pin D3 at the I/P wiring harness side, is the voltage normal?	Go to Step 7	Go to Step 6
6	Please check and repair the I/P wiring harness from the fuse (No.13) to the connector (X5, Pin D3), be sure it's no problem.	Go to Step 7	—
7	Use a DMM to measure the voltage of Pin C12 at the Connector (X5) (I/P harness side), is it normal?	Go to Step 9	Go to Step 8
8	Please check and repair the I/P wiring harness from the fuse (No.18) to the connector (X5), be sure it's no problem.	Go to Step 9	—
9	Remove the central lock module, turn the ignition switch to "ON", and use a DMM to measure the voltage of Pin 3 and Pin 9, is it normal?	Go to Step 11	Go to Step 10
10	Please check and repair the rear body wiring harness from the connector (x 5) to the central lock module according to the wiring diagram. Be sure it's no problem.	Go to Step 11	—
11	Use a new central lock module to replace the old module to see if the system is normal?	—	Go to Step 12
12	Use the DMM to measure the ground wire (Pin 11) of the central lock module, is it grounding well?	Go to Step 13	Go to Step 14
13	Separate the Connector (X6, X7, X9) between rear body and left front door (right front door, Lid - Rear Compartment) harness, and use the DMM to measure the ground (Pin 30, Pin F), is it grounding well?	Go to Step 16	Go to Step 15
14	Please repair the rear body wiring harness around the ground wire, is the system OK?	—	Go to Step 13
15	Please repair the ground wire at Connector (X6, X7, X9), and ensure it's grounding well.	Go to Step 16	—
16	Please disconnect the central lock motor connector and switch connector of each door, use the DMM to test and check the harnesses of Rear Body, Left Front Door, Right Front Door, Right Rear Door and Lid ñ Rear Compartment according to the wiring diagram; If necessary, repair the harnesses. Be sure the harness has no problem. Is the system OK?	—	Go to Step 17
17	Please check the central lock switch and inner structure of central motor of each door, if necessary, replace or repair it. The system runs ok.	—	—

8.11.3.1B Diagnostic Procedure for Central Lock System

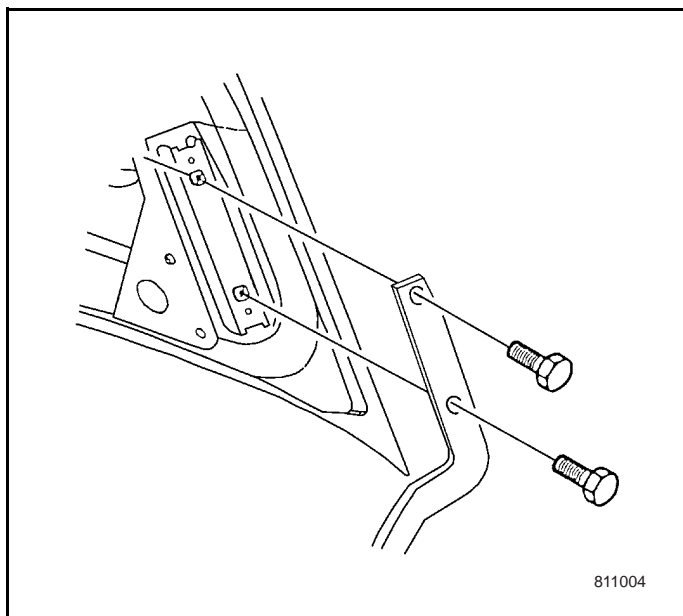
Step	Central Lock Inoperative	Yes	No
1	Please check the fuse (No.13, 20A), is it damaged?	Go to Step 2	Go to Step 3
2	Replace the damaged fuse.	Go to Step 3	—
3	Please check the fuse (No.18, 20A), is it damaged?	Go to Step 4	Go to Step 5
4	Replace the damaged fuse with a new 20 A fuse.	Go to Step 5	—
5	Separate the connector (X5) between I/P and rear body harness; Use a DMM to measure the voltage of Pin D3 at the I/P wiring harness side, is the voltage normal?	Go to Step 7	Go to Step 6
6	Please check and repair the I/P wiring harness from the fuse (No.13) to the connector (X5, Pin D3), be sure it's no problem.	Go to Step 7	—
7	Use a DMM to measure the voltage of Pin C12 at the Connector (X5) (I/P harness side), is it normal?	Go to Step 9	Go to Step 8
8	Please check and repair the I/P wiring harness from the fuse (No.18) to the connector (X5), be sure it's no problem.	Go to Step 9	—
9	Remove the central lock module (the connector is inside the rear body harness, turn the ignition switch to "ON", and use a DMM to measure the voltage of Pin 3 and Pin 9, is it normal?	Go to Step 11	Go to Step 10
10	Please check and repair the rear body wiring harness from the connector (x 5) to the central lock module according to the wiring diagram. Be sure it's no problem.	Go to Step 11	—
11	Use a new central lock module to replace the old module to see if the system is normal?	—	Go to Step 12
12	Use the DMM to measure the ground wire (Pin 11) of the central lock module, is it grounding well?	Go to Step 13	Go to Step 14
13	Separate the Connector (X6, X7, X9) between rear body and left front door (right front door, Lid - Rear Compartment) harness, and use the DMM to measure the ground (Pin 30, Pin F), is it grounding well?	Go to Step 16	Go to Step 15
14	Please repair the rear body wiring harness around the ground wire, is the system OK?	—	Go to Step 13
15	Please repair the ground wire at Connector (X6, X7, X9), and ensure it's grounding well.	Go to Step 16	—
16	Please disconnect the central lock motor connector and switch connector of each door, use the DMM to test and check the harnesses of Rear Body, Left Front Door, Right Front Door, Right Rear Door and Lid - Rear Compartment according to the wiring diagram; If necessary, repair the harnesses. Be sure the harness has no problem. Is the system OK?	—	Go to Step 17
17	Please check the central lock switch and inner structure of central motor of each door, if necessary, replace or repair it. The system runs ok.	—	—

8.11.4 Repair Instructions

8.11.4.1A Compartment Lid Adjustment - Rear

Adjusting Procedures

1. Open the rear compartment.
2. Release the bolt on rear compartment lid hinge. Screw down the bolt to maintain the adjusted position of rear compartment.
3. Align with the rear compartment lid.



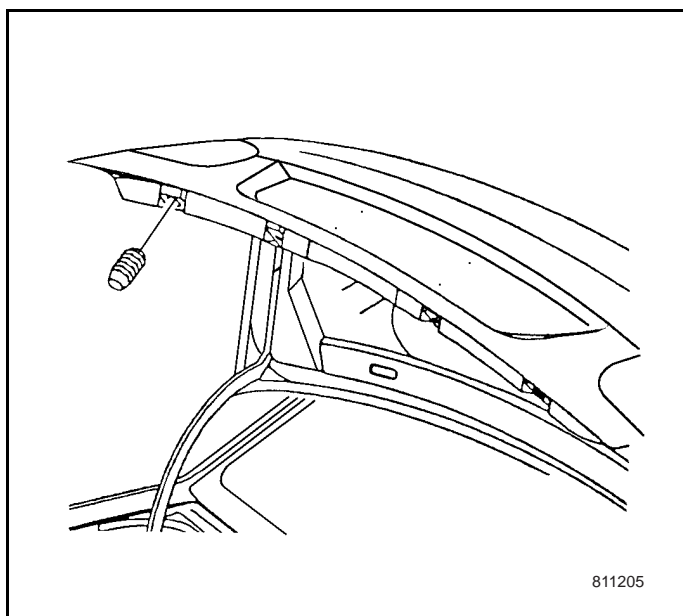
Adjust the rear corner upwards and downwards.

1. Screw in or out the rubber bumper to lower or raise the rear compartment lid according to the requirements.
2. Tighten the rear compartment lid hinge bolt.

Tightening

Tighten the hinge bolts to 7-10 N•m.

3. Close the rear compartment lid.



8.11.4.1B Rear Lift Gate Adjustment

Specification

Rear Lift Gate to Roof: At the area of both sides, the clearance is 7 ± 1.0 mm, and the parallel tolerance is 0-3.5mm, and at the central area it is 0-2 mm.

Rear Lift Gate to Triangle Window: The clearance is 5.5 ± 1.0 mm, and the parallel tolerance is -1.0 ± 1.0 mm.

Rear Window to Triangle Window: The clearance is 6.0 ± 1.0 mm, and the parallel tolerance is 4.0 ± 1.5 mm.

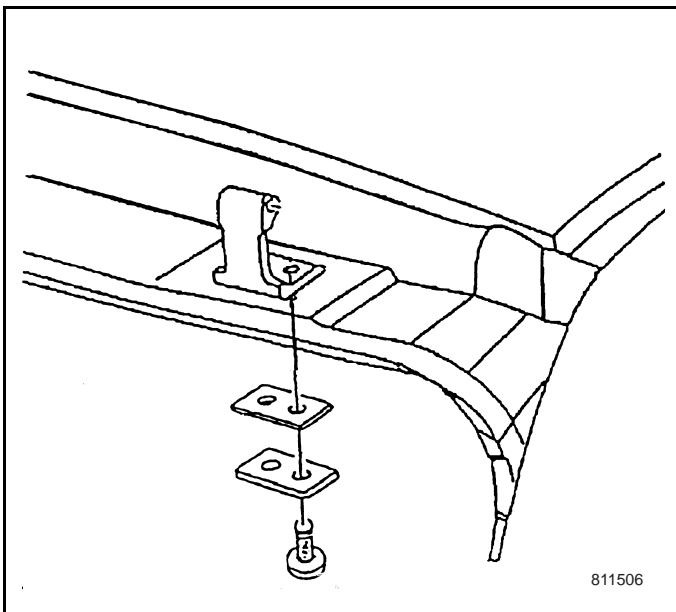
Rear Lift Gate Weather Strip to Rear Bumper: The clearance is 12.0 ± 1.5 mm, and the parallel tolerance is -3.0 ± 1.5 mm.

Adjusting Procedures

1. Open the rear lift gate.

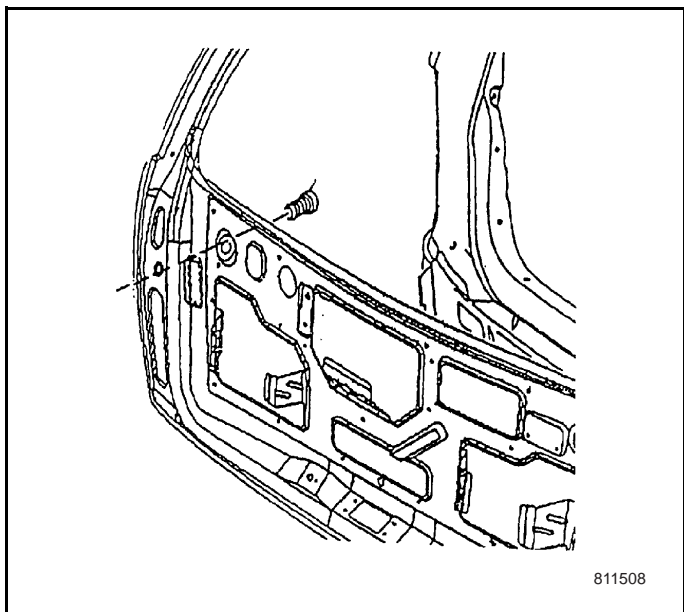
Adjust the upper parallel.

2. Release the bolt of rear lift gate hinge (Body Side).Screw the bolt tightly enough to maintain the adjusted position of rear lift gate.
3. Align the tail gate.Move the rear lift gate hinge (Body Side) backwards and forwards at each side, and adjust the rear lift gate position.
4. Close the rear lift gate.
5. Check the alignment.
6. Open the rear lift gate.Make adjustments, until the upper parallel of rear lift gate meets the specifications.

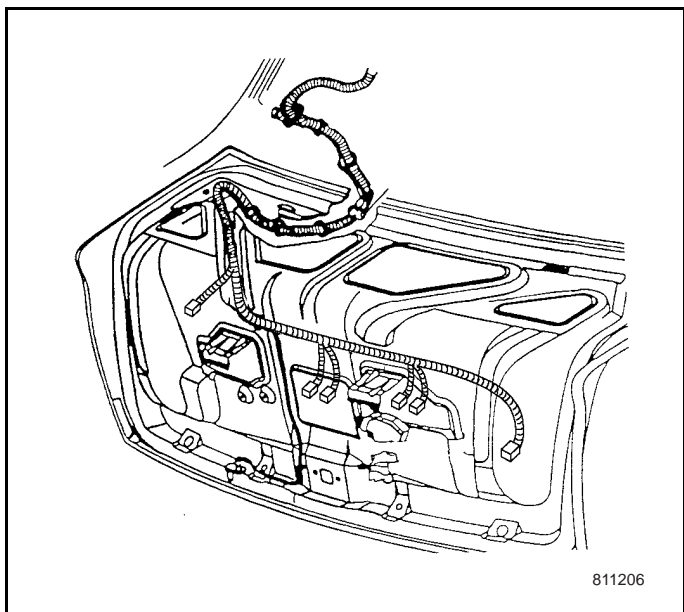


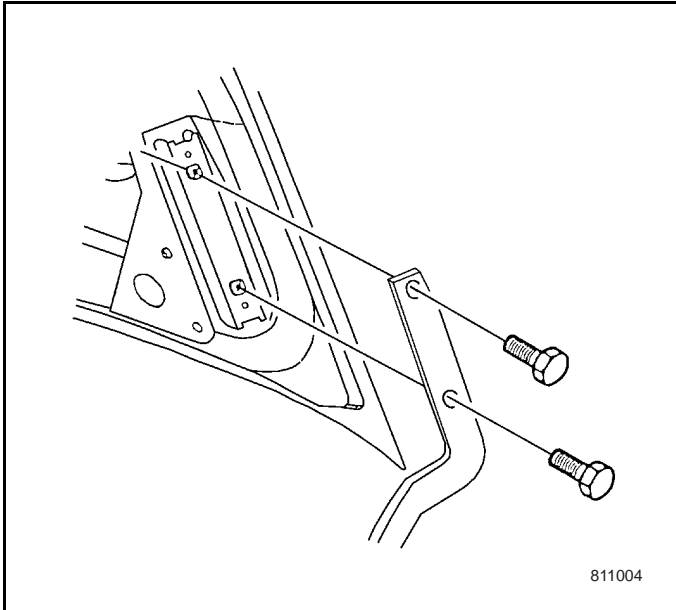
Adjust the lower parallel.

1. Release the bolt of rear lift gate latch. Screw the bolt tightly enough to maintain the adjusted position of rear lift gate.
2. Adjust the latch position to secure the rear lift gate.
3. Close the rear lift gate.
4. Check the alignment.
5. Open the rear lift gate. Make adjustments, until the lower parallel of rear lift gate meets the specifications.
6. Adjust the side bumper of rear lift gate according to the requirements, and ensure the front and rear parallel.
7. Screw down the bolt of rear lift gate hinge (Body Side). Refer to Rear Lift Gate Replacement.
8. Screw down the bolt of rear lift gate latch. Refer to Rear Lift Gate Latch Replacement.
9. Close the rear lift gate.

**8.11.4.2 A Compartment Lid Replacement - Rear****Removal Procedure**

1. Open the rear compartment lid.
2. Place a safety cover on the adjacent body panel.
3. Disconnect the electrical harness of rear compartment lid hinge. See Compartment Lid Harness Replacement - Rear.





4. Use a grease stick to mark the position of rear compartment lid hinge on rear compartment lid.
5. With the help of your assistant, remove the bolt from rear compartment lid hinge.
6. With the help of your assistant, remove rear compartment lid.
7. Remove the rear compartment lid latch, see *Compartment Lid Latch Replacement - Rear*.
8. Remove the rear compartment lid lock cylinder ASM and the handle assembly, see *Compartment Lid Lock Cylinder ASM Replacement - Rear* and *Compartment Lid Handle ASM Replacement - Rear*.
9. Remove all the rubber bumper on rear compartment lid.
10. Remove the lock linkage mechanism on rear compartment lid.

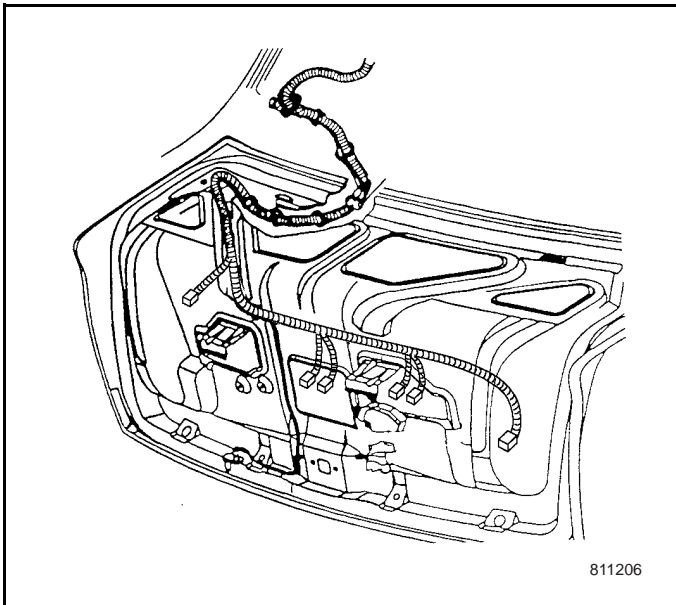
Installation Procedure

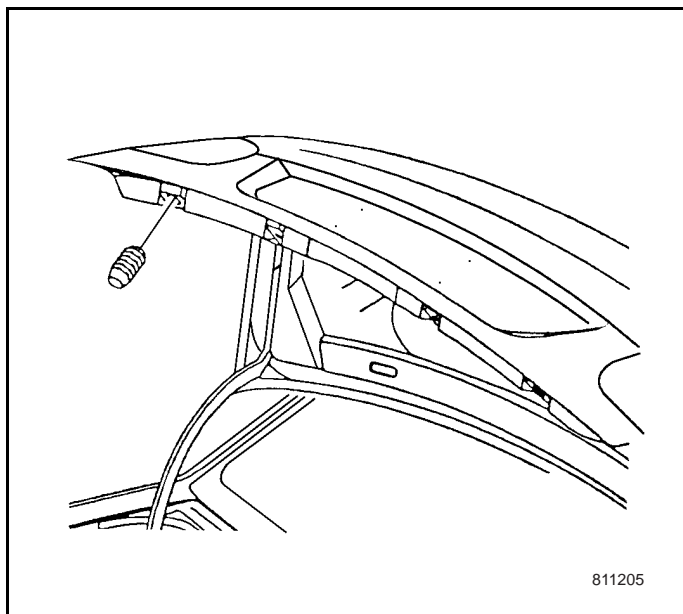
1. With the help of your assistant, place the rear compartment lid on the hinge and mark the position with a grease stick.
2. With the help of your assistant, install the bolt onto rear compartment lid hinge.

Tightening

Tighten the rear compartment lid hinge bolts to 7-10 N•m.

3. Connect the electrical harness. See *Compartment Lid Harness Replacement - Rear*.





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4. Install the rear compartment lid lock cylinder ASM and the handle assembly, see Compartment Lid Lock Cylinder ASM Replacement - Rear and Compartment Lid Handle ASM Replacement - Rear.
5. Install the rear compartment lid latch, see Compartment Lid Latch Replacement - Rear.
6. Install the rear compartment lid lock linkage mechanism, and check the actuating of rear compartment lid linkage mechanism.
7. Install the rubber bumper of rear compartment lid.
8. Adjust the bumper length according to the requirements, and consequently adjust the parallel of rear compartment lid and body.
9. Install the license nut of rear compartment lid.
10. Remove the safety cover.
11. Close the rear compartment lid.

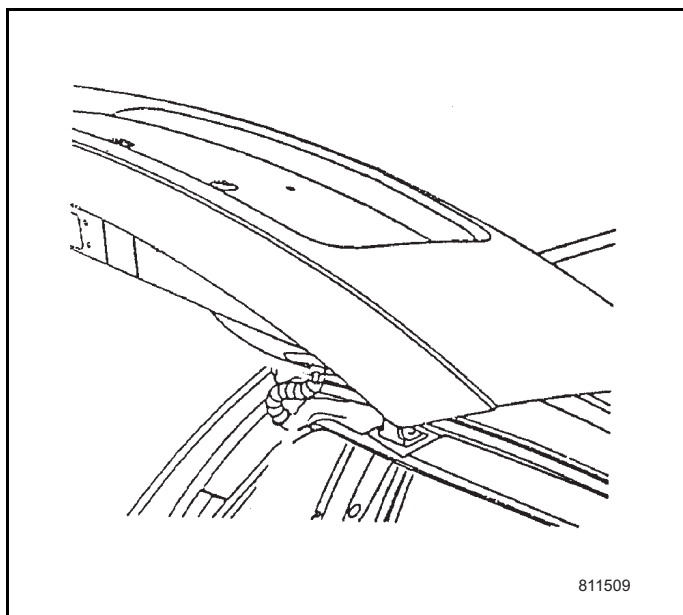
8.11.4.2B Rear Lift Gate Replacement

Removal Procedure

1. Open the rear lift gate.
2. Place a safety cover on the adjacent body panel.

Caution: When removing or installing the rear lift gate hold rod, an alternate hold rod should be provided to avoid the possibility of vehicle damage or personal injury.

3. Pull out the wire protective hose end from the rear lift gate hole.
4. Remove the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
5. Disconnect the rear harness clamped on the rear lift gate. Refer to Harness Replacement - Rear Lift Gate.
6. Remove the rear window washer nozzle and hose from the rear lift gate. See Washer Solvent Reservoir, Pump, Nozzle and Hose Replacement of Wiper/Washer System.
7. Remove the rear lift gate hold rod from the gate. Refer to Hold Rod Replacement - Rear Lift Gate.
8. With the help of your assistant, remove the pin retainer of rear lift gate hinge and the hinge pin of rear lift gate. Refer to Hinge Replacement - Rear Lift Gate.
9. With the help of your assistant, remove the rear lift gate assembly.
10. Remove rear wiper arm. See Wiper Arm Replacement - Rear in Wiper/Washer System.
11. Remove rear wiper blade. See Wiper Blade Replacement in Wiper/Washer System.

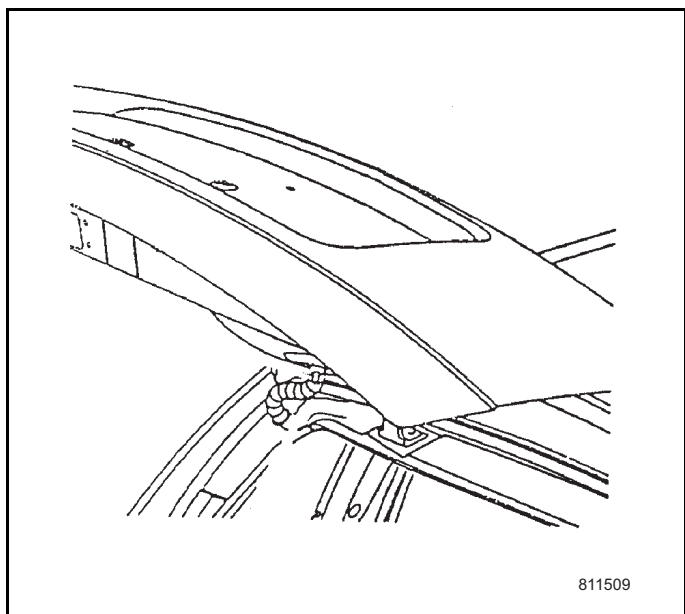


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12. Remove rear wiper motor. See Wiper Motor ASM Replacement - Rear in Wiper/Washer System.
13. Remove the rear lift gate lock cylinder assembly and the handle assembly. See Lock Cylinder ASM Replacement - Rear Lift Gate and Handle ASM Replacement - Rear Lift Gate.
14. Remove the actuator of rear lift gate. Refer to Actuator Replacement - Rear Lift Gate.
15. Remove the rear lift gate latch. Refer to Latch Replacement - Rear Lift Gate.
16. Remove the rear lift gate locking bar. Refer to Locking bar Replacement - Rear Lift Gate.
17. Remove the adjustable buffer of rear lift gate. Refer to Adjustable Buffer Replacement - Rear Lift Gate.
18. Remove the ball bolt/screw (at Rear Lift Gate side) of rear lift gate hold rod. Refer to Ball Bolt Replacement - Rear Lift Gate Hold Rod.
19. Remove the weather strip of rear lift gate. Refer to Weather Strip Replacement - Rear Lift Gate.
20. Remove the rear window of rear lift gate. See Rear Window Replacement in Stationary Window.

Installation Procedure

1. Install the weather strip of rear lift gate on the gate. Refer to Weather Strip Replacement - Rear Lift Gate.
2. Install the ball bolt/screw of rear lift gate hold rod on the gate. Refer to Ball Bolt Replacement - Rear Lift Gate Hold Rod.
3. Install the rear lift gate adjustable buffer on the gate. Refer to Adjustable Buffer Replacement - Rear Lift Gate.
4. Install the rear lift gate latch on the gate. Refer to Latch Replacement - Rear Lift Gate.
5. Install the rear lift gate actuator on the gate. Refer to Actuator Replacement - Rear Lift Gate.
6. Install the rear lift gate lock cylinder assembly and handle assembly on the rear lift gate. See Lock Cylinder ASM Replacement - Rear Lift Gate and Handle ASM Replacement - Rear Lift Gate.
7. Install the rear wiper motor on the rear lift gate. See Wiper Motor ASM Replacement - Rear in Wiper/Washer System.
8. Install the rear wiper blade on the rear lift gate. See Wiper Blade Replacement in Wiper/Washer System.
9. Install the rear wiper arm on the rear lift gate. See Wiper Arm Replacement - Rear in Wiper/Washer System.
10. With the help of your assistant, put the rear lift gate on the rear lift gate hinge (at Body side).
11. With the help of your assistant, install the hinge pin of rear lift gate and the pin retainer of rear lift gate hinge. Refer to Hinge Replacement - Rear Lift Gate.
12. Install the rear lift gate locking bar between the rear lift gate lock cylinder and the latch. Refer to Locking bar Replacement - Rear Lift Gate.
13. Connect the rear lift gate hold rod to the ball bolt of hold rod (at Rear Lift Gate side). Refer to Hold Rod Replacement - Rear Lift Gate.
14. Install the rear window washer nozzle and hose on the rear lift gate. See Washer Solvent Reservoir, Pump, Nozzle and Hose Replacement in Wiper/Washer System.
15. Install the rear window on the rear lift gate. See Rear Window Replacement in Stationary Window.
16. Connect the rear harness clamped on the rear lift gate. Refer to Harness Replacement - Rear Tail Gate.
17. Install the rear lift gate trim panel on the gate. See Trim Panel ASM Replacement - Rear Lift Gate.

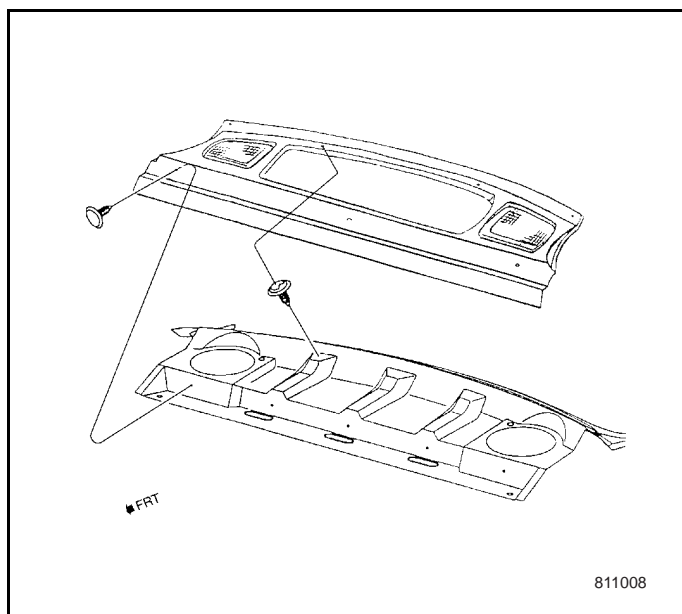
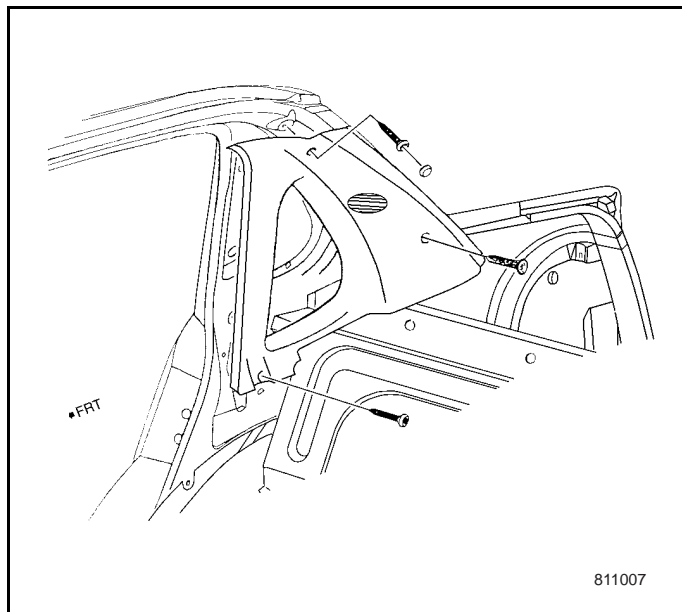


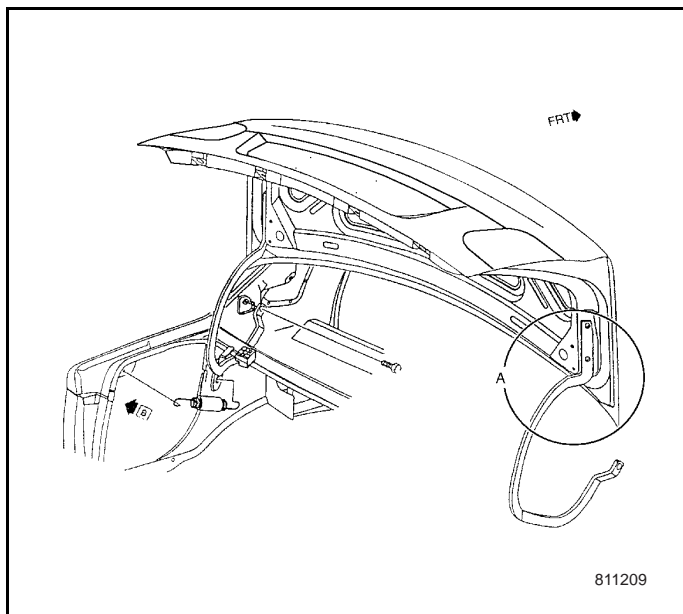
18. Thrust the bracket hose end in the rear lift gate hole.
19. Remove the safety cover from the adjacent body panel.
20. Close the rear lift gate.

8.11.4.3 A Compartment Lid Hinge Replacement - Rear

Removal Procedure

1. Remove the triangle window trim panel, see Triangle Window Trim Panel Replacement in Interior Trim.
2. Remove the coat hook trim panel, see Trim Panel Replacement - Coat Hook of Interior Trim.





3. Remove the bolts of rear compartment lid hinge, then the rear compartment lid.
4. Remove the spring of rear compartment lid hinge.
5. Remove the bumper of rear compartment lid hinge.
6. Remove the bolts of rear compartment lid hinge on the body side.
7. Remove the rear compartment lid hinge assembly.

Installation Procedure

1. Use bolts to install rear compartment lid hinge on rear body side.

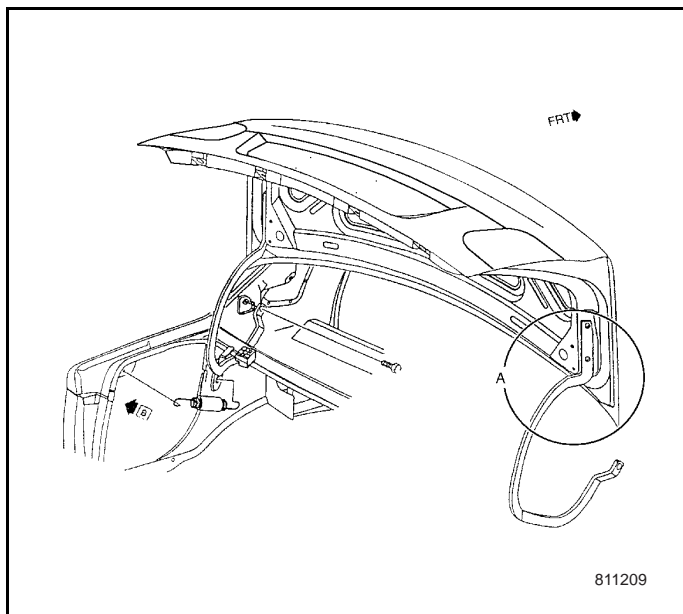
Tightening

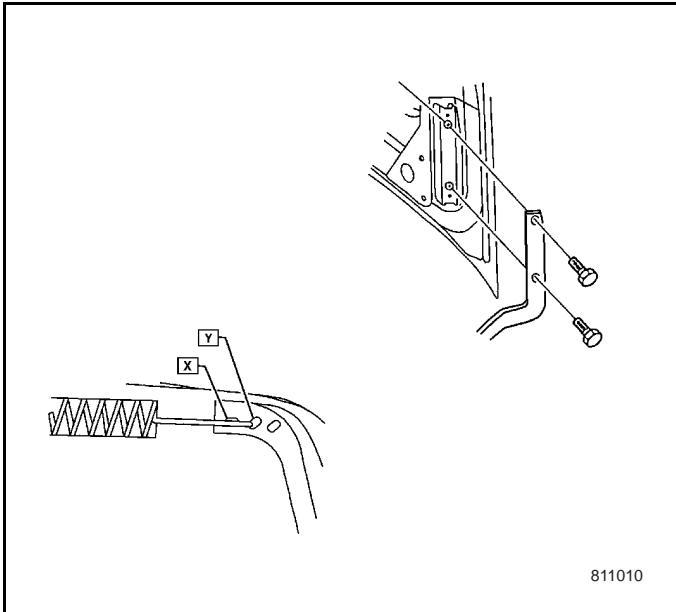
Tighten the bolts connecting rear compartment lid hinge to the body side to 15-25 N•m.

2. Install the rear compartment lid hinge bumper to the rear compartment lid hinge assembly.
3. Install the bolts connecting the rear compartment lid hinge assembly to the lid.

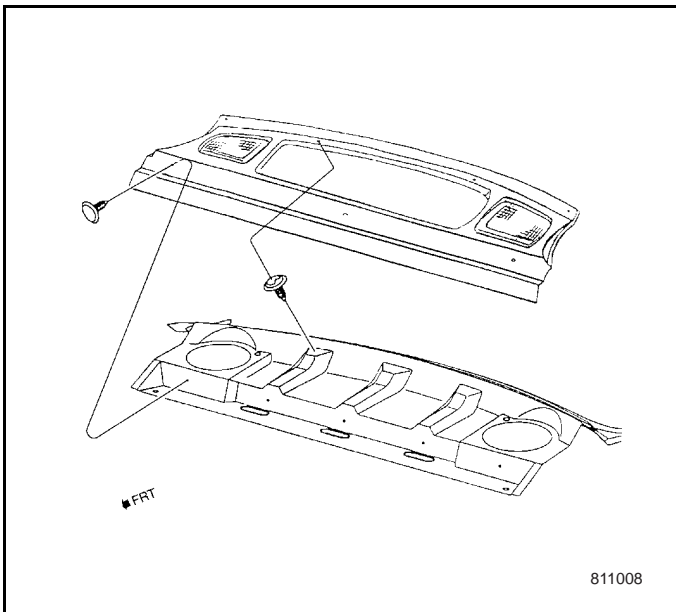
Tightening

Tighten the bolts connecting rear compartment lid hinge to rear compartment lid to 7-10 N•m.

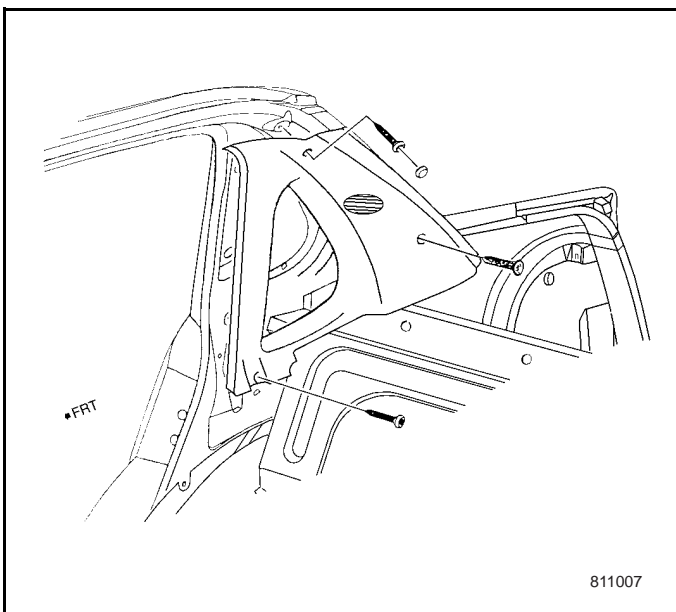




4. Install one end of the rear compartment lid hinge Spring E into the small hole of rear compartment lid hinge, and install the other end into the filling panel hole of body side panel.
5. Check the rear compartment lid switch. If the rear compartment lid springs up too fast, hang the spring at X hole location of body side outer panel filler; if the rear compartment lid cannot stop steadily, hang the spring at Y hole location of body side outer panel filler.
6. Check the alignment between the rear compartment lid and the body, and adjust as required. See Compartment Lid Adjustment - Rear.



7. Install the coat hook trim panel, see Trim Panel Replacement - Coat Hook of Interior Trim.



8. Install the triangle window trim panel, see Triangle Window Trim Panel Replacement in Interior Trim.

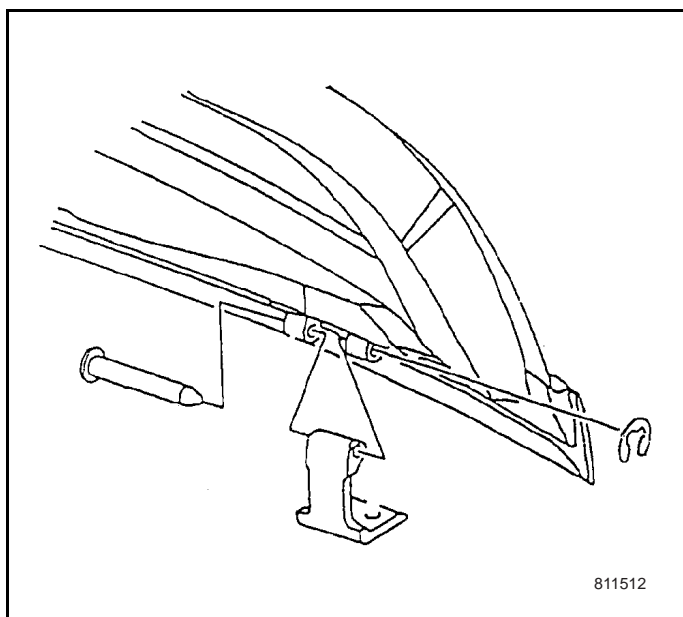
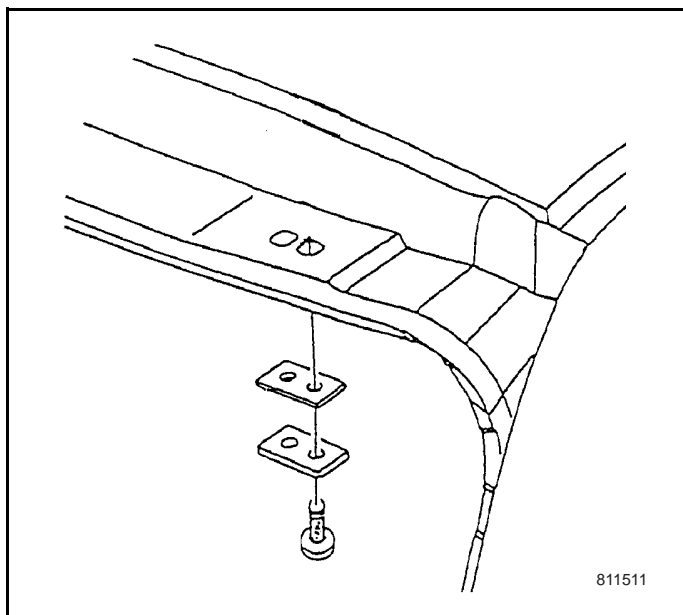
8.11.4.3B Hinge (Body Side) Replacement - Rear Lift Gate

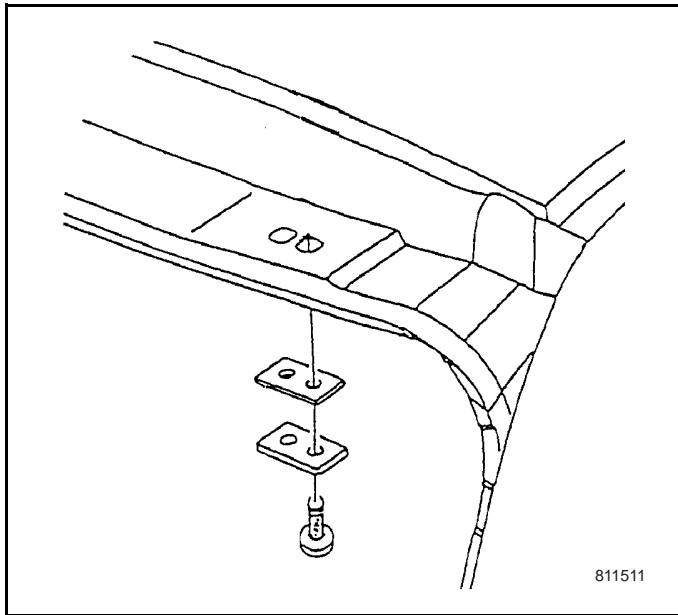
Removal Procedure

1. Open the rear lift gate.

Caution: When removing or installing the rear tail gate hold rod, an alternate hold rod should be provided to avoid the possibility of vehicle damage or personal injury.

2. Use a grease stick to mark the rear lift gate hinge position on the vehicle roof panel.
3. Remove the weather strip of rear lift gate opening. Refer to Weather Strip Replacement - Rear Lift Gate Opening.
4. Remove the retainer of rear headliner, and pull down the roof lining. Refer to Headliner Replacement in Interior Trim.
5. With the help of your assistant, remove rear lift gate hinge (at Body Side) bolt, rear lift gate hinge reinforcement (at Body Side) and sealing.
6. Use the pliers to remove the pin end retainer of rear lift gate hinge.
7. Use a hammer to hit the rear lift gate hinge pin to make it through the hinge.
8. Remove the rear lift gate hinge (at Body Side).





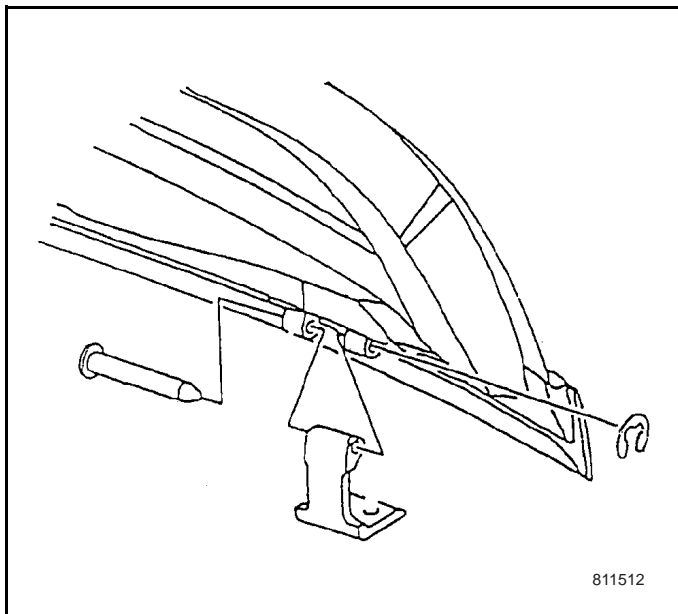
Installation Procedure

1. Install the rear lift gate hinge (at Body Side) on the marking position of roof panel.
2. Mount the rear lift gate hinge reinforcement and the rear lift gate hinge sealed on it, under the roof panel.
3. Tighten the rear lift gate hinge bolts to the rear lift gate hinge.

Tightening

Tighten the rear lift gate hinge bolts to 15.0-18.0 N•m.

4. With the help of your assistant, align the rear lift gate hinge (at Rear Lift Gate side) with the rear lift gate hinge (at Body Side).



5. Thrust in the rear lift gate hinge pins and put them through the hinge, then use a hammer to hit them to the end.

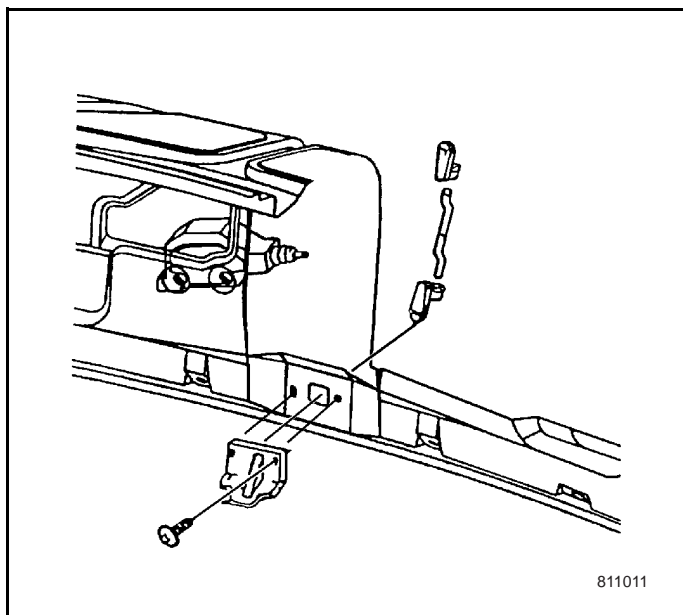
Note: Left pins should be leftwards, and right pins should be rightwards.

6. Install the rear lift gate hinge pin retainer in the groove of pin end to prevent the pin exposing.
7. Install the headliner. Refer to Headliner Replacement of Interior Trim.
8. Install the weather strip of rear lift gate opening. Refer to Weather Strip Replacement - Rear Lift Gate Opening.
9. Close the rear lift gate.

8.11.4.4 A Compartment Lid Latch Replacement - Rear

Removal Procedure

1. Open the rear compartment lid.
2. Remove the bolts fixing the rear compartment lid latch.
3. Pull out the latch and disconnect the release bar of rear compartment lid latch.



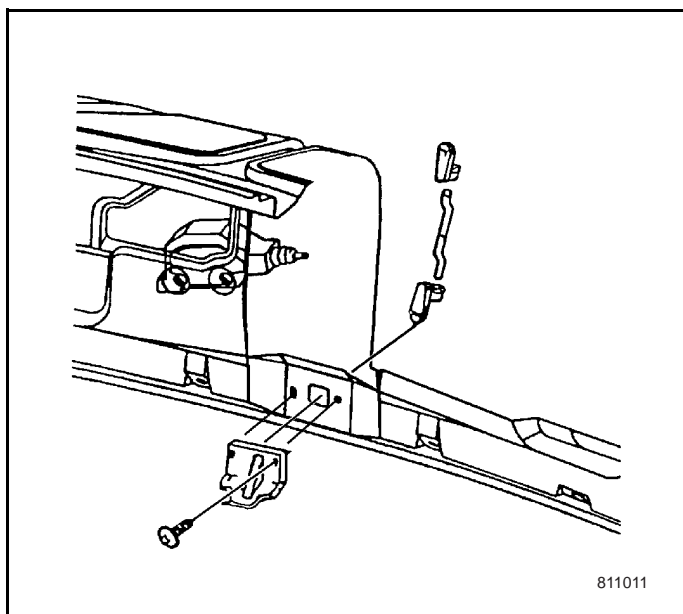
Installation Procedure

1. Connect the release locking bar of rear compartment lid to the latch.
2. Pull out the latch and locking bar of rear compartment lid.
3. Tighten the latch bolt of rear compartment lid.

Tightening

Tighten the latch bolt of rear compartment lid to 5.0-7.0 N•m.

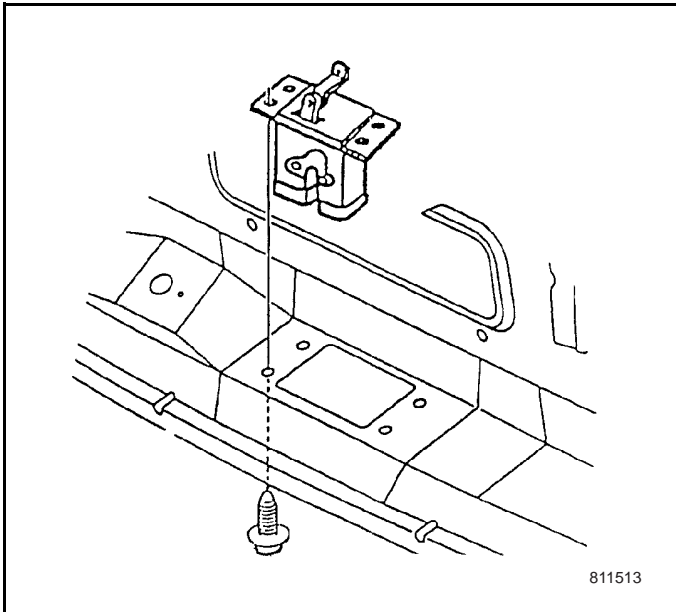
4. Close the rear compartment lid.



8.11.4.4B Latch Replacement - Rear Lift Gate

Removal Procedure

1. Open the rear lift gate.
2. Remove the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
3. Remove the latch bolt of rear lift gate.
4. Pull out the latch, and dismantle the release bar of rear lift gate latch. Refer to Locking bar Replacement - Rear Lift Gate.
5. Remove the latch.



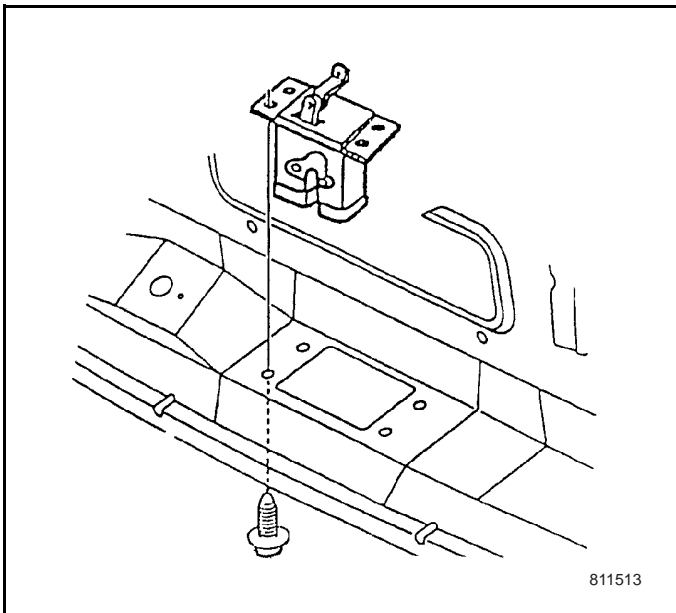
Installation Procedure

1. Engage the release bar of rear lift gate with the latch. Refer to Locking bar Replacement - Rear Lift Gate.
2. Pull the latch and locking bar onto the rear lift gate panel, and align with the hole location.
3. Tighten the bolts onto the rear lift gate latch.

Tightening

Tighten the latch bolt of rear lift gate to 5.0-7.0 N•m.

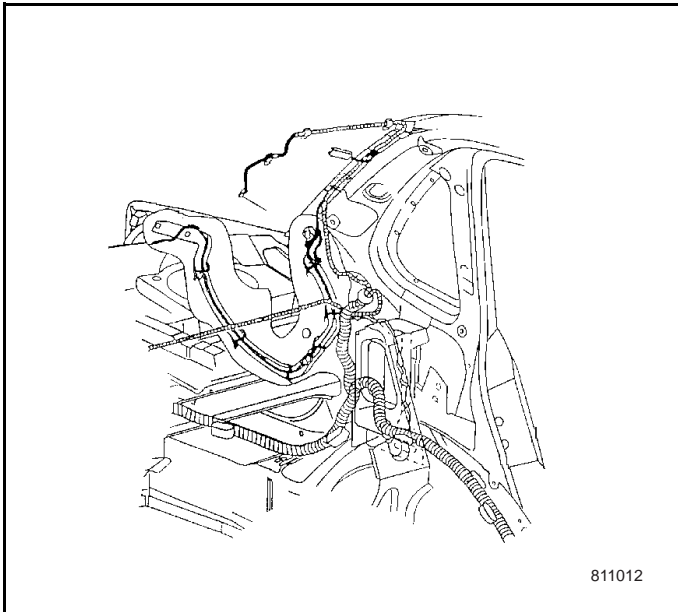
4. Install the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
5. Close the rear lift gate.



8.11.4.5 A Compartment Lid Harness Replacement - Rear

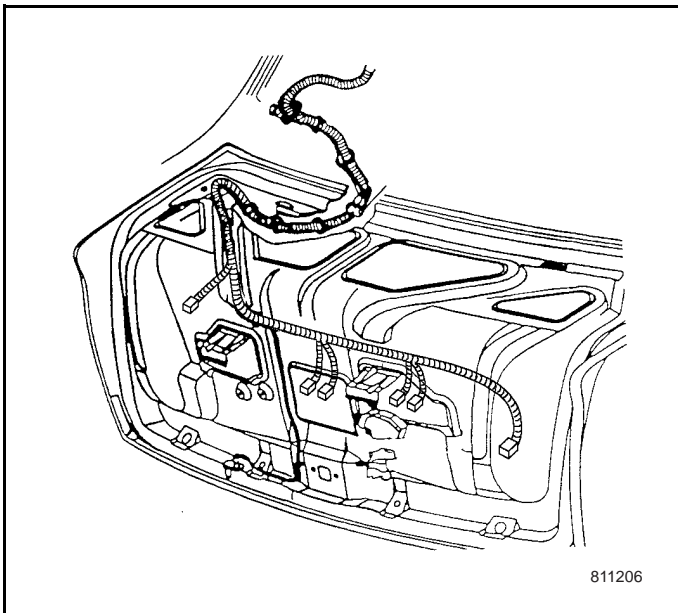
Removal Procedure

1. Disconnect the harness connector between rear body harness and rear compartment lid harness.
2. Disconnect the fastening strap of rear compartment lid harness.
3. Pull out the clips.
4. Pull out the rear compartment lid harness from Body.



Installation Procedure

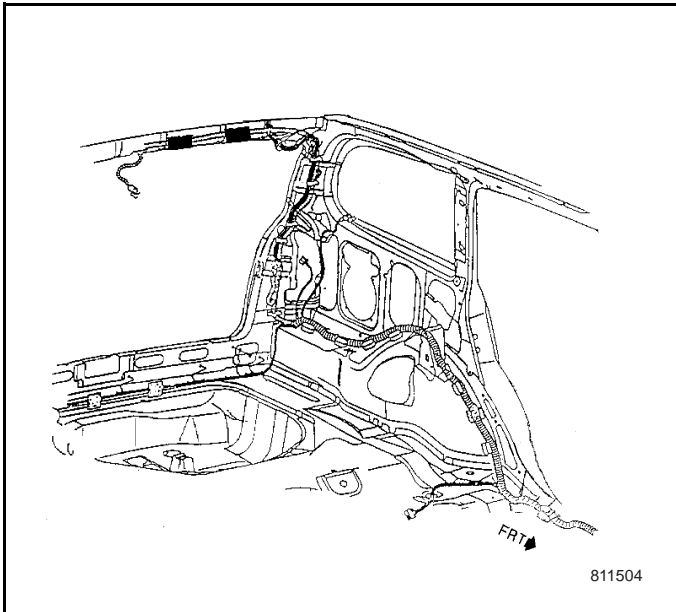
1. Make a harness routing for rear compartment lid in the rear compartment lid door, as shown in the figure.
2. Insert the clips into the body hole.
3. Use the strap to fasten the rear compartment lid harness according to the requirements.
4. Connect the harness connector between rear body harness and rear compartment lid harness.



8.11.4.5B Harness Replacement ñ Rear Lift Gate

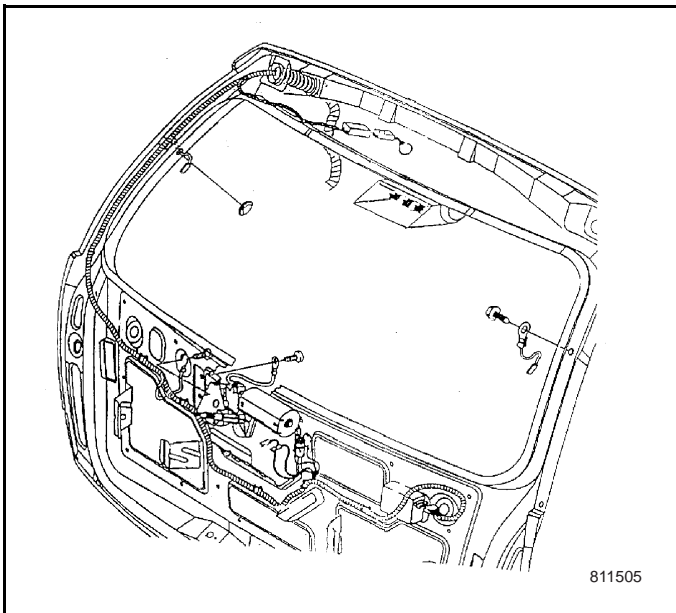
Removal Procedure

1. Disconnect the harness connector between rear body harness and rear compartment lid harness.
2. Disconnect the fastening strap of rear compartment lid harness.
3. Pull out the clips.
4. Pull out the rear compartment harness from Body.



Installation Procedure

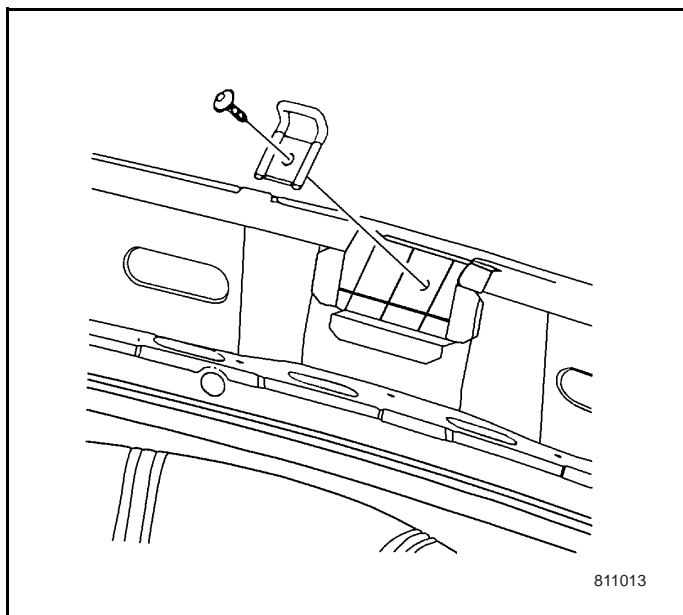
1. Make a harness routing for rear compartment lid in the rear compartment lid door, as shown in the figure.
2. Insert the clips into the body hole.
3. Use the strap to fasten the rear compartment lid harness according to the requirements.
4. Connect the harness connector between rear body harness and rear compartment lid harness.



8.11.4.6 A Compartment Lid Latch Replacement - Rear

Removal Procedure

1. Open the rear compartment lid.
2. Turn over the flap on the inner trim panel.
3. Remove the bolts, then the latch assembly of rear compartment lid.



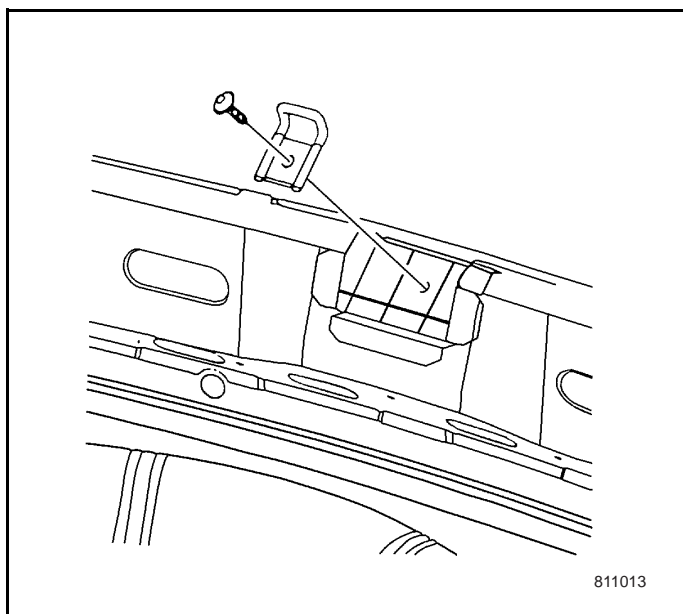
Installation Procedure

1. Locate the rear compartment lid latch on the body metal panel of rear compartment lid.
2. Mount the bolt into the central position of latch hole, and connect into the nut on the body metal panel of rear compartment lid.
3. Partly tighten the bolt to make the rear compartment latch adjustable.
4. Close the rear compartment lid to determine the adjustment of rear compartment lid.
5. Tighten the striker bolt of rear compartment lid.

Tightening

Tighten the striker bolts to 18-22 N•m.

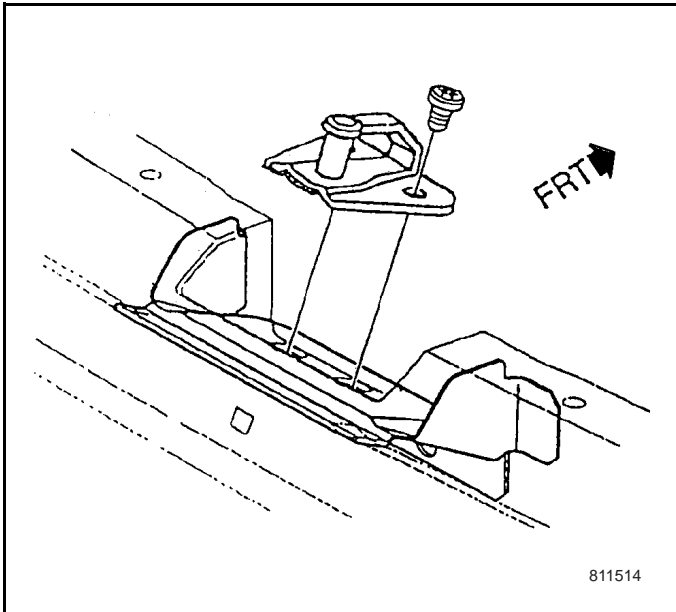
6. Close the trunk compartment.



8.11.4.6 B Latch Replacement - Rear Lift Gate

Removal Procedure

1. Open the rear lift gate.
2. Remove the door sill panel of trunk compartment, see Door Sill Panel Replacement - Trunk Compartment Door in Interior Trim.
3. Use a grease stick to mark the rear lift gate latch position on the rear panel.
4. Remove the latch bolt of rear lift gate.
5. Remove the rear lift gate latch.



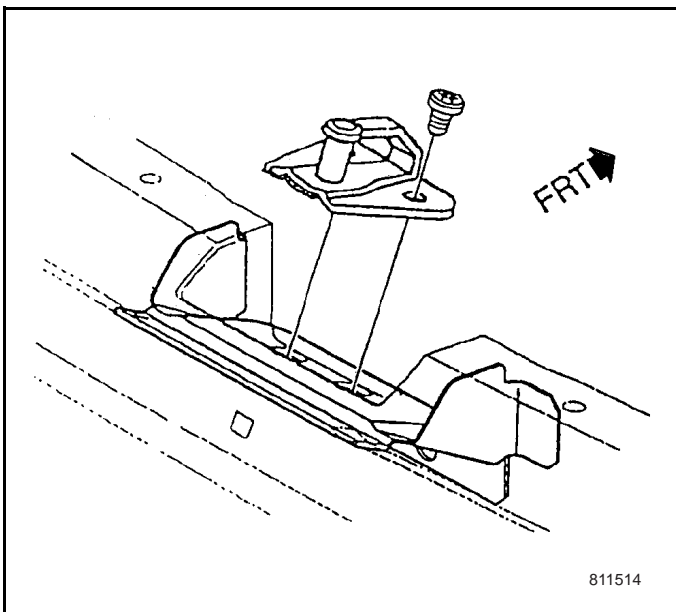
Installation Procedure

1. Place the rear lift gate latch on the marked position of rear panel.
2. Install the latch bolt of rear lift gate onto the rear panel.
3. Partly fasten the bolt. Maintaining the adjustment of rear lift gate latch is allowed.
4. Close the rear lift gate to make the latch agree with the lock striker of rear lift gate.
5. Tighten the bolt onto the latch.

Tightening

Tighten the latch bolt of rear lift gate to 18.0-22.0 N•m.

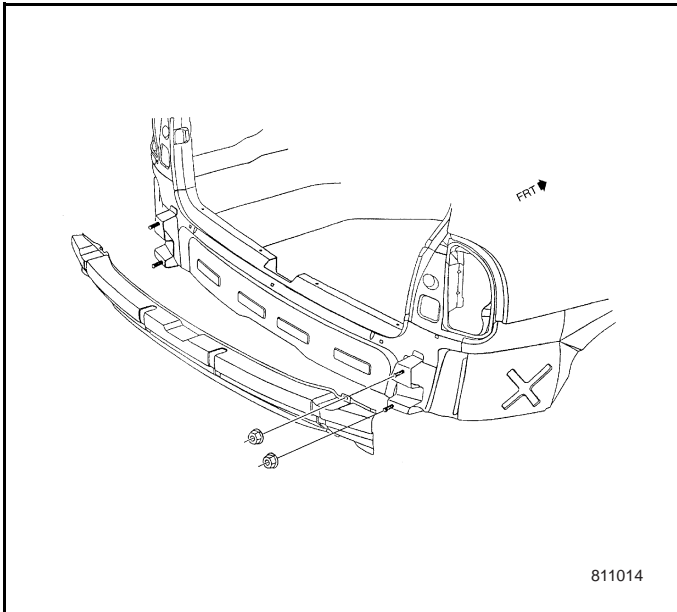
6. Remove the door sill panel of trunk compartment door, see Door Sill Panel Replacement - Trunk Compartment Door of Interior Trim.
7. Close the rear lift gate.



8.11.4.7 Impact Bar Replacement - Rear Bumper

Removal Procedure

1. Remove the rear bumper fascia assembly, see Bumper Fascia ASM Replacement - Rear in Exterior Trim.
2. Remove the nuts.
3. Remove the impact bar of rear bumper.



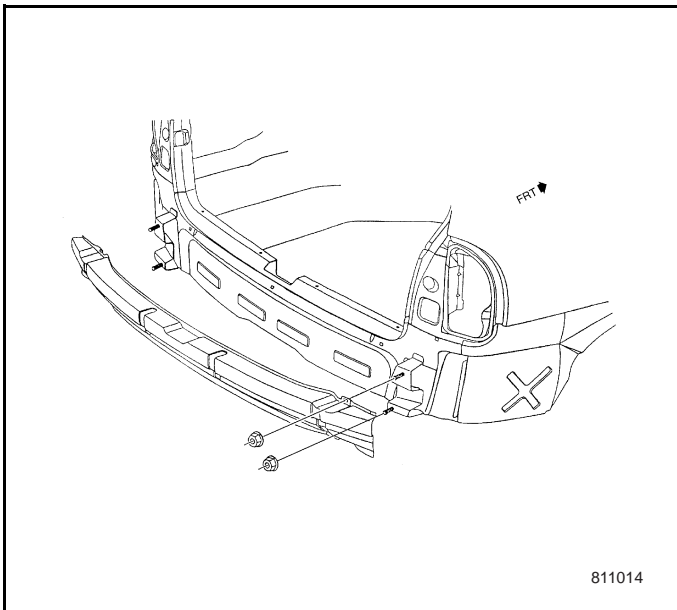
Installation Procedure

1. Install the impact bar of rear bumper on the bolt of body bracket.
2. Tighten the nut to fasten the rear impact bar.

Tightening

Tighten the nut of rear impact bar to 7.0-9.0 N•m.

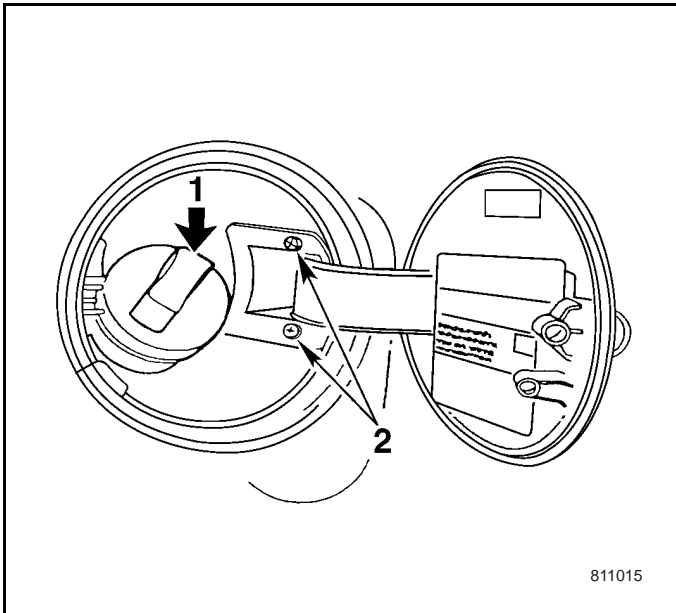
3. Install the rear bumper fascia assembly. Refer to Bumper Fascia ASM Replacement - Rear in Exterior Trim.



8.11.4.8 Oil Filling Port Replacement

Removal Procedure

1. Open the oil filling port.
2. Remove the oil filler cap (1).
3. Remove the screw (2) of oil filling port from outside of side panel.
4. Remove the oil filling port.



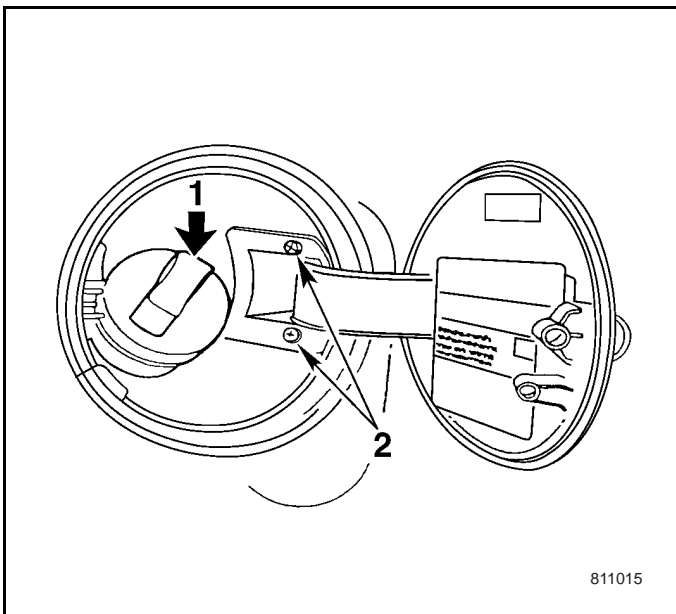
Installation Procedure

1. Align the oil filling port with the hole of side panel.
2. Use the screw (2) to mount the oil filling port on the side panel.

Tightening

Tighten the screw of oil filling port to 0.6-1.0 N•m.

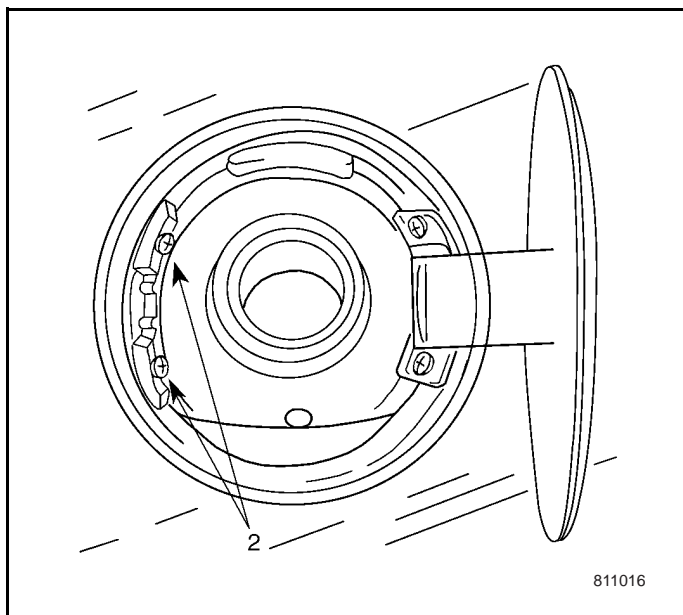
3. Install the oil filler cap (1).
4. Close the oil filling port.



8.11.4.9 Oil Filling Port Latch Replacement

Removal Procedure

1. Open the oil filling port.
2. Remove the latch screw (2) of oil filling port from the oil filler pipe sleeve.
3. Remove the latch of oil filling port.



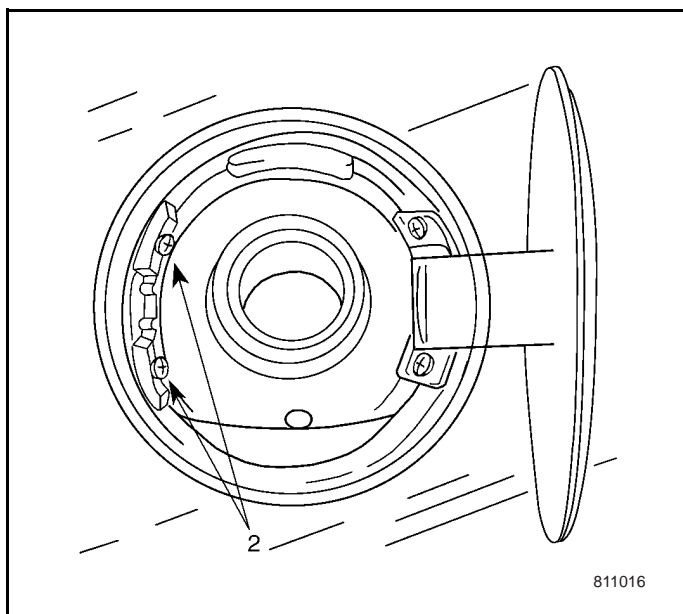
Installation Procedure

1. Align the lock of oil filling port with the hole of oil filler pipe sleeve.
2. Re-install the lock screw (2) of oil filling port.

Tightening

Tighten the lock screw of oil filling port to 1.0-2.5 N•m.

3. Close the oil filling port.



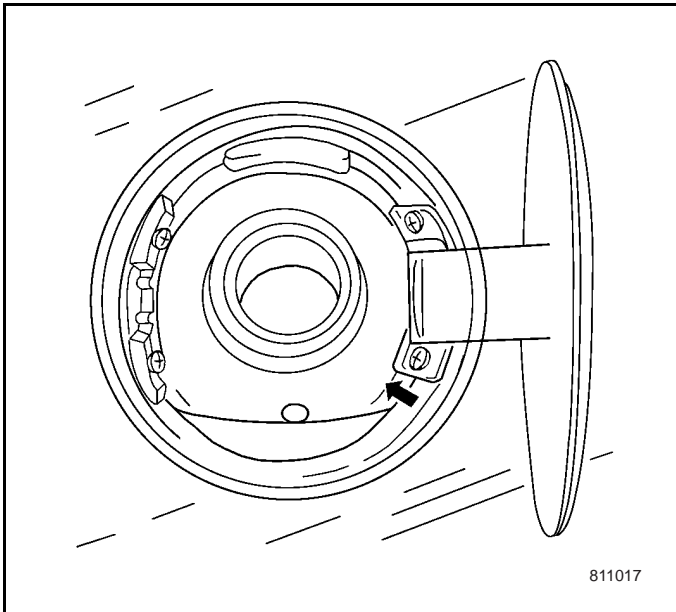
8.11.4.10 Rubber Seal Ring Replacement - Oil Filler Pipe

Removal Procedure

Caution: Wear safety glasses when using compressed air, because the flying dirt particle may hurt your eyes.

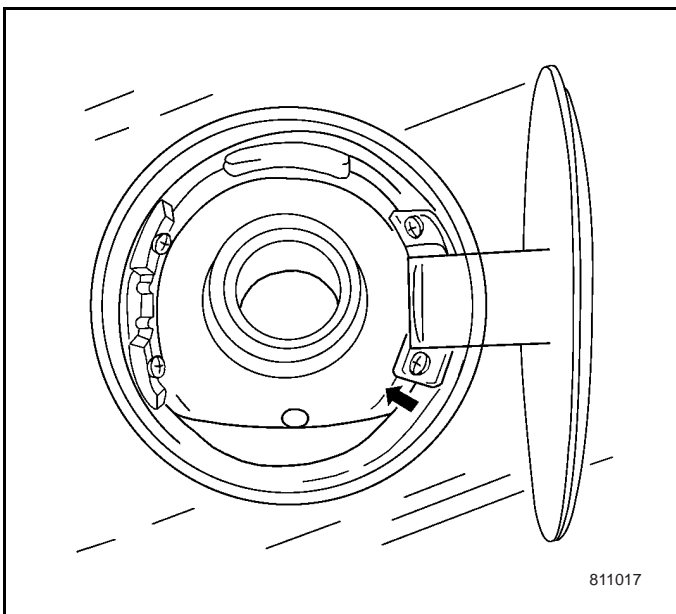
Important: When repairing the fuel system parts, please keep clean at any time.

1. Open the oil filling port.
2. Use compressed air to blow out the dirt in the oil filler pipe cover.
3. Remove the oil filling port cap.
4. Remove the rubber seal ring of oil filling pipe.



Installation Procedure

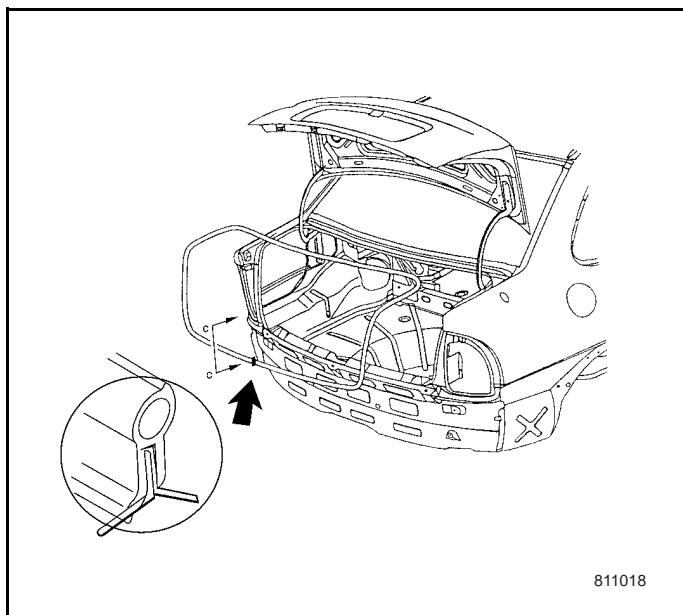
1. Use the GM designated 998 540 6 lubricant, and install the rubber seal ring of oil filling pipe.
2. Install the oil filler cap.
3. Close the oil filling port.



8.11.4.11A Weather Strip Replacement ñ Rear Compartment

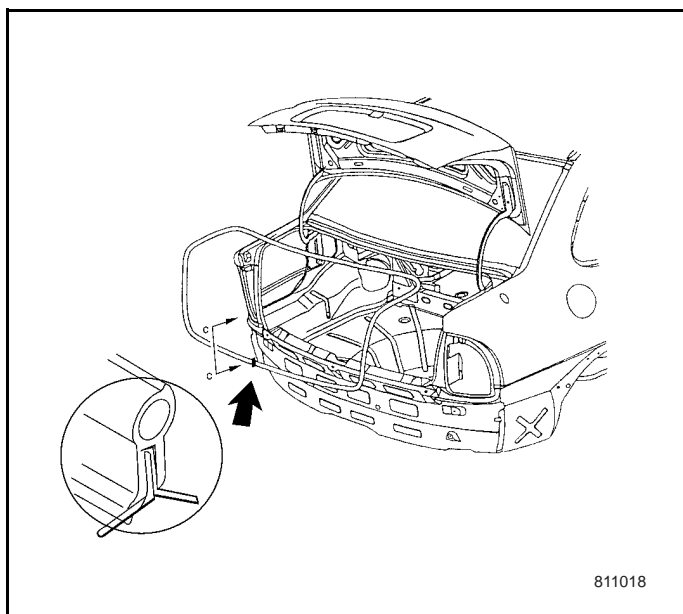
Removal Procedure

1. Open the rear compartment.
2. Grasp the weather strip of rear compartment. Take care to pull the weather strip upwards.
3. Remove the seal from the weld flange.



Installation Procedure

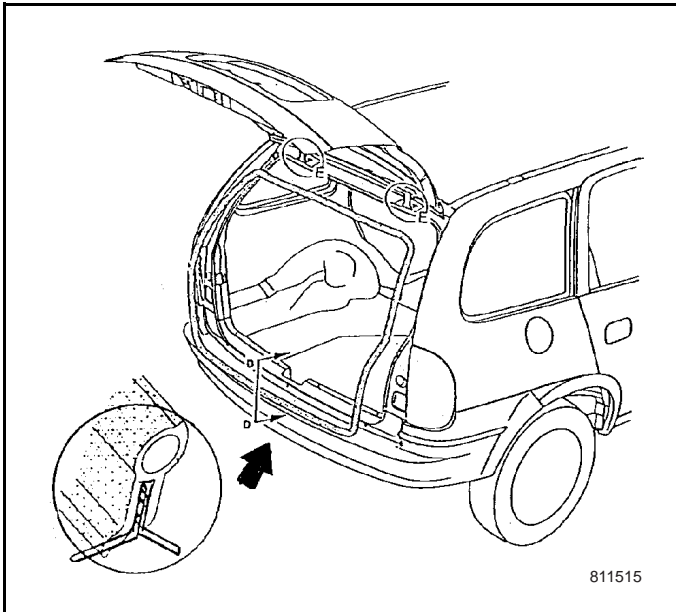
1. Install the weather- strip of rear compartment onto the weld flange.
2. Put the rear compartment connector (at Arrow) at the right bottom of body central line.
3. Embed the weather- strip of rear compartment into the weld flange.
 - Expand around beginning from the joint.
 - Use a rubber hammer to ensure that the weather strip of rear compartment is integrated completely with the weld flange.
4. Close the rear compartment.



8.11.4.11B Weather Strip Replacement - Rear Lift Gate

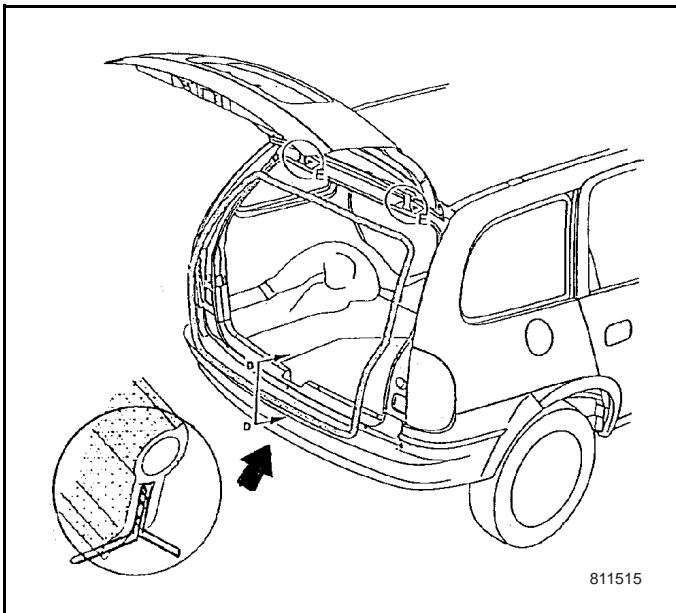
Removal Procedure

1. Open the rear lift gate.
2. Grasp the weather strip of rear lift gate. Take care to pull the weather strip upwards.
3. Remove the weather strip from the weld flange.



Installation Procedure

1. Install the weather- strip of rear lift gate onto the weld flange.
2. Put the weather strip connector of rear lift gate (at Arrow) at the right bottom of body central line.
3. Embed the weather- strip of rear lift gate into the weld flange.
 - Expand around beginning from the joint.
 - Use a rubber hammer to ensure that the weather strip of rear lift gate is integrated completely with the weld flange.
4. Close the rear lift gate.

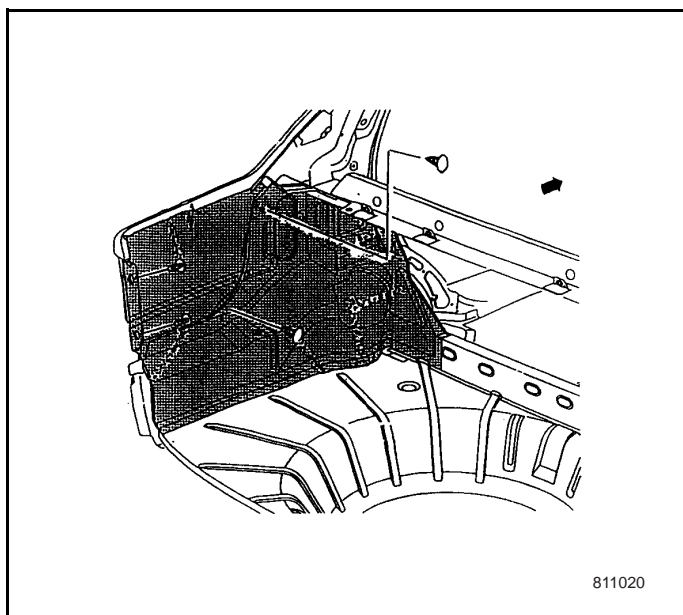
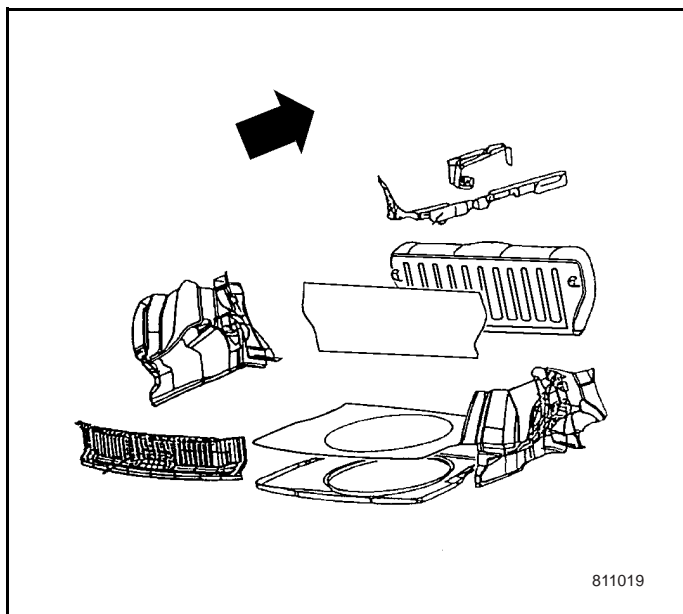


8.11.4.12A Trim Panel Replacement - Rear Compartment

Removal Procedure

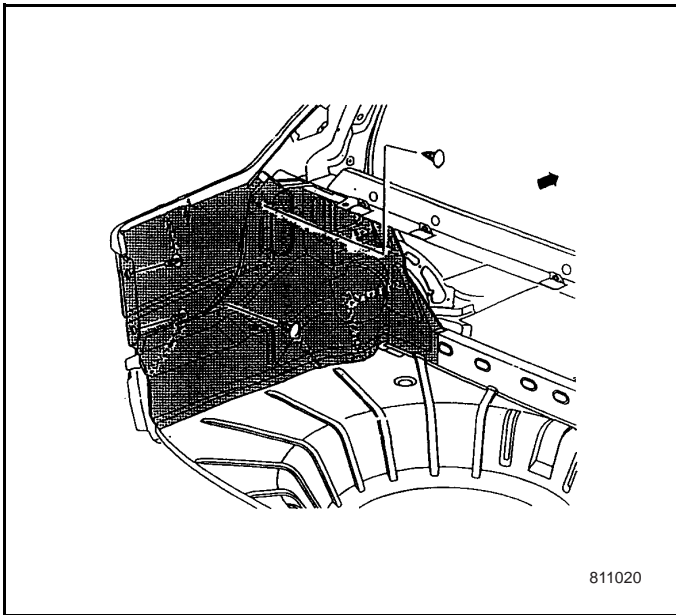
Required Tools

- J38778 Door Trim Pad and Garnish Clip Remover

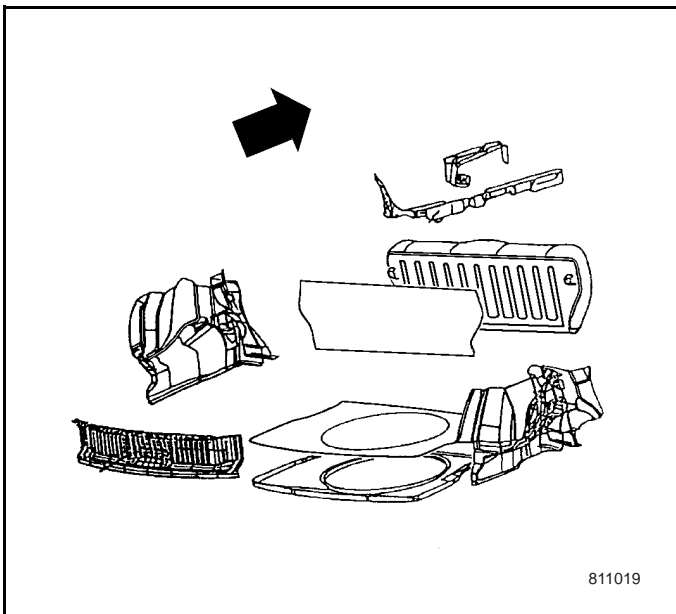


1. Open the rear compartment.
2. Remove the trunk carpet.
3. Remove the rubber gasket above the spare tire.
4. Remove the seat back blanket of rear row, see Seat Back Blanket Replacement - Rear Seat.
5. Remove the rear suspension cover.
6. Remove the door sill panel of trunk compartment door, see Door Sill Panel Replacement - Trunk Compartment Door of Interior Trim.
7. Remove the cover panel of seat guide rail, see Cover Panel Replacement - Seat Guide Rail of Interior Trim.
8. Turn over the cushion cover of rear seat.
9. Remove the seat back of rear row, see Seat Back Replacement - Rear Seat.
10. Remove the door sill, see Door Sill Replacement in Interior Trim.
11. Use J38778 to remove the thrust nail from the side blanket.
12. Draw out each blanket from the weather strip.
13. Remove the side blanket.

Installation Procedure



1. Open the rear compartment.
2. Install the side blanket of rear compartment.
3. Install the thrust nail on the side blanket.
4. Slip the side trim into the weather strip.
5. Install the door sill panel of trunk compartment, see Door Sill Panel Replacement - Trunk Compartment Door in Interior Trim.



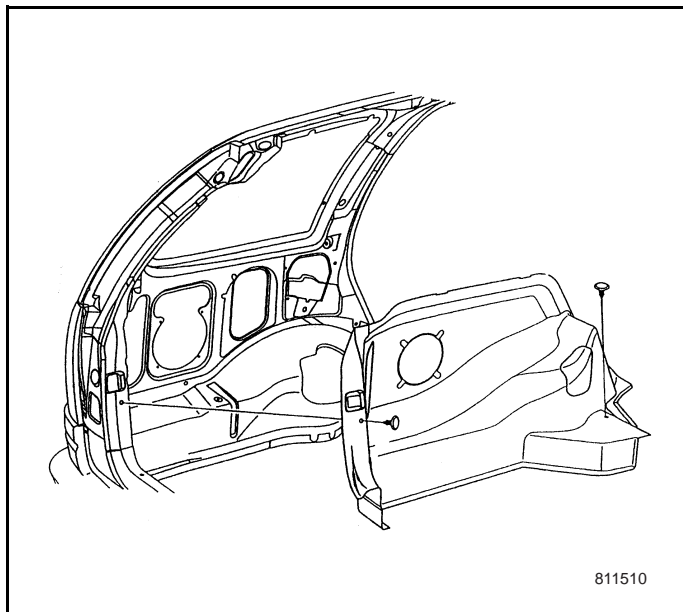
6. Install the rear suspension cover.
7. Install the door sill, see Door Sill Replacement of Interior Trim.
8. Install the cover panel of seat guide rail, see Cover Panel Replacement - Seat Guide Rail.
9. Lower down the seat cushion of rear row.
10. Install the seat back of rear row, see Seat Back Replacement - Rear Seat.
11. Install the seat back blanket of rear row, see Seat Back Blanket Replacement - Rear Seat.
12. Place the rubber gasket above the spare tire.
13. Put the trunk carpet in place.

8.11.4.12B Side Trim Panel Replacement - Rear Compartment

Removal Procedure

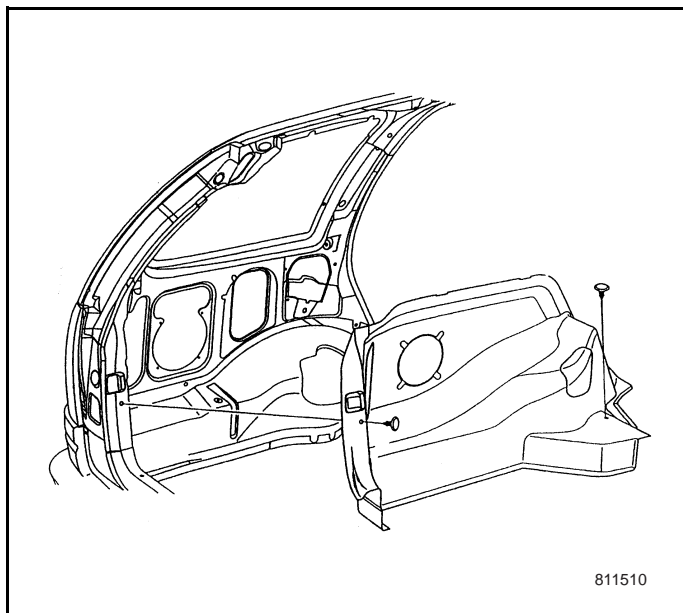
Required Tools

- J38778 Door Trim Pad and Garnish Clip Remover



1. Remove the storage case of bottom compartment. Refer to Storage Case Replacement - Bottom Compartment of Rear in Interior Trim.
2. Remove the trunk carpet.
3. Remove the lower trim panel of rear side window. Refer to Upper & Lower Trim Panel Replacement - Rear Window in Interior Trim.
4. Remove the door sill. Refer to Door Sill Replacement in Interior Trim.
5. Remove the rear speaker. Refer to Rear Speaker Replacement in Entertainment System.
6. Use J38778 (2 locations) to remove the thrust nail from the panel.
7. Remove the side trim panel.

Installation Procedure

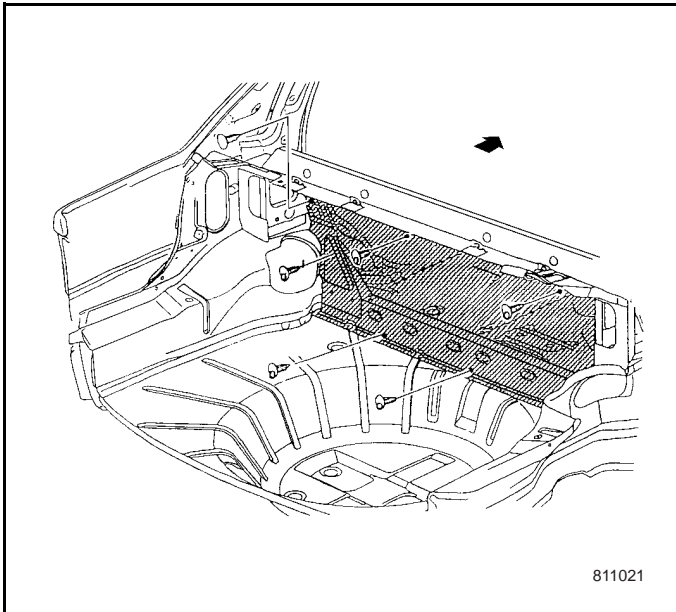


1. Put the side trim panel at the proper location of trunk compartment.
2. Push the retainer into the body thrust hole (2 locations).
3. Install the rear speaker. Refer to Rear Speaker Replacement in Entertainment System.
4. Install the door sill. Refer to Door Sill Replacement in Interior Trim.
5. Install the lower trim panel of rear side window. Refer to Upper & Lower Trim Panel Replacement - Rear Window in Interior Trim.
6. Install the trunk carpet.
7. Install the storage case of bottom compartment. Refer to Storage Case Replacement - Bottom Compartment of Rear in Interior Trim.

8.11.4.13A Seat Back Blanket Replacement - Rear Seat

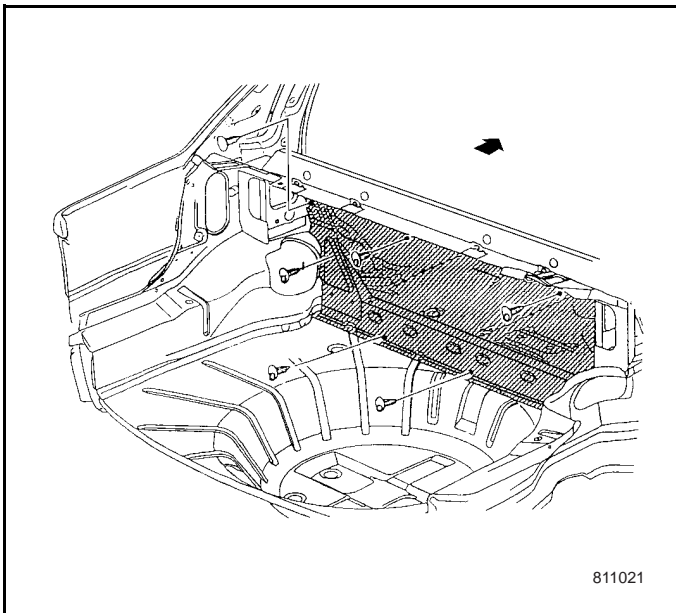
Removal Procedure

1. Open the rear compartment.
2. Remove the 9 thrust nails from the seat back blanket of rear seat.
3. Remove the seat back blanket of rear seat.



Installation Procedure

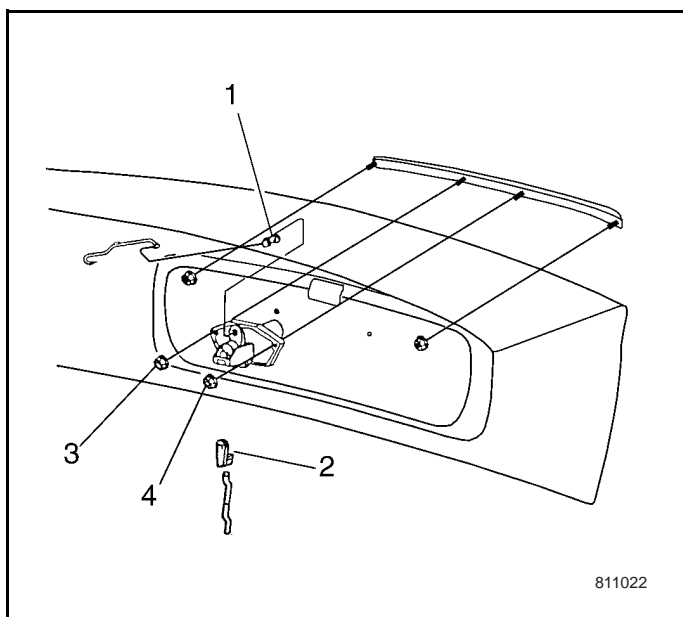
1. Open the rear compartment.
2. Put the seat back blanket of rear seat in place.
3. Install the thrust nails.



8.11.4.14A Lock Cylinder ASM Replacement - Rear Compartment Lid

Removal Procedure

1. Open the trunk compartment lid.
2. Remove the connector clips (1) from the lock cylinder, so that the locking rod can be released from the lock cylinder.
3. Remove the connector clips (2) from the lock cylinder, so that the cylinder rod can be released from the lock cylinder.
4. Remove the two tightening nuts (3) and (4), then remove the lock cylinder assembly.



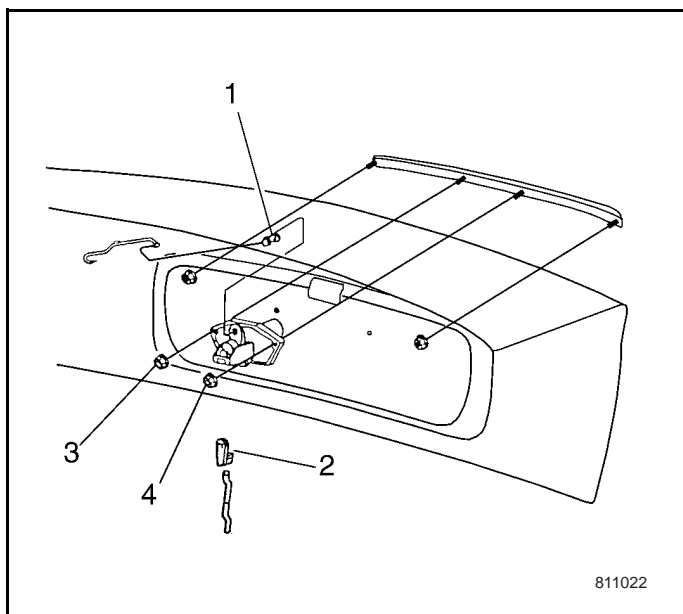
Installation Procedure

1. Use the nuts (3) and (4) to tighten the lock cylinder assembly.

Tightening

Tighten the nuts of lock cylinder assembly to 2.5-4.0 N•m.

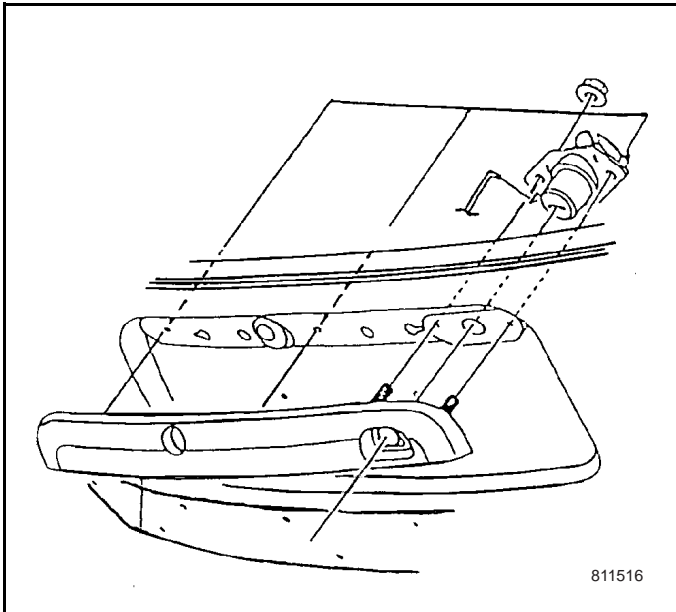
2. Connect the cylinder rod to the lock cylinder by connecting the connector Clip 2 to the lock cylinder.
3. Connect the cylinder rod to the lock cylinder by connecting the connector Clip 1 to the lock cylinder.



8.11.4.14B Lock Cylinder ASM Replacement - Rear Lift Gate

Removal Procedure

1. Open the rear lift gate.
2. Remove the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
3. Remove the rear lift gate locking bar from the lock cylinder. Refer to Locking bar Replacement - Rear Lift Gate.
4. Remove the fastening nuts on the lock cylinder, then remove the lock cylinder assembly.



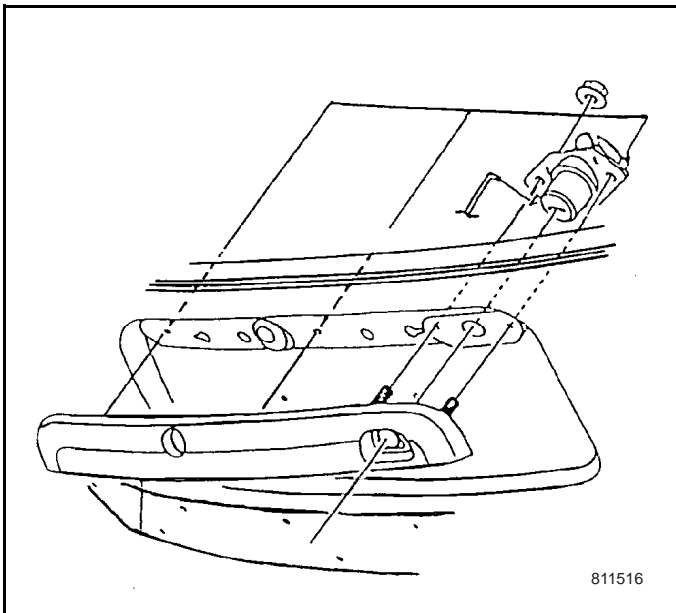
Installation Procedure

1. Connect the lock cylinder to the handle assembly of rear lift gate with bolts, then tighten the nuts.

Tightening

Tighten the lock cylinder nuts to 2.5-4.0 N•m.

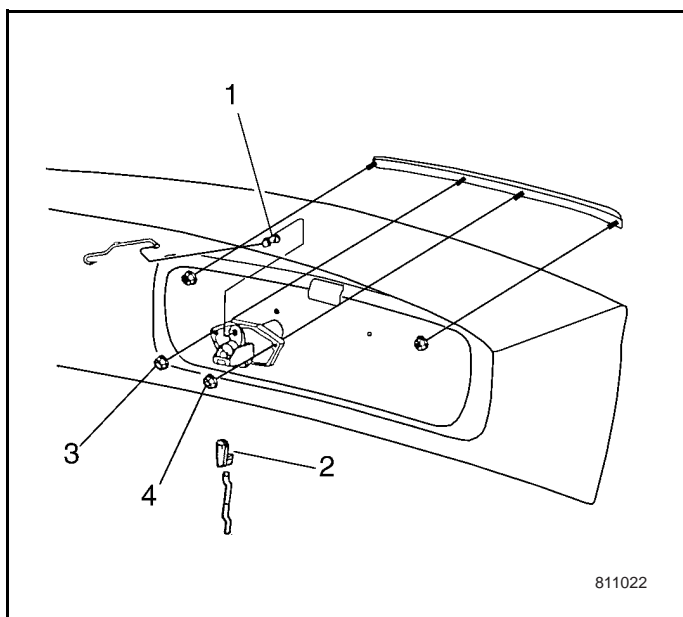
2. Connect the locking bar of rear lift gate to the lock cylinder. Refer to Locking bar Replacement - Rear Lift Gate.
3. Install the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
4. Close the rear lift gate.



8.11.4.15A Handle Assembly Replacement - Rear Compartment Lid

Removal Procedure

1. Remove the four nuts.
2. Remove the lock cylinder assembly. See Lock Cylinder ASM Replacement - Rear Compartment Lid.
3. Pull out the handle from the hole of compartment lid.

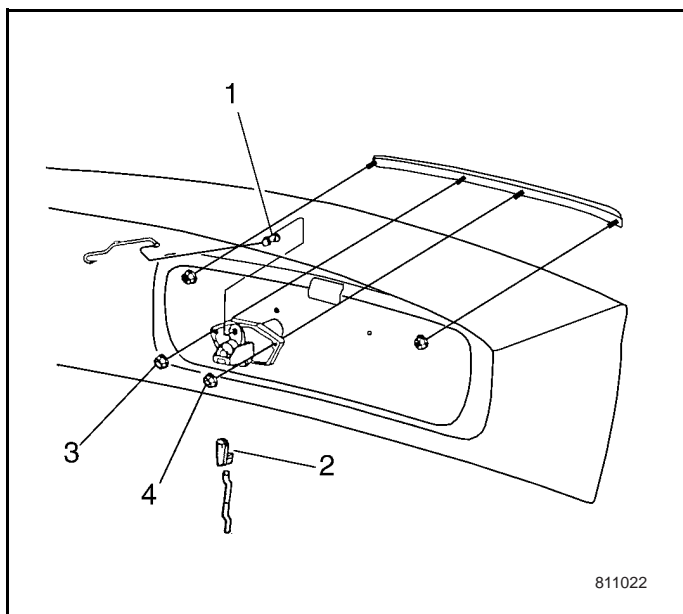


Installation Procedure

1. Put the handle assembly on the compartment lid. Align the four screws on the handle with the four holes on the compartment lid.
2. Put the lock cylinder assembly on the handle screws, and secure the lock cylinder well. See Lock Cylinder ASM Replacement - Rear Compartment Lid.
3. Use the four nuts to fasten the handle.

Tightening

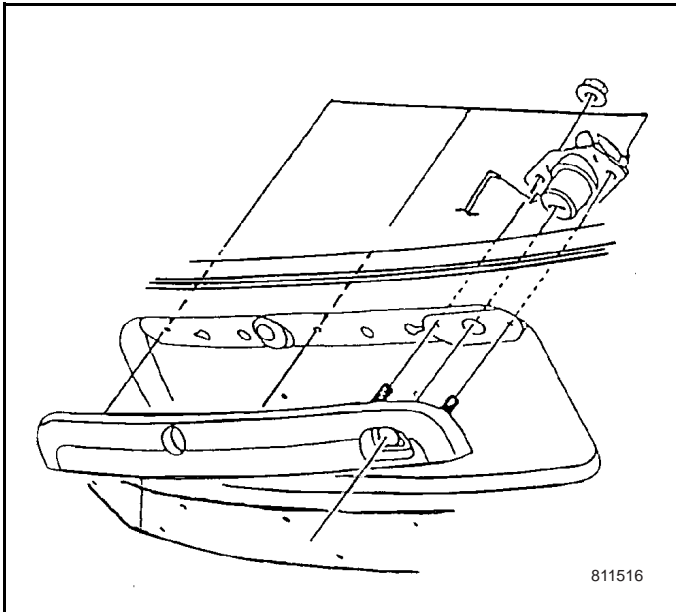
Tighten the nuts to 2.5-4 N•m.



8.11.4.15B Handle ASM Replacement - Rear Lift Gate

Removal Procedure

1. Open the rear lift gate.
2. Remove the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
3. Remove the lock cylinder. Refer to Lock Cylinder ASM Replacement - Rear Lift Gate.
4. Remove the fastening nuts of handle assembly, and remove the handle assembly.



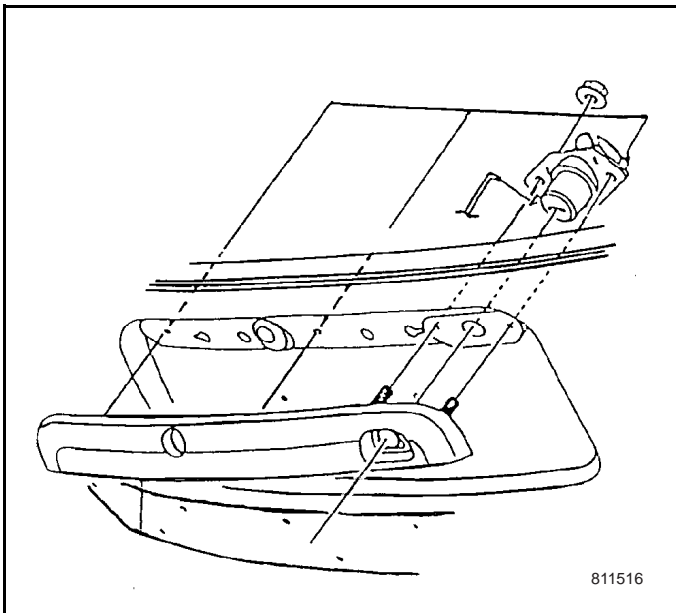
Installation Procedure

1. Connect the handle to the handle assembly of rear lift gate with bolts, then tighten the nuts.

Tightening

Tighten the nuts of handle assembly to 2.5-4.0 N•m.

2. Install the lock cylinder. Refer to Lock Cylinder ASM Replacement - Rear Lift Gate.
3. Install the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
4. Close the rear lift gate.



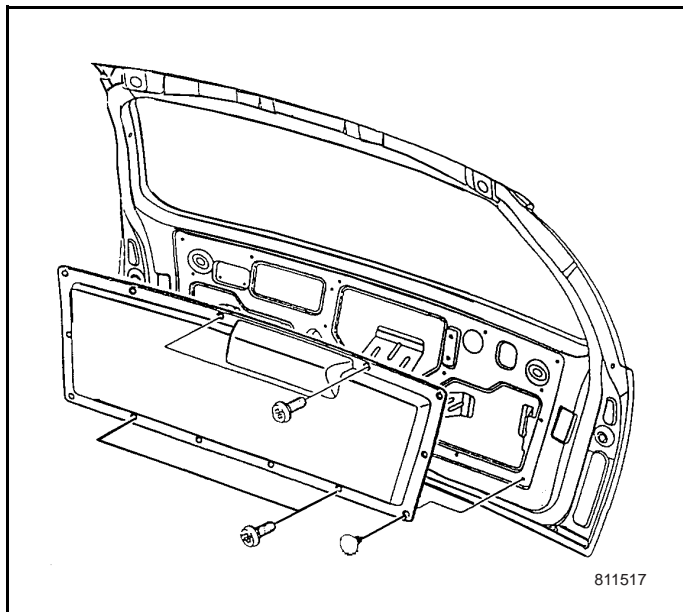
8.11.4.16B Trim Panel ASM Replacement - Rear Lift Gate

Removal Procedure

Required Tools

- J38778 Door Trim Pad and Garnish Clip Remover

1. Remove the four bolts on the trim panel.
2. Apply a special tool to remove the 9 retainers on the trim panel of rear lift gate.

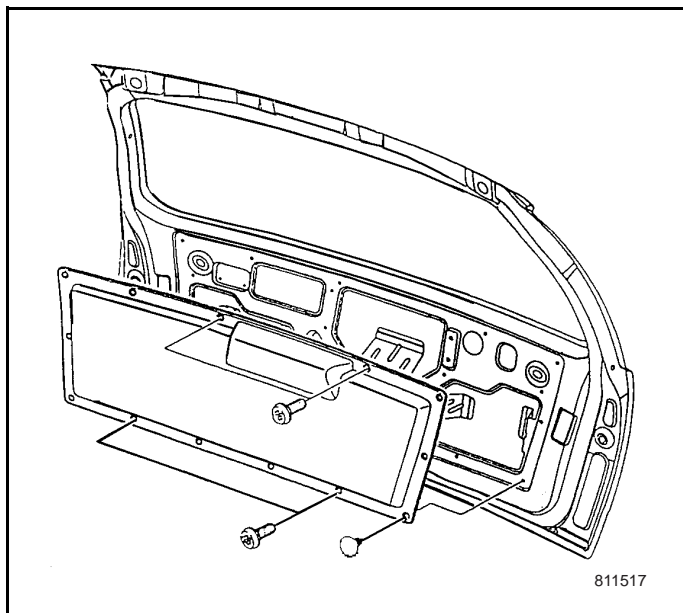


Installation Procedure

1. Put the trim panel assembly on the rear lift gate.
2. Install the retainer, so that install the trim panel assembly on the rear lift gate.
3. Tighten the bolts of trim panel assembly.

Tightening

Tighten the bolts of trim panel assembly to 1.4 ± 0.2 N•m.



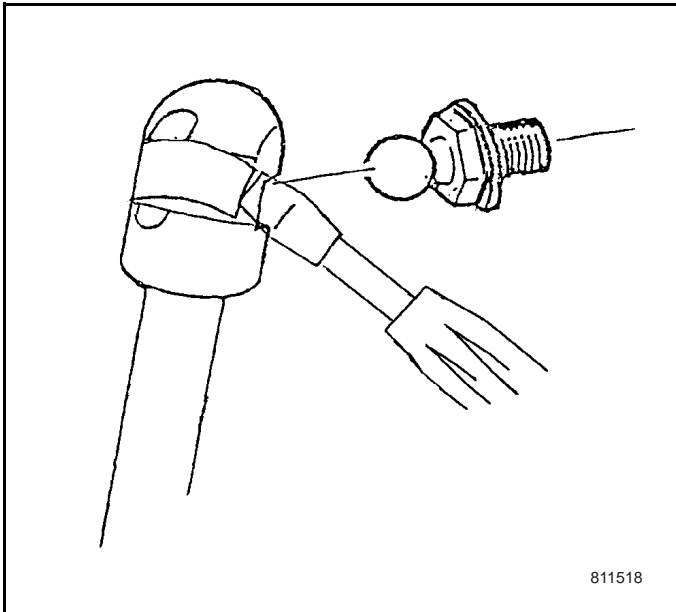
8.11.4.17B Hold Rod Replacement - Rear Lift Gate

Removal Procedure

1. Open the rear lift gate.

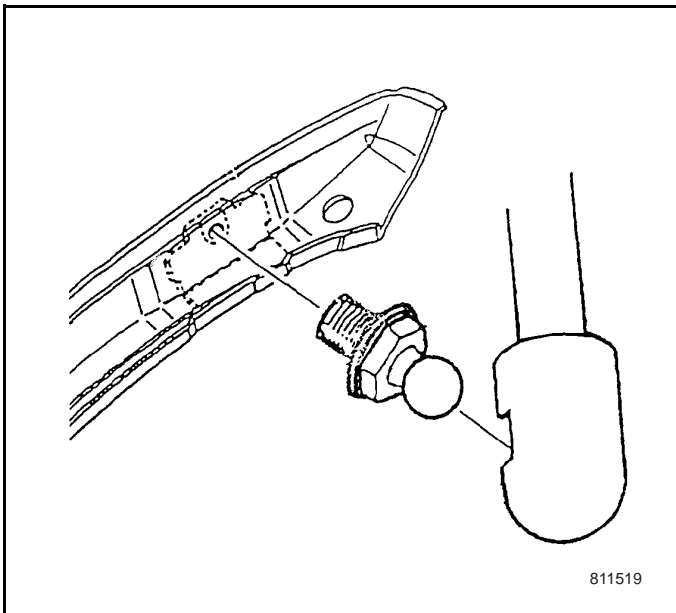
Caution: When removing or installing the rear lift gate hold rod, an alternate hold rod should be provided to avoid the possibility of vehicle damage or personal injury.

2. Use a small and flat sheet tool to lift up the locking clip on ball bolt of hold rod.
3. Disconnect the hold rod from ball bolt, and remove them.



Installation Procedure

1. Put the hold rod of rear lift gate on the ball bolt of hold rod.
2. Embed the ball bolts of lower hold rod (at Body Side).
3. Embed the ball bolts of upper hold rod (at Rear Lift Gate side).
4. Close the rear lift gate.



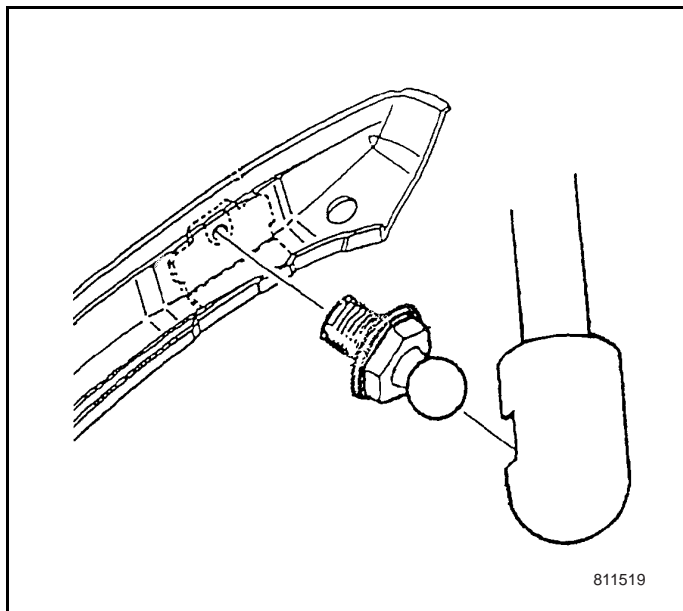
8.11.4.18B Ball Bolt/Screw Replacement - Hold Rod of Rear Lift Gate (at Body Side and Lift Gate side).

Removal Procedure

1. Open the rear lift gate.

Caution: When removing or installing the rear lift gate hold rod, an alternate hold rod should be provided to avoid the possibility of vehicle damage or personal injury.

2. Remove the hold rod of rear lift gate. Refer to Hold Rod Replacement - Rear Lift Gate.
3. Apply a special tool to remove the ball bolt of lift gate hold rod (at Body Side and Lift Gate side).



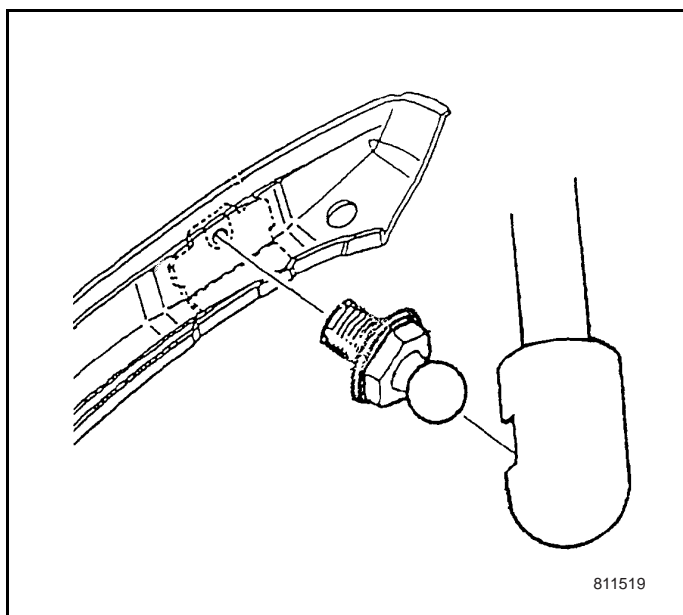
Installation Procedure

1. Tighten the ball bolt of rear lift gate hold rod onto the lift gate panel and body side panel.

Tightening

Tighten the ball bolts of rear lift gate hold rod to 15.0-18.0 N•m.

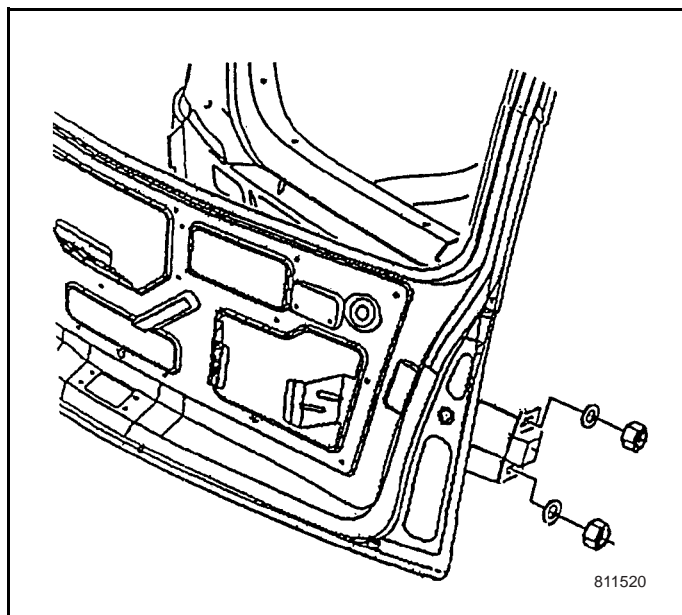
2. Install the hold rod of rear lift gate. Refer to Hold Rod Replacement - Rear Lift Gate.
3. Close the rear lift gate.



8.11.4.19B Adjustable Buffer Replacement ñ Rear Lift Gate

Removal Procedure

1. Open the rear lift gate.
2. Remove the buffer nuts from the adjustable buffer of rear lift gate.
3. Remove the adjustable buffer of rear lift gate.



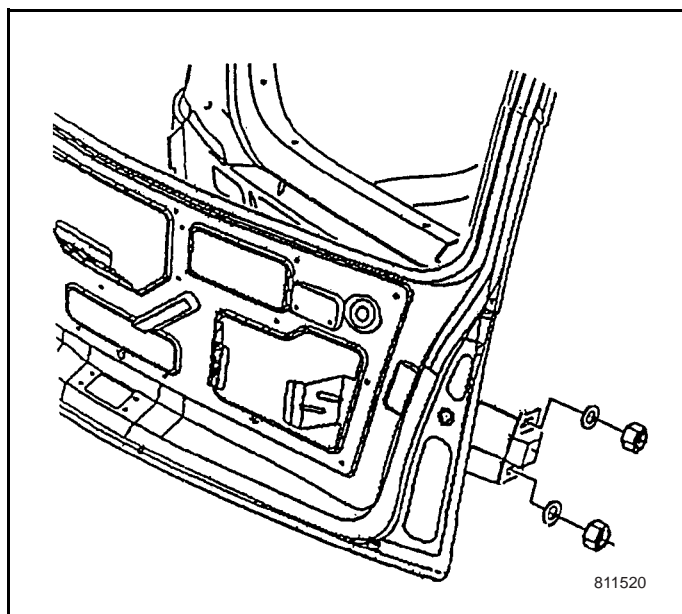
Installation Procedure

1. Install the adjustable buffer of rear lift gate on the retaining bolt of lift gate.
2. Tighten the buffer nut onto the adjustable buffer of rear lift gate.

Tightening

Tighten the buffer nut to 3.5-5.0 N•m.

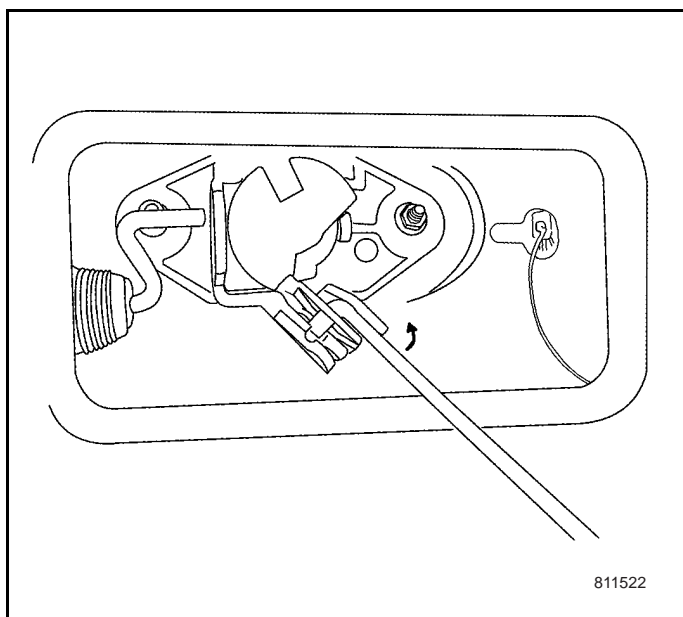
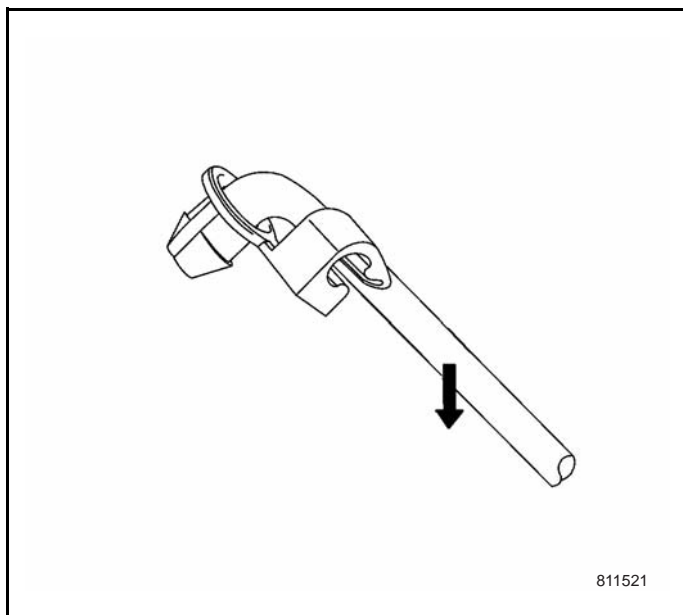
3. Close the rear lift gate.



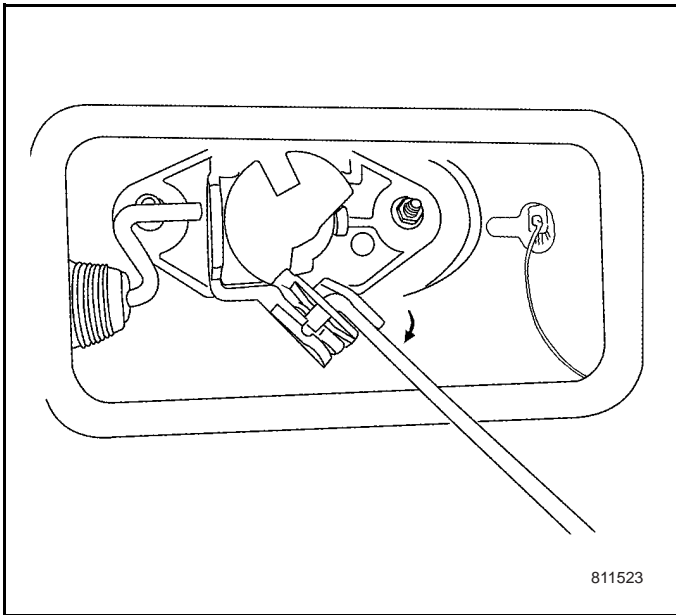
8.11.4.20B Locking Bar Replacement - Rear Lift Gate

Removal Procedure

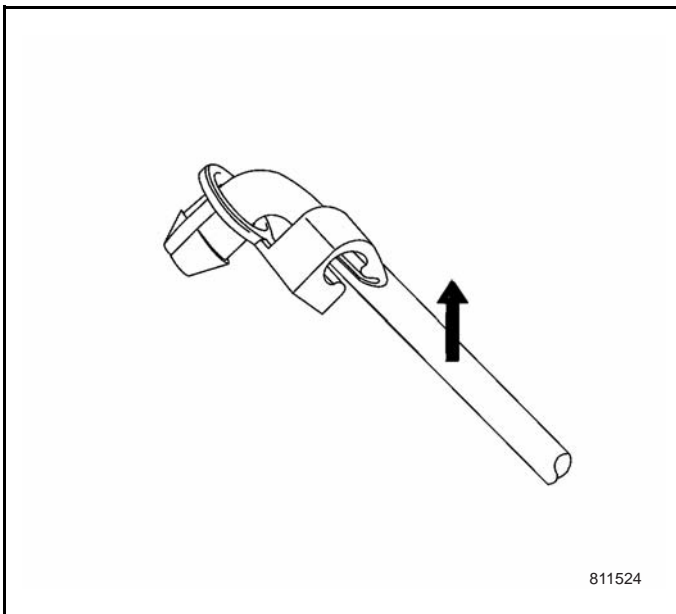
1. Open the rear lift gate.
2. Disconnect the trim panel assembly of rear lift gate. See Trim Panel ASM Replacement - Rear Lift Gate.
3. Remove the rear lift gate latch from the lift gate panel, and pull it out. Refer to Latch Replacement - Rear Lift Gate.
4. Dismantle the clip of locking bar at the latch side.
5. Rotate the clip, and pull out the locking bar from the clip.
6. Screw out the locking bar from the lock cylinder clip.
7. Remove the locking bar from the lock cylinder.



Installation Procedure



1. Thrust in the locking bar from the clip hole of lock cylinder.
2. Rotate the locking bar and put it in the clip.



3. Push the other end of locking bar, and allow it through the latch clip hole of rear lift gate.
4. Rotate the clip and engage with the locking bar.
5. Install the rear lift gate latch on the lift gate panel. Refer to Latch Replacement - Rear Lift Gate.
6. Install the rear lift gate trim panel assembly on the gate. See Trim Panel ASM Replacement - Rear Lift Gate.
7. Close the rear lift gate.

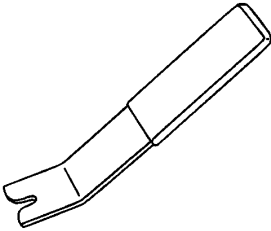
8.11.5 Description and Operation

8.11.5.1 Body Rear End Description

The chapter of Body Rear End introduces the following operation procedures to install the rear compartment lid metal components and parts on the lid:

- Removal
- Installation
- Adjustment
- Seal

8.11.6 Special Tools

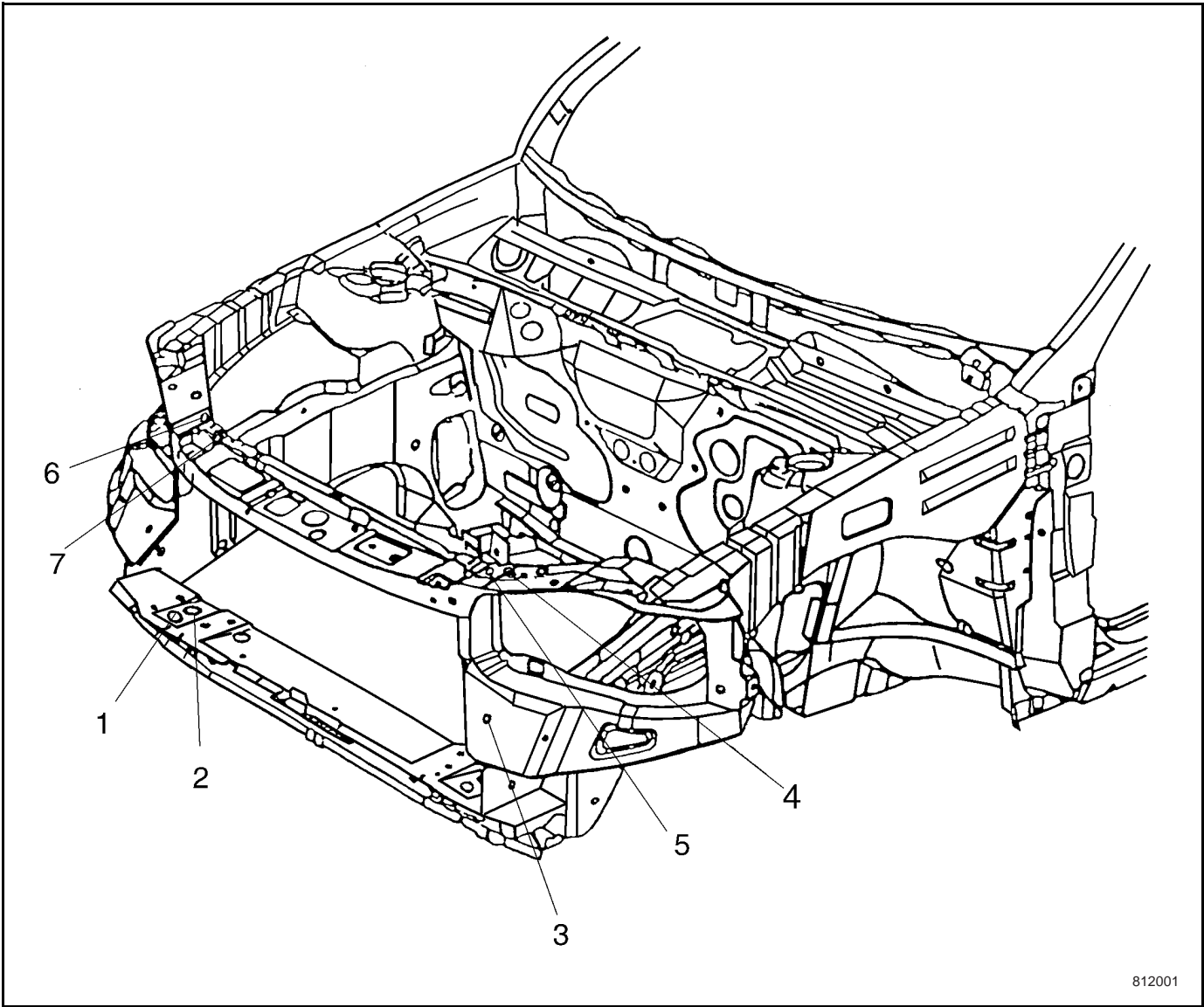
Illustration	Tool Number/Name
 <p>J38778</p>	<p>J38778 Door Trim Pad and Garnish Clip Remover</p>

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8.12 Underbody

8.12.1 Specifications

8.12.1.1 Dimensions - Body (Radiator Support)



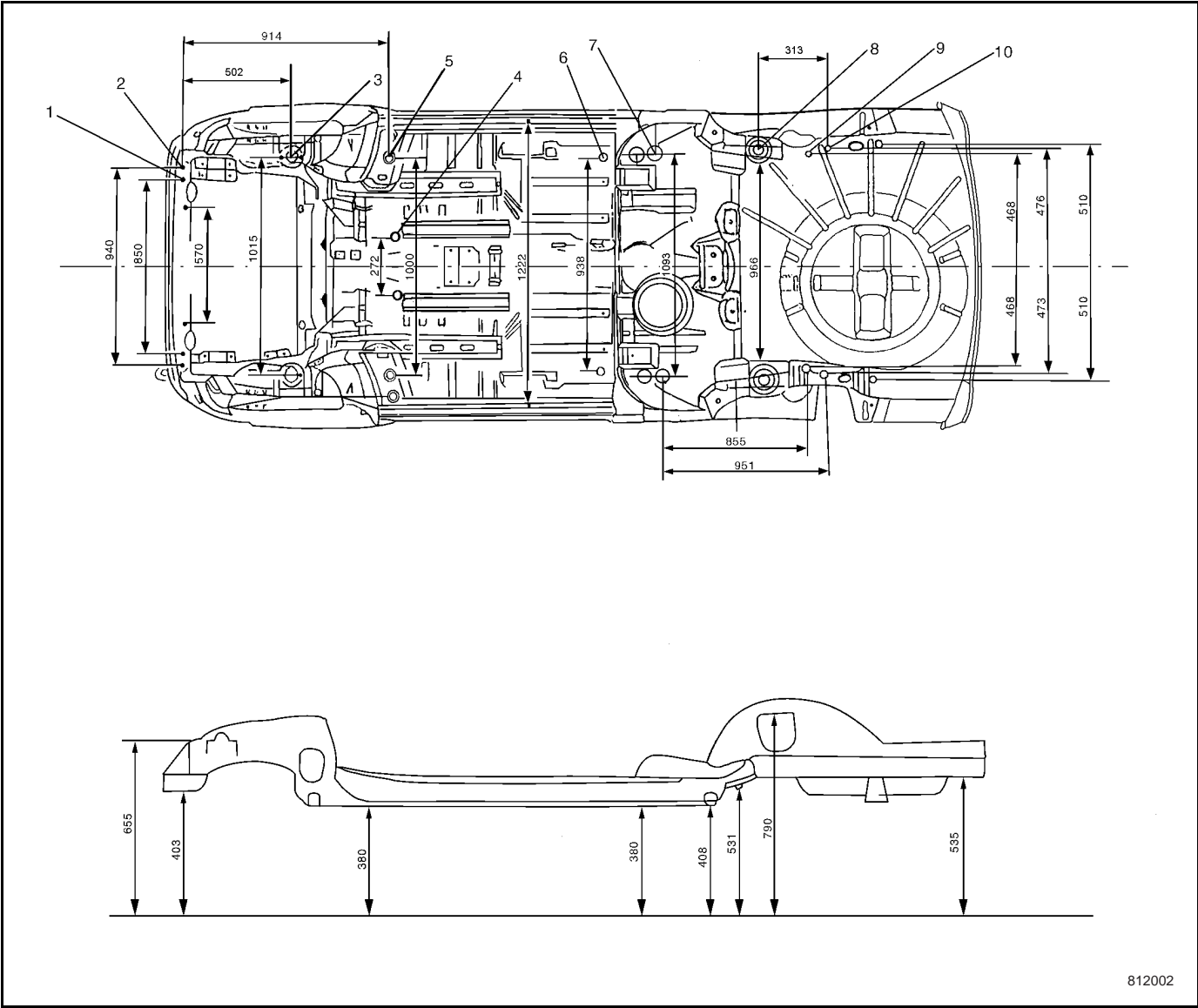
Dimensions - Body (Radiator Support)

Reference No.	Length (mm)	Width (mm)	Height (mm)	Feature Size
1	1258	357	487	14mm Condenser Mount Attach
2	1304	367	484	23.5mm Condenser Support Mount Attach
3	1254	-419	640	1317mm Bumper Bar Attach
4	1348	-137	858	8mm Radiator Support Mount Attach
5	-1325	-308	840	8mm Condenser Mount Attach

Dimensions - Body (Radiator Support) (Cont' d)

6	1349	371	855	8mm Radiator Support Mount Attach
7	1325	310	840	8mm Condenser Mount Attach
—	All dimensions are measured from a zero line, enter line, and a common datum. All dimensions are symmetrical unless otherwise specified.			

8.12.1.2A Dimensions - Underbody



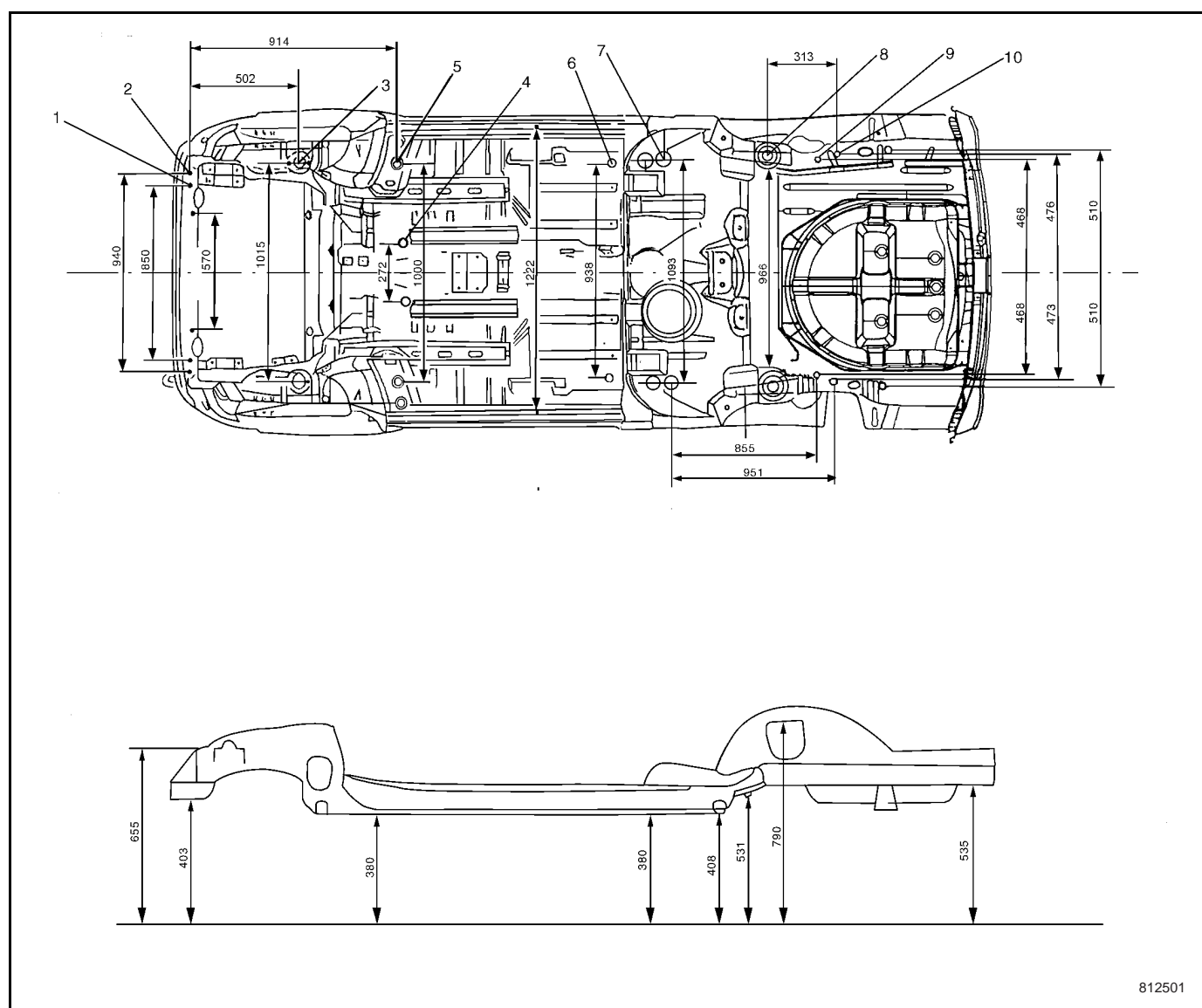
Measurements - Underbody

Reference No.	Length (mm)	Width (mm)	Height (mm)	Feature Size
1	1360.5	425	879.4	19.3mm gage hole
2	1345	470	883.3	14.1mm gage hole
3	1847	507.5	957	68mm gage hole
4	2300	136	362	35mm gage hole

Measurements - Underbody

5	2259	500	372	40mm gage hole
6	3381	469	360	35mm gage hole
7	3670	546.5	448.5	40mm gage hole
8	4146.7	498	531.4	22mm gage hole
9	4355	468	548	14mm gage hole
10	4460	476	536.2	24mm gage hole
—	All dimensions are measured from a zero line, enter line, and a common datum. All dimensions are symmetrical unless otherwise specified.			

8.12.1.2B Dimensions - Underbody



Measurements - Underbody

Reference No.	Length (mm)	Width (mm)	Height (mm)	Feature Size
1	1360.5	425	879.4	19.3mm gage hole

Measurements - Underbody

2	1345	470	883.3	14.1mm gage hole
3	1847	507.5	957	68mm gage hole
4	2300	136	362	35mm gage hole
5	2259	500	372	40mm gage hole
6	3381	469	360	35mm gage hole
7	3670	546.5	448.5	40mm gage hole
8	4146.7	498	531.4	22mm Measuring Hole
9	4355	468	548	14mm gage hole
10	4460	476	536.2	24mm Measuring Hole
—	All dimensions are measured from a zero line, enter line, and a common datum. All dimensions are symmetrical unless otherwise specified.			

8.12.1.3 Reference Points - Symmetrical

Symmetry Reference Points

The symmetrical reference points are two corresponding points on the opposite sides of the centerline that are equal specifications in length, in width and in height. Use the symmetrical reference points to make quick checks to determine the underbody structural damage.

8.12.1.4 Reference Points-Asymmetrical

Asymmetrical Reference Points

When two corresponding reference points have different measurements they are asymmetrical. If you perform a quick cross check and the measurements are unequal you must check the dimension charts to find out if the measuring points are symmetrical or asymmetrical. The underbody dimensions charts show specifications for both corresponding points when the measurements are equal.

8.12.2 Diagnostic Information and Procedures

8.12.2.1 Alignment Checking

Use a measuring tram gauge in order to determine the alignment of the underbody. In order to perform the recommended measuring inspections, the tram gauge set must include a vertical pointer capable of reaching 914 mm (36 in).

You may make the following measurements using a tram gauge:

- Direct point-to-point measurements.
- Measurements you calculate on a horizontal plane (datum line) parallel to the underbody.
- For each point to be measured, set one of the following pointers as specified:
 - The height pointer
 - The vertical pointer

Take the point-to-point measurements from the following components:

- The front structure steering component
- The suspension component

Ensure that the vertical pointers are equally set.

In some cases, you may directly take point-to-point measurements using one of the following tools:

- A tape measure
- An appropriate measuring tool

Measure the dimensions-to-gauge holes to the following areas:

- The leading edge or center of the holes
- The flush-to-adjacent surface metal

Refer to Measurements - Underbody Dimensions for the following information:

- The alphabetically identified points of measurement
- The metric-to-English dimensional conversion data

8.12.2.2 Alignment Checking - Underbody

Three-Dimensional Method

The repair equipment for measuring structural repair must be capable of measuring multiple points of length, height and width at the same time. Also you must measure 2/3 of the vehicle body to obtain accurate comparisons to the vehicle structure.

Universal measuring system combine the equipment and the techniques used to make the underbody and the upperbody three-dimensional measurement of length, width and height measurements at the same time.

8.12.3 Description and Operation

8.12.3.1 Datum Description

Datum

The datum line is a base line parallel to the plane of the underbody or the frame where all vertical measurements originate. A datum line is an imaginary horizontal plane that runs below and runs parallel to the vehicle. The height dimensions are calculated at right angles from the datum to a given a control or a reference point on the underbody.

The height dimensions determine the location of the datum based on the equipment being used. Different datum lines are established for the same vehicle. You can add or subtract an equal amount from all height dimensions and create a new datum line for your

usage. Refer to Collision Repair for datum line dimension.

Centerline

A centerline is an imaginary vertical plane that is perpendicular to the length of the datum plane through the center of the vehicle. The centerline is any line drawn through the center of the vehicles datum plane.

Form and Pierce

Form and pierce is a manufacturing process that forms an area in the metal structure to a desired three-dimensional measurement. The area is pierced with a hole or slot for dimensional gauging and may also be used for structural attachment of component pieces. All measurements are read from a formed surface and the centerline of the hole.

All Dimensions are measured from:

- A length to the Zero Line. (1)
- A height to Datum Line. (2)
- A width to Center Line. (3)

All dimensions are symmetrical unless otherwise specified.

Refer to measurement identification table for hole identification.

8.12.3.2 Centerline Description

A centerline is an imaginary vertical plane that is perpendicular to the length of the datum plane through the center of the vehicle. The centerline is any line drawn through the center of the vehicles datum plane.

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8.13 Painting/Coating

8.13.1 Specifications

8.13.1.1 Clearcoat Repair Specifications-3M product

Paint Conditions	Wet Sand Paper Grinding	Formulary	Rotary Polisher	Dual Function Locus Polisher	Hand Abrasive/ Polish
New Vehicle Preparation or Fine Sand Wheel Trace	—	—	—	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit DA 6-inch Support Pad P/N: 05776 	<ul style="list-style-type: none"> Quality Fluid/ Adhesive Wax P/N: 0654/06055
Vortex Trace, Water Trace or Light Oxidization	—	—	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit SBS/Trim Support Pad P/N: 05717/18 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi Hole Polish Trim Pad P/N: 05725/35 Hookit DA 6-inch Support Pad P/N: 05776 	<ul style="list-style-type: none"> Manual Trim Abrasive P/N: 05997 Quality Fluid/ Adhesive Wax P/N: 0654/06055
Over Due Paint or Medium Oxidization	—	<ul style="list-style-type: none"> Trim 11 Abrasive P/N: 059723 Trim 11 Foaming Agent Pad P/N: 05723/31 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit SBS/Trim Support Pad P/N: 05717/18 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit DA 6-inch Support Pad P/N: 05776 	<ul style="list-style-type: none"> Manual Trim Abrasive P/N: 05997 Quality Fluid/ Adhesive Wax P/N: 0654/06055
Oxidization Serious or Slight Acid Rain Spot	Minutene ss 2000	<ul style="list-style-type: none"> Trim 11 Abrasive Pad P/N: 059723 Trim 11 Foaming Agent Pad P/N: 05723/31 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit SBS/Trim Support Pad P/N: 05717/18 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit DA 6-inch Support Pad P/N: 05776 	<ul style="list-style-type: none"> Manual Trim Abrasive P/N: 05997 Quality Fluid/ Adhesive Wax P/N: 0654/06055
Dust Tip, Minute Scratches or Comparatively Large Acid Rain Spot	Minutene ss 1500 or 2000	<ul style="list-style-type: none"> Trim 11 Abrasive Pad P/N: 059723 Trim 11 Foaming Agent Pad P/N: 05723/31 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit SBS/Trim Support Pad P/N: 05717/18 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit DA 6-inch Support Pad P/N: 05776 	<ul style="list-style-type: none"> Manual Trim Abrasive P/N: 05997 Quality Fluid/ Adhesive Wax P/N: 0654/06055

8.13.1.1 Clearcoat Repair Specifications-3M product(Cont' d)

Orange Peel, Paint Falling Off or Loosen	Minutene ss 1200 or 1500	<ul style="list-style-type: none"> Trim 11 Abrasive Pad P/N: 059723 Trim 11 Foaming Agent Pad P/N: 05723/31 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit SBS/Trim Support Pad P/N: 05717/18 	<ul style="list-style-type: none"> Polish Trim Pad Abrasive P/N: 05995/05996 Multi-Hole Polish Trim Pad P/N: 05776 Hookit DA 6-inch Support Pad P/N: 05776 	<ul style="list-style-type: none"> Manual Trim Abrasive P/N: 05997 Quality Fluid/Adhesive Wax P/N: 0654/06055
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8.13.1.2 Clearcoat Repair Specification – Meguiar Product

Paint Conditions	Wet Sand Paper Grinding	Clean	Polish
New Vehicle Preparation or Fine Sand Wheel Trace	—	—	No Vortex Polishing (M-82) W-6000 Pad, Equipped for DA Polisher
Vortex Trace, Chemical Corrosion or Light Oxidization	—	—	No Vortex Polish (M-83) W-9000 Trim Pad
Over Due Paint or Medium Oxidization	—	Rough Grinding Cleaner (M-85) W-7000 Rough Grinding Pad	Vortex Polish (M-82) W-9000 Trim Pad
Oxidization Serious or Slight Acid Rain Spot	—	Compound Electrical Cleaner (M-84) W-4000 Rough Grinding Pad	No Vortex Polish (M-82) W-6000 Trim Pad
Dust Bulge Out	2000 Class Uniform Grain Grinding Stone	Compound Electrical Cleaner (M-84) W-7000 Rough Grinding Pad	No Vortex Polish (M-2) W-9000 Trim Pad
Small Scratches or Acid Rain Spot	2000 Class Uniform Grain Sand Paper	Compound Electrical Cleaner (M-84) W-7000 Rough Grinding Pad	No Vortex Polish (M-2) W-9000 Trim Pad
Comparatively Large Oil Drop or Sag	1500 Class Uniform Grain Grinding Stone	Compound Electrical Cleaner (M-84) W-7000 Rough Grinding Pad	No Vortex Polishing (M-2) W-6000 Pad, Equipped for DA Polisher
Comparatively Orange Peel Status or Acid Rain Spot	1500 Class Uniform Grain Sand Paper	Compound Electrical Cleaner (M-84) W-7000 Rough Grinding Pad	No Vortex Polishing (M-2) W-6000 Pad, Equipped for DA Polisher
Needing Protection	—	—	Fast Speed Fine Processor (M-6601) may be used for providing surface protection and will not produce strips. The machine uses the most gentle cleaning agent to ensure uniform applying or polishing.

8.13.2 Foreword

8.13.2.1 Primer/Clearcoat Coating System

Caution: Exposure in isocyanate environment may cause serious respiratory tract disease during paint preparation and application processes. Read and follow all instructions of paint material, equipment, and protection tool.

Caution: To reduce personal injury as far as possible, approved safety protection goggles and gloves should be worn as far as possible in construction.

Paint coating of all fixity appearance must reach GM standards. GM P/N 4901 M-D-99 of surface trim material manual approved by GM indicated paint material that may be used. Note to make a practice of the latest version of reference to 4901 M-D manual. Operational stipulations of all approved product including highly volatile organic mixture (VOC) may refer to paint application method recommended by every manufacturer. For detailed application steps used in paint repair of rigidity appearance, refer to the manufacturer's instruction of the material. To ensure mutual adherence of a multi layer of paint, all composition of paint coating should be designed in advance.

If necessary, site repair and color matching should be carried out to the body and outboard. Do not mix clearcoat on the body and panel outdoors. A next cut point must be coated with clearcoat (body side stamping, outline, or next body and outboard.)

Do not mix different lacquer paint together, and do not use a manufacturer's product to substitute the product of another manufacturer. If non mutual compatible product is used, it may cause the following problem:

- Bottom falling off caused by over-strong solvent corrosion in paint applied afterward.
- A inter-layer viscosity may be lost owing to incompatibility between several resin system.
- Solvent blow out may be caused by inappropriate solvent selection
- Unsound solidification may be caused due to using incompatible hardener resin or insufficient reaction.
- Luster reduction may be caused by using incompatible resin and/or solvent.
- Color unconformity may be further caused by mutual reaction of colors due to using incompatible resin and/or solvent.
- Coating defects may be caused by inferior material used in incompatible product (drop pit, bubble, orange skin, and lackluster)

8.13.2.2 Anti Corrosion Process and Repair

Caution: When using sound insulation and anti corrosion material, construction should be carried out carefully, and effective measures should be adopted to prevent the above material being sprayed to vehicle door or fender components such as door lock, window elevation slot, window open and close adjuster, and seat safety belt retractor, as well as bottom movement or rotation mechanical components or suspension components, particularly on the parking brake backstay cable. After using the above material, all water drainage holes on the body must be open. Inappropriate material application could cause corrosion possibilities or limit moving component operation, thus to cause personal injury.

Caution: Flames used by foaming sound insulation off body repair must surpass 152.4mm. When reinstall foaming sound insulation material, suction of smoke corpuscle pollutants should be prevented, because they are harmful to health.

Caution: To reduce personal injury as far as possible, approved safety protection goggles and gloves should be worn as far as possible in construction.

Notice: Before process of lacquering, anti rust, or Priming, existent theft proof tab for the main body, panel must be stamped at first. After the above process, the hood must be open. If incompliance with the above prevention steps for operation, the vehicle owner may assume the responsibility of breaching Federal Vehicle Theft Proof Criteria, the vehicle components must be suspected as from stolen.

The rust proof function and anti corrosion material is used on the inner and outer surface of the metal body and outboard. The above materials include the following metals:

- Single side zinc plating
- Double side zinc plating
- Double face zinc-iron alloy steel

The following components use the above processed metal:

- Thread board
- Door
- Rear thread board
- Door Sill Board
- Vehicle Cover
- Vehicle Inside Floor
- Hood
- Other important components

Metal regulator and primer are all used on the inner and outer surface. Applying sealant to the exposed seaming, sound insulation material of asphalt for dampproof is used on the hood, door inside, and some body bottom components.

Circumstances like that may damage the above special process effect like body and outboard replacement or crash repair, may cause metal material of the vehicle to lose protection and even corrosion as well as rust. Use repair type anti corrosion material to apply appropriate coating protection to the above surface is necessary.

Metal conditioner and primer coating has been already used on all metal body outboard during vehicle production. After installation of repair and/or replacement of components, all exposed metal must be processed by using metal moderator and reapply primer with zinc chromate paint. The above operation is carried out after using sealant, sound insulation material and anti rust compounds.

Some sealant is used to prevent water and dust to enter into the vehicle, and at the same time it is also an anti corrosion shield. Sealant is all used on the rear compartment lid flange, hood, rear fender, vehicle floor, front wall, roof and various other inter plate connection points. The earliest sealing seams are all obvious, and these damaged sealing position should all be repaired in time by sealing. Combination point replacing the new armour plate should be carried out for re-sealing. Replaced cover and door all need to perform sealing within the side flange area.

Flanging seam, overlapped seam and weld should go through sealing by using medium denseness quality sealant. All used sealant must maintain its flexibility and paint ability after curing.

Crack and seam need to be staffed with sealant should use material of high denseness and with leak preventive to perform sealing. Perform application according to the operational instruction attached on the selected material.

To restore the original appearance of the hood, fender, door, tail, cover, roof engine chamber, vehicle bottom and inner protection board, does it need for color. When it needs for colouring, perform operation according to conventional trim surface preparation, Primer, and colour technique.

To reach anti corrosion and seam purpose, sound insulation material (spray type) should be used on various metal plate. They have comparatively in a good

way controlled the normal noise level in the passenger area. When sound insulation material is damaged, or removed in the vehicle repair or new plate installation process, sound insulation material must use equivalent repair material for replacement. Sound insulation material application mode and position may be determined according to the original production installation circumstances.

Anti corrosion compound is of low denseness material, which can infiltrate into the fissure between the metal surface, for example: spot weld seam, flanging and an unibody plate connection point, here metal surface is hard to use conventional primer material to cover it, and also there is no way to perform paint. Material suitable for such application is GM P/N 12346225 anti corrosion compound (oil pan) or other substitutions. For large area Priming such as replacing door, tail outboard, vehicle floor, cover, hood, fender, it is recommended to employ conventional ways. During the painting process, it should be very much careful to prevent paint material to be sprayed to the door and sideboard mechanic components, such as door lock, glass elevation track, window adjuster, and seat safety belt retractor. At the body bottom, paint material should not be applied to the moving or rotary components, with energy absorbing sound silencing components or shock absorbing components. After applying Primer, all drainage holes on the body should be opened. Refer to the section of Anti Corrosion in Primer/Clearcoat System.

After burned during the original zinc plating material or other anti corrosion material welding or heating operational process, it is necessary to perform cleaning to the inner protection board or vehicle bottom plate. It is necessary to notice that to wipe the combustible remains from the inner surface of the box structure, and clear off the remains when it is not easy to enter into the metal structure of the inner surface. There are a few kind of methods for clearing the remains.

- For cleaning and prevention at exposed connection, body low part and curling flanging, it is better to employ sand spray method. Sand spray is the best effective method.
- Where uneasy to reach, putty knife or scraper could be used for cleaning action.
- Spray of compressed air can eliminate the most part of remains, and it is an effective practice for only limited entrance.

8.13.2.3 Paint Recognition

Foreward

Caution: Exposure in isocyanate environment may cause serious respiratory tract problem during paint preparation and application processes. Read and follow all instructions of paint material, equipment, and protection tool.

Note: Notice to make a practice to read GM approved surface trim material manual P/N 4901 M-D. It points out oil paint that may be used.

The Primer/clearcoat is applied to the vehicle in the factory in accordance with the following 4 layers, thus making the out workshop vehicle to have a glaring appearance.

1. Battery Primer
2. Bottom/surface paint
3. Primer
4. Clear paint

8.13.3 Repair Instructions

8.13.3.1 Clearcoat Repair Unnecessary for Repainting

Note:

- Do not wash vehicle under direct sunshine conditions.
- Do not use powerful decontamination soap or chemical ablument to wash the vehicle.
- Brushless auto washing equipment should be used to wash the vehicle.
- Do not use acid product (unless for such stipulated instances as process of vehicle beam dust accumulation)
- To clean accumulated ice and snow on the vehicle, do not use brush or broom.
- Do not wipe the cleanser and water dry quickly, and do not let the body surface to dry naturally.
- It is recommended to wipe dry with soft shamoy.
- Do not wipe and dry the cleanser and water quickly, and do not let the body surface to dry naturally.
- It is recommended to wipe and dry with soft shamoy.
- Do not polish the vehicle in general, unless only polishing can solve the vehicle surface problem. Refer to Transparent Repair Specification of Meguiar Product or 3M Product.
- If the surface condition is very serious, repair area should be as far as fewer (the least effect repair method to the vehicle).
- Do not remove excessive clearcoat (as far as possible before polishing, middle and used paint thickness gauge afterward). Refer to Oil Thickness Gauge.
- Only use recommended product in the specification (or equivalent) .Refer to Transparent Repair Specification of Meguiar Product or 3M Product.
- Ensure any electronic polishing equipment not to surpass the polishing requirements recommended by the manufacturer. The final sequence normally use a 1,500-2,000rpm track type polisher. Refer to Transparent Repair Specification of Meguiar Product or 3M Product.
- Do not use wax or silicon resin type product to hide the vortex mark (this kind of damage will reappear afterward to let the customer unsatisfied).
- Specific paint status (environment damage, vehicle beam dust accumulation) can employ the following method for correction:

- Refer to Environment Dust-Acid Rain.
- Refer to Repair of Vehicle Beam Dust Accumulation Damage.

1. Use liquid detergent and fluid wax GM P/N 1052870 or equivalent to completely wash the repair area.
2. Mark the paint film reading before performing operation. Refer to Oil Thickness Gauge.
3. Apply a small amount of appropriate oil painting material at the repair part and use the pad for floating. Refer to Transparent Repair Specification of Meguiar Product or 3M Product.
4. Use approximately 1,500-2,000rpm polisher to polishing the repair area. The pad should be maintained on the cover sheet for trim within 4-6 seconds applied with larger pressure. Thereafter polish with a comparatively small pressure for 6-8 seconds. Outline and protection board edge should be wiped in avoidance of melting through with hand.
5. Check the repair area frequently. Increase appropriate paint material according to needs.
6. Frequent mix or decor the outer edge of the repair area.
7. First check the repair area again after polishing.
8. If the vortex can be seen, repeat the polishing procedure.
9. Use a clean frickless soft cloth, solvent soaked with a 50/50 mixture of isopropyl and water to clean the repair area.
10. If needing for sand grinding, refer to Meguiar Product and 3M Product Clearcoat Repair Specification.

8.13.3.2 Environment Dust-Acid Rain

Paint/Coating Environment Falling Outs: Acid Rain; Acid Rain

Due to different damage level at various part, appropriate diagnosis made for different level is the key for successful repair work. On cleaning level surface (hood, dome plate, rear compartment cover) , perform diagnosis under the irradiation of high brightness fluorometry. There are 3 basic acid damage types.

Surface Layer Pollution

Only use silicon resin, wax and oil detergent to wash the vehicle, cleaning surface, neutralized acid remains to perform fine polishing, i.e. comparable restoration. Refer to Surface Layer Pollution Repair in this specification.

Clearcoat corrosion

After the above clean and fine polishing procedure, slight corrosion still can be seen. Refer to Slight Surface Coating Damage-Wet Grinding, Fine Polishing in the specification.

Primer Corrosion

Corrosion has been deepened into the primer from the clearcoat. 8.13.2.1 Primer/Clearcoat Coating System

Slight Surface Coating Damage-Wet Grinding, Fine Polishing

Notice: Thickness of cleaned surface coating exceeding 0.5mil will make failure of the early painting. Clearcoat contains shielded ultraviolet composition. It should be as thin as possible for the fine sand blasted, and it could be ok as long as the painting defect is removed.

Note: The mixing and polishing operation must be performed as per the detailed material application procedure in the instruction of the manufacturer product package.

1. Select a small piece of test area on the damaged plate.
2. Mark the reading of the painting construction before performing operation. Refer to Oil Thickness Gauge.
3. Use the ultra-fine sand paper and rubber sponge sanding block to perform wet grinding to the damaged area. For detailed application procedures used in the repair, refer to the manufacturer's product instruction. During the wet grinding process:
 - Adequate water should be used.
 - To make fine processing and workmanship, avoid removing excessive clearcoat.
4. Use rubber broom to clean excessive water and check the area. If damage can be repaired by wet grinding, continue to perform wet grinding to the whole plate.
5. Use a foam piece to perform fine polishing. Use the double action track polisher and foam piece to clean the trace of vortex. Refer to Transparent Repair Specification of Meguiar Product or 3M Product. During repairing, if you suspect or observed the corrosion has penetrated on the Primer, or during the sand grinding process, the clearcoat is grinded off too much or the primer has been transferred to on the grinding pad, then it is needed for application of the damaged area.
6. Clearcoat/primer or re-polished. Refer to Primer/Clearcoat
7. After all damaged areas have been repaired, perform polishing to the complete vehicle again.

Repair of Surface Layer Pollution

Notice: Paint could early fail to have effect if the thickness of the clearcoat cleaned exceeding 0.5mil. Clearcoat contains shielded ultraviolet composition. It should be as thin as possible for the fine sand blasted, and it could be ok as long as the painting defect is removed.

Note: The mixing and polishing operation must be performed as per the detailed material application procedure in the instruction of the manufacturer product package.

1. Use liquid detergent and fluid wax GM P/N 1052870 to completely wash the repair area.
2. Completely dry the repair position.
3. Use silicon resin, wax and degreaser to clean the damaged position.
4. Clean acidic residue on the damaged area with a mixture (1 tablespoon of baking soda per 1 quart of water) of baking soda and water. Rinse thoroughly and dry the cover sheet.
5. Use a foam piece to perform fine polishing. If the damaged area has been repaired, the double action track polisher and a foam piece can be used to clean all vortex traces. Refer to Transparent Repair Specification of Meguiar Product or 3M Product.
6. If the damaged circumstance remains unchanged, refer to Slight Clearcoat Damage-Wet Grinding, Fine Polishing in this specification.

8.13.3.3 Paint Thickness Gauges

Paint Thickness Gauges

Before, during or after sand blasted process, to accurately measure how much clearcoat has been removed, the paint thickness gauge may be used. The total thickness polished can be measured by the paint thickness gauge, which also can determine how much clearcoat has been removed during repair process. There are many source channels for the paint thickness gauge, as well as various kinds of product. Some of them are magnetic gravitation type while others are of complicated electronic type. The old magnetic type gauges, at best have a 5% accuracy range and not sensitive enough to detect removal of 0.02mm 0.5mil (0.0005in) clearcoat. The new type magnetic gauges have improved the accuracy range. Most gauges are confined to checking either ferrous metal (steel) or non ferrous metal, aluminum panel. So far there are no usable gauges for measuring of coating thickness on the composite plate (SGM vehicle door, responsive spray cast fender). More sophisticated electronic paint thickness gauges (ETG) digital type gauges are able to read the coating thickness on both ferrous and non ferrous metal panels. The measuring accuracy of the digital type

gauge can reach 1% and contains that of the re-aligned thickness standard. So far there are several types of paint thickness gauges in the following, which can be used .

Paint Thickness Gauges

- 147-5437-ETG standard type
- 147-5437-ETG-P Standard model with print option
- 147-5437-N-ETG-N Non-ferrous model for aluminum panels
- 147-5437-NP-ETG-NP Ferrous metal with print option
- 147-54437-SD-ETG steel and aluminum gauge

8.13.3.4 Clearcoat thickness

Clearcoat thickness on vehicles is generally 0.059-0.078 mm (1.5-2mil; 0.0015-0.0020in). The clearcoat contains ultraviolet screeners. Removing more than 0.5mil (0.019in) of the clearcoat can result in early paint failure.

8.13.3.5 Repair of Vehicle Beam Dust Accumulation Damage

Caution: To reduce personal injury as far as possible, approved safety protection goggles and gloves should be worn as far as possible in construction.

Note: If accumulated dust on vehicle beam has penetrated into the primer, then cover sheet surface needs to be re-polished. Before re-polishing all dust on vehicle beam should be cleared, otherwise rust spot will appear later on.

1. Vehicle beam dust damage comes from the iron particulates produced from the friction of the train wheel and the train track. If a vehicle is stored near surroundings where rust could be easily resulted in (e.g. steel ore factory), then vehicle beam dust could be accumulated. This kind of dust can both be floating on the paint surface and be embedded in them. People generally diagnosis them as paint surface lump or rust spot
2. Drive the vehicle to a shady and cool area to ensure the vehicle surface is cool during the clearing process.
3. Use liquid detergent and liquid wax GM P/N 1052870 or equivalent to completely wash the repair area.
4. Wipe the repair area dry.
5. Use silicon resin, wax and degreaser to the clean the damaged area.
6. Perform dust removal operation in accordance with the manufacturer's instruction for operation on repair material type (Gel Type Oxalic Acid or Clay Type Non-Acid Based). If particulates are still found when checking, the above process may be repeated. If damage has been repaired, perform repair to the entire cover sheet

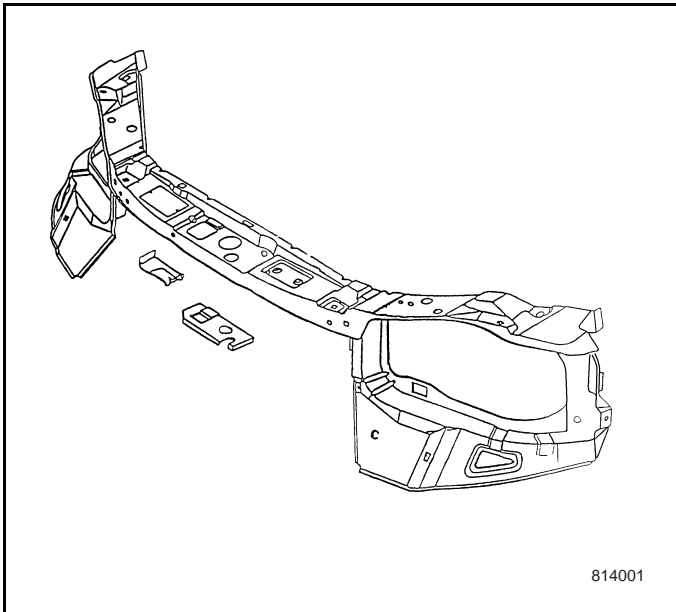
8.14 Collision repair

8.14.1 Repair Guidance

8.14.1.1 Radiator bracket - upper part, replacement

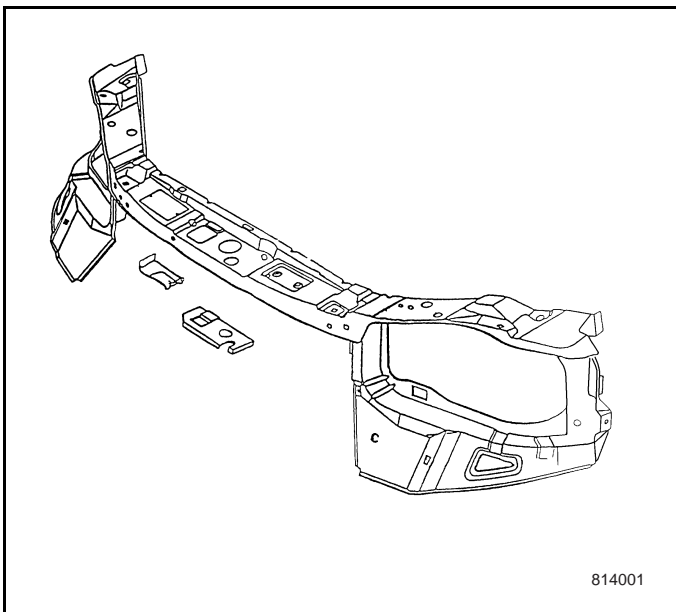
Removal Procedure

1. Remove all the related panels and components.
2. Visual inspection and restore the damaged part to the original specifications as much as possible.
3. Locate, mark and drill away all the original welding points. Record the number and position of the welding point so as to install the service assembly.
4. Remove the damaged radiator bracket assembly.



Installation Procedure

1. Pre-treat the matching surface when necessary.
2. Inspect if the service assembly is correctly installed.
3. Drill a 8 mm plug welding hole at the marked assembly position.
4. Locate the service assembly with 3-D measuring device.
5. During plug welding, measure frequently to ensure good matching and flatness.
6. Clean and prepare all the welding surfaces.
7. Coat with double combined catalysed primer.
8. Spray with sealing agent and anti-corrosion agent if necessary.
9. Install all relevant dampers and assemblies.



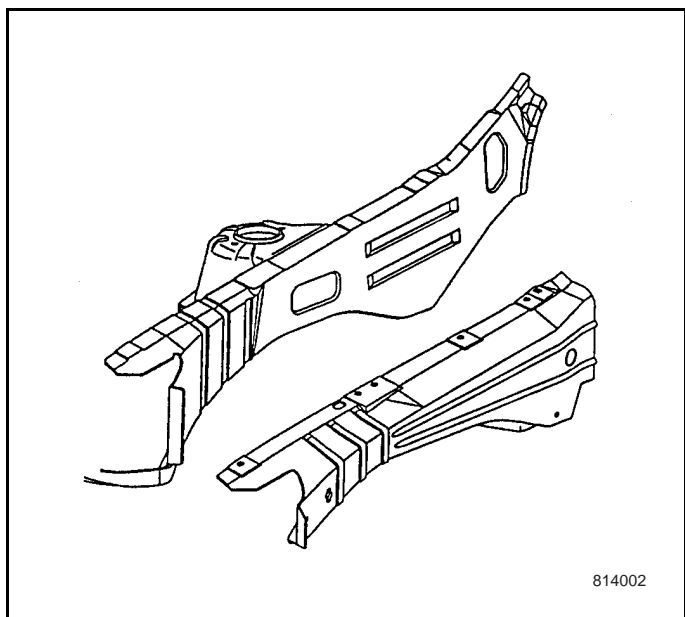
8.14.1.2 Replacement of vertical beam – upper

Note: Front upper vertical beam maybe maintained separately for the two components: inner plate (1) and outer plate (2). The inner plate contains guard board, front absorber and enhancement plate. You can only access the inner vertical beam after the outer vertical beam is removed.

Note: We recommend you not to cut the front upper vertical beam.

Removal Procedure

1. Remove all the related panels and components.
2. Clear away the sealing agent and anti-corrosion materials when necessary.
3. Locate, mark and drill away all original welding points connecting the outer vertical beam.
4. Remove the damaged outer vertical beam.
5. Locate, mark and drill away all original welding points connecting the inner vertical beam.
6. Remove the damaged inner vertical beam.

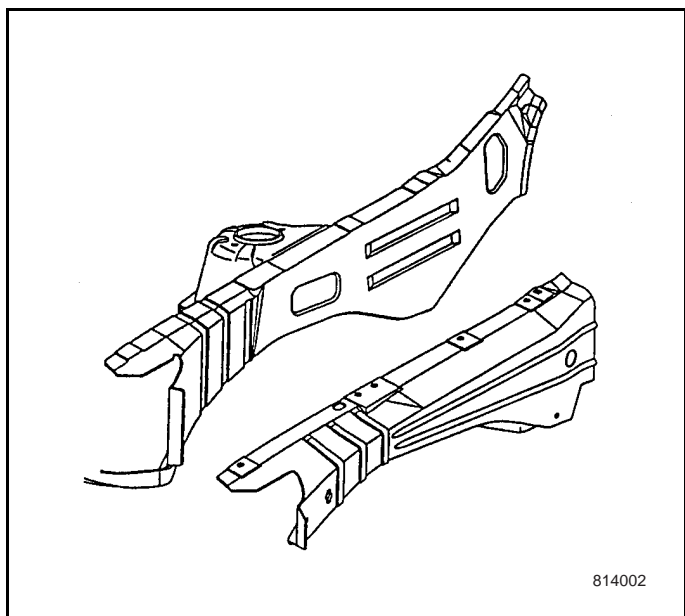


Installation Procedure

1. Pre-treat the matching surface when necessary.
2. Drill an 8 mm plug welding hole at the marked position on the original panels.

Note: if the original position can not be figured out due to damage, identify a plug welding hole at the interval of 40 mm.

3. Put the inner and outer vertical beam to the vehicles temporarily.
4. Use 3-D measuring device to locate the outer vertical beam and mark the bolt installation hole on the front fender.
5. Drill a 5.5mm bolt hole.
6. When the service panel is properly located, remove the outer panel when necessary and plug weld the inner panel.
7. Measure the position of outer vertical beam frequently to ensure proper assembly and centering.
8. Plug weld properly.
9. Clean and prepare all the welding surfaces.
10. Coat with double combined catalysed primer.



11. Spray with sealing agent and anti-corrosion materials when necessary.

Note: Prior to surface finishing, please refer to the recommended products in GM4901M-D surface finishing material manual. Do not use paint spraying system in confusion. Refer to recommendations by the paint factory.

12. Install all the related panels and components.

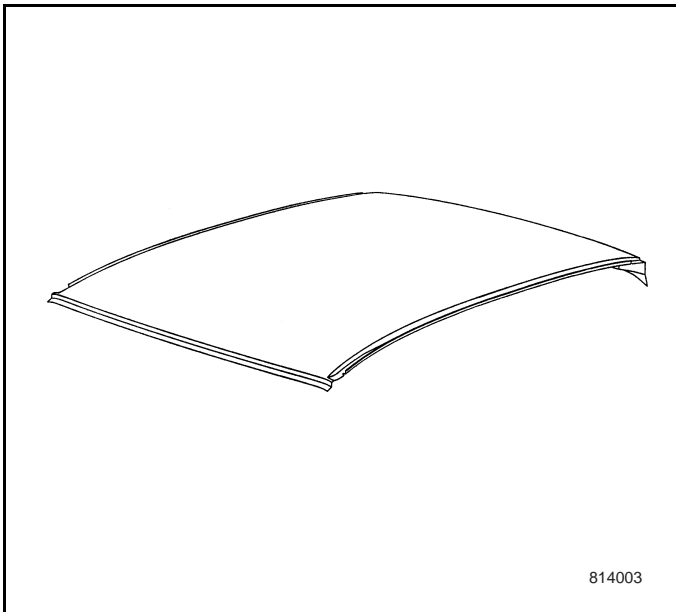
8.14.1.3 Replacement of roof outer panel

Removal Procedure

1. Remove all relevant protection panels and components until the welding seam connecting the ceiling to the vehicle exposes.
2. Visually inspect and restore the damaged part as much as possible.
3. Clear away sealing agent and anti-corrosion agent if necessary.
4. Locate, mark and drill away all original welding points. Pay attention to the number and position of the welding point so as to install the service assembly.

Note: You need an assistant to remove the ceiling assembly safely and meanwhile to avoid the vehicle from being damaged.

5. Remove the damaged ceiling panel.



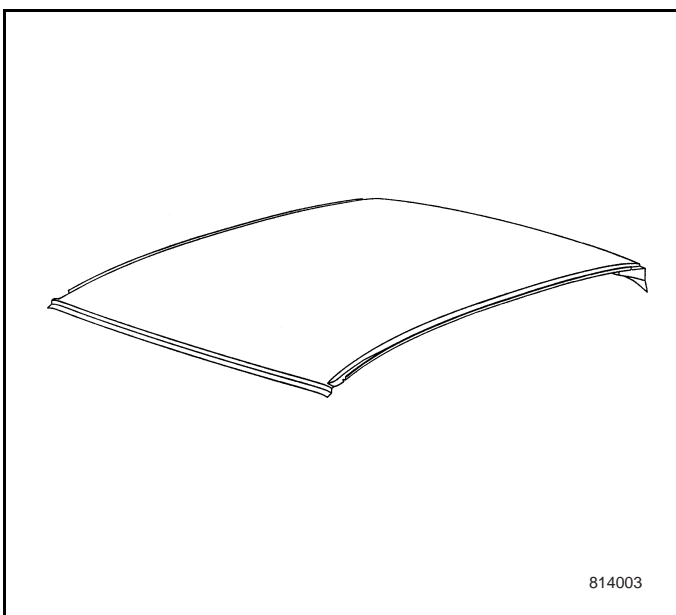
814003

Installation Procedure

1. Clean and prepare the matching surface if necessary.
2. Locate the ceiling panel onto the vehicle.
3. Inspect the assembly and alignment.
4. Locate the service parts properly and conduct relevant plug weldment.
5. Clean and prepare all the welding surfaces.
6. Coat with double combined catalysed primer.
7. Spray with sealing agent and anti-corrosion materials when necessary.

Note: Do not confuse different paint system. Refer to the usage recommendation by the paint manufacturer.

8. Install all the related panels and components.



814003

Blank

8.15 Instrument Panel, Gauges, and Console

8.15.1 Specifications

8.15.1.1 Fastener Tightening Torque

Application	Specification
Glove Box Screw	1.0-3.0 N•m
Ashtray Screw	2 ± 0.3 N•m
Console Screw	1.5-2.5 N•m
Steering Column Bracket Bolt	20-26 N•m
Nut of I/P Reinforcement Bracket	20-26 N•m
Steering Column Bracket ASM	20-26 N•m
I/P Reinforced Nut	18-22 N•m
Left and Right Side of I/P Screw	5-7 N•m
Tightening Screw of I/P Bracket and Floor	3.5-4.5 N•m
Nut of LH I/P Reinforcement Bracket	20-24 N•m
Steering Column Cover Bolt	2 ± 0.3 N•m
Nut of Air Bag Control Unit	8-11 N•m
Console Extension Screw	1.5-2.5 N•m
Side Screw of Trim Panel Jacket	1.5-2 N•m
Outlet Screw, Left	1.5-2.5 N•m
Outlet Screw, Right	1.5-2.5 N•m
Exterior Trim Screw of Instrument Panel Cover	1.5-2.5 N•m
Instrument Cluster Screw	1.7-2.3 N•m
Fuse Box Screw	1.5-2.5 N•m
Setscrew of Clock Temperature Module	1.0-3.0 N•m

8.15.2 Schematic and Routing Diagrams

8.15.2.1 Wiring Diagram - Instrument Cluster

See 8.20.2.5.

8.15.2.2 Wiring Diagram - Cigarette Lighter

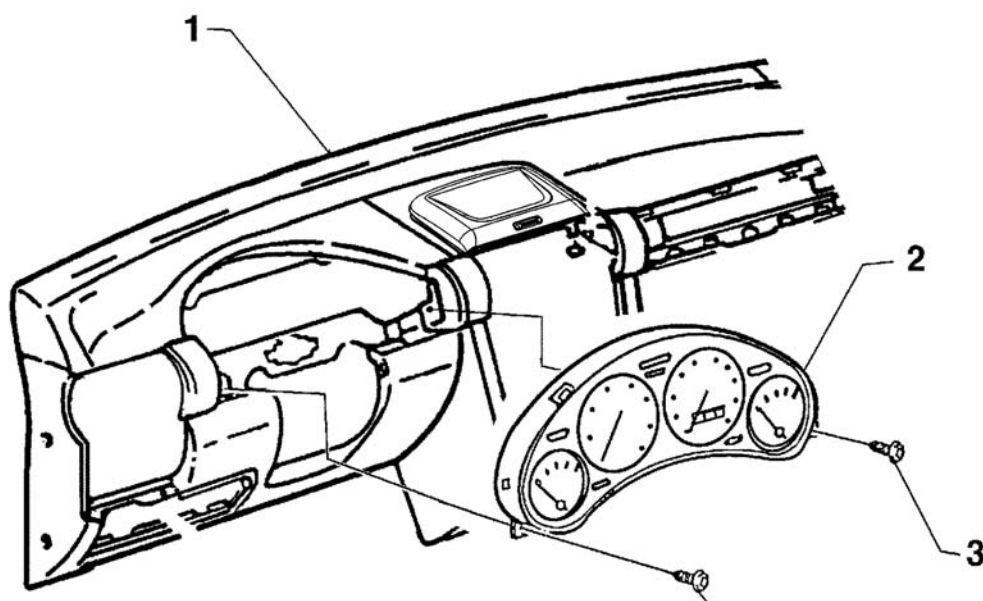
See 8.20.2.16.

8.15.2.3 Wiring Diagram - Clock Temperature Module

See 8.20.2.26.

8.15.3 Component Locator

8.15.3.1 Part-View Diagram - Instrument Cluster



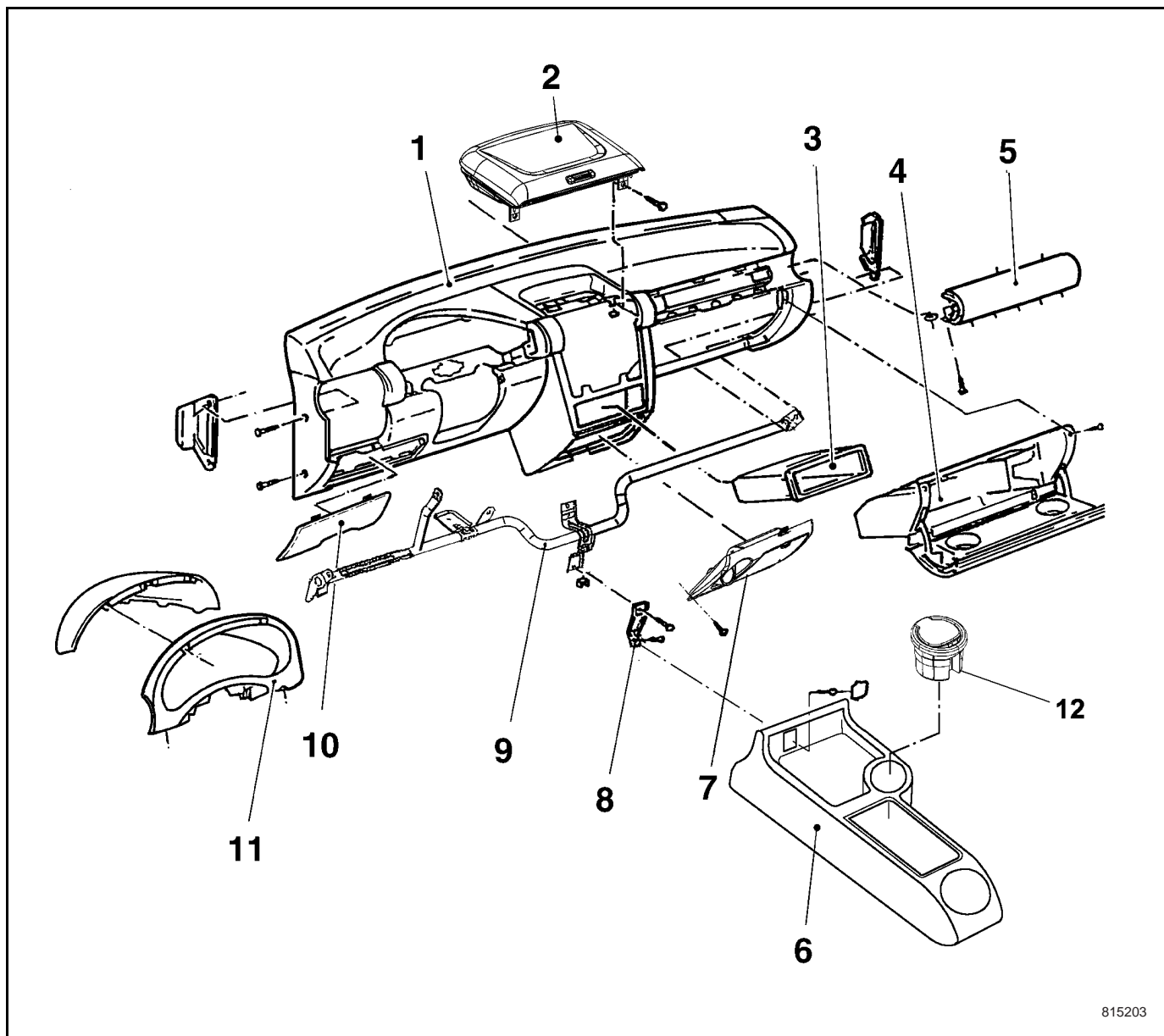
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Legend

- (1) Instrument Panel
- (2) Instrument Cluster

- (3) Screw for Fastening Instrument Cluster

8.15.3.2 Part-View Diagram - Instrument Panel Assembly

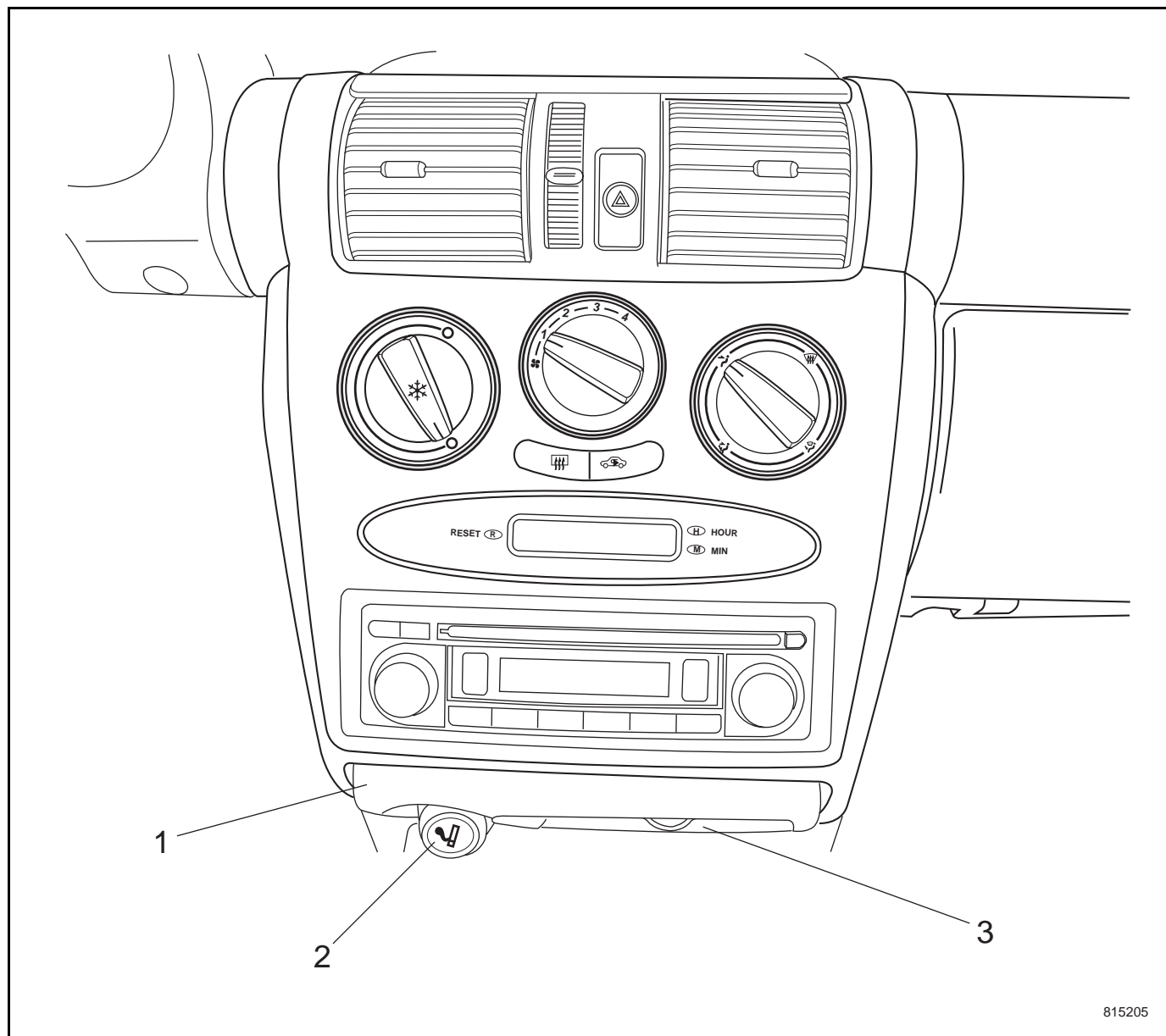


815203

Legend

- | | |
|--|--|
| (1) Instrument Panel | (7) Trim Panel at Instrument Panel |
| (2) Stow Compartment at Upper Instrument Panel | (8) Instrument Panel Bracket |
| (3) Radio (set)/CD | (9) Instrument Panel Bracket Reinforcement |
| (4) Glove Box | (10) Fuse Box Cover |
| (5) Instrument Panel Spacer | (11) Exterior Trim Cover of Instrument Panel |
| (6) Instrument Console | (12) Ashtray |

8.15.3.3 Part-View Diagram - Cigarette Lighter

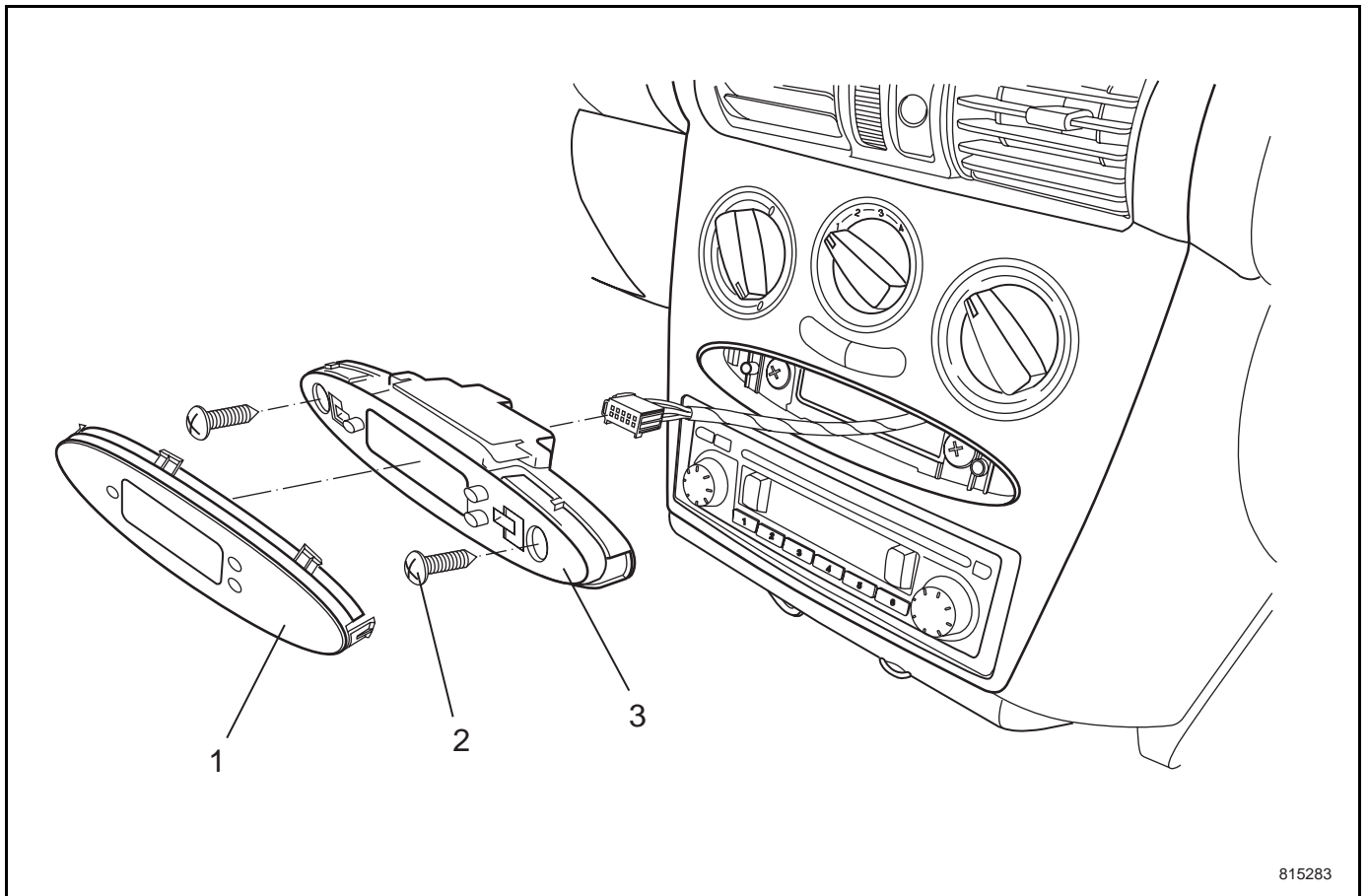


Legend

- (1) Trim Panel at Lower Instrument Panel
(2) Cigarette Lighter

- (3) License Storage Case

8.15.3.4 Part-View Diagram - Clock Temperature Module



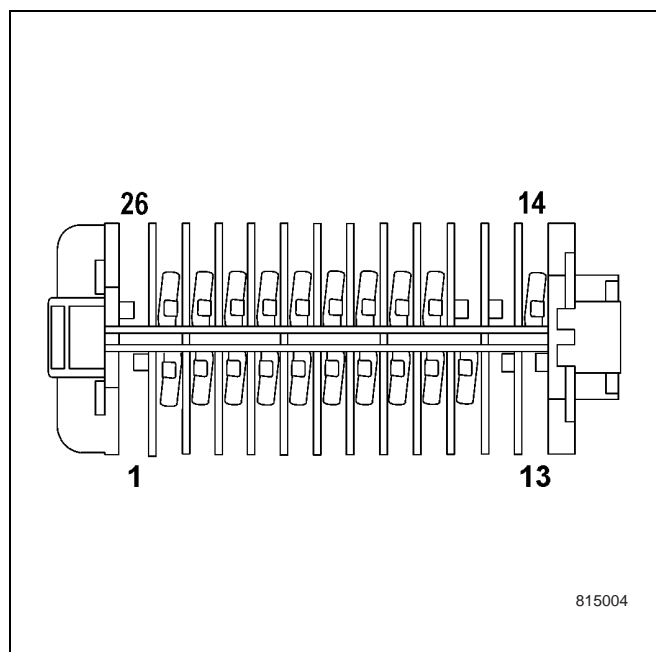
Legend

(1) Cover

(2) Screw

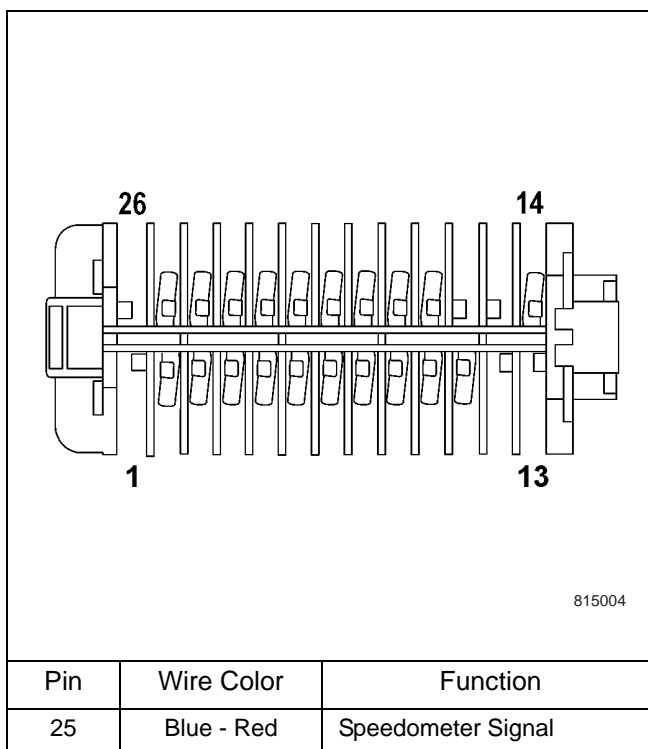
(3) Clock Temperature Module

8.15.3.5 Connector End View - Instrument Cluster



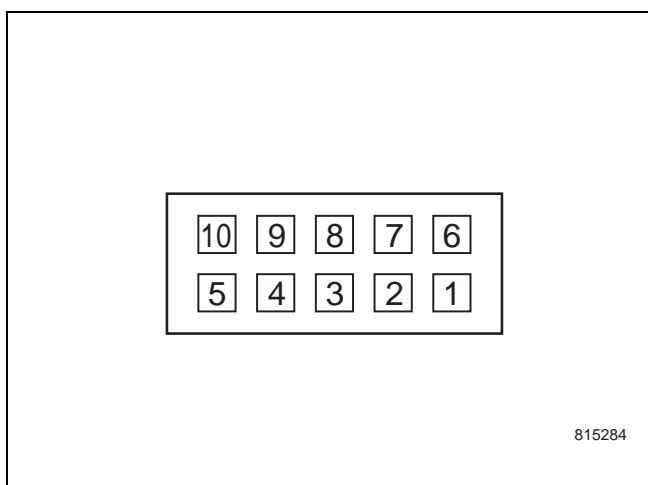
Pin	Wire Color	Function
2	Black - Green	Left Steering Input
3	Grey - Black	Backlight Lamp Input
4	—	Reserved
5	—	Reserved
6	Green	Right Steering Input
7	White	High Beam Input
8	Brown	Ground
9	Green	Tachometer Signal
10	Brown - Yellow	Air Bag Signal
11	Brown - Blue	Engine Input/Theft Input
12	—	Reserved
13	—	Reserved
14	Red	Battery Power Input
15	—	Reserved
16	—	Reserved
17	—	Reserved
18	Blue - Black	Fuel Sensor Signal
19	Blue - White	Charging Input
20	Brown - White	Brake Signal
21	Black	Ignition
22	Brown - Yellow	ABS Signal
23	Blue - Green	Oil Pressure Input
24	Blue	Engine Coolant Temperature Input

8.15.3.5 Connector End View - Instrument Cluster (Cont' d)



Pin	Wire Color	Function
25	Blue - Red	Speedometer Signal

8.15.3.6 Connector End View - Clock Temperature Module



Pin	Wire Color	Function
1	—	Reserved
2	Grey - Black	Sensor Ground
3	—	Reserved
4	Blue - Red	Speed Signal Input
5	Brown	Ground
6	—	Reserved
7	Grey - Green	Outside Temperature Sensor Input

8.15.3.6 Connector End View - Clock
Temperature Module (Cont' d)

10

9

8

7

6

5

4

3

2

1

815284

Pin	Wire Color	Function
8	—	Reserved
9	Black	ACC
10	Red	Battery Voltage



815284

Pin	Wire Color	Function
8	—	Reserved
9	Black	ACC
10	Red	Battery Voltage

8.15.4 Diagnostic Information and Procedures

8.15.4.1 Diagnostic System Check for Instrument Panel

Circuit Description

The diagnostic system check for instrument panel is a high efficient and orderly method to recognize the fault with regard to the instrument panel. Ensure this inspection is the starting point to diagnose any instrument panel failure. The previous principles may instruct you to enter the next logic procedure of diagnosis trouble. This instrument panel is a component with high reliability. This instrument panel is unlikely the reason that causes the failure. Most of the system failure occurs due to the following situation:

- Circuit Failure
- Connector Failure
- Component Failure

To correctly use the table may ensure to get the following results:

- Shorten the diagnostic time.
- Avoid the unnecessary part replacement.

Diagnostic Aid

Intermittent failure in the electronic system is hard to detect and make precise diagnoses. Make a I/P test on different failures for different vehicle status. Based upon the above considerations, to reproduce one failure, one complete driving test must be performed. If the system failure doesn't repeat during the driving test, good failure description may be very useful when finding out the intermittent failure. The following failed components cause most of the intermittent failure.

- Mismatched connector;
- Loose terminal;
- Distorted or damaged terminal;
- Worn wire;
- Poor connection from wire to terminal;
- The terminal is too dirty or corroded.

- The connector is damaged.
- Use a J35616-B
 - to detect the terminal.
 - Check the terminal.
 - Adapter may be used to ensure the acquirement of the following results:
- The terminal is not damaged.
- It indicates if the tensile force of the contact is enough.
- Inspect all the fuses related to the instrument panel (See the diagram). If the fuses are open, inspect if the supply circuits of these fuses are short to ground.
- Ensure that all the related ground electrodes are clean and tight.
- For the removal and replacement procedures of the instrument panel, see Instrument Panel Replacement.
- Inspect the disconnections (partly disconnections) inside the insulator, and they may cause the following results:
 - System Failure.
 - After the system is disconnected, its continuity/voltage inspection is normal.
 - These circuits are intermittent or hidden when loaded. If possible, inspect the circuits by using the operating system (with loads) to monitor the voltage drop.

Inspect for the correct installation of electronic equipment which is purchased on the aftersales market and may affect the integrity of other system.

Notice: Some terms presented in the Diagnostic Procedures can be explained like the following:

RUN: When the engine stops running, turn the ignition switch to "II" directly.

START: When the engine stops running, turn the ignition switch to "III" directly.

8.15.4.2 Instrument Cluster Diagnosis

Step	Action	Value	Yes	No
1	Turn the ignition switch to Start position. Use the DMM to back probe between the power supply circuit and the ground of the following instrument cluster. Instrument Cluster Pin 21 and 14 Is the voltage equal to the specified value?	12V	Go to Step 2	Go to Step 3
2	Use a test lamp to back probe between B+ and each of the following circuits. The instrument gauge Pin 8 is grounding. Does the test lamp of the circuit illuminate?	—	Go to Step 5	Go to Step 4
3	Repair the following conditions in the power supply circuit of the faulty instrument cluster: <ul style="list-style-type: none"> • Poor Connection • Fuse failure • Inspect the system Is the repair completed?	—	System OK	—
4	Repair the following conditions in the ground circuit of the faulty instrument cluster: <ul style="list-style-type: none"> • Poor Connection • Fuse failure • Inspect the system Is the repair completed?	—	System OK	—
5	After the engine is started or when the vehicle is driven, inspect the air bag indicator for any of the following conditions: <ul style="list-style-type: none"> • Inoperative • Always on • Flashes Does the air bag indicator have any of the above conditions?	—	Refer to Safety Air Bag Diagnosis and Inspection in Safety Air Bag	Go to Step 6
6	After the engine is started or when the vehicle is driven, inspect the ABS indicator (if equipped) for any of the following conditions: Is the ABS indicator inoperative?	—	Refer to ABS indicator always on/inoperative.	Go to Step 7
7	After the engine is started or when the vehicle is driven, inspect the ABS indicator (if equipped) for any of the following conditions: <ul style="list-style-type: none"> • Always on • Flashes Does the ABS indicator have any of the above conditions?	—	Refer to ABS indicator always on/inoperative	Go to Step 8
8	When the sport drive mode (if equipped) is selected for automatic transmission, does the automatic transmission control position indicator illumination operate properly?	—	Go to Step 9	Refer to Sport Mode Indicator Always On/ Inoperative.
9	Inspect the brake warning lamp. Is the brake warning indicator always on?	—	Refer to Brake Warning Indicator Always On/ Inoperative	Go to Step 10

8.15.4.2 Instrument Cluster Diagnosis (Cont' d)

Step	Action	Value	Yes	No
10	Set the vehicle at parking brake. When the vehicle is set at parking brake, does the brake warning indicator illuminate?	—	Go to Step 11	Refer to Brake Warning Indicator Always On/ Inoperative
11	Inspect the brake fluid. Does the brake warning indicator come on when there is insufficient brake fluid?	—	Go to Step 12	Refer to Brake Warning Indicator Always On/ Inoperative
12	Inspect the brake warning indicator. Is the indicator inoperative?	—	Refer to Brake Warning Indicator Always On/ Inoperative	Go to Step 13
13	Turn the ignition switch to Start position or drive the car. Inspect the charging indicator for the following conditions: <ul style="list-style-type: none"> • Always on • Flashes Does the charging indicator have any of the above conditions?	—	Refer to Battery Charge Indicator Inoperative	Go to Step 14
14	Turn the ignition switch to Start position or drive the car. Inspect the charging indicator for the following conditions: <ul style="list-style-type: none"> • Inoperative Does the charging indicator have any of the above conditions?	—	Refer to Battery Charge Indicator Inoperative	Go to Step 27
15	Turn the ignition switch to Start position or drive the car. Inspect the engine coolant temperature gauge for the following conditions: <ul style="list-style-type: none"> • Inoperative • Inaccurate • Operate unstably Does the temperature gauge have any of the above conditions?	—	Refer to Engine Coolant Temperature Gauge Inaccurate or Inoperative	Go to Step 16
16	Turn the ignition switch to Start position or drive the car. Inspect the fuel gauge for the following conditions: <ul style="list-style-type: none"> • Inoperative • Inaccurate • Operate unstably Does the fuel gauge have any of the above conditions?	—	Refer to Fuel Gauge Inaccurate or Inoperative.	Go to Step 17
17	Turn the ignition switch to ON position or drive the car. Inspect the high beam indicator for the following conditions: <ul style="list-style-type: none"> • Inoperative • Always on Does the high beam indicator have any of the above conditions?	—	Refer to High Beam Always On/ Inoperative	Go to Step 18

8.15.4.2 Instrument Cluster Diagnosis (Cont' d)

Step	Action	Value	Yes	No
18	Turn the ignition switch to START position. To dim the backlight lamp of instrument cluster, the dimmer switch can be adjusted (light adjustment). Is the backlight lamp of instrument cluster adjustable normally?	—	Go to Step 19	Refer to Backlight Lamp of Instrument Cluster Inoperative
19	Turn the ignition switch to Start position or drive the car. Verify the fuel gauge indicates at least 1/8 full. Does the low fuel indicator illuminate?	—	Refer to Low Fuel Indicator Always On	Go to Step 20
20	Turn the ignition switch to Start position or drive the car. Verify the fuel gauge indicates at least above 1/8 full. Is the low fuel indicator inoperative?	—	Refer to Low Fuel Indicator Inoperative	Go to Step 21
21	Turn the ignition switch to ON position or drive the car. Inspect the oil pressure indicator for the following conditions: <ul style="list-style-type: none"> • Always on • Flashes Does the oil pressure indicator have any of the above conditions?	—	Refer to Engine Oil Pressure Indicator Always On	Go to Step 22
22	Turn the ignition switch to START position. Inspect the oil pressure indicator. Is the oil pressure indicator inoperative?	—	Refer to Engine Oil Pressure Indicator Always On/Inoperative	Go to Step 23
23	Turn the ignition switch to Start position or drive the car. Inspect the SERVICE ENGINE indicator for the following conditions: <ul style="list-style-type: none"> • Always on • Flashes Does the SERVICE ENGINE indicator have any of the above conditions?	—	Refer to SERVICE ENGINE Indicator Always On/Inoperative	Go to Step 24
24	Turn the ignition switch to START position. Inspect the SERVICE ENGINE indicator. Inspect the SERVICE ENGINE indicator. Is it inoperative?	—	Refer to SERVICE ENGINE Indicator Always On/Inoperative	Go to Step 25
25	Turn the ignition switch to Start position or drive the car. Inspect the speedometer/odometer. Does the speedometer/odometer indicator operate inaccurately or unstably?	—	Refer to Speedometer and/or Odometer Inaccurate/Inoperative	Go to Step 26
26	Turn the ignition switch to Start position or drive the car. Inspect the speedometer/odometer. Is the speedometer/odometer indicator inoperative?	—	Refer to Speedometer and/or Odometer Inaccurate/Inoperative	Go to Step 27

8.15.4.2 Instrument Cluster Diagnosis (Cont' d)

Step	Action	Value	Yes	No
27	Turn the ignition switch to Start position or drive the car. Inspect the tachometer. Does the tachometer operate inaccurately or unstably?	—	Refer to Tachometer Inaccurate	Go to Step 28
28	Turn the ignition switch to Start position or drive the car. Inspect the tachometer. Is the tachometer indicator inoperative?	—	Refer to Tachometer Inoperative	Go to Step 29
29	Turn the ignition switch to Start position or drive the car. Inspect the left turn signal indicator. Is the left turn signal indicator inoperative?	—	Refer to Left/Right Turn Signal Indicator Inoperative	Go to Step 30
30	Turn the ignition switch to Start position or drive the car. Inspect the right turn signal indicator. Is the right turn signal indicator inoperative?	—	Refer to Left/Right Turn Signal Indicator Inoperative	Go to Step 31
31	Perform all the procedures in the diagnostic system check for instrument cluster. Is the inspection completed?	—	System OK	—

8.15.4.3 Brake Indicator Always On/Inoperative

Step	Action	Value	Yes	No
1	Turn the ignition switch to the Run position. Is the brake indicator always on?	—	Go to Step 2	Go to Step 7
2	Inspect if the parking brake is used.	—	Go to Step 3	Go to Step 6
3	When the parking brake is not used, inspect if the brake indicator is always on during the vehicle driving.	—	Go to Step 4	Go to System Check
4	Use the DMM to inspect the voltage of instrument cluster connector (Pin 20).	0V	Go to Brake System Check - Brake Fluid Control Switch and Parking Brake Switch	Go to Step 5
5	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
6	Inspect if the brake fluid level is low.	—	Go to Step 3	Go to Step 4
7	Use the DMM to inspect the voltage of instrument cluster connector (Pin 20).	12V	Go to Step 8	Go to Step 5
8	Use the DMM to inspect for a short between the instrument cluster connector (Pin 20) and the switch (S11 or S13).	—	Go to Step 2	Go to Brake System Check - Brake Fluid Control Switch and Parking Brake Switch

8.15.4.3 Brake Indicator Always On/Inoperative (Cont' d)

9	Repair the open circuit between the instrument cluster connector (Pin 20) and the switch (S11 or S13) ñ brown white or brown red wire.Is the repair completed?	—	Go to System Check	—
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8.15.4.4 Refer to ABS indicator always on/inoperative (if equipped)î.

Step	Action	Value	Yes	No
1	Turn the ignition switch to the Run position, and allow the engine to be OFF. Is the ABS indicator still on for several seconds?	—	Go to Step 2	Go to Step 5
2	Turn the ignition switch to the Start position, and allow the engine to be OFF. Does the ABS indicator go out?	—	Go to Brake System Check - ABS Control Unit	Go to Step 3
3	Use the DMM to inspect the voltage of instrument cluster connector (Pin 22).	0V	Go to Brake System Check - ABS Control Unit	Go to Step 4
4	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
5	Use the DMM to inspect the voltage of instrument cluster connector (Pin 22).	0V	Go to Step 4	Go to Step 6
6	Use the DMM to inspect the voltage of ABS control system (Pin 21 in U4).	0V	Go to Step 7	Go to Brake System Check - ABS Control Unit
7	Repair the open circuit (Brown - Yellow wire) between the instrument cluster connector (Pin 22) and the ABS (Pin 21 in U4). Is the repair completed?	—	Go to System Check	—

8.15.4.5 Air Bag Indicator Always On/Inoperative

Step	Action	Value	Yes	No
1	Turn the ignition switch to the Run position, and allow the engine to be OFF. Is the air bag indicator still on for several seconds?	—	Go to Step 2	Go to Step 5
2	Turn the ignition switch to the Start position, and allow the engine to be OFF. Does the air bag indicator go out?	—	Go to System Check in Air Bag Control Unit	Go to Step 3
3	Use the DMM to inspect the voltage of instrument cluster connector (Pin 10).	0V	Go to System Check in Air Bag Control Unit	Go to Step 4
4	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
5	Use the DMM to inspect the voltage of instrument cluster connector (Pin 10).	0V	Go to Step 4	Go to Step 6

8.15.4.5 Air Bag Indicator Always On/Inoperative (Cont' d)

6	Use the DMM to inspect the voltage of air bag control unit (Pin 6 in k31).	0V	Go to Step 7	Go to System Check in Air Bag Control Unit
7	Repair the open circuit (Brown - Yellow wire) between the instrument cluster connector (Pin 10) and the air bag control unit (Pin 6 in k31). Is the repair completed?	—	Go to System Check	—

8.15.4.6 Sport Mode Indicator Always On/Inoperative (if equipped)

Step	Action	Value	Yes	No
1	Select the Sport Drive [®] during the driving. Is the sport drive indicator always on?	—	Go to Step 2	Go to Step 4
2	Does the warning lamp flash during the driving?	—	Go to Step 3	Go to System Check
3	Stop the vehicle, turn off the engine and restart it. Does the vehicle lamp continue to flash?	—	Go to System Check in Automatic Transmission Control Unit	Go to System Check
4	Use the DMM to inspect the voltage of instrument cluster connector (Pin 17).	0V	Go to Step 5	Go to Step 6
5	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement.	—	Go to System Check	—
6	Use the DMM to inspect the voltage of automatic transmission control unit (Pin 12 in K85).	0V	Go to Step 7	Go to System Check in Automatic Transmission Control Unit
7	Repair the open circuit (Brown - Purple wire) between the instrument cluster connector (Pin 17) and the automatic transmission control unit (Pin 12 in k85). Is the repair completed?	—	Go to System Check	—

8.15.4.7 Engine Coolant Temperature Gauge Inaccurate or Inoperative

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Inspect the engine coolant system. Refer to Diagnostic Information and Procedures of Engine Coolant System. Is it normal?	—	Go to Step 3	Go to Engine Coolant System Repair
3	Replace the engine coolant temperature sensor. Refer to Coolant Temperature Sensor (CTS) Replacement [†] in Engine Controls. Is the problem solved?	—	System OK	Go to Step 4

8.15.4.7 Engine Coolant Temperature Gauge Inaccurate or Inoperative (Cont' d)

4	Use the DMM to test the circuit between the instrument cluster (Pin 24) and the temperature sensor. Is the circuit open?	—	Go to Step 5	Go to Step 6
5	Repair the circuit between the instrument cluster (Pin 24) and the temperature sensor. Is the problem solved?	—	System OK	Go to Step 6
6	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	System OK	—

8.15.4.8 Refer to Fuel Gauge Inaccurate or Inoperative

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Use the DMM to test the circuit between the instrument cluster (Pin 18) and the fuel sensor. Is the circuit open?	—	Go to Step 3	Go to Step 4
3	Repair the circuit between the instrument cluster and the temperature sensor. Is the problem solved?	—	System OK	Go to Step 4
4	Replace the fuel sensor. Is the problem solved?	—	System OK	Go to Step 5
5	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement Is the repair completed?	—	System OK	—

8.15.4.9 Speedometer and/or Odometer Indicates Inoperative/Inaccurate

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Use Tech2 to inspect the vehicle speed. Is the vehicle speed measured?	—	Go to Step 4	Go to Step 3
3	Replace the vehicle speed sensor. Is the problem solved?	—	System OK	Go to Step 2
4	Use the DMM to inspect the circuit between the instrument cluster (Pin 25) and the vehicle speed sensor. Is the circuit open?	—	Go to Step 5	Go to Step 6
5	Repair the open circuit. Is the problem solved?	—	System OK	Go to Step 6
6	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—

8.15.4.10 Tachometer Inaccurate

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Install a Tech2. Turn the ignition switch to Start position. Start the engine. Select the special functions on the main menu. Is the tachometer indicator completely the same as ECM output?	—	Go to Powertrain On-Board Diagnostic System Check in Engine Controls	Go to Step 3
3	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Inspect the system. Is the repair completed?	—	Go to System Check	—

8.15.4.11 Tachometer Inoperative

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Install a Tech2. Turn the ignition switch to Start position. Start the engine. Select the special functions on the main menu. Does the engine control module have tachometer output?	—	Go to Step 3	Go to Powertrain On-Board Diagnostic System Check in Engine Controls
3	Use the DMM to inspect the green circuit between the instrument cluster connector (Pin 9) and the engine control module (B13). Is the circuit open?	—	Go to Step 4	Go to Step 5
4	Repair the open harness. Is the repair completed?	—	Go to System Check	—
5	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—

8.15.4.12 Battery Charge Indicator Inoperative

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Turn the ignition switch to the Run position. Does the battery charge indicator illuminate after the order is sent out?	—	Go to Step 3	Go to Step 4
3	Turn the ignition switch to the Start position, and allow the engine to start. Does the battery charge indicator go out after the order is sent out?	—	Go to System Check	Go to Step 8

8.15.4.12 Battery Charge Indicator Inoperative (Cont' d)

4	Use the DMM to inspect the voltage of instrument cluster connector (Pin 19).	0V	Go to Step 5	Go to Step 6
5	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
6	Use the DMM to inspect the circuit between the instrument cluster connector (Pin 19) and the alternator connector (X4). Is it open?	—	Go to Step 7	Go to Alternator System Check
7	Repair the open circuit. Is the repair completed?	—	Go to System Check	—
8	Use the DMM to inspect the voltage of alternator connector (X4).	12V	Go to Step 5	Go to Alternator System Check

8.15.4.13 Engine Oil Pressure Indicator Always On/Inoperative

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Turn the ignition switch to the Run position, and allow the engine to be OFF. Does the low oil pressure indicator still illuminate?	—	Go to Step 3	Go to Step 4
3	Turn the ignition switch to the Start position, and allow the engine to start. Does the low oil pressure indicator go out?	—	Go to System Check	Go to Step 10
4	Use the DMM to inspect the voltage of instrument cluster connector (Pin 23).	0V	Go to Step 7	Go to Step 5
5	Use the DMM to inspect the voltage between the instrument cluster and the starter harness connector (Pin A in X4).	0V	Go to Step 8	Go to Step 6
6	Use the DMM to inspect the oil pressure sensor (S14) output.	0V	Go to Step 9	Go to Oil Pressure Sensor of Engine System Check
7	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
8	Repair the open circuit with Blue-Green wires between the instrument cluster and the starter connector (X4). Is the repair completed?	—	Go to System Check	—
9	Repair the open circuit with Blue-Green wires between the starter connector (X4) and the oil pressure sensor. Is the repair completed?	—	Go to System Check	—

8.15.4.13 Engine Oil Pressure Indicator Always On/Inoperative (Cont' d)

10	Use the DMM to inspect the oil pressure sensor output.	12V	Go to Step 7	Go to Oil Pressure Sensor of Engine System Check
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8.15.4.14 Low Fuel Indicator Always On

Step	Action	Value	Yes	No
1	Inspect the engine oil level. Is the engine oil level at the FULL mark on the dipstick?	—	Go to Step 3	Go to Step 2
2	Fill the engine oil level to the full mark on the dipstick. Turn the ignition switch to the Start position, and allow the engine to start. Does the low oil indicator still illuminate?	—	Go to Step 3	System OK
3	Inspect if the red area is reached on the fuel gauge.	—	Go to Fuel Sensor of Engine System Check	Go to Step 4
4	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—

8.15.4.15 Low Fuel Indicator Inoperative

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Turn the ignition switch to the Start position, and allow the engine to start. Observe the low fuel indicator input. Is there still any indication when the low fuel lamp reaches 1/8 oil tank or less fuel? Is the fuel indicator inoperative?	—	Go to Step 3	Go to Engine System Check
3	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—

8.15.4.16 Left/Right Turn Signal Indicator Inoperative

Step	Action	Value	Yes	No
1	Turn on the turn signal switch to switch on the left and right turn signal lights. Use the DMM to inspect the voltage of instrument cluster connector (Pin 6)/(Pin 2).	12V	Go to Step 2	Go to Step 5

8.15.4.16 Left/Right Turn Signal Indicator Inoperative (Cont' d)

2	Remove the instrument cluster. Inspect the instrument cluster connector and the left/right turn signal indicator to see if any open or untight connections. Do the instrument cluster connector and the left/right turn signal indicator operate normally?	—	Go to Step 3	Go to Step 4
3	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
4	Repair the instrument cluster connector or replace the left turn signal indicator. Is the repair completed?	—	Go to System Check	—
5	Repair the open circuit between the instrument cluster connector and the turn signal switch. Is the repair completed?	—	Go to System Check	—

8.15.4.17 Backlight Lamp of Instrument Cluster Inoperative

Step	Action	Value	Yes	No
1	Is the Diagnostic System Check for Instrument Cluster performed?	—	Go to Step 2	Go to System Check
2	Turn the ignition switch to Start position. Place the vehicle lamp switch in the parking position. Does the backlight lamp illuminate?	—	Go to Step 3	Go to Step 4
3	Move the dimmer control. Observe the backlight lamp to see if it changes with the adjustment of the dimmer control (S2.3).	—	System OK	Go to Step 8
4	Use the DMM to check the instrument cluster connector (Pin 3) for voltage.	—	Go to Step 7	Go to Step 5
5	Use the DMM to check the dimmer control (S2.3) for voltage output.	—	Go to Step 6	Go to Interior Lighting System Check - Switch
6	Repair the open circuit (Grey - Black wire) between the instrument cluster connector (Pin 3) and the dimmer control (Pin 5 in S2.3). Is the repair completed?	—	Go to System Check	—
7	Replace the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
8	Connect a test bulb between the instrument cluster connector (Pin 3) and the dimmer control (Pin 5 in S2.3). Does the test bulb flash with the moving of the dimmer control?	—	Go to Step 7	Go to Interior Lighting System Check - Switch

8.15.4.18 High Beam Always On/Inoperative

Step	Action	Value	Yes	No
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8.15.4.18 High Beam Always On/Inoperative (Cont' d)

1	Turn the ignition switch to Start position. Place the vehicle lamp switch in the low beam position. Place the switch from the low beam position (s5.2) to the high beam position. Does the high beam illuminate?	—	Go to System Check	Go to Step 2
2	Use the DMM to inspect the voltage of the instrument cluster connector (Pin 7).	12V	Go to Step 4	Go to Step 3
3	Repair the open circuit between the low beam (s5.2) switch and the instrument cluster connector (Pin 7). Is the repair completed?	—	Go to System Check	—
4	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—

8.15.4.19 Service Engine Indicator Always On/Inoperative

Step	Action	Value	Yes	No
1	Turn the ignition switch to the Run position, and allow the engine to be OFF. Does the service engine indicator still illuminate?	—	Go to Step 2	Go to Step 6
2	Turn the ignition switch to the Start position, and allow the engine to start. Is the indicator still always on after the engine begins to operate?	—	Go to Engine Control Module in Engine System Check	Go to Step 4
3	Turn the ignition switch to the Start position, and allow the engine to start. Does the indicator flash after the engine begins to operate?	—	Go to Vehicle Theft Module	Go to System Check
4	Use the DMM to inspect the voltage of instrument cluster connector (Pin 11).	0V	Go to Engine Control Module in Engine System Check	Go to Step 5
5	Replace the instrument cluster.Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement. Is the repair completed?	—	Go to System Check	—
6	Use the DMM to inspect the voltage of instrument cluster connector (Pin 11).	0V	Go to Step 5	Go to Step 7
7	Use the DMM to inspect the voltage of engine control module (Pin 6 in X2).	0V	Go to Step 8	Go to Engine Control Module of Engine System Check
8	Repair the open circuit (Brown - Blue wire) between the instrument cluster connector (Pin 11) and the engine control module (Pin 6 in X2). Is the repair completed?	—	Go to System Check	—

8.15.4.20 Cigarette Lighter System Check

Step	Action	Normal Result(s)	Abnormal Result(s)
1	Press the cigarette lighter into the hold until a click is heard.	When the cathode is electrified, the cigarette lighter will jump to the edge of the holder.	<ul style="list-style-type: none"> Cigarette Lighter Inoperative

8.15.4.21 Cigarette Lighter Inoperative

Step	Action	Yes	No
1	Check the fuse F18. Is the fuse blown?	Go to Step 3	Go to Step 2
2	Use a test lamp to connect to both positive terminal and negative terminal of the cigarette lighter to check for the electricity. Does the test lamp illuminate?	Go to Step 4	Go to Step 5
3	Replace the fuse.	—	Go to System Check
4	Replace the cigarette lighter.	—	Go to System Check
5	Repair the poor wiring harness connection.	—	Go to System Check

8.15.4.22 Diagnostic System Operation of Time/Temperature Module

Step	Action	Normal Result(s)	Abnormal Result(s)
1	Turn the ignition switch to ACC position.	<ul style="list-style-type: none"> The time/temperature display is normal. All the buttons can operate normally. 	<ul style="list-style-type: none"> The display is inoperative The buttons do not work.

8.15.4.23 Time/Temperature Display Inoperative

Step	Action	Value	Yes	No
1	Has the system operation been checked?	—	Go to Step 2	Go to Diagnostic System Operation
2	Connect one end of the DMM to the common power supply end (Harness End Connector 10), the other end to ground (Harness End Connector 5). Is the voltage equal to the specified value?	12V	Go to Step 3	Go to Step 4
3	Connect one end of the DMM to ground, the other end to ACC (Harness Connector 9).	12V	Go to Step 6	Go to Step 5
4	Repair the open in the ground wire of common power supply. Is the repair completed?	—	Refer to System Operation	—
5	Repair the open in ACC end. Is the repair completed?	—	Refer to System Operation	—

8.15.4.23 Time/Temperature Display Inoperative (Cont' d)

6	Replace the time/temperature display module. Refer to the replacement procedures of Time/Temperature Display Module. Is the repair completed?	—	Refer to System Operation	—
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8.15.4.24 Time/Temperature Module Button Key Inoperative

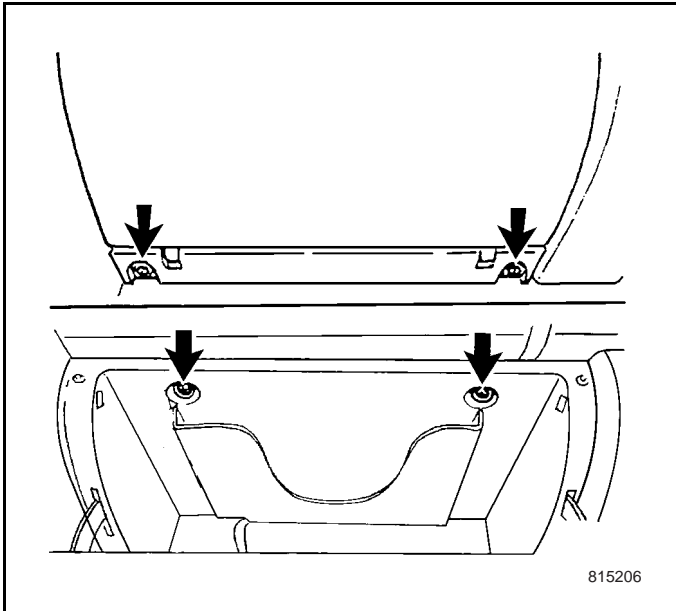
Step	Action	Value	Yes	No
1	Is the display normal?	—	Go to Step 2	Go to Diagnosis on Display Inoperative
2	Replace the time/temperature display module. Refer to the replacement procedures of Time/Temperature Display Module. Is the repair completed?	—	Go to System Operation	—

8.15.5 Repair Instructions

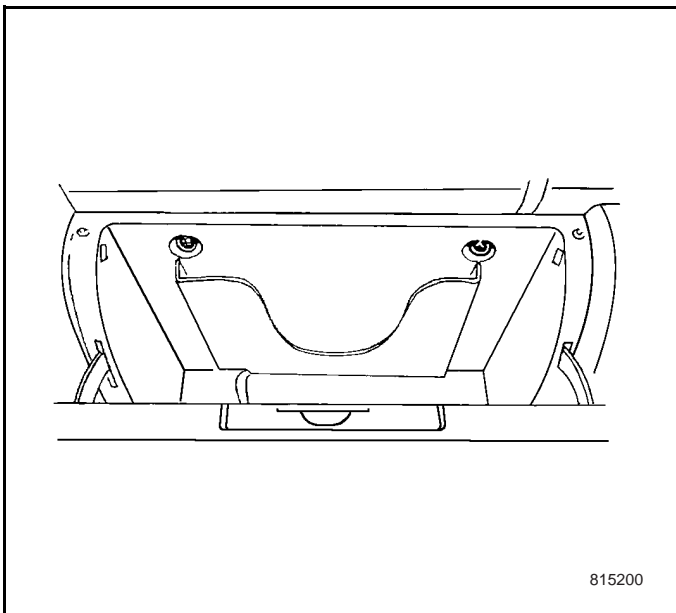
8.15.5.1 Glove Box Replacement

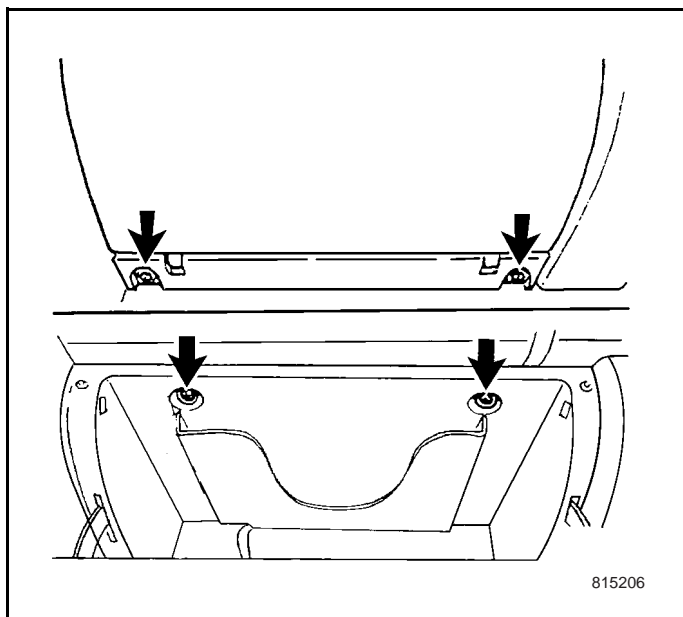
Removal Procedure

1. Open the glove box lid. Loosen the screws.



2. Pull out the glove box from the I/P opening.





Installation Procedure

1. Insert the glove box into the I/P opening. Tighten the screws of glove box.

Tightening

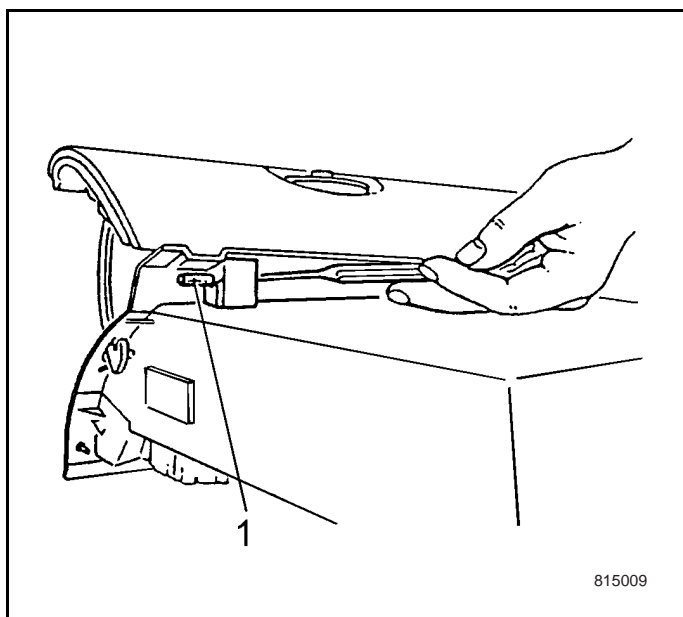
Tighten the screws of glove box to 1.0-3.0 N•m.

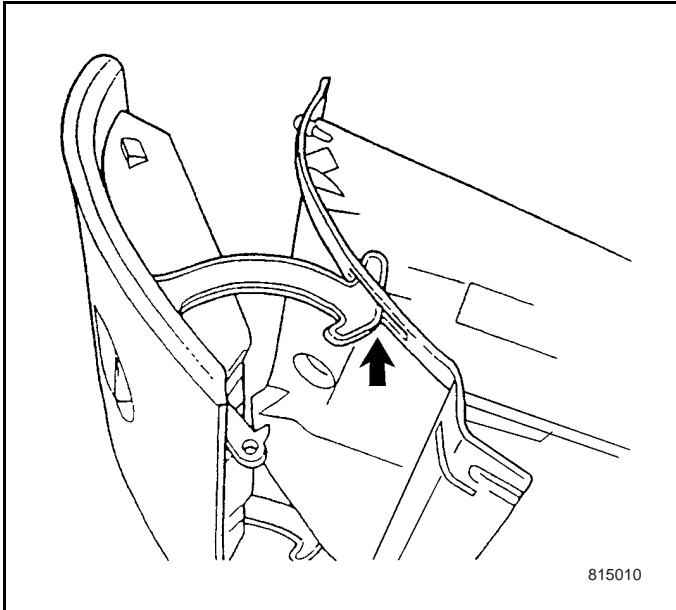
2. Close the glove box lid.

8.15.5.2 Glove Box Replacement

Removal Procedure

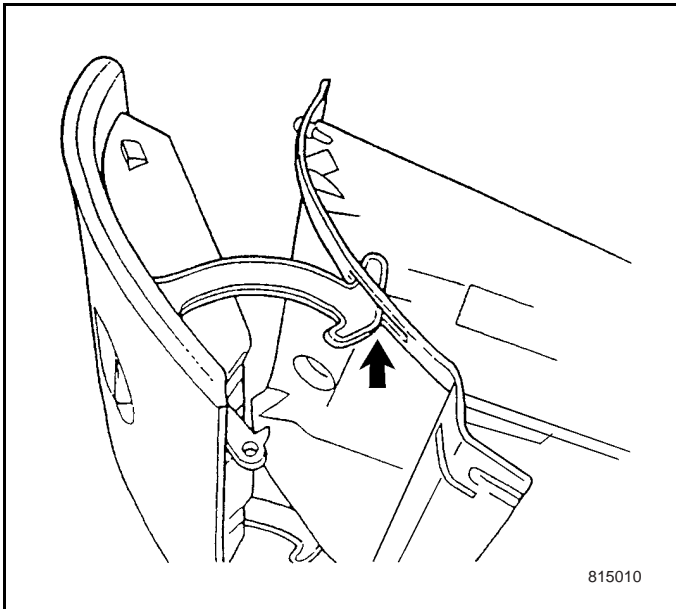
1. Remove the glove box. Refer to Glove Box Replacement. Use the punch to remove the two connecting pins (1) on the glove box lid.



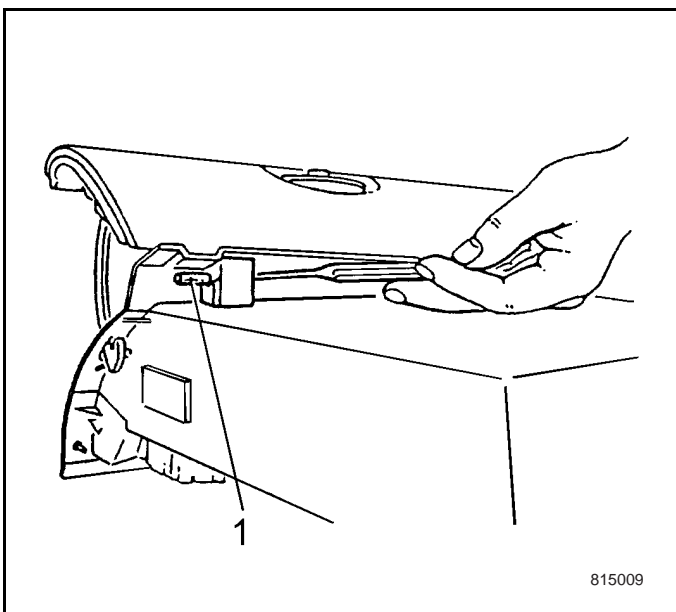


2. Remove the glove box hinge from the glove box opening. Remove the glove box lid.

Installation Procedure



1. Insert the glove box lid hinge into the glove box opening. Use the pins to tighten the glove box and its lid.

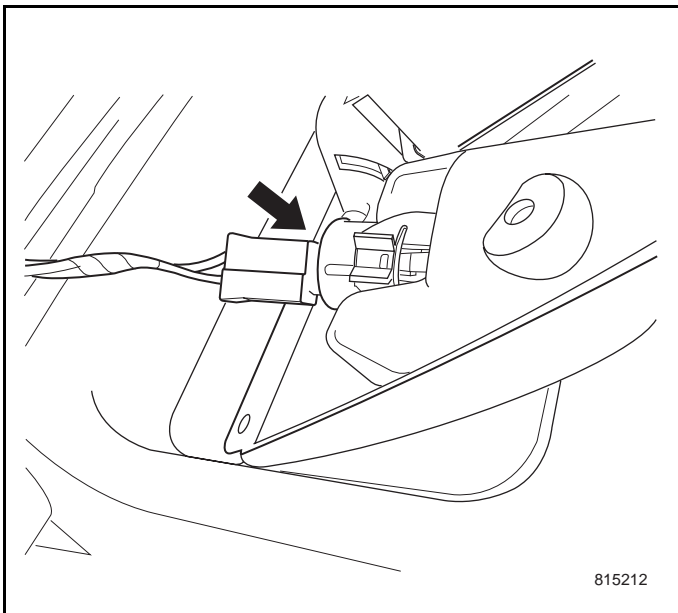
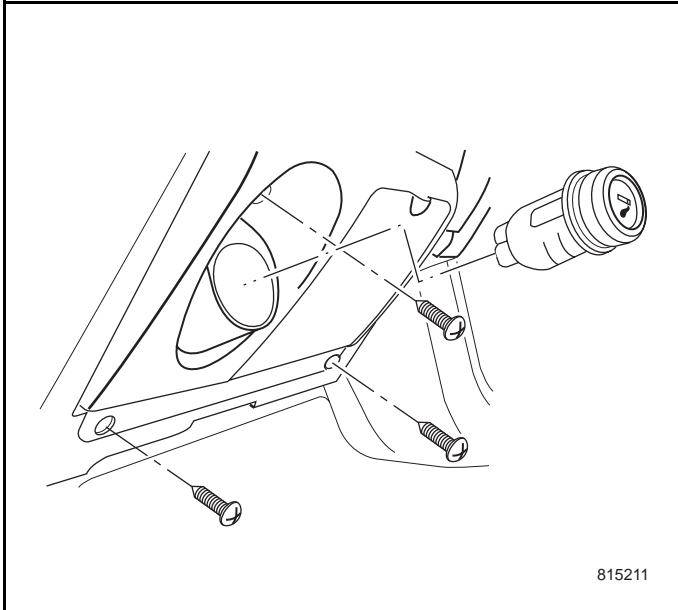


2. Install the glove box. Refer to Glove Box Replacement.

8.15.5.3 Lower I/P Trim Panel Replacement

Removal Procedure

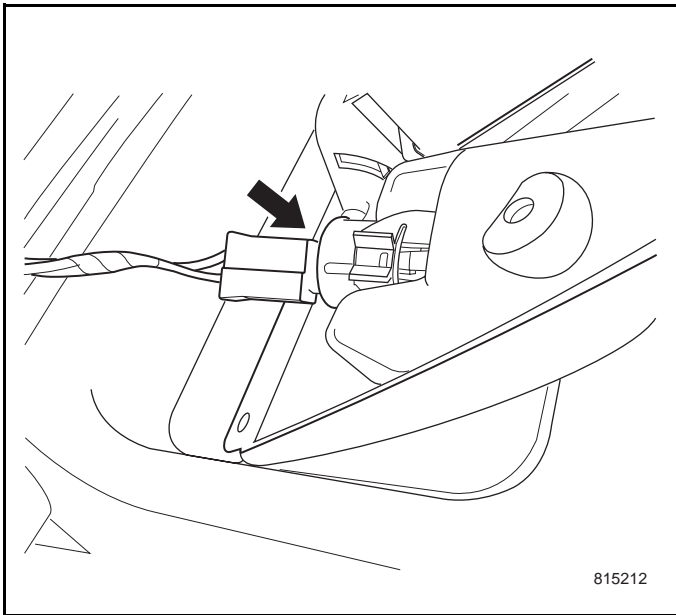
1. Remove the cigarette lighter. Loosen the screws of lower I/P trim panel. Pull out the lower I/P trim panel until the electrical connector can be touched.



2. Disconnect the electrical connectors of the cigarette lighter. Remove the lower I/P trim panel.

Installation Procedure

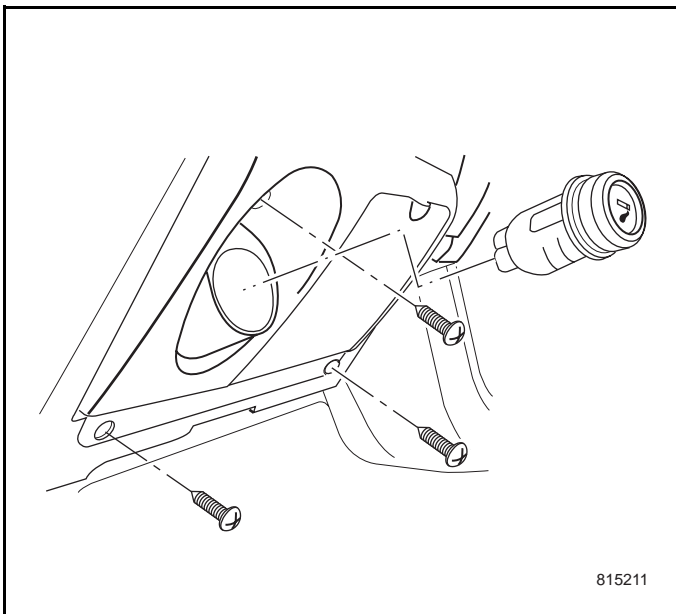
1. Connect the electrical connectors of the cigarette lighter. Place the lower I/P trim panel in the I/P opening.



2. Tighten the screws of lower I/P trim panel, and install the cigarette lighter.

Tightening

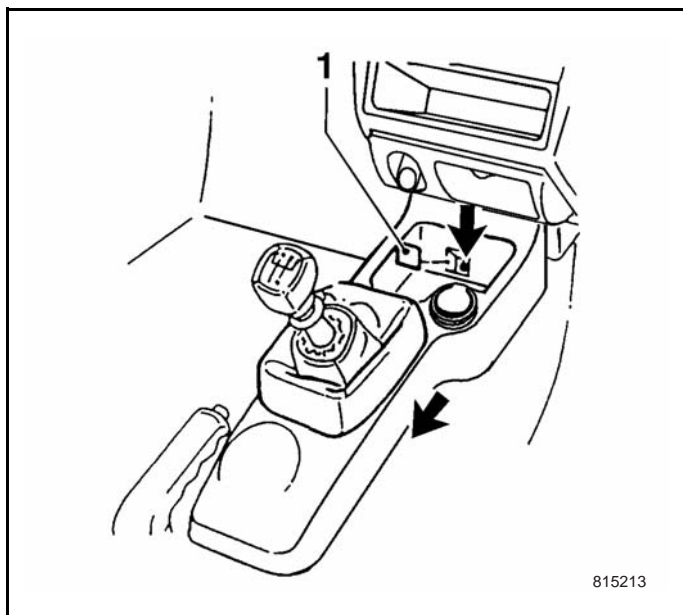
Tighten the screws of lower I/P trim panel to $2 \pm 0.3 \text{ N}\cdot\text{m}$.



8.15.5.4 Instrument Console Replacement

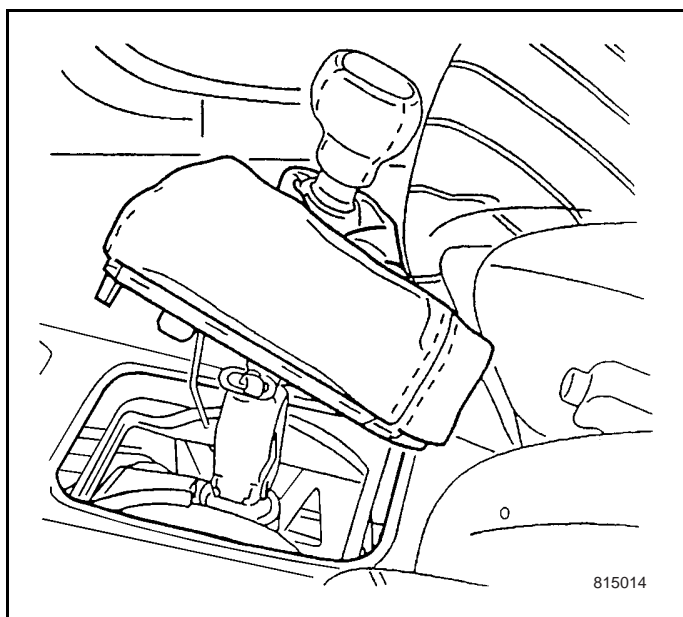
Removal Procedure

1. Push the Driver's seat and front passenger's seat backward all the way. Pull the gear shift lever upwards. Remove the bolt cap (1) from the instrument console. Remove the screws.



2. For the vehicle equipped with Automatic Transmission: Pull the instrument console backwards from the guide channel, and then pull upwards by the gear shift lever.

For the vehicle equipped with Manual Transmission: Pull out the gear shift lever cover upwards from the instrument console opening. Pull the instrument console backwards from the guide channel, and then pull upwards by the gear shift lever.

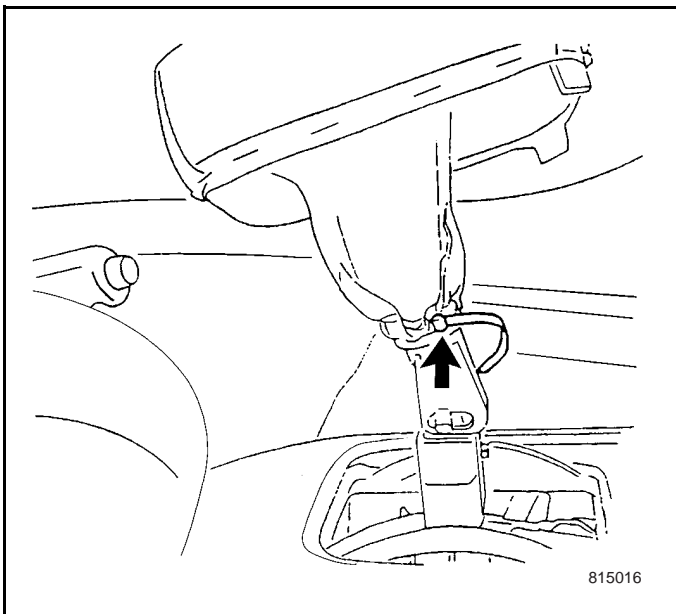
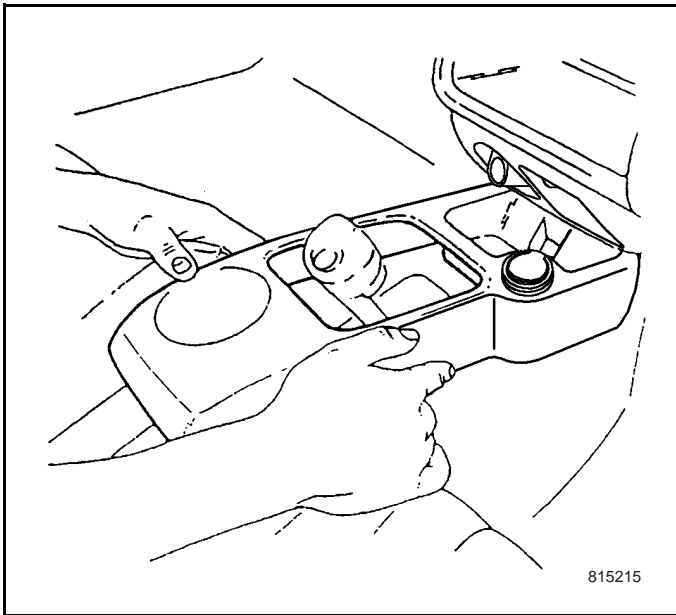


Installation Procedure

1. Pull the instrument console into the guide channel, and tighten the screws of instrument console. Install the bolt cap.

Tightening

Tighten the screws of instrument console to 1.5-2.5 N•m.

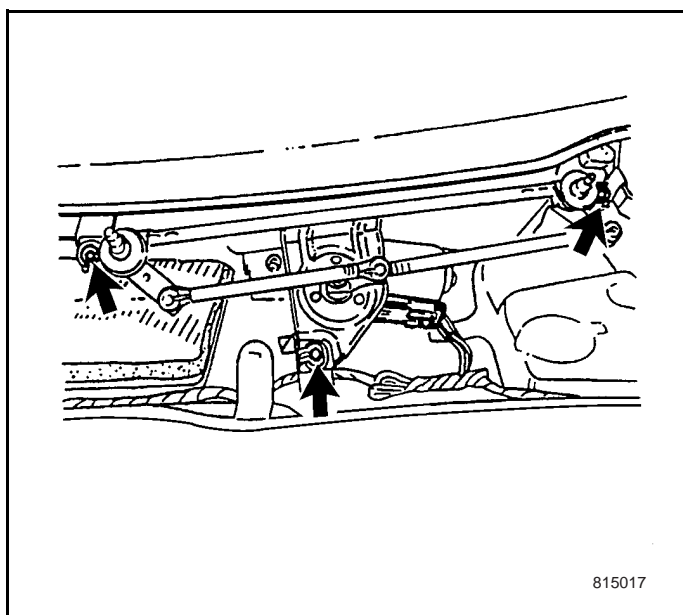
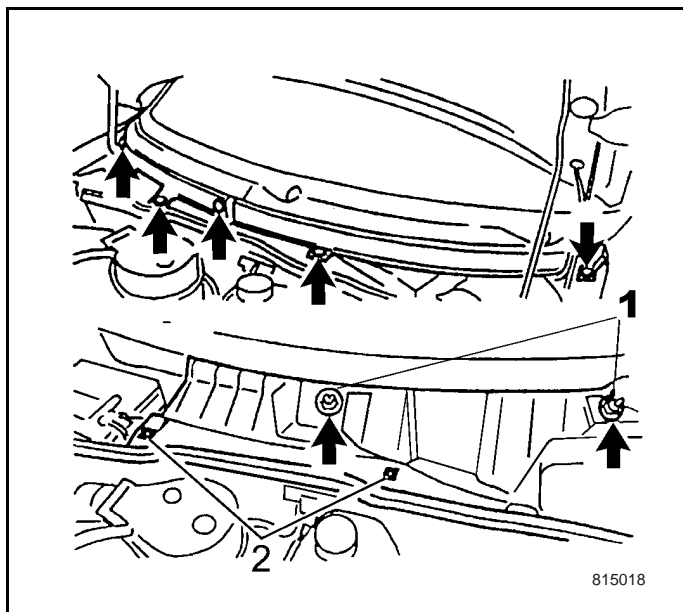


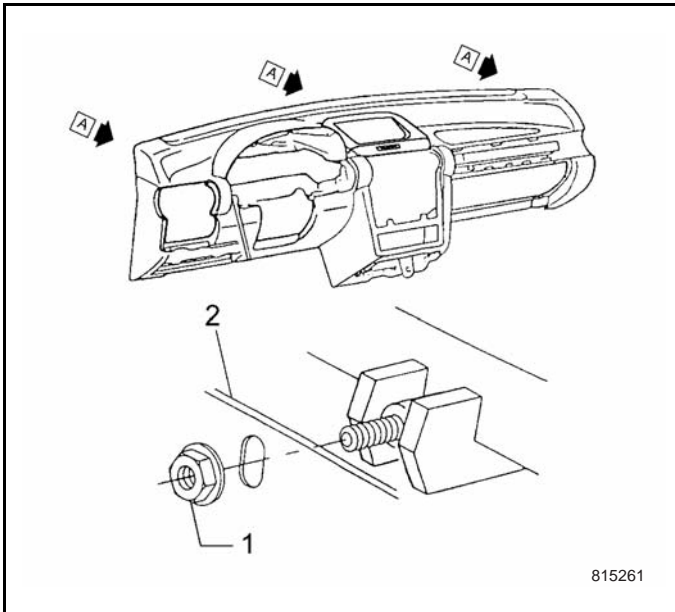
2. For the vehicle equipped with Manual Transmission: Install the dust cover onto the instrument console opening.

8.15.5.5 Instrument Panel Replacement

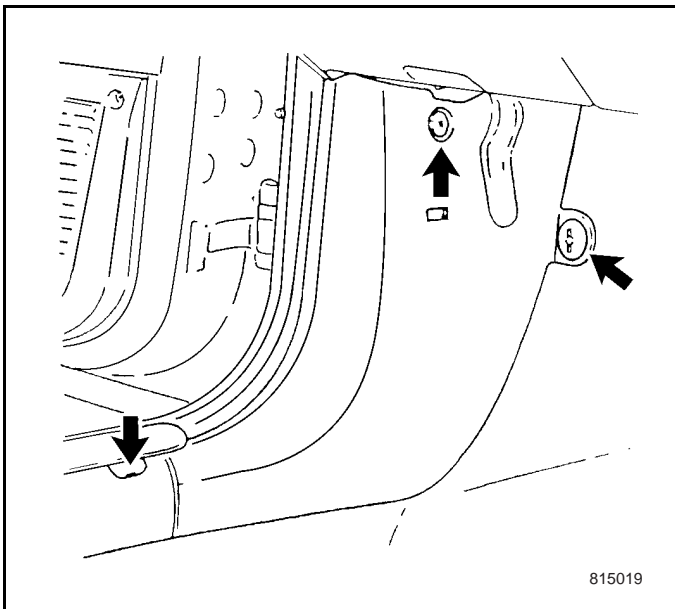
Removal Procedure

1. Disconnect the battery wires. Remove the windshield wiper arm assembly. See Wiper Arm ASM Replacement in Wiper/Washer System.
2. Remove the air inlet grille. Refer to Air Inlet Grille Panel Replacement in Body Front End.
3. Loosen the nut (1), remove the nut (2), and then remove the deflector from the partition board.
4. Disconnect the electrical connectors of windshield wiper motor. Remove the wiper motor, crank arm and driving member. Refer to Wiper/Washer System for Wiper Motor Replacement (with Crank Arm and Driving Member).
5. Disconnect the vehicle speed sensor harness.

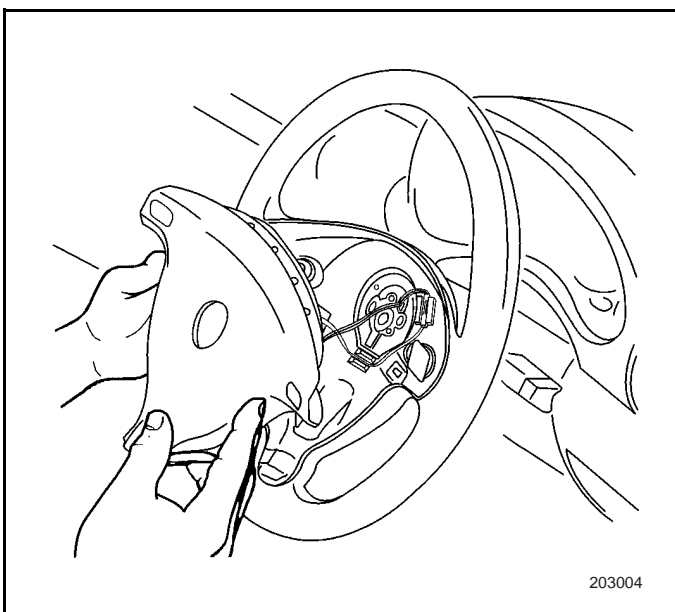




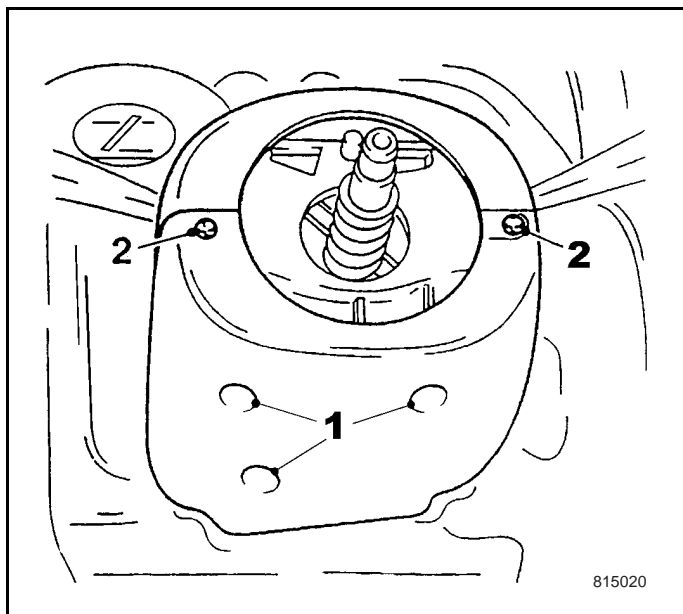
6. Remove the nut (1) from the partition board (2).
7. Remove the glove box. Refer to Glove Box Replacement.
8. Remove the radio. Refer to Radio Replacement in Entertainment System.
9. Remove the fuse box. Refer to Fuse Box Replacement.
10. Remove the air outlet (right, center and left). Refer to Air Outlet Replacement - Instrument Panel Outside.



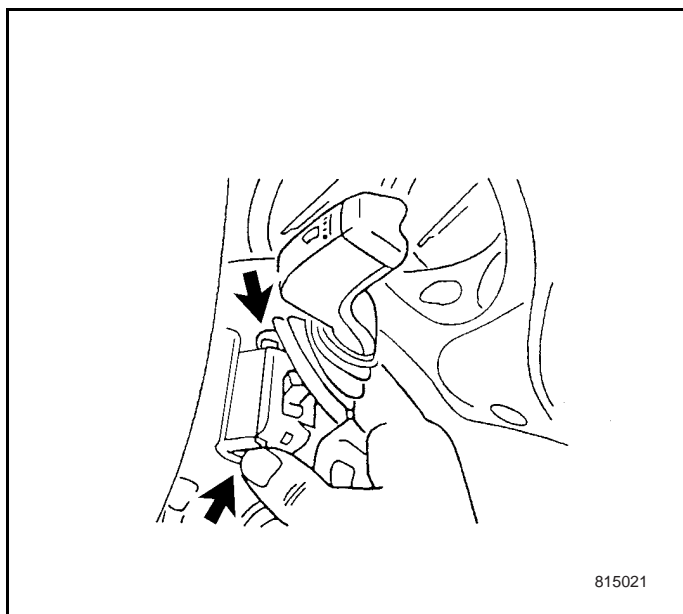
11. Remove the screws and buckles from the left and right base board. Remove the two base boards.
12. Disconnect the electrical connectors of A/C system relay.



13. Remove the steering wheel. Refer to Steering Wheel Replacement in Steering Wheel and Column.

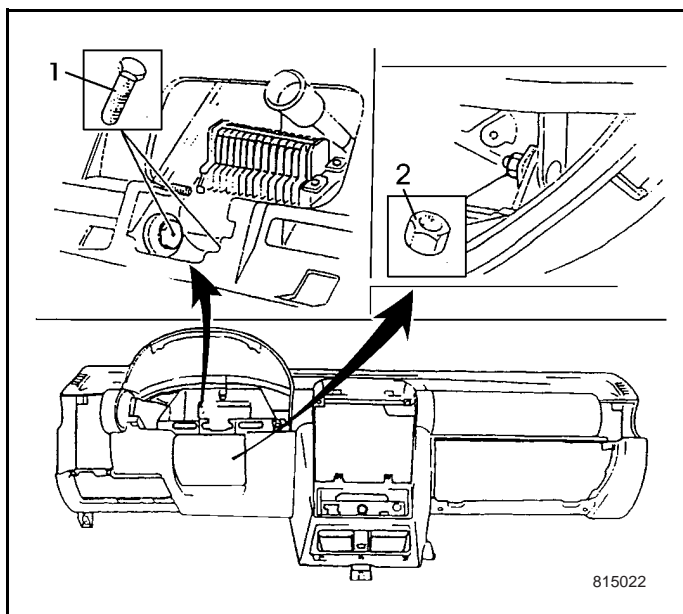


14. Loosen the screw (1), and (2) on the steering column cover. Then remove the lower and upper cover of the steering column.

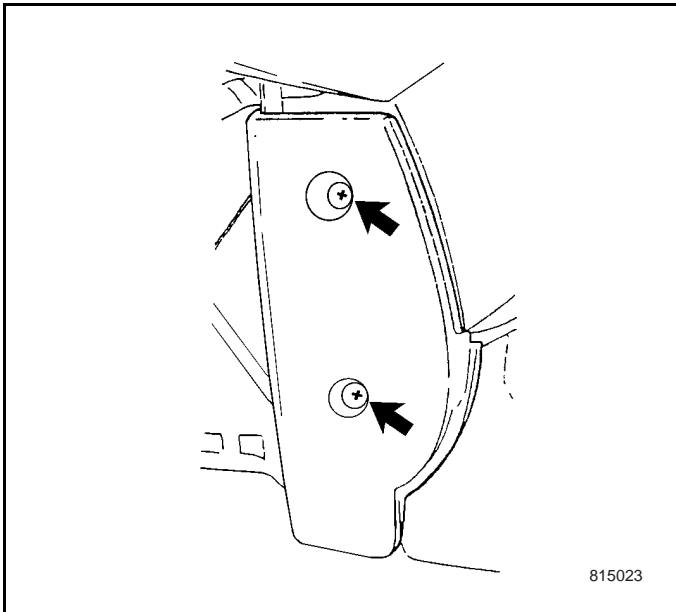


15. Remove the left turn signal lamp switch from the steering column. See Turn Signal Lamp Switch Replacement in Lighting System.
16. Remove the right windshield wiper switch from the steering column. Refer to Wiper Switch Replacement in Wiper/Washer System.
17. Remove the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement.

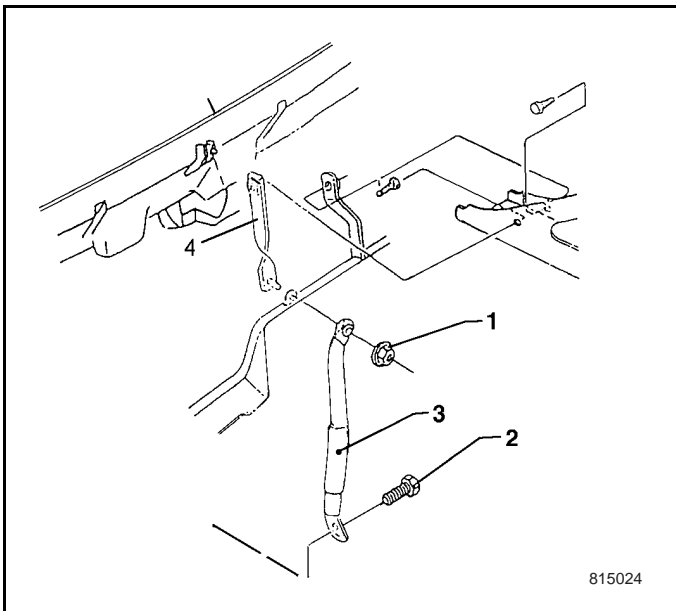
Note: The switch assembly cannot be dismantled any more.



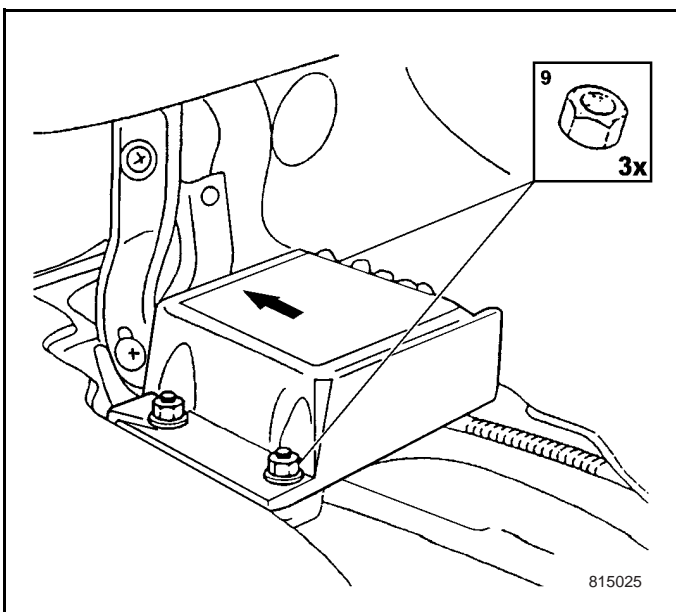
18. Remove the bolt (1) on the steering column bracket. Remove the nut (2) on the I/P reinforcement bracket.
19. Remove the instrument console. Refer to Instrument Console Replacement.



20. Loosen the screws and remove the side cover panel of A/C assembly.

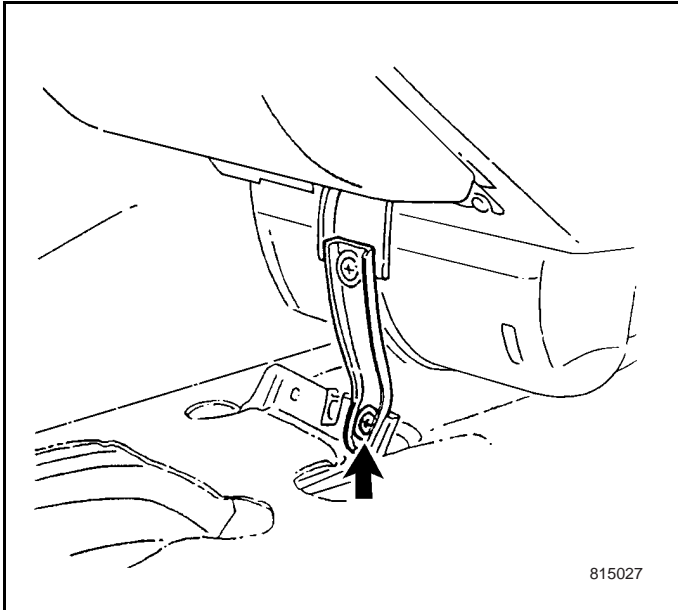


21. Remove the nut (1) on the I/P reinforcement bracket (4) and remove the screw (2) on the steering column bracket (3) assembly. Remove the steering column bracket ASM.

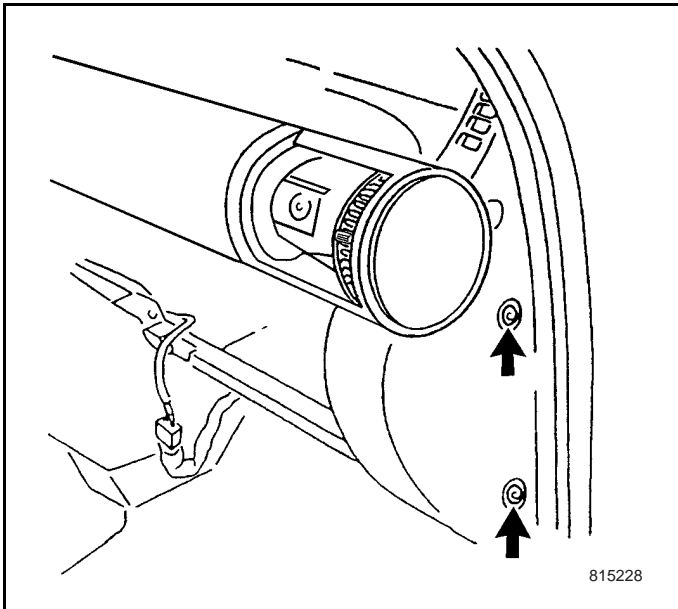


22. Remove the air bag control unit: Disconnect the electrical connector. Remove the nuts. Remove the air bag control unit.

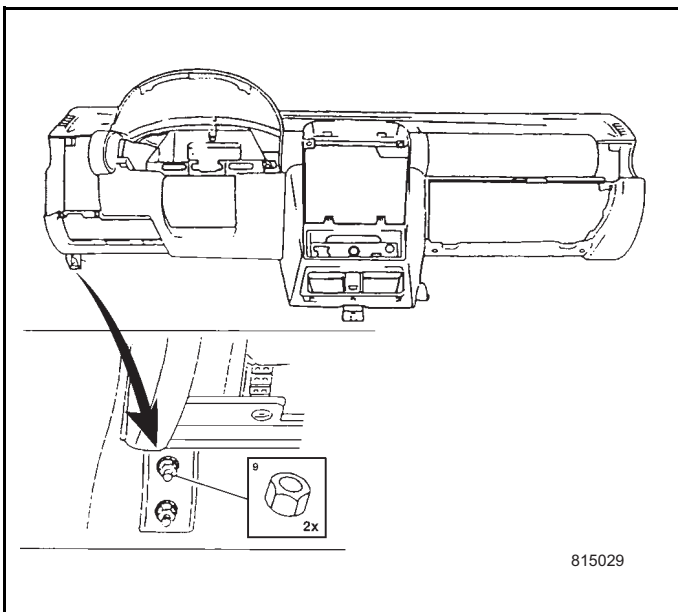
Notice: The air bag control unit is sensitive to the vibration. If it dropped from a height above 50cm, it could not be re-installed.



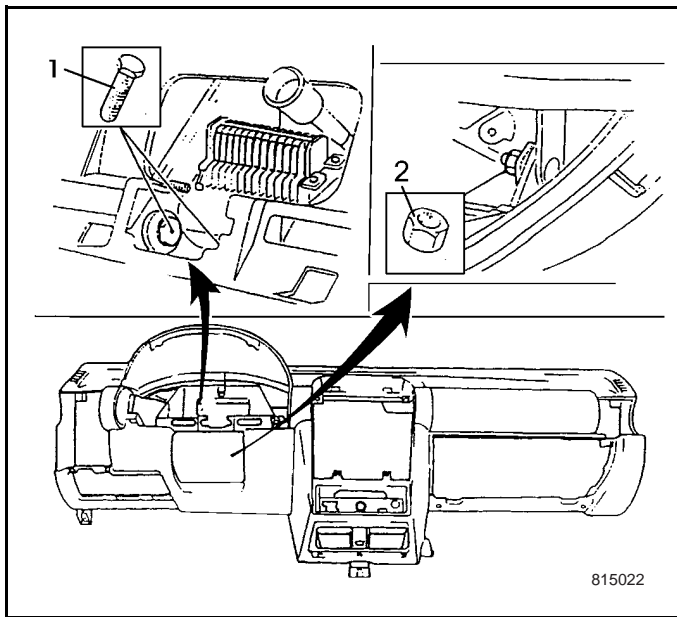
23. Loosen the tightening screws of floor from the I/P bracket (Arrow direction in the figure).



24. Remove the tightening bolts at both left and right side of instrument panel (Arrow direction as shown in the figure).



25. Remove the nut on the left I/P reinforcement bracket.
26. Remove the instrument panel.



Installation Procedure

1. Locate the instrument panel. Connect the electrical connector of the air bag system.
2. Tighten the screw (1) on the steering column bracket.

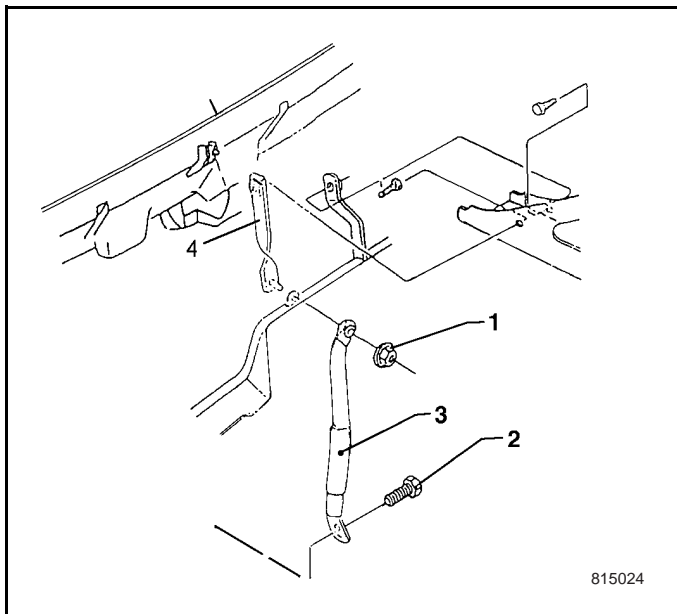
Tightening

Tighten the screws of steering column bracket (1) to 20-26 N•m.

3. Tighten the nut (2) of I/P reinforcement bracket.

Tightening

Tighten the nut (2) of I/P reinforcement bracket to 20-26 N•m.



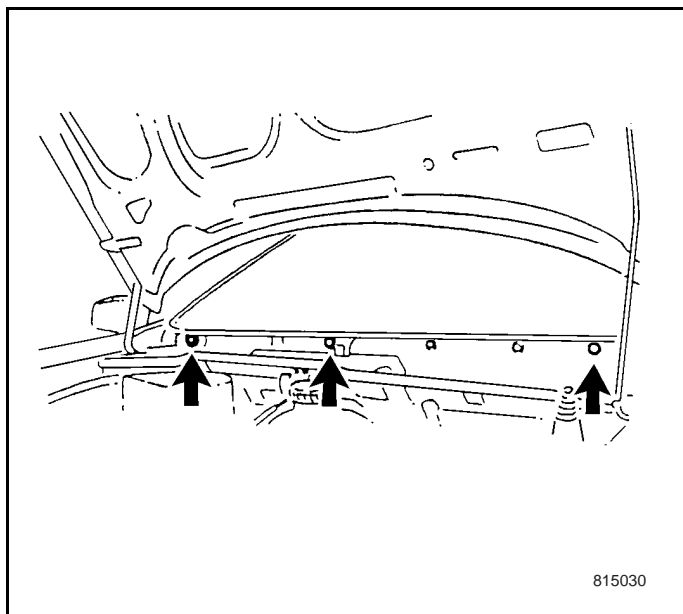
4. Install the steering column bracket ASM (3). Tighten the nut (1) to the instrument panel reinforcement bracket on the steering column bracket assembly (3) and the bolt (2) to the floor.

Tightening

Tighten the bolt (2) of the steering column bracket assembly to 20-26 N•m.

Tightening

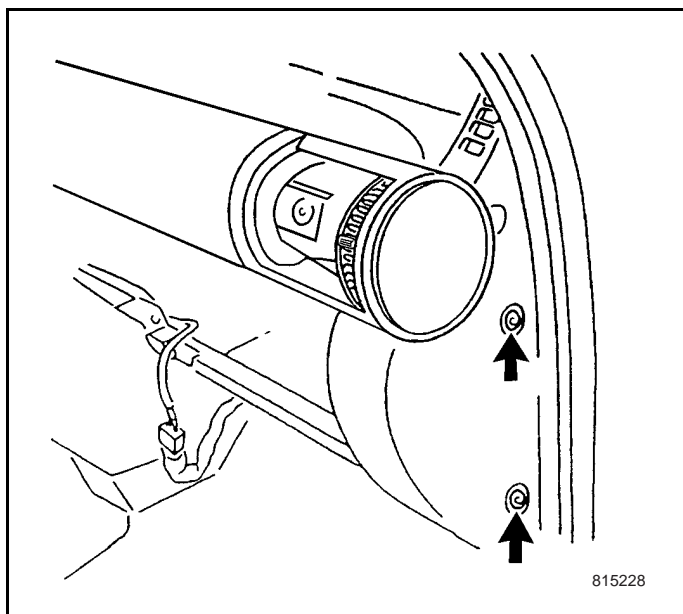
Tighten the nut (1) of the steering column bracket assembly to 20-26 N•m.



5. Instrument Panel (Engine Compartment) - Tighten the bolts and nuts on the partition board.

Tightening

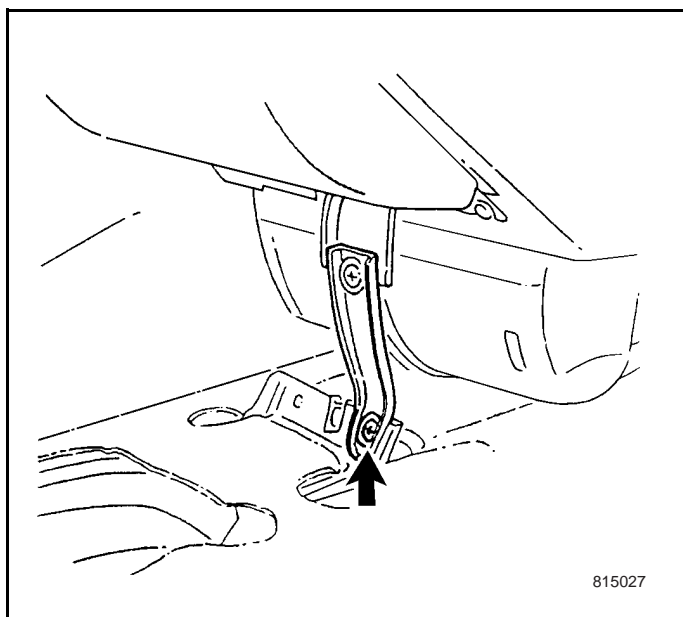
Tighten the bolts and nuts mounting the instrument panel onto the partition board to 18-22 N•m.



6. Instrument Panel (Interior Vehicle) - Tighten the bolts at both sides of instrument panel.

Tightening

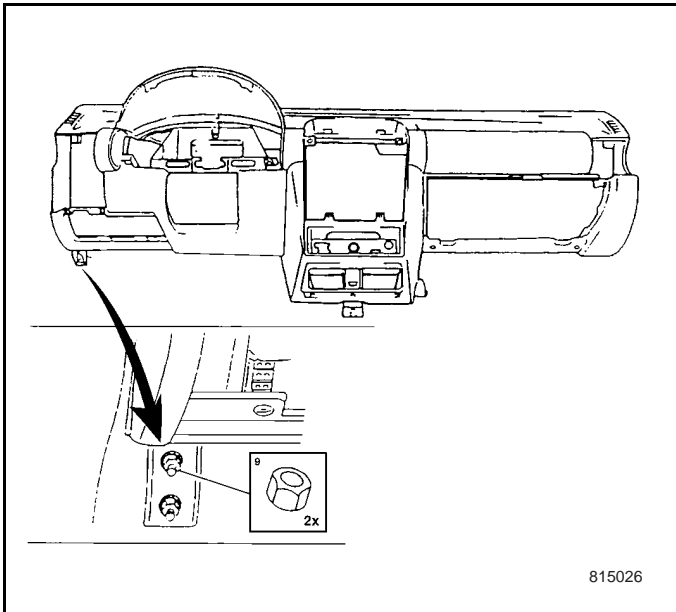
Tighten the bolts at both sides of instrument panel to 5-7 N•m.



7. Tighten the bolts from instrument panel bracket to floor.

Tightening

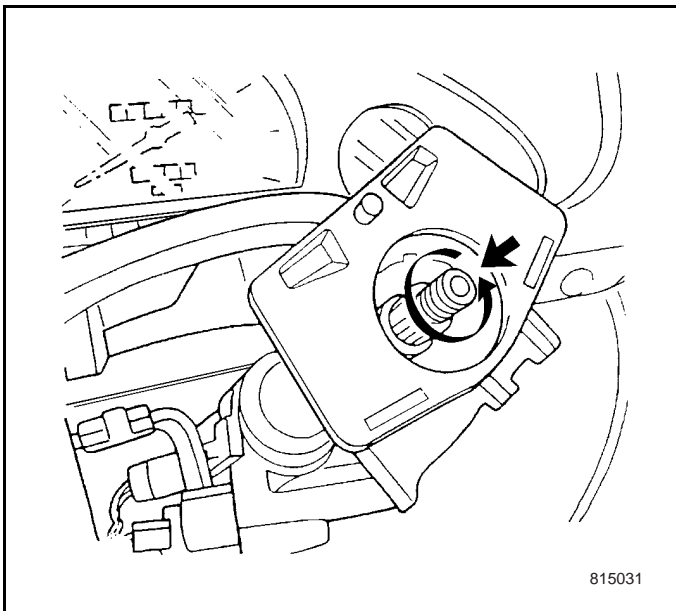
Tighten the bolts from instrument panel bracket to floor to 3.5-4.5 N•m.



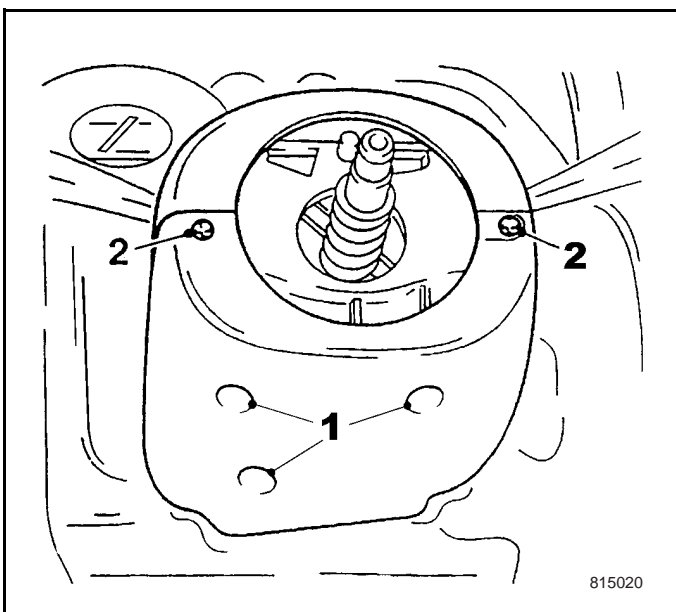
8. Tighten the nut on the left I/P reinforcement bracket.

Tightening

Tighten the nut of the left I/P reinforcement bracket to 20-24 N•m.



9. Install the instrument cluster. Refer to Instrument Panel Outer Cover and Instrument Cluster Replacement.
10. Install the left turn indicator switch and the right wiper switch. Connect the electrical connector. Refer to Turn Signal Indicator Switch Replacement in Lighting System and Wiper Switch Replacement in Wiper/Washer System.

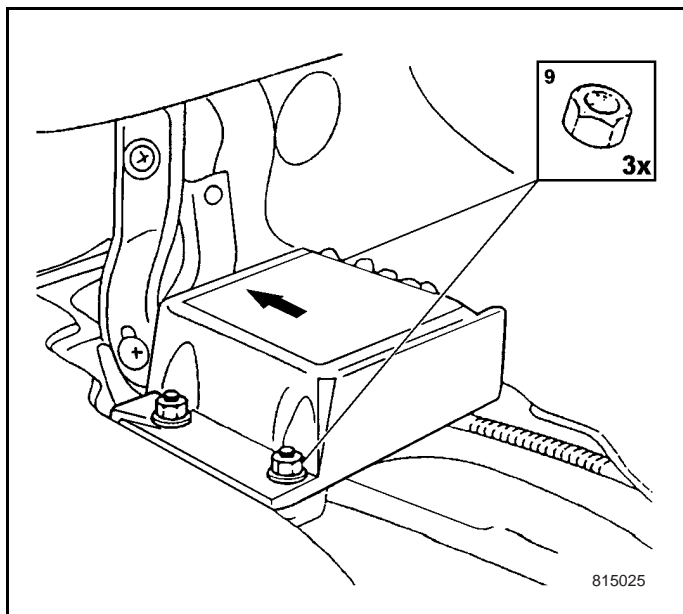


11. Tighten the screw on the steering column cover. Install the steering column cover.

Tightening

Tighten the screws of steering column cover lid to 2.0 ± 0.3 N•m.

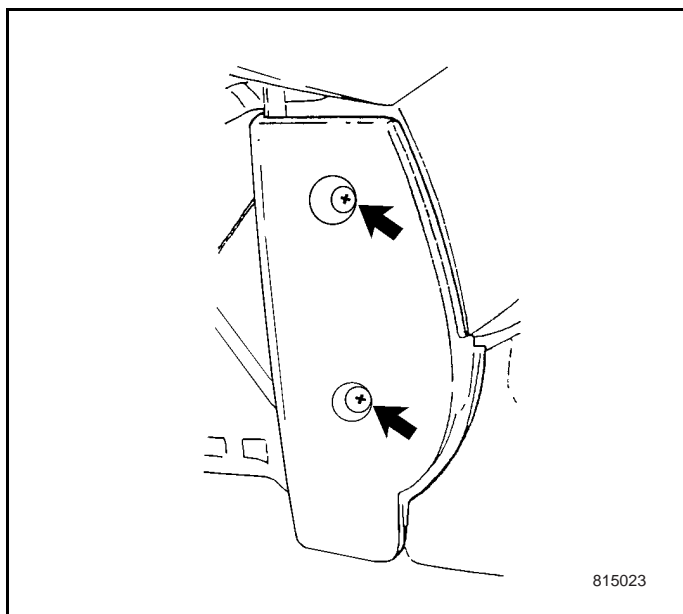
12. Install the steering wheel. Refer to Steering Wheel Replacement in Steering Wheel and Column.



13. Tighten the nuts of air bag control unit. Connect the electrical connector.

Tightening

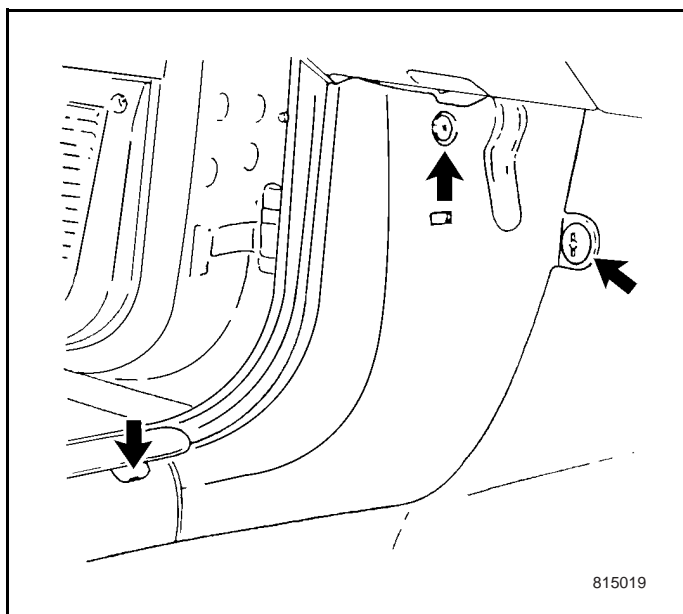
Tighten the nuts of air bag control unit to 8-11 N•m.



14. Install the instrument console. Refer to Instrument Console Replacement.
15. Install the screws of A/C assembly side cover panel.

Tightening

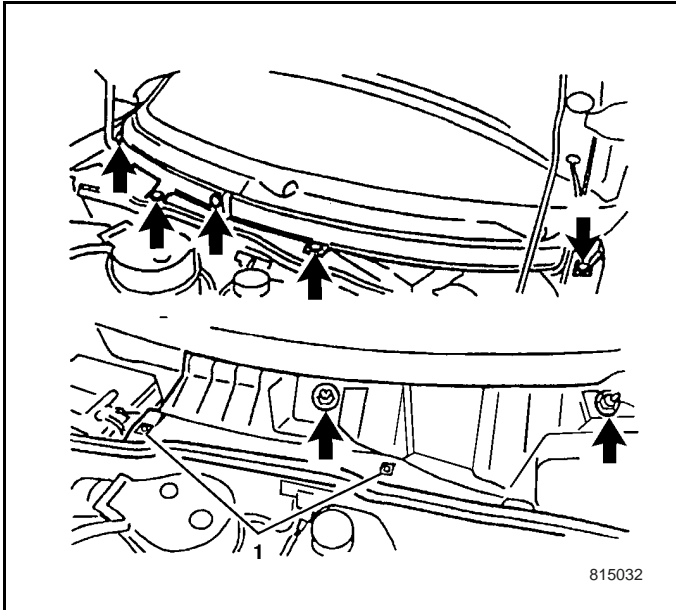
Tighten the screws of A/C assembly side cover panel to 1.5-2.5 N•m.



16. Install the left and right base board.

Tightening

Tighten the screws of base board to 1.5-2.0 N•m.



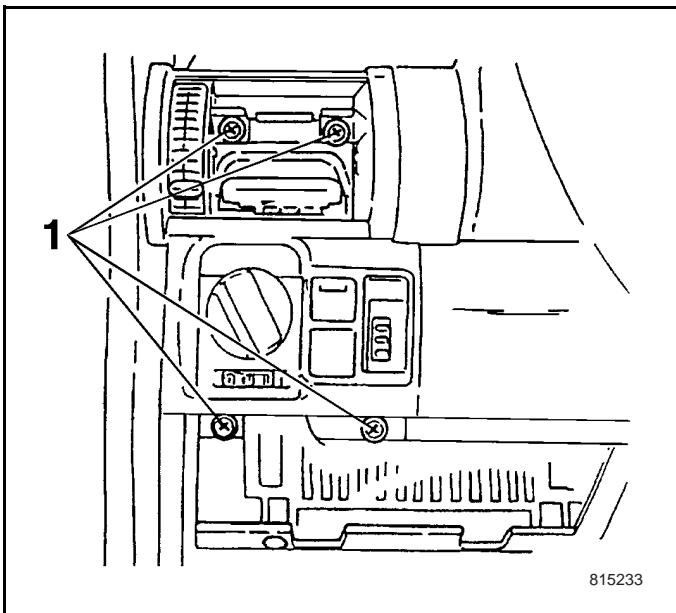
17. Install the windshield wiper motor, crank arm and driving member. Refer to Wiper Motor Replacement (with Crank Arm and Driving Member) in Wiper/Washer System.
18. Install the wiper arm assembly. See Wiper Arm ASM Replacement in Wiper/Washer System.

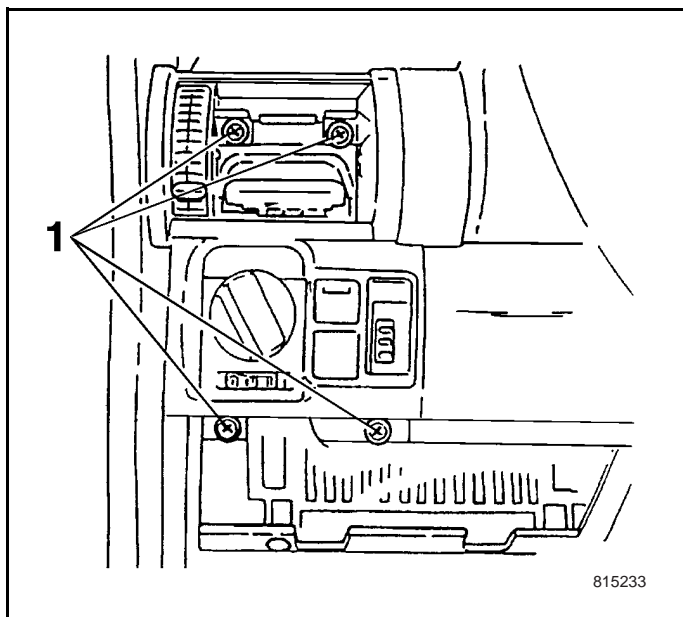
8.15.5.6 Air Outlet Replacement - Instrument Panel Outside

Left Air Outlet Replacement

Removal Procedure

1. Use two small drivers to pry the left air outlet grille open. Remove the screw (1), and remove the air outlet from the air passage.





Installation Procedure

1. Locate the left air outlet on the instrument panel. Tighten the screw (1) of the left air outlet grille. Install the left air outlet grille.

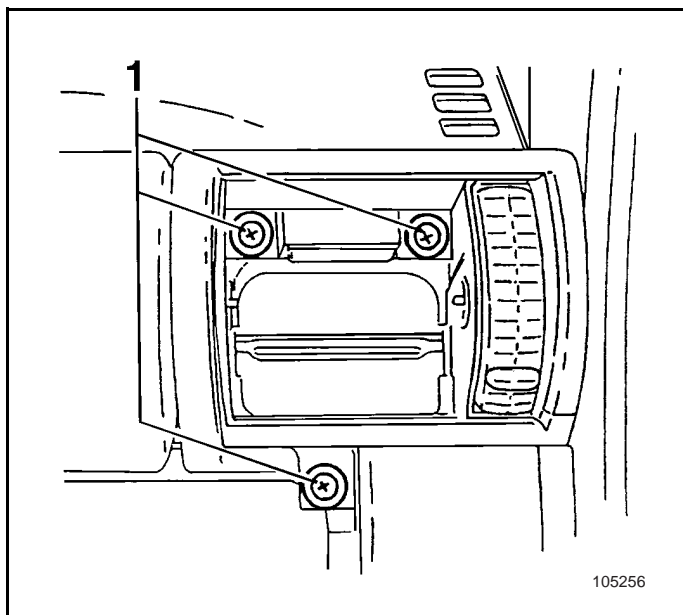
Tightening

Tighten the screws of left air outlet to 1.5-2.5 N•m.

Right Air Outlet Replacement

Removal Procedure

1. Use two small drivers to pry the right air outlet grille open. Remove the screw (1), and remove the air outlet from the air passage.

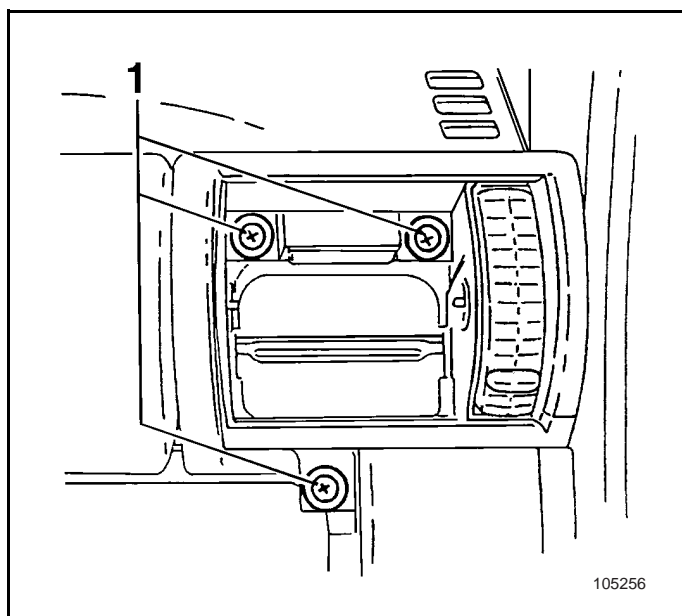


Installation Procedure

1. Locate the right air outlet on the instrument panel and connect to the air passage. Fasten the screw (1). Install the right air outlet grille.

Tightening

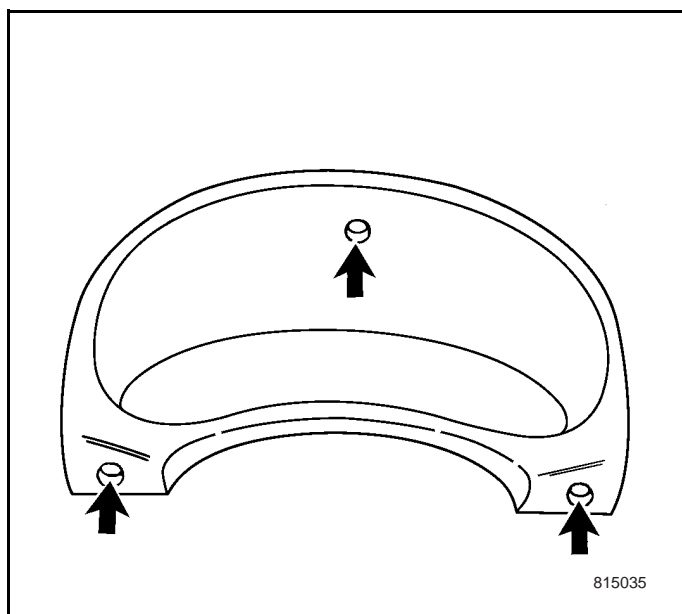
Tighten the screws of right air outlet to 1.5-2.5 N•m.

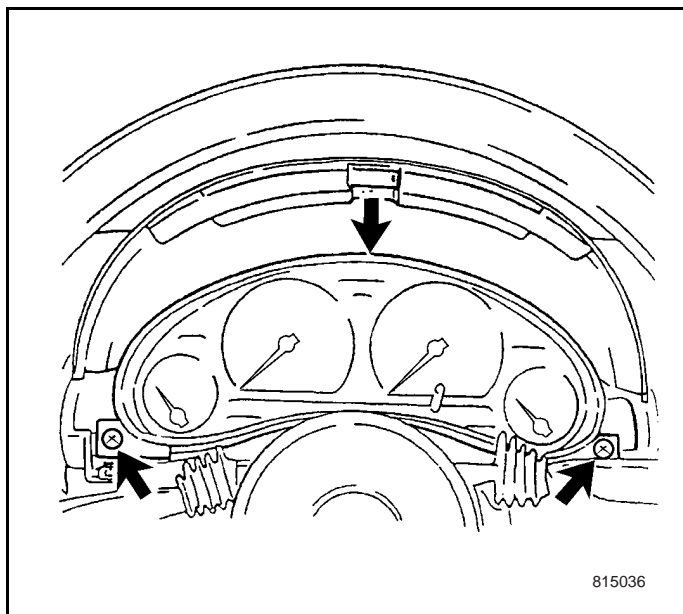


8.15.5.7 Instrument Panel Outer Cover and Instrument Cluster Replacement

Removal Procedure

1. Loosen the screw, and remove the instrument panel outer cover.





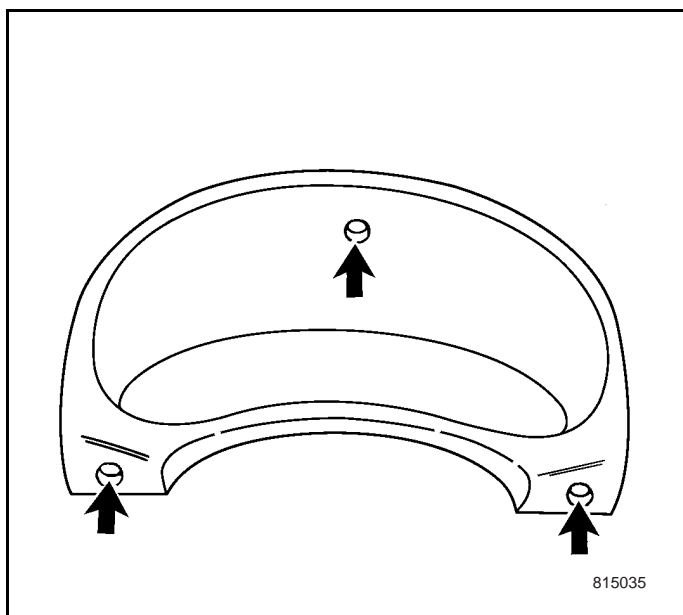
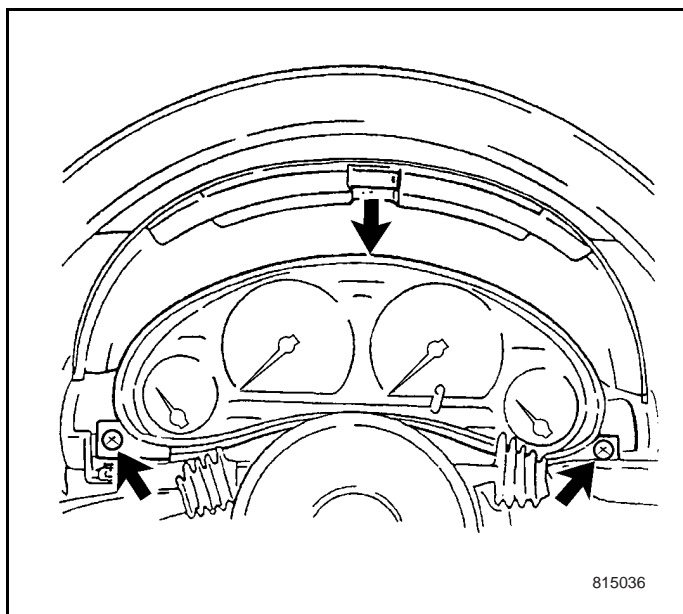
2. Loosen the screws.
3. Remove the instrument cluster.

Installation Procedure

1. Install the screws tightening the instrument cluster to the instrument panel.

Tightening

Tighten the screws of instrument cluster to 1.7-2.3 N•m.



2. Tighten the screws of instrument panel outer cover lid. Install the instrument panel outer cover lid.

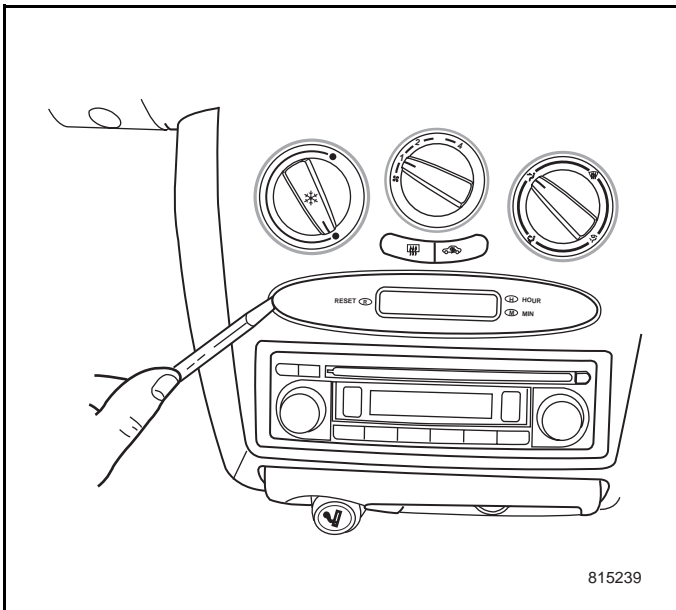
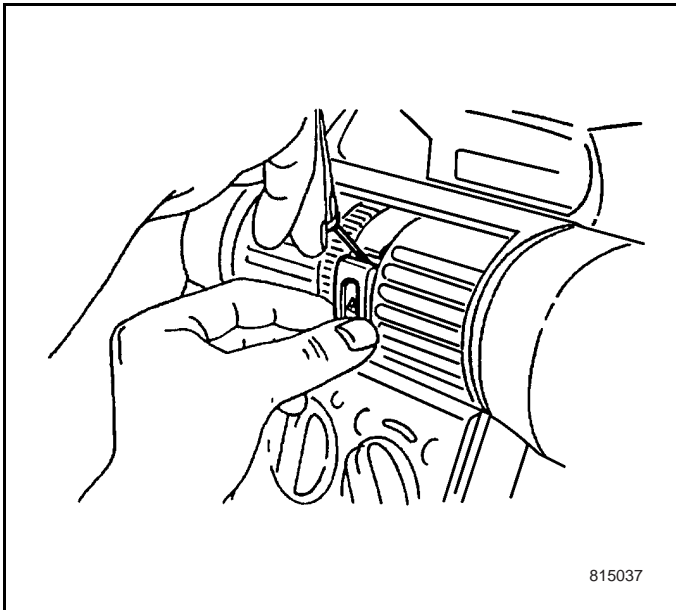
Tightening

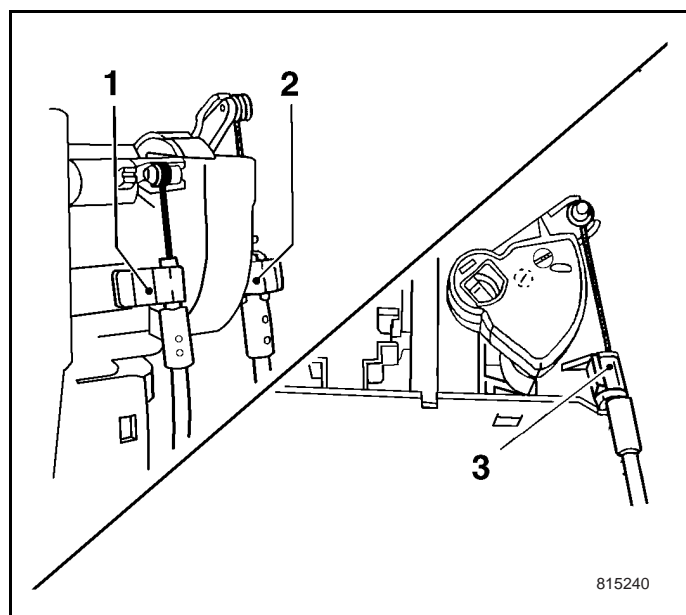
Tighten the screws of instrument panel outer cover lid to 1.5-2.5 N•m.

8.15.5.8 A/C Control Head Replacement

Removal Procedure

1. Disconnect the ground wire from the battery.
2. Remove the two mixed air nozzle (Central).
3. Loosen and remove the hazard warning system switch from the base.





5. Remove the four bolts from the instrument panel, and remove the A/C control head.
6. Loosen the Bowden cable (1, 2, 3) and disconnect the harness plug from the A/C control head.
7. Pry open the harness plug of hazard warning switch upwards from the socket - it can only be done after removing the switch.
8. Remove the A/C control head from the instrument panel.

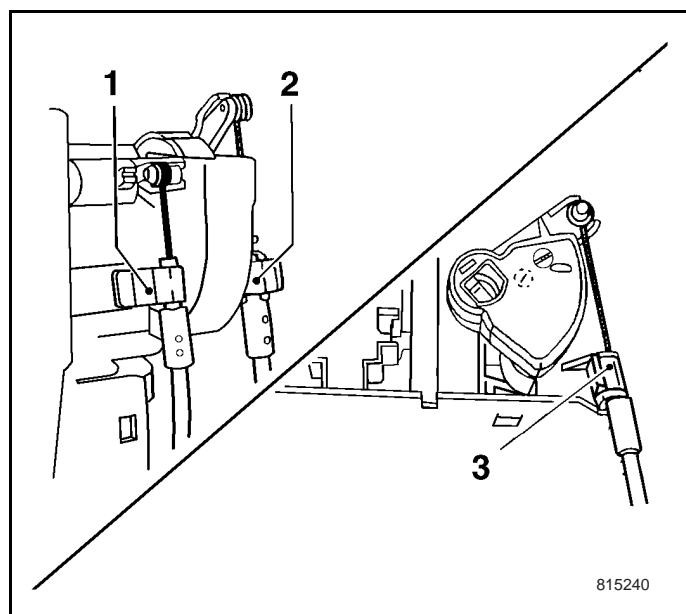
Installation Procedure

1. Connect the harness plug to the A/C control head and clip the Bowden cable (1, 2, 3).

Color code of Bowden cable terminal

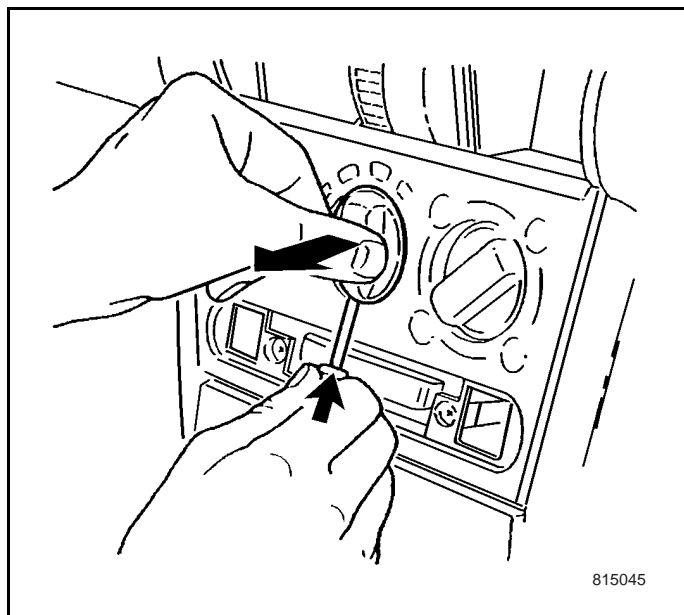
Vehicle	Left-hand Drive
Foot Mode Switch	Grey
Ventilation and Defrost Valve	Brown
Mixed Air Valve	Blue

2. Insert the A/C control head into the instrument panel and fasteners.
3. Install the LCD display.

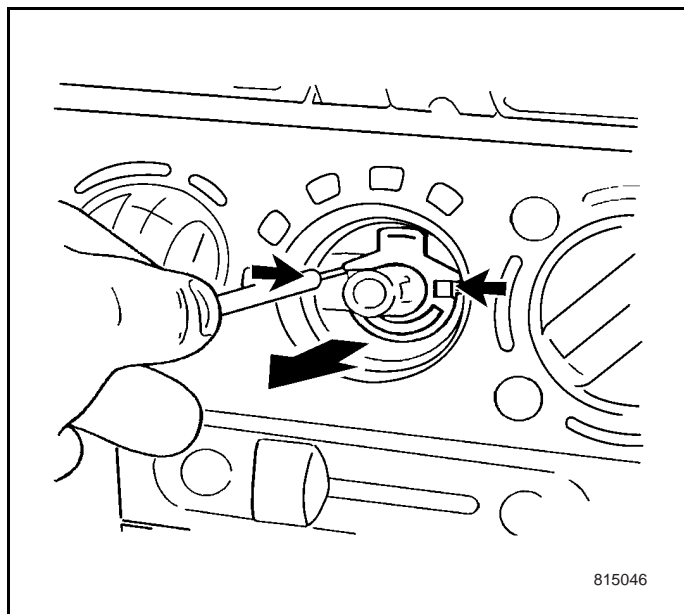


8.15.5.9 Fan Control Switch Replacement

Removal Procedure

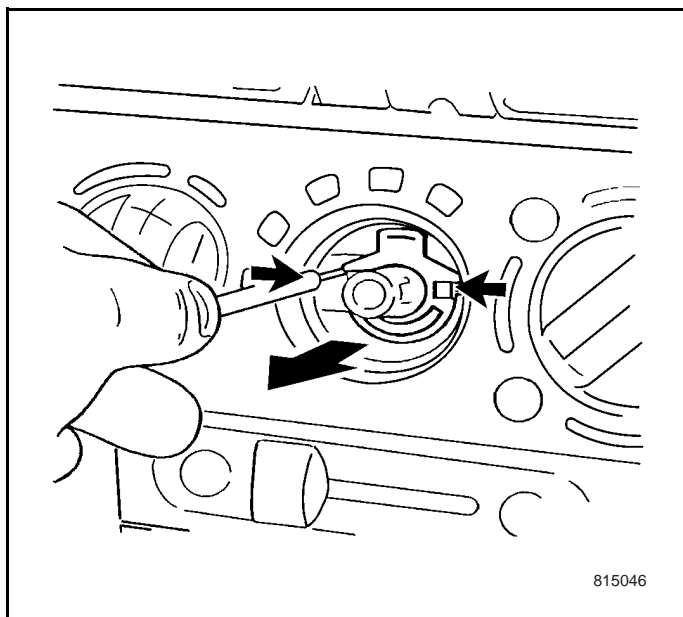


1. Use the punch to loosen and remove the fan control switch button.



2. Loosen the protruding head and remove the switch on the A/C control head.

Note: Pay attention to the matching between the tongue and the control button in the switch.



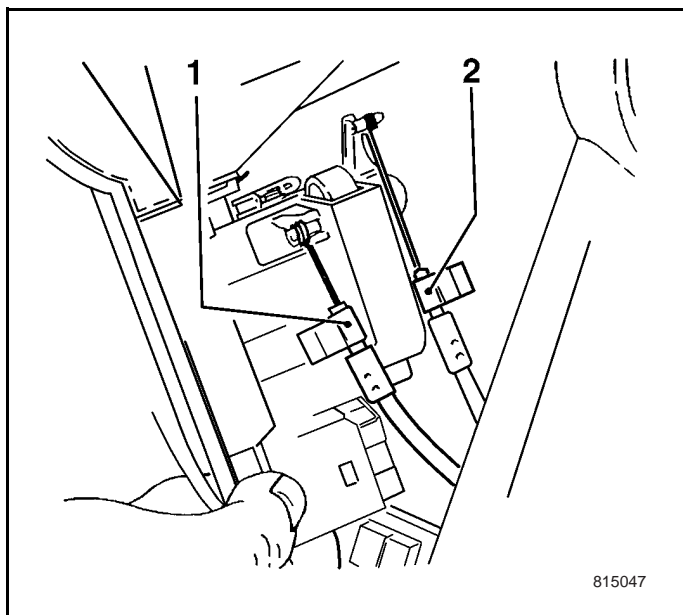
Installation Procedure

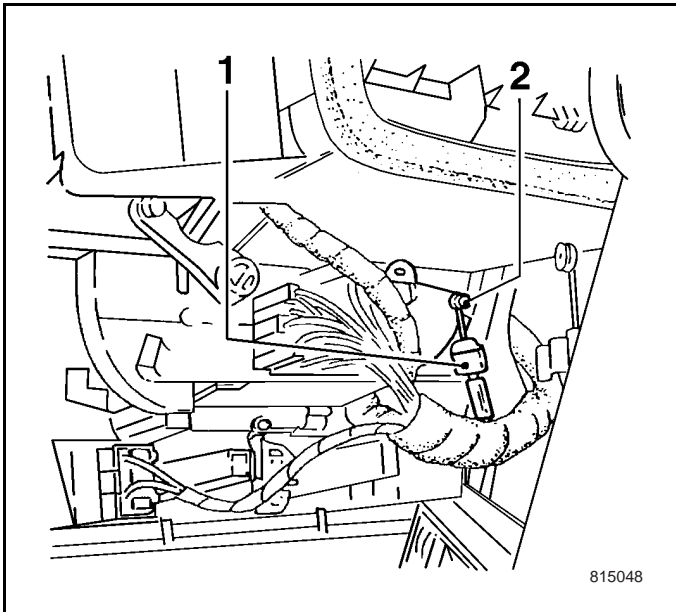
1. Lock the switch into the control head.
2. Connect the fan control switch button.

8.15.5.10 Bowden Cable of Mixed Air Valve Replacement

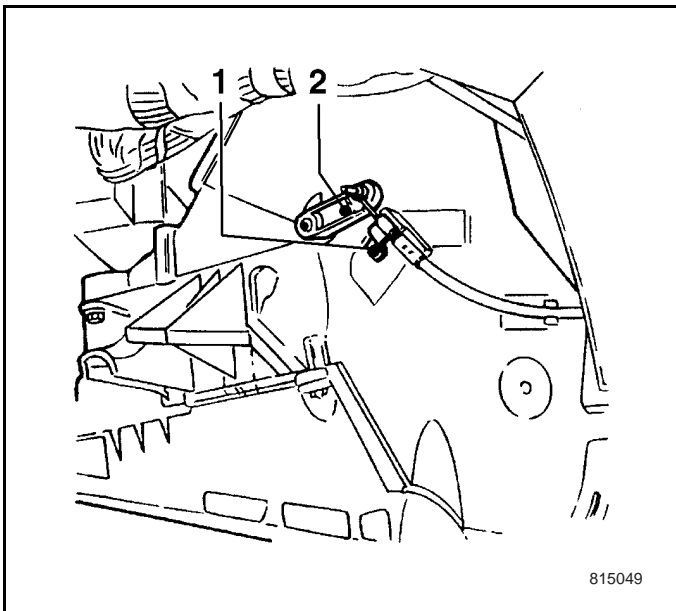
Removal Procedure

1. Remove the A/C control head. Refer to A/C Control Head Replacement.
2. Loosen the Bowden cable (1 and 2) from the control button, and remove the internal cable from the air distribution rod.

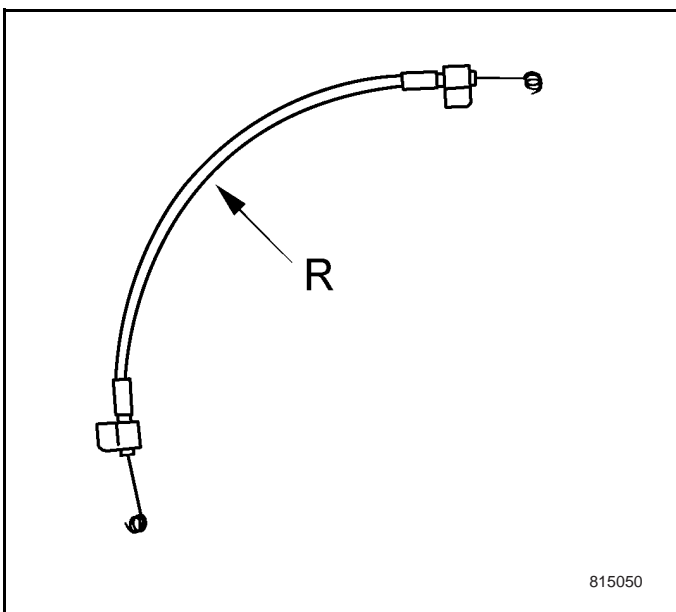




3. Rotate and pull out the control assembly from the instrument panel.
4. Loosen the blue Bowden cable (1) from the control button, and remove the internal cable from the air valve lever (2).

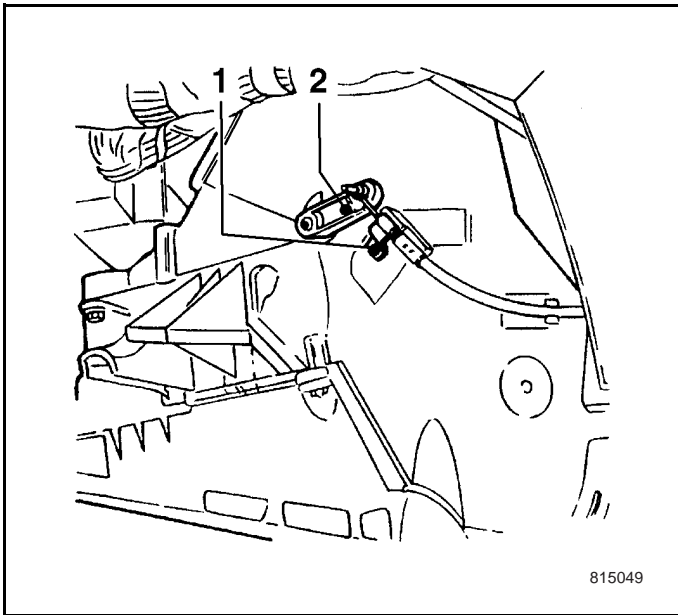


5. Loosen the left Bowden cable (1) from the air distributor cover and remove the internal cable from the mixed air valve lever (2).
6. Pry out the Bowden cable at the mounting location to the air distributor cover, and pull out the instrument panel.

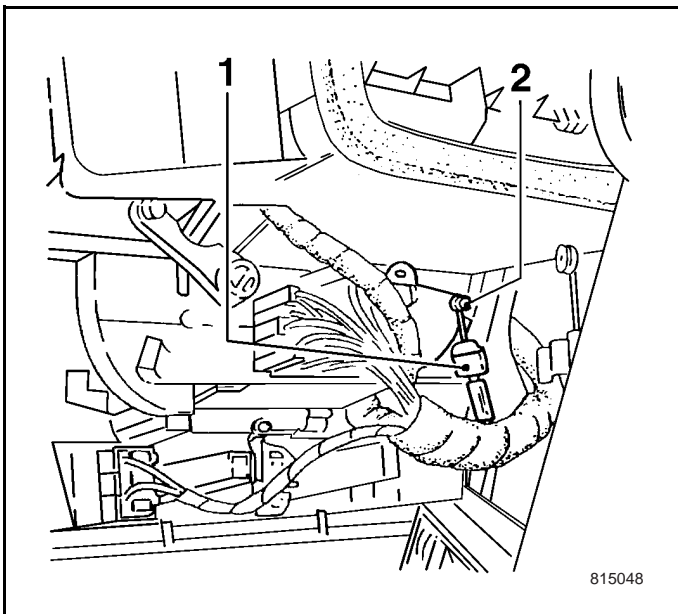


Note: During the routing and the installation, the Bowden cable radius (R) must be no less than 10 mm.

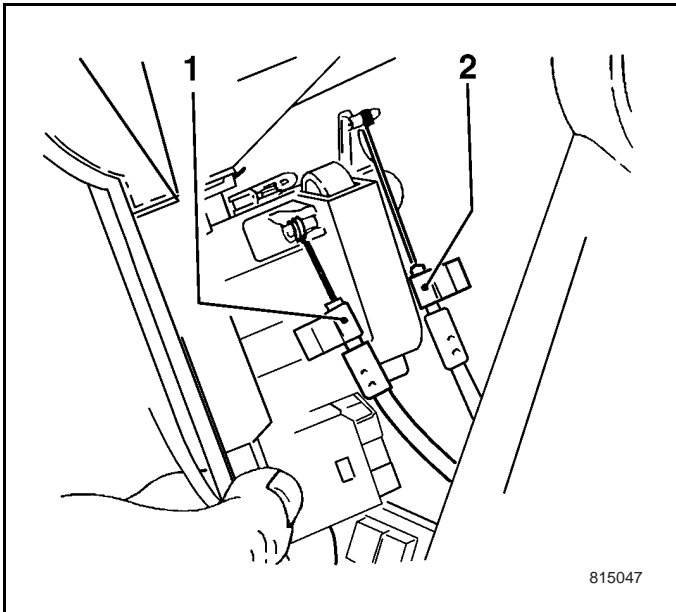
Installation Procedure



1. Pass the Bowden cable (both ends are black) of mixed air valve through the gap between steel support bracket and instrument panel to the controller.
2. Connect the internal cable to the mixed air valve lever (2) and lock the Bowden cable (1) into the air distributor cover.



3. Connect the internal cable to the control lever (2) and lock into the Bowden cable (1). Screw on the control assembly into the instrument panel.

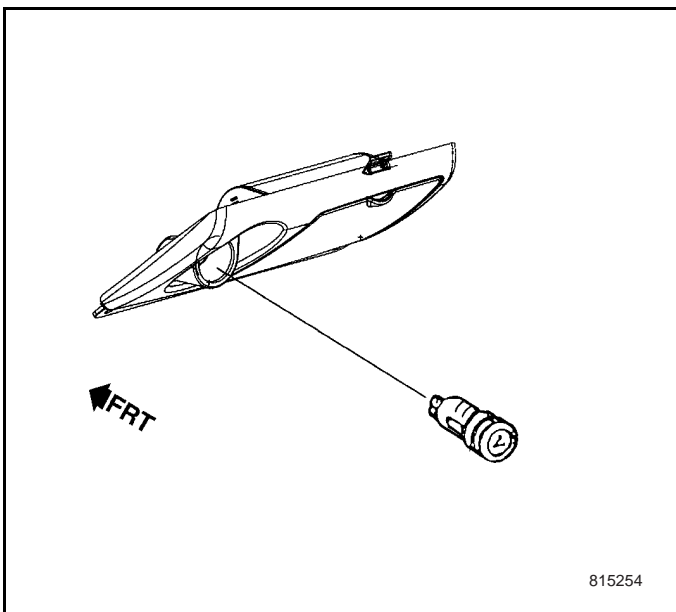


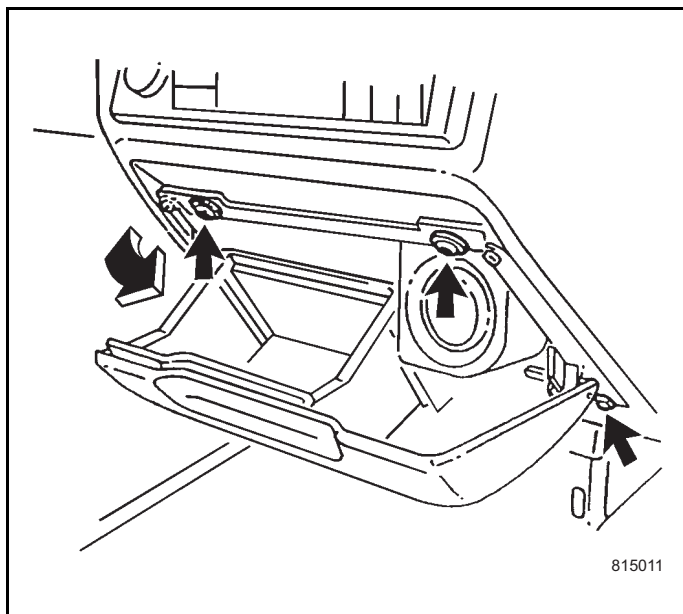
4. Connect the Bowden cable used for the outlet valve of foot well - grey (1) and the Bowden cable used for ventilation and defrost valve - brown (2) to the control button and the lock.
5. Tighten the A/C control head. Refer to A/C Control Head Replacement.

8.15.5.11 Cigarette Lighter ASM Replacement

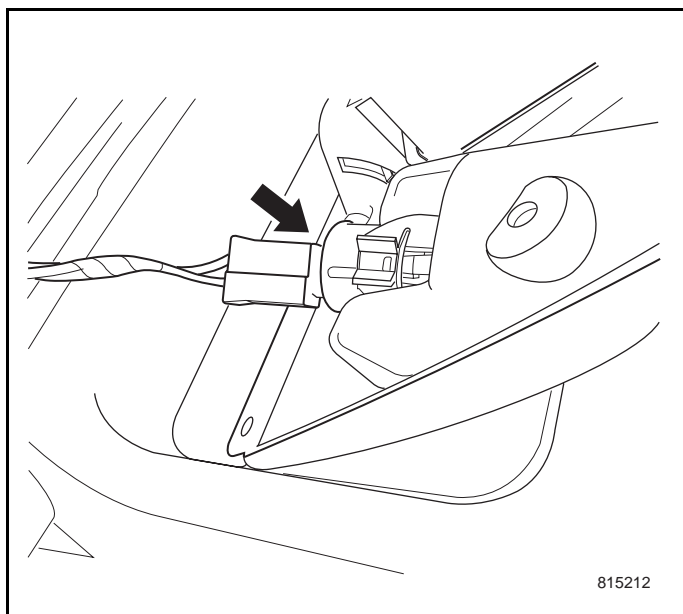
Removal Procedure

1. Pull out the cigarette lighter.

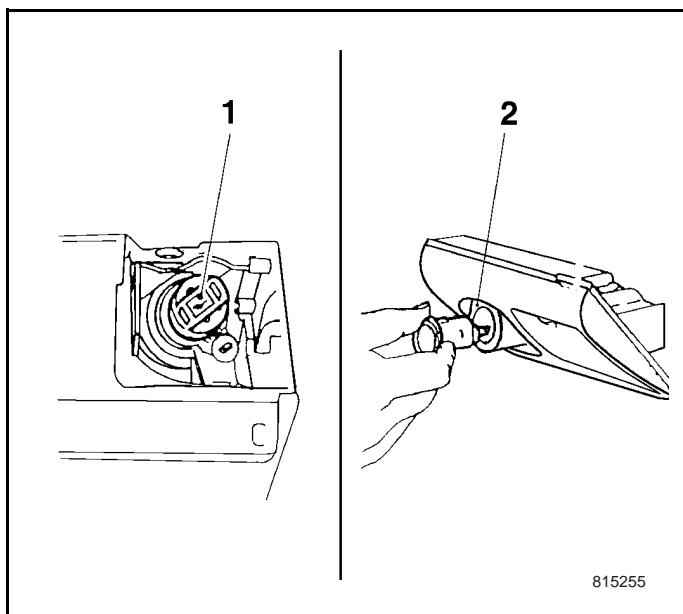




2. Loosen the screws and pull out the lower I/P trim panel. Refer to Lower I/P Trim Panel Replacement.



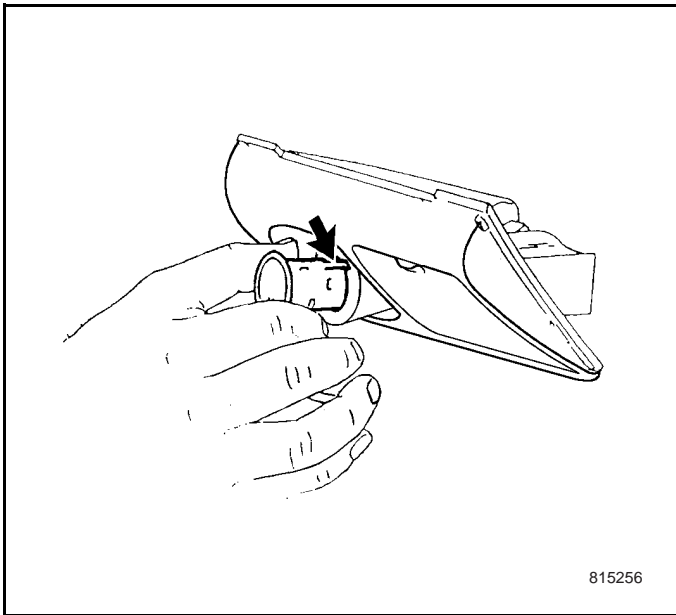
3. Disconnect the harness plug.



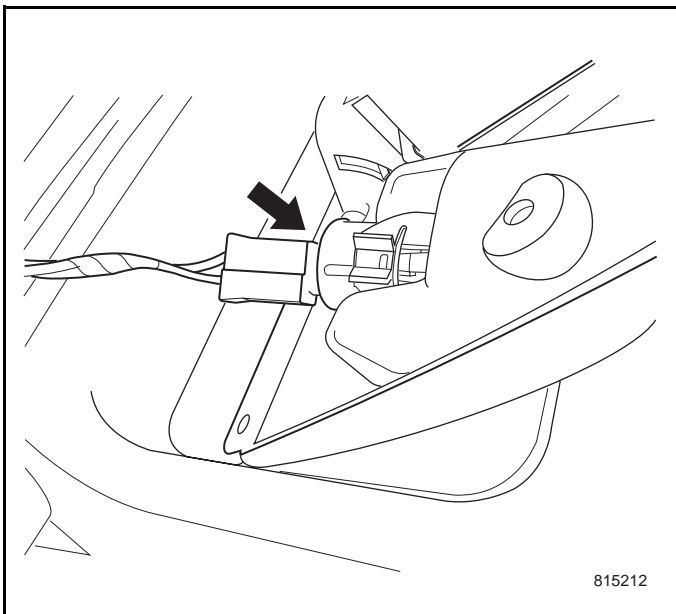
4. Press down the cigarette lighter assembly (1), and take out from the mounting base (2) behind the lower I/P trim panel.

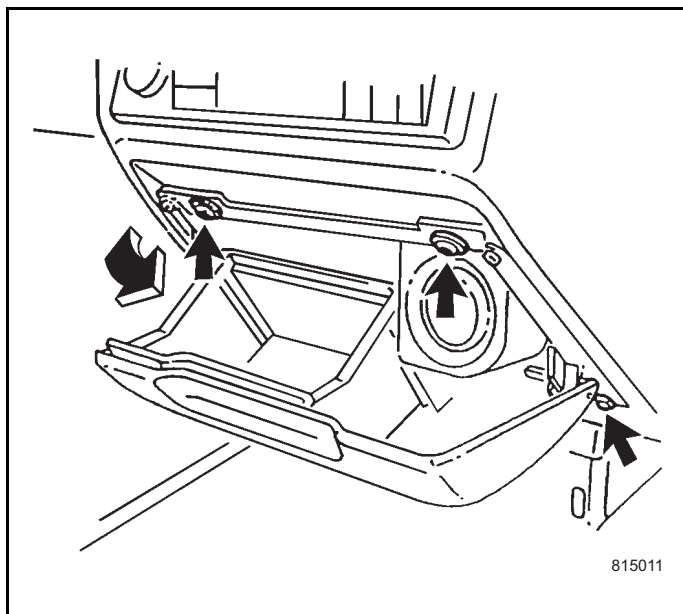
Installation Procedure

1. Install the cigarette lighter assembly into the mounting base (please align with the correct mounting groove).

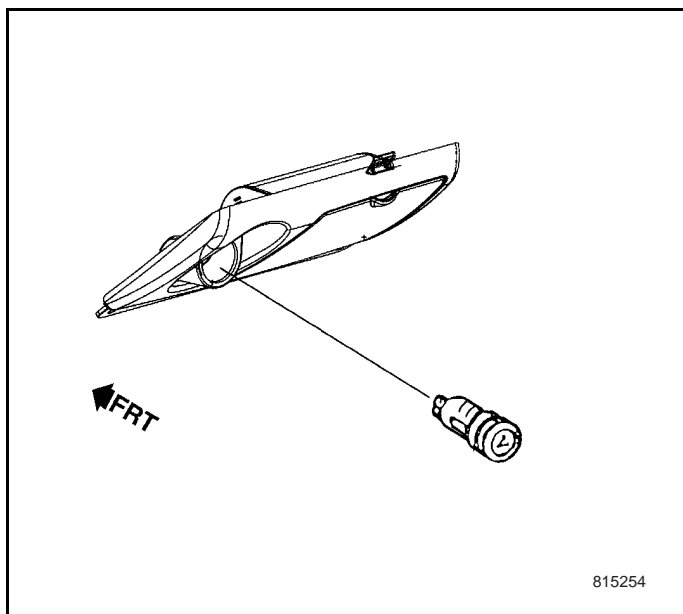


2. Connect the harness connectors.





3. Install the lower I/P trim panel. Refer to Lower I/P Trim Panel Replacement.

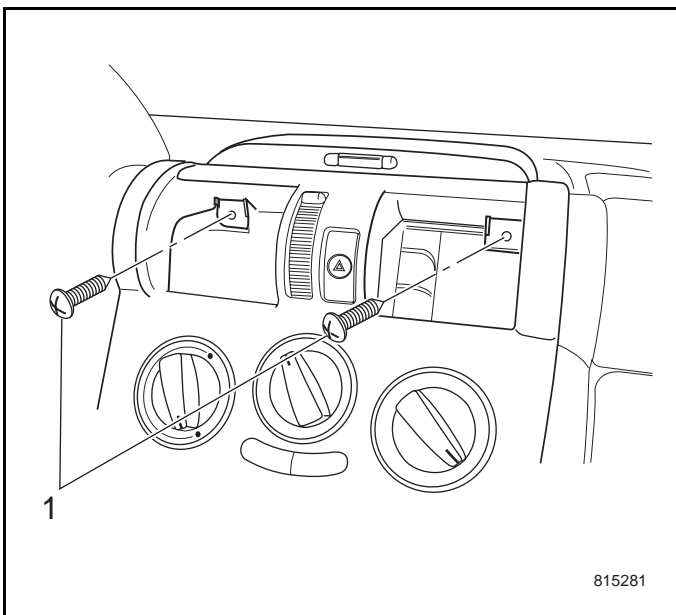
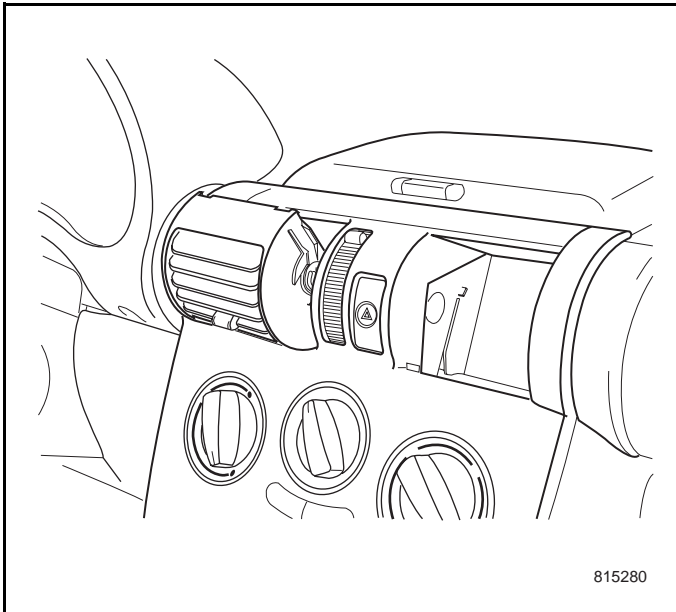


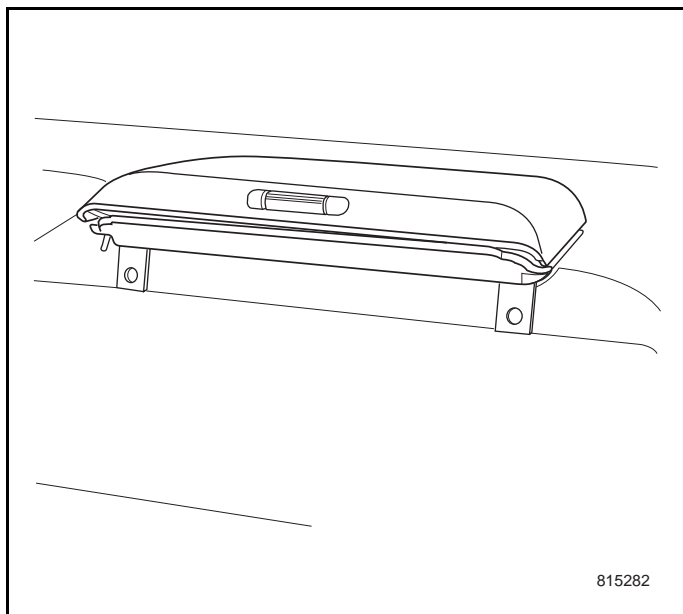
4. Insert the cigarette lighter.

8.15.5.12 Stow Compartment at Upper I/P Replacement

Removal Procedure

1. Remove the air outlet grille. Refer to Air Outlet Replacement - Instrument Panel Outside.

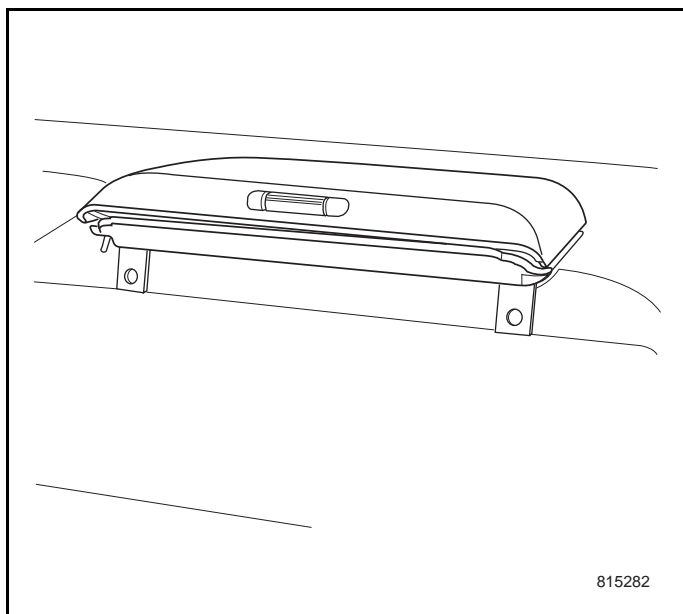




3. Remove the stow compartment at upper instrument panel.

Installation Procedure

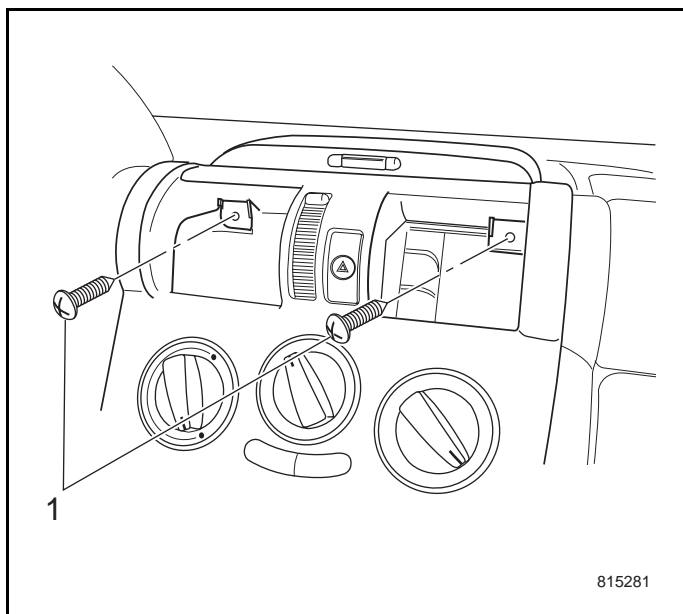
1. Locate the stow compartment of upper instrument panel at the I/P.

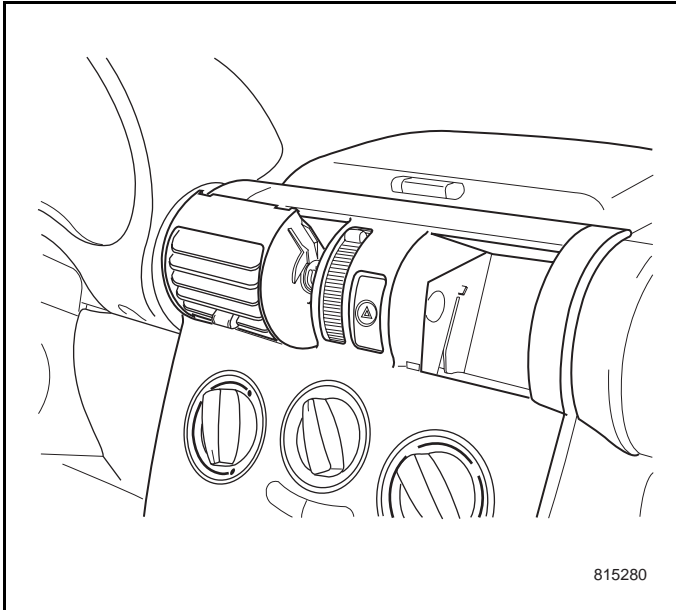


2. Screw down the stow compartment screw (1) of upper instrument panel.

Tightening

Tighten the screw of the stow compartment at upper instrument panel to $2 \pm 0.3 \text{ N}\cdot\text{m}$.



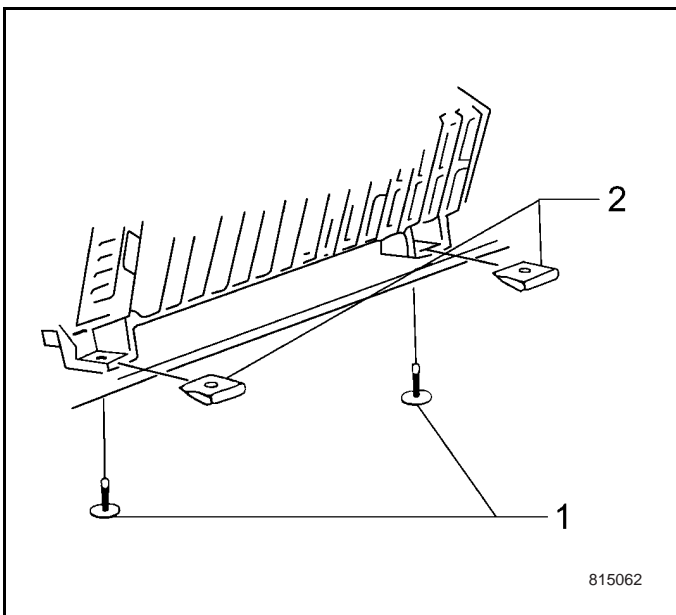


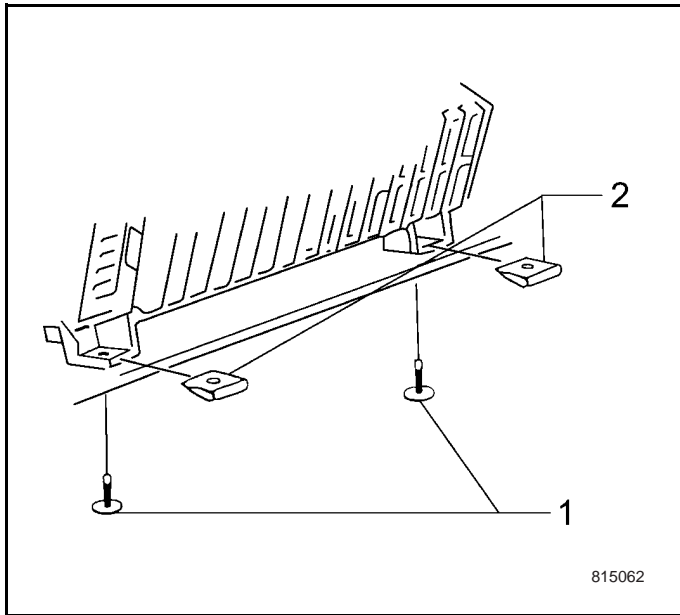
3. Install the air outlet grille. Refer to Air Outlet Replacement - Instrument Panel Outside.

8.15.5.13 Fuse Box Replacement

Removal Procedure

1. Loosen the screw (1), carefully remove the fuse box, leaving the nut (2) on the fuse box.





Installation Procedure

1. Install the fuse box with the nut (2) onto the instrument panel, and tighten the screw.

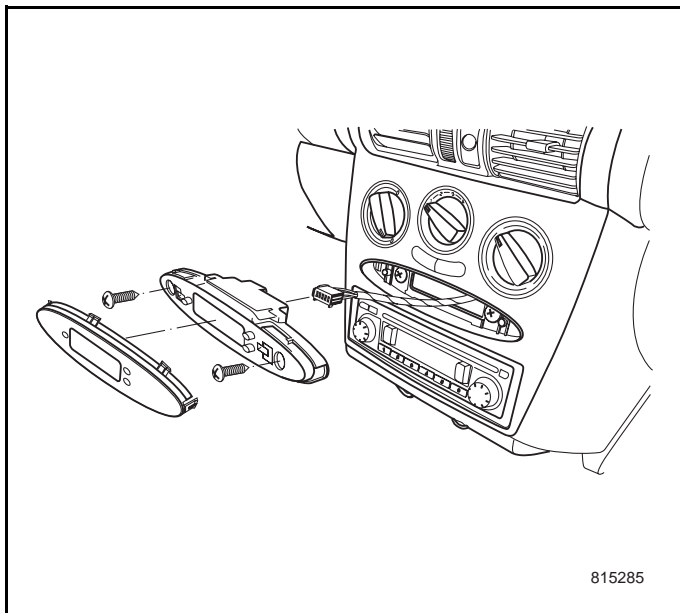
Tightening

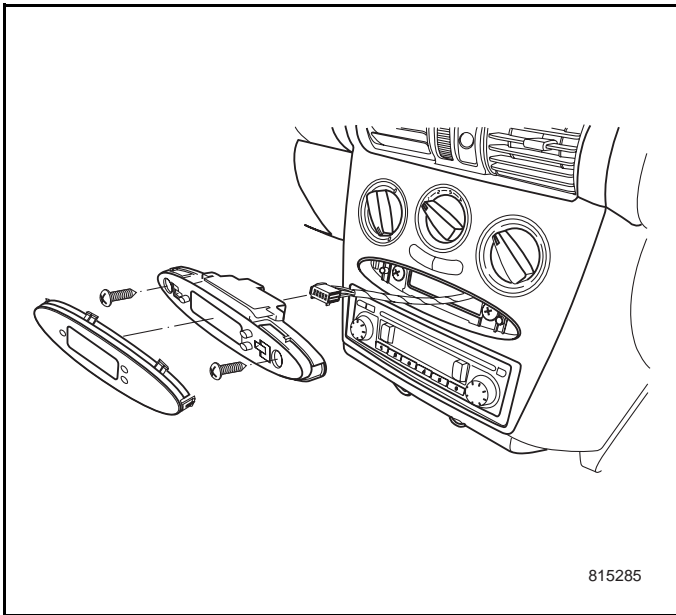
Tighten the screw to 1.5-2.5 N•m.

8.19.5.14 Time/Temperature Module Replacement

Removal Procedure

1. Use a thin screwdriver to tap at the top right corner of the panel, and remove the panel cover.
2. Screw off the two cross fixed screws.
3. Disconnect the electrical connector and remove the time/temperature module.





Installation Procedure

1. Connect the electrical connectors.
2. Use two cross screws to fasten the time/temperature module.

Tightening

Tighten the screw to 1.0-3.0 N•m.

3. Press down the panel cover all the way to the safety position.

8.15.6 Description and Operation

8.15.6.1 Circuit Description of Instrument Cluster

Air Bag Warning Indicator

The inflatable restraint diagnostic energy reserve module path sensor (SDM) over the analog circuit controls the air bag indicator. To perform the bulb inspection, the SDM indicator will illuminate for 3 seconds during the engine start. The SDM will turn the indicator ON in order to warn the driver of a supplemental inflatable restraint (SIR) electrical system malfunction, possibly affecting the operation of the SIR system.

ABS Indicator

The electronic brake control module (EBCM) over the analog circuit controls the warning indicator of ABS. To perform the bulb inspection, the EBCM indicator will illuminate for 3 seconds during the engine start. The EBCM flashes the ANTI - LOCK warning indicator in order to warn the driver that an ABS malfunction exists, possibly degrading the base brake performance. A solid (not flashing) ANTI-LOCK warning indicator warns the driver that a problem has been detected that affects the operation of the ABS (ABS may be disabled), but the normal base brake performance will remain.

Automatic Transmission Indicator

During the engine start, the transmission control module (TCM) indicator will illuminate for about 3 seconds, which is intended to check the bulb. Under the following conditions, the automatic transmission indicator will illuminate.

- It will illuminate when the sport mode drive is selected.
- The transmission will flash when a condition occurs. Please check the transmission.

Brake Warning Indicator

Under the following conditions, the brake warning indicator will illuminate:

- When the brake fluid is too little
- When the parking brake switch is turned off.

When a base brake problem may exist, the brake warning indicator will warn the driver.

Battery Charge Indicator

The battery charge indicator illuminates when the ignition begins, and goes out when the engine starts and the engine speed exceeds the idle speed.

If the battery charge indicator illuminates during the drive, the battery is not being charged. You should inspect the engine.

Low Oil Indicator

The low fuel indicator comes on when the fuel level drops below 1/8 of the range. At this time, the fuel sensor output is 151 ohms.

Oil Pressure Indicator

This indicator is directly controlled by the oil pressure switch. When the oil pressure doesn't reach the specified value, the instrument cluster will illuminate the oil pressure indicator.

Service Engine Indicator

When the ignition switch is turned on, this indicator illuminates, but goes out soon after the engine starts to run.

If it is always on, the engine may be checked.

High Beam Indicator

When the high beam is switched on, this indicator will illuminate. This signal is produced by the headlamp switch.

Turn Signal Indicator Lamp

The instrument cluster receives the signal of turning on the turn signal indicator by the following circuit:

- Left Turn Circuit (see the Instrumentation Circuit Diagram).
- Right Turn Circuit (see the Instrumentation Circuit Diagram).

When the ignition is at RUN position and under the following conditions, IC and each turn signal indicator begin to flash:

- Hazard Warning Switch is at the normal position.
- The turn signal switch is at one of the following positions:
 - Right Turn Position
 - Left Turn Position

If the hazard warning switch is at Hazard position, the following components begin to flash:

- Both Turn Signal Lamps
- Both Indicators

Light Control

The display light characteristics of the instrument cluster remains the same as the light characteristics of radio. After the parking lamp is turned on, the light and shade of instrumentation backlight will be controlled by the light adjusting switch.

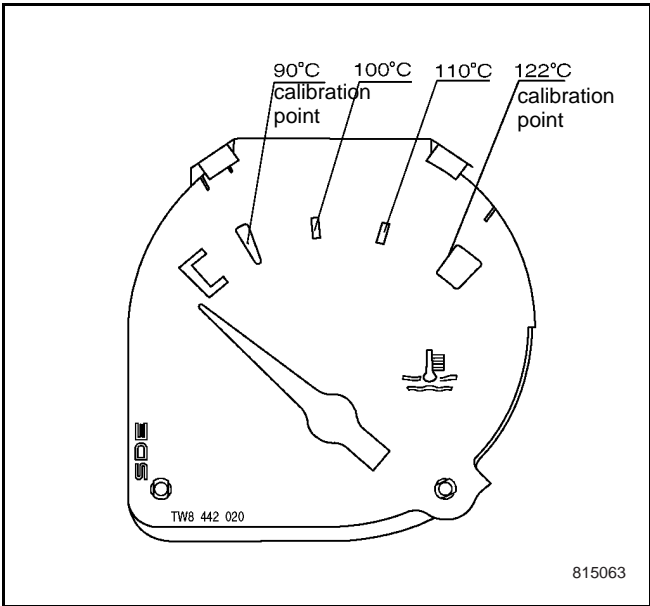
Engine Coolant Temperature Gauge

1. The instrument cluster gets the analog signal by the temperature sensor.

2. If the temperature reaches 122°C, the indicator will enter the red area, and at this time the resistance of temperature sensor is 44.9 ohms.

The test points as follows:

Reading (°C)	90	122
Proper Resistance Value (Ohm)	101.7	44.9

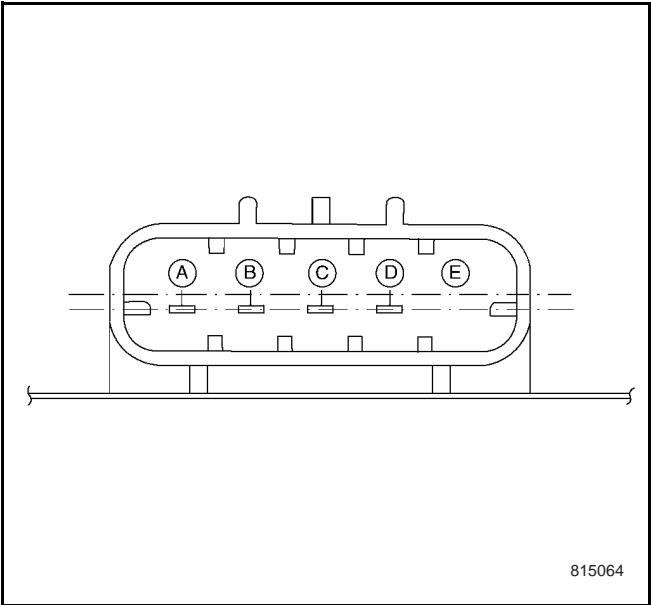


Fuel Gauge

The instrument cluster gets the signal by the fuel sensor. The low fuel indicator will point at the red area on the instrument cluster when the fuel level signal drops below 1/8 of the range. At this time, the fuel sensor resistance is 151 ohms. The resistance value may be measured between the connector End B and End D.

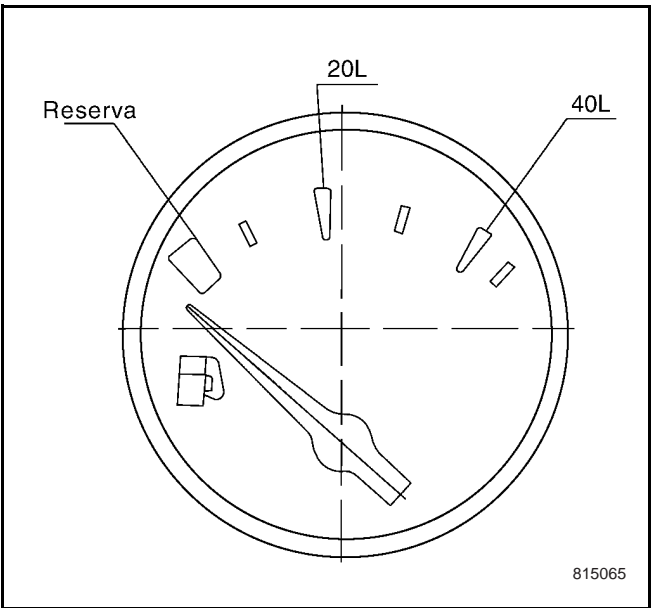
The test points as follows:

Indication	Warning Point	20	40
Related Resistance (Ohm)	151	77	48.5



Speedometer and Odometer

The vehicle speed sensor (VSS) is a magneto-electronic sensor. The sensor generates a square wave output with a frequency proportional to the vehicle speed. The signal can drive the following components:



- Speedometer
- Odometer

The odometer displays the accumulated kilometers of the vehicle for some time.

The trip odometer displays the accumulated kilometers since the last reset to the tenths of a kilometer. The trip odometer can be reset by pressing the Odometer Reset key for a longer time. The switching between big accumulated mileage display and small accumulated mileage display may be executed by press the Odometer Reset for a shorter time.

The odometer is capable of displaying the following values: 000.0 km → 999.9 km

- Reset to 0.
- Measured by the mileage.

Tachometer

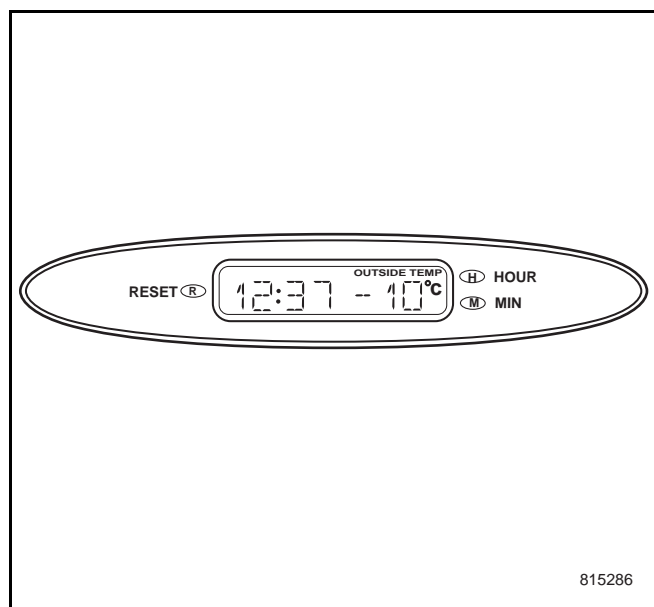
The tachometer displays the engine speed in revolutions per minute (RPM). The tachometer is driven by the signal of engine control module.

8.15.6.2 Clock Temperature Module Description

Module Function

The clock temperature module is used to display the 24-hour clock and the outside centigrade temperature.

Module Appearance



Module Performance

- Clock Precision: ± 2 sec/day
- Temperature Difference: $\pm 2^{\circ}\text{C}$
- Static Current: $< 2\text{mA}$
- Working Current: $< 100\text{ mA}$

Module Usage

1. When the module is connected to the battery for the first time or is re-connected after the power off, turn on the ACC, the clock displays 12:00, and flashes with a frequency of 1Hz. Press RESET key, the clock stops flashing and goes into the normal operating status. At this time, the clock may be adjusted, and the temperature display is the outside temperature.
2. During the normal operating, turn on the ACC, and the module displays the current time. It is considered that the temperature sensor is installed near the engine, therefore:
 - If the stop time is less than 2 hours, the temperature which is instantly memorized before the vehicle stop will be displayed.
 - If the stop time is more than 2 hours, the ambient temperature measured by the sensor will be displayed.
3. Turn off the ACC, OFF will be displayed, and the module goes into the STOP mode. Except the clock, all the function stop working.
4. Clock Adjustment:
 - Press the HOUR key, Hours + 1; Continuously press for 1.5 seconds, the Hours + 1 by a frequency of 2 Hz; the hour display range is 0-23.
 - Press the MIN key, Minutes + 1; Continuously press for 1.5 seconds, the Minutes + 1 by a frequency of 2 Hz; the minute display range is 0-59.
 - Press the RESET key, the clock display will change according to the following rules:

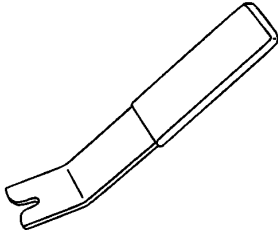
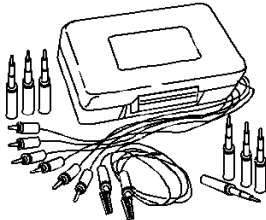
Before the RESET is pressed, if the clock displays: XX: YY

 - If 0YY30, press RESET once, the clock display will change to: XX: 00.
 - If 30<YY59, press RESET once, the clock display will change to: XX+1: 00.

When continuously pressing the RESET key, it will be the same as pressing the RESET key once.
5. Temperature Display:

The temperature display is the outside ambient temperature, and when the sensor has a failure, the temperature displays " — "

8.15.7 Special Tools

Illustration	Part Number / Description
 <p>J38778</p>	J38778 Door Trim Pad and Garnish Clip Remover
 <p>J35616-B</p>	J35616-B Connector Test Adapter Kit

8.16 Seats

8.16.1 Specification

8.16.1.1 Fastener Tightening Torque

Application	Specification
Seat Adjuster to Floor Attaching Bolts	15-25 N•m
Adjuster to Seat Cushion Frame Attaching Bolts	15-25 N•m
Seat Back to Seat Cushion Frame Attaching Bolts	40-50 N•m
Height Adjuster to Seat Cushion Frame Attaching Bolts	15-25 N•m

8.16.1.1A Fastener Tightening Torque

Application	Specification
Rear Seat Cushion Screw	4-5 N•m
Rear Seat Back Screw	10-22 N•m

8.16.1.1B Fastener Tightening Torque

Application	Specification
Central Bracket to Seat Back Attaching Bolts	18-22 N•m
Seat Back Hinge to Cab Attaching Bolts (front)	18-22 N•m
Seat Back Hinge to Cab Attaching Bolts (front)	18-22 N•m

8.16.2 Diagnostic Information and Procedures

8.16.2.1 Seat Adjuster Mechanical Adjuster

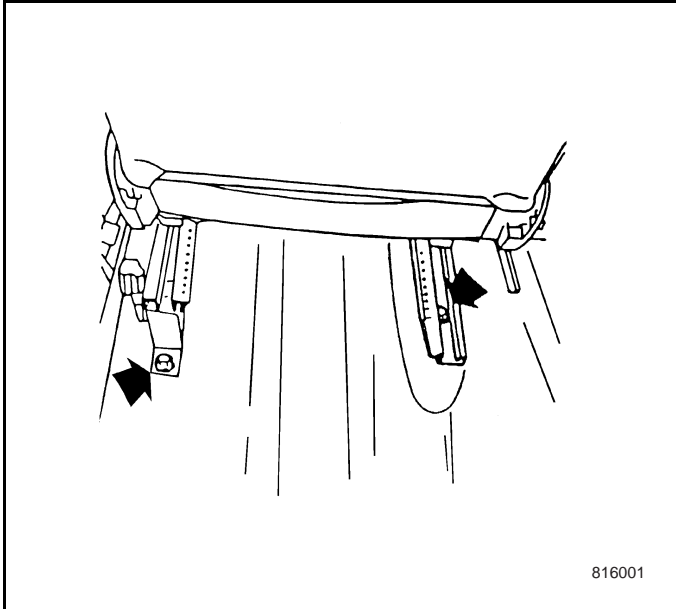
Front and Rear Seat Adjuster Mechanical Diagnosis Table

Conditions	Possible Causes	Correction
The adjuster cannot be self-locked.	<ul style="list-style-type: none"> The seat adjuster handle is twisted or bent. The adjuster latch return spring is broken. The lock is sticking on the adjuster. 	<ul style="list-style-type: none"> Repair the handle to ensure that both sides can be loosened and locked or replace the handle. Install a new adjuster. Apply lubricant to the latch pivot with application specific lubricant. If the latch is stuck, eliminate the cause of sticking or replace the adjuster.
It is difficult to move the seat back and forward.	<ul style="list-style-type: none"> The adjuster are new and not broken in yet. (required to be broken in 20 times). Improper lubrication to the adjusters. Unsmooth adjuster operation is caused by track bent or damage. 	<ul style="list-style-type: none"> Repeat moving the seat between the most forward and most rearward position several times to allow for smooth track sliding Apply application specific automotive lubricant or equivalent to the adjuster track. Replace the adjuster.
One Front and One Rear Adjuster Tracks.	The seat system just has one track at front and one track at rear at the time of installation.	<ol style="list-style-type: none"> Move the seat forward as far as possible. Loosen the adjuster to floor bolts. Lock the seat at forward most position and tighten the adjuster to floor bolts to 20 N•m.

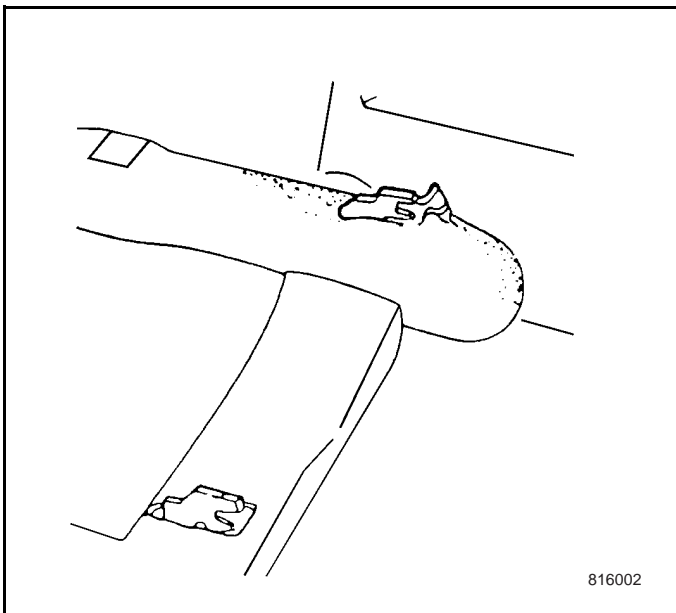
8.16.3 Repair Instructions

8.16.3.1 Seat Replacement-Front

Removal Procedure



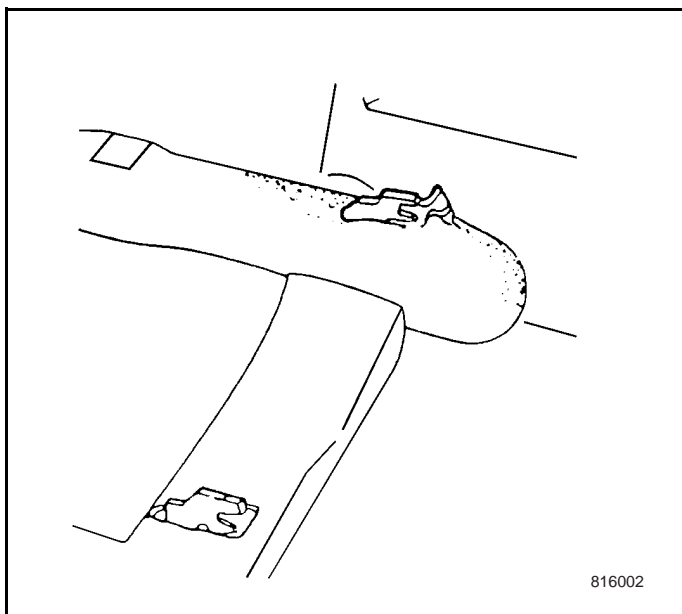
1. Remove the adjuster track cover sheet. Refer to Seat Adjuster Track Cover Sheet Replacement in Interior Trim.
2. Remove the head restraint. Refer to Front Seat Head Restraint Replacement.
3. Remove the left and right seat adjuster to floor bolts, and slide rearward the seat.
4. Push forward the seat adjuster.



5. Allow the front seats to be disengaged from the fixation hook.
6. Remove the seat from the vehicle.

Installation Procedure

1. Position the front seat in the vehicle.
2. Slightly tilt the seat forward to allow the seat adjuster to floor attaching hook to be engaged.

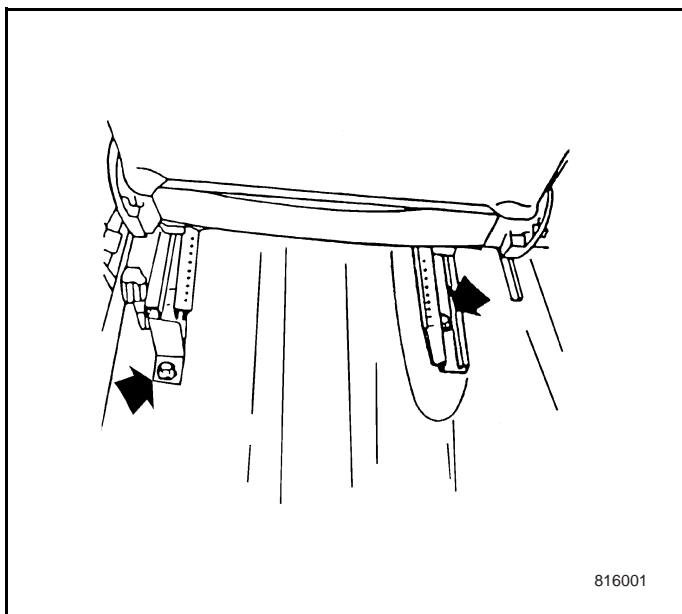


3. Tighten the seat adjuster to floor attaching bolts.

Tighten

Tighten the attaching adjuster to floor bolts to 15-25 N•m.

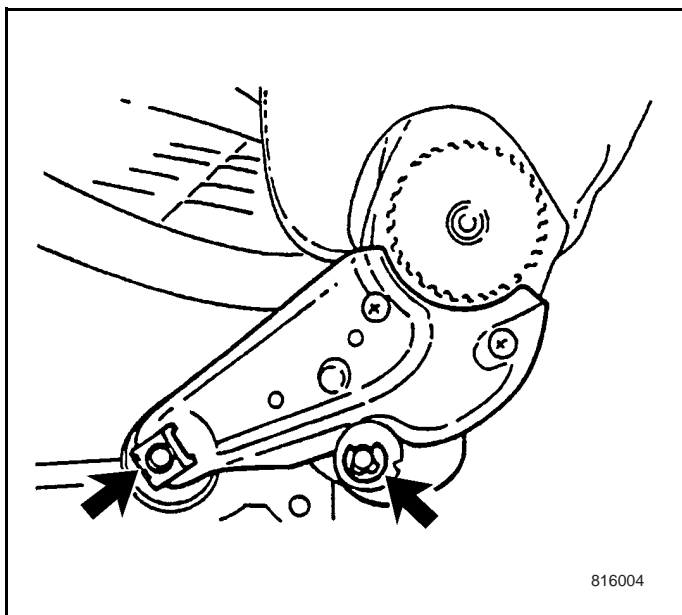
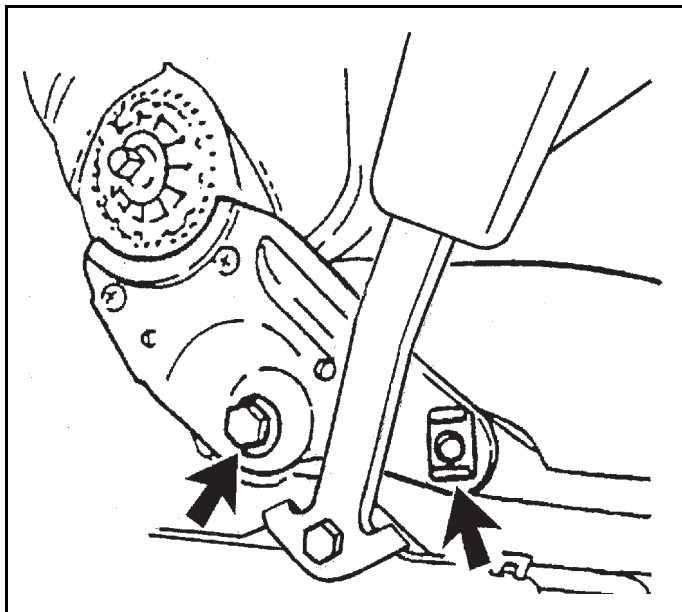
4. Move the seat to the original position.
5. Install the head restraint. Refer to Front Seat Head Restraint Replacement.



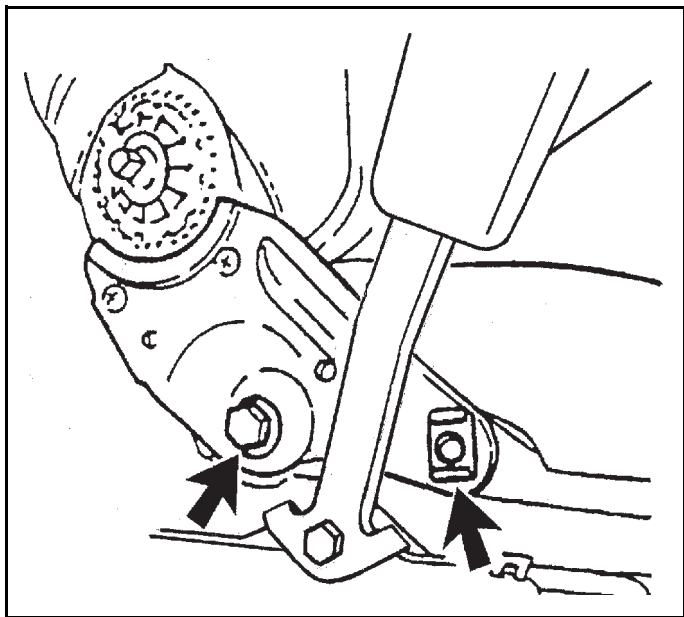
8.16.3.2 Seat Back Replacement-Front

Removal Procedure

1. Remove the front seat from the vehicle. Refer to Front Seat Replacement.
2. Remove the seat back adjuster trim cover from the front seats. Refer to Front Seat Back Adjuster Trim Cover Replacement



3. Remove the seat adjuster to seat cushion frame attaching bolts and fasteners.
4. Remove the front seat back from the front seats.

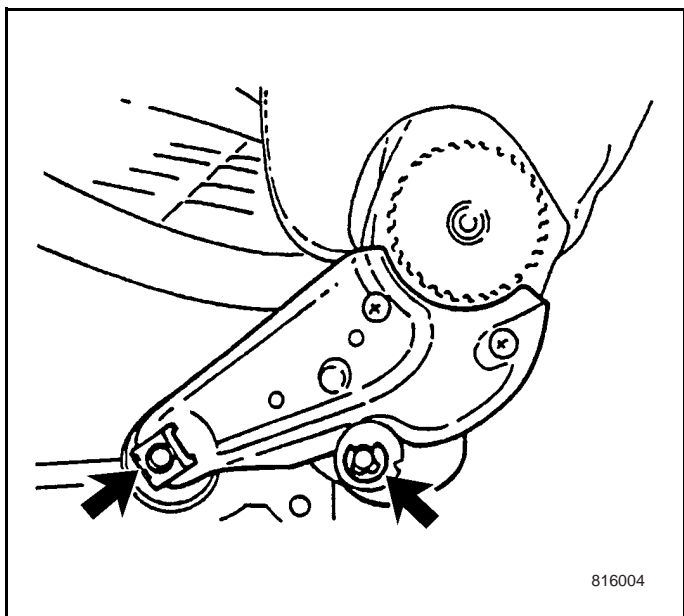


Installation Procedure

1. Position the front seat back to the attaching position with the front seat cushions.
2. Tighten the front seat back on the seat cushion frame with bolts and fasteners.

Tighten

Tighten the seat back to the seat cushion frame bolts to 40-50 N•m.



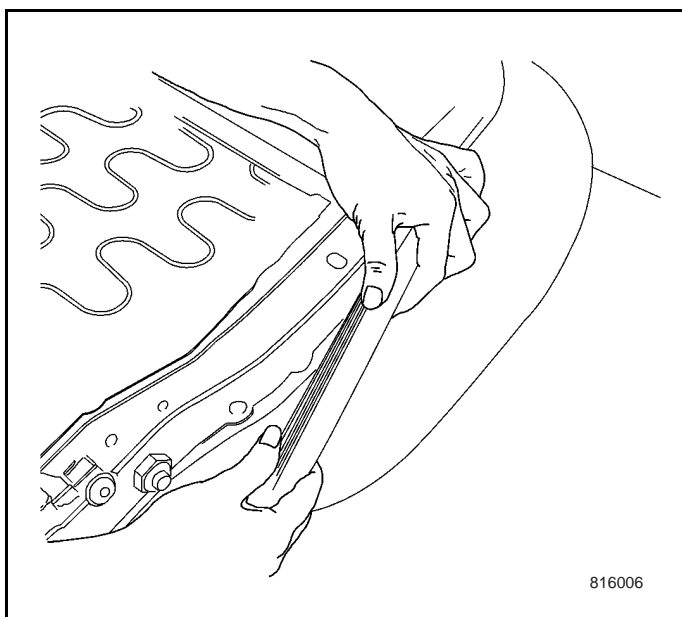
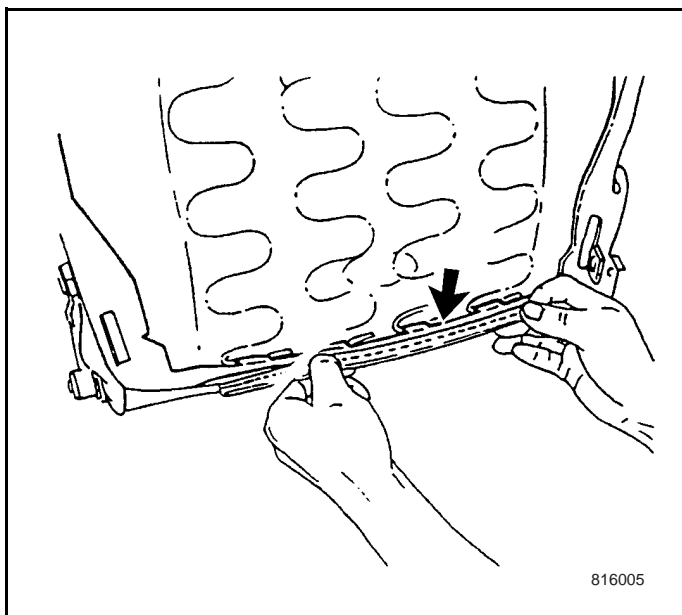
3. Install the seat back adjuster trim cover to the front seat. Refer to Front Seat Back Adjuster Trim Cover Replacement.
4. Install the seat head restraint. Refer to Front Seat Head Restraint Replacement.

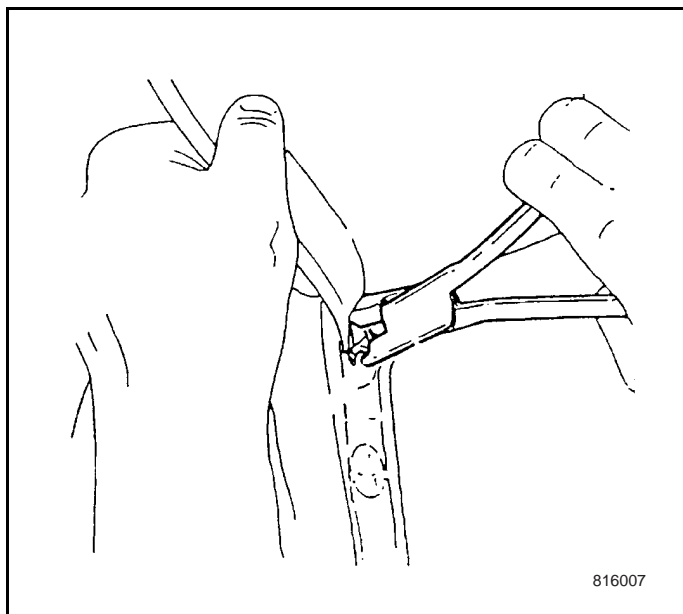
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8.16.3.3 Front Seat Cushion Cover Replacement

Removal Procedure

1. Remove the front seat. Refer to Front Seat Replacement.
2. Remove the front seat back. Refer to Front Seat Back Replacement.
3. Release the J strips at the back of the seat cushion.
4. Release the flat strips at the seat cushion bottom.
5. Remove the cover and cushion from the seat cushion frame.

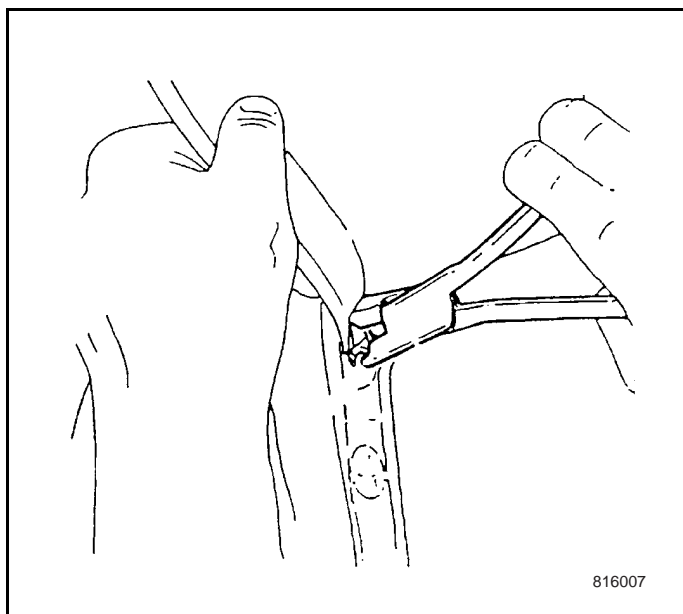


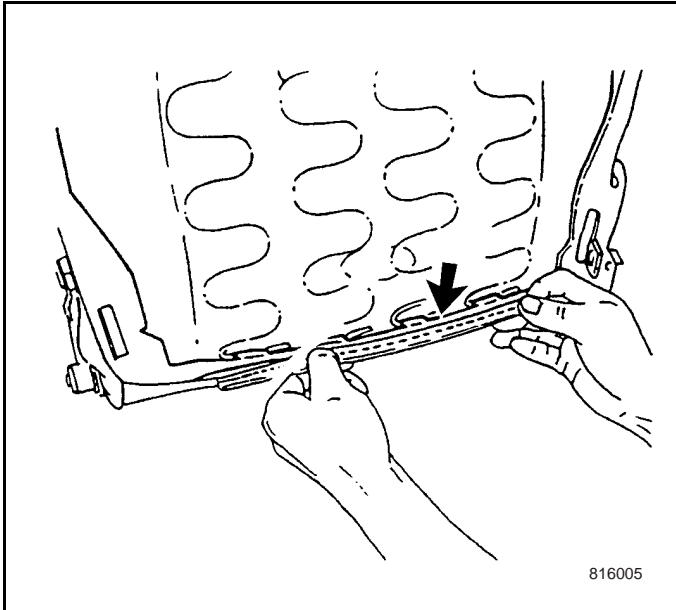


6. Remove the buckle to separate the cover and cushion.

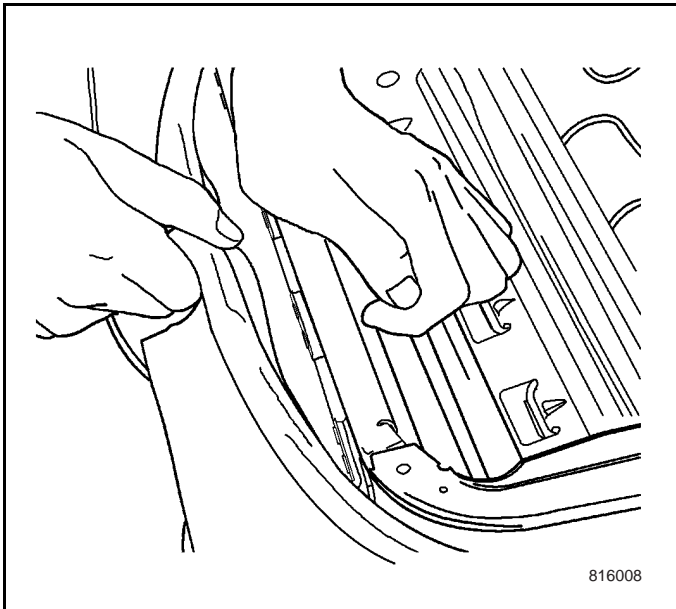
Installation Procedure

1. Install the seat cushion cover on to the cushion.
2. Tighten the seat cushion cover to seat cushion steel wire buckle.





3. Secure the J strip to the rear part of the seat cushion frame.

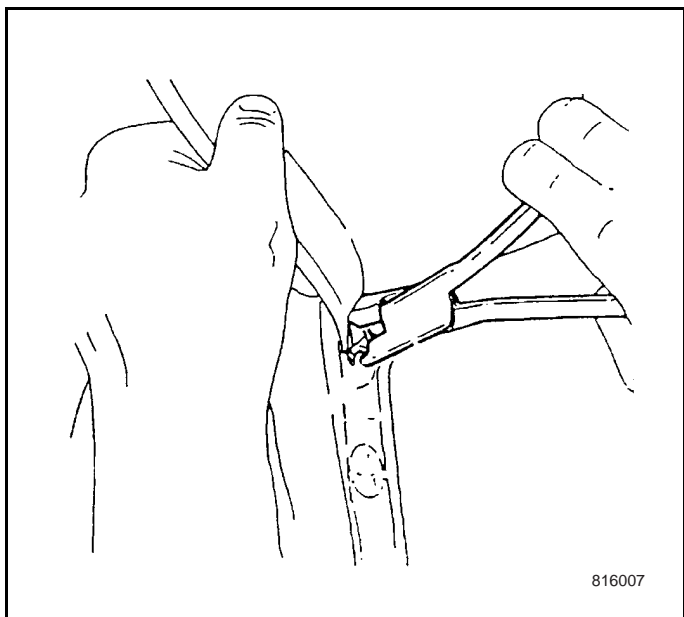
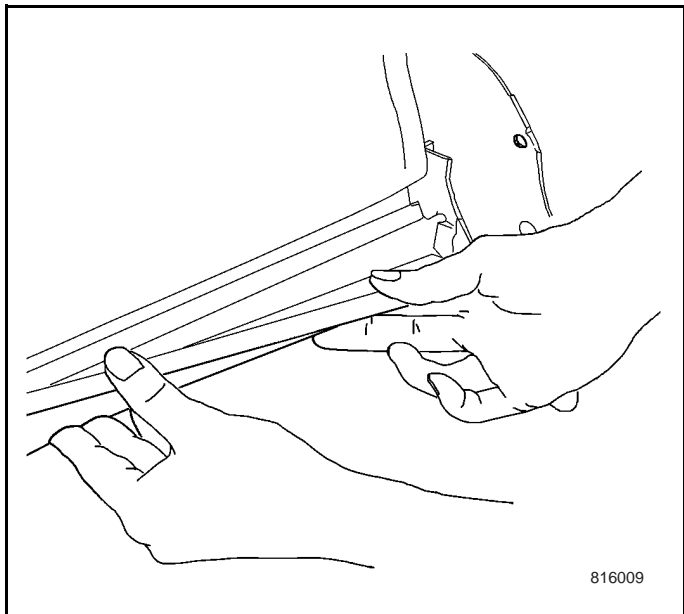


4. Press the cushion firmly, and secure the flat strip from the middle of the cushion front to the seat cushion frame.
5. Install the front seat back. Refer to Front Seat Back Replacement.
6. Install the front seat. Refer to Front Seat Replacement.

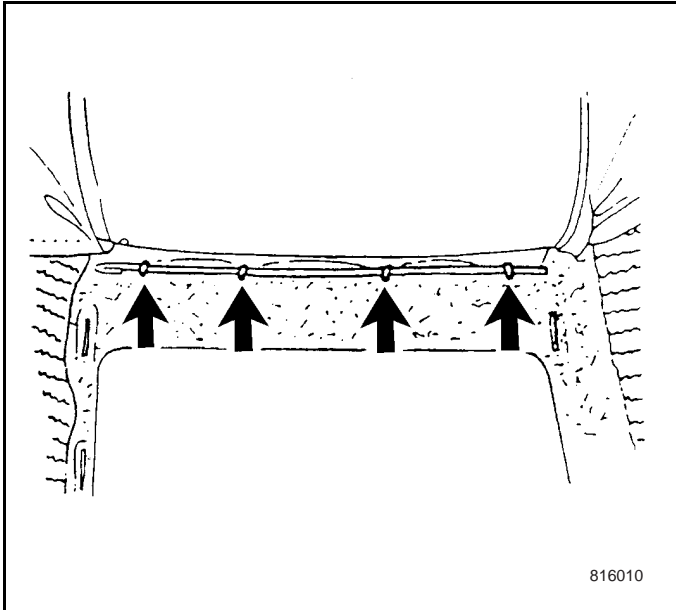
8.16.3.4 Seat Back Cover Replacement-Front

Removal Procedure

1. Remove the head restraint. Refer to Front Seat Head Restraint Replacement.
2. Release the J strip from the seat back cover bottom.



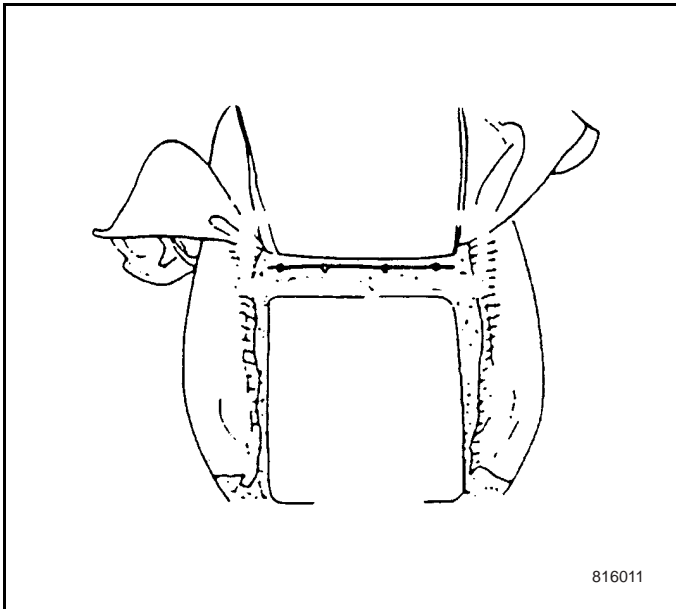
3. Release the buckle securing the seat back cover to the cushion.

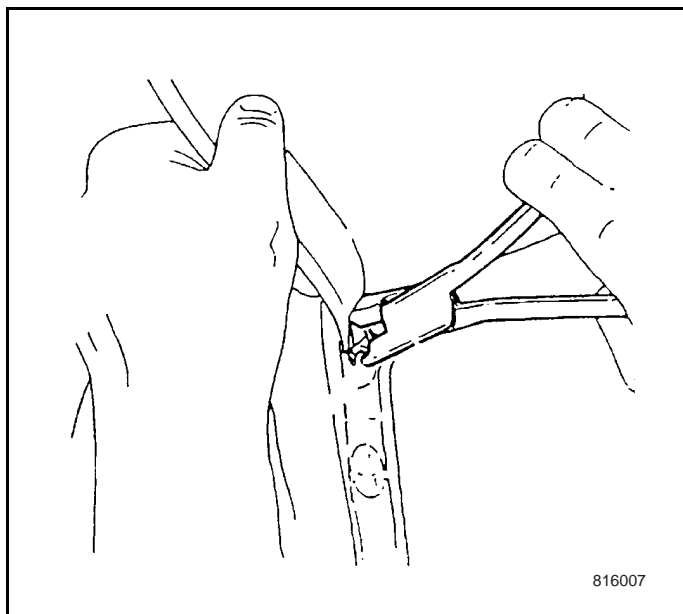


4. Remove the head restraint. Refer to Front Seat Head Restraint Cover Replacement.
5. Pull the seat back cover from the cushion.

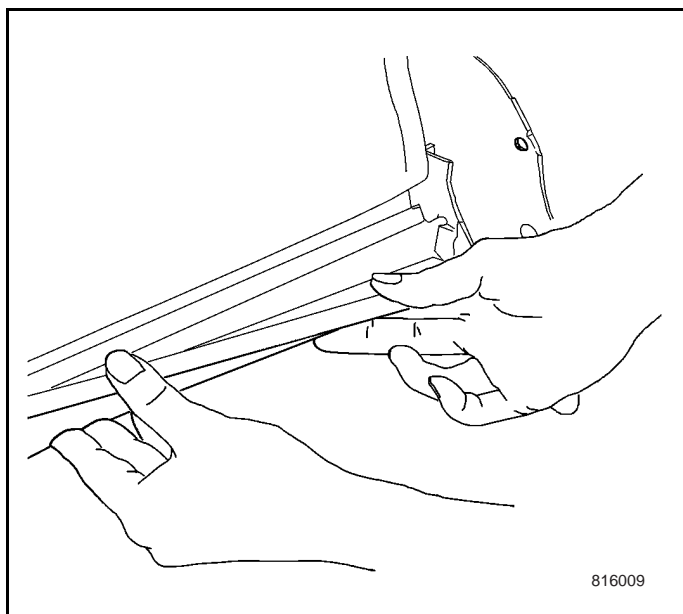
Installation Procedure

1. Cover the seat back cover to the cushion.





2. Tighten the buckle and attach the cover to the seat back cushion wire.
3. Install the head restraint cover. Refer to Front Seat Head Restraint Cover Replacement.

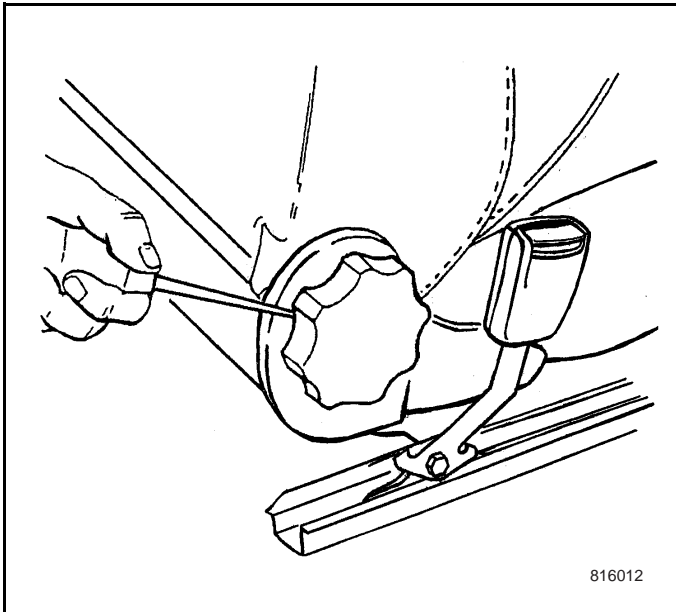


4. Tighten the J strip from the seat back cover bottom.
5. Install the head restraint. Refer to Front Seat Head Restraint Replacement.

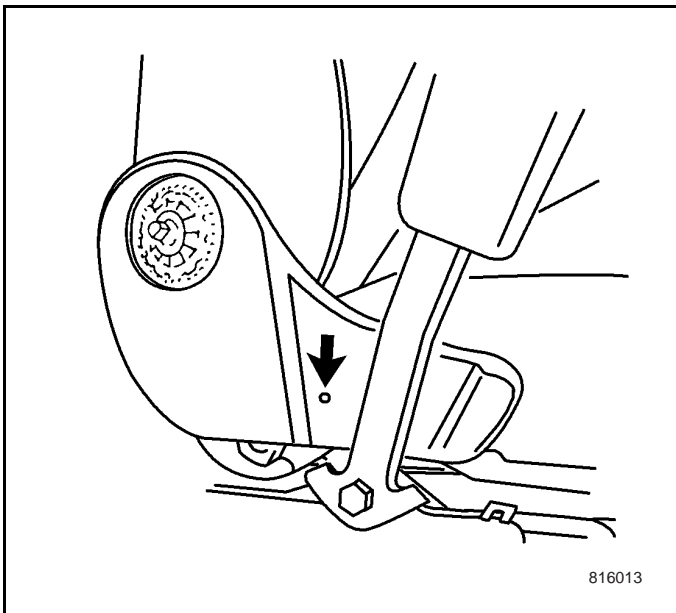
8.16.3.5 Front Seat Back Adjuster Trim Cover Replacement

Removal Procedure

1. Pry out the adjuster handwheel from the adjuster shaft.

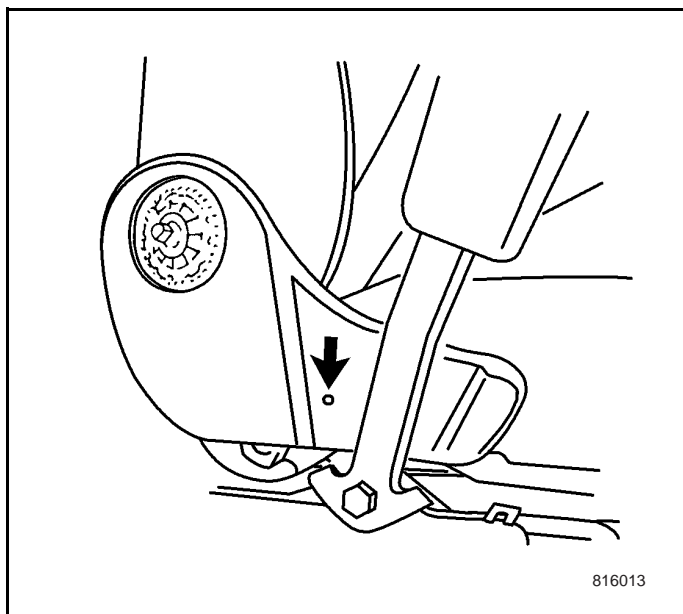


2. Push inward the pin located on both left and right adjuster trim cover, allowing it to be disengaged.
3. Remove the left and the right trim covers.

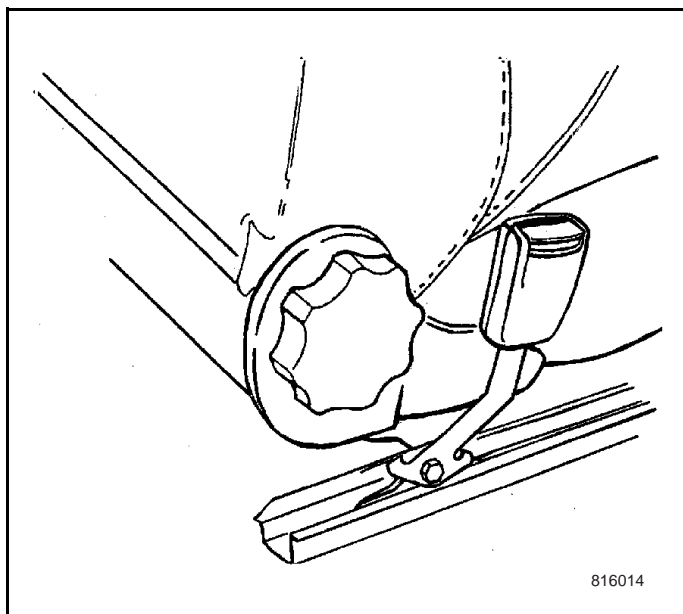


Installation Procedure

1. Install the seat back adjuster trim cover to the front seat.
2. Push the pin on the trim cover to be aligned with the trim cover surface.



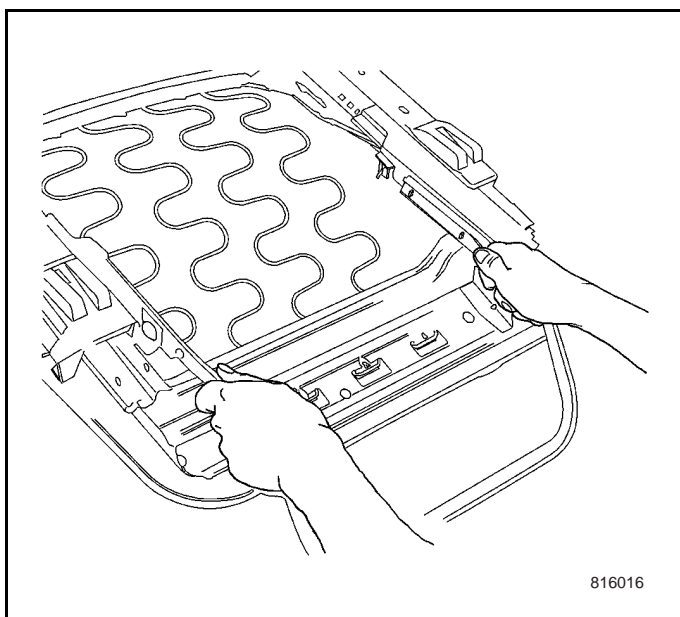
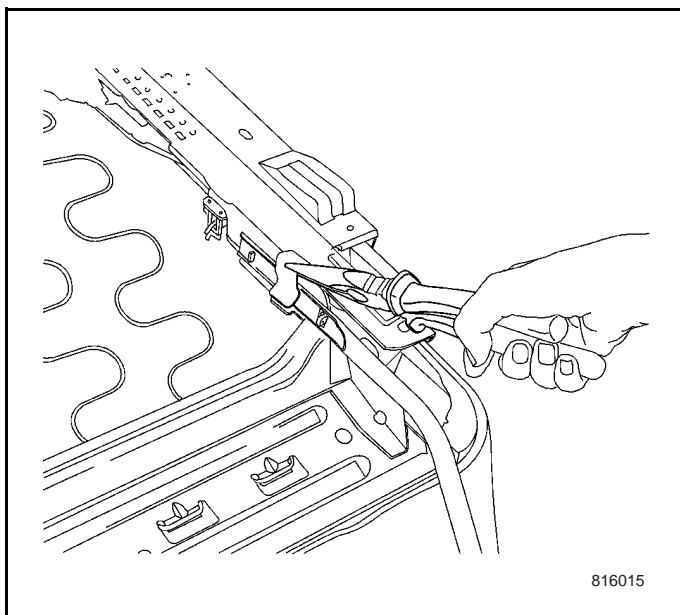
3. Install the adjuster hand wheel to the front seat.



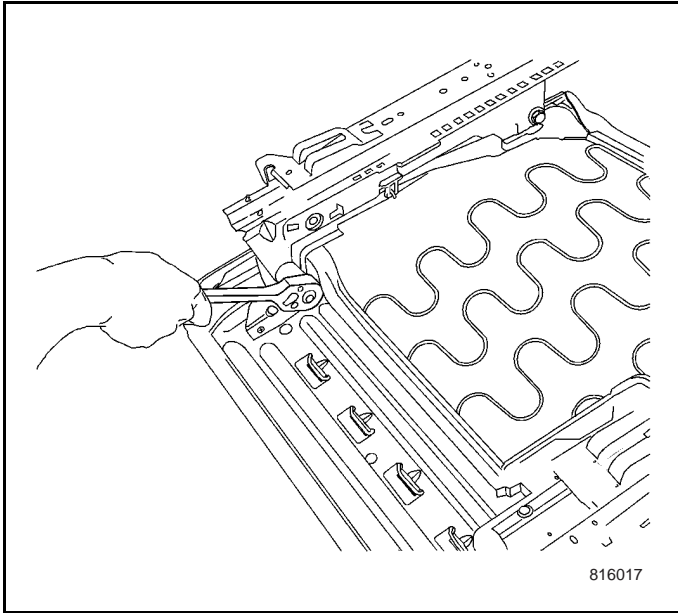
8.16.3.6 Front and rear seat adjuster replacement.

Removal Procedure

1. Remove the front seat from the vehicle. Refer to Front Seat Replacement.
2. Remove the buckle. Refer to Front Safety Belts Buckle Replacement in Safety Belts.
3. Remove the snap spring attaching the pull rod on the seat adjuster.



4. Remove the pull rod from the seat adjuster.



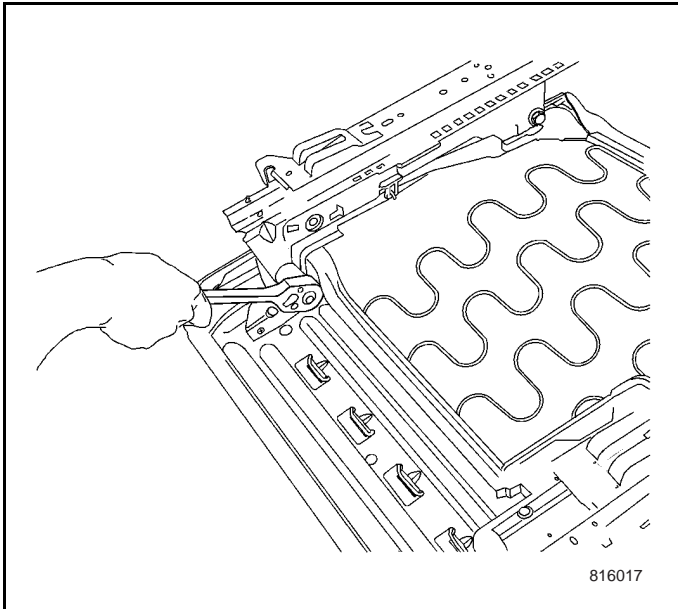
5. Remove the adjuster to the seat cushion frame bolt.
6. Remove the adjuster from the seat cushion frame.

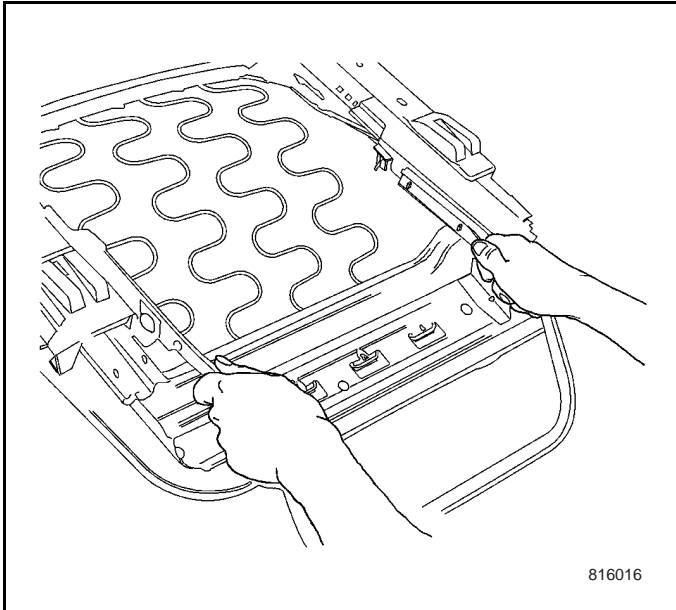
Installation Procedure

1. Install the seat adjuster to the seat.
2. Tighten the adjuster to the seat cushion frame bolts.

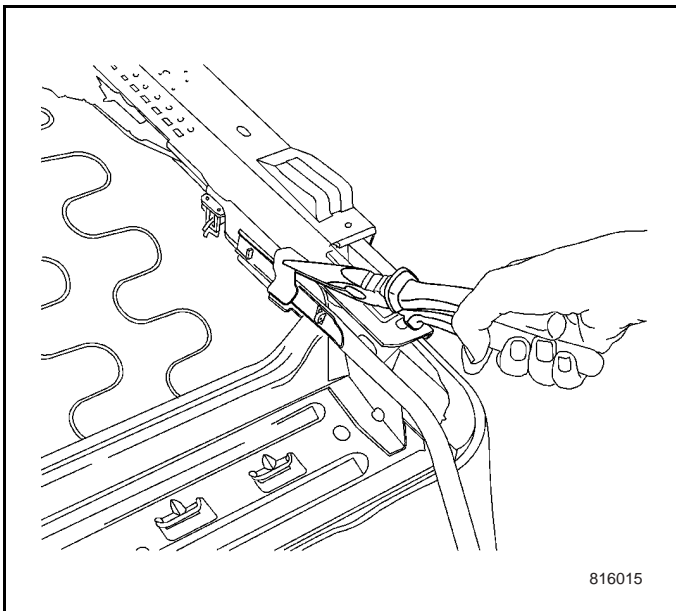
Tighten

Tighten the adjuster to the seat cushion frame bolts to 15-25 N•m.





3. Install the pull rod of the seat adjuster.

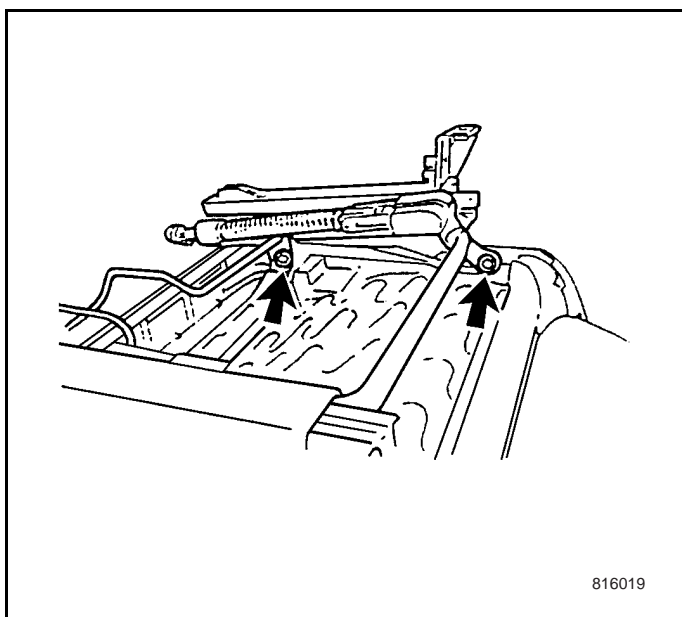
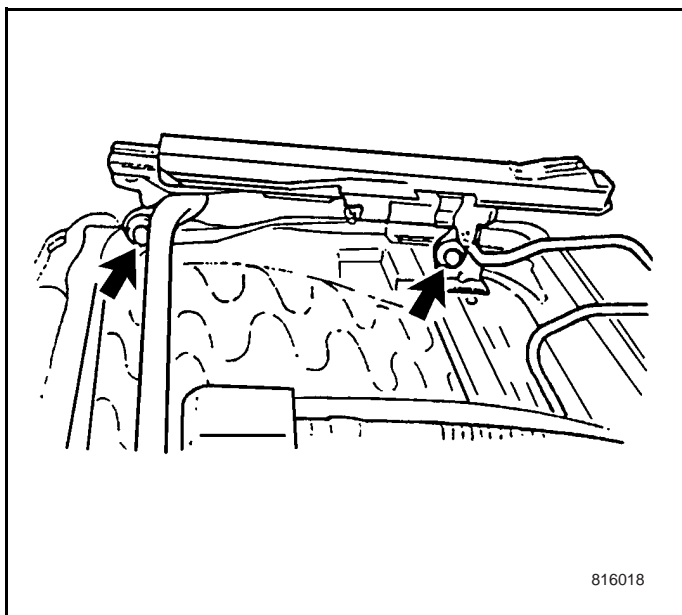


4. Install the snap spring securing the pull rod to the seat adjuster.
5. Install the buckle. Refer to Front Safety Belts Buckle Replacement in Safety Belts.
6. Install the front seat. Refer to Front Seat Replacement.

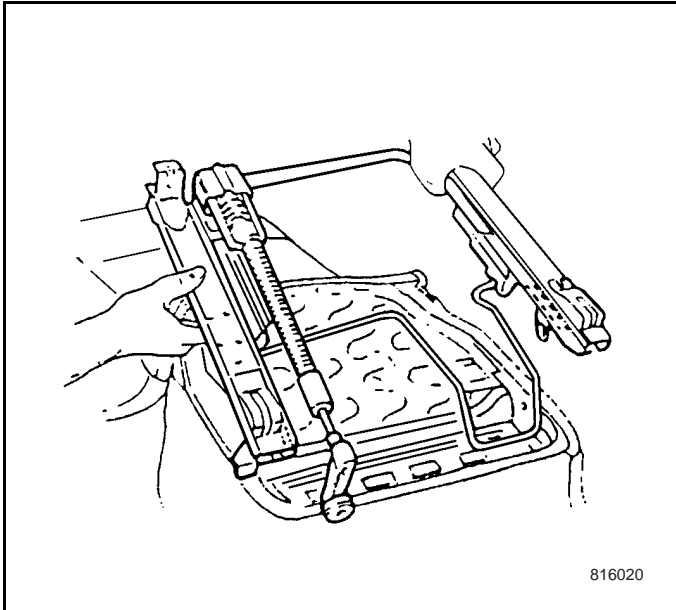
8.16.3.7 Seat Height Adjuster Replacement

Removal Procedure

1. Remove the front seat from the vehicle. Refer to Front Seat Replacement.
2. Remove the safety belt buckle. Refer to Front Safety Belts Buckle Replacement in Safety Belts.



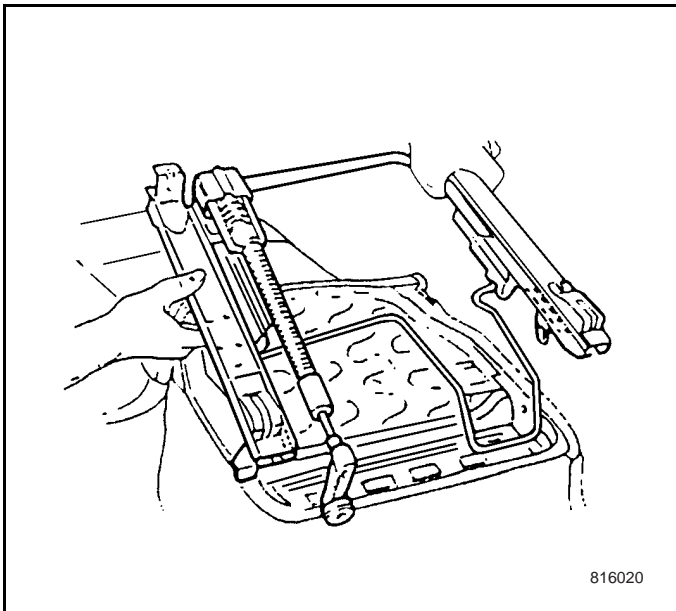
3. Remove the height adjuster to the seat cushion frame bolts.

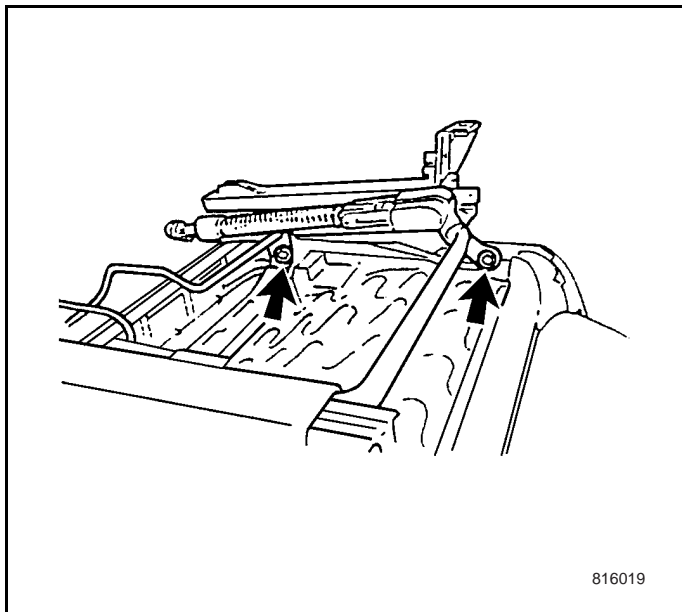


4. Remove the height adjuster from the seat cushion frame.

Installation Procedure

1. Install the height adjuster to the seat cushion frame.

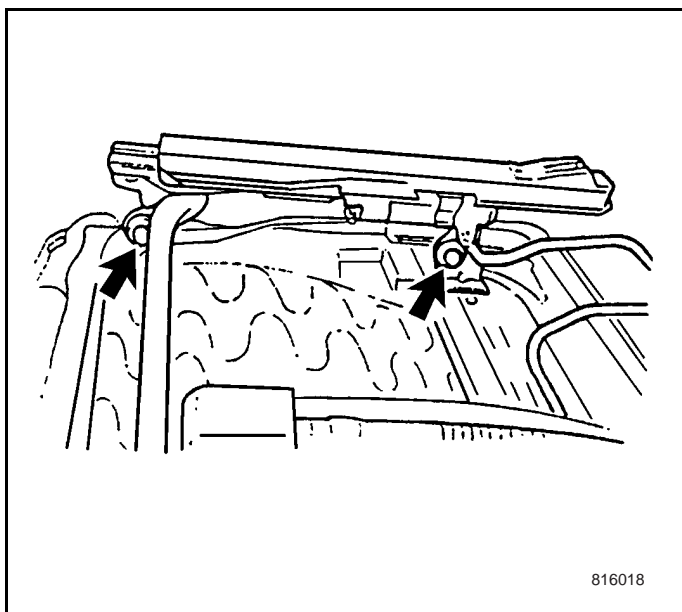




2. Tighten the height adjuster to the seat cushion frame bolts.

Tighten

Tighten the height adjuster to the seat cushion frame bolts to 15-25N•m.

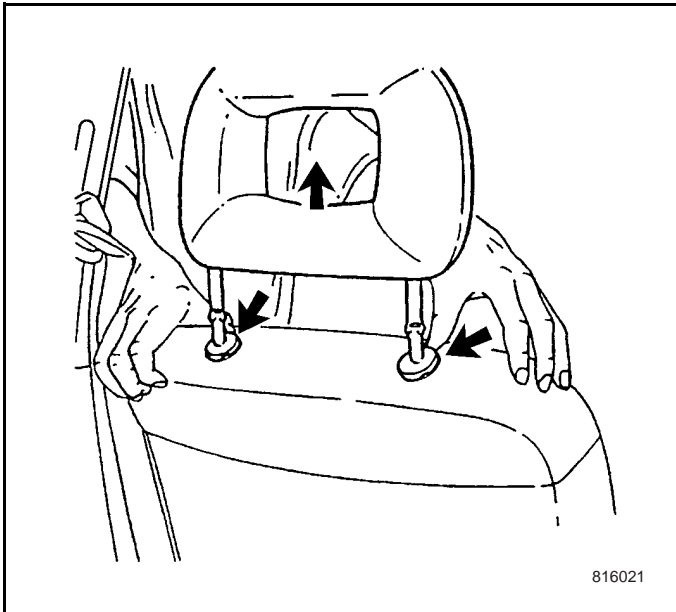


3. Install the safety belt buckle. Refer to Front Safety Belts Buckle Replacement in Safety Belts.
4. Install the front seat to the original position. Refer to Front Seat Replacement.

8.16.3.8 Front Seat Head Restraint Replacement

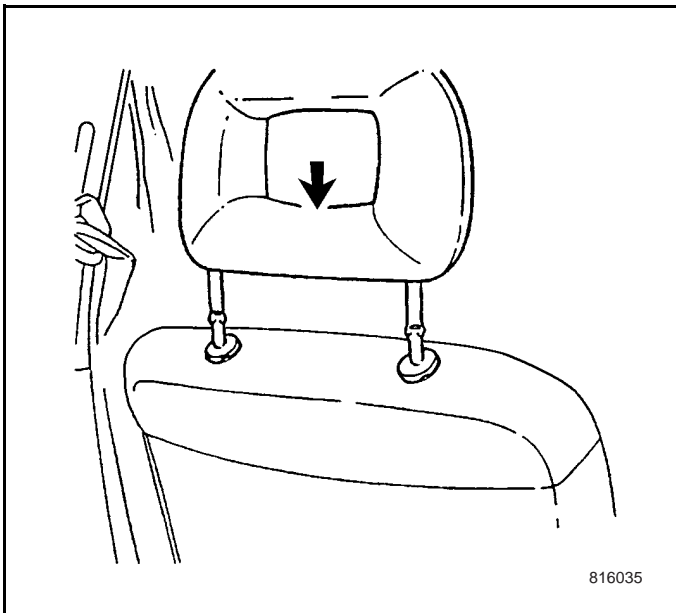
Removal Procedure

1. Elevate the head restraint to the highest position.
2. Press down the button on the head restraint cover, and release the lock spring.
3. Remove the head restraint from the seat back.



Installation Procedure

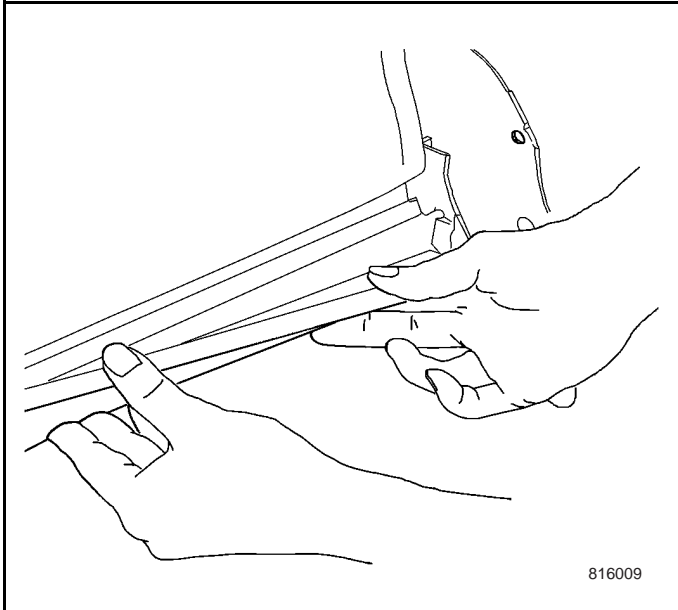
1. Place the head restraint on the seat back.
2. Press the head restraint downward as far as it will go.
3. Raise the head restraint to ensure it is locked at the bayonet.
4. Return the head restraint to the original position.



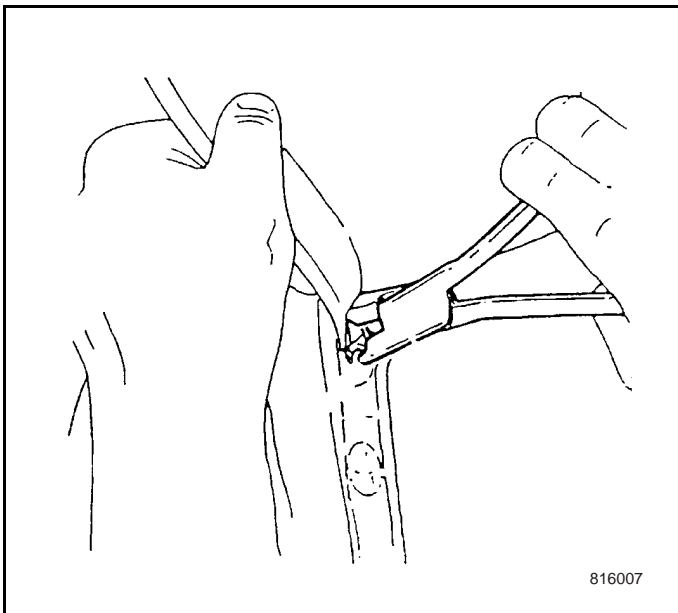
8.16.3.9 Front Seat Head Restraint Cover Replacement

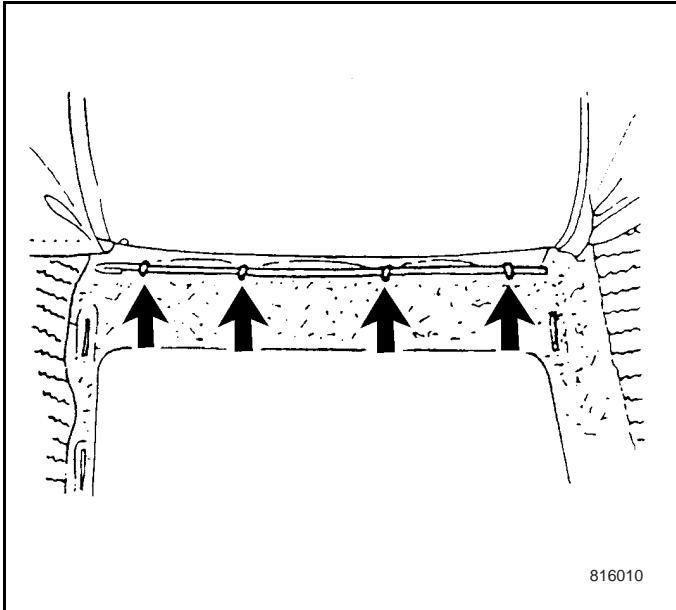
Removal Procedure

1. Remove the head restraint. Refer to Front Seat Head Restraint Replacement.
2. Remove the front seat back. Refer to Front Seat Back Replacement.
3. Take off the J strip from the seat back cover bottom.

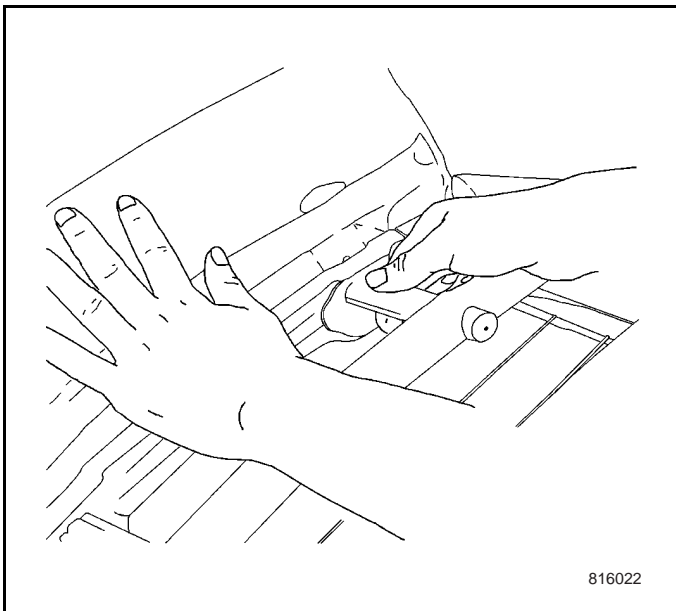


4. Remove the buckle securing the back cover to the cushion wire.





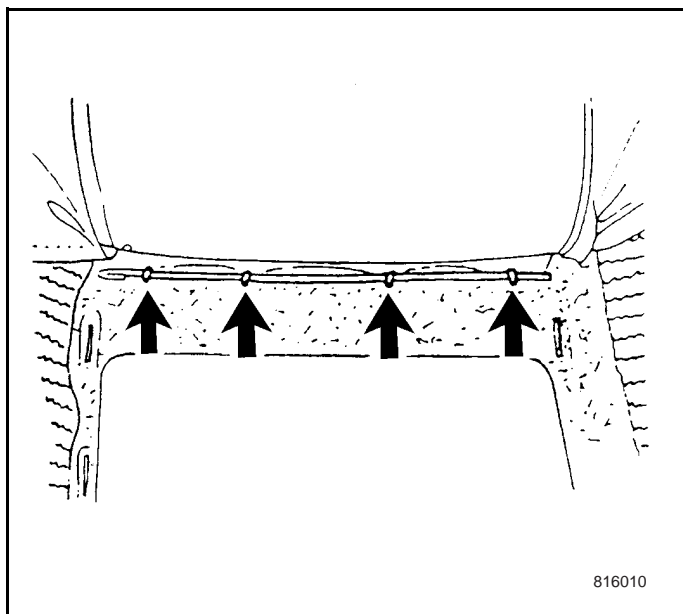
5. Remove the seat back cover to the hanging steel wire buckle.



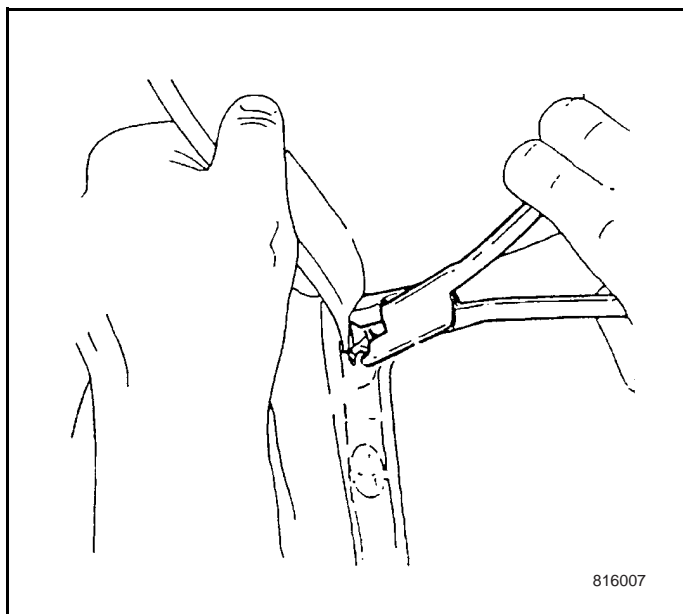
6. Turn upward the front seat back cover to allow your hand to contact the head restraint cover.
7. Squeeze both barbs of the cover and pull upward the cover from the seat back.

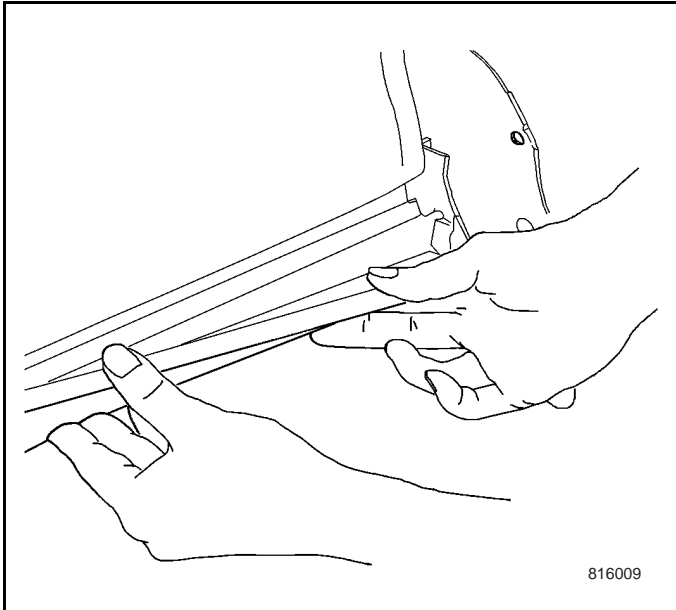
Installation Procedure

1. Tighten the seat back cover to the hanging steel wire buckle.

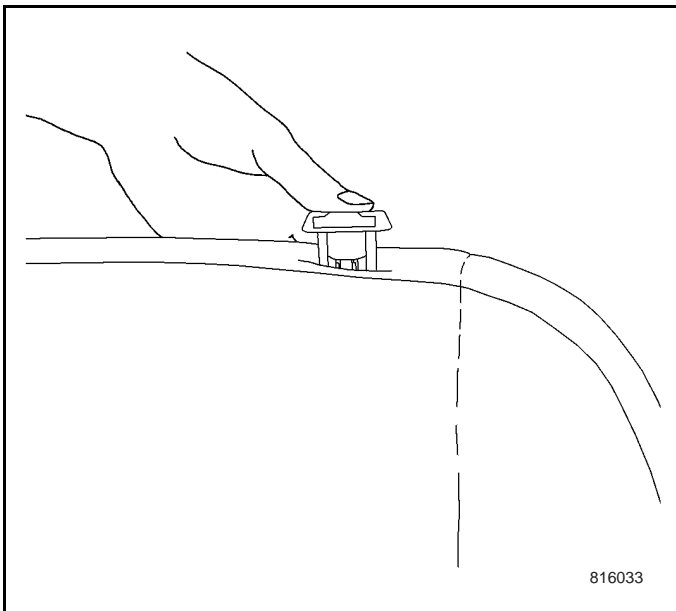


2. Tighten the seat cushion cover to the seat cushion steel wire buckle.





3. Tighten the J strip located at the seat back cover bottom.

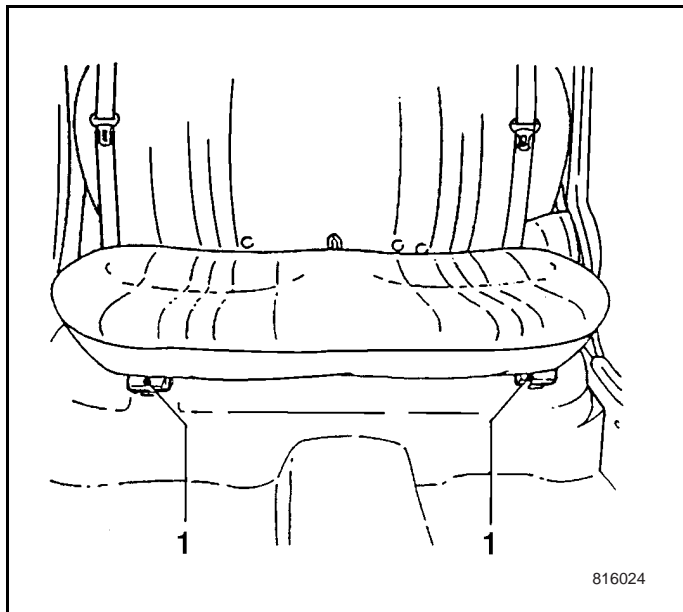


4. Press down the cover firmly, allowing it to be locked between the seat back cushion and frame.
5. Install the head restraint. Refer to Front Seat Head Restraint Replacement.

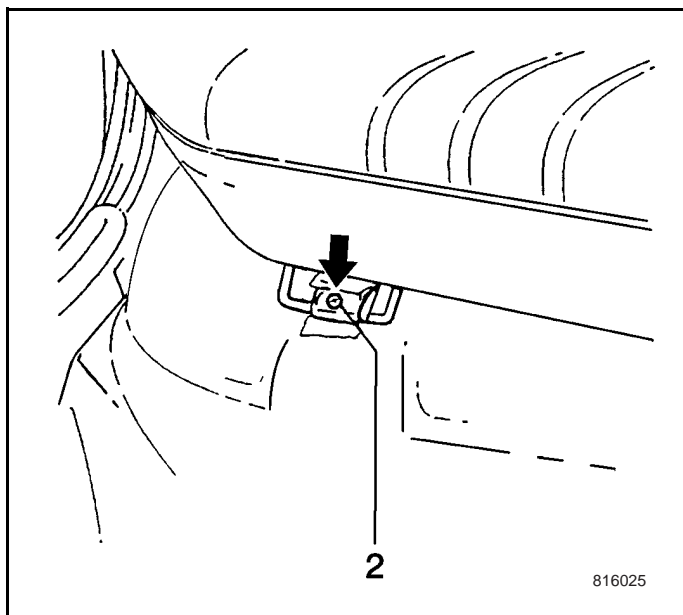
8.16.3.10 Seat Replacement - Rear

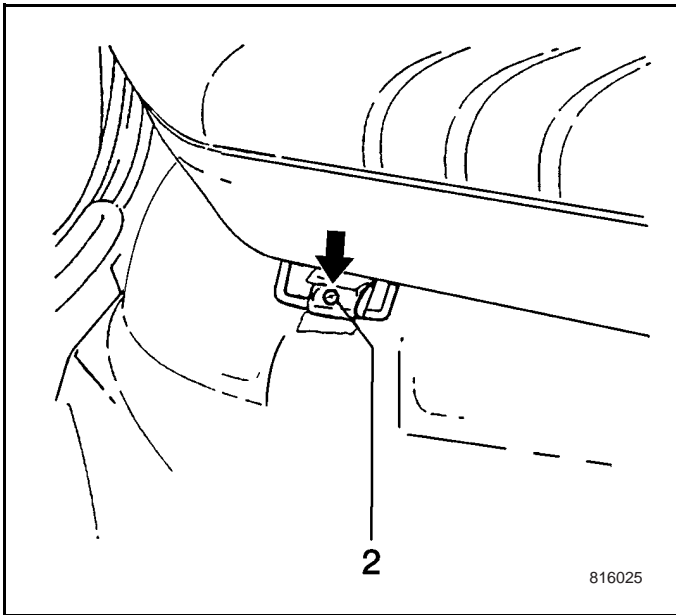
Removal Procedure

1. Take off the front end trim cover of the seat cushion frame (1).



2. Remove the cushion screw (2).
3. Pull the cushion from the floor panel support.





Installation Procedure

1. Move the seat to the original position.
2. Slide the seat cushion frame into the floor panel support.
3. Install the seat cushion screws.

Tighten

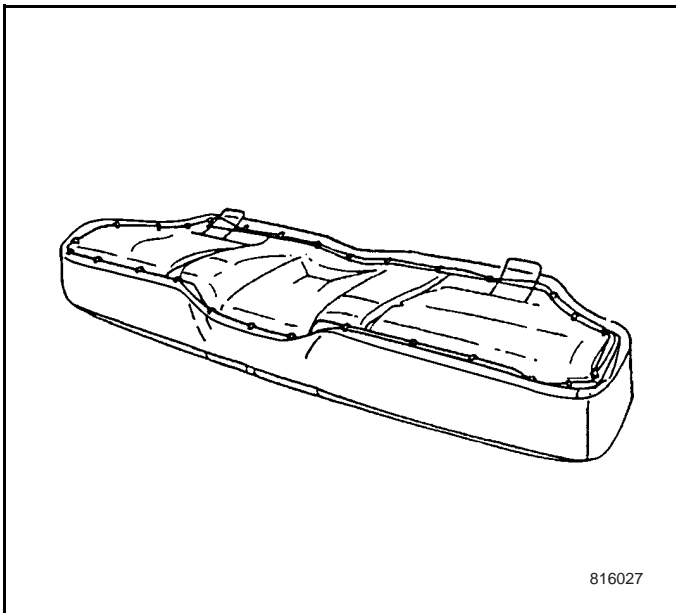
Tighten the seat cushion to 4-5 N•m.

4. Install the front end trim cover of the seat cushion frame (1).

8.16.3.11 Seat Cushion Cover Replacement - Rear

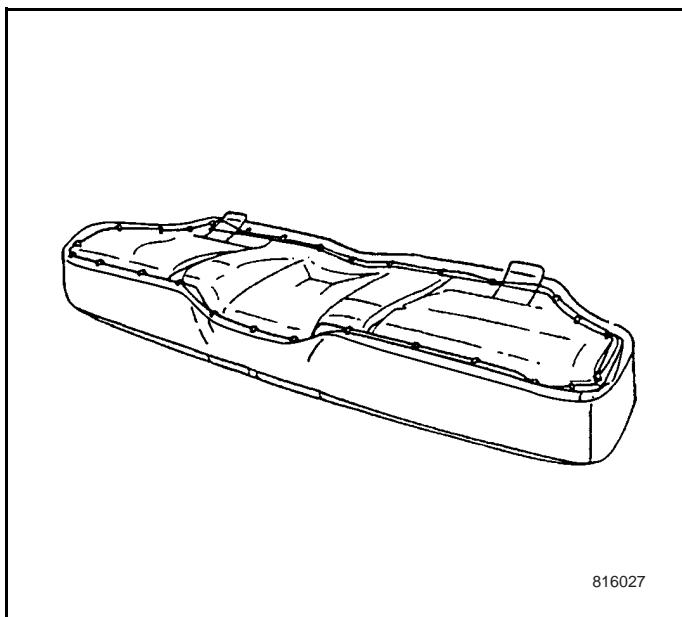
Removal Procedure

1. Remove the rear seat cushion. Refer to Rear Seat Cushion Replacement.
2. Remove the buckle from the seat cushion cover.
3. Remove the seat cushion cover from the foam pad.



Installation Procedure

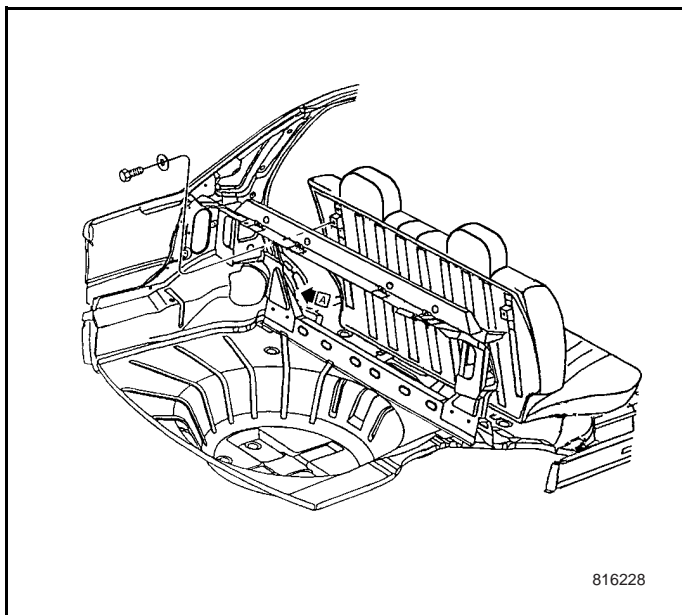
1. Return the seat cushion cover to foam pad.
2. Secure the seat cushion cover with the buckle.
3. Install the cushion. Refer to Rear Seat Cushion Replacement.

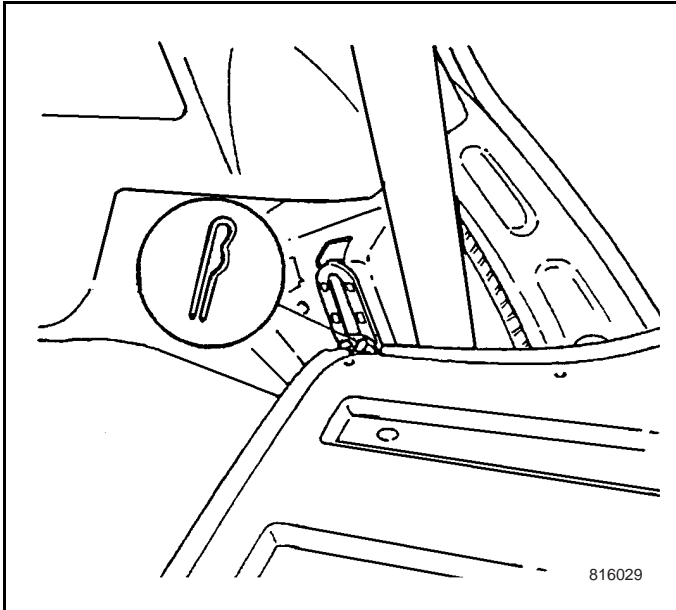


8.16.3.12A Seat Back Replacement - Rear

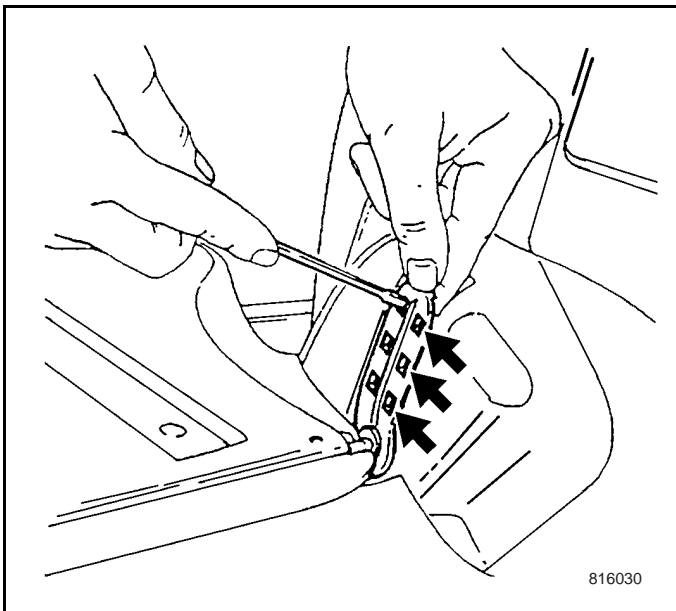
Removal Procedure

1. Remove the liner of the rear seat back. Refer to Rear Seat Back Decorative blanket Replacement in Body Rear End.
2. Remove the screws from the rear seat back.





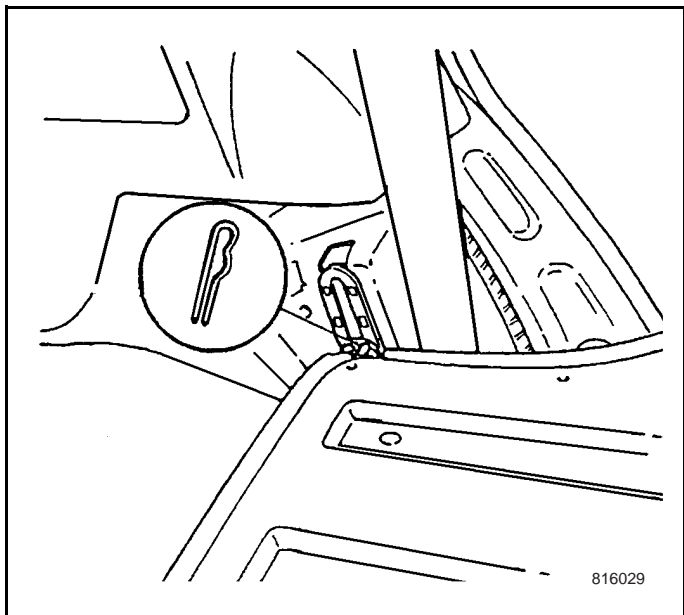
3. Remove the seat back side clamp.



4. Use a screw driver to remove the seat back attaching track.
5. Remove the seat back from the vehicle.

Installation Procedure

1. Return the seat back to the original position.
2. Install the seat back retaining track.
3. Install the side clamp.

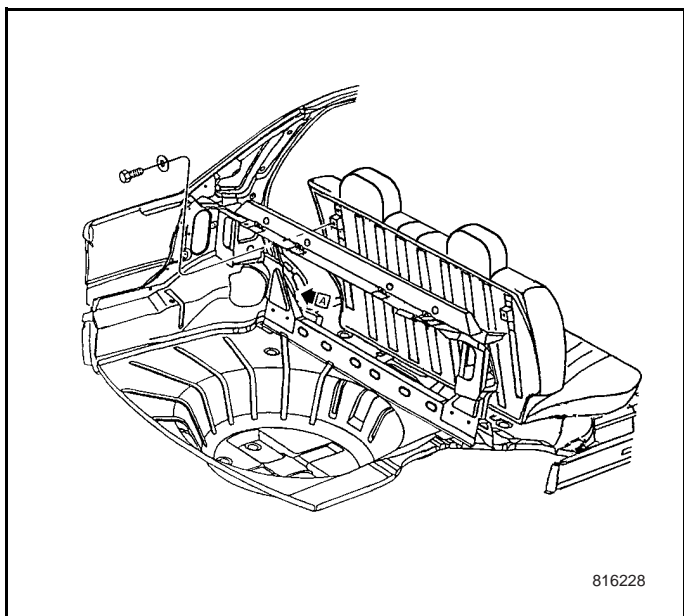


4. Install the screws to the rear seat back.

Tighten

Tighten the rear seat back screw to 10-22 N•m.

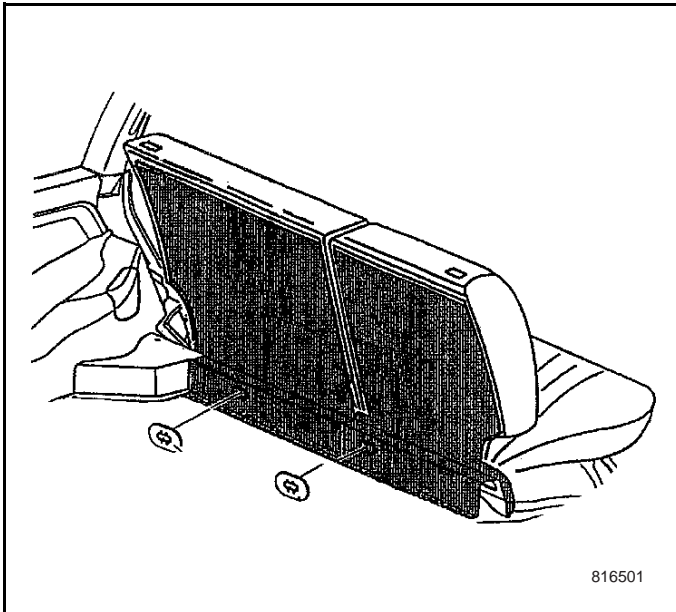
5. Install the trims to the rear seat back pad.



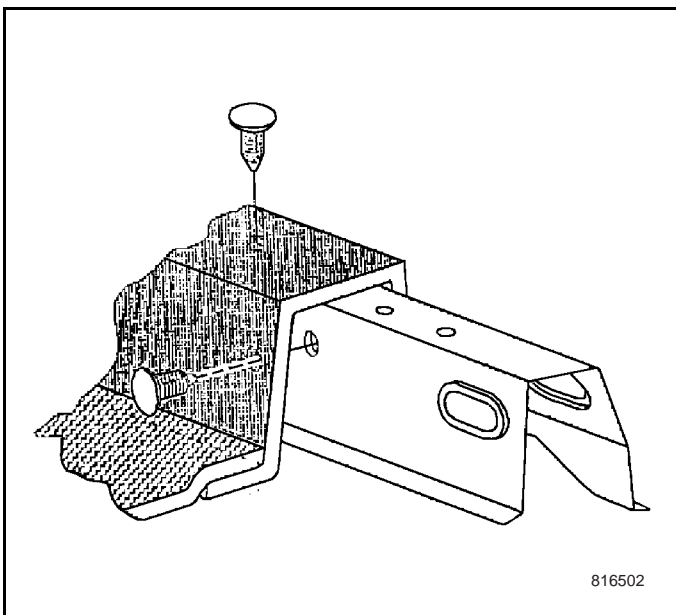
8.16.3.12B Seat Back Replacement - Rear

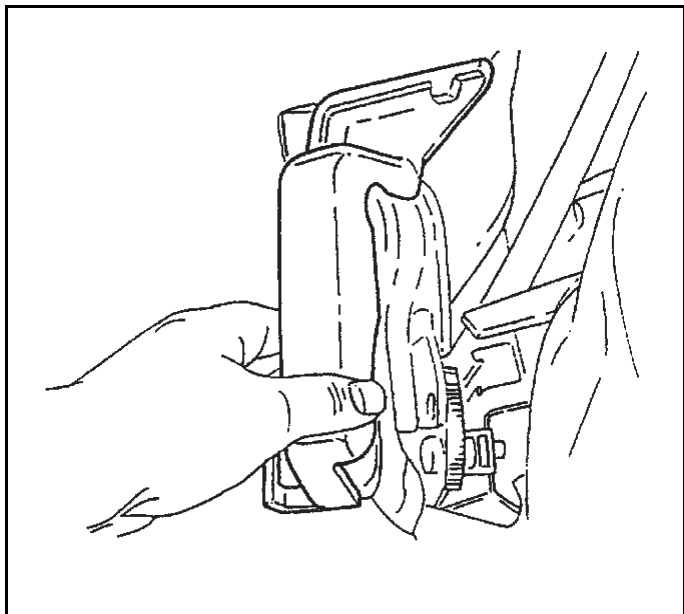
Removal Procedure

1. Remove the oval seat ring.

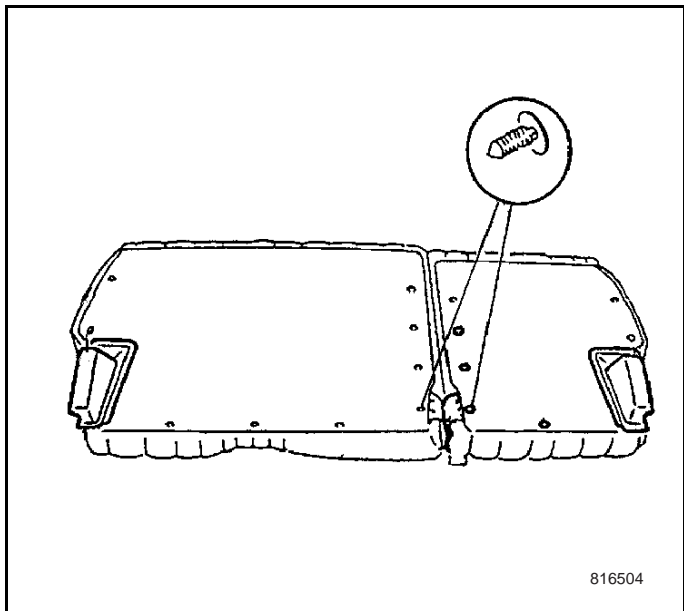


2. Remove the protective rings attaching the seat back carpet to the floor.

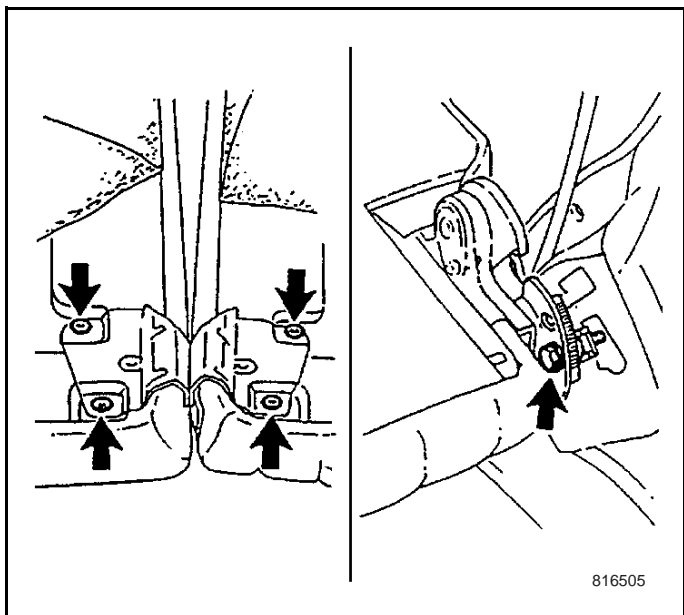




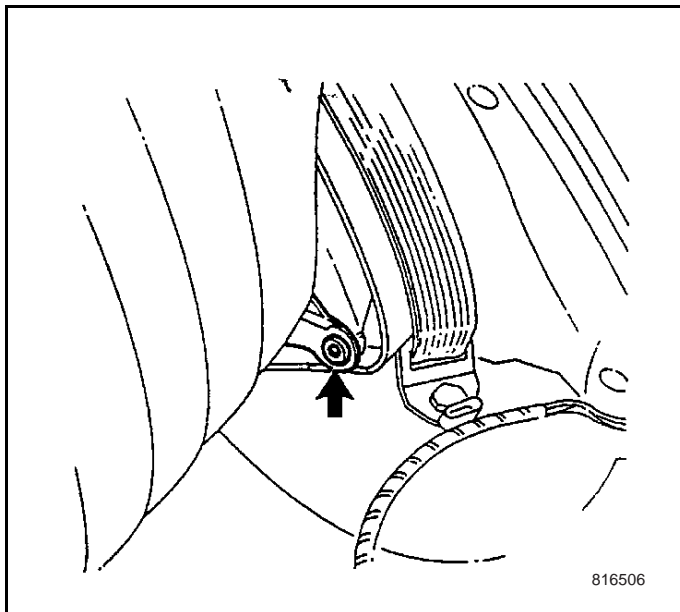
3. Push the pin on the hinge cover into the seat back frame.
4. Remove the hinge cover.



5. Remove both protective rings from the central bracket.



6. Remove the carpet of the central bracket area.
7. Remove the central bracket to the seat back bolts.
8. Remove bolts at the rear of seat back attaching the seat back hinge to the cab.



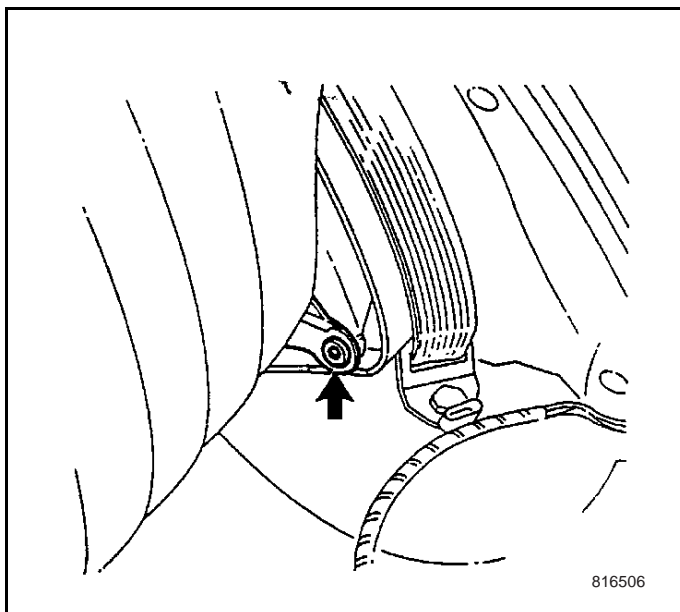
9. Turn up a bit forward the seat back, and remove the bolts at the front of the seat back attaching the seat hinge to the cab.
10. Remove the seat back.

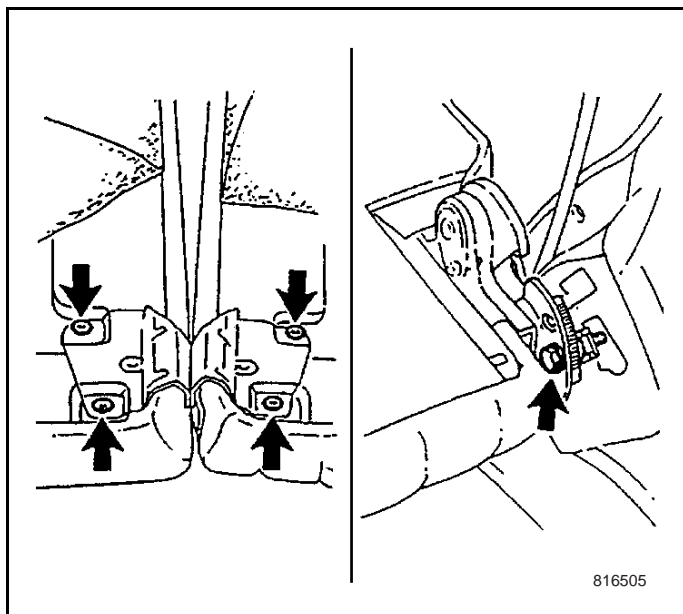
Installation Procedure

1. Return the seat back to the original position.
2. Install bolts at the front of the seat back attaching the seat back hinge to the cab.

Tighten

Tighten the seat back hinge to the cab bolts to 18-22 N•m.





3. Install bolts at the rear of the seat back attaching the seat back hinge to the cab.

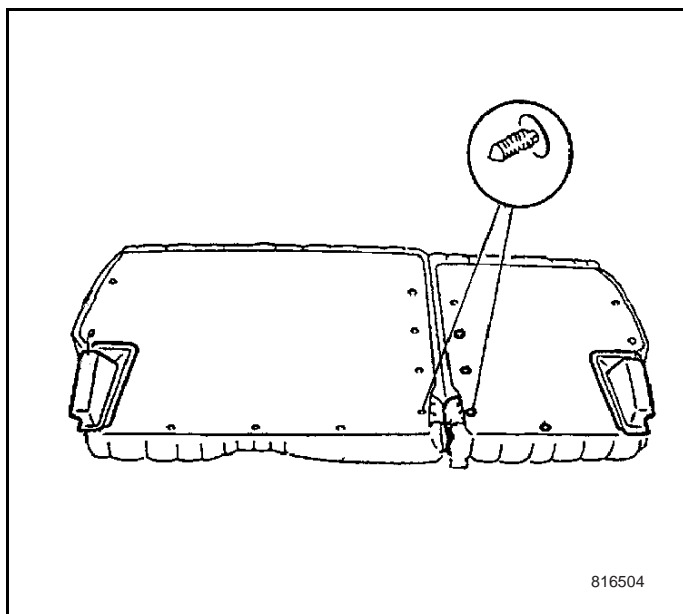
Tighten

Tighten the rear seat back hinge to the cab bolts to 18-22 N•m.

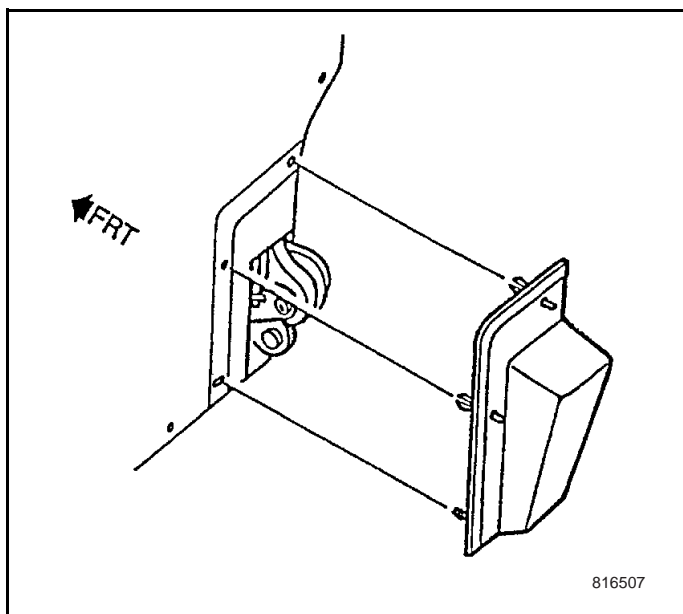
4. Install the bolts attaching the central bracket to the seat back.

Tighten

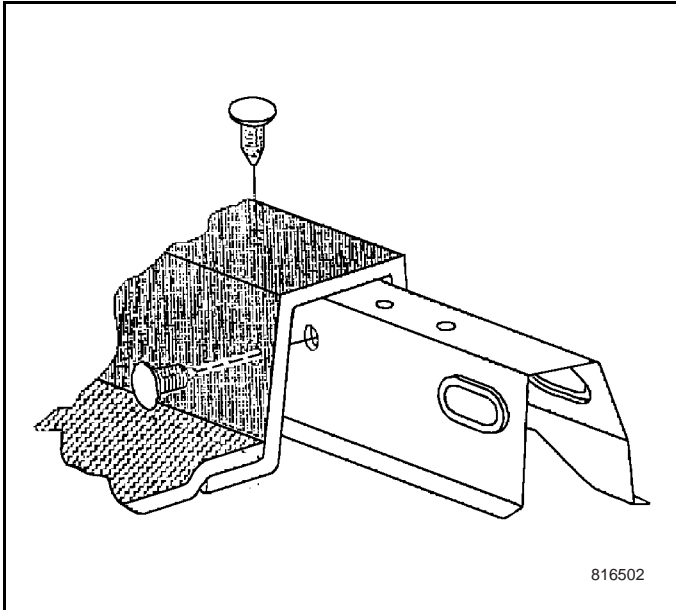
Install the bolts attaching the central bracket to the seat back to 18-22 N•m.



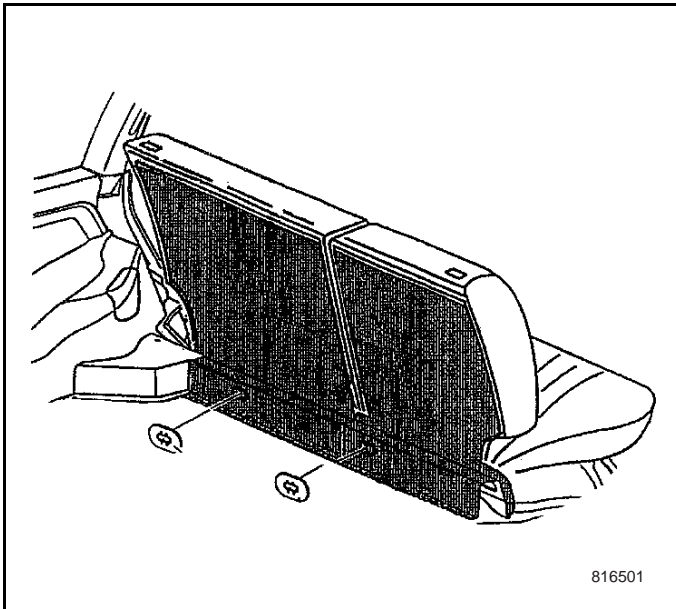
5. Install 2 protective rings to the central bracket to secure the carpet.



6. Install the hinge cover to the hinge. Insert the 2 pins into the hinge cover.



7. Install the protective rings to secure the seat back cover and the floor.

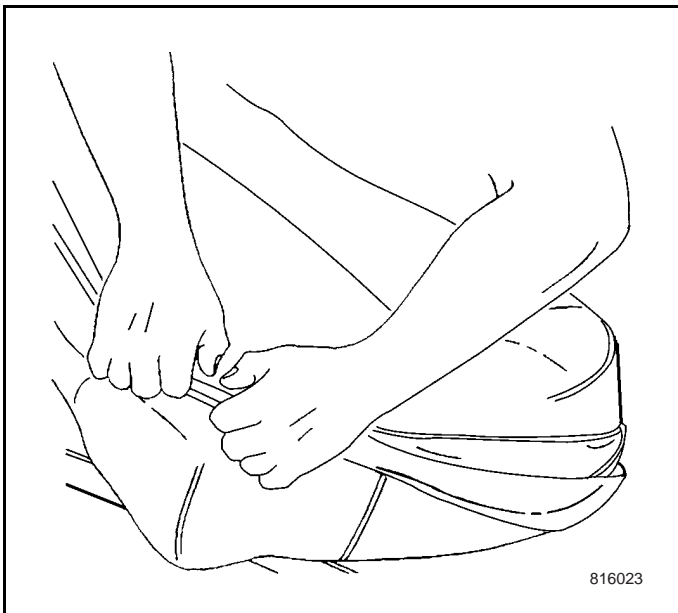
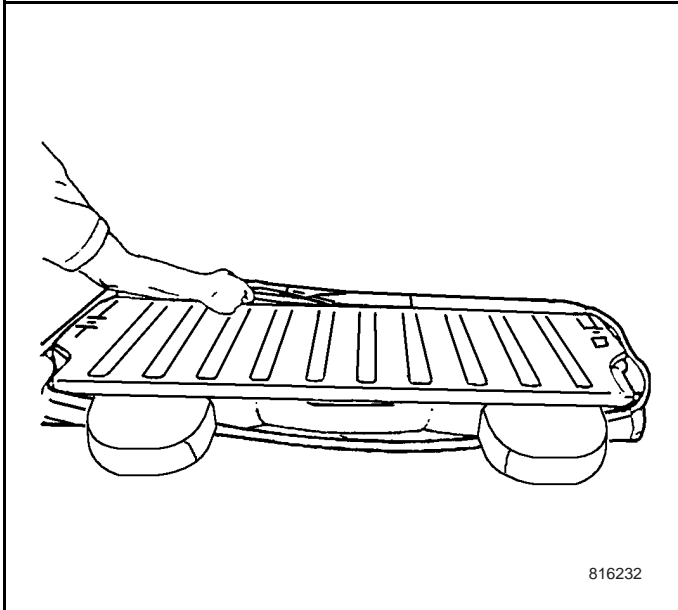


8. Install the oval protective ring.

8.16.3.13A Seat Back Cover Replacement - Rear

Removal Procedure

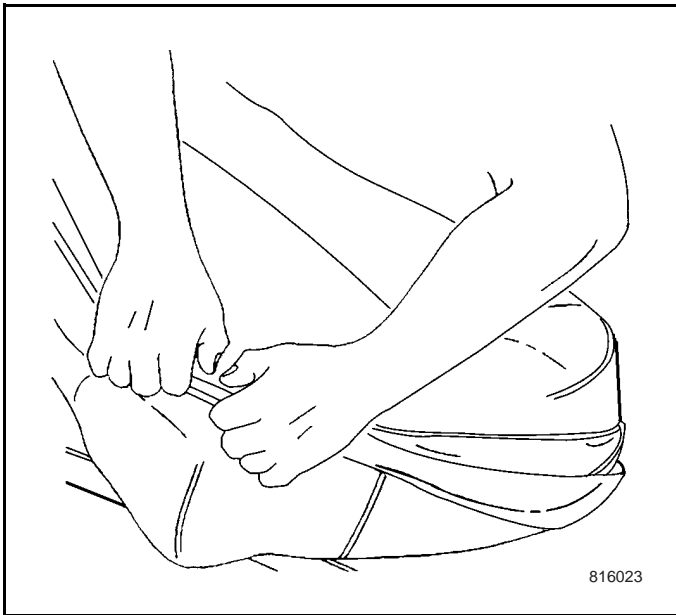
1. Remove the seat back. Refer to Rear Seat Back Replacement.
2. Release the J retainer from the seat back cover perimeter.



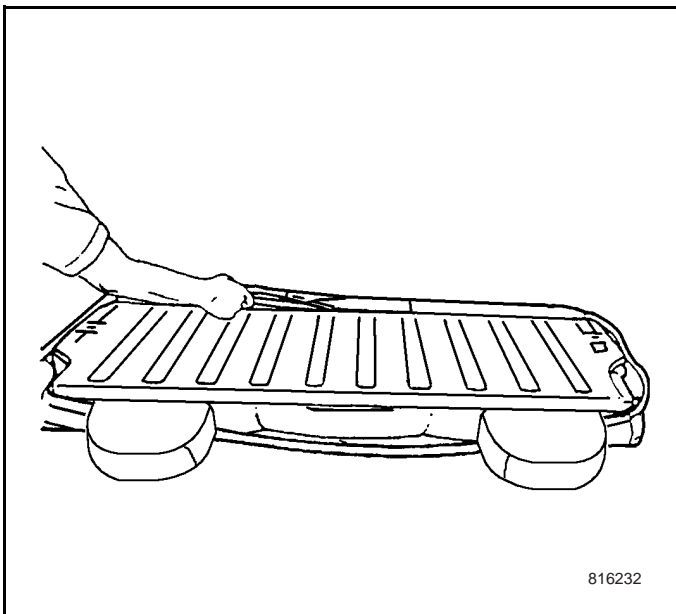
3. Remove the buckle from the seat back cover.
4. Remove the seat back cover from the foam pad.

Installation Procedure

1. Return the seat back cover to the foam pad.
2. Secure the seat back cover with the buckle.



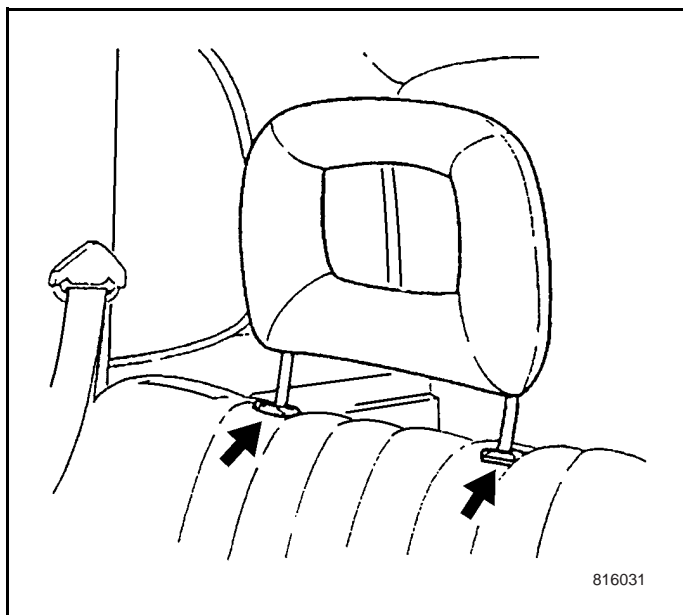
3. Secure the J retainer from the seat back cover perimeter to the back.
4. Install the seat back. Refer to Rear Seat Back Replacement.



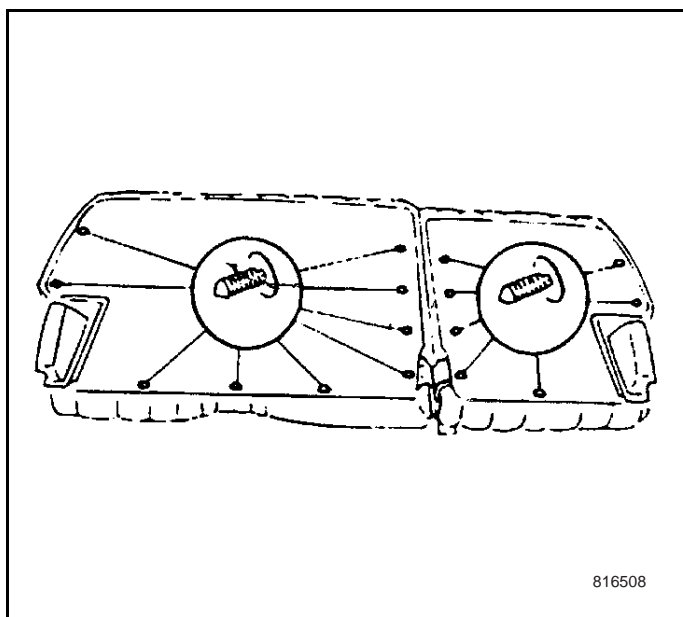
8.16.3.13B Seat Back Cover Replacement - Rear

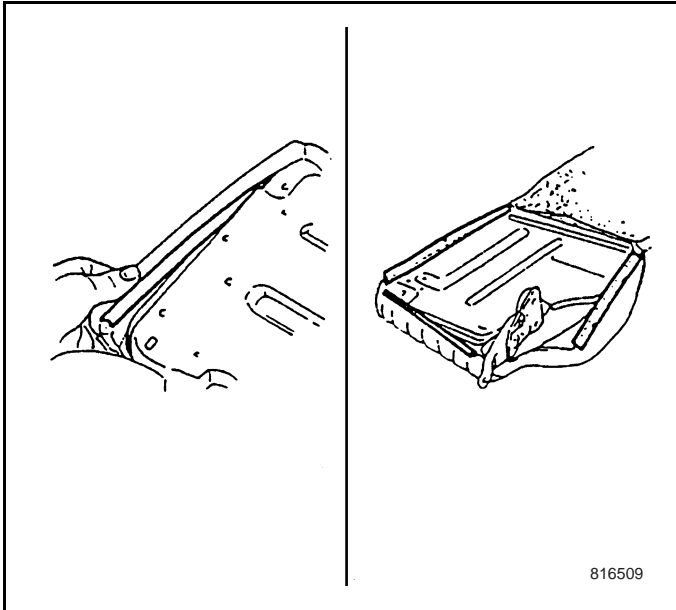
Removal Procedure

1. Remove the rear seat head restraint (if equipped). Refer to Seat Head Restraint Replacement - Rear.

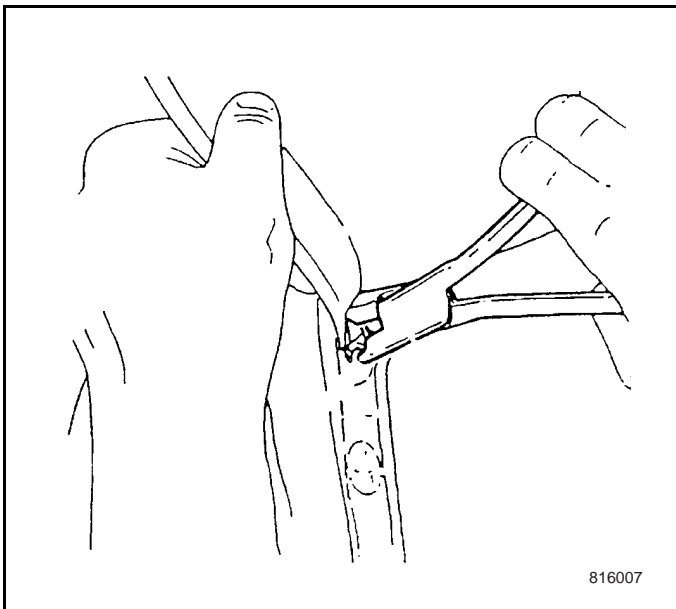


2. Remove the seat back. Refer to Rear Seat Back Replacement.
3. Remove the protective ring attaching the seat back carpet to the seat back frame.

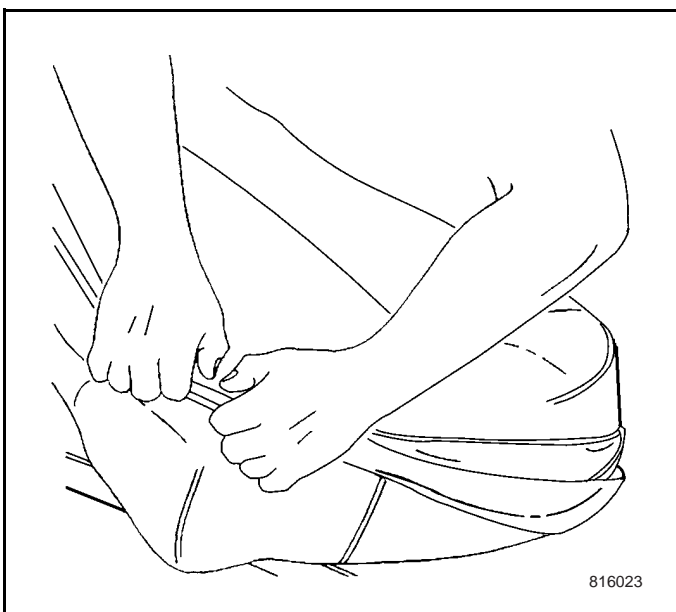




4. Remove the floor carpet.
5. Release the protective ring from the seat back cover perimeter.



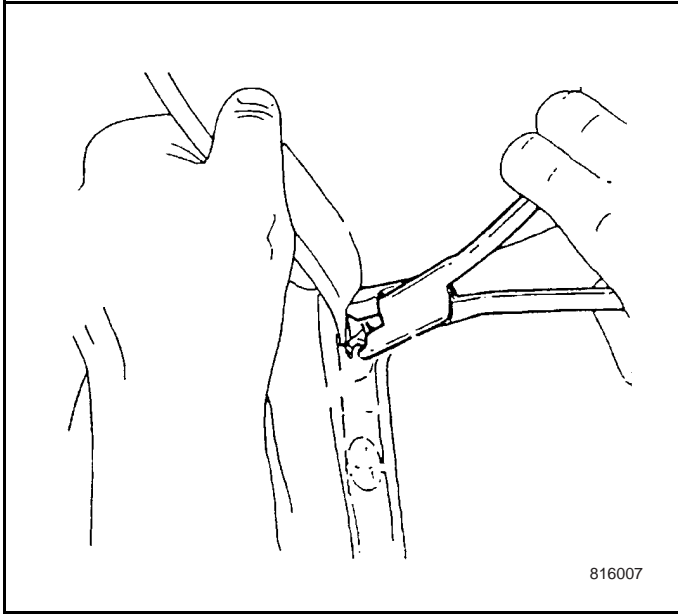
6. Remove the head restraint cover (if equipped).
7. Refer to Seat Head Restraint Cover Replacement - Rear.
8. Remove the seat back adjuster button. Refer to Seat Back Adjuster Trim Cover Replacement - Rear.
9. Remove the seat back cove and foam pad from the seat back.
10. Remove the buckle.



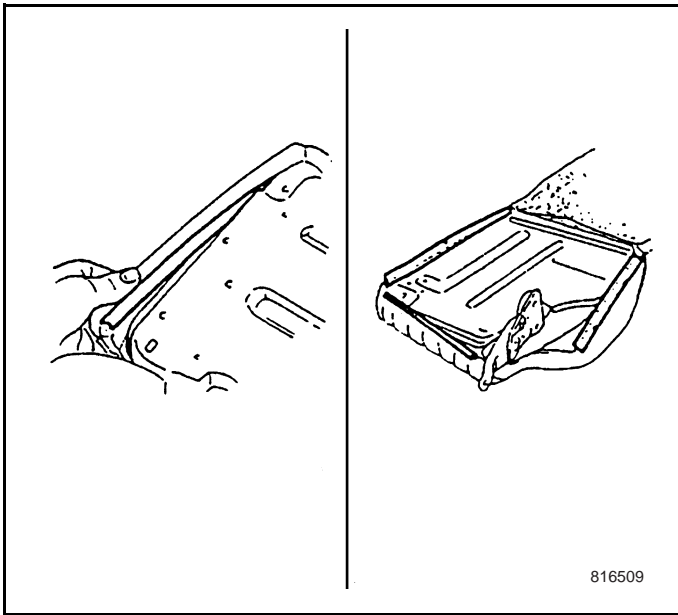
11. Remove the cover from the foam pad.

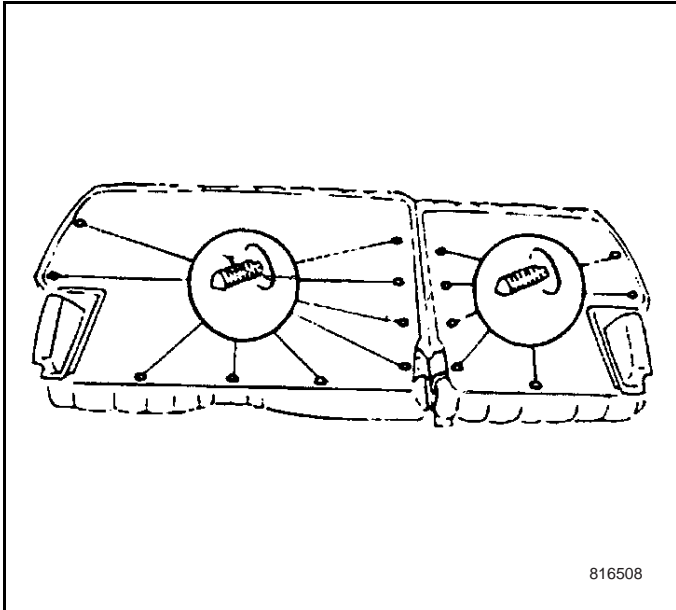
Installation Procedure

1. Return the seat back cover to the foam pad.
2. Install the buckle to secure the cover and cushion.



3. Install the seat back adjuster button to the front seat. Refer to Seat Back Adjuster Button Replacement.
4. Secure the stop bar on the seat back cover perimeter.
5. Position the floor carpet on the seat back frame.



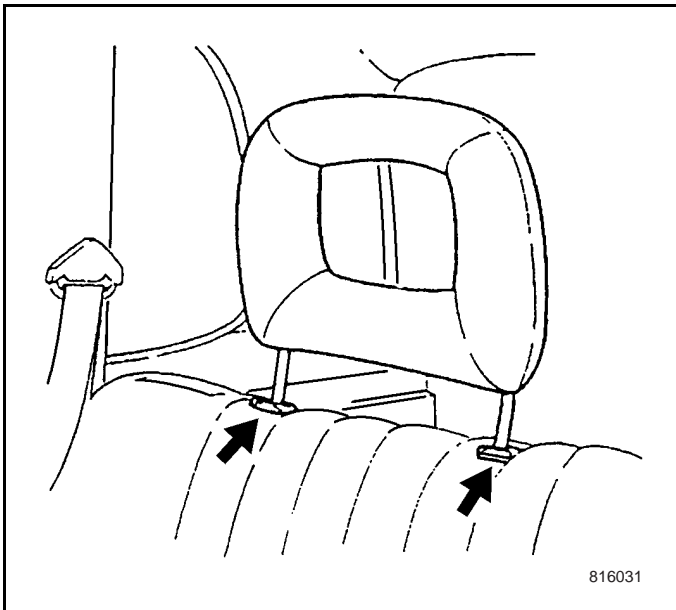


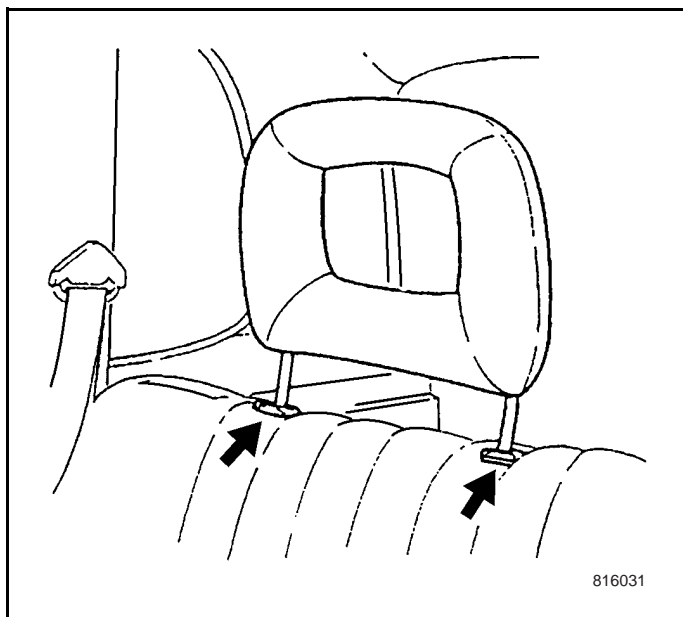
6. Install the protective ring attaching the seat back carpet to the seat back frame.
7. Install the head restraint cover (if equipped). Refer to Seat Head Restraint Cover Replacement - Rear.
8. Install the seat back. Refer to Rear Seat Back Replacement.
9. Install the head restraint (if equipped). Refer to Seat Head Restraint Replacement - Rear.

8.16.3.14B Seat Back Replacement - Rear

Removal Procedure

1. Elevate the head restraint to the highest position.
2. Press the lock pin of the head restraint cover to release the cover.
3. Remove the head restraint from the seat back.





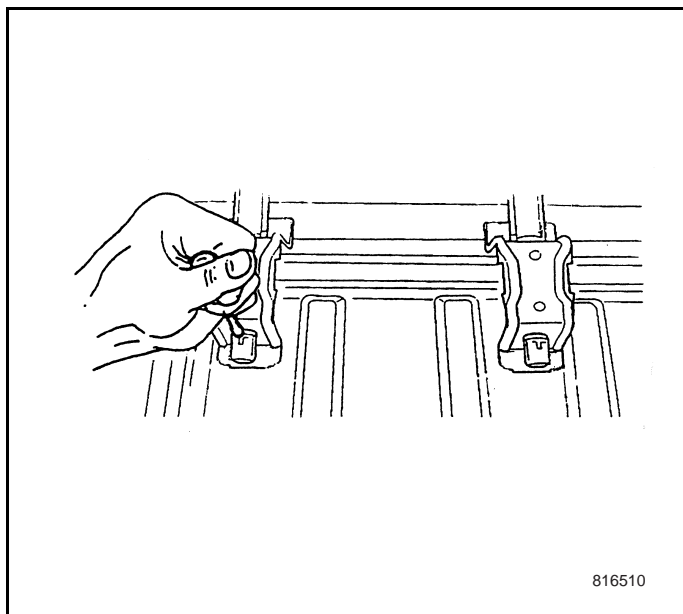
Installation Procedure

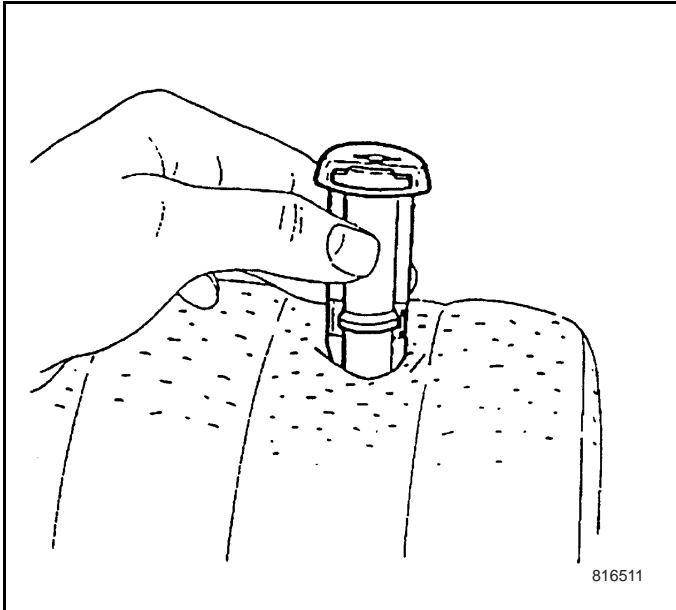
1. Position the head restraint on the head restraint cover.
2. Press the head restraint downward as far as it will go.
3. Raise the head restraint to ensure it can be stopped at the detent.
4. Return the head restraint to the original position.

8.16.3.15B Seat Back Replacement-Rear

Removal Procedure

1. Remove the head restraint. Refer to Seat Head Restraint Replacement-Rear.
2. Remove the rear seat back. Refer to Rear Seat Back Replacement.
3. Remove the seat back carpet. Release the stop bar on the seat back cover perimeter. Refer to Rear Seat Back Replacement.
4. Press the head restraint cover stopper.

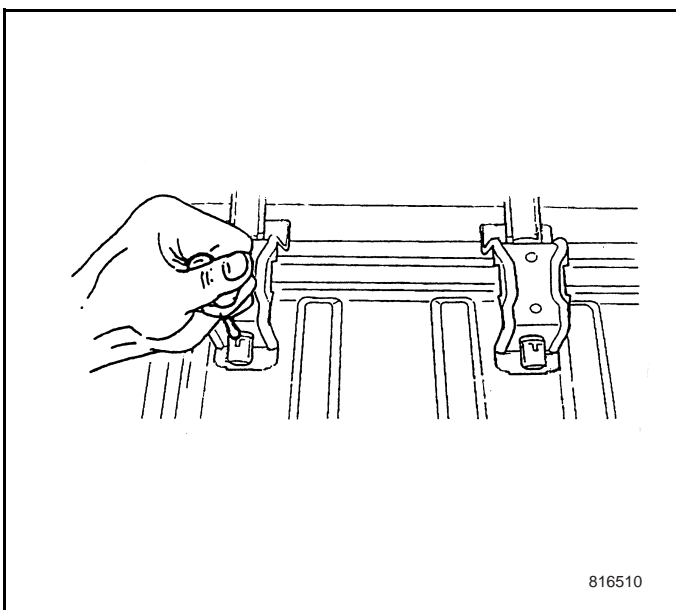
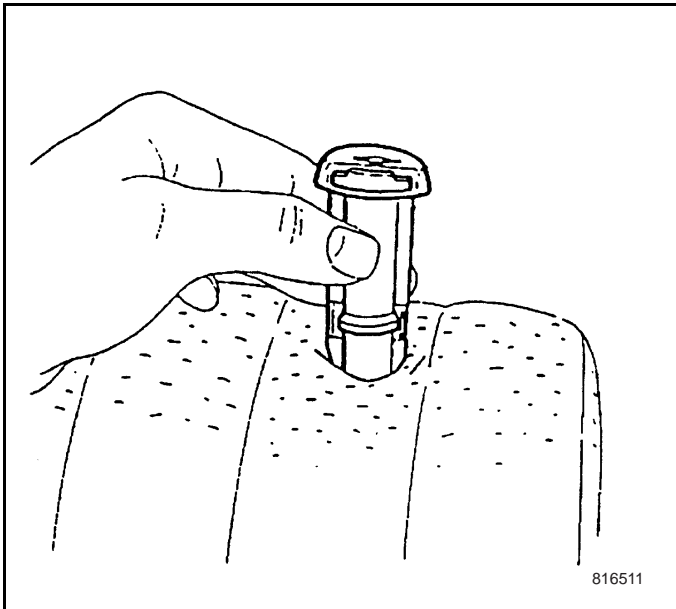




5. Pull the head restraint cover from the seat back frame.

Installation Procedure

1. Position the head restraint on the seat back.

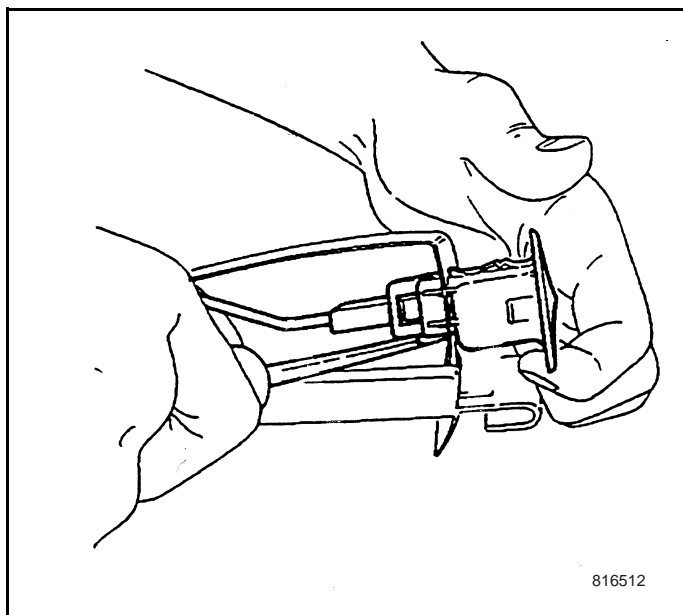


2. Press the cover firmly to be locked into the seat back frame.
3. Secure the stop baron the seat back cover perimeter. Install the seat back carpet. Refer to Rear Seat Back Replacement.
4. Install the rear seat back. Refer to Rear Seat Back Replacement.
5. Install the head restraint. Refer to Seat Head Restraint Replacement - Rear.

8.16.3.16B Seat Back Adjuster Button Replacement-Rear

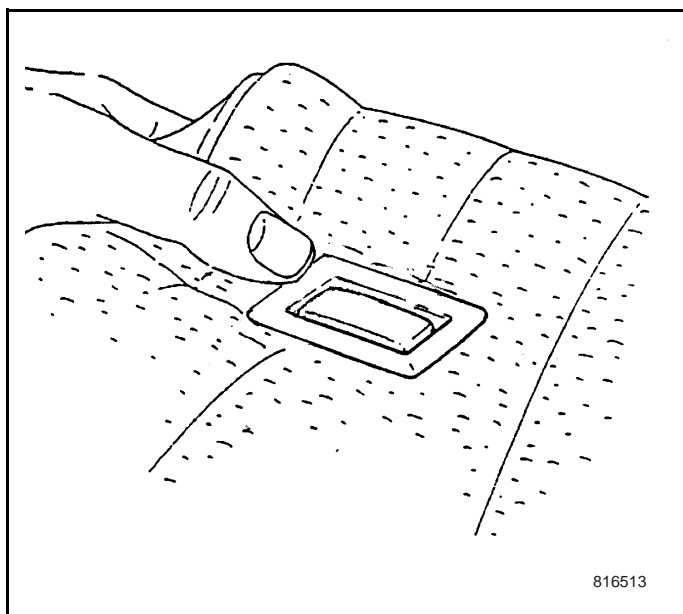
Removal Procedure

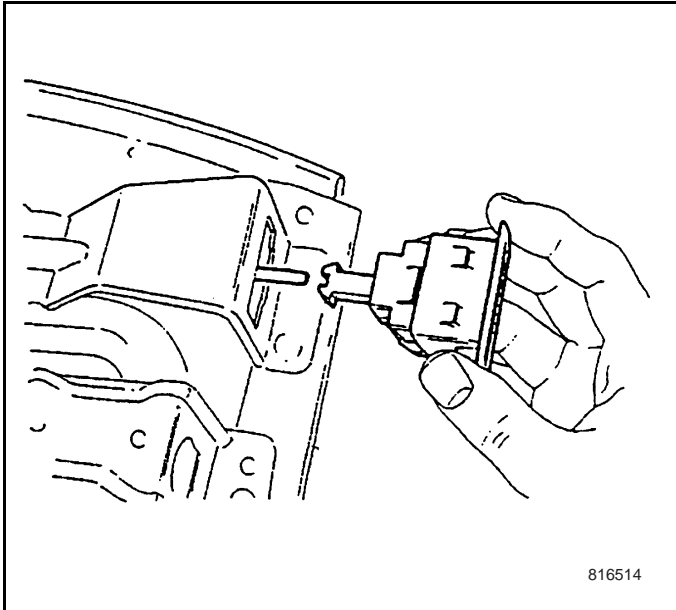
1. Remove the head restraint. Refer to Seat Head Restraint Replacement-Rear.
2. Remove the rear seat back. Refer to Rear Seat Back Replacement.
3. Remove the seat back carpet. Release the stop bar on the seat back cover perimeter. Refer to Rear Seat Back Replacement.
4. Press the stopper of the adjuster button with a screw driver, and pull the adjuster button from the seat back frame and the cover.



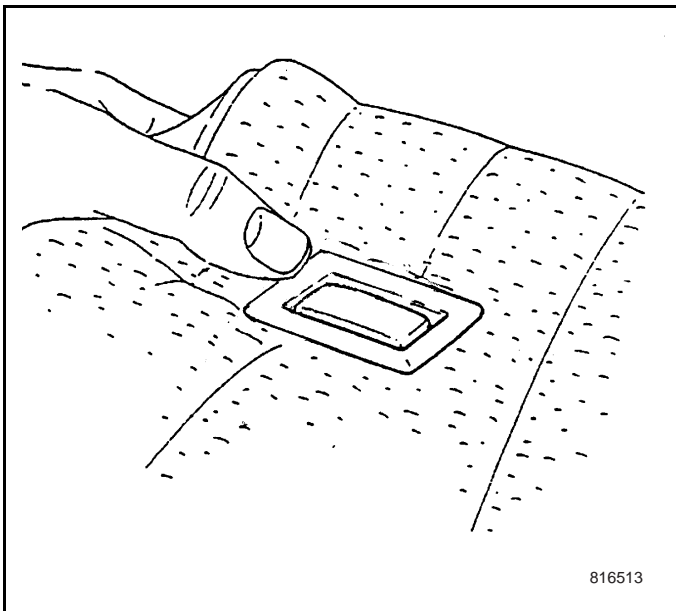
Installation Procedure

1. Insert the adjuster button into the foam pad.





2. Insert the adjuster button into the seat back operating arm.



3. Push in the adjuster button firmly to allow it being locked in the seat back frame.
4. Secure the stop bar on the seat back cover perimeter. Install the seat back carpet. Refer to Rear Seat Back Replacement.
5. Install the rear seat back. Refer to Rear Seat Back Replacement.
6. Install the head restraint. Refer to Seat Head Restraint Replacement - Rear.

8.16.4 Description and Operation

8.16.4.1 Front Seat Description

The front seats are secured to the floor by 2 hooks connected to the front floor and 2 rear bolts installed to the floor in the welded nuts.

The 2-way front adjusters only provide the longitudinal moving of the seat. After the front seat adjuster lever is pulled, the seat adjuster will open the lock to allow the seat moving. When the seat is in the ideal position, release the adjuster lever and let the seat to be locked.

The 2-way front adjusters also provide up and down moving of the seat except for only the longitudinal moving of the seat. The seat will raise when the crankshaft revolves clockwise, and it will be locked when the revolution stops.

All front seats have head restraints on the driver and passenger seat back. The head restraint is designed to allow no way for removing the head restraint from the seat back under in case of not pressing the head restraint retainer and releasing the locked spring.

The following front seat can be selected:

- Front seat with high quality clothes, 2-way adjusters and attaching head restraint.
- The front seat with high quality clothes, the driver's 4-way seat adjuster and no head restraint.
- The front seats with leather facing, the driver's 4-way seat adjuster and without head restraint.

Caution: Do not attempt to change the designed seat position by changing the seat adjuster-to-floor anchor placement or the seat adjuster-to-seat frame anchor placement. Changing the designed seat position may affect the seat safety performance and may cause personal injuries.

8.16.4.2 Rear Seat Description

High quality clothes and leather facing can be selected for the rear seat of a 3 long bench seat.

The rear seat of a vehicle of 3 compartments is a head restraint integrated seat.

The rear seat head restraint of a 2-compartment vehicle can be removed.

The rear seat cushion and seat cushion back have moulding foam pad equipped, respectively matching with the contour of the seat back and the contour of the seat pad bracket.

8.17 Interior Trim

8.17.1 Specification

8.17.1.1 Fastener Tightening Torque

Application	Specification
Sun Visor Screws	1.0-1.5 N•m
Assist Handle Screws	1.0-1.5 N•m
Safety Belts Guide Bolt	35 N•m
Kick Trim Panel Screws	1.2-1.6 N•m
Side Kick Panel Protective Ring	1.2-1.6 N•m
Upper Trim Panel Protective Ring of the Middle Pillar	1.2-1.6 N•m
Seat Skate Board Cover Screws	1.2-1.6 N•m
Windshield Pillar Trim Panel Screws	1.3-1.7 N•m

8.17.1.1A Fastener Tightening Torque

Application	Specification
Compartment Sill Plate Screws	1.2-1.6 N•m
Sill Trim Panel Screws	1.2-1.6 N•m
Interior Door Trim Panel and Interior Door Trim Panel Storage Box Mounting Screws	1.2-1.8 N•m
Front Handle Assembly Screws	1.2-1.8 N•m
Quarter Window Trim Panel Screws	1.3-1.7 N•m

8.17.1.1B Fastener Tightening Torque

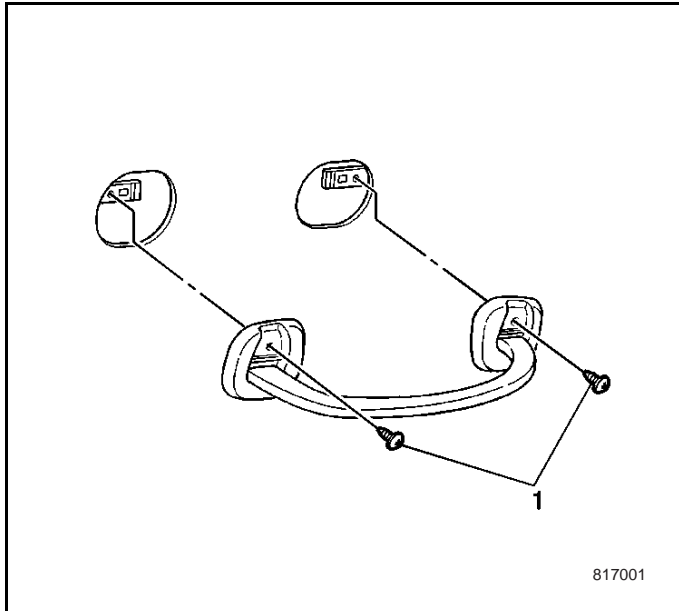
Application	Specification
Rock Arm Cover Screws	1.2-1.6 N•m
Interior Door Trim Panel and Interior Door Trim Panel Storage Box Mounting Screws	1.2-1.8 N•m
Front Handle Assembly Screws	1.2-1.8 N•m
Upper Trim Panel Bolts to the body	1.2-1.6 N•m
Lower Trim Panel Bolts to the body	1.2-1.6 N•m
Sill Trim Panel Bolts to the body	1.5-2.0 N•m

8.17.2 Repair Instructions

8.17.2.1 Assist Handle Replacement

Removal Procedure

1. Pull the assist handle to expose the attaching screw(1)
2. Remove the assist handle screw (1)
3. Remove the assist handle.



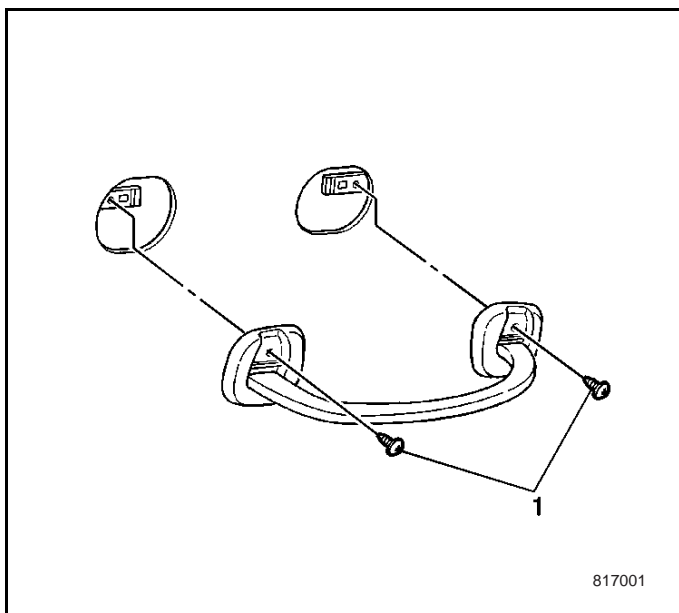
Installation Procedure

1. Position the assist handle to the mounting position.
2. Install the assist Handle Screws

Tighten

Tighten the assist handle screws to 1.0-1.5 N•m.

Note: If the screw slip the tooth, substitute with larger screw 90269702 (5,A type) for operation and tighten to approximately 1.0 N•m.

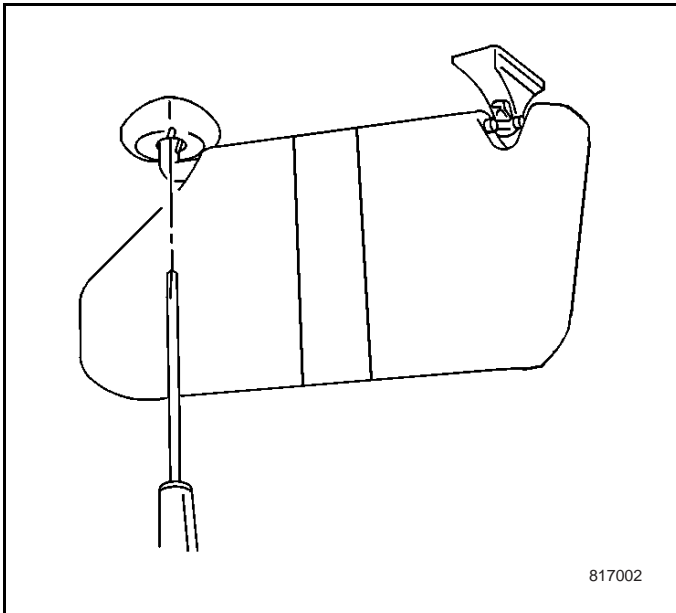


8.17.2.2 Sun Visor Replacement

Removal Procedure

The right sun visor has a cosmetic mirror, which can not be independently taken as a service part.

1. Fold up the sun visor and remove the lower shaft bracket screw.
2. Fold up the sun visor and remove another screw on the lower shaft support.
3. Remove the sun visor from the sun visor support.



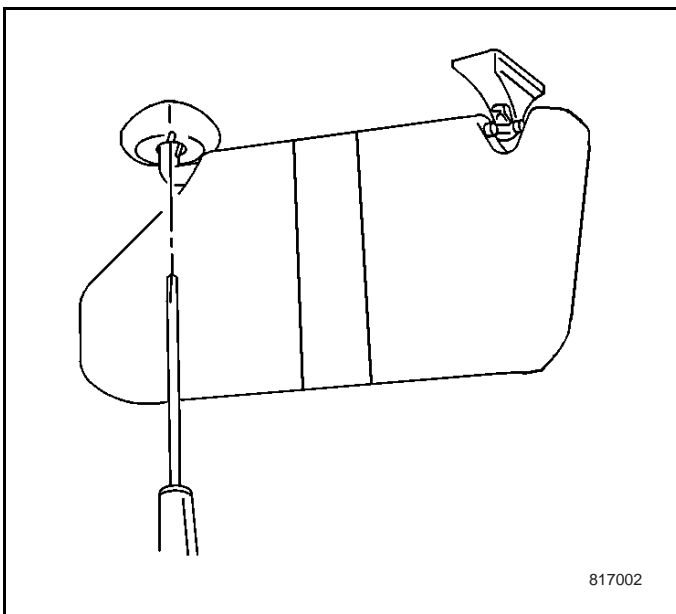
Installation Procedure

1. Place the sun visor to the mounting position.
2. Install the 2 screws on the shaft support.

Tighten

Tighten the screw to 1.0-1.5 N•m.

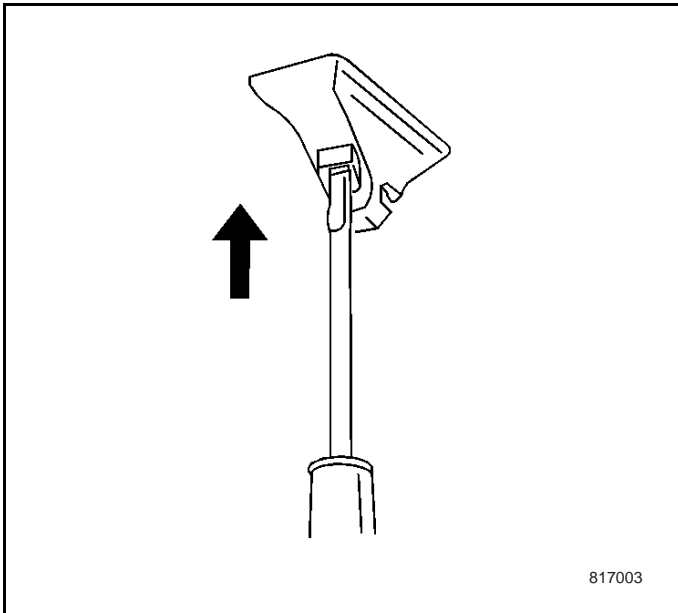
3. Lock the sun visor into the support.



8.17.2.3 Sun Visor Support Replacement

Removal Procedure

1. Remove the sun visor from the support.
2. Remove screws from the support.
3. Remove the support from the crest.



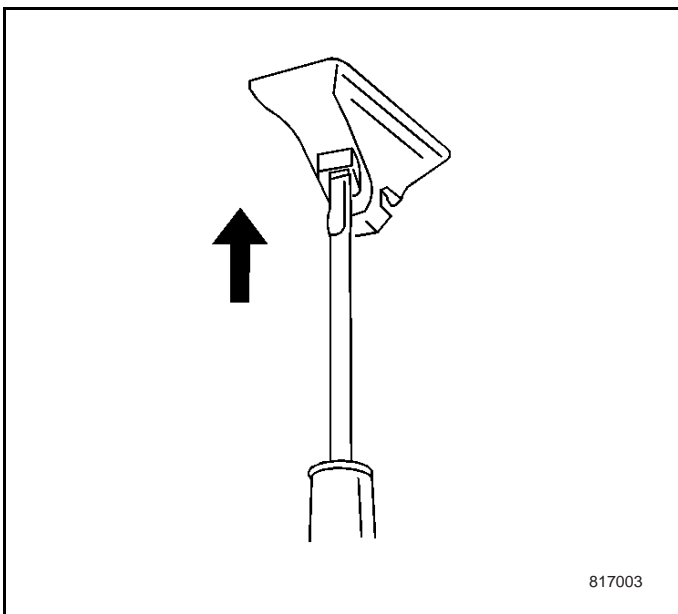
Installation Procedure

1. Place the support to the mounting position on the crest.
2. Use the tapping screw to secure the support.

Tighten

Tighten the screw to 1.0-1.5 N•m.

3. Lock the sun visor into the support.



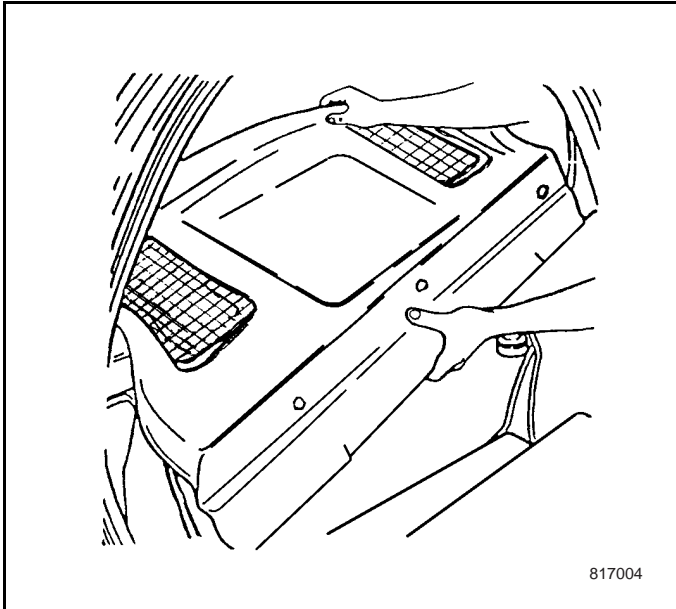
8.17.2.4A Trim Panel Replacement-Rear Window.

Coat Hook

Removal Procedure

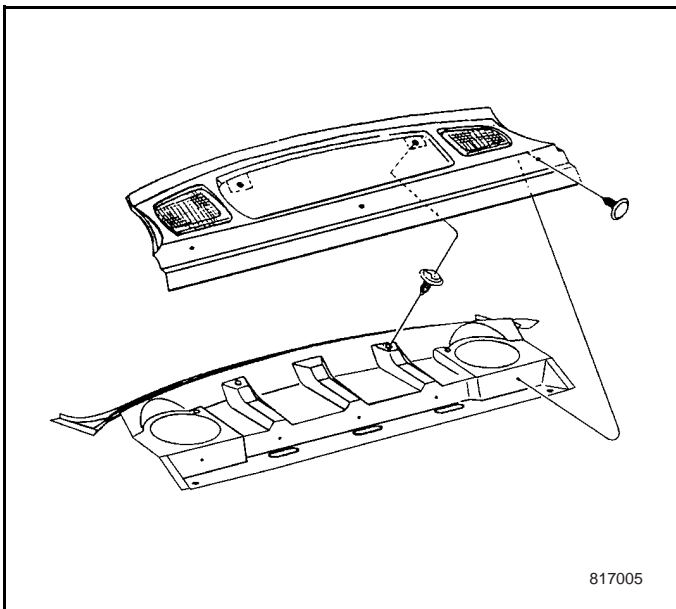
Tools required

- J 38778 Door Trim Pad and Trim Clip Remover
1. Remove the rear seat cushion. Refer to Rear Seat Cushion Replacement in Seat.
 2. Remove the rear seat back trim carpet. Refer to Rear Seat Back Decorative blanket Replacement in Body Rear End.
 3. Remove the rear seat back. Refer to Rear Seat Back Replacement in Seat.
 4. Remove the quarter window trim panel from both sides. Refer to Quarter Window Trim Panel Replacement in Interior Trim
 5. Use J 38778 to remove the 3 push-pin from the rear window trim panel.
 6. Pull the rear window trim panel forward to allow the push-pin to be disengaged with the clip seat located at the rear window trim panel back.
 7. Remove the rear window trim panel.
 8. Use J 38778 to remove the 2 push-pins from the body hole.



Installation Procedure

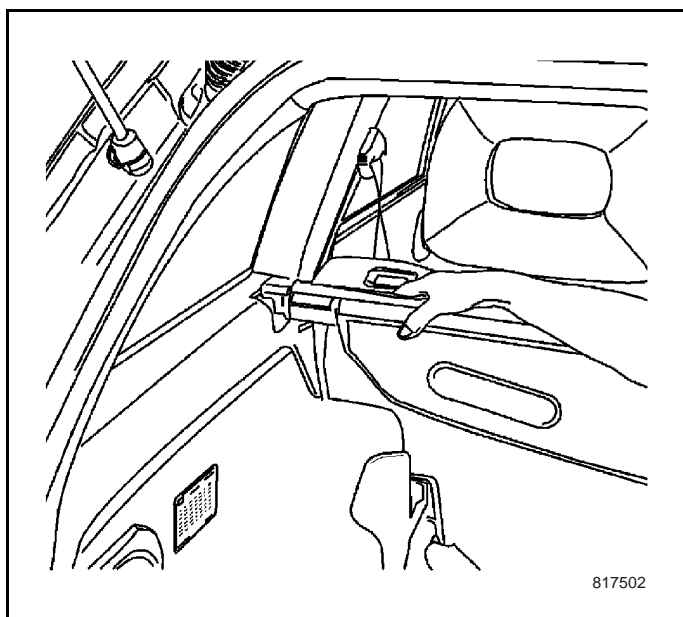
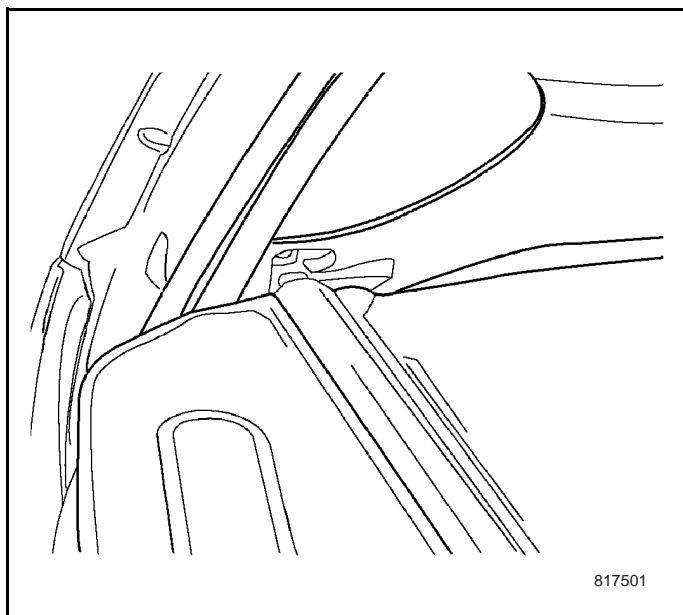
1. Connect the push-pin to the clip seat of the rear window trim panel back.
2. Raise the rear window trim panel to press the push-pin into the body attaching hole.
3. Install 3 push-pins at the rear window trim panel front.
4. Install the quarter window trim panel from both sides. Refer to Quarter Window Trim Panel Replacement in Interior Trim.
5. Install the rear seat back. Refer to Rear Seat Back Replacement in Seat.
6. Install the rear seat back trim carpet. Refer to Rear Seat Back Decorative blanket Replacement in Body Rear End.
7. Install the rear seat cushion. Refer to Rear Seat Cushion Replacement in Seat.



8.17.2.4B Rear Vehicle Compartment Trim Panel Assembly Replacement

Removal Procedure

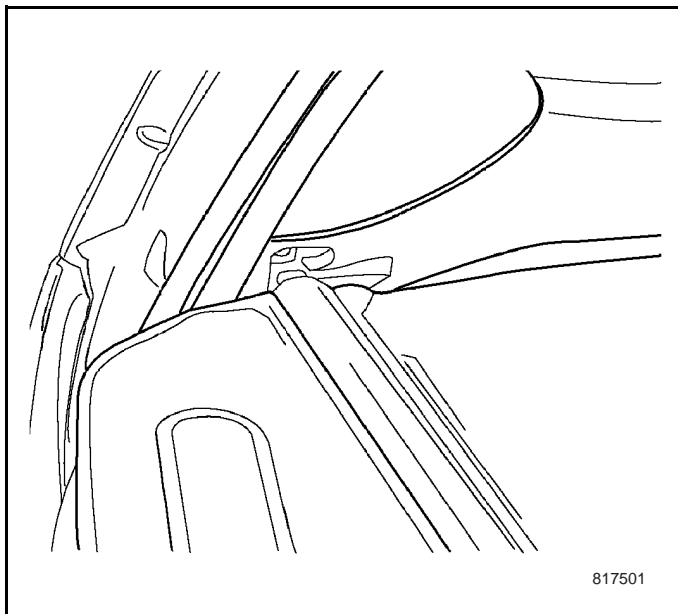
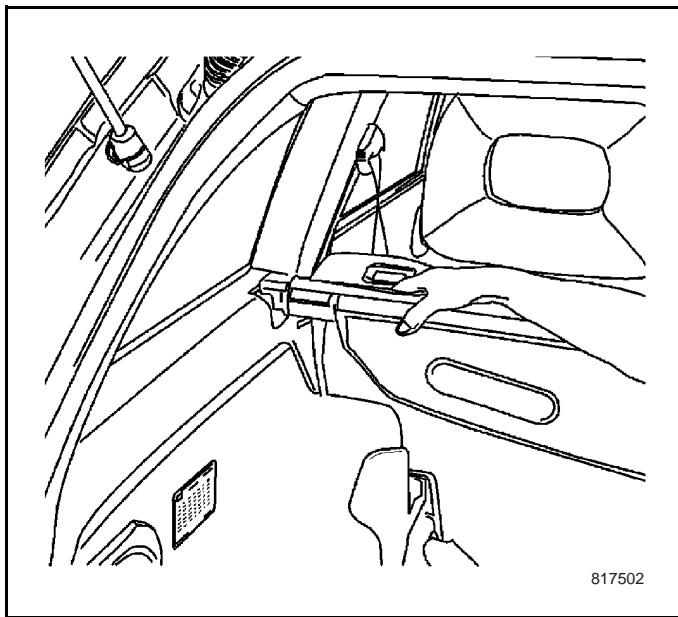
1. Release the quarter window trim panel assembly slot clamp.
2. Draw back the rear compartment trim panel assembly cover.



3. Remove the rear compartment trim panel assembly.

Installation Procedure

1. Clamp the rear compartment trim panel assembly end to the quarter window trim panel assembly slot.
2. Pull out the rear compartment trim panel assembly cover.



3. Insert the rear compartment trim panel assembly clamp into the lower quarter window trim panel assembly slot.

8.17.2.5 Front Door Handle Replacement

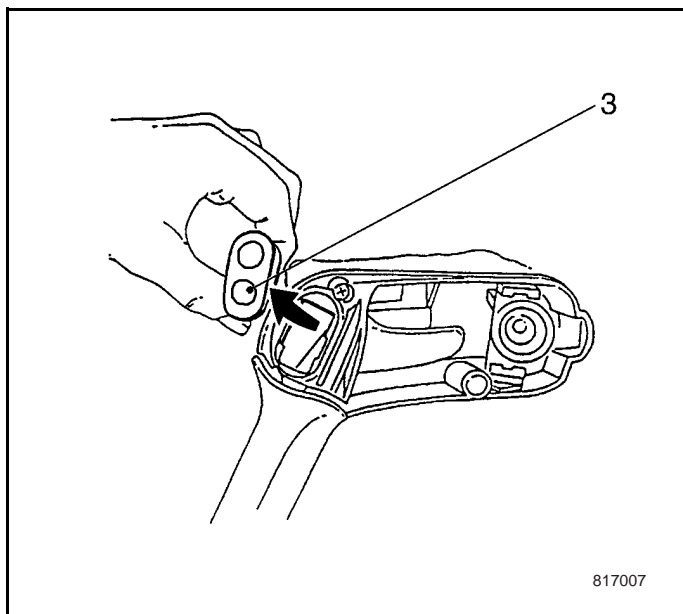
Removal Procedure

Note: Plastic wedge must be used to remove the handle cover in avoidance of damage.

Tools Required:

- Plastic Wedge

1. Use a plastic wedge to remove the cover from the front door handle.
2. Release the 3 handle screws(2) and remove the front door handle.
3. If the front door handle (left) has electric mirror switch, push the switch out.
4. If the handle has a high tone speaker, first pull it out.



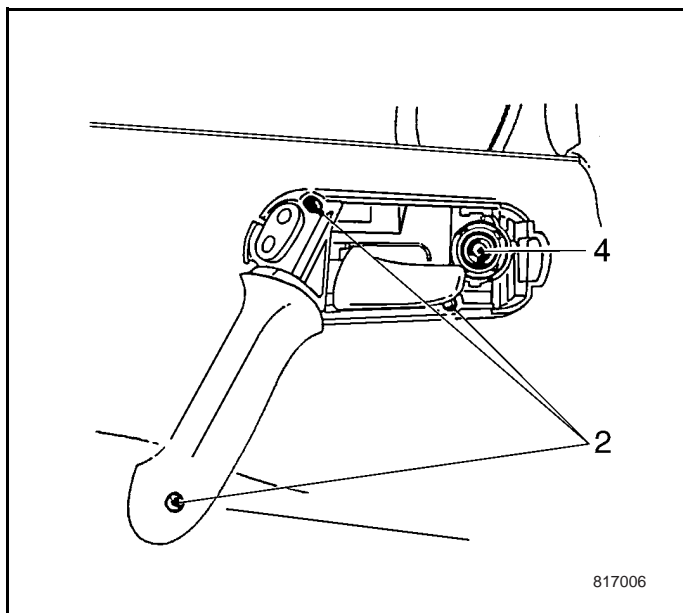
Installation Procedure

1. If the front door handle has the switch (3), first install it into the door handle.
2. Position the front door handle to the door trim and secure with 3 screws.

Tighten

Tighten the screw to 1.2-1.8 N•m.

3. If it is a handle with high tone speaker, first attach it to the high tone speaker connector and then install it into the handle.
4. Install the cover.



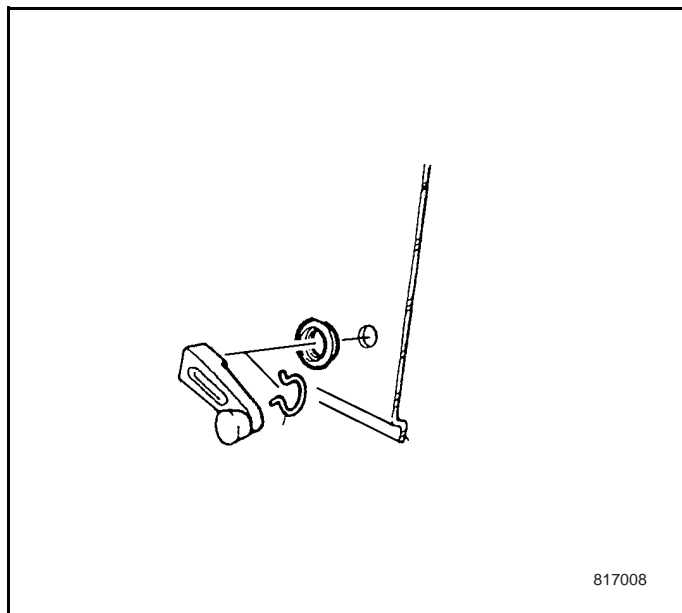
8.17.2.6 Glass Window Regulator Handle Replacement

Removal Procedure

Tools required

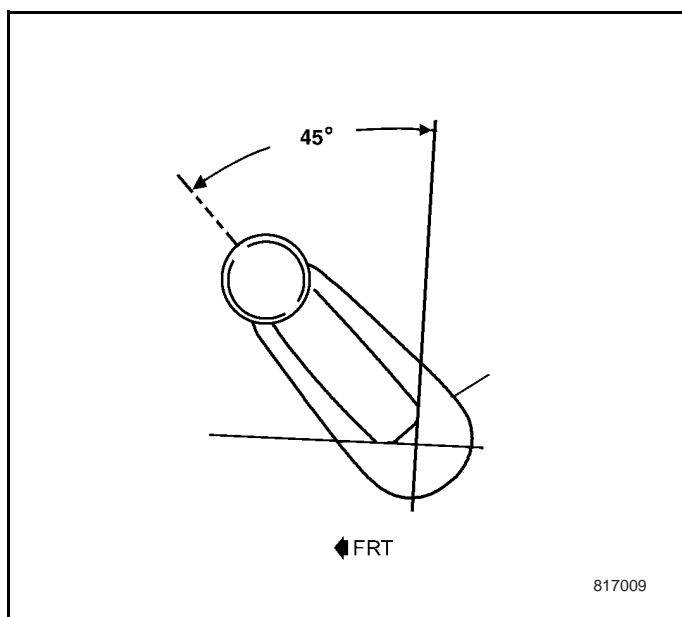
- J 38778 KM-317-A

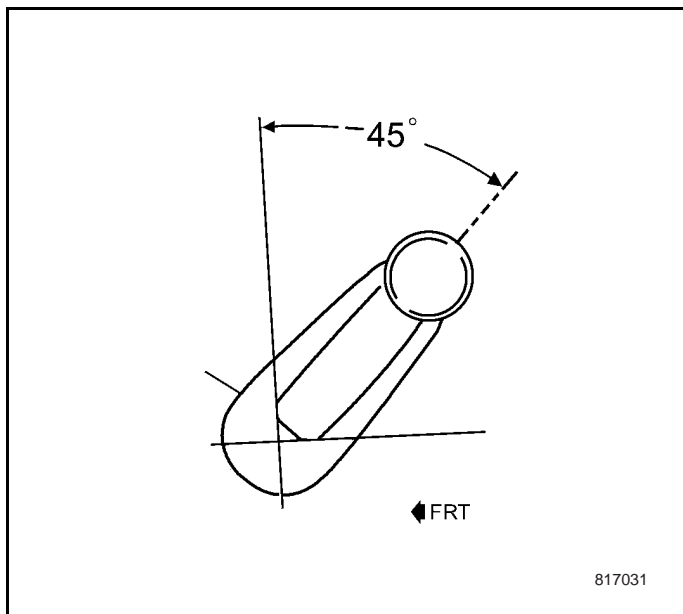
1. Use tool J38778 to press the glass window regulator handle spring out and remove the handle.



Installation Procedure

1. Press the spring into the handle.
2. Keep the window to be at the close position.
3. Install the rear window regulator handle. As shown in the figure, keep the handle angle to be 45 degrees.





If it is manual,

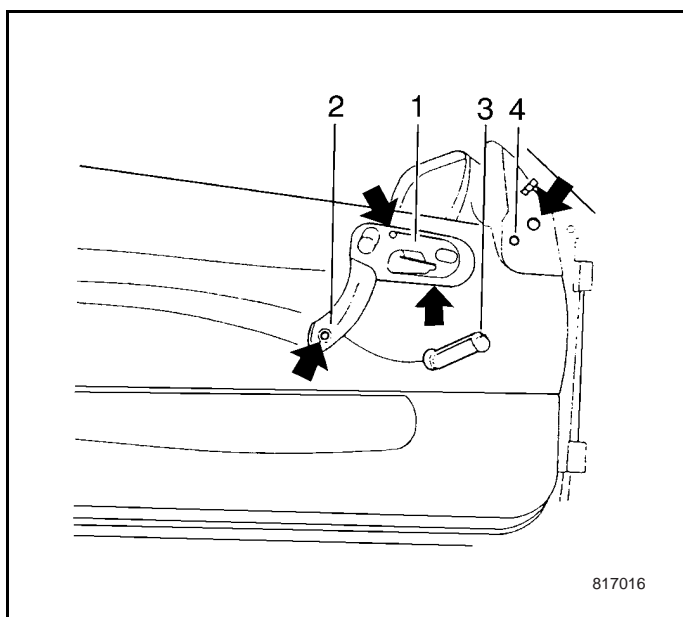
4. Install the front window regulator handle. As shown in the figure, keep the handle to be at -45 degrees.

8.17.2.7 Front Door Interior Trim Panel Replacement

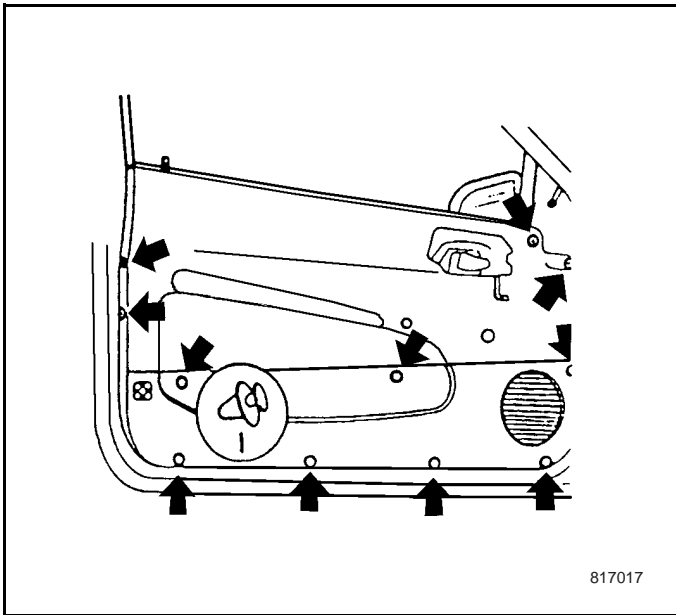
Removal Procedure

Tools required

- J 38778 KM-317-A Plastic Wedge



1. Remove the front door handle cover and the front door handle. Refer to Front Door Handle Replacement
2. Remove the glass window regulator handle (if it is manual). Refer to Glass Window Regulator Handle Replacement.
3. Remove the front door triangle trim panel. Refer to Frontdoor triangle trim panel Replacement.
4. Use a plastic wedge to remove the door window sealing strips. Refer to Window Sealing Strip Replacement-Front Door in Door.
5. Remove all the 9 screws.
6. Remove the front door interior trim panel and the storage box from the door. And disconnect the electrical connector (if it is electric).



Installation Procedure

Note: The front door interior trim panel is supported by 5 attaching clamps. Do not forget to install 5 attaching clamps before installing the front door interior trim panel.

1. Install the 5 attaching clamps to the interior body panel.
2. Hang the front door interior trim panel on the attaching clamp.
3. Attach the storage box to the front door interior trim panel.
4. Position the front door interior trim panel to the door.
5. Attach the electrical connector (if it is electric) And use screw to install the front door interior trim panel and the storage box.

Tighten

Tighten the 9 screws to 1.2-1.8 N•m.

6. Install the door window sealing strips. Refer to Window Sealing Strip Replacement-Front Door in Door.
7. Install the front door triangle trim panel. Refer to Front Triangle Trim Panel Replacement.
8. Install the handle. Refer to Front Door Handle Replacement.
9. Remove the glass window regulator handle (if it is manual). Refer to Glass Window Regulator Handle Replacement.

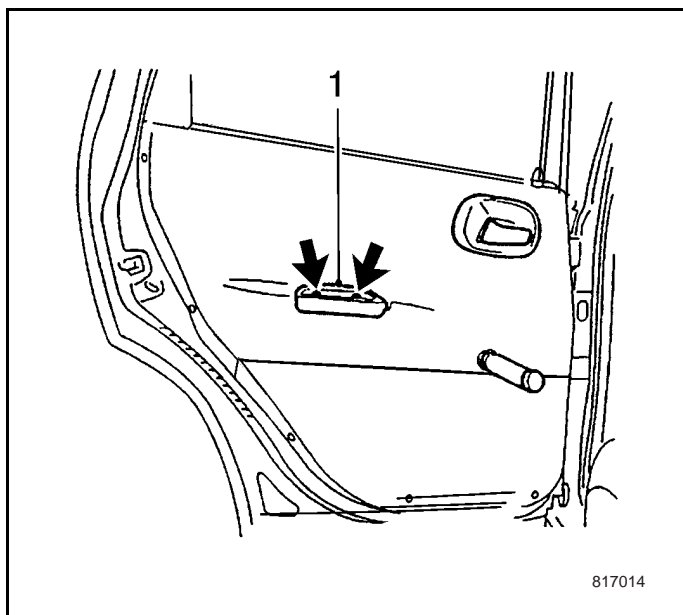
8.17.2.8 rear door inner trim panel Replacement

Removal Procedure

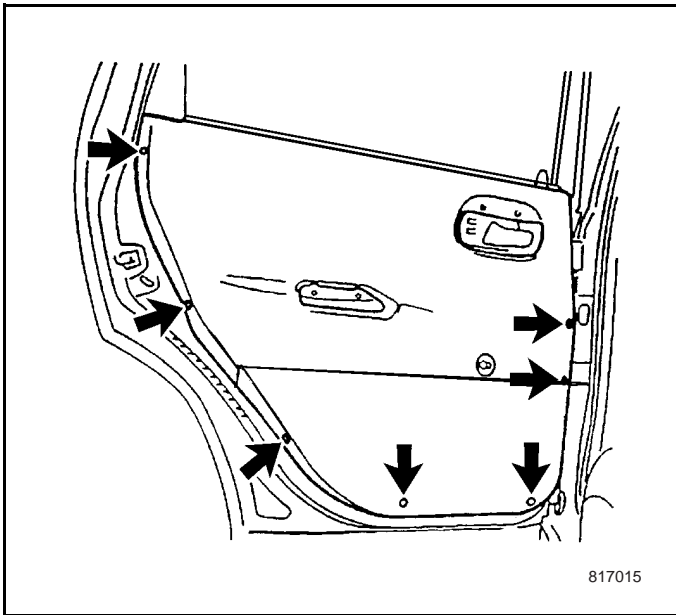
Note: Plastic wedge must be used to remove the cover in avoidance of damage.

Tools required

- J 38778 Trim Clip Remover
- KM-317-A Plastic Wedge



1. Unscrew the 2 screws from the rear door inner handle and take it off.
2. In case of manual window: remove the glass window regulator handle. Refer to Glass Window Regulator Handle Replacement. Use the plastic wedge to remove the handle cover from the handle (hint: first loose the rear side)
In case of electric window, use the plastic wedge to remove the handle cover from the handle (hint: first loose the rear side). Disconnect the electrical connector.
3. Remove the rear door triangle trim panel. Refer to Rear Door Triangle Trim Panel Replacement.
4. Use a plastic wedge to remove the door window sealing strips. Refer to Rear Door Window Sealing Strip Replacement-Front Door in Doors.
5. Release the 7 screws and remove the rear door inner trim panel.



Installation Procedure

Note: The rear door inner trim panel is hinged by 5 attaching clamps. Ensure to install the 5 attaching clamps before installing the rear door inner trim panel.

1. Install the 5 attaching clamps to the interior body panel.
2. Hang the rear door interior trim panel on the attaching clamp.
3. Position the rear door inner trim panel by the door.
4. Use 7 screws to install the rear door inner trim panel.

Tightening

Tighten the screw to 1.2-1.8 N•m.

5. Install the door window sealing strips. Refer to Rear Door Window Sealing Strip Replacement-Front Door in Doors.
6. Install the rear door triangle trim panel. Refer to Rear Door Triangle Trim Panel Replacement.
7. Install the rear inner handle (2 positions).

Tighten

Tighten the screw to 1.2-1.8 N•m.

In case of manual window: remove the glass window regulator handle. Refer to Glass Window Regulator Handle Replacement. Install the handle cover (hint: first connect the rear side).

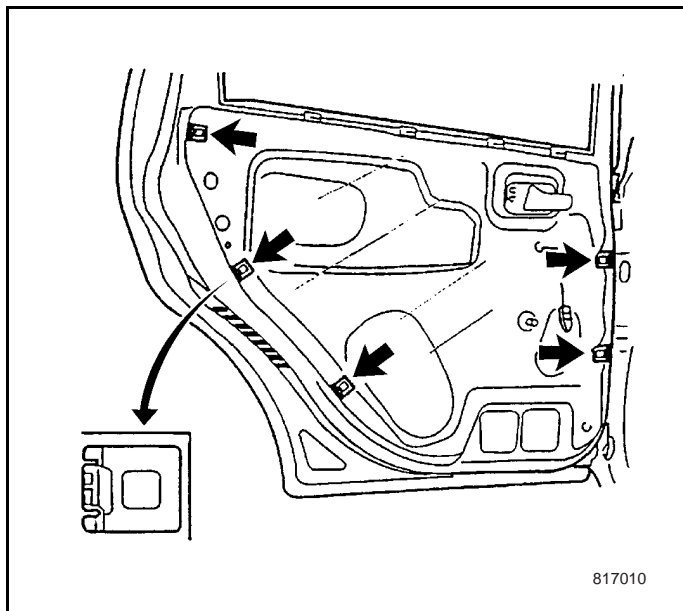
In case of electric window: first attach the electric connector. Install the handle cover (hint: first connect the rear side).

8.17.2.9 Rear Door Water Deflector and Rear Door Inner Trim Panel Plastic Support

Removal Procedure

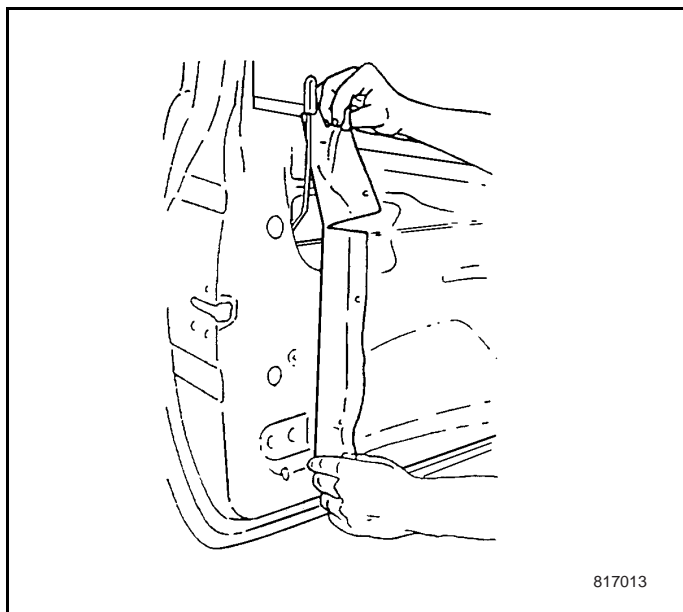
One plastic waterproof membrane is used to seal the door inner panel and to prevent rain water from into the body.

1. Remove the rear door inner trim panel. Refer to Rear Door Inner Trim Plate Replacement
2. Use the screw driver to release the plug pin. (rear door with 5 plastic supports)
3. Strip off the water deflector from the door inner panel and remove the waterproof in the manner of removing the waterproof tape.



Installation Procedure

1. Install the waterproof membrane to the door handle perimeter.
2. Install the waterproof membrane to the door inner panel, allowing it to be aligned with the door. Use the roller at the waterproof deflector periphery to ensure appropriate sealing.
3. Install the waterproof tape to any damaged position on the waterproof membrane.
4. Install the plastic support and press into the plug pin. (5 plastic supports)
5. Install the rear door inner trim panel. Refer to Rear Door Inner Trim Plate Replacement.

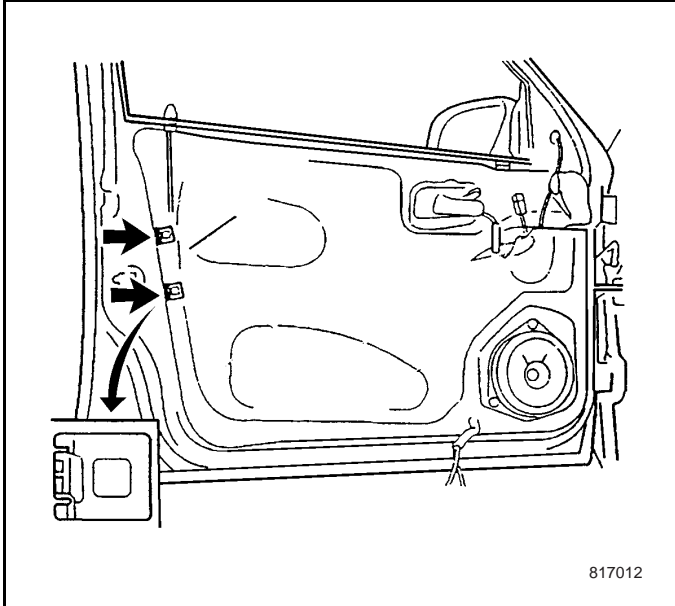


8.17.2.10 Front Door Water deflector and Front Door Inner Trim Panel Plastic Support

Removal Procedure

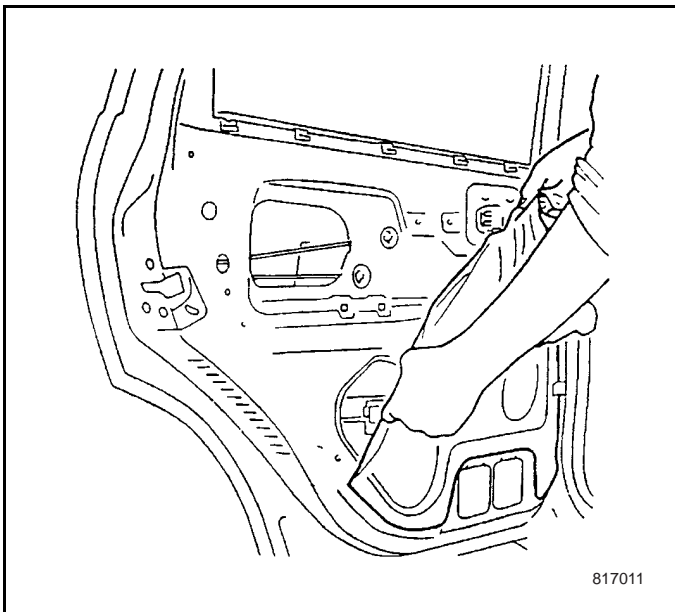
One plastic waterproof membrane is used to seal the door inner panel and to prevent rain water from into the body.

1. Remove the front door inner trim panel. Refer to Front Door Inner Trim Plate Replacement.
2. Use the screw driver to release the plug pin. (front door with 2 plastic supports)
3. Strip off the waterproof membrane from the door inner panel and remove the waterproof in the manner of removing the waterproof tape.



Installation Procedure

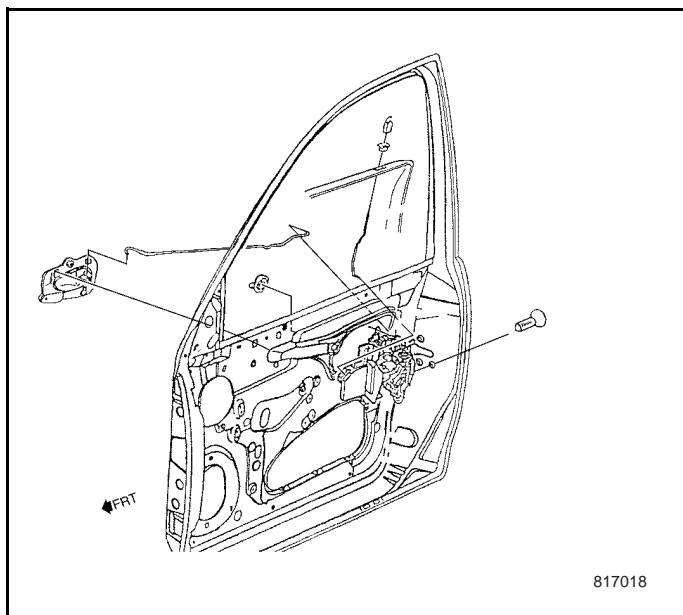
1. Install the waterproof membrane to the door handle perimeter.
2. Install the waterproof membrane to the door inner panel, allowing it to be aligned with the door. Use the roller at the waterproof membrane periphery to ensure appropriate sealing.
3. Install the waterproof tape to any damaged position on the waterproof membrane .
4. Install the plastic support and press in the plug pin. (front door with 2 plastic supports)
5. For installation of the front door inner trim panel, refer to Front Door Inner Trim Panel Replacement.



8.17.2.11 Front Door Inner Handle Replacement

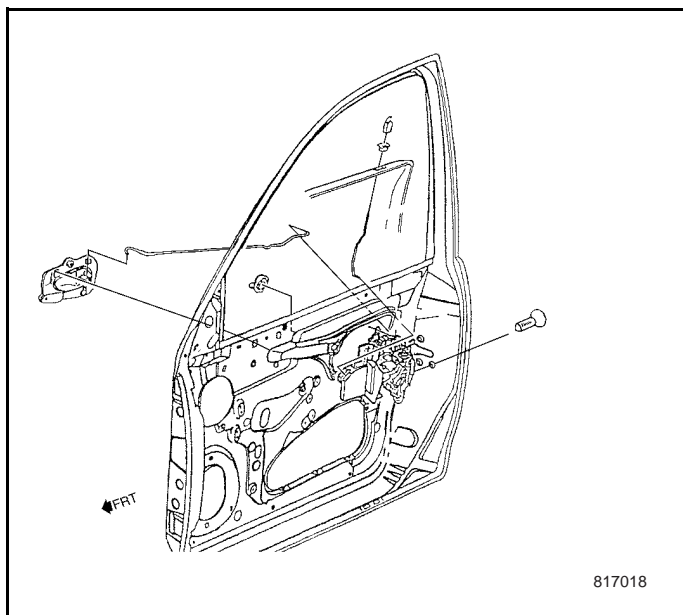
Removal Procedure

1. Remove the door inner side trim panel and water deflector. Refer to Front Door Waterproof Membrane and Front Door Inner Trim Panel Plastic Support Replacement.
2. Release the lock pull rod from the lock. Refer to Front Lock Pull Rod Replacement in Doors.
3. Pull the inner handle assembly from the inner panel.



Installation Procedure

1. Attach the lock pull rod to the inner handle assembly and press the inner handle in on the body inner panel.
2. Install the lock pull rod to the lock. Refer to Front Lock Pull Rod Replacement in Doors.

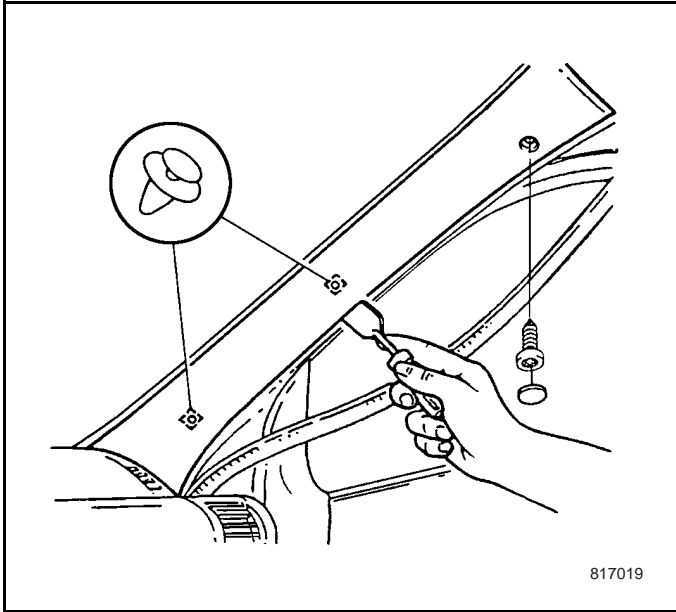


8.17.2.12 Trim Panel Replacement- Windshield Pillar

Removal Procedure

Tools required

- J 38778 Door Trim Pad and Trim Clip Remover
1. Remove the screw cap from the trim panel.
 2. Remove the screws.
 3. Remove the trim panel by using the tool J 38778 to release the clamp.



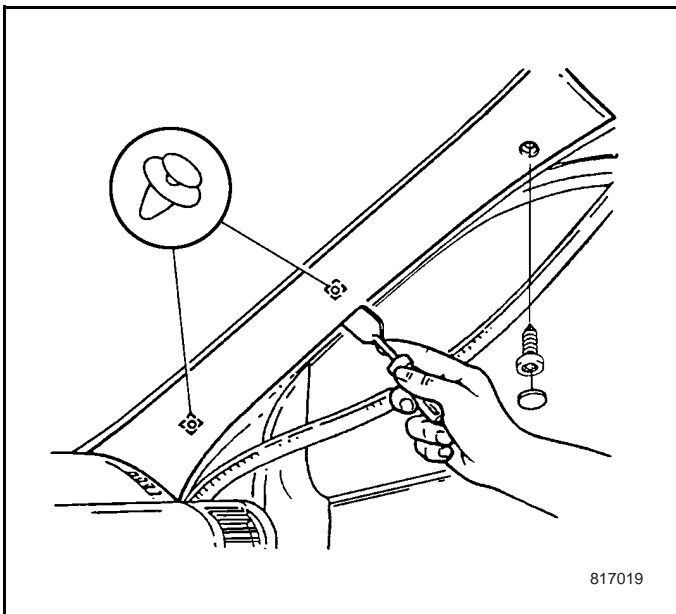
Installation Procedure

1. Secure the trim panel by installing the clamp.
2. Install the screws.

Tighten

Tighten the screw to $1.5 \pm 0.2 \text{ N}\cdot\text{m}$.

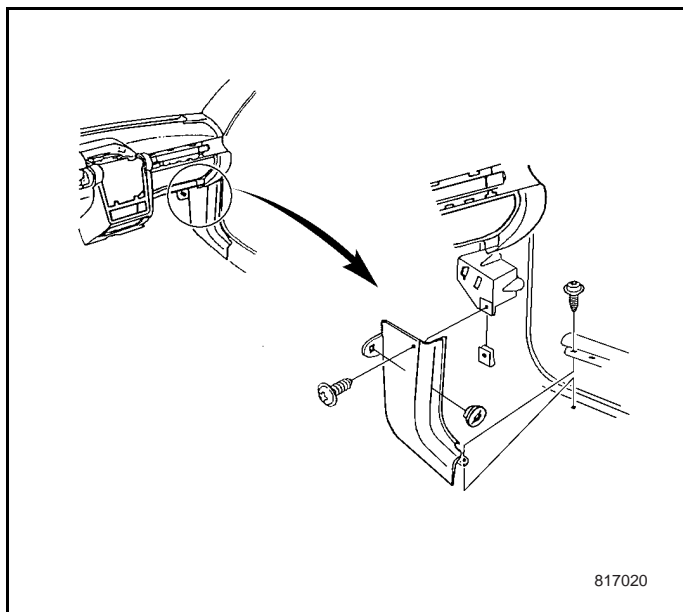
3. Install the screws cover.



8.17.2.13 Kick-Up Panel Replacement

Removal Procedure

1. Remove the sill trim plate. Refer to Rear Door Inner Trim Plate Replacement
2. Remove the bolt end cover and screws
3. Remove the kick panel.



Installation Procedure

1. Install the kick panel.
2. Install the bolt end cover.

Tighten

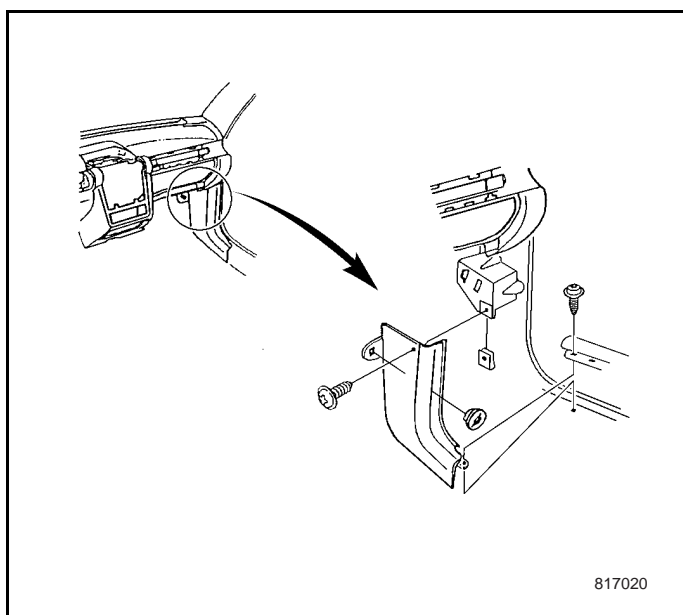
Tighten the bolt end cover to $1.4 \pm 0.2 \text{ N}\cdot\text{m}$.

3. Install the screws.

Tighten

Tighten the screw to $1.4 \pm 0.2 \text{ N}\cdot\text{m}$.

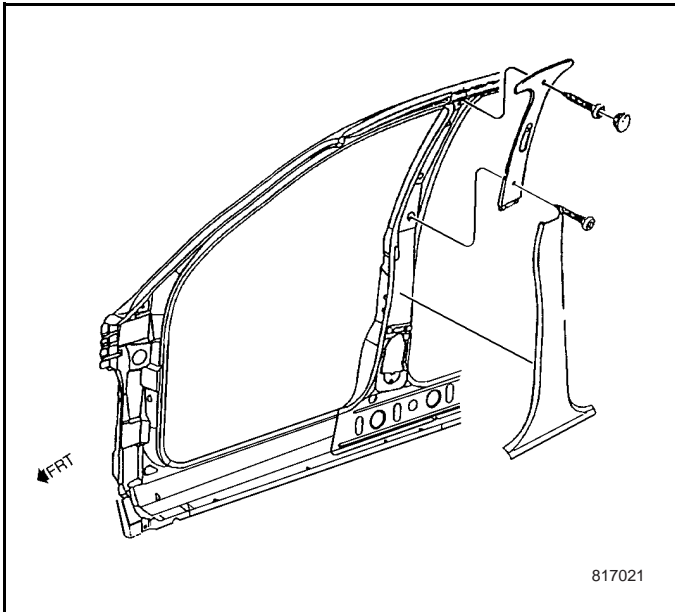
4. Install the door sill trim plate. Refer to Rear Door Inner Trim Plate Replacement.



8.17.2.14 Upper and Lower Trim Panel Replacement-Center Pillar

Removal Procedure

1. Open the upper guide ring trim cover of the upper safety belt.
2. Release the upper safety belt guide ring bolt.
3. Remove the upper safety belt guide ring from the height adjuster together with the bolt.
Refer to Height Adjuster Replacement-Front in Safety Belts.
4. Remove the trim panel screw cover.
5. Remove the 2 screws from the upper trim panel.
6. Pull out the upper trim panel lower end from the trim panel, and remove the upper and lower trim panel.



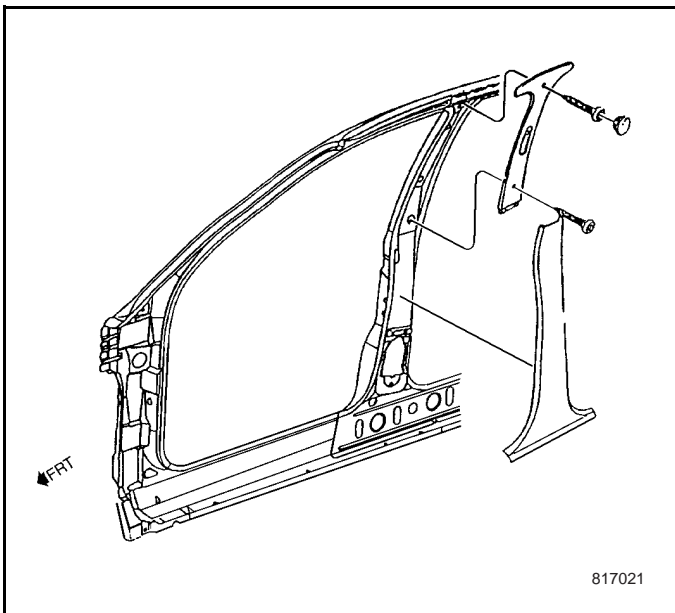
Installation Procedure

1. Install the lower trim panel to the center pillar after ensuring there is not any distortion with the safety belt.
2. Insert the upper trim panel into the lower trim panel, to allow the safety belt freely pass through between the upper and the lower trim panels.
3. Install the 2 screws on the upper trim panel.

Tighten

Tighten the screw to $1.4 \pm 0.2 \text{ N}\cdot\text{m}$.

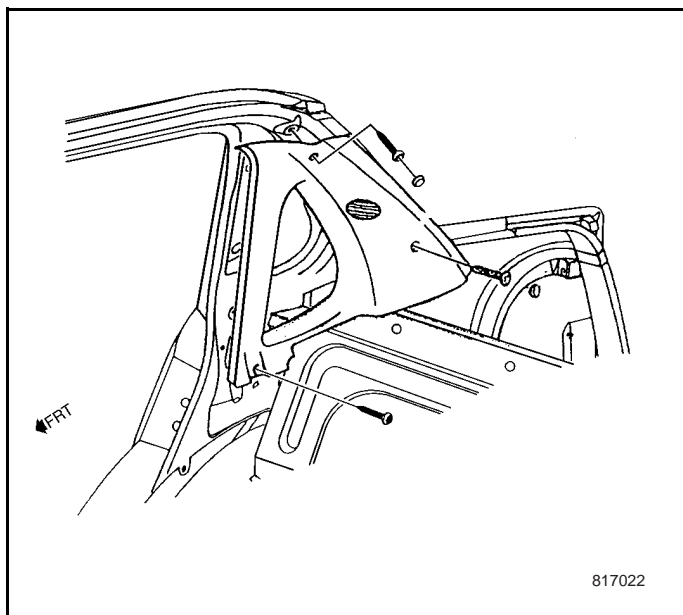
4. Install the upper trim panel screw cover.
5. Install the safety belt guide ring to the height adjuster together with the guide ring bolt. Refer to Height Adjuster Replacement-Front in Safety Belts.



8.17.2.15A Quarter Window Trim Panel Replacement

Removal Procedure

1. Remove the 2 screws from the rear seat back and the rear seat back. Refer to Rear Seat Back Replacement in Seats.
2. Open the safety belt guide ring trim cover.
3. Release the upper safety belt guide ring bolt.
4. Remove the upper and lower safety belt guide ring bolts and the guide rings. Refer to Connector Replacement-Rear in Safety Belts.
5. Remove the 2 screw covers from the quarter window trim panel.
6. Remove the 3 screws.
7. Remove the quarter window trim panel.



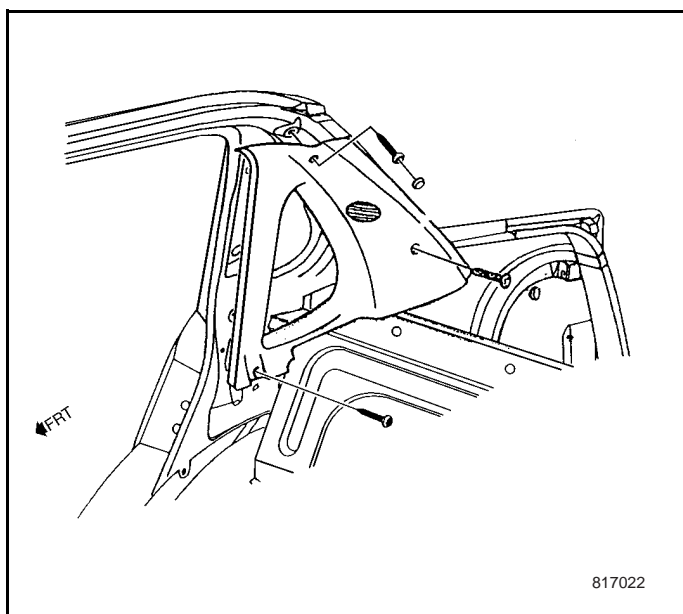
Installation Procedure

1. Install the quarter window trim panel.
2. Install the 3 screws.

Tighten

Tighten the screw to $1.5 \pm 0.2 \text{ N}\cdot\text{m}$.

3. Install the 2 screw cover.
4. Install the safety belt guide ring together with the bolt. Refer to Connector Replacement-Rear in Safety Belts.
5. Install the 2 screws to the rear seat back. Refer to Rear Seat Back Replacement in Seats.



8.17.2.15B Upper and Lower Trim Panel Replacement-Rear Side Window

Removal Procedure

1. For removal of the rear compartment trim panel assembly, refer to Rear Compartment Trim Panel Assembly Replacement.
2. Fold forward the rear seat back.
3. Remove the bolt from the 3 trim panels to the body.
4. Take out the rear safety belt from the lower trim panel clearance clearance.
5. Push forward the lower trim panel down and take it off.
6. Take off the 2 protective rings from the body.
7. Remove the rear safety belt guide ring. Refer to Connector Replacement-Rear in Safety Belts.
8. Remove the 2 screw covers.
9. Remove the bolt from the 3 trim panels to the body.
10. Push forward the upper trim panel down and take it off.
11. Take off the 2 protective rings from the body.

Installation Procedure

1. Install the 2 protective rings to the upper trim panel. Install the upper trim panel into the vehicle with 2 protective rings.
2. Remove the bolt from the 3 trim panels to the body.

Tighten

Tighten the bolt attaching the upper trim panel to the body to

$1.4 \pm 0.2 \text{ N}\cdot\text{m}$.

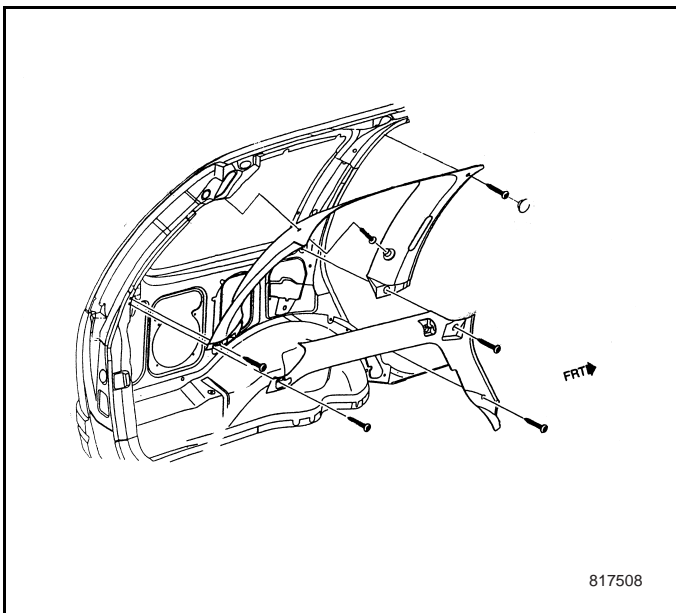
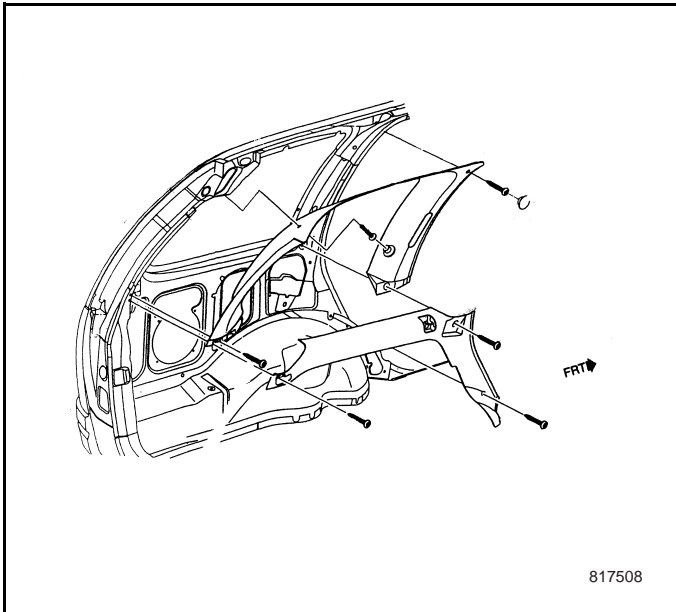
3. Install the 2 screw covers.
4. Install the rear safety belt guide ring. Refer to Connector Replacement-Rear in Safety Belts.
5. Install the rear safety belt into the lower trim panel through caulk on the face plate. Insert the front bottom end of the face plate into the kick panel cover.
6. Install the 2 protective rings to the lower trim panel. Install the lower trim panel into the vehicle with 2 protective rings.
7. Install the bolt from the 3 trim panels to the body.

Tighten

Tighten the bolt attaching the upper trim panel with the body to

$1.4 \pm 0.2 \text{ N}\cdot\text{m}$.

8. Reset the rear seat back.

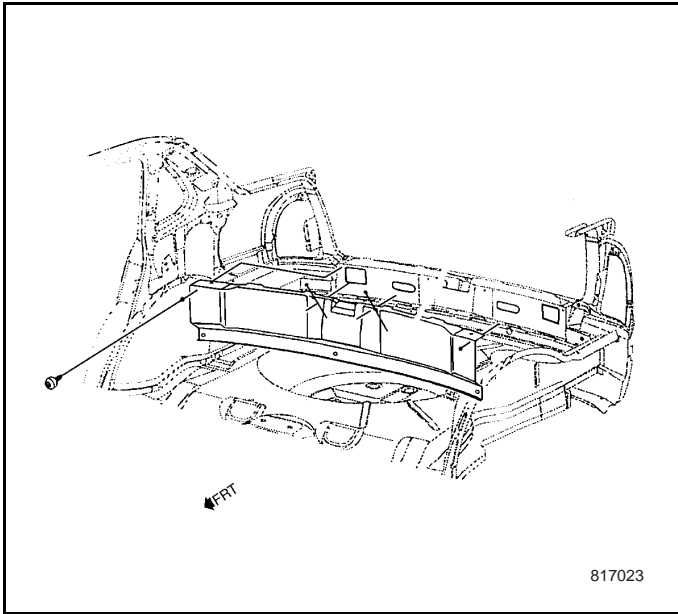


9. For installation of the rear compartment trim panel assembly, refer to Rear Compartment Trim Panel Assembly Replacement.

8.17.2.16A Compartment Sill Plate Replacement.

Removal Procedure

1. Remove the 4 screws.
2. Remove the compartment sill plate from the compartment sill.

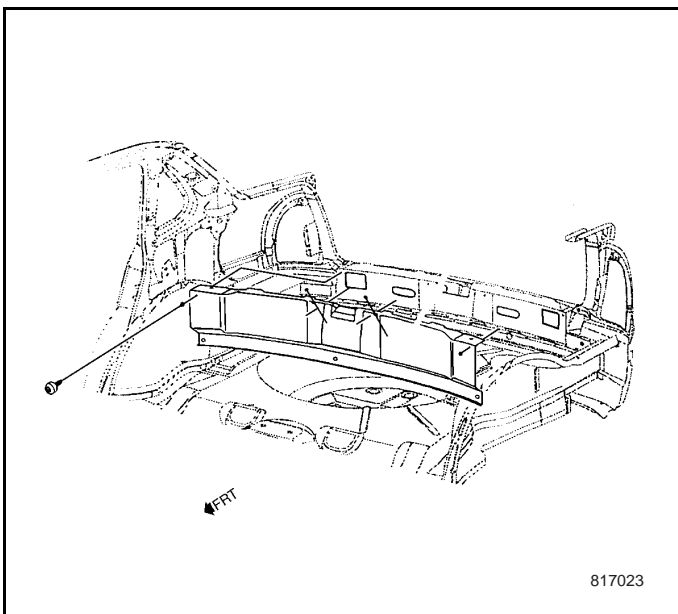


Installation Procedure

1. Install the compartment sill plate.
2. Install the 4 screws.

Tighten

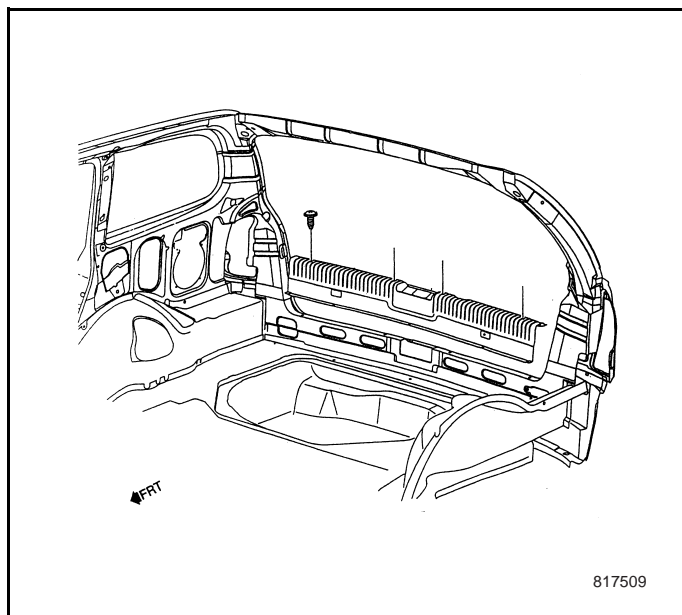
Tighten the 4 screws to $1.4 \pm 0.2 \text{ N}\cdot\text{m}$.



8.17.2.16B Rear Lift Gate Sill Plate Replacement

Removal Procedure

1. Remove the bolt from the 4 sill trim panels to the body.
2. Remove the liftgate sill trim panel.

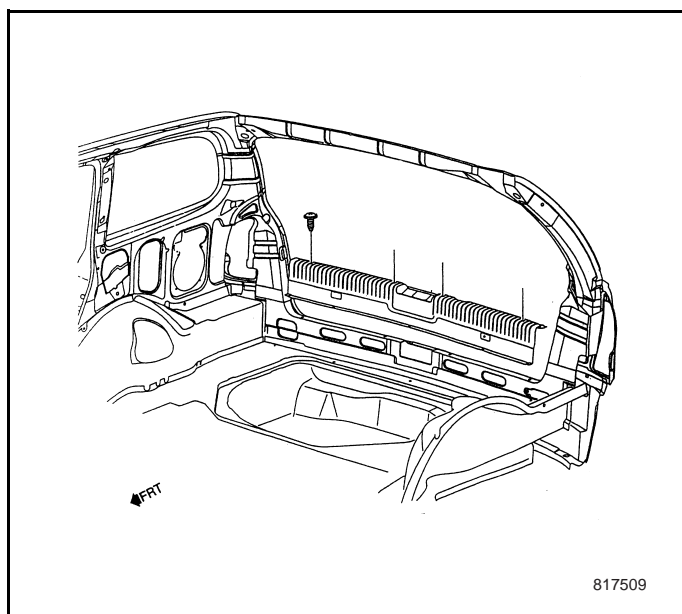


Installation Procedure

1. Install the liftgate sill trim panel into the vehicle.
2. Install the 4 liftgate sill trim panel-to-body bolts.

Tighten

Tighten the liftgate sill trim panel bolt to 1.75 ± 0.25 N•m.



8.17.2.17 Front Door Triangle Trim Panel Replacement

Removal Procedure

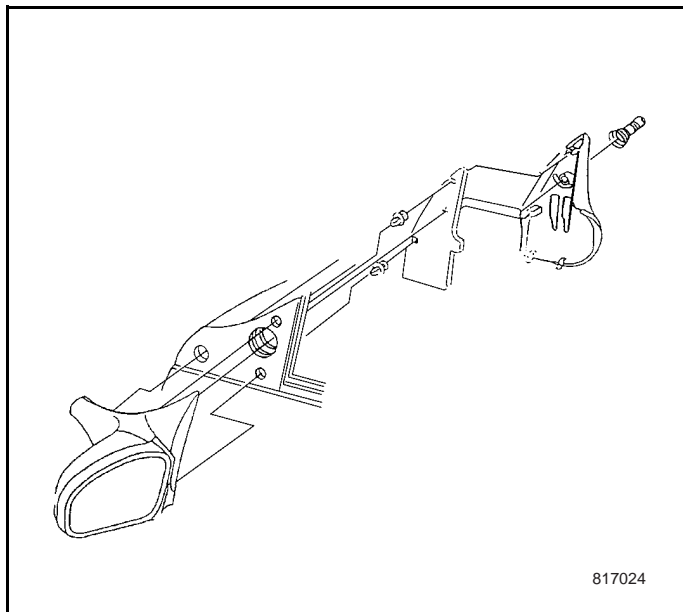
Tools required

- J 38778 Door Trim Pad and Trim Panel Clip Remover

1. Remove the inner adjusting handle from the manual exterior rear-view mirror.

Note: Electric Exterior Rear-view Mirror needs no this procedure.

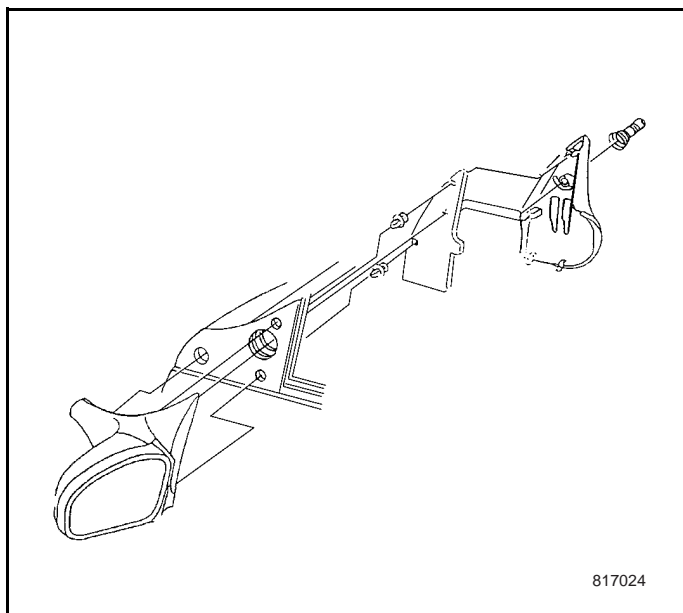
2. Push upward the front door triangle trim panel to disengage hanging hook on the trim panel and clip, and take off from the front door.
3. Use J 38778 to remove the 2 clips.



Installation Procedure

1. Install the front door triangle trim panel to the front door.
2. Push down the trim panel to allow the hanging hook on it to be clamped on the front sheet metal.
3. Push and press firmly the panel to allow the 2 clips to be engaged.
4. Install the inner adjusting handle to the manual exterior rear-view mirror.

Note: Electric Exterior Rear-view Mirror needs no this procedure.



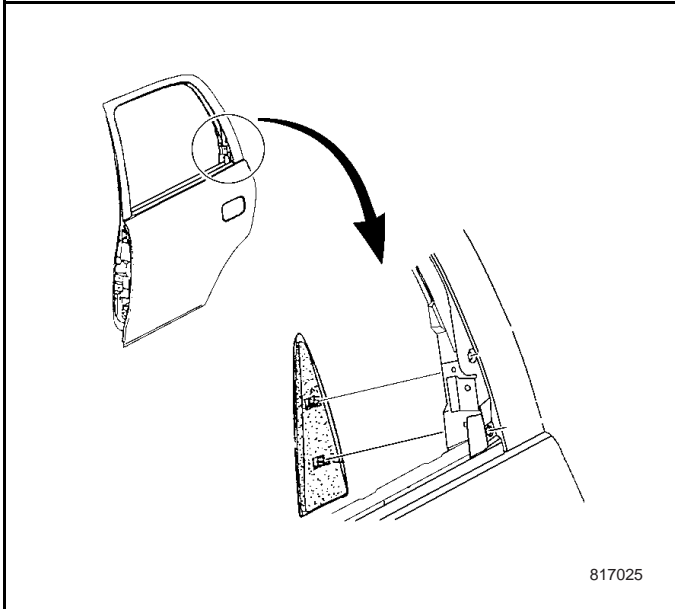
8.17.2.18 Rear Door Triangle Trim Panel Replacement

Removal Procedure

Tools required

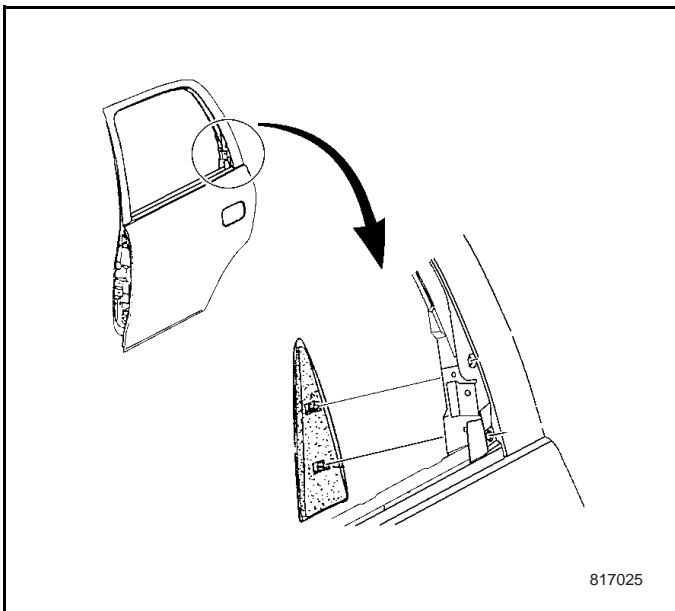
- J 38778 Door Trim Pad and Trim Panel Clip Remover

1. Push forward the rear door triangle trim panel to disengage the hanging hook on the trim panel and clip, and take it off from the front door.
2. Use J 38778 to remove the 2 clips.



Installation Procedure

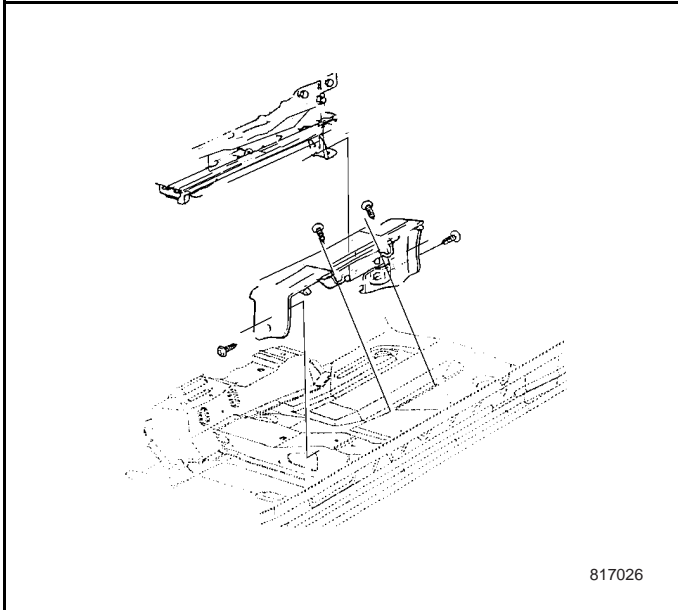
1. Install the rear door triangle trim panel to the rear door.
2. Push forward the trim panel to allow the hanging hook on it to be engaged on the front sheet metal.
3. Push and press firmly the trim panel to allow the 2 clips to be engaged.



8.17.2.19 Seat Adjuster Track Cover Plate Replacement

Removal Procedure

1. Open the cover, and the 2 screws can be seen.
2. Remove the 4 screws.
3. Remove the seat adjuster track cover plate from the sill trim plate.



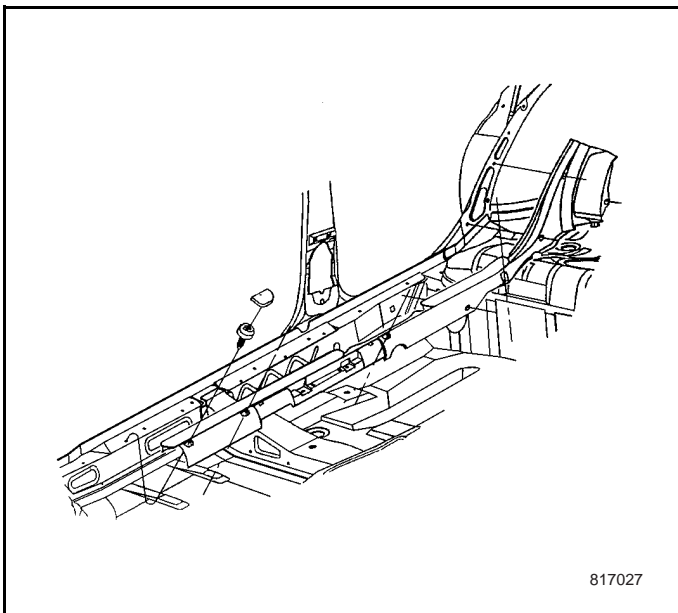
Installation Procedure

1. Install the seat adjuster track cover plate to the sill trim plate.
2. Install the 4 screws.

Tighten

Tighten the 4 screws to $1.4 \pm 0.2 \text{ N}\cdot\text{m}$.

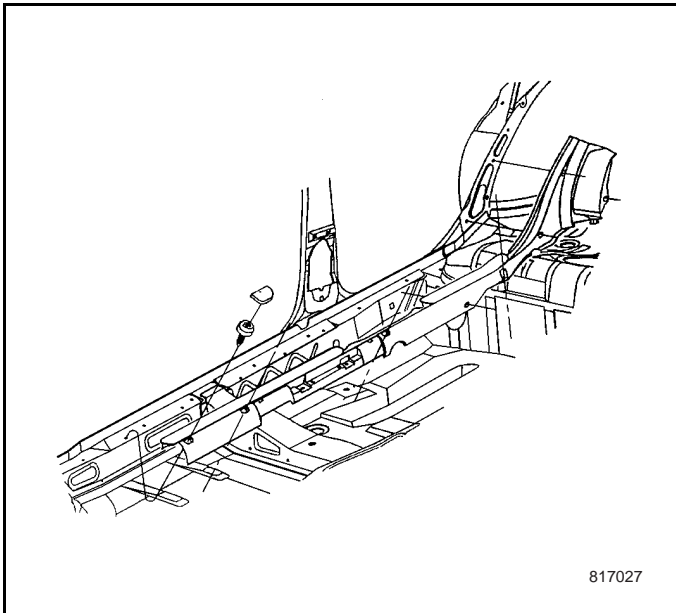
3. Close the cover.



8.17.2.20 Sill Trim Plate Replacement

Removal Procedure

1. Remove the seat track cover plate. Refer to Seat Track Cover Plate Replacement.
2. Remove the rear seat cushion. Refer to Rear Seat Cushion Replacement.
3. Remove the 3 screw covers.
4. Remove the 7 screws.
5. Remove the sill trim plate from the vehicle.



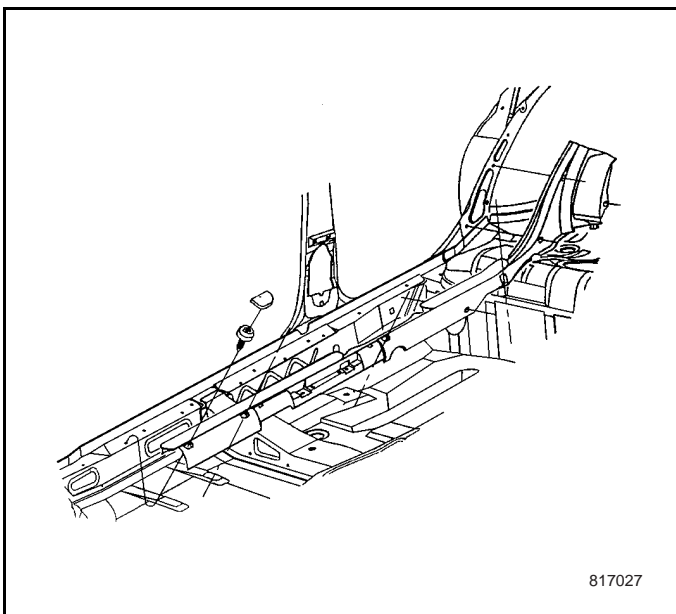
Installation Procedure

1. Install the sill trim plate to the vehicle.
2. Install the 7 screws.

Tighten

Tighten the 7 screws to $1.4 \pm 0.2 \text{ N}\cdot\text{m}$.

3. Install the 3 bolt covers.
4. Install the rear seat cushion. Refer to Rear Seat Cushion Replacement.
5. Install the seat track cover plate. Refer to Seat Track Cover Plate Replacement.

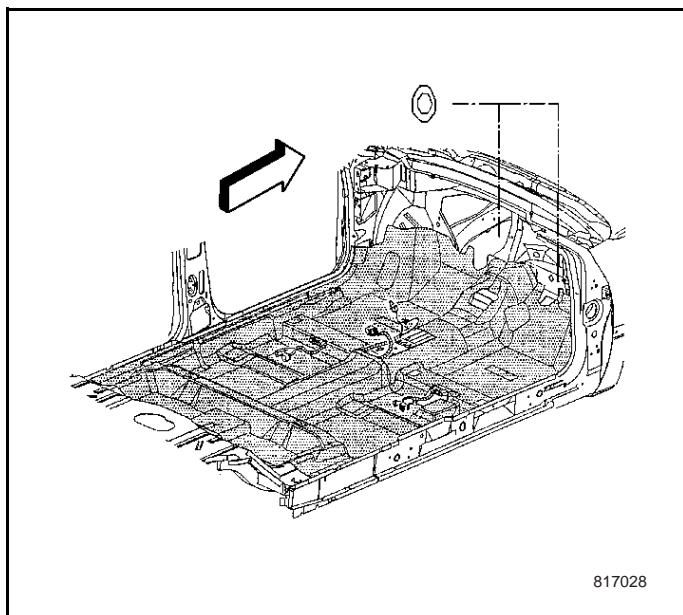


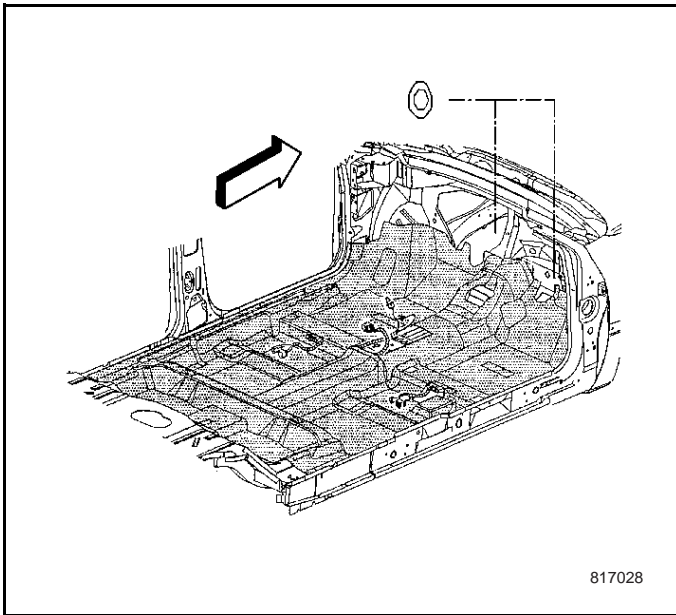
8.17.2.21 Front Floor Carpet Replacement

Removal Procedure

All the floor carpets consist of a molded one-piece carpet over both front and rear floor pan. Remove and replace the carpet according to the following procedures.

1. For removal of rear seat back, refer to Rear Seat Back Replacement in Seats.
2. For removal of the seat track cover plate, refer to Seat Track Cover Plate Replacement.
3. For removal of front seat, refer to Seat Replacement - Front in Seats.
4. For unscrew the attaching bolt of the front seat safety belt tensioners, refer to Safety Belt Tensioner Replacement-Left Front/Right Front in Safety Belts.
5. For removal of sill trim panel cover, refer to Sill Trim Panel Replacement.
6. For removal of the kick panel, refer to Kick Panel Replacement.
7. For removal of the instrument console assembly, refer to Instrument Console Replacement in Instrument Panel, Cluster, and Console.
8. For removal of the instrument console, refer to Instrument Panel Replacement in Instrument Panel, Cluster, and Console.
9. For removal of the engine control module assembly, refer to Engine Control Module Replacement in Engine Control System.
10. Unscrew the retainer assembly of the carpet.
11. Remove the compartment floor carpet.



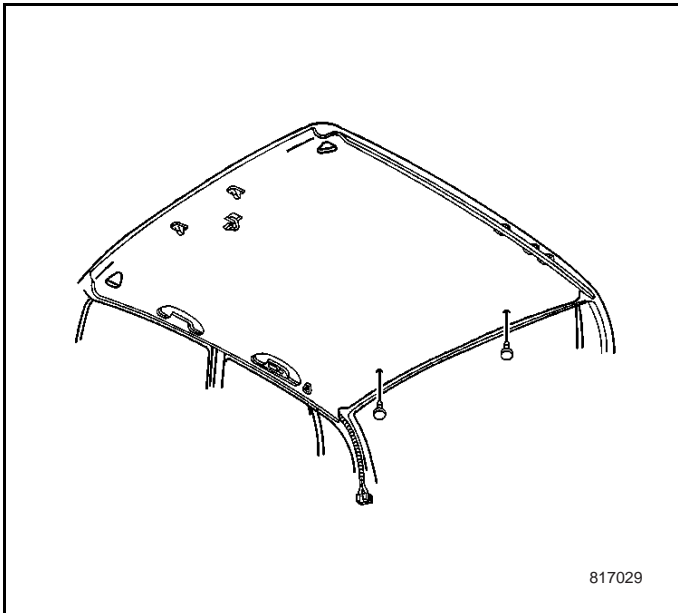


Installation Procedure

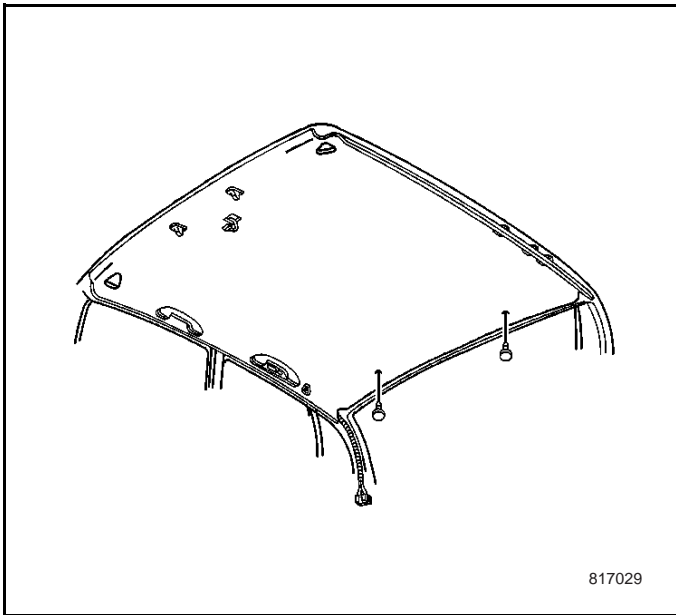
1. Position the compartment floor carpet.
2. Install the retainer assembly of the carpet.
3. For installation of the engine control module assembly, refer to Engine Control Module Replacement in Engine Control System.
4. For installation of the instrument console, refer to Instrument Panel Replacement in Instrument Panel, Cluster, and Console.
5. For installation of the instrument console assembly, refer to Instrument Console Replacement in Instrument Panel, Cluster, and Console.
6. For installation of the kick panel, refer to Kick Panel Replacement.
7. For installation of the sill trim panel cover, refer to Sill Trim Panel Replacement.
8. For tightening of the attaching bolt of the front seat safety belt tensioners, refer to Safety Belt Tensioner Replacement-Left Front/Right Front in Safety Belts.
9. For installation of the front seats, refer to Seat Replacement- Front.
10. For installation of the seat track cover plate, refer to Seat Track Cover Plate Replacement.
11. For installation of the rear seat cushions, refer to Seat Cushion Replacement-Rear.

8.17.2.22A Headliner Replacement

Removal Procedure



1. Remove the sun visor. Refer to Sun Visor Replacement
2. Remove the dome lamp. Refer to Dome Lamp Replacement in Lighting System.
3. Remove the sun visor clip. Refer to Sun Visor Support Replacement
4. Remove the assist pull rod hole clip. (Removal of the assist pull rod is only limited to the 2 types of SE and SE AT).
5. Remove the reading lamp cover. (Removal of the reading lamp is only limited to the 2 types of SE and SE AT).
6. Remove the front windshield pillar trim panel. Refer to Front Windshield Pillar Trim Panel Replacement.
7. Remove the quarter window trim panel. Refer to Quarter Window Trim Panel Replacement.
8. Remove the upper center pillar trim panel. Refer to Trim Panel Replacement-Upper and Lower Center Pillar.
9. Use tool J 38778 to remove the 2 clips behind the top headliner.
10. Rotate the right front seat back to the horizontal position.
11. Remove the top headliner from the door sealing strip.
12. Remove the top headliner from the right front door.



Installation Procedure

1. Move the headliner into the vehicle through the right front door.

Note: Don not bend the headliner too much at the time of installation.

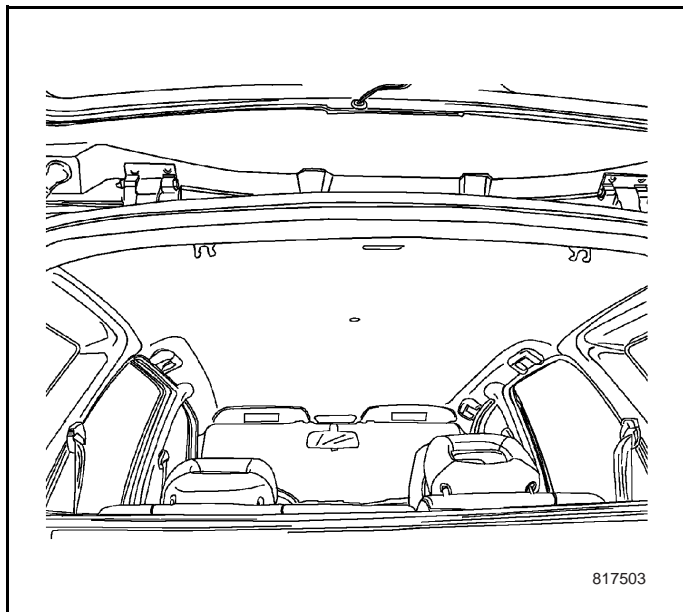
2. The sun visor hole on the top headliner and the 2 holes behind the top headliner should be aligned with respectively related holes on the body when installing the top headliner.
3. Install the right sun visor clip. Refer to Sun Visor Support Replacement
4. First install the left rear clip, and then the right rear.
5. Install the left sun visor support. Refer to Sun Visor Support Replacement
6. Install the sun visor. Refer to Sun Visor Replacement
7. Use the door sealing strip to secure the headliner.
8. Rotate the left front seat back to the vertical position.
9. Rotate the right front seat back to the vertical position.
10. Install the windshield pillar trim panel. Refer to Front Windshield Pillar Trim Panel Installation.
11. Install the quarter window trim panel. Refer to Quarter Window Trim Panel Replacement
12. Install the upper center pillar trim panel. Refer to Trim Panel Replacement-Upper and Lower Center Pillar.
13. Install the assist pull rod hole clip. (Installation of the assist pull rod is only limited to the 2 types of SE and SE AT).
14. Install the dome lamp. Refer to Dome Lamp Replacement in Lighting System.
15. Install the rear dome lamp lens. (Installation of the rear dome lamp is only limited to the 2 types of SE and SE AT).

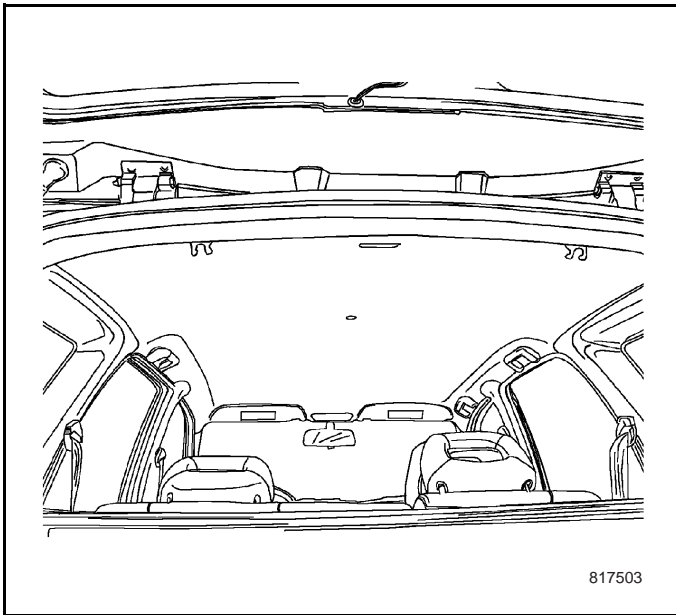
8.17.2.22B1 Headliner Replacement (without sun roof)

Removal Procedure

Tools required

- J 38778 Door Inner Trim Panel and Trim Panel Clip Remover.
1. Remove the sun visor. Refer to Sun Visor Replacement
 2. Remove the dome lamp. Refer to Dome Lamp Replacement in Lighting System.
 3. Remove the sun visor support. Refer to Sun Visor Support Replacement
 4. Remove the assist pull rod hole clip. (Removal of the assist pull rod is only limited to the 2 types of SE and SE AT).
 5. Remove the trunk lamp (only limited to the 2 types of SE and SE AT).
 6. Remove the windshield pillar trim panel. Refer to Windshield Pillar Trim Panel Replacement.
 7. Remove the quarter window trim panel-rear door. Refer to Quarter Window Trim Panel Replacement-Rear Door.
 8. Remove the upper center pillar trim panel. Refer to Trim Panel Replacement-Upper and Lower Center Pillar.
 9. Use tool J 38778 to remove the 2 clips in the middle of and behind the top headliner.
 10. Remove both the left and right supports.
 11. Rotate the right front seat back to the horizontal position.
 12. Remove the top headliner from the door sealing strip.
 13. Remove the headliner panel from the vehicle through the right front door.





Installation Procedure

1. Move the headliner into the vehicle through the right front door.

Note: Don not bend the headliner too much at the time of installation.

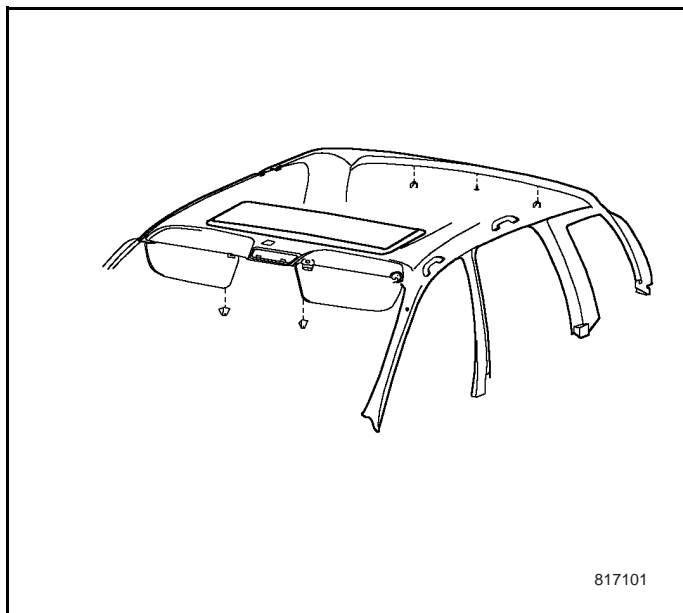
2. The sun visor hole on the top headliner and the 2 holes behind the top headliner should be aligned with respectively related holes on the body when installing the top headliner.
3. Install the right sun visor support. Refer to Sun Visor Support Replacement
4. Install both the rear and middle supports, then the left and right supports.
5. Install the left sun visor support. Refer to Sun Visor Support Replacement
6. Install the right and left sun visors. Refer to Sun Visor Replacement
7. Use the door sealing strip to secure the headliner.
8. Rotate the left/right front seat back to the vertical position.
9. Install the windshield pillar trim panel. Refer to Windshield Pillar Trim Panel Installation.
10. Install the rear door quarter window trim panel. Refer to Quarter Window Trim Panel Replacement-Rear Door.
11. Install the upper center pillar trim panel. Refer to Trim Panel Replacement-Upper and Lower Center Pillar.
12. Install the assist pull rod hole clip. (Installation of the assist pull rod is only limited to the 2 types of SE and SX AT).
13. Install the dome lamp. Refer to Dome Lamp Replacement in Lighting System.
14. Install the assist pull rod (only limited to the 2 types of SE and SX AT).

8.17.2.22B2 Headliner Replacement (without sun roof)

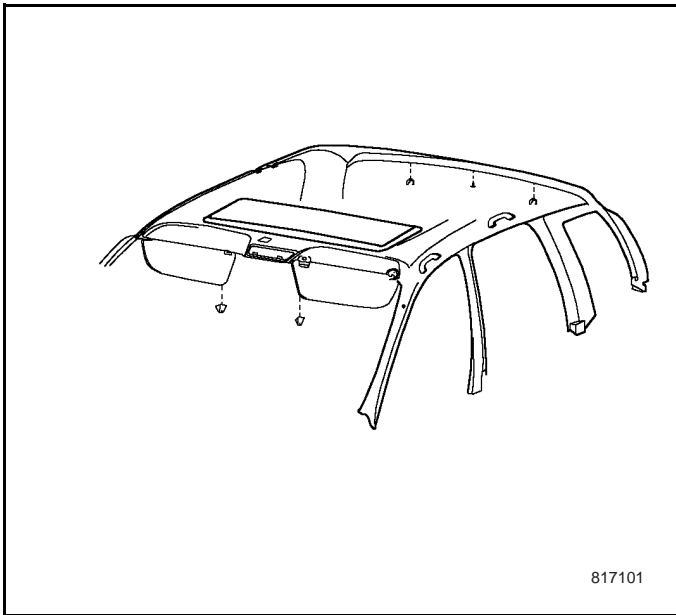
Removal Procedure

Tools required

- J 38778 Door Trim Pad and Trim Clip Remover



1. Remove the sun visor. Refer to Sun Visor Replacement.
2. Remove the dome lamp. Refer to Dome Lamp Replacement in Lighting System.
3. Remove the sun visor support. Refer to Sun Visor Support Replacement.
4. Remove the sun roof motor switch and switch support.
5. Remove the assist handle. Refer to Assist Handle Replacement.
6. Remove the trunk lamp. Refer to Trunk Lamp Replacement in Lighting System.
7. Remove the windshield pillar trim panel. Refer to Front Windshield Pillar Trim Panel Replacement.
8. Remove the rear window upper trim panel. Refer to Rear Window Upper and Lower Trim Panel Replacement.
9. Remove the upper center pillar trim panel. Refer to Trim Panel Replacement-Upper and Lower Center Pillar.
10. Rotate the right front seat back to the horizontal position.
11. Use J 38778 to remove the clip at the rear of the headliner.
12. Remove the 2 storage box hook behind the headliner.
13. Remove the headliner from the door sealing strip.
14. Disconnect the headliner with the sun roof mechanism at the sun roof opening.
15. Move the headliner out of the vehicle through the right front door.



Installation Procedure

1. Install the headliner into the vehicle through the right front door.

Note:

A Do not bent the headliner too much at the time of installing into the vehicle.

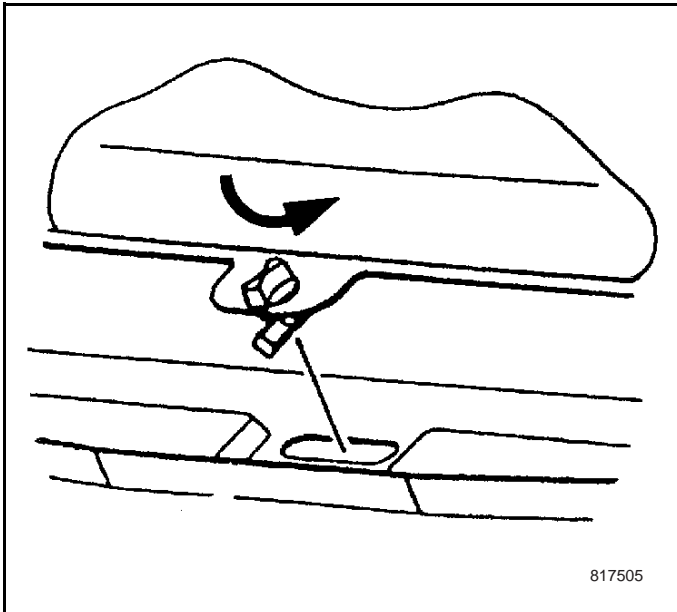
B Do not first fasten the headliner and sun roof mechanism through nylon clips to stick them together.

2. Align the sun visor hole on the headliner and the rear clip hole with the appropriate holes in the body construction, and position the headliner.
3. Install the right sun visor support. Refer to Sun Visor Support Replacement.
4. Install the clip at the rear of the headliner.
5. Install the left sun visor support. Refer to Sun Visor Support Replacement.
6. Install the left and right sun visor. Refer to Sun Visor Replacement.
7. Install the 2 rear storage box hanging hooks.
8. Use the door sealing strip to secure the headliner.
9. Rotate the right front seat back to the vertical position.
10. Install the windshield pillar trim panel. Refer to Front Windshield Pillar Trim Panel Replacement.
11. Install the upper center pillar trim panel. Refer to Trim Panel Replacement-Upper and Lower Center Pillar.
12. Install C-pillar upper trim panel. Refer to Rear Window Upper and Lower Trim Panel Replacement.
13. Remove the assist handle. Refer to Assist Handle Replacement.
14. Install the dome lamp. Refer to Dome Lamp Replacement in Lighting System.
15. Install the trunk lamp. Refer to Trunk Lamp Replacement in Lighting System.
16. Install the sun roof motor switch and switch base. Refer to Electric Sun Roof Switch and Switch Base Replacement in Sun Roof.
17. Push upward the headliner sun roof opening area surroundings by installing with hand to allow the headliner clip and the sun roof mechanism to be stuck tight.

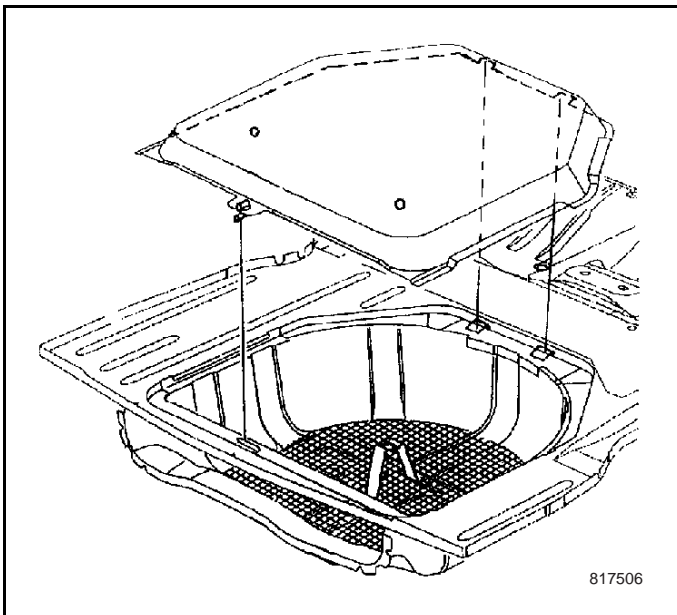
8.17.2.23B Standby Wheel Slot Cover Replacement

Removal Procedure

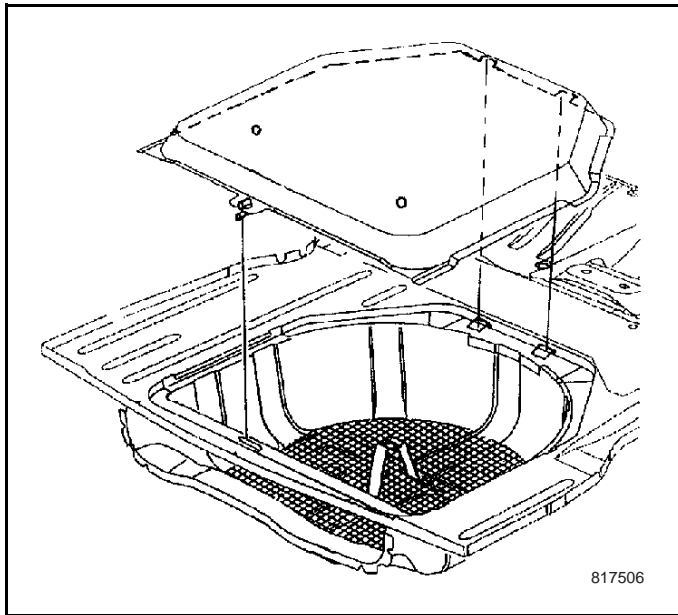
1. Remove the storage box. Refer to Rear Compartment Bottom Tank Hold Storage Box Replacement.
2. Remove the trunk floor carpet.
3. Rotate the button to the horizontal position to release the back.



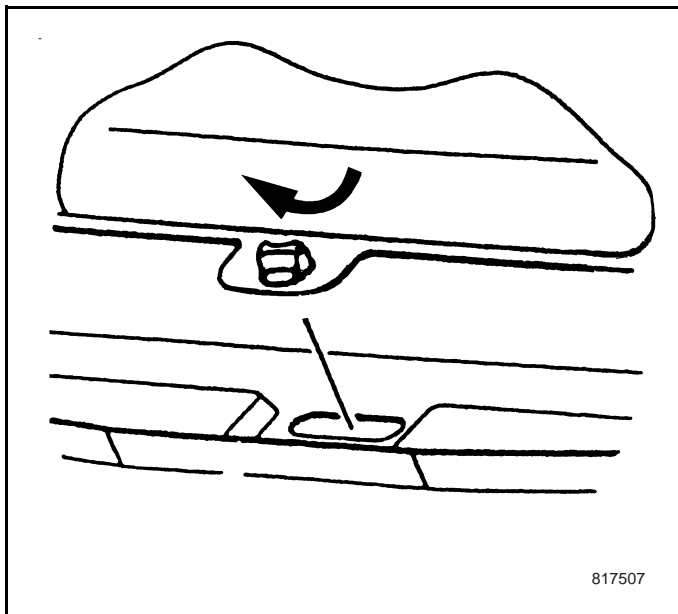
4. Lift upward the cover through the hole on the cover to allow it facing toward you.
5. Remove the spare wheel cover.



Installation Procedure



1. Tilt the cover to allow it fitting with the front side.
2. Place down the cover to allow the lower button enter into the body hole.

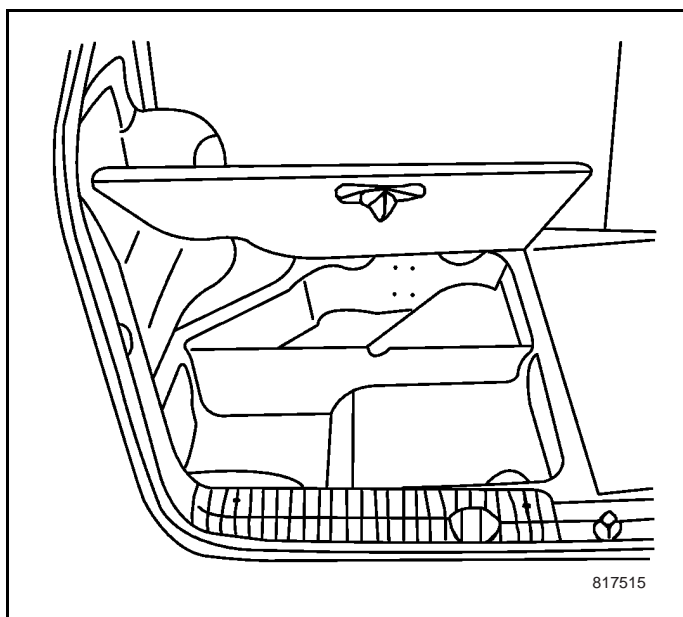
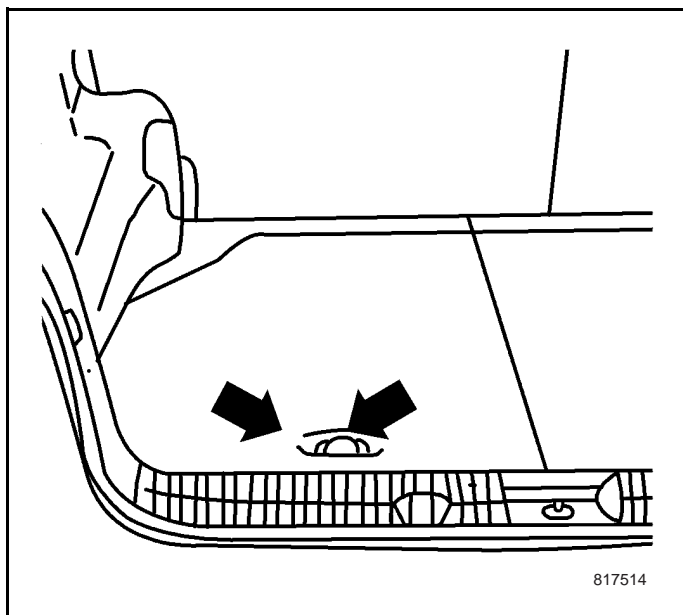


3. Rotate the button to the vertical position to allow it to match the back.
4. Install the trunk floor carpet.
5. Install the storage box. Refer to Rear Compartment Bottom Tank Hold Storage Box Replacement.

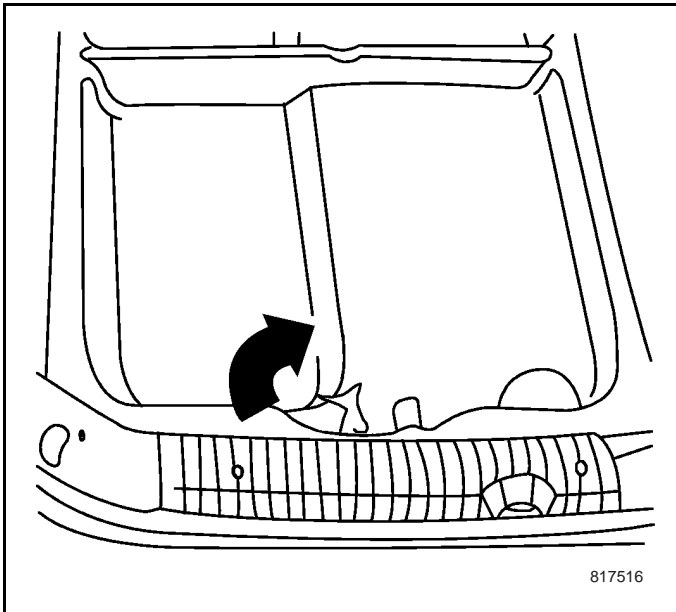
8.17.2.24B Rear Compartment Bottom Tank Storage Box Replacement.

Removal Procedure

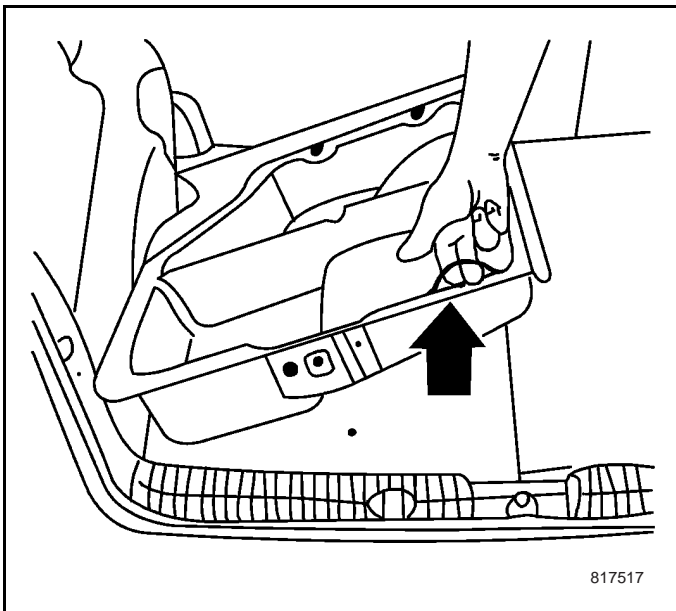
1. Press the button to open the first compartment cover.



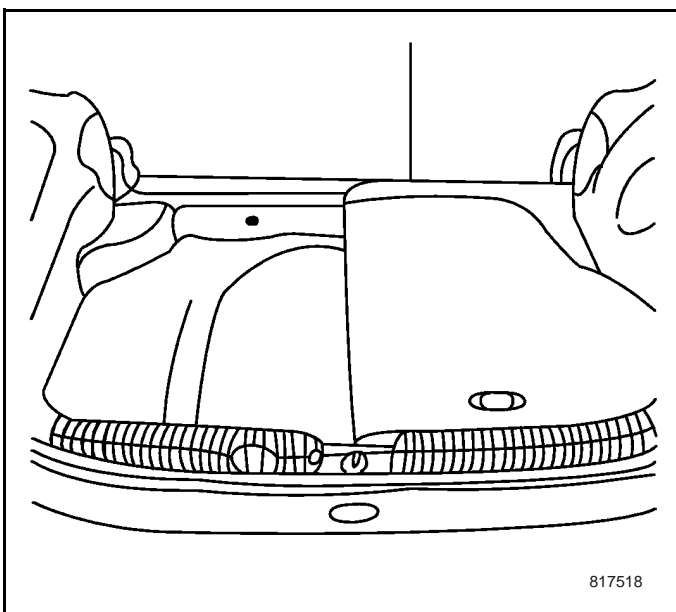
2. Lift the cover to allow it facing toward you.



3. Rotate the box lock to release the box back.



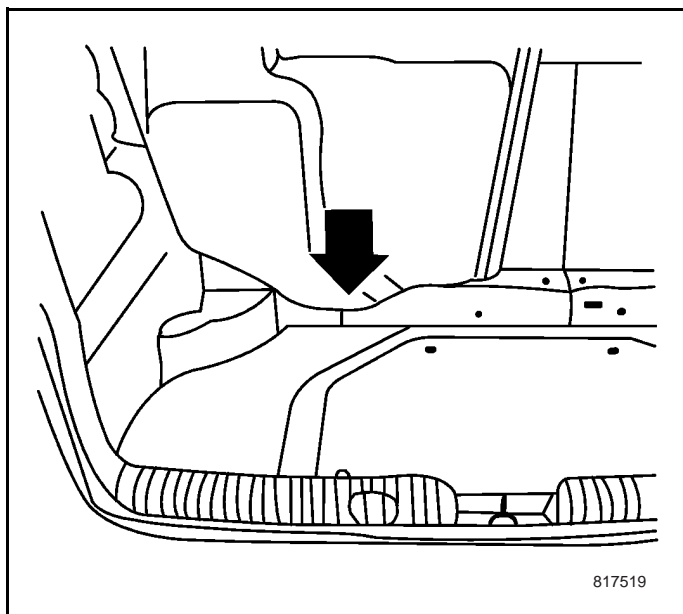
4. Pull the box upward through the box rope and to allow it facing towards you.



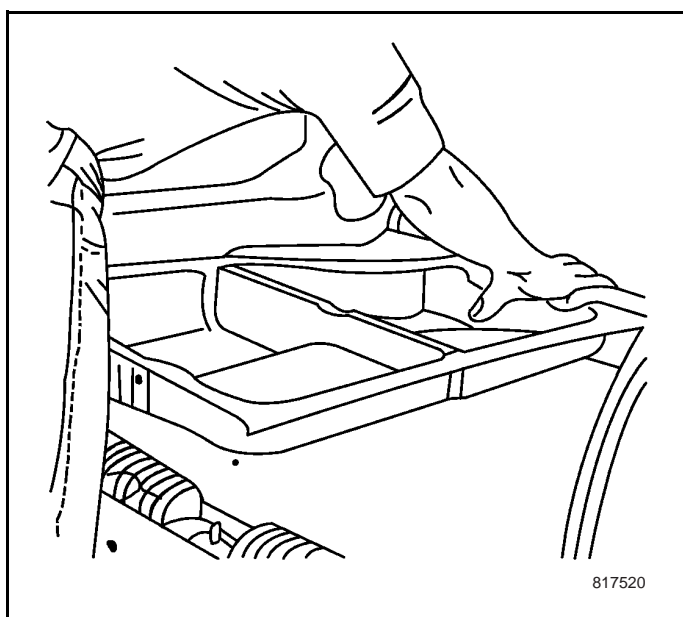
5. Repeat the steps 1,2,3,4 to perform the removal of the second box.

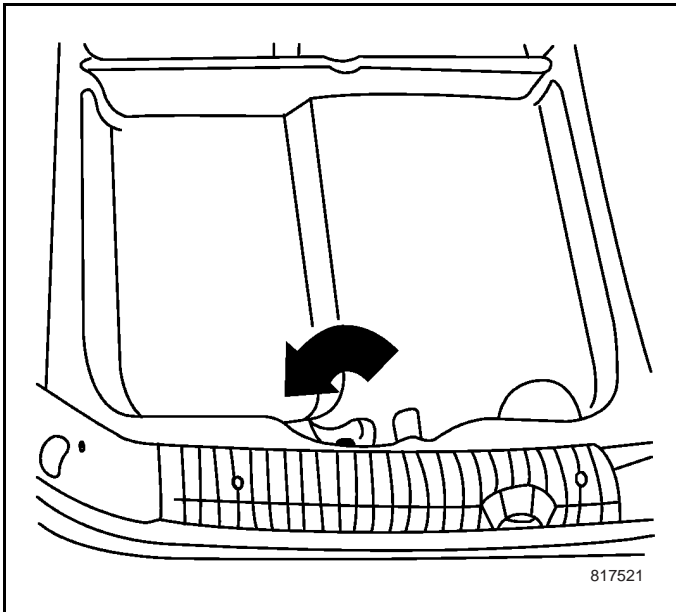
Installation Procedure

1. Tilt the cover to allow it fitting with the front side.

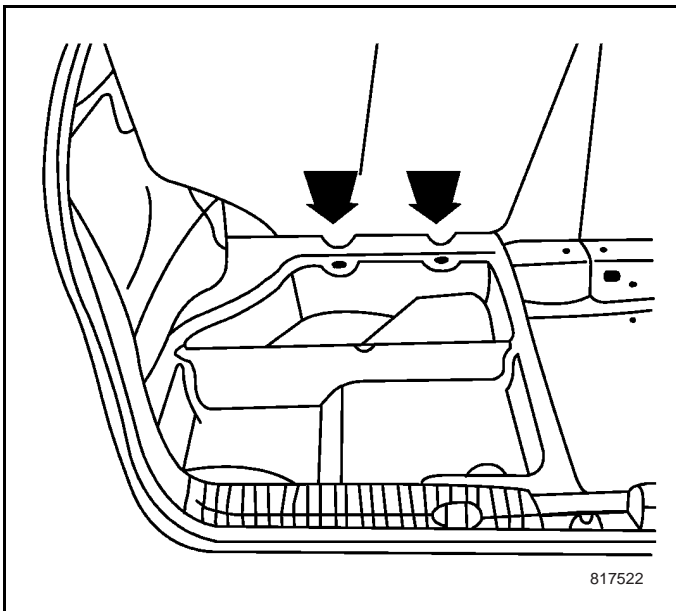


2. Apply a bit pressure at the front side of the box to allow it to sink.

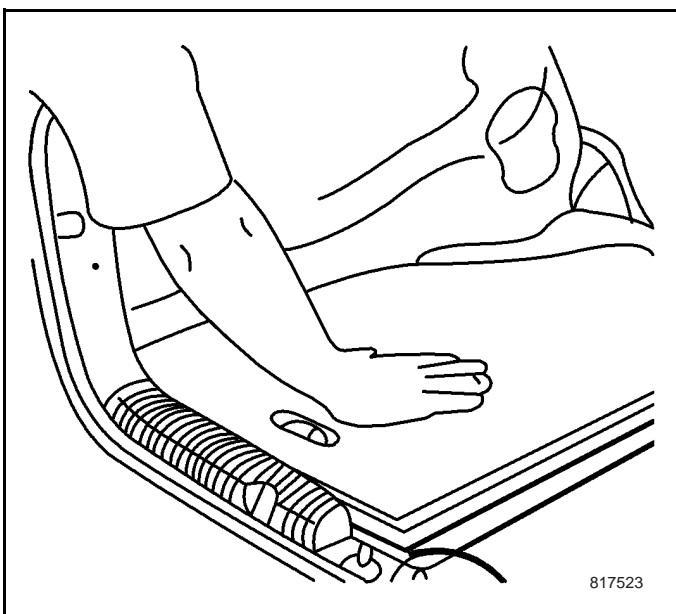




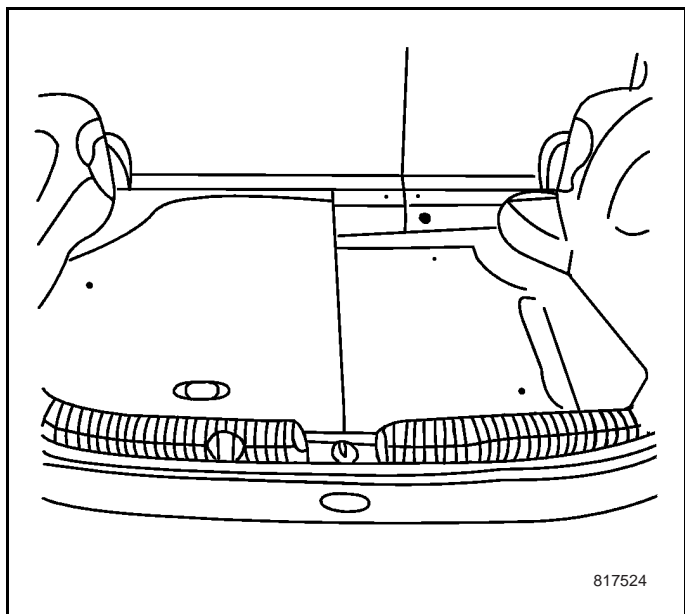
3. Rotate the box lock to release the box back.



4. Allow the front side matching the cover and make it to sink.



5. Press slightly the button front position on the cover.



6. Repeat the steps 1,2,3,4 to perform the installation of the second box.

8.17.3 Description and Operation

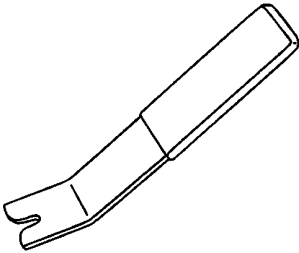
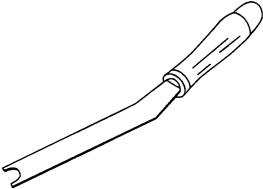
8.17.3.1 Headliner Description

A molded roof is made of by pressing of base and facing material. The headliner is attached to the position by the following components.

- Left rear and right rear clip of the headliner
- Installation of Related Components
- Interior Trim

The headliner must be serviced as a complete assembly.

8.17.4 Special Tools

Legend	Tool No./Name
 <p>J38778</p>	<p>J 38778 Door Trim Pad and Trim Clip Remover</p>
 <p>KM-317-A</p>	<p>KM-317-A Door Handle and Window Regulator Handle Remover</p>

8.18 Plastic Panel Information and Repair

8.18.1 Specifications

8.18.1.1 Repair Materials - Flexible Plastic Part

Thermoset Plastic Type	Repair	The recommended repair materials	Supplier
Most flexible and semi flexible plastics	Most repairs	GM Goodwrench Compoxy Repair Material (GM P/N 12377980 or equivalent)	GM dealer/retailer
		CMR-8 Composite Repair Material P/N 82091 or equivalent	Refer to a local paint supplier
TPO, TEO (Polyolefin Plastics) require the application of GM P/N 1052364 polyolefin adhesive primer before the GM P/N 12377980 repair compound is applied.			

8.18.1.2 Repair Materials - Rigid Plastic Part

Thermoset Plastic Type	Repair	The recommended repair materials	Supplier
Most rigid plastics	Cosmetic filling	GM Goodwrench Structural Bonding Epoxy (GM P/N 12345726 or equivalent)	GM dealer/retailer
		Sikkens Polystop LP or equivalent polyester repair putty	Refer to a local paint supplier
Most rigid plastics	Cosmetic repair; Adhesive bonding	GM Goodwrench Structural Bonding Epoxy (GM P/N 12345726 or equivalent)	GM dealer/retailer
		Lord Fusor SMC Body Panel Repair Adhesive or equivalent	Refer to a local paint supplier
Most rigid plastics	Adhesive bonding	GM Goodwrench Structural Bonding Epoxy (GM P/N 12345726 or equivalent)	GM dealer/retailer
		Dynatron Dyna-Weld Plio Grip or equivalent (OE structural adhesive)	Refer to a local paint supplier
Most rigid plastics	Adhesive structural bonding	GM Goodwrench Structural Bonding Epoxy (GM P/N 12345726 or equivalent)	GM dealer/retailer

8.18.1.2 Repair Materials - Rigid Plastic Part(Cont' d)

Thermoset Plastic Type	Repair	The recommended repair materials	Supplier
Most rigid plastics	Adhesive bonding Structural adhesive	US Chemical and Plastic System 2000 Structural Adhesive P/N 82007B = 30min P/N 82,014B = 9min	Refer to local paint supplier or US Chemicals customer service center 1-800-321-0672
Structural adhesive bonding may require the use of a pneumatic applicator, A8-37479-1A, or equivalent, to speed the application of the GM 12345726 epoxy.			Kent-Moore 1-800-GM- TOOLS

8.18.2 Repair Instructions

8.18.2.1 Plastic Panels

Repair Procedure

Note: Follow these guidelines when performing SMC repairs:

- Clean, scuff, and solvent wipe all the areas to be repaired.
 - For added strength and durability, V-groove and reinforce at least one side of SMC joints using a tacky mesh tape or equivalent.
 - When partial panel replacement is performed, use 2 inch backing patches made from SMC or E-coated steel, as a reinforcement for all the butt joints.
1. Scuff the area where repair is to be performed.
 2. Clean the bond area with a lint-free rag using a water-based cleaner.
 3. Cracks in SMC should be grooved and reinforced on at least 1 side using a tacky mesh tape or equivalent.
 4. Sectioning joints require backing strips 50mm (2 in) wide, which can be cut from leftover pieces of SMC.
 5. Apply a thin coat of Goodwrench Structural Bonding Epoxy GM P/N 12345726, or equivalent, to the entire joint area extending across the cut lines and across the backing strip.
 - Use a tacky mesh tape or an equivalent reinforcement matting.
 - Allow to cure according to the adhesive manufacturer's recommendations.
 6. Shape and refinish the repair areas as necessary to resemble the original appearance.

Bonding Procedure

Note: Use the following procedure when bonding undamaged SMC to epoxy ñ coated steel.

1. Prime all the bare metal areas with an anti-corrosion material. Refer to GM 4901 Refinish Manual for approved materials.
 - Some paint manufacturers recommend a pre-primer when bonding to epoxy.
 - The manufacturer's recommendations must be followed.
 - Do not combine paint systems.
2. Clean the bond area with a lint-free rag using a water-based cleaner.
3. Scuff both surfaces to be bonded using a scuff pad such as 3M's Scotch-Brite Red scuff pad P/N 07447 or equivalent.

4. Ensure that the surface is clean and dry before applying the adhesive.
 - Use compressed air.
 - Do not wipe the surface with a hand or rag.
5. Determine whether the adhesive is applied to the vehicle or the replacement panel.
6. Apply a consistent adhesive bond to the prepared surfaces.
7. Mechanically retain the panel in place in order to wet out the adhesive along the entire bonding surface.
8. Allow the area to cure according to the adhesive manufacturer's recommendations.

8.18.2.2 General Plastic Repair Instructions

The following procedures should be followed when repairing all types of thermoset plastic:

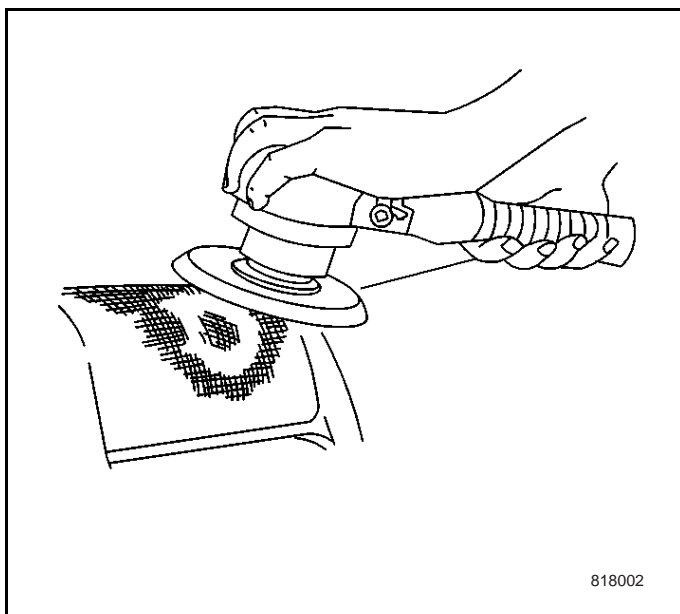
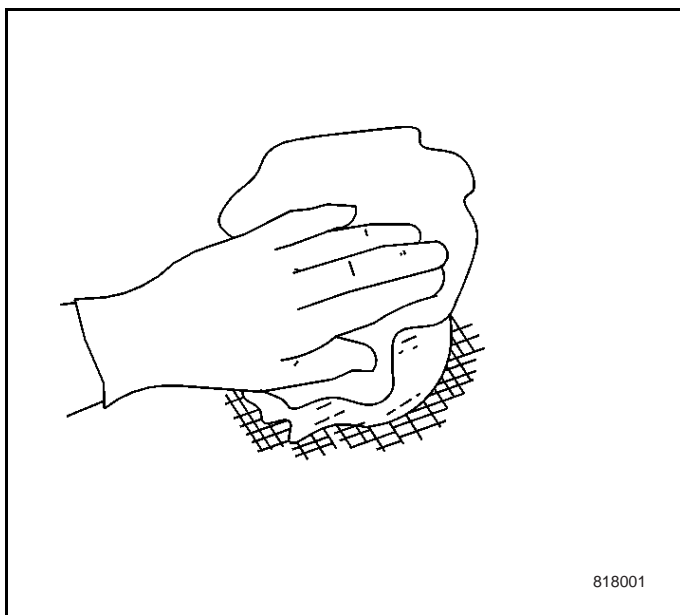
1. Use the supplies and the repair materials from the same manufacturer. Never combine the different systems. Mixing materials from different manufacturers can produce unsatisfactory results.
2. Clean the inner and outer surfaces of the repair area with a soap impregnated scouring pad in order to remove any dirt or mold release agent. A mold release agent is used during manufacturing in order to prevent the part from sticking to the mold. This release agent may be present in large enough concentrations to affect adhesion.
3. After washing, clean the area a second time with a wax and grease remover. Use only remover to wet the cleaning cloth. Too much of the solvent will saturate the panel and may migrate out later, affecting the finish. Use the cloth and air to clean the surface. Allow the panel to dry thoroughly.
4. Apply force around the damaged area in order to look for hidden damage such as hairline cracks. Small cracks and faults in the bonds and the panels will eventually grow larger if left unattended. Drill a 3mm (1/8 in) hole at each end of a crack in order to prevent any further cracking.
5. Remove the finish on repair areas. The adhesive is designed for bonding the plastic base not for the finish.
6. Prime a metal surface before applying the repair material.
7. Repair the inner surface of the panel first.

8. When using a mat reinforcement to repair the inner surface of a panel, inspect that there are no strands of the mat left uncovered or unsaturated with the repair material. If exposed, the mat may act as a wick and draw moisture into the repair area, affecting the integrity of the finish.
9. Inspect the rear of the damaged panel for tool clearance. If accessing the repair with a saturation roller, a grinder, or a sander is impossible, do the repairs by hand.
10. If damaged severely, locate the damaged or butt-joint area with a tie bar or clamp. For a smaller repair, use a heavy tape on the outer surface in order to maintain the alignment until the inner repair material has cured.
11. If welding is necessary, do not allow the flame or the welding heat to come into direct contact with the plastic body panels. Protect the surrounding area with a fire retardant fabric. Several layers of aluminum foil make an excellent heat shield if not in direct contact with the flame.
12. Inspect the rear side of the work area before making repairs in order to avoid possible damage to wires, motors, etc.
13. Fiberglass parts will not yield or take a set as with steel parts, thus they cannot be straightened. If poor alignment are suspected, due to a collision or other damage, inspect the steel reinforcements for damage and replace or repair them before repairing the plastic parts.
14. When cleaning up the work area, save any useful size pieces of repair material. These pieces can be used for reinforcing smaller repair areas.
15. Force dry Structural Bonding Epoxy with heat. Follow the manufacturer's curing recommendations. Heat speeds the cure time and increases the bond strength. Follow the manufacturer's recommended curing methods.

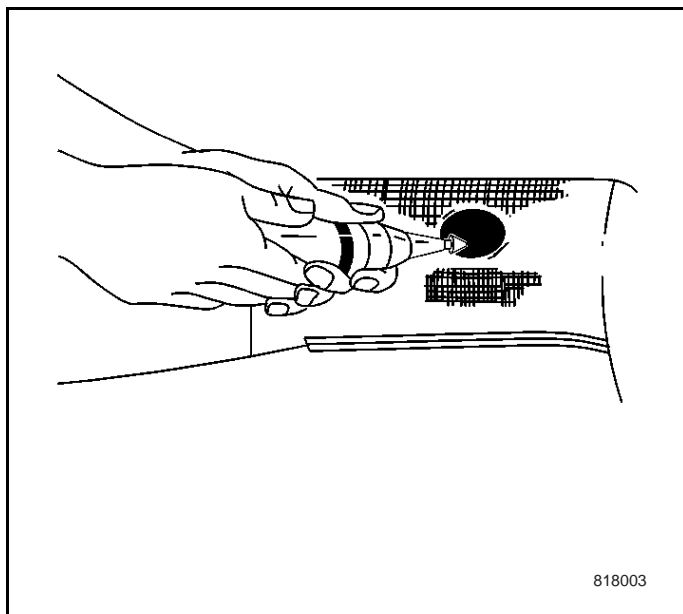
8.18.2.3 Gouge or Puncture Repair

Notice: When the fiberglass laminate is not pierced through or the damage extensive, the damaged area can be repaired using the following procedure:

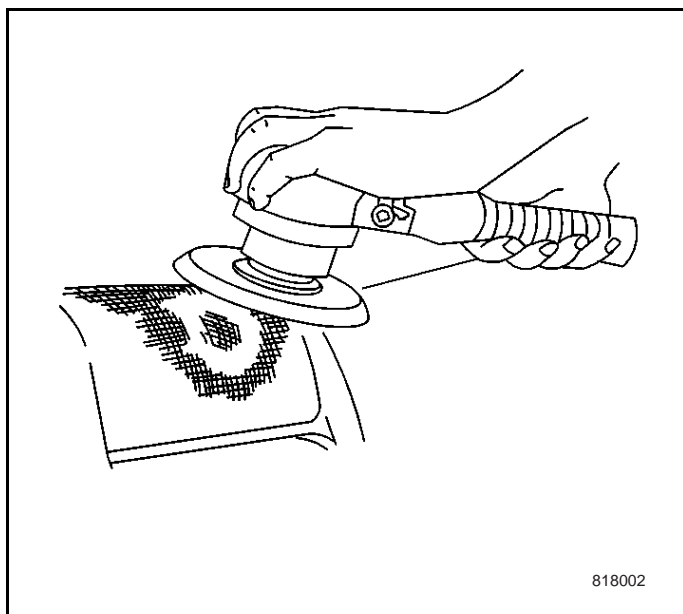
1. Clean and inspect the damaged area. Refer to General Plastic Repair Instructions.
2. Use the cloth and air to clean the surface.



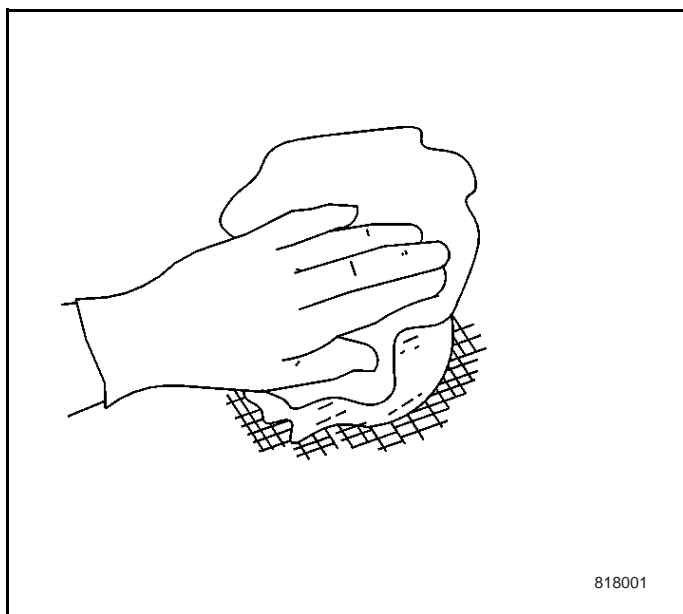
3. Sand the damaged area down to the fiberglass laminate. Use a sander with a vacuum attachment in order to minimize dust.



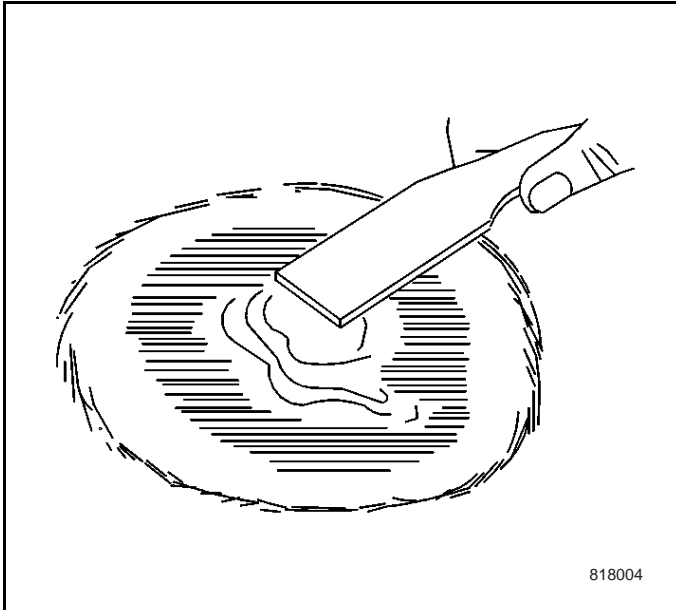
4. Grind or file the edges of the damaged area in order to form a dish. The side of the dish should have a pitch for a maximum bonding surface.



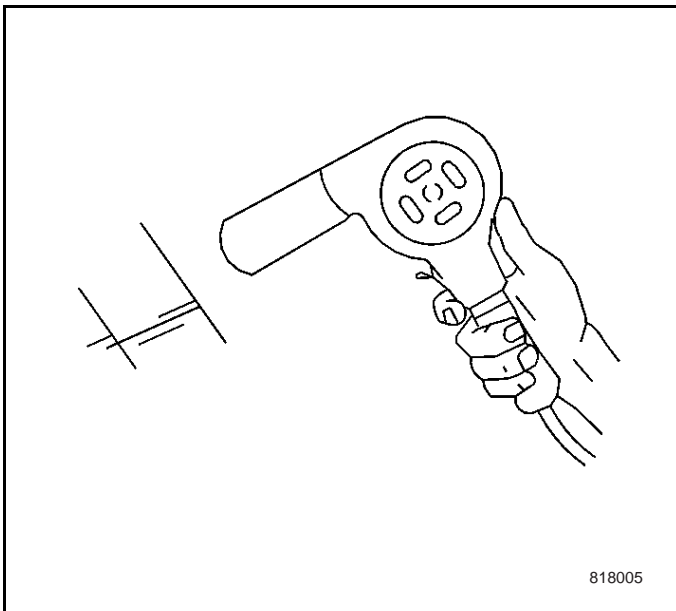
5. Scuff sand the area surrounding the damaged area in order to provide a good bonding surface.



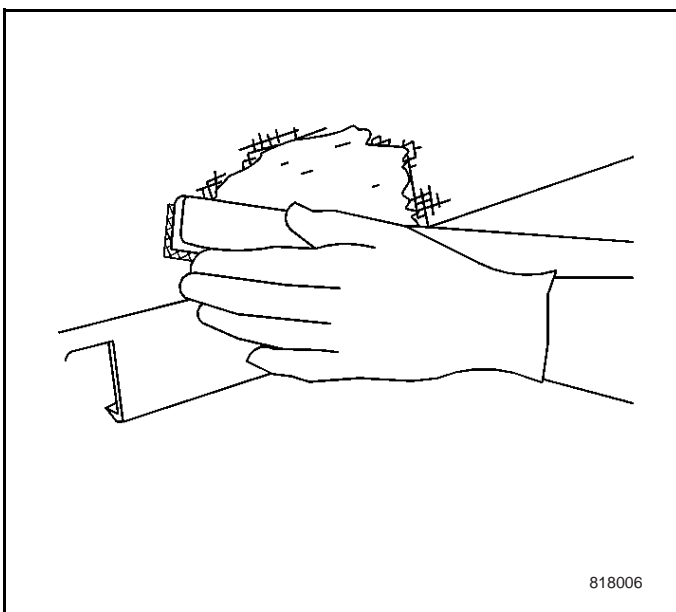
6. Clean the repair area again using a water based wax and grease remover.
7. Use the cloth and air to clean the surface.



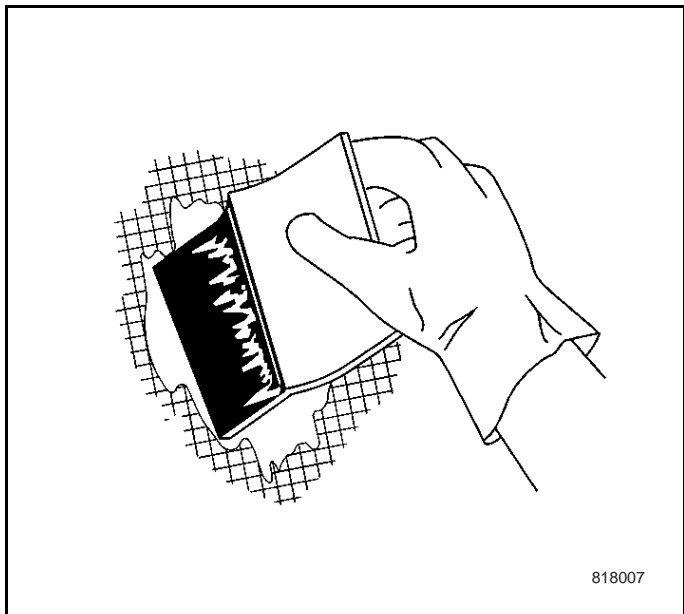
8. Combine the recommended repair materials. Refer to Repair Materials - Flexible Plastic Part or Repair Materials - Rigid Plastic Part.
9. Apply the repair material to the damaged area until the repair is slightly higher than the surrounding area.



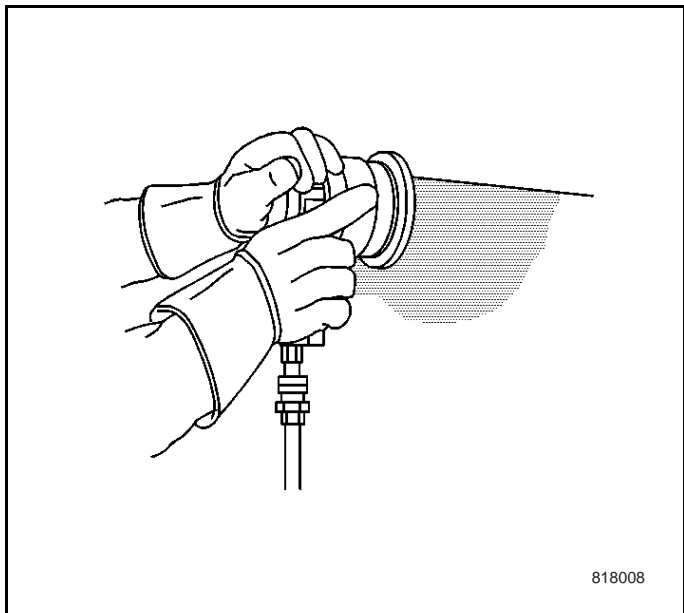
10. Cure the repair material. Follow the manufacturer's recommendations.



11. Rough out the surface using a 80 grit disc on a DA sander or a curved - tooth body file.



12. Apply a polyester type material, in order to provide a uniform surface for sanding, such as Silkens Polystop LP, or equivalent.

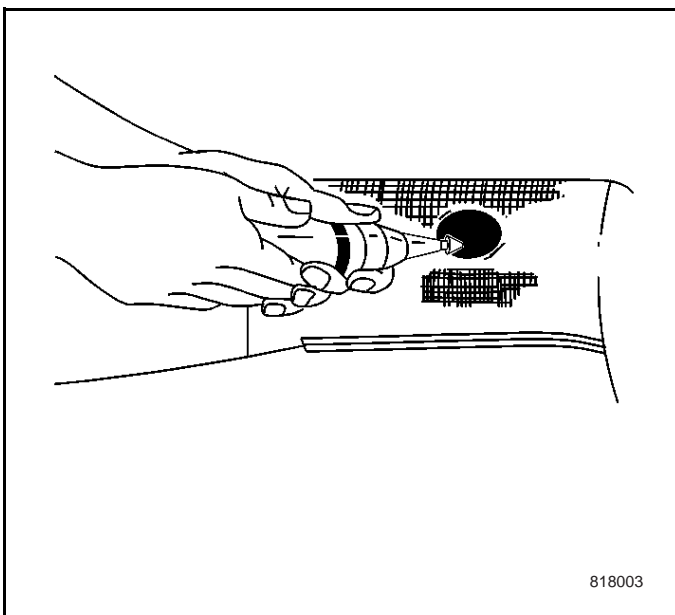
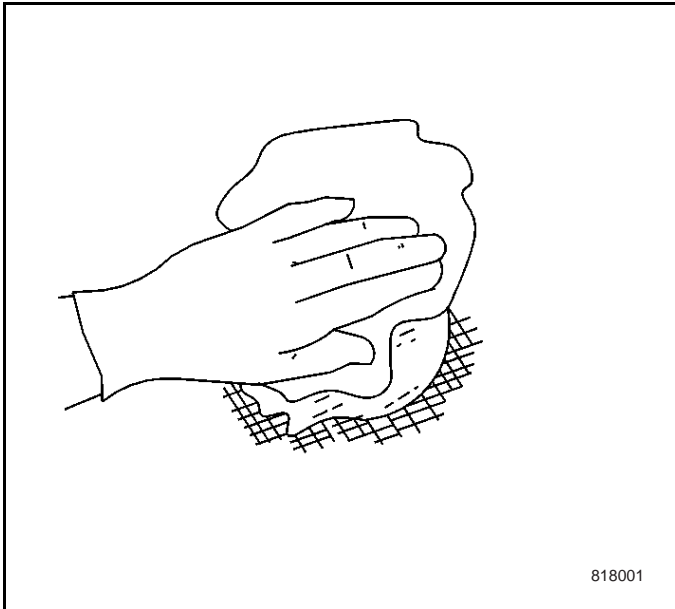


13. Finish sand with a dual action random orbital sander.
14. If necessary, apply primer and refinish. Refer to GM 4901 M-D for a listing of approved materials. Follow the procedures recommended by the material manufacturer.

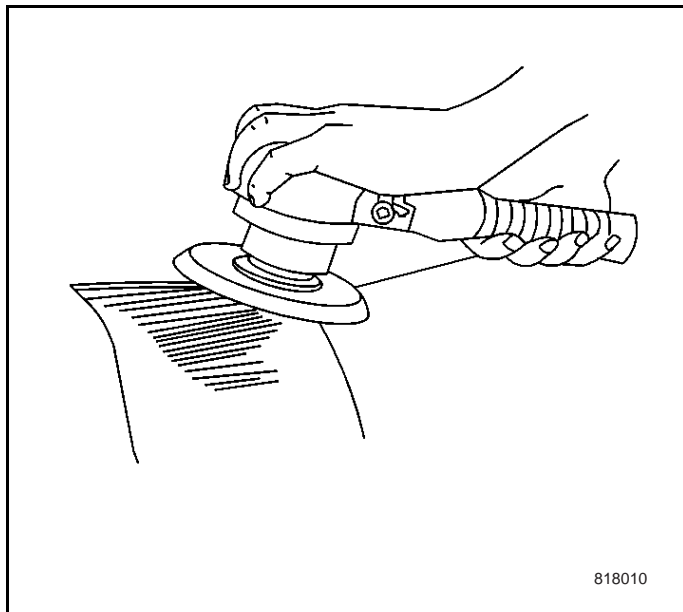
8.18.2.4 Panel Replacement - Partial

When you splice a replacement panel or a portion of a replacement panel to an existing panel, use the following procedure:

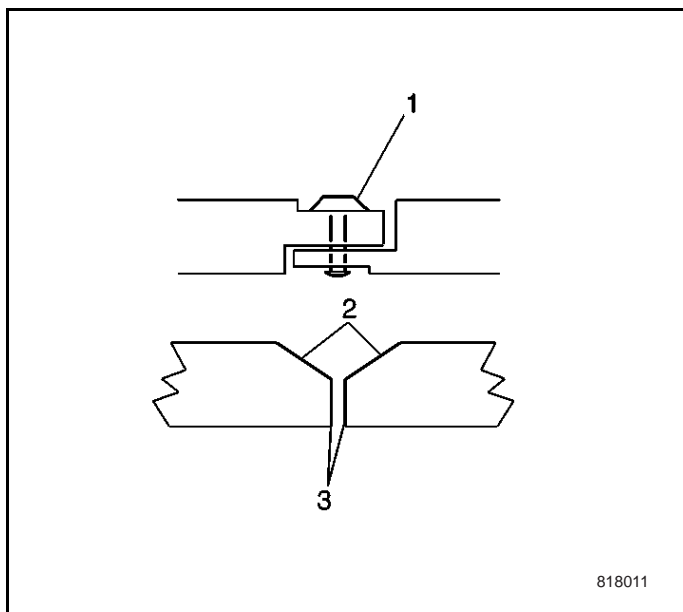
1. Clean and inspect the damaged area. Refer to General Plastic Repair Instructions.



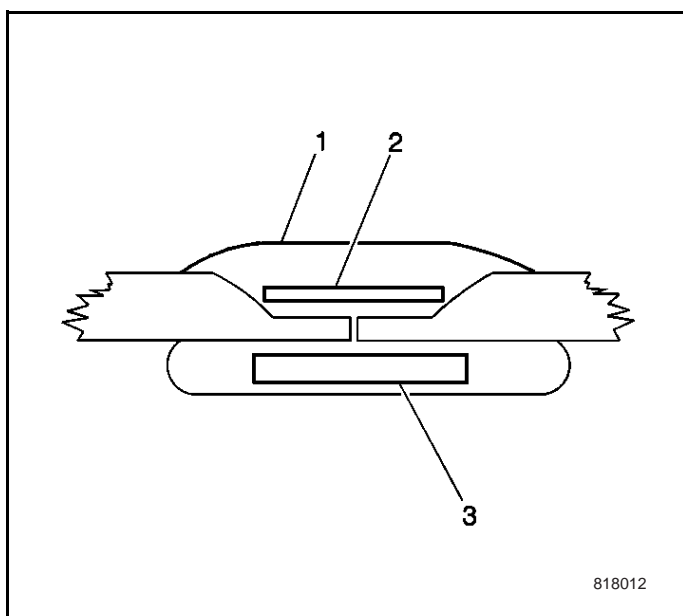
2. Cut the damaged area and/or the replacement panel to the appropriate size so that the panel fills the opening.



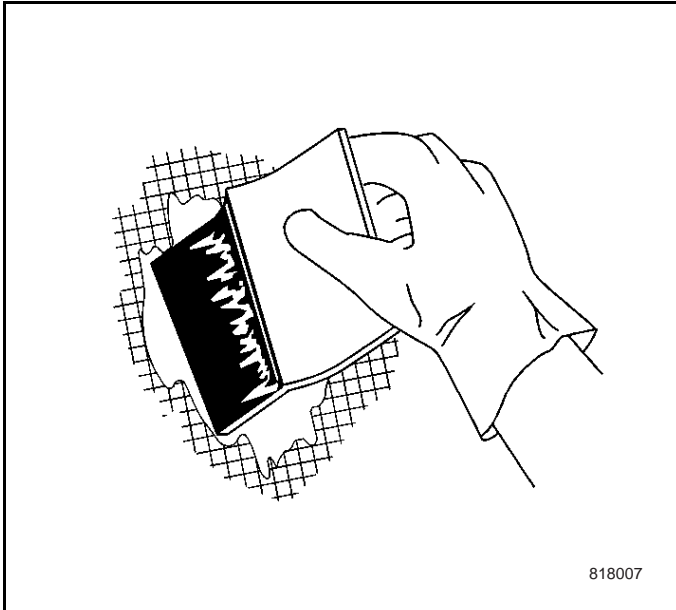
3. Scuff sand the damaged area and the replacement panel's mating surfaces.



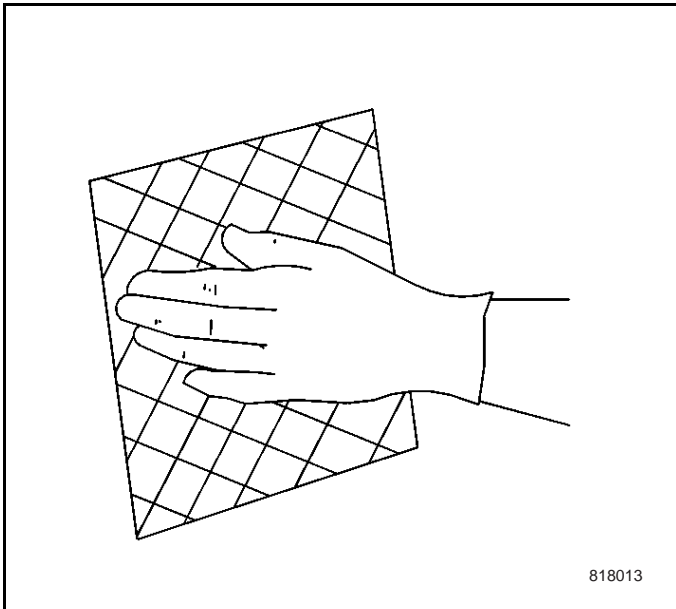
4. Install the panel onto the opening:
 - If the bonding strips are exposed, mechanically attach (1) and bond the strips together.
 - If the bonding strips are not exposed, cut or grind the edge of the panels in order to form a good butt joint (3). Then bevel the edge (2) to about 30 degrees in order to form a dish butt joint.



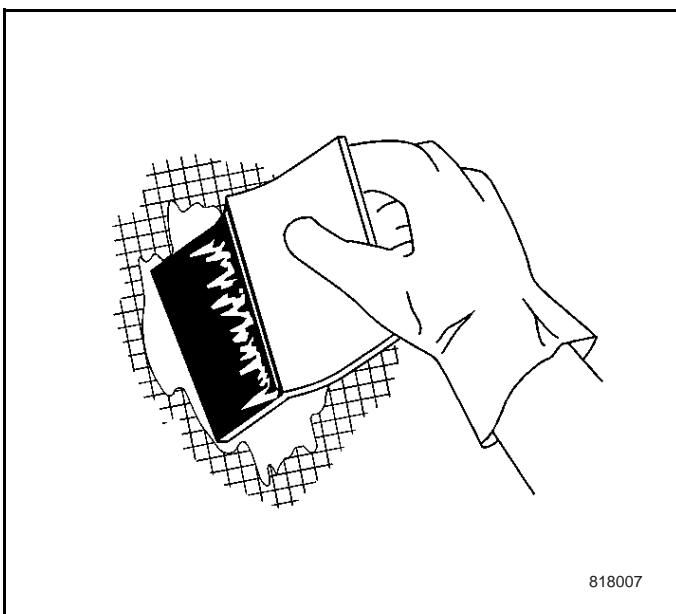
5. Install a backing patch (3). Refer to Backing Patch Fabrication.



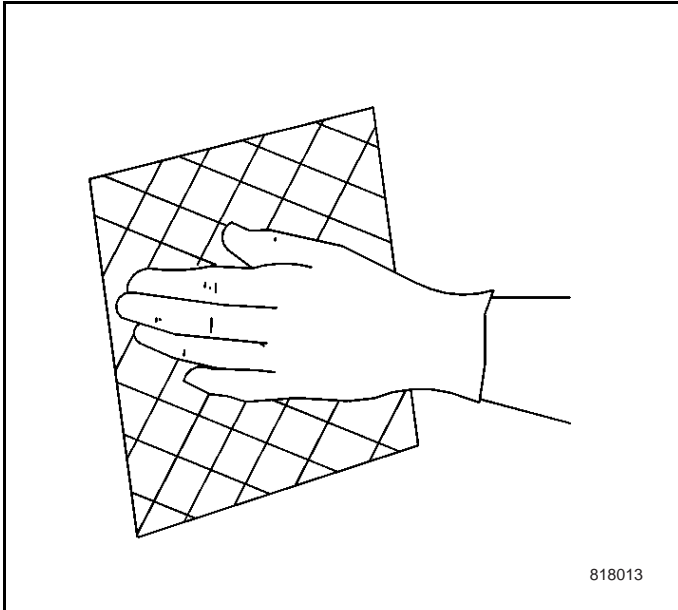
6. Following the manufacturer's instructions, mix and apply a light coat of the repair material to the outside of the damaged area.



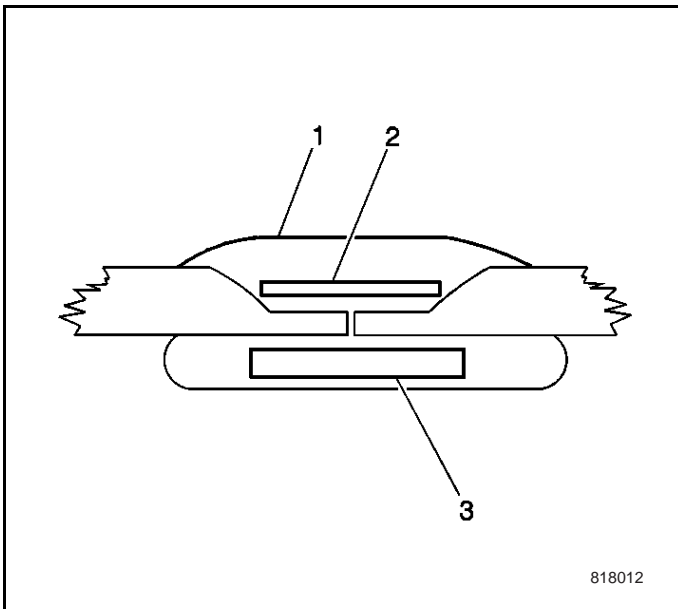
7. Lay a piece of reinforcement mat into the repair material.
- The mat should extend 38-51mm (1.5-2.0 in) beyond either side of the repair area.
 - All of the mat must be at a level below the final finished surface.
8. Using an applicator, saturate and remove any trapped air from the repair area.



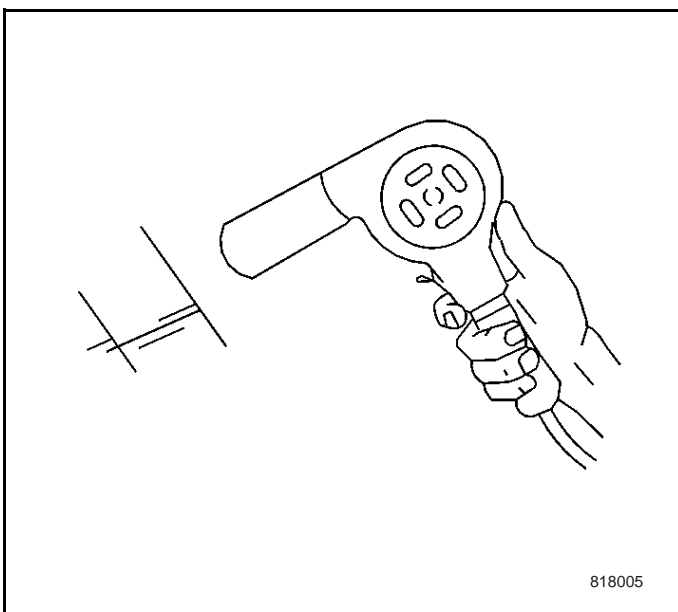
9. Apply a second coat of the repair material in the same manner.



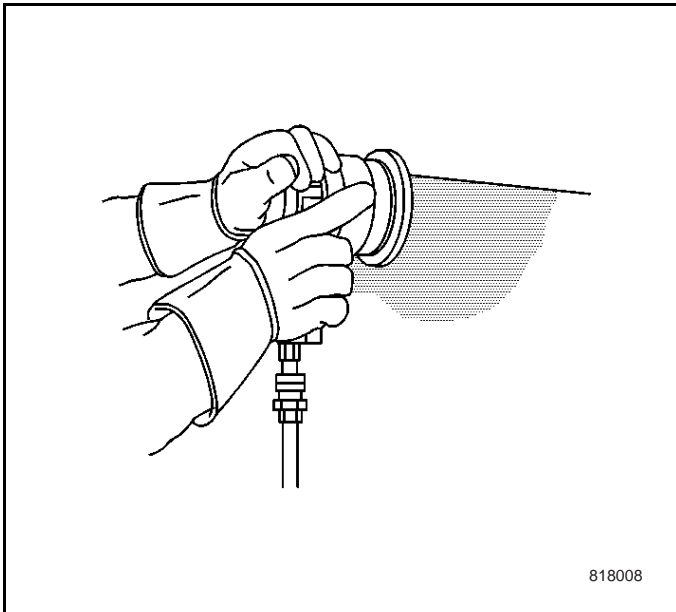
10. Lay a second piece of mat into the repair area in the same manner.



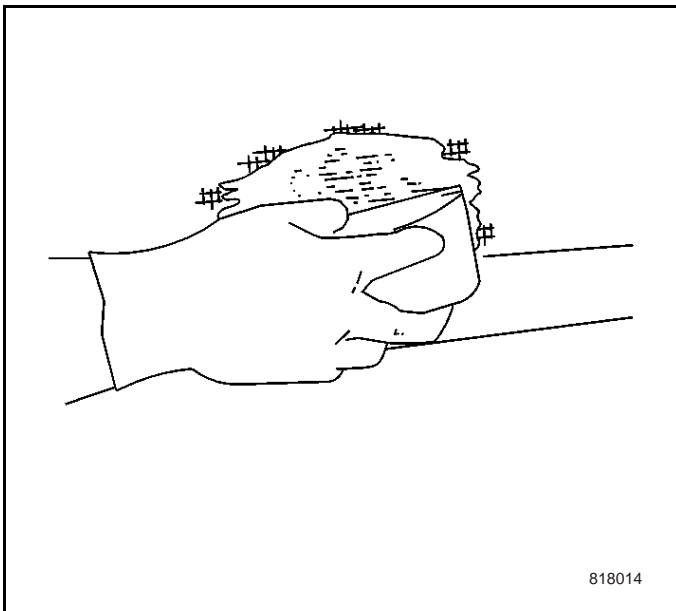
11. Apply the final layer or repair material in the same manner until the repair material (1) is at a level slightly higher than the surrounding area.



12. Cure the material according to the manufacturer's instructions.
13. Apply and cure additional layers as needed.



14. Rough out the surface using a 80 grit disc on a DA sander.



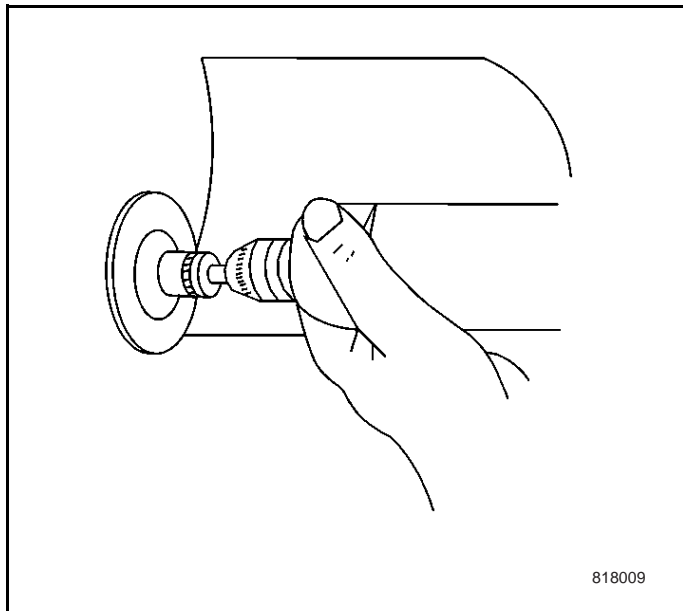
15. Apply a polyester type material to provide a uniform surface for sanding, such as Silkens Polystop LP, or equivalent.
16. If necessary, apply primer and refinish surface.
Refer to GM 4901 M-D for approved materials. Follow the procedures recommended by the material manufacturer.

8.18.2.5 Panel Replacement - Complete

Removal Procedure

Note: Wear safety equipment when you work with plastic.

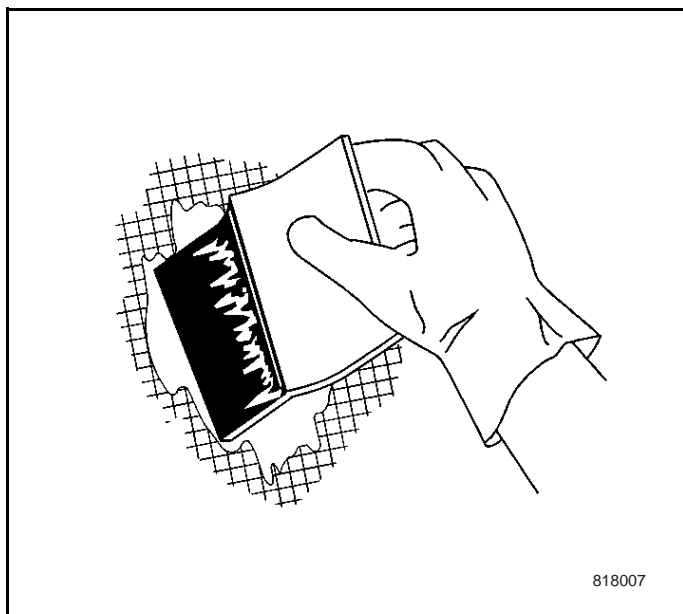
1. Cut a large window in the panel to be replaced to gain access to the bond adhesive.
 - Cut only deep enough to cut through the panel being replaced.
 - Most SMC plastic panels are 3mm thick.
2. Use a gun in order to soften the bonding adhesive.
3. Cut through the adhesive bond using a putty knife.
4. Remove the damaged panel.



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Installation Procedure

1. Use a scraper in order to remove all the old adhesive.
2. Wash the bonding surfaces with soap and water. DO NOT use a solvent.
3. Install the proper bonding material to the bond surface. Refer to Repair Materials - Rigid Plastic Part or Repair Materials - Plastic Part. Large panels require a pneumatic applicator in order to speed the application of the fast curing adhesive.
4. Put the panel in place.
5. Use the pincer or equivalent tool to clamp the panel.
6. Cure the repair material. Follow the recommendations suggested by the repair material manufacturer.



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8.18.2.6 Backing Patch Fabrication

Before proceeding, refer to General Plastic Repair Instructions and Plastic Repair Precautions.

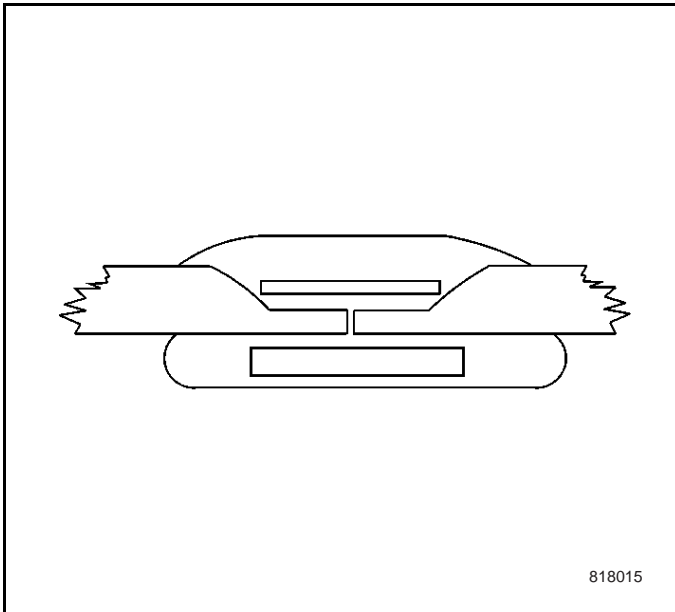
The following are three methods of fabricating a backing patch:

- Method 1: Fabricating a patch directly on the back of the damaged area. Layers of repair material and glass cloth mat are alternatively applied to a clean and sanded surface.
- Method 2: Cutting a patch from a scrap piece of a replaced panel.
- Method 3: Fabricating a patch on the outside of the damaged area to be reapplied to the inside of the damaged area.

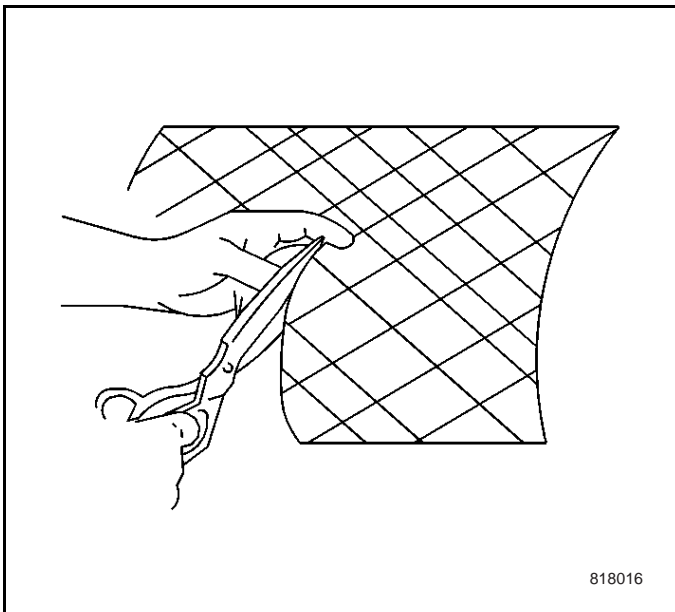
Any method can be used, but one method may be easier than another depending on the given situation. Read over each of the following methods in order to decide which will work best in a given situation.

Method 1

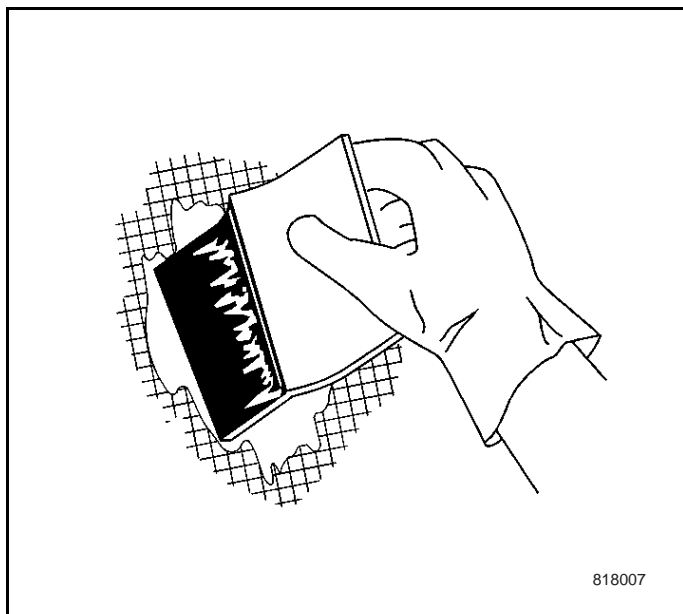
1. Cut a piece of the reinforcement mat, to the desired shape, so that the mat overlaps all sides of the back of the damaged area by 38-51mm.



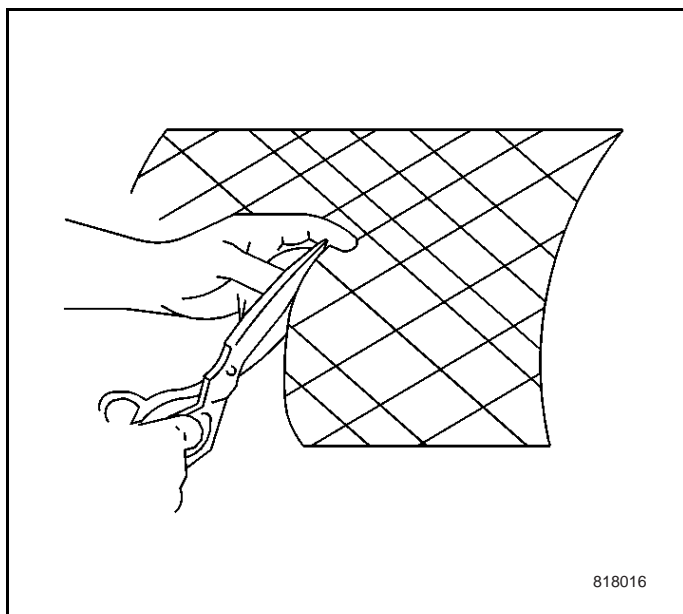
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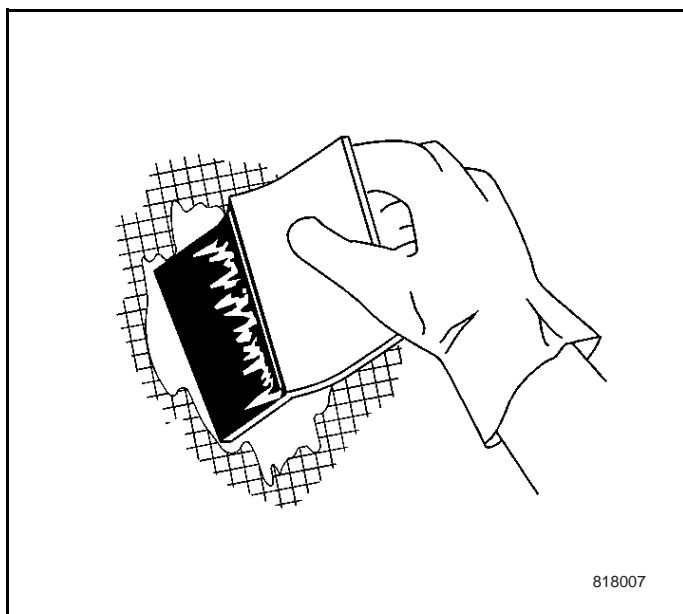
818016



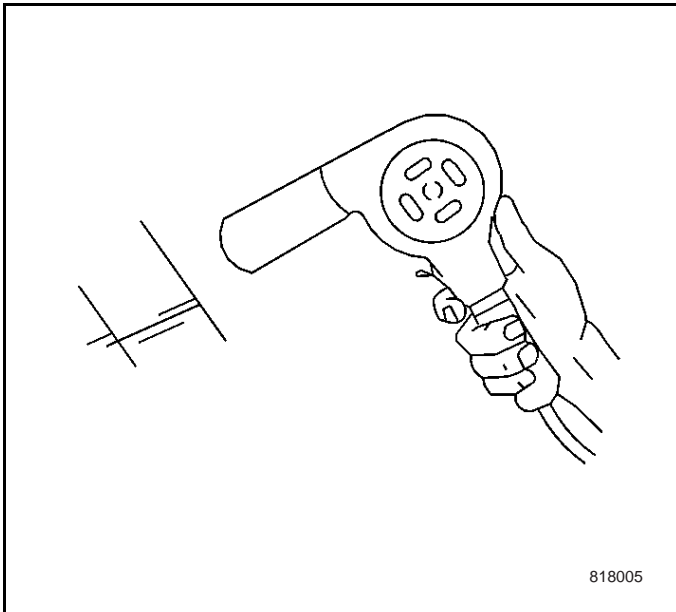
2. Determine the proper repair material. Refer to Repair Materials - Flexible Plastic Part or Repair Materials - Rigid Plastic Part.
3. Mix the material according to the manufacturer's instructions.
4. Following the manufacturer's instructions, apply a skim coat of the repair material to the back of the damaged area.



5. Lay the pre-cut piece of reinforcement mat into the skim coat of the repair material.
 - Use the applicator in order to press the mat until saturated.
 - Inspect for exposed fibers or trapped air.



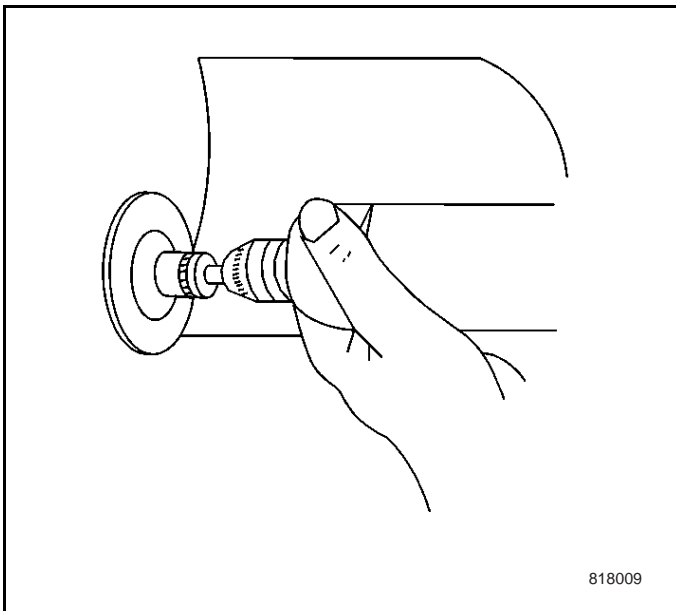
6. Apply additional skim coats as needed for strength.



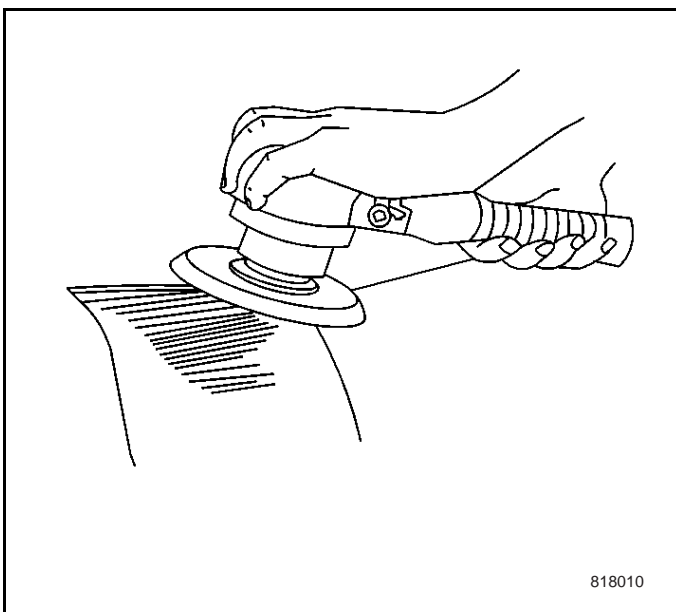
7. Allow the material to cure according to the manufacturer's instructions.
8. Allow the repair area to return to room temperature.

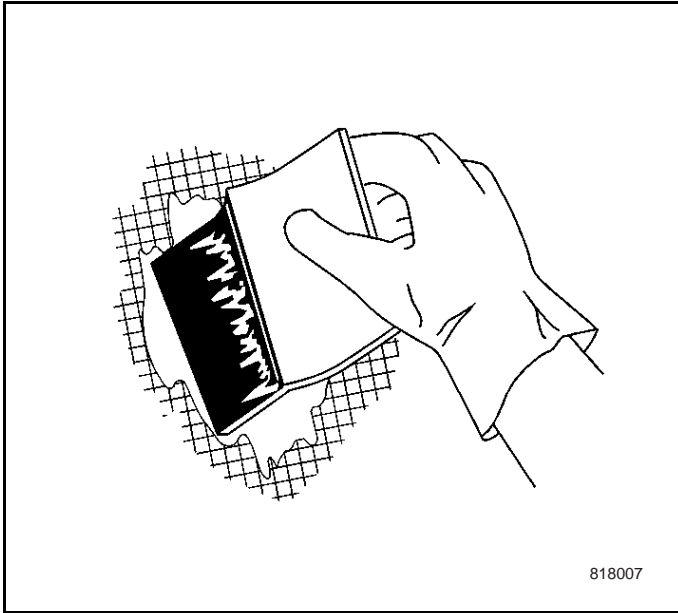
Method 2

1. Cut a patch from a scrap piece of a replaced panel, to the desired shape, so that the patch overlaps all sides of the damaged area by 38-51 mm.



2. Sand and clean the surface of the patch in order to remove any paint or finish material which does not use any proper bonding.
3. Determine the proper repair material. Refer to Repair Materials - Flexible Plastic Part or Repair Materials - Rigid Plastic Part.
4. Mix the material according to the manufacturer's instructions.

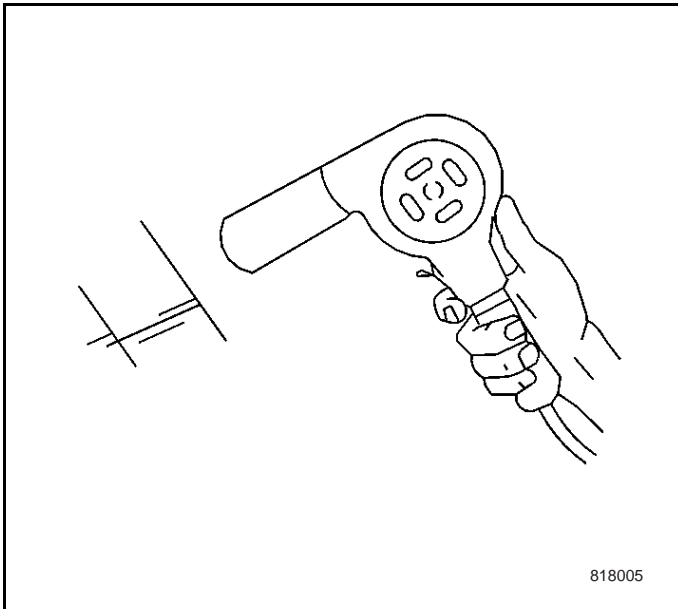




5. Following the manufacturer's instructions, apply a skim coat of the repair material to the back of the damaged area.

6. Install a patch:

- Align the patch over the damage on the back of the panel.
- Clamp or prop the patch onto the panel.
- Cover with repair material any voids or gaps at the edges of the patch that could allow entry of water or chemicals.

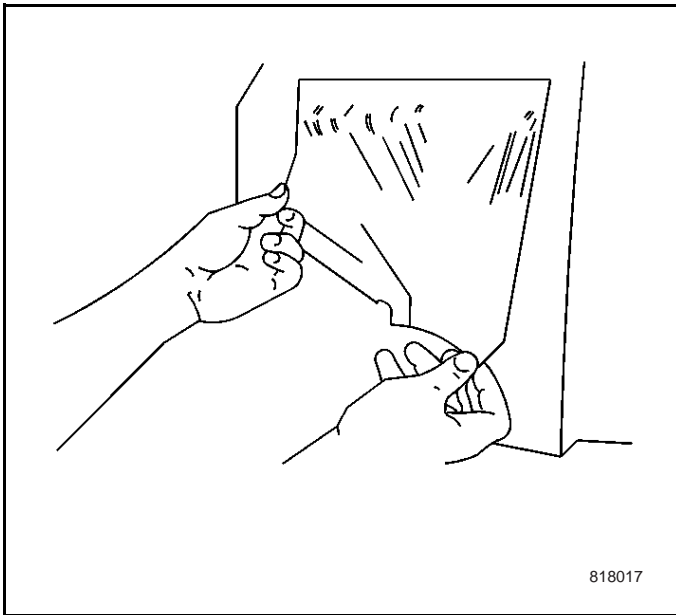


7. Cure according to the manufacturer's instructions.

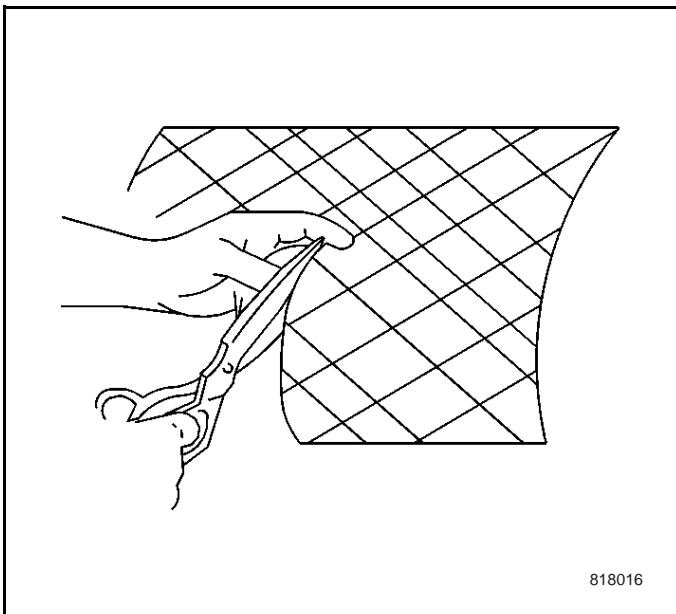
8. Remove the clamp or the prop when curing is complete.

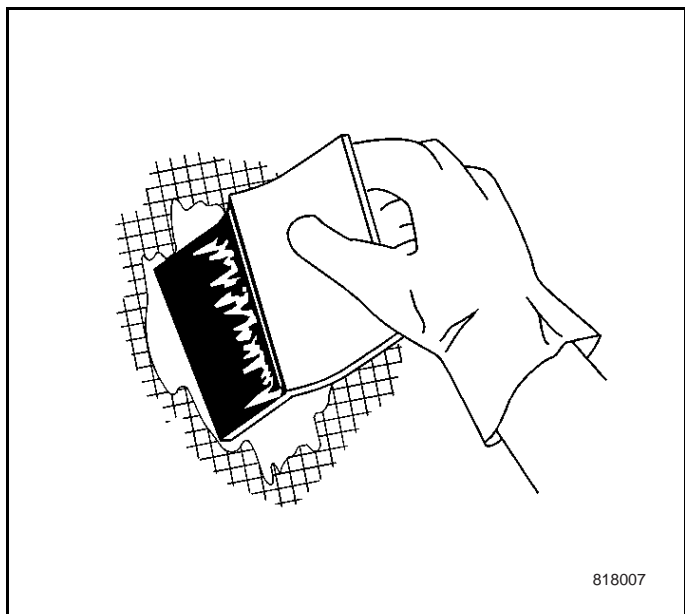
Method 3

1. Cut a piece of wax paper or polyethylene film material such as the used food bags.
 - Cut the material to extend about 75mm beyond the repair area.
 - Tape the material to the outside of the repair surface.

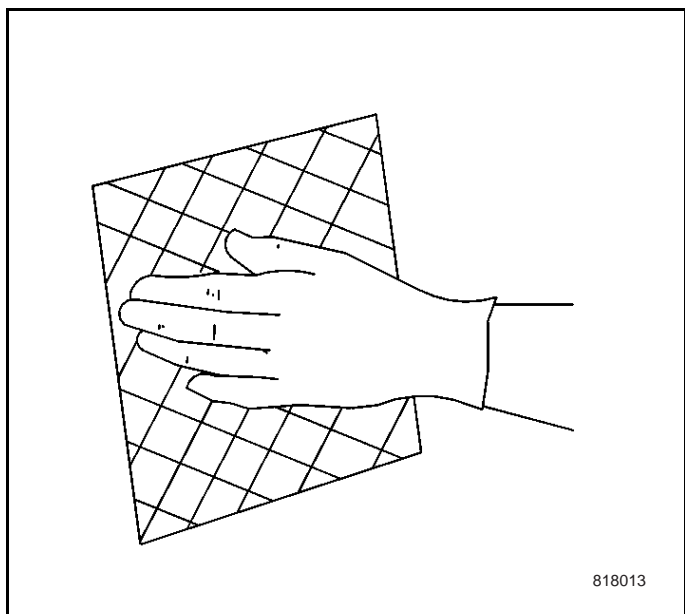


2. Cut a piece of the glass cloth mat to the desired shape, extending the mat 38-51mm beyond the repair area.

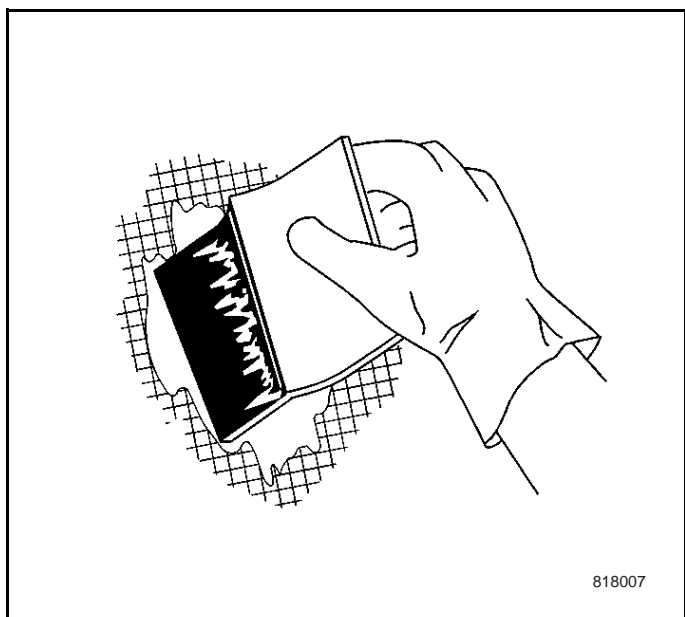




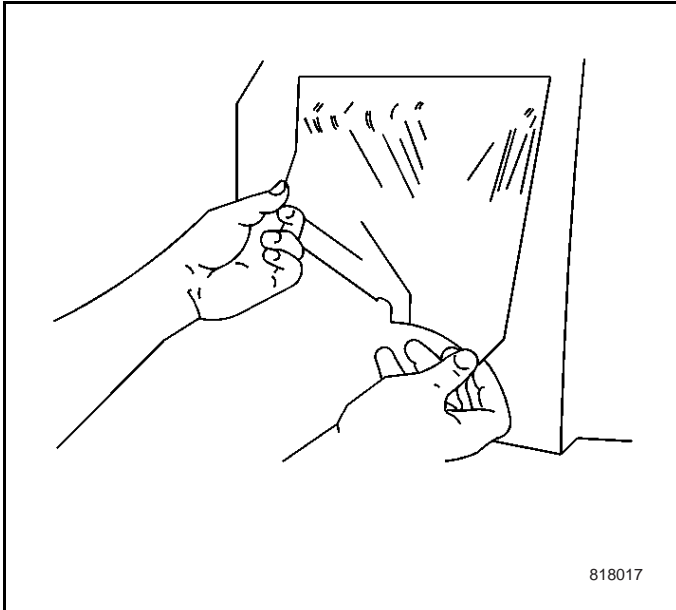
3. Determine the proper repair material. Refer to Repair Materials - Flexible Plastic Part or Repair Materials - Rigid Plastic Part.
4. Mix the material according to the manufacturer's instructions.
5. Apply a coat of repair material according to the manufacturer's instructions.



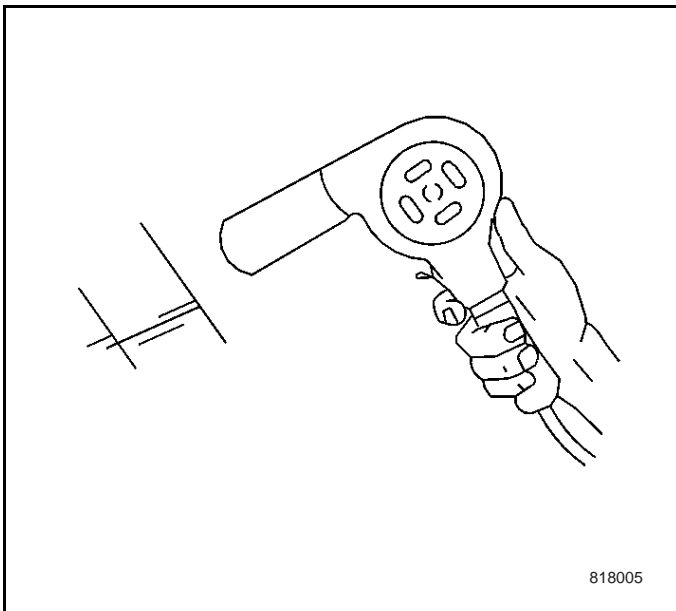
6. Place a layer of the mat over the repair material.
7. Smooth out any wrinkles in the mat. Follow the contour of the panel.



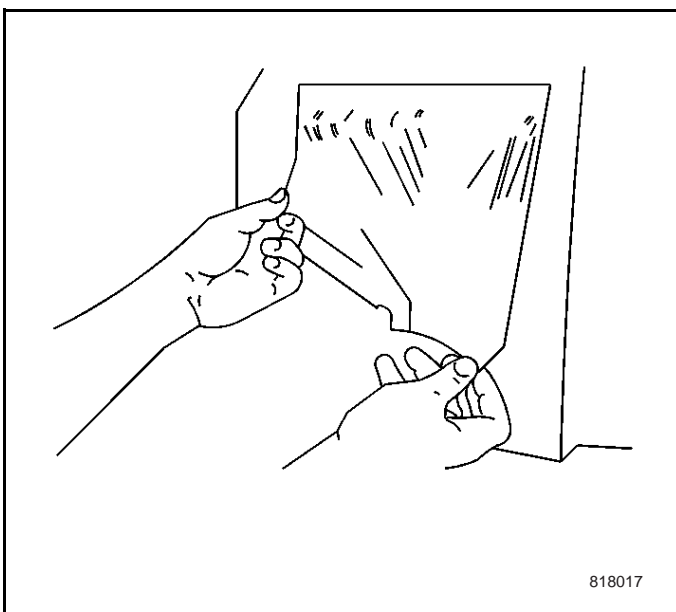
8. Apply a coat of repair material.



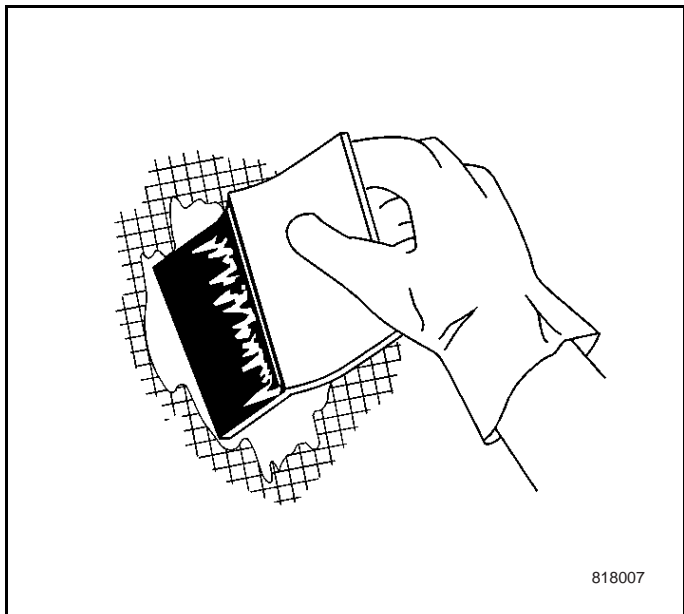
9. Cover the repair material with the wax paper or polyethylene.
10. Press against the wax paper with a saturation roller or squeegee in order to ensure saturation of the mat and to remove any air bubbles.
11. According to the requirements, continue to increase the coats in the previous manner for strength.
12. Form the patch to match as close as possible the surface of the panel.



13. Cure according to the manufacturer's instructions.
14. Return to the room temperature.
15. Pop off the patch.

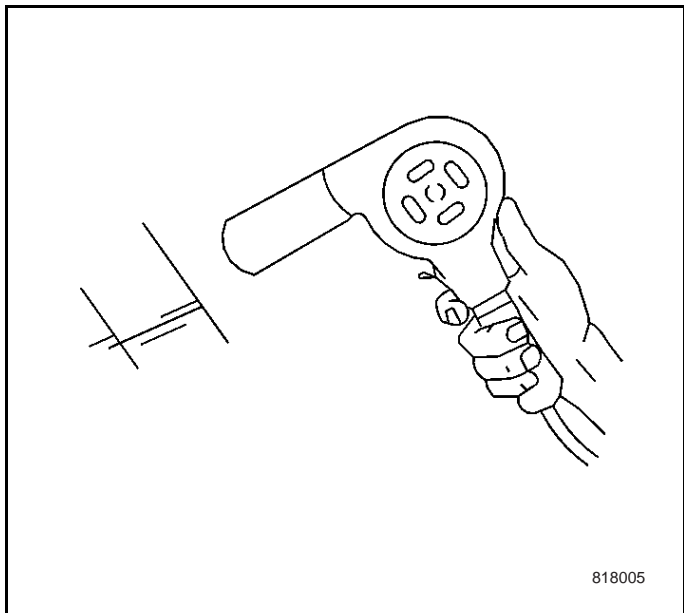


16. Remove the wax paper or polyethylene.



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17. Apply a skim coat of repair material.
18. Install a patch:
 - Align the patch over the damage on the back of the panel.
 - Clamp or prop the patch onto the panel.
 - Cover with repair material any voids or gaps at the edges of the patch that could allow entry of water or chemicals.



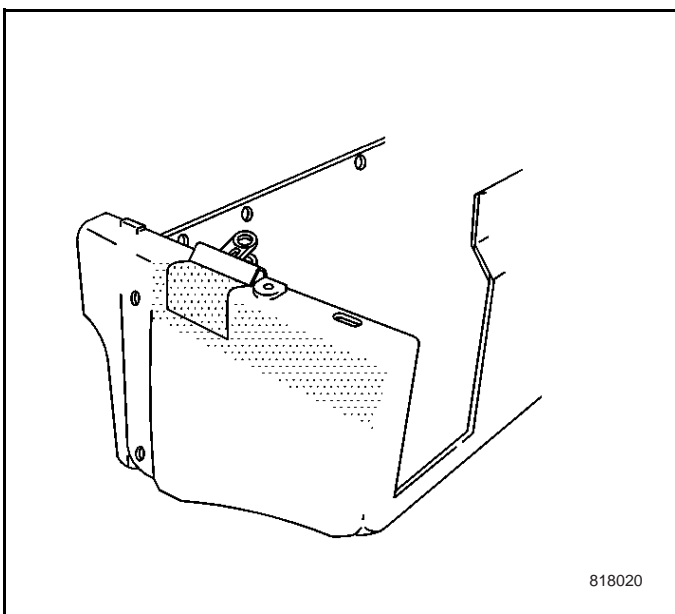
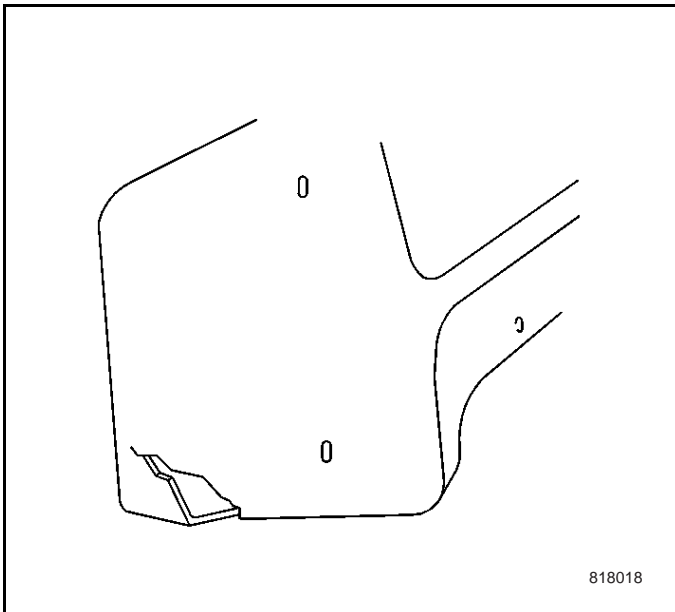
818005

19. Cure according to the manufacturer's instructions.
20. Remove the clamp or the prop when curing is complete.

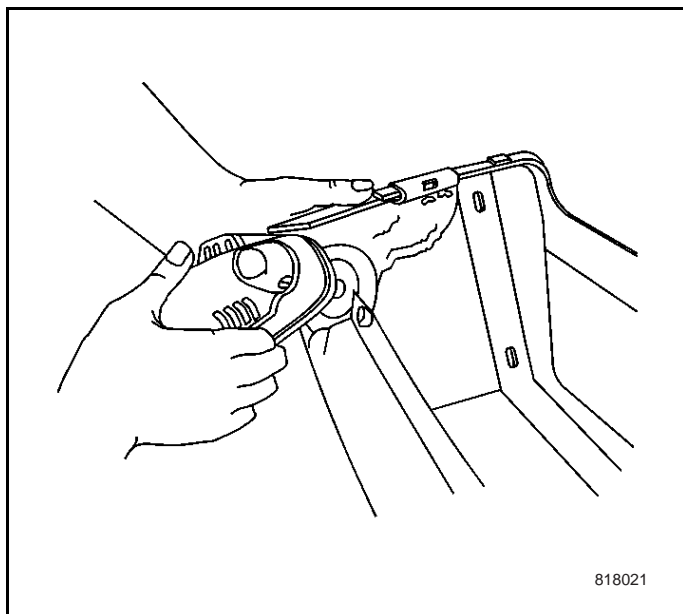
8.18.2.7 Plastic Structure Repair

Before proceeding, refer to General Plastic Repair Instructions and Plastic Repair Precautions.

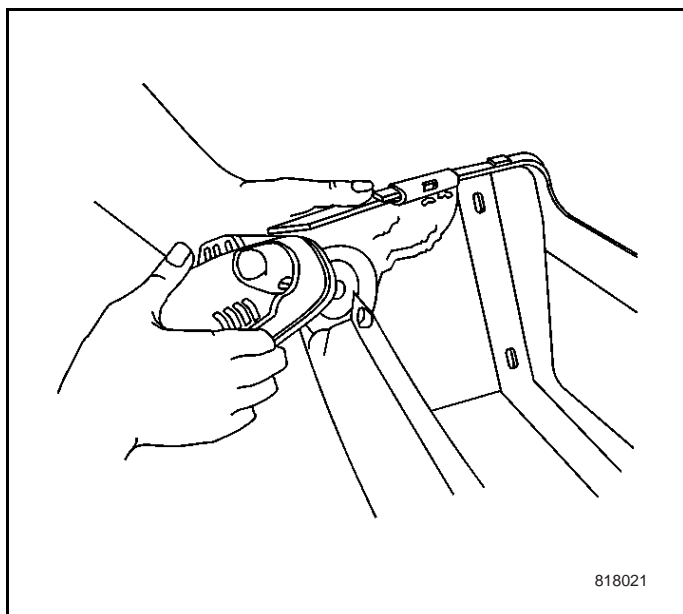
1. Clean and inspect the damaged area. Refer to General Plastic Repair Instructions.



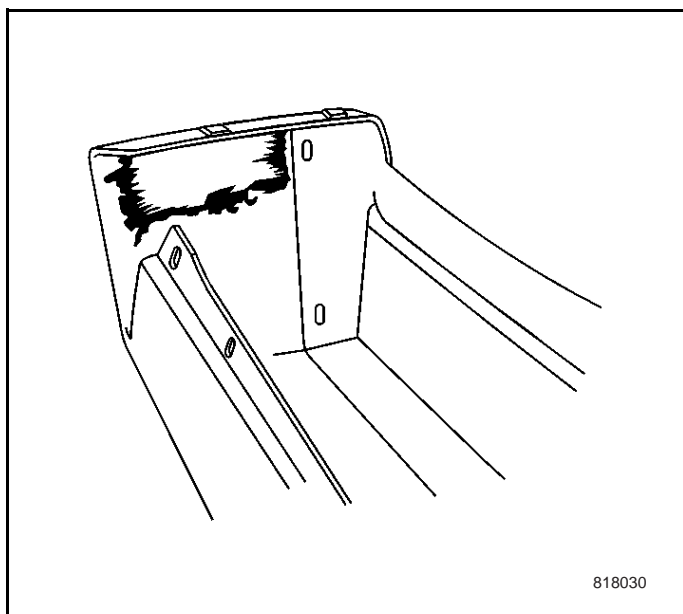
2. Clamp or tape the damaged area in order to maintain alignment.
3. Prepare the damaged area for the installation of a backing patch.
 - If the rear of the damaged area is accessible to repair, continue with Step 4 to Step 6.
 - If the rear of the damaged area is not accessible to repair, continue with Step 7.



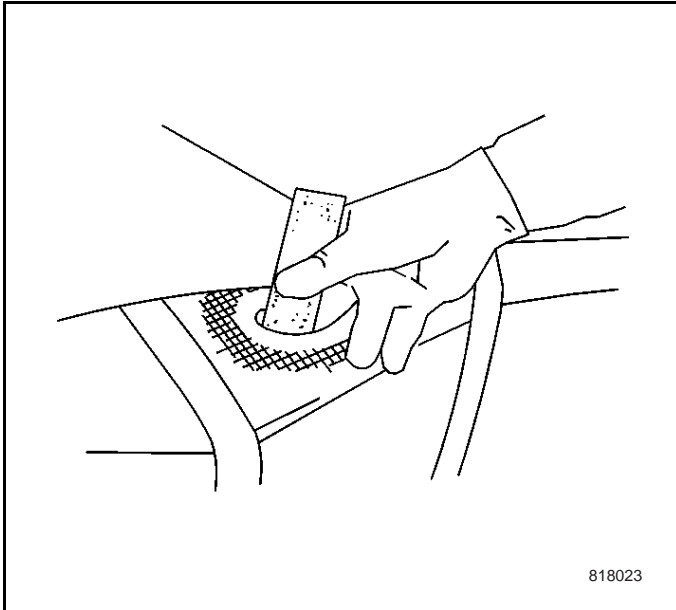
4. Scuff the inner surface with a 80 grit disc on a DA sander or by hand if the access is limited.



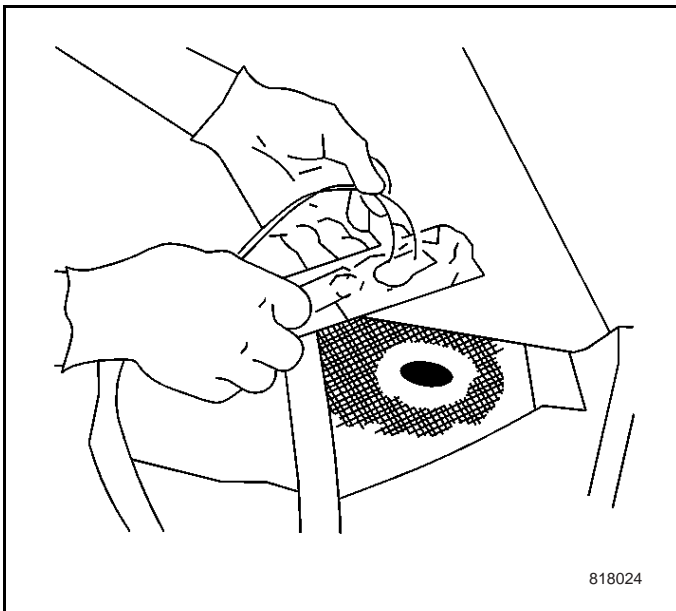
5. Determine the proper repair material. Refer to Repair Materials - Flexible Plastic Part or Repair Materials - Rigid Plastic Part.
6. Mix the material according to the manufacturer's instructions.
7. Following the manufacturer's instructions, apply the repair material to the inner surface.



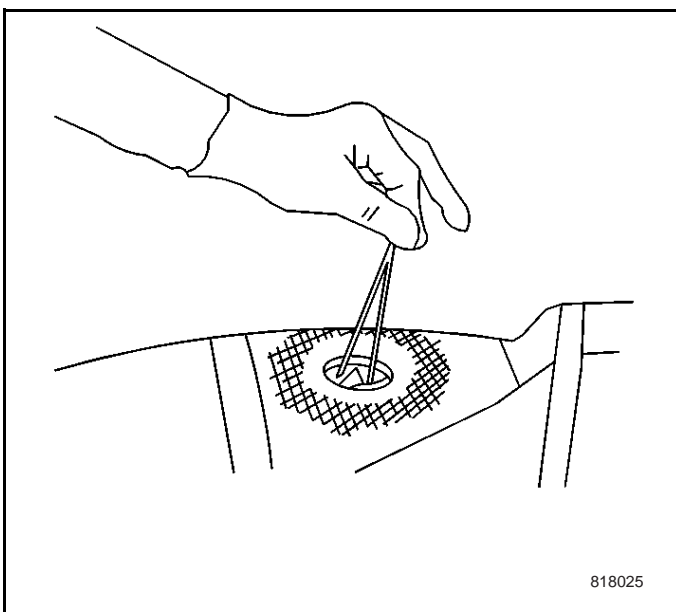
8. Apply a backing patch and proceed to Step 21. Refer to Backing Patch Fabrication.



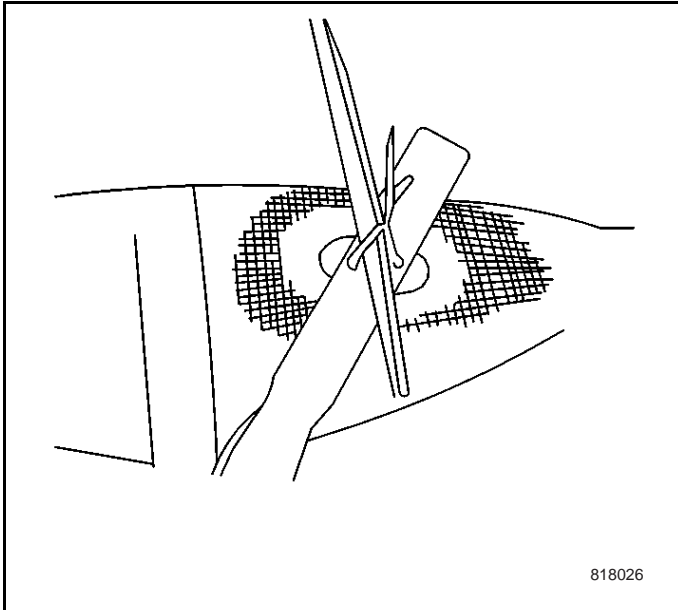
9. If the rear of the damaged area is not accessible, remove some of the damaged material in order to form an access hole through which you can slip a backing patch.
10. Cut a backing patch from a scrap piece of panel. Refer to Backing Patch Fabrication.
11. Sand the mating surface of the patch.
12. Reach through the access hole and sand the underside of the repair area.



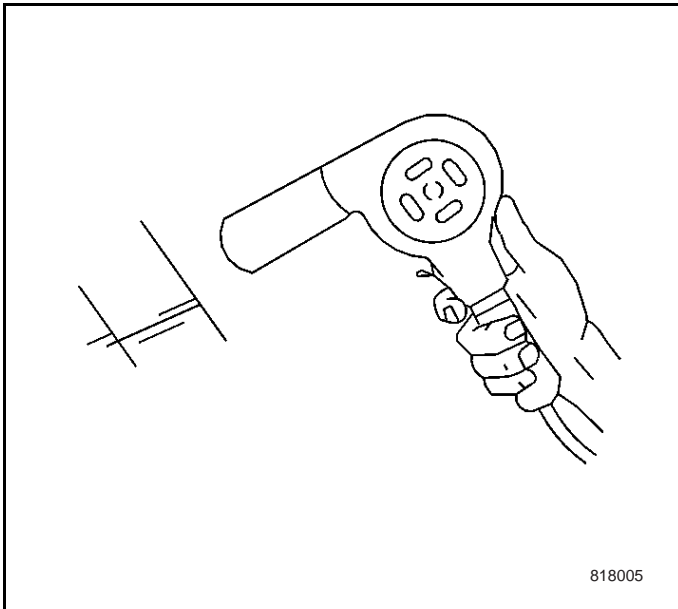
13. Drill 2 holes in the backing patch.
14. Thread a piece of waxed wire through the holes in order to assist in holding the patch in place after installation.
15. Determine the proper repair material. Refer to Repair Materials - Flexible Plastic Part or Repair Materials - Rigid Plastic Part.
16. Following the manufacturer's recommendations, mix the correct repair material.
17. Apply, following the manufacturer's recommendation, the correct repair material to the mating surface of the patch.



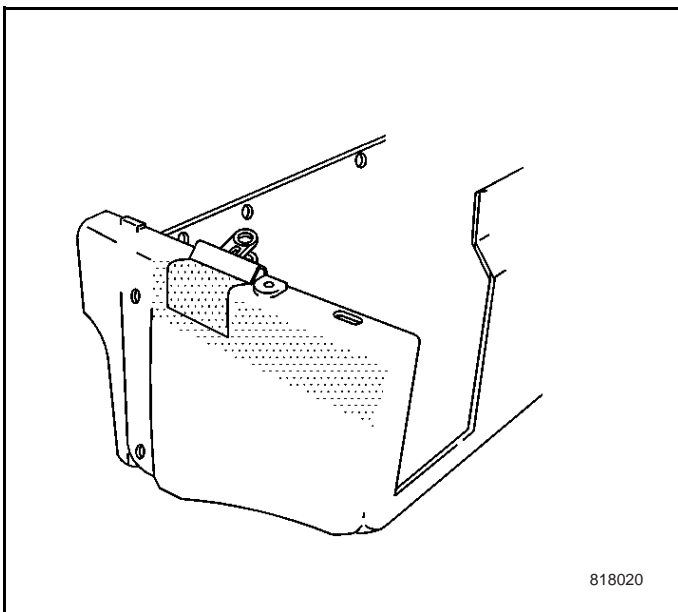
18. Slip the patch through the access hole.
19. Pull up hard on the waxed wire until the repair material squeezes out on all sides.



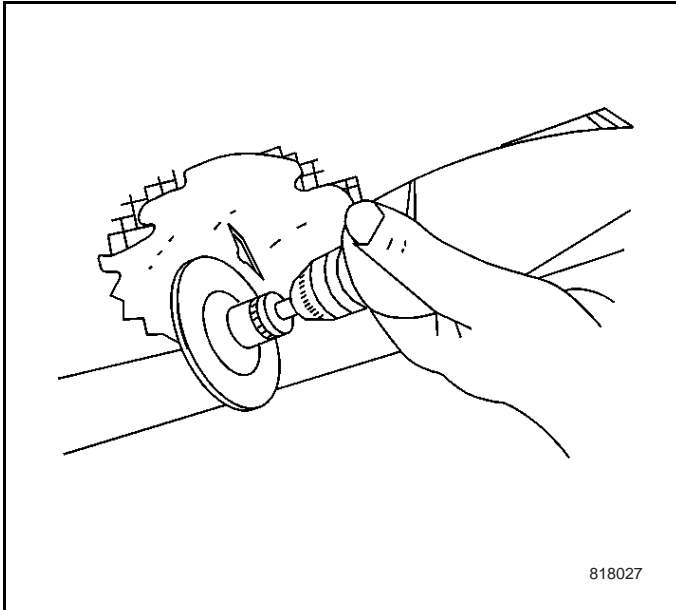
20. Twist the waxed wire around a piece of wood in order to hold the patch in position until the repair material cures.



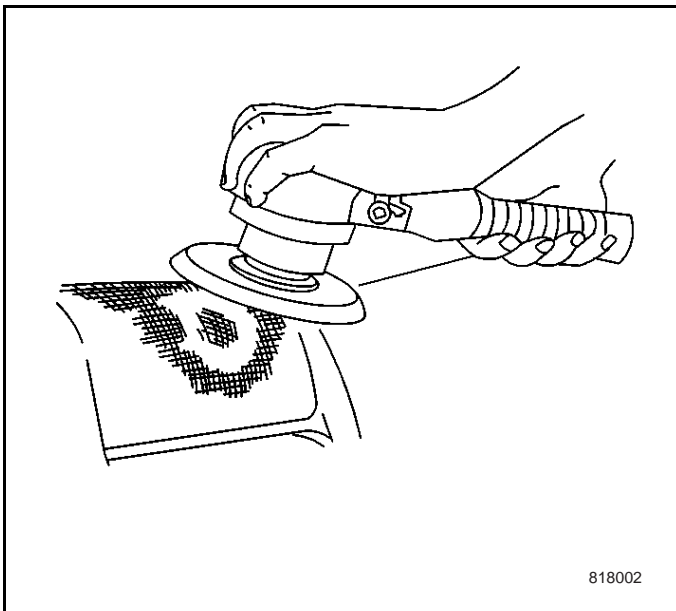
21. Cure the material according to the manufacturer's instructions.



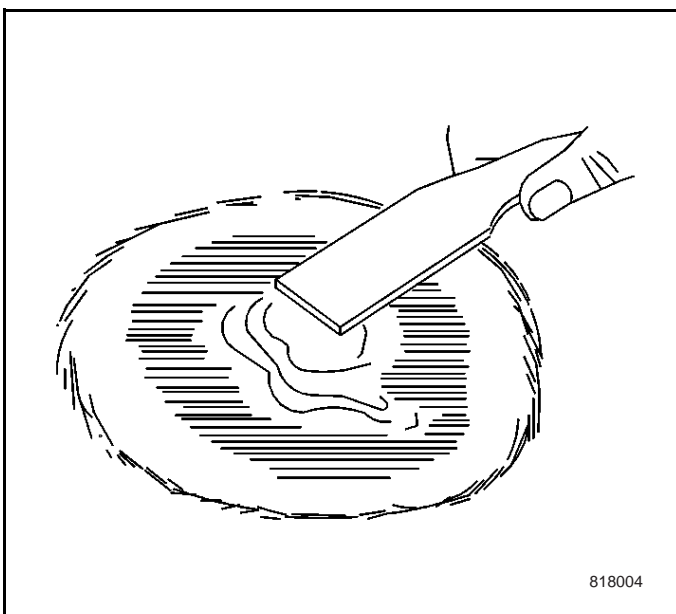
22. Remove any tape, clamps, or waxed wire used to maintain alignment.



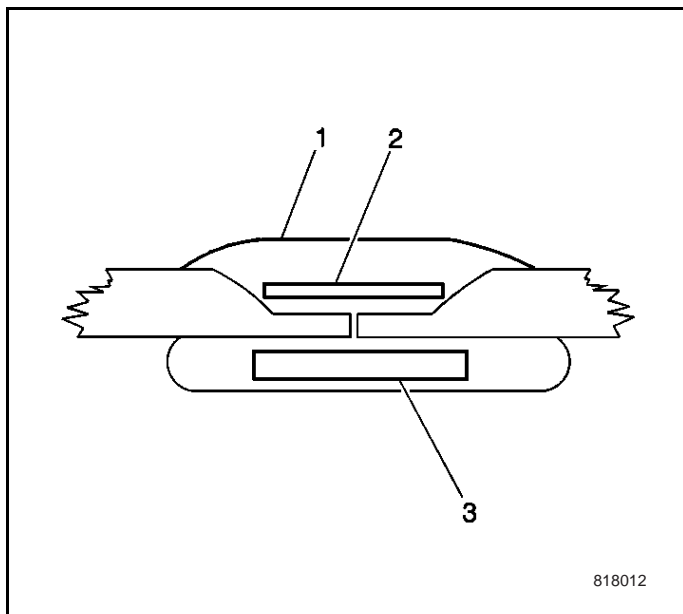
23. On the outer surface of the panel, bevel the damaged area with a #50 grit Roloc disc in order to extend the contact between the repair material and the substrate.



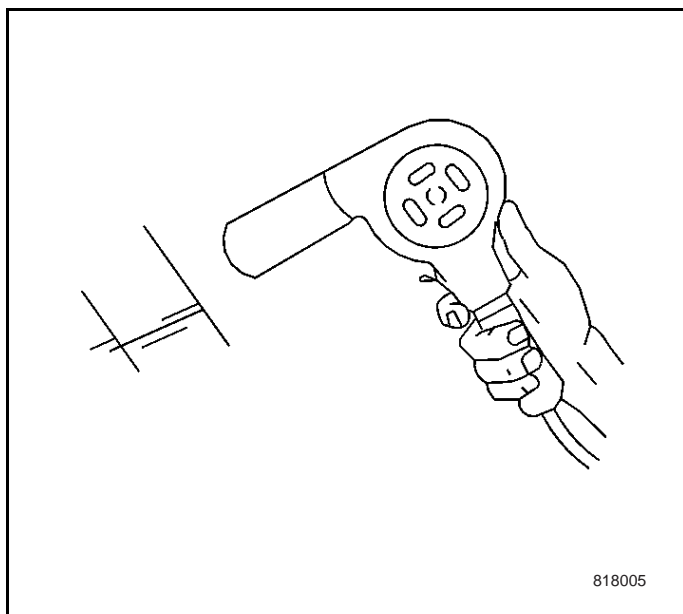
24. Using a DA sander, feather out several inches beyond the damaged area in order to remove any paint or primer from the substrate, and provide a proper adhesion surface.
- Use a #80 grit disc on rigid panels.
 - Use a #180 grit disc on flexible panels.



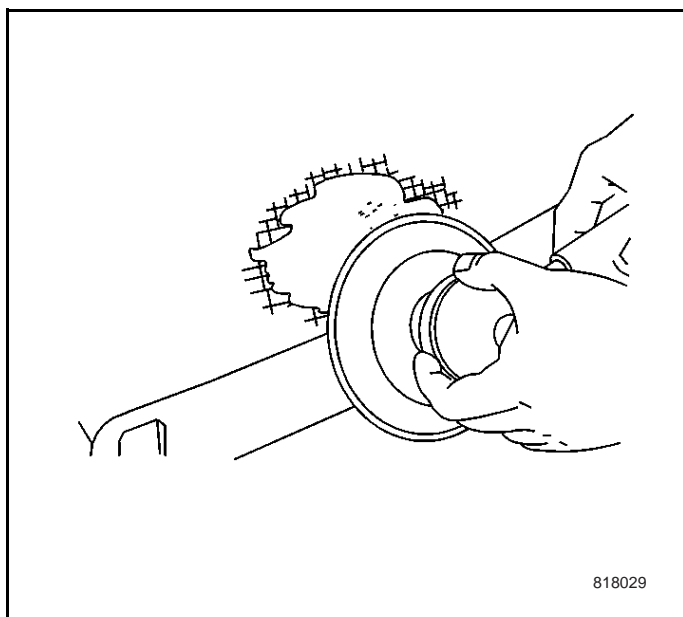
25. Carefully and smoothly apply a light coat of repair material to the damaged area.



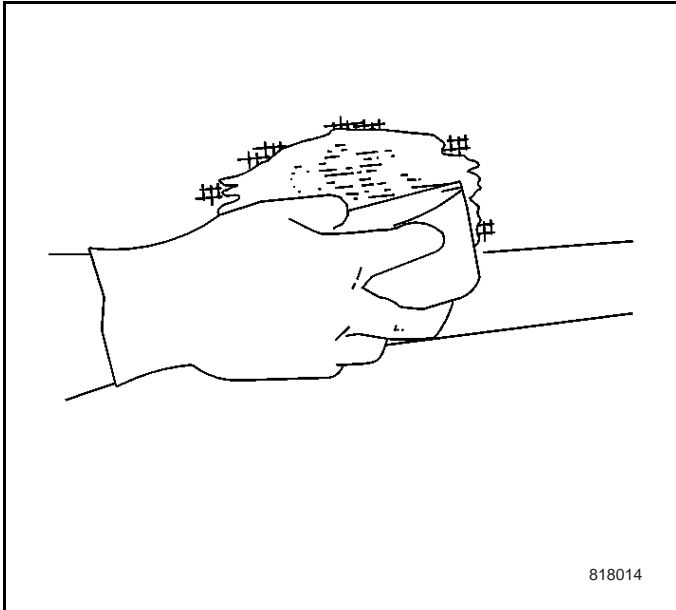
26. Add mat material as needed to strengthen.
27. Apply a final layer of repair material (1) at a slightly higher level than the surrounding area.



28. Cure the material according to the manufacturer's instructions.



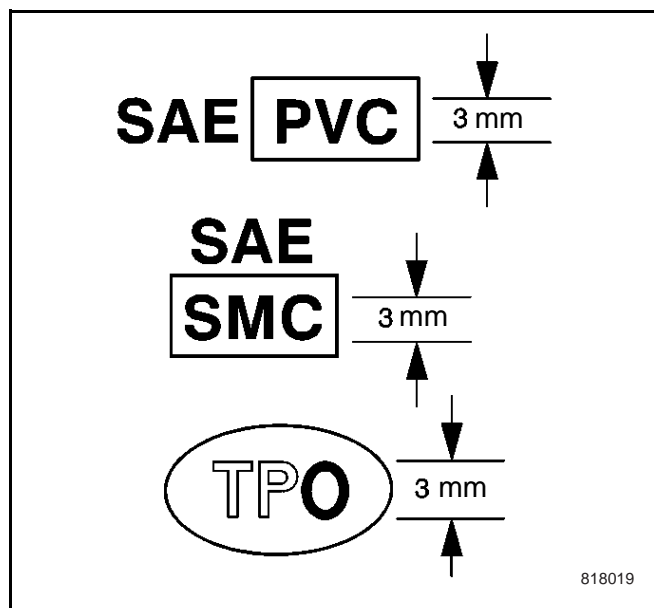
29. Rough out the surface using a 80 grit disc on a DA sander or a curved - tooth body file.



30. Finish sanding using a #220-320 grit wet or dry sandpaper on a sanding block.
31. If necessary, apply primer and refinish surface. Refer to GM 4901 M-D manual for approved materials. Follow the procedures recommended by the material manufacturer.

8.18.3 Description and Operation

8.18.3.1 How to Identify Plastic Parts



Plastic parts can be identified by the SAE code, which is usually found on the rear of the part, and/or by the characteristics of the plastic. Knowing the type of plastic aids in selecting the proper repair materials and in selecting the proper repair procedure.

Look for the SAE code stamped into the part.

8.18.3.2 Code Found

1. Match the code to those in the plastic identification chart to determine whether the plastic is thermoplastic or thermoset plastic, and whether the plastic is rigid or flexible. Refer to Plastic Identification and Refinishing Systems.
2. Identify any special handling procedures. Refer to Handling Precautions For Plastic.

8.18.3.3 No Code Found

Important: Do not use a plastic burn test in order to distinguish the types of plastics. The burn test produces vapors that are harmful to you.

Perform 1 or both of the following tests to determine if the part is thermoplastic polyolefin or thermoset non-polyolefin.

8.18.3.4 Float Test

1. Cut a shaving of plastic from the back of the part.
The shaving should be free of mold release agents and paint.
2. Place the shaving in a container of water.
 - Thermoplastic polyolefin floats
 - Thermoset non-polyolefin sinks

8.18.3.5 Abrasion Test

- Sand a spot near the damaged area with Grade 36 Roloc Disc.
- Thermoplastic polyolefin material melts or frays when sanded.
- Thermoset (non-polyolefin) material sands cleanly.

Thermoplastic and thermoset plastics can be either rigid or flexible. Thermoplastic plastic parts are best repaired with a hot iron plastic material-feed welder, but are usually replaced. Thermoset plastic can be repaired with epoxy or other more rigid 2 package repair material.

- For rigid thermoset repair materials, refer to Repair Materials - Rigid Plastic Part.
- For flexible thermoset repair materials, refer to Repair Materials - Flexible Plastic Part.
- For general repair instructions, refer to General Plastic Repair Instructions.

8.18.3.6 Plastic Identification and Refinishing Systems

Identifying Symbol - Old Symbol in ().	Chemical Composition or Plastic Family Name	Typical Area(s) Where Part is Used	Common Name/ Trade Name	Type of Plastic
ABS	Acrylonitrile/ Butadiene - Styrene	Armrest Support, Console, IPC, Steering Column Bracket/ Jacket, Trim Molding	ABS, Absafil, Abson, Cyclac, Dyl, Kralastic, Lustran	Thermoplastic Plastics
ABS+PC	Acrylonitrile/ Butadiene - Styrene+ Polycarbonate	Instrument Panel, IPC	Baybland, Cycology, KHA, Proloy	Rigid
ABS/PVC	Acrylonitrile - Butadiene - Styrene/ vinylite (soft)	Head Rest Cover, Instrument Panel Pad, Trim Molding/Panel	ABS Vinyl	Soft, Vinylite
EPDM	Ethylene-Propylene - Diene Monomer	Body Panel, Bumper Impact Strip	EPDM, Nordel	Rigid
EVA(EVAC)	Ethylene/Vinyl Acetate	Head Rest Cover, Misc Soft Trim	Elvax, Microthane	Soft
PA	Polyamide	Headlamp Bezel, Quarter Panel Extension, Exterior Finish Trim Panel	Nylon, Capron, Zytel, Rilsan, minion, Vydye, Welland	Rigid
PA, PAG, PAGG	Polyamide	Exterior Finish Trim Panel, Headlamp Bezel, Quarter Panel Extension	Capron, Minlon, Nylon, Rilsan, Vydye, Wellamid, Zytel	Rigid, Thermoset
PA+PPE	Polyamide+Polyphenyl ene ether	Exterior Trim, Fender	GTX	Rigid, Thermoset
PBT+TEEE (PBTP+EEBC)	Polybutylene, Terephthalate + Ether, Ester Block Compound	Trim, Doorsill Trim	Bexloy M	Rigid
PC	Polycarbonate	Interior Rigid/Hard Trim Panel, Valance Panel	Calibre, Lexan, Merlon	Rigid, Thermoset
PC+PETP	Polycarbonate + Polybutylene, Terephthalate	Bumper Fascia	Macroblend, Valox, Xenoy	Flexible, Thermoset
PE	Polyethylene	Fuel Tank Shield, Inner Fender Panel, Interior Trim Panel, Seat Belt Cover, Spoiler, Valance Panel	Alathon, Dylan, Foriflex, Hi-fax, Hosalen, Marlex, Paxon	Rigid, Thermoplastic
PF	Phenol Formaldehyde	Ashtray	Amberol, Bakelite, Durez, Genal, Phenolic, Plyophen, Resinox	Rigid, Thermoset

8.18.3.6 Plastic Identification and Refinishing Systems(Cont' d)

Identifying Symbol - Old Symbol in ().	Chemical Composition or Plastic Family Name	Typical Area(s) Where Part is Used	Common Name/ Trade Name	Type of Plastic
PP	Polypropylene	Bumper Fascia, Cowl Panel, Deflector Panel, Door Panel, Inner Fender, Interior Molding, Kick Panel, Load Floor, Radiator Shroud, Wheel Cover	Azdel, Daplen, Escorene, Marlex, Novolen, Oleflo, Profa, Tenite	Flexible, Thermoplastic
PPE(PPO)	Polyphenylene ether	Bezels, Chromed Plastic, Headlamp Door, Ornaments	Noryl, Oleflo, Prevex	Rigid, Thermoset
PS	Polystyrene	Instrument Panel, Door Panel	Durathon, Dylan, Lustrex, Polystyrol, Styron	Soft
PUR	Polyurethane, Thermoset (Unsaturated)	Bumper Fascia, Filler Panel, Front/Rear Body Panel	Bayflex, Castethane, RIM, RRIM	Thermoset
PVC	Polyvinyl Chloride (Vinyl)	Interior Soft Trim, I/P Skins, Roof Cover	Geon, Pliovic, Unichem, Vinoflex, Vinyl, Vinylite	Soft, Vinylite
SAN(SA)	Styrene-Acrylonitrile	Center Console, Glove Box Door, Interior Trim Panel	Foracryl, Lustran, Tyril	Rigid
TEO (EP, EPM, TPO)	Ethylene/Propylene (Rubber)	Air Dam, Bumper Fascia, Valance Panel	EPI, EPII, TPO, TPR (Thermoplastic Rubber)	Flexible, Thermoplastic
TPO	Thermoplastic Polyolefin	Bumper Cover	TPO	Flexible, Thermoplastic
TPU(TPUR)	Polyurethane, Polyolefin	Bumper Fascia, Gravel Deflector, Soft Filler Panel, Window Molding	Estane, Pellethane, Roylar, Toxin	Flexible, Thermoplastic
UP	Polyester/Thermoset	Air Scoop, Air Spoiler, Fascia Extension, Hood, Instrument Housing, Rear Compartment Lid, Roof, Ventilation Grid	Fiberglass, Premiglas, Selectron, SMC, Vibrinmat	Rigid, Thermoset
For symbols not listed in this table, contact the Society of Automotive Engineers, 400 Commonwealth Drive Warrendale, PA 15096-0001.				

8.18.3.7 Handling Precautions for Plastic

Abbreviation	Material Name	Heat Resisting Temperature °C (°F)	Resistance to Gasoline and Solvents	Other Precautions
AAS	Acrylonitrile acrylic rubber styrene	95(203)	Avoid gasoline and solvents.	Avoid brake fluid.
ABS	Acrylonitrile/ butadiene - styrene resin	90(194)	Avoid gasoline and solvents.	Avoid brake fluid.
AES	Acrylonitrile ethylene styrene	90(194)	Avoid gasoline and solvents.	Avoid brake fluid.
FRP	Fiber reinforced plastics	170(338)	Gasoline and most solvents are harmless.	—
PA, PAG, PAGG	Polyamide (nylon)	150(302)	Gasoline and most solvents are harmless.	Avoid soaking in the water.
PBT	Polybutylene terephthalate	140(284)	Gasoline and most solvents are harmless.	—
PC	Polycarbonate	120(248)	Avoid gasoline and solvents.	—
PE	Polyethylene	80(176)	Gasoline and most solvents are harmless.	Combustible
PMMA	Polymethyl methacrylate	90(194)	Avoid gasoline and solvents.	Avoid brake fluid.
POM	(POM) Polyacetal resin	120(248)	Gasoline and most solvents are harmless.	Avoid battery acid
PP	Polypropylene	90(194)	Gasoline and most solvents are harmless.	Combustible
PPC	Polypropylene composite	115(239)	Gasoline and most solvents are harmless.	Combustible
PPE	Polyphenylene ether	110(230)	Avoid gasoline and solvents.	—
PUR	Polyurethane	90(194)	Gasoline and most solvents are harmless.	Avoid brake fluid.
PVC	Polyvinyl chloride	90(194)	Gasoline and most solvents are harmless if wiped up quickly.	Toxic when burned.
TPE	Thermoplastic rubber composition	80(176)	Avoid gasoline and solvents.	-
TPR	Thermoplastic Rubber	80(176)	Avoid gasoline and solvents.	-

8.18.3.8 Plastic Repair Precautions

The following procedures should be followed when repairing thermoset plastic:

1. Apply protective cream to any exposed skin in order to prevent skin irritation.
2. Wear rubber gloves.
3. Wear safety glasses when using compressed air and when sanding.
4. Immediately remove any mixture that comes into contact with skin. The mixture hardens quickly.
5. Wear an air supplied respirator or dust mask when grinding or sanding.
6. Use a sander with a vacuum attachment whenever possible.
7. Wash skin with cold water in order to alleviate minor skin irritation from glass and resin dust.
8. Do not get any of the repair material on clothing.
9. Use repair materials in a well-ventilated surrounding. Fume particles or pollutant produced by the repair material is toxic.
10. Follow the instructions suggested by the repair material manufacturer.
11. Close all containers after use. Dirt or moisture contamination of the repair material can reduce the repair effects.

8.19 Entertainment

8.19.1 Specifications

8.19.1.1 Fastener Tightening Torque

Application	Specification
Radio Holder Screw	1.7-2.3 N•m
Antenna Amplifier Screw of Radio Holder	1.0-1.5 N•m
Speaker Screw of Radio Front Side Door	1.1-1.5 N•m

8.19.1.1A Fastener Tightening Torque

Application	Specification
Rear Speaker Screw of Radio	1.5-3.0 N•m

8.19.1.1B Fastener Tightening Torque

Application	Specification
Rear Speaker Screw of Radio	0.9-1.3 N•m

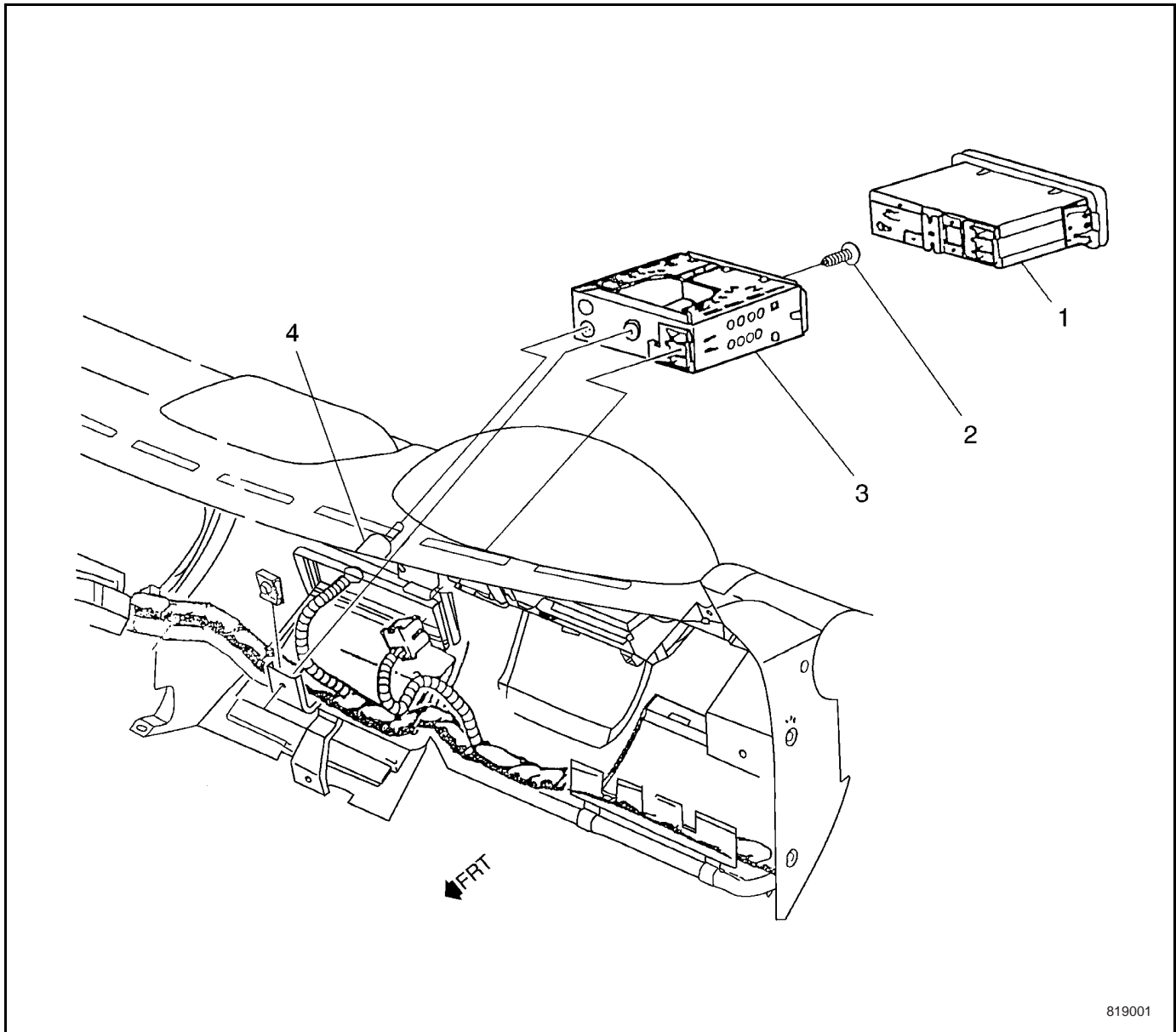
8.19.2 Schematic and Routing Diagrams

8.19.2.1 Wiring Diagram of Radio/CD Player System

See 8.20.2.6.

8.19.3 Component Locator

8.19.3.1 Radio ASM Locator

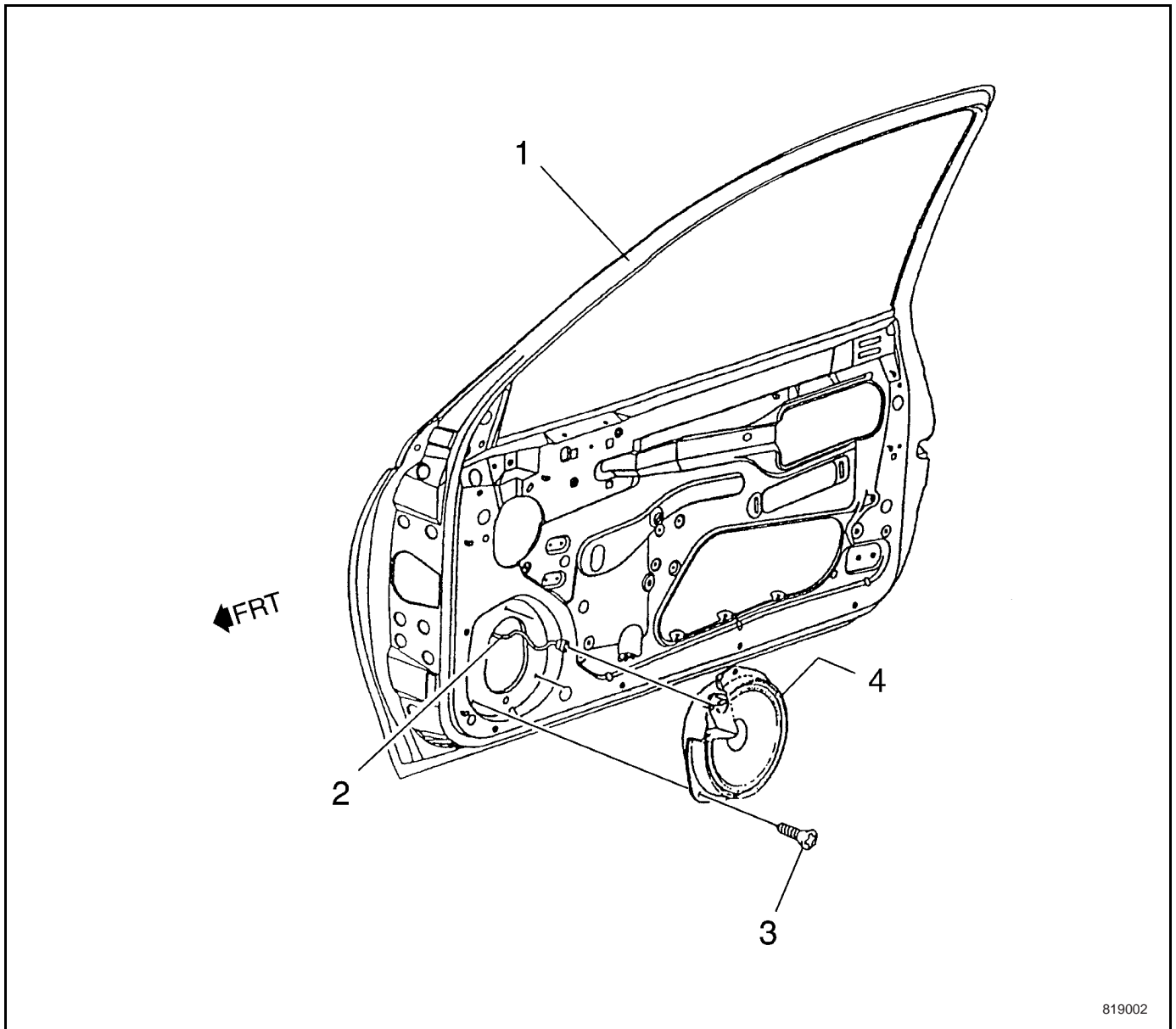


819001

Legend

- | | |
|---|-------------------------|
| (1) Radio ASM | (3) Radio Cover |
| (2) Secure the radio cover to the bolt/screw of the instrument panel. | (4) Antenna Signal Wire |

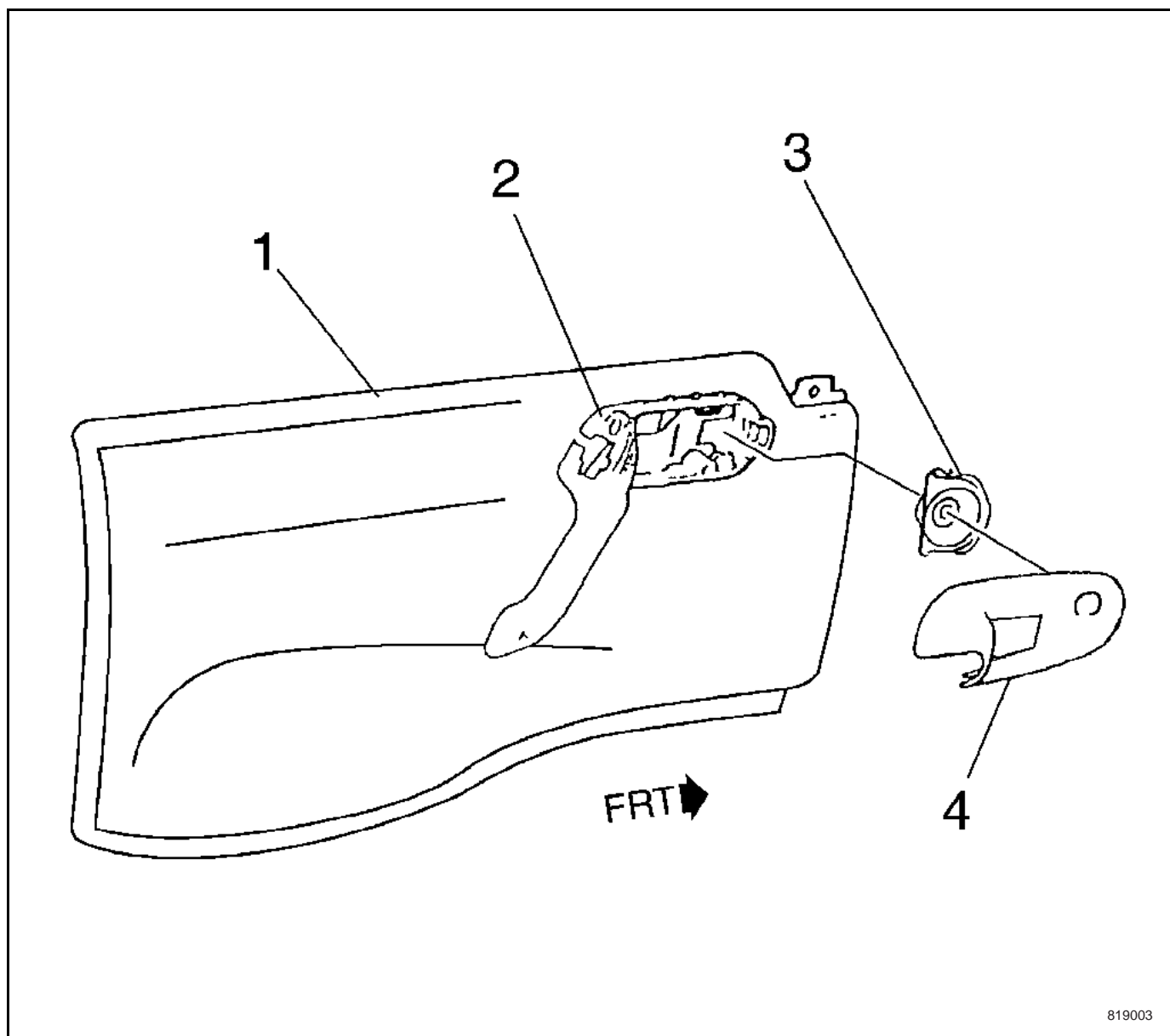
8.19.3.2 Front Lower Speaker Locator



Legend

- | | |
|------------------------|---|
| (1) Front Door | (3) Secure the speaker to the bolt/screw of front door. |
| (2) Front Door Harness | (4) Front Door Speaker |

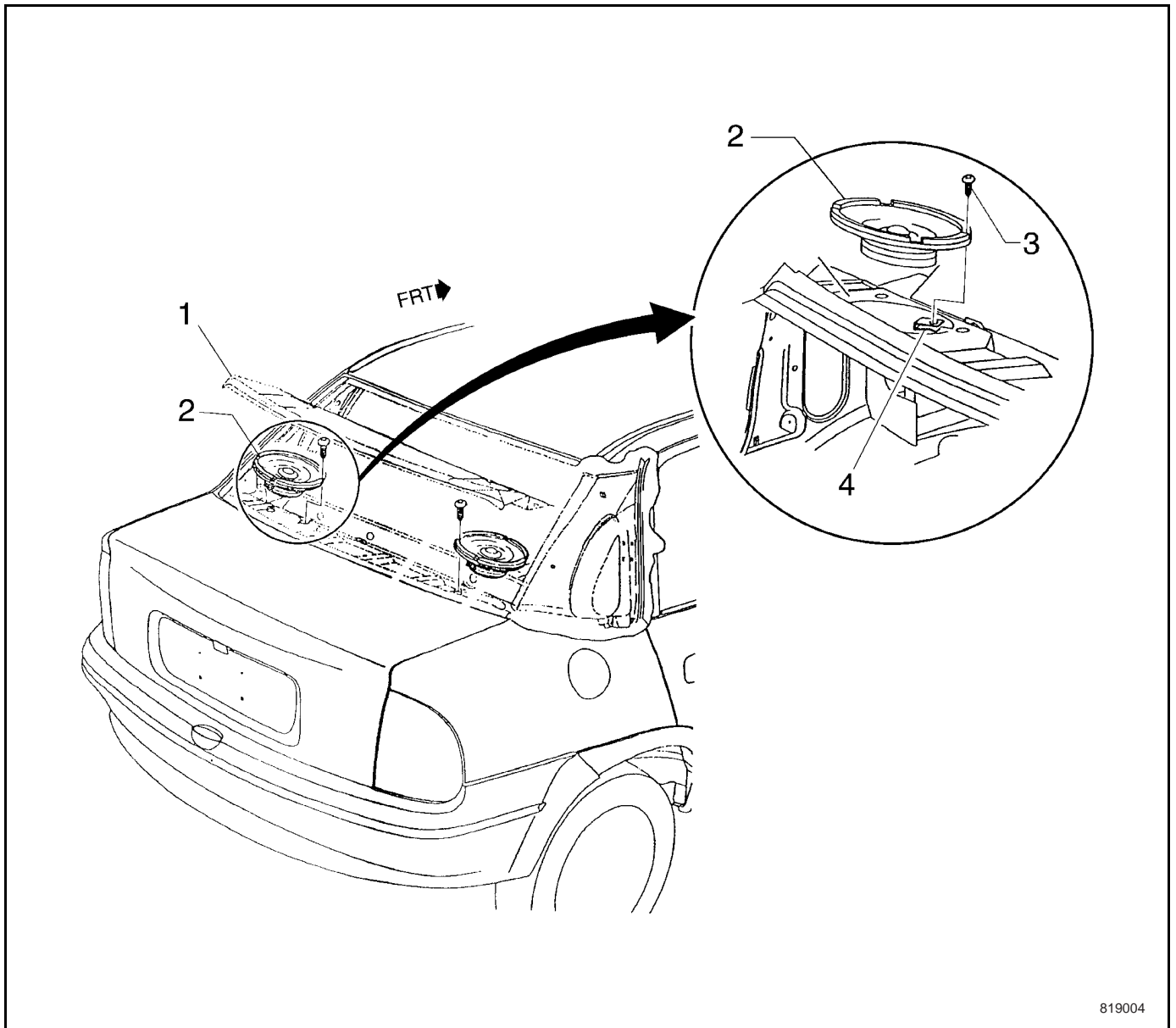
8.19.3.3 Front Tweeter Speaker Locator



Legend

- | | |
|-----------------------|---------------------------|
| (1) Front Door | (3) Front Tweeter Speaker |
| (2) Front Door Handle | (4) Door Handle Cover |

8.19.3.4A Rear Speaker Locator

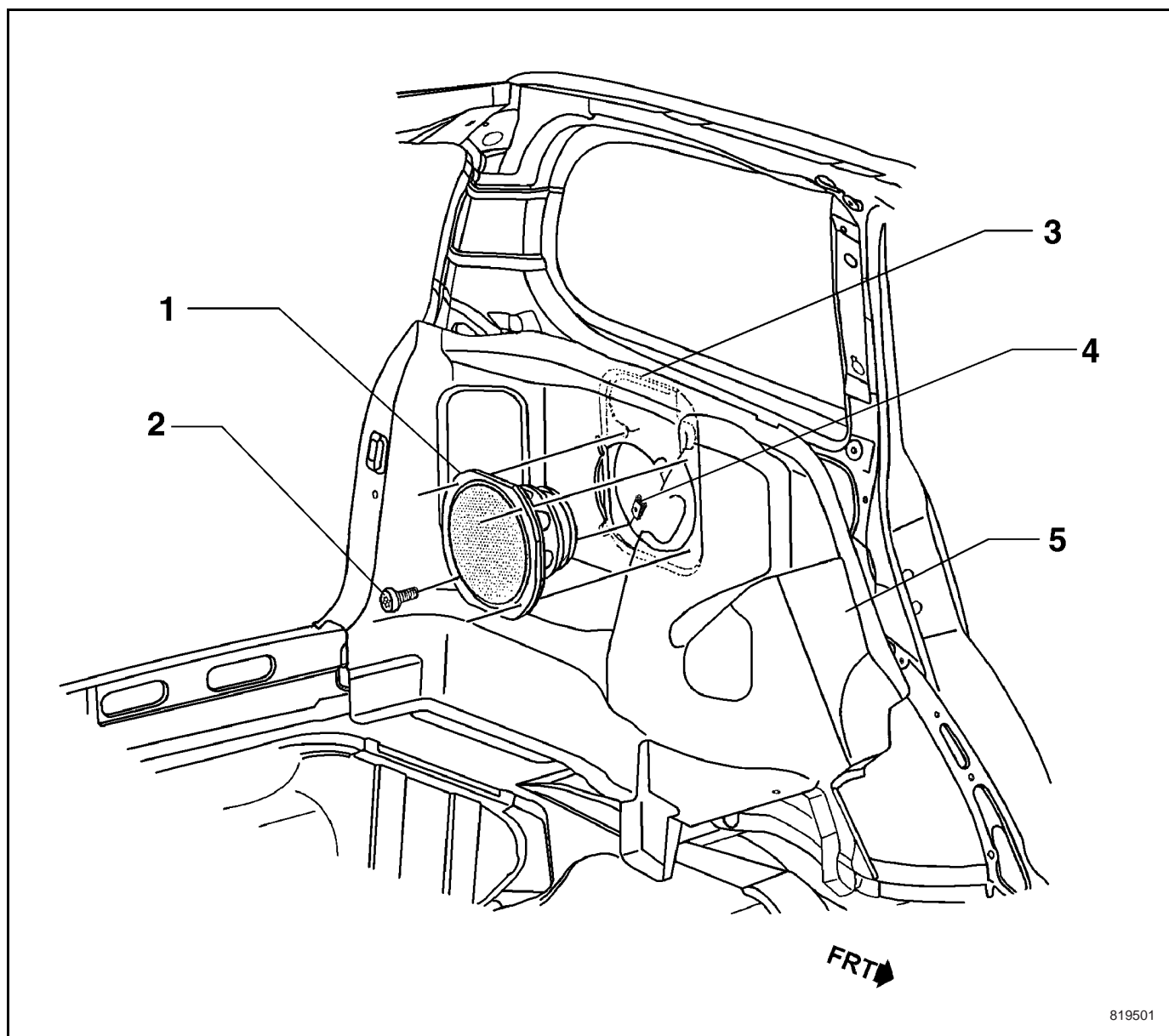


819004

Legend

- | | |
|------------------|------------------------------------|
| (1) Trunk Lid | (3) Secure the speaker bolt/screw. |
| (2) Rear Speaker | (4) Rear Speaker Nut |

8.19.3.4B Rear Speaker Locator

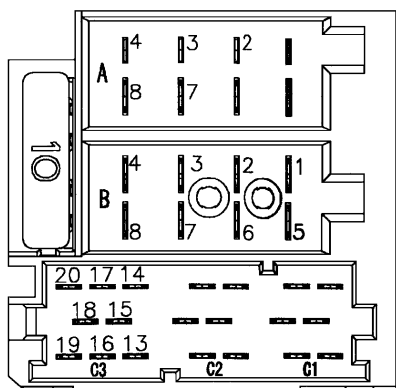


819501

Legend

- | | |
|------------------------------------|--------------------------------|
| (1) Rear Speaker | (4) Nut |
| (2) Secure the speaker bolt/screw. | (5) Rear Side Trim Panel Cover |
| (3) Side Inner Panel | |

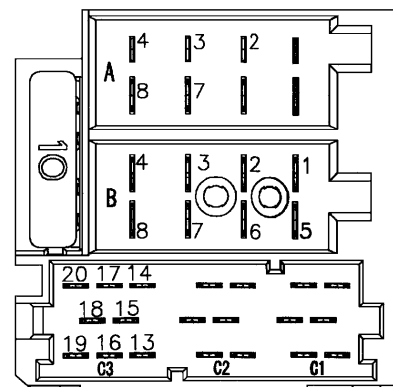
8.19.3.5 Radio Connector Views



819105

Pin	Wire Color	Circuit Ground Number	Function
A2	Black	2	Ignition Power (+)
A3	Grey Black	3	I/P Lighting
A4	Brown	4	Ground
A7	—	Reserv ed	Antenna Supply Power
A8	Red	8	Common Power Supply
B1	Brown White	9	Right Rear Speaker (-)
B2	Tan	10	Right Front Speaker (-)
B3	Brown Blue	11	Left Front Speaker (-)
B4	Brown Green	12	Left Rear Speaker (-)
B5	White	13	Right Rear Speaker (+)
B6	Yellow	14	Right Front Speaker (+)
B7	Blue	15	Left Front Speaker (+)
B8	Green	16	Left Rear Speaker (+)
C13	—	—	Tx Bus
C14	—	—	Rx Bus
C15	—	—	Power Grounding
C16	—	—	Power Supply

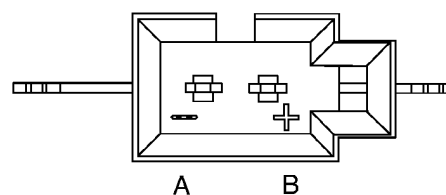
8.19.3.5 Radio Connector Views(Cont' d)



819105

Pin	Wire Color	Circuit Ground Number	Function
C17	—	—	Remote Control
C18	—	—	Left Channel
C19	—	—	Audio Grounding
C20	—	—	Right Channel
C13-C20 Aftersales Optional			

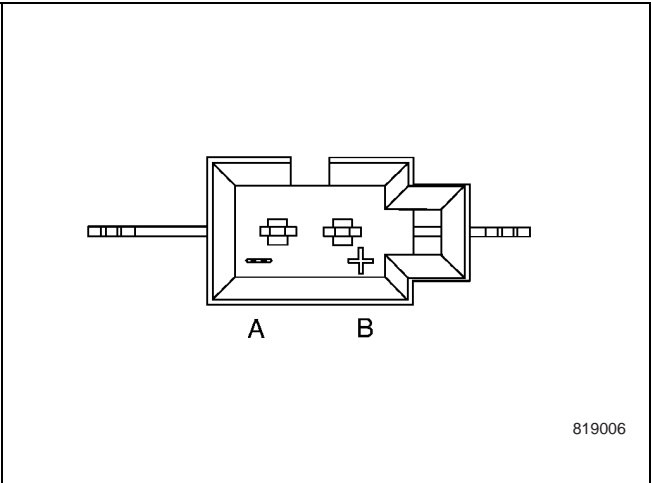
8.19.3.6A Rear Speaker of Radio Connector End View



819006

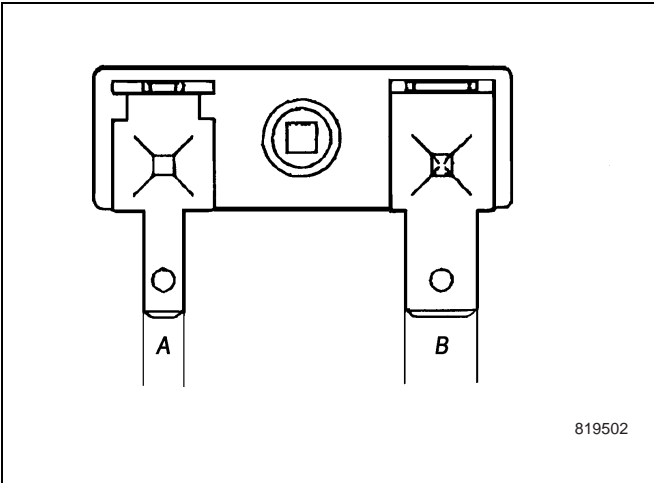
Information	Pin	Wire Color	Circuit Ground Number	Function
Right Rear (H40)	A	Brown White	2	Signal Return End of Right Rear Speaker
	B	White	1	Signal Input of Right Rear Speaker

8.19.3.6A Rear Speaker of Radio
Connector End View(Cont' d)



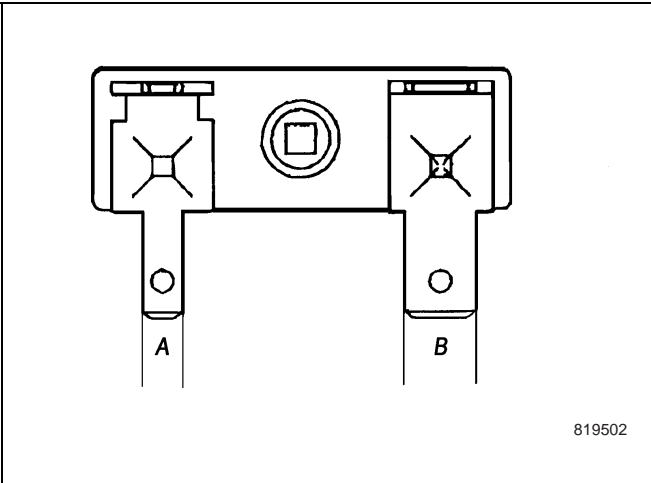
Information	Pin	Wire Color	Circuit Ground Number	Function
Left Rear (H39)	A	Brown Green	2	Signal Return Circuit of Left Rear Speaker
	B	Green	1	Signal Input of Left Rear Speaker

8.19.3.6B Rear Speaker of Radio
Connector End View(Cont' d)



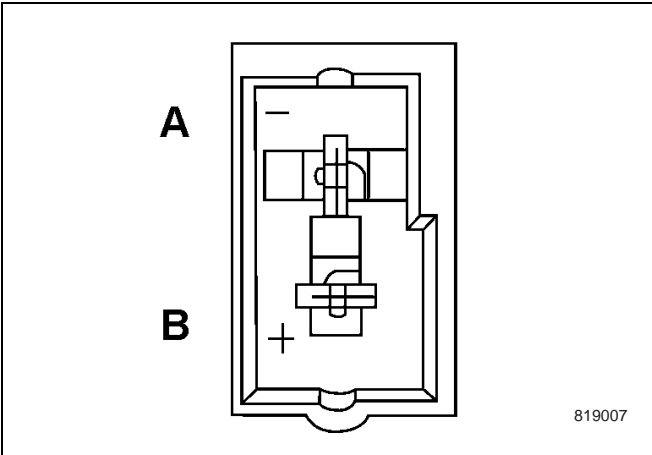
Information	Pin	Wire Color	Circuit Identification Number	Function
Left Rear (H39)	A	Brown Green	2	Signal Return Circuit of Left Rear Speaker
	B	Green	1	Signal Input of Left Rear Speaker

8.19.3.6B Rear Speaker of Radio
Connector End View



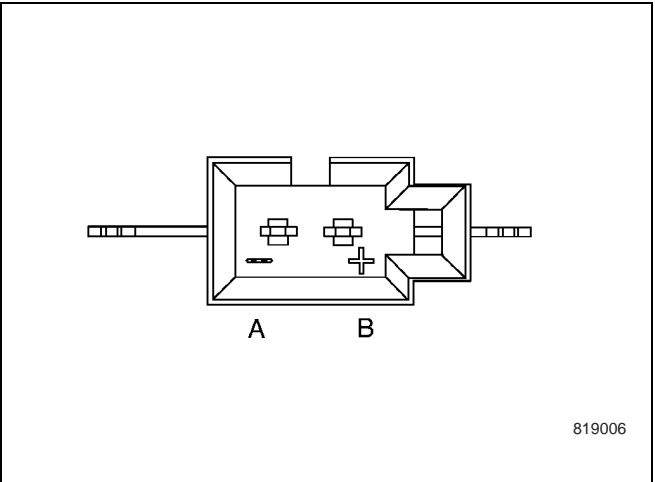
Information	Pin	Wire Color	Circuit Identification Number	Function
Right Rear (H40)	A	Brown White	2	Signal Return End of Right Rear Speaker
	B	White	1	Signal Input of Right Rear Speaker

8.19.3.7 Connector End View - Front Door
Tweeter Speaker



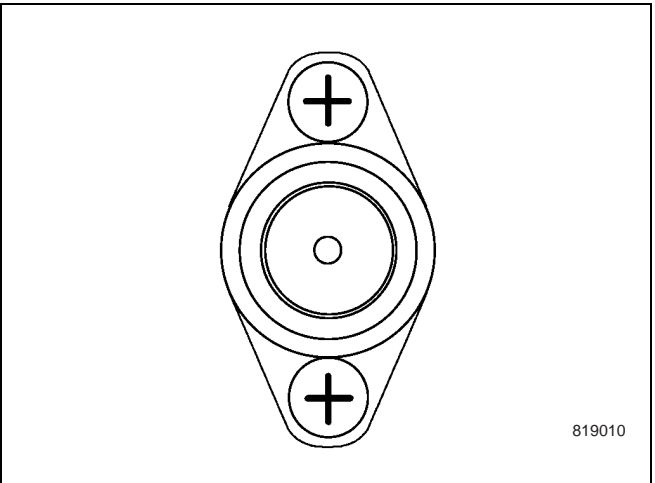
Information	Pin	Wire Color	Circuit Identification Number	Function
Right Front of Tweeter Speaker (H53)	A	Brown Blue	1	Return End of Right Front Tweeter Speaker
	B	Blue	2	Tweeter Speaker of Right Front Signal
Left Front of Tweeter Speaker (H53)	A	Brown Blue	1	Return End of Left Front Tweeter Speaker
	B	Blue	2	Tweeter Speaker of Left Front Signal

8.19.3.8 Connector End View - Front Door
Speaker



Information	Pin	Wire Color	Circuit Identification Number	Function
RF (H38)	A	Brown Blue	2	Signal Return End of Right Front Speaker
	B	Blue	1	Signal Input of Right Front Speaker
LF (H37)	A	Brown Blue	2	Signal Return End of Left Front Speaker
	B	Blue	1	Signal Input of Left Front Speaker

8.19.3.9 Frontal Antenna Connector End
View



Pin	Circuit Identification Number	Function
23	H1 and *H1	Signal Input

8.19.4 Diagnostic Information and Procedures

8.19.4.1 A Diagnostic System Operation - Radio/Audio System

Step	Action	Normal Result(s)	Abnormal Result(s)
1	1. Turn the ignition switch to RUN position. 2. Turn on the radio.	<ul style="list-style-type: none"> The radio can be used. All the speakers operate normally. 	<ul style="list-style-type: none"> Radio Displays Inoperative Radio Memory Inoperative Radio Inoperative
2	Turn the ignition switch to PARK position.	<ul style="list-style-type: none"> Radio Display Dimming. Radio cover illuminates. Radio buttons illuminate. 	When the parking lamp illuminates, the radio lighting is inoperative.
3	Insert the tape/CD into the radio.	The tape/CD is operative normally.	Tape/CD player is inoperative
*Refer to the appropriate symptom diagnostic table for the applicable abnormal result.			

8.19.4.2 Radio Poor Reception

Step	Action	Value	Yes	No
1	Have you checked the system operation?	—	Go to Step 2	Go to Diagnostic System Operation
2	1. Turn on the radio. 2. Use a DMM, with one end connected to common power of the antenna amplifier (u17), and the other end connected to ground, to measure. Is the voltage equal to the specified value?	12V	Go to Step 4	Go to Step 3
3	1. Keep the radio on. 2. Use a DMM, with one end connected to the common power (Pin 8 on H1 or *H1) of radio, the other end connected to ground (Pin 4 on H1 or *H1). Is the voltage equal to the specified value?	12V	Go to Step 5	Go to Step 6
4	Check if the signal cable between the antenna amplifier (u17) and the radio (Pin 23 on *H1 or H1) is normal. Is the coaxial cable OK?	—	Go to Step 7	Go to Step 8
5	Repair the open between the common power end of antenna amplifier (u17) and the common power end of radio (*H1, H1). Is the repair completed? Is the coaxial cable OK?	—	Refer to System Operation	—
6	Repair the open between the common power end of radio and the battery. Is the abnormal status recovered?	—	System OK	Go to Step 9
7	Replace the antenna amplifier (u17). Refer to Antenna Amplifier (u17) Replacement. Is the repair completed?	—	Refer to System Operation	—
8	Replace the signal cable. Refer to Antenna Signal Cable Replacement. Is the repair completed?	—	Refer to System Operation	—
9	Replace the radio. Refer to Radio Replacement. Is the repair completed?	—	Refer to System Operation	—

8.19.4.3 Radio Displays Inoperative

Step	Action	Value	Yes	No
1	Have you checked the system operation?	—	Go to Step 2	Go to System Operation
2	1. Turn the headlamp switch to OFF position. Turn on the radio. 2. Is sound present from the speaker?	—	Go to Step 3	Go to Step 4
3	Replace the radio. Refer to Radio Replacement. Is the status recovered?	—	System OK	Go to Step 6
4	Use a DMM, with one end connected to the radio power (Pin 2 on H1, *H1), the other end connected to ground (Pin 4 on H1, *H1), to measure. Is the voltage equal to the specified value?	12V	Go to Step 3	Go to Step 5
5	Check for the fuse or repair the open between the radio power and the ignition power. Is the repair completed?	—	Refer to System Operation	—
6	Check for the open between the speaker and the radio. Is it disconnected?	—	Go to Step 7	Go to Step 8
7	Repair the open between the speaker and the radio. Is the repair completed?	—	Refer to System Operation	—
8	Replace the speaker. Refer to Speaker Replacement.	—	Refer to System Operation	—

8.19.4.4 Radio Dashboard Illumination Inoperative (DIMMER Inoperative)

Step	Action	Value	Yes	No
1	1. Turn the headlamp switch to PARK position. 2. Use a test lamp or back probe between Pin 2 (on *H1 or H1) and ground. Does the test lamp illuminate?	—	Go to Step 3	Go to Step 2
2	Repair the open between Pin 3 (on *H1, H1) and the headlamp switch (S2.1). Is the status recovered?	—	Go to System Operation	—
3	Replace the radio. Refer to Radio Replacement. Have you finished the repair?	—	Go to System Operation	—

8.19.4.5 Radio Memory Inoperative

Step	Action	Value	Yes	No
1	Use a test lamp or back probe between Pin 8 (on *H1 or H1) and ground. Does the test lamp illuminate?	—	Go to Step 3	Go to Step 2
2	Repair the open between Pin 8 (on *H1 or H1) and the battery (+). Is the status recovered?	—	Go to System Operation	—
3	Replace the radio. Refer to Radio Replacement. Have you finished the repair?	—	Go to System Operation	—

8.19.4.6 Tape Player Inoperative

Step	Action	Value	Yes	No
1	Insert a fine tape into the player. Does the tape play weak, slow or garbled?	—	Go to Step 3	Go to Step 2
2	Check the tape player for an obstruction through the tape door. Is there an obstruction?	—	Go to Step 4	Go to Step 5
3	Perform motor speed test with the diagnostic test tape, used for repair procedures, from the J 39916-A. Is the motor speed OK?	—	Go to Step 4	Go to Step 5
4	1. Remove the said obstruction. 2. Inspect moving parts and tape head. 3. Clean moving parts and tape head. Refer to Tape Player Care and Cleaning. 4. Insert a cleaning tape. 5. Use a diagnostic test tape, used for the repair procedures, from the J 39916-A. Does the test tape operate normally?	—	System OK	Go to Step 5
5	Replace the radio. Refer to Radio Replacement. Is the repair completed?	—	Go to System Operation	—

8.19.4.7 Speakers General Diagnosis

Required Tools

- J 39916-A CD and Tape Diagnosis Kit

Note: Always compare the front speakers to the front and the rear speakers to the rear. Do not compare the front speaker to the rear speaker for the following reasons:

The front and the rear speakers could be different speakers.

The different front and rear speaker mounting environments could cause a sound difference.

Perform tone test and evaluation on the following components:

The coaxial speakers

Other complex speaker systems

Three basic tones are used:

50 Hz sine tone

500 Hz warble tone

9 kHz spectral tone

The combination tone is a blend of the above 3 tones.

Bass/Sub-Woofer Test (50 Hz Sine Tone)

The 50Hz sine tone evaluates the following items:

The bass response of an audio system

Audio systems that have separate sub-woofer amplifiers and speakers

Midrange Speaker Test (500 Hz Warble Tone)

The 500Hz warble tone evaluates the midrange speaker response. The 500Hz warble tone qualifies as a warble tone evaluation because of the different audio characteristics present as opposed to the sine tone. The 500Hz warble tone produces a warble sound. At midrange frequencies, use a warble tone instead of a sine tone because the location of a warble tone source, such as a speaker, is easier to identify. A normal sine tone can set up a standing wave within a vehicle. A standing wave may increase difficulty in determining the source location.

Tweeter Test (9 kHz Spectral Tone)

The 9 kHz spectral tone is used for the following evaluations:

- Tweeter
- High frequency

The 9 kHz spectral tone is a section of frequencies of equal amplitudes ranging from 8.5-9.5 kHz. The tone sounds like a group of crickets chirping.

The 9 kHz spectral tone is used for 2 reasons:

- In order to locate the source, much like the warble tone.

- For easier identification, for those people with high end hearing loss problems.

All Speaker Test

The combination tone is used for numerous audio problems:

- Distortion from speakers
- No sound from speakers

When using the combination tone, comparative AC voltage measurements can be made on the speaker terminals provided that the following controls are in the detent position.

- Fader
- Balance

With these voltage measurements, a determination can be made in the diagnosis of the following components:

- Speaker
- Amplifier

Speaker/Grill Rattle Test (50Hz - 8kHz Swept Sine)

The next part of tape diagnosis is used to test the rattle in the following components:

- Speaker
- Grill

The first test is 2 tones played back-to-back. The second test is a variable frequency tone, but frequency change is at a much slower rate. In order to repair the following problems, both two tests can be used:

- A speaker rattle
- A speaker buzz

If the problem causes are identified, complete the following procedures:

- Place the following controls at proper position:
Fader
Balance

Play the test tones in the specific problem area.

Motor Speed Test

There is a 2 minute time period marked in this section of tape for the purpose of inspecting the cassette tape motor speed. This portion of the diagnostic tape can also be used in order to verify that abnormal sound is coming from the cassette tape player. In some cases, improper tape motor speed can cause audio abnormalities. If the time taken for the motor speed test is between 116-121 seconds, the tape motor speed is within tolerance.

Noise Diagnosis (Dead Space)

This portion can be used for diagnosis such as alternator whine, switch pops, etc., which can be more

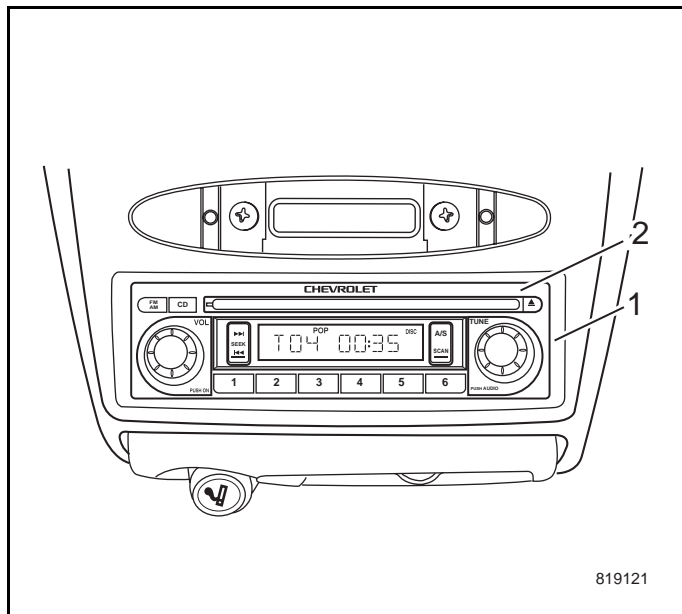
easily detected during dead space. Dead space is blank space between songs. This portion of the diagnostic kit may be used in conjunction with the noise diagnosis in Radio in Electrical Diagnosis.

8.19.5 Repair Instructions

8.19.5.1 Radio Replacement

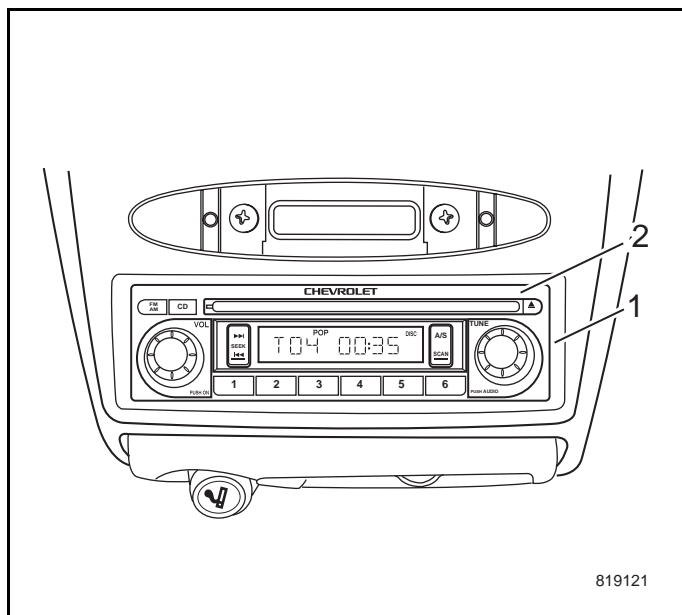
Removal Procedure

1. Remove the radio panel housing (1).
2. Remove the radio body (2) with 取机钥匙 (remover key??).



Installation Procedure

1. Press the radio (2) into the instrument panel until fully seated.
2. Press in the radio panel housing (1) until fully seated.



8.19.5.2 Tape Player Care and Cleaning

Required Tools

- J 39916 CD and Tape Diagnosis Kit

Operate according to the recommended cleaning time.

1. Clean the cassette tape player after every 15 hours of operation for optimum performance.
2. Clean the cassette player every 50 hours in order to prevent damage to the tape head.

Clean the following 2 parts on the tape player:

- Tape Head
- Tape Roller

Leave the tape player in the vehicle because you can reach the above parts through the tape door. Perform this service at least every 50 hours of cassette operation. After 50 hours of tape play, CLN (Clean) appears on the display as a reminder. Although the system will still function when this message is displayed, the following conditions may occur until the head and the capstan are cleaned:

- Sound quality reduced
- Tape damaged

After you clean the player, press and hold EJECT for five seconds to remove the CLN indicator. The radio displays ---, in order to show that the clean feature has been reset.

If you do not regularly clean the tape player, the tape player is subject to the following conditions:

- Sound quality reduced
- Tape damaged
- Mechanical part damaged

Properly store the tapes in their own plastic boxes in order to avoid the following conditions:

- Dirt
- From direct sunlight
- Extremely heated

Improper tape storage may cause the following results:

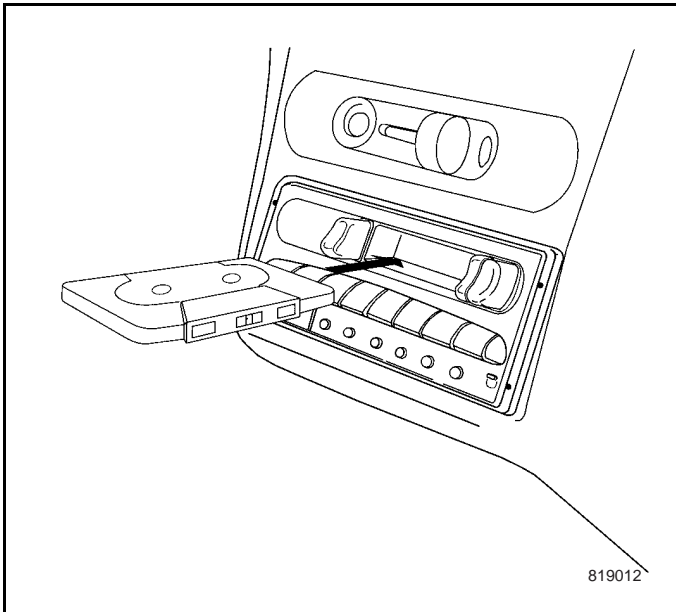
- Tape operative abnormally
- Premature failure of the tape player

The tape may fray the machine. The sound quality may reduce slowly.

Before servicing a tape player, verify that the following conditions exist:

- The tape is fine.
- The tape player is clean.

Clean the cassette tape player at least after every 50 hours of operation for optimum performance. Every 50 hours, CLN (Clean) appears on the radio as a reminder. If a reduction in the sound quality occurs, regardless of when the tape player was last cleaned, play a different cassette tape in order to see if the tape or the tape player is at fault. If the sound quality does not improve when the second tape is played, clean the cassette player.



Use a scrubbing action, non-abrasive cleaning cassette for proper tape player cleaning. This cleaner is a wet-type cleaning system. The wet-type cleaning system uses a cleaning cassette with pads. The pads scrub the tape head as the cleaner cassette turn.

If you use this kind of cleaner, the following will occur:

- The radio displays an error.
- The cartridge ejects.

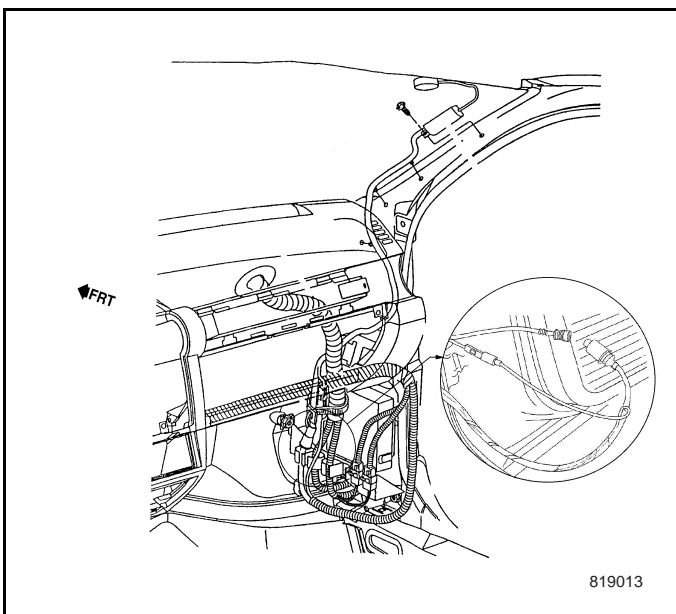
These conditions are normal and is the result of an added feature in the tape player that detects broken tapes.

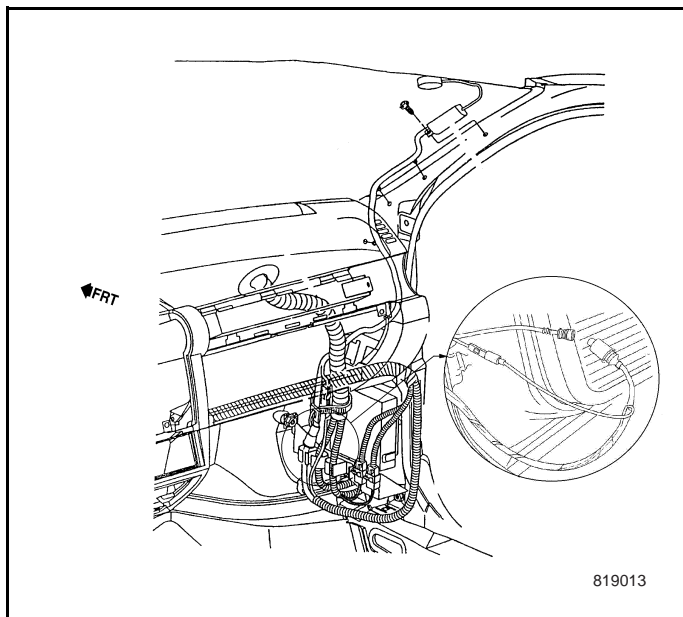
If an error occurs, insert the cleaning cassette at least 3 times in order to thoroughly clean the tape cleaner. You may also use a non-scrubbing action, wet type cleaning cassette. This cassette uses a fabric belt to clean the tape head. This kind of cleaning cassette will not damage the system, but may not clean as thoroughly as the scrubbing type.

8.19.5.3 Antenna Amplifier Replacement

Removal Procedure

1. Remove the windshield column trim panel. Refer to Trim Panel Replacement-Windshield Column in Interior Trim
2. Remove the glove box. Refer to Glove Box Replacement in Instrument Panel, Gauges and Console.
3. Pull the strap and the wiring harness out from the windshield column.
4. Disconnect the jumper harness from the body wiring harness.
5. Disconnect the coaxial cable from the body wiring harness.
6. Carefully disconnect the windshield antenna cable jumper harness from the windshield antenna connector.
7. Remove the antenna amplifier bolt.
8. Remove the antenna amplifier.





Installation Procedure

1. Install the antenna amplifier and the antenna amplifier bolt.

Tightening

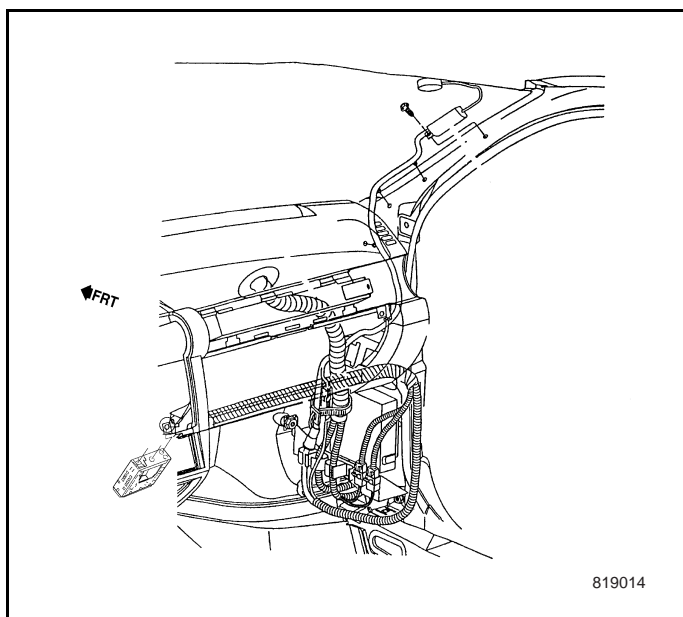
Tighten the antenna amplifier bolt to 1.5 N•m

2. Connect the windshield antenna cable jumper harness to the windshield antenna connector.
3. Connect the coaxial cable to the body wiring harness.
4. Connect the jumper harness to the body wiring harness.
5. Mount the wiring harness to the upper guard panel of the inner windshield.
6. Install the glove box. Refer to Glove Box Replacement in Instrument Panel, Gauges and Console.
7. Install the windshield column trim panel. Refer to Trim Panel Replacement-Windshield Column in Interior Trim.

8.19.5.4 Antenna Signal Cable Replacement

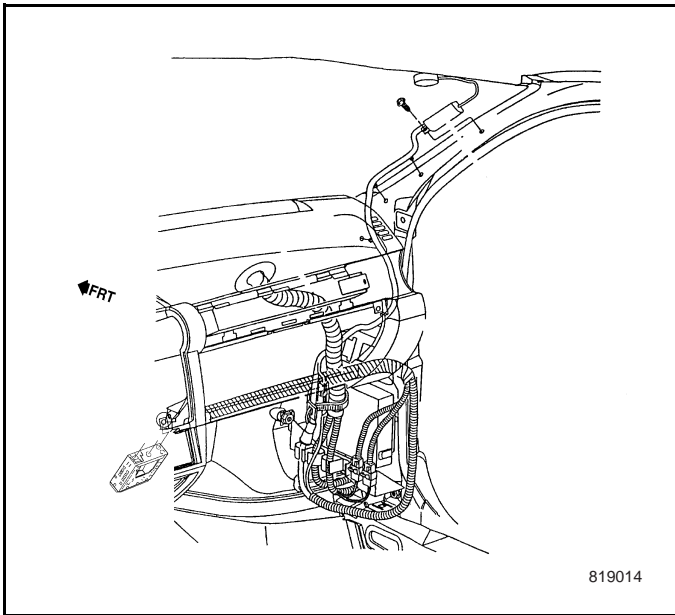
Removal Procedure

1. Remove the glove box. Refer to Glove Box Replacement in Instrument Panel, Gauges, and Console.
2. Disconnect the antenna signal cable from the antenna amplifier wires.
3. Remove the radio. Refer to Radio Replacement.
4. Disconnect the antenna signal cable connector at the rear of radio, and remove the antenna signal cable.



Installation Procedure

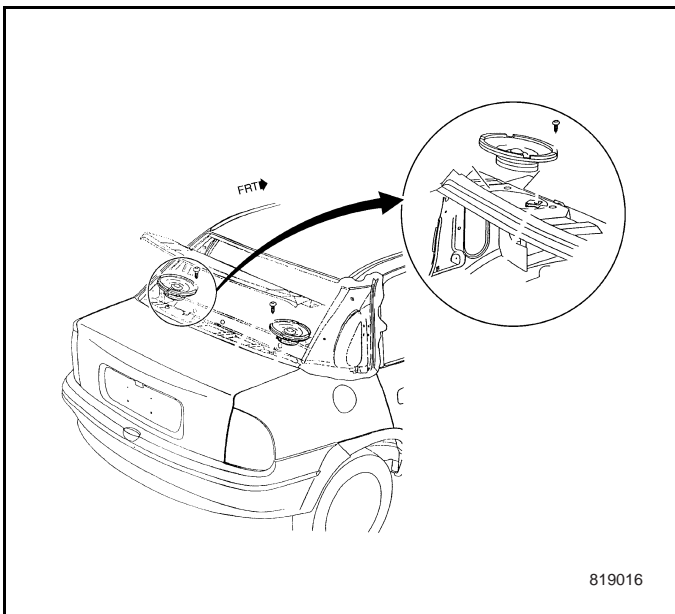
1. Connect one end of the antenna signal cable to the rear of radio. Install the radio. Refer to Radio Replacement.
2. Connect the other end of antenna signal cable to the antenna amplifier wire.
3. Install the glove box. Refer to Glove Box Replacement in Instrument Panel, Gauges, and Console.

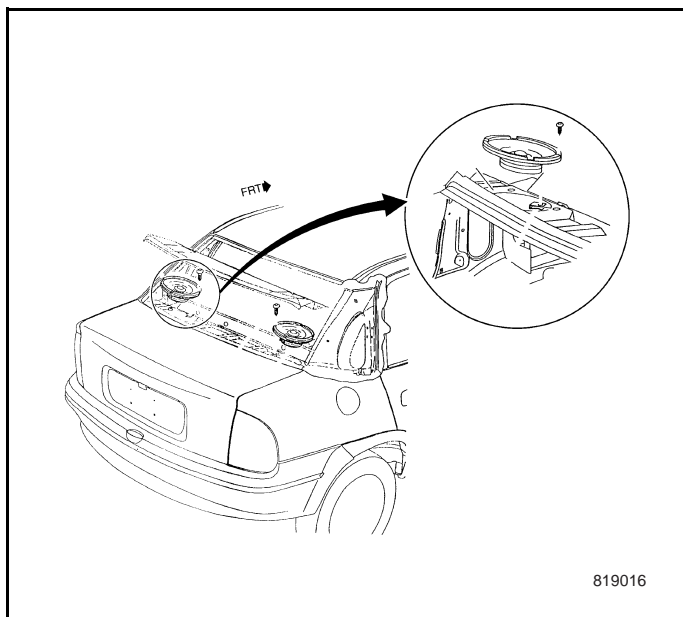


8.19.5.5A Speaker Replacement - Rear

Removal Procedure

1. Remove the rear window molding. Refer to Rear Window Trim Panel Replacement in Interior Trim.
2. Remove the four rear speaker bolts.
3. Lift the rear of speaker upward slightly.
4. Disconnect the electrical connectors of rear speaker.
5. Remove the rear speaker.





Installation Procedure

1. Connect the electrical connectors to the rear speaker.
2. Install the four rear speaker bolts.

Tightening

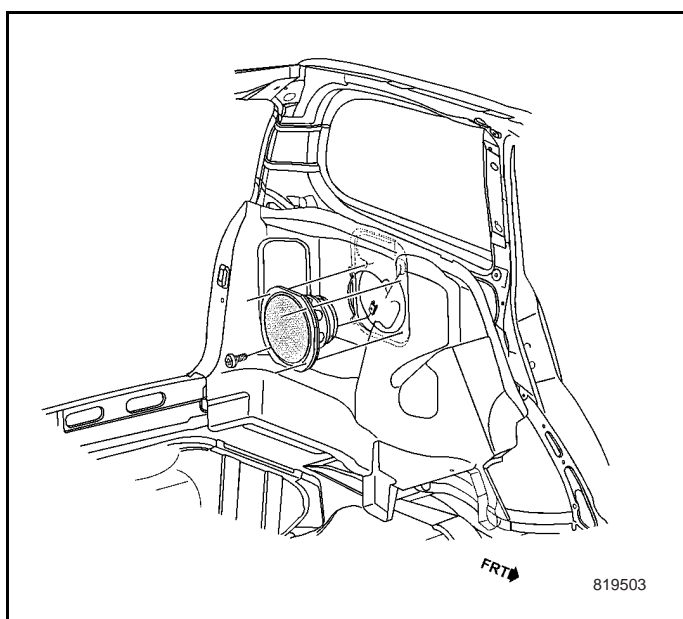
Tighten the rear speaker bolt to 3.0 N•m.

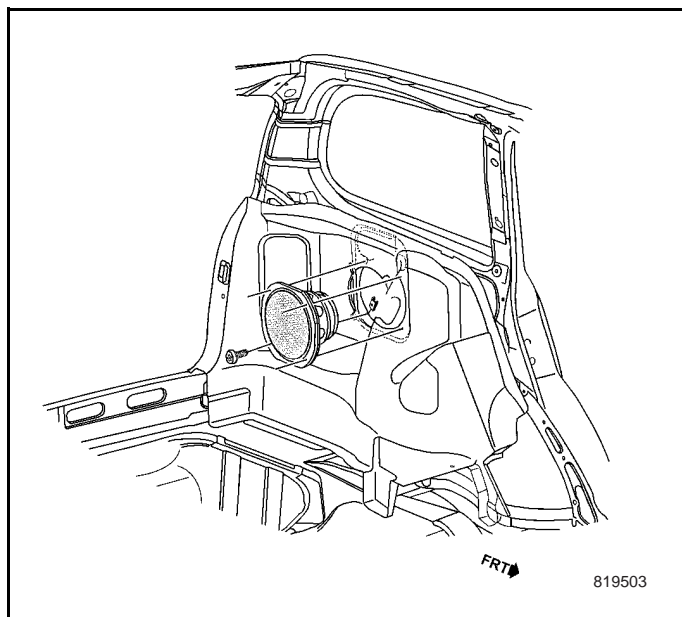
3. Install rear window trim panel. Refer to Rear Window Trim Panel Replacement of Interior Trim.

8.19.5.5B Speaker Replacement - Rear

Removal Procedure

1. Remove the side trim panel. Refer to Side Trim Panel Replacement - Rear Compartment in Body Rear End.
2. Remove the four rear speaker bolts.
3. Lift the rear of speaker upward slightly.
4. Disconnect the electrical connectors of rear speaker.
5. Remove the rear speaker.





Installation Procedure

1. Connect the electrical connectors to the rear speaker.
2. Install the four rear speaker bolts.

Tightening

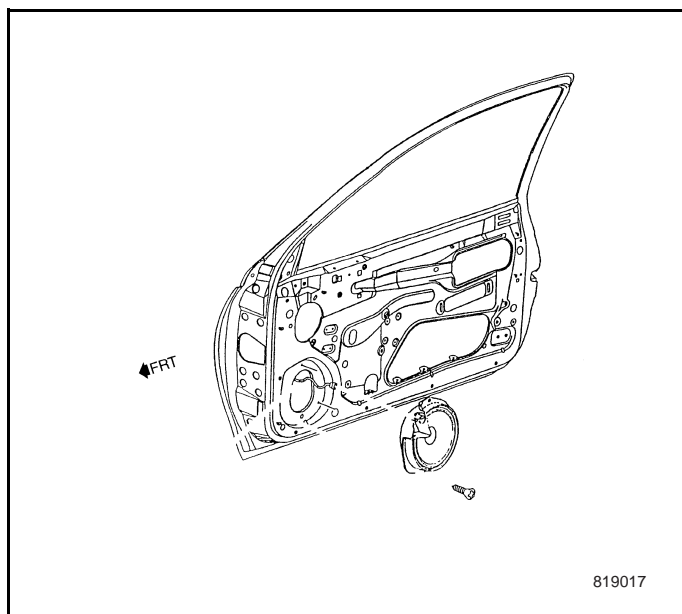
Tighten the rear speaker bolt to 1.1 N•m.

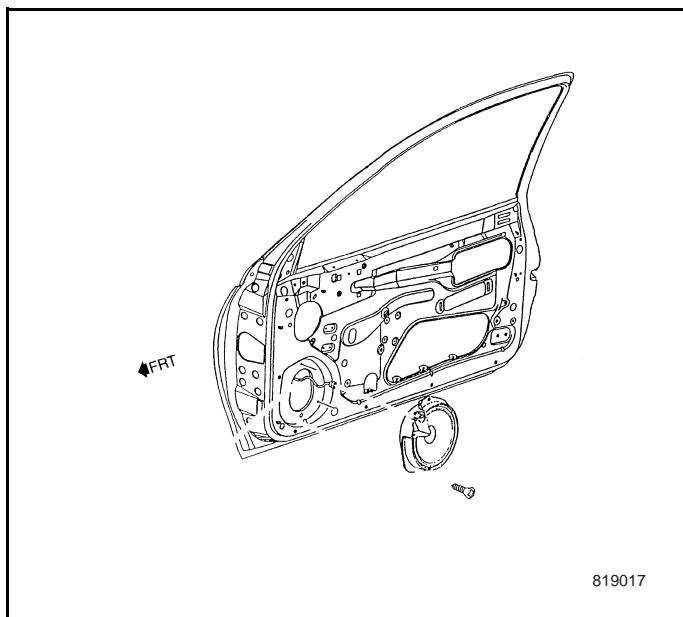
3. Install the side trim panel. Refer to Side Trim Panel Replacement in Rear Compartment in Body Rear End.

8.19.5.6 Speaker Replacement - Front Lower

Removal Procedure

1. Remove the front door trim panel. Refer to Front Door Trim Panel Replacement in Interior Trim.
2. Remove the three front door speaker bolts.
3. Disconnect the electrical connectors of front door speaker.
4. Remove the front door speaker.





Installation Procedure

1. Connect the electrical connectors of front door speaker.
2. Install the front door speaker.
3. Install the three front door speaker bolts.

Tightening

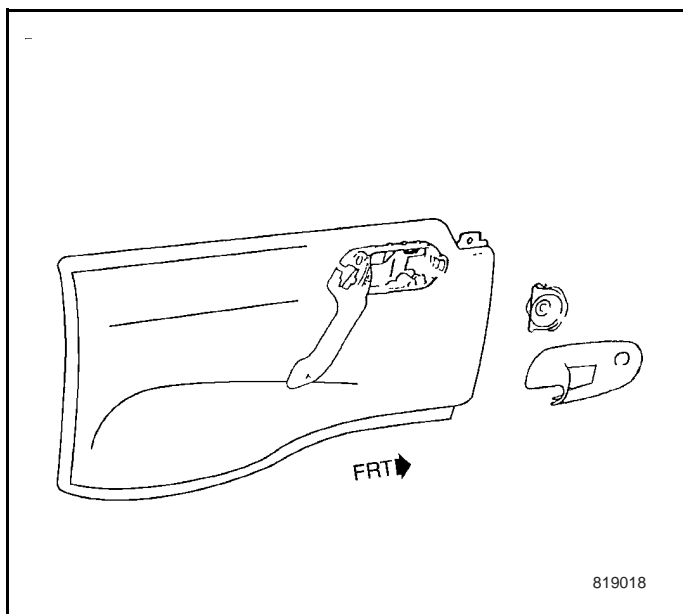
Tighten the front door speaker bolt to 2 N•m.

4. Install Front Door Trim Panel. Refer to Front Door Trim Panel Replacement of Interior Trim.

8.19.5.7 Speaker Replacement - Front Upper

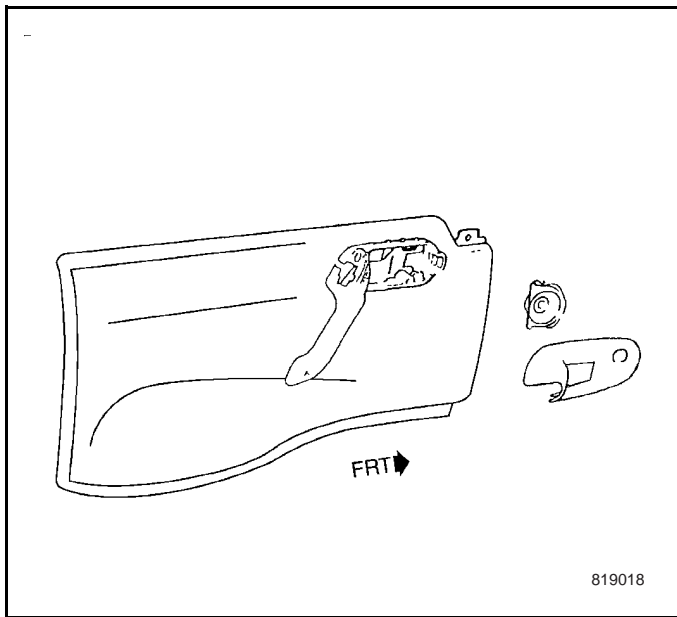
Removal Procedure

1. Remove the door handle cover. Refer to Front Door Handle Replacement of Interior Trim.
2. Disconnect the electrical connector.
3. Remove the front door upper speaker along the guide slot.



Installation Procedure

1. Connect the electrical connector.
2. Install the front door upper speaker along the guide slot.
3. Install the door handle cover. Refer to Front Door Handle Replacement in Interior Trim.



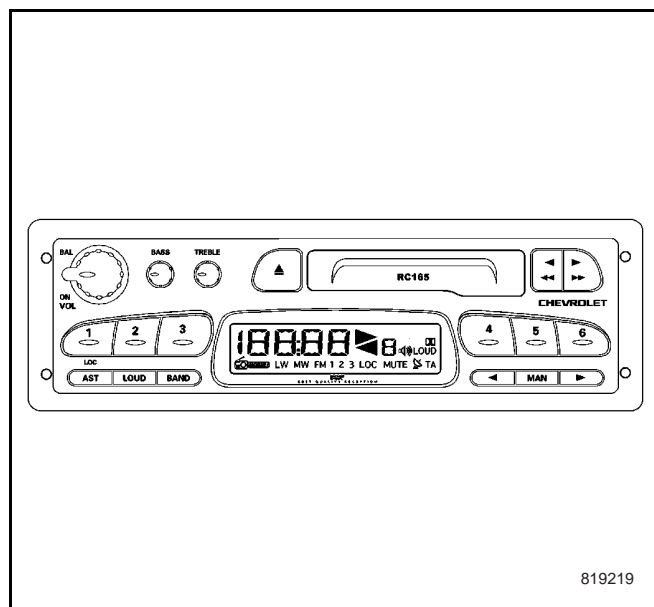
8.19.6 Description and Operation

8.19.6.1 Radio/Audio System Description

Radio

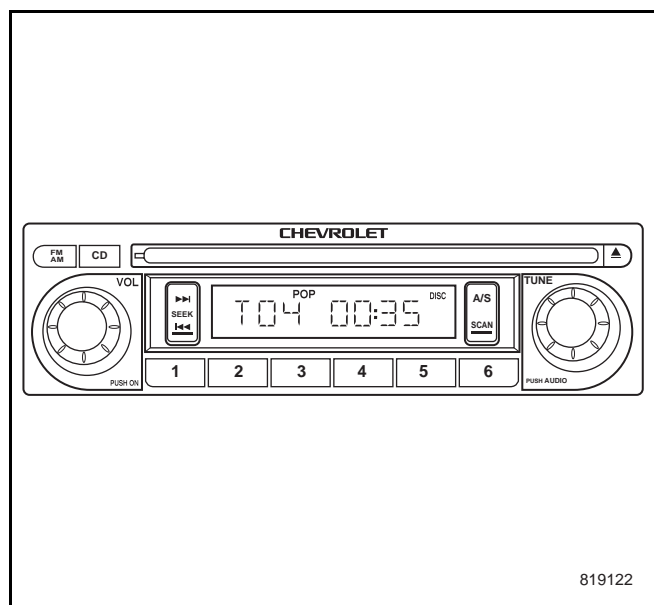
The following radio can be used in 2005 Scar Base,

- Radio, AM/FM Stereo, Seek/Scan, Automatic Reverse Music Search Cassette, Clock



The following radio can be used in 2005 Scar Uplevel or Uplevel II,

- Radio, AM/FM Stereo, Seek/Scan, Clock, CD player



AM

The range for most AM (Amplitude Modulated) stations is greater than for FM (Frequency Modulation) especially at night. However, if the transmitted distance

is too far, the interference between stations may occur with the distance. AM station can pick up noise from things like storms and power lines. Try reducing the treble to reduce the noise.

FM Stereo

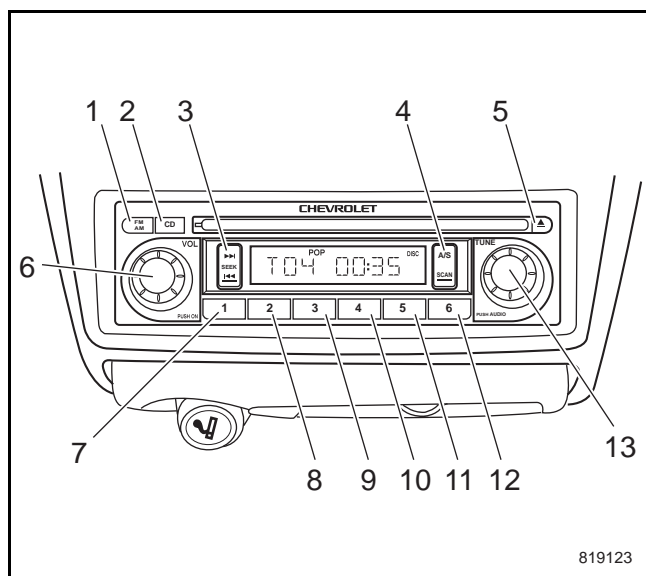
FM Stereo will give you the best sound. Tall buildings or hills can interfere with FM signals, causing the sound to come and go. If reception is poor, tune to a stronger station, in order to improve the reception quality.

Speaker

Performance enhance audio speaker system.

8.19.6.2 Radio/Audio System Operation - CD Player

Caution: To avoid the short, first disconnect the connection from vehicle battery negative, and do not re-connect until the installation and connection of equipment is completed.



Panel Function Description

- | | |
|----------------|--|
| 1 – FM/AM..... | Switch to Radio Mode
Band Selection |
| 2 – CD..... | Switch to CD Mode. |
| 3 – SEEK ►... | Current track forward (CD)
High End Frequency Seek
(Radio) |
| ◄... ◄ | Current track backward (CD)
Low End Frequency Seek
(Radio) |
| 4 – A/S..... | Automatic seek tuning memory
(Radio) |
| SCAN..... | Radio frequency scan (Radio)
CD track scan play |
| 5 – ▲..... | CD Ejection (CD) |

6 – PUSH ON...	Power Switch
VOL.....	Volume Adjustment
7 – <1>.....	Long press: Store current station (Radio) Long press: Store current play track (CD) Briefly press: Select stored station (Radio) Briefly press: Play stored track, press again to repeat current play track (CD)
8, 9, 10, 11, 12.....	Function is the same as 7
13 – TUNE.....	Manual seek tuning frequency (Radio)
PUSH AUDIO...	Turn: Previous/Next track selection (CD) Briefly press: Select Audio Mode (CD)

Audio Adjustment

On/Off

- Press PUSH ON key to turn on or off the main player.

Volume

- Turn the knob in order to adjust the volume.

Note: Please adjust the volume to a proper level to ensure you can still hear the traffic signals (hooter, alarm, horn, siren, etc.)

Sound Effects

- No matter what you want to hear, jazz, pop, classical, live Mode or rock, PUSHAUDIO (Sound Effects) key may meet your demands, Briefly press the knob to enter audio selection mode, then turn this knob to select.
 - BASS-TRE: The treble and bass may be set up randomly
 - ROCK: Rock and Roll
 - JAZZ: jazz
 - VOCAL: Live Mode
 - POP: Popular Music
 - CLASSIC: Classical Music

Audio Setting

- Briefly press PUSH AUDIO key, and select the audio setting which you want to adjust.
- Turn this knob to select the audio setting you need.
 - BASS (Bass, only for the audio mode of BASS - TREB you select)
 - TREBLE (Treble, only for the audio mode of BASS - TREB you select)
 - BALANCE: Volume balance between left and right speaker

- FADER: Volume balance between front and rear speaker.
- LOUDNESS (Off, Low, Middle, high, under BASS-TREB mode)

Radio

Band

- Press FM/AM key to select the desired band.

FM1-->FM2-->FM AST-->MW(AM)1-->MW(AM)AST

Seek Tuning

Automatic seek tuning

Press SEEK key to tune the stations of high end and low end frequencies.

- Press the same key to search another station.

Frequency Scan

Frequency scan function allows you to listen to local station on each current band for 10 seconds.

- Press SCAN key at least 3 seconds to turn on/off the frequency scan function.

Manual Tuning (if you have already known the station frequency)

- Turn TUNE knob to tune the station of high end and low end frequencies.

Preset Station

Manually store the station in the preset key, by using Preset key (1 to 6) to store 6 stations on each band.

- Tune in the desired station
- Press and hold the desired preset key at least 2 seconds, and the current station can be stored in this preset key.

Listen to the preset station

- Press the desired preset key (1 to 6), the preset station may be obtained.

Automatic Stored Station

You can store 6 strongest FM stations on FM AST band, or 6 stations on MW (AW) AST band. When you use the Automatic Stored Station again, the previous stored station on FM AST or MW (AW) ASM band will be replaced.

- Press A/S key to enter Automatic Storage, later
 - the machine will sound a crack, then mute.
 - After the storage, you will hear a crack again.
 - Begin to listen to the stored station in the preset key.

- Sometimes less than 6 stations can be found

CD play

CD play (CD player)

This CD player is for 12 cm disc. Do not use different shape disc (异形光碟 ??).

- Gently insert a disc with the label side up into the loading slot to play the disc.
- If a disc has been loaded, press CD key to select CD as sound source to play.

Previous/Next Track

- Directly turn PUSH AUDIO knob to select the desired track.
 - After selected, the track begins to play.

Backward/Forward

- When pressing SEEK key, the current play track will be forwarded or backwarded.
 - Release the key, the main machine will resume normal play.

Track Scan

Scan function can allow you to listen to the beginning of each track (about 10 seconds).

- Press SCAN key to enter/exit the track scan.

CD Track Storage

- Under the status of CD play, find the track that you want to store, press and hold the preset key (1-6) at least 2 seconds where you want to store the track. When hearing a crack, release the preset key and the selected track has been stored in the pressed preset key.

Note: When the disc ejects or the radio cassette is powered off, the storage will be lost.

- Play Stored Track
- Under the status of CD play, press any preset key. If this key has stored a track, the track may be played. At this time, if the preset key is pressed again, the track will be repeated. If this key hasn't stored any track, "NO STORE" will be displayed on the screen.

CD Track Sequential Play

This function can be used to circularly play the track which has been stored in the preset key 1-6, in sequence.

Note: At least one preset key has stored a track

- At the CD play mode, press CD key and release, then enter the sequential play mode. The machine will circularly play the track, which has been stored in the preset key, in sequence.

Note:

- Press the CD key again or perform the other CD operation to exit.

Disc Ejection (CD player)

- Press ▲ key to eject the disc.

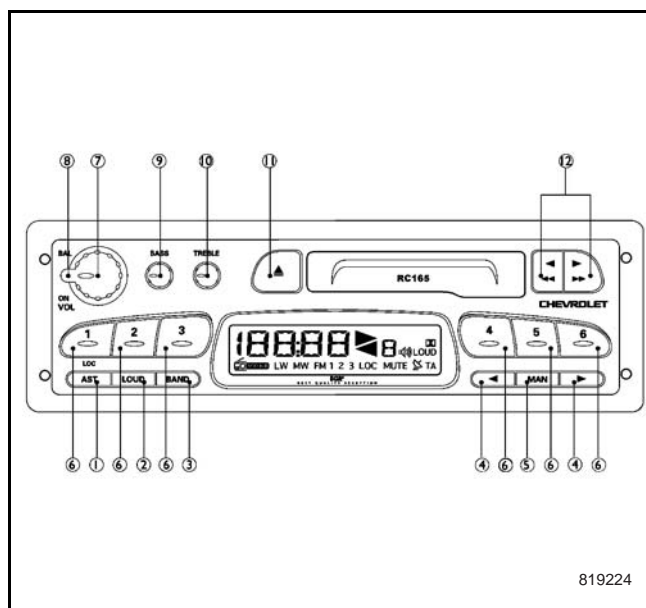
Disc Care

- Do not leave your fingerprints on the disc.
- After the disc is ejected, put it in the disc box to avoid the damage or dust.
- DO NOT allow the disc to be heated or exposed to the sunlight.

8.19.6.3 Radio/Audio System Operation ñ Cassette Tape Player

Caution: To avoid the short, first disconnect the connection from vehicle battery negative, and do not re-connect until the installation and connection of equipment is completed.

Note: The volume should be adjusted to a proper level to ensure you can hear the traffic signal sound (speaker, siren, etc.)



Legend

- (1) Automatic Stored Station (AST) Local/Distance Station Selection (LOC)
- (2) Loudness Control (LOUD)
- (3) Band Selection (BAND)
- (4) Automatic Station Selection and Manual Station Selection (◀ and ▶)
- (5) Manual Station Tuning Switch (MAN)
- (6) Preset Stored Station (1-6)
- (7) Volume Control Switch (ON-VOL)

- (8) Front and Rear Speaker Control (FAD)
- (9) Bass Control (BASS)
- (10) Treble Control (TREBLE)
- (11) Ejection Button(▲)
- (12) Forward and Backward (◀ and ▶)/Auto Reverse (◀ 4)

Usage Description

Audio Adjustment

- Switch and Volume Control: Use the volume control switch knob to turn on the radio and adjust the volume.
- Loudness Control (Used to increase treble): Press the loudness control button to perform the loudness control function of switch.
- Bass Control: Turn the bass control knob to adjust the bass volume.
- Treble Control: Turn the treble control knob to adjust the treble volume.
- Front and Rear Speaker Control: Turn the fader button to control the volume balancing between front and rear speaker.

If only connecting two horns, place the knob in the middle.

Radio

Band

- Briefly press BAND key to select the desired band. Display shows: FM1, FM2, or FM3, AM1, or AM2.

Automatic Station Selection

Use the automatic station selection button to quickly search the stations.

- Button ◀ or Button ▶

You can listen to the station in a short time. If you want to search another station, just press the button again.

If the entire FM bands have been searched, but no station has been found, change the LOC button setting to Distance Mode (DX).

Local/Distance Station Selection on FM Band

- Press LOC button at least 2 seconds (until you hear a buzz) to select the local or distance station reception.
 - Under the local reception mode, the display will show LOC.
 - For bands, local or distance reception will automatically switch over. During the process of seek tuning, the radio is first at local mode to seek the station. If no station is found, the radio will automatically switch to the distance mode to continue searching.

Manual Tuning (if you have known a station frequency)

- Briefly press MAN button, a tick later, the auto tuning has been switched to manual tuning mode.
- Use Button ◀ and ▶ to tune the desired station (Press and hold this button, the frequency can be changed quickly.)
 - ◀ = Tune the higher frequency station
 - ▶ = Tune the lower frequency station

Note: About 50 minutes later, the radio will automatically resume the automatic station selection mode with a tick sound.

Preset Station 1-6 (Store the station and preselect)

Each band can store 6 stations (1-6).

Station Storage

- Briefly press BAND key to select the desired station band.
- Tune the desired station frequency.
- Press one of the preset buttons 1-6 for two seconds. When you hear a tick, the station has stored the pressed number position.

Note: If a new station is stored, the previous stored station will be deleted.

Listen to the preset station

- Press BAND button to select the desired band.
- Press the desired preset button, listen to the preset station.
The display will show the band, frequency and preset button number which will be present.

Automatic Storage (AST)

- With the automatic storage (AST) function, the FM 3 band can store 6 FM stations, and AM 2 band can store 6 AM stations.

Note: This will also delete the original preset station.

Automatic Stored Station

Use BAND button to select the band.

- Press AST key.
- Playback is mute, and the display shows "AST".
- When the 6 stations has been stored, a tick will be heard.
- You will listen to the preset station in the No. 1 preset button.

Sometimes less than 6 stations may be found, then the remaining preset button will automatically set as 00.00 (Recording mute). If no station can be found, the preset station will remain.

Tape Playback

Note:

- Use the good quality tapes (the length is less than c-90).
- When not used, take out the tape, and put in the cassette case. Avoid the damage to tape or reproduce head
- Do not allow the tape to be exposed to the direct sunlight or be heated.

Playback

- Allow the opening of tape towards the right, place the full side into the cartridge near yourself direction. Then the radio stops working and begins to playback, the display shows the tape goes to TAPE ▶.

Stop Playback

- Press all the ejection buttons, stop the playback.
- Change to the recording status.
- Tape Ejection

Reverse (before the tape is ended)

- Press Button◀◀ and ▶▶ half way at the same time.

Quick Reverse (◀◀ or ▶▶)

The direction of quick play is depending on the direction of tape play.

The indicator appears	Action	Button
▶	Forward	▶▶
▶	Backward	◀◀
◀	Forward	◀◀

The indicator appears	Action	Button
◀	Backward	▶▶

During the quick play, the player switches to the recording function.

After the quick play ends, the player automatically resume the tape play.

Stop Quick Play

- Stop the quick play before the tape ends, press the unpressed Button◀◀ or ▶▶.
- The playback will resume.

Tape Ended

- When one side of the tape ends, the other side will be reversed automatically and continued the playback.

Maintenance

- After used for a long time, the tape head will accumulate with dirt or contaminant, and affect the playback.
- Regularly (once or twice a month), the capability reduced. Use the cleaning tape to clean the tape head.

Note:


- First inspect before applying the service.

Sometimes you may suspect that the vehicle radio operates abnormally. Before calling to ask for a service, please inspect the display reminder and the following table at first. You may possibly find that the obvious conditions are easier to repair.

	Symptom	Possible Cause/Repair Methods
General	The equipment doesn't work with no indications. The equipment is operative, but there is no sound or a poor sound quality.	Inspect the fuse (of the equipment and the vehicle) and the connection. Adjust the volume of the equipment, and cancel the mute. Inspect the fader and balance setting. Inspect the antenna and its connection.
Radio	The radio is of poor reception. Using the seek tuning cannot tune the desired station.	Inspect for the correct antenna connection. The desired station signal is too weak. Manually tune to the desired station. Inspect for the correct antenna connection.
Tape	The tape playback lacks of treble or a sound channel. Before the tape ends, the mechanical part of tape changes the direction of play.	Clean the tape head of the tape player. Refer to Tape Player Care and Cleaning. Return the tape to the beginning of the tape.

- If you still want to send your equipment for service, be sure to send a complete equipment. Do not try to open the equipment and repair it by yourself.

8.19.7 Special Tools

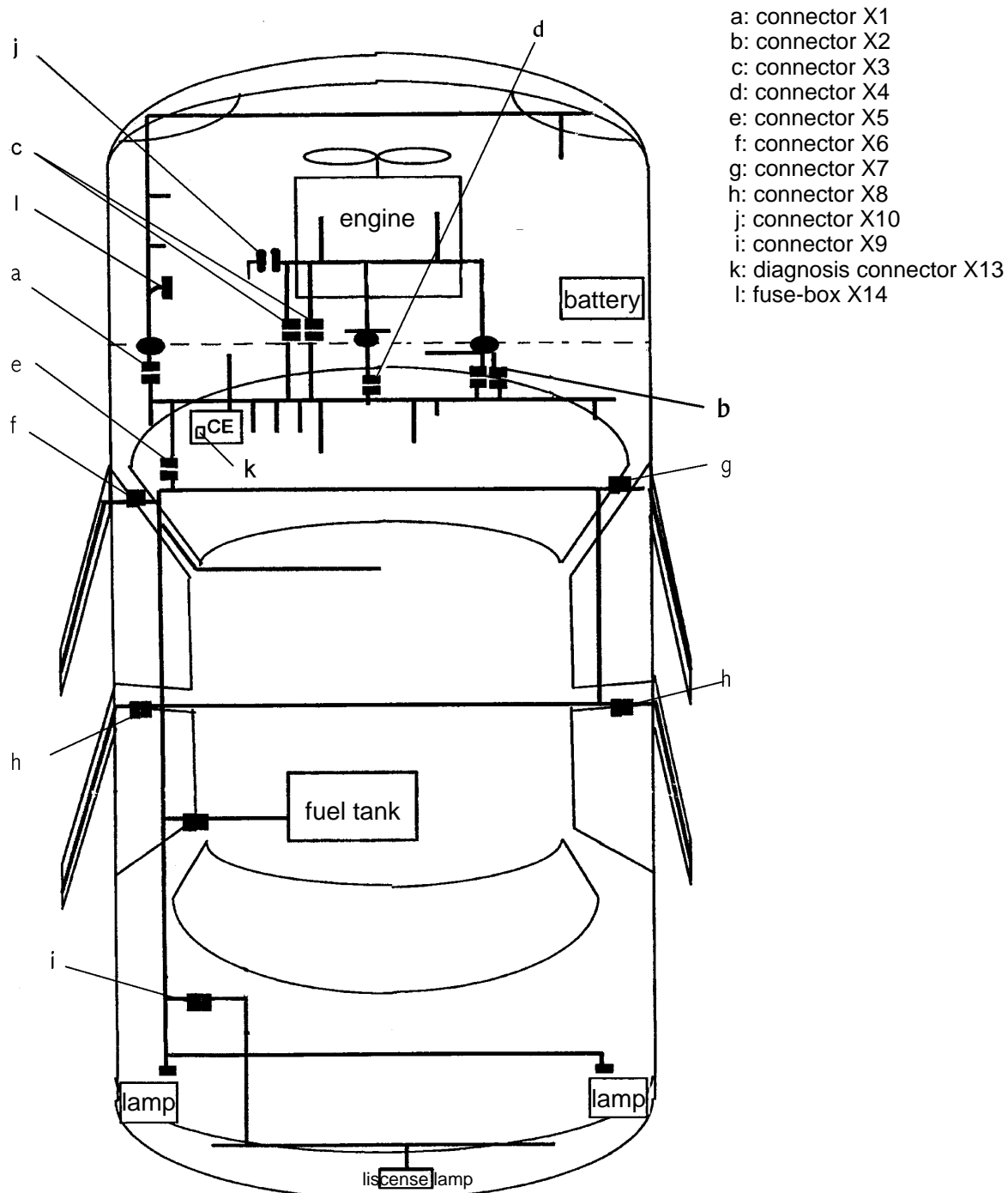
Illustration	Tool Number / Description
 <p>J39916-A</p>	J39916-A CD and Tape Diagnosis Kit

Blank

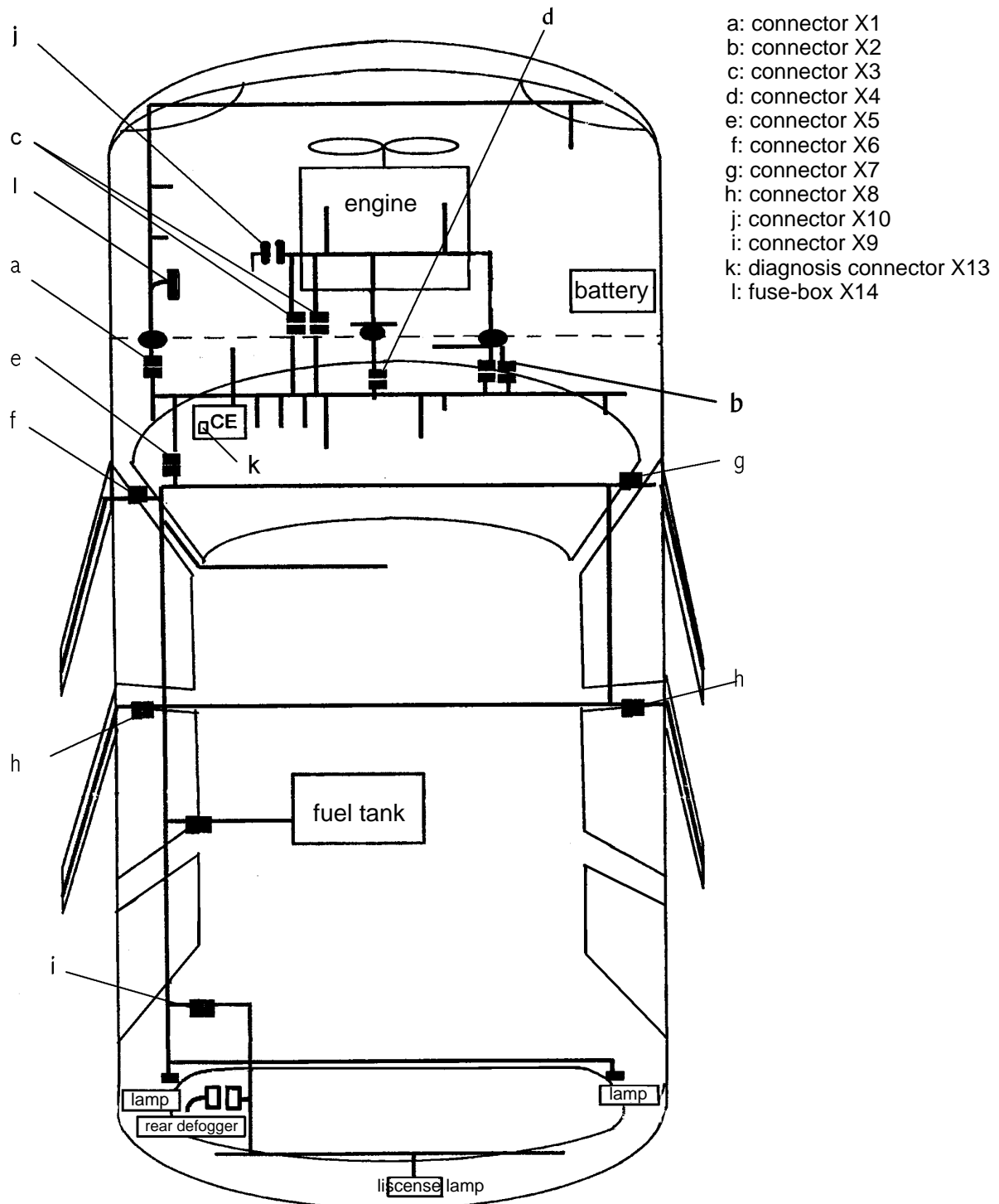
8.20Wiring System

8.20.1 General Information




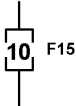
8.20.1.1A Wiring Harness




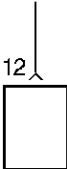
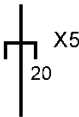
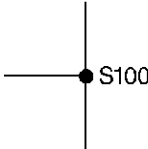
8.20.1.1.B Wiring Harness





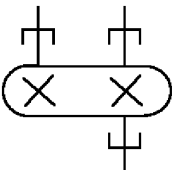

20.1.1.2 Electric Symbol

Sysmbol	Description
<div>  <div>820002</div> </div>	<p>Electrostatic Discharge (ESD) Legend.This legend is used to remind technicians that this system contains electrostatic sensitive components, which should be specially noticed before making any repairs.Refer to Electrostatic Discharge Notice in Cautions and Notices.</p>
<div>  <div>820006</div> </div>	<p>Portion of Components. When the component is represented by a broken line frame, the component and wiring harness have not been completely represented.</p>
<div>  <div>820007</div> </div>	<p>Complete Components. When the component is represented by a real line frame, the shown component and wiring harness have been completely represented.</p>
<div>  <div>820008</div> </div>	<p>Fuse (fuse 15, 10A)</p>



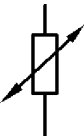

20.1.1.2 Electric Symbol(Cont' d)

Sysmbol	Description
<div>  <div>820009</div> </div>	<p>Fusible Connection</p>
<div>  <div>820010</div> </div>	<p>Connector attached to component</p>
<div>  <div>820011</div> </div>	<p>In-line Wiring Harness Connector (connector X5, needle 20)</p>
<div>  <div>820012</div> </div>	<p>Connection</p>





20.1.1.2 Electric Symbol(Cont' d)

Sysmbol	Description
<div> 820013</div>	Chassis Ground
<div> 820014</div>	Single Filament Light Bulb
<div> 820015</div>	Double Filament Light Bulb
<div> 820016</div>	Light Emitting Diode

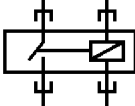
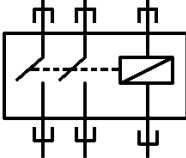
20.1.1.2 Electric Symbol(Cont' d)

Sysmbol	Description
<div> 820017</div>	Battery
<div> 820018</div>	Resistor
<div> 820019</div>	Variable Resistor
<div> 820020</div>	Switch

20.1.1.2 Electric Symbol(Cont' d)

Sysmbol	Description
<div>  <div>820021</div> </div>	Diode
<div>  <div>820022</div> </div>	Transistor
<div>  <div>820023</div> </div>	Motor
<div>  <div>820024</div> </div>	Solenoid

20.1.1.2 Electric Symbol(Cont' d)

Sysmbol	Description
<div>  <div>820026</div> </div>	Single Pole/Throw Relay
<div>  <div>820027</div> </div>	Double Pole/Throw Relay

8.20.1.3 General Electrical Diagnostic Information

Basic Knowledge Required

In no basic knowledge of electricity, it is very hard to use this section to present the diagnostic procedure. You should understand the basic theory of electricity and know the meaning of potential (voltage), current (amperes), and resistance (ohms). You should understand what happens in a circuit with an open or shorted wire. You should be able to read and understand a wiring diagram.

Refer to Diagnostic Strategy in General Information so as to correct diagnosis and service of customer concerns.

8.20.1.4 Checking Aftermarket Accessories

Aftermarket accessories may not be connected in the following circuit:

- Airbag System Circuit

Do always first check aftermarket accessories (non original) at the time of diagnosis of electrical failures. If the vehicle is equipped with aftermarket accessories, disconnect the system and verify that the aftermarket accessories are not the cause of the failure.

Possible cause related to aftermarket accessories include:

- Power supply connection point is not the battery.
- Antenna Position
- Emitter wire is too close to the vehicle electronic module or wire.
- Poor shielding or poor connectors on antenna feed line.
- Check the detailed installation instructions presented in the latest service bulletin for aftermarket accessories.

8.20.1.5 Circuit Test

The following diagnostic test information is presented in the section of Circuit Test. Use the information in conjunction with diagnostic procedures to identify the cause of electrical function failures.

- Use the connector to test the joint.
- Probe the electrical connector.
- Use a DMM to clear the problem.
- Use the test lamp to rectify the problem.
- Use fused jumper wire.
- Test for voltage

- Measure the pressure drop
- Continuity Test
- Test for a short to ground
- Test for a short to voltage

Use the connector to test the joint.

Note: The probe on the test equipment shall not be inserted into any connector or fuse box terminal. The probe diameter can cause most terminals to be deformed. Poor contact will be resulted in after terminal deformation, causing system failures. Always use J 35616-A connector test splice kit or J 42675 flat head wire probe connector kit, to probe the terminal from the front. Avoid using clips or other substitutes, or terminal damage and measuring error will be caused.

Probe the electrical connector.

Note: When reconnecting the connector or replacing the terminals, always to reinstall the connector position assurance (CPA) and terminal position assurance (TPA)

Front Probe

Disconnect the connector and probe the matching surface (front) of the connector.

Note: The probe on the test equipment shall not be inserted into any connector or fuse box terminal. The probe diameter can cause most terminals to be deformed. Poor contact will be resulted in after terminal deformation, causing system failures. Always use J 35616-A connector test splice kit or J 42675 flat head wire probe connector kit, to probe the terminal from the front. Avoid using clips or other substitutes, or terminal damage and measuring error will be caused.

Back Probe

Do not disconnect the connector, and the terminal should be probed from the wiring harness side (back) of the connector.

Note:

- Probe the connector terminal from the back only when it is specially required by the diagnostic procedure.
- Do not back probe the sealing (Weather Pack(r)) connector, less than a 280 series Metirc-Pack connector, a Micro-Pack connector or a flat wire (dock and lock) connector.
- Back probing may possibly damage the connector terminal. You must be specially careful at the time of operation, and avoid resulting terminal deformation due to test probe inserting the hole too deep or the used test probe dimension too large.
- Check the terminal for damage after back probing of any connectors. If the terminal damage is suspected, test for proper terminal contact.

Use a DMM to clear the problem.

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

Note: It includes any solid state control module circuit, such as the power system control module, and only a 10 megohm or higher resistance DMM can be employed to perform the test, e.g. J 39200.

J 39200 operation manual provides detailed instruction, and the entire text should be read after receiving the DMM while keeping it on hand at any time for reference.

When testing for voltage in high resistance circuit, a DMM should be used but not a test lamp. The test lamp can indicate if a voltage is available, and the DMM can indicate how high is the voltage appeared.

The ohm scale on the DMM indicate the resistance value between 2 points in the circuit. The lower the resistance in the circuit, the better it indicates for the continuity of the circuit.

Note: When using a DMM to measure for resistance, first disconnect the power supply of the suspected circuit. In this way, reading errors can be prevented from occurring. The used voltage is very low when the resistance is measured with a DMM, and only the reading for the resistance can be indicated.

The diode in the circuit and certain elements can cause the DMM to indicate false reading. If you want to determine if the components have any effect on the measured result, first obtain a reading then exchange the 2 lead wire with each other and obtain the second reading. If the reading differs, that indicates the element has an effect on the measured result.

The following example presents various methods connecting a DMM to the circuit to be tested:

- Back probe both ends of the connector, then press and hold the lead wire when operating the connector, or use a tape to adhere the lead wire to the wiring harness during other operation and road test to monitor on a continuous basis. Refer to Probe the Electrical Connector.
- Disconnect the wiring harness of both ends of the suspected circuit connected with components or other wiring harness.
- If the diagnosed system has designated pin-out or breakout box, then it can be used to simplify the connection of DMM and circuit, or for testing multiple circuit quickly.

Use the test lamp to rectify the problem.

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

The test lamp can simply and quickly check the low resistance circuit for voltage.

J 34142-B test lamp is compatible with the Micro-Pack, which consists of a 12v bulb and a pair of lead wire.

Use the tool properly according to the following procedure.

1. Connect a lead wire to the ground.
2. There should be different points to contact a lead wire along the circuit.
3. If the light bulb illuminates, it indicates there is voltage at the point being tested.

Use fused jumper wire.

Note: Fused jumper wire does not certainly prevent damaging solid state component.

Fused jumper wire J 36169-AJ 36169-A has a connector with a small clip, used for adapting to most connectors and will not result in any damage. The fused jumper has a 20A fuse, which is not certainly suitable to some circuits. Used fuse can not exceed the rated current of the fuse used on the tested circuit.

Test for voltage

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

Measure the voltage on the selected points in a circuit according to the following procedure.

1. If necessary, disconnect the electrical wiring harness connector on the circuit being tested.
2. Enable the circuit and/or system being tested. Perform the following procedures:
 - Turn on the ignition switch, and keep the engine burning out.
 - Start the engine.
 - Use the scan tool to turn ON the circuit and/or system in Output Control.
 - Turn ON the switch of the circuit and/or system being tested.
3. Select V(AC) or V(DC) position on the DMM.
4. Connect the positive lead of the DMM to the circuit point to be tested.
5. Connect the negative lead of the DMM to the reliable ground.
6. The DMM will display the voltage measured at this point.

Measure the pressure drop

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

The following procedure determines the difference in voltage potential between 2 points.

1. Set the DMM rotary dial to the V(DC) position. (DC) position.
2. Connect the positive lead of the DMM to one point of the circuit to be tested.

3. Connect the negative lead of the DMM to the other point of the circuit to be tested.
4. Control Circuit
5. The DMM displays the difference in voltage between the 2 points.

Measure the frequency

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

The following procedure determines the frequency of a signal.

Note: Connecting the DMM to the circuit before pressing the Hz button will the DMM to autorange to an appropriate range.

1. Apply power to the circuit
2. Set the DMM rotary dial to the V(AC) position.
3. Connect the positive lead of the DMM to the circuit to be tested.
4. Connect the negative lead of the DMM to the reliable ground.
5. Press the Hz button on the DMM.
6. The DMM will display the frequency measured.

Continuity Test

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

Test the circuit for good continuity according to the following procedure.

Using a digital multimeter.

1. Set the rotary dial of the DMM to the ? position.
2. Disconnect the power feed (i.e. fuse, control module) from the suspected circuit.
3. Disconnect the load.
4. Press the MIN MAX button on the DMM.
5. Connect one lead of the DMM to one end of the circuit to be tested.
6. Connect the other lead of the DMM to the other end of the circuit to be tested.
7. If the DMM displays low or no resistance and a tone can be heard, the circuit has good continuity.

Use a test lamp

Note: Only use the test lamp procedure on low resistance power supply and ground circuit.

1. Remove the power feed (i.e. fuse, control module) from the suspected circuit.
2. Disconnect the load.
3. Connect one lead of the test lamp to one end of the circuit to be tested.
4. Connect the other lead of the test lamp to battery positive voltage.

5. Connect the other end of the circuit to ground.
6. If the test lamp illuminates (full intensity), the circuit has good continuity.

Test for a short to ground

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

Test the circuit for a short to ground according to the following procedure.

Using a digital multimeter.

1. Remove the power feed (i.e. fuse, control module) from the suspected circuit.
2. Disconnect the load.
3. Set the rotary dial of the DMM to the ? position.
4. Connect one lead of the DMM to one end of the circuit to be tested.
5. Connect the other lead of the DMM to reliable ground.
6. If the DMM does not displays infinite resistance (OL), there is a short to ground in the circuit.

Use a test lamp

1. Remove the power feed (i.e. fuse, control module) from the suspected circuit.
2. Disconnect the load.
3. Connect one lead of the test lamp to battery positive voltage.
4. Connect the other lead of the test lamp to one end of the circuit to be tested.
5. If the test lamp illuminates, there is a short ground in the circuit.

Apply multiple loads to the fuse.

1. Refer to System Schematics and determine the open fuse.
2. Open the first connector or switch between the fuse and each load.
3. Connect the DMM with a jumper wire between the terminals of the fuse (be sure that the fuse is powered).
 - When the DMM displays voltage, the short is in the wiring leading to the first connector or switch.
 - If the DMM does not display voltage, refer to the next step.
4. Close each connector or switch until the DMM displays voltage in order to find which circuit is shorted.

Test for a short to voltage

Notice: Refer to Test Probe Special Notice in Caution and Special Notices.

Test the circuit for a short to voltage according to the following procedure.

1. Set the DMM rotary dial to the V(DC) position.
2. Connect the positive lead of the DMM to one end of the circuit to be tested.
3. Connect the negative lead of the DMM to the reliable ground.
4. Turn on the ignition switch to start and operate all accessories.
5. If the voltage measured is more than 1v, there is a short to voltage in the circuit.

8.20.1.6 Test for interruptive failure and poor connection.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Wiring broken inside the insulation.
- Poor contact between the negative and positive terminals on the connector. For detailed procedure, refer to Test for Proper Terminal Contact introduced in the following.
- Poor terminal-to-wire connection. Some conditions belonging to this instruction include poor pressing, spot welding, pressing on the insulation but not on the wiring, and corrosion at the contact position of the wire and terminal.
- Wiring insulation is rubbed through. This causes an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Refer to Inducing Intermittent Fault Conditions in order to duplicate the conditions required to verify complaints.
- Refer to Testing for Electrical Intermittent for test procedures to detect intermittent open, high resistance, short to ground, and short to voltage conditions.
- Refer to Scan Tool Quick Methods for advanced intermittent diagnosis method.

Test for proper terminal contact.

Always test terminal contact at the components and any in-line connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor contact may be caused by pollution or deformation if it occurs between the negative and positive terminals on the connector.

Improper connection of connector halves may result in pollution. Contamination is caused by the connector bodies being improperly connected, a missing or damaged connector seal, or damage to the connector itself, exposing the terminals to moisture and dirt. Pollution normally occurs in underhood or under

body connectors, causing an open or an intermittent open.

If appropriate joint probe connector terminal mating end is not employed, improper connection of connector halves or frequent disconnection, and connection of connector halves may cause deformation. Deformation, usually to the female terminal contact tab, can result in poor terminal contact, causing an open or an intermittent open.

Round Head Wiring Harness Connector

Follow the procedure below to test terminal contact of Metri-Pack or 56 series terminals. Refer to J 38125-B terminal repair kit or J 38125-4 Instruction Manual for terminal identification.

Follow the procedure below to test terminal contact.

1. Disconnect the connector halves.
2. Perform a visual check to the connector halves for pollution. Contamination may result in a white or green built-up within the connector body or between terminals, causing high terminal contact resistance, intermittent contact or an open circuit. If contamination occurs to the under hood or under body connectors, complete replacement must be made: terminals, sealings, and connector body.
3. Use the appropriate positive terminal in J 38125-B to test the retaining force between normal and suspect terminals for obvious difference.

Flat wire (dock or lock) connector

There are no serviceable parts for flat wire (dock and lock) connectors on the harness side or the component side.

Follow the procedure below to test terminal contact.

1. Remove the suspect components.
2. Perform visual check to both sides of the connector for pollution. Avoid contacting either side of the connector, otherwise grease on skin will also cause pollution.
3. Perform visual check to the terminal bearing surfaces of the flat wire circuits for splits, cracks, or other imperfections that could cause poor terminal contact. Visually inspect to component side connectors to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adaptor from the J 42675 Flat Wire Probe Adaptor Kit on the flat wire harness connector in order to test the circuit in question.

8.20.1.7 Inducing Intermittent Fault Conditions

In order to duplicate the customer's concern, it may be necessary to manipulate the wiring harness if the malfunction appears to be vibration related.

Circuit operation needs various actions, including:

- Swing the wiring harness
- Disconnect the connector and reconnect.
- Stressing the mechanical connection of a connector.
- Pull the wiring harness or wire in order to identify a separation/break inside the insulation.
- Rearrange the wiring harness or wire.

All these actions should be performed with some goal in mind. For instance, with a scan tool connected, wiggling the wires may uncover a faulty input to the control module. At this time, using the quick test option is appropriate. See Scan Tool Data List. When you attempt to reappear the problem by controlling the suspension system or frame, it may be necessary to use counterpoise, floor jack, jacking table, frame machines etc. The method is useful to search for short wiring harness and connector disconnection until sufficiently resulting poor contact conditions. Set it to Peak Min/Max mode and with the DMM connected with the suspect circuit at the time of testing, ideal result may be obtained. Refer to Test for Electrical Intermittents.

Of course, at the time of operation of circuit, use your vision, smell and hearing to obtain good result.

But there are also circumstances that failure conditions can not be obtained with independent operation of circuit. In this case, complement some additional conditions when it is necessary to operate the wiring harness. Such conditions would include high moisture conditions, along with exceptionally high or low temperatures. The following introduces how to make the circuit to be among these types of conditions.

Salt Water Spray

Some compounds possess the ability to conduct when dissolved in water, such as ordinary salt. Mixing sufficient salt with water can enhance the water's own conductivity, therefore, any circuit sensitive to moisture is easily to have failures after spray of this mixture without limitation.

Mix 12 ounce of water and 1 teaspoon of salt, and prepare a salt solution of 5%. Fill the solution into the ordinary spray bottle. The mixture is sufficient to enhance the conductivity properties of water. This may cause the circuit to fail more easily when sprayed. Once the mixture is completed, spray the suspect area liberally with the solution. Then, while monitoring either a scan tool or DMM, manipulate the harness as discussed previously.

High Temperature Conditions

If the complaint tends to be heat related, you can simulate the condition using the J25070 Heat Gun. Using the heat gun, you can heat up the suspected area or component. Manipulate the harnesses under high temperature conditions while monitoring the scan tool or DMM to locate the fault condition. The high temperature condition may be achieved simply by test driving the vehicle at normal operating temperature. If a heat gun is unavailable, consider this option to enhance your diagnosis. This option does not allow for the same control, however.

Low Temperature Conditions

Depending on the nature of the fault condition, placing a fan in front of the vehicle while the vehicle is in the shade can have the desired effect.

If this is unsuccessful, use local cooling treatments such as ice or a venturi type nozzle (one that provides hot or cold air). This type of tool is capable of producing air stream temperatures down to 0 °F from one end and 160 °F from the other. This is ideally suited for localized cooling needs.

Once the vehicles, component, or harness has been sufficiently cooled, manipulate the harness or components in an effort to duplicate the concern.

8.20.1.8 Refer to Test for Electrical Intermittents.

Perform the following procedures while wiggling the harness from side to side. Continue this at convenient points (about 6 inches apart) while watching the test equipment.

- Test for a short to ground
- Test for an open.
- Test for a short to voltage

If the fault is not identified, perform the procedure below using the MIN MAX feature on the J39200 DMM. This feature allows you to manipulate the circuit without having to watch the J39200. The J39200 will generate an audible tone when a change is detected.

Note: The J 39200 must be used in order to perform the following procedure since the J39200 can monitor current, resistance or voltage while recording the minimum (MIN), and maximum (MAX) values measured.

1. Connect the J 39200 to both sides of a suspected connector (still connected), or from one end of a suspected circuit to the other. Refer to Troubleshooting with a Digital Multimeter for information on connecting the J39200 to circuit.
2. Set the rotary dial of the J39200 to the V (AC) or V (DC) position.

3. Press the range button of the J39200 in order select the desired voltage range.
4. Press the MIN MAX button of the J39200. The J39200 displays 100 ms RECOED and emits an audio tone

Note: The 100 ms RECORD mode is the length of time an input must stay at a new value in order to record the full change.

5. Simulate the condition that is potentially causing the intermittent connection, either by wiggling the connections or the wiring, test driving, or performing other operations. Refer to Inducing Intermittent Fault Conditions.
6. Listen for the audible Min Max Alert which indicates that a new minimum or maximum value has been recorded.
7. Press the MIN MAX button once in order to display the MAX value and note the value.
8. Press the MIN MAX button again in order to display the MIN value and note the value..
9. Determine the difference between the MIN and MAX values.
 - If the variation between the recorded MIN and MAX voltage values is 1 volt or greater an intermittent open or high resistance condition exists. Repair the condition as necessary.
 - If the variation between the recorded MIN and MAX voltage values is less than 1 volt an intermittent open or high resistance condition does not exist.

8.20.1.9 Scan Tools Snapshot Procedure

Snapshot is a recording of what a control module on the vehicle was receiving for information while the snapshot is being made. A snapshot may be used to analyze the data during the time a vehicle condition is current. This allows you to concentrate on making the condition occur, rather than trying to view all the data in anticipation of the fault. The snapshot contains information around a trigger point that you have determined. Only a single data list may be recorded in each snapshot. The Scan Tool has the ability to store two snapshots. The ability to record two snapshots allows comparing hot versus cold and good versus bad vehicle scenarios. The snapshots are stored on a first in, first out basis. If a third snapshot is taken, the first snapshot stored in the memory will be lost.

Snapshots can be one of two types:

- Snapshot - taken from the Snapshot menu choice
- Quick Snapshot - taken from the Data Display soft key choice (Does not contain DTC information)

When a snapshot is taken, it is recorded on the memory card and may contain as many as 1200 frames of information. Because the snapshot is recorded onto the memory card, snapshots are not lost if the Scan Tool is powered down.

The snapshot replay screen has a plot soft key that can be of great value for intermittent diagnosis.

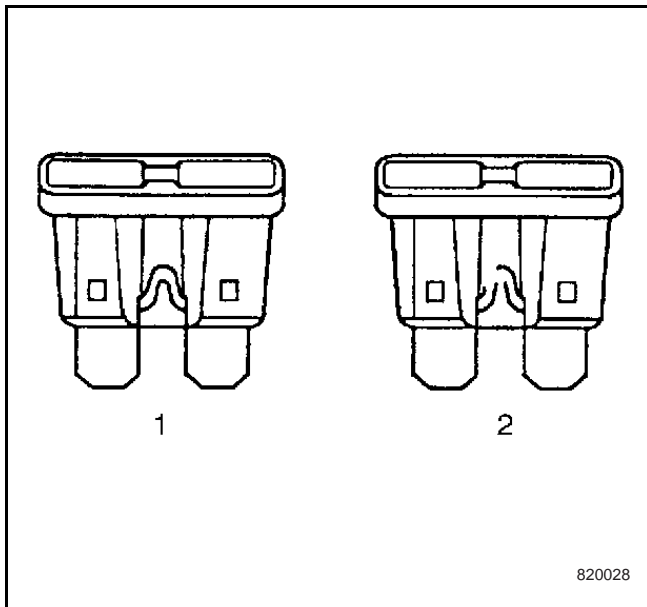
The snapshot plot feature can help you to quickly determine if a sensor is outside of its expected values by plotting three parameters at a time. The data will be displayed both graphically and numerically showing the minimum and maximum values for all frames captured. This is helpful, especially if the fault occurs only once and does not set a DTC.

8.20.1.10 Wiring Repairs

The Wiring Repairs section contains the following types of wiring repair information. Using these elements together will make wiring repair faster and easier:

- Circuit Protection - Fuses
- Circuit Protection - Circuit Breakers
- Circuit Protection - Fusible Links
- Repairing Damaged Wire Insulation
- Splicing Copper Wire Using Slice Clips
- Splicing Copper Wire Using Splice Sleeves
- Splicing Twisted or Shielded Cable
- Splicing Inline Harness Diodes
- Heated Oxygen Sensor (HO2S) Wiring Repairs
- SIR/SRS Wiring Repairs
- Flat Wire Repairs

Circuit Protection ñ Fuses



The fuse is the most common method of an automotive wiring circuit protection. Whenever there is an excessive amount of current flowing through a circuit the fusible element will melt and create an open or incomplete circuit. Fuses are a one time protection device and must be replaced each time the circuit is overloaded. To determine if a fuse is open, remove the suspected fuse and examine the element in the fuse for an open (break). If not broken, also check for continuity using a J39200 DMM or a continuity test. If the element is open or continuity is suspect, replace the fuse with one of equal current rating.

Fuse Types

Current Rating Amperes	Color
Auto Fuses, Mini Fuses	
2	Grey
3	Violet
5	Tan
7.5	Brown
10	Red
15	Blue
20	Yellow
25	White or Natural
30	Green
Maxi Fuses	
20	Yellow
30	Light Green

Fuse Types

Current Rating Amperes	Color
40	Orange or Amber
60	Blue
50	Red

Circuit Protection - Circuit Breakers

A circuit breaker is a protective device that is designed to open the circuit when a current load is in excess of the rated breaker capacity. If there is a short or other type of overload condition in the circuit, the excessive current will open the circuit between the circuit breaker terminals. Two types of circuit breakers are used.

Circuit Breaker: This type opens when excessive current passes through it for a period of time. It closes again after a few seconds, and if the cause of the high current is still present, it will open again.

The circuit breaker will continue to cycle open and closed until the condition causing the high current is removed.

Positive Temperature Coefficient (PTC) Circuit Breaker: This type greatly increases its resistance when excessive current passes through it. The excessive current heats the PTC device, as the device heats its resistance increases. Eventually the resistance gets so high that the circuit is effectively open. Unlike the ordinary circuit breaker the PTC unit will not reset until the circuit is opened, by removing the voltage from its terminals. Once the voltage is removed the circuit breaker will re-close within a second or two.

Circuit Protection - Fusible Links

Fusible link is wire designed to melt and break continuity when excessive current is applied. It is often located between or near the battery and starter or electrical center. Use a continuity tester or a J39200 DMM at each end of the wire containing the fusible link in order to determine if it is broken. If broken, it must be replaced with fusible link of the same gage size.

Repairing a Fusible Link

Note: Fusible links cut longer than 225 mm (approx. 9 inches) will not provide sufficient overload protection.

Refer to Splicing Copper Wire Using Splice Clips.

Repairing Damaged Wire Insulation

If the conductive portion of the wire is not damaged, locate the problem and apply tape around the wire. If the damage is more extensive, replace the faulty segment of the wire. Refer to Splicing Copper Wire Using Splice Clips and follow the instruction to repair the wire.

Wire Size Conversion

Metric Wire Sizes (mm ²)	AWG Sizes
0.22	24
0.35	22
0.5	20
0.8	18
1.0	16
2.0	14
3.0	12
5.0	10
8.0	8
13.0	6
19.0	4
32.0	2
50.0	1/0

Splicing Copper Wire Using Slice Clips

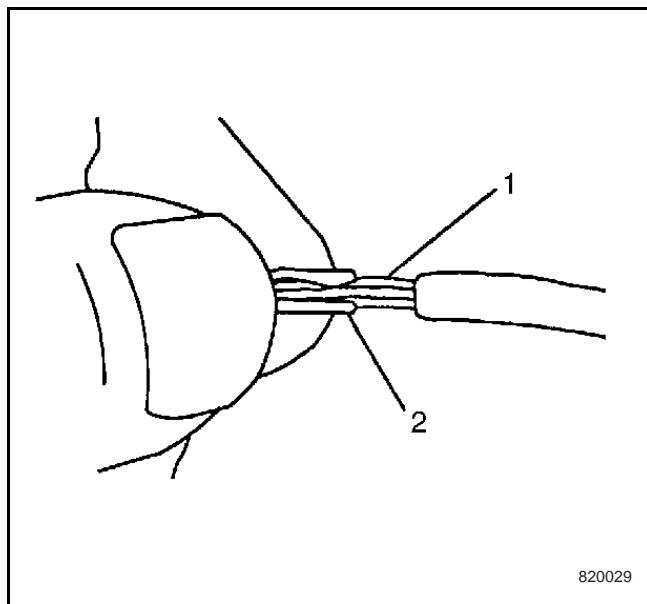
Tools Required

- J 38125-B Terminal Repair Kit
1. Open the harness.
 - If the harness is taped, remove the tape.
 - To avoid wiring insulation damage, use a sewing ripper in order to cut open the harness.
 - If the harness has a black plastic conduit, pull out the desired wire.
 2. Cut the wire.
 - Cut as little wire off the harness as possible.
 - Ensure that each splice is at least 40 mm (1.5 in) away from other splices, harness branches, and connectors. This helps prevent moisture from bridging adjacent splices and causing damage.
 3. Select the proper size and type of wire.
 - The wire must be of equal or greater size than the original (except fusible link).
 - The wire's insulation must have the same or higher temperature rating.
 - Use general purpose insulation for areas that are not subject to high temperatures.
 - Use a cross-linked polyethylene insulated wire for areas where high temperatures are expected.

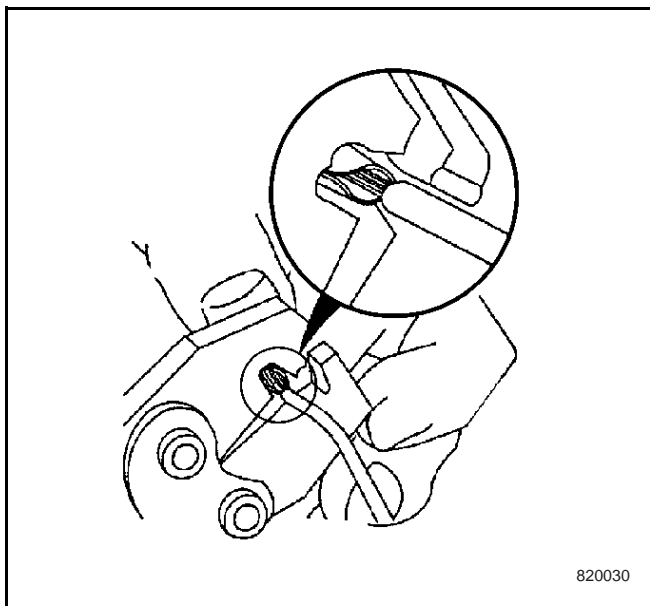
Note: Use Cross-linked polyethylene wire to replace PVC, but do not replace cross-linked polyethylene with PVC.

Cross-linked polyethylene wire is not fuel resistant. Do not use to replace wire where there is the possibility of fuel contact.

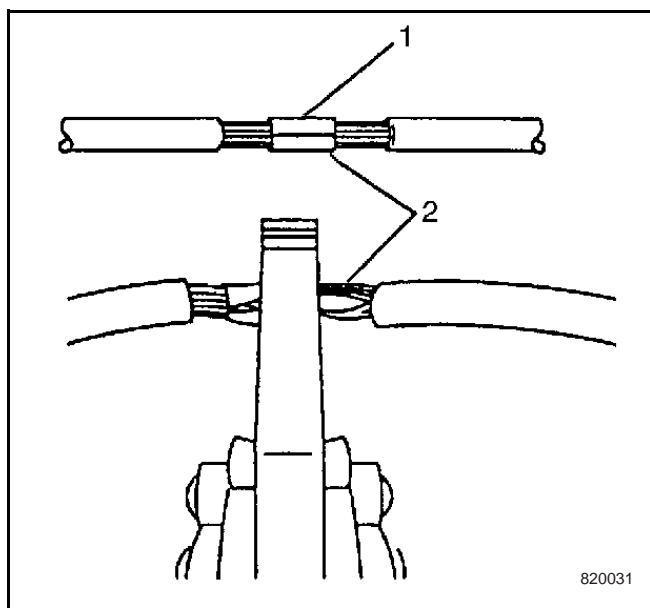
4. Strip the insulation.
 - Select the correct size opening in the wire stripper or work down from the largest size.
 - Strip approximately 7.5 mm (5/16 in) of insulation from each wire to be spliced. (0.313 in) insulation.
5. Select the correct size opening in the wire stripper or work down from the largest size. Follow the instructions in the J38125-B Terminal Repair Kit in order to determine the proper clip size crimp tool and anvil.
6. Overlap the two stripped wire ends and hold them between thumb and forefinger.



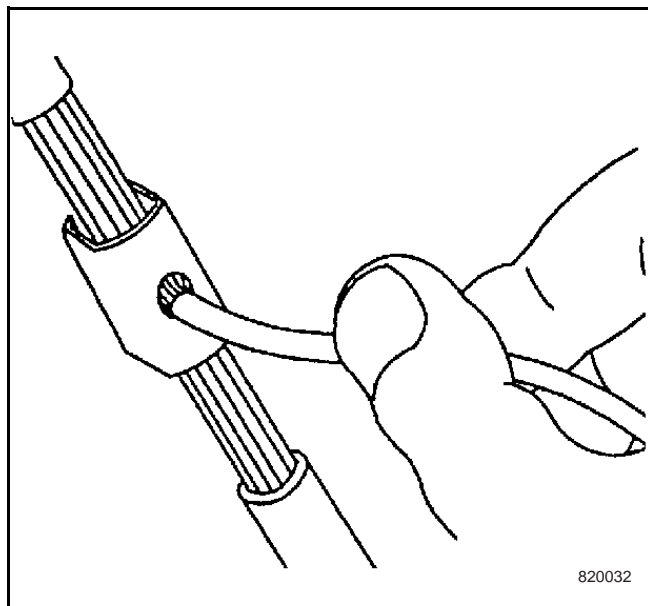
7. Center the splice clip (2) over the stripped wires (1) and hold the clip in place.
 - Ensure that the wires extend beyond the clip in each direction.
 - Ensure that no insulation is caught under the clip.



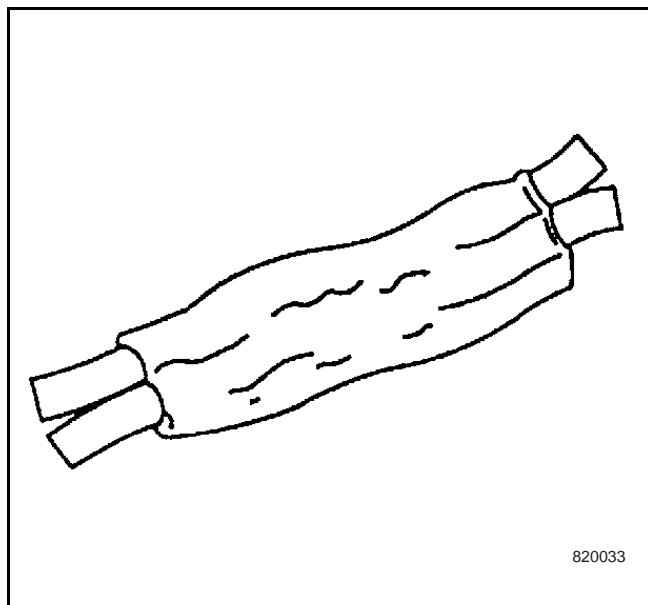
8. Center the crimp tool over the splice clip and wires.
9. Apply steady pressure until the crimp tool closes. Ensure that no strands of wire are cut.



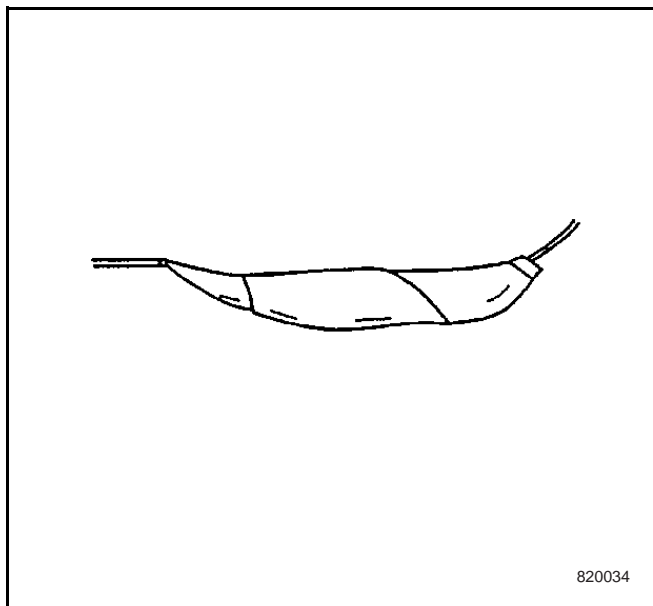
10. Crimp the splice on each end (2).



11. Apply 60/40 rosin core solder to the opening in the back of the clip. Follow the manufacturer's instructions for the solder equipment.



12. Tape the splice. Roll on enough tape in order to duplicate the thickness of the insulation on the existing wires.



13. Additional tape can be applied to the wire if the wire does not belong in a conduit or another harness covering. Use a winding motion in order to cover the first piece of tape.

Splicing Copper Wire Using Splice Sleeves

Use crimp and seal splice sleeves to form a one-to-one splice on all types of insulation except tefzel and coaxial to form a one-to-one splice. Use tefzel and coaxial where there is special requirements such as moisture sealing. Follow the instructions below in order to splice copper wire using crimp and seal splice sleeves.

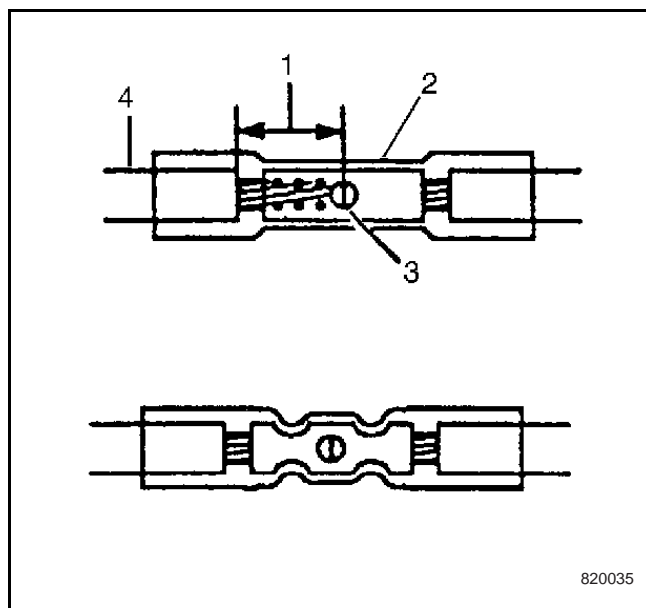
Crimp and Seal Splice Table

Splice Sleeve Color	Crimp Tool Nest Color	Wire Gauge AWG/ (Metric)
Salmon	Red	20,18/(0.5,0.8)
Blue	Blue	16,14/(1.0,2.0)
Yellow	Yellow	12,10/(3.0,5.0)

Tools Required

- J 38125 - B Terminal Repair Kit
- Open the harness.
 - If the harness is taped, remove the tape.
 - To avoid wiring insulation damage, use a sewing ripper in order to cut open the harness.
 - If the harness has a black plastic conduit, pull out the desired wire.
 - Cut the wire.
 - Cut as little wire off the harness as possible.

- Ensure that each splice is at least 40 mm (1.5in) away from other splices, harness branches, and connectors. This helps prevent moisture from bridging adjacent splices and causing damage.



- Select the proper size and type of wire.
 - The wire must be of equal or greater size than the original.
 - The wire's insulation must have the same or higher temperature rating (4).
 - Use general purpose insulation for areas that are not subject to high temperatures.
 - Use a cross-linked polyethylene insulated wire for areas where high temperatures are expected.

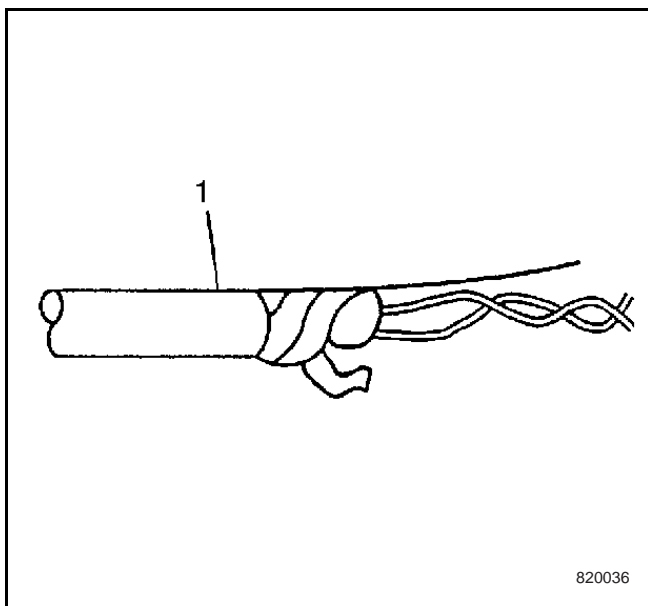
Note:

- Use Cross-linked polyethylene wire to replace PVC, but do not replace cross-linked polyethylene with PVC.
 - Cross-linked polyethylene wire is not fuel resistant.
 - Do not use to replace wire where there is the possibility of fuel contact.
- Strip the insulation.
 - Select the correct size opening in the wire stripper or work down from the largest size.
 - Strip approximately 7.5 mm (5/16 in) of insulation from each wire to be spliced (1). (0.313 in) insulation.
 - Select the proper splice sleeve (2) and the required crimp nest tool, refer to the Crimp and Seal Splice Table,
 - Place the nest tool in the J38125 crimp tool.

7. Place the splice sleeve in the crimp tool nest so that the crimp falls at point 1 on the splice.
8. Close the hand crimper handles slightly in order to hold the splice sleeve firmly in the proper crimp tool nest.
9. Insert the wires into the splice sleeve until the wire hits the barrel stop. The splice sleeve has a stop in the middle of the barrel in order to prevent the wire from passing through the splice (3).
10. Close the handles of the J38125 until the crimper handles open when released. The crimper handles will not open until the proper amount of pressure is applied to the splice sleeve.
11. Shrink the insulation around the splice.
 - Using the heat torch apply heat to the crimped area of the barrel.
 - Gradually move the heat barrel to the open end of the tubing.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.
 - SIR/SRS Wire Pigtail Repair

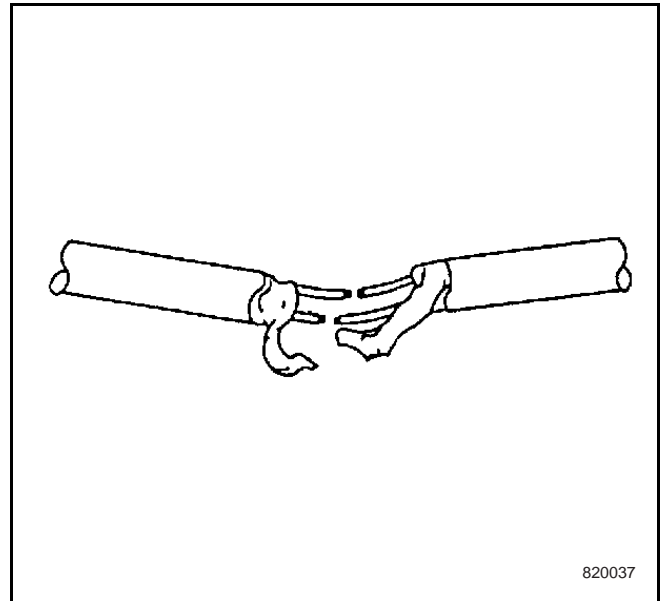
Splicing Twisted or Shielded Cable

Splicing twisted or shielded cable is used to prevent wiring from electrical noise. Two-conductor cable of this construction is used between the radio and the Delco-Bose speaker/amplifier units and other applications where low level, sensitive signals must be carried. Follow the instructions below in order to repair the twisted/shield cable.

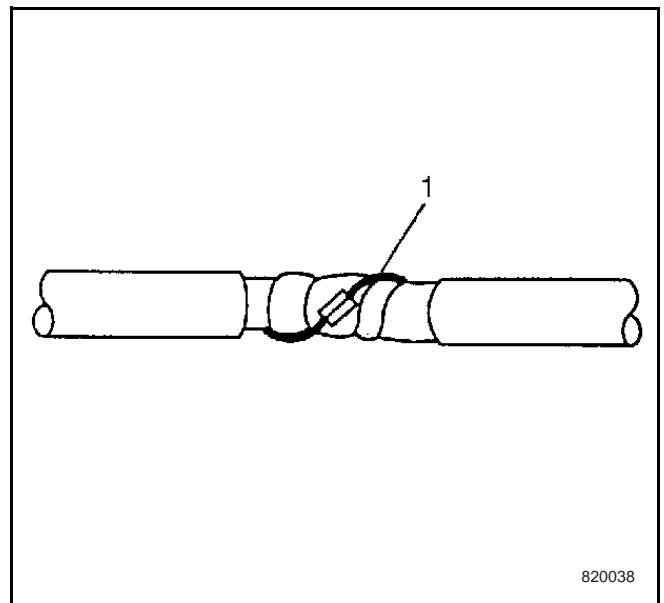


1. Remove the outer jacket (1). Use care not to cut into the drain wire of the mylar tape.

2. Unwrap the tape. Do not remove the tape. Use the tape in order to rewrap the twisted conductors after the splice is made.

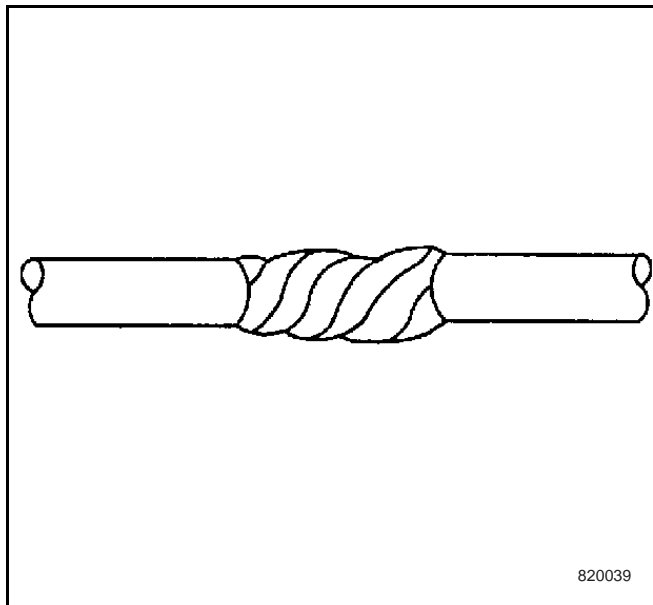


3. Prepare the splice. Untwist the connectors and follow the splicing instructions for copper wire. Staggering the splices by 65mm is recommended.



4. Re-assemble the cable.
 - Rewrap the conductors with the mylar tape.
 - Use caution not to wrap the drain wire in the tape (1).
 - Follow the splicing instructions for copper wire and splice the drain wire.
 - Wrap the drain wire around the conductors and tape with mylar tape.

Note: Apply the mylar tape with the aluminum side inward. This ensures good electrical contact with the drain wire.



5. Tape over the entire cable. Use a winding motion when you apply the tape.

Splicing Inline Harness Diodes

Many vehicle electrical systems use a diode to isolate circuits and protect the components from voltage spikes. When installing a new diode use the following procedure.

1. Open the harness.
 - If the harness is taped, remove the tape.
 - To avoid wiring insulation damage, use a sewing ripper in order to cut open the harness.
 - If the harness has a black plastic conduit, pull out the diode.
2. If the diode is taped to the harness, remove all of the tape.
3. Check and record the current flow direction and orientation of diode.
4. Remove the inoperative diode from the harness with a suitable soldering tool.

Note: If the diode is located next to a connector terminal remove all of the terminal(s) from the connector to prevent damage from the soldering tool.

5. Carefully strip away a section of insulation next to the old soldered portion of the wire(s). Do not remove any more than is needed to attach the new diode.
6. Check current flow direction of the new diode, being sure to install the diode with correct bias. Refer to the appropriate service manual

wiring schematic to obtain the correct diode installation position.

7. Attach the new diode to the wire(s) using 60/40 rosin core solder. Before soldering attach some heat sinks (aluminum alligator clips) across the diode wire ends to protect the diode from excessive heat. Follow the manufacturer's instruction for the soldering equipment.
8. Reinstall terminal(s) into the connector body if previously removed
9. Tape the diode to the harness or connector using electrical tape.

Note: To prevent shorts to ground and water intrusion, completely cover all exposed wire and diode attachment points with tape.

Heated Oxygen Sensor (HO2S) Wiring Repairs

Note: Do not solder repairs under any circumstances as this could result in the air reference being obstructed.

If the heated oxygen sensor pigtail wiring, connector, or terminal is damaged the entire oxygen sensor assembly must be replaced. Do not attempt to repair the wiring, connector, or terminals. In order for the sensor to function properly it must have a clean air reference. This clean air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference and degrade oxygen sensor performance.

The following guidelines should be used when servicing the heated oxygen sensor:

- Do not apply contact cleaner or other materials to the sensor or vehicle harness connectors. These materials may get into the sensor, causing poor performance. Also, the sensor pigtail and harness wires must not be damaged in such a way that the wires inside are exposed. This could provide a path for foreign materials to enter the sensor and cause performance problems.
- Neither the sensor nor vehicle lead wires should be bent sharply or kinked. Sharp bends, kink, etc., could block the reference air path through the lead wire.
- Do not remove or defeat the oxygen sensor ground wire (where applicable). Vehicles that utilize the ground wire sensor may rely on this ground as the only ground contact to the sensor. Removal of the ground wire will also cause poor engine performance.
- To prevent damage due to water intrusion, be sure that the peripheral seal remains intact on the vehicle harness connector.

The engine harness may be repaired using the J38125-B.

SIR/SRS Wiring Repairs

The supplemental inflatable restraint (SIR) system/supplemental restraint system (SRS) requires special wiring repair procedures due to the sensitive nature of the circuitry. Follow the specific procedures and instructions when working with the SIR/SRS system wiring, and the wiring components (such as connectors and terminals).

Note: Do not use the terminals in the kit in order to replace damaged SIR/SRS system terminals unless specifically indicated by the terminal package.

Tools Required

- J 38125 - B Terminal Repair Kit

The tool kit J38125-B contains the following items:

- Special sealed splices- in order to repair the SIR/SRS system wiring
- A wire stripping tool
- A special crimping tool
- A heat torch
- An instruction manual

The sealed splices have the following 2 critical feature:

- A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.
- A cross hatched (knurled) core crimp provides necessary contact integrity for the sensitive, low energy circuits.

The J38125-B also serves as a generic terminal repair kit. The kit contains the following items:

- A large sampling of common electrical terminals
- The correct tools in order to attach the terminals to the wires
- The correct tools in order to remove the terminals from the connectors

SIR/SRS Connect (Plastic Body and Terminal Metal Pin) Repair

Use the connector repair assembly packs in order to repair the damaged SIR/SRS wire harness connectors and the terminals. Do not use the connector repair assembly pack in order to repair the pigtails. These kits include an instruction sheet and the sealed splices. Use the sealed splices in order to splice the new wires, connectors, and terminals to the harness. The splice crimping tool is color keyed in order to match the splices from the J38125-B. You must use splicing crimping tool on the splices.

The terminals in the SIR/SRS system are made of a special metal. This metal provides the necessary contact integrity for the sensitive, low energy circuits. These terminals are only available in the

connector repair assembly packs. Do not substitute any other terminals for those in the assembly packs.

If the individual terminals are damaged on the sensing and diagnostic module (SDM) harness connector, use 1 of the following 2 components in order to replace the SDM harness connector:

- The SDM harness connector pigtail assembly
- The SDM harness connector replacement kit

If the individual terminals are damaged on any other SIR/SRS connection, use the appropriate connector repair assembly pack in order to replace the entire connection. Replace the entire SIR/SRS Wiring harness, if needed, in order to maintain SIR/SRS circuit integrity.

SIR/SRS Wire Pigtail Repair

Note: Do not make wire, connector, or terminal repairs on components with wire pigtails. A wire pigtail is a wire or wires attached directly to the device (not by a connector). If a wiring pigtail is damaged, you must replace the entire component (with pigtail). The inflatable restraint steering wheel module coil is an example of a pigtail component.

Wiring Repair Procedure

Tools Required

- J 38125-B Terminal Repair Kit

Note: Refer to Wiring Repairs in Wiring Systems in order to determine the correct wire size for the circuit you are repairing. You must obtain this information in order to ensure circuit integrity.

If any wire except the pigtail is damaged, repair the wire by splicing in a new section of wire of the same gauge size (0.5mm, 0.8mm, 1.0mm etc.).

Use the sealed splices and splice crimping tool from the J38125-B. Use the following wiring repair procedures in order to ensure the integrity of the sealed splice.

Note: You must perform the following procedures in the listed order. Repeat the procedure if any wire strands are damaged. You must obtain a clean strip with all of the wire strands intact.

Splice Sleeve Color	Crimp Tool Nest Color	Wire Gauge mm (AWG)
Salmon (Yellow-pink)	Red (1)	0.035-0.8/ (18-20)
Blue	Blue(2)	1.0-2.0/(14-16)
Yellow	Yellow (3)	3.0-5.0/(10-12)

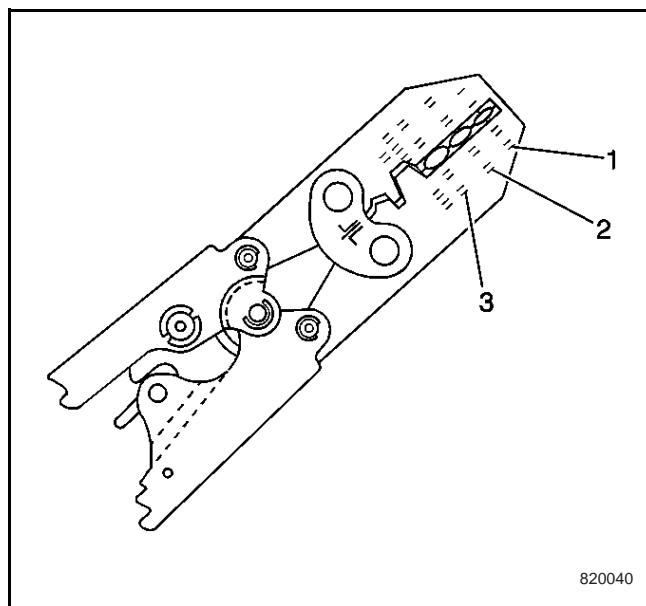
1. Open the harness by removing any tape:
 - Use a sewing seam ripper (available from sewing supply stores) in order to cut open

the harness in order to avoid wire insulation damage.

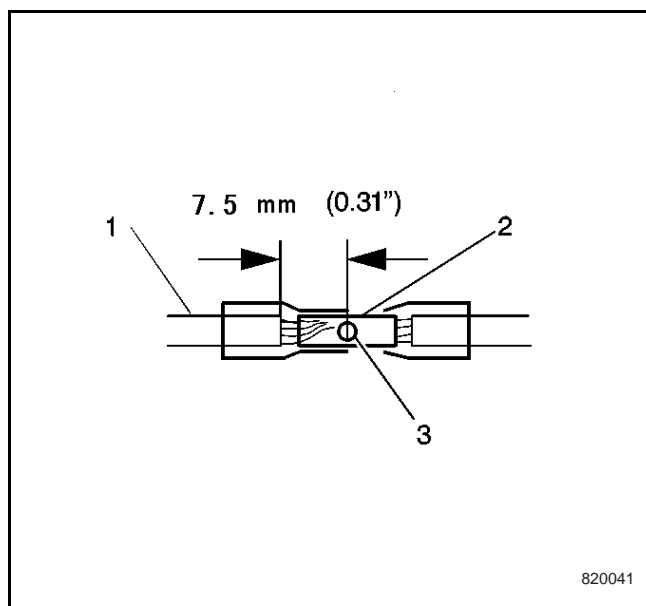
- Use the crimp and sealed splice sleeves on all types of insulation except tefzel and coaxial.
 - Do not use the crimp and sealed splice sleeve to form a splice with more than 2 wires coming together.
2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.
- Adjust splice locations so that each splice is at least 40 mm (1.5in) away from the other splices, harness branches, or connectors.
3. Strip the insulation:
- When adding a length of wire to the exiting harness, use the same size wire as the original wire.

Perform one of the following items in order to find the correct wire size

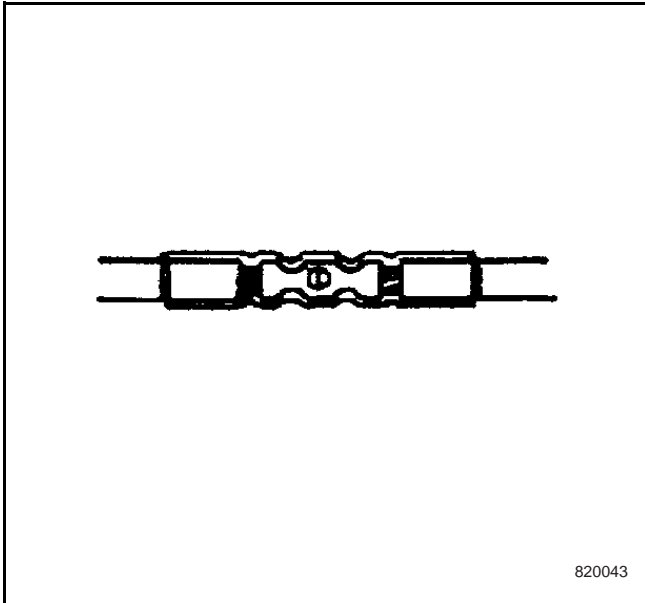
- Find the wire on the schematic and convert the metric size.
 - Use an AWG wire gauge.
 - If you are unsure of the wire size, begin with the largest opening in the wire stripper and work down until achieving a clean strip of the insulation.
- Strip approximately 7.5 mm (5/16 in) of insulation from each wire to be spliced. (0.313 in) insulation.
 - Do not nick or cut any of the strands. Inspect the stripped wire for nicks or cut strands.
 - If the wire is damaged, repeat this procedure after removing the damaged section.
4. Select the proper sealed splice sleeve according to the wire size. Refer to the above table at the beginning of the repair procedure for the color coding of the splice sleeves and the crimp tool nests.



5. Use the Splice Crimp Tool from the J38125-B in order to position the splice sleeve in the proper color nest of the Splice Crimp Tool

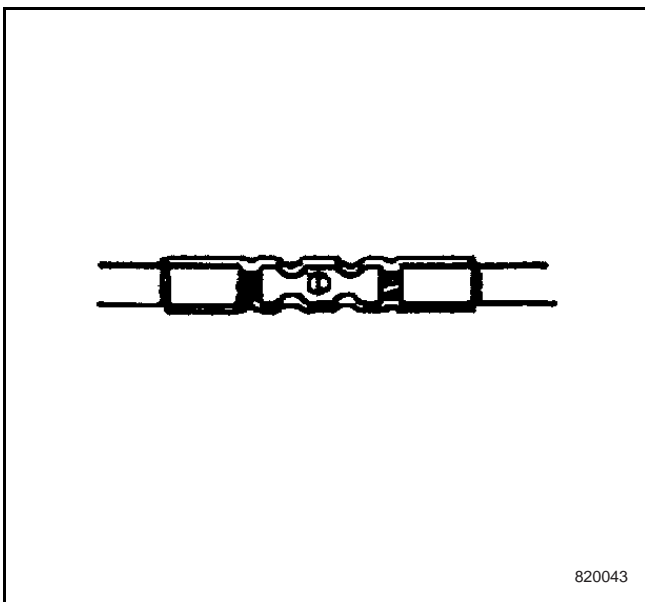


6. Place the splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the splice sleeve in the proper nest.



820043

7. Insert the wire into the splice sleeve barrel, until the wire hits the barrel stop.
8. Tightly close the handles of the crimp tool until the crimper handles open when released. The crimper handles will not open until you apply the proper amount of pressure to the splice sleeve. Repeat steps 4 and 5 for the opposite end of the splice.



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9. Using the heat torch, apply heat to the crimped area of the barrel.
10. Gradually move the heat torch to the open end of the barrel.
 - The barrel will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the barrel when sufficient shrinkage is achieved.

Note: Apply a new splice (not sealed) from the J38125-B if damage occurs to any of the original equipment splices (3 wires or more) in the SIR/SRS wiring harness. Carefully follow the instructions included in the kit for proper splice clip application.

Connector Position Assurance (CPA)

The connector position assurance (CPA) is a small plastic insert that fits through the locking tabs on all the SIR/SRS system electrical connectors. The CPA ensures that the connector halves cannot vibrate apart. You must have the CPA in place in order to ensure good contact between the SIR/SRS mating terminals.

Terminal Position Assurance (TPA)

The terminal position assurance (TPA) insert resembles the plastic combs used in the control module connectors. The TPA keeps the terminal securely seated in the connector body. Do not remove the TPA from the connector body unless you remove a terminal for replacement.

Flat Wire Repairs

Notice: The flat wire within the flex wiring harness is not serviceable. If an open or short exists within the flex wiring harness, the complete harness must be replaced.

8.20.1.11 Connector Repairs

The Connector Repairs section contains the following types of connector repair information. Using these elements together will make connector repair faster and easier.

- Connector Position Assurance Locks
- Terminal Position Assurance Lock
- Pull-to-Seat Connectors
- Pull-to-Seat Connectors
- Weather Pack Connectors
- Repairing Connector Terminals

Connector Position Assurance Locks

The Connector Position Assurance (CPA) is a small plastic insert that fits through the locking tabs on all the SIR system electrical connectors. The CPA ensures that the connector halves cannot vibrate apart. You must have the CPA in place in order to ensure good contact between the SIR mating terminals.

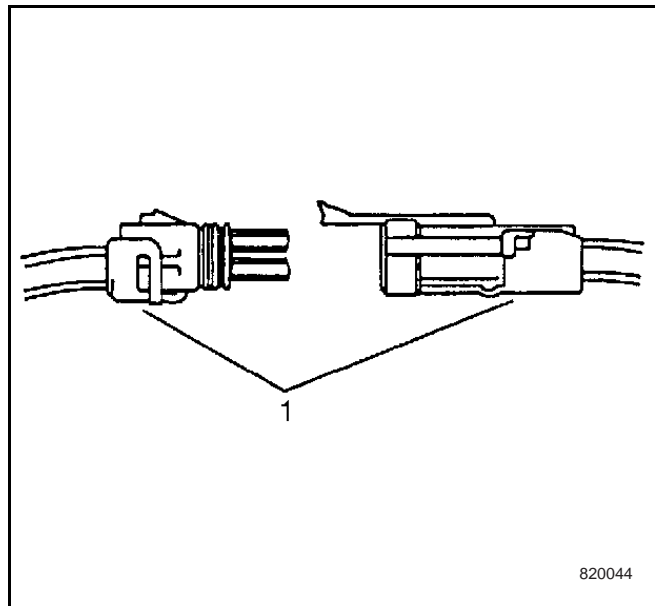
Terminal Position Assurance Locks

The terminal position assurance (TPA) insert resembles the plastic combs used in the control module connectors. The TPA keeps the terminal securely seated in the connector body. Do not remove the TPA from the connector body unless you remove a terminal for replacement.

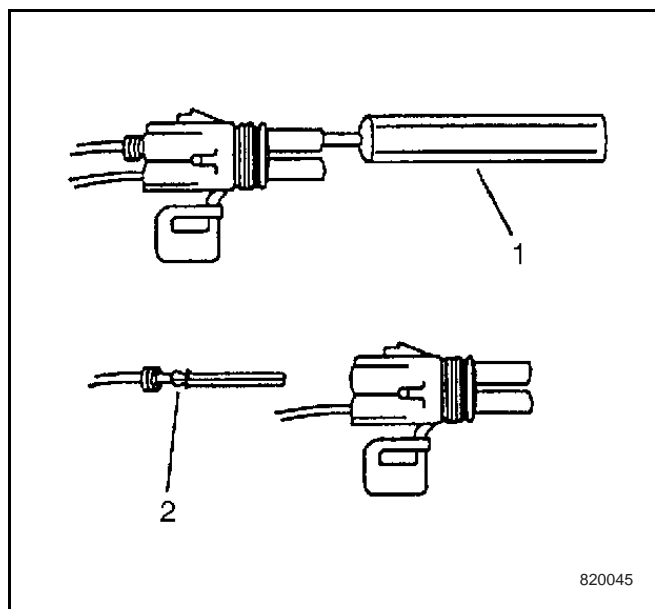
Push-to-Seat Connectors

Terminal Removal

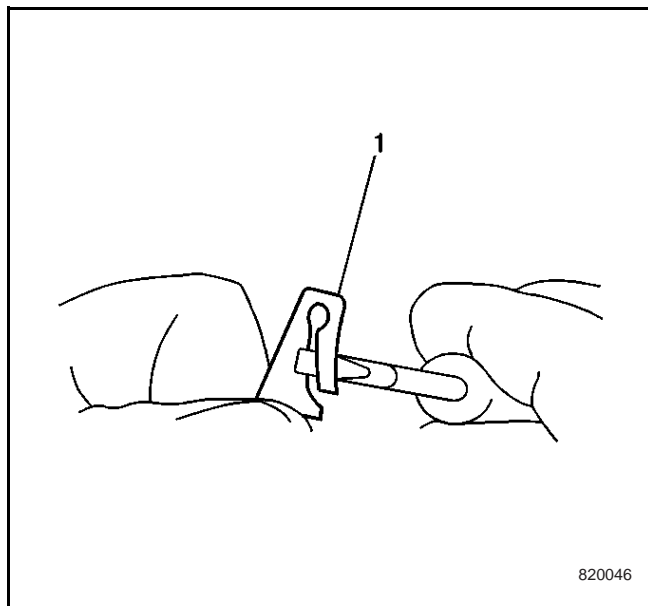
Follow the steps below in order to repair push-to-seat connectors.



1. Remove the terminal position assurance (TPA) device, the connector position assurance (CPA) device, and/or the secondary lock.
2. Separate the connector halves (1).



3. Use the proper pick or removal tool (1) in order to release the terminal.
4. Gently pull the cable and the terminal (2) out of the back of the connector.



5. Reform the locking device if you are going to reuse the terminal (1).
6. To repair the terminal, refer to Terminal Repair.

Terminal Repair

1. Slip the cable seal away from the terminal.
2. Cut the wire as close to the terminal as possible.
3. Slip a new cable seal onto the wire.
4. Strip 5mm (3/16 in) of insulation from the wire.
5. Crimp a new terminal to the wire.
6. Solder the crimp with rosin core solder.
7. Slid the cable seal toward the terminal.
8. Crimp the cable seal and the insulation.
9. If the connector is outside of the passenger compartment, apply grease to the connector.

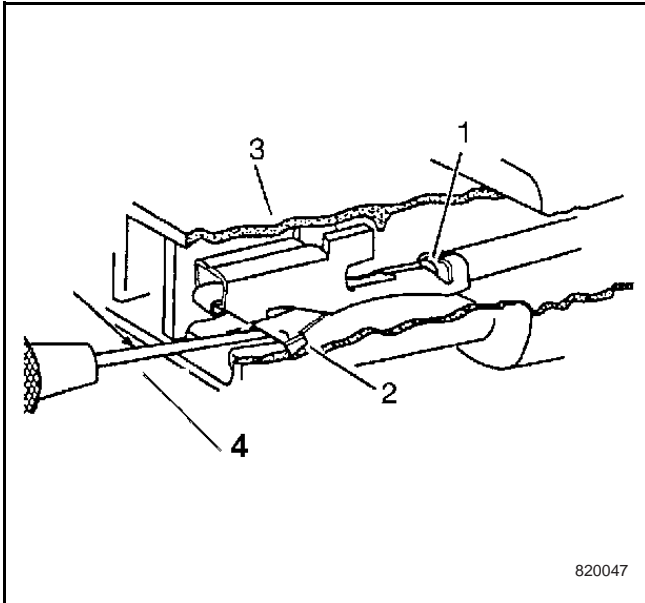
Reinstalling Terminal

1. In order to reuse a terminal or lead assembly. Refer to Wiring Repairs.
2. Ensure that the cable seal is kept on the terminal side of the splice.
3. Insert the lead from the back until it catches.
4. Install the TPA, CPA and/or the secondary locks.

Pull-to-Seat Connectors

Terminal Removal

Follow the steps below in order to repair pull-to-seat connectors.



1. Remove the terminal position assurance (TPA) device, the connector position assurance (CPA) device, and/or the secondary lock.
2. Separate the connector halves.
3. Using the proper pick or removal tool (4) insert into the front of the connector body.
4. Grasp the wire at the back of the connector body and gently pull the terminal (1) from the connector body (3).
5. Inspect the terminal for damage, if damaged, refer to Terminal Repair.
6. Reform the locking tab (2) if the terminal is being reused.

Terminal Repair

1. Slip the cable seal away from the terminal.
2. Cut the wire as close to the terminal as possible.
3. Slip a new cable seal onto the wire.
4. Strip 5mm (3/16 in) of insulation from the wire.
5. Crimp a new terminal to the wire.
6. Solder the crimp with rosin core solder.
7. Slide the cable seal toward the terminal.
8. Crimp the cable seal and the insulation.
9. If the connector is outside of the passenger compartment, apply grease to the connector.

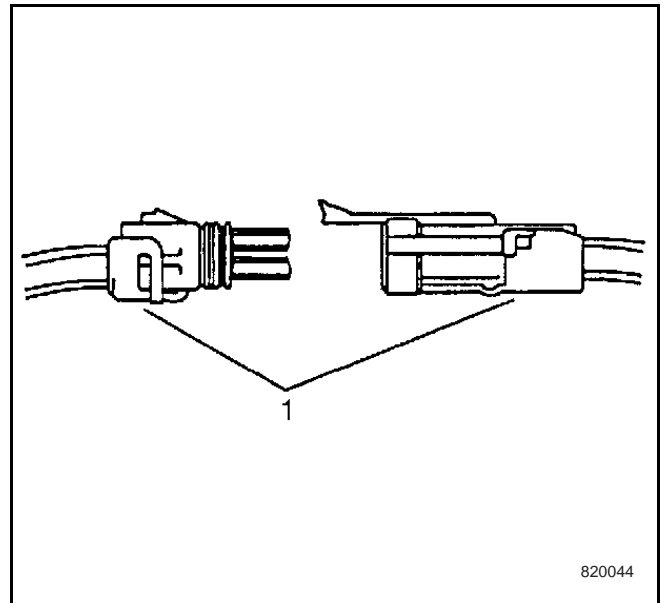
Terminal Installation

1. Inspect the terminal for damage. If damaged, refer to Terminal Repair.
2. Reform the locking tab (2) if the terminal is being reused.
3. Ensure that the cable seal is kept on the terminal side of the splice.

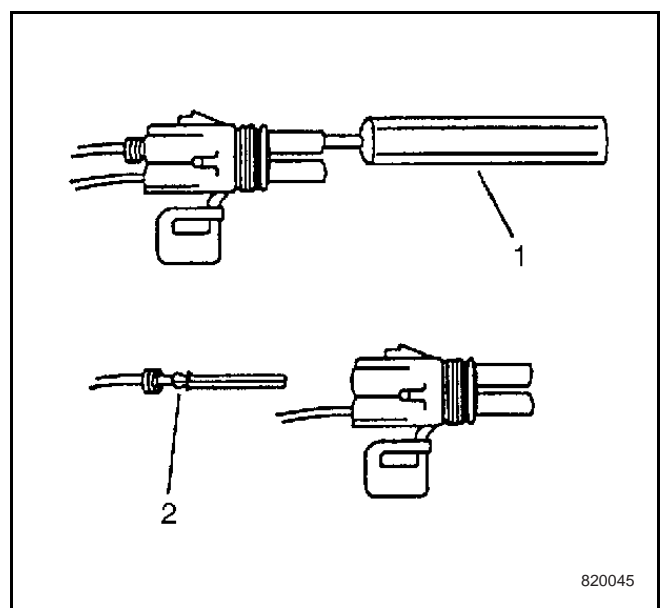
4. Insert the terminal into the back of the connector body. Push until the terminal locking tab locks into the connector body.
5. Install the TPA, CPA and/or the secondary locks.

Weather Pack Connectors

The following is the proper procedures for the repair of Weather Pack Connectors.



- Separate the connector halves (1).
- Open the secondary lock. A secondary lock aids in terminal retention and is usually molded in the connector (1).
- Grasp the wire and push the terminal to the most forward position. Hold the wire in this position.



- Insert the Weather Pack terminal removal tool into the front (mating end) of the connector cavity until it reaches the cavity shoulder (1).
- Gently pull on the wire to remove the terminal through the back of the connector (2).

Note: Never use force to remove a terminal from a connector.

- Inspect the terminal and connector for damage. Repair as necessary. Refer to Repairing Connector Body.
- Reform the lock tab and reset terminal in connector body.
- Close the secondary locks and join connector halves.
- Verify that circuit is complete and working satisfactorily.
- Perform system check.

Repairing Connector Terminals

Use the following repair procedures in order to repair the following:

- Push-to-Seat Terminals
- Pull-to-Seat Terminals

- Weather Pack Terminals

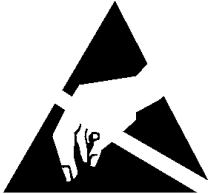
Some terminals do not require all of the steps shown.

Skip the unnecessary steps in order to speed up the terminal repair process. The J38125-B Terminal Repair Kit contains further information.

1. Cut off the terminal between the core and the insulation crimp. Minimize any wire loss.
2. Apply the correct seal per gauge size of the wire. For Weather Pack terminals, slide the seal back along the wire in order to enable insulation removal.
3. Remove the insulation.
4. For Weather Pack terminals only, align the seal with the end of the cable insulation.
5. Position the strip in the terminal. For Weather Pack terminals, position the strip and seal in the terminal.
6. Crimp the core wings by hand.
7. Crimp the insulation wings by hand. For Weather Pack terminals, crimp the insulation wings around the seal and the cable by hand.
8. Solder all of the crimped terminals by hand.

8.20.2 Schematic and Routing
Diagrams

8.20.2.1 Power and Grounding Schematic Icons

Legend:	Icon Definition
<div><p>820048</p></div>	<p>Refer to ESD Notice in Cautions and Notices.</p>

8.20.2.2 General Information

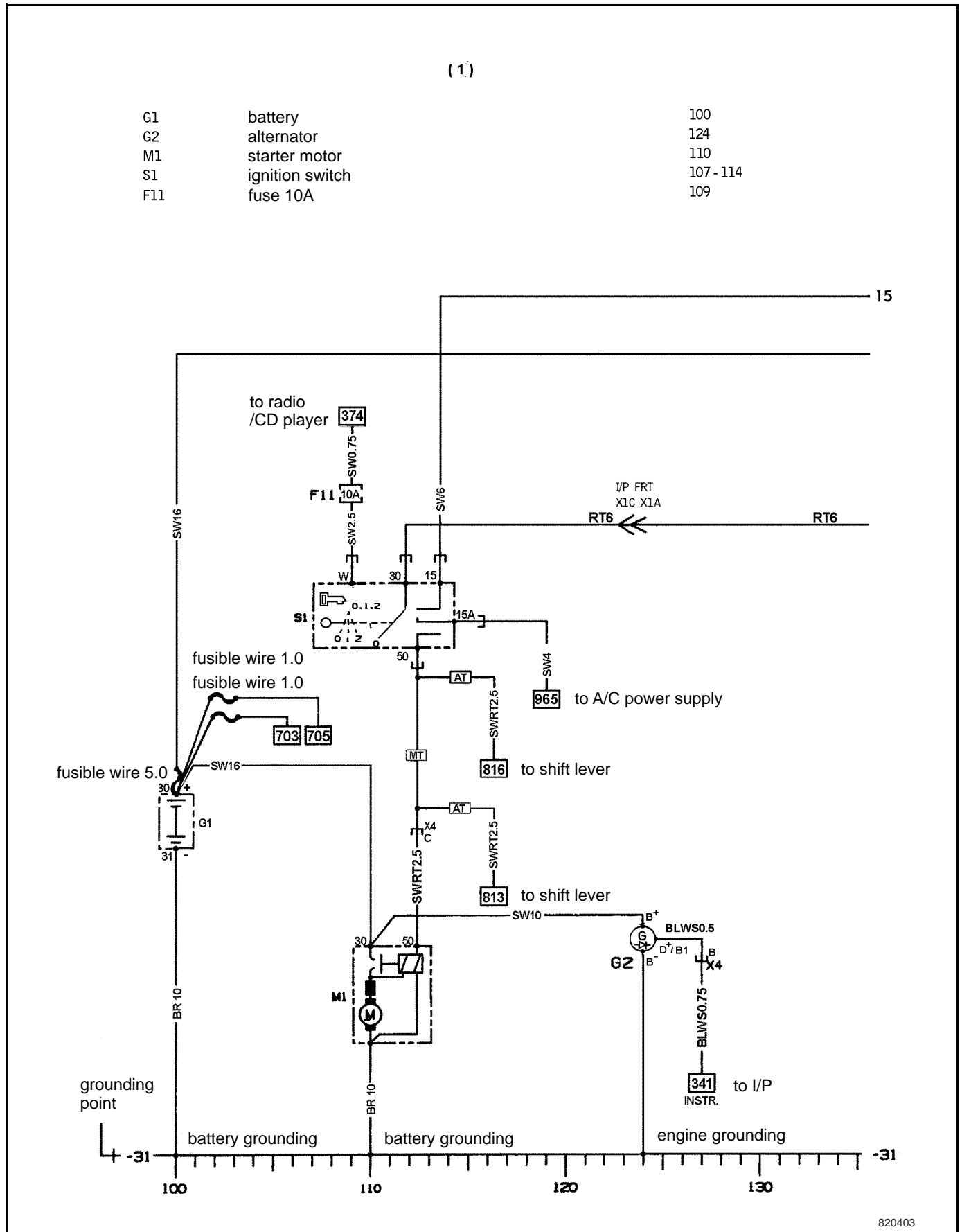
Wiring Harness System Connection

X1	Connection between I/P Wiring Harness & Front Body Wiring Harness
X2	Connection between I/P Wiring Harness & Engine Wiring Harness
X3	Connection between I/P Wiring Harness & A/T Wiring Harness
X4	Connection between I/P Wiring Harness & Start Wiring Harness
X5	Connection between I/P Wiring Harness & Rear Body Wiring Harness
X6	Connection between Rear Body Wiring Harness & Left Front Door Wiring Harness
X7	Connection between Rear Body Wiring Harness & Right Front Door Wiring Harness
X8	Connection between Rear Body Wiring Harness & Rear Door Wiring Harness
X9	Connection between Rear Body Wiring Harness & LID Wiring Harness
X10	Connection between Engine Wiring Harness & A/T Wiring Harness

Wire Color

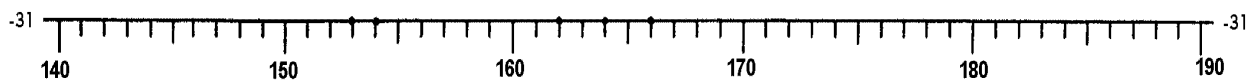
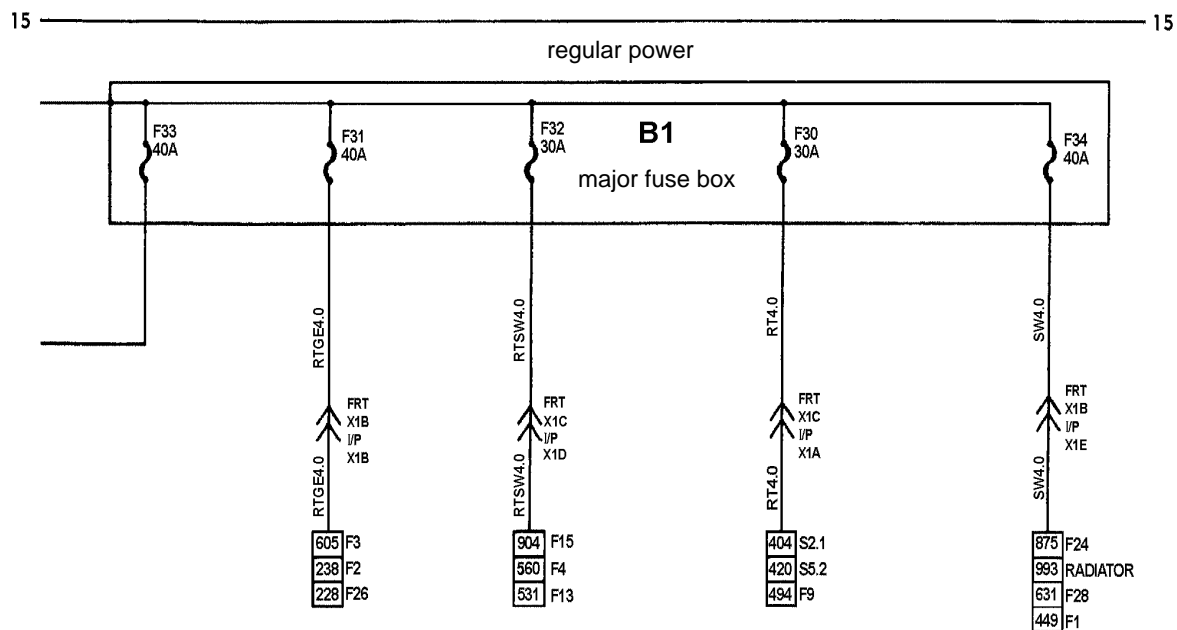
Diagram wire information	Wire Color
BL	Blue
BR	Brown
GE	Yellow
GN	Green
GR	Grey
RT	Red
SW	Black
VI	Violet
WS	White

8.20.2.3 Starter Motor & Alternator Wiring Diagram (7165SL, 7165SE, 7165SE AT, 7166SL, 7166SE)



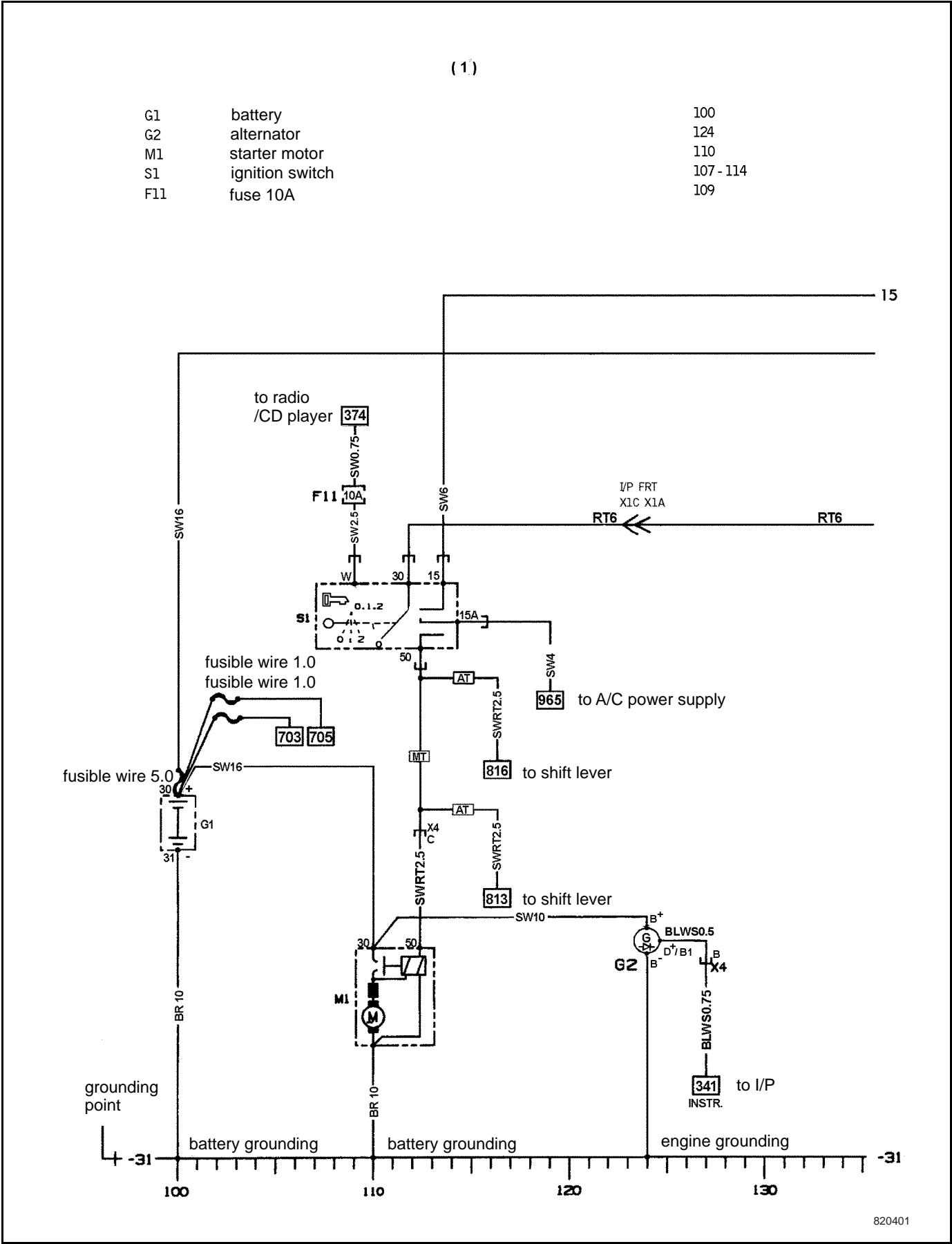
(2)

B1	major fuse box	138-195
F30	fuse 30A (lamps)	173
F32	fuse 30A (blower)	162
F31	fuse 40A (engine system)	153
F33	fuse 40A (ignition)	145
F34	fuse 40A (radiator fan)	184



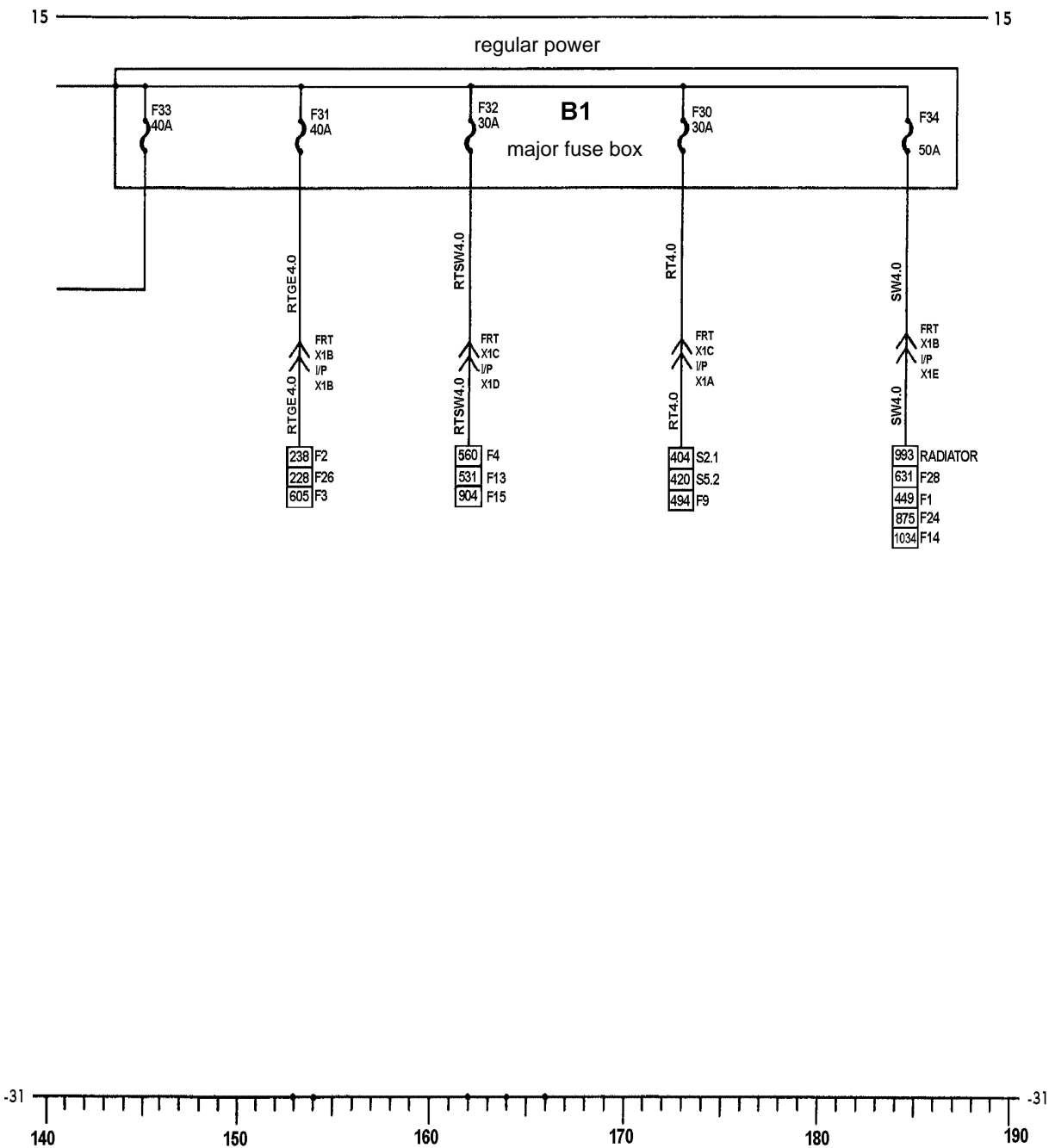
820404

8.20.2.4 Starter Motor & Alternator Wiring Diagram (7166SX AT)



(2)

B1	major fuse box	138-195
F30	fuse 30A (lamps)	173
F32	fuse 30A (blower)	162
F31	fuse 40A (engine system)	153
F33	fuse 40A (ignition)	145
F34	fuse 40A (radiator fan)	184



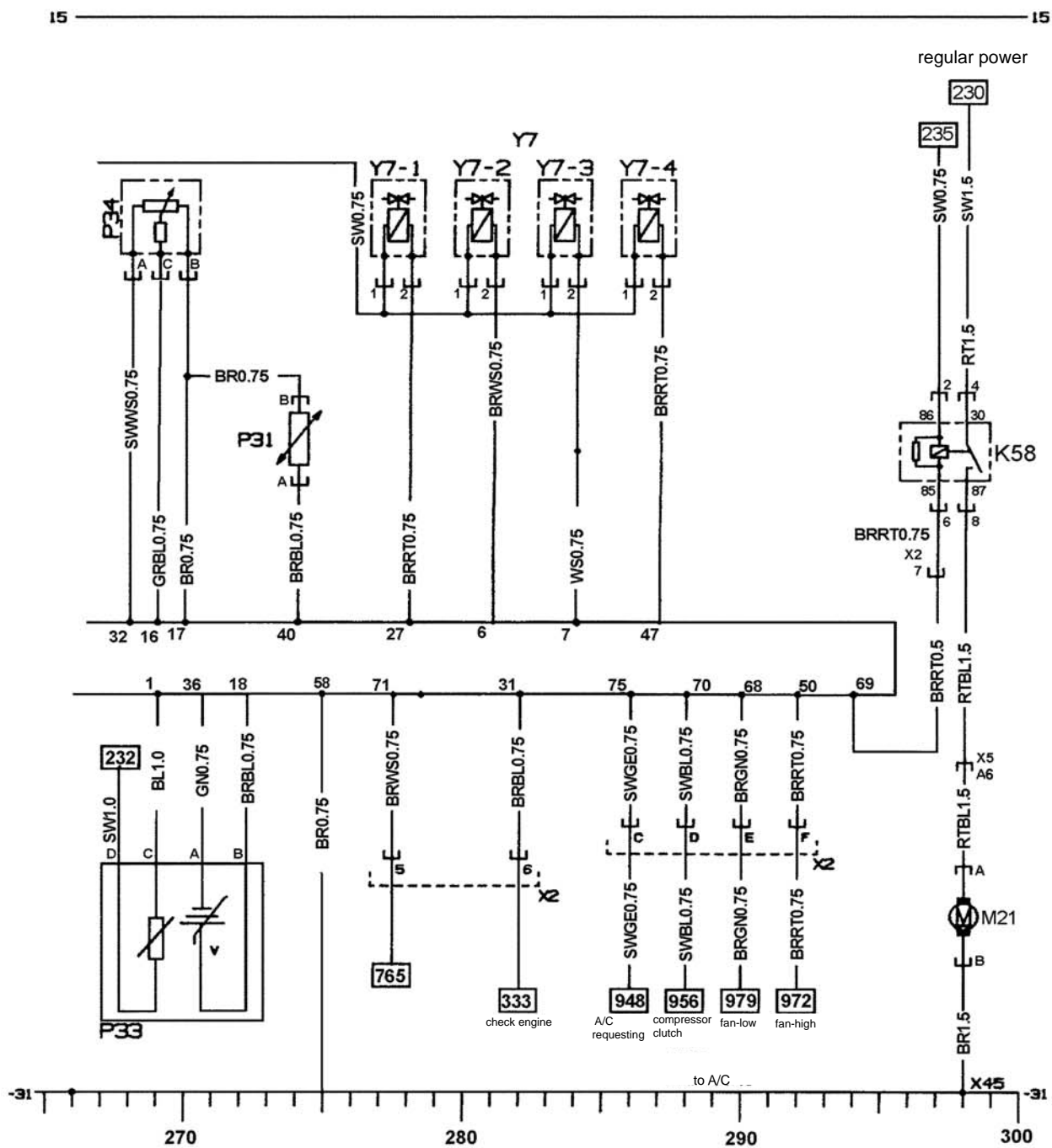
(1)

K80	main relay	225-228	Y34	fuel tank vacuum control valve	255
F26	fuse 25A	226	P30	engine coolant temperature sensor	260
F2	fuse 10A	238	P35	camshaft position sensor	263-266
L2	ignition coil	238-243	P23	air intake pressure sensor	284
P46	knock sensor	240	M66	throttle control valve	247-252
F19	fuse 10A	247	K29	ECM	233-296
F7	fuse 15A	247			



(2)

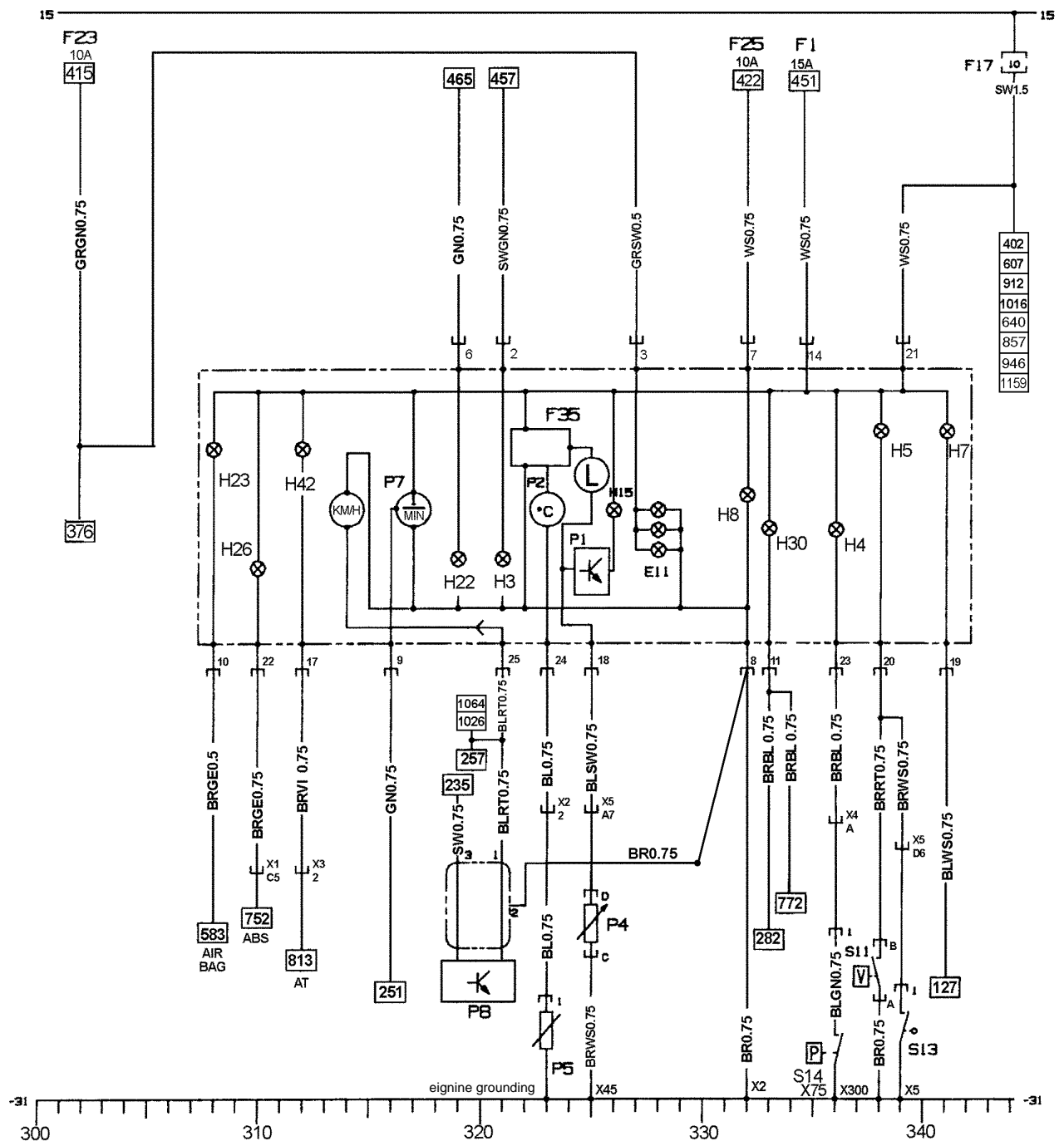
K58	oil pump relay	296-298
M21	fuel pump	298
P31	air intake temperature sensor	274
P33	oxygen sensor	260
P34	throttle sensor	268-272
Y7	fuel injector mouth	277-287



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8.20.2.6 Instrument Cluster Wiring Diagram

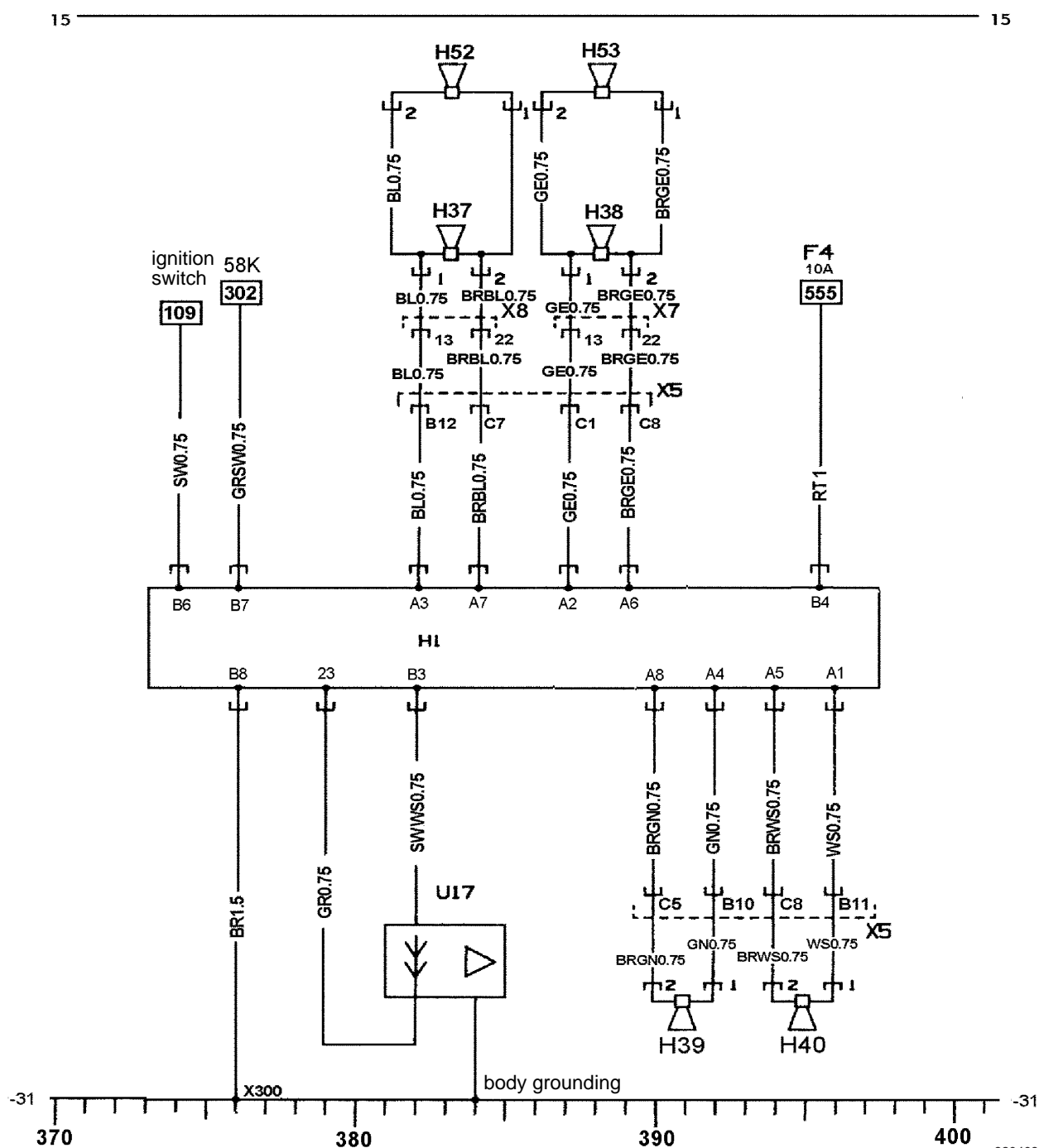
E11	instrument lamp	327 - 329	H42	signal device- automatic transmission	311
F17	fuse-10A	344	P1	fuel indicator	325
F35	voltage regulator	322 - 323	P2	engine coolant temperature sensor	323
H3	steering indicator (left)	321	P4	sensor- fuel	325
H4	engine oil pressure indicator	336	P5	engine coolant temperature sensor	323
H5	braking system indicator	338	P7	tachometer	317
H7	battery charging indicator	341	P8	vehicle speed sensor	320
H8	headlamp high beam indicator	332	S11	control switch- brake fluid	338
H15	fuel volume alarm indicator	326	S13	park brake switch	339
H22	steering indicator (right)	319	S14	oil pressure switch	336
H23	SIR indicator	308			
H26	ABS indicator	310			
H30	engine controls indicator	333			



8.20.2.7 Radio/Audio System (if equipped) Wiring Diagram

with CD, 6-speaker system

H1	radio/ CD	373 - 397
H37	speaker-left front	383
H38	speaker- right front	388
H39	speaker-left rear	391
H40	high frequency speaker- left front	395
H52	high frequency- right front	383
H53	high frequency- right front	388
U17	amplifier- antenna	382 - 384

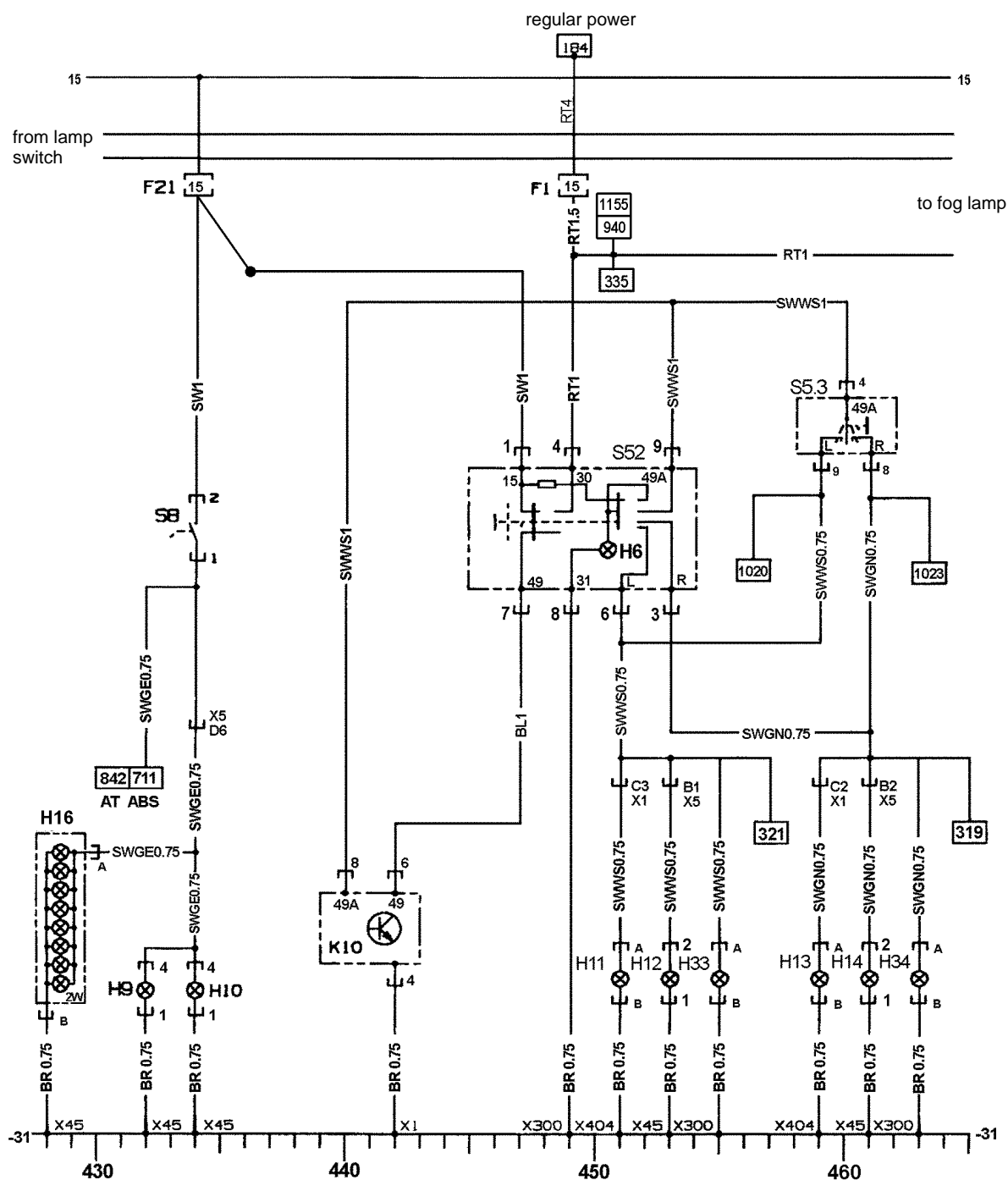


8.20.2.8 Parking, Tail Lamp & High/Low Beam Lamps Wiring Diagram



20.2.9A Stop Lamp, Turn Signal & Hazard Lamps Wiring Diagram

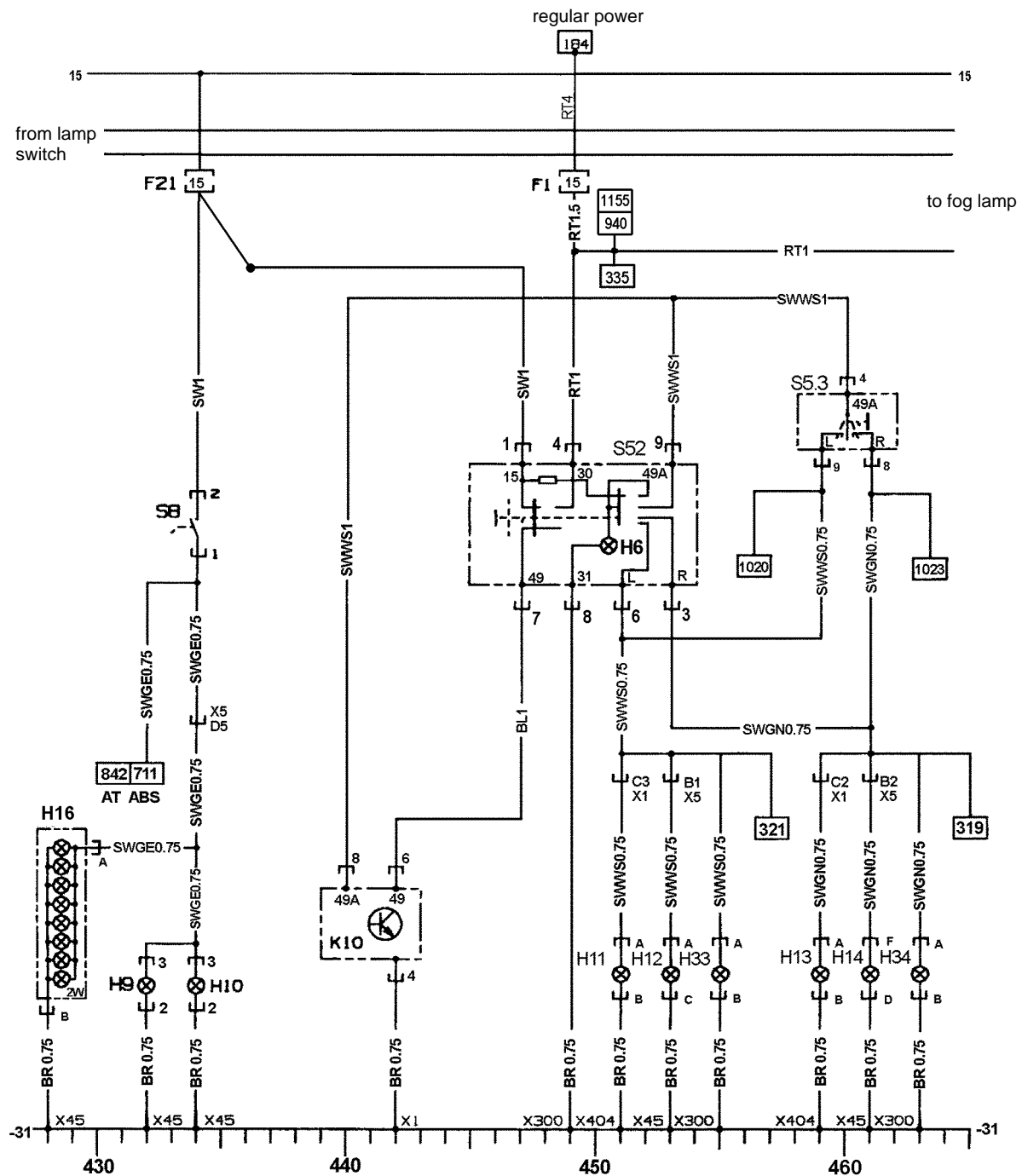
F1	fuse 15A	449	H14	steering lamp- right rea	461
F21	fuse 15A	434	H16	high-mounted stop lamp	429 - 430
H6	signal device- danger alarm system	450	H33	side steering lamp- left	455
H9	brake lamp- left	432	H34	side steering lamp-right	463
H10	brake lamp- right	434	K10	alarming lamp-steering lamp control unit	440 - 442
H11	steering lamp- left front	451	S5.3	steering lamp switch	459 - 461
H12	steering lamp- left rear	453	S8	stop lamp switch	434
H13	steering lamp- right front	459	S52	danger alarm signal lamp switch	446 - 453



20.2.9B Stop Lamp, Turn Signal & Hazard Lamps Wiring Diagram

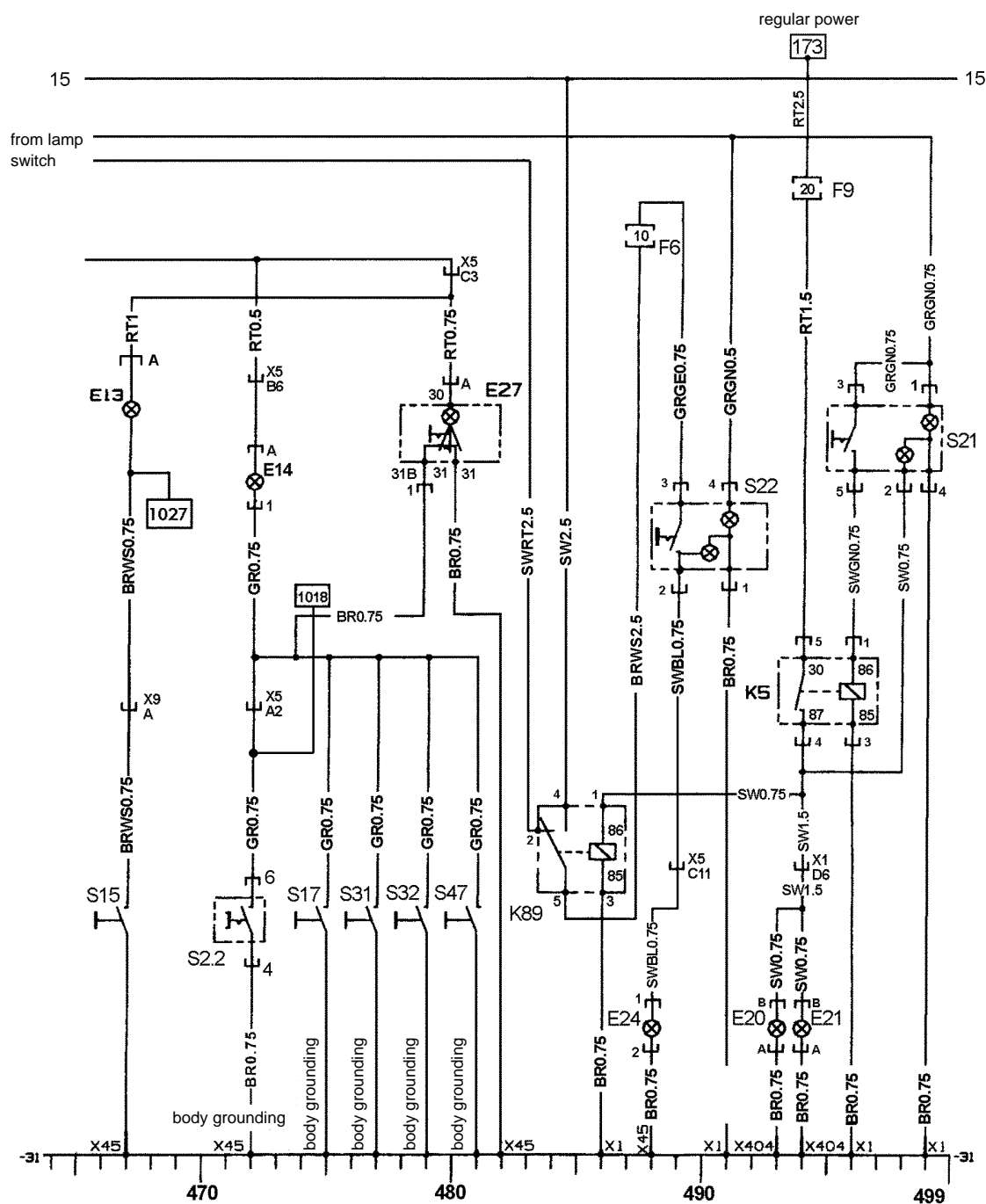
F1	fuse 15A	449
F21	fuse 15A	434
H6	signal device- danger alarm system	450
H9	brake lamp- left	432
H10	brake lamp- right	434
H11	steering lamp- left front	451
H12	steering lamp- left rear	453
H13	steering lamp- right front	459

H14	steering lamp- right rear	461
H16	high-mounted stop lamp	429 - 430
H33	side steering lamp- left	455
H34	side steering lamp-right	463
K10	alarming lamp-steering lamp control unit	440 - 442
S5.3	steering lamp switch	459 - 461
S8	stop lamp switch	434
S52	danger alarm signal lamp switch	446 - 453



20.2.10A Interior Lamps and Fog Lamps

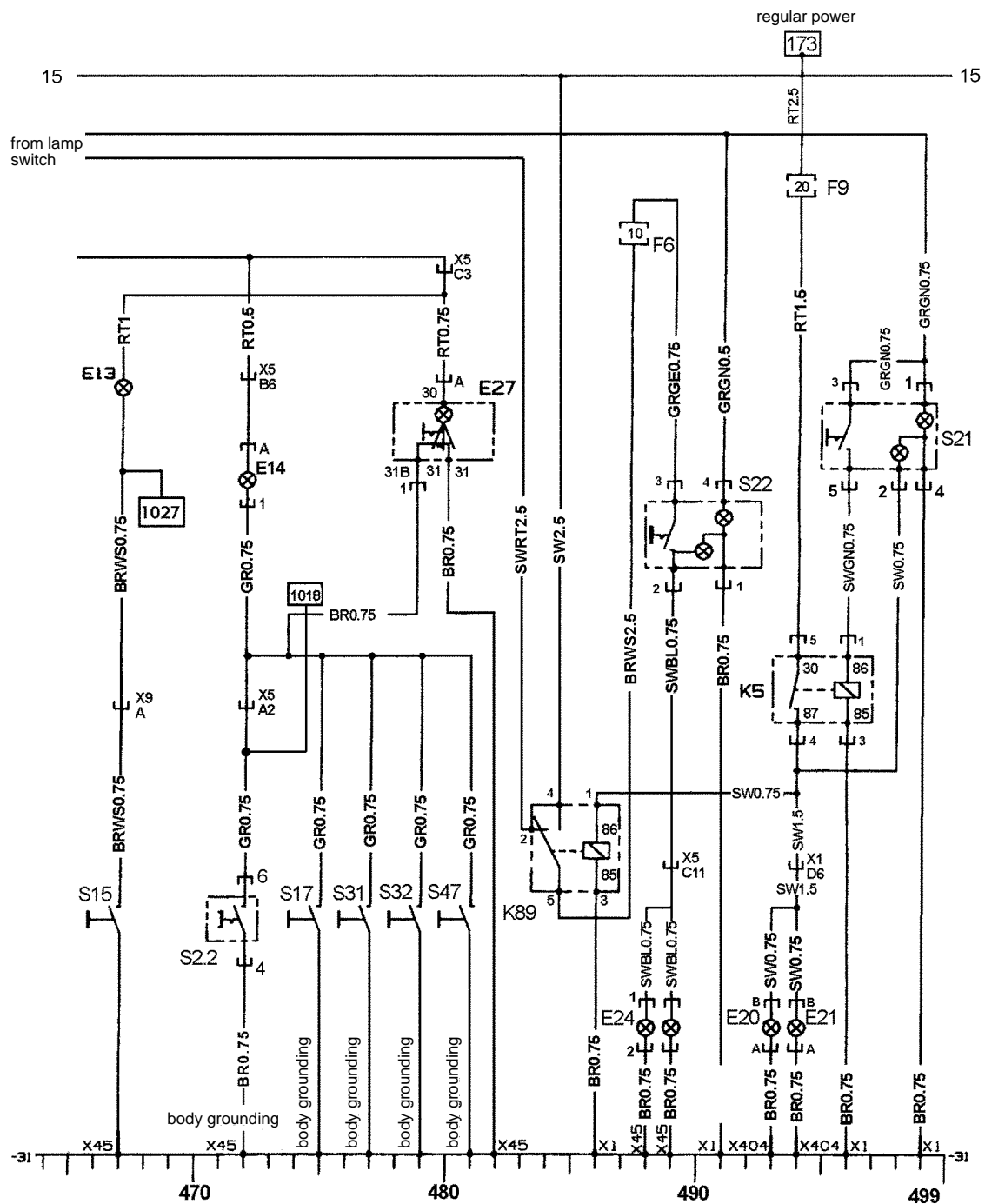
E13	luggage compartment lamp	467	K5	relay- fog lamp, front	494 - 496
E14	lamp- passenger compartment	472	K89	relay- fog lamp, rear	483 - 491
E20	fog lamp- left front	493	S2.2	switch-lamp,passenger compartment (if equipped)	472
E21	fog lamp- right front	494	S15	switch-lamp, luggage compartment/ cargo compartment (if equipped)	467
E24	fog lamp- left rear	488	S17	contact switch- front passenger's side door	475
E27	courtesy lamp- passenger compartment	480	S21	fog lamp switch, front	496 - 499
E39	fog lamp- right rear	489	S22	fog lamp switch, rear	489 - 491
F9	fuse 20A	494	S31	contact switch, left rear door	477
F6	fuse 20A	489	S32	contact switch, right rear door	479
			S47	contact switch, driver's side door	481



20.2.10B Interior Lamps and Fog Lamps

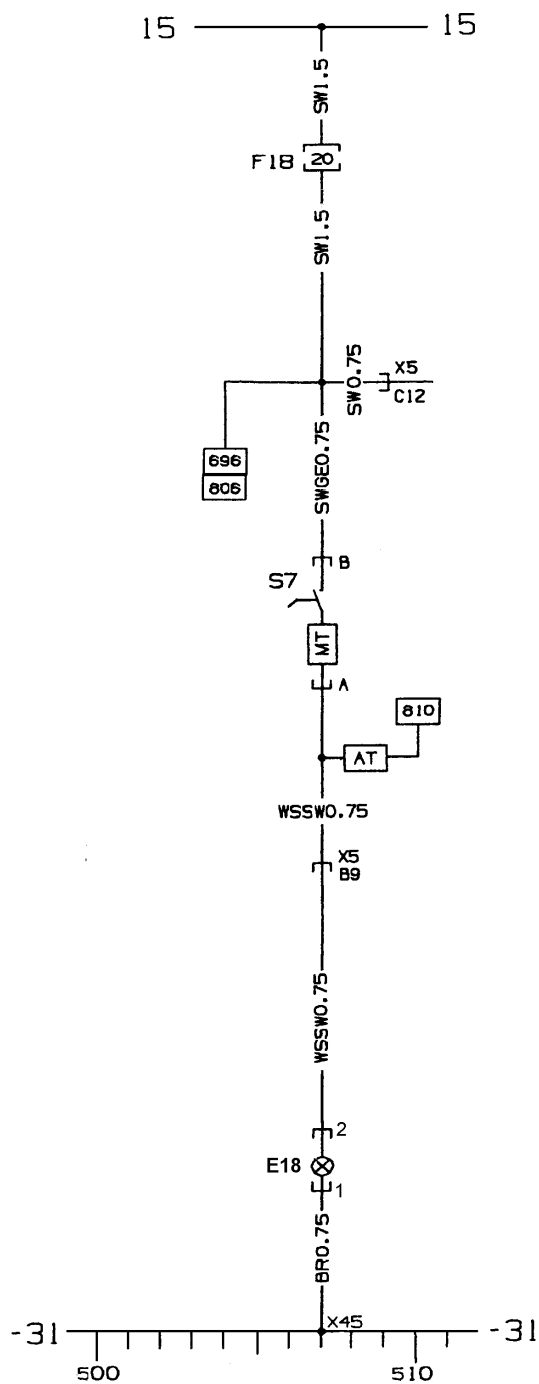
E13	luggage compartment lamp	467
E14	lamp- passenger compartment	472
E20	fog lamp- left front	493
E21	fog lamp- right front	494
E24	fog lamp- left rear	488
E27	courtesy lamp- passenger compartment	480
E39	fog lamp- right rear	489
F9	fuse 20A	494
F6	fuse 20A	489

K5	relay- fog lamp, front	494 - 496
K89	relay- fog lamp, rear	483 - 491
S2.2	switch-lamp,passenger compartment (if equipped)	472
S15	switch-lamp, luggage compartment/ cargo compartment (if equipped)	467
S17	contact switch- front passenger's side door	475
S21	fog lamp switch, front	496 - 499
S22	fog lamp switch, rear	489 - 491
S31	contact switch, left rear door	477
S32	contact switch,right rear door	479
S47	contact switch, driver's side door	481



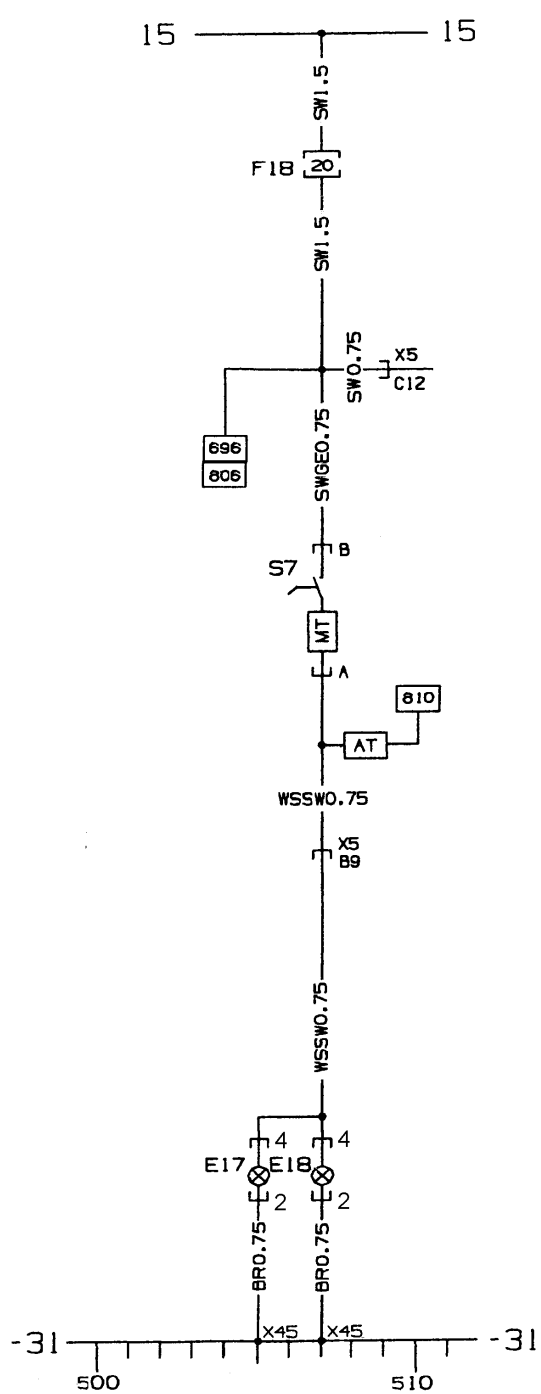
20.2.11A Backup Lamp Wiring Diagram

E18	back up lamp	507
F18	fuse 20A	507
S7	back up lamp switch	507



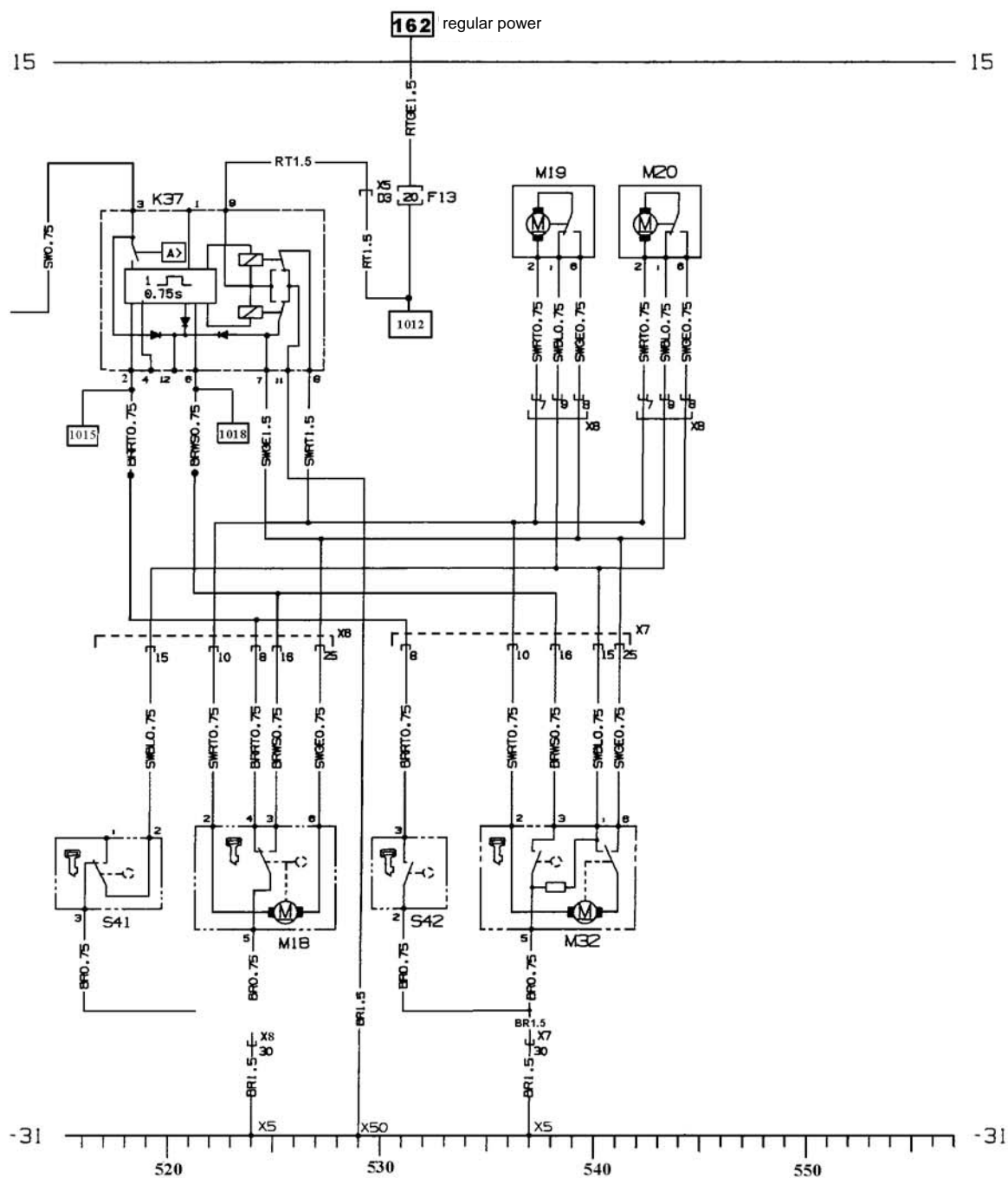
20.2.11B Backup Lamp Wiring Diagram

E17	back up lamp -left	505
E18	back up lamp- right	507
F18	fuse 20A	507
S7	back up lamp switch	507



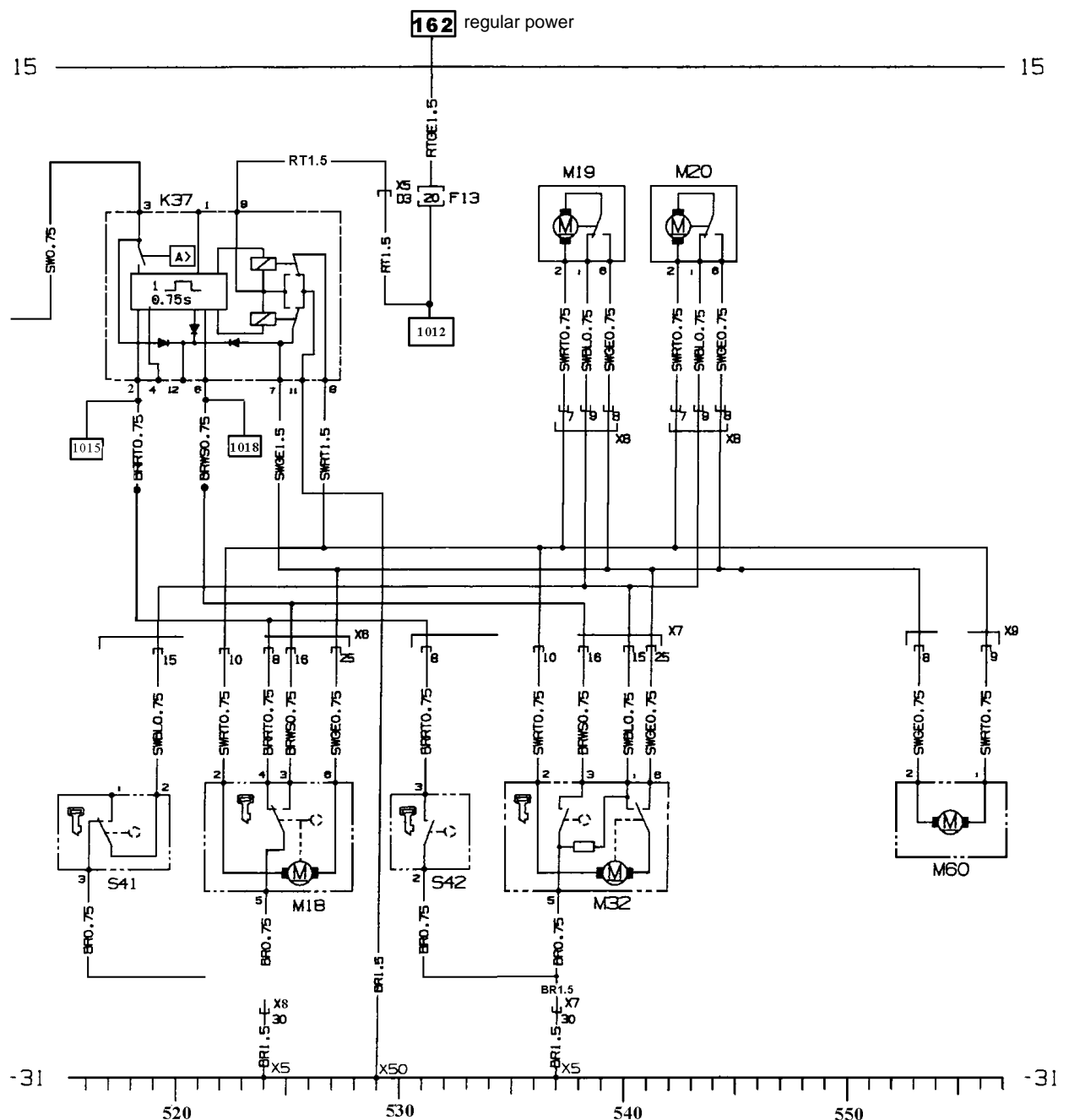
8.20.2.12A Central Door Locking System (7165SE, 7165SE AT)

M19	motor-central lock, door, left rear	537-539
M20	motor-central lock, door, right rear	542-544
M32	motor-central lock, front passenger's side door	536-541
F13	fuse 20A	531
K37	central lock control module	518-527
M18	motor-central lock, driver's side door	522-527
S41	switch-central lock, driver's side door	516-519
S42	switch-central lock, front passenger's side door	530-533

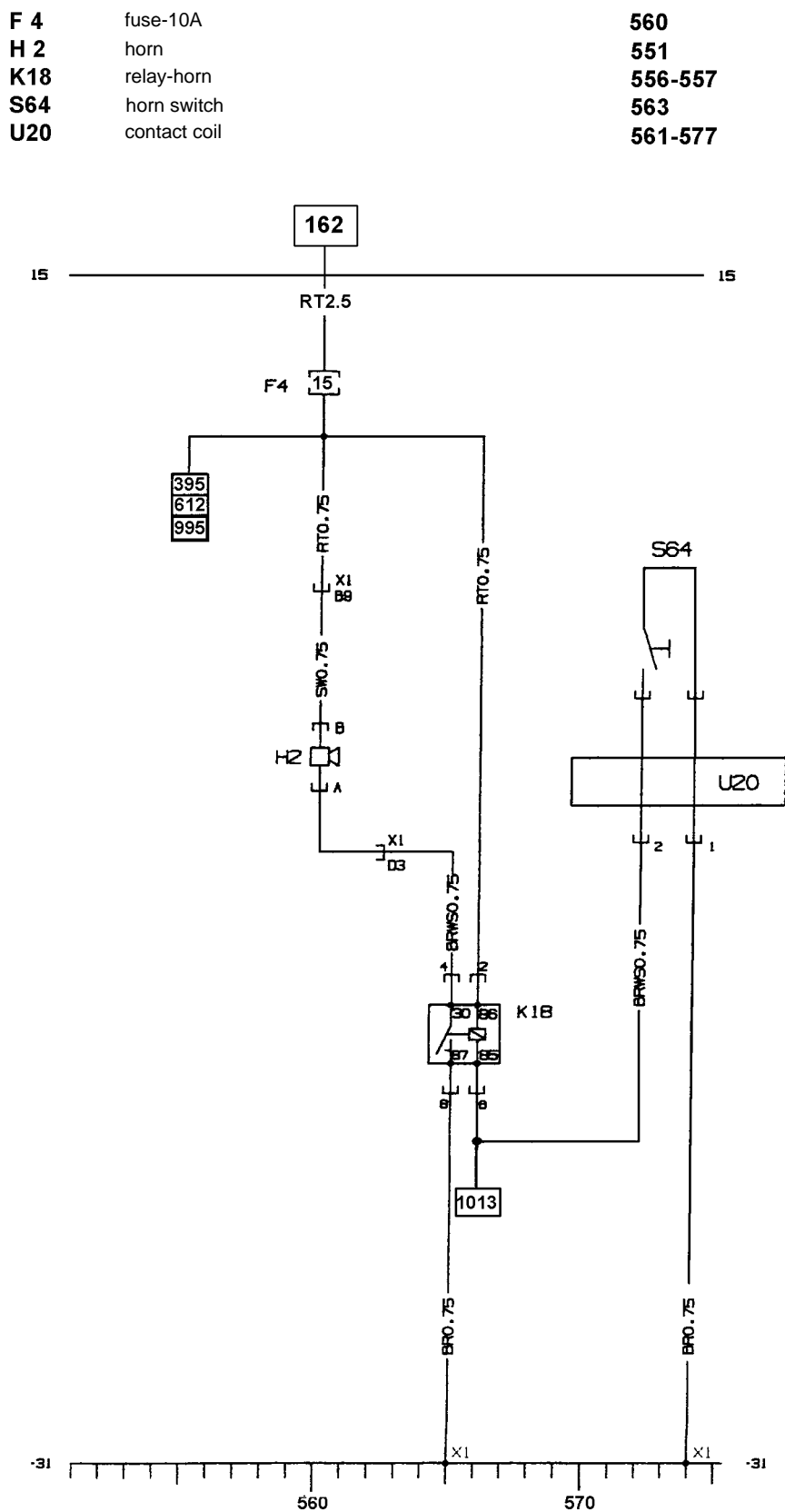


8.20.2.12B Central Door Locking System (7166SE,7166SX AT)

- | | | |
|------------|--|----------------|
| M19 | motor-central lock, door, left rear | 537-539 |
| M20 | motor-central lock, door, right rear | 542-544 |
| M32 | motor-central lock, front passenger's side door | 536-541 |
| M60 | motor-central lock, liftgate (wagon) | 552-557 |
| F13 | fuse 20A | 531 |
| K37 | central lock control module | 518-527 |
| M18 | motor-central lock, driver's side door | 522-527 |
| S41 | switch-central lock, driver's side door | 516-519 |
| S42 | switch-central lock, front passenger's side door | 530-533 |



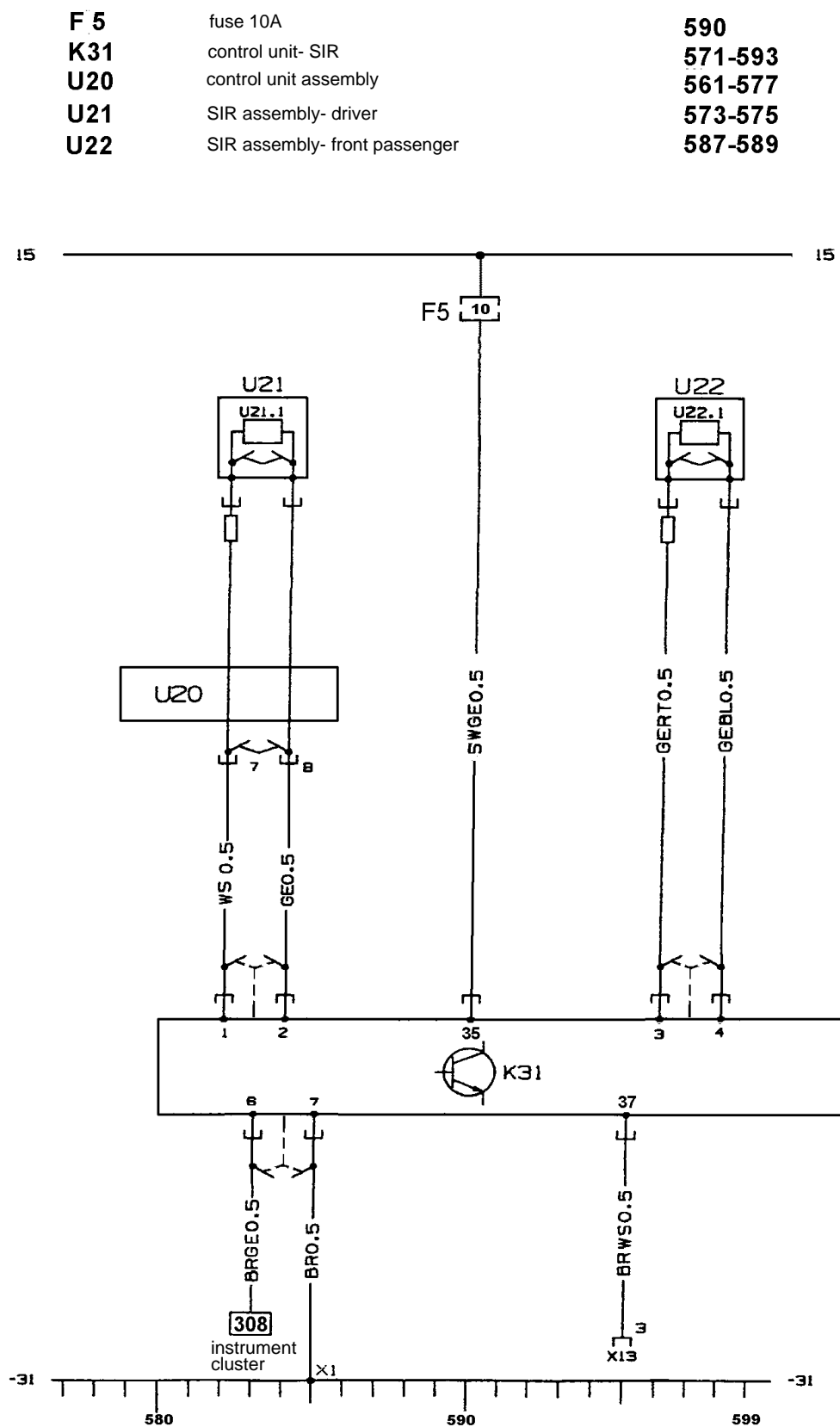
8.20.2.13A Horn Wiring Diagram



F 4	fuse-10A	560
H 2	horn	551
K18	relay- horn	556-557
S64	horn switch	563
U20	contact coil	561-577



8.20.2.14 Air Bag System Wiring Diagram



8.20.2.15 Rear Window Defogger Wiring Diagram

- E19

F3

F17

K1

rear window defogger

fuse 25A

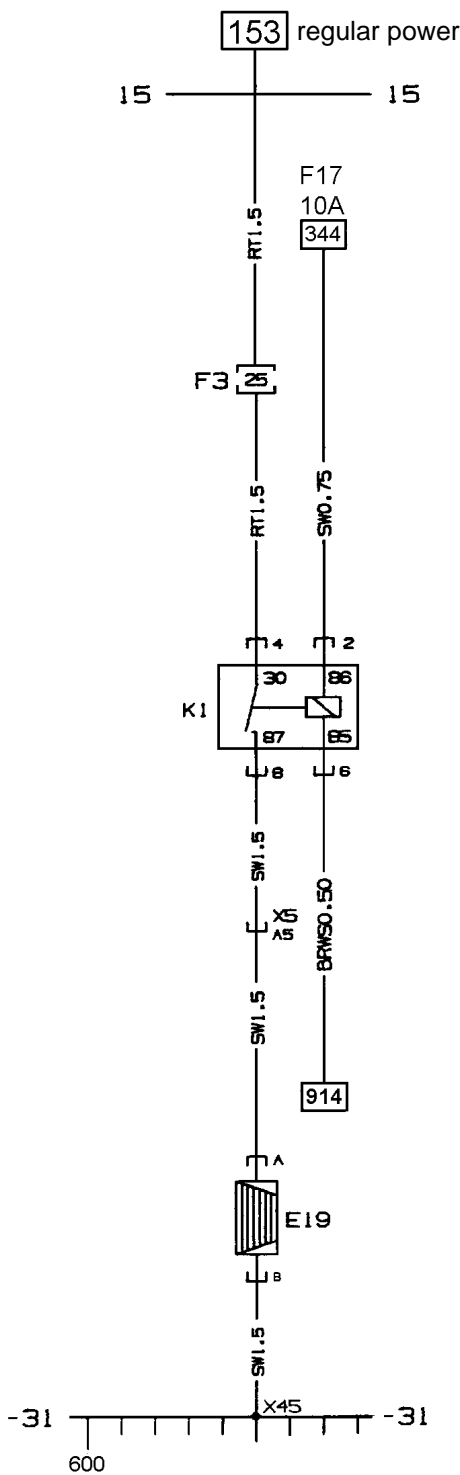
fuse 10A

relay- rear window defogger
- 605

605

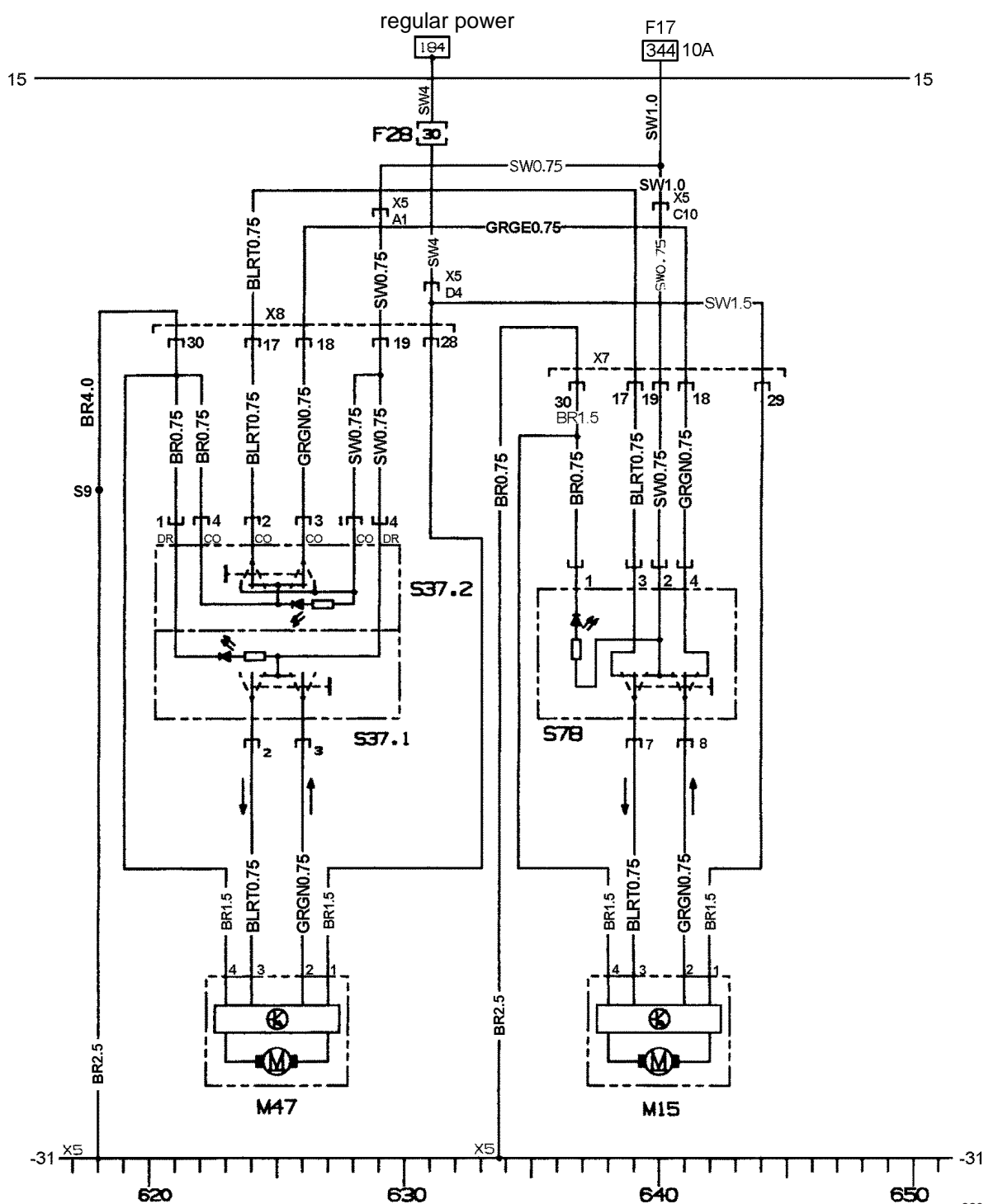
607

605-607



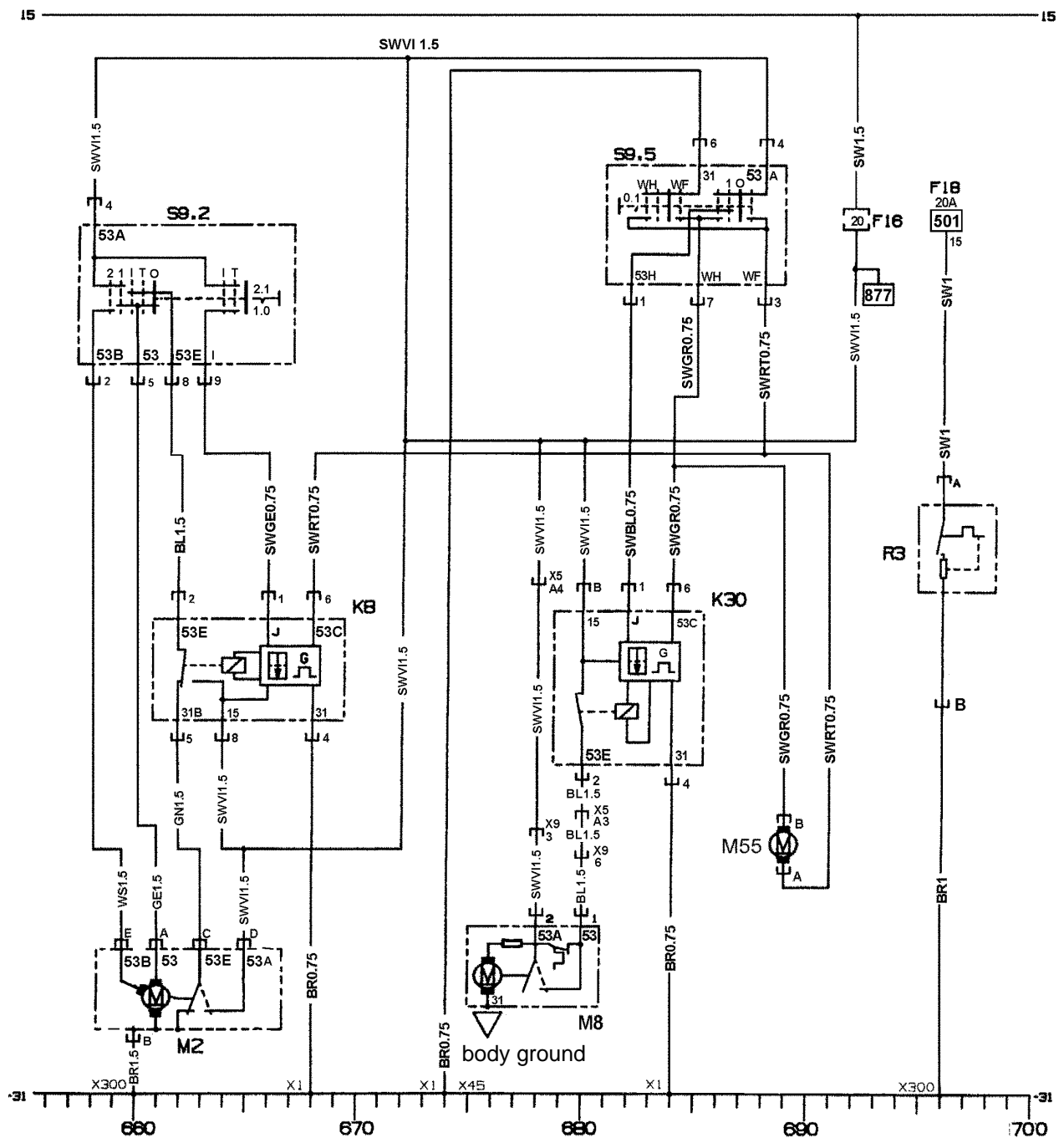
8.20.2.16 Front Window Power Lifter Wiring Diagram (7165SE, 7165SE AT, 7166SE)

F17	fuse 10A	644
F24	fuse 10A	647
F28	fuse 30A	631
M15	motor- window riser, front passenger's side door	638 - 642
M47	motor- window riser, driver's side door	623 - 627
S37.1	switch- window riser, driver's side door	621 - 629
S37.2	switch- window riser, front passenger's side door	622 - 628
S78	switch- window riser, front passenger's side door	636 - 642

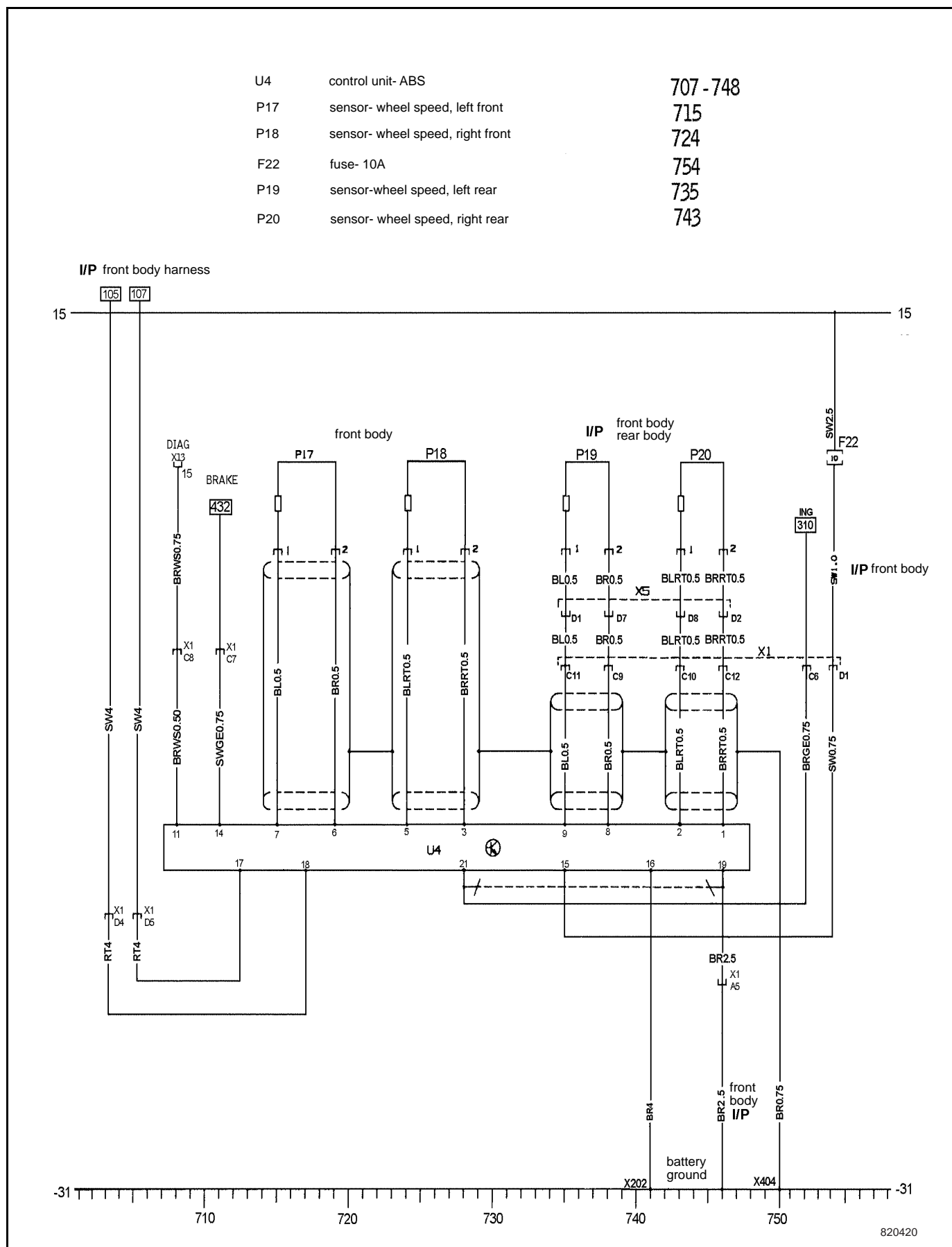


8.20.2.17 Wiper/Washer System Wiring Diagram

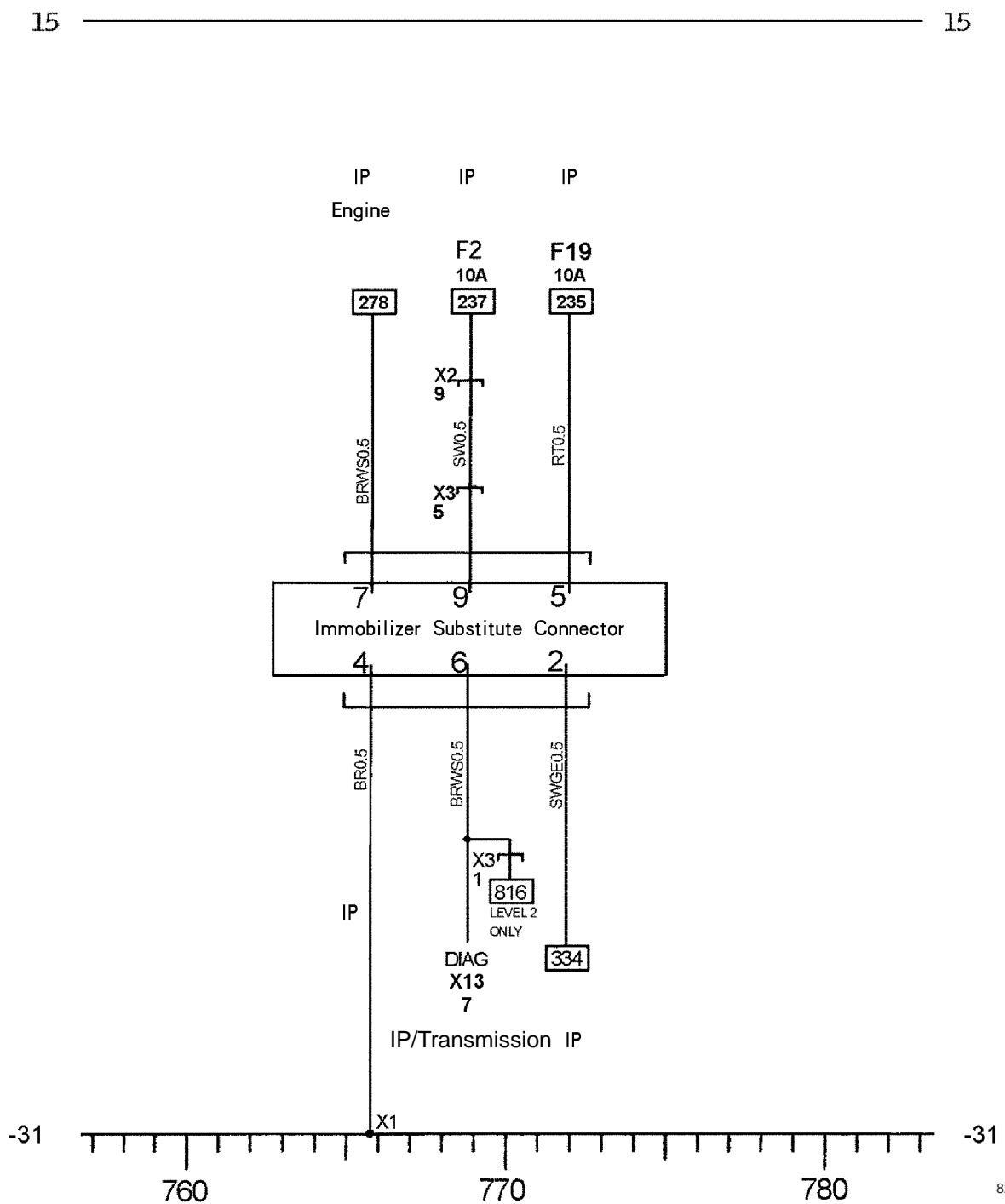
F16	fuse 20A	692
F18	fuse 20A	696
K8	windshield wiper relay	662 - 668
K30	rear windshield wiper relay (if equipped)	680 - 684
M2	windshield wiper motor	660 - 665
M8	motor- rear windshield wiper (if equipped)	676 - 680
M55	rear windshield washer	689
R3	smoke lighter	696
S9.2	windshield wiper switch	658 - 667
S9.5	rear windshield wiper/ washer switch	682 - 688



8.20.2.18 ABS (if equipped) Wiring Diagram



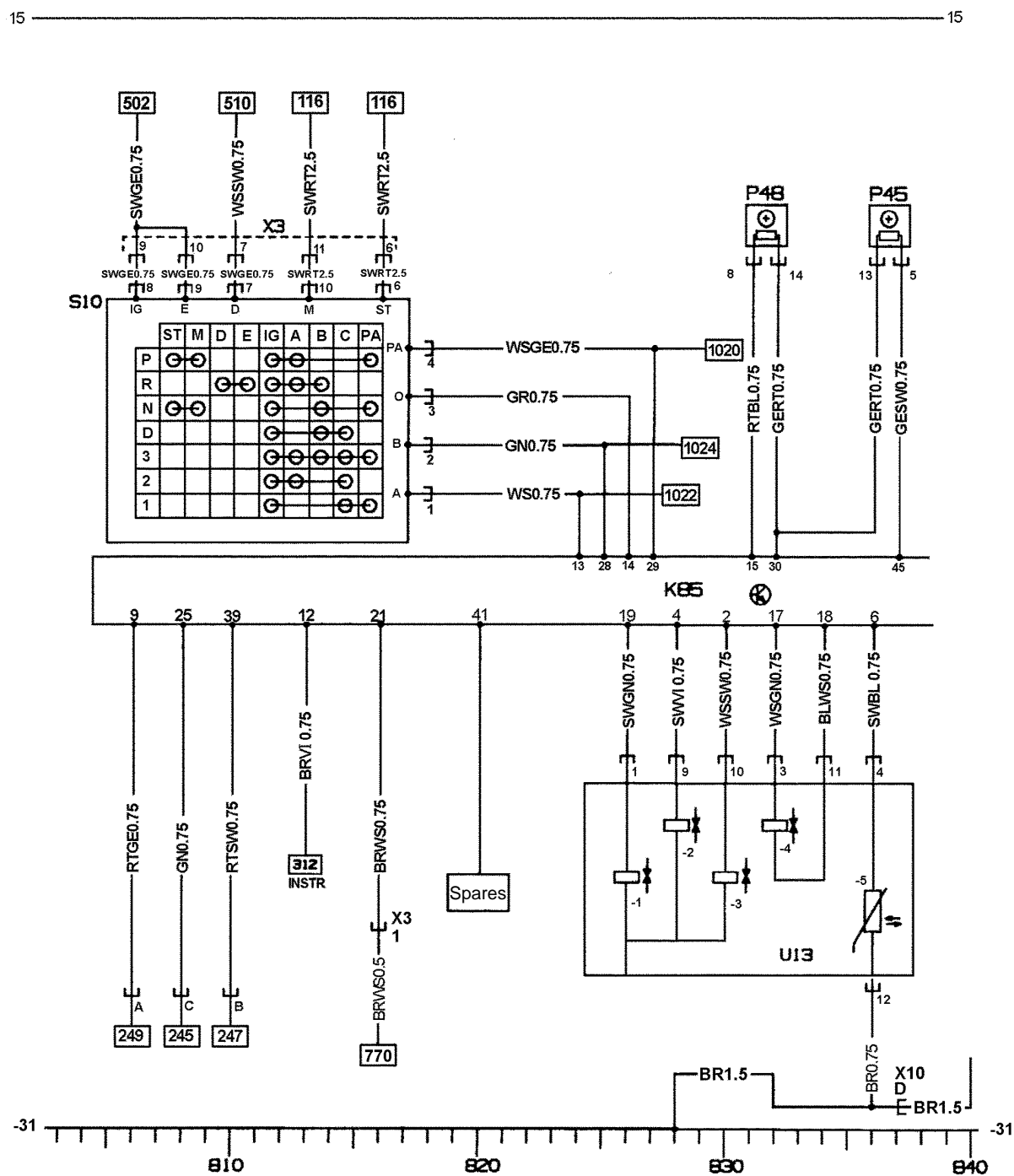
8.20.2.19 Connectors



8.20.2.20 Auto Transmission Control Module Wiring Diagram

(1)

k85	control unit- automatic transmission	806 - 855
P48	sensor- vehicle speed, transmission output	831 - 832
S10	shift lever position	806 - 816
P45	sensor- vehicle speed, transmission input	836 - 837
U13	valve	826 - 836

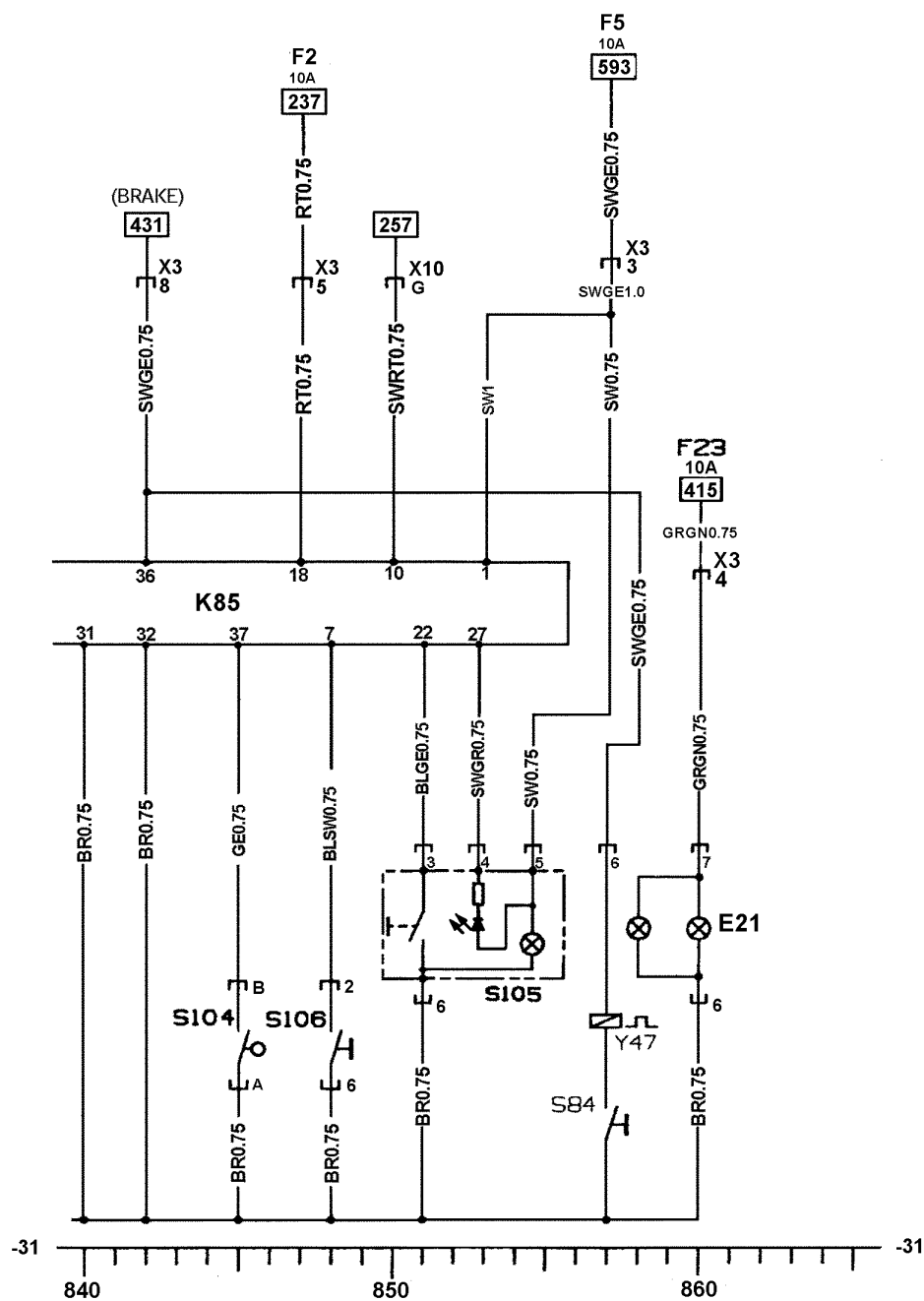


(2)

K85	control unit- automatic transmission	806 - 855
F5	fuse-10A	857
S104	forced downshift switch	847
S105	snow mode switch	851 - 855
S106	switch, procedure, economic/ power	844
S84	shift contact switch	857
Y47	unlock solenoid	857
E21	transmission working mode indicator, on shift lever	858 - 860

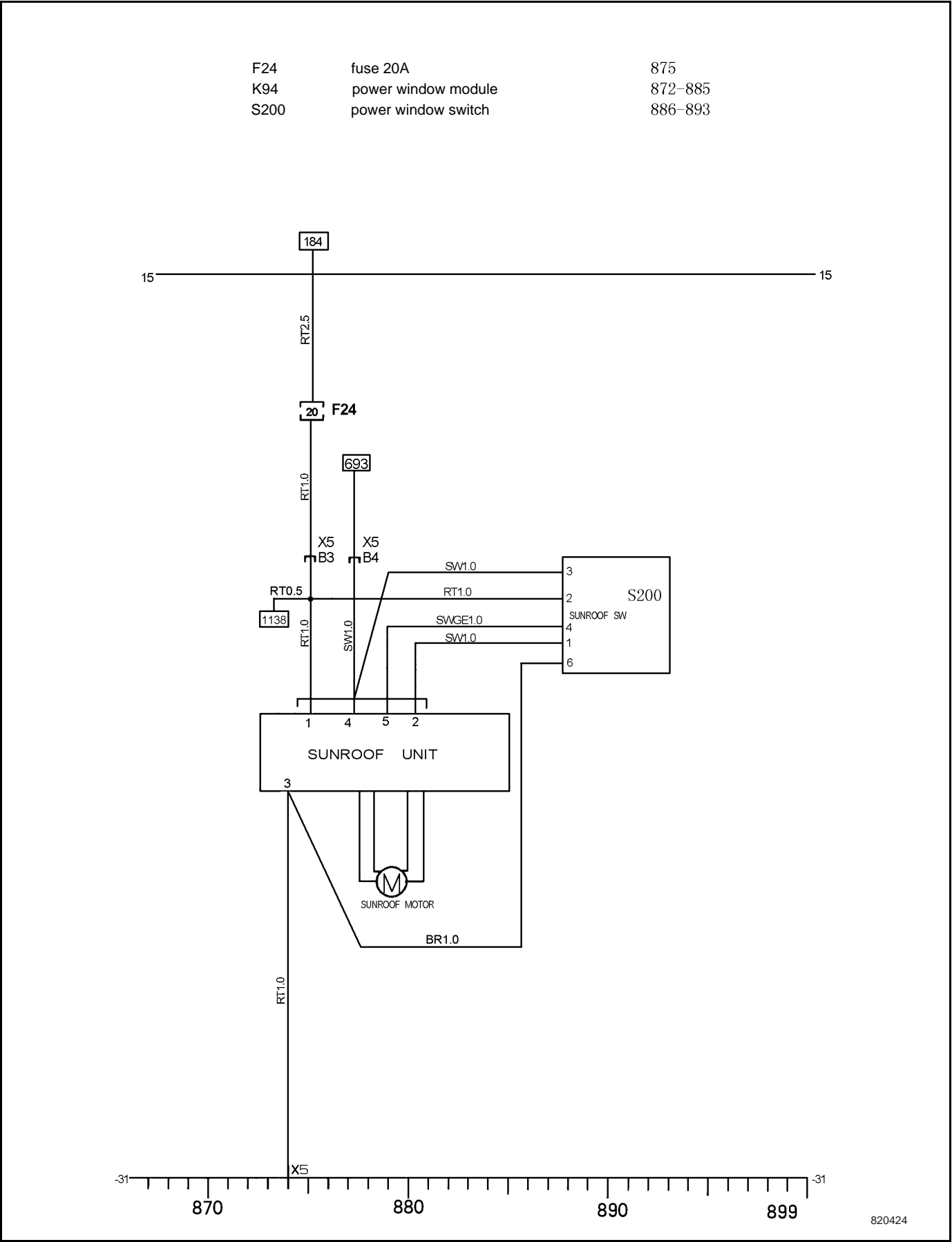
15

15

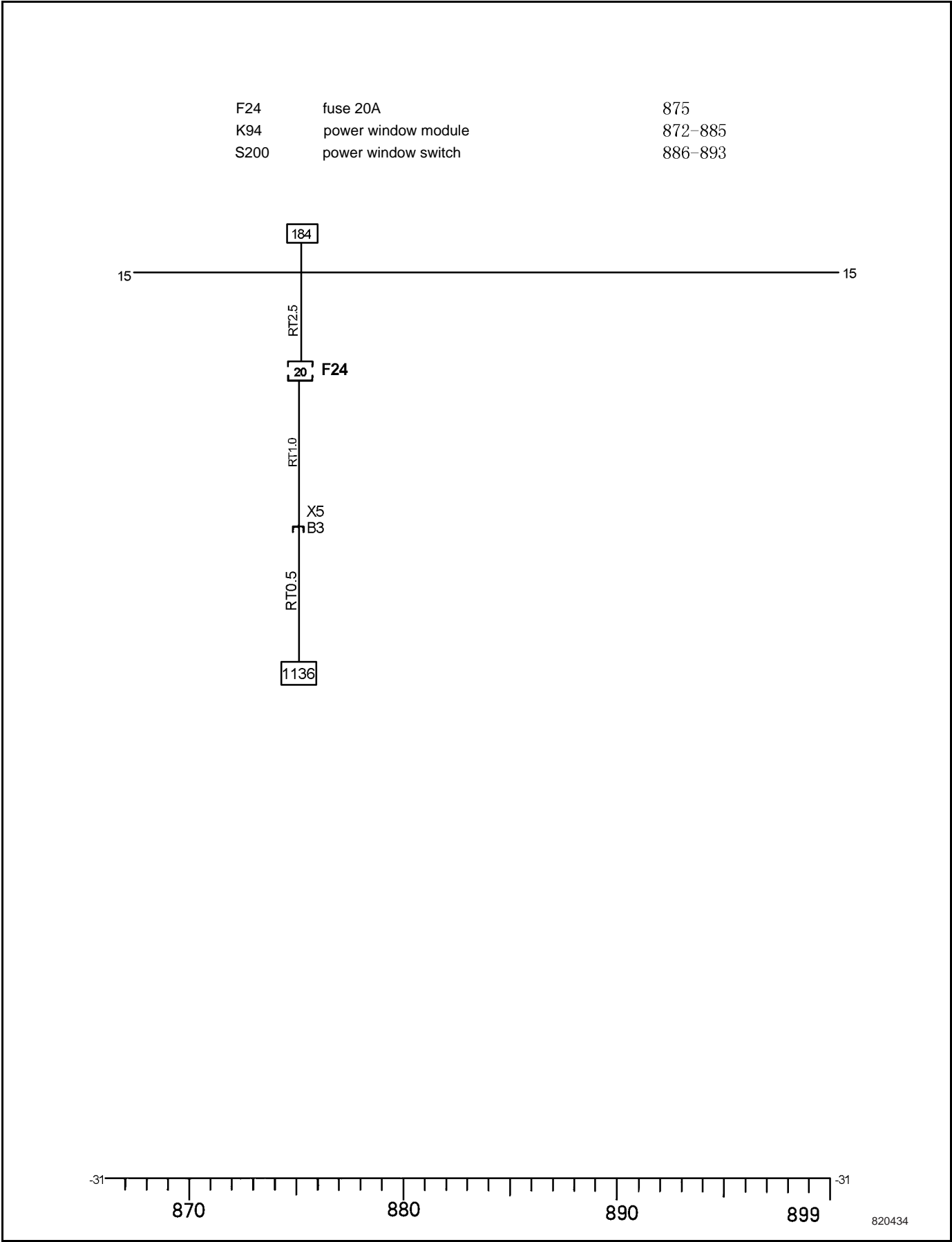


820323

8.20.2.21A Power Sunroof (7166SX AT) Wiring Diagram



8.20.2.21B Power Sunroof (7166SE) Wiring Diagram

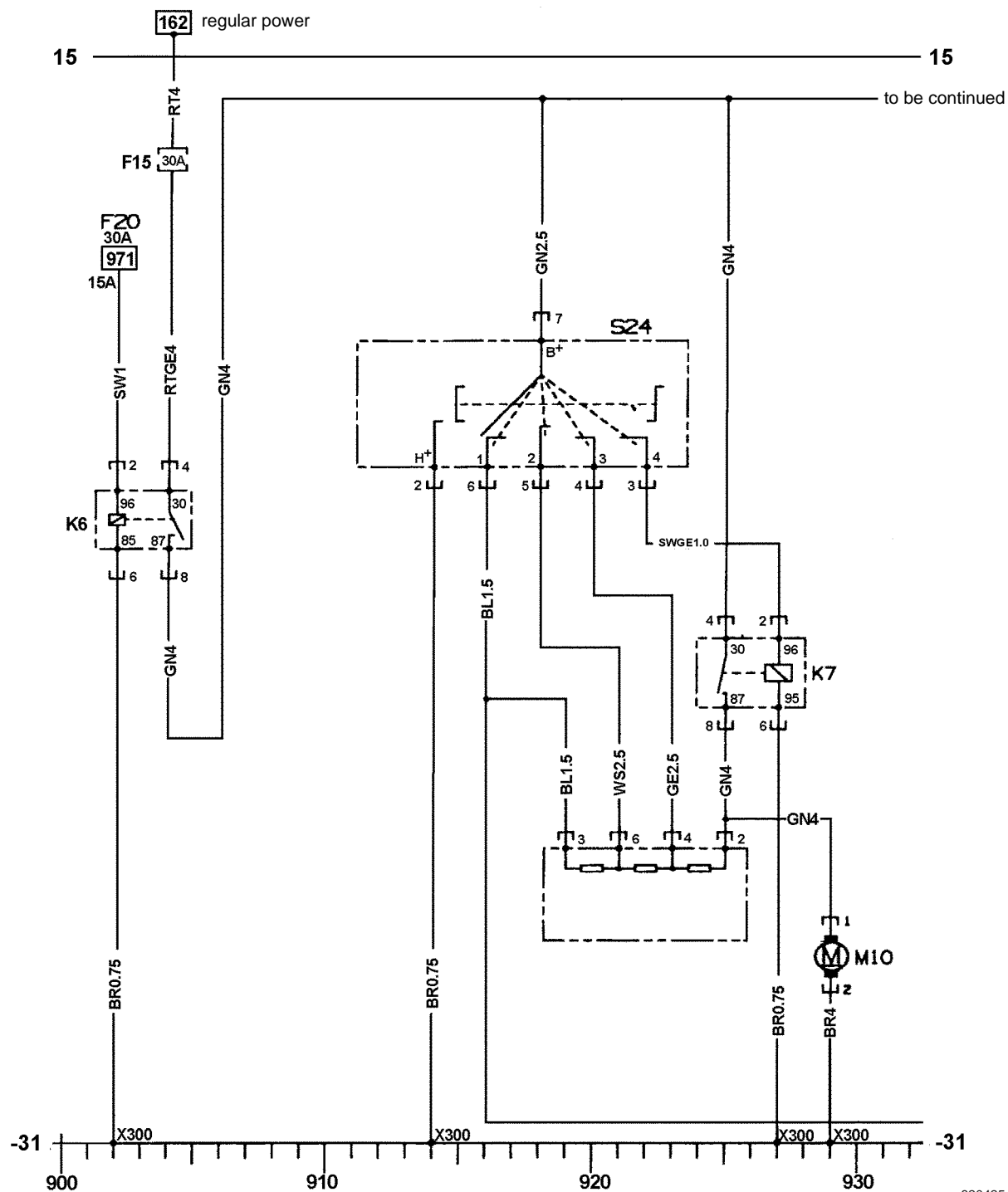


8.20.2.22 A/C System Wiring Diagram

(1)

F15 fuse-30A
 F20 fuse-30A
 K6 A/C load relief relay
 K7 A/C, fan relay
 M10 A/C- fan motor
 S24 fan shift switch

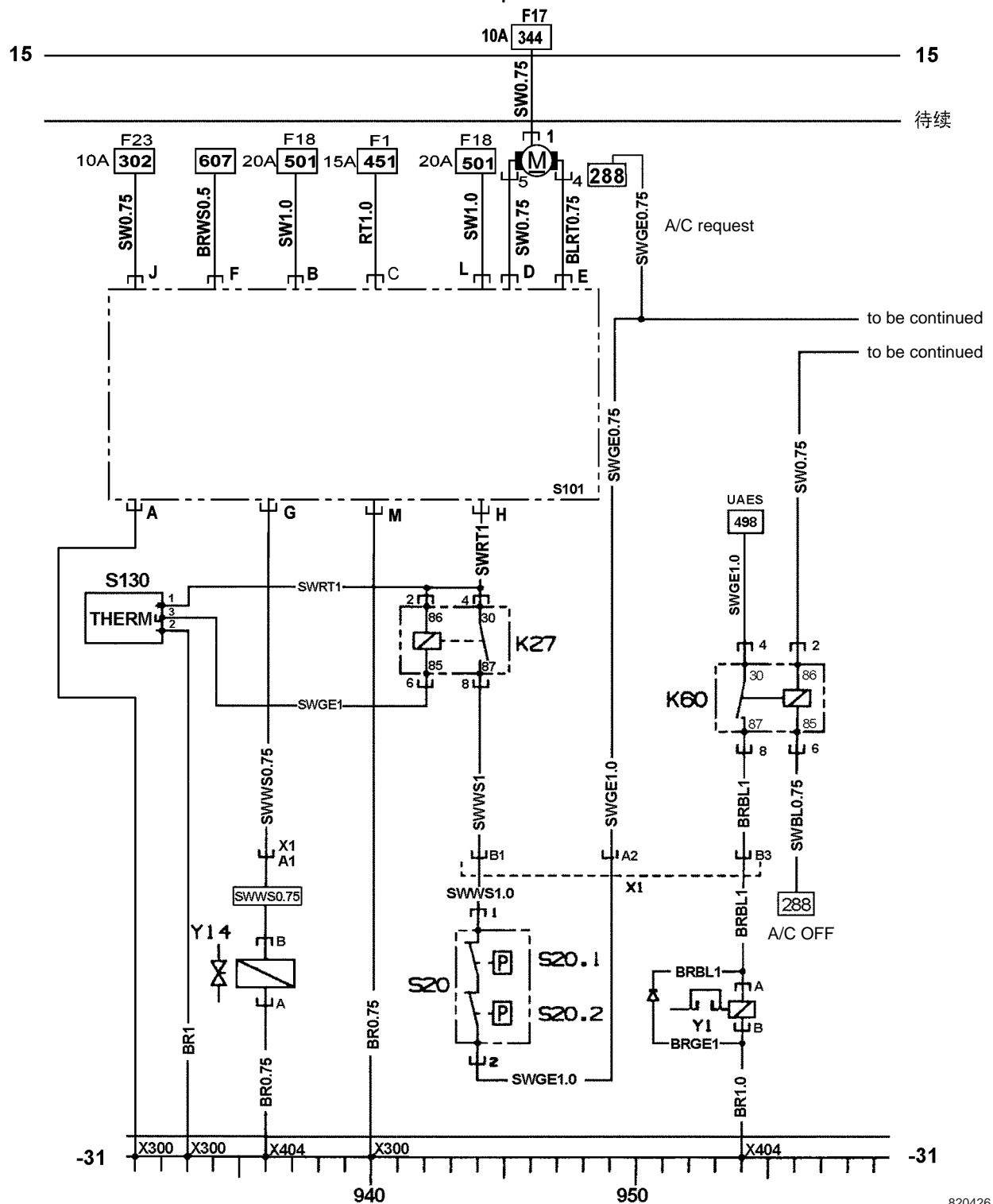
804
 902
 902 - 904
 925 - 927
 919 - 925
 912 - 922



(2)

S130 temperature controller switch 929 - 932
 K27 temperature controller relay 943
 K60 A/C compressor relay 948
 S20.1 pressure switch 940
 S20.2 pressure switch 940

S101 A/C switch 934 - 946
 Y1 A/C clutch- compressor 972
 Y14 coolant solenoid 932

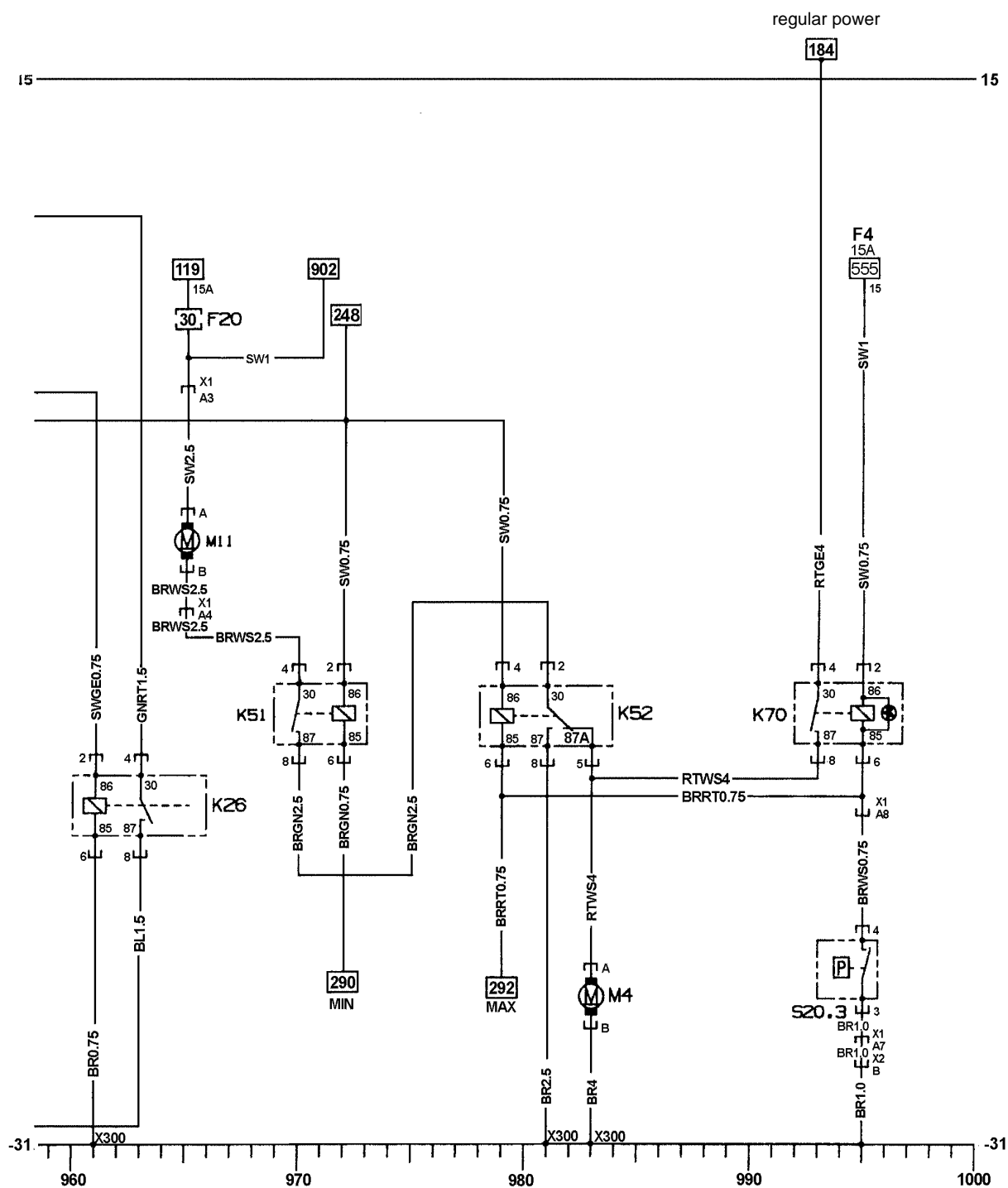


(3)

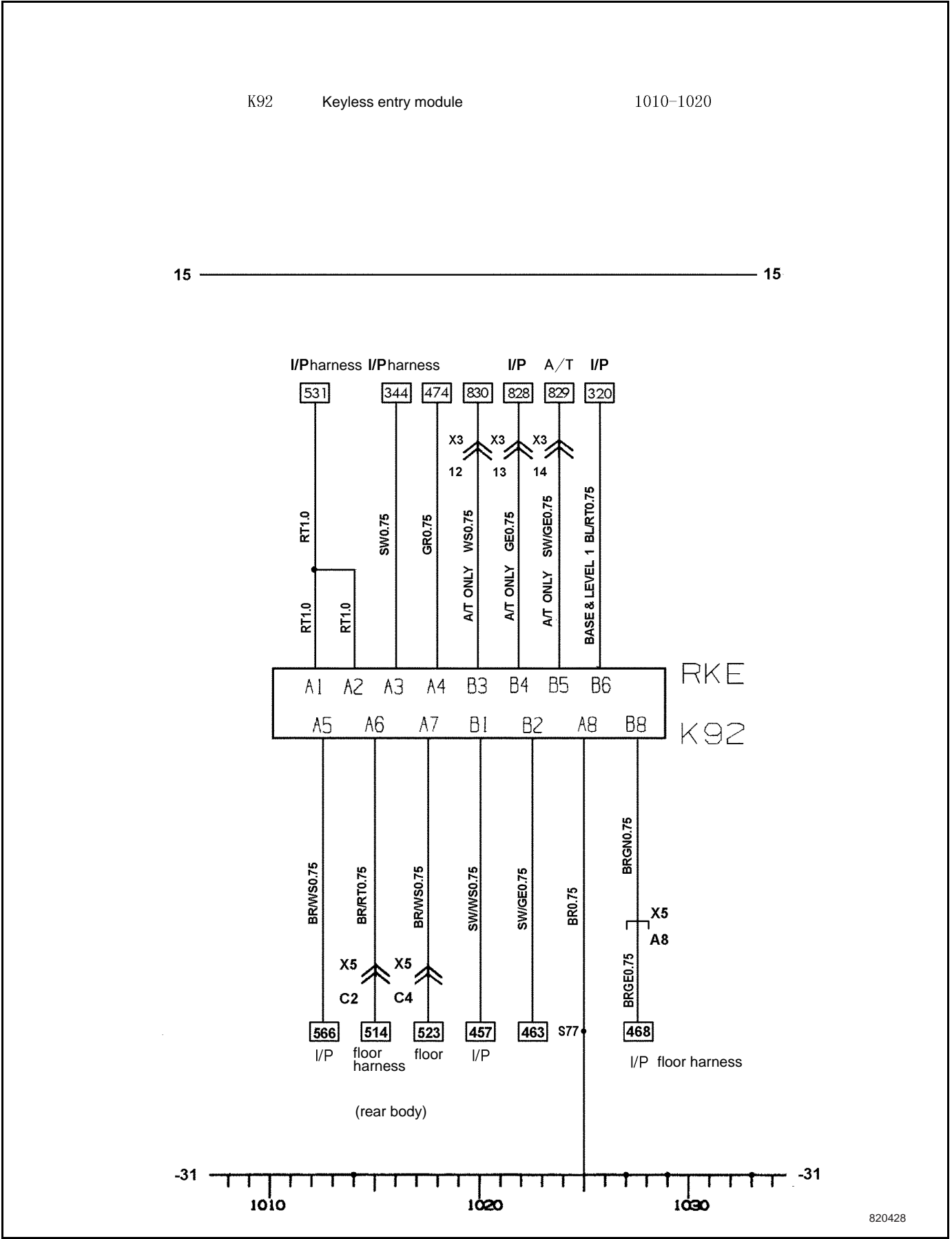
F17 Fuse 10A
 F20 Fuse 20A
 K26 relay-fan, radiator
 K51 relay-fan, radiator
 K52 relay-fan, radiator

995 K70 relay-fan, radiator
 965 M4 motor-fan, radiator
 962 M11 motor-fan, condenser
 957 S20.3 pressure switch
 970

989
 979
 962
 975



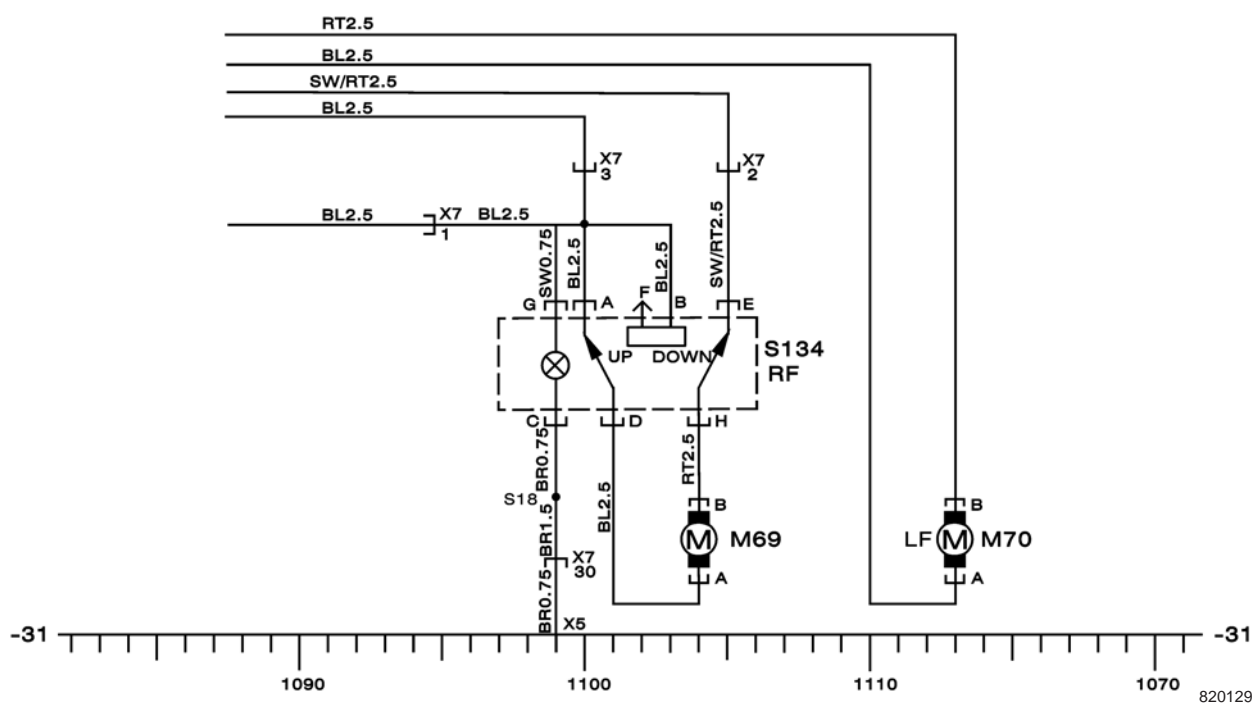
8.20.2.23 Central Lock System Wiring Diagram



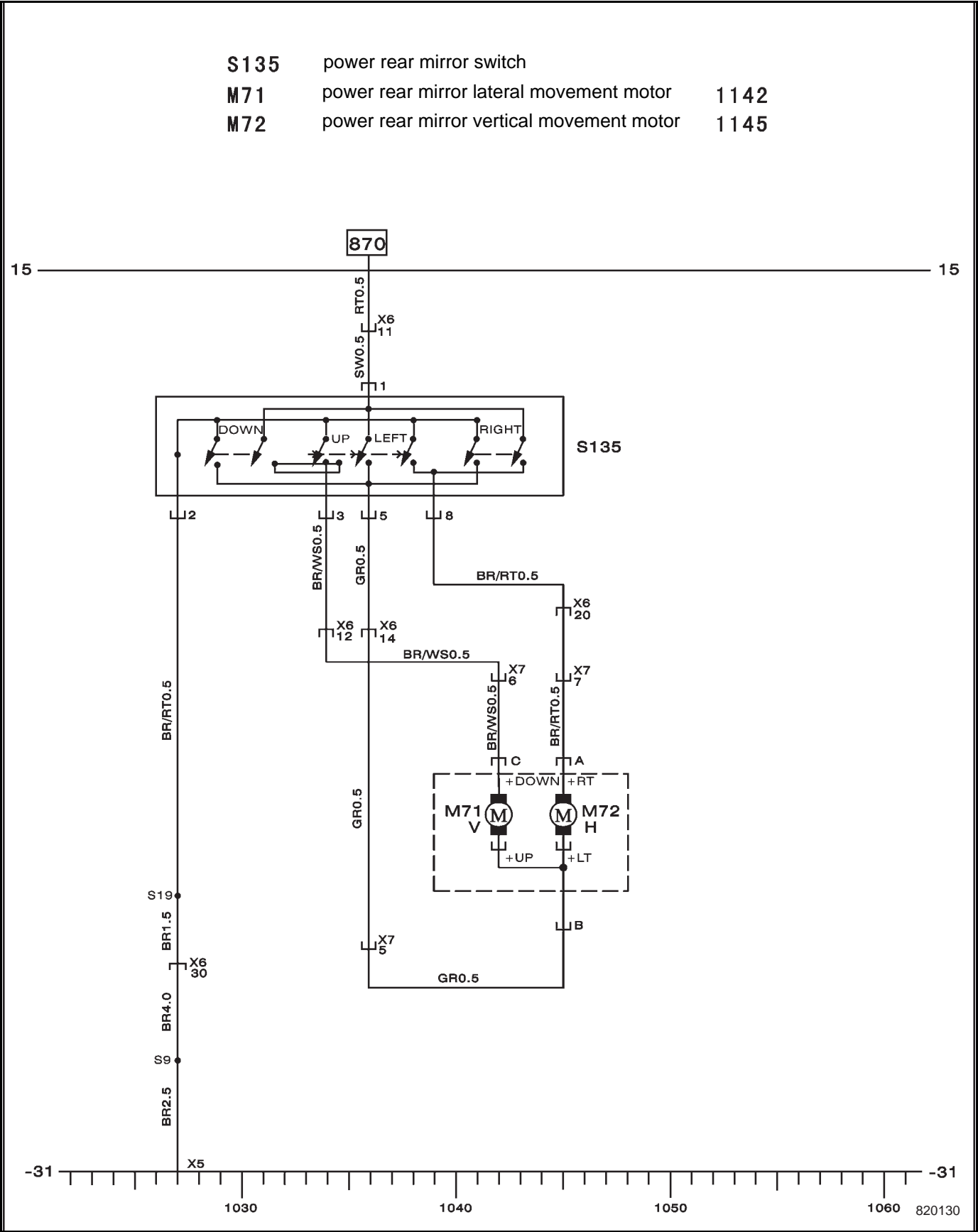
(2)

- | | | |
|-------------|--|------------------|
| S134 | front passenger side power window switch | 1101-1104 |
| M69 | front passenger side power window motor | 1104 |
| M70 | driver's side power window motor | 1113 |

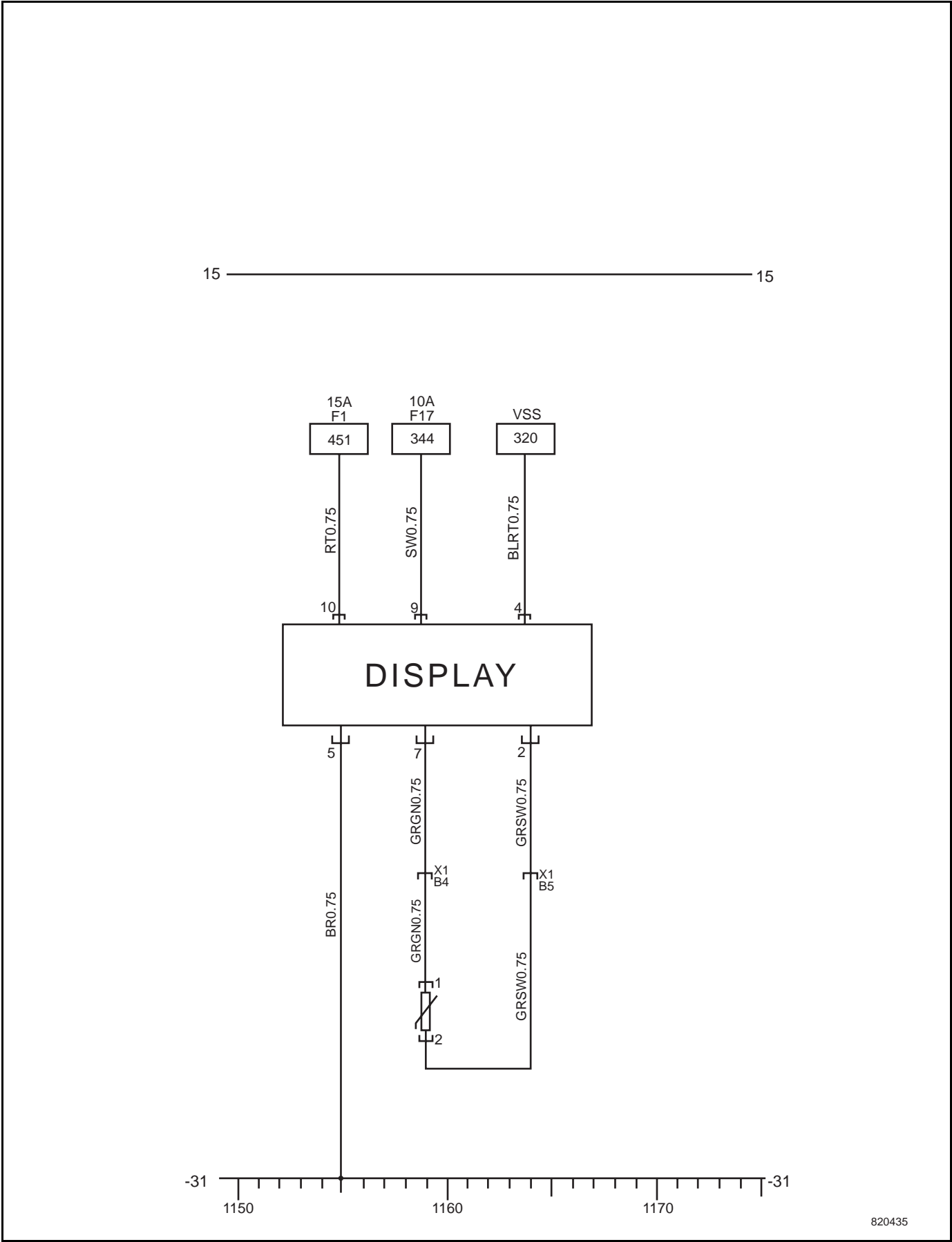
15 15



8.20.2.25 Power Mirror (If equipped) Wiring Diagram

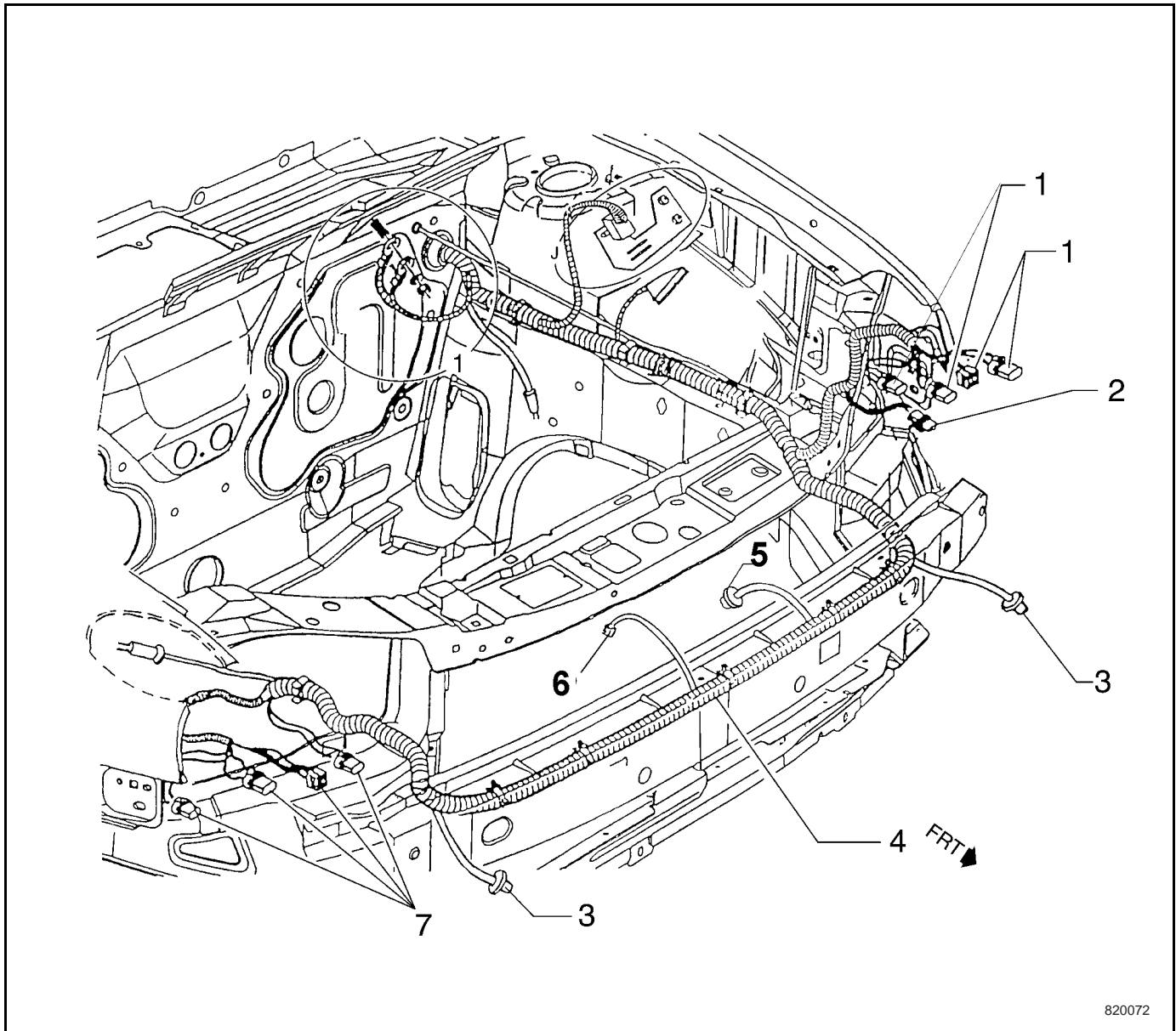


8.20.2.26 Clock Temperature Display Wiring Diagram



8.20.3 Component Locator

8.20.3.1 Front-Body Wiring Harness Routing in the Engine Compartment

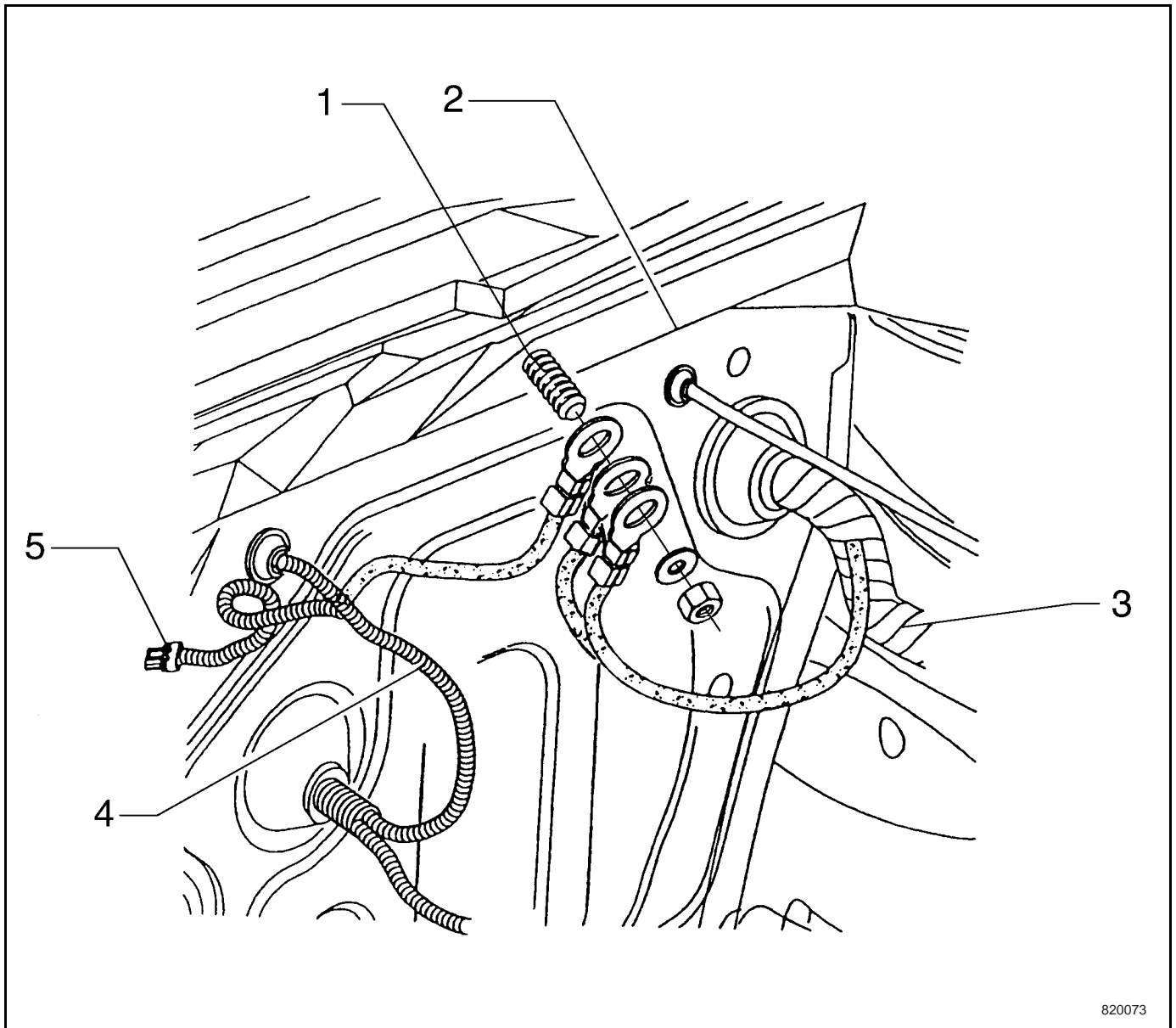


820072

Legend:

- | | |
|-------------------------------|-----------------------------------|
| (1) Headlamp connection (LH) | (5) A/C pressure switch connector |
| (2) Horn Connector | (6) Condenser fan motor connector |
| (3) Fog lamp connector | (7) Headlamp connector (RH) |
| (4) Front body wiring harness | |

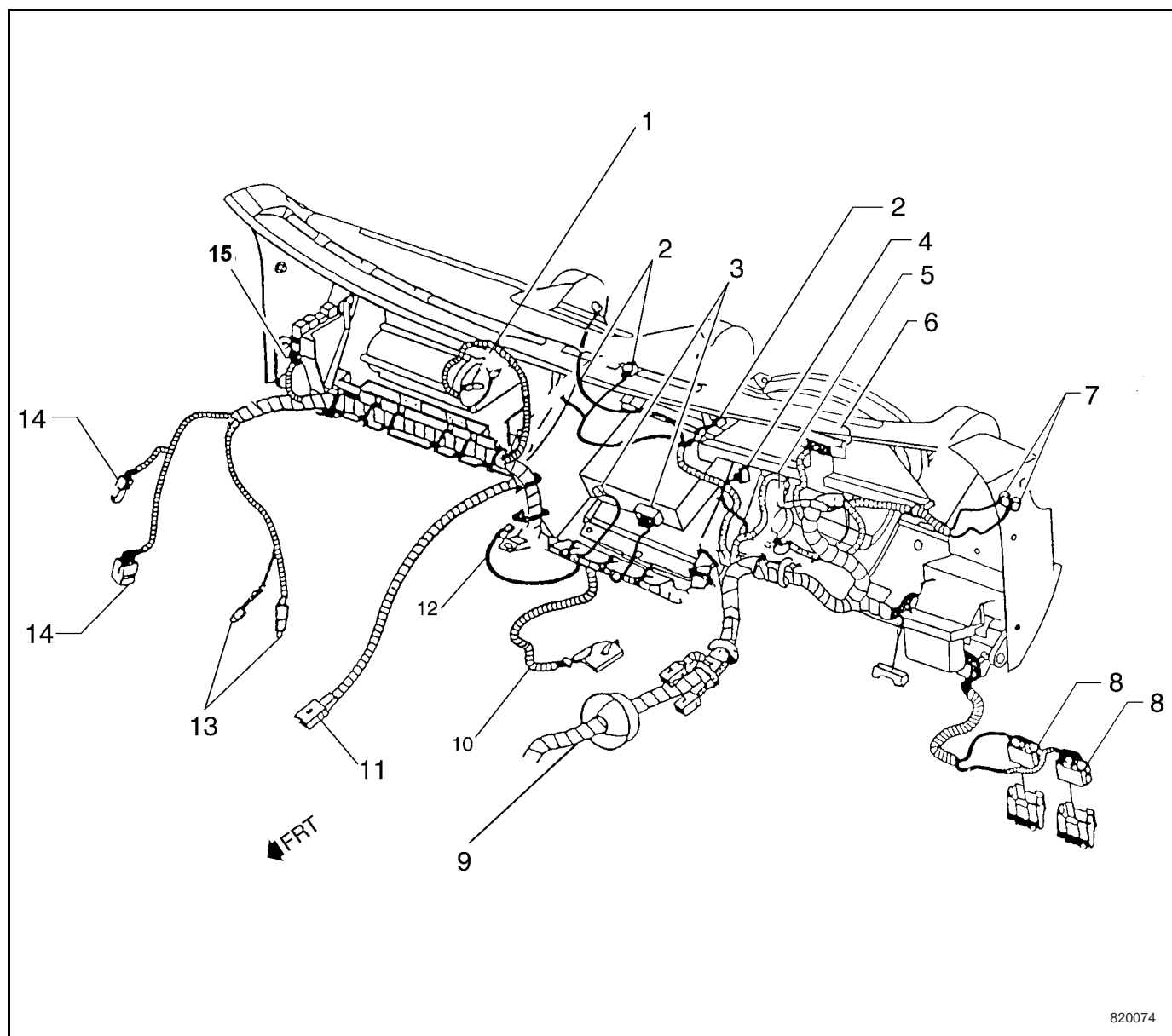
8.20.3.2 Grounding Point at the Firewall



Legend:

- | | |
|--------------------------------|-------------------------------------|
| (1) Grounding screw-dash panel | (4) I/P wiring harness |
| (2) Dash panel | (5) Brake fluid reservoir connector |
| (3) Front body wiring harness | |

8.20.3.3 I/P Wiring Harness Routing in the Back of the Instrument Panel

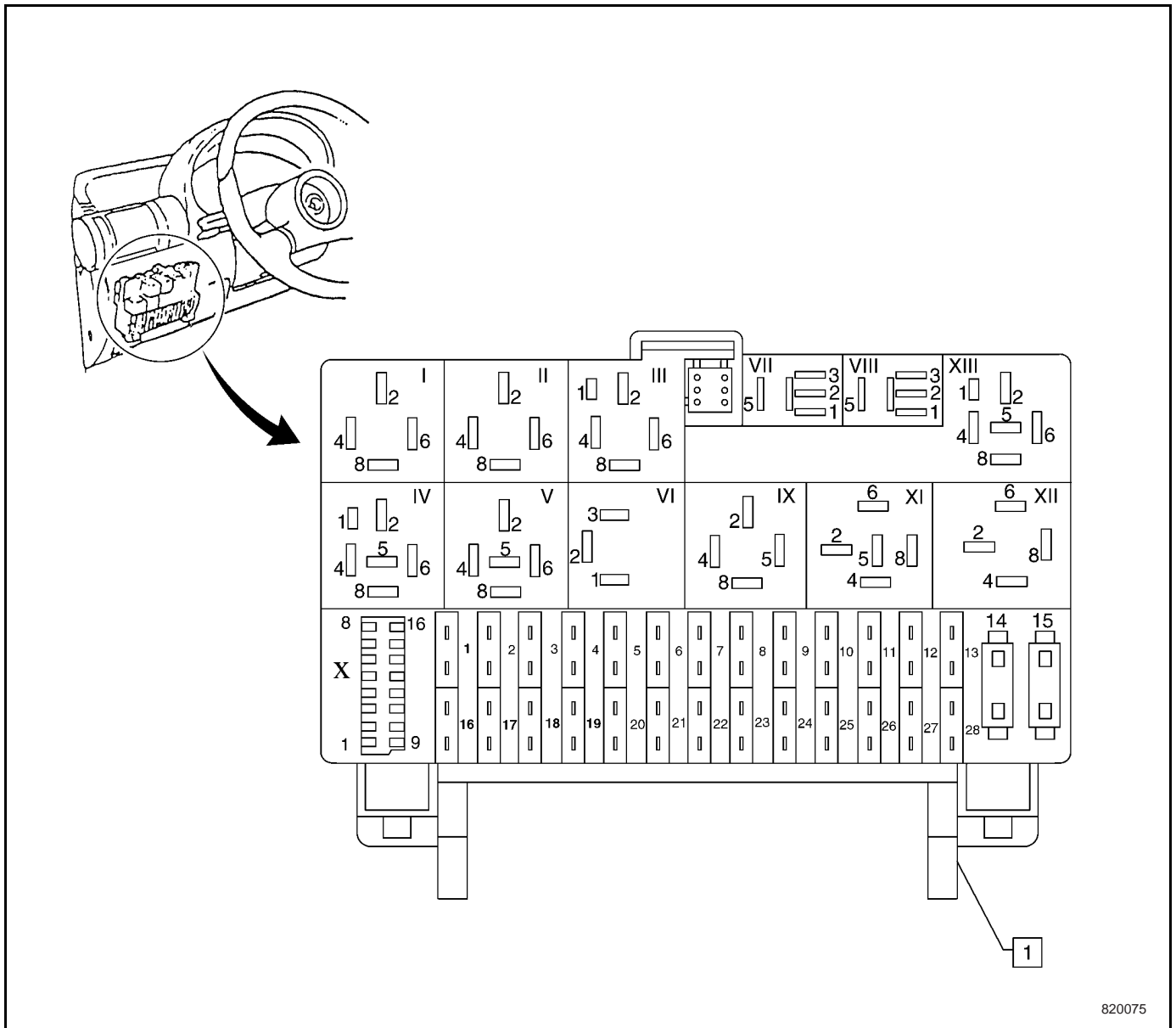


820074

Legend

- | | |
|---|---|
| (1) Connection to air bag (co-driver) | (9) I/P wiring harness |
| (2) Connection to interior ventilation control | (10) Connection to air bag control unit |
| (3) Connection to radio | (11) Connection to radiator fan |
| (4) Connection to air bag (driver) | (12) Connection to cigarette lighter |
| (5) Grounding point at I/P | (13) Connection to antenna |
| (6) Connection to instrument cluster | (14) Connection to engine wiring harness (X2) |
| (7) Connection to lamp switches | (15) Connection to relays |
| (8) Connection to front/rear body wiring harness (X1, X5) | |

8.20.3.4 Fuse & Relay Box Position and Description



820075

Legend:

(1) Fuse and relay box

Relay Arrangement

- | | |
|---|-------------------------------------|
| I. A/C condenser relay K27 (03447012) | VII. Rear fog lamp relay (90414477) |
| II. A/C condenser relay K60 (03447012) | IX. Fuel pump relay (90464759) |
| III. Rear window wiper motor relay (90240092) | X. Diagnostic connector |
| IV. Windshield wiper motor relay (9069864) | XI. Main relay (03447012) |
| V. Rear window defogger relay (03447012) | XII. Empty |
| VI. Turn signal/hazard lamp relay (90055543) | XIII. Horn relay (03447012) |
| VII. Fog lamp relay (90229206) | |

Fuse Description

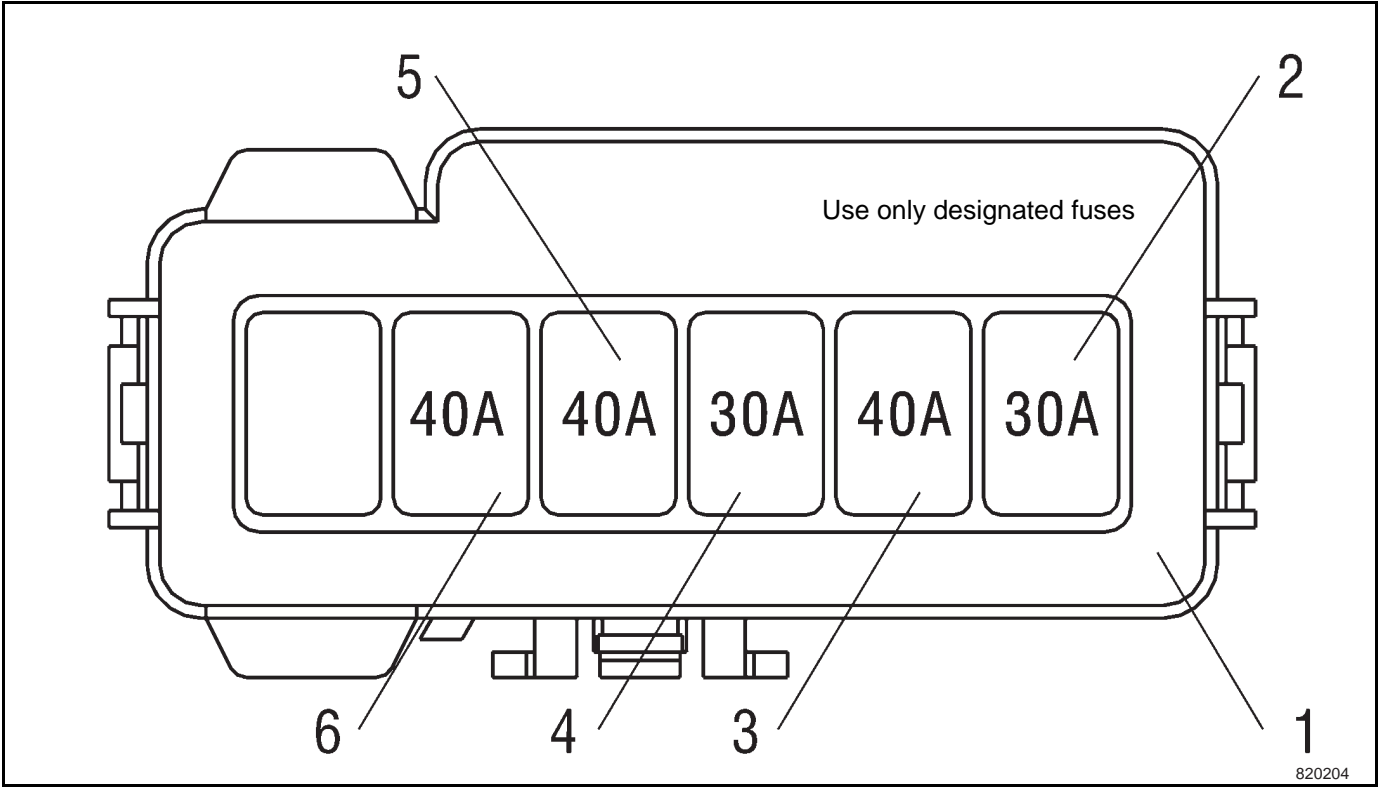
	Slow-blow Fuse No.	AMPs	Fuse No.	AMPs	Protection Circuit
30	F34	40 A	F1	15 A	Hazard warning flasher, hazard warning indicator, reading lamp front & rear passenger side, DIC
30	F31	40 A	F2	10 A	TCM module, ECM module
30	F31	40 A	F3	25 A	Rear window defogger
30	F32	30 A	F4	15 A	Radio, cooling fan control relay coil, horn
15	F33	40 A	F5	10 A	Air bag
30	F30	30 A	F6	10 A	Rear fog lamp, left and right side; rear fog lamp indicator
			F7	15 A	ECM module
30	F30	30 A	F8	10 A	Parking lamp, left front; parking lamp, left rear
30	F30	30 A	F9	20 A	Front fog lamp, left and right; rear fog lamp control relay coil; front fog lamp switch indicator
30	F30	30 A	F10	10 A	High beam, left side
IG SW WPIn	F33	40 A	F11	10 A	Vehicle audio
30	F30	30 A	F12	10 A	Low beam, left side
30	F32	30 A	F13	20 A	Central lock control, remote control module
30 A	F34	30 A	F14	30 A	Four power windows
30	F32	30 A	F15	Max. 30 A	Blower motor, blower motor high speed control relay coil, AC temperature protection circuit relay coil, AC clutch, radiator fan relay
15	F33	40 A	F16	20 A	Wiper and Wash System, Sunroof module
15	F33	40 A	F17	10 A	Cluster indicator, Headlamp lighting, Rear defogger control relay coil, AC control panel, Remote control, DIC, TCM module
15	F33	40 A	F18	20 A	Backup lamp, left and right; Cigarette lighter; TCM reverse signal input, Central lock control
15	F33	40 A	F19	10 A	ECM module, PASS-key module
15	F33	40 A	F20	30 A	AC switch control relay coil; Radiator fan; Condenser fan; Radiator fan serial operation or radiator fan high speed
15	F33	40 A	F21	15 A	Brake lamp; High center brake lamp; ABS signal input; Turn signal lamp indicator; Turn signal lamp, left side or right side; TCM brake signal input
15	F33	40 A	F22	10 A	ABS
30	F30	30 A	F23	10 A	Parking lamp, front and rear right; License lamp; Cluster light source; Fog lamp switch tell-tale, front and rear; Front fog lamp control relay coil; Radio panel light source
15	F34	40 A	F24	20 A	Sunroof motor, Window lifter switch indicator
30	F30	30 A	F25	10 A	High beam, right side; High beam indicator
30	F31	40 A	F26	25 A	Main relay, ECM, Fuel pump
30	F30	30 A	F27	10 A	Low beam, right side

Fuse Description (Cont' d)

30	F34	40 A	F28	30 A	Window lifter motor
----	-----	------	-----	------	---------------------

8.20.3.5 Slow-blow Fuse Box Component
View

I Only power window



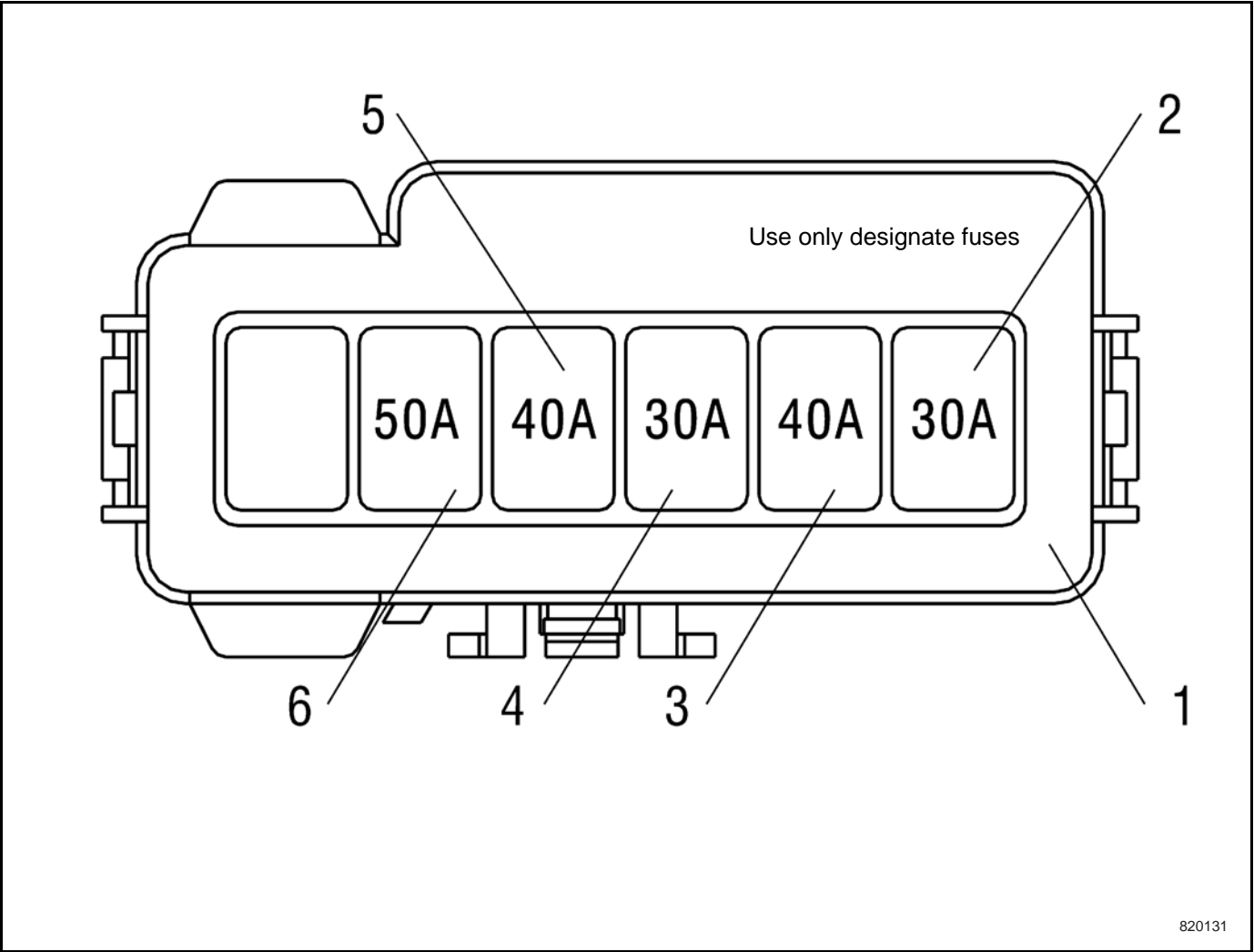
Legend:

(1) Slow-blow fuse box	(4) Slow-blow fuse F32 Fan fuse
(2) Slow-blow fuse F30 Lighting fuse	(5) Slow-blow fuse F33 Ignition fuse
(3) Slow-blow fuse F31 Engine system fuse	(6) Slow-blow fuse F34 Radiator fan fuse

Slow-blow fuse

Current	Slow-blow fuse box	AMPs	Protection Circuit
30	F30	30 A	See Fuse Description
30	F31	40 A	
30	F32	30 A	
30	F33	40 A	
30	F34	40 A	

II Four windows are all power windows



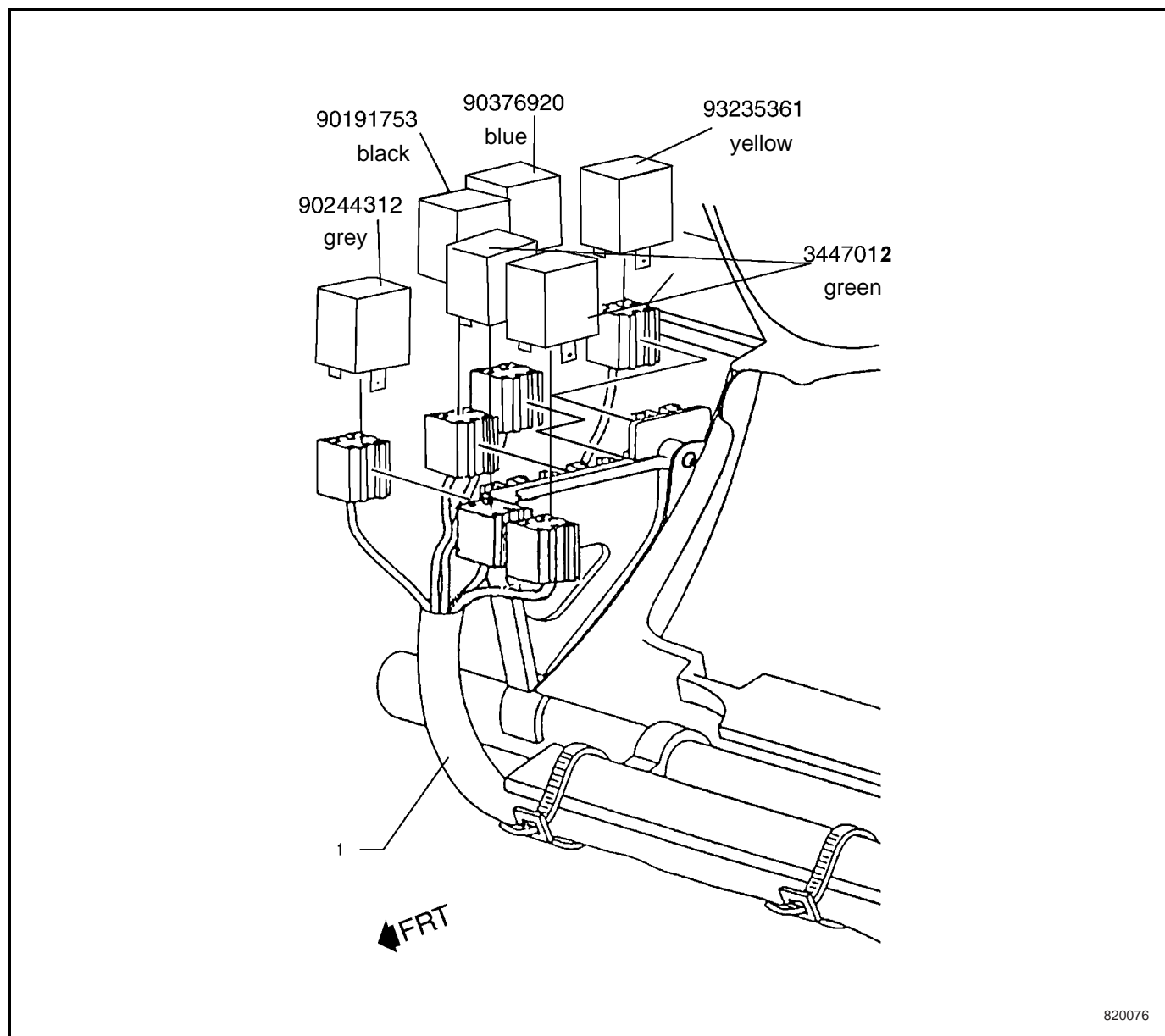
Legend:

- | | | | | | |
|-----|--------------------|--------------------|--------------------|--------------------|-------------------|
| (1) | Slow-blow fuse box | (4) | Slow-blow fuse F32 | Fan fuse | |
| (2) | Slow-blow fuse F30 | Lighting fuse | (5) | Slow-blow fuse F33 | Ignition fuse |
| (3) | Slow-blow fuse F31 | Engine system fuse | (6) | Slow-blow fuse F34 | Radiator fan fuse |

Slow-blow fuse

Current	Slow-blow fuse box	AMPs	Protection Circuit
30	F30	30 A	See Fuse Description
30	F31	40 A	
30	F32	30 A	
30	F33	40 A	
30	F34	50 A	

8.20.3.6 A/C System Relay Component View (Location) at the Right Side of I/P



820076

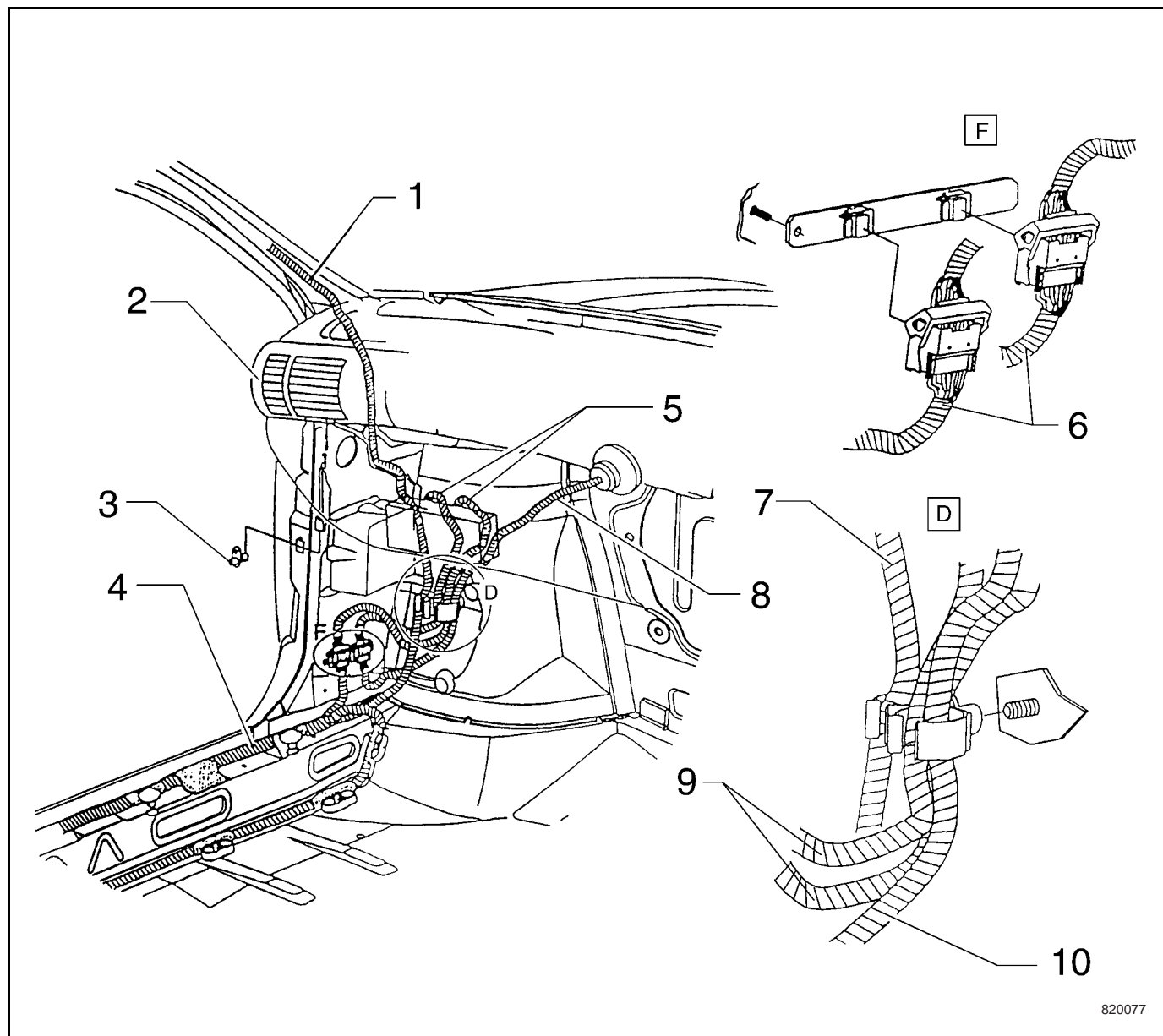
Legend:

(1) I/P wiring harness

90191753 K52 Relay-Fan, Radiator
 90244312 K26 Relay-Fan, Radiator
 90376920 K6 Relay-Compressor, A/C

93235361 K70 Relay-Fan, Radiator
 3447012 K7 Relay-Fan, A/C
 3447012 K51 Relay-Fan, Radiator

8.20.3.7 The I/P Rear Body and Front Body Wiring Harness Routing in the Driver Compartment

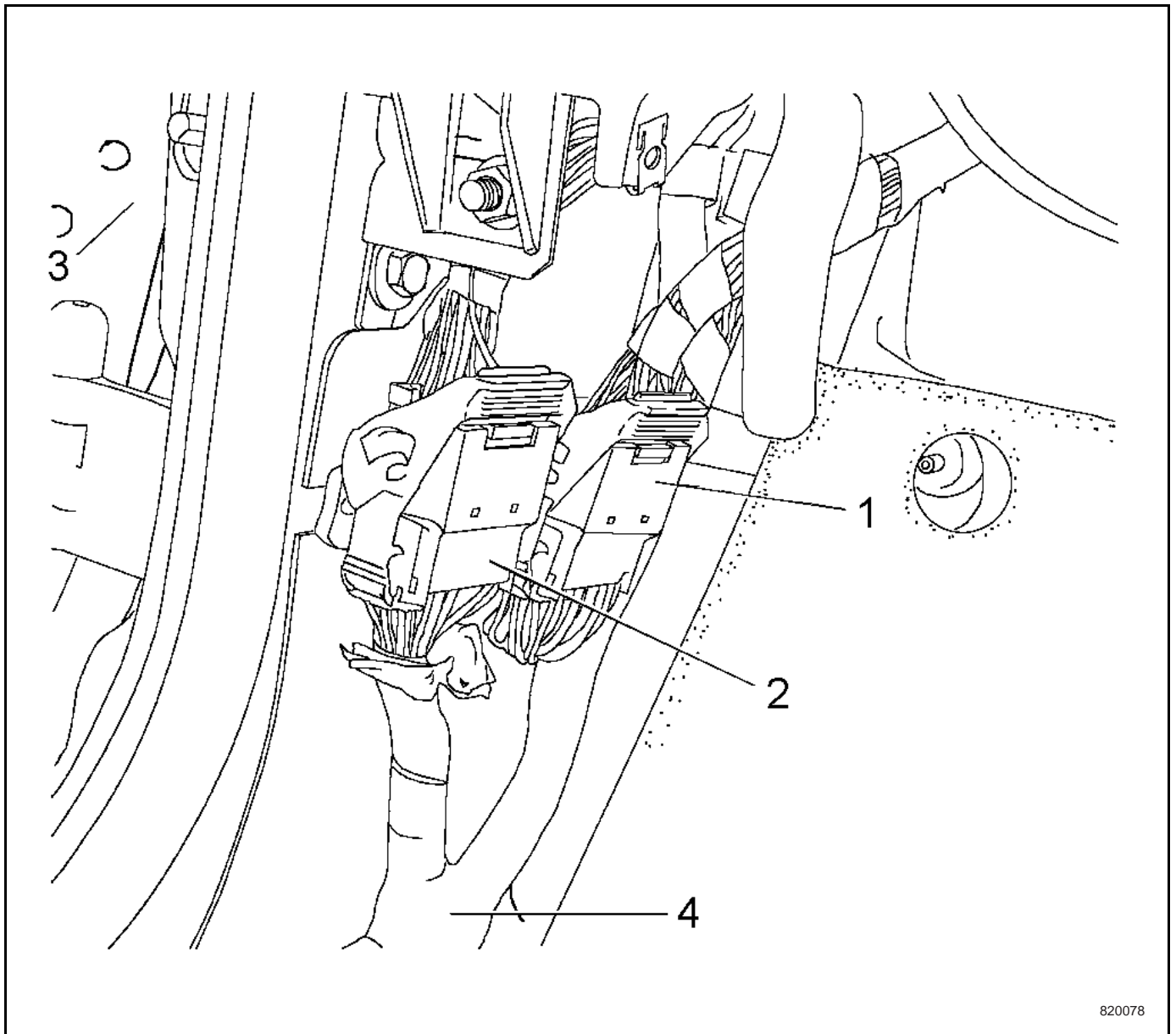


820077

Legend:

- | | |
|-------------------------------|--|
| (1) Rear body wiring harness | (6) Front/rear body wiring harness connection (X1, X5) |
| (2) Instrument Panel | (7) Rear body wiring harness |
| (3) Front door contact switch | (8) Front body wiring harness |
| (4) Rear body wiring harness | (9) I/P wiring harness |
| (5) I/P wiring harness | (10) Front body line |

8.20.3.8 Inline Connection X1, X5 Information

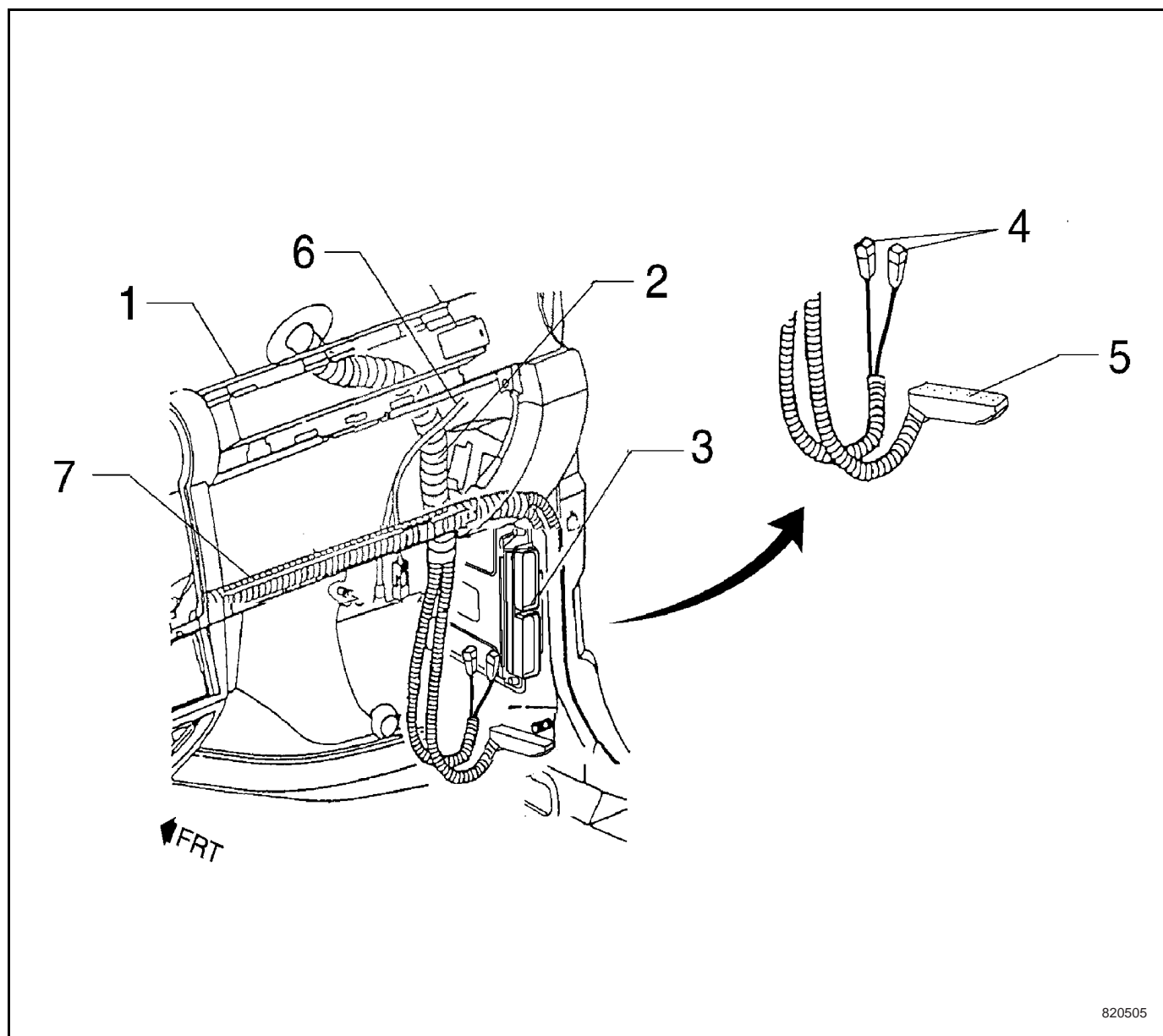


820078

Legend:

- | | |
|--|------------------------------|
| (1) Inline Connection X1 between the I/P and Front Body Wiring Harness | (3) Left Front Door |
| (2) Inline Connection X5 between the I/P and Rear Body Wiring Harness | (4) Rear body wiring harness |

8.20.3.9 The I/P and Engine Wiring Harness Routing in the Co-Driver Compartment

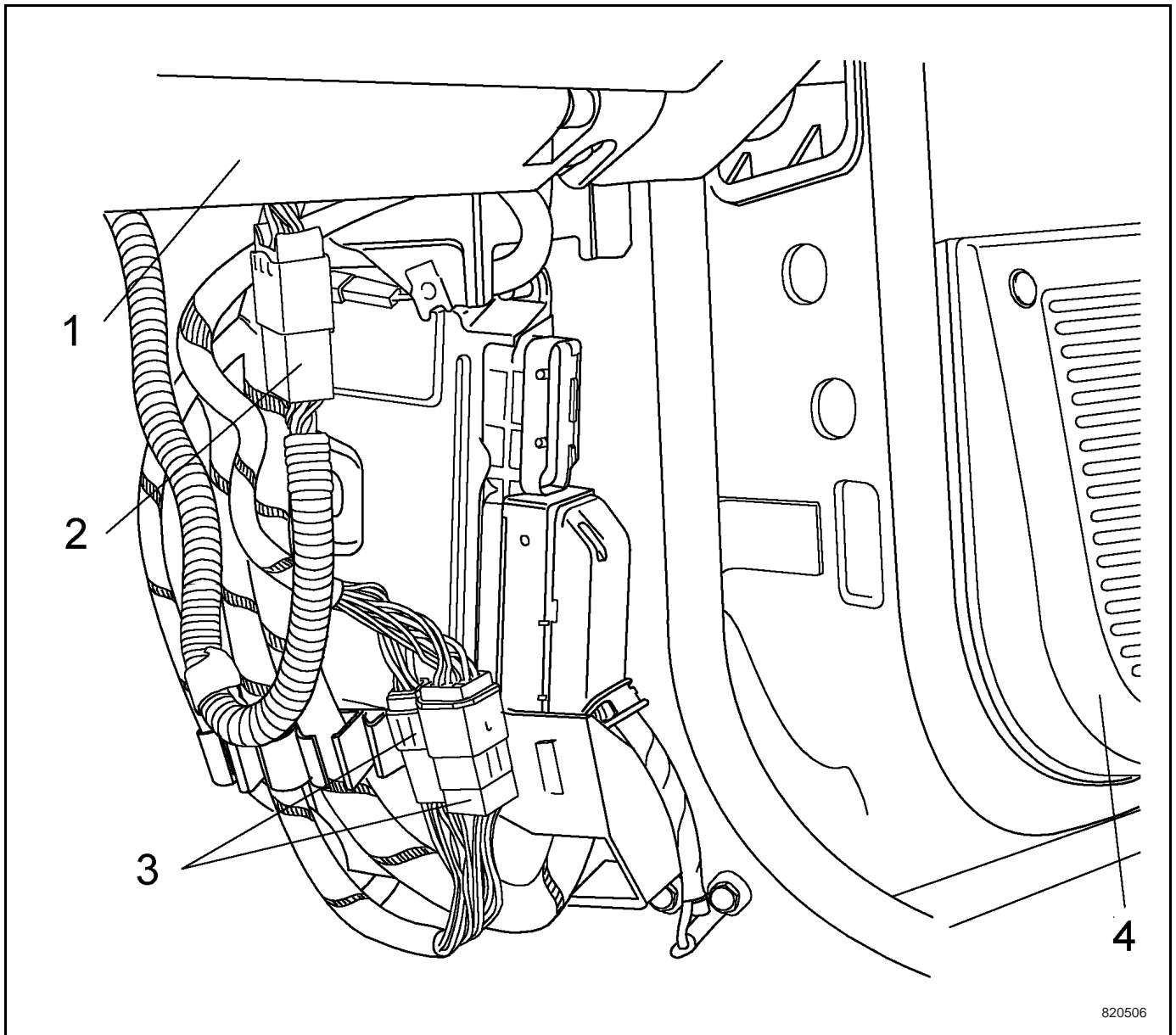


820505

Legend:

- | | |
|---|---|
| (1) Instrument Panel | (5) Engine wiring harness connection to ECM |
| (2) Engine wiring harness | (6) Antenna amplifier cable |
| (3) Engine Control Module (ECM) | (7) I/P wiring harness |
| (4) Engine wiring harness connection to I/P wiring harness (X2) | |

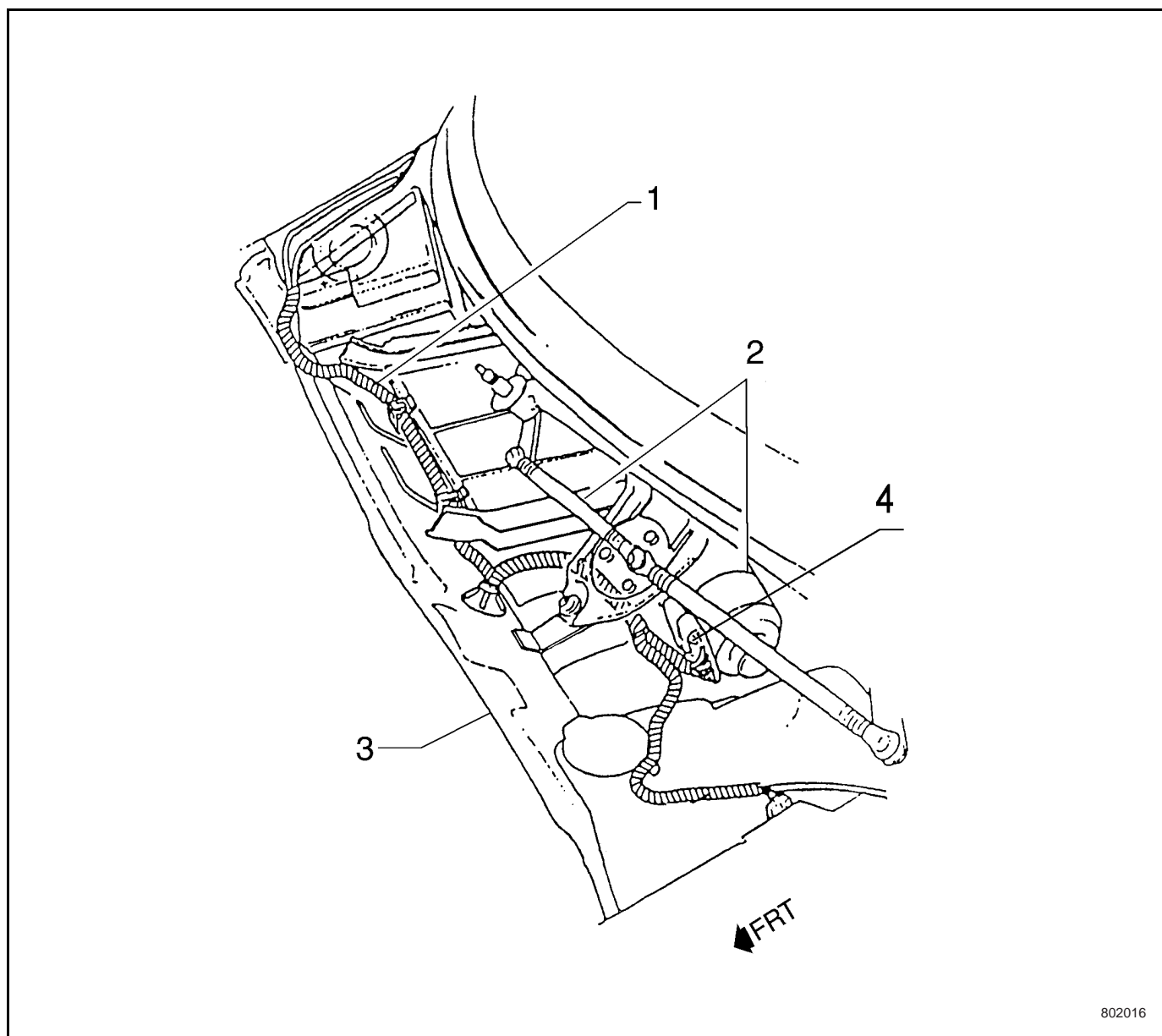
8.20.3.10 Inline Connection X2, X3 Information



Legend:

- | | |
|---|--|
| (1) Instrument Panel (Right side) | (3) Inline Connection X2 between the I/P and the Engine wiring harness |
| (2) Inline Connection X3 between the I/P and the A/T wiring harness | (4) Right Front Door |

8.20.3.11 Wiring Harness Routing in the Dash Panel



802016

Legend:

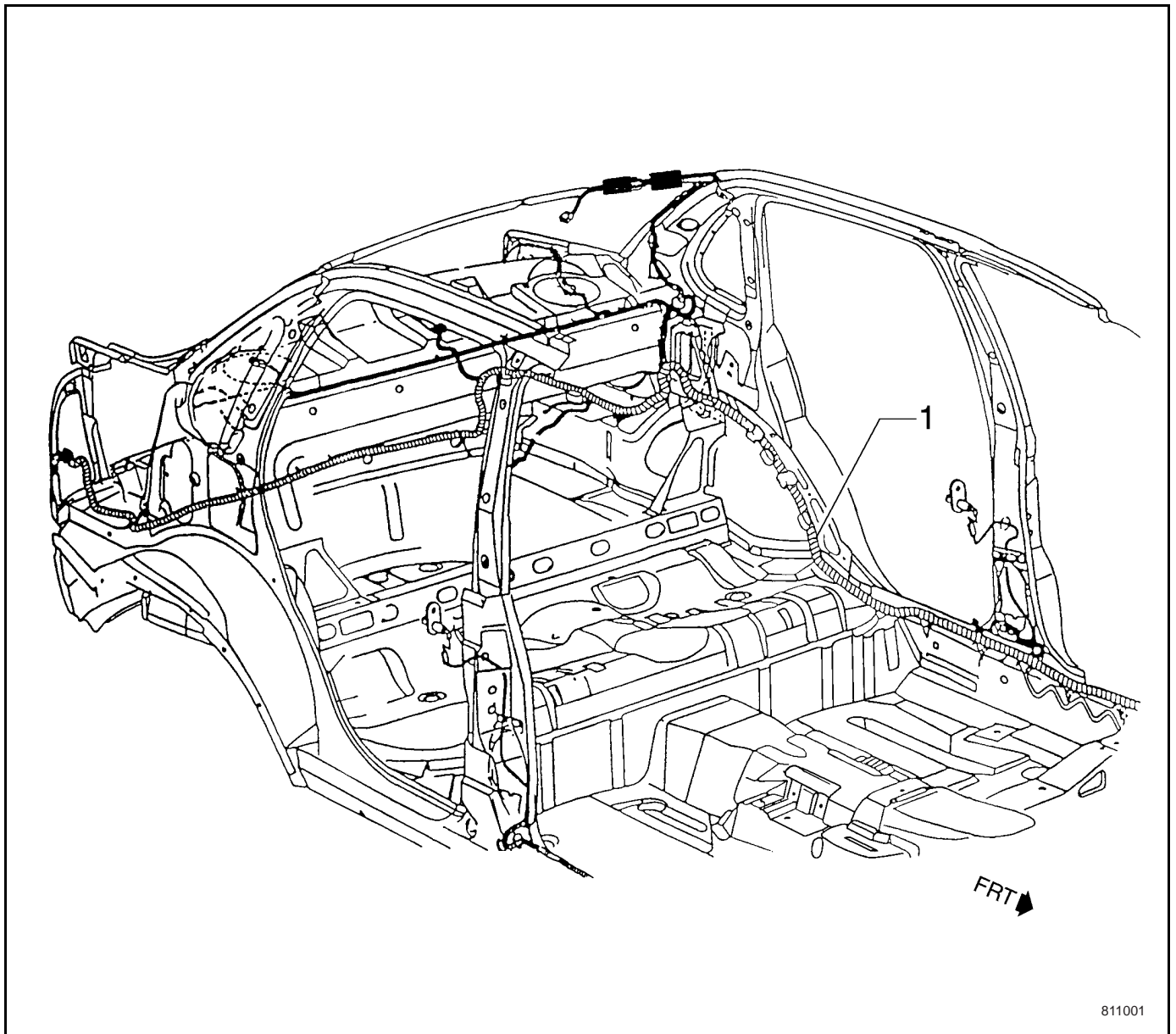
(1) I/P wiring harness

(2) Windshield wiper assembly

(3) Firewall

(4) I/P wiring harness

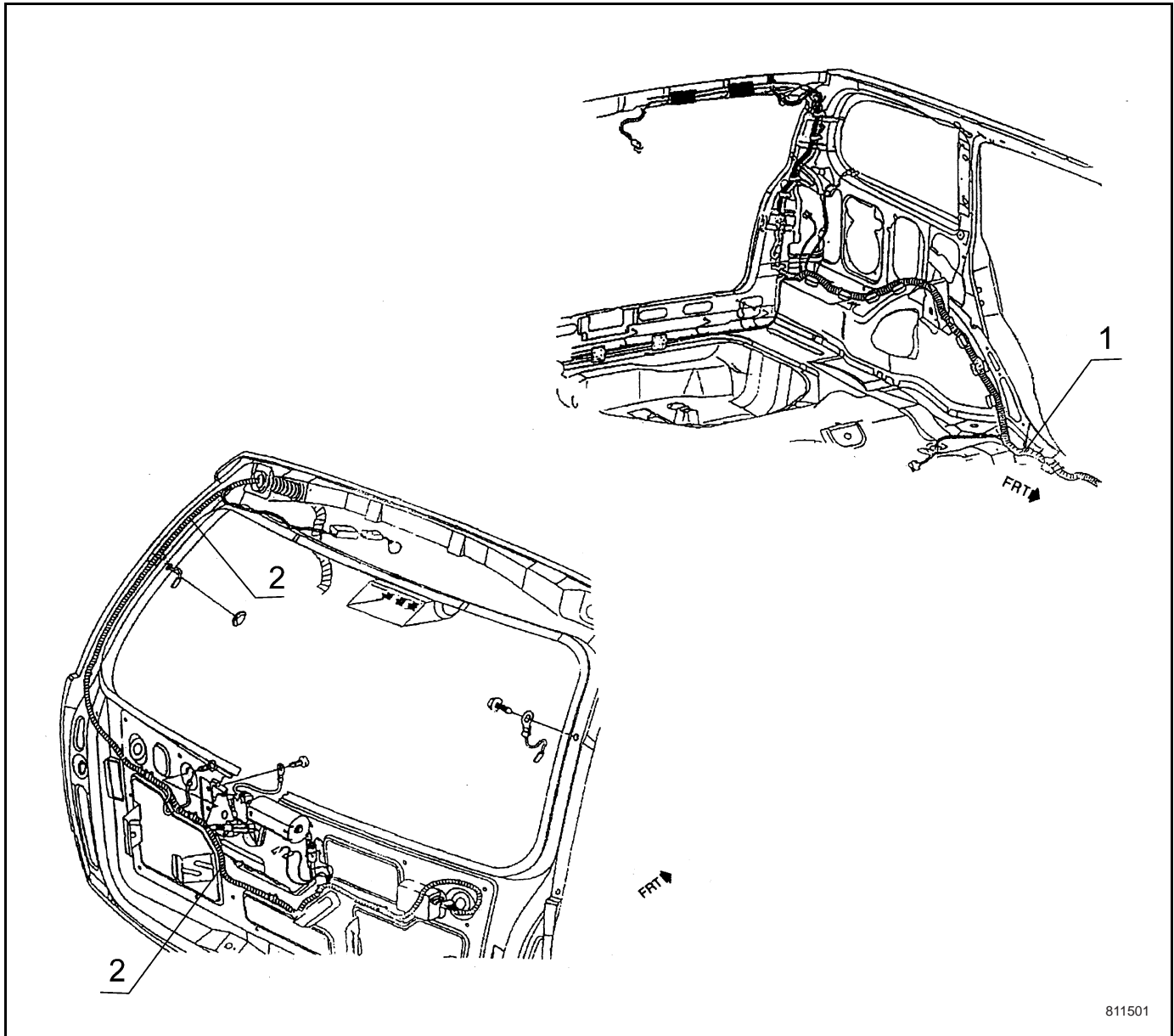
8.20.3.12A Rear Body Wiring Harness Routing



Legend:

- (1) Rear body wiring harness

8.20.3.12B Rear Body Wiring Harness Routing

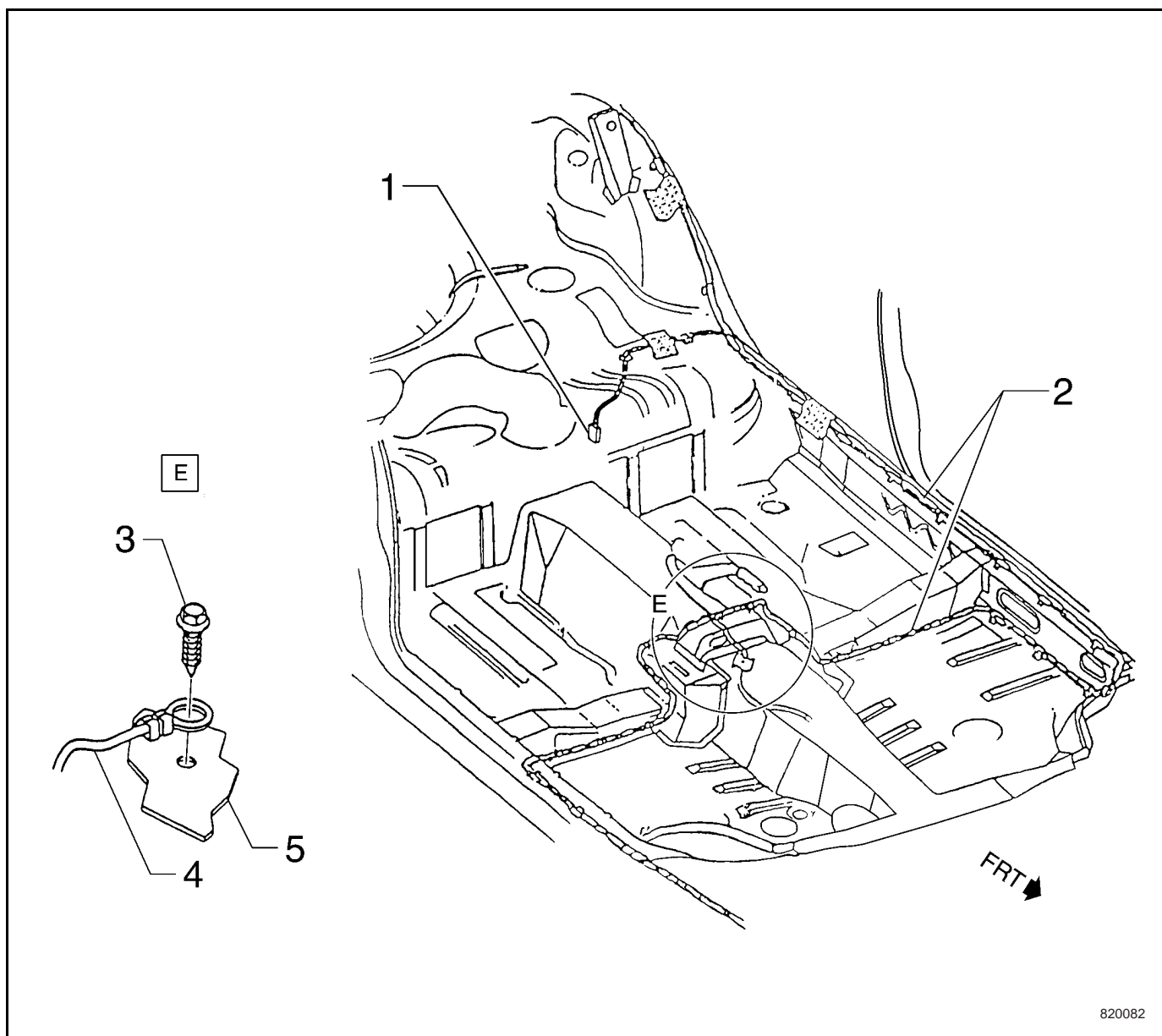


Legend:

(1) Harness ASM - Body RR WRG

(2) Harness ASM - Rear L/Gate WRG

8.20.3.13 Rear Body Wiring Harness Routing and Grounding Point at the Floor Panel

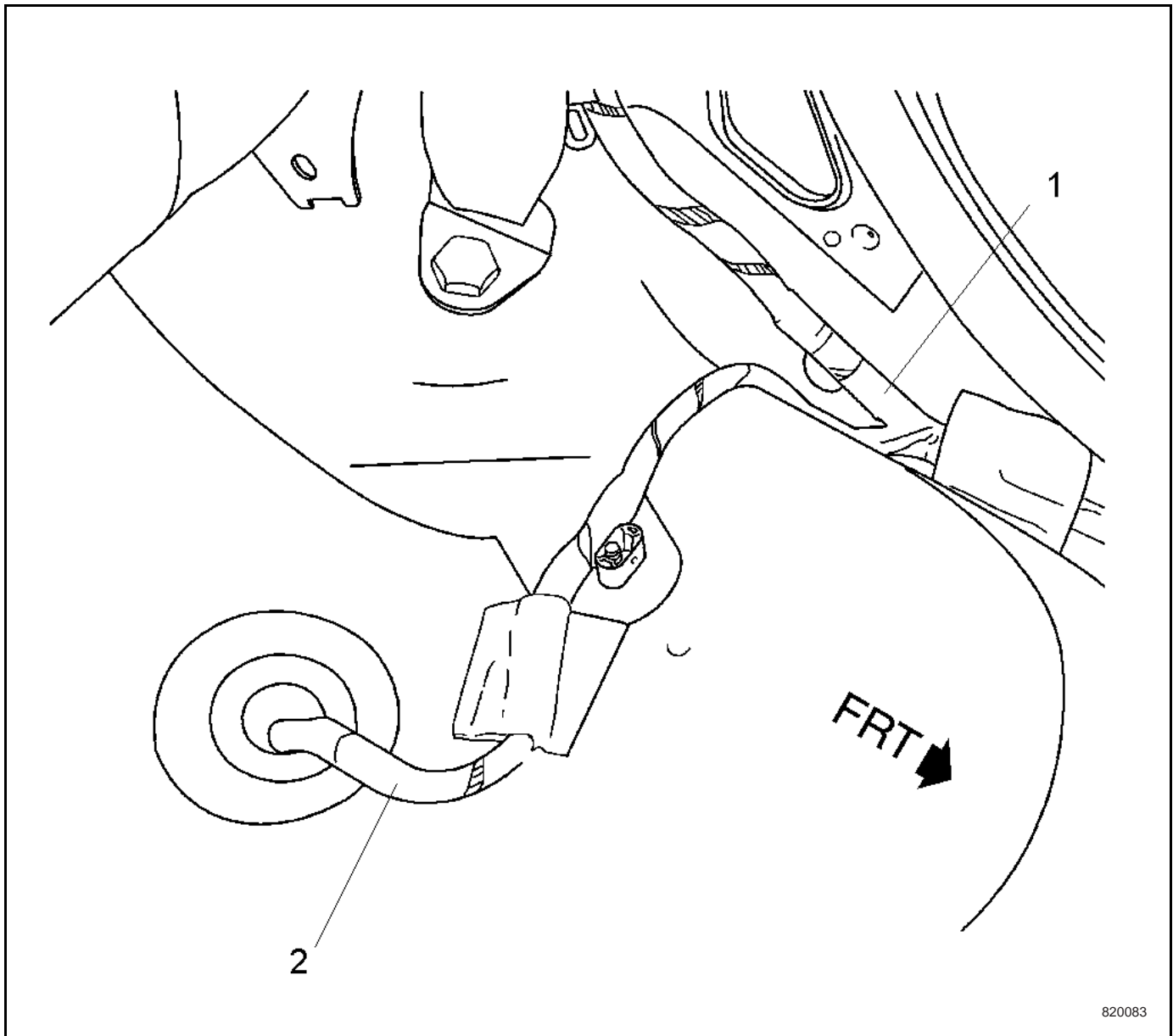


820082

Legend:

- | | |
|---|--|
| (1) Rear body wiring harness to fuel tank | (4) Rear body wiring harness (ground wire) |
| (2) Rear body wiring harness | (5) Floor assembly |
| (3) Grounding screw | |

8.20.3.14 Rear Body Wiring Harness - Fuel Tank



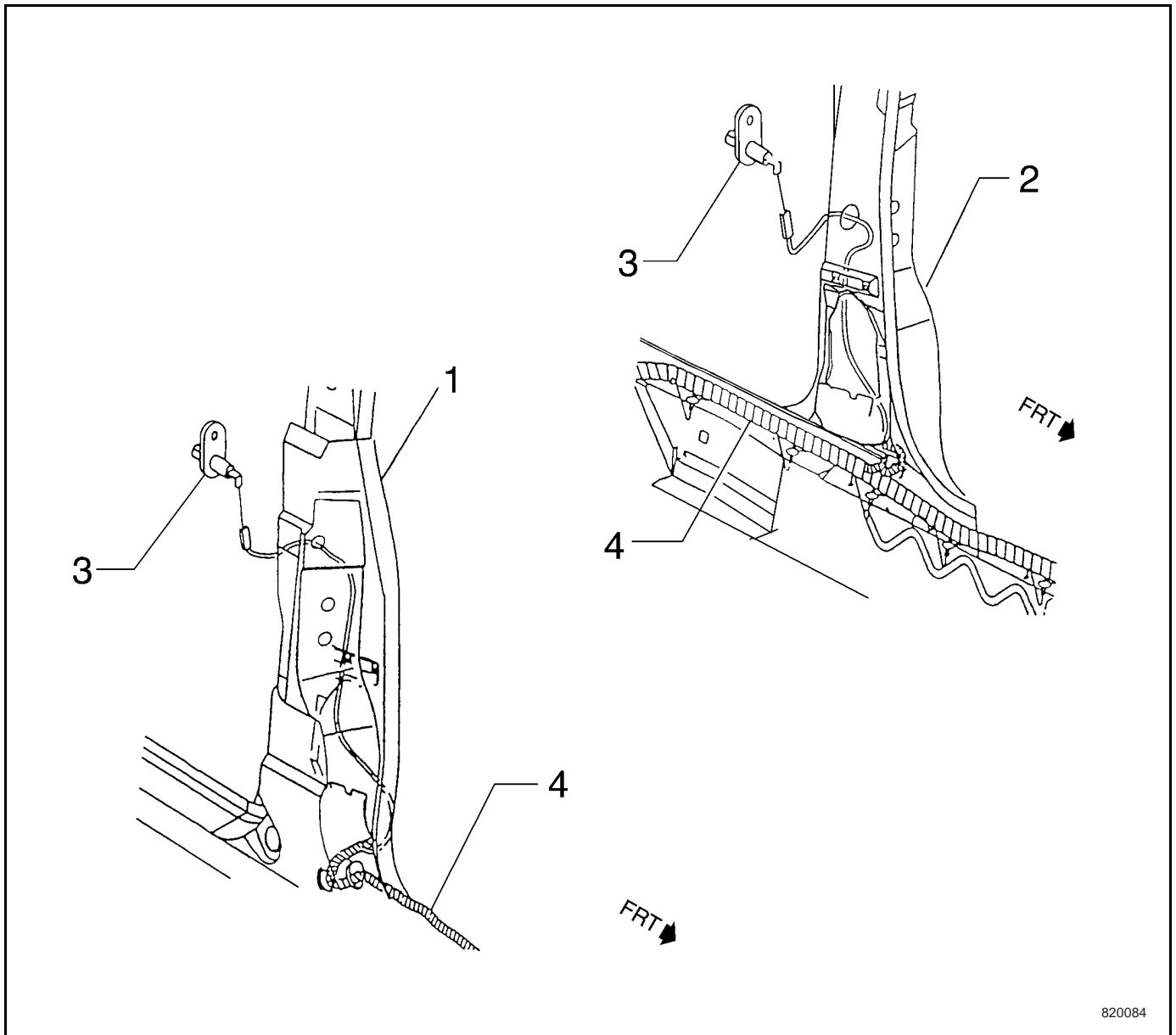
820083

Legend:

(1) Rear body wiring harness

(2) Rear body wiring harness to fuel tank

8.20.3.15 Rear Body Wiring Harness Routing (to the rear door contact switch)



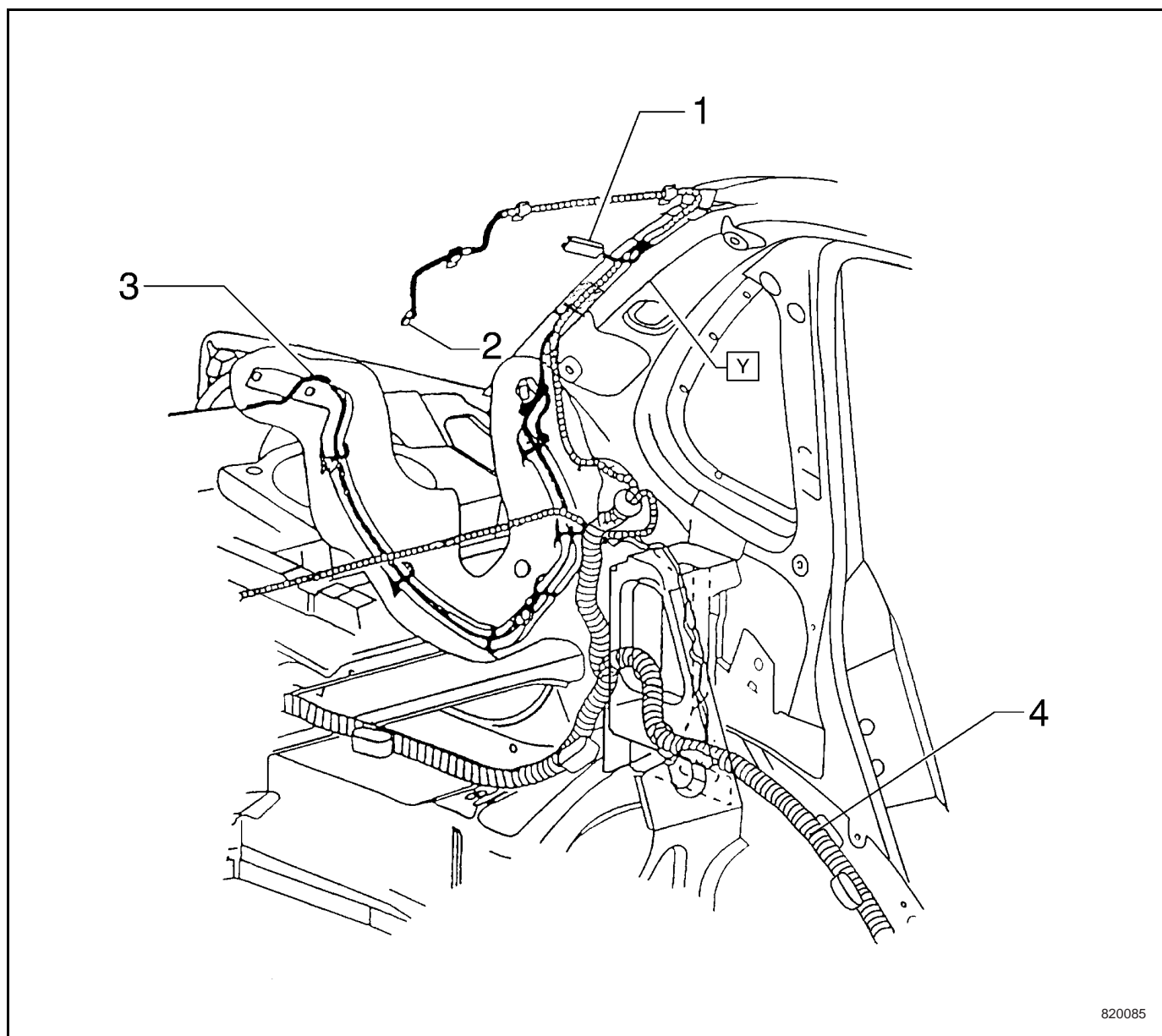
820084

Legend:

- (1) Side panel pillar (RH)
- (2) Side panel pillar (LH)

- (3) Rear door contact switch
- (4) Rear body wiring harness

8.20.3.16A Part View and Rear Body and Lid-Trunk Wiring Harness Routing

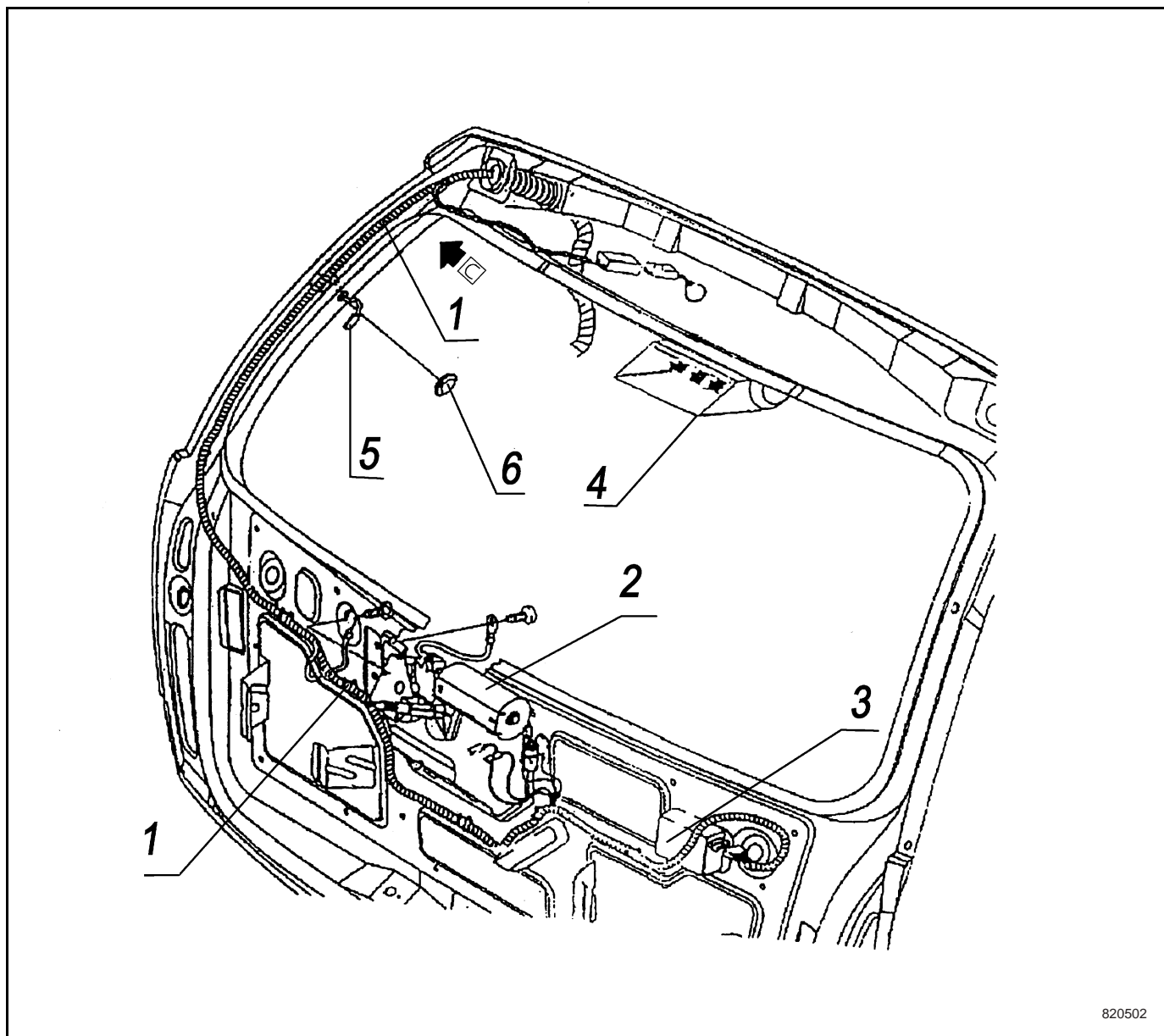


820085

Legend:

- | | |
|---|------------------------------|
| (1) Connection to rear defogger | (3) Lid-Trunk wiring harness |
| (2) Connection to high level brake lamp | (4) Rear body wiring harness |

8.20.3.16B Part View and Rear Body and Lid-Trunk Wiring Harness Routing

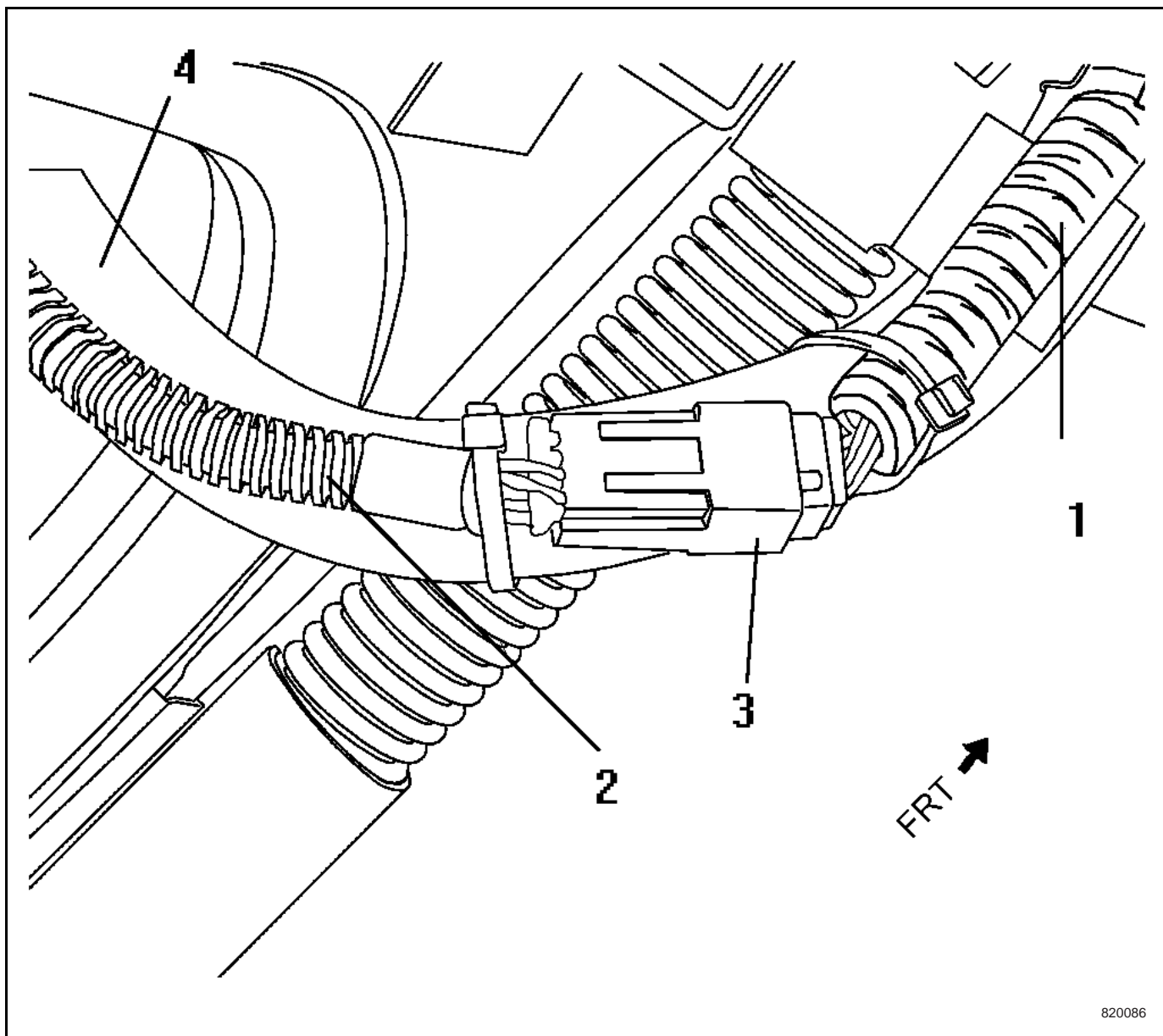


820502

Legend:

- | | |
|-----------------------------------|---------------------------------------|
| (1) Harness ASM - Rear L/Gate WRG | (4) High level brake lamp |
| (2) Wiper/Washer Motor, Rear | (5) Rear Window Defogger Ground |
| (3) Actuator, Rear Lift Gate | (6) Grommet-Rear Window Defogger Wire |

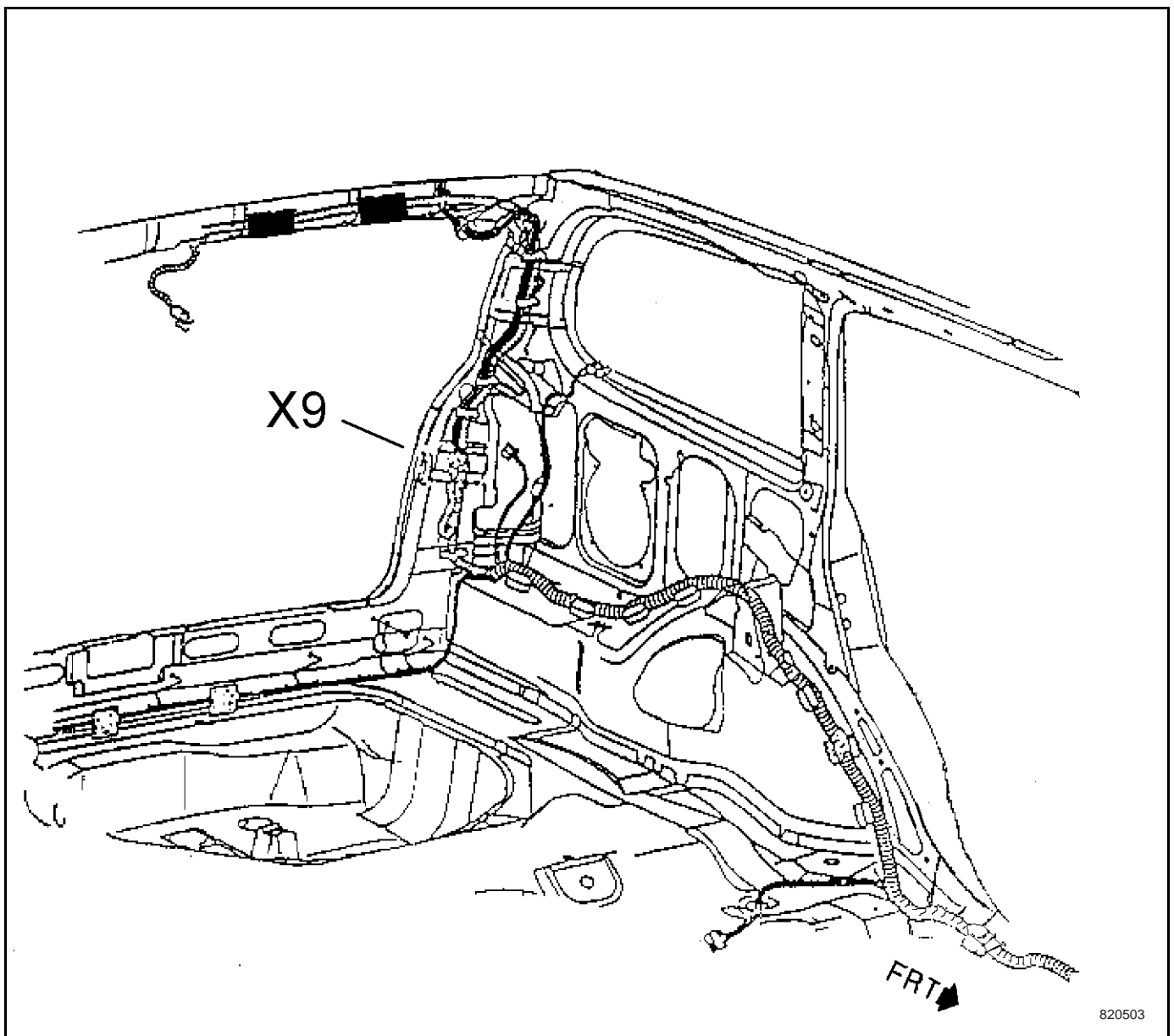
8.20.3.17A Inline Connection X9 Between Rear Body and Lid-Trunk Wiring Harness



Legend:

- | | |
|------------------------------|---|
| (1) Rear body wiring harness | (3) Inline Connection X9 between Rear Body and Lid-Trunk Wiring Harness |
| (2) Lid-Trunk wiring harness | (4) Lid-Trunk hinge |

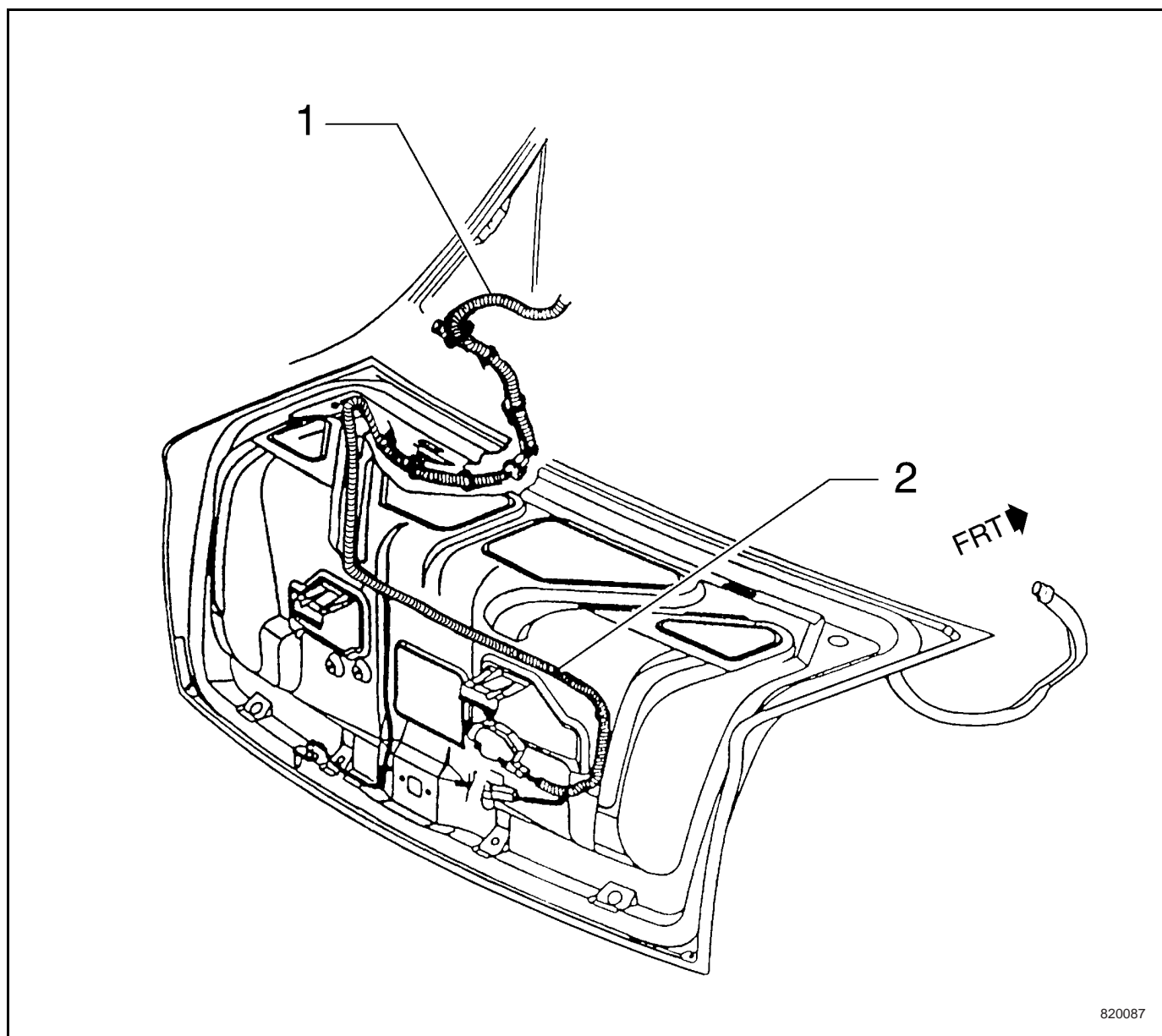
8.20.3.17B Inline Connection X9 Between Rear Body and Lid-Trunk Wiring Harness



Legend:

- (1) Inline Connection X9 between Rear Body and Rear Lift Gate Wiring Harness

8.20.3.18A Lid-Trunk Wiring Harness Routing

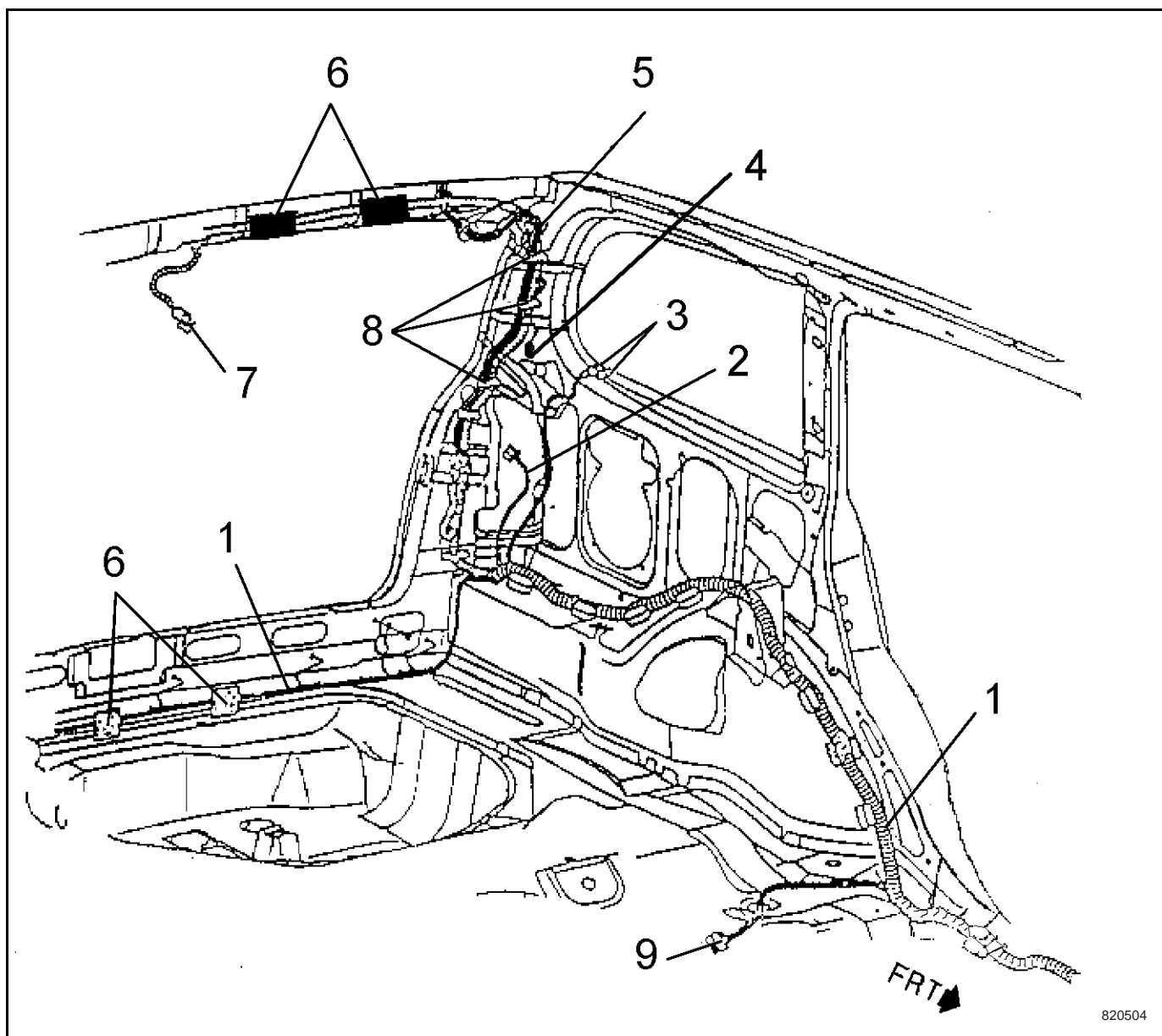


Legend:

(1) Rear body wiring harness

(2) Lid-Trunk wiring harness

8.20.3.18B Lid-Trunk Wiring Harness Routing

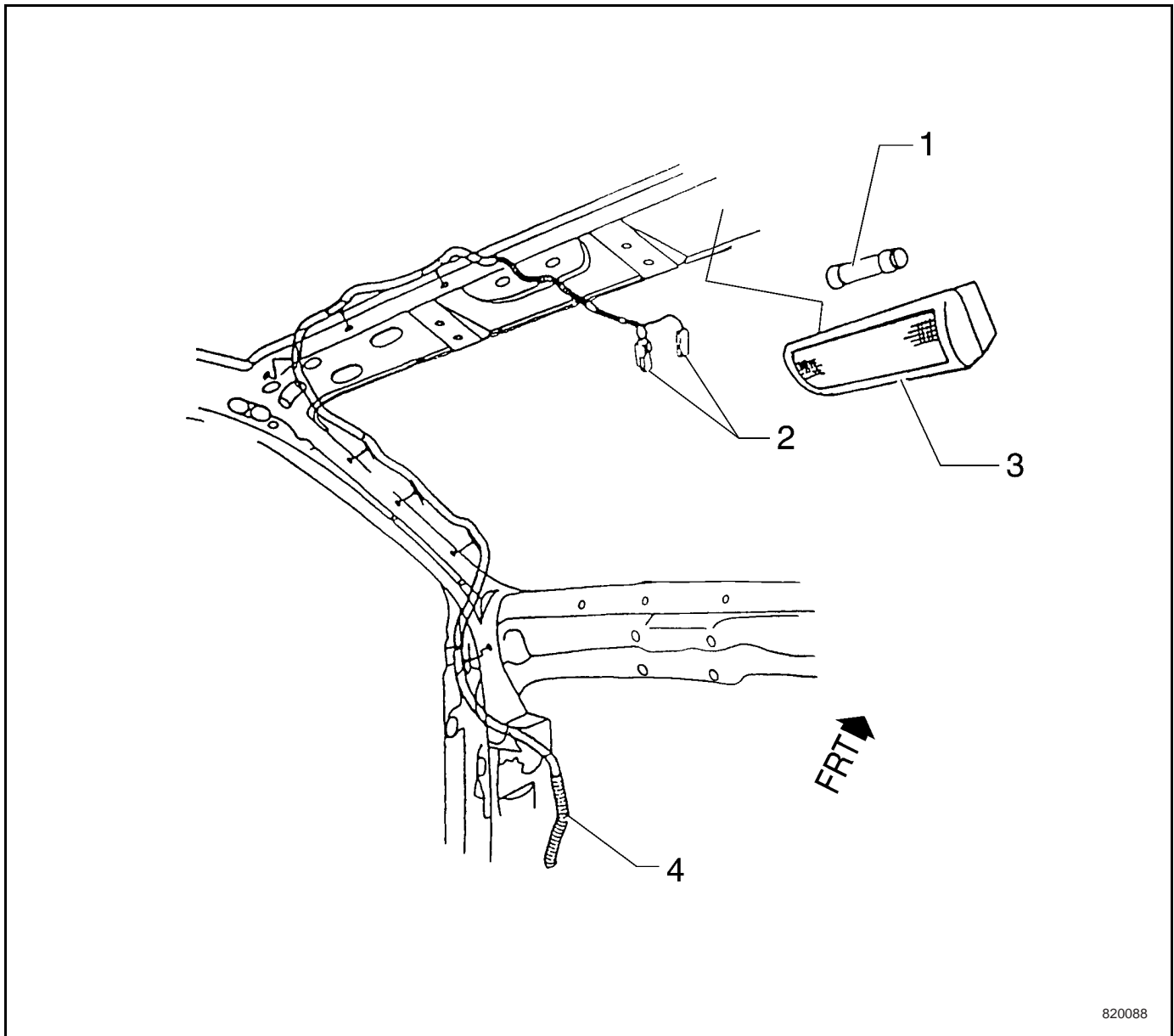


820504

Legend:

- | | |
|-----------------------------------|-------------------------------------|
| (1) Harness ASM - Body RR WRG | (6) Tape - Rear Body Wiring Harness |
| (2) Connector to Tail Lamp | (7) Connector, Roof Lighting |
| (3) Connector, Speaker | (8) Clip - Rear Body Wiring Harness |
| (4) Connector, Tweeter | (9) Connector to Fuel Tank |
| (5) Harness ASM - Rear L/Gate WRG | |

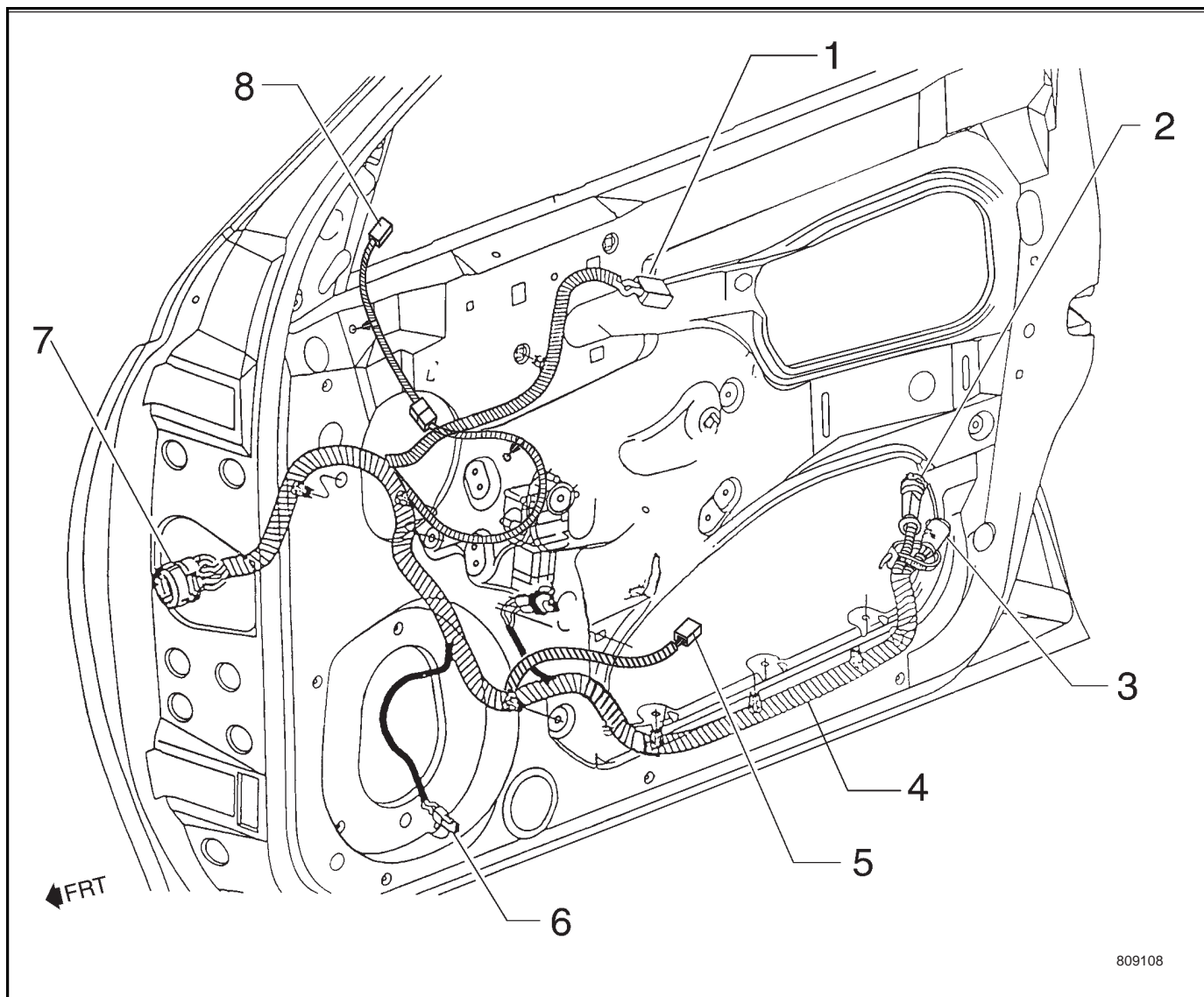
8.20.3.19 Rear Body Wiring Harness Routing (to the driver reading lamp)



Legend:

- | | |
|--------------------------------|------------------------------|
| (1) Reading Lamp bulb | (3) Reading lamp - driver |
| (2) Connection to reading lamp | (4) Rear body wiring harness |

8.20.3.20 Right Front Door Wiring Harness Routing

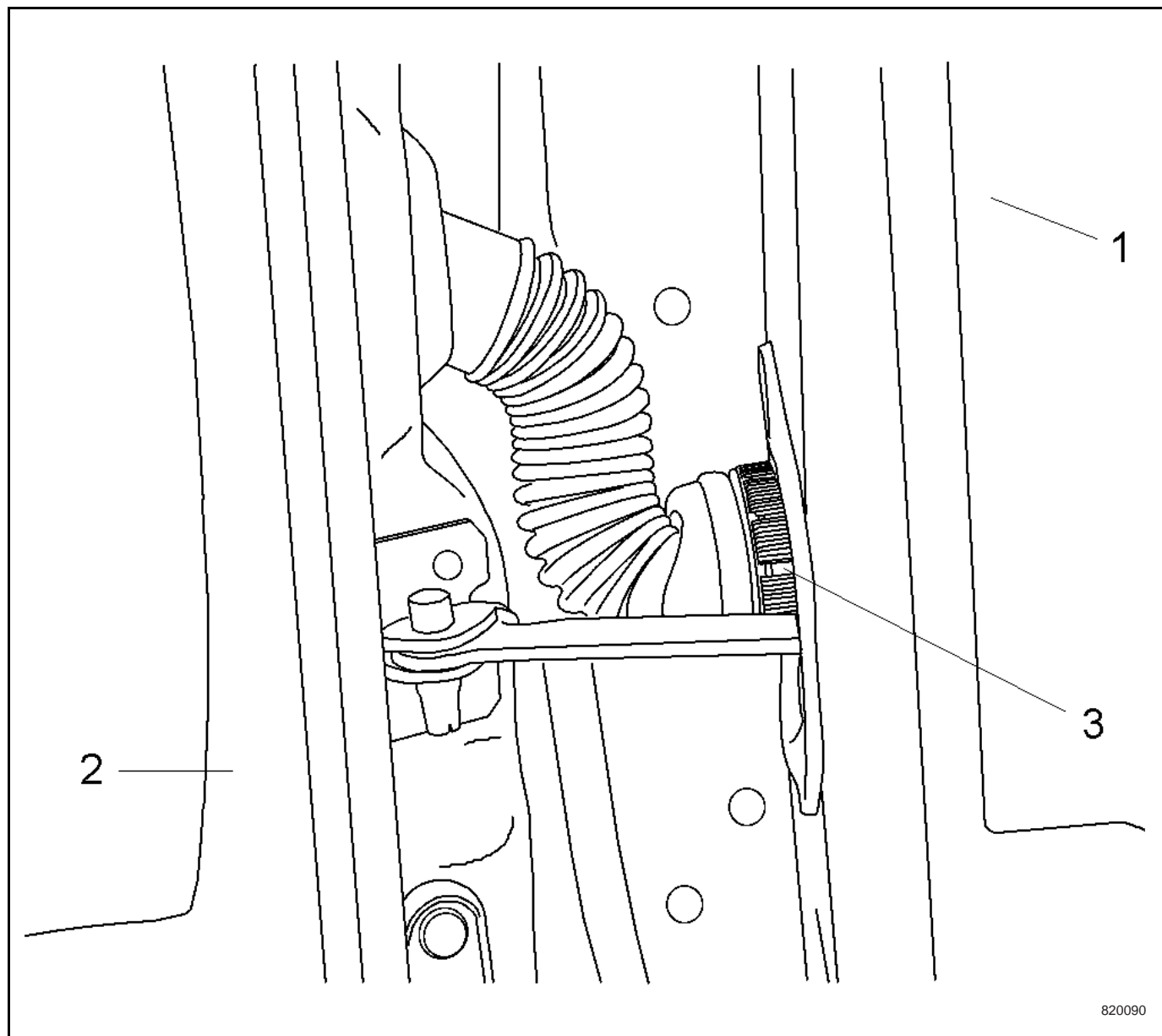


809108

Legend:

- | | |
|---|--|
| (1) Connection to Tweeter (12L) | (5) Connection to window lifter switch (co-driver) |
| (2) Connection to door lock switch | (6) Connection to Tweeter (12L) |
| (3) Connection to door lock | (7) Connection to body harness |
| (4) Connection to front door wiring harness | (8) Connection to outside rearview mirror switch |

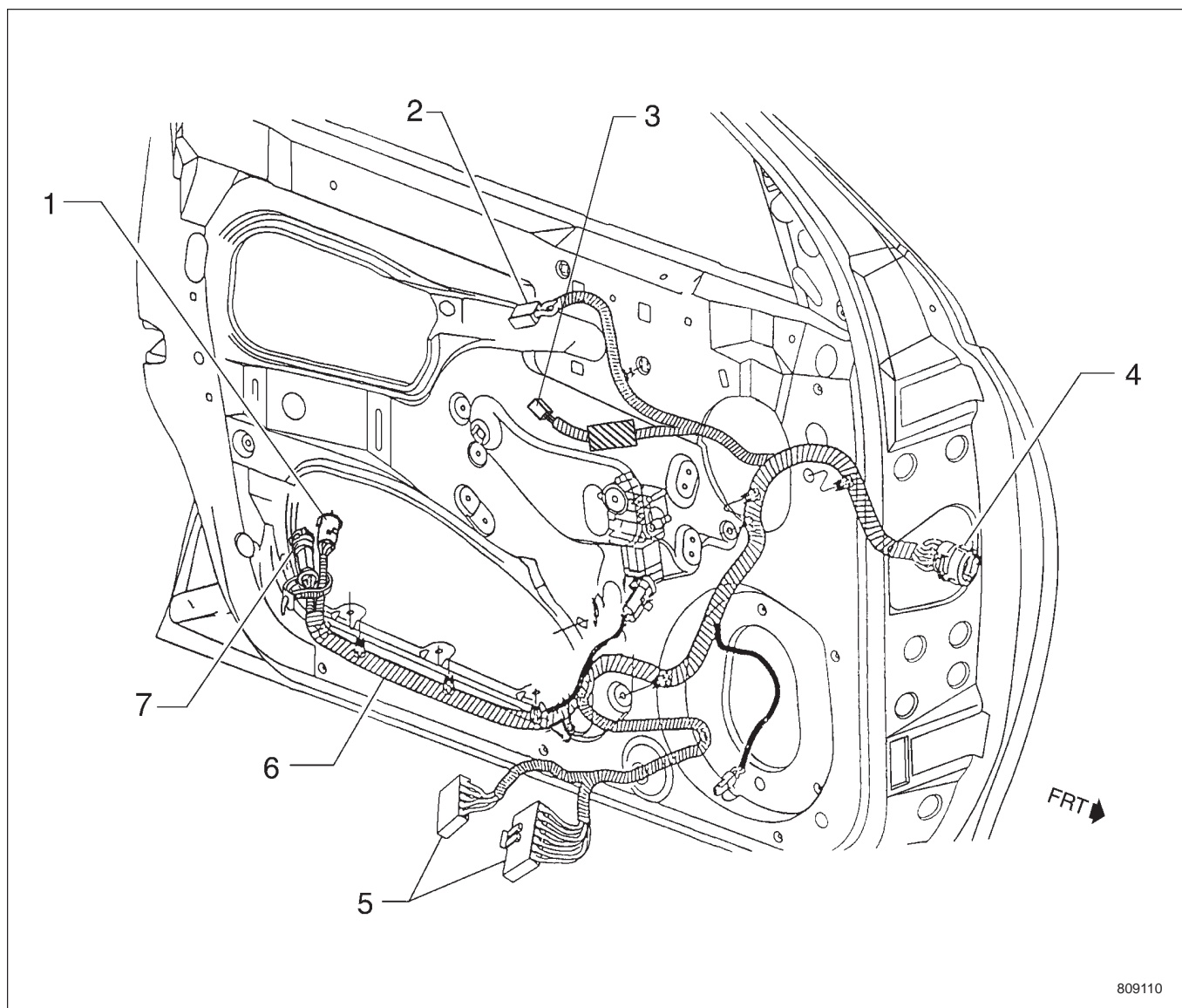
8.20.3.21 Inline Connection X7 (X6) Between Rear Body and Right (Left) Front Door Wiring Harness



Legend:

- | | |
|------------------------------------|--|
| (1) Right (Left) Front Door | (3) Inline Connection X7 (X6) Between Rear Body and Right (Left) Front Door Wiring Harness |
| (2) Right (Left) side panel pillar | |

8.20.3.20 Left Front Door Wiring Harness Routing

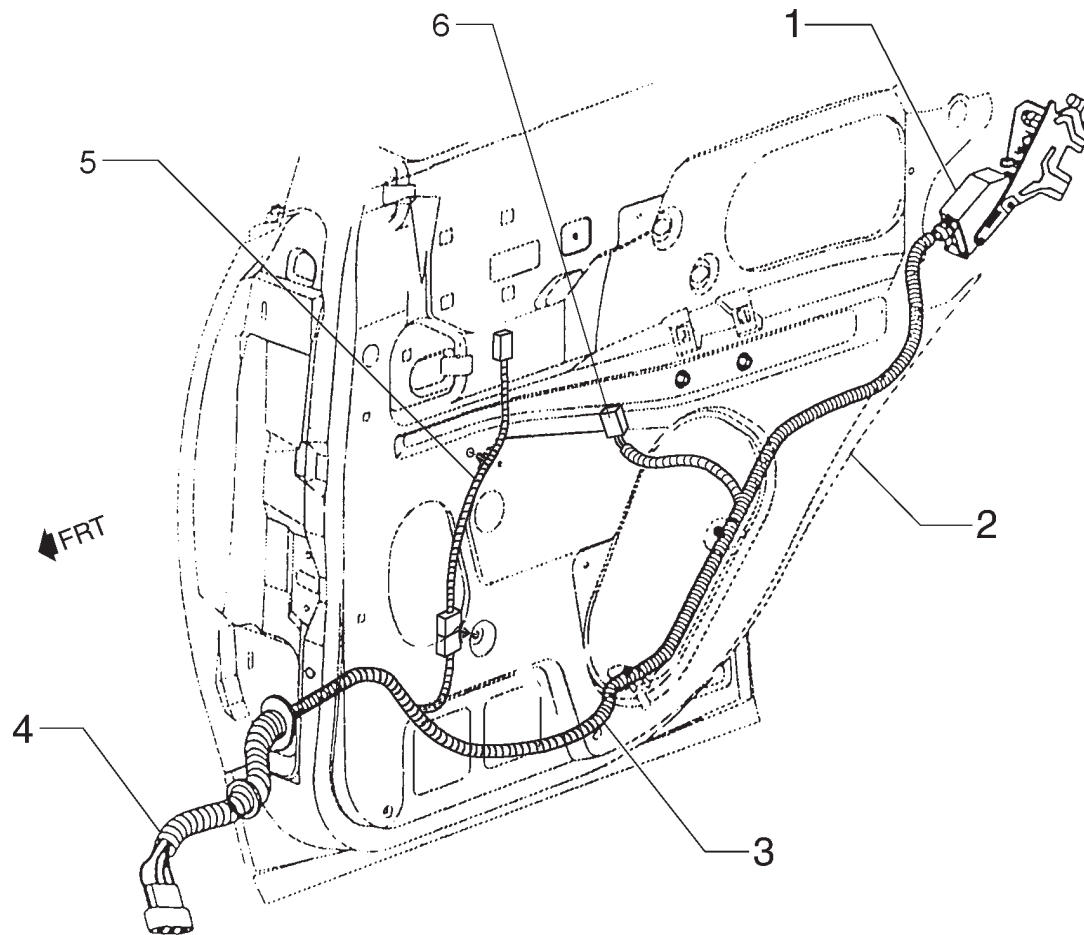


809110

Legend:

- | | |
|---|--|
| (1) Connection to door lock switch | (5) Connection to power window switch |
| (2) Connection to Tweeter | (6) Connection to Front Door Harness ASM |
| (3) Connection to outside power mirror switch | (7) Connection to Door Lock Actuator |
| (4) Connection to body harness | |

8.20.3.23 Right Rear Door Wiring Harness Routing (Left Rear Door)

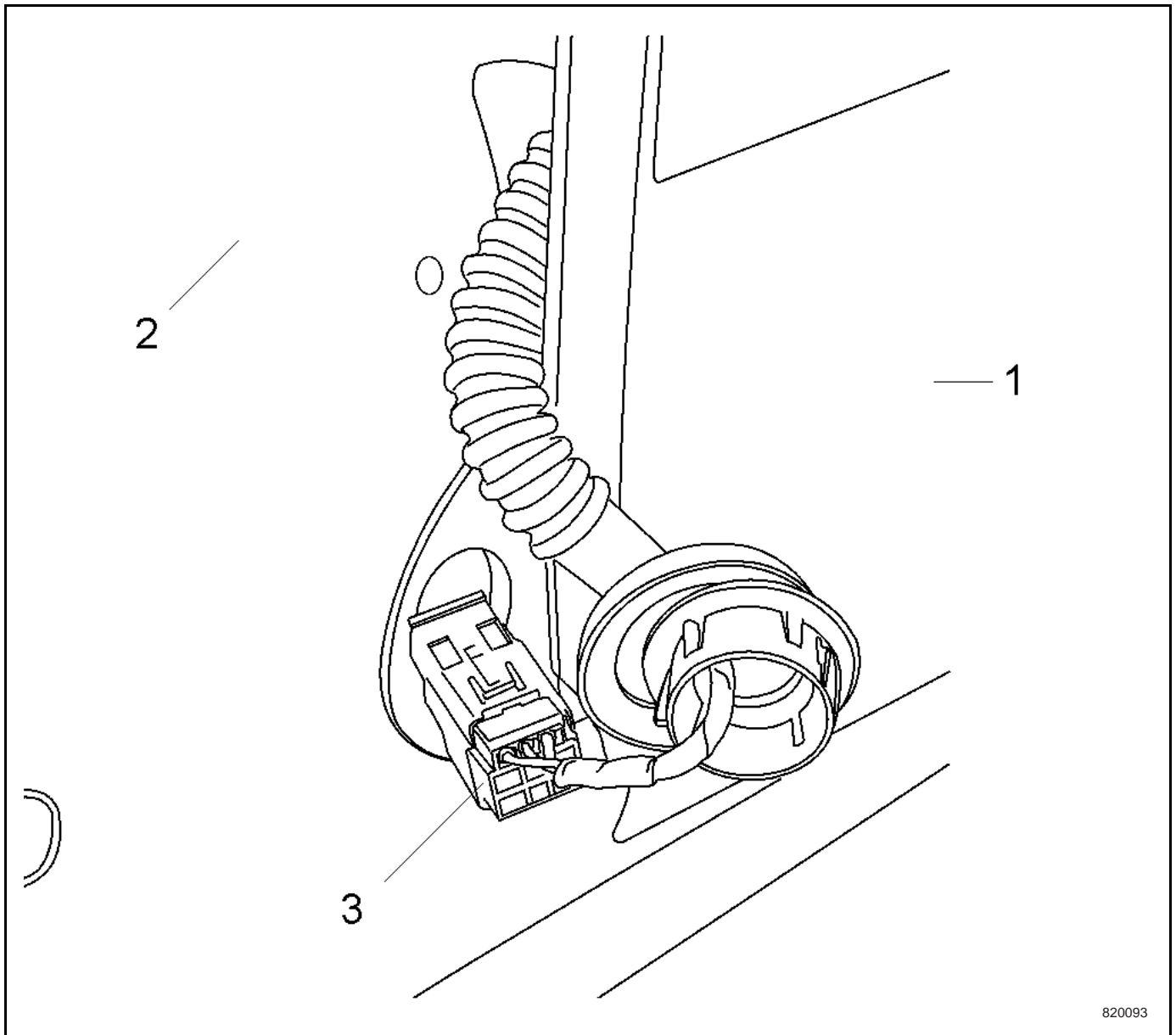


809109

Legend:

- | | |
|--------------------------------------|--|
| (1) Connection to Door Lock Actuator | (4) Connection to Rear Body Line |
| (2) Rear Door (Left) | (5) Connection to Window Lifter Switch |
| (3) Harness ASM - Body RR WRG | |

8.20.3.24 Inline Connection X8 Between Rear Body and Rear Door Wiring Harness

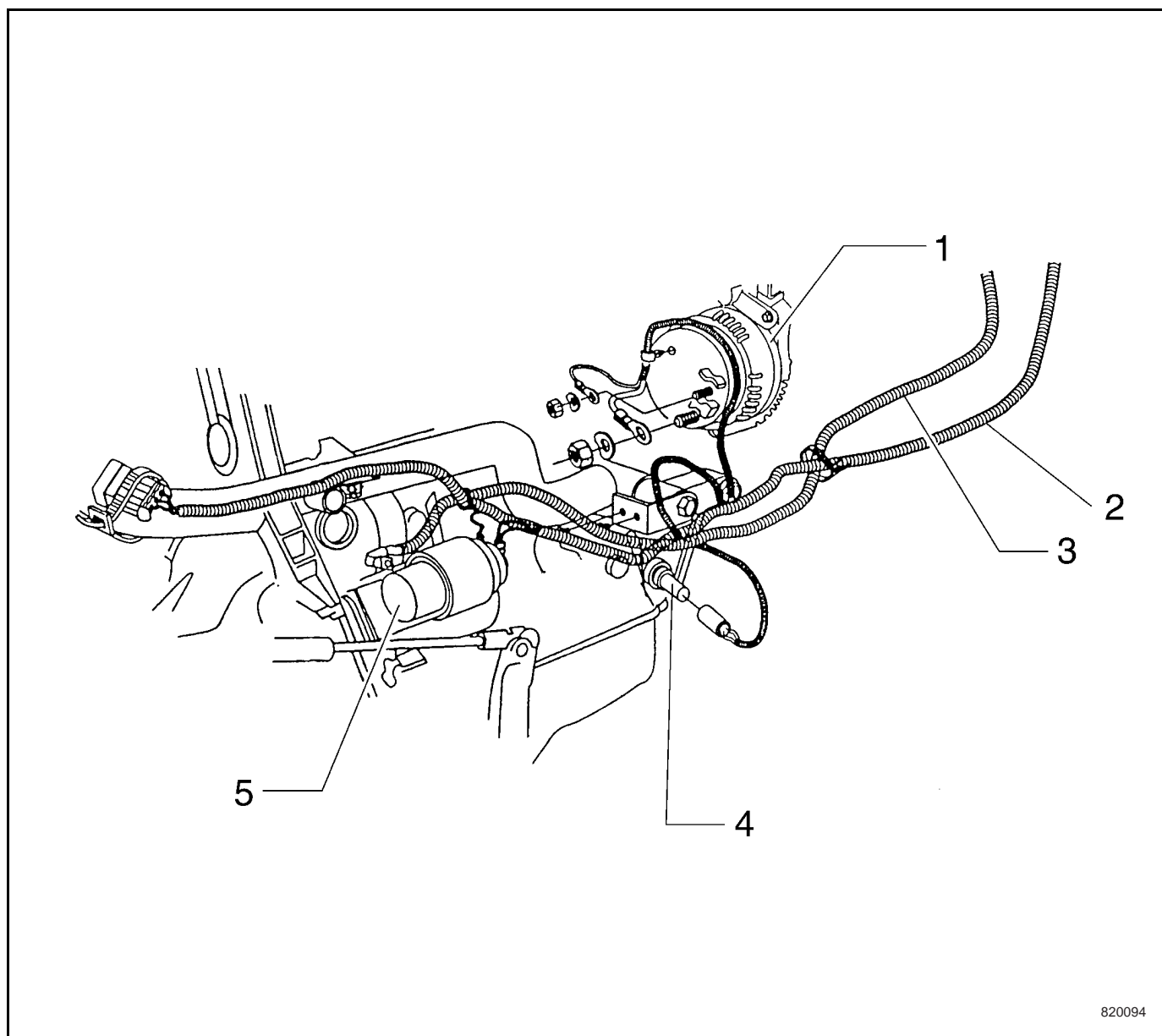


820093

Legend:

- | | |
|--------------------------------------|---|
| (1) Left rear door (Right door) | (3) Inline Connection X8 between Rear Body and Rear Door Wiring Harness |
| (2) Left and right side panel pillar | |

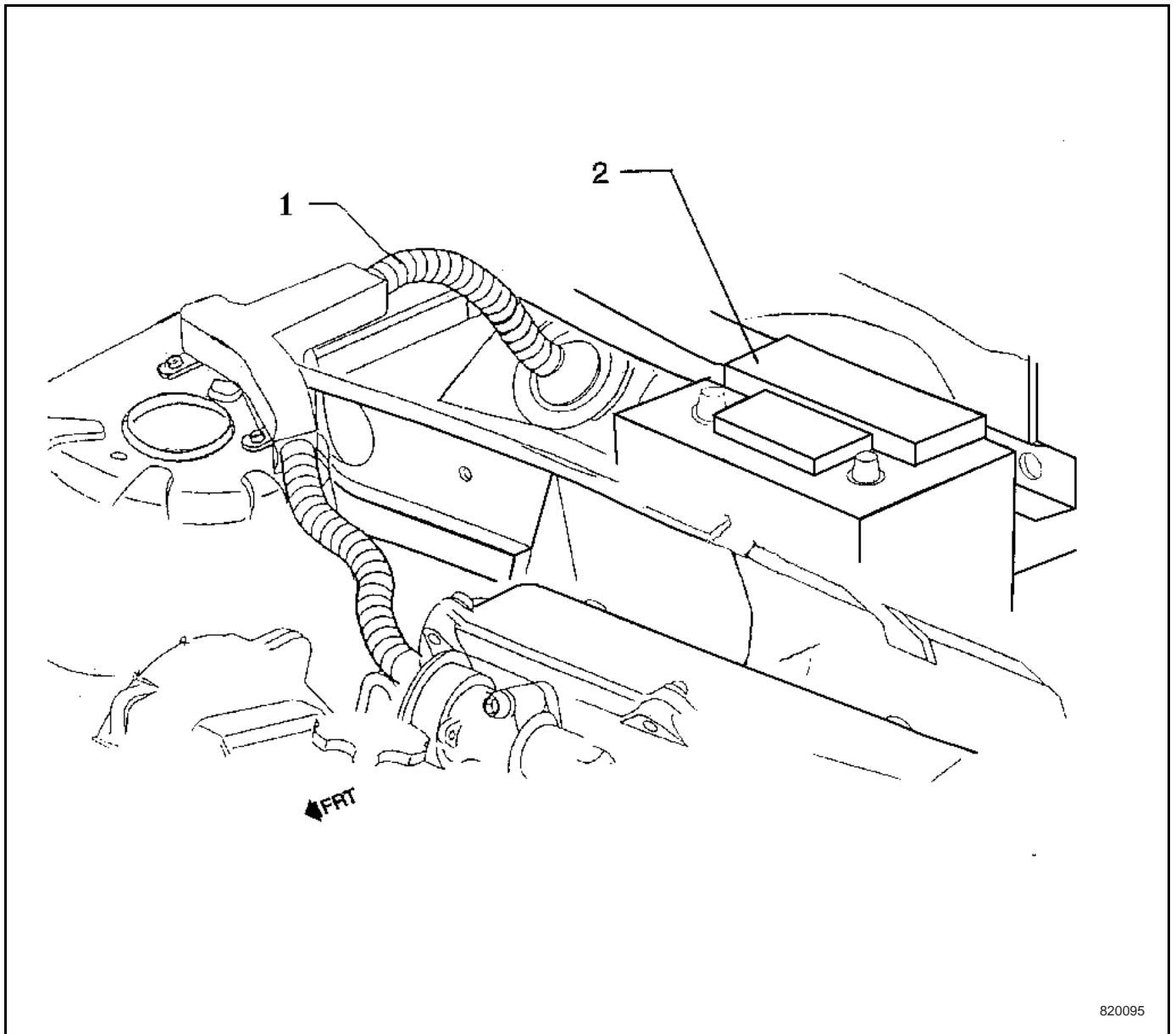
8.20.3.25 Start Wiring Harness Routing in the Engine Compartment



Legend:

- | | |
|---------------------------------------|-------------------------|
| (1) Alternator | (4) Oil pressure sensor |
| (2) Starter wiring harness | (5) Starter |
| (3) Battery cable assembly - negative | |

8.20.3.26 Engine Wiring Harness Routing

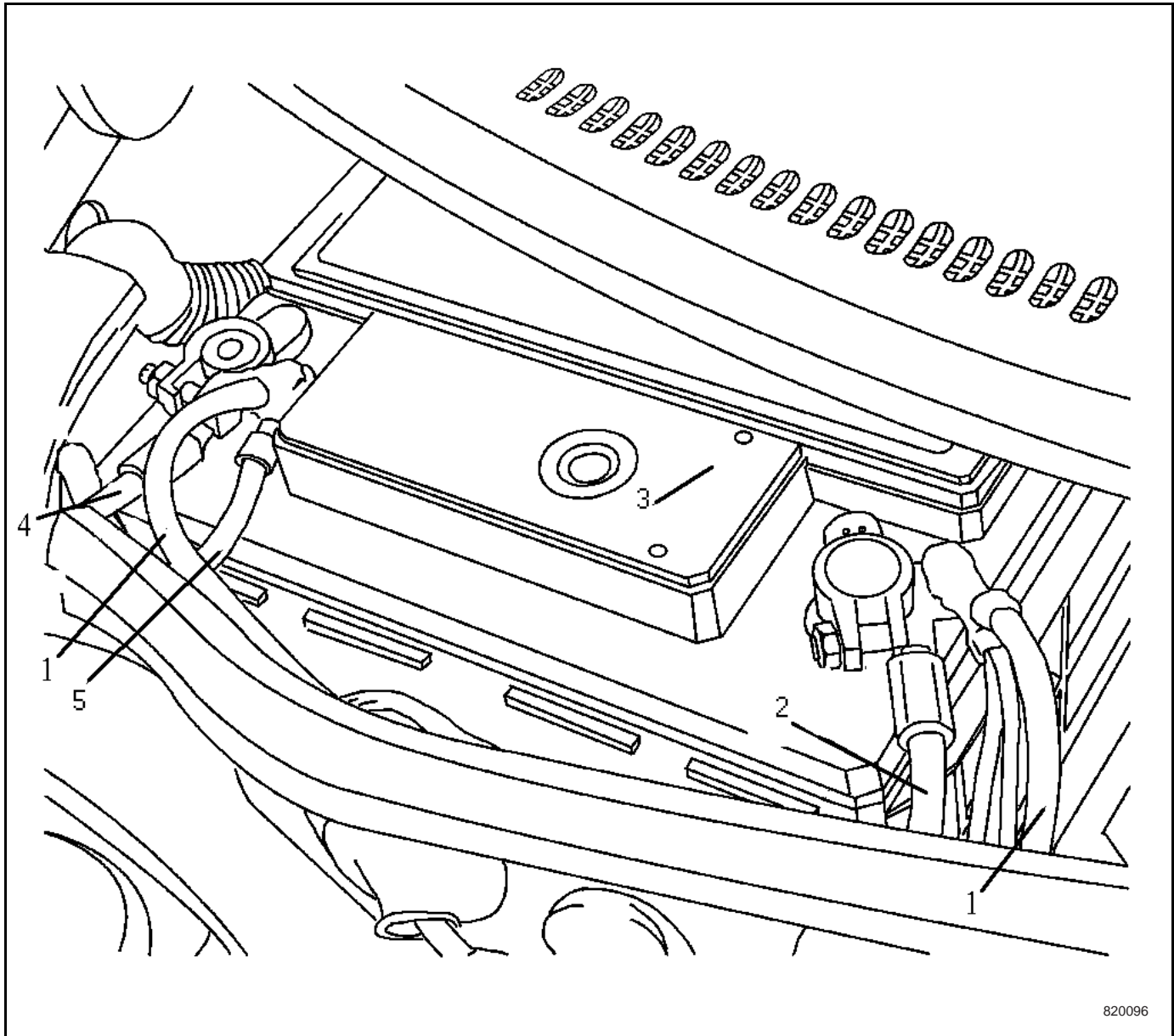


Legend:

(1) Engine wiring harness

(2) Battery

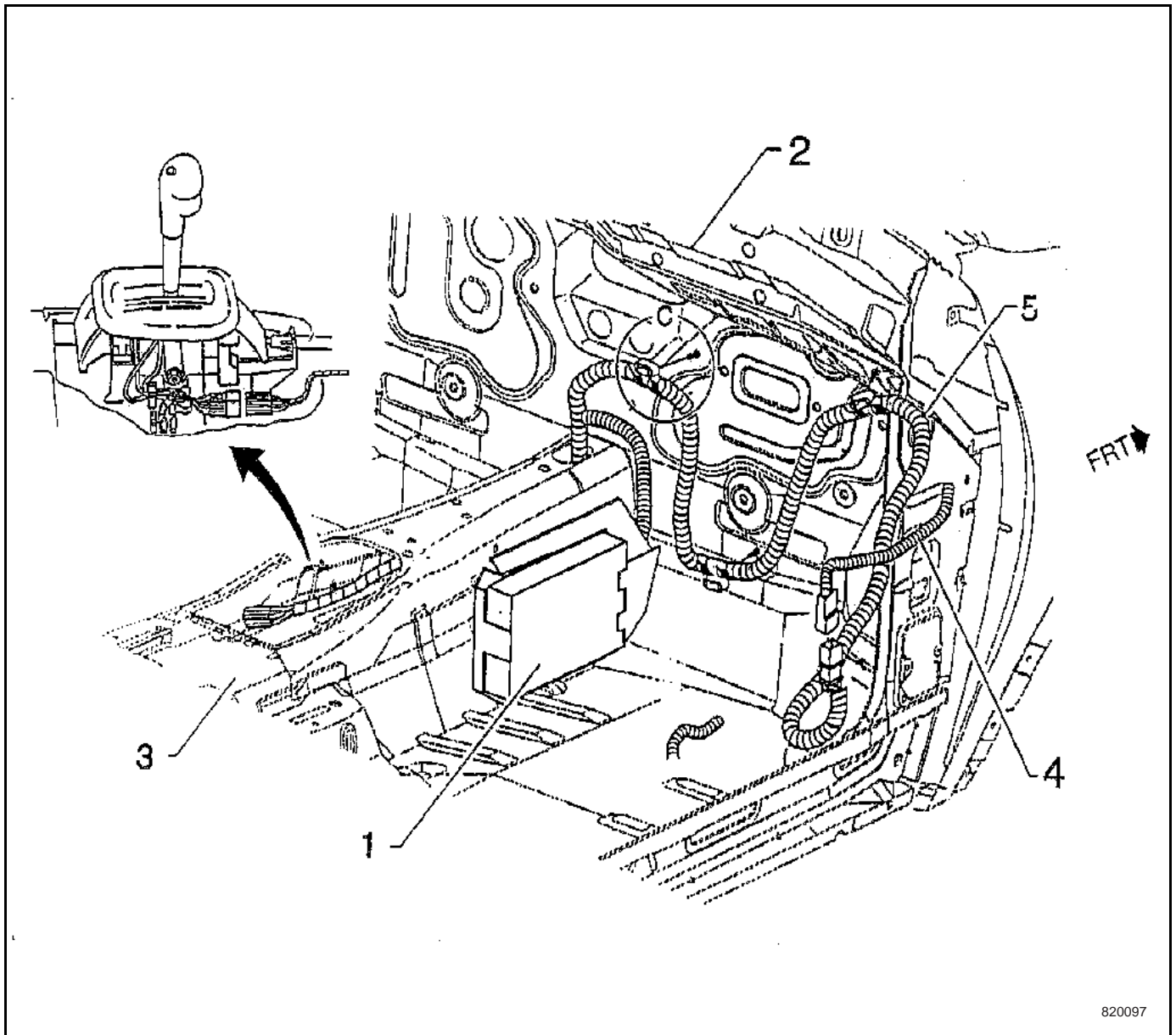
8.20.3.27 Battery Cable and Battery



Legend:

- | | |
|--|--|
| (1) Instrument panel wiring harness to battery | (4) Battery cable - negative to Engine |
| (2) Battery cable - positive | (5) Battery cable - negative to Body |
| (3) Battery | |

8.20.3.28 Auto Transmission Wiring Harness Routing

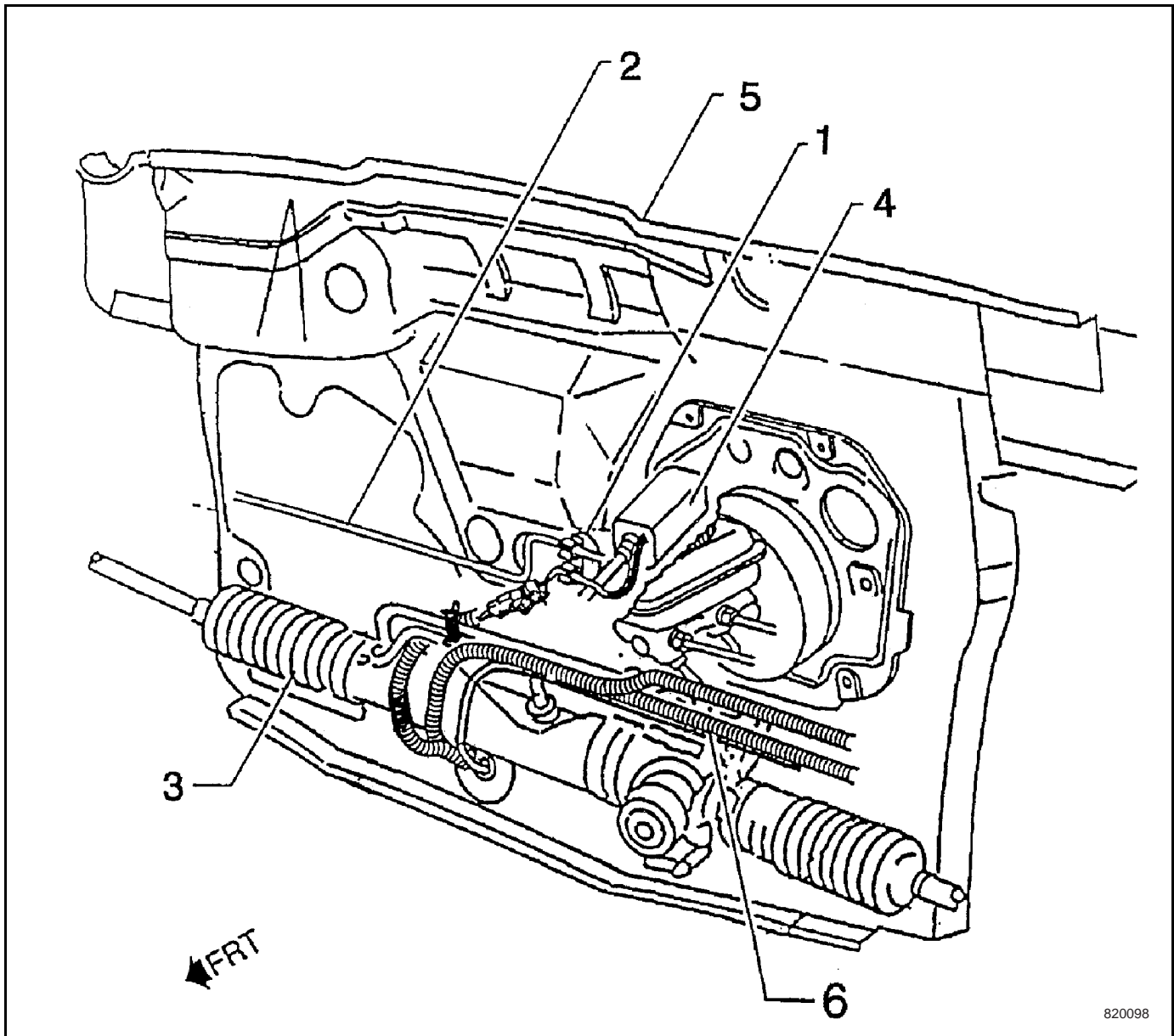


820097

Legend:

- | | |
|------------------------------|--------------------------------------|
| (1) Auto transmission module | (4) I/P wiring harness |
| (2) Dash panel assembly | (5) Auto transmission wiring harness |
| (3) Floor Assembly | |

8.20.3.29 Wiring Harness Routing in the Dash Panel

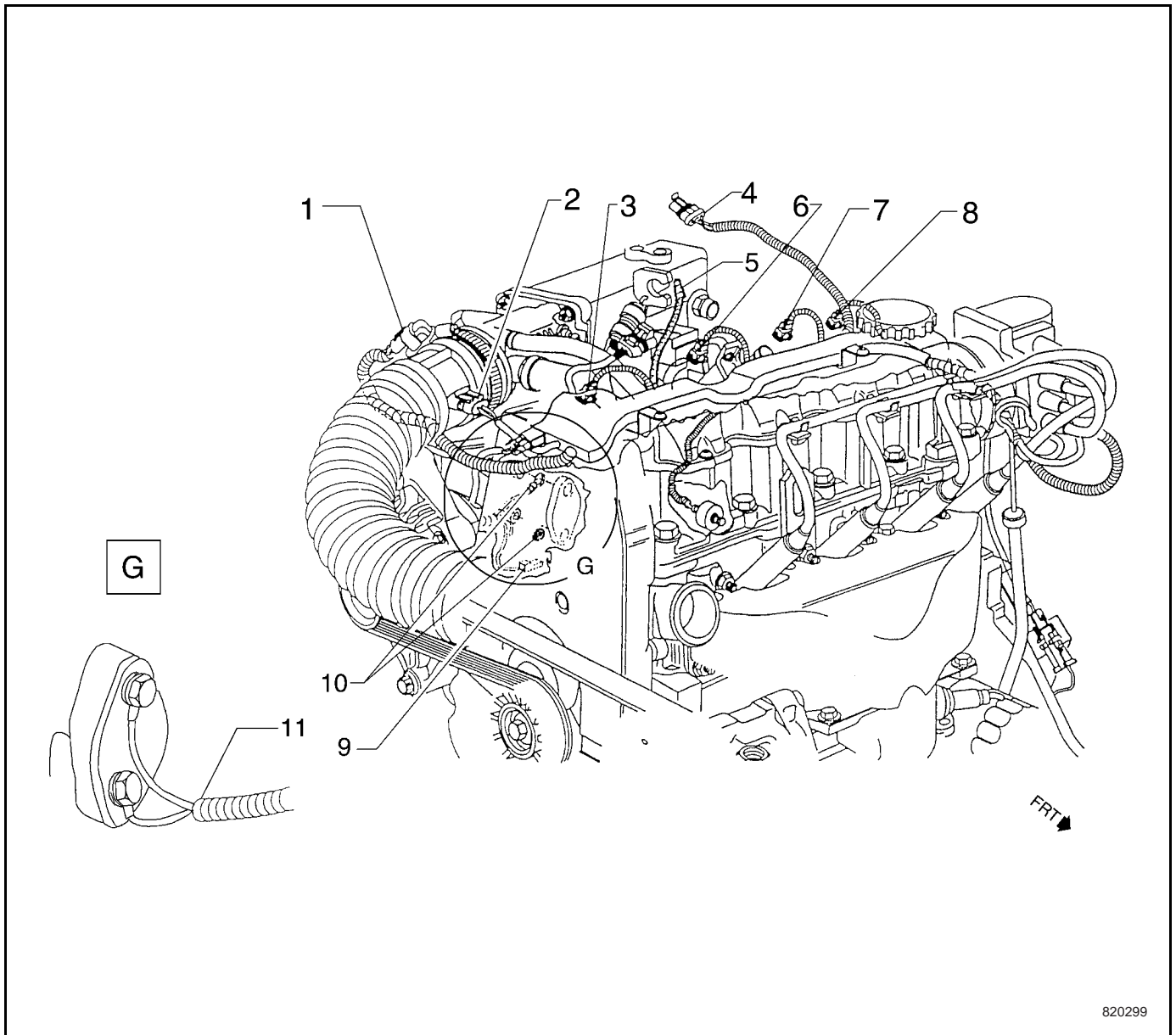


820098

Legend:

- | | |
|-------------------------|---|
| (1) Clip-Brake pipe | (4) Accelerator cable, kick down switch and kick down switch pipe, brake attachment |
| (2) Brake pipe | (5) Dash panel frame |
| (3) Power steering gear | (6) Auto transmission wiring harness (if equipped) |

8.20.3.30 Engine Wiring Harness Routing in the Engine Compartment

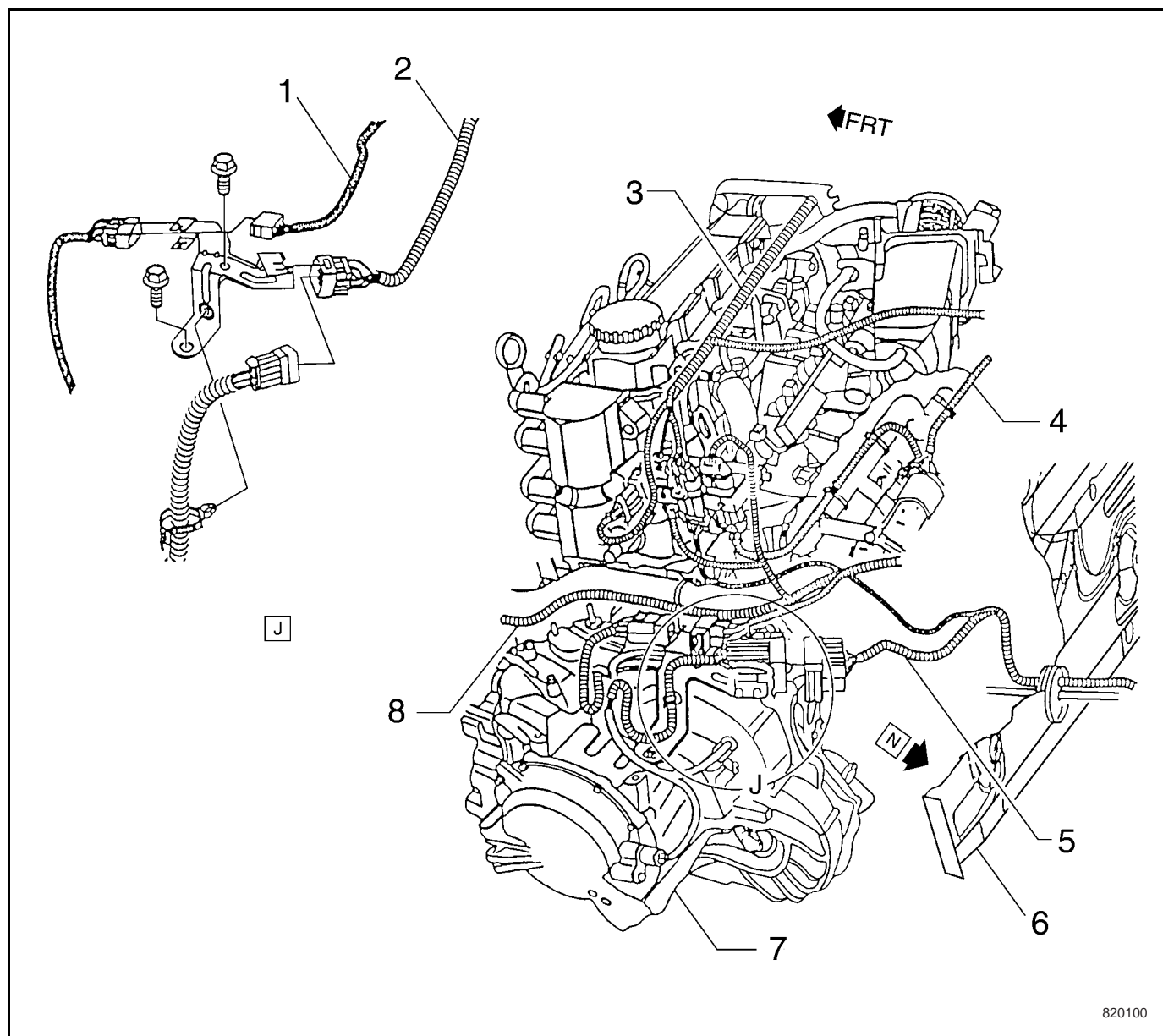


820299

Legend:

- | | |
|--|--|
| (1) Idle Sensor connection | (7) Cylinder 3 Injector connection |
| (2) Intake Air Temperature Sensor connection | (8) Cylinder 4 Injector connection |
| (3) Cylinder 1 Injector connection | (9) Temperature Sensor connection |
| (4) Absolute pressure sensor connection | (10) Engine wiring harness ground terminal |
| (5) Canister Purge Valve connector | (11) Engine wiring harness |
| (6) Cylinder 2 Injector connection | |

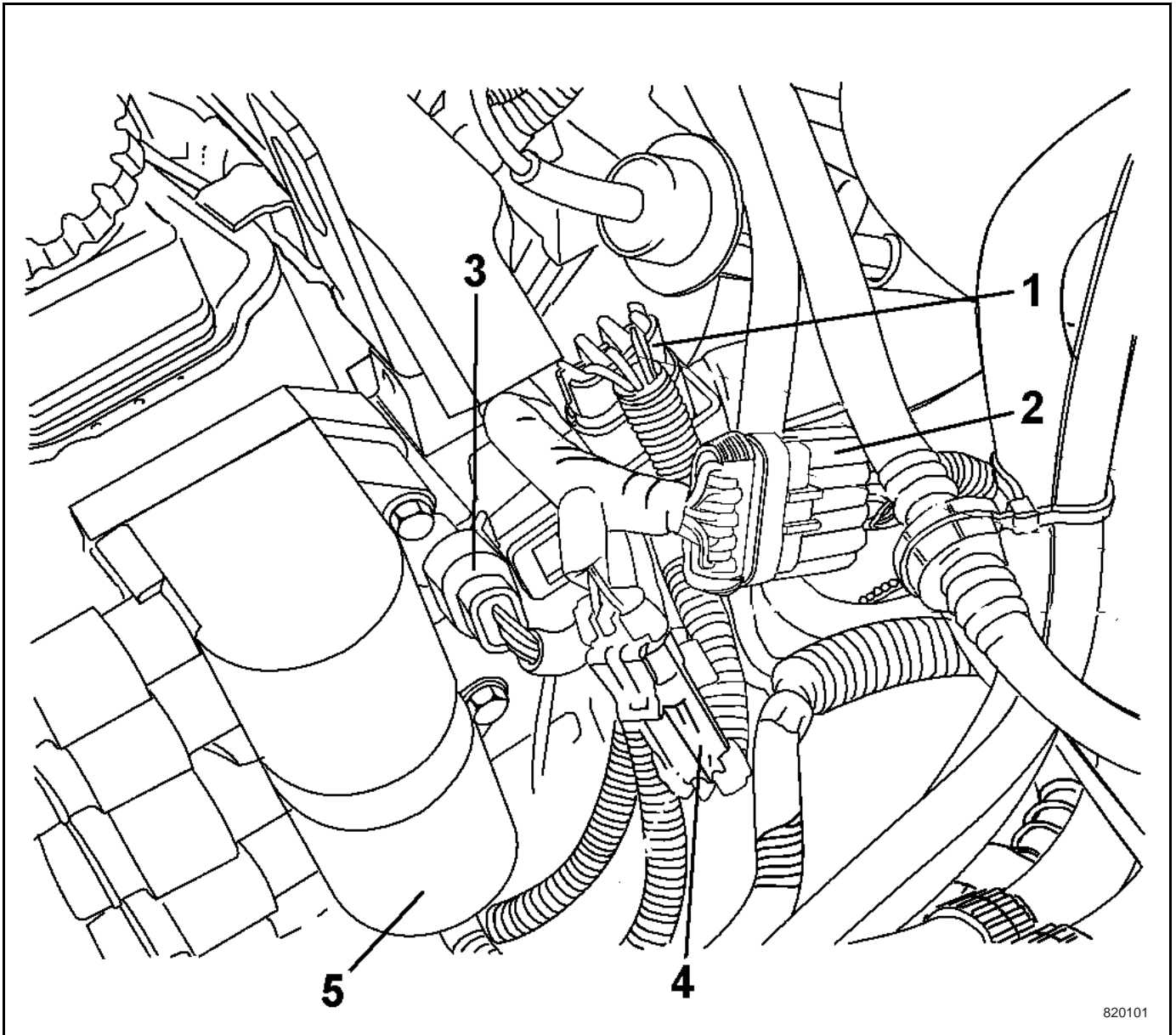
8.20.3.31 Engine and Auto Transmission Wiring Harness Routing



Legend:

- | | |
|--------------------------------------|--------------------------------------|
| (1) Auto transmission wiring harness | (5) Auto transmission wiring harness |
| (2) Engine wiring harness | (6) Firewall |
| (3) Starter wiring harness | (7) Auto transmission |
| (4) Auto transmission wiring harness | (8) I/P wiring harness |

8.20.3.32 Inline Connection X2, X4, X10 in the Engine Compartment

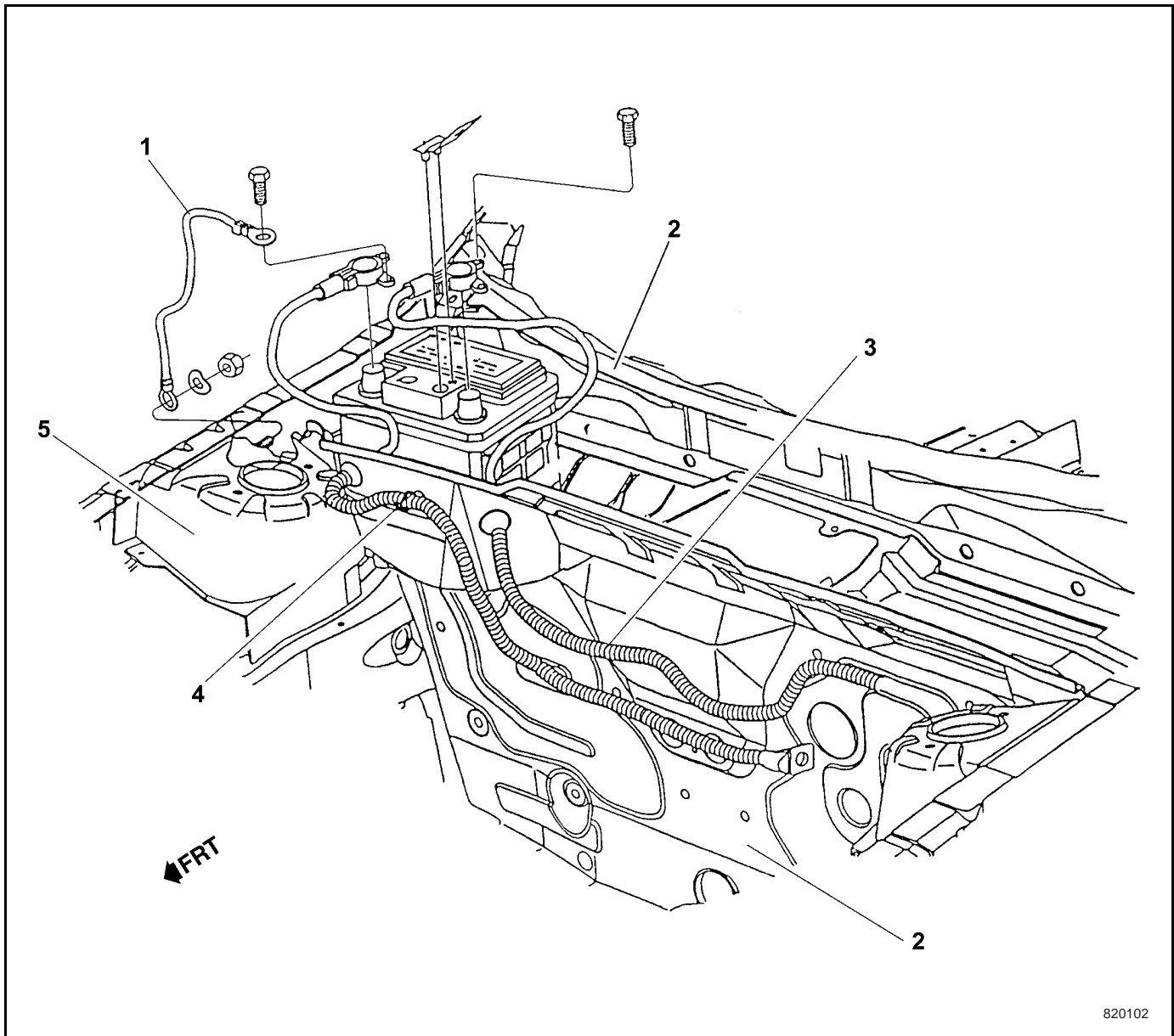


820101

Legend:

- | | |
|---|--|
| (1) Inline connection X4 (3 pin) between the starter and the I/P wiring harness | (3) Inline connection X2 (1 pin) between the engine and the I/P wiring harness |
| (2) Inline connection X10 (8 pin) between the engine and the A/T wiring harness | (4) Connection to knock sensor (2 pin) |
| | (5) Ignition coil |

8.20.3.33 Battery Cable Routing



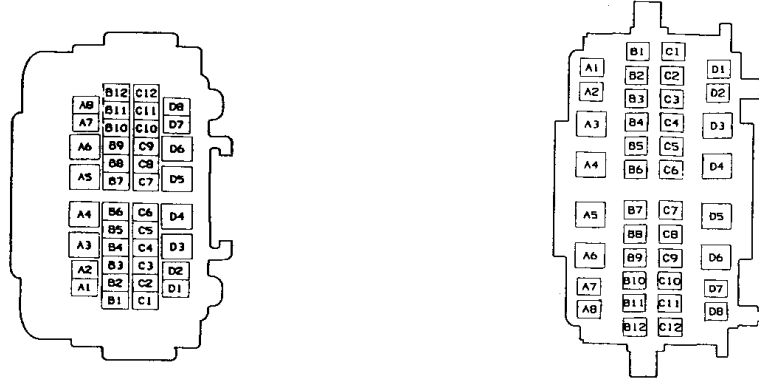
820102

Legend:

- | | |
|--------------------------------------|--|
| (1) Battery cable - negative to Body | (4) Battery cable - negative to Engine |
| (2) Dash panel assembly | (5) Wheel house (Right-Front) |
| (3) Starter wiring harness | |

8.20.4 Connector End View

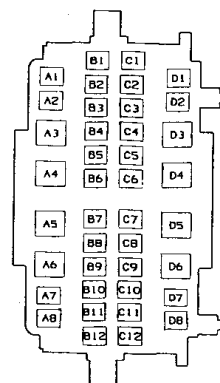
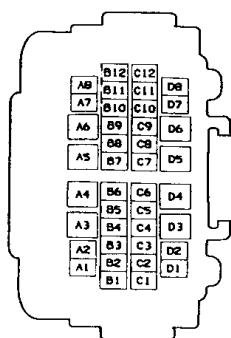
8.20.4.1 Inline Connector X1 between the I/P and Front Body Wiring Harness



820103

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 15358701 Black Front Body Harness Side 			<ul style="list-style-type: none"> 15358702 Black I/P Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
A1	Black/White	A/C Valve Switch Signal	A1	Black/White	A/C Valve Switch Signal
A2	Black/Yellow	Pressure Switch Signal	A2	Black/Yellow	Pressure Switch Signal
A3	Black	F20 Fuse Supply Circuit	A3	Black	F20 Fuse Supply Circuit
A4	Brown/White	Condenser fan return	A4	Brown/White	Condenser fan return
A5	Brown	Ground	A5	Brown	Ground
A6	Not Used	Not Used	A6	Not Used	Not Used
A7	Brown	Pressure Switch Ground	A7	Brown	Pressure Switch Ground
A8	Brown/White	Pressure Switch Supply Circuit	A8	Brown/Red	Pressure Switch Supply Circuit
B1	Black/White	Thermostat Relay Supply Circuit	B1	Black/White	Thermostat Relay Supply Circuit
B2	Not Used	Not Used	B2	Not Used	Not Used
B3	Brown/Blue	Compressor Relay Supply Circuit	B3	Brown/Blue	Compressor Relay Supply Circuit
B4	Grey/Green	Display Potentiometer Regulating Circuit	B4	Not Used	Not Used
B5	Grey/Black	Display Potentiometer Regulating Circuit	B5	Not Used	Not Used
B6	Not Used	Not Used	B6	Not Used	Not Used
B7	Not Used	Not Used	B7	Not Used	Not Used
B8	Not Used	Not Used	B8	Not Used	Not Used
B9	Black	Horn Supply Circuit	B9	Red	Horn Supply Circuit
B10	Grey/Black	Supply Circuit of Left Parking Lamp	B10	Grey/Black	Supply Circuit of Left Parking Lamp
B11	White	Supply Circuit of Left High Beam	B11	White	Supply Circuit of Left High Beam

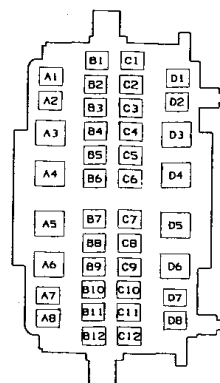
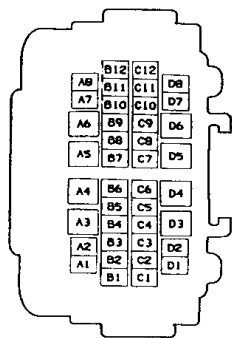
8.20.4.1 Inline Connector X1 between the I/P and Front Body Wiring Harness(Cont' d)



820103

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 15358701 Black Front Body Harness Side 			<ul style="list-style-type: none"> 15358702 Black I/P Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
B12	Grey/Red	Supply Circuit of Right Parking Lamp	B12	Grey/Red	Supply Circuit of Right Parking Lamp
C1	White	Supply Circuit of Left Low Beam	C1	White	Supply Circuit of Left Low Beam
C2	Black/Green	Turn Signal, Right Side Supply Circuit	C2	Black/Green	Turn Signal, Right Side Supply Circuit
C3	Black/White	Turn Signal, Left Side Supply Circuit	C3	Black/White	Turn Signal, Left Side Supply Circuit
C4	Yellow	Supply Circuit of Right High Beam	C4	Yellow	Supply Circuit of Right High Beam
C5	Yellow	Supply Circuit of Right Low Beam	C5	Yellow	Supply Circuit of Right Low Beam
C6	Brown/Yellow	ABS Telltale	C6	Brown/Yellow	ABS Telltale
C7	Black/Yellow	Brake Signal	C7	Black/Yellow	Brake Signal
C8	Brown/White	Diagnostic Serial Data Connection	C8	Black/White	Diagnostic Serial Data Connection
C9	Brown	ABS Wheel Speed Sensor, Rear Left	C9	Brown	ABS Wheel Speed Sensor, Rear Left
C10	Blue/Red	ABS Wheel Speed Sensor, Rear Right	C10	Blue/Red	ABS Wheel Speed Sensor, Rear Right
C11	Blue	ABS Wheel Speed Sensor, Rear Left	C11	Blue	ABS Wheel Speed Sensor, Rear Left
C12	Brown/Red	ABS Wheel Speed Sensor, Rear Right	C12	Brown/Red	ABS Wheel Speed Sensor, Rear Right
D1	Black	Lighter Power Supply Circuit	D1	Black	Lighter Power Supply Circuit
D2	Not Used	Not Used	D2	Not Used	Not Used
D3	Brown/White	Horn Return	D3	Brown/White	Horn Return
D4	Red	Battery Supply Circuit	D4	Black	Battery Supply Circuit
D5	Red	Battery Supply Circuit	D5	Black	Battery Supply Circuit
D6	Black	Front Fog Lamp Supply Circuit	D6	Black	Front Fog Lamp Supply Circuit
7D	Not Used	Not Used	7D	Not Used	Not Used

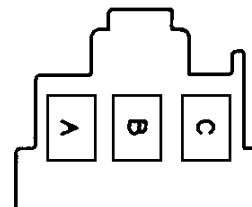
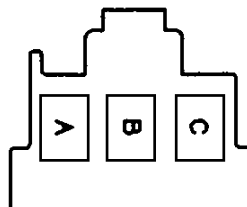
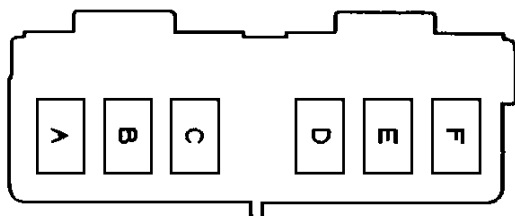
8.20.4.1 Inline Connector X1 between the I/P and Front Body Wiring Harness(Cont' d)



820103

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 15358701 Black Front Body Harness Side 			<ul style="list-style-type: none"> 15358702 Black I/P Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
D8	Not Used	Not Used	D8	Not Used	Not Used

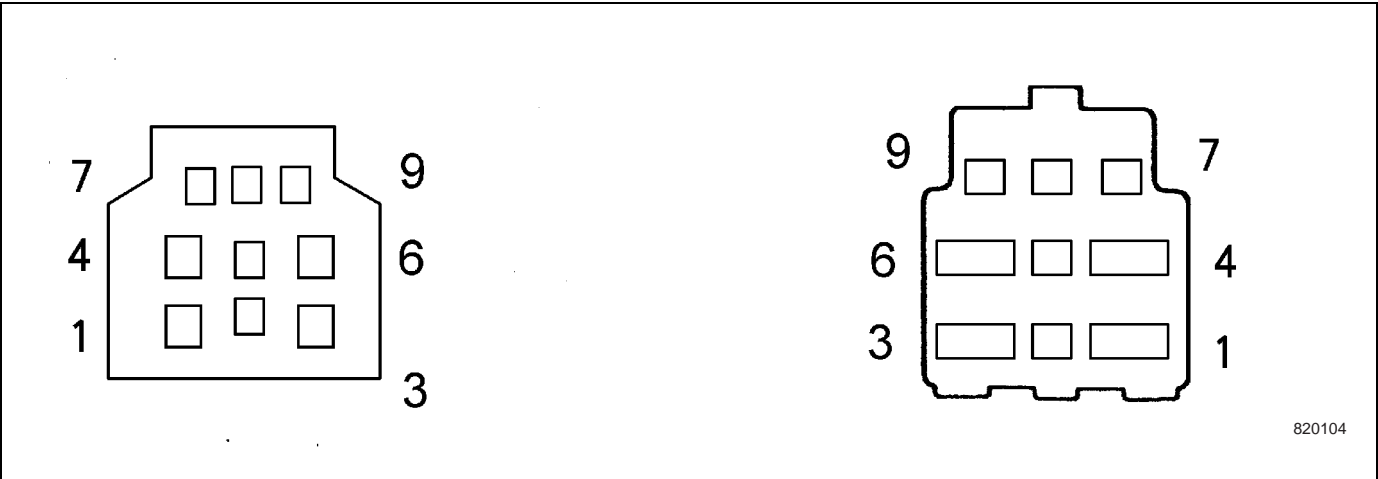
Inline Connector X1 between the I/P and Front Body Wiring Harness



820203

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 15358701 Black Front Body Harness Side 			<ul style="list-style-type: none"> 15358702 Black I/P Harness Side 		
A	Red	Light Control	A	Red	to Battery
B	Red Green	TCM, Rear Defrosting	B	Red Green	to Battery
C	Red	Ignition Switch 30 Pin	C	Red Black	to Battery
D	Red Black	Central door locking, Horn, Heater motor	A	-	-
E	Black	Radiator Fan, Electric Fan, Signal Lamp	B	Black	to Battery
D6	Not Used	-	C	Red	to Battery

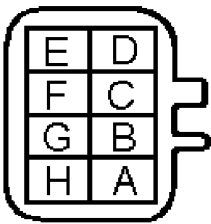
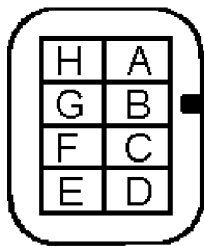
8.20.4.2 Inline Connector X2 between the I/P and Engine Wiring Harness



Connector Part Information			<ul style="list-style-type: none">12147772Engine Harness Side	Connector Part Information			<ul style="list-style-type: none">12147773 BlackI/P Harness Side
Pin	Wire Color	Function		Pin	Wire Color	Function	
1	Black	ECM module supply circuit		1	Black	ECM module supply circuit	
2	Blue	Coolant Temperature Sensor		2	Blue	Coolant Temperature Sensor	
3	Black	Ignition Coil Supply Circuit		3	Black	Ignition Coil Supply Circuit	
4	Black	Fuel Pump Power Supply Circuit		4	Black	Fuel Pump Power Supply Circuit	
5	Brown/White	Diagnosis		5	Brown/White	Diagnosis	
6	Green	Inspect the ENG signal device		6	Green	Inspect the ENG signal device	
7	Brown/Red	Fuel Pump Control Relay Circuit		7	Brown/Red	Fuel Pump Control Relay Circuit	
8	Blue/Red	Tachometer Signal		8	Blue/Red	Tachometer Signal	
9	Red	ECM Module Power Supply Circuit		9	Red	ECM Module Power Supply Circuit	

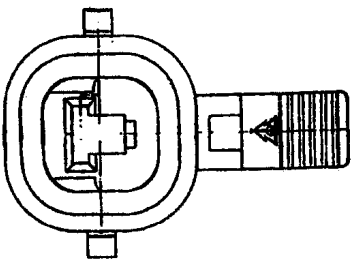
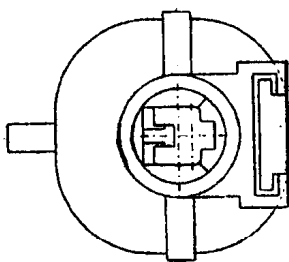


Connector Part Information			<ul style="list-style-type: none">12045688 Black	Connector Part Information			<ul style="list-style-type: none">12047886 Black
Pin	Wire Color	Function		Pin	Wire Color	Function	
A	Not Used	Not Used		A	Not Used	Not Used	



820105

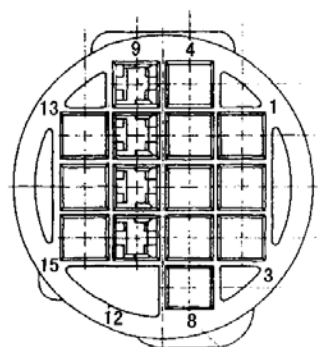
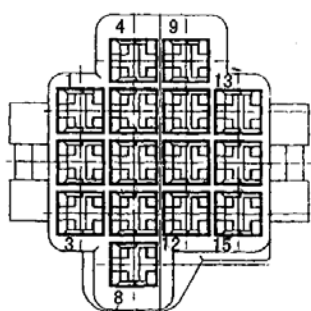
Connector Part Information			• 12045688 Black			Connector Part Information			• 12047886 Black		
Pin	Wire Color	Function				Pin	Wire Color	Function			
B	Blue/Red	Vehicle Speed Sensor				B	Blue/Red	Vehicle Speed Sensor			
C	Black/Yellow	A/C Request				C	Black/Yellow	A/C Request			
D	Black/Blue	A/C Compressor Clutch				D	Black/Blue	A/C Compressor Clutch			
E	Brown/Green	Lower Cooling Fan				E	Brown/Green	Lower Cooling Fan			
F	Brown/Red	High Cooling Fan				F	Brown/Red	High Cooling Fan			
G	Brown	Pressure Switch Ground				G	Brown	Pressure Switch Ground			
H	Not Used	Not Used				H	Not Used	Not Used			



820106

Connector Part Information			• 12197129			Connector Part Information			• 15316496		
Pin	Wire Color	Function				Pin	Wire Color	Function			
1	Black	Lighter Power Supply Circuit				1	Black	Lighter Power Supply Circuit			

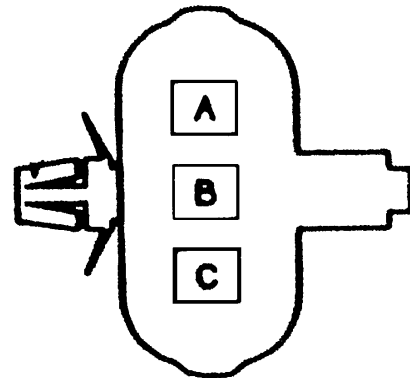
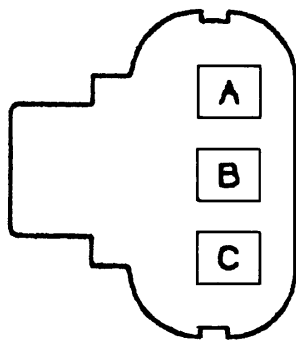
8.20.4.3 Inline Connector X3 between the I/P and Automatic Transmission



820207

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 12185284 I/P Harness Side 			<ul style="list-style-type: none"> 12184963 Auto Transmission Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
1	Brown/White	Diagnostic Signal	1	Brown/White	Diagnostic Signal
2	Brown/Purple	AT Signal Device	2	Brown/Purple	AT Signal Device
3	Black/Yellow	F17 Fuse Supply Circuit	3	Black/Yellow	F17 Fuse Supply Circuit
4	Grey/Green	F23 Fuse Supply Circuit	4	Grey/Green	F23 Fuse Supply Circuit
5	Red	F2 Fuse Supply Circuit	5	Red	F2 Fuse Supply Circuit
6	Black/Red	Park/Neutral Signal	6	Black/Red	Park/Neutral Signal
7	White/Black	Backup Signal	7	White/Black	Backup Signal Wire
8	Black/Yellow	Brake Signal	8	Black/Yellow	Brake Signal
9	Black/Yellow	F18 Fuse Supply Circuit	9	Black/Yellow	F18 Fuse Supply Circuit
10	Black/Yellow	F18 Fuse Supply Circuit	10	Black/Yellow	F18 Fuse Supply Circuit
11	Black/Red	Park/Neutral Signal	11	Black/Red	Park/Neutral Signal
12	White	Remote Control Central Lock A Signal	12	White	Gearshift Switch A Signal
13	Green	Remote Control Central Lock B Signal	13	Green	Gearshift Switch B Signal
14	Black/Yellow	Remote Control Central Lock PA Signal	14	Black/Yellow	Gearshift Switch PA Signal

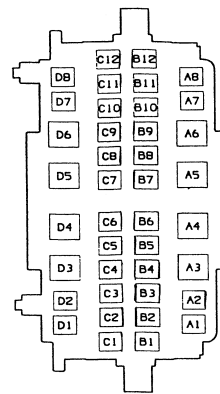
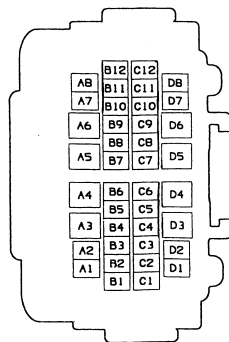
8.20.4.4 Inline Connector X4 between the I/P and Starter Wiring Harness



820108

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 12040977 Black I/P Harness Side 			<ul style="list-style-type: none"> 15300003 Black Starter Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
A	Blue/Green	Oil Pressure Switch	A	Blue/Green	Oil Pressure Switch
B	Blue/White	Generator	B	Blue/White	Generator
C	Black/Red	Starter Switch Signal	C	Black/Red	Starter Switch Signal

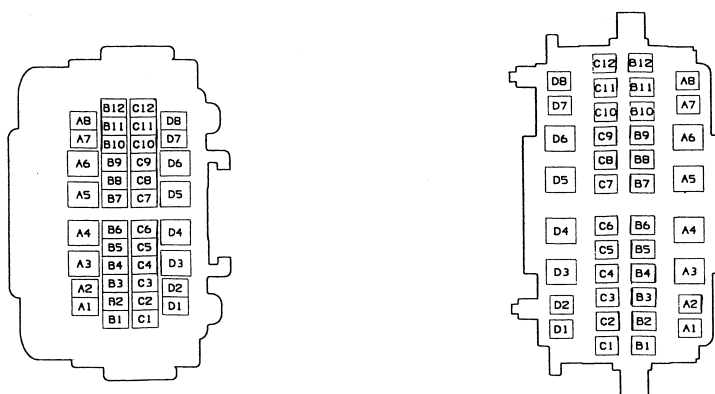
8.20.4.5 Inline Connector X5 between the I/P and Rear Body Wiring Harness



820109

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 15358704 Rear Body Harness Side 			<ul style="list-style-type: none"> 15358705 I/P Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
A1	Black	Lighter Power Supply Circuit	A1	Black	Lighter Power Supply Circuit
A2	Grey	Passenger Lamp Return	A2	Grey	Passenger Lamp Return
A3	Not Used	Not Used	A3	Not Used	Not Used
A4	Not Used	Not Used	A4	Not Used	Not Used
A5	Black	Rear Defroster Supply Circuit	A5	Black	Rear Defroster Supply Circuit
A6	Blue/Red	Fuel Pump Supply Circuit	A6	Blue/Red	Fuel Pump Supply Circuit

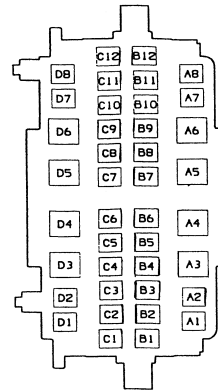
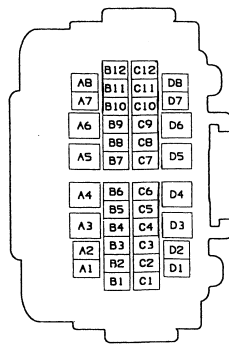
8.20.4.5 Inline Connector X5 between the I/P and Rear Body Wiring Harness(Cont' d)



820109

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 15358704 Rear Body Harness Side 			<ul style="list-style-type: none"> 15358705 I/P Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
A7	Blue/Black	Fuel Level Sensor	A7	Blue/Black	Fuel Level Sensor
A8	Brown/Yellow	Central Door Lock Output Signal	A8	Not Used	Not Used
B1	Black/White	Left Rear Supply Circuit of Turn Signal Lamp	B1	Black/White	Left Rear Supply Circuit of Turn Signal Lamp
B2	Black/Green	Rear Right Supply Circuit of Turn Signal Lamp	B2	Black/Green	Rear Right Supply Circuit of Turn Signal Lamp
B3	Red	Sunroof Ignition Switch Signal	B3	Red	Sunroof Supply Circuit
B4	Black	Sunroof Ignition Switch Signal	B4	Black	Sunroof Ignition Switch Signal
B5	Grey/Black	Supply Circuit of Left Parking Lamp	B5	Grey/Black	Supply Circuit of Left Parking Lamp
B6	Red	Supply Circuit of Passenger Lamp	B6	Red	Supply Circuit of Passenger Lamp
B7	Grey/Red	Supply Circuit of Right Tail Lamp	B7	Grey/Red	Supply Circuit of Right Tail Lamp
B8	Not Used	Not Used	B8	Not Used	Not Used
B9	White/Black	Supply Circuit of Backup Lamp	B9	White/Black	Supply Circuit of Backup Lamp
B10	Green	Rear Speaker Supply Circuit - Left	B10	Green	Rear Speaker Supply Circuit - Left
B11	White	Rear Speaker Supply Circuit - Right	B11	White	Rear Speaker Supply Circuit - Right
B12	Blue	Front Speaker Supply Circuit - Left	B12	Blue	Front Speaker Supply Circuit - Left
C1	Yellow	Front Speaker Supply Circuit - Right	C1	Yellow	Front Speaker Supply Circuit - Right
C2	Brown/Red	Central Door Lock Input Signal	C2	Brown/Red	Central Door Lock Input Signal
C3	Red	Reading Lamp Supply Circuit	C3	Red	Reading Lamp Supply Circuit
C4	Brown/White	Central Door Lock Input Signal	C4	Brown/White	Central Door Lock Input Signal
C5	Brown/Green	Rear Speaker Return - Left	C5	Brown/Green	Rear Speaker Return - Left
C6	Brown/White	Rear Speaker Return - Right	C6	Brown/White	Rear Speaker Return - Right
C7	Brown/Blue	Front Speaker Return - Left	C7	Brown/Blue	Front Speaker Return - Left

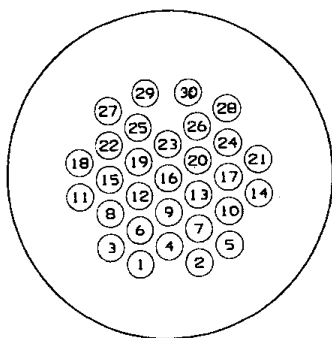
8.20.4.5 Inline Connector X5 between the I/P and Rear Body Wiring Harness(Cont' d)



820109

Connector Part Information		<ul style="list-style-type: none"> 15358704 Rear Body Harness Side 	Connector Part Information		<ul style="list-style-type: none"> 15358705 I/P Harness Side
Pin	Wire Color	Function	Pin	Wire Color	Function
C8	Brown/Yellow	Front Speaker Return - Right	C8	Brown/Yellow	Front Speaker Return - Right
C9	Not Used	Not Used	C9	Not Used	Not Used
C10	Black	Lighter Power Supply Circuit	C10	Black	Lighter Power Supply Circuit
C11	Black/Blue	Rear Fog Lamp Supply Circuit	C11	Black/Blue	Rear Fog Lamp Supply Circuit
C12	Black	Central Lock Supply Circuit	C12	Black	Central Lock Supply Circuit
D1	Blue	ABS Wheel Speed Sensor, Rear Left	D1	Blue	ABS Wheel Speed Sensor, Rear Left
D2	Brown/Red	ABS Wheel Speed Sensor, Rear Right	D2	Brown/Red	ABS Wheel Speed Sensor, Rear Right
D3	Red	Central Lock Battery Supply Circuit	D3	Red	Central Lock Battery Supply Circuit
D4	Black	Fuse Battery Feed Circuit - Window Lifter	D4	Black	Fuse Battery Feed Circuit - Window Lifter
D5	Black/Yellow	Stop Lamp Supply Circuit	D5	Black/Yellow	Stop Lamp Supply Circuit
D6	Brown/White	Parking Brake Switch	D6	Brown/White	Parking Brake Switch
D7	Brown	ABS Wheel Speed Sensor, Rear Left	D7	Brown	ABS Wheel Speed Sensor, Rear Left
D8	Blue/Red	ABS Wheel Speed Sensor, Rear Right	D8	Blue/Red	ABS Wheel Speed Sensor, Rear Right

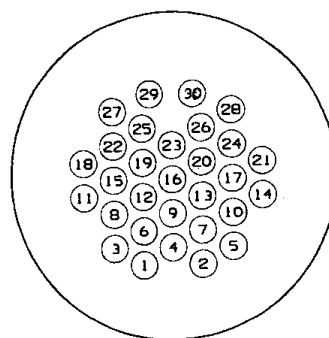
8.20.4.6 Inline Connector X6 between Rear Body and Left Front Door Wiring Harness



820110

Connector Part Information		<ul style="list-style-type: none"> 12147161 Rear Body Harness Side
Pin	Wire Color	Function
2	Black/Red	Window Lifter Circuit, Right Front Side
3	Blue	Window Lifter Circuit, Right Front Side
4	Brown/White	Window Lifter Circuit, Left Front Side
5	Green	Window Lifter Circuit, Left Front Side
6	Green	Window Lifter Circuit, Right Rear Side
7	Black/Yellow	Lighter Power Supply Circuit
8	Brown/Red	Motor, Central Lock, Driver's Door
9	Brown/White	Window Lifter Circuit, Right Rear Side
10	Black/Red	Motor, Central Lock, Driver's Door
11	Black	Control Switch Circuit of Power Mirror
12	Brown/White	Control Switch Circuit of Power Mirror (Upper/Lower)
13	Blue	Front Speaker Supply Circuit - Left
14	Grey	Power Mirror Motor Return Circuit
15	Black/Blue	Switch, Central Lock, Driver's Door

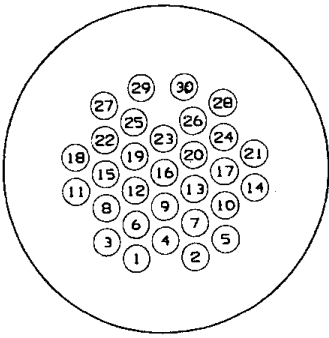
8.20.4.6 Inline Connector X6 between Rear Body and Left Front Door Wiring Harness(Cont' d)



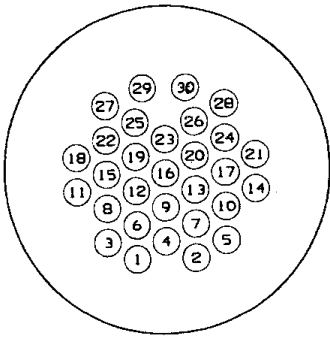
820110

Connector Part Information		<ul style="list-style-type: none"> 12147161 Rear Body Harness Side
Pin	Wire Color	Function
16	Brown/White	Motor, Central Lock, Driver's Door
17	Blue/Red	Switch, Central Lock, Driver's Door
18	Grey/Green	Switch - Driver's Door Window Lifter
19	Black	Lighter Power Supply Circuit - Driver's Door Window Lifter
20	Brown/Red	Switch Circuit of Power Mirror (Left/Right)
22	Brown/Blue	Front Speaker Return - Left
25	Black/Yellow	Motor, Central Lock, Driver's Door
29	Black	Fused Battery Feed Circuit of Driver's Door Window Lifter Motor
30	Brown	Ground

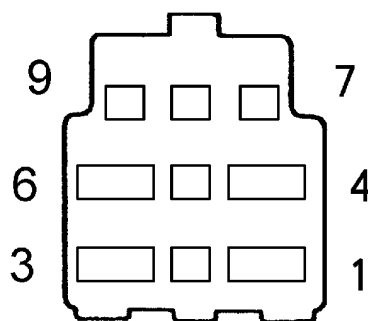
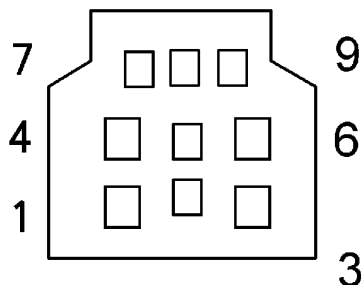
8.20.4.7 Inline Connector X7 between Rear Body and Right Front Door Wiring Harness

		
820110		
Connector Part Information		<ul style="list-style-type: none"> 12147161 Rear Body Harness Side
Pin	Wire Color	Function
2	Black/Red	Window Lifter Circuit, Right Front Side
3	Blue	Window Lifter Circuit, Right Front Side
5	Grey	Power Mirror Motor Return Circuit
6	Brown/White	Motor Return Circuit of Power Mirror (Upper/Lower)
7	Brown/Red	Motor Return Circuit of Power Mirror (Left/Right)
8	Brown/Red	Switch, Central Lock, Co-Driver's Door
10	Black/Red	Motor, Central Lock, Co-Driver's Door
13	Yellow	Front Speaker Supply Circuit - Right
15	Black/Blue	The same with P/N 10
16	Brown/White	The same with P/N 10
17	Blue/Red	Switch - Co-Driver's Door Window Lifter
18	Grey/Green	Switch - Co-Driver's Door Window Lifter
19	Black	Lighter Power Supply Circuit - Co-Driver's Door Window Lifter
22	Brown/Yellow	Front Speaker Return - Right

8.20.4.7 Inline Connector X7 between Rear Body and Right Front Door Wiring Harness(Cont' d)

		
820110		
Connector Part Information		<ul style="list-style-type: none"> 12147161 Rear Body Harness Side
Pin	Wire Color	Function
25	Black/Yellow	The same with P/N 10
29	Black	Fused Battery Feed Circuit of Co-Driver's Door Window Lifter Motor
30	Brown	Ground

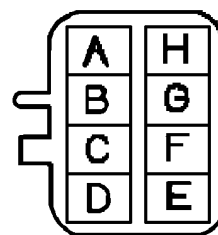
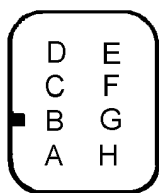
8.20.4.8 Inline Connector X8 between Rear Body and Rear Door Wiring Harness



820127

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 12147772 Black Rear Body Harness Side 			<ul style="list-style-type: none"> 15300003 Black Rear Door Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
3	Brown/White	Window Lifter Motor Circuit	3	Brown/White	Window Lifter Motor Circuit
4	Green	The same as PIN 3	4	Green	The same as PIN 3
7	Black/Red	Central Lock Motor, Rear Door	7	Black/Red	Central Lock Motor, Rear Door
8	Black/Yellow	The same as PIN 7	8	Black/Yellow	The same as PIN 7
9	Black/Blue	The same as PIN 7	9	Black/Blue	The same as PIN 7

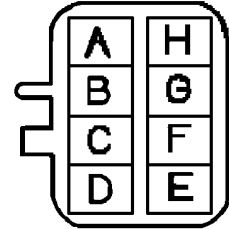
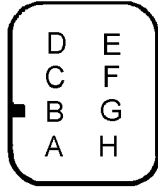
8.20.4.9 Inline Connector X9 between Rear Body and Lid-Trunk Wiring Harness



820111

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 12045688 Black Lid-Trunk wiring harness 			<ul style="list-style-type: none"> 15300003 Black Rear Door Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
A	Brown/White	Trunk Lamp	A	Brown/White	Trunk Lamp
B	Not Used	Not Used	B	Not Used	Not Used
C	Not Used	Not Used	C	Not Used	Not Used
D	Not Used	Not Used	D	Not Used	Not Used

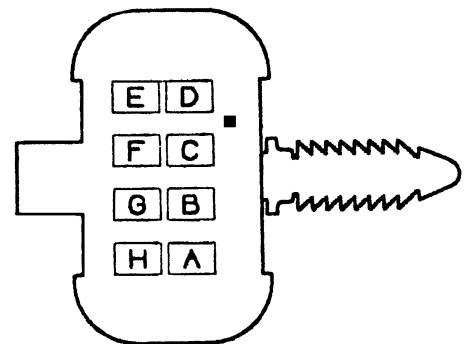
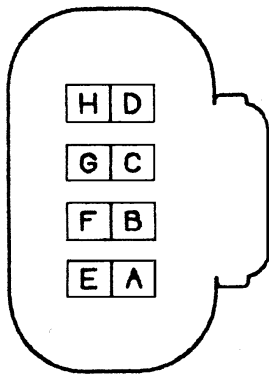
8.20.4.9 Inline Connector X9 between Rear Body and Lid-Trunk Wiring Harness(Cont' d)



820111

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 12045688 Black Lid-Trunk wiring harness 			<ul style="list-style-type: none"> 15300003 Black Rear Door Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
E	Not Used	Not Used	E	Not Used	Not Used
F	Brown	Ground	F	Brown	Ground
G	Not Used	Not Used	G	Not Used	Not Used
H	Not Used	Not Used	H	Not Used	Not Used

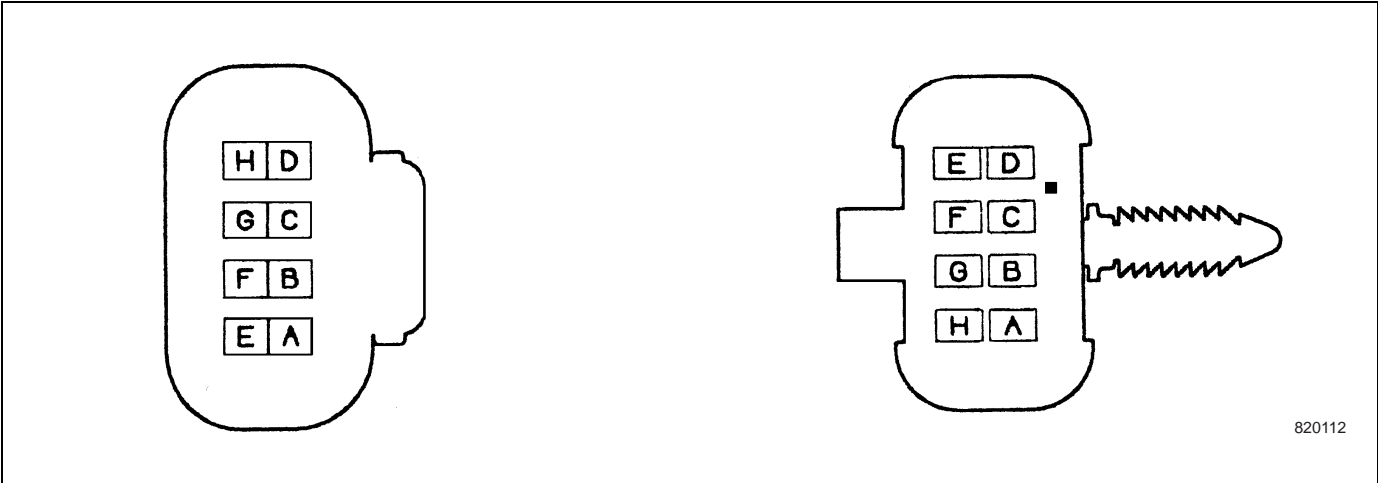
8.20.4.10 Inline Connector X10 between Auto Transmission and Engine Wiring Harness



820112

Connector Part Information			Connector Part Information		
<ul style="list-style-type: none"> 12047937 Black Engine wiring harness 			<ul style="list-style-type: none"> 12047931 Black Auto Transmission Harness Side 		
Pin	Wire Color	Function	Pin	Wire Color	Function
A	Green	Engine Speed	A	Green	Engine Speed
B	Green	Torque Control	B	Green	Torque Control
C	Black/Red	Engine Load	C	Black/Red	Engine Load
D	Brown	Ground	D	Brown	Ground
E	Not Used	Not Used	E	Not Used	Not Used

8.20.4.10 Inline Connector X10 between Auto Transmission and Engine Wiring



Connector Part Information		<ul style="list-style-type: none">• 12047937 Black• Engine wiring harness	Connector Part Information		<ul style="list-style-type: none">• 12047931 Black• Auto Transmission Harness Side
Pin	Wire Color	Function	Pin	Wire Color	Function
F	Brown	Ground	F	Brown	Ground
G	Black/Red	Park/Neutral Signal	G	Black/Red	Park/Neutral Signal
H	Not Used	Not Used	H	Not Used	Not Used

8.20.5 Diagnostic Information and Procedures

8.20.5.1 Starter Inoperative

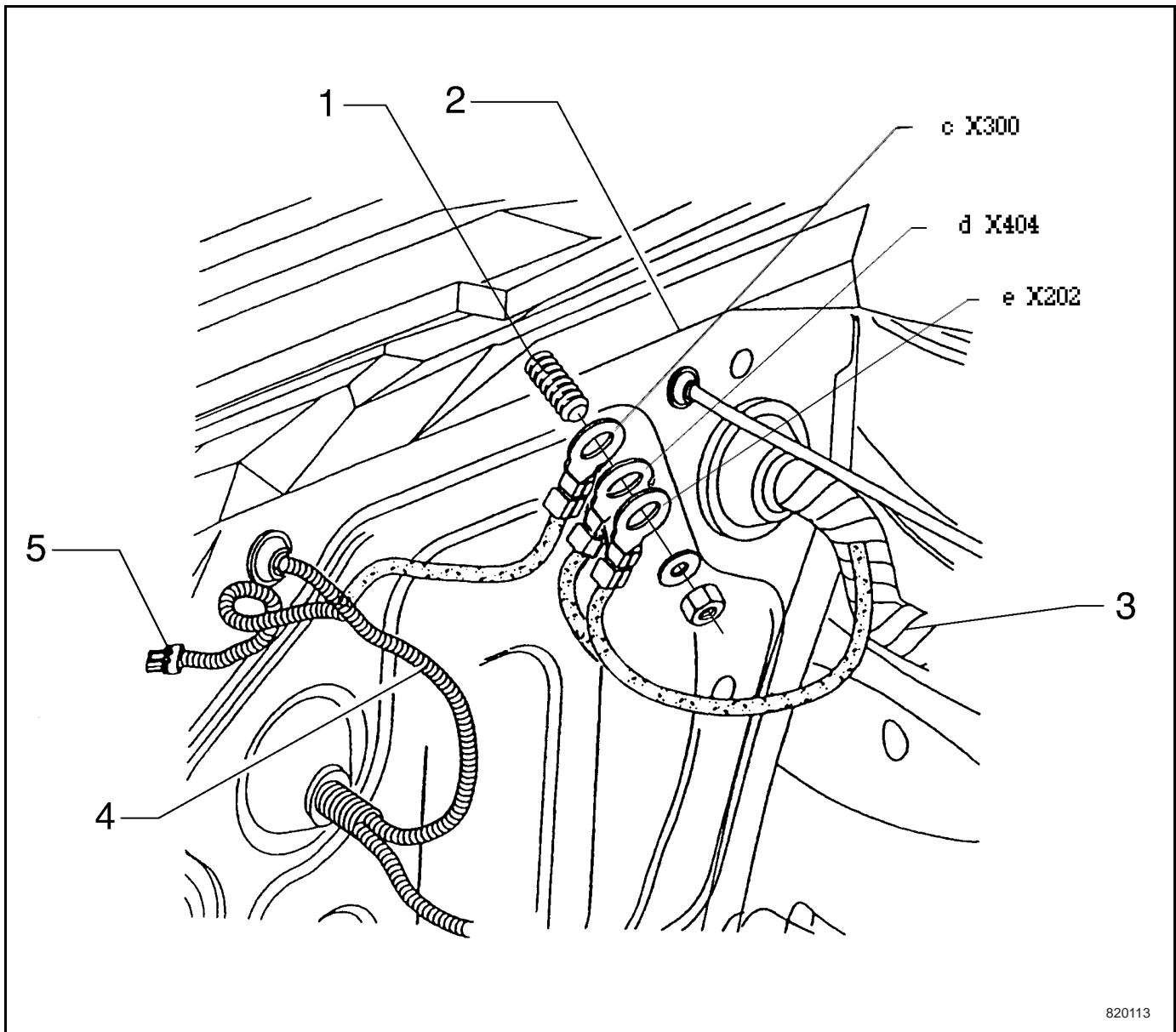
Step	Action	Yes	No
1	Ensure that the shift lever is at N Gear position. (Only for AT vehicles)	Go to Step 3	Go to Step 2
2	Position the selector lever switch at N Gear. (Only for AT vehicles)	—	—
3	Inspect for the battery positive and negative cables. Is there a good connection?	Go to Step 5	Go to Step 4
4	Secure the batter cables with a good connection..	—	—
5	Inspect the battery voltage. Is it ok?	Go to Step 7	Go to Step 6
6	Charge the battery or replace the battery.	—	—
7	Inspect the stater motor terminals. Is it ok?	Go to Step 9	Go to Step 8
8	Inspect the wire from battery to starter motor.	—	—
9	Switch the ignition switch to Start Position, and inspect the starter motor coil terminal voltage. Is it ok?	Go to Step 10	Go to Step 11
10	If the starter motor has a condition, repair or replace the starter motor.	—	—
11	Disconnect the connector (X4) between starter and I/P harness, and switch the ignition switch to Start. Inspect the Pin C voltage. Is it ok?	Go to Step 12	Go to Step 13
12	Inspect and repair the wire between the connector (X4) and starter motor coil terminal.	—	—
13	Inspect the ignition switch and I/P harness, and repair.	—	—

8.20.5.2 Charging is Abnormal

Step	Action	Yes	No
1	Start the engine, depress the accelerator.Does the charging indicator illuminate?	Refer to Instrument Cluster Diagnosis in Instrument Panel, Gauges and Console.	Go to Step 2
2	Switch the ignition switch to OFF Position, use the DMM to measure the resistance between battery positive and alternator B terminal. Is there a short?	Go to Step 3	Go to Step 4
3	Alternator has a condition, repair or relace it.	—	—
4	Inspect the starter wiring, and secure the battery wiring in order to make a good connection.	—	—

8.20.6 Wiring Harness Ground Point Information

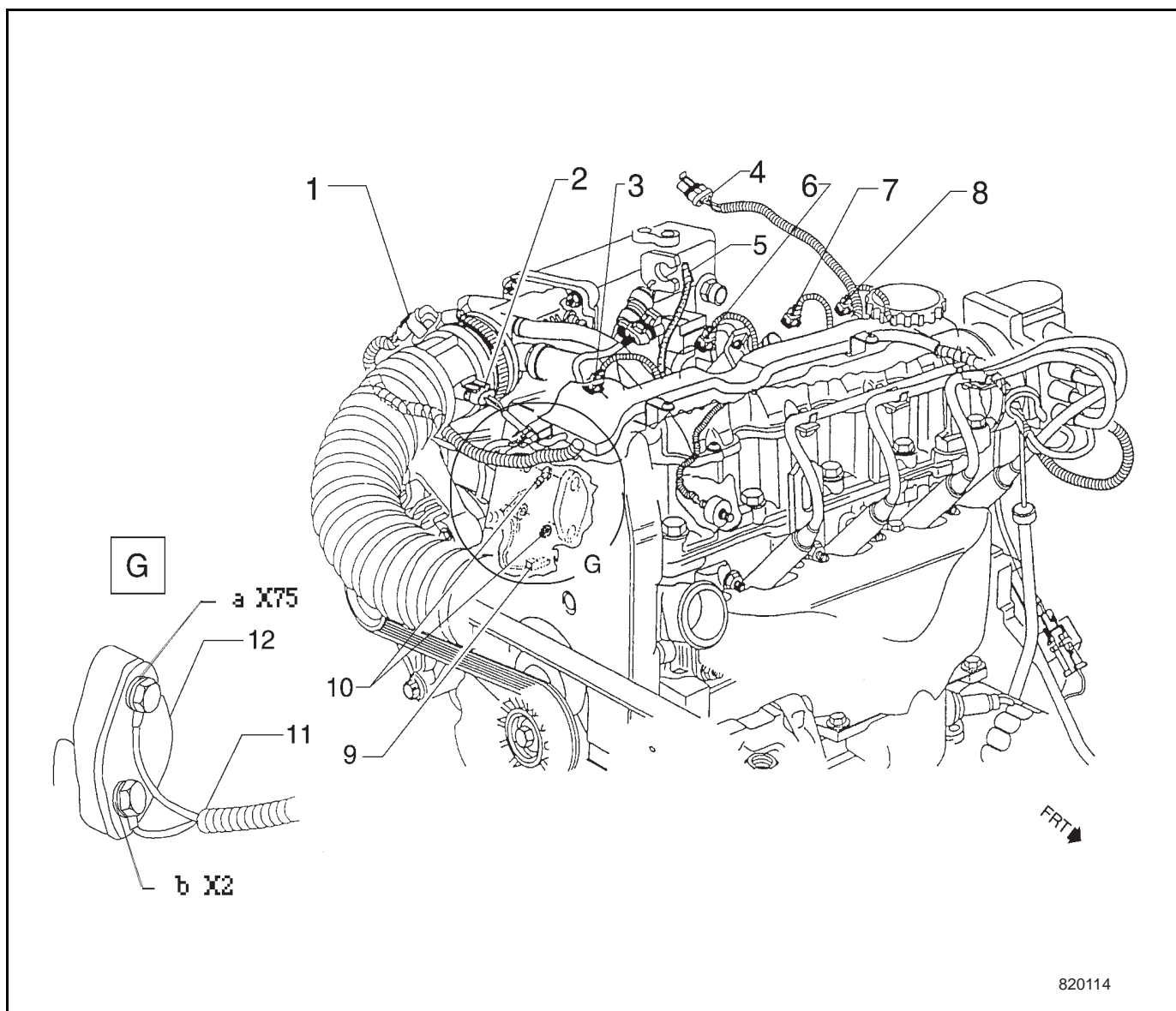
8.20.6.1 Grounding Point at the Dash Panel (I/P and Front Body Wiring Harness)



Legend:

- | | |
|-------------------------------|--------------------------------------|
| (1) Ground Point | (4) I/P Wiring Harness |
| (2) Dash Panel | (5) Brake Fluid Reservoir connection |
| (3) Front Body Wiring Harness | |

8.20.6.2 Engine Wiring Harness Routing in the Engine Compartment

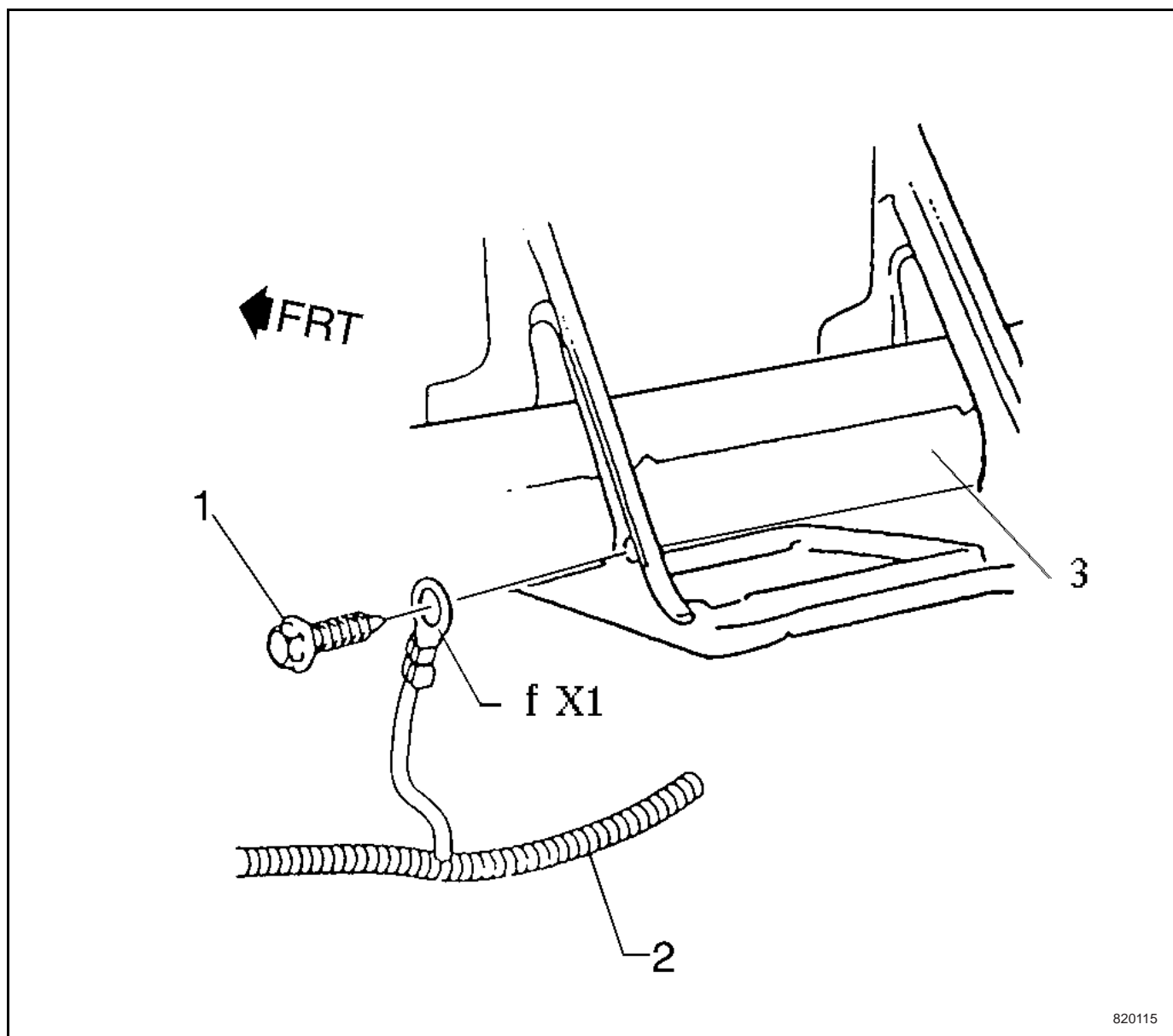


820114

Legend

- | | |
|--|--|
| (1) Idle Sensor connection | (7) Cylinder 3 Injector connection |
| (2) Intake Air Temperature Sensor connection | (8) Cylinder 4 Injector connection |
| (3) Cylinder 1 Injector connection | (9) Temperature Sensor connection |
| (4) Absolute pressure sensor connection | (10) Engine wiring harness ground terminal |
| (5) Canister Purge Valve connector | (11) Engine wiring harness |
| (6) Cylinder 2 Injector connection | (12) Ground Point |

8.20.6.3 Grounding Point Position at the I/P (I/P Wiring Harness)

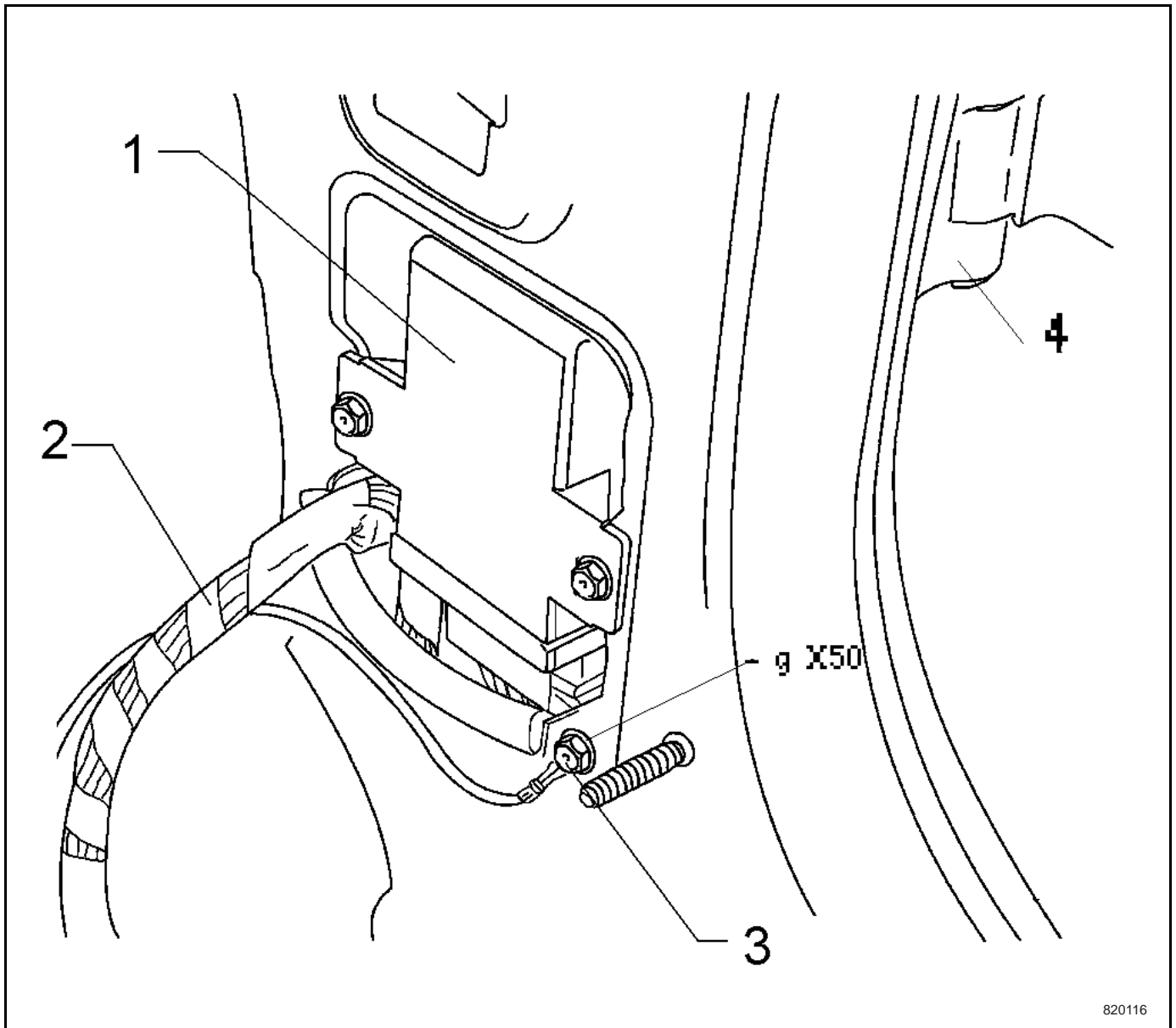


820115

Legend

- | | |
|--|----------------------|
| (1) Grounding screw beside steering column | (3) Instrument Panel |
| (2) I/P wiring harness | |

8.20.6.4 Grounding Point at the Right Front Side Panel Pillar (Rear Body Wiring Harness)

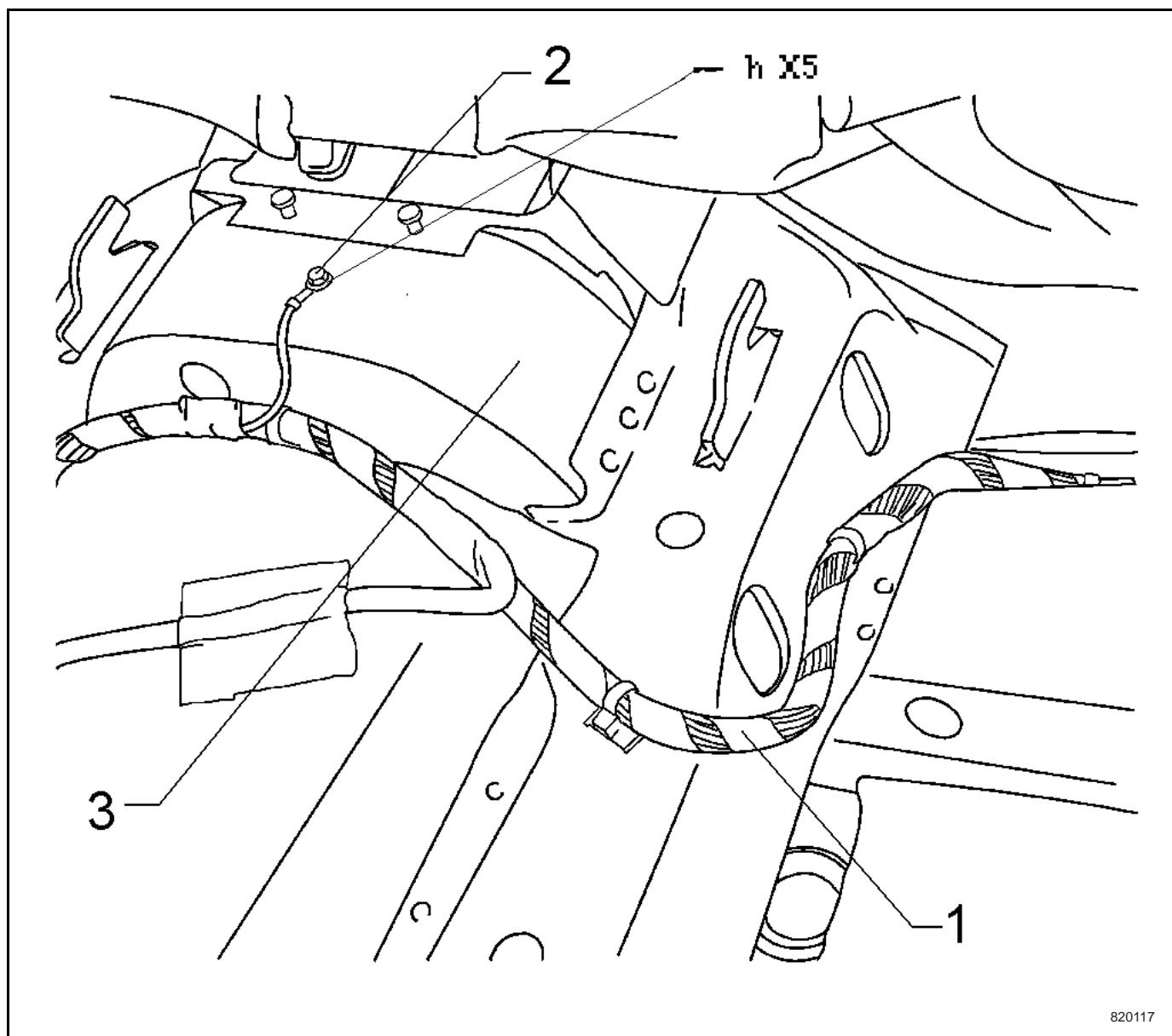


820116

Legend

- | | |
|-------------------------|----------------------|
| (1) Central Lock Module | (3) Ground Point |
| (2) Rear Body Harness | (4) Right Front Door |

8.20.6.5 Grounding Point at the Middle of Floor Assembly (Rear Body Wiring Harness)



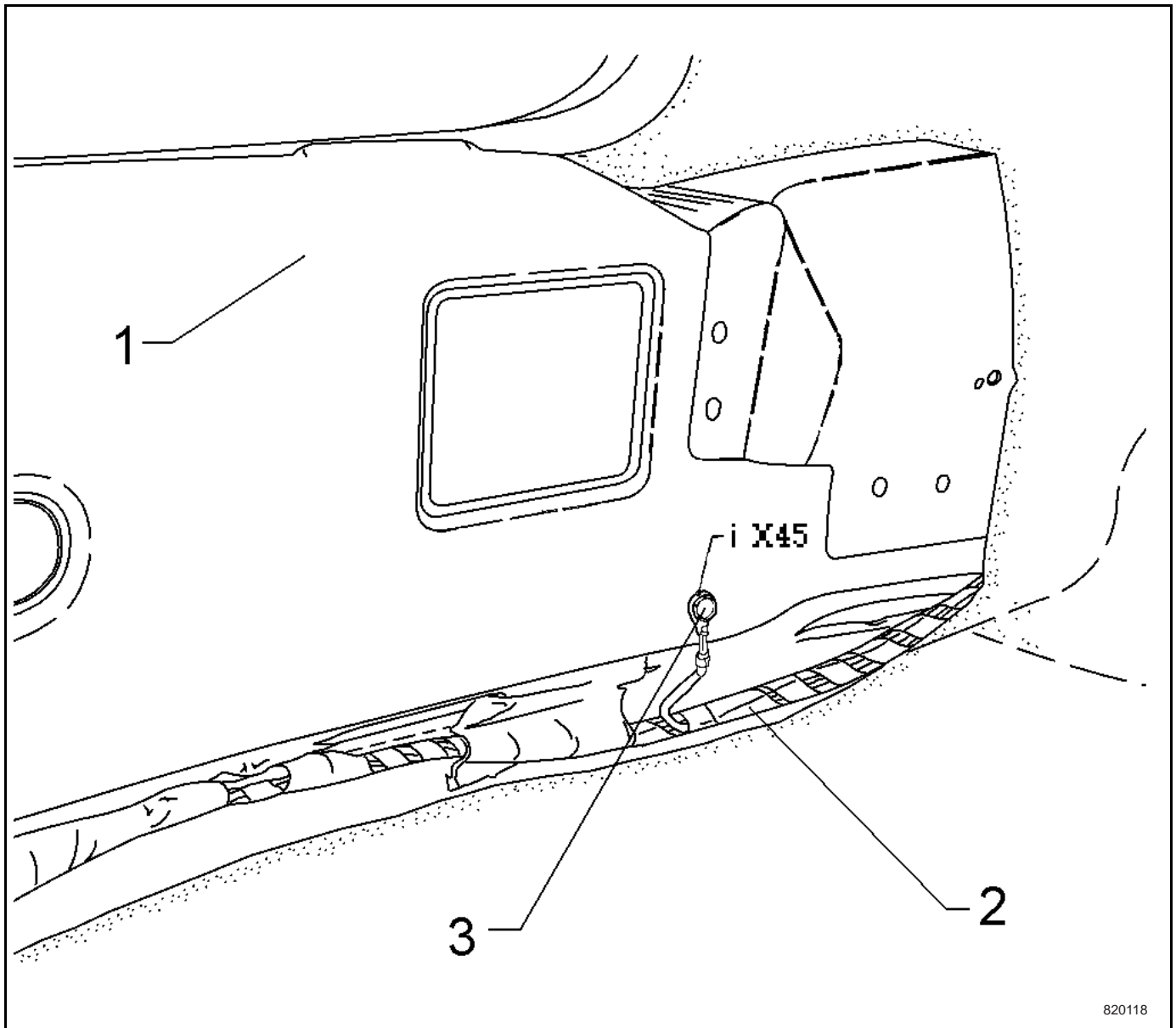
820117

Legend

- (1) Rear body wiring harness
- (2) Ground Point

- (3) Floor Assembly

8.20.6.6A Grounding Point at the Left Rear End of Lid-Trunk



820118

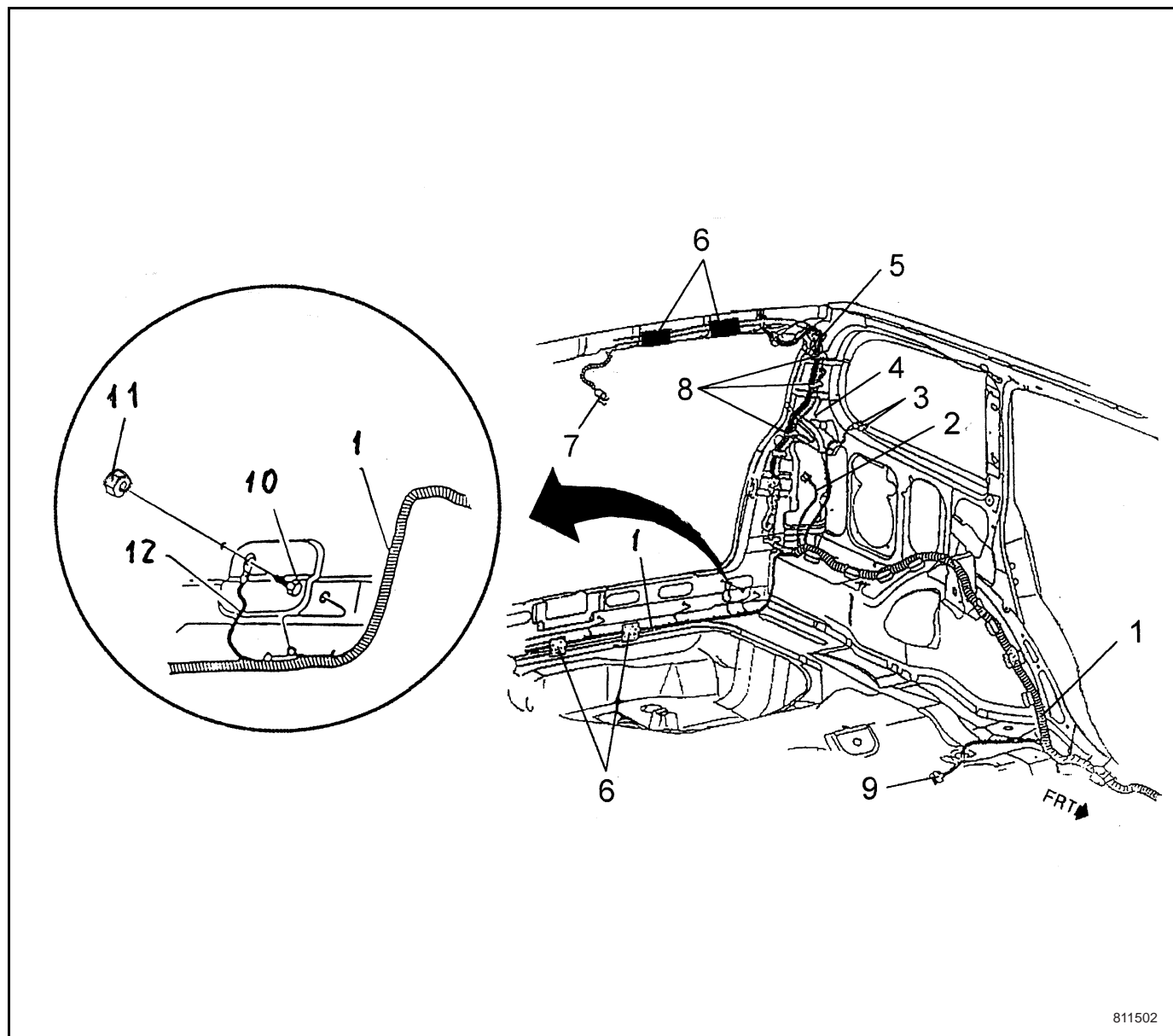
Legend

(1) Vehicle Rear

(2) Rear body wiring harness

(3) Ground Point

8.20.6.6B Grounding Point at the Left Rear End of Lid-Trunk

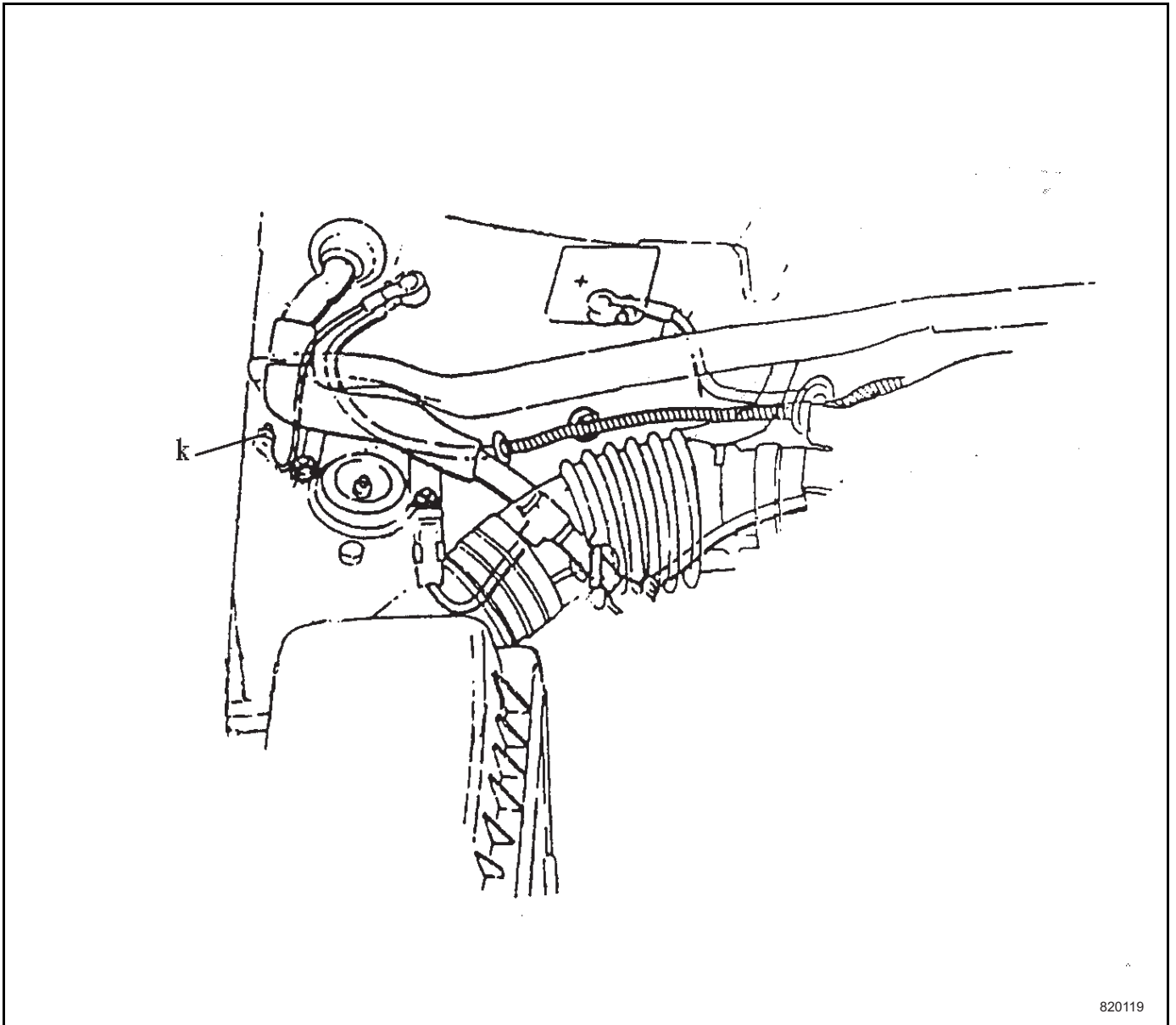


811502

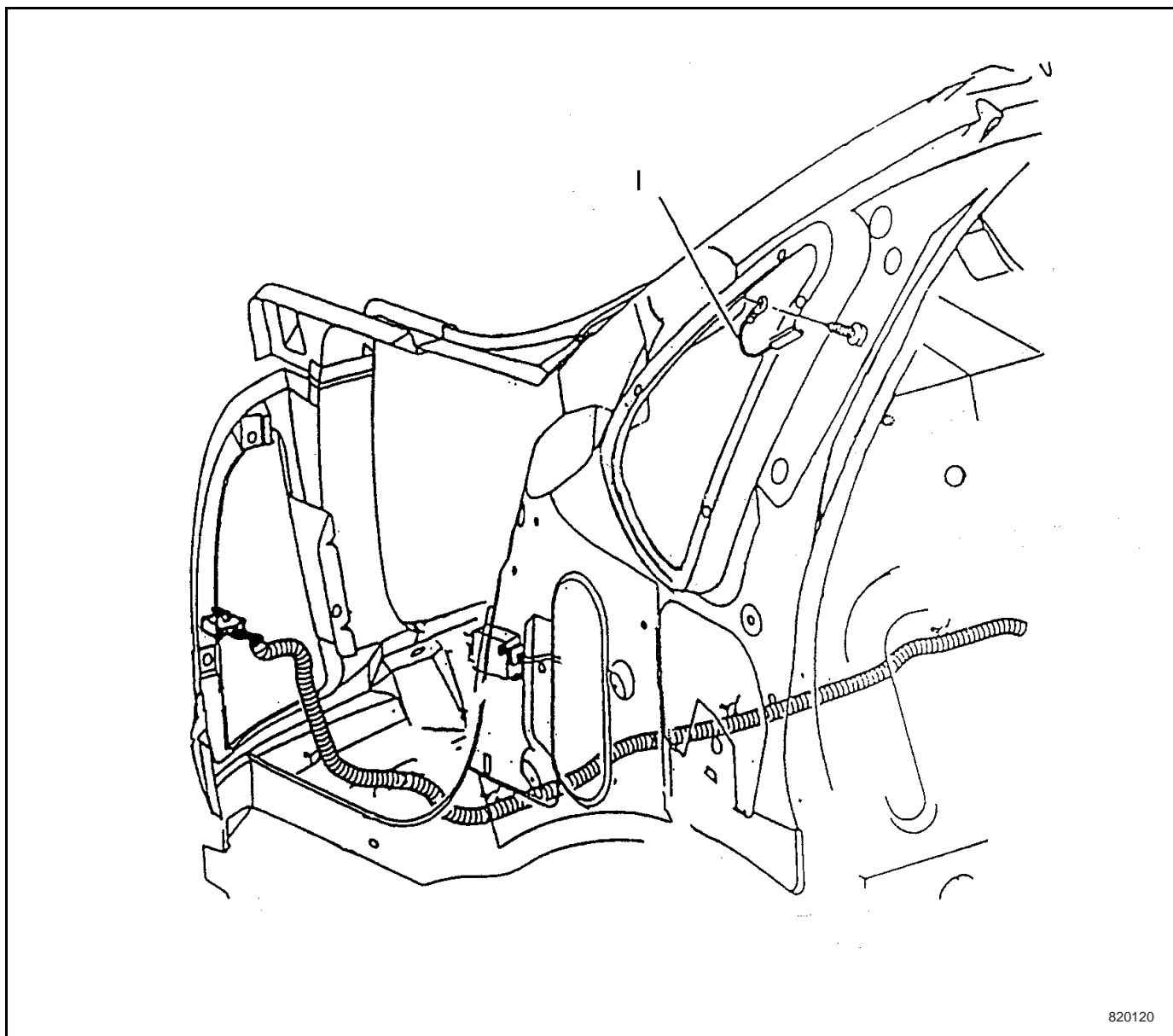
Legend:

- | | |
|-----------------------------------|--|
| (1) Rear Body Wiring Harness ASM | (7) Connector, Roof Lighting |
| (2) Connector to Tail Lamp | (8) Clips - Rear Body Harness |
| (3) Connector, Speaker | (9) Connector to Fuel Tank |
| (4) Connector, Tweeter | (10) Bolt/Screw - Rear Body Harness Ground |
| (5) Harness ASM - Rear L/Gate WRG | (11) Nut - Rear Body Harness Ground |
| (6) Strap - Rear Body Harness | (12) Connector, Rear Lower Ground Point |

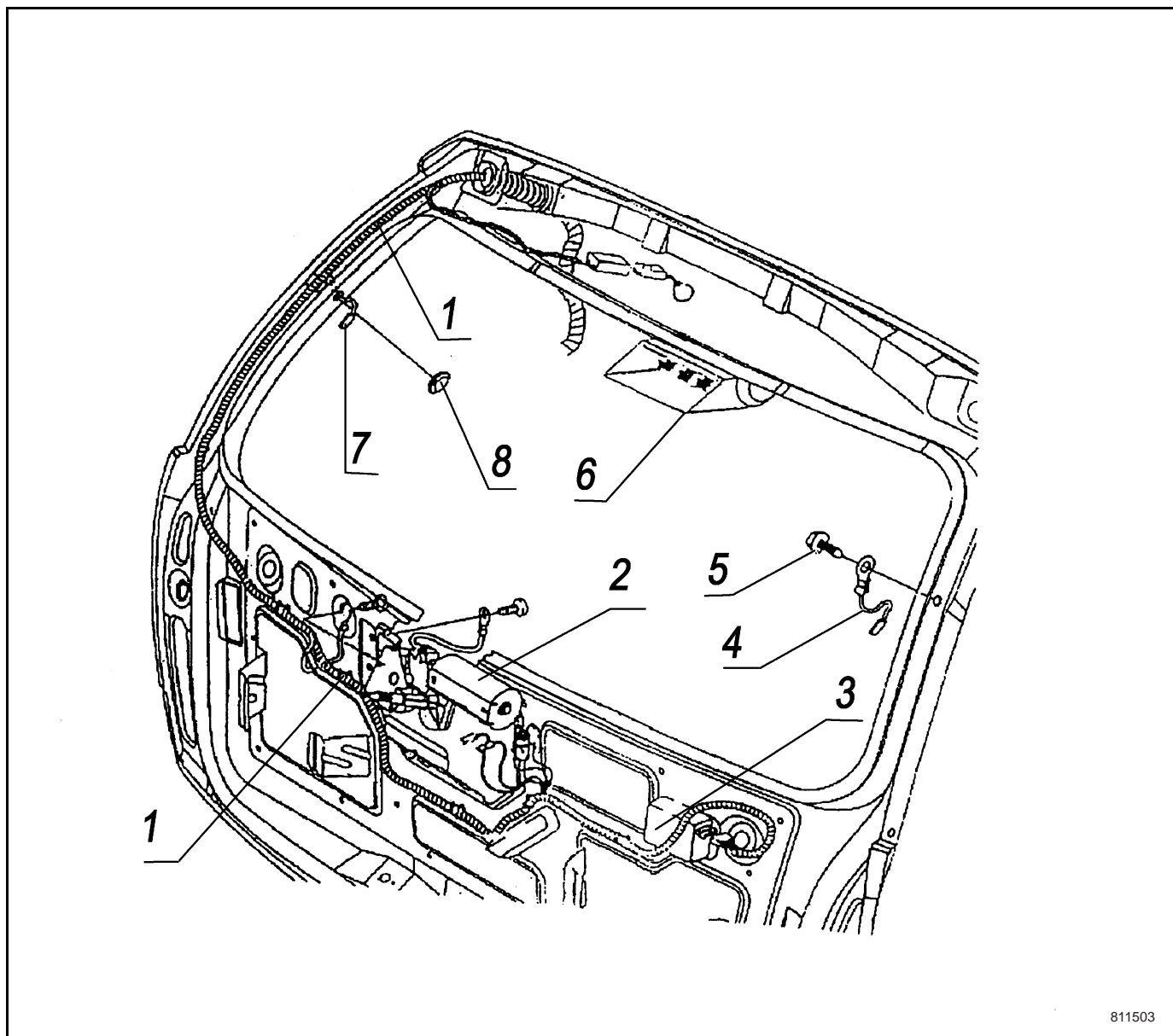
8.20.6.7 K-Battery Ground



8.20.6.8A i-Rear Windscreen Heater Grounding Point



8.20.6.8B i-Rear Window Heater Grounding Point



811503

Legend

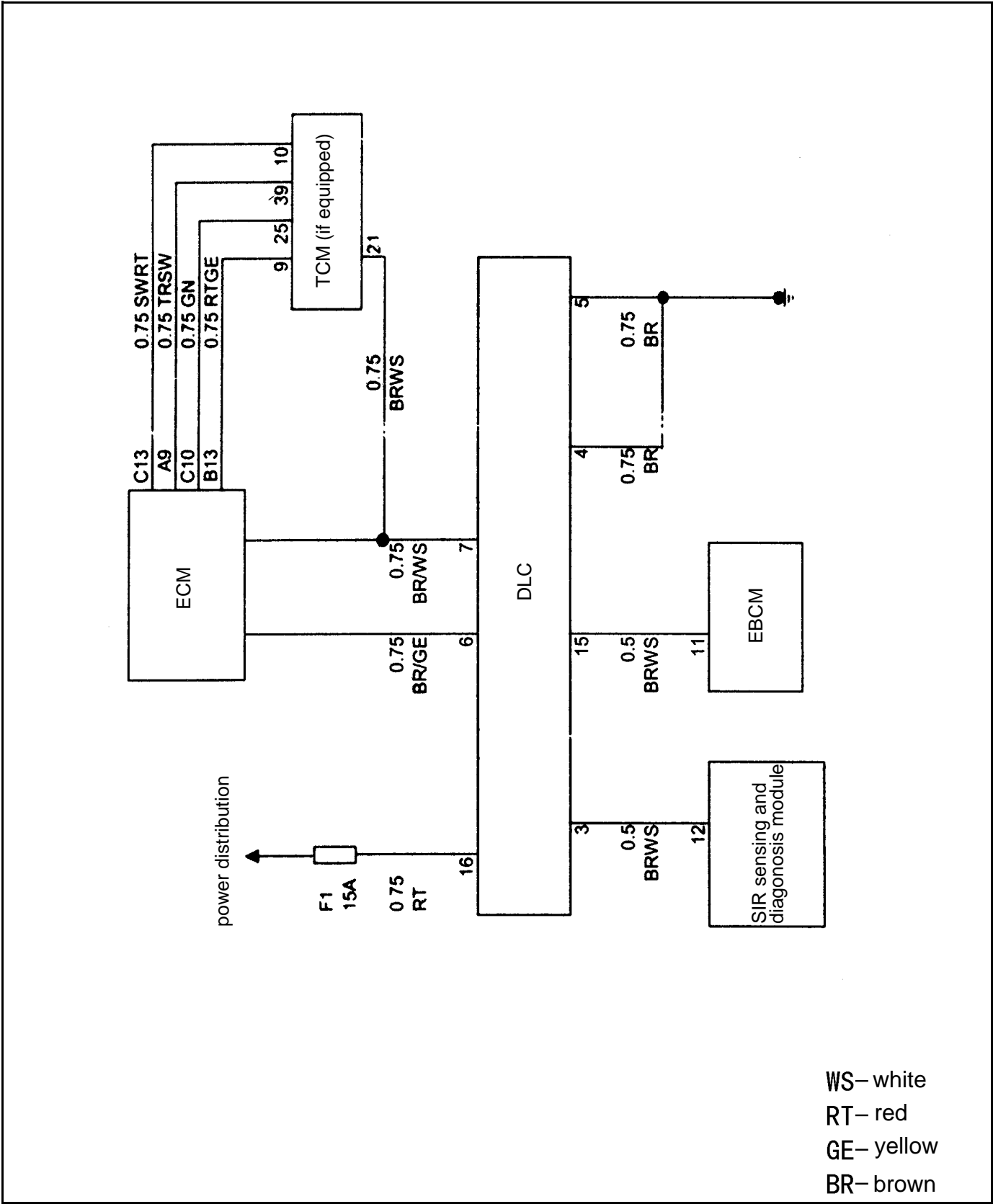
- | | |
|---|--|
| (1) Harness ASM - Rear L/Gate WRG | (5) Bolt/Screw - Rear Window Defogger Harness Ground |
| (2) Rear Wiper/Washer Motor | (6) Lamp, Auxiliary Brake |
| (3) Actuator, Rear Lift Gate | (7) Rear Window Defogger, Ground |
| (4) Rear Window Defogger Harness Assembly | (8) Seal Ring-Rear Defogger Wire |

Blank

8.21Data Link Communications

8.21.1 Schematic and Wiring Diagram

8.21.1.1 Diagram of Data Link Connectors

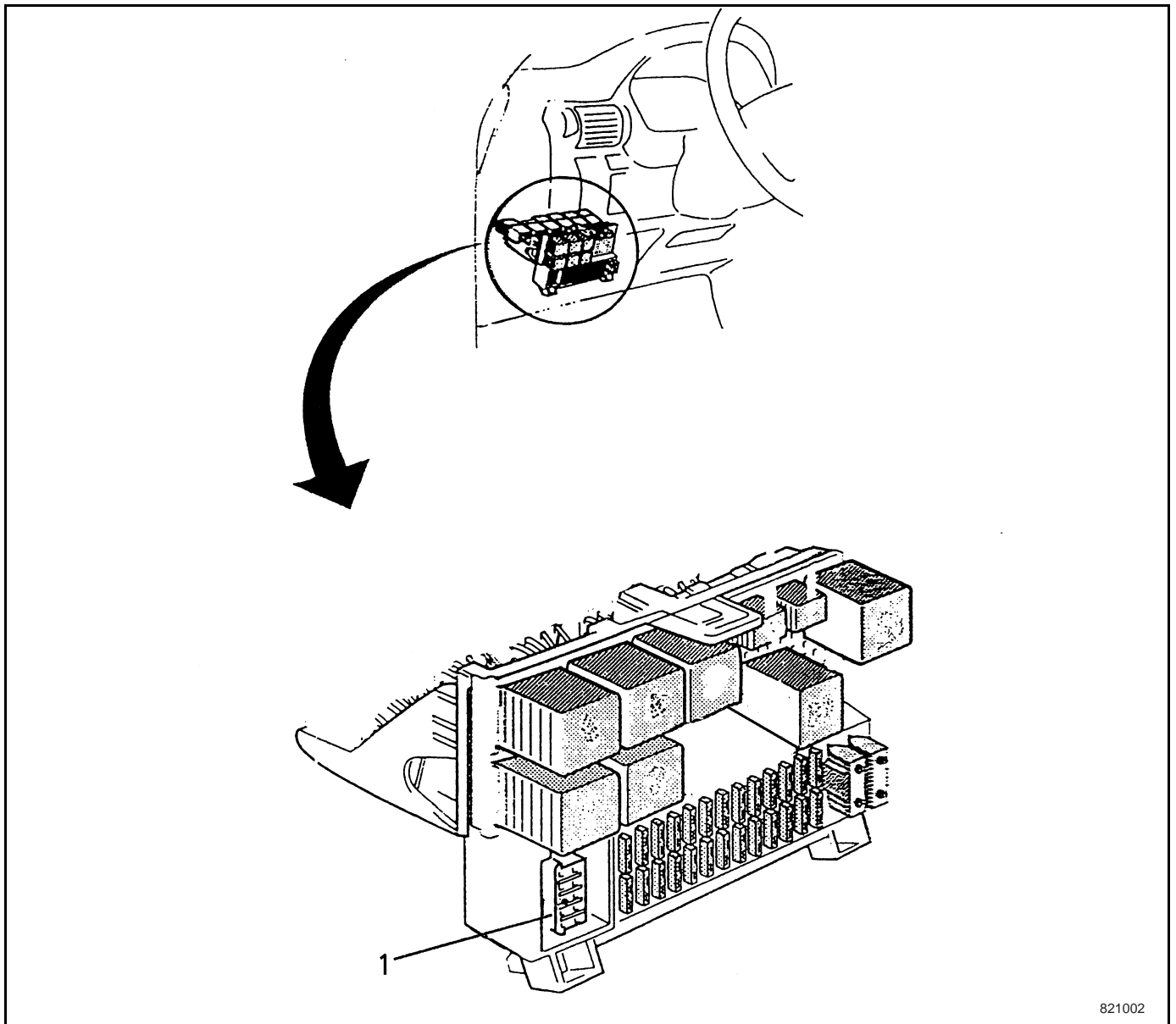


8.21.2 Component Location

8.21.2.1 Data Link Communication Component Location

Name	Location	Component Locator
Data Link Connector (DLC)	Assembled in the fuse box under the left bottom of the instrument panel and to the left of the steering column.	Refer to the Data Link Connector's Component View at the next page.
Engine control module (ECM)	to the right bottom of Column A near the right leg of the front passenger.	—
Automatic Transmission Control Module (TCM) (if equipped)	within the instrument console and above the front floor	—
SIR system sensing and diagnostic module (SDM) (if equipped)	within the instrument console and above the front floor	—
Electronic braking control module (EBCM) (if equipped)	engine compartment and integrated with the ABS system braking module	—

8.21.2.2 Data link connector component view (at the left bottom of the instrument panel)

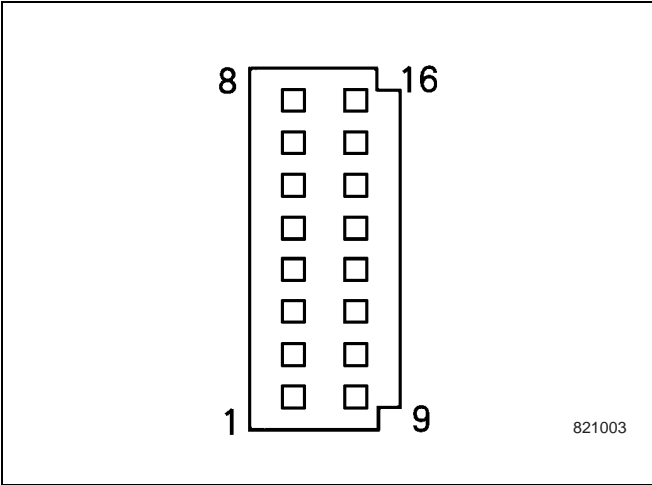


821002

legend

- (1) Data Link Connector

8.21.2.3 Data Link Connector Endview



pin	wire color	function
1-2	Not used	Not used
3	Brown/ White	data link with SDM
4	Brown	ground
5	Brown	ground
6	Brown/ Yellow	data link with ECM
7	Brown/ White	data link with ECM and TCM
8-14	Not used	Not used
15	Brown/ White	data link with EBCM
16	red	Fused power supply

WS-white
RT-red
GE-yellow
BR-brown

8.21.3 Diagnostic Information and Procedures

8.21.3.1 No power supplied to the scan tool

circuit description

DLC pin 16 (battery positive voltage) and pin 4 (ground) provide operating voltage for the scan tool. DLC pin 3, 6, 7 and 15 provide communication links and pin 5 provide signal ground. The scan tool may power up with the ignition OFF.

Test description

The numbers below refer to the step numbers on the diagnostic table.

1. Fuse F1 (15A) in the fuse box provides pin 16 of the data link connector with signal.
2. Circuit between the battery positive voltage and ground of the data link connector operates regularly. The failure must be caused by the failure of the scan tool itself.

No power supplied to the scan tool

step	action	yes	no
1	Test if the circuit of the DLC power supply is open or short with the ground. Refer to Circuit Test and Wire Repair in the Wiring System. Did you find and correct the condition?	to relevant diagnostic system inspection in the Control Module Reference	Go to Step 2
2	Test data link communication pin 4 is open to the ground. Refer to Circuit Test and Wire Repair in the Wiring System. Did you find and correct the condition?	to relevant diagnostic system inspection in the Control Module Reference	Go to Step 3
3	Test if the connection between pin 16 of the data link communication and pin 4 of the scan tool is poor, which is included in Step 1 and Step 2.	to relevant diagnostic system inspection in the Control Module Reference	Go to Step 4
4	There may be failure in the scan tool, refer to the User's Guidance of the Scan Tool. Did you find and correct the condition?	to relevant diagnostic system inspection in the Control Module Reference	—

8.21.4 Description & Operation

8.21.4.1 DLC Communication Description

DLC provides KW82 and KW2000 serial data link.

DLC also provides power to the scan tool.

1. DLC provides battery voltage (B+) at pin 16.
2. DLC pin 4 and 5 will ground

8.21.4.2 DLC Communication Description

KW82 serial data link allows the scan tool to communicate with the following modules during diagnostic and test.

1. Engine control module (ECM)
2. transmission control module (TCM)
3. SIR diagnostic module (SDM)
4. Electronic braking control module (EBCM)

The scan tool shall communicate with the engine control module through pin 6 and 7 of the DLC in line with KW2000 serial data protocol.

The scan tool shall communicate with the transmission control module through pin 7 of the DLC in line with KW2000 serial data protocol.

The scan tool shall communicate with the SDM through pin 3 of the DLC in line with KW82 serial data protocol.

The scan tool shall communicate with the EBCM through pin 15 of the DLC in line with KW82 serial data protocol.

Diagnostic Starting Point

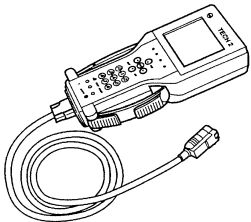
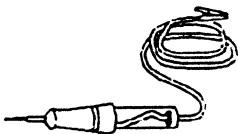
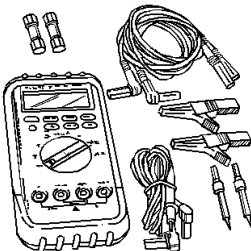
The user may conduct diagnostic system inspection to the concerned systems with the scan tool to start the diagnostic and test procedures.

The diagnostic system inspection will direct you to the correct steps within each section.

If there is no power supplied to the scan tool when it is connected to the data link module, please refer to the section No Power Supplied to the Scan Tool. If the scan tool is supplied with power after it is connected to the data link module, but it cannot communicate with the modules with ignition and engine turned off, please

check the power and grounding of each module. If the power and grounding of each module is normal, there must be failure in the modules. Please re-start after replacement of relevant module in line with the removal and installation steps.

8.21.5 Special Tools

View	Description
 <p>TECH2</p>	TECH 2 Scan tool
 <p>J34142-B</p>	J 34142-B power supply test lamp
 <p>J39200</p>	J 39200 DDM

Blank

8.22Central controlled keyless entry system

8.22.1 Specifications

8.22.1.1 Fastener Tightening Specifications

application	specification
keyless entry receiver mounting screw	1.8-2.2 N•m

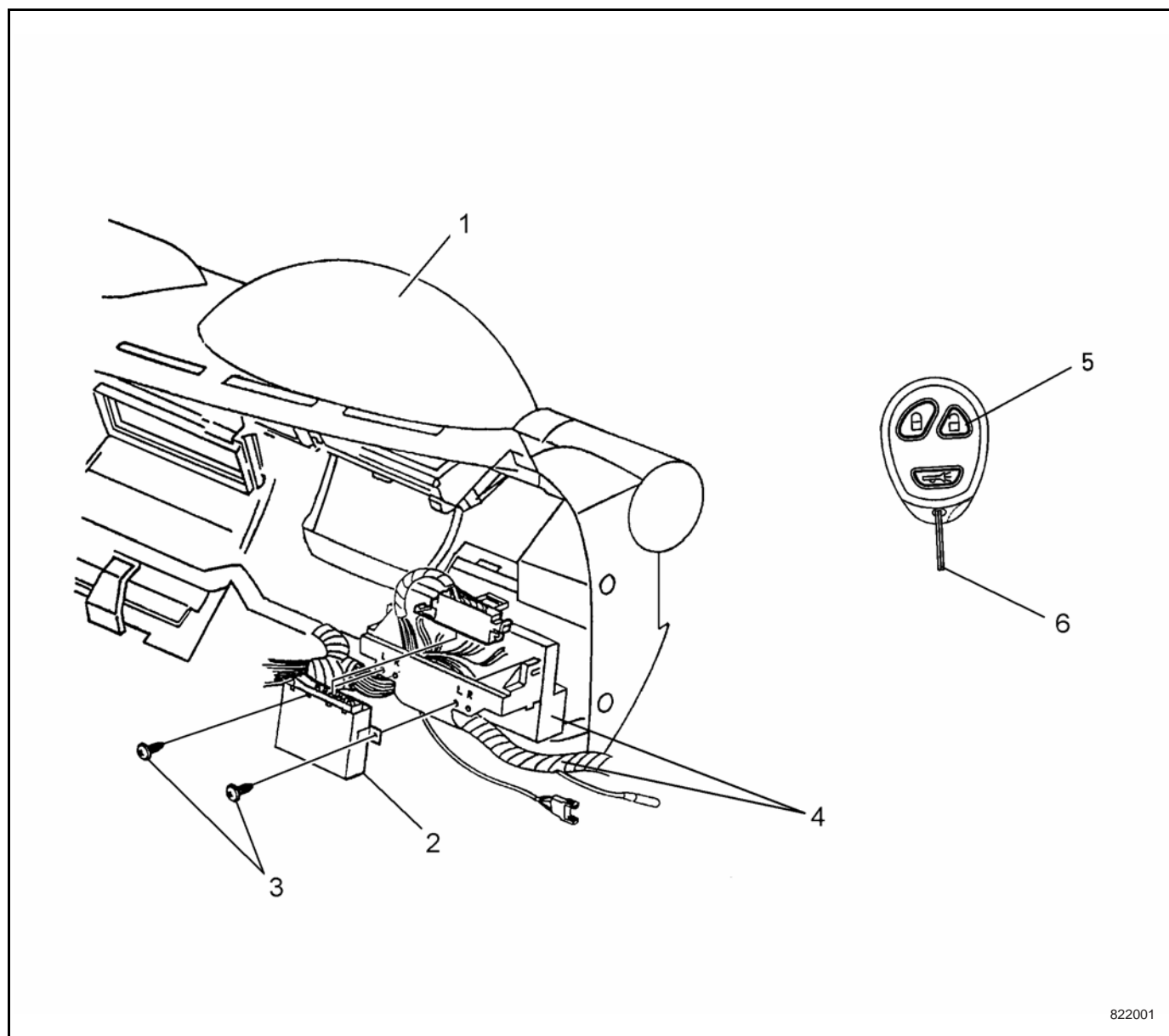
8.22.2 Schematic and Wiring Diagram

8.22.2.1 Wiring diagram of the central controlled keyless entry system

Refer to 8.20.2.22.

8.22.3 Component Location

8.22.3.1 Location of the keyless system transmitter

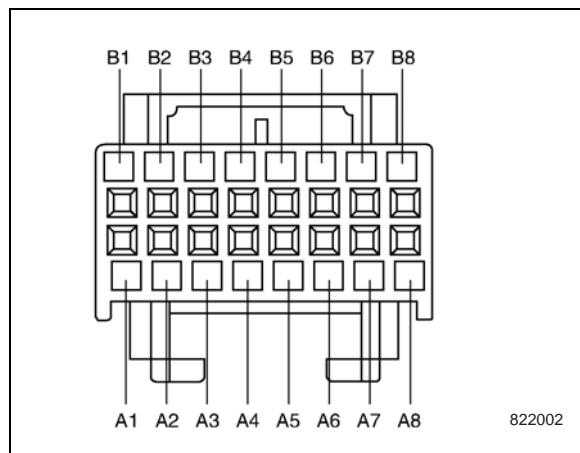


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legend

- | | |
|---|--|
| (1) instrument cluster assembly | (4) instrument cluster harness assembly |
| (2) keyless system receiver | (5) keyless system transmitter (2 for each vehicle) |
| (3) keyless entry receiver mounting screw | (6) Key ring |

8.22.3.2 Keyless entry system receiver adapter



pin	wire color	function
A1	red	power
A2	red	power
A3	black	ignition cable
A4	grey	door switch
A5	brown /white	horn
A6	brown red	lock
A7	brown /white	unlock
A8	brown	ground
B1	black & white	left steering lamp
B2	green black	right steering lamp
B3	white	automatic transmission PA cable
B7	unused	unused
B8	brown yellow	steering lamp control signal
B4	green	automatic transmission A cable
B5	yellow black	automatic transmission B cable
B6	blue red	speed signal

8.22.4 Diagnostic information and procedure

8.22.4.1 System function inspection

step	action	normal result
1	press button LOCK	The horn gives out one sound and steering lamps flash twice, then lock actuator locks the door.
2	Press down LOCK and UNLOCK simultaneously.	The steering lamps flash twice and the actuator locks the door.
3	press button UNLOCK	The steering lamps flash once and the actuator unlocks the door.
4	press button 寻车	The horn will sound twice and the steering lamps flash for 15 seconds.(Press the 寻车 button again within the 15 seconds, the searching process will stop)
5	Any one of the 4 doors is opened, press any key on the remote control unit	the system has no reaction
6	Press the UNLOCK button, and do not open any of the four doors within 30 seconds.	The horn gives out one sound and steering lamps flash twice, then lock actuator locks the door.
7	Turn on ignition (IGNON), press any key on the remote control unit	the system has no reaction
8	When speed is higher than 13KM/H,	the actuator will lock the door automatically
9	Turn off the ignition	the actuator will unlock the door automatically
10	When the lever is shifted out of P,	the actuator will lock the door automatically
11	When the lever is shifted into P,	the actuator will unlock the door automatically

Note:Conduct Step 8 and 9 for vehicles with manual transmissions and Step 10 and 11 for vehicles with automatic transmissions.

8.22.4.2 Troubleshooting

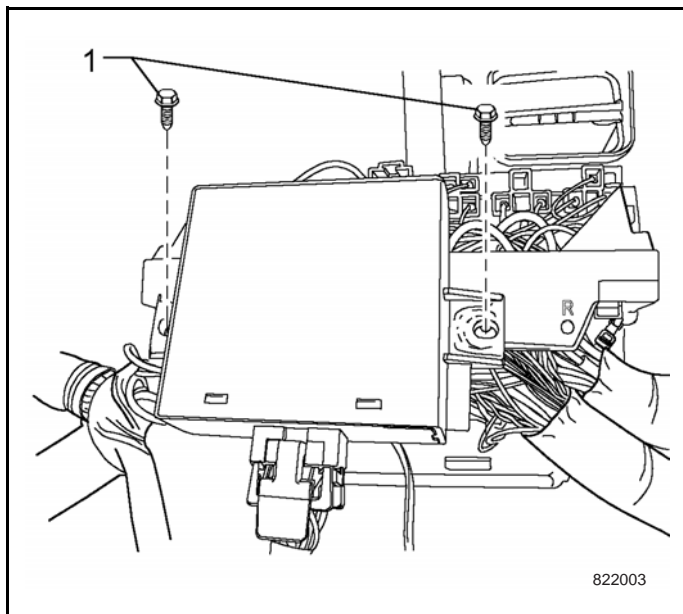
trouble	possible causes	confirmation method	service method
Keyless entry inoperative	<ol style="list-style-type: none"> 1. if the transmitter's battery voltage presents 2. if the receiver's voltage presents 	<ol style="list-style-type: none"> 1. measure the voltage of the battery 2. measure if the receiver's voltage is 12V 	<ol style="list-style-type: none"> 1. replace with new battery 2. power circuit inspection
fail to read	<ol style="list-style-type: none"> 1. if the transmitter's battery voltage presents 2. code of the transmitter invalid 3. keyless entry receiver turned on ignition / door switch fails 4. the receiver presents no voltage 	<ol style="list-style-type: none"> 1. measure the voltage of the battery 2. replace with new keyless entry receiver and enter into READ mode 3. Verify if the keyless entry receiver enters READ mode 4. measure if the receiver's voltage is 12V 	<ol style="list-style-type: none"> 1. replace with new battery 2. replace with new transmitter 3. Service if the vehicle's ignition/door switch signal is normal 4. power circuit inspection
ACTR cannot lock	<ol style="list-style-type: none"> 1. ACTR damaged 2. Lock controller damaged 3. no signal received by the central control unit 	<ol style="list-style-type: none"> 1. Manually operate the central control lock system to see if it operates regularly. 2. Replace the central control unit to see if it operates normally 3. The central control unit operates normally but the door fails to lock automatically. 	<ol style="list-style-type: none"> 1. replace ACTR 2. replace the central control unit 3. service the remote control door lock receiver's circuit
Steering lamps function irregularly	<ol style="list-style-type: none"> 1. check if the bulbs of the steering lamps are damaged 2. circuit connection is loose 3. internal circuit of the receiver damaged 	<ol style="list-style-type: none"> 1. visually inspect or measure the bulbs 2. Does the output of B1.B2 read 12V? 3. Does the output of B1.B2 read 12V? 	<ol style="list-style-type: none"> 1. replace the bulbs 2. re-connect the circuit or replace the remote control receiver's connection 3. replace the remote control door lock receiver
Horn inoperative	<ol style="list-style-type: none"> 1. relay damaged 2. horn damaged 3. circuit connection loosened 	<ol style="list-style-type: none"> 1. check if the relay acts 2. measure if the coil of the horn is regular 3. Check if there is output from the connector A5 	<ol style="list-style-type: none"> 1. replace the relay 2. replace the horn 3. re-connect the connectors
13KM/hr fails to lock	<ol style="list-style-type: none"> 1. no speed signal input 2. ACTR damaged 	<ol style="list-style-type: none"> 1. Check if there is change of signal at B6 2. Manually operate ACTR to check if it operates. 	<ol style="list-style-type: none"> 1. Service to check if the speed signal of SPG is normal. 2. replace the remote control door lock receiver 3. replace ACTR
Shift in/out P fails to unlock/lock	<ol style="list-style-type: none"> 1. shift signal input fails 2. no input of IGN signal 	<ol style="list-style-type: none"> 1. measure if there is change of signal at connector B3.B4.B5 2. Measure if there is signal at connector A3 	<ol style="list-style-type: none"> 1. replace the remote control door lock receiver 2. ignition power circuit service
if there is no action taken within 30 seconds, auto lock function fails.	<ol style="list-style-type: none"> 1. Door lock switch has grounding signal 	<ol style="list-style-type: none"> 1. Measure if there is signal at connector A4 	<ol style="list-style-type: none"> 1. Service the door control switch and the connection wiring

8.22.5 Repair Guidance

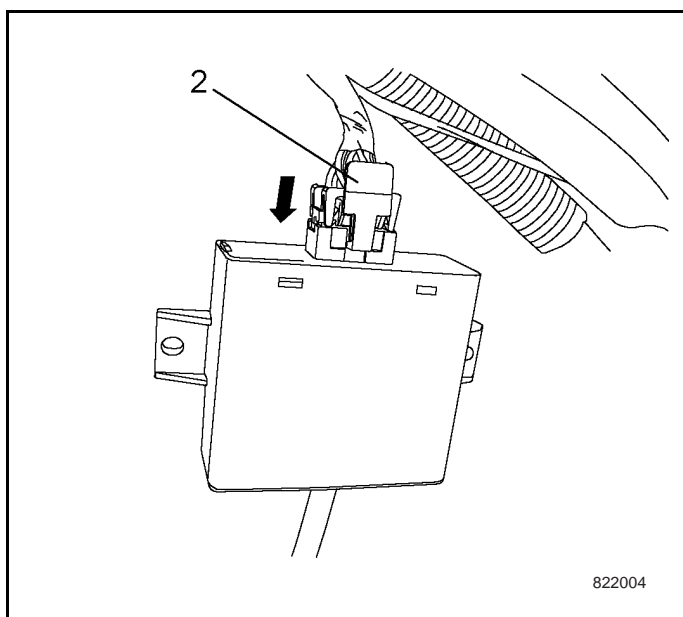
8.22.5.1 Replacement of the remote control door lock receiver

Removal Procedure

1. Remove the two mounting screws (1) of the remote control door lock receiver.

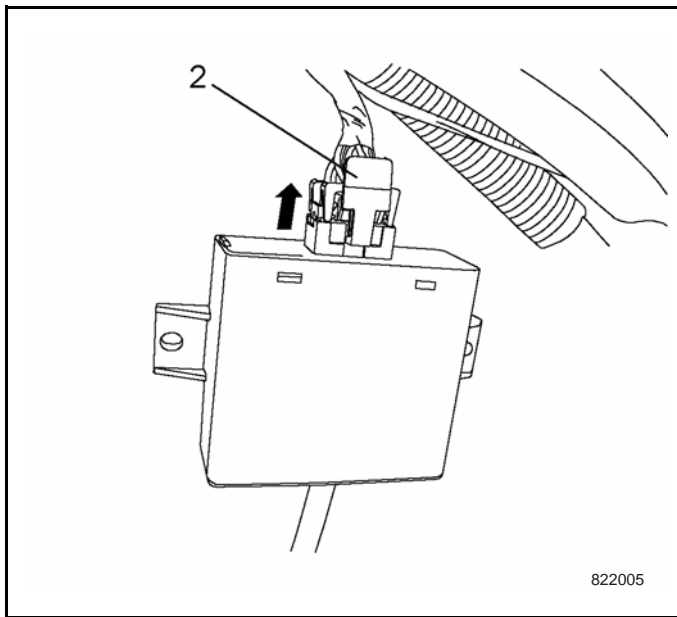


2. Unplug the receiver's adapter (2).



Installation Procedure

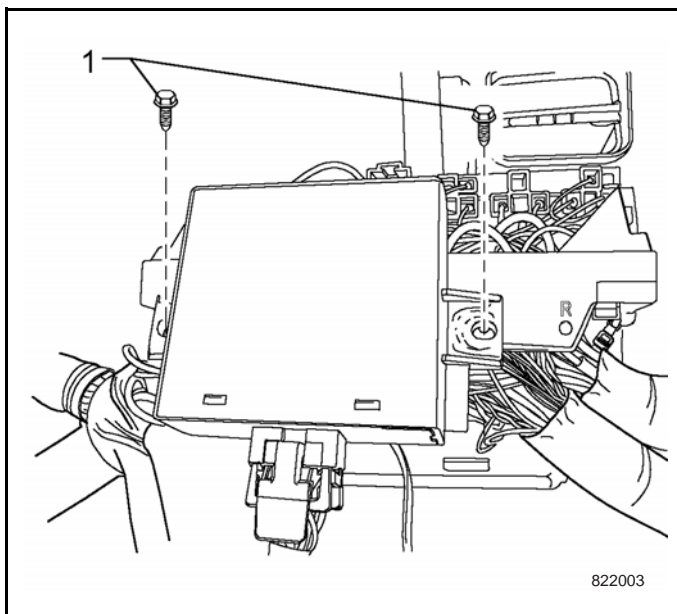
1. Plug the receiver's adapter (2).



2. Fix the RCDLR at the bracket of the fuse box with two screws (1).

Fastening

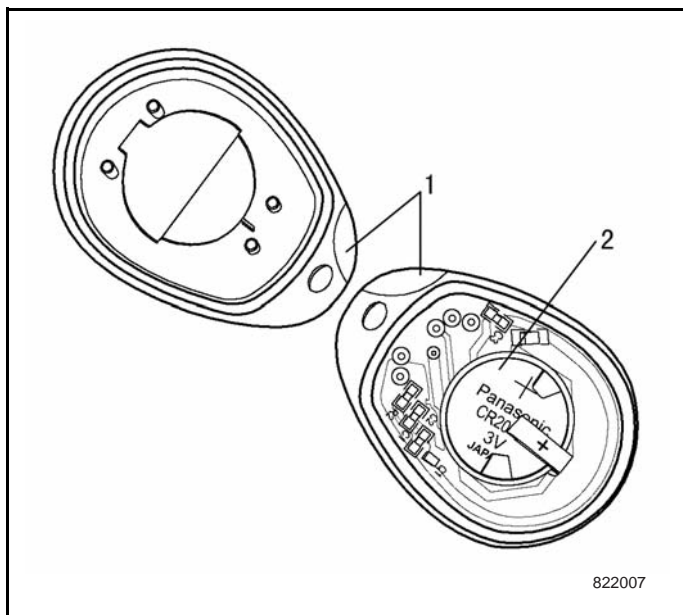
Fasten the two screws to 1.8-2.2 N•m.



8.22.5.2 Replacement of the RCDLR battery

Removal Procedure

1. Insert a one-yuan coin to the jaw (1).
2. Rotate the coin to open the case of the receiver.
3. remove the two 3V old button batteries (2).

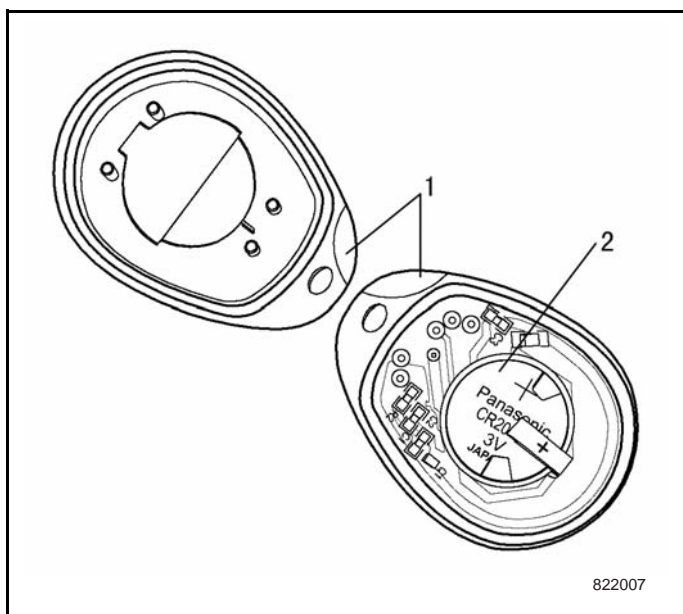


Installation Procedure

1. Press in two new 20mm-diameter 3V button batteries (2).

Note: The positive pole "+" of the batteries faces upward.

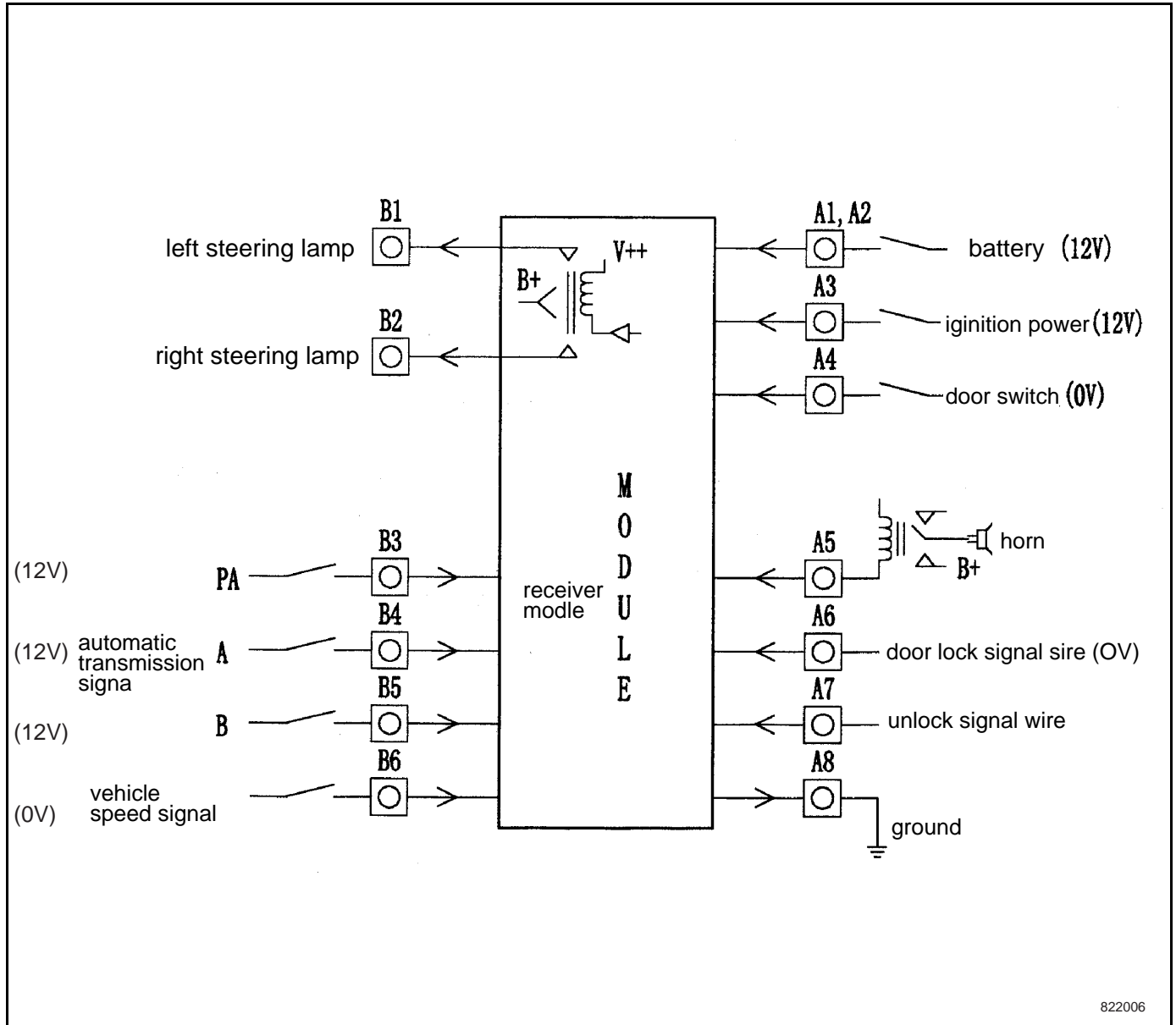
2. Press the case of the receiver onto the seat along its edge until you hear a "click".



8.22.6 Description & Operation

8.22.6.1 System Operation Principles

1. Operating frequency: 315 MHz_250 KHz ;
2. Usage range: within 10 m;
3. Operating Principle Diagram: refer to the next page.



8.22.6.2 Reading of the remote control transmitter

Enter READ mode

- Under unlock condition, close and open the door within 3 seconds twice (keep the door opened finally);
- Insert the key into ignition lock cylinder, turn ignition on and off 5 times within 10 seconds, keep it off finally;
- The steering lamps flash once to indicate that the system has entered code-reading mode.

Reading of the transmitter

- Within 16 seconds after the system enters reading mode, press the 1st button LOCK to read, the steering lamps flash once to indicate that the reading is finished successfully;
- If there is second transmitter to read, repeat the above operation within 16 seconds;
- Each remote control door lock controller can read at most two transmitters.

Exit the reading mode

There are three ways to exit the reading mode after transmitters have finished reading:

- Close all the doors. The steering lamps flash twice to indicate the exit of reading mode;
- Turn ignition on (IGNON). The steering lamps flash twice to indicate the exit of reading mode;
- If no actions taken within 16 seconds, and the steering lamps flash twice to indicate exit of the reading mode.

8.23B Roof (if equipped)

8.23.1 Specifications

8.22.1.1 Fastener Tightening Specifications

Application	Specification
Roof module to roof ring screw	3.5 N•M
Sunroof module to roof ring screw	3.5 N•M
Roof motor to roof ring screw	3.5 N•M
Roof drain channel to roof ring screw	3.5 N•M
Roof screw box to roof ring screw	3.5 N•M

8.23.2 Schematic and Wiring Diagram

8.23.2.1 Power roof schematics

Refer to 8.20.2.20B.

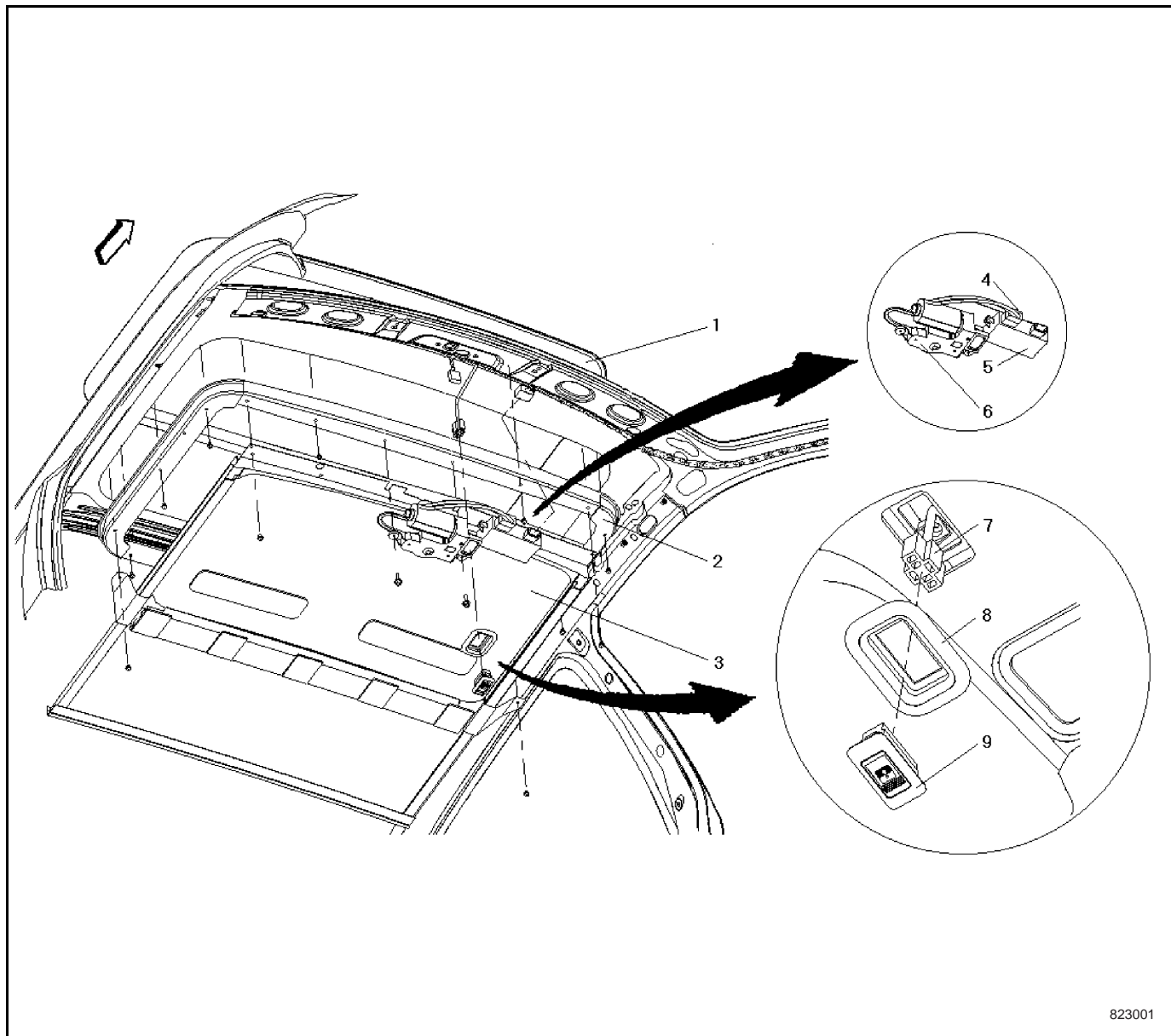
8.23.3 Component Location

8.23.3.1 Power Roof System Components

Name	Location	Component Locator	Connector end view
Fuse box	To the left of the instrument panel, under the steering wheel	Refer to 8.20.3.4 Location & Introduction to the Fuse & Relay Box	Refer to 8.20.3.4 Location & Introduction to the Fuse & Relay Box
Roof motor	At the front center of the roof	Refer to Power Roof System Component View	—
Roof control module	At front left of the rood, inside the roof lining	Refer to Power Roof System Component View	—
Roof switch and switch seat	At front center of the roof, inside roof motor	Refer to Power Roof System Component View	—
Roof motor and control module connector (6 pins)	At front left of the roof	Refer to Power Roof System Component View	Refer to Power Roof System Connector End View
Roof switch connector (3 pins)	At front center of the roof, inside roof motor	refer to Power Roof System Component View	Refer to Power Roof System Connector End View

8.23.3.2 Power Roof System Component View

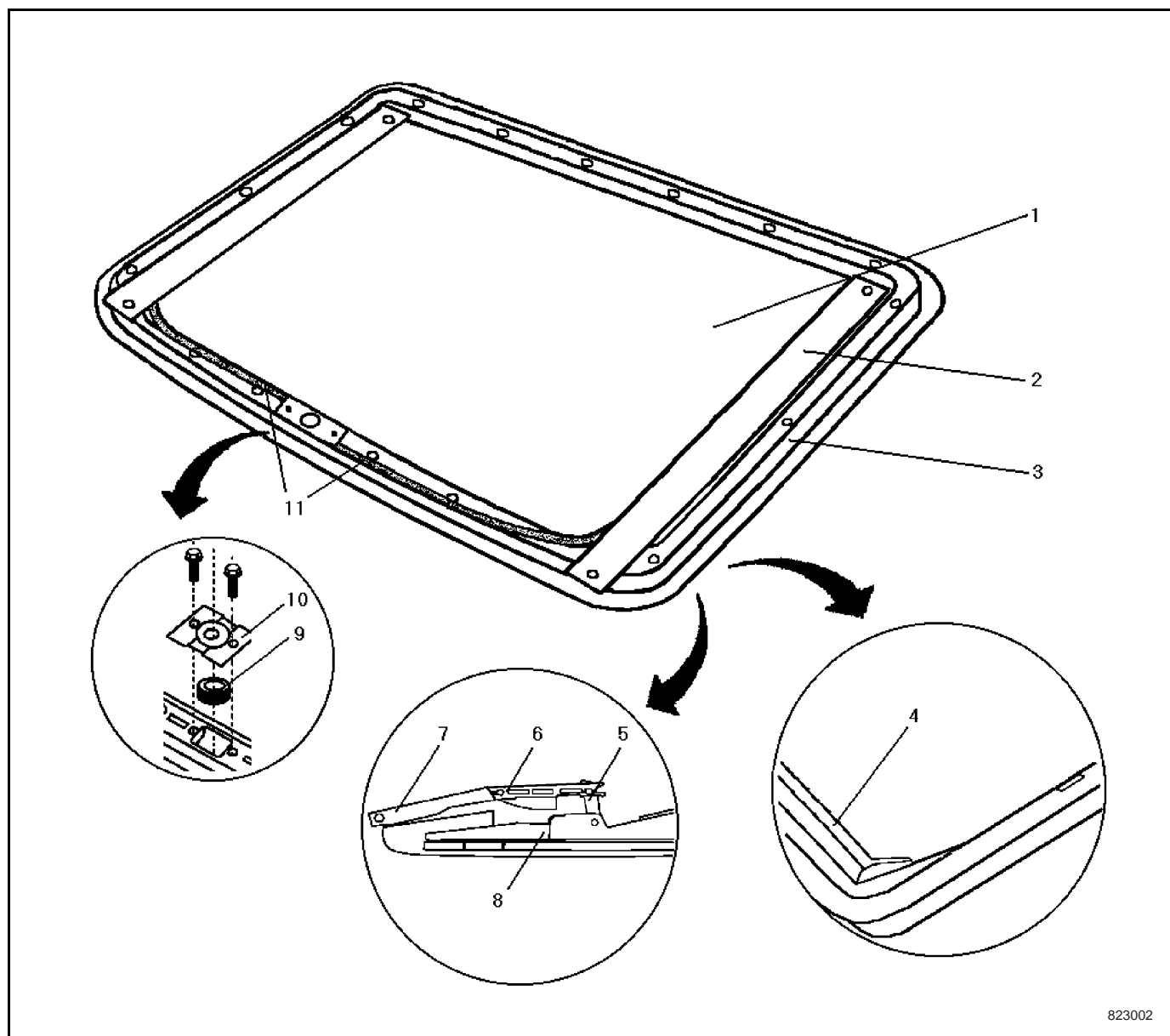
Roof (regular optional part CF5)



legend

- | | |
|---|---------------------------|
| (1) roof ring assembly | (6) Roof motor |
| (2) roof inner fixing frame | (7) roof switch connector |
| (3) sunroof and fixing frame assembly | (8) roof switch seat |
| (4) roof motor and control module connector | (9) roof switch |
| (5) roof control module | |

roof ring assembly



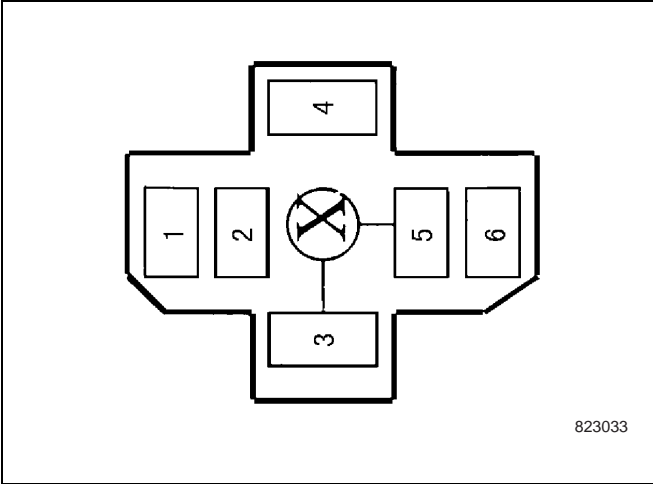
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legend

- | | |
|---------------------------|------------------------|
| (1) sunroof glass panel | (7) rotation linkage |
| (2) sunroof glass channel | (8) glass support seat |
| (3) roof upper frame | (9) gear |
| (4) roof drain panel | (10) screw box |
| (5) control lever | (11) drive shaft |
| (6) drive slip | |

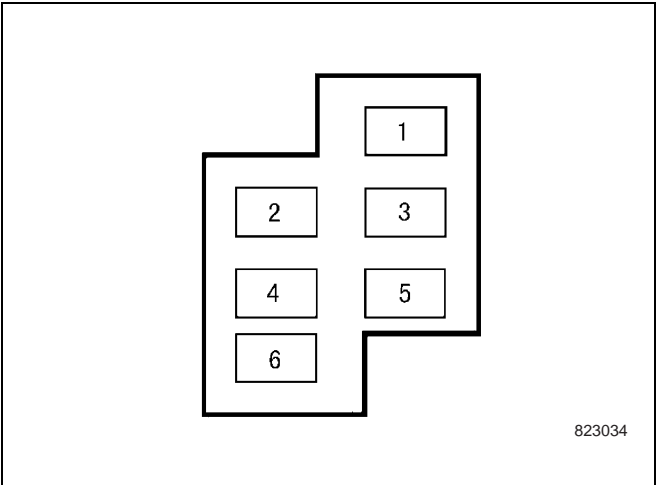
8.23.3.3 Power Roof System Connector
End View

Switch adapter



pin	wire color	function
1	black	roof closed signal output
2	red	input with fuse
3	black	ignition switch power input
4	black / yellow	roof open signal output
5	black	unused
6	brown	ground

control module adapter



pin	wire color	function
1	red	battery power
2	black	roof closed signal input
3	brown	ground
4	black	ignition switch power input
5	black / yellow	roof open signal input
6	—	unused

8.23.4 Diagnostic information and procedure

8.23.4.1 Power roof system inspection

Step	Action	Normal result	Abnormal result
1	<ol style="list-style-type: none"> 1. Ensure the roof is closed 2. Press the open button (rear of the switch) less than 0.3 seconds 	<p>Roof glass panel shall tilt and slip rearwards to fully open unless one of the following conditions occur.</p> <ul style="list-style-type: none"> • roof switch button is pressed down 	Refer to Power Roof Inoperative
2	<ol style="list-style-type: none"> 1. Ensure the roof is fully open 2. Press the close button (front of the switch) less than 0.3 seconds 	<p>Roof glass panel slips to close (frontward) unless one of the following conditions occur.</p> <ul style="list-style-type: none"> • roof switch button is pressed down • roof glass panel reaches the fully closed position • roof glass panel encounters obstacles 	Refer to Power Roof Inoperative
3	<ol style="list-style-type: none"> 1. Ensure the roof is fully closed 2. Press and hold the open button (rear of the switch) more than 0.3 seconds 	<p>The glass panel fails to open after rising until one of the following conditions occurs.</p> <ul style="list-style-type: none"> • roof switch button is released • The glass panel opens to fully tilt ventilation position 	Refer to Power Roof Inoperative
4	<ol style="list-style-type: none"> 1. Ensure the roof is at full tilt ventilation position 2. Press and hold the open button (rear of the switch) more than 0.3 seconds 	<p>The glass panel slips afterwards until one of the following conditions occur.</p> <ul style="list-style-type: none"> • roof switch button is released • roof glass panel reaches the full open position 	Refer to Power Roof Inoperative
5	<ol style="list-style-type: none"> 1. Ensure the roof is fully open 2. Press and hold the close button (front of the switch) more than 0.3 seconds 	<p>The glass panel slips frontwards until one of the following conditions occur.</p> <ul style="list-style-type: none"> • roof switch button is released • Roof glass panel reaches the tilt ventilation position 	Refer to Power Roof Inoperative
6	<ol style="list-style-type: none"> 1. Ensure the roof is at tilt ventilation position 2. Press and hold the close button (front of the switch) more than 0.3 seconds 	<p>The glass panel slips downward until one of the following conditions occur.</p> <ul style="list-style-type: none"> • roof switch button is released • roof glass panel reaches the fully closed position 	Refer to Power Roof Inoperative
7	<ol style="list-style-type: none"> 1. Open the roof to full open status 2. Press the close button (front of the switch) less than 0.3 seconds 3. Set physical obstacle during the glass panel is slipping frontward. 	<p>The roof glass panel slips frontward and returns backward when contacting the obstacles, it will keep moving back and forth until one of the following conditions occur.</p> <ul style="list-style-type: none"> • The obstacle is removed 	Refer to Power Roof Inoperative

8.23.4.1 Power roof system inspection (Cont' d)

Step	Action	Normal result	Abnormal result
8	<ol style="list-style-type: none"> 1. Open the roof glass panel to any position 2. Turn off ignition switch 	<p>Roof glass panel will close (frontward) automatically after about 4 seconds unless one of the following conditions occur.</p> <ul style="list-style-type: none"> • Roof switch is pressed (any direction) • roof glass panel reaches the fully closed position • roof glass panel encounters obstacles 	Refer to Power Roof Fail to Close Automatically with Ignition Off
9	<ol style="list-style-type: none"> 1. Ensure the ignition is turned off and the roof glass panel stays at open position. 2. Press the close button (front of the switch) less than 0.3 seconds, or hold the close button so that the glass panel will slip to the tilt ventilation position, release the button, and then press and hold the close button. 	Roof glass panel moves forward to fully closed position	Refer to Power Roof Fail to Close Automatically with Ignition Off

8.23.4.2 Power Roof Inoperative

Step	Action	Value	Yes	No
1	Have you conducted power roof system inspection?	—	Go to Step 2	to Power roof system inspection†
2	<p>Turn ignition to ON position.</p> <ol style="list-style-type: none"> 1. Remove the roof switch from the roof lining and keep the harness connectors of the roof switch connected. 2. Measure the grounding of pin 2 of the roof switch connector and read its voltage in DDM. <p>Is the measured voltage within the specified value?</p>	11-12V	Go to Step 10	Go to Step 3
3	Check to see if the roof fuse F24 is fusing.	—	Go to Step 4	Go to Step 5
4	Replace roof fuse F24, is the system OK?	—	—	Go to Step 5
5	Check if the circuit between fuse F24 lower end and terminal 2 of the roof switch harness connector is short or open. Is the system Ok after being serviced?	—	—	Go to Step 6
6	Check to see if fuse F34 is fusing.	—	Go to Step 7	Go to Step 8
7	Replace fuse F34, is the system OK?	—	—	Go to Step 8
8	Check if the circuit between fuse F34 lower end and roof fuse upper end F24 is short or open. Is the system Ok after being serviced?	—	—	Go to Step 9
9	Check and correct the short or open circuit between fuse F34 and the positive pole of the battery. Is the system OK?	—	—	Go to Step 10

8.23.4.2 Power Roof Inoperative (Cont' d)

Step	Action	Value	Yes	No
10	Disconnect the harness connector of roof control module and turn ignition switch to ON position. 1. Measure the roof control module harness connector terminal 2 to ground with test lamp. 2. While observing the test lamp, press the roof switch and keep it at CLOSE position. Is the test lamp on?	—	Go to Step 13	Go to Step 11
11	Check and correct the connection between roof switch terminal 1 and roof control module terminal B2. Repeat step 10. Is the test lamp on?	—	Go to Step 13	Go to Step 12
12	Replace the roof switch, re-connect the roof control module harness connector. Is the system OK?	—	—	Go to Step 13
13	Disconnect the harness connector of roof control module and turn ignition switch to ON position. 1. Measure the roof control module harness connector terminal B5 to ground with test lamp. 2. While observing the test lamp, press the roof switch and keep it at OPEN position. Is the test lamp on?	—	Go to Step 15	Go to Step 14
14	Check and correct the connection between roof switch terminal 6 and roof control module terminal B5. Repeat step 10. Is the test lamp on?	—	Go to Step 15	Go to Step 12
15	Check and correct the poor connection between module connection terminal B3 and ground. Is the system OK?	—	—	Go to Step 16
16	Replace roof control module, is the system OK?	—	—	Go to Step 17
17	Check the roof motor, replace if necessary.	—	—	—

8.23.4.3 Power Roof Fail to Close Automatically with Ignition Off

Step	Action	Value	Yes	No
1	Have you conducted power roof system inspection?	—	Go to Step 2	Go to Power roof system inspection
2	Check to see if fuse F16 is fusing.	—	Go to Step 3	Go to Step 5
3	Replace fuse F16, is the system OK?	—	Go to Step 3	Go to Step 4
4	Check if the circuit between fuse F16 lower end and terminal B42 of the roof switch harness connector is short or open. Is the system Ok after being serviced?	—	—	Go to Step 5
5	Check to see if fuse F33 is fusing.	—	Go to Step 6	Go to Step 7
6	Replace fuse F33, is the system OK?	—	—	Go to Step 7
7	Check if the circuit between fuse F34 lower end and roof fuse upper end F24 is short or open. Is the system Ok after being serviced?	—	—	Go to Step 8
8	Check and correct the short or open circuit between fuse F33 and the positive pole of the battery. Is the system OK?	—	—	Go to Step 9

8.23.4.3 Power Roof Fail to Close Automatically with Ignition Off (Cont' d)

9	Turn ignition ON, measure the output voltage of pin 15 of the ignition switch and confirm if it is within the specified value.	11-12V	—	Go to Step 10
10	Turn ignition OFF, measure the output voltage of pin 15 of the ignition switch and confirm if it is within the specified value.	0V	—	Go to Step 11
11	Check and serve the ignition switch, replace if necessary. Is the system OK?	—	—	Go to Step 12
12	Check and correct the poor connection between module connection terminal B3 and ground. Is the system OK?	—	—	Go to Step 13
13	Check the roof control module, replace if necessary.	—	—	—

8.23.4.4 Power Roof Switch Indicator Inoperative

step	action	Value	yes	no
1	Have you conducted power roof system inspection?	—	Go to Step 2	Go to Power roof system inspection
2	Check and serve the ignition switch, replace if necessary. Is the system OK?	—	—	Go to Step 3
3	Check to see if fuse F16 is fusing.	—	Go to Step 4	Go to Step 5
4	Replace fuse F16, is the system OK?	—	—	Go to Step 5
5	Check if the circuit between fuse F16 lower end and terminal B5 of the roof switch harness connector is short or open. Is the system Ok after being serviced?	—	—	Go to Step 6
6	Check to see if fuse F33 is fusing.	—	Go to Step 7	Go to Step 8
7	Replace fuse F33, is the system OK?	—	—	Go to Step 8
8	Check if the circuit between fuse F34 lower end and roof fuse upper end F24 is short or open. Is the system Ok after being serviced?	—	—	Go to Step 9
9	Check and correct the short or open circuit between fuse F33 and the positive pole of the battery. Is the system OK?	—	—	Go to Step 10
10	Turn ignition ON, measure the output voltage of pin 15 of the ignition switch and confirm if it is within the specified value.	11-12V	—	Go to Step 11
11	Turn ignition OFF, measure the output voltage of pin 15 of the ignition switch and confirm if it is within the specified value.	0V	—	Go to Step 12
12	Check and correct the poor connection between switch connection terminal B3 and ground.	—	—	Go to Step 13
13	Check and serve the roof switch, replace if necessary.	—	—	—

8.23.4.5 Power Roof Mechanical Malfunction Diagnosis

Malfunction	Cause	Remedy
Roof glass panel can not close and hard to open	Lock check slip seat damaged	Replace the lock check slip seat
The glass panel tilts unparallelled when it is closed or opened.	gear positioning error	Put the gear and driving shaft to the correct position
Roof glass panel fails to be parallel with the roof frame when it is closed.	Glass panel calibration error	Calibrate the glass panel (with red nut)
Roof glass panel slips slowly	Mechanical unit polluted or needs lubrication	Clean the mechanical unit or lubricate the mechanism with oil
	Motor driving shaft damaged	Replace the motor
Roof glass panel fails to move with the motor turned on	Distance between motor driving shaft and gear inadequate	Re-install the motor and adjust the driving shaft to the correct position.

8.23.4.6 Roof water leakage diagnosis

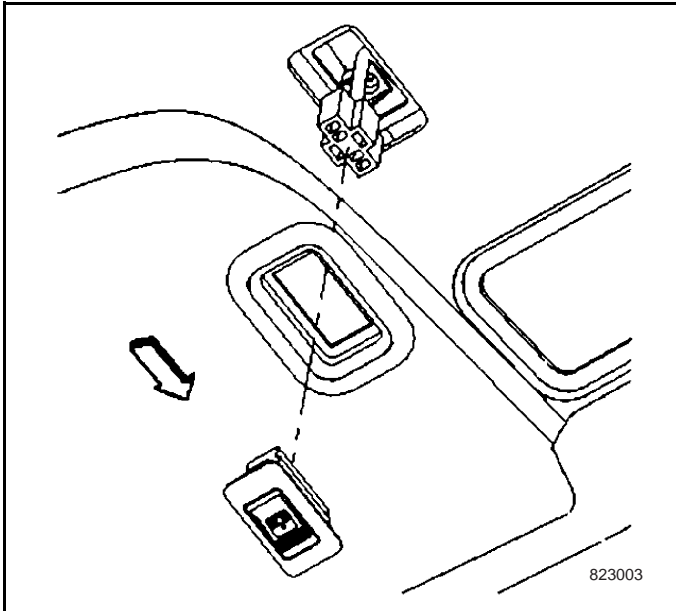
Malfunction	Cause	Remedy
water leakage (ordinary)	weatherstrip got dirt or damaged	Clean or replace the weatherstrip and notice the client causes of the leakage.
	Dust and particles accumulated under the roof glass panel	Clean the bottom of the glass panel and notice the client causes of the leakage.
	The roof is opened when there is water accumulated on the roof.	Remove the accumulated water and notice the client causes of the leakage.
	The roof fails to be well closed during rain or snow days	Remove the accumulated water and notice the client causes of the leakage.
Rear corner of the roof glass panel leaks	Lock check slip seat damaged	replace the lock check slip seat

8.23.5 Repair Guidance

8.23.5.1 Replacement of the power roof switch and switch seat

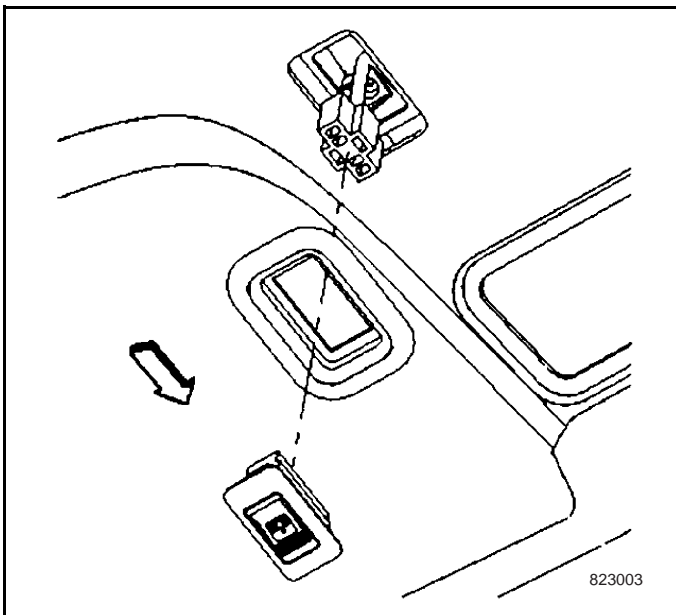
Removal Procedure

1. Grasp the front and rear sides of the switch seat.
2. Pull the seat downward to separate the switch bracket of the switch and motor.
3. Disconnect the electrical connector of the switch.
4. Remove the switch and switch seat from the vehicle.
5. Draw the switch out from its seat so as to separate them.



Installation Procedure

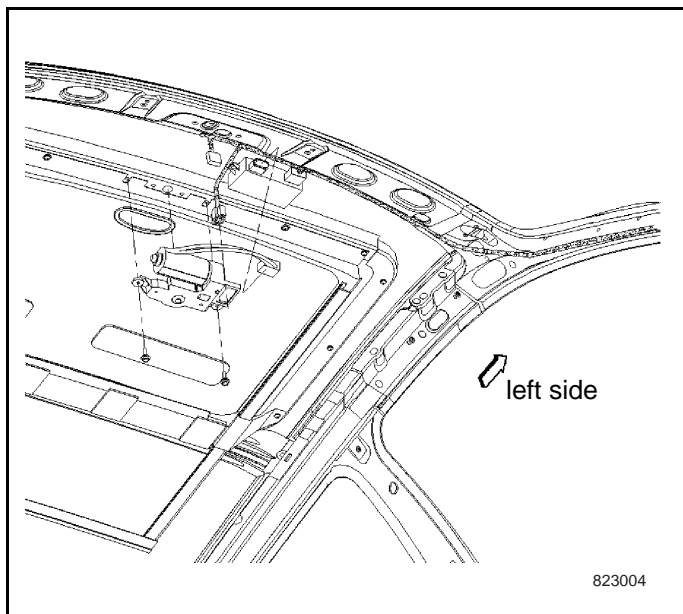
1. Push the switch into its seat until they are locked.
 2. Connect the electrical connector to the switch.
- Note: Place the part of switch with strips facing forward.
3. Press the switch with force into the switch bracket of the motor and fix the assembly.



8.23.5.2 Replacement of the roof motor

Removal Procedure

1. Remove roof switch and switch seat. Refer to Replacement of the Power Roof Switch and Switch Seat
2. Remove the ceiling trim. Refer to Ceiling Trim Replacement (with roof) in Interior Trim.
3. Disconnect the motor and the white connector of the control module to separate them.
4. Remove the two screws mounting roof motor to roof ring.
5. Pull down the motor to remove it from the roof.



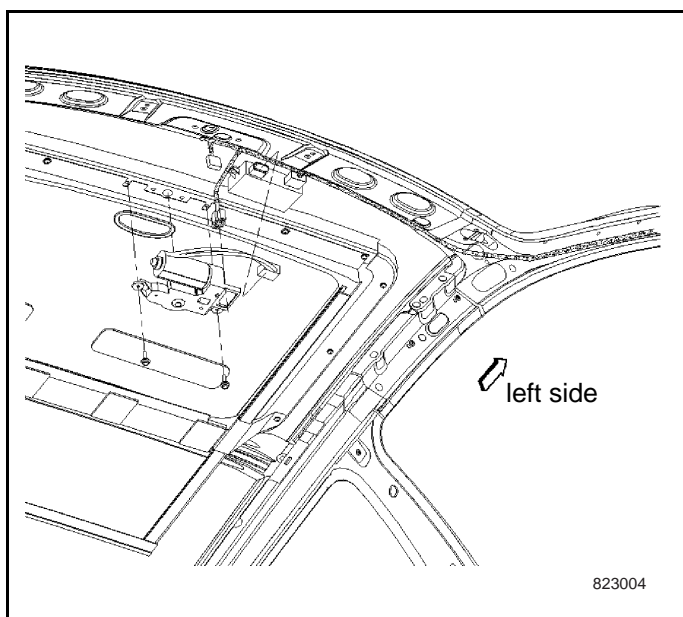
Installation Procedure

1. Insert the output shaft of the motor into gear of the roof ring.
2. Install the two screws mounting roof motor to roof ring.

Fastening

Fasten screws mounting the roof motor to roof ring to 3.5N•M.

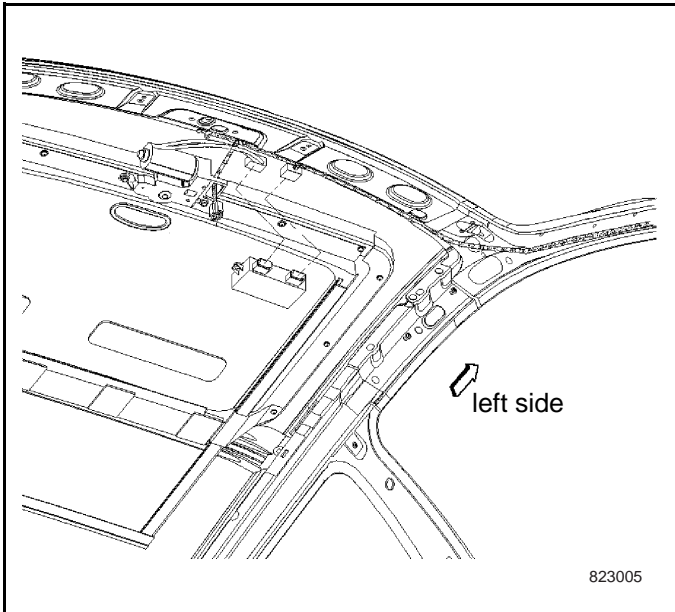
3. Connect the white motor and control module connectors.
4. Insert the roof switch connector through the switch bracket hole of the motor.
5. Connect the roof switch and connector and start the vehicle to verify if the roof operated normally.



8.23.5.3 Replacement of Roof Control Module

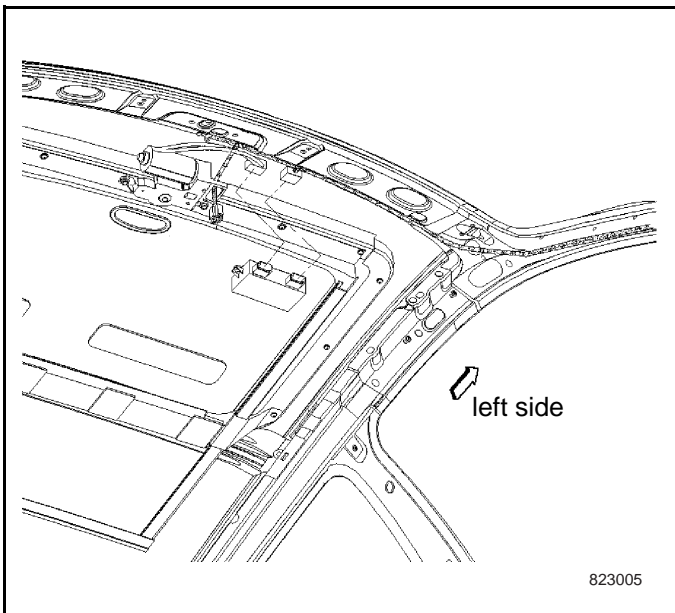
Removal Procedure

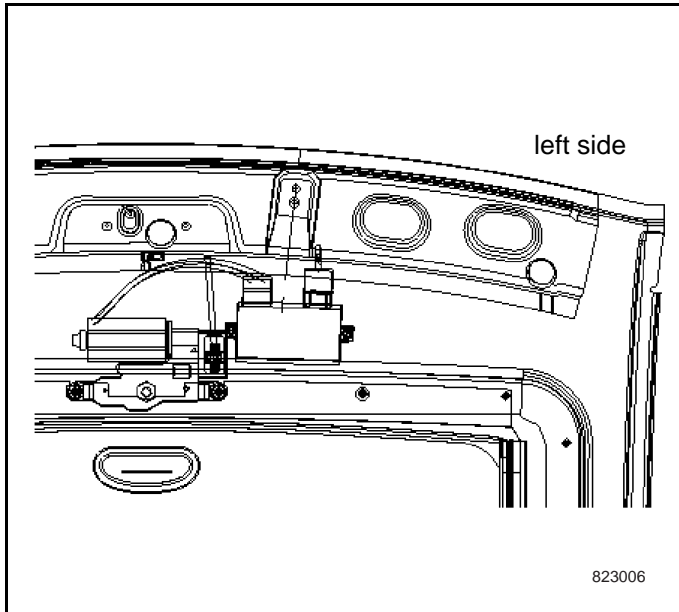
1. Remove roof switch and switch seat. Refer to Replacement of the Power Roof Switch and Switch Seat.
2. Remove the ceiling trim. Refer to Ceiling Trim Replacement (with roof) in Interior Trim.
3. Disconnect the control module from the body harness.
4. Disconnect the white motor and control module connectors.
5. Pull the control module downward forcefully to separate it from the vehicle ceiling.



Installation Procedure

1. Connect the white motor and control module connectors.



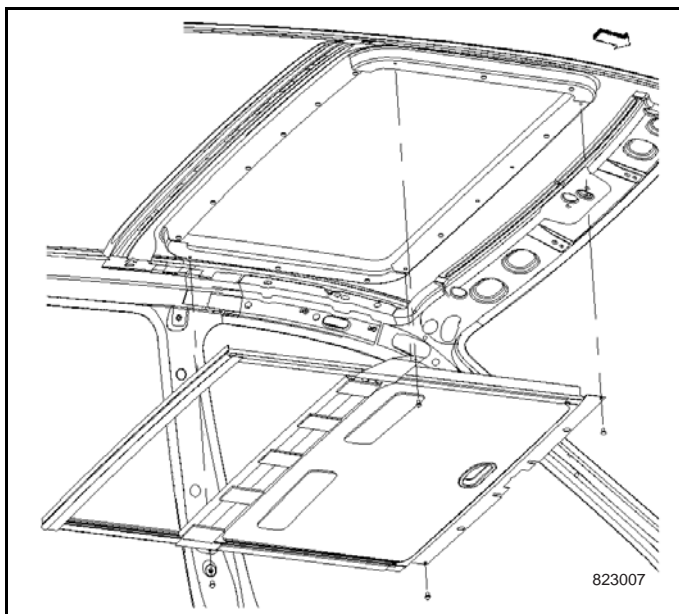


2. Tear away the adhesive protection paper on the control module.
3. Stick the control module on the front left ceiling inner surface and trim it with the reinforcing bar on the front ceiling cross member as shown in the figure.
4. Connect the roof switch and connector and start the vehicle to verify if the roof operated normally.

8.23.5.4 Sunroof and Fixing Frame Assembly

Removal Procedure

1. Remove roof motor. Refer to Replacement of the Roof Motor.
2. Remove the four screws mounting sunroof module to roof ring.
3. Remove the sunroof and fixing ring assembly from the vehicle through doorway.

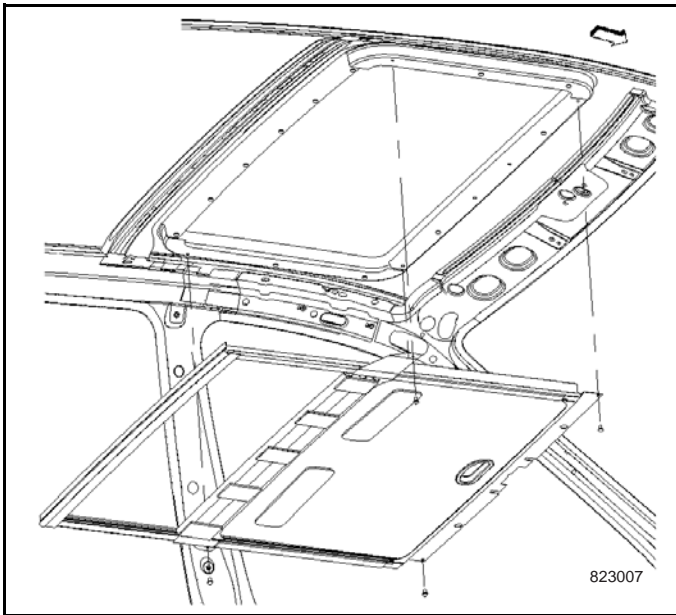


Installation Procedure

1. Put the sunroof and fixing ring into the vehicle and push it upward.
2. Install the four screws mounting sunroof module to roof ring.

Fastening

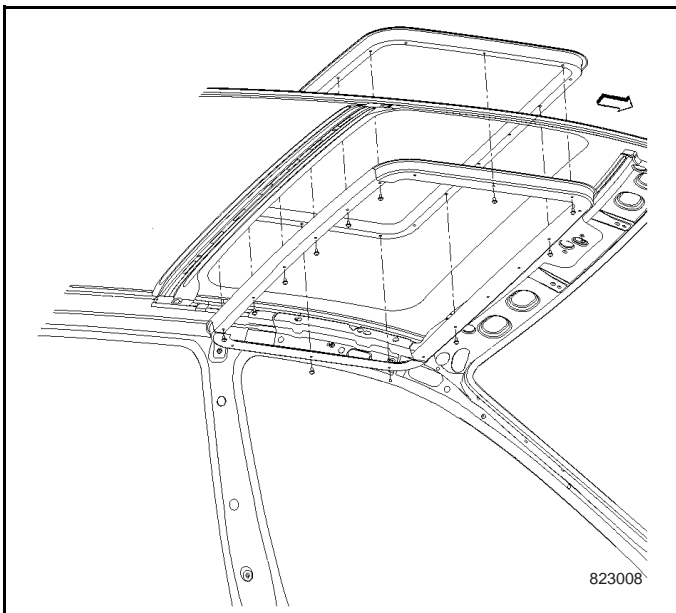
Fasten screws mounting the sunroof to roof ring to 3.5 N•M.



8.23.5.5 Replacement of Roof Inner Fixing Frame

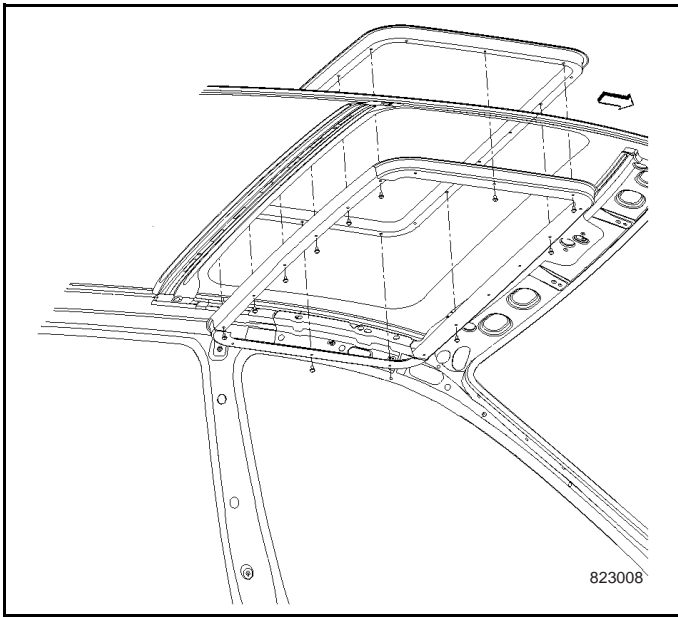
Removal Procedure

1. Remove the sunroof and fixing frame assembly. Refer to Replacement of Sunroof and Fixing Frame Assembly.
2. Remove the 12 screws mounting roof inner frame to roof ring.
3. Remove the roof inner fixing frame from the vehicle through doorway.



Installation Procedure

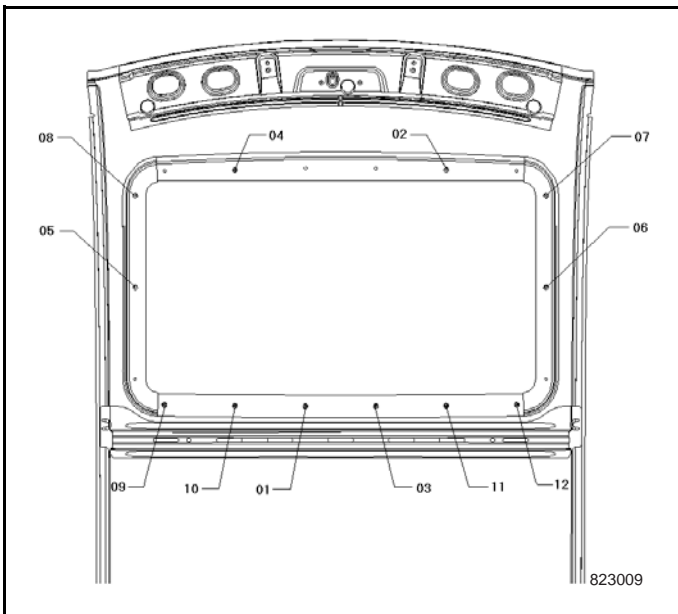
1. Adjust the roof upper frame assembly so that it locates at the center of the ceiling hole.
2. Press down the roof upper frame assembly so that the ceiling deforms and the two parts bind together at the contacting surfaces.
3. Put the sunroof and fixing ring into the vehicle and push it upward.



4. Install the 12 screws mounting roof inner frame to roof ring in order as shown in the diagram.

Fastening

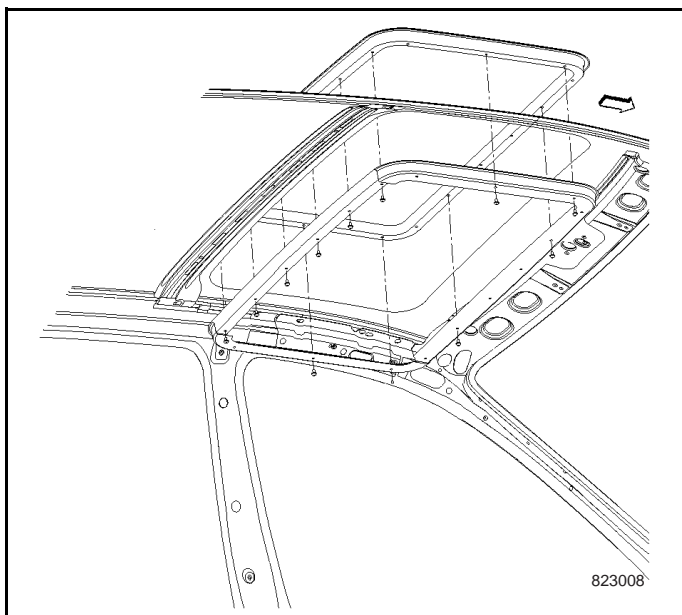
Fasten the screws mounting roof inner fixing frame to roof ring to 3.5 N•M.



8.23.5.6 Replacement of Roof Upper Frame Assembly

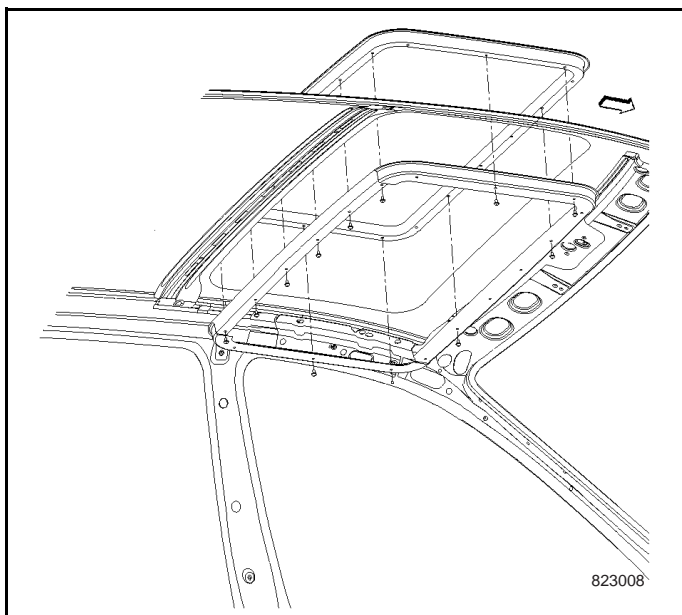
Removal Procedure

1. Remove the roof inner fixing frame. Refer to Replacement of Roof Inner Fixing Frame.
2. Take the roof upper frame assembly from the ceiling hole.



Installation Procedure

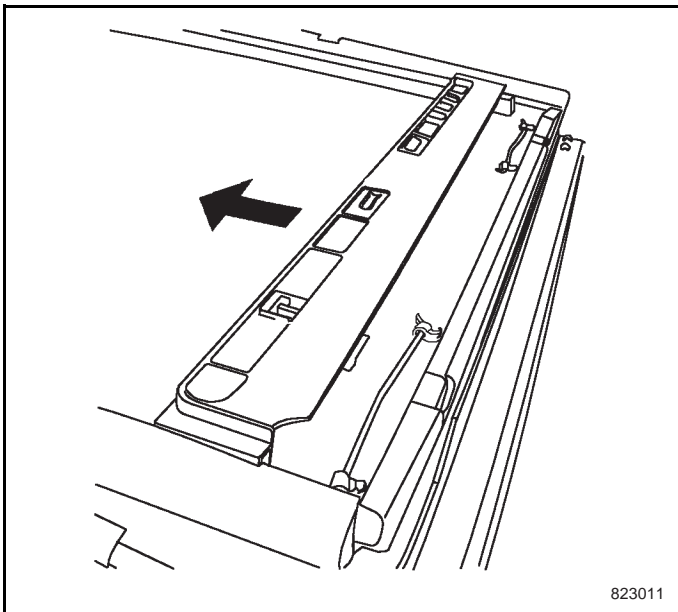
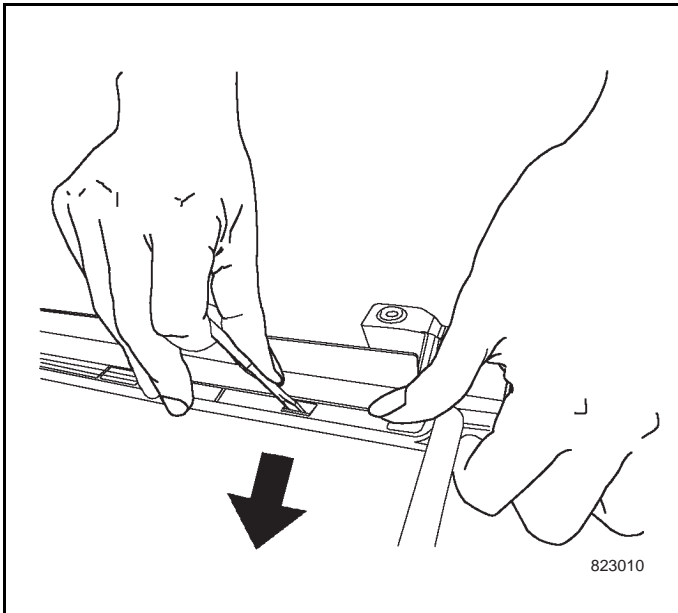
1. Install the roof inner fixing frame. Refer to Replacement of Roof Inner Fixing Frame.



8.23.5.7 replacement of Sunroof

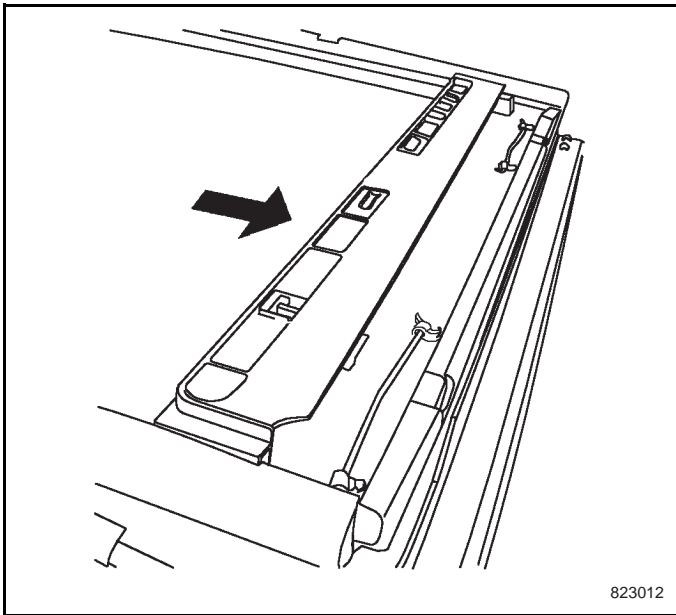
Removal Procedure

1. Remove the sunroof and fixing frame assembly. Refer to Replacement of Sunroof and Fixing Frame Assembly.
2. use flat screwdriver to pry the 4 iron wires at the two sides of the sunroof to make them fall out from the board.

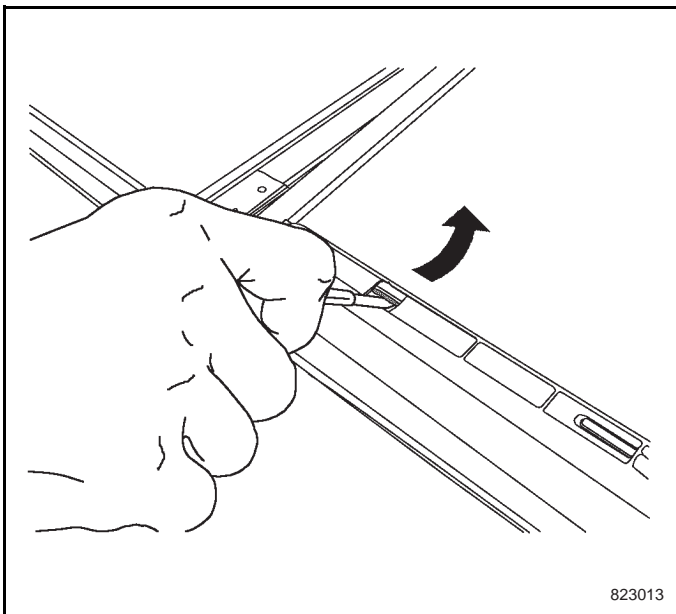


3. Remove the two sunroof fastening chips from the sunroof.
4. Remove the sunroof panel.

Installation Procedure



1. Put the sunroof at the guiding channel of the sunroof ring.
2. Lock the two sunroof fastening chips at the two sides of the sunroof and push the slip on the fastening chips into the guiding channel of the sunroof.

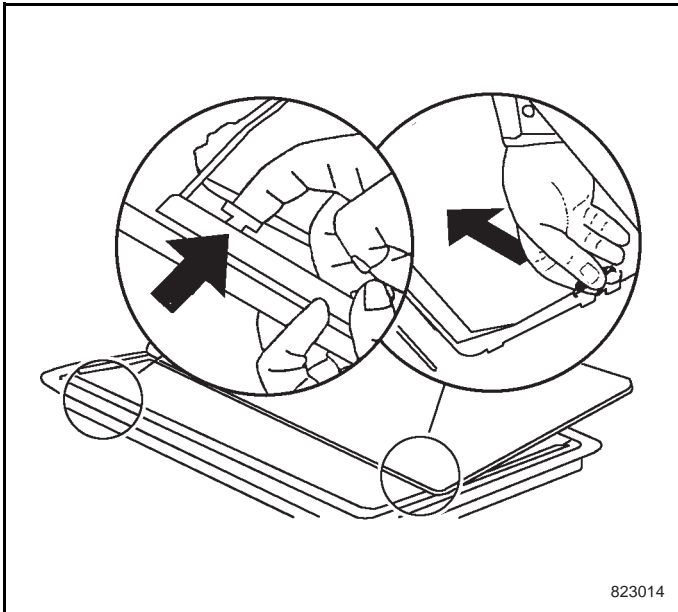


3. Pry the 4 iron wires at the sunroof with flat screwdriver and make them lock at the board.
4. Slip the front and back sunroof to check its installation.

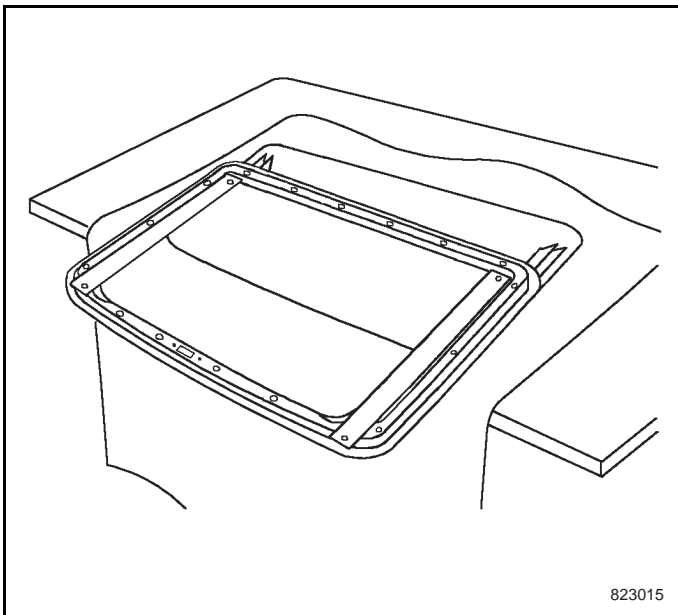
8.23.5.8 Replacement of Roof Glass Panel

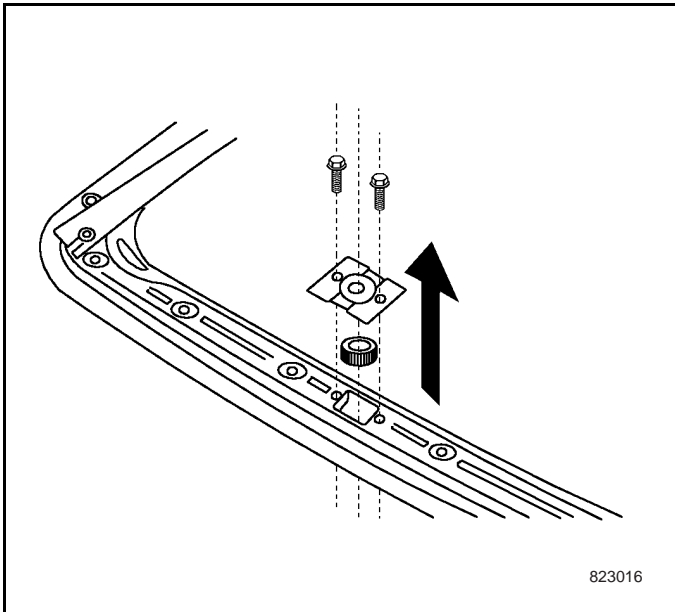
Removal Procedure

1. Open the roof glass and stop it at about 1cm away from its full open position.
2. Remove the sunroof upper frame assembly. Refer to Replacement of Sunroof Upper Frame Assembly.
3. Dislodge the slip board at the front of the deflector from the sunroof frame. Pull out the installation block of the deflector from the glass guiding channel. Remove the sunroof deflector.

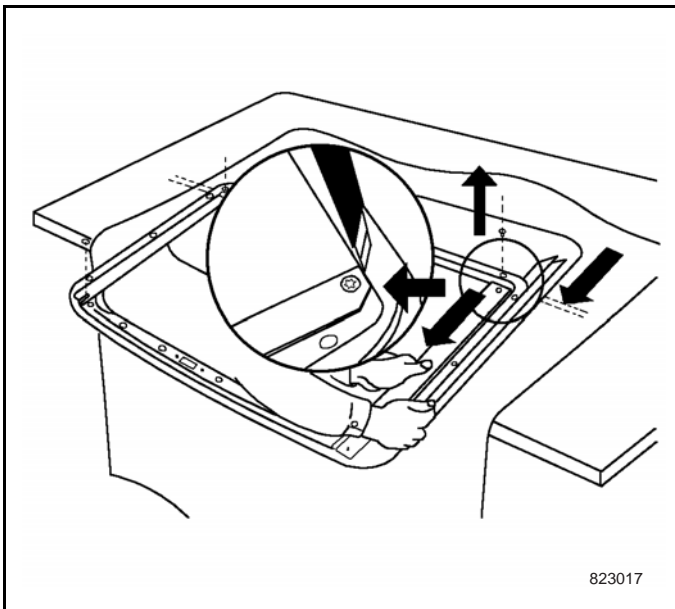


4. Put the sunroof upper frame upside down on a piece of cloth that will not scratch the glass with its front facing the removing operators.

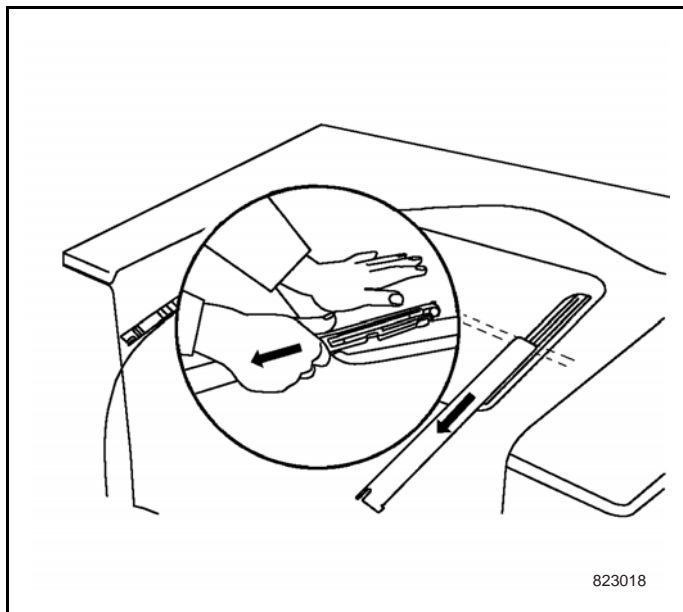




5. Remove the two screws mounting the sunroof screw box to the sunroof upper frame. Remove the screw box and gear.
6. Take out the driving soft shaft from the sunroof upper frame and remove the black guiding pipes.

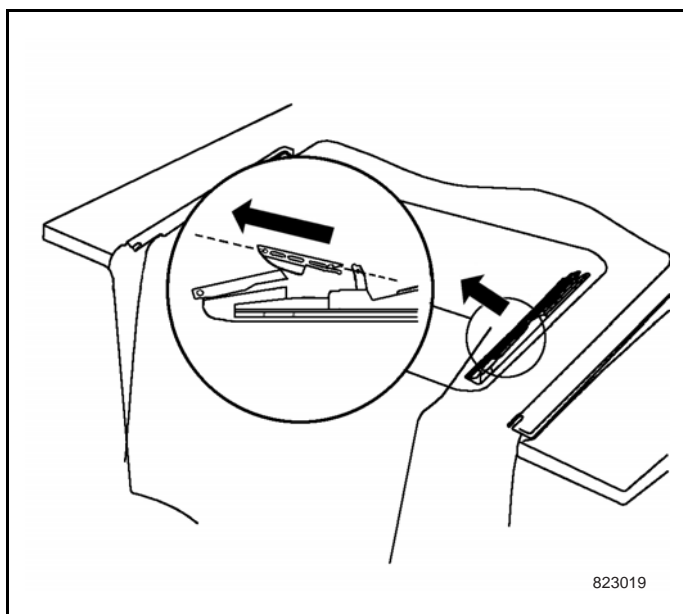


7. Mark the relative position of the glass guiding channel and the sunroof upper frame.
 8. Remove the four red screws at the corners mounting the sunroof glass channel to sunroof upper frame.
 9. Pull the glass channel forward about 1cm and tilt upward the bottom of the glass channel so that it will separate with the sunroof upper frame.
- Note: Support the sunroof upper frame during removal.
10. Rotate the sunroof upper frame forward and downward and move forward so as to remove the sunroof upper frame.

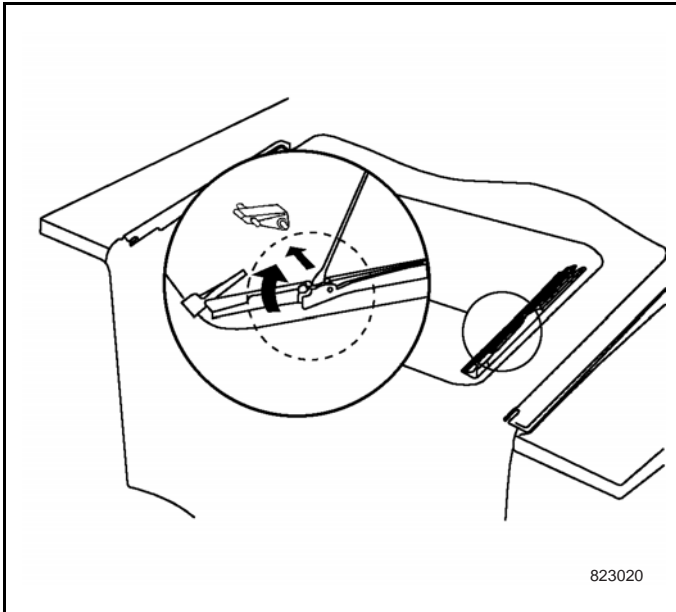


11. Pull the glass channel forward so as to separate the glass channel with the rotation link of the glass support.

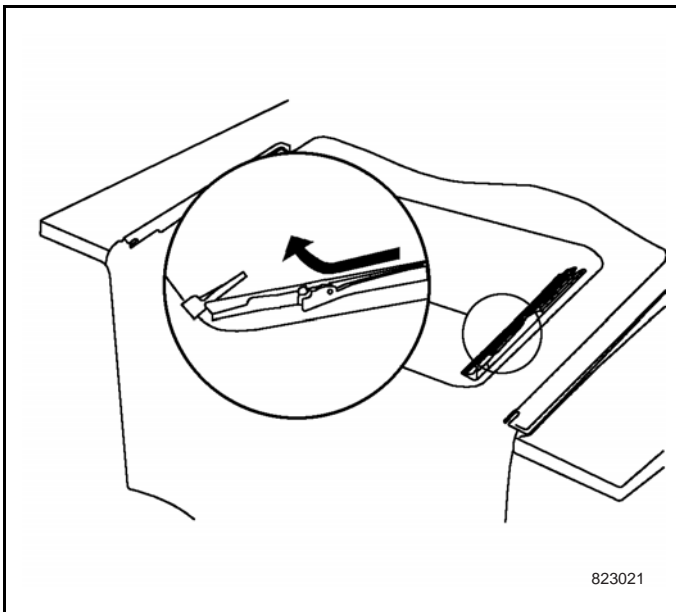
Note: Do not bend the glass channel downward during pulling operation.



12. Take the driving soft shaft from the driving slip block. Then remove the driving slip block from the control lever and rotation lever.

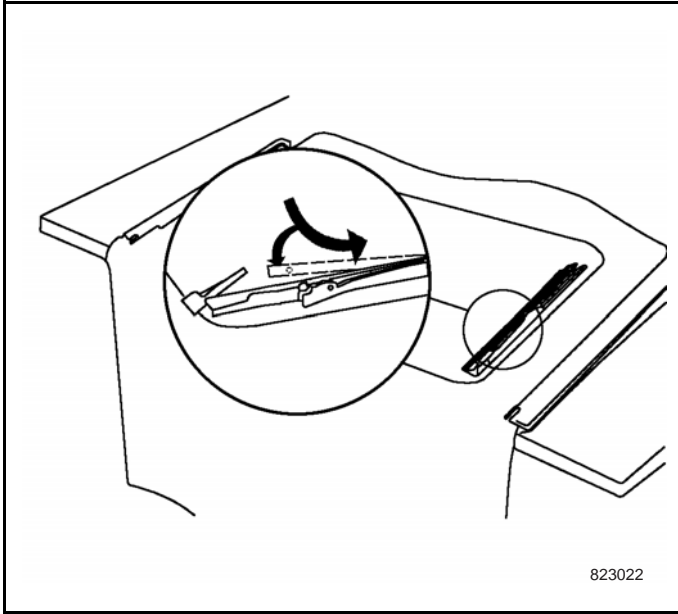


13. Rotate the control lever forward and pull it with the slip lock seat forward to the end.
14. Insert the flat screwdriver blade into the lock slip seat and glass support seat to force its front end expand outward so as to separate the pin of the control lever from the hole of the lock slip seat. Remove the left and right control lever.

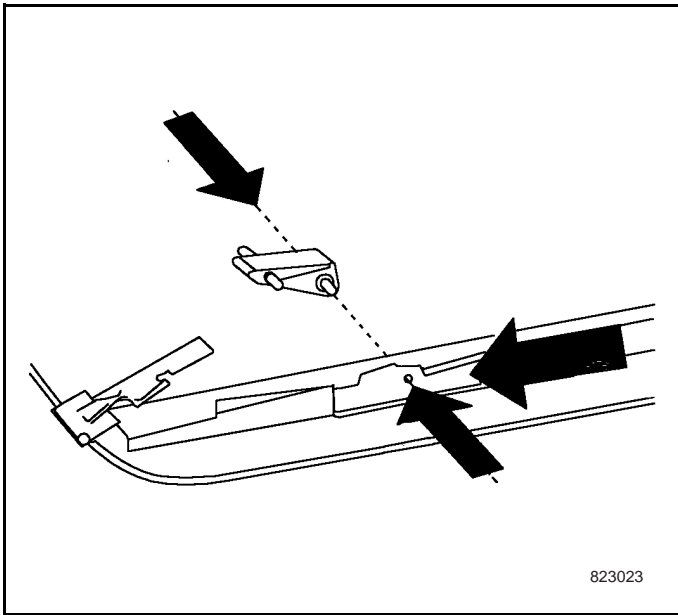


15. Maintain the status of the slip lock seat as described in the above step, raise the front end of the slip lock seat so that it slips forward. Remove the left and right slip lock seat.
16. Take out the glass panel assembly (including only the glass panel and two glass support seat).

Installation Procedure

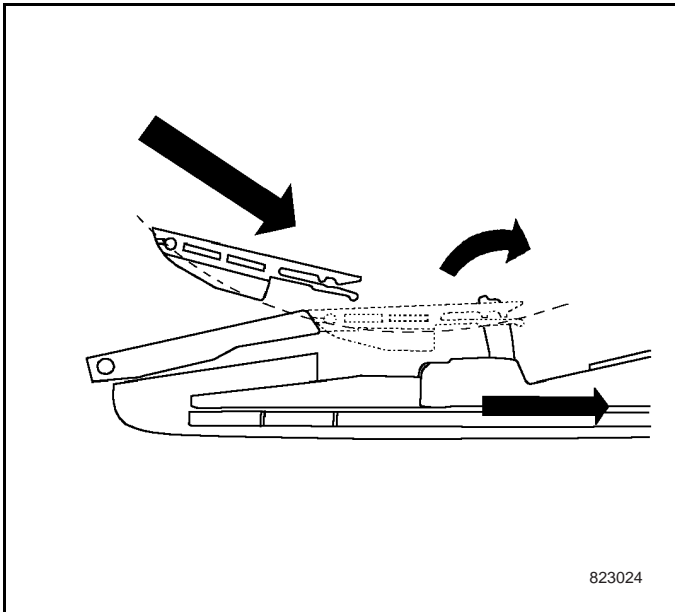


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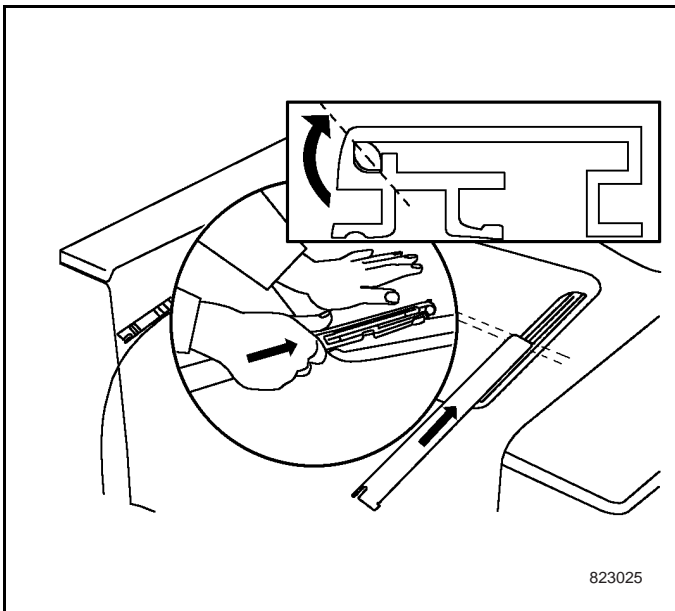


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1. Lubricate the glass channel, driving soft axis, control lever, slip lock seat and glass support with Teflon (poly-tetrafluoroethylene).
2. Put the front end of the slip lock on the glass support, slip it backward so that it locks on the glass support.
3. Slip the lock forward to the end and take the pin of the control lever carefully through the slip slot on glass support and insert it into the hole of the slip lock.



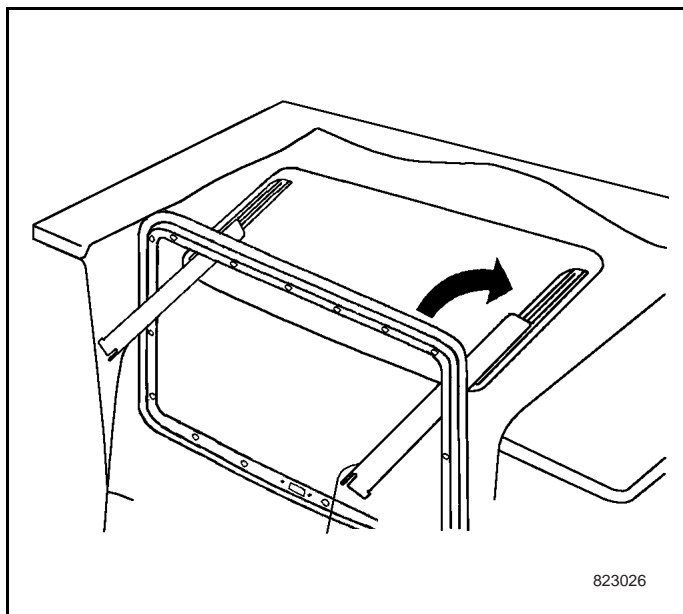
4. Slip the control lever and the slip lock backward to the end and rotate the control lever backward.
5. Wedge the driving slip and the pin of the control lever and meanwhile, rotate the pin at the linkage to place the pin onto the end of the driving slip slot.



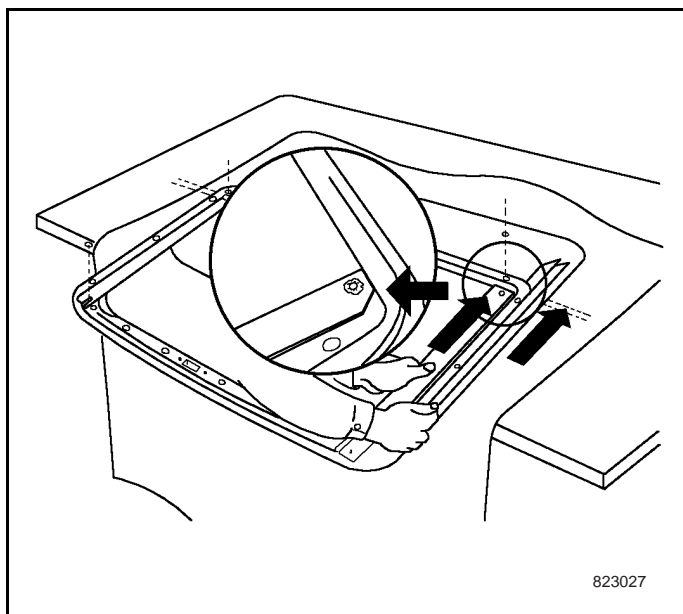
6. Straighten the rotation linkage and driving slip board.
7. Slip the glass guiding channel so that the rotating linkage and driving slip are locked into the guiding channel until there is 4-5cm remained out of the glass guiding rail.

Note: Do not use too much force during installation to avoid damage to the parts.

8. Insert the driving soft shaft into the glass guiding rail and embed one end of the metal bar into the driving block with the other end pulling through the long narrow hole near the front end of the glass guiding rail.
9. Slip the glass guiding rail backward until the driving slip block is 1cm away from the glass guiding rail.



10. Insert the two glass guiding rail into roof upper frame, then introduce the rear end of the glass rail between the guiding rail and glass support. Pull the sunroof upper frame forward and install the sunroof upper frame onto the glass assembly.
11. House the black guiding pipe onto the driving soft shaft, and push the driving soft shaft into the slot of sunroof frame.

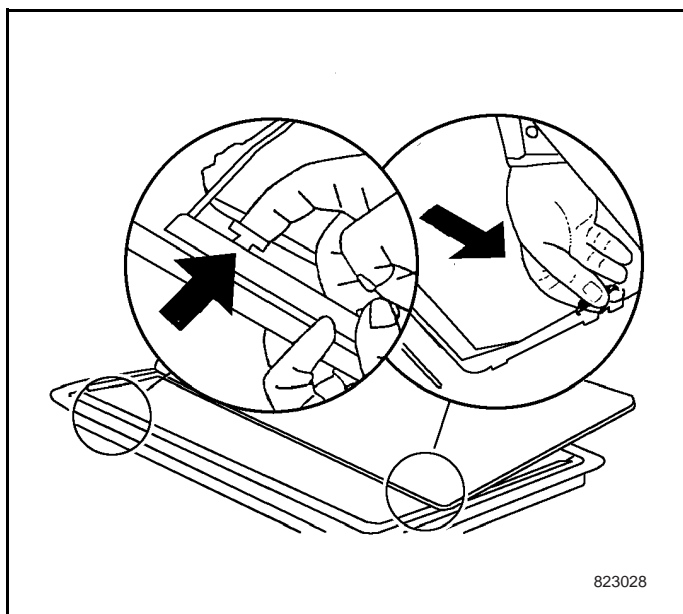


12. Slide the glass rail in line with the mark done during removal so that it corresponds with its location at removal.
13. Install the four red screws mounting the sunroof glass rail to the sunroof upper frame.

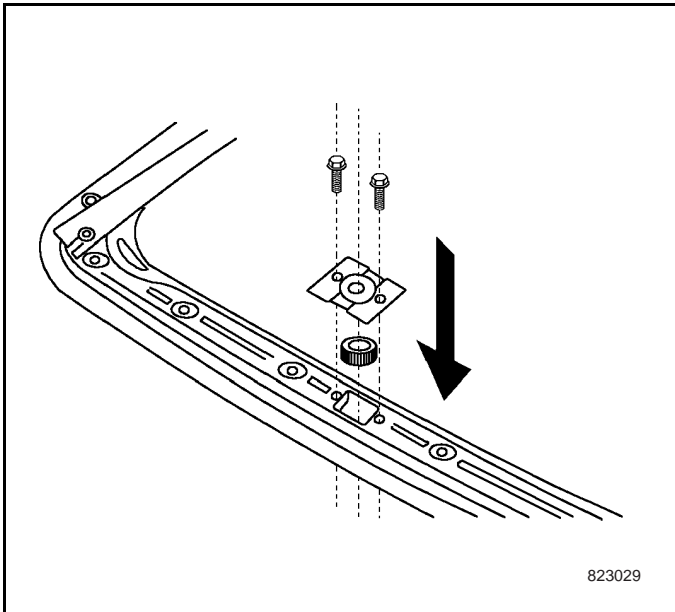
Fastening

Fasten the screws mounting the sunroof glass rail to roof ring to 3.5 N•M.

Note: Pay attention to the position of the driving soft shaft during installation.



14. Install the sunroof deflector. Wedge the installation block of the deflector into glass rail and hang the sliding block at the front of the deflector to the sunroof upper frame.
15. Push the sunroof glass panel so that it opens to the maximum.



16. Put the gear at the bearing of the sunroof upper frame so that the two opposite driving soft shaft joggle with each other.
17. Install the screw box to the sunroof upper frame with two screws.

Fastening

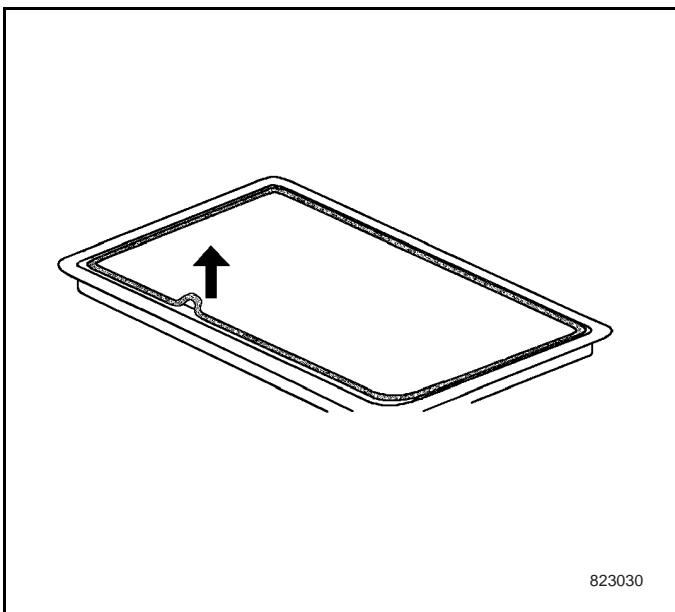
Fasten the screw mounting the roof screw box to roof ring to 3.5 N•M.

18. Connect the roof upper frame assembly with the motor, roof control module and switches. Connect the roof control module and body harness. Start the vehicle to verify if the roof operates normally.
19. Remove the motor, control module and switch.

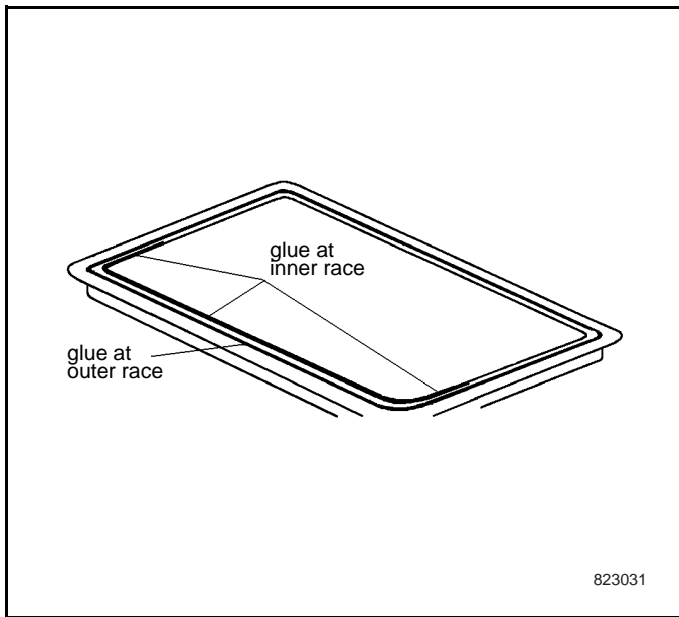
8.23.5.9 Replacement of the Roof Weatherstrips

Removal Procedure

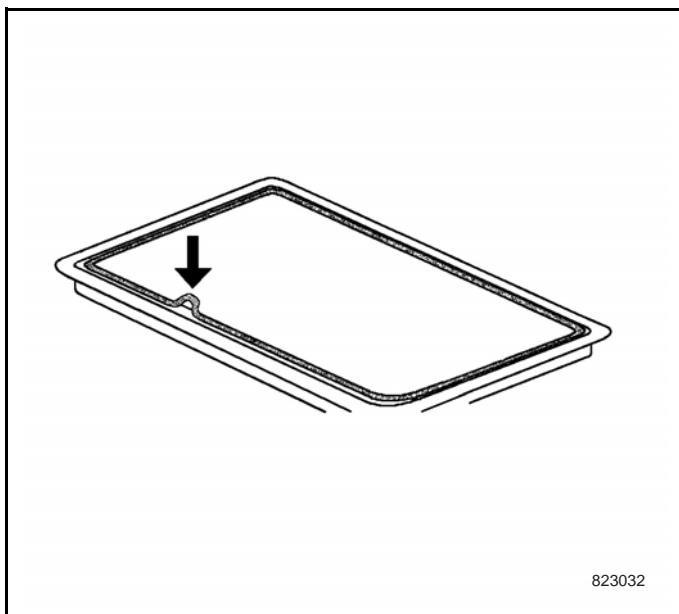
1. Remove the roof upper frame. Refer to Step 1-10 of the removal procedures in Replacement of the Roof Glass Assembly.
2. Pull away the roof weatherstrip from the roof frame from the middle and then remove the entire circle of the sealing strip from the frame.
3. Immerse the roof weatherstrip installation slot in banana water for 4-5 minutes, discharge the banana water, clean away the sealing glue remained on the weatherstrip with flat screwdriver.
4. Wiper clean the sealing strip installation slot at the roof upper frame.



Installation Procedure



1. Apply 2-3mm silicon gel to the outer ring of the bottom of the installation slot of the sealing strip of the roof upper frame.
2. Apply 2-3mm silicon gel to the inner ring of the front installation slot bottom as well as the front 1/3 inner ring at the two sides.



3. Press the weatherstrip into the installation slot of the roof upper frame. Be sure to press the entire weatherstrip into the installation slot so as to ensure the uniform compression between the glass and weatherstrip later.

Note:

- Avoid spill of gel during installation of the weatherstrip.
- Keep the roof upper frame with weatherstrip installed for 8 hours under room temperature before any further operation.

8.23.6 Description & Operation

8.23.6.1 Power Roof Description

Power roof (CF5, optional) features the following characters.

1. Manually operated sunroof panel. At the front of the sunroof, a handle is provided to open and close the sunroof.
2. Control module at the front of the roof to keep the roof glass at full close, tilt ventilation and open positions. It also offers the roof with automatic closing and obstruction proof function.
3. Roof upper frame is equipped with deflector, when the roof glass moves from tilt ventilation position to full open position, the deflector may rise automatically and lower itself when the glass moves near the close position.

Function of the deflector is that under any vehicle speed, when the glass opens, it will reduce the speed of air running through the roof opening.

4. Within the roof motor, there is a heat-sensing device. When the roof meets heavy obstruction or encounters overload, the heat sensor may cut off power in 6 seconds so as to prevent the parts of the roof from being damaged.

When the function is actuated, the roof will de-function and stop at any position it locates. Press the operation button, the roof gives out no reaction at completely stationary status, or moves shortly and stops immediately. Turn off the power of the roof and maintain for two seconds. Turn on the power again and the roof will restore its normal operation.

5. Power roof switch is double-positioned rocker type to be operated with power. The switch locates on the headliner at the front of the roof. The user may operate the roof with the following control mode.

- (1) Manual: Turn on ignition, press and hold the button OPEN (rear of the switch) for more than 0.3 second, the glass panel will raise and open. When the button is released or the glass panel moves to fully tilt and ventilation position, the movement stops. When the glass panel moves to fully tilt position, release the button, press and hold the button OPEN for more than 0.3 second. When the button is released or the glass panel moves to the maximum open position, it stops moving. To close the glass panel, press and hold the OFF button (front of the switch) until the glass panel moves to fully tilt ventilation position and stops,

release the button and then press and hold the OFF button, the glass panel will move to the fully closed position.

- (2) Auto Operation, Turn on ignition, press the ON (rear of the switch) button less than 0.3 second, the glass panel tilts and automatically opens to the maximum opening position. Similarly, press OFF button (front of the switch) less than 0.3 second, the glass panel will move to the fully closed position. Press the button during the movement of the roof (at any direction), the glass panel may stop at any position of its movement track.

When the glass panel stays at any position, it may be operated manually or automatically.

- (4) Auto Close, About 4 seconds after ignition is turned off, the roof may be closed automatically. Press the button before the roof is fully closed (at any direction), the function will be cancelled, the glass panel will stay at open position. To close the roof, there is no need to turn on ignition, press the CLOSE button (front of the switch) manually or automatically.
- (5) Anti-seizure function, During auto closing movement, when the roof meets obstacles, it will return automatically until the obstacle is removed. After ignition is turned off, during the automatic closing movement of the roof, the function remains effective.

Notice: When the roof glass moves, do not stretch out your head or hand.

6. Whenever the roof is re-fitted or replaced with new fuses, it is necessary to re-programming the roof system, or functions such as auto operation, auto close and anti-seizure may be prohibited for the time being, only manual operation is allowed to control the roof.

Steps for programming, press the ON button (rear of the switch) continuously, manually operate the roof glass panel to the fully tilt and ventilation position, release the button and press the ON button continuously, operate the glass panel manually to the fully OPEN position. Press the CLOSE button (front of the switch) continuously, manually operate the roof glass panel to the tilt and ventilation position, release the button, press the CLOSE button continuously until the glass panel is fully closed. Programming ends. All functions of the roof will recover.

7. There is sealing strip equipped at the inner ring of the roof near the glass panel to seal the gap between the glass panel and roof upper frame.
8. Solid sealing glue is filled in the channels of roof ring to seal the gaps between roof ring frame and ceiling cover.

Maintenance of the Roof

1. Clean the window surface with cloth soaked with GM-approved cleaner GM P/N 10500427 or other effective products.
2. Maintenance to the Sealing Strips.
 - (1) Frequently use of talcum powder can relieve the aging of the sealing strips. It will

also do help to the sealing effect and prolong the life the sealing strips.

- (2) If the vehicle often drives under dusty conditions, clean the sealing strips frequently to reduce their wearing and avoid failure of sealing. Use a piece of cloth to wrap the top of the screwdriver and insert it to the bottom of the sealing strip to clean.
3. After rain or washing to the car, do not open the roof until water is dried (about 10 minutes) or wipe the body directly with dry cloth. This may avoid occurrence of water leakage.

8.23.6.2 Operation of Power Roof

Power roof (CF5, optional) features the following characters.

- Outward roof glass panel
- Manually operated sunroof panel.

The power sunroof system will operate only with the ignition turned to ACCY and ON positions. The power sunroof is operated with a double-positioned rocker switch located at the front of the switch. The sunroof glass panel may be tilted and slipped to any of the following positions with the control switch:

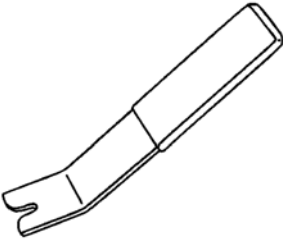
- tilt / vent
- outward to open
- fully closed

. You may also press the ON button (rear of the switch) continuously to manually control the sunroof glass panel to fully tilt and centilation position, release the button, then press and hold the button until the glass panel moves to any open position.

fully closed

To close the sunroof fully, press the CLOSE button (front of the switch) less than 0.3 second so that the sunroof will move from any position to the CLOSE position. Or, press and hold the CLOSE button to tilt/vent position, release the button, and then press and hold the CLOSE button at least 0.3 second so that the roof glass panel will fully close. To close the sunroof panel, manually pull it forward to the end.

8.23.7 Special Tools and Equipment

Illustration	Number & Name of the Tools
 J38778	J 38778 Door trim pad and trim clamp remover

Blank

9

Safeguard Device

9.1 Safety Belt.....	9-3		
9.1.1 Specification	9-3		
9.1.1.1 Fasteners Tightening Torque.....	9-3		
9.1.2 Diagnostic Information and Procedures	9-4		
9.1.2.1 Operation and Function Inspection	9-4		
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Blank

9.1 Safety Belt

9.1.1 Specification

9.1.1.1 Fasteners Tightening Torque

Application	Specification
Fixing Bolt	35 N•m
Anchor Bolts on Front Seat Safety Belt Side (Driver side)	35 N•m
Anchor Bolts on Front Seat Safety Belt Side (Passenger side)	35 N•m
Guide Ring Bolts	35 N•m
Bracket Bolt of Shoulder Belt Height Adjuster	20 N•m
Bracket Bolt of Shoulder Belt Height Connector	20 N•m
Bracket Bolt of reeling up Reel	35 N•m
Rear Seat Central Safety Belt Nuts	35 N•m

9.1.2 Diagnostic Information and Procedures

9.1.2.1 Operation and Function Inspection

Safety Belt Inspection

Caution: To avoid personnel injury caused by vehicle colliding under safeguard system having not been restored:

- Replace every worn safety belt during vehicle colliding, except for slightly collided ones.
- Inspect every safety belt; replace safety belt system in case of any parts/components being suspected of faulty.

Following inspection procedure must be taken for driver seat:

Refer to Description of Safety Belt System.

1. Inspect should belt guide ring for the following:
 - Shoulder guide ring should be turning smoothly.
 - Safety fabric belt is able to enter guide ring groove neatly.
 - No stagnant on safety fabric belt.
2. Ensure the safety belt side where buckle is located faces inside and properly positioned.
3. Ensure that safety belt reel is reliable and firm.
4. Ensure that safety belt fixing bolt is reliable and firm.
5. Fully pull out safety fabric belt, and ensure it won't be twisted or torn.
6. Inspect safety belt reel to ensure it'll be reeled up and off neatly.
7. Insert safety belt buckle latch into the anchorage.
8. Pull safety belt buckle tongue and anchorage abruptly, ensuring them to keep tightly locking during pulling.
9. Press the button on the belt anchorage.
10. Ensure that the buckle tongue can be easily bounced out.
11. Ensure the button to return back to its original position.
12. Repeat the inspect procedure for front passenger seat (step 2 to 10).
13. Repeat the inspect procedure for rear passenger seat (step 2 to 10).

Perform following inspect procedure for rear seat safety belt.

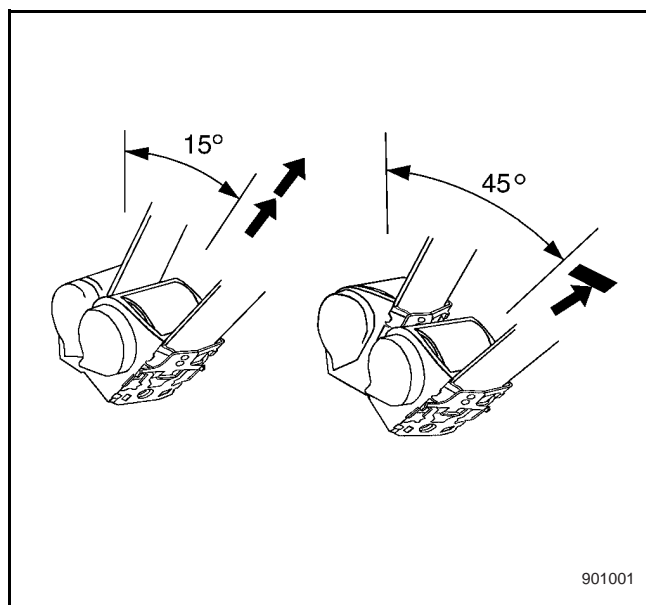
1. Ensure central safety belt can be reached.
2. Ensure no twisting or tearing at the edge of central safety belt is found.

3. Insert central safety belt buckle tongue into the anchorage.
4. Pull safety belt buckle tongue and anchorage abruptly, ensuring them to keep tightly locking during pulling.
5. Press the button on the belt anchorage.
6. Ensure that belt buckle tongue can be easily bounced out.
7. Ensure the button to return back to its original position.

To realize information of uninstalling rear seat cushion, please refer to Rear Seat Cushion Replacement or Rear Seat Replacement.

Caution: Abovementioned test should be carried out at the area where no vehicle or passengers appears. To test on public road is forbidden. Wide and open parking area might be suitable. Otherwise vehicle damage and personnel injury might be caused.

1. Tighten safety belt, an assistant might be needed in case the reel tested is not a component of driver safety seat belt.
2. Slowly accelerate vehicle to 16 km/h (10 mph) and then step on brake pedal.
3. Ensure safety belt locking tightly while stepping on brake.
4. Perform the following in case safety belt is not locked tightly.
 - 4.1 Remove safety belt reel assembly.
 - 4.2 Tilt safety belt reel slowly.



- 4.3. Ensure safety fabric belt could be reeled off when tilting angle is smaller than 15 degree, and could not be reeled off when

tilting angle equals or bigger than 45 degree.

4.4. Replace the reel if it cannot be operated as mentioned above.

- Refer to Safety Belt Reel Replacement-Left Front.
- Refer to Safety Belt Reel Replacement-Right Front.
- Refer to Safety Belt Reel Replacement-Rear Row.

9.1.2.2 Note for Safety Belt Utilization

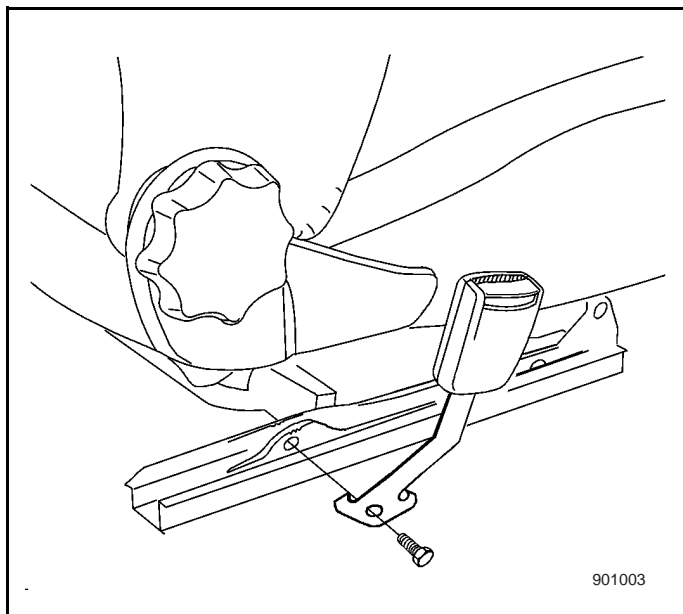
- To use bleached or dyed fabric safety belt is forbidden. Only mild soap, water deliquescent material, soft brush and cloth can be used to clean fabric safety belt.
- Remove from the belt the object that may lacerate and damage fabric. Avoid to bend or damage safety belt anchorage and buckle tongue.
- Replace safety belt fabric on which any type of cut and damage occurs.
- Specified safety belt fixing studs and bolts should be used.
 - Tighten studs and bolts to secure proper torque, refer to Fasteners Tightening Torque.
 - Ensure bolts screw to be aligned with that of nuts when install safety belt fixing bolts.
- Special maintaining parts kit must be used when repair some kind of safety belt and its reel.
- Ensure replaced parts are properly located at the right vehicle seat position. Replace safety belt from different seat is not allowed.
- Only safety belt with warning notice can be used to replace.
- Some safety belt owns energy control system, i.e., drapes formed during sewing up. Safety belt need to be replaced if any sewing up separates.

9.1.3 Repair Instructions

9.1.3.1 Safety Belt Anchorage Replacement-Left Front.

Removal Procedure

1. Uninstall left front seat from the vehicle, refer to Front Seat Replacement of Seats.
2. Remove bolts from the anchorage on the side face of the seat.
3. Remove safety belt anchorage from left front seat.



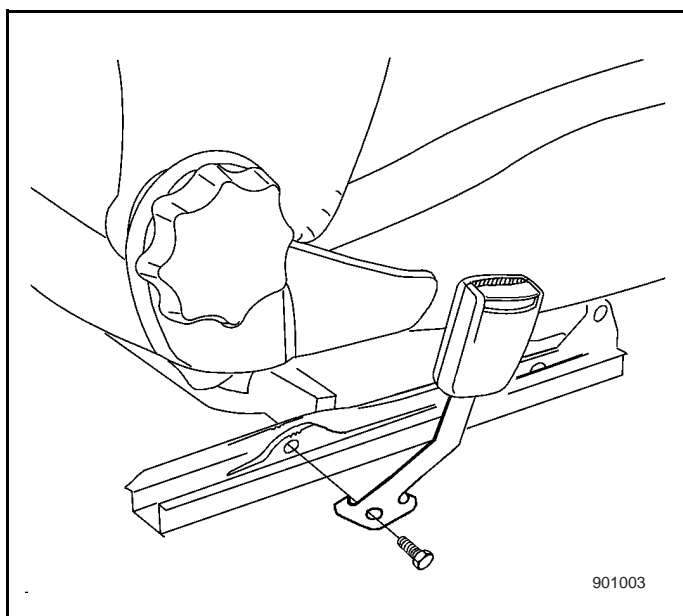
Installation Procedure

1. Install safety belt anchorage on left front seat.
2. Install anchorage bolts of seat safety belt.

Tightening

Tighten anchorage bolts of the seat safety belt to 35 N•m.

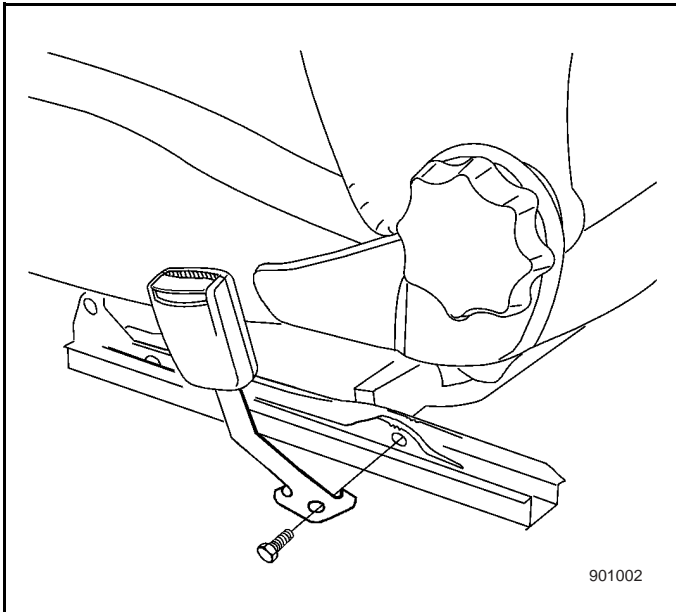
3. Install driver-seat on the vehicle; refer to Front Seat Replacement in Seats.



9.1.3.2 Safety Belt Anchorage Replacement-Right Front

Removal Procedure

1. Uninstall front passenger seat from the vehicle, refer to Front Seat Replacement in Seats.
2. Remove bolts from the anchorage on the side face of the seat.
3. Remove safety belt anchorage from right front seat.



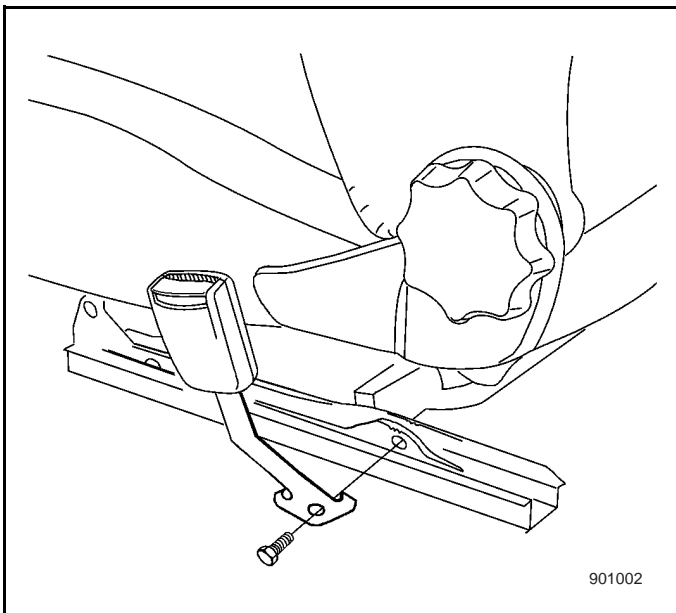
Installation Procedure

1. Install safety belt anchorage on right front seat.
2. Install anchorage bolts of seat safety belt.

Tightening

Tighten anchorage bolts of the seat safety belt to 35 N•m.

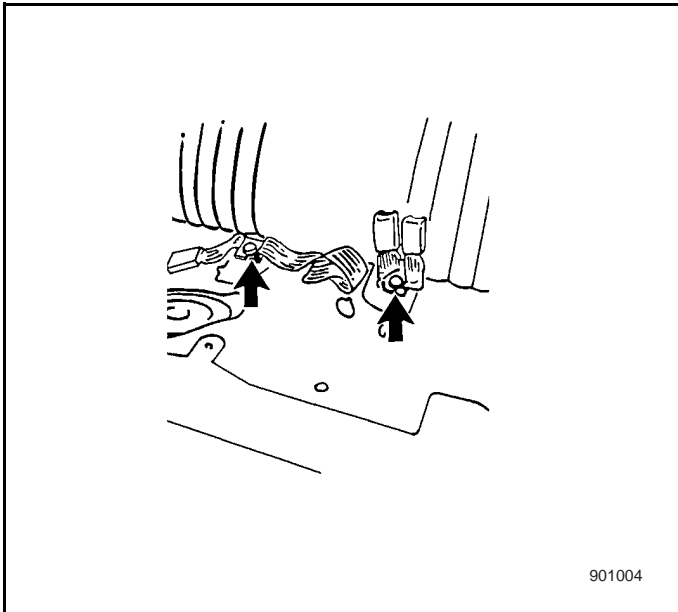
3. Install right front seat on the vehicle, refer to Front Seat Replacement in Seats.



9.1.3.3 Safety Belt Replacement-Central Rear Seat

Removal Procedure

1. Fold up rear seat cushion to its forefront position.
2. Remove safety belt bolts of central seat.
3. Remove central seat safety belt from the vehicle.



Installation Procedure

Note: Position the rear seat safety belt fixing plate properly at its right direction.

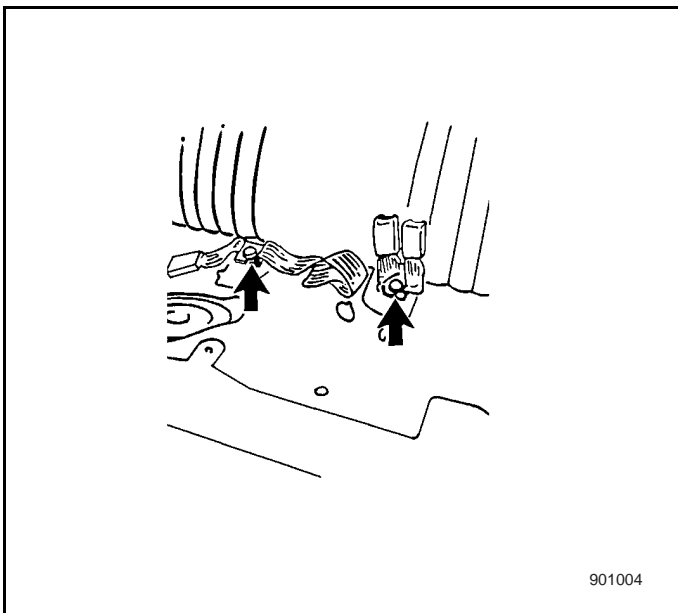
1. Ensure rear seat safety belt fixing plate to be positioned properly at its right direction.
2. Install central seat safety belt on the vehicle.
3. Install safety belt bolts of central seat.

Tightening

Tighten safety belt bolts of central rear seat to 35 N•m.

4. Place rear seat cushion to its normal position.

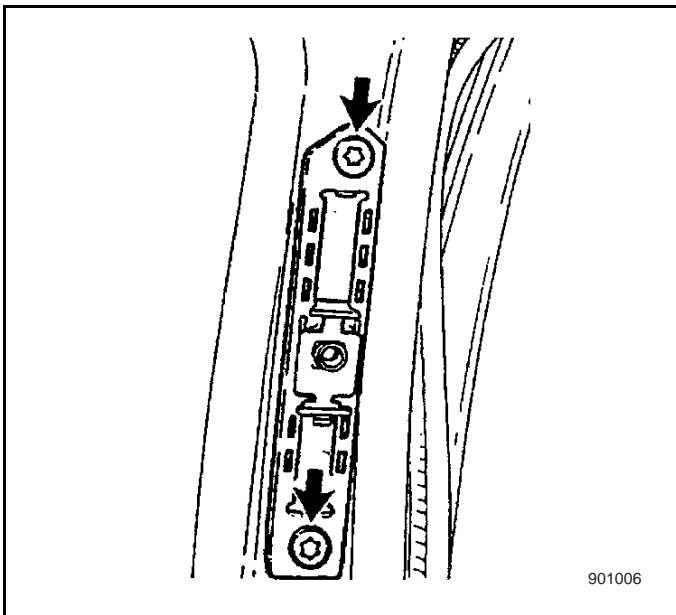
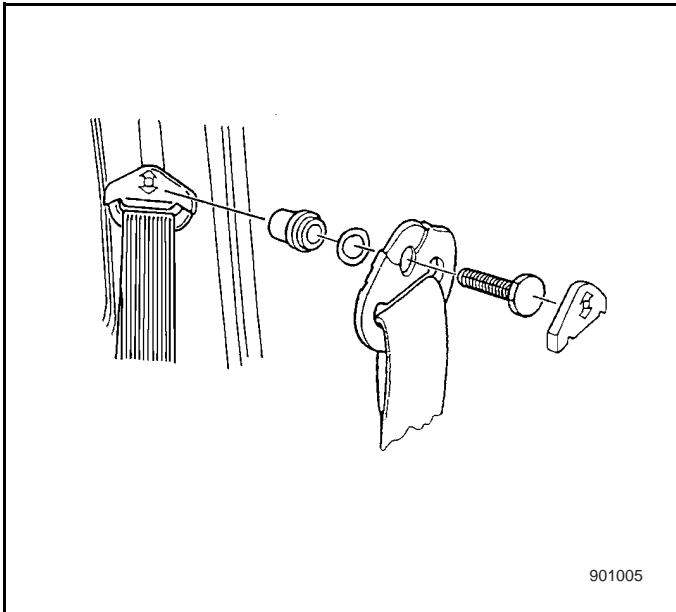
Note: Ensure that belt anchorage position goes through seat cushion correctly.

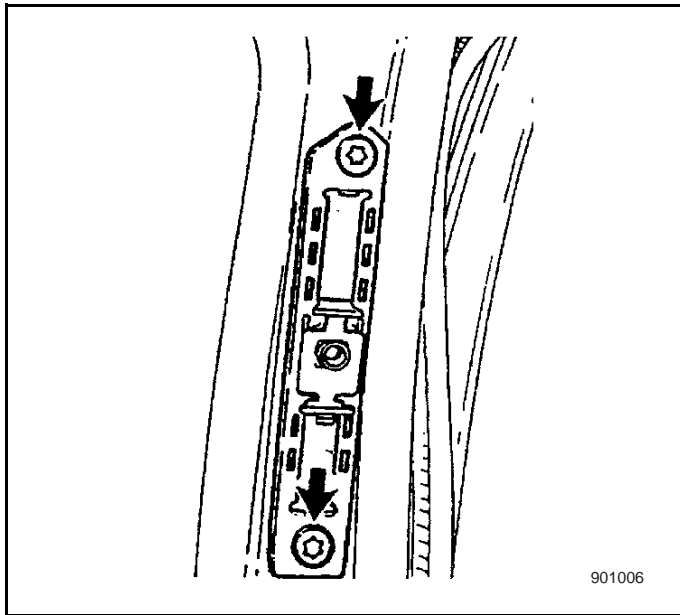


9.1.3.4 Height Adjuster Replacement--- Front Row

Removal Procedure

1. Open the guide ring trim lid of the seat safety belt.
2. Remove guide ring bolts.
3. Remove guide ring (along with guide cylinder washer) from height adjuster.
4. Remove trimming plate on central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
5. Loosen fixing bolt on height adjuster.
6. Remove height adjuster from central stanchion.



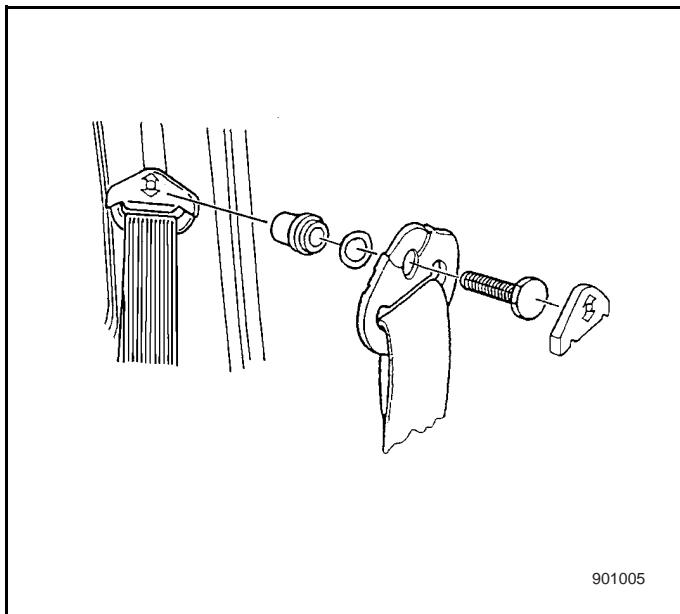


Installation Procedure

1. Install height adjuster on the central stanchion.
2. Install fixing bolt on height adjuster.

Tightening

Tighten fixing bolt on height adjuster to 20 N•m.



3. Install upper trimming plate on central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
4. Install guide ring (along with guide cylinder washer and bolts) onto height adjuster stanchion, and tighten bolts.

Tightening

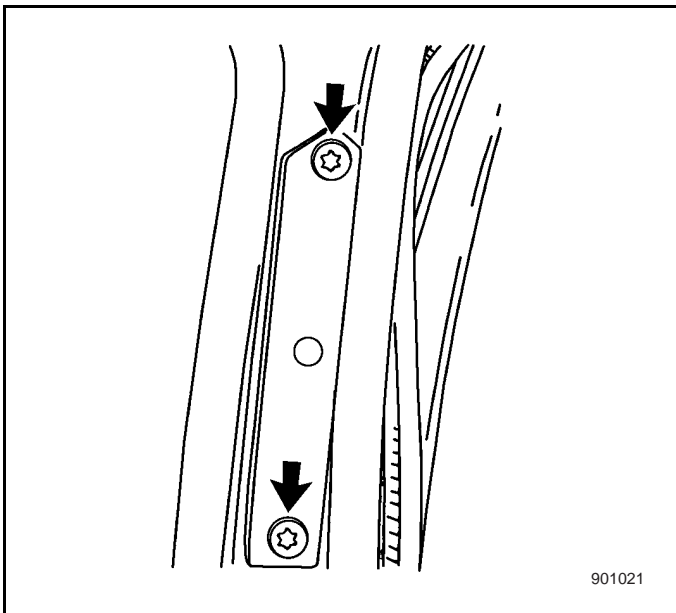
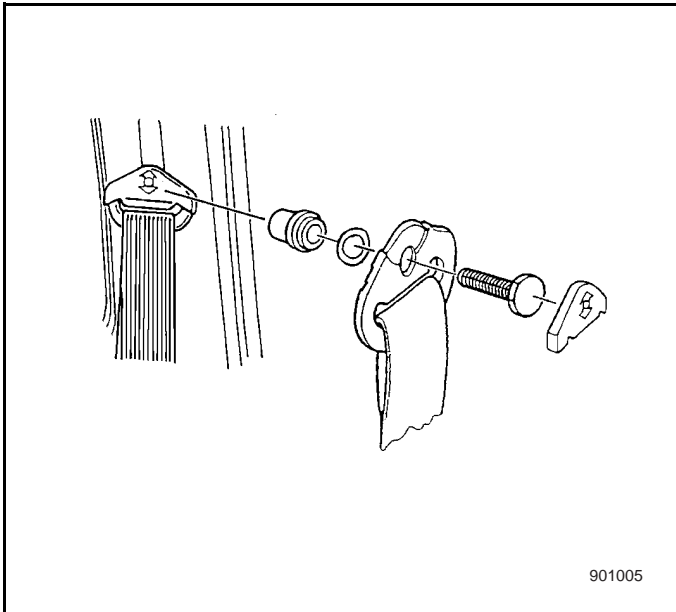
Tighten guide ring bolts to 35 N•m.

5. Cover guide ring trimming lid of the seat safety belt.

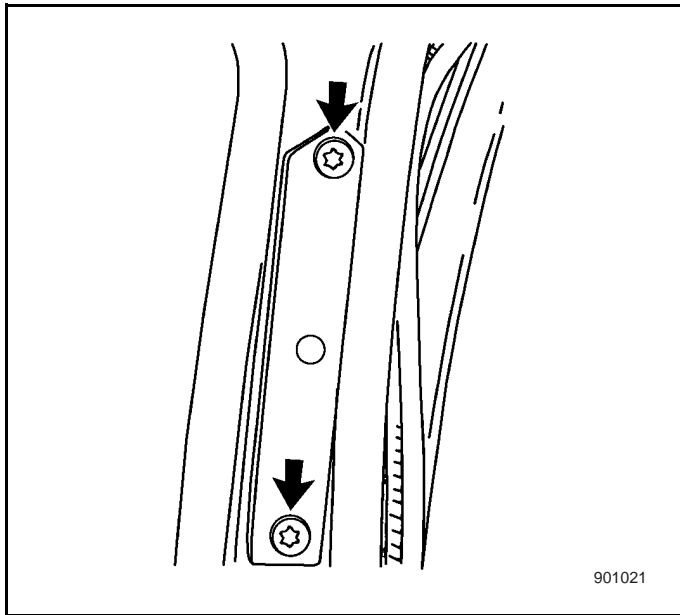
9.1.3.5 Connector Replacement-Rear Row

Removal Procedure

1. Open guide ring trimming lid of the safety belt.
2. Remove guide ring bolts.
3. Remove guide ring (along with guide cylinder washer) from connector stanchion.
4. Remove rear triangle window trim panel. Refer to Triangle Panel Replacement of Interior Trim.



5. Loosen fixing bolts on the connector.
6. Remove connector's fixing bolts from rear side panel.

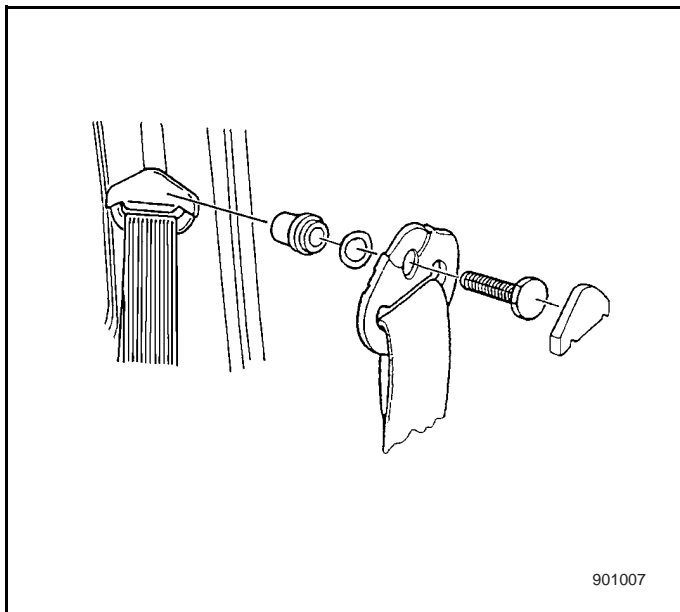


Installation Procedure

1. Place connector onto rear side panel.
2. Install fixing bolts on the connector.

Tightening

Tighten fixing bolt on the connector to 20 N•m.



3. Install triangle window trim panel. Refer to Triangle Trim Panel Replacement of Interior Trim.
4. Install guide ring (along with guide cylinder washer and bolts) onto connector, and tighten bolts.

Tightening

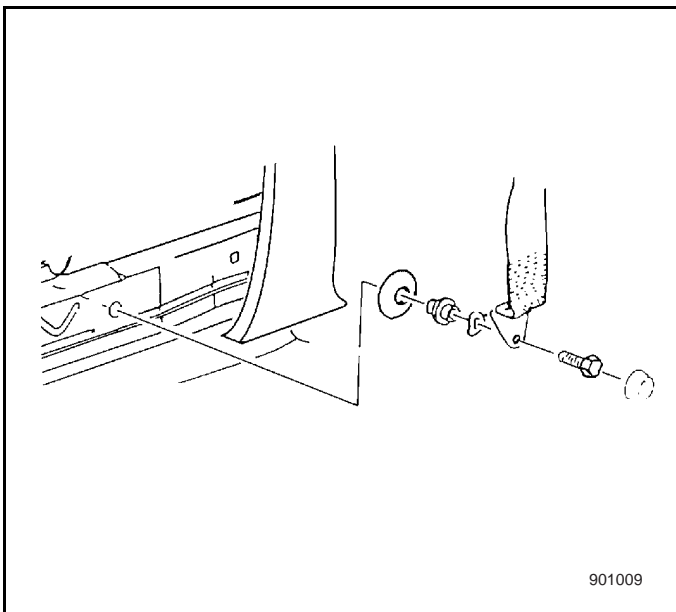
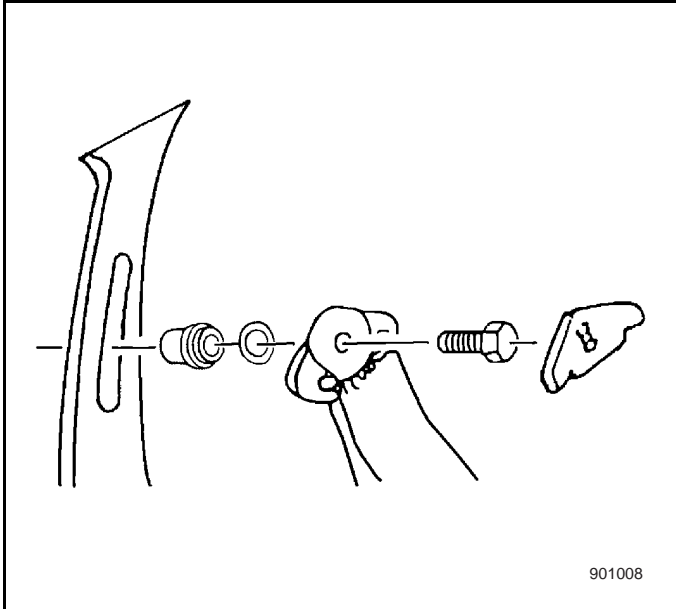
Tighten guide ring bolts to 35 N•m.

5. Cover guide ring trimming lid of the safety belt.

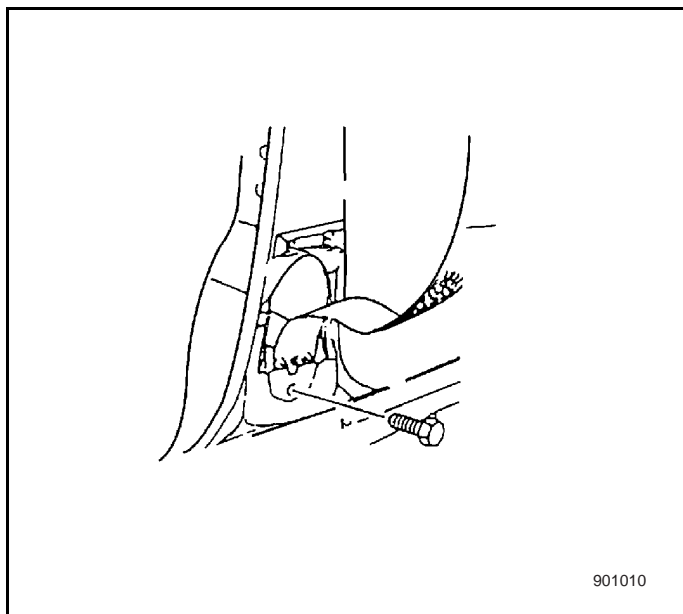
9.1.3.6 Refer to Safety Belt Reel Replacement-Left Front.

Removal Procedure

Note: Whether front passenger seat reel possess reeling up device of emergent and automatic locking.



1. Open the guide ring trim lid of the seat safety belt.
2. Remove guide ring bolts.
3. Remove guide ring (along with guide cylinder washer) from height adjuster stanchion.
4. Remove fixing bolt's head cup from central stanchion's lower part.
5. Remove fixing bolt (along with guide cylinder washer) from central stanchion's lower part.
6. Remove fixing plate (along with guide cylinder washer) from central stanchion's lower part.
7. Remove upper and lower inner trim panel from central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
8. Remove upper and lower trim plates, loosen fabric belt.



9. Remove reel bolts.
10. Remove reel from central stanchion.

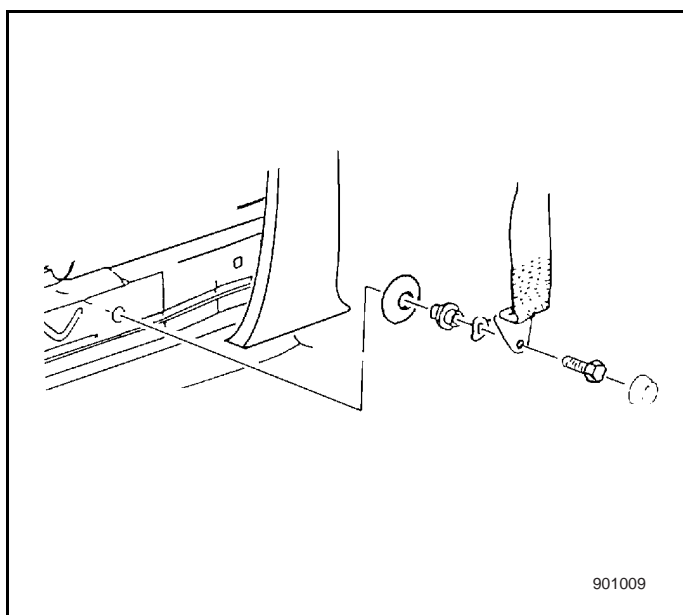
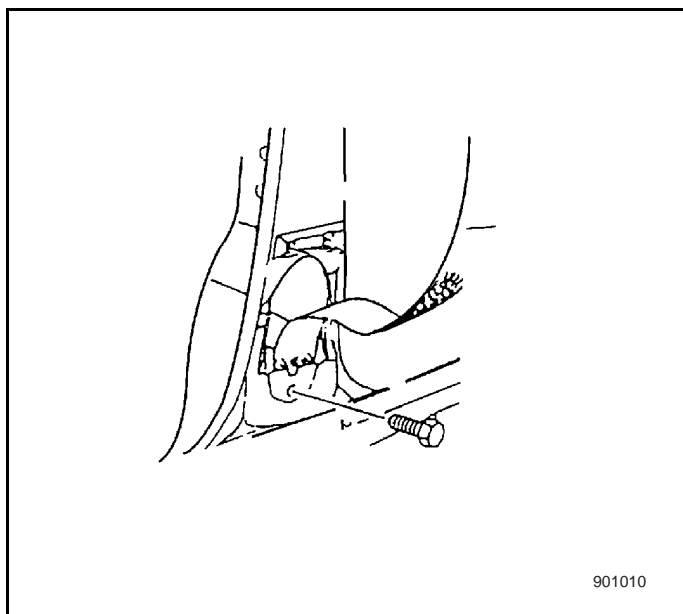
Installation Procedure

1. Install safety belt reel into cavity of central stanchion, ensuring the orienting paw to be blocked into the groove.

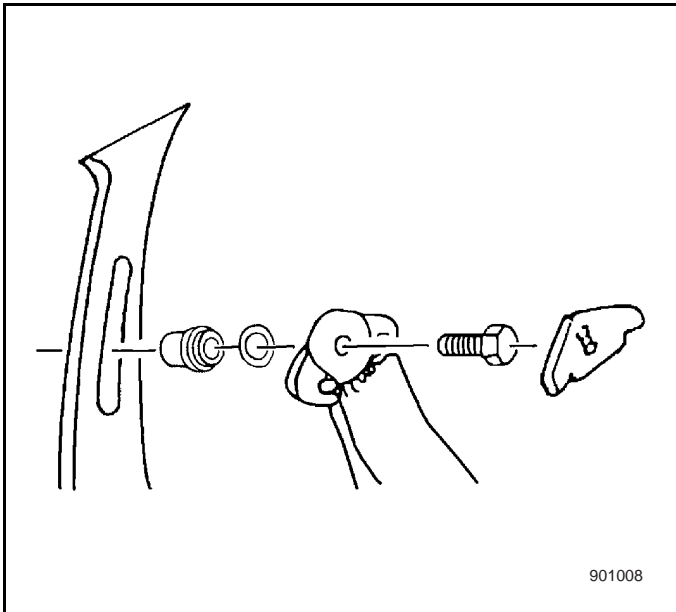
2. Install reel bolts.

Tightening

Tighten reel bolts to 35 N•m.



3. Ensure no any twisting occurs on safety fabric belt. Install lower trimming plate on central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
4. Install upper trimming plate on central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
5. Place fixing plate (along with guide cylinder washer) at central stanchion's lower part.
6. Install fixing bolts at the lower part of central stanchion.
7. Tighten supporting bolts to 35 N•m.

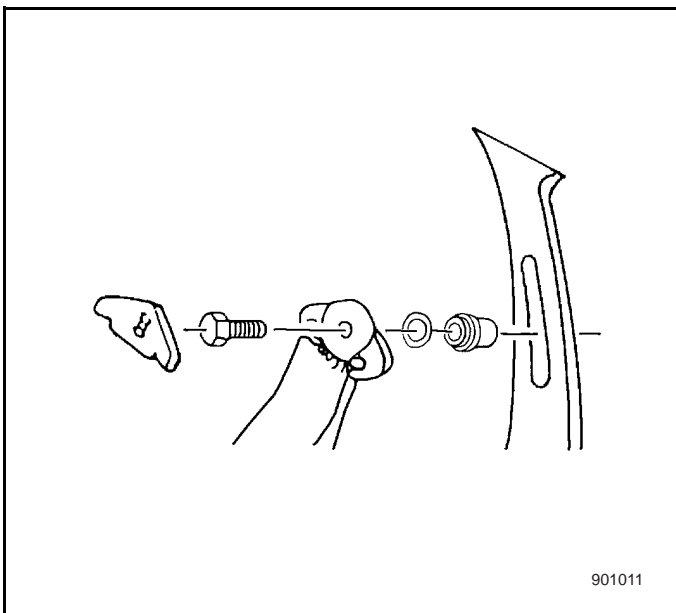


8. Install guide ring (along with guide cylinder washer) onto guide adjuster.
9. Install guide ring bolts.
10. Tighten guide ring to 35 N•m.
11. Close guide ring lid.

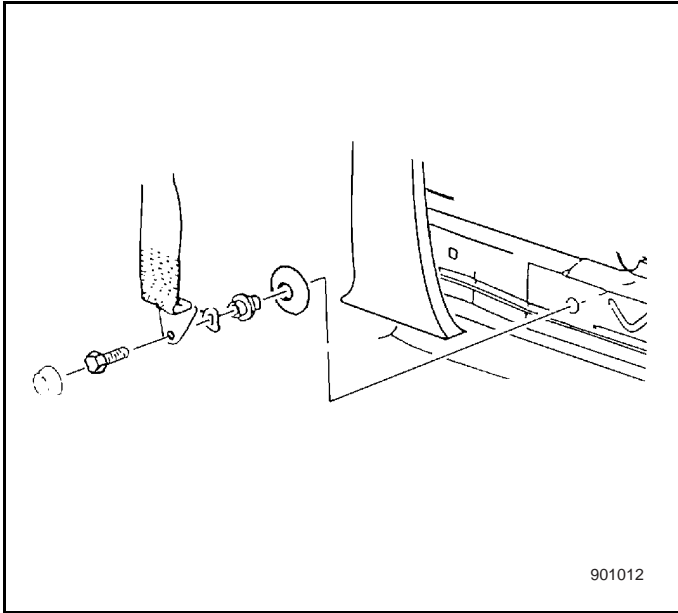
9.1.3.7 Refer to Safety Belt Reel Replacement-Right Front.

Removal Procedure

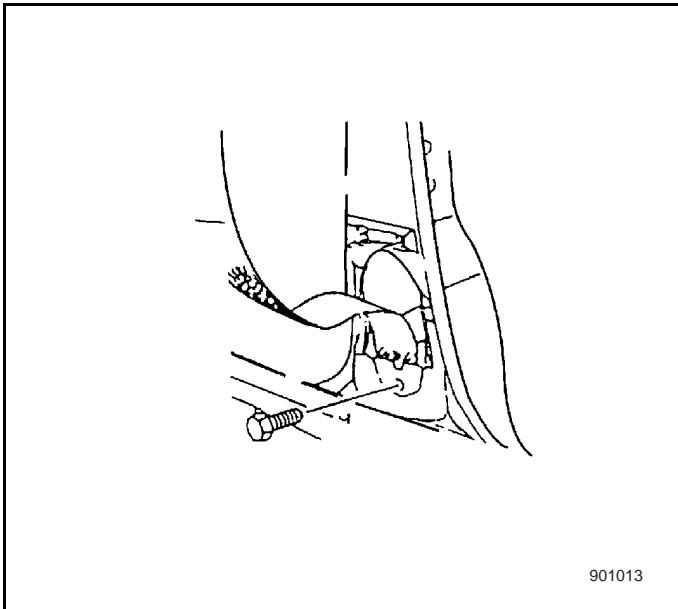
Note: Whether front passenger seat reel possess reeling up device with emergent and automatic locking.



1. Open guide ring lid of the seat safety belt.
2. Remove guide ring bolts.
3. Remove guide ring (along with guide cylinder washer) from guiding adjuster bracket.



4. Remove head cup of the fixing plate's bolts from central stanchion's lower part.
5. Remove fixing plate's bolts from central stanchion's lower part.
6. Remove fixing plate (along with guide cylinder and washer) from central stanchion's middle part.
7. Remove upper and lower trimming plate on central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
8. Take apart upper and lower trimmings, loosen fabric belt.



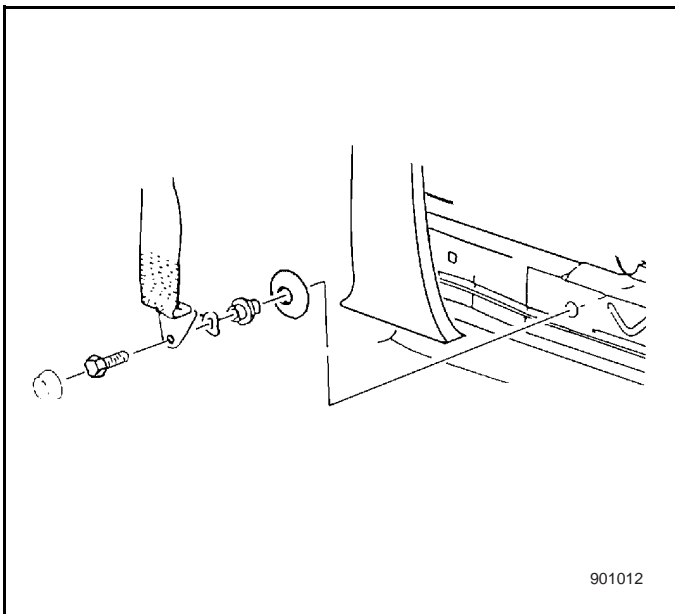
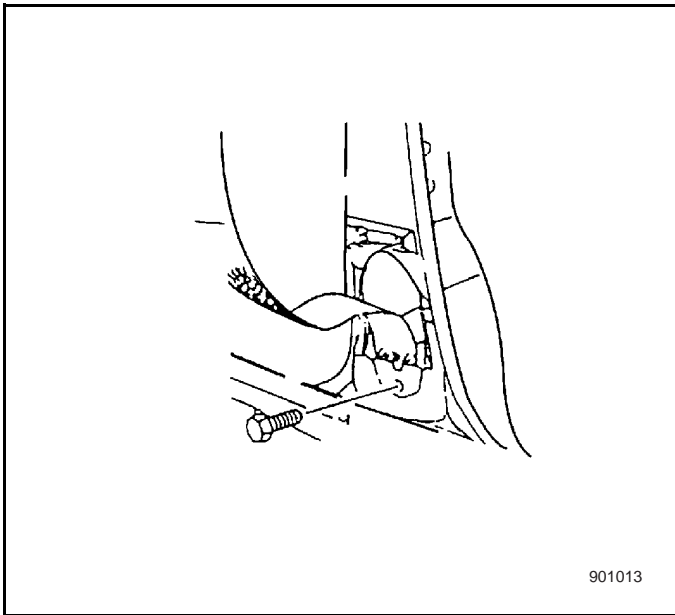
9. Remove reel bolts.
10. Remove reel from central stanchion.

Installation Procedure

1. Install safety belt reel into cavity of central stanchion, ensuring the orienting paw to be blocked into the groove.
2. Install reel bolts.

Tightening

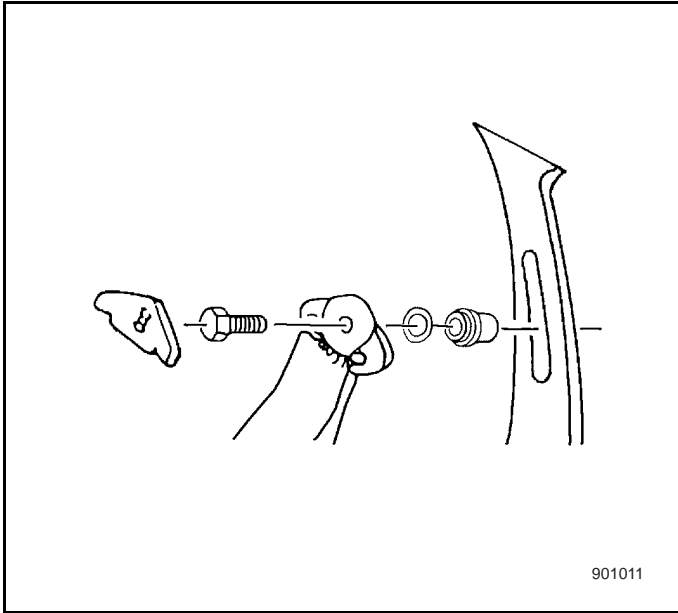
Tighten safety belt bolts of the reel to 35 N•m.



3. Ensure no any twisting occurs on safety fabric belt. Install lower trimming plate on central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
4. Install upper trimming plate on central stanchion. Refer to Central Stanchion Upper & Lower Trim Panel Replacement in Interior Trim.
5. Place fixing plate (along with guide cylinder washer) at central stanchion's lower part.
6. Install fixing bolts at the lower part of central stanchion.

Tightening

Tighten fixing bolts to 35 N•m.



7. Place guide ring (along with guide cylinder washer) onto guide adjuster.
8. Install guide ring bolts.

Tightening

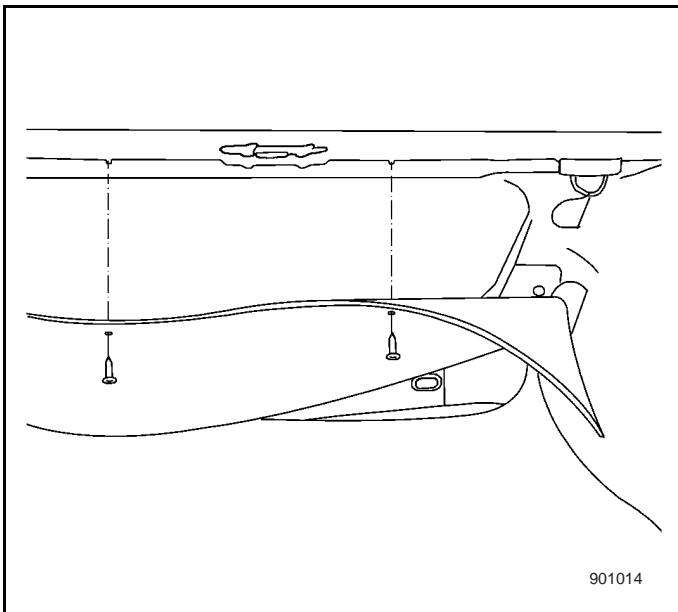
Tighten guide ring bolts to 35 N•m.

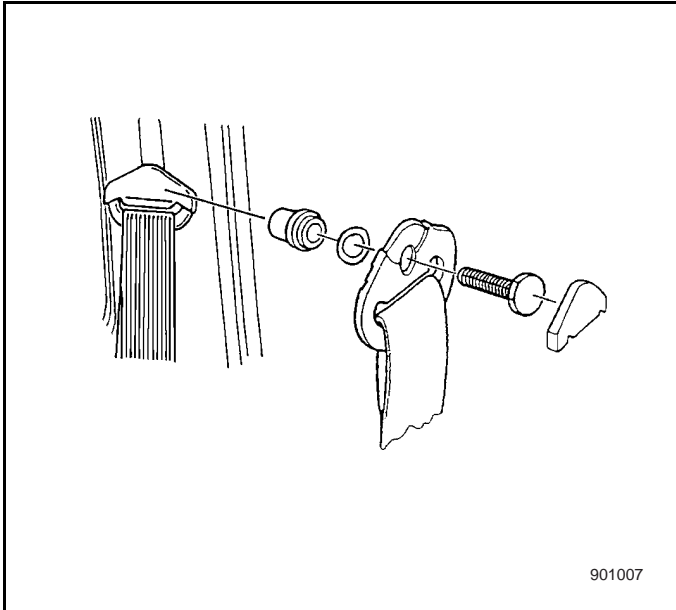
9. Cover guide ring trim with its lid.

9.1.3.8 Refer to Safety Belt Reel Replacement-Rear Row.

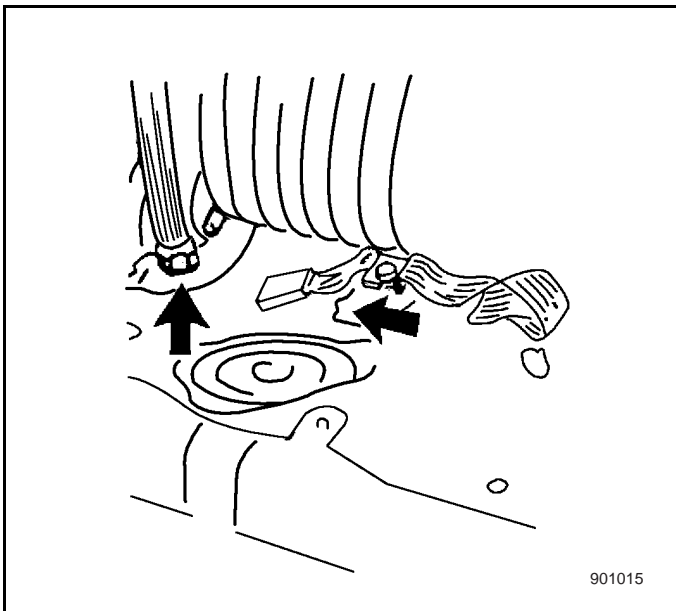
Removal Procedure

1. Take apart rear seat back trim panel.
2. Remove rear seat back. Refer to Rear Seat Back Replacement of Seats.
3. Fold up rear seat cushion to its forefront position.

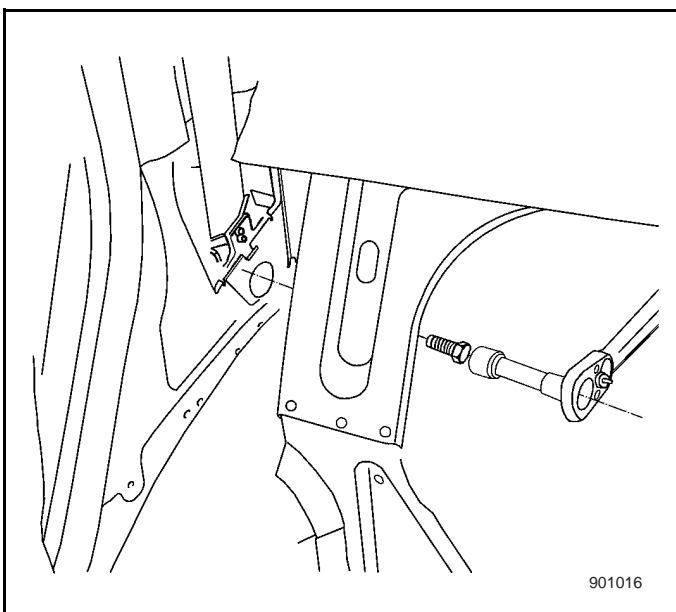




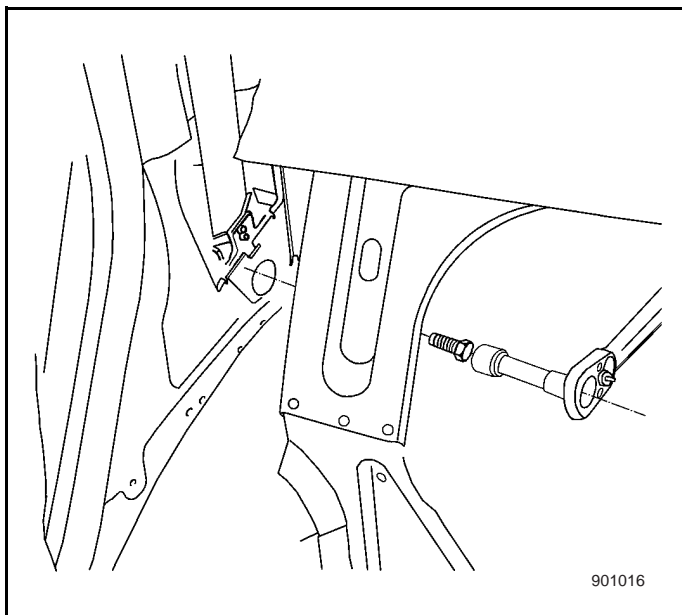
4. Remove safety belt reel's fixing bolts of rear row seats.



5. Open the guide ring trim lid of the seat safety belt.
6. Remove guide ring bolts.
7. Remove guide ring (along with guide cylinder washer) from connector bracket.
8. Take apart side trim panel of luggage boot's front part to reach safety belt reel.



9. Remove reel bolts.
10. Remove reel from rear side panel.



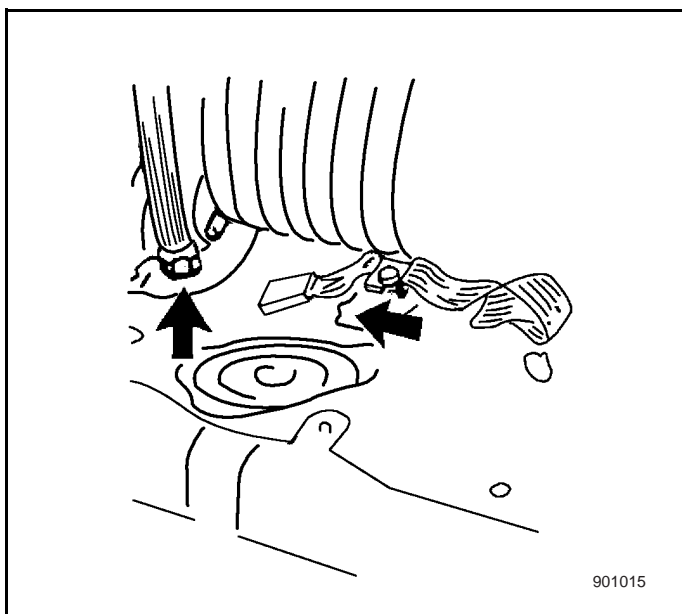
Installation Procedure

1. Open side trim panel's front part of luggage boot.
2. Install safety belt reel into cavity of rear side panel, ensuring the orienting paw to be blocked into the groove.
3. Install reel bolts.

Tightening

Tighten reel bolts to 35 N•m.

4. Recover the front part of luggage boot's side trim panel to its normal position.

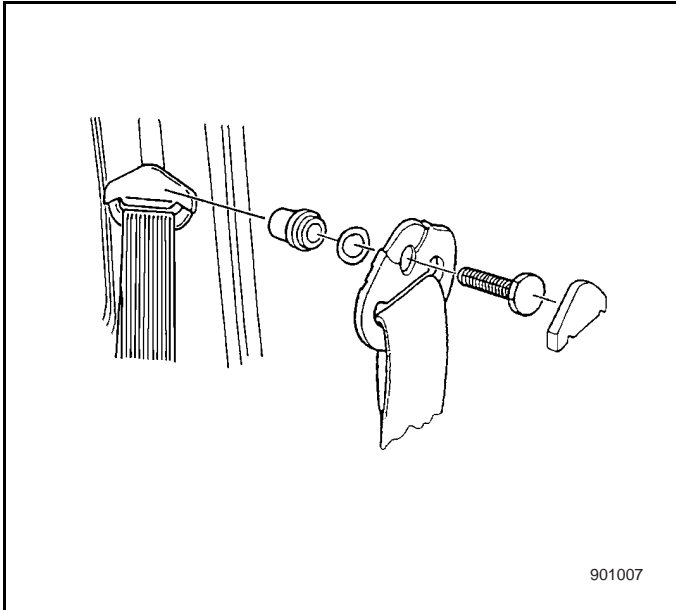


5. Place guide ring (along with guide cylinder washer) onto the connector.
6. Install guide ring bolts.

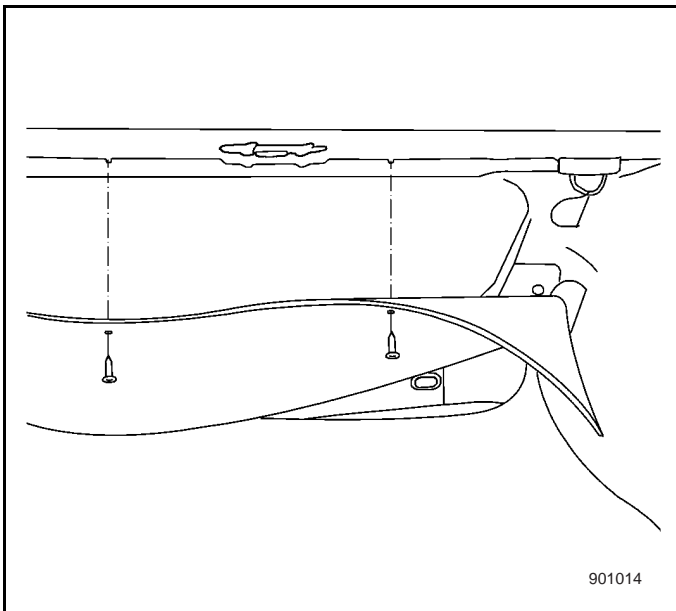
Tightening

Tighten guide ring bolts to 35 N•m.

7. Cover guide ring trim with its lid.



8. Ensure rear seat cushion to be folded up to its forefront position.
9. Install safety belt reel's fixing bolts of rear row seats.
10. Recover seat cushion to its normal position.



11. Install rear seat back. Refer to Rear Seat Back Replacement of Seats.
12. Install rear seat back trim panel.

9.1.4 Description and Operation

9.1.4.1 Description of Safety Belt system

Caution: Except for the slight collide, safety belt, reel and all hardware being used should be replaced, meanwhile, in case partial damage caused by collide occurs, safety guard system should be replaced and fixing anchorage repaired carefully. Safety belt system should be replaced if any doubt exists. Any damage whether visible or not may cause personnel injury in the accident.

Safeguard System

Caution: To avoid personnel injury caused by vehicle colliding under safeguard system having not been restored:

- Replace every worn safety belt during vehicle colliding, except for slightly collided ones.
- Inspect every safety belt; replace Safety belt system in case of any parts/components being suspected of faulty.

Safety belt is passenger's most important safeguard device.

Under following circumstances, safety belt may greatly reduce colliding effect to passengers in the passenger compartment:

- Front collision
- Rear collision
- Side collision
- Turnover

All seats are equipped with emergent locking device. Under normal operating and driving, reel keeps unlocked to ensure all passengers upper body is able to move naturally.

The Location of safety fabric belt is locked by a sensor, which will block the gear on reel shaft when following circumstances happen.

- Safety belt shrinks quickly and reel up in the reel
- Vehicle speed varies abruptly
- Vehicle's running direction varies abruptly
- Vehicle climbs a sharp slope
- Vehicle slips down

Safety belt possesses automatic locking function. Locking function works when safety fabric belt reels off the reel, this may prevent fabric belt from being pulled away

The function will be automatically cancelled when fabric belt has been fully reeled on. When the function is cancelled, fabric belt can still be pulled off from the reel as belt hasn't been locked.

Apart from safety belt system, vehicle is equipped with an auxiliary safeguard system again--- Air Bag System. Refer to 9.2 Air Bag System for details.

9.1.4.2 Front Row Safety Belt System

Vehicle front row safety belt is equipped with adjustable shoulder belt guide ring. Pressing guide ring button on the central stanchion is able to adjust any one location among shoulder belts 6 locations to ensure to adjust to user's suitable height.

Front passenger seat safety belt possesses composite function of emergent locking and automatic locking.

Front seat safety belt consists of following components:

- Safety belt with reel located at driver and passenger side.
- All passenger cars safety belt that is equipped with reels on both sides is positioned onto the central pillar.
- Safety belt anchorages of front passengers seats are all located between two seats (inner side).
- These safety belt anchorages are connected with seats.

9.1.4.3 Rear Row Safety Belt System

Passenger car rear row outer seats are equipped with two shoulder safety belts and middle seat---one belly belt.

Rear passenger seat safety belt possesses composite function of emergent locking and automatic locking.

Rear seat safety belt consists of following components:

- Rear seat outer side safety belt reel, located in the cavity of luggage boot's side trim panel.
- Rear middle seat safety belt anchorage and outer seats belt anchorages are all located at the middle of the seat cushion and connected to the rear floor.

9.2 Safety Guard Air Bag system

9.2.1 Specification

9.2.1.1 Fasteners Tightening Torque

Application	Specification
Connecting bolts between air bag and steering wheel	10 N•m
Connecting bolts between steering wheel and steering column	25 N•m
Connecting bolts between air bag and the bracket	8 N•m
Connecting nuts between safeguard air bag and the bracket	8-11 N•m

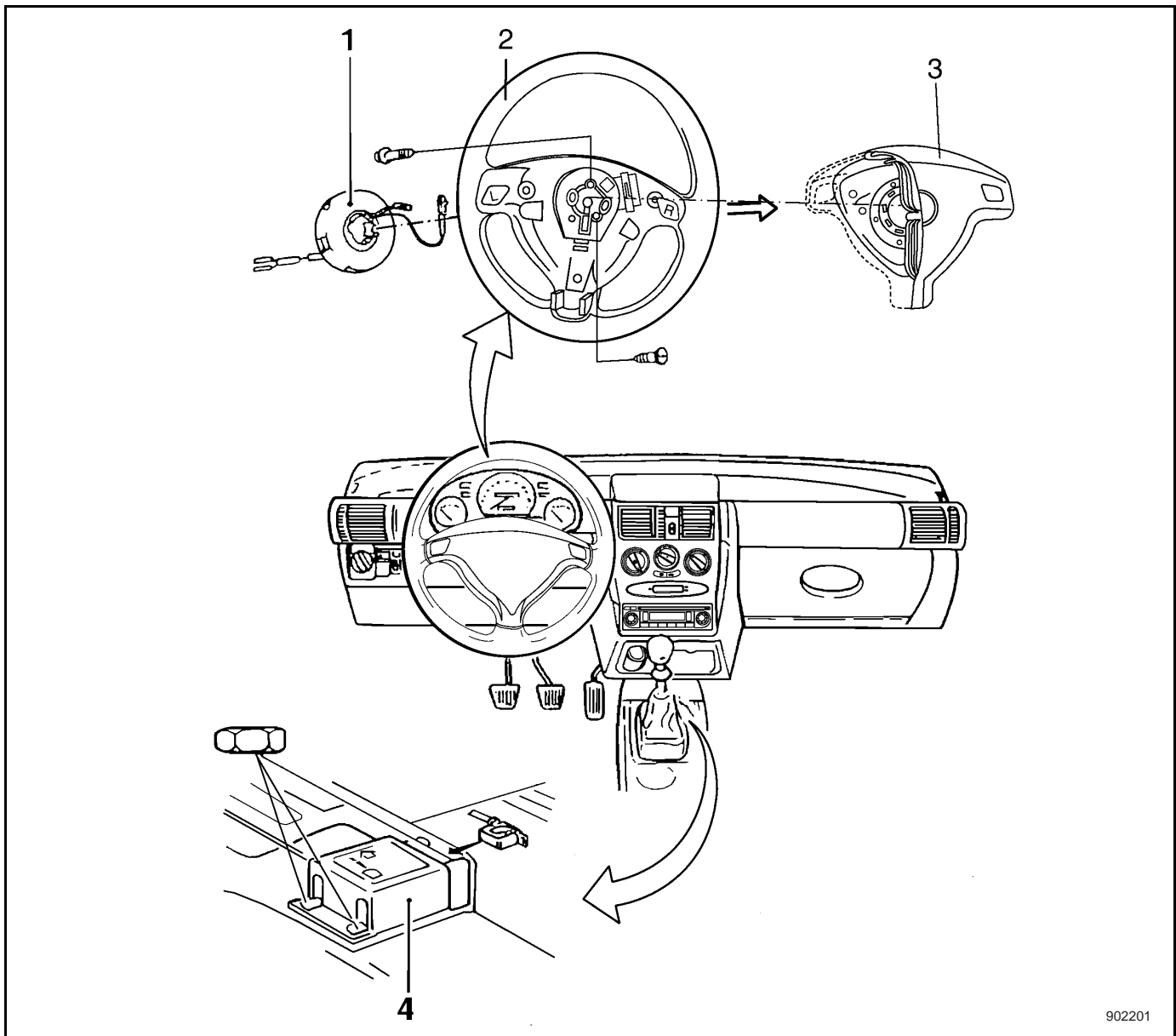
9.2.2 Schematic and Wiring Diagram

9.2.2.1 Safeguard Air Bag System Wiring Diagram

Refer to 8.20.2.13.

9.2.3 Component Position

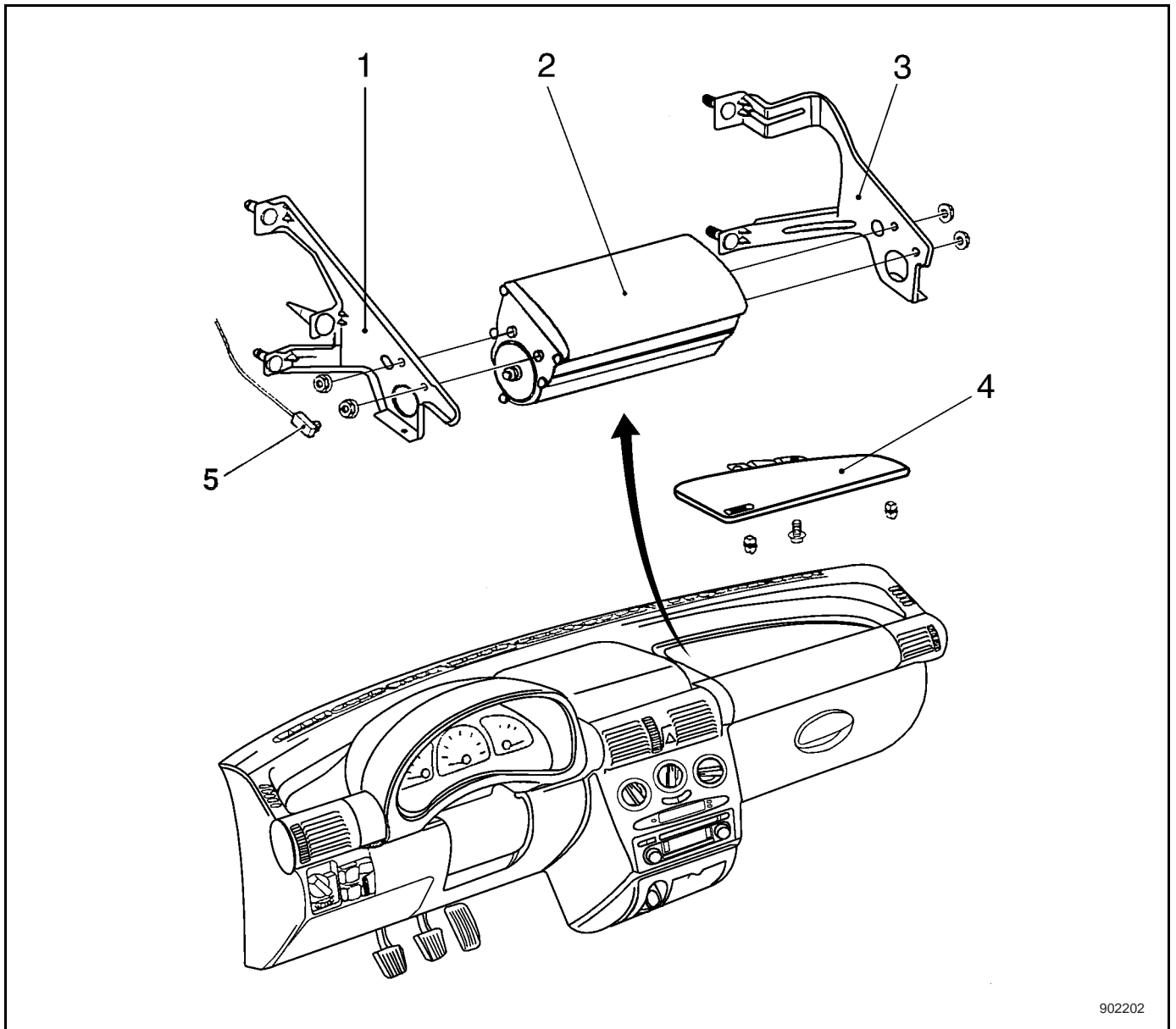
9.2.3.1 Safeguard Air Bag System - Driver Seat Side



Legend

- | | |
|---|--|
| (1) Contacting Device | (3) Safeguard Air Bag Device and Air Charging Device, Bag and Lid |
| (2) Safeguard Air Bag Steering Wheel | (4) Safeguard Air Bag Control Module |

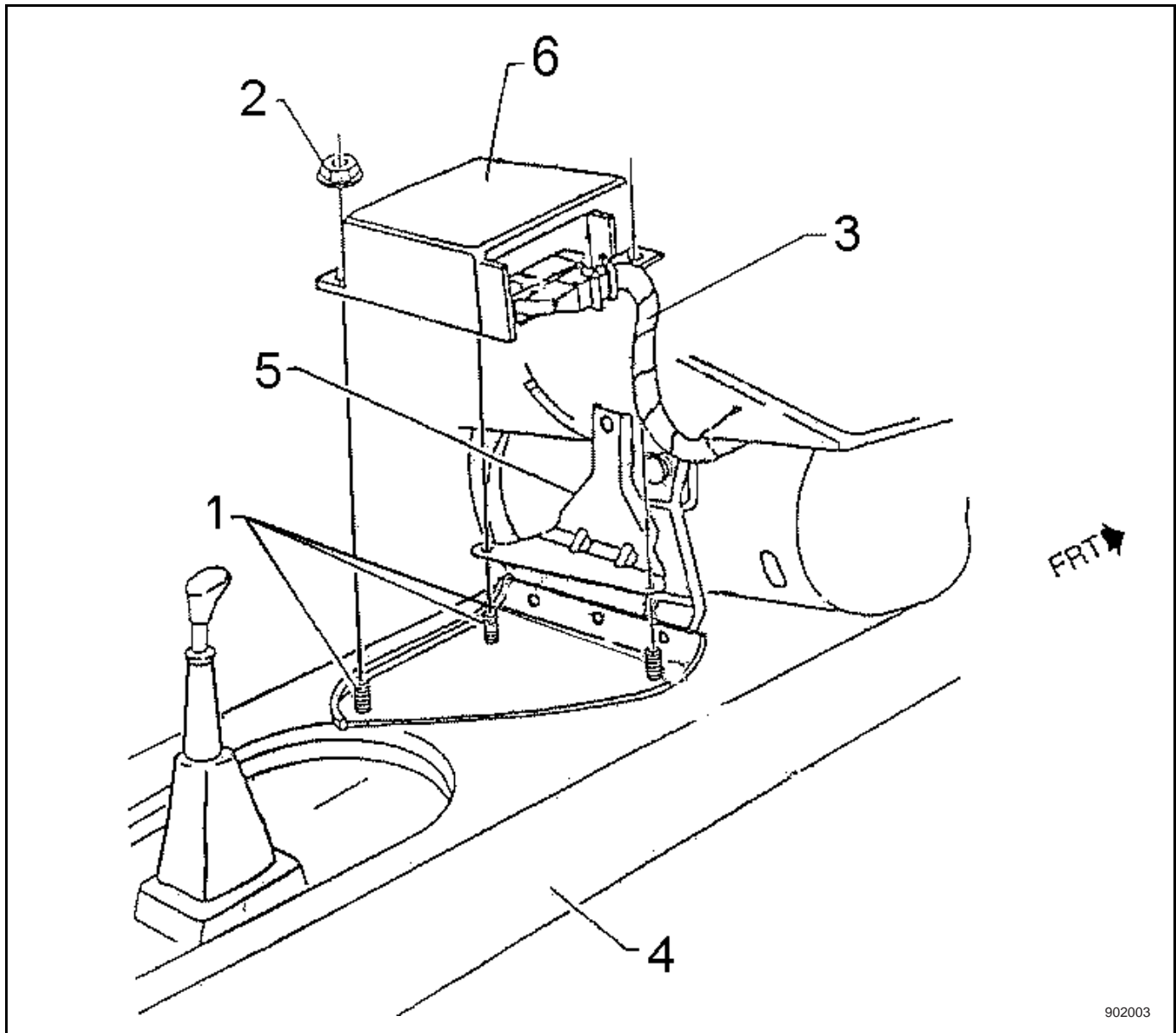
9.2.3.2 Safeguard Air Bag System - Front Passengers



Legend

- | | |
|------------------------------|---|
| (1) Inner Side Bag Bracket | (4) Safeguard Air Bag Lid |
| (2) Safeguard Air Bag Device | (5) Safeguard Air Bag Wiring Harness Plug |
| (3) Outer Side Bag Bracket | (6) Air Bag Lid |

9.2.3.3 Safeguard Air Bag System--Control Module



902003

Legend

- | | |
|-----------------------------------|--|
| (1) Studs, Air Bag Control Module | (4) Front Floor |
| (2) Nuts, Air Bag Control Module | (5) Front Floor Auxiliary Instrument Board Bracket |
| (3) Instrument Panel Harness | (6) Safeguard Air Bag Control Module |

9.2.4 Diagnostic Information and Procedures

9.2.4.1 Diagnosis and Inspection of Safety Air Bag System

Diagnostic Trouble Code (DTC)	Meaning of Diagnostic Trouble Code (DTC)	Possible Cause of Troubles	Repairing Measures
4	Voltage of Driver Seat Air Bag Loop over high	Power supply short circuit or short to the ground	Inspect the wiring harness
5	Voltage of Front Passenger Seat Air Bag Circuit over high	Power supply short circuit or short to the ground	Inspect the wiring harness
31	Driver Seat Air Bag Open Circuit	<ol style="list-style-type: none"> 1. Connecting loop between controller and winding assembly open circuit 2. Connecting loop between air bag and winding assembly open circuit 3. Wiring harness open circuit 	<ol style="list-style-type: none"> 1. Ensure a good connection between controller and winding assembly 2. Ensure a good connection between air bag and winding assembly 3. Ensure wiring harness a good condition
32	Resistance of Driver Seat Air Bag Loop over low	<ol style="list-style-type: none"> 1. Air bag connectors short circuit 2. Winding assembly connectors short circuit 3. Controller connectors short circuit 	<ol style="list-style-type: none"> 1. Ensure harness connectors connecting air bag a good condition 2. Ensure harness connectors connecting winding assembly a good condition 3. Ensure harness connectors connecting controller a good condition
33	Front passenger seats air bag loop open circuit	<ol style="list-style-type: none"> 1. Air bag controller loop open circuit 2. Wiring harness disconnected 	<ol style="list-style-type: none"> 1. Ensure front passenger seats air bags connect the controller effectively 2. Ensure no damage occurs on wiring harness
34	Resistance of Front Passenger Seat Circuit over low	<ol style="list-style-type: none"> 1. Air bag connectors short circuit 2. Controller connectors short circuit 	<ol style="list-style-type: none"> 1. Ensure no damage occurs on air bags harness connectors connecting front passengers seats 2. Ensure no damage occurs on harness connectors connecting controller
43	Warning indicating circuit short to the power supply	<ol style="list-style-type: none"> 1. Warning light short circuit 2. Instrument subassembly damaged 	<ol style="list-style-type: none"> 1. Replace warning light 2. Repair instrument subassembly
44	Warning light loop open circuit or short to the ground	Fuse of warning light filament melted	Replace warning light
52	Controller hasn't been initialized (delivery status)	All controllers are set to shipping mode when delivering from SIMENS	Initialize at vehicle production line terminal
53	Initialization not matching	Incorrect initialization or add additional air bag	Redo initialization and replace air bag controller, if possible.
55	Internal fault in the controller	Fault diagnosed cannot be eliminated	Replace air bag controller.

9.2.4.1 Diagnosis and Inspection of Safety Air Bag System (Cont' d)

Diagnostic Trouble Code (DTC)	Meaning of Diagnostic Trouble Code (DTC)	Possible Cause of Troubles	Repairing Measures
56	Controller can not be used any more	In general, driver seat air bag had unwrapped or other air bags unwrapped wrongly for 3 times totally	Replace air bag controller.
65	Front passenger seats air bags unwrapped.	Front passenger seats air bags unwrapped.	Replace air bag controller.
66	Driver seat air bag unwrapped	Driver seat air bag unwrapped	Replace air bag controller.

9.2.5 Repair Instructions

9.2.5.1 Air Bag safety Rule

General

- All Air Bag System repairing must be operated by dealers and trained professionals authorized by GM Shanghai.
- When ignition is switched on, signal device must be illuminated, and extinguished in roughly 4 seconds time.
- System fault occurs if signal device doesn't illuminate when ignition is switched on.
- System fault occurs if signal device can't be extinguished or illuminated, or, the air bag system doesn't function.
- Air bag steering wheel can only be replaced by wheels that have been certified By GM Shanghai.
- Never glue, cover steering wheel's shock absorbing cushion or replace it, only dry cloth or wet rag and special cleaning agent certified by GM Shanghai can be used to do the cleaning.
- Air bag can't be a substitute for safety belt. Passenger must fasten safety belt to reach best protection effect.
- Driver seat must be properly adjusted as according to driver's bodily form.
- Never place children's seat on front passenger seats where air bags are equipped.
- Sell safe guard air bag parts to the third party is not allowed.

Fault Diagnosis

- Air bag device and controlling parts can only be inspected by TECH II.
- Only TECH II can be used to connect diagnosis connector.
- When using test lamp, voltage meter or resistor meter to inspect wiring harness, plugs of air bag device and controlling unit must be disconnected.
- Higher inspecting current may cause air bag to be unwrapped unconsciously, never check air - charging device by testing lamp, voltage meter or resistor meter.

Shipping and storage

- Purchasing, shipping and storage, as according to Safety Rule, can only be performed by dealers, after sales service and repair professionals authorized by GM Shanghai.

- In some nations, the use of air bag device should follow local law; related national law and regulations must be obeyed.
- Only those air bags, which cannot be unwrapped and original package is still kept, are allowed to return.

Installment, Removal and Replacement

- If air bags are unwrapped during the accident, controlling parts, air bag device and contacting device must be replaced by new ones.
- Air bag system harness must be replaced if it is damaged.
- Never change air bag system's harness
- Disconnect battery negative pole and wrap its terminal before operating air bag system and electrical system.
- Wait for one minute for capacitor's discharging, and then operate the air bag system.
- To avoid damaging connecting device while steering wheel is being removed, fix the steering column at going forwards position when remove steering wheel.
- When air bag device is stored, its lining side must be placed upwards.
- Removed wrapped air bag device must be locked and stored if vehicle maintenance period is long.
- In general, never alter air bag system in any way.
- Never treat air bag system by grease, detergent and alike corrosive.
- Air bag system and control device are sensitive to collide, if air bag system and control device drop from a height of 50 cm/ 20 in, they won't be installed.
- Welding cable must be connected near the welding spots when welding is performed. Controlling parts must be separated from harness and the connector of air charging device must be disconnected.
- Air bag system is not allowed to be stored in the environment of 90_C/194_F, even if it is a short time storage.
- Never repair damaged or fragmentary parts, just replace them immediately.
- Never open air bag device by force.
- Before installing, inspect again for battery disconnected, terminals covered, ignition key locating at 0 position.

Discarding

- Air bag device must be opened as according to regulation stipulated by GM Shanghai, and discarded when it fails in working.
- Air bag can only be unwrapped when it is fastened onto the vehicle.
- Before unwrapping, any scattered stuffs located inside air bag's expansion area must be removed.
- Air bags must be unwrapped when vehicle doors are closed, side window opens.
- Unwrapping procedure can only be performed on the open ground.
- Only special unwrapping tools can be used.
- Public who could be affected should be notified the noise level.
- Even for those irrelevant viewers who are standing in front of the vehicle.
- Keep a safe distance of 10m/10 yard away from the unwrapping vehicle.
- Finally connect the power supply.
- Never dispose of air bags, which have not been unwrapped, as a normal waste.
- Move the opened air bag after 15 minutes cooling down.
- Opened air bag can be disposed of as a normal waste.
- If unwrapping fails, you can approach to the vehicle 5 minutes later with power disconnected.
- Remove air bag that couldn't open, and through appointment in advance, return back along with its original package.

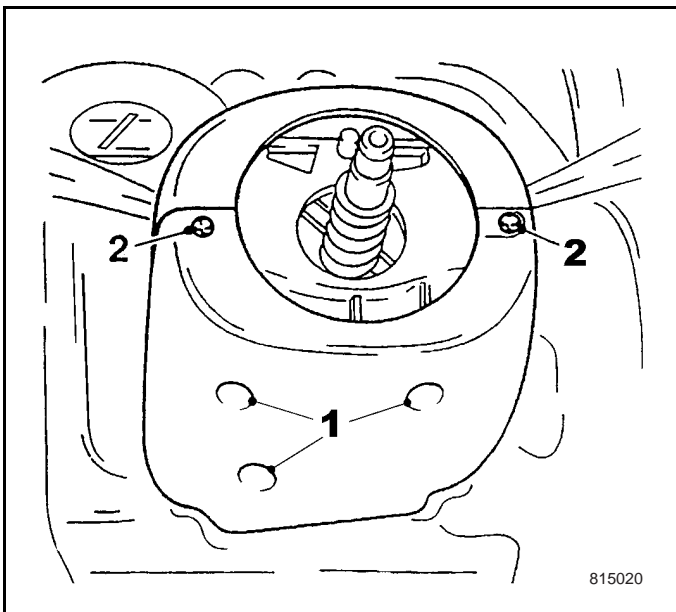
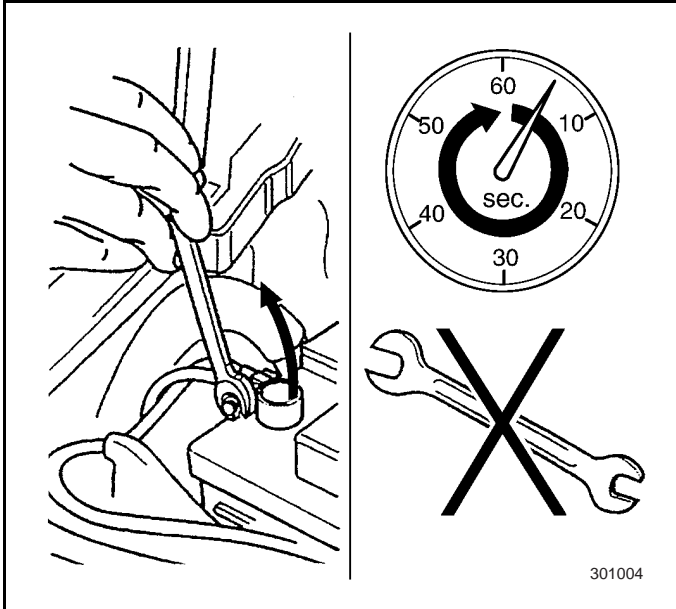
9.2.5.2 Replacement of Air Bag Device---- Driver Side

Caution: Follow Safety Regulation during safe guard air bag operating.

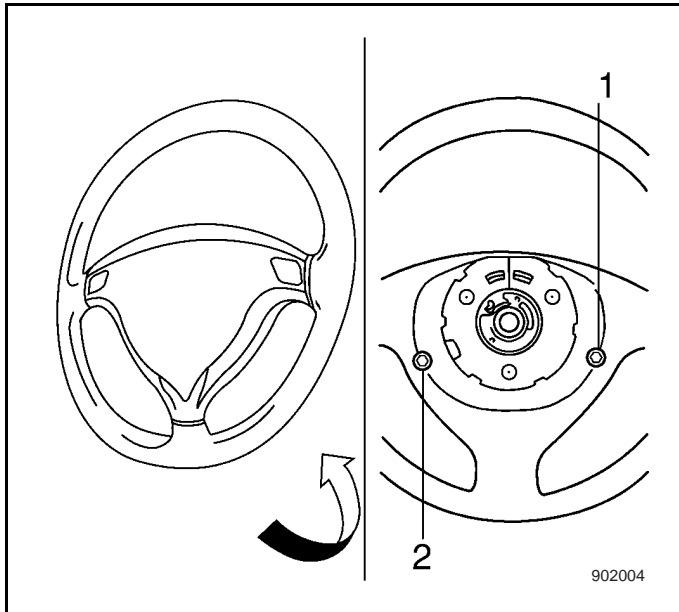
Removal Procedure

1. Disconnect battery cable, cover negative pole terminal.

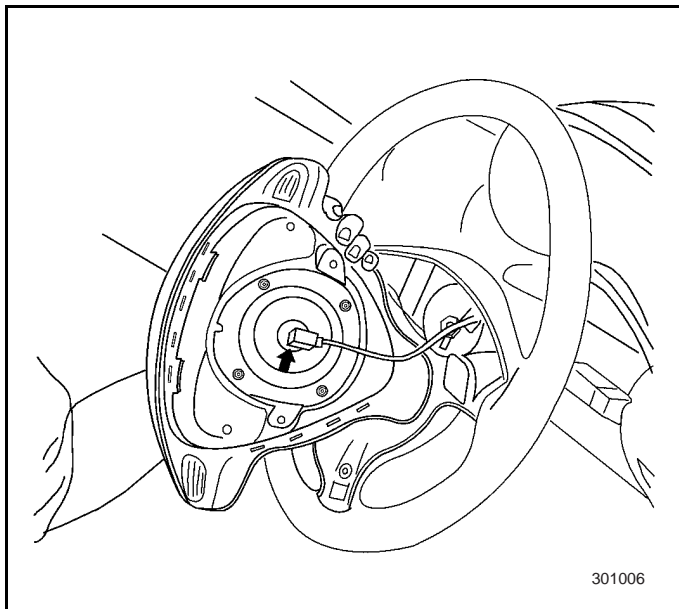
Notice: Wait for one minute for capacitor fully discharging, and then perform air bag operation.



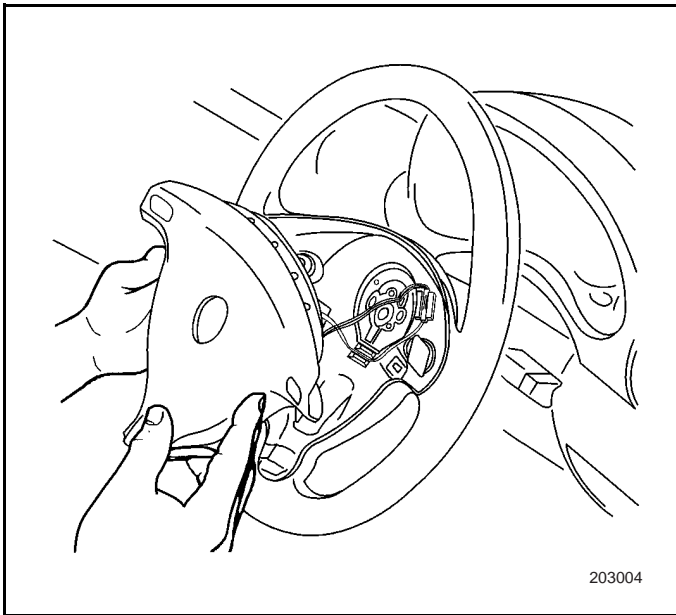
2. Loosen fastening bolts of instrument panel's outer lid.
3. Take apart steering column outer lid, loosen bolts of upper and lower trim panels (1,2).



4. Position the steering wheel to straight front direction, turn right 90 degree, loosen air bag bolt TX30 from the opposite side of the steering wheel, turn it 180 degree adversely and then loosen the second bolt from its opposite side. Finally turn the steering wheel back to straight front direction, lift the air bag carefully, disconnect harness plug of its air-charging device and move it away.



5. Never open the air bag by foreign force, place its lining cushion upwards.



Installation Procedure

1. Connect harness plug of air charging device, fix air bag device on the steering wheel by bolts.

Tightening

Fasten the air bag device onto steering wheel - 10 N •m.

2. Fasten bolts of instrument panel's outer lid, install signal switch plate, and connect battery feed wire.

Caution: Newly installed air bag device must be registered. Registration of air bag device and control parts must be matched with vehicle identification code to identify particular air bag device and control device have been mounted on which vehicle.

Delivery of each new air bag device and control parts must be attached by a registration card, which must be filled up when dealers accept or install them.

9.2.5.3 Replacement of Safeguard Air Bag Steering Wheel

Refer to Steering Wheel Replacement in Steering Wheel and Column.

9.2.5.4 Replacement of Contacting Device

Caution: Follow Safety Regulation during safeguard air bag operating. Before installing, central position of the contactor must be ensured.

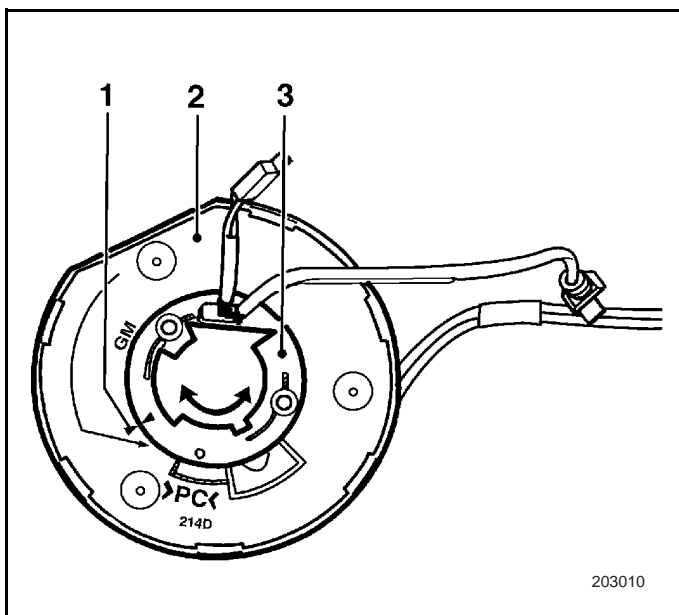
Removal Procedure

1. Remove air bag device and safeguard air bag steering wheel; refer to Air Bag replacement - Driver Side and Steering Wheel Replacement in Steering Wheel and Steering Column. Remove contacting device from steering column.

Adjustment

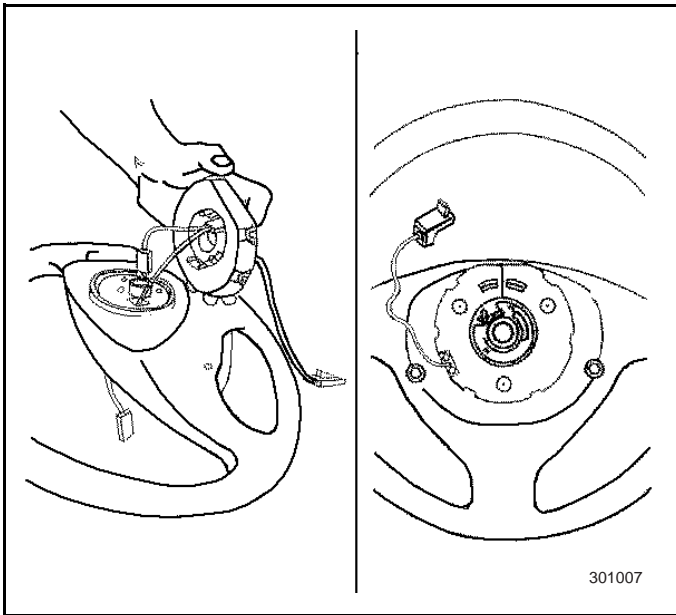
Make sure the central position of the contacting device.

Turn the connector (3) of contacting device (2) to left clockwise till significant resistance occurs, and then turn to right adversely for 2.5 circles to the position where an arrow (1) is marked.



Installation Procedure

1. Install the contacting device onto steering wheel, then install safeguard air bag steering wheel and air bag device, refer to Steering Wheel Replacement and Air Bag Replacement- Driver Side in Steering Wheel and Steering Column.



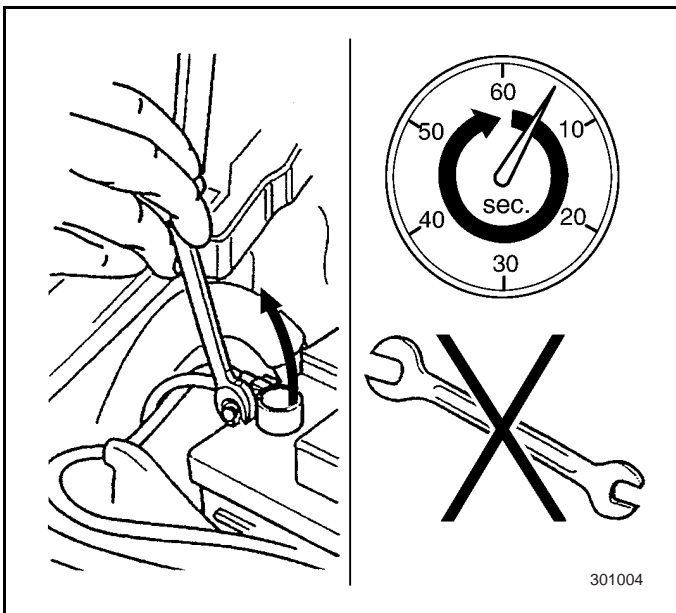
9.2.5.5 Replacement of Safety Air Bag Controlling Device

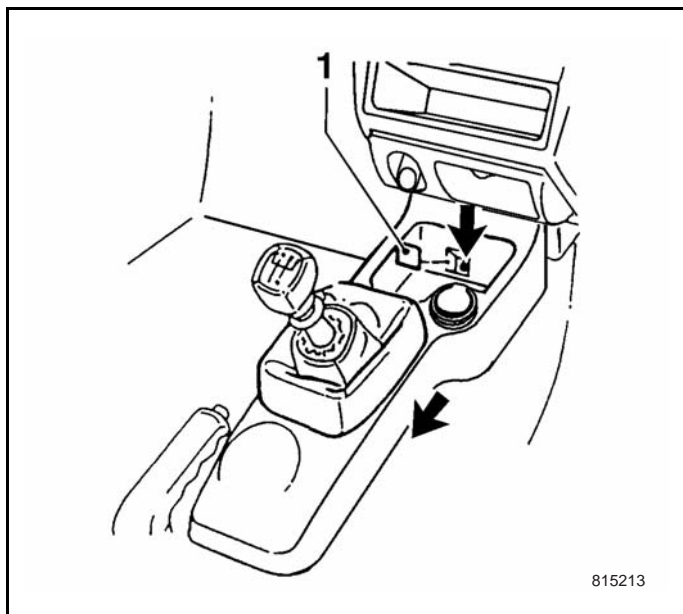
Caution: Follow Safety Regulation during air bag device operating!

Removal Procedure

1. Disconnect battery cable, cover negative pole terminal.

Notice: Wait for one minute for capacitor fully discharging, and then perform air bag operation.



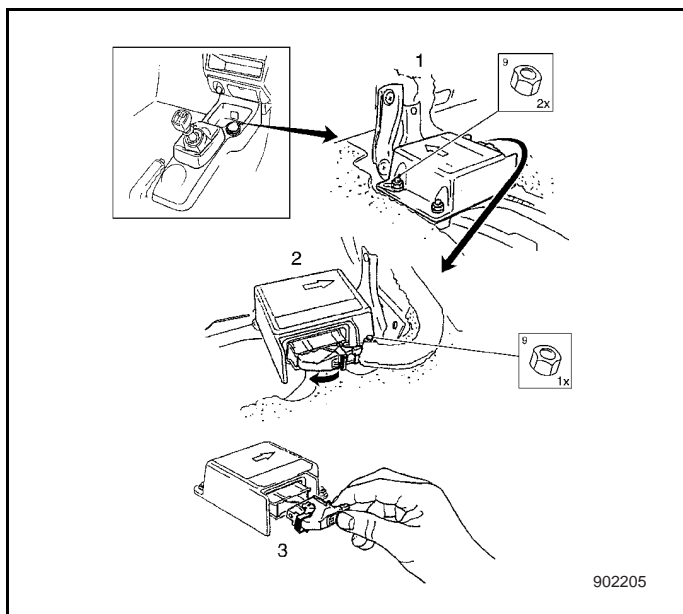


2. Remove sealing lid (1) of central control board, and loosen bolts, turn over corrugated cover of the gear lever (in case of manual gear) and remove it, and then push backwards the central control table till it leaves the clip to be removed.
3. Disconnect harness plug of controlling device, loosen hexagon nut on the control parts and then remove air bag controlling device.

Notice: Air bag controlling device is sensitive to collision, it won't be installed if it drops from the height of 50 cm; when install new controlling device, program should be set again.

Installation Procedure

1. Fasten controlling parts by hexagon nuts, connect harness plug of controlling parts and lock it.
2. Install central control board and lock its bolts.
3. Install sealing lid. In case of manual gear, tighten corrugated cover and connect battery wire.



9.2.5.6 Replacement of Air Bag Device- Front Row Passenger

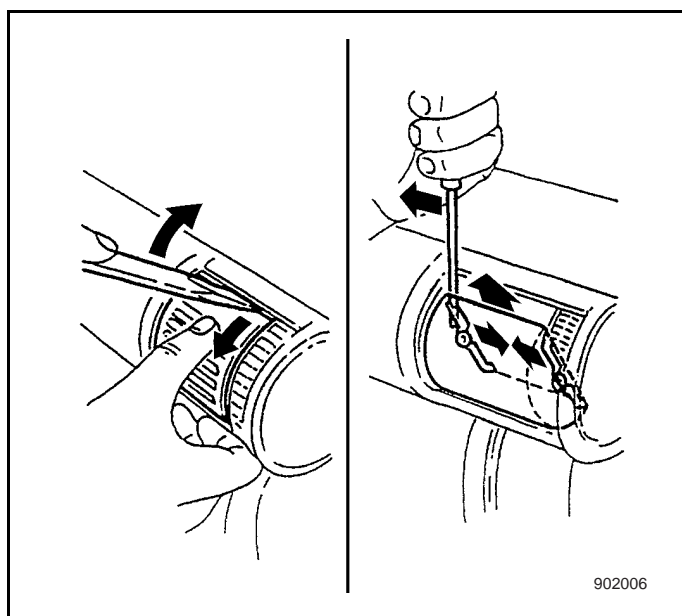
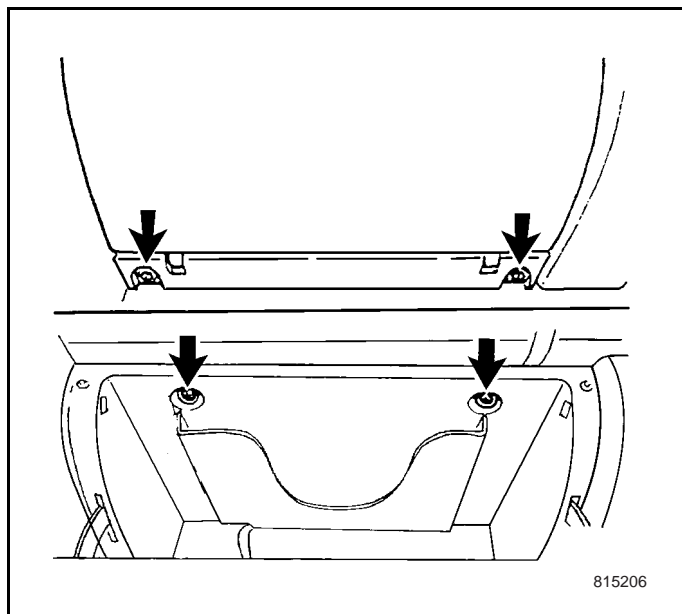
Caution: Follow Safety Regulation during air bag device operating!

Removal Procedure

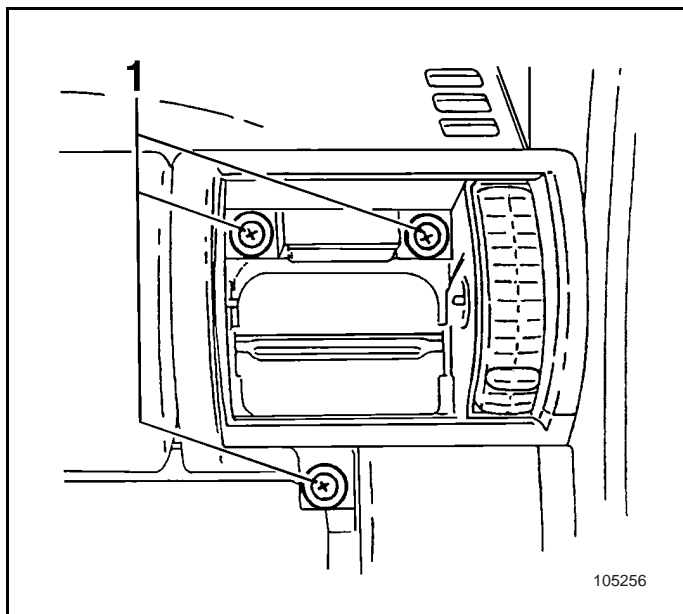
1. Disconnect battery cable, cover negative pole terminal.

Notice: Wait for one minute for capacitor fully discharging, and then perform air bag operation.

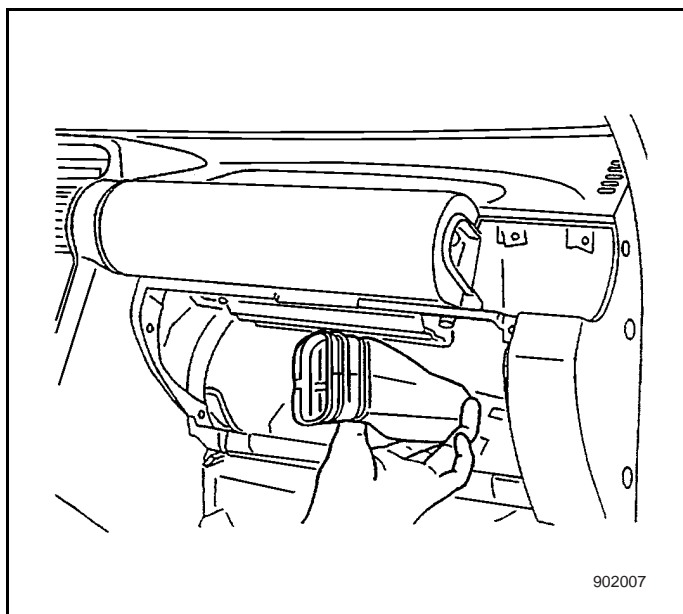
2. Remove glove box; refer to Glove Box Replacement in Instrument Panel, Composite Instrument and Auxiliary Instrument Panel.



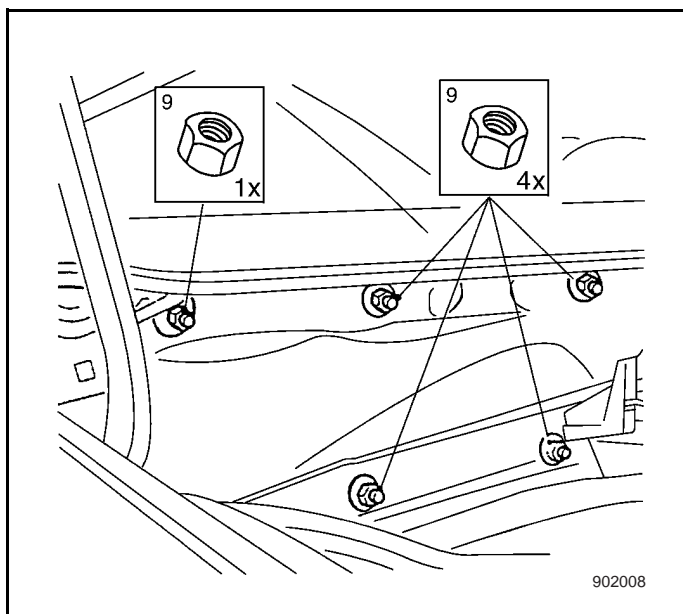
3. Turn ventilation outlet till it couldn't be done, a 1.5 cm wide gap could be seen at its upper part; insert a wedge like plastic tool into outlet shaft and pull out it upwards and backwards.



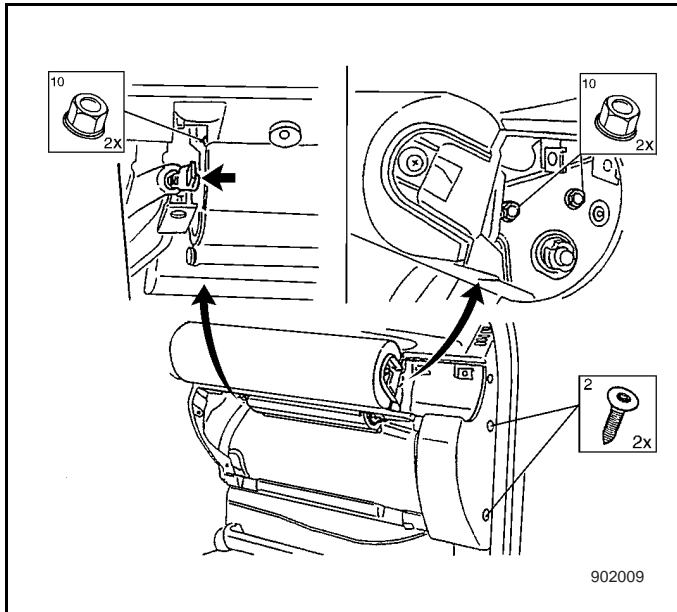
4. Loosen nuts outside the outlet that is located at the front passenger seat side of instrument panel.



5. Remove ventilation outlet's outer frame from the instrument panel, remove air-distributing channel from air distributing chamber connection.



6. Remove air-intake grid, refer to Air intake Grid Replacement in Vehicle Front End.
7. Then remove battery, Refer to Battery replacement in Engine Electrical.
8. Screw off hexagon nuts of air bag bracket on the firewall, screw off fixing nuts of instrument panel on the firewall.



9. Disconnect harness connector of air bag device. Screw off air bag nuts from its inner as well as outer bracket, screw off right side fixing bolts of instrument panel and pull its right side backwards and then take off safeguard air bag.

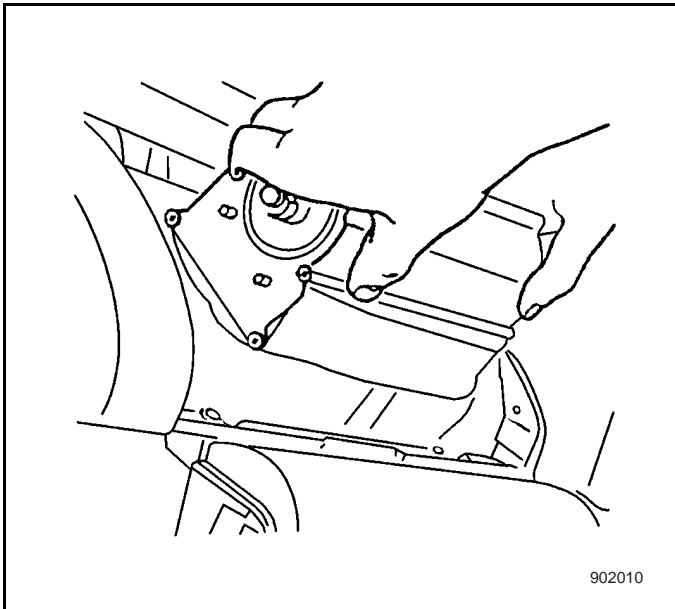
Installation Procedure

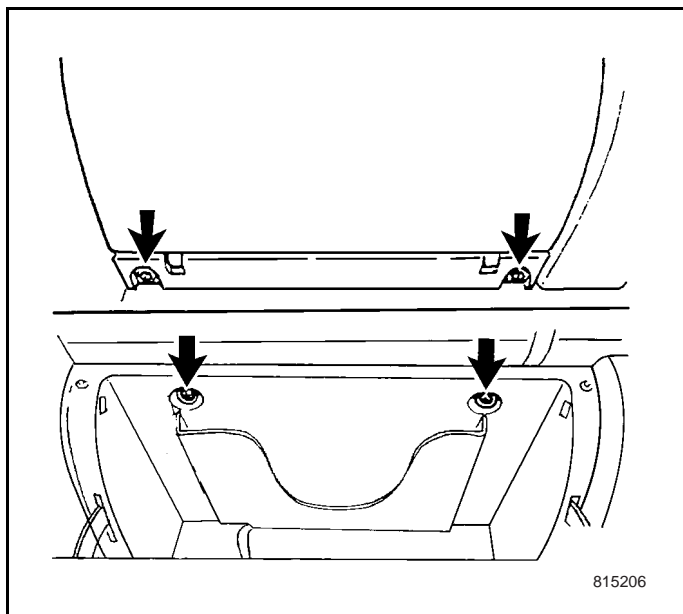
1. Insert air bag device into bracket and tighten nuts.

Tightening

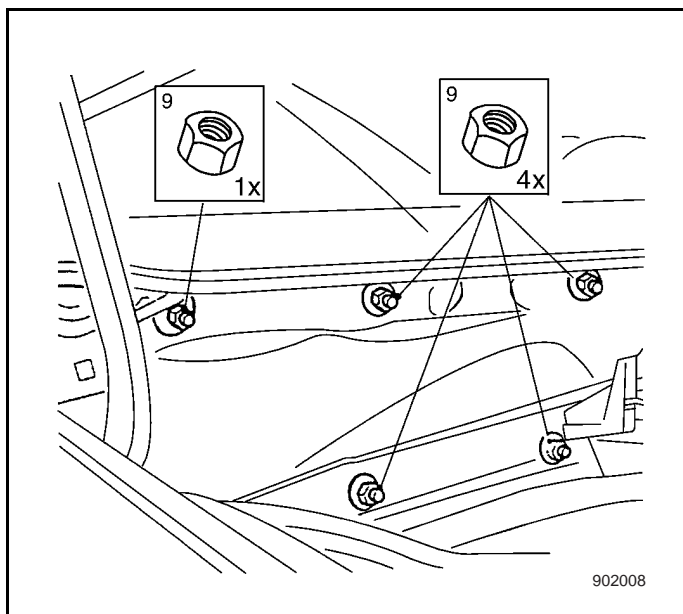
Tighten air bag and bracket to 8 N•m.

2. Connect harness and airbag, fix and tighten bolts of instrument panel's right side.





3. Move the air distributing channel to air distributing chamber connection, connect ventilation outlet frame and distributing channel and fix them to instrument panel, insert the outlet into its frame; then, connect alarm system harness connector to control module, and install glove box, tighten bolts.



4. Tighten air bag bracket bolts on the firewall.

Tightening

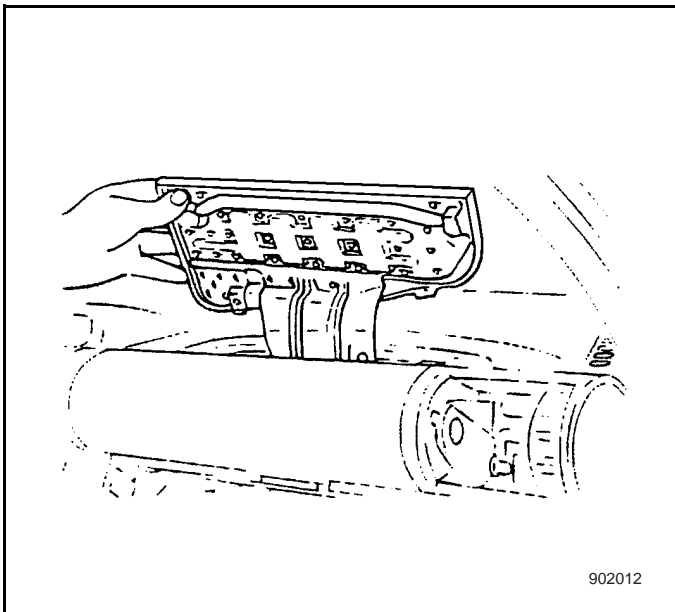
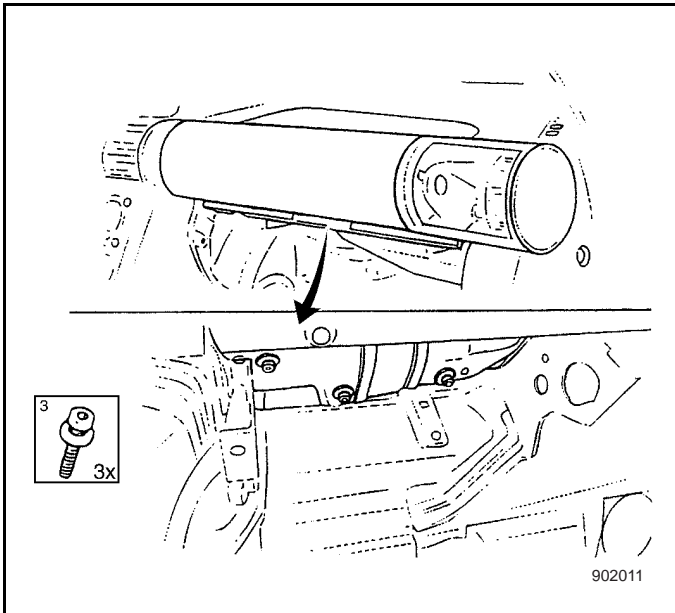
Tighten air bag bracket bolts on the firewall to 22 N • m.

5. Install battery, Refer to Battery replacement in Engine Electric.
6. Install air-intake grid, refer to Air intake Grid Replacement in Vehicle Front End.

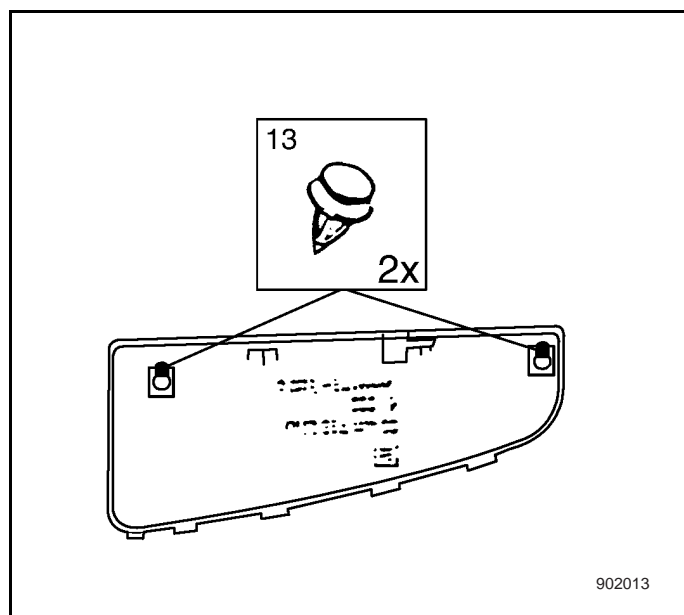
9.2.5.7 Air Bag Lid Replacement

Removal Procedure

1. Remove air bag device, refer to Air Bag Device Replacement-Front Row Passenger Side. Screw off lid fixing nuts.



2. Push the lid upwards and remove it from the instrument panel.



3. Clipping clamps are not allowed to use on vehicles that are equipped with front row passenger seat safeguard air bag. Lid and clamp of vehicle without front row passenger seat safety air bag are shown in the right figure.

Installation Procedure

Press tightly air bag lid and tighten bolts.

Tightening

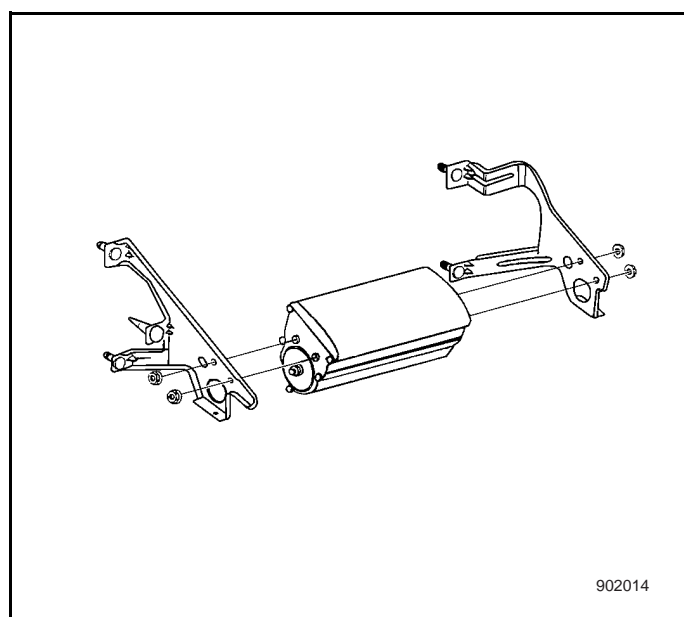
Tighten the screws to 8 N•m.

Install air bag device, refer to Air Bag Device Replacement-Front Row Passenger.

9.2.5.8 Air Bag Bracket Installing and Removal

Removal Procedure

1. Remove Instrument panel; refer to Instrument Panel Replacement in Instrument panel, Composite Instrument and Auxiliary Instrument Panel.
2. Screw off hexagon nuts connecting air bag and its bracket, remove bracket.



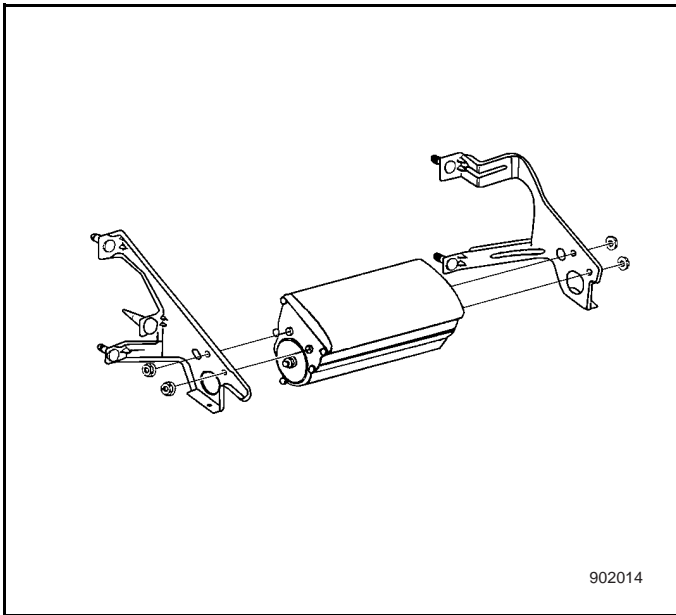
Installation Procedure

1. Tightly screw nuts connecting bracket and air bag.

Tightening

Tighten the bolt to 8 N•m.

2. Install Instrument panel; refer to Instrument Panel Replacement in Instrument panel, Composite Instrument and Auxiliary Instrument Panel.



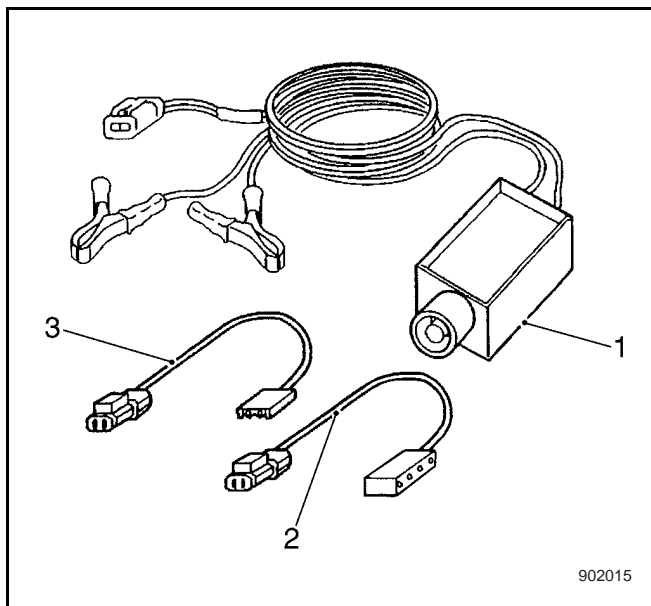
9.2.6 Description and Operation

9.2.6.1 Disposing of the Air bag

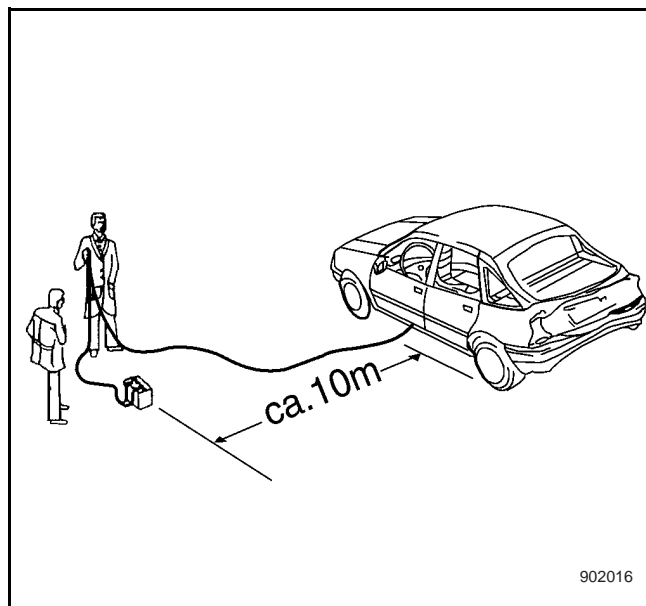
If Vehicle's side and rear have worn severely, it won't be restored. Air bags should be exploded on purpose and then to be disposed of, repair tool KM-799 is designed for doing this.

Procedure of explosion on purpose by tool KM-799:

- Disconnect the plug connecting signal transmission device (below steering wheel).

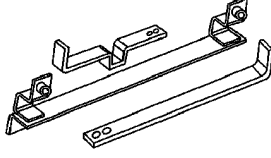
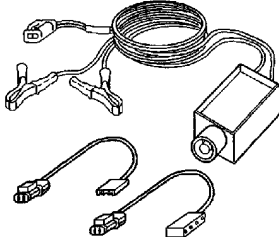
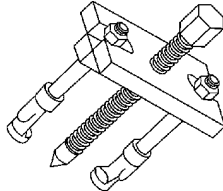


- Connect the orange plug of tool KM-799-1 (3), which is a special tool used to connect tool KM-799-3 (1) and the wire, ready to explode driver's and front row passenger's air bags simultaneously.
- Remove central auxiliary instrument board.
- Connect tool KM-799-3 (1) and wire KM-799-2 (2) to air bag control module.



- Extend the wire outside the vehicle through door joint.
- Connect outer power supply.
- Explode it 10 m/10 yard away from the vehicle.

9.2.7 Special Tools and equipment

Legend	Tool Code/Description
 S-9409203	S 9409203 Inspect steering's Straight Front Direction by Inspecting Measures
 KM-799	KM-799 Safeguard Air Bag Explosion Tools
 J-830901	J 830901 Steering Wheel Extractor

Blank